

# IGNITION SYSTEM

## SPECIFICATIONS

### GENERAL SPECIFICATIONS

#### CRANK ANGLE SENSOR <Up to 1992 model>

Items	Specifications
Type	Contact pointless type
Identification No.	T1 T49371
Part No.	MD1 53464
Advance mechanism	Controlled by engine control unit
Firing order	1 - 2 - 3 - 4 - 5 - 6

### IGNITION COIL

Items	Specifications
Type	Mold 3-coil
Identification No.	F-536
Part No.	MD152648

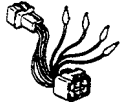
### SPARK PLUG

Items	Specifications
NGK	PFR6J-11
NIPPON DENSO	PK20PR-P11

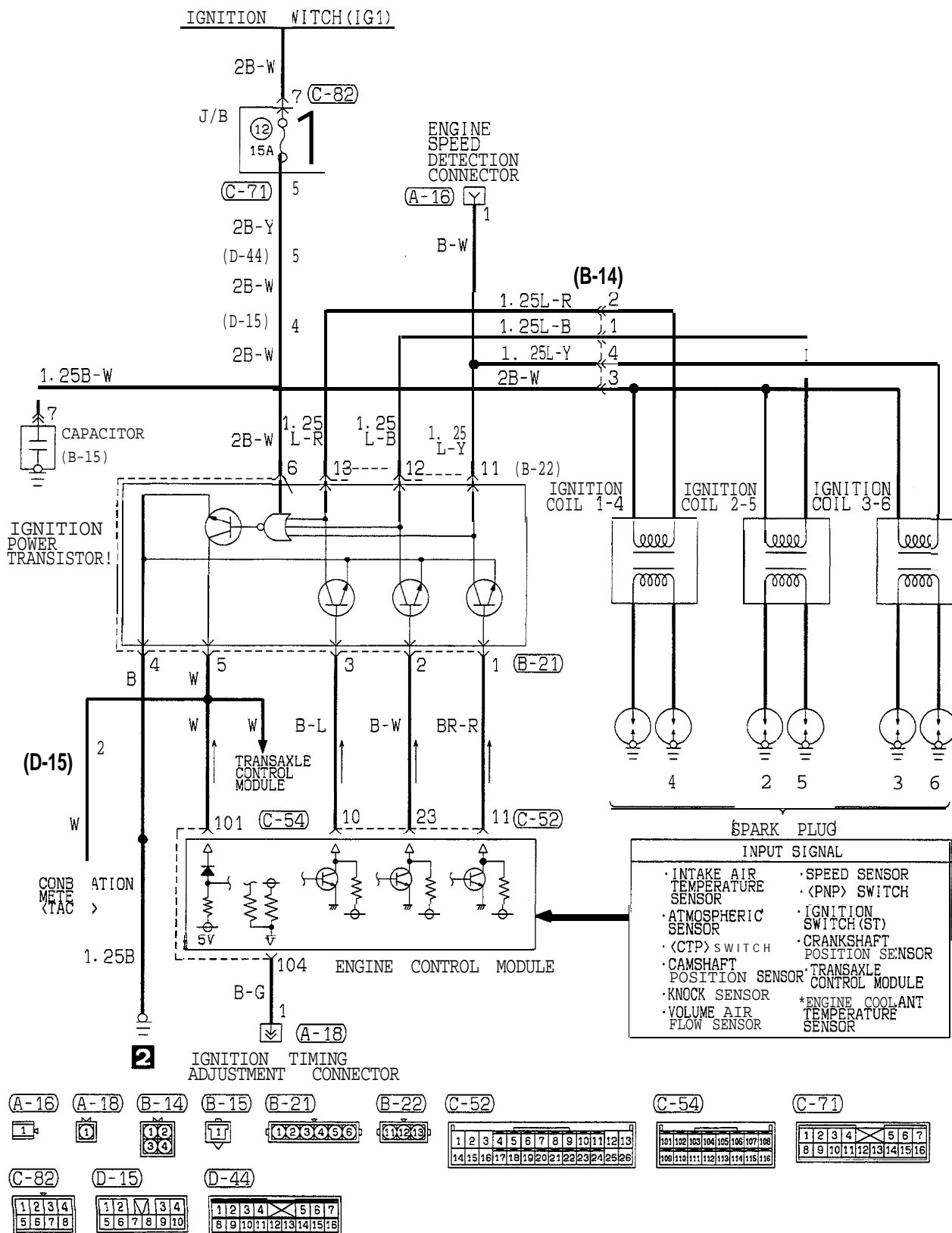
### SERVICE SPECIFICATIONS

Items		Standard value	Limit
Ignition coil	Primary coil resistance at 20°C (68°F) $\Omega$	0.67–0.81	
	Secondary coil resistance at 20°C (68°F) $k\Omega$	11.3–15.3	
Spark plug gap mm (in.)		1.0–1.1 (0.39-0.43)	1.3 (.051)
Spark plug cable $k\Omega$			Max. 22

## SPECIAL TOOLS

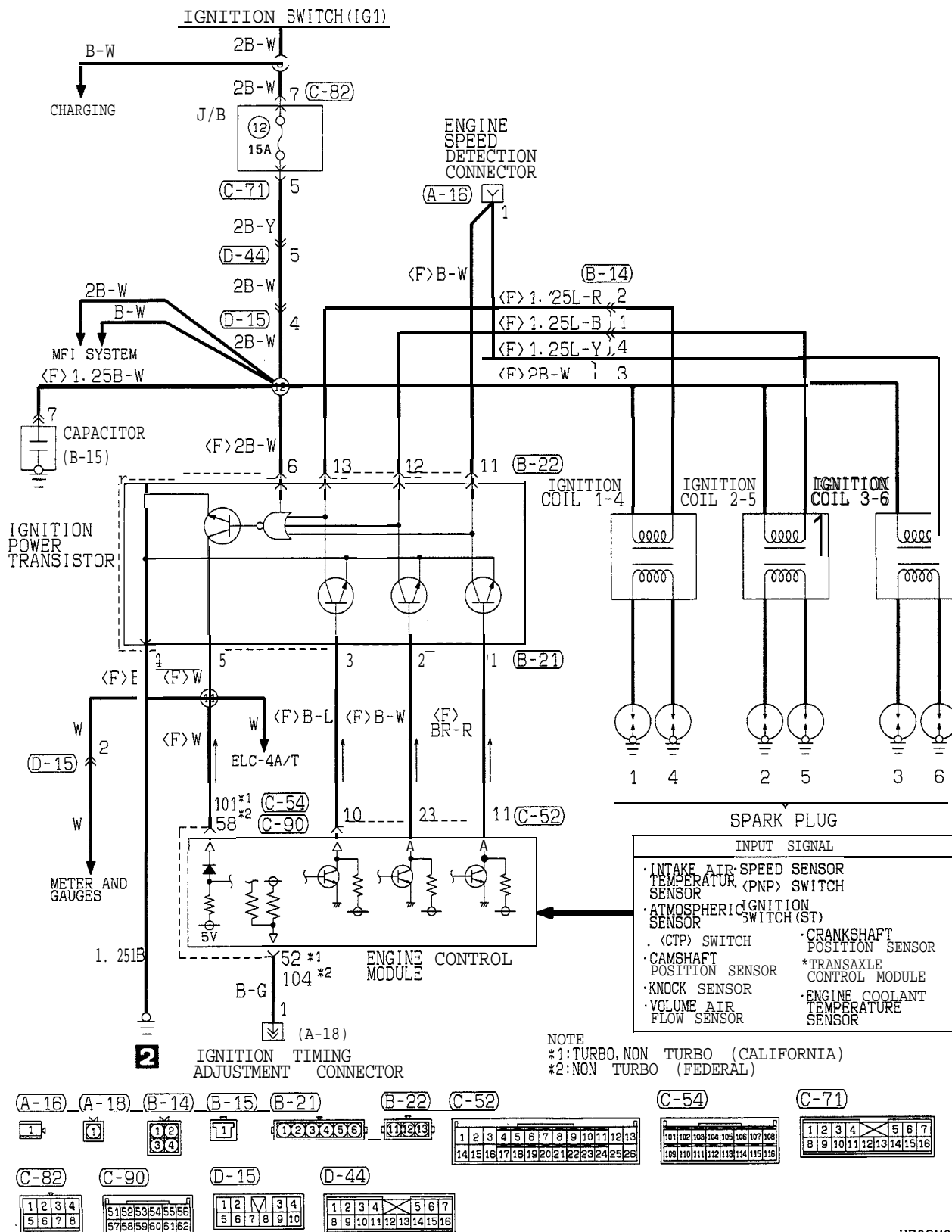
Tool number and name	Supersession	Application
 MD998464 Harness connector (4 pin, square)		Check of ignition primary voltage (connection of ignition coil connector)

## CIRCUIT DIAGRAM



## (UP TO 1995 MODELS)

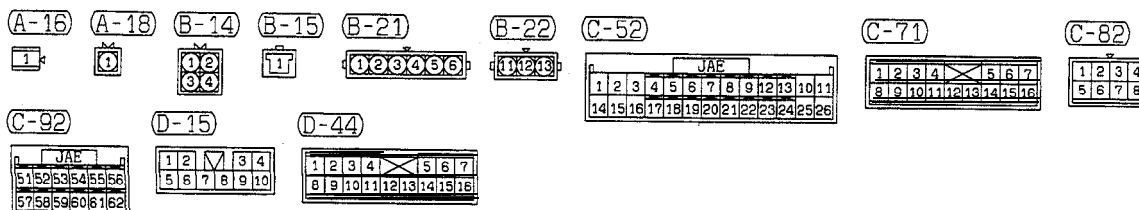
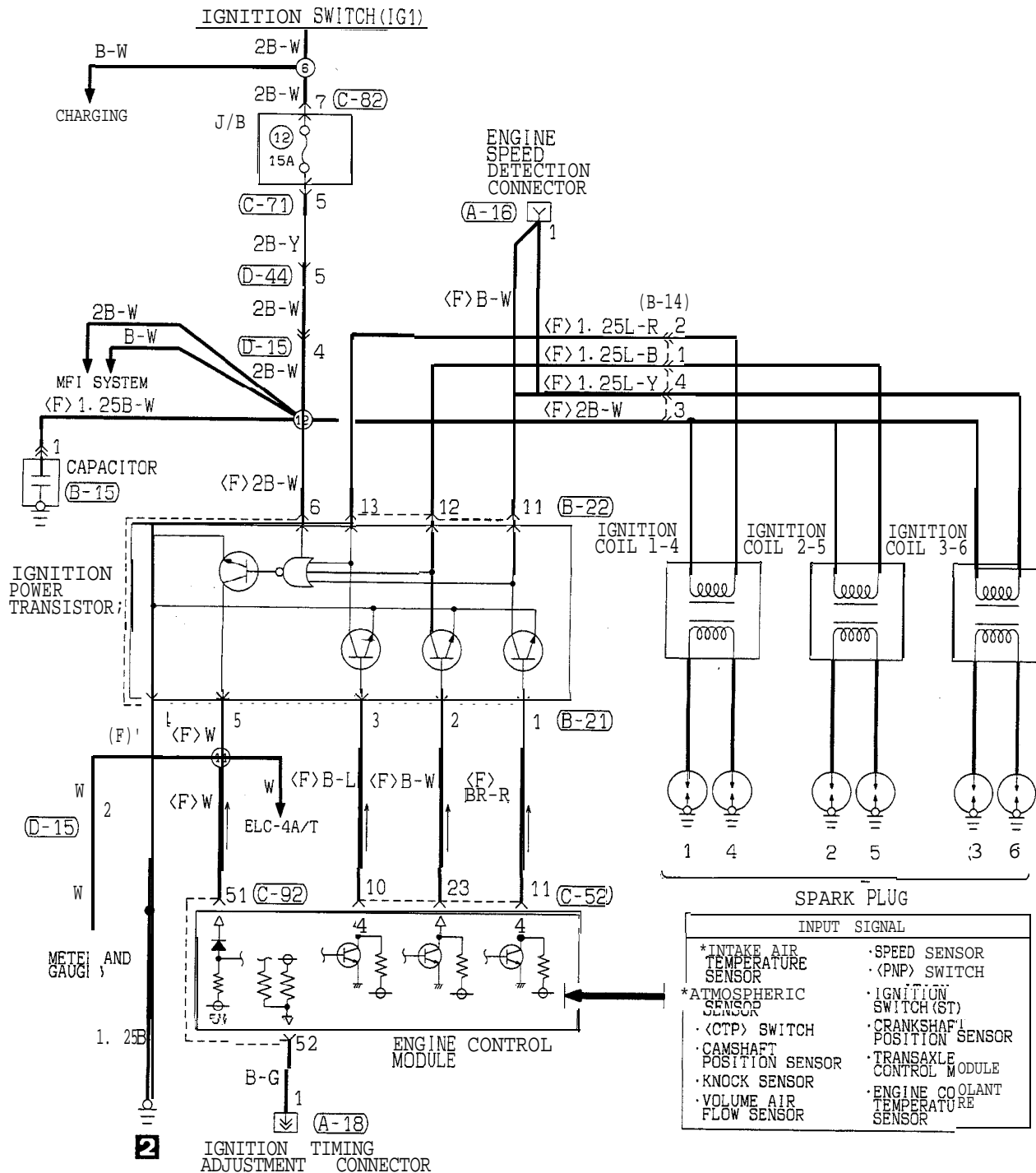
## CIRCUIT DIAGRAM



HR03M01AA

## (FROM 1996 MODELS)

## CIRCUIT DIAGRAM

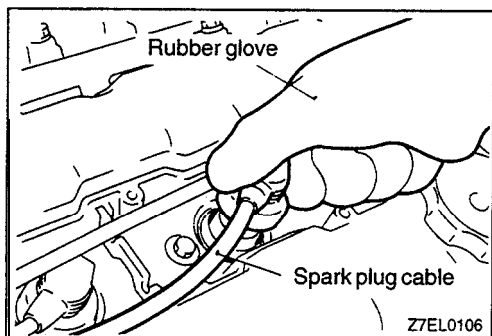


**OPERATION**

- Turn ignition switch to .“ON” position, and battery voltage will be applied to primary winding of ignition coil.
- When crankshaft position sensor and camshaft position sensor signal is input to engine control module, engine control module makes ON-OFF control of power transistors one by one.
- When power transistor is turned on, current flows from ignition coil (primary winding) to ground through power transistor.
- When power transistor A is turned from ON to OFF, the spark plugs of No. 1 and No. 4 cylinders spark. Turning of power transistor B from ON to OFF will produce sparking in spark plugs of No. 2 and No. 5 cylinders. Furthermore, when power transistor C is turned from ON to OFF, sparking is produced in spark plugs of No. 3 and No. 6 cylinders.

**TROUBLESHOOTING HINTS**

1. Engine cranks, but does not start.
  - (1) Spark is insufficient or does not occur at all (on spark plug).
    - Check ignition coil.
    - Check camshaft position sensor and crankshaft position sensor
    - Check power transistor.
    - Check spark plugs.
    - Check spark plug cable.
  - (2) Spark is good.
    - Check ignition timing.
2. Engine idles roughly or stalls.
  - Check spark plugs.
  - Check ignition timing.
  - Check ignition coil.
  - Check spark plug cable.
3. Poor acceleration
  - Check ignition timing.
  - Check spark plug cable.
  - Check ignition coil.



## ON-VEHICLE SERVICE

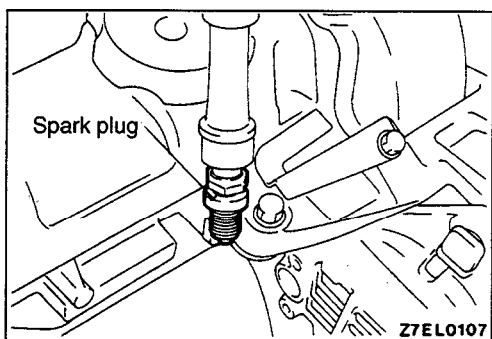
### SPARK PLUG CABLE TEST

- (1) Disconnect, one at a time, each of the spark plug cables while the engine is idling to check whether the engine's running performance changes or not.

#### Caution

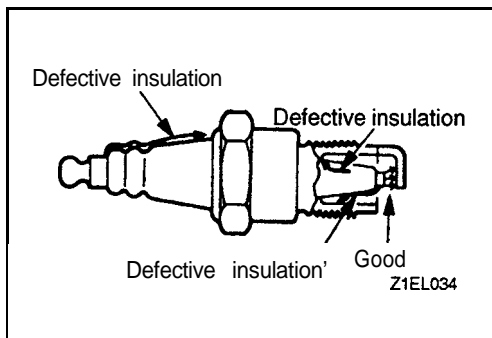
**Wear rubber gloves while doing so.**

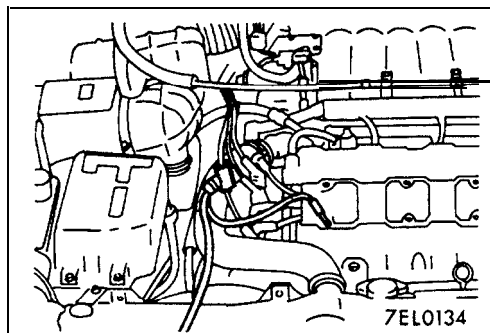
- (2) If the engine performance does not change, check the resistance of the spark plug cable, and check the spark plug itself.



### SPARK PLUG TEST

- (1) Remove the spark plug and connect to the spark plug cable.
- (2) Ground the spark plug outer electrode (body), and crank the engine.  
Check to be sure that there is an electrical discharge between the electrodes at this time.





## IGNITION SECONDARY VOLTAGE WAVE-FORM CHECK

### MEASUREMENT METHOD

- (1) Clamp SECONDARY PICKUP around spark plug cable.

#### NOTE

1. The ignition voltage peak appears reversely between when the spark plug cables of the cylinders No.4, No. 5 and No. 6 are clamped and when those of the cylinders No. 1, No. 2 and No. 3 are clamped.
2. Since the 2-cylinder simultaneous ignition system is employed, the wave-form for two cylinder appears group by group when the wave-form is observed. (Cylinder No. 1 – cylinder No. 4, cylinder No. 2 – cylinder No. 5 and cylinder No. 3 – cylinder No. 6 as the respective groups) Here, the wave-form is observed for the cylinder whose spark plug cable is clamped with the secondary pickup.

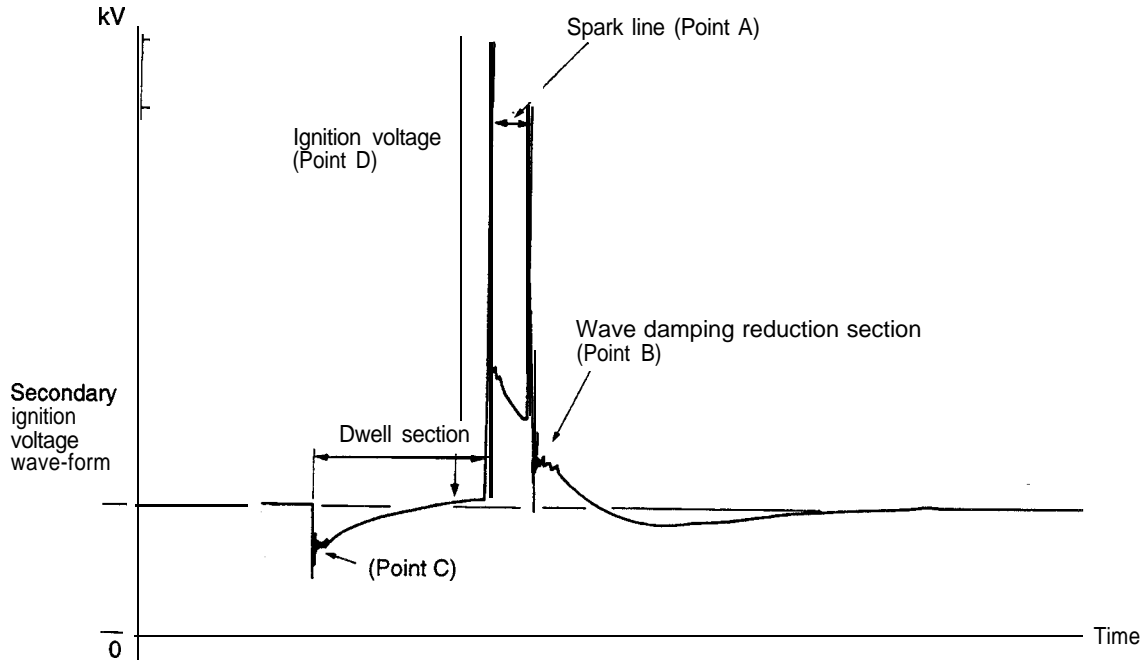
- (2) Clamp the spark plug cable with the trigger pickup.

#### NOTE

1. Clamp the spark plug cable of the cylinders No.1, No. 2 or No. 3 which belongs to the same group of the cylinders clamped with the secondary pickup.
2. Though it is difficult to isolate the cylinder of the wave-form, the wave-form of the cylinders clamped with the secondary pickup is stable. Use this as a reference for isolation.

STANDARD WAVE-FORM  
Observation Conditions

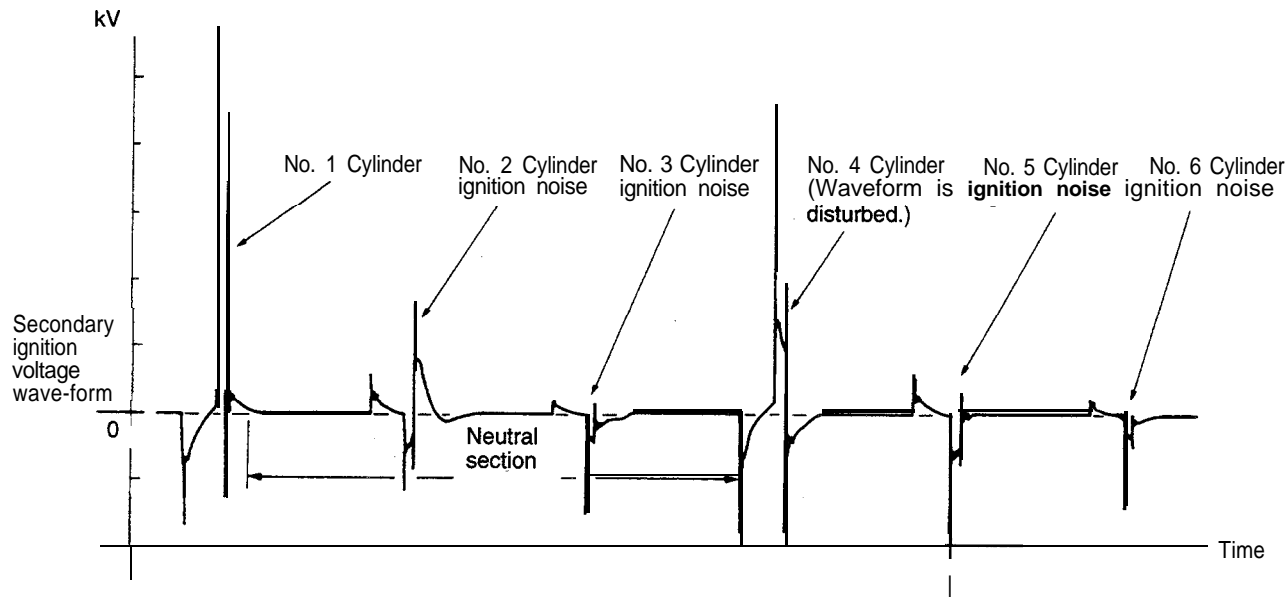
FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



7EL0147

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

PATTERN SELECTOR	DISPLAY
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7EL0148



**Wave-form Observation Points**

Point A: The height, length and slope of the spark line (refer to abnormal wave-form 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 wave-form example 5)

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




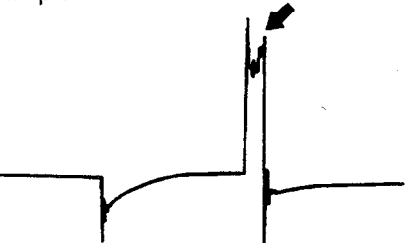
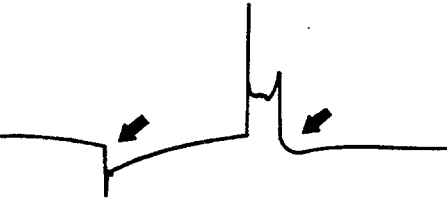
Point C: Number of vibrations at beginning of dwell section (Refer to abnormal wave-form example 5)

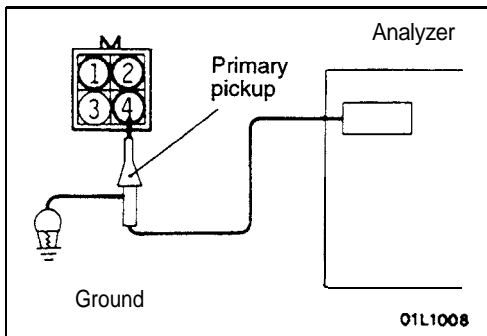
Number of vibrations	Coil
5 – 6 or higher	Normal
Except above	Abnormal

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 WAVE-FORMS

Abnormal wave-form	Wave characteristics	Cause of problem
<p>Example 1</p>  <p>Z01P0215</p>	Spark line is high and short.	Spark plug gap is too large.
<p>Example 2</p>  <p>Z01P0216</p>	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.
<p>Example 3</p>  <p>Z01P0217</p>	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
<p>Example 4</p>  <p>Z01P0218</p>	Spark line is high and short. Difficult to distinguish between this and abnormal wave-form example 1.	Spark plug cable is nearly falling off. (Causing a dual ignition)
<p>Example 5</p>  <p>Z01P0219</p>	No waves in wave damping section.	Rare short in ignition coil.



## IGNITION PRIMARY VOLTAGE WAVE-FORM CHECK

### MEASUREMENT METHOD

- (1) Remove the ignition coil connector and connect the special tool (harness connector: MD998464) in between.
- (2) When observing the No. 1 – No. 4 cylinder group, connect the primary pickup of the analyzer probe to the ignition coil side connector terminal No. 2 (black clip on the special tool).  
For the No. 2 – No. 5 cylinder group, connect to terminal No. 1 (red clip), and for the No. 3 – No. 6 cylinder group, connect to terminal No. 4 (white clip).
- (3) Ground the primary pickup ground terminal.
- (4) Clamp the spark plug cable with the trigger pickup.

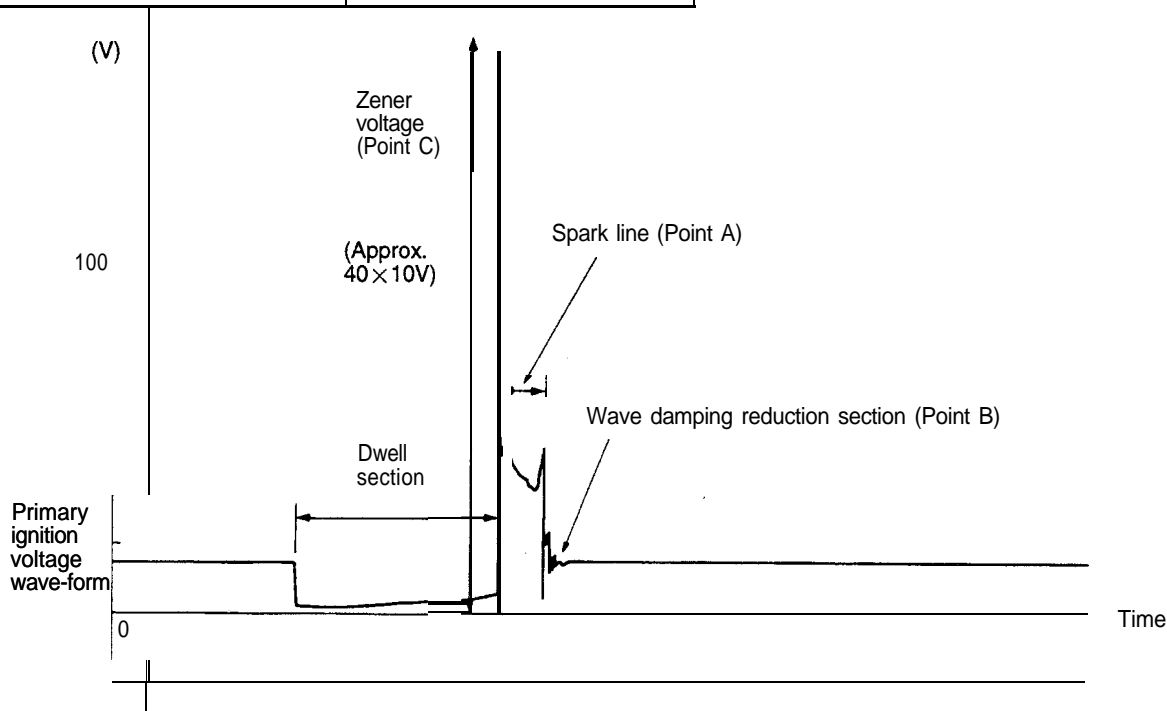
### NOTE

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

## STANDARD WAVE-FORM

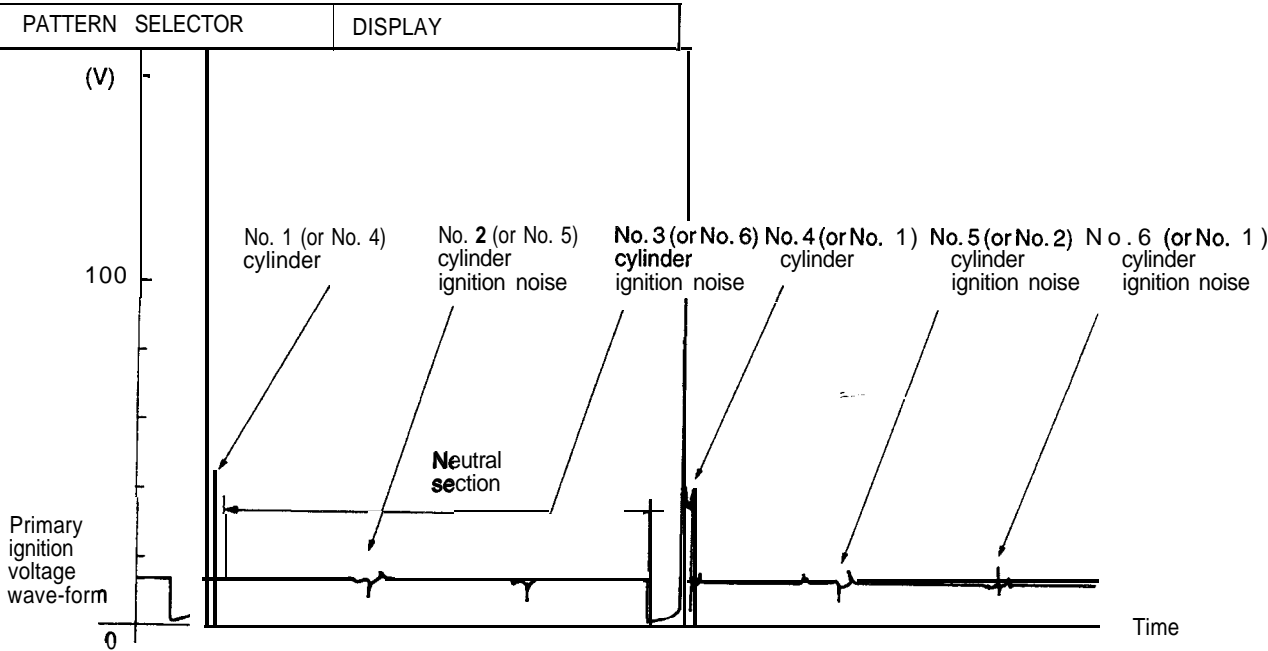
### Observation Conditions

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



7EL0149

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



7ELO151

**Wave-form Observation Points**

Point A: The height, length and slope of the spark line (refer to abnormal wave-form 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	–			

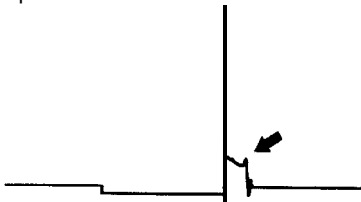
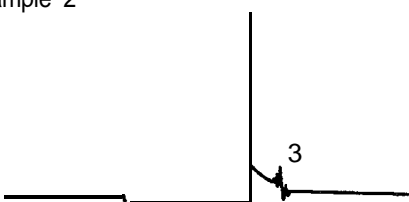

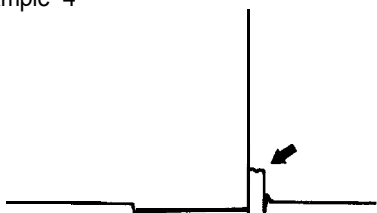
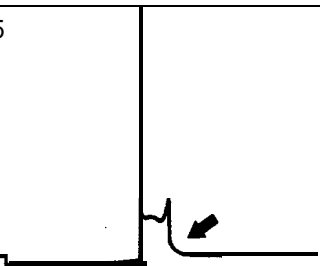
Point B: Number of vibrations in reduction vibration section  
(Refer to abnormal wave-form example 5)

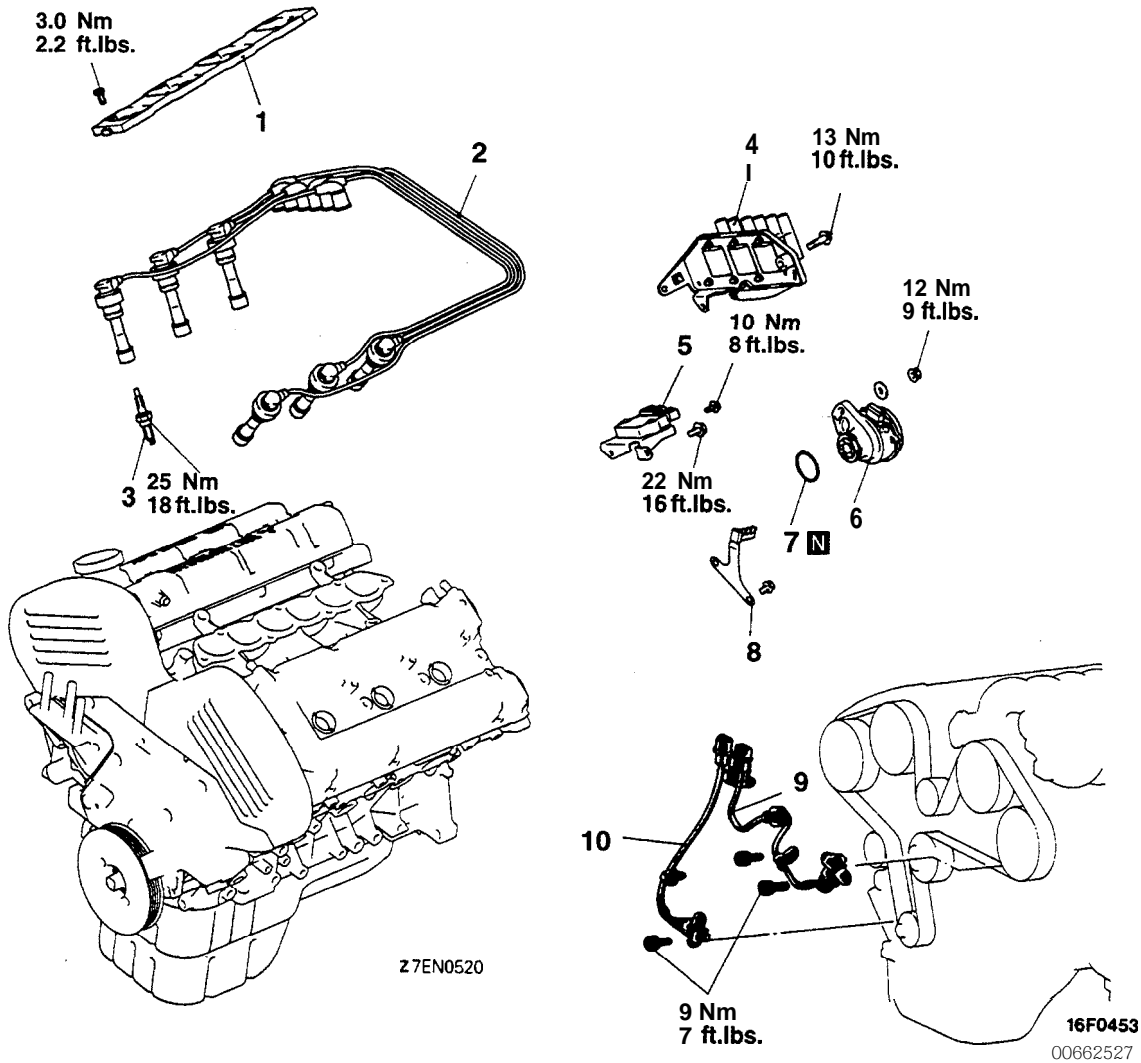
Number of vibrations	Coil and condenser
3 or higher	Normal
Except above	Abnormal

Point C: Height of Zener voltage

Height of Zener voltage	Probable cause
Higher	Problem in Zener diode
Lower	Abnormal resistance in primary coil circuit

## EXAMPLES OF ABNORMAL WAVE-FORMS

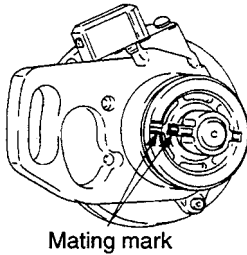
Abnormal wave-form	Wave characteristics	Cause of problem
<p>Example 1</p>  <p>Z01P0210</p>	Spark line is high and short.	Spark plug gap is too large.
<p>Example 2</p>  <p>Z01P0211</p>	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
<p>Example 3</p>  <p>Z01P0212</p>	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
<p>Example 4</p>  <p>Z01P0213</p>	Spark line is high and short.	Spark plug cable is nearly falling off. (Causing a dual ignition)
<p>Example 5</p>  <p>Z01P0214</p>	No waves in wave damping section.	Rare short in ignition coil.

**IGNITION SYSTEM****REMOVAL AND INSTALLATION****Removal steps**

- Intake manifold plenum (Refer to GROUP 15 – Intake Manifold.)

1. Center cover
2. Spark plug cable
3. Spark plug
4. Ignition coil
5. Ignition power transistor
6. Crankshaft position sensor <1 992 models>

7. O-ring <1992 models>
8. Clamp <From 1993 models>  
Camshaft position sensor, Crankshaft position sensor removal steps <From 1993 models>
- Timing belt cover (Refer to GROUP 11 – Timing Belt)
9. Camshaft position sensor
10. Crankshaft position sensor



Z7EL0095

**INSTALLATION SERVICE POINTS****▶A◀CRANKSHAFT POSITION SENSOR INSTALLATION  
<Up to 1992 model>**

- (1) Turn the crankshaft so that the No. 1 cylinder is at compression top dead center.

**Caution**

**Be careful not to turn it to the No. 4 cylinder compression top dead center by mistake.**

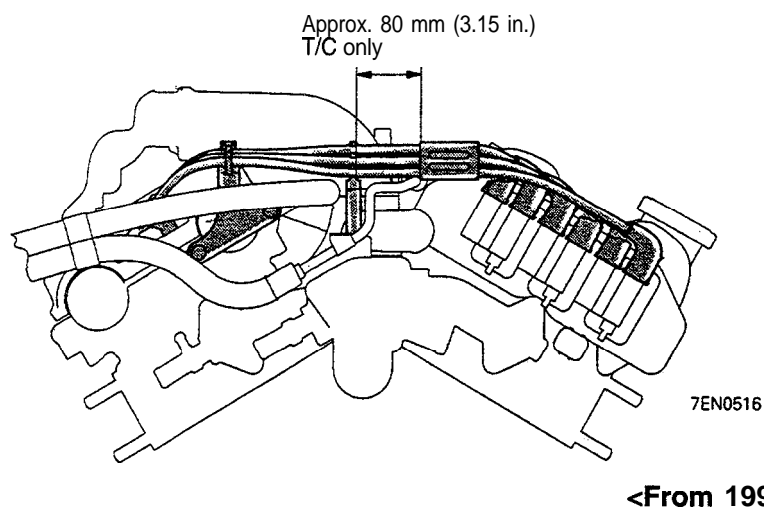
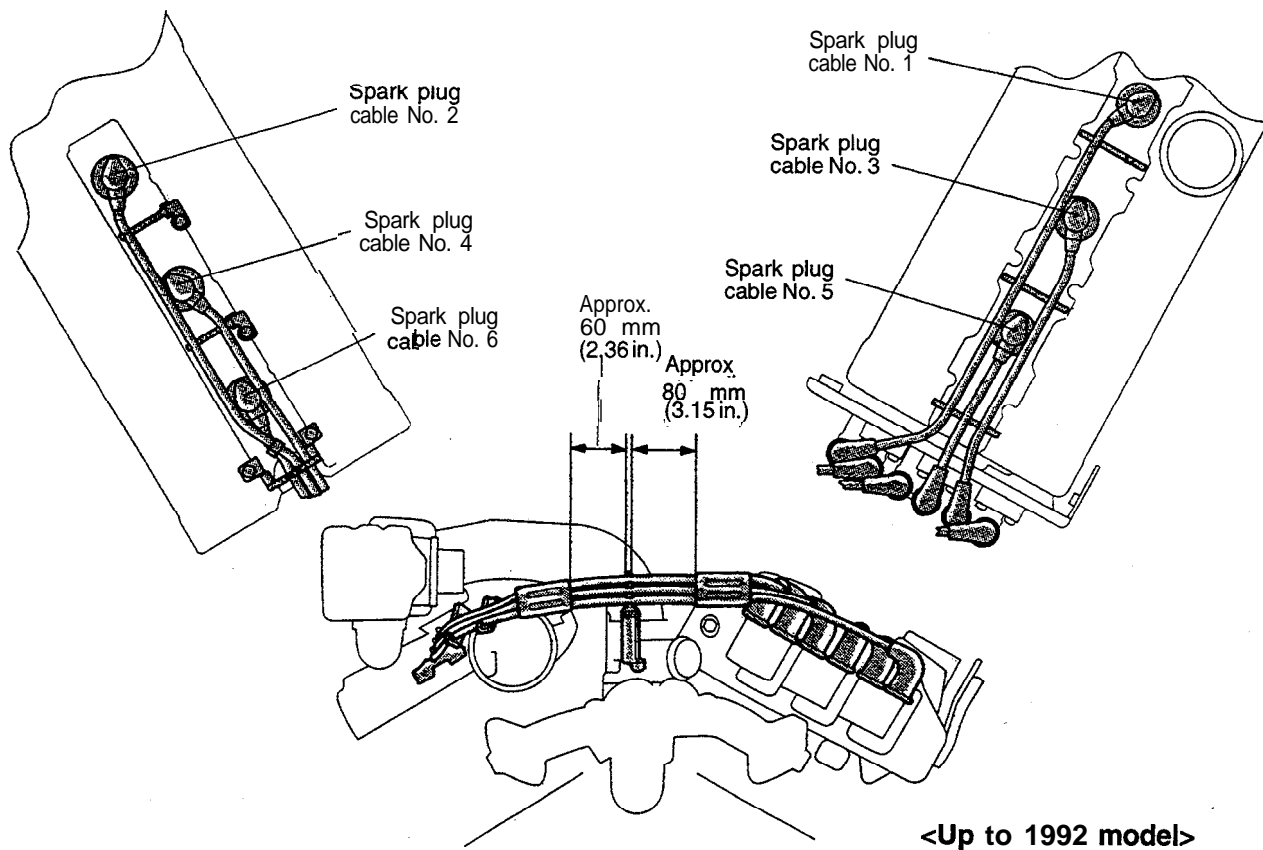
- (2) Install, lining up the matchmarks on the crankshaft position sensor housing and the coupling.

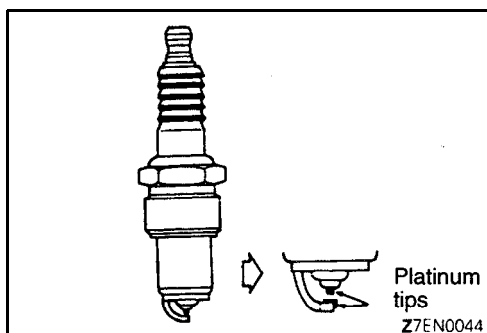
**▶B◀SPARK PLUG CABLE INSTALLATION**

Improper arrangement of spark plug cables will induce voltage between the cables, causing miss firing and developing a surge at acceleration in high-speed operation. Therefore, be careful to arrange the spark plug cables properly by the following procedure.

1. install the spark plug cable clamps as shown in the illustration.
2. The numerals on the support and clamp indicate the spark plug cable No.
3. Pay attention to the following items when the spark plug cables are installed.
  - (1) Install the cables securely to avoid possible contact with metal parts.
  - (2) Install the cables neatly, ensuring they are not too tight, loose, twisted or kinked.





**INSPECTION****SPARK PLUG**

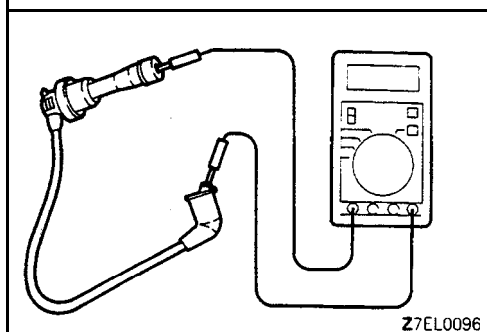
Check the plug gap and replace if the limit is exceeded.

**Standard value:** 1.0–1.1 mm (.039–.043 in.)

**Limit:** 1.3 mm (.051 in.)

**Caution**

1. Do not attempt to adjust the gap of the platinum plug.
2. Cleaning of the platinum plug may 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.

**SPARK PLUG CABLE**

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

**Limit:** Max. 22 kΩ

**IGNITION POWER TRANSISTOR****NOTE**

An analog-type circuit tester should be used.

**No. 1-No. 4 coil side**

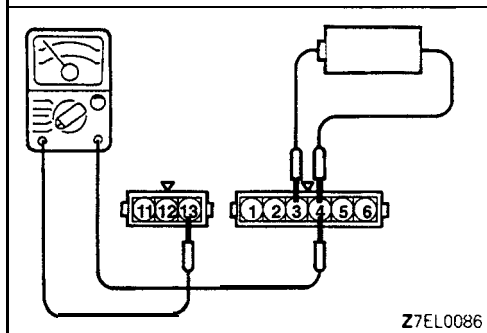
- (1) Connect the negative (–) terminal of the 1.5 V power supply to terminal (4) of the ignition power transistor; then check whether there is continuity between terminal (13) and terminal (4) when terminal (3) and the positive (+) terminal are connected and disconnected.

**N O T E**

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

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

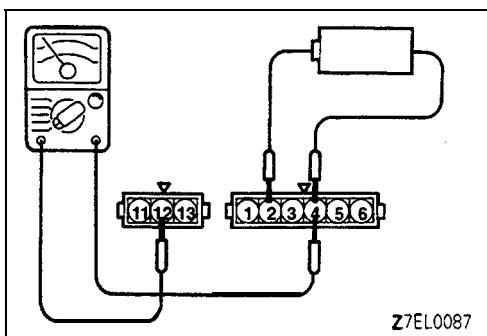
- (2) Replace the ignition power transistor if there is a malfunction.

**No. 2–No. 5 coil side**

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

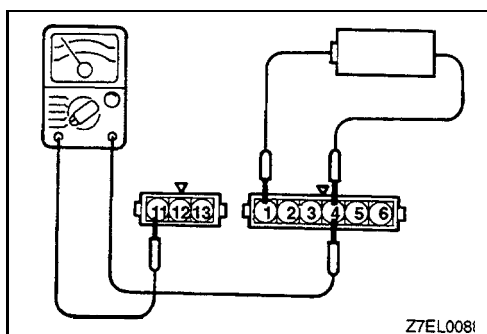
**NOTE**

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



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

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



### No. 3–No. 6 coil side

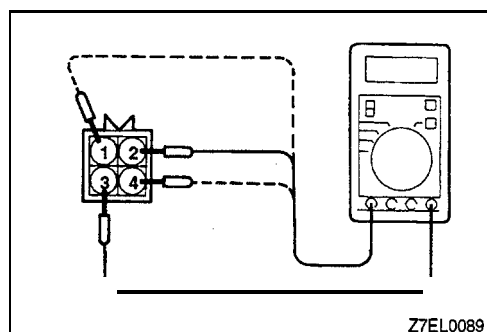
- (1) Connect the negative (–) terminal of the 1.5 V power supply to terminal (4) of the ignition power transistor; then check whether there is continuity between terminal (11) and terminal (4) when terminal (1) and the positive (+) terminal are connected and disconnected.

#### NOTE

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

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

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



## IGNITION COIL

### 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  $\Omega$

### 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 k $\Omega$

