Slowly Spinning Bergey XL.1 Diagnostic Procedure

There are two causes for a turbine to spin slowly, more slowly than it should for a given wind speed:

- 1. A short circuit across the phases (electrical)
- 2 Something wrong with the bearings (mechanical)

#### Tracking Down a Short

First, disconnect the turbine from the controller. If the turbine starts spinning fast again, then the problem is in the controller. If there is no change, there is a short up the tower. There are three locations where a short is most likely to occur:

### 1. The slip rings/brushes.

A short here is generally quite obvious. There would be melting/heat scars around the slip rings.

### 2. The stator.

To test the stator, first disconnect the three leads from the rectifier. Now place your hand on the side of the alternator and rotate the magnet can back and forth. It only needs to rotate a few degrees. Just rock it back and forth smoothly but quickly in 1/4 turns or so, try to get a feel for how hard it is to turn the alternator. Now short two of the stator leads together, and repeat this rocking motion. It should be noticeably harder to rotate the alternator with the leads shorted. Repeat this test for all three shorting combinations (i.e. short leads 1 to 2, then 2 to 3 then 1 to 3). It should be the same for all combinations.

If no difference in force is required to rotate when you short any of two leads, the stator is internally shorted. If there is a difference, then the stator is fine.

## 3. The rectifier.

One way to test the rectifier is to use the "diode check" setting on a multi-meter. There is one diode between the positive terminal and each of the three AC terminals (so three diodes here). There are another three diodes between the negative terminal and each of three AC terminals (another three diodes here). With the diode checker, measure each of the six diodes in both directions. (e.g. put one of your multi-meter probes on the positive terminal and one on an AC terminal, observe the measurement, now reverse your probes and measure/observe again. One of the six diodes is tested.) A good diode will read "OL" in one direction and "~0.4V" in the other direction. Both measurements are critical.

But another way to test is a variation on the stator test above in step 2. You must have a functional stator for this test to be valid. First disconnect the three stator leads and the two DC leads (+ and -) from the rectifier. (Be sure to mark the positive lead, so you know which one to reconnect to the positive terminal after the test) Again grab the spinner and get a feel for the force required to rock the alternator back and forth. Now reconnect the only the three alternator leads to the rectifier, and try the rocking test again. There should be no difference between the two situations. If it is harder to rotate the alternator once you connect the rectifier, there is a short in the rectifier.

# Testing the Bearings

To check the bearings, once the turbine is lowered, rotate the alternator. Feel/listen for any "grindy" spots/sounds. Everything should be very smooth. There may be a slight cogging feeling as the magnets "grab" consecutive teeth in the stator. Then from the front of the alternator (stand such that the spinner points towards your chest), grab the alternator on opposite sides. Now push with one hand and pull with the other. Wiggle the alternator back and forth like this, pushing and pulling. If the alternator feels loose, you need to re-seat your bearings. Or the bearings may need to be replaced. Please contact me for this procedure and related part numbers.

To re-seat the bearings:

Remove the cotter pin from the nut.

You should spin the alternator while you are torqueing the nut, this will ensure pressure is evenly applied. This pre-loading torque is 18ft-lbs.

Once the nut is torqued, gently crack it loose. At this point, the alternator is still preloaded, don't move or spin it again, else you must repeat the pre-loading.

Now re-tighten the nut "hand tight", no tools.

Install the cotter pin in the tightest, "hand tight" hole that will fit.