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ELECTRICAL

SPECIFICATIONS

IGNITION

Spark Timing Advance

Range 0°-35° BTDC
 Start 0° BTDC

Idle Speed 1000-1050 RPM

Spark Plugs

Size 14 mm
 Gap 0.038-0.043 in.
 Type Harley-Davidson No. 5R6A (No Substitute)

Ignition Coil Resistance

Primary 2.5 to 3.1 Ohms
 Secondary 11,250 to 13,750 Ohms

BATTERY

All 12 volt, 19 amp. hr.

ALTERNATOR

AC Voltage Output 16-20 VAC per 1000 rpm
 Stator Coil Resistance 0.1-0.2 ohms

REGULATOR

Voltage output @ 3600 rpm 13.8-15 @ 75°F
 Amperes @ 3600 rpm 32 Amps

Circuit Breakers

CIRCUIT	CIRCUIT BREAKER RATING (Amperes)
Main	30
Ignition	15
Lights	15
Accessory	15

BULB CHART

The bulb chart below gives the location and bulb requirements for Harley-Davidson Softail motorcycles.

FLSTC/F, FXSTC/S

LAMP DESCRIPTION (ALL LAMPS 12 V)	NUMBER OF BULBS REQUIRED	CURRENT DRAW (Amperage)	HARLEY-DAVIDSON PART NUMBER
Headlamp	1		
FLSTC/F	1	3.9	67713-86
FXSTC/S	1	2.73	67698-81
Tail and Stop Lamp	1		68168-89
Tail Lamp		0.59	
Stop Lamp		2.10	
Instrument Lamps			
High Beam Indicator	1	0.04	71092-68A
Oil Pressure Signal	1	0.08	68462-64
Neutral Indicator	1	0.08	68462-64
Turn Signal Indicator	1	0.08	68462-64
Speedometer	1	0.27	71090-64A
Turn Signal Lamps			
Front	2	2.10	68168-89
Rear	2	2.10	68572-64B
Fender Tip Lamps - FLSTC	2	0.5	53439-79
Passing Lamps - FLSTC	2	2.34	68674-69

IGNITION SYSTEM

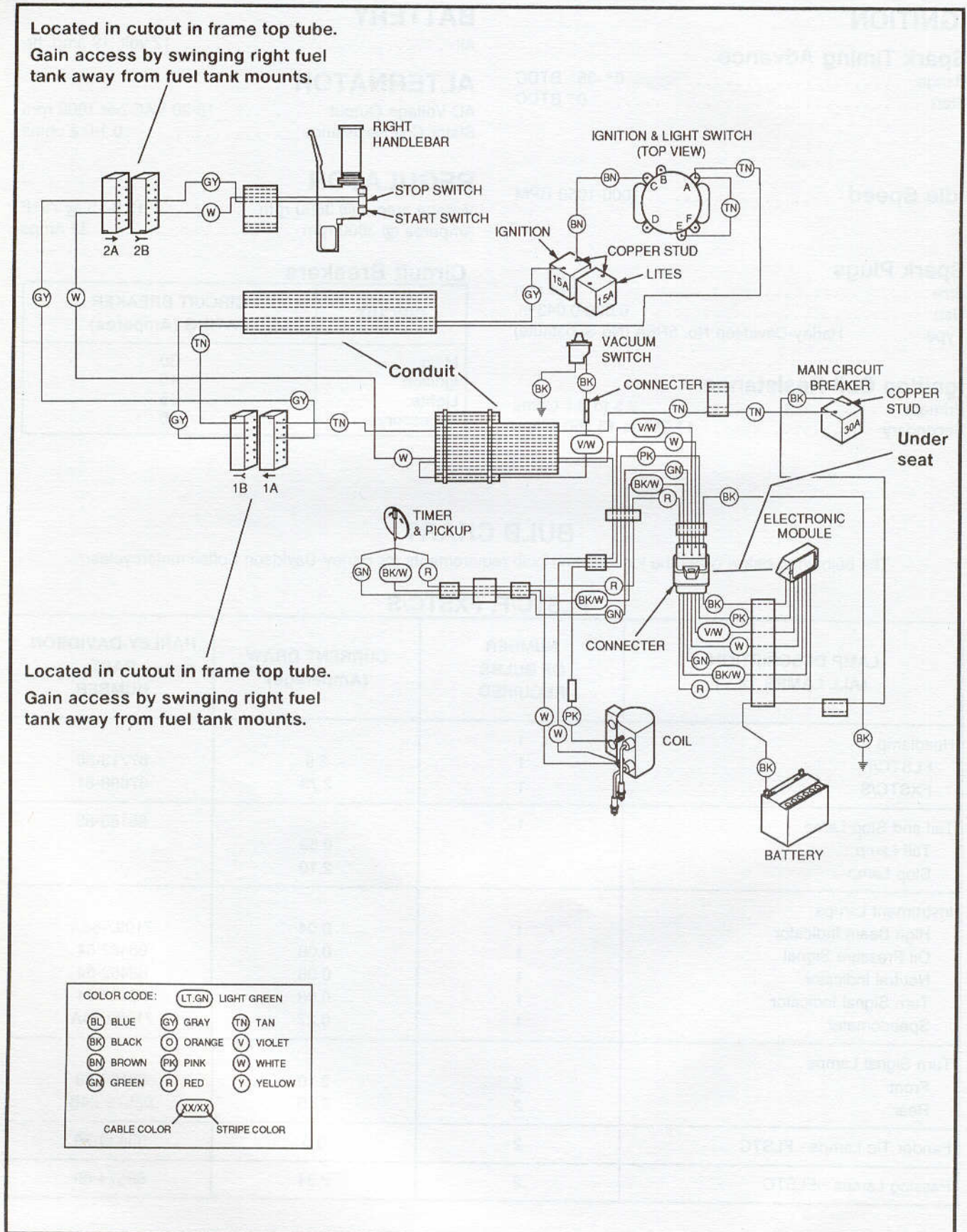


Figure 8-1. Ignition Circuit

GENERAL

The ignition system is a breakerless inductive discharge ignition system. It has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil winding, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The computerized ignition system consists of three components, the rotor and sensor plate, the computerized microprocessor module, and the vacuum operated electric switch (V.O.E.S.). The rotor and sensor plate are located in the cam gearcase cover on the right side of the

motorcycle. The computer module is mounted on the oil tank, on the frame member. The computer has two functions. First, it computes the spark advance for proper ignition firing. Second, it opens and closes the low voltage circuits between the battery and ignition coil to produce high voltage discharge to the spark plugs.

The vacuum operated electric switch (V.O.E.S.) senses intake manifold vacuum through an opening in the carburetor body. The V.O.E.S. is connected to the carburetor with a vacuum hose. The switch is open under acceleration and high engine load conditions (low vacuum) and closed under low engine load conditions (high vacuum).

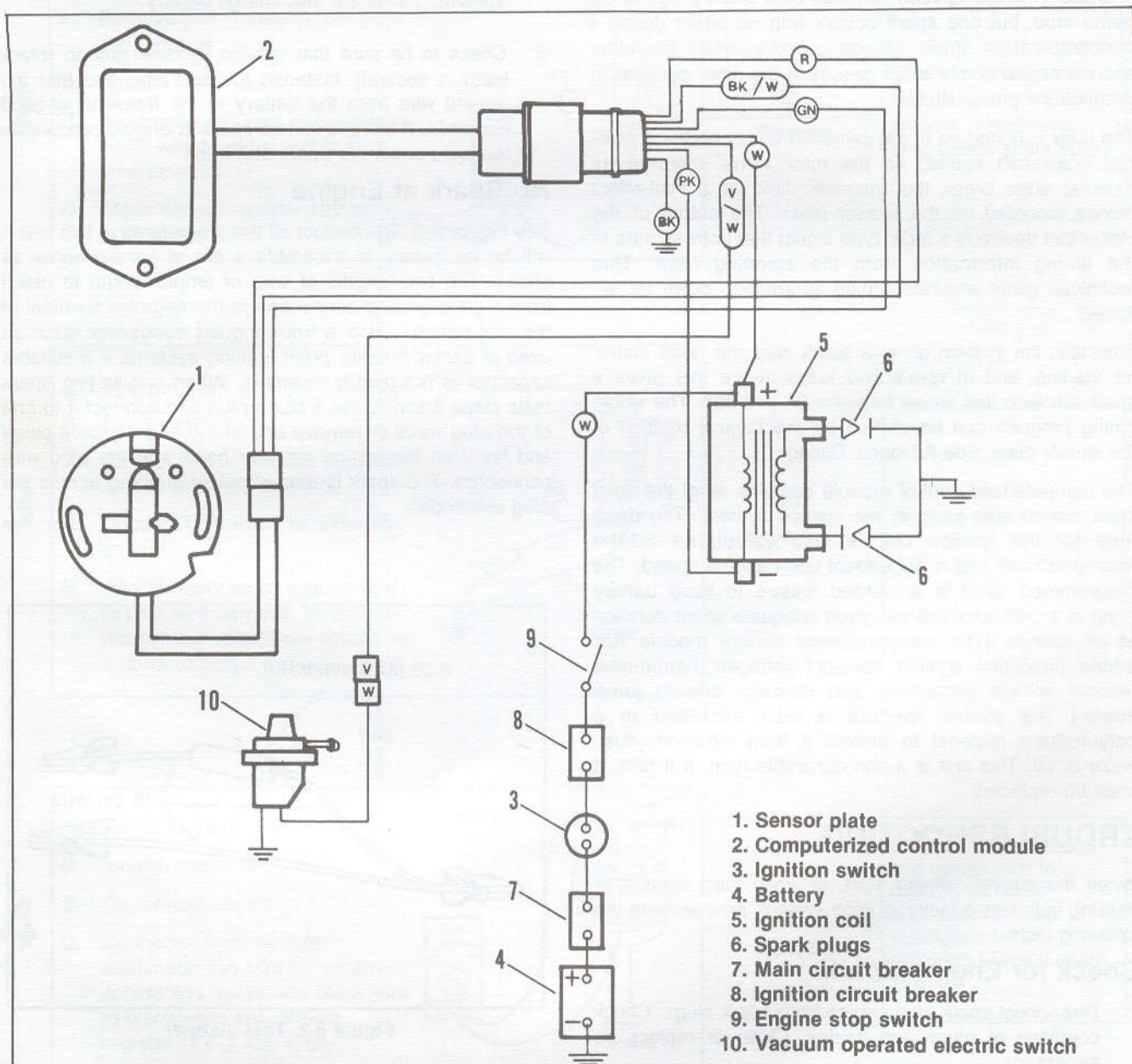


Figure 8-2. Ignition System Components

The computer module is programmed with two spark advance curves to meet varying engine loads. The high vacuum curve selected for maximum spark advance under normal light load cruising conditions provides improved fuel economy and performance. The low vacuum curve (retarded spark) minimizes spark knock, while maintaining performance, under high load conditions (acceleration and highway driving).

The computer module selects the proper curve when it receives an open or closed electrical signal from the V.O.E.S. This system ensures correct timing to suit starting, low and high speed requirements.

The ignition timer includes a rotor, sensor plate, and a computerized microprocessor control module and a V.O.E.S. A single ignition coil fires both spark plugs at the same time, but one spark occurs with no effect during a noncompression stroke of one cylinder, while the other spark fires the combustible gasses in the other cylinder to produce the power stroke.

The rotor is bolted on to the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its external edge break the magnetic field of a Hall-effect device mounted on the sensor plate. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to "0" speed.

Basically, the system gives a spark near top dead center for starting, and at rpm's and loads above this gives a spark advance that varies between 0° and 35°. The whole timing program can be shifted by mechanical rotation of the sensor plate. See Advance Timing.

The computerized control module contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon engine speed. The programmed dwell is an added feature to keep battery drain to a minimum and yet gives adequate spark duration at all speeds. (The microprocessor control module has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The control module is fully enclosed in a polyurethane material to protect it from vibration, dust, water or oil. This unit is a non-repairable item. If it fails, it must be replaced.

TROUBLESHOOTING

When the engine will not start, or when hard starting or missing indicates a faulty ignition system, proceed with the following tests.

Check for Engine Spark

1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.

2. Insert a conductive adapter into spark plug cable nipple and establish a 3/16 in. gap between adapter and cylinder head. Turn on ignition and engine stop switches. Crank engine. Check to see if there is a spark across the gap. If there is a spark, the problem is not in the electronic system or coil. Check carburetion, choke and spark plugs.
3. If there is no spark, check battery voltage and battery connection condition. Battery voltage must be 11-13V DC.
4. Check specific gravity of battery electrolyte with hydrometer. Specific gravity must be 1.250 (temperature corrected) or higher. If voltage and specific gravity are low, charge battery.
5. Check to be sure that ignition module ground (black lead) is securely fastened to the frame and that the ground wire from the battery to the frame is in good condition. If there is still no spark at engine proceed to the tests under No Spark at Engine.

No Spark at Engine

See Figure 8-3. To conduct all the procedures in this test it will be necessary to assemble a set of jumper wires as shown. Cut two lengths of wire of ample length to reach from a good ground connection to the negative terminal of the coil primary. Use a known good condenser such as used in earlier breaker point ignition systems if a suitable capacitor is not readily available. When conducting spark tests steps 3 and 5, use a spare plug and connect it to one of the plug wires or remove one of the engine spark plugs and lay it on the engine cylinder head with the plug wire connected. The spark is then checked jumping across the plug electrodes.

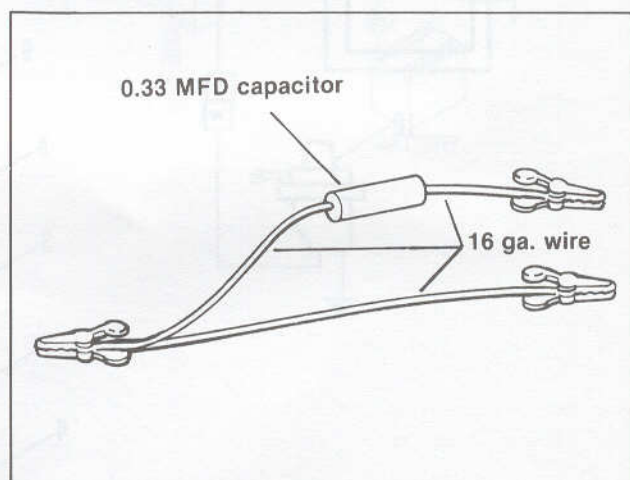
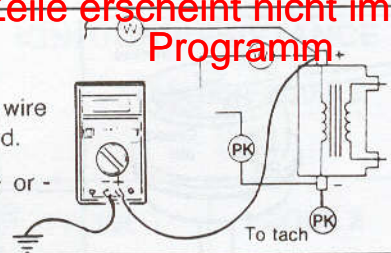


Figure 8-2. Test Jumper

1

- Ignition switch on.
- Multimeter red wire to white wire terminal, black wire to ground.
- Meter should register 12V + or - one volt.



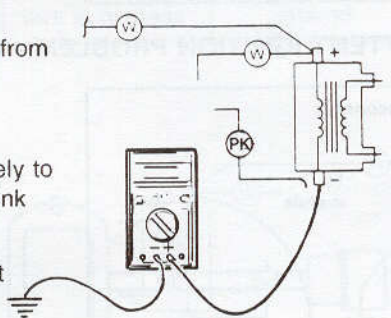
No
Power

Check Circuit breaker, loose wires, switches. See Troubleshooting Section 5.

Yes

2

- Remove pink (module) wire from coil terminal.
- Ignition switch on.
- Multimeter red wire alternately to white wire terminal and to pink wire terminal.
- Meter should register 12V at both terminals.



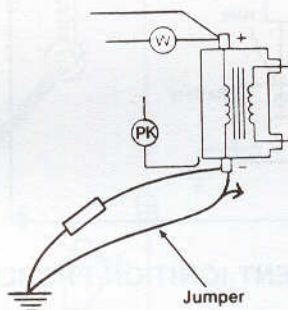
No
Power

Check coil resistance. See COIL later in this section. Resistance O.K. Check spark step 3.

Yes

3

- Pink (module) wire disconnected.
- Ignition switch on.
- Jumper wire -- connect capacitor wire to pink wire terminal.
- Connect both wires to common ground.
- Momentarily touch ground wire to pink wire terminal. When you remove the wire, there should be a spark at plug.



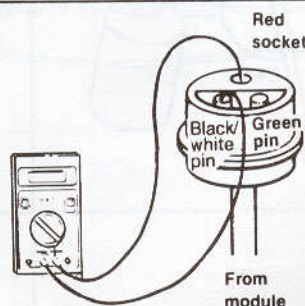
No
Spark

Replace coil.

Yes

4

- Reconnect pink wire to coil.
- Ignition switch on.
- Disconnect sensor.
- Connector from module--multimeter red wire to red wire socket and multimeter black wire to black/white pin. Should register 12V \pm 0.5 volts.



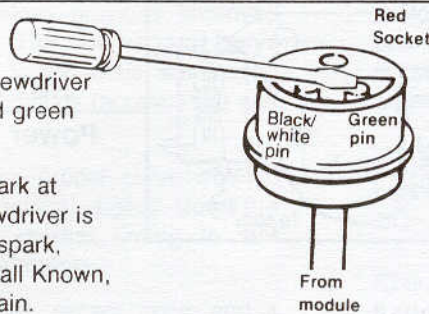
No
Power

Check module ground and power wire to module for loose connections. (See resistance test, following.) Check spark, step 5.

Yes

5

- A. Ignition on.
- B. Momentarily place screwdriver across black/white and green connector pins.
- C. Strong evidence of spark at spark plug when screwdriver is removed. If there is a spark, sensor is suspect. Install Known, good sensor & test again.



No
Spark

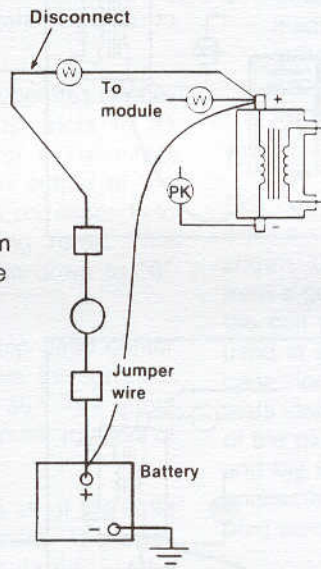
Check module resistance. See Ignition Module Resistance Test. Replace module if resistance is bad.

INTERMITTENT IGNITION PROBLEM - VIBRATION

- A. Check battery connections. Disconnect module ground (scrape paint, add star washer).
- B. Disconnect white wire at coil terminal (not module feed).
- C. Connect 16 ga. jumper wire from battery positive terminal to white wire terminal of coil.
- D. Operate vehicle to see if problem is eliminated.

NOTE

Vehicle no longer has an engine stop switch. Engine must be stopped by removing jumper wire.

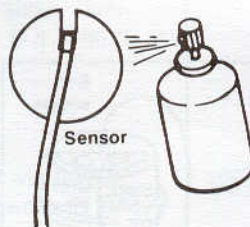


Yes

Problem is vibration, possibly loose connection at safety switches in starter circuit. See TROUBLESHOOTING section 5.

INTERMITTENT IGNITION PROBLEM - TEMPERATURE

- A. Remove outer timing cover.
- B. Remove inner timing cover and gasket.
- C. Start-up vehicle.
- D. Spray nose of sensor with coolant (obtainable at electronic supply houses) to see if engine kills.
- E. With engine hot, at operating temperature and cover off, apply heat (blow dryer) to nose of sensor and see if engine kills.
- F. Apply heat to module (blow dryer) and see if engine kills.



Yes

Problem is temperature sensitive sensor or module. Replace sensor or module.

Resistance Test

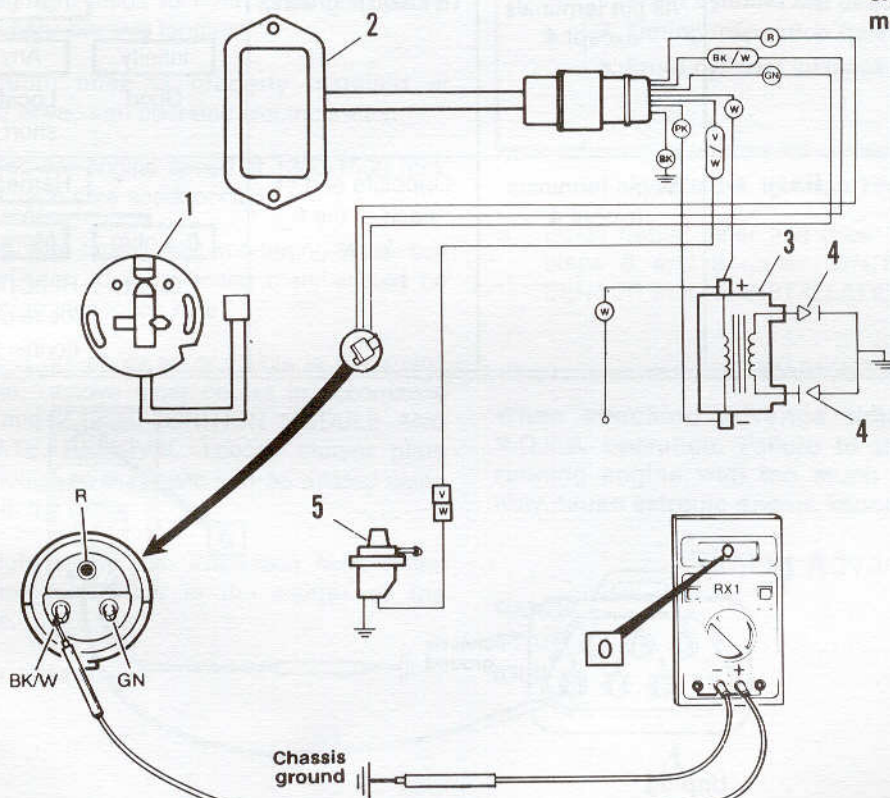
IGNITION RESISTANCE TEST

IGNITION MODULE

TEST	METER SETTING	PROBE 1	PROBE 2	METER READING
------	---------------	---------	---------	---------------

Check for grounds	RX1	To black/white wire in harness	To chassis ground
-------------------	-----	--------------------------------	-------------------

Module
0 - 1 ohm
Good
More than 1 ohm
Check harness for opens. See next page. If harness checks OK, replace module.



1. Sensor plate
2. Computerized control module
3. Ignition coil
4. Spark plugs
5. Vacuum operated electric switch

CAUTION

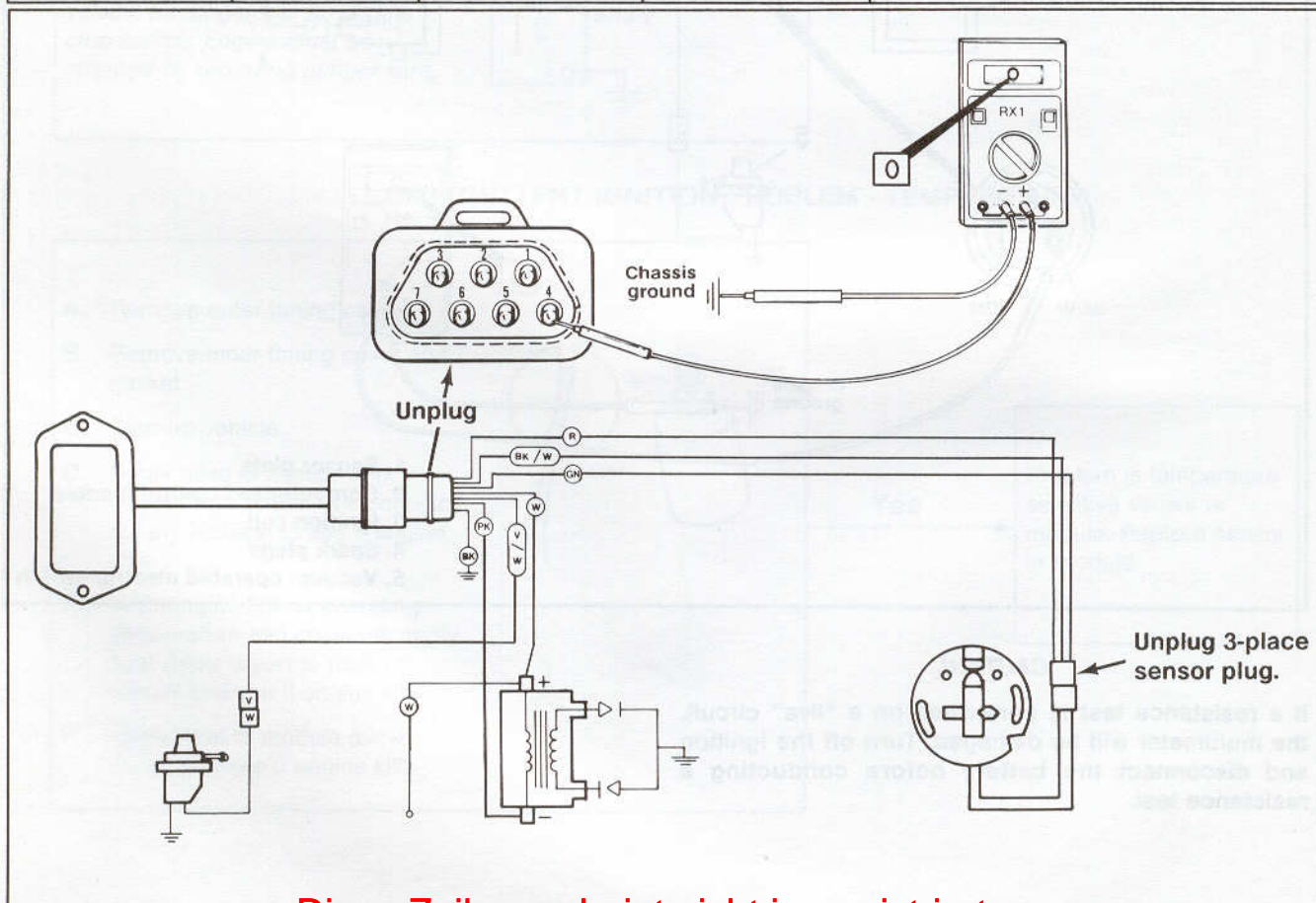
If a resistance test is performed on a "live" circuit, the multimeter will be damaged. Turn off the ignition and disconnect the battery before conducting a resistance test.

IGNITION RESISTANCE TEST

IGNITION MODULE HARNESS

TEST CONDITIONS: Engine Stop switch on right handlebar must be in "OFF" position and 7-place and sensor 3-place connectors must be unplugged for these tests. Shake or wiggle the harness to detect any breaks in the wiring.

TEST	METER SETTING	PROBE 1	PROBE 2	METER READING
Check for grounds	RX1	To pin 4 in 7 pin connector	To chassis ground	<div style="display: flex; justify-content: space-around;"> <div> Harness <div style="border: 1px solid black; padding: 2px;">0-1 ohm</div> Good </div> <div> <div style="border: 1px solid black; padding: 2px;">More than 1 ohm</div> Repair/clean ground connection. </div> </div>
Check for grounds	RX1	All pin terminals except 4	To chassis ground	<div style="display: flex; justify-content: space-around;"> <div> Harness <div style="border: 1px solid black; padding: 2px;">Infinity</div> Good </div> <div> <div style="border: 1px solid black; padding: 2px;">Any resistance</div> Locate and repair short to ground </div> </div>
Continuity	RX1	All pin terminals except 4	Opposite end of each of the 6 leads	<div style="display: flex; justify-content: space-around;"> <div> Harness <div style="border: 1px solid black; padding: 2px;">0-1 ohm</div> Good </div> <div> <div style="border: 1px solid black; padding: 2px;">More than 1 ohm</div> Repair broken wire or loose/dirty connection. </div> </div>



ADJUSTMENT/TESTING

Special Tools	Torque Values (ft-lbs)
HD-33813 Inductive timing light HD-96295-65D Timing mark view plug	None

Advance Timing (Figure 8-4)

Ignition timing should be checked every 5000 miles.

Use an **INDUCTIVE TIMING LIGHT**, Part No. HD-33813 (timing gun) to view ignition timing mark on flywheel through **TIMING MARK VIEW PLUG**, Part No. HD-96295-65D, screwed into timing inspection hole. Be sure view plug does not touch flywheel.

1. Connect timing light leads to front spark plug cable, ground and battery positive terminal.
2. Be sure vacuum hose is properly installed at carburetor and at vacuum operated electric switch.
3. Start engine and set engine speed at 1300-1500 rpm. Light will flash each time spark occurs.
4. See Figure 8-4. Aim timing light into timing inspection hole. Front cylinder advance timing mark should be centered in timing inspection hole.
5. If timing mark is not centered or visible in the timing inspection hole, remove timer covers in accordance with steps 1 and 2 under **IGNITION MODULE AND SENSOR PLATE, REMOVAL**. Loosen sensor plate screws just enough so that plate can be rotated using a screwdriver in the notch.
6. With timing light aimed into inspection hole, rotate plate until timing mark is in the center of the inspection hole.
7. Tighten sensor plate screws.

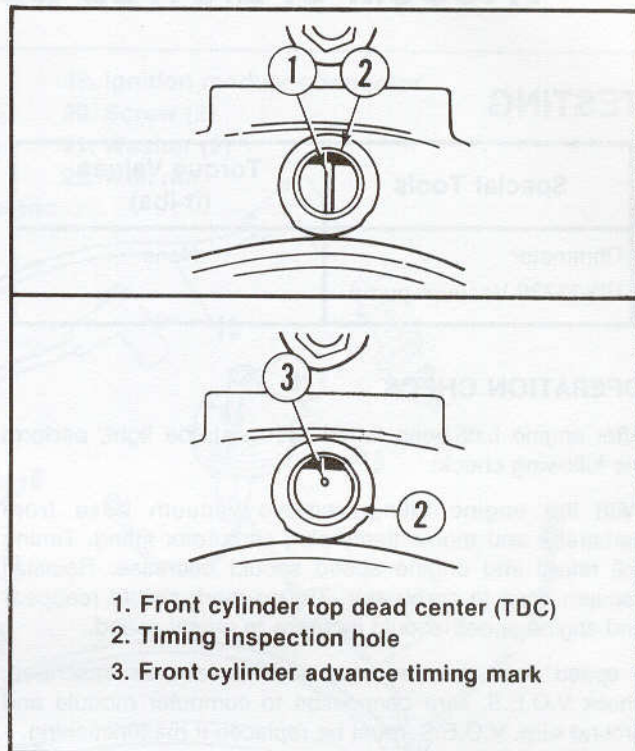


Figure 8-4. Ignition Timing Mark

8. Install gasket inner and outer timer covers following steps 8 and 9 under **IGNITION MODULE AND SENSOR PLATE, INSTALLATION**.

WARNING

When checking advance timing, always check **V.O.E.S.** operation. Failure to do so may result in running engine with too much spark advance, and may cause extreme engine knock and engine failure.

Timing Advance

RANGE	0°-35° BTDC
START	5° BTDC
IDLE	35° BTDC

VACUUM OPERATED ELECTRIC SWITCH (V.O.E.S.)

TESTING

Special Tools	Torque Values (ft-lbs)
Ohmmeter HD-23738 Vacuum pump	None

OPERATION CHECK

After engine has been timed with a strobe light, perform the following check:

With the engine idling, remove vacuum hose from carburetor and momentarily plug carburetor fitting. Timing will retard and engine speed should decrease. Reinstall vacuum hose to carburetor. Timing mark should reappear and engine speed should increase to preset speed.

If speed does not decrease and increase as described, check V.O.E.S. wire connection to computer module and ground wire. V.O.E.S. must be replaced if malfunctioning.

REMOVAL AND INSPECTION

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing any of the following procedures.

1. Disconnect wire from V.O.E.S. to computer module.
2. Disconnect V.O.E.S. ground wire from engine.
3. Remove V.O.E.S.
4. Connect ohmmeter across two V.O.E.S. wires. Ohmmeter should indicate an open circuit (∞ ohms).
5. Attach hose of VACUUM PUMP, Part No. HD-23738, to V.O.E.S.
6. Slowly squeeze vacuum pump handle and observe vacuum gage and ohmmeter.
7. The ohmmeter should indicate switch closure (0 ohms) at 3.5-4.5 in. of mercury.
8. Vacuum readings other than those listed above require V.O. E.S. replacement.
9. Refer to the latest Harley-Davidson Parts Catalog for V.O.E.S. part number.

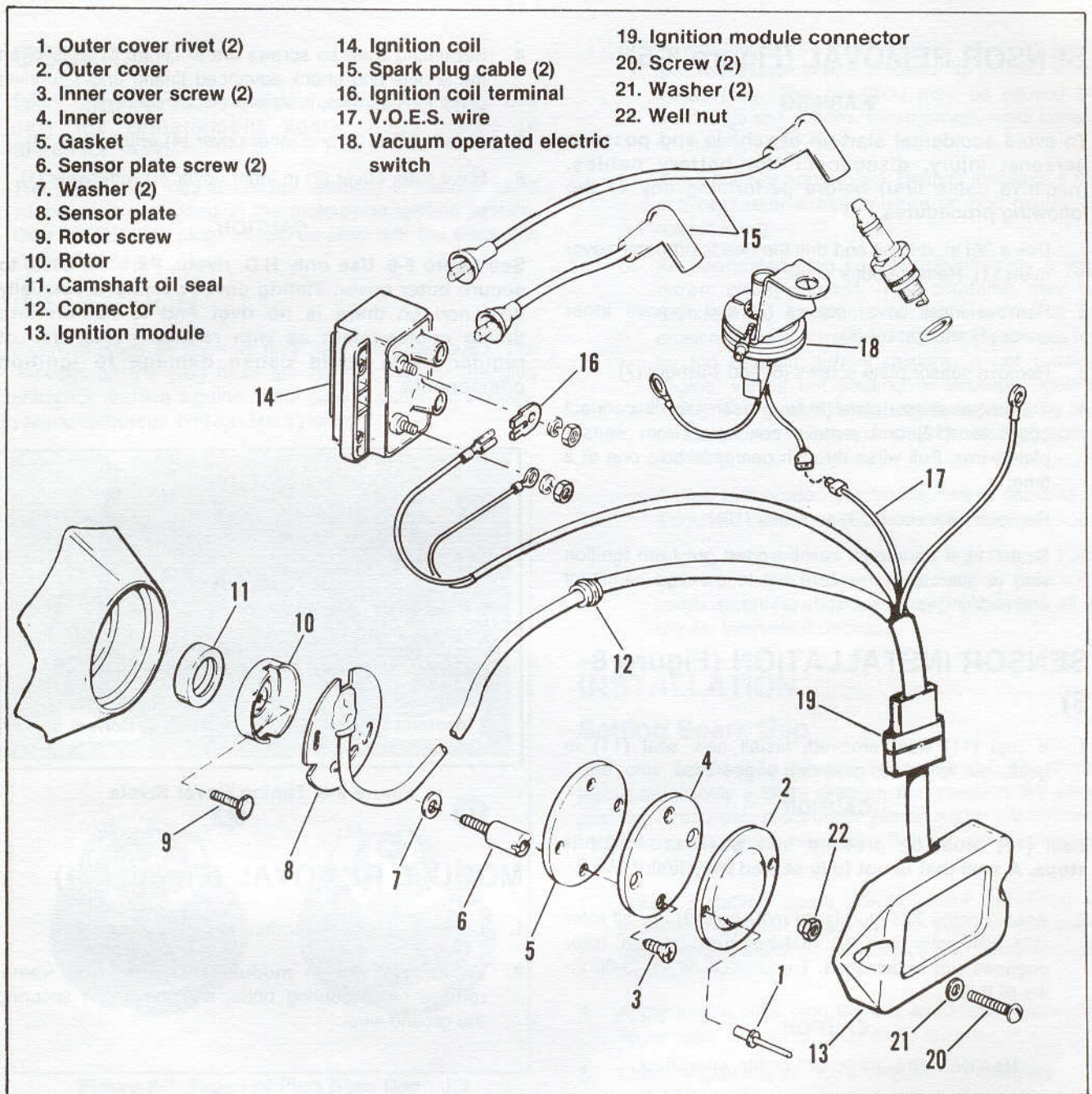


Figure 8-5. Ignition Components

SENSOR REMOVAL (Figure 8-5)

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing any of the following procedures.

1. Use a 3/8 in. drill bit and drill the heads off outer cover rivets (1). Remove outer cover (2).
2. Remove inner cover screws (3) and remove inner cover (4) and gasket (5).
3. Remove sensor plate screws (6) and washers (7).
4. To remove sensor plate (8) from gearcase, disconnect connector (12) and remove connector from sensor plate wires. Pull wires through gearcase hole one at a time.
5. Remove rotor screw (9) and rotor (10).
6. Seal (11), if damaged, can be pried out from ignition side of gearcase. Use care not to damage camshaft end and/or gear cover while prying.

SENSOR INSTALLATION (Figure 8-5)

1. If seal (11) was removed, install new seal (11) in gearcase, lip side to gear side of gearcase.

CAUTION

Seal (11) must be pressed into gearcase until it stops. A seal that is not fully seated may leak.

2. Apply Loctite 222 (purple) to rotor bolt (9). Install rotor (10) with rotor bolt (9) making sure tab on rotor engages slot in camshaft. Torque bolt (9) to 75-80 in-lbs (6 ft-lbs).

CAUTION

Use only the grade of Loctite specified.

3. Install sensor plate (8) with screws (6) and washers (7). Tighten screws to 15-30 in-lbs torque.

NOTE

If sensor plate was completely removed, it may be necessary to install new wire pins, sockets and body receptacle.

4. Set timing plate so screws are in center of slots. Start the engine and check advanced timing under running conditions as described in previous sections.
5. Install gasket (5) and inner cover (4) with screws (3).
6. Rivet outer cover (2) to inner cover (4) with rivets (1).

CAUTION

See figure 8-6. Use only H.D. rivets, Part No. 8699, to secure outer cover. Timing cover rivets are specially designed so there is no rivet end to fall off into timing compartment as with regular rivets. Use of regular rivets could cause damage to ignition components.

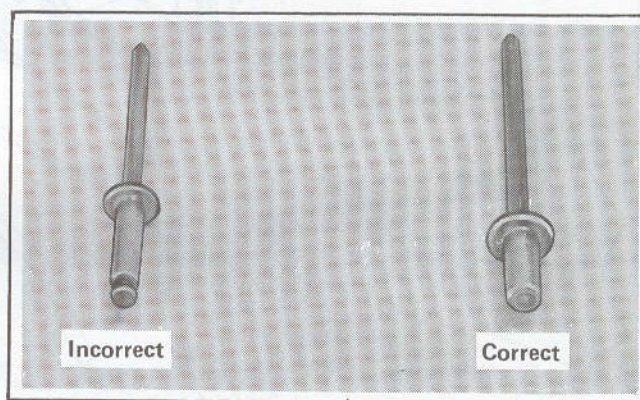


Figure 8-6. Timing Cover Rivets

MODULE REMOVAL (Figure 8-4)

1. Disconnect ignition module at 7-pin connector.
2. To remove ignition module (13), from the frame, remove two mounting bolts, and the screw securing the ground wire.

MODULE INSTALLATION (Figure 8-4)

1. Install ignition module (13) on frame mounting bracket.
2. Connect ignition module at 7-pin connector.

SPARK PLUGS

GENERAL

Spark plugs should be replaced every 5000 miles. Use only the replacement spark plugs listed in SPECIFICATIONS.

The 5R6A plug has a resistor element to reduce radio interference originating in the motorcycle ignition system. Only resistor type plugs should be used with the electronic ignition system.

INSPECTION

Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the plug efficiency and are a guide to the general condition of rings, valves, carburetor and ignition system.

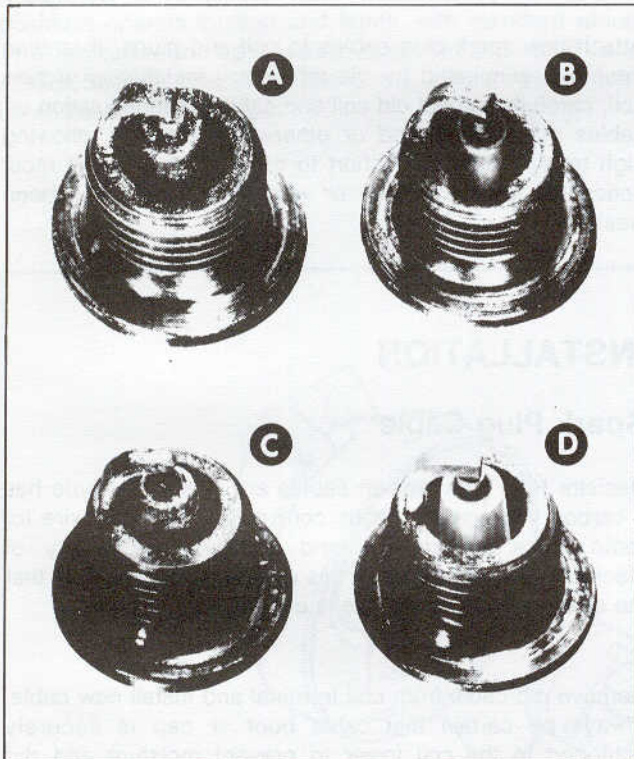


Figure 8-7. Types of Plug Base Deposits

- A. A wet black and shiny deposit on plug base, electrodes and ceramic insulator tip indicate an oil fouled plug. The condition may be caused by worn rings and pistons, loose valves, weak battery or faulty ignition.
- B. A dry fluffy or sooty black deposit indicates a too rich carburetor air/fuel mixture or long periods of engine idling.
- C. An overheated plug can be identified by a light brown, glassy deposit. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This condition is caused by too lean an air/fuel mixture, a hot running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high speed misfiring.
- A plug with eroded electrodes, heavy deposits or a cracked insulator should be replaced.
- D. A plug with a white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

INSTALLATION

Setting Spark Gap

Use only a wire-type gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.043 in.

1. Before installing spark plugs, check condition of threads in cylinder head and on plug. If necessary soften deposits with penetrating oil and clean out with a thread chaser.
2. Apply engine oil to plug threads and install spark plug finger tight. Tighten to 18-22 ft-lbs torque.
3. Check engine idle speed, and adjust if necessary.

IGNITION COIL

GENERAL

The ignition coil is a pulse type transformer that transforms or steps up low battery voltage to the high voltage necessary to jump the electrode at the spark plug in the cylinder head. Internally the coil consists of primary and secondary windings with a laminated iron core. It is sealed in water-proof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is faulty, it must be replaced.

TROUBLESHOOTING

Special Tools	Torque Values (ft-lbs)
Ohmmeter	None

See Figure 8-8. When engine will not start or when hard starting or missing indicates a faulty ignition system, follow the troubleshooting procedure listed under the respective ignition system sections. If condition persists, check primary and secondary resistance of ignition coil with an ohmmeter. Resistances should be within the following limits:

Primary 2.5 - 3.1 ohms

Secondary 11,250 - 13,750 ohms

If an ohmmeter is not available, temporarily substitute a new ignition coil by attaching it at any convenient point near old coil (coil will function without being securely grounded). Transfer terminal wires to new coil as shown in wiring diagram for that particular model.

CAUTION

Connect ignition coil wires as shown in wiring diagrams. Reversing polarity to the ignition control module will permanently damage the control module.

Attach new spark plug cables to coil and plugs. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil and cables. The insulation on cables may be cracked or otherwise damaged, allowing high tension current to short to metal parts. This is most noticeable in wet weather or when motorcycle has been washed.

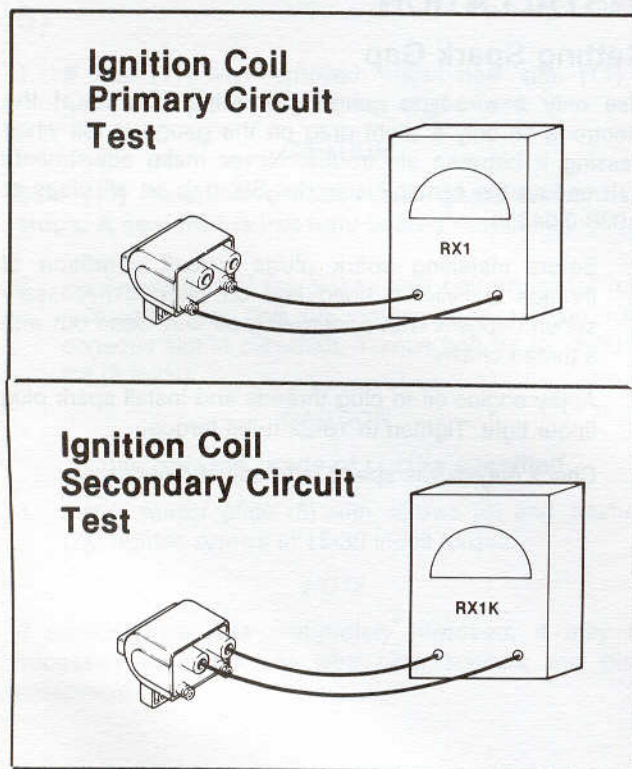


Figure 8-8. Test Ignition Coil

INSTALLATION

Spark Plug Cable

Resistor type high tension cables are used. This type has a carbon impregnated fabric core instead of solid wire for radio noise suppression and improved reliability of electronic components. For this reason, it is necessary that the exact replacement cable is used.

Remove old cable from coil terminal and install new cable. Always be certain that cable boot or cap is securely tightened to the coil tower to prevent moisture and dirt from contacting the high tension lead. Replace boot or cap if damaged or loose fitting.

CAUTION

When disconnecting cable connector from spark plug terminal, do not pull on the cable itself because the cable carbon core will be damaged. Always pull on the rubber boot as close as possible to the spark plug terminal.