POWERTECH

300W 12VDC and 24VDC Wind Generators

User Manual

MG-4580 (12VDC)
MG-4582 (24VDC)

Table of Contents

300W 12VDC and 24VDC Wind Generators

1. Safety Precautions

Please follow the instructions and recommendations in the User Manual. This will help assure safe and rewarding use of your new renewable energy system.

WARNING!

It is essential you read the entire contents of the User Manual prior to installation and operation.

Wind generator (or wind turbine) systems present mechanical, electrical and chemical (battery) hazards that can be life threatening. The generator, tower or support structure could fall and cause injury or death and property destruction. A component of the wind generator could become loose if not maintained properly, or if the maximum wind speed of 40m/s (144kph) is exceeded and the necessary steps are not taken to minimise the risk of failure. These conditions could cause injury or death. If the wind generator is connected to a DC to AC power inverter, then high voltages from the inverter could cause injury or electrocution. A burn injury can result from an electrical short. A severe chemical burn, including blinding, can occur from a battery explosion or contact with the sulphuric acid in a lead-acid battery.

These conditions are addressed in the following safety messages:

WARNING! The WFD300W-B 12VDC and 24VDC 300W Wind Generators (MG-4580 and MG-4582 respectively) are designed for permanent terrestrial installation and use only.

WARNING! It is your responsibility to obtain all required permits and engineering certifications for your tower, guy wires and tower location. Professional advice should be obtained. Soil and wind conditions vary from area to area and tower foundations, including the tower/ mast configuration, must be designed for dynamic wind loading that is specific to the area. The tower must be positioned so that it can not fall on occupied buildings, neighbour's property or power lines. The manufacturer recommends locating the tower well away from occupied buildings and power lines ie typically 100m minimum. Tower climbing is dangerous and should only be attempted by experienced and qualified personnel using proper safety equipment.

WARNING! If the generator appears to be loose or vibrate in the tower, or is making an unusual sound, the condition must be rectified immediately. A loose generator or component presents an extremely dangerous situation as it may fall from the tower. Never stand in line with a rotating propeller.

WARNING! If excessive wind speeds are anticipated that would exceed the wind generator's maximum wind speed specification, a three phase shorting switch with a suitable electrical rating must be fitted to the generator's three phase output to short the windings of the generator for dynamic braking purposes. The switch must be applied under these atmospheric conditions to minimise the risk of mechanical failure.

WARNING! It is strongly recommended you install protection barriers to prevent unauthorized persons or children climbing the tower. Never allow an untrained person or someone without the proper safety equipment to climb the tower. Choose a calm, dry day for your installation and always stop the propeller before climbing the tower. Falling from the tower or contact with the rotating blades can be lethal.

WARNING! High voltage systems (systems with a DC to AC inverter) can represent a dangerous shock hazard and could be lethal. All high voltage systems must be wired and maintained by a qualified and licensed electrician.

WARNING! Batteries can emit dangerous and explosive gas while charging. Never turn on a light switch or any other electrical connection near a recently charged or charging a battery (or battery bank). Never light a match or make any type of spark near a recently charged or charging battery. Use protective gloves and eyeglasses when working with lead-acid batteries. Remove all personal metal items such as rings, bracelets, necklaces, and watches when working with lead-acid batteries. A lead-acid battery can produce short-circuit currents high enough to weld a ring or similar metal, causing a severe burn. Turn off all loads and be extremely careful when making a final battery connection.

WARNING! Never place objects on top of, or near the charge controller, the DC to AC inverter, or any other associated electronics. These devices may dissipate heat and require unrestricted airflow as part of normal operation. **FIRE AND FAILURE** may result if airflow is blocked to these devices.

WARNING! To reduce the risk of fire or electric shock, make sure the installed wiring and terminations are in good electrical condition and that all cables are appropriately sized to carry the necessary charge currents.

WARNING! To reduce the risk of electric shock, do not operate the wind turbine without connecting it to an appropriate ground. Grounding procedures must be followed along with any regulatory codes. Grounding the tower is essential for lightning and static protection.

Disclaimer
Unless specifically agreed to in writing, we:

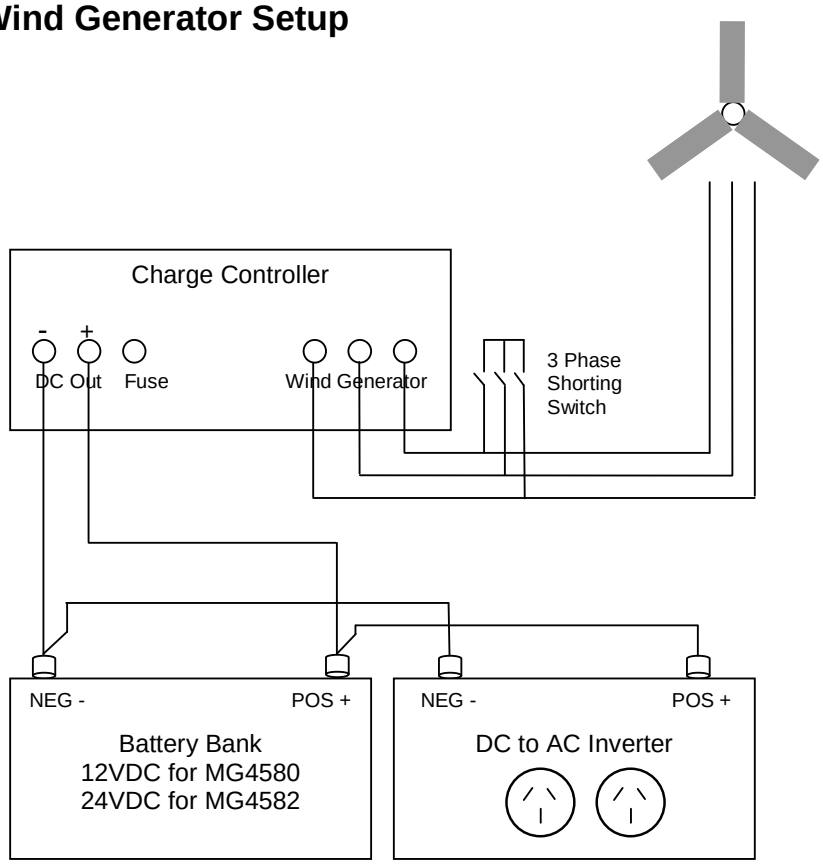
(a) Make no warranty as to the accuracy, sufficiency or suitability of any technical or other information provided in this manual or other documentation.
(b) Assume no responsibility or liability for loss or damage, whether direct, indirect, consequential or incidental, which might arise out of the use of such information. The use of any such information will be entirely at the user's risk.

2. Preliminary Overview

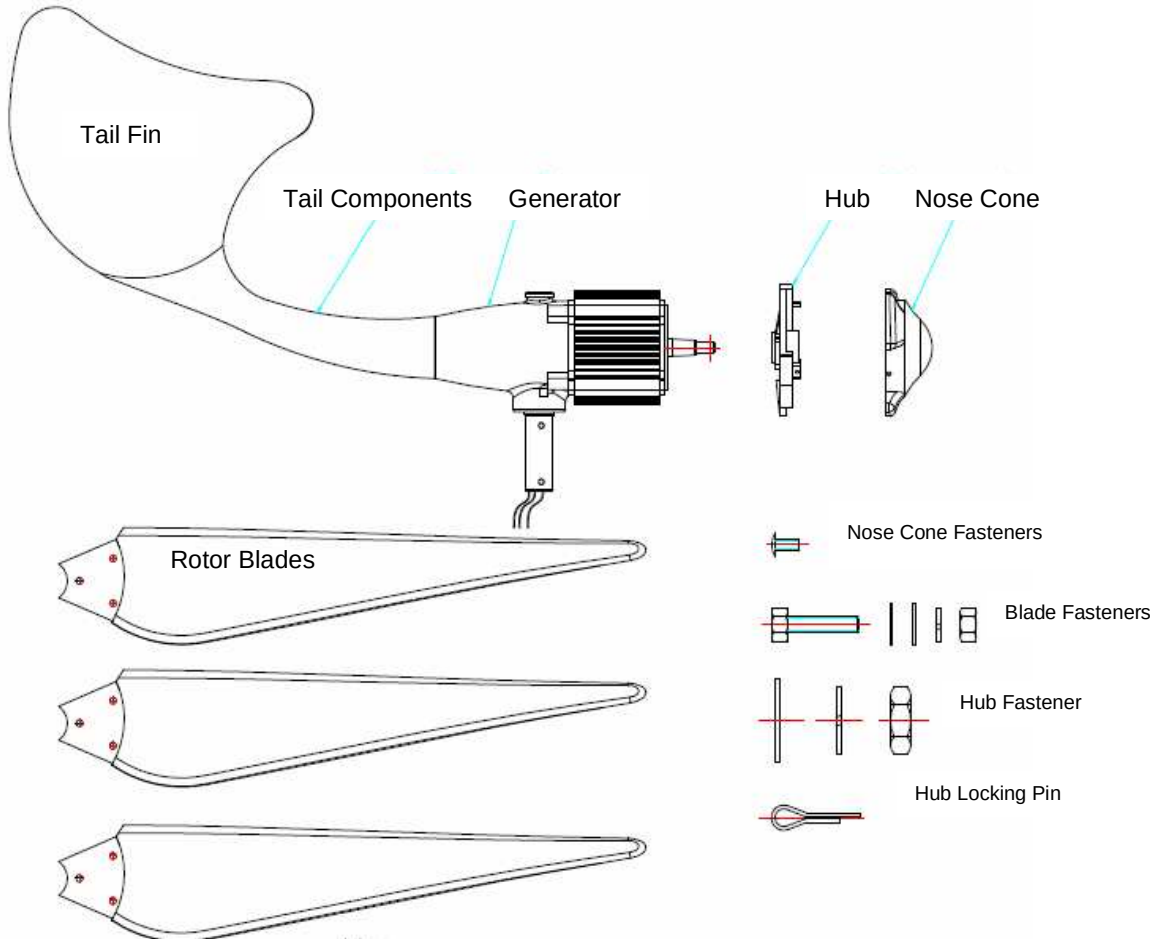
The WFD300W-B Series Wind Generators are advanced 300W alternator/ charge controller systems designed to charge batteries and supply electrical power in a 12VDC or 24VDC system. When used in conjunction with a suitable DC to AC sine-wave inverter and a battery bank, the generator can also provide high voltage AC for powering mains type AC appliances.

The 300W generators feature marine quality powder coated aluminium body, stainless steel hardware, a water tight housing and an external charge controller that provides the necessary voltage regulation to charge batteries, and slow the blades when the battery bank is charged.

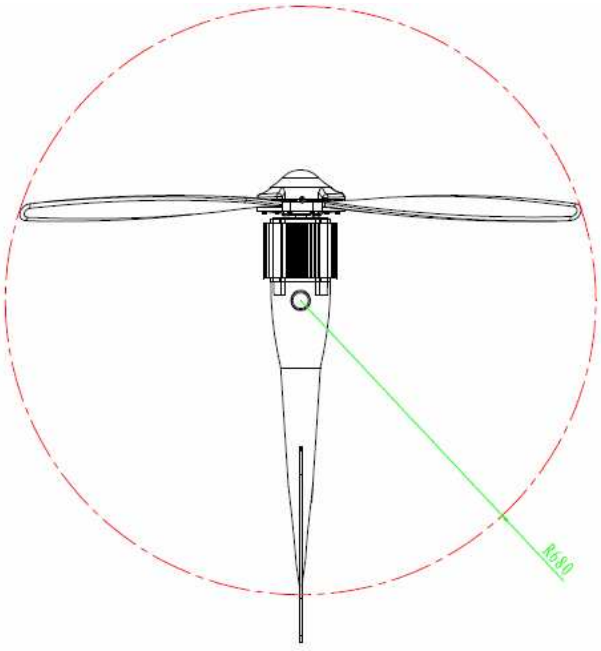
Typical Wind Generator Setup



2.1 What you should have with the 300W Wind Generator



1	Tail Fin
2	Tail Components
3	Rotor blades
1	Generator with output cables
1	Hub for mounting Rotor Blades
1	Nose Cone
1 Set	Fasteners (Bolts, Nuts, Washers, Split Pin, Screws, etc)
1	User Manual



3. System Description

The major components of the wind generator are listed below.

3.1 Rotor and Blade System

The rotor and blade system consists of three ABS engineered plastic blades fastened to a hub. The rotor blades convert the energy of the wind into rotational forces that drive the generator. The ABS blades are exceptionally strong, however, they may be damaged if they come in contact with a solid object ie a bird or flying debris. If this occurs, the blades should be inspected and replaced as necessary. Note: the ABS blades are supplied in a balanced set of three, so if one or more are damaged, all three must be replaced.

3.2 Alternator

The 300W wind generator is a horizontal axis wind generator that mounts to a vertical pole/ tower. The wind generator consists of an alternator that utilises extremely strong permanent magnets to produce 3 phase electricity.

The alternator produces a three-phase alternating current (AC) output which is rectified ad regulated into direct current (DC) by the external charge controller. Note, since the alternator uses permanent magnets, it will generate electricity/ voltage whenever the rotor is turning.

3.3 Nacelle

The nacelle is the aluminium housing that surrounds the main body of the wind generator. It contains the main structural backbone of the generator (called the mainframe), the yaw bearings, and the yaw shaft or tower mount. The yaw bearings allow the wind generator to freely pivot around the top of the tower so that the rotor faces the wind at all times

3.4 Tail Assembly

The tail assembly comprises a curved tail fin, which keep the rotor blades aligned into the oncoming wind direction.

3.5 Charge Controller

The charge controller serves as the central connection device for the electrical components of the system. The charge controller has three primary functions:

- rectifies the three-phase AC output from the alternator into DC
- regulates the DC output and charges the battery bank
- provides a load on the alternator when the batteries are fully charged

The controller continually monitors the battery voltage and compares it to the regulation set point. The regulation set point is factory set. When the battery voltage rises above the set point, it automatically stops charging the batteries. It then waits for the battery voltage to drop slightly before normal charging resumes.

WARNING! Bad connections and terminations, undersized cables, excessive cable lengths and in-line isolation diodes (blocking diodes) will prevent the charge controller from working properly.

3.6 Battery Bank Capacity

The recommended battery bank capacity should be a minimum of 400 amp hours for a 12VDC system, and 200 amp hours for a 24VDC system.

4. System Operation

4.1 Normal Operation

The rotor blade assembly of the WFD300W-B wind generator should begin to rotate when the wind speed reaches approximately 3m/s. For the first several weeks of operation, the start-up wind speed will be slightly higher because the bearing seals take a short period of time to wear in. Battery charging should commence shortly after the rotor spins up to speed. Once the rotor assembly is turning, it will continue to do so in lower wind speeds, typically down to approximately 2.5m/s.

Rotor speed increases with increased wind speed. This results in the wind generator providing a higher output. The output increases rapidly because the energy available in the wind is a function of the third power (cubed power) of the wind speed. For example, if the wind speed doubles from 5m/s to 10m/s, the energy in the wind increases by a factor of eight ie $2^3 = 2 \times 2 \times 2 = 8$.

One disadvantage of this relationship is that there is very little energy available in light winds.

WARNING! The wind generator is designed to survive in wind speeds of up to 40m/s (144km/hr).

WARNING! If wind speeds are anticipated that would exceed the wind generator's maximum wind speed specification, a three phase shorting switch with a minimum rating of 30A per phase must be connected to the three generator input terminals on the side of the charge controller. The purpose of the switch is to short the three phase windings of the generator for dynamic braking purposes. The switch must be applied when necessary to minimise the risk of mechanical failure in the event of excessive winds.

5. Wind Generator Installation

When installing the WFD300W-B wind generator, exercise care at all times. The generator weighs typically 10kg and can be awkward to handle. It is best to plan the installation carefully in advance and use qualified personnel when erecting the machine and tower to avoid accidents.

NOTE: Complete as much of the installation as possible at ground level.

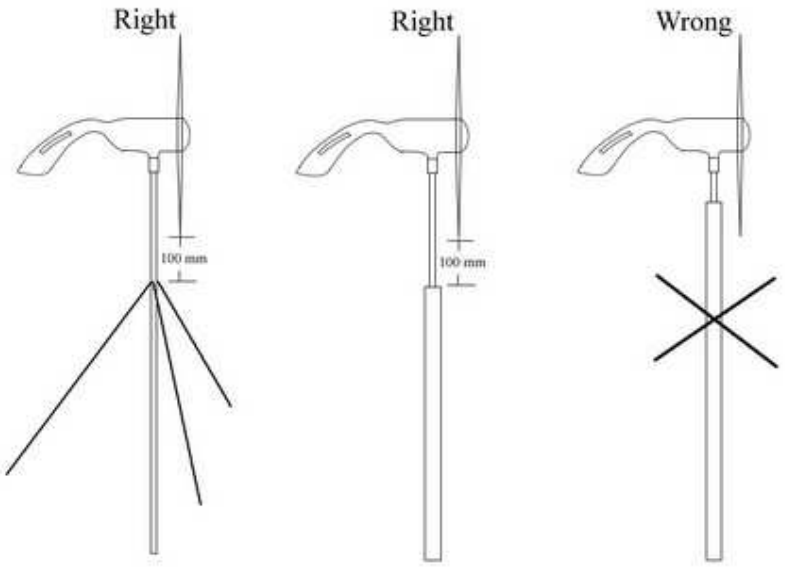
NOTE: Choose a calm, dry day for your installation.

The generator is robustly engineered, but contains high-energy permanent magnets that can be easily damaged from impacts if the machine is dropped or heavily handled.

CAUTION! Make sure the generator is disconnected from the batteries during installation.

5.1 Blade to Tower Clearance

Make sure the wind generator blades have adequate clearance from the tower. A minimum clearance of 100mm must be allowed for between the blade tips and the tower or associated rigging.



5.2 Installation

Selection of tower and rigging materials is important. Avoid connecting, or joining different metals together ie copper and aluminium as this will create an electrochemical reaction or galvanic cell that will eventually erode one of the metals. Corrosion resistant materials should be used to prevent an electrochemical reaction.

NOTE: All external electrical cables should be protected to prevent damage from wildlife. Run all wires inside conduit for protection.

The powerhead yaw shaft has a diameter of 41mm for mounting to the tower. The tower mounting pole should be made of steel and have an internal diameter of typically 42mm, with at least a 3mm thickness. The two M10 mounting holes are 82mm apart.

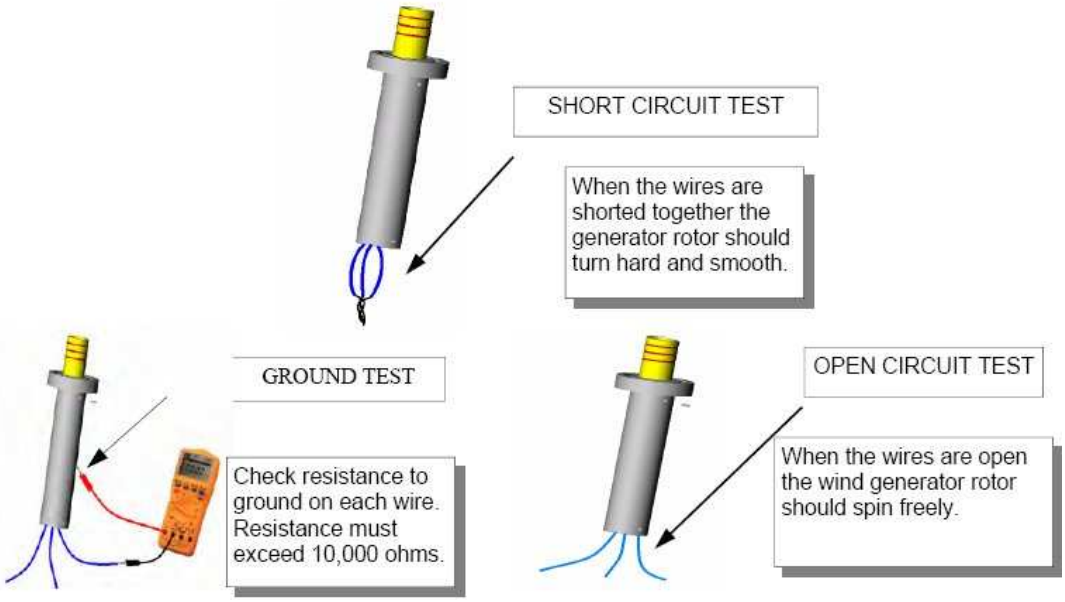
Step 1: With the tower tilted down, place the powerhead of the wind generator near the top end of the tower.

Step 2: Raise the tower about 1 metre off the ground to allow space to assemble the generator. We recommend using a temporary support stand to hold the tower up during generator assembly.

Step 3: If not already done, remove a small amount of insulation from the three generator wires. Then conduct the following electrical tests.

Electrical Tests

Complete these tests before mounting blades to rotor, and before installing turbine to top of tower.
These tests confirm that the wind generator is functional and ready to install on the tower.



Step 4: The connecting wires from the powerhead to the battery bank should be appropriately sized to minimise cable loss. For low voltage machines, transmission losses can be considerable, so try to keep the cable run as short as possible to the charge controller. Typically, you should use at least 4 square mm copper cables for runs up to 14m, and 6 square mm for longer runs approaching 20m.

Now run three extension wires from the generator down inside the tower to the charge controller location before mounting the powerhead assembly to the tower.

Step 5: Join the generator output wires to the extension wires running inside the tower using high current waterproof connectors or solder. If soldered, use heat-shrink tubing, self amalgamating tape or similar to insulate and protect. The connections must be done properly and made waterproof to minimise the possibility of oxidation and failure.

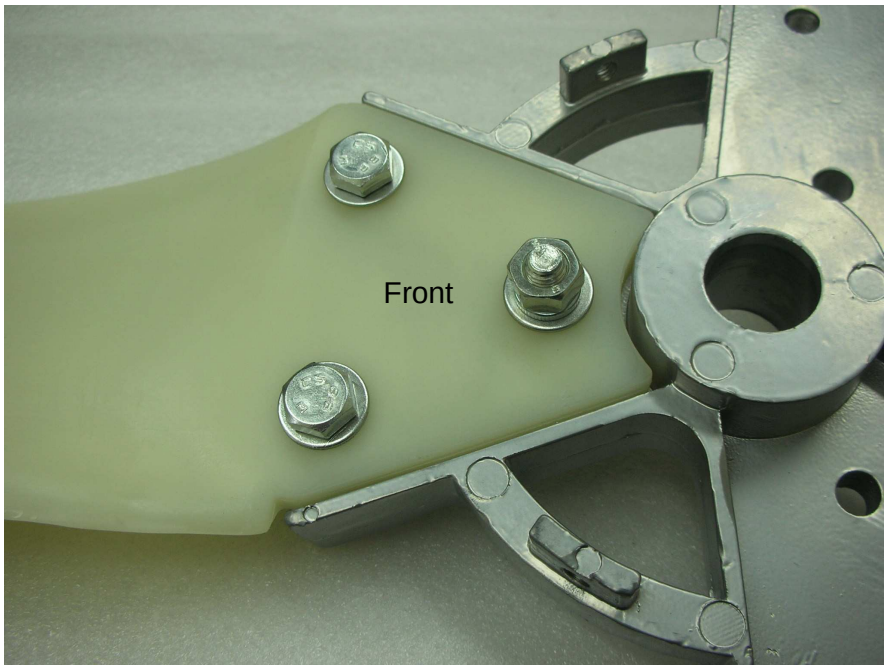
Step 6: Electrically short all three extension wires at the charge controller end with a small piece of wire to prevent the generator from turning and producing power. Note: the short-circuit wire must be removed during the electrical installation stage later on.

Step 7: Gently pull the three wires down through the tower, being careful not to damage or pinch the cabling. Then mount the powerhead to the top of the tower. Check the powerhead is securely mounted to the tower with the two M10 bolts supplied, as it must hold firmly in high velocity winds. Use Loctite, or similar to prevent the bolts from working loose.

Step 8: Using a torque wrench, tighten all powerhead/ tower mounting fasteners to 54Nm.

Step 9: Bolt the tail fin to the generator with the four screws and flat washers. Then screw the two side cover plates onto the tail assembly.

Step 10: Attach the rotor blades to the hub with the red coloured tips facing the front, or oncoming wind direction, using the hardware provided. Note the direction of the bolts. Use Loctite, or similar to prevent the bolts from working loose. Bolt one blade up solidly and leave the other two somewhat loose ie finger tight.



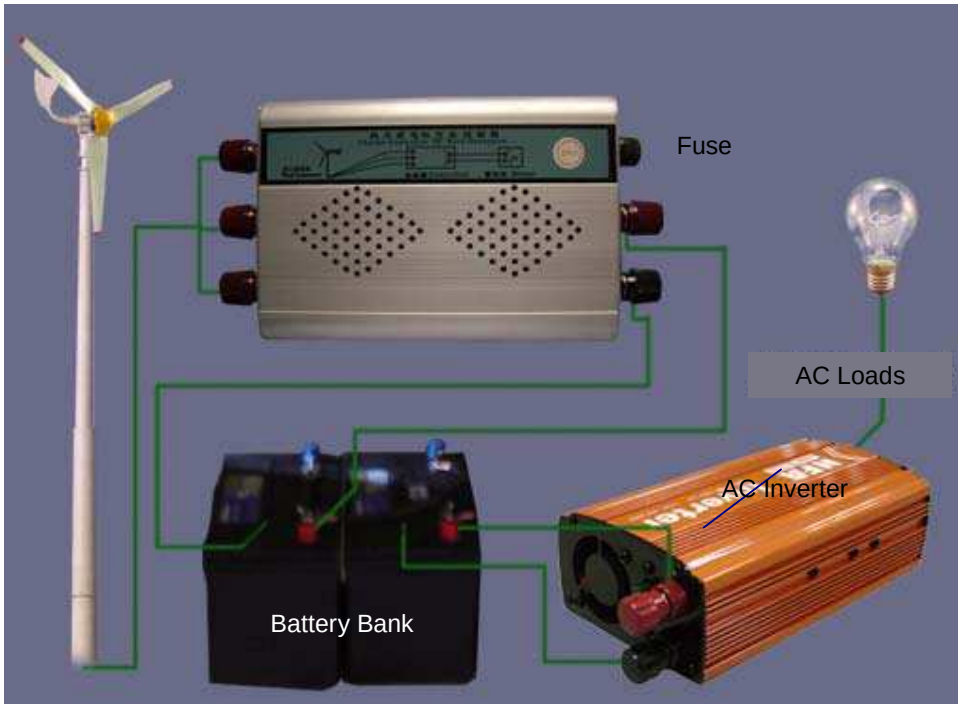
Step 11: Carefully slide the rotor blade assembly onto the generator shaft. Place the flat washer, then the split washer, then the nut on the generator shaft and tighten with a torque wrench to 68 to 88Nm. Insert the Cotter pin and bend the ends to prevent the nut from becoming loose.

Step 12: Accurately check the tip-to-tip blade distance and adjust as necessary so they are all equal. This will optimise configuration, alignment and balance of the blade assembly. Tighten all blade nuts once balanced using a torque wrench to 14 to 16Nm.

Step 13: Carefully place the nose cone over the hub and rotor blade assembly. Insert the three screws and tighten. Use Loctite, or similar to prevent the screws from working loose.

Step 14: Carefully raise the tower making sure not to damage the wind generator; especially the blades and rotor assembly. Secure the tower firmly with guy wires as required.

6. Electrical Connections



The general electrical configuration or setup is illustrated in Section 2 and above. The tower should also be grounded for electrical safety. In most cases the loads will probably be 240VAC/50Hz and will obtain power via an AC inverter connected to the battery bank.

The charge controller must be installed in a waterproof cabinet or indoors, and should be located relatively close the battery bank to minimise cable losses.

WARNING! Do not install the charge controller outdoors without protection; it is not waterproof.

WARNING! Never place objects on top of, or adjacent to the charge controller. The charge controller dissipates heat and requires unrestricted airflow as part of normal operation. **FIRE AND FAILURE** may result if airflow is blocked. Do not mount the charge controller near anything that is flammable or heat sensitive.

WARNING! Connect the battery first to the charge controller.

Step 1: Connect the battery leads to the charge controller. First connect the negative (-) battery wire to the negative (-) terminal on the charge controller, then connect the positive (+) battery wire to the charge controller. If a very large spark occurs, the connections are reversed. Check wiring configuration if this occurs.

WARNING! The user must connect batteries to the wind generator system. Without the batteries connected, the wind generator or charge controller may be damaged after some time!

Step 2: Remove the shorting wire from the three extension wires. Connect the three wind generator leads to the three terminals on the charge controller. The three wires are interchangeable and therefore are not labelled. Any lead can go to any of the three input terminals.

Step 3: If wind speeds are anticipated that would exceed the wind generator's maximum wind speed specification, a three phase shorting switch with a minimum rating of 30A per phase must also be connected to the three generator input terminals on the side of the charge controller. The purpose of the switch is to short the three phase windings of the generator for dynamic braking purposes. The switch must be applied to minimise the risk of mechanical failure in the event of excessive winds.

The switch should also be applied prior to conducting any maintenance on the generator head.

Note: The switch must be left open under normal operating conditions.

Step 3: If the system includes a DC to AC inverter, connect the inverter DC leads to the battery terminals, not to the charge controller. The controller circuit board is not designed to handle the high currents that are possible when power inverters are fully loaded. Inverters can draw extremely high currents, hence the reason they should be directly and securely connected to the batteries with appropriately sized cables. Refer to suppliers recommended cable sizes.

WARNING! Do not connect the wind generator directly to an inverter without batteries. The inverter will not work and may suffer permanent damage.

WARNING! Do not disconnect the batteries while the inverter or wind generator is running. Permanent damage may occur.

Ensure that you have the correct battery size, voltage and capacity for your system. The MG-4580 utilises a 12VDC battery system. The MG-4582 utilises a 24VDC battery system.

Ensure that the batteries used are identical types and of identical age. Mixing different types/sizes/ages of battery will cause all the batteries in the bank to fail or age prematurely. If you need to replace batteries, you should replace all at once.

WARNING! If it is necessary to disconnect the generator for some reason, do so before disconnecting the battery from the charge controller.

7. Maintenance - Monthly

7.1 Wind Generator

Check the wind generator monthly for mechanical noises, rattles, buzzes or vibration. These conditions can be damaging and must be investigated and addressed. It is essential the rotor blades and hub are balanced and do not wobble.

WARNING! If the blades or the wind generator wobble it must be rectified immediately.

WARNING! If the blades appear to be out of alignment or bent they should be replaced immediately.

WARNING! Any maintenance conducted on the wind generator should be conducted on a calm and dry day. The three phase shorting switch must be applied prior to any maintenance being conducted. Never approach the wind generator during windy conditions as this is considered extremely dangerous.

Open the three phase shorting switch once the maintenance has been completed.

7.2 Tower

Undertake all maintenance requirements outlined by the tower manufacturer/ supplier. Inspect the tower thoroughly including guy wires and foundations. Tighten all nuts and bolts, especially wire clips. Check for cracks, corrosion, bent or broken parts and inspect the anchors and tower base structure. Check for broken strands and tighten guy wires as necessary.

7.3 Cable Connections and Batteries

Consult the battery manufacturer's maintenance guide and follow the instructions for periodic maintenance. Check and tighten all cable and battery connections as loose terminations can cause localised heating and a reduction in output power. Remove any corrosion and protect the terminals.

8. Maintenance - Yearly

8.1 Wind Generator and Tower

WARNING! Any maintenance conducted on the wind generator should be conducted on a calm and dry day. The three phase shorting switch must be applied prior to any maintenance being conducted. Never approach the wind generator during windy conditions as this is considered extremely dangerous.

Lower the tower and thoroughly inspect the wind generator. Fix or replace any worn, damaged or loose parts. Check and tighten all mounting nuts and bolts. Check and tighten all rotor blade mounting bolts. Check the bearings for 'play'. Just perceptible 'play' is acceptable. Clean the blades with a mild detergent to remove all dirt and debris. Avoid scratching the surface.

Replace rotor blades if they are cracked or damaged in any way. Note: the ABS blades are supplied in a balanced set of three, so if one or more are damaged, all three must be replaced.

Open the three phase shorting switch once the maintenance has been completed.

9. Trouble Shooting

The following table should be used as a guide to pinpoint the cause of any operational problems.

Problem	Cause(s)	Diagnosis	Remedy
Battery voltage gets too high.	Charge controller output voltage regulation too high.	Excessive battery gassing. Use a precision DC voltmeter to check battery voltages. Use a hydrometer to check the specific gravity of the battery acid if applicable. Compare results to battery manufacturer's recommendations.	Contact factory or distributor for repair.
Batteries do not reach full state of charge.	Charge controller output voltage regulation too low.	Battery not providing enough power. Use a precision DC voltmeter to check battery voltages. Use a hydrometer to check the specific gravity of the battery acid if applicable. Compare to battery manufacturer's recommendations.	Contact factory or distributor for repair.
	Cable losses too high.	Check cable sizes (ie gauge size) and cable runs. Cable sizes too small or cable runs too long. This can result in excessive voltage drops.	Increase cable size (ie reduce gauge) or shorten cable runs.
	Connector or termination losses too high	Check connectors and terminations. Loose connectors and terminations can cause voltage drops, as well as localised heating.	Properly secure connectors and cable terminations.
	Loads are too large.	Remove largest load and check if the battery bank now reaches full state of charge. If so, the system was overloaded.	Reduce loads
	Insufficient wind power	System not providing enough power.	No remedy
Rotor spins, but the system does not charge batteries at all.	Possible damaged stator winding, or damaged charge controller	Check three phase AC output voltage from generator with a True RMS AC voltmeter, also check DC output voltage from the charge controller with a DC voltmeter.	Replace charge controller, or wind generator powerhead as necessary.
Rotor is unbalanced, causing the generator to vibrate or move back and forth as it spins.	Blade tips not evenly spaced or out of alignment ie blades are out of balance for some reason	Accurately check the blade tip-to-tip distances. The tip-to-tip distances should all be equal.	Loosening one blade at a time, adjust the tip-to-tip spacing so that they are all equal. Check that the rotor blade assembly if evenly balanced.

10. Limited Warranty

We provide free replacement cover for all defects with respect to parts and workmanship for a period of two years from the date of purchase. Our obligation is limited to replacing parts which have been promptly reported to the seller as having been in his opinion defective, and are so found by us upon inspection.

Defective parts must be returned to us as soon as possible, or to an authorised agent.

This warranty is void in the event of damage due to improper installation, failure to comply with required regulations and certificates, owner neglect, blade damage resulting from flying objects, or natural disasters such as lightning, extreme winds, and does not extend to any additional devices connected to the system.

This warranty is also void if any modifications are carried out on the wind generator.

No responsibility is assumed for incidental or consequential damage, damage caused by the use of any unauthorised components.

11. Specifications

Model No.	WFD300W-B
Rated Power	300W
Maximum Power	500W
Rated DC Output Voltage	MG-4580 12VDC, MG-4582 24DCV
Start-up Wind Speed	3m/s
Rated Wind Speed	12m/s
Maximum Wind Speed	40m/s
Cut-Out Wind Speed	None, Fixed
Temperature Range	-40 to +60 Deg. C
Rotor/ Blade Diameter	1.5m
Rotor speed	550rpm
Blade material	ABS Engineered Plastic
Height of tower (Recommended)	6 m
Generator	3 phase Iron Boron Neodymium magnet alternator
Turbine Weight	11kg