ENGINE ELECTRICAL

CONTENTS

E16AA--

CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16BA--

ALTERNATOR

Items	4G13	4G92, 4G93	4D68
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/65, 70*1, 75*2	12/75, 90*3	12/75, 90*4, 105*5
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

NOTE
*1: Vehicles with standard specifications built from October, 1993
*2: Vehicles with cold region specifications
*3: Vehicles with automatic transmission for cold regions built from October, 1993
*4: Vehicles with EGR for cold regions built up to September, 1993
*5: Vehicles with cold region specifications built from October, 1993

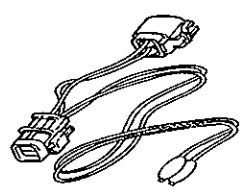
SERVICE SPECIFICATIONS

E16BB--

Items	Specifications
Alternator	
Standard value	
Regulated voltage	
Ambient temp. at voltage regulator V	
–20°C (–4°F)	14.2–15.4
20°C (68°F)	13.9–14.9
60°C (140°F)	13.4–14.6
80°C (176°F)	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)

SERVICE ADJUSTMENT PROCEDURES

E16BGAG

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.

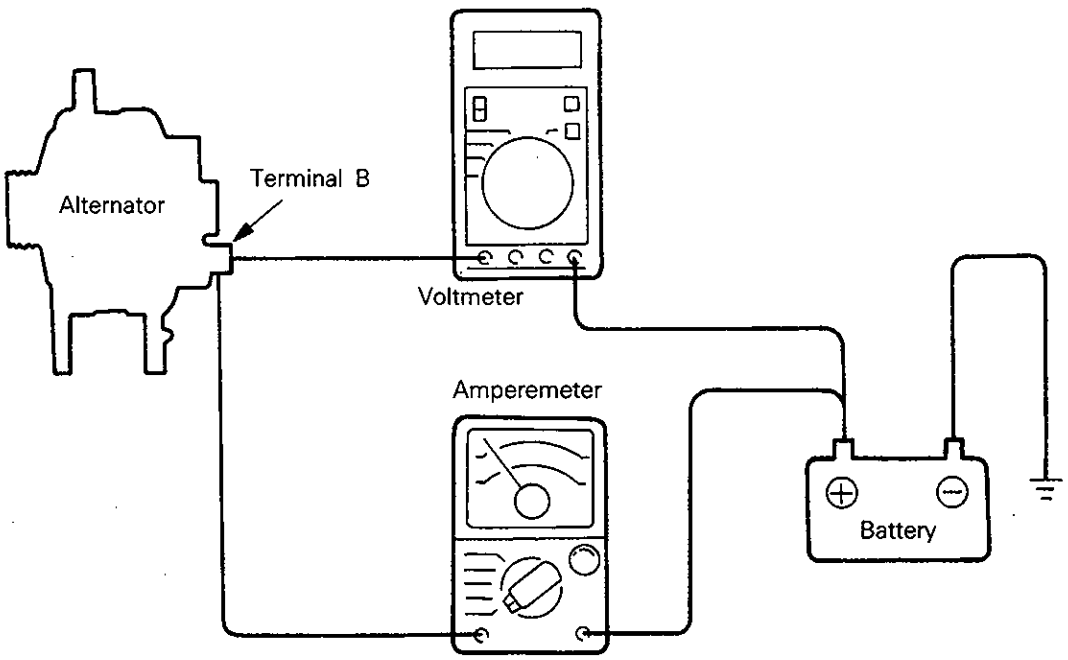
(1) Always be sure to check the following before the test.
- Alternator installation
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

(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.)

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT LINE



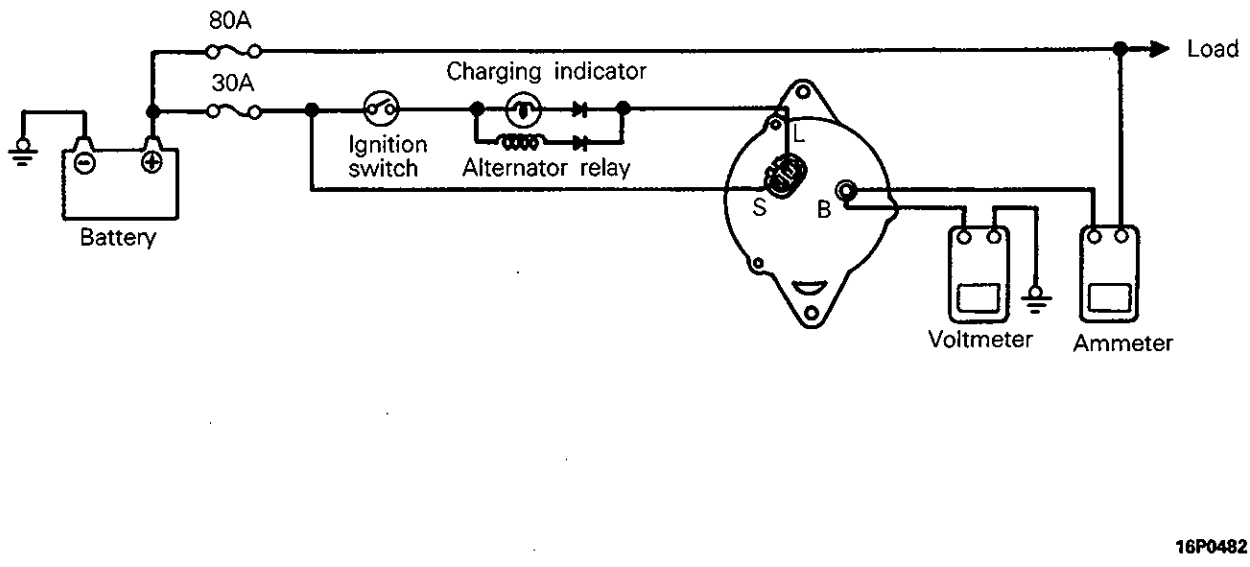
5EL0015

(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 30 A.
Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30 A. 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



16P0482

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.) dures.)
- 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.)

Caution
Never use clips but tighten bolts and nuts to connect the line. Otherwise 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.)
(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.

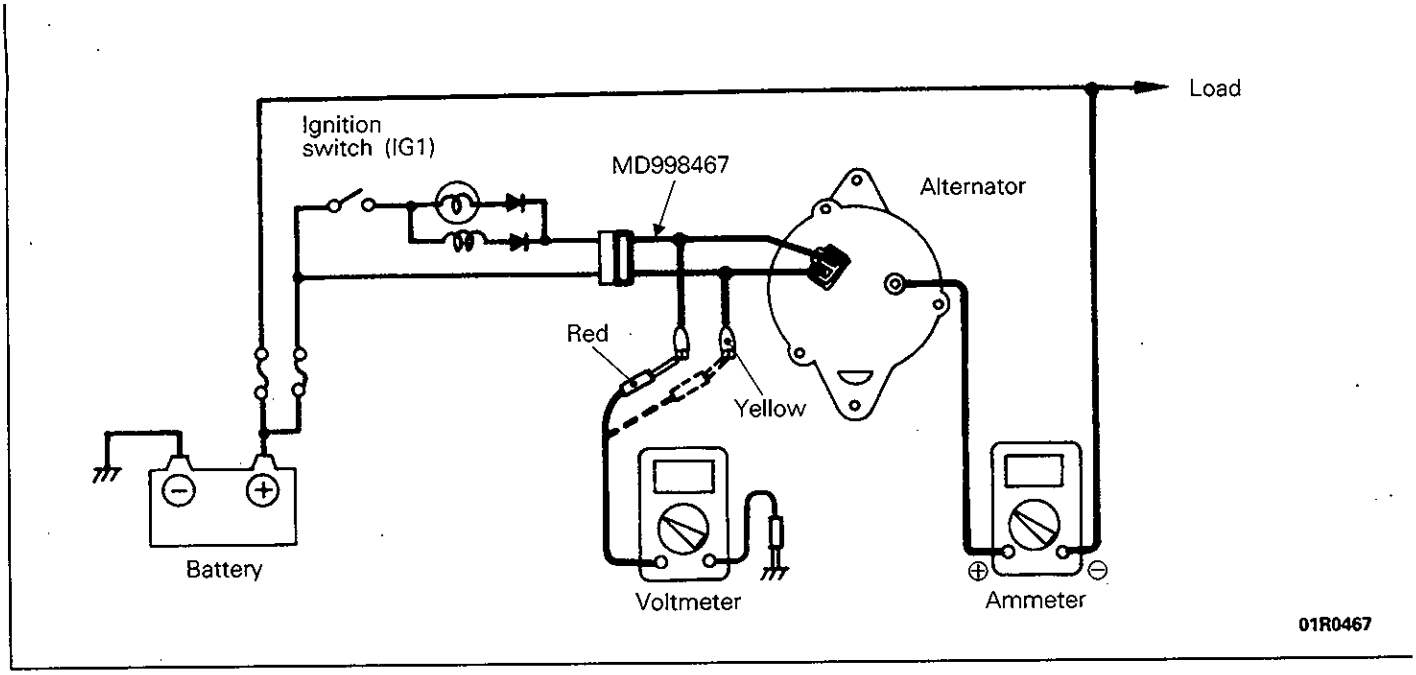
NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

(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 a digital-type voltmeter between the alternator "S" terminal and the earth. (Connect the (+) lead of the voltmeter to the "S" terminal, and then connect the (–) lead of the voltmeter to a secure earth or to the battery (–) terminal.)
(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.)
(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.

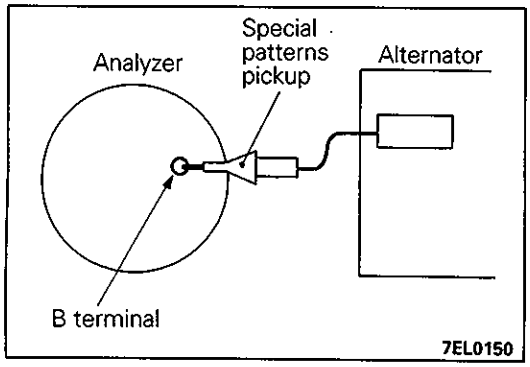
(11)Start the engine.
(12)Increase the engine speed to 2,500 r/min.
(13)Read the value displayed on the voltmeter when the current output by the alternator becomes 10 A or less.
(14)If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
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"	–20 (–4)	14.2–15.4
	20 (68)	13.9–14.9
	60 (140)	13.4–14.6
	80 (176)	13.1–14.5

(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.

NOTES



CHECKING WITH AN ANALYZER

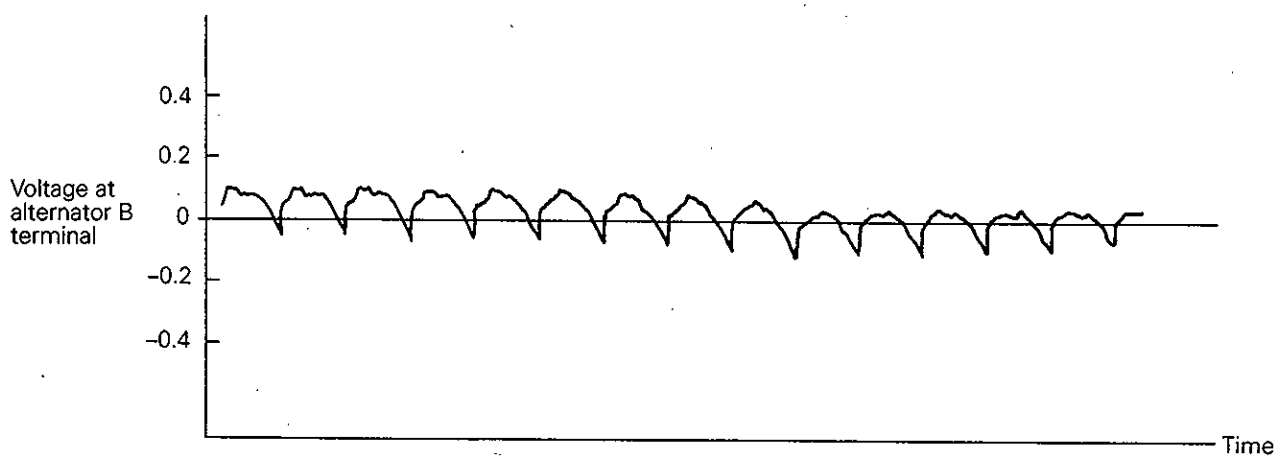
MEASUREMENT METHOD

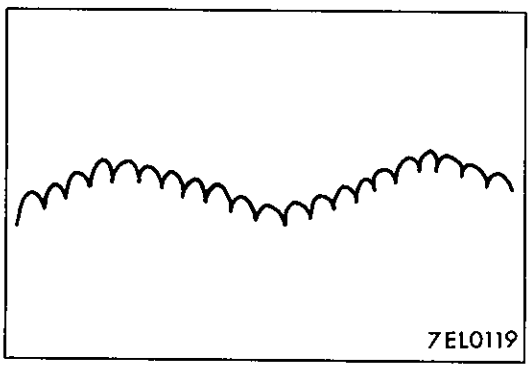
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

FUNCTION	SPECIAL PATTERNS
PATTERN HEIGHT	VARIABLE
VARIABLE knob	Adjust while viewing the wave pattern
PATTERN SELECTOR	RASTER
Engine speed	Curb idle speed

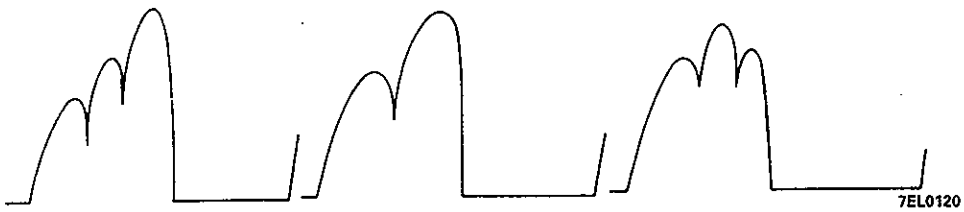
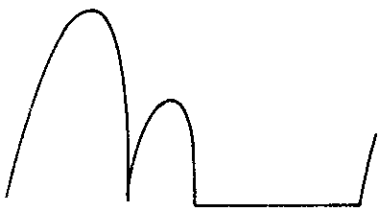


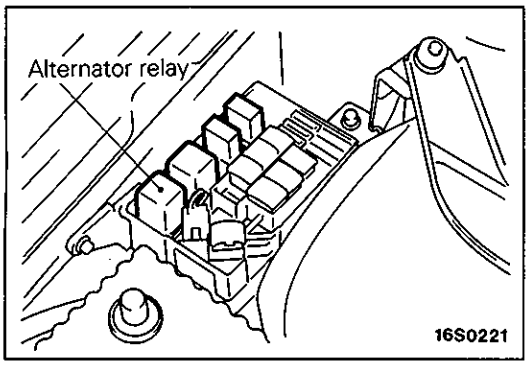


NOTE
Furthermore, the voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

EXAMPLES OF ABNORMAL WAVEFORMS

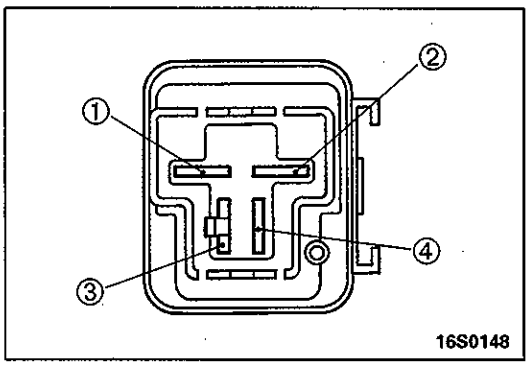
NOTE
1. The size of the waveform patterns differs largely depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
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 RELAY CONTINUITY CHECK

(1) Remove the alternator relay from the relay box inside the engine compartment.



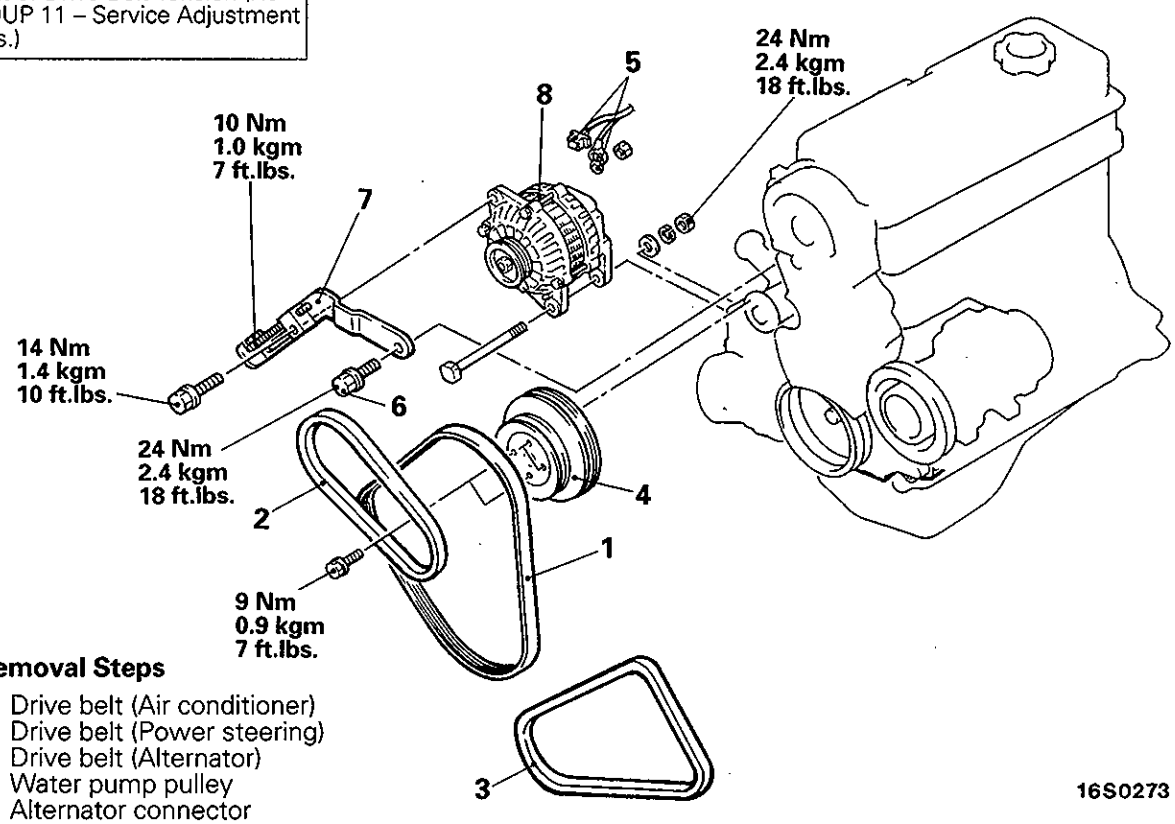
(2) Set the circuit tester to the Ω range and check that there is continuity when the (+) terminal of the tester is connected to terminal ④ of the alternator relay and the (−) terminal is connected to terminal ②.
(3) Next, check that there is no continuity when the (+) terminal is connected to terminal ② and the (−) terminal is connected to terminal ④.
(4) If the continuity checks in steps (2) and (3) show a defect, replace the alternator relay.

ALTERNATOR <4G13>

REMOVAL AND INSTALLATION

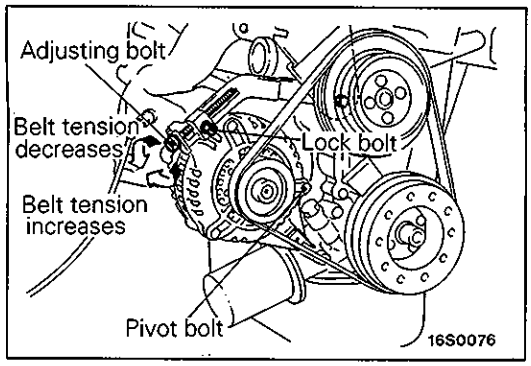
E16BH-1

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



Removal Steps

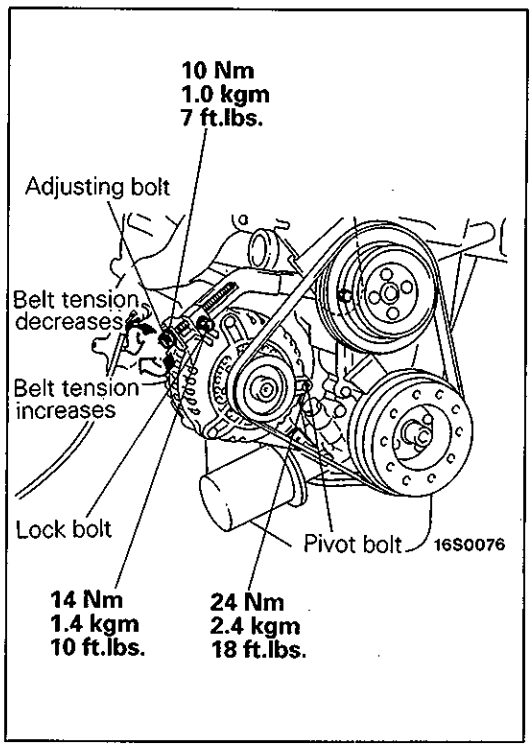
1. Drive belt (Air conditioner)
2. Drive belt (Power steering)
◀◆ ◆▶ 3. Drive belt (Alternator)
4. Water pump pulley
5. Alternator connector
6. Alternator brace mounting bolt
◆▶ 7. Alternator brace
◆▶ 8. Alternator



SERVICE POINTS OF REMOVAL E16BHCF

3. REMOVAL OF DRIVE BELT (ALTERNATOR)

(1) Loosen the pivot bolt nut and the lock bolt as shown in the illustration.
(2) Loosen the adjusting bolt and lift it upwards.
(3) Push the alternator towards the engine to remove the drive belt.



SERVICE POINTS OF INSTALLATION E16BHDE

8. INSTALLATION OF ALTERNATOR/7. ALTERNATOR BRACE/3. DRIVE BELT (ALTERNATOR)

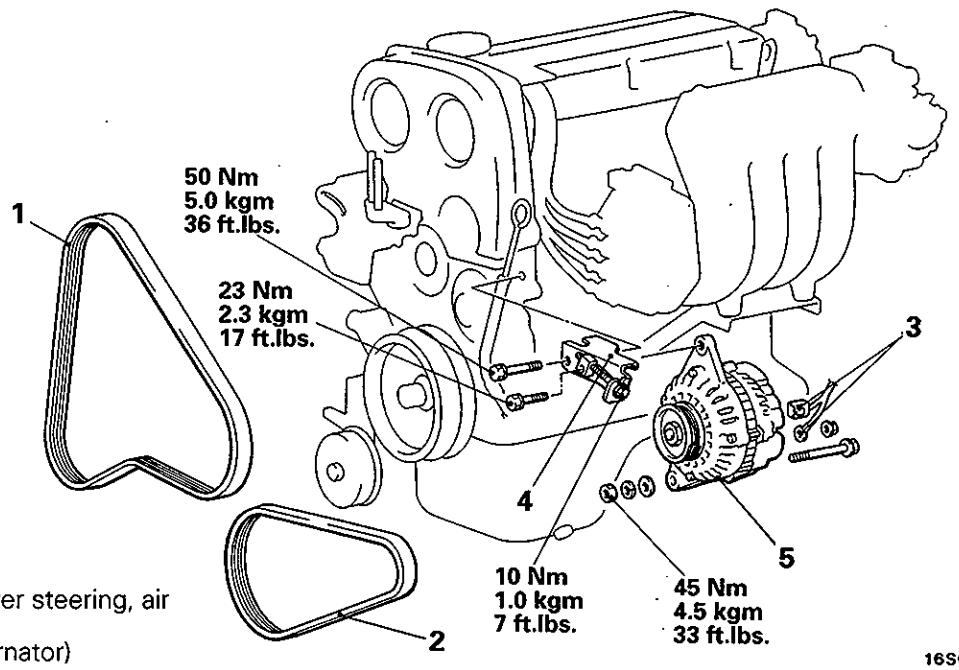
(1) Install the alternator to the cylinder block and front case mounting boss with the pivot bolt, and provisionally tighten the nut to still allow the alternator to move smoothly.
(2) Insert the alternator brace between the power steering oil pump bracket and the water pump, and tighten it to the specified torque.
(3) Press the alternator body towards the engine, and provisionally tighten the alternator and alternator brace with the lock bolt.
(4) Install the alternator drive belt and adjust the belt tension using the adjusting bolt. (Refer to GROUP 11 – Service Adjustment Procedures.)
(5) After adjusting the belt tension, fully tighten the nut of the pivot bolt and the lock bolt to the specified torque, and then tighten the adjusting bolt to the specified torque.

ALTERNATOR <4G92, 4G93>

E16BH-2

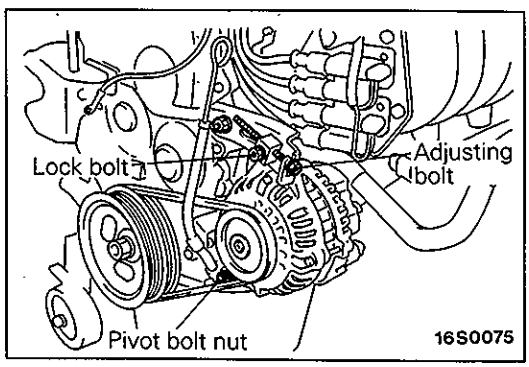
REMOVAL AND INSTALLATION

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



16S0113

Removal steps
1. Drive belt (Power steering, air conditioner)
2. Drive belt (Alternator)
3. Alternator connector
4. Alternator brace
5. Alternator



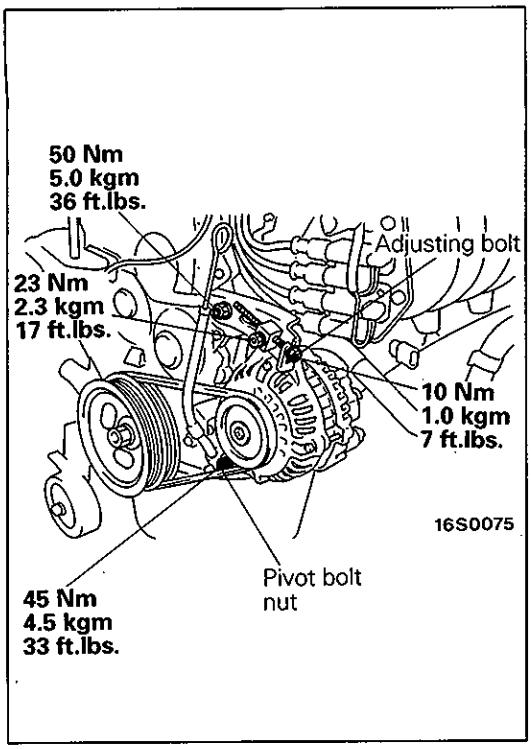
16S0075

SERVICE POINTS OF REMOVAL

E16BHCF

2. REMOVAL OF DRIVE BELT (ALTERNATOR)

(1) Loosen the pivot bolt nut and the lock bolt as shown in the illustration.
(2) Loosen the adjusting bolt and lift it upwards.
(3) Push the alternator towards the engine to remove the drive belt.



SERVICE POINTS OF INSTALLATION E16BHDE

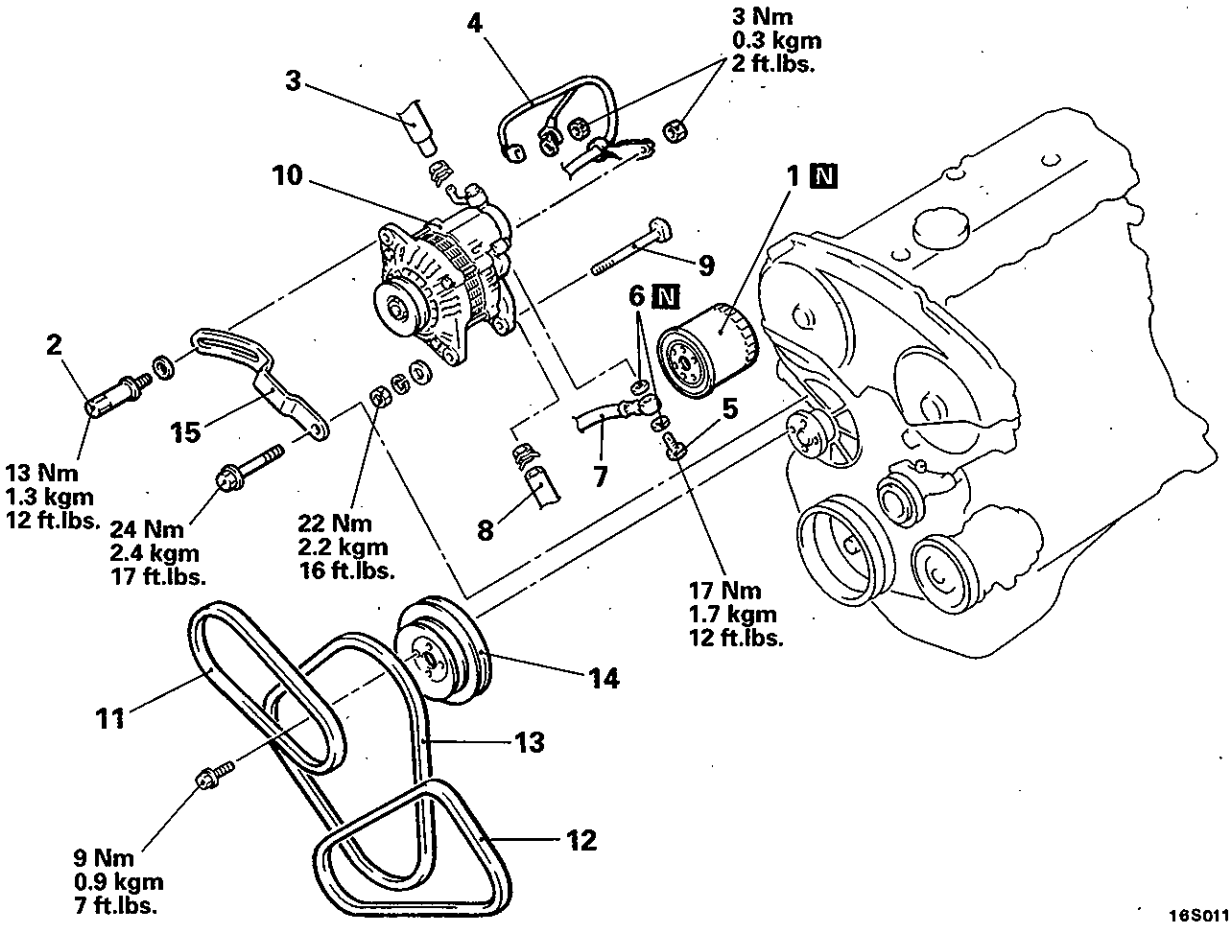
5. INSTALLATION OF ALTERNATOR/4. ALTERNATOR BRACE/2. DRIVE BELT (ALTERNATOR)

(1) Install the alternator to the front case mounting boss with the pivot bolt, and provisionally tighten the nut to still allow the alternator to move smoothly.
(2) Install the alternator brace to the water pump, and tighten it to the specified torque.
(3) Press the alternator body towards the engine, and provisionally tighten the alternator and alternator brace with the lock bolt.
(4) Install the alternator drive belt and adjust the belt tension using the adjusting bolt. (Refer to GROUP 11 – Service Adjustment Procedures.)
(5) After adjusting the belt tension, fully tighten the nut of the pivot bolt and the lock bolt to the specified torque, and then tighten the adjusting bolt to the specified torque.

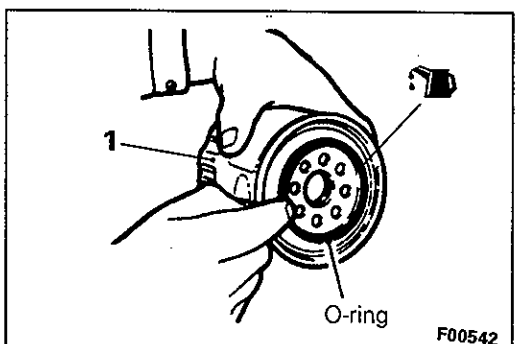
ALTERNATOR <4D68>
REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Engine Oil

Post-installation Operation
- Supplying Engine Oil
- Adjustment of Drive Belt Tension (Refer to GROUP 11 – Service Adjustment Procedures.)



16S0112



Engine oil

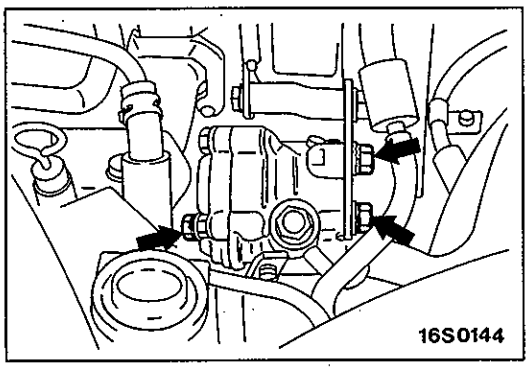
Removal steps

- ◆◆ 1. Engine oil filter
- 2. Alternator brace bolt
- 3. Brake booster vacuum hose connection
- 4. Alternator connector
- 5. Eye bolt
- 6. Gasket
- 7. Oil hose assembly connection
- 8. Oil hose connection
- 9. Alternator mount bolt
- ◆◆ 10. Alternator
- ◆◆ 11. Drive belt (Power steering)
- ◆◆ 12. Drive belt (Air conditioner)
- 13. Drive belt (Alternator)
- 14. Water pump pulley
- 15. Alternator brace

SERVICE POINTS OF REMOVAL

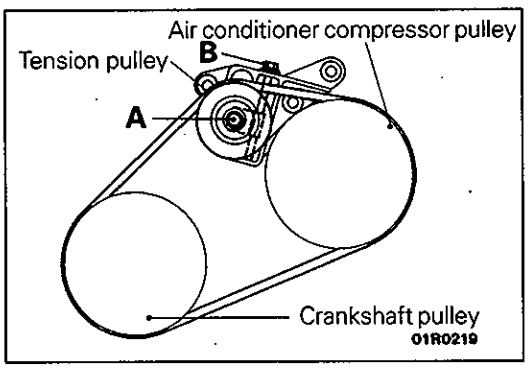
10. REMOVAL OF ALTERNATOR

(1) Remove the engine oil filter and check to be sure that these is enough space to take out the alternator.
(2) Remove the alternator from the bottom of the engine compartment.



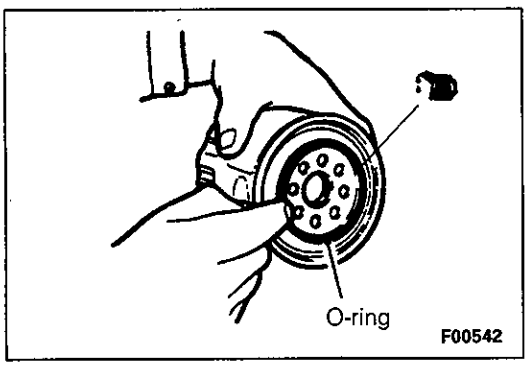
11. REMOVAL OF DRIVE BELT (POWER STEERING)

Loosen the power steering oil pump fixing bolt and remove the drive belt.



12. REMOVAL OF DRIVE BELT (AIR CONDITIONER)

(1) Loosen tension pulley fixing bolt A.
(2) Loosen adjustment bolt B and remove the drive belt.



SERVICE POINTS OF INSTALLATION

1. INSTALLATION OF ENGINE OIL FILTER

(1) Clean the filter bracket side mounting surface.
(2) Apply a small amount of engine oil to the O-ring of the new oil filter.
(3) Turn the oil filter by hand to install.

NOTE
Tightening torque 20 Nm (2.0 kgm, 14 ft.lbs.)

(4) Fill with engine oil.
(5) Race the engine 2–3 times, and check to be sure that no engine oil leaks from the installation section of the oil filter.

STARTING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

STARTER

<4G13>

Items		M/T – standard	A/T M/T – cold climate zone
Type		Direct drive	Direct drive
Rated output	kw/V	0.7/12	0.9/12
No. of pinion teeth		8	8

<4G92, 4G93>

VEHICLES BUILT UP TO APRIL 1992

Items		M/T – standard	A/T M/T – cold climate zone
Type		Direct drive	Direct drive
Rated output	kw/V	0.7/12	0.8/12
No. of pinion teeth		8	8

VEHICLES BUILT FROM MAY 1992

Items		M/T A/T – standard	A/T – cold climate zone
Type		Direct drive	Reduction drive with planetary gear
Rated output	kw/V	0.9/12	1.0/12
No. of pinion teeth		8	8

<4D68>

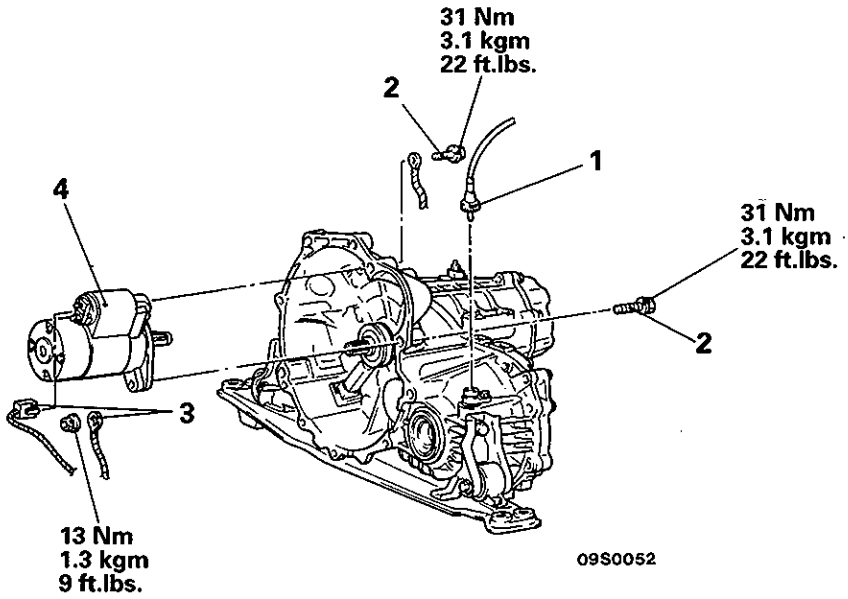
Items		Standard	Cold climate zone
Type		Reduction drive with planetary gear	Reduction drive with planetary gear
Rated output	kw/V	2.0/12	2.2/12
No. of pinion teeth		10	10

STARTER

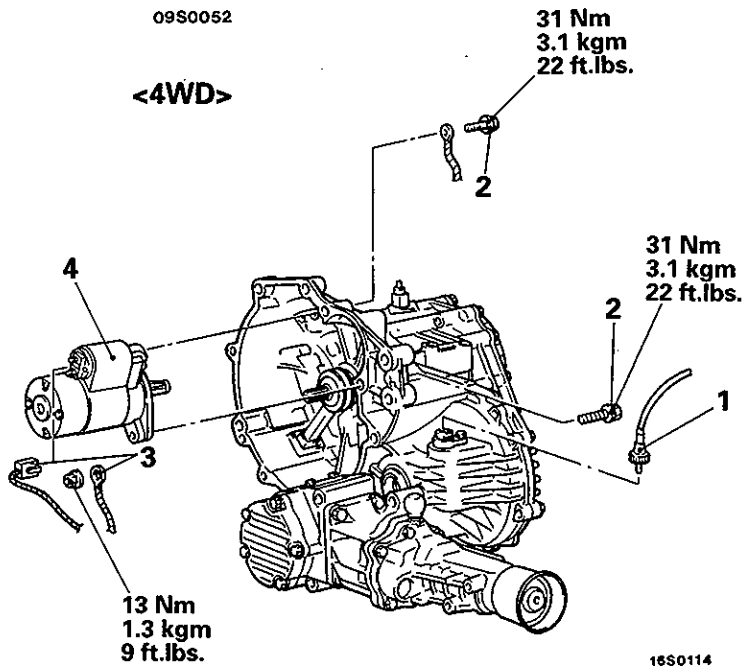
REMOVAL AND INSTALLATION

E16CI--

<2WD>



<4WD>



Removal steps

1. Speedometer cable connection
2. Starter mounting bolt
3. Starter connector
4. Starter

IGNITION SYSTEM

SPECIFICATIONS

E16DA--

GENERAL SPECIFICATIONS

DISTRIBUTOR

Items	4G13, 4G92
Type	Contact pointless with built-in ignition coil
Advance mechanism	Electronic
Firing order	1–3–4–2

CRANK ANGLE SENSOR

Items	4G93
Type	Contact pointless
Advance mechanism	Electronic

IGNITION COIL

Items	SOHC	DOHC
Type	Molded single-coil with a built-in distributor	Molded 2 coil
Identification No.	—	F-648

SPARK PLUG

Items	4G13	4G92 (Except MVV), 4G93	4G92-MVV
NGK	BPR5ES-11	BKR6E-11	BKR5E-11
NIPPON DENSO	W16EPR-11	K20PR-U11	K16PR-U11

SERVICE SPECIFICATIONS

E16DB--

IGNITION COIL

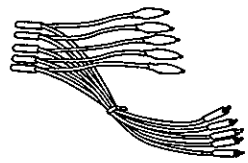
Items		4G13, 4G92	4G93
Primary coil resistance	Ω	0.9–1.2	0.70–0.86
Secondary coil resistance	kΩ	20–29	11.3–15.3

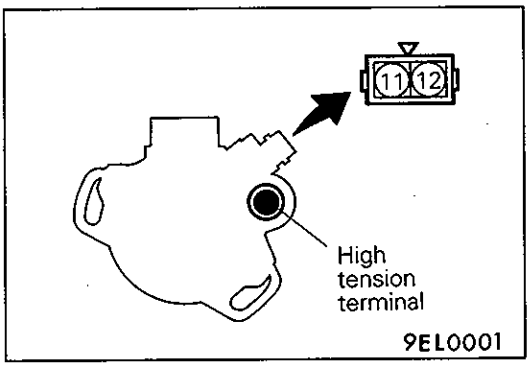
SPARK PLUG

Items		Specification
Spark plug gap	mm (in.)	1.0–1.1 (0.039–0.043)

SPECIAL TOOL

E16DF--

Tool	Number	Name	Use
	MB991348	Test harness set	Inspection of ignition primary voltage



SERVICE ADJUSTMENT PROCEDURES

E16DGAY

IGNITION COIL INSPECTION

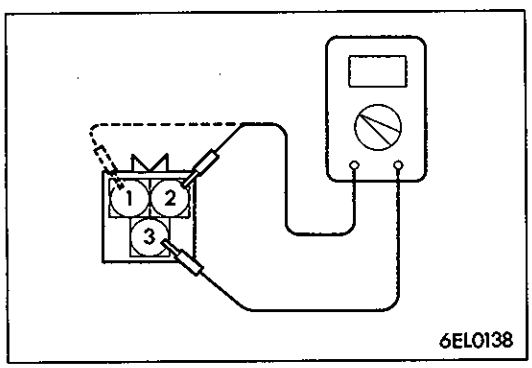
<4G13, 4G92>

(1) Measurement of the primary coil resistance
Measure the resistance between connector terminal ⑪ and ⑫ of the distributor.

Standard value: 0.9–1.2 Ω

(2) Measurement of secondary coil resistance
Measure the resistance between the high-voltage terminals and connector terminals ⑪ or ⑫ .

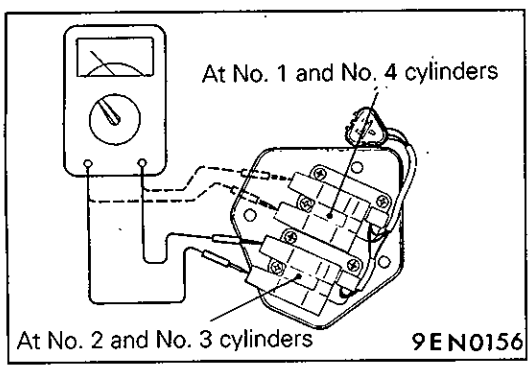
Standard value: 20–29 kΩ



<4G93>

(1) Measurement of the primary coil resistance.
Measure the resistance between connector terminals 3 and 2 (the coils at the No. 1 and No. 4 cylinder sides) of the ignition coil, and between terminals 3 and 1 (the coils at the No. 2 and No. 3 cylinder sides).

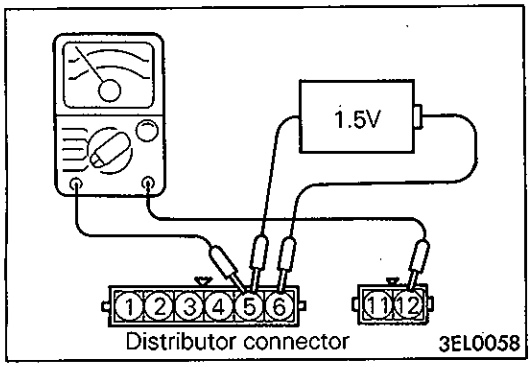
Standard value: 0.70–0.86 Ω



(2) Measurement of secondary coil resistance.
Measure the resistance between the high-voltage terminals for the No. 1 and No. 4 cylinders, and between the high-voltage terminals for the No. 2 and No. 3 cylinders.

Standard value: 11.3–15.3 kΩ

Caution
Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.



POWER TRANSISTOR INSPECTION

<4G13, 4G92>

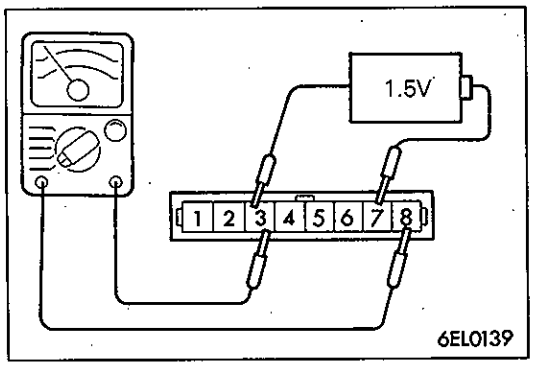
NOTE
An analog-type circuit tester should be used.

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal ⑤ of the power transistor; then check whether there is continuity between terminal ⑤ and terminal ⑫ when terminal ⑥ and the positive (+) terminal are connected and disconnected.

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

Terminal ⑥ and (+) terminal	Terminal ⑤ and terminal ⑫
Connected	Continuity
Unconnected	No continuity

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



<4G93>

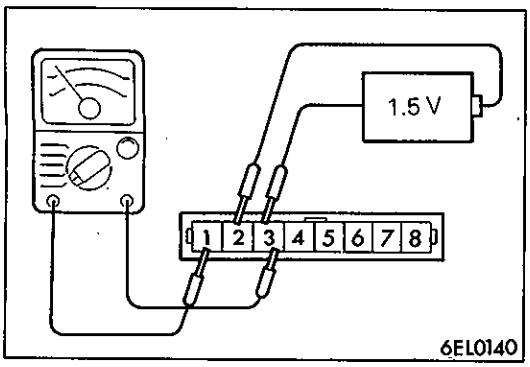
NOTE
An analog-type circuit tester should be used.

No. 1–No. 4 coil side

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal ③ of the power transistor; then check whether there is continuity between terminal ③ and terminal ⑧ when terminal ⑦ and the positive (+) terminal are connected and disconnected.

NOTE
Connect the negative (–) probe of the circuit tester to terminal ⑧.

Terminal ⑦ and (+) terminal	Terminal ③ and terminal ⑧
Connected	Continuity
Unconnected	No continuity



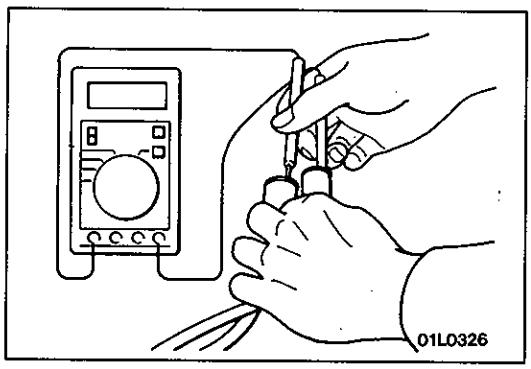
No. 2–No. 4 coil side

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

NOTE
Connect the negative (–) probe of the circuit tester to terminal ①.

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

If the problem is still evident after checking as described above, replace the power transistor.



RESISTIVE CODE INSPECTION

Measure the resistance of the all spark plug leads.
(1) Check cap and coating for cracks.
(2) Measure resistance.

Unit : kΩ

	Spark plug cable			
	No. 1	No. 2	No. 3	No. 4
4G13	11.5	9.1	9.0	6.6
4G92 (Except MVV)	12.6	11.7	9.4	8.5
4G92–MVV	5.3	4.9	3.9	3.6
4G93	6.7	8.6	10.4	10.7

CHECKING THE DETONATION SENSOR <4G92, 4G93>

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

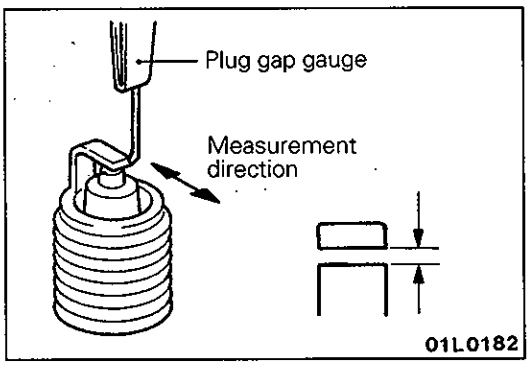
NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13 – Troubleshooting.

SPARK PLUG CHECK AND CLEANING E11FRAF

(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 (0.040–0.043 in.)

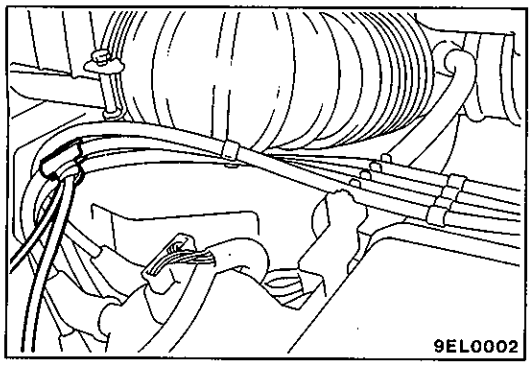
If the plug gap is not within the standard value range, adjust by bending the ground electrode.
(6) Clean the engine plug holes.

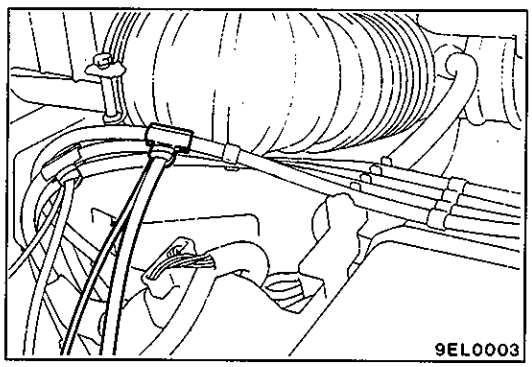
Caution
Use care not to allow foreign matter in cylinders.

(7) Install the spark plugs.

CRANK ANGLE SENSOR, TOP DEAD CENTER SENSOR INSPECTION

Refer to GROUP 13 – On-vehicle Inspection of MPI Components





WAVE PATTERN INSPECTION USING AN ANALYZER (Ignition primary and secondary voltage wave forms)

IGNITION SECONDARY VOLTAGE INSPECTION <4G13, 4G92>

MEASUREMENT METHOD

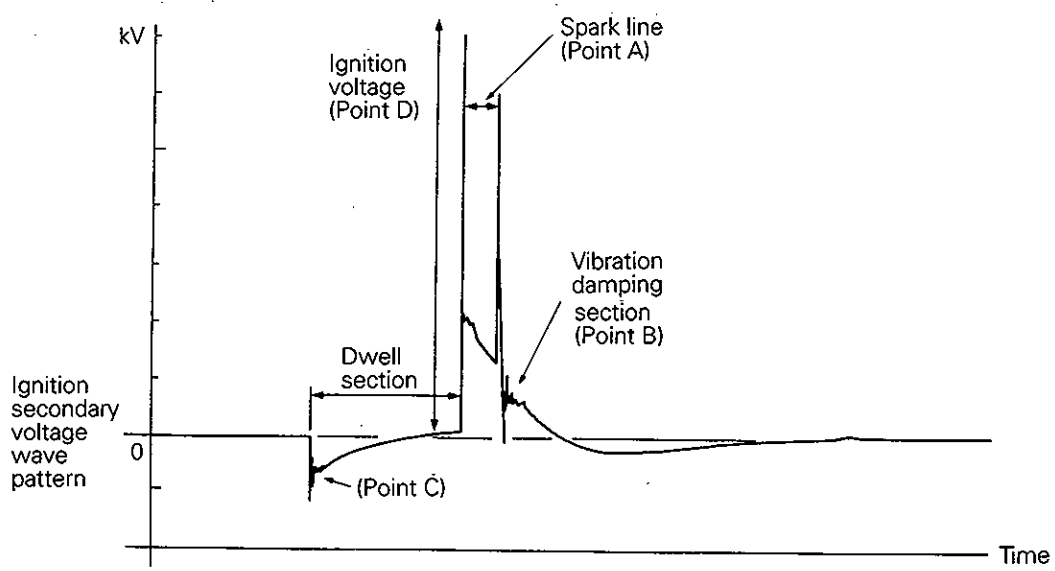
(1) Clamp the spark plug cable (No. 1, No. 2, No. 3 or No. 4) with the secondary pickup.

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

STANDARD WAVE PATTERN

Observation conditions

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



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

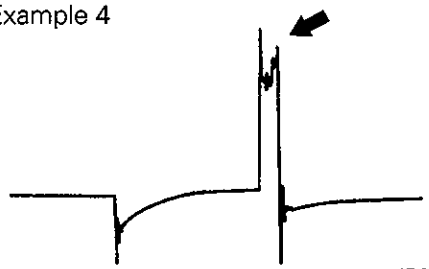
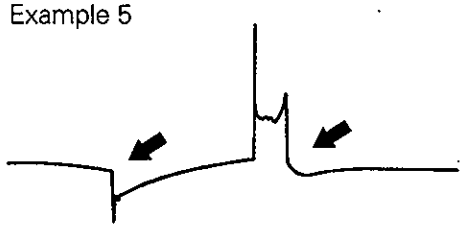
Point C: Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5)

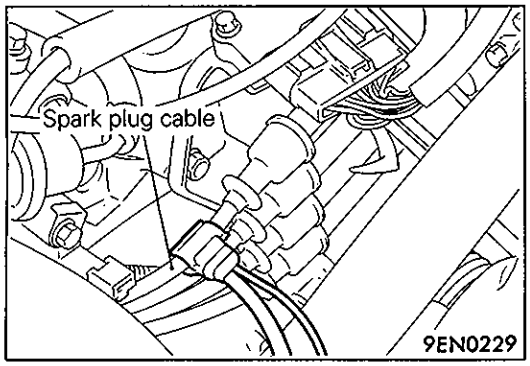
Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

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 problem
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 misfiring.	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.



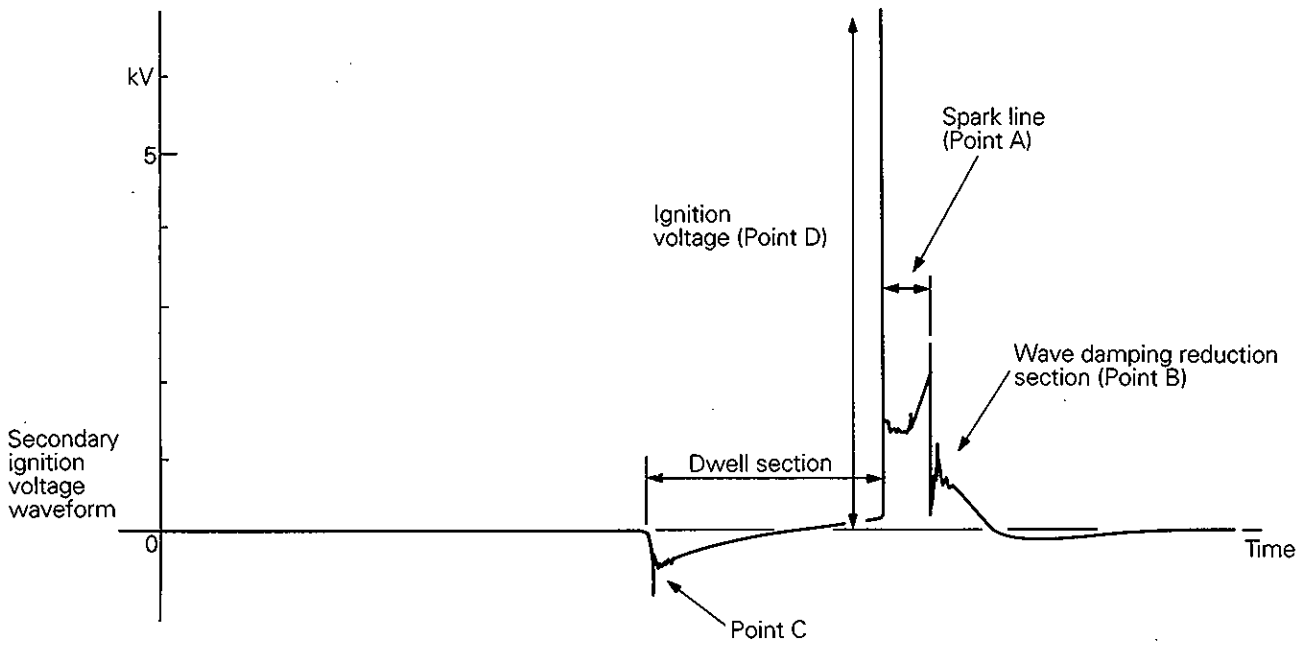
<4G93>

MEASUREMENT METHOD

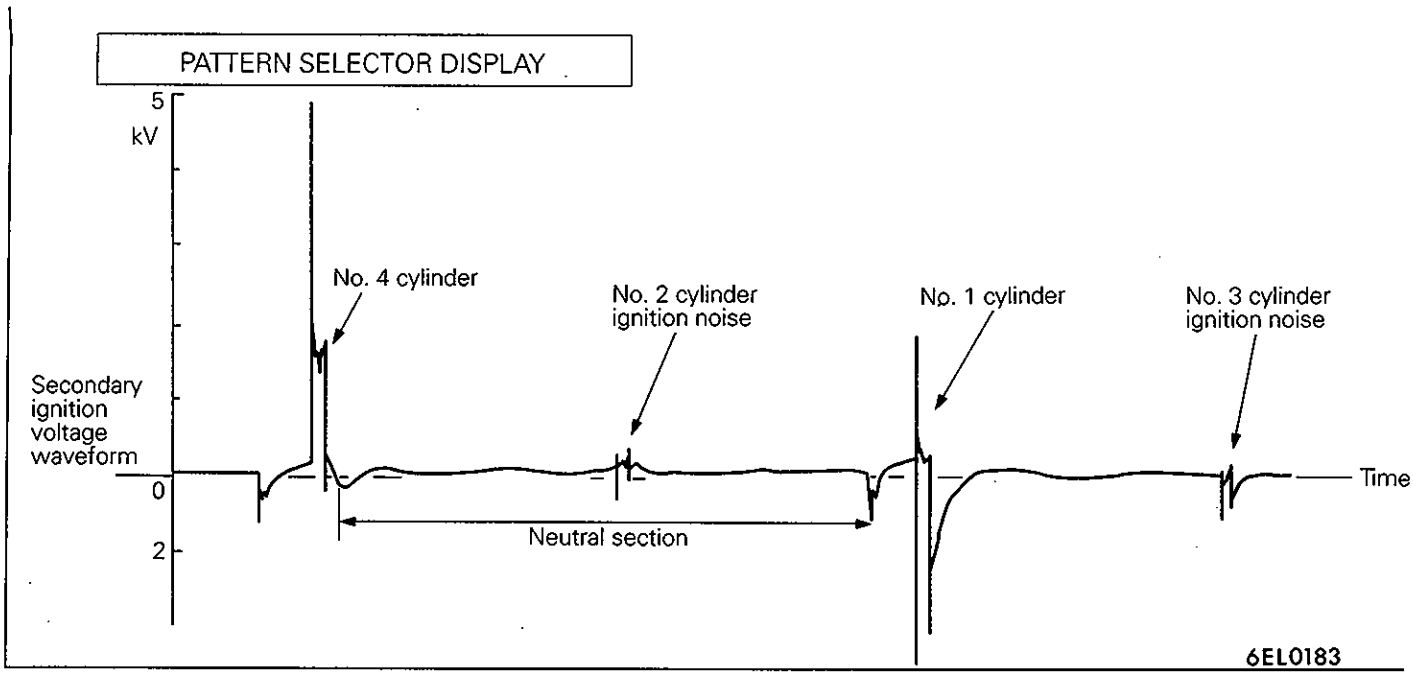
(1) Clamp the secondary pickup around spark plug cable.
NOTE
1. The peak of the ignition voltage will be reversed when the spark cables of No. 2 and No. 4 cylinders are clamped and when the spark plug cables of No. 1 and No. 3 cylinders are clamped.
2. Because of the two-cylinder simultaneous ignition system, the waves for two cylinders in each group appear during wave observation (No. 1 cylinder – No. 3 cylinder, No. 2 cylinder – No. 4 cylinder). However, wave observation is carried out for the cylinder with the spark plug cable clamped by the secondary pickup.

(2) Clamp the spark plug cable with the trigger pickup.
NOTE
1. Clamp the spark plug cable for the No. 1 and No. 3 cylinder of the same group with the cylinder that is clamped with the secondary pickup.
2. Identification of which cylinder wave pattern is displayed can be difficult, but the wave pattern of the cylinder which is clamped with the secondary pickup will be stable, so this can be used as a reference for identification.

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



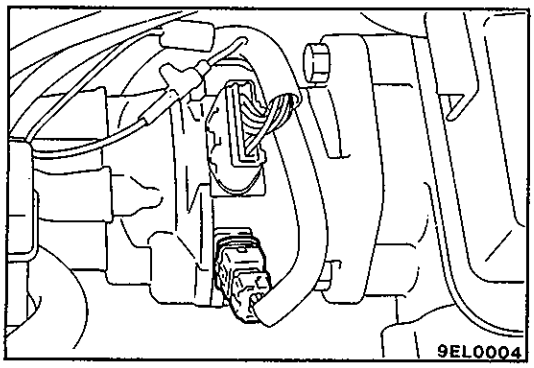
Observation conditions
(Only pattern selector below changes from the above conditions.)



Caution
As measurements are made by the clamp-type probe, voltage values such as ignition voltage will be different from actual values.

WAVEFORM OBSERVATION POINTS
Refer to 16-21.

EXAMPLES OF ABNORMAL WAVEFORMS
Refer to 16-22.

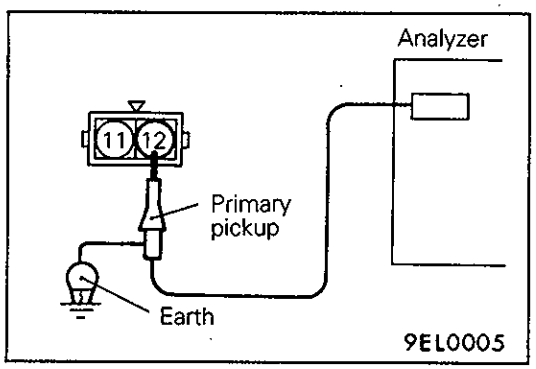


IGNITION PRIMARY VOLTAGE WAVE PATTERN CHECK

<4G13, 4G92>

MEASUREMENT METHOD

(1) Disconnect the distributor 2 pin connector and connect the special tool (test harness: MB991348) in between. (All of the terminals should be connected.)



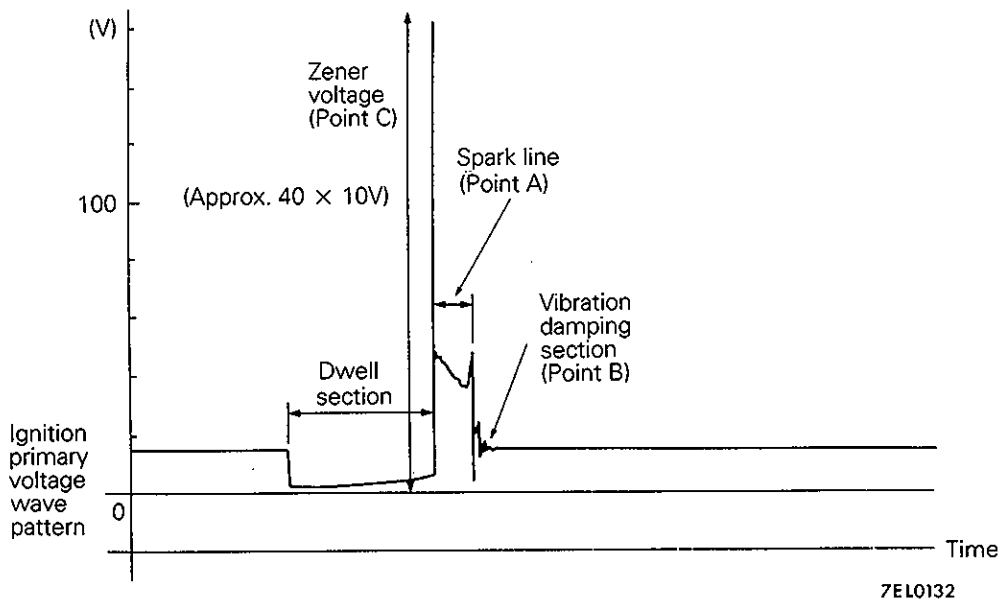
(2) Connect the analyzer primary pickup to the distributor connector terminal ⑫.
(3) Connect the primary pickup earth terminal.
(4) Clamp the spark plug cable with the trigger pickup.

NOTE
The wave pattern of the cylinder clamped to the trigger pick-up will appear at the left edge of the screen.

STANDARD WAVE PATTERN

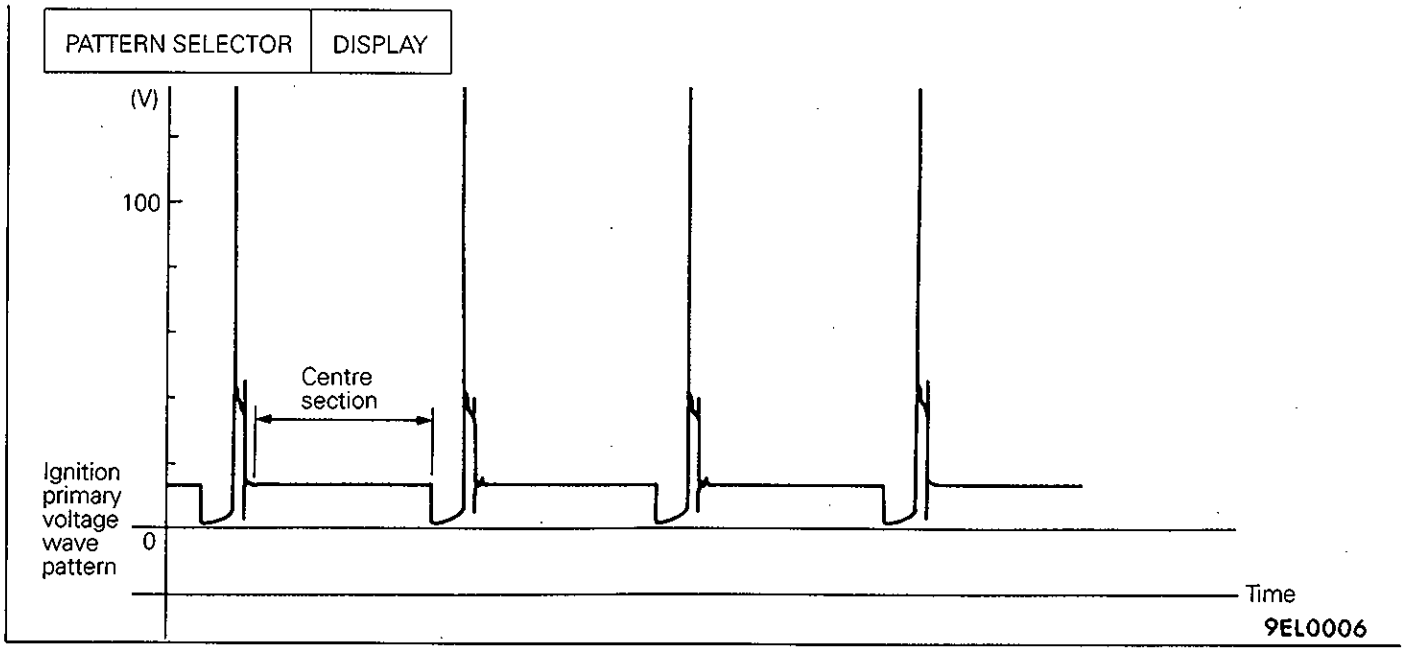
Observation conditions

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



Observation conditions

(Only the pattern selector shown below changes from the previous conditions)



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	–	–	–	–

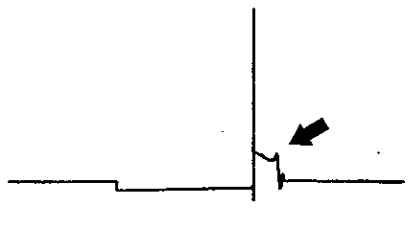
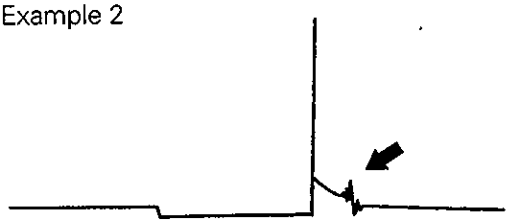
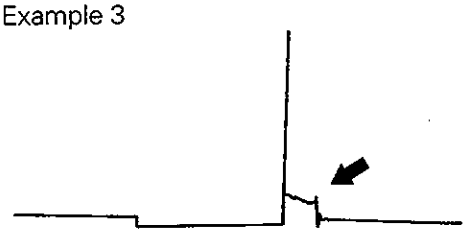
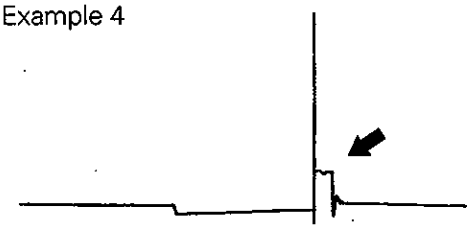
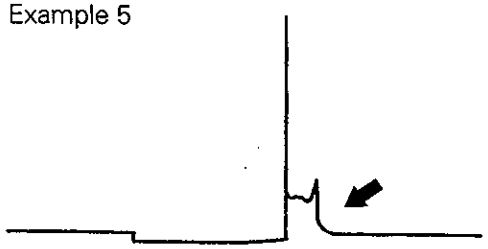
Point B: Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

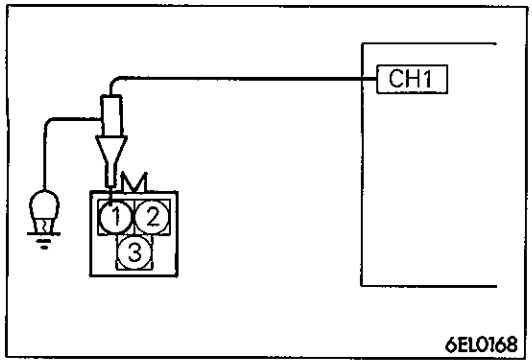
Number of vibrations	Coil, condenser
3 or higher	Normal
Except above	Abnormal

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 sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	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.



Injector control signal for synchronization	Waveform to be observed
No. 1	No. 4
No. 2	No. 3
No. 3	No. 2
No. 4	No. 1

<4G93>

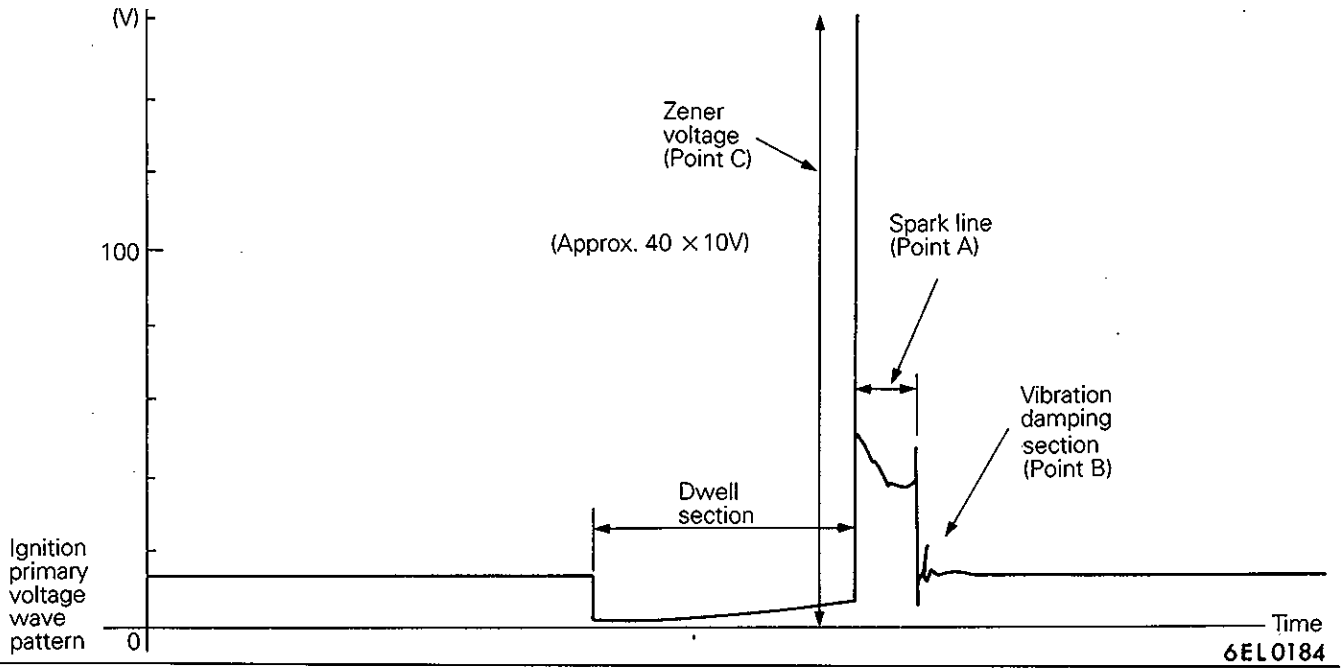
MEASUREMENT METHOD

(1) Disconnect the ignition coil connector and connect the special tool (test harness: MB991348) in between. (All of the terminals should be connected.)
(2) When observing the No.2 - No.3 cylinder group, connect the oscilloscope probe to the ignition coil side connector terminal ① (red clip on the special tool). For the No.1 - No.4 cylinder group, connect to terminal ② (black clip).
(3) In order to distinguish which observed waveform pertains to which cylinder, and to check the synchronization accurately, simultaneously observe the injector control signals.
Also, simultaneous observation of the TDC sensor output waveform will enable the cylinders to be differentiated. (For the measurement methods for the injectors and TDC sensor, refer to GROUP 13 – On-vehicle Inspection of MPI Components.)

STANDARD WAVE PATTERN

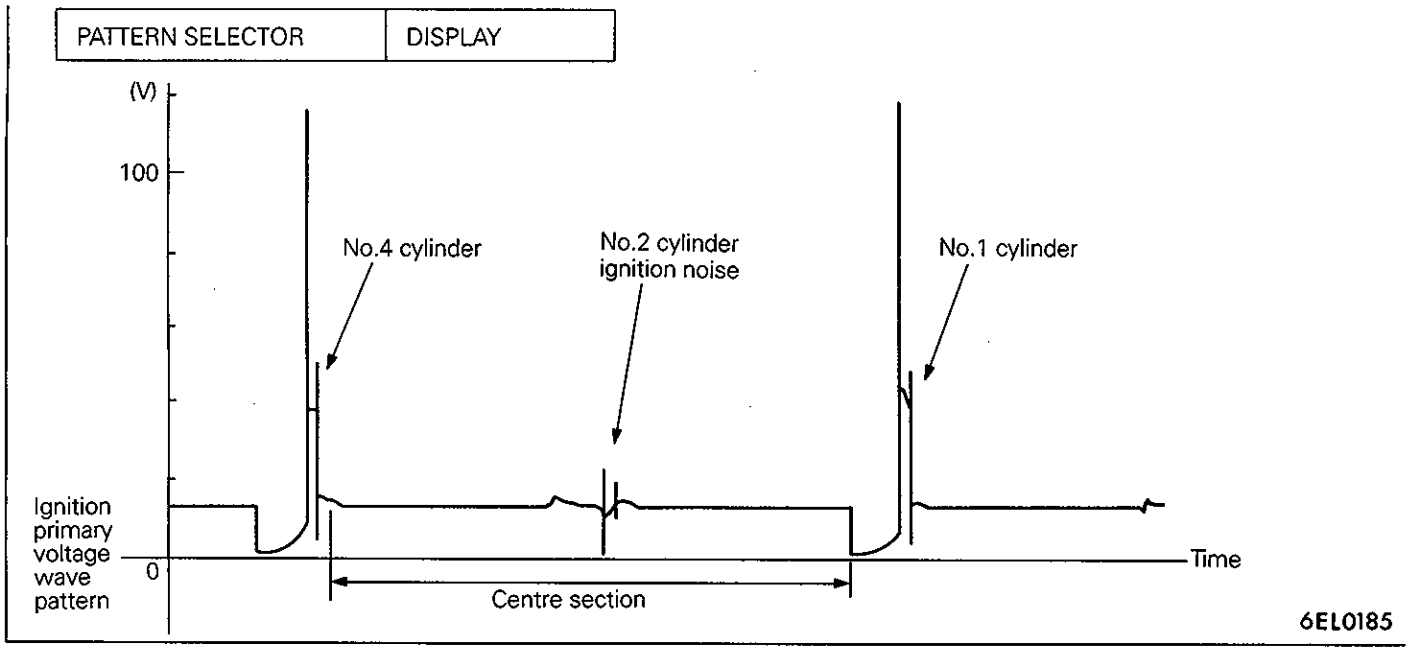
Observation conditions

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



Observation conditions

(Only the pattern selector shown below changes from the previous conditions)



WAVEFORM OBSERVATION POINTS

Refer to 16-26.

EXAMPLES OF ABNORMAL WAVEFORMS

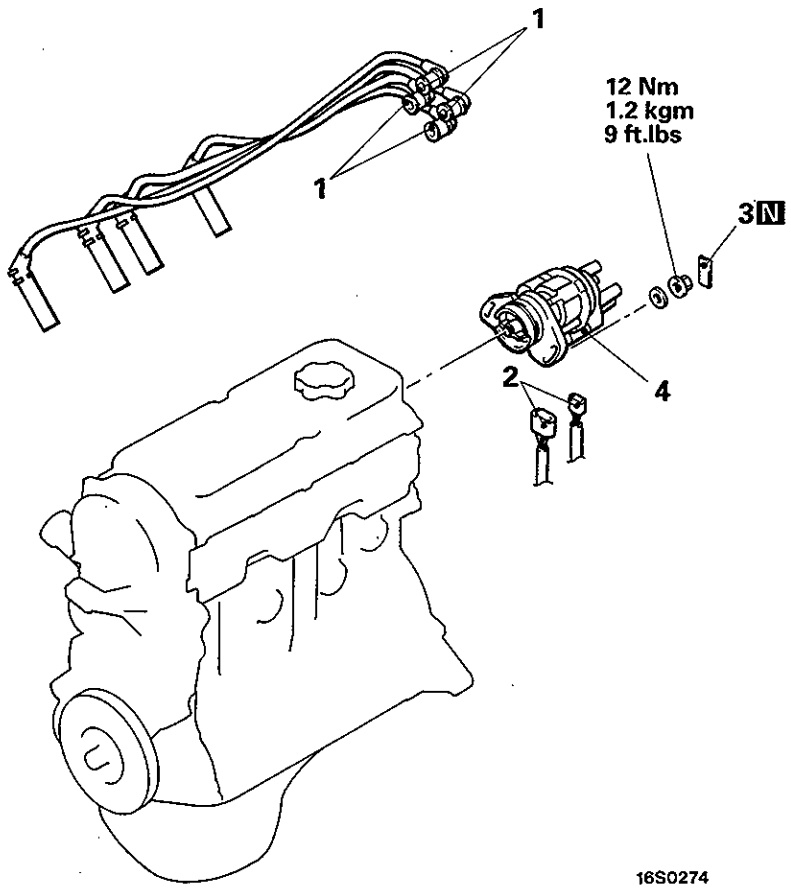
Refer to 16-27.

DISTRIBUTOR

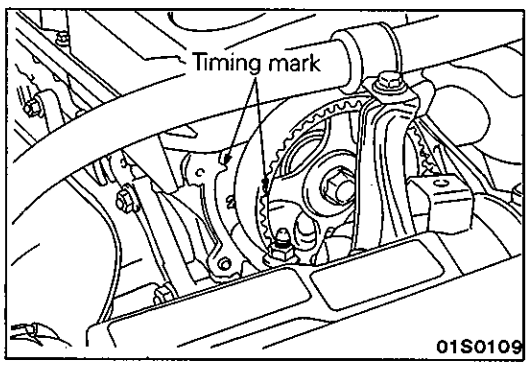
E16DH--

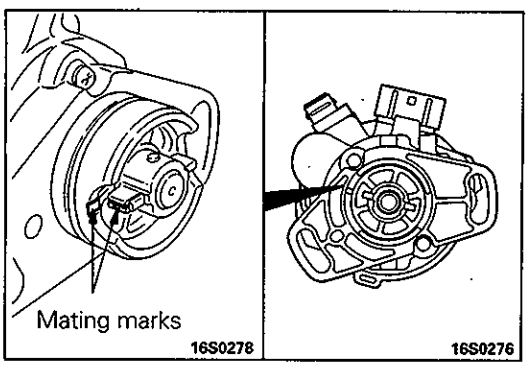
REMOVAL AND INSTALLATION

Post-installation Operation
- Engine Adjustment (Refer to GROUP 11 – Service Adjustment Procedures.)



Removal steps
1. Spark plug cable connection
2. Distributor connector
3. Sealing tape
4. Distributor





INSPECTION

E16DHDA

CAMSHAFT POSITION SENSOR, CRANKSHAFT POSITION SENSOR

Refer to GROUP 13–On-Vehicle Inspection of MPI Components.

SERVICE POINTS OF INSTALLATION

E16DHCB

4. INSTALLATION OF DISTRIBUTOR

(1) Remove the timing belt upper cover.
(2) Turn the crankshaft clockwise to align the timing marks.
NOTE
The No. 1 cylinder will be at compression top dead centre if the timing mark on the camshaft sprocket is aligned with the timing mark on the cylinder head.
(3) Align the mating mark on the distributor housing side with the mating mark on the coupling side.
(4) Install the distributor to the engine while aligning the distributor fixing stud bolt with the oblong hole on the distributor mounting flange.

3. INSTALLATION OF SEALING TAPE

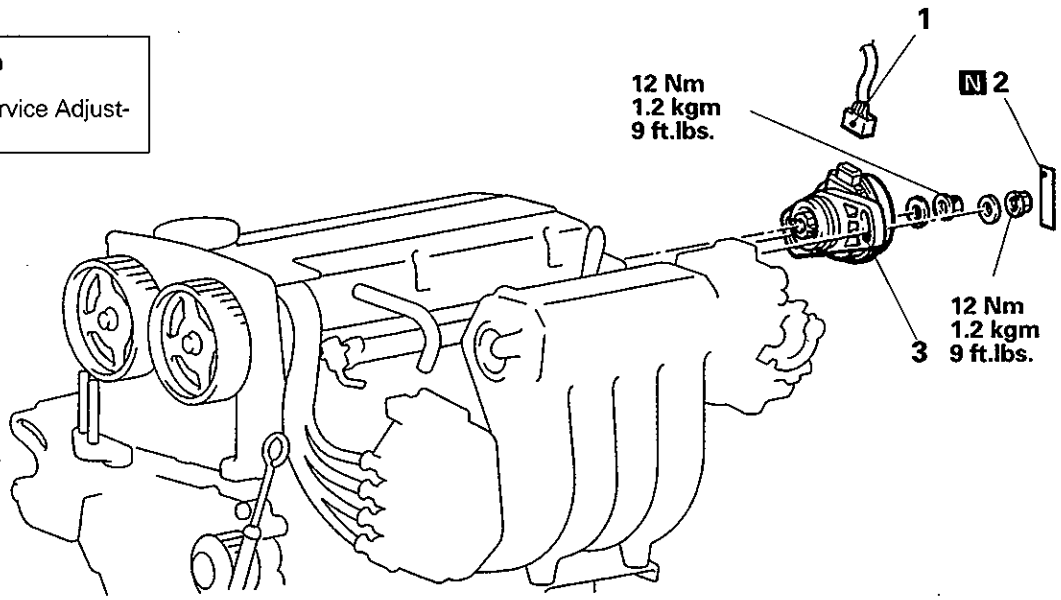
After adjusting the ignition timing, apply sealing tape.

CRANK ANGLE SENSOR <4G93>

E16DL–

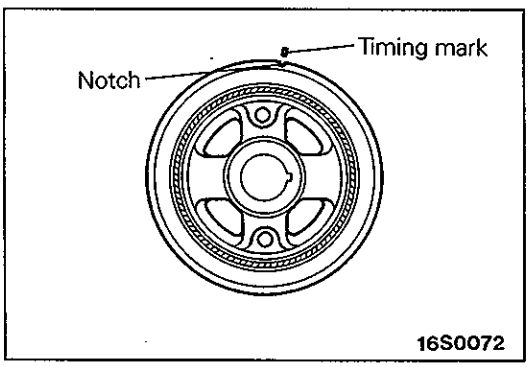
REMOVAL AND INSTALLATION

Post-installation Operation
- Engine Adjustment
  (Refer to GROUP 11 – Service Adjustment Procedures.)

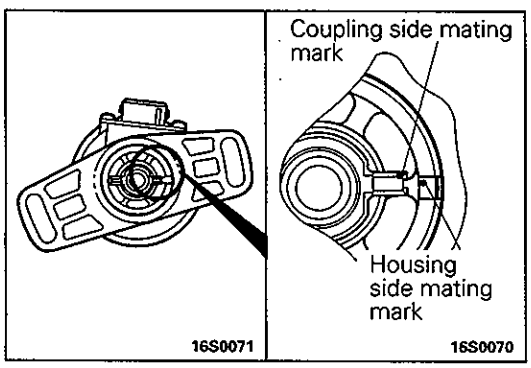


16S0117

Removal steps
1. Crank angle sensor connector
2. Sealing tape
3. Crank angle sensor



16S0072



16S0071 16S0070

SERVICE POINTS OF INSTALLATION

E16DLAB

3. INSTALLATION OF CRANK ANGLE SENSOR

(1) Turn the crankshaft clockwise to align the crankshaft pulley notch and the timing mark and to set the No. 1 cylinder to compression top dead centre.

Caution

Take note that when the timing mark and the notch are aligned, the No. 4 cylinder will also be at compression top dead centre.

(2) Align the mating mark on the crank angle sensor hosing side with the mating mark on the coupling side.
(3) Install the crank angle sensor to the engine while aligning the crank angle sensor fixing stud with the oblong hole on the crank angle sensor mounting flange.

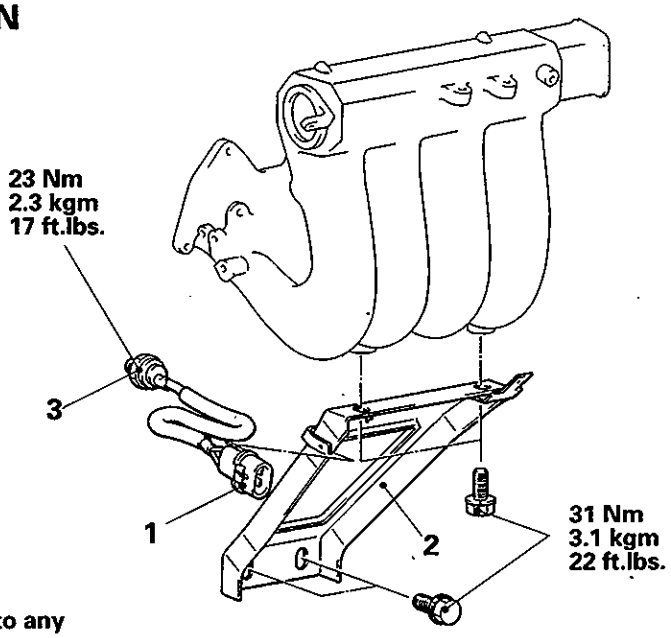
2. INSTALLATION OF SEALING TAPE

After adjusting the ignition timing, apply sealing tape.

DETONATION SENSOR <4G93>

E16DM--

REMOVAL AND INSTALLATION



Removal steps

1. Detonation sensor connector
2. Intake manifold stay
3. Detonation sensor

Caution
Do not subject the detonation sensor to any shocks.

INSPECTION

E16DMBA

DETONATION SENSOR

Refer to GROUP 13–On-Vehicle Inspection of MPI Components.

GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

E16EA--

Items		Specifications
Standard value		
Glow plug resistance [at 20°C (68°F)]	Ω	
<Super quick glow system>		0.20–0.26
<Self-regulating glow system>		0.4–0.6
Dropping resistor resistance [at 20°C (68°F)]	Ω	
<Super quick glow system>		0.15–0.17
Engine coolant temperature sensor resistance [at 20°C (68°F)]	kΩ	2.92–3.58

SEALANT

E16EE--

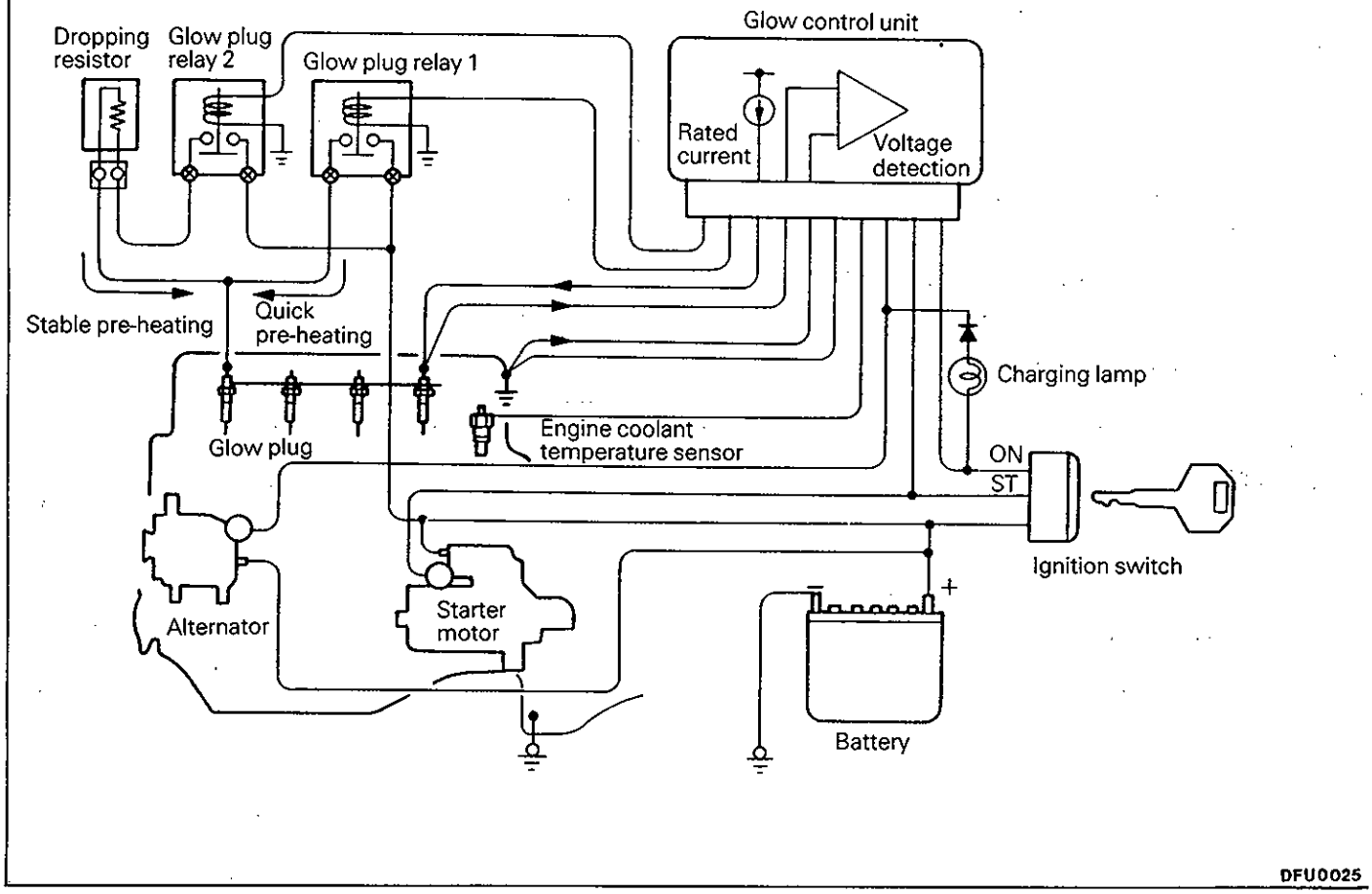
Item	Specified sealant	Remark
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SERVICE ADJUSTMENT PROCEDURES

E16EGAI

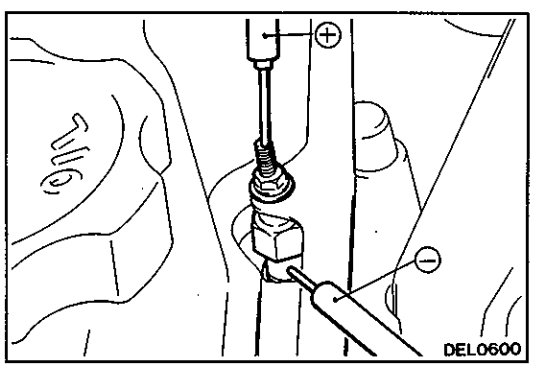
SUPER QUICK GLOW SYSTEM

SUPER QUICK GLOW SYSTEM INSPECTION



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

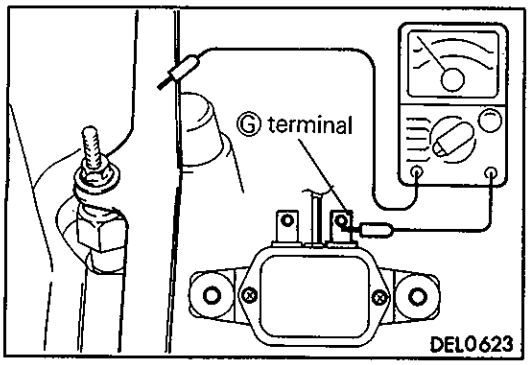
NOTE
If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.



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

Standard value: 0.05–0.07 Ω [at 20°C (68°F)]

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



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

Standard value: 0.15–0.17 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.)

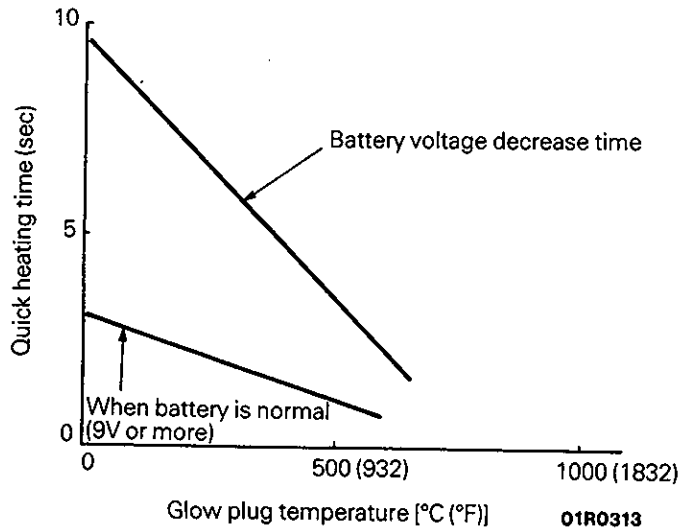
(7) Measure the voltage while the engine is cranking.

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 55°C (131°F) or more, or if 180 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: 5–7 V

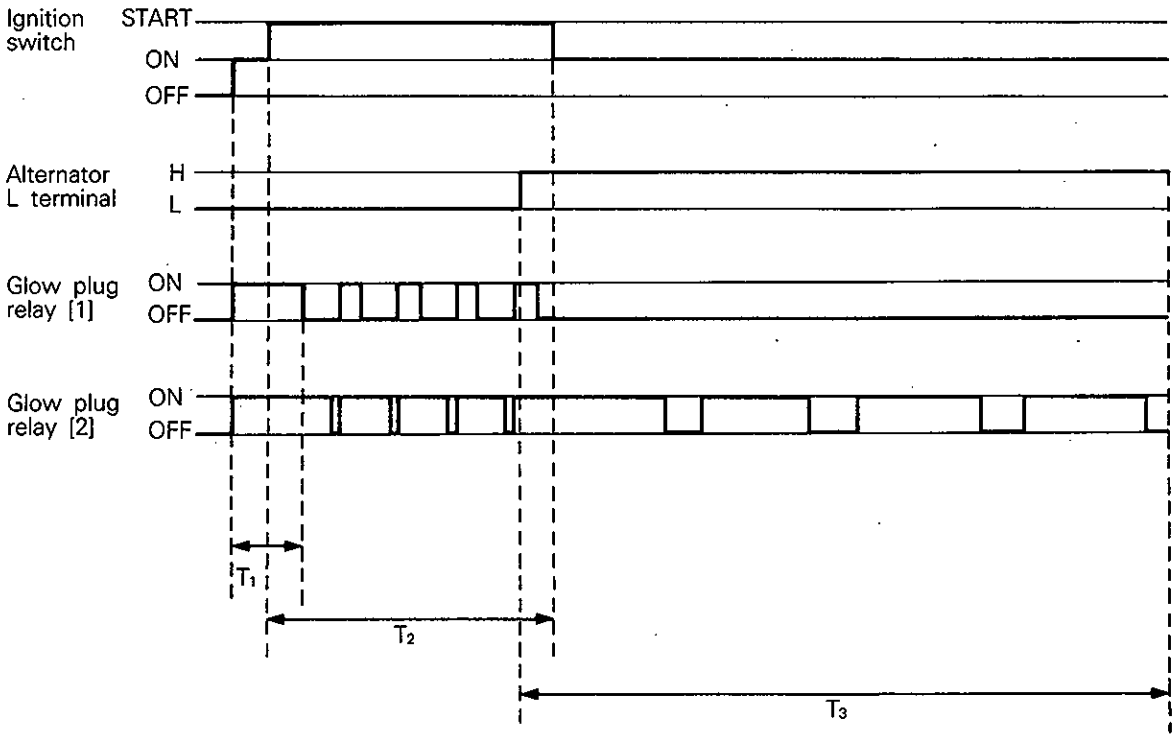
Reference
Relationship between glow plug temperature (resistance value) and current flow time



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

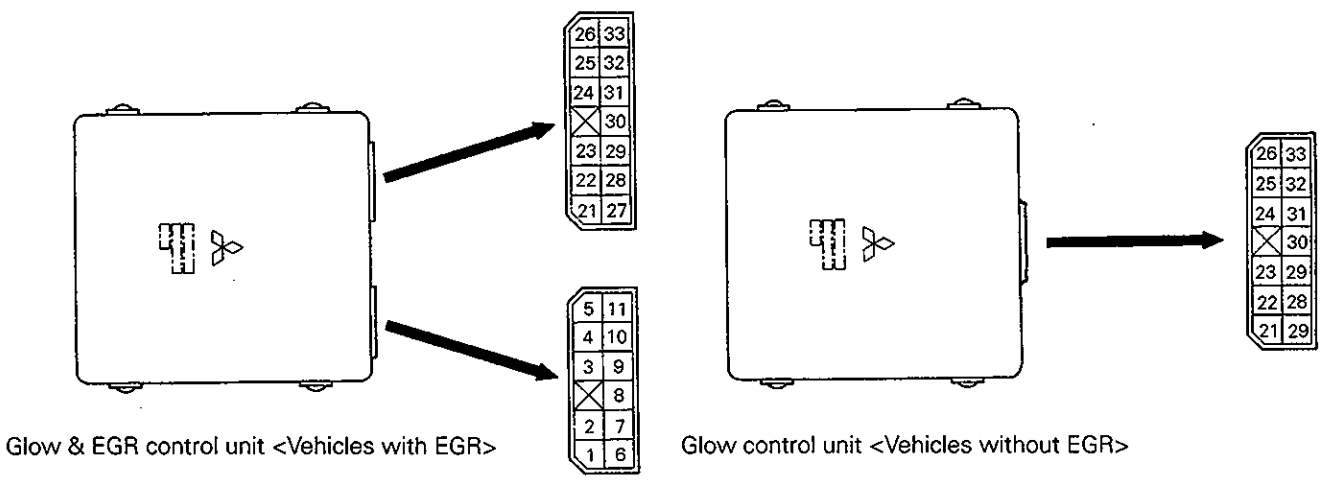


DEL0601

T_1: Quick heating time
T_2: Glow plug relay [1] drive time when engine is cranking
T_3: Glow plug relay [2] drive time after engine starts (after glow)

NOTE
After glow occurs only when engine coolant temperature is approximately 55°C (131°F) or less, and for approximately 180 seconds after the engine is started, it turns ON and OFF to prevent the temperature of the glow plugs from exceeding the target temperature [approx. 900°C (1,652°F)].

GLOW CONTROL UNIT INSPECTION



Glow & EGR control unit <Vehicles with EGR>

Glow control unit <Vehicles without EGR>

EGR CONTROL CONNECTOR

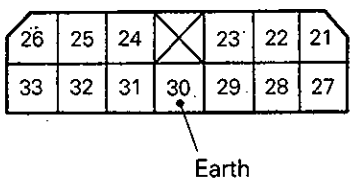
DEN0734

(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
21	Ignition switch (IG power supply)	Ignition switch	"OFF" → "ON"	Battery voltage
			"ON" → "OFF"	0 – 0.5V
22	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
26	Alternator L–terminal	Ignition switch	"OFF" → "ON"	1 – 4V
		Idle		More than 11V
27	Glow plug relay 1	Ignition switch	"OFF → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
28	Glow plug relay 2	Ignition switch	"OFF" → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
33	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

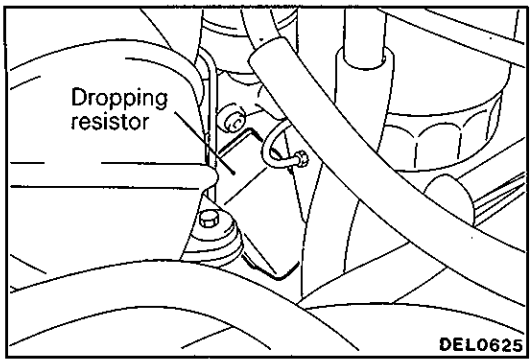
View of harness-side connector of glow control unit from terminal side (13P)



DEL0602

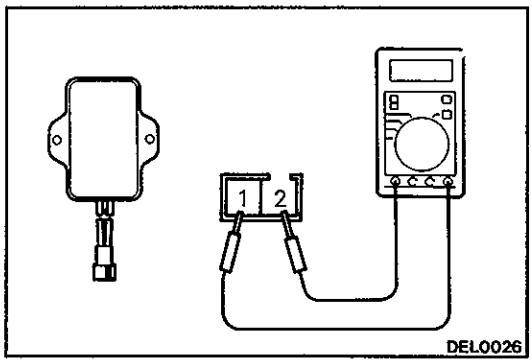
(2) Remove the control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
24 – 30	Glow plug constant current circuit	Continuity (approx. 0.06Ω)
25 – 31	Glow plug voltage measurement circuit	Continuity (approx. 0.06Ω)
27 – 30	Glow plug relay 1	Continuity (approx. 20 Ω)
28 – 30	Glow plug relay 2	Continuity (approx. 20 Ω)



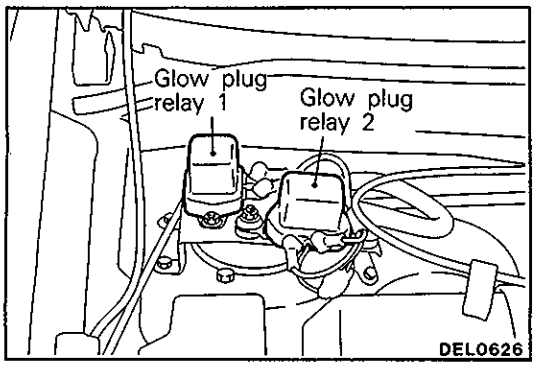
DROPPING RESISTOR INSPECTION

(1) Disconnect the dropping resistor connector.

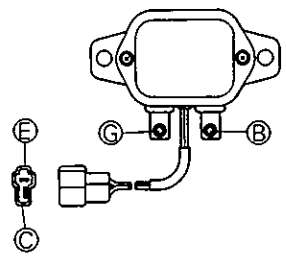


(2) Measure the resistance between the dropping resistor terminals.

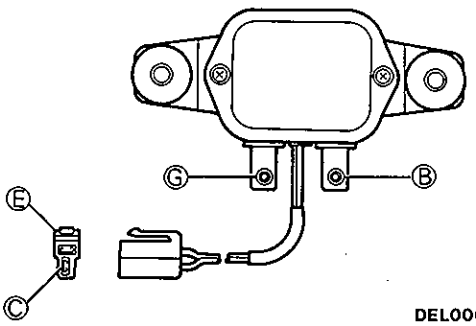
Standard value: 0.15–0.17 Ω [at 20°C (68°F)]

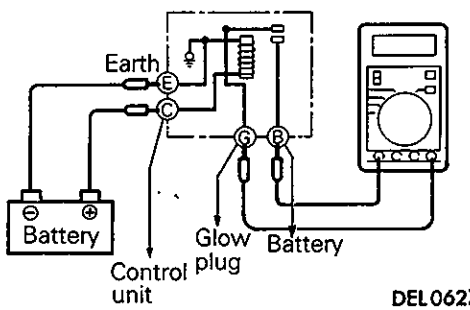


Glow plug relay (No. 1)



Glow plug relay (No. 2)





GLOW PLUG RELAY INSPECTION

(1) Check to be sure that there is continuity (approx. 20 Ω) between glow plug relay terminals (C)–(E).

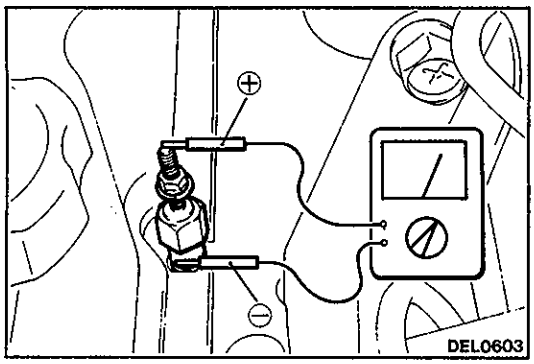
(2) Use jumper leads to connect the glow plug relay terminal (C) with the battery (+) terminal and terminal (E) with the battery (–) terminal.

Caution

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

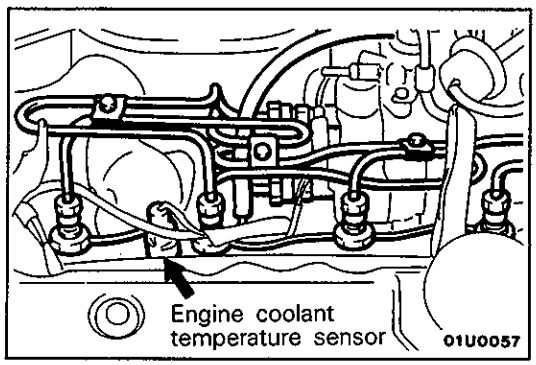
Jumper lead from battery (–) terminal	Continuity between terminals (B) – (G)
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (∞ Ω)



GLOW PLUG INSPECTION

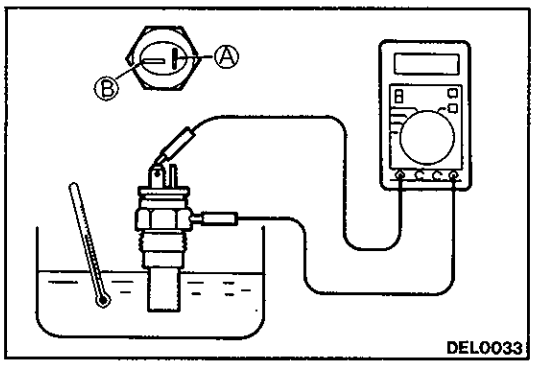
(1) Remove the glow plug plate.
(2) Measure the resistance between the glow plug terminals and the body.

Standard value: 0.20–0.26 Ω [at 20°C (68°F)]



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.

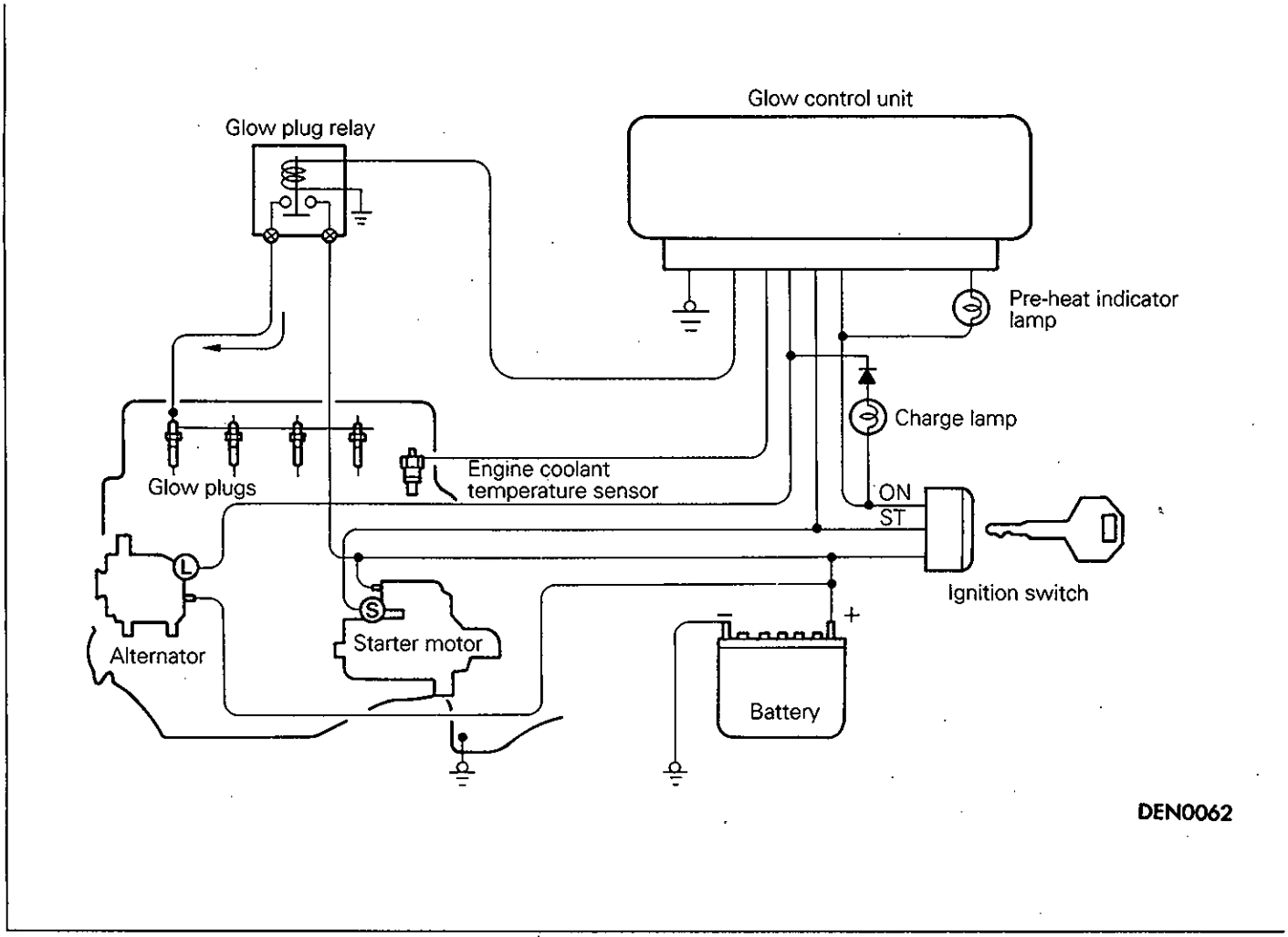
Temperature [°C (°F)]	Resistance value (kΩ)
−20 (−4)	24.8±2.5
0 (32)	8.6
20 (68)	3.25±0.33
40 (104)	1.5
80 (176)	0.3

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

Specified sealant: 3M Nut Locking Part No. 4171 or equivalent
Tightening torque: 35 Nm (3.5 kgm, 25 ft.lbs.)

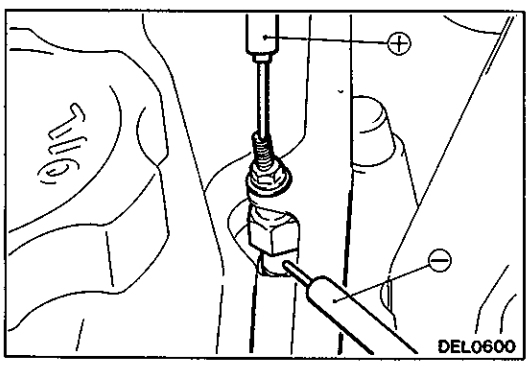
SELF-REGULATING GLOW SYSTEM

SELF-REGULATING GLOW SYSTEM INSPECTION



(1) Check that the battery voltage is 11–13V.
(2) Check 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: 0.1–0.15 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: 9–11 V (Drops to 0 V after 4–8 seconds have passed)

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

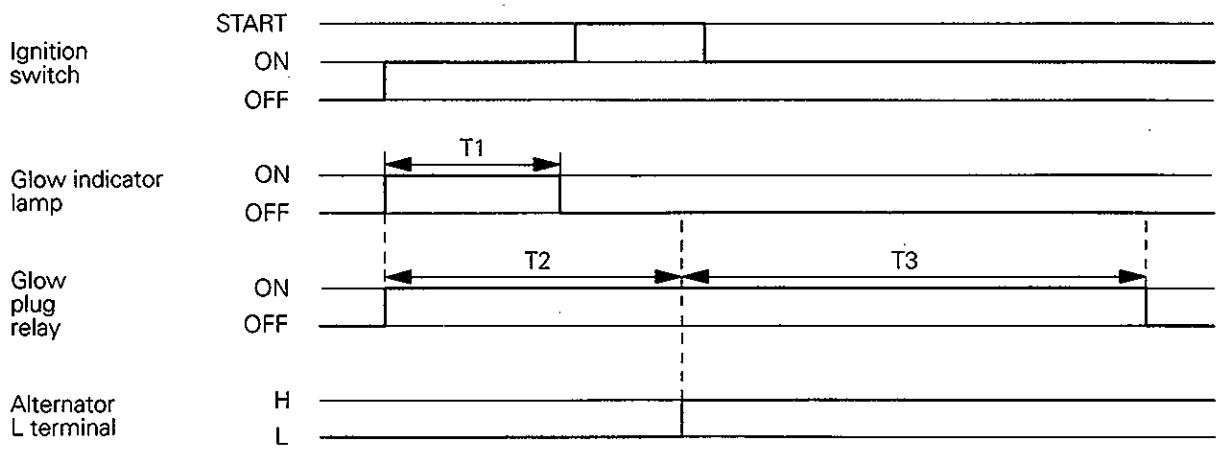
NOTE
The time during which the voltage appears (energising time) will depend on the engine coolant temperature.

(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 or when 180 seconds have passed since the engine was started, the voltage will always return to 0 V. (Refer to the Glow Plug Energisation Timing Chart.)
Standard value:12-15 V

<Reference>
Glow Plug Energisation Timing Chart

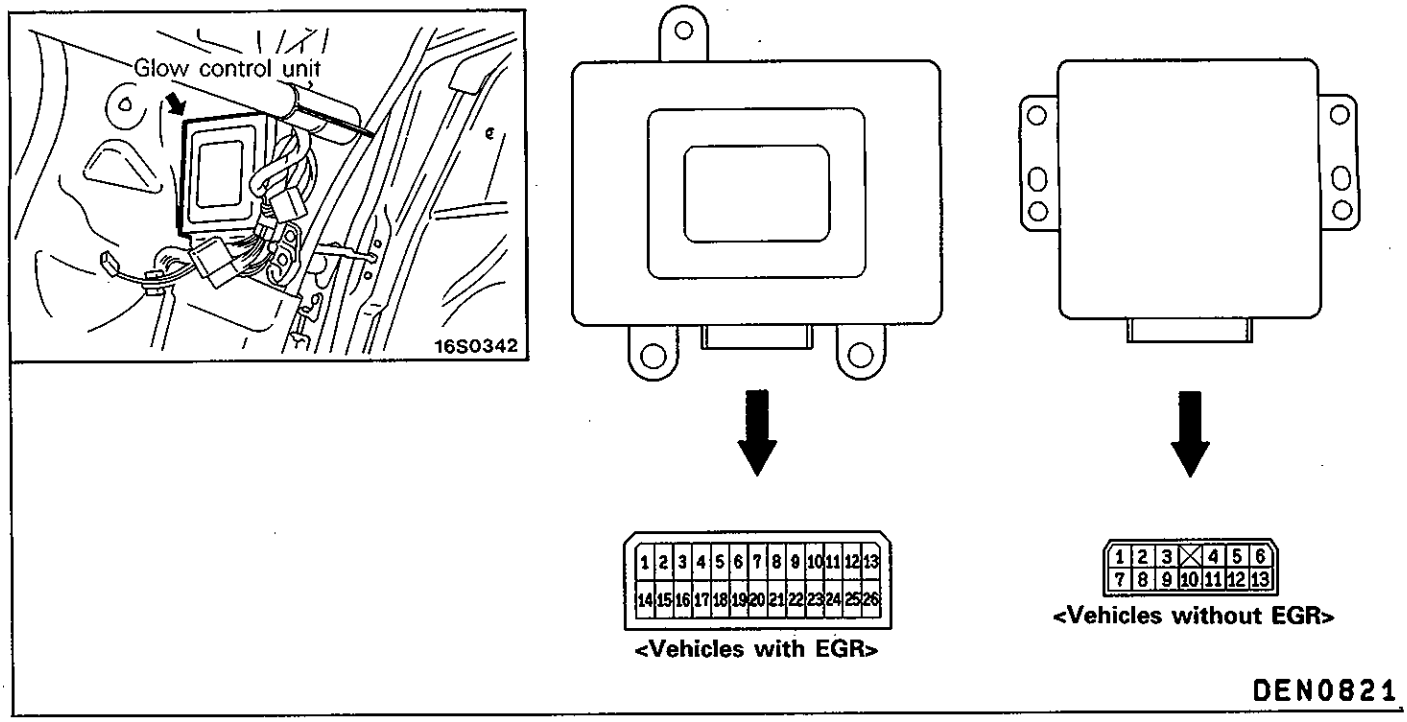


T_1: Glow indicator lamp
T_2: Glow plug relay drive time after ignition switch is turned ON
T_3: Glow plug relay drive time after engine starts (afterglow)

DEN0063

NOTE
Afterglow time T3 becomes longer as the engine coolant temperature drops.

GLOW CONTROL UNIT INSPECTION



(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 13 (10 for vehicles without EGR) 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
17 3*	Glow indicator lamp	• Ignition switch • Engine coolant temperature	"OFF" → "ON" 40°C (104°F) or less	0–1V after approximately 1 seconds {at 20°C (68°F)} 11–13V
23 6*	Alternator L terminal	Ignition switch	"OFF" → "ON"	1–4V
		Idle		More than 11V
14 7*	Glow plug relay	• Ignition switch • Engine coolant temperature	"OFF" → "ON" 40°C (104°F) or less	9–12V after approximately 8 seconds {at 20°C (68°F)} 0–0.5V
12 2*	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
5 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

NOTE
*: indicates vehicles without EGR.

View of harness-side connector of glow control unit from terminal side

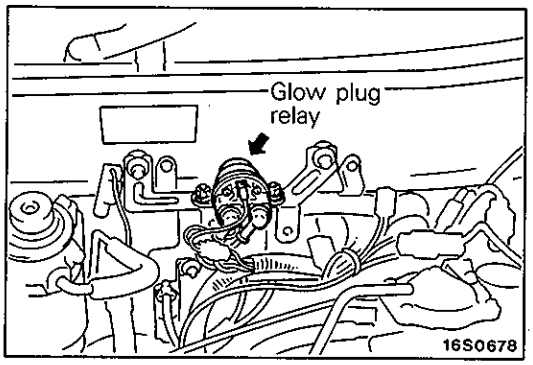
<Vehicles with EGR>

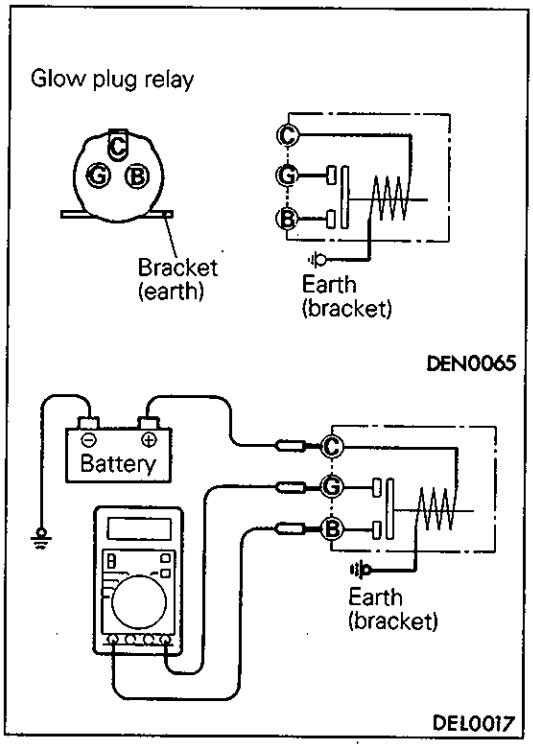
13	12	11	10	9	8	7	6	5	4	3	2	1
26	25	24	23	22	21	20	19	18	17	16	15	14

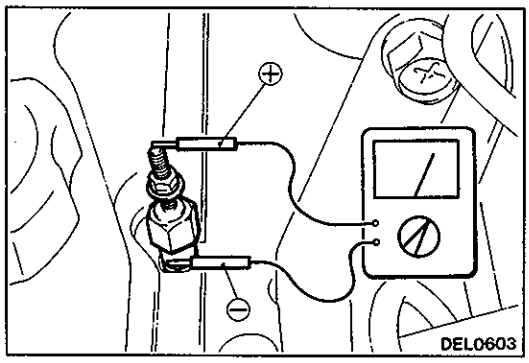
<Vehicles without EGR>

6	5	4		3	2	1
13	12	11	10	9	8	7

DEN0822







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

Inspection terminal	Inspection item	Continuity (resistance value)
13–14 7–10*	Glow plug relay	Continuity (approx. 3Ω)

NOTE
*: indicates vehicles without EGR.

GLOW PLUG RELAY INSPECTION

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

Caution
(1) Always be sure to disconnect the harnesses connected to glow plug relay terminals (B) and (G) before using the jumper cables.
(2) The terminals of the disconnected harnesses must not be shorted to earth.
(3) When connecting the jumper cables, be very careful not to make a mistake in connecting the terminals, as this will cause damage to the relay.

(3) Check the continuity between glow plug relay terminals (B) and (G) while disconnecting and connecting the jumper cable at the battery (+) terminal.

Jumper cable at battery (+) terminal	Continuity between terminals (B)-(G)
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: 0.4 – 0.6 Ω [at 20°C (68°F)]

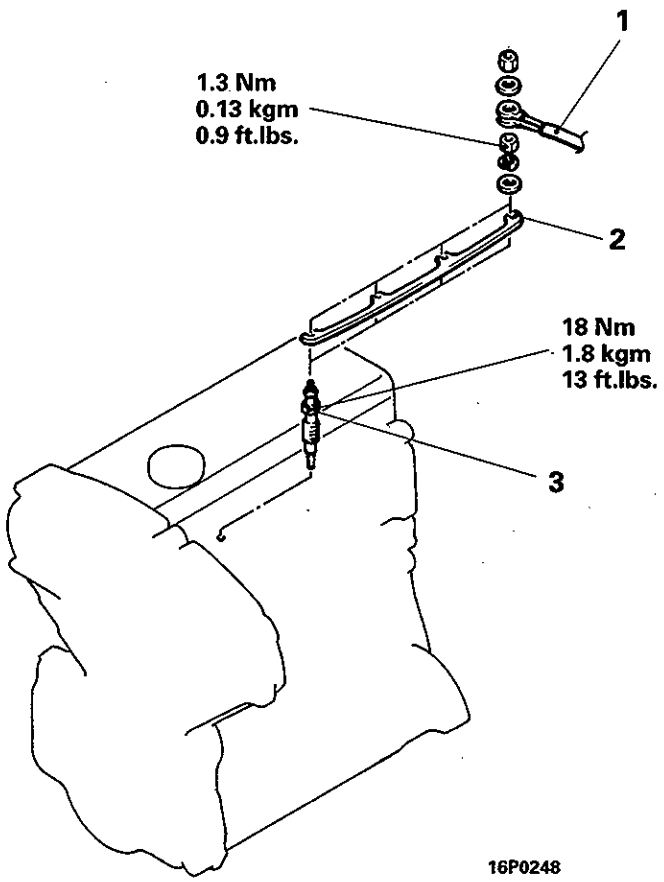
ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Refer to P.16-40.

GLOW PLUG

E16EH–

REMOVAL AND INSTALLATION



Removal steps
1. Connector connection
2. Glow plug plate
3. Glow plug

SERVICE POINTS OF REMOVAL

E16EHBA

3. REMOVAL OF GLOW PLUG

Remove glow plug by hand after loosening with tool as its ceramic part is fragile.

SERVICE POINTS OF INSTALLATION

E16EHDA

3. INSTALLATION OF GLOW PLUG

Tighten glow plug with tool after screwing in by hand as its ceramic part is fragile.

NOTES