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PHONO SOLAR TECHNOLOGY CO., LTD.

Dual glass PV Module

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1 IMPORTANT SAFETY GUIDE

This manual contains information regarding product identification and the safe installation and maintenance of photovoltaic modules (hereafter referred to as "module") supplied by PHONO SOLAR TECHNOLOGY CO., LTD. (hereafter referred to as "PHONO SOLAR"). The term "module" can be interpreted as a single module or multiple modules depending on the context.

Installers must already be familiar with the mechanical and electrical requirements for a photovoltaic system. Installers must also read this manual carefully prior to installation. We recommend that you keep this manual in a safe place for future reference and in case of future sale or disposal of the module.

1.1 General Safety

- The installation of a photovoltaic system requires specialized skills and knowledge and must only be carried out by licensed/qualified persons.
- Installers should assume all risks of injury and do everything to avoid potential damages and risks that might occur during installation, including but not limited to, the risks of electric shock.
- PHONO SOLAR modules do not need special cables for connection. All of the modules have permanent junction boxes, cables and connectors.
- Do not use mirrors or magnifiers to concentrate sunlight onto the modules.
- The modules generate DC electrical energy from sunlight. They are designed for outdoor use and can be mounted onto frames on rooftops or in the ground etc.
- Do not paint the module or attach anything on to the back of the module.
- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.

1.2 Handling safety

- Insulated gloves must be worn while handling the module and during the installation.
- Do not wear metal ornaments while handling the module or during the installation.
- Do not install or handle modules in wet or strong windy conditions.
- Do not expose the back of the module to direct sunlight.
- Do not install or handle module in wet or strong windy conditions.
- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.

1.3 Installation safety

- Local, regional and state laws and regulations must be adhered to while installing a photovoltaic system. For example, any necessary licenses must be obtained prior to the installation.
- Do not use module near equipment or in places where flammable gases may be generated or collected.
- Inappropriate transportation and installation may break the module.
- Do not use mirrors or magnifiers to concentrate sunlight onto the modules.
- The modules generate DC electrical energy from sunlight. They are designed for outdoor use and can be mounted onto frames on rooftops or in the ground etc.
- Do not paint the module or attach anything on to the back of the module.
- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.
- Insulated gloves must be worn while handling the module and during the installation.
installation commencing. Regulations around vehicles and ships must also be observed during the installation.

- Observe all safety rules for the other system components, including the cables, connectors, charging controllers, inverter and storage battery etc.
- Do not place the modules near a location where flammable gases are either generated or collected.
- Insulated gloves must be worn during the installation.
- Do not wear metal ornaments during the installation.
- Do not drill holes in the frame.
- Under normal conditions, a module is likely to produce more current and/or voltage than reported under Standard Test Conditions (STC). Accordingly, the values of Isc and Voc marked on the module nameplate should be multiplied by a factor when determining the component voltage ratings, conductor current ratings, fuse sizes, and the size of controllers connected to the photovoltaic system. The exact factor value should be suggested by a licensed/qualified person.

- The live connector may cause fire, spark or lethal shocks even when the modules are not connected.
- Electricity can be generated when the modules are exposed to sunlight, even if they are not connected. It is dangerous to touch 30V DC or higher, so never open the electrical connectors or unplug the electrical connectors while the circuit is under load, and do not touch the live connectors during the installation when the modules are exposed to sunlight.
- Children should be kept away from the photovoltaic system.
- In order to prevent current and voltage generation during installation an opaque board can be used to cover the modules.
- Only use licensed/qualified insulated tools.
- The frame of the modules may be grounded according to local, regional and state safety and electrical standards.

2 PRODUCT IDENTIFICATION

On the back of each module there are 2 labels that provide the following information:

**Nameplate**: Describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all as measured under STC; weight, dimensions etc.; the maximum system voltage of 1000V DC.

**Warning**: The value of Voc multiplied by the number of modules in series should not be bigger than the maximum system voltage marked in the nameplate.

**Barcode**: This is used to identify each module. Each module has a unique and traceable serial number in the form of barcode. The barcode of each PHONO SOLAR module has 15 letter/digits.

**Warning**: Do not remove the nameplate or barcode. The PHONO SOLAR product warranty will be void if either the module nameplate or barcode is removed.

3 MECHANICAL INSTALLATION

(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)

3.1 Select suitable locations for installation

- Select a suitable location for installing the modules.
- PHONO SOLAR recommends that to achieve the best performance the modules should face south in northern latitudes and north in southern latitudes. The exact tilt angle and orientation of mounted modules should be recommended by a licensed/qualified installer.
- The modules should be completely free of shade at all times.
- Do not place the modules near a location where flammable gases are either generated or collected.

**Note**: Saline environments can accelerate the processes of electrical insulation losses and galvanic corrosion, especially when different metals with high electrochemical potential come into contact each other.

In saline environments, based on the distance to seashore, Phono Solar generally classifies coastal PV installation into three different levels:

- From 0 up to 50 meters, Phono Solar does not recommend any installation due to concerns for salt-mist corrosion.
- From 50 to 500 meters, Phono Solar regards this as “Near-Coast” installation requiring adherence to salt-mist corrosion prevention.
- From 500 meters and onwards, Phono Solar estimates the risk of salt mist corrosion is minor and only requires annual preventive maintenance.

In “Near-Coast” installation, Phono Solar PV modules must be installed under the following conditions:

- During the installation, do not scratch or break the corrosion-resistant coating (e.g. electroplated layer, oxidized coating, etc.) on the modules and mounting systems.
- The modules shall be mounted with a minimum tilt angle of 10° in respect to the horizon.
- Use corrosion-resistant materials (e.g. stainless steel SUS 316) for components (nut,
Stability / Reliability / Creativity

The module clamps should not come into contact with the front glass of cell area to avoid any shadowing effects from the module clamps. Regardless of the orientation chosen, at least 4 clamps must be used on each module. Depending on the local wind and snow loads, additional clamps may be required. The applied torque should be about 8 Nm. Please find detailed mounting information in the below illustration:

PHONO SOLAR modules can be mounted using two methods, the following two methods are suitable for roof mounting and ground project mounting:

**Clamp fitting:** Use suitable module clamps on the LONG side of the module frame to mount the module.

The module clamps should not come into contact with the front glass of cell area to avoid any shadowing effects from the module clamps. Regardless of the orientation chosen, at least 4 clamps must be used on each module. Depending on the local wind and snow loads, additional clamps may be required. The applied torque should be about 8 Nm. Please find detailed mounting information in the below illustration:

3.2 Select suitable mounting rails

- Please observe the safety regulations and installation instructions included with the mounting rail. If necessary please contact the supplier directly for further information.
- The modules must be safely set onto the mounting rail. The whole rail supporting the photovoltaic system must be strong enough to resist potential mechanical pressures caused either by wind or snow, in accordance with local, regional and state safety (and other associated) standards.
- Make sure that the mounting rail will not deform or affect the modules when it expands as a result of thermal expansion.
- The mounting rail must be made of durable, anti-corrosive and UV-resistant materials.

<table>
<thead>
<tr>
<th>Clamp Image</th>
<th>Clamp description</th>
<th>Supplier</th>
<th>Length</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schletter Laminate Profi</td>
<td>Schletter</td>
<td>80mm</td>
<td>+2400Pa/-2400Pa</td>
<td>+5400Pa/-5400Pa</td>
</tr>
<tr>
<td>K2 Grip</td>
<td>K2 Systems</td>
<td>100mm</td>
<td>+2400Pa/-2400Pa</td>
<td>+5400Pa/-5400Pa</td>
</tr>
<tr>
<td>Nissei Clamp</td>
<td>NISSEI METALS</td>
<td>120mm</td>
<td>+2400Pa/-2400Pa</td>
<td>+5400Pa/-5400Pa</td>
</tr>
</tbody>
</table>

Phono Solar recommends the following installation methods. The method of using six mounting clamps is certified by TUV, all the other mounting method are tested by Phono Solar itself. Please select the appropriate installation method depending on the load (see below for more detailed information).

Module dimension 1685mm X 997mm X 6mm
3.4 When installing a module on a pole ensure that the pole and mounting rail can withstand anticipated local winds. The pole must be installed on a hard base.

3.5 Ensure that the installation height is such that the lowest modules will not be covered by accumulated snow or shaded by the surroundings.

3.6 Ensure that there is adequate ventilation under the modules, conforming to local, regional and state standards and regulations.

3.7 A minimum distance of 10cm, between the roof plane and the frame of the module is generally recommended.

3.8 Observe the linear thermal expansion of the module frames. A minimum distance of 1cm between two modules is generally recommended.

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**CLAMP OVERVIEW**

<table>
<thead>
<tr>
<th>Component name</th>
<th>Overview</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle clamp</td>
<td><img src="image" alt="Middle Clamp" /></td>
<td>Connects modules</td>
</tr>
<tr>
<td>Edge clamp</td>
<td><img src="image" alt="Edge Clamp" /></td>
<td>Caps fringe modules</td>
</tr>
</tbody>
</table>

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**CLAMP FITTING METHOD INSTALLATION**

- **Step 1:** Install the bottom half of the clamp. Insert the screw into rail, and fit the bottom half of the clamp snugly perpendicular to the rail as shown below.

- **Step 2:** Install the module. Ensure the module edge is flush against the back edge of the bottom clamp. The clamp must overlap the module edge by at least 14mm but by no more than 16mm.

- **Step 3:** Install the top half of the clamp. Screw the top half of the clamp on the module ensuring the module remains flush against the back edge of the top and bottom piece of each clamp.

- **Step 4:** Tighten the M8 screws, which torque is 16-20 Nm.

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**Warning:** Do not attempt to drill holes in the glass surface of the module. Any such modifications will void the PHONO SOLAR product warranty.
4 ELECTRICAL INSTALLATION

(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)

4.1 Any hardware used must be compatible with the mounting material to avoid galvanic corrosion.

4.2 Only use connectors that are designed for photovoltaic systems and that match PHONO SOLAR modules.

4.3 When working with the connectors only use tools as recommended by the connector manufacturer.

4.4 PHONO SOLAR recommends that the same type of modules are connected together in order to avoid any system power loss.

4.5 The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions.

4.6 Select insulated cables that are able to resist to ultraviolet radiation and extreme weather conditions.

4.7 The rated voltage of the cable chosen must be appropriate to the overall maximum voltage of the system.

4.8 The module frame must be grounded according to local, regional and state safety and electrical standards. Ensure that a recommended connector or equivalent is used for the grounding cable. The grounding cable must be properly fastened to the module frame.

4.9 In order to reduce the risk of potential induced degradation (PID), Phono Solar strongly recommends to use anti-PID solar modules in wet regions (i.e. shores, wetlands), or to use the system negative grounding where the negative polarity of the PV modules array (i.e. negative grounding at the DC bus bar level) is connected to the ground. Failure to comply with this recommendation may reduce the module performance and will invalidate the limited power warranty of the module.

5 MAINTENANCE

In order to ensure optimum module performance, PHONO SOLAR recommends the following:

5.1 If necessary, the glass front of the module can be cleaned with water and a soft sponge or cloth. A mild, non-abrasive detergent can be used to remove more stubborn stains.

5.2 Check the electrical and mechanical connections periodically and make sure they are clean, safe, complete and secure.

5.3 In the event of a problem, consult with a licensed/qualified person.

6 DISCLAIMER OF LIABILITY

Since it is impossible for PHONO SOLAR to control installation, operation, application and maintenance of the photovoltaic system according to this instruction, PHONO SOLAR does not accept responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

PHONO SOLAR will not take any responsibilities for any possible violation of patent rights and third party rights that are related to application of the solar energy system. No permission of patents is given through implication.

The information of this instruction is from knowledge and experiences of PHONO SOLAR, and so it is reliable. However, the instructions and suggestions of this instruction do not make an external or internal of guarantee. PHONO SOLAR reserves the right to revise this instruction, products and all the information about products without prior notification to customers.

7 DISPOSAL OF END OF LIFE PRODUCTS

Phono Solar is a member of PV CYCLE, a European non-profit association managing a collection and recycling scheme for end-of-life solar modules throughout Europe. Please visit the website: http://www.pvcycle.org/ for further information.