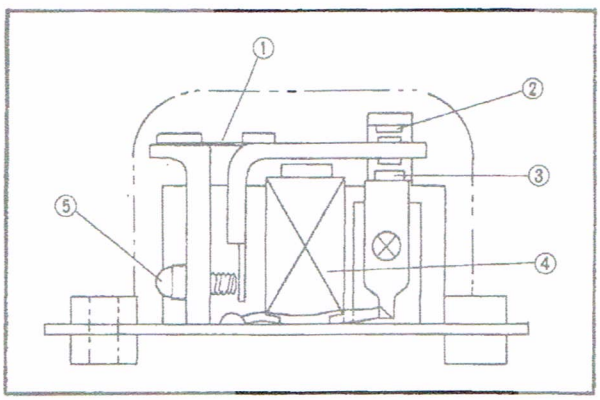
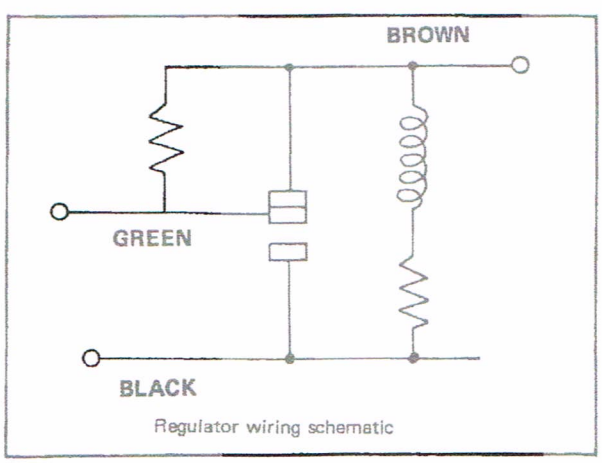
1) Regulator

This circuit consists of the battery to first provide voltage to the rotor field windings, regulator, ACG (alternating current generator), rectifier, and main switch.

a) The regulator's function is to pass a controlled amount of voltage to the rotor windings which create a magnetic field that produces charging voltage in the stator.

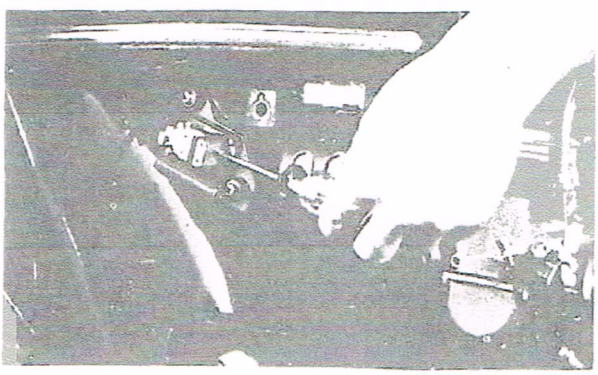




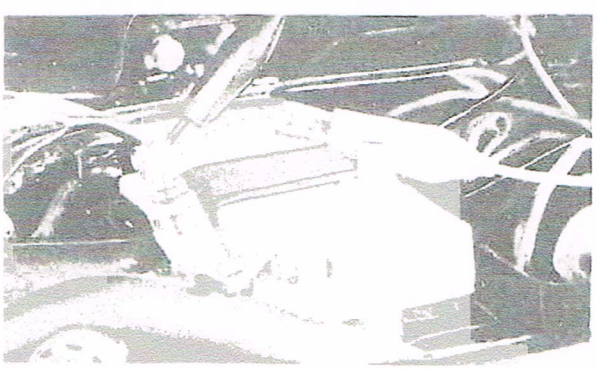
Regulator wiring schematic

b) The regulator operates as a magnetic switch. As charging voltage rises, part of this voltage is routed through an electro-magnet in the regulator. Rising voltage creates greater regulator magnetism, which in turn pulls the central contact point through different positions. Different resistors are switched into the circuit as this central contact point moves. These resistors cut down the amount of voltage passing to the rotor windings, which reduces the charging voltage output.

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.



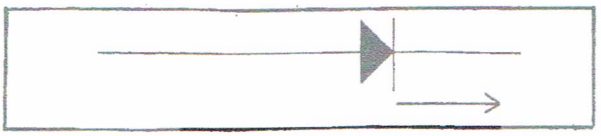
d) Start the engine. Disconnect the fuse box wire leading to the battery and hook up a voltmeter from the fuse box to ground. Accelerate the engine to 2,500 rpm. The voltmeter should read 14.5~15 volts DC. If it varies from this amount twist the adjusting screw in to raise the charging voltage or out to reduce the voltage. Make sure the locknut on the adjusting screw is securely tightened.



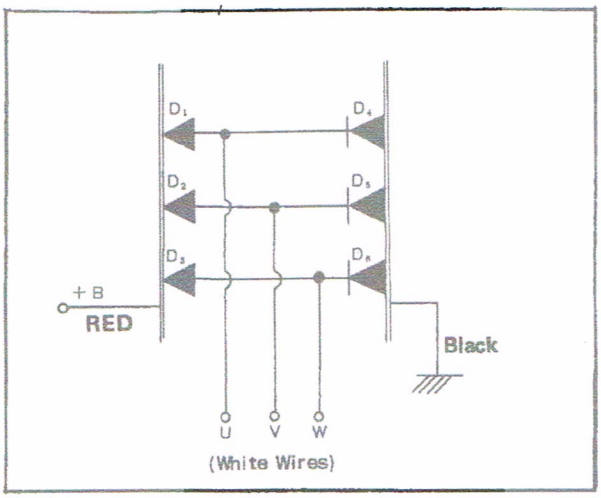
No load voltage test hook up.

2) Rectifier

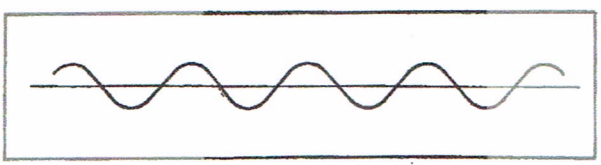
a) The XS650 unit is a full wave rectifier which changes alternating current (AC) generated by the alternator to direct current (DC) by passing the AC through six silicon diodes. The diodes permit only one-way current flow. DC is sent to the battery and main switch.



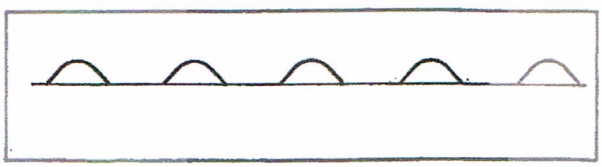
b) This symbol indicates a one-way diode. Current flows in the direction the sign is pointing.



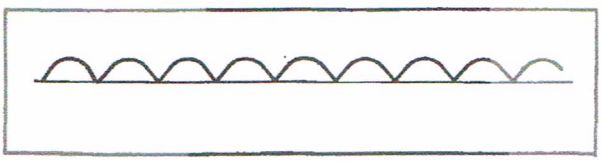
c) Schematic representation of the three phase, fullwave rectifier in the XS650 generating circuit.



d) Wave form of standard alternating current.



e) Wave form of alternating current after rectification by one diode (now direct current)



f) Wave form of AC after full wave rectification.

3) Rotor (Alternating Current Generator)

The rotor of the ACG (Alternating Current Generator-alternator) is the source for the magnetic field which induces current flow in the stator windings. Current for the rotor windings comes from the voltage regulator and is supplied either by the battery (when the machine is not running) or by the stator windings themselves.

NOTE:

In order to make the explanation easier remember that current flows as a result of voltage (electromotive attraction). Current flows from Negative to Positive. Voltage does not "flow" but is instantly present when a circuit is closed. However, we shall discuss the operation of this circuit in terms of voltage "flow". As soon as voltage is present on a circuit, and there is a complete path for current to flow, it will. The amount of current flow is dependent upon the amount of voltage present to act upon the electrons and the amount of resistance present to oppose electron flow.

a) When the ignition switch is turned on, voltage flows from the battery, through the closed contacts in the voltage regulator, bypassing the dropping resistors in the voltage regulator.

b) From the voltage regulator, voltage passes through the positive brush, to the single rotor winding. If the winding is intact, and the negative brush has good electrical contact, current will begin to flow through the rotor winding.

c) When this current flows, it creates a magnetic field around the wire it flows in. Wind this wire into a tightly concentrated coil and the magnetism will become quite intense. The rotor has now become an electromagnet.

d) The rotor is attached directly to the crankshaft. When the crankshaft revolves, the magnetic field surrounding the rotor windings (due to current flow through the windings) rotates also. The brushes and slip ring on the rotor are necessary in order to maintain electrical contact and current flow during this rotation.

4) Stator (Alternating Current Generator)

The stator consists of three windings of wire surrounding the rotor assembly. It is within the stator windings that current is generated for recharging the battery and running the various electrical circuits on the machine.

a) When the magnetic field surrounding the rotor winding begins to spin, its lines of magnetic flux (force) intersect the windings within the stator. As this takes place, current is generated within the stator windings.

b) This current flow is in the form of alternating current. It is transmitted on the three (white) stator winding wires to the rectifier where it is changed to direct current by the diodes of the rectifier.

c) The stator assembly also holds the brushes for the rotor circuit.

5) Troubleshooting

Troubleshooting the electrical system is relatively simple if a few basic facts are kept in mind.

First; the entire electrical system is composed of the following assemblies.

1. Rotor
2. Stator
3. Rectifier
4. Voltage regulator
5. Turn signal relay
6. Ignition points/condensors
7. Ignition coils
8. Spark plugs
9. Main switch
10. Battery/fuse
11. Accessory switch
12. Light bulbs
13. Wiring loom
14. Horn

In the majority of instances where a failure occurs the assembly is replaced. This includes lights, switches, coils plugs, relays, points, condenser and, in most cases, horn.

Second; in the assemblies, remember that they are made out of wire and only two things can go wrong with a piece of wire:

1. It can break in,, two stopping current flow. (Lose continuity)

2. Its insulation can be lost causing it to short circuit with ground or another wire. This can be a direct short with zero ohms between or "insulation leakage" with as much as two million ohms between.

Our troubleshooting list defines the steps taken to search for these two possibilities.

NOTE:

ALL THESE TESTS CAN BE COMPLETED WITH THE PARTS STILL ATTACHED TO THE MACHINE. THERE SHOULD BE NO NECESSITY TO REMOVE ANYTHING EXCEPT INSPECTION COVERS OR MISCELLANEOUS ITEMS TO GET TO THE PART.

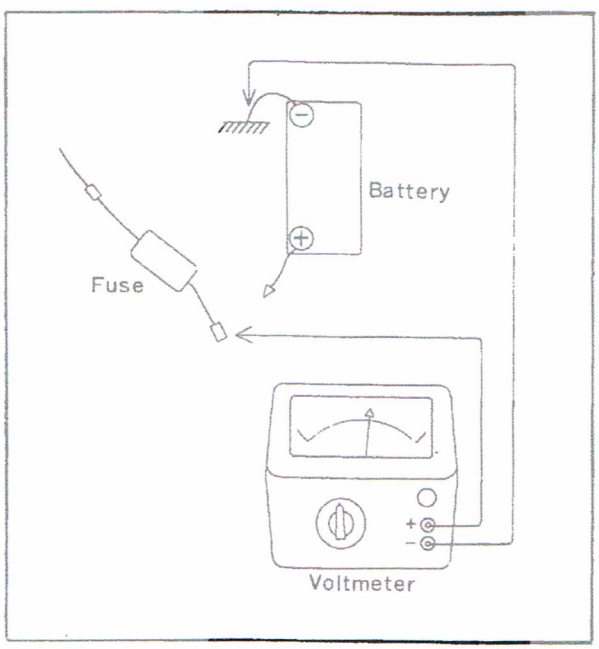
a) Charging voltage output

1) Start the engine.

2) Disconnect the red wire at the fuse box. Hook up a voltmeter from the regulator side of the fuse box to ground.

3) Accelerate the engine to approximately 2,500 rpm and check the generated voltage. It must read between 14.5~15 DC.

4) If voltage output is off, (and not correctable by regulator adjustment), then each part of the charging circuit must be checked to locate the defective part. Perform these checks in the sequence listed below.



CAUTION

BEFORE EACH RESISTANCE TEST, BE SURE THAT THE OHMMETER DIAL HAS BEEN SET AT THE CORRECT POSITION AND NEEDLE ADJUSTED TO ZERO.

b) Broken Wires

1) Check for obviously broken wires or separated connectors (especially multiple connectors). Pay particular attention to any parts that are subject to wear or might be subjected to vibration.

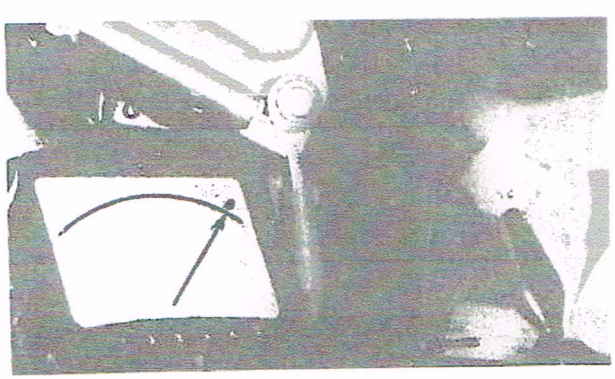
c) Regulator

1) A defective regulator can cause abnormally low or high voltage output. Remove the regulator cover and examine all internal parts for signs of failure. All point surfaces should be reasonably clean. If they are very pitted, or if the central contact point has fused to a stationary point, then this is the trouble spot. Clean the points if possible. If this does not help, replace the regulator. Also, if any wire is broken, and cannot be soldered back in place, replace the regulator.

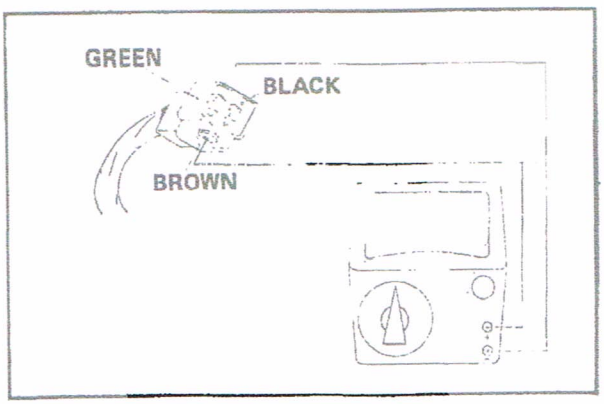
2) If visual inspection does not locate any trouble spot then check for proper resistance through all regulator circuits. This is done by separating the regulator multiple connector and measuring resistance through the green, black, and brown wires at the multiple connector.

3) Hook up an ohmmeter, (0~20 ohms), one probe attached to the black wire and one probe to the regulator base. It must read zero ohms resistance. Several ohms resistance indicates a frayed or broken black wire.

NOTE: Voltage output will be excessively high if this black wire is broken anywhere between the regulator and the stator.

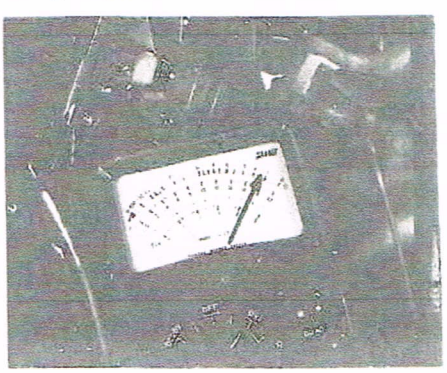


4) Hook one meter probe to the brown wire and the other probe to the green wire.

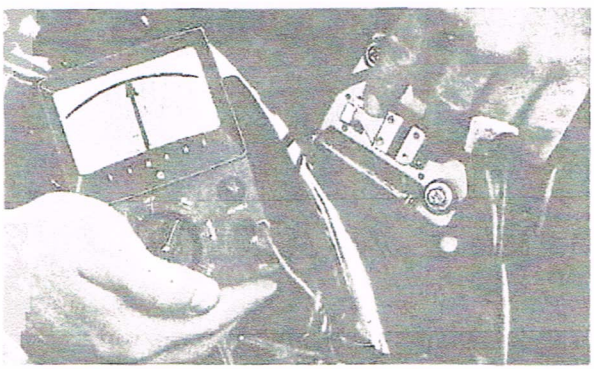


5) Remove the regulator cover.

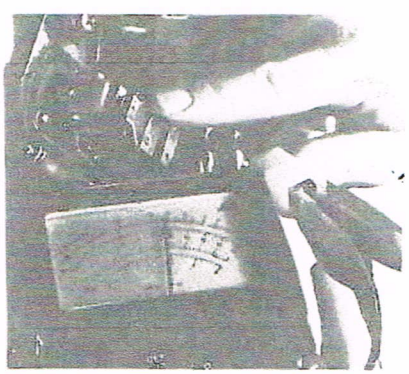
6) With the central contact point held against the top point by the spring (as in the low rpm position), the meter should show no resistance at all (two ohms resistance is too much). If high resistance exists, one of the wires is broken, a soldered joint has separated, or the points are burned. The unit usually requires replacement if the problem cannot be cured by cleaning the points.



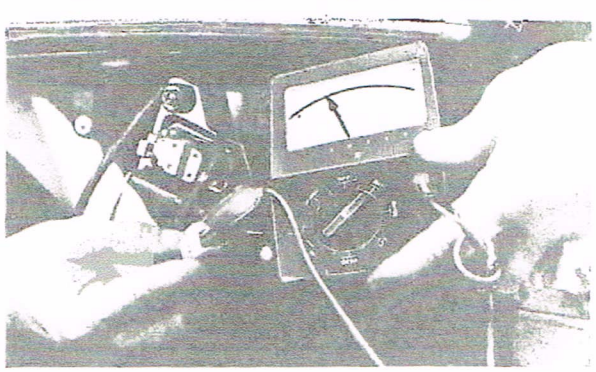
7) Maintain the same meter hook-up as step four. Push the central point arm until the point is positioned mid-way between the top and bottom points. The meter must read 9~10Ω resistance. If the observed resistance varies from this figure, the 10Ω regulator resistor has failed; either internally or at its solder points.



8) Maintain the same meter hook-up as step four. Push the central point down until it contacts the bottom point. The meter must show a 7~8Ω resistance value. Check the condition of both contact points as burnt points can cause an improper reading.



9) At the multiple connector, hook the ohmmeter to the black and brown wires. Permit the central point to spring up against the top point and measure the resistance. It must measure 36~38Ω resistance.

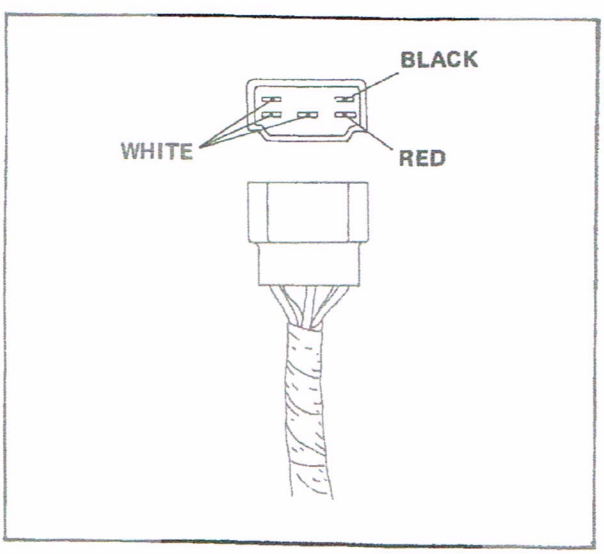


10) A correctly operating regulator will give the resistance values as listed in each test. If the measured values differ, and the variation cannot be blamed on a broken or disconnected wire (that can be resoldered), replace the regulator unit. If a complete regulator resistance test shows all circuits to have correct resistance, the regulator is probably not the cause of improper voltage output. The next charging circuit component must be checked.

d) Rectifier

1) Check the rectifier for proper one-way electrical flow through the diodes. Trace the rectifier wiring back to its multiple connector and disconnect it. Inside the connector are five metal prongs.

2) The prongs are connected to three white wires (that hook up to the alternator wires), one black wire (to ground) and one red wire (to battery and main switch). Perform the following tests, using an ohmmeter (0~1000Ω scale) to check the condition of the rectifier.

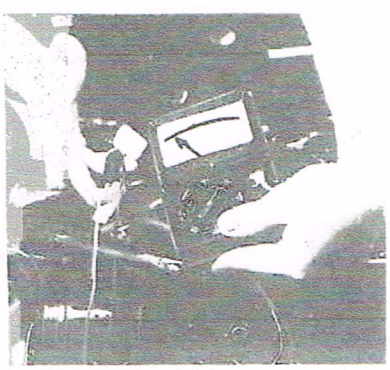


3) Visually check all rectifier wires for breaks.

NOTE: The black rectifier lead, which starts at the rectifier and passes through the main wiring loom, is grounded to one of the secondary ignition coil bolts. If this black wire breaks, voltage output will increase radically. Remember this point when troubleshooting.

4) Clamp the black probe to the black wire and touch the other positive test lead to each white wire in the connector. Next, reverse the position of the meter probes and again touch each of the white wires. For these diodes to be good the meter must show a small resistance (75~150) reading one way and almost infinite resistance with the probes reversed.

5) Attach one meter probe to the red wire and again touch each white lead with the other probe. Reverse the probes and again touch each white lead. The resistance readings must be identical to those in 4).

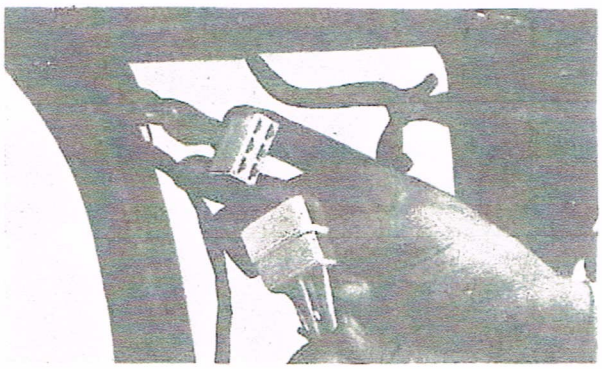


6) All rectifier wires directly attached to the diodes are fully insulated. If any are broken, replace the unit.

7) If resistance results of steps 4) and 5) show that current can flow both ways, or neither way, then one or more diodes have been damaged. Replace the unit.

e) Stator Winding

1) Trace the ACG wiring up to the multiple connector. Disconnect the connector and perform the following test to the three white wire ends at the multiple connector (there are a total of six wire ends in the connector).



2) All three white wires are interconnected in the stator windings. Use an ohmmeter to check resistance between any two white wires (three possible combinations). Each of the three measurements should show 0.8~1.0Ω resistance.

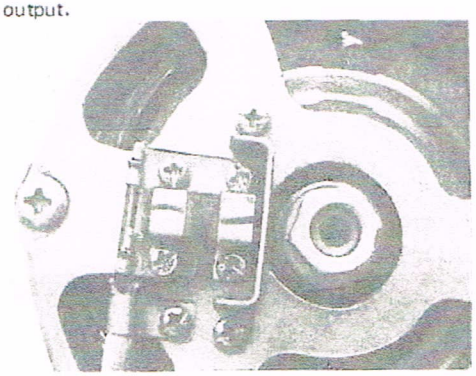
3) Set the ohmmeter scale to read at least in kilo-ohms. Clamp the ohmmeter probe to the stator housing and touch each white wire with the other probe. There should be infinite resistance.

4) If resistance values in steps two & three vary from those specified, then the stator windings are broken, shorted together, or shorted to the housing. Replace the entire unit.

f) Carbon Brushes

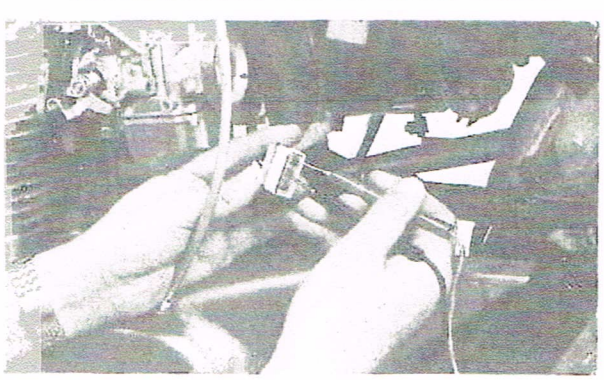
1) If the carbon brushes do not function correctly, electricity cannot pass to the rotor field windings. This reduces alternator output.

2) Visually inspect the carbon brush holder and brushes for obvious breakage or wear. Standard brush length is 14.5 mm (.572"). Wear limit is 7.0 mm(.276"). Also check for carbon dust that could 'short out' the insulated brush, thereby cutting down maximum possible output.



3) Both carbon brush wires (black and green) are located in the same wiring loop as the three white stator wires. They share the same multiple connector which has already been disconnected.

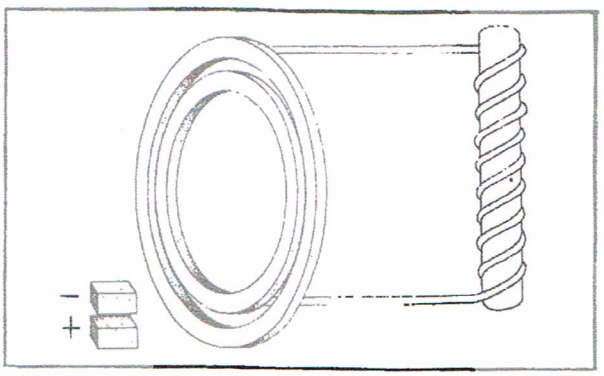
4) Check wiring resistance from the multiple connector to the carbon brush first through the green wire and then the black wire. There must be zero resistance.



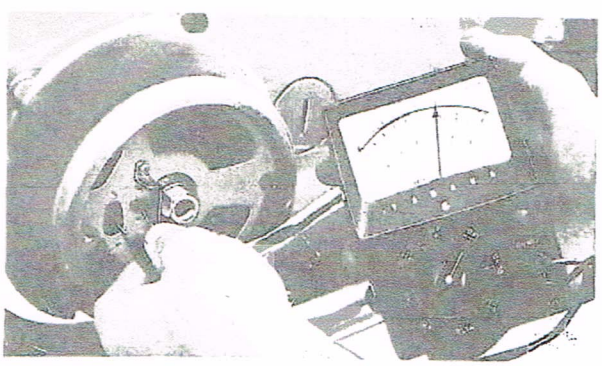
5) If high resistance exists in either wire, it is frayed or broken. Repair or replace the entire wire.

g) Rotor Windings

1) The field windings are one continuous coil of wire, each end attached to an insulated slip ring.

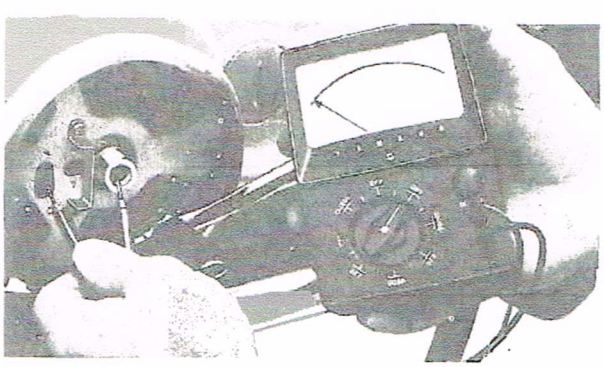


2) Use an ohmmeter (Ω x 1) to check resistance from one slip ring to another. Resistance should measure 5~7Ω.



NOTE:
Both slip rings must be clean or an inaccurate reading will result.

3) Use an ohmmeter set to register at least kilo-ohms resistance. Measure insulation between each slip ring and the rotor core. This must show infinite resistance.



4) If resistance measurements differ greatly from those specified, the winding is either broken, shorted to itself, or shorted to the core. Replace it.