Southwest Windpower, Inc.

Renewable Energy Made Simple

Owners Manual

Installation, Operation and Maintenance

WHISPER WIND GENERATORS

MODEL Whisper 200 HV

For the *NEW* Whisper Link
Utility-Tie System

CE

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WELCOME TO YOUR RENEWABLE ENERGY SYSTEM!

ELECTRICITY FROM THE WIND AND SUN:
Renewable electric power systems provide independent electric power for boats, homeowners, farms, villages and commercial applications such as telecommunications. If utility power is available, your renewable energy system can reduce the electric bill and provide back up electricity during storms or line failure. The most common sources of renewable electric power in these systems are small wind powered generators and solar photovoltaic (pv) modules that convert sunlight directly to electricity. Renewable means power sources that do not deplete the world's finite fossil fuel resources, do not pollute or warm the atmosphere and do not generate hazardous waste. Electricity means your children can study at night for a better future and you can benefit from appliances, power tools and communication technologies that make life easier and more rewarding. Nearly three billion people in the world do not have electricity and by necessity most will ultimately get their electricity from renewable resources to the benefit of everybody. You are a pioneer and part of the solution!

BEFORE YOU BEGIN:
Read this entire manual. Identify and note your model wind generator where it appears in this manual. Following the instructions and recommendations in this manual will help assure safe and enjoyable use of your new renewable energy system.

SAFETY INFORMATION: These systems present mechanical and electrical hazards that can be life threatening. The tower or support structure could fall and cause injury or death and property destruction. A component of the wind generator could come loose causing injury or death and property destruction. Contact with the high speed propeller can result in severe injury or death. High voltage from the wind generator or the inverter can cause injury or electrocution. A burn injury can result from an electrical short.

These conditions are addressed in the following safety messages:

WARNING: HIGH VOLTAGE SYSTEM

SYSTEMS WITH VOLTAGES OF 64V AND ABOVE OR ON THE PRIMARY SIDE OF ANY SYSTEM WITH A TRANSFORMER REPRESENT A DANGEROUS SHOCK HAZARD AND COULD BE LETHAL. ALL HIGH VOLTAGE SYSTEMS SHOULD BE WIRED AND MAINTAINED BY A QUALIFIED, LICENSED ELECTRICIAN.

STOP! DANGER! It is your responsibility to obtain all required permits and engineering certifications for your tower and tower location. Soil and wind conditions vary and towers and tower foundations must be designed for your specific location. Tower must not be able to fall on occupied buildings, neighbor's property or power lines. Tower climbing is dangerous and should be attempted only by experienced personnel using proper safety equipment. A fold-over tower can eliminate climbing. Locate your mounting mast (tower) well away from occupied buildings and power lines; a minimum of 100m (300 ft) is recommended.

STOP! DANGER! If the generator appears or sounds loose in the tower or is making an unusual sound, the condition must be corrected immediately. A loose generator or component will soon damage itself further and may fall from the tower or lose parts that could be lethal. Never stand in line with any spinning propeller.

STOP! DANGER! Provide climbing protection against all unauthorized persons or children. Never allow an untrained person or someone without the proper safety equipment to climb the tower. Always stop the propeller before climbing the tower. Both falling from the tower and contact with the spinning propeller can be lethal.

STOP! DANGER! NEVER place objects on top or near the Whisper Link enclosure. These devices must dissipate heat as part of normal operation. FIRE AND FAILURE can result if airflow is blocked.

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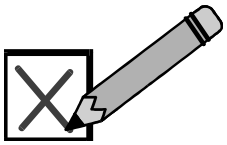
INTRODUCTION



FOLLOW STEP-BY-STEP INSTALLATION

LOOK FOR THE SHADED BOXES AND FOLLOW THE STEPS IN ORDER. CHECK THE PROVIDED BOX WHEN COMPLETE.

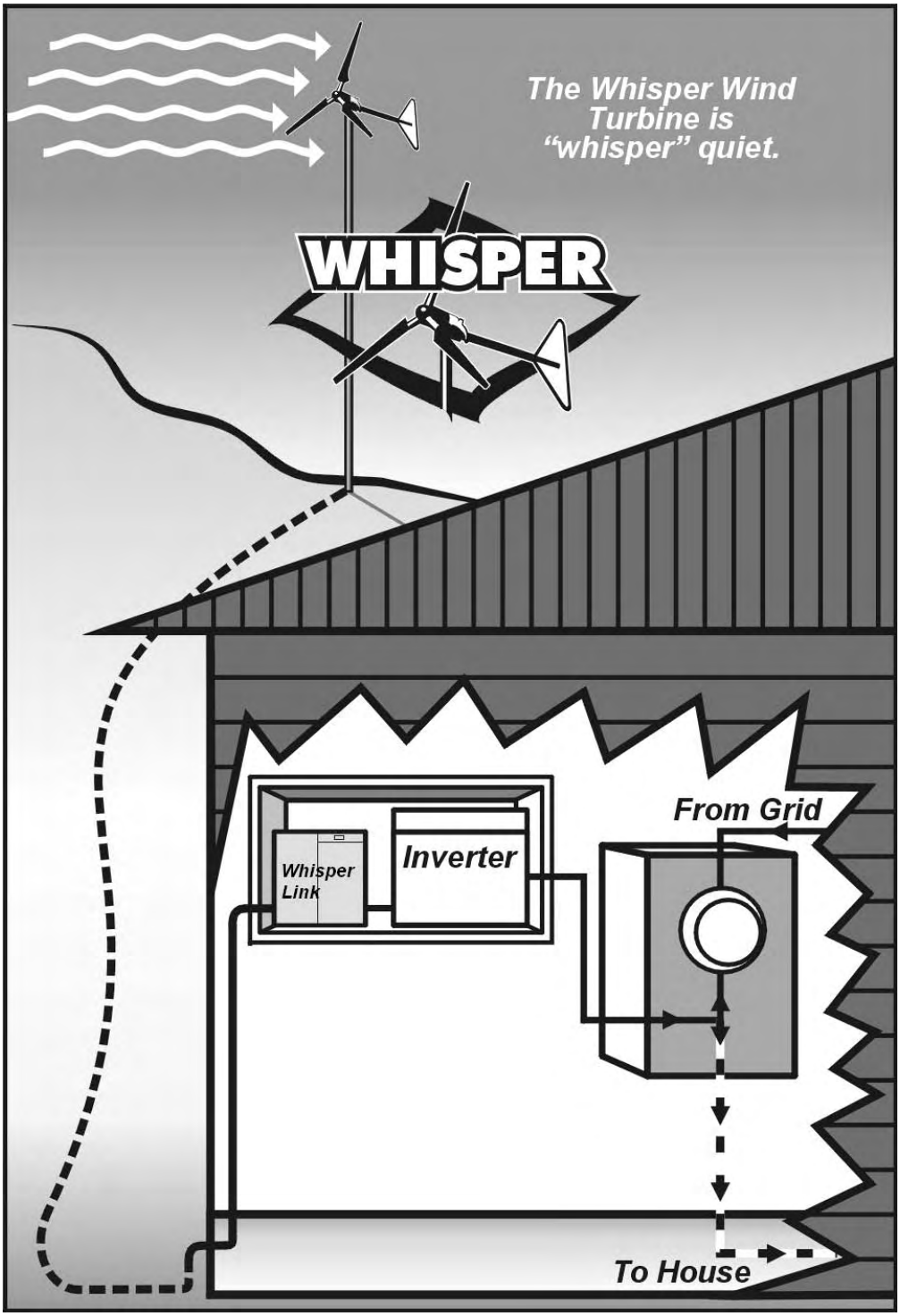
SUGGESTED TOOLS AND EQUIPMENT YOU WILL NEED

Round or Half Round File	Pliers
Carpenters Level (optional)	(2) 9/16” or 15mm Wrenches/Sockets
Torque Wrench w/ 9/16” socket	Large Adjustable Wrench
5/16” Wrench	Tubing or Pipe for Tower
Sawhorse	Hex Wrenches, Phillips and bladed screwdriver
Electrical Wire (see p. 6)	Ground Rod and Clamp
Wire Connectors (preferably copper split bolts)	Soldering Iron and Solder
Pipe Insulation (to prevent wire “rattle” inside pole)	Electrical tape
3/8” Drill Motor	3/8” or 10mm Metal Cutting Drill Bit
Blue Loctite	Long T-handle 3/16” allen wrench

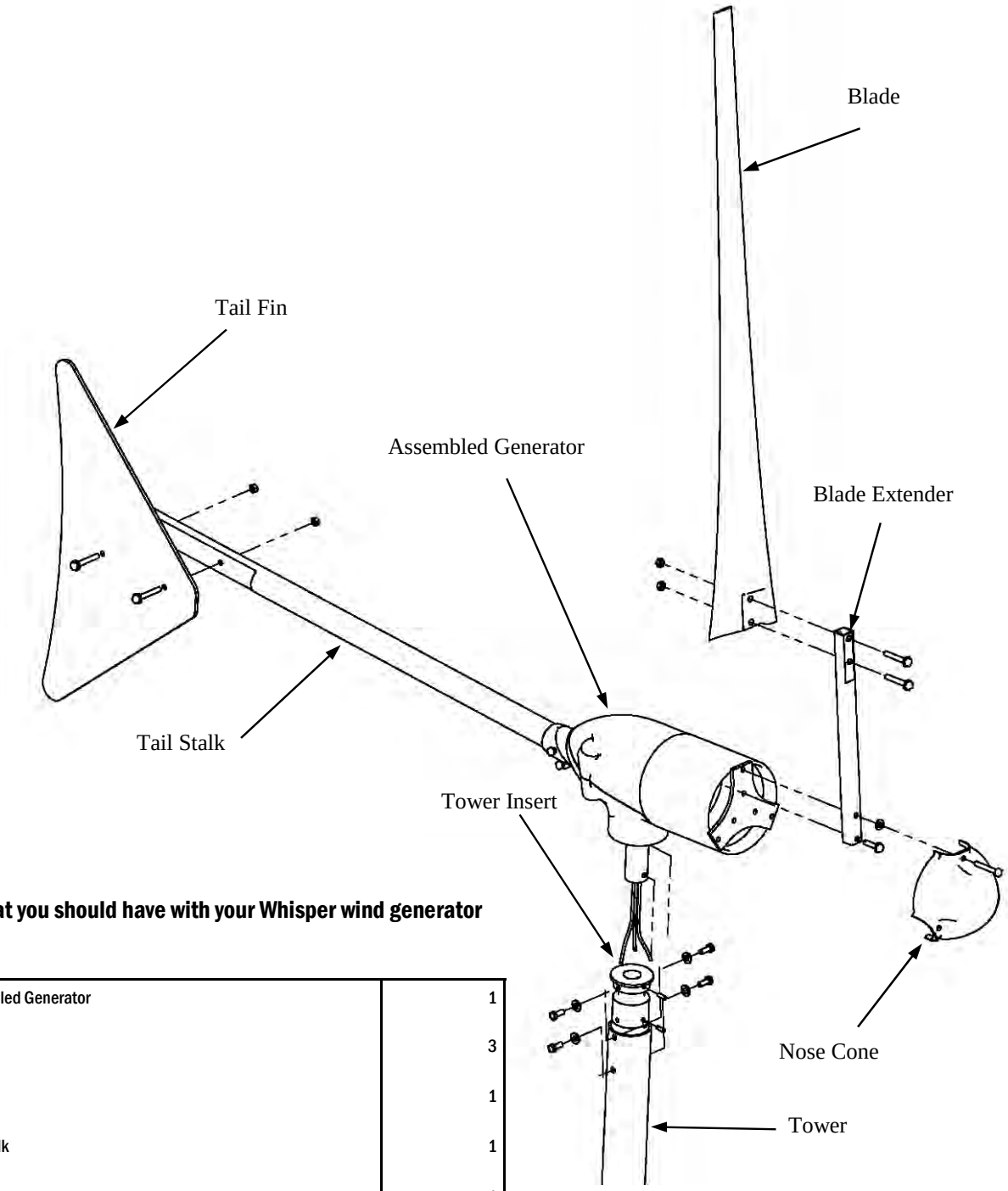
DESCRIPTION OF SYSTEMS

The illustration below depicts a typical installation. For more information regarding specifications of wind, wind/solar and inverter systems, contact Southwest Windpower. Note that the illustration below is for information purposes only. See the appropriate section to properly wire your own wind system.

Whisper Wind Generators (Whisper 200 HV with Whisper Link) include the turbine, Whisper Link, SMA Windy Boy inverter, and the user supplies the tower, and wiring.



Overview of Wind Generator Whisper 200 HV Shown

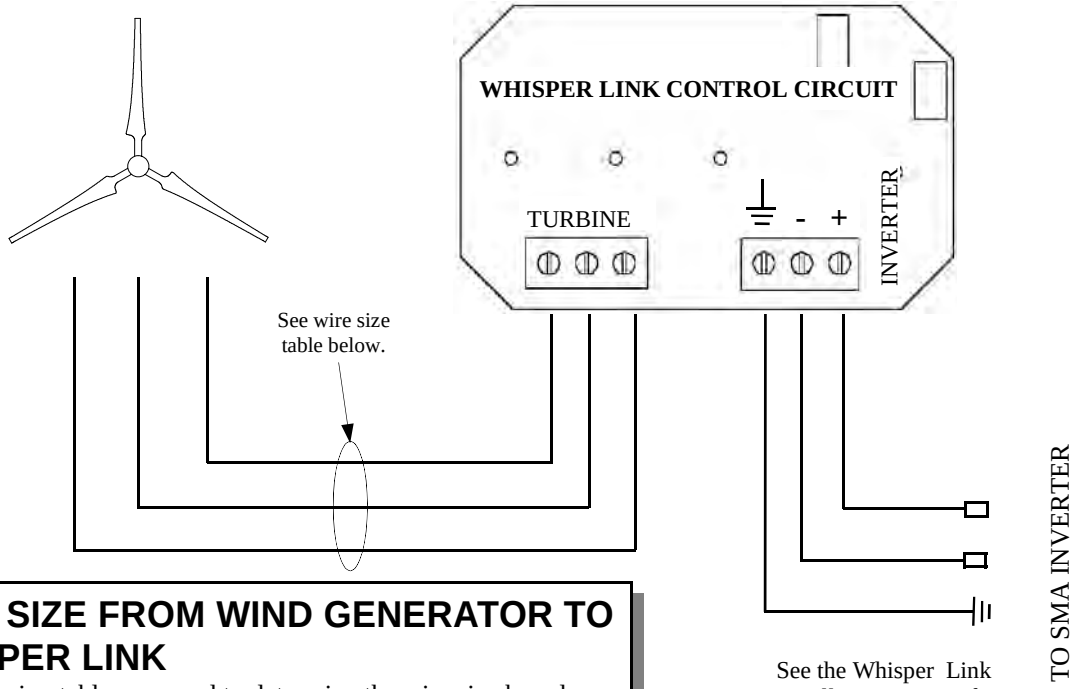


What you should have with your Whisper wind generator

Assembled Generator	1
Blades	3
Tail Fin	1
Tail Stalk	1
Nose Cone	1
Tower Insert Kit	1
Hardware Kit	1
Whisper Link	1
100 amp Fuse	1

Typical Grid Interconnect Renewable Energy System Wiring

You will need to make the electrical connections as shown below.



WIRE SIZE FROM WIND GENERATOR TO WHISPER LINK

The following tables are used to determine the wire size based on your system voltage and the distance required to connect your Whisper 200 HV to the Whisper Link. Distances are maximum one way distances from the turbine connection to Whisper Link

COPPER WIRE SIZE	FEET	METERS
AWG 20	115	20
AWG 18	180	35
AWG 16	295	55
AWG 14	476	90
AWG 12	771	145
AWG 10	1230	235

Between Whisper Link and Inverter:

Locate the SMA inverter no more than 50 feet of wire length from the Whisper Link. Use nothing larger than 12AWG wire. 14AWG, or smaller is recommended for ease of wiring. Losses here are insignificant.

*If using aluminum wire, multiply the distances in the table by 0.65.

Inch to Metric Conversion — AWG vs European

AWG SIZE	20	18	16	14	12	10	8	6	4	3	2	1
Diam inches	0.032	0.04	0.051	0.064	0.081	0.102	0.129	0.162	0.204	0.229	0.258	0.289
Area mm^2	0.516	0.821	1.310	2.500	4.000	6.000	10.000	16.000	25.000	25.000	35.000	35.000

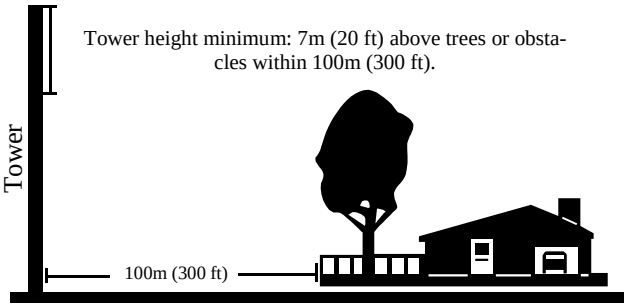
1. TOWER INSTALLATION

1. TOWER LOCATION/TYPE AND HEIGHT. INSTALL TOWER

(Install tower following manufacturer's instructions.)

Tower height minimum is 7 meters (20 feet) above trees or obstacles within 100m (300ft). The highest point on your property is generally best, but this and wind generator distance to the Whisper Link determines the correct wire size (Refer to wire size table pg. 6). A self supporting tower occupies less ground area than a guyed tower but is more expensive. The recommended tilt-up design permits easy installation and maintenance on the ground and eliminates the need for climbing.

Seek consultation with a professional engineer to determine proper type and location of tower installation.



2. WIND GENERATOR ELECTRICAL PRE-TESTS

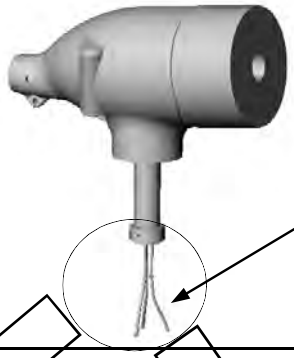
Complete these tests before mounting blades to rotor.
These tests confirm that the wind generator was not damaged in shipment and is ready to install on the tower.

GROUND TEST

Check resistance to ground on any wire. Resistance must exceed 10,000 ohms.

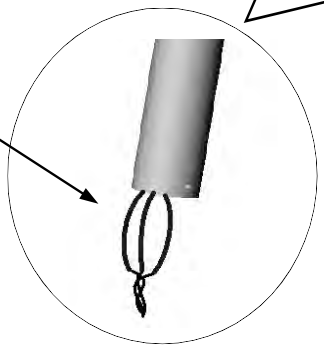
OPEN CIRCUIT TEST

When the wires are uncon-nected the wind generator rotor should spin freely.



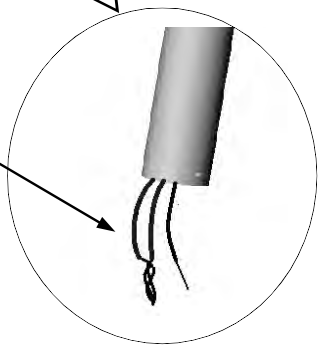
SHORT CIRCUIT TEST

When all the wires are shorted together the generator rotor should turn hard and smooth.



PHASE TO PHASE TEST

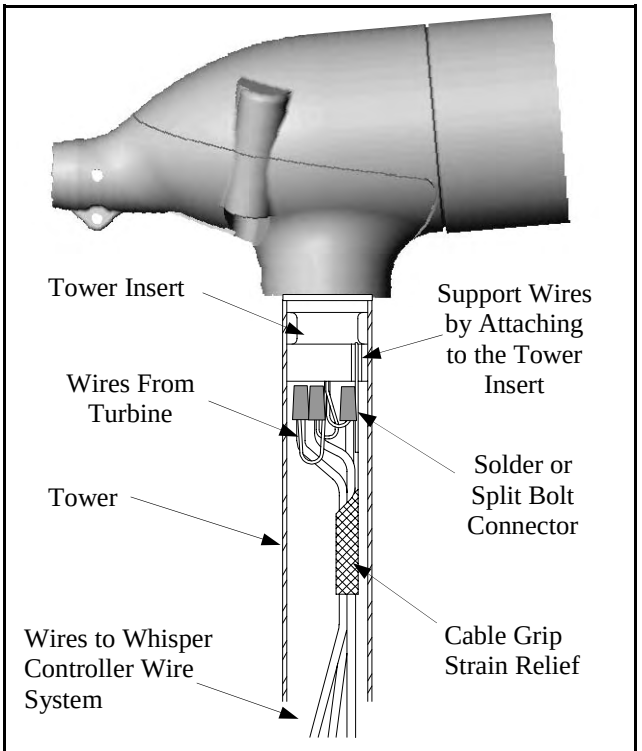
When two wires are shorted together the generator rotor should turn lumpy as though there are smooth and bumpy portions of the rotor



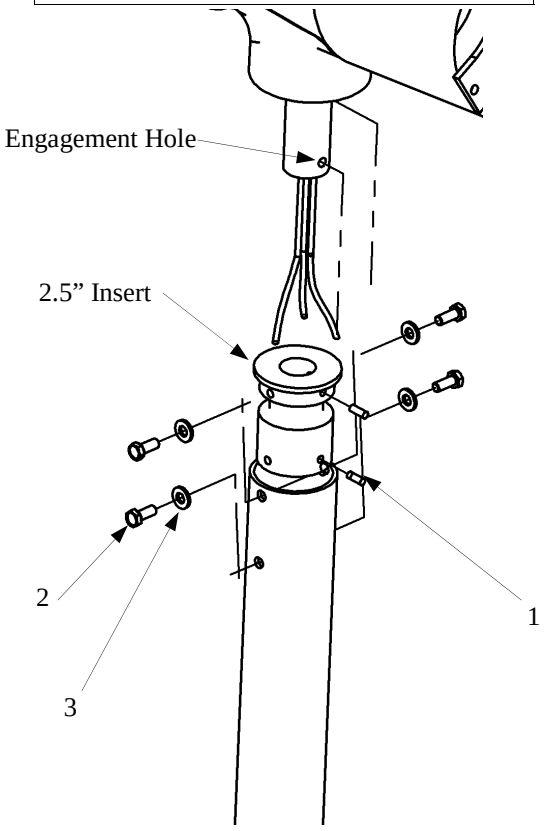
3. CONNECT WIRES AND MOUNT WIND GENERATOR TO TOWER

Mounting Instructions
The Whisper 200 HV turbine is designed to be mounted on 2.5" schedule 40 pipe (2.875" OD x .20" Wall). Check fit of insert by placing it inside the tower. A maximum of 1.5 mm (1/16 in) play is allowed. You must be able to pull pipe or tube tight against insert with mounting bolts. Next, using the template supplied on the last page of this manual, drill holes in the tower tube. Check to see that the holes in the tower line up with the threaded holes in the insert. Install insert on yaw shaft with slot facing down. The slot is used for tower cable grip strain relief. Use medium-strength thread locking compound on all fasteners. M6 X 20 Allen head set-screws must engage both engagement holes in yaw shaft.

Solder or use split bolts to make electrical connections. **A good wire connection is crucial.** Any wind generator wire can go to any tower wire. Wrap connections thoroughly with electrical tape to prevent shorts to tower. Support wires to avoid weight on slip ring wires and wire connections. Slide generator without propeller into tower and install mounting hardware as shown. Make sure the top flange of the tower insert is resting on the top end of the tower pipe. Insert and torque all four insert mounting bolts (M8 x 35mm) to 10-11 ft-lb. (12-14 N-m) repeating any tightening sequence used at least four times. As an option, the tower tube may be insulated with pipe insulation to prevent the wires from rattling.

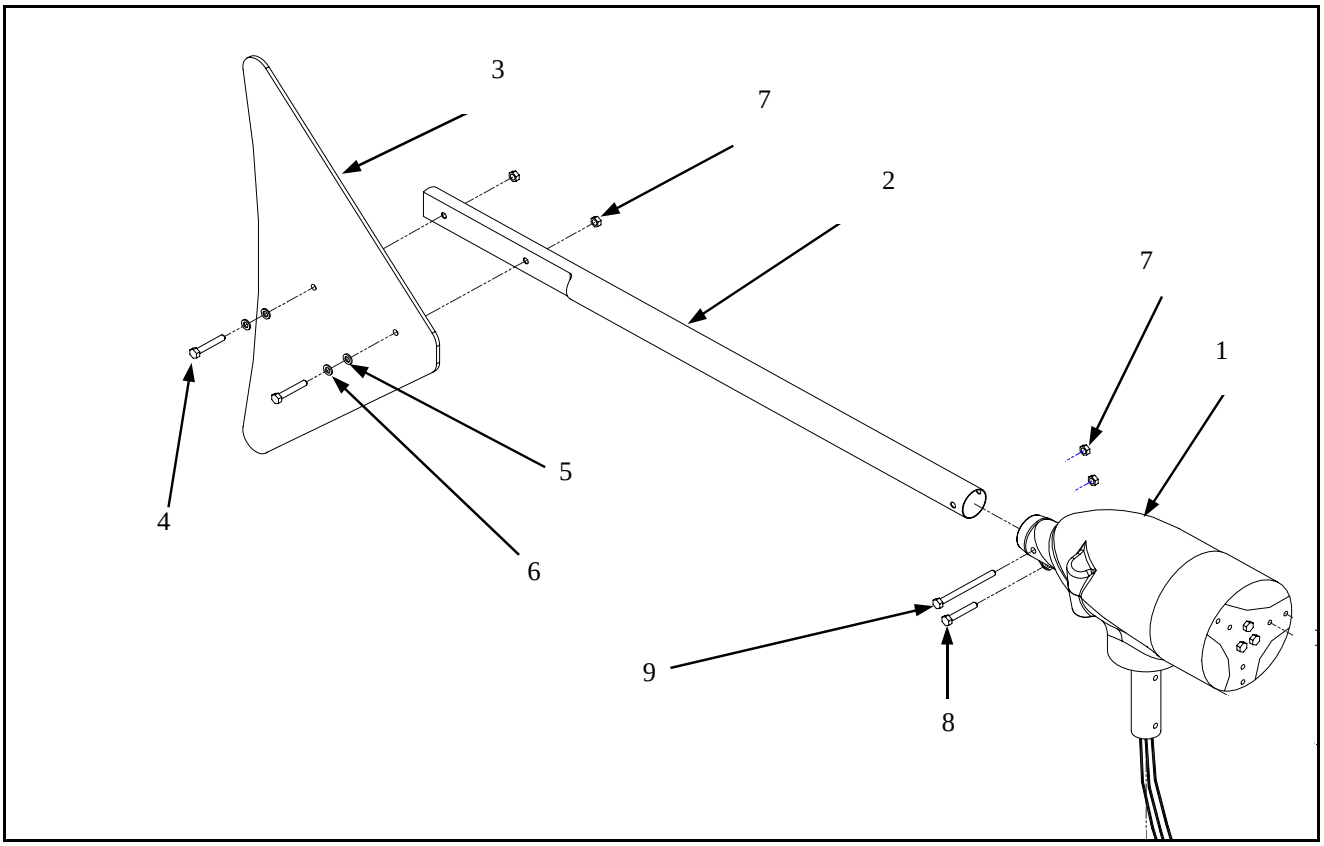


Tower Insert Kit
For 2.5 Schedule 40 Pipe (2.875 O.D. x .20Wall)



Item	Description	2.5" QTY
1	Set Screw (M6 X 20)	2
2	Bolt M8 X 35	4
3	M8 SS Nylock Nut	4

4. INSTALL TAIL



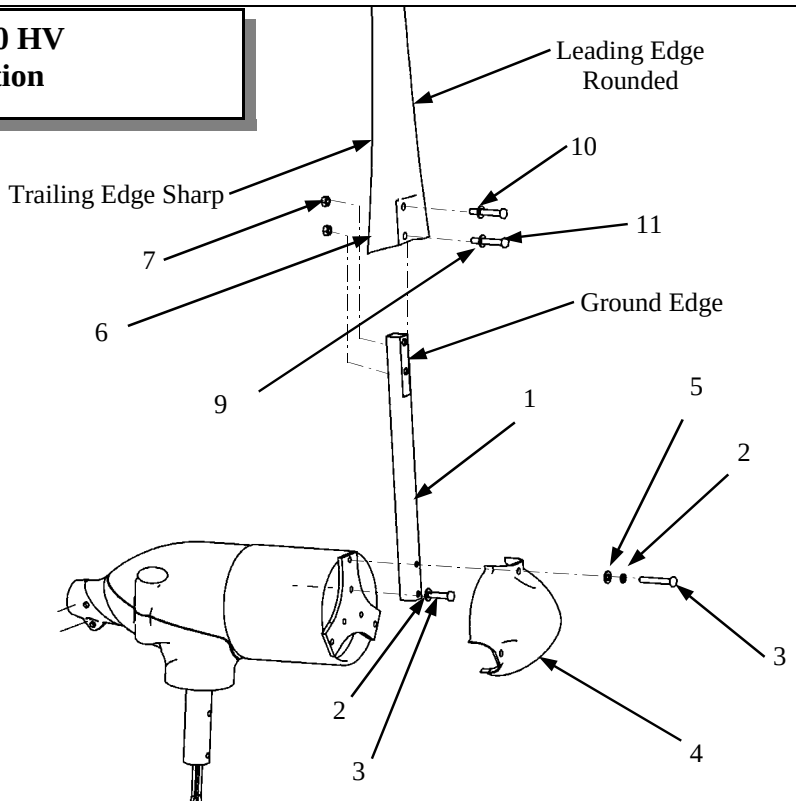
Item Number	Description	Quantity
1	Assembled Generator	1
2	Tail Stalk	1
3	Tail Fin	1
4	Hex Bolts, M8 x 55	2
5	Nylon Washer, M8 X 31	2
6	SSTL Washer, M8 x 24	2
7	Nylock Nut, M8	4
8	Hex Bolt, M8 x 25	1
9	Hex Bolt, M8 x 70	1

5. INSTALL BLADES AND NOSE CONE.

INSTALL BLADE AND NOSE CONE. DIVERSION SWITCH IN "STOP" POSITION.

1. Bolt down Blade Extension (#1) to rotor using only the one bolt (#3) and lock washer (#2) nearest center of rotor. Insure remaining Extension bolt-hole lines up with rotor by loosely inserting bolt in outer hole and tighten inner bolt securely. Repeat for each Blade Extension.
2. Line up bolts (#3) through Nose Cone (#4) using Flat Washers (#5), and lock washers (#2). Tighten to 18 Ft-lbs (24Nm) torque.
3. Install blade (#6), rounded edge advancing clock-wise, on Extension (#1) using cut washer (#10) on outside mounting bolt. Using bolts (#11), Washers (#9 and #10), and Nuts (#7), tighten all bolts to 18 Ft-lbs (24Nm) torque. Repeat for remaining Blades. Note: Tapered ground end of extensions faces towards blades.

WHISPER 200 HV
Blade Installation

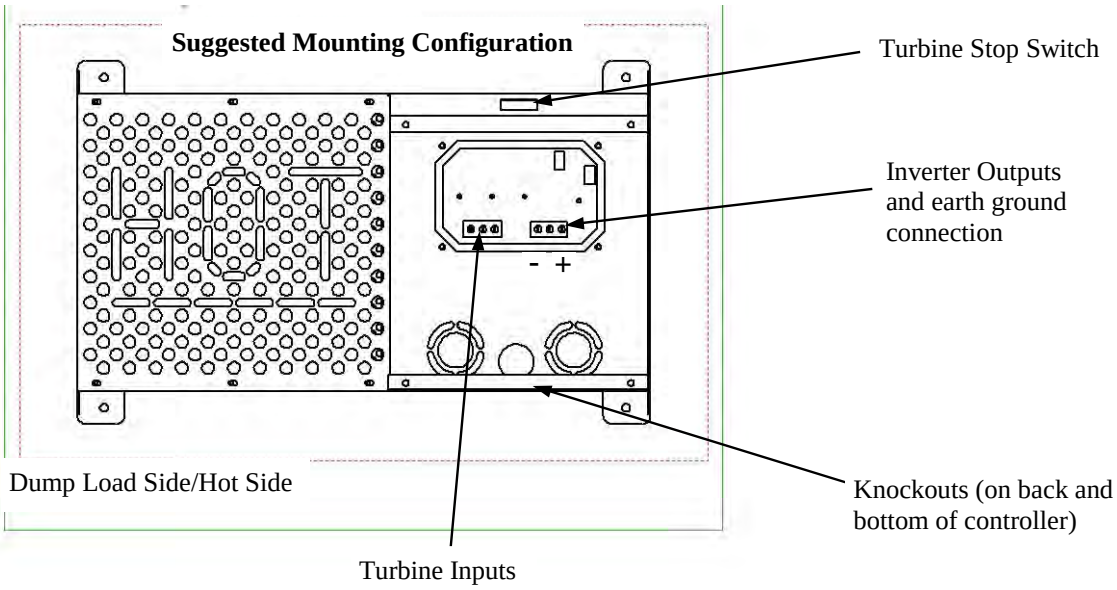


Item	Description	Quantity
1	SS Blade Extension	3
2	SS Lock Washer, M10	6
3	SS Hex Bolt M10 x 40	6
4	Nose Cone	1
5	SS Flat Washer M10 x 20 (Thin)	3
6	Blade	3
7	SS Nylock Nut M10	6
9	SS Flat Washer M10 x 30 (Thick)	3
10	SS Shaved Flat Washer M10 x 30	3
11	SS Hex Bolt, M10 x 50	6

6. WHISPER LINK - MOUNTING

Mounting

The Whisper Link should be mounted against a vertical wall with the ON/OFF Switch to the top. The object is that the heat sink fins on the back of the unit be mounted vertically for good heat convection. The dump load side of the unit may in some situations get very hot. Do not mount the unit near anything flammable or heat sensitive. Conduit connections are only necessary if required by local codes. The knockouts on the bottom of the controller unit are designed to accommodate 0.75", 1.25", and 1.5" nominal size conduit. An earth ground connection terminal is provided inside the Whisper Link on the left-most terminal of the Inverter Output block.



WHISPER LINK - WIRING

Connecting

All connections should be made and the Whisper Link enclosure closed before the turbine is lifted into the wind. HIGH VOLTAGE IS PRESENT ANY TIME THE TURBINE IS SPINNING, EVEN SLOWLY. If the turbine has already been erected, choose a windless day for installation. If there is a light wind, keep all three phases in short-circuit at all times to prevent startup. This can be easily accomplished with an alligator clip jumper.

Refer to the silkscreen labels on the circuit board. The three phases of the turbine are connected to the three connector mounts labeled "Turbine." They may be connected in any order. The (+) and (–) connections should be connected to the positive and negative inputs of the SMA inverter. The ground on the Whisper Link circuit connects to any earth ground, but the inverter's own earth ground is the recommended location. **Earth grounding is very important and must be connected.**

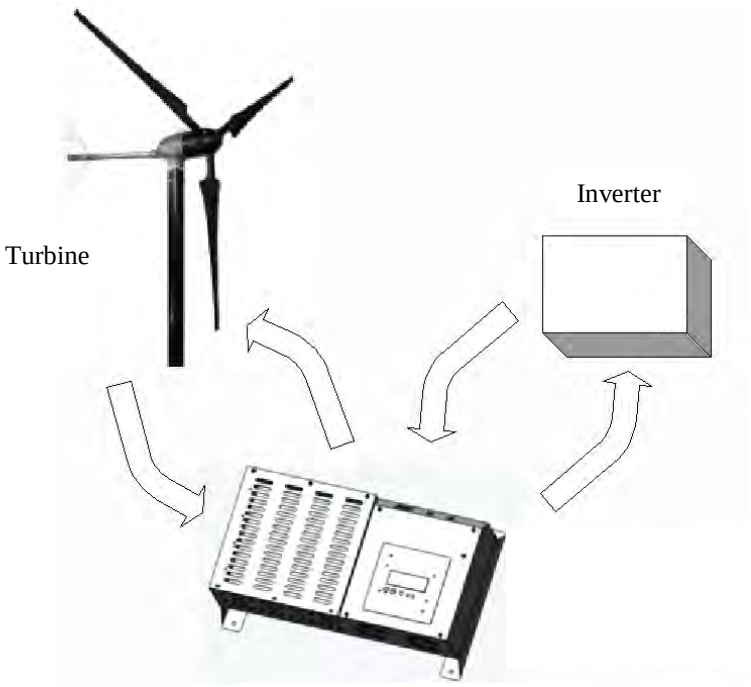
WHISPER LINK - NORMAL OPERATION

1. Normal Operation –

In normal operation the Whisper Link rectifies the 3-phase AC out of the turbine, and provides the inverter with a DC output voltage. If the utility grid should fail the inverter will no longer have a load. This will result in an open circuit condition. To prevent over-voltage damage to the inverter the Whisper Link automatically diverts power to its resistive heater.

2. Stop Switch

The switch on the top of the Whisper Link enclosure is designed to keep the turbine from spinning. It simply diverts the turbine output to the dump load. The switch can be turned OFF at any time. **IT IS NOT SAFE TO OPEND THE ENCLOSURE UNLESS THE TURBINE IS STOPPED.** Under light wind conditions, selecting the OFF position should stop the turbine and keep it stopped. In strong winds, the slowing action may be delayed, but once stalled, the turbine will not return to operation until the switch is returned to the ON position.



Whisper Link

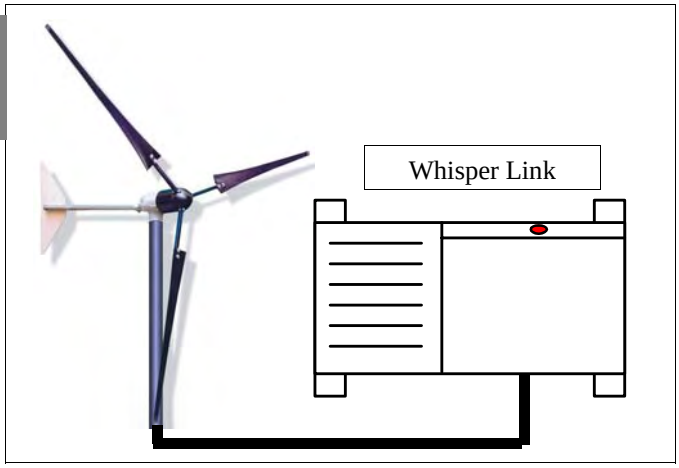
3. Windy Boy Inverter

Refer to the Windy Boy manual for operation of the inverter.

7. MAINTENANCE- MONTHLY

1. TEST STOP CONTROL

(This checks electrical wiring.)
STOP THE WIND GENERATOR BY SETTING THE STOP SWITCH TO OFF IN A MODERATE WIND (CHARGING BUT NOT FURLING). No unusual difficulty or noise should be experienced in stopping the propeller. A noise during braking can indicate a disconnected wire.

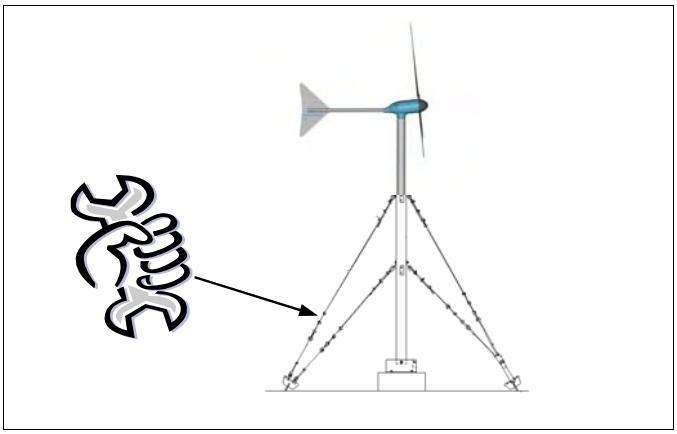


2. CHECK MECHANICAL CONDITION

WATCH AND LISTEN FROM THE TOWER BASE. Use binoculars. There should be no mechanical noise, rattle, or vibration. The propeller and tail should appear steady in consistent wind conditions. Lower the tower for inspection when necessary. There should be no buzzing either heard or felt with your hand on the tower mast. See the section Electrical Problems for further instructions.

3. INSPECT THE TOWER

Follow all inspection and maintenance requirements of the tower manufacturer. Tighten all nuts and bolts, especially wire clips. Check for cracks and bent or broken parts at the anchors and base structure. Check for broken strands and tighten guys.



8. MAINTENANCE - ANNUAL

LOWER TOWER AND GIVE WIND GENERATOR A COMPLETE MECHANICAL CHECK. FIX OR REPLACE ANY WORN OR LOOSE PARTS. (See p. 24 and 25 for part descriptions.)

In wind sites with greater than a 12 mph average wind speed, this maintenance should be performed at least twice annually.

1. Check tightness of ALL tower mounting, tail and fin mounting, and propeller mounting bolts.
2. Check all bearings. Just-perceptible play is acceptable.
3. Check the pivot assembly for play. Just-perceptible play is acceptable. Contact the distributor or factory for instructions on resetting the pivot.
4. Clean the propeller with mild detergent to remove all dirt and debris. Avoid scratching the surface. Replace blades if they are cracked or damaged.

Maintenance Log

Observe Monthly and Annual Inspection Requirements! Record ALL maintenance and repair work!

Date	Problem/Observation	Action Taken

9. TROUBLESHOOTING AND REPAIR

WIND GENERATOR SYSTEM

First, one must determine if the problem is mechanical or electrical. Refer to the two illustrations below and then proceed to the appropriate section.

Propeller does not turn = Mechanical Problem **(or turns slowly)**	**Propeller turns slowly = Electrical Problem**
Proceed directly to **Table: Symptoms of Mechanical Problems, p. 22**	Proceed to **ELECTRICAL DIAGNOSIS PAGE, Page 18,** to diagnose the type of electrical problem the turbine is experiencing.

Table: Symptoms of Electrical Problems

Symptom	Possible Cause	Correction
1. Propeller turns slowly even in strong wind, but will not start	a. Stop switch is in OFF position	i. Turn Stop switch to ON position.
	b. Incorrect turbine wiring	i. Rewire, see p. 20, Condition I.
	c. Short circuit in wiring from generator to Whisper Link	i. Check wiring from tower, see p. 21, Condition I.
	d. failed component in Whisper Link	i. See p. 20, Condition I.
	e. Short circuit in brush card, or yaw shaft	i. See p. 20, Condition I.
	f. Short in turbine	i. See p. 20, Condition I.
	g. Inverter disconnected	i. Check all connections
2. Propeller runs too fast, may whistle, no output, no unusual mechanical noise	a. Two or three wires open between turbine and Whisper Link.	i. See p. 21, Condition II.
	b. Whisper Link diodes open, or wire is disconnected at diode terminal	i. See p. 21, Condition II.
3. Propeller runs too fast, may whistle, low output, no unusual mechanical noise	a. Turbine may be in regulation, but the wind may be too high for the turbine to stop	i. Wait for calmer conditions and engage stop switch to determine proper operation
4. Propeller runs too fast, may whistle, output less than 50% for wind speed, growling, buzzing, or vibration felt by hand on tower mast	a. Disconnected wire between the turbine and the Whisper Link	i. See p. 21, Condition II.
	b. One open, or disconnected diode	i. See p. 21, Condition II.
	c. One slip ring, or brush not making good connection.	i. See p. 21, Condition II.

Table: Symptoms of Whisper Link Problems

Symptom	Possible Cause	Correction
1. Propeller turns slowly, even in strong wind	a. Stop Switch in OFF position	i. Move switch to ON.
	b. Shorted diode	i. See p. 20, Condition I.
	c. Short in wiring to turbine	i. See p. 20, Condition I.
2. Will not stall with stop switch.	a. Bad switch	i. See p. 21, Condition II.
	b. Runaway condition, wind speed is too high	i. Wait for calmer conditions, retry.
4. Resistive heater always on	b. Switch set to OFF or disconnected.	i. Move switch to ON.
	a. Circuit board bad	i. See p. 20, Condition I.

ELECTRICAL DIAGNOSIS - DETERMINING THE TYPE OF ELECTRICAL PROBLEM

Electrical problems can be in the generator, wiring, Windy Boy or in the Whisper Link. Determine which as follows:

Condition I: Wind generator will not start, spins slowly (as if the diversion switch is engaged), and/or unusual noise/ vibration is transmitted to the tower:

!!WHENEVER THE TURBINE IS SPINNING HIGH VOLTAGES MAY BE PRESENT!!

On a day of moderate wind, perform the following:

1) Set the ON/OFF switch on the Whisper Link to the OFF position.
2) Disconnect the SMA Windy Boy inverter from the utility grid at the breaker box.
3) Lower the tower to ensure **NO** rotation of the blades.
4) Wait at least 5 minutes after the blades have stopped spinning and the inverter has been disconnected from the grid.
5) Open the Whisper Link and disconnect the three turbine wires from the Whisper Link circuit's TURBINE terminals.

A. Check the resistance of each combination of two turbine wires and of each wire to an earth ground (6 tests) with your ohmmeter. If the resistance between any two of the turbine wires or to ground is lower than 30 ohms then the problem is most likely in the tower wiring or the wind generator. Work toward the turbine to find the location of the short circuit, or contact your distributor or the factory. If resistances are correct, proceed to step B.

B. Unplug the ON/OFF switch from the circuit board, and set the switch to the ON position. Check the resistance between the two, pronged terminals in the ON/OFF switch plug-in connector. The resistance should be very high (approximately 270 kOhms). Now set the switch to the OFF position and check the resistance. The resistance should be nearly zero. Some slight resistance here is OK, but the difference between the two measurements should be dramatic. Contact your distributor or the factory for replacement of the switch if your findings are inconsistent with these indications. If the switch functions correctly, proceed to step C.

C. Disconnect the SMA Windy Boy inverter from the Whisper Link circuit's INVERTER terminals, and check resistance between the (+) & (-) wires of the SMA Windy Boy inverter.

1. If the resistance is lower than 270 kOhms, then the problem is most likely in the SMA Windy Boy inverter or the wiring from the Whisper Link. Work toward the inverter to locate the short, and consult the Windy Boy manual. Contact your distributor or SMA for repair recommendations.

2. If the resistance is higher than 270 kOhms, the problem is most likely in the Whisper Link. Contact the factory for repair recommendations.

ELECTRICAL DIAGNOSIS - DETERMINING THE TYPE OF ELECTRICAL PROBLEM
Electrical problems can be in the generator, wiring, Windy Boy or in the Whisper Link. Determine which as follows:

Condition II: Turbine blades appear to spin too quickly, unit fails to stall in diversion, low or no incoming power is detected.

A. Set the Whisper Link ON/OFF switch to the OFF position and observe in **light** to **moderate** winds.

1. If the turbine will stall or if the resistive heater in the Whisper Link becomes warm, then proceed to step B.
2. If the turbine will not stall or the resistive heater in the Whisper Link does not become warm, then the problem is most likely in the turbine, tower wiring, or in the Whisper Link. Go to step D.

!!WHENEVER THE TURBINE IS SPINNING HIGH VOLTAGES MAY BE PRESENT!!

B. Perform steps 1-5 as in Condition I on p. 20, check the fuse on the circuit board of the Whisper Link, and replace it if necessary. Check the fuse on the circuit board of the Whisper Link.

1. If the fuse has failed, replace the fuse.

2. If the fuse is good, then proceed to step C.

C. Check for continuity in the wiring between the Whisper Link and SMA Windy Boy inverter by checking the terminals: Whisper Link (+) to SMA (+) and Whisper Link (-) to SMA (-) with your ohmmeter.

1. If the wiring is electrically continuous (resistance is very low or zero), then the problem is most likely in the SMA Windy Boy inverter.

2. If the wiring or connections to the inverter are faulty, repair or replace the wiring.

D. Perform steps 1-5 as in Condition I on p. 20, and check the resistance of each combination of two turbine wires (3 tests) with your ohmmeter.

1. If the resistance between any two of the turbine wires is higher than 50 Ohms then the problem is most likely in the tower wiring or the wind generator. Work toward the turbine to find the location of the open-circuit, or contact your distributor or the factory.

2. If the resistance between all combinations of two of the turbine wires is 30 to 50 Ohms, then the problem is most likely in the Whisper Link. Proceed to step E.

E. Unplug the ON/OFF switch from the circuit board, and set the switch to the ON position. Check the resistance between the two, pronged terminals in the ON/OFF switch plug-in connector. The resistance should be very high (approximately 270 kOhms). Now set the switch to the OFF position and check the resistance. The resistance should be nearly zero. Some slight resistance here is OK, but the difference between the two measurements should be dramatic.

1. If resistance checks are as indicated above, the problem is most likely in the Whisper Link. Contact your distributor or the factory for repair recommendations.

2. If resistance checks are not as indicated above, contact your distributor or the factory for replacement of the switch.

Table: Symptoms of Mechanical Problems

Symptom	Possible Cause	Correction
1. Propeller is stationary, even in high winds	a. Ice in generator, or ice on propeller b. Debris between rotor and stator c. Loose, broken or rubbing magnet d. Bad or worn bearing	i. Wait for warm weather i. Turn propeller gently by hand and blow or use piece of paper to dislodge debris i. Contact factory or distributor to remove rotor and re-glue magnets i. Contact factory or distributor to replace bearing(s)
2. Propeller will not turn at all except in high wind, scraping or rubbing sound at low rpm, always stops at same propeller position	a. Same as above, except more likely to be high magnet or bad bearing. b. Swelled wire keepers due to high moisture	i. Same as above i. Contact factory.
3. Propeller is harder starting, output is lower & there is more propeller noise than usual. Seems out of balance.	a. Ice on blade b. Dirty blade c. Split, warped or damaged blade d. One or more blades on backwards	i. Wait for warm weather. Prop will eventually shed ice, leave running unless there is substantial vibration i. Clean with mild detergent i. Contact factory or distributor to replace broken or damaged blade i. See blade installation
4. Propeller turns a little, never spins rapidly	a. Blades on backwards. (See blade installation)	i. Turn blades over. Leading edge advances clockwise from upwind view.
5. Tail, generator and tower vibrate or shake excessively at all or some wind speeds	a. Blade out of balance b. Blade not tracking c. Rotor (magnet can) out of balance	i. Contact factory to replace blade i. Contact factory to replace mounting plate i. Return to factory or distributor
6. Rattle or clunking from generator	a. Generator loose in tower. Loose rotor (magnet can) on shaft, loose tail, missing rubber bumper, wires slapping inside of mast, governor pivot bolt loose. c. Worn bearings d. Shaft broken	i. Inspect for damage. Repair as required. Retighten mounting hardware, use Loctite or equivalent thread-locking compound. i. Contact factory to replace bearings i. Contact factory to replace shaft

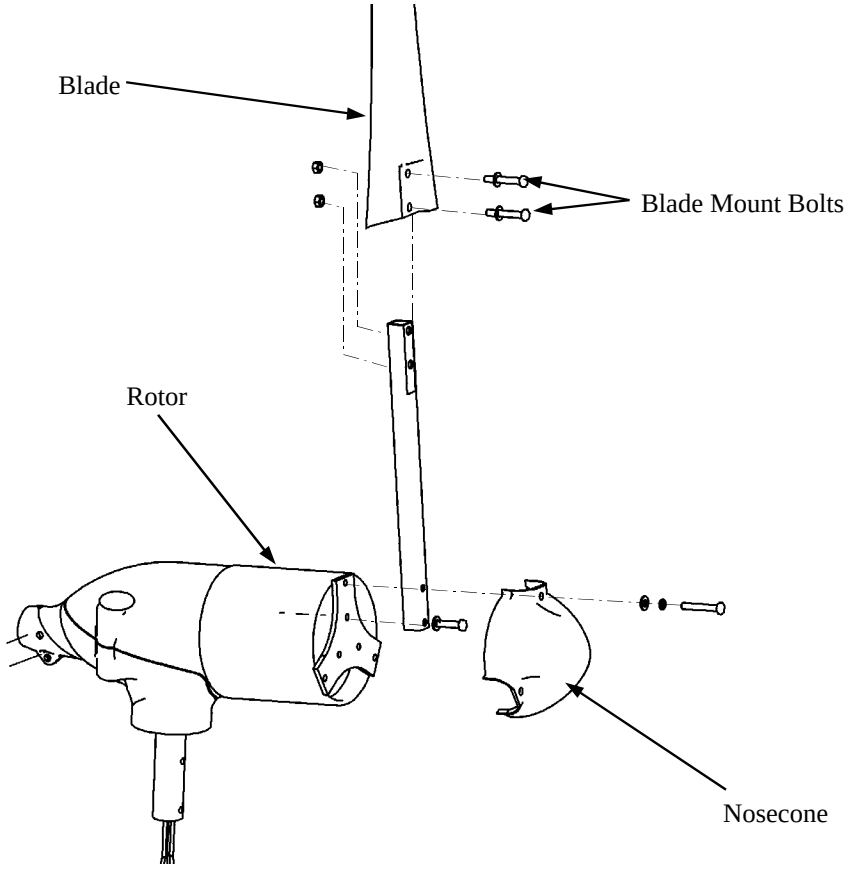
10. MECHANICAL REPAIRS AND PARTS REPLACEMENT

Do not attempt these repairs on top of the tower. Perform repairs only after tower has been lowered.

BLADE UNMOUNTING

Remove blade, see Installation step #7, page 11 (Disassemble in reverse order). Remove rotor bolts and blade strap. See exploded view.

Typical Blade Assembly

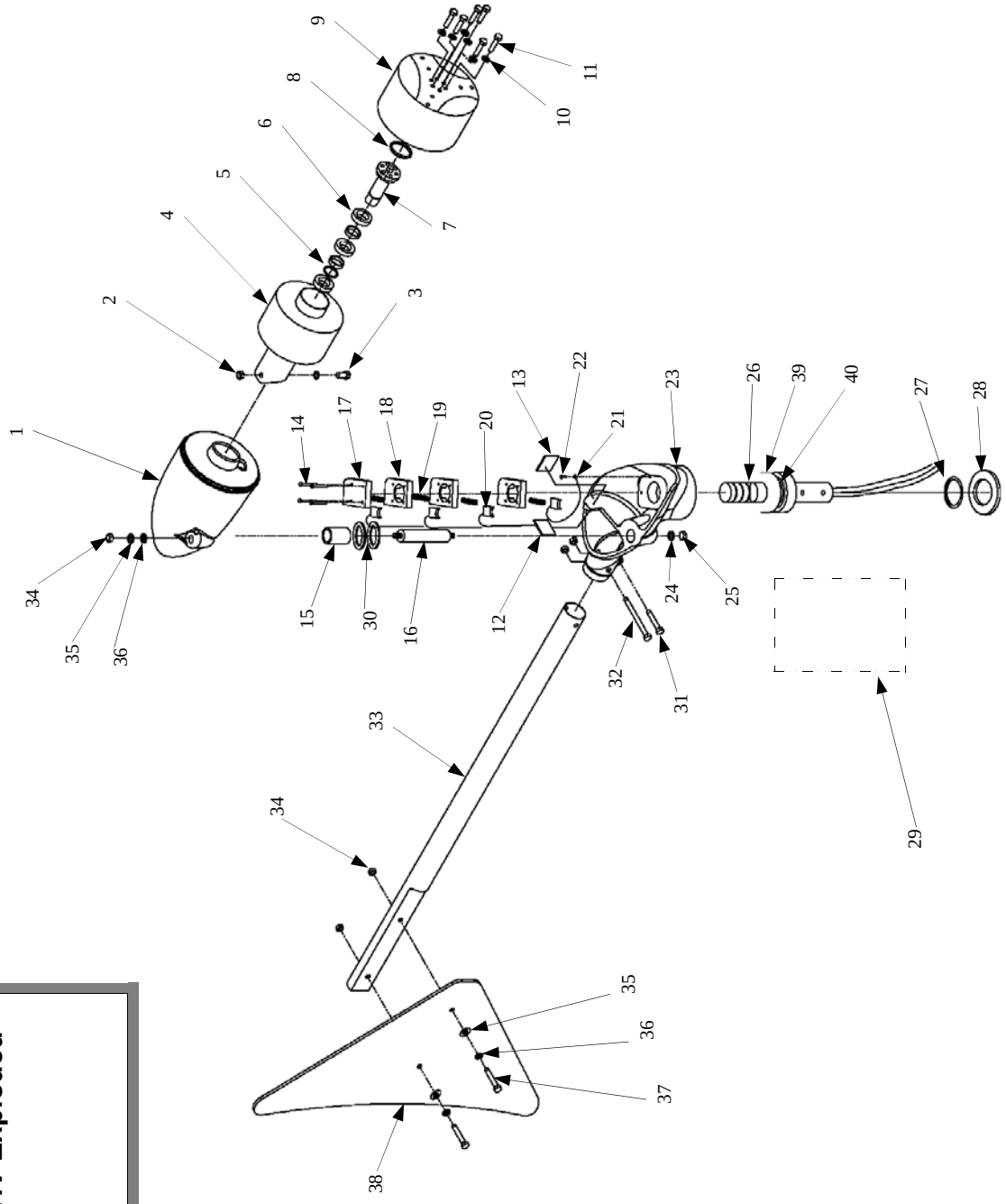


MECHANICAL REPAIRS AND PARTS REPLACEMENT

The following two sheets provide a complete exploded view and parts list of the Whisper 200 HV. It is included as a guide for replacement parts and troubleshooting. It is, however, recommended that any internal repair of the turbine be performed by the factory or your authorized distributor. Any unauthorized attempt to repair the turbine leading to damage is not covered by warranty.

Exploded View Parts List-Whisper 200 HV

Item No.	Description	Quantity	Southwest Windpower Part # - H80
1	Casting Top	1	IAA07
2	Nylock Nut, M8	1	IAR17
3	Hex Head Cap Screw M8 x20	1	IAR07
4	Stator	1	IAR019
5	Snap Ring (20 mm)	2	IAR18
6	Bearing	3	IAJ01
7	Spindle	1	IAP06
8	Snap Ring (47 mm)	1	IAR22
9	Rotor	3	IAE20
10	Washer M6, SS	3	IAR05
11	Socket Head M6 x 16	3	IAR06
12	Stop Head, Rubber Pad	1	IAL03
13	Stop Head, Rubber Pad	1	IAL04
14	Pan Head Screw, M5 x 60	4	IAR02
15	Bronze Bushing	1	IAJ04A
16	Pivot Shaft	1	IAG06
17	Brush Cover	1	IAF09
18	Brush Holder	3	IAF06
19	Spring	4	IAF03
20	Brush with wire	3	IAF02
21	Brush, wire with terminal	1	IAF02, IAF01
22	Ground Screw M6 x 10	1	IAR03
23	Casting Bottom	1	IAB07
24	Washer, M8 x 16	1	IAR48
25	Nylock Nut, M8	1	IAR17
26	Yaw Shaft	1	IAD03
27	Snap Ring (62mm),	1	IAR21
28	Seal	1	IAR22
29	Light Assembly (Not Available)	1	IAK06
30	Bronze Thrust Washer	1	IAJ12
31	Hex Bolt, M8 x 25 SS	1	IAR09
32	Hex Bolt, M8 x 70 SS	1	IAR13
33	Tail Stock	1	IAQ07
34	Nylock Nut, M8	3	IAR17
35	Nylon Washer, M8 x 31	3	IAR16
36	SS Washer, M8 x 24	3	IAR15
37	Hex Bolts M8 x 55 SS	2	IAR12
38	Tail Fin	1	IAS04
39	Yaw Bearing	2	IAJ02
40	Yaw Shaft Snap Ring	1	IAR19



Whisper 200 HV Exploded View

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