MULTIPOINT FUEL INJECTION (MPI) <4G63>

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GENERAL

OUTLINE OF CHANGE

Following service procedures have been established due to the addition of vehicles with 4G63-MPI engine for Russia.

GENERAL INFORMATION

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-A/T-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-A/T-ECU. The engine-A/T-ECU

FUEL INJECTION CONTROL

The injector drive times and injection 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

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-A/T-ECU drives the idle speed control motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air

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

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

carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-A/T-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

engine-A/T-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-A/T-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.

conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the idle speed control 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.

engine operating conditions. The ignition timing is determined by the engine-A/T-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

code corresponding to the abnormality is output.

 The RAM data inside the engine-A/T-ECU that is related to the sensors and actuators can be read by means of the M.U.T.-II/III. 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
- a. 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.
- Purge Control Solenoid Valve Control
 EGR Control Solenoid Valve Control

Item		Specification
Throttle body	Throttle bore mm	60
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type
Engine-A/T- ECU	Identification No.	E6T37983
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
Actuators	Engine control relay	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	HDA250E
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	328

GENERAL SPECIFICATIONS

MULTI-POINT FUEL INJECTION SYSTEM DIAGRAM





AK301594

SERVICE SPECIFICATIONS

Items		Specifications	
Basic idle speed r/min		750 ± 50	
Throttle position sensor adjusting voltage mV		535 – 735	
Throttle position sensor resista	ance kΩ	3.5 - 6.5	
Idle speed control servo coil re	sistance (at 20°C) Ω	28 – 33	
Intake air temperature sensor	–20°C	13 – 17	
	0°C	5.3 - 6.7	
	20°C	2.3 - 3.0	
	40°C	1.0 – 1.5	
	60°C	0.56 -0.76	
	80°C	0.30 – 0.42	
Engine coolant temperature	–20°C	14 – 17	
sensor resistance KS2	0°C	5.1 – 6.5	
	20°C	2.1 – 2.7	
	40°C	0.9 – 1.3	
	60°C	0.48 – 0.68	
	80°C	0.26 – 0.36	
Oxygen sensor output voltage	(at racing) V	0.6 – 1.0	
Oxygen sensor heater	front	4.5 - 8.0	
resistance (at 20°C) Ω	rear	11 – 18	
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at kerb idle	
	Vacuum hose connection	Approximately 265 at kerb idle	
Injector coil resistance (at 20°C) Ω		10.5 – 13.5	

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
B991502	MB991502	M.U.TII sub assembly	 Reading diagnosis code MPI system inspection Measurement of fuel pressure
A MB991824 B MB991827 C DO NOT USE MB991910 D MB991910 D MB991910 E MB991915 F MB991825 F MB991825 K MB991825 K MB991826 MB991825	MB991955 A: MB991824 B: MB991827 C: MB991910 D: MB991911 E: MB991825 F: MB991826 M.U.TIII sub assembly A: Vehicle com- munication in- terface (V.C.I.) B: M.U.TIII USB cable C: M.U.TIII WSB cable C: M.U.TIII main harness A (Vehicles with CAN commu- nication system) D: M.U.TIII main harness B (Vehicles with- out CAN com- munication sys- tem) E: M.U.TIII measurement adapter F: M.U.TIII trigger harness	M.U.TIII sub assembly	 Reading diagnosis code MPI system inspection Measurement of fuel pressure
	MB991348	Test harness set	 Inspection using an oscilloscope

ТооІ	Number	Name	Use
м897722	MB991709	Test harness	 Measurement of voltage during troubleshooting Inspection using an oscilloscope Check of idle speed control servo
	MD998478	Test harness (3-pin, triangle)	 Measurement of voltage during Troubleshooting Inspection using an oscilloscope
. В991536	MB991536	Check harness for throttle position sensor adjustment	 Measurement of voltage during Troubleshooting Adjusting of throttle position sensor
	MD998464	Test harness (4-pin, square)	 Measurement of voltage during Troubleshooting Inspection of oxygen sensor (front)
B991658	MB991658	Test harness	 Measurement of voltage during Troubleshooting Inspection of oxygen sensor (rear)
A B C	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	 Check at the ECU terminals A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
D C991223			

Tool	Number	Name	Use
A A A A A A A A A A A A A A A A A A A	MD998709	Adaptor hose	Measurement of fuel pressure
E	MD998742	Hose adaptor	
B991637	MB991637	Fuel pressure gauge set	
0000-0000 MB991981	MB991981	Fuel pressure gauge set	
	MB992076	Injector test set	Checking the spray condition of injectors
MB991607	MB991607	Injector test harness	
MD998741	MD998741	Injector test adaptor	
MB991976	MB991976	Injector test holder assembly	



TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE

If the engine-A/T-ECU is replaced, ring antenna with built in immobilizer-ECU should be replaced, ignition key can be kept, but must be registered.

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Engine-A/T-ECU
Oxygen sensor (front)
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
Ignition coil, power transistor unit
Injector
Immobilizer system
Oxygen sensor (rear)

NOTE

If the engine warning lamp illuminates because of a malfunction of the engine-A/T-ECU, communication between M.U.T.-II/III and the engine-A/T-ECU is impossible. In this case, the diagnosis code cannot be read.

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

INSPECTION USING M.U.T.-II/III 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 M.U.T.-II/III 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 M.U.T.-II/III, and then start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	 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. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel into the cylinders in the order 1-3-4-2 with irregular timing. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition timing for standard petrol.
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor (front) system	13D-13
12	Air flow sensor system	13D-15
13	Intake air temperature sensor system	13D-16
14	Throttle position sensor system	13D-18
21	Engine coolant temperature sensor system	13D-20
22	Crank angle sensor system	13D-22
23	Camshaft position sensor system	13D-23
24	Vehicle speed signal system	13D-25
25	Barometric pressure sensor system	13D-26
31	Detonation sensor system	13D-28
41	Injector system	13D-29
44	Ignition coil (power transistor) system	13D-30
54	Immobilizer system	13D-31
59	Oxygen sensor (rear) system	13D-32
64	Alternator FR terminal system	13D-34

NOTE

1. Do not replace the engine-A/T-ECU until a through terminal check reveals there are no short/open circuit.

2. Check that the engine-A/T-ECU earth circuit is normal before checking for the cause of the problem.

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 11 Oxygen sensor (front) system	Probable cause
 Range of Check More than 3 minutes passed after completion of start of engine The engine coolant temperature is approximately more than 80°C. Intake air temperature 0 - 55°C. The engine speed is more than 1,800 - 3,500 r/min. The volumetric efficiency is 16 - 60% or more 	 Malfunction of the oxygen sensor (front) Oxygen sensor (front) circuit disconnection, short-circuit, or connector contact defect. Malfunction of the engine-A/T-ECU
Set Conditions	
• For 30 seconds, the oxygen sensor output voltage continues to be 0.5 V or lower, or 0.5 V or higher.	
• The Engine-A/T-ECU monitors for this condition once during the drive cycle.	









Code No. 13 Intake air temperature sensor system	Probable cause
 Range of Check 60 seconds after the ignition switch is set to the "ON" position, or after the completion of the start of engine. Set Conditions The sensor output voltage is more than 4.6 V for 4 seconds (Equivalent to intake air temperature less than -40°C) Or The sensor output voltage is less than 0.2 V for 4 seconds (Equivalent to intake air temperature of more than 120°C) 	 Malfunction of the intake air temperature sensor Intake air temperature sensor circuit disconnection, short-circuit, or connector contact defect Malfunction of the engine-A/T-ECU





Code No. 14 Throttle position sensor system	Probable cause
 Range of Check 60 seconds after the ignition switch is set to the "ON" position, or after the completion of start of engine. Set Conditions The sensor output voltage is 4.3 V or more for 4 seconds and volumetric efficiency 40 % or less. or The sensor output voltage is 0.2 V or less for 2 seconds 	 Malfunction of the throttle position sensor Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-A/T-ECU









MPI <4G63> - Troubleshooting





Replace the engine-A/T-ECU.









Code No. 21 Detension concerns		Drobable agues
Code No. 31 Detonation sensor system		Probable cause
 Range of Check 60 seconds after the ignition switch is set to the "ON" por completion of start of engine. The engine speed is more than 2,500 r/min. Volumetric efficiency 30 % or more Set Condition Changes in sensor output voltage (detonation sensor pead crankshaft rotation) in 200 consecutive cycles are 0.078 M 	osition, or aft k voltage pe V or less.	 Malfunction of the detonation sensor Open or short circuit in the detonation sensor circuit or loose connector contact Malfunction of the engine-A/T-ECU
	¬ NG	
Check the following connector: B-117		► Repair
ОК	_ NG	
 Measure at the detonation sensor connector B-117. Disconnect the connector and measure at the harness side. The resistance between terminal 2 and earth OK: 2 Ω or less 		Check the harness wire between the detonation sensor and earth, and repair if necessary.
ОК		
Check the following connector: C-126	NG	► Repair
ОК		
Check the harness wire between the detonation sensor and the engine-A/T-ECU.		► Repair
ОК	_ _ OK	
Check the trouble symptoms.		 Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions)
NG		
Replace the detonation sensor.		
Check the trouble symptoms.		
NG	_	
Replace the engine-A/T-ECU.		

Range of Check Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in forced drive (actuator test) mode. Fuel out and injector not in the engine A/TECU Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Malfunction of the engine A/TECU and the injector connector, and repair if necessary. Mal	Code No. 41 Injector system		Probable cause
M.U.TII/III Actuator Test OK Intermittent malfunction Q1 No. 3 injector Q4 No. 4 injector Q4 No. 4 injector Q6 The Iding condition should change NG Check the following connectors: B-02, B-03, B-04, B-05 VOK Check the injector connector B-02, B-03, B-04, B-05. VOK Measure at the injector connector B-02, B-03, B-04, B-05. VOK Measure at the injector connector B-02, B-03, B-04, B-05. VOK Check the following connector: C-122 VOK Check the following connector: C-122 VOK Check the following connector: C-122 VOK Check the following connector C-122 VOK Check the following connector C-122 VOK Check the following connector C-122 VOK Check the trouble symptoms. VOK Check the trouble sympto	 Range of Check Fuel cut and injector not in forced drive (actuator test) mode. The engine speed is 50 – 1,000 r/min The throttle position sensor output voltage is 1.15 V or less. Set Condition 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-A/T-ECU
NG NG Check the following connectors: NG B-02, B-03, B-04, B-05 OK Check the injector. (Refer to P.13D-101.) NG Check the injector connector, B-02, B-03, B-04, B-05. NG Disconnect the connector, and measure at the harness side. VG Voltage between 1 and earth (Ignition switch: ON) NG OK Check the following connector: C-122 VO OK Measure at the engine-A/T-ECU connector C-122. OK NG Measure at the engine-A/T-ECU connector C-122. Disconnect the connector, and measure at the harness side. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK Check the trouble symptoms. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK Check the trouble symptoms. Value at the pick-up harness side. Engine: Idling Othe or phaness side. Engine: Idling The voltage betweent reminal 2 and earth OK Check the following connector proceed as described on P13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG	M.U.TII/III Actuator Test 01 No. 1 injector 02 No. 2 injector 03 No. 3 injector 04 No. 4 injector OK: The idling condition should change	OK Interr (Refe	nittent malfunction er to GROUP 00 – Points to Note for Intermittent Malfunctions.)
OK NG Replace OK OK Measure at the injector connector Bo2, B-03, B-04, B-05. NG Disconnect the connector, and measure at the harness side. Voltage between 1 and earth (Ignition switch: ON) OK NG Check the following connector: C-122 NG Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) NG OK Check the following connector: C-122. NG NG Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) NG OK Check the rouble symptoms. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK Check the trouble symptoms. OK Use an analyzer to measure the signal waveform at injector connector, and repair if necessary. OK Check the trouble symptoms. OK Use an enalyzer to measure the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P r13D-80 (INSPECTION PROCEDURE USING AN ANALYZER). NG NG NG NG	NG Check the following connectors: B-02 B-03 B-04 B-05	NG ► Repa	ir
OK NG Measure at the injector connector B-02, B-03, B-04, B-05. NG • Disconnect the connector, and measure at the harness side. NG • Voltage between 1 and earth (ignition switch: ON) OK Check the following connector: C-122 NG • OK NG Measure at the engine-A/T-ECU connector C-122. NG • OK Check the following connector: C-122. • OK NG Measure at the engine-A/T-ECU and the harness side. NG • OK Check the following connector C-122. • Disconnect the connector, and measure at the harness side. NG • OK Check the trouble symptoms. • OK NG Use an analyzer to measure the signal waveform at injector connector, B-02, B-03, B-04, B-05. OK • Use an analyzer to measure the signal waveform at injector connector, B-02, B-03, B-04, B-05. OK • Use an analyzer to measure the signal waveform at injector connector, and measure at the pick-up harness side. OK • Engine: Idling OK Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.) • Use at est harness (INSPECTION PROCEDURE USING AN ANALYZER). NG	OK Check the injector. (Refer to P.13D-101.)	NG ► Repl	ace
 Voltage between 1 and earth ((gnition switch: ON)) OK: System voltage OK Check the following connector: C-122 MG Measure at the engine-A/T-ECU connector C-122. Disconnect the connector, and measure at the harness side. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON)) OK: System voltage OK Check the trouble symptoms. MG Check the trouble symptoms. OK Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG 	OK Measure at the injector connector B-02, B-03, B-04, B-05.	NG Chec	k the harness wire between the engine control relay and the
NG NG Check the following connector: C-122 NG Measure at the engine-A/T-ECU connector C-122. NG Obsconnect the connector, and measure at the harness side. NG Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) NG OK Check the trouble symptoms. Voltage between 2, 2, 9, 24 and earth (Ignition switch: ON) OK Check the trouble symptoms. NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. OK O Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG	Voltage between 1 and earth (Ignition switch: ON) OK: System voltage OK		,
OK Measure at the engine-A/T-ECU connector C-122. Disconnect the connector, and measure at the harness side. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK OK Check the trouble symptoms. NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P-13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG	Check the following connector: C-122	_NG ► Repa	ir
Measure at the engine-A/T-ECU connector C-122. • Disconnect the connector, and measure at the harness side. • Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK: System voltage OK Check the trouble symptoms. NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. • Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. • Engine: Idling • The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG • Check the harness wire between the engine-A/T-ECU and the injector connector, and repair if necessary. • Check the harness wire between the engine-A/T-ECU and the injector connector, and repair if necessary. • Check the trouble symptoms. • OK • Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.) • Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. • Engine: Idling • The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). • NG	ок		
OK Check the trouble symptoms. NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG	 Measure at the engine-A/T-ECU connector C-122. Disconnect the connector, and measure at the harness side. Voltage between 1, 2, 9, 24 and earth (Ignition switch: ON) OK: System voltage 	Chec inject	k the harness wire between the engine-A/T-ECU and the or connector, and repair if necessary.
Check the trouble symptoms. NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER).	↓ ОК		
NG Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. • Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. • Engine: Idling • The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). NG	Check the trouble symptoms.		
Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. • Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. • Engine: Idling • The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER).	NG		
	 Use an analyzer to measure the signal waveform at injector connector B-02, B-03, B-04, B-05. Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side. Engine: Idling The voltage between terminal 2 and earth OK: A normal waveform should be displayed as described on P.13D-83 (INSPECTION PROCEDURE USING AN ANALYZER). 	OK Interr (Refe	nittent malfunction er to GROUP 00 – Points to Note for Intermittent Malfunctions.)
	NG	7	
Replace the engine-A/T-ECU.	Replace the engine-A/T-ECU.		

Code No. 44 Ignition coil system	Probable cause
 Range of Check The engine speed is 1,500 - 4,500 r/min Volumetric efficiency 30 - 55 % Fuel cut and injector not in forced drive (actuator test) mode. The throttle deviation is within the range of -0.06 V/25 ms to 0.06 V/10 ms. The coolant temperature is 80°C or higher, and the intake air temperature is -10°C or higher. Set condition After driven for 250 rotations or more in the above check range, crank angle sensor detects abnormal rotation caused by misfire (one failed coil of the two 	 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-A/T-ECU



Cord No. 54 Immobilizer system	Probable cause
 Range of Check Ignition switch: ON Set Condition Improper communication between the engine-A/T-ECU and the immobilizer-ECU 	 Open or short circuit, or loose connector contact Malfunction of the immobilizer-ECU Malfunction of the engine-A/T-ECU

NOTE

- (1) If the registered ignition keys 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. 59 Oxygen sensor (rear) system	Probable cause
 Range of Check More than 3 minutes passed after completion of start of engine The engine coolant temperature is approximately more than 80°C. Intake air temperature 0 - 55°C The engine speed is more than 1,800 - 3,500 r/min. The volumetric efficiency is 16 - 60% or more. Other than the fuel cut mode When 0.2 seconds or more of the fuel cut passed, 30 seconds elapsed after return. The air flow sensor output frequency is 81 Hz or more. Set Conditions When the throttle position sensor is 4.4 V or higher, other than the engine is idling, and other than in feedback mode, all the following states continue to be true for 5 seconds or more: the oxygen sensor (front) output voltage is 0.5 V or higher; the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.78 V. When the air/fuel ratio is forcibly turned to a rich state for 10 seconds, all the following states continue to be true for 5 seconds or more: the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.1 V; and the oxygen sensor (rear) output voltage is less than 0.1 V; 	 Malfunction of the oxygen sensor (rear) Oxygen sensor (rear) circuit disconnection, short-circuit, or connector contact defect Malfunction of the engine-A/T-ECU
• The engine-A/T-ECU monitors for this condition once during the drive cycle.	







INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom			Reference page
Communication with M.U.TII/	Communication with all systems is not possible.	1	13D-39
III is impossi- ble.	Communication with engine-A/T-ECU only is not possible.	2	13D-39
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13D-40
	The engine warning lamp remains illuminating and never goes out.	4	13D-40
Starting	No initial combustion (starting impossible)	5	13D-41
	Initial combustion but no complete combustion (starting impossible)	6	13D-42
	Long time to start (improper starting)	7	13D-43
Idling stability	Unstable idling (Rough idling, hunting)	8	13D-44
	Idling speed is high. (Improper idling speed)	9	13D-46
	Idling speed is low. (Improper idling speed)	10	13D-46
Idling stability	When the engine is cold, it stalls at idling. (Die out)	11	13D-47
	When the engine is hot, it stalls at idling. (Die out)	12	13D-48
	The engine stalls when starting the car. (Pass out)	13	13D-50
	The engine stalls when decelerating.	14	13D-50
Driving	Hesitation, sag or stumble	15	13D-51
	The feeling of impact or vibration when accelerating	16	13D-52
	The feeling of impact or vibration when decelerating	17	13D-52
	Poor acceleration	18	13D-53
	Surge	19	13D-54
	Knocking	20	13D-55
Dieseling		21	13D-55
Too high CO and HC concentration when idling		22	13D-56
Low alternator output voltage (approx. 12.3 V)			13D-57
Idling speed is im	proper when A/C is operating	24	13D-57
Fans (radiator far	n, A/C condenser fan) are inoperative	25	13D-58

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	Hunting	Engine speed doesn't remain constant; changes at idle.		
Stability	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. 2		
Vehicle speed	Normal Initial ac- celerator pedal de- pression Idling	Stumble
	Time	1FU0224
PROBLEM SYMPTOMS TABLE

Inspection procedure No.	Trouble symptom	Reference page
1	Communication with all system is not possible	13D-39
2	Communication with engine-A/T-ECU only is not possible	13D-39
3	The engine warning lamp does not illuminate right after the ignition switch is turned to the "ON" position	13D-40
4	The engine warning lamp remains illuminating and never goes out	13D-40
5	No initial combustion (Starting impossible)	13D-41
6	Initial combustion but no complete combustion (Starting impossible)	13D-42
7	It takes too long time to start (Incorrect starting)	13D-43
8	Unstable idling (Rough idling, hunting)	13D-44
9	Idling speed is high (Improper idling speed)	13D-46
10	Idling speed is low (Improper idling speed)	13D-46
11	When the engine is cold, it stalls at idling (Die out)	13D-47
12	When the engine is hot, it stalls at idling (Die out)	13D-48
13	The engine stalls when starting the car (Pass out)	13D-50
14	The engine stalls when decelerating	13D-50
15	Hesitation, sag or stumble	13D-51
16	The feeling of impact or vibration when accelerating	13D-52
17	The feeling of impact or vibration when decelerating	13D-52
18	Poor acceleration	13D-53
19	Surge	13D-54
20	Knocking	13D-55
21	Dieseling	13D-55
22	Too high CO and HC concentration when idling	13D-56
23	Low alternator output voltage (approx. 12.3 V)	13D-57
24	Idling speed is improper when A/C is operating	13D-57
25	Fans (radiator fan, A/C condenser fan) are inoperative	13D-58
26	Check the engine-A/T-ECU power supply and earth circuit	13D-59
27	Power supply system and ignition switch-IG system	13D-59
28	Fuel pump system	13D-60
29	Ignition switch-ST and inhibitor switch system	13D-62
30	Power steering fluid pressure switch system	13D-63

13D-38

Inspection procedure No.	Trouble symptom	Reference page
31	A/C switch and A/C relay system	13D-63
32	Idle speed control (ISC) servo (Stepper motor) system	13D-64
33	Purge control solenoid valve system	13D-65
34	EGR control solenoid valve system	13D-65

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1



M.U.TII/III communication with engine-A/T-ECU is impossible.	Probable cause
One of the following causes may be suspected: • No power supply to engine-A/T-ECU. • Defective earth circuit of engine-A/T-ECU. • Defective engine-A/T-ECU. • Improper communication line between engine-A/T-ECU and M.U.TII/III	 Malfunction of the engine-A/T-ECU powersupply circuit Malfunction of the engine-A/T-ECU Open circuit between engine-A/T-ECU and diagnosis connector



The engine warning lamp does not illumina the ignition switch is turned to the ON posit	after Probable cause	
Because there is a burnt-out bulb, the engine-A/T-ECU causes lamp to illuminate for five seconds immediately after the ignition ON. If the engine warning lamp does not illuminate immediately after is turned to ON, one of the malfunctions listed at right has p	the engine was switch is turn switch is turn or the ignition sprobably occu	 arning Burnt-out bulb Defective warning lamp circuit Malfunction of the engine-A/T-ECU
	NG	
M.U.TII/III Data list 16 Engine-A/T-ECU power supply voltage (Refer to P.13D-66.)		(Refer to P.13D-59, INSPECTION PROCEDURE 26.)
ок		NG
 Measure at the engine-A/T-ECU connector C-122. Disconnect the connector, and measure at the harness side. 	•	Check the following ► Repair connector: C-122
• Earth the terminal No. 22. OK: The engine warning lamp illuminates.		OK
NG	-	Check the trouble symptom.
NG		NG
Check a burnt-out bulb.		Replace the engine-A/T-ECU.
OK	NG	NG
 Measure at the combination meter connector C-04. Disconnect the connector, and measure at the harness side. Voltage between 9 and earth (Ignition switch: ON) 		Check the following connectors: C-03, C-212, C-210 ► Repair
OK: System voltage		ОК
		Check the trouble symptom.
		NG
		Check the engine warning lamp power supply circuit, and repair if necessary.
Check the following connectors: C-13, C-122	NG►	Repair
↓ ОК	NG	
Check the trouble symptom.		Checktheharnesswirebetweencombinationmeterandengine-A/T-ECU, and repair if necessary.

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-A/T-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-A/T-ECU Malfunction of the engine-A/T-ECU

	_ YES	
M.U.TII/III Self-Diag code Are diagnosis codes displayed?		Refer to P.13D-12, INSPECTION CHART FOR DIAGNOSIS CODES
NO		
 Measure at the combination meter connector C-04. Disconnect the connector, and measure at the harness side. Disconnect the projector A/T_ECH connector. 		Checkthe harness wire between combination meter and engine-A/T-ECU connector, and repair if necessary.
 Continuity between 17 and earth OK: No continuity 		
ок	_	
Replace the engine-A/T-ECU.]	

No initial combustion (starting impossible)			Probable cause	
In cases such as the above, the cause is probably that a spart or that the supply of fuel to the combustion chamber is defer In addition, foreign materials (water, kerosene, etc.) may be m	k plug is defective, ctive. nixed with the fuel.		 Malfunction of the ignition system Malfunction of the fuel pump system Malfunction of the injectors Malfunction of the engine-A/T-ECU Malfunction of the immobilizer system <australia></australia> Foreign materials in fuel 	
	NC			
Check battery voltage when cranking. OK: 8 V or higher		Check	the battery. (Refer to GROUP 54 - Battery.)	
ок				
Is an immobilizer-ECU diagnosis code displayed?	TES ►	Check	the immobilizer.	
NO	-	(Refer	to GROUP 54 – Ignition Key and Immobilizer.)	
M.U.TII/III Data list 16 Engine-A/T-ECU power supply voltage (Refer to P.13D-66.)	NG ►	Check (Refer	the power supply system and ignition switch-IG system. to P.13D-59, INSPECTION PROCEDURE 27.)	
ζοκ				
Does the camshaft rotate at the engine cranking? (When oil filler cap is removed.)	NO NO	Check	timing belt for breakage.	
YES				
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	YES -	Refer	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS S.	
NO		0000		
MIIT-II/III Data list	NG	Check	the crank angle sensor system. (Refer to P.13D-56, INSPEC-	
22 Crank angle sensor OK: Cranking speed is displayed.		TION	PROCEDURE FOR DIAGNOSIS CODE 22.)	
ок				
M.U.TII/III Actuator test 07 Fuel pump (Refer to P.13D-70)	NG ►	Check PROC	the fuel pump system. (Refer to P.13D-60, INSPECTION EDURE 28.)	
OK	, ,,,,			
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.)	NG ►	Check P.13D-	the engine coolant temperature sensor system. (Refer to 20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE	
OK	21.)		21.)	
Can any sound be heard from the injectors when cranking?	NG ►	Check	the injector system. (Refer to P.13D-29, INSPECTION PRO-	
ок		CEDUI	RE FOR DIAGNOSIS CODE 41.)	
 Does the engine tachometer display the cranking speed? Set the tachometer of primary voltage detection type. 		Check PROC	the ignition coil system. (Refer to P.13D-30, INSPECTION EDURE FOR DIAGNOSIS CODE 44.)	
ОК	_			
Check the ignition timing when cranking. OK: Approx. 5° BTDC		Check	that the crank angle sensor is installed properly.	
ОК	-			
 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 fue Check the compression pressure. 	el.			

• Check the immobilizer system.

Initial combustion but no complete combus (starting impossible)	tion	Probable cause		
In such cases as the above, the cause is probably that the spark pl sparks but the sparks are weak, or the initial mixture for starting		 Malfunction of the ignition system Malfunction of the injector system Foreign materials in fuel Poor compression Malfunction of the engine-A/T-ECU 		
	_ NG			
Check battery voltage when cranking. OK: 8 V or higher	►	Check the battery. (Refer to GROUP 54 – Battery.)		
ок	⊣ YES			
M.U.TII/III Self-Diag code Are diagnosis codes displayed?		CODES.		
NO	_ _ NG			
M.U.TII/III Actuator test 07 Fuel pump (Refer to P.13D-70)	•	 Check the fuel pump system. (Refer to P.13D-60, INSPECTION PROCEDURE 28.) 		
OK M.U.TII/III Data list	NG ►►	Check the engine coolant temperature sensor system.		
21 Engine coolant temperature sensor (Refer to P.13D-66.)		(Heferto P. 13D-55, INSPECTION PROCEDUREFORDIAGNOSIS CODE 21.)		
M.U.TII/III Data list 18 Ignition switch-ST (Refer to P.13D-66.)	_NG ►	► Check the ignition switch-ST and inhibitor switch system (Refer to P.13D-62, INSPECTION PROCEDURE 29.)		
OK Can any sound be heard from the injectors when cranking? OK Is starting good if the engine is cranked with the accelerator pedal slightly depressed? NO	NG YES	 Check the injector system, (Refer to P.13D-29, INSPECTION PRO-CEDURE FOR DIAGNOSIS CODE 41.) Check ISC servo for operation sound. (Refer to P.13D-102.) OK Clean the throttle valve area. (Refer to P.13D-90.) 		
	– NG			
Check the ignition timing when cranking. OK: Approx. 5°BTDC		- Check that the crank angle sensor is installed properly.		
ок				
 Check the following items. Check the ignition coil, spark plugs, spark plug cables. Check if the injectors are clogged. Check the compression pressure. Check fuel lines for clogging. Check if foreign materials (water alcohol, etc.) got into fuel. 				

It takes too long time to start. (Incorrect sta	rting)		Probable cause	
In cases such as the above, the cause is probably that the spark is difficult, the initial mixture for starting is not appropriate, or su pressure is not being obtained.	is weak and ignition ifficient compression		 Malfunction of the ignition system Malfunction of the injector system Inappropriate gasoline use Poor compression 	
	NG			
Check battery voltage when cranking OK: 8 V or higher	•	Check	the battery. (Refer to GROUP 54 - Battery.)	
ОК				
M.U.TII/III Self-Diag code Are diagnosis codes displayed?		YES ► Refer to P.13D-12, INSPECTION CHART FOR CODES.		
NO	 NG			
M.U.TII/III Actuator test 07 Fuel pump (Refer to P.13D-70)		Check (Refer	the fuel pump system. to P.13D-60, INSPECTION PROCEDURE 28.)	
ок	 NG			
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.)		Check (Refert	the engine coolant temperature sensor system. 0P.13D-20, INSPECTION PROCEDUREFORDIAGNOSIS 21.)	
OK V	NG		,	
M.U.TII/III Data list 18 Ignition switch-ST (Refer to P.13D-66.)	► CI (F		eck the ignition switch-ST and inhibitor switch system. ofer to P.13D-62, INSPECTION PROCEDURE 29.)	
ОК				
Can any sound be heard from the injectors when cranking?	NG ►	Check	the injector system. (Refer to P.13D-29, INSPECTION PRO-	
ОК		CEDU	DURE FOR DIAGNOSIS CODE 41.)	
Check the ignition timing when cranking. OK: Approx. 5°BTDC	Check that the crank angle sensor is installed proper			
ОК				
 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 full 	el.			

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. Were the battery terminals disconnected? Were the battery terminals disconnected? MU.T.T.II/III Self-Diag code Are diagnosis codes displayed? NO VES VES Maturction of the ignition system VES Maturction of the gore compression Does idling speed fluctuate excessively? NO VES NO Check the ISC servo for operation sound. (Refer to P.13D-102.) NG Check the ISC servo for operation sound. (Refer to P.13D-102.) NG Check the ISC servo for operation sound. (Refer to P.13D-102.)	
Were the battery terminals disconnected? YES MU.TII/III Self-Diag code YES Are diagnosis codes displayed? Refer to P.13D-12, INSPECTION CHART FOR DIAC CODES. NO YES Does idling speed fluctuate excessively? • Check the throttle valve area. (Refer to P.13D-90.) NO YES Does idling speed fluctuate excessively? • Check the throttle valve area. (Refer to P.13D-90.) NO YES Ocheck the trouble symptom. NG Inspect the intake of air into the air intake system. • Broken intake manifold gasket • Broken vacuum hose • Positive crankcase ventilation valve does not operation Check the ISC servo for operation sound. (Refer to P.13D-102.) NG	əm system em
Were the battery terminals disconnected? YES After warming-up, let the engine run at idling for 10 m NO YES After warming-up, let the engine run at idling for 10 m M.U.TII/III Self-Diag code Are diagnosis codes displayed? YES Refer to P.13D-12, INSPECTION CHART FOR DIAG CODES. Does idling speed fluctuate excessively? YES • Check the throttle valve area. (Refer to P.13D-90.) NO YES Ocheck the trouble symptom. NG Inspect the intake of air into the air intake system. • Broken air intake hose • Broken air intake hose • Does idling speed for operation sound. (Refer to P.13D-102.) NG	
NO M.U.TII/III Self-Diag code Are diagnosis codes displayed? NO Does idling speed fluctuate excessively? NO NO VES Check the throttle valve area. (Refer to P.13D-90.) NO Check the trouble symptom. NG Inspect the intake of air into the air intake system. Broken intake manifold gasket Broken vacuum hose Positive crankcase ventilation valve does not operation Check the ISC servo for operation sound. (Refer to P.13D-102.) NG Check the ISC servo system.	inutes.
M.U.TII/III Self-Diag code Are diagnosis codes displayed? Refer to P.13D-12, INSPECTION CHART FOR DIAC CODES. NO YES Does idling speed fluctuate excessively? • Check the throttle valve area. (Refer to P.13D-90.) NO YES Ocheck the trouble symptom. • NG Inspect the intake of air into the air intake system. • Broken air intake hose Broken air intake hose • Positive crankcase ventilation valve does not operation NG • Check the ISC servo for operation sound. (Refer to P.13D-102.)	
NO YES Does idling speed fluctuate excessively? Check the throttle valve area. (Refer to P.13D-90.) Check the trouble symptom. Check the trouble symptom. 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 operation NG Check the ISC servo for operation sound. (Refer to P.13D-102.) NG Check the ISC servo system.	NOSIS
Does idling speed fluctuate excessively? Check the throttle valve area. (Refer to P.13D-90.) NO Check the trouble symptom. 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 operation NG Check the ISC servo for operation sound. (Refer to P.13D-102.) NG	
NO Check the 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 operation NG Check the ISC servo for operation sound. (Refer to P.13D-102.)	
Check the ISC servo for operation sound. (Refer to P.13D-102.)	
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 operation NG Check the ISC servo for operation sound. (Refer to P.13D-102.)	
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 operation NG Check the ISC servo for operation sound. (Refer to P.13D-102.)	
Check the ISC servo for operation sound. (Refer to P.13D-102.)	te.
Check the ISC servo for operation sound. (Refer to P.13D-102.)	
(Refer to P.13D-64, INSPECTION PROCEDURE 32.)	
Check the injector for operation sound.	NPRO-
M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.)	3D-18, 14.)
NG	
M.U.TII/III Data list 13 Intake air temperature sensor (Refer to P.13D-66.) OK CODE 13.)	NOSIS
M.U.III/III Data list 25 Barometric pressure sensor (Refer to P.13D-66.) Check the barometric pressure sensor system. (Refer to P.13D-66.)	3D-26, 25.)
NG	
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.)	NOSIS
OK NG	
M.U.TII/III Actuator test NG 08 Purge control solenoid valve Check the purge control solenoid valve system. (Refer to P.' (Refer to P.13D-70.) INSPECTION PROCEDURE 33)	3D-65,
OK NO	
M.U.TII/III Actuator test 10 EGR control solenoid valve (Refer to P.13D-70.)	
ОК	
To the next page	



Idling speed is high. (Improper idling speed))		Probable cause
In such cases as the above, the cause is probably that the intak- idling is too great.	ke air volume during		Malfunction of the ISC servo systemMalfunction of the throttle body
M.U.TII/III Self-Diag code Are diagnosis codes displayed? NO Check the ISC servo for operation sound. (Refer to P.13D-102.) OK M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.) OK M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.) OK	YES NG NG NG NG NG NG	Refer to CODES Check t (Refer t Check t (Referto CODE Check t (Referto CODE 2	b P.13D-12, INSPECTION CHART FOR DIAGNOSIS the ISC servo system. b P.13D-64, INSPECTION PROCEDURE 32.) the throttle position sensor system. P.13D-18, INSPECTION PROCEDURE FOR DIAGNOSIS 14.) the engine coolant temperature sensor system. P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS 21.)
M.U.TII/III Data list 28 A/C switch (Refer to P.13D-66.) OK Basic idle speed adjustment (Refer to P.13D-91.)] <mark>NG</mark> →[Check t (Refer t	he A/C switch and A/C relay system. p P.13D-63, INSPECTION PROCEDURE 31.)
Check the trouble symptom.] <mark>NG</mark> →[Clean tl	ne throttle valve area. (Refer to P.13D-90.)

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 systemMalfunction of the throttle body

	YES	
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	►	Refer to P.13D-12, INSPECTION CHART FOR DIAGNOSIS CODES.
NO	NG	
Check the ISC servo for operation sound. (Refer to P.13D-102.)	►	Check the ISC servo system.
ОК	-	(Refer to P.13D-64, INSPECTION PROCEDURE 32.)
	NG	[
M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.)	▶	Check the throttle position sensor system. (Referto P.13D-18, INSPECTION PROCEDURE FORDIAGNOSIS CODE 14.)
OK		
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.)	NG]►	Check the engine coolant temperature sensor system. (Referto P.13D-20, INSPECTION PROCEDURE FORDIAGNOSIS CODE 21.)
	1	
Basic idle speed adjustment (Refer to P.13D-91.)		
The second secon	NG	
Check the trouble symptom.	├	Clean the throttle valve area. (Refer to P.13D-90.)

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 in appropriate 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 			
	YES					
Were the battery terminals disconnected?	} ►	After w	varming-up, let the engine run at idling for 10 minutes.			
NO	VES					
M.U.TII/III Self-Diag code Are diagnosis codes displayed?		Refer CODE	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS S.			
NO						
Does the engine stall right after the accelerator pedal is released?	TES ►	Clean	the throttle valve area. (Refer to P.13D-90.)			
NO						
Is engine-idling stable after the warming-up?	_ NO ►	Check	if the unstable idling (Rough idling, hunting).			
YES		(Refer	to P.13D-44, INSPECTION PROCEDURE 8.)			
	¬ NG					
Check the ISC servo for operation sound. (Refer to P.13D-102.)	╞	Check	the ISC servo system. to P.13D-64, INSPECTION PROCEDURE 32.)			
OK						
Check the injector for operation sound.	NG	Check	the injector system. (Referto P.13D-29, INSPECTION PRO-			
ОК		CEDU	RE FOR DIÁGNOSIS CODE 41.)			
	_ NG					
M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.)		Check INSPE	the throttle position sensor system. (Refer to P.13D-18, CTION PROCEDURE FOR DIAGNOSIS CODE 14.)			
ок	NG					
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.)		Check (Refer	the engine coolant temperature sensor system. toP.13D-20,INSPECTION PROCEDUREFORDIAGNOSIS			
ОК		CODE	21.)			
	_ NG	Charle	the FOD control colonaid value system			
10 EGR control solenoid valve (Refer to P.13D-70.)		(Refer	to P.13D-65, INSPECTION PROCEDURE 34.)			
ОК						
Check the fuel pressure. (Refer to P.13D-92.)]					
ОК	_					
Check the ignition timing. (Refer to GROUP 11C – On-vehicle Service.)	¬ NG ►	Check	that the crank angle sensor is installed properly.			
ОК						
Check the following items.]			
 Check the ignition coil, spark plugs, spark plug cables. Check the compression pressure. Check the engine oil viscosity. 						

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.		ixture, nector	 Malfunction of the ignition system Malfunction of the air-fuel ratio control system Malfunction of the ISC system Drawing air into intake system Improper connector contact 			
	VEC					
Were the battery terminals disconnected?	FES ►	After v	varming-up, let the engine run at idling for 10 minutes.			
NO						
M.U.TII/III Self-Diag code Are diagnosis codes displayed?		Refer CODE	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS S.			
NO	NG					
Check the ISC servo for operation sound. (Refer to P.13D-102.)] ──►	Check	the ISC servo system.			
ок	NO		10 F.13D-64, INSPECTION PROCEDURE 32.)			
Check the injector for operation sound.	- NG ┣───►	Check	the injector system. (Refer to P.13D-29, INSPECTION PRO-			
ОК		CEDU	RE FOR DIAGNOSIS CODE 41.)			
Does the engine stall right after the accelerator pedal is released?	_YES ►	• Cle	ean the throttle valve area. (Refer to P.13D-90.)			
NO						
Does the engine stall easily again?	_NO ►	While	carrying out an intermittent malfunction simulation test (Refer			
YES	_	to GRC for suc • Cra • Inje	DUP 00 – Points to Note for Intermittent Malfunctions.), check dden changes in the signals shown below. ank angle sensor signal ector drive signal • Primary and secondary ignition signal • Fuel pump drive signal • Engine-A/T-ECU power supply voltage			
M.U.TII/III Data list	_NG ►	Check	the throttle position sensor system. (Refer to P.13D-18,			
14 Throttle position sensor (Refer to P.13D-66.)		INSPE	CTION PROCEDURE FOR DIAGNOSIS CODE 14.)			
ОК	NG					
M.U.TII/III Data list 13 Intake air temperature sensor (Refer to P.13D-66.)	•	Check (Refer	the intake air temperature sensor system. toP.13D-16,INSPECTIONPROCEDUREFORDIAGNOSIS 13.)			
UK	⊣ NG		- /			
M.U.TII/III Data list 25 Barometric pressure sensor (Refer to P.13D-66.) OK	╞	Check (Refer CODE	the barometric pressure sensor system. to P.13D-26, INSPECTION PROCEDUREFORDIAGNOSIS 25.)			
M.U.TII/III Data list	_ NG ►	Check	the engine coolant temperature sensor system.			
21 Engine coolant temperature sensor (Refer to P.13D-66.)		(Refer	toP.13D-20, INSPECTION PROCEDUREFORDIAGNOSIS			
OK	NG	CODE	21.)			
M.U.TII/III Actuator test 10 EGR control solenoid valve (Refer to P.13D-70.)		Check (Refer	the EGR control solenoid valve system. to P.13D-65, INSPECTION PROCEDURE 34.)			
ОК	_ NG					
 M.U.TII/III Data list 59 Oxygen sensor (rear) Transmission: D range Driving with throttle widely open OK: 600 - 1,000 mV 		Check (Refer CODE	the oxygen sensor (rear) system. toP.13D-32,INSPECTION PROCEDUREFORDIAGNOSIS 59.)			
ОК	NO					
M.U.TII/III Data list 11 Oxygen sensor (front) OK: 600 – 1,000 mV during sudden racing OK	NG	Check (Refer CODE	the oxygen sensor (front) system. toP.13D-13,INSPECTIONPROCEDUREFORDIAGNOSIS 11.)			
To the next page	1					



· Check if foreign materials (water, alcohol, etc.) got into fuel.

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
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	YES Rei CO	er to P.13D-12, INSPECTION CHART FOR DIAGNOSIS DES.
NO M.U.TII/III Actuator test 10 EGR control solenoid valve (Refer to P.13D-70.) OK	NG (Re	eck the EGR control solenoid valve system. fer to P.13D-65, INSPECTION PROCEDURE 34.)
 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 		

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



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 the air-fuel ratio control system Malfunction of the fuel supply system Malfunction of the EGR control solenoid valve system Poor compression 			
	YES					
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	•	Refer to CODES	0 P.13D-12, INSPECTION CHART FOR DIAGNOSIS			
v NO	NG					
Check the injectors for operation sound.		Check the CEDUR	he injector system. (Referto P.13D-29, INSPECTION PRO- IE FOR DIAGNOSIS CODE 41.)			
Check the ignition timing.	NG	Check t	that the crank angle sensor is installed properly.			
(Refer to GROUP 11C – On-vehicle Service.)						
M.U.TII/III Data list	NG	Check t	the intake air temperature sensor system.			
13 Intake air temperature sensor (Refer to P.13D-66.)		(Referto	pP.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS 13.)			
M.U.TII/III Data list	NG	Check t	the barometric pressure sensor system.			
25 barometric pressure sensor (Refer to P.13D-66.)		(Referto	DP.13D-26, INSPECTION PROCEDURE FOR DIAGNOSIS 25.)			
M.U.TII/III Data list	NG	Check t	the engine coolant temperature sensor system.			
21 Engine coolant temperature sensor (Refer to P.13D-66.)		(Referto	pP.13D-20, INSPECTION PROCEDURE FORDIAGNOSIS 21.)			
M.U.TII/III Data list	NG	Check t	the throttle position sensor system. (Refer to P.13D-18,			
14 Throttle position sensor (Refer to P.13D-66.)		INSPEC	CTION PROCEDURE FOR DIAGNOSIS CODE 14.)			
	NG					
M.U.TII/III Actuator test 10 EGR control solenoid valve (Refer to P.13D-70.)	•	Refer t	the EGR control solenoid valve system. to P.13D-65, INSPECTION PROCEDURE 34.)			
OK	NG					
M.U.TII/III Data list 59 Oxygen sensor (rear) • Transmission: D range • Driving with throttle widely open OK: 600 – 1,000 mV		Check t (Referto CODE	the oxygen sensor (rear) system. bP.13D-32,INSPECTIONPROCEDUREFORDIAGNOSIS 59.)			
ок	NG					
M.U.TII/III Data list 11 Oxygen sensor (front) OK: 600 – 1,000 mV during sudden racing		 Check t (Referto CODE 	the oxygen sensor (front) system. PP.13D-13,INSPECTIONPROCEDUREFORDIAGNOSIS 11.)			
vк						
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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		

		YES						
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	?	▶	Refer to CODES.	P.13D-12,	INSPECTION	CHART	FOR	DIAGNOSIS
	NO							

Check the following items.

• Check the ignition coil, spark plugs, spark plug cables.

Check for occurrence of ignition leak.

The feeling of impact or vibration when decelerating.		Probable cause		
Malfunction of the ISC system is suspected.			Malfunction of the ISC system	
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	YES	Refer CODE	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS S.	
Check the ISC servo for operation sound. (Refer to P.13D-102.)		Check (Refer	the ISC servo system. to P.13D-64, INSPECTION PROCEDURE 32.)	
M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.)		Check INSPE	the throttle position sensor system. (Refer to P.13D-18, CTION PROCEDURE FOR DIAGNOSIS CODE 14.)	
Clean the throttle valve area. (Refer to P.13D-90.)]			

Poor acceleration			Probable cause			
Defective ignition system, abnormal air-fuel ratio, poor compression pressure are suspected.		e, etc.	 Malfunction of the ignition system Malfunction of the air-fuel ratio control system Malfunction of the fuel supply system Poor compression pressure Clogged exhaust system 			
		YES				
M.U.TII/III Self-Diag code Are diagnosis codes displayed	?	▶	Refer CODE	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS S.		
	NO	 NG				
Check the injectors for operati	on sound.		Check	the injector system. (Refer to P.13D-29, INSPECTION PRO- RE FOR DIAGNOSIS CODE 41.)		
Check the ignition timing.		_NG ►	Check	that the crank angle sensor is installed properly.		
(Refer to GROUP 11C - On-v	OK					
M.U.TII/III Data list 13 Intake air temperature sens	sor (Refer to P.13D-66.)	NG ►	Check (Refer	the intake air temperature sensor system. to P.13D-16, INSPECTION PROCEDUREFORDIAGNOSIS		
	ОК	NG				
M.U.TII/III Data list 25 Barometric pressure sensor	r (Refer to P.13D-66.)		(Refer	the barometric pressure sensor system. to P.13D-26, INSPECTION PROCEDUREFORDIAGNOSIS 25.)		
	ok ▼	NG				
M.U.TII/III Data list 21 Engine coolant temperature	e sensor (Refer to P.13D-66.)		(Refer	the engine coolant temperature sensor system. toP.13D-20, INSPECTION PROCEDUREFORDIAGNOSIS 21.)		
	ok ▼	_ NG				
M.U.TII/III Data list 14 Throttle position sensor (Re	efer to P.13D-66.)	•	INSPE	the throttle position sensor system. (Hefer to P.13D-18, CTION PROCEDURE FOR DIAGNOSIS CODE 14.)		
	ОК	_ NG				
M.U.TII/III Actuator test 10 EGR control solenoid valve	(Refer to P.13D-70.)		(Refer	the EGR control solenoid valve system. to P.13D-65, INSPECTION PROCEDURE 34.)		
	ок	_ NG				
 M.U.TII/III Data list 59 Oxygen sensor (rear) Transmission: D range Driving with throttle widely OK: 600 - 1,000 mV 	open		Check (Refer CODE	the oxygen sensor (rear) system. toP.13D-32,INSPECTION PROCEDUREFORDIAGNOSIS 59.)		
	ок					
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• Clogged air cleaner

Surge		Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are sus	spected.	 Malfunction of the ignition system Malfunction of the air-fuel ratio control system Malfunction of the EGR control solenoid valve system
M.U.TII/III Self-Diag code	YES	to P.13D-12, INSPECTION CHART FOR DIAGNOSIS
NO	NG Chaol	
Check the injectors for operation sound.		JRE FOR DIAGNOSIS CODE 41.)
Check the ignition timing. (Refer to GROUP 11E – On-vehicle Service.)	► Checl	k that the crank angle sensor is installed properly.
M.U.TII/III Data list 13 Intake air temperature sensor (Refer to P.13D-66.)	NG Checl INSPI	ktheintakeairtemperaturesensorsystem. (Referto P.13D-16, ECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK M.U.TII/III Data list 25. Baramatria prossura concor (Pafar to B12D 66.)		k the barometric pressure sensor system. (Refer to P.13D-26,
	NG	
M.U.TII/III Data list 21 Engine coolant temperature sensor (Refer to P.13D-66.) OK	Check (Refe CODE	k the engine coolant temperature sensor system. rtoP.13D-20, INSPECTION PROCEDUREFORDIAGNOSIS E 21.)
M.U.TII/III Data list 14 Throttle position sensor (Refer to P.13D-66.)	Check (Refe CODE	k the throttle position sensor system. rtoP.13D-18,INSPECTIONPROCEDUREFORDIAGNOSIS E 14.)
M.U.TII/III Actuator test 10 EGR control solenoid valve (Refer to P.13D-70.)	NG Checl (Refe	k the EGR control solenoid valve system. r to P.13D-65, INSPECTION PROCEDURE 34.)
OK	Т	



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 plugDefective detonation sensor

	YES	
M.U.TII/III Self-Diag code Are diagnosis codes displayed?	▶	Refer to P.13D-12, INSPECTION CHART FOR DIAGNOSIS CODES.
NO	NO	
Does knocking occur when driving with the detonation sensor connector disconnected? At this time, use the M.U.TII/III to check if the timing is retarded compared to when the detonation sensor connector is disconnected.		Check the detonation sensor system. (Refer to P.13D-28, INSPEC- TION PROCEDURE FOR DIAGNOSIS CODE 31.)
YES	-	
Check the following items. • Spark plugs • Check if foreign materials (water, alcohol, etc.) got into fue	91.	

INSPECTION PROCEDURE 21

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

Check the injectors for fuel leakage.

Too high CO and HC concentration when idling		Probable cause			
Abnormal air-fuel ratio is susp	pected.			Malfunction of the air-fuel ratio cDeteriorated catalyst	ontrol system
		YES			
M.U.TII/III Self-Diag code Are diagnosis codes displayed	?	}	 Refer CODE 	to P.13D-12, INSPECTION CHART S.	FOR DIAGNOSIS
	NO				
Check the ignition timing. (Refer to GROUP 11C - On-v	ehicle Service.)		► Check	that the crank angle sensor is install	ed properly.
	ок				
M.U.TII/III Data list 21 Engine coolant temperature	e sensor. (Refer to P.13D-66.)		 Check (Refer 	the engine coolant temperature sense to P.13D-20, INSPECTION PROCEDURE	or system. EFORDIAGNOSIS
	ок		CODE	21.)	
M.U.TII/III Data list 13 Intake air temperature sens	sor (Refer to P.13D-66.)		Check (Refer	the intake air temperature sensor system o P.13D-16, INSPECTION PROCEDURE	stem. EFORDIAGNOSIS
	OK	NG		10.)	
M.U.TII/III Data list 25 Barometric pressure senso	r (Refer to P.13D-66.)		 Check (Refer 	the barometric pressure sensor system to P.13D-26, INSPECTION PROCEDURE	em. EFORDIAGNOSIS
	ок V	NG		23.)	
 M.U.TII/III Data list 59 Oxygen sensor (rear) Transmission: D range Driving with throttle widely OK: 600 - 1,000 mV 	open		 Check (Refer CODE 	the oxygen sensor (rear) system. pp.13D-32, INSPECTION PROCEDURE 59.)	EFORDIAGNOSIS
	ок				
M.U.TII/III Data list 11 Oxygen sensor (front) OK: 600 - 1,000 mV whe	en racing suddenly.		 Check (Refer CODE 	the oxygen sensor (front) system. oP.13D-13,INSPECTION PROCEDURE 11.)	EFORDIAGNOSIS
	ок				
M.U.TII/III Data list 11 Oxygen sensor (front)			► Replac	e the oxygen sensor.	
idling.	1600 – 1,000 mV alternately when		Check	the trouble symptom	
	NG	_	Chicon	NG	
Check the fuel pressure. (Refe	er to P.13D-92.)				
	ок			•	
Check the following items. • Check the injectors for ope • Check the injectors for fue • Check the ignition coil, spa • Check the compression pre • Check the positive crankca • Check the purge control sy • Check the EGR control sy	eration sound. I leakage. ark plugs, spark plug cables. essure. use ventilation system. ystem. stem.				
	↓				
Check the trouble symptom.]			
	NG				
Replace the catalytic converte	r.]			

Low alternator output voltage	Probable cause	
The alternator may be defective, or malfunctions, which are listed in the right column, may be suspected.		 Malfunction of the charging system (Refer to GROUP 16 – Charging System.) Short circuit in harness between alternator G terminal and engine-A/T-ECU Malfunction of the engine-A/T-ECU
Measure at the alternator connector side B-26. • Connect the connector. (Test harness: MB991519) • Voltage between 1 (black clip) and earth (Engine: Idling)	 Measure at the alternator connection B-26 Disconnect the connector, measure at the harness side Disconnect the engine-A/T-connector. Continuity between 1 and eagle 	ector. and and ECU arth
(Radiator fan: Not operating) (Head lamp: OFF \rightarrow ON) (Stop lamp: OFF \rightarrow ON) (Rear defogger switch: OFF \rightarrow ON) OK: Voltage rises by 0.2 – 3.5 V.	OK: No continuity OK Check the following connecto B-18. C-122	rs: ⊣ NG ► Repair
ОК	↓ ок	NG
Check the alternator. (Refer to GROUP 16 – Charging System.)	Check the trouble symptom.	► Replace the engine-A/T-ECU.

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

	OK	
Measure at the engine-A/T-ECU connector C-124. • Connect the connector.	Check the following connector: C-124	
 Voltage between 61 and earth (Engine: at idle, outside air temperature: 25°C or more) OK: 0 - 3 V [When A/C is MAX. COOL condition (when the load by A/C is high] 	n OK	NG V Benair
System voltage [When A/C is MAX. HOT condition (when the load by A/C is low)]	Check the trouble symptom.	перан
NG	NG	
Check the A/C system. (Refer to GROUP 55 – On-vehicle Service.)) Replace the engine-A/T-ECU.	

Fans (radiator fan, A/C condenser fan) are inoperative.		e.	Probable cause		
The engine-A/T-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.)		engine on this omes.)	 Malfunction of the Malfunction of the Malfunction of the Open or short circ Malfunction of the 	fan motor relay fan motor fan controller cuit, or poor connector contact engine-A/T-ECU	
	NG				
Measure at the engine-A/T-ECU connector C-122.	⊢	Check the harness wire between the engine-A/T-ECU and fan con-			
 Disconnect the connector, measure at the harness side. Voltage between terminal 18 and earth 		troller.	OK	NG	
(Ignition switch: ON) OK: 4.8 - 5.2 V (The fan runs at high speed.)				¥ Ponoir	
• Earth terminal 18.			•	Repair	
(Ignition switch: ON) OK: The fan stops.		Check th	ne radiator fan and cond	lenser fan circuit. (Refer to GROUP	
ОК	J	14 - 11	oubleshooting.)		
	NG	_ .			
Check the following connector: C-122		- Repair			
	_				
Check the trouble symptom.					
NG	NG				
 M.U.TII/III Data list 21 Engine coolant temperature sensor OK: After the engine has been warmed up, the engine coolant temperature during idling is identical to the M.U.TII/III reading. 		Check tl P.13D-2 21.)	he engine coolant temp 0, INSPECTION PROC	perature sensor system. (Refer to CEDURE FOR DIAGNOSIS DODE	
OK	NG				
Check the thermostat.		- Replace	•		
ОК	_				
Replace the engine-A/T-ECU.					

Check the engine-A/T-ECU power supply and earth circuit.



Power supply system and ignition switch-IG system		Probable cause			
When an ignition switch ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU turns the engine control relay ON. This causes battery voltage to be supplied to the engine-A/T-ECU, injectors and air flow sensor.		CU Malfunction of the ignition switch Malfunction of the engine control relay Improper connector contact, open circuit or short-circuited harness wire Disconnected engine-A/T-ECU earth wire Malfunction of the engine-A/T-ECU			
Check the engine control relay. (Refer to P.13D-96.) N OK OK • Disconnect the connector, and measure at the harness side. N • Voltage between 3, 4 and earth OK: System voltage	NG NG ► Check conne	the following Ctor: A-13 OK			
OK	Check	the trouble symptom.			
Check the engine-A/T-ECU power supply and earth circuit. (Refer to P.13D-59, INSPECTION PROCEDURE 26.)	Check and re	he harness wire between battery and control relay connector, pair if necessary.			





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



Power steering fluid pressure switch system	n Probable cause
The presence or absence of power steering load is input to th The engine-A/T-ECU controls the idle speed control (ISC) serve l	 Malfunction of the power steering fluid pressure swith Improper connector contact, open circuit short-circuited harness wire Malfunction of the engine-A/T-ECU
Check the power steering fluid pressure switch. (Refer to GROUP 37A – On-vehicle Service.)	NG ► Replace
OK Measure at the power steering fluid pressure switch connector B-115. Disconnect the connector, and measure at the harness side. Voltage between 1 and earth (Ignition switch: ON) OK: System voltage	NG ► Check the following connector: C-124 OK Check the trouble sumptom
OK V Check the following connector: B-115 ↓ OK Check the trouble symptom.	NG NG NG NG NG NG NG ► Repair tween engine-A/T-ECU and power steering fluid pressure switch connec- tor.
↓ NG	
Replace the engine-A/T-ECU.	Replace the engine-A/T-ECU.

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

	¬ NG	
Check the A/C compressor relay. (Refer to GROUP 55 – On-vehicle Service.)		► Replace
ок	NG	
Measure at the engine-A/T-ECU connectors C-122, C-126.	}►	► Check the A/C system. (Refer to GROUP 55 – On-vehicle Service.)
 Disconnect the connectors, and measure at the harness side. Voltage between 20 and earth, and 83 and earth (Ignition switch: ON, A/C switch: ON) OK: System voltage Short circuit between 20 and earth OK: A/C compressor clutch turns on. 	ок	► Check the following connectors: C-122, C-126
		V V
		Check the trouble symptom.
		∎ NG
		Replace the engine-A/T-ECU.



Purge control solenoid valve system			Probable cause
The purge control solenoid valve controls the purging of air from inside the intake manifold.	the canister I	located	 Malfunction of the solenoid valve Improper connector contact, open circuit or short-circuited harness wire. Malfunction of the engine-A/T-ECU
Check the purge control solenoid valve. (Refer to GROUP 17 – Emission Control System.) OK Measure at the purge control solenoid valve connector B-105. • Disconnect the connector and measure at the harness side. • Voltage between 2 and earth (Ignition switch: ON)	NG NG	Replace Check value of the content of the	ethe harness wire between engine control relay and solenoid connector, and repair if necessary.
OK: System voltage OK Measure at the engine-A/T-ECU connector C-122.	NG	Check	the following connector: B-105
 Disconnect the connector and measure at the harness side. Voltage between 34 and earth (Ignition switch: ON) OK: System voltage OK Check the following connector: C-122 NG Repair 		Check Check valve o	OK the trouble symptom. NG the harness wire between engine-A/T-ECU and solenoid connector, and repair if necessary.
Check the trouble symptom. INSPECTION PROCEDURE 34	NG	Replac	e the engine-A/T-ECU.
EGR control solenoid valve is controlled by the negative prese EGR operation leaking to port "A" of the throttle body.	ssure resultir	ng from	 Probable cause Malfunction of the solenoid valve Improper connector contact, open circuit or short-circuited harness wire. Malfunction of the engine-A/T-ECU
Check the EGR control solenoid valve. (Refer to GROUP 17 – Emission Control System.) OK Measure at the EGR control solenoid valve connector B-101. • Disconnect the connector and measure at the harness side. • Voltage between 1 and earth (Ignition switch: ON) OK: System voltage OK	NG NG	 Replace Check valve of 	the harness wire between engine control relay and solenoid connector, and repair if necessary.
Measure at the engine-A/T-ECU connector C-122. Disconnect the connector and measure at the harness side. Voltage between 6 and earth (Ignition switch: ON) OK: System voltage OK Check the following connector: C-122 NG Repair OK	NG	Check	the following connector: B-101 NG ↓ OK the trouble symptom. ↓ NG the harness wire between engine-A/T-ECU and solenoid onnector, and repair if necessary.
Check the trouble symptom.			

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.

ltem No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine:After having warmed up Air/fuel mixture is	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. 11	13D-13
		richer when racing.	When engine is suddenly raced	600–1,000 mV	-	
		Engine:After having warmed up The oxygen sensor signal is used to check	Engine is idling	400 mV or less (Changes) 600–1,000 mV	-	
		ratio, and control condition is also checked by the en- gine-A/T-ECU.	2,500 r/min	400 mV or less (Changes) 600–1,000 mV		
12	Air flow	Engine coolant	Engine is idling	18 – 44 Hz	_	_
	sensor "	80 – 95 °C	2,500 r/min	83 – 123 Hz		
		 Lamps and all accessories: OFF Transmission: P range 	Engine is raced	Frequency increases in response to racing	-	
13	Intake air temperature	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13	13D-16
	561501		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		

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ltem No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page					
14	Throttle	Ignition switch: ON	Set to idle position	535–735 mV	Code No.	13D-18					
	sensor		Gradually open	Increases in proportion to throttle opening angle	14						
			Open fully	4,500–5,000 mV							
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 27	13D-59					
18	Cranking signal	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 29	13D-62					
	(ignition switch-ST)		Engine: Cranking	ON							
21	Engine coolant temperature	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	–20°C	Code No. 21	13D-20					
	sensor		When engine coolant temperature is 0°C	0°C	-						
			When engine coolant temperature is 20°C	20°C	-						
			When engine coolant temperature is 40°C40°C								
			When engine coolant temperature is 80°C	80°C	-						
22	Crank angle sensor	 Engine: Cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II/III.	Accord	Code No. 22	13D-22					
		 Engine: Idling Idle position switch: ON 	When engine coolant temperature is -20°C	1,103 – 1,303 r/min							
			When engine coolant temperature is 0°C	1,103 – 1,303 r/min	-						
			When engine coolant temperature is 20°C	1,103 – 1,303 r/min	-						
			When engine coolant temperature is 40°C	924 – 1,124 r/min							
			When engine coolant temperature is 80°C	650 – 850 r/min							

ltem No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
25	Barometric	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No.	13D-58
	pressure sensor		At altitude of 600 m	95 kPa	- 25	
			At altitude of 1,200 m	88 kPa	-	
			At altitude of 1,800 m	81 kPa	-	
27	Power steering fluid	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 30	13D-63
	switch		Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is	A/C switch: OFF	OFF	Procedure No. 31	13D-63
		ON, A/C compressor should be operating.)	A/C switch: ON	ON	-	
29	Inhibitor	Ignition switch: ON	P or N	P or N	Procedure	13D-62
	SWIICH		D, 3, 2, L or R	D, 3, 2, L or R	NO. 29	
37	Volumetric efficiency	 Engine coolant temperature: 	Engine is idling	20 – 30 %	-	-
	,	85–95°C ● Lamps, and all	2,500 r/min	20 – 30 %	-	
		accessories: OFFTransmission:P range	When engine is suddenly raced	Increases		
41	Injectors *2	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	14.7 – 22.1 ms	-	_
			When engine coolant temperature is 20°C	26.2 – 39.4 ms		
			When engine coolant temperature is 80°C	6.6 – 9.8 ms		
	Injectors* ³	 Engine coolant temperature: 	Engine is idling	2.2 – 3.4 ms	-	-
		 85-95°C Lamps, electric cooling fan and all 	2,500 r/min	2.5 – 3.7 ms		
		accessories: OFF Transmission: P range	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) 	Engine is idling	2 – 18°BTDC	-	-
		set in order to check actual ignition timing.)	2,500 r/min	20 – 40°BTDC		

ltem No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
45	ISC (stepper) motor position *4	 Engine coolant temperature: 85–95°C Lamps, electric cooling fan and all accessories: OFF Transmission: P range 	A/C switch: OFF A/C switch: OFF \rightarrow ON	2–25 STEP Increases by 10–70 steps	_	-
		 Engine: Idling When A/C switch is ON, A/C compressor should be operating 	 Select lever: N range → D range 	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	13D-63
			A/C switch: ON	ON (Compressor clutch is operating)		
59	Oxygen sensor (rear)	Engine: After having warmed up	Engine is raced	600 – 1000 mV	Code No. 59	13D-32

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection con	tents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having w	armed up/En-	Idling condi- tion becomes	Code No. 41	13D-29
02	-	Cut fuel to No. 2 injector	(Cut the fuel s injector in turn	and check	comes unsta- ble).		
03	-	Cut fuel to No. 3 injector	idling.)	n don't affect			
04	-	Cut fuel to No. 4 injector	-				
07	Fuel pump	Fuel pump operates and fuel is recircu- lated.	 Engine: Cranking Fuel pump: Forced driving Inspect according 	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 28	13D-60
			to both the above condi- tions.	Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.	-	
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch:	ON	Sound of op- eration can be heard when solenoid valve is driven.	Procedure No. 33	13D-65
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch:	: ON	Sound of op- eration can be heard when solenoid valve is driven.	Procedure No. 34	13D-65
17	Basic ignition timing	Set the engine- A/T-ECU to igni- tion timing ad- justment mode	 Engine: Id Timing light 	ling nt is set	5 °BTDC	_	-
21	Fan controller	Drive the fan motors	 Ignition sw A/C switch 	vitch: ON n: ON	Fan motor runs	Procedure No. 25	13D-58



CHECK AT THE ENGINE-A/T-ECU TERMINALS TERMINAL VOLTAGE CHECK CHART

- 1. Connect a needle-nosed wire probe (test harness: MB991223) to a voltmeter probe.
- 2. Insert the needle-nosed wire probe into each of the engine-A/T-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-A/T-ECU connectors connected.
- (2) You may find it convenient to pull out the engine-A/T-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-A/T-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-A/T-ECU Connector Terminal Arrangement

-	•	J		ω	4								0	n	"		[7	ω	1 1	42	t	2]		44	45	46	71	72	73		77						75	76	77	101	102		ε01	104						105	106	107	
4	• 5	5	11	12	11	;;;	1	5	16	;	17	18	51	5	č	21		ςς	53	2.7	48	ţ		05	51	20	10	n 4	54	55	56	57	78	79	80		20	8	8 3	84	85	86 0	87	88	89	108	109	110	111	112	113	114	115	110	117	118	119	120	
4		u л		26	1.7		ы Ж	29		ļ	а О	3 1	5	، د י د	ω		4	٩	ш S	58	5 9		ŀ	60	61	20	0	U U		64	ი ე	66	90 0	91		30	00	۵ ۵	94		95 5	96 96		76	86	121	122	123		124	125		126	127	128		129	130	

			Y 6 0 3 2 B L						
Terminal No.	Check item	Check condition (Engine condition)	Normal condition						
1	No. 1 injector	While engine is idling after having warmed	From 11 – 14 V,						
9	No. 2 injector		slightly						
24	No. 3 injector								
2	No. 4 injector								
3	Oxygen sensor	Engine: Idling after warming up	1 V or less						
	(ITOTIC) Treater	Engine r/min: 5,000 r/min	System voltage						
6	EGR control sole-	Ignition switch: "ON"	System voltage						
		While engine is idling, suddenly depress the accelerator pedal	From system voltage, momentaly drops						
8	Alternator G termi- nal	 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						
11	Ignition coil – No. 1, No. 4	Engine r/min: 3,000 r/min	0.3 – 3.0 V						
12	Ignition coil – No. 2, No. 3								
14	Stepper motor coil <a>	 Engine: Soon after the warmed up engine is started. A/C switch: OEE > ON (A/C compressor) 	System voltage ↔ 1 V or less (Changes repeatedly)						
28	Stepper motor coil 	is operating)							
15	Stepper motor coil <c></c>								
29	Stepper motor coil <d></d>								
18	Fan controller	Radiator and condenser fan is not operating	0 – 0.3 V						
		Radiator and condenser fan is operating	0.7 V or more						
19	Air flow sensor	Engine: Idle speed	0 – 1 V						
	I COCL OIGHAI	Engine r/min: 3,000 r/min	6 – 9 V						
Terminal No.	Check item	Check condition (Engine condition)		Normal condition					
---------------------	------------------------------------	--	---	---					
20	A/C relay	 Engine: Idle speed A/C switch: OFF → ON (A/C compressor is operating) 		System voltage or momentarily 6 V or more \rightarrow 1 V or less					
21	Fuel pump relay	Ignition switch: "ON"		System voltage					
		Engine: Idle speed		1 V or less					
22	Engine warning lamp	Ignition switch: "LOC	K" (OFF) → "ON"	1 V or less → System voltage (After several seconds have elapsed)					
26	Oxygen sensor (rear) beater	Engine: Idling after w	arming up	1 V or less					
		Engine: Racing		System voltage					
34	Purge control sole-	Ignition switch: "ON"		System voltage					
		Running at 3,500 warming up after hav	r/min while engine is ing been started	1 V or less					
41	Power supply	Ignition switch: "ON"		System voltage					
47									
43	Tachometer signal	Engine r/min: 3,000 r/min		0.3 – 3.0 V					
44 Engine temper	Engine coolant temperature sen-	Ignition switch: "ON"	When engine coolant temperature is -20°C	3.9 – 4.5 V					
	301		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 60°C	0.7 – 1.3 V					
			When engine coolant temperature is 80°C	0.3 – 0.9 V					
45	Crank angle sen-	Engine: Cranking		0.4 – 4.0 V					
	501	Engine: Idle speed		1.5 – 2.5 V					
46	Sensor impressed voltage	Ignition switch: "ON"		4.9 – 5.1 V					
49	Engine control	Ignition switch: "LOCK" (OFF)		System voltage					
	(power supply)	Ignition switch: "ON"		1 V or less					
52	Power steering fluid pressure	Engine: Idling after warmed up	When steering wheel is stationary	System voltage					
Switch	When steering wheel is turned	1 V or less							

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Terminal No.	Check item	Check condition (Engine condition)		Normal condition
54	Alternator FR terminal	 Engine: Warm, idle (radiator fan: OFF) Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger switch: OFF → ON 		Voltage decreases
55	Barometric pres-	Ignition switch:	When altitude is 0 m	3.8 – 4.2 V
	sure sensor		When altitude is 600 m	3.5 – 3.9 V
			When altitude is 1,200 m	3.3 – 3.7 V
			When altitude is 1,800 m	3.0 – 3.4 V
56	Camshaft position	Engine: Cranking		0.4 – 3.0 V
	Sensor	Engine: Idling		1.5 – 3.0 V
58	Ignition switch – ST	Engine: Cranking		8 V or more
61	A/C load signal	Refer to GROUP 55 – Troubleshooting (Inspection at Automatic compressor – ECU t		erminal)
64 Intake air temperature sensor	Ignition switch: "ON"	When intake air tem- perature is -20°C	3.8 – 4.4 V	
	sensor		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 60°C	0.8 – 1.4 V	
			When intake air temperature is 80°C	0.4 – 1.0 V
65	Air flow sensor	Engine: Idle speed		2.2 – 3.2 V
		Engine r/min: 2,500 r/min		
66	Backup power supply	Ignition switch: "LOCK" (OFF)		System voltage
71	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)
73	Oxygen sensor (rear)	Engine: Idling after warmed up (Check using a digital type voltmeter)		$0 \leftrightarrow 0.6 V$ (Changes repeatedly)
78	Throttle position sensor	Ignition switch: "ON"	Set throttle valve to idle position	0.535 – 0.735 V
			Fully open throttle valve	4.4 – 5.3 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
83	A/C switch	Engine: Idle speed	Turn the A/C switch OFF	0.5 V or less
			Turn the A/C switch ON (A/C compressor is operating)	System voltage
98	Ignition switch – IG	Ignition switch: "ON"		System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

- 1. Turn the ignition switch to "LOCK" (OFF) position.
- 2. Disconnect the engine-A/T-ECU connector.
- 3. Measure the resistance and check for continuity between the terminals of the engine-A/T-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-A/T-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-A/T-ECU Harness Side Connector Terminal Arrangement



Y 6 0 3 3 B L

Terminal No.	Inspection item	Normal condition (Check condition)
1 – 41	No. 1 injector	10.5 – 13.5 Ω (At 20°C)
9 – 41	No. 2 injector	
24 – 41	No. 3 injector	
2 – 41	No. 4 injector	
3 – 41	Oxygen sensor (front) heater	4.5 – 8.0 Ω (At 20°C)
6 – 41	EGR control solenoid valve	30 – 34 Ω (At 20°C)
14 – 41	Stepper motor coil (A)	28 – 33 Ω (At 20°C)
28 – 41	Stepper motor coil (B)	
15 – 41	Stepper motor coil (C)	
29 – 41	Stepper motor coil (D)	
26 – 41	Oxygen sensor (rear) heater	11 – 18 Ω (At 20°C)
34 – 41	Purge control solenoid valve	29 – 35 Ω (At 20°C)
42 – Body earth	Engine-A/T-ECU earth	Continuity (0 Ω)
48 – Body earth		
44 – 57	Engine coolant temperature sensor	14 – 17 kΩ (When coolant temperature is –20°C)
		5.1 – 6.5 k Ω (When coolant temperature is 0°C)
		2.1 – 2.7 k Ω (When coolant temperature is 20°C)
		$0.9 - 1.3 \text{ k}\Omega$ (When coolant temperature is 40°C)
		0.48 – 0.68 k Ω (When coolant temperature is 60°C)
		$0.26 - 0.36 \text{ k}\Omega$ (When coolant temperature is 80°C)

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MPI <4G63> - Troubleshooting

Terminal No.	Inspection item	Normal condition (Check condition)
64 – 16 Intake air temperature sensor		13 – 17 k Ω (When intake air temperature is –20°C)
		5.3 – 6.7 k Ω (When intake air temperature is 0°C)
		2.3 – 3.0 k Ω (When intake air temperature is 20°C)
		1.0 – 1.5 k Ω (When intake air temperature is 40°C)
		0.56 – 0.76 k Ω (When intake air temperature is 60°C)
		0.30 – 0.42 k Ω (When intake air temperature is 80°C)



INSPECTION PROCEDURE USING AN OSCILLOSCOPE

The output signals of the sensors and the conditions of the actuation signals of the actuators can be inspected visually by observing the waveforms on the oscilloscope.

AIR FLOW SENSOR

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 oscilloscope special patterns pickup to air flow sensor connector terminal No. 3.

Alternate Method (Test harness not available)

1. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 65.

Standard Wave Pattern Observation conditions

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

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.



• 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

AKX01597

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

- Disconnect the camshaft position sensor connector and 1. connect the special tool test harness (MB991709) in between (All terminals should be connected).
- 2. Connect the oscilloscope special pattern pickup to camshaft position sensor terminal No. 2.
- 3. Disconnect the crank angle sensor connector and connect the special tool test harness (MD998478) in between.
- 4. Connect the oscilloscope special patterns pickup to crank angle sensor terminal No. 2.

Alternate Method (Test harness not available)

- 1. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 56 (When checking the camshaft position sensor signal wave pattern).
- 2. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 45 (When checking the crank angle sensor signal wave pattern).

Standard Wave Pattern

Observation condition

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

Standard wave pattern



Wave Pattern Observation Points

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







Examples of Abnormal Wave Patterns

• Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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

Example 2

Cause of problem

Loose timing belt Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

INJECTOR

Measurement Method

- 1. Disconnect the injector connector, and then connect the special tool test harness set (MB991348) in between (All terminals should be connected).
- 2. Connect the oscilloscope special patterns pickup to terminal No. 2 of the injector connector.

Alternate Method (Test harness not available)

- 1. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 1 (When checking the No. 1 cylinder).
- Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 9 (When checking the No. 2 cylinder).
- Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 24 (When checking the No. 3 cylinder).
- 4. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 2 (When checking the No. 4 cylinder).

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



Wave Pattern Observation Points

Point A: Height of solenoid back electromotive force

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

Point B: Injector drive time



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



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

- 1. Disconnect the ISC servo connector, and connect the special tool test harness (MB991709) in between.
- 2. Connect the oscilloscope special patterns pickup to the ISC servo side connector terminal No. 1, No. 3, No. 4 and No. 6 respectively.

Alternate Method (Test harness not available)

 Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 14, connection terminal No. 15, connection terminal No. 28, and connection terminal No. 29 respectively.

Standard wave pattern Observation conditions

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

Standard wave pattern



Wave pattern Observation Points

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

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

Point B: Height of coil reverse electromotive force

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







Examples of Abnormal Wave Pattern

• Example 1

Cause of problem

Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

• Example 2

Cause of problem

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

Wave pattern characteristics

Current is not supplied to the motor coil on the open circuit side (Voltage does not drop to 0 V).

Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.



IGNITION COIL AND POWER TRANSISTOR

Measurement Method

- 1. Disconnect the ignition coil connector, and connect the special tool test harness set (MB991348) in between (All terminals should be connected).
- 2. Connect the oscilloscope special patterns pickup to terminal No. 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

1. Connect the oscilloscope special patterns pickup to engine-A/T-ECU terminal No. 11 (No. 1 – No. 4), connection terminal No. 12 (No. 2 – No.3) respectively.

Standard Wave Pattern Observation condition

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



Standard wave pattern

Wave Pattern Observation Points

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

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





Examples of Abnormal Wave Patterns

Example 1
 Wave pattern during engine cranking
 Cause of problem

Open-circuit in ignition primary circuit

Wave pattern characteristics

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

• Example 2

Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.



ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

- 1. Remove the air intake hose from the throttle body.
- 2. Spray cleaning fluid on a clean cloth.

Caution

- Do not spray the cleaning fluid directly to the throttle valve.
- Make sure the cleaning fluid does not enter the motor from the bypass line. Also make sure it does not enter the sensor through the shaft.
- Be careful not to rub off the molybden applied around the throttle valve shaft.
- 3. Wipe off the dirt around the throttle valve with the cloth sprayed with cleaning fluid.
- 4. Attach the air intake hose.
- 5. Adjust the basic idle speed (Refer to P.13D-91.)



THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the M.U.T.-II/III to the diagnosis connector. When not using the M.U.T.-II/III, proceed as follows.



- Disconnect the throttle position sensor connector and connect the special tool 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 (special tool's yellow clip on the sensor output) and the terminal No. 4 (special tool's red clip on the sensor earth) of the throttle position sensor connector.
- 2. Turn the ignition switch to "ON" position (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 M.U.T.-II/III. If the M.U.T.-II/III 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 M.U.T.-II/III or disconnect the negative battery cable from the battery terminal and then leave it for at least 10 seconds. After that, reconnect the battery cable, and then let the engine run at idle for approximately 10 minutes.

BASIC IDLE SPEED ADJUSTMENT

Caution

- 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.
- 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.
- 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 M.U.T.-II/III to the diagnosis connector (16-pin).

NOTE

When the M.U.T.-II/III 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 M.U.T.-II/III actuator test. NOTE

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

5. Check the idle speed.

Standard value: 750 ± 50 r/min



NOTE

- (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
- (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it (Refer to P.13D-90.)
- 6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment. NOTE

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

7. Press the M.U.T.-II/III 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 M.U.T.-II/III.
- 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.

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.

- 2. Disconnect the high-pressure fuel hose at the delivery pipe side.
- 3. Assemble the fuel pressure measurement tools as follows.

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

- Remove the union joint and bolt from the special tool adaptor hose (MD998709) and attach the special tool hose adaptor (MD998742) to the adaptor hose.
- (2) Via a gasket, install the special tool fuel pressure gauge set (MB991637 or MB991981) into the special tool that has already assembled as described in (a) above.





<When using the fuel pressure gauge>

- (1) Remove the union joint and bolt from special tool adaptor hose (MD998709) and attach the special tool hose adaptor (MD998742) to the adaptor hose.
- (2) Via a suitable O-ring or gasket, install the fuel pressure gauge to the special tool that has already assembled as described in (a) above.

4. Install the assembled fuel pressure measurement tools between the fuel rail and high-pressure fuel hose.

Caution

To prevent damage to the M.U.T.-II/III, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting the M.U.T.-II/III

- 5. Connect the M.U.T.-II/III to the diagnosis connector.
- 6. Turn the ignition switch to "ON" position (But do not start the engine)
- 7. Select "Item No. 07" from the M.U.T.-II/III 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. Fuel pressure measurement while the engine is running at idle.

Standard value: Approximately 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	Clogged fuel filter	Replace fuel filter
 No fuel pressure in fuel return hose 	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
Low fuel pump delivery pre		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	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.

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.

- 17. Remove the fuel pressure gauge and special tool from the delivery pipe.
- 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 toque.

Tightening torque: 5.0 ± 1.0 N·m

- 20. Check for any fuel leaks by following the procedure in step 7.
- 21. Disconnect the M.U.T.-II/III.

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COMPONENT LOCATION

Name	Symbol	Name	Symbol
Air flow sensor (with intake air temperature sensor and	G	Engine warming lamp (check engine lamp)	S
balometric pressure sensor)		Fan controller	М
A/C compressor relay	н	Fuel pump relay (1) and (2)	R
A/C switch	U	Idle speed control servo	E
Camshaft position sensor	0	Ignition coil	L
Crank angle sensor	В	Injector	С
Detonation sensor	J	Oxygen sensor (front)	К
Diagnosis connector	Т	Oxygen sensor (rear)	Q
EGR control solenoid valve	I	Power steering fluid pressure switch	А
Engine control relay	н	Purge control solenoid valve	I
Engine coolant temperature sensor	N	Throttle position sensor	D
Engine-A/T-ECU	V	Vehicle speed sensor	F









ENGINE CONTROL RELAY CONTINUITY CHECK

Tester Connection Terminal	Battery Voltage	Normal State
2 – 3	No Voltage	Continuity
1 – 4	No Voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to termi- nal No. 2 and nega- tive (-) terminal of battery to terminal No. 3.)	Continuity



FUEL PUMP RELAY CONTINUITY CHECK

Tester Connection Terminal	Battery Voltage	Normal State
1 – 4	No Voltage	Continuity
2 – 3	No Voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to termi- nal No. 1 and nega- tive (-) terminal of battery to terminal No. 4.)	Continuity





INTAKE AIR TEMPERATURE SENSOR CHECK

- 1. Disconnect the air flow sensor connector.
- 2. Measure resistance between terminals No. 5 and No. 6.

Standard value:

- 13 17 kΩ (at -20°C) 5.3 - 6.7 kΩ (at 0°C) 2.3 - 3.0 kΩ (at 20°C) 1.0 - 1.5 kΩ (at 40°C) 0.56 - 0.76 kΩ (at 60°C) 0.30 - 0.42 kΩ (at 80°C)
- 3. Remove the air flow sensor
- 4. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (k Ω)
Higher	Smaller

- 5. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.
- 6. Install the air flow sensor and tighten it to the specified torque.

Tightening torque: 8.8 ± 1 N·m









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:

14 - 17 k Ω (at -20°C) 5.1 - 6.5 k Ω (at 0°C) 2.1 - 2.7 k Ω (at 20°C) 0.9 - 1.3 k Ω (at 40°C) 0.48 - 0.68 k Ω (at 60°C) 0.26 - 0.36 k Ω (at 80°C)

- 3. If the resistance deviates from the standard value greatly, replace the sensor.
- 4. Apply sealant to threaded portion.

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

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

Tightening torque: 29 ± 10 N·m

THROTTLE POSITION SENSOR CHECK

- 1. Disconnect the throttle position sensor connector.
- Measure the resistance between the throttle position sensor side connector terminal No. 1 and terminal No. 4.

Standard value: 3.5 – 6.5 k Ω

 Measure the resistance between the throttle position sensor side connector terminal No. 2 and terminal No. 4.

Normal condition:

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

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

NOTE

For the throttle position sensor adjustment procedure, refer to P.13D-90.





OXYGEN SENSOR CHECK

Oxygen sensor (front)

- 1. Disconnect the oxygen sensor connector and connect the special tool test harness (MD998464) to the connector on the oxygen sensor side.
- 2. Make sure that there is continuity $(4.5 8.0 \Omega \text{ at } 20^{\circ}\text{C})$ between terminal No. 1 (red clip of special tool) and No. 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. Perform a tracing for 5 minutes or more with the engine speed of 4,500 r/min.
- Connect a digital voltage meter between terminal No. 2 (black clip of special tool) and No. 4 (white clip of special tool).
- 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 oxy- gen sensor will output a voltage of 0.6 – 1.0 V.

Caution

- Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8V is applied to the oxygen sensor heater.

NOTE

If the sufficiently high temperature (of approximate 400 $^{\circ}$ C or more) is not reached although the oxygen sensor is normal, the output voltage would be possibly low although the rich air-fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (red clip of special tool) and the terminal No. 3 (blue clip of special tool) of the oxygen sensor with a (+) terminal and (–) terminal of 8 V power supply respectively, then check again.

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

NOTE

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



Oxygen sensor (rear)

- 1. Disconnect the oxygen sensor connector and connect the special tool test harness (MB991658) to the connector on the oxygen sensor side.
- 2. Make sure that there is continuity (11 18 Ω at 20°C) between terminal No. 3 and No. 4 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. Perform a tracing for 5 minutes or more with the engine speed of 4,500 r/min.
- 6. Connect a digital voltage meter between terminal No. 1 and No. 2.



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 oxy- gen sensor will output a voltage of 0.6 – 1.0 V.

Caution

- Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
- Be careful the heater is broken when voltage of beyond 12 V is applied to the oxygen sensor heater.

NOTE

If the sufficiently high temperature (of approximately 400° C or more) is not reached although the oxygen sensor is normal, the output voltage would be possibly low although the rich air-fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.3 and the terminal No. 4 of the oxygen sensor with a (+) terminal and (-) terminal of 12 V power supply respectively, then check again.

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

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





INJECTOR CHECK

Check the Operation Sound

1. Use a stethoscope to listen to the operation sound (clicking) of the injectors while the engine is idling or cranking.

Caution

Beware that the operation sounds of other injectors can be heard even if the injector that is being inspected might not be operating.

2. Verify that the operation sound increases with the engine speed.

NOTE

If the operating sound cannot be heard, inspect the injector actuation circuit.

Measurement of Resistance between Terminals

- 1. Disconnect the injector connector.
- 2. Measure the resistance between terminals.

Standard value: 10.5 – 13.5 Ω (at 20°C)

3. Connect the injector connector.

Check the Injection Condition

- 1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel.
- 2. Remove the injector.
- 3. Assemble the following special tools as shown in Fig.
 - Injector test set (MB992076)
 - Injector test harness (MB991607)
 - Injector test adaptor (MD998741)
 - Injector test holder assembly (MB991976)
- 4. Connect the M.U.T.-II/III to the diagnosis connector.
- 5. Turn the ignition switch to "ON" position (But do not start the engine).
- 6. Select "Item No. 07" from the M.U.T.-II/III 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. Without the fuel pump operation, operate the injector to draw the fuel out.
- 10. If the spraying is extremely poor or the fuel leakage from the injector nozzle deviates from the standard value, replace the injector.
- 11. Disconnect the M.U.T.-II/III.

Idle speed control servo

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

Check 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 turned to the "ON" position (but without starting the engine).
- 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-A/T-ECU.



Check the Coil Resistance

- 1. Disconnect the idle speed control servo connector.
- 2. Measure the resistance between terminal No. 2 and either terminal No. 1 or terminal No. 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 No. 5 and either terminal No. 6 or terminal No. 4 of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

4. If the resistance deviates from the standard value greatly, replace the idle speed control servo.

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 (approximately 6 V) to the terminals No. 2 and No. 5.
- AKX01626

MB991709

Terminal 5

Terminal 2

lac motor

AKX01627AC

- 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 terminal No. 1 and terminal No. 4.
 - (2) Connect the negative (–) terminal of the power supply to the terminal No. 3 and terminal No. 4.
 - (3) Connect the negative (–) terminal of the power supply to the terminal No. 3 and terminal No. 6.
 - (4) Connect the negative (-) terminal of the power supply to the terminal No. 1 and terminal No. 6.
 - (5) Connect the negative (–) terminal of the power supply to the terminal No. 1 and terminal No. 4.
 - (6) Repeat the tests in sequence from (5) to (1).
- 6. If vibration is detected during the test, the stepper motor can be considered to be normal.

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.