AWP3.6 V3.0
Wind Generator

Owners Manual

Version 3.0

(DRAFT1.0)

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Safety Warning !

1. Electrical Shock hazard
   The Wind generator can produce higher than nominal voltages when running open circuit. This is especially dangerous in the higher voltage machines. Keep the output wires shorted initially and carefully follow the installation instructions.

2. The AWP36 is a heavily built machine and can cause injury if not assembled and raised carefully, following the instructions and using the correct equipment.

3. Do not get close to the machine while the blades are spinning- they can cause serious injury!

Notice

African Windpower has made every effort to ensure that the information presented in this manual is accurate but assumes no responsibility for any errors or omissions. Users of this information and AWP products assume full responsibility and risk.

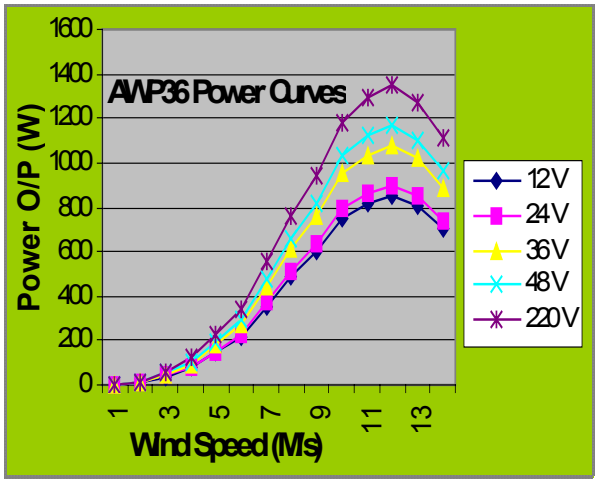
2. **Introduction.**

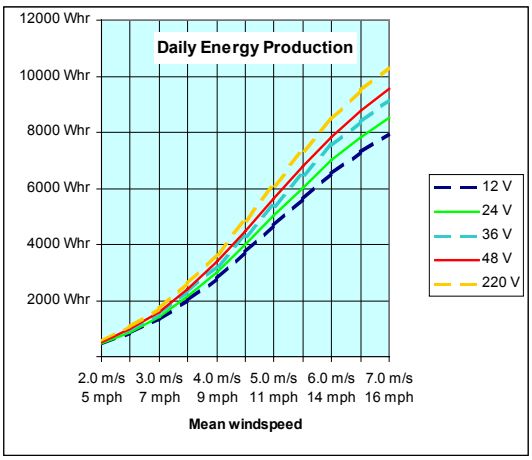
This manual contains all necessary information for assembling, operating and maintaining the AWP36 Wind generator, please read it carefully and retain for future reference.
The manual covers all machines from 12v to 220v.
The AWP36 can be used for charging batteries or powering electric pumps and space heaters.
The AWP36 is built ruggedly , in the style of the ”Heavy Metal School”. The 30 pole machine operates at a relatively low RPM, which together with only 3 moving parts, ensures very long life with little maintenance. It’s large swept area ensures energy capture from low wind speeds other machines ignore, but is also good in high winds. The simple gravity yaw system protects the machine by reliably swinging the rotor out of winds faster than 12 m/sec (40Km/Hr).

3. AWP3.6 V3.0 Specification

Peak Power Rating	**1200 W at 48V - 1500 W in 110/220V Inverter Grid Connect System**
Rated Wind Speed	**12m/s**
Start up wind Speed	**3.5m/sec**
Cut in Wind Speed	**3m/sec**
Energy Production	**3m/s 2KWHr/Day - 4m/s 5KWHrs/Day - 5m/s 8KWHr/day**
Alternator Design	**30 Pole (Ceramic Magnet) Rotor, Laminated Axial Stator**
Electrical Output	**3 Phase 'Wild' AC, 0-100Hz, 12V,24V,36V,48V,96V,110/220V**
Rotor Diameter	**3.6 Meters**
Maximum RPM	**450**
Number of Blades	**3**
Blade Construction	**Foam Core, Resin Transfer Moulded, GRP Composite design**
Speed/Power Control	**Gravity Yaw System**
Max Design Windspeed	**60m/sec**
Configuration	**Upwind Rotor - furling tail**
Tail Construction	**Mild steel powder coated, Marine version - Stainless Steel**
Yaw Head Construction	**Mild steel powder coated, Marine version - hot dip galvanised**
Cable Connection	**Heavy duty slip rings**
Tower Top Mounting	**3 Inch Table D Flange - (4 x 18mm Bolt holes on 150mm PCD)**
Tower Top Weight	**120Kgs (220 Pounds)**
Battery Charge Control	**Diversion dump control, turbine side, high side switching**
Dump Load	**Wall mounted resistive heater 1500W**
Shipping dimensions	**Wooden crate 1900 x 570 x 540mm (74x23x21ins) 160Kgs (358Lbs)**
Reccomended tower **pipe sizes - guyed tilt up type**	**90mm x 5mm Tubing up to 18 meters** **115mm x 5mm Tubing 18 to 30 meters**

Curves Power and Energy Production





4. Equipment Supplied

QTY	DESCRIPTION	OK
1	ALTERNATOR	
1	YAW HEAD	
3	16MM ALTERNATOR MOUNTING BOLTS	
4	16MM YAW HEAD MOUNTING BOLTS	
2	TAIL FIN PIECES	
2	TAIL BOOM PIECES	
7	TAIL FIN BOLTS	
2	TAIL BOOM BOLTS	
1	16MM TAIL BOOM BOLT	
3	BLADES	
6	BLADE BOLTS,WASHERS,NYLOCK NUTS	
3	POLYURATHANE BLADE PADS	
3	STEEL CLAMPING PLATES	
3	NOSE CONE MOUNTING BRACKETS	
3	NOSE CONE, 3 x 6MM MACHINE SCREWS	
1	CABLE CLAMP, 2 STUDS,WASHERS, 6MM NUTS, CLAMPING BAR, INSULATOR PAD	
1	TOP CAP, 2 x 6MM SCREWS	
1	CABLE SUSPENSION EYE, WASHER, BOLT	
1	CONTROLLER	
1	DUMP LOAD	
1	MANUAL	

And if ordered from African Windpower:

Tower Kit	
High Voltage Controller	
Step Down Controller	

From other suppliers :

Drop Wires 3 core (Flexible in non slip ring version)	
Cable to connect from tower to controller	
Batteries, connectors and battery cable	
Inverter and AC Wiring	
Main Battery Fuse	
Locktite	

5. Tools required.

10mm RING SPANNER	
13mm RING SPANNER	
17mm RING SPANNER	
24mm RING SPANNER	
8” ADJUSTABLE SPANNER	
SOCKET SET	
GREASE GUN	
ELECTRICAL PLIERS	
CRIMPING TOOL	

6. Assembly Outline

- First assemble the tower, then raise it without the turbine, and adjust all the rigging so that the tower stands vertical and will lower and raise correctly.
- It is best to assemble the machine while on the ground, onto the lowered tilt-up tower, which can then be raised. Due to the considerable weight of the generator (125 kg), it is difficult and dangerous to attach it to a raised tower.
- Although one person can assemble the machine with mechanical aids, it is advisable to have an assistant since many parts are heavy and cumbersome to manoeuvre into position. At least two people are needed to raise the machine.
- Keep the alternator wrapped in the plastic sheeting as long as possible to prevent dirt or metal objects from entering the alternator and becoming lodged between the magnets and the rotor.

Assembly Procedure :

a. The top of the lowered tower should be supported about 1,5 meters (4 feet) off the ground. See pic (1).

Non Slip Ring Option

b. Bolt the Yaw Head to the tower top flange(1). Pull the cables through the tower pipe and yaw head inner tube using a length of fencing wire or other suitable device (2). Screw the shorter threaded section of the cable clamp studs into the threaded holes on the top of the Yaw Head. Fit the cable clamp onto the studs, feed the drop wires down the conduit and then fit the top cable clamp piece and insulator pad onto the studs and clamp the cable in place (3).

Slip Ring Option

c. The drop cable must be supported just below the tower top flange. Drill an 8.5mm hole through the tower pipe 50mm below the flange (4) Leaving a tail of 300mm loop the cable around the cable eye and bind it securely with heavy duty cable ties(5). Bolt the eye to the pipe with the 8mm bolt and over size washer passing through the drilled hole and the centre of the eye.
d. Hang the Yaw Head from the Tower Top flange with 1 x 16mm bolt and join the 3 wires from the slip rings to the drop wires (5). Insulate the joins with plenty of PVC tape. Swing the Yaw Head up to the flange and bolt on using the remainder of the16mm bolts, washers and nylock nuts provided. (1)
e. Screw the shorter threaded end of the 2 cable clamp stud bolts into the holes in the top surface of the yaw mount (2). Fit the top clamp piece and insulator and tighten down with nuts.

Both versions :

f. Fit top cap, and secure by 6mm screws into lower cable clamp casting (15).
g. Offer up the alternator to the yaw mount. The alternator weighs about 75 Kgs and is very awkward to hold, so plan this carefully. The tail gate of a pick up truck works well, or you could use a wheel barrow or drum etc. (6)

h. Line up the bolt holes and pass the cables through the correct hole provided. Take care not to crush the cable while doing this and tighten the 16mm bolts not forgetting the lock washers (7). Locktite could be used on the bolt threads for extra security.
Screw the shorter threaded section of one blade stud bolt into one of the threaded bolt holes on the front of the alternator. Use it as a handle to turn the turbine at a steady rate and check that there is a similar AC voltage measured across the 3 drop wires at the foot of the mast (3 measurements). If ok screw in the remaining 5 stud bolts (8).

i. Insert the front tail section between the 2 hinge lugs on the rear of the yaw mount and insert the hinge bolt and nylock nut and tighten so that the bolt will not rotate. (9)

j. Bolt rear tail boom section to front section. Bolt the two tail fin sections to the rear tail boom. (10)

k. Fit the three blades onto the blade studs with flat side to the front. (10)

l. Fit the polyurathane pressure pads and clamping plates on the three blades and place the Nose Cone clamping brackets between the blades (11). Fit 12mm washers and nylock nuts. Moderately tighten one blade then check for even spacing of the blades by measuring tip to tip (12). When spacing is with in 10mm tighten the nuts to 75KgM (75FtLbs) torque.

m. Check that the rotor can turn freely and that the blades pass the tower at equal distances. If there is more than 10mm difference determine that there are no foreign bodies causing the problem. Short (connect together) the drop wires at the foot of the tower, this acts as a brake on the turbine, preventing it from turning whilst the tower is being raised. Check that there is now resistance to turning the rotor. Attach any logos or signage provided to tail.

n. Fit nose cone and secure with 6mm bolts (14).

o. Make sure the brushes are sitting well, and all connections in the tterminal box are secure, then secure the door closed, then proceed to raise the tower.

p. Once raised, check again that the tower is vertical so that the turbine can yaw (turn into the wind) properly.

q. Put the stop switch in the controller to the STOP position and connect the controller, dump load and battery according to the Controller Instructions below. Remove the shorting bridge wire from the drop cable and switch the Brake switch to RUN. If you have some wind the turbine will soon start turning. Section 12 will help if you have problems with the operation of the turbine.

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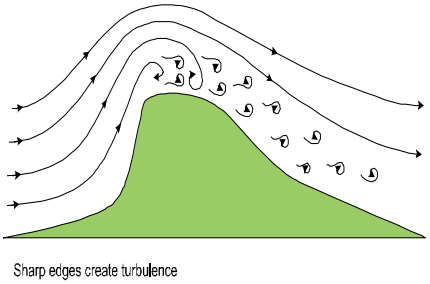
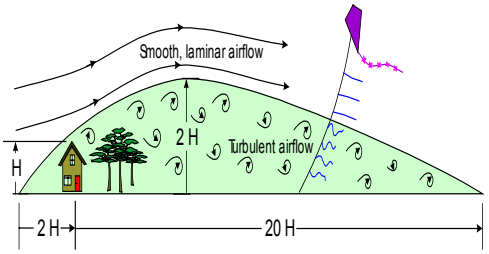
7. Siting the Wind Generator

To ensure good performance from the Wind Generator it is important that care is taken in the siting of the machine.





Turbulent airflow created by obstructions (Ad. P.Gipe, 93)

Buildings, trees and rocky outcrops disrupt the smooth flow of wind creating a wind shear with the wind velocity nearer the ground being slower than that higher up.

Turbulence is also created by these obstructions. Turbulence is detrimental as the swirling air causes the turbine to yaw continually thus stressing the mechanical parts and greatly increasing wear and tare. Therefor, as a general rule the Turbine should be mounted twice as high as any such obstructions. The power obtained from the wind is proportional the cube of the wind speed, and the wind speed increases with height from the ground. A 26% increase in wind speed from a higher tower will yield a 100% increase in power from the turbine. A little more money spent on a higher tower will harvest the same power as 2 machines!

Preference should be given to the prevailing wind direction but it should be noted that tall features behind the Turbine can also slow down the wind flow through the turbine.

8. Towers and Rigging

Great care should be taken in the selection and preparation of the wind turbine tower as this is the most difficult and crucial aspect of the entire installation. Towers can be the triangulated ridged type used with traditional wind rose water pumps(not recommended as they are normally about 8 meters high with surrounding established trees out growing them. Much preferred (by me as I don't like working up a tower) are the guyed tilt up tubular type. They can easily be raised and lowered for maintenance using a gin pole and hand operated Tirfor winch or vehicle winch. The turbine should be mounted on a 90mm pipe extending at least 1400mm from the last flange to which guys are attached.
There should be a minimum of 300mm measured horizontally from the lowest tip of the blade to any part of the tower. A separate manual covering towers in detail is available.

9. Inspection and Maintenance

a. **Wind Turbine-** The turbine has been designed to operate with a minimum of maintenance.
   - Every 6 months check excessive twisting of the electrical cables inside the tower and if necessary disconnect at tower base and untwist. At a site that does not experience excessive turbulence the average clockwise turns will be cancelled by anti clockwise turns. Listen for unusual alternator or blade noise and look for excessive vibration which would all call for close inspection.
   - Inspect the blades for leading edge ware and apply grease to all lubricating points. This should be done either by lowering the tower or by climbing it.

b. Tower

Every 6 months

- Check that the guys are tight. Check that the guy cable clamps are tight by ensuring that there is still a slack loop between the upper most clamp and the next lower one.
- Check that the shackles are tight.
- Check that the stay rod bolts are still locked together.
- Check all cables for excess fraying or rust.

Every 12 months

- Check the upper guy joints for wear and rust
- Paint all exposed metal parts**.**

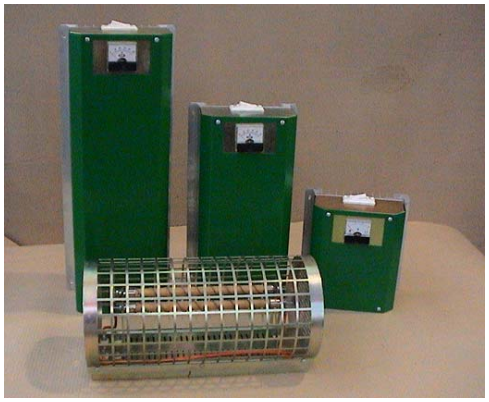
10. Fault Finding

Symptoms	**Possible Causes**	**Solutions**
Turbine Fails to Turn in good wind	**Shorted cables** **Shorted diodes** **Failed bearings** **Foreign body in generator**	**Remove short** **Replace faulty diode(s)** **Replace** **Remove obstruction**
Turbine turns slowly in good wind	**Partial short in cables** **1 diode short**	**Remove short** **Replace diode**
Turbine growls and amps are low	**1 phase open circuit** **Faulty diodes**	**Repair open circuit** **Replace diodes**
Low output **Batteries flat**	**Insufficient wind** **High power usage**	**Improve tower siting/height** **Economise on power use**
Turbine vibrates excessively	**Blades out of balance** **Yaw bearing worn**	**Check blade geometry/balance** **Replace yaw bearing**
Turbine fails to swing into the wind	**Tower top not vertical** **Yaw bearing worn/ broken**	**Adjust guy cables** **Replace yaw bearing**
Turbine running at high speed no output	**Cables disconnected** **Battery Fuse blown** **Controller Ammeter open circuit**	**Fix cables** **Replace fuse** **Replace meter**

Charge Controller Information

Contents

1. General information
2. Controller Description
3. Installation instructions
4. Electrical schematic
5. Cable and fuse ratings



1. General Information

Controller Voltage	12v	24v	36v	48v
Code	AWP36CC-12	AWPCC36-24	AWP36CC-36	AWP36CC-48
Dimensions (mm)	550x220x120	400x220x120	220x220x120	220x220x120
Weight (Kgs)	8	6	3	3
Factory set Dump volts	14V	28V	42V	56V
Factory set Pre dump volts	13V	26V	40V	52V
Code	AWP36DL-12	AWP39DL-24	AWP36DL-36	AWP36DL-48
Dimensions (mm)	470x160x160	470x160x160	470x160x160	470x160x160
Weight (Kg)	2	2	2	2

2. Controller Description

The charge controller rectifies the 3 phase AC current from the wind turbine producing DC current to charge batteries. The controller has a Brake switch connected to the input terminals, which can be used to stop the turbine in moderate winds and keep the turbine braked. The meter on the controller front panel indicates the amount of current produced by the wind turbine. When the battery voltage reaches the Pre-dump voltage, set by P1 on the control card, a relay switches on. The contacts of this relay can be used to turn on some useful load which will use the excess energy rather than have it burnt off in heat when the battery reaches the higher dump voltage. When the battery reaches this higher "Float" voltage set by P2, a power transistor on the control card begins to divert pulses of current to the 1200W Dump Load which dissipates the extra power in heat.

3. Installation Instructions

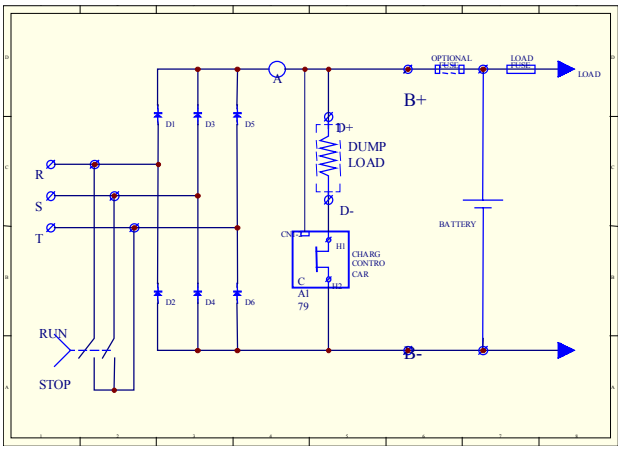
The AWP Charge controller should be mounted on a vertical surface in a dry well ventilated area near to the battery.
NOTE : Never allow the Wind Turbine to feed power to the Controller before the battery and dump load are connected. The turbine develops high voltages when not loaded and this causes serious damage to the controller. To prevent damage put the Brake Switch to the STOP position, then after crimping suitable lugs to the three cables from the wind generator, connect the cables to the terminals marked R S T. These connections can be made in any order. The dump load should be connected to the two terminal marked Dump Load + and – and can be connected in any order. The battery must be connected with the CORRECT polarity to the terminals market Battery + and Battery-. Reversal of these connections will destroy the rectifier diodes in the controller. It is advisable to

connect the controller to the battery via a suitable a fuse near to the battery. Please note the Pre Dump relay is for control only – it should not carry load current. It should be used to turn on a larger relay or electronic switch that can carry higher currents.

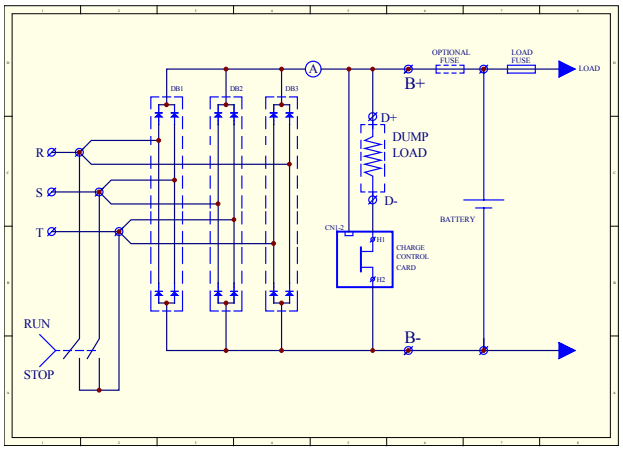
NOTE : When disconnecting any part of the electrical system , first stop the generator with the Brake switch and leave it parked until all components have been reconnected correctly.

4. Electrical schematics

a. 12V and 24V Versions



b. 36V and 48V Versions



5. Ratings for cables and fuses

Controller Voltage	12	24	36	48
Battery Fuse	100 Amp	50 Amp	40 Amp	30 Amp
Battery Cable Size	16mm	10mm	10mm	6mm
Dump Load Cable Size	10mm	8mm	6mm	6mm
Turbine Cable cross section 50 meters run	16mm	10mm	6mm	4mm
Turbine Cable cross section 100 meters run	25mm	16mm	10mm	6mm
Turbine cable cross section 150 meters run	32mm	25mm	16mm	10mm