ENGINE ELECTRICAL

CONTENTS

E16AA--

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NOTES

CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16BA--

ALTERNATOR

<SOHC>

Items		Not cold climate zone	Cold climate zone
Type		Battery voltage sensing	Battery voltage sensing
Rated out put	V/A	12/90	12/110
Voltage regulator		Electronic built-in type	Electronic built-in type

<DOHC>

Items		Vehicles without ECS	Vehicles with ECS
Type		Battery voltage sensing	Battery voltage sensing
Rated out put	V/A	12/90	12/110
Voltage regulator		Electronic built-in type	Electronic built-in type

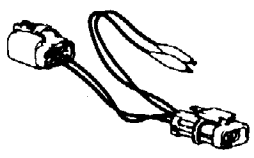
SERVICE SPECIFICATIONS

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)

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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

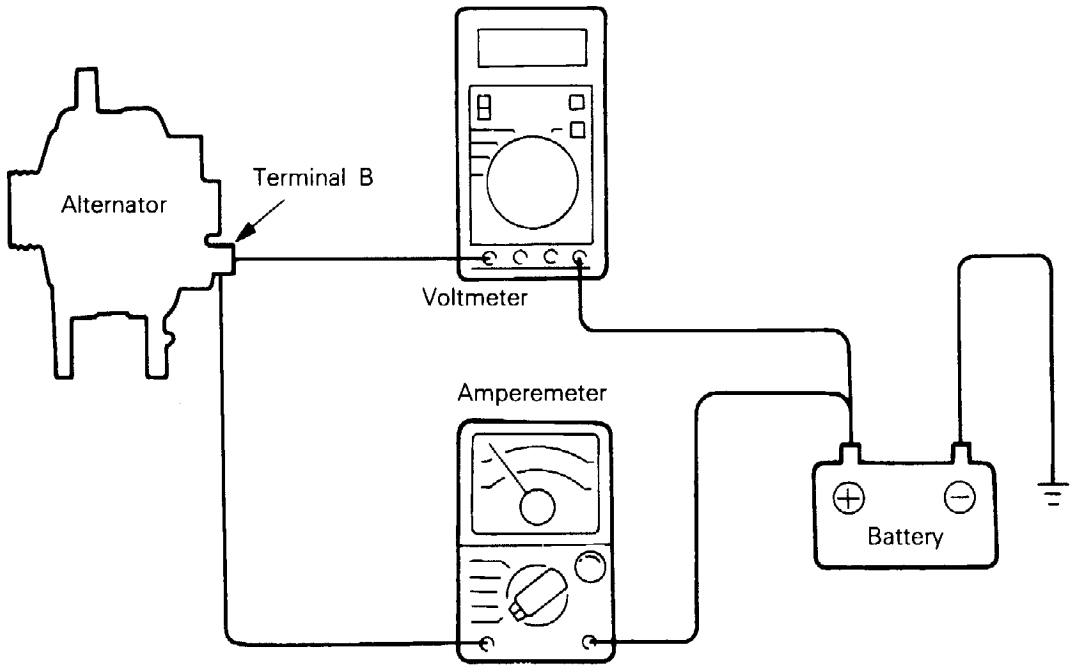
(2) Turn the ignition switch to the OFF position.

(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.)



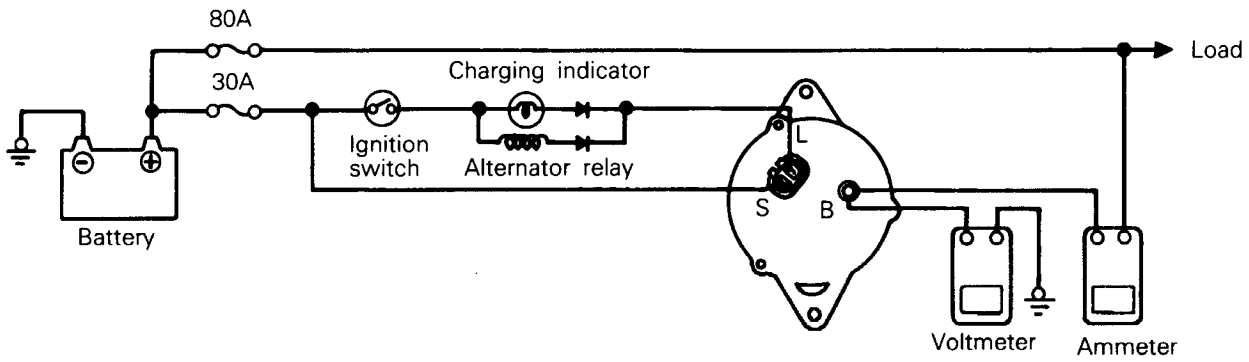
5EL0015

(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.

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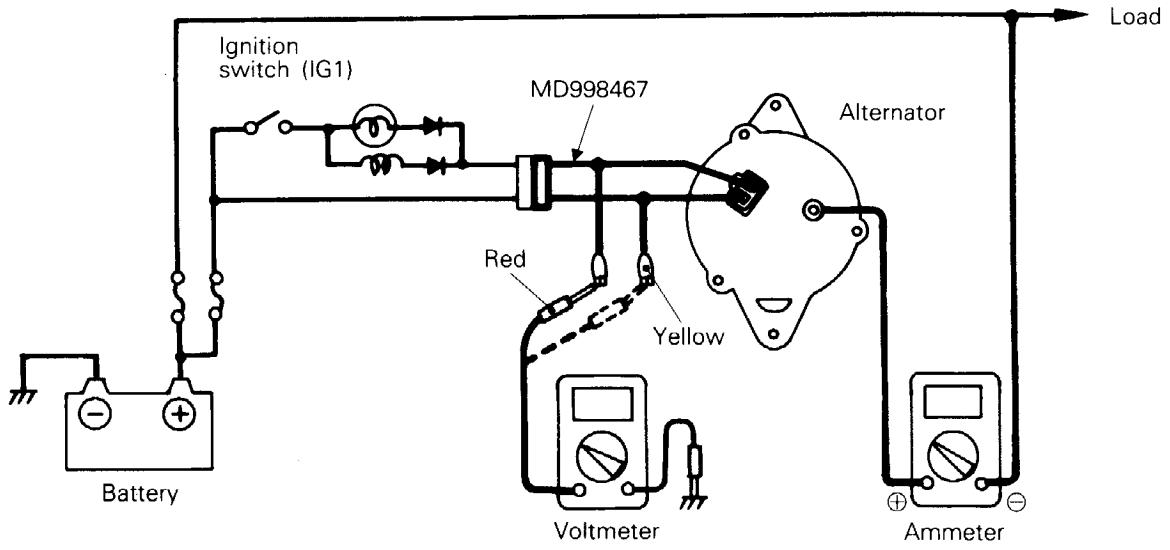
REGULATED VOLTAGE TEST



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

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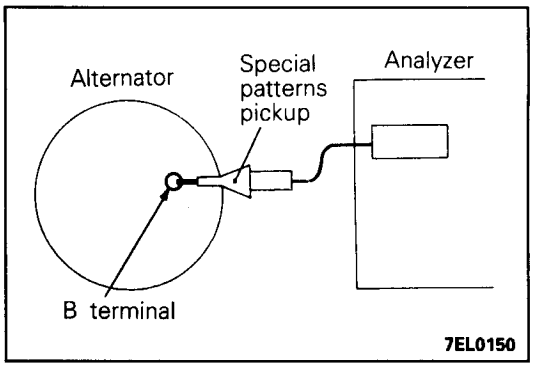


INSPECTION USING AN ANALYZER

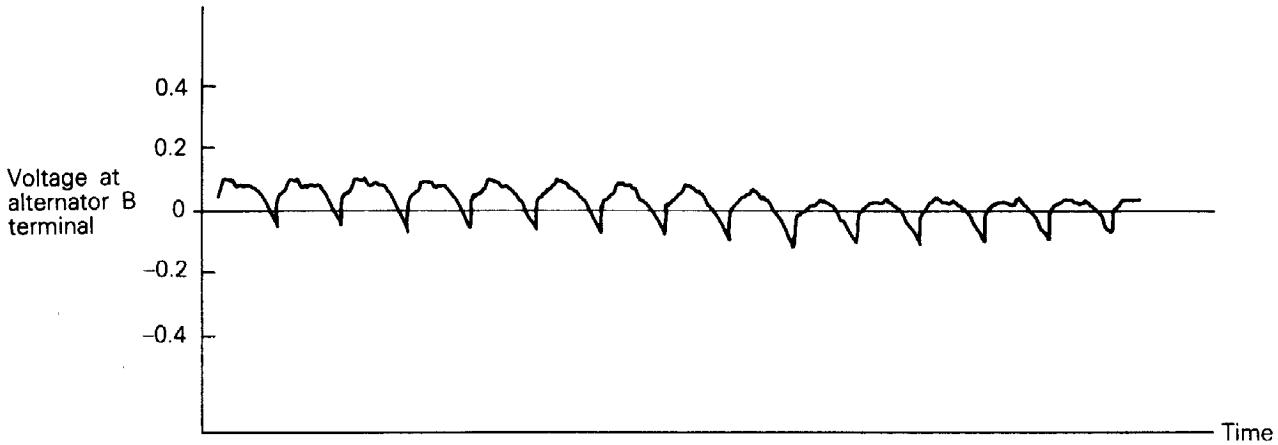
MEASUREMENT METHOD

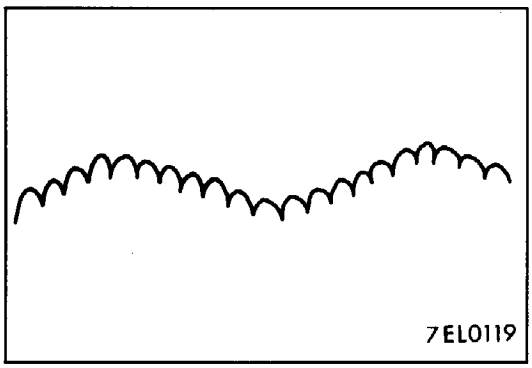
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Raster
Engine revolutions	Idle (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.

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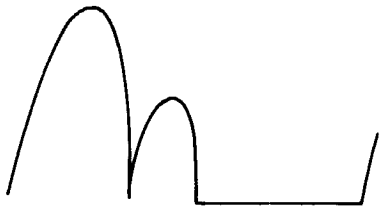
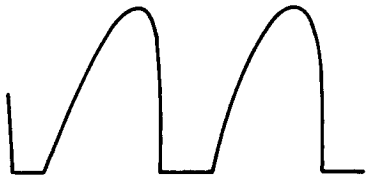
EXAMPLES OF ABNORMAL WAVEFORMS

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.

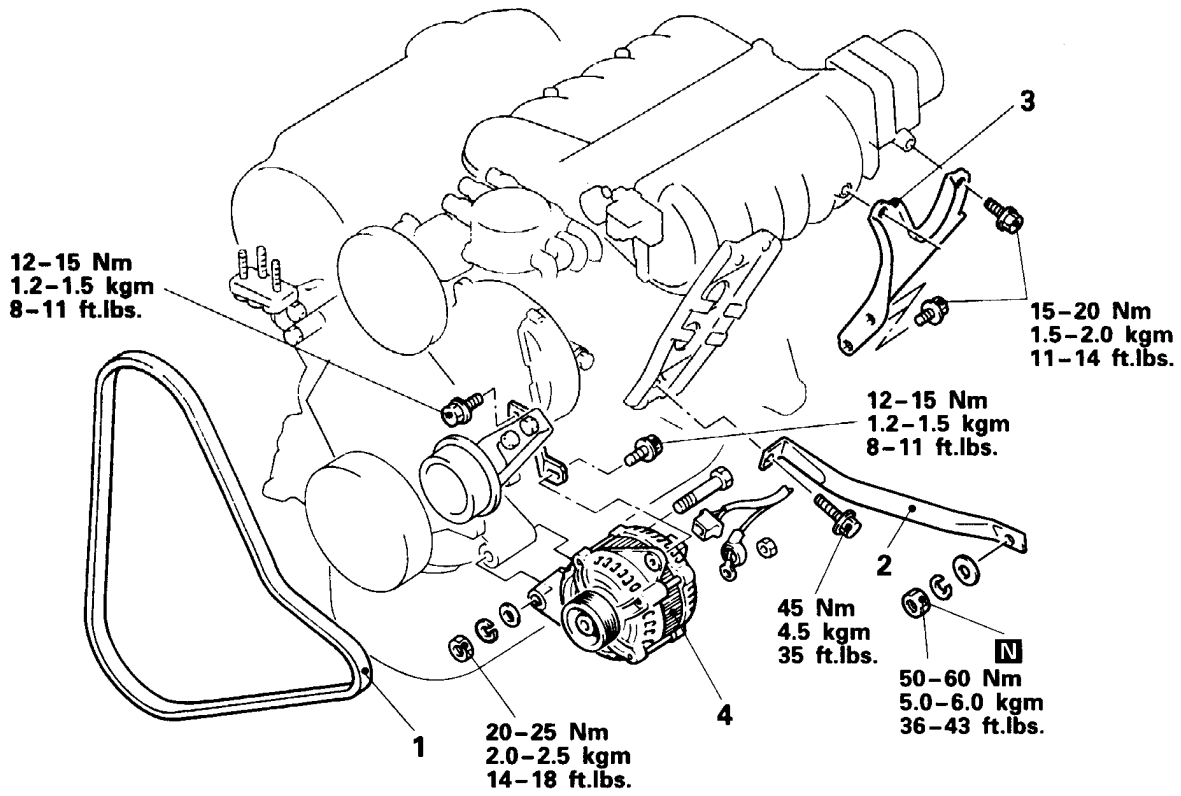
Abnormal waveforms	Problem cause
Example 1  7EL0120	• Open diode
Example 2  7EL0121	• Short in diode
Example 3  7EL0122	• Broken wire in stator coil
Example 4  7EL0123	• Short in stator coil
Example 5  NOTE: At this time, the charge lamp is illuminated. 7EL0124	• Open supplementary diode

ALTERNATOR <SOHC>

E16BH--1

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Air Intake Hose



Removal steps
- Adjustment of Drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures)

1. Drive belt
2. Roll stopper stay
3. Air intake plenum stay
4. Alternator

01N0114

SERVICE POINTS OF REMOVAL

E16BHCC

4. REMOVAL OF ALTERNATOR

(1) Remove the mounting nut and bolt.
(2) Take out the alternator from the transmission side through the bottom of the air intake plenum.

NOTE
There is only a small room to take out the alternator, so be careful not to damage the nearby components.

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ALTERNATOR <DOHC>

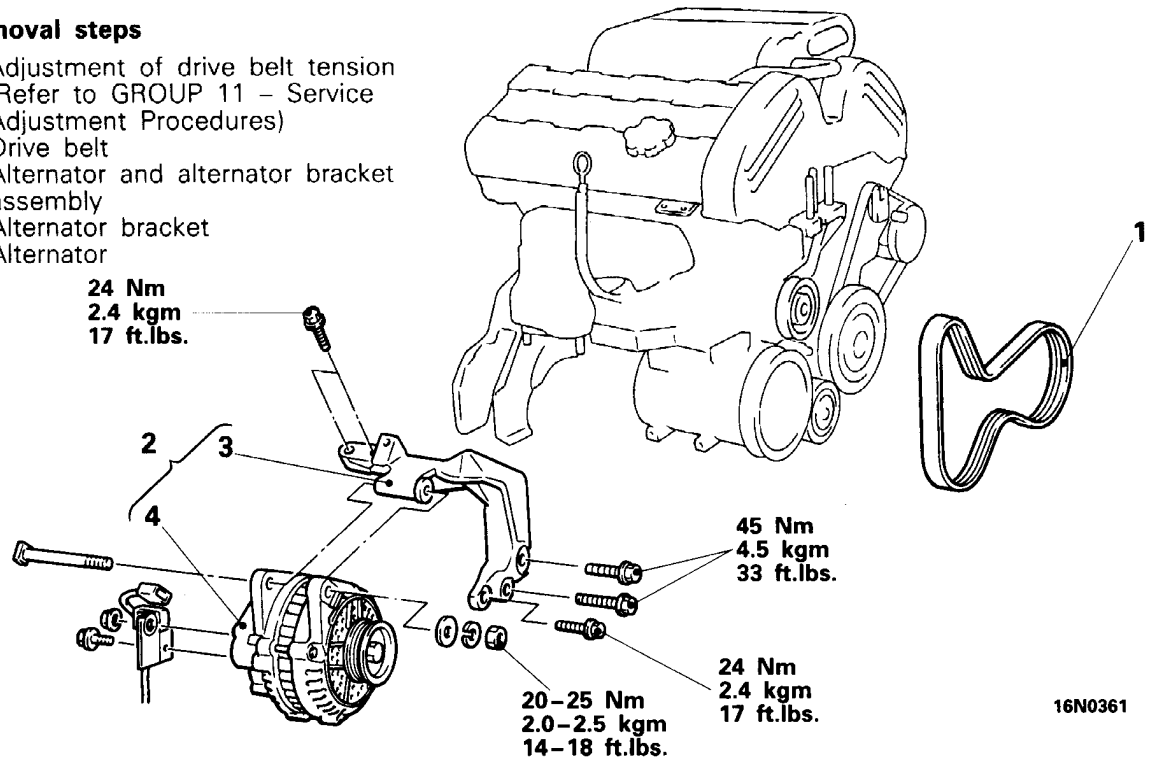
E16BH--2

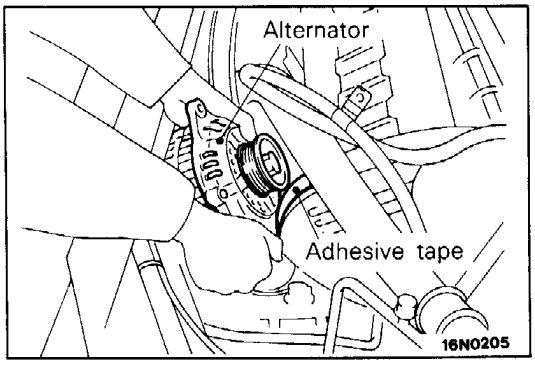
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Headlamp Washer Tank
- Removal and Installation of Condenser Fan
- Removal and Installation of Upper Radiator Insulator

Removal steps
- Adjustment of drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures)

1. Drive belt
2. Alternator and alternator bracket assembly
3. Alternator bracket
4. Alternator





SERVICE POINTS OF REMOVAL

E16BHCD

2. REMOVAL OF ALTERNATOR AND ALTERNATOR BRACKET ASSEMBLY

Before removing the assembly with the engine, loosen the assembly bolt by which the alternator is fixed at the alternator bracket.

4. REMOVAL OF ALTERNATOR

NOTE
There is only a small room to take out the alternator, so be careful not to damage the nearby components.

SERVICE POINTS OF INSTALLATION

E16BHDD

4. INSTALLATION OF ALTERNATOR/3. ALTERNATOR BRACKET

Before installing the alternator bracket to the engine, install the alternator in the engine compartment.

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STARTING SYSTEM

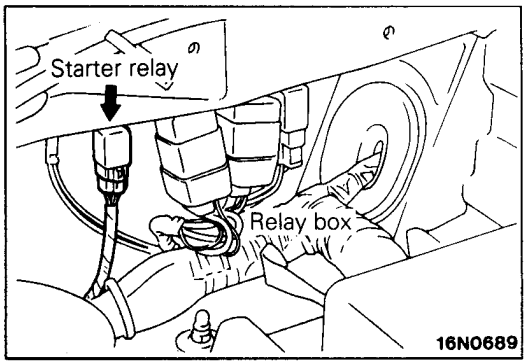
SPECIFICATIONS

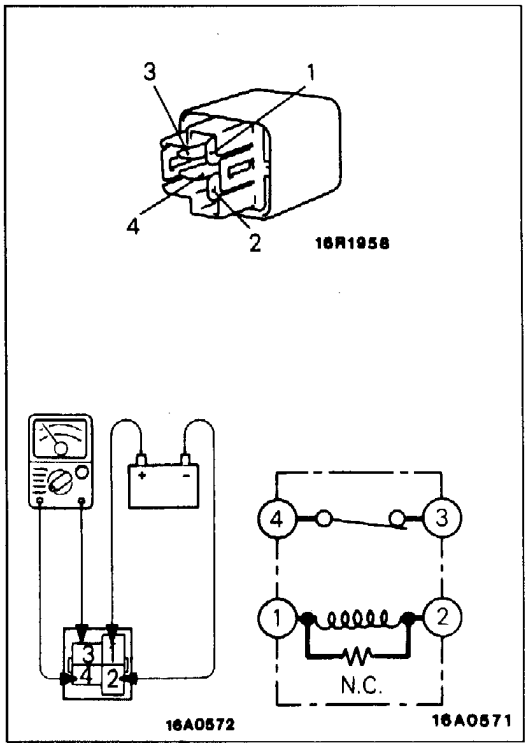
GENERAL SPECIFICATIONS

E16CA--

STARTER MOTOR

Items	M/T	A/T
Type	Reduction drive with planetary gear	Reduction drive with planetary gear
Identification No.	MIT72581	MIT73281
Part No.	MD162842	MD162843
Rated output kW/V	1.2/12	1.2/12
No. of pinion teeth	8	8





SERVICE ADJUSTMENT PROCEDURES

E16CHAA

STARTER RELAY INSPECTION

< VEHICLES WITH THEFT-ALARM SYSTEM >

(1) Remove the battery and air cleaner assembly.
(2) Remove the starter relay.
(3) Apply battery voltage to terminal ① and check the continuity between the terminals when terminal ② is earthed.

Power is supplied between (1)-(2)	3-4 terminals	No continuity
Power is not supplied	1-2 terminals	Continuity
	3-4 terminals	Continuity

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NOTES

IGNITION SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16DA--

DISTRIBUTOR

Items	SOHC engine
Type	Contact pointless
Advance mechanism	Electronic
Firing order	1–2–3–4–5–6

CRANK ANGLE SENSOR

Items	DOHC engine
Type	Contact pointless
Advance mechanism	Electronic

IGNITION COIL

Items	SOHC	DOHC
Type	Molded single-coil type	Molded 3 coil type
Identification No.	F-504	F-536
Part No.	MD166146	MD152648

SPARK PLUG

Items	SOHC	DOHC
NGK	BPR6ES-11	PFR6J-11
NIPPON DENSO	W20EPR11	PK20PR-P11

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SERVICE SPECIFICATIONS

E16DE--

IGNITION COIL

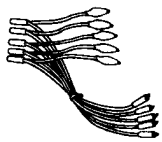
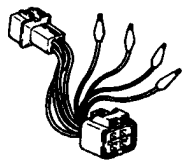
Items		SOHC	DOHC
Primary coil resistance	Ω	0.72–0.88	0.67–0.81
Secondary coil resistance	kΩ	10.3–13.9	11.3–15.3

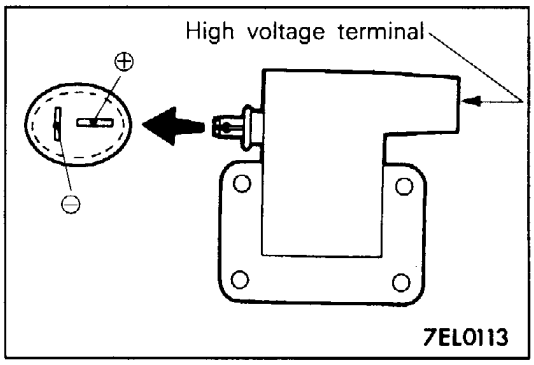
SPARK PLUG

Items		Specifications
Standard value		
Spark plug gap	mm (in.)	1.0–1.1 (0.039–0.043)
Limit		
High tension cable and spark plug cable resistance	kΩ	Max. 22
Spark plug gap (Platinum plug only)	mm (in.)	1.3 (0.051)

SPECIAL TOOLS

E16DF--

Tool	Number	Name	Use
	MB991348	Test harness set	Inspection of ignition primary voltage (power transistor connection)
	MD998464	Harness connector (4-pin, square)	Inspection of ignition primary voltage (ignition coil connection)



SERVICE ADJUSTMENT PROCEDURES <SOHC>

E16DGAP

IGNITION COIL INSPECTION

(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: 10.3–13.9 kΩ

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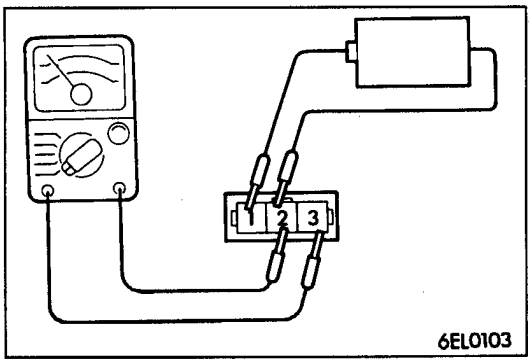


POWER TRANSISTOR INSPECTION

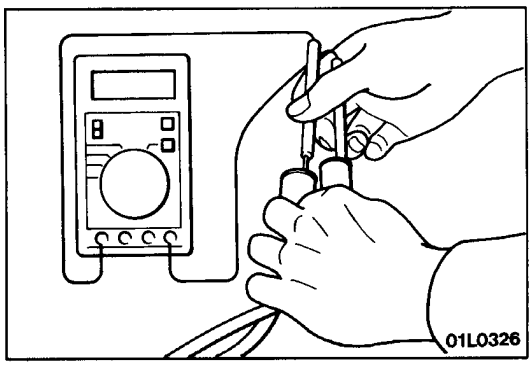
NOTE
An analog-type circuit tester should be used.

(1) Connect the negative (–) terminal of the 15V 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.

NOTE
Connect the negative (–) probe of the circuit tester to terminal ③.

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

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



RESISTIVE CODE INSPECTION

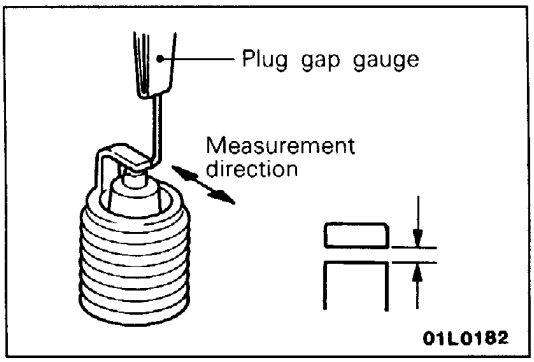
Measure the resistance of the high tension cable and all spark plug leads.
(1) Check cap and coating for cracks.
(2) Measure resistance.
Limit: Max. 22 kΩ

CHECKING THE DETONATION SENSOR

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.

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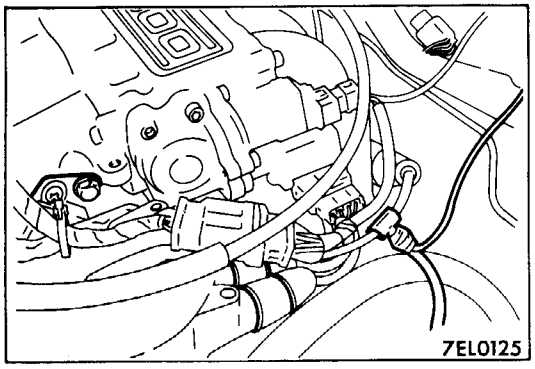
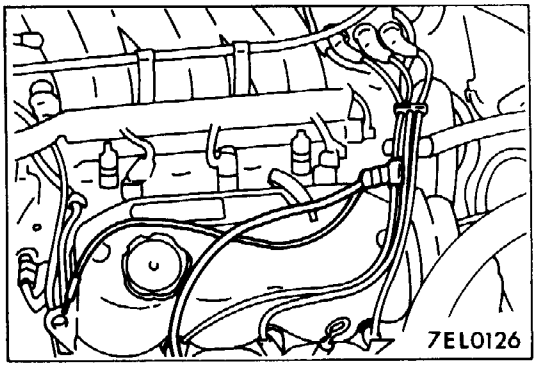


INSPECTION USING AN ANALYZER (SECONDARY AND PRIMARY IGNITION VOLTAGE WAVEFORMS)

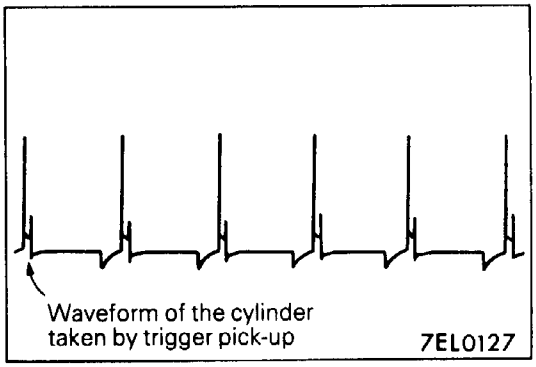
INSPECTION OF SECONDARY IGNITION VOLTAGE

MEASUREMENT METHOD

(1) Clamp the Secondary pickup around high tension cable.



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

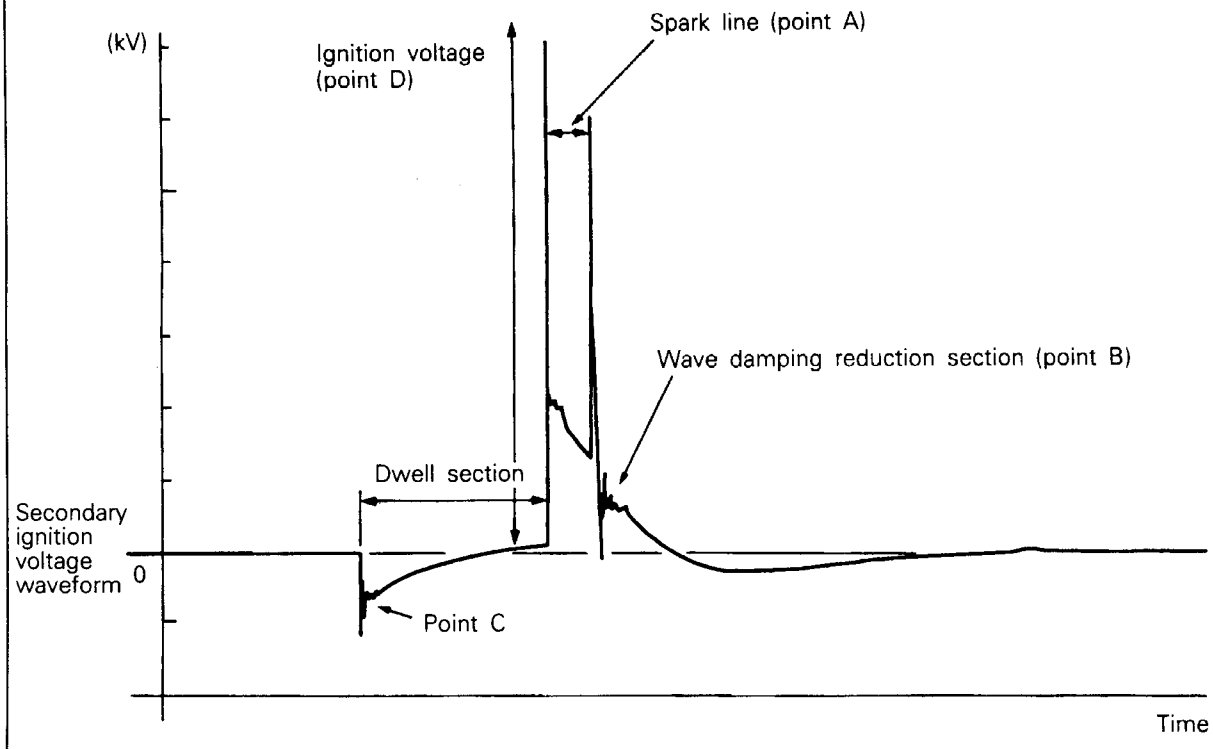


NOTE
The cylinder waveform taken by the trigger pickup appears from the left side of the screen.

STANDARD WAVEFORM

Observation Conditions

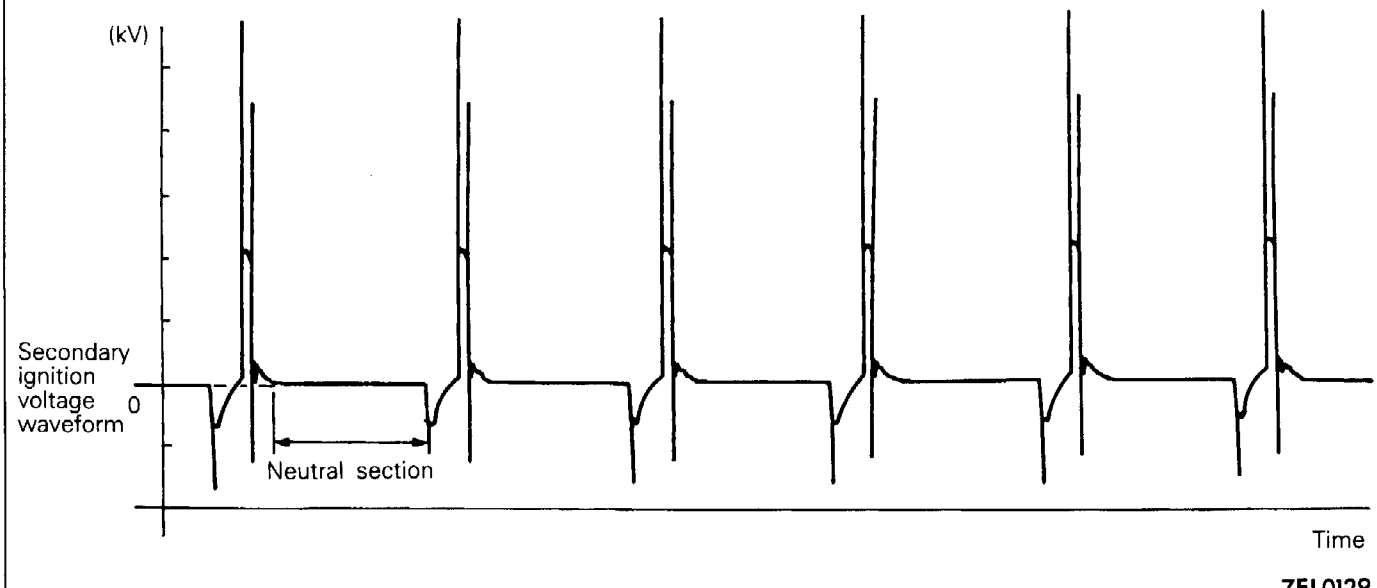
Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Idle (700 r/min.)



7EL0128

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

Pattern selector	Display



7EL0129

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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

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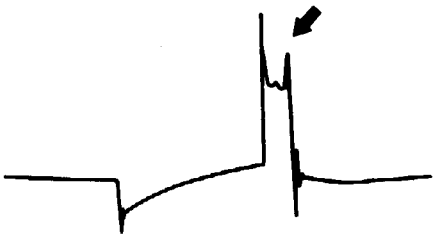
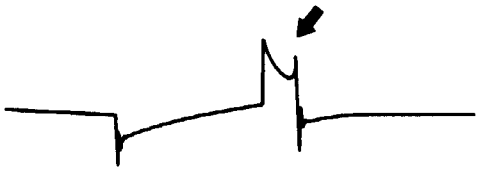
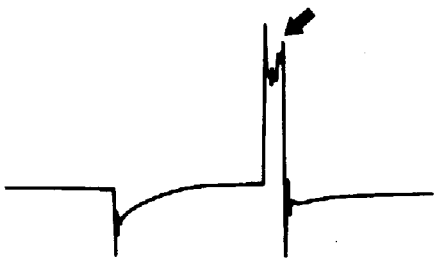
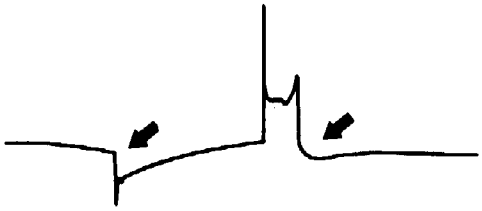
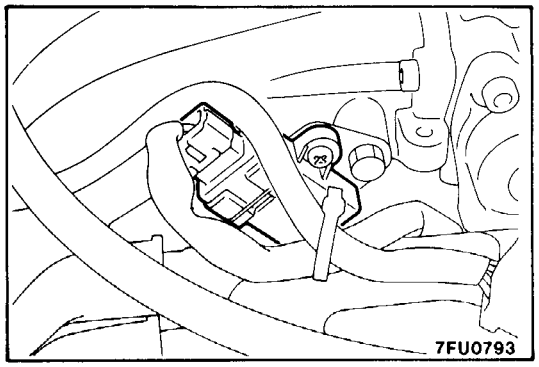
EXAMPLES OF ABNORMAL WAVEFORMS

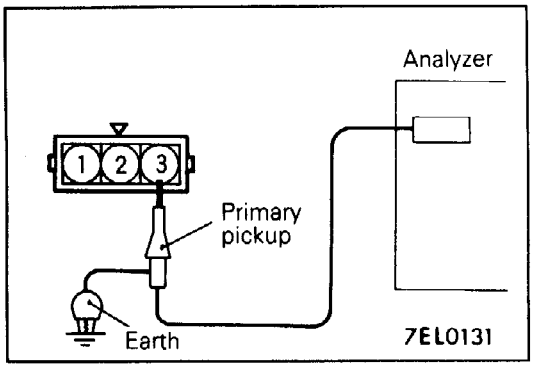
Abnormal waveform	Wave characteristics	Cause of probrem
Example 1  01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0216	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of mis-firing.	Spark plug gap 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 PRIMARY IGNITION VOLTAGE WAVEFORMS

MEASUREMENT METHOD

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



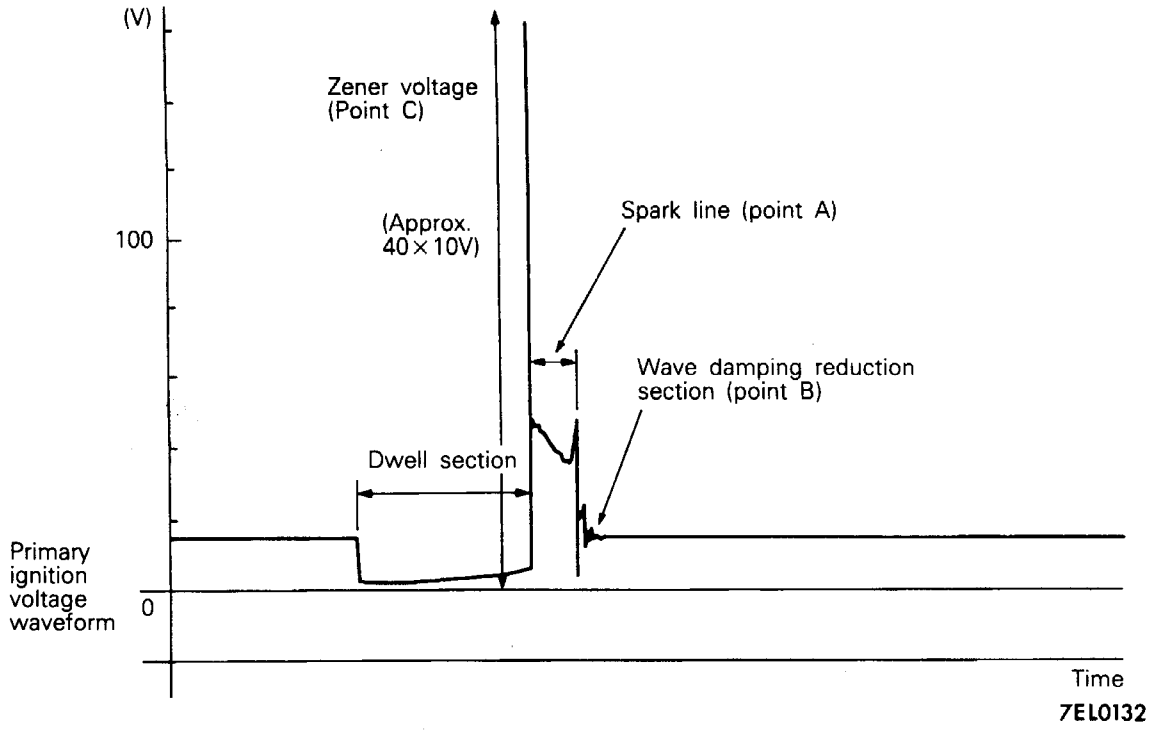
(2) Connect the primary pickup of the adjuster to the power transistor connector terminal (3).
(3) Earth the primary pickup earth terminal.
(4) Clamp the spark plug cable with the primary pickup.

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

STANDARD WAVEFORM

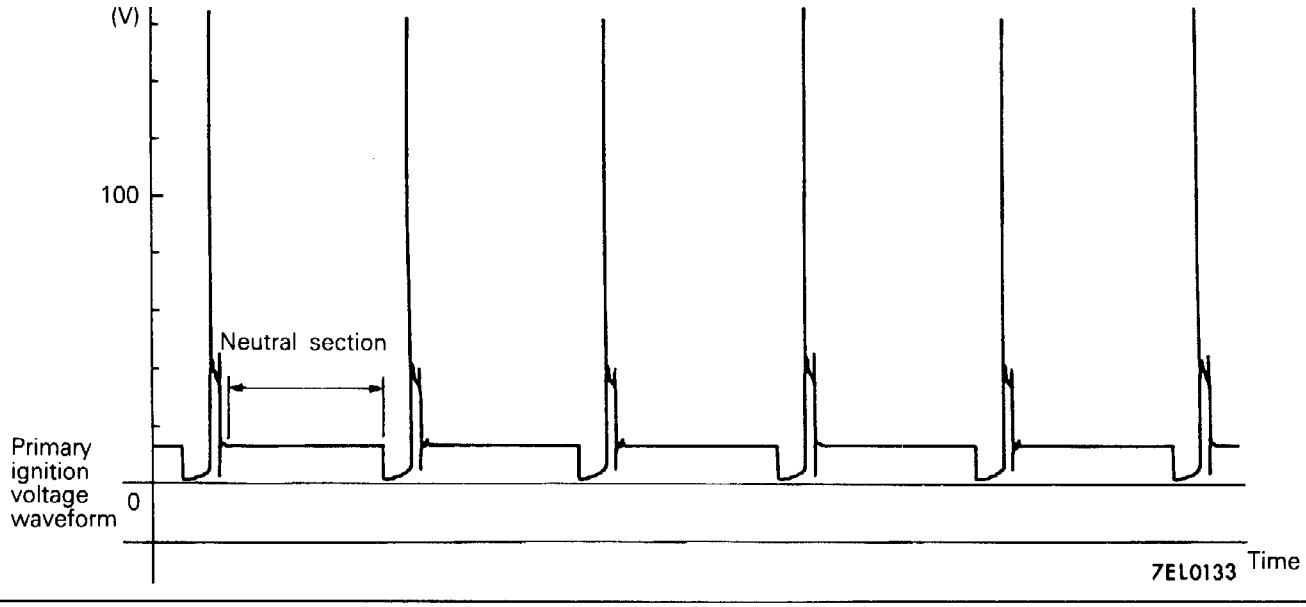
Observation Conditions

Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Idle (700 r/min.)



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	–	–	–	–

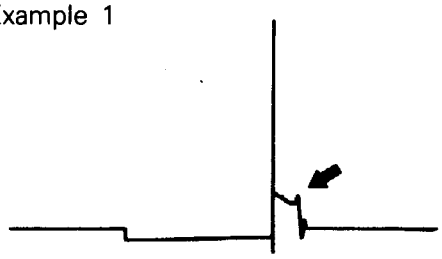
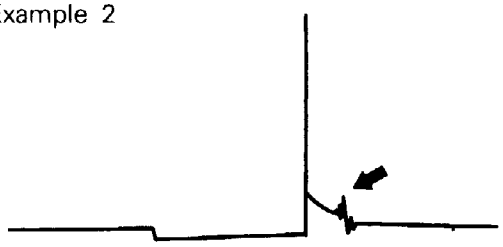
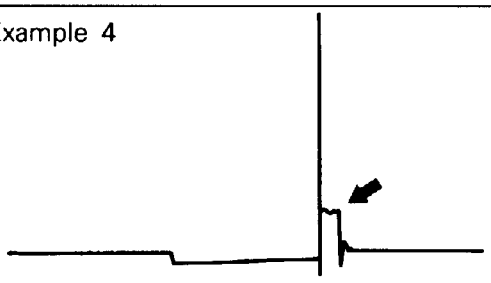
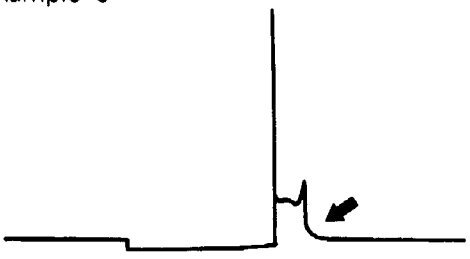
Point B : Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

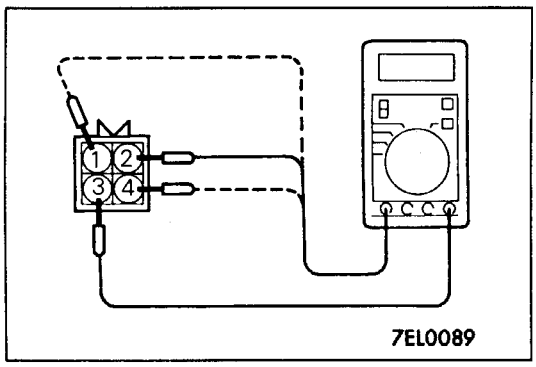
Number of vibrations	Coil, condenser
3 or higher	Normal
Except above	Abnormal

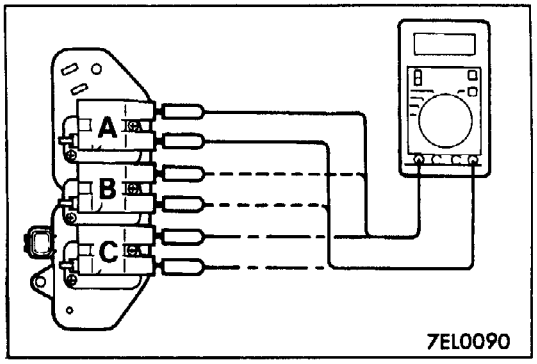
Point C : Height of Zener voltage

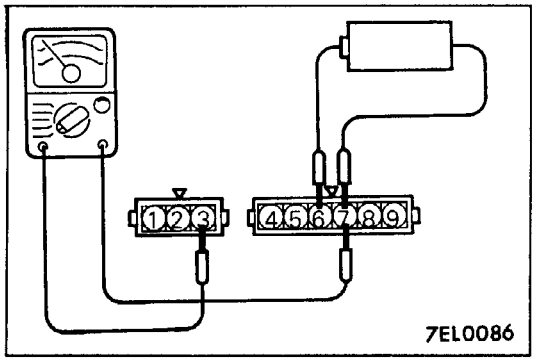
Height of Zener voltage	Probable cause
High	Problem in Zener diode
Low	Abnormal resistance in primary coil circuit

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 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.







SERVICE ADJUSTMENT PROCEDURES <DOHC>

E16DGAQ

IGNITION COIL INSPECTION

Primary Coil Resistance

Measure the resistance between connector terminal ③ (power) and each coil terminal.

Measuring point:

Coil A (No. 1 – No. 4 cylinder side coil) ..... ②–③
Coil B (No. 2 – No. 5 cylinder side coil) ..... ①–③
Coil C (No. 3 – No. 6 cylinder side coil) ..... ④–③

Standard value: 0.67–0.81 Ω

Secondary Coil Resistance

Measure the resistance between each coil high voltage terminals.

Measuring point:

Coil A (No. 1 – No. 4 cylinder side coil)
Coil B (No. 2 – No. 5 cylinder side coil)
Coil C (No. 3 – No. 6 cylinder side coil)

Standard value: 11.3–15.3 kΩ

POWER TRANSISTOR INSPECTION

NOTE
An analog-type circuit tester should be used.

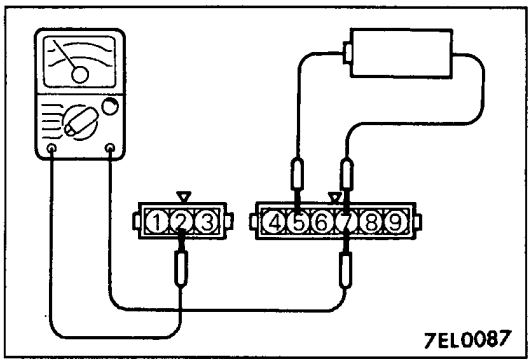
No. 1 – No. 4 coil side

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal ⑦ of the power transistor; then check whether there is continuity between terminal ③ and terminal ⑦ when terminal ⑥ and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ③.

Terminal ⑥ and (+) terminal	Terminal ③ and terminal ⑦
Connected	Continuity
Unconnected	No continuity

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



No. 2 – No. 5 coil side

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal 7 of the power transistor; then check whether there is continuity between terminal 2 and terminal 7 when terminal 5 and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ②.

Terminal ⑤ and (+) terminal	Terminal ② and terminal ⑦
Connected	Continuity
Unconnected	No continuity

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

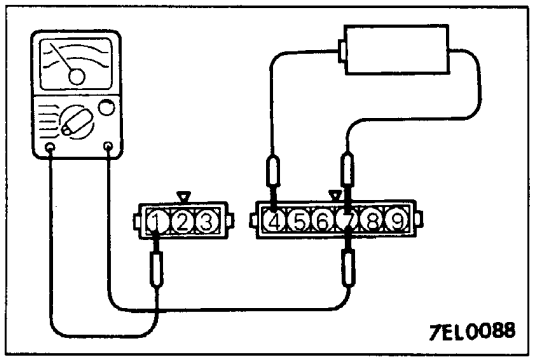
No. 3 – No. 6 coil side

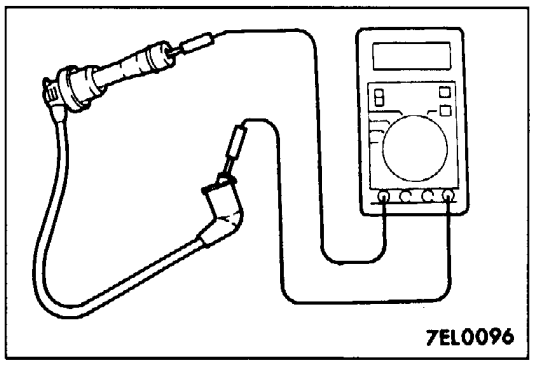
(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal 7 of the power transistor; then check whether there is continuity between terminal 1 and terminal 7 when terminal 4 and the positive (+) terminal are connected and disconnected.

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

Terminal ④ and (+) terminal	Terminal ① and terminal ⑦
Connected	Continuity
Unconnected	No continuity

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





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.

Unit: kΩ

Spark plug cable					
No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
8.6	13.9	6.4	11.5	4.5	11.7

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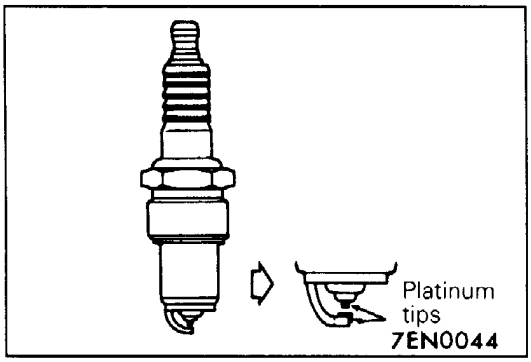
CHECKING THE DETONATION SENSOR

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.



SPARK PLUG CHECK

(1) Remove the center cover from the front bank.
(2) Remove the air intake plenum from the rear bank.
(3) Remove the spark plug cables.

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

(4) Remove the spark plugs.
(5) 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.**

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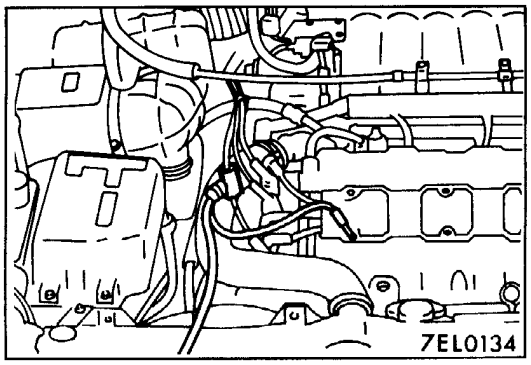

INSPECTION USING AN ANALYZER (SECONDARY AND PRIMARY IGNITION VOLTAGE WAVEFORMS)

INSPECTION OF SECONDARY IGNITION VOLTAGE

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.4, No.5, No.6 cylinders are clamped and when the spark plug cables of No.1, No.2, 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.4 cylinder, No.2 cylinder - No.5 cylinder, No.3 cylinder - No.6 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, No.2 or 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.

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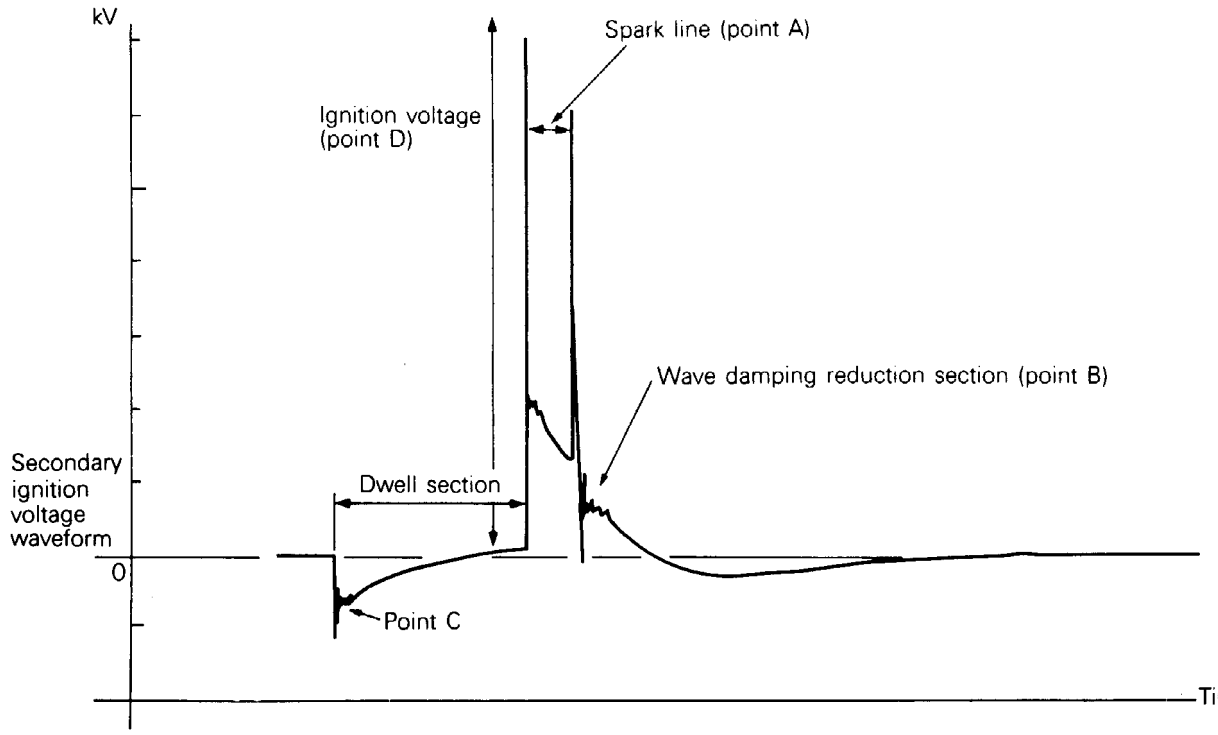
STANDARD WAVEFORM

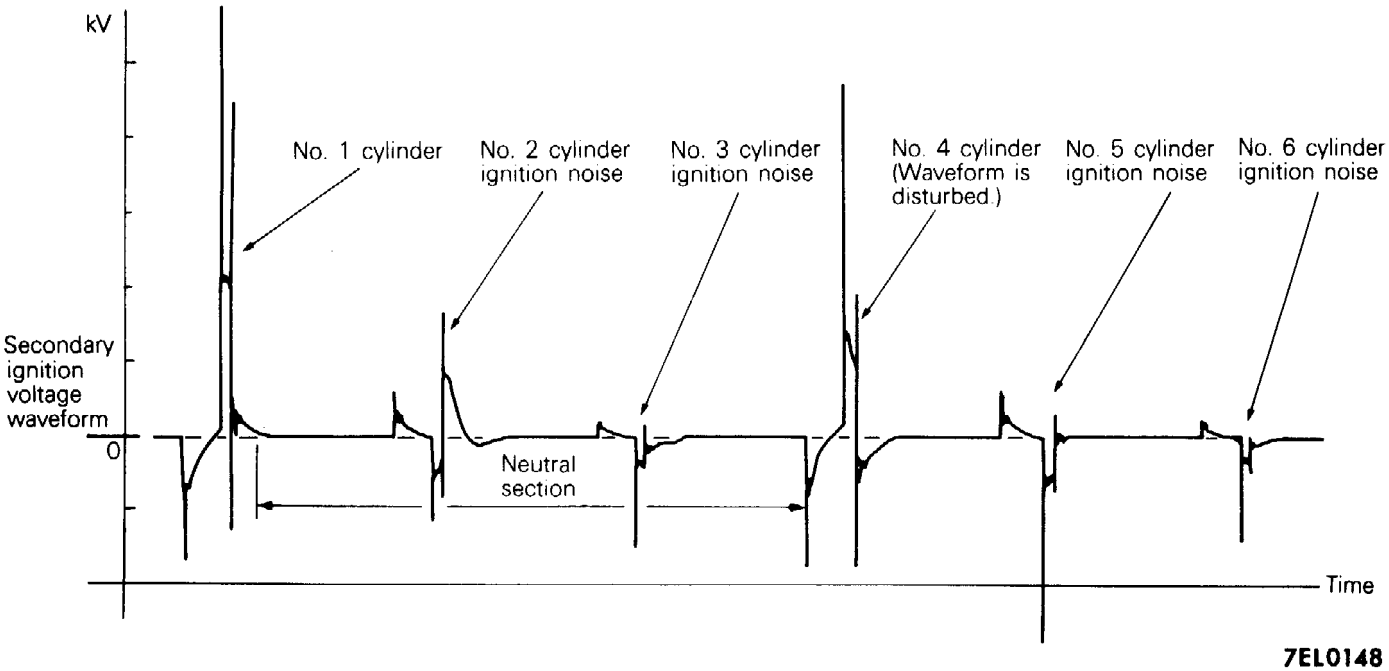
Observation Conditions

Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Idle (700 r/min.)



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

Pattern selector	Display.

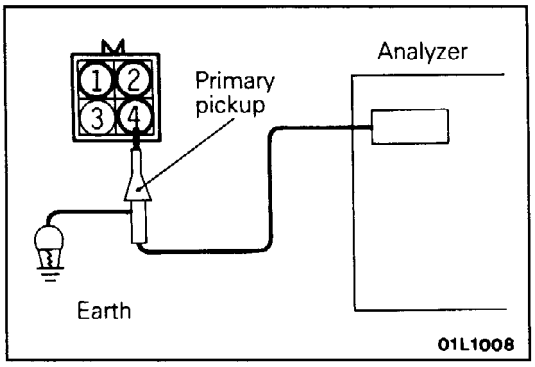


WAVEFORM OBSERVATION POINTS

For waveform observation points, refer to P. 16-12-3

EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P. 16-12-4



INSPECTION OF PRIMARY IGNITION VOLTAGE

MEASUREMENT METHOD

(1) Disconnect the ignition coil connector and connect the special tool (harness connector: MB998464) in between.
(2) Connect the analyzer primary pickup to the ignition coil connector terminal (2) (black clip on the special tool) when observing the No. 1 - No. 4 cylinder group, terminal (1) (red clip) for the No. 2 - No. 5 cylinder group, and terminal [4] (white clip) for the No. 3 - No. 6 cylinder group.
(3) Connect the primary pickup earth terminal.
(4) Clamp the spark plug with the trigger pickup.

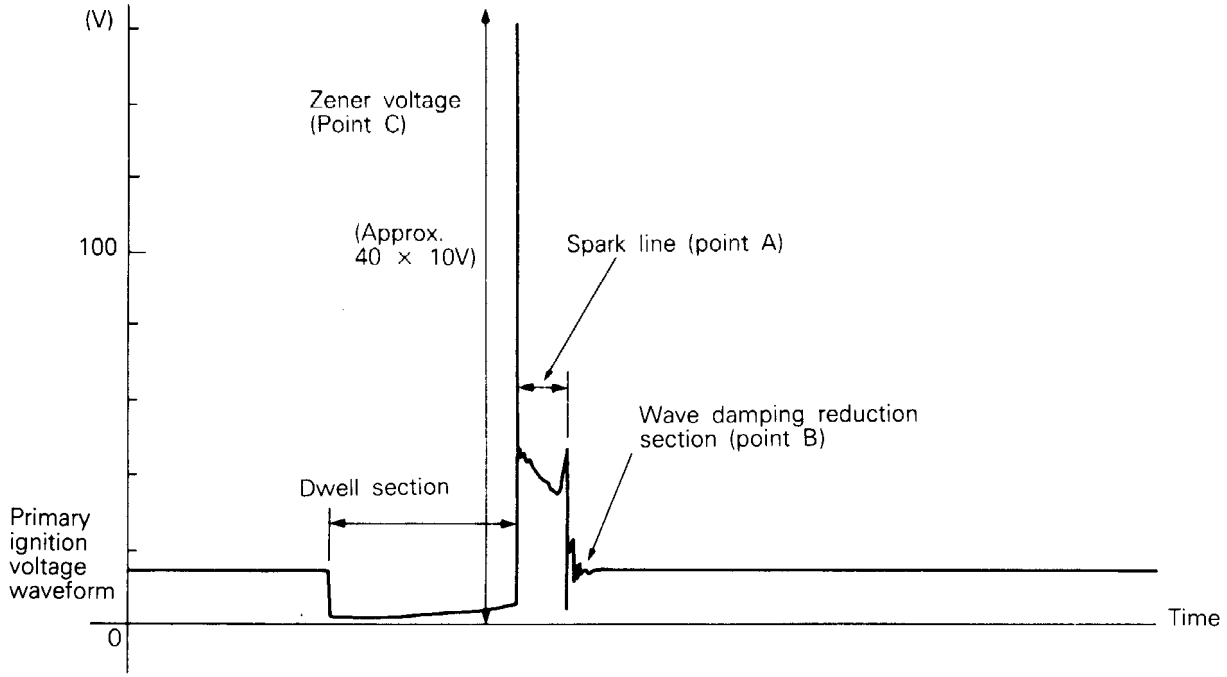
NOTE

1. Clamp the spark plug cable for No.1, No.2 and No.3 cylinders of the same group with the cylinder that is connected to the primary pickup.
2. The wave pattern of either cylinder in the same group will appear at the left edge of the screen.

STANDARD WAVEFORM

Observation Conditions

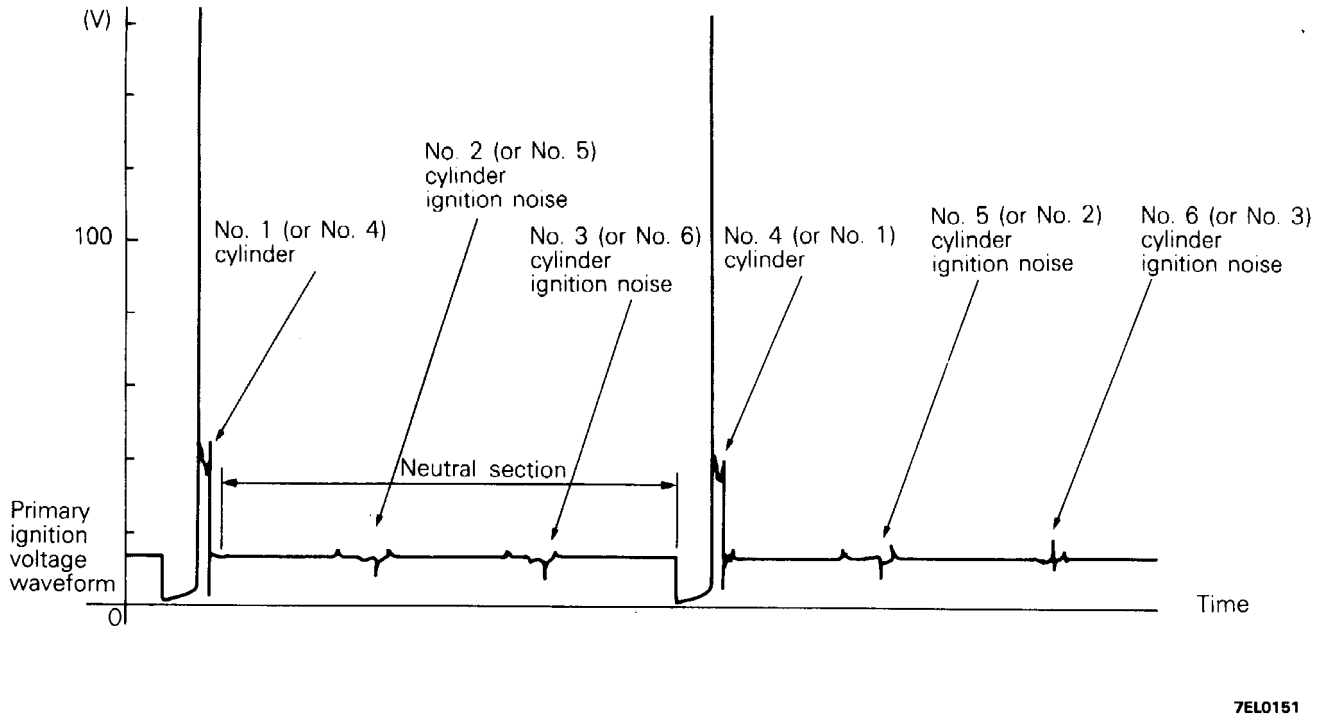
Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Idle (700 r/min.)



7EL0149

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

Pattern selector	Display



WAVEFORM OBSERVATION POINT

For waveform observation points, refer to P.16-12-7

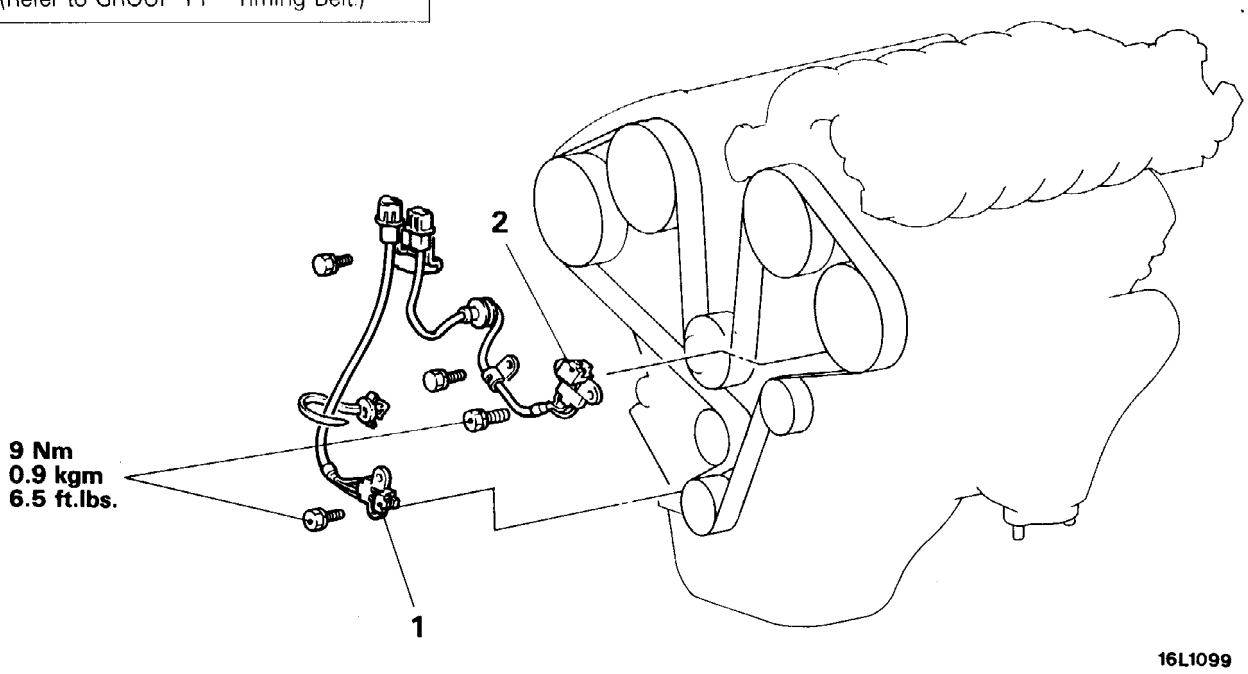
EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P. 16-12-8

CRANK ANGLE SENSOR AND CAMSHAFT POSITION SENSOR <DOHC BUILT FROM NOVEMBER, 1992>

REMOVAL AND INSTALLATION

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



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

INSPECTION

For information concerning the inspection of the camshaft position sensor and the crank angle sensor, refer to GROUP 13 – On-Vehicle Inspection of MPI Components.