CHARGING SYSTEM (1975 & EARLIER)

ALTERNATOR

GENERAL

The synchro alternator consists of two main components: the rotor (magnetic field) which is mounted on the engine sprocket shaft, and the stator (armature) which is bolted to the engine crankcase.

ROTOR

The rotor is circular in shape with an outer flange that extends over the stator. On the inside of the flange there are twelve (12) pole shoes which are ceramic magnets having a steel inner face and form a field ring of alternate north and south poles, six (6) of each.

STATOR

The stator consists of twelve (12) coils, each wound over a laminated iron core. The coils are positioned radially around the engine crankshaft and bolted to the outside of the engine crankcase.

There are two series windings on the stator, an output winding and a regulator winding. The output winding consists of several strands of wire in parallel, wound around each core, forming a continuous circuit from coil to coil. The regulator winding consists of a single strand of the same size wire also wound continuously around each core from coil to coil, but wound in the reverse direction. The output winding has a center tap which permits full wave rectification in the rectifier-regulator unit, called a module.

RECTIFIER-REGULATOR

GENERAL

The rectifier-regulator module consists of two basic circuits, a rectifying circuit which converts alternating current to direct current and a regulating circuit which controls the voltage output of the alternator. The components of the rectifier-regulator are encapsulated in a rubberized plastic material to form a permanent module. A temperature compensator, which is located in a wiring harness end not encapsulated with the rectifier-regulator components, increases the voltage output of the alternator during colder weather.

OPERATION (Figure 5-8)

When a magnetic pole in the rotor passes over the end of a laminated core in the stator, a current is induced in the stator coils. This current passes through terminal BE and isolation diode (3). When the rotor movement brings the next magnetic pole, which has an opposite polarity, over the laminated core of the coil, the current within the coil reverses in direction. This action occurs simultaneously in all twelve coils, with six (6) coils having current induced in one direction and the remaining six (6) in the other direction. As the twelve (12) sets of rotor magnets move to the next set of stator coils, the current in all the stator coils reverses.

Current flow into the rectifier-regulator module can only enter through isolation diode (3). Rectifier diodes (1) and (2) prevent reverse current from entering the rectifier-regulator diode. Since terminal (BE) is center tapped to each coil, there will be current flow into the rectifier-regulator during each current reversal (half cycle). This results in a full wave rectification of the single phase AC output of the stator.

The center tap alternator-to-rectifier arrangement prevents damage to the alternator system in the event of incorrect battery or booster battery connection. One half of the output producing winding is in series with each diode. Isolation diode (3) isolates the stator from the battery in the event of a stator coil ground or rectifier short and also improves dead battery rechange capability.

The voltage control (regulator) circuit consists of a silicon controlled rectifier (SCR) (4), capacitor (5), resistor (6), thermistor (7) and zener diodes (8) and (9). When the system voltage across A and B exceeds the rated values (approximately 14 volts) of the zener diodes (8) and (9), the zener diodes conduct and apply a voltage to the control element of SCR (4). When the voltage reaches a predetermined value, the SCR (4) allows a proportionate flow of current through the alternator regulating windings to ground at terminal B. An increase of current flow in the alternator regulator windings opposes the current flow in the stator output windings and the power from the output windngs is decreased. Conversely, a decrease in system voltage across A and B below the rated values of the zener diodes (8) and (9) would produce an increase in power from the stator output windings. In this manner, the voltage regulator senses the system voltage across the battery and supplies the necessary regulating current for limiting it to a predetermined value.

The thermistor (7) is a temperature compensating resistor which controls the operating point of the zener diode (8) so that a higher system voltage is produced when needed in cold weather and a lower system voltage in hot weather.

Capacitor (5) serves to suppress transient voltages in the system.

PRECAUTIONS to be exercised with alternator charging system.

1. DO NOT reverse battery connections. This is for a negative ground system only.

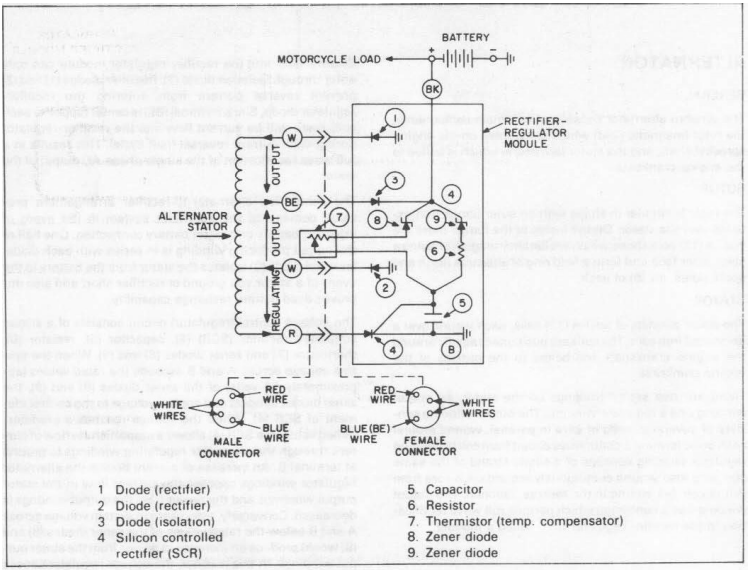
2. Connect booster batteries properly: positive to positive and negative to negative.

3. DO NOT polarize the alternator.

4. DO NOT ground any wires from stator or modules which terminate at connectors.

5. DO NOT operate engine with battery disconnected from system.

6. Disconnect negative battery lead if battery charger is used to charge battery.



1 Diode (rectifier)
2 Diode (rectifier)
3 Diode (isolation)
4 Silicon controlled rectifier (SCR)
5. Capacitor
6. Resistor
7. Thermistor (temp. compensator)
8. Zener diode
9. Zener diode

Figure 5-8. Charging System - Schematic Diagram

7 Never use a fast battery charger to boost the battery output to start engine.

8 The connector used at crankcase prevents incorrect wiring from the stator to the rectifier and regulator module. To prevent damage to module, DO NOT CONNECT OR DISCONNECT PLUG WHILE ENGINE IS RUNNING.

9 The rectifier and regulator modules are grounded to the engine and therefore should not be removed and mounted at some remote location. This is a negative ground circuit. Be sure battery is grounded properly to frame and engine.

CHECKING CHARGING SYSTEM

GENERAL

When the charging system fails or is not charging at a satisfactory rate, as is visually evidenced by a weak battery and dim lights, it is recommended that the following checks be made.

PRELIMINARY CHECKS

Battery: Check for weak or bad battery. See Battery Section. Battery must be fully charged for following electrical tests.

Wiring: Check for corroded or loose connections in charging circuit. Regulator module base must have a good, clean, tight connection to engine crankcase for proper grounding.

ELECTRICAL CHECKS

If the preliminary inspection shows components to be in good condition, make the following electrical checks: (See Figures 5-9 and 5-10.)

1. Regulating Voltage Check: Connect an ammeter in series with the alternator output (blue wire terminal at battery). Connect load rheostat (carbon pile) and voltmeter across battery. Check regulating voltage while running engine at 3600 rpm.

Turn load rheostat (or carbon pile) to off position. With engine and module stabilized at operating temperature voltage reading should be between 13.8 and 15.0 volts at 3.5 amperes output with 75° air temperature measured near the regulator thermistor (in wire).

NOTE

Voltage will vary with air temperature as shown in curve and should be within limits shown for any temperature. (See Figure 5-12.)

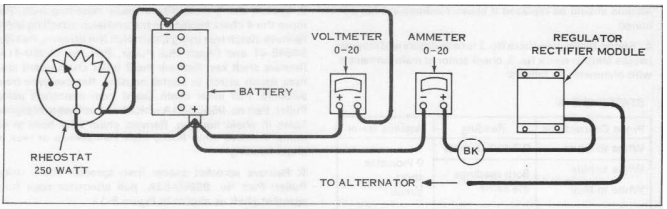


Figure 5-9. Test Arrangement with Individual Components

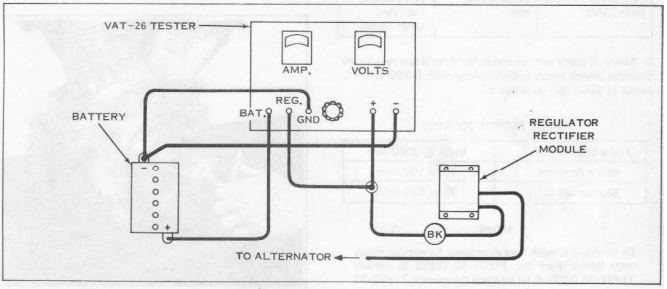


Figure 5-10. Test Arrangement with Sun Vat-26 Tester

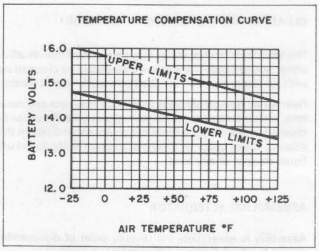


Figure 5-11. Regulating Voltage

2. Output Check: Run engine at 2000 rpm and adjust load rheostat (carbon pile) to obtain a constant 13.0 volts. The alternator output current should be 10.5 amperes minimum. If check is unsatisfactory proceed to check No. 3.

3. If output in check No. 2 is unsatisfactory, check module as follows: Remove module plug from stator plug. With ohmmeter or 12 volt test lamp and battery, check circuits at female connector as follows:

MODULE CHECK

Probe Connections	Reading			
	+ Polarity		- Polarity	
	Light	Ohm-meter	Light	Ohm-meter
White to module base (GND)	Off	Infinity	On	3 to 15
White to module base (GND)	Off	Infinity	On	3 to 15
Blue to black	On	3 to 15	Off	Infinity
Red to module base (GND)	Off	Infinity	Off	Infinity

Module should be replaced if above readings are not obtained.

4. Stator: If output in check No. 2 is satisfactory and module passes tests in check No. 3, check stator at male connector with ohmmeter as follows:

STATOR CHECK

Probe Connections	Reading	Replace Stator
White to white	0.3 to 1.0 ohms	0 indicates short circuit
White to blue White to blue	Both readings the same	
Blue to red	1.5 to 2.0 ohms	
Any pin to module base (GND)	100K ohms min.	Any reading indicates short circuit

5. Stator: If stator passes check No. 4, or if test results are doubtful, check stator output voltage with 0-150 volt A.C. meter at 2000 rpm as follows:

STATOR OUTPUT VOLTAGE

Probe Connections	Volts @ 2000 rpm
White to white	50 to 100 volts
Blue to red	75 to 125 volts

NOTE

To facilitate checks, use Alternator Connector Plugs with Wires, Part No. 71871-70 (1975 & earlier) 71871-75 (1976 & later) Male Connector, 71872-70 (1975 & earlier) or 71872-75 (1976 & later) Female Connector.

DISASSEMBLING ALTERNATOR

1. Remove left footrest and chain housing cover. If motorcycle is equipped with compensating sprocket, use Compensating Sprocket Shaft Nut Wrench, Part No. 94557-55, to remove compensating sprocket shaft nut. If not equipped with compensating sprocket, use 1-3/8 in. socket or box wrench to remove nut. Loosen nut by striking wrench handle several sharp blows with hammer.

2. Remove chain adjuster mounting bolt and large brass starter shaft thrust washer.

3. Remove push rod adjusting screw locknut (nut on center screw on clutch sprocket), slip washer (any metal washer about 1-3/4 in. in diameter with 3/8 in. hole) over push rod adjusting screw and replace locknut. Remove three spring tension adjusting nuts and pull clutch outer disc and spring collar assembly off clutch drive hub pins. Move clutch sprocket and motor sprocket out and remove from shafts with chain.

4. Remove three bolts, attaching chain housing at engine sprocket shaft.

5. Loosen the 5 transmission base mounting nuts. Remove the 4 chain housing to transmission attaching bolts. Remove clutch hub using Clutch Hub Nut Wrench, Part No. 94645-41 and Clutch Hub Puller, Part No. 95960-41A. Remove shaft key. Remove the 2 inner chain guard stud nuts which attach to starter housing. Remove wire from solenoid. Pull inner chain guard from mainshaft using Puller, Part no. 95960-41A which has 4 screws to fit tapped holes in chain housing. Remove chain oiler hose at oil pump. Remove other hoses from connections at back of chain housing.

6. Remove sprocket spacer from sprocket shaft. Using Puller, Part No. 95960-52A, pull alternator rotor from sprocket shaft as shown in Figure 5-12.

7. Remove 4 screws securing stator to crankcase. Disconnect wire plug and remove stator from engine.

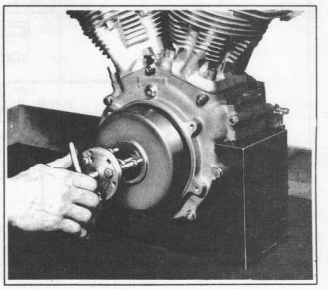


Figure 5-12. Pulling Alternator Rotor

CLEANING AND INSPECTING ALTERNATOR

The alternator rotor or stator may be replaced individually if either is damaged. The stator windings can be checked out with an ohmmeter as described previously in this section.

Remove all foreign particles from rotor magnets and clean rotor and stator before reassembling to engine. Rotor can be cleaned in petroleum solvent but do not clean stator in this solvent. Clean stator by wiping with clean cloth; do not use liquid cleaner of any kind.

ASSEMBLING ALTERNATOR

Assembly is essentially the reverse order of disassembly except for the following differences:

After assembling stator to crankcase and tightening 4 screws to 30-40 in-lbs torque, use Tool, Part No. 97225-55, to press rotor onto sprocket shaft so that it bottoms tightly against seal spacer. See Figure 5-13.

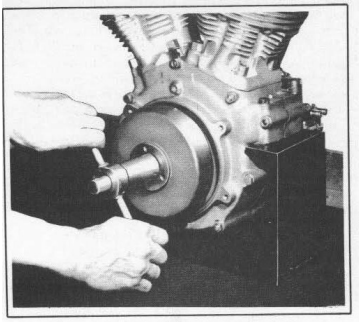


Figure 5-13. Installing Alternator Rotor

Harley-Davidson "Stud and Bearing Mount," Part No. 99626-77, should be applied to transmission shaft ball bearing recess in chain housing and on shaft. Pack ball race with grease after housing is tapped in place. Apply aluminum paint to joining surface of chain housing and transmission. Use new chain housing O-ring in groove of engine crankcase, also use new cover gasket when reassembling.

NOTE

Leave transmission base mounting nuts loose until engine and transmission are secured to chain housing.

NOTE

Engine sprocket is aligned with clutch sprocket by a selection of spacers between sprocket and crankcase bearing. Reinstall same thickness of spacers as was removed, or determine correct spacer size as given in Section 2.

IMPORTANT

After assembly, chain housing must be air tight. Vacuum in chain housing can be checked with Vacuum Gauge, Part No. 96950-68 and should be 20 in. of water or more at 1500 rpm with hose to vent tee closed off. A lower reading than this indicates an air leak into chain housing at gasket, solenoid, starter shaft or hoses.