

CHAPTER 6. ELECTRICAL

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CHAPTER 6. ELECTRICAL

6-1. STARTER

A. Armature

1. If the commutator surface is dirty, clean with #600 grit sandpaper as shown in the drawing below.
After sanding, wash thoroughly with electrical contact cleaner and dry with high-pressure air steam.
2. The mica insulation between commutator segments should be 0.5 ~ 0.8 mm (0.02-0.03 in). below the segment level. If not, scrape to proper limits with appropriately shaped tool. (A hacksaw blade can be ground to fit).
3. Each commutator segment should show zero ohm resistance to the others and at least $3M\Omega$ resistance to the core. If there is less than $3M\Omega$ resistance to the core, or one of segments is open, replace the armature.

In addition, the armature can be placed on a "growler" (testing device) and checked magnetically for internal shorts. Follow manufacturer's test recommendations.

4. If the commutator surface shows heavy scoring, it can be turned down on a lathe or commutator turning machine. Check the specification chart for minimum allowable commutator diameter. Recut the mica after.

NOTE: _____
Should turning be required, check the condition of the cover bearings, armature electrical properties starter amperage draw and rpm and, finally, carbon brushes.

B. Yoke

1. If the yoke area is dirty, clean with clean solvent and dry with high-pressure air.
2. Yoke coil resistance is 0.05 ohm.
The coil should be show zero ohm resistance, if it shows more than zero ohm, replace it.
If the yoke shows leakage to ground (re-

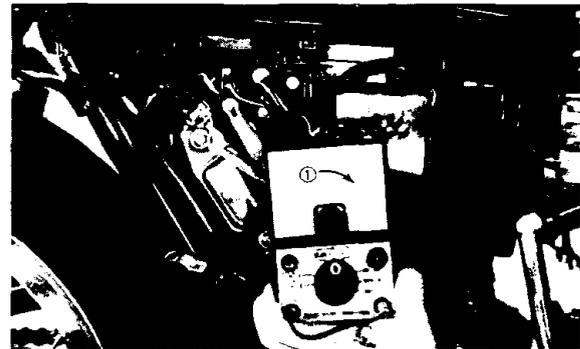
sistance is less then 100 $k\Omega$) replace it.

NOTE: _____
Immediately after cleaning, the yoke may show some insulation leakage. Wait for it to thoroughly dry before checking or re-installing.

C. Starter relay switch

1. Inspection

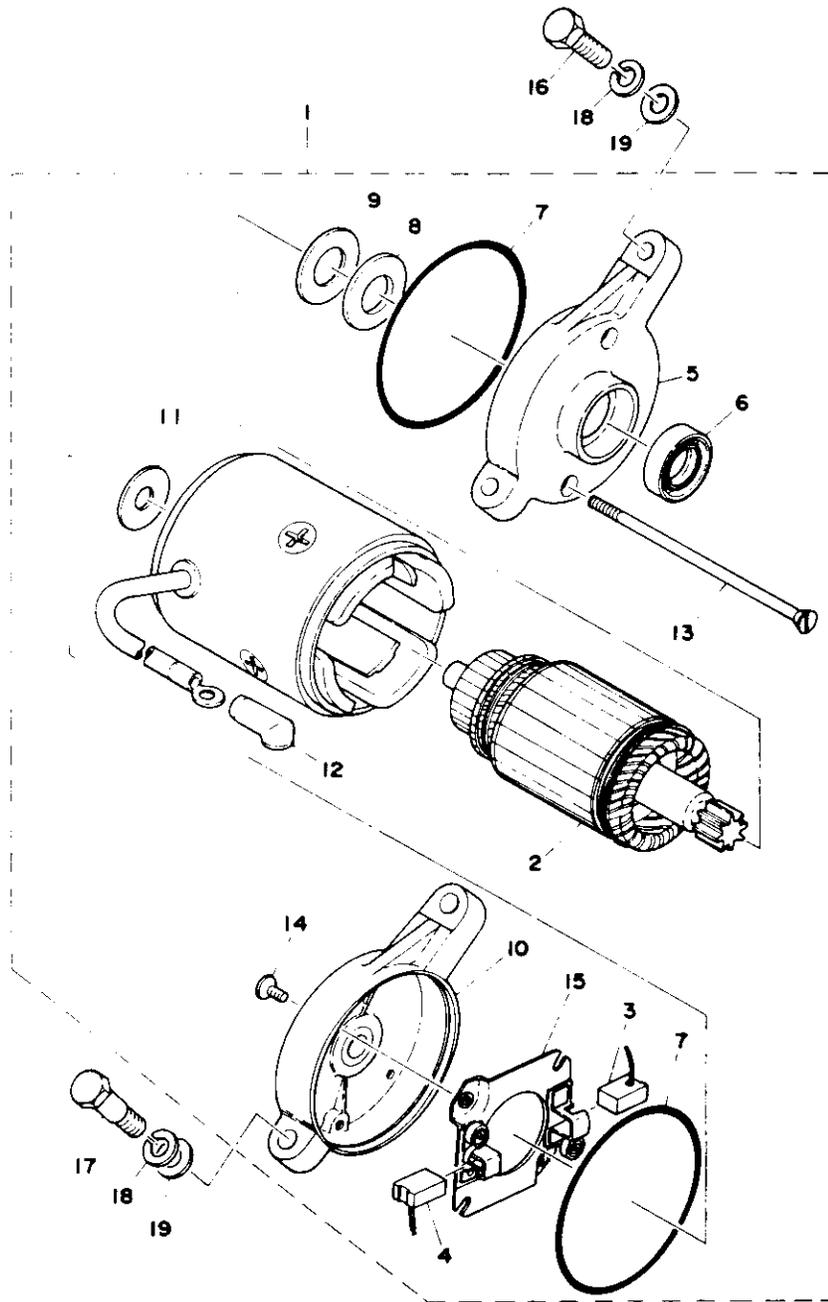
- a. Disconnect starter relay leads at the relay.
- b. Connect pocket tester leads to the relay terminals (ohm x 1 scale).
- c. Turn ignition ON ("1" position) and engine stop switch to "RUN".
- d. Push starter button. The relay should click once and the scale should read zero ohm. If the relay clicks but the scale does not read zero, the relay must be replaced.



1. Starter button "ON"

- e. If the relay does not click, check the wires from the starter button and the battery (red/white, blue/white). Turn ignition off. Use (ohm x 1) scale on tester. The resistance between these wires should be no more than 3.5Ω . If there is more resistance, the relay should be replaced.

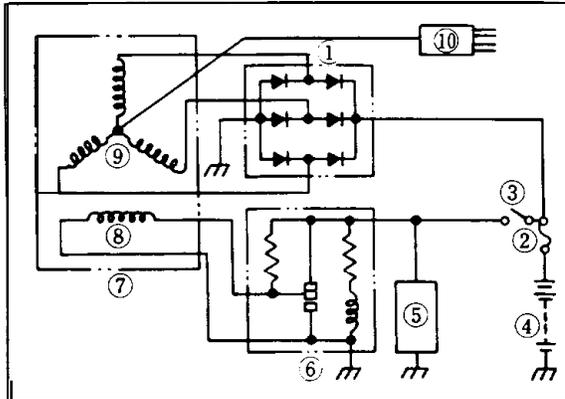
STARTING MOTOR



- | | |
|----------------------------|---------------------|
| 1. Starting motor Ass'y | 11. Thrust 2 washer |
| 2. Armature | 12. Cap |
| 3. Brush 1 | 13. Special screw |
| 4. Brush 2 | 14. Flathead screw |
| 5. Starting motor 1 cover | 15. Brush holder |
| 6. Oil seal | 16. Bolt |
| 7. O-ring | 17. Hexagon bolt |
| 8. Special washer | 18. Spring washer |
| 9. Thrust 1 washer | 19. Plain washer |
| 10. Starting motor 2 cover | |

6-2. CHARGING SYSTEM

A. Charging circuit diagram



- | | | |
|----------------|----------------------|----------------|
| 1. Rectifier | 4. Load | 9. Stator coil |
| 2. Fuse | 6. Voltage regulator | 10. Relay unit |
| 3. Main switch | 7. A.C. Generator | |
| 4. Battery | 8. Field coil | |

B. A.C. Generator

1. Checking method.

- Connect D.C. voltmeter to the battery terminals. Battery should be fully charged.
- Start engine.
- Accelerate engine to approximately 2,000 rpm or more and check generated voltage.

Generated voltage:
 $14.5 \pm 0.5 \text{ v}$

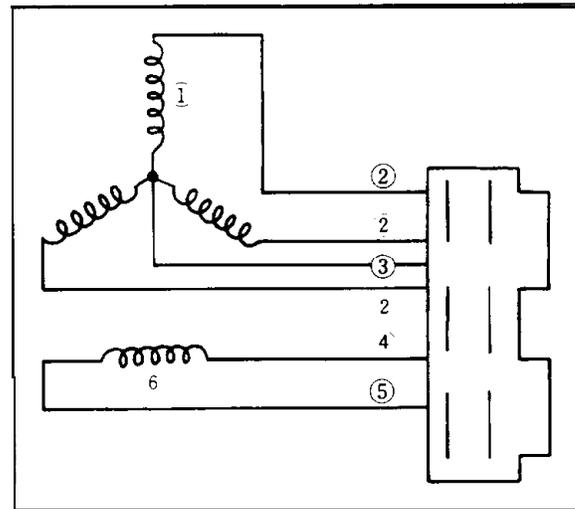
- If the indicated voltage cannot be reached, then perform the tests in step 2.

NOTE:

Never disconnect wires from the battery while the generator is in operation. If the battery is disconnected, the voltage across the generator terminals will increase, damaging the diodes.

- Resistance test of field coil and stator coil. Check the resistance between terminals. If resistance is out of specification, coil is broken. Check the coil connections. If the coil connections are good, then the coil is broken inside and it should be replaced.

Field coil resistance:
(Green-Black)
 $5.25\Omega \pm 10\%$ at 20°C
Stator coil resistance:
(W1-W2, W2-W3, W3-W1)
 $0.46\Omega \pm 10\%$ at 20°C

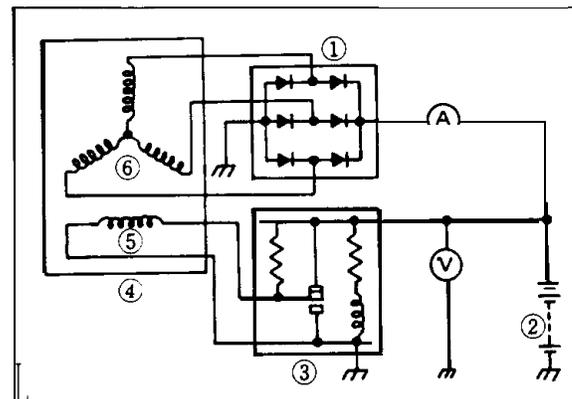


- | | |
|---------------------------|---------------|
| 1. Stator coil | 4. Black |
| 2. White | 5. Sky blue |
| 3. Yellow (Pick up cable) | 6. Field coil |

C. Voltage regulator

The regulator's function is to pass a controlled amount of current through the field windings which creates a magnetic field that produces a charging voltage in the three stator windings.

- When adjusting the regulator, a D.C. voltmeter, ammeter, and tachometer are necessary. They are connected as illustrated, and adjustment should be made in the following sequence:

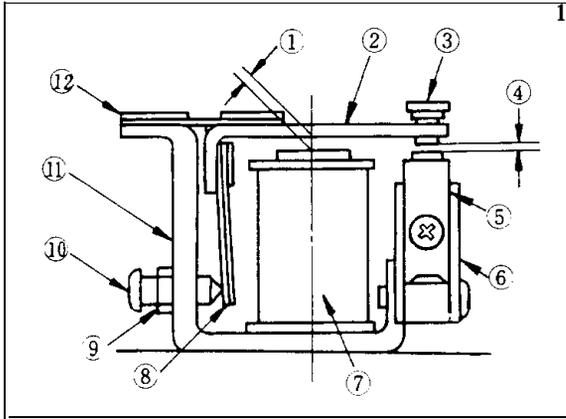


- | | | |
|--------------|----------------------|------------------|
| A. Ammeter | 1. Rectifier | 4. AC. Generator |
| V. Voltmeter | 2. Battery | 6. Field coil |
| | 3. Voltage regulator | 6. Stator coil |

- Remove the regulator from the frame, and check the contact points. If the point surfaces are rough, they should be smoothed with sand paper (#500 or #600). After sandpapering, thoroughly clean contact points with contact point cleaner.

b. Check the core and points for gap adjustment. If any gap is incorrect, it should be adjusted.

First adjust the core gap and then the point gap
 Core gap 0.6 ~ 1.0 mm
 Point gap 0.3 ~ 0.4 mm



- 1 Core gap
- 2 Armature
- 3 Lower contact
- 4 Point gap
- 5 upper contact
- 6 Contact set
- 7 Coil
- 8 Adjusting spring
- 9 Locknut
- 10 Adjusting screw
- 11 Yoke
- 12 Contact spring

c. Charging voltage output can be controlled at the regulator. Inside the housing is a screw that pushes against a flat spring steel plate. This is the adjusting screw.

d. Before starting engine, disconnect wire connector (coupler) containing 5 wires from rectifier (1 red, 1 black, 3 white). Remove the RED wire from the connector. Connect pocket tester (DC20V) red tester lead (+) to red wire from rectifier. Connect tester black (-) to good ground. Start engine. Tester should indicate 14.5 ~ 15 V (DC).

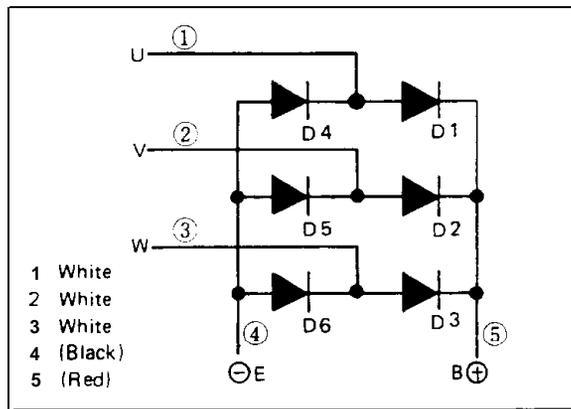
CAUTION:
 Take care to not short the red wire. If this wire is shorted, the rectifier could be damaged.

D. Checking silicon rectifier

1. Check silicon rectifier as specified using the Yamaha Pocket Tester.

Continuity: Con

Checking element	Pocket tester connecting point		Element O.K.	Replace (element shorted)	Replace (element opened)
	(+) (red)	(-) (black)			
D1	B U	U B	Con ∞	Con Con	
D2	B V	V B	Con ∞	Con Con	
D3	B W	W B	Con ∞	Con Con	∞
D4	U E	E U	Con ∞	Con Con	∞ ∞
D5	V E	E V	Con ∞	Con Con	∞ ∞
D6	W E	E W	Con ∞	Con Con	∞



Even if only one element is broken, replace assembly.

CAUTION:
 The silicon rectifier can be damaged if subjected to overcharging. Special care should be taken to avoid a short circuit, and/or incorrect connection of the positive and negative leads at the battery. Never connect the rectifier directly to the battery to make a check.

E. Battery

1. Checking

- a. If battery sulfation (white accumulation) occurs on plates due to lack of battery electrolyte, the battery should be replaced.
 - b. If the bottoms of the cells are filled with corrosive material falling off the plates, the battery should be replaced.
2. The service life of a battery is usually 2 to 3 years, but lack of care as described below will shorten the life of the battery.

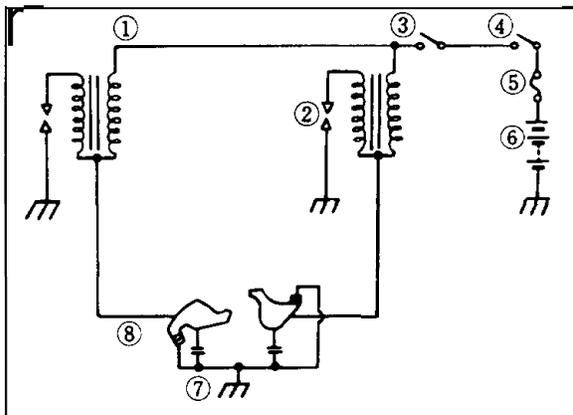
- a. Negligence in keeping battery topped off with distilled water.
- b. Battery being left discharged.
- c. Over-charging with heavy charge.
- d. Freezing.
- e. Filling with water or sulfuric acid containing impurities.
- f. Improper charging voltage or current on new battery.

Battery	12V, 14AH
Electrolyte	Specific gravity: 1.28
Initial charging current	1.4 amp (new battery)
Recharging current	1.4 amp until specific gravity reaches 1.28
Refill fluid	Distilled water (to maximum level line)
Refill period	Check once per month (or more often, as required)

3. If the motorcycle is not to be used for a long time, remove the battery and have it stored. The following instructions should be observed :
 - a. Recharge the battery periodically.
 - b. Store the battery in a cool, dry place.
 - c. Recharge the battery before reinstallation.

6-3. IGNITION SYSTEM

A. Ignition circuit diagram



- | | |
|-----------------------|--------------------|
| 1. Ignition coil | 5. Fuse (20A) |
| 2. Spark plug | 6. Battery |
| 3. Engine stop switch | 7. Condenser |
| 4. Main switch | 8. Contact breaker |

B. Governor assembly

1. Inspection
 - a. Both weights must pivot smoothly or ignition advance will not occur at the

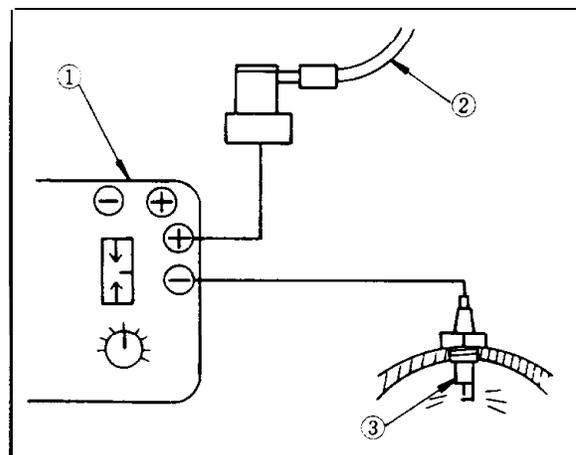
proper rpm, nor will it advance to its fullest extent. On occasion, lightweight grease must be applied to the weight pivot pins.

- b. Check the operation of the point cam on the shaft. It must rotate smoothly.
- c. Examine point cam surface. If surface is pitted or worn, the governor assembly must be replaced.

C. Spark gap test

The entire ignition system can be checked for misfire and weak spark using the Electro Tester. If the ignition system will fire across a sufficient gap, the engine ignition system can be considered good. If not, proceed with individual component tests until the problem is found.

1. Warm up engine thoroughly so that all electrical components are at operating temperature.
2. Stop engine and connect tester as shown.



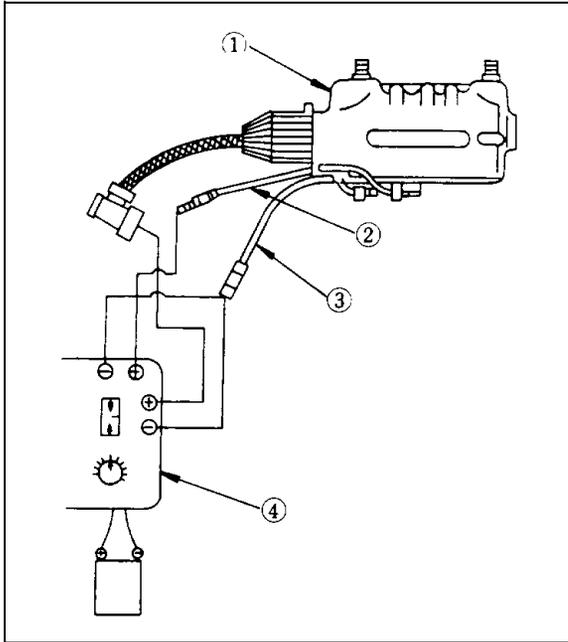
1. Electro tester
2. Plug wire from coil
3. Spark plug

3. Start engine and increase spark gap until misfire occurs. (Test at various rpm's between idle and red line.)

**Minimum spark gap:
6 mm (0.24 in)**

D. Ignition coil

1. Coil spark gap test.
 - a. Remove fuel tank and disconnect ignition coil from wire harness and spark plug.
 - b. Connect Electro Tester as shown.

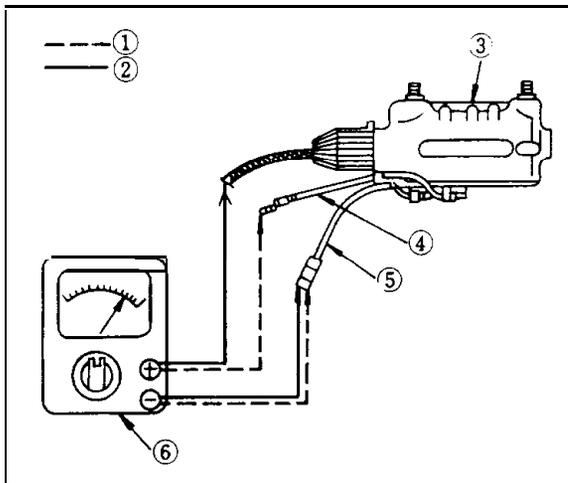


1. Ignition coil 3. Orange
2. Red/white 4. Electro tester

- c. Connect fully charged battery to tester.
- d. Turn on spark gap switch and increase gap until misfire occurs.

**Minimum spark gap:
6 mm (0.24 in)**

2. Direct current resistance test.
Use a pocket tester or equivalent ohmmeter to determine resistance and continuity of primary and secondary coil windings.



1. Primary coil resistance value 4. Red/white
2. Secondary coil resistance value 5. Orange
3. Ignition coil 6. Ohmmeter ($\Omega \times 1$)

Standard values:

Primary coil resistance:

$3.9\Omega \pm 10\%$ at 20°C

Secondary coil resistance:

$8\text{K}\Omega \pm 20\%$ at 20°C

E. Condenser test

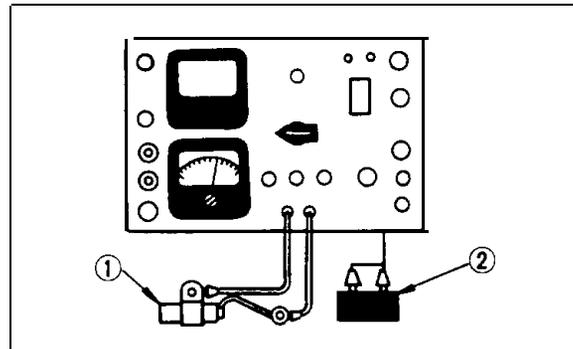
If the contact points show excessive wear, or the spark is weak (but the ignition coil is in good condition), check the condenser.

1. Capacity test (use Electro Tester).
 - a. Calibrate capacity scale.
 - b. Connect tester.
 - c. Meter needle will deflect and return to center as condenser is charged. After needle stops, note reading on " μF " scale.

Condenser capacity:

$0.22\mu\text{F} \pm 10\%$

2. Insulation test.
 - a. Connect ohmmeter as shown ($\Omega \times 1,000$ or more).
 - b. Resistance reading should be ∞ or at least 3MR. If less, replace.



1. Condenser
2. Battery

CAUTION:

After this measurement, the condenser should be discharged by shorting the positive lead wire to the condenser case.

6-4. SPARK PLUG

The life of a spark plug and its discoloring vary according to the habits of the rider. At each periodic inspection, replace burned or fouled plugs with suitable ones determined by the color and condition of the bad plugs.

One machine may be ridden only in urban areas at low speeds; another may be ridden for hours at high speed. Confirm what the present plugs indicate by asking the rider how long and how fast he rides. Recommend a hot, standard, or cold plug type accordingly. It is actually economical to install new plugs often since it will tend to keep the engine in good condition and prevent excessive fuel consumption.

A. How to "Read" a spark plug (condition)

1. **Best condition:** When the porcelain around the center electrode is a light tan color.
2. If the electrodes and porcelain are black and somewhat oily, replace the plug with a hotter type for low speed riding.
3. If the porcelain is burned or glazed white and/or the electrodes are partially burned away, replace the plug with a colder type for high speed riding.

B. inspection

Instruct the rider to:

1. Inspect and clean the spark plug every 3,200 km. (2,000 mil)
2. Clean the electrodes of carbon and adjust the electrode gap.
3. Be sure to use the proper reach plug as a replacement to avoid overheating, fouling or piston damage.

Spark plug type: N-7Y (Champion) or BP7ES (NGK)
--

Spark plug gap: 0.7 ~ 0.8 mm (0.027 ~ 0.031 in)
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6-5. LIGHTING AND SIGNAL SYSTEMS

A. Lighting tests and checks

The battery provides power for operation of the horn, tail light, stop light, neutral light, and flasher light. If none of the above

operates, always check battery voltage before proceeding further. Low battery voltage indicates either a faulty battery, low battery water, or a defective charging system. See section 6-2 Charging System, for checks of battery and charging system. Also check fuse condition. Replace any "open" fuses. There are individual fuses for various circuits.

1. Horn does not work:
 - a. Check for 12V on brown wire to horn.
 - b. Check for good grounding of horn (pink wire) when horn button is pressed.
2. Stop light does not work:
 - a. Check bulb.
 - b. Check for 12V on yellow wire to stop light.
 - c. Check for 12V on brown wire to each stop light switch (front brake and rear brake switches).
3. Tail light does not work:
 - a. Check bulb.
 - b. Check for 12V on blue wire.
 - c. Check for ground on black wire to tail/stop light assembly.
4. Flasher light(s) do not work:
 - a. Check bulb.
 - b. Right circuit:
 - 1) Check for 12V on dark green wire to light.
 - 2) Check for ground on black wire to light assembly.
 - c. Left circuit:
 - 1) Check for 12V on dark brown wire to light.
 - 2) Check for ground on black wire to light assembly.
 - d. Right and left circuits do not work:
 - 1) Check for 12V on brown/white wire to flasher switch on left handlebar.
 - 2) Check for 12V on brown wire to flasher relay.
 - 3) Replace flasher relay.
 - 4) Replace flasher switch.
 - e. Check flasher self-canceling system. (Refer to flasher self-canceling system.)
5. Neutral light does not work:
 - a. Check bulb.
 - b. Check for 12V on sky blue wire to neutral switch.
 - c. Replace neutral switch.

B. Reserve lighting system

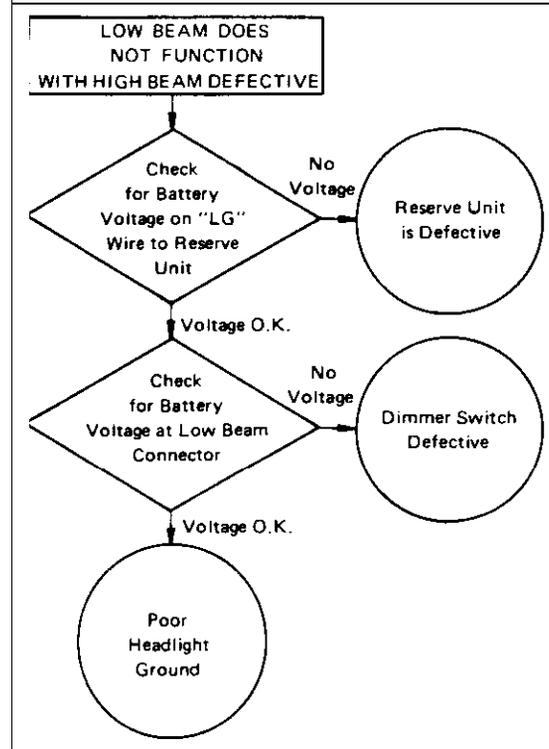
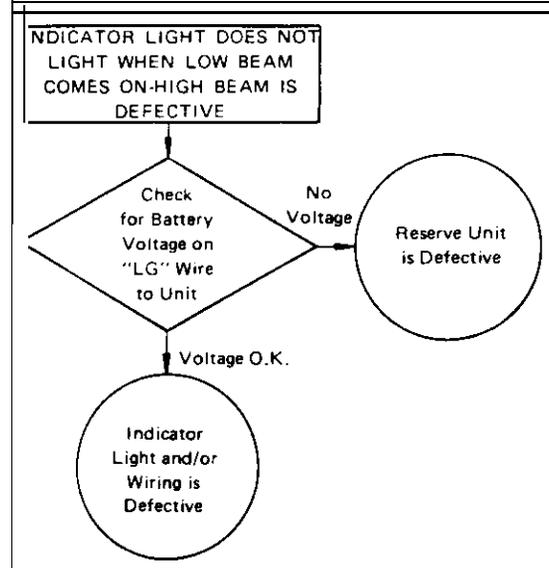
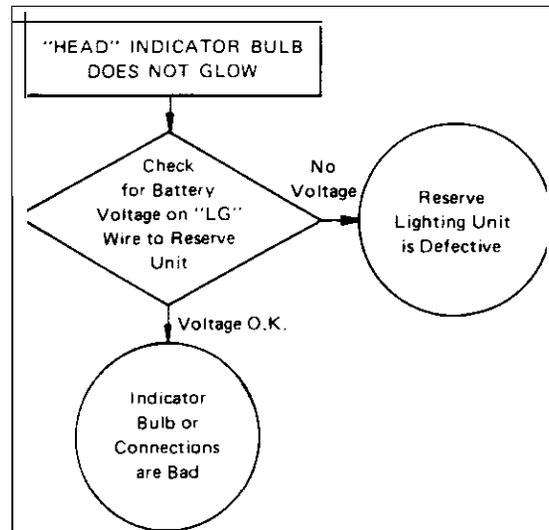
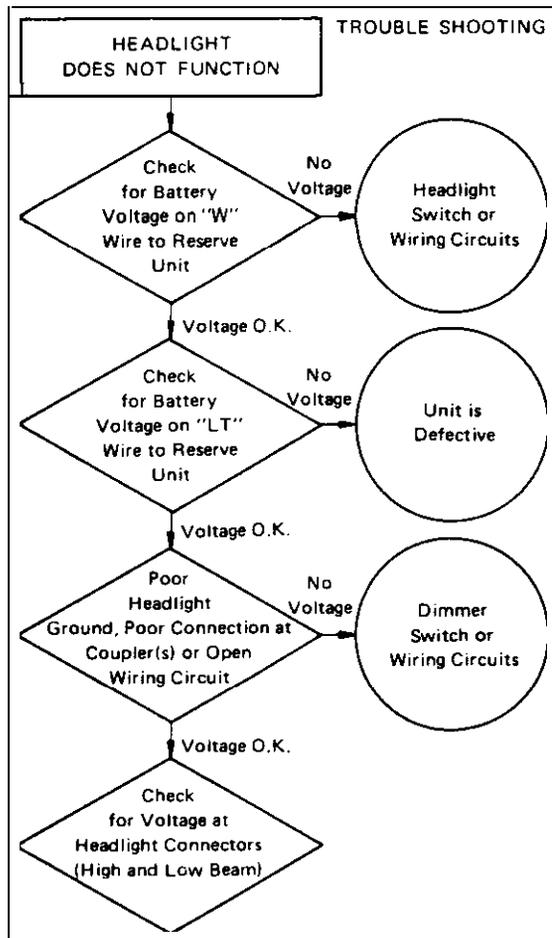
1. Description:

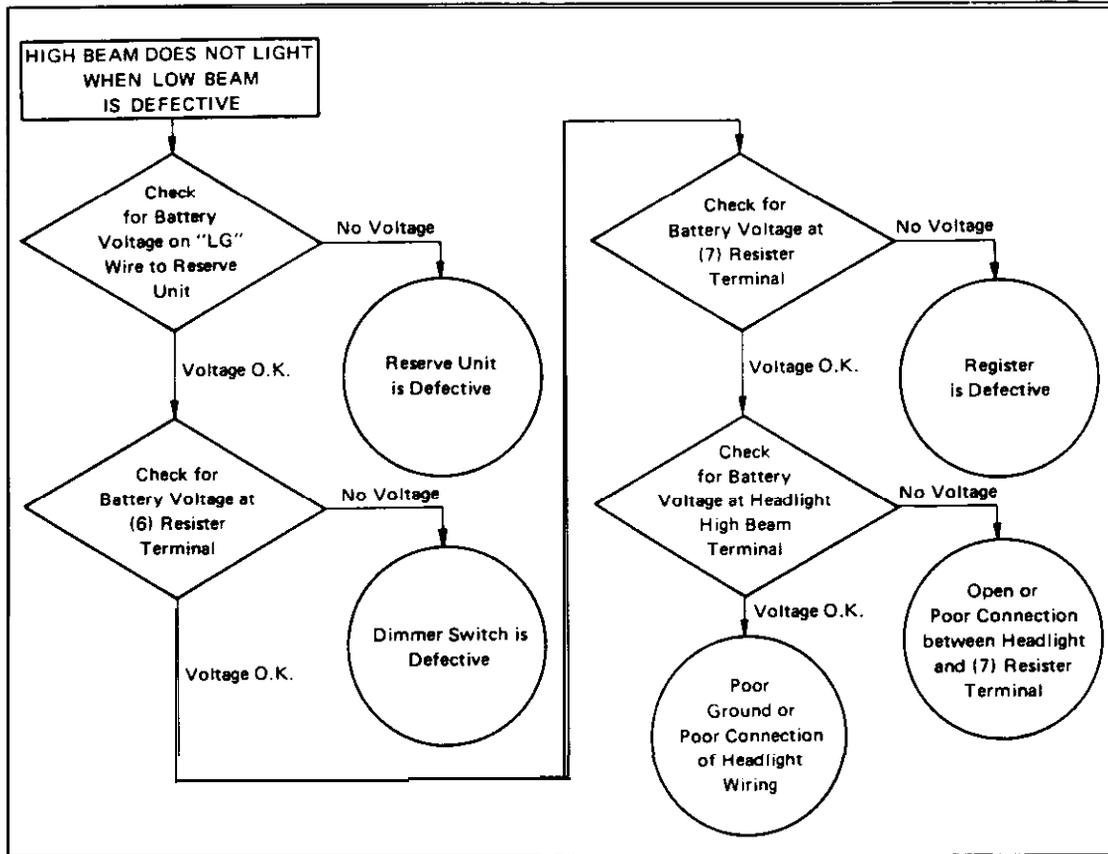
The reserve lighting system has two functions: (1) It notifies the rider that one of the head lamp filaments is inoperative, and (2) it switches current from the inoperative filament to the remaining functional filament.

The system is connected to the headlight circuit only. The reserve lighting system unit is located under the fuel tank.

HEADLIGHT CONDITION	"HEAD" INDICATOR LIGHT	RESERVE LIGHTING FUNCTION
Normal	* Comes on (very dim)
High beam faulty	Comes on	Low beam comes on
Low beam faulty	Comes on	High beam comes on at low brilliance

*Can only be seen by removing cover and inspecting bulb.





C. Self-canceling flasher system

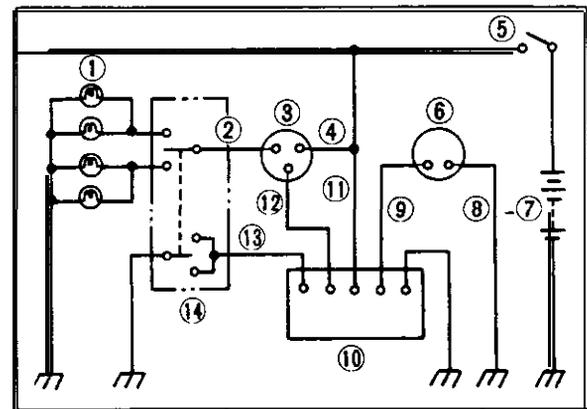
1. Description

The self-canceling flasher system turns off the turn signal after a period of time or distance involved in turning or changing lanes. Generally, the signal will cancel after either 10 seconds, or 130 meters, whichever is greater. At very low speed, the function is determined by distance; at high speed, it is determined by time. At low speed, especially when changing speeds, the canceling determination is a combination of both time and distance.

2. Operation:

The handle switch has three positions: L (left), OFF, and R (right). The switch lever will return to the "OFF" position after being pushed to L or R, but the signal will function. By pushing the lever in, the signal may be cancelled manually,

3. Circuit diagram.



1. Flasher light
2. Brown/White
3. Flasher relay
4. Brown
5. Main switch
6. Speedometer sensor
7. Buffery
8. Black
9. White/Green
10. Flasher cancelling unit
11. Brown
12. Yellow/green
13. Yellow/red
14. Handle switch

4. Inspection:

If the flasher self-canceling system should become inoperative, proceed as follows:

- a. Pull off the 6-pin connector from the flasher canceling unit, and operate the handle switch. If the signal operates normally in L, R, and OFF, the following are in good condition:

- 1) Flasher unit.
- 2) Bulb.
- 3) Lighting circuit.
- 4) Handle switch light circuit.

If (1) through (4) are in good condition, the following may be faulty:

- 1) Flasher canceling unit.
- 2) Handle switch reset circuit.
- 3) Speedometer sensor circuit.

- b. Pull off the 6-pin connector from the flasher canceling unit, and connect a tester ($\Omega \times 100$ range) across the white/green and the black lead wires on the wire harness side. Turn the speedometer shaft. If the tester needle swings back and forth, four times between 0 and ∞ , the speedometer sensor circuit is in good condition. If not, the sensor or wire harness may be inoperative.
- c. Pull off the 6-pin connector from the flasher canceling unit. Check if there is continuity between the yellow/red lead wire on the wire harness side and the chassis.

Flasher switch OFF ∞
Flasher switch L or R 0Ω

If the test needle does not swing as indicated above, check the handle switch circuit and wire harness.

- d. If no defect is found with the above three check-ups and the flasher canceling system is still inoperative, replace the flasher canceling unit.
- e. If the signal flashes only when the handle switch lever is turned to L or R and it turns off immediately when the handle switch lever returns to center, replace the flasher canceling unit.

