SPECIFICATIONS 7.1

BATTERY	
Size	12 VDC
Type	Sealed

REGULATOR	
Voltage Output @ 75°F	13.8-15 VDC
Amperes @ 3600 RPM	22 Amps

SPARKPLUGS		
Size	12 mm	
Style	10R12	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque	11-18 ft-lbs	15-24 Nm

IGNITION COIL RESISTANCE	
Primary Winding	0.5-0.7 ohms
Secondary Winding	5500-7500 ohms

ALTERNATOR	
AC Voltage Output	19-26 VAC per 1000 engine RPM
Stator Coil Resistance	0.2-0.4 Ohms

ELECTRICAL SYSTEM	AMPERES
Main Circuit Breaker	30
Ignition Fuse	20
Light Fuse	15
Accessory Fuse	15
Instrument Fuse	15
Odometer Fuse	15

BULB CHART		BULBS REQUIRED	WATTS	AMPS	PART NUMBER
Headlamp	High/Low (replaceable bulb)	1	60/55	5.0/4.58	67969-96Y
	Position Lamp (European models only)	1	4	0.33	67968-96Y
Marker Lamps	Tail/Stop Lamp	1	5/21	0.42/1.75	68075-94Y
	Turn Signal Lamp (front and rear - 1 bulb each)	4	2.0	0.17	68968-99Y
Indicator Lamps on Instrument Support	High Beam Indicator	1	2.1	0.15	68024-94
	Turn Signal Indicator	2	2.1	0.15	68024-94
	Oil Pressure Indicator	1	2.1	0.15	68024-94
	Neutral Indicator	1	2.1	0.15	68024-94
Instruments	Speedometer Illumination	1	1.7	0.14	67421-99Y
	Tachometer Illumination	1	1.7	0.14	68073-99Y
	Low Fuel Lamp (in Tachometer)	1	1.7	0.14	68073-99Y
	Check Engine Lamp (in Tachometer)	1	1.7	0.14	68073-99Y

TORQUE VALUES

ITEM	TORQUE		NOTES
Battery (+) to Starter Nut	60-85 **in-lbs**	7-10 Nm	(metric), page 7-25
Battery Strap Locknut	40 **in-lbs**	4.5 Nm	page 7-29
Battery Terminal Bolts	60-96 **in-lbs**	7-11 Nm	(metric), page 7-24
Dash Panel Mounting Screws	4-5 ft-lbs	5-7 Nm	page 7-42
Dash Panel Screws	4-5 ft-lbs	5-7 Nm	page 7-44
Handlebar Control Housing Screws (left side)	25-33 **in-lbs**	3-4 Nm	page 7-38
Handlebar Control Housing Screws (right side)	12-17 **in-lbs**	1-2 Nm	longer screw on bottom, page 7-38
Headlamp Housing Screws	6-8 ft-lbs	8-11 Nm	metric, page 7-32
Neutral Indicator Switch	3-5 ft-lbs	4-7 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-53
Rotor Mounting Bolts	90-110 **in-lbs**	10-12 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-22
Spark Plugs	11-18 ft-lbs	15-24 Nm	page 7-1
Stator TORX Mounting Screws	30-40 **in-lbs**	3-4 Nm	T-27 TORX with retaining compound, replace with new after each removal, page 7-22
Turn Signal Nut (Rear)	96-120 **in-lbs**	11-14 Nm	page 7-35
Turn Signal Screws (Front)	25-28 **in-lbs**	2.8-3.2 Nm	page 7-34
Voltage Regulator Mounting Screws	9-11 ft-lbs	12-15 Nm	page 7-23

GENERAL

The vehicle uses a breakerless inductive-discharge ignition system. The system has both a primary and secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil windings, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, spark plugs and associated wiring. See Figure 7-1.

The scan tool can access the information received by and stored in the electronic control module.

The electronic control module (ECM) attaches to the vehicle frame next to the fuse block. The module has three primary functions. First, it computes the spark advance for proper ignition timing based on sensor input. Second, it controls the independent, primary windings of the spark coil and is thus able to provide sequential and independent firing of the spark plugs (non waste spark). Third, it calculates the correct air/fuel ratio based on input from the sensors.

The electronic control module contains all the solid-state components used in the ignition system. The dwell time for the ignition coil is also calculated by the ECM microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to keep battery drain to a minimum and to adequately charge the coil at all speeds. The ECM has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts. The ECM is fully enclosed to protect it from vibration, dust, water and oil. The module is not repairable. Replace the unit if it fails.

The ECM uses six different sensors to monitor rider demands and changing engine conditions. These sensors are:

- Throttle Position (TP) Sensor
- Cam Position (CMP) Sensor
- Intake Air Temperature (IAT) Sensor
- Engine Temperature (ET) Sensor
- Oxygen (O2) Sensor
- Bank Angle Sensor (BAS)

The ECM uses the information provided by the TP and CMP sensors to calculate how much air is entering the engine.The TP Sensor monitors the amount of air entering the engine by how far the throttle is open, whether it is opening or closing and how fast it is opening or closing. The IAT sensor measures the temperature of the air entering the engine, providing the rest of the information necessary to determine the density of the air entering the engine. The ECM also monitors the CMP sensor to determine the exact position of both cylinders in the combustion cycle and the engine speed.

The ET sensor provides the ECM the current engine temperature. Proper fuel and spark delivery are dependent on the temperature of the engine. The ECM will provide a richer fuel mixture on start up and a higher degree of spark advance. As the vehicle warms up to operating temperature the fuel mixture will lean and the spark advance will decrease.

The information provided by the O2 sensor allows the ECM to ensure a proper air/fuel mixture by monitoring the final combustion efficiency in the exhaust system. This ensures optimum engine performance at any altitude or barometric pressure. The O2 sensor input to the ECM is required to ensure a stoichiometric (14.6:1) air/fuel ratio during closed loop operation.

The Bank Angle Sensor (BAS) provides input to the ECM on whether the vehicle lean is greater than 55 degrees. As long as lean angle does not exceed 55 degrees fuel supply and ignition operation are unaffected. If the vehicle exceeds a 55 degree lean angle, the BAS will interrupt the operation of the ignition system and fuel supply.

The ECM-controlled ignition coil fires each spark plug independently on the compression stroke of each cylinder (no waste spark). The spark plug in the front cylinder fires at the end of that cylinder's compression stroke, thereby igniting the air/fuel mixture. The same sequence occurs at the end of the rear cylinder's compression stroke (thereby igniting the air/fuel mixture in the rear cylinder).

The rotor and cam position sensor are located in the gearcase cover on the right side of the motorcycle. The Cam position sensor consists of a Hall-effect device, magnet and plate. The plate is mounted over a rotating cup ("rotor cup"). The rotor cup is mounted on the camshaft and operates at one-half crankshaft speed. As the rotor cup turns inside the gearcase, six asymmetrical teeth on the rotor cup sequentially break the magnetic field between the magnet and the Hall-effect device. The edges of these teeth are cut to correspond to specific positions of the camshaft during the engine cycle such as TDC for the front cylinder. The output of the CMP sensor is used by the ECM to not only determine engine position, but also to calculate engine speed. This method of measuring camshaft position provides accurate information on engine position down to zero engine speed.

For more information on the sensors used in conjunction with the ECM see Section 4 Fuel System.

See the wiring diagrams at the end of this section for additional information on ignition system circuits.

TROUBLESHOOTING

See Section 4 Fuel System for troubleshooting information.

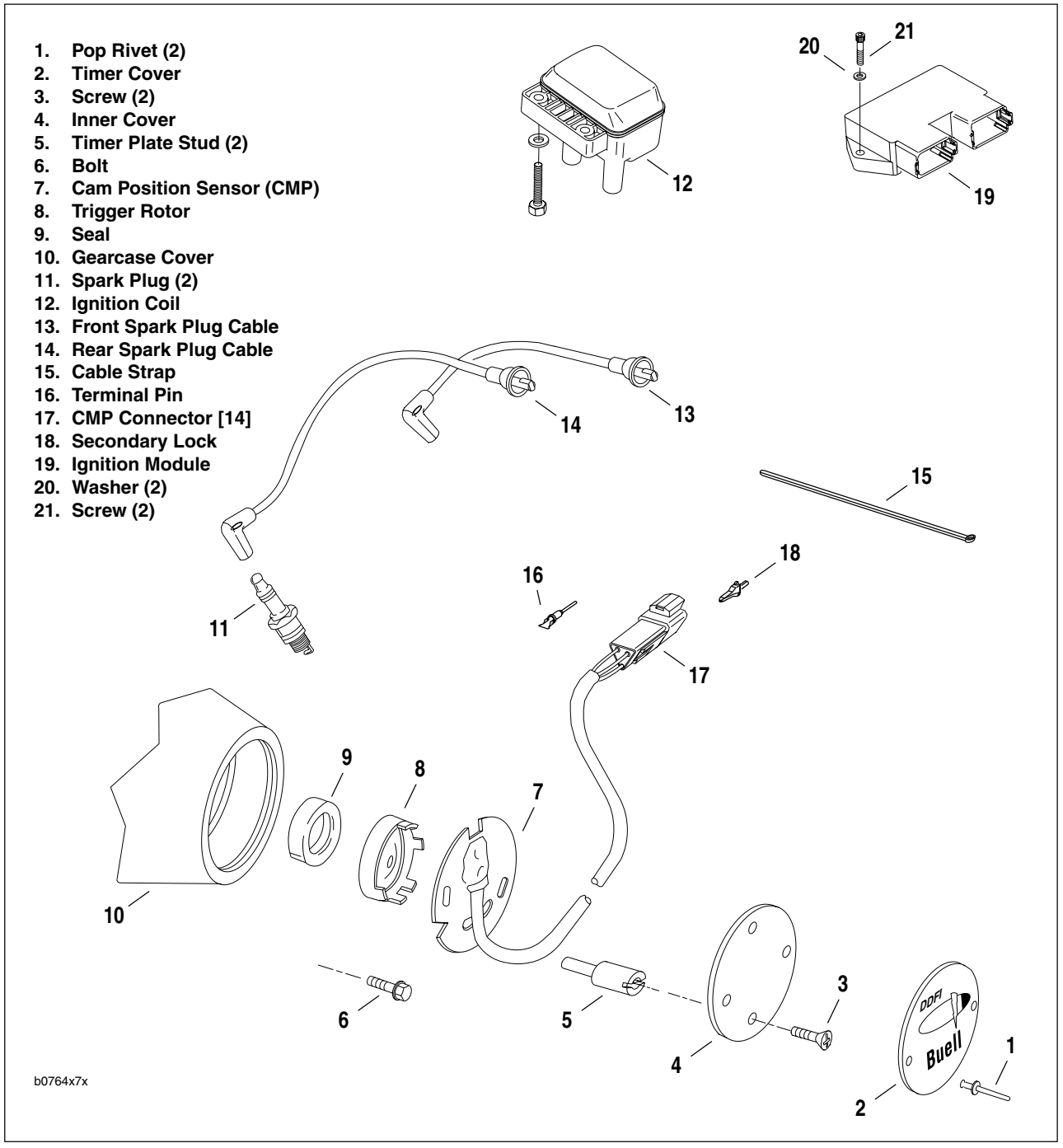


Figure 7-1. Ignition System Components

IGNITION/HEADLAMP KEY SWITCH 7.3

GENERAL

⚠WARNING

DO NOT modify the ignition/headlamp switch wiring to circumvent the automatic-on headlamp feature. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

See Figure 7-2. The three-position combination ignition/headlamp key switch is not repairable. Replace the unit if it fails.

Switch positions are explained in Table 7-1.

CAUTION

When turning off the ignition, verify that the key is removed in the OFF position and that the lights are not left on. If the rider stops the engine and inadvertently removes the key in the P position, the battery will be drained of its charge if the vehicle is left standing too long.

NOTE

The key locks the ignition system and is removable in both the LOCK and P positions. The P position is located between the OFF and IGNITION positions and allows the rider to remove the key while leaving the lights on. When the key is placed in the P position, several indicator markers are or can be activated. See Table 7-2.

REMOVAL

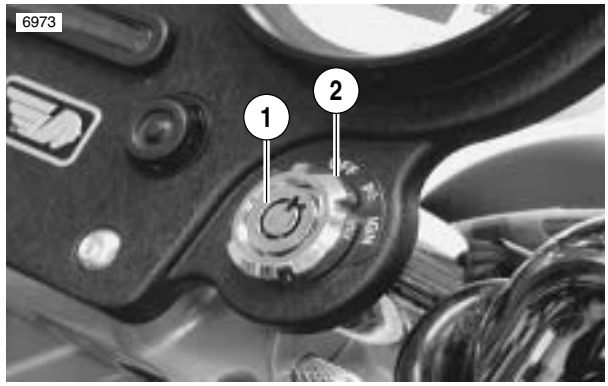
⚠WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative battery cable first. If the positive battery cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect **both** battery cables, negative cable first.
2. Remove four screws and washers to detach windscreen from mounting brackets.
3. Disconnect ignition key switch connector [33] from main wiring harness.
4. See Figure 7-2. Remove ignition switch face nut (2). Remove ignition switch (1) from behind dash panel.



1. Ignition Switch
2. Ignition Switch Face Nut

Figure 7-2. Ignition/Headlamp Key Switch

Table 7-1. Ignition Key Switch Positions

LABEL	NAME	IGN.	LAMPS	REMOVE KEY
OFF	locked	off	off	yes
P	markers	off	See note & Table 7-2.	yes
IGN	ignition	on		no

Table 7-2. Indicator Markers

ITEM	P	IGN
Headlamp position marker (European models only)	on	on
Headlamp high/low beam	off	on
Speedometer illumination lamp	on	on
Stop lamp	can be activated	
Front and rear turn signals	can be activated	
Horn	can be activated	

INSTALLATION

1. Install ignition key switch.
   a. See Figure 7-2. From behind the dash panel, insert ignition switch (1) into hole. The word “TOP” stamped on the switch body should face upward toward the lettering on the switch position decal.
   b. Loosely install face nut (2).
2. See Figure 7-3. Attach ignition key switch connector to main wiring harness.
3. See Figure 7-2. Tighten face nut to secure switch within dash panel.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

4. Install battery cables, positive cable first.

⚠WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

5. Check ignition key switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
6. Install four screws and washers to attach windscreen to mounting brackets.

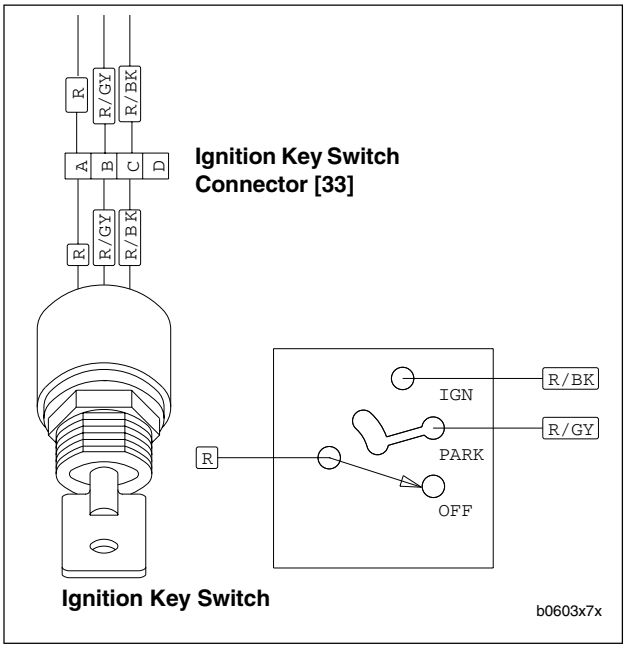


Figure 7-3. Ignition Key Switch Wiring

SPARK PLUG CABLES 7.4

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

REMOVAL

⚠WARNING

Never disconnect a spark plug cable with the engine running. If you disconnect a spark plug cable with the engine running, you may receive a potentially fatal electric shock from the ignition system which could result in death or serious injury.

CAUTION

When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.

INSPECTION

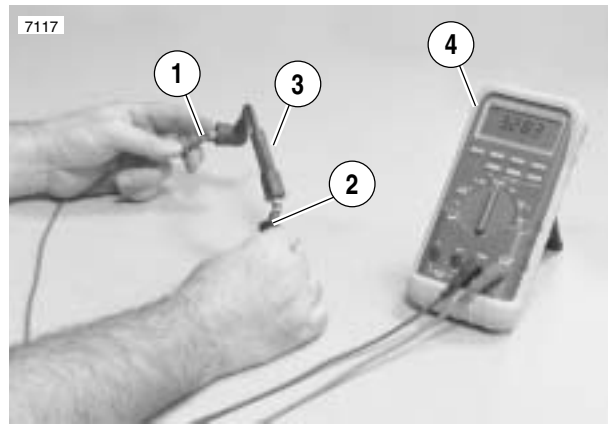
1. Inspect spark plug cables. Replace cables that are worn or damaged.
   a. Check for cracks or loose terminals.
   b. Check for loose fit on ignition coil and spark plugs.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
3. See Figure 7-4. Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications.
   a. 4750-11,230 ohms for 19.0 in. (483 mm) cable.
   b. 1812-4375 ohms for 7.25 in. (184 mm) cable.

INSTALLATION

Connect spark plug cables to ignition coil and spark plugs. Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.

NOTE

See 1.18 SPARK PLUGS for spark plug information.



1. Ohmmeter Positive Lead
2. Ohmmeter Negative Lead
3. Spark Plug Cable (7.25 in. shown)
4. Ohmmeter

Figure 7-4. Testing Resistance

STARTER INTERLOCK 7.5

GENERAL

The starter interlock system is designed to prevent unintended start-up and/or forward motion of the motorcycle with the vehicle's side stand not retracted.

Two circuits make up the starter interlock system.

Starter Circuit

The starter circuit prevents the motorcycle from being started unless a ground has been established at the starter relay. This ground may come from one of two sources.

- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Once the starter circuit is grounded and the starter button pushed, the starter relay can be energized. The energized relay then permits the starter motor to crank the engine.

Ignition Circuit

The ignition circuit prevents the motorcycle from operating unless a ground is established at the ignition relay. If this ground is not established, the ignition system will be not turned on and the motorcycle will not run. Grounds may be established three ways.

- By retracting the side stand and grounding through the side stand switch.
- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Note that the ignition circuit allows operation in gear with the side stand extended if the clutch is disengaged. However, if the motorcycle is in gear with the side stand extended, and the clutch is released, the ignition ground is lost and the ignition system is turned off. This system will prevent vehicle operation if forward motion is attempted with the side stand down.

See Figure 7-8.

Table 7-3. Starter Interlock Troubleshooting

PROBLEM	CHECK FOR	CORRECTION
Electric starter will not crank.	Battery problems.	See 7.10 BATTERY.
	Inappropriate gear selected.	Place vehicle in neutral.
	Clutch lever not disengaged.	Pull in clutch lever.
	Starter relay problems.	Listen for starter relay "click". If click is not heard, perform starter relay tests.
		Follow starter troubleshooting in Section 5.
Electric starter cranks, but vehicle will not start.	Side stand not retracted.	Retract side stand.
Motorcycle will not start with side stand retracted.	Clutch lever not disengaged.	Pull in clutch lever.
Motorcycle will not start with side stand retracted or clutch disengaged.	Ignition relay problems.	Listen for relay "click". If click is not heard, perform ignition system tests.
Motorcycle will not start after starter relay tests.	No spark at spark plug.	Check for 12 VDC at coil W/BK wire.
		Follow ignition system troubleshooting.

DIAGNOSTICS

The reference numbers below correlate with the circled numbers in the 7.5 STARTER INTERLOCK flow charts.

1. Check diode with an ohmmeter as shown in Figure 7-5.
2. Check diode polarity as shown in Figure 7-6.

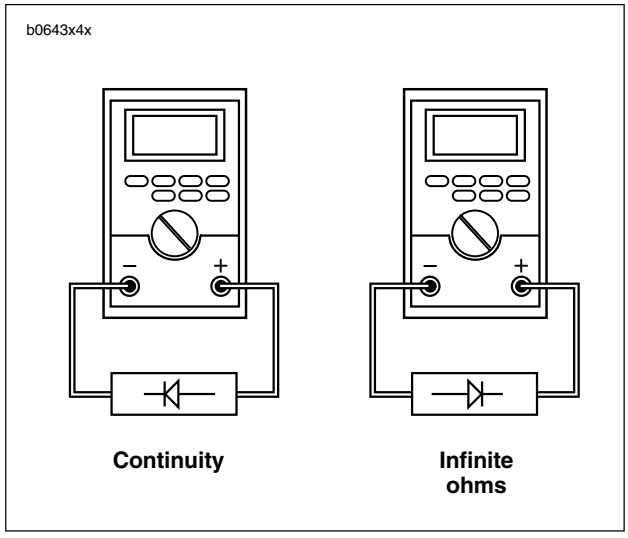


Figure 7-5. Ohmmeter Diode Test

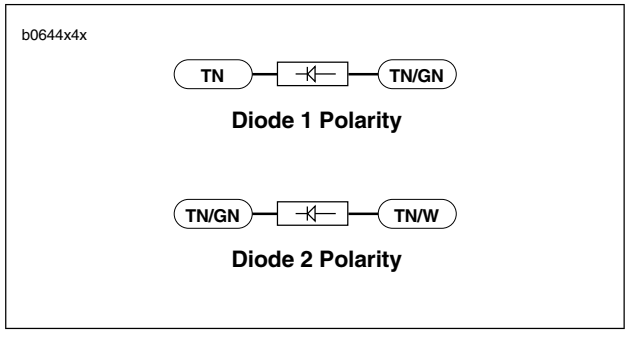


Figure 7-6. Diode Polarity

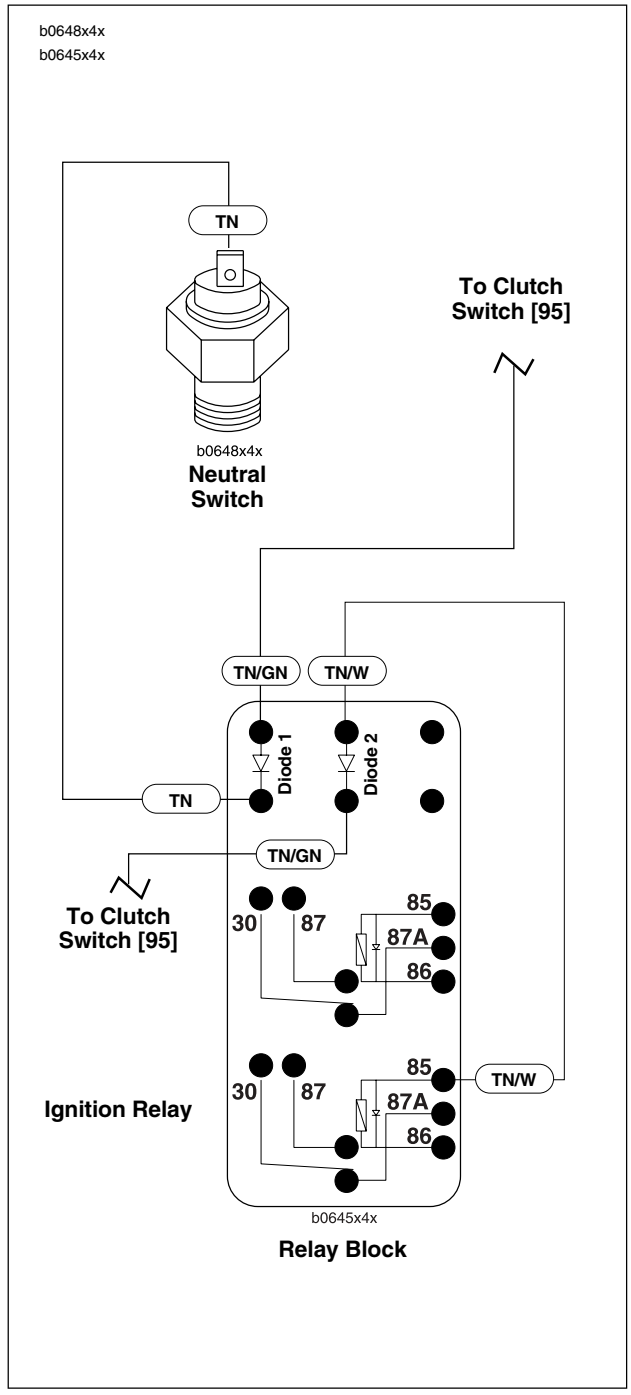
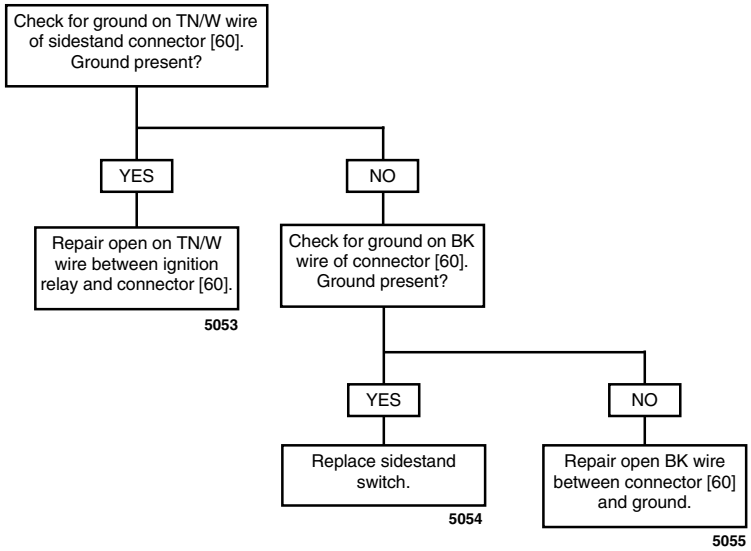


Figure 7-7. Diode Wiring

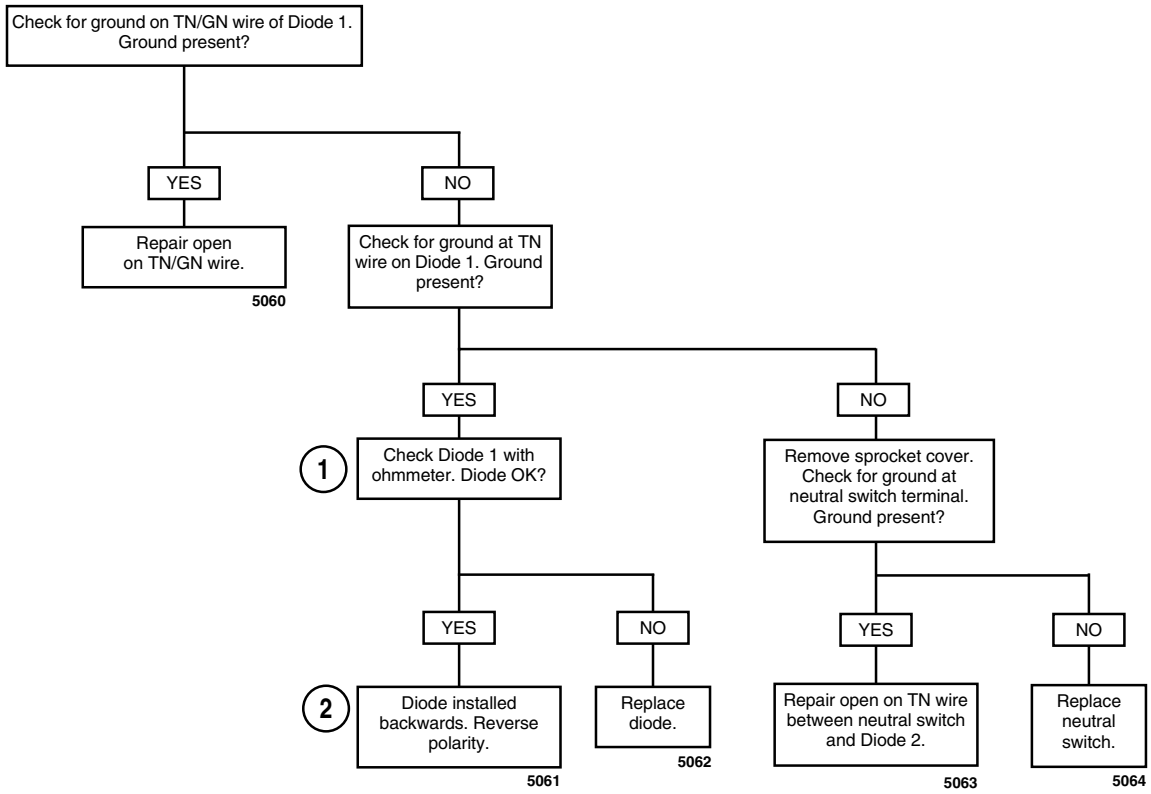
Ignition Test

CONDITION: Sidestand up and key ON, transmission in neutral and clutch engaged



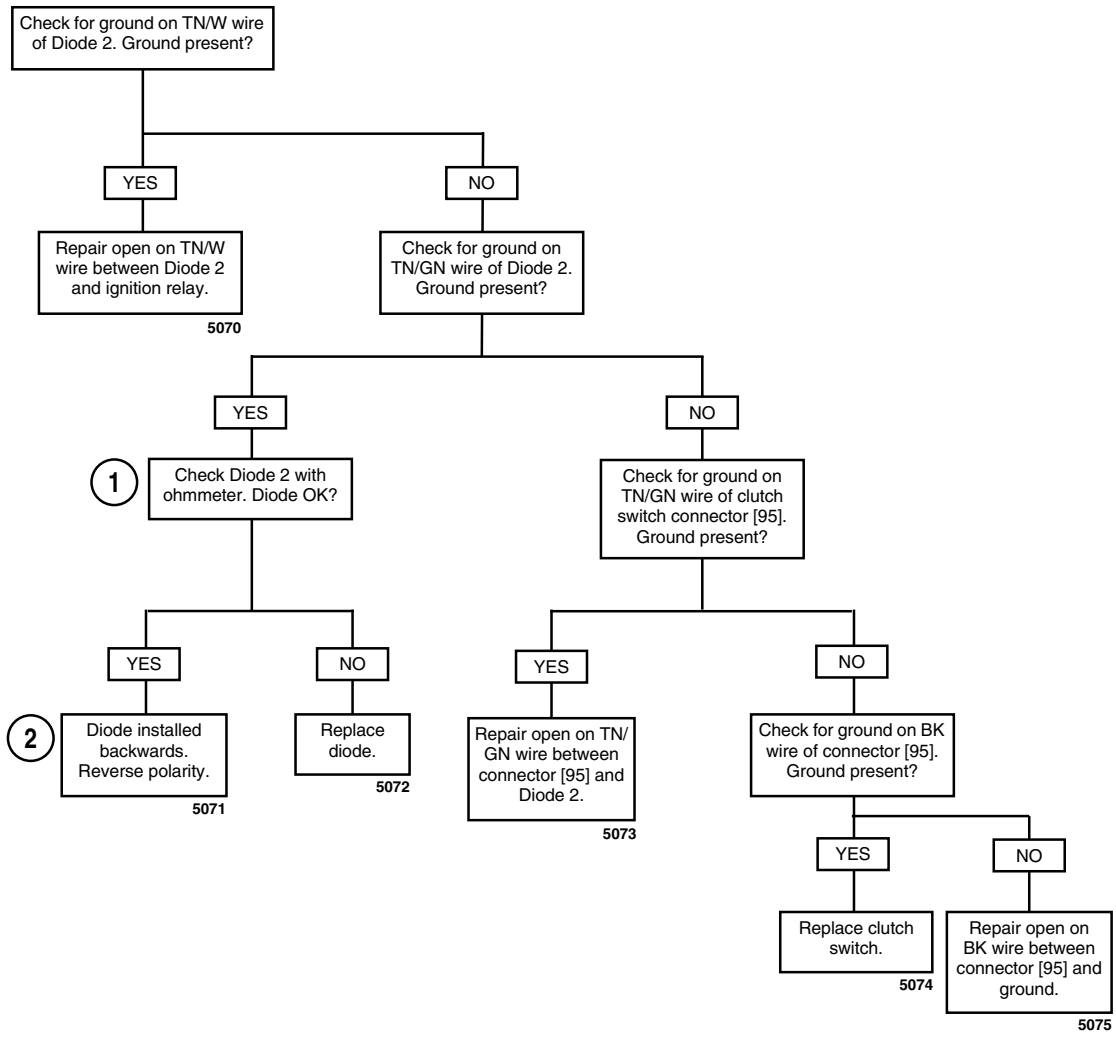
Sta rter Test (Part 1 of 2)

CONDITION: Sidestand down, key ON, transmission in neutral and clutch engaged



Starter Test (Part 2 of 2)

CONDITION: Sidestand down, key ON, transmission in gear and clutch disengaged



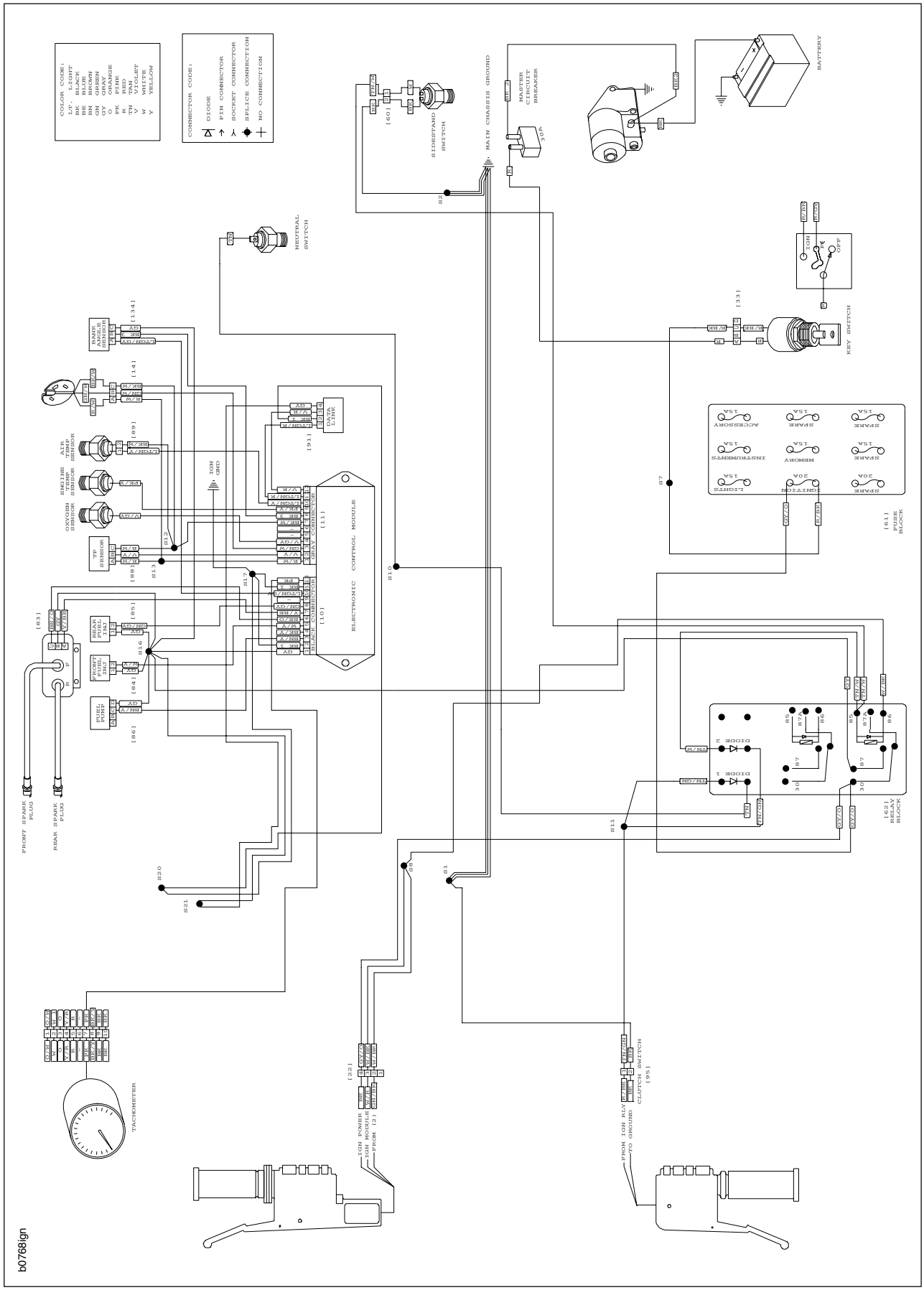


Figure 7-8. Starter/Ignition Interlock System

TESTING/REPLACEMENT

Side Stand Switch

See Figure 7-9. The side stand switch is a simple spring loaded plunger. The switch completes a path to ground for the ignition relay when the side stand is in the retracted position. Test the switch as follows:

1. Unplug the 2-place side stand switch connector [60].
2. Test the switch using an ohmmeter.
   a. With side stand down (1) (switch open), the switch should show ∞ ohms (infinite ohms).
   b. With side stand up (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary. Remove side stand switch from frame by removing two nuts.

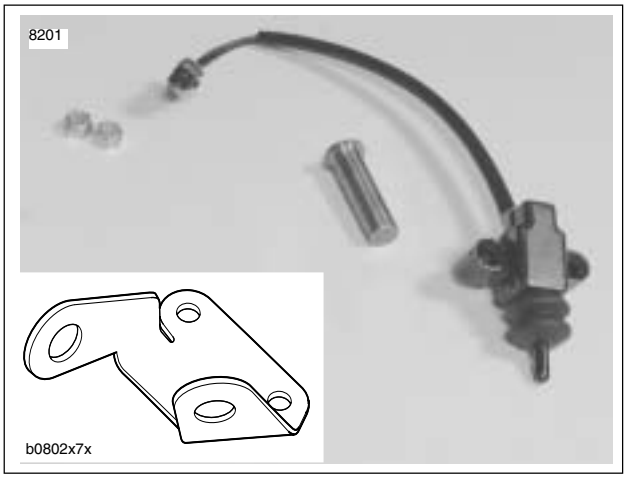
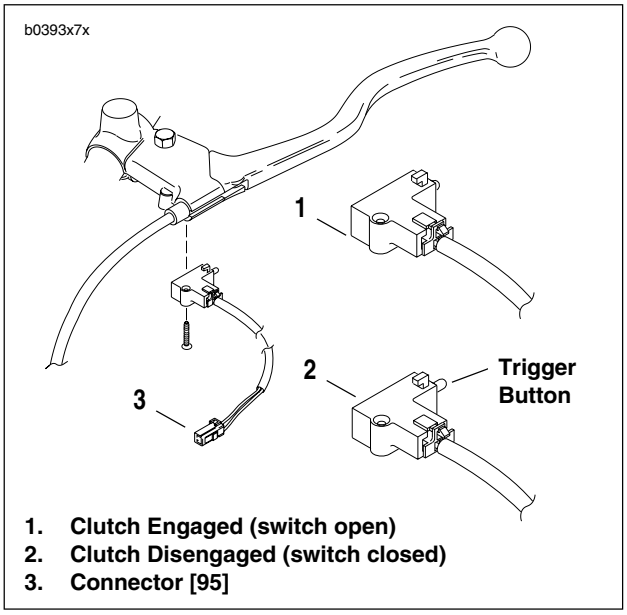


Figure 7-9. Side Stand Switch and Bracket

Clutch Switch

See Figure 7-10. The clutch switch attaches to the clutch control lever bracket. The switch completes a path to ground for the ignition relay and the starter relay when the clutch is disengaged. Test the switch as follows:

1. Unplug the 2-place clutch switch connector [95].
2. Test the switch using an ohmmeter.
   a. With clutch engaged (1) (switch open), the switch should show ∞ ohms (infinite ohms).
   b. With clutch disengaged (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary.
   a. Remove small Phillips screw.
   b. Depress clutch lever and hold.
   c. Detach switch by depressing switch trigger button and pulling switch towards the end of the handlebar.
   d. Install **new** switch.



1. Clutch Engaged (switch open)
2. Clutch Disengaged (switch closed)
3. Connector [95]

Figure 7-10. Clutch Switch

Ignition Relay

See Figure 7-11. The ignition relay is under the seat. Test the relay as follows:

1. See Figure 7-12. Remove seat and locate ignition relay (1) within relay/diode block.
2. Test the relay in the same fashion as the starter relay. See Section 5.
3. Replace the relay with a **new** relay if necessary.

Starter Relay

The starter relay (2) is under the seat. See 5.3 STARTING SYSTEM DIAGNOSIS.

Ignition Fuse

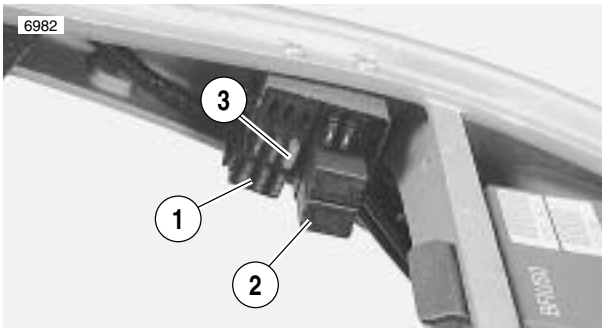
See Figure 7-11. The ignition fuse (3) is in the fuse block under the seat. Always replace the fuse with another 20 ampere fuse.

Diodes

1. Remove seat and locate diodes within relay block (2).
2. Test diodes using Starter Test flow charts under DIAGNOSTICS.
3. Identify the diode which must be replaced. Replace both diodes if necessary.
4. Replace the diodes by pulling them straight out. The spare diode may be used in either circuit as long as it is installed in the correct direction.

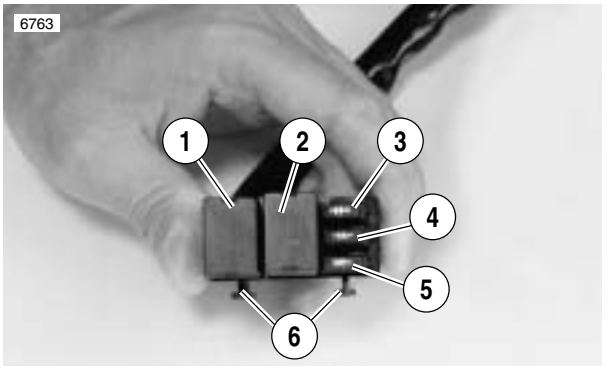
Main Circuit Breaker

Attached to the frame above the battery, the main circuit breaker links the ignition key switch and the battery. See 7.23 FUSES AND CIRCUIT BREAKERS for more information.



1. **Fuse Block**
2. **Relay Block**
3. **Ignition Fuse**

Figure 7-11. Fuse and Relay Blocks



1. **Ignition Relay**
2. **Starter Relay**
3. **Starter Circuit Diode**
4. **Ignition Circuit Diode**
5. **Spare Diode**
6. **Mounting Tabs**

Figure 7-12. Ignition Relay and Diodes