

Solarspace Double Glass Photovoltaic Modules Installation Manual

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1.General Information

Thanks for choosing SolarSpace Solar PV modules.

This guide contains information regarding the installation and safe handling of SolarSpace photovoltaic module (hereafter is referred to as "module").

During Modules installation and routine maintenance, operators should follow all safety precautions in this manual and local regulations. If you have any questions, please contact our sales department for further explanation.

Please read this manual carefully before installing and using Modules. Installers should be familiar with the mechanical and electrical requirements of this system. Please keep this manual safe for future maintenance and maintenance or sale or disposal of Modules.

2.Regulations And Regulations

Modules mechanical and electrical installations must comply with all local, regional and national statutory regulations and obtain installation licenses if necessary. These regulations vary depending on the installation location, such as building roof installation, vehicle-mounted applications, etc. Requirements may also vary with the voltage and current nature of the installed system (DC or AC), please contact your local authority for details.

3.Product Identification

Each Module has three labels that provide the following information:

1.Nameplate: it describes the product type, standard rated power, rated current, rated voltage, open circuit voltage, short circuit current, weight, size, certification mark, maximum system voltage and other information under test conditions, and pasted on the back of Modules.

2. Barcode: Each individual Modules has its own serial number. The serial number contains the component's model number, manufacturing time, corresponding serial number (unless specified by the customer), and only a barcode for each Module. It will always stick inside the Modules and is clearly visible from the top of the front of the Modules. The barcode was placed before laminating.

3. Current grade mark: Some orders require Modules to be graded according to rated current and pasted on the side of the long frame together with the bar code of the frame.

4. Safety Precautions

Solarspace Solar PV Modules are designed in accordance with the IEC61215 and IEC61730 standards, and the application grade rating is class A: Modules can be used for systems with dc greater than 50V or 240W, according to IEC61730-1 and IEC61730-2 standards, the quality of Modules meets the safety requirements and the safety level IS II.

4.1 General Safety

- The installation of photovoltaic systems requires professional skills and knowledge. The installation can only be carried out by qualified personnel. The installation personnel must bear all risks that may occur during the installation process, including but not limited to electric shock risks;
- Modules can be installed on the ground or on the roof, and system designers and installers are responsible for the proper design of the supporting structure;
- Photovoltaic power generation system can only use matching equipment, connectors, wiring and support;
- Fall protection must be provided when working at heights. Comply with occupational Safety and Health Act (OSHA) or local safety regulations for fall protection;
- Do not sit, stand, step on, or walk on Modules, including stands;



- Do not soak any part of the Modules in water or continuously hit the Modules with water, except for natural rainfall or periodic Modules cleaning.

4.2 Electrical Safety

- A single Module can generate a DC voltage of more than 30V in direct sunlight. Therefore, contact with the DC is potentially risky. Avoid contact with the DC under any circumstances;
- Modules also generate voltages when no load or external circuit is connected. When operating Modules in the sun, use an insulating tool and wear rubber gloves;
- Modules don't have a switch on or off, so they can only be stopped by moving them out of the light or blocking them with cloth, cardboard, or a completely opaque material, or by placing them front on a smooth, flat surface;

- Do not open the electrical connection or pull out the connector when the circuit is loaded;
- Only work in a dry environment and use dry tools. Do not work in a wet environment without wearing any protective measures;
- Connectors must be kept dry and clean to ensure they are in good working condition. Do not insert other metal objects into the connector or make electrical connections in any other way;
- If Modules glass or other packaging material is damaged, wear a personal protective device to separate Modules from the circuit.

4.3 Operating Safety

- Modules During shipping and storage, do not open the package unless Modules arrives at the installation location;
- To avoid glass breakage, do not apply excessive loads or distort components on Modules;
- Before unpacking Modules, put the packing case in a ventilated, rain - proof and dry place;
- Do not hold the Modules junction box or the lead wire to lift the Modules. Do not drop the Modules or make objects fall on them. Do not place anything heavy or sharp on the Modules;
- Do not disassemble Modules, move any nameplates or attached parts;

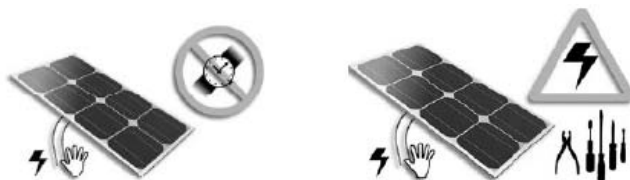


- Do not use mirrors or lenses to focus sunlight on Modules;
- Do not paint or apply any other adhesive on the Modules surface;
- Please do not scratch or hit Modules, which may easily lead to glass burst;
- Modules that are damaged cannot be repaired and may cause electric shock. Do not use Modules that are damaged;
- Do not drill holes in the frame, which may damage the strength of the frame, lead to rust and nullify of the warranty;

- Do not scratch the anodized layer of the stand (except the ground connection on the back of the Modules) as this may cause rust or break the strength of the frame;
- If you want to store the uninstalled Modules outdoors for a period of time, always cover the Modules and ensure that the front glass is downward and placed on a soft plane (the Modules without frames need to be separated by foam to prevent the glass from pressing into the junction box) to prevent water inside the Modules and damage to the connectors.
- Do not repair Modules by yourself.

4.4 Installation Safety

- When connecting Modules, only use the connector of the same model to connect to other devices. Removing the connector will void the warranty;
- Do not touch Modules unnecessarily during installation. Glass surfaces and supports may generate high temperatures, and may be hazardous to burns and electric shocks;
- Touching Modules live parts, such as connectors, whether or not the panel is connected can cause burns, sparks, and a fatal electric shock;
- To prevent deterioration of Modules' insulation, avoid scraping, cutting cables and connectors, or exposing them to the sun for a long time;
- Do not install Modules in rainy, snowy, or windy weather;
- Keep children away from the system when installing Modules;
- Do not wear metal rings, wristwatches, earrings, nose rings, lip rings or other metal substances when installing or repairing the Photovoltaic (pv) system;



- Use only insulation tools that comply with related electrical installation standards;
- Comply with local safety regulations (e.g., for operating power stations) and other system components, including wiring and cables, connectors, charge regulators, inverters, batteries, rechargeable batteries, etc.;



–Normally, a Module may generate more current and voltage than under standard test conditions. Therefore, when calculating the Modules rated voltage, rated current, safety fuses, and control specifications connected to the PV output, multiply the I_{sc} and V_{oc} values marked on the Modules by a factor of 1.25.

4.5 Fire Safety

–According to IEC61730-2 standard, Solarspace dual-glass Modules fire rating is Class A, before installation consult local authorities for installation or building fire safety guidance and requirements;

–The structure of the roof and the way it is installed can affect the fire safety of the building and improper installation can lead to fire hazards;

–When installing the roof, the roof must be covered with a layer of fireproof material using this grade, and ensure adequate ventilation between the backplane and the installation surface;

–To ensure fire rating on the roof, the Modules frame should be at least 10cm away from the roof surface;

–Use Modules accessories such as fuses, circuit breakers, and grounding connectors according to local regulations;

–Do not use Modules in an environment or near a device where flammable gas may be generated.

5. Mechanical Installation

5.1 Selecting the Location

–Install Modules in the right position to receive the maximum light intensity. In the northern hemisphere, it's best to face south, and in the southern hemisphere, it's best to face north;

–Modules should be installed in a position where the sun can fully shine and ensure that it is not blocked at any time;

–Modules must be protected against lightning if installed in an area with frequent lightning activity;

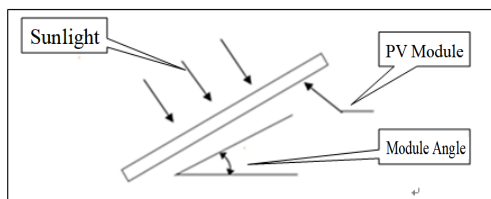
–Modules Limit The operating temperature ranges from -40°C to 85°C . Solarspace recommends Modules be installed in an operating temperature range from -20°C to 45°C , which is the monthly average minimum and maximum temperature of the installation site;

–Don't install Modules where they might be flooded;

–SolarSpace Solar PV Modules pass the IEC61701 salt spray corrosion test, but corrosion may occur where the frame is connected to the bracket, or where the ground is connected. SolarSpace recommends Modules to be installed at least 500m from the coastline. For offshore installation, you need to confirm with SolarSpace and install the Modules after obtaining approval.

5.2Tilt Angle Selection

The tilt Angle of PV Modules refers to the Angle between the Modules' surface and the ground plane. The Modules get maximum output power when facing directly into the sun.



For details on the optimal installation inclination, refer to the standard Solar PV installation guide or consult a reliable solar system installation company.

SolarSpace recommends that Modules be installed at an Angle of no less than 10°, so that when it rains, the dust on the surface is easily taken away by the rain. This reduces the cleaning frequency of Modules, and helps the water flow away from the surface, so as to avoid long-term massive water leaving traces on the glass, which affects the appearance and performance of components.

Serially-connected Modules should be installed in the same orientation and Angle. If the orientation or Angle is different, different modules may receive different amounts of solar radiation, resulting in output power loss. In order to achieve maximum annual power generation, you should choose the optimal orientation and tilt of PV Modules in the installed area to ensure that sunlight can still reach the Modules on the shortest day of the year.

If connected to an independent photovoltaic system, the Modules should be installed at an Angle that maximizes the power output depending on the season and light conditions. If the output of the Modules can be met even with the lowest light intensity during the year, then the selected Angle of the Modules' power output will be sufficient for the whole year. For grid-connected systems, the installation Angle of Modules should be chosen based on the basic principle of maximizing output throughout the year.

5.3 General Requirements

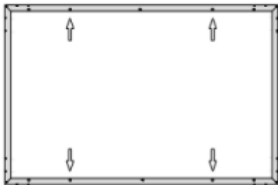
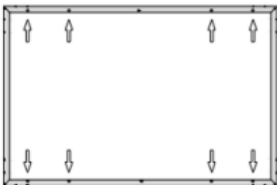
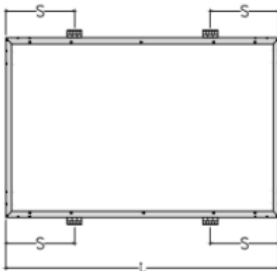
- Modules support structures must be made of durable, rust-resistant and uv resistant materials;
- Ensure that the Modules mount and stand system is robust enough to withstand the intended load conditions, use support structures that have been tested and approved;
- Modules must be firmly placed on the support structure. If using entrainer fixture installation method, please follow the fixture system supplier's instructions, the recommended maximum pressure for each fixture is 20Mpa, to prevent damage to Modules support;
- In areas where there is a lot of snow in winter, choose the height of the support system so that the lowest edge of the Modules will not be covered with snow at any time. Also, make sure the lowest parts of Modules are placed high enough so that plants and trees don't block out the sun;
- For ground-mounted systems, we recommend that the minimum distance between the ground and the bottom of Modules be at least 60cm;
- Before installing Modules on the roof, make sure the roof is properly structured. In addition, any roof on which Modules are to be installed must be sealed to prevent leakage and not allow Modules to overlap or exceed the roof;
- Provide adequate ventilation clearance at the base of Modules according to your local regulations. A minimum of 10cm is usually recommended between the roof plane and the supports of Modules;
- The distance between the two Modules is recommended to be at least 1cm to prevent damage caused by extrusion caused by thermal expansion;
- Avoid side tension and pressure to the frame, avoid the frame off or crushed glass;
- When installing Modules on columns, select columns and Modules support structures that can withstand local wind and snow loads. Ensure that the Modules do not withstand wind and snow loads that exceed the maximum allowable load, and do not withstand thermal expansion force of the supporting structure;
- Make sure that the back of the Modules does not touch any supports or structures that can access the Modules, especially if there is external pressure on the Modules surface;
- Modules can be installed horizontally or vertically. When installing Modules, ensure that the water drain hole in the frame is not blocked.

5.4 Installation Guide

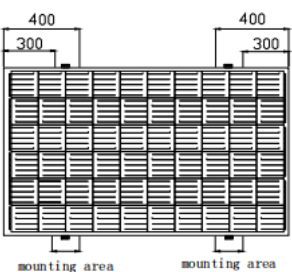
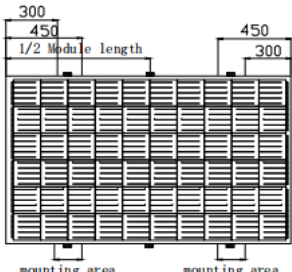
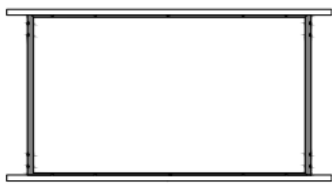
Low/normal load conditions, for most environmental conditions: the Modules can withstand a maximum load of 2400Pa on the front and 2400Pa on the back, and the Modules can withstand a maximum design pressure of 1600Pa on the front and 1600Pa on the back with a safety factor of 1.5.

High load conditions, suitable for harsh environmental conditions (such as storm, snow, etc.) : The Modules can withstand a maximum load of 5400Pa on the front and 2400Pa on the back, the Modules can withstand a maximum design pressure of 3600Pa on the front and 1600Pa on the back, with a safety factor of 1.5.

5.4.1 Framed Module Bolt and Clamp Installation

Installation manual	Test Load: positive2400Pa/negative2400Pa Design Load: positive1600Pa/negative1600Pa		Test Load: positive5400Pa/negative2400Pa Design Load: positive3600Pa/negative1600Pa
Mounting with Bolts	 use 4 mounting holes	Mounting with Bolts	 use 8 mounting holes
	 Allowed assembly with clamp $(1/4L-50) \leq S \leq (1/4L+50)$		 Allowed assembly with clamp $(1/4L-50) \leq S \leq (1/4L+50)$
Assemble on the long side with clamp		Assemble on the long side with clamp	

5.4.2 Frameless Clamp Installation

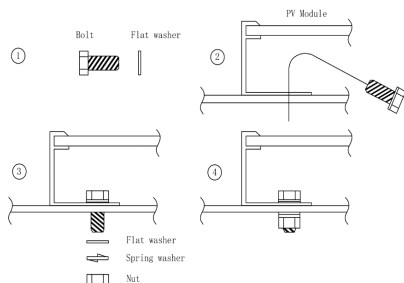
Installation manual	Test Load: positive2400Pa/negative1600Pa Design Load: positive1600Pa/negative1067Pa	Test Load: positive3600Pa/negative2400Pa Design Load: positive2400Pa/negative1600Pa
Frameless double glass long edge clamp installation		
Installation manual	Test Load: positive2400Pa/negative2400Pa Design Load: positive1600Pa/negative1600Pa	
Bifacial double glass long edge clamp installation		

5.5 Installation

5.5.1 Mounting with Holes

Bolt the Modules to the stand through the mounting hole in the rear border of the Modules. Each module has four mounting holes in its border, which are great for attaching Modules to support structures to optimize load tolerance.

To maximize installation life, it is strongly recommended to use corrosion resistant (stainless steel) fasteners, with torque recommended to be maintained at 15-20 N·m when tightening, as shown in the following installation details:

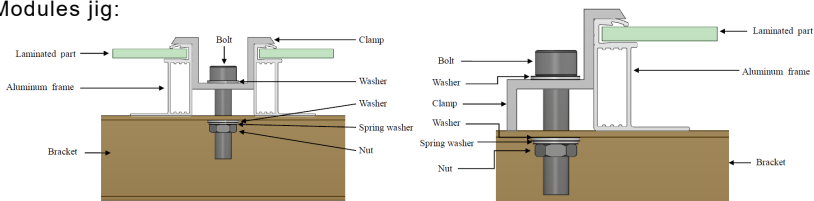


Bolt	Flat washer
Material: stainless steel	Material: stainless steel
Size: M8*20mm	Size: M8
	Thickness: $\geq 1.6\text{mm}$
Spring washer	Nut
Material: stainless steel	Material: stainless steel
Size: M8	Size: M8
Thickness: $\geq 2\text{mm}$	

5.5.2 Mounting with Clamps

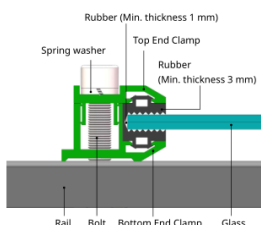
When selecting a fixture installation method, at least four fixtures should be used on each Module. Install two fixtures on each long (vertical) or short (horizontal) side of the Modules. Depending on the local wind and snow conditions determine if additional fixtures are needed to make sure the Modules can handle the load. The minimum recommended length for each fixture is 50mm and the torque applied shall be in accordance with the mechanical design standards of the bolts used by the customer, e.g. M8 ---- 18-24N·m.

The jig must keep at least 7mm but no more than 10mm of overlap with the Modules frame. In any case, the Modules jig should not contact the front glass and should not deform the frame. Please be sure to avoid the shading effect of Modules jig:

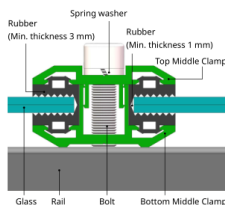


Framed module clamp

END CLAMP:



MIDDLE CLAMP:



Frameless module clamp



6. Electrical Installation

Modules Under standard test conditions, the nominal electrical performance parameters of the nameplate deviate from the actual value by $\pm 3\%$. (Irradiance 1000 W/m^2 , AM1.5 spectrum, cell temperature 25°C (77°F)).

- It is not recommended to use Modules configured differently on the same system;
- Any mounting accessories used must be compatible with each other in materials to avoid electrochemical corrosion. Failure due to corrosion will result in void warranty;
- Excess cables must be organized or adequately secured, for example, using non-metallic binding to secure them to the bracket, Modules cables, connectors and junction boxes should not be exposed to water, rain or snow for long periods of time, or soaked in water (IP65/67/68);
- For applications requiring high operating voltage, multiple components can be connected in series to form a component string; System voltage is equal to the sum of the voltages of each component;
- For applications requiring high operating current, multiple components can be connected in series and parallel; System current is equal to the sum of the current of each component string;
- Modules' maximum system voltage is 600V or 1000V or 1500V according to the standard;
- The maximum number of Modules connected in series depends on the system design, the type of inverter used, and environmental conditions;
- Based on Modules' maximum series fuse rating and local electrical installation specifications, if Modules are in parallel, a suitable series fuse should be fitted. There is no special limit to the number of Modules that can be connected in parallel. The number of Modules is determined by system design parameters such as current or power output;
- To prevent overheating of cables and connectors, select cables and connectors suitable for the maximum short-circuit current of the system. Recommended cables are pv cables with a cross section of at least 4mm^2 ;
- Note: Do not let the cable under excessive pressure, any damage caused by cable connection is not covered by Solarspace quality assurance;
- Please refer to local regulations to determine the wiring size, type and temperature of the system;



–Solarspace Solar Modules are supplied with connectors for electrical connections to the system. Solarspace strongly recommends using genuine connectors of the models specified in the Solarspace product data sheet;

–To ensure a reliable electrical connection and prevent possible entry of moisture, when two connectors are interfacing, they must be locked until a "click" is heard;

–Long-term exposure to moisture may result in poor connector connectivity, resulting in leakage and poor conductivity, which will nullify the warranty. Solarspace recommends proper management of connectors/cables/wiring to prevent moisture from entering. Depending on the severity of moisture, Solarspace recommends checking your installation system periodically to ensure that Modules are performing well;

–The direct current generated by photovoltaic systems can be converted into alternating current and used in the public grid. As policies for connecting renewable energy systems to the grid vary from region to region, always consult a qualified system designer or integrator for advice. Installation permits and inspection and approval by local authorities are usually required;

–Solarspace recommends using lightning protection methods that meet local requirements and regulations.

7. Grounding

Modules design, the use of anodized corrosion resistant aluminum alloy frame as a rigid support, in order to use safety, to avoid the Modules by lightning and static damage, the Modules frame must be grounded, grounding device must be fully in contact with the aluminum alloy, through the oxide film on the surface of the frame.

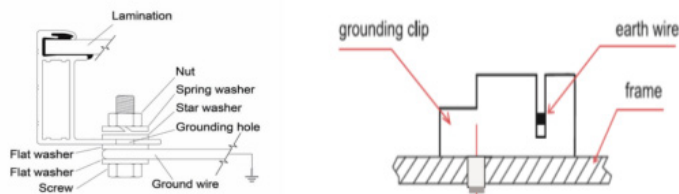
The border is pre-drilled and marked with a grounding mark. These holes are for grounding only, not for installing Modules.

Solarspace recommends always referring to local and national codes and requirements for pv module grounding. Solarspace recommends negative grounding if local agencies allow it.

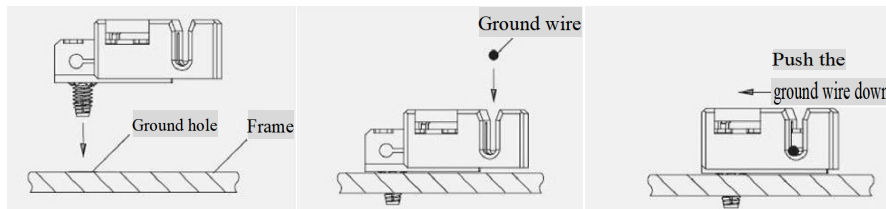
The ground conductor or ground wire may be copper, copper alloy, or any other material used as an electric conductor that meets the requirements of the corresponding National Electrical Code. The ground conductor must be connected to the earth by a suitable ground electrode.

Solarspace recommends using the following grounding parts:

1. Use the ground hole to ground the ground cable, as shown in the following figure. Use M8 bolts and washers to connect the ground cable to the ground hole reserved in the frame to enable the ground cable. Tighten the nut with a torque of 3-7 N·m. Nuts and washers are made of stainless steel. It is recommended that exposed copper wires of 4-14 mm² (AWG6-12) be used for ground cables.



2. Ground using a grounding clamp, as shown below, containing a sliding contact, base and turning tapping screw or 8-32 bolt and hex nut. The grounding clip can hold bare copper wire in the range of 10-12 AWG.



3. Other third party grounding devices, Solarspace Solar PV Modules can be grounded using third party grounding devices, but their grounding must be reliable and proven, the grounding devices are operated according to the manufacturer's requirements.

8. Maintenance And Care

Modules need to be checked and maintained regularly, especially during warranty. To ensure the Modules are performing at their best, Solarspace recommends the following maintenance measures: If necessary, clean the Modules' glass surfaces with a soft sponge or cloth dipped in water.

8.1 Visual Inspection

Please check the Modules carefully for any appearance defects, focusing on the following points:



- Modules using antireflection film technology, if there is a color difference between components observed at different angles, it is a normal phenomenon;
- Modules Whether the glass is broken;
- Is there a sharp object touching the Modules surface;
- Modules Whether blocked by obstacles and foreign objects;
- Whether there is corrosion near the grid line of the battery cells, which is caused by water vapor penetrating into the Modules due to the damage of the Modules surface packaging material during installation or transportation;
- Check for loose or damaged screws between Modules and support, and adjust or repair them in time.

8.2Cleaning

- If necessary, clean the Modules' glass surfaces with a soft sponge or cloth soaked in water. Under no circumstances should you use rough-faced materials for Modules cleaning;
- Use a mild, non-abrasive cleaning agent to remove the stubborn scale;
- Do not use chemicals to clean Modules, which may affect Modules maintenance and power output;
- To reduce potential electric shocks or burns, Solarspace recommends cleaning Modules in the early morning or late afternoon when the light is low and Modules are cool, especially in warmer areas;
- Do not attempt to clean Modules with features such as broken glass or bare wires, as there is a risk of electric shock.

8.3Inspection of Connector and Cable

It is recommended to perform the following preventive maintenance every 6 months:

- Check the sealant of the junction box to ensure no cracks or gaps;
- Check the tightness of the connector and cable connection is firm, check the Modules are well grounded;
- If there is any doubt, check it by qualified personnel and observe the maintenance instructions for all components used in the system (such as supports, charging rectifiers, inverters, and batteries).



9.Disclaimer Of Liability

Solarspace shall not be liable for any loss, damage or expense incurred in connection with the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) products that are beyond Solarspace's control.

Solarspace is not liable for any infringement of third party patents or other rights that may result from the use of photovoltaic (PV) products. Customer does not obtain any license, express or implied, to use Solarspace's products or any patent rights.

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