22. BATTERY/CHARGING/LIGHTING SYSTEM

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 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.

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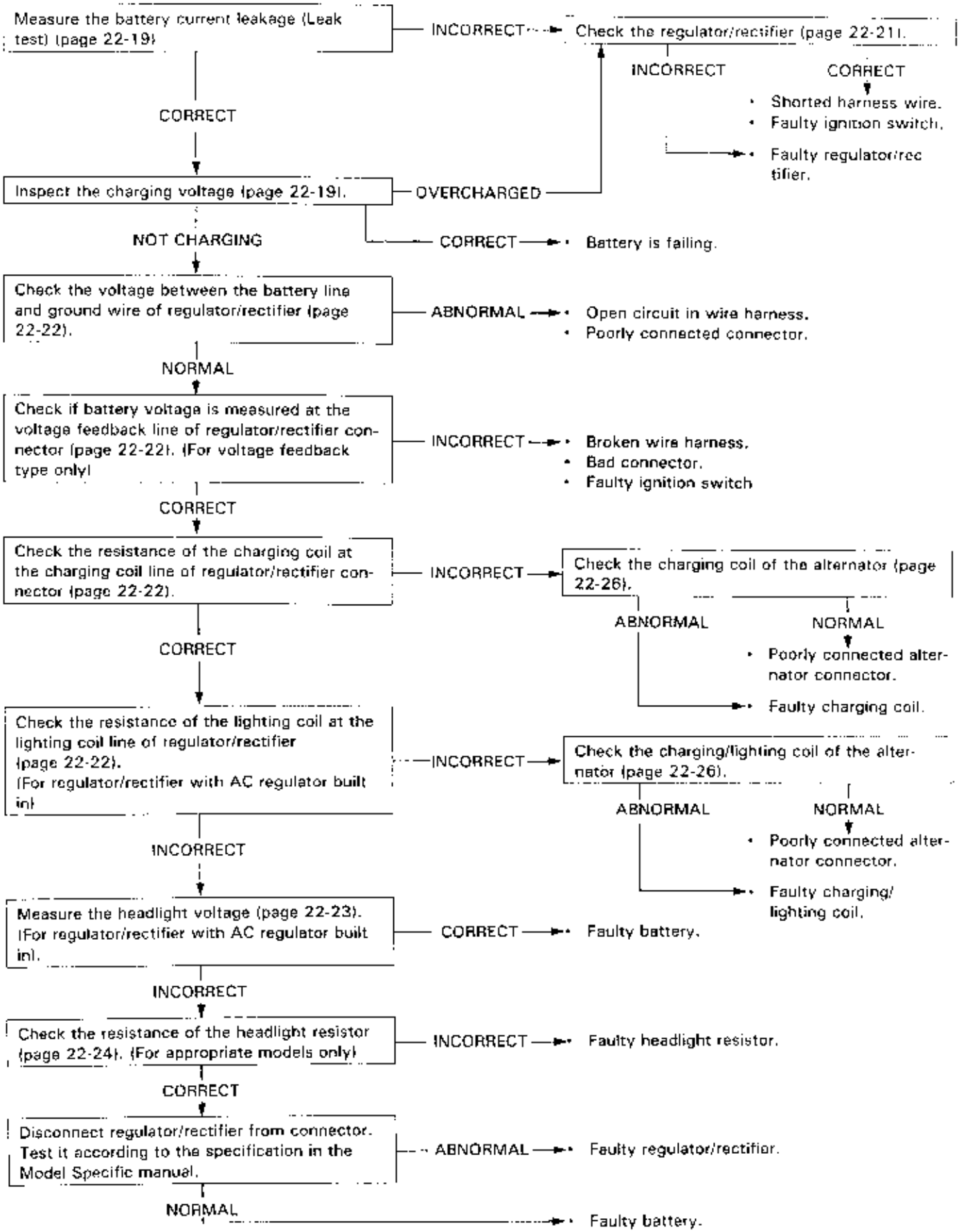
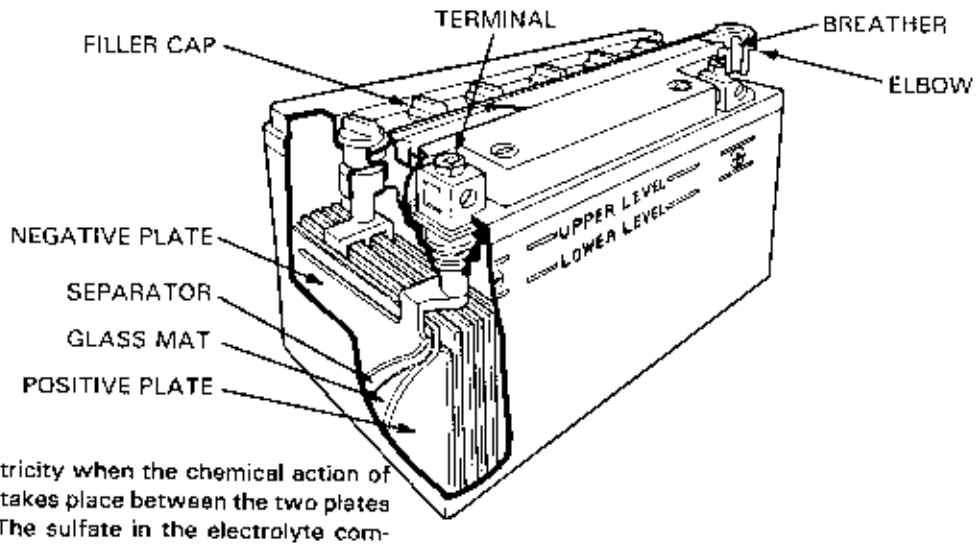
CHARGING SYSTEM



BATTERY DESCRIPTIONS

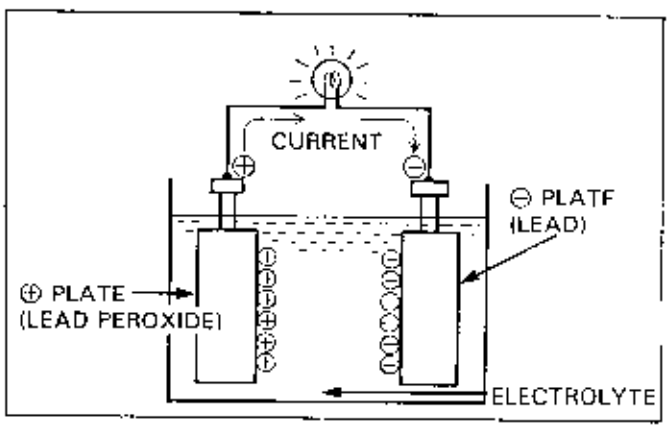
There are two types of batteries used in Honda motorcycles, scooters and ATVs: the conventional battery and the Maintenance free battery.

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.**

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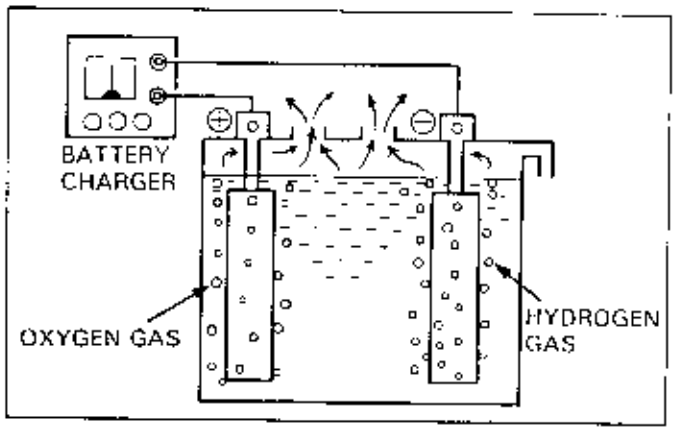
When you charge the lead/acid battery, electrolysis breaks the water down into its components, hydrogen and oxygen. Because of the generation of these gases, you must remove the filler plugs while charging the battery.

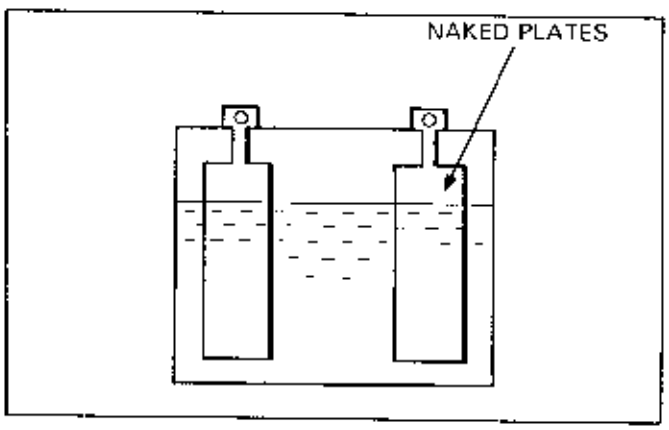
The battery is equipped with a vent, usually routed overboard into tube, to rid it of the gases produced during normal use.

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.



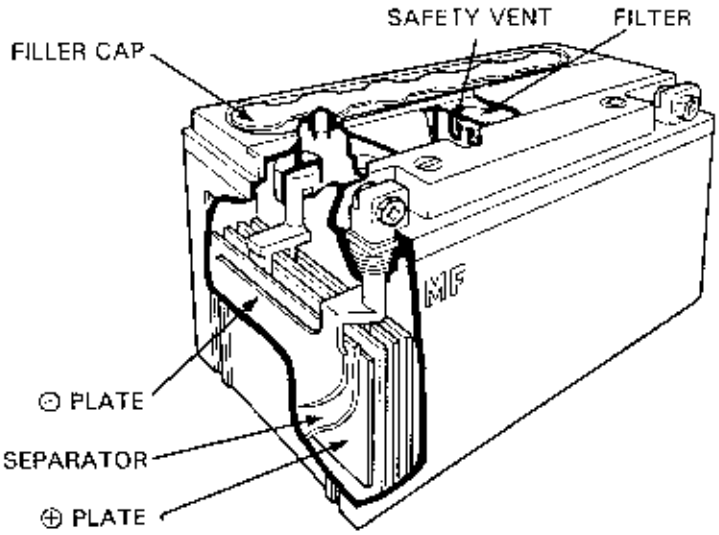
Because the motorcycle battery is constantly subjected to charging and discharging cycles, the water in the electrolyte is boiled off.

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 hydorogen gas is 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 cigaretta 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.**

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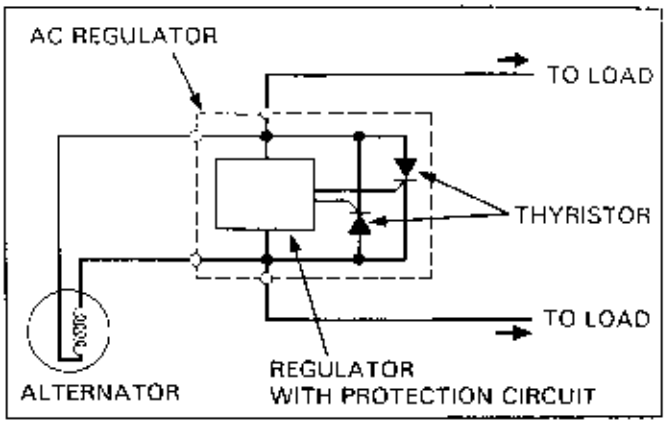
MOTORCYCLES WITHOUT BATTERIES

Some motorcycles do not have batteries in their electrical systems. These models power electrical component with the electricity generated by the alternator, which is regulated by an AC regulator. For components using transistors which require DC current, a small rectifier (CD power unit) is used to rectify alternator signals to DC and feed DC current to these components.

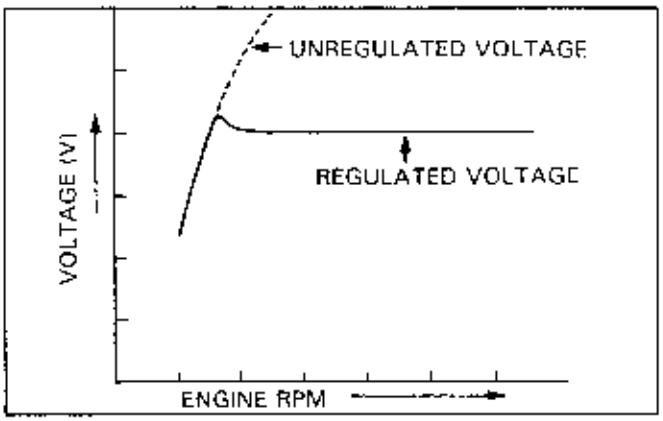


Voltage regulator

To provide a stable current without using a battery, a high power output alternator that feeds sufficient current at low engine rpm is utilized. If the alternator continues supplying current as the engine rpm increases, the excessive current may burn out light bulbs.

To prevent this, the AC regulator maintains the output voltage of the alternator in the specified range.

Some AC regulators have a protection circuit built into the alternator regulator circuit to prevent abrupt voltage increases on cold engine starts.



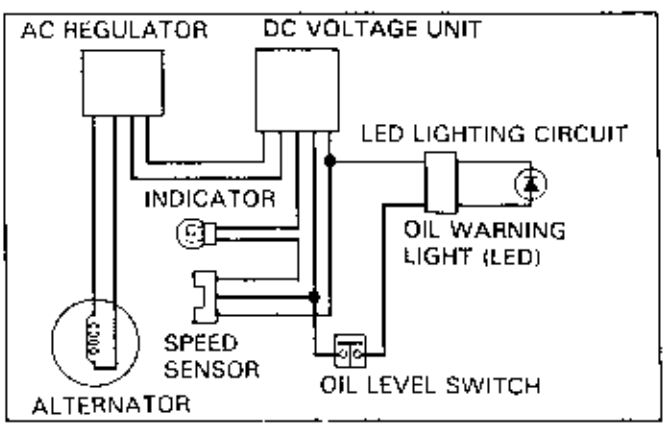
The current generated from the alternator flows directly to the loads at voltage levels lower than the regulated voltage value. As the engine rpm increases, the regulator detects the rise and directs current to thyristor, shorting the alternator output to ground. When the alternator voltage goes over the specified voltage, the regulator cuts off the excess voltage, maintaining a constant voltage output.

DC voltage unit

Although most electrical components receive AC current, there are systems such as the engine oil warning system which require DC current to operate their transistors and LEDs.

Therefore, a compact and light weight DC voltage unit regulates the AC current to these systems.

There are systems and components used specifically for AC: alternating flash turn signals, whose front and rear signals flash alternately, and AC horn which use electrical circuits and components designed for models without batteries.



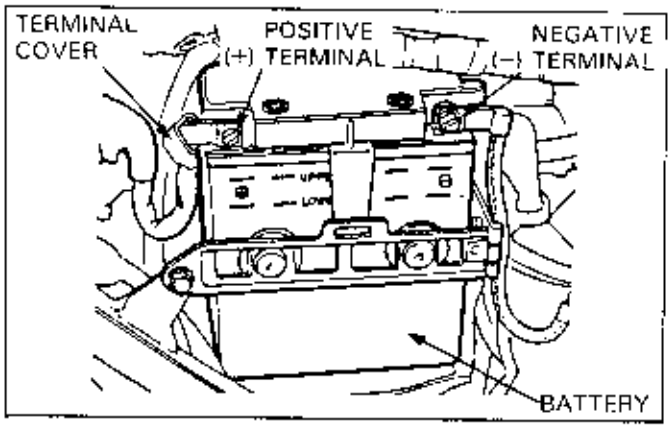
BATTERY REMOVAL/INSTALLATION

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.**



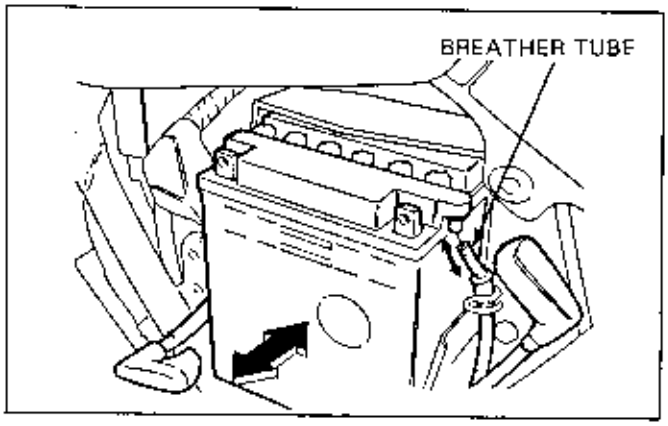
For conventional batteries, always disconnect the breather tube before removing battery.

NOTE

- Some electrolyte may remain in the breather tube.

⚠WARNING

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

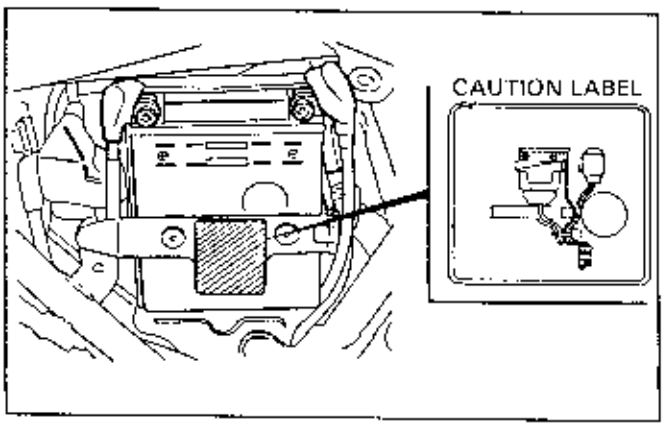


INSTALLATION

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 banding 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.

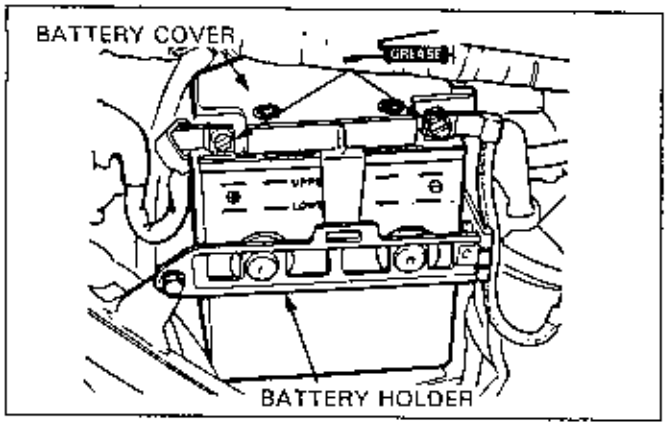
Secure the battery with the battery holder.

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.



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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

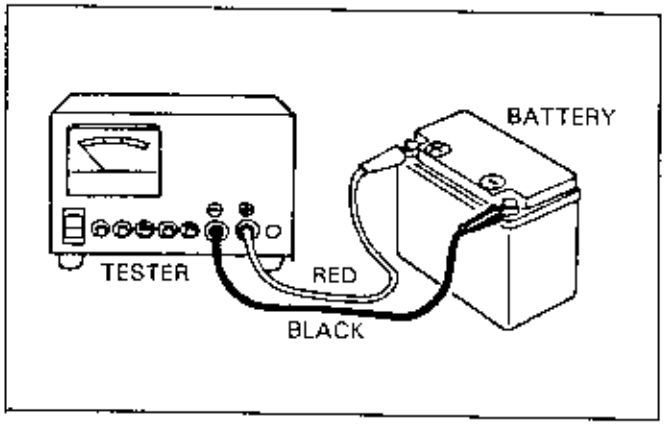
Use the following steps to remove the battery from the motorcycle:

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.

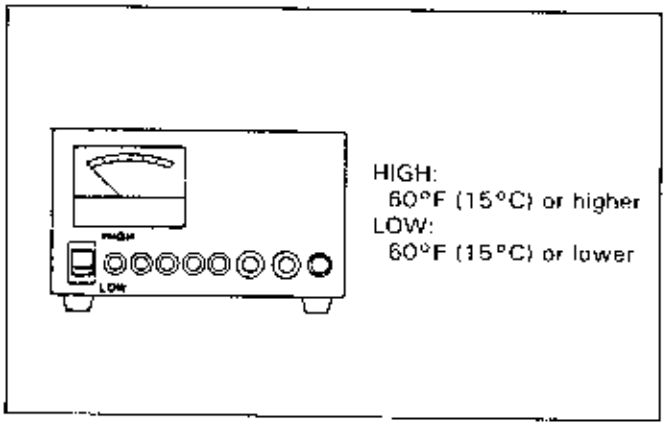
Securely connect the tester's positive (+) cable first — then connect the negative (–) cable.

NOTE

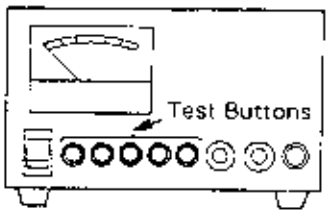
- For accurate test results, be sure the tester's cables and clamps are in good working condition and that a secure connection can be made at the battery.



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



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



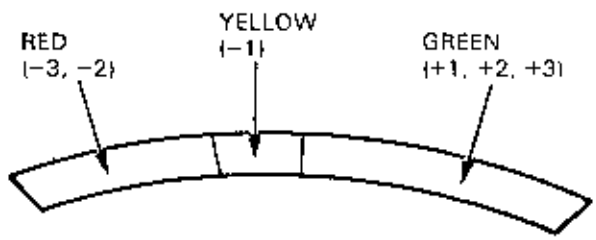
NOTE

- 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

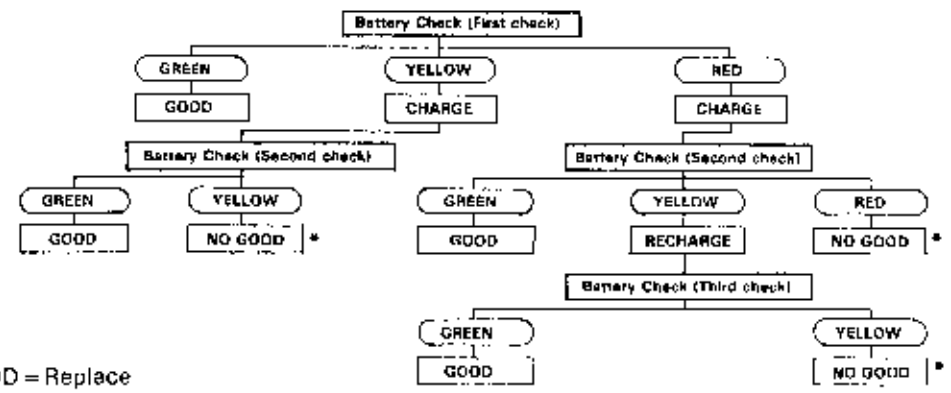
- **To avoid damaging the tester, only test batteries with an amperage rating of less than 30 Ah.**
- **Tester damage can result from overheating when:**
  - **— The test button is pushed in for more than three seconds.**
  - **— The tester is used without being allowed to cool for at least one minute 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

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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.

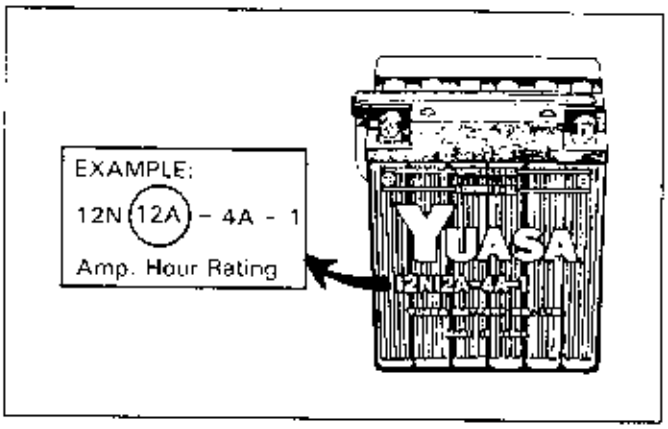
NOTE

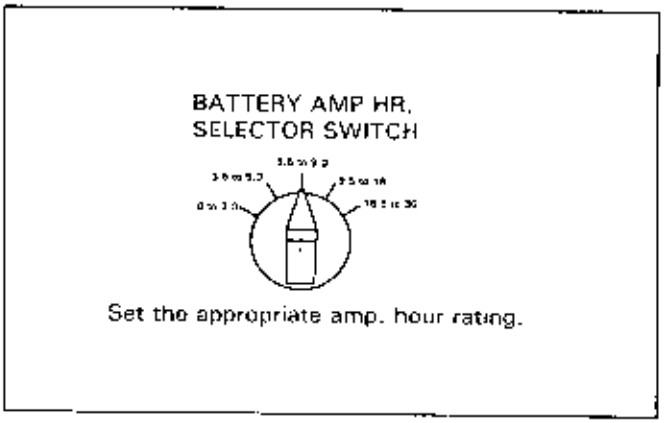
- The charger will automatically switch to the Trickle mode after the set charging time has elapsed.

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

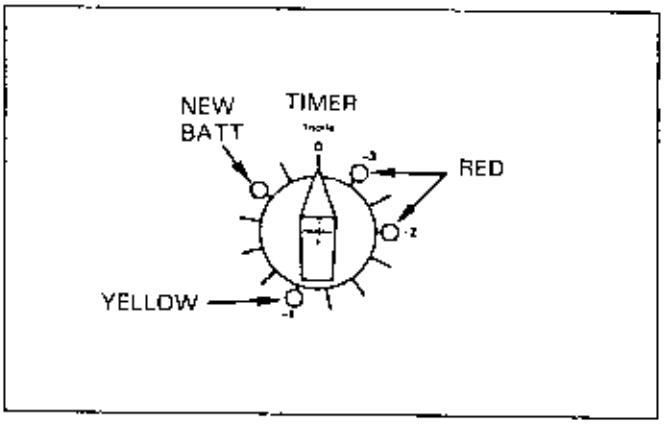
NOTE

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



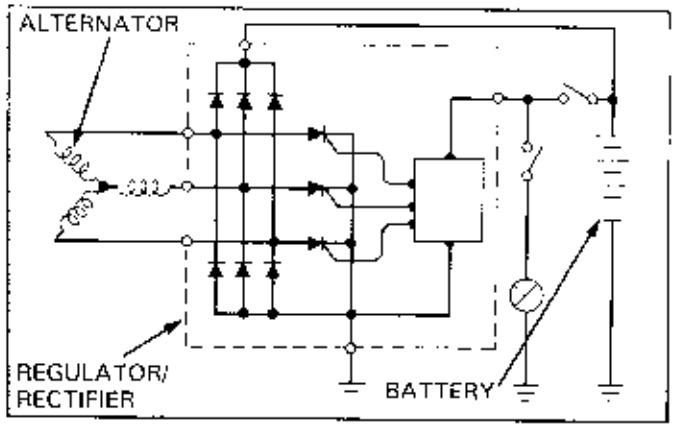


Set the appropriate amp. hour rating.



CHARGING SYSTEM DESCRIPTION

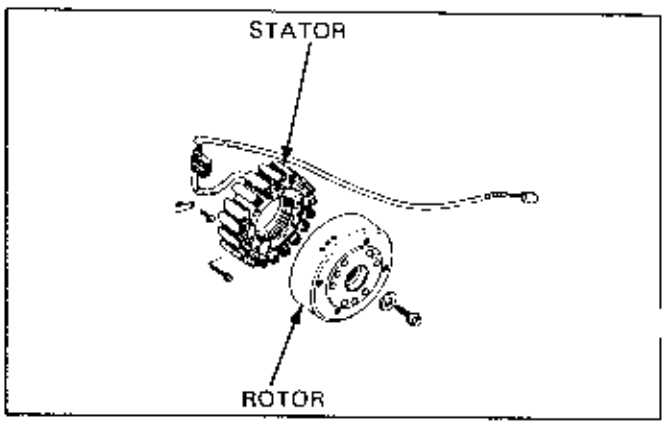
The charging system basically consists of the following components.



Component name	Function
Regulator/rectifier	• Regulates voltage so that it stays within the specified range. • Converts alternating current (AC) to direct current (DC).
Alternator	• A generator producing current (AC) and which is powered by engine revolution.
Battery	• Stores regulated DC current.

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 arround 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 safely 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.

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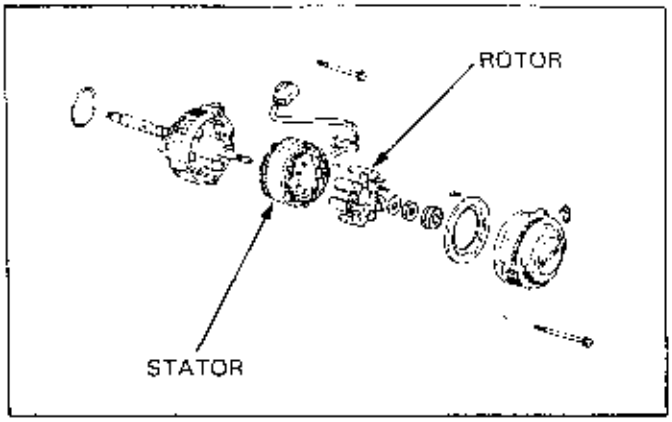
Brushless Excited Field Coil Type

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.

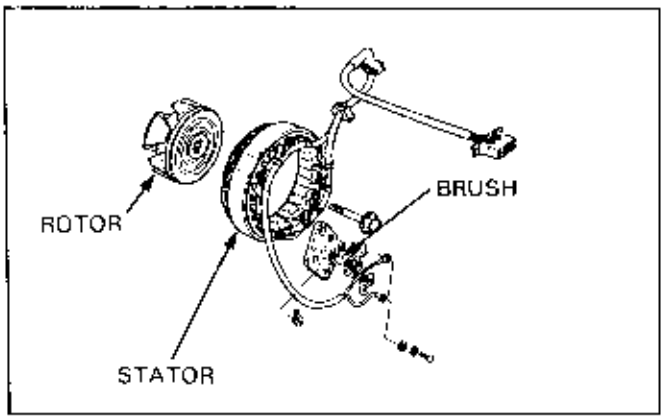
Its structure differs fundamentally from the previous alternator in that it does not utilize a permanent magnet. Instead, the field coil magnetizes the rotor and generates power as the rotor passes the coil.



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

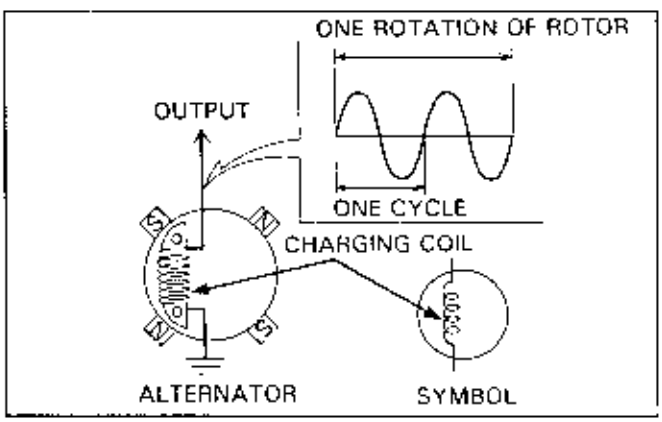
Single Phase Output Type

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.

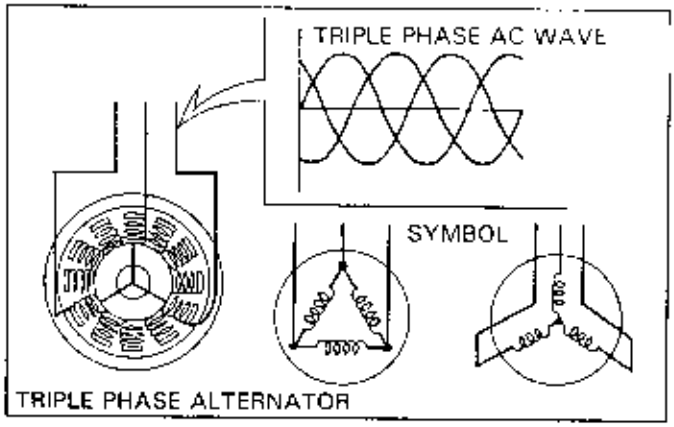
The generator in the diagram on the right has two pairs of magnets, and its output has two cycles for every rotation of the rotor.

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.

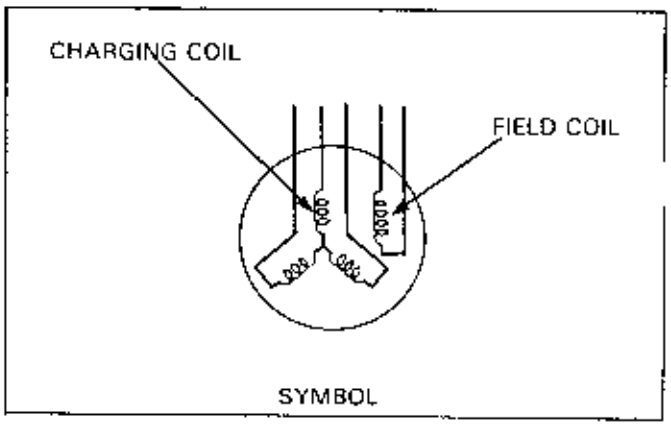


Triple Phase Output Type
This type consists of three coils connected to each other, producing single phase alternating currents independently. The output of the alternator is three single phase AC wave forms where each is 120° out of phase with each other.

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.

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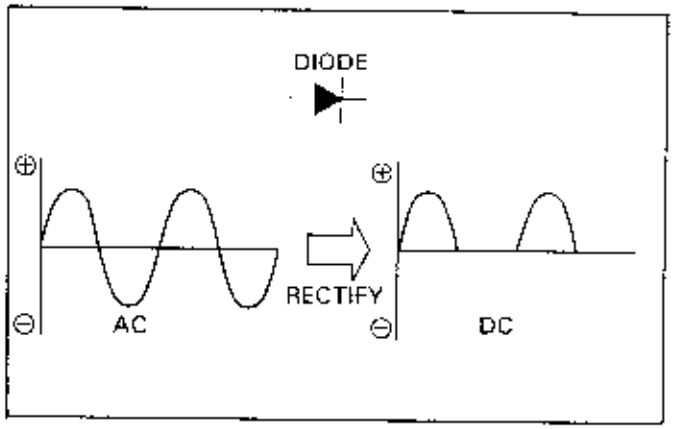
Single Phase, Half-Wave Rectifiers

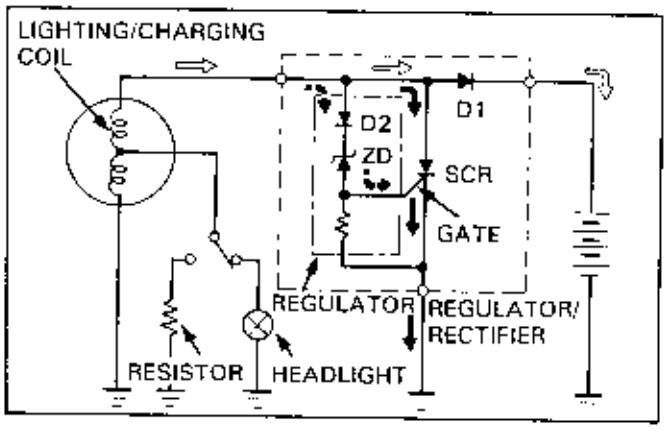
(Diode rectification method)
This method uses only a diode to convert alternating current to direct current. The diode allows current to flow in one direction only. Thus when a single phase AC waveform flows through the diode the negative voltage of the waveform is cut off and the positive voltage drops 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.

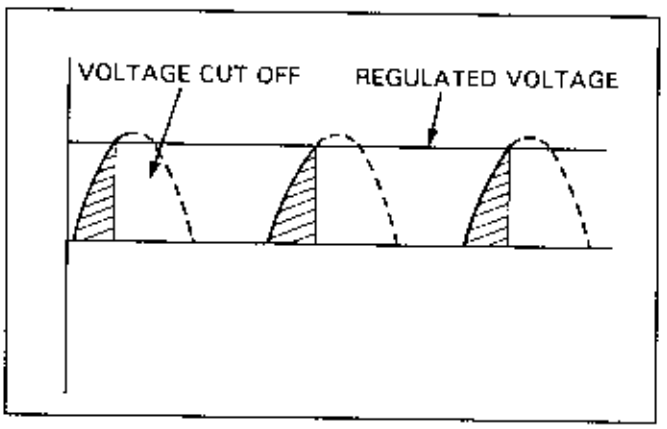
The single phase half wave rectifier utilizes two voltage feedback methods.

(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).



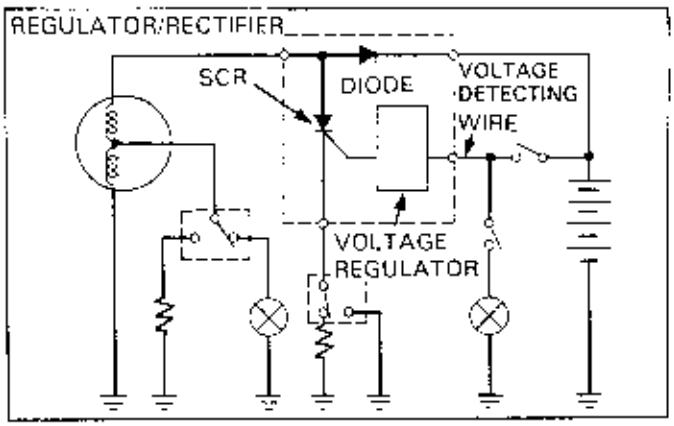
As the engine rpm (rotation per minute) increases, the output of the alternator increases and that output is rectified by diode D2. This singnal then goes to the zener diode (ZD). Current flows in the normal direction of the zener diode but does not flow in the reverse direction until a certain amount 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.

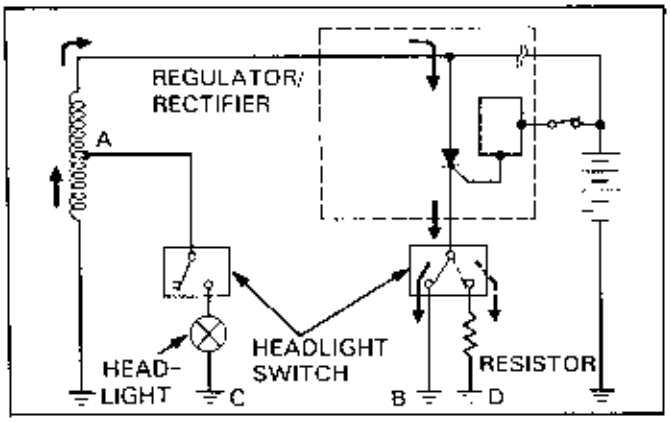


For alternators with the charging/lighting coil combined (charging and lighting systems powerd by the same coil), the headlight lighting system affects the performance of battery charging. Since the input of the lighting system is taken from the charging coil, if the load of the lighting coil is not 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.

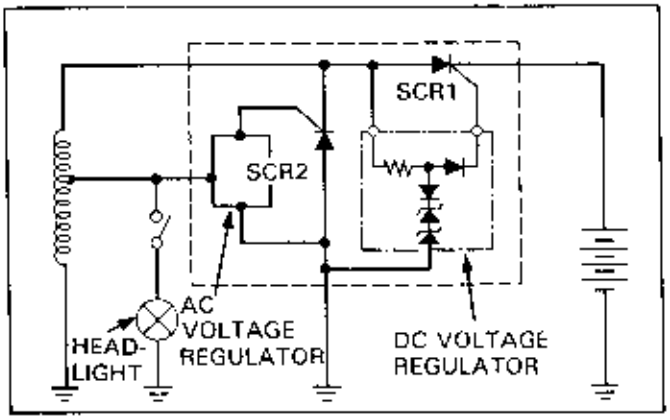
(Battery)
This method is similar to the method mentioned previously except that the voltage regulation is done after the signal is converted to DC at the input of the battery. Since this method regulates output voltage of alternator after it is rectified, its charging is precisely controlled.



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.



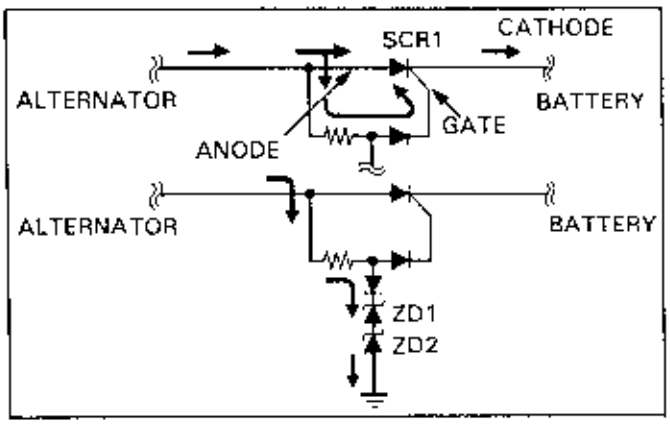
(SCR switching regulation/AC regulator built in type)
This type is used for models with small displacement engines. Unlike the type above, the SCR is used for switching and the ZD (zener diode) is used for voltage regulation.



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.



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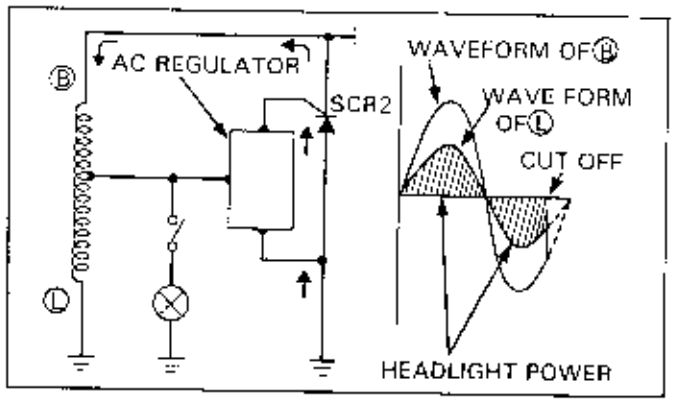
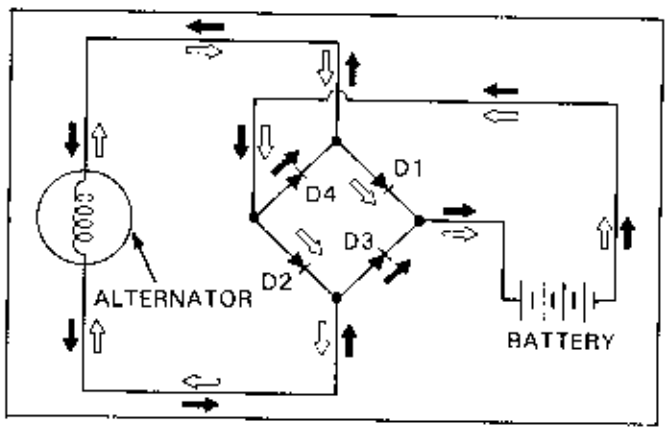
AC regulator function:
The AC regulator regulates the voltage to the headlight. Thus, no resistor is required. When the negative output of the charging coil reaches a certain voltage, the AC regulator feeds current to the gate of SCR2 and turns it ON. The SCR2 is shorted and a negative current to the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

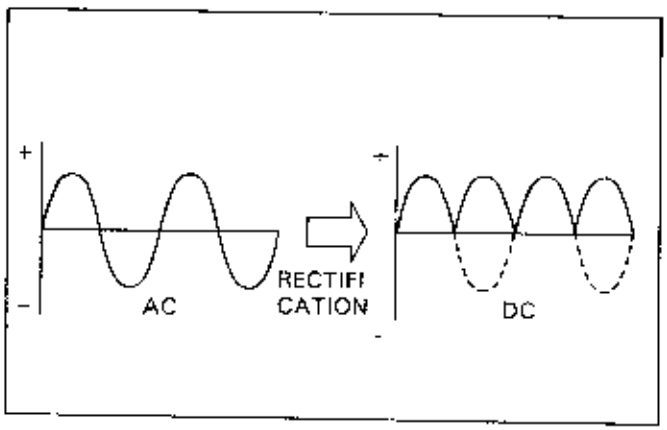
However, since when the negative output of the coil is cut off the headlight voltage is also cut off, the AC regulator regulates the output voltage to the headlight.

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.

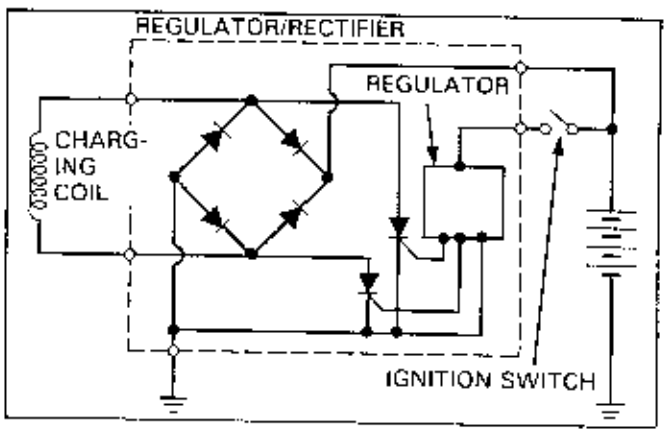


In order to convert the AC output of the alternator to DC, the diodes are arranged as in the right diagram, inside the regulator/rectifier. When the alternator is positive the current flows through D1 → battery → D2 → and when the alternator is negative the current flows through D3 → battery → D4 shown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

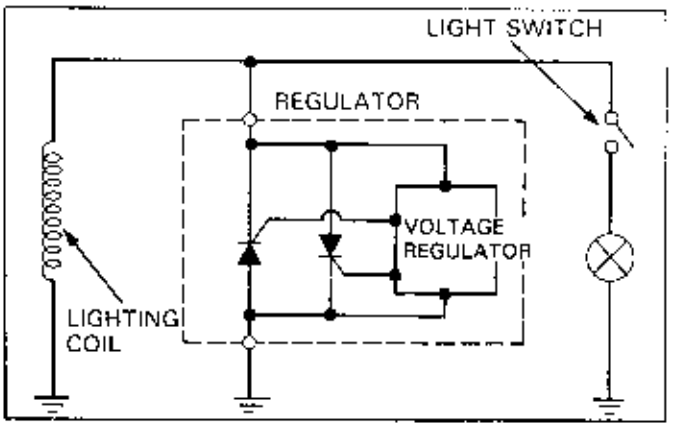


AC Regulator

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.

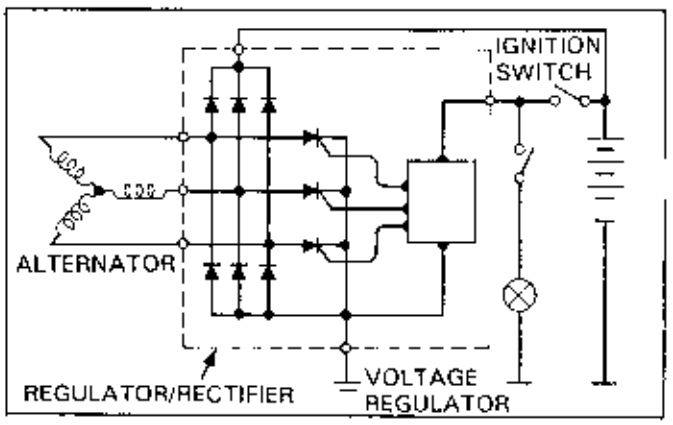
There are regulators which regulate both positive and negative outputs and ones which regulate negative output only.

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.

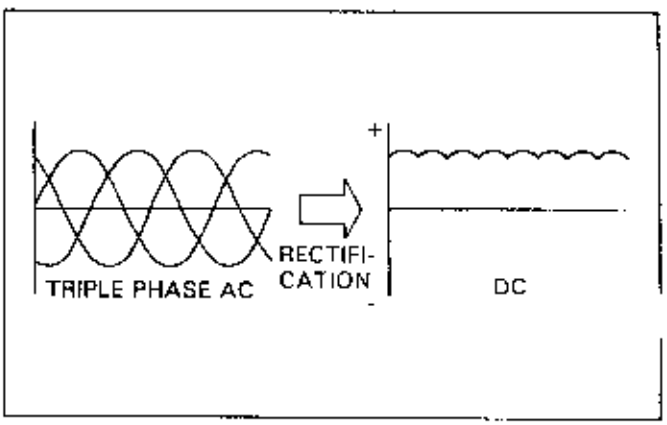


Triple Phase Full-Wave Rectifier

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.



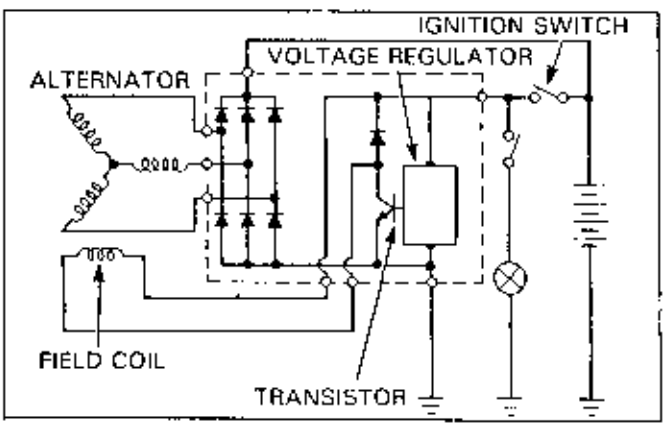
The rectified waveform of the triple phase AC output is more stable than the single phase AC type.



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.



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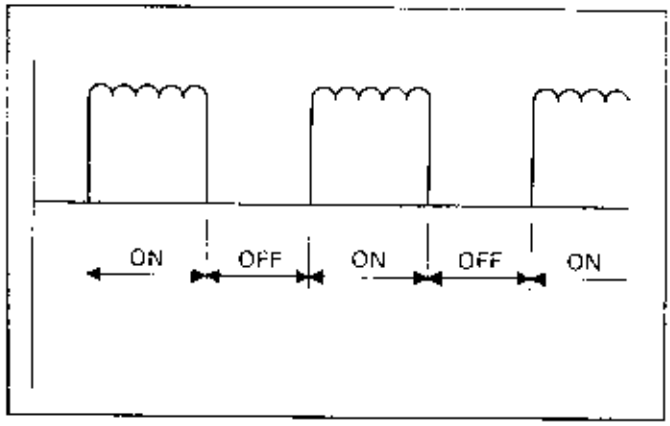
The voltage regulation is performed by a high frequency ON/OFF cycle of the alternator. When the DC voltage of the output waveform is measured by a voltmeter, a value smaller than the peak voltage is measured.

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.



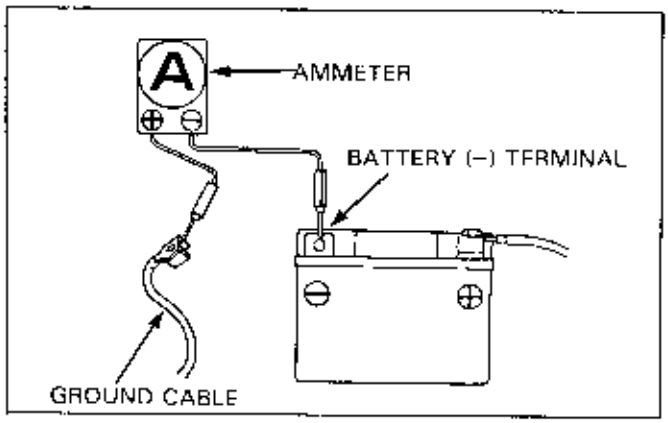
CHARGING SYSTEM INSPECTION

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.

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

Connect a multitester between the battery terminals.

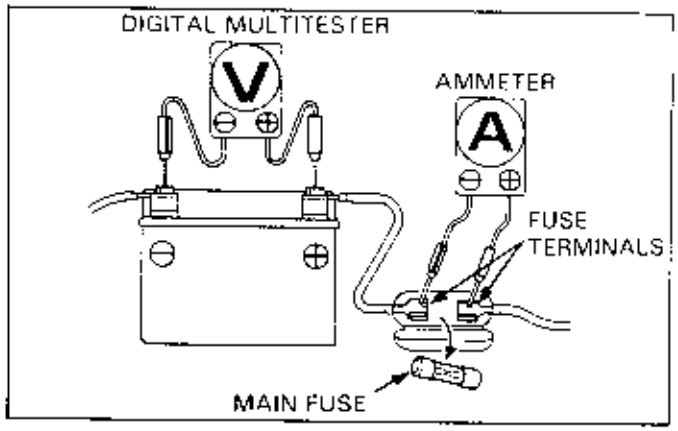
S ronL

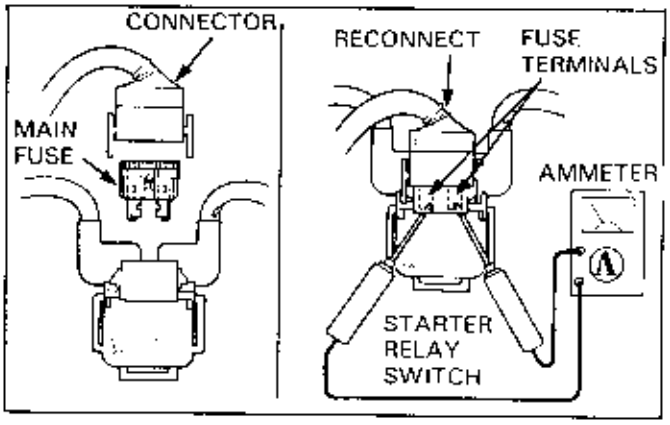
DIGITAL MULTITESTER 07411-0020000

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 multitester.
- 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.

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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.

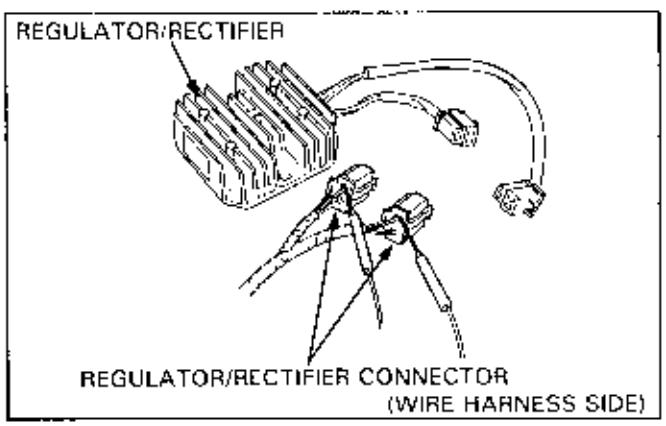
② Charging voltage normal but charging current abnormal
- The replacement battery is old or underrated.
- The battery used was undercharged or overcharged.
- Blown out ammeter fuse.
- Incorrect connection of ammeter.

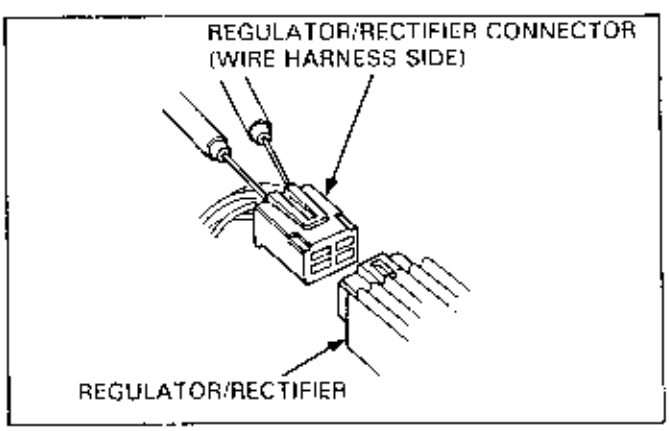
③ Charging current normal but charging voltage abnormal
- Blown out voltmeter fuse. (Check for faulty fuse by 0 Ω adjustment)

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.

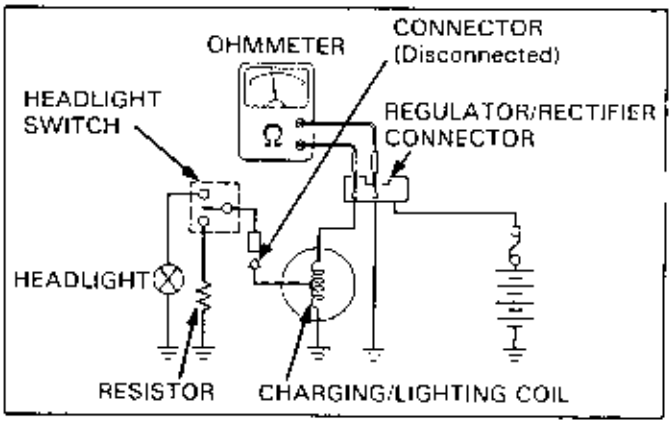




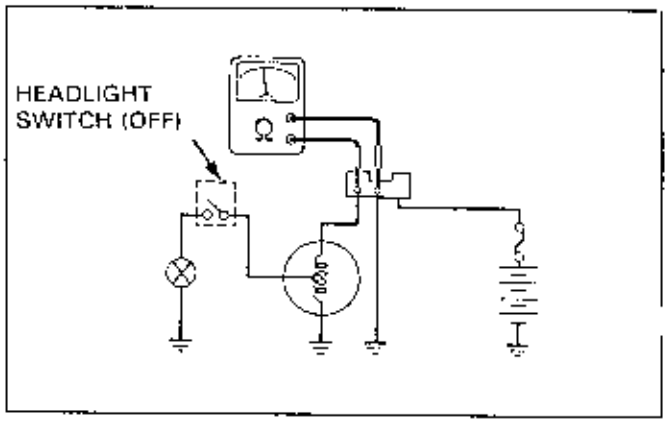
Items (wire colors)	Inspection
Battery wire(red/white or red)	Check that there is voltage between battery line (+) and ground line.
Ground wire (green)	Check continuity between ground and frame.
Voltage detection line (black) (external voltage detection type)	Check that there is battery voltage between 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.)

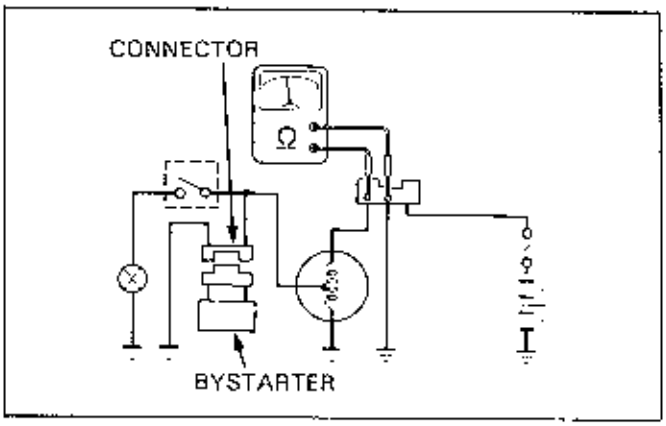
- For lighting systems whose headlight connector is connected to a resistor when the headlight is turned OFF, either disconnect the handlebar switch connector or disconnect the lighting output line of the alternator. (Refer to diagram at right.)



- 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.

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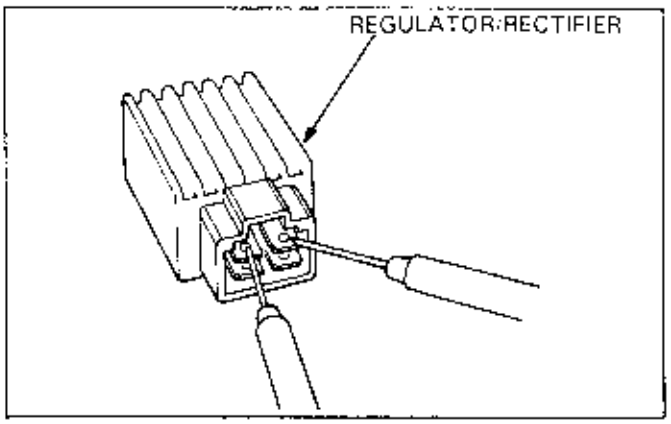
UNIT INSPECTION



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.)

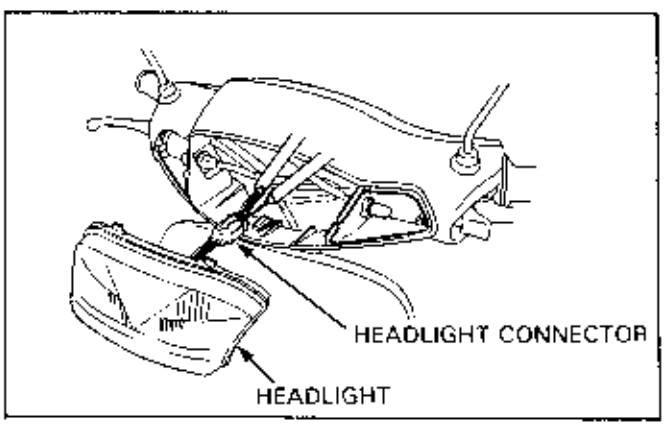
NOTE

- Resistance value will not be accurate if the probes touch your fingers.
- Use the following recommended multitester.
- 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: kΩ
  KOWA Tester: x 100 Ω
- An old, weak multitester battery could cause inaccurate readings. Check the battery if the multitester registers incorrectly.
- When using the Kowa multitester, 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.

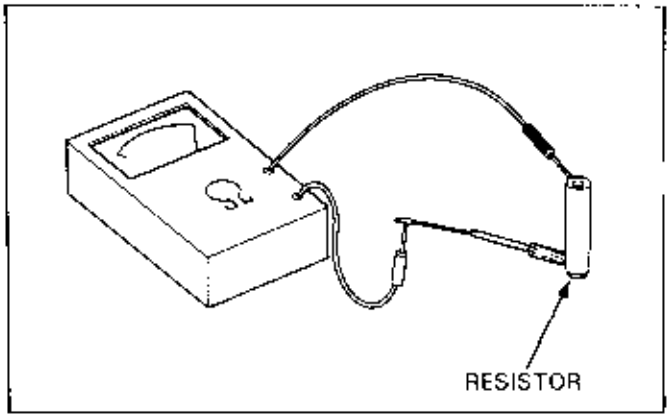
Gradually increase the engine speed and read the voltage at the specified rpm.

Refer to Model Specific manual for service data.

Select the AC range on your multitester. (AC current flows to the headlight).
Use the specified multitester. The measured headlight-regulated voltage may vary depending on the multitester used because of the characteristics of the output waveform.

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)**

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



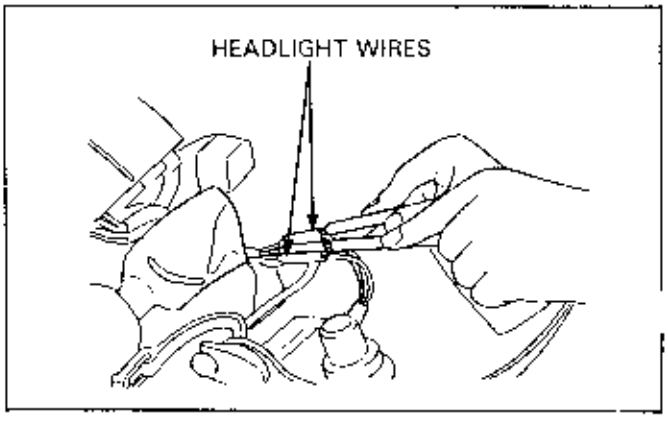
AC Regulator Type:

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 multitester. (AC current flows to the headlight).
Use the specified multitester. The measured headlight-regulated voltage may vary depending on the multitester used because of the characteristics of the output waveform.

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)**

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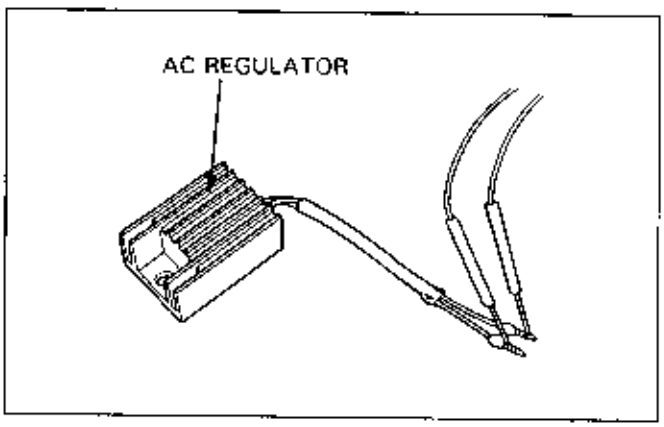
- If the headlight lighting voltage is abnormally high, check the alternator connector and the alternator unit.
- If there is no headlight lighting voltage, check the following areas.
  - Loose or poor contact at a connection in the lighting circuit.
  - Continuity test for dimmer switch.
  - AC regulator.
  - 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 multitester.
- 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 Ω
  KOWA Tester: x 100 Ω
- An old, weak multitester battery could cause inaccurate readings. Check the battery if the multitester registers incorrectly.
- When using the Kowa multitester, 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.

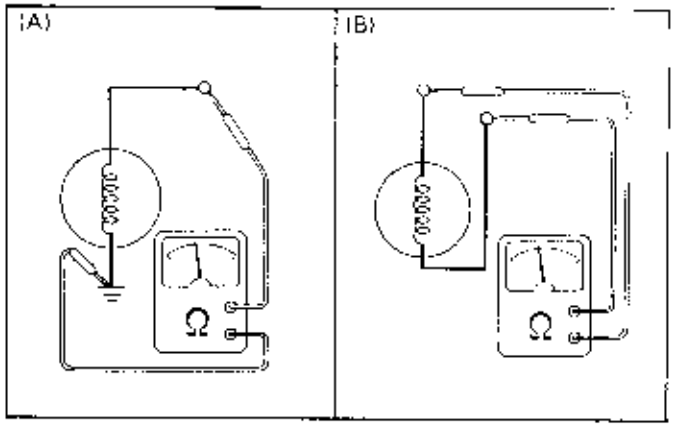
(C) For single phase, combined charging/lighting coils, measure the resistance at the charging output line and at lighting output line.

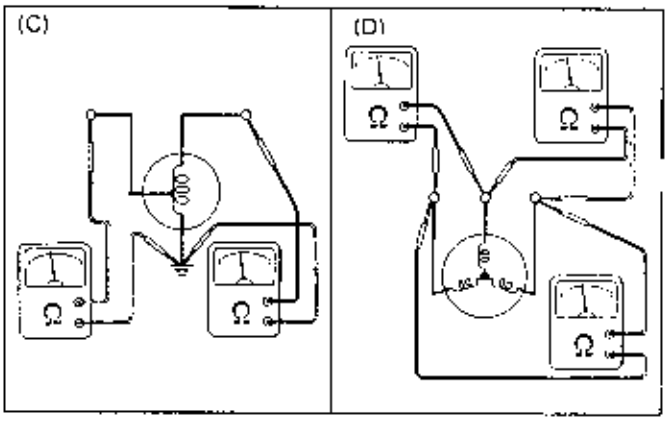
(D) For three phase coils, measure resistance between each output line, and check that there is no continuity between each output line and ground.

If the resistance values are much larger (∞) 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.





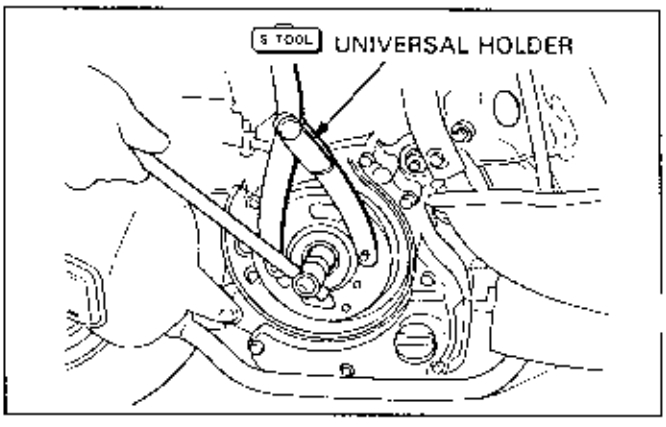
STATOR REMOVAL

Remove alternator cover. Watch for oil spilling out.

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

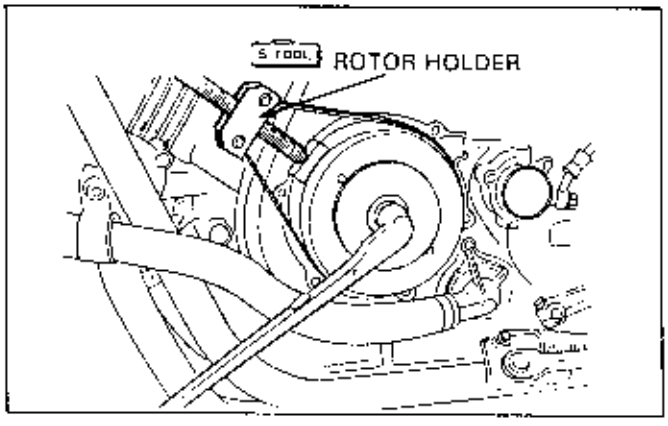
S TOOL

UNIVERSAL HOLDER	**07725—0030000 or**
ROTOR HOLDER	**07725—0040000**



CAUTION

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



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Insert flywheel puller into the rotor and remove the rotor.

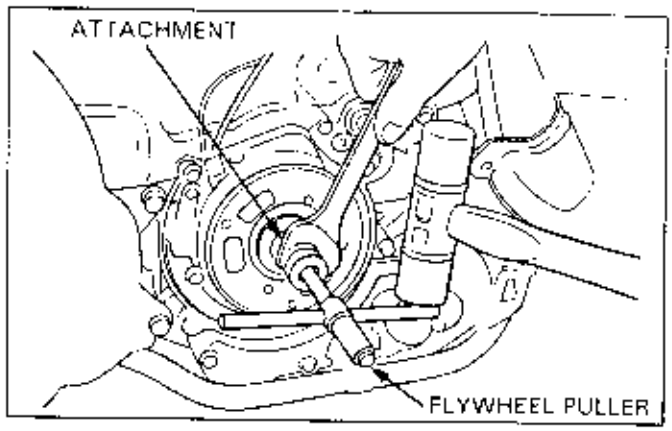
S TOOL

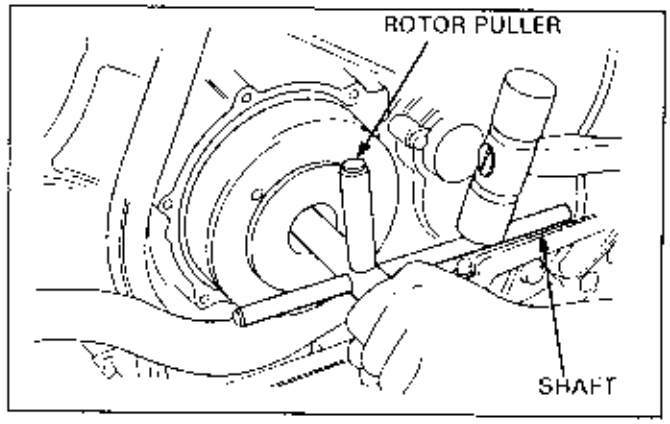
FLYWHEEL PULLER	**07733—0010000 or**
ROTOR PULLER	**07733—0020001**

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

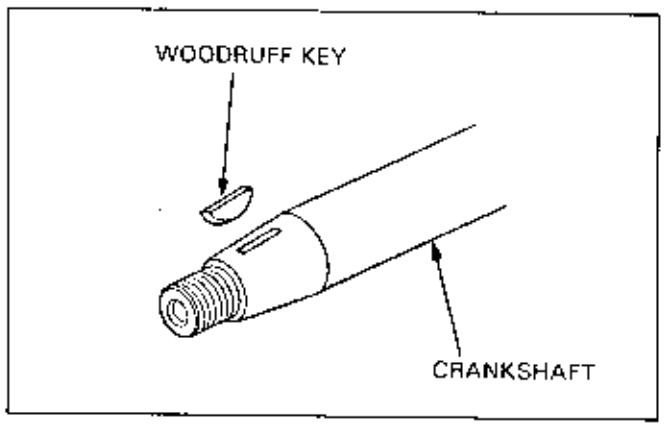
CAUTION

- **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.



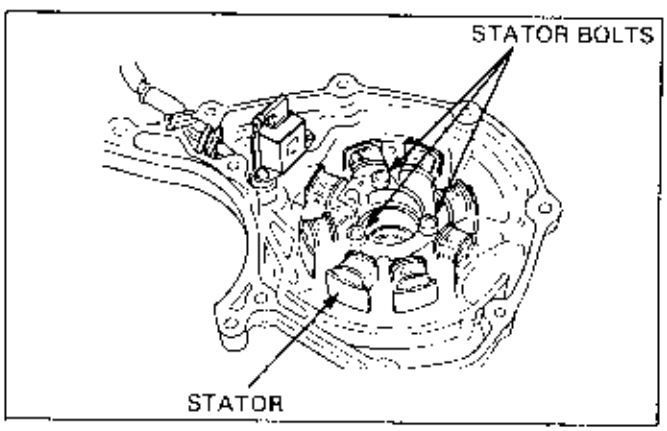
STATOR REMOVAL

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.



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.

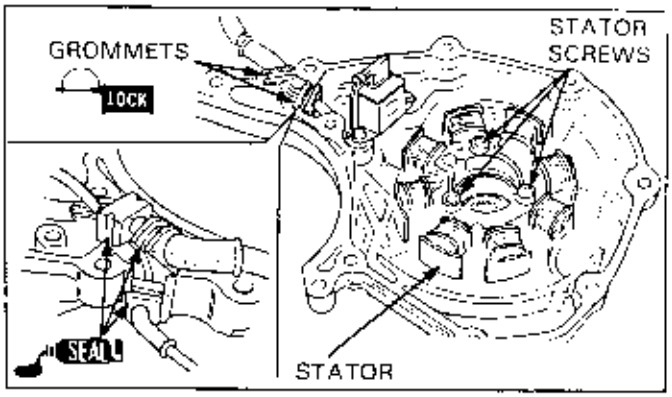
CAUTION

- **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.

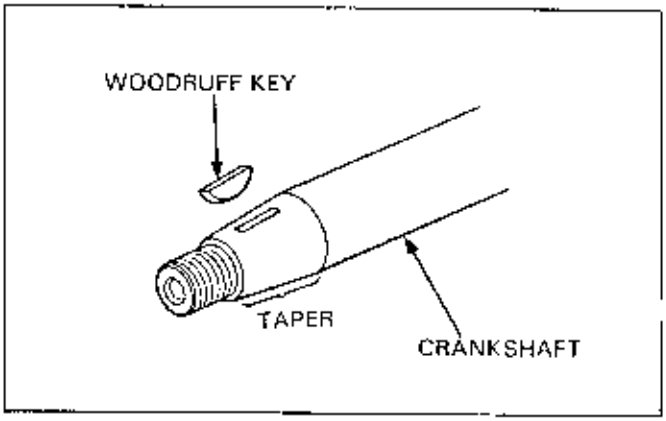


ROTOR INSTALLATION

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.



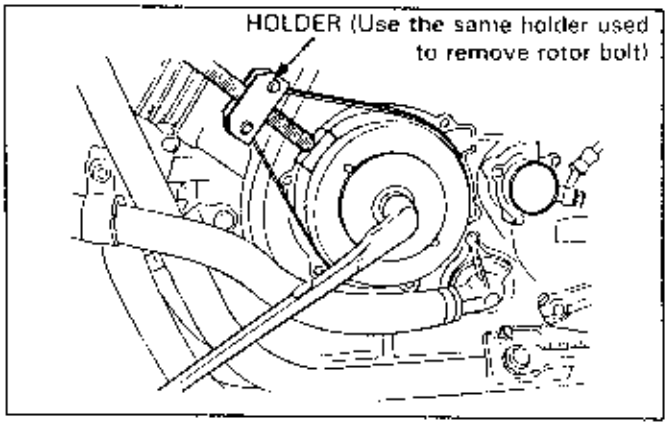
Set the rotor groove to the woodruff key and install the rotor on the crankshaft.

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.



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

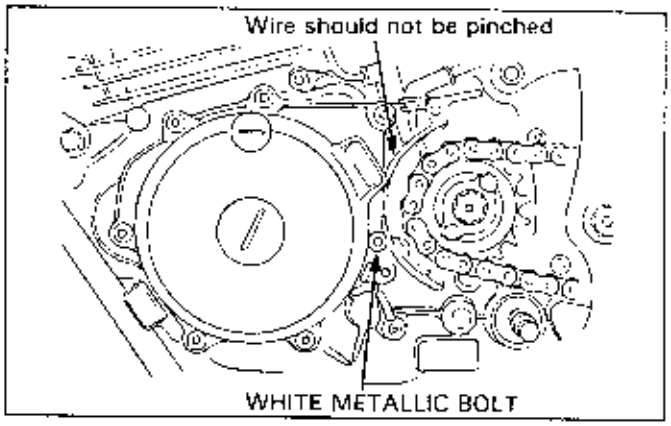
Install the crankcase cover onto the engine.

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

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.

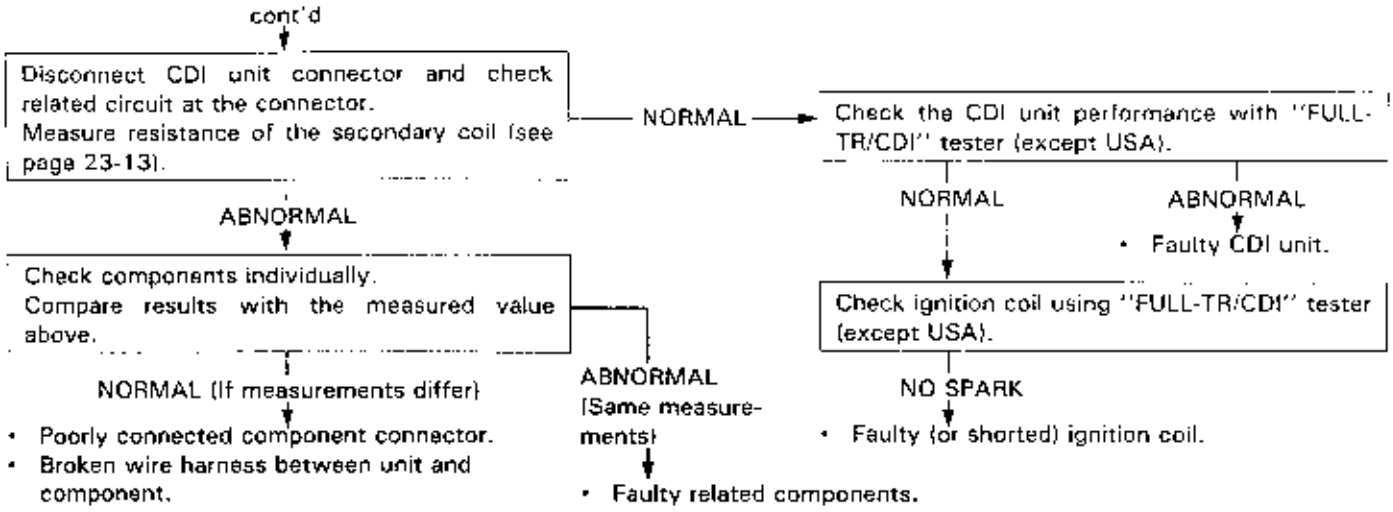
No spark at spark plugs. (CDI unit)

Replace with known good spark plugs, conduct the spark plug test.
- SPARK → • Faulty plugs.
- NO SPARK ↓

Check for poorly connected or loose spark plug wires. If loose, screw spark plug cap securely into the spark plug wire.
- SPARK → • Loose wires.
- NO SPARK ↓

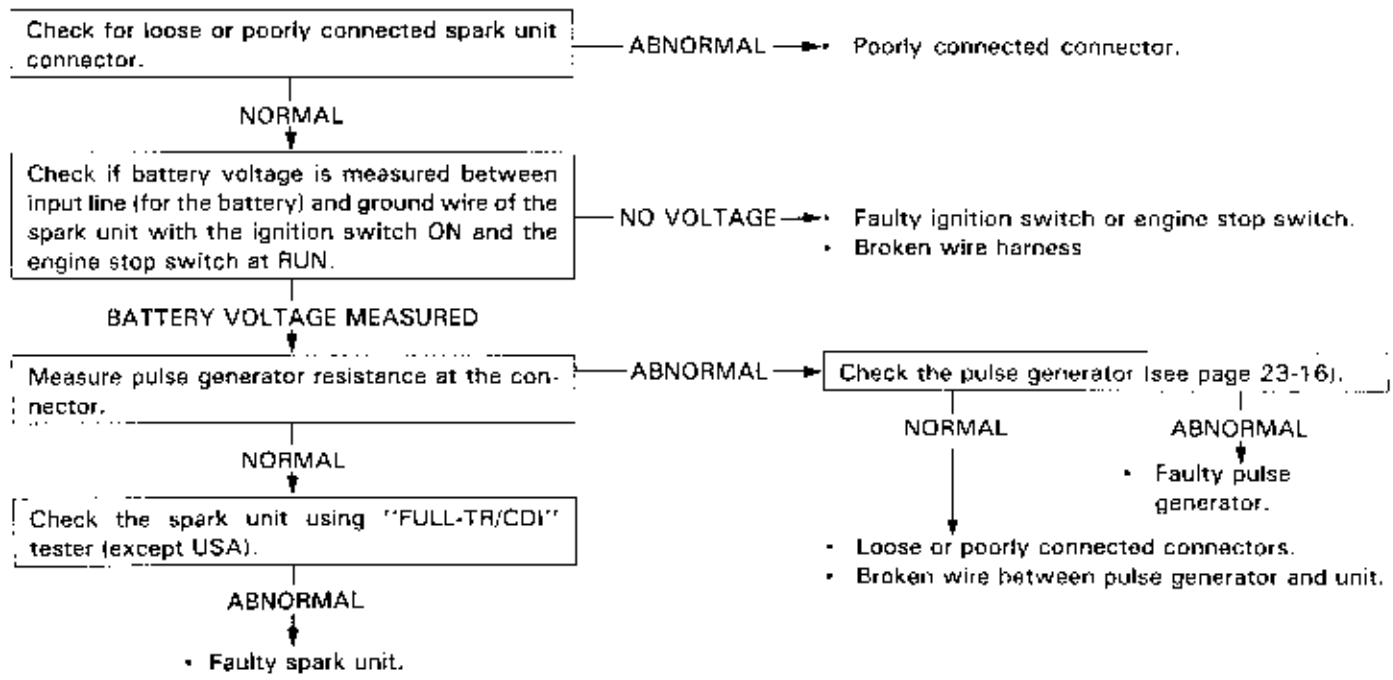
Check for loose or poorly connected CDI unit. Correct it and conduct the spark plug test again.
- SPARK → • Poorly connected CDI unit connector.
- NO SPARK ↓

cont'd



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.



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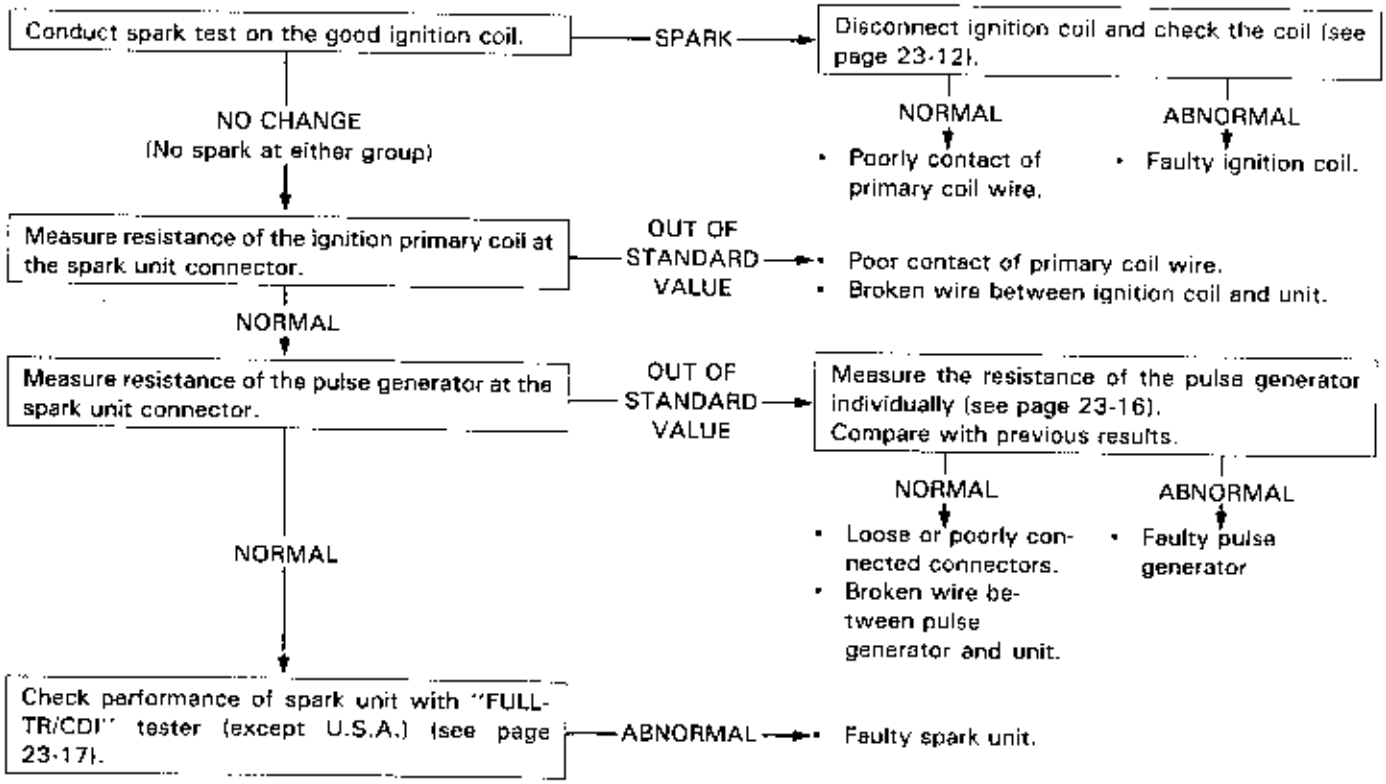
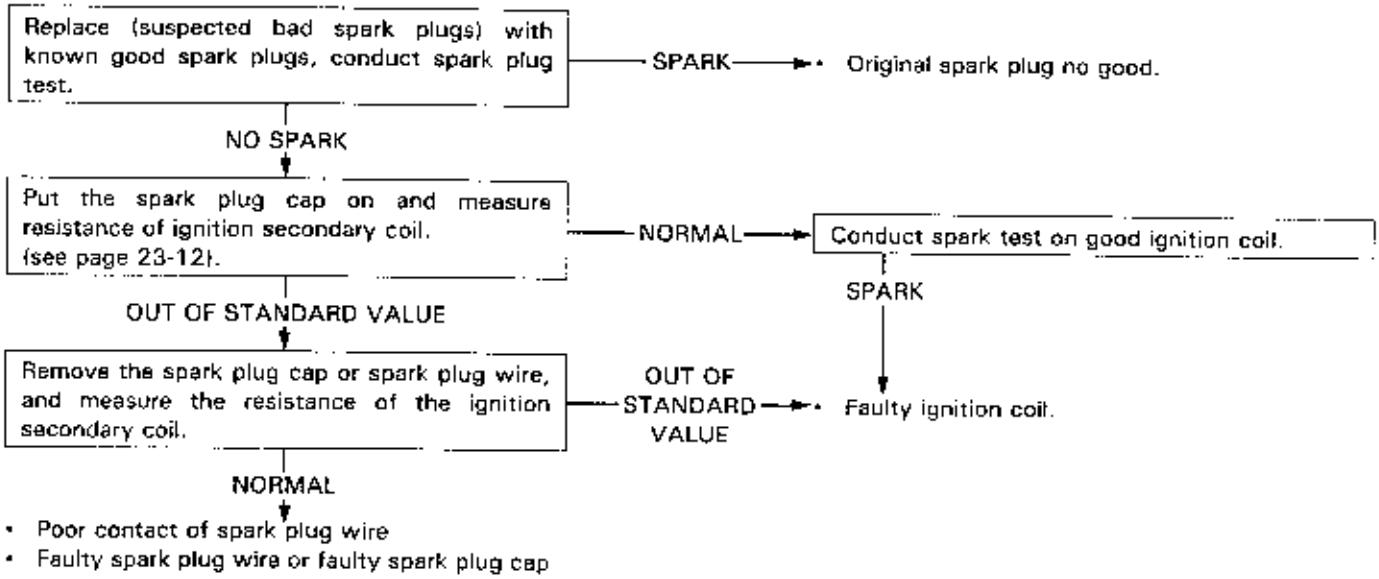
No spark at either ignition group. <Multi-cylinder transistorized ignition system>

- 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 Modal 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

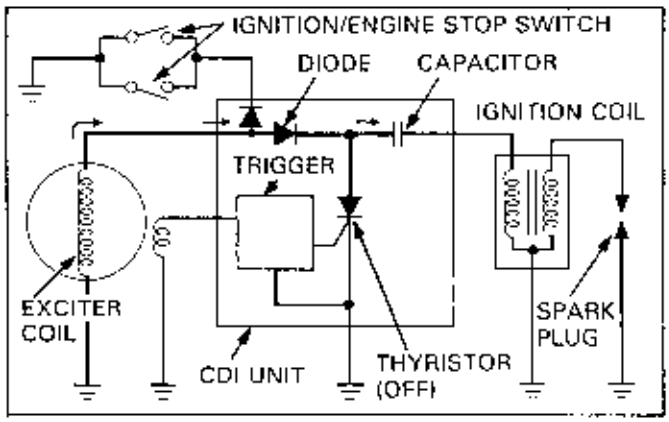
Most motorcycles use electrically controlled ignition systems. These ignition systems can be divided into two types, depending on how they operate.
Namely, there is the CDI and the transistorized type. Although their function is the same, the way they operate is different. In order to service these systems, 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

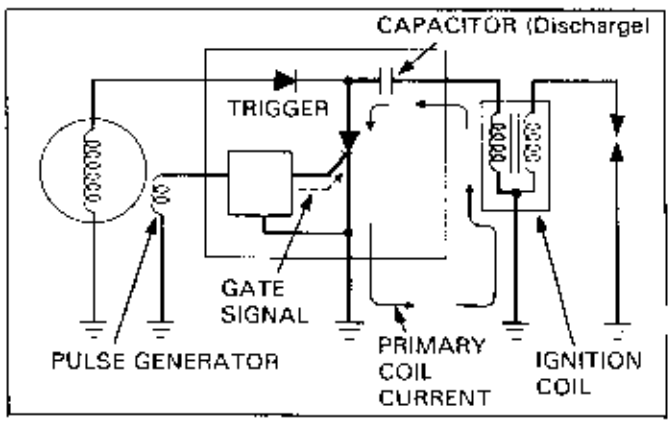
The term CDI is an abbreviation for "Capacitive Discharge Ignition." The CDI produces quick and stable secondary voltage and is resistant to spark plug fouling. It is also designed to increase its secondary voltage as rpm increases. The CDI is used mainly on small engine displacement models.

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.

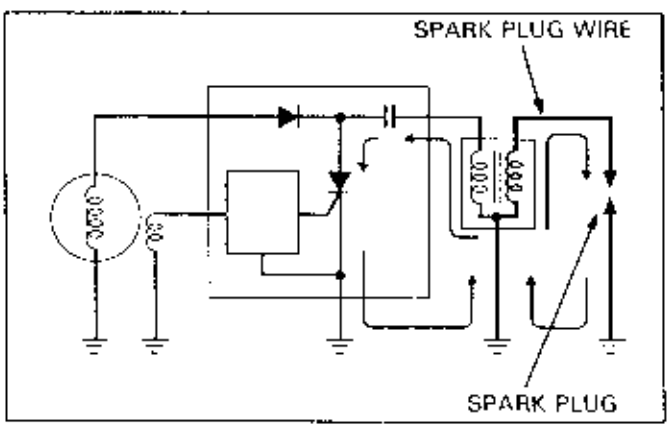
When the engine is turned off, the current induced by the exciter coil is shorted to ground, thus cutting off current to the capacitor and turning off the spark.



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.



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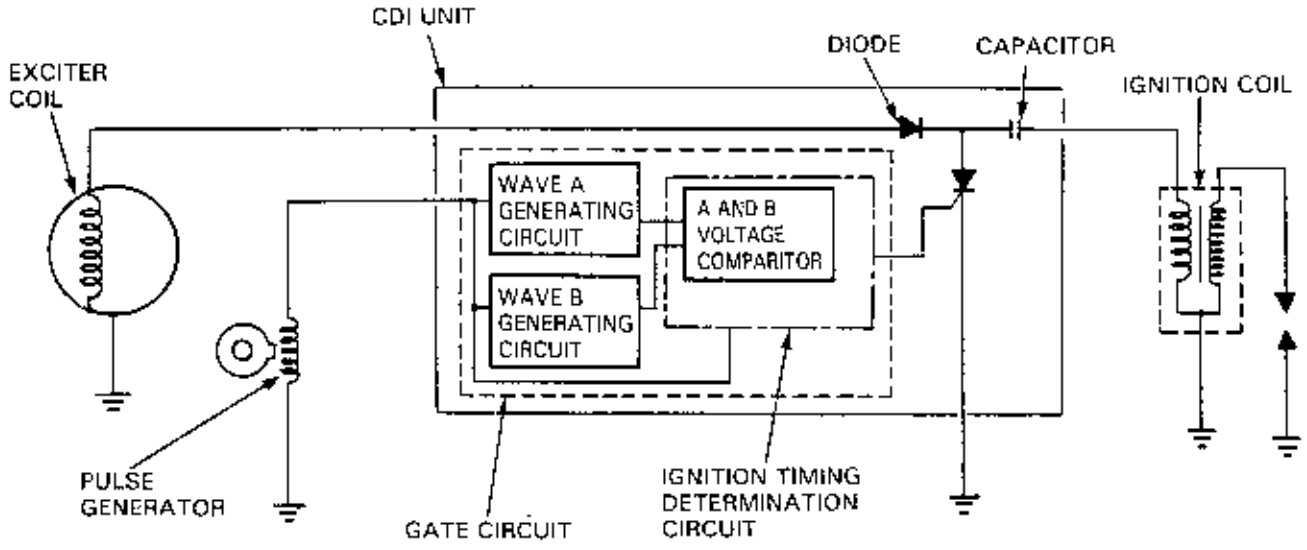
Principle of Ignition Timing Advance

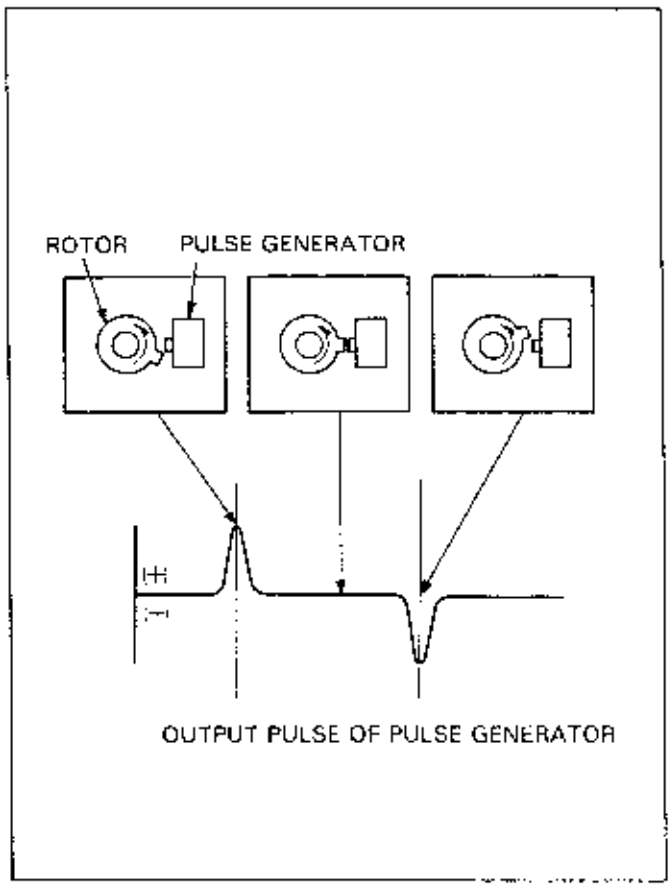
Another function of the electrically controlled ignition system is that the ignition timing advance (or retard) is controlled electrically. This system requires no mechanical advance and has no mechanical wear. The overall design eliminates periodic adjustments and maintenance.

This section explains the operating principles of the ignition timing advanve. 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.



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

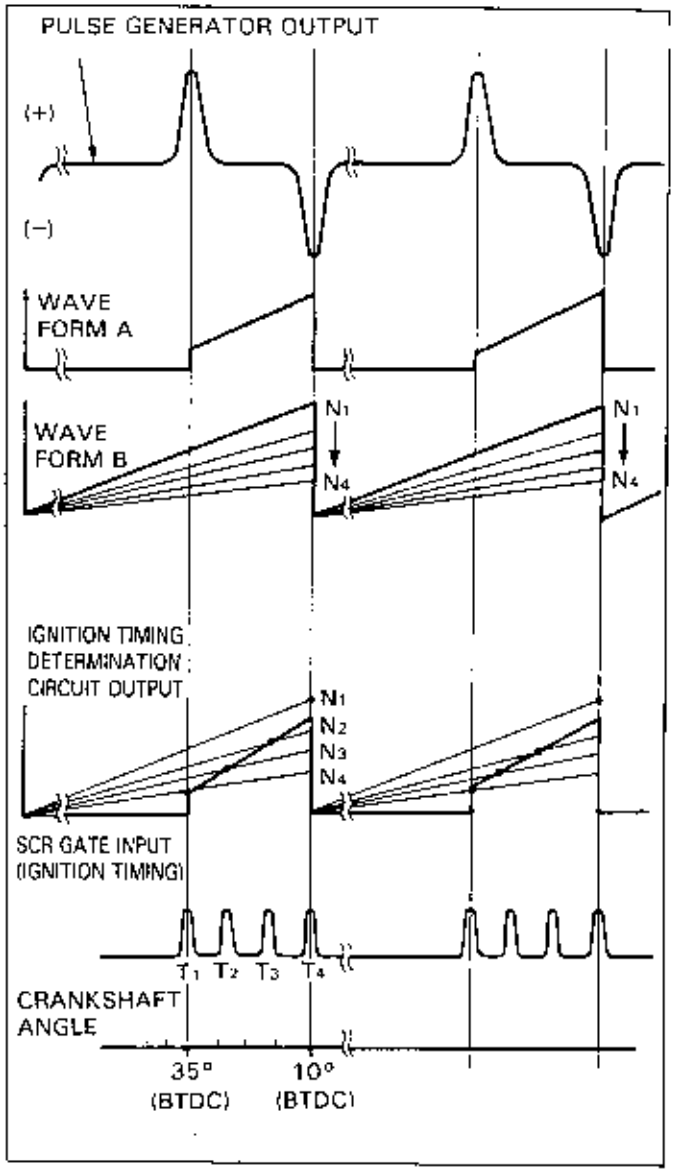
Basic wave A is unaffected by engine speed and remains constant.

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.



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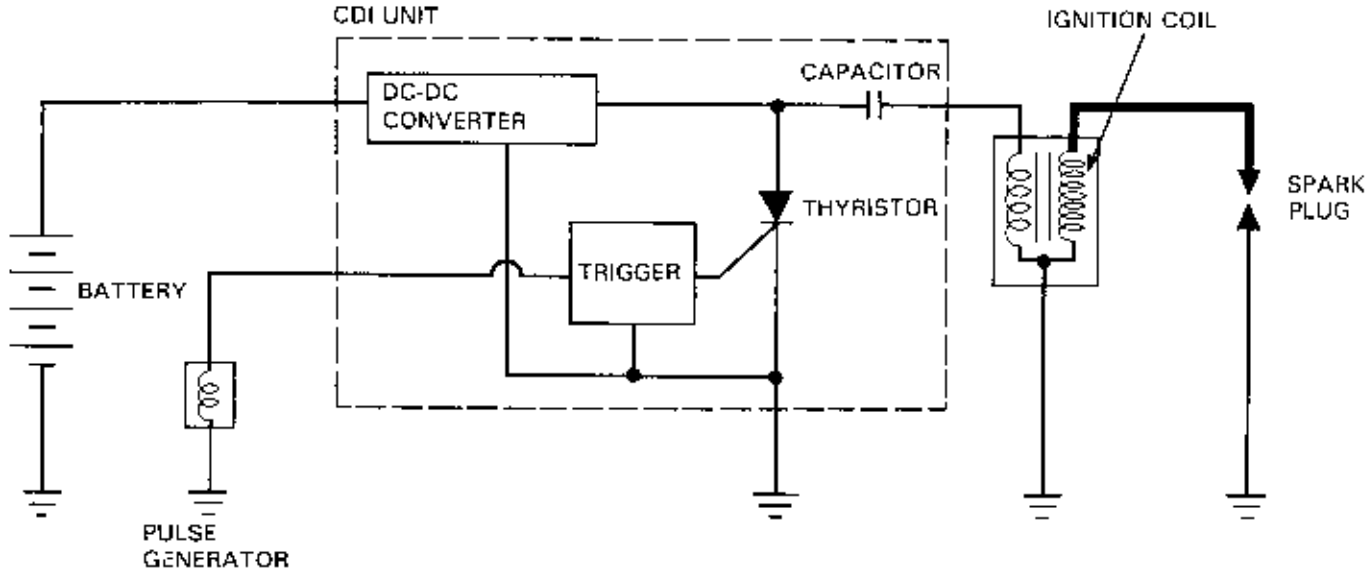
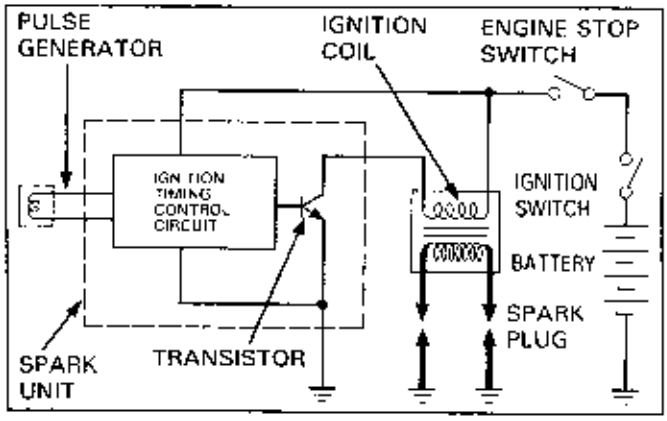
DC-CDI

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.

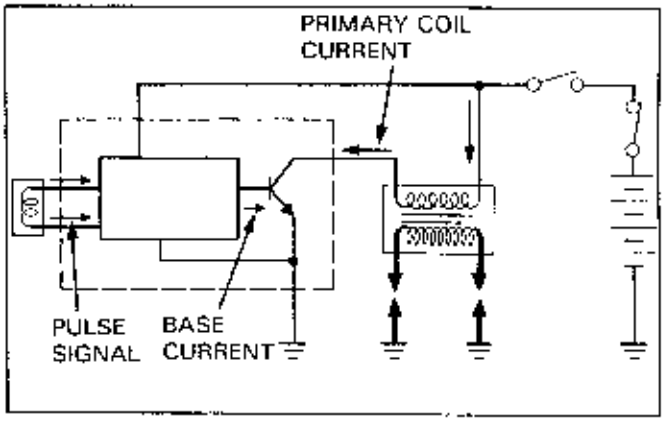


Operating Principles

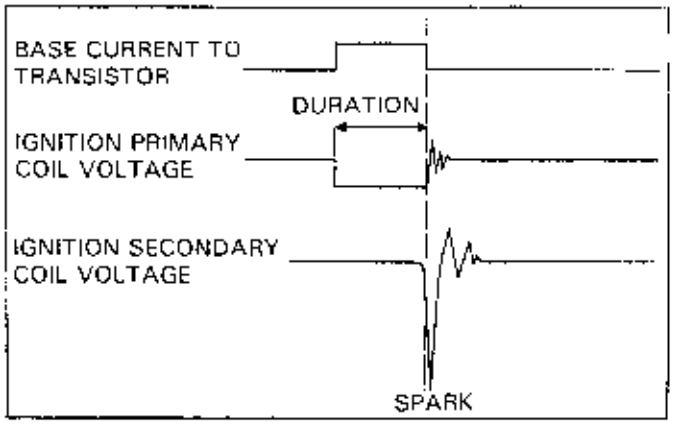
The battery feeds current to the ignition primary coil via the ignition switch and engine stop switch when the transistor inside the spark unit is turned ON. This current is turned off when the transistor is OFF.

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.



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.



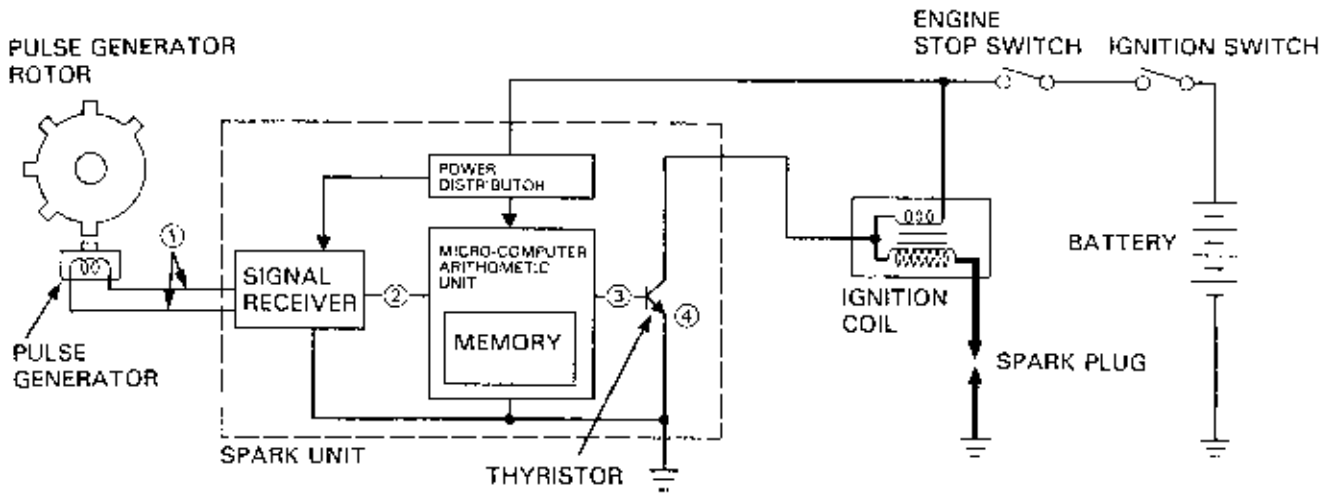
DIGITALLY CONTROLLED TRANSISTORIZED IGNITION SYSTEM

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 irregularily 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.



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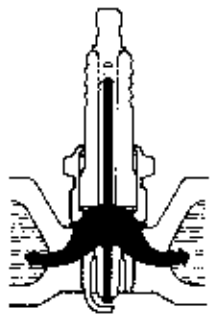
SPARK PLUG

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.



Heat dissipation

Spark plug heat range

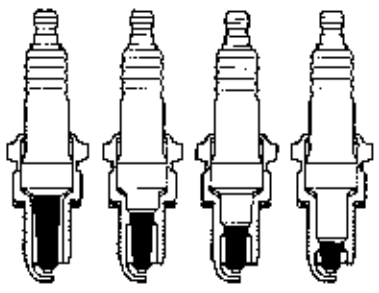
As the spark plug is constantly exposed to the engine combustion gas, it is necessary to dissipate heat in order to keep the spark plug at a certain temperature at which carbon deposits are burned off.

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

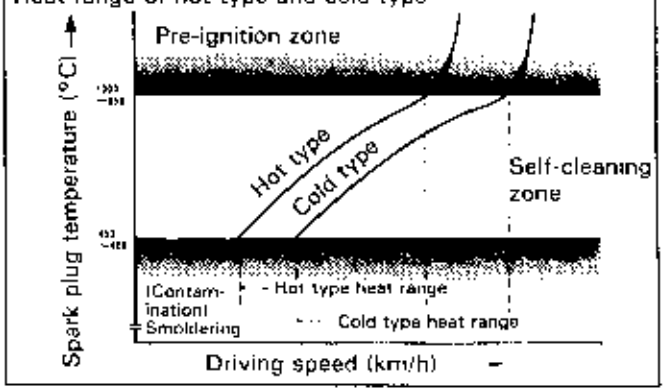
<Spark plugs of each heating value, or heat range, based on heat dissipation>



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.

Heat range of hot type and cold type



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	8	E	A-9
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 copper wick V: Narrow center electrode K: Side electrode Number indicates the plug gap. "9": 0.9 mm

ND plug

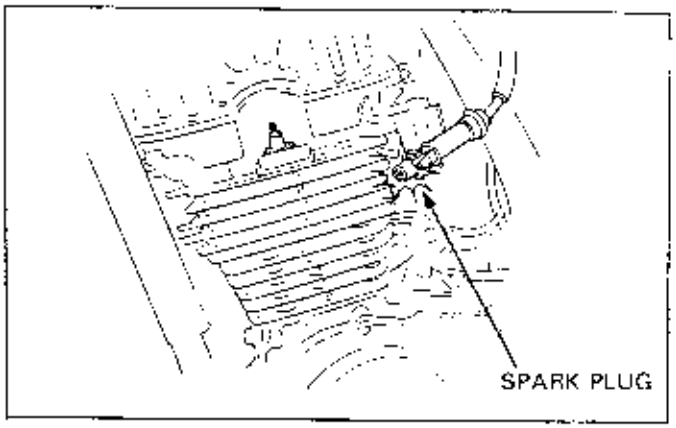
X	24	E	P U	-9
Thread dia.	Heating value	Thread length	Remark	Remark
M: 18 mm W: 14 mm X: 12 mm U: 10 mm	14 (Hot type) 16 20 22 24 27 (Cold type)	E: 19 mm F: 12.7 mm	P: Porcelain projected type L: Special plug R: Resistor spark plug S: Porcelain not projected type U: With "U" groove in the side electrode	"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.



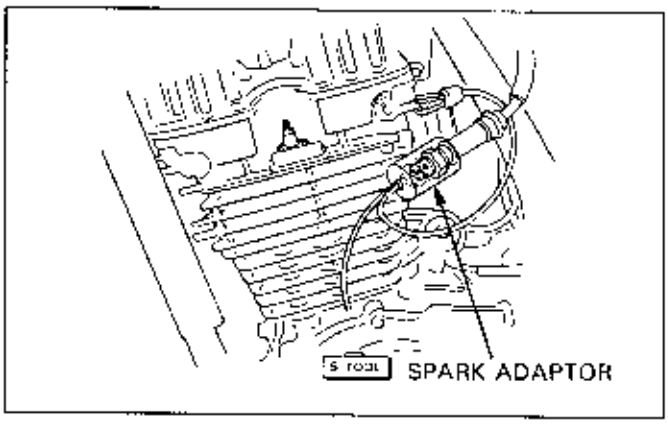
⚠WARNING

- **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 turns 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.



S 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.

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IGNITION TIMING

Warm up the engine.

Connect timing light to the spark plug wire.

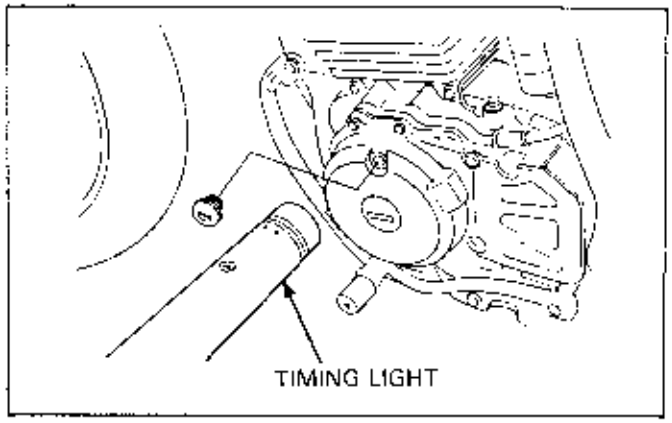
For models with no tachometer, connect an engine tachometer.

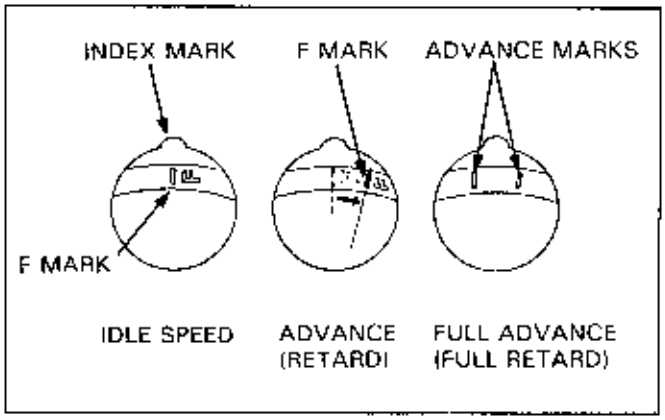
NOTE

- 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.

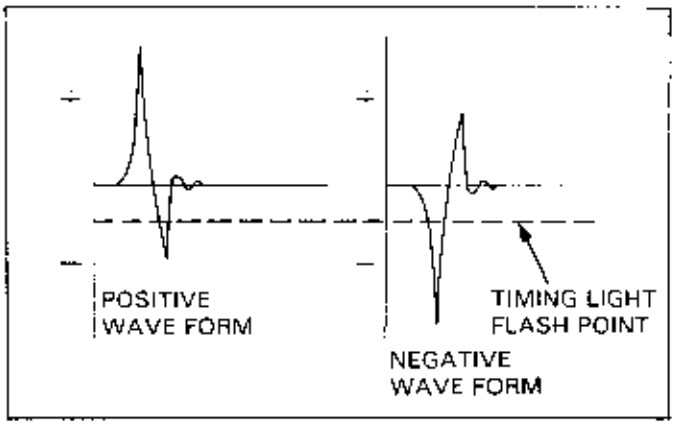
NOTE

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

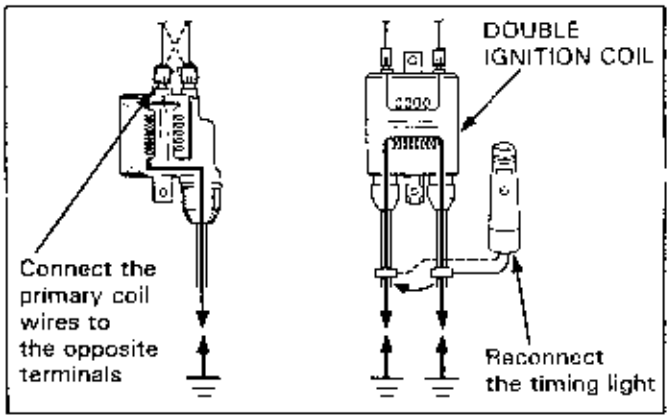
Depending on the kind of timing light used when checking the ignition timing, an abnormal advance timing could be observed.

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

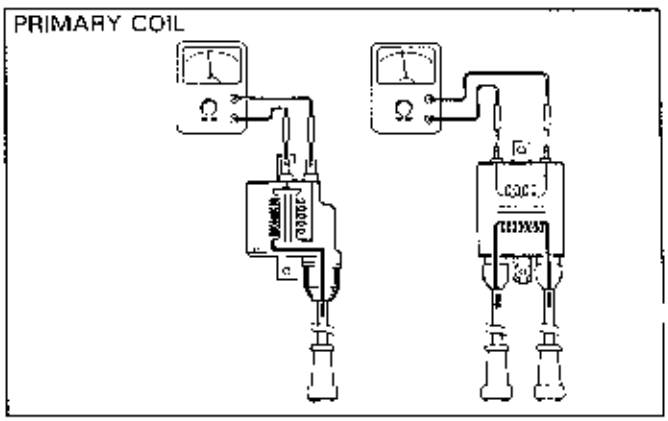
- Since the resistance value of the primary coil is inherently very small, it is difficult to distinguish it from a shorted wire.
- Measure the coil resistance as a guideline for checking the coil. Check the performance of the coil with the "FULL-TR/CDI" tester (except U.S.A.).

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 ∞ (infinite), replace the coil with a new one.



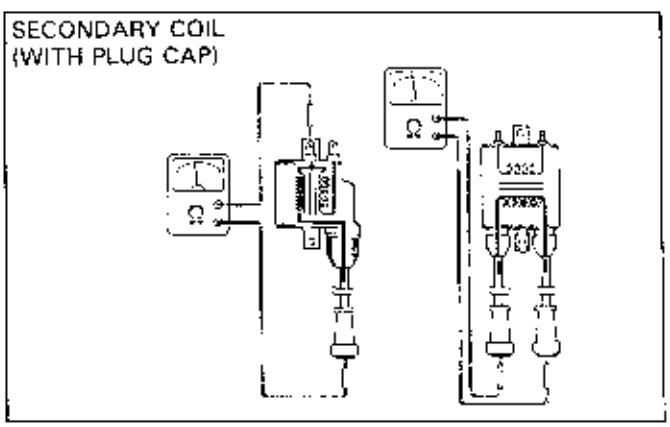
SECONDARY COIL INSPECTION

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 ∞ (open wire), disconnect the spark plug cap and measure the secondary coil resistance.



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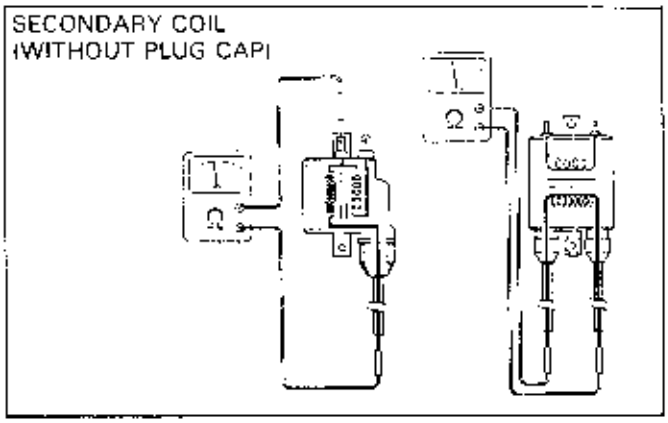
Measure resistance between the primary coil terminal and spark plug wire.

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.)

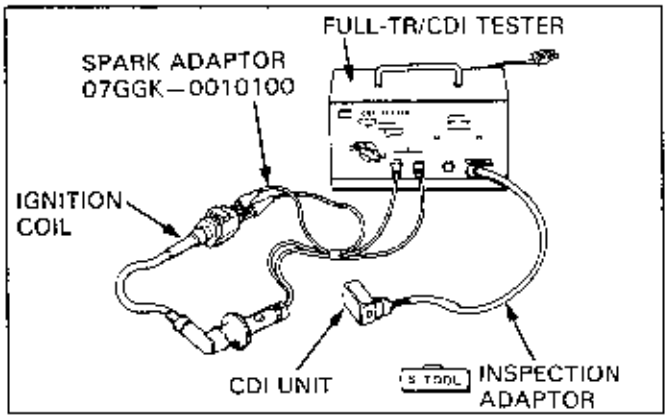
Test the spark performance of the ignition coil, using the Full-transistor/CDI tester.
Replace the coil if no spark occurs inside the spark adaptor.

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 requried.

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.



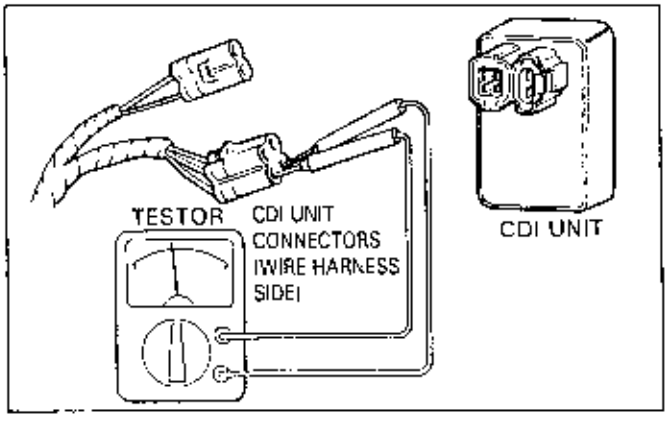
CDI SYSTEM

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.



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 anbnormal 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.

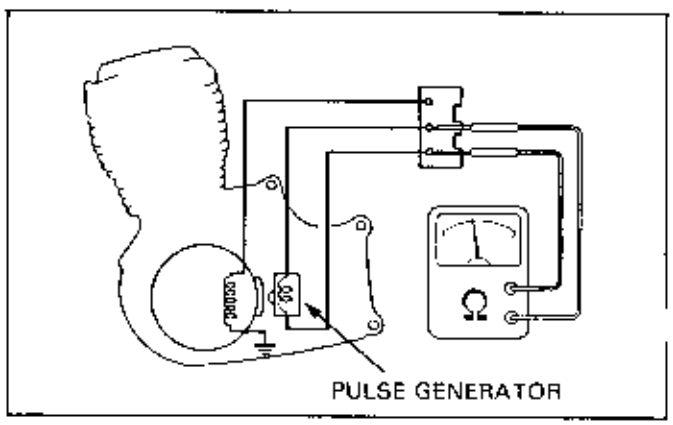
If the resistance value is within the specified range, the pulse generator is good.

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.



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EXCITER COIL INSPECTION

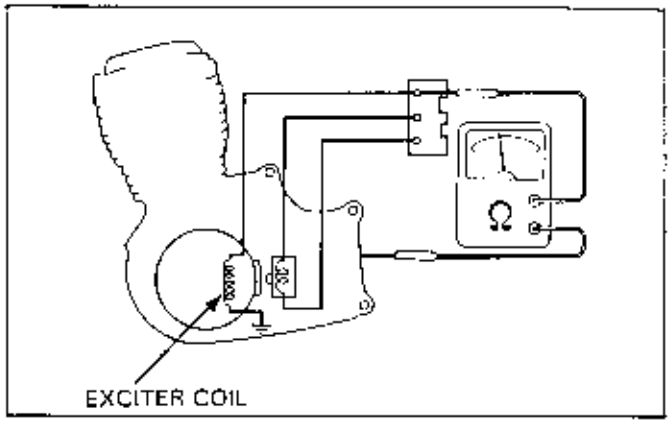
Disconnect the alternator from the wire harness and measure the exciter coil resistance.

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.)

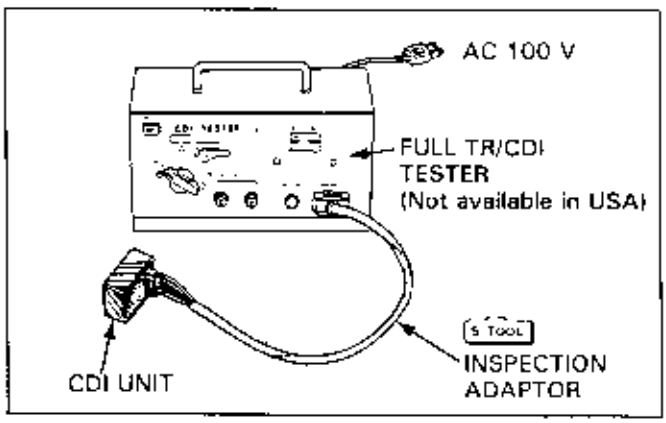
The CDI unit is checked by the Full transistor/CDI tester.

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.

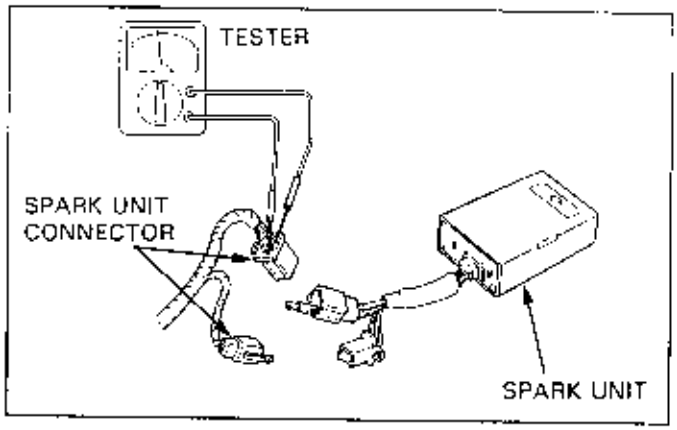
TRANSISTORIZED IGNITION SYSTEM

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.

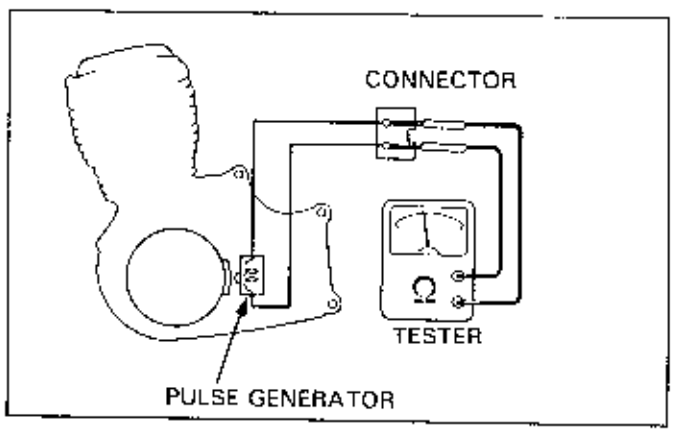
The pulse generator is good if the resistance value is within the specified range.

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.



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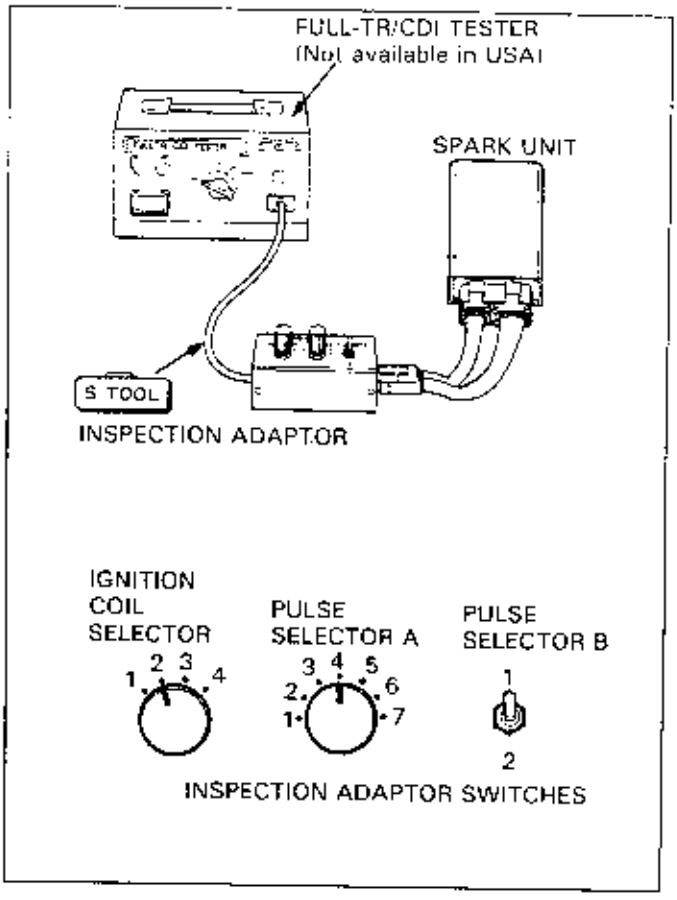
SPARK UNIT PERFORMANCE TEST (EXCEPT U.S.A.)

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