

Shanghai Aeolus Windpower Technology Co., Ltd.

The introduction and operation manual of 10kw vertical axis wind turbine of



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1 Description

Thank you for purchasing an SAWT PK10-AB wind turbine.

The Shanghai Aeolus Windpower Technology Co., LTD. (abbreviated to SAWT) CE Certified Vertical Axis Wind Turbines are able to utilize wind from any unspecified direction and angle, the thermal wind to the axis (upward) angle over buildings converts that energy with an even higher efficiency.

No other wind turbine in our knowledge has these properties to utilize the ever-changing wind direction within the cities. Constantly shifting winds are a serious problem for the Horizontal Axis wind turbine.

Vertical Axis Wind Turbines (VAWT) employing individual blade pitch and the over speed control with aerodynamics.

Over speed control is accomplished by change on the attack angle of the blades.

Our Vertical Axis Wind Turbines (VAWT) has odd number of 5 blades with a fixed distance to the shaft. They are far safer, high aerodynamic efficiency, no noticeable vibration and are maintenance free.

This gives Vertical Axis Wind Turbine an advantage over Horizontal Axis wind turbine.

Another advantage is the low surrounding noise created by Vertical Axis Wind Turbine which brings the VAWT very close to residential area.

The PK10-AB is a Vertical Axis Wind Turbine (VAWT) which can utilize the wind from all directions to maximize the power output. The product adopts the **auto-brake function** and the **over speed-control system** to gain the even higher wind utilization ratio. Little noise, better safety, easier installation and lower maintenance make the product be suitable for family and industry application.

1.1 Working Rationale

The whole unit consists of pillar, wind generator, and controller and inverter. The wind mill is pushed by wind at speed ranging from 4m/s to 25m/s to rotate to make the generator produce power in AC form. Then the power will be changed into DC form by the charging controller. As last, DC power is changed into standard AC power through the inverter.

1.2 Application

This product can be used by in any areas where has good wind resource, such as building roofs in cities, environment favorable buildings, and dependent small power stations in suburbs. It can provide stable and reliable electricity for lighting, household electrical appliances, beacon light, microwave communication, equipment, meters, etc. It is ideal power supply equipment for families and companies.

Also the SAWT wind turbine can be installed in combination with a proportionate amount of solar photovoltaic panels (solar PV), as wind and solar power are highly complementary sources of renewable, carbon neutral, clean energy.



2 Safety Instructions

This Manual contains important instructions, guidelines and safety notes that should be followed during the installation and maintenance of the SAWT PK10-AB Wind Turbine System.

Please refer to the following symbols which are used throughout this manual to indicate potentially dangerous situations, important safety instructions or important notes for you to know.



WARNING This WARNING symbol indicates a possible dangerous condition. Please use extreme caution when processing the procedure.



CAUTION This CAUTION symbol identifies an improper operation that could result in critical safety issue or damage to the system controller or related devices.



NOTE This NOTE symbol describes an important procedure or issue for you to know to properly and safely operating the device.

2.1 Mechanical Dangers

The main dangers are the rotating rotor (The blades and the supporting arms). The PK10-AB blades are made of very solid fiber reinforced plastics and the supporting arms are made of very strong steel. Please do not touch these blades and supporting arms even at low rotating speeds.



- ◆ Never touch the rotating rotor (The blades and the supporting arms).
- ◆ Never try to stop the wind turbine by hand.
- ◆ Do not install the rotor where people or animals may reach the swept area of the blade.
- ◆ Avoid any objects entering the running rotor.
- ◆ Use gloves when handling the rotor and the blades.
- ◆ Wear a safety helmet before entering the radius of the rotor.

2.2 Electrical Dangers

The PK10-AB generator is designed to provide the heat-rising protection in wiring system. The open circuit voltage from the generator can range from 83 volts AC to 285 volts AC in the wiring run between the turbine and the controller. Please follow the instructions in the PK10-AB controller manual carefully before connecting the wind turbine and the controller.



- ◆ Performing improper work may lead to death.
- ◆ Burn hazards.
- ◆ Electric shock, deadly voltages are present in the Wind controller.
- ◆ Switch off the device completely (AC and DC side) free of voltage charge.
- ◆ Never pull any cable out of the equipment during operation.
- ◆ Observe the countries regulation applicable for the installations.

2.3 Assembly Dangers

Most of the PK10-AB parts are pre-assembled before delivery. The clients only need to assemble the supporting arms, blades and the tower. Very careful attention must be taken while assembling the whole system.

A fall from the height at which a wind turbine is ordinarily mounted will often result in death or serious injury. Therefore whenever practicable carry out as much work as possible on the wind turbine at deck or ground level. If it is necessary to work on an installed wind turbine then use an appropriate access system such as a mast that is designed to carry the load of a person; a 'man-rated' winch or rope access system; a hydraulic lift or other safe working platform. Wear appropriate safety equipment and make the general working area as tidy and safe as possible. If possible work during daylight on windless days (and in calm seas if on a boat). Above all else think carefully about what you need to do and plan your work carefully, have all the tools and equipment ready before you start, then brief all the members of the work team thoroughly – including the actions in the event of an accident and/or injury.

 **CAUTION**

- ◆ Whenever possible work on the ground or deck, not at a height.
- ◆ Use safety harnesses, safety helmets, and safety slings, etc.
- ◆ Use 'man-rated' lifting equipment and access systems
- ◆ Work in daylight, on windless days (and in calm seas).
- ◆ Keep the work area clear, plan your work, have your entire equipment ready, and brief the team before starting the job.

Falling objects are potentially fatal. Do not step underneath hanging loads or folding/tilted masts. Make sure that onlookers are kept back beyond the collapse radius of any masts. Ensure that any suspended objects or tools are secured (e.g. by safety lanyards). Prevent onlookers from approaching (e.g. erect a safety barrier and warning signs).

 **CAUTION**

- ◆ Secure any objects that might fall.
- ◆ Do not go underneath hanging loads and the work area; wear safety helmets.
- ◆ Keep onlookers at a safe distance.

When working on the wind turbine, especially when working at height, it is important to make sure it is first electrically safe. Therefore prevent it generating (use the stop switch, turn it out of wind, and/or tie one of the rotor blades to the mounting system or mast) and disconnect it from the battery system.

 **CAUTION**

- ◆ Disconnect all batteries and other power sources.
- ◆ Prevent the generator from unintended starting.
- ◆ Never approach the running rotor.

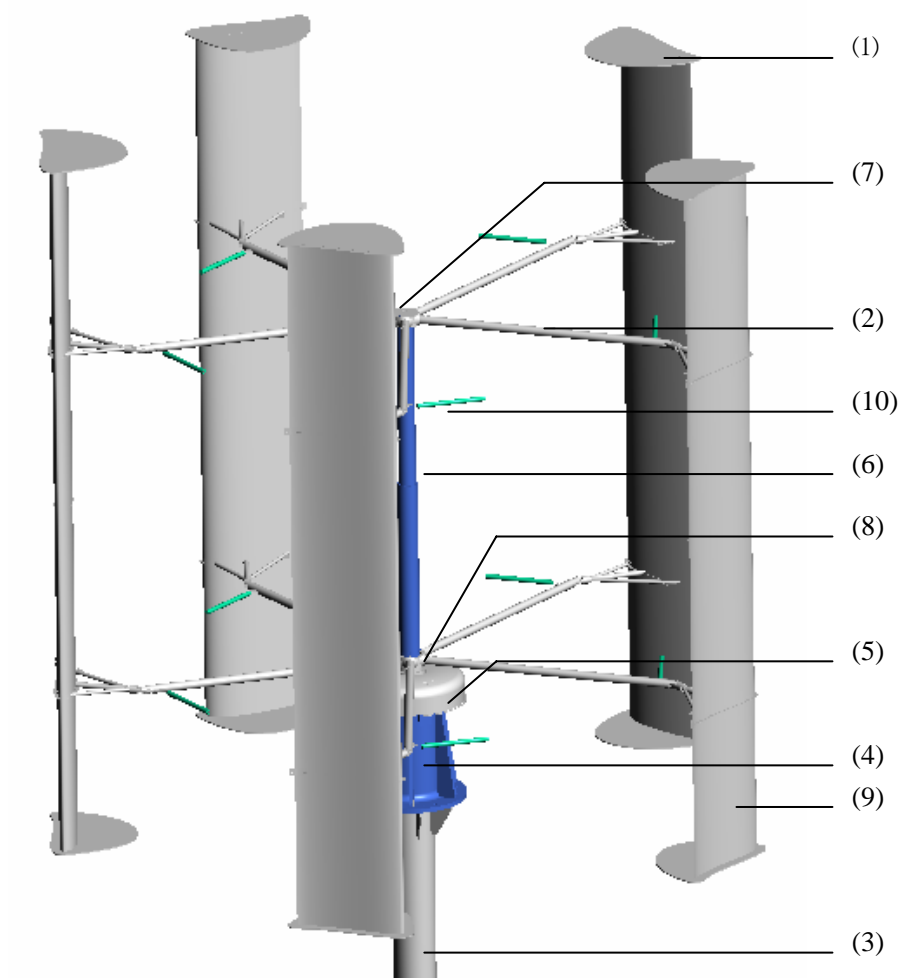
3 System Introduction

The PK10-AB is a wind-driven generator (wind turbine) capable of supplying up to 12000 Watts of electrical power at 110 volts for charging batteries (off-grid system) or at 80-400 volts for connecting to the national grid (on-grid system). The complete system includes the wind mill, the controller, the inverter, and the tower.

3.1 General View

The following Drawing A shows a general view and major components of the PK10-AB wind turbine System.

Drawing A



(1)	Flaps
(2)	Sustaining arms
(3)	Pillar
(4)	Generator
(5)	Water proofing cover
(6)	Main axis
(7)	Top flange
(8)	Nether flange
(9)	Blades
(10)	Springs

3.2 Wind Mill Specification

PK10-AB 10kw (on-grid and off-grid) (Auto electromagnetism brake, easy installation)	
Wind Mill Diameter:	600cm;
Mill height:	620cm
Produce power wind speed:	4-25m/s
Rated Wind speed:	12m/s
Subsistence wind speed:	55m/s
Controller output range:	80-400 Volts DC for on-grid, 110 Volts DC for off-grid
Over speed controller:	Aerodynamics
Brake style:	Auto brake
Tower:	5.5m
Mill Weight:	2250 Kg (Not include the tower)
Generator parameters:	
Generator type:	3 phase, direct drive, synchronous, alternating PMG
Rated voltage:	250 Volts AC
Rated current:	23.1 Ampere AC
Protection level:	IP54
Weight:	1500 KG

3.3 Wind Controller Specification

The Shanghai Aeolus Windpower Technology PK10-AB controller is equipped with Microchip MCU and static switch. The controller has two types of application: PK10C-A/I for off-grid, PK10C-G/I for on-grid.

To achieve high degree of efficiency and reliability the integrated controller is equipped with different protective mechanisms to protect the batteries and Wind generator.

3.3.1 On-Grid Controller

PK10C-G/I Wind Controller inverts AC current coming from the wind generator into DC current which is further connected to a Grid machine for countries local specifications.

PK10C-G/I wind controller specification:

Output voltage allowing scope	80-400 VDC
Rated voltage	350 VDC
Rated power	10000 Watt
Peak power	12000 Watt
Weight	26Kg
Control	Max. Power Point Tracker, Wind Energy
Protection	Grid failure, short circuit
Operation temperature	-20°C to + 50°C
Dimensions	470mmX420mmX205mm

NOTE

- ◆ Controller is connected to the local electrical supply system through a single 230 Volts AC 50Hz or 110 Volts AC 60Hz
- ◆ It is designed as an on grid system. Not used power is fed back into the grid automatically.
- ◆ Controller is reverse connection protected of DC output.
- ◆ Controller is over load or short circuit protected.
- ◆ Controller shuts down in an event of over heating.

3.3.2 Off-Grid Controller

PK10C-A/I Wind Controller inverts AC current coming from the wind generator into DC current which is further connected to charge the battery.

PK10C-A/I wind controller specification:

System voltage grade	110 Volts DC
Voltage range	90-135Volts DC

Rated power	10000 Watt
Peak power	12000 Watt
Weight	20Kg
Control	Max. Power Point Tracker, Wind Energy
Protection	Over charge, short circuit
Operation temperature	-20°C to + 50°C
Dimensions	470mmX420mmX205mm

NOTE

- ◆ It is designed as an off grid system.
- ◆ Controller is reverse connection protected of DC output.
- ◆ Controller is over load or short circuit protected.
- ◆ Controller shuts down in an event of over heating.

3.3.3 Connecting Sequence

CAUTION

- ◆ Please make sure that all connections are **switched off** before starting any electrical connecting procedure, otherwise there is a danger of causing injuries or burns.

The procedure of connecting the wires to the Wind Controller is as following:

<p>On grid connection:</p> <ul style="list-style-type: none"> • 1st, connect the GROUND • 2nd, connect the DC OUTPUT • 3rd, connect the GRID AC INPUT • 4th, connect the WIND TURBINE INPUT • 5th, connect the SOLENOID VALVE • 6th, turn on ON/OFF SWITCH • 7th, turn on WIND INPUT MINIATURE CIRCUIT BREAKER (3P) 	<p>Off grid connection:</p> <ul style="list-style-type: none"> • 1st, connect the GROUND • 2nd, connect the BATTERY • 3rd, connect the WIND TURBINE INPUT • 4th, connect the SOLENOID VALVE • 5th, turn on BATTERY MINIATURE CIRCUIT BREAKER • 6th, turn on ON/OFF SWITCH • 7th, turn on WIND INPUT MINIATURE CIRCUIT BREAKER (3P)
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CAUTION

- ◆ After switching on the Wind Controller, Please avoid touching any related cables with your hands.

The procedure of shutting down or switching off the running system:

1. First switch off the Wind Turbine **INPUT** to the Wind Controller
2. Second switch off the **ON/OFF** switch on the right side under the Wind Controller
3. Third switch off the **DC OUTPUT** (on grid) or the **BATTERIES** (off grid)



- ◆ Please follow switching sequence as mentioned above, otherwise damage may occur to the Wind Controller electronic components.
- ◆ After the Wind Controller has been switched off, please wait at least 10 minutes before opening the front cover. This waiting time is required for the electronic components to discharge the static current. There is always a danger of getting electro shock or damaging the component through fire.

3.4 Packing Size

The standard packing of PK10-AB contains: the long supporting arms, the short supporting arms, the blades, the frame, the PK10-AB on-grid controller or the PK10-AB off-grid controller, the PK10-AB off-grid inverter, and the tower. The off-grid inverter and the tower are optional.



Before the installation, please check all the components that you have received from the shipment with the packing list that comes along with the invoice. Make sure that you have received all the standard components for the PK10-AB wind turbine system. If any missing components are found from the original packing, please do not hesitate to contact SAWT for replacement accordingly.

The following table indicates the standard packing of PK10-AB wind turbine.

PK10-AB Packing Size

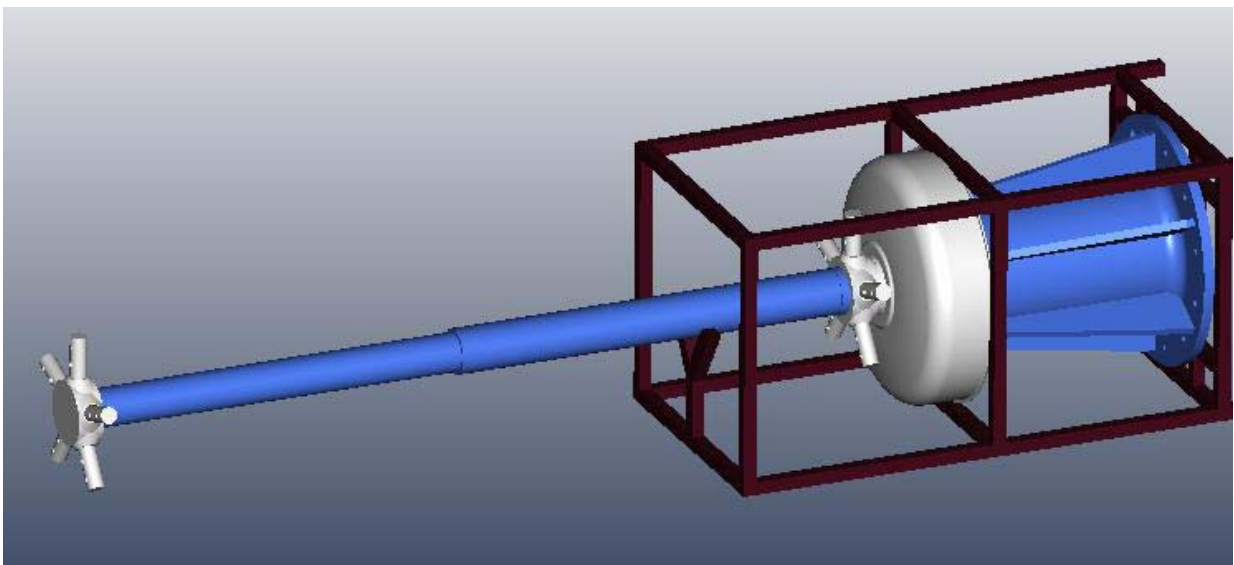
Mark	Description	Volume	Gross(KG)	net(KG)	Package
PK10-S/L	Long Arms	233cm*58cm*30cm	310	290	Veneer box
PK10-S/S	Short Arms	110cm*110cm*45cm	110	100	Veneer box
Frame		420cm*100cm*100cm	1785	1585	Iron frame
PK10-B	Blades	630cm*110cm*27cm*5	75*5	55*5	Paper box
PK10C-A/I	Off-grid controller	46cm*37cm*26cm	32	26	Veneer box
PK10I-A/I	Off-grid inverter	110cm*56cm*46cm	105	95	Veneer box
PK10C-G/I	On-grid controller	46cm*37cm*26cm	32	26	Veneer box
PK10-Tower	Tower	550cm*94cm*94cm	1100	1100	No package

It can be put 3.5pcs for a 40ft open top container (Not include the tower)

 **NOTE**

SAWT has pre-assembled the wind generator, the auto-brake system, the axis, the upper flange and the down flange. The whole assembled unit is called the **Frame**. This is in order to prevent any concentric problems caused by the users in the installation procedure.

Following Drawing D shows the actual photo of the installed frame

Drawing D

Frame

3.5 Optional Parts

The necessities of the PK10-AB wind turbine are the wind mill and the controller. The off-grid inverter, the tower and the lightning rod are optional.

 **NOTE**

- ◆ SAWT do not provide the on-grid inverter. We recommend using the Power-One on-grid inverters (Aurora Series), which is an Italian supplier. Our on-grid controller can work well with them. Also, the clients could purchase on-grid inverters worldwide. Ensure that the input DC voltage range of the inverter match with the output DC voltage range of SAWT on-grid controller.

3.5.1 Off-Grid Inverter

The Shanghai Aeolus Windpower Technology PK10-AB off-grid inverter is the new generation of appropriation power supply in electric power control system, it mainly aims at the characteristics of the electric power control system and requests to design and manufacturing. The inverter is in kept with the request of the high quality and credibility of electric power control system to the power supply equipments. It is satisfied with the need of the power supply in terminal equipments.

The system adopts the micro-computer to control, having good in a sudden response, high efficiency in inverting, outputting stability voltage and so on, in the meantime it has very good EMI index sign. This power supply protections of DC input and output in over-voltage/owe voltage, reverse-connection in DC input, the protections also include the over-power of AC output, short-circuit, over heat inside of the machine etc. these protections make various function index signs and credibility of the power supply have enough technique assurance.

3.5.2 Mounting Tower

For the purpose of avoiding the high freight occurred during transportation and in consideration of the various applications of the PK10-AB wind turbine, SAWT does not include the required tower in the necessary package of the product.

The clients may choose to purchase SAWT towers or manufacture in their local market. If the latter, SAWT could provide the specifications of the towers.

SAWT provides the standard free-standing tower with 5.5 heights. The material of the tower is steel with hot-galvanized treatment on surface which could prevent the corrosion and is applicable for the seaside or tropical area.

Following Drawing E shows the actual photo of the SAWT 5.5m standard tower

Drawing E



3.5.3 Lightning Rod

SAWT could provide the complete set of the lightning protection system for the PK10-AB wind turbine, or the users may mount the lightning rod by themselves. Provided that users would mount the lightning rod on the body of PK10-AB wind turbine, the permission of SAWT must be obtained before such installation; otherwise SAWT has the right not to fulfil the maintenance for any damages caused due to the installation of the lightning protection system.

Please contact SAWT for more details concerning the lightning protection system for the PK10-AB wind turbine,



NOTE

- ◆ SAWT are wind turbine designer and manufacturer, we are not designers of building lightning protection systems. It is the responsibility of the building owner to ensure that the building lightning protection system is suitable for the installation of a wind turbine. An independent consultant with lightning protection expertise should be consulted if there is any doubt.

4 Wind Mill Assembly and Installation

Before the installation of the PK10-AB wind turbine system, please check carefully the components included in the original package. Prepare all the required tools according to the installation procedure. Also the common tools like the screw drivers, the spanners, the wire strippers, the wire crimpers, the multimeters, etc. would be helpful.



WARNING

- ◆ All safety issues must have been well thought and followed during the whole process of assembly and installation.

4.1 Installation Location

Site selection has a significant effect on annual energy production. It is, therefore, worth the additional time and effort to locate the most suitable site to ensure optimal energy production and maximize the wind turbine's lifespan. If any doubt, please contact SAWT or the distributors for help.

The main parts of the PK10-AB wind turbine are gone through the galvanized treatment and the connecting parts are 304 stainless steel. The survival wind speed is 55m/s. All

these factors make the PK10-AB wind turbine be suitable to be installed in various locations, such as mountains, seaside, islands, deserts, icy surroundings, family gardens, industrial zones, top of the buildings, etc.

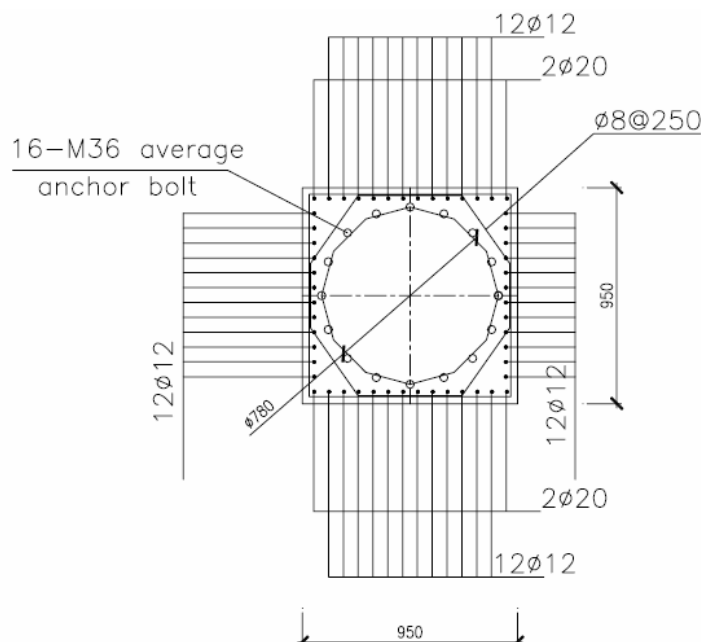


- ◆ The product should be installed in a flat area with good wind resource
- ◆ Without big trees or building around.
- ◆ There should not be any buildings higher than the product within 30-meter area around it.
- ◆ Please avoid installing the PK10-AB Wind Turbine at a site where anyone can easily approach the rotating blades.
- ◆ Always follow your local regulations, codes about restrictions applied to such system installation.
- ◆ Always have your PK10-AB grounded to avoid the lightning strike
- ◆ Please contact with SAWT in advance if you want to install a lightning rod on the wind turbine.
- ◆ Choose a fine and windless day to install the wind turbine.
- ◆ Assemble the wind mill at the ground level before install on the top of the tower.

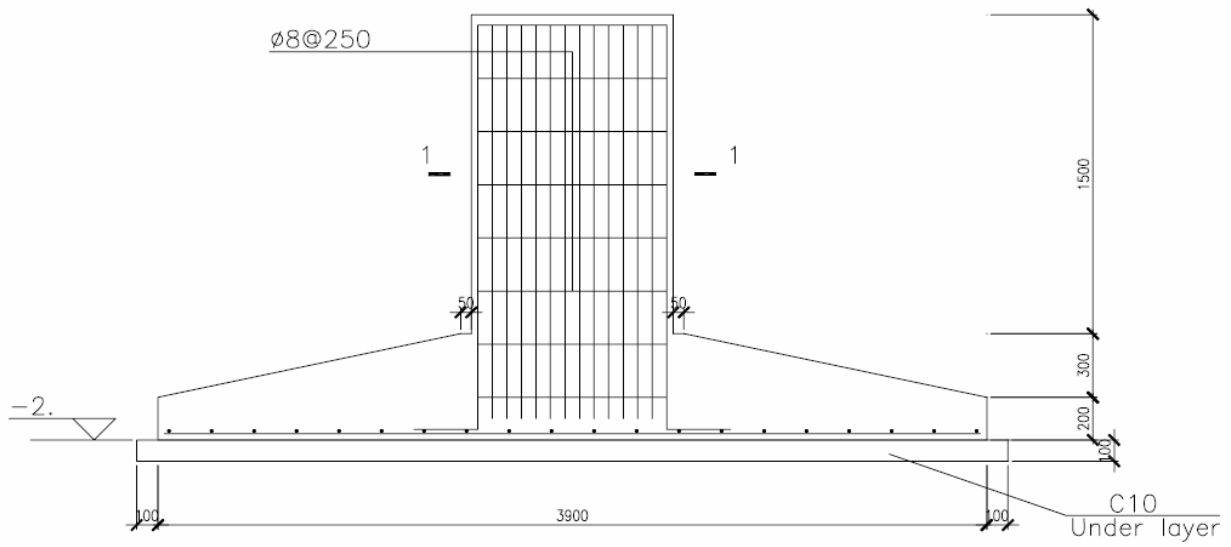
4.2 Subgrade Foundation

Please follow the SAWT sub-grade foundation drawing (As below Draw F, G, H), and check the surrounding area when determines the length of the mast. Avoid any existing objects that affect the performance of wind energy or cause hazards.

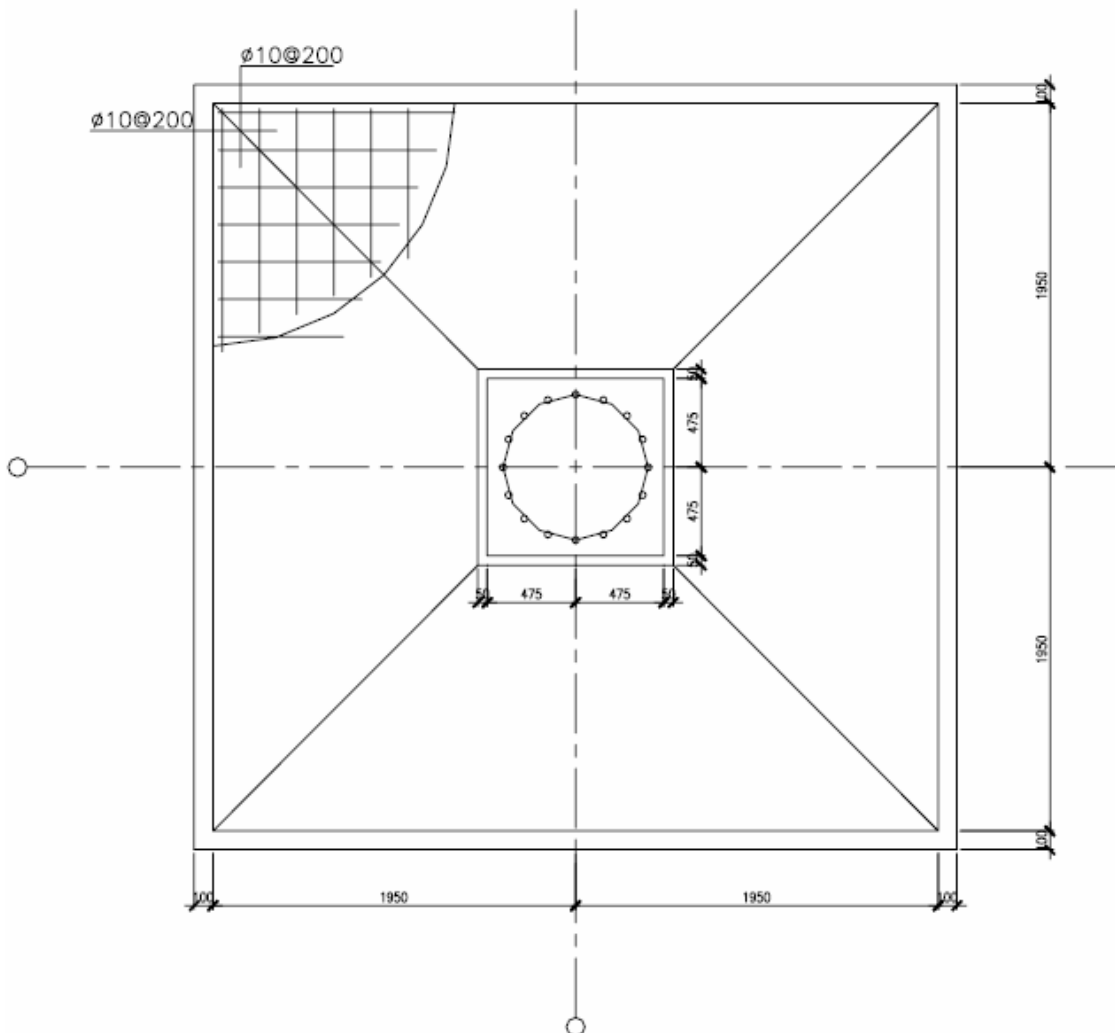
Drawing F



Drawing G



Drawing H



 **NOTE**

- ◆ The material of anchor bolt is 35# steels.
- ◆ Concrete is C20.
- ◆ Reinforcing steel bar is grade I.
- ◆ The anchorage length of anchor bolt is no less than 25d and the horizontal length of hook is no less than 4d.
- ◆ The anchor bolt stretches out the surface of foundation length to be no less than 5d.

 **CAUTION**

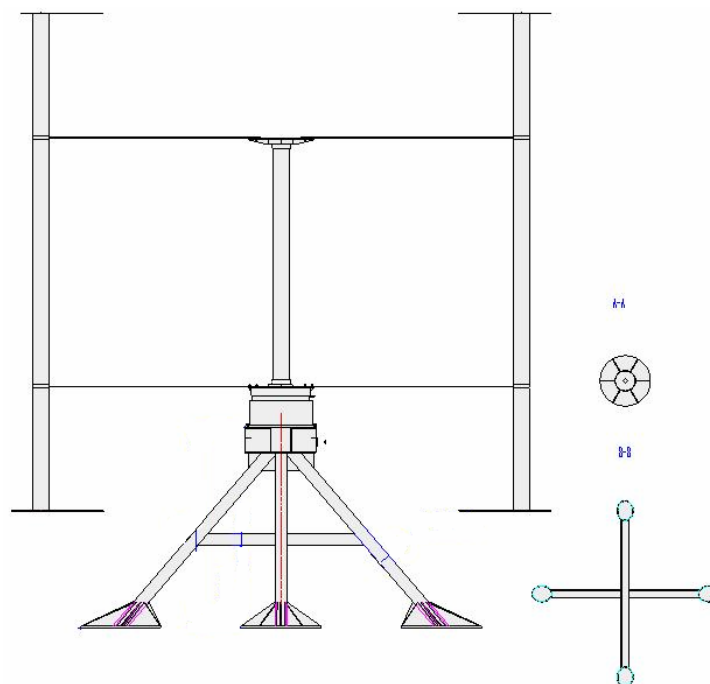
- ◆ The foundation drawing is only for installation on the ground.
- ◆ Fix the base onto the concrete foundation according to the Figure of Foundation, and adjust the base to be flat.
- ◆ Curing period for the concrete foundation is 100 hours.
- ◆ Enough space should be given to lift the wind turbine unit.
- ◆ The central point of the generator to the inverter/controller should be less than 13-14 meters.

4.3 Tower for roof installation

If you are going to install the PK10-AB wind turbine on the top of the building, you should consult the architect or the structure expert before the installation. Ensure the roof strength is big enough to hold the whole wind turbine system including the tower in the max load condition. For example, when the wind speed is close to 55m/s, the load on the bottom of the tower would reach to the maximum value.

Following drawing I shows the reference for install the PK10-AB on the roof:

Drawing I



WARNING

- ◆ The drawing is only a reference for install the wind turbine on the roof of the building.
- ◆ Please check with your structural engineer to evaluate the feasibility of such installation.
- ◆ Although the roof installation is a choice, SAWT does not recommend installing the wind turbine on the top of the building unless you are 100% sure that the structure of the building is capable of doing so.
- ◆ SAWT is not responsible for any damage or losses caused by the inadequate structural design the building.
- ◆ Please follow your local rules and regulations closely before you install the wind turbine on the top of the building.

5 Connection Diagram & Testing

PK10-AB wind turbine system has two types of connection: off-grid and on-grid. Both of the two connections have their own application.

5.1 Off-Grid Connection

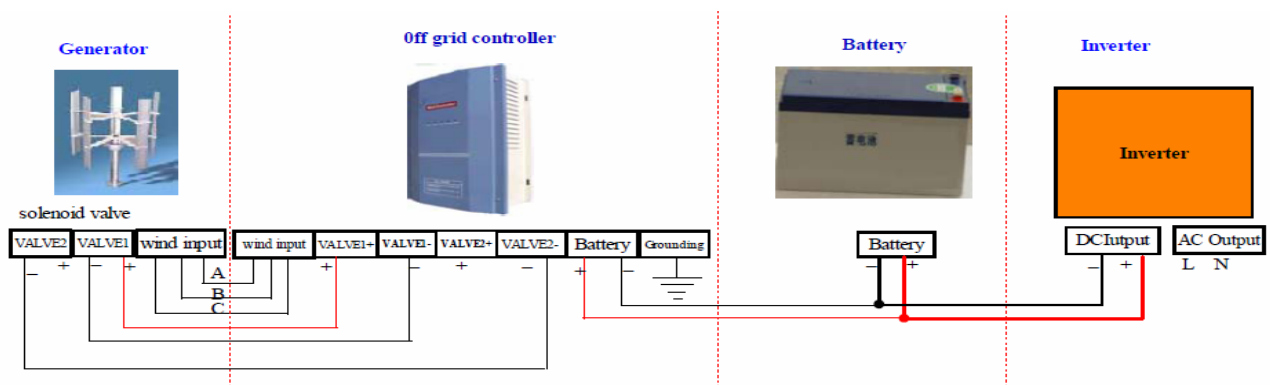
For off-grid connection, the output voltage of the controller is 110 volts DC and the controller could be connected to the 9 pieces of 12V batteries. Then the inverter changes the DC power to AC for use.

Wiring for off grid

Description	Wireless Diameter	Amount of Cables
Wind Generator Input AC	8mm ² PG25tie-in	Three(3)
Battery +, -	25mm ²	Two(2)one Plus and one Minus
Ground	8mm ²	One(1)
DC output to control Valve 1 +,-	1mm ² PG11 tie-in	Two(2)one Plus and one Minus
DC output to control Valve 2 +,-	1mm ² PG11 tie-in	Two(2)one Plus and one Minus

Following drawing Q shows the connection diagram for off-grid connection:

Drawing Q



5.2 On-Grid Connection

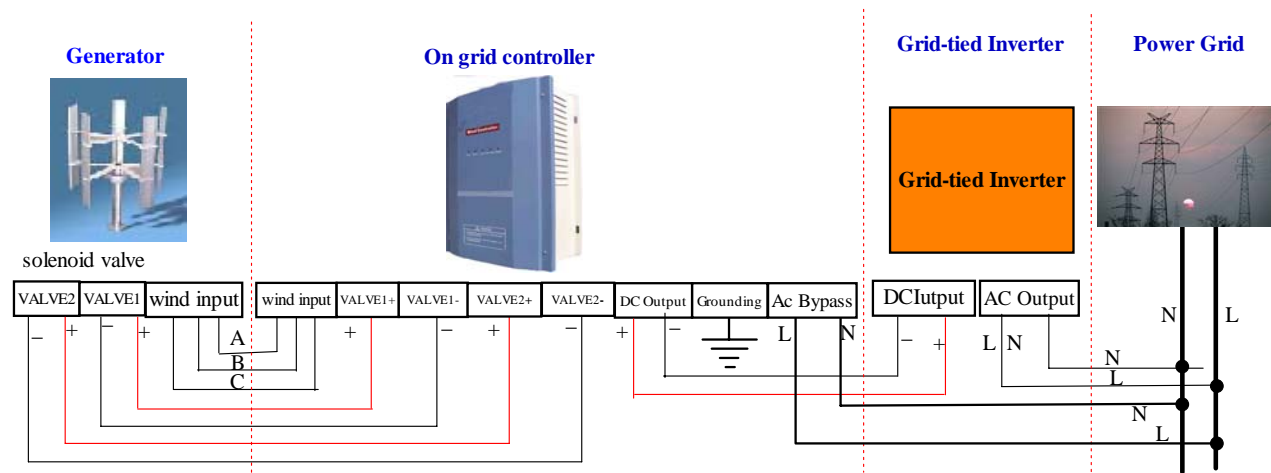
For on-grid connection, the controller output voltage ranges from 80 volts DC to 400 volts DC. Because SAWT does not provide the on-grid inverter, the users may choose from the inverter suppliers worldwide. It is recommendation to use 2 pieces of the Power-One's Aurora PV-6000 inverter for the PK10-AB wind turbine on-grid system.

Wiring for on grid

Description	Wireless Diameter	Amount of Cables
Wind Generator Input AC	8mm ² PG-25 tie-in	Three(3)
DC Output +, -	10mm ²	Two(2)one Plus and one Minus
Grid Input L, N	1.5mm ²	Two (2)one Live and one Negative
Ground	8mm ²	One(1)
DC output to control Valve 1 +,-	1mm ² PG-11 tie-in	Two(2)one Plus and one Minus
DC output to control Valve 2 +,-	1mm ² PG-11 tie-in	Two(2)one Plus and one Minus

Following drawing R shows the connection diagram for on-grid connection:

Drawing R



5.3 System Testing

- Check all the bolts before the testing to make sure they are all securely tightened.
- Turn around the mill slightly with hands to check if there is any collision. Fix it where there is.
- For off-grid use, connect all the wires: connect the generator, controller/inverter and the storage batteries with cables provided as shown in Drawing Q. For on-grid use, connect the generator, controller/inverter and grid as shown in Drawing R.



- ◆ To avoid danger and accident, installation must not be conducted when local wind speed is over 7m/s.

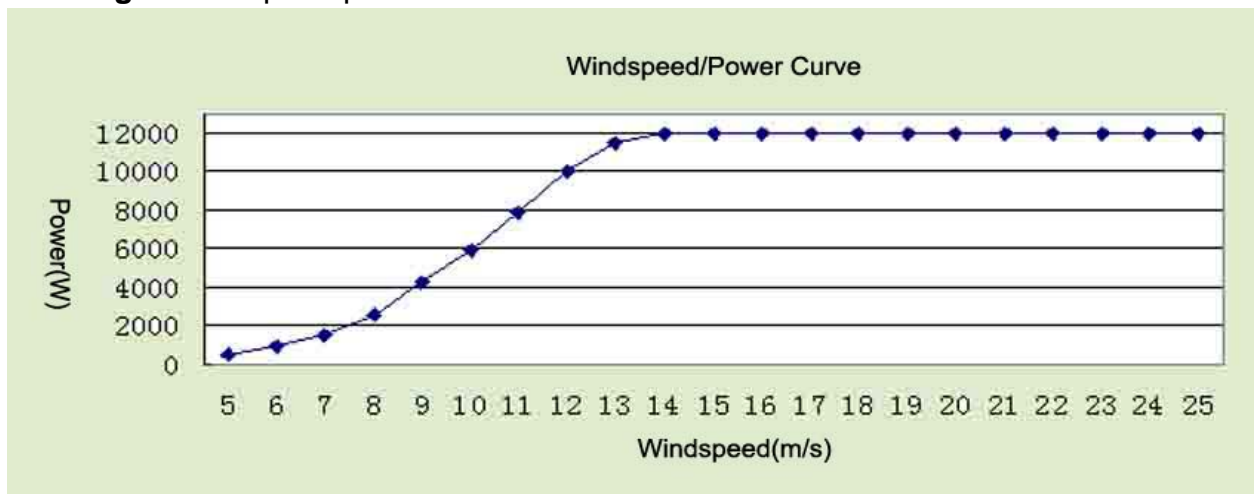
5.4 Performance

Following Wind energy Datasheet shows the power output, generator voltage, generator line current, on-grid controller output voltage, on-grid controller output current against the wind speed. Following Drawing S shows the power curve of PK10-AB.

Wind Energy Datasheet On-grid data

	PK10-AB	Power	generator line current	on grid controller output	on grid controller output
wind speed	V(AC)	(W)	AC(A)	V(DC)	A(DC)
4	83	300	2.1	117	2.6
5	104	650	3.6	146	4.5
6	125	1,200	5.5	175	6.9
7	146	2,000	7.9	204	9.8
8	167	3,000	10.4	233	12.9
9	188	4,300	13.3	263	16.4
10	208	6,000	16.6	292	20.6
11	229	7,900	19.9	321	24.6
12	250	10,000	23.1	350	28.6
13	270	11,000	23.5	378	29.1
14	285	12,000	24.3	399	30.1
15	285	12,000	24.3	399	30.1
16	285	12,000	24.3	399	30.1
17	285	12,000	24.3	399	30.1
18	285	12,000	24.3	399	30.1
19	285	12,000	24.3	399	30.1
20	285	12,000	24.3	399	30.1
21	285	12,000	24.3	399	30.1
22	285	12,000	24.3	399	30.1
23	285	12,000	24.3	399	30.1
24	285	12,000	24.3	399	30.1
25	285	12,000	24.3	399	30.1

Drawing S wind speed/power curve



6 Maintenance

The PK10-AB wind turbine has the life time of 20 years. The product does not need a frequent maintenance due to the totally different from the traditional horizontal axis wind turbine.

Instructions on maintenance

- a) Inspect and clean all the rotating parts once a year.
- b) Clean the blade surface once a year.
- c) Clean, de-rust and paint all the exposed parts in every two years when used over five years.
- d) When inspecting the controller and inverter, for off-grid system, the DC out-put should be disconnected first and when problem fixed, the batteries should be connected before the windmill is connected. For on-grid system, the grid should be disconnected first and reconnected after problem is fixed.



CAUTION

- ◆ Appropriate and timely maintenance of the system is directly related to the performance and life cycle of it.



WARNING

- ◆ Inverter/controller should be placed in a dry, ventilated and non-polluted environment.
Read carefully the manual of the controller and the inverter.
- ◆ The storage batteries will leak certain amount of caustic gas, so they should be placed in a ventilated area without flames.
- ◆ It is forbidden to leave anything on the terminals of the storage batteries to prevent short circuits.

7 Trouble shooting

This section contains a brief discussion of each major problems occurred and the corresponding solutions. See the list below for a summary of trouble shooting guidelines and recommendations.

When troubleshooting it can generally be assumed that only one fault exists. A failure can be due to a malfunctioning component, one that still works but with reduced capacity, a broken connection (mechanical or electrical), a set point which has drifted from its original calibration, a loose or poor electrical connection, an improperly grounded cable shield or an intermittent problem, i.e. one that can fall into any one of the previous categories after a certain period of time.

Multiple failures can occur but are not typical and normally it will not be clear from the

outset whether a failure has single or multiple causes. The best course of action is to assume a single failure and proceed to correct the obvious symptoms first. As troubleshooting progresses, additional causes or failures can come to light

Problems	Causes	Solutions
Abnormal noise	<ol style="list-style-type: none"> 1. Fastened parts are getting loose 2. Connection between the bearing of the generator and the base is getting loose 3. Mill rubs with other parts 	<ol style="list-style-type: none"> 1. Check the loose parts and fasten again 2. Find out the exact point and fix it 3. Repair the rubbing points
Rotating speed of the mill is obviously decreasing	<ol style="list-style-type: none"> 1. Mechanical brake and flange rubs with each other 2. Short circuit occurred in rotor winding 3. The Switch is in the Off position 	<ol style="list-style-type: none"> 1. Keep the generator and flange concentric. 2. Find out the point with short circuit to peel off and insulate 3. Put the switch into On
Output voltage is low	<ol style="list-style-type: none"> 1. Rotating speed of the generator is low 2. Permanent magnet rotor is demagnetized. 3. Short circuit exists in the stator winding 4. Low voltage power line too long, wire too slim 	<ol style="list-style-type: none"> 1. Find the causes to restore the normal speed 2. Change the rotor 3. Find out the point, and paint it to insulate 4. Shorten the wire or enlarge the wire diameter to decrease lost in transferring
No output currents from the generator	<ol style="list-style-type: none"> 1. Output wire is broken 2. Stator winding burned and caused broken 	<ol style="list-style-type: none"> 1. Find out the point and reconnect 2. Disassemble and fix
There is AC output, but no DC output	<ol style="list-style-type: none"> 1. Output wire is broken 	<ol style="list-style-type: none"> 1. Find out the point and reconnect
Output capacity of the storage batteries is not enough	<ol style="list-style-type: none"> 1. Output voltage is too low from the generator, or no power 2. Terminals of the storage batteries are acid etching, conductance broken 3. Storage batteries expired 	<ol style="list-style-type: none"> 1. Refer to the solutions for Problem 3 2. Clean the joints, fasten the connection and apply protection oil 3. Change the batteries

8 Warranty Statements

SAWT standard warranty period is one years starting from the date one month after delivery. Sequence numbers on the nameplate of generator or on the installation manual will be required for warranty services. Please contact local distributor (seller) for warranty service. For end-users, please fill in the warranty card in one month after purchase. Then send back the **【Manufacturer Page】** to SAWT by express, mail, fax or E-mail (scan the warranty card). SAWT would confirm you through E-mail.

In the warranty period, any of the below problems occurred due to manufacturing quality, exchange for new parts and reparation is free.

- a) With normal installation and use of the product according to the installation manual, power generating is abnormal due to rotor stopping working, short circuit in stator, the generator will be replaced.
- b) With normal installation and use of the product according to the installation manual, brokenness happened on exterior shell of the generator and the base which may affect the performance of the system. The part will be replaced.
- c) With normal installation and use of the product according to the installation manual, blades that fell over will be replaced.
- d) With normal installation and use of the product according to the installation manual, because of quality reason, the weight-holding part of the pillar has tip off, it will be replaced or repaired at the option of SAWT.
- e) With normal operation and use according to the controller/inverter manual, the controller/inverter is unable to work or damaged, it will be replaced or repaired at the option of SAWT upon damage situation.

SAWT will charge for repair when warranty does not cover any other problems including those that arise as a result of,

- a) Components fall down or damaged because external force collide with the pillar, and other parts.
- b) Damages to the blades because stopping the mill in wrong measures, e.g., with a wood pole to stop the blades. Or some parts get broken because of improper operating when the system is running at a high speed.
- c) Problems occurred because moving the product and wiring is not conducted according to the installation manual. Or changing the installation methods and locations at one's own will.
- d) Damages due to force majeure, e.g., earthquake, sand storm, strong hail, hurricane and typhoon over product's survival wind speed, thunder strike, gird failure, replace and repair will be charged.



NOTE

- ◆ The repairing procedure and cost are on local distributor (or the seller to the customer), SAWT provides the replacing parts to the nearest port to the distributor (or the seller). Whether to be sent by air or not is at the option of SAWT depending on the replacing part's size and weight.
- ◆ Any damage due to installation or operation not according to the installation manual is not covered in the warranty.
- ◆ **Disassembly of the generator and the brake hub discreteness without SAWT's permission will invalidate the warranty.**
- ◆ In case the warranty card is not received, SAWT retains the right to refuse maintenance free of charge.