Figure 3.17 — Troubleshooting Flow Chart For “Direct Excited” (Brush Type) Generators

Note: A "Rotor and Stator Resistance Tables" manual is available which lists Rotor and Stator winding resistances for many Generac portable, RV and Marine generators. To order the manual, specify Part No. 87971. Rev C or later.

Test 1: Check AC output voltage and frequency

Low voltage less than 6 volts or zero

Test 2: Flash the field

AC Good?

END

No Change

Low voltage above 6 volts frequency good

Test 3: Check rotor

Bad

Good

Replace stator assembly

Clean slip rings replace bad brushes replace bad rotor

Test 5: Check stator excitation (DPE) windings

Bad

Good

Test 4: Check & adjust engine governor

Does engine appear overloaded?

No

Yes

Test 6: Check stator AC power windings

Good

Check generator wiring

Good

Test 7: Bypass bridge rectifier or voltage regulator
Troubleshooting “Direct Excited” (Brush Type) Generators

Refer to Figure 3.17

Test 1: — Check AC Output Voltage & Frequency

Connect the test leads of an AC voltmeter or a volt-ohm-millimeter VOM into a generator receptacle. Also connect an (AC) frequency meter. Disconnect any electrical loads.

- Start the generator engine, let it stabilize and warm up.

Read the “no-load” voltage and frequency, and analyze the results as follows:

- If zero volts or less than 6VAC is indicated: Go to Test 2.
- If low voltage is indicated, but reading is above 6VAC and AC frequency is normal: Go to Test 3.
- If low voltage is indicated, but reading is above 6VAC and AC frequency is low: Engine Governor may need adjustment. (Refer to the appropriate engine manual)

Test 2: — Flash The Field

In normal generator operation, upon startup there is some “residual” magnetism in the rotor to get the generating process started. Residual magnetism is the magnetism left in the rotor after the unit is shut down. When residual magnetism is lost, the unit will have an output voltage that will remain at zero. If residual magnetism is lost it can usually be restored by “flashing the field” with a simple process involving a (DC) battery. This usually occurs if the unit is out of use for a long period of time.

NOTE: Some units are equipped with “FIELD BOOST” and should never lose residual magnetism unless a field boost failure has occurred. Field boost current flashes the field on every startup (see “Field Boost” on Page 45). Refer to the appropriate electric schematic and/or wiring diagram to determine if a unit has field boost.

If the unit is equipped with a voltage regulator or a bridge rectifier, flash the field as follows:

- Obtain a 12VDC battery.
- Get two jumper leads that can go from the battery to the brushes (wires with alligator clips work well).
- Find the brushes inside the alternator portion of the unit.
- Start the engine and get it up to running speed.
- Connect the battery positive (+), to the positive brush, which will be the brush closest to the rotor bearing.
- Connect the battery negative (-), to the negative brush, which is the brush farthest away from the rotor bearing. (Refer to Figure 3.18).

![Figure 3.18 — Restoring Residual Magnetism](image)
If the unit is equipped with a brush/bridge rectifier (refer to Figure 3.19), proceed as follows:

1. Locate the brush/bridge rectifier inside the alternator portion of the unit.
2. Remove the DPE wires 2 & 6 (or red and blue) from the rectifier terminals J1 and J2.
3. Start the engine and get it up to running speed.
4. Apply 12VDC across terminals J1 and J2. (Polarity is not important.)
5. After about five seconds, disconnect the 12VDC from the rectifier, and stop the engine.
6. Reconnect the DPE wires to the rectifier terminals. Wire number 2 (blue) connects to J1, and wire number 6 (red) connects to J2.
7. Restart the unit and check once again for proper (AC) output voltage.

**Test 3: Check Rotor**

Little or no (AC) output voltage can be caused by a rotor failure.

**NOTE:** The voltage surge that occurs at the moment of rotor failure can result in damage to the bridge rectifier or voltage regulator. For that reason, if a rotor has failed, be sure to check the bridge rectifier, voltage regulator, or power regulator board.

Before testing the rotor, inspect the brushes and slip rings. Replace brushes if they are worn excessively, or if they are cracked or damaged. Do not use any metallic grit to clean up slip rings.

To test the rotor with a volt-ohm-milliammeter VOM, set the VOM to its “OHM” scale and zero the meter. Then, test for an open, shorted or grounded condition as follows:

**Step 1: Checking Rotor Resistance**

1. Remove the brush assembly.
2. Set the VOM to its “OHM” scale.
3. Connect the test leads to the rotor slip rings (See Figure 3.20).

Because of the cramped quarters inside the rear bearing carrier, it is necessary to remove the power cable grommet as shown in Figure 3.21.

![Figure 3.19 — Brush & Rectifier Combination](image)

![Figure 3.20 — Checking Rotor Resistance](image)

![Figure 3.21 — Access To Rotor Slip Rings](image)
Measure the rotor resistance and compare it to the nominal resistance from the appropriate resistance table (Briggs & Stratton Power Products® “Portable Generator Rotor/Stator Resistance Tables Pub. #87971 Rev 6 or later).

A reading of “infinity” or a very high resistance indicates an open circuit or a partially open condition in the rotor windings.

A very low resistance indicates a shorted rotor.
- Connect one test lead to the rotor shaft and the other test lead to either rotor slip ring (Figure 3.22).

A reading of “infinity” should be measured. A reading other than infinity indicates a rotor winding shorted to the rotor shaft.

**NOTE:** Sometimes a rotor may only fail while it is spinning at rated RPM. This condition is called a “Flying Open” or “Flying Short.”

To diagnose, use the “Rotor Current Draw Test.”

**Step 2: Rotor Current Draw Test**
- Locate the brush wires. (Normally these wires are #4 and #1.) Isolate the brushes from the bridge rectifier or voltage regulator.
- Connect a (DC) amp meter between the positive brush wire #4, and the positive post on a 12VDC battery.

**Figure 3.22 — Checking Rotor Short To Ground**

- Connect a jumper wire between the negative brush and the negative post on the battery (See Figure 3.23).

**NOTE:** Amp draw may vary slightly due to exact battery voltage, rotor resistance, and meter calibration etc. Look for extreme differences.

**Test 4: — Check And Adjust Governor**
Refer to the appropriate engine manual.
Test 5: — Check Stator Excitation (DPE) Windings

NOTE: The excitation wires may be colored or numbered. The numbered wires are #2 and #6. The colored wires are blue and red. Be sure not to confuse the colored excitation wires with the colored power wires. The excitation wires are the wires connected to the bridge rectifier or voltage regulator.

- Set the VOM to its “OHM” scale.
- Connect the test leads to the stator excitation wires (Figure 3.24).

Measure the resistance and compare it to the nominal resistance from the appropriate table (Briggs & Stratton Power Products® Portable Generator Rotor/Excitation Tables Pub. #87971 Rev 6 or later). A reading of infinity or high resistance indicates an opening in the excitation winding. A low reading indicates a shorted stator winding.

- Connect one test lead to a stator power wire. Connect the other test lead to one of the stator excitation wires (Figure 3.25).

A reading of infinity should be measured. A reading other than infinity indicates a power winding shorted to an excitation winding. Replace Stator

- Connect one test lead to an excitation wire. Connect the other test lead to a good metal ground. (Figure 3.26)

A reading of “infinity” should be measured. A reading other than infinity indicates a winding shorted to ground. Replace Stator

Figure 3.24 — Checking DPE Resistance

Figure 3.25 — Testing For Short Between Windings

Figure 3.26 — Checking DPE “Short To Ground”
Test 6: — Testing Stator AC Power Windings

Testing Single Voltage Type Power Winding

- Set a VOM to its “OHM” scale.
- Connect the meter test leads across the (AC) power wires. (Wire #11 and wire #22 or blue and red wires (Figure 3.27).

Measure the resistance and compare it to the nominal resistance from the appropriate table (Briggs & Stratton Power Products’ “Portable Generator Rotor/Stator Resistance Tables Pub. #87971 Rev 6 or later).

A reading of infinity or high resistance indicates an opening in the stator winding. **Replace Stator**

A low reading indicates a shorted stator winding. **Replace Stator**

- Connect one meter test lead to a good ground.
- Connect the other test lead to the stator power winding (Figure 3.28).

Testing Dual Voltage Type Power Windings

- Set a VOM to the “OHM” scale.
- Connect the test leads to the stator wires #11 and #22.

Measure the resistance and compare it to the nominal resistance from the appropriate table (Briggs & Stratton Power Products’ “Portable Generator Rotor/Stator Resistance Tables Pub. #87971 Rev 6 or later).

- Connect the test leads to the stator wires #22 and #44.

Measure the resistance and compare it to the nominal resistance from the appropriate table. Analyze the results the same as in “Testing Single Voltage Type Power Winding”.

- Connect one meter test lead to a good ground.
- Connect the other test lead to the stator power winding. (Refer back to Figure 3.28).

A reading of infinity should be measured. A reading other than infinity indicates a stator winding shorted to ground. **Replace Stator**
Testing Battery Charge Windings

- Set VOM to “OHM” scale.

If a single winding is used:
- Connect the meter test leads across wires No. 55 and 66.

Compare the reading obtained with the resistance value from the Briggs & Stratton Power Products® “Portable Generator Rotor/Stator Resistance Tables” Pub. #87971 Rev 6 or later.

If dual Battery Charge Windings are used, take meter readings as follows:
- Read across Wires No. 55 (black) and 66 (brown).
- Read across Wires No. 55 (black) and 77 (brown).

Measure the resistance and compare it to the nominal resistance from the appropriate table. Analyze the results the same as in “Testing Single Voltage Type Power Winding”.

NOTE: The resistance table gives only two resistance values for “multi-tap” Battery Charge Windings, even though there are actually four (4) windings. The difference in resistance between 55-66A and 55-77A, and 55-66 and 55-77 is minimal and insignificant.

Test 7: — Bypassing the Voltage Regulator or Bridge Rectifier

NOTE: Bypassing the bridge rectifier and voltage regulator are similar tests, the difference being that six wires are unplugged from the voltage regulator where only two or four are removed from the bridge rectifier. During the bridge rectifier test you measure (AC) output at the stator power and excitation windings only, there are no sensing wires on a bridge rectifier system.

Verify that the field flash has taken place (Voltage Regulator types only). Watch the light on the Voltage Regulator. If it comes on at all, field flash has occurred.
- Disconnect all wires from the Voltage Regulator or Bridge Rectifier and keep them completely isolated from the circuit.
- Apply 12VDC to the brush wires, normally wires #4 (+), and #1 (-).

- Start the generator (make sure the remaining wires are not touching each other or the control panel, etc.).

Measure (AC) output across sensing wires #11 and #22 (on voltage regulator types only). On bridge rectifier types, measure (AC) output at the 120VAC receptacle. At least 60VAC should be measured, slightly higher is okay (Figure 3.29).

![Figure 3.29 — Testing Power Winding Output](image)

Measure (AC) output across excitation winding wires #2 and #6. At least 60VAC should be measured. It can be higher (Figure 3.30).

![Figure 3.30 — Testing Excitation Winding Output](image)
Analyze the test results as follows:

If any of the (AC) voltage readings are below 60VAC (slightly higher is ok) and rotor current draw is within specification:

- The problem is in the stator windings. **Replace Stator**

If the rotor current draw (Test 3) is higher than specified:

- A “flying short” exists in the rotor. **Replace Rotor**

If current draw (Test 3) is lower than specification:

- A “flying open” exists in the rotor. **Replace Rotor**

If (AC) output and current draw are within specifications and the rotor and stator are ok:

- The voltage regulator is defective.