ENGINE ELECTRICAL

CONTENTS

E16AA--

CHARGING SYSTEM 2

SPECIFICATIONS 2
General Specifications 2
Service Specifications 2-1

SPECIAL TOOL 2-1

SERVICE ADJUSTMENT PROCEDURES ... 3
Voltage Drop Test of Alternator Output Wire 3
Output Current Test 4
Regulated Voltage Test 6
Checking with An Analyzer 7

ALTERNATOR 9

STARTING SYSTEM 10

SPECIFICATIONS 10
General Specifications 10

IGNITION SYSTEM 11

SPECIFICATIONS 11
General Specifications 11
Service Specifications 11

SERVICE ADJUSTMENT PROCEDURES ... 12
Spark Plug Check and Cleaning 12
High Tension Cable Spark Test 12
Resistive Code Inspection 13
Ignition Coil Inspection 13
Power Transistor Inspection 13
Checking the Detonation Sensor <6G74> 13-2
Inspection Using An Analyzer (Secondary and Primary Ignition Voltage Waveforms) 14

DETONATION SENSOR 21-3

CRANK ANGLE SENSOR AND CAM POSITION SENSOR 21-3

GLOW SYSTEM 22

SPECIFICATIONS 22
Service Specifications 22
Sealant 22

SERVICE ADJUSTMENT PROCEDURES ... 23

SUPER QUICK GLOW SYSTEM 23
Super Quick Glow System Inspection . 23
Glow Control Unit Inspection 25
Glow Plug Relays 1 and 2 Inspection 27
Glow Plug Inspection 27
Dropping Resistor Inspection 27
Engine Coolant Temperature Sensor Inspection 28

AUTO GLOW SYSTEM 28
Auto Glow System Inspection 28
Glow Control Unit Inspection 30
Glow Plug Relay Inspection 32
Glow Plug Inspection 32
Engine Coolant Temperature Sensor Inspection 32

SELF-REGULATING GLOW SYSTEM ... 33
Self-Regulating Glow System Inspection 33
Glow & EGR Control Unit Inspection 35
Glow Plug Relay Inspection 36
Glow Plug Inspection 36
Engine Coolant Temperature Sensor Inspection 36

NOTES

CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16BA--

ALTERNATOR

<4G64>

Items	Canvas top & Wagon	Wagon	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/65	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<6G72-12 VALVE>

Items	M/T	M/T (Cold climate zone), A/T
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type

<6G74, 6G72-24 VALVE>

Items	Specifications
Type	Battery voltage sensing
Rated output V/A	12/90
Voltage regulator	Electronic built-in type

<4D56>

Items	Canvas top & Wagon	Wagon	Cold climate zone & Vehicles with super-charging pressure relief solenoid valve
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing & Alternator-generation-voltage sensing type
Rated output V/A	12/65	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<4M40>

Items	Standard	Cold climate zone & Vehicle with supercharging pressure relief solenoid valve
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type

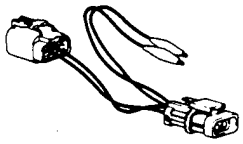
SERVICE SPECIFICATIONS

E16BB--

Item	Specifications
Standard value Alternator regulated voltage Ambient temp. at voltage regulator V – 20°C (– 4°F) 20°C (68°F) 60°C (140°F) 80°C (176°F)	 14.2–15.4 13.9–14.9 13.4–14.6 13.1–14.5
Limit Output current	 70% of nominal output current

SPECIAL TOOL

E16BF--

Tool	Number	Name	Use
	MD998467	Alternator harness connector	Checking the alternator (S terminal voltage)

NOTES

SERVICE ADJUSTMENT PROCEDURES

E16BGAG

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT LINE

This test determines whether the wiring from the alternator "B" terminal to the battery (+) terminal (including the fusible link) is in a good condition or not.

(1) Always be sure to check the following before the test.
- Alternator installation
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

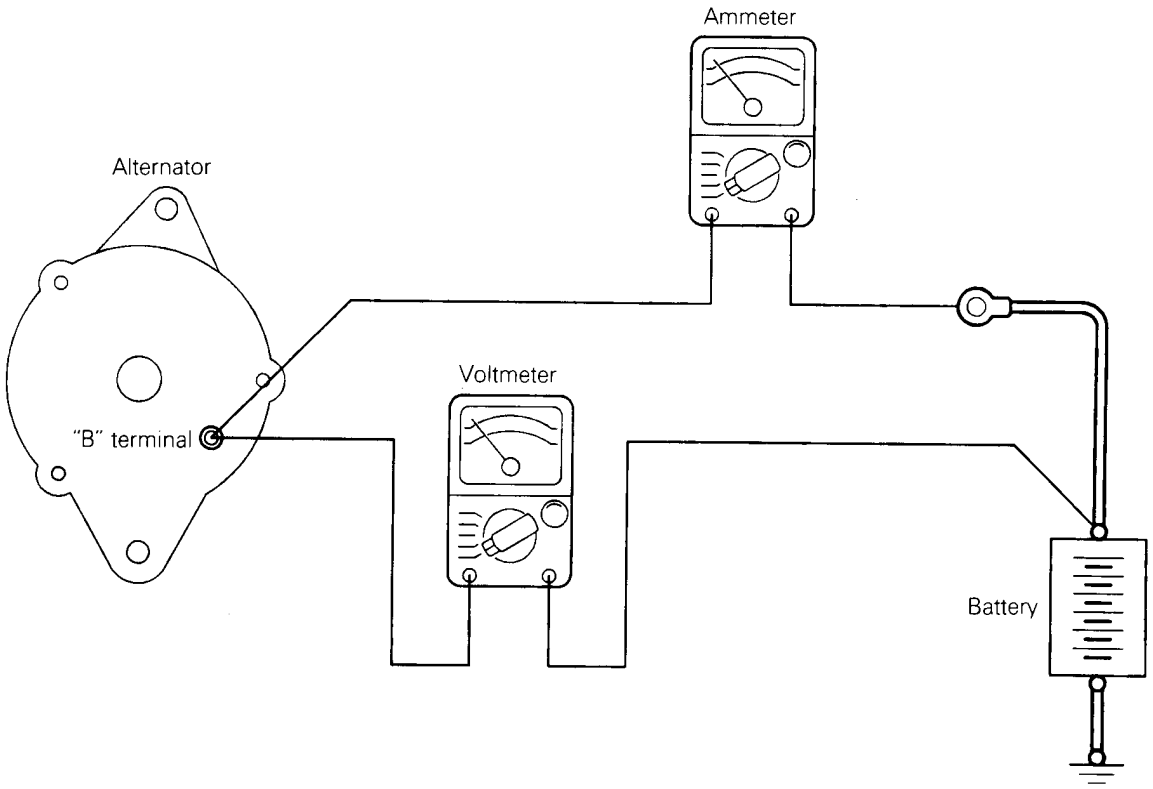
(2) Turn the ignition switch to the OFF position.

(3) Disconnect the negative battery cable.

(4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0 – 100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Because, if a vehicle in which the voltage may have dropped due to an imperfect connection at the alternator "B" terminal is being inspected, and so if the alternator "B" terminal is loosened and a test ammeter is connected, the connection will be complete at the time of connection and the possibility of finding problems will be reduced.

(5) Connect a digital-type voltmeter between the alternator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the battery (+) cable.)



6EN0892

(6) Connect a tachometer. (For the procedure for connecting the tachometer, refer to GROUP 11 – Service Adjustment Procedures.)
(7) Reconnect the negative battery cable.
(8) Leave the hood open.
(9) Start the engine.
(10) With the engine running at 2500 r/min., turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 30A.
Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30A. Take a reading of the value displayed on the voltmeter at this time.

Limit value: Max. 0.3 V

NOTE
When the alternator output is high and the value displayed on the ammeter does not decrease until 30A, set the value to 40A. Read the value displayed on the voltmeter at this time.
In this case the limit value becomes max. 0.4V.

(11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the alternator output wire, so check the wiring between the alternator "B" terminal and the battery (+) terminal (including fusible link).
If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair and then test again.
(12) After the test, run the engine at idle.
(13) Turn off all lamps and turn the ignition switch to the OFF position.
(14) Disconnect the negative battery cable.
(15) Disconnect the ammeter, voltmeter and tachometer.
(16) Connect the alternator output wire to the alternator "B" terminal.
(17) Connect the negative battery cable.

OUTPUT CURRENT TEST

This test determines whether the alternator outputs normal current.
(1) Before the test, always be sure to check the following.
- Alternator installation
- Battery (Refer to GROUP 54 – Battery.)

NOTE
The battery to be used should be slightly discharged. The load in a fully-charged battery will be insufficient and the test may not be able to be carried out correctly.

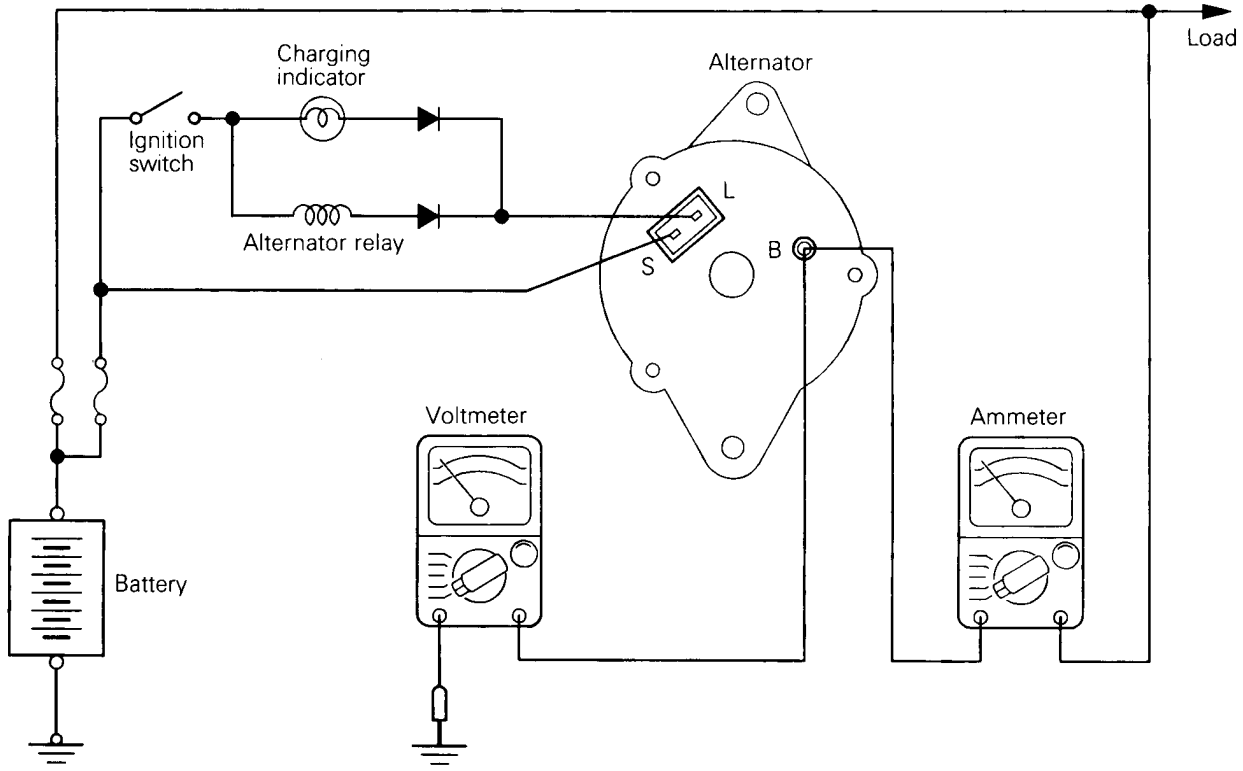
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running.

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0 – 100A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

Caution
Never use clips but tighten bolts and nuts to connect the line. Otherwire loose connections (e.g. using clips) will lead to a serious accident because of high current.

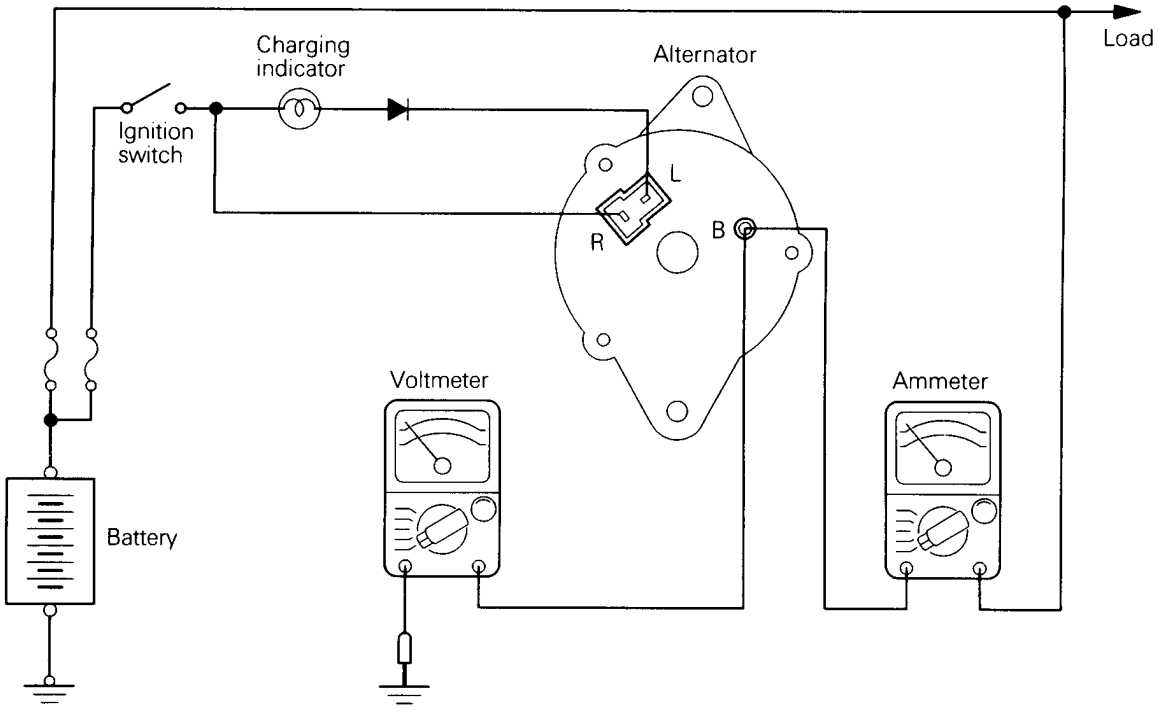
NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended.
(5) Connect a voltmeter with a range of 0 – 20 V between the alternator "B" terminal and the earth. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the earth.)

Battery-voltage sensing type



6EN0893

Alternator-generation-voltage sensing type



6EN0912

(6) Connect a tachometer. (For the procedure for connecting the tachometer, refer to GROUP 11 – Service Adjustment Procedures.)
(7) Connect the negative battery cable.
(8) Leave the hood open.
(9) Check to be sure that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

(10) After turning the light switch on and turning on the headlamps, start the engine.
(11) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min. and read the maximum current output value displayed on the ammeter.
Limit value: 70% of normal current output

NOTE
- For the nominal current output, refer to the Alternator Specifications.
- Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
- The current output value will depend on the electrical load and the temperature of the alternator body.
- If the electrical load is small while testing, the specified level of current may not be output even though the alternator is normal. In such cases, increase the electrical load by leaving the headlamps turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
- The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.

(12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
(13) Run the engine at idle speed after the test.
(14) Turn the ignition switch to the OFF position.
(15) Disconnect the negative battery cable.
(16) Disconnect the ammeter, voltmeter and tachometer.
(17) Connect the alternator output wire to the alternator "B" terminal.
(18) Connect the negative battery cable.

REGULATED VOLTAGE TEST

This test determines whether the voltage regulator is correctly controlling the alternator output voltage.
(1) Always be sure to check the following before the test.
- Alternator installation
- Check to be sure that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Connect the digital-type voltmeter.

<Battery-voltage sensing type>

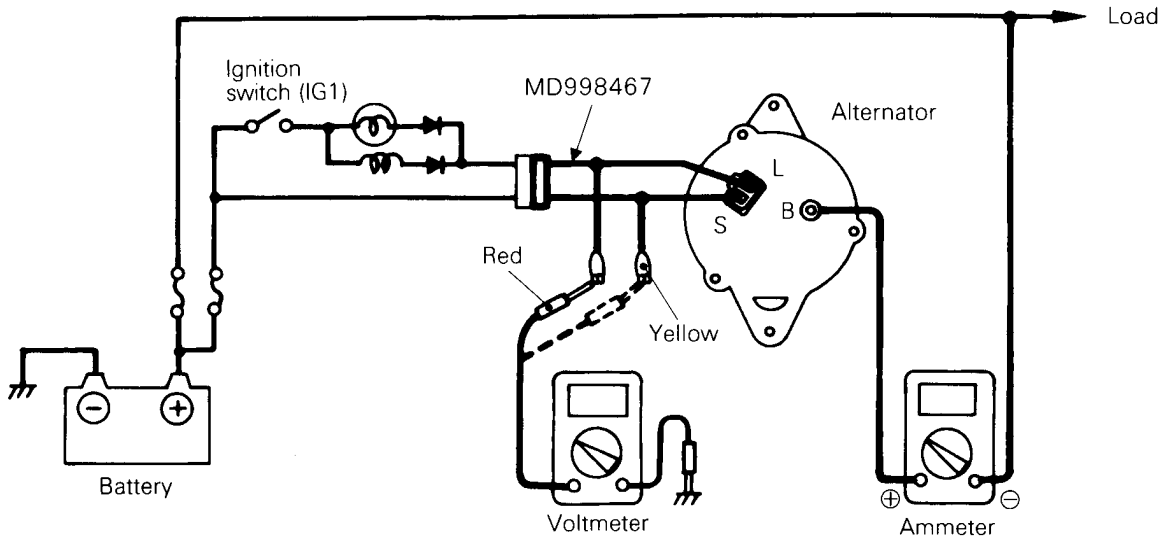
Use the special tool (alternator harness connector MD998467) to connect the alternator "S" terminal to the earth. (Use the special tool to connect the (+) lead of the voltmeter to the "S" terminal, and then connect the (−) lead of the voltmeter to an earth.)

<Alternator generation-voltage sensing type>

Connect the alternator "L" terminal to the earth. (Connect the (+) lead of the voltmeter to the "L" terminal, and then connect the (−) lead of the voltmeter to an earth.)

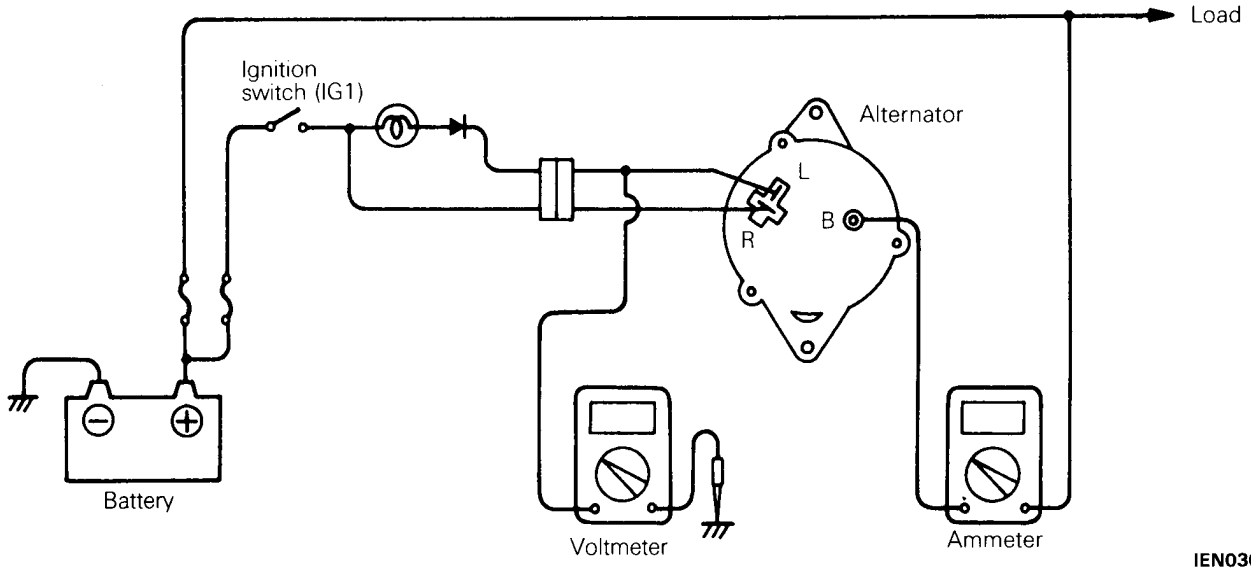
(5) Disconnect the alternator output wire from the alternator "B" terminal.
(6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

Battery-voltage sensing type



01R0467

Alternator-generation-voltage sensing type



IEN0303

(7) Connect a tachometer. (Refer to GROUP 11 – Service Adjustment Procedures.)
(8) Reconnect the negative battery cable.
(9) Turn the ignition switch to the ON position and check that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery (+) terminal.

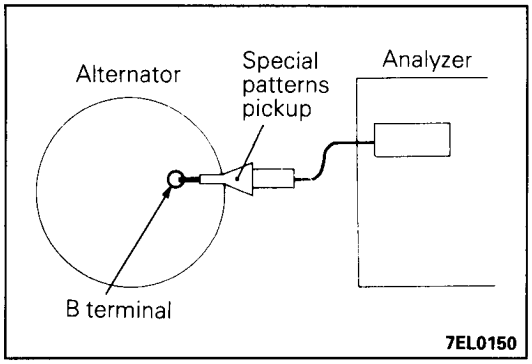
(10) Check to be sure that all lamps and accessories are off.

(11)Start the engine.
(12)Increase the engine speed to 2,500 r/min.
(13)Read the value displayed on the voltmeter when the current output by the alternator becomes 10 A or less.
(14)If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
If the voltage is outside the standard value, there is a malfunction of the voltage regulator or of the alternator.

Voltage Regulation Table

Inspection terminal	Voltage regulator ambient temperature °C (°F)	Standard value V
Terminal "S" <Battery-voltage sensing type>	-20	14.2–15.4
	20	13.9–14.9
	60	13.4–14.6
	80	13.1–14.5
Terminal "L" <Alternator-generation-voltage sensing type>	-20	14.4–15.6
	20	14.2–15.2
	60	13.8–15.1
	80	13.6–15.0

(15)After the test, lower the engine speed to the idle speed.
(16)Turn the ignition switch to the "OFF" position.
(17)Disconnect the negative battery cable.
(18)Disconnect the ammeter, voltmeter and tachometer.
(19)Connect the alternator output wire to the alternator "B" terminal.
(20)Connect the negative battery cable.



CHECKING WITH AN ANALYZER

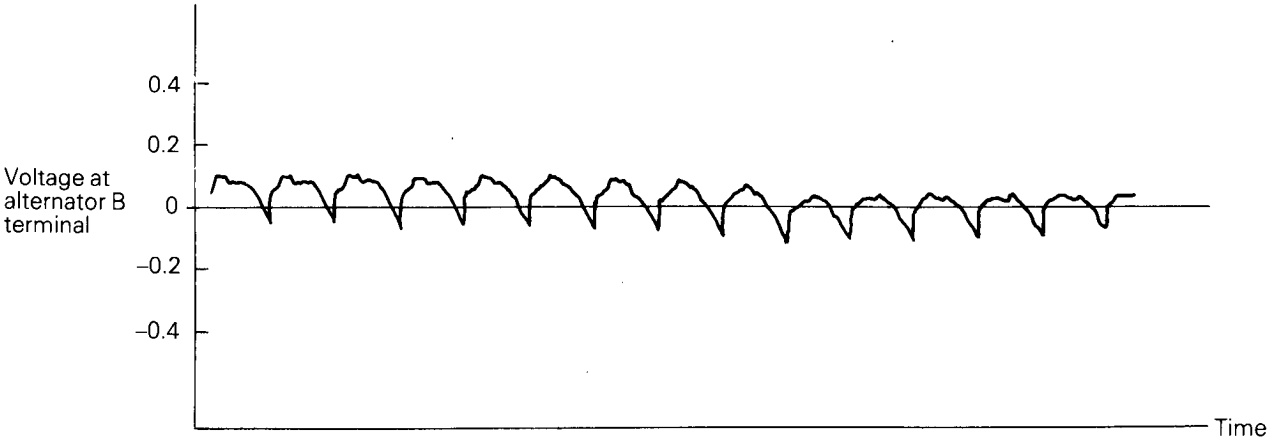
MEASUREMENT METHOD

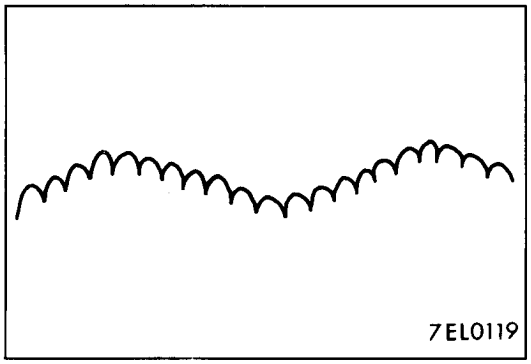
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Raster
Engine revolutions	Idle (4G64:750r/min., 6G72:700r/min.)



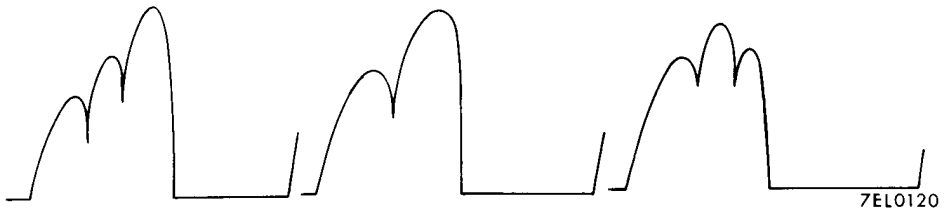
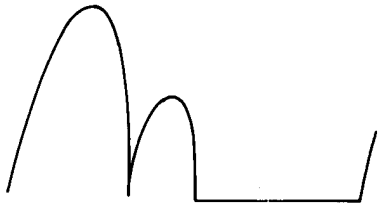
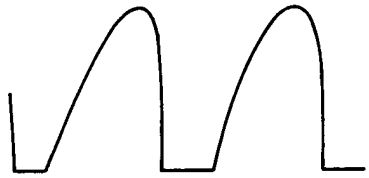


NOTE

Furthermore, the voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

EXAMPLES OF ABNORMAL WAVEFORMS

NOTE
1. The size of the waveform patterns differs largely depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charge lamp (illuminated/ not illuminated) also, and carry out a total check.

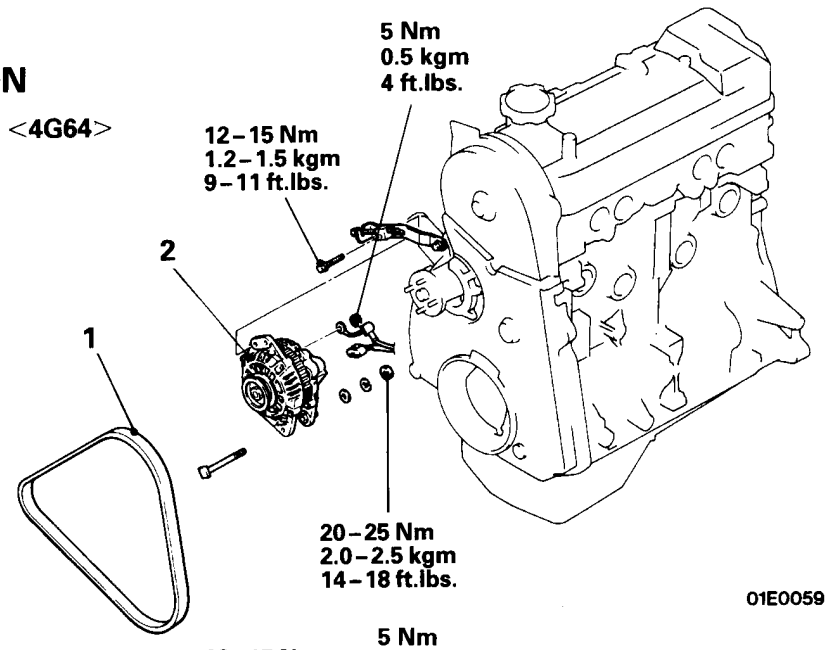
Abnormal waveforms	Problem cause
Example 1  7EL0120	• Open diode
Example 2  7EL0121	• Short in diode
Example 3  7EL0122	• Broken wire in stator coil
Example 4  7EL0123	• Short in stator coil
Example 5  NOTE: At this time, the charge lamp is illuminated. 7EL0124	• Open supplementary diode

ALTERNATOR

REMOVAL AND INSTALLATION

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to GROUP 11 – Service Adjustment Procedures)

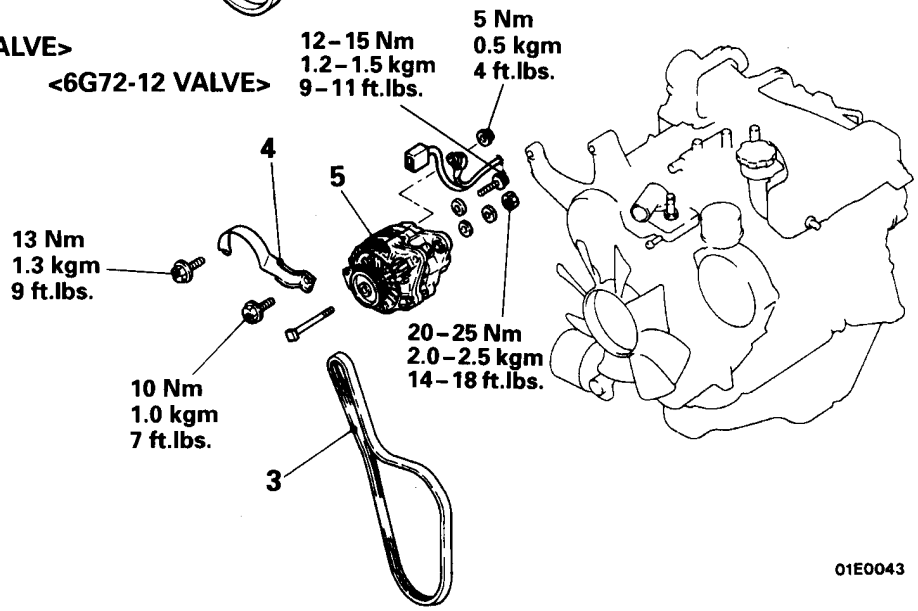
<4G64>



Removal steps <4G64>
1. Drive Belt
2. Alternator

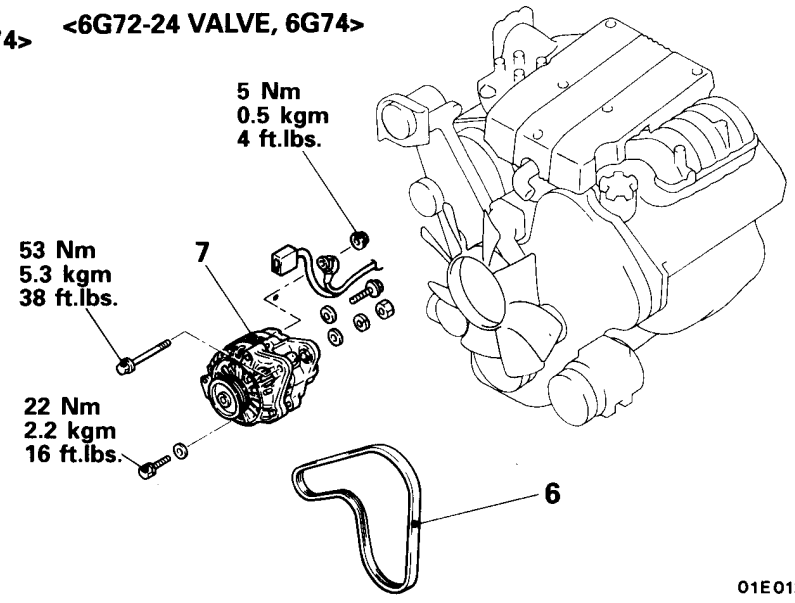
Removal steps <6G72-12 VALVE>
3. Drive Belt
4. Alternator cover
5. Alternator

<6G72-12 VALVE>



Removal steps <6G72-24 VALVE, 6G74>
- Air cleaner case
6. Drive Belt
7. Alternator

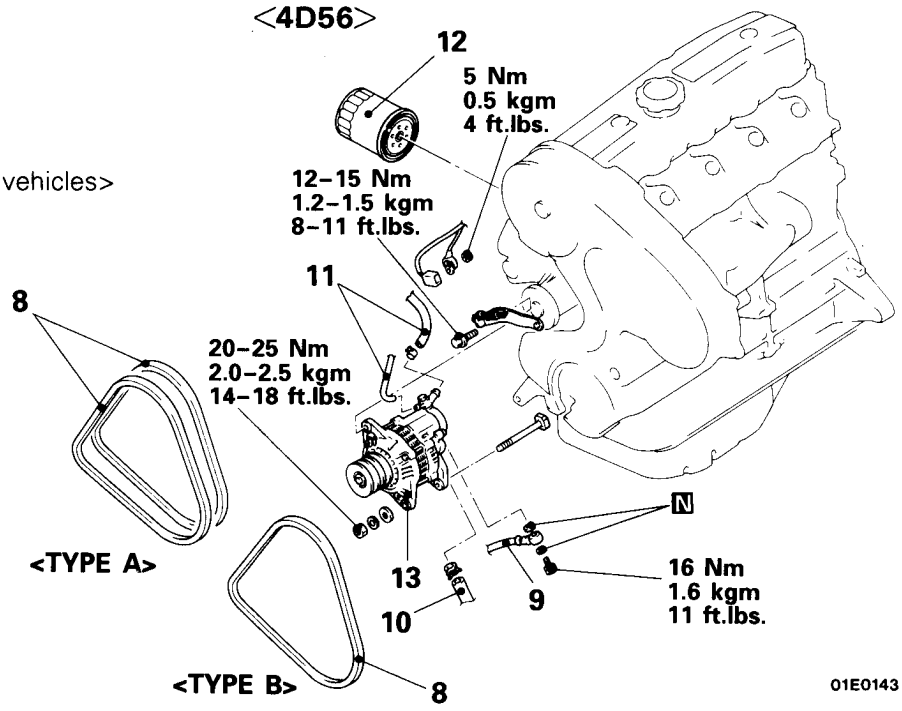
<6G72-24 VALVE, 6G74>



Removal steps <4D56>

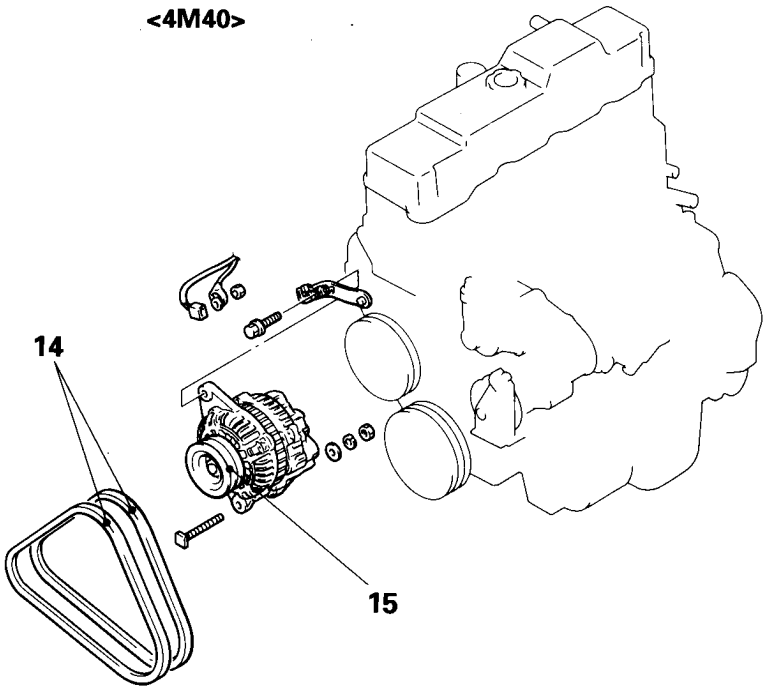
- Air intake hose
- Under cover

8. Drive belt
9. Oil pipe
10. Oil return hose
11. Vacuum hose
12. Oil filter <R.H. drive vehicles>
13. Alternator



Removal steps <4M40>

14. Drive Belt
15. Alternator



Caution
When replacing a drive belt, both belts should be replaced at the same time.

NOTES

STARTING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16CA--

STARTER MOTOR

<4G64, 6G72, 6G74>

Items	4G64 (Standard specification)	4G64 (Cold climate zone)	6G72, 6G74
Type	Direct drive	Planetary gear reduction drive	Planetary gear reduction drive
Rated output kW/V	0.9/12	1.2/12	1.2/12
No. of pinion teeth	8	8	8

<4D56>

Items	M/T	M/T (cold climate zone)	A/T
Type	Spur gear reduction drive	Spur gear reduction drive	Spur gear reduction drive
Rated output kW/V	2.0/12	2.2/12	2.2/12
No. of pinion teeth	13	13	13

<4M40>

Items	Specifications
Type	Spur gear reduction drive
Rated output kW/V	2.2/12
No. of pinion teeth	10

IGNITION SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16DA--

DISTRIBUTOR

Items \ Engine	4G64	6G72-12 VALVE
Type	Contact pointless	Contact pointless
Advance mechanism	Electronic	Electronic
Firing order	1-3-4-2	1-2-3-4-5-6

IGNITION COIL

Items \ Engine	4G64	6G72 12 VALVE	6G72 24 VALVE	6G74
Type	Mold type	Mold type	Mold 3 coil	Mold 3 coil
Identification No.	F-088	F-504	F-608	F-722

SPARK PLUG

Items \ Engine	4G64	6G72 12 VALVE	6G72 24 VALVE	6G74
NGK	BPR6ES-11	BPR5ES-11	PFR6J-11	PFR5J-11
NIPPON DENSO	W20EPR11	W16EPR11	PK20PR-P11	PK16PR-P11
CHAMPION	RN9YC4	RN11YC4	–	–

SERVICE SPECIFICATIONS

E16DB--

Items		4G64, 6G72-12 VALVE	6G74
Ignition coil			
Primary coil resistance	Ω	0.72–0.88	0.69–0.85
Secondary coil resistance	kΩ	10.29–13.91	15.3–20.7
Spark plug gap	mm (in.)	1.0–1.1 (0.039–0.043)	1.0–1.1 (0.039–0.043)

SERVICE ADJUSTMENT PROCEDURES

E16DGAS

SPARK PLUG CHECK AND CLEANING

<4G64, 6G72-12 VALVE>

(1) Remove the spark plug cables.

Caution
When pulling off the spark plug cable from the plug, always hold the cable cap, not the cable.

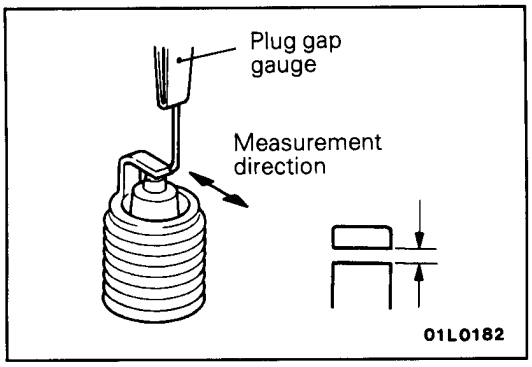
(2) Remove the spark plugs.
(3) Check for burned out electrode or damaged insulator. Check for even burning.
(4) Remove carbon deposits with wire brush or plug cleaner. Remove sand from plug screw with compressed air.
(5) Use a plug gap gauge to check that the plug gap is within the standard value range.

Standard value: 1.0–1.1 mm (0.039–0.043 in.)

If the plug gap is not within the standard value range, adjust by bending the earth electrode.
(6) Clean the engine plug holes.

Caution
Use care not to allow foreign matter in cylinders.

(7) Install the spark plugs.



<6G74, 6G72-24 VALVE>

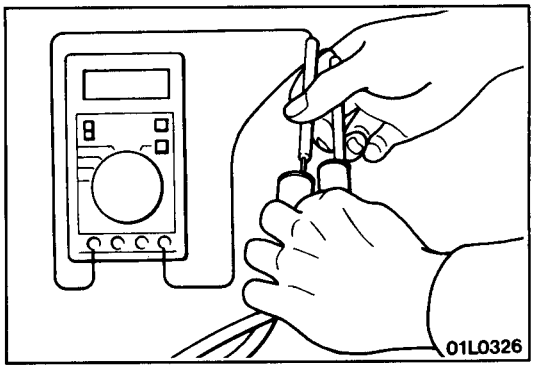
(1) Remove the spark plugs.
(2) Check the plug gap and replace if the limit is exceeded.

Standard value: 1.0–1.1 mm (0.039–0.043 in.)
Limit: 1.3 mm (0.051 in.)

Caution
1. **Do not attempt to adjust the gap of the platinum plug.**
2. **Cleaning of the platinum plug may result damage the platinum tip. Therefore, if carbon deposits must be removed, use a plug cleaner and complete cleaning within 20 seconds for protection of the electrode. Do not use wire brushes.**

HIGH TENSION CABLE SPARK TEST

(1) Disconnect the high-tension cable from the distributor cap.
(2) Hold the high tension cable about 6–8 mm (0.24–0.31 in.) away from engine (proper earth portion such as cylinder block) and crank engine to verify that sparks are produced.

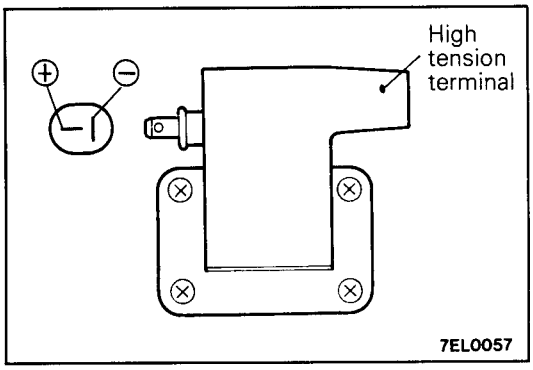


RESISTIVE CODE INSPECTION

Measure the resistance of the high tension cable and all spark plug leads.

(1) Check cap and coating for cracks.
(2) Measure resistance.

Limit: Max. 26 kΩ



IGNITION COIL INSPECTION

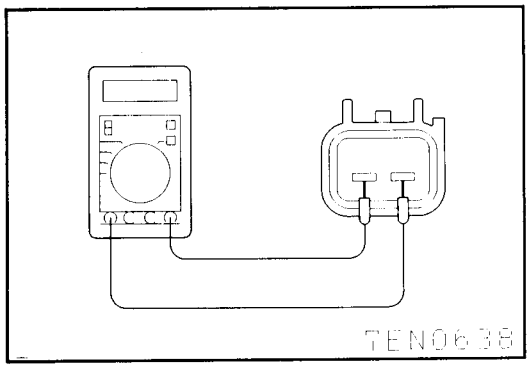
<4G64, 6G72-12 VALVE>

(1) Measurement of the primary coil resistance
Measure the resistance of the positive (+) terminal and negative (–) terminal of the ignition coil.

Standard value: 0.72–0.88 Ω

(2) Measurement of the secondary coil resistance
Measure the resistance between the ignition coil's positive (+) terminal and the high tension terminal.

Standard value: 10.29–13.91 kΩ



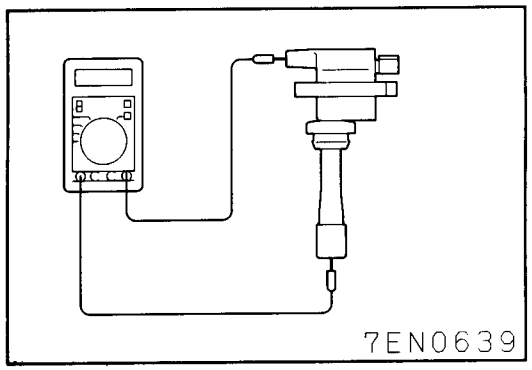
<6G74, 6G72-24 VALVE>

(1) Measurement of the primary coil resistance.
Measure the resistance between the terminals for each cylinder (No. 1 – No. 4, No. 2 – No. 5, No. 3 – No. 6) of the ignition coil as shown in the illustration.

Standard value: 0.69 – 0.85 Ω

(2) Measurement of the secondary coil resistance.
Measure the resistance between the high-voltage terminals for each cylinder (No. 1 – No. 4, No. 2 – No. 5, No. 3 – No. 6) of the ignition coil as shown in the illustration.

Standard value: 15.3 – 20.7 kΩ



POWER TRANSISTOR INSPECTION

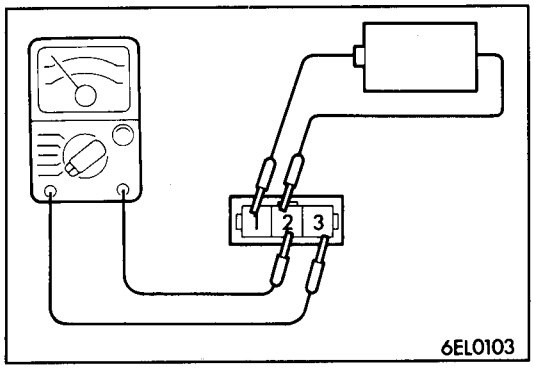
<4G64, 6G72-12 VALVE>

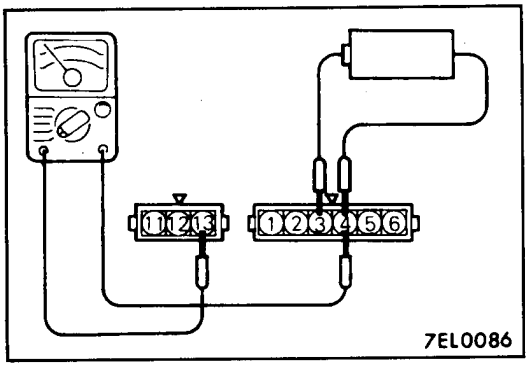
NOTE
1. An analogue type of circuit tester should be used.
2. Connect the circuit tester (–) probe (black) to terminal (3).

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal (2) of the power transistor: then check whether there is continuity between terminal (3) and terminal (2) when terminal (1) and the positive (+) terminal are connected and disconnected.

Terminal (1) and (+) terminal	Terminal (3) and terminal (2)
Connected	Continuity
Unconnected	No continuity

(2) Replace the power transistor if there is a malfunction.





<6G74, 6G72-24 VALVE>

NOTE
An analog-type circuit tester should be used.

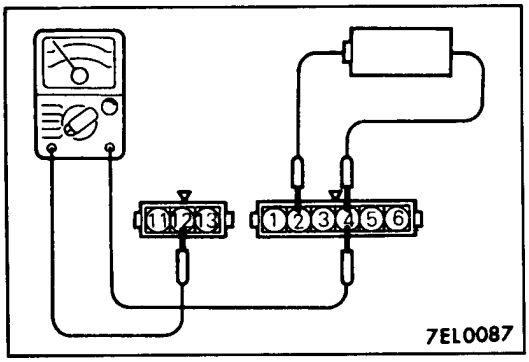
No. 1 – No. 4 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑬ and terminal ④ when terminal ③ and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑬.

Terminal 3 and (+) terminal	Terminal 13 and terminal 4
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



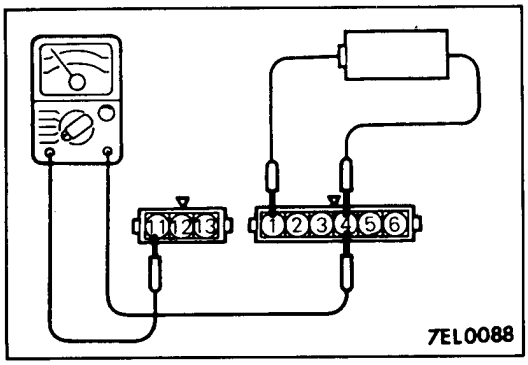
No. 2 – No. 5 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑫ and terminal ④ when terminal ② and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑫.

Terminal 2 and (+) terminal	Terminal 12 and terminal 4
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



No. 3 – No. 6 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑪ and terminal ④ when terminal ① and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑪.

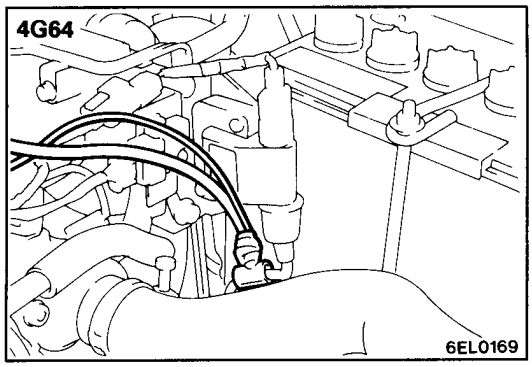
Terminal 1 and (+) terminal	Terminal 11 and terminal 4
Connected	Continuity
Unconnected	No continuity

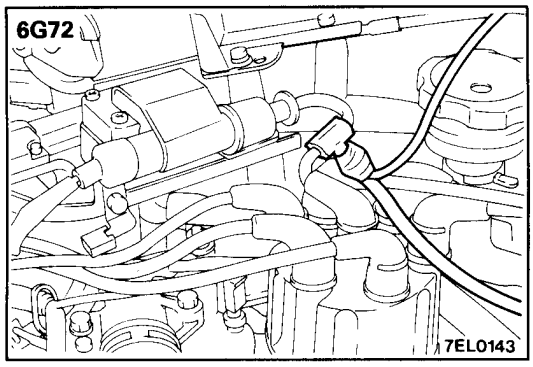
(2) Replace the ignition power transistor if there is a malfunction.

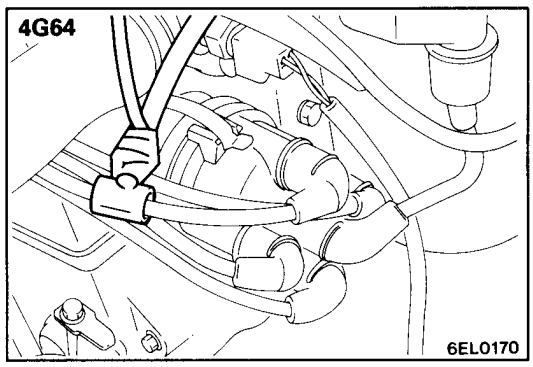
CHECKING THE DETONATION SENSOR <6G74>

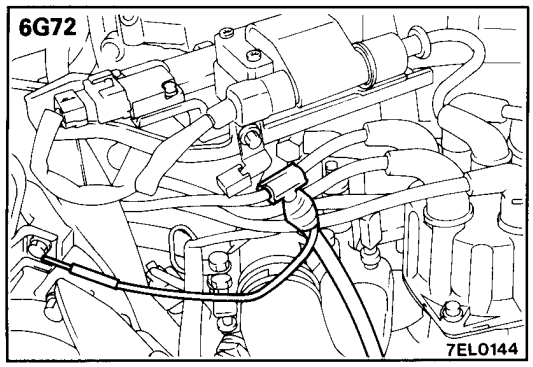
Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

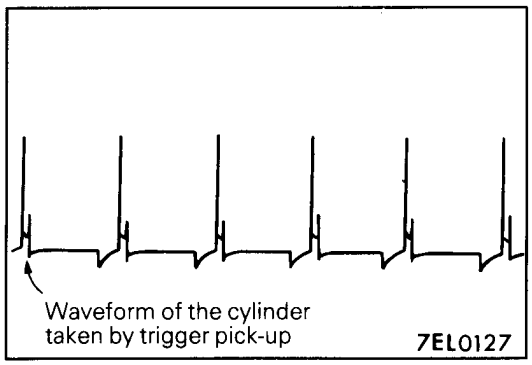
NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13 – Troubleshooting.











INSPECTION USING AN ANALYZER (SECONDARY AND PRIMARY IGNITION VOLTAGE WAVEFORMS)

INSPECTION OF SECONDARY IGNITION VOLTAGE <4G64, 6G72-12 VALVE>

MEASUREMENT METHOD

(1) Clamp the high tension cable.

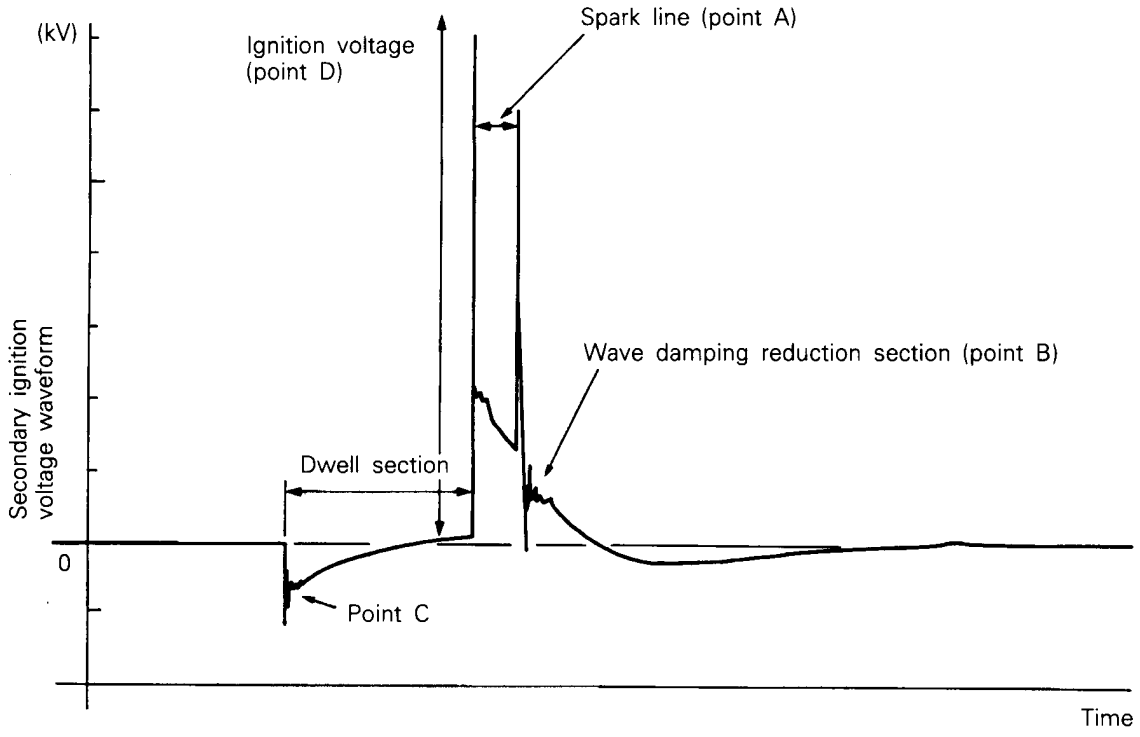
(2) Clamp the spark plug cable with the trigger pickup. (Basically, clamp the No.1 cylinder spark plug cable.)

(3) The cylinder waveform taken by the trigger pickup appears from the left side of the screen.

STANDARD WAVEFORM

Observation Conditions

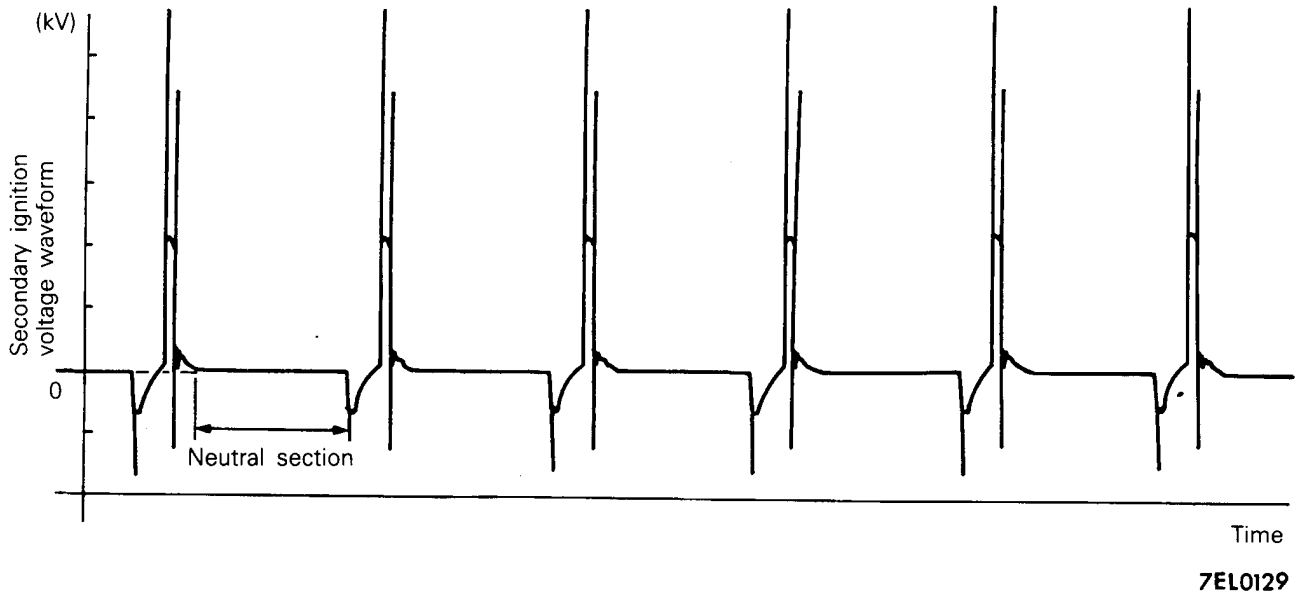
Function	Secondary
Pattern height	HIGH (or LOW)
Pattern selector	Raster
Engine revolutions	Curb idle speed



7EL0128

Observation Condition (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



7EL0129

WAVEFORM OBSERVATION POINTS

Point A : The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B : Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

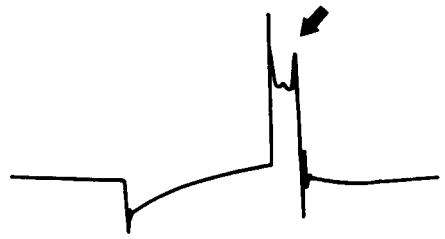
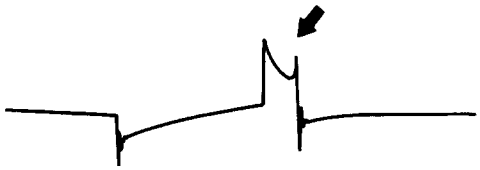
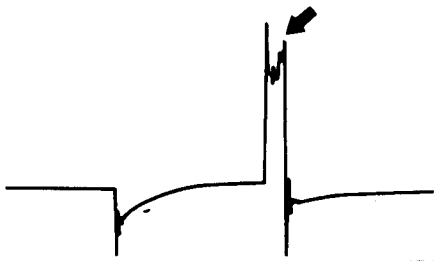
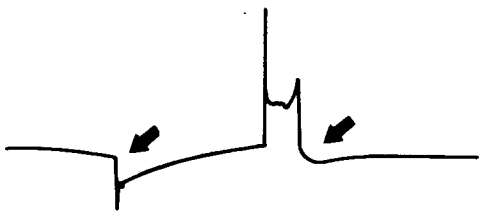
Point C : Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

Point D : Ignition voltage height (distribution per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

EXAMPLES OF ABNORMAL WAVEFORMS

Abnormal waveform	Wave characteristics	Cause of probrem
Example 1  01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0216	Spark line is low and long, and is sloping. ALso, the second half of the spark line is distorted. This could be a result of mis-firing.	Spark plug gap is too small.
Example 3  01P0217	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0218	Spark line is high and short. Difficult to distinguish between this and abnormal wave pattern example 1.	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5  01P0219	No waves in wave damping section.	Rare short in ignition coil.

INSPECTION OF SECONDARY IGNITION VOLTAGE <6G74, 6G72-24 VALVE>

MEASUREMENT METHOD

(1) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the secondary pickup.

NOTE
1. Because of the two-cylinder simultaneous ignition system, the waves for two cylinders in each group appear during wave observation. However, wave observation is carried out for the cylinder (No. 1, No. 3 or No. 5) with the spark plug cable which has been clamped by the secondary pickup.
2. Identification of which cylinder waveform is displayed can be difficult, but the waveform of the cylinder which is clamped by the secondary pickup will be stable, so this can be used as a reference for identification.

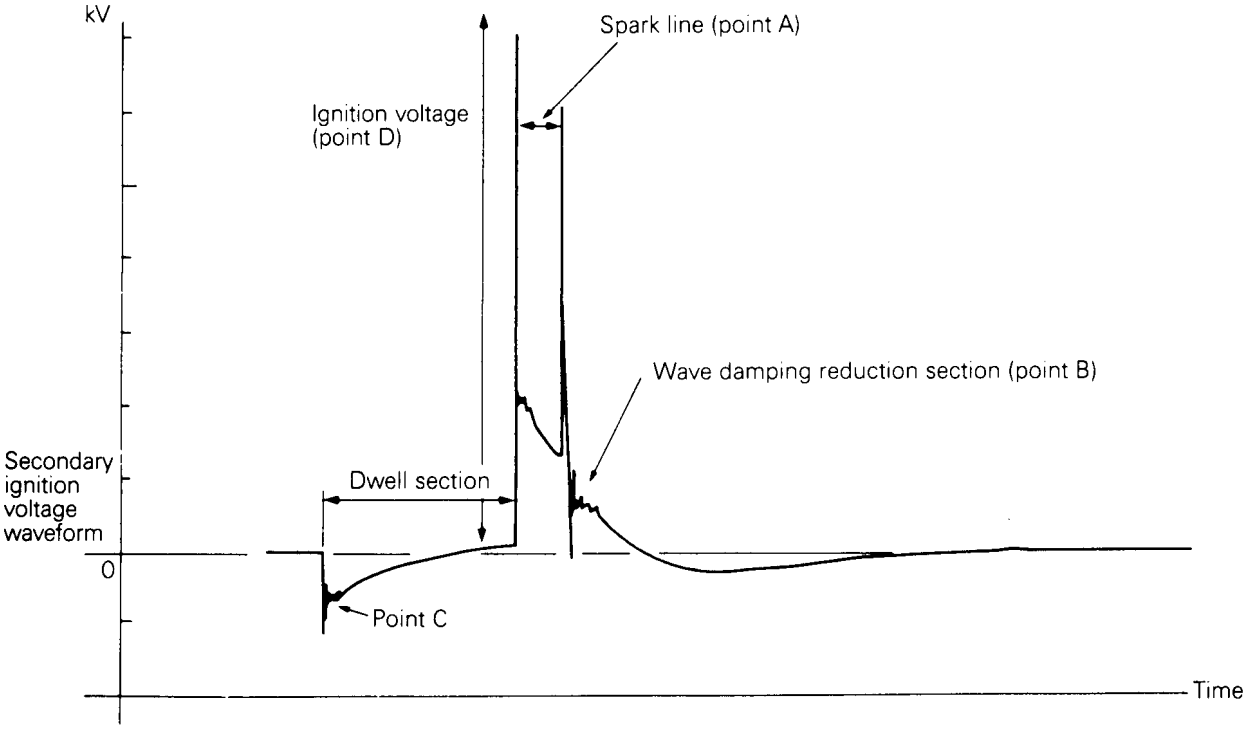
(2) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the trigger pickup.

NOTE
Clamp the same spark plug cable as the one which has been clamped by the secondary pickup.

Standard Waveform

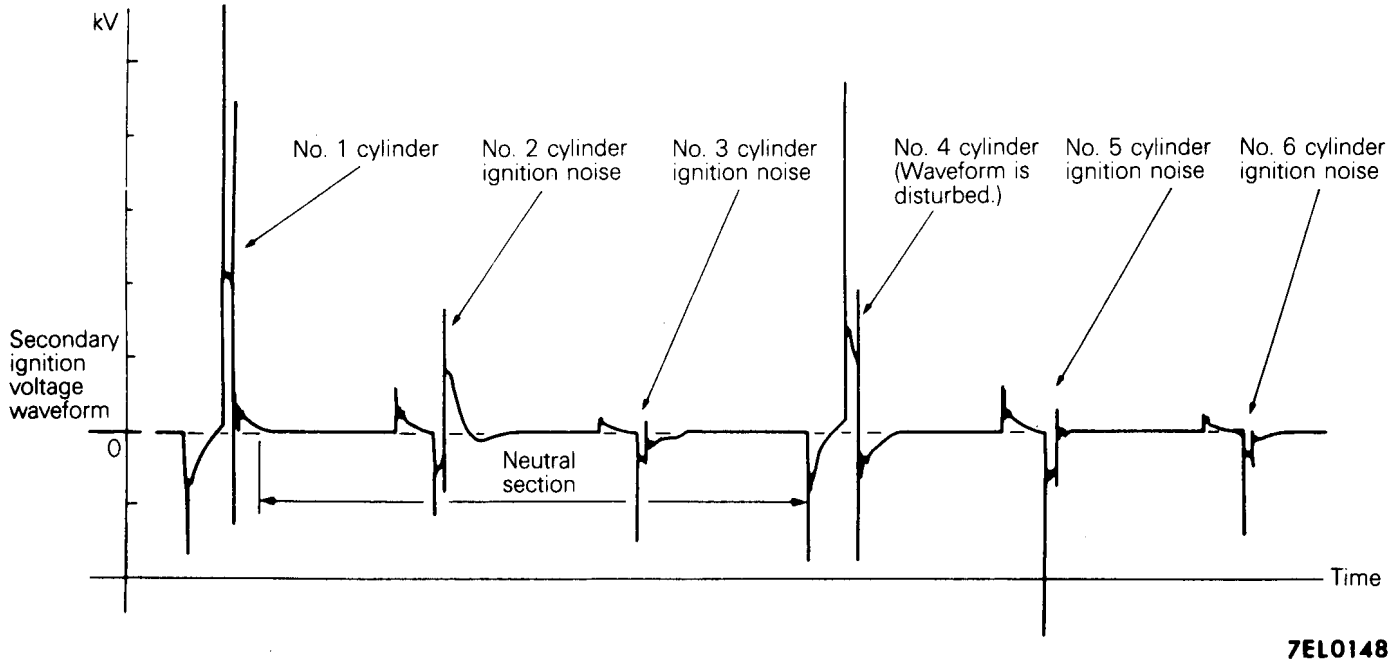
Observation conditions

FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



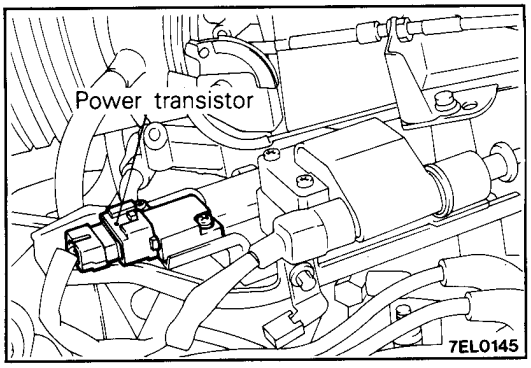
WAVEFORM OBSERVATION POINTS

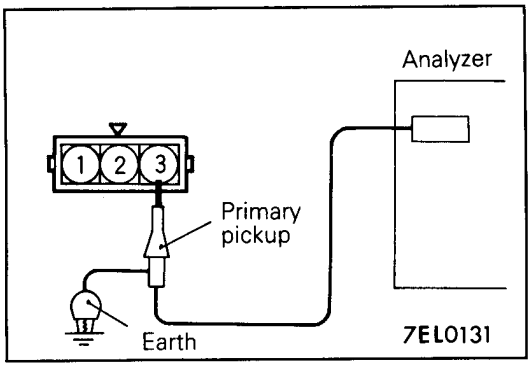
For waveform observation points; refer to P.16-16.

EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P.16-17.

NOTES





INSPECTION OF PRIMARY IGNITION VOLTAGE <4G64, 6G72-12 VALVE>

MEASUREMENT METHOD

(1) Remove the power transistor connector and connect the special tool (Harness connector: MB991348) in between. All terminals should be connected.

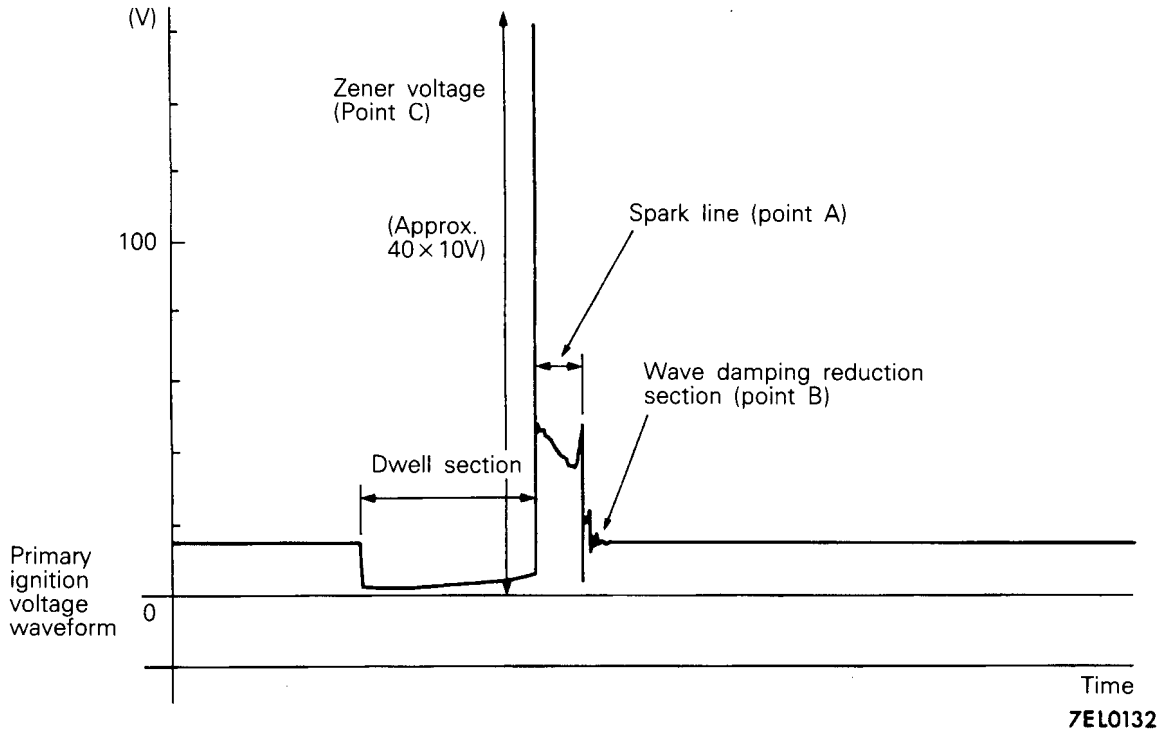
(2) Connect the primary pickup of the adjuster to the power transistor connector terminal (3).
(3) Earth the primary pickup earth terminal.
(4) Clamp the spark plug cable with the primary pickup.

NOTE
The waveform of the cylinder clamped by the trigger pickup appears from the left side of the screen.

STANDARD WAVEFORM

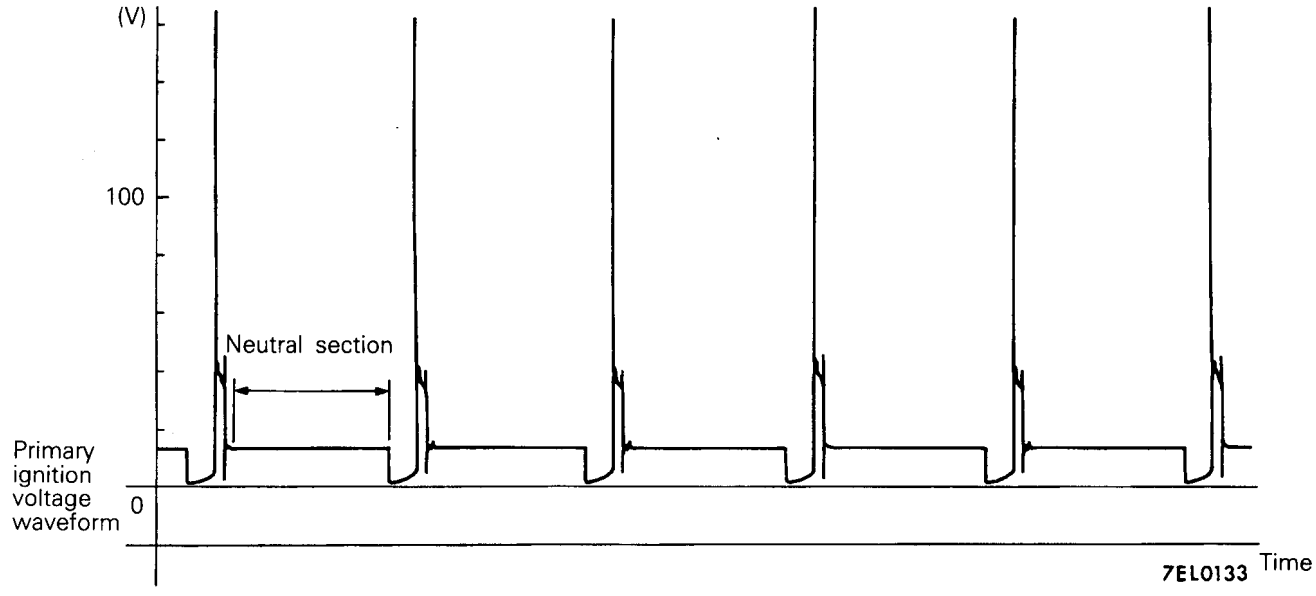
Observation Conditions

Function	Secondary
Pattern height	HIGH (or LOW)
Pattern selector	Raster
Engine revolutions	Curb idle speed



Observation Conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



WAVEFORM OBSERVATION POINTS

Point A : The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	High tension cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

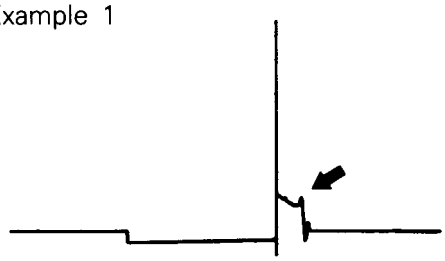
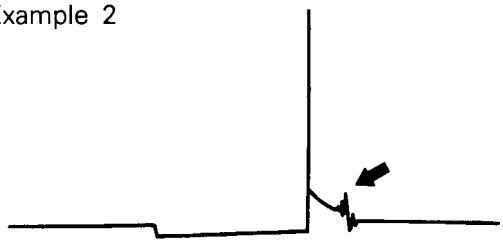
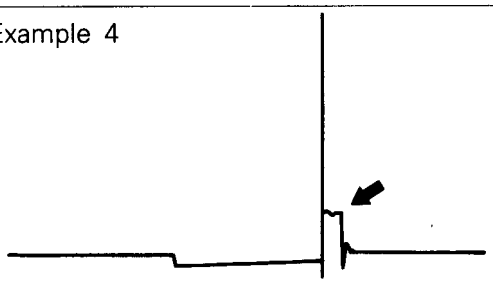
Point B : Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

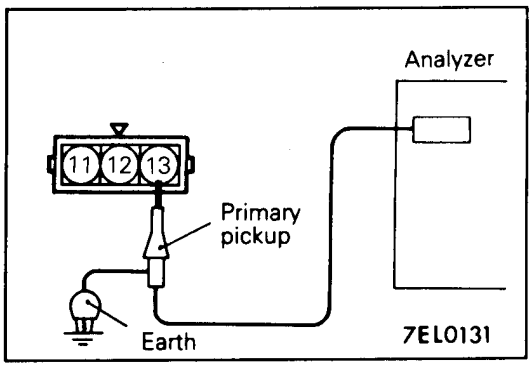
Number of vibrations	Coil, condenser
3 or higher	Normal
Except above	Abnormal

Point C : Height of Zener voltage

Height of Zener voltage	Probable cause
High	Problem in Zener diode
Low	Abnormal resistance in primary coil circuit

EXAMPLES OF ABNORMAL WAVEFORMS

Abnormal waveform	Wave characteristics	Cause of problem
Example 1  01P0210	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0211	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of mis-firing.	Spark plug gap is too small.
Example 3  01P0212	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0213	Spark line is high and short	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5  01P0214	No waves in wave damping section.	Rare short in ignition coil.



INSPECTION OF PRIMARY IGNITION VOLTAGE <6G74, 6G72-24 VALVE>

MEASUREMENT METHOD

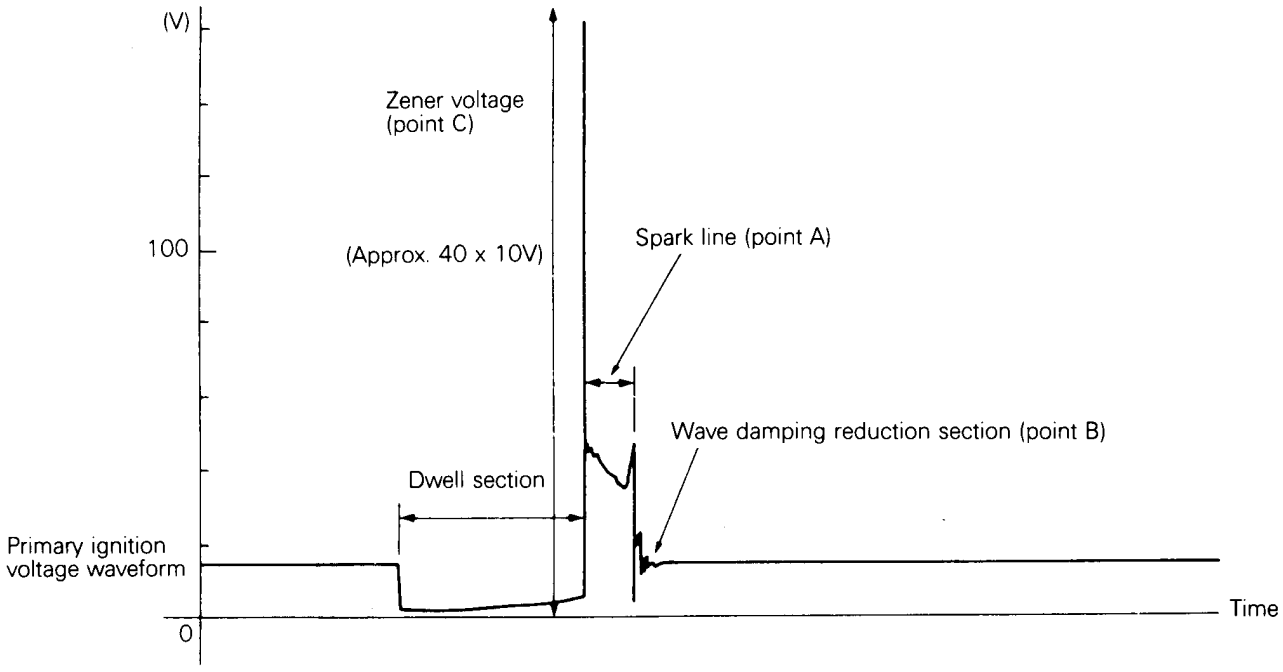
(1) Remove the ignition power transistor connector and connect the special tool (Harness connector: MB991348) in between. All terminals should be connected.
(2) When observing the No. 1 – No. 4 cylinder group, connect the primary pickup of the analyzer probe to the power transistor side connector terminal ⑬.
For the No. 2 – No. 5 cylinder group, connect to terminal ⑫ and for the No. 3 – No. 6 cylinder group, connect to terminal ⑪.
(3) Ground the primary pickup ground terminal.
(4) Clamp the spark plug cable with the trigger pickup.

NOTE
(1) Clamp the spark plug cable of cylinder No. 1, No. 3 or No. 5 which belongs to the same group of the cylinder to which the primary pickup is connected.
(2) The waveform of any cylinder in the same group is displayed on the left side of the screen.

Standard Waveform

Observation conditions

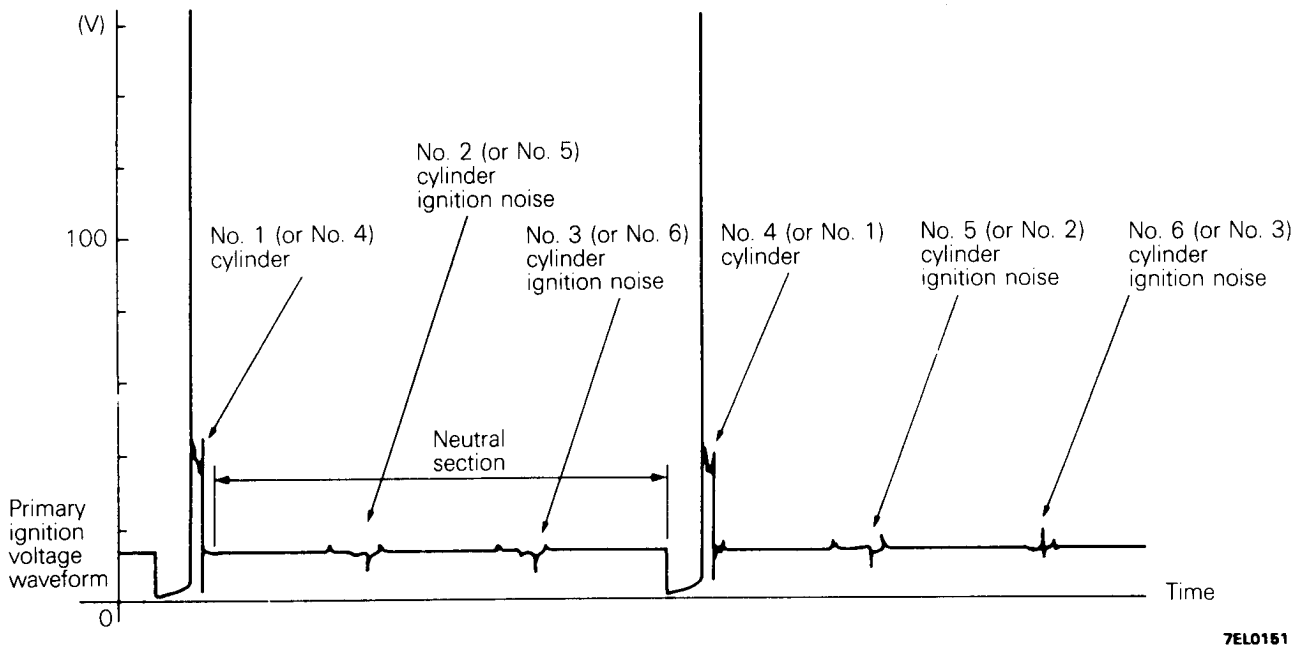
FUNCTION	PRIMARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



7EL0149

Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



WAVEFORM OBSERVATION POINTS

For waveform observation points, refer to P.16-20.

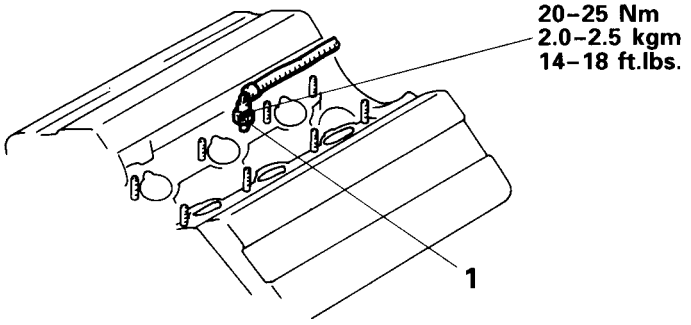
EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P.16-21.

DETONATION SENSOR

REMOVAL AND INSTALLATION

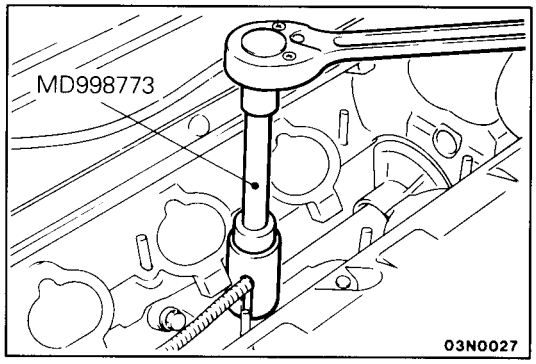
Pre-removal and Post-installation Operation
- Removal and installation of intake manifold (Refer to GROUP 15 – Intake Manifold)



Removal

◀■▶ ▶■◀ 1. Detonation sensor

Caution
Do not subject the detonation sensor to any shocks.



SERVICE POINT OF REMOVAL

1. REMOVAL OF DETONATION SENSOR

SERVICE POINT OF INSTALLATION

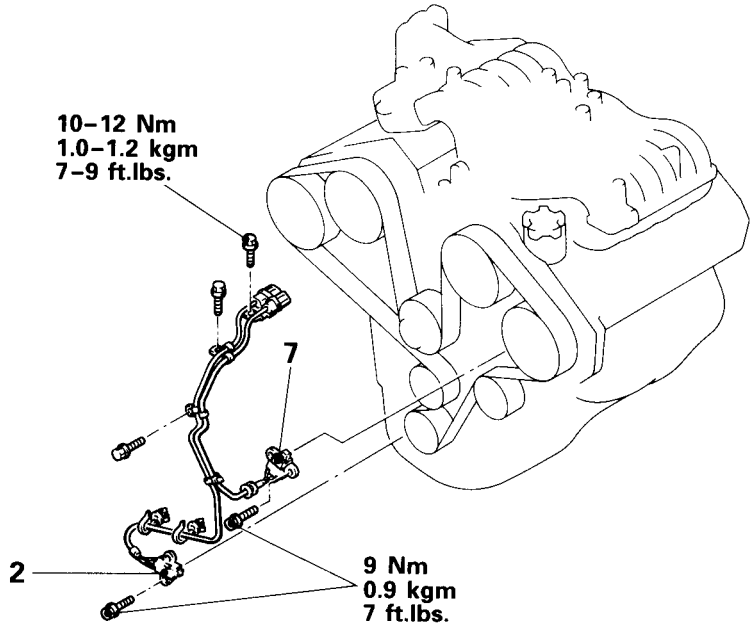
1. INSTALLATION OF DETONATION SENSOR

When the detonation sensor is installed, be sure to tighten it precisely to the specified torque as its installation affects the engine control.

CRANK ANGLE SENSOR AND CAM POSITION SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Cover Removal and Installation (Refer to GROUP 11 – Timing Belt.)



Removal steps
1. Cam position sensor
2. Crank angle sensor

NOTES

GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

E16EB--

Items		Specifications
For super quick glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.20 – 0.26
Glow plug relay coil resistance	Ω	3
For auto glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.22 – 0.28
Glow plug relay coil resistance	Ω	20
For self-regulating glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.5
Glow plug relay coil resistance	Ω	approx. 3
Dropping resistor resistance	Ω	0.14 – 0.16

SEALANT

E16EE--

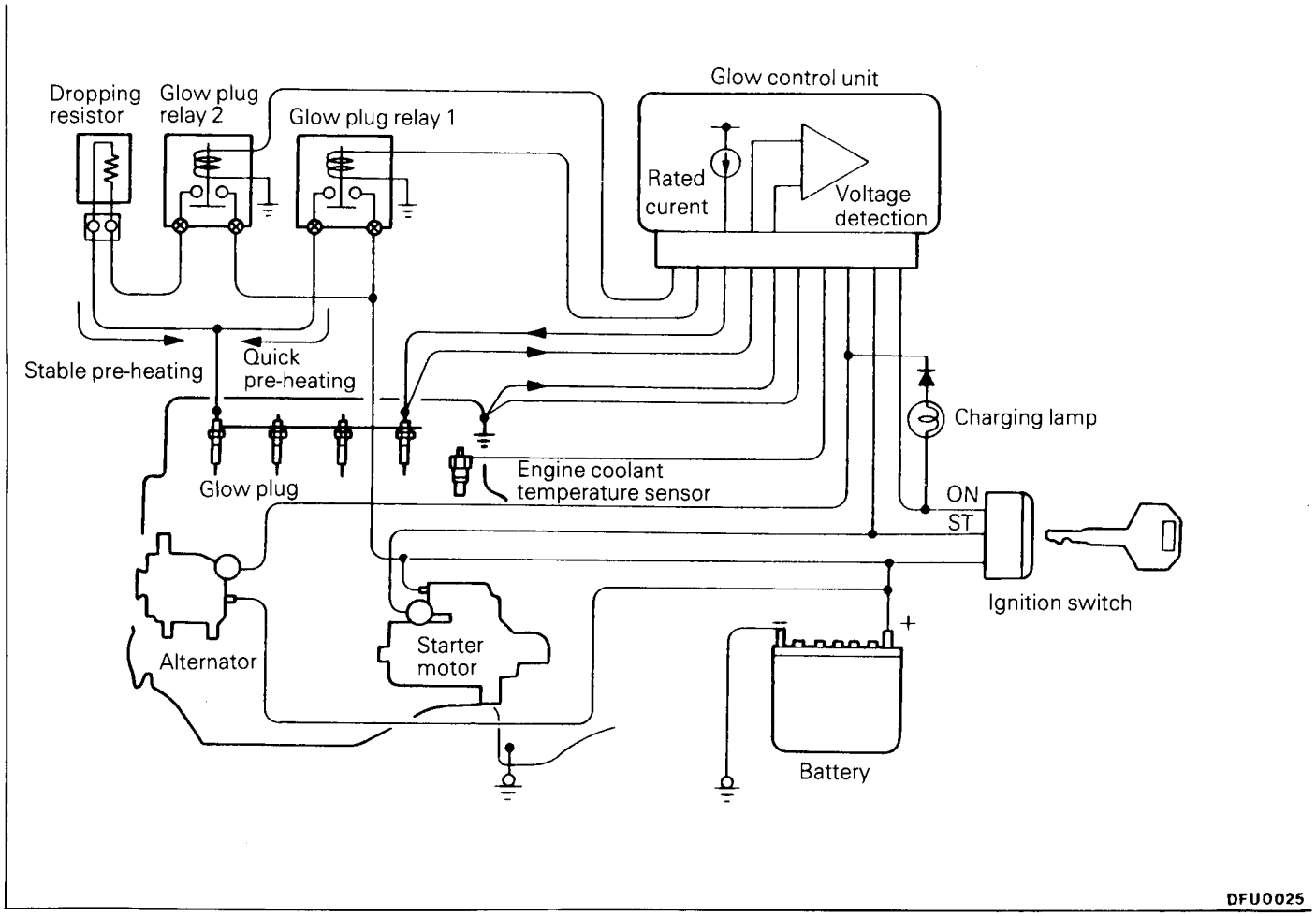
Item	Specified sealant	Remark
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SERVICE ADJUSTMENT PROCEDURES

E16EGAI

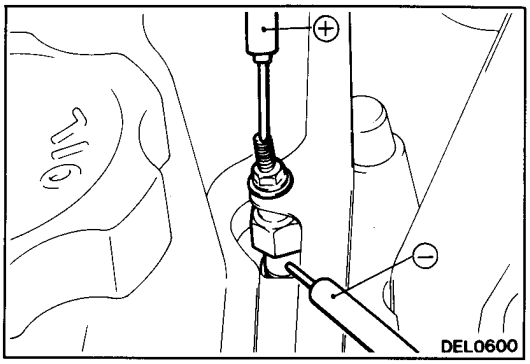
SUPER QUICK GLOW SYSTEM

SUPER QUICK GLOW SYSTEM INSPECTION



(1) Check that the battery voltage is 11-13V.
(2) Check that the engine coolant temperature is 20°C (68°F) or less.

NOTE
If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.

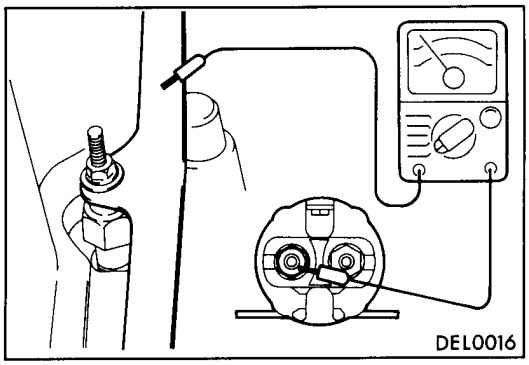


(3) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value: 0.05–0.07 Ω [at 5–35°C (41–95°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

PWJE9086



(4) Measure the resistance between the (G) terminal of glow plug relay 2 and the glow plug plate.

Standard value: 0.14–0.16 Ω

Caution
Measure the resistance after checking that battery voltage is not applied to the (G) terminal.

(5) Connect the voltmeter between the glow plug plate and the glow plug body.

(6) Measure the voltage immediately after the ignition switch is turned to "ON" (without starting the engine).

Standard value: 9–11V (after approx. 2–4 seconds it drops to 0V)

NOTE
The time taken for the voltage to drop will vary depending on the temperature of the glow plugs and the voltage applied. (Refer to the reference illustration.)

(7) Measure the voltage while the engine is cranking.

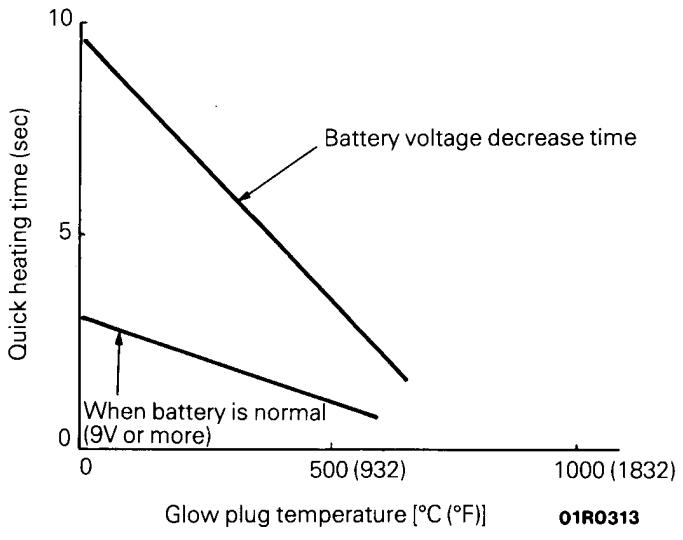
Standard value: 4V or more

(8) Start the engine and measure the voltage while the engine is warming up. However, if the engine coolant temperature increases to 30°C or more, or if 30 seconds have elapsed since the engine was started, the voltage will normally become 0V. (Refer to the reference illustration on the next page.)

Standard value: 5–8V

Reference

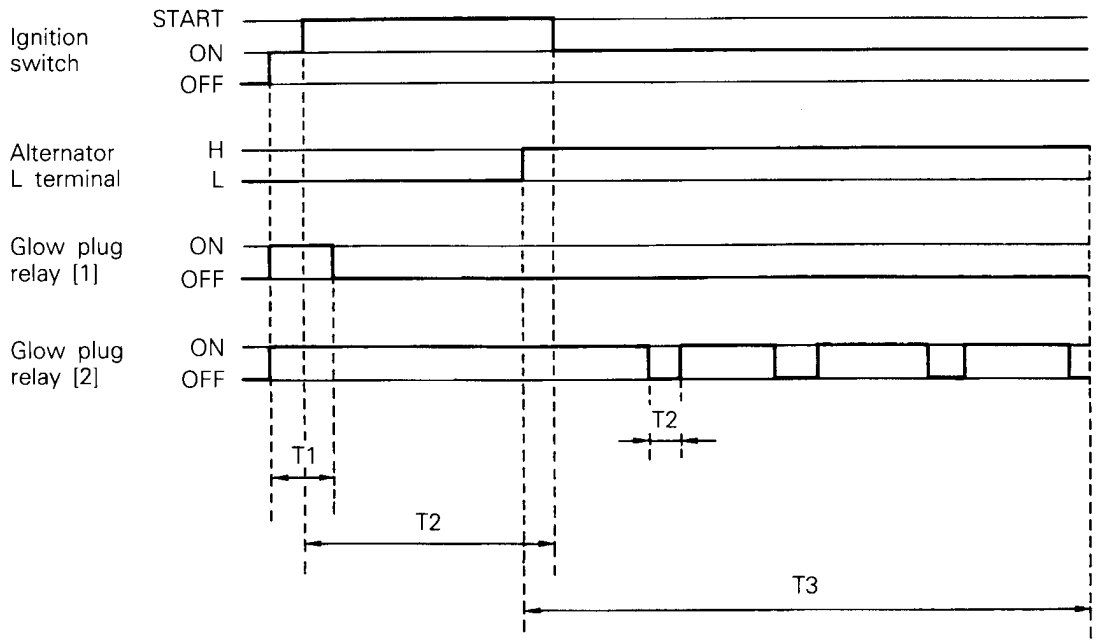
Relationship between glow plug temperature (resistance value) and current flow time



Example
① When battery voltage is normal (9V or above) and the glow plugs are cold, even to heat the plugs to 900°C (1652°F) or more takes approximately 3 seconds.
② On the other hand, when battery voltage is normal (9V or more) and the glow plugs are hot [500°C (932°F)] or more, the time taken for current to flow is reduced.

Reference

Glow plug current timing chart

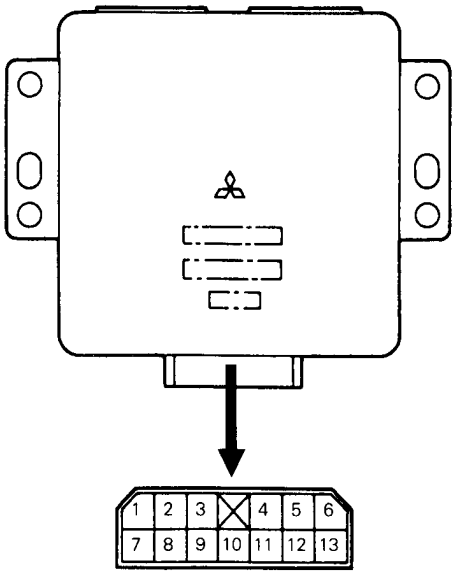


DEL0021

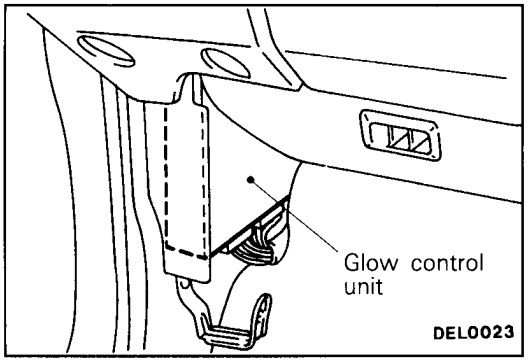
T1: Quick heating time
T2: Glow plug relay [2] drive time when engine is cranking
T3: Glow plug relay [2] drive time after engine starts
T4: Turns off when temperature rises too far

NOTE Afterglow occurs only when engine coolant temperature is 30°C (86°F) or less, and for approximately 30 seconds after the engine is started, turns ON and OFF to prevent the temperature of the glow plugs from exceeding the target temperature [approx. 1050°C (1922°F)].

GLOW CONTROL UNIT INSPECTION



DEL0034



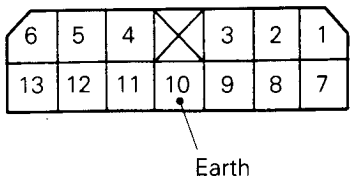
DEL0023

(1) Measure the voltage at the control unit terminals.
NOTE
(1) Inspect with the control unit connector connected.
(2) When measuring the voltage, connect the control unit terminal (10) to the earth.

Terminal Voltage Reference Table

Control unit inspection terminal	Inspection item	Inspection conditions		Standard value
1	Ignition switch (IG power supply)	Ignition switch	"OFF" → "ON"	Battery voltage
			"ON" → "OFF"	0 – 0.5V
2	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
6	Alternator L-terminal	Ignition switch	"OFF" → "ON"	1 – 4V
		Idle		More than 11V
7	Glow plug relay 1	Ignition switch	"OFF → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
8	Glow plug relay 2	Ignition switch	"OFF" → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
13	Engine coolant temperature sensor	Ignition switch "OFF → "ON"	When engine coolant temperature is −20°C (−4°F)	4.3 – 4.5V
			When engine coolant temperature is 0°C (32°F)	3.7 – 3.9V
			When engine coolant temperature is 20°C (68°F)	2.8 – 3.0V
			When engine coolant temperature is 40°C (104°F)	1.9 – 2.1V
			When engine coolant temperature is 80°C (176°F)	0.5 – 0.7V

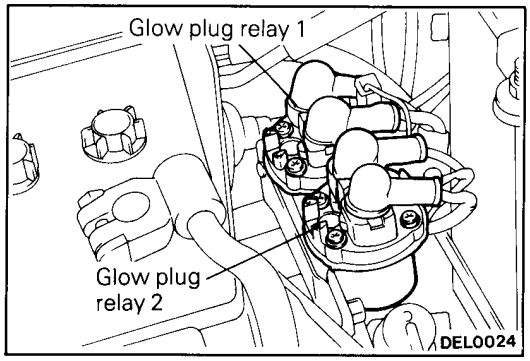
View of harness-side connector of glow control unit from terminal side (13P)



DEL0602

(2) Remove the control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
4 – 10	Glow plug constant current circuit	Continuity (approx. 0.06Ω)
5 – 11	Glow plug voltage measurement circuit	Continuity (approx. 0.06Ω)
7 – 10	Glow plug relay 1	Continuity (approx. 3Ω)
8 – 10	Glow plug relay 2	Continuity (approx. 3Ω)



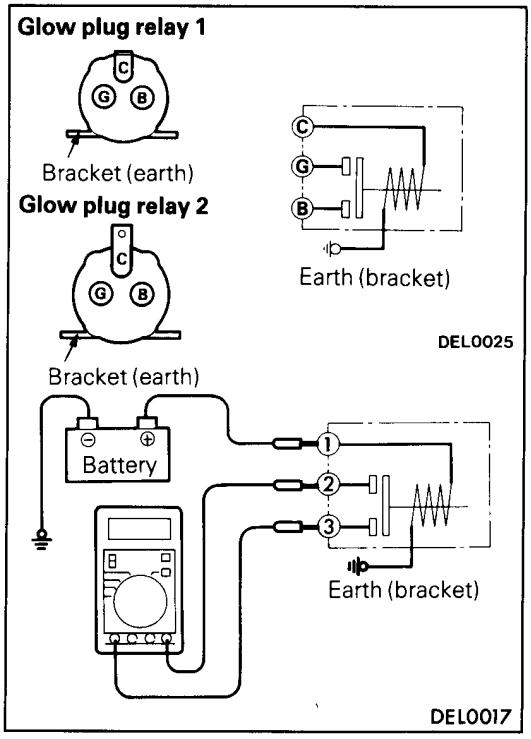
GLOW PLUG RELAYS 1 AND 2 INSPECTION

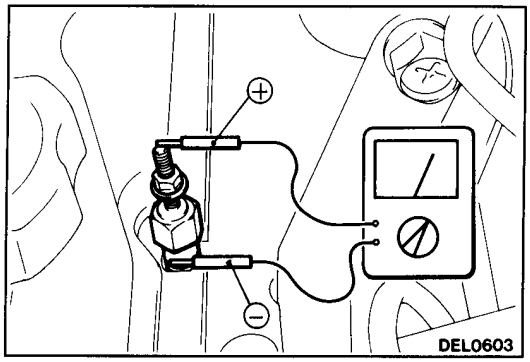
(1) Check that there is continuity (approx. 3 Ω between the glow plug relay (C) terminal and the bracket (earth).
(2) Use jumper leads to connect the glow plug relay terminal (C) with the battery (+) terminal and the bracket with the battery (–) terminal.

Caution
(1) Before using the jumper leads, the harnesses connected to glow plug relay (B) and (G) Terminals must always be removed.
(2) Do not short out the disconnected harness-side terminals to the earth.
(3) Be extremely careful when connecting the jumper leads, as if the terminals are connected incorrectly, it will damage the relays.

(3) Check the continuity between glow plug relay (B) and (G) terminals with the jumper lead connected from the battery (–) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between (B) and (G) terminals
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (∞ Ω)

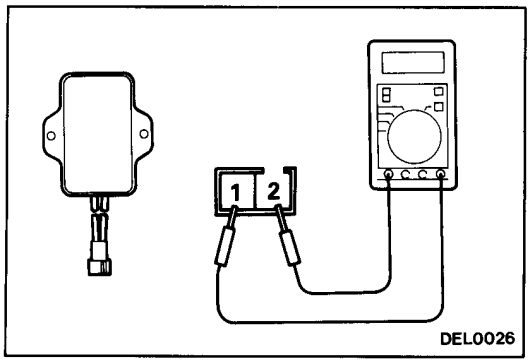




GLOW PLUG INSPECTION

(1) Remove the glow plug plate.
(2) Measure the resistance between the glow plug terminals and the body.

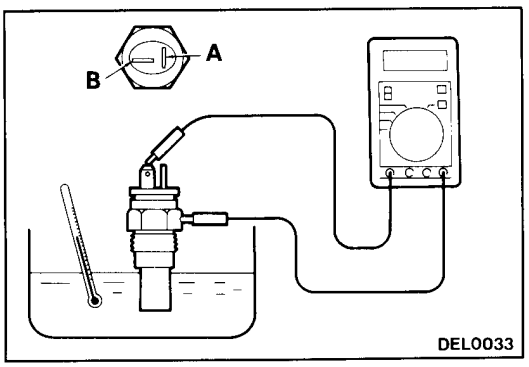
Standard value: 0.20–0.26 Ω [at 5–35°C (41–95°F)]



DROPPING RESISTOR INSPECTION

(1) Disconnect the dropping resistor connector.
(2) Measure the resistance between the dropping resistor terminals.

Standard value: 0.14–0.16 Ω



ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.
(2) While the sensor section of the engine coolant temperature sensor is submerged, measure the resistance between (B) terminal and the body.

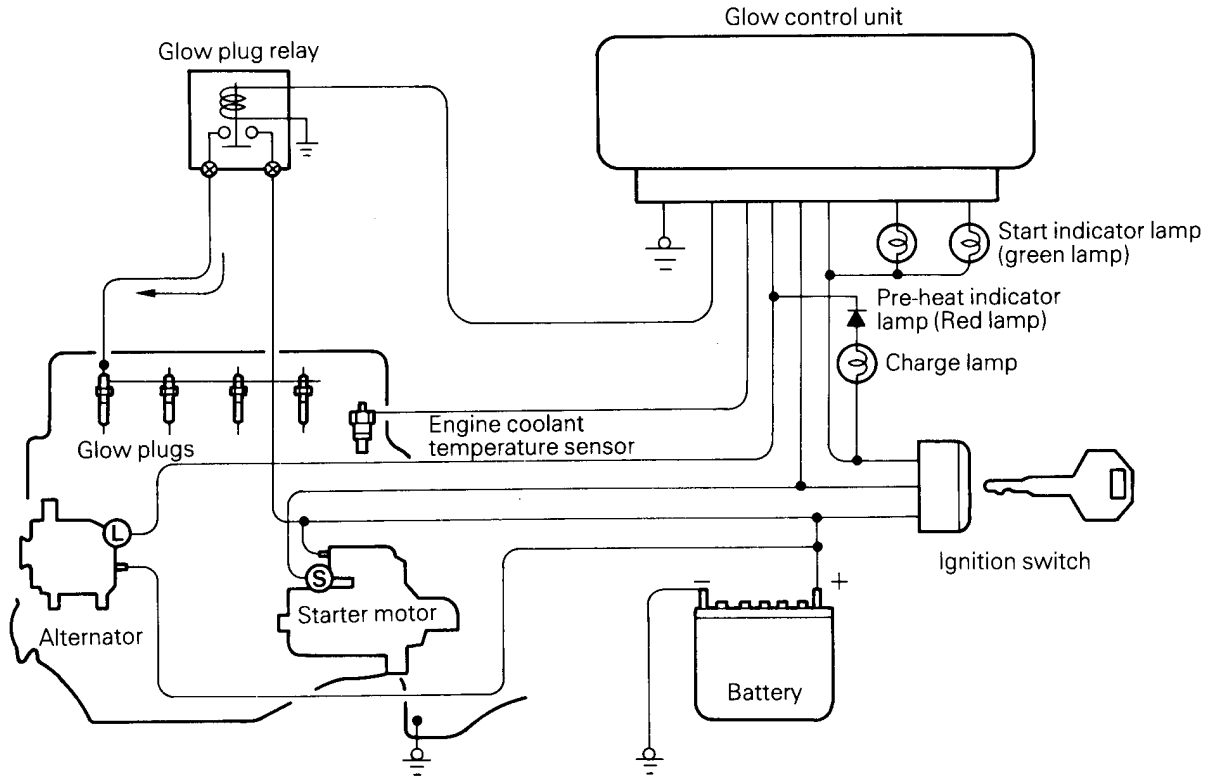
Temperature [°C (°F)]	Resistance value (k Ω)
−20 (−4)	24.8 ± 2.5
0 (32)	8.6
20 (68)	3.25 ± 0.33
40 (104)	1.5
80 (176)	0.3

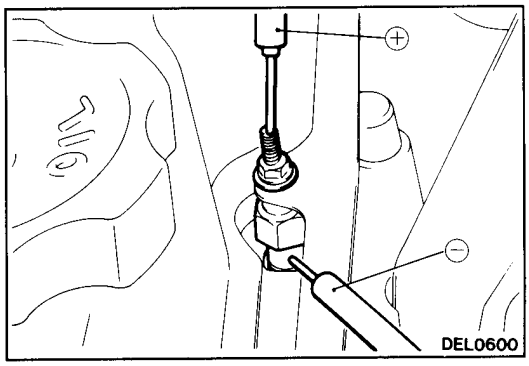
(3) After applying specified sealant to the thread, tighten to the specified torque.

Specified sealant: 3M Nut Locking Part No. 4171 or equivalent
Tightening torque: 30 Nm (3kgm, 22 ft.lbs.)

AUTO GLOW SYSTEM

AUTO GLOW SYSTEM INSPECTION





(1) Check that the battery voltage is 11-13V.
(2) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value: 0.05–0.07 Ω [at 5–35°C (41–95°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

(3) Connect the voltmeter between the glow plug plate and the glow plug body (earth).
(4) Measure the voltage immediately after the ignition switch is turned to "ON" (without starting the engine).

Standard value: 9–11V (after 30–60 seconds it drops to 0V)

Furthermore, check that the pre-heat indicator lamp (red) illuminates immediately after the ignition switch is turned to "ON", and that as soon as it switches off the start indicator lamp (green) illuminates.

NOTE
The time taken for the voltage to appear (current flow time) will vary depending on the engine coolant temperature.

(5) Measure the voltage while the engine is cranking.

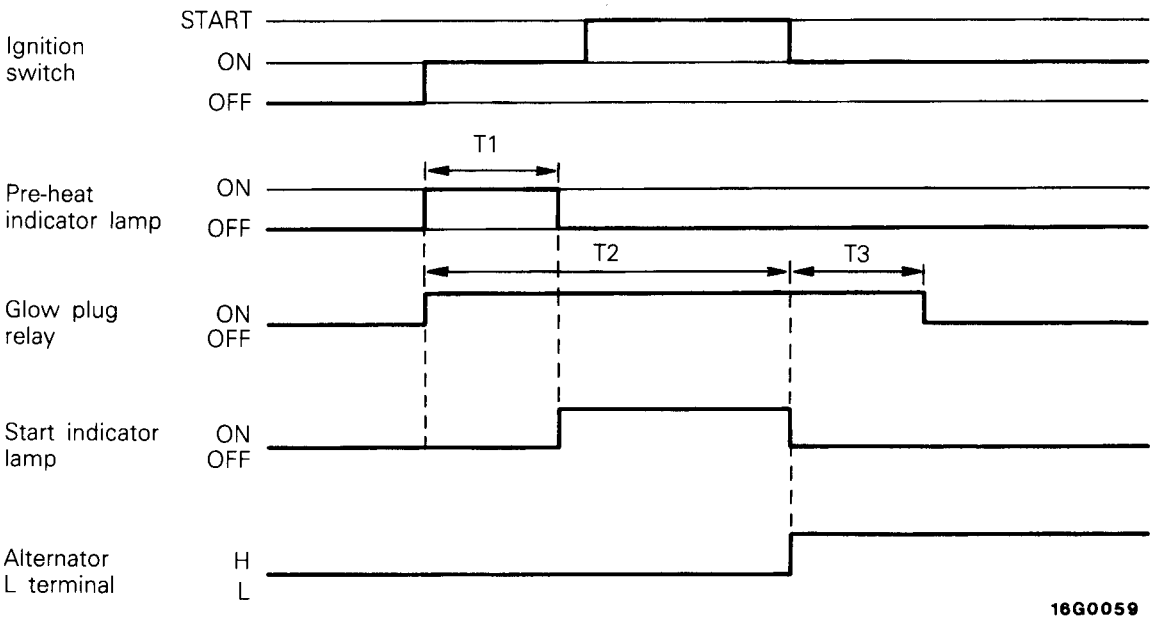
Standard value: 6V or more

(6) Start the engine and measure the voltage while the engine is warming up. However, the voltage will normally become 0V between 1 – 30 seconds after the engine was started. (Refer to the reference illustration on the next page.)

Standard value: 12–15V

Reference

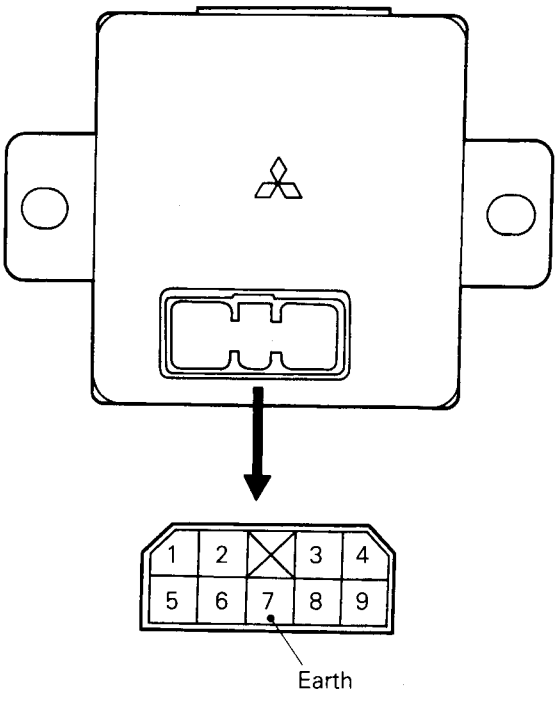
Glow plug current timing chart

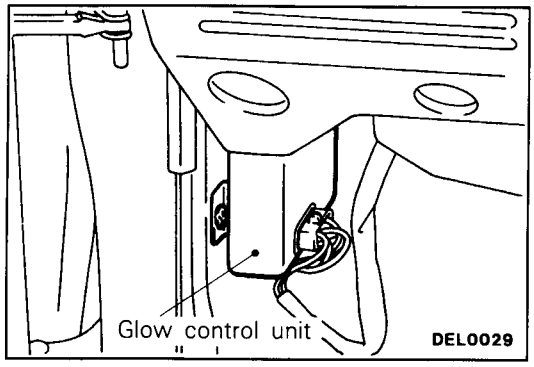


T1: Pre-heating indicator lamp
T2: Glow plug relay drive time after power is ON
T3: Glow plug relay drive time after combustion is completed (afterglow)

NOTE The lower the engine coolant temperature, the longer the after-glow time for T3.

GLOW CONTROL UNIT INSPECTION



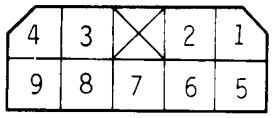


(1) Measure the voltage at the control unit terminals.
NOTE
1. Inspect with the glow control unit connector connected.
2. When measuring, connect the glow control unit terminal ⑦ to the earth.

Terminal Voltage Reference Table

Control unit inspection terminal	Inspection item	Inspection conditions		Standard value
1	Ignition switch (IG power supply)	Ignition switch	"OFF" → "ON"	Battery voltage
			"ON" → "OFF"	0 – 0.5V
3	Pre-heat display lamp	Ignition switch	"OFF" → "ON"	0 – 1V After approx. 6 seconds [when engine coolant temperature is 20°C (68°F)] 11 – 13V
4	Alternator L-terminal	Ignition switch	"OFF" → "ON"	1 – 4V
		Idle		More than 11V
5	Glow plug relay 1	Ignition switch	"OFF" → "ON"	9 – 12V After approx. 36 seconds [when engine coolant temperature is 20°C (68°F)] 0 – 0.5V
6	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
8	Start display lamp	Ignition switch	After "OFF" → "ON" After approx. 6 seconds have passed [when engine coolant temperature is 20+DO+C (68°F)]	0 – 1V After approx. 30 seconds [when engine coolant temperature is 20°C (68°F)] 11 – 13V
9	Engine coolant temperature sensor	Ignition switch "OFF" → "ON"	When engine coolant temperature is −20°C (−4°F)	4.3 – 4.5V
			When engine coolant temperature is 0°C (32°F)	3.7 – 3.9V
			When engine coolant temperature is 20°C (68°F)	2.8 – 3.0V
			When engine coolant temperature is 40°C (104°F)	1.9 – 2.1V
			When engine coolant temperature is 80°C (176°F)	0.5 – 0.7V

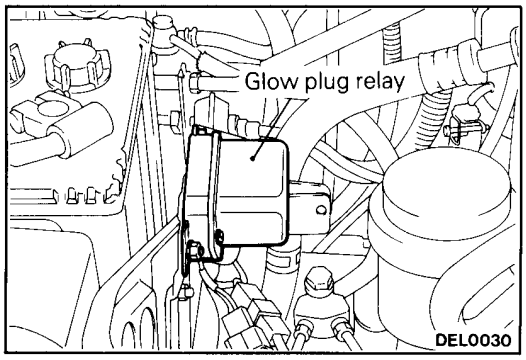
Glow control unit harness-side connector seen from terminal side



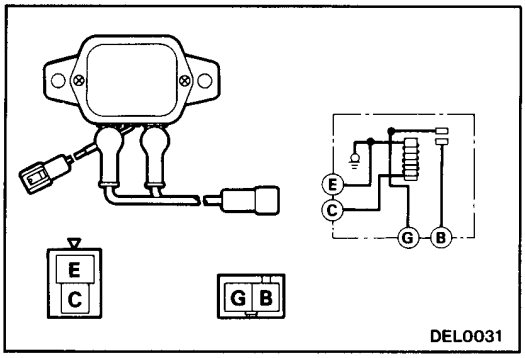
16G0053

(2) Disconnect the glow control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
5–7	Glow plug relay	Continuity (approx. 20Ω)



DEL0030



DEL0031

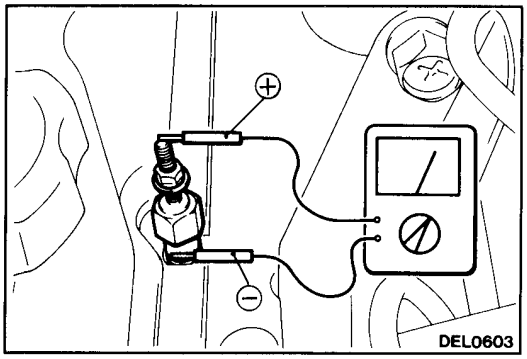
GLOW PLUG RELAY INSPECTION

(1) Check that there is continuity (20 between glow plug relay terminal (C) and terminal (E).
(2) Use jumper leads to connect the glow plug relay terminal (C) with the battery (+) terminal and terminal (E) with the battery (–) terminal.

Caution
(1) Before using the jumper leads, the harnesses connected to glow plug relay (B) and (G) terminals must always be removed.
(2) Do not short out the disconnected harness-side terminals to the earth.
(3) Be extremely careful when connecting the jumper leads, as if the terminals are connected incorrectly, it will damage the relays.

(3) Check the continuity between glow plug relay (B) and (G) terminals with the jumper lead connected from the battery (–) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between (B) and (G) terminals
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (∞ Ω)



DEL0603

GLOW PLUG INSPECTION

(1) Remove the glow plug plate.
(2) Measure the resistance between the glow plug terminals and the body.

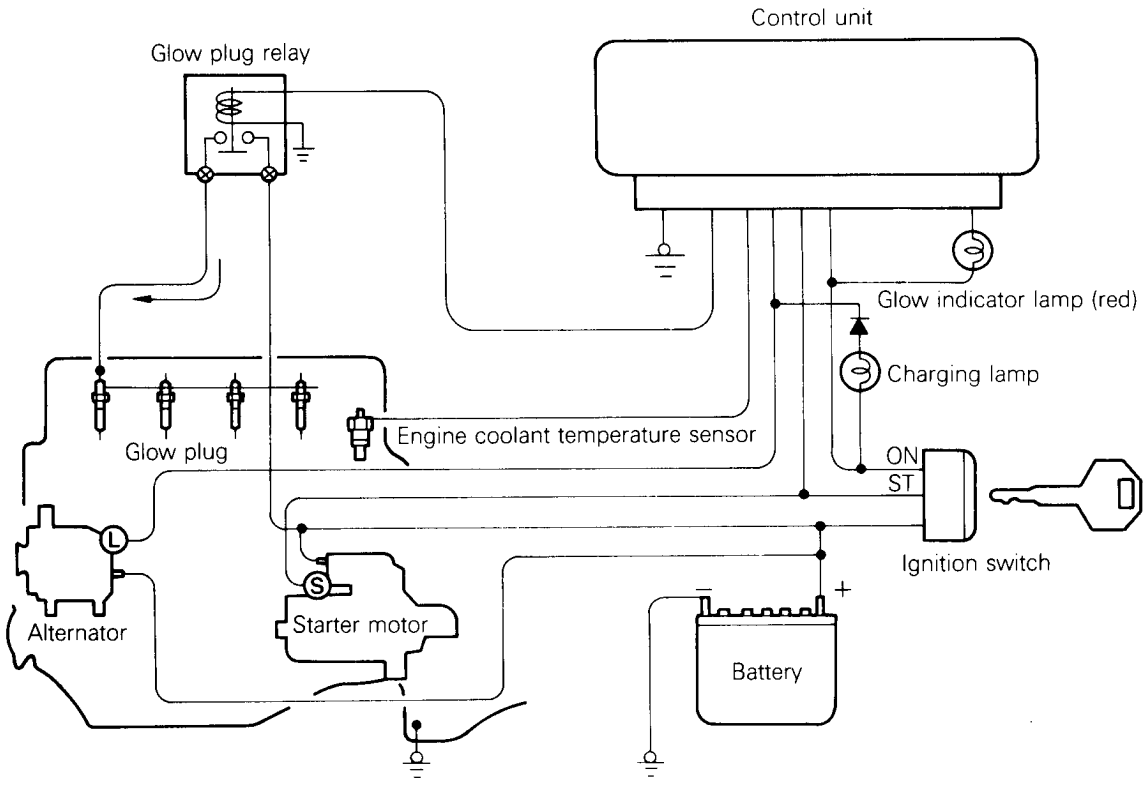
Standard value: 0.22–0.28Ω [at 5–35°C (41–95°F)]

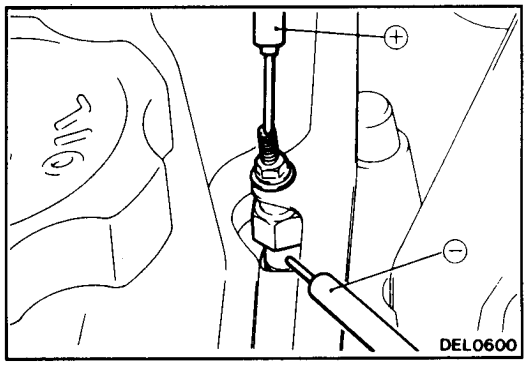
ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Refer to P.16-28.

SELF-REGULATING GLOW SYSTEM

SELF-REGULATING GLOW SYSTEM INSPECTION





(1) Check to be sure that the battery voltage is 11 – 13V.
(2) Check to be sure that the engine coolant temperature is 40°C (104°F) or less.

NOTE
If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.

(3) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value : 0.10–0.15 Ω [at 20°C (68°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

(4) Connect a voltmeter between the glow plug plate and the glow plug body (earth).

(5) Measure the voltage immediately after the ignition switch is turned to ON (without starting the engine).

Standard value : 9–11V
Drops to 0 V after 4-8 seconds have passed)

In addition, check to be sure that the glow indicator lamp (red) illuminates and then switches off immediately after the ignition switch is turned to ON.

NOTE
The time during which the voltage appears (energising time) will depend on the engine coolant temperature.

(6) Measure the voltage while the engine is cranking.

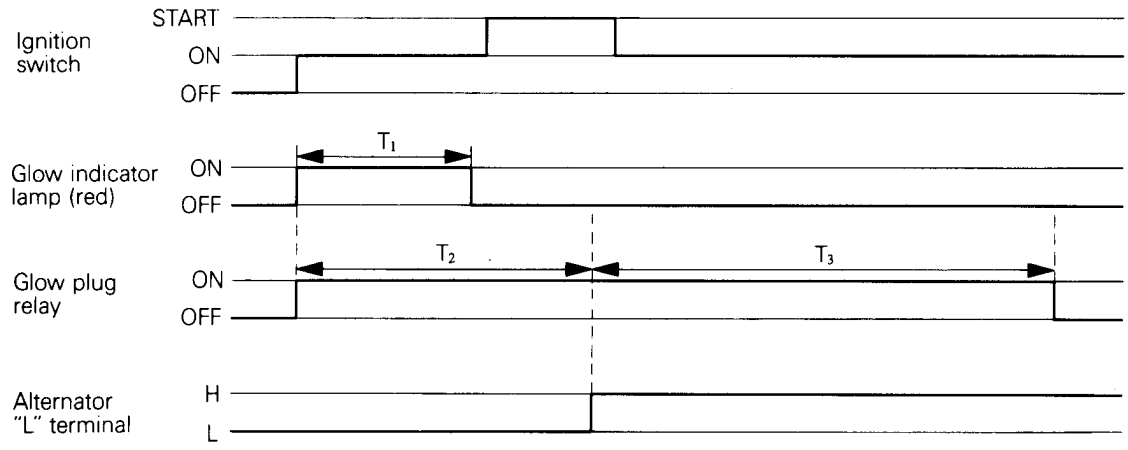
Standard value: 6 V or more

(7) Start the engine and measure the voltage while the engine is warming up.
However, if the engine coolant temperature rises above 60°C (140°F) or when 180 seconds have passed since the engine was started, the voltage will normally return to 0 V. (Refer to the Glow Plug Energisation Timing Chart.)

Standard value: 12–15 V

<Reference>

Glow Plug Energisation Timing Chart



DEN0063

T_1 : Glow indicator lamp
T_2 : Glow plug relay drive time after ignition switch is turned ON
T_3 : Glow plug relay drive time after engine starts (afterglow)

NOTE
Afterglow time T_3 becomes longer as the engine coolant temperature drops.

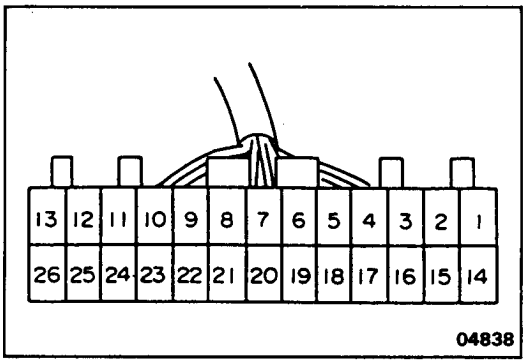
GLOW & EGR CONTROL UNIT INSPECTION

<TERMINAL VOLTAGE MEASUREMENT>

NOTE
1. Inspect with the glow & EGR control unit connector connected.
2. Connect glow & EGR control unit terminal ㉖ to the earth.

Terminal Voltage Quick-Reference Table

Glow & EGR ECU inspection terminal	Inspection item	Inspection condition		Standard value
5	Engine coolant temperature sensor (Engine coolant temperature detection)	Ignition switch "ON" → "OFF"	Engine coolant temperature: –20°C (–4°F)	4.3 – 4.5V
			Engine coolant temperature: 0°C (32°F)	3.7 – 3.9V
			Engine coolant temperature: 20°C (68°F)	2.8 – 3.0V
			Engine coolant temperature: 40°C (104°F)	1.9 – 2.0V
			Engine coolant temperature: 80°C (176°F)	0.5 – 0.7V
12	Ignition switch (power supply)	Ignition switch "OFF" → "START"		8V or more
14	Glow plug relay (glow time control)	Ignition switch "OFF" → "ON" Engine coolant temperature: 40°C (104°F) or less (Pre-glow function inspection)		9–12V ↓ 0–0.5V after approx. 8 sec. (when engine coolant temperature is 20°C (68°F))
17	Glow indicator lamp	Ignition switch "OFF" → "ON" Engine coolant temperature: 40°C (104°F) or less		0–1V ↓ 11–13V after approx. 1 sec. (when engine coolant temperature is 20°C (68°F))
23	Alternator charging signal ("L" terminal)	Ignition switch "OFF" → "ON"		1 – 4V
		Engine is idling		11V or more
26	Earth	—		—

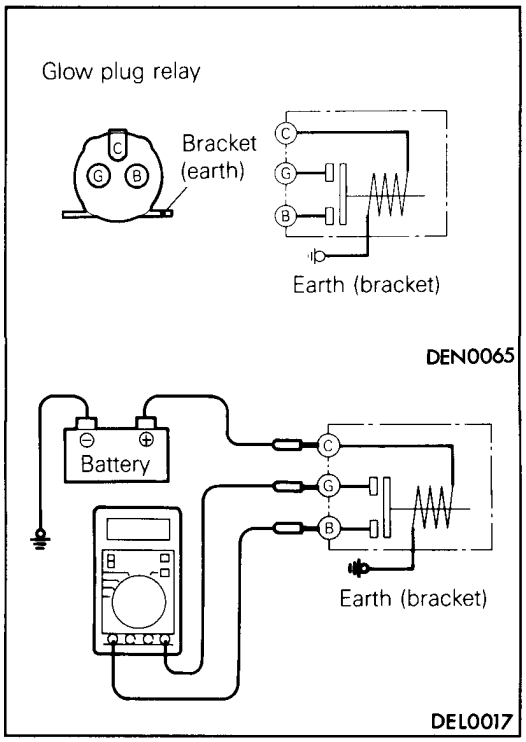


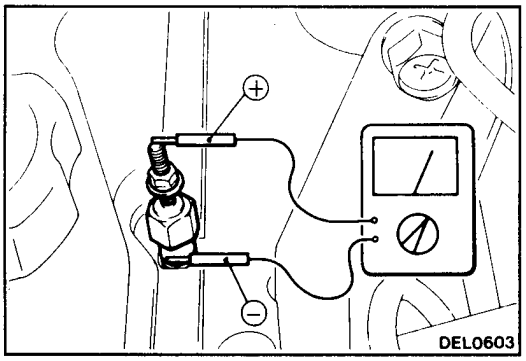
<HARNESS CONTINUITY INSPECTION>

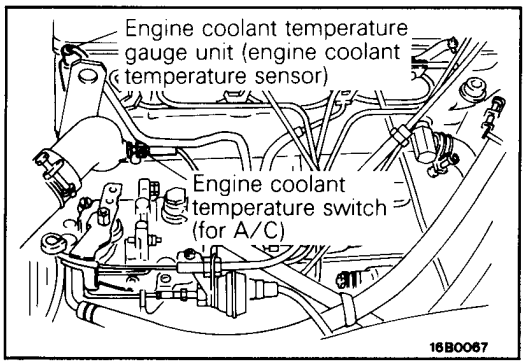
(1) Disconnect the glow & EGR control unit connector.
(2) Check the continuity between the harness-side connector terminals.

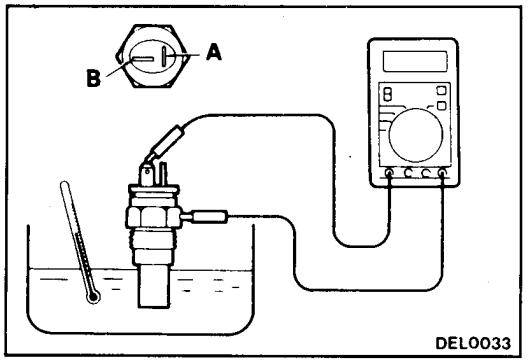
Inspection terminals	Inspection item	Continuity
14 – 26	Glow plug relay	Continuity (approx. 3Ω)

ADDED









GLOW PLUG RELAY INSPECTION

(1) Check to be sure that there is continuity (approx. 3Ω) between the glow plug relay Ⓒ terminal and the bracket (earth).

(2) Use jumper leads to connect the glow plug relay terminal Ⓒ with the battery (+) terminal and the bracket with the battery (–) terminal.

Caution

(1) Before using the jumper leads, the harnesses connected to glow plug relay terminals Ⓑ and Ⓖ must always be disconnected.

(2) Do not short the disconnected harness-side terminals to the earth.

(3) Do not connect the jumper leads to a wrong terminal, or the relays may be damaged.

(3) Check the continuity between glow plug relay terminals Ⓑ – Ⓖ with the jumper lead connected from the battery (+) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between terminals (B) – (G)
Connected	Continuity (0.01Ω or less)
Disconnected	No continuity (∞Ω)

GLOW PLUG INSPECTION

(1) Remove the glow plug plate.

(2) Measure the resistance between the glow plug terminals and the body.

Standard value : 0.5 Ω [at 20°C (68°F)]

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.

(2) Measure the resistance between terminal Ⓐ and the body while immersing the engine coolant temperature sensor in warm water.

Temperature [°C (°F)]	Resistance value kΩ
–20 (–4)	24.8 ± 2.5
0 (32)	8.6
20 (68)	3.25 ± 0.33
40 (104)	1.5
80 (176)	0.3

(3) After applying specified sealant to the thread section, tighten the sensor to the specified torque.

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

Tightening torque : 30 Nm (3.0 kgm, 22 ft.lbs.)