Central Georgia Generator LLC

Trouble shooting the ST

Understanding how the ST works will help in trouble shooting problems.
If unsure, enlist the help of a certified electrician
First understand the unit. The ST consists of two main windings that are 120 Volts AC each. When connected in series, it will form 120/240 Volts AC with the midpoint (where the windings connect together) being the neutral point. In this configuration it will have 120 volts between the neutral point (usually U3-U4 or U5-U6 on the ST) where the windings are tied together and each end of the windings. There is 240 volts across both the windings. (U1 and U2 on the ST)

There is an excitation winding on the stator with the main windings. This excitation winding feeds 4 to 50 volts AC (depending on the load on the generator) to the rectifier. This in turn rectifies the AC and makes DC voltage to be fed to the rotor by the way of the brushes and slip rings to produce magnetism.

A magnetic field in the rotor is required to produce AC voltage out of the main windings and also the excitation windings.

There is a residual magnetism in the rotor that was placed there by the factory by flashing the rotor with a good, strong 12 volt car battery. This residual magnetism will produce enough AC voltage to get the generator to work. By the way, this is actually an alternator. Generator is the most common term that everyone uses so thus we will use the term “generator”

There are several reasons for a generator to lose the residual magnetism.

1) Allowing the generator to sit for a long period of time without use
2) Engine running out of fuel and generator stopped under load
3) Not turning off the electrical supply from the generator before starting or stopping the generator

First thing to do when there is no output from the main 240 Volt Terminals (usually U1 and U2 on the ST) is to check the brushes and brush holders

The brushes must make good contact with the slip ring in order to pass the DC Voltage from the rectifier, in the proper polarity, to the rotor windings.

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Do the following test:

1) Make sure the slip ring is clean and shiny by using fine sand paper or crocus cloth. This should be less than 1 ohm for proper operation.
2) Locate the wire going from the brush holder on the rear brush to the rectifier. (This is the brush nearest the rear bearing). Mark this wire at the rectifier. If the rectifier is marked, then this usually is the negative output. This may not always be the case. Sometimes the inside brush will be negative. If at all possible, look on the rectifier for the markings of + and – and mark the wires accordingly.
3) Do the same for the forward brush holder wire, (brush closest to the rotor winding) mark this wire appropriately.
4) Remove the wire from the rectifier that goes to the rear brush holder. Take a known good volt-ohm meter and put it on the lowest scale possible (RX1 if available) check the resistance from the end of the wire removed from the rectifier and the slip ring itself (again, make sure the slip ring is clean and shiny). This should be less than 1 ohm for proper operation. If not less than 1 ohm, check for loose connections or dirty slip rings
5) If this wire to slip ring is less than 1 ohm, put wire back on.
6) Check the front or inside brush holder same way as you did the one above. This should be less than 1 ohm for proper operation. If not less than 1 ohm, check for loose connections or dirty slip rings.
7) Now with the wire from the front slip ring still disconnected at the rectifier, check across both the wires that go to the brushes from the rectifier, should be approximately 2.7 ohms.
8) If the brush needs to be lowered to decrease the resistance between the brush and the slip ring, loosen the bolt that holds the wire to the brush holder and lower the holder.
9) Reconnect the wire that was disconnected in step 4.
10) Start engine/generator.
11) Check the output voltage across the main output (usually U1 and U2 on the ST)
12) If you have 4 to 10 volts or more, then the generator still has some residual magnetism, maybe not enough but has some.
13) Stop the engine/generator.

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The next steps will be to flash the field with a good, strong 12 volt car battery. Please read the instructions thoroughly before proceeding and use gloves and other proper personal protection equipment.

Remove the + and - wire from the rectifier and perform the steps that follow.
Make 2 long jumper wires so you can connect a good, strong 12 volt car battery to the + and – following the instructions below:

1) Connect the negative lead of the battery to the – lead of the brush wire removed from the rectifier.
2) Start the generator and make sure it is running at 1860 RPM or close to it.
3) Connect the positive lead of the battery to the + lead of the brush wire removed from the rectifier. It should have a small spark. If it does not, then there is a loose connection on the cables; fix it and continue. If it does, continue on.
4) The volt meter should read between 70 and 90 volts or more.
5) This will tell us that the generator is capable of working correctly and the problem is in the excitation circuit, I.E. rectifier, excitation windings, or AVR if one is installed.
6) If the 70-90 volts is not present with the 12 volts applied to the + and – from the rectifier,
    a. Stop engine/generator, and check resistance of the main winding between U1 and U3-U4 or U5-U6. This should read less than 1 ohm. Do the same for windings between U2 and U3-U4 or U5-U6
    b. If higher than 1 ohm, the main winding may be open or a poor connection where the windings connect to the terminals (bolts, studs) coming through the mounting board.
    c. Check the resistance from the frame of generator to the U1 terminal and then frame and U2. There should be an open circuit (no resistance at all) or infinity. If there is any resistance, the main windings are shorted. Be sure not to have your hand or finger on the meter lead when doing this test as it will read the resistance in your body.
7) If problem has been found and/or fixed, reconnect the + and - wire from the rectifier. If not keep the + and - wire disconnected from the rectifier.

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If there was 70-90 volts from the main output terminals, then proceed to the excitation circuit.

Stop the engine and remove one of the excitation wires.

1) The remaining two wires connected to the rectifier is the AV from the excitation circuit
2) Measure the AC from the excitation circuit. It should be 6-20 volts with the 12 volt battery attached to the brushes. If not present, stop the engine, remove one of the excitation wires from the rectifier, start the engine and recheck for the voltage at the end of the wire just removed and remaining wire from the excitation circuit to the rectifier.
3) If the voltage returns, the rectifier is shorted. If it does not return, the excitation winding is open or if an AVR is installed this may be the problem. Check the resistance of the excitation winding with a least one wire removed from the rectifier. This resistance will depend on the KW of the generator but it is usually around 2-4 ohms.
4) If you have an AVR installed, this will have one lead of the excitation circuit in series with the AVR Z terminals; or red wire or orange wire from the AVR depending on the AVR used. The Z terminals, the red wires or the orange wires will show a dead short when checking across them when the AVR is removed from the circuit if AVR is good.
5) The AVR can be removed from the circuit by taking the wire from the excitation circuit that went to the AVR and put on the rectifier or put a temporary jumper on the two Z terminals of the AVR. This will eliminate the AVR. If the AVR uses the 2 red or orange wires in the excitation circuit, then it can be eliminated by putting a jumper across the 2 wires to bypass the AVR.

If the excitation winding is open, then a 115 Volt AVR may be used to eliminate the excitation winding therefore saving the generator.

This uses one of the 120 Volt main windings for the excitation winding and the other 120 volt main winding for the sense.

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