



DS-1500

Vertical Axis Wind Turbine

User Manual



Hi-VAWT Technology Corporation
www.hi-vawt.com.tw

Version 3.

Table of Contents

WARNING	4
DISCALIMER.....	6
1. Safety Precautions	8
1.1 Mechanical Hazards	9
1.2 Electrical Hazards	9
1.3 Assembly.....	10
1.4 Installation	11
1.5 Operation	12
2. Introduction.....	13
2.1. DS-1500 Specification	14
2.2. DS-1500 Standard Packing	15
2.4. DS-1500 Kit Packing.....	17
2.5. DS-1500 Optional Parts	17
2.3.1 Power Management Devices.....	17
2.3.2 Mounting Mast	19
3. Preparation of Assembly and Installation	19
3.1 Selecting Location.....	19
3.2 Mast Preparation.....	20
3.3 Foundation for Roof Installation	23
3.4 Foundation of Ground Installation	25
4. DS-1500 Assembly and Installation.....	29
4.1 Tools Required for Assembly and Installation	29
4.2 DS-1500 Assembly	31
4.3 DS-1500 Installation.....	35

5. DS-1500 System Wiring	40
5.1 General Information.....	40
5.2 DS-1500 Wire Size.....	40
5.3 DS-1500 Control Box Wiring Diagram	41
5.3.1 Stand-alone (Off-Grid) Control Box Wiring Diagram.....	41
5.3.1 Grid-Tied Control Box Wiring Diagram.....	43
6. Warranty	45

Table of Figures

<i>Figure 2-1 General View of the DS-1500 VAWT System</i>	<i>13</i>
<i>Figure 2-2 DS-1500 System Standard Packing Contents.....</i>	<i>16</i>
<i>Figure 2-3 DS-1500 Power Management Devices</i>	<i>18</i>
<i>Figure 3-1 Dimension for Mast</i>	<i>21</i>
<i>Figure 3-2 Dimension for Bedplate</i>	<i>24</i>
<i>Figure 3-3 DS-1500 Ground Foundation</i>	<i>26</i>
<i>Figure 3-4 Holding Templates.....</i>	<i>27</i>
<i>Figure 4-1 DS-1500 Tools reference</i>	<i>30</i>
<i>Figure 4-2 DS-1500 Pre-Assembled Components.....</i>	<i>31</i>
<i>Figure 4-3 DS-1500 Darrieus Assembly Step 1.....</i>	<i>32</i>
<i>Figure 4-4 DS-1500 Darrieus Assembly Step 2.....</i>	<i>33</i>
<i>Figure 4-5 DS-1500 Darrieus Assembly Steps 3.....</i>	<i>34</i>
<i>Figure 4-6 DS-1500 Installation Procedures – 1</i>	<i>35</i>
<i>Figure 4-7 DS-1500 Installation Procedures – 2.....</i>	<i>36</i>
<i>Figure 4-8 DS-1500 Installation Procedures – 3.....</i>	<i>37</i>
<i>Figure 4-9 DS-1500 Installation Procedures – 4.....</i>	<i>38</i>
<i>Figure 4-10 DS-1500 Completed Installation View.....</i>	<i>39</i>
<i>Figure 5-1 Off-Grid Control Box Wiring Diagram</i>	<i>42</i>
<i>Figure 5-2 Grid-Tied Control Box Wiring Diagram</i>	<i>43</i>

Table Index

<i>Table 2-1 DS-1500 Wind Turbine Technical Specification</i>	<i>14</i>
<i>Table 2-2 Locations of DS-1500 System Component.....</i>	<i>15</i>
<i>Table 5-1 Wire Sizing Reference</i>	<i>41</i>

WARNING

THIS USER'S MANUAL PROVIDES INSTRUCTIONS AND GUIDELINES FOR ASSISTANCE WITH ASSEMBLY OF THE HI-VAWT'S DS-1500 VAWT SYSTEM. ALTHOUGH THE DS-1500 WIND TURBINE SYSTG HAS BEEN DESIGNED AS EASY AS POSSIBLE FOR THE INSTALLATION, IT STILL REQUIRES SPECIALIZED SKILLS, TOOLS AND EXPERIENCE AS WELL. FOR THE PURPOSES OF ASSEMBLING, INSTALLING, OPERATING AND MAINTAINING THE DS-1500 VAWT SYSTEM, WE ASSUME THAT PERSONNEL WHO INVOLVED IN THE WHOLE PROCESSES HAS THE SKILLS, TOOLS REQUIRED TO DO SO. NO ONE SHOULD ATTEMPT TO ASSEMBLE, INSTALL, OPERATE AND MAINTAIN THE DS-1500 VAWT SYSTEM WITHOUT THE NECESSARY SKILLS, EXPERIENCE, TOOLS AND SAFETY EQUIPMENT.

DISASSEMBLING THE PARTS FROM ORIGINAL IS RESTRICTED. ALL PRE-ASSEMBLED PARTS ARE FACTORY ADJUSTED, BALANCED AND TESTED. HI-VAWT TECHNOLOGY CORPORATION ASSUMES NO WARRANTIES AND LIABILITIES OF DOING SO.

HI-VAWT TECHNOLOGY CORPORATION (Hi-VAWT) ASSUMES NO DIRECT OR CONSEQUENTIAL LIABILITY IF FAULTY OR DANGEROUS ASSEMBLING, INSTALLATION OR MAINTENANCE PRACTICES ARE PERFORMED. PLEASE CONTACT HI-VAWT IF CONSULTATION OR ASSISTANCE IS REQUIRED.

HI-VAWT RECOMMENDS THE DS-1500 SHOULD BE SITED ACCORDINGLY IN AN EXCLUSION ZONE WITH CONTROLLING PUBLIC ACCESS. APPROPRIATE WARNING SIGNS SHOULD BE PLACED ON THE OPERATING SITE

THE DS-1500 SHOULD NOT BE INSTALLED NEAR UNPROTECTED POWER LINES, TREES OR ANY OBJECTS THAT WOULD POSSIBLY CAUSE THE HAZARDS OF THE OPERATION.

Hi-VAWT Technology Corporation

No. 168, Jhu-lin 1st Rd., Lin-kuo town, 244, Taipei County, Taiwan

Tel: +886-2-8601-4373

Fax: +886-2-8601-1263

E-Mail: sales@hi-vawt.com.tw

Website: www.hi-vawt.com.tw

DISCALIMER

Although HI-VAWT recommends 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 DS-1500 VAWT System.

HI-VAWT makes no warranties by either expressed or implied that the information contained in the manual is accurate or complete. Hi-VAWT Technology Corporation makes no warranties of fitness for a particular purpose and /or site. Hi-VAWT Technology Corporation will not be responsible for any direct or consequential damages, or an incidental expense.

All instructions, figures and diagrams are believed to be accurate at the time of printing. The success and safety in working with tools depend greatly on individual accuracy, skill and caution. For this reason, HI-VAWT is not able to guarantee the result of any contained procedure in the manual, nor can they assume responsibility for any damage to property or injury to persons resulting from procedures contained in this manual. Persons who engage in the procedures take their own responsibility and risk.

Actual power resources and selected site conditions will highly affect the energy production, which will vary with wind turbine maintenance, surrounding environment, therefore, HI-VAWT makes no representation or warranties regarding energy production.

Wind generators, like other sources of electrical power, Must be installed following the guidelines established by local and national regulations. Please consult a local electrical contractor for details and regulations.

The information and all specifications contained within this manual are subject to change without notice.

1.Safety Precautions

The DS-1500 is designed with user safety in mind. However, there are inherent dangers involved with any structural, mechanical and electrical equipment, the surrounding environment as well.

Safety must be the primary concern as you plan the location, assembly, installation and operation of the DS-1500 wind turbine. At all times be aware of electrical, mechanical and rotor blade hazards.

This Owner’s Manual contains important instructions, guidelines and safety notes that should be followed during the installation and maintenance of the Hi-VAWT’s DS-1500 VAWT System.

Please read thoroughly and follow the instructions in this USER’S MANUAL before assembling and installing the DS-1500 VAWT 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.



*This **WARNING** symbol indicates a possible dangerous condition.*

Please use extreme caution when processing the procedure.



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



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

1.1 Mechanical Hazards

Rotating blades present the most serious mechanical hazard. The DS-1500's rotor blades are made of very strong anodized aluminum. Some edge of the blades are sharp, please do not touch those sharp blades. Even though, with the built-in airfoil, the edges of those blades are not as sharp, they still will cause serious injury when they start rotating, even at low speed.



- NEVER TOUCH THE RUNNING ROTOR.
- NEVER TRY TO STOP THE ROTOR BY HAND.
- DO NOT INSTALL THE DS-1500 WIND TURBINE WHERE ANYONE CAN APPROACH THE PATH OF THE BLADES.
- AVOID ANY OBJECTS TOUCHING THE RUNNING ROTOR.

1.2 Electrical Hazards

The DS-1500 VAWT System is equipped with sophisticated generator and designed to provide protection from electrical dangers.

Heat in wiring system is often a result of too much current flowing through and undersized wire or through a bad connection. It is important to follow the suggested wire-sizing chart to ensure a safe electrical system

The battery, if applied, should never be short-circuited as it will result a danger of setting the battery and cable on fire. In order to

avoid the threat and protect the cabling, fuses should be installed in the lines connecting to the battery.

 **WARNING**

- WIRING CABLE WITH INSUFFICIENTLY DIMENTIONED CROSS SECTION CAN CAUSE ELECTRICAL FIRE.
- NEVER SHORT-CIRCUIT THE BATTERY IF APPLIED.

1.3 Assembly

The DS-1500 VAWT System shipped with varied packing formats based on customer's needs. Although most of the parts are pre-assembled, due to the weight and size of the DS-1500 VAWT System, the Darrieus Blades and Savonius Buckets may not be pre-assembled. This user's manual will guide you through the assembly procedures with detailed illustrations.

 **NOTE**

- Please carefully read the assembly instructions in this manual before proceeding.
- It is important to have a suitable working environment for performing the assembly tasks.
- Refer to the suggested list of tools required for the assembly and have all of them ready before proceeding.

WARNING

- DUE TO THE SIZE AND WEIGHT OF THE DS-1500 VAWT SYSTEM, PLEASE ALWAYS KEEP SAFETY IN MIND WHILE PERFORMING THE ASSEMBLY PROCEDURES.
- ALWAYS WEAR SAFE HELMET AND GLOVES!

1.4 Installation

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 think carefully about what you need to do and plan your work carefully, have all the tools and equipment ready before your start.

CAUTION

- Installation procedures should be performed as much as possible at ground level.
- Use safety harnesses, safe Helmets, gloves, etc.
- Make sure that all batteries, if applied, are disconnected from the system throughout the installation process.

- The DS-1500 generator 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.
- Please keep the rotor straight up or lie on the suggested V-Block stands at all-time during the installation process to prevent the blades twisted or lost balance.
- Please perform the installation at a calm and windless day.

1.5 Operation

Please check the support structures, blades and electrical system on regular basis.

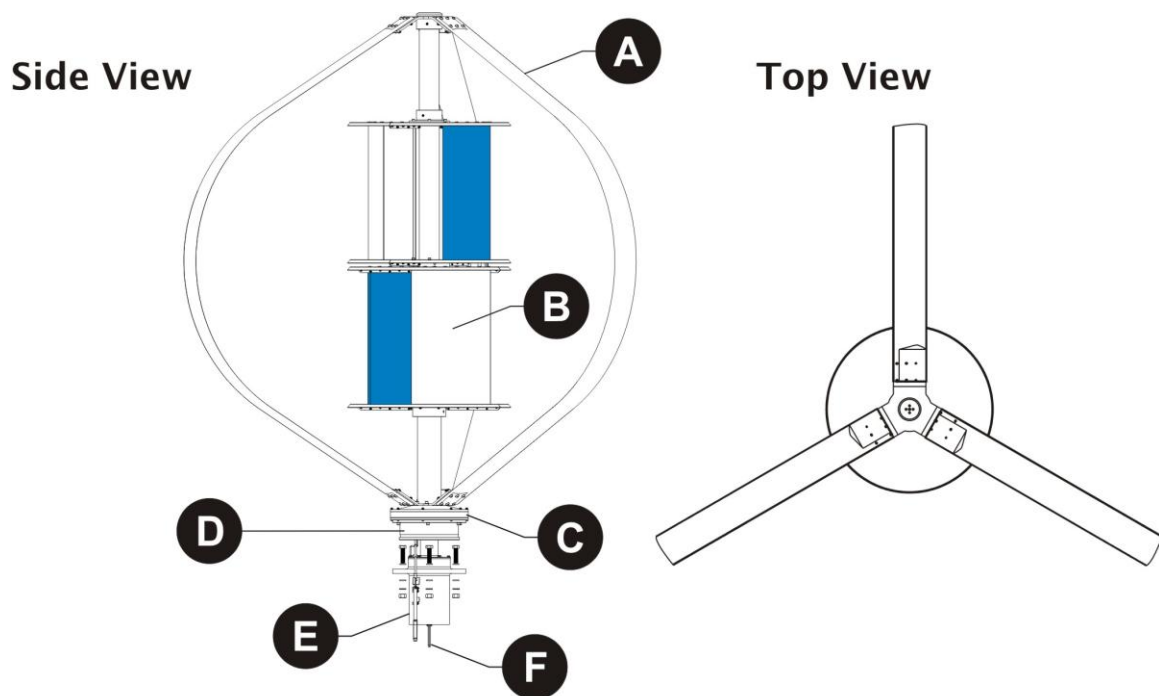
- Even though the rotor blades are very strong, however, if they come in contact with a solid object, they can be distorted or even broken.
- When perform routine inspections, or at any time you must approach the path of the blades, please disconnect the power leads from the batteries and short-circuit the wind turbine output leads (use the Stop SW after installation or tie the output leads together) to stop the rotor blades from rotating. The DS-1500 is designed to be shut down through the use of stop switch (brake switch).
- **NEVER APPROACH THE TURBINE DURING OPERATION.**

2. Introduction

The DS-1500 is a hybrid Vertical Axis Wind Turbine (VAWT) system which combines both drag-based and lift-based design. It incorporates an S-type of Savonius rotor and three airfoil blades of egg-type Darrieus to maximize the output performance.

The following Figure 2-1 shows a general view and major components of the DS-1500 VAWT System.

Figure 2-1 General View of the DS-1500 VAWT System



A	3 Air foiled Darrieus blades.
B	S-Type Savonius.
C	3-Phase, Direct Drive, Water Sealed, Mechanically Integrated Permanent Magnet Generator.
D	Integrated Mechanical Manual Brake
E	Damper/Isolator
F	3-Phase R-S-T Generator Wires.

2.1. DS-1500 Specification

The following table shows the technical specification of the DS-1500 VAWT System.

Table 2-1 DS-1500 Wind Turbine Technical Specification

General Dimension	
Rotor Diameter:	2,8m
Height:	3m
Weight:	380 Kgs
Blade	
Number of Blade:	3
Blade Material:	Anodized Aluminum
Operation Mode	
Cut-In Wind Speed:	3 m/s
Cut-Out Wind Speed:	15 m/s
Survival Wind Speed:	60 m/s
Brake	
Over Speed Braking:	Yes. (Setup by Power System Controller)
Auto Shutdown:	Yes. (Setup by Power System Controller)
Manual Brake:	Mechanical Manual Braking System
Generator	
Type:	AC, Direct Drive, Weather Sealed, 3-Phase Synchronism PMG.
Rated Output:	1,500 W
Mounting	
Foundation Mounting:	Min. Height above building: 3 meters.
Roof Mounting:	Min. Height above building: 2 meters.
Bedplate Mounting:	Used where deep excavation cannot be applied
Limited Warranty:	1 year on components.

2.2. DS-1500 Standard Packing

Before starting the installation, please check all components you receive from the shipment with the packing 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 DS-1500 VAWT System accordingly. If any missing parts from the original packing, please contact HI-VAWT for replacement.

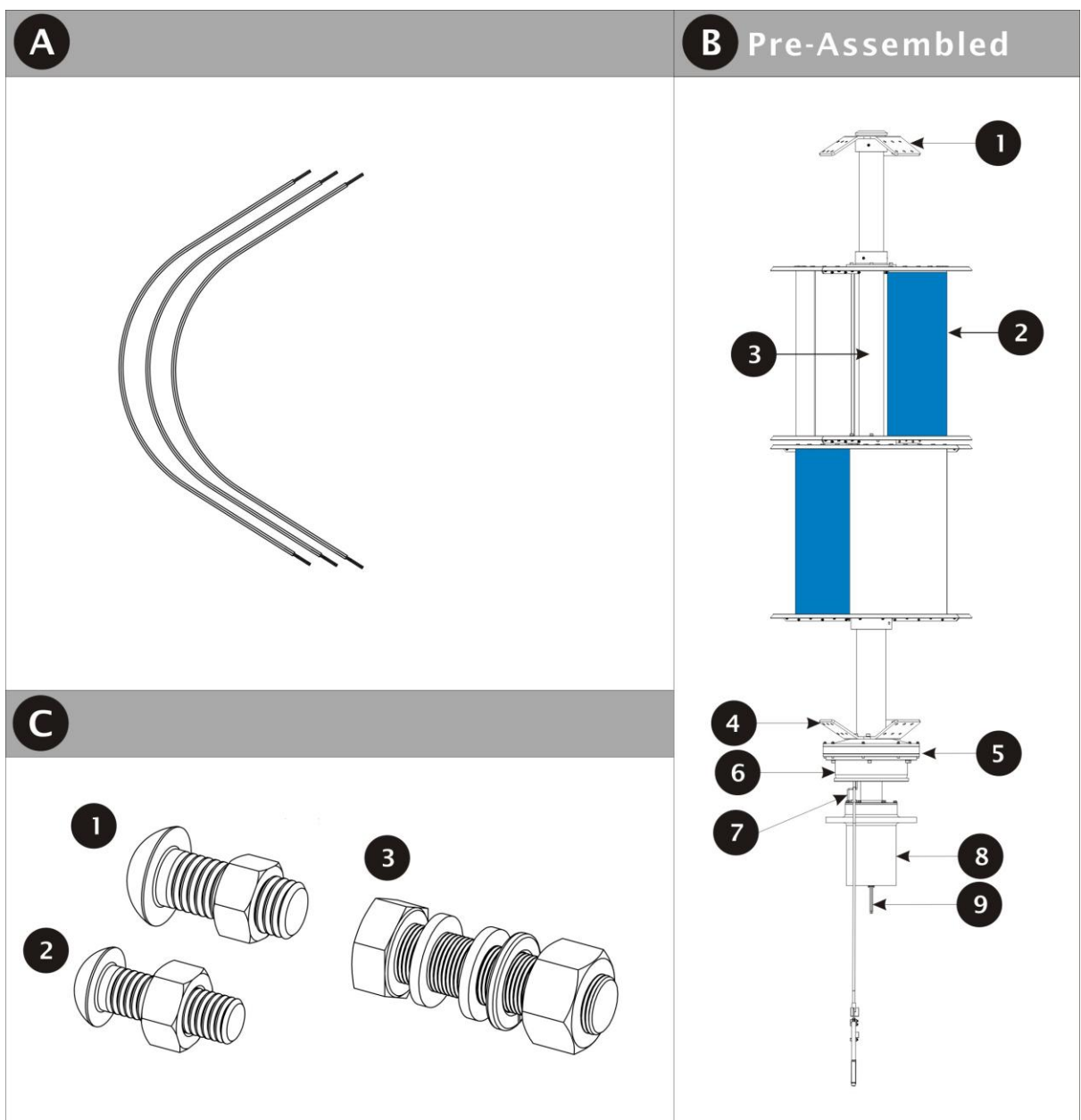
The standard packing of DS-1500 VAWT System includes parts listed in the following Table 2-2. Please also refer to Figure 2-2 for part locations. Detail assembly instructions will be discussed in the *Chapter 4 - Assembly and Installation*.

Table 2-2 Locations of DS-1500 System Component

Labels	Description	Quantity Included
A	Anodized Aluminum Blade (Assembly Needed)	3
B	Pre-assembled Components	1
1	Upper Blade Connecting Plate	1
2	S-Type Savonius	1
3	Vertical Axis	1
4	Lower Blade Connecting Plate	1
5	1,500 W PMG	1
6	Mechanical Manual Brake	1
7	Surge Wire	1
8	Damper	1
9	R.S.T Generator Wiring Cables	3

C	Bolt Sets	
1	M12 x 40mm Button Hex Head Bolt and Lock Nut (Set)	30
2	M10 x 40mm Button Hex Head Bolt and Lock Nut (Set)	6
3	M22 x 80mm Hex Head Bolt/Flat Washers x 2/Spring Washer/Nut (Set)	6

Figure 2-2 DS-1500 System Standard Packing Contents



NOTE

The standard packing is referred to the shipment of one set of DS-1500 VAWT System only.

2.4. DS-1500 Kit Packing

The DS-1500 VAWT System is also alternatively packed as a kit which requires more tools, skills and spaces to complete the assembly. This type of packing is basically shipped for Hi-VAWT's dealers or customers who have such skills and equipment with volume purchase. Hi-VAWT does not recommend this type of packing for end users.

Please refer to the DS-1500 VAWT Assembly Manual for Distributor for detailed descriptions.

2.5. DS-1500 Optional Parts

This DS-1500 VAWT System is designed with simplicity in mind, so there are just a few parts needed which all included in the standard package.

Other major parts needed to complete the whole wind power system are:

2.3.1 Power Management Devices

- For stand-alone application, the WG481500 Wind Power System Controller can incorporate with DS-1500 VAWT System for stand-alone (off-grid) power management
- For grid application, there are two power management devices specially designed for DS-1500 Wind Turbine, which are Hi-VAWT's WT21500D Wind Power Grid-Tied Inverter and Ginlong GCI-1500 Wind Power Grid-Tied Inverter.

Please refer to Figure 2-3 for choice of Power Management Devices.

Figure 2-3 DS-1500 Power Management Devices

WG481500 Wind Power Off-Grid Controller	WT21500 Wind Power Grid Tied Inverter
 A blue rectangular device with a yellow label on the front panel.	 A blue rectangular device with a digital display and buttons on the front panel.
GCI-1500 Grid Tied Inverter	
 A white rectangular device with a digital display and buttons on the front panel.	

Above Three power-management devices are fully tested with Hi-VAWT's DS-1500 VAWT System, you may select any one of these devices accordingly.

2.3.2 Mounting Mast

Concerning the shipping cost of the weight and size of the DS-1500 VAWT System, and different applications for the DS-1500 VAWT System, the required mast to set up the wind turbine is not included in the standard package.

The standard length of the mast for the DS-1500 ground installation is from 2 meters to 6 meters. For the roof installation, the length of the mast should not be over 3 meters. The design of the mounting mast will be discussed in *Preparation of Assembly and Installation* Section.

3. Preparation of Assembly and Installation

Before going through the DS-1500 VAWT System installation procedures, please double check parts included in the package. Prepare all required tools and equipment accordingly and have them ready on hands. More importantly, all safety issues have been well thought and followed.

3.1 Selecting Location

The DS-1500 Wind Turbine is designed with flexibility to fulfill user's applications. It 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 of affecting the performance of DS-1500 Wind Turbine for all proposed applications is the location of optimizing wind energy.

NOTE

We assume that the proper site of installing the DS-1500 VAWT System has been well evaluated by users themselves for optimizing the wind energy environment before any installing procedures performed.

WARNING

- DO NOT install the DS-1500 VAWT System at a site where anyone can easily approach the rotating blades.
- DO NOT install the DS-1500 VAWT System at a site surrounded by obstructions. For example, Trees, power lines, etc.
- DO NOT install the DS-1500 VAWT System at a site with unsuitable structure to hold the DS-1500 System.

 **CAUTION**

- Always follow your local regulations, codes about restrictions applied to such system installation.
- Always have your DS-1500 grounded to avoid the lightning strike.
- Perform the installation of the DS-1500 System in a calm and windless day.
- Perform all required assembly for the DS-1500 System at ground level.

3.2 Mast Preparation

As mentioned before, shipping charge of the mast made by Hi-VAWT will be costly. If you prefer making your own mast for DS-1500 VAWT System rather than purchasing from Hi-VAWT, we will show you here how the mast can be made by your local supplier.

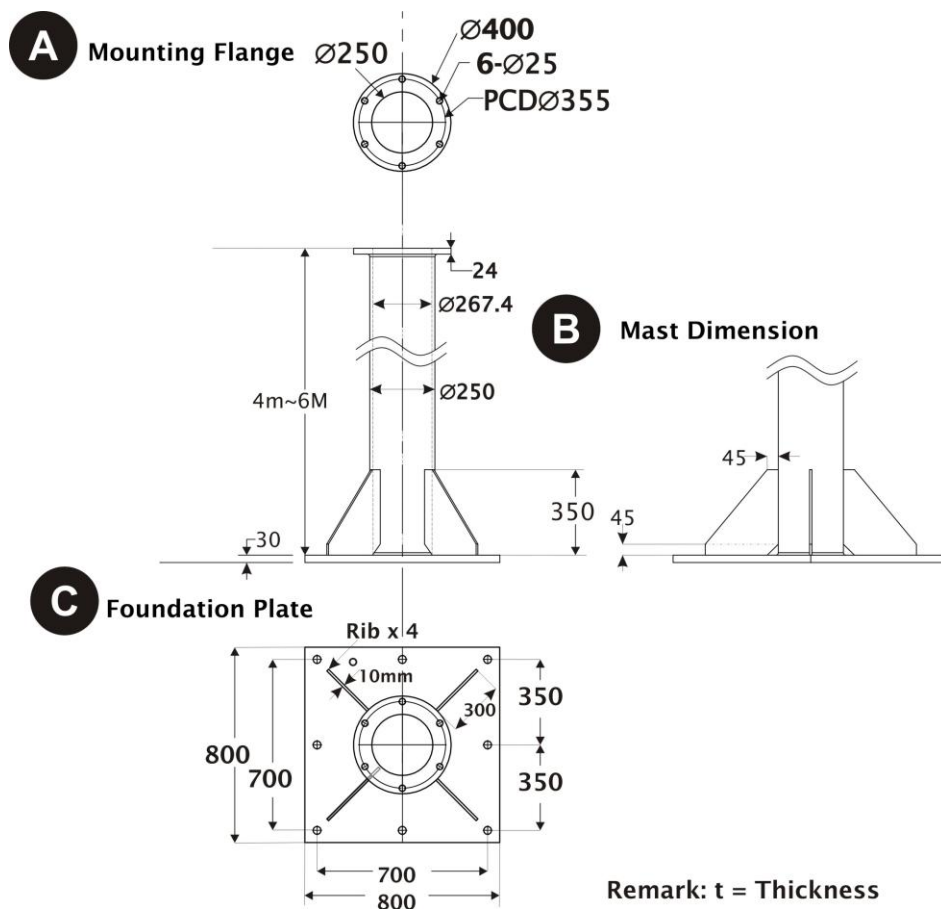
In the Figure 3-1, the Mast Specification was originally designed and tested on the DS-1500 VAWT System. It has been approved and applied as the standard DS-1500 VAWT System. It is important to follow the diameters shown in Figure 3-1 for Mounting Flange and Mast of the DS-1500 VAWT System.

⚠ CAUTION

- Please carefully check the structure of the building if you are going to install DS-1500 VAWT System on the roof. Make sure the structure is strong enough to endure DS-1500 VAWT System in terms of total weight, impact from gusty wind or earthquake, etc. HI-VAWT suggests the length of the mast is 3m max for the roof installation and 4m for the ground.
- Carefully 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.

The following Figure 3-1 shows the diagram for making the mast.

Figure 3-1 Dimension for Mast



<p style="text-align: center;">A</p>	<p>This portion shows the dimension of the mounting flange which should be welded on top of the mast for connection with the DS-1500 VAWT System.</p> <ul style="list-style-type: none"> • Flange Inner Dia. = $\varnothing 250\text{mm}$ • Flange Outer Dia. = $\varnothing 267.4\text{mm}$ • 6 - $\varnothing 25\text{mm}$ bolt holes on PCD $\varnothing 355\text{mm}$ (45° each) • Flange thickness = 24mm
<p style="text-align: center;">B</p>	<p>Mast Dimension:</p> <ul style="list-style-type: none"> • Prototype Design material: 267.4mm x 45m/m galvanized steel pipe. • Mast Outer Dia. = $\varnothing 267.4\text{mm}$ • Mast Inner Dial. = $\varnothing 250\text{mm}$ • Standard Length of the Mast = 4m~6m • Mounting flange welded on the top of the Mast. • Foundation Plate welded under the bottom of the Mast with 4 support ribs (t=10mm) • Drill a hole on the bottom side of the Mast for Generator wires exit.
<p style="text-align: center;">C</p>	<p>Foundation Plate Dimension:</p> <ul style="list-style-type: none"> • 800mm x 800mm • Thickness = 30mm • 6 x $\varnothing 32\text{mm}$ bolt holes on 700mm x 700mm. • 4 x 10mm in thickness of support ribs.

3.3 Foundation for Roof Installation

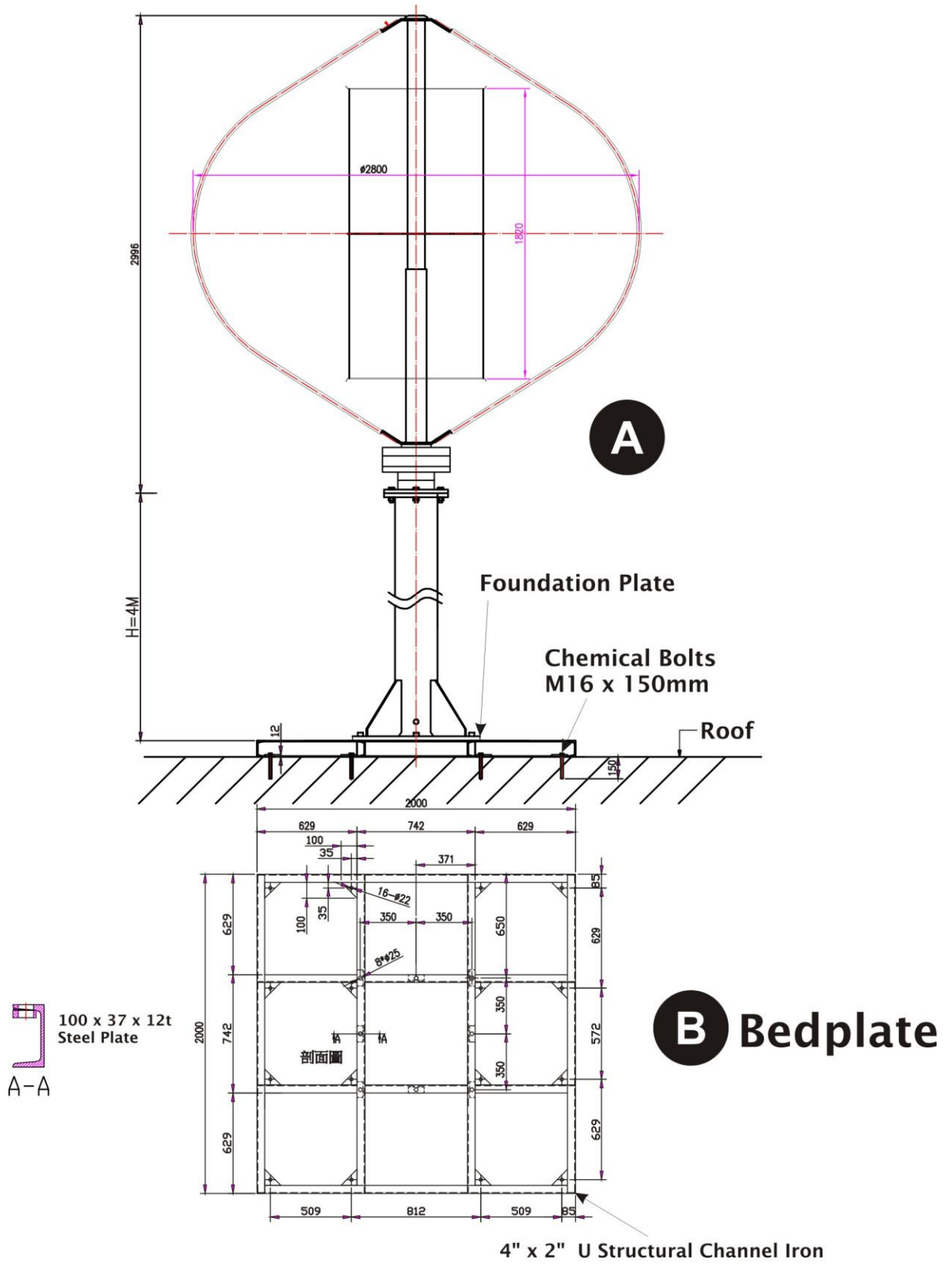
If you are planning to install the DS-1500 VAWT System on top of the building, please consult your architect or structure engineer for the structure inspection. Ensure the building structure is strong enough to hold the total weigh of DS-1500 VAWT System, plus the mast during the high wind.

Although you may drill holes on the roof to hold the mast, but we strongly recommend you also make a bedplate or pedestal for the mast installation. This application is working very well specially for the installation site where deep excavation is difficult.

In Figure 3-2, it shows the dimension of making bedplate for mast installation.

A	Weld the Mast Foundation Plate on the Bedplate, and use 16 M16 x 150mm Chemical Anchors to secure the Bedplate on the roof.
B	Please follow the dimension of the Bedplate shown in the Figure 3-2 B Section. The Bedplate is made out of U-Channel type steel.

Figure 3-2 Dimension for Bedplate



This drawing is ONLY for reference, please consult your structural engineer for best design for DS-1500 installation site.

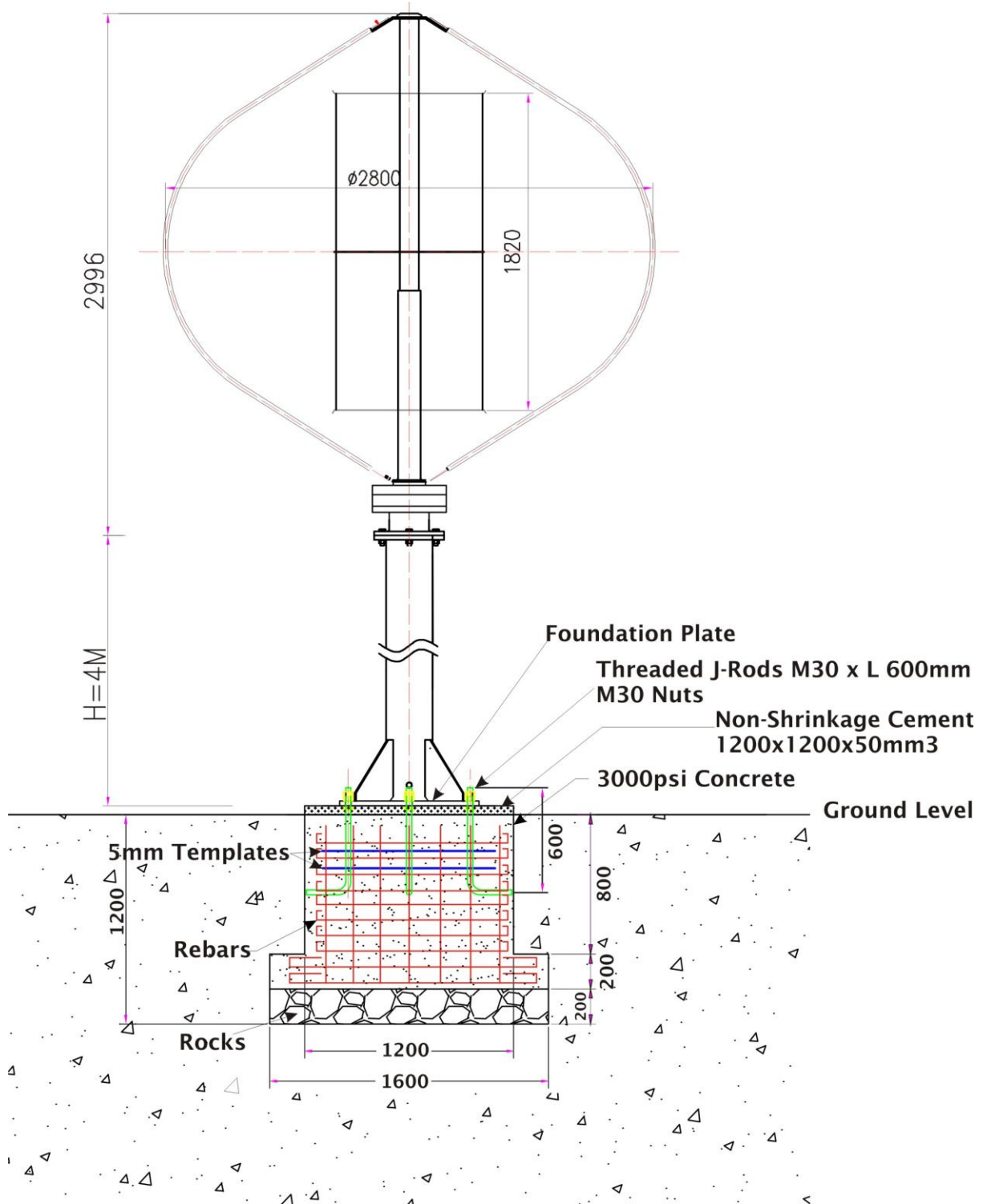
3.4 Foundation of Ground Installation

This section of how to prepare foundation for DS-1500 VAWT System ground installation is only intended to be a guideline for building concrete foundation on solid soils infrastructure. Please contact your local civil or structure engineer for more information.

Based on Hi-VAWT's standard 4m mast design and factory tested, initially the foundation should be prepared as 1.728 cubic meters in dimension (L 1,200mm x W 1,200 mm x Depth 1,200mm) dug into the soil. Please follow the diagram shown in the Figure 3-4.

- 40mm height from the bottom should be expanded to L 1,600mm x W 1,600mm.
- The bottom layer is filled with rocks (L 1,600mm x W 1,600mm x Depth 200mm).
- Arrange required rebar for the second layer (L 1,600mm x W 1,600mm x Depth 200mm).
- Use 2 templates (L 800mm x W 800mm x t 5mm) surrounding the foundation for the top layer.
- Follow the Figure 3-4 diagram and make two holding templates with 5mm in thickness steel plate. These two templates will be used to temporarily hold eight anchors bolts vertically and electrical conduit (if applied) on the precise position while pouring concrete into the foundation hole later.

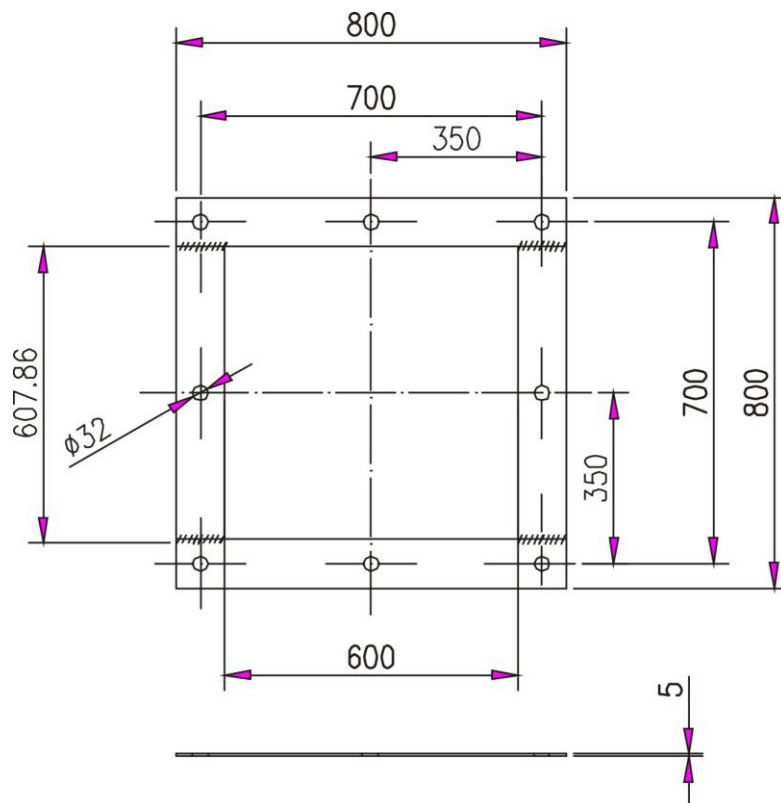
Figure 3-3 DS-1500 Ground Foundation



This drawing is for reference, please consult your civil engineer for best ground foundation for DS-1500 installation

- Insert all required rebar into the foundation and jack up to approximately the proper height.
- Insert 8 threaded M30 Anchored Bolts through two holding templates and secure them on the position. Make sure there have at least 100mm of thread above the concrete level.

Figure 3-4 Holding Templates



- Fix the conduit through the center of the template and push the other end of the conduit to the side of the foundation (if applied).
- Pouring concrete by using a vibrating poker to remove air voids from the pour. It is very important to make sure the all eight rods are hooked under the rebar. Once the concrete is all poured, make sure that the template has no air voids directly underneath. More importantly, make sure the template is leveled out.

- Next, clear excess concrete from above the template and use a suitable cover to prevent the foundation from rain. Wait until the concrete has set completely before removing the template (It will take at least for one week) .

Just remember, a solid with perfect leveled foundation is one of the key factors to achieve the success of the installation.

WARNING

- Although, the DS-1500 VAWT System is designed to be installed on the roof alternatively, but Hi-VAWT does not recommend to do so unless you are 100 percent sure that the structure of the building is capable of doing so.
- Please consult your local structural engineer and carefully evaluate such implementation before taking any further actions.
- It is user's responsibility to make sure that the structure of the building is able to sustain the force of operating DS-1500 VAWT System on the roof. Hi-VAWT is not responsible for any potential damage or dangerous factors caused by insufficiency of structural design of the building.
- Please closely follow your local government's regulations regarding related issues if you are going to install DS-1500 VAWT System on the roof.
- If you are going to install the DS-1500 VAWT System on the ground level, please consult your local civil engineer and

carefully evaluate the nature of the soil and design of the foundation accordingly.

4.DS-1500 Assembly and Installation

4.1 Tools Required for Assembly and Installation

Tools required for entire assembly and installation will be varied which highly depends on the following circumstances:

- Type of DS-1500 VAWT System package you purchased.
- The location of DS-1500 VAWT System you are planning to install.
- The type of the mast to be used for mounting the DS-1500 VAWT System.

CAUTION

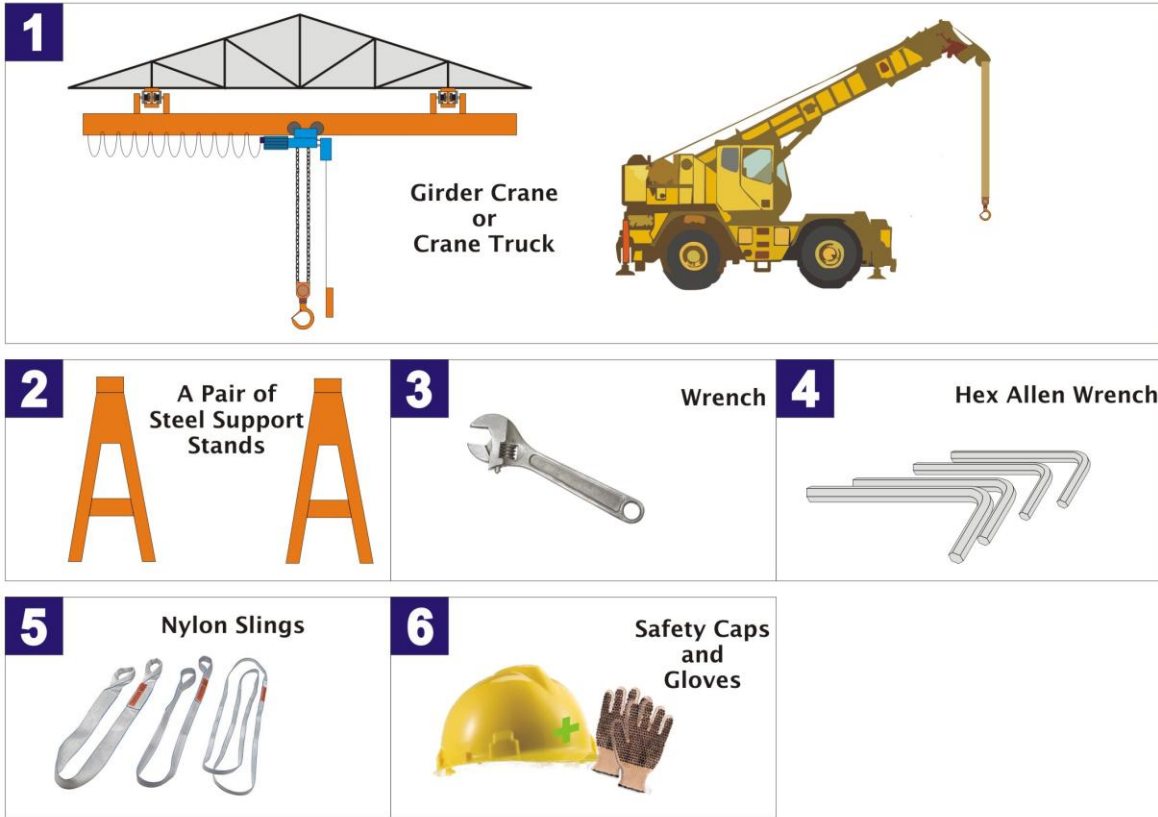
- Please evaluate the place you are going to install the DS-1500 with care and prepare all required tools accordingly.
- We strongly recommend you to prepare all suggested tools before proceeding the assembly and installation.
- Please always keep safety in mind while working on the assembly and installation.
- Preparing any extra equipment or safety devices accordingly if instructed by your local authority.

In Figure 4-1, it shows all basic tools required to assembly and install the DS-1500 VAWT System for reference.

Figure 4-1 DS-1500 Tools reference

DS-1500

Assembly/Installation Tools



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 assembly work is going to be performed outdoor, a crane truck with approximately same capacity with be required. **It is very important to have certified person to operate the crane.**

2 Steel Support Stands

A pair of steel support stands will be required for the assembly procedures. The height of each stand should be approximately 115cm to 120cm. Please also make sure all stands can hold up the weight of the DS-1500 VAWT. (The weight of the DS-1500 VAWT is about 380 kgs)

3 Adjustable Wrenches or Other Proper Wrenches

4 Hex Allen Wrenches: M10 and M12 Hex Allen Wrenches

5 Nylon Slings: At least two Nylon Slings with proper length.

6 Safety Caps and Gloves

NOTE: FOR YOUR SAFETY, PLEASE WEAR SAFETY CAP AND GLOVE AT ALL TIME.

4.2 DS-1500 Assembly

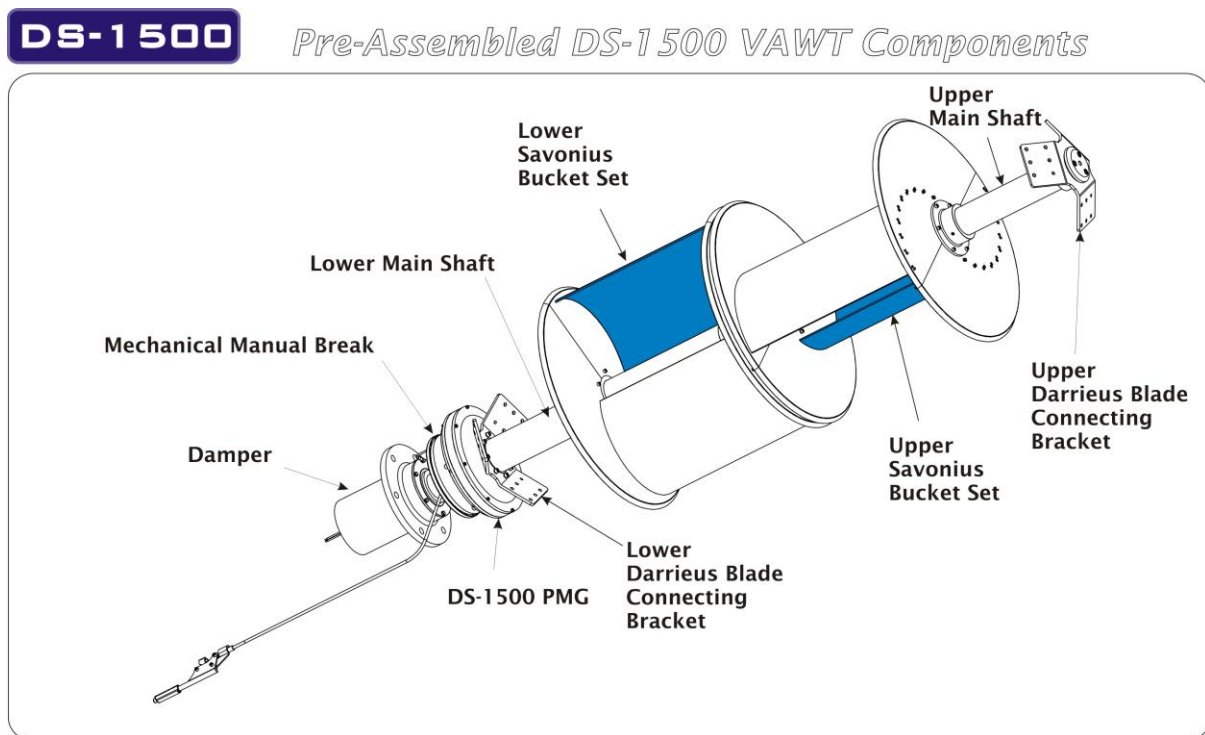
As mentioned before, the degree of assembly procedures is based on the type of package purchased. This manual will only discuss the assembly procedures for standard packing. Please follow detailed assembly illustrations to complete the entire assembly works.

NOTE

- Please skip the procedure if you find that it has been pre-assembled.

In Figure 4-2, it shows the pre-assembled parts.

Figure 4-2 DS-1500 Pre-Assembled Components



● For End User Only

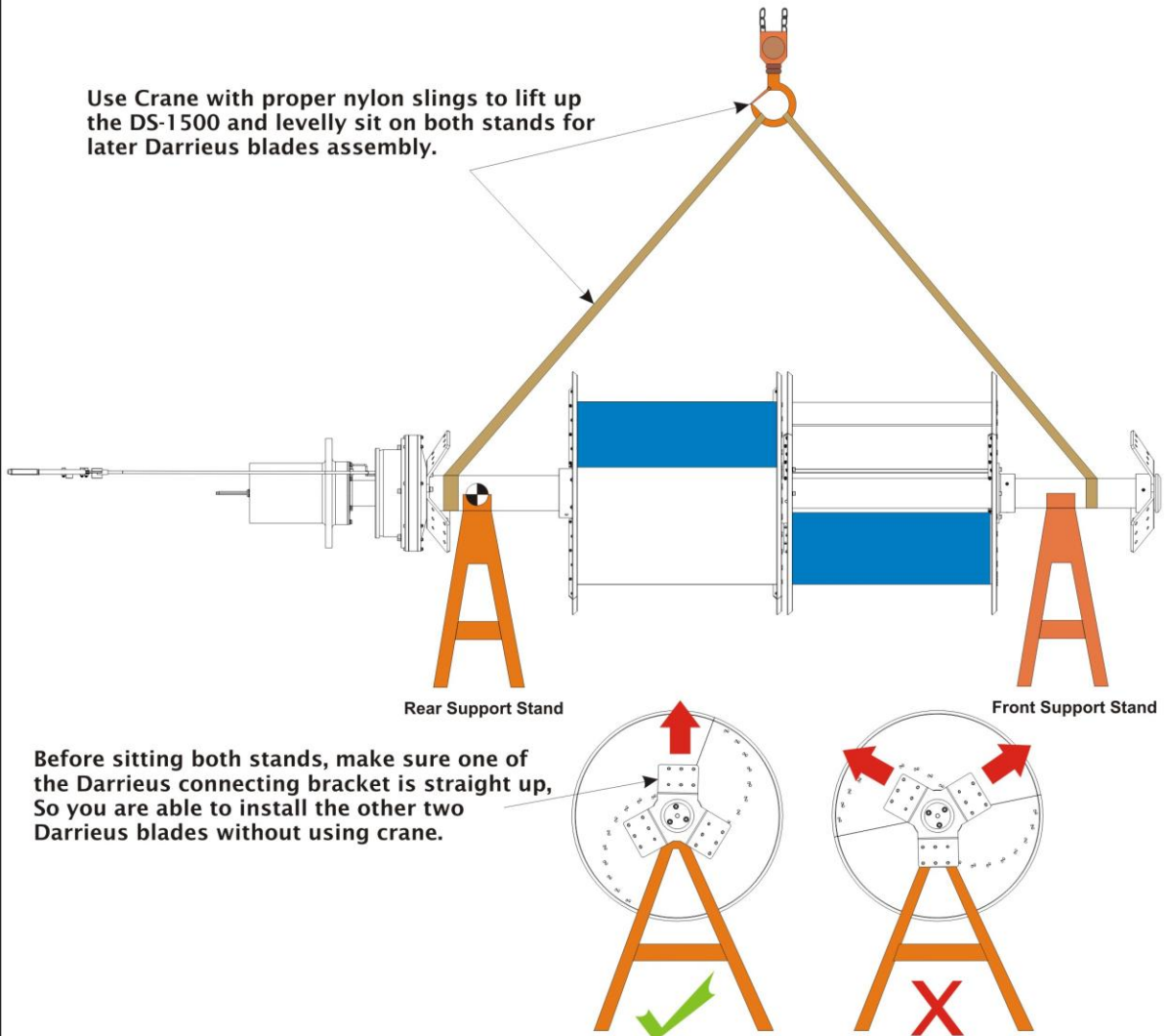
Figure 4-3 to Figure 4-5 shows necessary assembly procedures.

Figure 4-3 DS-1500 Darrieus Assembly Step 1

DS-1500

Darrieus Blades Assembly Illustration

Step 1.



NOTE:


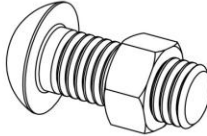
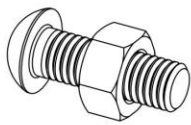
- When lifting the DS-1500, please pay attention to Center of Gravity of the main shaft. The end with Generator and Damper is heavier than the other end. So please properly adjust the nylon slings location on the main shaft.
- Lifting the DS-1500 up slowly.
- It is extremely important to have qualified person to operate the crane.

● For End User Only

Figure 4-4 DS-1500 Darrieus Assembly Step 2

DS-1500 Darrieus Blades Assembly Illustration

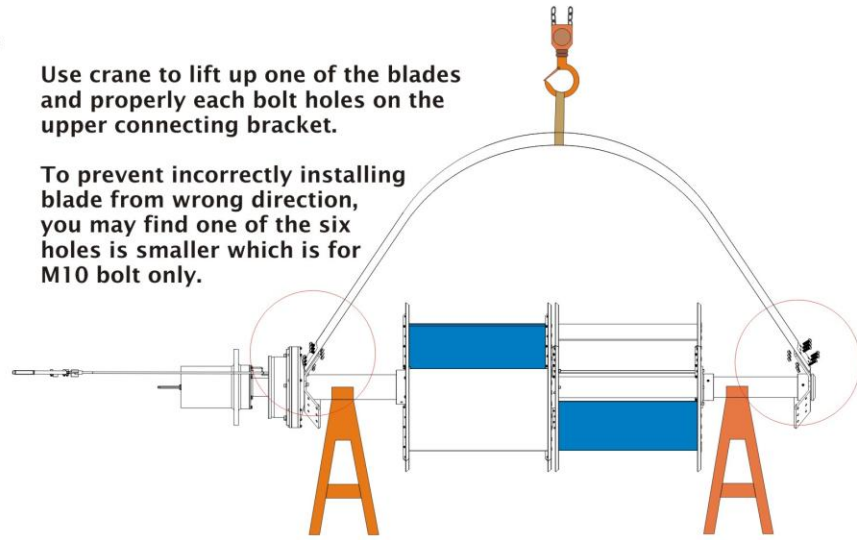
Parts for Darrieus Blades Assembly

<p>A P/N: DS15-0330-00-1 Qty: 3 pcs</p>  <p>Darrieus Blades</p>	<p>B P/N: BT02-1240-00-1 P/N: NT02-1200-00-1 Qty: 30 Each</p>  <p>Button Hex Head Bolt M12 x 40mm (BT02-1240-00-1) Lock Nut M12 (NT02-1200-00-1)</p>	<p>C P/N: BT02-1040-00-1 P/N: NT02-1000-00-1 Qty: 6 Each</p>  <p>Button Hex Head Bolt M10 x 40mm (BT02-1040-00-1) Lock Nut M10 (NT02-1000-00-1)</p>
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Step 2.

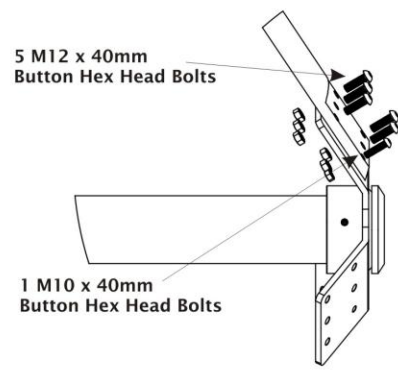
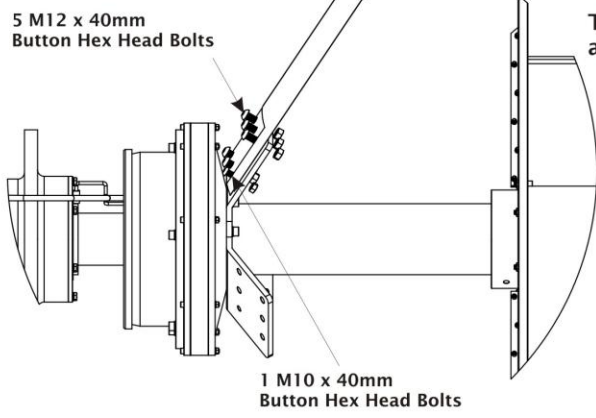
Use crane to lift up one of the blades and properly each bolt holes on the upper connecting bracket.

To prevent incorrectly installing blade from wrong direction, you may find one of the six holes is smaller which is for M10 bolt only.



Insert 5 M12 x 40mm Button Hex Head Bolts and 1 M10 x 40mm Hex Head Bolt into both upper and lower bracket holes.

Then securely use 5 M12 Lock Nuts and 1 M10 Lock Nut to fasten up.



● For End User Only

Figure 4-5 DS-1500 Darrieus Assembly Steps 3

DS-1500

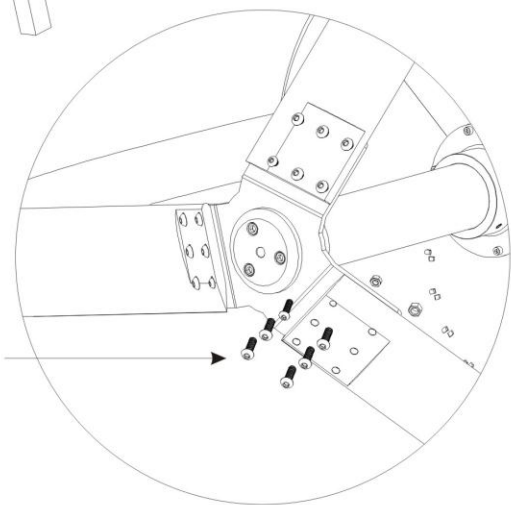
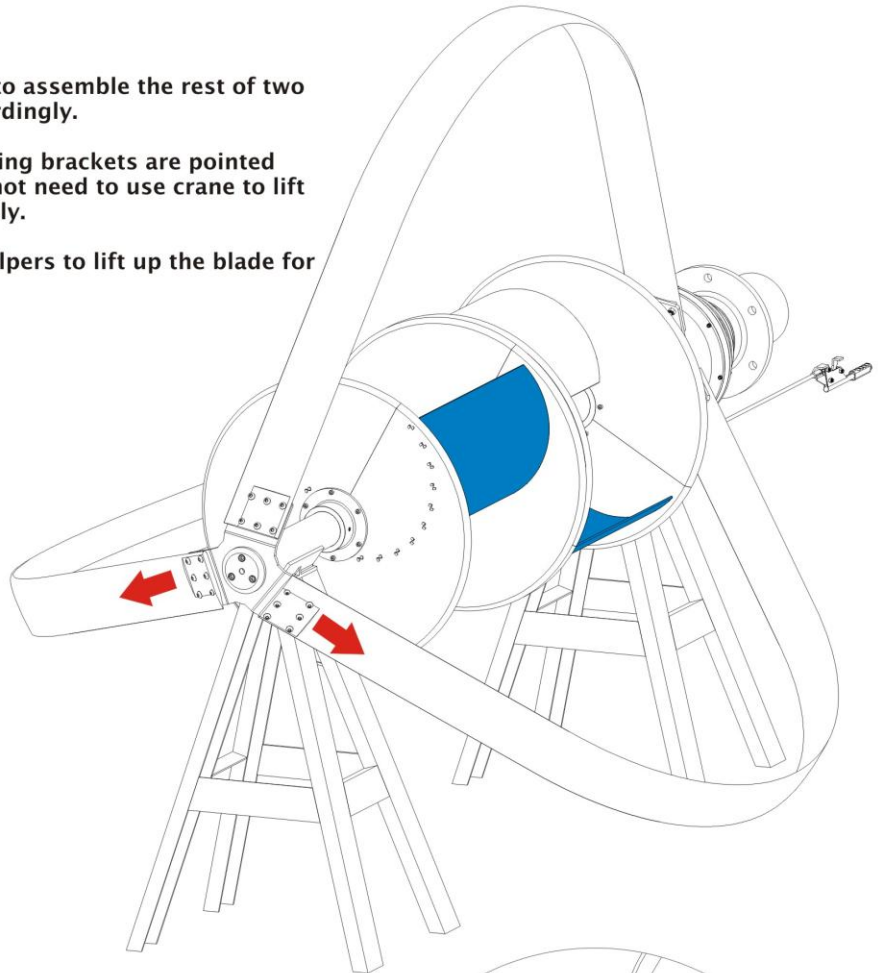
Darrieus Blades Assembly Illustration

Step 3.

Simply follow Step 2 to assemble the rest of two Darrieus Blades accordingly.

As these two connecting brackets are pointed downward, you may not need to use crane to lift up blades for assembly.

You may need two helpers to lift up the blade for bolt fastening.



Use 5 M12 x 40mm Button Hex Head Bolts /M12 Lock Nuts and 1 M10 x 40mm Button Hex Head bolt to fasten both blades and connecting brackets.

● For End User Only

Above steps have concluded the required assemble procedures for DS-1500 VAWT.

4.3 DS-1500 Installation

WARNING

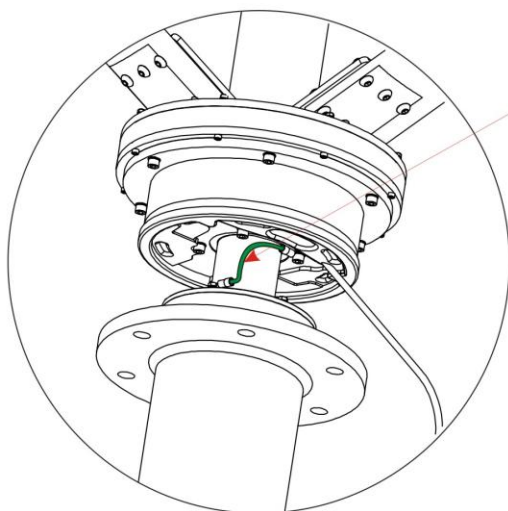
- Double check with assembly procedures and make sure all screws are securely fastened. Any loosen screw will cause serious vibration and parts damaged.
- If you are going to install the DS-1500 VAWT System at certain height, please have proper safety devices ready for proceeding installation.

Figure 4-6 DS-1500 Installation Procedures - 1

DS-1500

Site Installation Illustration

Step 1.



Before installing the complete DS-1500 VAWT onto the mast, please double check the surge wire is well connected between the break unit and damper although it is pre-installed out of factory.

In Figure 4-6, please double check the surge wire is well connected between the break unit and the damper flange.

⚠ WARNING

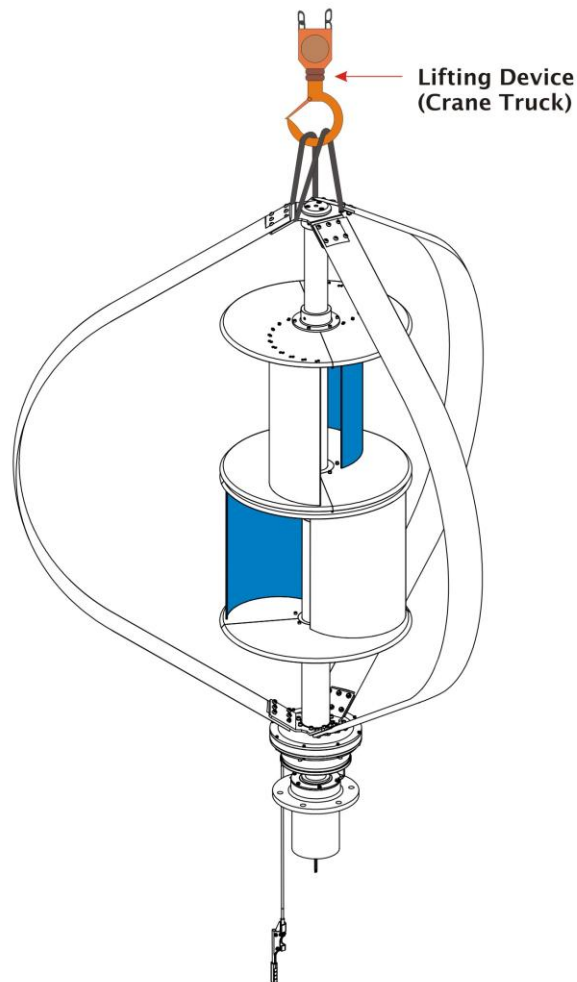
- Fail to connect the surge wire may cause damage of the DS-1500 System by lightning strike.

Figure 4-7 DS-1500 Installation Procedures - 2

DS-1500 *Site Installation Illustration*

Step 2.

For site installation, please use proper lifting device (Crane Truck) to lift the DS-1500 VAWT at straight up position.



👉 NOTE

- There are 3 proper size and length of wires should be pre-installed inside the Mast

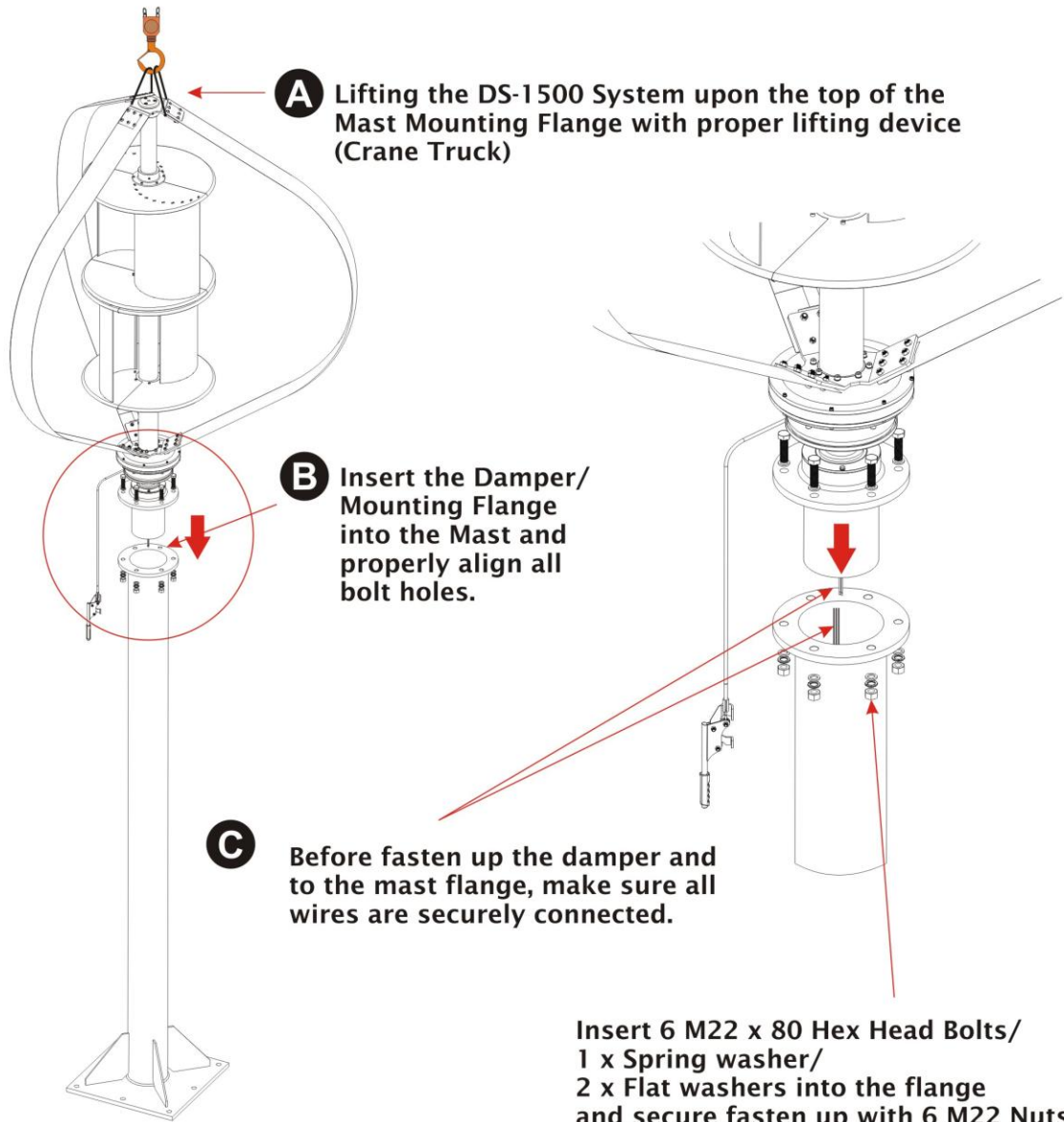
- Securely connect the RST Generator Wires with these 3 pre-installed wires.

Figure 4-8 DS-1500 Installation Procedures - 3

DS-1500

Site Installation Illustration

Step 3.



Follow the Figure 4-19 for DS-1500 System mast mounting. Make sure the RST Generator wires are not interfered by the mounting flange and well connected.

Figure 4-9 DS-1500 Installation Procedures - 4

DS-1500 Site Installation Illustration

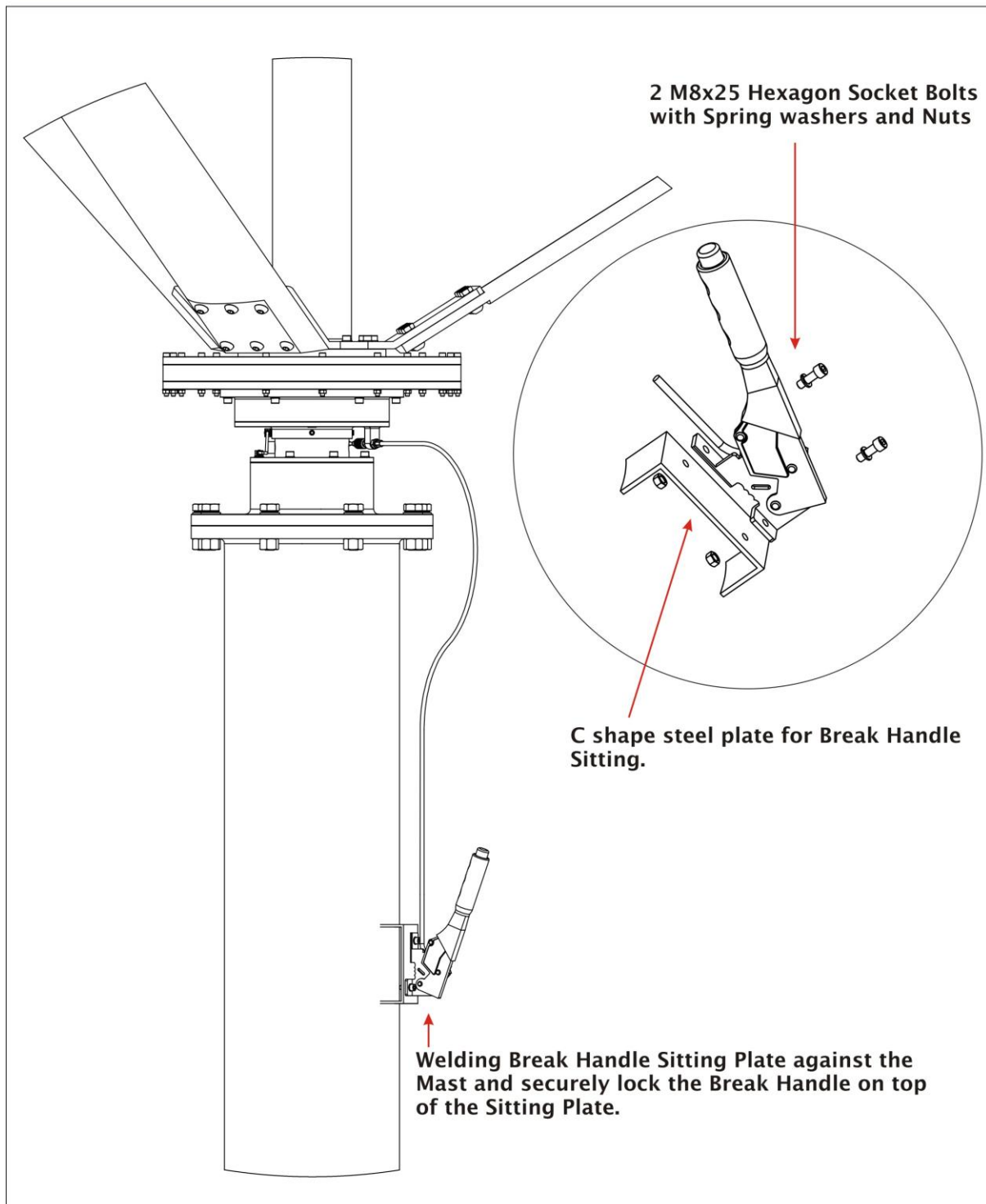
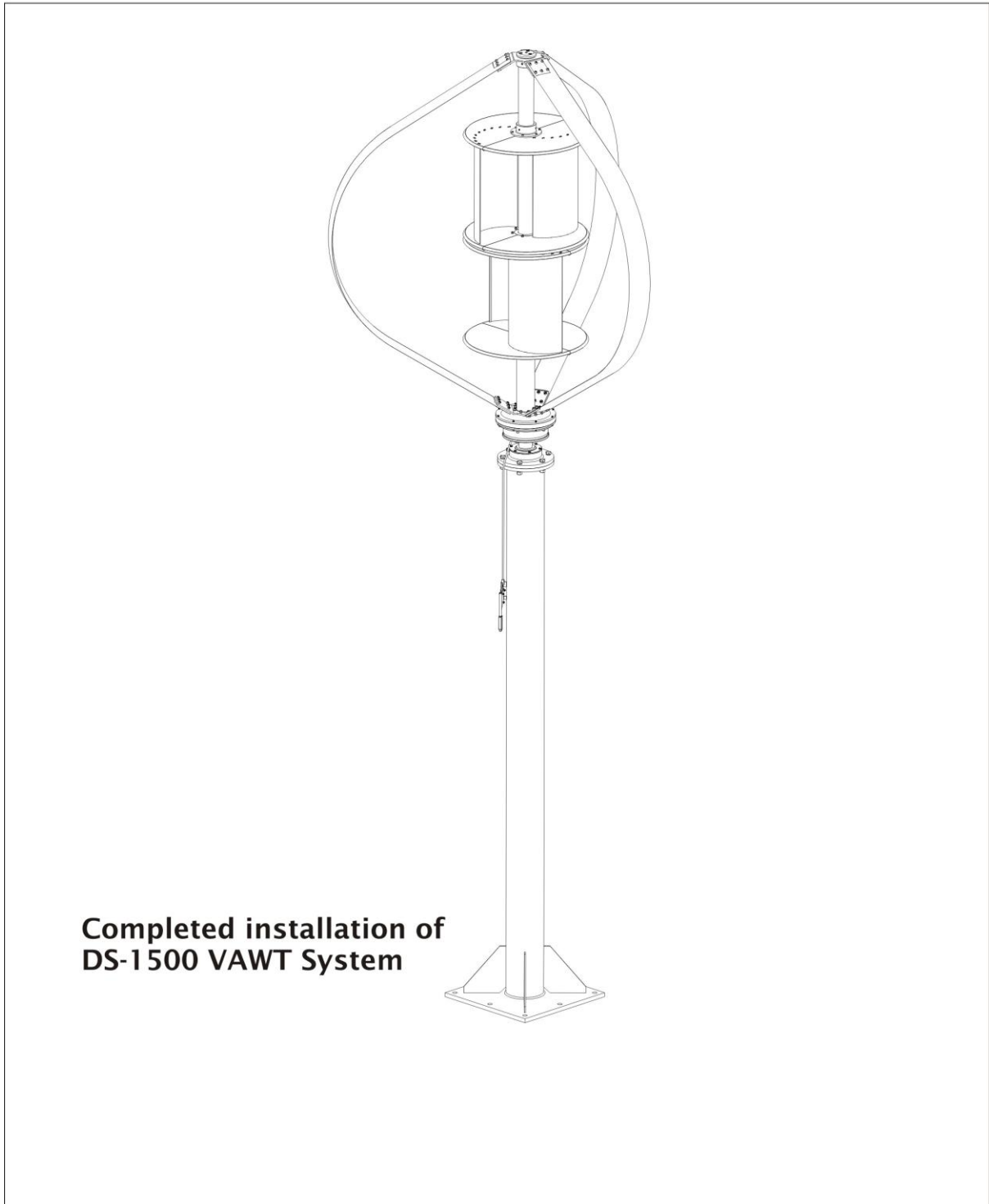


Figure 4-10 DS-1500 Completed Installation View

DS-1500 *Site Installation Illustration*



5.DS–1500 System Wiring

5.1 General Information

Please refer to local and national codes or special regulations to be followed accordingly before installation. All works on the electrical system like installation, maintenance, and repair should be carried out by qualified technicians and make sure that they read all technical information and instructions contained in related manuals.

The wiring diagram should be planned ahead and make sure all required wiring components are well prepared accordingly.

CAUTION

- Carefully plan all required electrical components, and install electrical components first before any electrical connection.
- Make sure that batteries (if applied) should be disconnected all installation works are completed.
- All electrical power cables should be physically protected. Run the wires inside the mast of conduit for maximum protection.

5.2 DS–1500 Wire Size

The cross section of the wire to be used depends on its length and voltage of the wind generator. All electrical systems lose energy from the resistance of the wire used. Larger wire size has smaller losses, but can be considerably more costly.

NOTE

- Closely measure the distance between DS-1500 VAWT System and the location of the Controller.

Please follow the reference table below for wire sizing:

Table 5-1 Wire Sizing Reference

Distance Between Generator and Controller					
	0-10m	10-20m	20-30m	30-50m	>50m is not suggested.
AWG Gauge	14	12	10	8	

5.3 DS-1500 Control Box Wiring Diagram

The DS-1500 Wind Turbine is designed in collaboration with WG481500 Wind Power System Charger for Off-Grid application, both WT21500D Wind Power Grid-Tied Controller and GCI-1500 Wind Power Grid-Tied Controllers are for grid-tied application.

WARNING

- HI-VAWT makes no warranty that DS-1500 VAWT System will work with power management devices other than above mentioned wind power controllers in terms of performance and functionality.

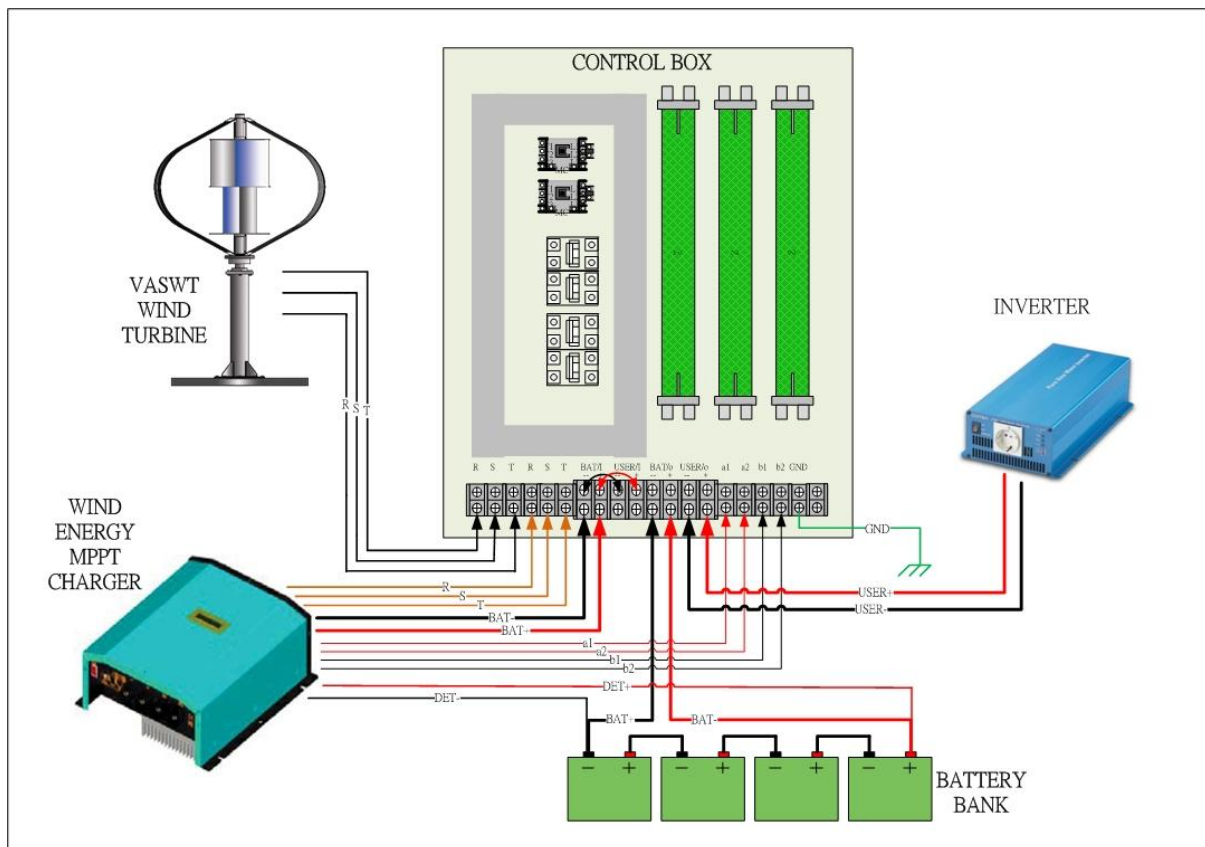
5.3.1 Stand-alone (Off-Grid) Control Box Wiring Diagram

The control box for stand-alone application is to provide the following circuitry functions:

- Battery Charge ON/OFF Switch.
- Output ON/OFF Switch.
- 3-Phase Short-Circuit Manual Brake Switch.
- Manual Resister Speed Reduction (Load Dump).
- Easy-Connection Terminal Panel.

Please refer to Figure 5-1. It is a recommendation control box design for WG481500 Wind Power Charger in collaboration with DS-1500 VAWT System as a total solution for Off-Grid application.

Figure 5-1 Off-Grid Control Box Wiring Diagram



5.3.1 Grid-Tied Control Box Wiring Diagram

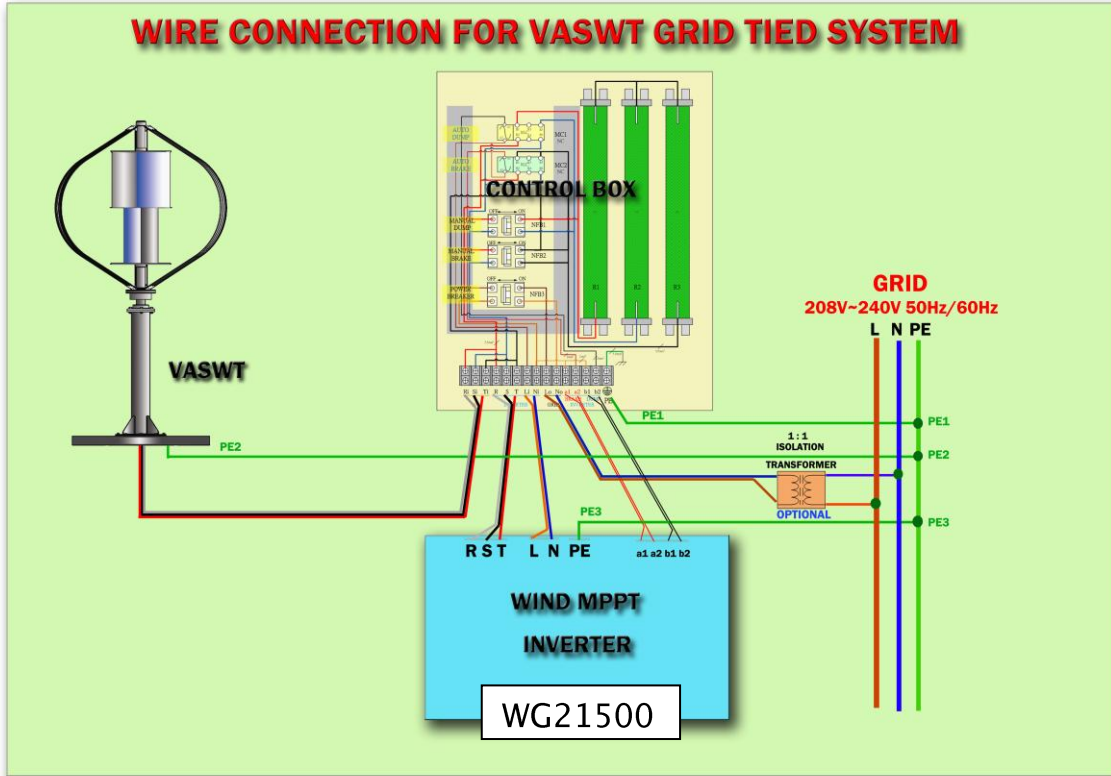
The control box wiring diagram shown in Figure 5-2 is for Grid-Tied application purpose which is to provide the following circuitry functions:

- Circuit ON/OFF Switch.
- 3-Phase Short-Circuit Manual Brake Switch.
- Manual Resistor Speed Reduction (Load Dump).
- Automatic Short-Circuit Brake.
- Automatic Resistor Speed Reduction (Load Dump).
- Easy-Connection Terminal Panel.
-

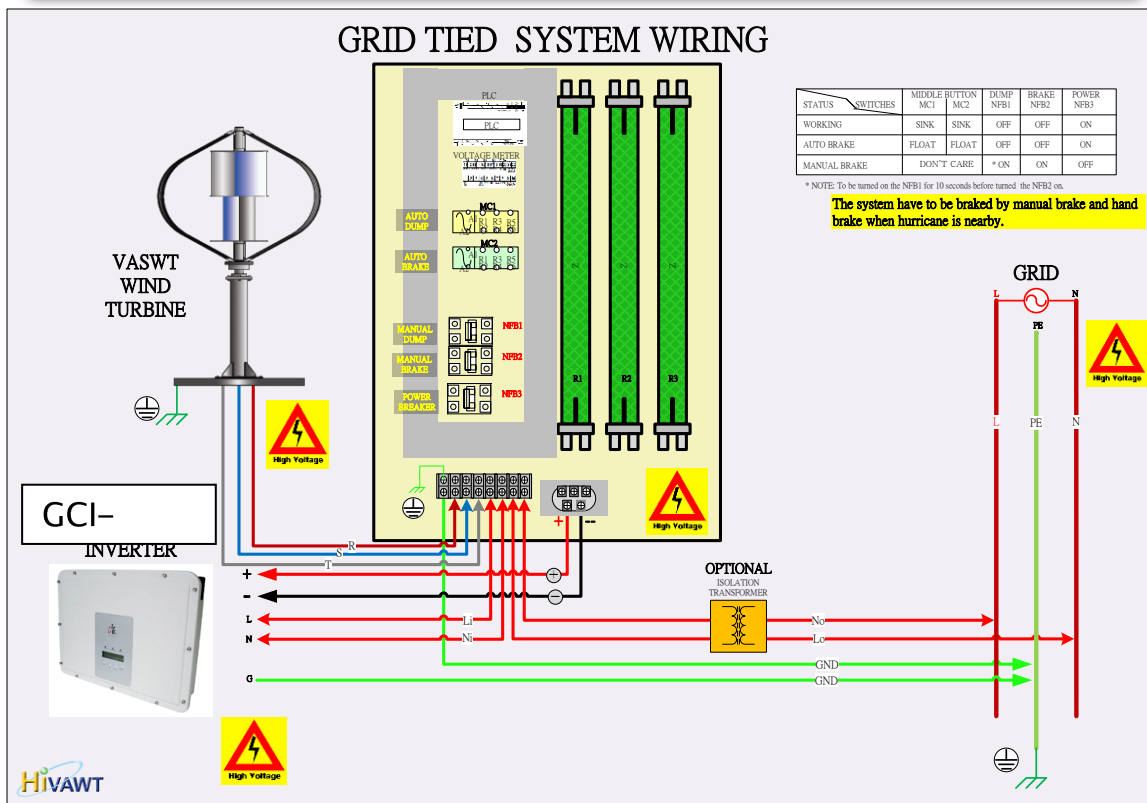
It is a recommended control box design for WT21500D Wind Power Controller in collaboration with DS-1500 VAWT System as a total solution for Grid-Tied application.

Figure 5-2 Grid-Tied Control Box Wiring Diagram

WIRE CONNECTION FOR VASWT GRID TIED SYSTEM



GRID TIED SYSTEM WIRING



Additional information regarding WG481500, WT21500D and GCI-1500 Wind Power Charger/Controller, please refer to WG481500, WT21500D and GCI-1500 User Manuals accordingly.

6. Warranty

The Hi-VAWT Technology Corporation (HI-VAWT) provides one (1) year limited warranty (Warranty Period) for products it manufactures and covers defects in materials, workmanship and quality (Defeats) in the DS-300 Wind Turbine System. The warranty is valid from the date of invoice to the original user. The limited warranty is also transferable and applied to subsequent owners only within the Warranty Period.

Hi-VAWT will repair or replace the defective products for free under the following conditions:

- The user has notified Hi-VAWT of the Defeat within the Warranty Period.
- Hi-VAWT verifies the existence of a Defeat that is covered within the limited warranty by its inspection, troubleshooting and any possible mean to identify.
- Shipping cost from Hi-VAWT to user for replacement or repaired parts.

Hi-VAWT has the option to use new or reconditioned parts in performing repair or replacement. HI-VAWT also reserves the right to use parts or improved design in the repair or replacement.

If you purchase the product from our dealer in your area, contact the dealer for repair or replacement or you may contact us directly at the following numbers:

Telephone: + 886 2 8601 4373

Fax: + 886 2 8601 1263

Email Address: sales@hi-vawt.com.tw

Please provide the proof of purchase (dated invoice) for defective products repair or replacement.

The limited warranty does not apply to any product or part thereof damaged by the following conditions:

- Any alteration to the product either internally or externally, or disassembly of the product.
- Not been used in accordance with the User's Manual supplied with the product.
- Installed and used in an unsuitable environment.
- Operation or installation contrary to instructions pertaining to the product.
- Damaged during shipping, mishandled, neglected, improperly installed.
- Repair or service provided by an unauthorized repair facility.
- Lightning strikes without proper grounding.

Hi-VAWT does not warrant or guarantee the workmanship performed by any person or firm installing its products.

HI-VAWT MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN MANUAL OR OTHER DOCUMENTATION PROVIDED BY IT IN CONNECTION WITH THE PRODUCT.

ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, 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.

 **WARNING Limitations on Use**

Please Note, the Hi-VAWT's DS-1500 VAWT System is not intended for use as the power source of life support systems or other medical equipment or devices and Hi-VAWT makes no representation or warranty in connection with any use of the product for such purposes.



P/N: 
DS 1 5 - UME N - 0 0 - 3

S/N: 
201006151100

Hi-VAWT Technology Corporation
www.hi-vawt.com.tw
No. 168, Jhulin 1st Road.,
Linkou Township,
Taipei County 24443, Taiwan