



SolarSpace Double Glass Photovoltaic Modules Installation Manual



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1. Introduction

Thanks for choosing photovoltaic modules from SolarSpace Technology Co., Ltd.

This manual contains the information regarding the installation and safe handling of photovoltaic modules (hereafter is referred to as “module”) from SolarSpace Technology Co., Ltd. (hereafter is referred to as “SolarSpace”).

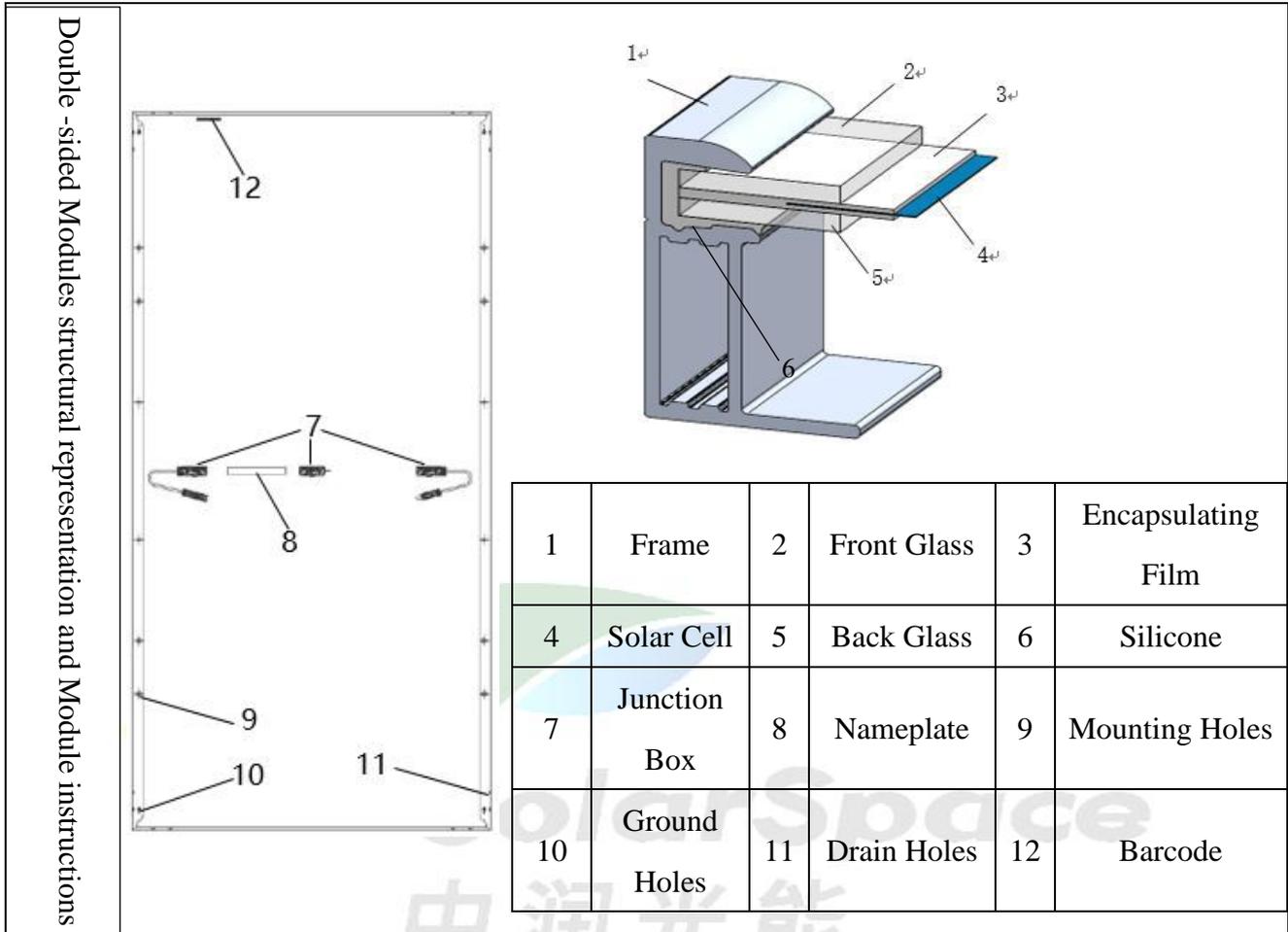
During modules installation and routine maintenance, operators should follow all safety precautions in this manual and local regulations. If you have any questions, please contact our sales department for further explanation.

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. Laws 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. General Information

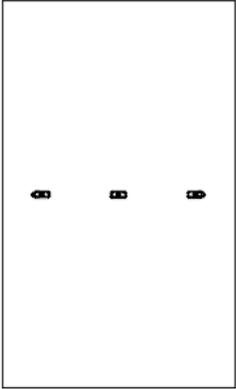
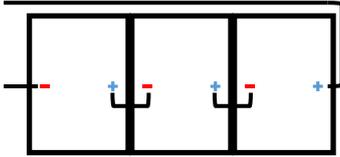
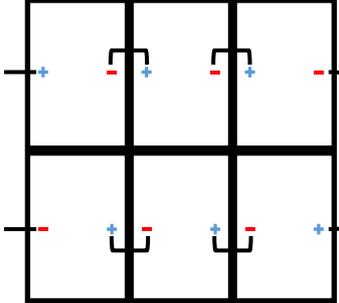
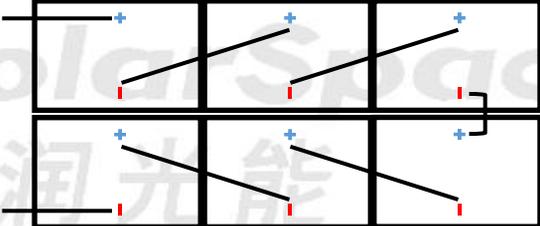


3.1 Modules Identification

Each module has three labels that provide the following information:

1. Label 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 the standard test conditions, and pasted on the back of modules.
2. Label 2-Barcode: Each module has a unique serial number that is printed on a barcode, placed into the module before laminating, and cannot be torn off after laminating. In addition, an identical serial number can be found on the back of the module.
3. Label 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. Module front description: The side without the nameplate design is the front side.

3.2 Junction Box Style and Wiring Method

Junction Box Location Icon	Recommended Wiring Method (Common arrangement)
	<p style="text-align: center;">Vertical Installation: Standard Cable length</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Note: An extension cord is required at the rotor head of the double row module and at the end of the single row.</p>
	<p>Horizontal: 54/60 The length of a single line shall be 1.2m, 72 The length of a single line should be 1.4m.</p> 

4. Safety Guideline

SolarSpace PV modules are designed in accordance with the international IEC 61215 and IEC 61730 standards, and the application grade rating is class A: modules can be used for systems with dc greater than 50V or 240W, according to IEC 61730-1 and IEC 61730-2 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 install or handle modules in adverse conditions, including but not limited to strong winds or gusts on wet or sandy roofs.

★ 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 Performance 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.

★ 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 Operation Safety

★ Modules during shipping and storage, do not open the package unless modules arrive at the installation location.

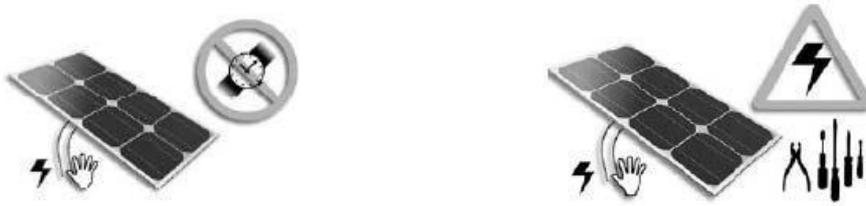
- ☆ To avoid glass breakage, do not apply excessive load or twist modules on the modules.
- ☆ Before unpacking modules, put the packing case in a ventilated, rain - proof and dry place;
- ☆ Do not hold the modules junction box or the lead wire to lift the modules. Do not drop the modules or make objects fall on them. Do not place anything heavy or sharp on the modules.
- ☆ Do not walk or stand on the module.
- ☆ Do not disassemble modules, move any nameplates or attached parts.
- ☆ It is strictly forbidden to use mirrors or lenses to focus sunlight and other artificial light-gathering behaviors to shine on the modules.



- ☆ Do not paint or apply any other adhesive on the modules surface.
- ☆ Do not scratch or hit modules, which may cause damage to the cell and glass burst.
- ☆ Modules that are damaged cannot be repaired and may cause electric shock. Do not use modules that are damaged, such as the damaged glass or backplane.
- ☆ Do not drill holes in the frame. This will reduce the load resistance of the frame and cause corrosion of the frame, which will void the limited warranty of the module.
- ☆ Do not scratch the anodized layer of the frame (except the ground connection on the back of the modules) as this may cause rust or break the strength of the frame.
- ☆ 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 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 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 modules, including wiring and cables, connectors, charge regulators, inverters, batteries, rechargeable batteries, etc.

☆ Under normal circumstances, the current and voltage values generated by the module product may be higher than those obtained under standard test conditions of the module; Therefore, when determining the accessories of the photovoltaic power generation system, such as the rated voltage wire capacity fuse capacity and module power output are associated with the parameters, the corresponding short circuit current and open circuit voltage should be amplified 1.25 times before application.

4.5 Fire Safety

☆ 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 the same grade with the module, 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.

☆ SolarSpace recommends modules be installed in an operating temperature range from -40°C to 45°C, which is the monthly average minimum and maximum temperature of the installation site. The limited operating ambient temperature of modules ranges from -40°C to 85°C.

☆ Don't install modules where they might be flooded. The humidity in the working environment of the module is preferably below 85% RH.

☆ Do not install modules in places where combustible gases are likely to be generated or gathered.

☆ Do not install modules in hail, snow, sand, dust, air pollution, soot and other excessive environment.

☆ Do not install modules where there are strong corrosive substances such as salt, salt spray, saltwater, active chemical vapors, acid rain, or anything else that will corrode modules, affect their safety or performance.

☆ Ensure that the modules are installed with wind or snow pressure that does not exceed the maximum allowable load.

☆ In severe environment such as heavy snow, extreme cold, strong wind or near water, island or desert close to salt fog, please use appropriate protection measures to ensure the reliable and safe installation of modules.

☆ SolarSpace PV modules pass the IEC 61701 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.

☆ The altitude for modules installation is $\leq 2000\text{m}$.

5.2 Selection of Tilt Angles

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 modules.

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 Regular 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 clamp installation method, please follow the clamp system supplier's instructions, the recommended maximum pressure for each clamp is 20MPa, to prevent damage to module frame.
- ☆ 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 module plane.
- ☆ 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

1. 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.

2. 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.

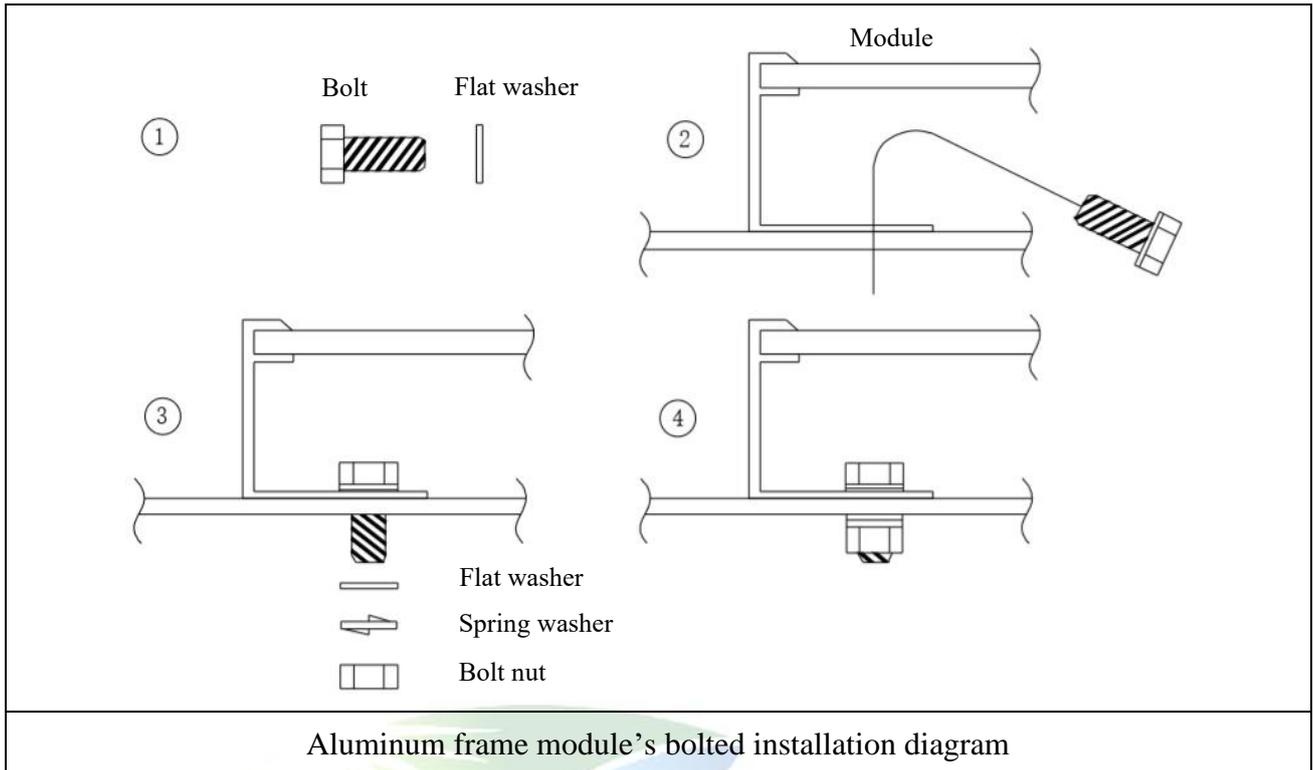
5.5 Installation Method

5.5.1 Bolted Installation

There are mounting holes on the back bezel of the module for connection to the bracket system, including 14×9mm and 10×7mm mounting holes. By passing through the mounting hole on the frame on the back of the module, use the bolt to secure the module to the bracket. With 4 mounting holes on the border of each module, these mounting holes are good enough to anchor the module to the support structure to optimize its load tolerance. Generally, the M8 bolt set is used for the 14×9mm mounting hole, and the M6 bolt set is used for the 10×7mm mounting hole, please see the table below.

To maximize the installation life, using corrosion-resistant (stainless steel) clamps is highly recommended. The torque is recommended to be held at 16-20 Nm for M8 bolts and 9-12Nm for M6 bolts.

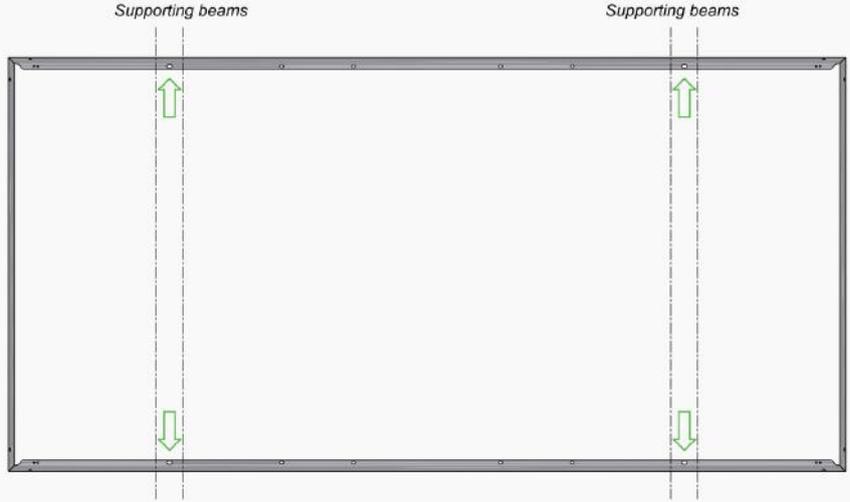
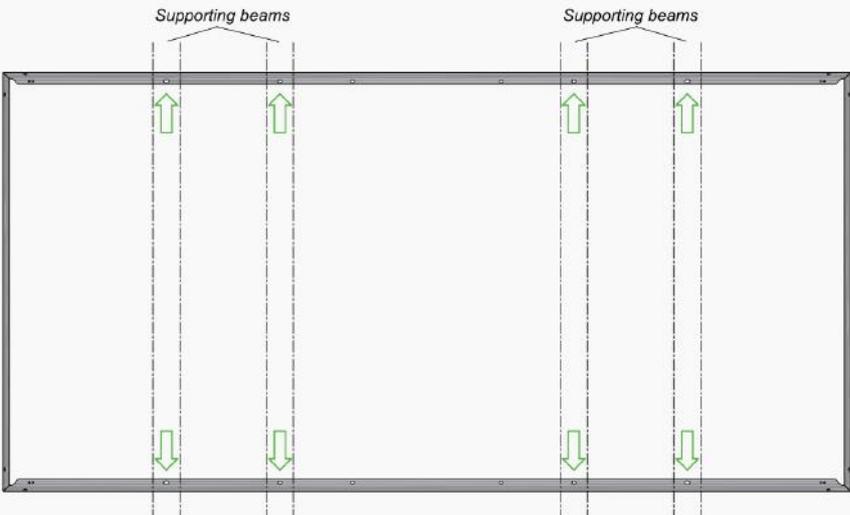
Installation details are shown in the figure below:



The recommended bolt sets are as follows:

Install the fasteners	M8 bolt set	M6 bolt set	Notes
Bolt	M8*20mm	M6*20mm	The material is stainless steel, or can be selected according to the local environment, it is recommended to use corrosion resistant material.
Flat washer	2*M8, thickness: $\geq 1.6\text{mm}$	2*M6, thickness: $\geq 1.5\text{mm}$	
Spring washer	8mm, thickness: $\geq 2.0\text{mm}$	6mm, thickness: $\geq 2.0\text{mm}$	
Bolt nut	M8	M6	
Torque range (N·m)	16-20	9-12	

The bolted installation method is as follows:

Bolted Installation	<p>Method ①: Long-side vertical outer-four-hole bolted installation</p>	
	<p>Method ②: Long-side vertical outer-eight-hole bolted installation</p>	
	<p>Method ③: Long-side parallel outer-four-hole bolted installation</p>	

Installation methods and corresponding qualified loads are recorded as follows:

Module type	Frame height(mm)	Method ①: Long-side vertical	Method ②: Long-side vertical	Method ③: Long-side parallel

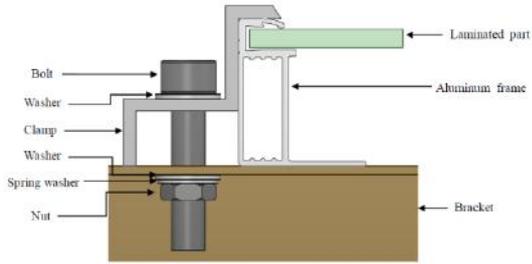
		outer-four-hole bolted installation	outer-eight-hole bolted installation	outer-four-hole bolted installation
		Test load: front/back(Pa)	Test load: front/back(Pa)	Test load: front/back(Pa)
SS6-72HD	B30	+5400/-2400	+5400/-2400	-
	B35	+5400/-2400	+5400/-2400	-
SS8-54HD	B30	+5400/-2400	+5400/-2400	+3600/-1600
SS8-72HD	B30	+5400/-2400	+5400/-2400	+3600/-1600
	B35	+5400/-2400	+5400/-2400	-
SS9-66HD	B30	+5400/-2400	+5400/-2400	-
	B33	+5400/-2400	+5400/-2400	-
	B35	+5400/-2400	+5400/-2400	-
SSA-48HD	B30	+5400/-2400	+5400/-2400	-
SSA-66HD	B30	+5400/-2400	+5400/-2400	-

5.5.2 Clamp Installation

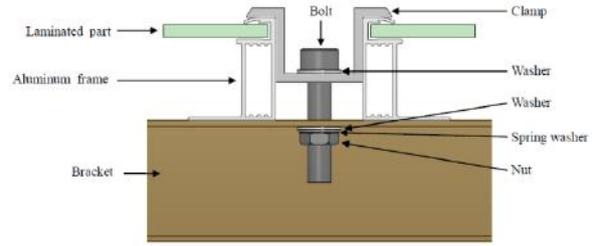
When selecting the clamp installation method, at least four clamps must be used on each module, and the clamps need to be arranged symmetrically. Depending on the local wind and snow conditions, determine whether additional clamps are required to ensure that the modules can withstand the load. The size of each clamp is be: length (L)≥50mm, thickness (t)≥4mm, (Material use is recommended 6005-T6, Rp0.2≥225MPa, Rm≥265MPa). The torque applied shall be determined according to the mechanical design standards of the bolts used by the customer, for instance: M8 — 18-24N·m (Consult the installer or support supplier for specific torque values).

The clamp must overlap with plane A of the module frame by 8mm-12mm (The overlap range of method ⑨: short-side four-corner clamps installation should be ≥ 10mm). In any case, the module clamp does not contact with the glass surface on the front side, and shall not deform the frame. Be sure to avoid the shading effect of the module clamp. And the clamp does not exceed the edge of the module. The overlap width of the support cross beam of the supporting beams and the module frame should not be less than 20mm.

The installation details are shown below:

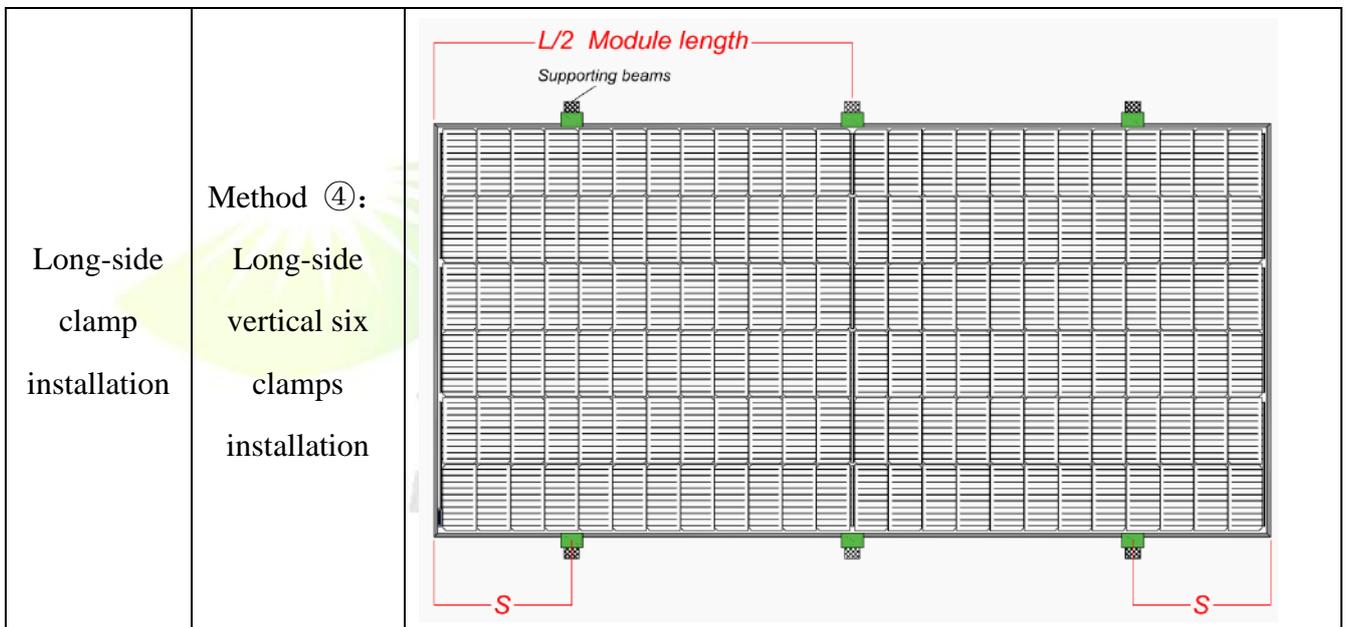


Side clamp

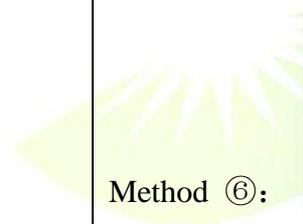


Middle clamp

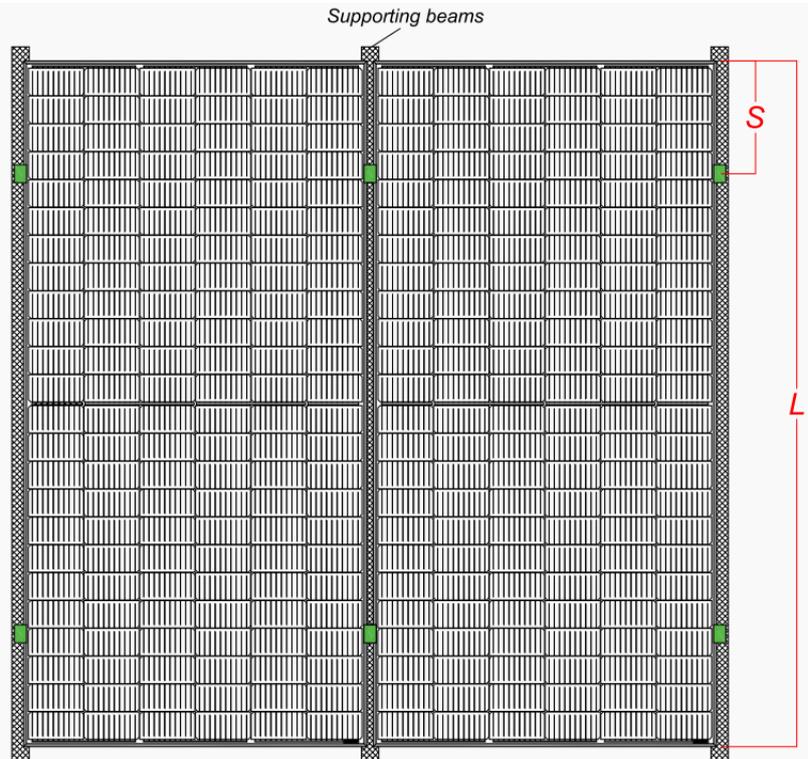
The clamp installation method is as follows:

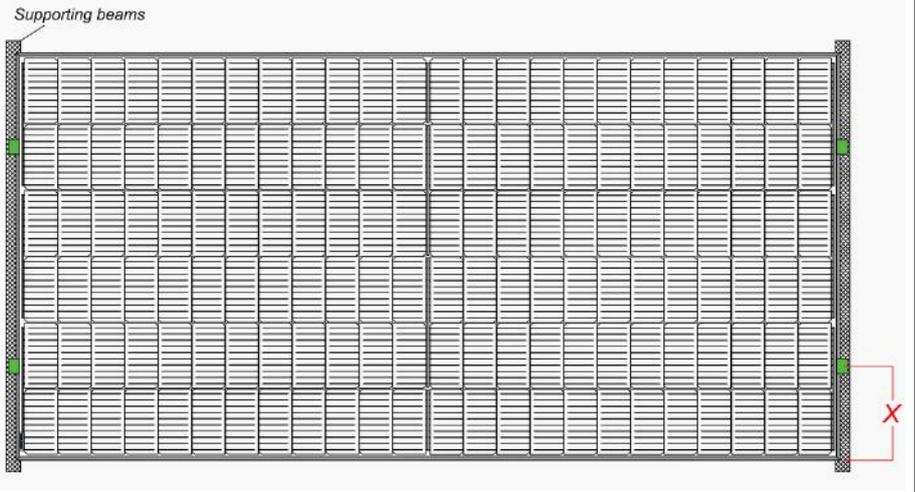
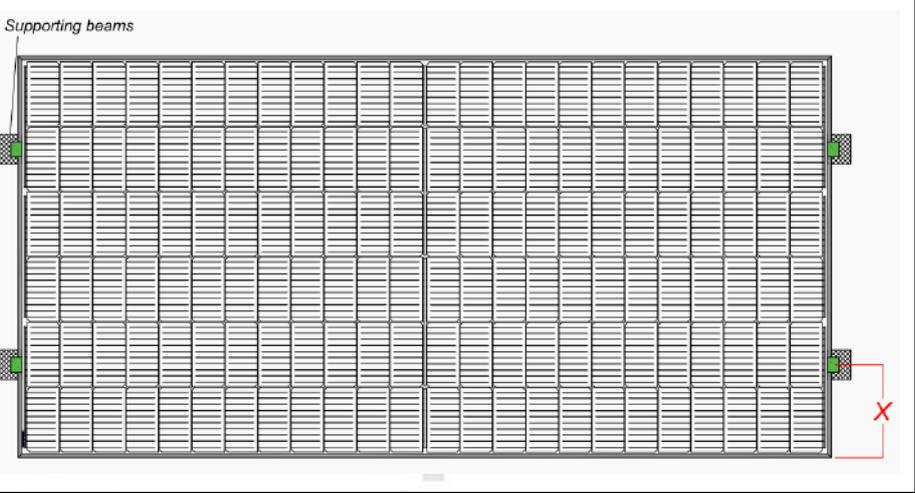
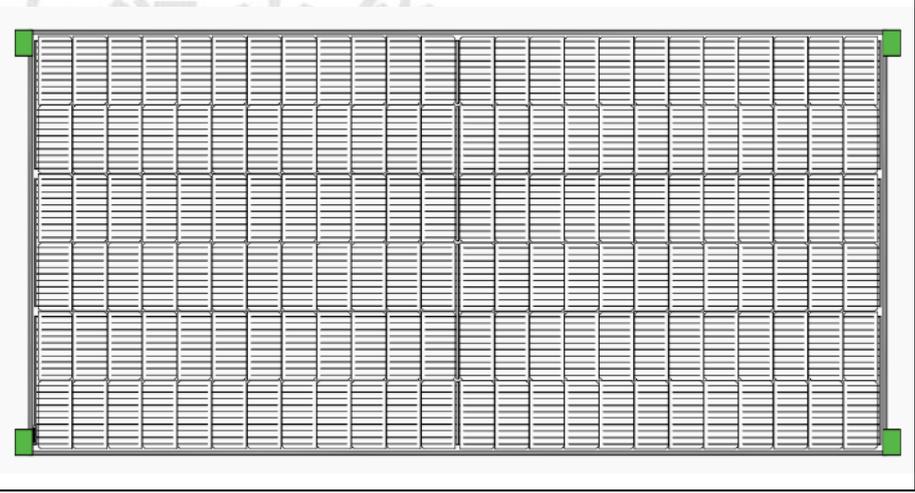


Method ⑤:
Long-side
vertical four
clamps
installation

Method ⑥:
Long-side
supporting
four clamps
installation



Short-side clamp installation	Method ⑦: Short-side supporting four clamps installation	
	Method ⑧: Short-side vertical four clamps installation	
	Method ⑨: Short-side four-corner clamps installation	

Long-side clamp installation methods and corresponding qualified loads are recorded as follows:

Module type	Frame height (mm)	Method ④: Long-side vertical six clamps installation	Method ⑤: Long-side vertical four clamps installation	Method ⑥: Long-side vertical four clamps installation

		Location S(mm)	Test load: front/back(Pa)	Location S(mm)	Test load: front/back(Pa)	Location S(mm)	Test load: front/back(Pa)
SS6- 72HD	B30	L/2、 350≤S≤450	+5400/-2400	S=400±50	+5400/-2400	-	-
	B35	L/2、 350≤S≤450	+5400/-2400	S=400±50	+5400/-2400	-	-
SS8- 54HD	B30	L/2、 350≤S≤450	+5400/-2400	S=400±50	+5400/-2400	S=400±50	+5400/-2400
SS8- 72HD	B30	L/2、 350≤S≤450	+5400/-2400	S=450±50	+5400/-2400	S=400±50	+3600/-1600
	B35	L/2、 350≤S≤450	+5400/-2400	S=450±50	+5400/-2400	-	-
SS9- 66HD	B30	L/2、 350≤S≤450	+5400/-2400	S=500±50	+5400/-2400	-	-
	B33	L/2、 350≤S≤450	+5400/-2400	S=500±50	+5400/-2400	-	-
	B35	L/2、 350≤S≤450	+5400/-2400	S=500±50	+5400/-2400	-	-
SSA- 48HD	B30	L/2、 350≤S≤450	+5400/-2400	S=400±50	+5400/-2400	S=400±50	+3600/-1600
SSA- 66HD	B30	L/2、 350≤S≤450	+5400/-2400	S=500±50	+5400/-2400	-	-

Short-side clamp installation methods and corresponding qualified loads are recorded as follows:

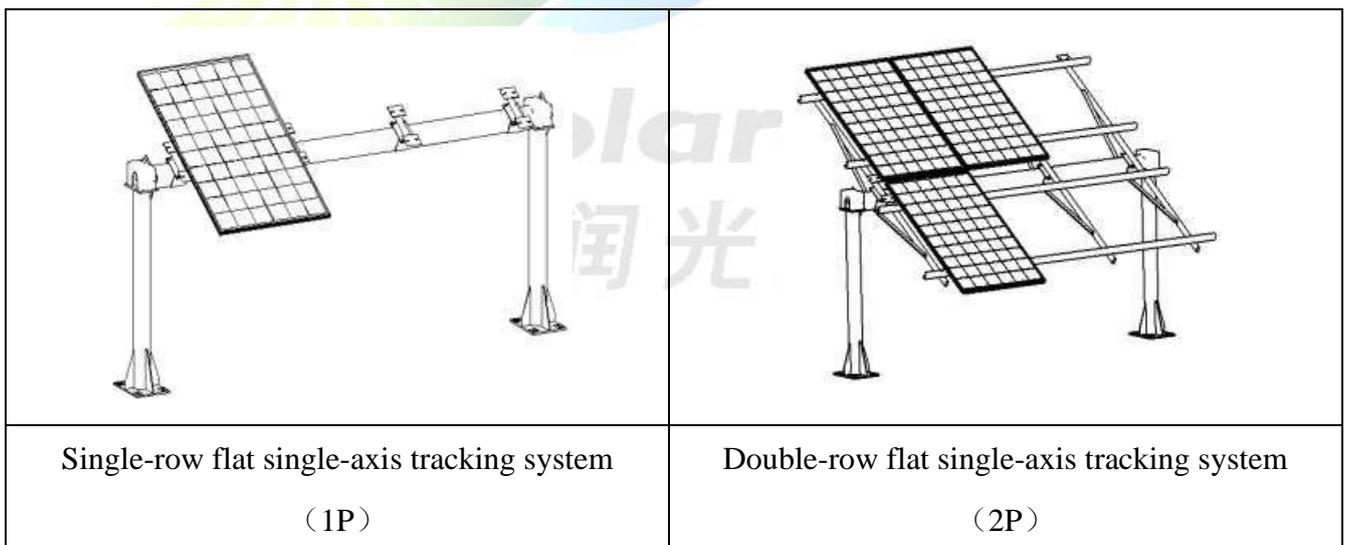
Module type	Frame height (mm)	Method ⑦: Short-side supporting four clamps installation		Method ⑧: Short-side vertical four clamps installation		Method ⑨: Short-side four- corner clamps installation
		Location	Test load:	Location	Test load:	Test load:

		X(mm)	front/back(Pa)	X(mm)	front/back(Pa)	front/back(Pa)
SS8-54HD	B30	$X=250 \pm 50$	+1600/-1600	-	-	+1600/-1600
SSA-48HD	B30	$X=250 \pm 50$	+2400/-2400	-	-	-

5.5.3 Tracking Bracket Installation

The tracking bracket of photovoltaic modules is a bracket system that can dynamically adjust the Angle of the module according to the position of the sun, compared with the fixed bracket, it can significantly improve the power generation efficiency (usually improved by 10%-30%).

At present, SolarSpace uses single-axis tracking photovoltaic brackets, mainly single-row flat single-axis tracking system (1P) and double-row flat single-axis tracking system (2P) two bracket models.

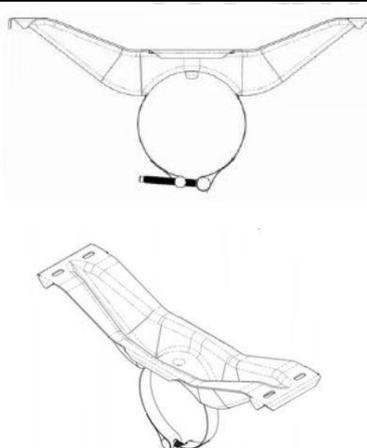
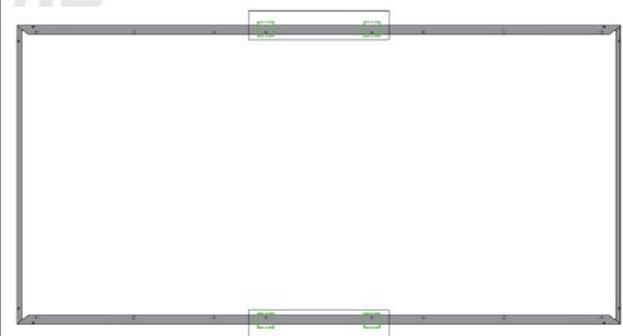


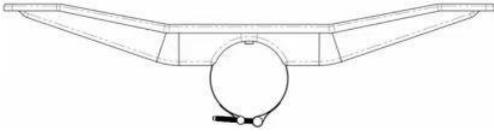
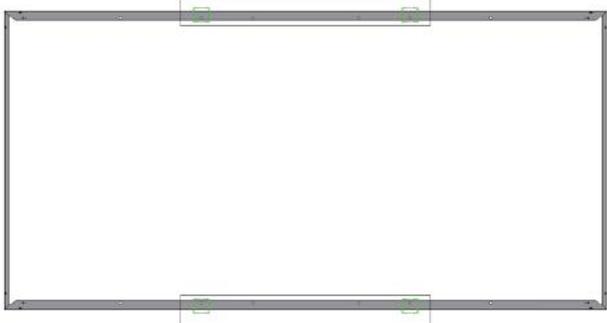
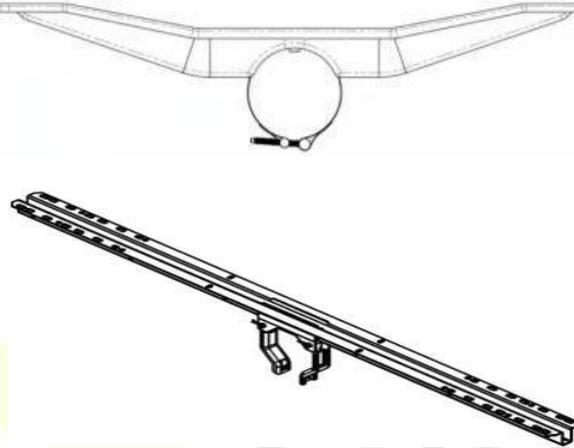
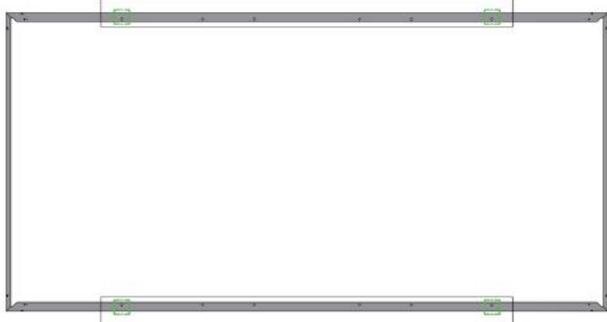
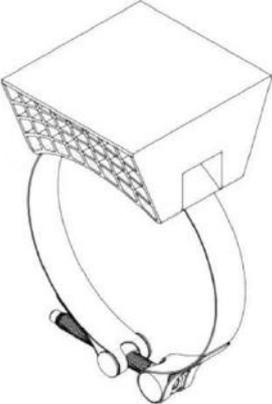
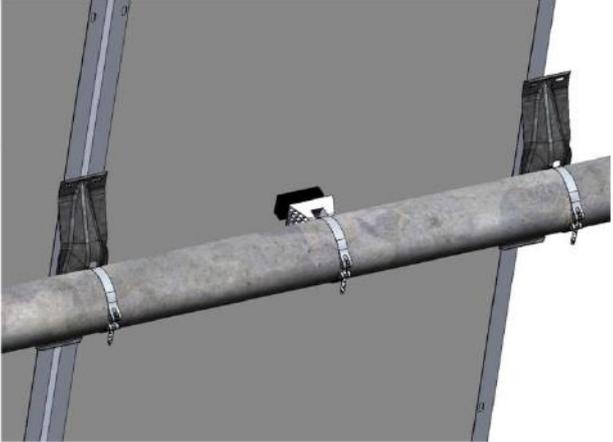
SolarSpace double-glass modules choose the following five manufacturers' tracking brackets nowadays. The choice of design accessories for the tracking bracket system. The installation of modules needs to be completed by a professional system installer. You can refer to the mechanical load tracking bracket described in the maximum design load. In the calculation of the maximum test load, need to take into account 1.5 times the safety factor, greater than the design load scheme please consult the support supplier.

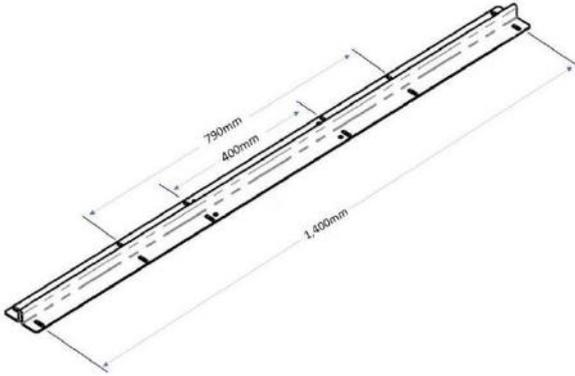
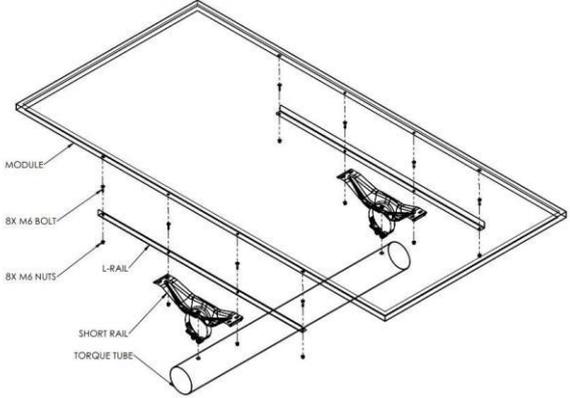
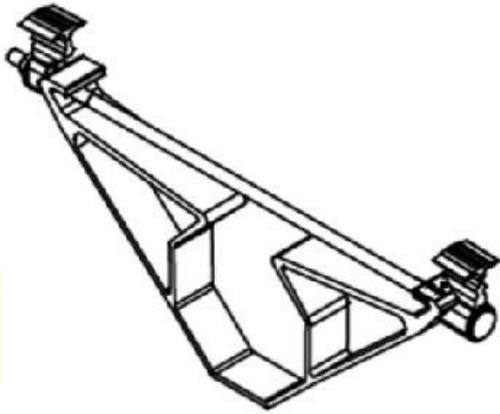
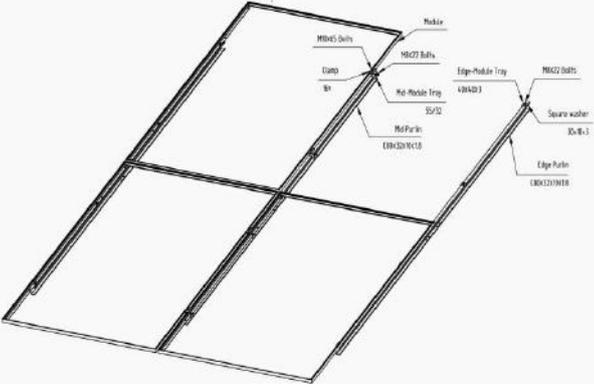
Tracker Company	Tracker Product Brand	Tracker Type	Module Type	Frame Thickness (mm)	Test Schedule	
					Tracker Model	Test Load (/Pa)
FTC Solar	Voyager/ Voyager +	2P	SS6-72HD-M	35	FTC 2P Tracker 2.5m rail 4 PowAR Cinch Clips	+1500/-1000
Nextracker	NX Horizon	1P	SS6-72HD-M	30/35	400mm rail	+2400/-2400
					400mm rail + 1300mm Supplemental Rail	+3000/-3000
			SS8-72HD-N	30/35	400mm rail	+2400/-1950
					790mm rail	+3000/-2550
					400mm rail + 1400mm Supplemental Rail	+3100/-3000
					790mm rail + 1400mm Supplemental Rail	+3600/-3000
			SSA-66HD-N	30	400mm rail	+2100/-2100
					790mm rail	+2400/-2400
					400mm rail + 1400mm Supplemental Rail	+2400/-2400
					790mm rail + 1400mm Supplemental Rail	+3000/-3000
			SS9-66HD-N	33/35	400mm rail	+2100/-2100
					790mm rail	+2400/-1600
					400mm rail + 1400mm Supplemental Rail	+2400/-2400
					790mm rail + 1400mm Supplemental Rail	+2700/-2600
Array Technologies	DuraTrack HZ v3	1P	SS8-72HD-N	30/35	300mm hi-rise clamp (21050)	+1000/-1000
					400mm hi-rise clamp (21048)	+1500/-1500
					400mm thru-bolt 16 gauge (21063)	+1800/-1800
					400mm thru-bolt 14 gauge (21011)	+1800/-1800
					1400mm thru-bolt (20916)	+3200/-3200
					1400mm thru-bolt (21029-200)	+3200/-3200
			SSA-66HD-N	30/35	1400mm thru-bolt purlin, (21029-200)	+3194/-3069

					1400mm thru-bolt purlin (21029-210)	+3194/-3069
			SS9-66HD-N	33/35	400mm hi-rise clamp (21048)	+1700/-1700
					400mm thru-bolt 16 gauge (21063)	+1800/-1800
					400mm thru-bolt 14 gauge (21011)	+1800/-1800
					1400mm thru-bolt (20916)	+2200/-2200
					1400mm thru-bolt (21029-200)	+2200/-2200
Gamechange Solar	GENIUS TRACKER™	1P	SS8-72HD-N	30	470mm SpeedClamp	+1200/-1200
					600mm SpeedClamp	+1450/-1600
					870mm SpeedClamp	+1850/-2400
		SSA-66HD-N	30	470mm SpeedClamp	+1200/-1200	
				600mm SpeedClamp	+1450/-1600	
				870mm SpeedClamp	+1850/-2400	
MOKUN Renewable	MK-PENDULUM	1P	SS8-72HD-N	30	400mm rail + 400mm clamp	+3600/-3600
		2P			1400mm rail + 1400mm clamp	+3900/-3900
		1P	SSA-66HD-N	30	400mm rail + 400mm clamp	+3600/-3600
		2P			1400mm rail + 1400mm clamp	+3900/-3900

The tracking bracket installation also has two types of bolted installation and clamp installation, and the two installation methods will also work on the module when necessary.

Tracking bracket model	Diagram	Location
400mm rail (1P)		 <p>Install bolts in the 400mm mounting holes</p>

<p>790mm rail (1P)</p>		 <p>Install bolts in the 790mm mounting holes</p>
<p>1400mm rail & thru-bolt purlin (1P)</p>		 <p>Install bolts or clamps or both in the 1400mm mounting holes</p>
<p>400mm bumper (1P)</p>		

<p>1400mm supplemental rail (1P)</p>		
<p>Hi-rise clamp (1P)</p>		
<p>Long rail bolt and clamp (2P)</p>		

6. Electrical Installation

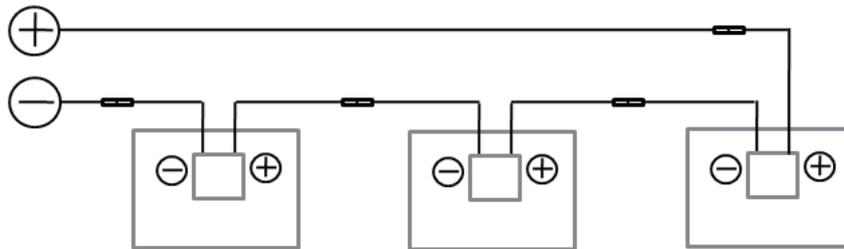
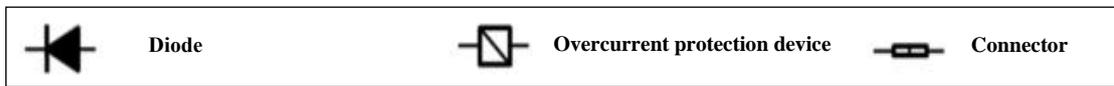
Direct current generated by the photovoltaic system can be converted into alternating current, and it is used in the public power grid. With every regional agency's varying policies on connecting renewable energy systems to the grid, please always consult a qualified system designer or integrator

for your advice. Installation permits and local agency inspections and approval are often required.

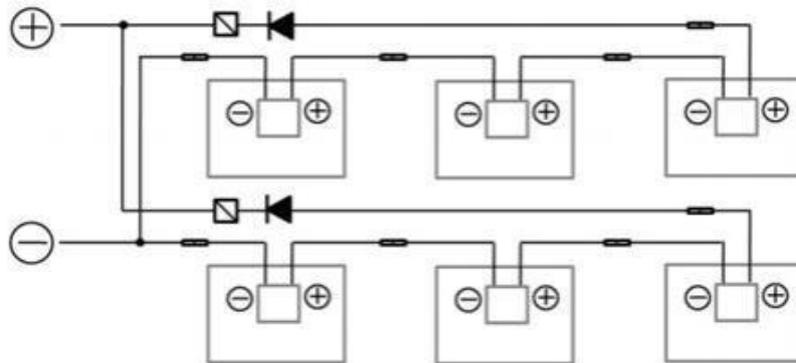
6.1 Electrical Performance

There is a $\pm 3\%$ deviation between the values of the nominal electrical performance parameters such as I_{sc} , V_{oc} and P_{max} on the nameplate and the actual values under standard test conditions. Module's standard test conditions (Definition of STC) : irradiance 1000 W/m^2 、cell temperature 25°C 、air mass AM1.5.

- ☆ Modules with different electrical performance models cannot be connected together.
- ☆ According to the standard, the maximum system voltage of the module is 1000V or 1500V.



Electrical diagram of the series line



Electrical diagram of series and parallel lines

☆ For applications requiring a high operating voltage, multiple modules can be connected in series to form a module string. The system voltage is equivalent to the sum of the voltage of each module.

☆ For applications that require a high operating current, multiple modules or module strings can be connected in parallel. The system current is equivalent to the sum of the current of each module or module string.

☆ The maximum number of single-string modules must be calculated according to the requirements of the relevant regulations. The open circuit voltage at the local expected minimum temperature shall not exceed the maximum system voltage specified by the module (SolarSpace The maximum module system voltage is DC1000V / DC1500V. The actual system voltage is designed according to the selected module model and the inverter) and the required values of other DC current modules.

☆ The open circuit voltage Voc correction factor can be calculated according to the following formula: $C_{Voc}=1-\beta_{Voc}\times(25-T)$. T is the minimum ambient temperature expected at the system installation position. β (% /°C) is the temperature coefficient of the selected module Voc (Refer to the corresponding module parameter table).

☆ If there is a possible reverse current exceeding the maximum module fuse current passing through the module, the same specification of the overcurrent protection device must be used to protect the modules. If the number of parallel ≥ 2 strings, there must be an overcurrent protection device on each string of modules.

☆ SolarSpace recommend to adopt the lightning protection laws in accordance with the local requirements and regulations.

6.2 Cables and Wirings

☆ To prevent overheating of cables and connectors, select cables and connectors suitable for the maximum short-circuit current of the system. The recommended cables are PV cables with a cross section of at least 4mm².

	Test standard	Cable specifications	Rated temperature
Minimum field wiring rating	TUV 2 PFG 1169	4mm ²	-40°C~+90°C

☆ Please refer to the local regulations to determine the wiring size, type and temperature of the system.

☆ When the cable is fixed to the bracket, mechanical damage to cables or modules should be avoided. Do not press the cable hard. The cable shall be fixed to the support by specially designed aging wires and wire cards. Although the cable is aging-resistant and waterproof, it should also be protected from direct sunlight and rain.

☆ When the junction box cable is fixed to the shelf system, the minimum bending radius is 60mm.

☆ Attention: do not place excessive pressure on the cable. Any damage caused by the cable connection is not covered with the quality assurance range of SolarSpace.

☆ Do not shorten the positive and negative electrode cables.

6.3 Connectors

☆ Connectors given to customers or purchased by customers must be of the same brand and the same specifications as the junction box connectors used by modules. Connectors of different brands and specifications are not allowed to be inserted into each other.

☆ Please keep the connector dry and clean, make sure that the connector nut is fastened before connecting, and do not connect the connector when the connector is wet, dirty or in other bad condition.

☆ The connector should not come into contact with the following chemicals: gasoline, white flower oil, medicated oil, mold temperature oil, engine oil (such as KV46), grease (such as Molvkote EM - 50L, etc.), lubricating oil, rust-preventive oil, stamping oil, butter, diesel, edible oil, acetone, alcohol, essential balm, bonesetting lotion, thinner, release agent (such as Pelicoat S - 6, etc.), sticky plate adhesives and potting adhesives that can generate oxime gas (such as KE200, CX - 200, chemlok, etc.), TBP (plasticizer), cleaning agents, etc.

☆ If the connector is not connected, the connector is not waterproof. The modules shall be connected as soon as possible after installation. Avoid infiltration into water vapor and dust. Avoid direct sunlight and immersion in water. Avoid the connector landing on the ground or on the roof.

☆ Long-term direct sunlight and exposure to moisture may lead to poor connector connectivity, lead to electrical leakage and poor conductivity, which will void the warranty, SolarSpace recommends that the connector be properly managed to prevent moisture entry. According to the severity of the

moisture, it is recommended to check the installation system regularly to ensure the good performance of the modules.

☆ Wrong connections may create arcs and shocks. To ensure reliable electrical connections and to prevent possible moisture entry, they must be locked until a "click" voice when the two connectors dock with each other.

6.4 Diodes

☆ The junction box of the solar module contains the bypass diode in parallel on the cell string in the module. When the hot spot occurs in the module, the diode will work so that the main current no longer flows from the hot spot cell, thus limiting the heating and performance loss of the module.

☆ The bypass diode is not an overcurrent protection device.

☆ When a diode failure is identified or suspected, the installer or the system maintenance provider should contact SolarSpace. Please do not try to open the junction box of the module by yourself.

☆ Any mounting accessories used must be mutually material-compatible to avoid the electrochemical corrosion. A failure due to corrosion will void the warranty.

☆ The module cables, connectors and junction boxes shall not be exposed to water, rain or soak in water for a long time, and the junction box is IP68 protection grade.

7. Grounding

In the design of the module, the anodized corrosion-resistant aluminum alloy frame is used as a rigid support. In order to use safely and avoid the module from lightning and static damage, the module frame must be grounded. When grounding, the grounding device must be fully in contact with the aluminum alloy and penetrate the oxide film insulation layer on the surface of the frame to ensure grounding reliability.

The border is pre-drilled (Ø4.2mm diameter ground hole) and marked with a grounding mark. These holes are for grounding only, not for installing modules. Please do not drill additional grounding holes in the module, otherwise the warranty will be invalid.

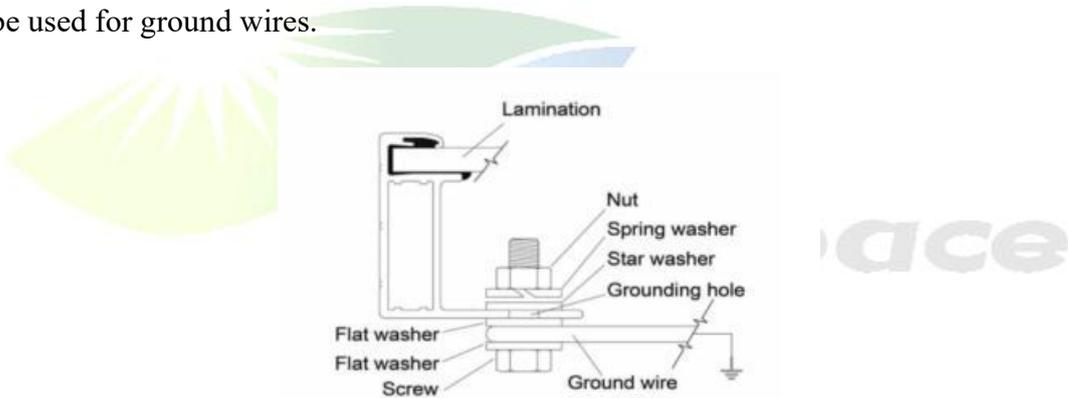
SolarSpace recommends always referring to local and national codes and requirements for PV

modules grounding. SolarSpace recommends negative grounding if local agencies allow it.

The grounding must be confirmed by a qualified electrician, and the grounding device must be manufactured by a qualified electrical manufacturer. 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. All conductive connection points must be securely connected.

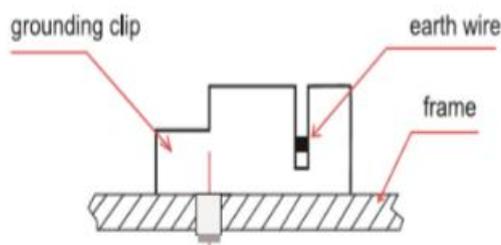
SolarSpace recommends using the following grounding parts:

1. Use the grounding hole to ground. As shown in the figure below: use M4 bolts and washers to connect and fix the ground wire with the frame at the reserved grounding hole of the frame and form a conduction. The nut tightening torque is 3-7 N·m. The bolts, nuts, washers and other related parts are made of stainless steel. It is recommended that exposed copper wires of IEC: 4-14 mm² (UL: 6-12 AWG) be used for ground wires.



2. Use unused mounting holes for grounding. The method is similar to the grounding hole, and the bolts, nuts and other parts used are M8 or M6 size (choose the size that matches the specific mounting hole).

3. Use a grounding clamp to ground. 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 IEC: 4-6 mm² (UL: 10-12 AWG).



4. Use other third-party grounding devices. SolarSpace PV modules can be grounded using third party grounding devices, but their grounding must be reliable and proven, and 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 anti-reflection film technology, if there is a color difference between modules observed at different angles, it is a normal phenomenon.
- ★ Whether the module glass is broken or not.
- ★ Is there a sharp object touching the modules' surface;
- ★ Whether the module is blocked by obstacles or foreign objects.
- ★ Whether there is corrosion near the grid line of the cell, 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.

8.2 Cleaning

- ★ 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.

☆ For other specific cleaning methods and precautions, please refer to the “SolarSpace Photovoltaic Modules Cleaning Manual”.

8.3 Inspection of Connectors and Cables

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 modules 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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Document Formulation/Revision Record Sheet

Date	Revision	Description	Applicant	Approval
2021-12-28	A/0	Intiate	Zhang Xiaoqiang	Chen Shi
2025-03-26	A/1	1. Update the template. 2. Update the short-side installation methods. Add the list of multi-load tests for each module type. 3. Add information on the front of the module and information on the maximum altitude of the installation. 4. Add tracking bracket installation content.	Wu Zihan	Zhang Nan
Countersigning Department				
Production Department	Quality Control Department	Equipment Department	Engineering Department	Facility Department
Dong Haohao, Mao Dengfeng	Ren Haikuan, Duan Shuxia, Zou Ming		Wang Meng, Zhu Jie	
Factory Manager	Project Management Department	Planning and Material Control Department/Planning Management Department	EHS	Financial Center
Sun Peng, Hua ZiZheng		Zhang Guofang, Xue Li, Hu Song		
Integrated Management Center	Risk Control Center	Business Center	Technical Center	New Energy Research Institute
			Zhang Nan	
Quality Control Center	Manufacture Operation Center	Solar Cells Manufacturing Business Unit (Domestic)	Overseas Manufacturing Business Unit (Solar Cells/Module)	Module Business Unit
Jia Qiongyao, Yuan Yangyang				Hao Jingxiang, Zhou Haohao, Lou Jun

Investment and Financing Department	Securities Affair Department	Vice President	Executive Vice President	President
		Feng Ping, Xin Guojun		

