

Instruction manual for small wind turbines Stormy Wings 400, 600, 1000

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Introduction

Thank you for purchasing this wind turbine. Surely you won't have any problems installing it and we are sure you will rejoice over using it for many years.

Please read this instruction manual carefully before mounting, installing and operating the wind turbine. Phaesun doesn't assume any liability for damage that developed from disregard of this instruction manual. This manual can be helpful in using the small wind turbine correctly, but no focus has been put on single components of the plant. The figures only serve as a reference; differences with the actual components are possible.

In case of questions and suggestions, we are happy to help you during our office hours.

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Safety Instructions

1. Please read these instructions carefully before mounting, installing and operating the wind turbine.

1. Do not install the wind turbine on a windy day with wind speed exceeding 3m/s.
2. Do not wear any wet gloves or clothes while installing the plant.
3. Installation and maintaining of the turbine shall only be done under guidance of professional staff or through an authorized dealer.
4. Only use cables according to the standards listed in section 4 of this manual. Cables of insufficient width or poor quality can possibly lead to leakage, fire and line losses.
5. It is forbidden to open the generator enclosure, in case of violation any warranty claim will lapse.
6. Grounding must be done in accordance with the standards and the installation instructions in this manual.
7. When wiring the battery, make sure no flammable material is near the working environment, because sparking is possible.
8. Make sure the controller and the battery is not exposed to high humidity, rain, direct sunlight, vibration or corrosion. Close distance to heaters and other sources of heat should also be avoided.

2. Selection and installation of the controller:

1. Controller specifications need to match the voltage and current of the solar module and the wind turbine.
2. Controller and battery should be installed in a well ventilated room without access for unauthorized people. Ensure safety measures that prevent children from approaching the room.
3. The installation of the controller and battery should be done in accordance with the relevant electrical equipment specifications and comply with the operation specification given by the manufacturer.

3. Wiring:

1. The hardwired connections between components in the system should be installed firmly and securely
2. Appropriate to the expected currents the length and cross section of the wire should be selected such that the voltage drop is as low as possible.
3. All wires and lines that potentially can be damaged by external influences need to be protected in a cable conduit.

4. Safety precautions:

The operating staff has to be a qualified electrician and make themselves familiar with the safety instructions.

1. All operations must:
 - a. follow this instruction manual.
 - b. be carried out by specialized staff.
 - c. wrong operation might result in accident and injury to workers and equipment.
2. The operating staff has to :
 - a. be familiar with equipment.
 - b. be able to run the system correctly.
 - c. be familiar with the safety instructions

In this instruction manual:



WARNING: Danger of severe injury or danger to life. Serious damage to the system possible – act carefully and follow all the instructions accurately.



TIP: Instruction or advice that possibly simplifies either operation or assembly



IMPORTANT: Instruction or advice that is critical for correct assembly or operation. Damage to equipment may result if not heeded

Warranty

Phaesun provides 2 years of limited warranty on faulty manufacture as of the date of delivery. This warranty includes all components damaged during this warranty period. A replacement at no charge of components or the whole turbine will only be allowed after remote diagnosis and fault analysis. Phaesun reserves the right to choose the most suitable solution concerning replacement of component or the whole turbine and its shipping. Phaesun cannot be held responsible for installing the system on unfavorable site with too little wind speeds. This lies in the responsibility of the installer.

Warranty services will only be provided, if the original invoice of the seller is presented.

Warranty does not cover:

- Wind turbine has not been installed, operated, repaired or maintained in accordance with instructions given by Phaesun GmbH; Or if wind turbine has been modified.
- Frequent inspections, maintenance, repair and replacement of components damaged through regular operation.
- Transport costs, shipping costs and shipping risk that are directly or indirectly connected to this warranty.
- Travelling costs to and from repair site, fault repair, diagnosis and repair work.

- Damage that is caused by wrong operation of this plant, especially when installed on an inappropriate tower. In case of damage the customer has to provide proof that the installation was carried out on a suitable tower.
- Damage through force majeure or any other reasons Phaesun cannot be held responsible for, especially lightning, floods, snow load, fire and others.

If the product is demounted and has to be installed again after repair or replacement, costs of dismounting and installation will not be covered by Phaesun GmbH. If repair or replacement is necessary or not will be decided by the manufacturer. If neither of the two is possible the customer has the right to cancel the invoice.

As far as no mandatory rules state differently the claims of the customer are limited to these warranty terms. Neither Phaesun nor the distributor of the product assume any further accountability for indirect or direct damage.

Warranty Claim Procedures

In order to get service under this warranty, the customer has to provide the following information.

1. Serial number of the wind turbine, duration of operation, moment of disturbance.
2. Detailed description of defects and corresponding test results, that have been generated during troubleshooting.
3. Technician may ask for further testing in order to identify defects such that solutions can be put in action promptly and precisely.
4. Installation pictures (details on the installation location and its surrounding).
5. Video or pictures of damaged machine.
6. The technician will provide final solution according to the descriptions and the results of the troubleshooting.

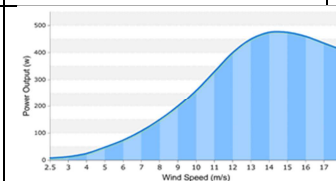
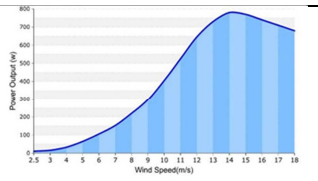
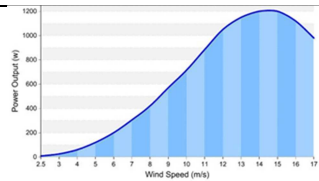
The customer is responsible for shipping of damaged components in case of repair. Phaesun will repair the components free of charge or replace it with new ones and eventually ship it to the customer on his costs.

Consequential losses

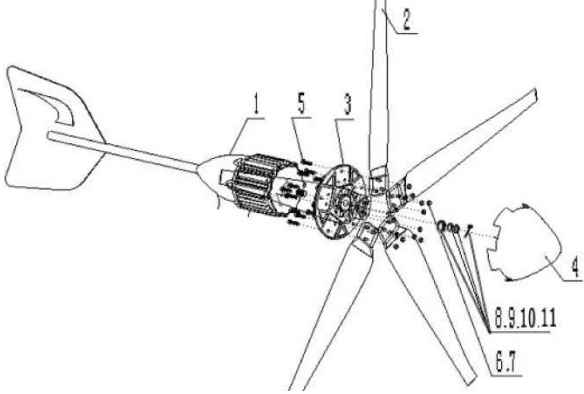
Phaesun cannot be held responsible for consequential losses.

1. Indirect, unexpected or special losses or damages;
2. Losses of margin in any way related to the product.

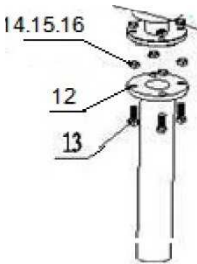
1. Technical specification

Model	Stormy Wings 400	Stormy Wings 600	Stormy Wings 1000
Rated power	400W	600W	1000W
Max. power	500W	750W	1200W
Rated voltage	12 24 48 VDC	24 48 VDC	24 48 VDC
Rated rotations per minute	750rpm	750rpm	750rpm
Start-up wind speed	2.0m/s	2.0m/s	2.0m/s
Cut-in wind speed	2.5m/s	2.5m/s	2.5m/s
Rated wind speed	12m/s	12m/s	12m/s
Max. wind speed	50m/s	50m/s	50m/s
Rotor diameter	1.55m	1.75m	1.96m
Number of blades	5	5	5
Swept area	1.89m ²	2.4m ²	3.01m ²
Generator Type	3-phase PMA		
Temperature	-40°C~60°C		
Wind protection mode	Electromagnetic brake, blades aerodynamic		
Weight	22kg	25kg	28kg
			

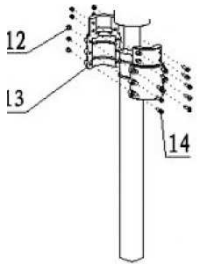
Partlist of generator with flange			
Item	Description	Pcs.	Remark
1	Tail vane	1	
2	Blades	5	
3	Hub	1	
4	Nosecone	1	
5	Hex bolts M8 x 40	15	For mounting the blades on the hub.
6	Flat washer Ø8	15	
7	Locknut M8	15	
8	Flat washer Ø16	1	For mounting the hub on the generator.
9	Spring washer Ø16	1	
10	Nut M16×1.5	1	
11	Cotter Ø4×28	1	
12	Pole flange	1	For mounting the flange.
13	Hex bolts M10×40	4	
14	Flat washer Ø10	4	
15	Spring washer Ø10	4	
16	Nut M10	4	For mounting the pole clamp
12	Locknut M6	10	
13	Pole clamp	1	
14	Socket head cap screw M6×30	10	



Flange



Clamp

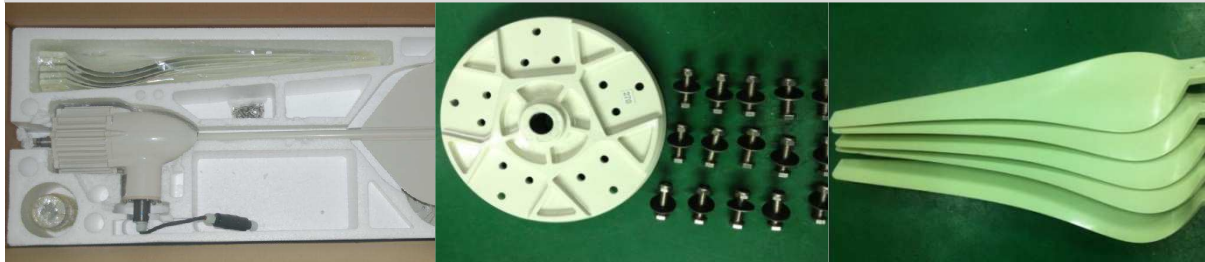


2. Wind turbine assembly

Installation on site is simple, mainly including mounting blades on the hub, securing the hub to the turbine body, installing the nosecone on the blade hub and mounting wind turbine on the pole.

Please install the whole turbine in accordance with the following instructions.

2.1 Mounting the blades on the hub



Check all components

Hub, washer, bolt and locknut

Blades



Pass the hex bolts through the back side of the hub.

Place the blade, flat washer and locknut on the hub and tighten the nut with 18 Nm.

Assembled.

2.2 Electrical connection of the wind turbine



Generator

Unscrew cable cover.

Pass the wires through the cover.



Connect the three-phase wires of the generator to the terminals of the controller. Choose the right cross section in dependency to the length of the wire



Close the cable cover



Close the waterproof cover and screw the cable seal and the pull relief in place

2.3 Mounting the tower

2.3.1 Flange connection



Place the cable through the pole.



Connect the turbine to the pole with hex bolts.



Place flat washer and spring washer on the nut. Tighten the nut with 37 Nm

2.3.2 Clamp connection



Tower clamp and mounting material.



Place rotating shaft on the upper part of the clamp.



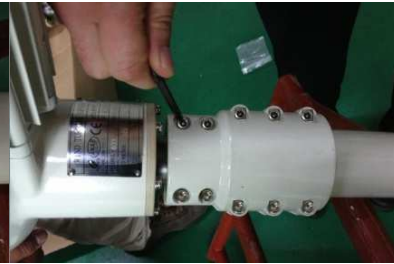
Assemble the clamp with socket head screws and locknuts. Leave the nuts not fully tightened.



Pass the wire through the pole.

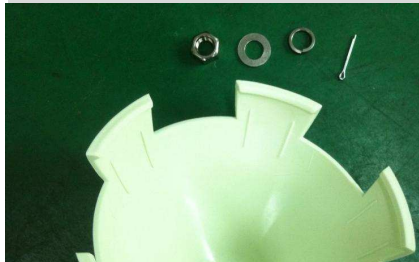


The pole is inserted into the lower part of the clamp.



Tighten the nut with 9Nm.

2.4 Mounting the hub



Nosecone and mounting material.



Place the hub with blades onto the rotor shaft. The place in sequence flat washer, spring washer and hex nut.



Fully tighten the nut with 154 Nm.



Insert the cotter into the shaft bore and separate the tails as shown.



Snap the nosecone into position over the outside edges of the blade hub. Make sure all five edges of the nosecone snap over the edge of the blade hub. Make sure it is not rubbing against the front cover of the generator.



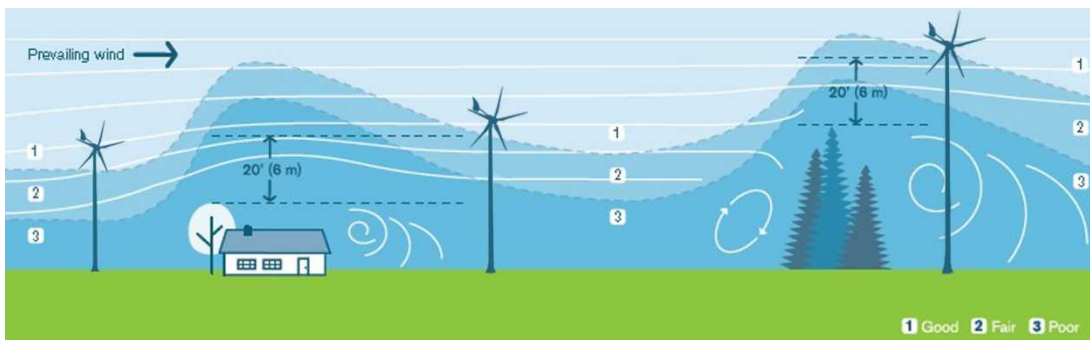
Completed assembly.

3 Tower installation

3.1 Siting

In order to operate a wind turbine successfully sufficient wind from a stable direction is required. Small changes in wind speed and direction can have great effect on electricity production. The higher the tower and the better the wind conditions, accordingly higher will be the electricity production. Therefore you should carefully think about the place of installation. Every installation differs and is often influenced by height of pole, distance to battery bank, local geographical circumstances and obstacles such as buildings and trees. The following requirements should be fulfilled:

- The minimum tower height is 6 m on open ground or 6 m above close obstacles. (see figure).
- Try to position wind turbine in an area free of turbulences. Turbulences reduce efficiency of the wind turbine and can accelerate the wear of rotating components.
- Place the generator on a location without obstacles within 200 m.
- Installation distance between two turbines should not be less than 8- 10 times rotor diameter.
- Installation site has to be complied with local regulations.



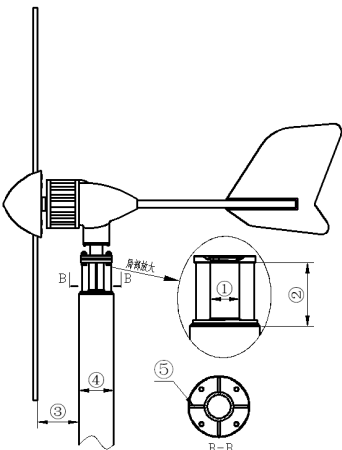
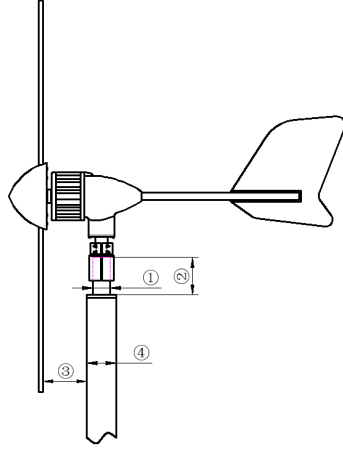
Safety must be the primary concern when selecting the mounting location. Even if installing the wind turbine on a less ideal location, don't attempt to mount the turbine while blades are spinning.



Warning: During installation the three-phase wires must be short circuited to prevent the blades from spinning

3.2 Design requirements

The tower has a direct effect on the safety of the wind turbine. The following section provides a summary of the available towers.

Flange		Tower clamp	
Dimensions:		Dimensions:	
①	External diameter 50 mm, material thickness 5 mm	①	External diameter 60 mm, material thickness 5 mm
②	100... 150 mm	②	100... 150 mm
③	130 mm	③	130 mm
④	External diameter 100... 150 mm material thickness 5 mm	④	External diameter 100... 150 mm material thickness 5 mm
⑤	4 strenghtened fins		

4. Wire size selection

All electrical systems lose energy due to resistance in the wires.

- The larger the wire is, the lower is the resistance and therefore also the losses.
- Resistance losses will also increase with increasing current; therefore, if your installation is at a site with high wind speed, it may be worthwhile to go with a thicker wire to lower the losses and increase the output of your wind turbine.
- Conversely, in low wind sites it may not be cost effective to increase the wire size since power production will be comparatively lower.

To determine the cross section of the wire, measuring the distance from the batteries to wind turbine is necessary. Make sure to include height of the tower.

Refer to the appropriate chart for your system voltage and select the wire size.

The following wire sizes provide maximum annual energy losses of 3% for most sites.

Distance from wind generator to controller	VDC	0–10m	11–20m	21–30m	31–40m	41–50m	51–60m	61–70m	71–90m
Stormy Wings 400 AWG / metric	12	9/6 mm ²	5/16 mm ²	4/21 mm ²	2/33 mm ²	1/42 mm ²	1/42 mm ²	0/53 mm ²	00/67 mm ²
	24	11/4 mm ²	9/6 mm ²	8/8 mm ²	7/10 mm ²	6/13 mm ²	5/16 mm ²	4/21 mm ²	3/26 mm ²
	48	13/2.5 mm ²	13/2.5 mm ²	13/2.5 mm ²	13/2.5 mm ²	11/4 mm ²	10/5 mm ²	9/6 mm ²	8/8 mm ²
Stormy Wings 600 AWG / metric	24	11/4 mm ²	11/4 mm ²	9/6 mm ²	8/8 mm ²	7/10 mm ²	5/16 mm ²	5/16 mm ²	4/21 mm ²
	48	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²	10/5 mm ²	8/8 mm ²	8/8 mm ²	7/10 mm ²
Stormy Wings 1000 AWG / metric	24	10/5 mm ²	6/13 mm ²	4/21 mm ²	3/26 mm ²	2/33 mm ²	1/42 mm ²	1/42 mm ²	0/53 mm ²
	48	11/4 mm ²	11/4 mm ²	10/5 mm ²	9/6 mm ²	8/8 mm ²	7/10 mm ²	6/13 mm ²	5/16 mm ²
	110	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²	11/4 mm ²

5. Troubleshooting

5.1 Troubleshooting

5.1.1 Vibration

- The blades mounting bolts get loose → tighten
- Ice on the blade surface → remove
- Distorted blades → Replace
- Tower is not strong enough or ropes got loose.
- Wind turbine turns unsteady → Check voltage of each phase.



Important: Turbine operation should be stopped as soon as abnormal vibration is noticed until problems are solved to avoid damage to persons and machine.

5.1.2 Wind direction

- If the generator does not adjust to wind direction the turbine alternator shaft may be damaged or the tower is out of plumb.
- The tower flange does not match with the turbine flange, which disturbs the turbine when trying to adjust to wind direction.
 - Check if original flange was used.
 - Check if flange of turbine is loose.
- Wind turbine is swinging back and forth.
 - Unfavorable operation site with too much turbulence.

5.1.3 Rotation speed decreases dramatically

- Generator is braked electromagnetically because battery is fully charged. → will be unlocked as soon as battery can be charged again.
- Generator is braked electromagnetically because rotational speed was too high due to too high wind speed. will be unlocked as soon as wind speed lowers.
- Mechanical friction between rotor and stator → faulty generator
- Faulty bearings → faulty generator
- Overheated generator → faulty generator
- Distorted or damaged blades → Brake blades through shortening the three phases of the generator and replace the blades.

5.1.4 Abnormal Power output

- a. Connecting Wire to long or cross section to small → Voltage drop to high → check dimensions according to chapter 4
- b. Unequal voltage on the three phases → check wiring and clamps
- c. If generator doesn't show output voltage, check if there is a short circuit in the installation.



Warning: Never check the wind turbine on a windy day, when blades are rotating.

5.1.5 Abnormal Noise

- a. Friction between rotor and stator, or bearings damaged → contact the supplier to solve the problem.
- b. Check if the turbine rotates abnormally or if noise is generated through self-vibration. (cp. 5.1.1).

5.2 System Troubleshooting

5.2.1 Off-grid wind and solar hybrid system

5.2.1.1 Solar output voltage too low or no output

- a. Check if solar module ist shorted or if circuit is disconnected.
- b. Check if solar module is damaged or to much dust has accumulated on the module.

5.2.1.2 Abnormal charging

If the wind turbine does not charge the battery it is mostly because of the following causes:

- a. Wind speed is too low to reach cut-in point. In off-grid systems, charging the battery only starts when the input voltage exceeds the battery voltage.
- b. Wind speed is high and the generator is braked.
- c. Battery is fully charged and the wind turbine brakes due to overcharge protection of the controller.

6. Maintainence

The wind turbine needs regular maintenance:

No.	Maintenance	After storm	Every 6 months	Every year	Every 2 years	Every 5 years
1	Check blades for cracks and chips	√				
2	Check the blade bolts and the hub nut for tight	√	√			
3	Check nosecone	√	√			
4	Clean blades	√	√			
5	Check all electrical connections to make sure they are tight and free from corrosion.	√	√			
6	Replace blades					√
7	Replace battery					√



Important: We suggest to reduce pole height or demount turbine before storms and to short the three-phases.