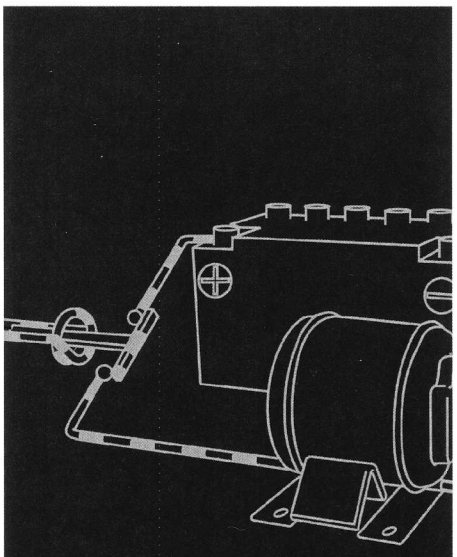
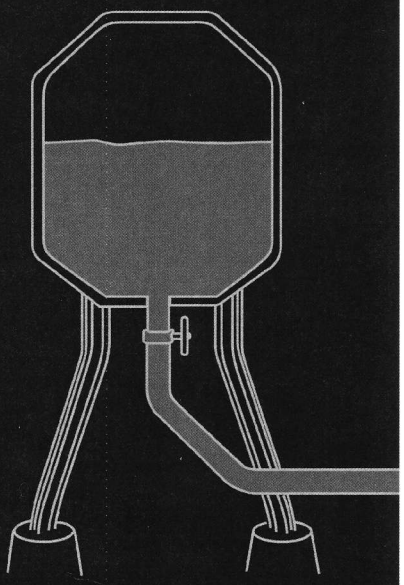
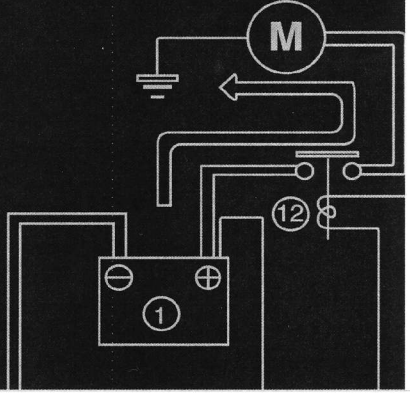
Capacitor Discharge Ignition Systems





YAMAHA



FOREWORD

The following is a list of terms and their definitions which you will encounter in this booklet:

ANODE - The positive element of a semiconductor. Opposite to cathode.

CAPACITOR - A device that stores an electrical charge.

CATHODE - The negative element of a semiconductor. Opposite to anode.

CURRENT - The flow of electrons, measured in amperes.

DIODE - An electronic device (semiconductor) that allows current to flow in only one direction.

ELECTROMAGNETIC INDUCTION - When a conductor is moved across a magnetic field, a voltage is induced in the conductor. This inducing of voltage is known as "electromagnetic induction."

MUTUAL INDUCTION - If a changing magnetic field created by current flow in one coil cuts across the windings of a second coil, a voltage will be induced in the second coil. The property whereby a voltage is induced in one coil because of a changing current in another coil is called "mutual induction."

RELUCTOR - A metal device that helps to protect voltage output when passed through the magnetic field of a pulser coil or pickup coil.

THYRISTOR - A semiconductor in which current passing through a third element called the gate turns on the current flow from anode to cathode, while the anode-to-cathode voltage controls turn-off.

TRANSFORMER - A device that raises or lowers a voltage through inductive coupling.

TRANSISTOR - A three-terminal semiconductor generally used in circuits as an amplifier to increase electrical currents or voltages, or as a switch to provide signal functions.

CAPACITOR DISCHARGE IGNITION

CDI CIRCUIT COMPONENTS

Source Coil

The source coil, or charge coil, is the point of origin for ignition, or spark output. The coil produces an alternating current (AC) voltage by induction as magnets on the magneto flywheel rotate past it.

CDI Unit

A capacitor in the CDI unit stores the output from the source coil, and releases it when signaled by the pulser coil. The CDI unit also controls ignition timing advance on most vehicles.

Pulser Coil

The pulser coil also produces an AC voltage by induction. Its output is carefully timed to release the charge held by the capacitor in the CDI unit at precisely the right moment.

Ignition Coil

The ignition coil, or secondary coil, is a transformer that increases the output from the CDI unit many times. The increase is enough to cause a spark to jump the gap between the spark plug electrodes.

Spark Plug

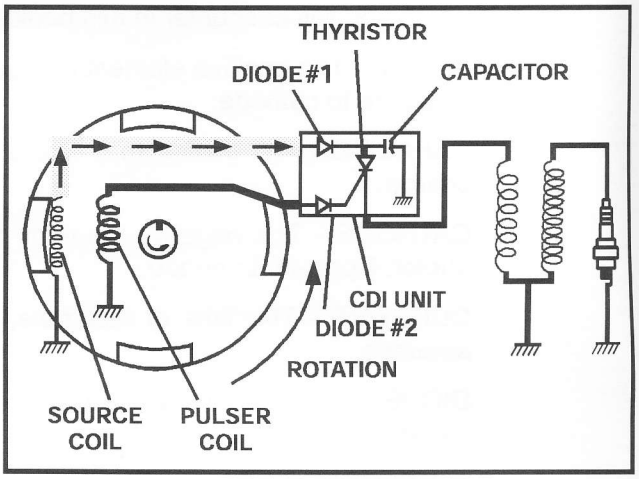
The spark plug is the final link in the chain of ignition components. It delivers the spark to the combustion chamber where the fuel-air mixture is ignited.

Wire and Connectors

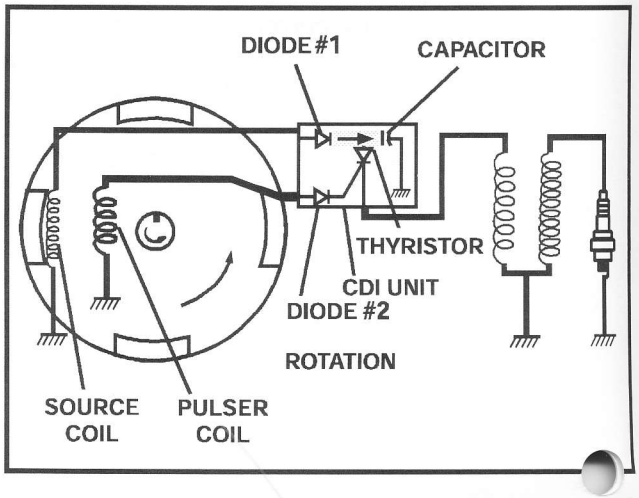
Throughout the ignition system, wire and their connectors are necessary to route the electrical current. Careful inspection and handling of these components are always important.

Operation

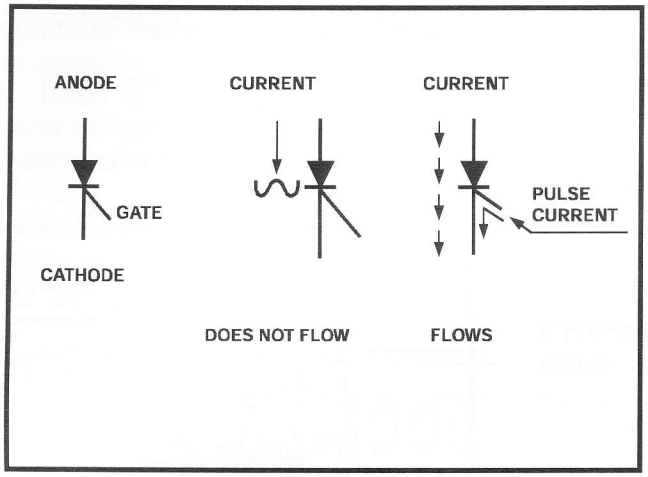
As the flywheel rotates, magnets attached to it pass very close to the source coil. The close proximity of the moving magnets causes the source coil to produce AC voltage.



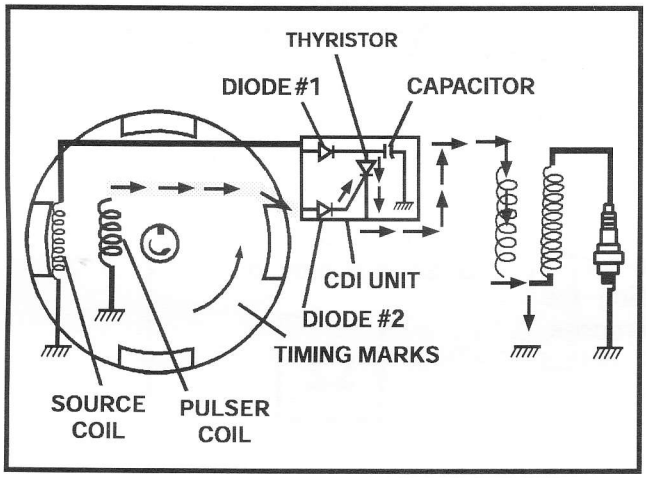
The AC voltage is sent to the CDI unit along the brown wire, where it is converted to a Direct Current (DC) voltage by diode #1. This DC voltage charges the capacitor in the CD unit, where it is stored.



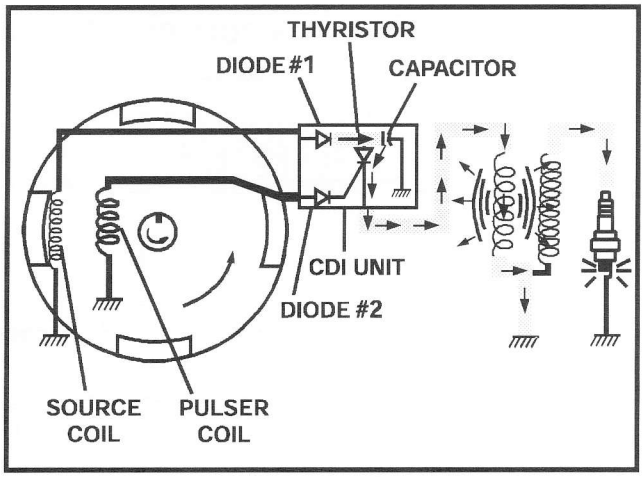
Also inside the CDI unit is a Thyristor, also known as a Silicon Controlled Rectifier (SCR). A thyristor is similar to a diode or transistor in that is allows current to flow in one direction only. The thyristor differs in that it will not allow current to flow until it receives an adequate pulse current at its gate. After the gate triggers, the thyristor will not turn off until current flowing from the anode to the cathode stops, even if the current to the gate is interrupted. This characteristic allows the thyristor to be used as an electronic switch.



The pulser coil operates on the same principle as the source soil. The difference being is output is much lower, and rather than having a continuous output, it allows output only at a preset time. This pulsed output occurs when the timing mark on the flywheel aligns with the timing mark on the crankcase. At this moment, the pulsed current is sent to the thyristor, along the White/Red wire, and is converted to DC voltage by diode #2. The pulse triggers the gate, and allows the thyristor to operate. When the thyristor begins to pass current, the current stored in the capacitor quickly flows through the thyristor to the primary winding of the ignition coil.



As the current flows through the primary winding of the ignition coil, a magnetic field builds up around the coil. As this magnetic field builds from zero, its lines of force expand through the coil's secondary winding. This process is mutual induction. This is the key to the magneto ignition coil's operation. The CDI magneto ignition coil operates on the expansion method of induction. As a result of the mutual induction, a very high voltage is developed in the secondary winding and flows to the spark plug through the spark plug wire. This voltage is high enough to cause a spark to jump across the electrodes of the spark plug.



Now let's quickly review what you've learned about the fundamentals of a CDI system.

1. An AC voltage is generated by the magneto (flywheel and source coil). This AC voltage is directed to the CDI unit where it is converted to a DC voltage and used to charge a capacitor.
2. Each time the timing marks on the engine case and the flywheel are in alignment, the pulser coil generates a small voltage pulse.
3. This pulse is directed to the CDI unit, where it triggers the gate of the thyristor.
4. Triggering the thyristor gate allows the charged capacitor to discharge quickly through the thyristor and then through the primary winding of the ignition coil.
5. Through mutual induction, a voltage is created in the secondary winding of the ignition coil. This voltage is high enough to cause a spark to jump across the spark plug electrodes and ignite the fuel mixture.

NOTE: Some vehicles require ignition advance. The CDI unit also handles the ignition advance function. Even with this additional function, the basic operation of the CDI unit remains the same. These are:

1. Convert AC voltage to DC voltage.
2. Storage of the DC voltage.
3. Release of the DC voltage.
4. Automatic timing control.

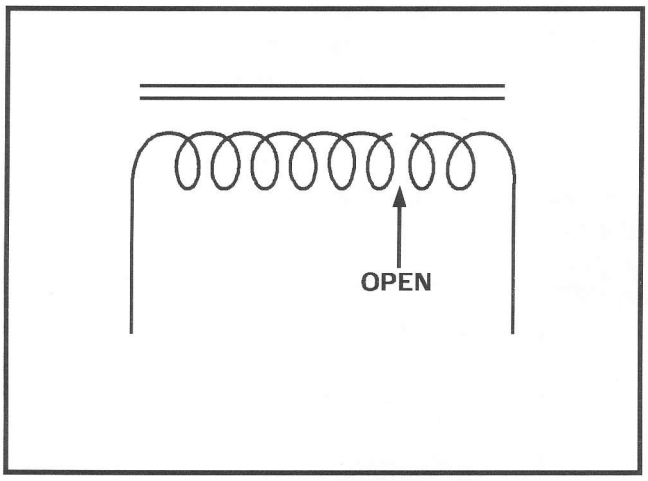
HOW IGNITION COMPONENTS FAIL

Except for the CDI unit, which contains the capacitor and thyristor, the entire magneto CDI system is made up of a series of coils. When diagnosing an ignition problem, think about what can go wrong with a coil.

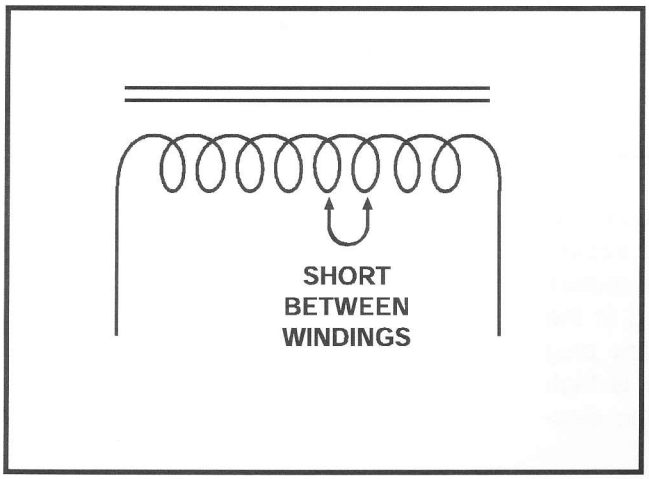
COIL FAILURES

A coil is simply a length of wire wrapped around a steel or iron core. The wire must be of a certain length. The windings of the coil must be insulated from each other and insulated from the metal core. Coils perform different functions depending on the size and length of the wire used.

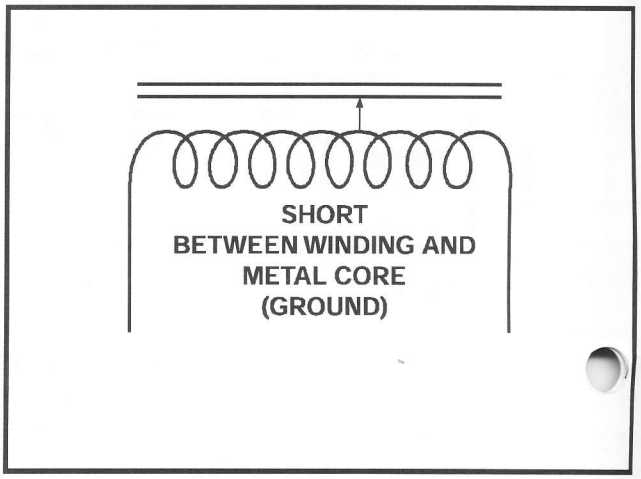
There are three problems that can cause a coil to fail:



1. **A partial or complete open (break) in the winding.**
   A partial open in the winding makes it harder for current to pass through the wire, raising the resistance of the wire. As resistance increases, current flow decreases, and the coil output decreases. A complete open will result in no output from the coil.



2. **A short circuit between windings.**
   A short circuit between windings creates an easier path for electrons to travel. This results in some of the coil windings not being used. Since the coil is smaller (shorter in length), its output will be smaller.



3. **A short circuit from a winding to the metal core (ground).**
   As a coil produces output there is only one path for electrons to travel. When a coil shorts to ground, an alternate path for electrons is created. This can create many unusual symptoms, and can complicate circuit troubleshooting. Symptoms of the problem may depend on where the short is within the coil.

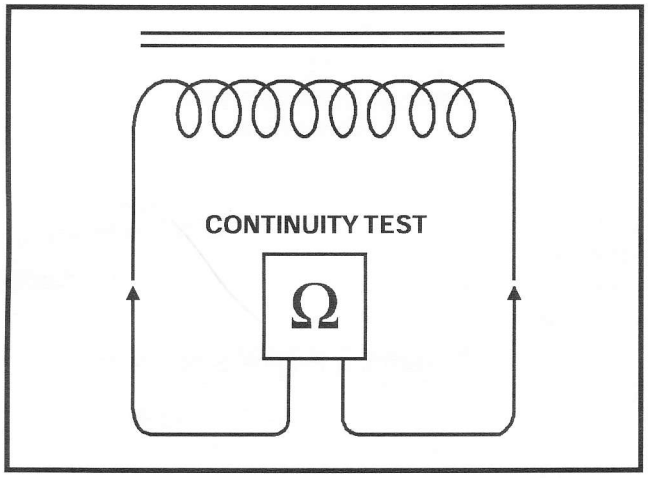
In spite of the many symptoms a bad coil might produce, only one of three coil failures is possible:

1. Open
2. Short between winding
3. Short to ground.

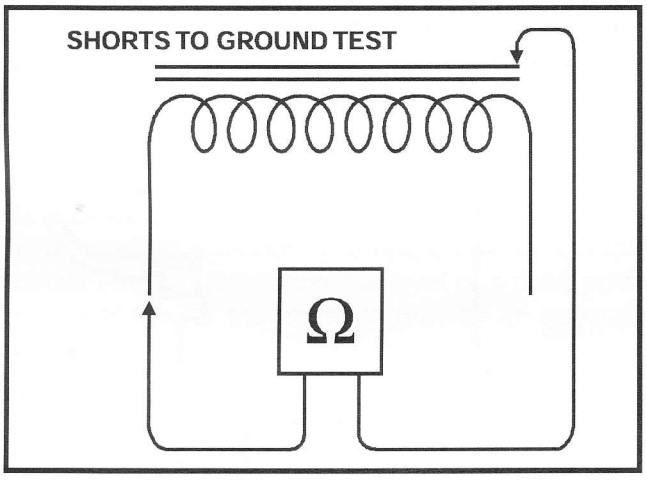
RESISTANCE TESTING COILS

Charge Coils and Pulser Coils

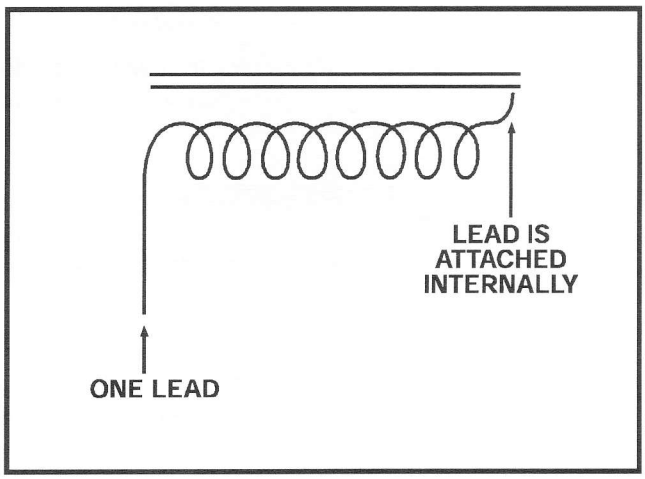
Charge coils and pulser coils are of the same basic construction. Charge coils simply have many more windings on a larger core. There are two types of coils. The first coil is completely isolated from the core, and has two leads. Two tests must be performed.



1. **Continuity test between the leads.**
   Place one ohmmeter lead on each coil lead. Use the lowest scale that will read the specification you are looking for. A resistance value should be within the printed specifications.



2. **Shorts to ground test.**
   In this test, one ohmmeter lead is attached to either coil lead, and the other lead is attached to the metal core (ground). Use the highest scale on the meter, and be sure not to touch the metal probes with your hand. The meter is sensitive enough to read your body resistance on the high scale. The specification for all coils using this test is infinite, meaning no current can flow between the winding and the metal core.



The second type of coil has one end of the winding attached to the core internally, and there is only one external lead attached. The other lead is the mounting base.

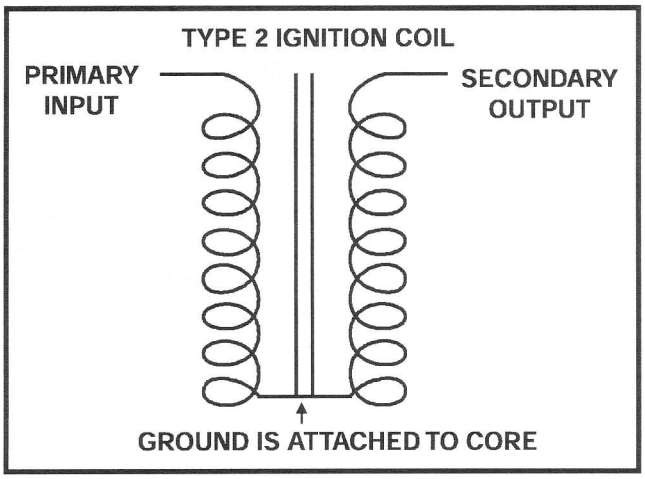
This type of coil only has one resistance test. A resistance test is a short to ground test. Use only the continuity test to find a problem. Attach one ohmmeter lead to the metal core, and one meter lead to the external coil lead. Follow the instructions for a continuity test. If a short to ground exists in the coil, the resistance of the coil will be lower than specification.

Ignition Coils

Ignition coils are basically two coils in one, the primary winding and the secondary winding. You must test each winding separately, but the tests are the same for any ignition coil.

Primary Winding Continuity

Use the low scale on the meter. Attach one meter lead to the primary input lead. Attach the other meter lead to either the metal core or the primary ground lead, if the coil has one. Resistance should be within specifications.



Secondary Winding Continuity

Use the lowest scale that will read the specification you are looking for. Attach one meter lead to the high tension spark plug lead. Attach the other lead to either the metal core, or primary ground lead. Resistance should be within specifications.

LIMITATIONS OF RESISTANCE TESTS

During a resistance test, the ohmmeter is actually a power source. The meter supplies power to the coil being tested. A certain amount of current will travel through the coil depending on the coil resistance. The meter measures the current flow, and calculates the resistance.

The power supply for the meter is about 3 and 9 volts, depending on the meter. Many coils operate at much higher voltages and currents than an ohmmeter can supply. This means that partial opens or shorts may not show up under low power.

For this reason, do not rely on resistance tests as an absolute indicator of the component condition. Output tests give better evidence of component condition. (i.e. Coil Testing)

TROUBLESHOOTING PROCEDURES

Tips:

Because the Y-1 tester is an energy level tester, the source coil output and the CDI unit output will normally produce similar readings.

If cranking speed is low because of a low battery, weak starter motor, or a weak pull on the manual pull starter, the CDI readings will usually be low.

NECESSARY PRETEST PROCEDURES

Before actual testing of the CDI outputs, perform the following two procedures.

Disconnect the Black/White wire at the CDI unit. This ensures that the main switch, emergency stop switch, or any wiring is not the problem. If the problem is fixed, repair the Black/White wire, or the switches.

Visually check for spark, using a new spark plug or a spark tester. If no spark, or poor-quality spark, is apparent, continue with the output tests. If a good spark is evident, the problem is not with the CDI system, but is with the spark plug or some other component.

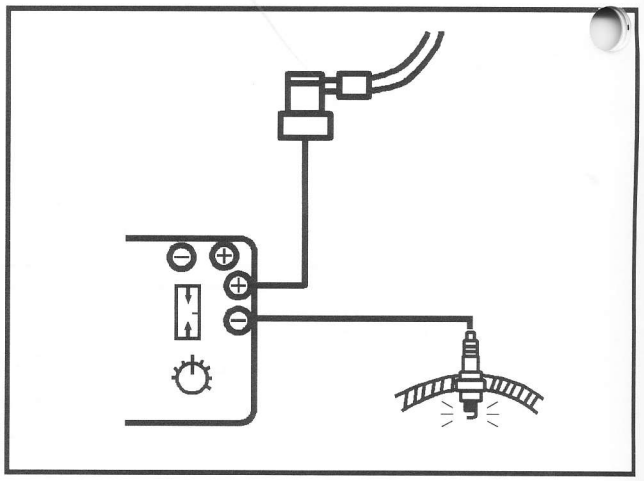
Ignition problems are two types: intermittent problems or no spark. Intermittent problems can cause a weak spark resulting in hard starting or ignition misfire. The vehicle will run, but it will not run correctly. No spark problems are basically a failure of one or more components. Troubleshooting these problems requires a knowledge of the system and a logical approach.

First, check the spark plugs to verify you have an ignition problem. The next test performed is the Dynamic Spark Test using the Yamaha Coil Tester. This test will help you determine if the ignition is the faulty system. If the Dynamic Spark Test proves the ignition to be in good working order, check the plug caps, and ignition timing. If the ignition is faulty, there are two ways in which to test the system. If there is a weak or intermittent spark, use a voltmeter. If there is no spark, use the Yamaha Ignition Tester.

DYNAMIC SPARK TEST

Begin troubleshooting by conducting a dynamic spark test.

1. Turn the Engine Stop Switch to RUN.
2. Check the spark plug(s). Replace them if they are worn or fouled.
3. Visually inspect the caps for cracks or carbon tracking. Check the resistance of the spark plug cap. Yamaha vehicles use resistor type spark plug caps. Compare the resistance to specifications found in the service manual. If the resistance is greater or less than specification, replace the plug cap.
4. Connect one lead of the Yamaha Coil Tester (P/N YU-34487) to the spark plug lead and the other tester lead to the spark plug.



5. Start the engine and let it idle. The spark should be able to jump a 6mm spark gap. Some models require this test at idle and at higher rpm. Check the appropriate service manual for the correct spark gap specification. Check each cylinder on multicylinder models.

6. If the spark is good, check the safety switches, fuel, or mechanical systems.

NOTE: The Dynamic Spark Test will not show that the spark plugs or plug caps are defective. If the spark can find ground (a complete circuit) through the spark plug caps and plugs, the test will show a functioning ignition system. Be sure these are in good condition before troubleshooting the remainder of the ignition system.

TIP: If there is no spark, or a weak spark, and all components test good, check the ignition coil ground wire. Vibration from the engine may break the coil ground wire terminal.

YAMAHA IGNITION TESTER (Kent-Moore Part Number YU-91022-B)

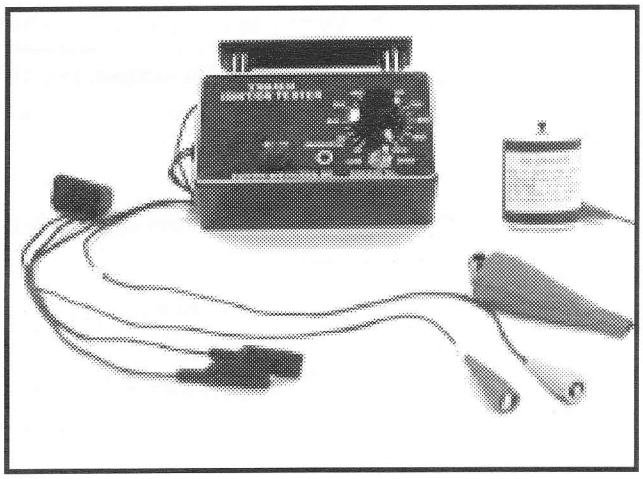
One piece of test equipment used with the component connected is a special type of voltmeter. The Yamaha Ignition Tester can test components either connected in the system, or isolated from the system. The Y-1 tester leads have a much lower resistance between them than a voltmeter. This lower resistance partly loads an isolated component, providing a more accurate sign of its condition than a voltmeter can.

The ignition energy output is referenced against a 0 ~100 scale on the tester. The higher the energy output, the higher the value shown on the scale. Indication is provided by a lamp that lights when the scale knob is set at a position corresponding to the energy output.

Ignition system output pulses rise and fall so rapidly that a regular voltmeter can't respond fast enough to provide an accurate reading. The Y-1 tester is a peak reading voltmeter and has a built in memory circuit that can remember the level of a peak pulse long enough for the meter to provide an accurate readout.

The tester has two input ranges, selectable by a toggle switch. The LOW range is sensitive to AC or DC voltages from 0.5 ~27 volts. The HIGH range is sensitive to AC or DC voltages of approximately 75~500 volts.

The correct dial setting and input range for each test is obtained from the Dial Settings Table. These dial settings were gained by actual tests on a number of identical machines that were in good operating condition. The values given are minimum dial settings (not averaged) and the ignition system tested should meet or exceed these values for dependable operation.



TO TEST THE METER

A test simulator comes with each tester to test the lamp, the detector circuit, and the batteries. Check the operation of the ignition tester as follows:

High Scale Test

1. Move the RANGE switch to HIGH position. Plug the simulator into a 110VAC electric outlet for 10 seconds.

2. Remove the simulator from the outlet and connect the P and N leads from the tester to the simulator as shown on the bottom of the simulator.

3. Set the tester dial to 50, or lower. Press the button on the simulator. The indicator lamp on the tester should light. Press the reset button to prepare the tester for the next test.

Low Scale Test

1. Move the RANGE switch to the LOW position.
2. Set the tester dial to 50, or lower.
3. Connect the yellow lead to the negative terminal of a 12-volt battery. Connect the red lead to the positive terminal of the battery. The indicator lamp should light.

NOTE: If the lamp does not light, check the tester batteries. If they are installed correctly and are good, check the clip leads for faulty connections. If no fault can be found, refer to the warranty statement shipped with the tester for instructions on how to return the tester to the manufacturer for repair. DO NOT SEND THE TESTER TO YAMAHA OR KENT-MOORE FOR REPAIR.

FAILED SYSTEM

Troubleshooting a CDI system that has failed is simply a matter of finding out which area of the system is not performing its function. First of all, eliminate the obvious:

1. Disconnect the ignition stop switch and check the system again.
2. Check any wires that are close to moving parts for signs of rubbing.
3. As you check the output of each area of the system, check the physical condition of the connectors and wires for any obvious problems.

Spark Plug Check

The easiest place to start is the spark plug. Pull the plug and examine it. If it is old, worn, or fouled, replace it. If it seems to be in good condition, plug it back into the cap. Hold it against the engine block while cranking the engine to make sure that it is not getting any spark.

⚠WARNING

The ignition coil produces a high voltage spark. Don't shock yourself and don't perform any type of ignition test near gasoline or a battery charging station.

If there is a spark, then you could have got an intermittent problem, which will be covered later. If there is no spark, then put the plug back in the cylinder and make sure that the cap is on firmly. It's easier to crank the engine with the spark plug out, however, in order to test CDI outputs at true cranking speed, compression is needed.

CAUTION:

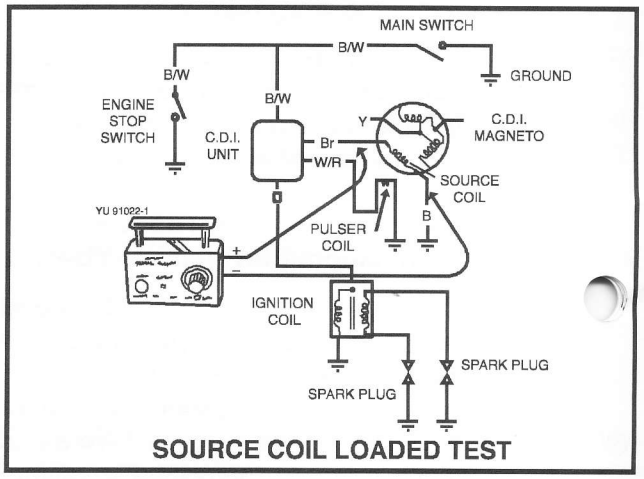
Make sure the spark plug wire is attached to the spark plug before cranking the engine over, or damage may occur to the ignition system.

Output Tests

Output tests actually measure the output of the component being tested. This measurement can be done two ways. The first way is to measure output with the component connected. The advantage of this method is that the component is loaded by the system in the normal manner. The load on the component determines how hard the component has to work to generate voltage.

Y-1 TEST PROCEDURES FOR ALL COMPONENTS

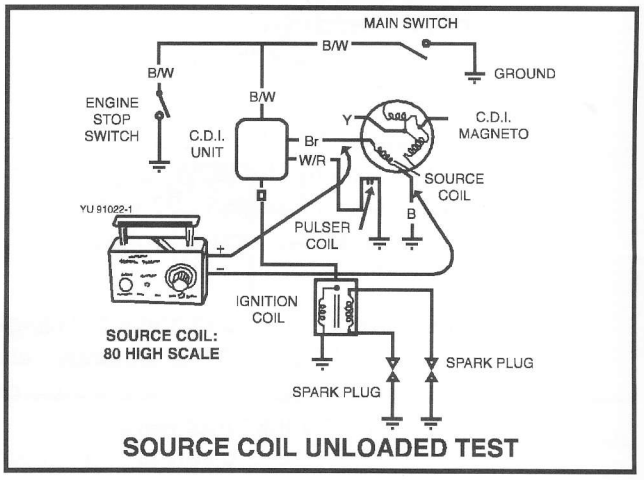
1. Test the component connected in the ignition system (fully loaded). This test actually loads a component to its maximum level. The tester provides a load in addition to the load provided by the system. If the component passes this test, it is good.



SOURCE COIL LOADED TEST

2. If the component fails the fully loaded test, disconnect the component and connect it directly to the Y-1 tester. This is a partly loaded test. If the component fails the partly loaded test, it is bad. If the component fails the fully loaded test, but passes the partly loaded test, it may have a short to ground.

   To determine if the component is good, use a short to ground resistance test. If there is no short to ground, but the component fails the loaded test, look for some other bad component besides the one you are testing.



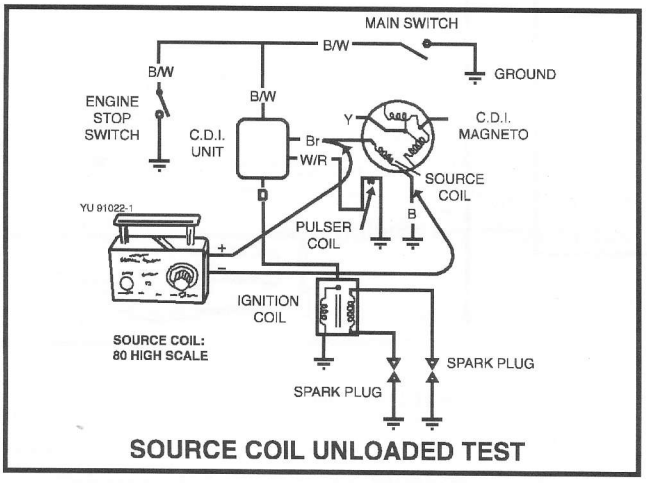
SOURCE COIL UNLOADED TEST

Output At Cranking Speed

When using the Y-1 tester, there are a few points to keep in mind. The tester has two scales, high and low. Both are referenced on a 0~100 scale. These numbers are reference numbers only and are not actual voltage readings. Start at 100 and work your way down until you get a consistent reading. (A reading is indicated when the tester light lights.) You should get the same reading twice. A good rule is that all of the high-and low-scale outputs should read at least 70 at cranking speed. There are some exceptions to this rule, but it will give you a starting point when you have no specifications at all to work with. The logical place to start testing for output is the magneto. There are two reasons for this:

1. The magneto is the originator of both the current and the timing pulses.
2. The magneto is the only area of the system that has moving parts.

Charge Coil Check

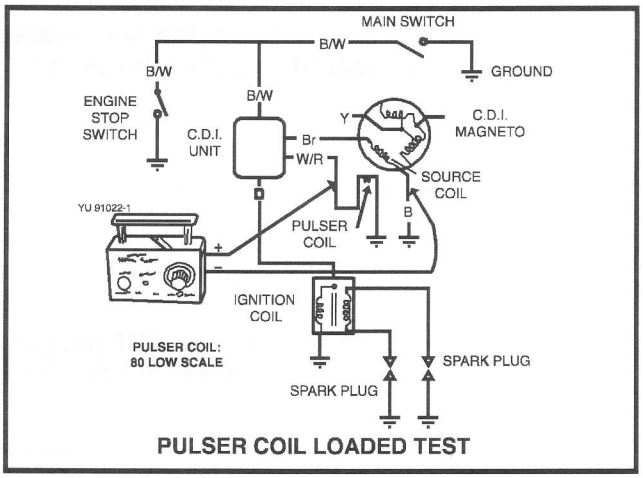


SOURCE COIL UNLOADED TEST

Once you have found the appropriate color codes in your technical service data, start with the charge (source) coil(s). Disconnect the colored wires between the magneto and the CDI unit that are shown. If the proper test connections are from a colored wire to a black wire (ground), attach the positive tester lead to the colored wire and negative tester lead to the black wire. If the proper test connections are from a colored wire to another colored wire, you will have to test one way, and reverse the leads, using the highest reading. Once you have connected the test leads to the proper wires, crank the engine over enough to get the same reading twice in a row.

NOTE: The charge coil(s) output is usually measured on the high scale of the Y-1 tester. Check your readings against specifications if available, or against a known good unit.

Pulser Coil Check

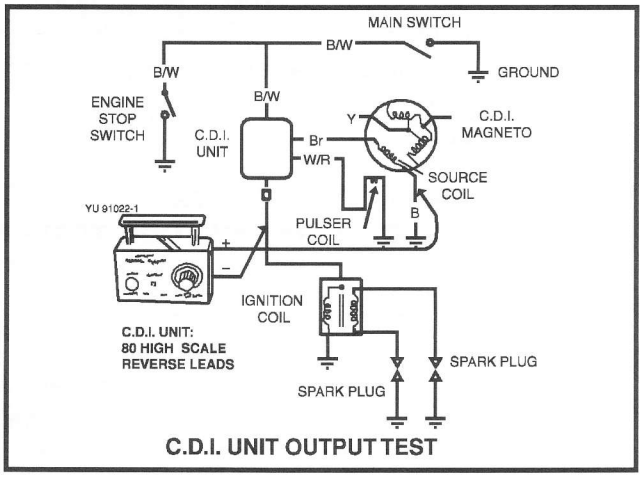


PULSER COIL LOADED TEST

To test the pulser coil(s), follow the same procedure. Find the appropriate color codes in your technical service data, attach the tester positive lead to the colored wire and attach the tester negative lead to the black wire. If the proper test connections are from a colored wire to another colored wire, you will have to test one way, and then reverse the leads, using the highest reading. Once you have connected the test leads to the proper wires, crank the engine over enough to get the same reading twice in a row.

NOTE: The pulser coil(s) output is usually measured on the low scale of the Y-1 tester. Check your readings against specifications if available, or against a known good unit.

CDI Unit Output Check



C.D.I. UNIT OUTPUT TEST

If all magneto outputs are functioning properly, you must check the output of the CDI unit. Disconnect the orange wire between the CDI unit and the ignition coil. Attach the tester negative lead to the orange wire, and the positive tester lead to ground. Crank the engine over enough to get the same reading twice in a row.

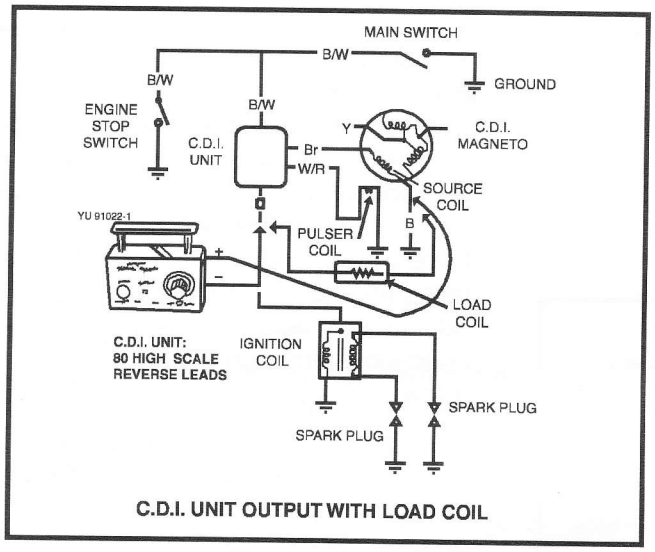
NOTE: The CDI output is always measured on the high scale of the Y-1 tester. Check your readings against specifications if available, or against a known good unit.

CAUTION:

Never crank the engine over unless the CDI unit is connected to either the ignition coil or a test instrument. Internal damage to the CDI unit may result.

Use Of The Load Coil

The load coil is used with the Y-1 tester to simulate actual operating conditions. The load coil can cause a marginal CDI unit to break down under testing, but will not affect a good unit. If you get no reading for the CDI unit output test, try the test using the load coil.

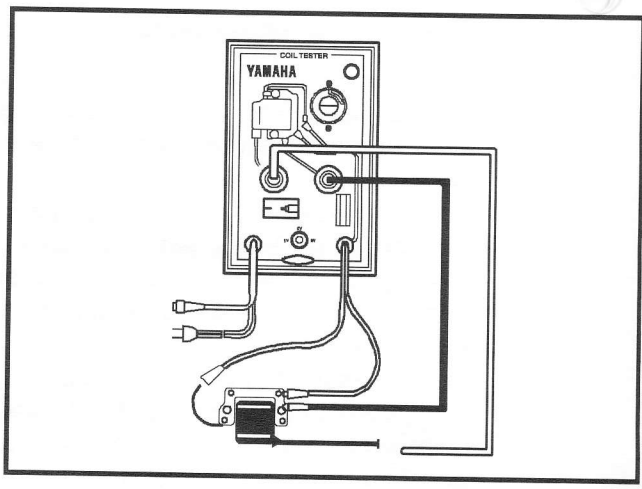


C.D.I. UNIT OUTPUT WITH LOAD COIL

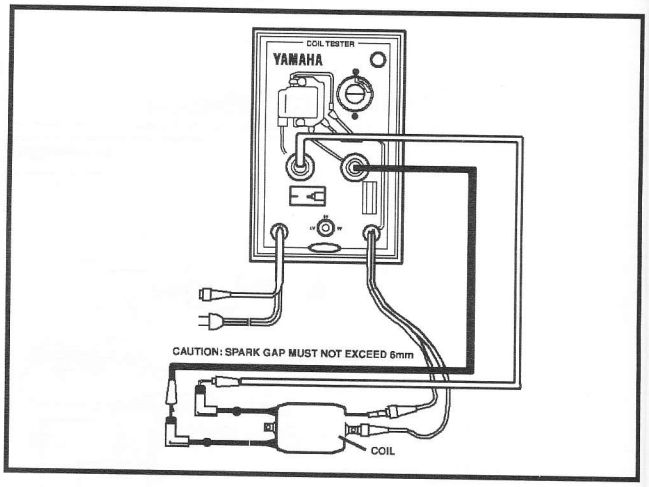
The load coil can be especially useful when testing CDI output to a suspected bad ignition coil (shorted primary). The load coil can be substituted for the ignition coil primary, thereby providing a way to fully load the CDI unit with a good coil attached (load coil).

IGNITION COIL TESTS USING THE YAMAHA COIL TESTER (Ken-Moore Part Number YU-33261 A)

The ignition coil receives the output from the CDI unit. The output voltage increases to an amount capable of jumping the gap between the spark plug electrodes. Single cylinder and some triple cylinder engines use a single-lead ignition coil. This coil requires the connection to the Yamaha Coil Tester as shown.



Twin cylinder engines use a dual-lead ignition coil. The function and operation of this coil is similar to the single lead ignition coil, however it requires a different connection to the coil tester as shown.



Test Procedure

Disconnect the coil from the wiring harness and conduct a static spark test as follows:

1. Remove the spark plug caps from the coil leads and test the resistance of the plug caps. Compare the readings to the specifications found in the service data. Replace the plug caps if the resistance is out of specification.
2. Connect the red (+) primary tester lead to the coil's primary lead.
3. Connect the black (-) primary tester lead to the coil's mounting bracket (ground).
4. Connect the red (+) secondary tester lead, and the black (-) secondary tester lead to the coil's secondary (spark plug) leads.

   For single lead coils, connect the red (+) secondary tester lead to the spark plug lead and connect the black (-) secondary tester lead to the coil's mounting bracket (ground).

5. Adjust the spark gap to 6~7mm by rotating the adjusting knob. Do not open the gap more than 6~7mm or damage to the coil may result.
6. Connect the tester to a 110VAC power source (outlet) and turn the power switch to 6V.
7. A coil in good condition should be capable of jumping the 6~7mm gap. Let the test run for three to fine minutes to allow the coil to reach operating temperature.

   If the spark becomes intermittent after the warm-up period, the coil is defective and should be replaced.
8. Attach the tester's ground clip to a screwdriver blade as the coil is being tested. Holding the screwdriver by its handle, place the tip of the screwdriver close to the coil's plug lead and move the screwdriver along the length of the leads. If spark jumps to the screwdriver blade, the lead wire's insulation is bad. Replace the coil.
9. Return the switch to the OFF position before disconnecting the ignition coil.

INTERMITTENT PROBLEMS

Intermittent problems with a CDI system are a little harder to isolate, but they can be found. First, make sure that you are dealing with an ignition problem. Carburetion and ignition problems are often mistaken for each other.

The difference between a carburetion problem and an ignition problem on an engine is that the ignition system can be accurately tested. Yamaha recommends that you use the Y-1 tester to measure each output at cranking speed. If outputs check good, a voltmeter can be used to test the system operation dynamically.

Source Coil

As discussed previously, the magneto source (charge) coil produces AC voltage by induction. This output increases considerably as engine rpm increases.

Test Procedure

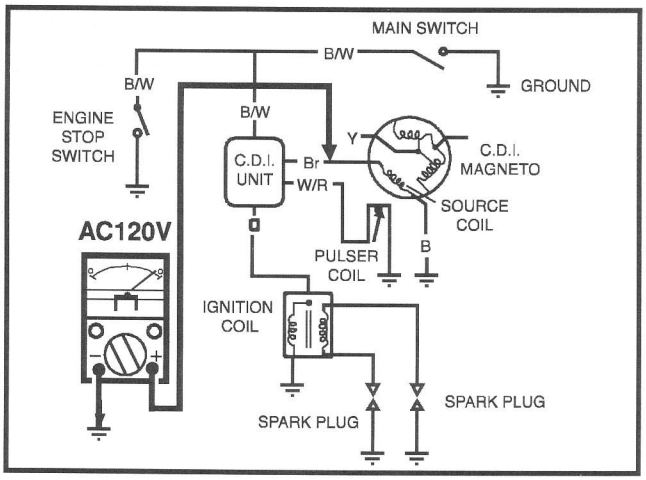
1. Locate the wiring connectors for the wires coming from the CDI magneto.
2. Connect the pocket tester (AC-120V scale) between the source coil output wire (brown) and ground (black). Do not unplug the connectors because it is necessary to run the engine for this test.

NOTE: On some machines, the connections may not be to ground. Refer to the service data and service manual for the model being tested and use the same connections used for resistance checks.

3. Start the engine and increase the rpm. If the engine won't start, or has a hard starting problem, check the amount of voltage being produced. If the voltmeter reads less than 30~40VAC under cranking, replace the source coil.

   If the engine misfires, rev the engine until the misfire occurs. If the voltmeter reading remains steady during the misfire, the source coil is not bad. If the needle swings rapidly toward zero with each misfire, the source coil is bad and needs replacing.

NOTE: Some machines have only one source coil and some have both low-speed and high-speed coils. If a machine has two coils, both should be checked. Because of voltage differences, it may be necessary to switch to the AC-20V scale for some coils for accurate readings. Always start with the meter set on the 120V scale and switch to the 20V scale only if the voltage readings remain below 20 volts on the higher scale.



Pulser Coil

The pulser coil sends a small AC voltage to the CDI unit. This voltage is sent at a predetermined moment, and is used to trigger the thyristor gate and release the charge stored in the capacitor.

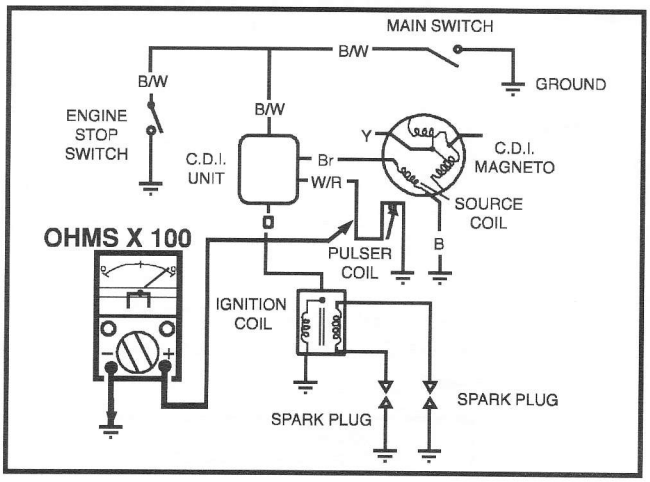
Test Procedure

1. Locate the wiring connectors for the wires coming from the magneto on the engine.
2. Connect the pocket tester (Ohms X 100 scale) inline with the pulser coil output wire (white/red) and ground (black). Do not unplug the connectors because you must run the engine for this test.
3. Start the engine and increase the rpm. If the engine misfires, rev the engine until the misfire occurs. If the meter reading remains steady dur-

ing the misfire, the pulser coil is not at fault. The reading on the meter will be close to the static resistance reading; it may rise slightly as engine rpm increases.

If the needle swings rapidly toward infinity during the misfire, the pulser coil is at fault and requires replacement.

NOTE: Because the pulser coil output is low, you must use the Ohms X 100 scale for this test. The pulser voltage output is low enough so the meter will not be damaged.



CDI UNIT

The CDI unit cannot be tested accurately for intermittent running problems. Therefore, if all other components check good, and an ignition problem still exists, test with a known good component.

Remember there are exceptions. If the ignition system checks properly at cranking speed, and you cannot adjust the carburetion enough to remove the problem, then try to match a symptom with the area of the ignition system that handles that function.

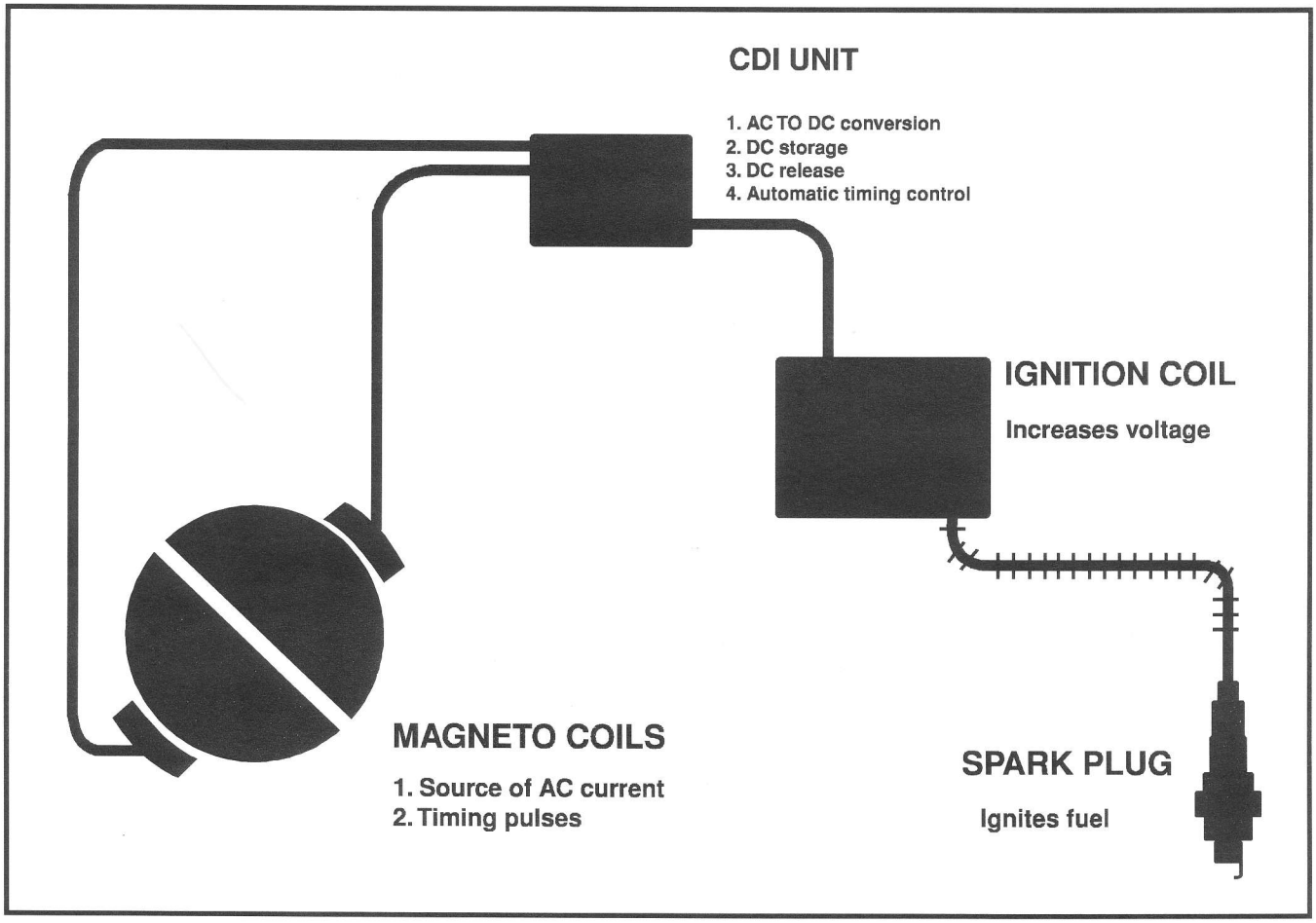
A. Hard Starting
   1. Spark plug worn or fouled
   2. Source coil partially grounded
   3. Pulser coil partially grounded
   4. Defective ignition coil

B. Timing Error
   1. Spark plug glazed
   2. Source coil partially grounded
   3. Pulser coil partially grounded
   4. Defective ignition coil

C. Intermittent Spark
   1. Defective CDI unit
   2. Source coil partially grounded
   3. Pulser coil partially grounded
   4 Defective ignition coil

CDI TROUBLESHOOTING TIPS AND SPECIFICATIONS

Yamaha uses completely self-contained CDI systems. The system components and their functions are shown below.



Note: If there is a hard starting or poor top-end performance problem, it may be caused by an excessive pulser coil gap.

Use one of the following ways to check:

1. **Y-1 Tester**
   Measure the output of the pulser coils (refer to the specific model service manual for pin location). If the readings are lower than 50 on the low scale, with the spark plug installed, the pulsar coil gaps are too large and need to be adjusted.

2. **Digital Voltmeter**
   Set the meter to a scale capable of reading 0.5VAC. Measure the AC voltage of the two pulsar coils (refer to the specific model service manual for pin location). A reading of less than 0.5VAC, will require gap adjustment.

3. **Measure**
   Remove the stator cover and place a small amount of modeling clay on the reluctor of the flywheel. Reinstall the cover and rotate the crankshaft. Remove the cover again and measure the thickness of the clay. If it is greater than 0.75mm, you will need to adjust the gap.

   In some cases, it may be necessary to enlarge the pulsar coil mounting hole to enable proper adjustment. Be careful not to decrease the gap to the point of contact with the flywheel, as the pulsar coil will be damaged.

   The proper pulsar coil gap should be between 0.5mm (0.20") to 0.75mm (0.29").