60024

Vertical Axis Maglev Wind Turbine

User Manual

The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new, original, and ornamental design for an article of manufacture. The title and description of the design are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the design shall be granted under the law.

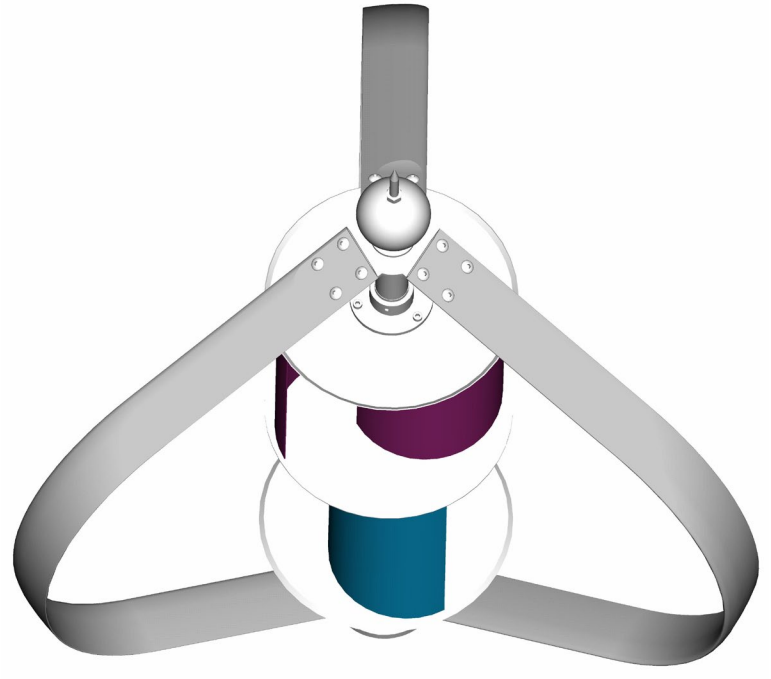
Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the design throughout the United States of America or importing the design into the United States of America for the term of fourteen years from the date of grant of this patent, subject to any disclaimer under 35 U.S.C. 253.

David J. Kappos

Director of the United States Patent and Trademark Office



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CAUTION

⚠ Before assembling and installing the 60024 vertical axis wind turbine (60024), please read the entire User Manual thoroughly.

⚠ During assembly and installation, please use proper isolated tools and do not use inferior tools.

⚠ Wiring cable should have sufficient dimension cross section; otherwise it will cause electrical fire.

⚠ The 60024 is equipped with sophisticated alternator, to protect the alternator and avoid electrical hazards, never try to disassemble the alternator from original.

⚠ Never place the 60024 in an environment with strong causticity or electromagnetic field.

⚠ Keep the surrounding of the 60024 tidy and open.

⚠ Considering safety, please keep children away from the workplace when performing the installation.

⚠ In case of fire and cauterization, the battery, if applied, should be in good quality. In order to eliminate electrical threat and protect the wiring cables, fuses should be installed on the lines connecting to the batteries.

DISCLAIMER

Even though we recommend reading the entire manual thoroughly prior to assembly and installation to ensure proper performance and safety, this manual is intended as a guide only. It should not be considered as a replacement of professional services or as a definitive text for assembling and installing the 60024 system.

The success and safety in working with tools depend greatly on individual accuracy, skill and caution. For this reason, we are not able to guarantee the result of any procedure contained in the manual, nor can we assume responsibility for any damage to property or injury to persons resulting from

procedures indicated in this manual. People who engage in the procedures take their own responsibilities and risks.

Actual wind resources and conditions of selected site will highly affect the energy production, which also varies with wind turbine maintenance and surrounding environment. Therefore, we make no representation or warranties regarding energy production.

All information and specifications in this manual are subject to change without notice.

We have the ultimate right to the interpretation of this manual.

1. SAFETY NOTES

The design of the 60024 is based on the conception of "Safety First". In reality, threats such as mechanical hazards and electrical hazards involved with structure, mechanical and electrical equipments, the surrounding as well are unavoidable. Safety must be the primary consideration when planning the location, assembly, installation and operation of the 60024 system.

Inside this User Manual are some important instructions, guidelines and safety notes that should be followed when performing the installation and maintenance of the 60024 system. Please read thoroughly and follow the instructions in this User Manual.

1.1 Mechanical Hazards

The rotating blades of 60024 present the severest mechanical hazards. Blades of 60024 are made of high intensity anodized aluminum. Some parts of the blade are sharp and some are blunt. However, those blunt parts can still result in serious injury once the rotor is rotating.

⚠WARNING

- *NEVER TRY TO STOP THE ROTOR BY HAND.*
- *NEVER TOUCH THE SPIINNING ROTOR.*
- *DO NOT INSTALL THE 60024 WHERE ANYONE CAN APPROACH THE ROTATING AREA OF THE ROTOR.*

- *AVOID ANY OBJECTS TOUCHING THE ROTATING BLADES.*

1.2 Electrical Hazards

Alternator of the 60024 is complicated and may cause electrical shock. For safety consideration, do not try to disassemble the alternator.

Fire in wiring system is often a result of too much current flowing through and undersized wire or a bad connection. It is necessary to follow the suggested wire-sizing chart to choose an appropriate size of wire to ensure a safe electrical system.

If the battery is used, please keep it in mind that the battery should never be short-circuited or it may set the battery and cable on fire.

2. Introduction on 60024

Vertical Axis Maglev Wind Turbine involves a variety of subjects, such as Structure Mechanics, Product Design, Permanent-Magnet Machine, Machine Design, Aerodynamics, Wind Tunnel Test, Computational Fluid Dynamics and Maglev Technology. VAWT is made of light-weight aluminum, titanium and other light special materials, mainly connected by stainless steel fasteners. Owing to the advanced Maglev Technology and the power of Super Magnets, VAWT works stably without any mechanical friction. When driven by wind, the permanent-magnet machine rotates and the coil winding inside is moved relative to the permanent magnet, and thus AC is generated.

60024 is designed with flexibility to fulfill user's application. It can be applied to wind and solar power supply system. Together with solar panels, 60024 charges batteries to supply power for street lamps, monitoring systems and other small-size electrical equipments. 60024 itself can also be installed in the city or urban area for courtyard illumination, landscape illumination, unattended monitoring system in the field and advertising use.

3. 60024 Technical Specifications

Table 3-1 is the technical specifications of 60024.

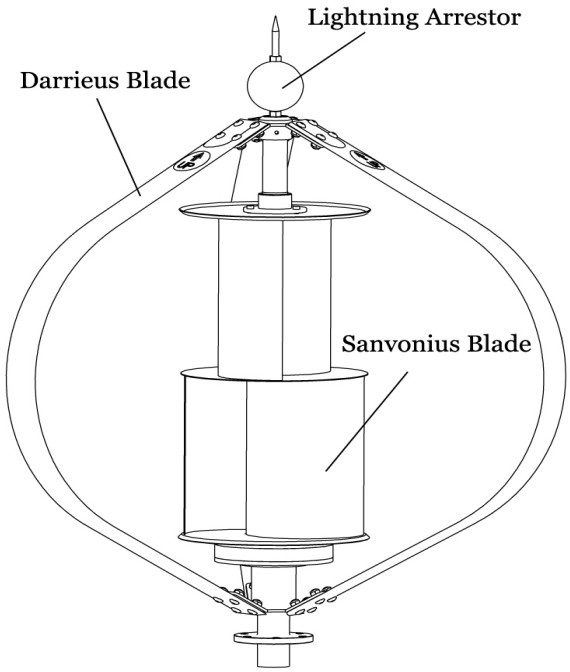
Table 3-1 60024 Technical Specifications

NO.	Description	Specification
1	Rated Output	600W
2	Type of Alternator	3-Phase,AC
3	Start-up Wind Speed	1.3M/S
4	Working Wind Speed	2.5—15M/S
5	Height	1.10M
6	Rotating Diameter	1.25M
7	Weight	32KG
8	Output Voltage(Controller)	DC 24V
9	Braking System(Controller)	Over Speed Braking by 3-Phase Short-Circuit
10	Limited Temperature	-40℃——50℃

4. Structure of 60024

60024 is a hybrid Vertical Axis Wind Turbine (VAWT) system which combines drag-based design and lift-based design together. It incorporates an S-type of Savonius rotor and three airfoil blades of egg-type Darrieus rotor to maximize the output performance. The following Figure 4-1 shows the structure and major components of 60024.

Figure 4-1 Structure of 60024



Before starting the installation, please check all components you receive from the shipment with the packaging list that comes with the purchase invoice or the enclosed parts list in the shipment. Ensure that you receive all standard components or parts for the 60024 system accordingly. If there is any missing part from the original packaging, please contact us for replacement.

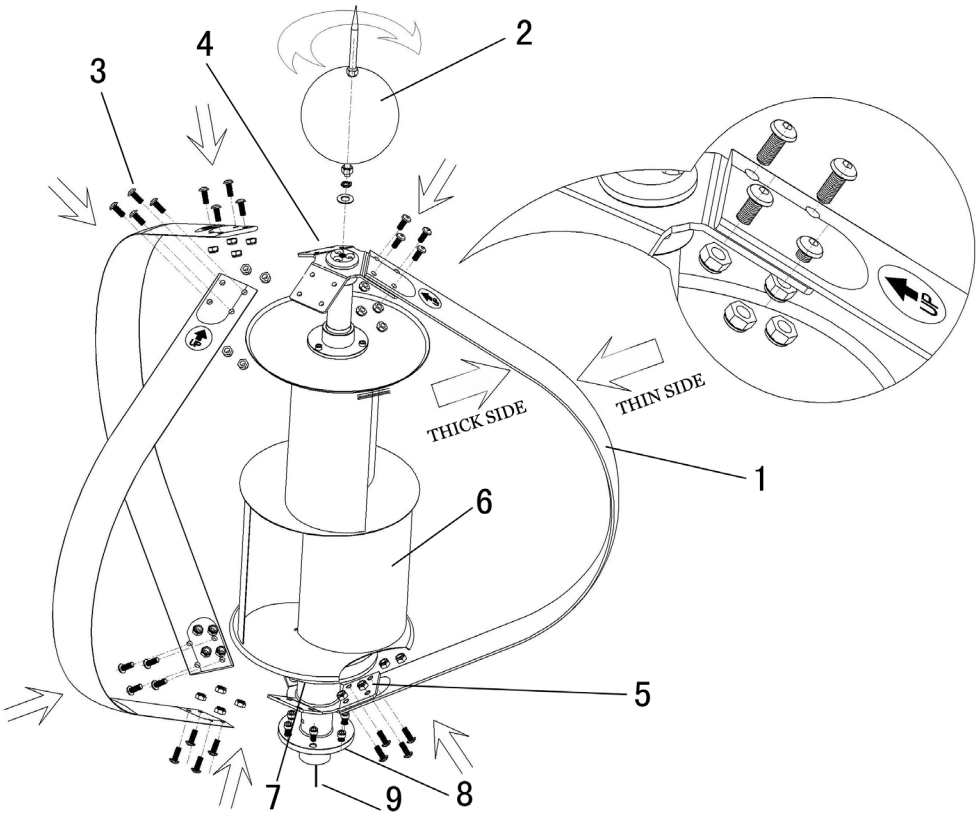
The standard components of 60024 are showed as Table 4-1. The following components present the standard configuration of 60024. Since application of every user differs, actual configuration will also be different. Please refer to the packaging list or the parts list for details.

Table 4-1 Components of 60024

Labels	Components		Qty.
	Pre-assembled	To be Assembled	
1		Anodized Aluminum Blades	3
2		Lightning Arrestor	1
3		Rounded Hex Non-slip Bolts and Nuts(Set)	24
4	Upper Blade Connector		1
5	Lower Blade Connector		1
6	S Type Blades(Set)		1
7	Permanent-Magnet Alternator(PMA)		1
8	Flange		1
9	Wiring Cable of PMA		3
Total Qty.			36

Figure 4-2 shows standard components of 60024 and their locations. Please assemble and install the 60024 accordingly. Specific instruction on assembly and installation will be discussed in **5 Assembly and Installation**.

Figure 4-2 Components of 60024 and Their Positions



5. Assembly and Installation

5.1 Preparation

Before going through the 60024 system installation procedures, please double check parts included in the package. Prepare all required tools and equipments according to the shipment and have them ready on hands. More importantly, all safety issues should have been well thought and followed.

5.2 Selecting Location

60024 can be installed along the sea shore, on the mountain, in the city, urban area, or just right on top of the roof of the building. The major key factor affecting the performance of 60024 for all proposed applications is the wind power of selected location.

TIIMAR presumes that the proper site of installing the 60024 system has been well evaluated by users themselves for optimizing the wind energy environment before any installing procedures performed.

⚠ WARNING

- *DO NOT install the 60024 system at a site where anyone can easily approach the rotating blades.*
- *DO NOT install the 60024 system at a site surrounded by obstructions, for example, trees, power lines, etc.*
- *DO NOT install the 60024 system at a site where CANNOT hold the 60024 system.*

5.3 60024 Assembly

The 60024 System is designed in "Almost Ready to Use" format and shipped with factory pre-assembled packaging. The only assembly work required is the assembly of three Darrieus blades and one lightning arrestor. This User's Manual will guide you through the assembly procedures with detailed illustrations. But this User's Manual is intended as a guide only; it cannot be the replacement of professional service.

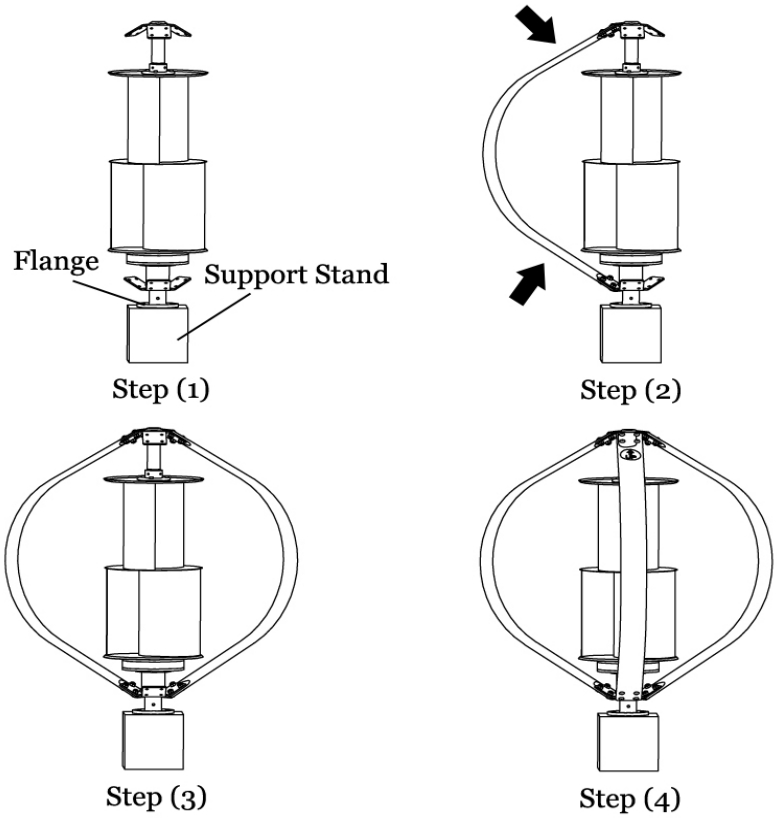
⚠ WARNING

- *Please keep the rotor straight up during the assembly process to prevent the blades twisted or lose balance.*
- *For safety concern, please short-circuit the Wiring Cables of PMA temporarily to stop the rotor from rotation.*

5.3.1 Blades Assembly

Please follow Figure 5-1 to complete the blades assembly. Each blade has a mark of **"UP"** on the side, please connect the **"UP"** end with the upper blade connector. DO NOT connect **"UP"** end with lower blade connector. Then insert 4 Rounded Hex Non-slip Bolts for each one of the blades on the upper blade connector. Do not lock these 4 bolts yet until another 4 sets of Rounded Hex Non-slip Bolts are inserted for Lower Blade Connector. Now use Wrench to securely lock blade on upper blade connector and lower blade connector. Repeat this step for second blade and third blade and lower section as well.

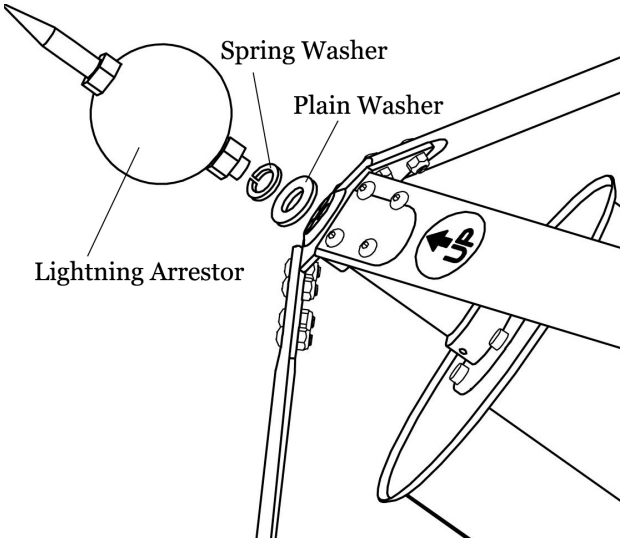
Figure 5-1 Blades Assembly of 60024



5.3.2 Lightning Arrestor Assembly

The lightning arrestor should be assembled on the top of the 60024. Please install the fasteners as follows: plain washer at the bottom, then the spring washer and lock the lightning arrestor. Figure 5-2 is a guide for the assembly of lightning arrestor.

Figure 5-2 Lightning Arrestor Assembly of 60024



5.4 60024 Installation

⚠ WARNING

- *Check again assembly procedures carefully and make sure all screws are securely locked. Any loosen screw will cause serious vibration and parts damaged.*

A fall from the height at which a wind turbine is ordinarily mounted will often result in death or serious injury. Therefore whenever practicably carry out as much work as possible on the wind turbine at ground level. If it is necessary to work on the installation at such height 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. Work during the daylight on windless days. Above all else thinking carefully about what you need to do and plan your work carefully, have all the tools and equipment ready before you start. Figure 5-3 provides the common tool preparation of lifting the 60024 for reference. Figure 5-4 presents the lifting of 60024. Figure 5-5 shows the Base Flange Dimension of 60024.

Figure 5-3 Common Tool Preparation of Lifting 60024

1) Girder Crane or Crane Truck

For indoor assembly, you may need a girder crane with capacity of 2 tons and at least 12 meters height of lifting space. If the installation work is going to be performed in the outdoors, a crane truck with approximately same capacity will be required. It is very important to have certified person to operate the crane.

2) Steel Support Stand

A steel support stand will be required to hold the wind turbine during the assembly procedure. Please prepare a proper size of Support Stand according to **Figure 5-5** Base Flange Dimension of 60024.

3) Adjustable Wrenches or Other Proper Wrenches

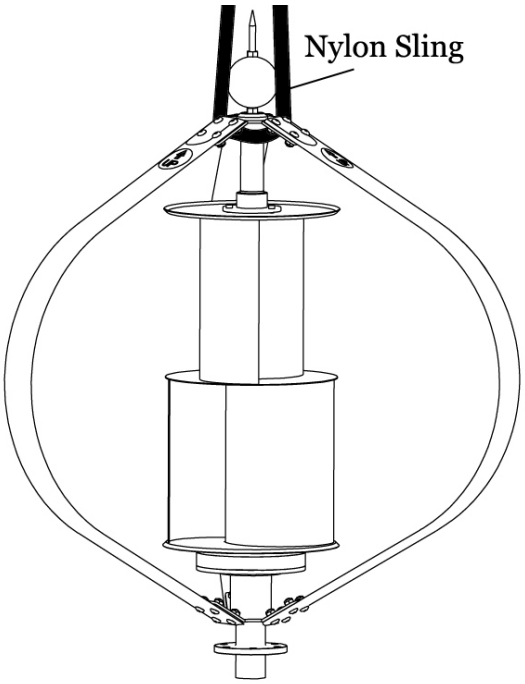
4) Hex Allen Wrenches with Proper Sizes

5) Nylon Slings

At least 1 Nylon Sling with proper length is needed.

6) Safety Caps and Gloves

Figure 5-4 Lifting of 60024

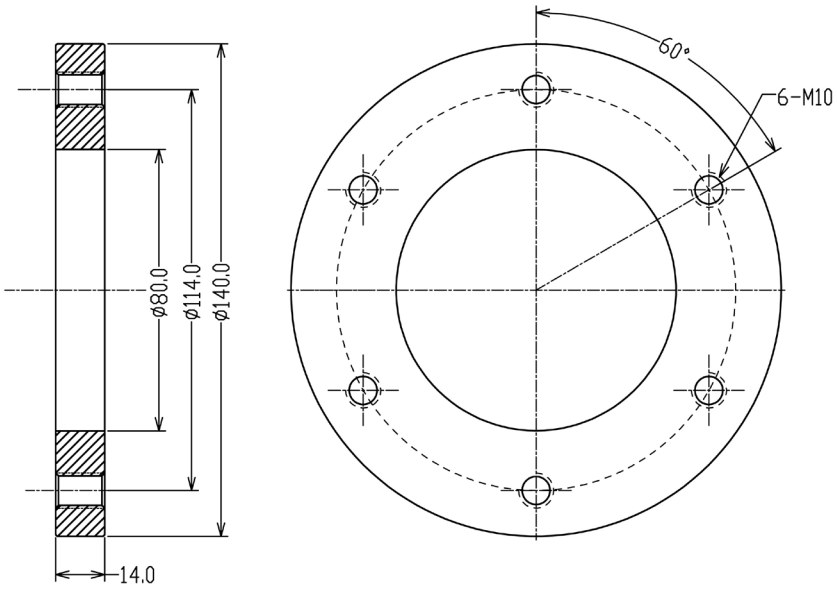


⚠ WARNING

- *Please use soft slings to lift the 60024, Nylon Slings for example. To protect the blades and blades connector, please DO NOT use Steel Wire Rope to lift the 60024 directly.*

- *When lifting the 60024, the correct part to tie the Nylon Slings with is the* ***Upper Blades Connector****.*

Figure 5-5 Base Flange Dimension of 60024



⚠ CAUTION

- *Make sure that all batteries, if applied, are disconnected from the system throughout the installation process.*

- *The 60024 alternator is short-circuited to prevent unintended rotating during the shipment. Please install the extension cable on the ground level and keep it short-circuited throughout the installation process.*

6. Wiring

6.1 60024 Wire Size

The cross section of the wire to be used depends on its length, resistance and rated current. All electrical systems lose energy from the resistance of the wire used. Larger wire size has smaller losses, but can be considerably more costly. Table 6-1 can be a reference for wire sizing.

Table 6-1 Wire Sizing Reference

Distance Between Alternator and Controller					
	0-10m	10-20m	20-30m	30-50m	>50m is not suggested.
AWG Gauge	12	12	10	8	

6.2 60024 Wiring Diagram

The 60024 System is designed in collaboration with Wind-Solar Hybrid System Controller. The Wiring Diagram is illustrated in Figure 6-1 and Figure 6-2.

Figure 6-1 Wiring Diagram for Wind Turbine and Controller

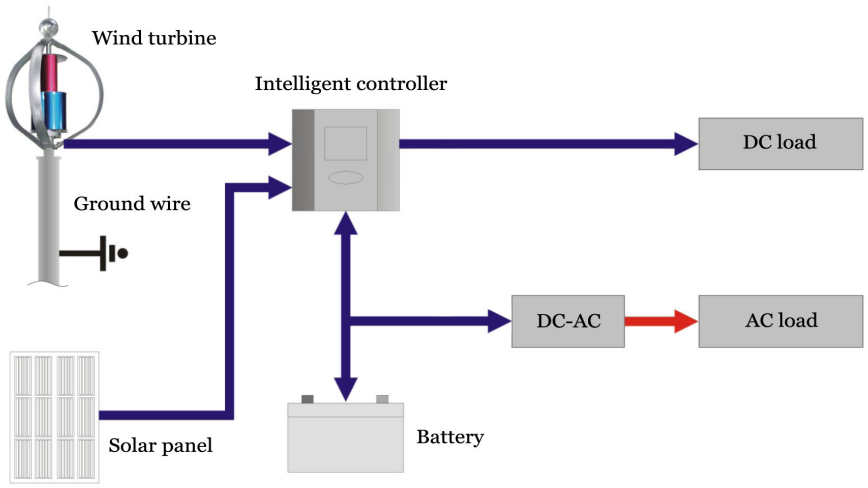
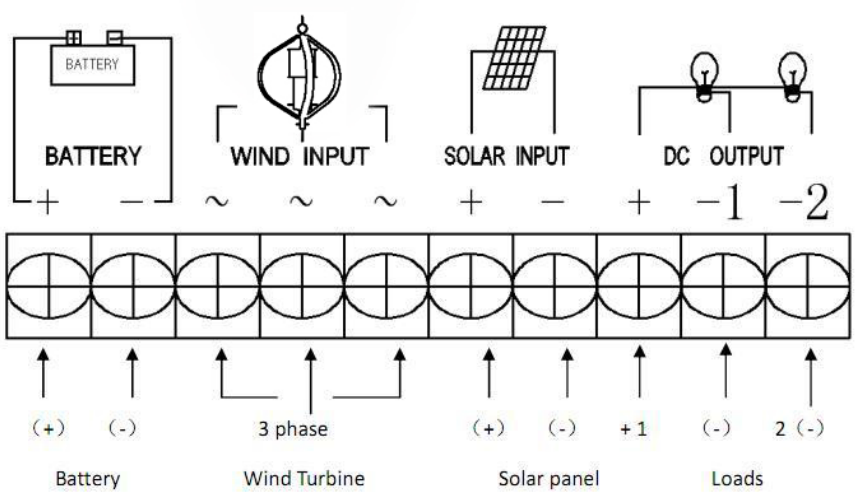


Figure 6-2 Wiring Diagram for Terminals of Controller



⚠ WARNING

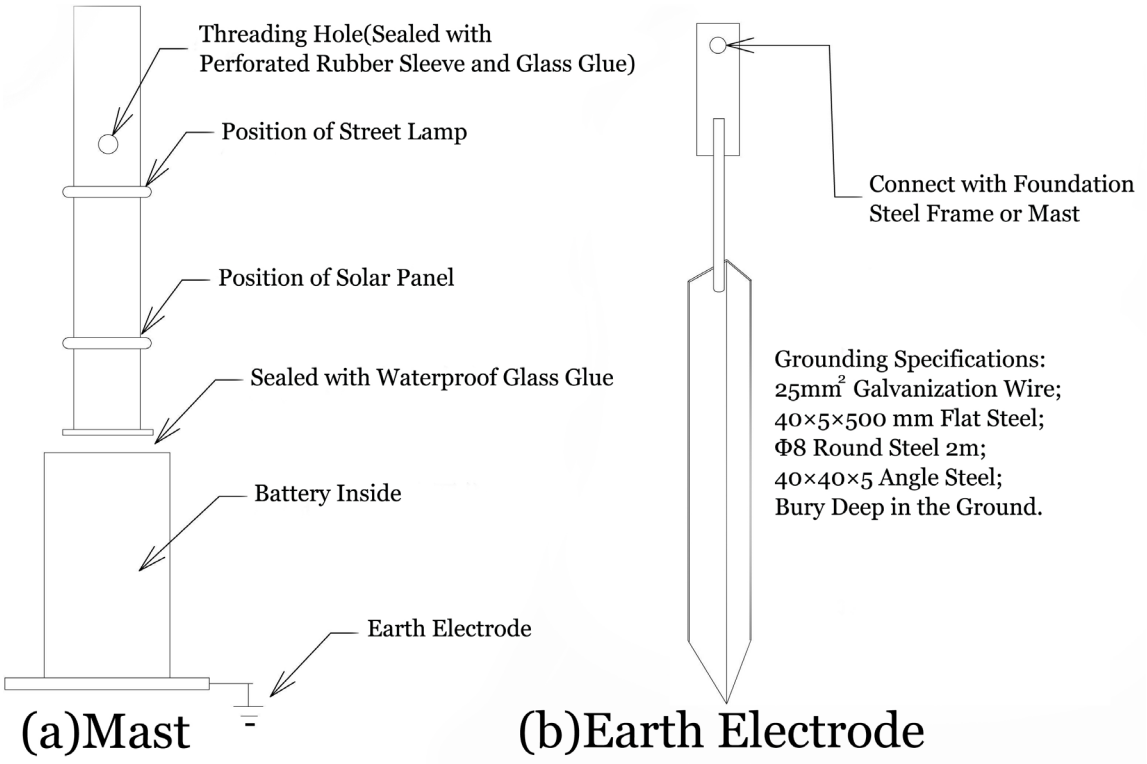
- *Carefully plan all required electrical components, and install electrical components first before any electrical connection.*
- *Make sure that batteries (if applied) should not be connected until all installation works are completed.*
- *To protect the controller, positive and negative of the battery, solar panel and DC output can NEVER be reversed.*

7. Grounding

In order to protect the 60024 System against being damaged by lightning, properly grounding the 60024 System is very necessary. Grounding procedures must be followed along with local electrical codes.

The design of the grounding system depends on the local conditions, like the site of the installation, type of soil, or a grounding bus already existing. If you are in doubt, contact your local electrician for more information. Users who do not purchase grounding systems should request their installation companies/technicians to design and install grounding systems. Figure 7-1 presents installation of common grounding system.

Figure 7-1 Common Grounding System



8. Maintenance

1) Never approach the wind turbine during operation.

2) When perform routine inspections, or at anytime you must enter the path of the blades, please disconnect the power leads from the batteries and short-circuit the wind turbine output leads (use the Stop Switch after installation or tie the output leads together) to stop the blades from rotating. The 60024 is designed to be shut down through the use of stop switch (Brake Switch).

3) Avoid any object touching rotating blades. Even though the blades are very strong, if they come in contact with a solid object, they can be distorted or even broken.

4) For safety concern, please keep children away from the location of 60024 system.

5) The surface roughness of blade is important for the performance of 60024. Please keep the surface of blades tidy.

6) The type of battery applied should be matched with wind turbine, storage battery is recommended. Battery for car starting is not suitable for wind turbine as the life of this type of battery will be largely shortened in this case.

7) The ideal battery parameters for the controller are 12V and 100-200Ah.

8) Terminals of controller and battery should be sealed with paraffin to prevent oxidation and corrosion.

9) Do not expose the controller to conditions of humidity, rain, vibration, cauterization or strong electromagnetic field.

10) Please keep the controller ventilated and cool. Do not place the controller under sunshine or near heater and other heat sources.

11) Never install or operate the controller in an environment with combustible gas. Do not put any flammable, explosive and dangerous objects around the controller.

12) Labels on the controller should be kept clear, tidy and complete.

13) Proposed frequency of Routine Inspection of the controller and wiring cables is one month a time. Once aging, corrosion or damage of cable occurs, please replace related part with new one in time.

9. Usual Malfunctions and Measurements

Malfunctions	Check as Followings	Analysis and Measurements
Wind Turbine Does Not Rotate	1. Check the indicator of battery power level on controller. 2. Check the brake switch. 3. Check the braking indicator. 4. Measure the value of resistance between every two wiring cables of PMA.	1. Indicator is on, it means the battery is full, thus the wind turbine stop rotating. 2. If the switch is off, please turn it on. 3. When the braking indicator is on, wind turbine stops rotating to protect itself from being destroyed by extremely strong wind. 4. If any value is less than 0.4Ω, the PMA may be short-circuited. Please repair the PMA.
Charging Unavailable	1. Check all the cables and their terminals. 2. No wind or sunshine during a long period. 3. Measure the value of voltage between solar panel terminals on controller. 4. Measure the value of voltage between every two input terminals of wind turbine on controller.	1. When bad connection is found, please use new cables or terminals. 2. State of charging is normal. 3. If the value is too low, it indicates that related cable may be broken or the solar panel is damaged. Please repair related parts. 4. If the value is too low or values are not equal, the coil winding of PMA or wiring cables from PMA may have problems. Please repair related parts.