

## World Power Technologies' Whisper H40

Installed near Bismarck, ND

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This turbine was beta-tested for the manufacturer. The links on this page provide you with the testing reports I submitted to the manufacturer. As long as I copied my a copy of my comments to the manufacturer, I was allowed to say anything I wanted to according to my testing agreement.

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Note: The Whisper H900 referred to here was renamed the Whisper H40 in 2000.

06/30/1999

According to my testing agreement with WPT and their H900, I must submit a monthly report concerning the turbine. The following text is the report I submitted. It is also posted on my WWW site, from the H900 link.

The Whisper H900 was delivered impressively well-packaged. The packaging was protective and thorough. All of the necessary components for installation were in the packaging.

The installation was quick and easy. I found installation manual straightforward, however, the tower drilling template was confusing until I realized that I was only drilling 4 holes for this machine, unlike the 6 that were drilled for our H4500's. I liked the circular tower insert (as compared to the rather triangular one with the H4500), as it will reduce noise generated from the tower top, however, it was rather difficult to ground the generator with this tower insert as compared with the H4500. A tapped hole and bolt specifically for attaching a ground wire might be a useful addition.

I was very impressed with how quietly it operates. I would imagine it is going to be hard to make a quieter high speed turbine of the same generating capacity. There were minor surface blemishes on the leading edge of the blades that could possibly be removed to make it even a little quieter, but right out of the box, it is impressively quiet.

The voltage regulator on the EZ-Wire system center stopped working on 06/26, and the machine was turned off on 06/28 once it was obvious this was the problem. The machine and rectifier were still working fine at the time. The ONLY reason the machine was turned off is that the loading on the batteries was minimal, and it was turned off to protect the batteries.

Two very windy days (probably 20 mph ave) of data were lost since operation began, but the following statistics are from the data that was taken through 06/26/99. The turbine has seen far more wind than this data suggests, so the average wind speed is undoubtedly higher, as is the amount of wind that has passed the turbine:

Max Wind Speed: 73.337 mph (32.785 m/s)

Ave Wind Speed: 9.736 mph ( 4.352 m/s)

Length of Data: 588.6 hours (24.52 days)

Wind that has passed turbine: 5730 miles (9221 km)

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Note: The Whisper H900 was renamed the Whisper H40 in 2000.

07/29/1999

Here is my second testing report on my Whisper H900.

I am guessing you'd like to receive them when I send them to WPT. If there's an enormous outcry 8^) against it, I won't post them in the future. It is also available on my web site.

A further point to ponder about the "abuse" a turbine gets...in these 46 days of data, with an average wind speed of 9.41 mph (4.2 m/s), 10,439 miles (16,800 km) of wind have passed this turbine. That's a lot of wind. I would guess that this turbine already has at least 40 million RPMS under its belt (too bad I wasn't counting from the beginning).

Whisper H900 Beta Testing Update #2: 07/28/99

The replacement FET block has arrived and has been installed since the last report. The replacement took less than 10 minutes from start to end. However, it would be nice if some of the wires attached to the FET block were a couple inches longer so that it could be more easily removed and replaced. The top wire in particular is quite short, and does not allow the quickest and easiest replacement of the FET block (installation is simple, and relatively fast, but I dropped the top screw multiple times trying to get it started). It looks like the FET block is probably one of the first items installed in the EZ-Wire System Center, and that might explain the shorter wire length, but I could be wrong about that.

The machine has been performing flawlessly, despite the EZ-Wire problem I had. Before reaching governing speeds, the blades can be seen to parallel the tower. The blades flex that much, but they have never flexed more than paralleling the tower.

The output has been as expected. (I will generate a power curve at some point in time.)

The maximum wind speed sustained since the last report has not changed, but here is the data taken since the machine was installed:

Max Wind Speed: 73.337 mph (32.785 m/s)

Ave Wind Speed: 9.420 mph ( 4.211 m/s)

Length of Data: 1108.2 hours (46.17 days)

Wind that has passed turbine: 10,439 miles (16,800 km)



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Here's the 3rd report...a quick explanation on the new FET block. WPT wanted me to switch out the FET block that I had to a new one. The "old" one was fully functional at the time of the replacement.

08/28/1999

As of this date, the new FET block the factory sent to upgrade the current working FET block has been replaced. The blades stopped very quickly when the brake switch was turned on in a 15-17 mph breeze to accomplish this upgrade. The turbine was off for about 10 minutes to accomplish this task.

Other than that, the machine has been operating very well. It could just be my perception, but perhaps in the 10-15 mph range, from upstream of the turbine, it seems a to make a little more noise than it used to, but it is still very quiet in higher winds.

Current data on the turbine is as follows:

Max Wind Speed: 73.337 mph (32.785 m/s)

Ave Wind Speed: 9.005 mph ( 4.026 m/s)

Length of Data: 1822.9 hours (75.95 days)

Wind that has passed turbine: 16,415 miles (26,417 km)

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Date: 11/01/99

As of this date, the H900 was reinstalled at the same site as one of our 4500's. It is on a 42 foot tower, just like it had been before.

It has survived the last 2 days worth of wind, which has been rather brisk. Last night when the wind picked up, my brother said:

"as long as it doesn't die tonight, i really don't have any complaints"

Well, it made it through something like 18 hours of wind speeds in excess of 35 mph, with some hours averaging in the 50's. He says it is very quiet. During this wind, he has been able to look up and see it turning, but not hear it. Occassionally, he does hear it flutter (but not frequently).

He tried to turn it off in wind speeds of 30-40 mph today, but the brake didn't stop the machine.

Here is the data summary since 10/18/99 thru 10/31/99:

Number of Points: 219,346 (5 second averages)

Length of Data: 12.69 days

Max Wind Speed: 63.54 mph

Ave Wind Speed: 10.81 mph

Miles of Wind: 3,259.6 miles

Total # of Revolutions: 6,783,859

# of Governing Cycles: 569

(My definition of 1 governing cycle begins with a data point with a wind speed in excess of 27 mph, and ends with a data point with a wind speed less than 22 mph.)





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Date: 12/01/99

I don't really have anything new to say about this turbine, other than the fact that it is still in the air and it is holding its own rather well.

Here is the data summary since 10/18/99 thru 11/29/99:

Number of Points: 718,416 (5 second averages)

Length of Data: 41.58 days

Max Wind Speed: 63.54 mph

Max this month: 55.48 mph

Ave Wind Speed: 10.03 mph

Ave this month: 9.73 mph

Miles of Wind: 10,006.0 miles

Mile this month: 6,746.4 miles

Total # of Revolutions: 20,995,863 revolutions

Revs this mth: 14,212,004 revolutions

# of Governing Cycles: 2,207

# Gov Cyc this month: 1,638

(My definition of 1 governing cycle begins with a data point with a wind speed in excess of 27 mph, and ends with a data point with a wind speed less than 22 mph.)

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01/31/00

As of this date, the Whisper H900 has been recieved back from the factory after the yaw shaft/brush assembly failure of 12/19/99 and re-installed. Due to illness and the weather, the turbine reinstallation was delayed 2 weeks.

When the turbine was removed from the tower to send back to the factory, the blades were sanded where the molding flashing was still present. It is expected that this will reduce noise (not that it is noisy - it is a quiet turbine), and make it an even quieter machine. I think it may reduce or eliminate the very occassional flutter we have encountered in governing winds.

Since the last update on 12/01/99, before the failure, the turbine did see an additional:

9,368,847 revolutions

4,475 miles of wind

1,065 governing cycles

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03/03/00

Since the last report, we have had not had any problems with the Whisper H40. It is performing well. I added a current sensor on 03/04/2000, so we should be getting more performance information soon.

There was about a week when the data acquisition system was off, so this is, and has always been a minimum of what the turbine has seen.

Here is the data as it stands now:

Description	Since last report	Life
-----	-----	-----
# of data points	404,089	1,893,689
max wind speed	45.58 mph	63.54 mph
ave wind speed	10.38 mph	10.23 mph
miles of wind	5,725 miles	26,870 miles
govern. cycles	956	4,232
max rpm	1,169 rpm	1,296 rpm
ave rpm	352 rpm	315 rpm
turbine		
revolutions	11,215,353	42,983,876

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### Whisper H40 Monthly Report #8 05/15/00

My apologies for the time gap between reports. I have been busy doing some turbine maintenance. I have also done some business travel, preventing me from doing some reporting and data reduction.

Since the last report, we have had not had any problems with the Whisper H40.

Most of the data was unusable since the last report.

We had a storm system go through that recorded 80+ mph at my sister's site, 60+ at my site, and likely 60+ at my brother's site...data which was lost, however the turbine survived it just fine.

Also, last week, hail was reported in the very local vicinity of this turbine, but my brother was not home at the time to verify whether or not the turbine was subject to flying ice. It survived if it was in it.

As always, this is the minimum abuse the turbine has taken:

As of 05/01/00 (only 12 more days of new data)

Description	Life
-----	-----
# of data points	2,203,216
max wind speed	63.54 mph
ave wind speed	10.43 mph
miles of wind	31,906 miles
govern. cycles	5,806
max rpm	1,296 rpm
ave rpm	342 rpm
turbine	
revolutions	53,391,685

since 03/18/00 (only have 12 days of data)

Max Power:	998.5 watts
Avg Energy/day:	3.15 kWh

Avg wind speed: 12.47 mph

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**Whisper H40 Monthly Report #9 07/10/00**

Since the last report (05/15, reporting for April), we have had not had any problems with the Whisper H40. It's just been doing what it's supposed to do!

The performance is a little lackluster, but due to no fault of the turbine. It is on the site of one of our Whisper 4500's, which is down, and has been down for a while. This little turbine is attempting to maintain a very large battery pack (designed for a turbine 6 times larger than it). With a lower battery voltage most of the time, the turbine output is a little under its normal expected performance.

As always, this is the minimum abuse the turbine has taken (as of 07/01/00):

Description	Life	Since last report
-----	-----	-----
# of data points	2,881,887	678,671
max wind speed	63.54 mph	63.38 mph
ave wind speed	10.69 mph	10.89 mph
miles of wind	42,779 miles	10,873 miles
govern. cycles	9,236 cycles	3,430 cycles
max rpm	1,296 rpm	1,222 rpm
ave rpm	311 rpm	358 rpm
turbine		
revolutions	74,764,165	21,372,480

since 03/18/00

Max Power:	1,020 watts
Avg Energy/day:	2.81 kWh
Avg wind speed:	11.73 mph

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Whisper H40 Monthly Report #10 08/06/00 (as of 08/01/00):

Since the last report, we have had no problems whatsoever. With the Whisper 4500 still down, the power production is a little less than normal, because the battery voltage on average is staying lower than it should, and this little turbine is trying to maintain a large battery bank.

Since we installed the turbine originally on 05/22/1999, we have surpassed the 1 year beta testing time frame, if we include the 1 month the turbine was down when I dropped the tower. (I feel like I owe WPT an extra month because of that.) The next report will be the last one required by my beta testing agreement for this turbine. I need to comment on things I have not commented on as of yet.

I will probably continue to send A-W-H testing reports, but they will probably be every other month instead of monthly.

Since the inverters cut out several times on low battery voltage, this is only a subset of what happened this month. As always, this is the minimum abuse the turbine has taken (as of 08/01/00):

Description	Life	Since last report
-----	-----	-----
# of data points	3,065,268	183,381
max wind speed	63.54 mph	39.20 mph
ave wind speed	10.79 mph	12.18 mph
miles of wind	45,940 miles	3,161 miles
govern. cycles	9,946 cycles	710 cycles
max rpm	1,296 rpm	1,141 rpm
ave rpm	319 rpm	425 rpm
turbine		
revolutions	81,399,173	6,635,008
Max Power:	806 watts	
Avg Energy/day:	2.76 kWh	
Avg wind speed:	10.79 mph	

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Whisper H40 Monthly Report #11 09/19/00 (as of 09/17/00):

This is my final required testing report on this machine. I had hoped to end on a positive note, but since the EZ-Wire went down a month ago, I still do not have it back, so the machine has been off for the last month. It's hard to make energy in the windiest month we've had in a long time without the EZ-Wire. ;(

I would like to note that I was testing the old Whisper H40. SWWP has redesigned it with a stronger alternator, and I believe they changed the EZ-Wire System Center. It may be a brand new machine now, but this report is for the old machine.

My testing agreement required that at some point in the regular monthly reports that I comment on the following points. While I may have commented on some of these throughout the course of the last year, I thought I would summarize once again here. The points were:

- 1) General Appearance
- 2) Ease of Installation
- 3) Noise
- 4) Power Output
- 5) Power Curve Maintenance in High Winds
- 6) Start Generating Wind Speed
- 7) Output in Light Winds
- 8) Quality of Manufacture
- 9) Price/Value.

1) General appearance. This is a sleek machine. I like the looks. The only two things that I may change are the tail stalk and the tail fins. The only reason I might change them is because the tail stalk is rather polished stainless steel and the tail fins are smooth plexiglass. In the bright sun they do cause a pretty good reflection. These are very minor issues, however, and easily modifiable to suit one's tastes.

2) Ease of Installation. The machine was fairly easy to install. I believe I mentioned these things before, but the tower drilling template is a little confusing if you don't quite look at it right. The blade straps add a couple extra pieces, but are easy to install. The only annoying thing at all is that one of the bolts that holds each blade on must also be used to hold the nosecone on. Therefore, the inside bolt which is hidden by the nosecone must be tightened first, but to do that requires that the second bolt must be partially tightened, then removed, then tightened when the nosecone is put on. It's not difficult, just a minor inconvenience. And it

really isn't a problem if you don't ever have to take the blades off. I moved the machine a couple more times than would happen on a normal install. ;)

3) Noise. I don't find the noise annoying. It truly is a whisper. It seems a little louder in lower wind speeds when it's running at higher tip speed ratios, however, last weekend, I was listening to a flock of birds fly by overhead, and their wings were pretty loud, too. In higher wind speeds, it is very difficult to hear through the noise of the surrounding terrain. It occasionally will get close to a flutter, but it hasn't been annoying since a couple modifications were made in the testing process.

4) Power Output, 5) Power Curve Maintenance in High Winds 6) Start Generating Wind Speed and 7) Output in Light Winds. The power curve isn't showing the turbine starting in the advertised 7.5 mph winds...it's a little higher (8.5mph-9mph). However, my power curve is not adjusted to our higher altitude, which would reduce this wind speed somewhat also. I don't know the real impact of this adjustment, but the 1 mph or so is probably reasonable. In the beta testing program, I also had to sand the leading and trailing edges of the blades (to remove manufacturing flashing to quiet the turbine and reduce the tendency to flutter), and this may account somewhat for the higher startup speed. I didn't design the airfoil, so I may not have sanded it quite appropriately. Generally, I am pleased with the machine's performance. In high winds, output is excellent, and output remains up as windspeeds go up. From the output perspective, it is a good machine for higher wind sites, as it doesn't really ever get so far out of the wind that you are seemingly not charging the batteries. Some time ago, I calculated the estimated output from our site, and found that the original WPT energy estimates were very respectable, and certainly not anything I could argue against with my data. The original WPT estimates for energy output appear to be right on the money.

8) Quality of Manufacture. As for the quality of manufacture, we had a couple bugs with the original machine that have been worked out through the beta testing process. The cast housing had to be modified because the wires were rubbing against it in a bad way, causing a couple shorts. The blades needed to be sanded to remove the flashing from the manufacturing process, and the brush assembly had a failure due to a vendor quality control issue. These issues have all been resolved in the manufacturing process, and the potential owner wouldn't have to do any of those steps. It is a nice looking machine that was delivered well-packaged.

The only piece of the installation that is seriously lacking at all in my mind is the EZ-Wire System Center. I say that hesitantly because the EZ-Wire is a joy to work with from the installation standpoint. It gives lots of feedback to the user about their system, and makes electrical connections easy. However, I do not believe it is heat-sinked well enough to give years of trouble-free service in a good wind regime. SWWP has supposedly modified it for the current version of the H40, as compared to what I have been testing. We roasted a rectifier and a FET block during the last year.

My recommendation for anybody with one of these EZ-Wire System Centers is simply not to run the machine when the battery is full and you have strong winds. If the battery isn't full, it isn't going to be a dramatic issue. You may or may not have a problem with it. But, if you can avoid running the turbine on a 30mph day with a full battery, you shouldn't get an unexpected failure. ;)

The plastic governing sleeve probably will need to be cleaned annually to keep the machine governing properly. Mine built up a little dirt that seemed to be causing the governing action to stiffen up. Aside from this issue, I can't see any more periodic maintenance that will be required. When I took the machine down a month or so ago, it still looked like new (with the exception of the plastic sleeve). The blades are staying clean on their own. There was no buildup of dirt or bug residue on the blades at all. It was rather surprising how clean they were.

Overall, after one year of service, it has shown little signs of wear. Those items that have been mentioned here have been addressed at the factory in the machine's current production configuration with the exception

of the plastic governing sleeve (to the best of my knowledge). I know SWWP was looking into perhaps a change in materials for the sleeve, but I am uncertain what they have changed (if anything).

9) Price/Value. What can I say? The old Whisper H40 puts amps into the battery at a more affordable rate than PV and probably very competitively with other small turbines. I like it because it's a small turbine that doesn't require a massive tower, but it is big enough to generate meaningful energy for an off-grid application. This machine certainly is a better machine now than it was a year ago. The factory has been very responsive to issues that arose during the beta testing.

Here's the latest data [as of 08/19/00 (when the turbine last ran)]:

Description	Life	Since last report
-----	-----	-----
# of data points	3,321,549	256,281
max wind speed	70.09 mph	70.09 mph
ave wind speed	10.76 mph	10.64 mph
miles of wind	49,623 miles	3,683 miles
govern. cycles	10,133 cycles	187 cycles
max rpm	1,296 rpm	1,112 rpm
ave rpm	310 rpm	360 rpm
turbine		
revolutions	85,826,727	4,427,554
Max Power:	1,020 watts	843 watts
Avg Energy/day:	2.41 kWh	1.28 kWh
Avg wind speed:	11.56 mph	10.64 mph

85 million recorded revs in the last year. It probably is 100 million revs if we include the days it was running that I don't have data for. That's a lot of spinning for a little machine. It's easy to see that a wind turbine takes a lot of abuse in a short time period. It's amazing that after this time, there were no immediate signs of wear to the bearings, the blades, etc. This machine will probably be around for a long time.



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### Whisper H40 Update

This machine is doing fine. This is the old Whisper H40, with the 900 watt alternator, cast aluminum housing, and injection-molded blades.

Now that I had a chance to catch up on the data, here's the minimum progress to date:

Data as of: 01/20/2001

First Service Date: 10/18/1999

Description	Life
-----	-----
# of data points	4,453,646
max wind speed	70.09 mph
ave wind speed	10.67 mph
miles of wind	66,026 miles
govern. cycles	14,863 cycles
max rpm	1,296 rpm
ave rpm	321 rpm
turbine	
revolutions	119,188,233
power data:	
-----	
Max Power:	1,063 watts
Avg Energy/day:	2.55 kWh

Avg wind speed: 11.03 mph

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