MULTIPOINT FUEL INJECTION (MPI) <4G9>

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GENERAL INFORMATION

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

FUEL INJECTION CONTROL

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

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

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

IDLE AIR CONTROL

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

IGNITION TIMING CONTROL

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

SELF-DIAGNOSIS FUNCTION

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

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control <Vehicles with catalytic converter>
   Refer to GROUP 17.
5. EGR Control Solenoid Valve Control
   Refer to GROUP 17.

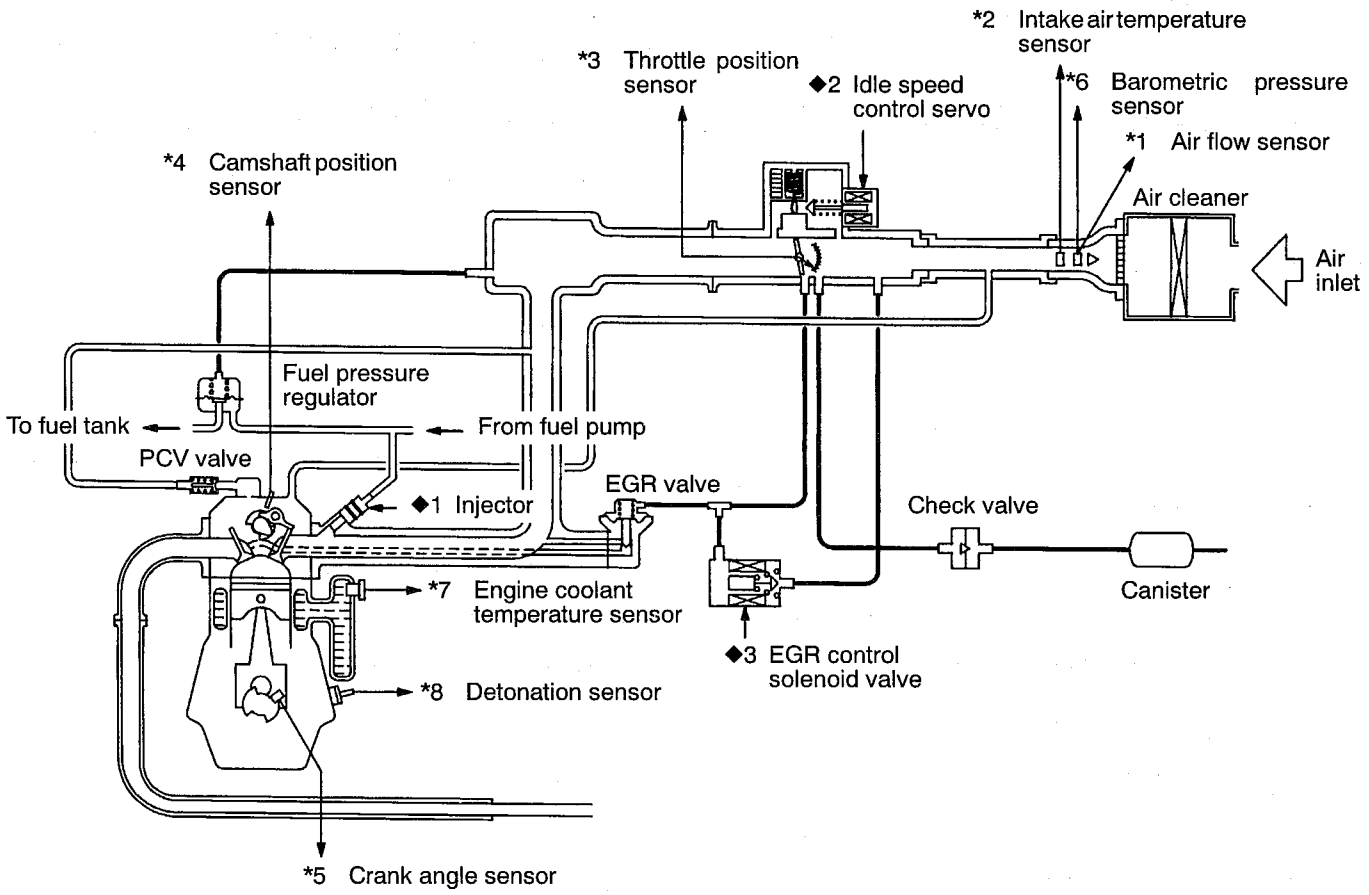
GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	50
	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)
Engine-ECU	Identification model No.	E2T74472 or ET74477 <Vehicles without catalytic converter> E2T74471 or E2T74273 <Vehicles with catalytic converter>
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 <Vehicles with catalytic converter>	Zirconia type
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Magnetic resistive element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control relay type	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	CDH 210
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve <Vehicles with catalytic converter>	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	329

MULTI-POINT FUEL INJECTION SYSTEM DIAGRAM

<Vehicles without catalytic converter>

*1 Air flow sensor *2 Intake air temperature sensor *3 Throttle position sensor *4 Camshaft position sensor *5 Crank angle sensor *6 Barometric pressure sensor *7 Engine coolant temperature sensor *8 Detonation sensor	• Power supply • Ignition switch – IG • Ignition switch – ST • Vehicle speed sensor • A/C switch • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • Mixture adjusting screw (Variable resister) • A/T-ECU	⇨ Engine-ECU ⇨	◆1 Injector ◆2 Idle speed control servo ◆3 EGR control solenoid valve	• Engine control relay • Fuel pump relay • A/C relay • Ignition coil • Fan controller • Engine warning lamp • Tachometer • Diagnosis output • Alternator G terminal • A/T-ECU



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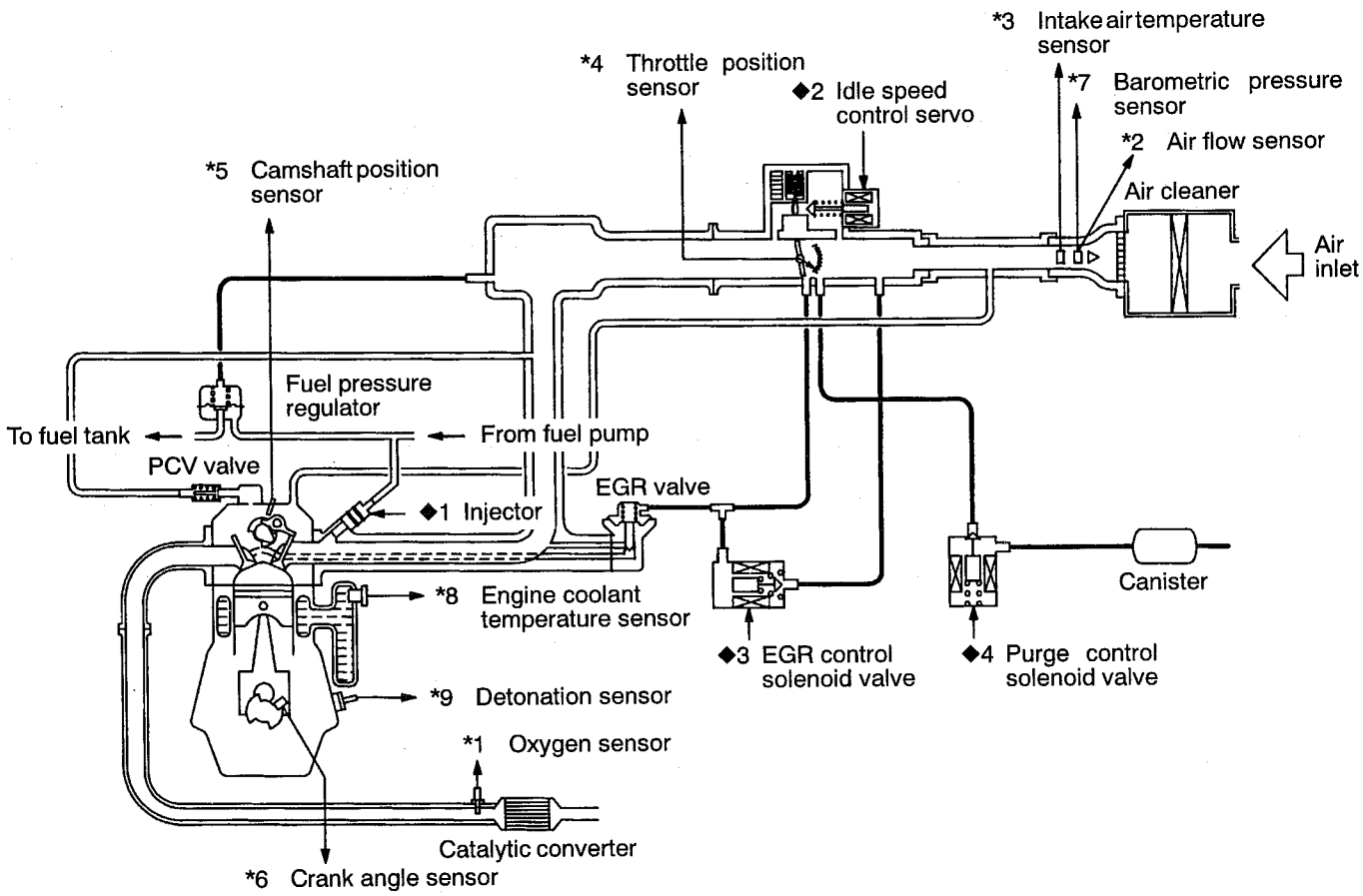
<Vehicles with catalytic converter>

*1 Oxygen sensor *2 Air flow sensor *3 Intake air temperature sensor *4 Throttle position sensor *5 Camshaft position sensor *6 Crank angle sensor *7 Barometric pressure sensor *8 Engine coolant temperature sensor *9 Detonation sensor	• Power supply • Ignition switch – IG • Ignition switch – ST • Vehicle speed sensor • A/C switch • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • A/T-ECU	⇨ Engine-ECU ⇨	◆1 Injector ◆2 Idle speed control servo ◆3 EGR control solenoid valve ◆4 Purge control solenoid valve	• Engine control relay • Fuel pump relay • A/C relay • Ignition coil • Fan controller • Engine warning lamp • Tachometer • Diagnosis output • Alternator G terminal • A/T-ECU	



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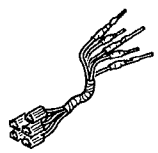
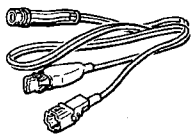
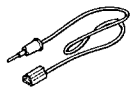
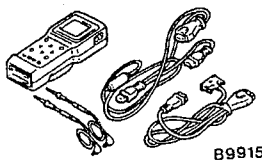
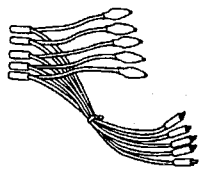
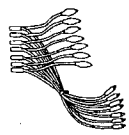
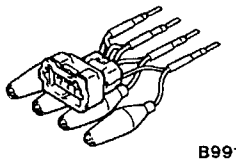
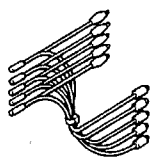
SERVICE SPECIFICATIONS

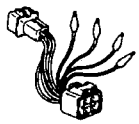
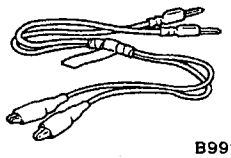
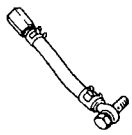
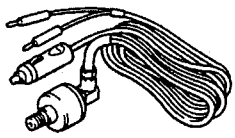
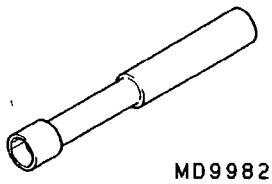
Items		Specifications
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV		535 – 735
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	20°C	2.3 – 3.0
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	20°C	2.1 – 2.7
	80°C	0.26 – 0.36
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at curb idle
	Vacuum hose connection	Approx. 265 at curb idle
Injector coil resistance Ω		13 – 16 (at 20°C)

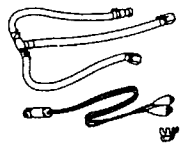
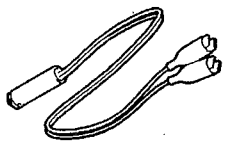
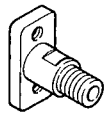
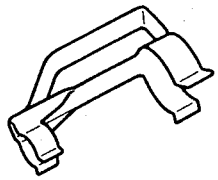
SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	• Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
 B991536	MB991536	TPS adjustment harness	Adjustment of throttle position sensor
 B991658	MB991658	Test harness	• Measurement of voltage during trouble-shooting • Inspection using an analyzer

Tool	Number	Name	Use
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	
 MD998299	MD998299	MAS screwdriver	Mixture adjusting screw check

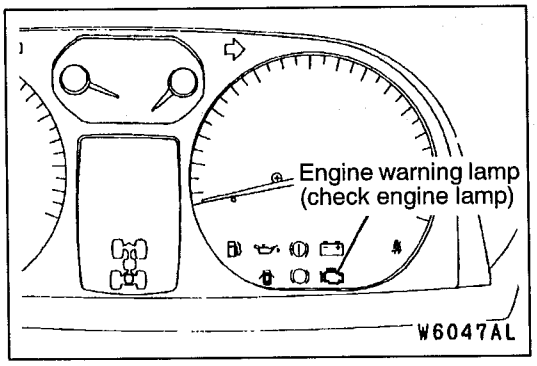
Tool	Number	Name	Use
	MD998706	Injector test set	Checking the spray condition of injectors
 MB991607	MB991607	Injector test harness	
 MD998741	MD998741	Injector test adaptor	
	MB991608	Clip	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
If the engine-ECU for vehicles for Australia is replaced, the steering lock cylinder and ignition key should be replaced together with it.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Engine-ECU
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Ignition coil
Immobilizer system <Australia, New Zealand and South Africa>

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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

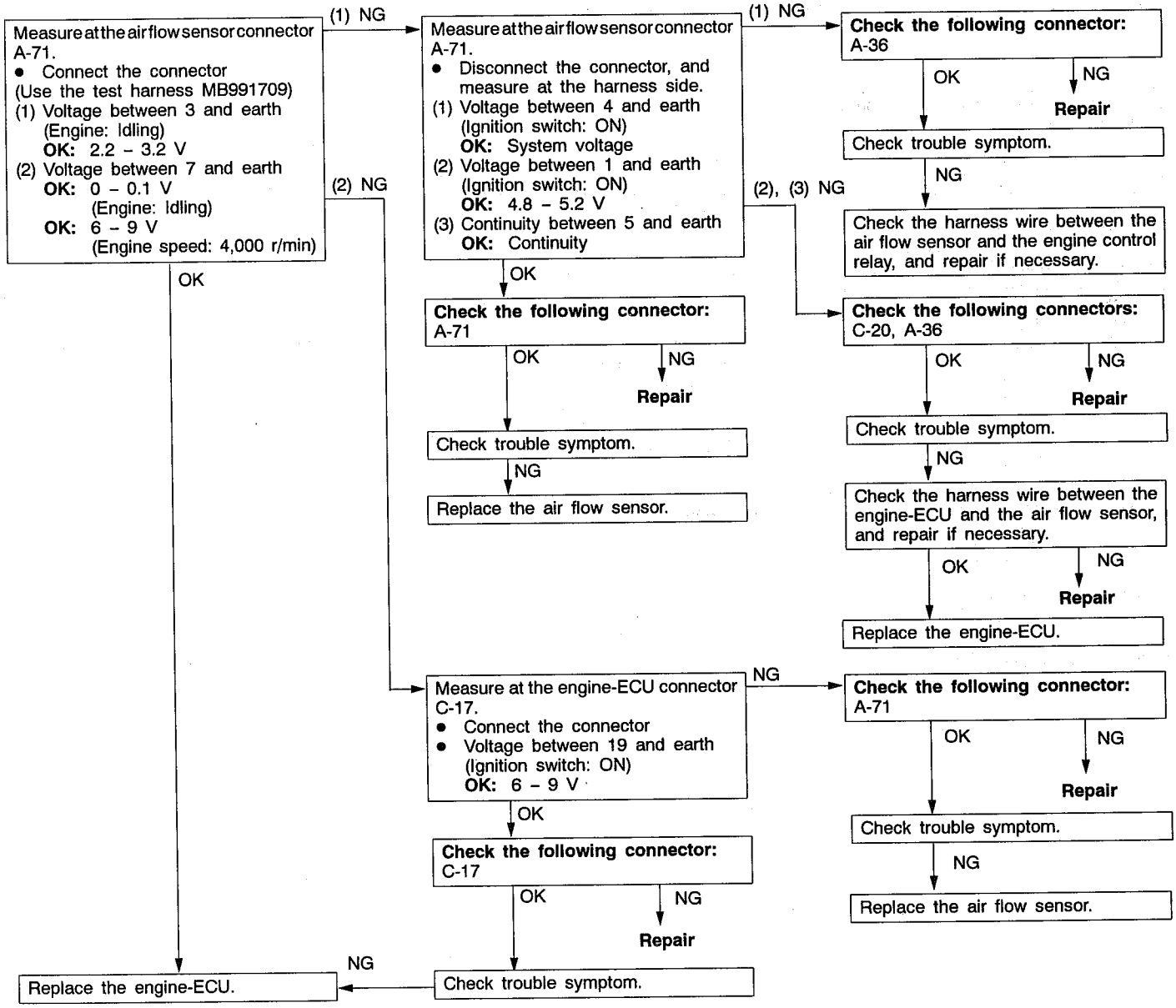
Malfunctioning item	Control contents during malfunction
Vacuum sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed 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	Cuts off the fuel supply 4 seconds after a problem is detected. (However, after the ignition switch is turned to ON, the No.1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition for standard petrol.
Ignition coil	Cuts off the fuel supply to cylinders with an abnormal ignition.
Communication wire with transmission control unit <A/T>	Ignition timing is not retarded during transmission gear shifting (overall engine and transmission control).
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)

INSPECTION CHART FOR DIAGNOSIS CODES

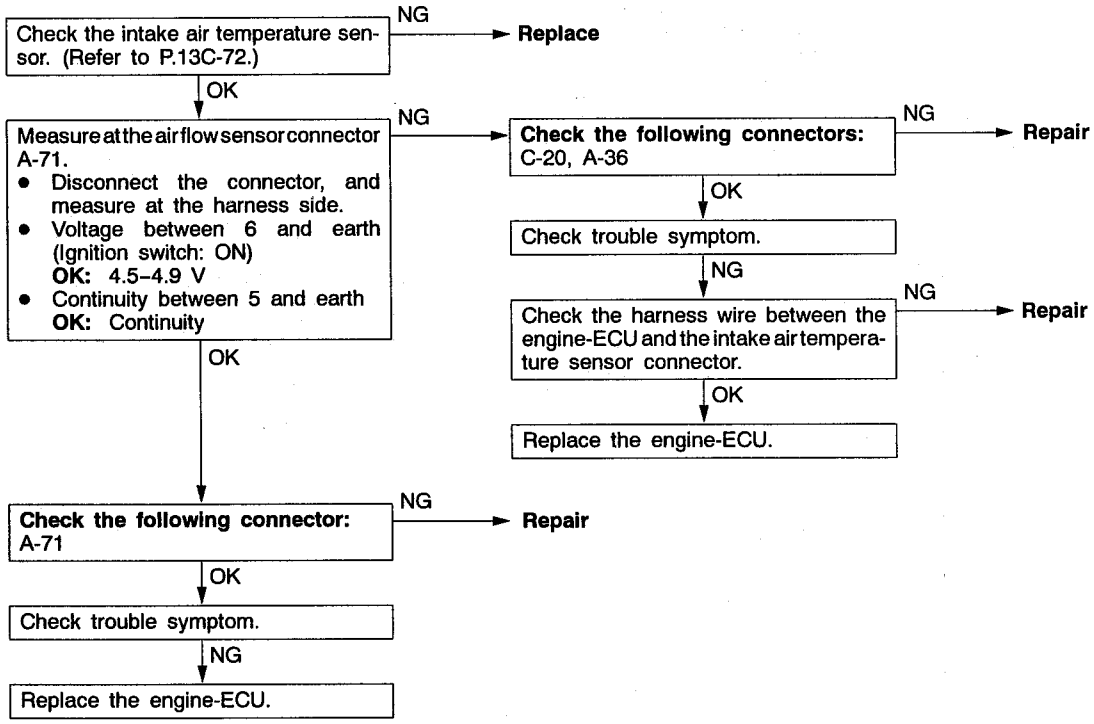
Code No.	Diagnosis item	Reference page
12	Air flow sensor system	13C-13
13	Intake air temperature sensor system	13C-14
14	Throttle position sensor system	13C-15
21	Engine coolant temperature sensor system	13C-16
22	Crank angle sensor system	13C-17
23	Camshaft position sensor system	13C-18
24	Vehicle speed sensor system	13C-18
25	Barometric pressure sensor system	13C-19
31	Detonation sensor system	13C-20
41	Injector system	13C-20
44	Ignition coil system	13C-21
54	Immobilizer system <Australia, New Zealand and South Africa>	13C-22
61	Communication wire with A/T-ECU system <A/T>	13C-23
64	Alternator FR terminal system	13C-23

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

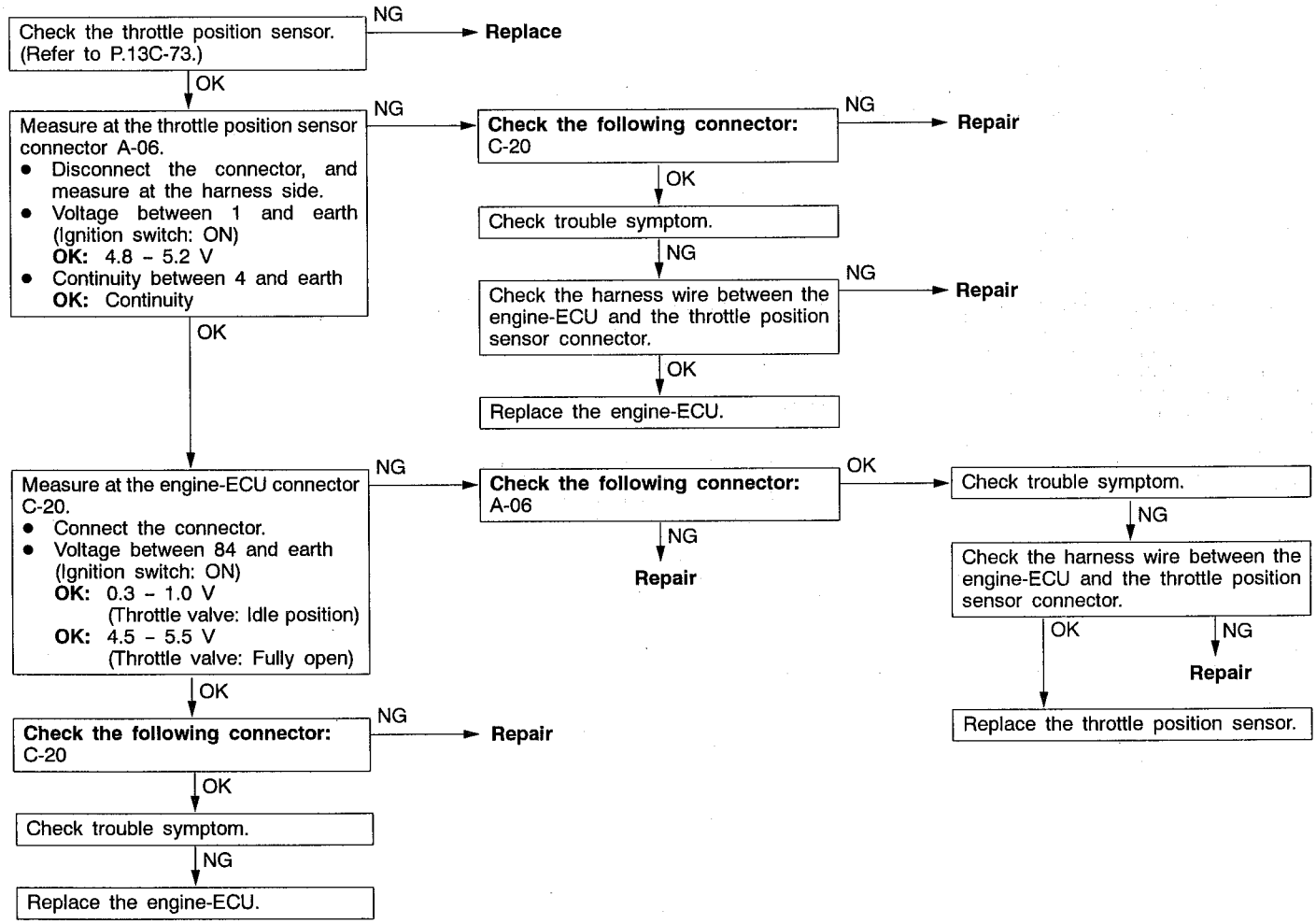
Code No.12 Air flow sensor system	Probable cause
Range of check • Engine speed is 500 r/min or more. Set conditions • Sensor output frequency is 3.3 Hz or less for 4 seconds.	• Malfunction of the air flow sensor • Open circuit or short-circuited harness wire of air flow sensor circuit • Malfunction of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



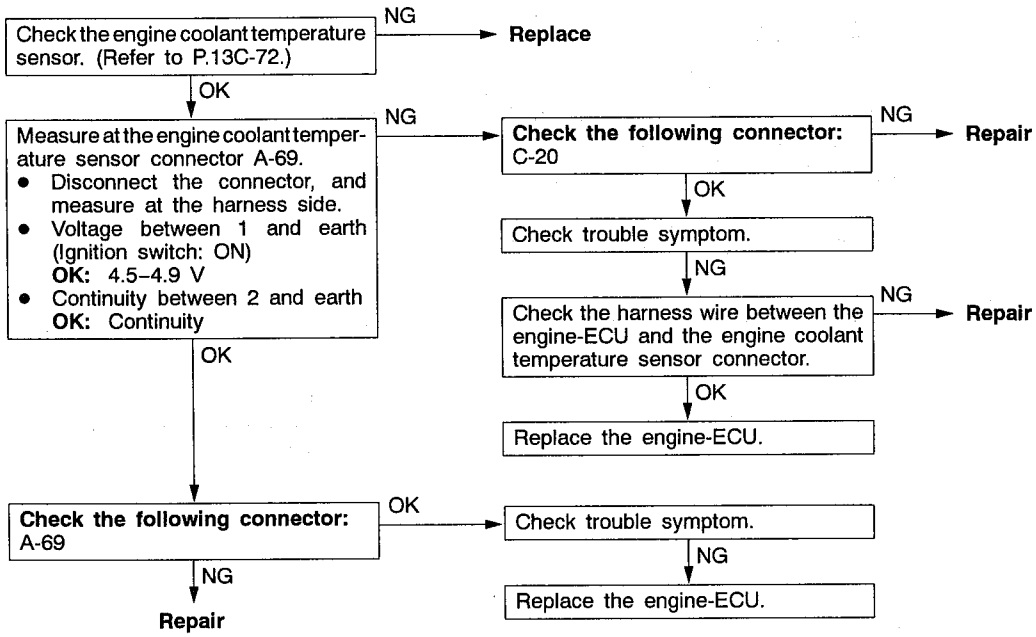
Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions • Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature 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



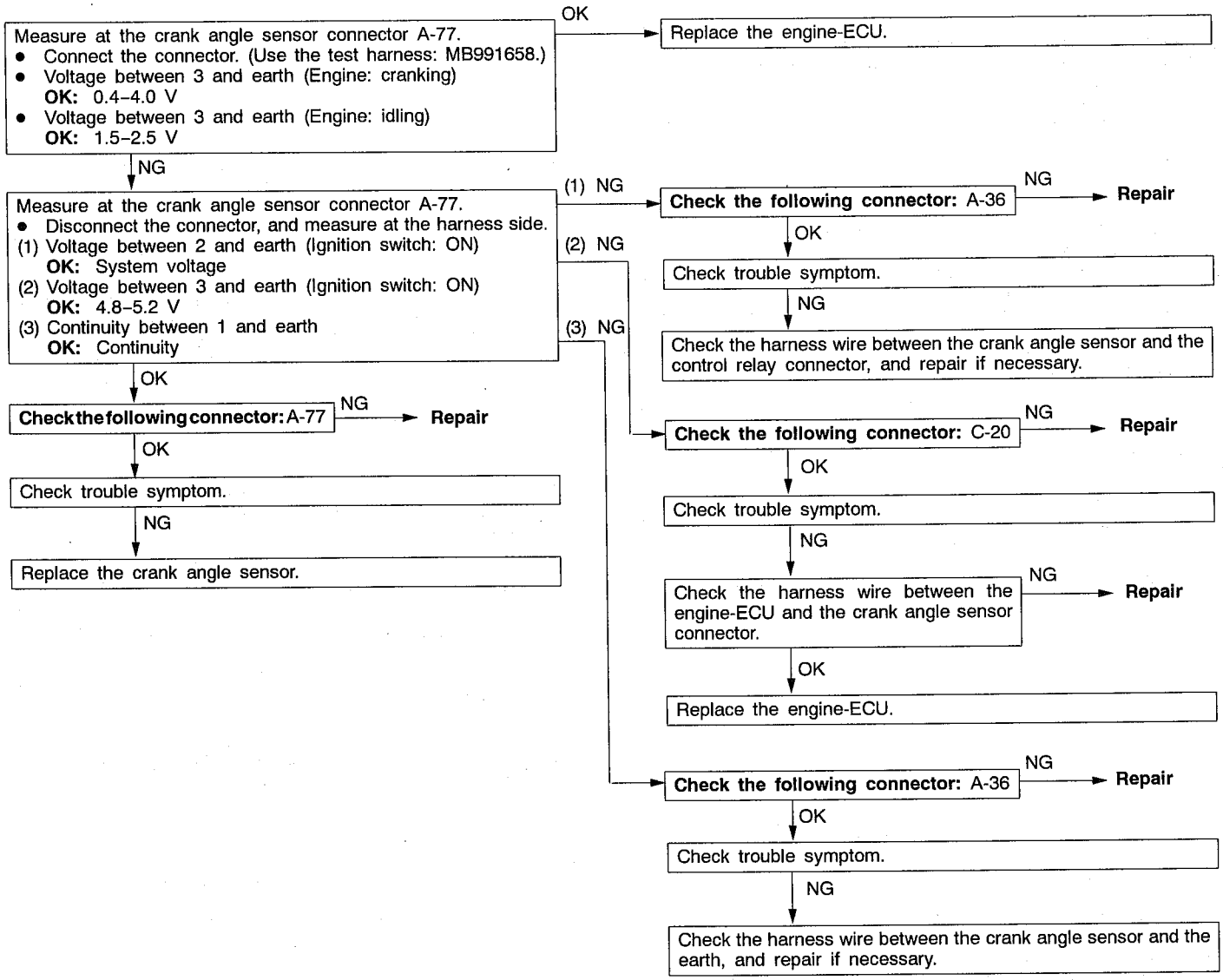
Code No.14 Throttle position sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions • Engine speed is 3,000 r/min or less, and volumetric efficiency is 30% or less, TPS output voltage is 4.6 V or more for 4 seconds. or • Engine speed is 2,000 r/min or more, and volumetric efficiency is 60% or more, TPS output voltage is 0.8 V or less for 4 seconds.	• Malfunction of the throttle position sensor • Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit • Malfunction of the engine-ECU



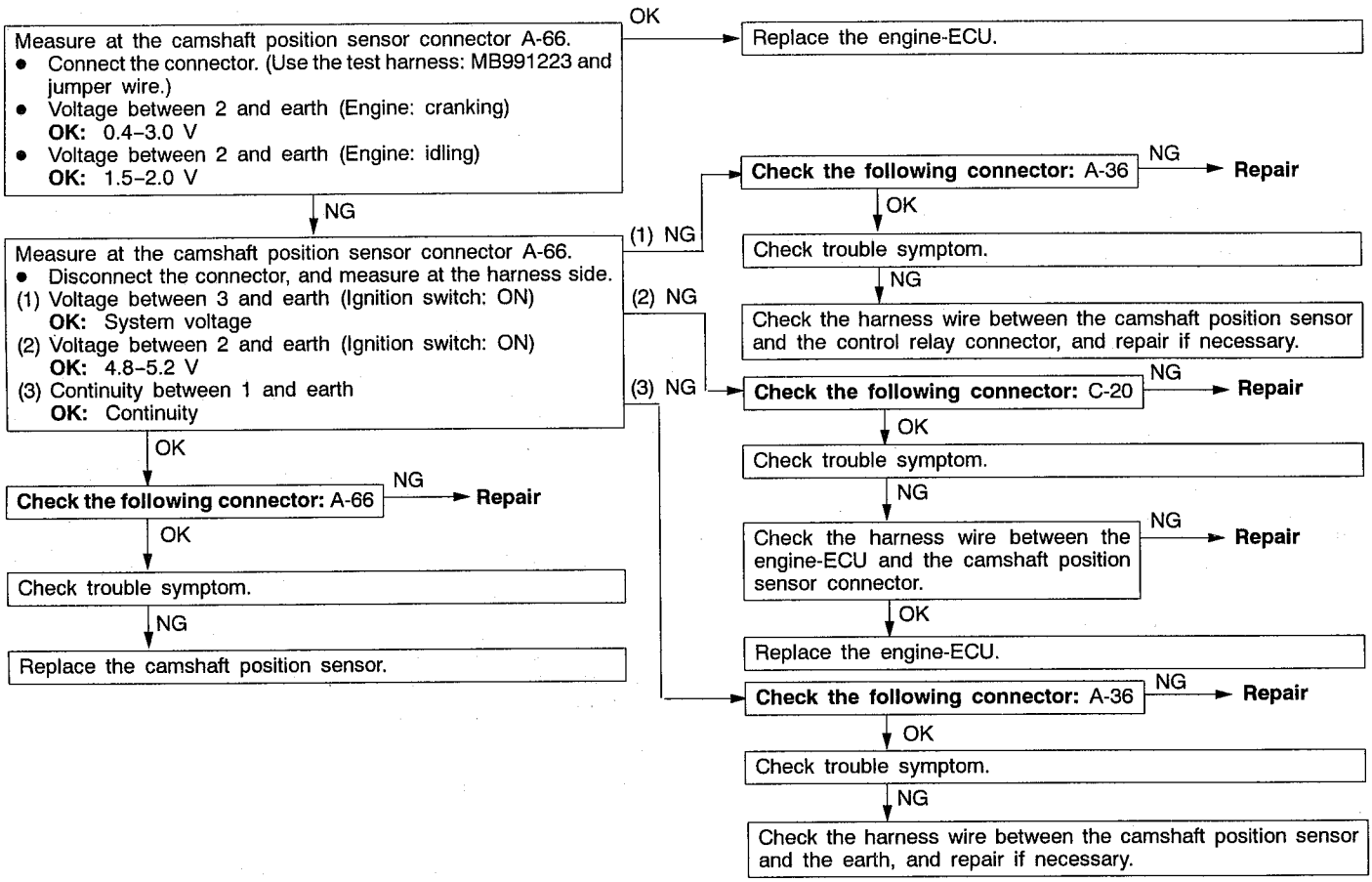
Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions • Sensor output voltage is 4.6 V or more (corresponding to an engine coolant 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.	



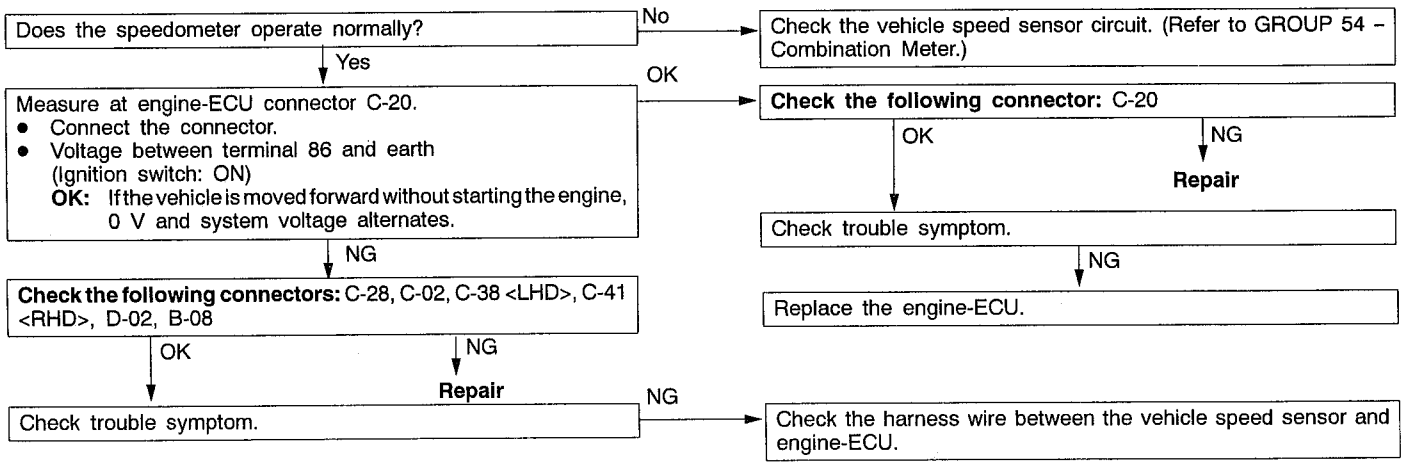
Code No. 22 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the crank angle sensor • Improper connector contact, open circuit or short-circuited harness wire of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



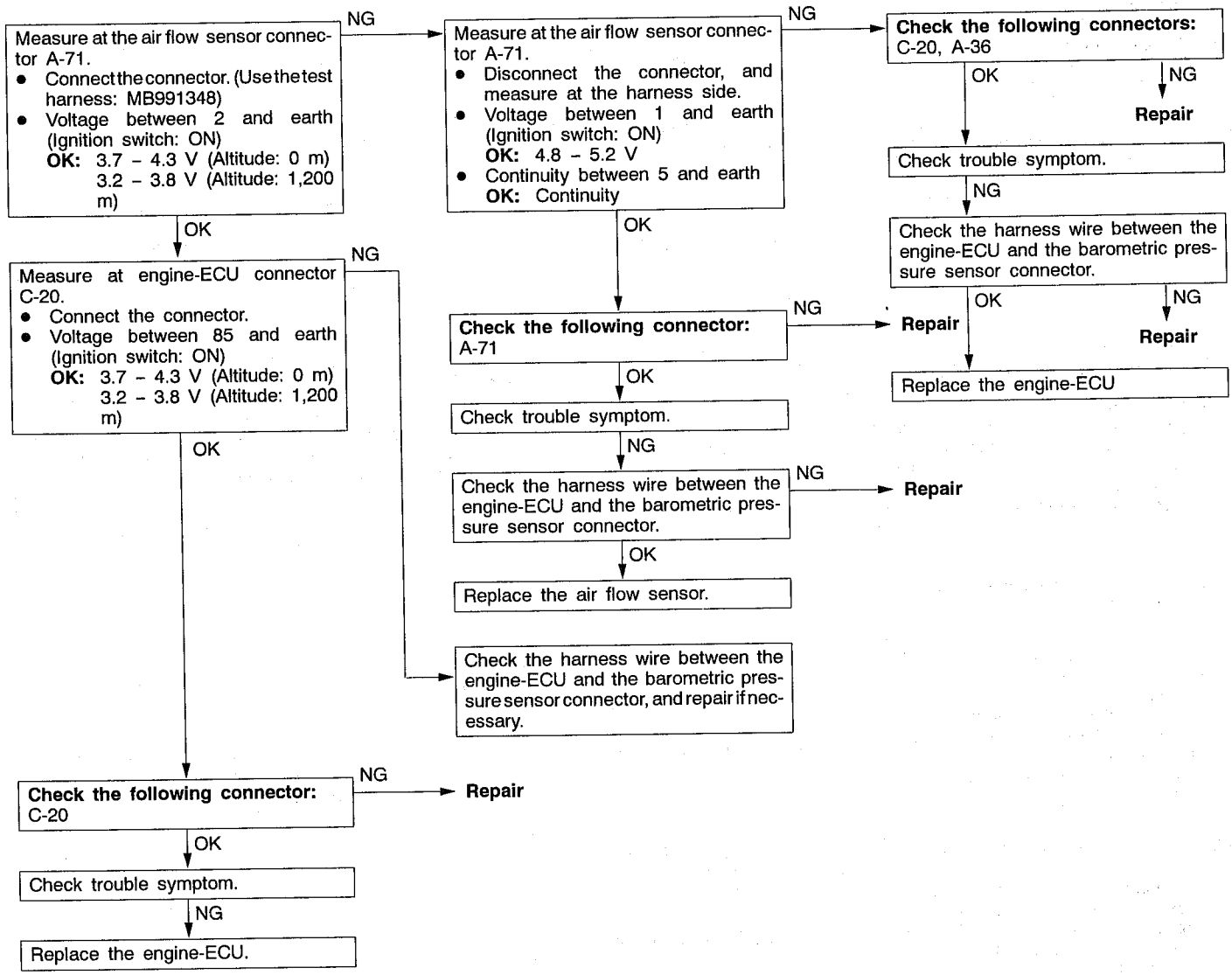
Code No. 23 Camshaft position sensor system	Probable cause
Range of Check • Ignition switch: ON • Engine speed is approx. 50 r/min or more. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the camshaft position sensor • Improper connector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



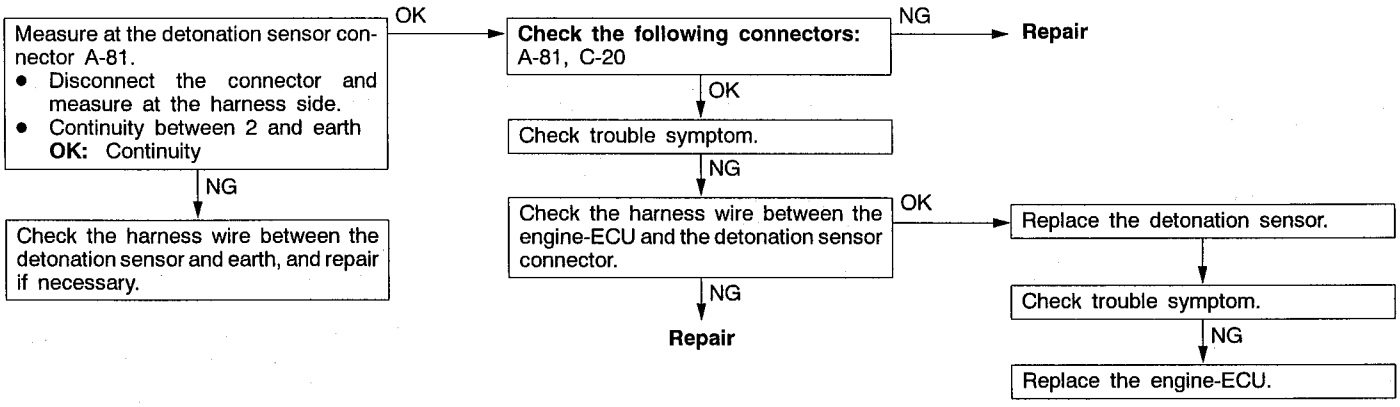
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. • Engine speed is 3,000 r/min or more. • Driving under high engine load conditions. Set conditions • Sensor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



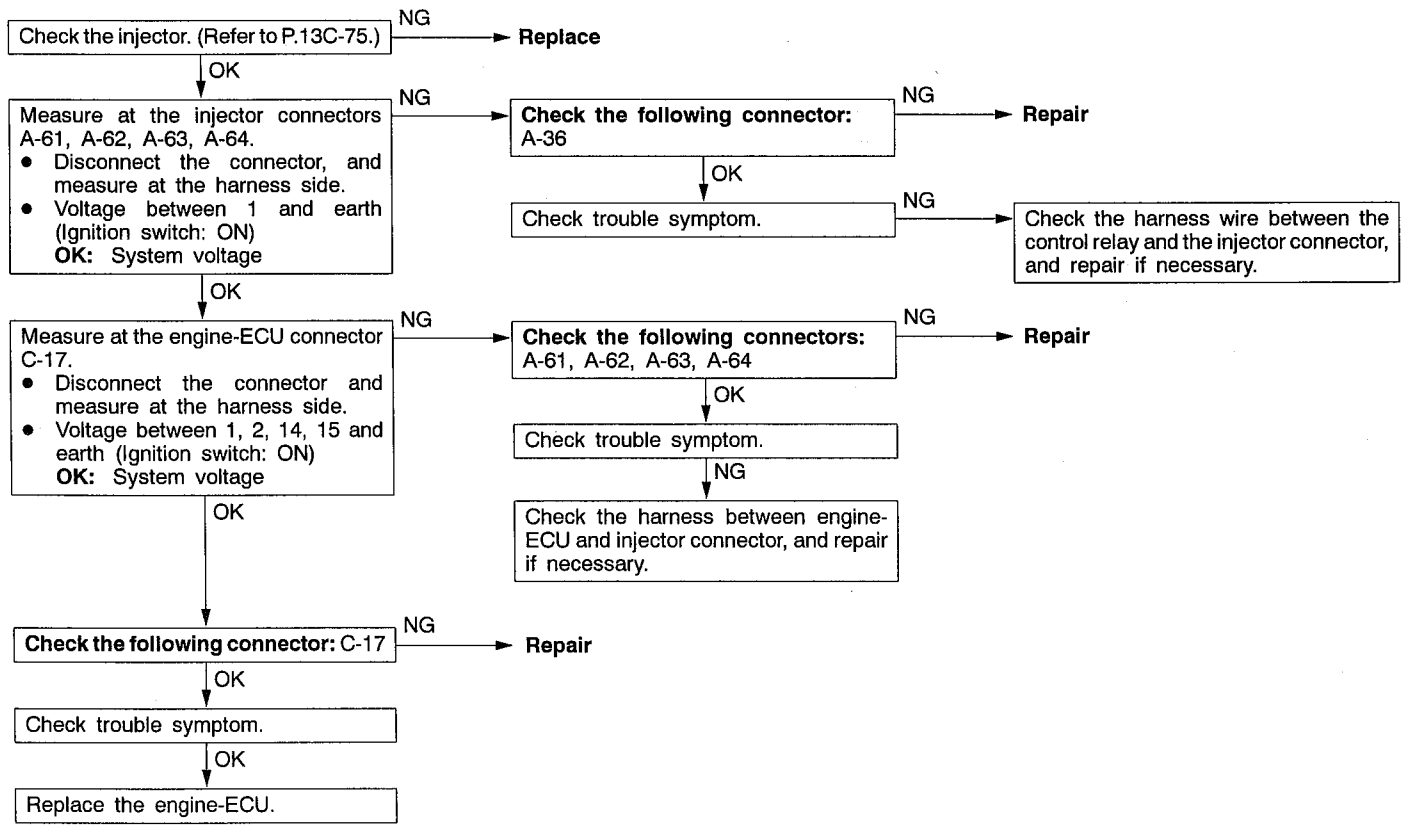
Code No. 25 Barometric pressure sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. • Battery voltage is 8 V or more. Set conditions • Sensor output voltage is 4.5 V or more (corresponding 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



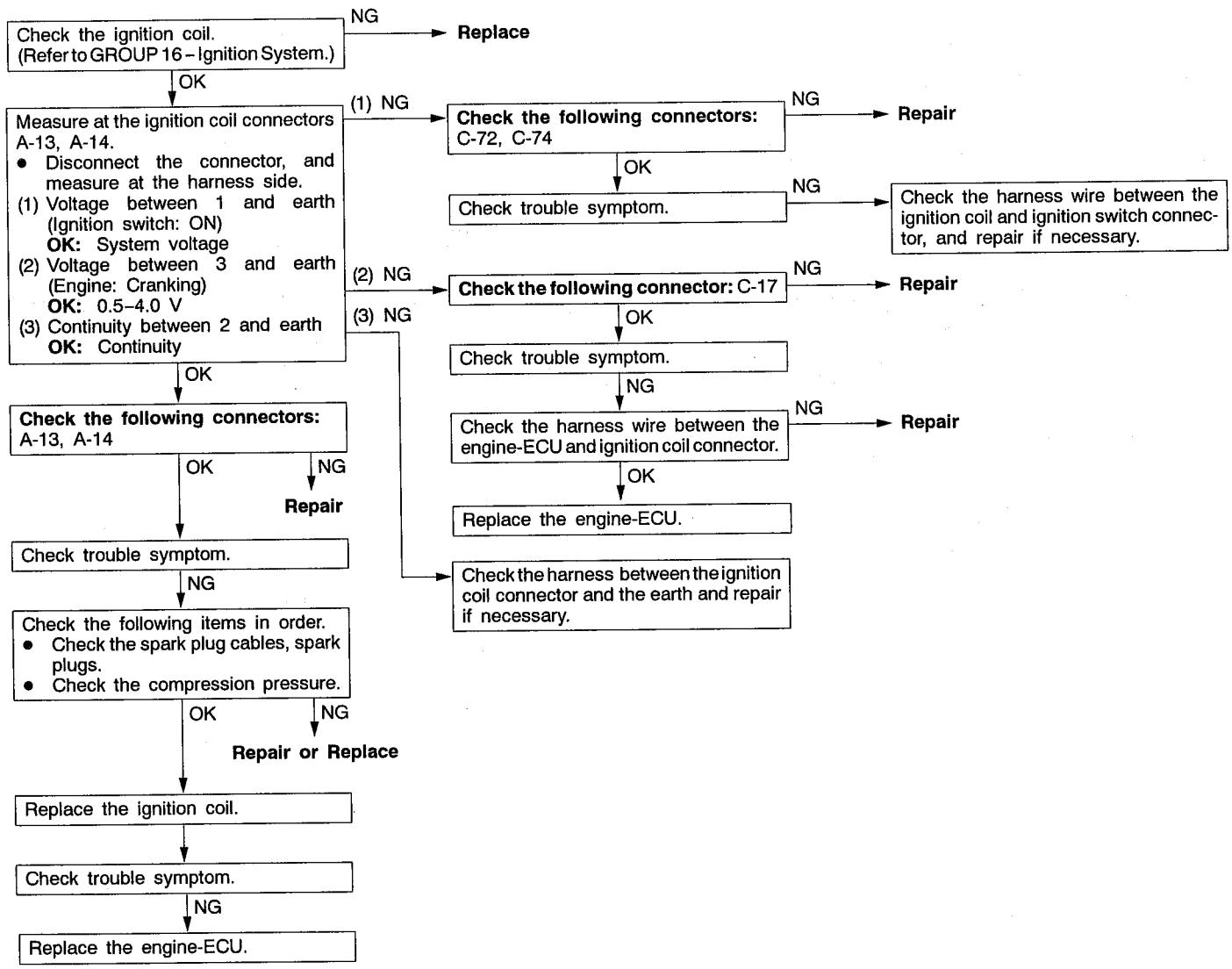
Code No. 31 Detonation sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. • Engine speed is approx. 5,000 r/min or more Set conditions The change in the detonation sensor output voltage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



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

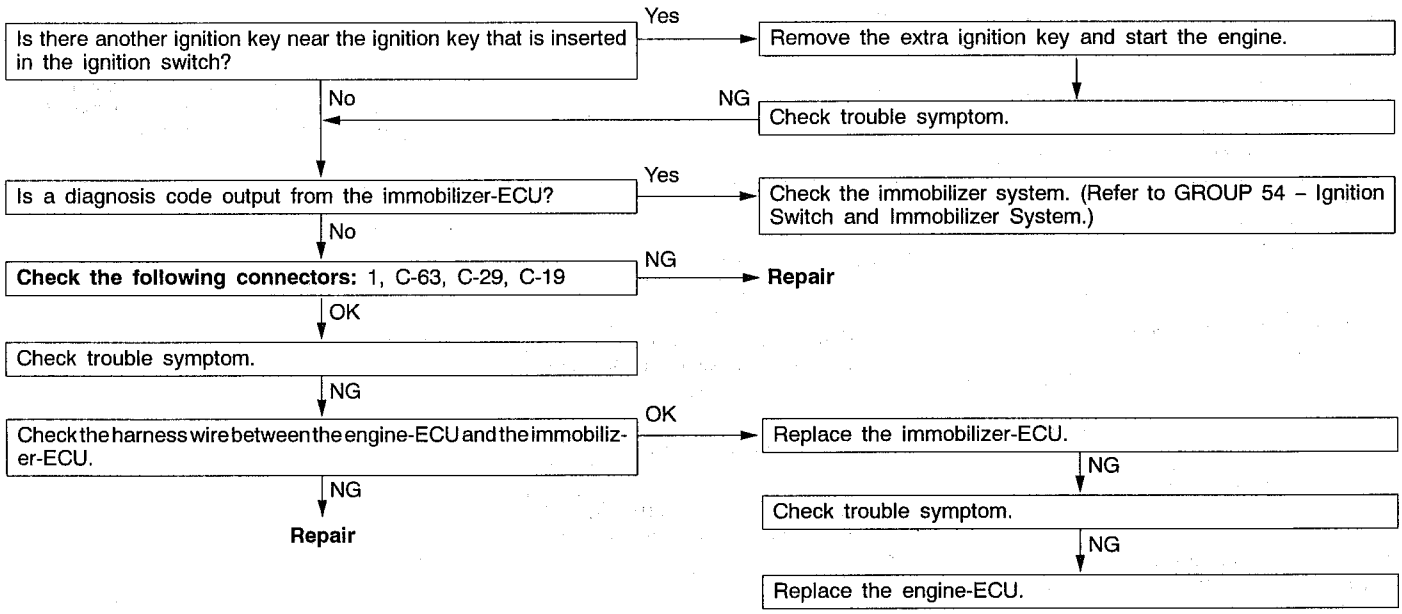


Code No. 44 Ignition coil system	Probable cause
Range of Check • Engine speed is approx. 50–4,000 r/min • Except deceleration and rapid acceleration/deceleration. Set conditions • Misfiring occurs more than the specified number of times in cylinders No.1 and No.4, or No.2 and No.3 every 1,000 r/min of the engine speed.	• Malfunction of the ignition coil • Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit • Malfunction of the spark plug and spark plug cable. • Faulty compression • Malfunction of the engine-ECU

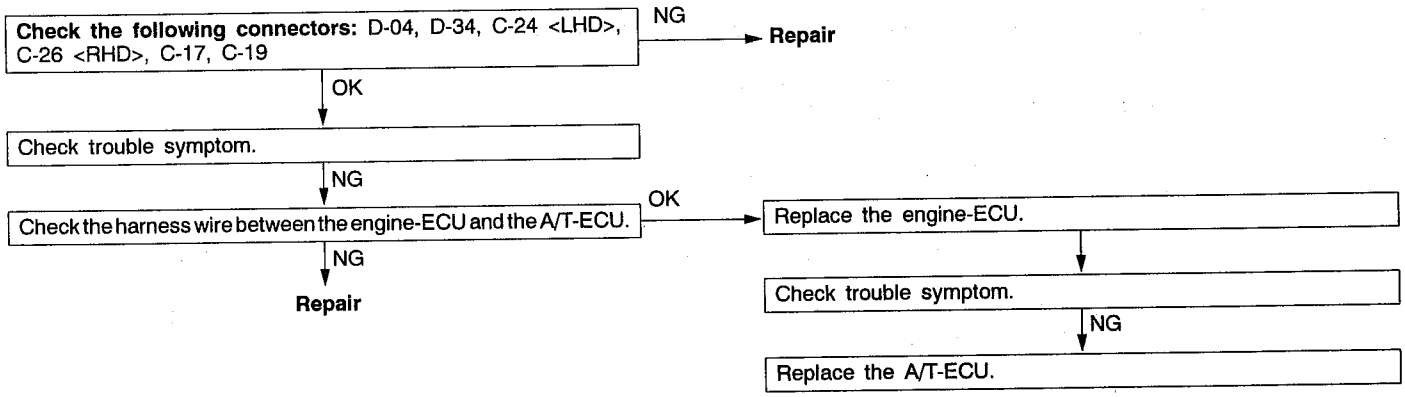


Code No.54 Immobilizer system <Australia, New Zealand and South Africa>	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Improper communication between the engine-ECU and immobilizer-ECU	• Radio interference of ID codes • Incorrect ID code • Malfunction of harness or connector • Malfunction of immobilizer-ECU • Malfunction of engine-ECU

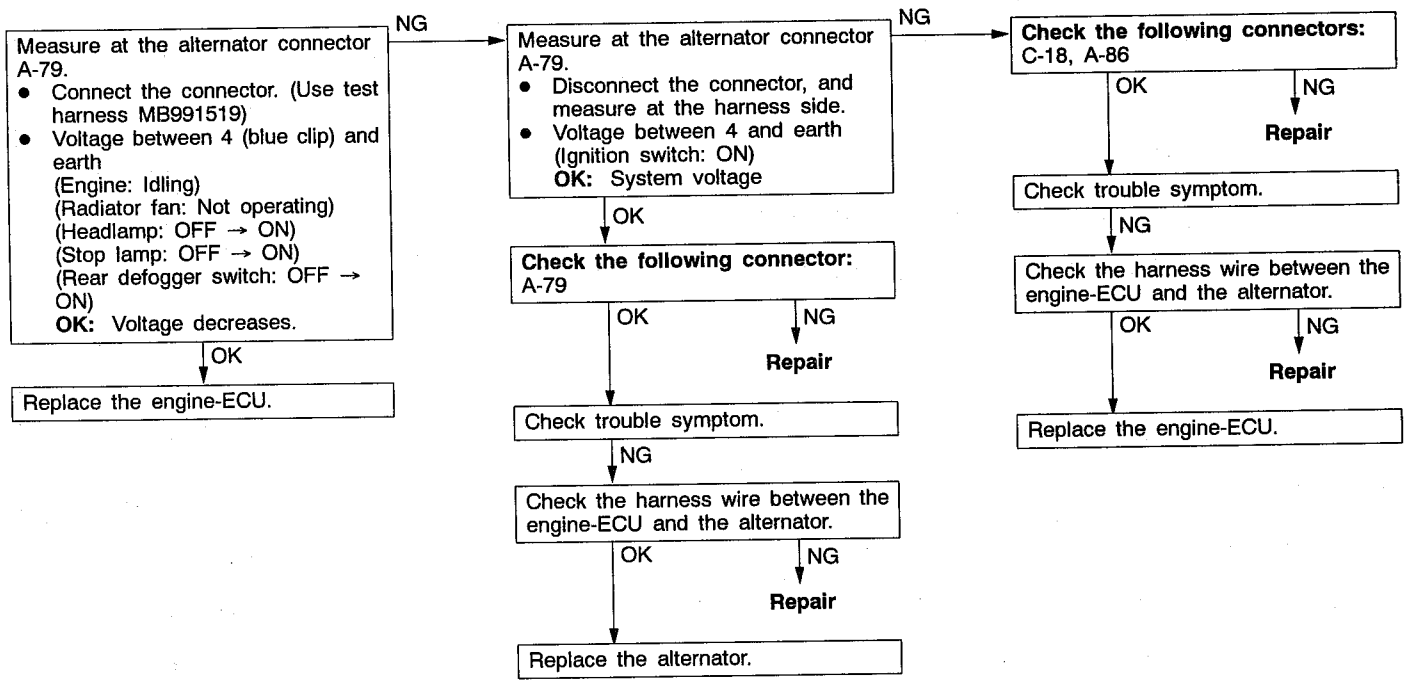
NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



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



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



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13C-26
	Communication with engine-ECU only is not possible.	2	13C-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	13C-27
	The engine warning lamp remains illuminating and never goes out.	4	13C-27
Starting	No initial combustion (starting impossible)	5	13C-28
	Initial combustion but no complete combustion (starting impossible)	6	13C-29
	Long time to start (improper starting)	7	13C-30
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13C-31
	Idling speed is high. (Improper idling speed)	9	13C-33
	Idling speed is low. (Improper idling speed)	10	13C-33
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13C-34
	When the engine becomes hot, it stalls at idling. (Die out)	12	13C-35
	The engine stalls when starting the car. (Pass out)	13	13C-37
	The engine stalls when decelerating.	14	13C-37
Driving	Hesitation, sag or stumble	15	13C-38
	The feeling of impact or vibration when accelerating	16	13C-39
	The feeling of impact or vibration when decelerating	17	13C-39
	Poor acceleration	18	13C-40
	Surge	19	13C-41
	Knocking	20	13C-42
Dieseling		21	13C-42
Too high CO and HC concentration when idling		22	13C-42
Low alternator output voltage (approx. 12.3 V)		23	13C-44
Fans (radiator fan, A/C condenser fan) are inoperative		24	13C-44

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

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

Fig. 1

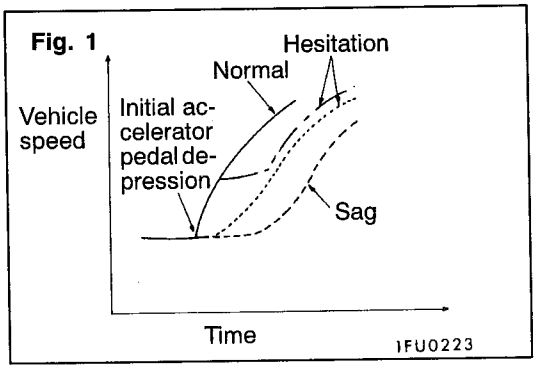
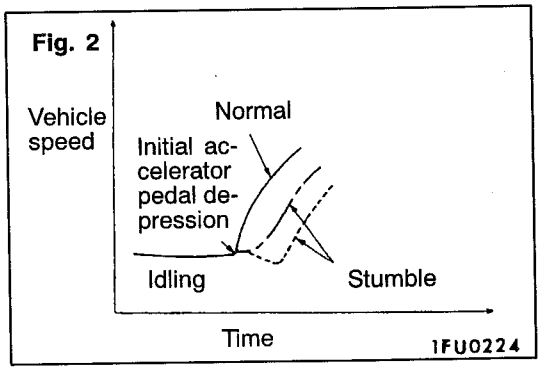


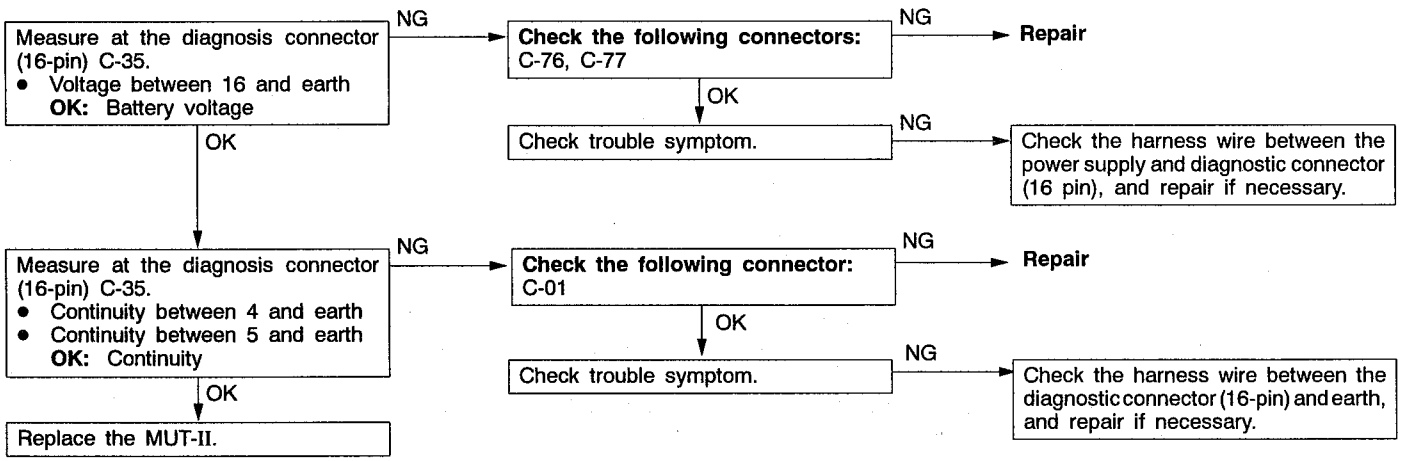
Fig. 2



INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

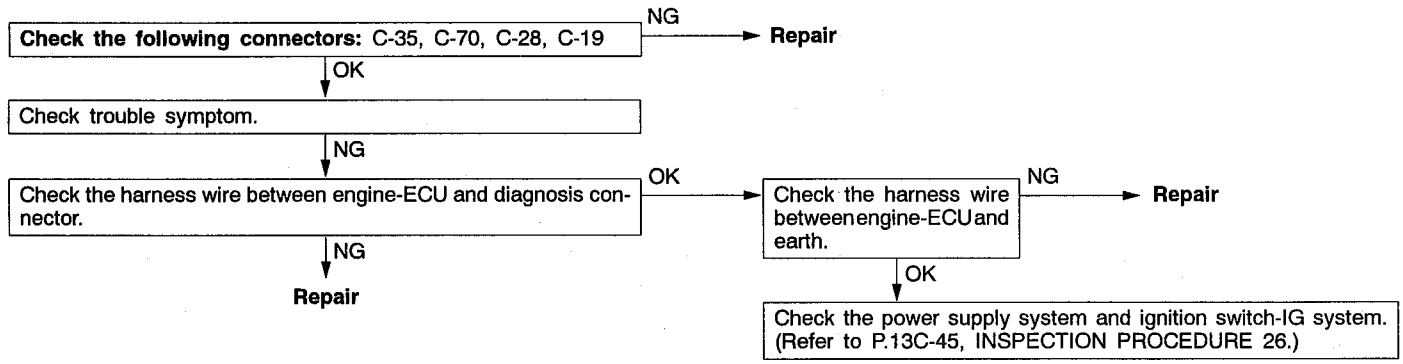
INSPECTION PROCEDURE 1

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



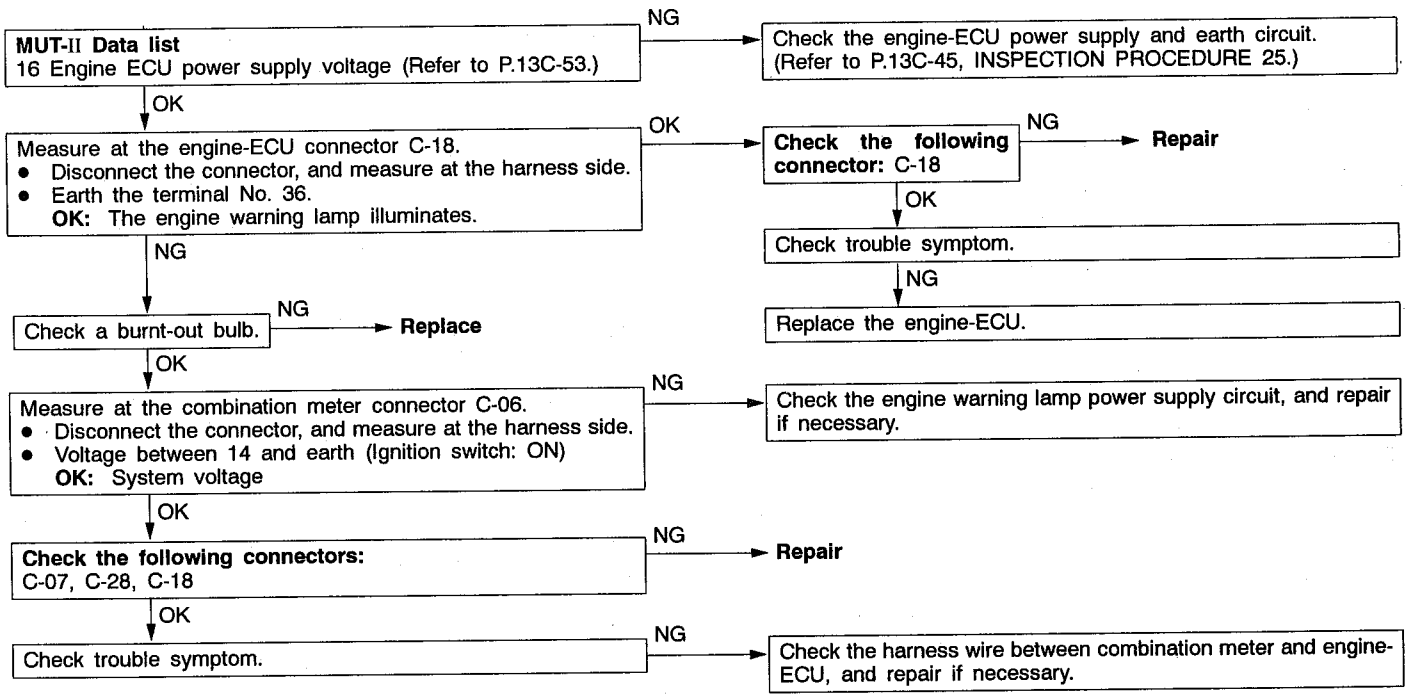
INSPECTION PROCEDURE 2

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



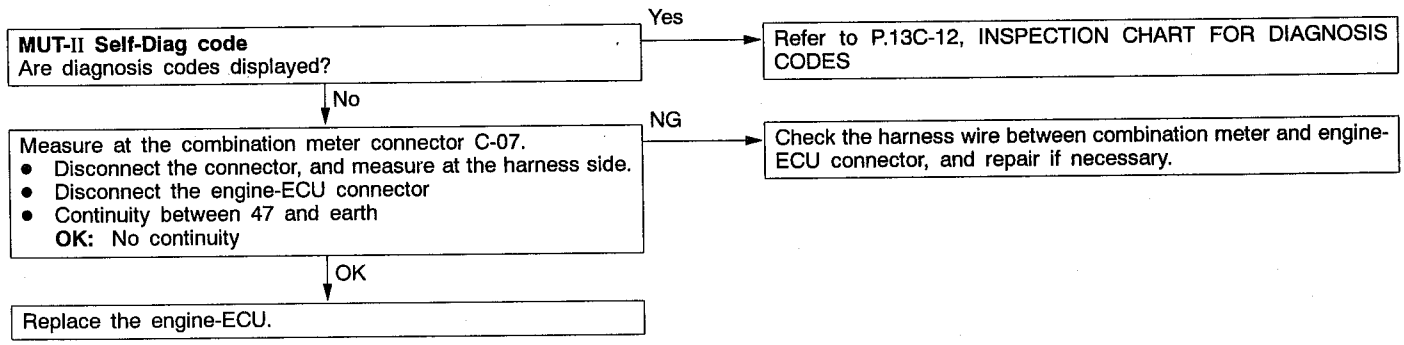
INSPECTION PROCEDURE 3

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



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

MUT-II Data list
16 Voltage of engine-ECU power source (Refer to P.13C-53.)
- NG → Check the power supply system and ignition switch-IG system. (Refer to P.13C-45, INSPECTION PROCEDURE 26.)
- OK ↓

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

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

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

MUT-II Actuator test
07 Fuel pump (Refer to P.13C-56)
- NG → Check the fuel pump system. (Refer to P.13C-46, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

Can any sound be heard from the injectors when cranking?
- NG → Check the injector system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

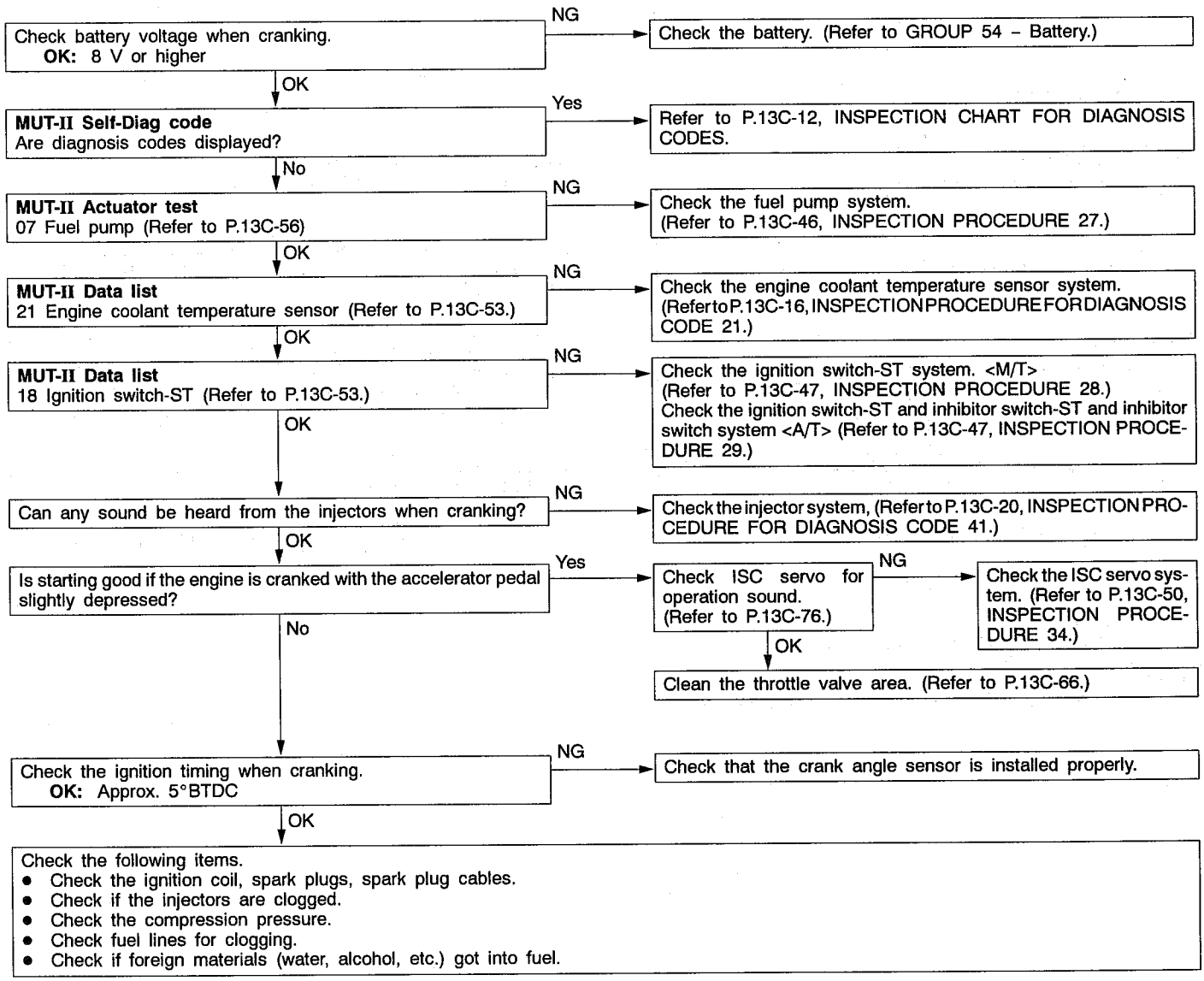
Does the engine tachometer display the cranking speed?
- Set the tachometer of primary voltage detection type.
- NG → Check the ignition coil system. (Refer to P.13C-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)
- OK ↓

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

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

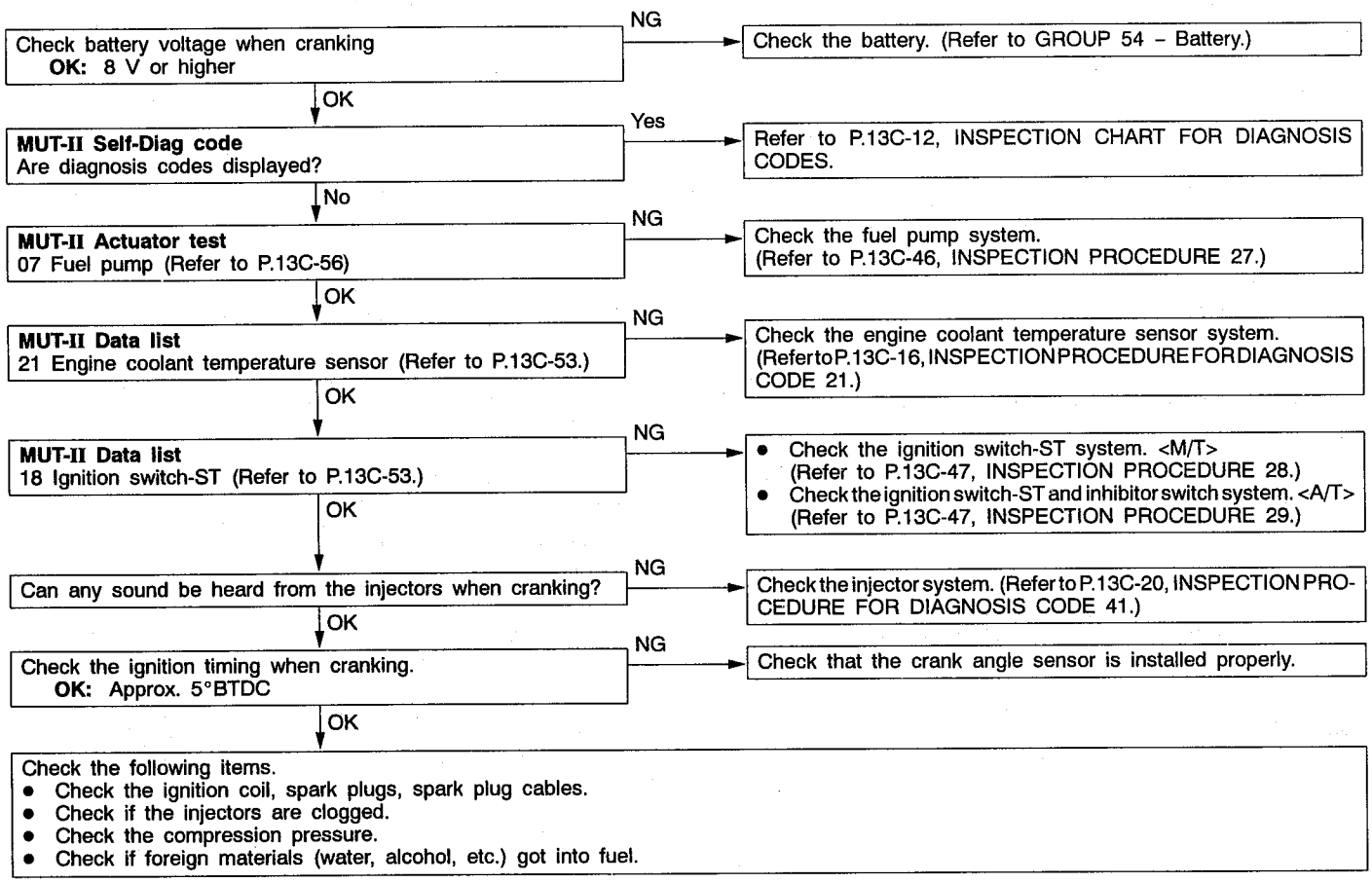
INSPECTION PROCEDURE 6

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

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



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 <Vehicles with catalytic converter> • Malfunction of the EGR solenoid valve system • Poor compression • Drawing air into exhaust 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.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does idling speed fluctuate excessively?
- Yes → Check the throttle body. (Refer to P.13C-66.)
  - 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.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13C-76.)
- NG → Check the ISC servo system. (Refer to P.13C-50, INSPECTION PROCEDURE 34.)
- OK ↓

Check the injector for operation sound.
- NG → Check the injector system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
- NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-52.)
- NG → Check the intake air temperature sensor system. (Refer to P.13C-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve <Vehicles with catalytic converter> (Refer to P.13C-56.)
- NG → Check the purge control solenoid valve system. <Vehicles with catalytic converter> (Refer to P.13C-51, INSPECTION PROCEDURE 35.)
- OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
- OK ↓

MUT-II Data list
17 Mixture adjusting screw (variable resistor) <Vehicles without catalytic converter>
OK: 1,000 – 4,000 mV (Refer to P.13C-53.)
- NG → Check the mixture adjusting screw (variable resister) system. (Refer to P.13C-50, INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: 600 – 1,000 mV during sudden racing
- NG → Check the oxygen sensor system. (Refer to P.13C-49, INSPECTION PROCEDURE 32.)
- OK ↓

To next page

From previous page

OK

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13C-68.) 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.13C-54.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13C-48, INSPECTION PROCEDURE 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13C-54.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13C-48, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
29 Inhibitor switch <A/T> (Refer to P.13C-54.)

NG → Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13C-47, INSPECTION PROCEDURE 29.)

OK

MUT-II Data list
45 ISC servo position (Refer to P.13C-55.)

NG → Adjust the basic idle speed. (Refer to P.13C-67.)

OK

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

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

OK

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

INSPECTION PROCEDURE 9

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

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

Check the ISC servo for operation sound. (Refer to P.13C-76.)
NG → Check the ISC servo system. (Refer to P.13C-50, INSPECTION PROCEDURE 34.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13C-54.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13C-48, INSPECTION PROCEDURE 31.)
OK ↓

Basic idle speed adjustment (Refer to P.13C-67.) ↓

Check trouble symptom.
NG → Clean the throttle valve area. (Refer to P.13C-66.)

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

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

Check the ISC servo for operation sound. (Refer to P.13C-76.)
NG → Check the ISC servo system. (Refer to P.13C-50, INSPECTION PROCEDURE 34.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

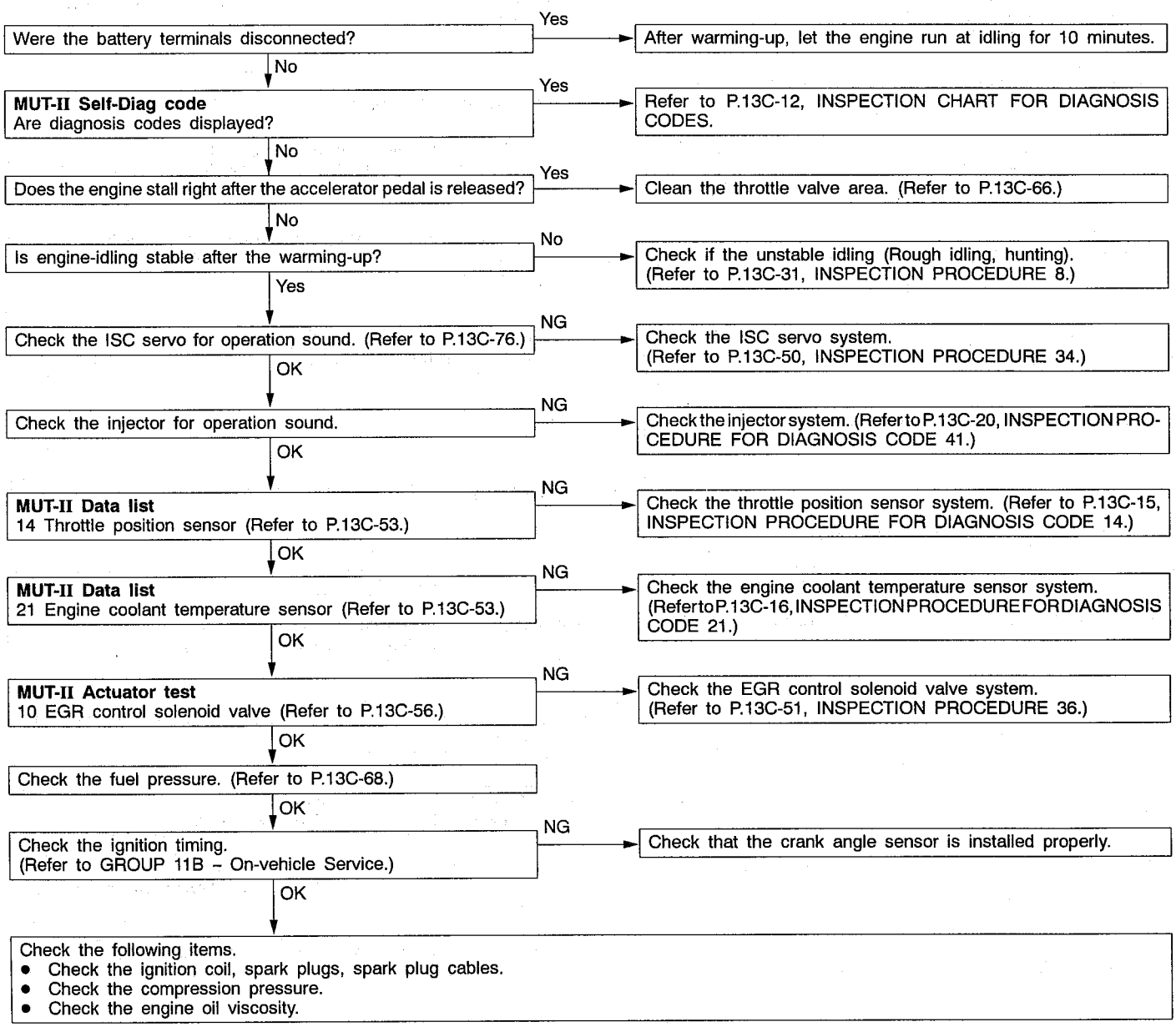
MUT-II Data list
29 Inhibitor switch <A/T> (Refer to P.13C-54.)
NG → Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13C-47, INSPECTION PROCEDURE 29.)
OK ↓

Basic idle speed adjustment (Refer to P.13C-67.) ↓

Check trouble symptom.
NG → Clean the throttle valve area. (Refer to P.13C-66.)

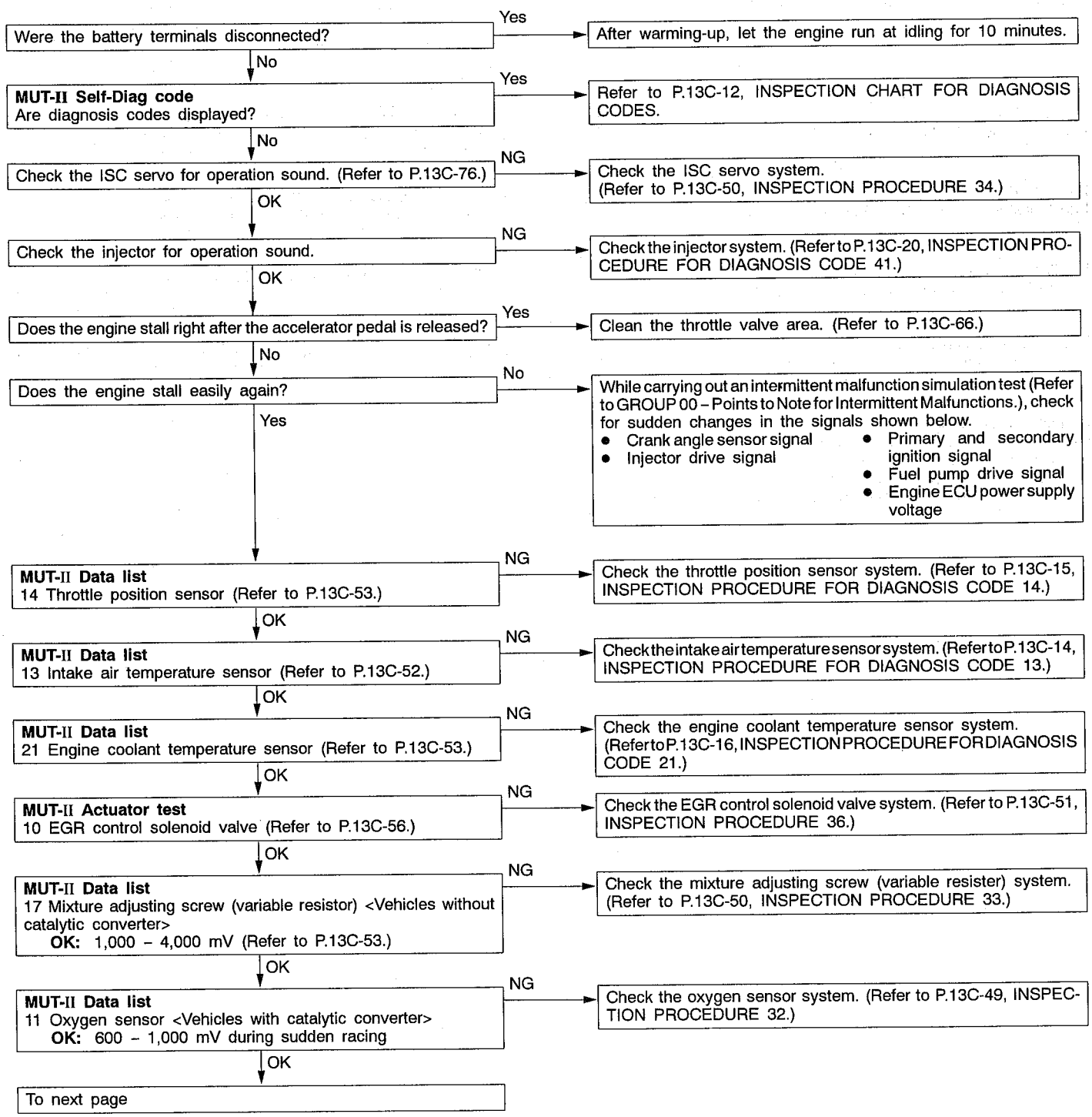
INSPECTION PROCEDURE 11

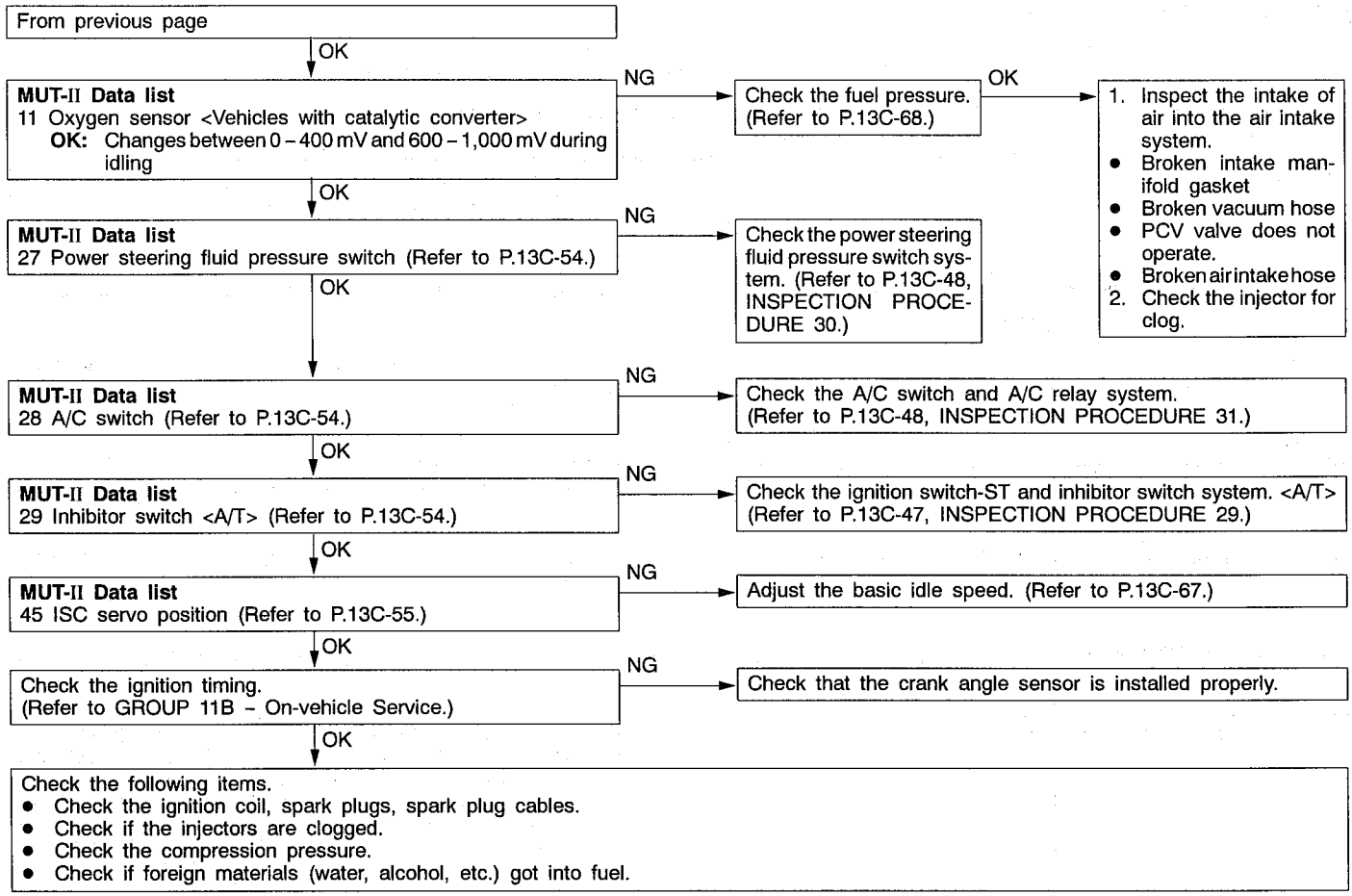
When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle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



INSPECTION PROCEDURE 12

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




From previous page
OK
MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG
Check the fuel pressure. (Refer to P.13C-68.)
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.13C-54.)
NG
Check the power steering fluid pressure switch system. (Refer to P.13C-48, INSPECTION PROCEDURE 30.)
OK
MUT-II Data list
28 A/C switch (Refer to P.13C-54.)
NG
Check the A/C switch and A/C relay system. (Refer to P.13C-48, INSPECTION PROCEDURE 31.)
OK
MUT-II Data list
29 Inhibitor switch <A/T> (Refer to P.13C-54.)
NG
Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13C-47, INSPECTION PROCEDURE 29.)
OK
MUT-II Data list
45 ISC servo position (Refer to P.13C-55.)
NG
Adjust the basic idle speed. (Refer to P.13C-67.)
OK
Check the ignition timing. (Refer to GROUP 11B – On-vehicle Service.)
NG
Check that the crank angle sensor is installed properly.
OK
Check the following items.
• Check the ignition coil, spark plugs, spark plug cables.
• Check if the injectors are clogged.
• Check the compression pressure.
• Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 13

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

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

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
- 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.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
- NG → Check the throttle position sensor system. (Refer to P.13C-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.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)
  - No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
- OK ↓

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

INSPECTION PROCEDURE 15

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

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

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

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

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-52.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
OK ↓

MUT-II Data list
17 Mixture adjusting screw (variable resistor)
<Vehicles without catalytic converter>
OK: 1,000 – 4,000 mV (Refer to P.13C-53.)
NG → Check the mixture adjusting screw (variable resistor) system. (Refer to P.13C-50, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor system. (Refer to P.13C-49, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

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

OK ↓

Check the fuel pressure. (Refer to P.13C-68.)
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.13C-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.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No

Check the ISC servo for operation sound. (Refer to P.13C-76.)
→ NG → Check the ISC servo system. (Refer to P.13C-50, INSPECTION PROCEDURE 34.)
↓ OK

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
→ NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
↓ OK

Clean the throttle valve area. (Refer to P.13C-66.)

INSPECTION PROCEDURE 18

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

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

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

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

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-52.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
OK ↓

MUT-II Data list
17 Mixture adjusting screw (variable resistor)
<Vehicles without catalytic converter>
OK: 1,000 – 4,000 mV (Refer to P.13C-53.)
NG → Check the mixture adjusting screw (variable resister) system. (Refer to P.13C-50, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor system. (Refer to P.13C-49, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

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

OK ↓

Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

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

INSPECTION PROCEDURE 19

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

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

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

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

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-52.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-53.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-53.)
NG → Check the throttle position sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-56.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-51, INSPECTION PROCEDURE 36.)
OK ↓

MUT-II Data list
17 Mixture adjusting screw (variable resistor)
<Vehicles without catalytic converter>
OK: 1,000 – 4,000 mV (Refer to P.13C-53.)
NG → Check the mixture adjusting screw (variable resister) system. (Refer to P.13C-50, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor system. (Refer to P.13C-49, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
11 Oxygen sensor <Vehicles with catalytic converter>
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

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

OK ↓

Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

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

INSPECTION PROCEDURE 20

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

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

Does knocking occur when driving with the detonation sensor connector disconnected? At this time, use the MUT-II to check if the timing is retarded compared to when the detonation sensor connector is disconnected.
No → Check the detonation sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
Yes ↓

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

INSPECTION PROCEDURE 21

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

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

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

<Vehicles without catalytic converter>

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

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

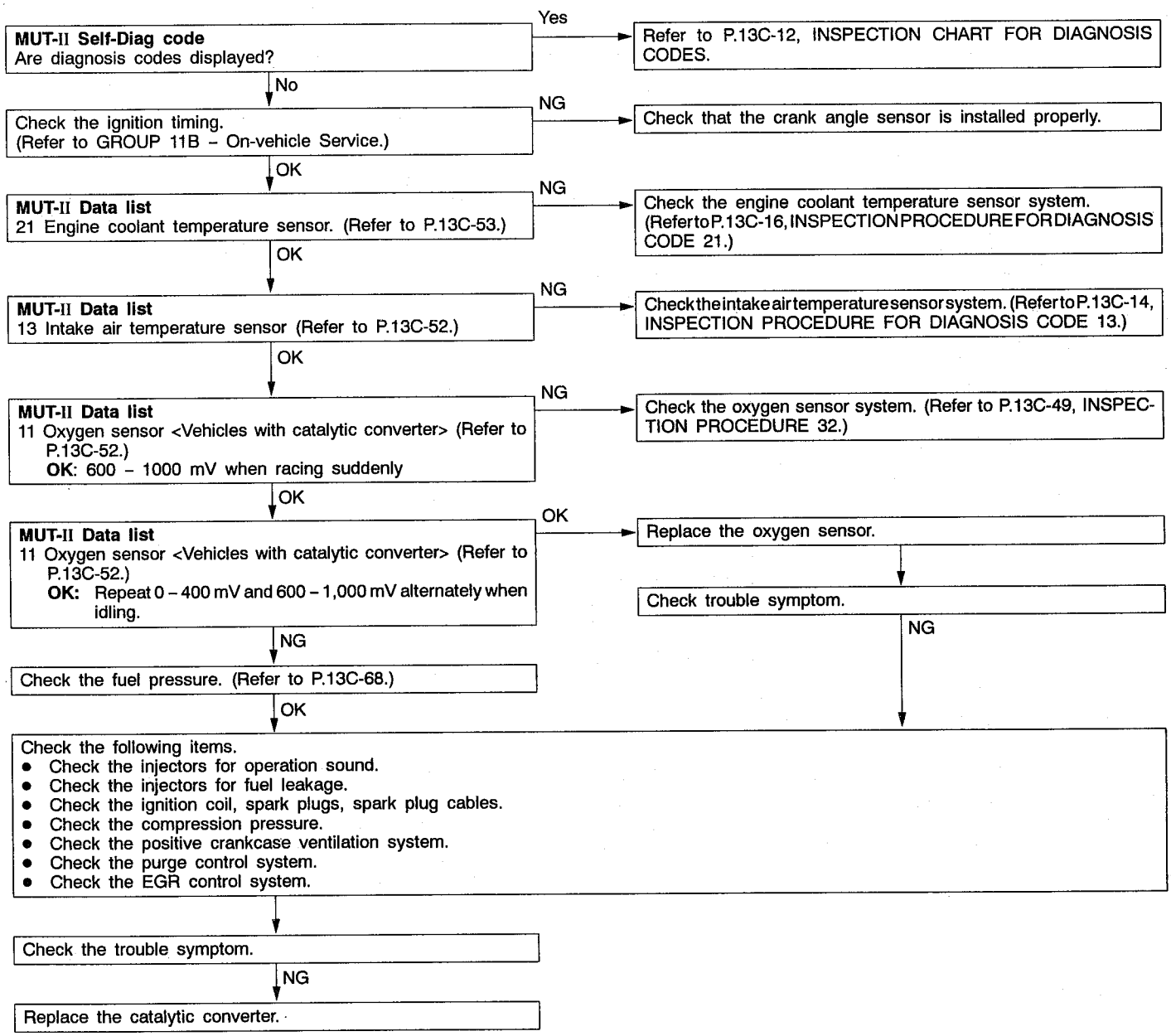
MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13C-53.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
17 Mixture adjusting screw (Variable resistor) (Refer to P.13C-53.)
OK: 1,000 – 4,000 mV
NG → Check the mixture adjusting screw (variable resistor) system. (Refer to P.13C-50, INSPECTION PROCEDURE 33.)
OK ↓

Check the fuel pressure. (Refer to P.13C-68.)
OK ↓

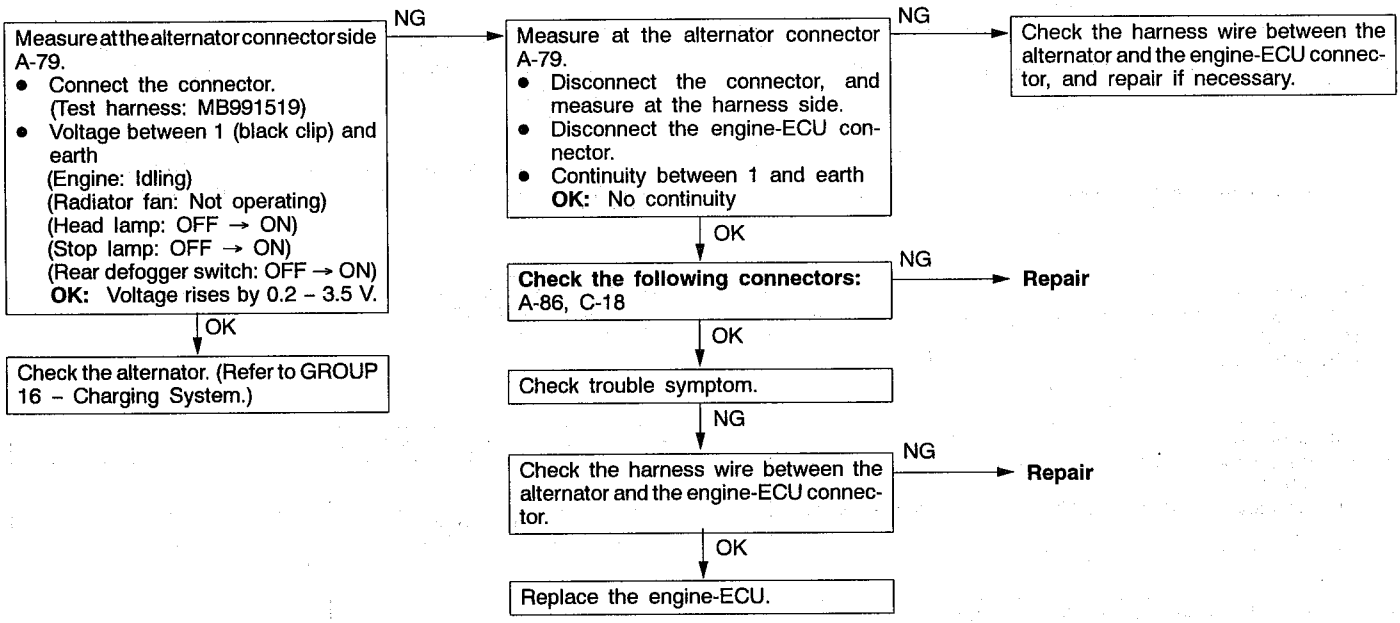
Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the EGR control system.

<Vehicles with catalytic converter>



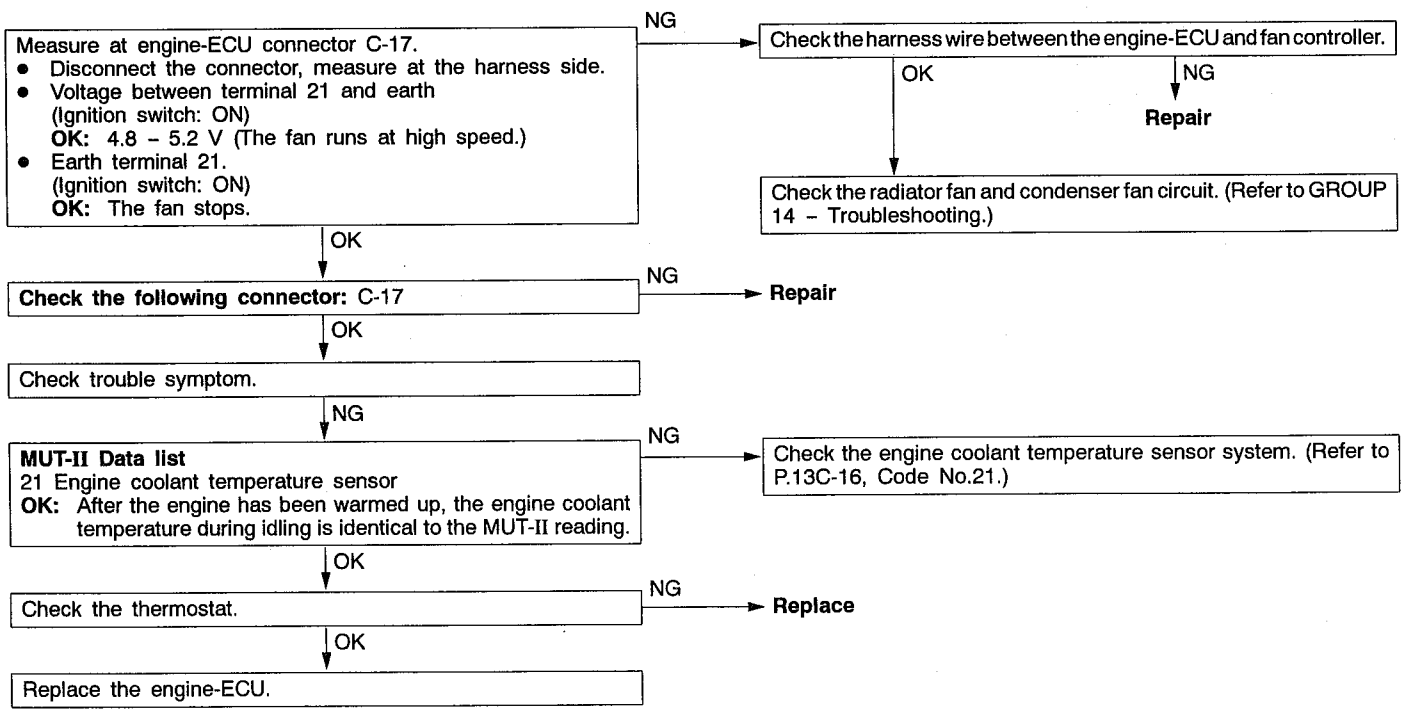
INSPECTION PROCEDURE 23

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



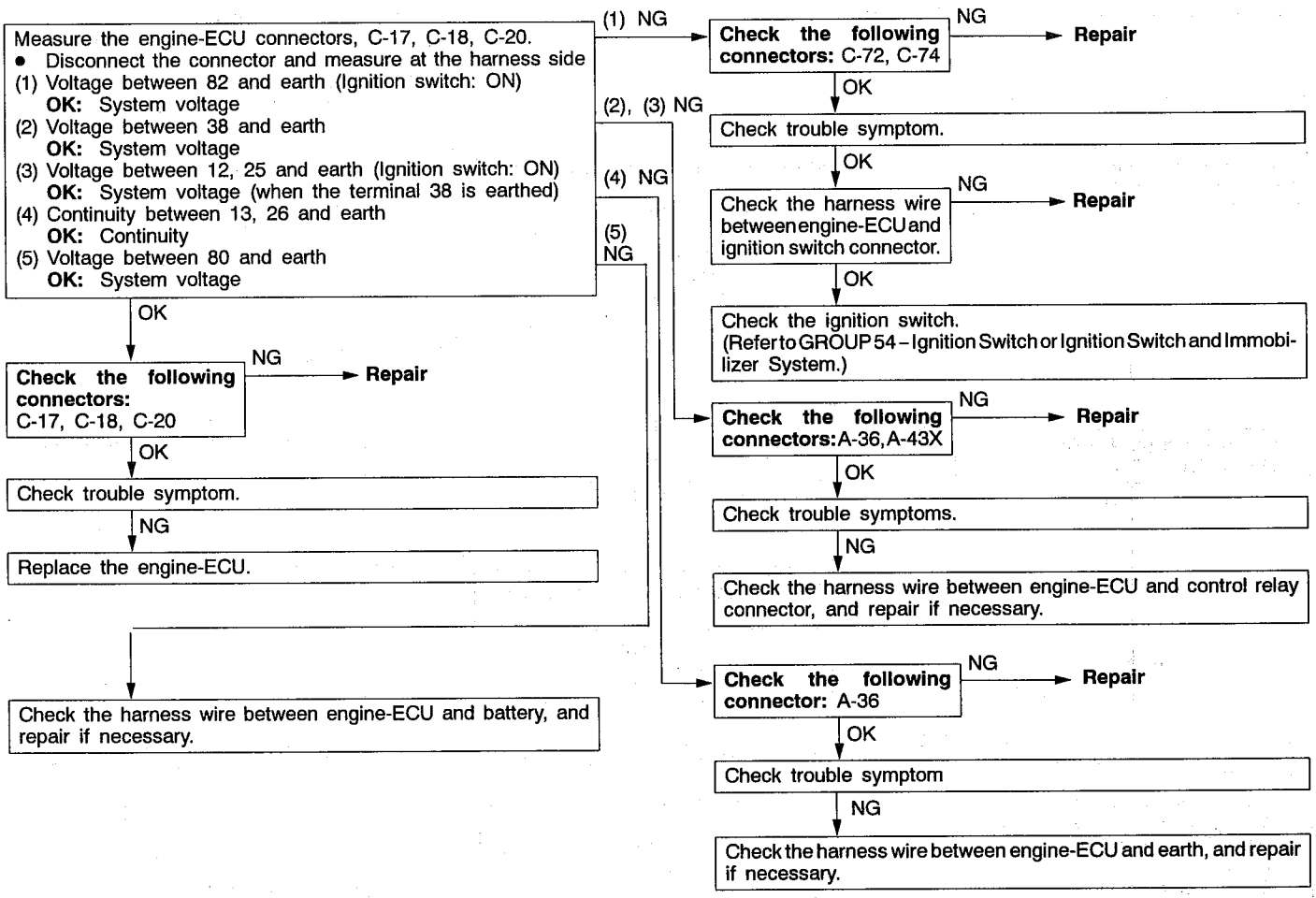
INSPECTION PROCEDURE 24

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



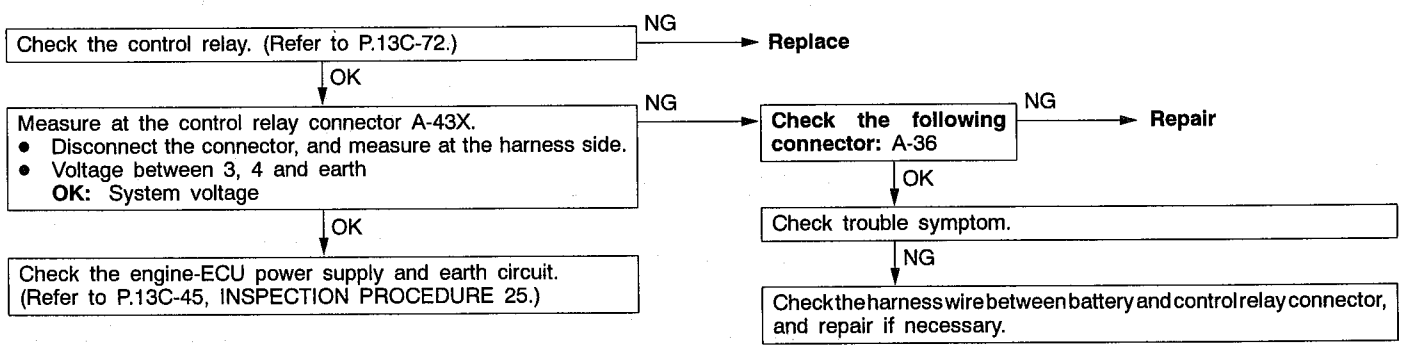
INSPECTION PROCEDURE 25

Check the engine-ECU power supply and earth circuit.



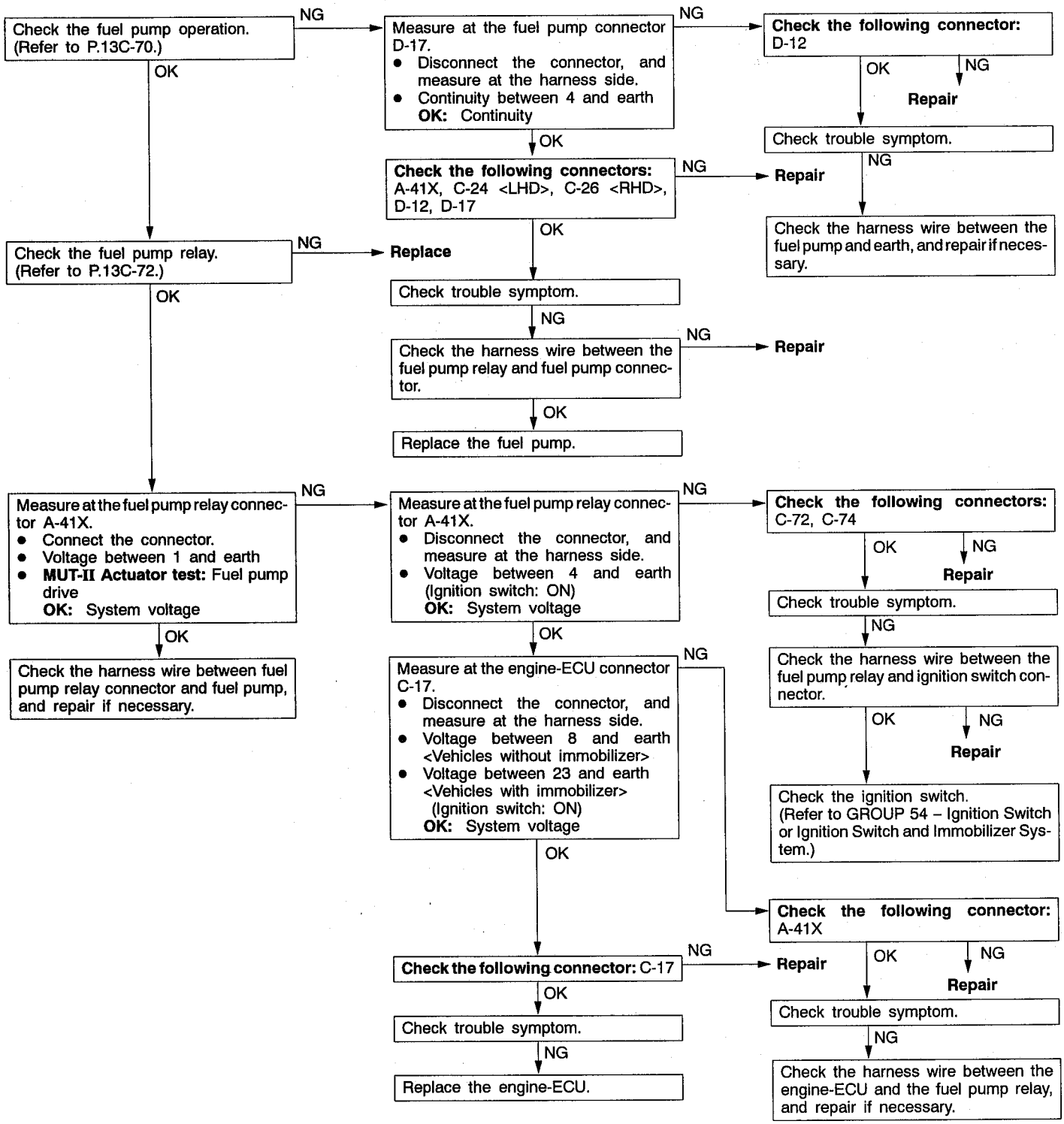
INSPECTION PROCEDURE 26

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



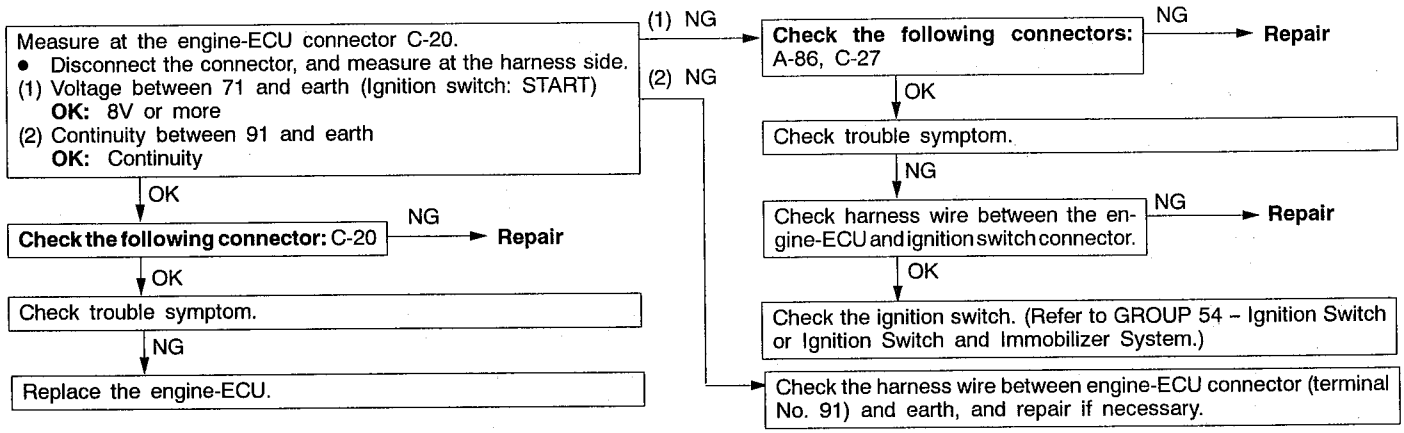
INSPECTION PROCEDURE 27

Fuel pump system	Probable cause
The engine-ECU turns the fuel pump 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



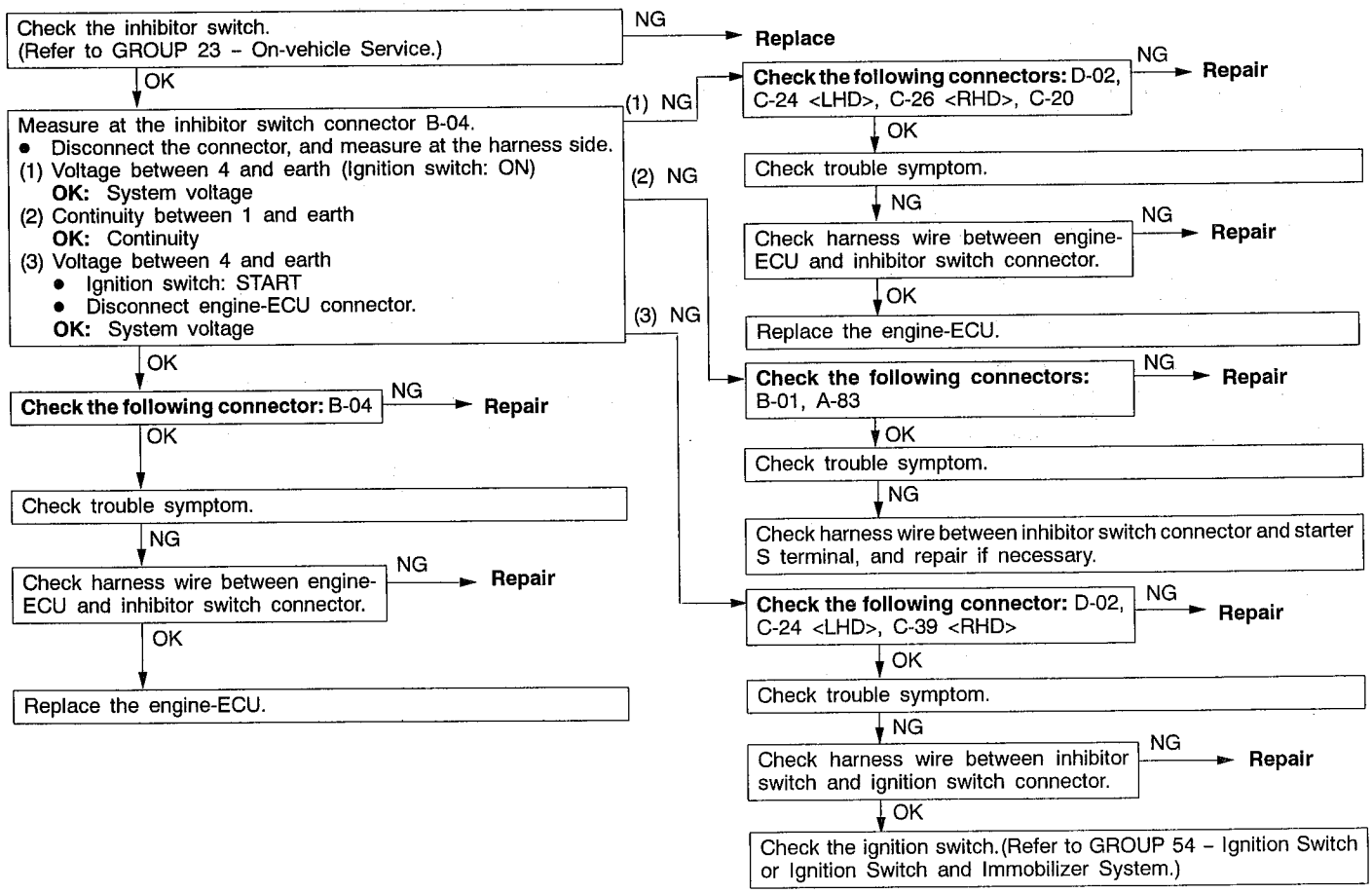
INSPECTION PROCEDURE 28

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



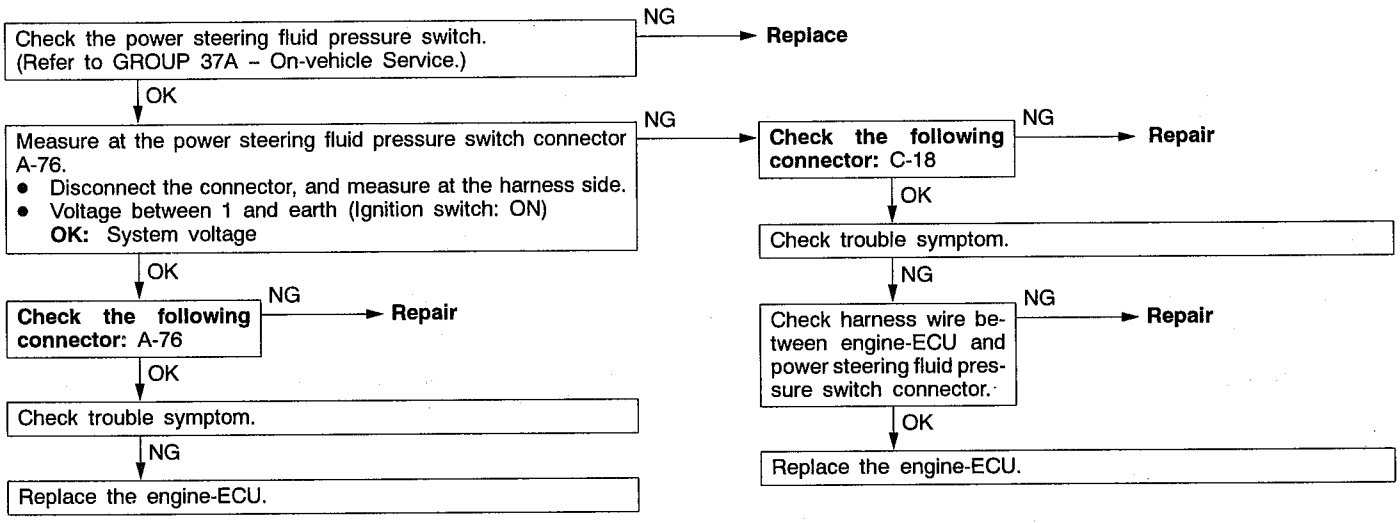
INSPECTION PROCEDURE 29

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



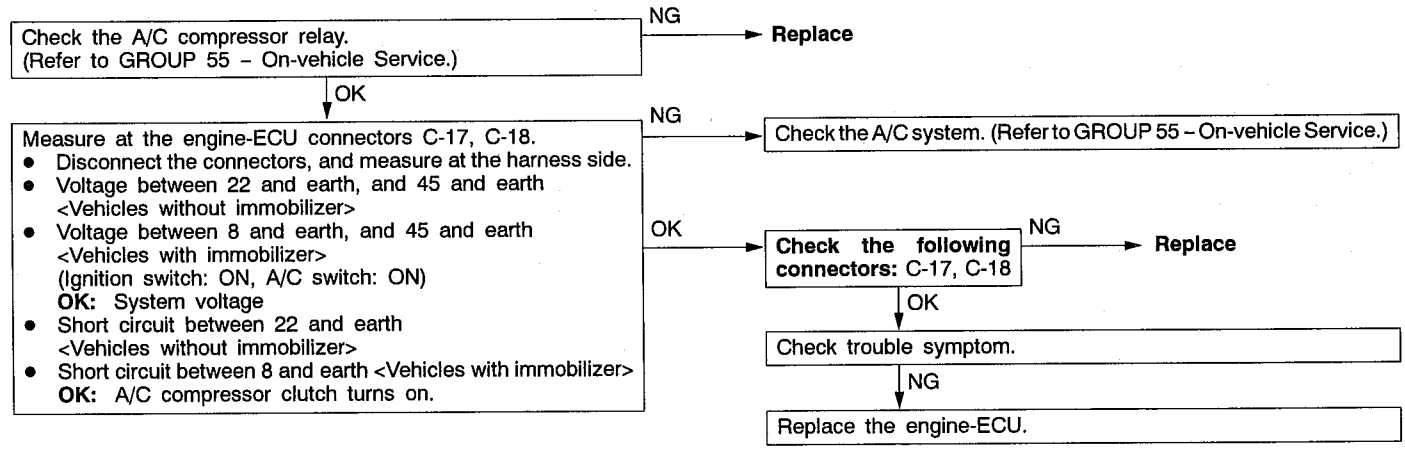
INSPECTION PROCEDURE 30

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



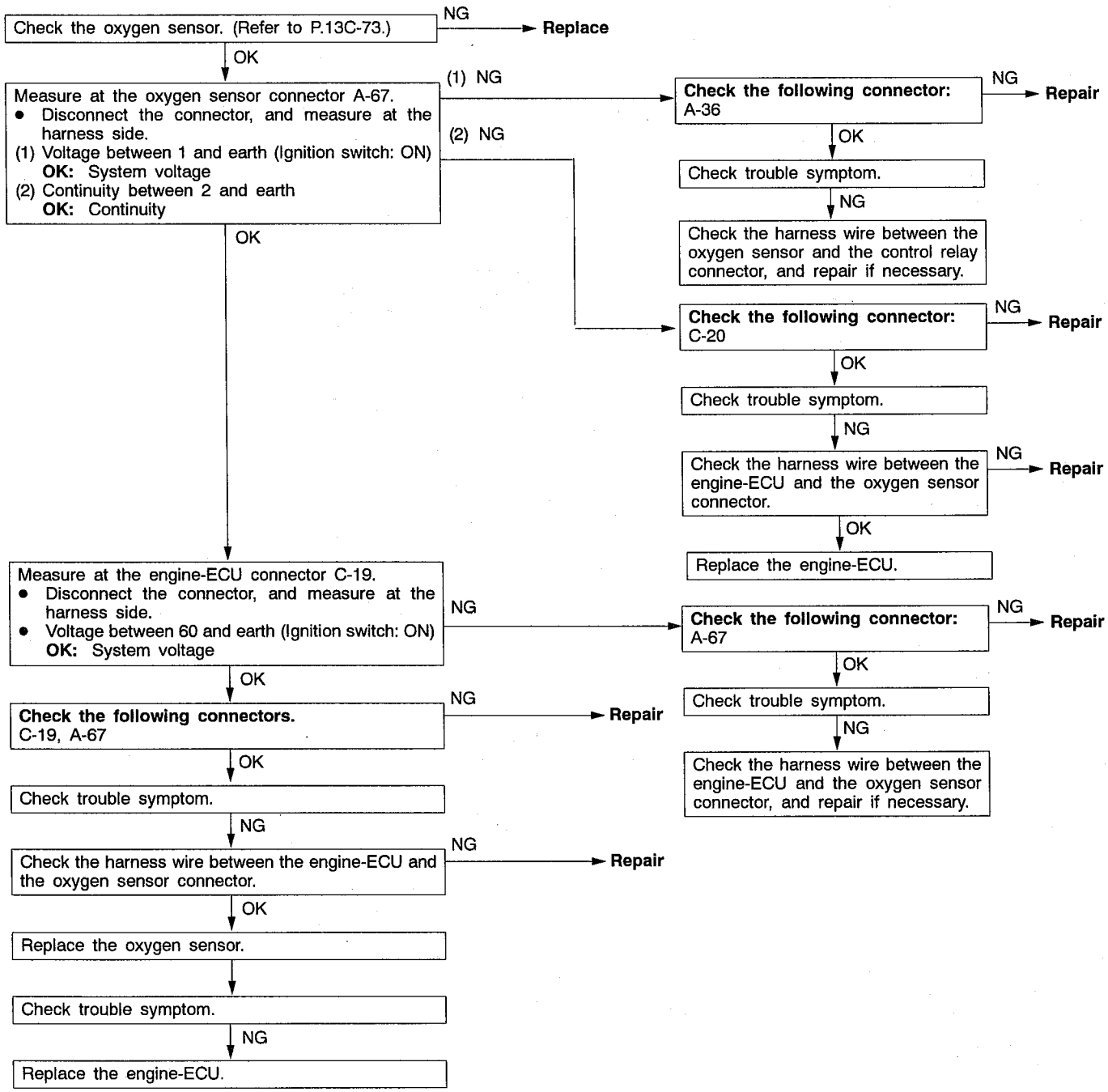
INSPECTION PROCEDURE 31

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



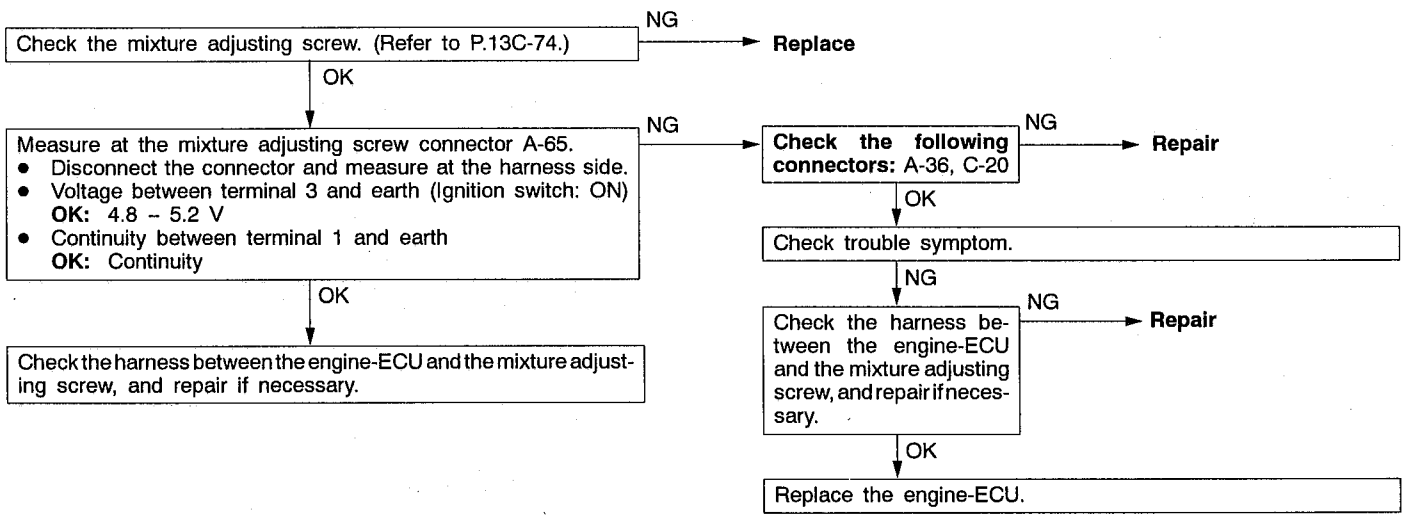
INSPECTION PROCEDURE 32

Oxygen sensor system <Vehicles with catalytic converter>	Probable cause
If the CO and HC contents are high, the probable causes mentioned to the right column are suspected. • The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage, and sends the voltage to the engine-ECU. • The engine-ECU controls the fuel injection amount to adjust the air/fuel ratio to theoretical one.	• Malfunction of the oxygen sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



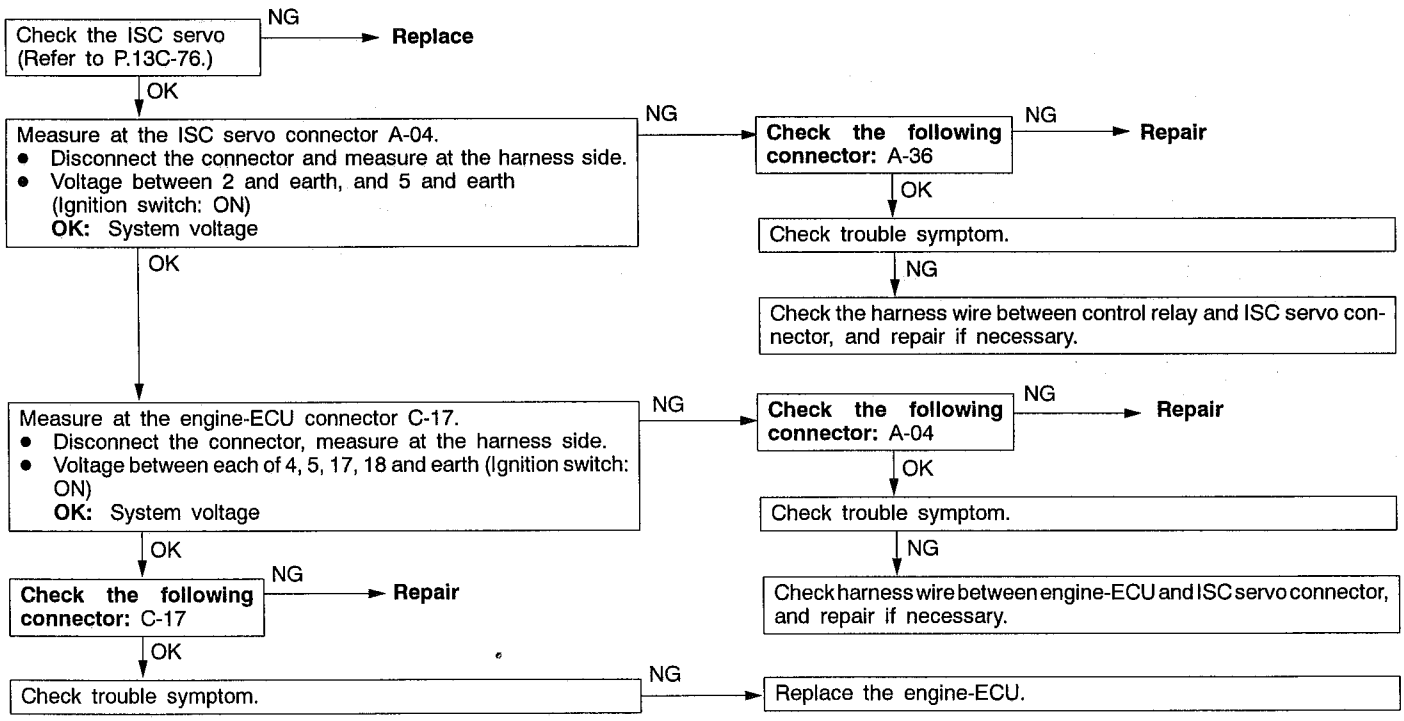
INSPECTION PROCEDURE 33

Mixture adjusting screw (variable resistor) system <Vehicles without catalytic converter>	Probable cause
The mixture adjusting screw is a variable resistor for manually adjusting the idling fuel mixture. When the shaft of the mixture adjusting screw is turned, the resistance between the output terminal and the earth terminal changes. Because of this, the output voltage also changes in accordance with the turning of the shaft. The engine-ECU controls the injectors to produce a richer idling fuel mixture in accordance with the increase in the output voltage.	• Malfunction of the mixture adjusting screw • Open or short-circuit or improper connector contact • Malfunction of engine-ECU



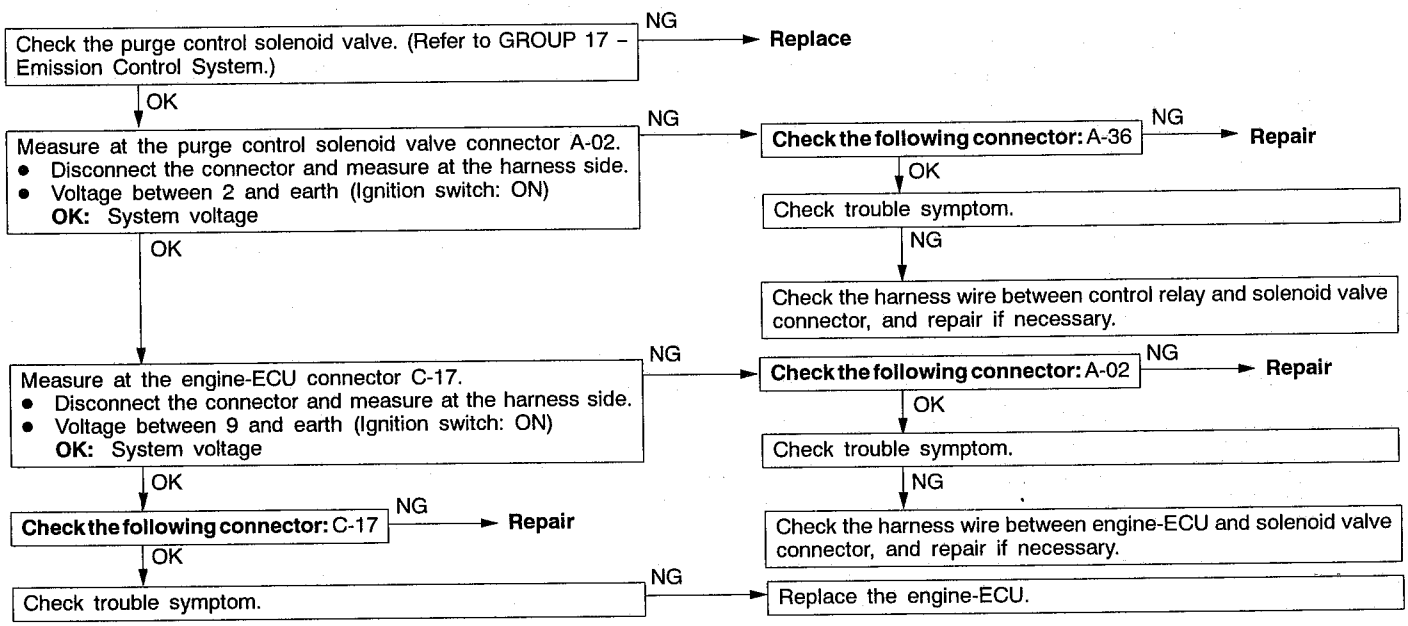
INSPECTION PROCEDURE 34

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



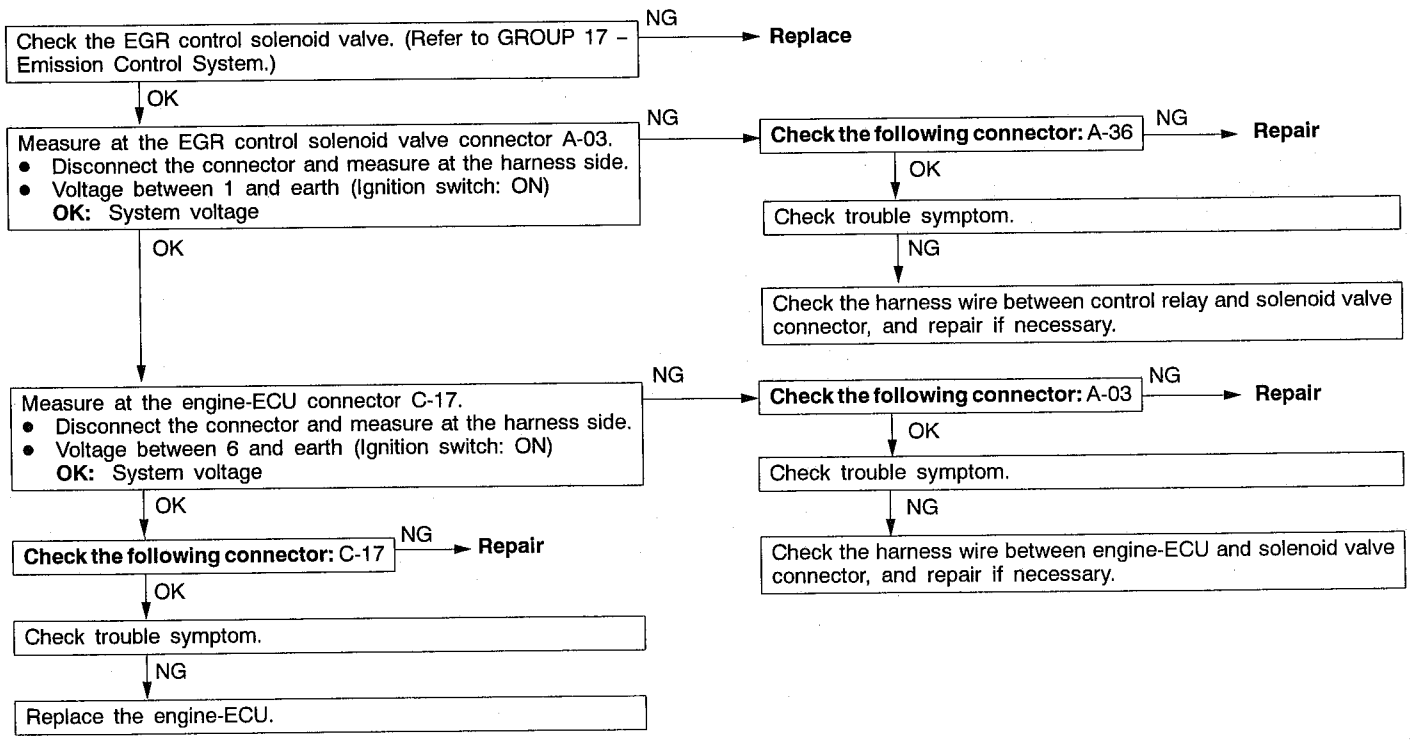
INSPECTION PROCEDURE 35

Purge control solenoid valve system <Vehicles with catalytic converter>	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 36

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



DATA LIST REFERENCE TABLE

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

NOTE
*1: In a new vehicle [driven approximately 500 km or less], the air intake plenum pressure is sometimes 10% higher than the standard pressure.
*2. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
*3. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*4. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front) <Vehicles with catalytic converter>	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	Procedure No. 32	13C-49
			When engine is suddenly raced	600–1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400 mV or less (Changes) 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	18 – 44 Hz	–	–
			2,500 r/min	68 – 108 Hz		
			Engine is raced	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13	13C-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		

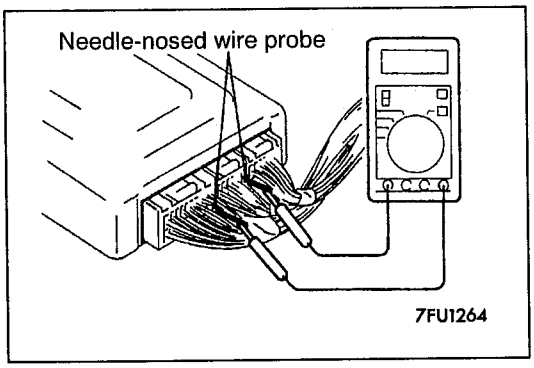
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300–1,000 mV	Code No. 14	13C-15
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500–5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 26	13C-45
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28 <M/T> Procedure No. 29 <A/T>	13C-47 <M/T> 13C-47 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. 21	13C-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	13C-17
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1400 – 1600 r/min		
			When engine coolant temperature is 0°C	1300 – 1500 r/min		
			When engine coolant temperature is 20°C	1250 – 1450 r/min		
			When engine coolant temperature is 40°C	1000 – 1200 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	13C-19
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 30	13C-48
			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. 31	13C-48
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 29	13C-47
			D, 2, L or R	D, 2, L or R		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injectors *2	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	15 – 22 ms	–	–
			When engine coolant temperature is 20°C	31 – 46 ms		
			When engine coolant temperature is 80°C	7.2 – 10.8 ms		
	Injectors*3	• Engine coolant temperature: 80–95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T : P range)	Engine is idling	2.0 – 3.2 ms	–	–
			2,500 r/min	1.7 – 2.9 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 – 18°BTDC	–	–
			2,500 r/min	22 – 42°BTDC		
45	ISC (stepper) motor position *4	• Engine coolant temperature: 80–95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T : P range) • Idle position switch: ON • Engine: Idling • When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	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. 31	13C-48
			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	13C-20
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 27	13C-46
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
08	Purge control solenoid valve <Vehicles with catalytic converter>	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 35	13C-51
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. 36	13C-51
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up		5 °BTDC	–	–
21	Fan controller	Drive the fan motors	• Ignition switch: ON		Fan motor runs	Procedure No. 24	13C-44



CHECK AT THE ENGINE-ECU TERMINALS

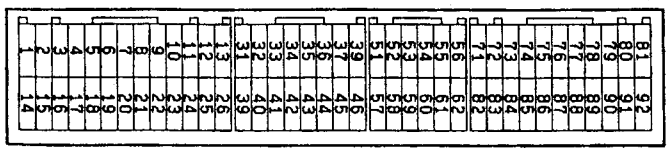
TERMINAL VOLTAGE CHECK CHART

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

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

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

Engine-ECU Connector Terminal Arrangement



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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		

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
4	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 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	Fuel pump relay	Ignition switch: ON	System voltage
		Engine: Idle speed	0 – 3 V
9	Purge control solenoid valve	Ignition switch: ON	System voltage
		Running at 3,000r/min while engine is warming up after having been started.	0 – 3 V
10	Ignition coil – No.1, No.4	Engine r/min: 3,000 r/min	0.3 – 3.0 V
23	Ignition coil – No.2, No.3		
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
21	Fan controller	Radiator and condenser fan is not operating	System voltage
		Radiator and condenser fan is operating	0 – 3 V
22	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor runs)	System voltage or momentarily 6 V or more → 0–3 V
33	Alternator G terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON	Voltage increases by 0.2 – 3.5 V
41	Alternator FR terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON	Voltage decreases
36	Engine warning lamp	Ignition switch: LOCK (OFF) position → ON	0–3 V → System voltage (After several seconds have elapsed)

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
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: LOCK (OFF) position		System voltage
		Ignition switch: ON		0 – 3 V
45	A/C switch	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
58	Tachometer signal	Engine r/min: 3,000r/min		0.3 – 3.0 V
60	Oxygen sensor heater <Vehicles with catalytic converter>	Engine: Idling after warming up		0 – 3 V
		Engine r/min: 5,000r/min		System voltage
71	Ignition switch – ST	Engine: Cranking		8V or more
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)
	Mixture adjusting screw (variable resistor) <Vehicles without catalytic converter>	Ignition switch: ON		1 – 4 V
77	A/C thermo sensor	• Ignition switch: ON • Temperature at sensor: 25°C (1.5 kΩ)		2.2 V
80	Backup power supply	Ignition switch: LOCK (OFF) position		System voltage
81	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5 V
82	Ignition switch – IG	Ignition switch: ON		System voltage

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
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
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ System voltage (Changes repeatedly)
88	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idling		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		
91	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0 – 3 V
			Set selector lever to Other than P or N	8 – 14 V

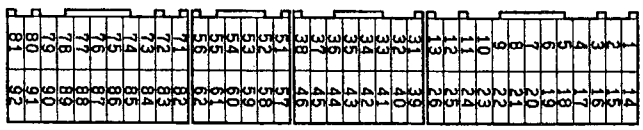
CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

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

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

   Caution
   If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
   Be careful to prevent this!
4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement



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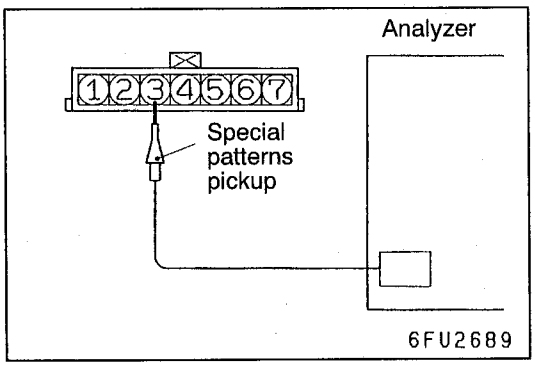
Terminal No.	Inspection item	Normal condition (Check condition)
1–12	No. 1 injector	13 – 16 Ω (At 20°C)
14–12	No. 2 injector	
2–12	No. 3 injector	
15–12	No. 4 injector	

Terminal No.	Inspection item	Normal condition (Check condition)
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)
9–12	Purge control solenoid valve	36 – 44 Ω (At 20°C)
13–Body earth	ENGINE-ECU earth	Continuity (0Ω)
26–Body earth	ENGINE-ECU earth	
60–12	Oxygen sensor heater <Vehicles with catalytic converter>	11 – 18 Ω (At 20°C)
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)
91–Body earth	Inhibitor switch <A/T>	Continuity (when select lever is at P or N)
		No continuity (when select lever is at D, 2, L or R)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

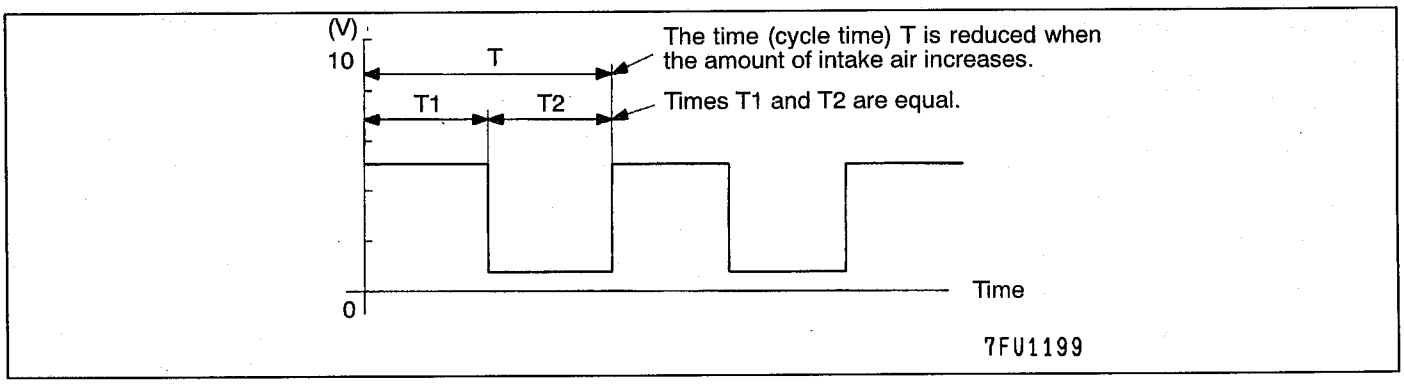
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

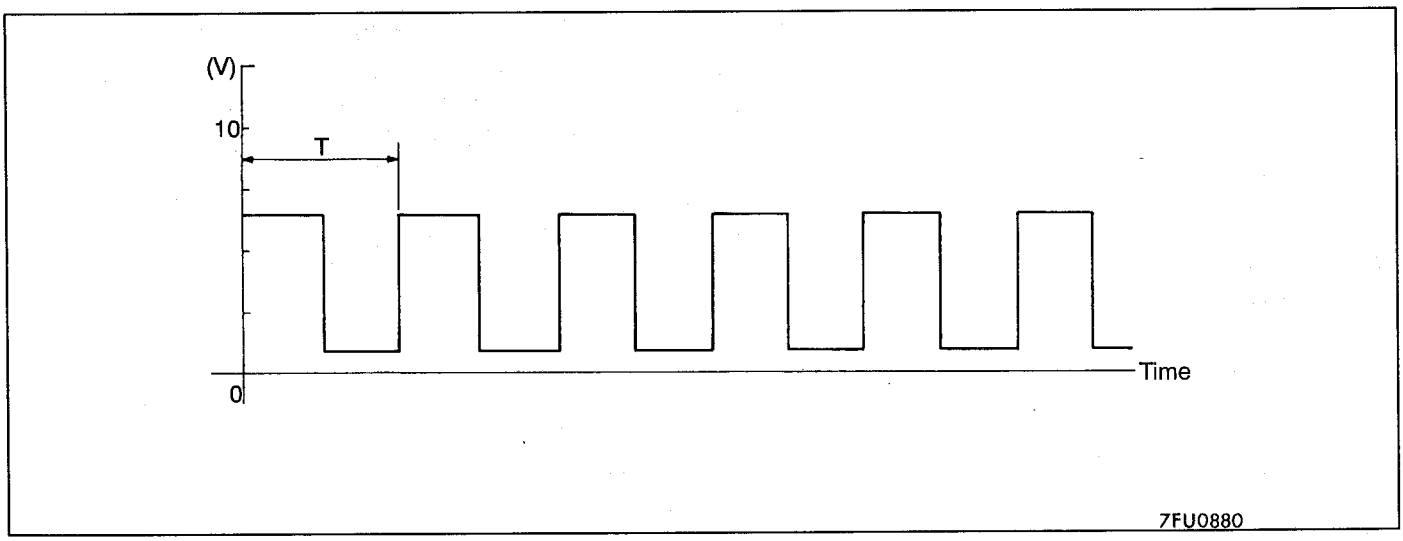
Observation conditions

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

Standard wave pattern

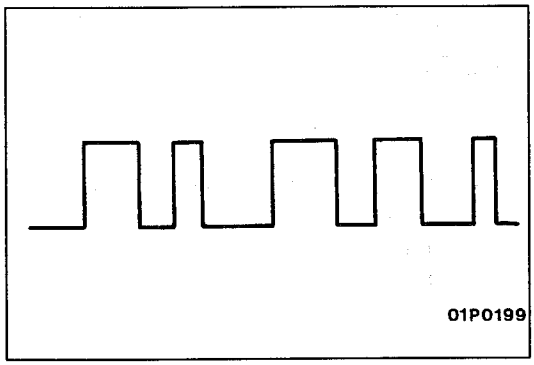


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

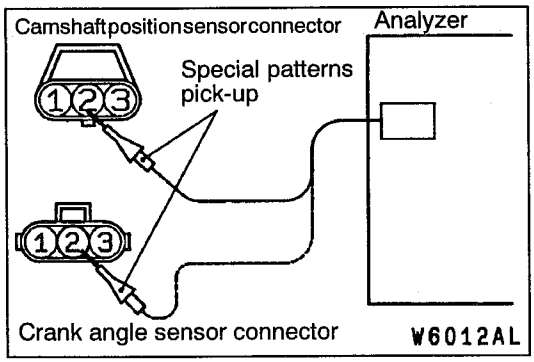
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991659) and jumper wire in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MB991658) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 3.

Alternate Method (Test harness not available)

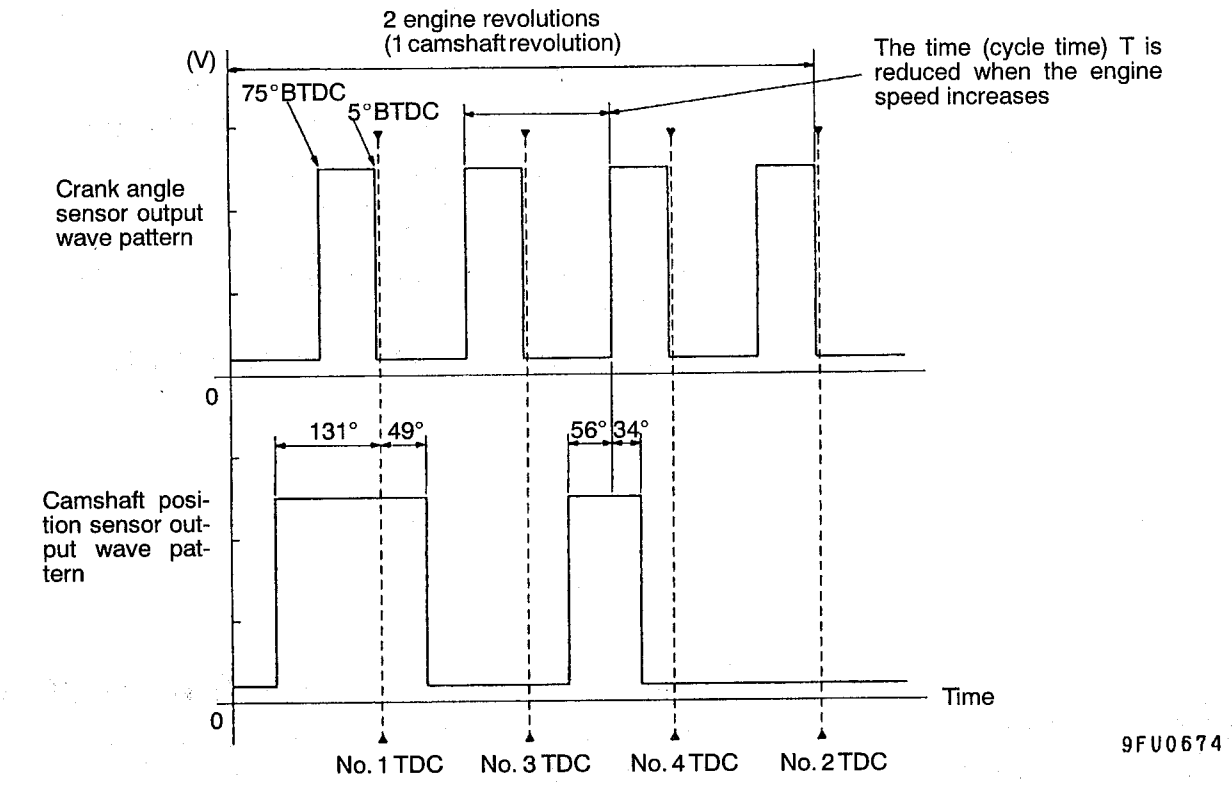
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

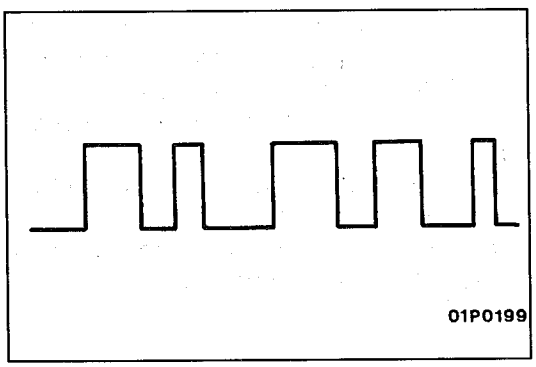
Standard wave pattern



TDC: Top dead centre

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

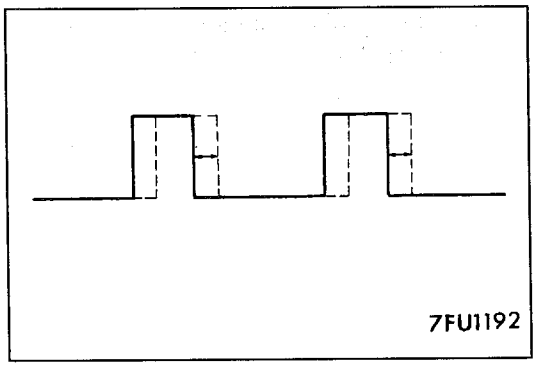
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.

INJECTOR

Refer to GROUP 13B – Troubleshooting.

IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Refer to GROUP 13B – Troubleshooting.

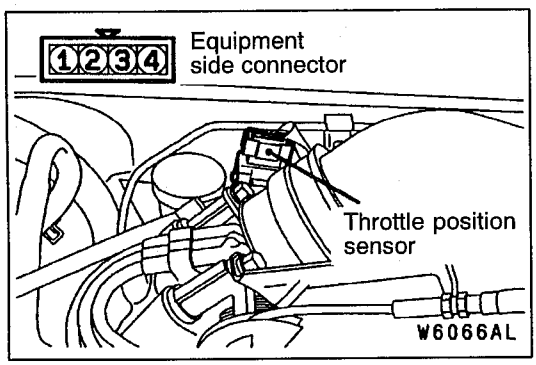
IGNITION COIL AND POWER TRANSISTOR

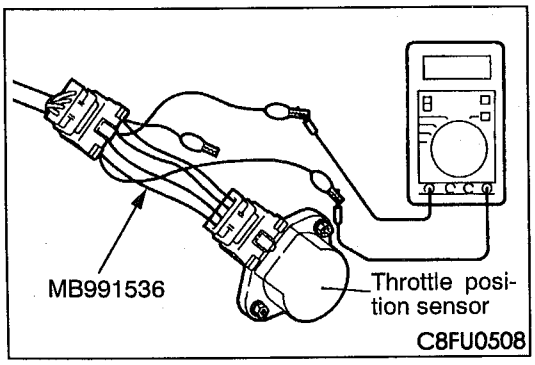
Refer to GROUP 13B – Troubleshooting.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

Refer to GROUP 13B – On-vehicle Service.

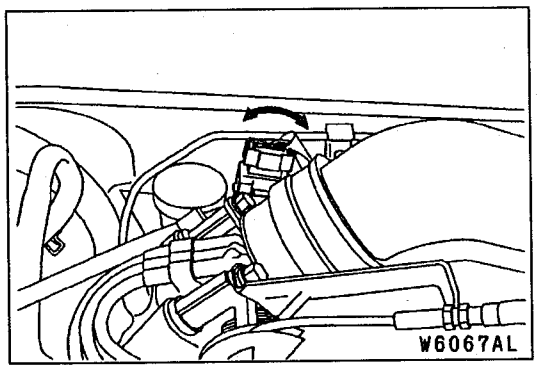




THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector. When not using the MUT-II, proceed as follows:
   (1) Disconnect the throttle position sensor connector, and connect the special tool (throttle position sensor test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.
   (2) Connect digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and the terminal No.4 (sensor earth: black clip of special tool) of the throttle position sensor connector.
2. Turn the ignition switch to ON (but do not start the engine).
3. Check the output voltage of the throttle position sensor.

   Standard value: 535 – 735 mV



4. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
5. Turn the ignition switch to LOCK (OFF) position.
6. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
7. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable, and then let the engine run at idle for approx. ten minutes.

BASIC IDLE SPEED ADJUSTMENT

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

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

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

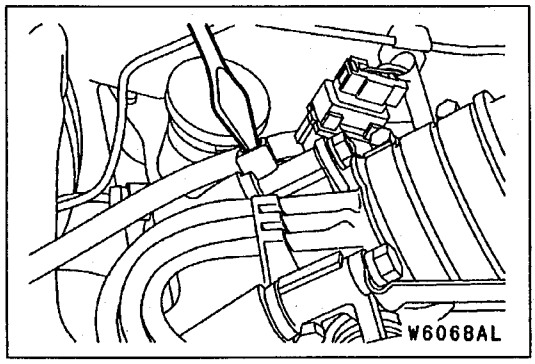
3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.

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

5. Check the idle speed.

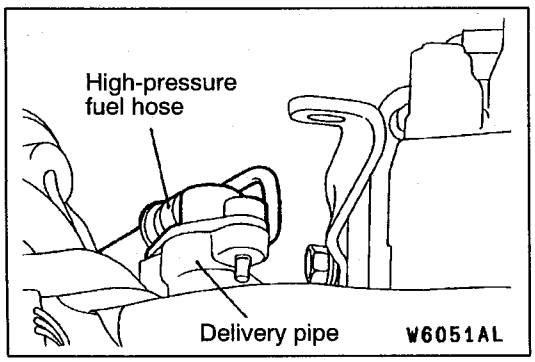
Standard value: 700 ± 50 r/min

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.13C-66.)



6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.
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. Turn the ignition switch to LOCK (OFF) position.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.

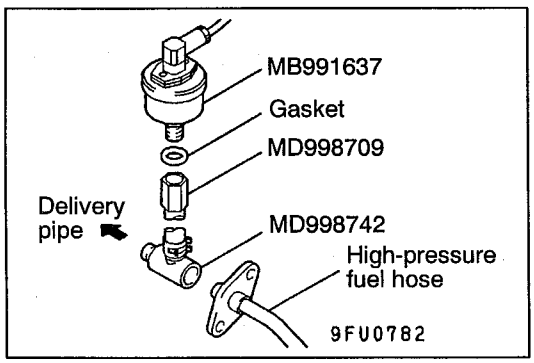


FUEL PRESSURE TEST

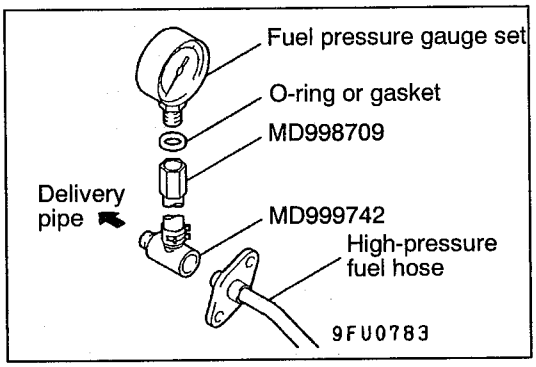
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13C-70.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

   Caution

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



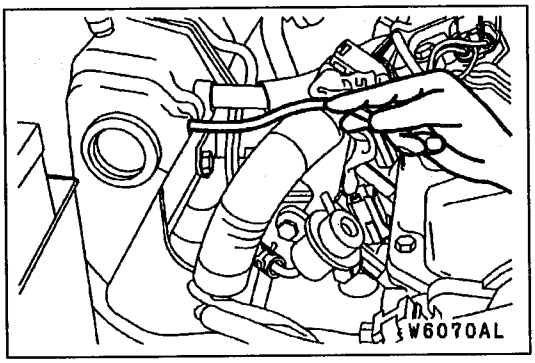
3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.
   <When using the fuel pressure gauge set (special tool)>
   (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the delivery pipe.
   (2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
   (3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



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

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

Standard value: Approx. 265 kPa at kerb idle



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

Standard value:
324–343 kPa at kerb idle

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

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

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

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

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

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

16. Release residual pressure from the fuel pipe line. (Refer to P.13C-70.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

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

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

    Tightening torque: 5 Nm

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

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

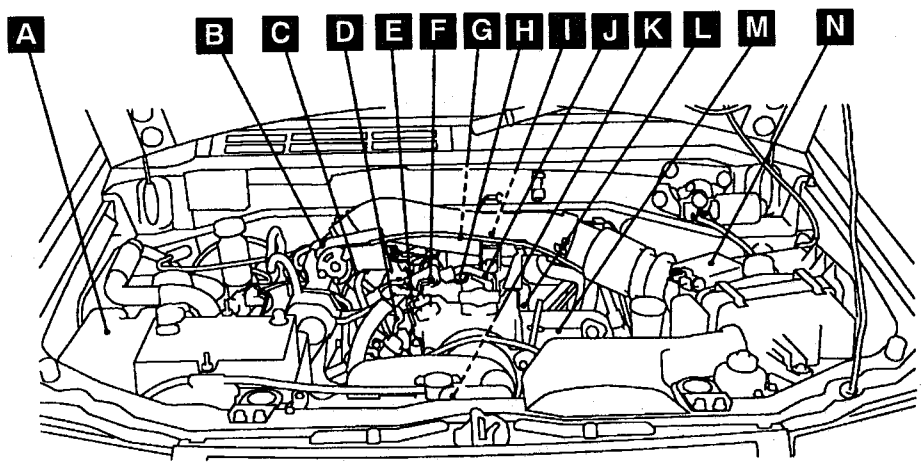
Refer to GROUP 13B – On-vehicle service.

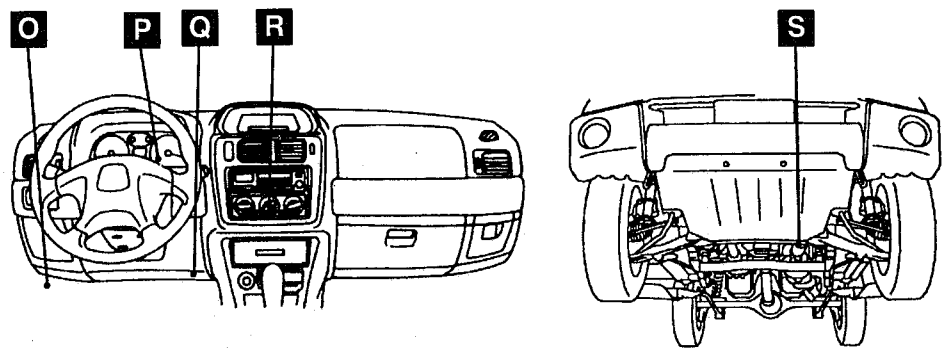
FUEL PUMP OPERATION CHECK

Refer to GROUP 13A – On-vehicle service.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	A	Idle speed control servo	C
A/C switch	R	Ignition coil	F
Air flow sensor (With intake air temperature sensor and barometric pressure sensor)	N	Inhibitor switch <A/T>	I
Camshaft position sensor	H	Injectors	E
Control relay and fuel pump relay	A	Mixture adjusting screw <Vehicles without catalytic converter>	J
Crank angle sensor	K		
Diagnosis connector	Q	Oxygen sensor	S
EGR control solenoid valve	D	Power steering fluid pressure switch	M
Engine coolant temperature sensor	L	Purge control solenoid valve <Vehicles with catalytic converter>	D
Engine-ECU	O	Throttle position sensor	B
Engine warning lamp (check engine lamp)	P	Vehicle speed sensor	G





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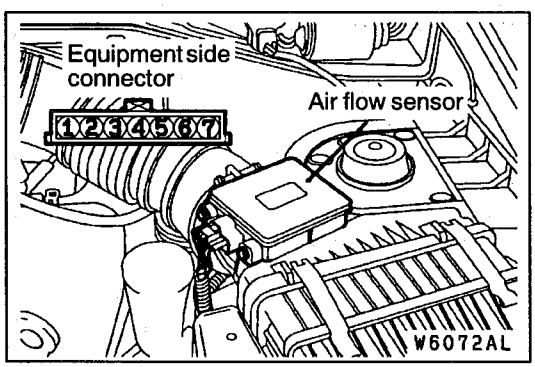
CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

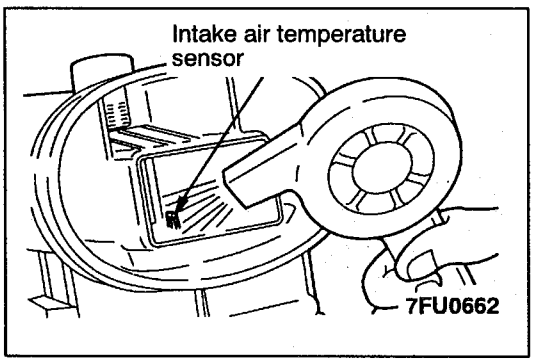
Refer to GROUP 13B – On-vehicle service.



INTAKE AIR TEMPERATURE SENSOR CHECK

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

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

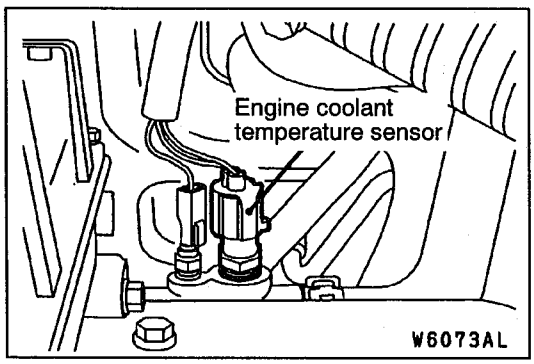


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

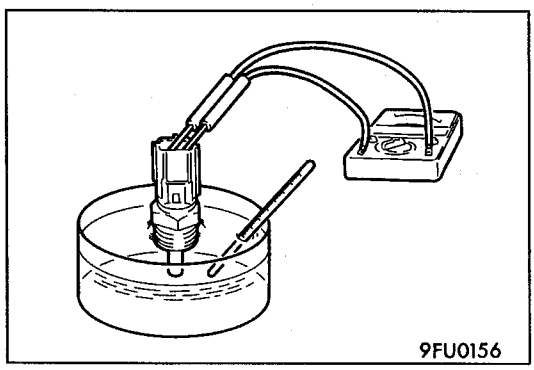
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

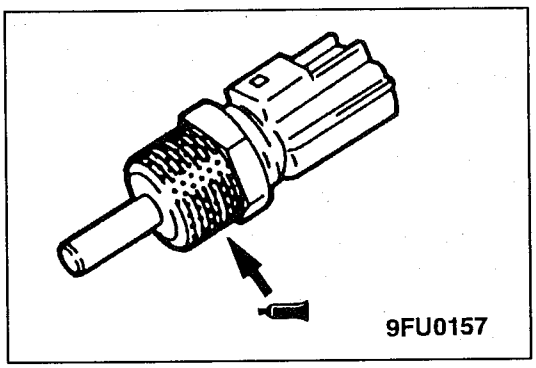
1. Remove the engine coolant temperature sensor.



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

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

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

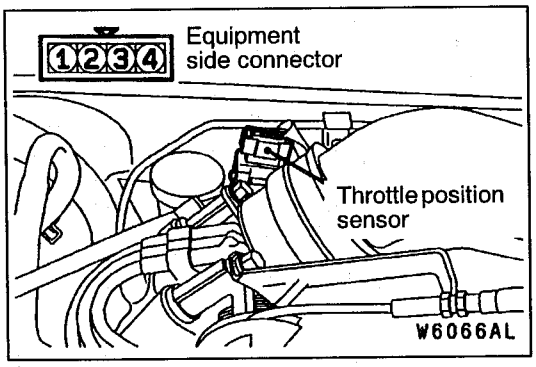


4. Apply sealant to threaded portion.

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

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

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

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

   Standard value: 3.5 – 6.5 kΩ

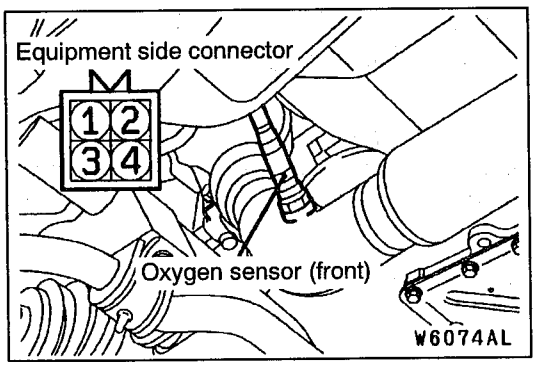
3. Measure the resistance between the throttle position sensor side connector terminal 2 and terminal 4.

   Normal condition:

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

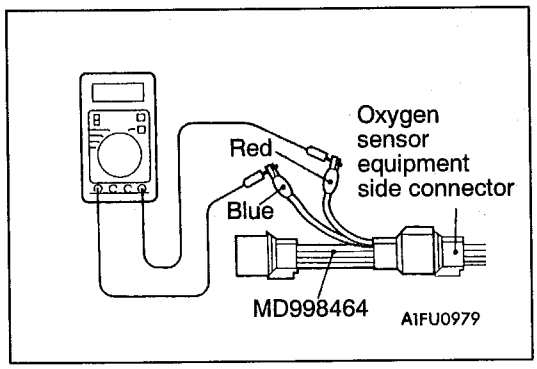
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13C-66.

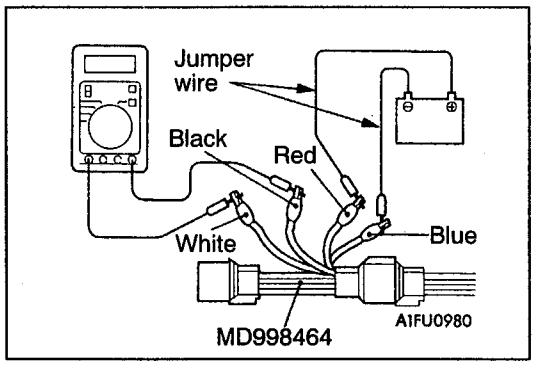


OXYGEN SENSOR CHECK
<Vehicles with catalytic converter>

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.

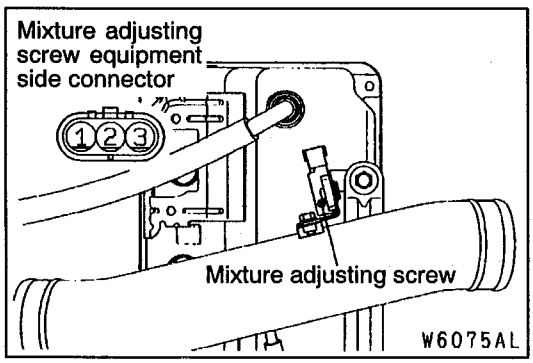
   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   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.

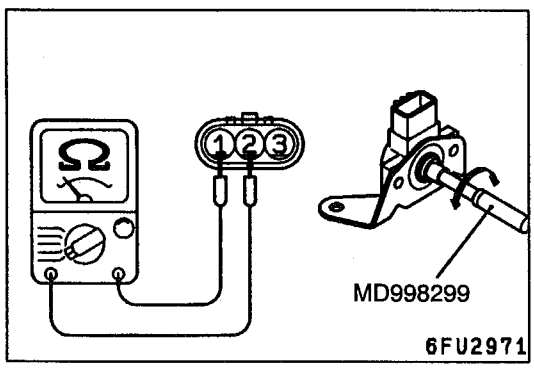
   NOTE
   For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



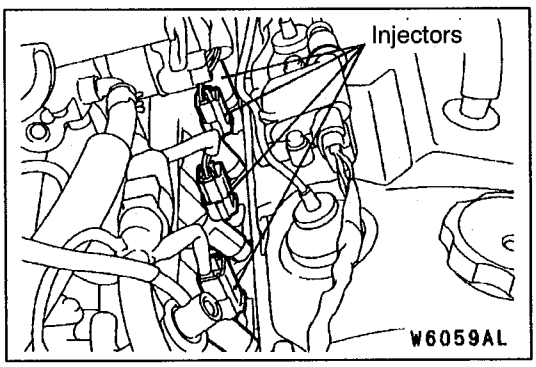
MIXTURE ADJUSTING SCREW (VARIABLE RESISTOR) CHECK <Vehicles without catalytic converter>

1. Disconnect the variable resistor connector.
2. Use a circuit tester to measure the resistance between terminal No.1 and terminal No.3 of the variable resistor connector.

   Standard value: 4 – 6 kΩ



3. Connect the circuit tester between the terminal No.1 and terminal No.2.
4. Check that the resistance changes smoothly when the adjusting screw is rotated by the special tool (MAS screwdriver).
5. Inspect the body for crack or other damage.
6. If any defect is found, replace the variable resistor as an assembly.



INJECTOR CHECK

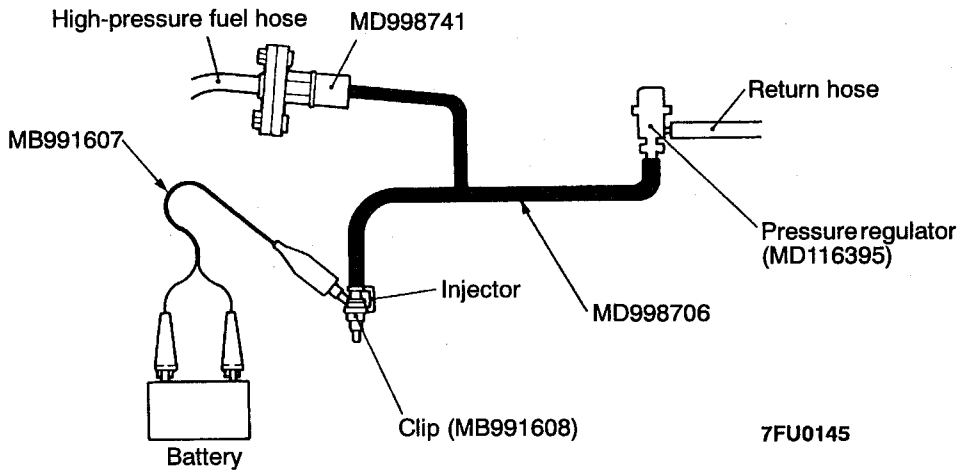
Measurement of Resistance between Terminals

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

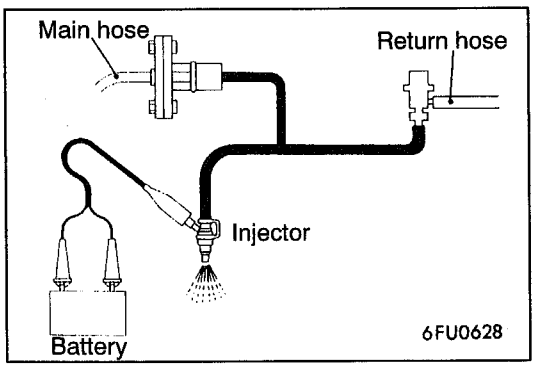
   Standard value: 13 – 16 Ω (at 20°C)
3. Install the injector connector.

Checking the Injection Condition

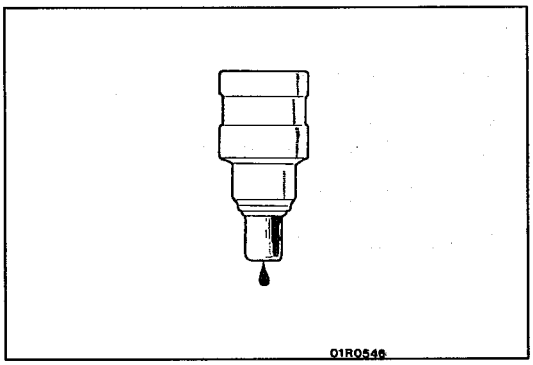
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13C-70.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



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



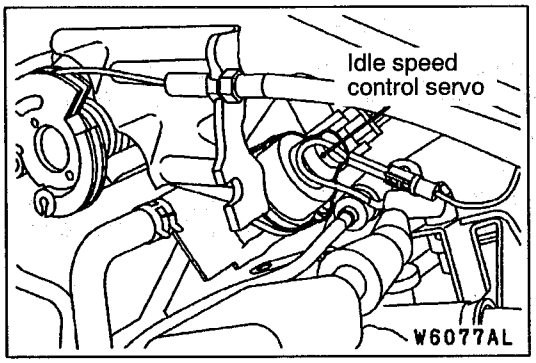
7. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.



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

   Standard value: 1 drop or less per minute

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



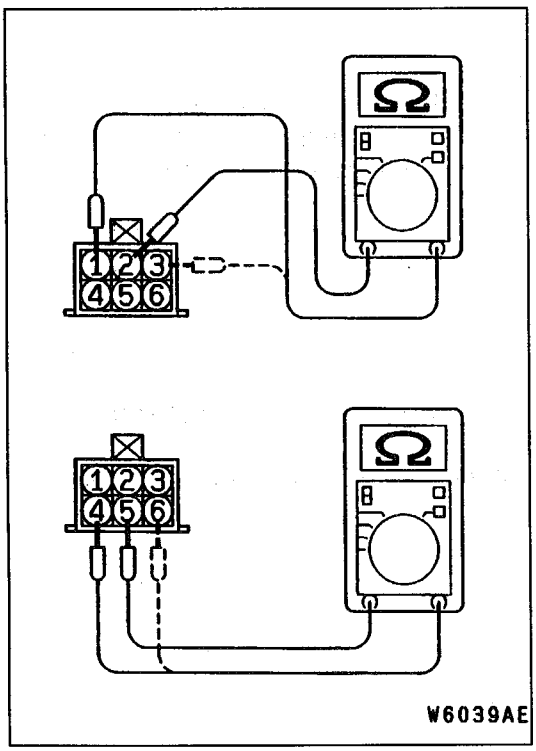
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

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

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

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



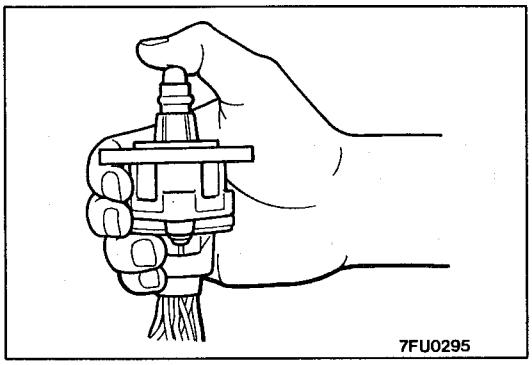
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector.
2. Measure the resistance between terminal 2 and either terminal 1 or terminal 3 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 and either terminal 6 or terminal 4 of the connector at the idle speed control servo side.

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



Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness: MB991709) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 V) to the terminals 2 and 5.
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 <Vehicles with catalytic converter>

Refer to GROUP 17 - Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

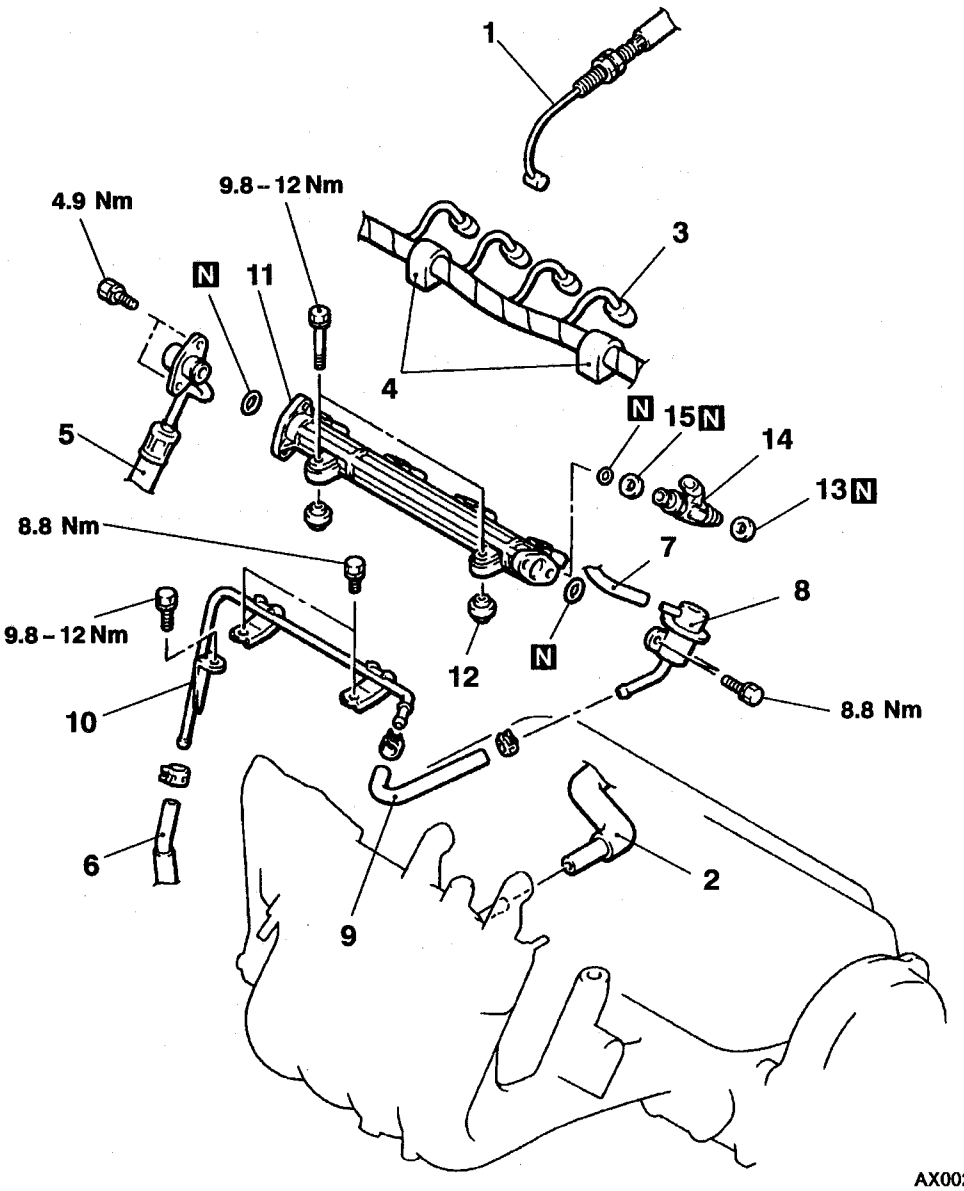
Refer to GROUP 17 - Emission Control System.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to P.13C-70.)
- Air Cleaner and Air Intake Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



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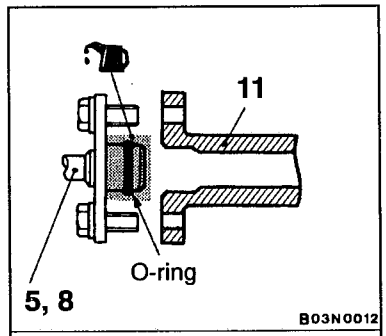
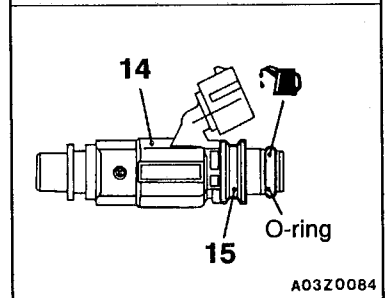




Engine oil

Removal steps

1. Accelerator cable connection
2. PCV hose
3. Injector connector
4. Injector harness clamp
5. ▶A◀ High-pressure fuel hose connection
6. Fuel return hose connection
7. Vacuum hose connection
8. ▶A◀ Fuel pressure regulator
9. Fuel hose
10. Fuel return pipe
11. ◀A▶ Delivery pipe
12. Insulator
13. Insulator
14. ◀A▶ ▶A◀ Injector
15. Grommet

REMOVAL SERVICE POINT

◀A▶ DELIVERY PIPE/INJECTOR REMOVAL

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

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

INSTALLATION SERVICE POINT

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

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

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

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

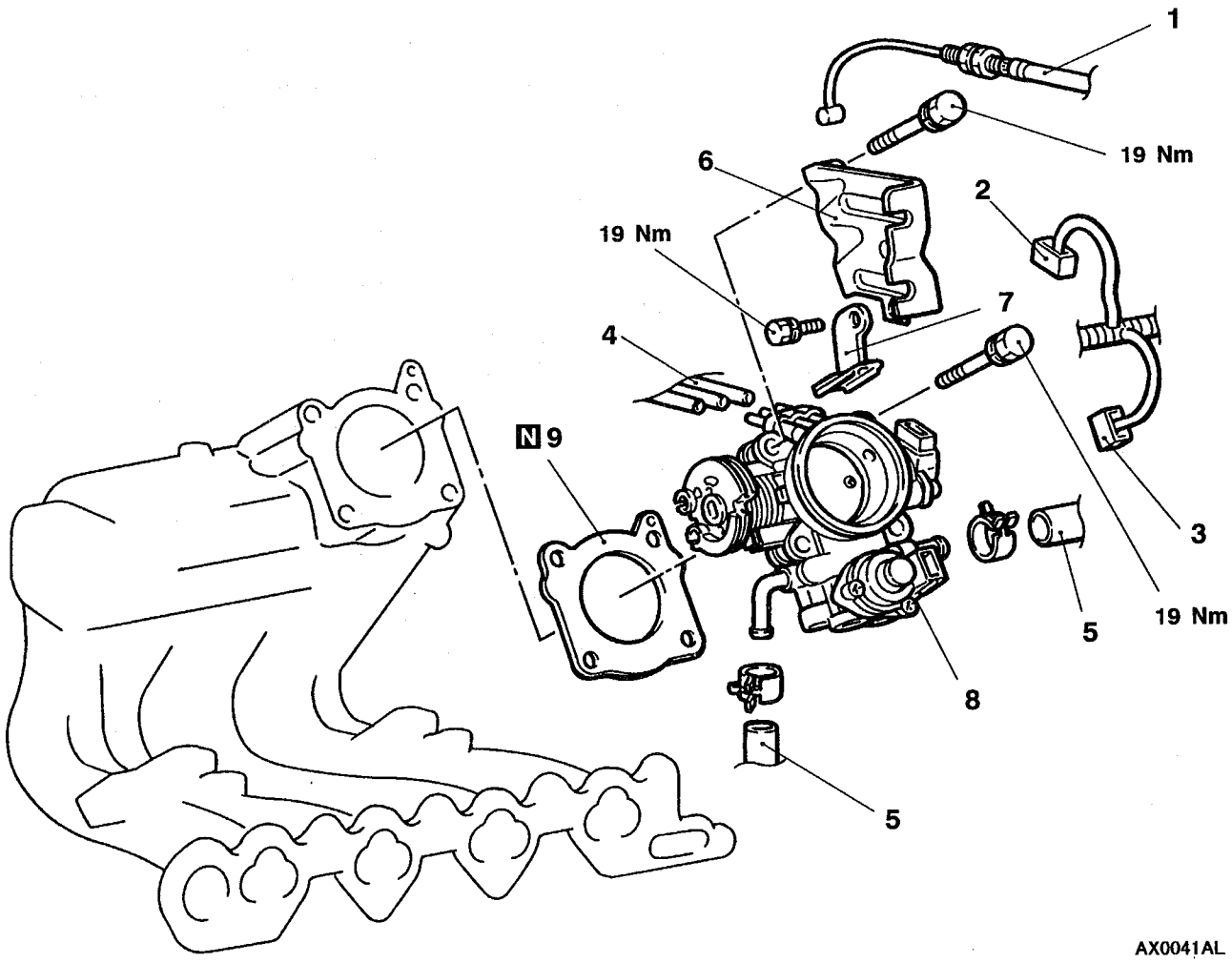
   Tightening torque:
   8.8 Nm (Fuel pressure regulator)
   4.9 Nm (High-pressure fuel hose)

THROTTLE BODY

REMOVAL AND INSTALLATION

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

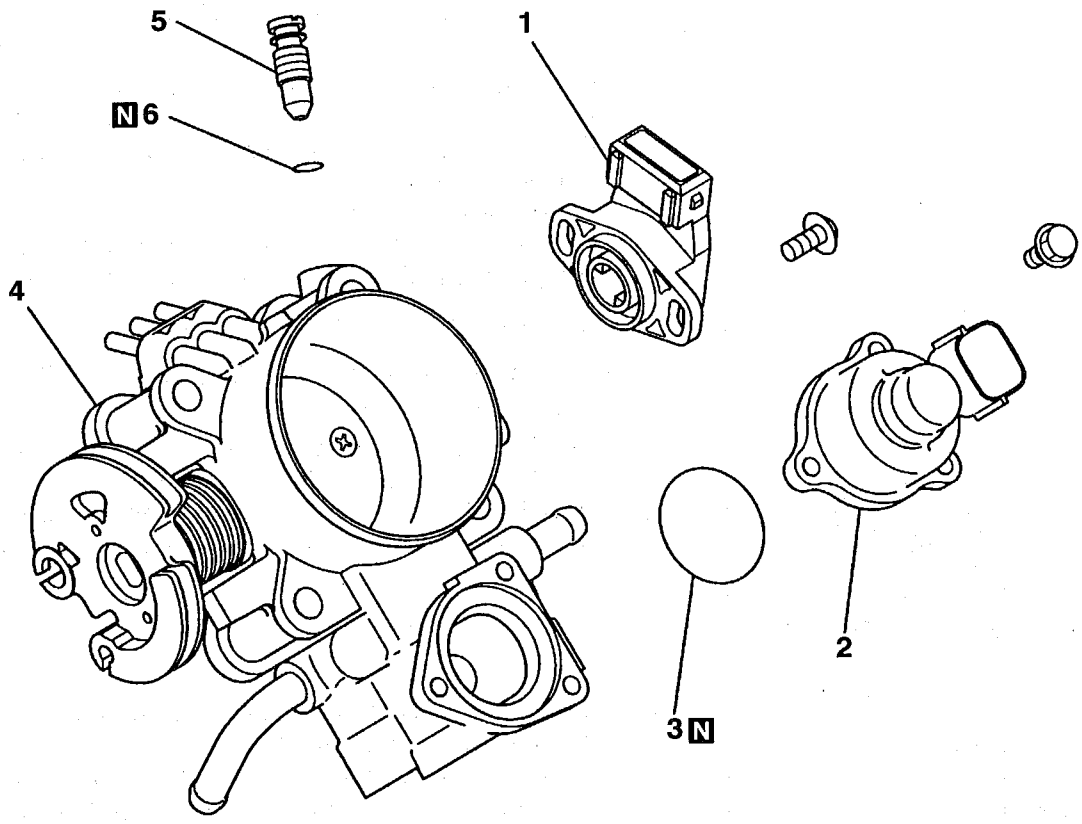
Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Engine Coolant Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



Removal steps

1. Accelerator cable connection
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Vacuum hose connection
5. Water hose connection
6. Throttle cable bracket
7. Harness Clamp
8. Throttle body
9. Throttle body gasket

DISASSEMBLY AND REASSEMBLY



Disassembly steps

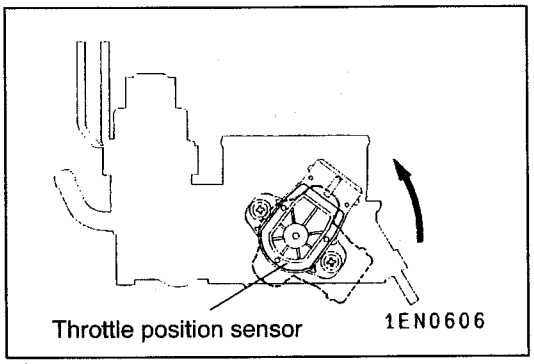
▶A◀ 1. Throttle position sensor
2. Idle speed control body assembly
3. O-ring
4. Throttle body
5. Speed adjusting screw
6. O-ring

NOTE
1. The speed adjusting screw is correctly adjusted at the factory and should not be removed.
2. If the speed adjusting screw has 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

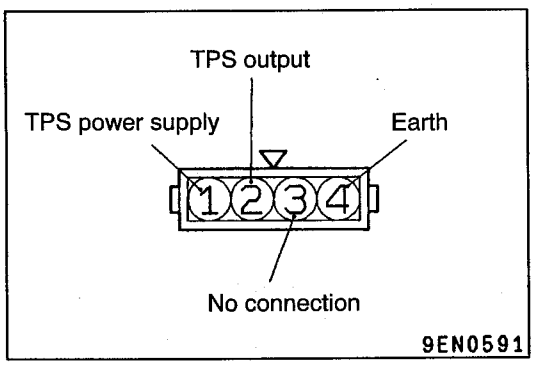
   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.



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. Turn the throttle position sensor to the position shown in the illustration, and then tighten the screw.



3. Connect a multimeter between terminal (1) (TPS power supply) and terminal (2) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
4. If there is an abnormality, replace the TPS.