

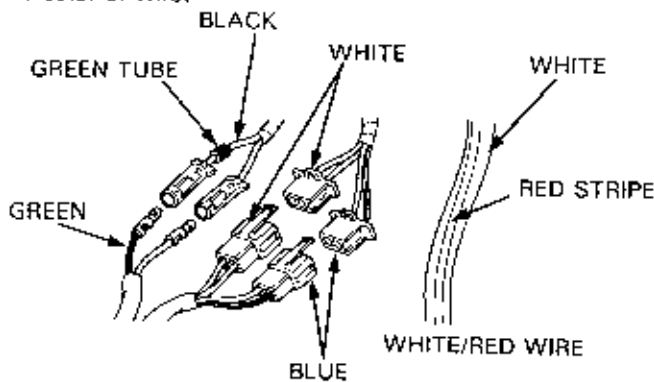
# 21. ELECTRICAL FUNDAMENTALS

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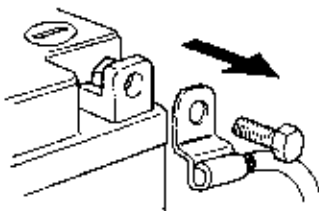
This chapter illustrates the safety precautions and the basic knowledge required for servicing electrical systems. Other chapters related to electrical systems do not contain the basic information presented in this chapter. Read this chapter thoroughly in order to understand the basic safety procedures and diagnostic methods before starting any servicing.

## SERVICE INFORMATION

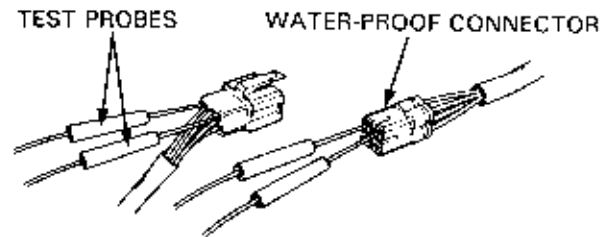
- Connect wires only with wires of the same color. However, in the few instances when wires with different colors are connected, there is always a colored band near the connector.
- Connect connectors with the same colored connectors.
- On wires with stripes, the stripe color is indicated after the color of wire.



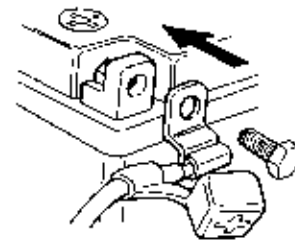
- Disconnect the negative cable of the battery before working on any electrical component.
- Do not let the tool contact the frame when disconnecting the cable.



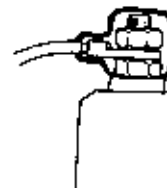
- When measuring voltage and resistance of wire terminals using testers; insert the probes from behind the connector. For water-proof connectors, insert the probes from the front to avoid opening the wire terminal.



- Connect the positive terminal first when connecting the battery.
- Coat terminals with clean grease after connection. Make sure the protective cover is secured on the terminal.



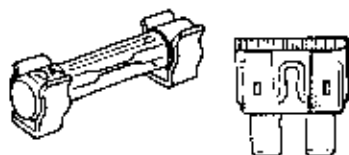
- After completing the job, check that all terminal protectors are placed correctly.



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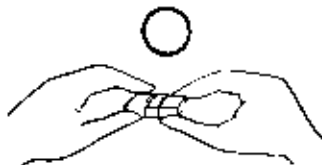
# ELECTRICAL FUNDAMENTALS

- If a fuse blows out, diagnose the cause and repair it. Replace the fuse with one of the correct rating.

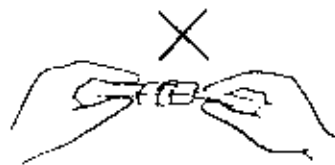


- When separating connectors, pull only on the connector housing. Do not pull on the wires.

CORRECT



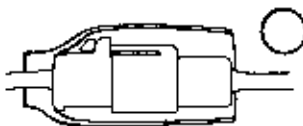
INCORRECT



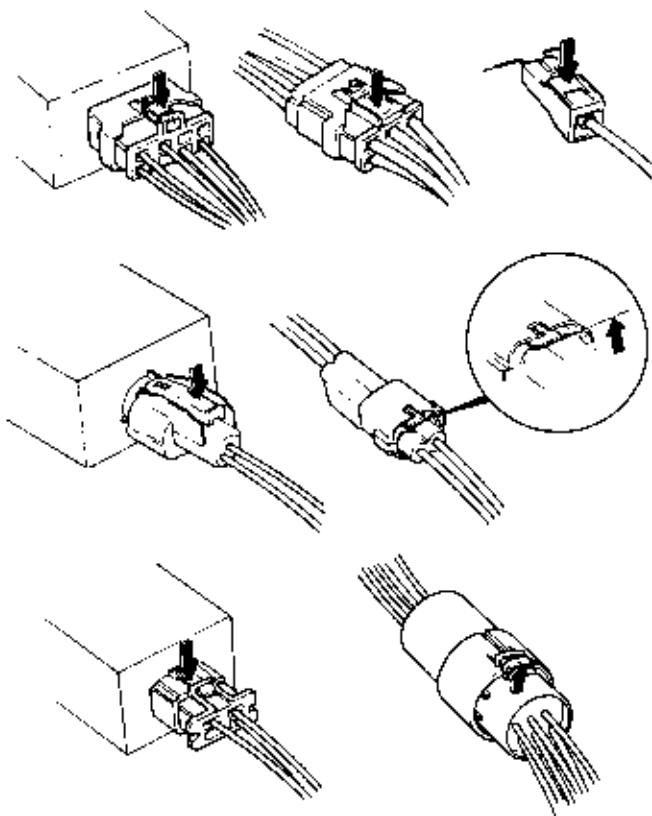
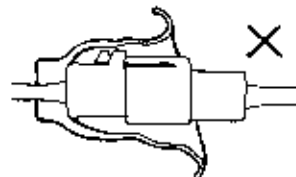
- Always separate the connectors with the ignition switch in the OFF position.
- Before separating the connector, check whether the connector is of the push-in type or pull-up type.
- For connectors with locks, push the connector in lightly then unlock the lock before disconnecting.

- Make sure protectors completely cover the connectors.

GOOD



NO GOOD



- Insert connectors all the way in.
- For connectors with locks, check that the lock is securely fastened.
- Make sure that the harnesses are secured to the motorcycle properly.

GOOD



CLICK

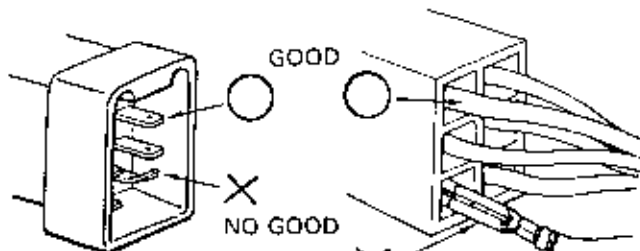


NO GOOD



- Before connecting connectors, check that the pins are straight and that all the wire terminals are intact and tight.
- If a terminal is corroded, clean it thoroughly before connecting.

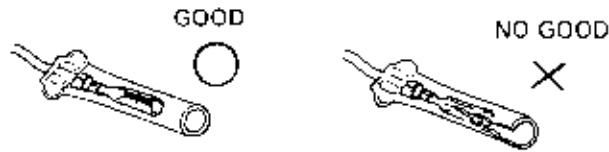
GOOD



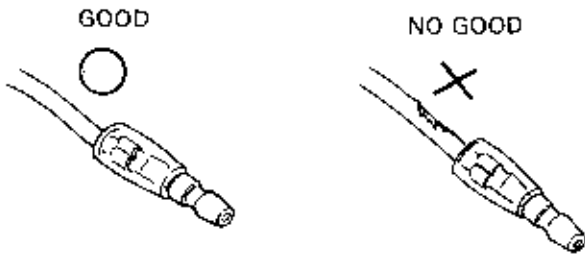
NO GOOD

NO GOOD

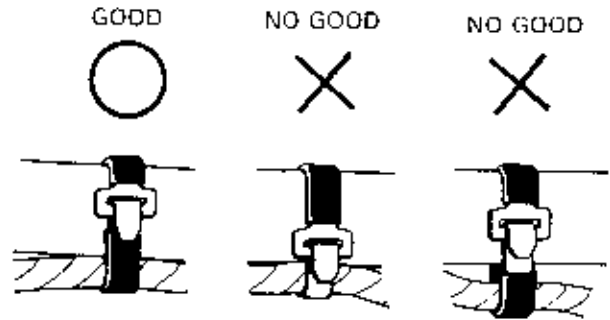
- Check for torn protective covers and oversized, loose fitting, female terminals before installation.



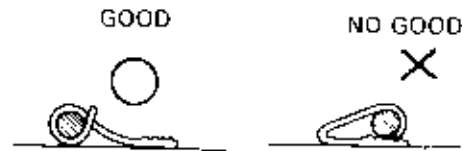
- Replace damaged wires with new ones.



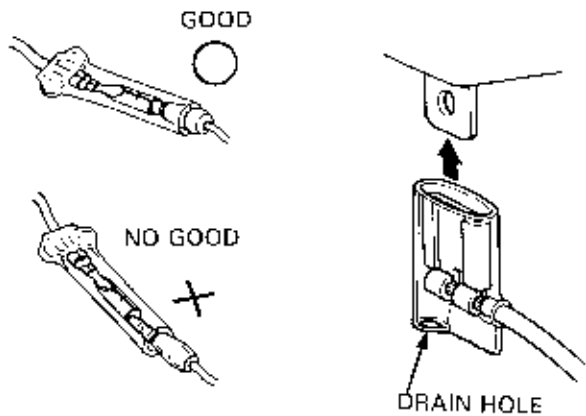
- Secure wires and wire harnesses to the frame with wire bands at the designated locations. Install the bands so that only the insulated surfaces contact the wires or wire harnesses.



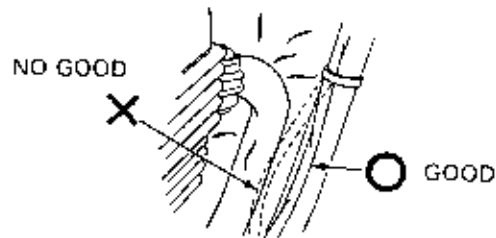
- Do not squeeze a wire against a weld or the end of its clamps.



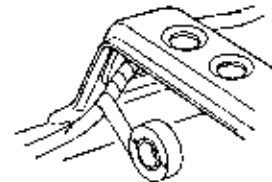
- When installing a connector, push it until it clicks into place.
- Check that connector protectors cover the terminals completely.
- Connectors with protectors facing up must have a drain hole.



- Check that harnesses cannot come in contact with hot parts after clamping.



- Protect wires and harnesses with at least two layers of electrical tape or with electrical harness tubes if they contact a sharp edge or corner.

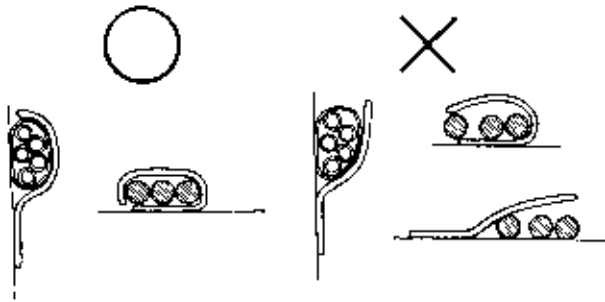


# ELECTRICAL FUNDAMENTALS

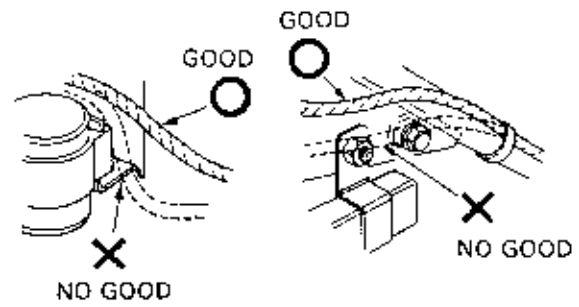
- Check that the wire harness is securely clamped at all locations.

GOOD

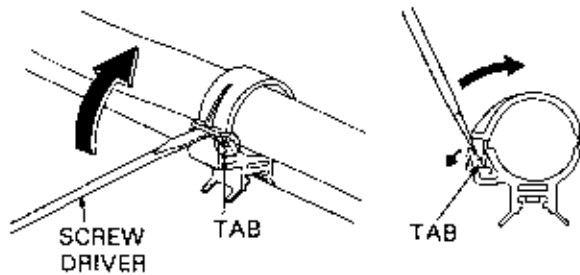
NO GOOD



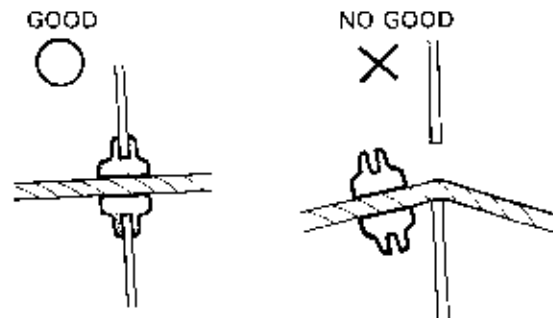
- Route wire harnesses to avoid sharp edges, corners or the projected ends of bolts and screws.



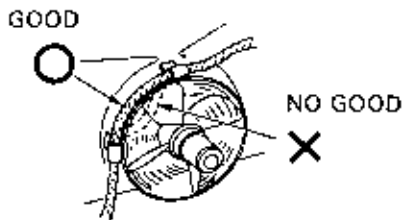
- To unlock wire harness or hose from a clip, use a screwdriver to open up the tab. When locking the clip, press firmly until it clicks. If the clip was removed from the frame, replace it with new one.



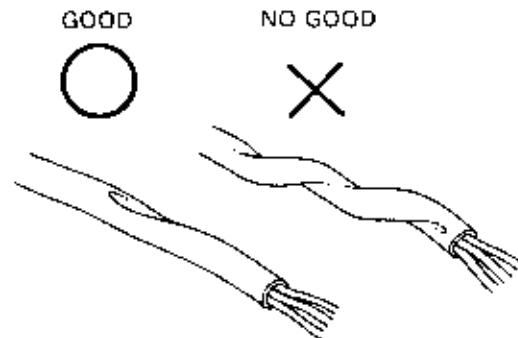
- Seat grommets in their holes properly.



- Check that the wire harness does not interfere with any moving or sliding parts after clamping.



- Do not bend or twist wire harnesses.

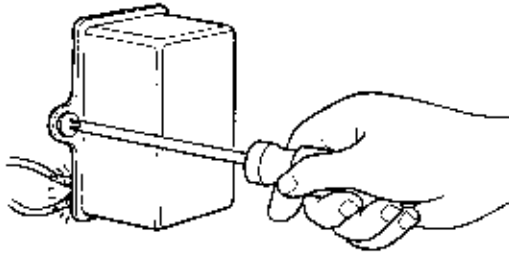


- Before using testers, read the instructions.

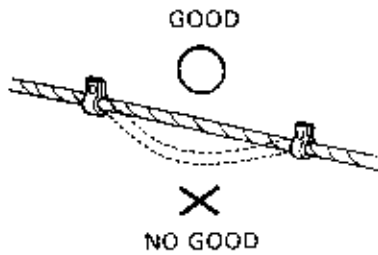
### CAUTION

- Do not drop parts containing semiconductors. Semiconductors are fragile and sensitive to shock. Dropping a semiconductor could damage or destroy it.

- Be careful not to pinch or trap wires or harnesses under items during installation.



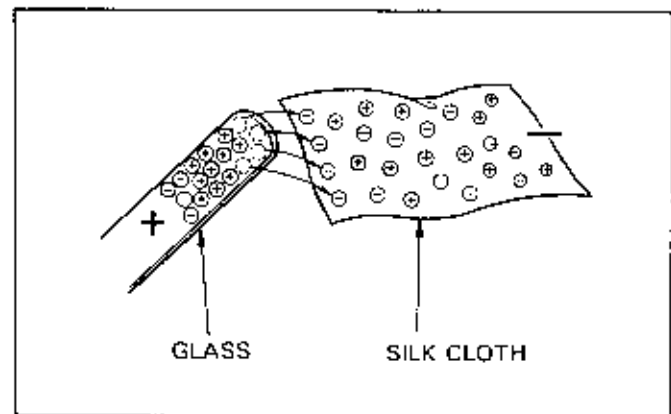
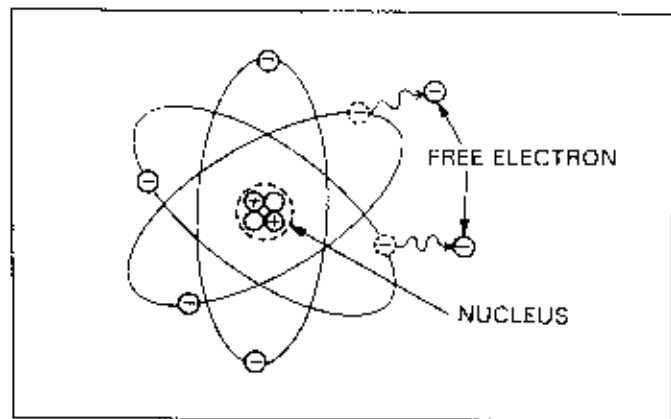
- Route wires and wire harness so that they are not too tight or loose when the handlebar is turned all the way to the right or left.
- Avoid routing wires and harnesses through sharp bends and around tight corners.
- Route harnesses so they are neither pulled taut nor have excessive slack.



## BASIC ELECTRONIC KNOWLEDGE

All matter, whether solid, liquid, or gas, are a collection of molecules, and each molecule is made up of atoms. Each atom consists of a nucleus, which is made up of protons and neutrons, and electrons which circle around the nucleus.

Electricity flows when these electrons freely move outward from their orbits. Some materials become conductors when there are a lot of free electrons and some become insulators when there are no free electrons. It is a well known fact that when a piece of glass is rubbed with silk cloth, it generates "Static Electricity" attracting a piece of paper towards it. This happens because the free electrons in glass move into the silk due to the heat generated by rubbing. As a result, the glass takes on a positive charge and the silk cloth takes on a negative charge.

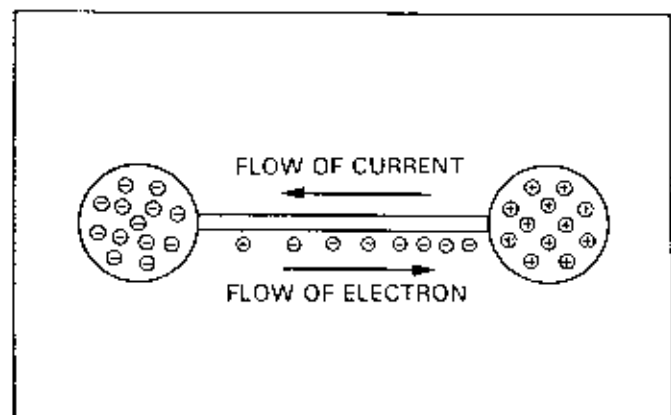


## CURRENT FLOW

When a positive charged material and a negative charged material are connected with a conductor, free electrons flow from negative charged to positive charged material. This flow of electrons is called "electricity". For a long time it was thought that electrical current flowed from the positive side of the source to the negative side. When it was discovered that electrons actually flow the other way it was too late to change existing publications on electricity. As a result, just for convenience, technical publications compromise by saying that electrical current flows from the positive to the negative side while electrons flow from the negative to the positive side.

It is convenient to think of the flow of electrical current as the flow of water.

The number of electrons passing any given point in a circuit in one second determines the current flowing through the circuit. The amount of current flow is measured in "Amperes (A)".



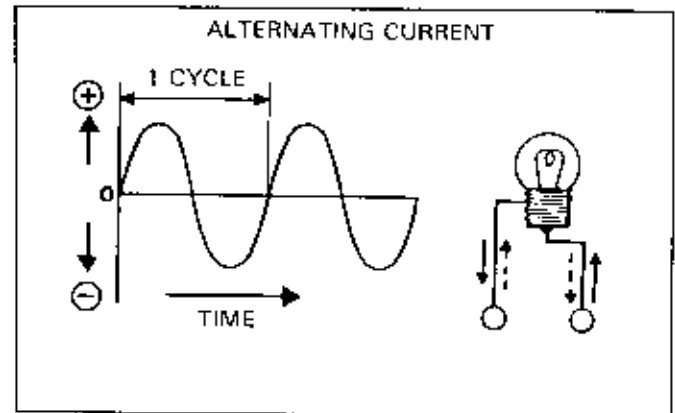
## ALTERNATING CURRENT AND DIRECT CURRENT

All electrical components are supplied with either alternating current or direct current, abbreviated as AC or DC respectively.

The fundamental characteristic of the two currents differ completely, and for the purpose of servicing, you need to have a good understanding of these differences.

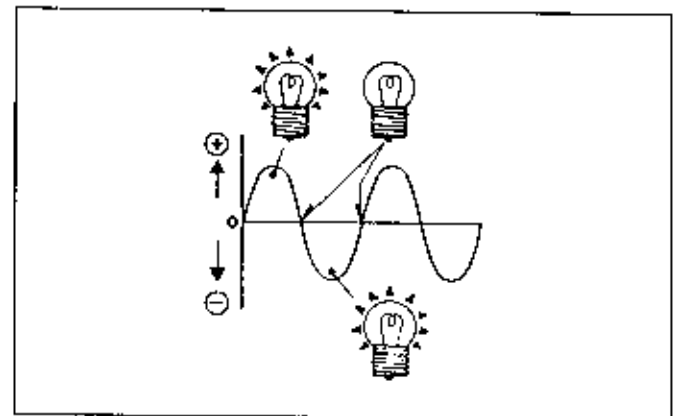
**Alternating-current**

Alternating current (AC) changes in voltage value and polarity with time. AC current flows in one direction until peak voltage is reached and then drops to zero volts. AC current then changes direction or polarity until peak voltage is achieved and again drops to zero and again changes polarity. From peak positive voltage to peak negative voltage and back again to peak positive voltage is known as a cycle.



In motorcycles, all electricity generated is AC. However, AC can be converted to direct current (DC) by rectification. The DC current is then supplied to components operating on DC. For example, some models use DC for their headlights and others use AC.

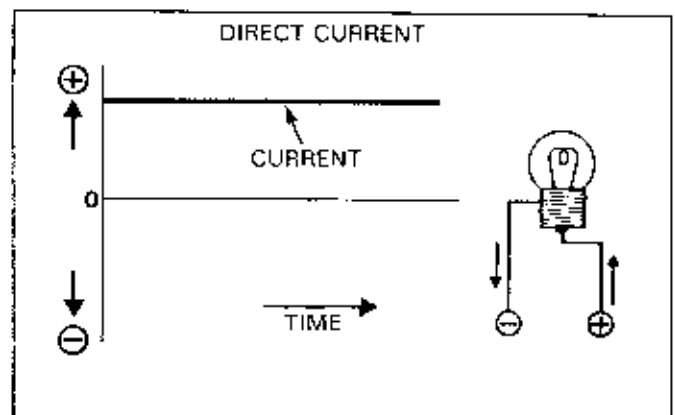
For headlights operating on AC, the lights turn off when the current flow is zero, and then go back on again as the polarity becomes reversed. This ON-OFF cycle is repeated at a high frequency (number of cycles in one second) and is not noticeable.

**Direct current**

Direct current is a current whose magnitude and direction remain constant. Its form is shown in the graph. Direct current is abbreviated as DC. Motorcycle batteries, and household batteries supply DC.

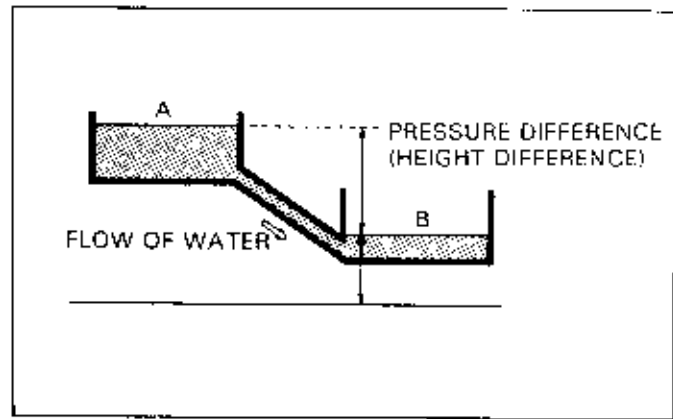
DC has the following characteristics as opposed to AC.

- DC can be stored in batteries and discharged when needed. (AC cannot be stored)
- DC is capable of a large current flow. (Good for starter motors)
- DC voltage cannot be stepped up or down. (AC can change its voltage by using a transformer)

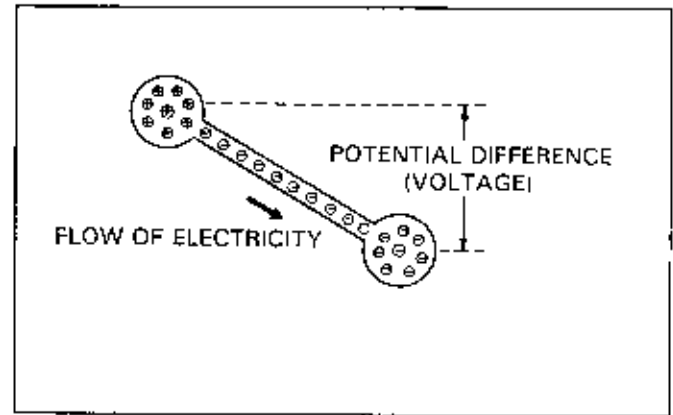


## VOLTAGE

As illustrated in the figure to the right, when two water tanks, A and B, are connected, water flows from tank A to tank B. This flow is the result of a pressure difference between the two tanks.

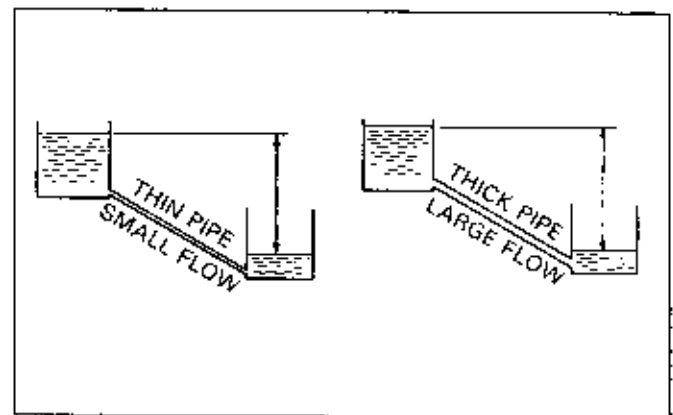


This same concept applies to electricity. The pressure difference, called the electrical potential difference, causes current to flow through a circuit. The pressure of the current is measured as voltage (V).

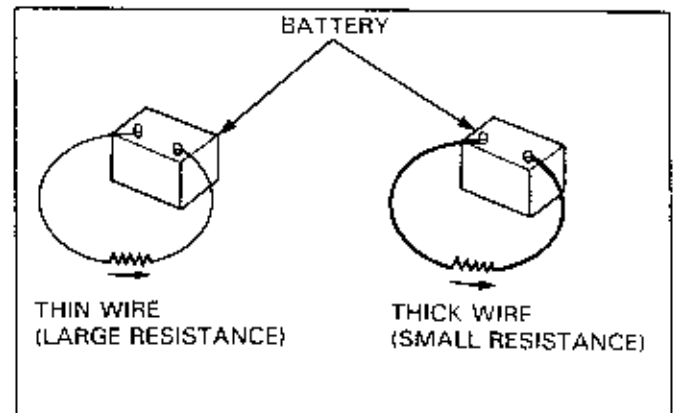


## RESISTANCE

As everyone knows, water flows through a larger pipe easier than a smaller pipe. This is because the smaller pipe provides greater resistance. Similarly, electrical current flows through a thicker wire (conductor) more easily than a thinner wire. The resistance limiting the flow of electricity through a wire is measured in Ohms ( $\Omega$ ).



Resistance increases as the size of wire become smaller and longer. This resistance value can be measured with an ohmmeter.



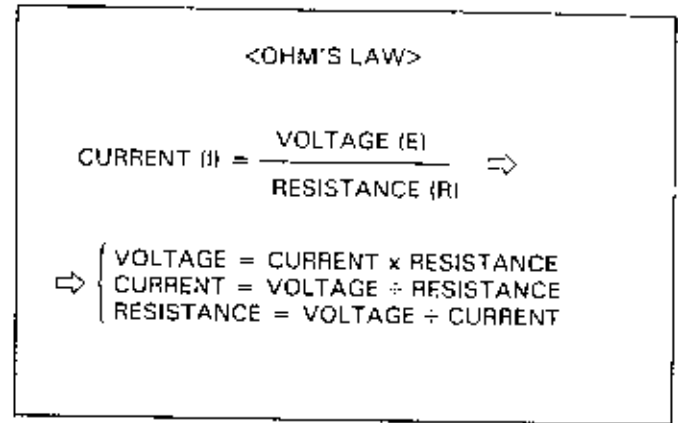


## OHM'S LAW

The amount of current flowing through a conductor in a closed circuit is proportional to the voltage applied to the conductor. The relationship between voltage and current flow and resistance is known as Ohm's law.

For example, if a 6  $\Omega$  resistor is connected to the + and - terminals of a 12 V battery, the current flowing through the resistor can be calculated by Ohm's law:

$$\text{Current} = \text{Voltage} \div \text{Resistance} = 12 \div 6 = 2 \text{ A}$$



## POWER

We use electricity to operate headlights or starter motors, or we convert it to heat.

The amount of work required to do these things is measured in Watts. Changing voltage (Volts) or the rate of current flow (Amperes) increases or decreases electrical power output (Watts).

The relationship is defined as:

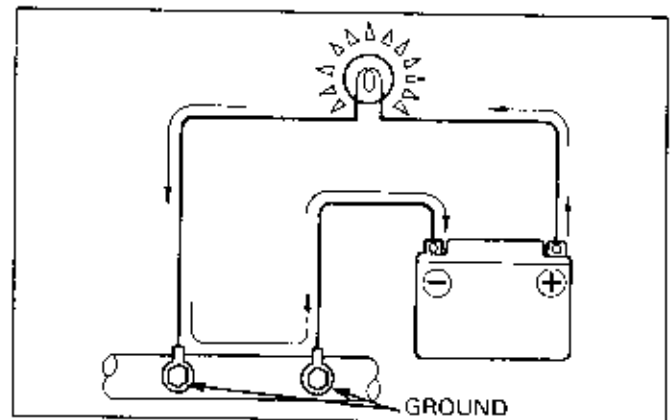
$$W = E \cdot I \text{ (Power} = \text{Voltage} \times \text{Current)}$$

## ELECTRICAL CIRCUIT

As shown in the right diagram, when a light bulb is connected to a battery, the current flows in the direction of the arrow and the light bulb turns on.

The path in which an electric current flows, is called a circuit. On Honda motorcycles, scooters and ATVs, the ground wire of an electrical circuit is connected to the engine or frame. Grounding the negative terminal is called a negative terminal ground type.

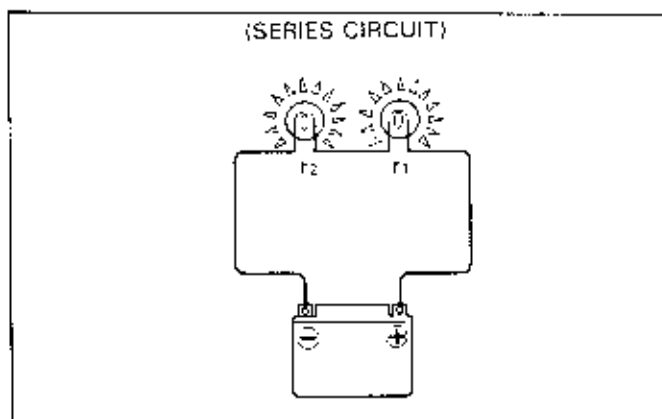
All Honda motorcycles, scooters and ATV share the negative ground circuit shown in the right diagram.



## ELECTRICAL FUNDAMENTALS

### Series circuit

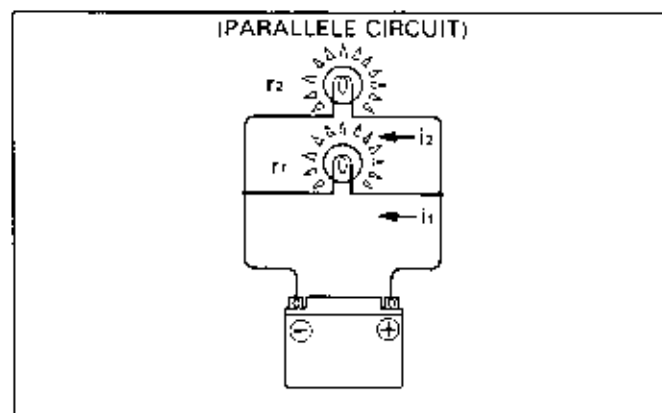
A series circuit is an electric circuit in which the current flows through one device into another, and then to ground. There is only one current path and the voltage is distributed by the loads. The total resistance ( $R$ ) can be found by simply adding all the resistances. eg.  $R = R1 + R2$



### Parallel circuit

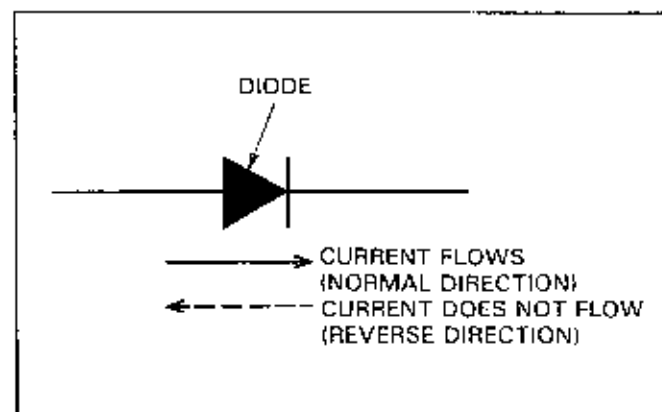
A parallel circuit is an electric circuit which has two current paths, one for the positive and one for negative. The devices are connected across the two paths. The voltage on each load is the same, but the current branches out to each load. the current flow to each load can be calculated as  $i1 = E \div r1$ ,  $i2 = E \div r2$ .

The total current ( $I$ ) is the sum of all current flowing to each load.



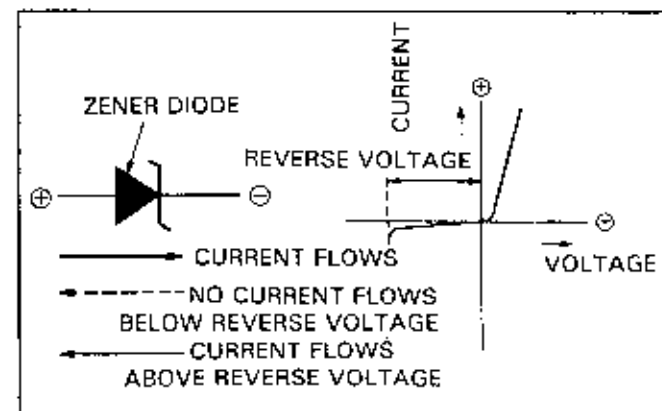
## DIODE

The diode allows current to flow in only one direction. When current is flowing, there is a slight voltage drop across the diode.



## ZENER DIODE

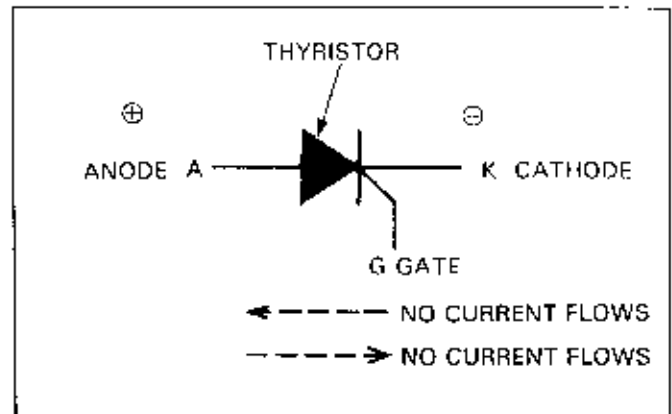
The zener diode allows current to flow in one direction similar to the diode above. When a certain reverse voltage is applied, current abruptly flows in the reverse direction. When the voltage is reduced below the reverse voltage, current flow in the reverse direction stops.



## THYRISTOR (SCR)

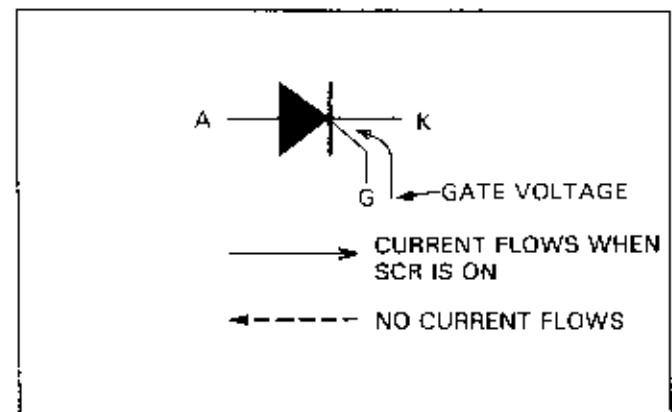
Thyristors have three terminals: anode, cathode, and gate. The current flowing from the anode to cathode is said to be in the positive direction.

Like diodes, thyristors do not flow current in the negative direction. Thyristors allow current to flow from anode to cathode only when the thyristor is turned on.



The thyristor is turned on when a certain amount of voltage is applied to the gate. This input to the gate is called gate voltage or trigger voltage.

Once the thyristor is turned on, there is no need to continuously apply voltage to the gate, and its characteristic becomes identical to a regular diode.



## SEMICONDUCTOR

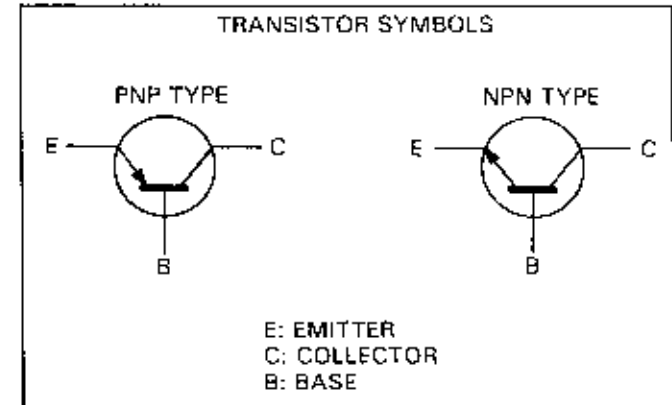
The electrical conductivity of semiconductors lies between that of conductors and insulators.

Before understanding how they work in circuits, you need to have a basic knowledge of its characteristics.

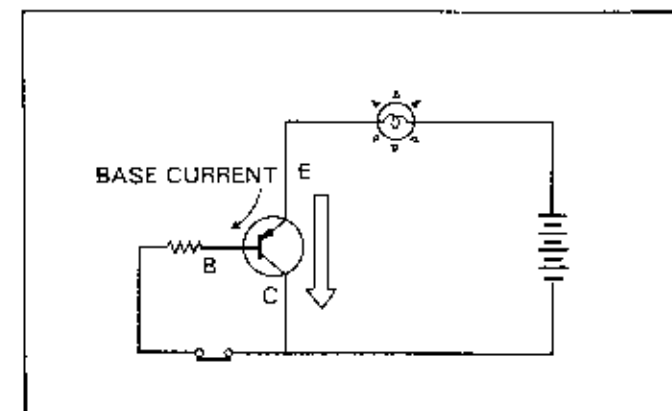
### Transistor

A transistor has three terminals; emitter (E), collector (C), and base (B).

There are two types of transistors: PNP and NPN type.



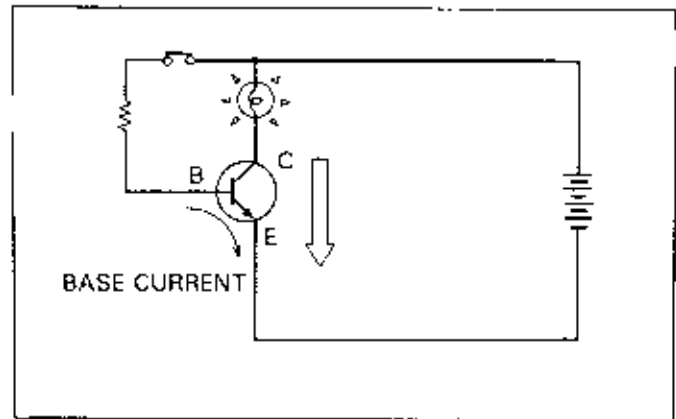
In PNP type transistors, when a positive voltage is applied to the emitter and negative voltage to the collector, almost no current flows from the collector to the emitter. If the emitter voltage is raised slightly higher than the base voltage and a small amount of current flows from the emitter to the base, a large amount of current flows from the emitter to the collector.



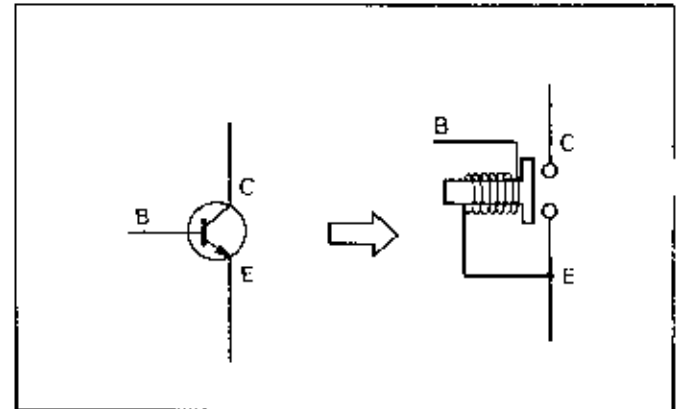
## ELECTRICAL FUNDAMENTALS

In the NPN type, almost no current flows when a positive voltage is applied to the collector and a negative voltage to the emitter. When a small current flows from the base to the emitter, a large current flows from the collector to the emitter.

In this way, the transistor resembles an amplifier in that the amount of collector to emitter current is controlled by the base current.



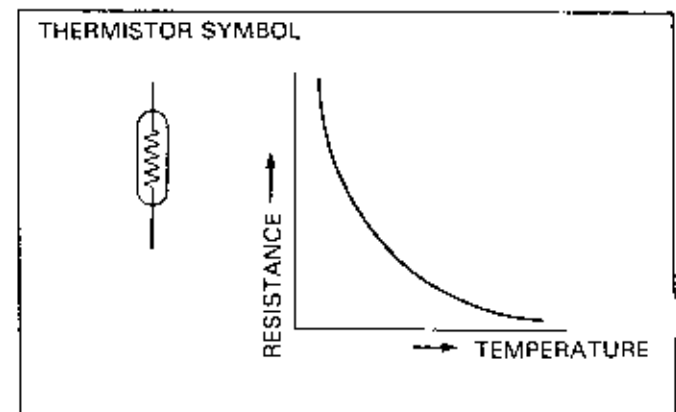
Transistors also resemble switching devices. The transistor is turned on, allowing collector to emitter current to flow when there is base current, and turn off when no base current exists.



### Thermistor

In general, the resistance value of most metals, including copper, increases as the temperature rises. In contrast, the resistance of a thermistor decreases as the temperature rises. When heat is applied to a substance, the activity of its molecules increases and prohibits the flow of free electrons. This increases the resistance.

For the thermistor, the number of free electrons increases as heat is applied. In this case, the activity of the molecules no longer obstructs the flow of electrons and the resistance decreases.



# ELECTRICAL SYMBOLS

The symbols below are the most common type of symbols used in electrical circuits.

Abbreviations used in switching devices are as follows:  
 NO (Normally Open): Switch is open at rest  
 NC (Normally Closed): Switch is closed at rest.

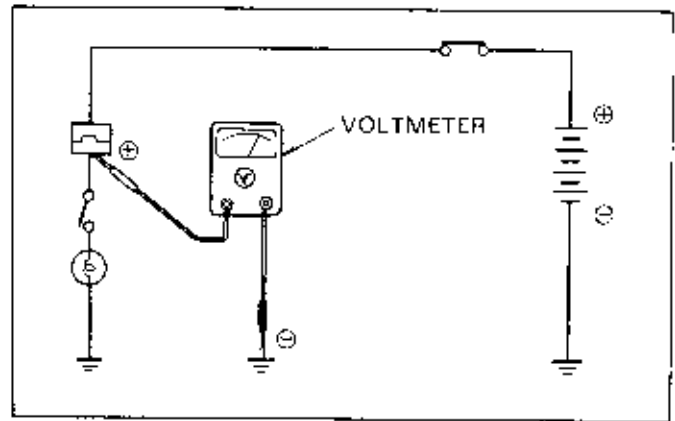
BATTERY	CONNECTION		MULTI-TESTER			MOTOR
	Connected	No connection	Voltmeter	Ohmmeter	Ammeter	
<b>PUMP</b> 	<b>CONNECTOR</b> P = # of pin COLOR  Female side Male side	<b>CONNECTOR (Round type)</b>  Female side Male side	<b>CONNECTOR (Flat type)</b>  Female side Male side	<b>EYELET TERMINAL</b> 		
<b>IGNITION SWITCH (Circuit symbol)</b> 	<b>IGNITION SWITCH (Wiring symbol)</b> 	<b>SWITCH (Two terminal)</b>  NO NC	<b>SWITCH (Three terminal type)</b>  HL Hi Lo		<b>SWITCH (Combination type)</b> 	
<b>FUSE</b> 	<b>RELAY (NO type)</b> 	<b>RELAY (NC type)</b> 	<b>LIGHT BULB</b>  DOUBLE FILAMENT		<b>GROUND</b> 	
<b>THREE PHASE ALTERNATOR</b> 	<b>SINGLE PHASE ALTERNATOR</b> 	<b>PULSE GENERATOR</b> 	<b>IGNITION COIL (Single type)</b> 		<b>IGNITION COIL (Dual type)</b> 	
<b>SPARK PLUG</b> 	<b>RESISTOR</b> 	<b>VARIABLE RESISTOR</b> 	<b>COIL</b> 	<b>SOLENOID</b> 	<b>LED</b> 	<b>CAPACITOR</b> 

# BASIC ELECTRICAL DIAGNOSTIC METHODS

## VOLTAGE MEASUREMENT

Measuring voltage is a fundamental method of checking circuit components. The measurement is conducted for the following reasons.

- ① To check if voltage exists. A test light could be used.
- ② To measure the actual voltage value. A voltmeter is used to determine if electrical component is operating normally.

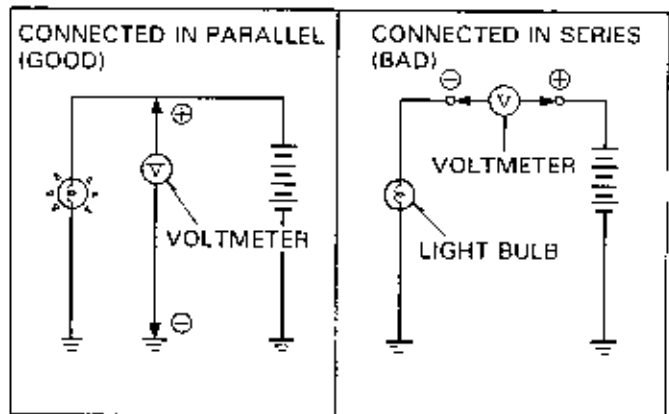


## HOW TO MEASURE VOLTAGE USING VOLTMETER

### NOTE

- Make sure the ground surface is clean and free of paint. Use a bolt attached directly to the frame.

Select a range that is one scale higher than the desired voltage value. Apply the red probe to the positive end and the black probe to the negative end of circuit. The diagram on the right shows that the voltmeter registers the voltage across the light bulb. Voltmeters are always connected in parallel, not in series.

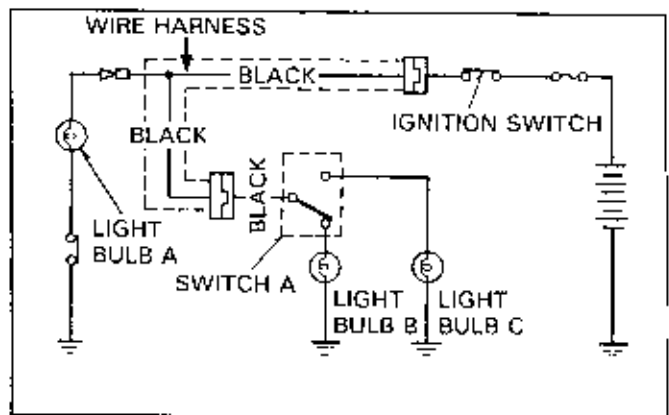


### Example 1

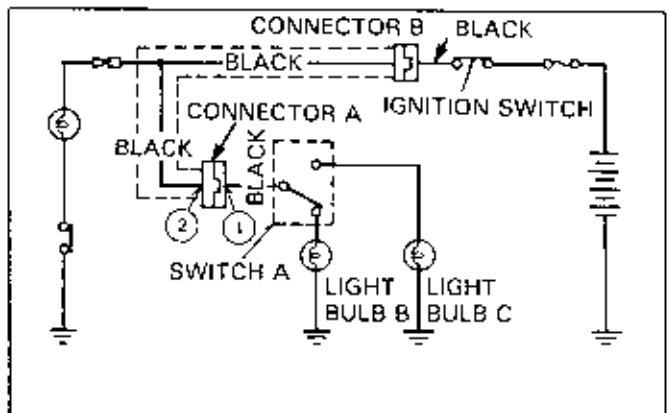
First study the circuit diagram.

If light bulbs B and C do not work, and A is OK, the malfunction is between the grounds at B and C and switch A.

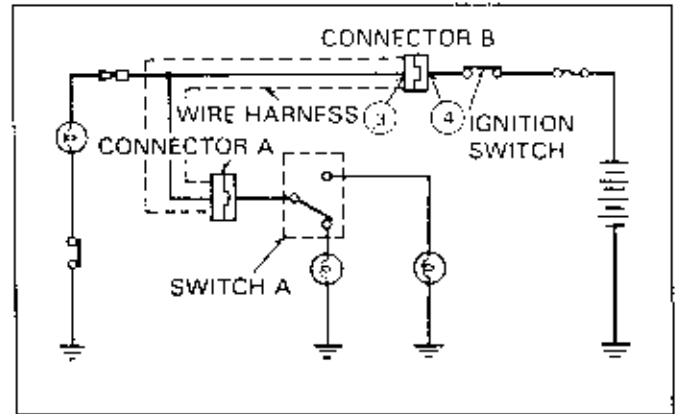
If light bulb A does not work also, the problem is between the grounds at A, B, and C and the ignition switch.



1. With the ignition switch ON and both light bulbs B and C do not work, check voltage at ①.
  2. If no voltage is measured at ①, check voltage at ② in case of false connection at connector A. If voltage exists at ② and not at ①, there is problem in the connection at connector A.
- If voltage registers at both ① and ②, switch A should be checked.



3. If voltage at ① and ② do not exist, check voltage at ③ and ④ in a similar manner.
- If there is no voltage at ③ and ④, check wiring between ignition switch and battery.
  - If there is voltage at ③ and ④, check for a broken wire or a short circuit in the wire harness. Exchange the wire harness with a new one if necessary.
  - If there is voltage at ④ and not at ③, then check for loose connector B.



### Example 2

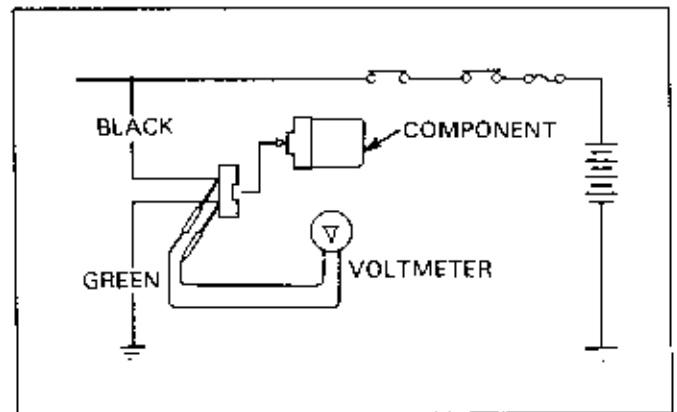
Sometimes it is easier to diagnose a component by measuring from its input terminals directly.

Here, the (+) probe goes to the positive input terminal and (-) probe goes to the ground wire of the component.

If no voltage is measured, there are two possible causes.

- ① No voltage at the positive input terminal.
- ② A loose ground wire.

For ①, check for voltage between the input terminal leading to the battery and ground. For ②, check for continuity between the green wire terminal to ground.

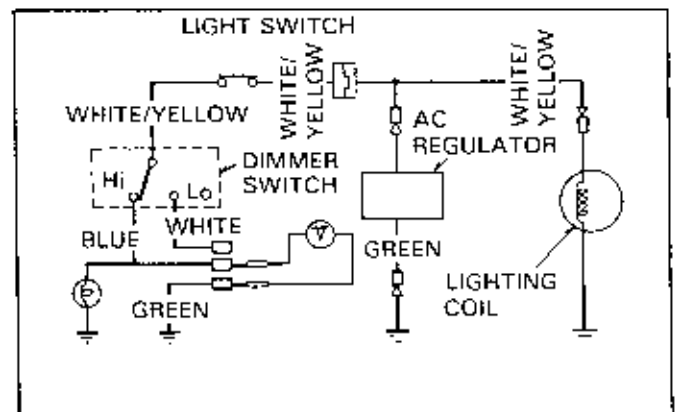


### Example 3

Voltage measurement is frequently used to check if a system is working correctly.

For instance, if a light bulb blows out frequently, it needs to be checked with an AC voltmeter to see if an excessive voltage is apparent.

In this case, measure the AC voltage of the light bulb terminals to see if it is within the specified voltage range.

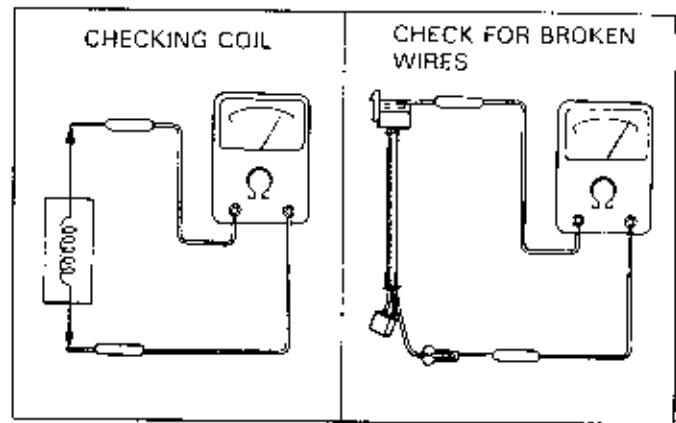


MEASURING RESISTANCE

Along with voltage, resistance is another basic parameter for diagnosing circuits and their components.

Resistance is measured for the following reasons.

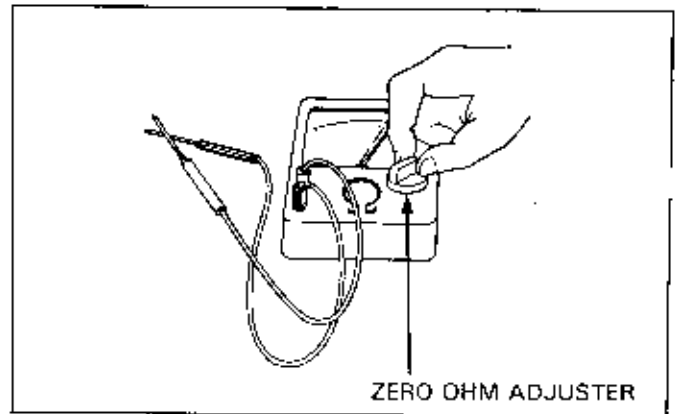
- ① To check if components are working properly.  
The resistance value of a coil (eg. ignition coil) indicates if it is normal or malfunctioning.
- ② To check for a broken wire.  
A continuity check indicates if a wire is intact or broken.



How to measure resistance using an ohmmeter.

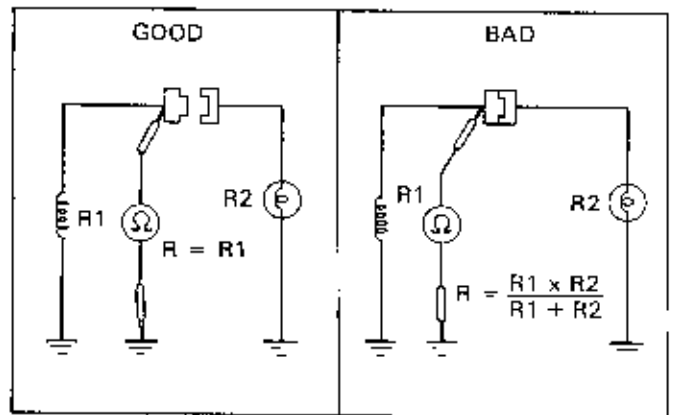
NOTE

- Proper zeroing of the ohmmeter is necessary to obtain correct measurements. Touch the two probes and adjust the ohmmeter so that it registers 0 (ohms symbol).

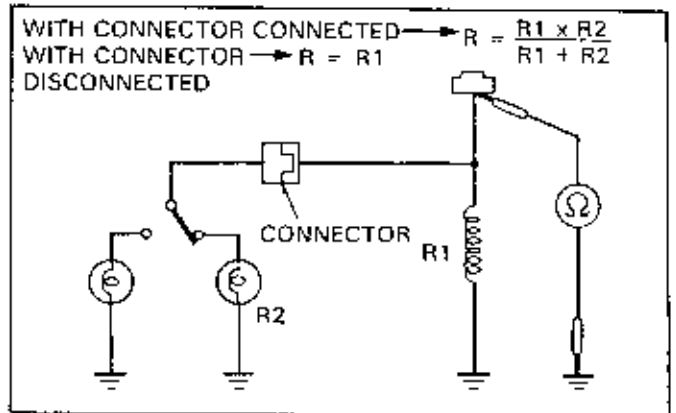


Since the polarity of terminals is not important, either probe may be applied to the terminal. However, since diodes allow current to flow in one direction only, the polarity is important.

Unlike when measuring voltage, it is necessary to disconnect the component from the circuit. If resistance is measured with the entire circuit connected, the ohmmeter will read a smaller value than the correct value.



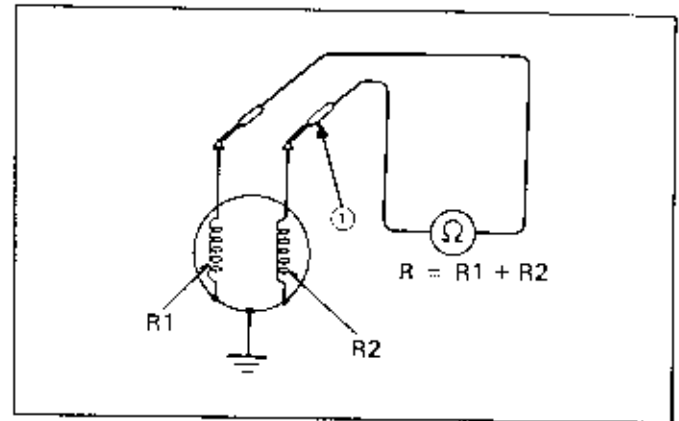
Similarly, if a circuit has branches, the connector leading to the specific branch needs to be disconnected in order to read correctly.





When the ohmmeter is connected in series, resistance values are large.

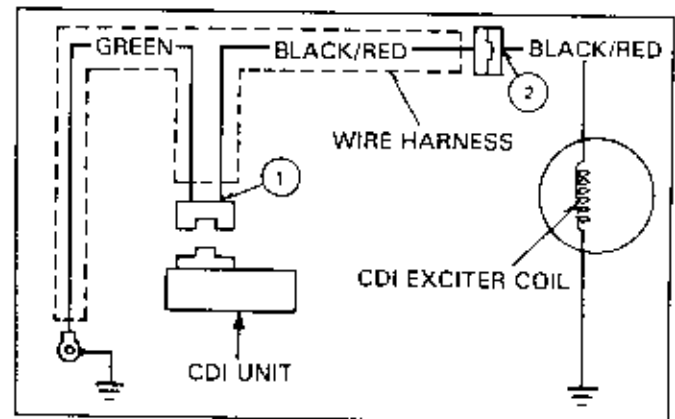
In the diagram, measure resistance  $R_1$  by moving the probe shown at ①, to a ground.



#### Example

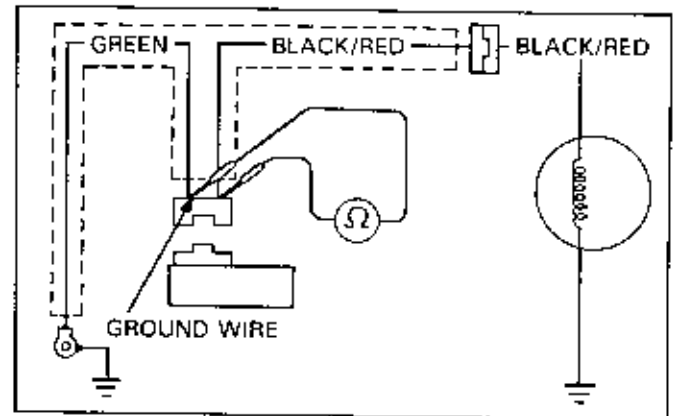
To check the CDI exciter coil, resistance can be measured at ① and ②. Measuring resistance at ①, automatically checks for a broken wire (black/red) and for a bad connection at the alternator connector. If the resistance is normal at ①, ② need not be checked.

If ② was checked first and correct resistance was measured, there is still a possibility of a broken wire and loose connection. That would require more investigation to locate the fault.



If, while measuring resistance at ①, the negative probe is placed on the ground wire (green), then the connection to ground is checked as well.

To check the operation of an exciter coil, place the probes as shown in the diagram. If the resistance is normal, then the exciter coil, the wire connected to the coil (black/red), and the ground wire (green) are all normal.



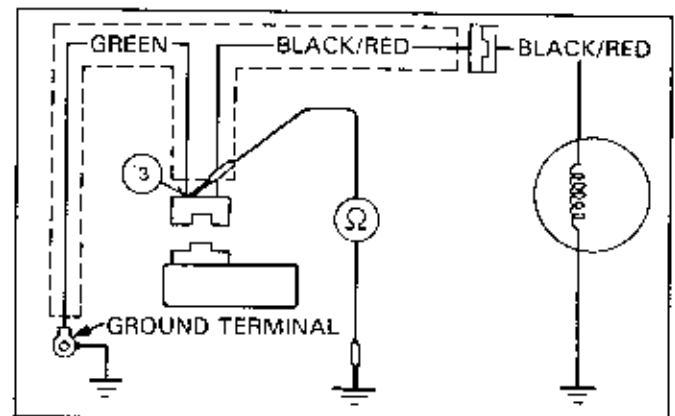
If the resistance is far off the standard value, check the following:

#### 1. Broken ground wire (green)

Place a probe at ③ and measure resistance.

If  $0\Omega$  is measured, then the green wire is properly grounded.

If  $\infty$  (infinity) is measured, then a broken wire (green) or loose connection at the ground terminal is suspect.

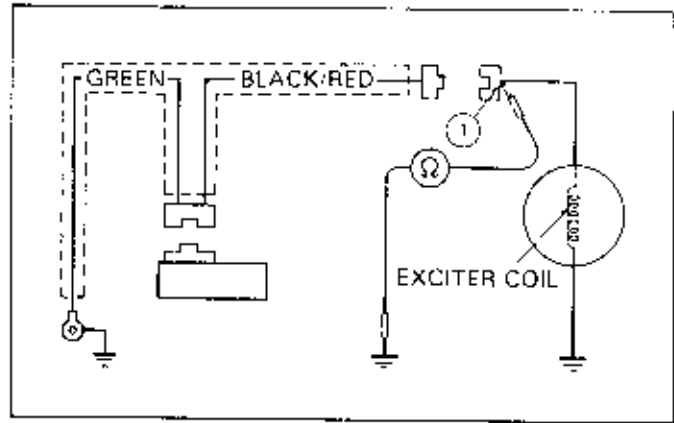


## ELECTRICAL FUNDAMENTALS

### 2. Faulty exciter coil

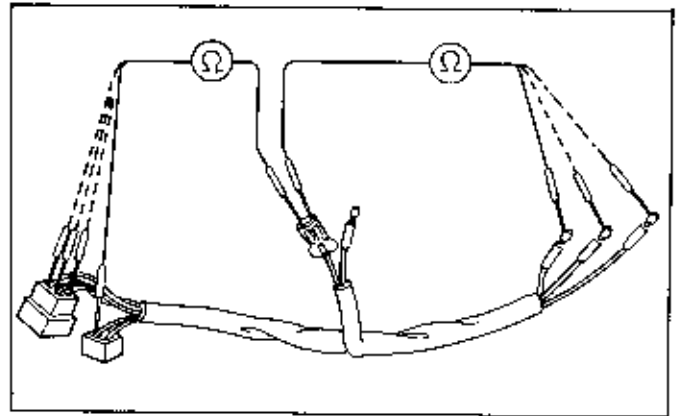
Disconnect the alternator connector, compare the resistance value at ② (measured on the previous page) and at ①.

- If the two values are not the same, a broken black/red wire or loose alternator connector is suspect.
- If both resistance values are the same, but not in the correct range, the exciter coil may be faulty.



### 3. Shorted wire or wire harness.

To see if the green or black/red wire is shorted, check the continuity between different colored wires. If you have continuity between other wires, replace the wire harness.



## MEASURING CURRENT

Current is not normally checked during motorcycle service procedures. Though it is used for testing components, current measurements are not used for checking continuity within circuits.

### How to measure current using ammeter

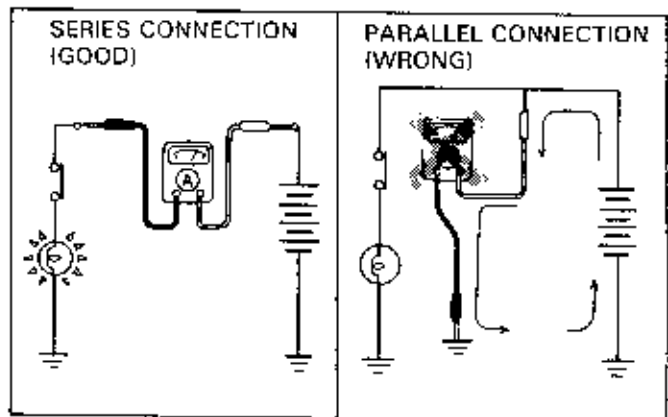
Ammeter is connected in series in the circuit and measures the current flowing through it.

Place the ⊕ (⊕ in circle symbol) red probe to the positive end of circuit and ⊖ (⊖ in circle symbol) black probe to the negative end.

Make sure the current flow does not exceed the maximum range selected.

### CAUTION

- Placing the ammeter in parallel, like a voltmeter, can damage the ammeter from a current overflow.
- Connecting the ammeter between the battery terminals will damage the ammeter.
- Turning on the starter motor while the ammeter is connected between the battery terminal and battery cable will damage the ammeter.



# 22. BATTERY/CHARGING/LIGHTING SYSTEM

SERVICE INFORMATION	22-1	CHARGING SYSTEM DESCRIPTIONS	22-12
TROUBLESHOOTING	22-2	CHARGING SYSTEM INSPECTION	22-19
BATTERY DESCRIPTIONS	22-4	REGULATOR/RECTIFIER INSPECTION	22-21
BATTERY REMOVAL/INSTALLATION	22-8	HEADLIGHT VOLTAGE INSPECTION	22-23
BATTERY TESTING/CHARGING	22-9	ALTERNATOR	22-26

## SERVICE INFORMATION

### ▲ WARNING

- The battery gives off explosive gases; keep sparks, flames, and cigarettes away. Provide adequate ventilation when charging or using the batteries in an enclosed space.
- The battery contains sulfuric acid (electrolyte). Contact with skin or eyes may cause severe burns. Wear protective clothing and a face shield.
  - If electrolyte gets on your skin, flush with water.
  - If electrolyte gets in your eyes, flush with water for at least 15 minutes and call a physician immediately.
- Electrolyte is poisonous. If swallowed, drink large quantities of water or milk and follow with milk of magnesia or vegetable oil and call a physician.
- KEEP OUT OF REACH OF CHILDREN.

Always turn off the ignition switch before disconnecting any electrical component.

### CAUTION

- Some electrical components may be damaged if terminals or connectors are connected or disconnected while the ignition is ON and current is present.

For extended storage, remove the battery, give it a full charge, and store it in a cool, dry place.

For a battery remaining in a stored motorcycle, disconnect the negative battery cable from the battery terminal.

### Conventional Battery:

- Use only distilled water in the battery.

### CAUTION

- Tap water will shorten the service life of the battery.

Immediately wash off any spilled electrolyte.

### CAUTION

- Avoid filling the battery above the UPPER LEVEL line to prevent an electrolyte overflow which could corrode the engine or nearby parts.

### Maintenance Free Battery:

### NOTE

- The maintenance free battery must be replaced when it reaches the end of its service life.

### CAUTION

- The battery caps should not be removed. Attempting to remove the sealing caps from the cells may damage the battery.

- Refer to section 21 for basic electrical service and safety steps.
- Refer to section 2 for battery fluid and specific gravity.
- This section explains the basic steps for diagnosis and service. Refer to the Model Specific manual for the location of specific components.

## BATTERIES/CHARGING/LIGHTING SYSTEM

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- Batteries can be damaged if overcharged or undercharged, or if left to discharge for long periods. These same conditions contribute to shortening the "life span" of the battery. Even under normal use, the performance of batteries deteriorates after 2–3 years.
- Battery voltage may recover after battery charging, but under heavy load, battery voltage will drop quickly and eventually die out. For this reason, the charging system is often suspected to be the problem. Battery overcharge often results from problems in the battery itself, which may appear to be an overcharge symptom. If one of the battery cells is shorted and battery voltage does not increase, the regulator supplies excess voltage to the battery. Under these conditions, the electrolyte level goes down quickly.
- Before troubleshooting the charging system, check for proper use and maintenance of the battery. Check if the battery is frequently under heavy load, such as having the headlight and taillight ON for long periods of time.
- The battery will self-discharge if allowed to stand idle for a long time. For this reason, charge the battery every two weeks to prevent sulfation from forming when the vehicle is not in use.
- Filling a new battery with electrolyte will produce some voltage, but in order to achieve its maximum performance, always charge the battery. Also, the battery life is lengthened when it is charged.
- When checking the charging system, always follow the steps in the troubleshooting flow chart.

## TROUBLESHOOTING

### BATTERY OVERCHARGING

On combined, lighting/charging coil systems, check the following areas. (A check is unnecessary for an independent lighting and charging system.)

- Headlight bulb rating (Wattage too low)
- Broken output wire
- Faulty headlight resistor (Open headlight circuit)
- Faulty lighting switch connection
- Broken regulator/rectifier ground wire or faulty connection

On a single phase, half-wave rectifier, check the following areas.

- Broken regulator/rectifier ground wire or faulty connection

On regulator/rectifiers with a battery voltage feedback circuit, check the following areas. (A check is unnecessary for a voltage feedback type.)

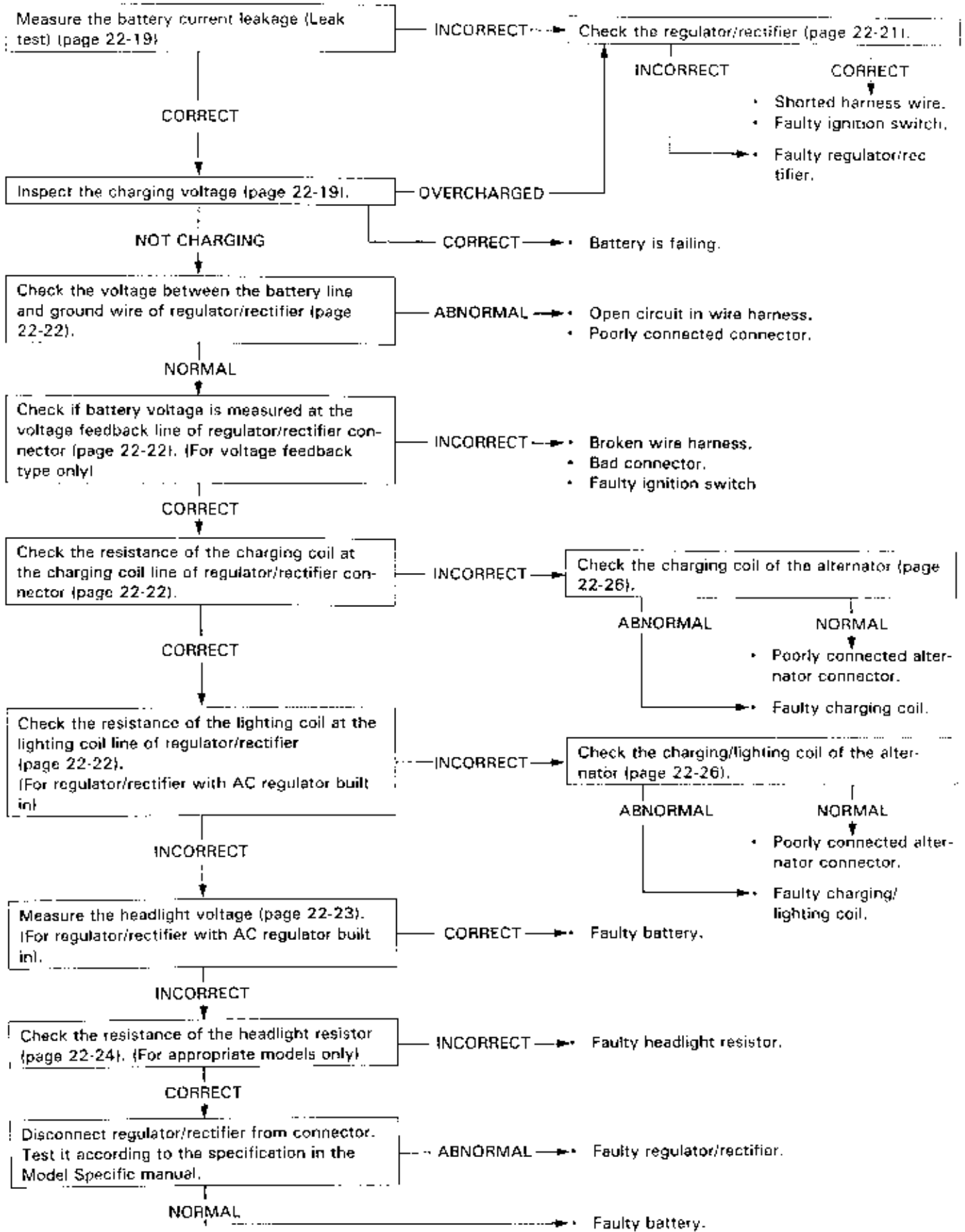
- Check if battery voltage is measured at voltage feedback line (black wire). If not, the problem may be a broken voltage feedback line.
- Check the voltage feedback line for a loose connection at the regulator/rectifier connector

On alternator with field coil, check the following areas.

- Continuity between field coil wire and ground.

If there are no problems in the above areas, replace the regulator/rectifier with a new one.

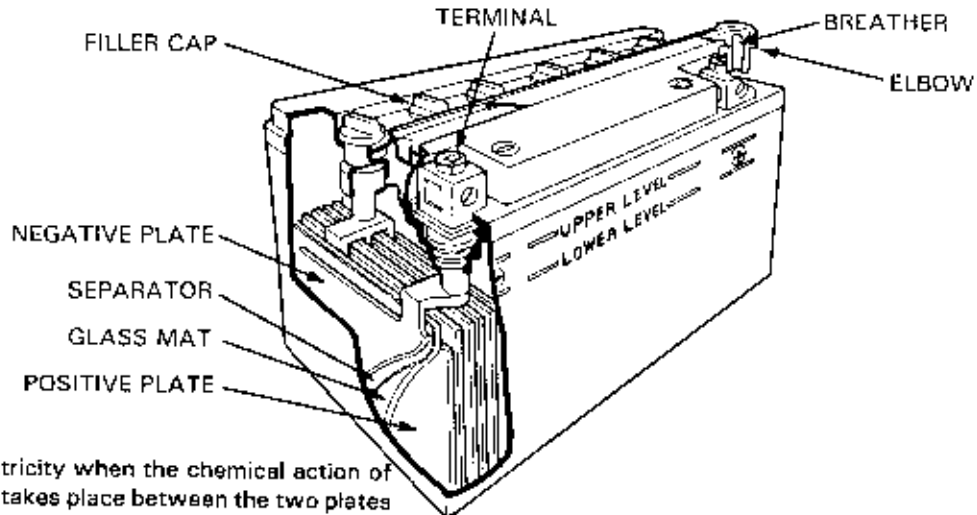
CHARGING SYSTEM



## BATTERY DESCRIPTIONS

There are two types of batteries used in Honda motorcycles, scooters and ATVs: the conventional battery and the Maintenance free battery.

### THE STRUCTURE OF A CONVENTIONAL BATTERY



#### Conventional Battery:

This battery conducts electricity when the chemical action of electrolyte (sulphuric acid) takes place between the two plates (lead peroxide and lead). The sulfate in the electrolyte combines with the plate materials, forming lead sulphate (battery discharge). By passing an electric current back into the battery, the plates revert to lead peroxide and lead (battery charge).

Since the specific gravity of the electrolyte (relative weight of sulphuric acid as compared with an equal volume of water) varies, the battery state of charge is determined by measuring the electrolyte's specific gravity.

#### ⚠ WARNING

- The battery gives off explosive gases; keep sparks, flames and cigarettes away. Provide adequate ventilation when charging or using the batteries in an enclosed space.
- The battery contains sulfuric acid (electrolyte). Contact with skin or eyes may cause severe burns. Wear protective clothing and a face shield.
  - If electrolyte gets on your skin, flush with water.
  - If electrolyte gets in your eyes, flush with water for at least 15 minutes and call a physician immediately.
- Electrolyte is poisonous. If swallowed, drink large quantities of water or milk and follow with milk of magnesia or vegetable oil and call a physician.
- KEEP OUT OF REACH OF CHILDREN.

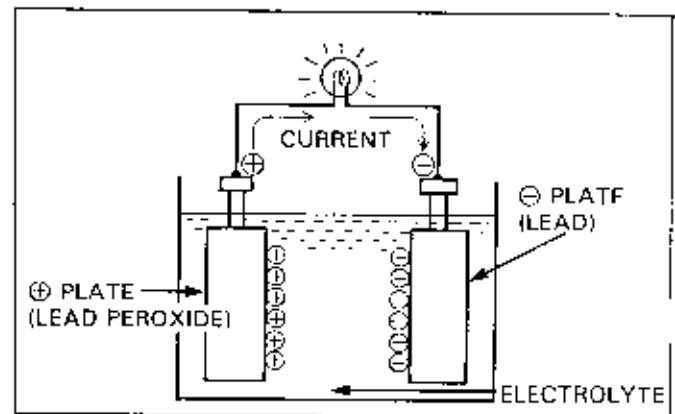
Use only distilled water in the battery.

#### CAUTION

- Tap water will shorten the service life of the battery.

#### CAUTION

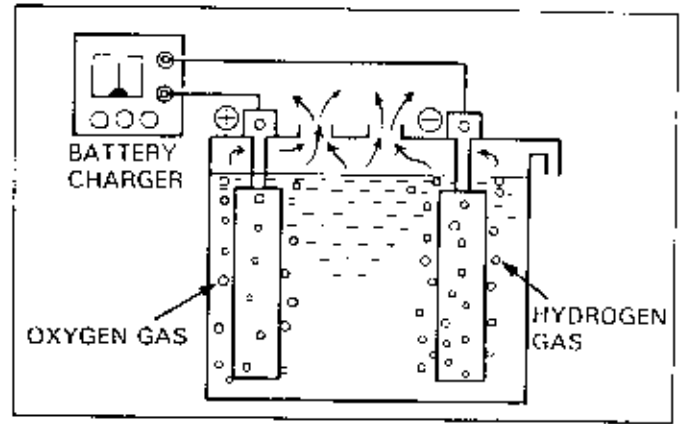
- Avoid filling the battery above the UPPER LEVEL line to prevent an electrolyte overflow which could corrode the engine or nearby parts.



When you charge the lead/acid battery, electrolysis breaks the water down into its components, hydrogen and oxygen. Because of the generation of these gases, you must remove the filler plugs while charging the battery.

The battery is equipped with a vent, usually routed overboard into tube, to rid it of the gases produced during normal use.

The battery is said to be overcharged when an excess current is supplied to the battery. When the battery is overcharged, volatile gas is emitted from the plates, and electrolyte temperature rises. This temperature rise causes more rapid loss of water from the battery electrolyte. This water loss and temperature rise will shorten the battery life. If left unchecked, water loss and high temperature will damage the battery beyond repair.



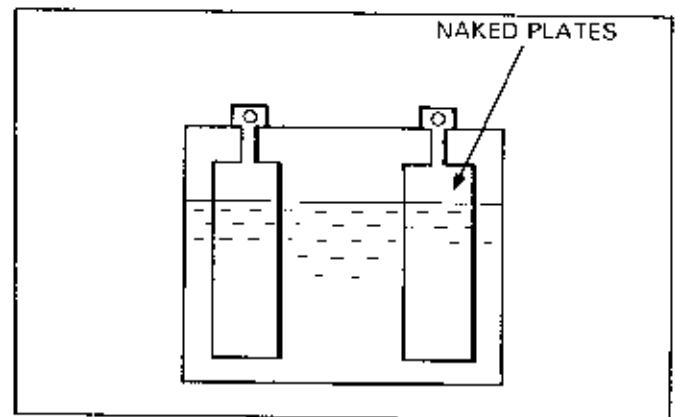
Because the motorcycle battery is constantly subjected to charging and discharging cycles, the water in the electrolyte is boiled off.

When the water is boiled off to the point where the plates become exposed, a white crystalline deposit forms. This process is called sulfation (lead sulfate).

The white crystalline lead sulfate, unlike the lead sulfate produced by discharging, is difficult to revert to lead peroxide and lead.

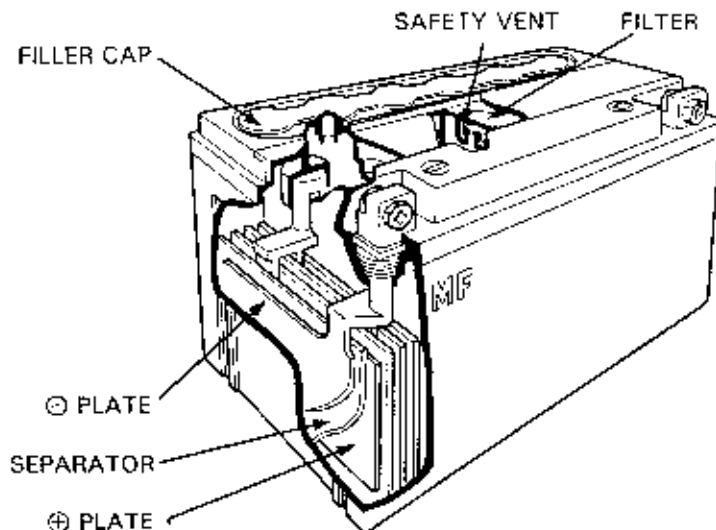
This causes damage to the battery and shortens the battery life. This can occur not only when the electrolyte level is low but also when the battery is discharged for long periods.

Remember that the electrolyte level goes down when the water in the battery evaporates. Always add distilled water, not electrolyte.



### MAINTENANCE-FREE BATTERY

The Maintenance-Free battery is a sealed battery that requires no electrolyte level inspection or periodic refilling.



Similar in design to the conventional battery, the MF battery produces hydrogen and oxygen gas. However, the plates are designed not to convert to lead completely. (This state of lead is called sponge lead.)

When the battery is overcharged and the positive plates produce oxygen gas, the negative plates are not completely converted to lead. There is no hydrogen gas produced.

The oxygen produced from the positive plate reacts with the active material (lead) on the negative plate, and produces water. Therefore, the water does not need to be added to MF batteries.

The MF batteries have safety valves designed to open up when excessive gas is produced. The safety valves close and seal the battery again when the internal pressure returns to normal. A ceramic filter is placed over the safety valves to prevent any internal ignition of the gases produced.

#### ⚠ WARNING

- Electrolyte is poisonous.
- Explosive gas can vent out from a battery when it is overcharged. For this reason, keep an open flame or lit cigarette away from a battery.

Use the electrolyte container designated for the specific battery.

#### CAUTION

- The MF battery life depends largely on the proper amount of electrolyte being added at the start of service.

#### NOTE

- Avoid interchanging conventional and MF batteries. They have different charging components.

#### CAUTION

- Removing the sealing caps from the cells may damage the battery.





## BATTERY REMOVAL/INSTALLATION

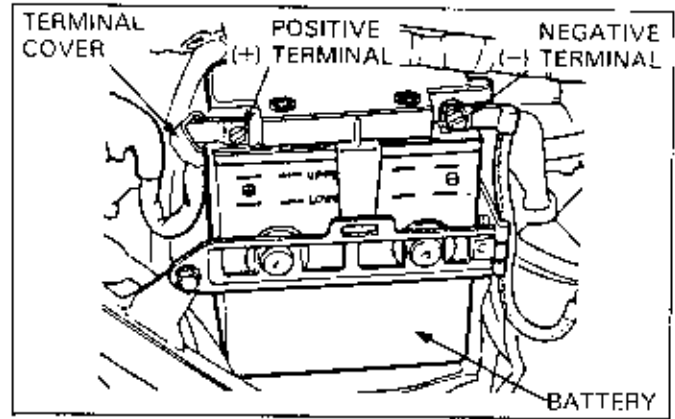
### REMOVAL

Turn off the ignition switch.

Remove the terminal cover and disconnect the negative (-) battery cable first, and then disconnect the positive (+) cable.

#### ⚠ WARNING

- Disconnecting the positive (+) cable first could cause an accidental direct short between the two terminals when the tool disconnecting the terminal contacts the frame. The spark could ignite or damage the battery.



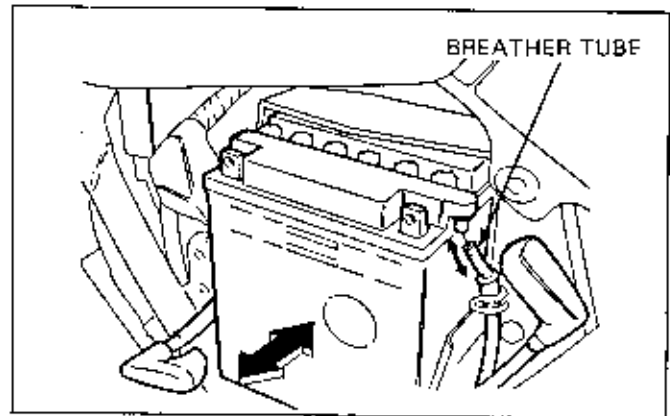
For conventional batteries, always disconnect the breather tube before removing battery.

#### NOTE

- Some electrolyte may remain in the breather tube.

#### ⚠ WARNING

- Keep electrolyte away from your eyes or skin while disconnecting the battery breather tube.

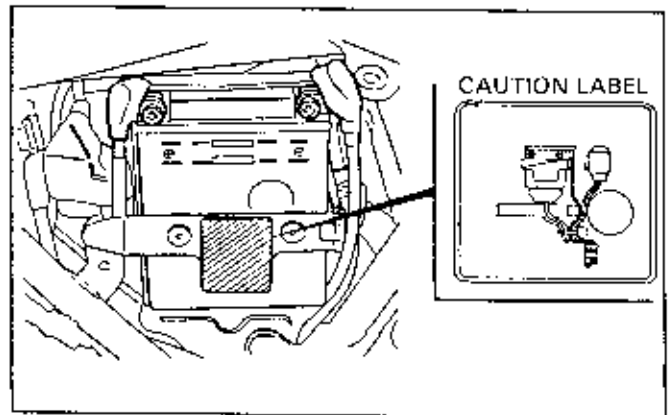


### INSTALLATION

Be sure to route the breather tube properly on conventional batteries.

#### ⚠ WARNING

- Take care to prevent spilling electrolyte from the breather tube because it can corrode components.
- Take care with the breather tube. Pay attention to the following points:
  - Connect the breather tube securely.
  - Follow the caution label and route the tube accordingly.
  - Avoid bending or squeezing the breather tube. Check that the breather tube has not been bent or squeezed by the surrounding components. Failure to replace a bent or squeezed breather tube may lead to a pressure buildup that can cause the battery to explode.



Place the battery into the frame.

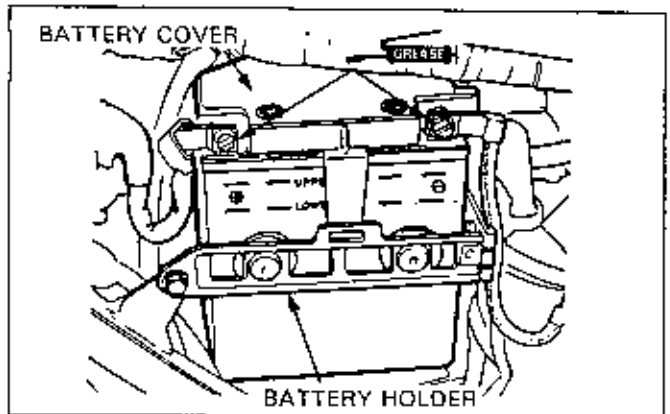
Secure the battery with the battery holder.

#### CAUTION

- Improper installation may cause vibrations which can damage the battery case.

To prevent shorting, always connect the positive (+) cable first.

After installing the battery, coat the terminals with clean grease to prevent corrosion.



## BATTERY TESTING/CHARGING

### BEFORE USING THE TESTER:

- Place the tester on a clean, flat and level surface.
- Be sure the work area is well ventilated, clear of flammable materials, and free from heat, humidity, water or dust.
- Always take the battery to the work bench/test area — continually moving of the tester or operation on an uneven surface may shorten its service life and reduce sensitivity over a period of time.

### NOTE

- Always clear the work area of flammable materials such as gasoline, brake fluid, electrolyte, or cloth towels when operating the tester, the heat generated by the tester may cause a fire.

### BATTERY TESTING

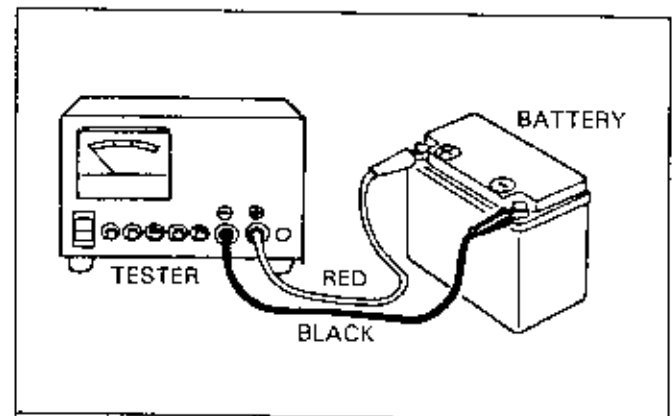
Use the following steps to remove the battery from the motorcycle:

- 1) Disconnect the negative (-) terminal lead.
- 2) Remove the battery holder.
- 3) Remove the battery cover (when applicable).
- 4) Disconnect the positive (+) terminal lead.
- 5) Remove the battery breather tube (when applicable).
- 6) Pull out the battery.
- 7) If necessary, clean the battery terminals.

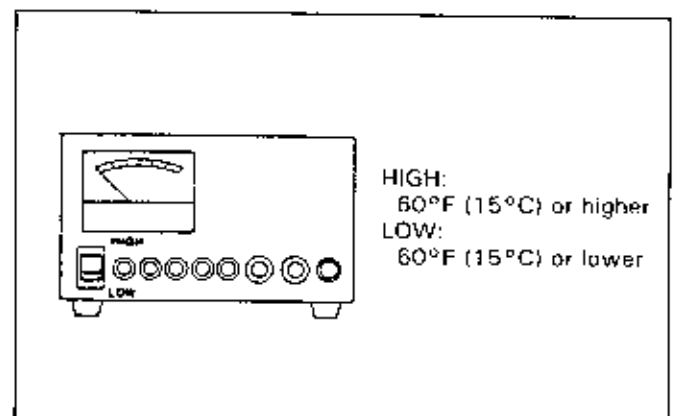
Securely connect the tester's positive (+) cable first — then connect the negative (-) cable.

### NOTE

- For accurate test results, be sure the tester's cables and clamps are in good working condition and that a secure connection can be made at the battery.



Set the temperature switch to "HIGH" or "LOW" depending on the ambient temperature.

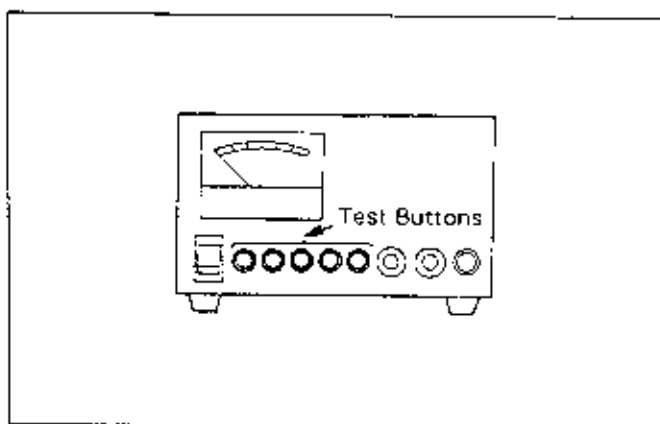


## BATTERIES/CHARGING/LIGHTING SYSTEM

Push in the appropriate test button for **three seconds** and read the condition of the battery on the meter.

### NOTE

- Be sure you've selected the correct test button that corresponds to the battery being tested — see the chart below. For the first check, **DO NOT** charge the battery before testing — test it in an "as is" condition.



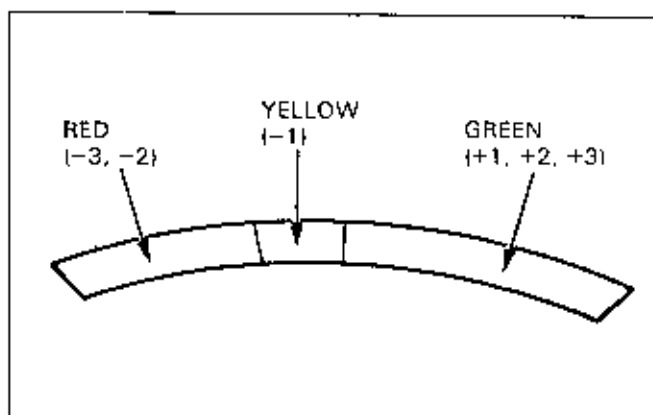
Capacity	-3 Ah	3.5 Ah-5 Ah		5.5 Ah-9 Ah	9.5 Ah-16 Ah		16.5 Ah-30 Ah
Type	YB25L-C-1-2 YB3L-A	TB4L-B YB4L-B-Ca YB5L-B YB5L-B-Ca	YT4L-12 YT4L-12B YT5L-12 YT5L-12B	12N9-4B-1 YB9(L)-B YB9-B-CA YB9A-A YTH9-12B	YB12A(L)-A YB12A-B YB9-B-Ca YB14L-A1 YB14A-A2	YB16B-A HYB16A-A YT12-12 YTH12-12B YTH14-12B	YB18(L)-A Y50-N18L-A

### CAUTION

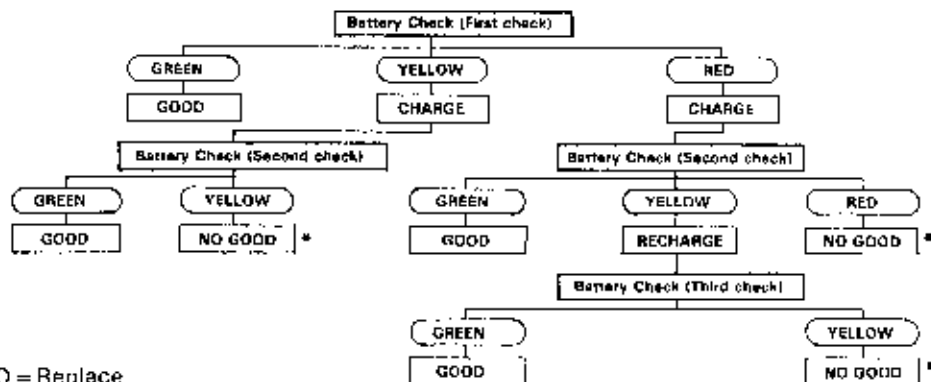
- To avoid damaging the tester, only test batteries with an amperage rating of less than 30 Ah.
- Tester damage can result from overheating when:
  - The test button is pushed in for more than three seconds.
  - The tester is used without being allowed to cool for at least one minute when testing more than one battery.
  - More than ten consecutive tests are performed without allowing at least a 30-minute cool-down period.

### NOTE

- The result of a test on the meter scale is relative to the amp. hour rating of the battery. **ANY BATTERY READING IN THE GREEN ZONE IS OK.** Batteries should only be charged if they register in the **YELLOW** or **RED** zone.



**EXAMPLE:** Gold Wing batteries (Y50-N18L-A, 18 AMP HOUR) using the 16.5-30 amp. hour setting may read in the **GREEN** zone, but close to the **YELLOW** (charge) zone. As long as the meter reads in the **GREEN** zone, the battery is OK.



\*NO GOOD = Replace

BATTERY CHARGING

Before Operating The Charger

- Be sure the area around the charger is well ventilated, clear of flammable materials, and free from heat, humidity, water and dust.
- Clean the battery terminals and position the battery as far away from the charger as the leads will permit.
- Do not place batteries below the charger — gases from the battery may corrode and damage the charger.
- Do not place batteries on top of the charger. Be sure the air vents are not blocked.

**WARNING**

- Always clear the work area of flammable materials such as gasoline, brake fluid, electrolyte, or cloth towels when operating the tester, or the heat generated by the tester may cause a fire.

1. Turn the Power Switch to the OFF position.
2. Set the Battery Amp. Hr. Selector Switch for the size of the battery being charged.
3. Set the Timer to the position indicated by the Honda Battery Tester; RED-3, RED-2, or YELLOW-1. If you are charging a new battery, set the switch to the NEW BATT position.
4. Attach the clamps to the battery terminals — RED to Positive, BLACK to Negative.

Connect the battery cables only when the Power Switch is OFF.

**WARNING**

- Connecting the cables with the Power Switch ON can produce a spark which could ignite or explode the battery.

5. Turn the Power Switch to the ON position.
6. When the timer reaches the "Trickle" position, the charging cycle is complete. Turn the Power Switch OFF and disconnect the clamps.

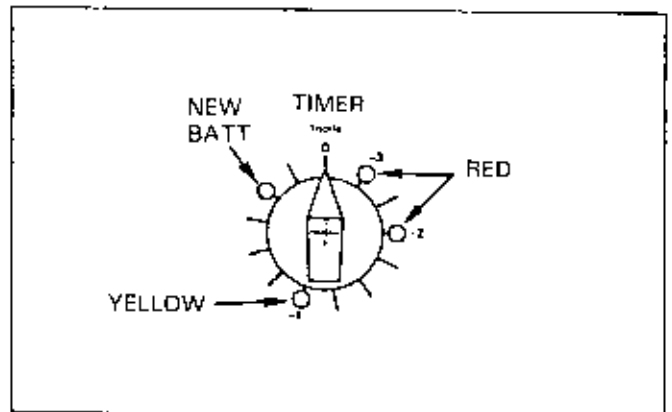
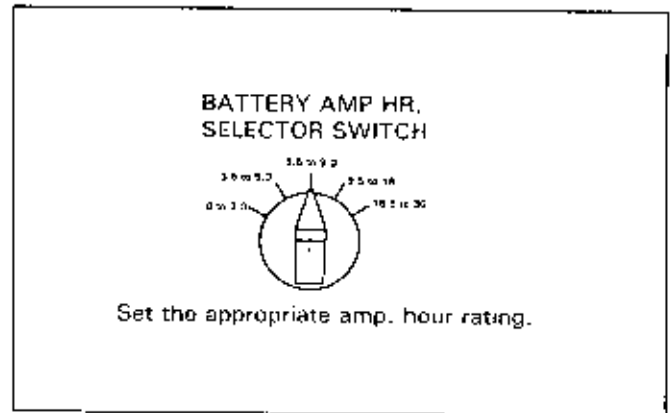
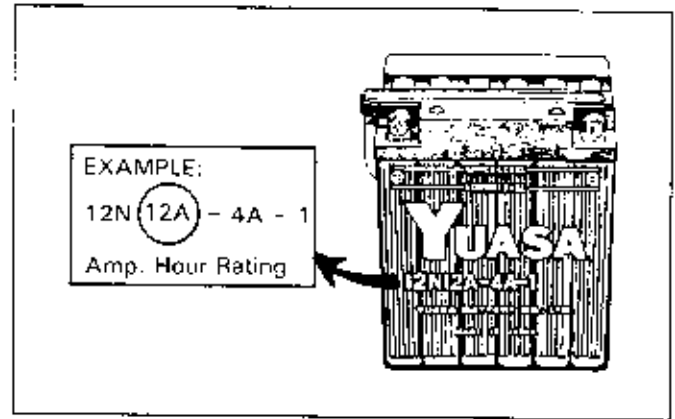
NOTE

- The charger will automatically switch to the Trickle mode after the set charging time has elapsed.

7. Retest the battery using the Honda Battery Tester and recharge if necessary using the above steps.

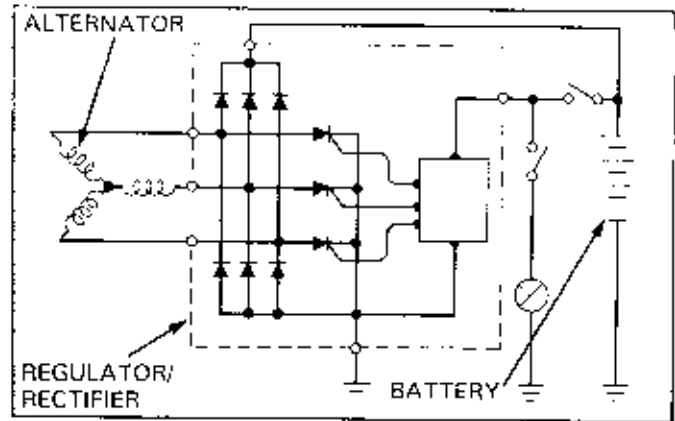
NOTE

- For accurate test results, let the battery cool for at least ten minutes or until gassing subsides after charging.



**CHARGING SYSTEM DESCRIPTION**

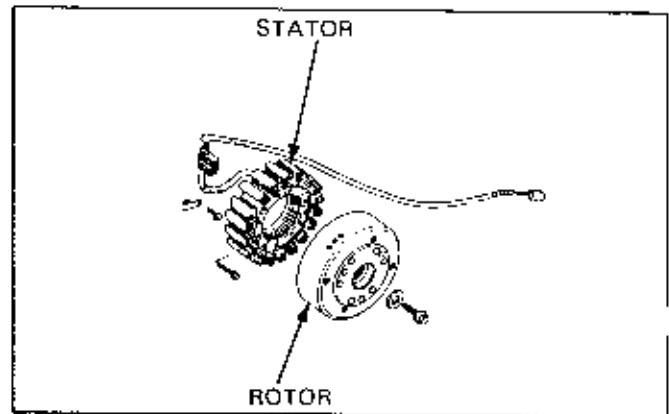
The charging system basically consists of the following components.



Component name	Function
Regulator/rectifier	<ul style="list-style-type: none"> <li>Regulates voltage so that it stays within the specified range.</li> <li>Converts alternating current (AC) to direct current (DC).</li> </ul>
Alternator	<ul style="list-style-type: none"> <li>A generator producing current (AC) and which is powered by engine revolution.</li> </ul>
Battery	<ul style="list-style-type: none"> <li>Stores regulated DC current.</li> </ul>

**ALTERNATOR TYPES**

The alternator consists of a rotor and a stator. The rotor consists of a flywheel made up of a series of magnets and is usually driven by the crankshaft. The stator consists of a series of soft iron poles around which are wound coils of wire. When the engine starts, the rotor rotates with the crankshaft. When the outer (or inner) core of the coil passes through the magnetic field, current is generated. This is called electromagnetic induction, and other systems such as the ignition and AC lighting systems generates power under the same principle. In addition, the rotor acts a safety wheel on the crankshaft, smoothing out engine pulsations at low engine rpm.

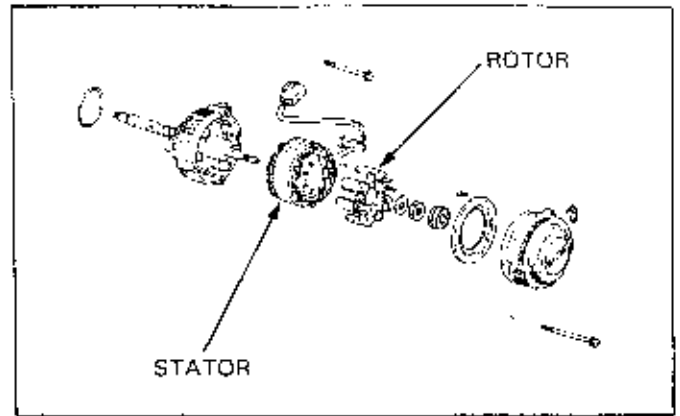


**Permanent Magnet Type**

This is the most common type of alternator with the stator placed inside the rotor. The permanent magnet is assembled on the inner walls of the rotor. In general, the stator consists of several coils producing power for the charging, ignition and lighting systems. Current for charging the battery is generated by the charging coil.

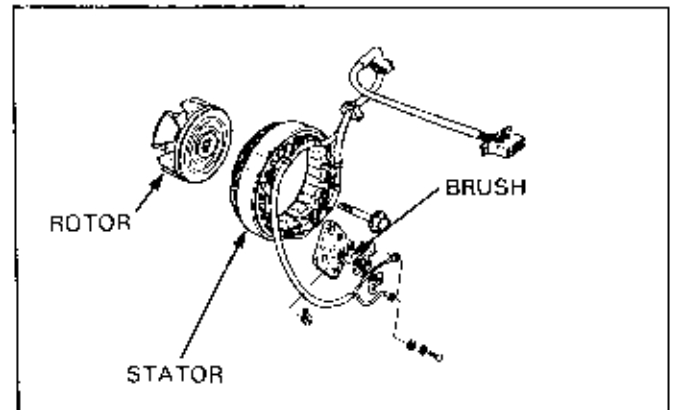
**Brushless Excited Field Coil Type**

The alternators previously mentioned are located within the engine. The alternator is exposed outside the engine because it is air cooled. In general, the rotor speed is multiplied by gears or chains connected to the crankshaft. This type is the most powerful among the triple phase alternators and is primarily used for power on large displacement motorcycles. Its structure differs fundamentally from the previous alternator in that it does not utilize a permanent magnet. Instead, the field coil magnetizes the rotor and generates power as the rotor passes the coil.



**Excited Field Coil Type With Brushes**

This type has a field coil placed inside the rotor. Current flows through the brushes to the field coil and electromagnetically induces the rotor. This generator has a strong magnetic force, large output, and is small and light weight.



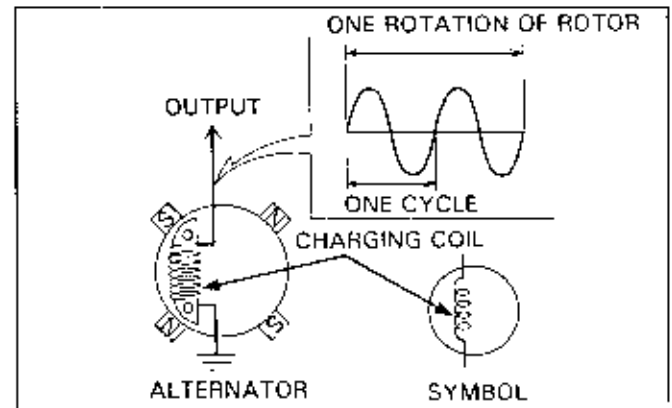
**ALTERNATOR FUNCTION**

**Single Phase Output Type**

Since this type uses only one charging coil, the output voltage is single phase AC wave. The output frequency varies depending on the number of magnets on the rotor.

The generator in the diagram on the right has two pairs of magnets, and its output has two cycles for every rotation of the rotor.

The single phase output type has a low output, and its small size is best suited for engines of small displacement and a small electrical load.



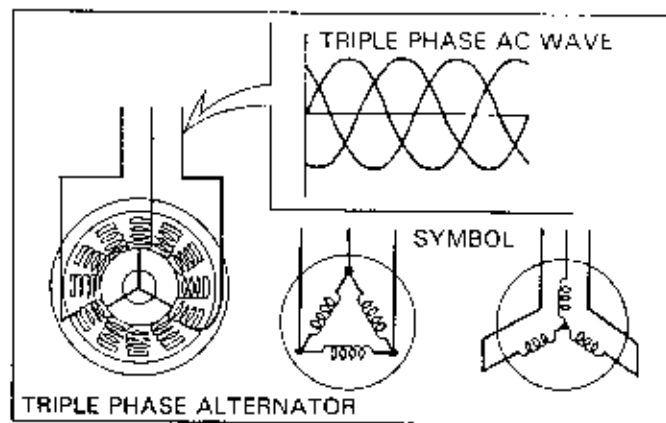
## BATTERIES/CHARGING/LIGHTING SYSTEM

### Triple Phase Output Type

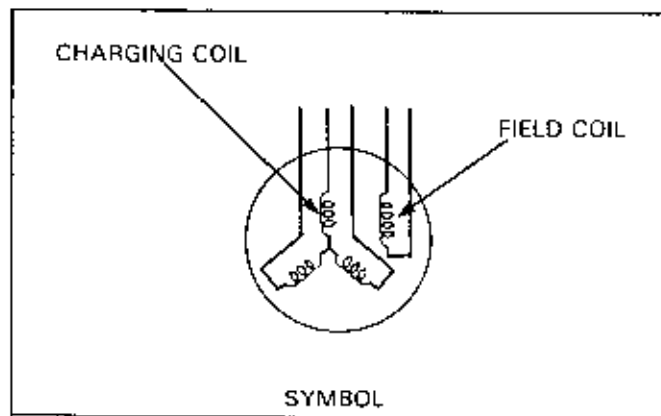
This type consists of three coils connected to each other, producing single phase alternating currents independently. The output of the alternator is three single phase AC wave forms where each is 120° out of phase with each other.

The symbol for this alternator has only three coils as in the diagram. The actual stator coil consists of several coils connected in series.

The triple phase output type is used in engines of medium to large displacement with large electrical loads. Depending on how the coils are connected, there are two symbols for this type. Servicing is the same for both types.



Most triple phase output types are used in electromagnetically induced type alternator, which has a permanent magnet on the rotor. The excited field coil type alternator feeds current to the field coil to magnetize the rotor which then acts like a permanent magnet. The symbol for this type has a field coil along with the charging coil.



## REGULATOR/RECTIFIER

The regulator/rectifier uses semiconductors such as thyristors which radiate heat in operation. Thus these components use printed circuit boards which are resined onto an aluminum case. The aluminum case has many fins for better heat dissipation.

As the engine revolutions increase, the output voltage of the alternator also increases. The function of the regulator/rectifier is to keep this AC output voltage within a certain range and to convert the AC output voltage to DC voltage — for powering various components and charging the battery.

### Type of Regulator/Rectifiers

Regulator/rectifiers are categorized as one of several types, based on its method of regulation and rectification. The chart below shows the different types of regulator/rectifiers.

Input AC wave form	Rectification method	Voltage feedback method	Regulation method
Single phase	Half-wave rectification	Internal voltage feedback	SCR shorted
Triple phase	Full wave rectification	Battery voltage feedback	

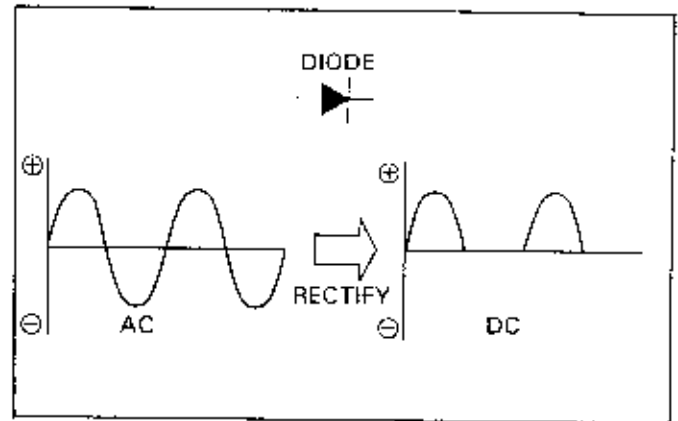
Since the input wave form is the same as the output wave form of the alternator, refer to the alternator section for the types of input wave form.



**Single Phase, Half-Wave Rectifiers**

**(Diode rectification method)**

This method uses only a diode to convert alternating current to direct current. The diode allows current to flow in one direction only. Thus when a single phase AC waveform flows through the diode the negative voltage of the waveform is cut off and the positive voltage drops slightly. As a result, the output consist of the positive half cycles of the input waveform. Thus the signal is said to have been rectified; because only half cycles are utilized, this is called half-wave rectification.

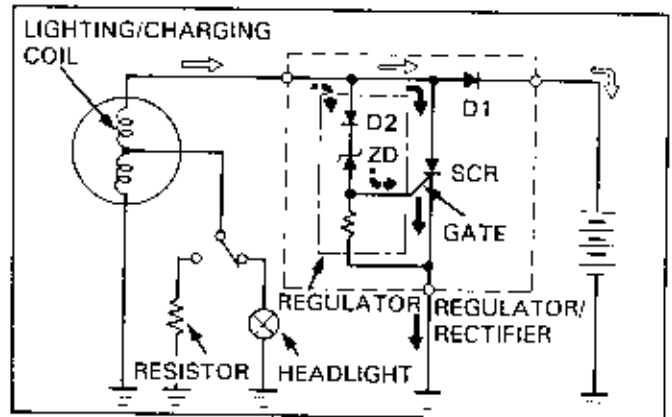


Single phase half wave rectification is used in models with small electrical loads.

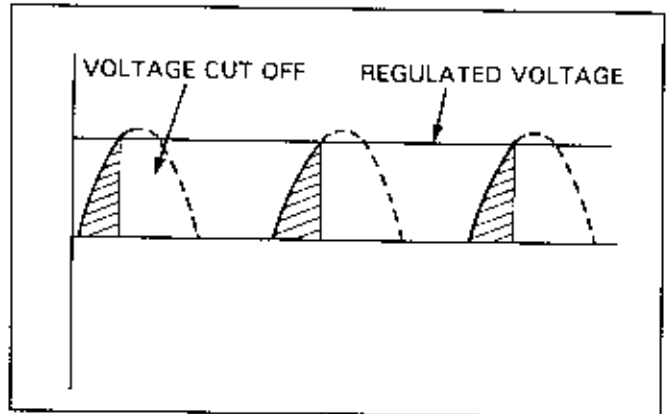
The single phase half wave rectifier utilizes two voltage feedback methods.

**(Internal voltage regulation method)**

The right circuit is the most basic regulator circuit. The signal from the charging coil is half-wave rectified through diode D1, which is inside the regulator/rectifier circuit, and is then fed to the battery. Voltage is regulated by the voltage regulation circuit and the SCR (thyristor).



As the engine rpm (rotation per minute) increases, the output of the alternator increases and that output is rectified by diode D2. This signal then goes to the zener diode (ZD). Current flows in the normal direction of the zener diode but does not flow in the reverse direction until a certain amount of voltage is applied in the reverse direction. Then this voltage is reached, the zener diode abruptly conducts current in the reverse direction. In this way, if the engine rpm increases and a certain voltage level is applied to the ZD, current is fed to the gate of SCR which then turns ON.



When the SCR turns ON, the output from the alternator is shorted to ground through SCR. For this reason, if the ground wires of the regulator/rectifier are broken or poorly connected, the battery becomes overcharged.

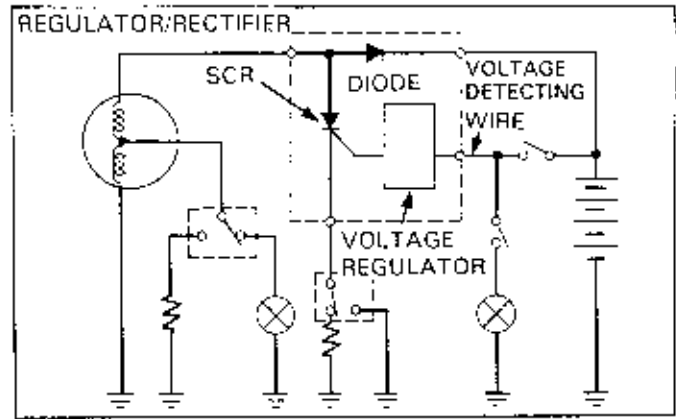
For alternators with the charging/lighting coil combined (charging and lighting systems power by the same coil), the headlight lighting system affects the performance of battery charging. Since the input of the lighting system is taken from the charging coil, if the load of the lighting coil is not stable, the charging of battery will be unstable. To prevent this from happening, when the headlight are off, the output from the charging coil is connected to a resistor equivalent to the impedance of the headlights.

It is clear from above that if the lighting output lines are broken or shorted, or if the switch has contact problems, the charging system is adversely affected.

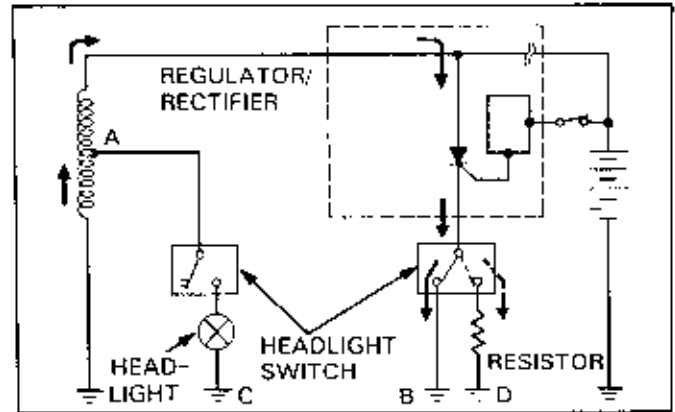
## BATTERIES/CHARGING/LIGHTING SYSTEM

### (Battery)

This method is similar to the method mentioned previously except that the voltage regulation is done after the signal is converted to DC at the input of the battery. Since this method regulates output voltage of alternator after it is rectified, its charging is precisely controlled.

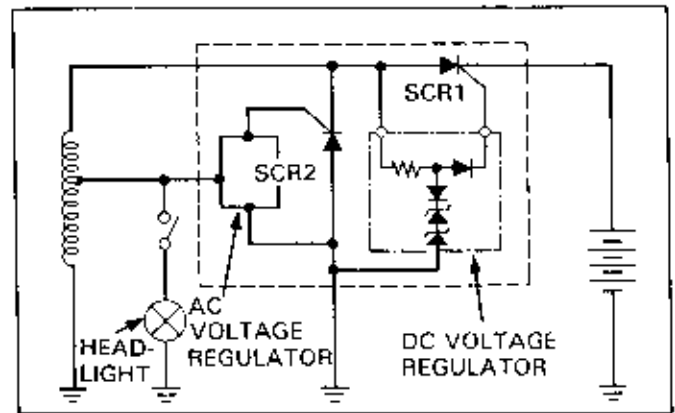


In order to regulate the current going to the headlight, there is sometimes a resistor connected to the ground wire of the regulator/rectifier through a switch. Since the charging coil powers the headlights as well, the headlight flickers and dims when the output of the charging coil is shorted to ground through the SCR. This happens because when the ground wire of the regulator/rectifier is connected to ground, the resistance AB becomes less than AC, thus less current is diverted to the headlight. In order to keep current flowing to the headlight steadily, a resistor, whose value is greater than resistance between AC, is placed between AD.



### (SCR switching regulation/AC regulator built in type)

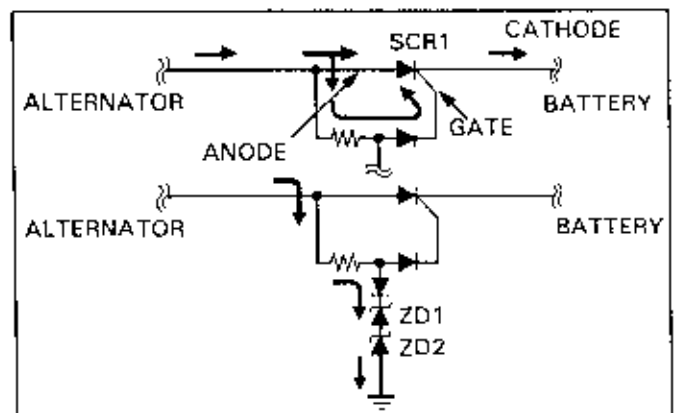
This type is used for models with small displacement engines. Unlike the type above, the SCR is used for switching and the ZD (zener diode) is used for voltage regulation.



The output of the alternator goes to the gate of SCR1 via the DC voltage regulator. When the voltage at the cathode of the SCR1 is less than the voltage at the gate, it is turned ON and thus SCR1 conducts current to the battery. When AC output of the alternator changes from the positive to negative, the gate voltage of SCR1 becomes zero, hence turning OFF the SCR1 and cutting off the negative signal to the battery.

The output voltage is regulated by the ZD1 and the ZD2 which turns ON (and shorts to ground) when the output voltage of the charging coil increases beyond a specified value.

The regulator may overcharge the battery if the ground wire is broken or if there are poor connections at the terminals.

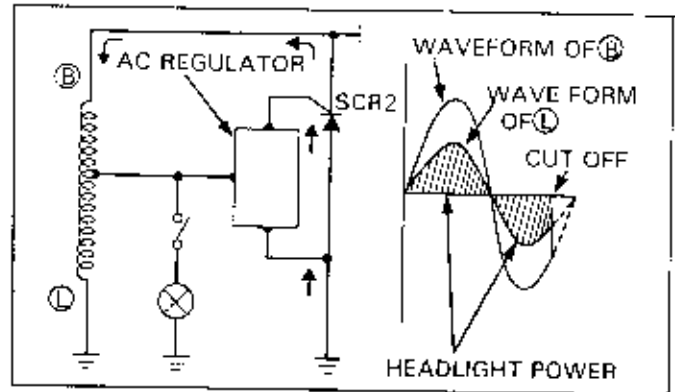


**AC regulator function:**

The AC regulator regulates the voltage to the headlight. Thus, no resistor is required. When the negative output of the charging coil reaches a certain voltage, the AC regulator feeds current to the gate of SCR2 and turns it ON. The SCR2 is shorted and a negative current to the coil regulates its output voltage.

Since the negative output voltage of the charging coil is not used for charging the battery, the AC regulator has no effect on charging the battery.

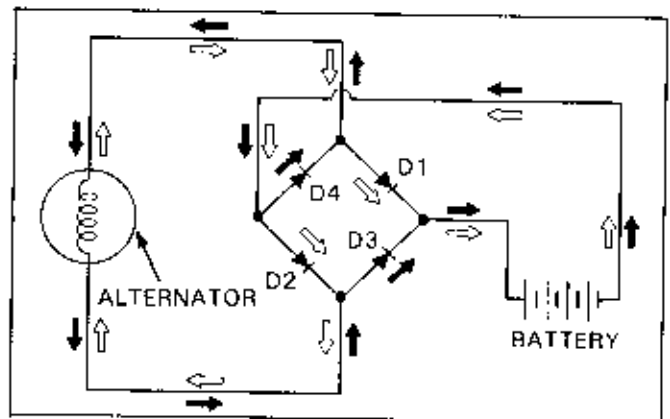
However, since when the negative output of the coil is cut off the headlight voltage is also cut off, the AC regulator regulates the output voltage to the headlight.



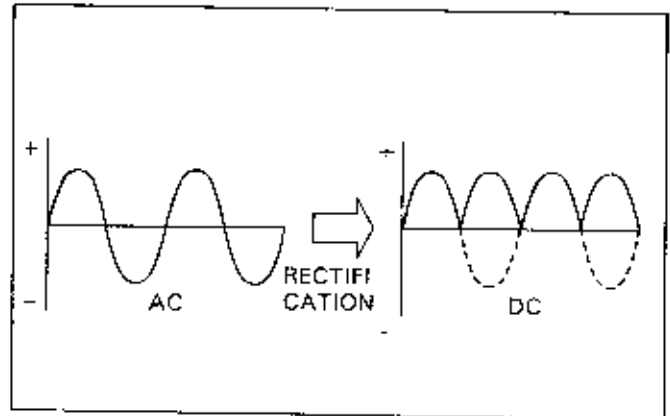
**Single Phase, Full-Wave Rectifiers**

This type is used on medium engine displacement models. Compared to the half-wave rectifier, the full-wave rectifier is more efficient in using the alternator output for charging the battery.

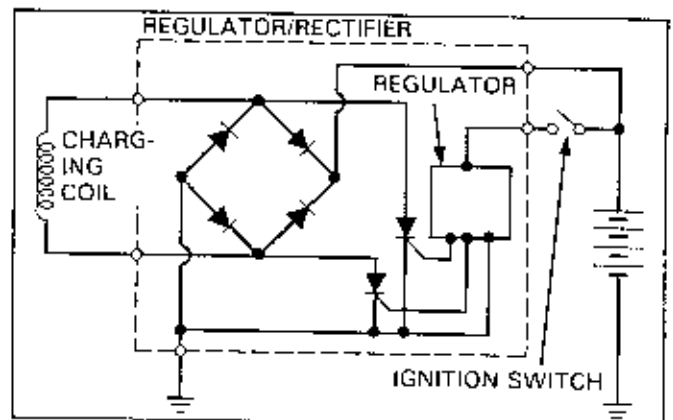
In order to convert the AC output of the alternator to DC, the diodes are arranged as in the right diagram, inside the regulator/rectifier. When the alternator is positive the current flows through D1 → battery → D2 → and when the alternator is negative the current flows through D3 → battery → D4 shown by the white arrow and black arrow respectively.



In this way, the AC output of the alternator is converted to a DC waveform. This circuit is called the full-wave rectifier and is distinguished from the half-wave rectifier.



Similar to the single phase half-wave rectifier, the full-wave rectifier has a battery voltage feedback method and internal voltage feedback method. The circuit at right uses the battery voltage feedback method.



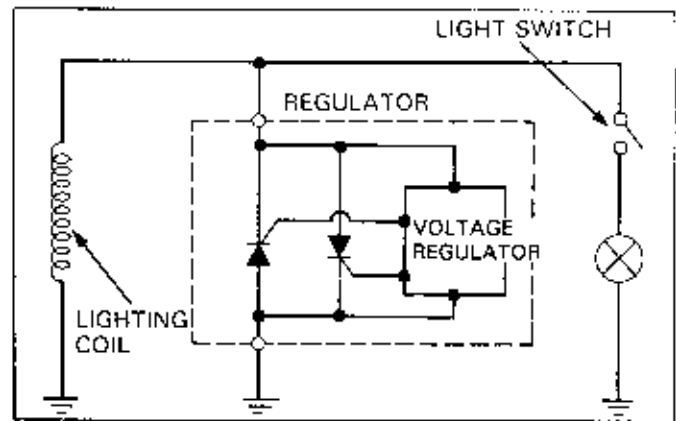
## BATTERIES/CHARGING/LIGHTING SYSTEM

### AC Regulator

Most medium engine displacement motorcycles have independent lighting and charging coils. For these models, the lighting coil has its own independent AC regulator. The regulator detects the AC voltage of the lighting coil inside the regulator/rectifier and shorts out all excessive output.

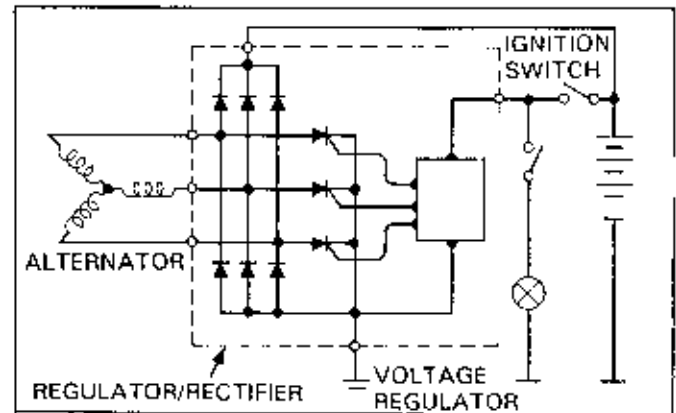
There are regulators which regulate both positive and negative outputs and ones which regulate negative output only.

Since these regulators have lighting and charging coils that operate independently, even if one of the coils does not work, the other is not affected.

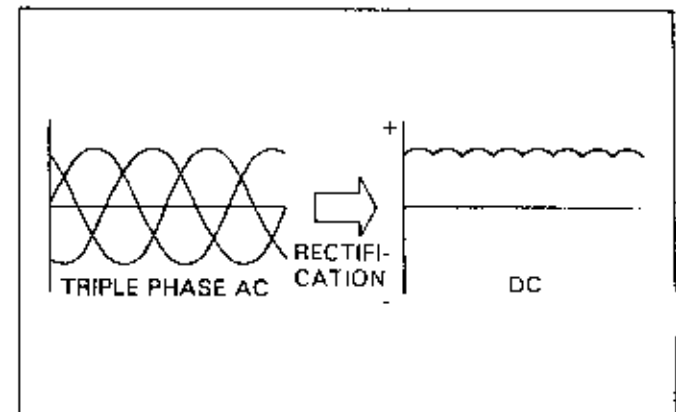


### Triple Phase Full-Wave Rectifier

This type is mainly used in medium and large engine displacement models. The rectifier is connected directly to the three phase alternator. This circuit has no lighting coil but instead, the battery feeds DC current to the lighting system.



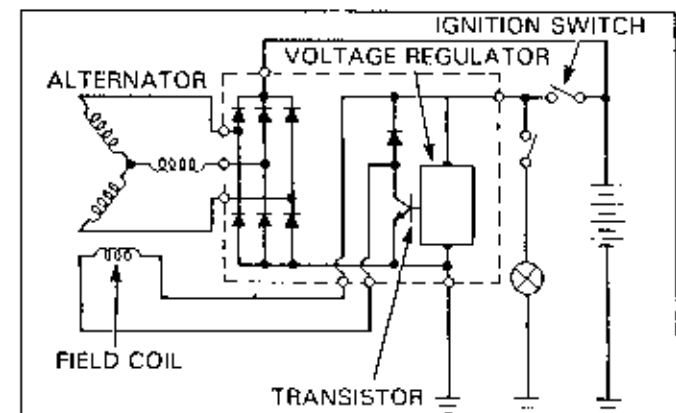
The rectified waveform of the triple phase AC output is more stable than the single phase AC type.



### Triple Phase Full-Wave Rectifiers With Field Coils

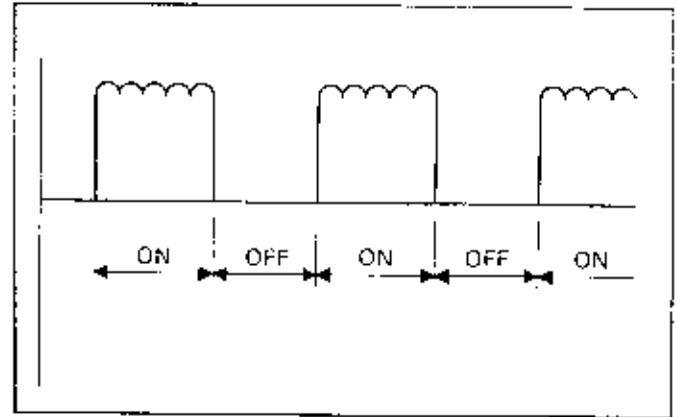
This type regulates the alternator output by the current flowing through the field coil. The regulator/rectifier has a voltage regulator for the field coil. The voltage regulator detects the voltage at the battery and feeds current to the base of transistor, turning it ON. When the transistor is ON, the battery feeds current through: ignition switch → field coil → transistor → ground. The field coil magnetizes the rotor, and the alternator generates power.

When the alternator reaches a certain voltage, the voltage regulator turns off the transistor and cuts off current to the field coil, hence the alternator stops generating power.



The voltage regulation is performed by a high frequency ON/OFF cycle of the alternator. When the DC voltage of the output waveform is measured by a voltmeter, a value smaller than the peak voltage is measured.

A broken wire in the field coil in this type of system will result in insufficient charging of alternator. If the ground wire of the field coil wire is shorted to ground (transistor shorted), the battery will be overcharged.



## CHARGING SYSTEM INSPECTION

### LEAK TEST

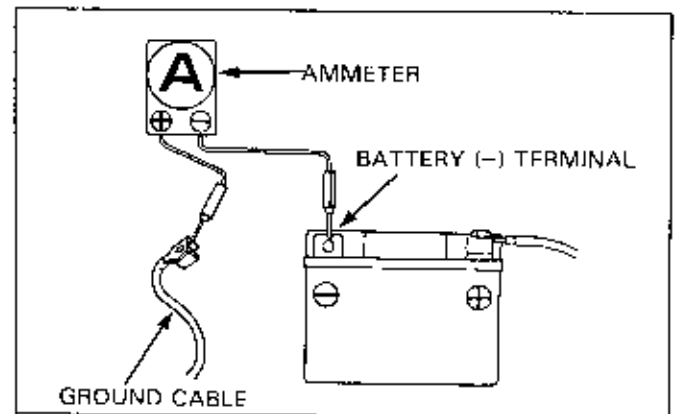
Turn off the ignition switch, and disconnect the ground (-) cable from the battery.

Connect an ammeter between negative (-) terminal and ground cable.

With the ignition switch off, measure the leakage current.

#### NOTE

- When measuring current using a tester, set it to a large range, and then bring it down the range to an appropriate level. Current flow larger than the range selected may blow out the fuse in the tester.
- While measuring current, do not turn the ignition on. A sudden surge of current may blow out the fuse in the tester.



If current leakage exceeds the standard value, a shorted circuit is likely to exist.

Locate the short by disconnecting connections one by one and measuring the current.

### CHARGING VOLTAGE INSPECTION

#### NOTE

- Be sure that the battery is fully charged before performing this test. The amount of current flow may change abruptly if not sufficiently charged.
  - For MF battery; use a battery whose voltage between its terminals is greater than 13.0 V.
  - For conventional battery, use battery whose specific gravity is greater than 1.27 (20°C/68 F).
- When the engine is started using the starter motor, a large amount of current may flow from the battery temporarily. Use the kick starter to start the engine for models equipped with both a starter motor and a kick starter.

## BATTERIES/CHARGING/LIGHTING SYSTEM

After warming up the engine, replace the battery with a fully charged battery.

Connect a multimeter between the battery terminals.

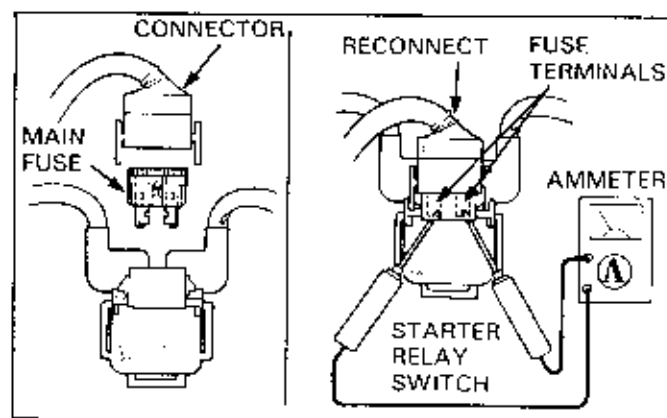
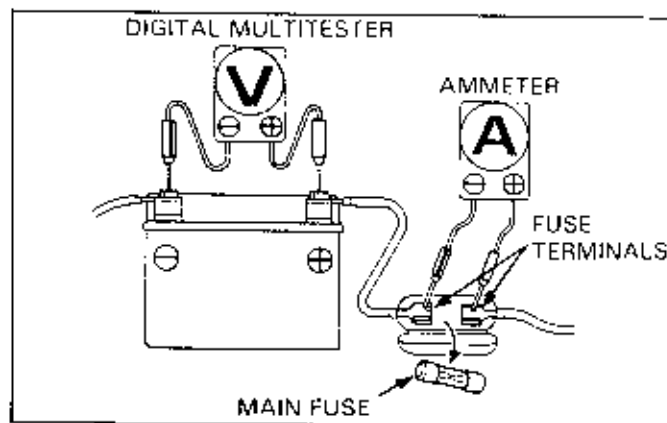


**DIGITAL MULTITESTER** 07411-0020000

Connect an ammeter between the terminals of the main fuse.

### NOTE

- If the probes are connected in reverse order, the registered current flow direction when charging and discharging the battery will be reversed as well. Refer to the Model Specific manual for proper connection of the multimeter.
- Use an ohmmeter that registers both positive and negative current flow. An ammeter which registers in only one direction will measure 0A for discharging.



### NOTE

- Be careful not to short any wires.
- Although the current could be measured when the ammeter is connected between the battery positive terminal and the positive (+) cable, a sudden surge of current to the starter motor could damage the ammeter. Always use the kick starter to start the engine.
- Always turn the ignition off when conducting the test. Disconnecting the ammeter or wires when current is flowing may damage the ammeter.

For models with no tachometer, connect an engine tachometer.

Turn the headlight ON (Hi beam) and start the engine. Gradually increase the engine speed and measure the charging voltage at the specified rpm.

### NOTE

- If the charging current and voltage measurements are normal when the battery is replaced with a new battery, it is likely that the original battery's effective life span has passed.

For the following conditions, the problem is most likely related to the charging system. Follow the steps in the troubleshooting chart.

- ① Charging voltage fails to increase beyond battery terminal voltage and charging current is in the discharging direction.
- ② Both charging voltage and current greatly exceed the standard value.

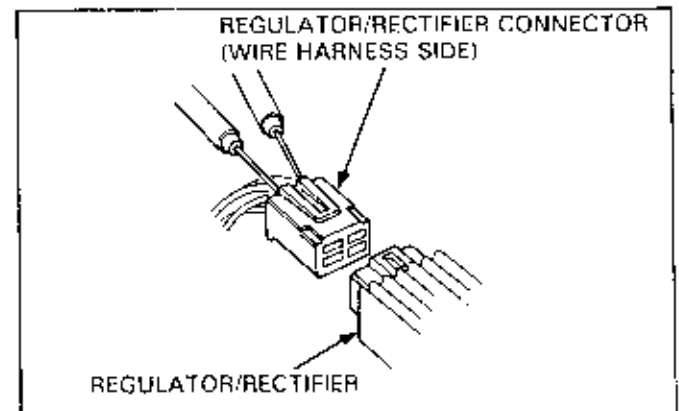
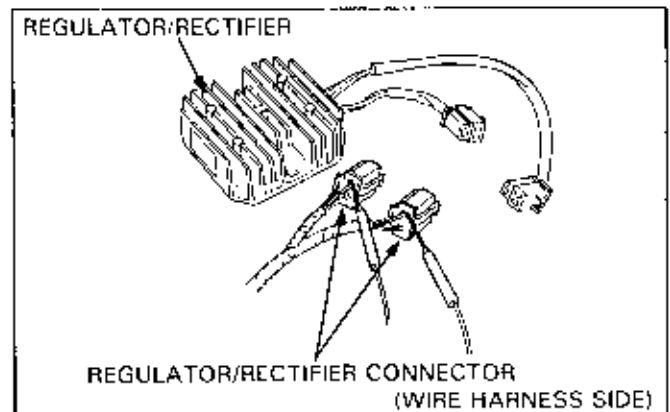
For conditions other than the ones mentioned above, the problem is most likely associated with an area other than the charging system, conduct the following inspection and follow the troubleshooting chart.

- ① Standard charging voltage/current is reached when the engine rpm exceeds the specified rpm.
  - Excessive electric load due to the use of light bulbs beyond the specified rating.
  - The replacement battery is old or underrated.
- ② Charging voltage normal but charging current abnormal
  - The replacement battery is old or underrated.
  - The battery used was undercharged or overcharged.
  - Blown out ammeter fuse.
  - Incorrect connection of ammeter.
- ③ Charging current normal but charging voltage abnormal
  - Blown out voltmeter fuse. (Check for faulty fuse by 0  $\Omega$  adjustment)

## REGULATOR/RECTIFIER INSPECTION

Service according to the troubleshooting chart. Since the regulator/rectifier is an electrical component using semiconductor devices, the component itself is not serviced. Instead, the connector on the regulator/rectifier is checked.

Inspect the regulator/rectifier at the terminals of each connector.

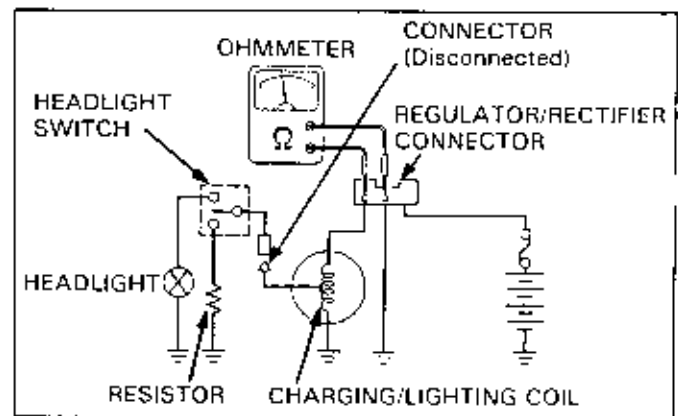


## BATTERIES/CHARGING/LIGHTING SYSTEM

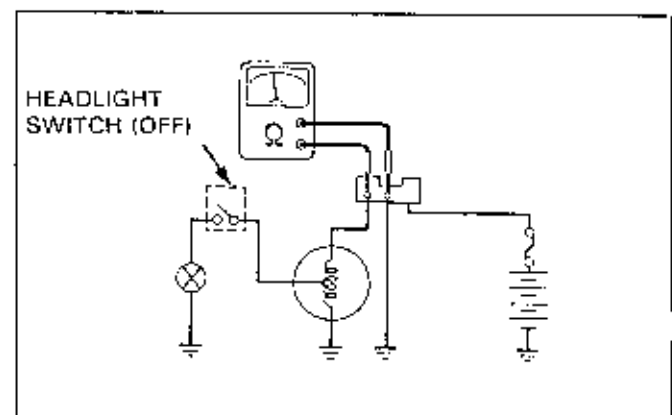
Items (wire colors)	Inspection
Battery wire (red/white or red)	Check that there is voltage between battery line (+) and ground line.
Ground wire (green)	Check continuity between ground and frame.
Voltage detection line (black) (external voltage detection type)	Check that there is battery voltage between voltage detection line (+) and ground wire when the ignition is ON.
Charging coil wire (refer to Model Specific manual)	Check that the resistance of the coil is within the specified range.
Charging/lighting coil wire (refer to Model Specific manual)	Check that the resistance of the coil is within the specified range. (Because the lighting system effects the resistance value, follow the steps below.)

For the charging/lighting coil (charging and lighting shared by a single coil), disconnect the output connector when measuring resistance. The headlight resistance will be included in the ohmmeter measurement if the connector is not disconnected. (If the headlight connector is connected, the measured resistance will be smaller, because the resistance of the headlight is connected in parallel.)

- For lighting systems whose headlight connector is connected to a resistor when the headlight is turned OFF, either disconnect the handlebar switch connector or disconnect the lighting output line of the alternator. (Refer to diagram at right.)



- For lighting systems that have a headlight ON and OFF switch, just turn off the headlight switch. (Refer to diagram at right.)

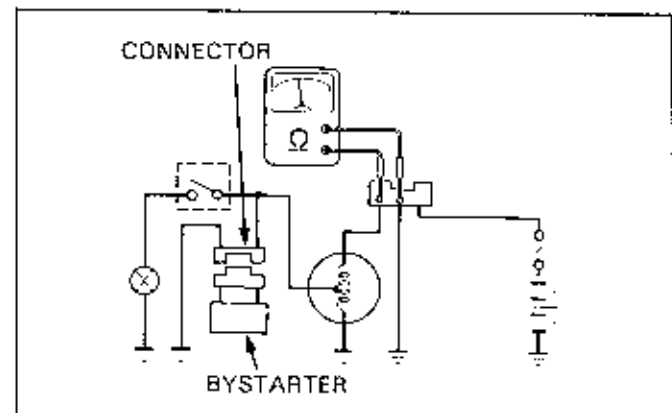


- Disconnect the auto-bystarter connector if applicable. (See diagram at right.)

If there is an abnormality in the diagnosis above, check the following:

- Battery wire → Broken wire harness (repair or replace)
- Ground wire → Broken wire harness (repair or replace)
- Charging coil wire (charging/lighting coil wire)
  - Check the charging coil (charging/lighting coil) of the alternator

If the resistance value of the alternator is normal (ie the resistance value measured by the above method is different from the alternator resistance), check for a broken or shorted wire harness between the regulator/rectifier and alternator or for poor connection at alternator connector.





## UNIT INSPECTION

Provided that all inspections on the wire harness side are normal and there are no loose connections at the regulator/rectifier connector, inspect the regulator/rectifier unit by measuring the resistance between the terminals. (Refer to Model Specific manual for specific data.)

### NOTE

- Resistance value will not be accurate if the probes touch your fingers.
- Use the following recommended multimeter.
- Using another manufacturer's equipment may not allow you to obtain the specified values. This is due to the characteristic of semiconductors, which have different resistance values depending on the applied voltage.

#### SPECIFIC MULTIMETER:

- 07411-0020000 (KOWA Digital type)
- KS-AHM-32-003 (KOWA Digital type; USA only)
- 07308-0020001 (SANWA Analogue type)
- TH-5H (KOWA Analogue type)

- Select the following range.

SANWA Tester:  $k\Omega$

KOWA Tester:  $\times 100 \Omega$

- An old, weak multimeter battery could cause inaccurate readings. Check the battery if the multimeter registers incorrectly.
- When using the Kowa multimeter, remember that all readings should be multiplied by 100.

Replace the regulator/rectifier unit if the resistance value between the terminals is abnormal.

## HEADLIGHT VOLTAGE INSPECTION

### Regulator/Rectifier With Built-in AC Regulator:

For a regulator/rectifier with a built-in AC regulator, measure the headlight lighting voltage.

### CAUTION

- Failure to measure the headlight voltage may lead to electrical damage of lighting components.

If the model is not equipped with a tachometer, connect an engine tachometer.

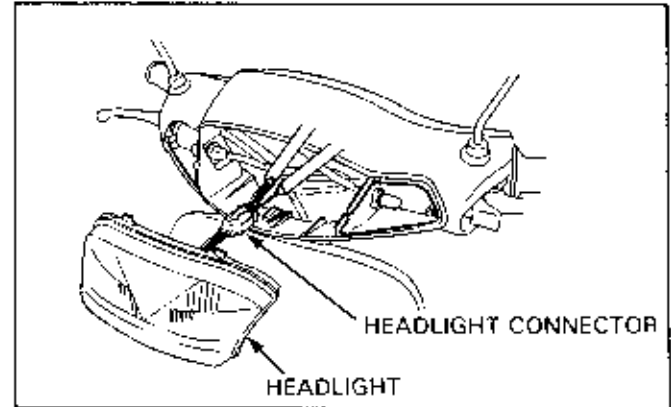
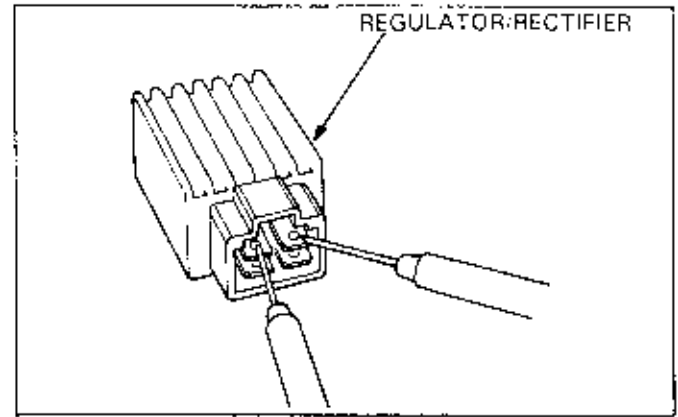
Remove the headlight and start the engine.

Turn the headlight on Hi-beam.

With the headlight wires still connected, measure the headlight lighting voltage between the terminals connected to blue (+) and green (-) wires.

Gradually increase the engine speed and read the voltage at the specified rpm.

Refer to Model Specific manual for service data.



## BATTERIES/CHARGING/LIGHTING SYSTEM

Select the AC range on your multimeter. (AC current flows to the headlight).

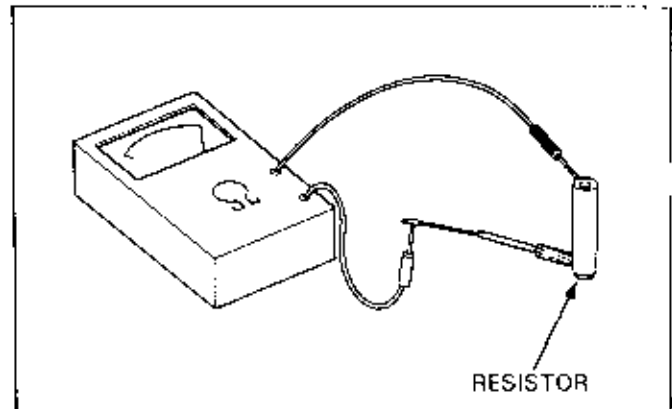
Use the specified multimeter. The measured headlight-regulated voltage may vary depending on the multimeter used because of the characteristics of the output waveform.

### SPECIFIC MULTIMETER:

- 07411-0020000 (KOWA Digital type)
- KS-AHM-32-003 (KOWA Digital type; USA only)
- 07308-0020001 (SANWA Analogue type)
- TH-5H (KOWA Analogue type)

### Resistor Inspection

For models with headlight resistor or an auto bystarter, measure the resistance of the resistor.



### AC Regulator Type:

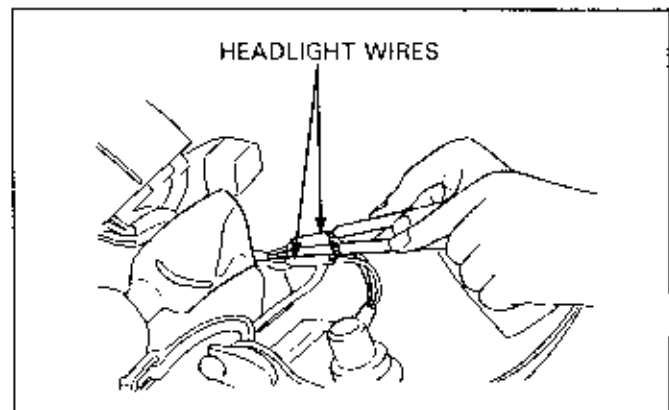
#### NOTE

- This section explains the inspection procedures for models which have an independent lighting coil powering the headlight system.
- For models with combined lighting and charging coil, refer to the regulator/rectifier inspection section.

For models not equipped with tachometer, connect engine tachometer.

Remove the headlight as shown, start the engine, and switch the headlight on Hi-beam.

With the headlight wires connected, measure the headlight lighting voltage between the blue (+) and green (-) wire terminals.



Increase the engine speed gradually and read the voltage at the specified engine rpm. Refer to the Model Specific manual for service data.

Select the AC range on your multimeter. (AC current flows to the headlight).

Use the specified multimeter. The measured headlight-regulated voltage may vary depending on the multimeter used because of the characteristics of the output waveform.

### SPECIFIC MULTIMETER:

- 07411-0020000 (KOWA Digital type)
- KS-AHM-32-003 (KOWA Digital type; USA only)
- 07308-0020001 (SANWA Analogue type)
- TH-5H (KOWA Analogue type)

- If the headlight lighting voltage is abnormally high, check the alternator connector and the alternator unit.
- If there is no headlight lighting voltage, check the following areas.
  - Loose or poor contact at a connection in the lighting circuit.
  - Continuity test for dimmer switch.
  - AC regulator.
  - Lighting coil in the alternator.

### AC REGULATOR INSPECTION

After checking that the connectors have no loose or poor connections, inspect the alternator unit by measuring the resistance between the terminals. (Refer to the Model Specific manual for service data.)

#### NOTE

- Resistance value will not be accurate if the probes touch your fingers.
- Use the following recommended multimeter.
- Using another manufacturer's equipment may not allow you to obtain the specified values. This is due to the characteristic of semiconductors, which have different resistance values depending on the applied voltage.

#### SPECIFIC MULTITESTER:

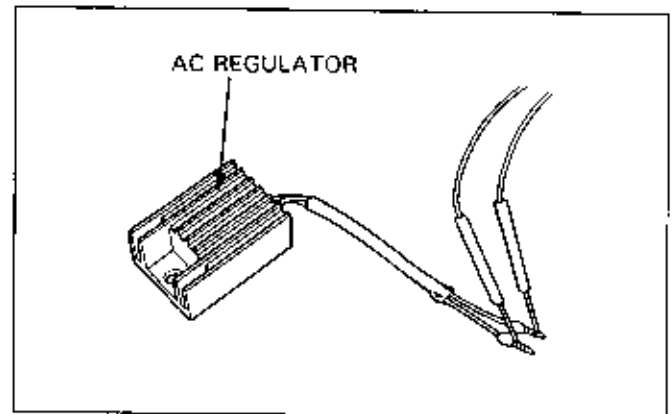
- 07411-0020000 (KOWA Digital type)
- KS-AHM-32-003 (KOWA Digital type; USA only)
- 07308-0020001 (SANWA Analogue type)
- TH-5H (KOWA Analogue type)

- Select the following range.

SANWA Tester: k  $\Omega$

KOWA Tester: x 100  $\Omega$

- An old, weak multimeter battery could cause inaccurate readings. Check the battery if the multimeter registers incorrectly.
- When using the Kowa multimeter, remember that all readings should be multiplied by 100.



If the resistance between the terminals is out of standard value, replace the regulator with a new one.

## ALTERNATOR

### CHARGING (CHARGING/LIGHTING) COIL INSPECTION

**NOTE**

- It is not necessary to remove the alternator from the engine.

Disconnect the alternator connector and check continuity between the wires.

(A) For single phase coils whose end is grounded, measure the resistance between output line and ground. (If the measured value is not correct, check the continuity between stator ground wire and ground, and between ground wire of alternator cover and ground.)

(B) For coils with two output lines, measure resistance between the two lines. Check that there is no continuity between engine ground and the output lines.

(C) For single phase, combined charging/lighting coils, measure the resistance at the charging output line and at lighting output line.

(D) For three phase coils, measure resistance between each output line, and check that there is no continuity between each output line and ground.

If the resistance values are much larger ( $\infty$ ) than the specified value, replace the stator.

If measurements are only slightly off the specified value, the stator may not need to be replaced.

Check other areas and decide if replacement is required.

### STATOR REMOVAL

Remove alternator cover. Watch for oil spilling out.

Hold the flywheel rotor with a holder and remove rotor bolt.

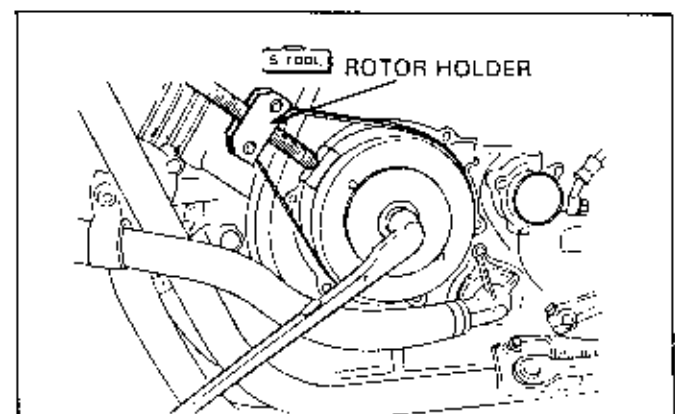
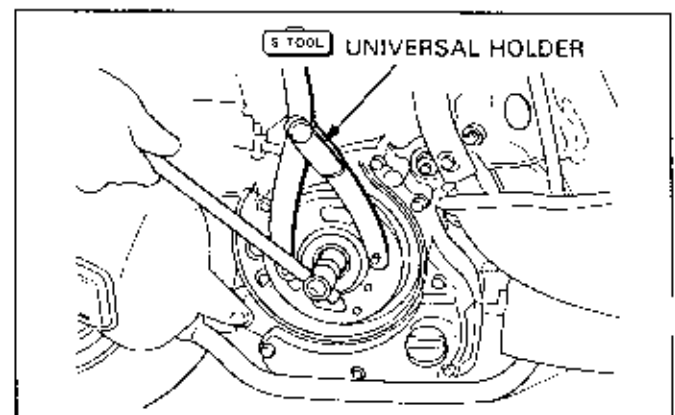
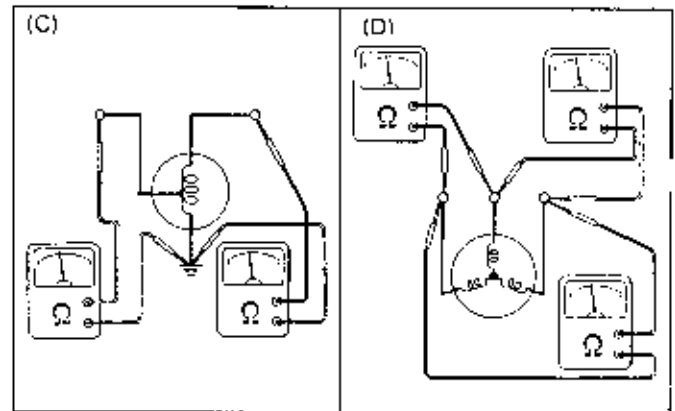
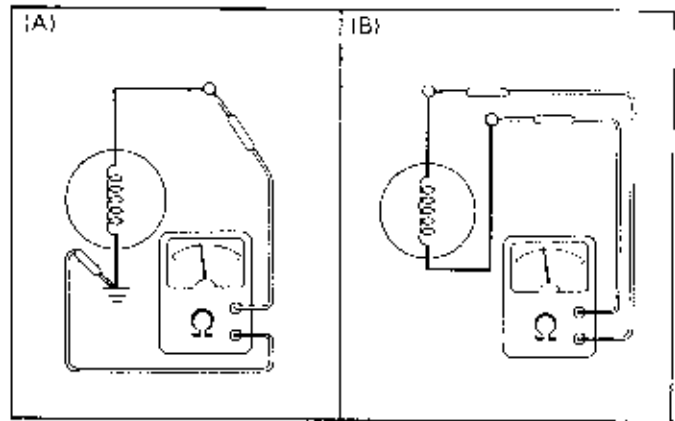
**3 TOOL**

**UNIVERSAL HOLDER**  
**ROTOR HOLDER**

**07725-0030000 or**  
**07725-0040000**

**CAUTION**

- Choose the correct holder. Using the wrong tool may damage components. Refer to the Model Specific manual for the correct holder.



Insert flywheel puller into the rotor and remove the rotor.

5 "00L

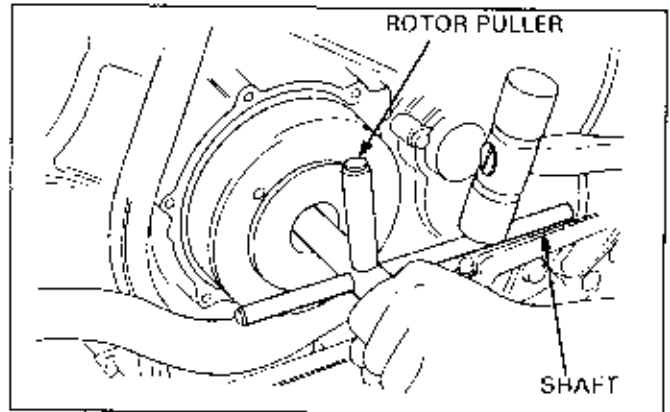
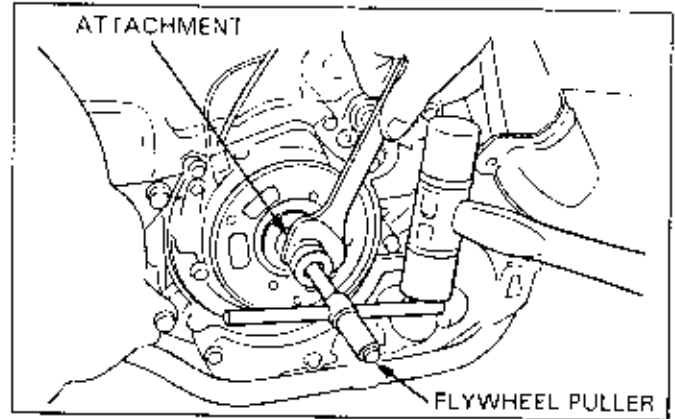
FLYWHEEL PULLER  
ROTOR PULLER

07733-0010000 or  
07733-0020001

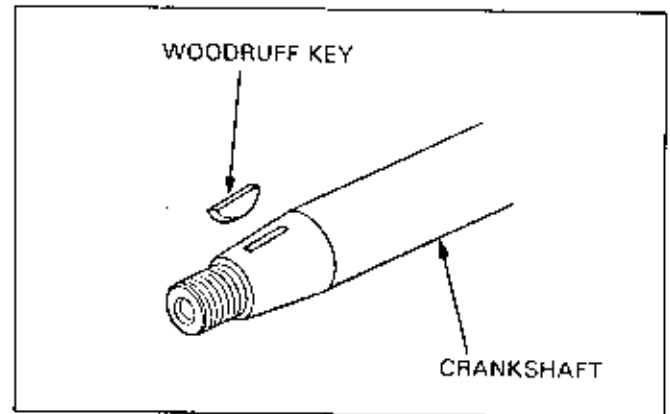
To remove the rotor, screw in the attachment, hold it securely with a wrench, and then screw in the puller shaft.

**CAUTION**

- Strong hammering on the puller shaft may damage the rotor.
- Always use a holder and a puller to remove the rotor. Do not try to remove the rotor by hammering directly on it. The crankshaft or components could be damaged.



Remove the woodruff key with care not to lose it.



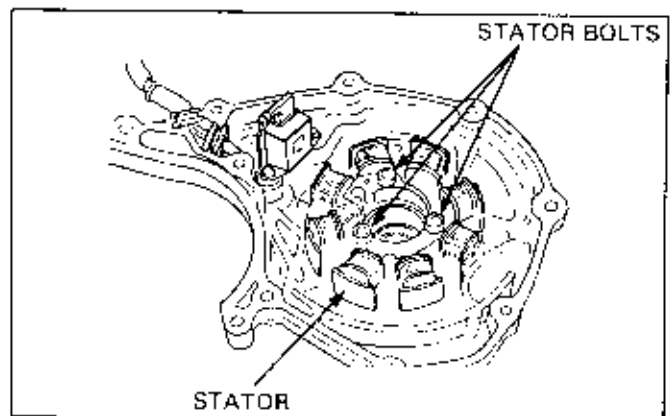
**STATOR REMOVAL**

Disconnect the alternator connector.

Remove the bolt or screw on the alternator cover or engine.

Remove the stator.

Stator bolts are often secured with locking agents. For this reason, use an impact driver.



## BATTERIES/CHARGING/LIGHTING SYSTEM

### STATOR INSTALLATION

Note the direction of stator, and install the stator on the crankcase.

Apply a locking agent to the bolt (or screw) threads and tighten it to the specified torque.

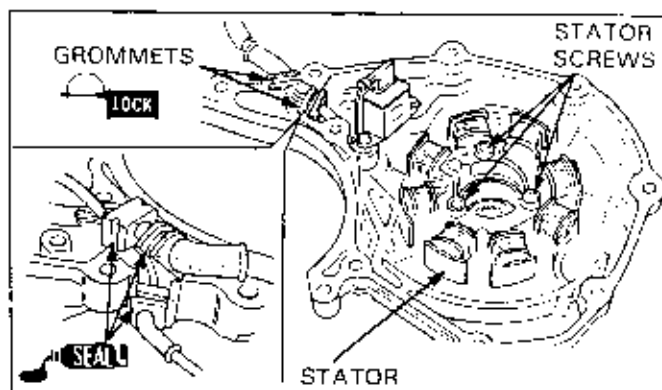
#### CAUTION

- If the stator bolt becomes loose, it may come into contact with the rotor and cause damage.

Route the stator wire correctly on the crankcase cover.

#### NOTE

- Route the stator wire so that it does not come into contact with the rotor.
- If there is a wire clamp or clip, secure the wire with it.
- Apply sealant to the grommet groove to prevent oil or water leakage.

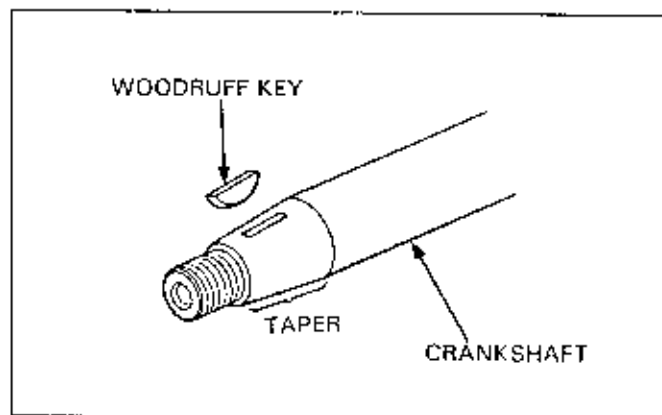


### ROTOR INSTALLATION

Clean the tapered portion of the crankshaft.

If the rotor is installed with dust or dirt on the taper, the taper will not make secure contact with the rotor and there will be excessive force on the woodruff key.

Insert the woodruff key into the key groove in the crankshaft.



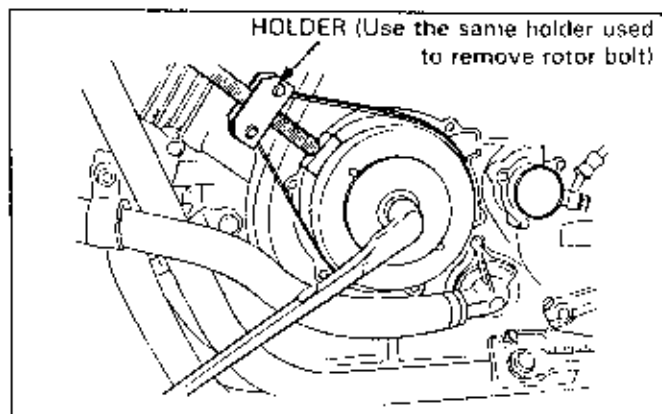
Set the rotor groove to the woodruff key and install the rotor on the crankshaft.

Tighten the rotor bolt (or nut) with your fingers.

#### CAUTION

- Before installing the rotor, check that no nuts or bolts are magnetically attached to the rotor. Installing the rotor with anything attached to it could damage the stator coil.

Hold the flywheel rotor with a holder and tighten the bolt (nut) to the specified torque.



Before bolting on the crankcase cover, check that the wires are not pinched.

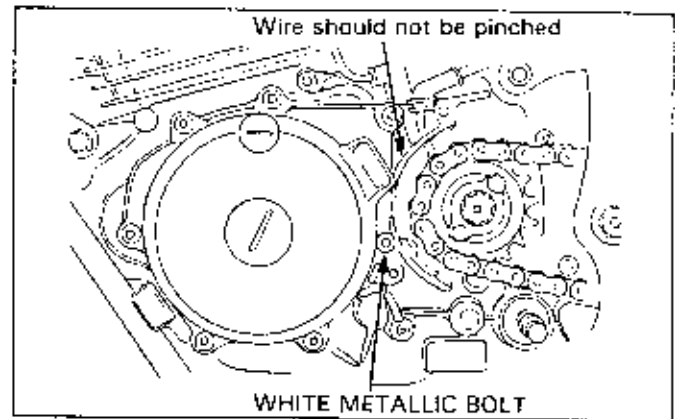
Install the crankcase cover onto the engine.

### CAUTION

- Use the crankcase (white metallic) ground bolt to ensure continuity between the engine and crankcase cover. (All other crankcase bolts are black.) The white bolt must be grounded properly to allow the electrical system to operate normally.

### NOTE

- For reassembly, install the white metallic bolt in the case hole with the unpainted seating surface.



# 23. IGNITION SYSTEMS

SERVICE INFORMATION	23-1	IGNITION TIMING	23-11
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SYSTEM DESCRIPTIONS	23-4	CDI SYSTEM	23-13
SPARK PLUG	23-9	TRANSISTORIZED IGNITION SYSTEM	23-16
SPARK TEST	23-10		

## SERVICE INFORMATION

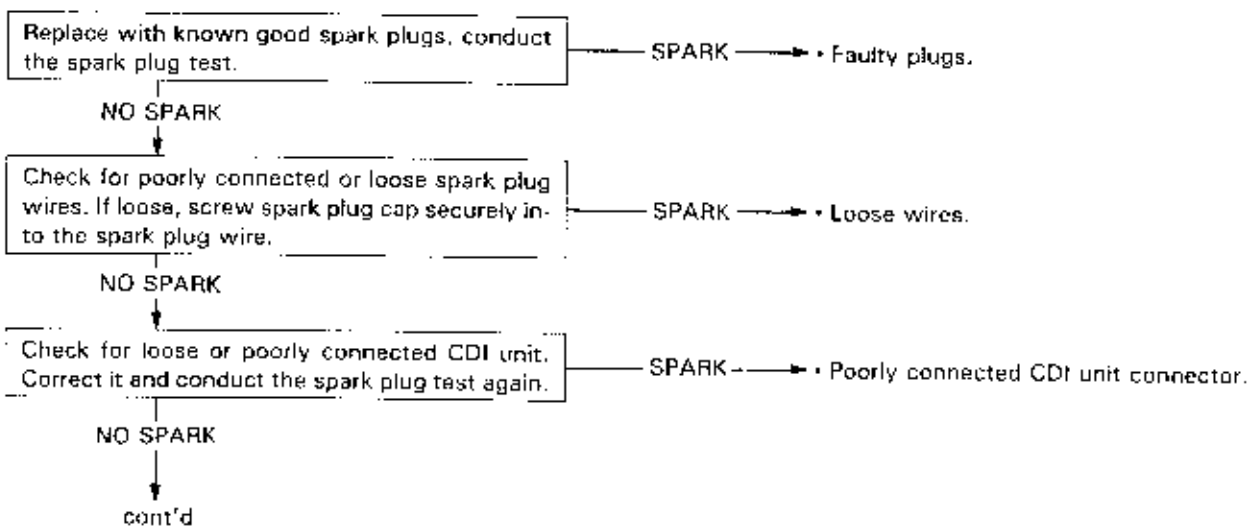
### GENERAL

- Follow the steps described in the troubleshooting flow chart when servicing the ignition system.
- The CDI unit and transistorized ignition system use an electrically controlled ignition timing system. No adjustments can be made to the ignition timing.
- For multi-cylinder engines, a rough diagnosis can be made by identifying the cylinder whose spark timing is incorrect.
- The CDI unit and the transistorized unit may be damaged if dropped. Also, if the connector is disconnected when current is flowing, the excessive voltage may damage the unit. Always turn off the ignition switch before servicing.
- A faulty ignition system is often related to poorly connected connectors. Check those connections before proceeding.
- For models with an electric starter, make sure the battery is adequately charged. Using the starter motor with a weak battery results in a slower engine cranking speed as well as a weak spark at the spark plugs.
- Use spark plugs of the correct heat range. Using spark plugs with an incorrect heat range can damage the engine. Refer to chapter 2 for servicing spark plugs.

## TROUBLESHOOTING

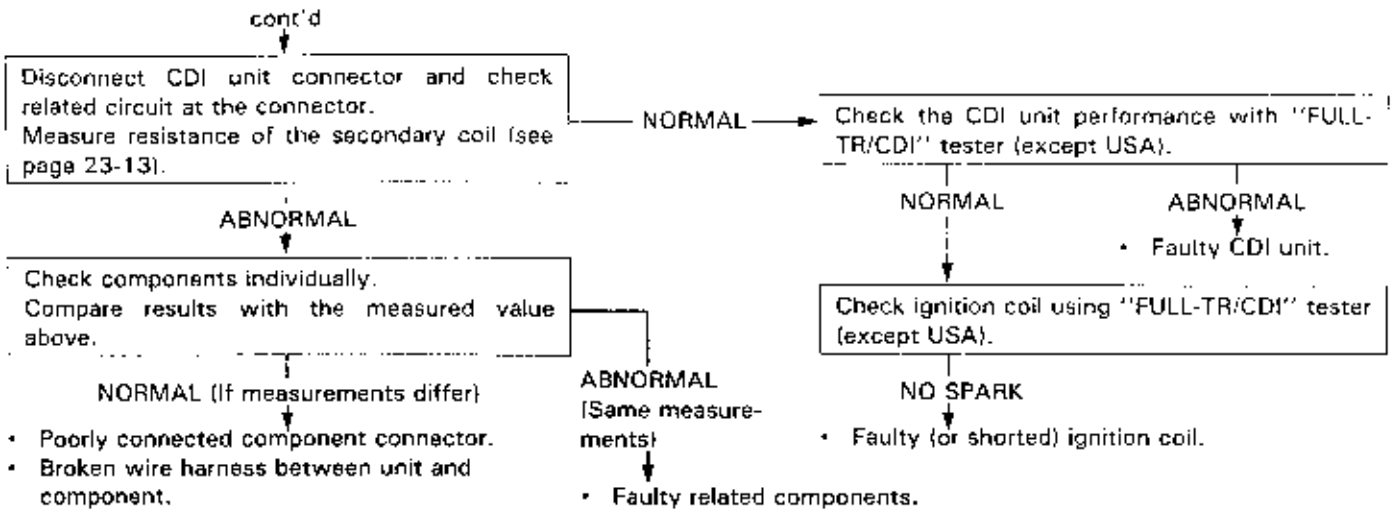
The diagnostic steps presented here are general methods of troubleshooting the CDI and transistorized units. The steps and methods used in diagnosing may differ depending on each model. Refer to the Model Specific service manual for details concerning the ignition system.

### No spark at spark plugs. (CDI unit)



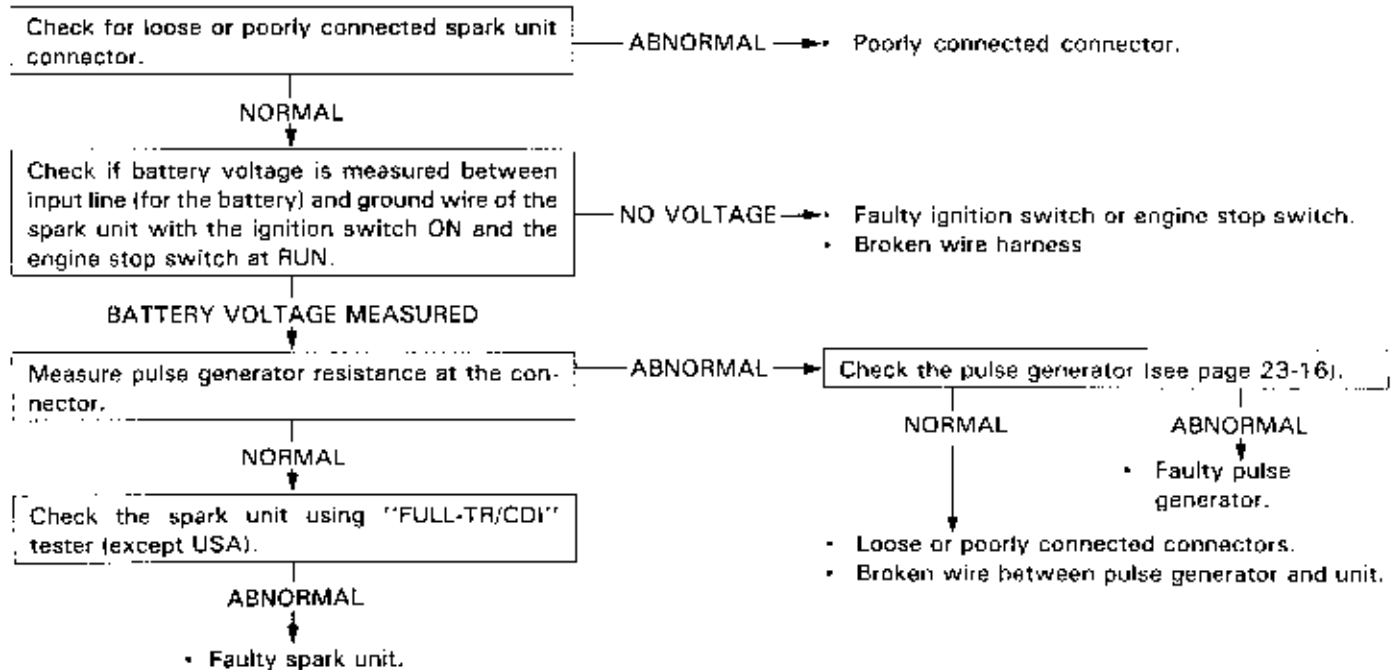


# IGNITION SYSTEMS



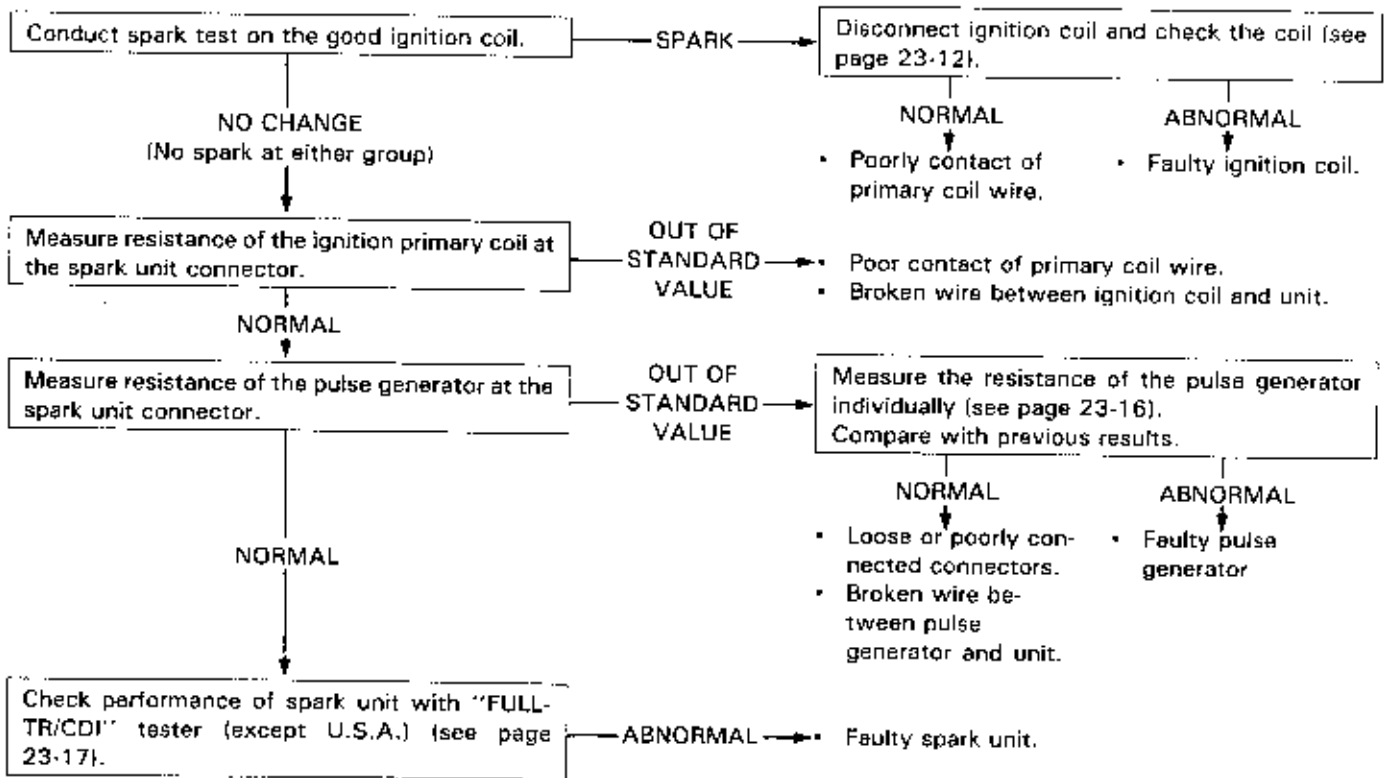
## No spark at all plugs. (Faulty Input system) <Transistorized ignition system>

If there is no spark at all plugs, the problem could be at the input of the ignition system (pulse generator, power supply circuit of the unit, spark unit).



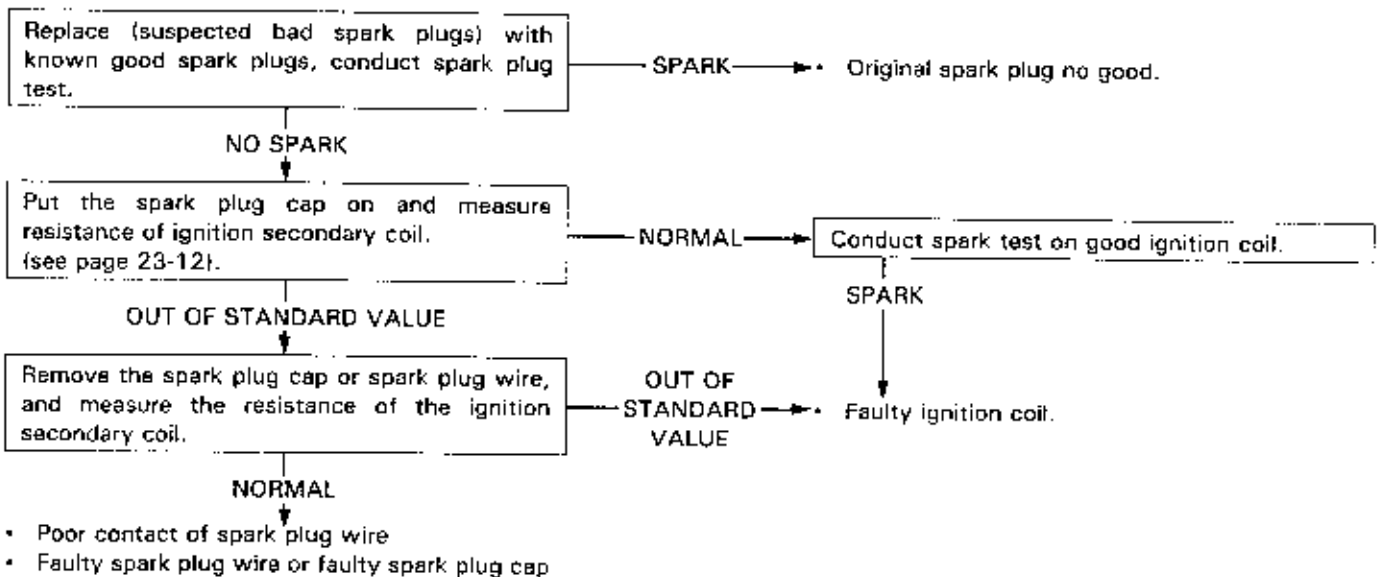
**No spark at either ignition group. <Multi-cylinder transistorized ignition system>**

- If there is no spark at either group, the problem is suspected in the primary coil side of the ignition system. (i.e. ignition coil, unit and ignition coil circuit.) However for models with several spark units where each fires its own group, faulty input components are suspected. Check input components described on the previous page.
- Ignition group is determined by the type of engine. Refer to Model Specific manual for details.



**No spark at one plug. (Trouble in secondary coil side) <Multi-cylinder transistorized ignition system>**

- For models with independent coils for each cylinder, the problem is suspected on the primary coil side. Refer to the above flow chart. (No spark at either ignition group)
- For double ignition coil (one coil igniting two spark plugs), faulty spark plug is most likely.



## SYSTEM DESCRIPTIONS

Most motorcycles use electrically controlled ignition systems. These ignition systems can be divided into two types, depending on how they operate.

Namely, there is the CDI and the transistorized type. Although their function is the same, the way they operate is different. In order to service these systems, one needs to understand their basic operation. Since both control their ignition-system components electrically, there is no mechanical wear, and periodic maintenance and adjustment is unnecessary.

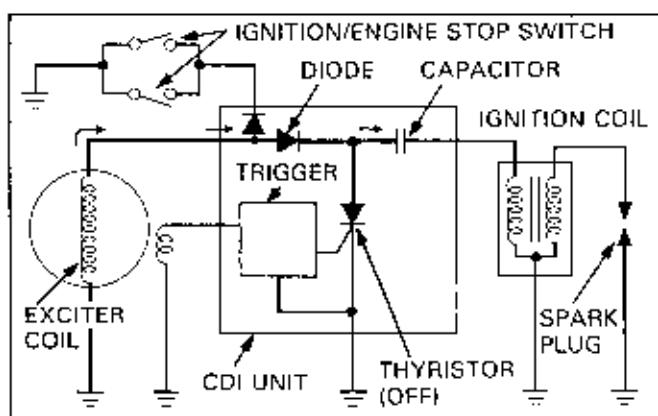
### CDI

The term CDI is an abbreviation for "Capacitive Discharge Ignition." The CDI produces quick and stable secondary voltage and is resistant to spark plug fouling. It is also designed to increase its secondary voltage as rpm increases. The CDI is used mainly on small engine displacement models.

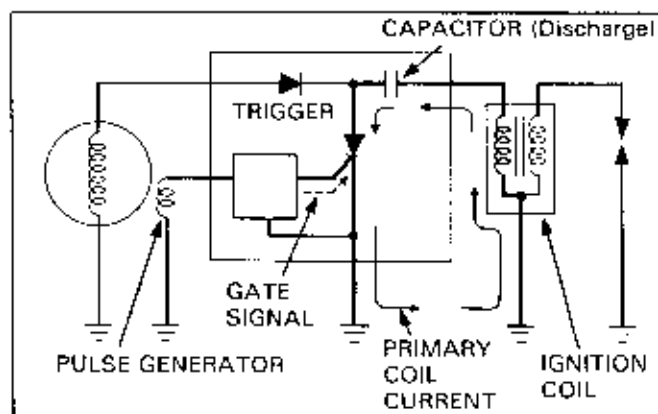
#### Operating Principles

As the alternator rotor turns, current is induced in the alternator (exciter coil). This current (AC) is fed to the CDI unit with a voltage of 100-400 volts. This AC current is half-wave rectified by a diode and is stored in the capacitor inside the CDI unit.

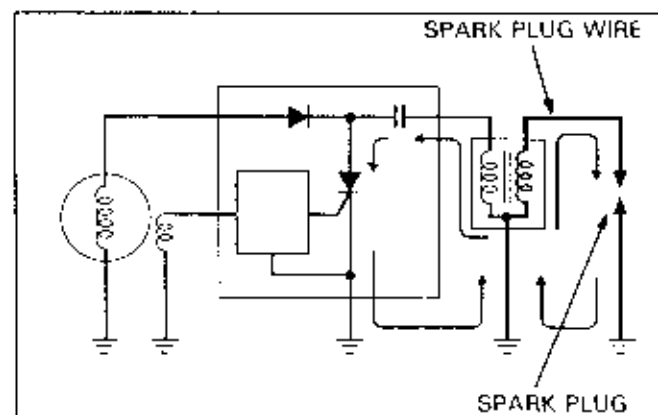
When the engine is turned off, the current induced by the exciter coil is shorted to ground, thus cutting off current to the capacitor and turning off the spark.



The capacitor cannot discharge until the SCR is turned ON. The SCR is turned ON as the pulse generator sends pulses to the trigger circuit which, in turn, feeds current to the gate of SCR.



When the SCR is turned ON, the capacitor discharges current to the ignition primary coil. A high voltage surge included in the secondary coil jumps the spark plug gap.

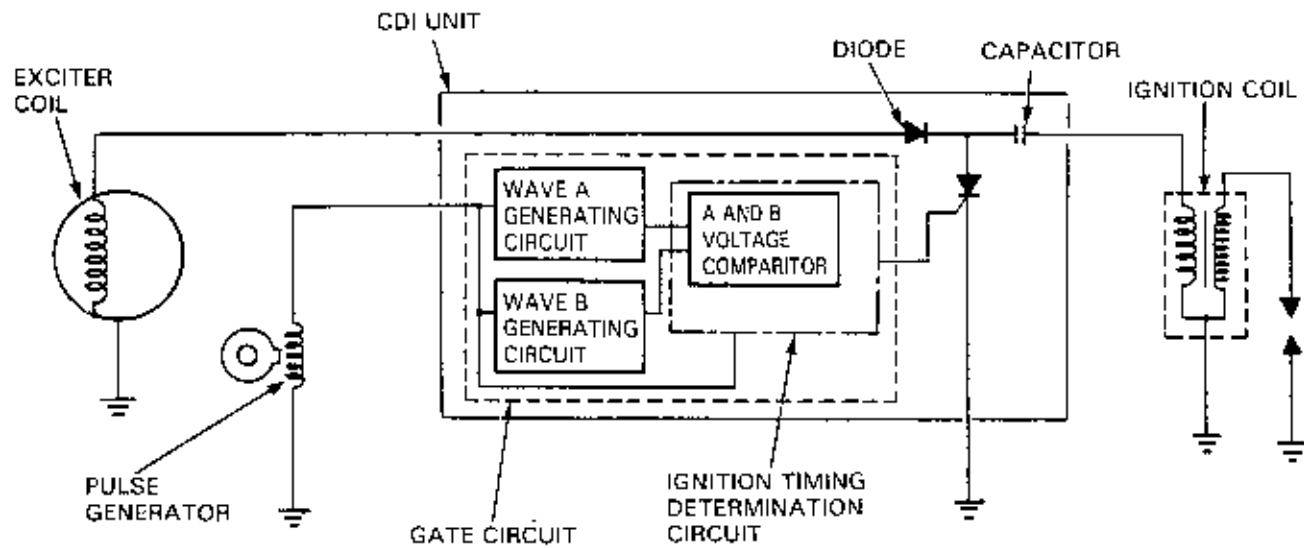


**Principle of Ignition Timing Advance**

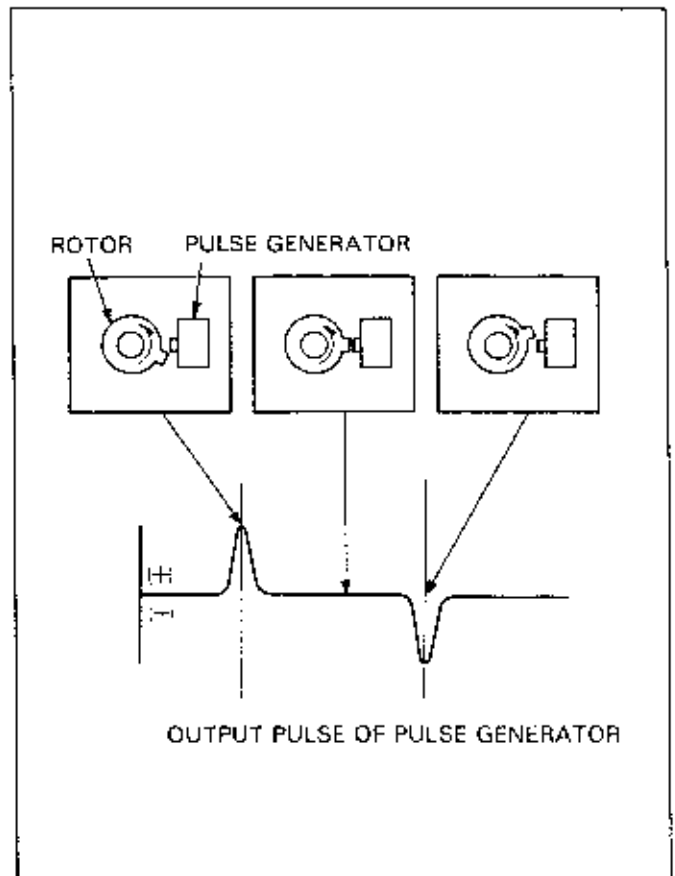
Another function of the electrically controlled ignition system is that the ignition timing advance (or retard) is controlled electrically. This system requires no mechanical advance and has no mechanical wear. The overall design eliminates periodic adjustments and maintenance.

This section explains the operating principles of the ignition timing advance. The ignition timing retard system operates under the same principles.

The trigger circuit consists of a wave A and wave B generating circuit which converts the output from the pulse generator to wave forms A and B, and an ignition timing selector circuit.



The pulse generator produces positive and negative voltage pulses when the rotor reluctor crosses the generator.



## IGNITION SYSTEMS

The output from the pulse generator is converted into basic waves A and B.

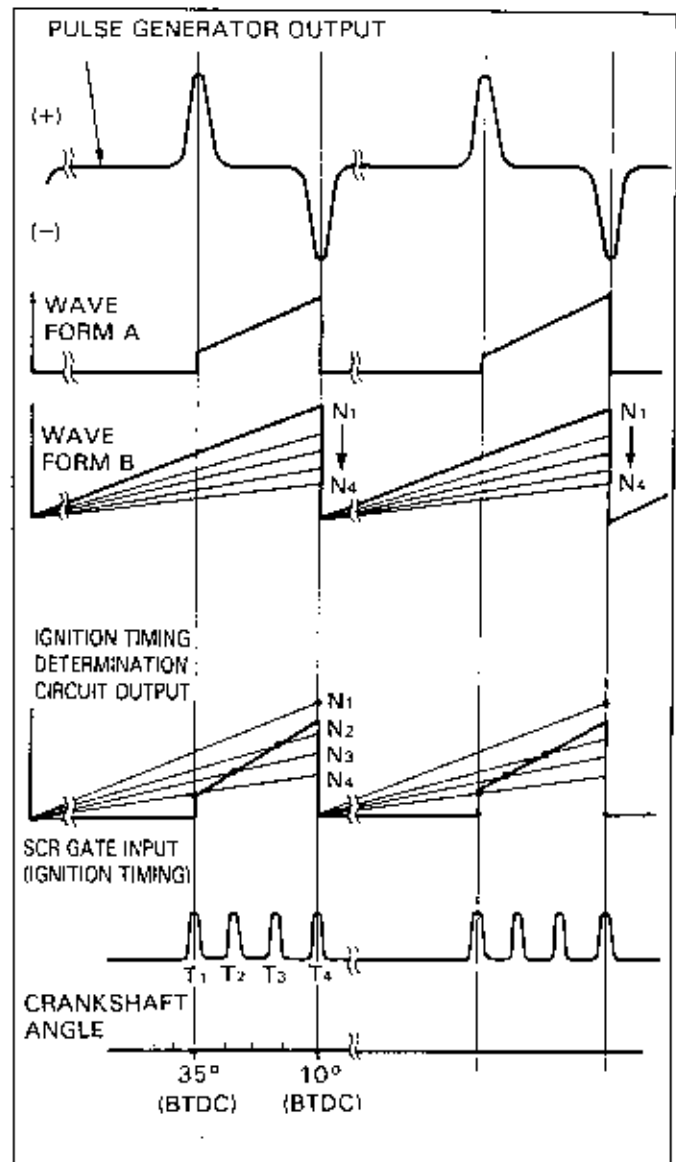
Basic wave A is unaffected by engine speed and remains constant.

Basic wave B changes its gradient as the engine speed increases as shown in the right graph.

The ignition timing determination circuit sends current to the gate of SCR when a negative voltage pulse from the pulse generator is input to the determination circuit or when the wave A becomes greater than wave B. The current to the gate of SCR turns on the SCR and ignites the spark.

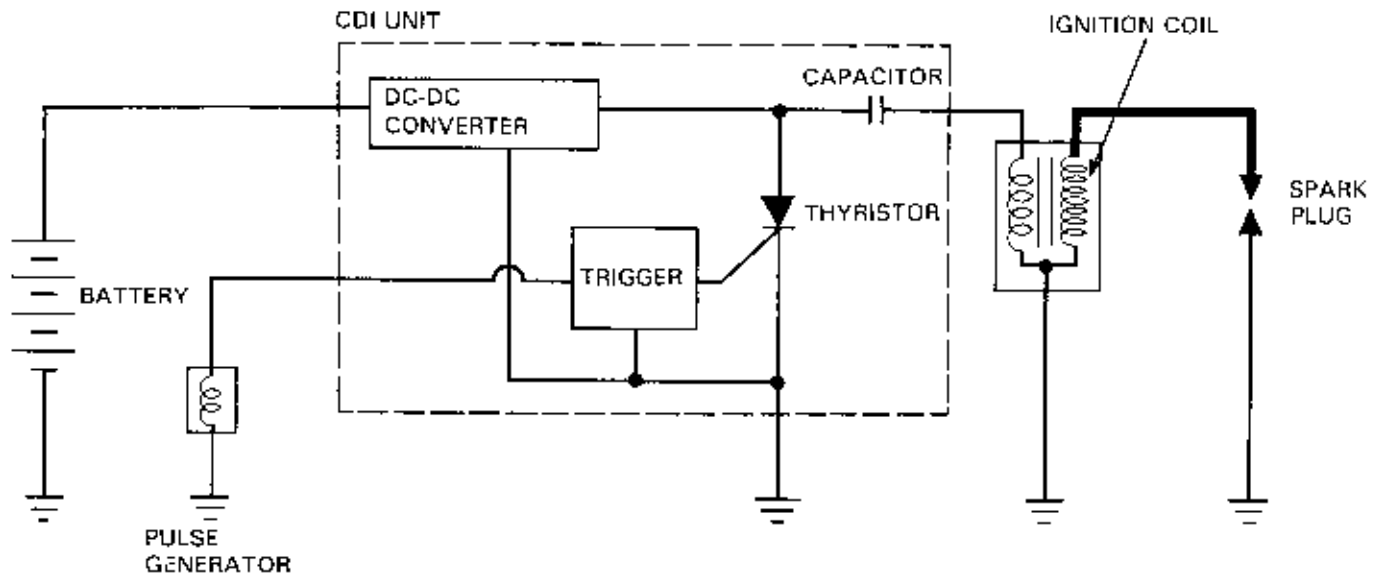
Since wave A remains constant and wave B changes its waveform, as the engine rotation increases, wave B becomes smaller than wave A. As the engine speed increases, the timing at which wave A becomes greater than wave B advances. When the engine speed increases above N4, ignition timing no longer advances because basic wave A is not inclined.

At N1, wave B is larger than wave A and thus ignition timing is determined by the negative voltage pulse from the pulse generator.



## DC-CDI

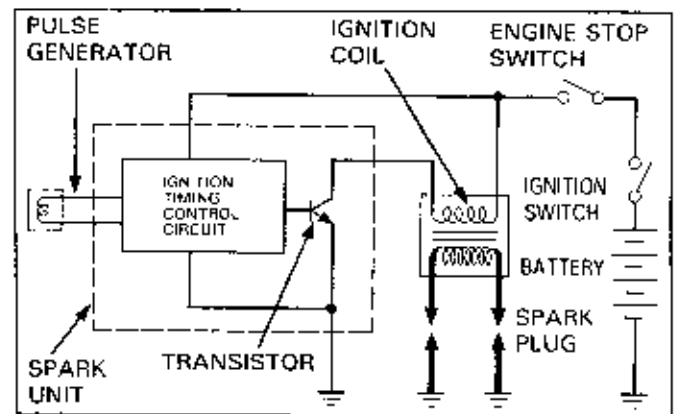
The DC-CDI ignition system is basically a CDI system except that the battery is used for the source. The DC-CDI control unit includes a DC-DC converter which amplifies the battery voltage to about 220 V, which is then stored in the capacitor. Except for the DC-DC converter, the DC-CDI control unit is identical to the CDI unit. Compared to conventional exciter coil-powered CDI, the DC-CDI provides greater spark energy at low rpm since the power source is stable battery energy.



## TRANSISTORIZED IGNITION SYSTEM

The transistorized ignition system also utilizes the battery, but its ignition operation works differently.

Since the duration of time the spark plug fires is longer than that of the CDI, a larger ignition system is well suited for large displacement engines.

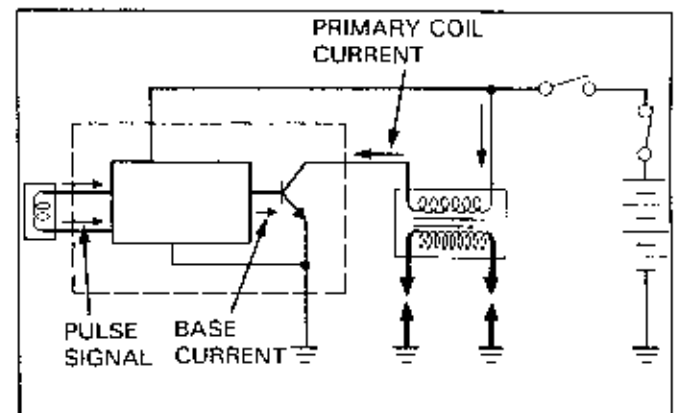


## Operating Principles

The battery feeds current to the ignition primary coil via the ignition switch and engine stop switch when the transistor inside the spark unit is turned ON. This current is turned off when the transistor is OFF.

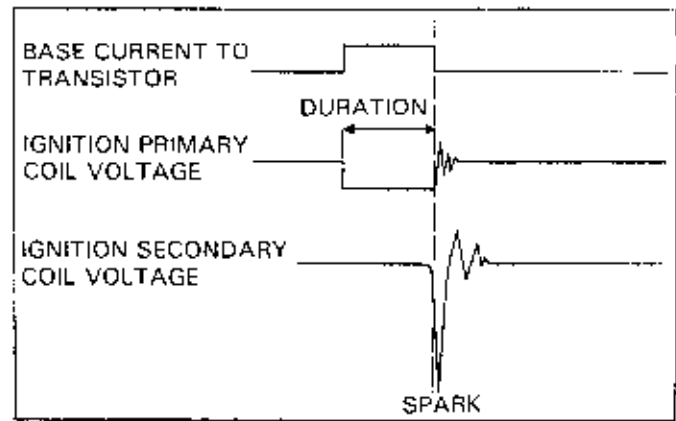
When the engine is turned on, the pulse signal from the pulse generator is fed to the ignition timing control circuit. The ignition timing control circuit determines the ignition timing based on the pulse signal and sends current to the base of transistor.

After current pulse flows through the primary coil, the transistor is turned OFF and current is cut off to the coil. At that moment, an induced voltage on the secondary coil ignites the spark plugs.



## IGNITION SYSTEMS

As the engine speed increases, the duration of current flow through the primary coil becomes shorter and thus the secondary coil voltage does not go high enough. For this reason, the ignition timing control circuit controls the duration of current flow through the ignition primary coil.



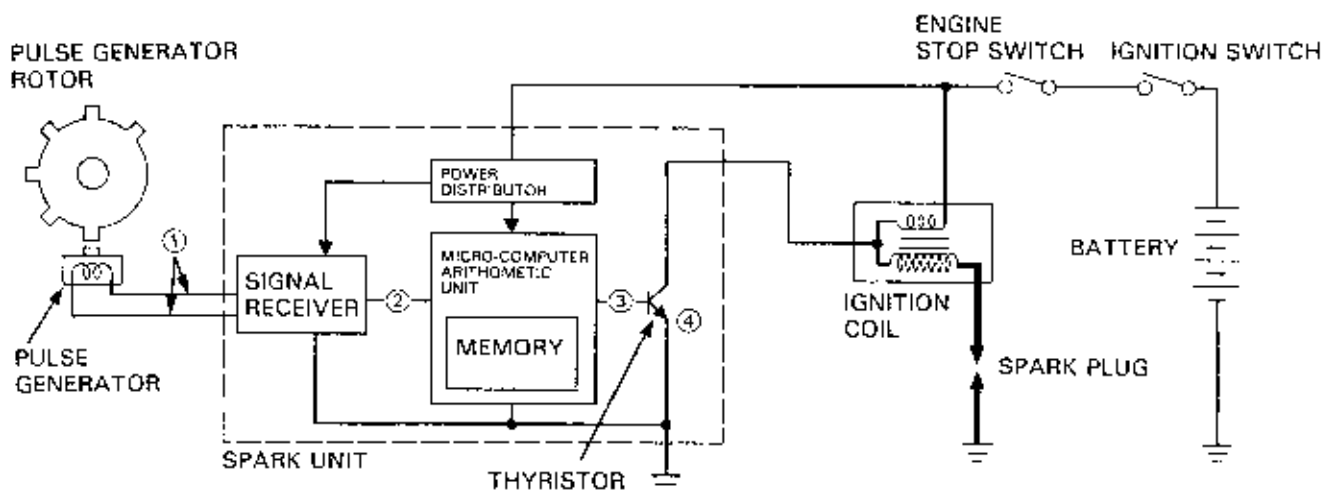
### DIGITALLY CONTROLLED TRANSISTORIZED IGNITION SYSTEM

This system digitally controls the ignition timing by a microcomputer inside the spark unit and calculates the ideal ignition timing at all engine speeds. It also has a fail-safe mechanism which cuts off power to the ignition coil in case the ignition timing becomes abnormal.

The control unit consists of a distributor, a signal receiver, which processes the pulse signals from the pulse generator, and a microcomputer which has a memory and an arithmetic unit.

The pulse generator rotor has reluctors which are irregularly spaced. When these reluctors move past the generator, pulses are fed to the spark unit. The number of reluctors and the angle between each reluctor differ depending on the number of cylinders and their arrangement. The circuit below is the ignition system of a 90° V-type 2 cylinder engine.

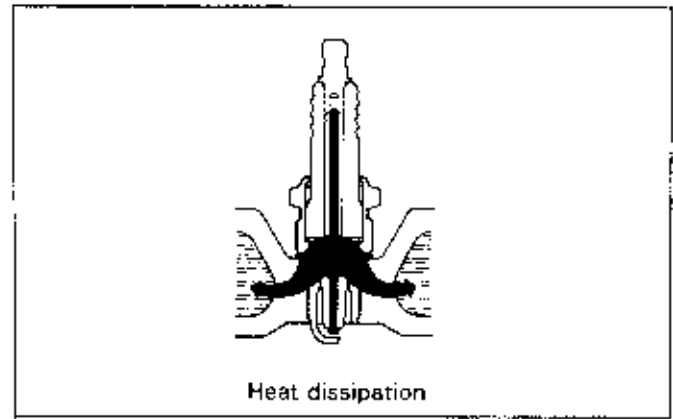
- ① As the engine starts, a pulse signal from the pulse generator is sent to the spark unit.
- ② The signal receiver converts the pulse signal to a digital signal and it is fed to the microcomputer.
- ③ As the microcomputer receives the digital signal, it processes signals containing information on the crankshaft angle and engine speed. The microcomputer then reads the information on ignition timing, which is based on the engine speed, from its memory, and determines the ignition timing. Then, the microcomputer sends current to the base.
- ④ As the current from the microcomputer flows to the base of transistor, the transistor is turned ON, and ignites the spark plug, identical to the transistorized ignition system.



## SPARK PLUG

Due to the high voltage generated at the ignition coil, sparks jump across the center electrode and side electrode of the spark plug and ignite the fuel mixture in the combustion chamber.

Use spark plugs of the proper size and heat range appropriate for the engine, or the engine will not perform to its full potential and damage to the engine may occur.



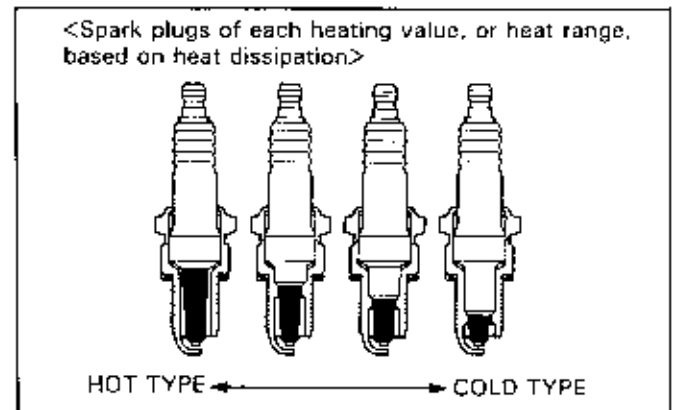
### Spark plug heat range

As the spark plug is constantly exposed to the engine combustion gas, it is necessary to dissipate heat in order to keep the spark plug at a certain temperature at which carbon deposits are burned off.

The capacity of dissipating the heat is called "heating value" or the heat range.

It is important to install the spark plug of the proper heating value, because the combustion gas temperature varies according to the engine type and driving conditions.

- Hot type ..... Heat is dissipated slowly.
- Cold type ..... Heat is dissipated quickly.
- Heating value is indicated by a number;
  - Smaller number ..... Hotter type
  - Larger number ..... Colder type

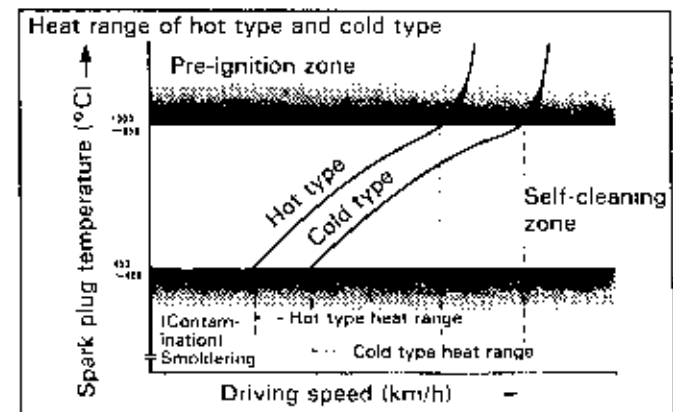


If an improper cold type spark plug is installed, the sparks do not jump across the electrodes as easily or it may contaminate the plug with oil/gasoline.

If an improper hot type is installed, it causes overheating or preignition and may result in melted electrodes and/or a hole in the piston.

Optional spark plugs are often listed for the Honda motorcycles.

Replace the plug with the optional one whenever the heating value of the original plug does not comply with the driving conditions.



There are several types of spark plugs, grouped according to the heating value, thread diameter and construction, as shown below.

### NGK plug

D	P	R	E	A-Z
Thread dia.	Remark	Heating value	Thread length	Remark
A: 18 mm B: 14 mm C: 10 mm D: 12 mm	P: Porcelain projected type R: Resistor spark plug	4 (Hot type) 5 6 7 8 9 (Cold type)	E: 19 mm H: 12.7 mm	A, Z: Special type S: With cupped wick V: Narrow center electrode K: Side electrode Number indicates the plug gap. "8": 0.8 mm

### ND plug

X	24	E	P	U	-9
Thread dia.	Heating value	Thread length	Remark	Remark	Remark
M: 18 mm W: 14 mm X: 12 mm J: 10 mm	14 (Hot type) 15 20 22 24 27 (Cold type)	E: 19 mm F: 12.7 mm	P: Porcelain projected type L: Special plug R: Resistor spark plug S: Porcelain non-projected type U: With "U" groove in the side electrode	"9" indicates that the plug gap is 0.9 mm. If no number is listed, it usually indicates that the gap is 0.7 mm	



### SPARK TEST

Remove spark plugs from the cylinder head and connect spark plugs to the plug caps.

Ground the spark plug to the cylinder head and turn the ignition ON. Check if a good spark occurs while cranking the engine with the starter.

A high voltage spark will appear at the gap of the spark plug.

#### ⚠ WARNING

- Avoid touching the spark plug to prevent electric shock.

For multi-cylinder engines, remove spark plug from each cylinder.

For some models with the CDI system, there is a circuit within the CDI unit designed to turn off the spark at low cranking speeds (below 200–500 rpm). In this case, leave the spark plug in the cylinder head and try the spark test with known good spark plug.

Some CDI units are designed to turn off the spark when the transmission is at neutral or reverse position.

If the plug fires, the spark plug is good.

Note that the plug is more difficult to fire in dense air than in normal atmospheric conditions.

Thus, even though spark occurs under normal atmospheric conditions, it may not occur in the compressed cylinder environment.

For this reason, you should check that the secondary coil has sufficient voltage by following the procedure that follows.

Attach a spark plug adaptor. Ground the black wire to the engine and conduct the spark plug test.

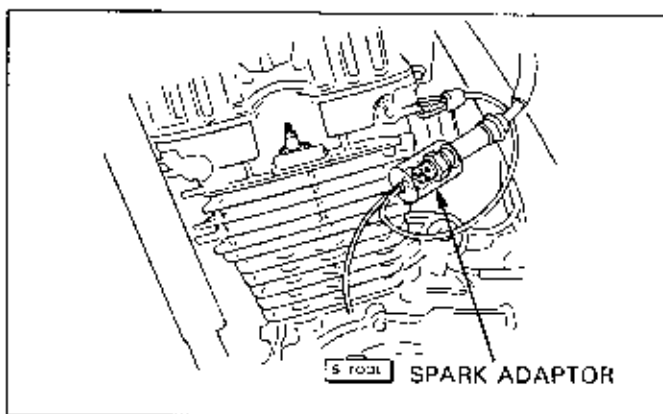
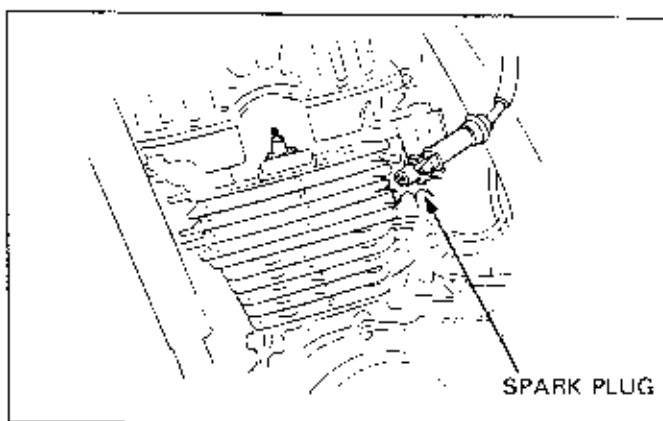
If there is a spark across the gap in the adaptor, the ignition coil is good.

#### ⓘ Tool

SPARK ADAPTOR

07GGK-0010100  
(Except USA)

If spark occurs across the spark plug gap, but no spark occurs with the adaptor on, the secondary coil voltage is insufficient.



## IGNITION TIMING

Warm up the engine.

Connect timing light to the spark plug wire.

For models with no tachometer, connect an engine tachometer.

### NOTE

- Read the instructions for timing light and engine tachometer before operating.

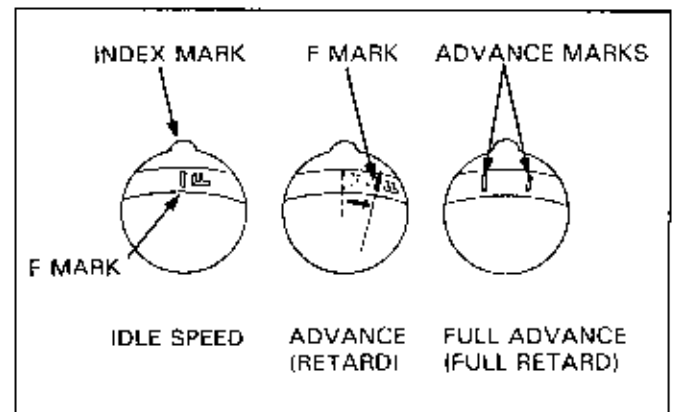
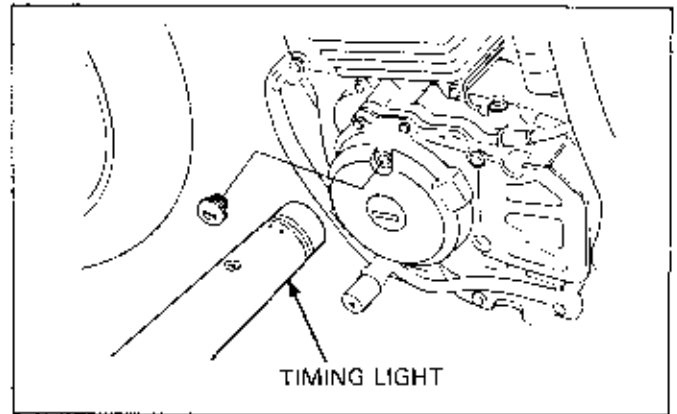
Remove the timing hole cap from the engine (Refer to the Model Specific manual for position of cap).

Start the engine and check if the following results are obtained.

- If the F mark on the rotor is aligned with the index mark on the case at the correct idling speed, then the timing is correct.
- Increase engine speed by rotating the stop screw on the carburetors.  
Check if the F mark begins to move when the engine speed reaches the advance (or retard) start rpm.  
However, this check cannot be done on models with a large ignition timing variation.
- At full advance/retard rpm, the ignition timing is correct if the index mark is between the two advance/retard marks.  
However, because models with large ignition timing variation cannot be checked this way, there are no advance/retard marks on the rotor for these models.

### NOTE

- For models with no advance (or retard) mark, check only the F mark position.

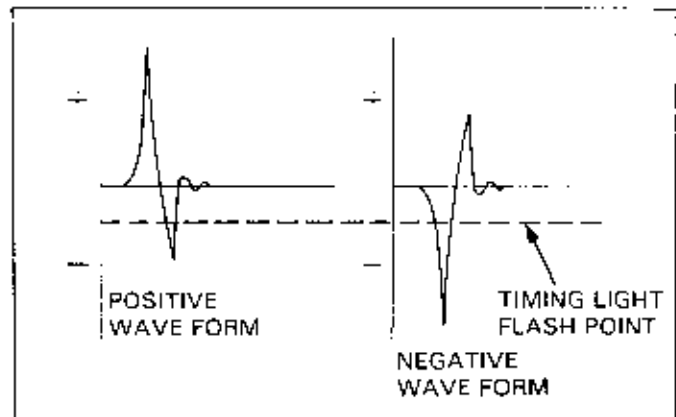


## IGNITION SYSTEMS

Depending on the kind of timing light used when checking the ignition timing, an abnormal advance timing could be observed.

This is because the spark plug wire being measured is not receiving a negative pulse. Most timing lights are designed to receive negative pulses.

If the spark plug wire being measured is receiving positive pulses, the input of the timing light will be receiving the alternated portion of the waveform. Thus, the timing light flickers.



Since the polarity of the waveform has no effect on the spark plug, connect the ignition primary coil wires to the opposite terminals. For double ignition coil types (a single coil firing two spark plugs), connect the timing light to the opposite wire of the same coil. The correct timing should then be observed.

## IGNITION COIL

### NOTE

- Since the resistance value of the primary coil is inherently very small, it is difficult to distinguish it from a shorted wire.
- Measure the coil resistance as a guideline for checking the coil. Check the performance of the coil with the "FULL-TR/CDI" tester (except U.S.A.).

### PRIMARY COIL INSPECTION

Measure the resistance between the two terminals of the ignition primary coil.

If the resistance value is within the specified range, the coil is good.

If resistance is  $\infty$  (infinite), replace the coil with a new one.

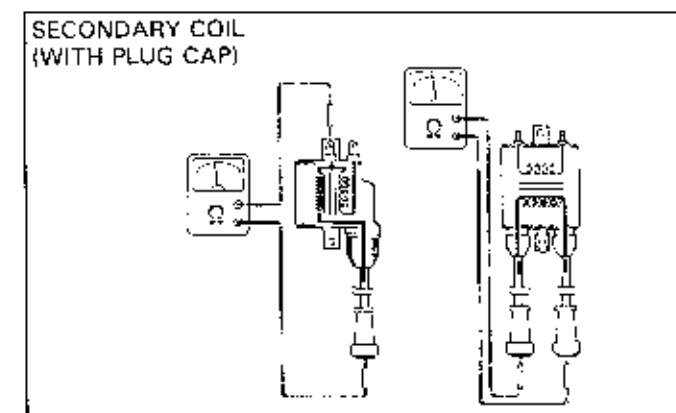
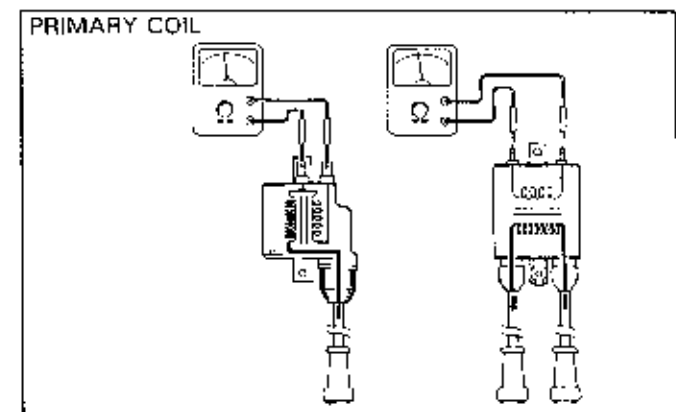
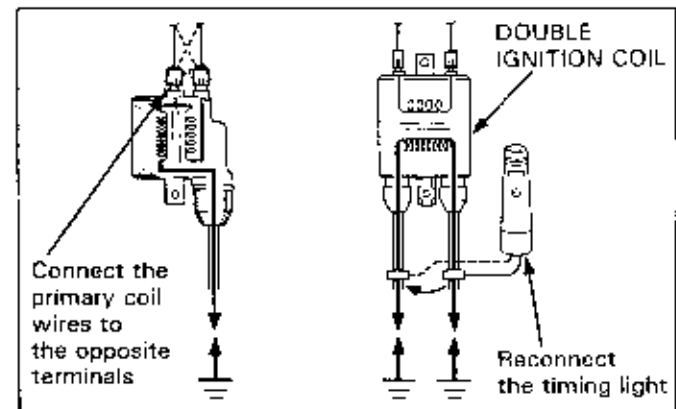
### SECONDARY COIL INSPECTION

With the spark plug cap on, measure the resistance between the primary coil terminal and the spark plug cap.

For double ignition coil, measure the resistance between the spark plug caps.

If the resistance value is within the specified range, then the coil is good.

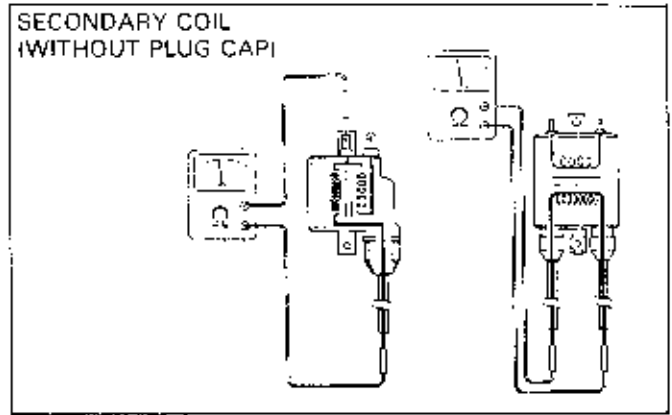
If the resistance is  $\infty$  (open wire), disconnect the spark plug cap and measure the secondary coil resistance.



Measure resistance between the primary coil terminal and spark plug wire.

For double ignition coil, measure the resistance between the spark plug wires.

If the resistance value is within the specified range, the coil is good.



### PERFORMANCE TEST (EXCEPT U.S.A.)

Test the spark performance of the ignition coil, using the Full-transistor/CDI tester.

Replace the coil if no spark occurs inside the spark adaptor.

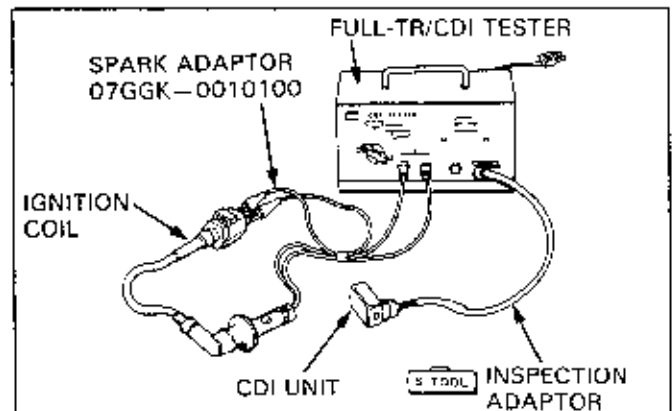
Read the instructions for the tester carefully and conduct the tests correctly.

The type of inspection adaptor used differs from model to model. Refer to the Model Specific manual for information on the type of adaptor required.

#### CAUTION

- The CDI unit or tester could be damaged if they were connected incorrectly.

Refer to the Model Specific manual for the connections of inspection adaptor (07508-0010400) whose wires are connected to the unit one by one.



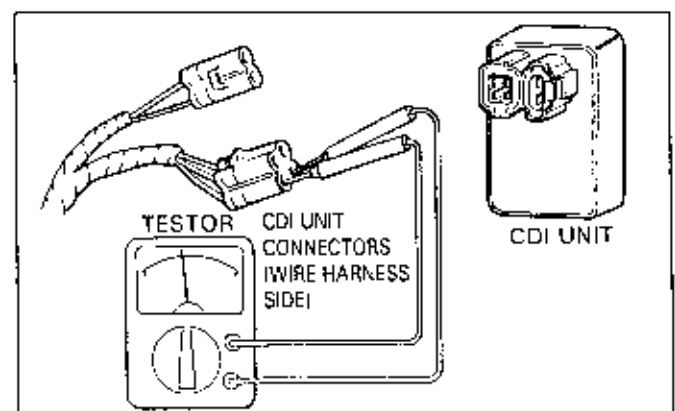
## CDI SYSTEM

### CIRCUIT INSPECTION

#### NOTE

- For diagnosing the ignition system, follow the steps in the troubleshooting flow chart.
- Refer to the Model Specific manual for service data, wiring diagrams, and wire colors.

Disconnect the connector from the CDI unit and diagnose the ignition related components by testing the connectors on the wire harness side.



## IGNITION SYSTEMS

### Checking items at the CDI unit connector

Checking item		Diagnosis
Ignition switch/Engine stop switch wire (excluding DC-CDI)		When the ignition switch is ON and engine stop switch at RUN, check for continuity between body ground and ignition switch wire.
Exciter coil wire (excluding DC-CDI)		Check if the specified resistance value is obtained between body ground and exciter coil wire.
Pulse generator wire		Check if the specified resistance value is obtained between body ground and pulse generator wire.
Ignition primary coil wire		Check if the specified resistance value is obtained between body ground and primary coil wire.
Neutral, reverse, change switch (for certain models only)		Check for continuity between ground and the wire corresponding to the transmission gear position.
Wire harness	Battery input line (only for DC-CDI)	When the ignition is ON and engine stop switch at RUN, check if battery voltage appear between battery input line and ground wire.
	Ground wire	Check for continuity between ground wire and body ground wire.

- If the above inspections are normal but the spark plug still does not fire, the problem could be related to the CDI unit or ignition coil. Check the CDI unit or ignition coil using the CDI/FULL-TR tester.
- If there is an abnormal circuit in the above inspection, check all items first and then check each component individually.

### PULSE GENERATOR INSPECTION

Disconnect pulse generator wire from the wire harness and measure resistance of coil between the two wire terminals.

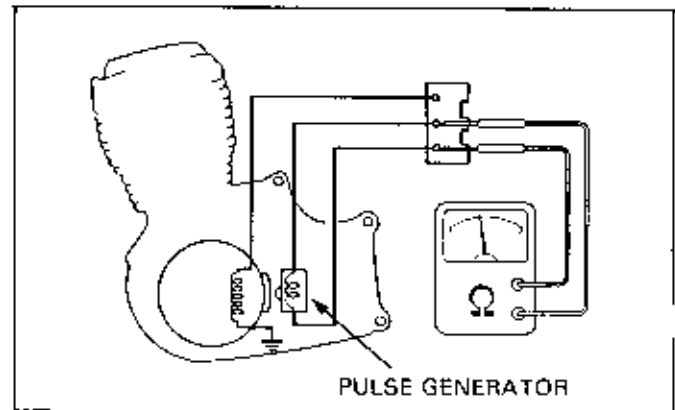
If the resistance value is within the specified range, the pulse generator is good.

If the resistance is far off the specified range, replace the pulse generator.

#### NOTE

- If the resistance value is slightly off the standard value, it may not necessarily have any effect on its function. In this case, check all of the related components for trouble in other areas.

For removal and replacement of pulse generator, refer to the Model Specific manual.



**EXCITER COIL INSPECTION**

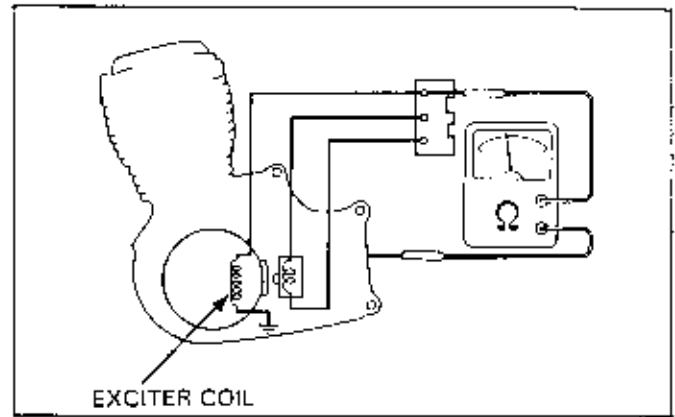
Disconnect the alternator from the wire harness and measure the exciter coil resistance.

For engine ground type, measure the resistance between the exciter coil output line and body ground.

For exciter coil with ground wire, measure the resistance between the exciter coil output line and ground wire.

If the resistance value is within the specified range, the exciter coil is good.

If the resistance value is far off the specified value, replace the stator with a new one.



**NOTE**

- If the resistance value is only slightly off the standard value, it may not necessarily have any effect on its function. In this case, check all of the related components for trouble in other areas.

**CDI UNIT PERFORMANCE TEST (EXCEPT U.S.A.)**

The CDI unit is checked by the Full transistor/CDI tester.

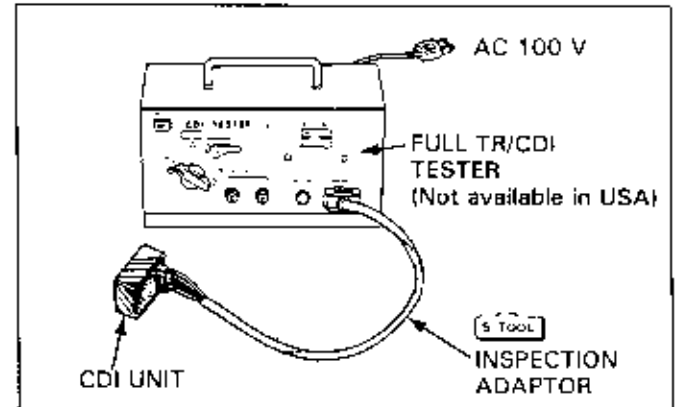
Follow the tester manufacturer's instructions.

Refer to the Model Specific manual for the type of inspection adaptor required.

**CAUTION**

- Improper connections could damage the CDI unit or tester.

For inspection adaptor, refer to the Model Specific manual.



Switch	Good condition	Bad condition
OFF	No spark	---
P	No spark	---
EXT	No spark	Spark
ON1	Spark	No spark
ON2	Spark	No spark

If there are any 'Bad' symptoms in the checks above, replace the CDI unit.

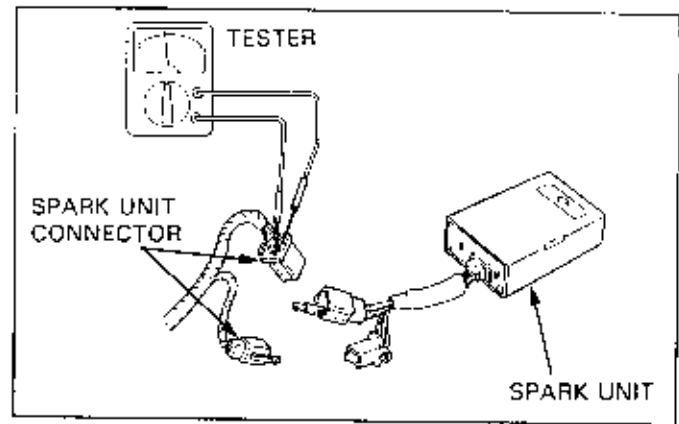
# TRANSISTORIZED IGNITION SYSTEM

## CIRCUIT INSPECTION

**NOTE**

- Follow the steps in the troubleshooting flow chart for servicing.
- Refer to the Model Specific manual for service data, wiring diagrams, and wire colors.

Disconnect the connector from the spark unit and conduct these tests at the connector.



**Spark unit connector inspection item**

Inspection item	Diagnosis
Power source input line	Check if there is battery voltage between the power source input line and the ground line when the ignition switch is "ON" and engine stop switch is at "RUN".
Pulse generator coil	Check if the resistance value between the wires is in the specified range.
Ignition primary coil	Check if the resistance value between the coil wire and body ground or ground wire is in the specified range.
Ground wire	Check for continuity between the ground wire and body ground.

- If the above diagnosis reveals no abnormality, but the spark plug still will not fire, the ignition coil or spark unit could be faulty. Check the spark unit or ignition coil using a CDI/Full transistor tester.
- If the above diagnosis indicates a faulty circuit, check all circuits, then check each of the components individually.

## PULSE GENERATOR INSPECTION

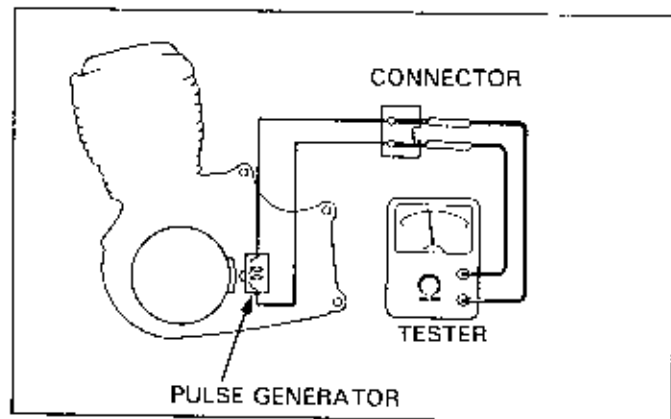
Disconnect the pulse generator from the wire harness and measure the resistance between the wire terminals.

The pulse generator is good if the resistance value is within the specified range.

Replace the pulse generator if the value is far off the specified range.

**NOTE**

- If the resistance value is only slightly off the standard value, it may not necessarily have any effect on its function. In this case, check all related components for trouble in other areas.



Refer to the Model Specific manual for removal and replacement of pulse generator.

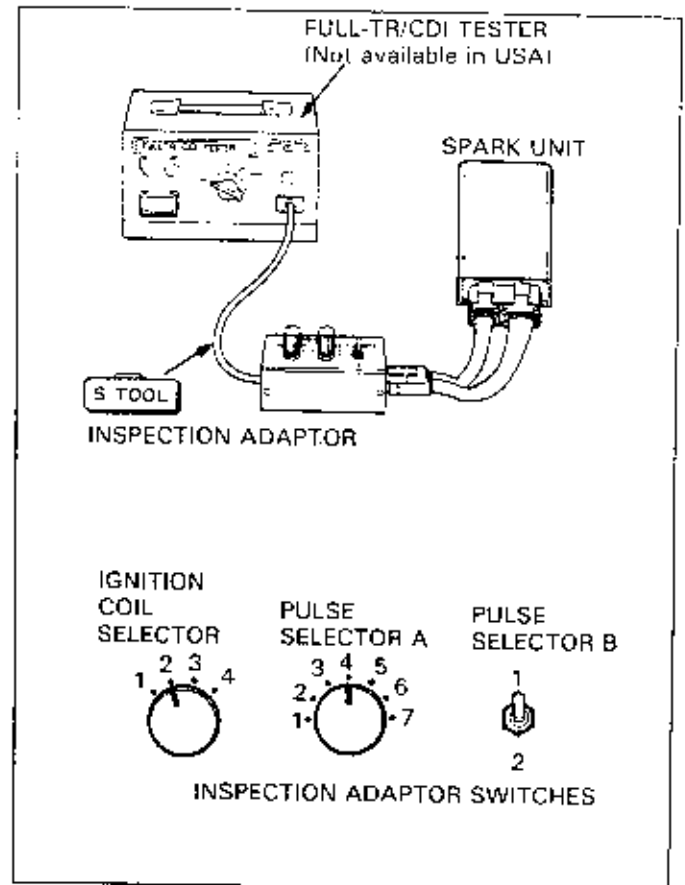
**SPARK UNIT PERFORMANCE TEST  
(EXCEPT U.S.A.)**

Use the "Full-TR/CDI" tester to test spark unit performance. Follow the tester manufacturer's instruction. Refer to the Model Specific manual for the type of inspection adaptor required.

**CAUTION**

- Improper connections could damage the CDI unit or tester.

Switch	Good condition	Bad condition
OFF	No spark	—
P	No spark	—
EXT	No spark	Spark
ON1	Spark	No spark
ON2	Spark	No spark



For digital-controlled spark unit, use spark adaptor (07508-0013600).

Select the proper position for the selector switch before testing.

Selector	Item
IG Coil Selector	Number of ignition coil
P. Selector A	Pulse signal No. (Refer to Model Specific manual for switch position)
P. Selector B	Firing interval (No. of cylinder) "1": 2, 4 cylinders "2": 3, 6 cylinders



# 24. ELECTRIC STARTER/STARTER CLUTCH

SERVICE INFORMATION	24-1	CLUTCH SWITCH DIODE INSPECTION	24-8
TROUBLESHOOTING	24-1	STARTER CLUTCH INSPECTION	24-8
STARTER MOTOR	24-3	STARTER PINION INSPECTION	24-9
STARTER RELAY SWITCH	24-6		

## SERVICE INFORMATION

### ⚠ WARNING

- Always turn the ignition switch OFF before servicing the starter motor. The motor could suddenly start, causing serious injury.

- Refer to the Model Specific manual for removal and installation of the starter motor.
- A weak battery may be unable to turn the starter motor quickly enough, or, supply adequate ignition current.
- If the current is kept flowing through the starter motor to turn it while the engine will not be cranking, the starter motor may be damaged.
- For models with a centrifugal clutch, incorrect adjustment of the brake light switch could prevent the starter motor from operating.

## TROUBLESHOOTING

### Starter motor turns slowly.

- Low specific gravity in battery (or Dead battery).
- Poorly connected battery terminal cable.
- Poorly connected starter motor cable.
- Faulty starter motor.
- Poorly connected battery ground cable.

### Starter motor turns, but engine does not turn.

- Starter motor is running backwards.
  - Brushes assembled improperly.
  - Case assembled improperly.
  - Terminals connected improperly.
- Faulty starter clutch.
- Damaged or faulty starter pinion.
- Damaged idler gear or reduction gear.
- Broken starter motor drive chain.
- Faulty starter clutch.

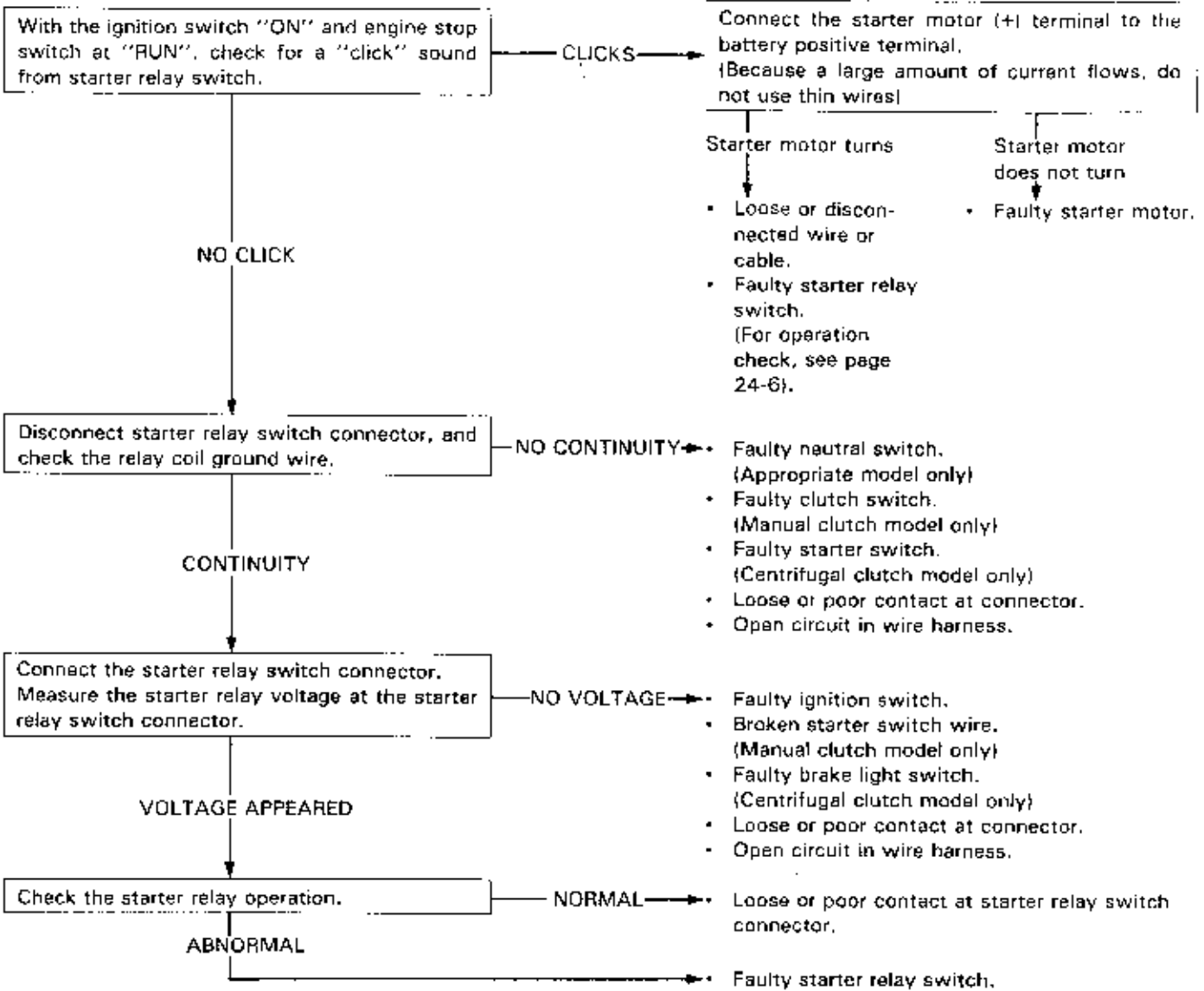
### Starter motor relay "clicks", but engine does not turn over.

- Crankshaft does not turn due to engine problems.
- Excessive reduction gear friction.
- Faulty starter pinion engagement.

# ELECTRIC STARTER/STARTER CLUTCH

## Starter motor will not turn.

- Check for a blown out main or sub fuse before servicing.
- For models with a centrifugal clutch, check that the brake light switch is correctly adjusted.



## STARTER MOTOR

### DISASSEMBLY

Before disassembling the starter motor mark the position of the case and cover so the starter can be assembled correctly later.

Remove the starter motor case screws and remove the cover.

### NOTE

- For models with shims between the armature and cover, record the location and number of shims.
- Record the order so the parts can be installed correctly later.

### INSPECTION

Check for continuity of the starter motor case.

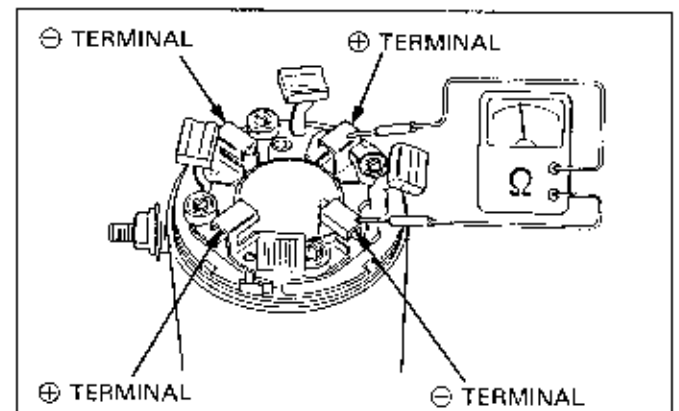
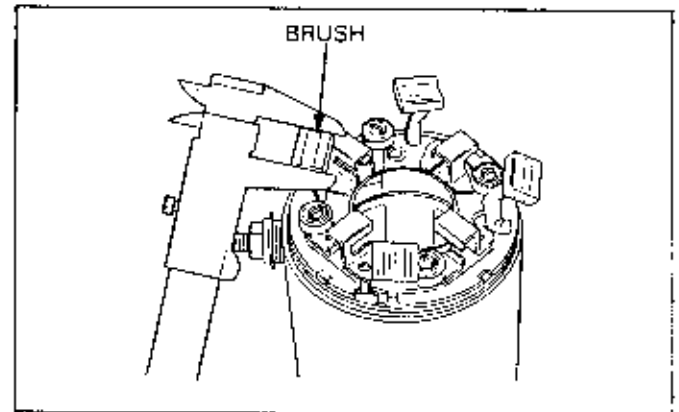
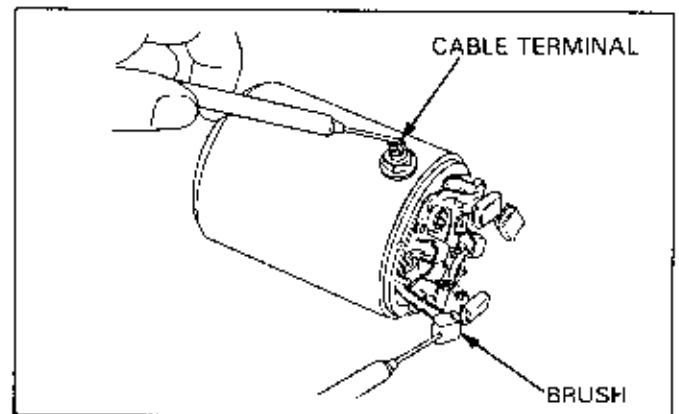
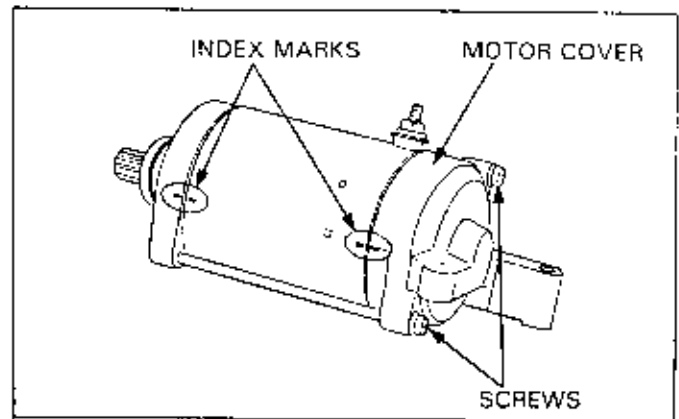
- Between cable terminal and case: normal if no continuity.
- Between cable terminal and brush (black wire): normal if there is continuity.

If abnormal, replace with a new one.

Measure the brush length.

Replace the brush if it is worn beyond the service limit.

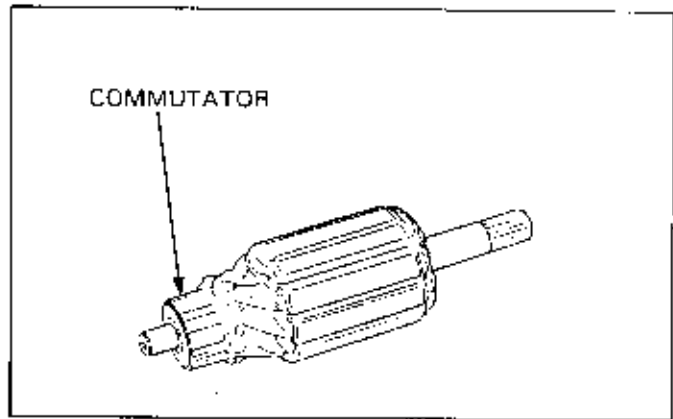
Check for continuity between  $\oplus$  and  $\ominus$  terminals of the brush



## ELECTRIC STARTER/STARTER CLUTCH

Check the commutator for:

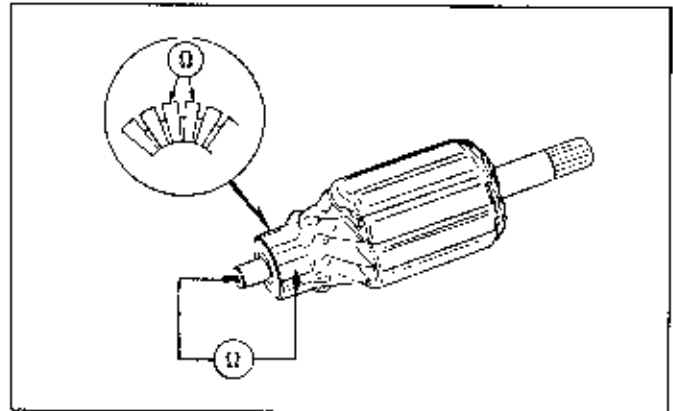
- Damage or abnormal wear. → Replace with a new one.
- Discoloration of the commutator bar.
  - Replace with a new one.
- Metallic debris between commutator bars.
  - Clean it off.



Check for continuity between pairs of commutator bars.

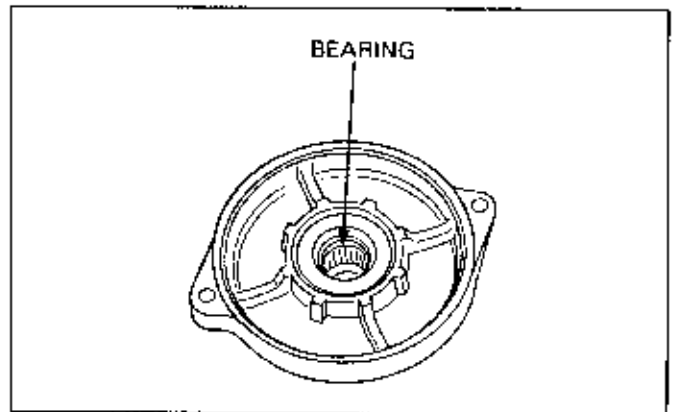
Make a continuity check between individual commutator bars and the armature shaft.

There should be no continuity.



Check the bearings. (For applicable models only)

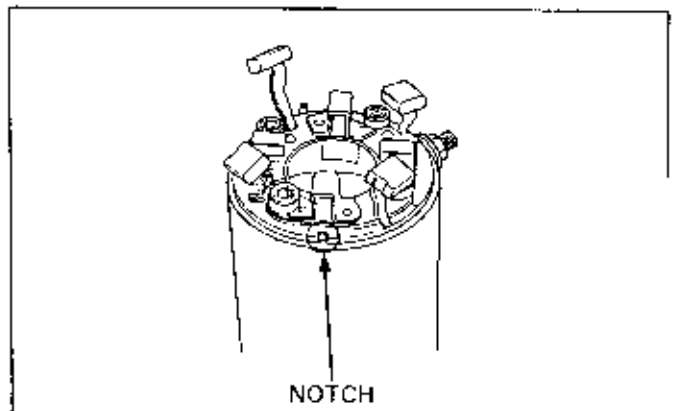
- Do not rotate smoothly. → Replace with a new one.
- Loose bearing. → Replace with a new one.



## ASSEMBLY

Align the case notch with the brush holder pin and install the case.

Place the O-ring (seal ring) on the case. (For applicable models only)



Carefully insert the brushes into the brush holder.

**CAUTION**

- The sliding surfaces of the brushes can be damaged if they are not installed properly.

Apply grease to both ends of the armature shaft.

Push and hold the brush inside the brush holder, and insert the armature through the brush holder.

When inserting the armature into the case, hold the armature tightly to keep the magnet from pulling the armature against the case.

**CAUTION**

- The coil may be damaged if the magnet pulls the armature against the case.

Insert the shims in the correct order to the armature shaft. (For applicable models only)

Insert the O-ring. (For applicable models only)

Align the mark (that you made earlier) and install the cover.

**CAUTION**

- When installing the cover, take care to prevent damaging the oil seal lip with the shaft.

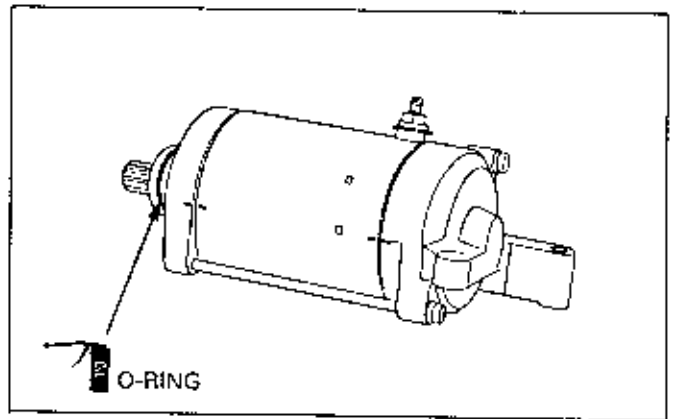
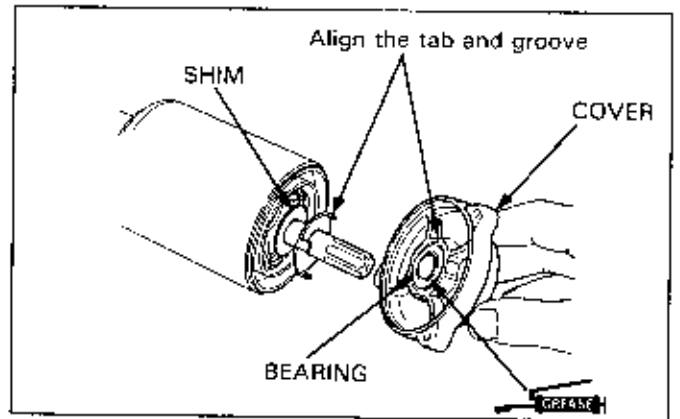
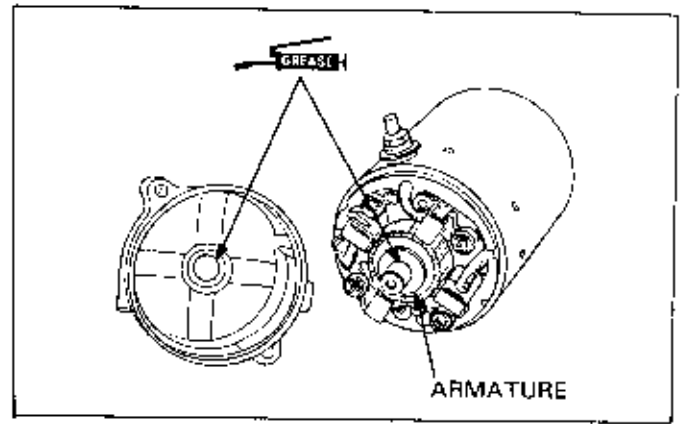
Tighten the cover screws.

For starter motors that are mounted within a motor mount hole, check for a damaged O-ring. In order to prevent damage, grease the O-ring.

Refer to the Model Specific manual for installation.

**CAUTION**

- Overtightening the cable terminal nuts may cause the terminals to turn inside the starter motor, resulting in serious damage to the inner connectors.



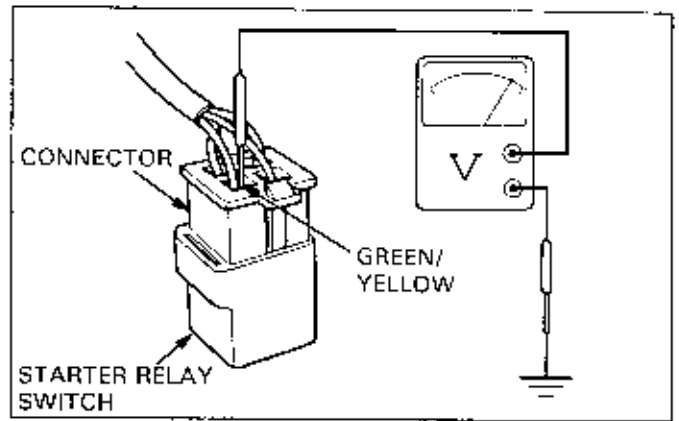
◀Circuit B▶

Measure the voltage between the green/yellow wire and ground at the starter relay switch connector.

If battery voltage is measured when the front or rear brake are applied, it is normal.

NOTE

- If the brake light adjustment is incorrect, no voltage will appear when the brake is ON.

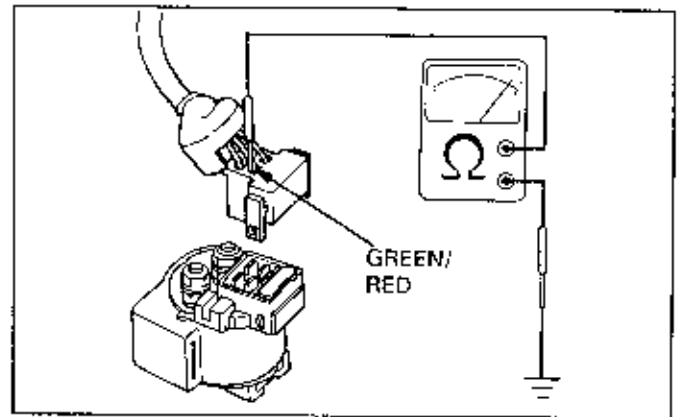


Starter relay switch ground line

◀Circuit A▶

Disconnect the connector from the starter relay switch and check for continuity between the ground wire (green/red) and ground.

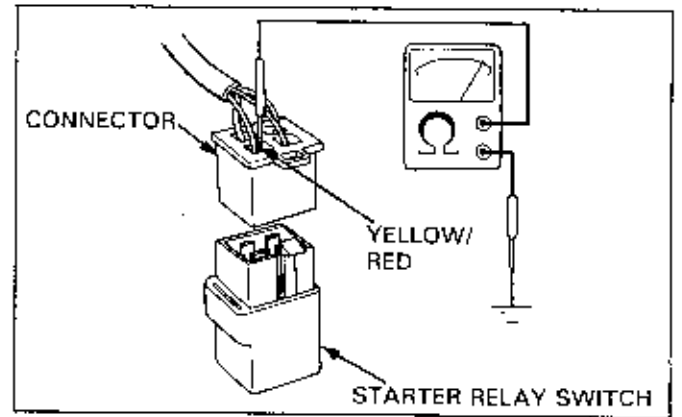
If there is continuity when the transmission is in neutral or when the clutch is disengaged, the ground circuit is normal. (In neutral, there is a slight resistance due to the diode.)



◀Circuit B▶

Disconnect the connector from the starter relay and check for continuity between the ground wire (yellow/red) and ground.

If there is continuity only when the starter switch is pressed, the ground circuit is normal.



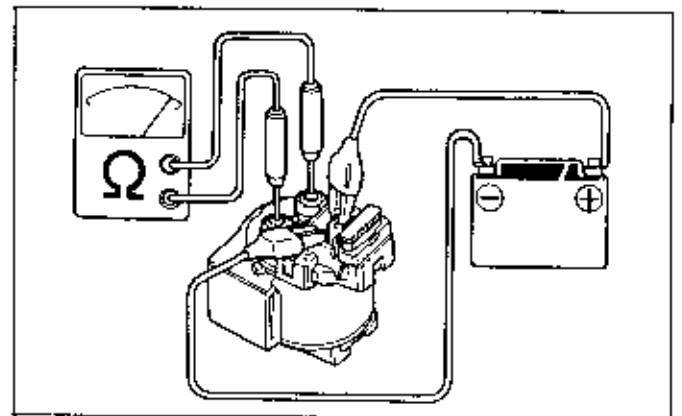
OPERATION CHECK

Apply battery voltage between the two relay coil terminals. Check for continuity between B (battery) and M (rotor) terminals.

◀Circuit A▶

Apply battery voltage between yellow/red and green/red terminals.

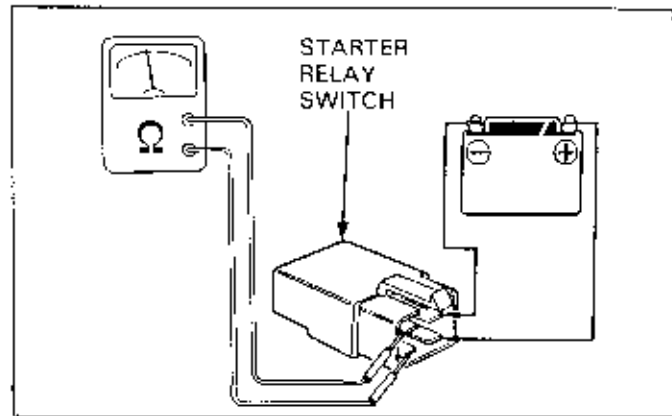
If there is continuity between B and M terminals, it is normal.



## ELECTRIC STARTER/STARTER CLUTCH

### «Circuit B»

When battery voltage is applied between the starter relay green/yellow wire and yellow/red terminals, there should be continuity between the red and red/white terminals. The terminals are distinguished by the corresponding wire color of the wire harness connector.



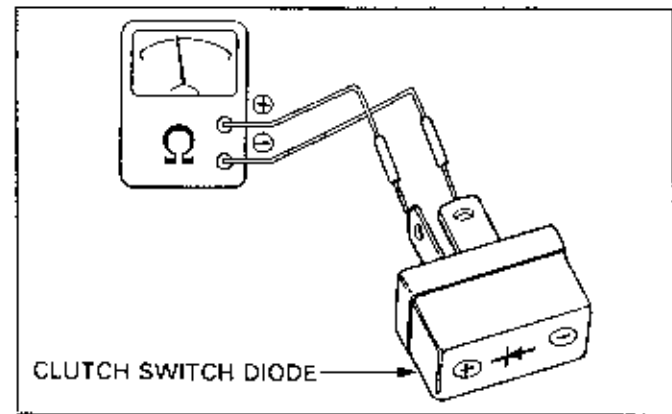
## CLUTCH SWITCH DIODE INSPECTION

The purpose of the clutch switch diode is to prevent reverse current flow from the neutral indicator to the clutch switch.

- Faulty diode. → Neutral indicator turns ON when clutch is disengaged.
- Loose connections at diode terminal.
  - Starter motor does not turn when transmission is in neutral.

Check for continuity between diode terminals. When there is continuity, a small resistance value is measured.

- If there is continuity in one direction, the clutch switch diode is good.

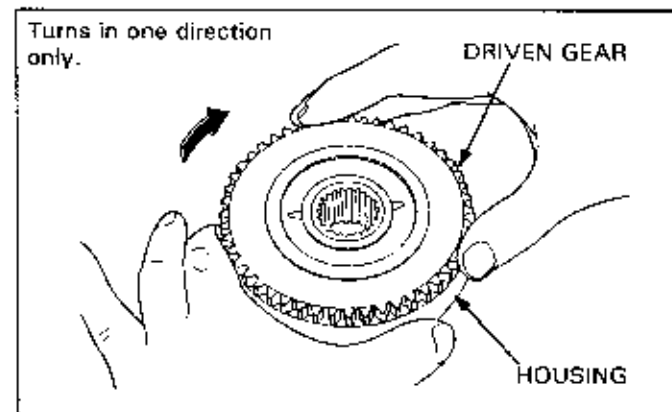


## STARTER CLUTCH INSPECTION

Refer to Model Specific manual for starter clutch removal and installation.

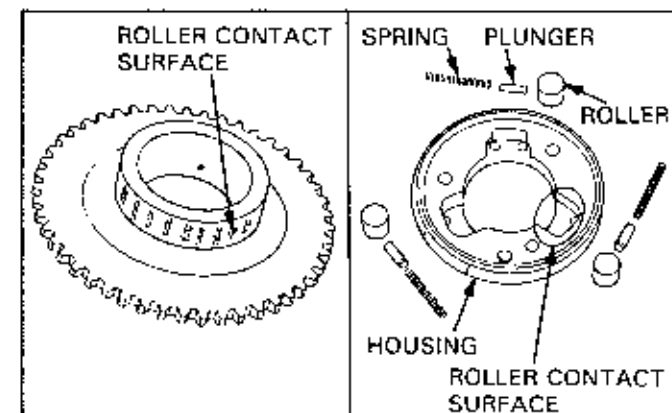
Install the driven gear into the housing.  
With all parts assembled, check the starter clutch.

- Check that the gear, or sprocket, turns smoothly in one direction and locks up in the other direction.



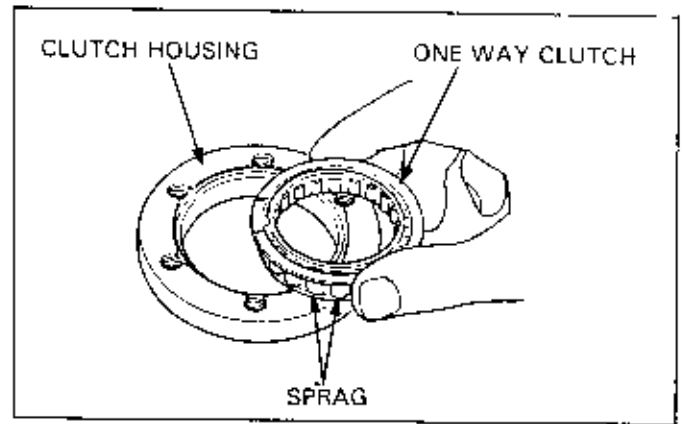
### Disassemble the housing.

- Check the roller contact surface of the gear, or sprocket, for damage. → Replace with a new one.
- Check the roller contact surface of the housing for damage. → Replace with a new one.
- Damage to roller. → Replace with a new one.
- Deformation or damage to the spring. → Replace with a new one.



For one-way sprag clutch, check each sprag, clutch housing, and all inner portion contact surfaces.

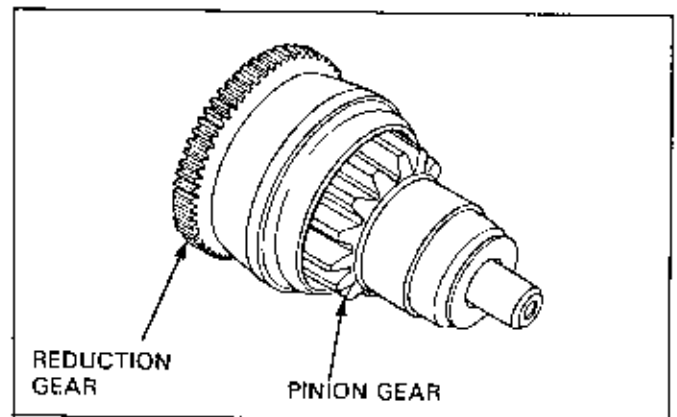
- Abnormal wear or damage to sprag.  
→ Replace with a new one.
- Irregular movement of the sprag.  
→ Replace with a new one.
- Damage to the clutch housing or inner portion contact surface. → Replace with a new one.



### STARTER PINION INSPECTION

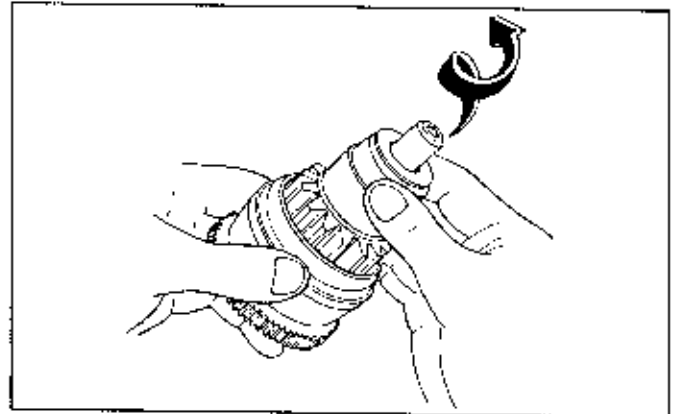
Refer to the Model Specific manual for starter pinion removal and installation.

- Wear or damage to the pinion, reduction gears  
→ Replace with a new one.
- Worn journals. → Replace with a new one.



Check if the pinion gear moves smoothly along the axis.

- Pinion gear does not move smoothly.  
→ Replace with a new one.





# 25. LIGHTS/METERS/SWITCHES

SERVICE INFORMATION	25-1	LOW FUEL INDICATOR	25-8
OIL PRESSURE WARNING LIGHT (4-STROKE ENGINE)	25-2	FUEL PUMP	25-9
OIL LEVEL INDICATOR (2-STROKE ENGINE)	25-2	HEADLIGHT BULB	25-11
FAN MOTOR SWITCH	25-4	SWITCHES	25-12
COOLANT TEMPERATURE GAUGE	25-5	TURN SIGNAL LIGHTS	25-16
FUEL GAUGE	25-7	HORN	25-17

## SERVICE INFORMATION

### ⚠ WARNING

- Halogen headlight bulbs become very hot while the headlight is ON, and remain hot for a while after they are turned OFF. Be sure to let them cool down before servicing.

Use a flame and heated water/coolant mixture for the thermo sensor inspection.

### ⚠ WARNING

- Keep all flammable materials away from the flame. Wear protective clothing, gloves and eye protection.

- Refer to the section 21 for the general service rules.
- This section covers the general inspection/service procedures of the lights, meters and switches. Refer to the Model Specific manual for the location and arrangement of components on the model being serviced.
- Note the followings when replacing the halogen headlight bulb.
  - Wear clean gloves while replacing the bulb. Do not put finger prints on the headlight bulb, as they may create hot spots on the bulb and cause it to break.
  - If you touch the bulb with your bare hands, clean it with a cloth moistened with alcohol to prevent its early failure.
  - Be sure to install the dust cover after replacing the bulb.
- A continuity test can be made with the switches installed on the motorcycle.
- Check the battery condition before performing any inspection that requires proper battery voltage.
- There are two types of lighting systems; AC lighting that takes power from the alternator coil, and DC lighting that takes power from the battery. On DC lighting systems, the headlight comes on without starting the engine. On AC lighting systems, the headlight comes on when the engine is running. (Refer to section 21).

## OIL PRESSURE WARNING LIGHT (4 stroke engine)

### THEORY

When the oil pressure is below the specifications, the oil pressure switch senses it and the oil pressure warning light comes on. It should be OFF while the engine is running.

### INSPECTION

- Oil pressure warning light does not come on with the ignition switch turned ON.

1. Disconnect the oil pressure switch wire and turn the ignition switch ON. Check for battery voltage between the wire and ground.

No voltage

Voltage

- Oil pressure switch faulty.

2. Check for the voltage between the black/brown terminal of the instruments and ground.

No voltage

Voltage

- Ignition switch faulty.
- Sub fuse blown.

- Broken wire between the warning light and oil pressure switch.
- Bulb blown.

- Oil pressure warning light stays on while the engine is running.

1. Check the engine oil level.

Specified oil level

Low oil level

- Oil insufficient.

2. Disconnect the oil pressure switch wire and turn the ignition switch ON.

Indicator lights

Indicator does not light

- Shorted blue/red wire between the warning light and pressure switch.

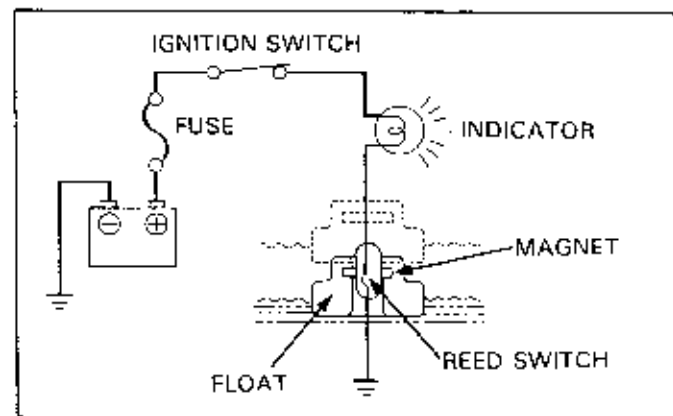
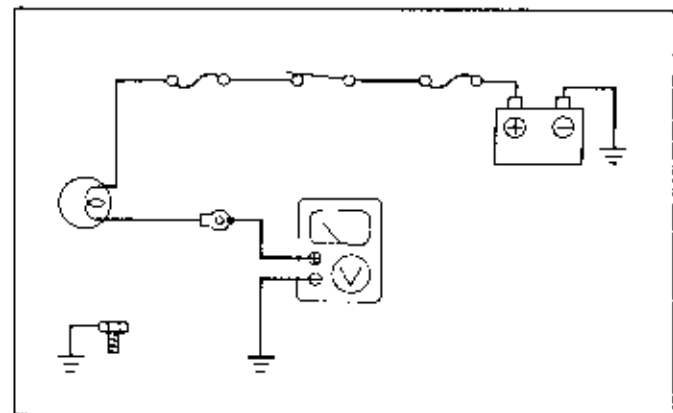
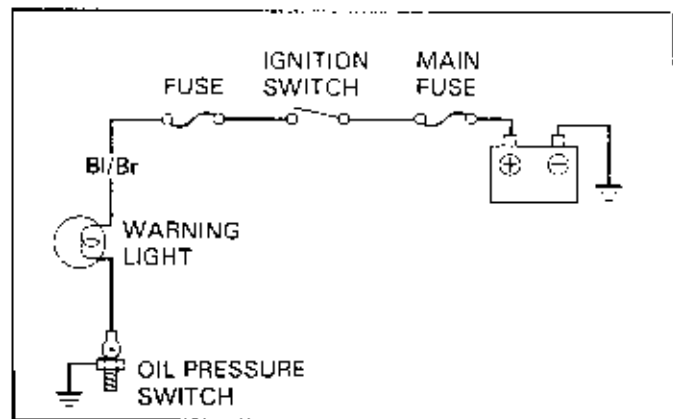
- Faulty oil pressure switch.
- Low oil pressure. (see section 3)

## OIL LEVEL INDICATOR (2 stroke engine)

### THEORY

The oil level switch float in the oil tank moves up and down in accordance with the volume of oil in the tank. When the oil level is low, the float also goes down and the reed switch (oil level switch) is closed by the magnetic force of the float.

When the ignition switch is turned ON, current flows through the reed switch and the oil level indicator comes on.



**INSPECTION**

- Oil level indicator comes on when the oil in the tank reaches a specified level.

1. Disconnect the wires from the oil level switch and turn the ignition switch ON.

Indicator lights

Indicator does not light

- Shorted wire between the indicator and oil level switch.
- Faulty oil level switch.

- Oil level indicator does not come on with no or low oil level in the tank.

1. Disconnect the wires from the oil level switch and connect a jumper wire between the wire terminals. Turn the ignition switch ON and check the indicator.

Indicator does not come on

Indicator comes on

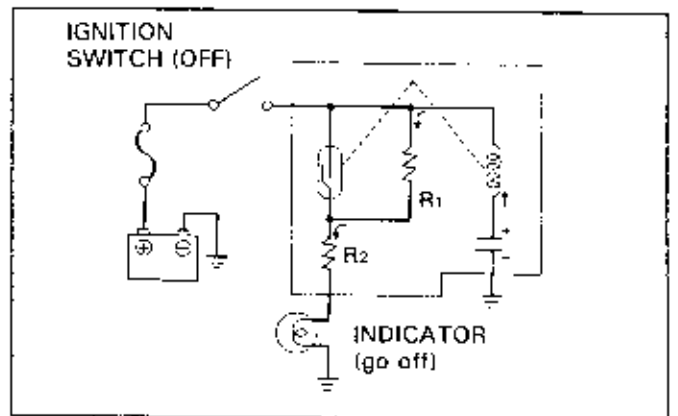
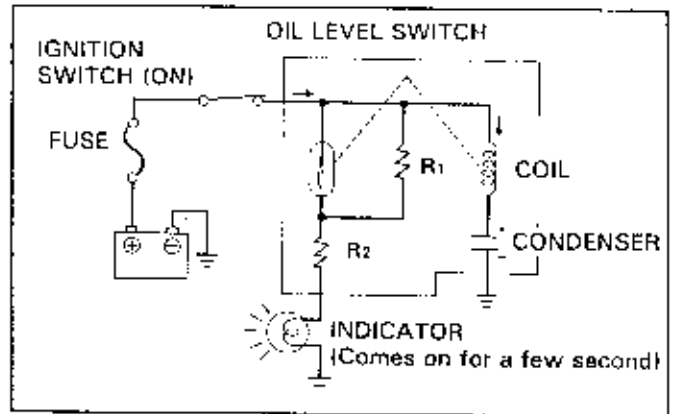
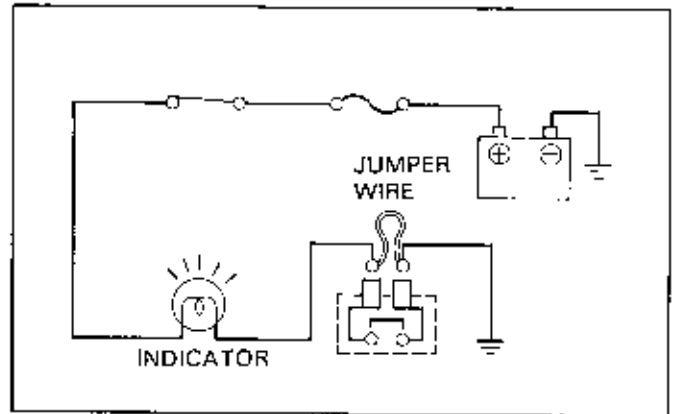
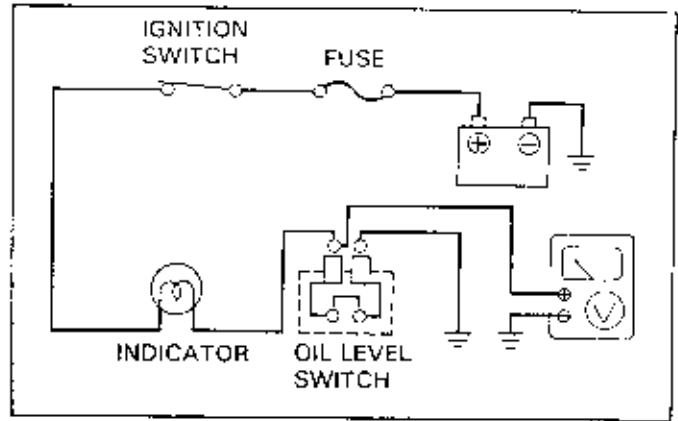
- Faulty oil level switch.
- Poor wire connection.

2. Disconnect the wires from the oil level switch and check for voltage between the wire and ground.

No voltage

Voltage

- Broken wire between the oil level indicator and level switch.
- Blown bulb.
- Faulty oil level switch.
- Poor oil level switch wire connection.



**TIMER TYPE THEORY**

A timer type indicator has a bulb check function so as to check the oil level indicator for proper operation.

When the ignition switch is turned ON, current flows through the exciter coil to the condenser, generates the electromagnetic force at the exciter coil and closes the reed switch. Current flows from the reed switch through the resistor R<sub>2</sub> to the oil level indicator and turns it on. When the condenser is fully charged, current flows through the exciter coil to the condenser decreases and, consequently, electromagnetic force at the coil decreases, the reed switch opens and the oil level indicator turns off.

When the ignition switch is turned OFF, current stored in the condenser flows through the exciter coil and through resistors R<sub>1</sub> and R<sub>2</sub> to the oil level indicator. The oil level indicator does not come on this time.

TIMER TYPE INDICATOR INSPECTION

- Oil level indicator comes on when the oil in the tank reaches a specified level.
  - Faulty oil level switch.
  - Shorted wire harness.
- Oil level indicator does not come on with no oil or low oil level in the tank.

1. Disconnect the oil level switch connector and connect a jumper wire to the power supply wire (black or black/brown) terminal and the indicator wire (green/red) terminal to short. Turn the ignition switch ON and check the oil level indicator.

Indicator does not come on

Indicator comes on

- Faulty oil level switch.
- Poor connection of the connector.

2. Disconnect the oil level switch connector and check for voltage between the power supply wire (black or black/brown) and ground.

Voltage

No voltage

- Broken power supply wire.
- Faulty sub fuse.
- Faulty ignition switch.
- Poor connection of the sub fuse connector.

3. Connect the jumper wire to the power supply wire and oil level indicator wire to short and check for voltage between the indicator wire and ground.

Voltage

No voltage

- Blown bulb.
- Faulty ground.
- Broken indicator wire.

FAN MOTOR SWITCH

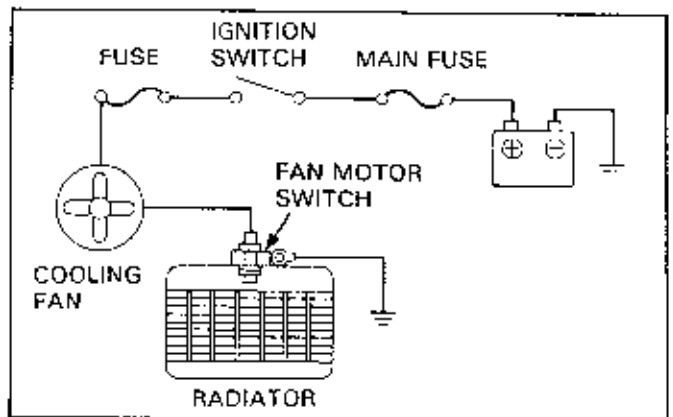
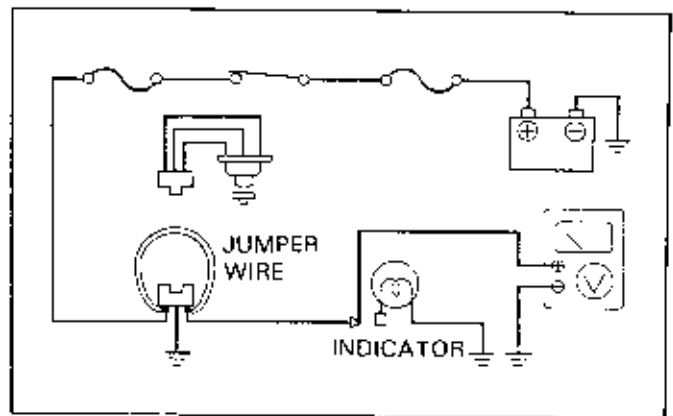
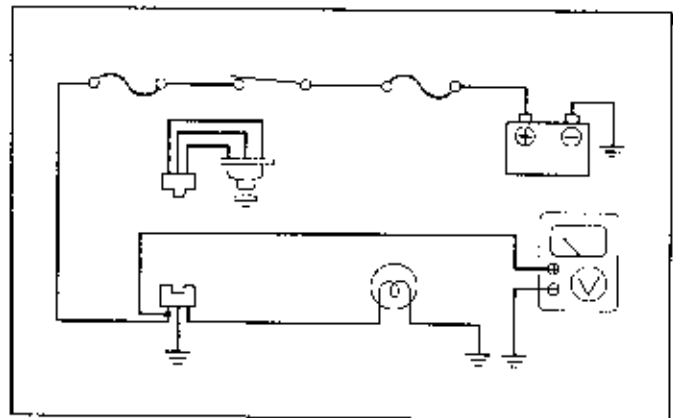
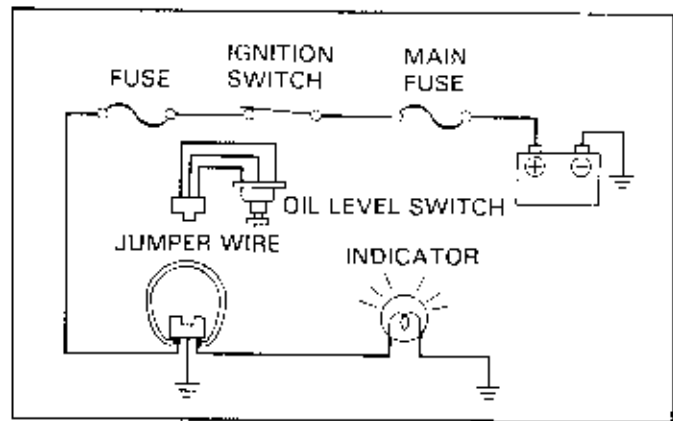
NOTE

- The fan motor may continue to run, even when the ignition switch is turned OFF. However, this does not necessarily indicate trouble.

When the coolant temperature increases to above the specification, the fan motor switch turns on to operate the fan motor. When the coolant temperature is below the specification, it turns off to stop the fan motor.

NOTE

- Check the coolant level and bleed air from the cooling system if the coolant is apt to overheat. (see page 5-6 for coolant replacement and air bleeding.)



**INSPECTION**

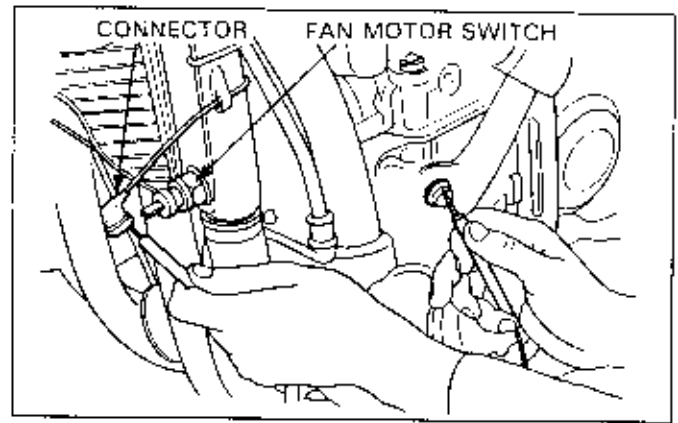
• Fan motor does not stop.

1. Turn the ignition switch OFF, disconnect the connector from the fan motor switch and turn the ignition switch ON again.

↓  
Motor does not stop

↓  
Motor stops

- Shorted wire between the fan motor and switch.
- Faulty fan motor switch.



• Fan motor does not start.

1. Disconnect the connector from the fan motor switch and ground the connector to the body with a jumper wire. Turn the ignition switch ON and check the fan motor.

↓  
Motor does not start

↓  
Motor starts

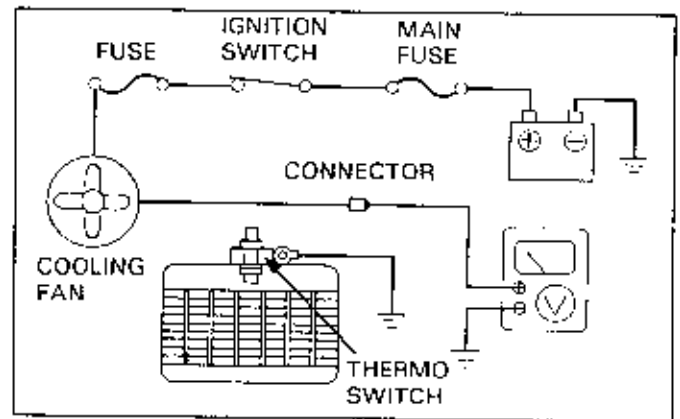
- Faulty fan motor switch.
- Poor connection of the fan motor switch connector.

2. Check for the battery voltage between the fan motor switch connector and ground.

↓  
No battery voltage

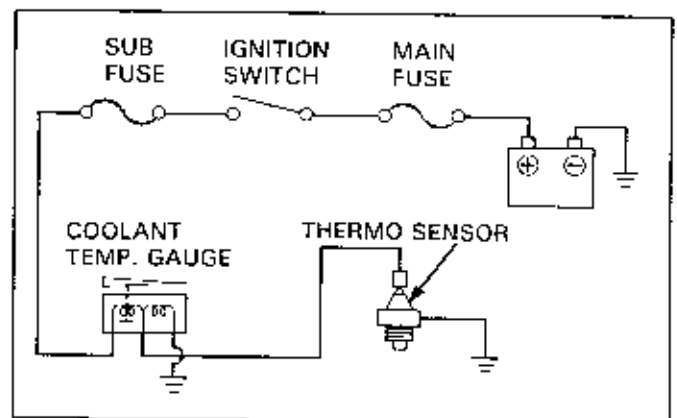
↓  
Battery voltage

- Broken wire harness
- Blown sub fuse.
- Faulty ignition switch
- Poor connection of the connector (between the ignition switch and fuse box).
- Faulty fan motor.



**COOLANT TEMPERATURE GAUGE**

The thermo sensor changes the amperage of the current that flows to the coolant temperature gauge in accordance with the change in coolant temperature and moves the temperature gauge needle.



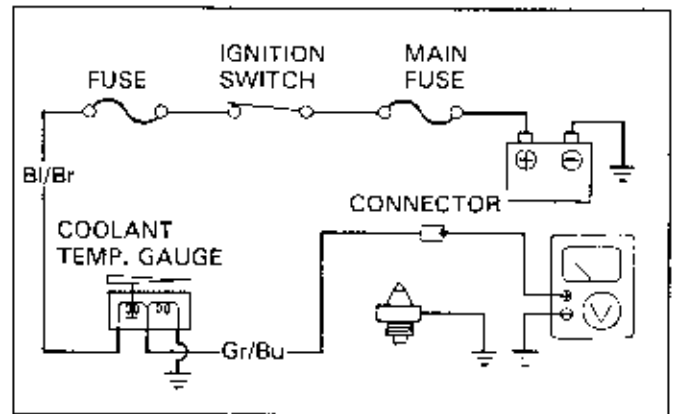
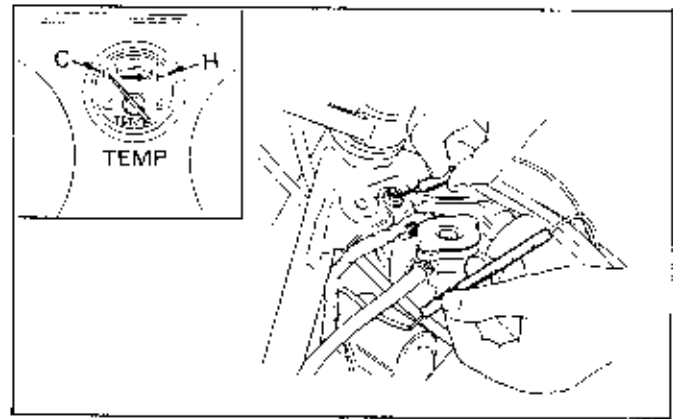
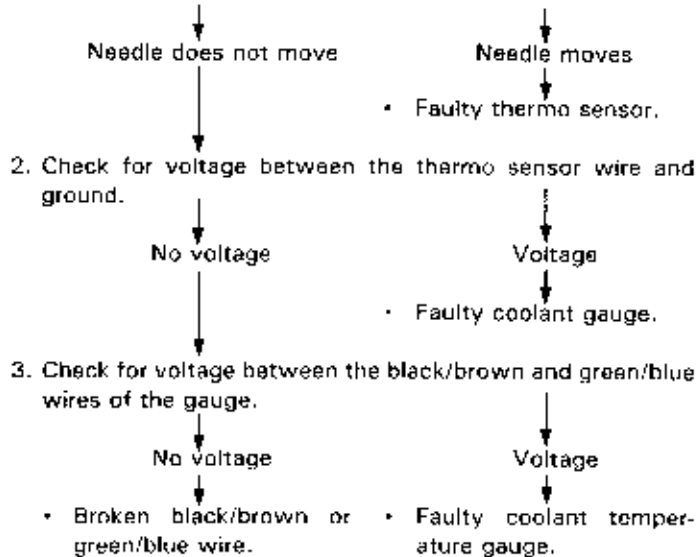
## LIGHTS/METERS/SWITCHES

### INSPECTION

1. Disconnect the wire from the thermo sensor.  
Ground the thermo sensor wire with a jumper wire.  
Turn the ignition switch ON and check the coolant gauge.  
Disconnect the thermo sensor wire from the ground immediately if the gauge needle moves fully to H.

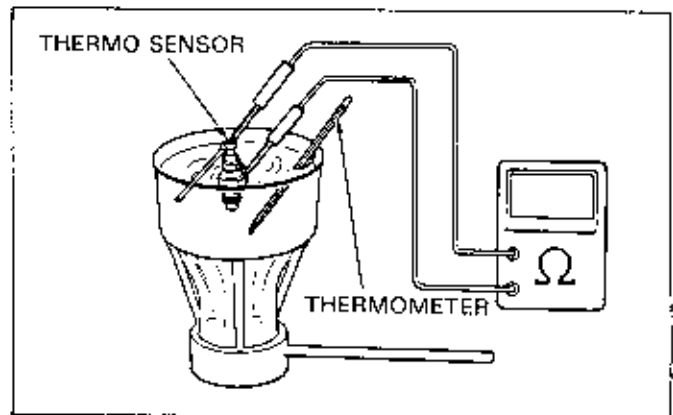
#### CAUTION

- Immediately disconnect the wire from the ground when the needle moves to H (hot) to prevent damage to the gauge.



### THERMO SENSOR INSPECTION

- Drain the coolant (see page 5-6).  
Disconnect the wire from the thermo sensor.  
Remove the thermo sensor.  
Suspend the thermo sensor in a pan of coolant (50-50 mixture) over a burner and measure the resistance through the sensor as the coolant heats up.



#### WARNING

- Keep flammable materials away from the burner.
- Wear insulated gloves and eye protection.

#### NOTE

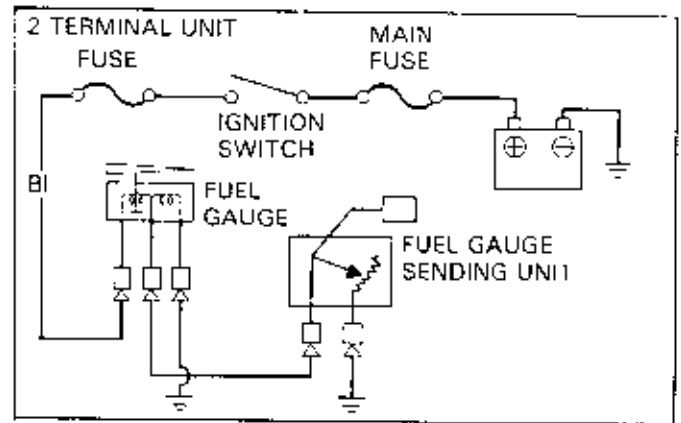
- Soak the thermo sensor in coolant up to its threads with at least 40 mm (1.57 in) from the bottom of the pan to the bottom of the sensor.
- Keep temperature constant for 3 minutes before testing. A sudden change of temperature will result in incorrect readings. Do not let the thermometer or thermo sensor touch the pan.
- Apply sealant to the threads on the thermo sensor prior to installation.

## FUEL GAUGE

Fuel unit resistance changes in accordance with the float in the fuel unit moving up and down. The fuel gauge needle is moved by the change of amperage that flows through the fuel gauge.

There are two types of fuel gauges: The "Return type" where the needle returns to "Empty" when the ignition switch is turned OFF, and "Stop type" where the needle stays in position when the ignition switch is turned OFF.

Check the fuel gauge if its needle does not move.



## INSPECTION

1. If the fuel unit connector has 2 terminals, short the gauge terminals with a jumper wire.

If the unit connector has 3 terminals, short the gauge side yellow/white terminal and green terminal with a jumper wire.

Turn the ignition switch ON and check the gauge needle.

Needle does not move

Needle moves

- Check the fuel unit.

2. Check for continuity between the unit and fuel gauge.

Continuity

No continuity

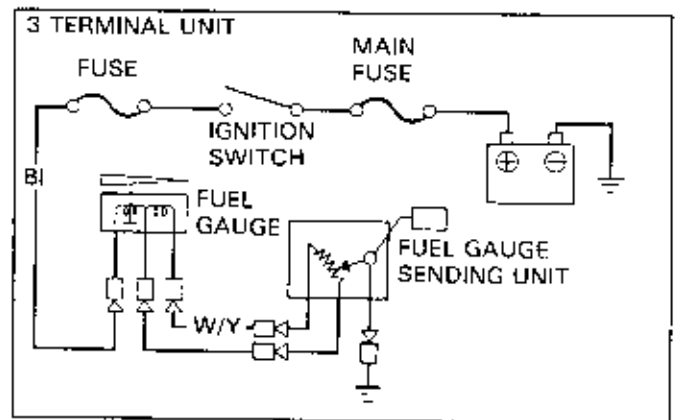
- Broken wire between the unit and gauge.

3. Check for voltage at the black or black/brown (positive power line) and ground wires of the fuel gauge.

No voltage

Voltage

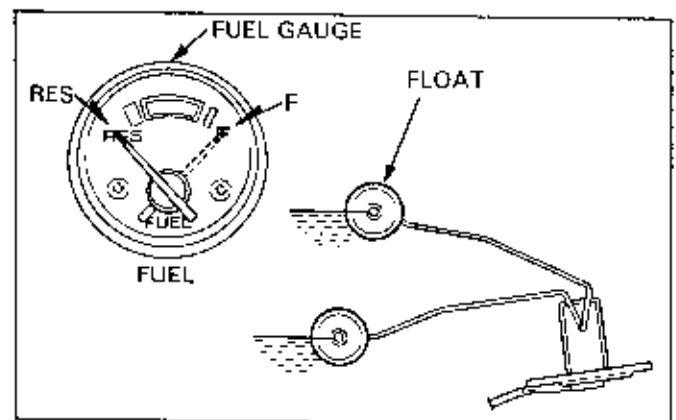
- Broken positive power line.
- Faulty fuel gauge.



## FUEL UNIT INSPECTION

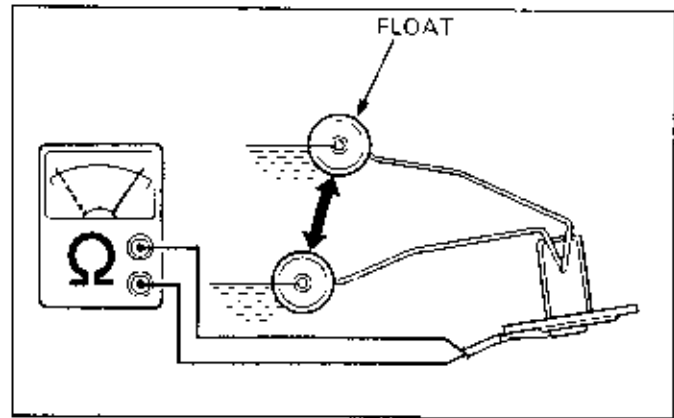
Refer to the Model Specific manual for the fuel unit removal/installation.

1. Connect the fuel unit connector.  
Turn the ignition switch ON.  
Move the float up and down to be sure that the fuel gauge needle moves to "F" and "RES".  
If the needle does not move, go to the step 2.



2. Measure the resistance between the connector terminals with the float in up and down positions.

If the resistance is normal, check the fuel gauge.  
If the resistance is not normal, replace the fuel unit.

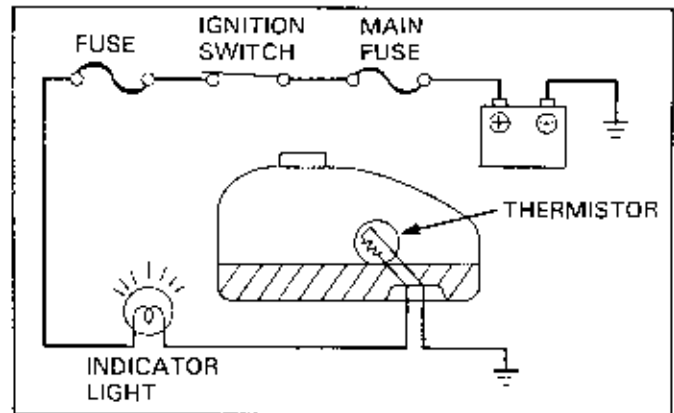


## LOW FUEL INDICATOR

A thermistor is built into the fuel level sensor in the fuel tank and the fuel warning light turns on due to the thermistor's self radiation of heat.

When the thermistor is in the gasoline, radiation of heat increases and the self heating action is reduced. As the resistance increases and the current does not flow at this time, the fuel warning light does not turn on.

When the thermistor is out of gasoline, i.e. fuel level is low, radiation of heat decreases and the self heating increases. As the resistance is low at this time, current flows and the low fuel indicator turns on.



## INSPECTION

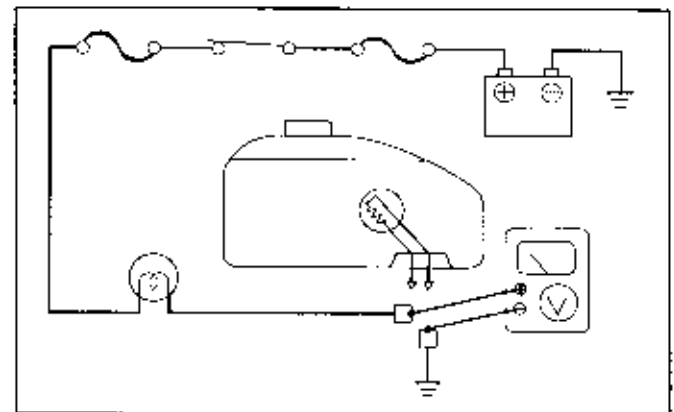
If the low fuel indicator does not go off, check as noted below. Check for battery voltage between the fuel level sensor connector terminals.

Battery voltage

- Faulty fuel level sensor.
- Poor connection of the connector.

No battery voltage

- Shorted wire between the indicator light and sensor.
- Faulty ground.





If the fuel warning light does not turn on, check as noted below.

1. Check for battery voltage between the fuel level sensor connector terminals.

No battery voltage

Battery voltage

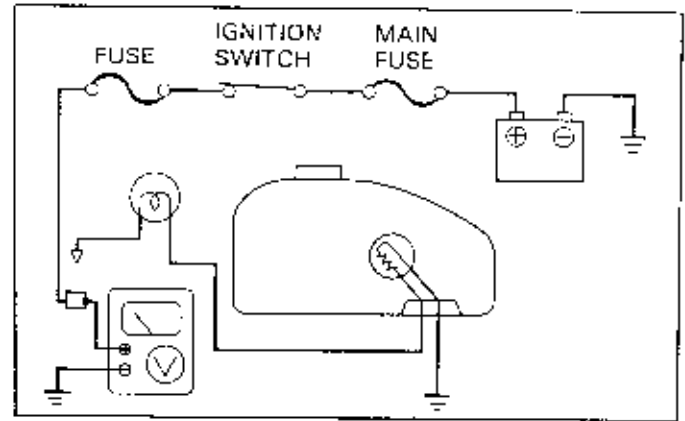
- Faulty fuel level sensor.
- Poor connection of the connector.

2. Check for battery voltage between the battery side of the wire from the indicator light and ground.

No battery voltage

Battery voltage

- Faulty sub fuse.
- Faulty ignition switch.
- Poor connection of the fuse holder connector.
- Blown bulb.
- Broken wire between the warning light and sensor.
- Faulty ground.



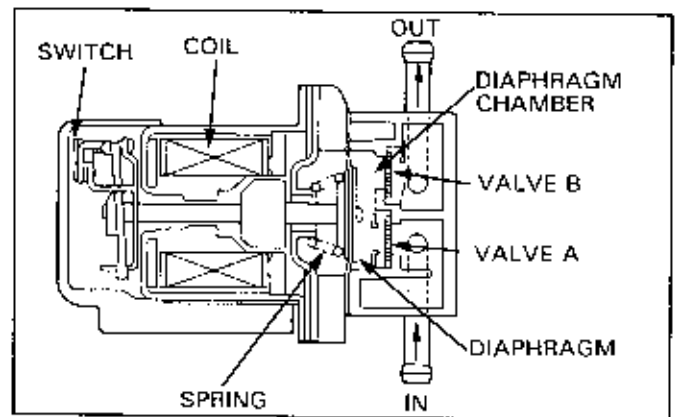
## FUEL PUMP

### DESCRIPTION

Certain models are equipped with a low pressure electromagnetic fuel pump to send the fuel to the carburetor.

When the engine is started, the switch is turned on by the function of the fuel cut-off relay (refer to the description of fuel cut-off relay), which generates the electromagnetic force at the coil and moves the plunger and diaphragm up. The valve A is then opened by the vacuum and the fuel flows to the diaphragm chamber. The plunger pushes the switch up and turns it off. As the electromagnetic force at the coil goes out this time, the plunger and diaphragm are returned by the spring and the fuel in the diaphragm chamber is sent to the carburetor through the valve B.

Certain types of this fuel pump have the fuel cut-off relay built in.



FUEL CUT-OFF RELAY

With the ignition switch ON, current flows to the transistor and thyrister but it does not flow to the fuel pump. To fill the carburetor float chamber with fuel when the ignition switch is turned ON, certain types of the fuel cut-off relay have a timer function that sends current to the fuel pump for a few seconds.

While the engine is running, pulses are transmitted from the spark unit to the ignition primary circuit and, when it is transmitted to the transistor, current flows from the transistor to the thyrister to turn it ON. The battery current flows to the fuel pump this way.

As the fuel cut-off relay is controlled by the ignition primary circuit, the relay does not operate unless the ignition primary circuit operates properly.

INSPECTION

Turn the ignition switch ON and perform the following inspections.

1. Check for battery voltage between the black wire (+) of the fuel cut-off relay connector (pump connector if the relay is built in the pump) and ground (-).

Battery voltage

No battery voltage

- Broken black wire.
- Faulty sub-fuse.
- Faulty ignition switch.
- Poor connection of the fuse holder connector.

2. Check for continuity between the black/blue wire of the relay connector and ground (or black/yellow wire and green wire of the pump connector, if the relay is built into the pump).

No continuity

Continuity

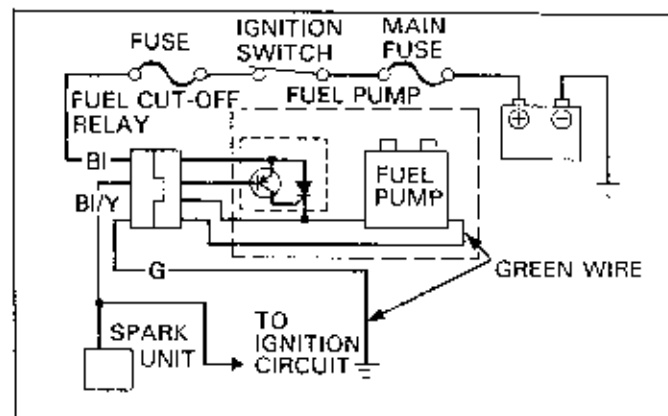
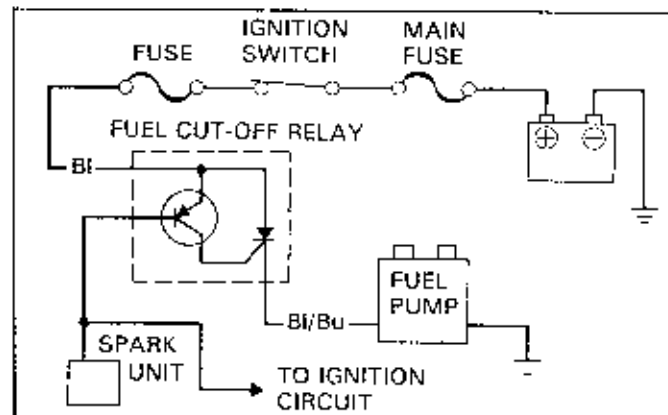
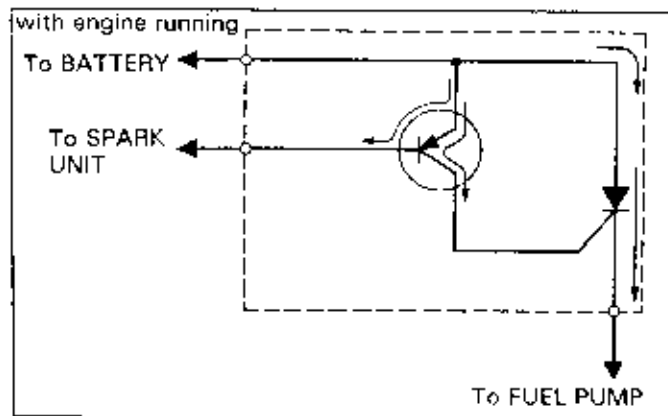
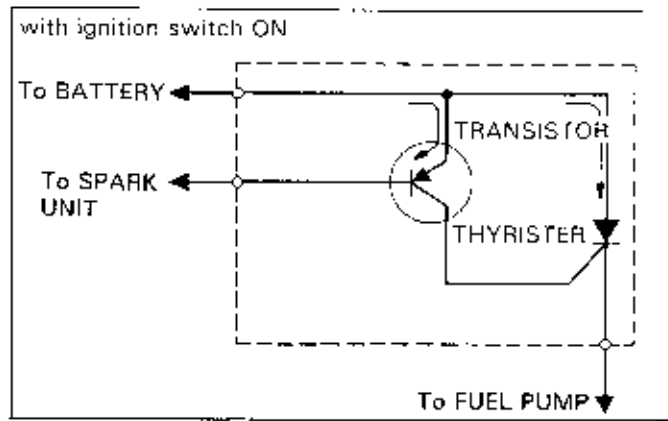
- Faulty fuel cut-off relay (pump).

3. Short the black and black/blue wires of the relay connector with a jumper wire and check for battery voltage between the black/blue (+) wire and green wire of the pump connector.

No battery voltage

Battery voltage

- Broken green or black/blue wire.
- Faulty fuel pump.
- Faulty ground.



**DISCHARGE VOLUME INSPECTION**

Turn the ignition switch OFF.

Disconnect the fuel pump-to-carburetor tube from the carburetor and place the tube end in a beaker.

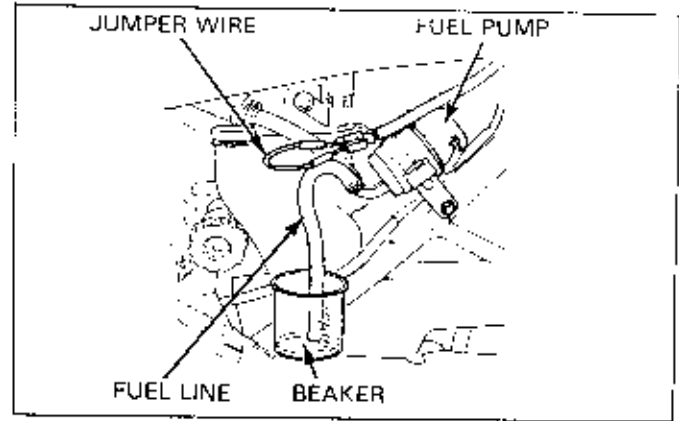
**NOTE**

- If it is hard to reconnect the tube to the carburetor, disconnect it from the fuel pump and connect the other tube to the pump (gasoline discharge port).

Refer to step 3 of INSPECTION and short the relay connectors. If the relay is built into the pump, short the black and black/yellow wires.

Turn the ignition switch ON for 5 seconds and drain the pump.

Multiply the drained fuel by 12. It should be as specified in the Model Specific manual.

**HEADLIGHT BULB**

Before replacing the bulb, be sure to check the switches for loose connection of the connectors.

**WARNING**

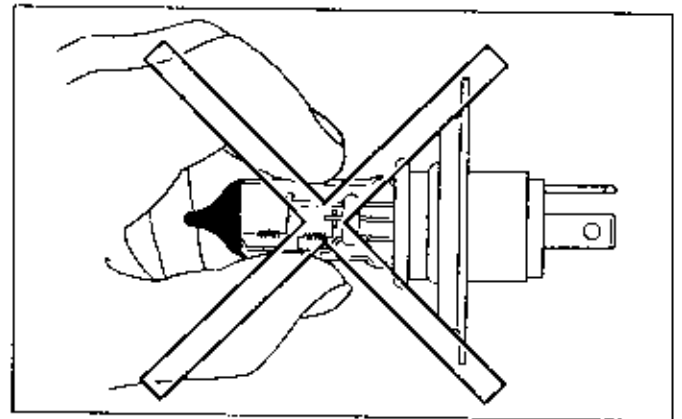
- Halogen headlight bulbs become very hot while the headlight is ON, and remain hot for a while after they are turned OFF. Be sure to turn the ignition switch OFF and let the bulb cool down before replacement.

If you touch the bulb with your bare hands, clean it with a cloth moistened with denatured alcohol to prevent early bulb failure.

**CAUTION**

- Avoid touching Halogen headlight bulbs. Finger prints can create hot spots that cause a bulb to break.

Be sure to install the dust cover after replacing the bulb.



## SWITCHES

### INSPECTION

Disconnect the connector that is nearest to the switch that you are to inspect and check for continuity between the switch side terminals of the connector.

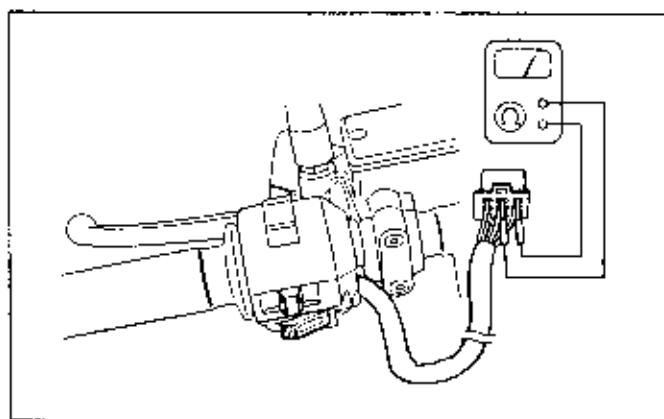
There should be continuity between the  $\bigcirc - \dots - \bigcirc$  positions on the continuity chart. (Refer to the Model Specific manual for the continuity chart.)

Example: Turn signal switch

Wire color	Orange	Gray	Blue
Switch position			
L	$\bigcirc - \dots - \bigcirc$	$\bigcirc - \dots - \bigcirc$	
N			
R		$\bigcirc - \dots - \bigcirc$	$\bigcirc - \dots - \bigcirc$

With the turn signal switch in N (neutral), there should be no continuity between the wires.

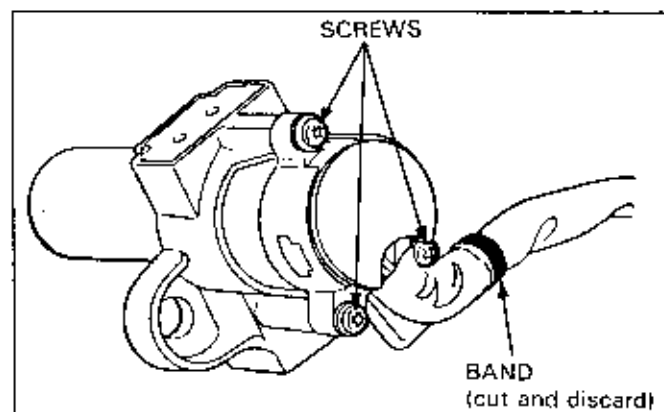
With the switch in L (left), there should be continuity between the orange and gray wires and with the switch in R (right), there should be continuity between the blue and gray wires.



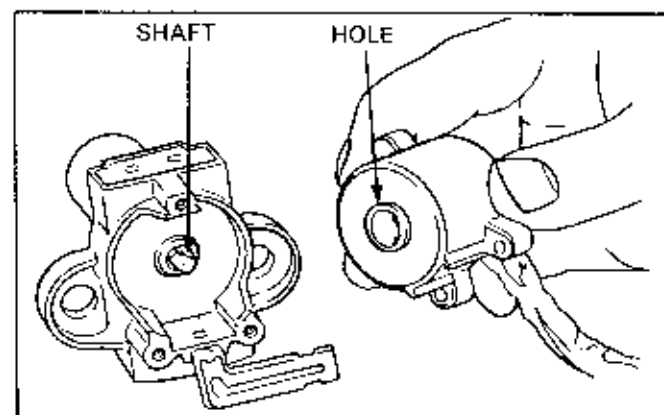
### CONTACT BASE REPLACEMENT

When the contact base is mounted with screws;  
Remove the ignition switch.

Remove the band and three screws, then remove the switch from the switch cylinder.

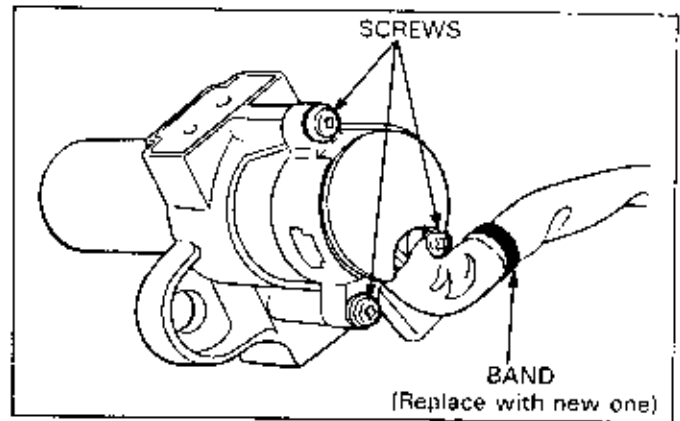


Reassemble the switch and cylinder with the cylinder shaft aligned with the hole in the switch.



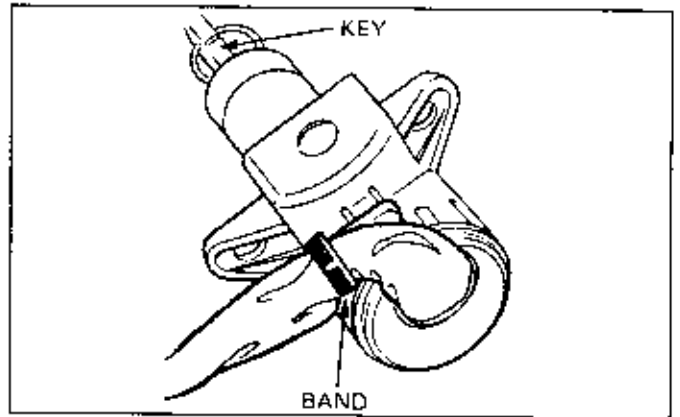
Tighten the contact base with the three screws.

Clamp the wires with a wire band and cut off the excess portion of the band. Check the ignition switch.



When the contact base is secured with tabs; Remove the ignition switch and band.

Insert the ignition switch key and turn it to the position between ON and OFF.

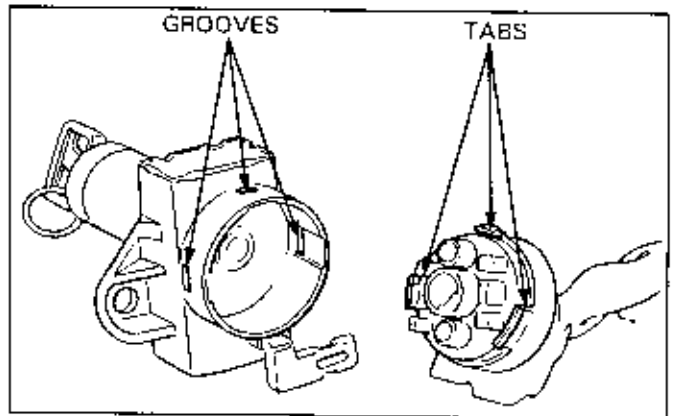


Push the contact base tabs in with a screwdriver so that they are out of the slots in the ignition switch body, and remove the contact base.

Insert the contact base on the ignition switch body with its tabs aligned with the slots in the ignition switch body.

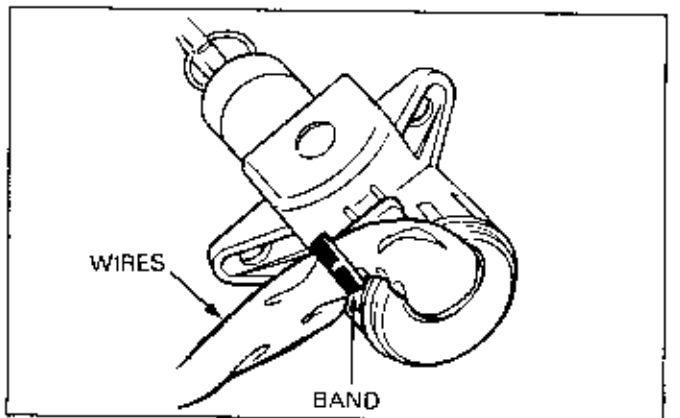
**NOTE**

- Be sure that the ignition switch key is in the position between ON and OFF before attempting to remove the contact base.



Clamp the wires with a wire band and cut off the excess portion of the band.

Check the ignition switch.



## LIGHTS/METERS/SWITCHES

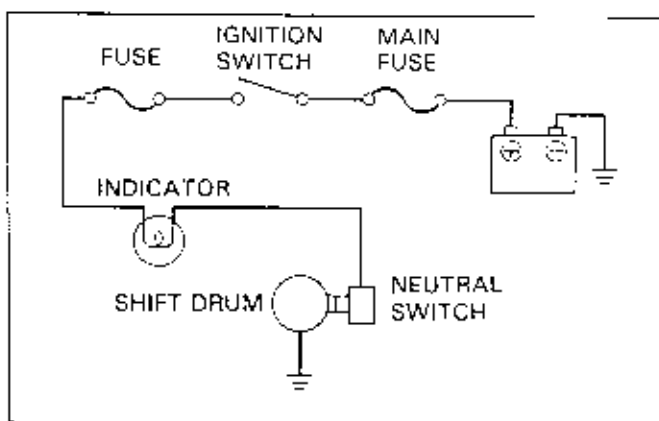
### NEUTRAL SWITCH

When the ignition switch is ON and the transmission is in neutral, the neutral switch turns the indicator on.

Some models are equipped with a change switch and/or over drive switch.

The change switch detects the gear position by the position of the shift drum and sends a signal to the gear position indicator/CDI unit.

The overdrive switch turns the overdrive indicator on when the transmission is in OD (overdrive) position.



### INSPECTION

#### Neutral Indicator does not go off;

Disconnect the light green/red wire from the neutral switch and turn the ignition switch ON.

Indicator does not light

- Faulty neutral switch

Indicator lights

- Broken light green/red wire

#### Neutral indicator does not come on;

Disconnect the light green/red wire from the neutral switch and turn the ignition switch ON.

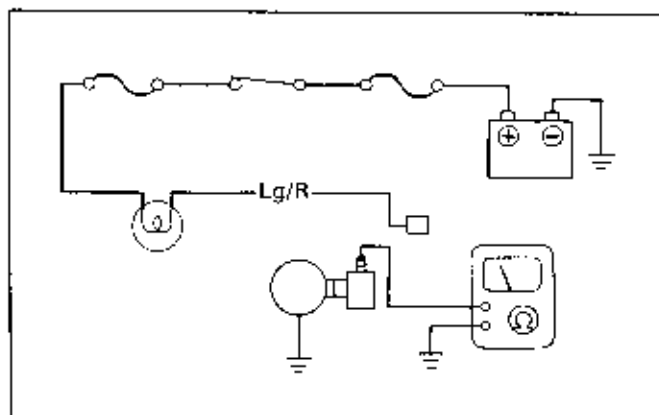
Check for battery voltage between the light green/red wire and ground.

Battery voltage

- Faulty neutral switch.

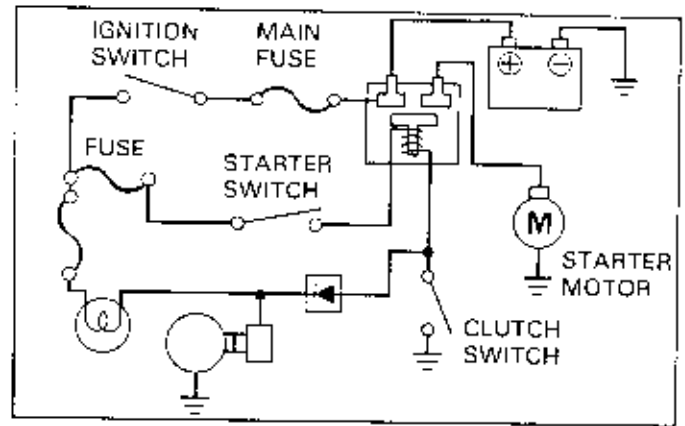
No battery voltage

- Broken light green/red wire between the indicator and neutral switch.
- Blown bulb.
- Blown sub fuse.
- Poor connection of the fuse connector.



## CLUTCH SWITCH

The clutch switch prevents the starter motor from rotating while the engine is running and the transmission is in positions other than neutral.



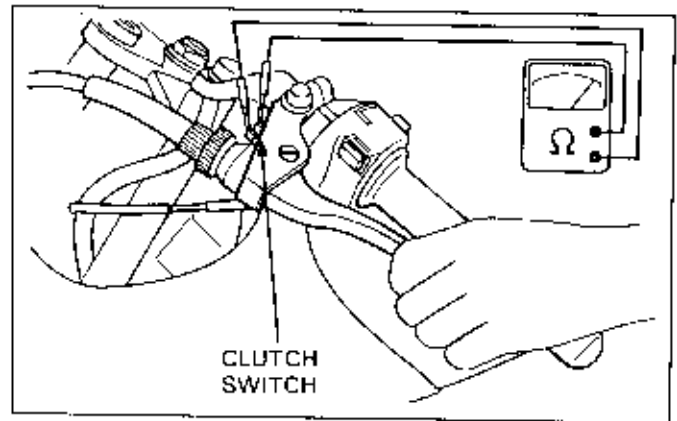
### INSPECTION

Check the starter system if the starter motor rotates with the transmission in positions other than neutral. The starter motor should be operated with the clutch lever squeezed and not be operated with the lever released. If the system is normal, check the following.

Disconnect the wire from the clutch switch and check for continuity between the clutch switch terminals while operating the clutch lever.

When the clutch lever is pulled in:  
There should be continuity between the terminals.

When the clutch lever is released:  
There should be no continuity between the terminals.



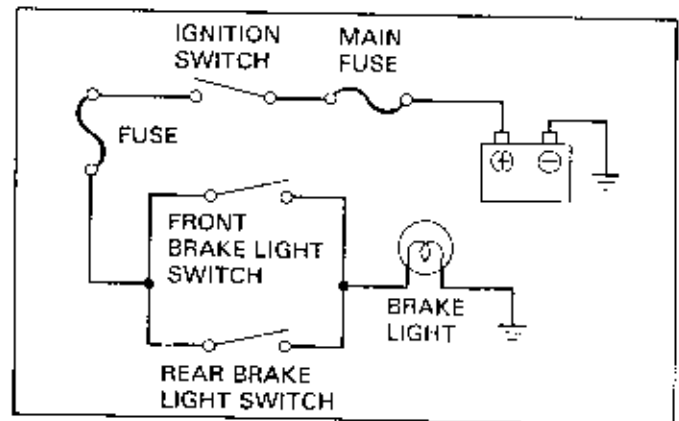
If the clutch switch is normal, check the following.

- Check for shorted wire between the starter relay switch and the clutch switch.
- Check the neutral switch.

## BRAKE LIGHT SWITCH

The brake light comes on when the brake lever (or pedal) is applied.

Starter motor equipped scooters: To prevent the accidental start up of the scooter, current does not flow to the starter motor unless the brake lever (or pedal) is applied.

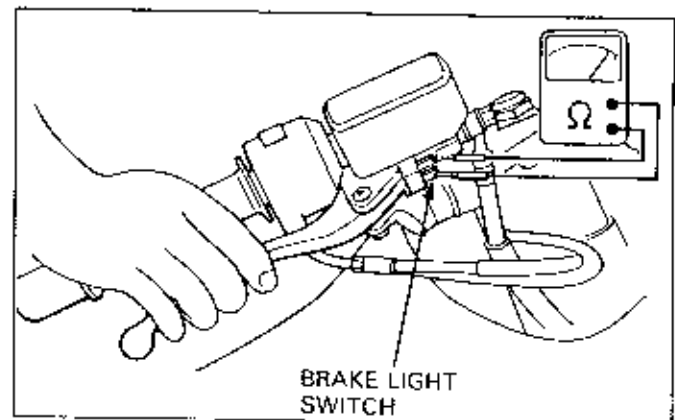


### INSPECTION

Brake light does not come on;

1. Check for the following.

- Burned bulb.
- Poor connection of the brake light switch connector.



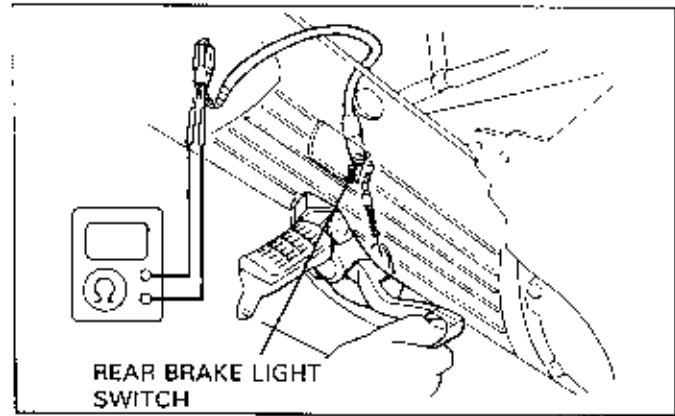
## LIGHTS/METERS/SWITCHES

2. If normal, disconnect the brake light switch connector and check for continuity between the terminals while operating the brake lever (or pedal).

When the brake lever (or pedal) is depressed:  
There should be continuity between the terminals.  
When the brake lever (or pedal) is released:  
There should be no continuity between the terminals.

3. If the brake light switch is normal, check for the following.

- Burned sub fuse.
- Ignition switch.
- Poor connection of the fuse connector.
- Broken wire between the sub fuse and brake light switch.
- Broken wire between the brake light switch and brake light.



## TURN SIGNAL LIGHTS

If the turn signal light does not blink, check the following.

- Is the battery normal?
- Is the bulb burned out?
- Is the bulb of the specified wattage?
- Is the fuse burned out?
- Are the ignition switch and turn signal switch normal?
- Is the connector properly connected?

If normal, check as noted below.

- When the turn signal relay has 2 terminals:

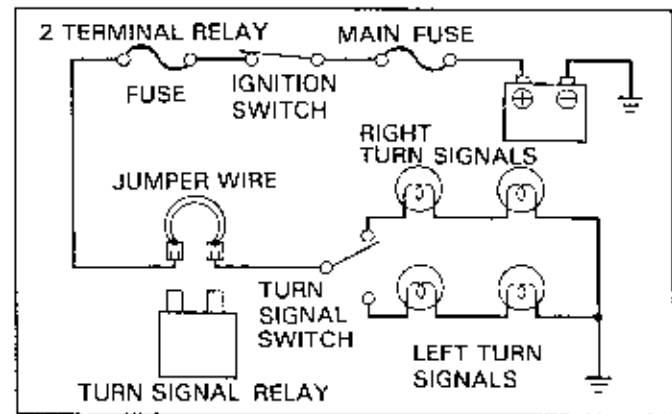
Disconnect the connector from the relay and short the connector with a jumper wire. Turn the ignition switch ON and check the turn signal light by turning the switch ON.

Light does not come on

- Broken wire harness.

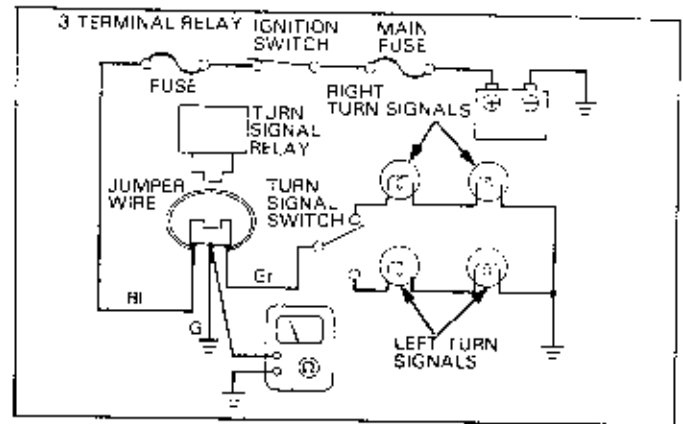
Light comes on

- Faulty turn signal relay.
- Poor connection of the connector.





- When the turn signal relay has 3 terminals;
  1. Short the black and gray terminals of the turn signal relay connector with a jumper wire. Turn the ignition switch ON and check the turn signal light by turning the switch ON.
    - Light comes on
      - Broken wire harness.
    - Light does not come on
      - Broken wire harness.
  2. Check for continuity between the green terminal of the relay connector and ground.
    - Continuity
      - Faulty turn signal relay.
      - Poor connection of the connector.
    - No continuity
      - Broken ground wire.



## HORN

### Horn does not sound:

1. Check the ignition switch and horn switch. If normal, check the following.
2. Disconnect the wire from the horn. Turn the ignition switch ON, press the horn switch (or start the engine and press the horn switch if your motorcycle is battery-less type) and check for voltage between the light green wire and ground.
  - Voltage
    - Broken light green wire.
    - Faulty sub fuse.
  - No voltage
    - Broken light green wire.
    - Faulty sub fuse.
3. Check for continuity between the green wire and ground.
  - Continuity
    - Faulty horn.
  - No continuity
    - Broken green wire.
    - Faulty ground.

