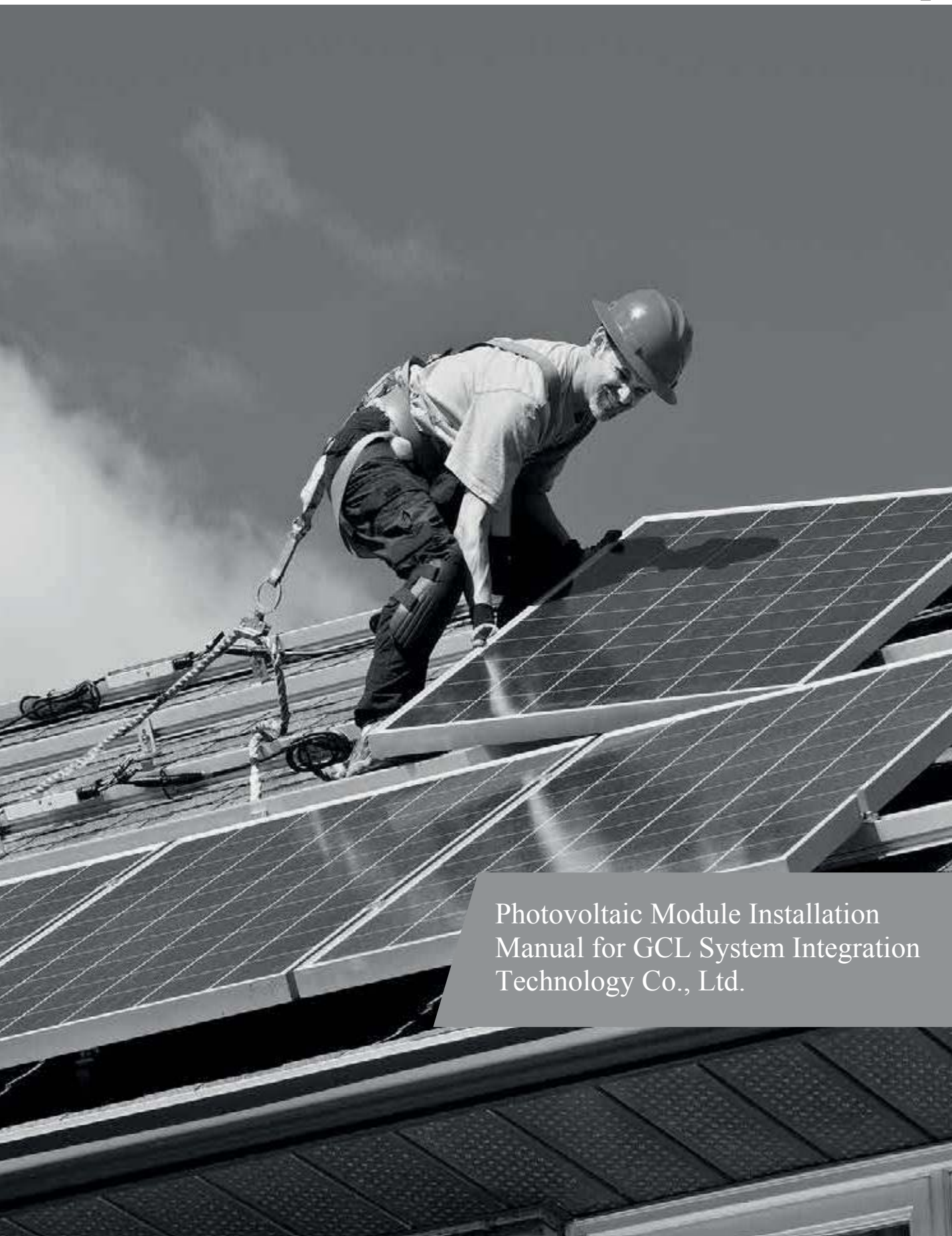




Version: GCL/XXJC/2-RD-638_A5



Photovoltaic Module Installation
Manual for GCL System Integration
Technology Co., Ltd.

CONTENTS

PURPOSE OF THIS MANUAL2

DISCLAIMER.....2

SAFETY & TRANSPORT.....3

MECHANICAL INSTALLATION6

ELECTRICAL INSTALLATION.....16

GROUNDING.....18

BYPASS DIODES AND BLOCK DIODES19

MAINTENANCE.....20

PURPOSE OF THIS MANUAL

- This manual applies exclusively to the solar photovoltaic module with frame (hereinafter referred to as Module) of GCL System Integration Technology Co., Ltd. (hereinafter referred to as GCLSI). The contents of this manual involve the installation methods, operation safety and maintenance information of GCLSI's Modules.
- Modules must be installed by professionals. Please read this manual carefully before installation. The installers must follow all the rules in this manual strictly as well as local requirements and regulations by law or authorized organizations.
- Before installing, the installer must be familiar with their mechanical and electrical requirements. Please keep this manual in a safe place for future reference (care and maintenance) and in case of sale or disposal of the Modules.

DISCLAIMER

- GCLSI shall not be responsible for any loss arising from the installation, operation, use or maintenance of the Modules which is not complying with the guidance of this manual, including breakdown or damage of the Modules or any other expenses incurred.
- Any customer shall not get any patent or authorization of the patent when using the Modules, expressed or implied. Any infringement of patents or other rights of the third party, which may result from the use of the Module, is not within the responsibility scope of GCLSI. The information in this manual is based on GCLSI's knowledge and experience and is believed to be reliable, but such information including product specification (without limitation) and relevant suggestions do not constitute a warranty, expressed or implied.
- GCLSI reserves the rights to change the manual, the Modules, the specifications or any other information of the Modules without prior notice.

SAFETY & TRANSPORT

General Detailed Rules

- Keep all the Modules and electrical connectors clean and dry before installation.
- Use dry and ventilated room when storing uninstalled Modules.
- Use both hands to carry Modules. Do not overlap Modules.
- Be cautious when carrying Modules. Slip-proof gloves are necessary.
- Use supportive disassembling tools when unpacking.



Do not stamp on Modules or put weight on Modules.



Do not disassemble or drop Modules. Do not remove any nameplate or component of the module.



Do not use mirrors or magnifiers to concentrate sunlight onto Modules.



Do not lift the module by grasping the junction box or cable wire.



Do not use any sharp object with Modules.



Do not directly apply pressure on the glass surface or backsheet of Modules. Must use both hands to carry Modules.

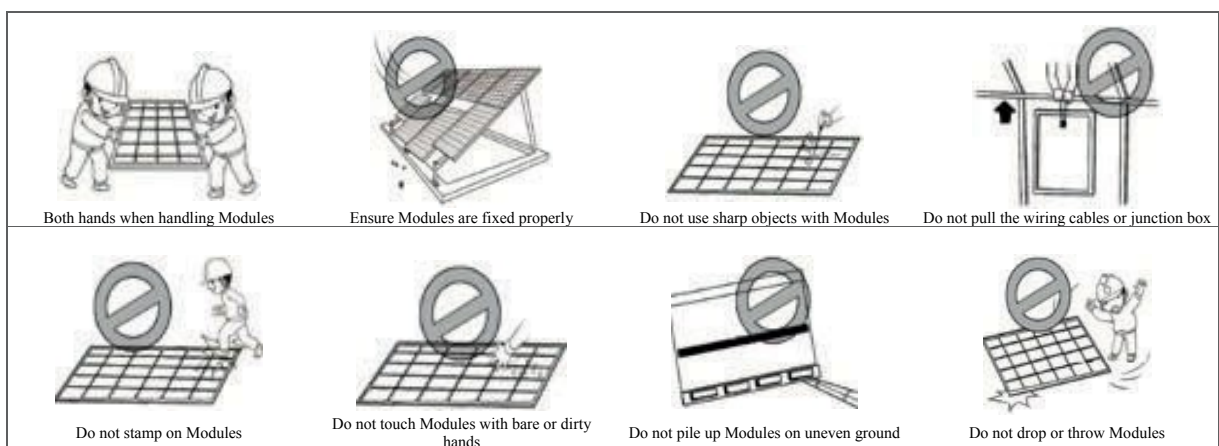


Do not touch the surface of the coated glass with bare hands.



Ensure all contacts and the operating environment are clean and dry.



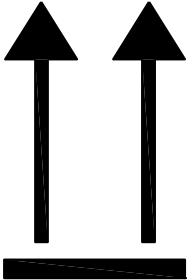
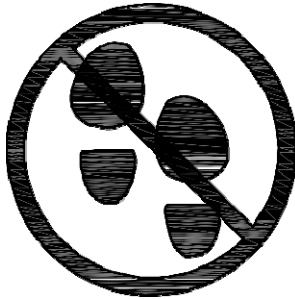

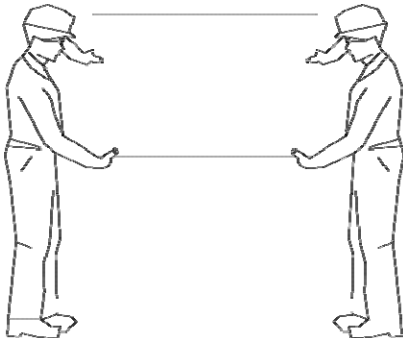
Module Carry and Installation Instruction



SAFETY & TRANSPORT

Description of Package Signs

Before the operation, it is necessary to read carefully the unpacking instruction and outer packing box instruction, and carry out the operation as instructed.

<p>1. DO NOT expose the module to rain or moisture.</p> 	<p>2. The Modules in the carton box are fragile. Handle with care.</p> 
<p>3. The package shall never be upside down during the transportation.</p> 	<p>4. It is prohibited to tramp on the packing box and module.</p> 
<p>5. During the stacking of the Modules, the outer packing box can be stacked not exceed the maximum layer allowed(n=2 means it is allowed to stack for at most two layers.)</p> 	<p>6. One module shall be handled by two people together.</p> 

SAFETY & TRANSPORT

Unloading, Transportation and Storage

- When the Modules are delivered to the project site, the freight car shall be ready in the flat, even and open area for parking and unloading.
- Choose the appropriate carrying forklift according to the commodity weight, unload the Modules from the freight car, and place them on flat ground.
- It is prohibited to stack the Modules in the project site.
- During the transportation in the project site, the Modules shall not be stacked, but only allowing for one layer in transportation.
- Storage in the project site:
Storage environment requirements: humidity<85%, temperature -20℃~+50℃;
Modules statically stacked for ≤ 2 layers.
- Temporary storage in the project site:
The Modules shall be stored in a dry ,well-ventilated place . They shall not be stacked but shall be covered with waterproof cloth to prevent dampness in the Modules.

MECHANICAL INSTALLATION

Location Selection

- Select suitable places to install Modules. The module in the north latitude region shall face south, and shall face north in the south latitude region.
- Install Modules at the places with sufficient sunlight and without shade at any time. If a module is shaded or even partially shaded, it will result in lower power output.

A permanent or regular shade will cause damage, which will result in the invalidity of product's limited warranty.

- Do not store, install or use Modules at the places where combustible gas is easily generated or gathering.
- The straight-line distance between the installation site and coastline shall not be shorter than 1 km unless there is a written approval from GCLSI or an engagement specified in the contract.

Location Selection

- Modules in the same string should be installed at the same angle. Modules installed in different angles will receive different irradiation, which will cause current different. As a result, it will decrease the operation efficiency of the system.
- Please refer to Table 1 for the recommended mounting tilt angles of the Modules.

Local latitude	Mounting Tilt Angles
0°~15°	15°
15°~ 25°	Local latitude
25°~30°	Local latitude + 5°
30°~35°	Local latitude + 10°
35°~40°	Local latitude + 15°
>40°	Local latitude + 20°

Table 1 Mounting Tilt Angle of Modules

MECHANICAL INSTALLATION

Module Installation

➤ General Installation

- Ensure the module installation means and support system sufficiently robust, so that the Modules can undertake the preset loading conditions, the support installer or supplier shall provide necessary guarantee and other related certifications. The installation support system shall pass the inspection and test by the third-party test institution with the static mechanic analysis capability, and use the local national or international standards, such as DIN1055 or equivalent.
- The support structure shall be made of the durable, corrosion resistant and ultraviolet resistant materials.
- The module shall be firmly mounted on the support.
- Choose proper installation height of the photovoltaic support system, and ensure the lowest part of the module is high enough, to avoid being shaded by plant or being damaged by the flying sand. or being covered by snow for a long time in winter .
- When the module is installed on the roof or the building, it is necessary to ensure that the roof structure is fixed firmly and will not be damaged by heavy wind or heavy snow, and the back of the module shall be well-ventilated to facilitate the cooling of the module (the minimum gap between the module and installation surface is 10cm).
- Considering the influence of linear thermal expansion of the module frame, the minimum distance between two Modules should not be less than 20mm..
- Ensure that the module backside will not contact the support or architectural structure even if there is the module surface is under the external pressure.
- It is required to observe the instruction guide and safety rules attached on the support. It is not allowed to drill the hole in the glass surface or frame of the module. otherwise ,the guarantee will be invalidated
- When to install the Modules on the roof, it is necessary to guarantee the roof structure is suitable for the module installation. and the installed modules should not be beyond the roof zone. Additionally, the roof area where it is penetrated by module installation shall be properly sealed to prevent the roof from water leakage
- When the module is installed on the supporting column, it is necessary to ensure the supporting column and module installation structure is capable of withstanding the expected local wind.

MECHANICAL INSTALLATION

➤ Installation Method

- The Modules may be installed and fixed with the following methods:
- Mounting hole system: Use the corrosion-resistant M8 bolt, for fixing with the installation support through the installation hole in the side frame of the module, as shown in Fig. 1.
- Clamping system: use proper clamp, and fix the module with the installation support, as shown in Fig. 2.

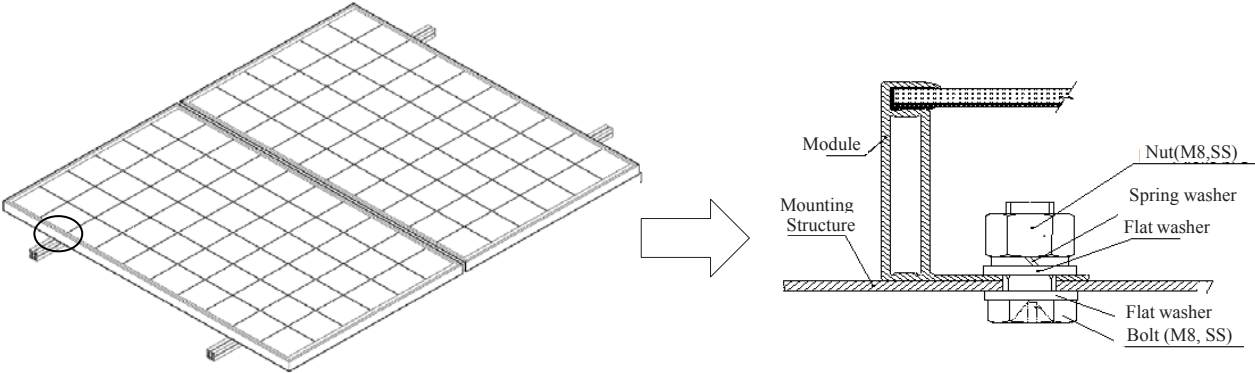


Figure 1 Mounting holes

The mounting accessories recommended are listed below:

Bolt	Flat washer	Spring washer	Nut
Material: stainless	Steel material: stainless steel	Material: stainless steel	Material: stainless steel
Size: M8	Size: M8	Size: M8	Size: M8

The range of torque for screw tightening is 14N.m to 20N.m.

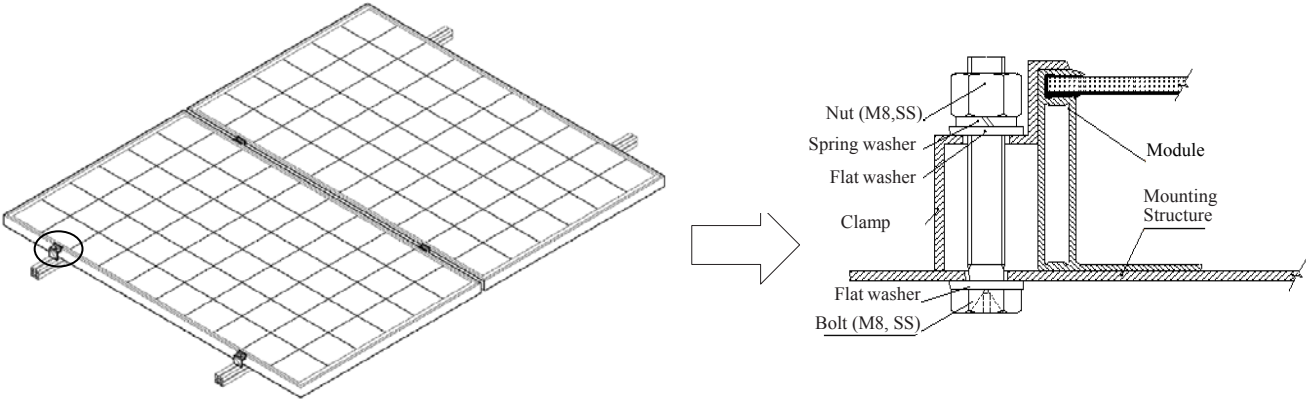


Figure 2 Mounting clamps

MECHANICAL INSTALLATION

➤ Nomal module

- Choose the proper installation method according to the loading requirement, the detailed information is shown in Fig. 3. The loading requirement of 6000Pa/4000Pa is only applicable to GCL-P6/60、GCL-P6/60H、GCL-M6/60、GCL-M6/60H、GCL-P6/72、GCL-P6/72H、GCL-M6/72、GCL-M6/72H when the frame's height is 35mm.

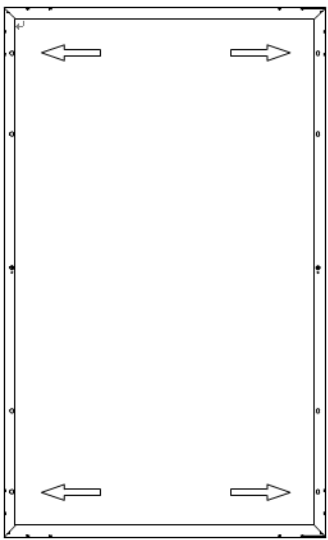
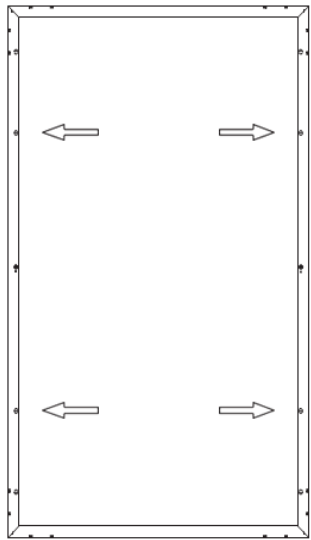
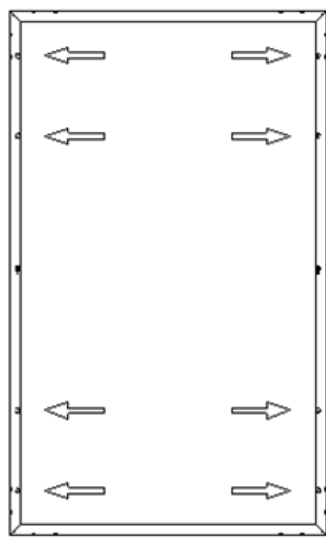
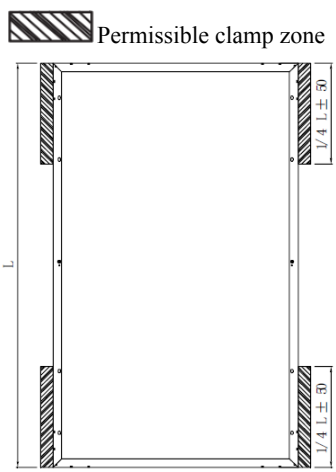
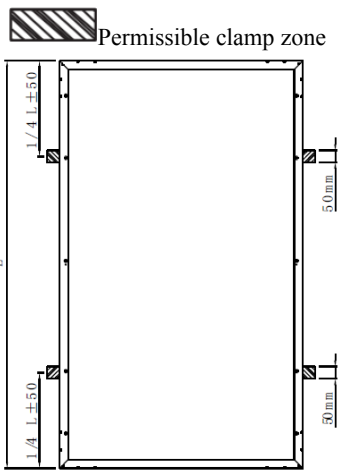
Snow loading/ Wind loading	2400Pa/2400Pa	5400Pa/2400Pa	6000Pa/4000Pa
Installation with the mounting hole	 <p>Use 4 mounting holes</p>	 <p>Use 4 mounting holes</p>	 <p>Use 8 mounting holes</p>
Installation with the mounting clamp	 <p>Use 4 mounting clamps</p>	 <p>Use 4 mounting clamps</p>	NA

Figure 3. Installation method

MECHANICAL INSTALLATION

Module Specification (as shown in Figure 4 and Table 2)

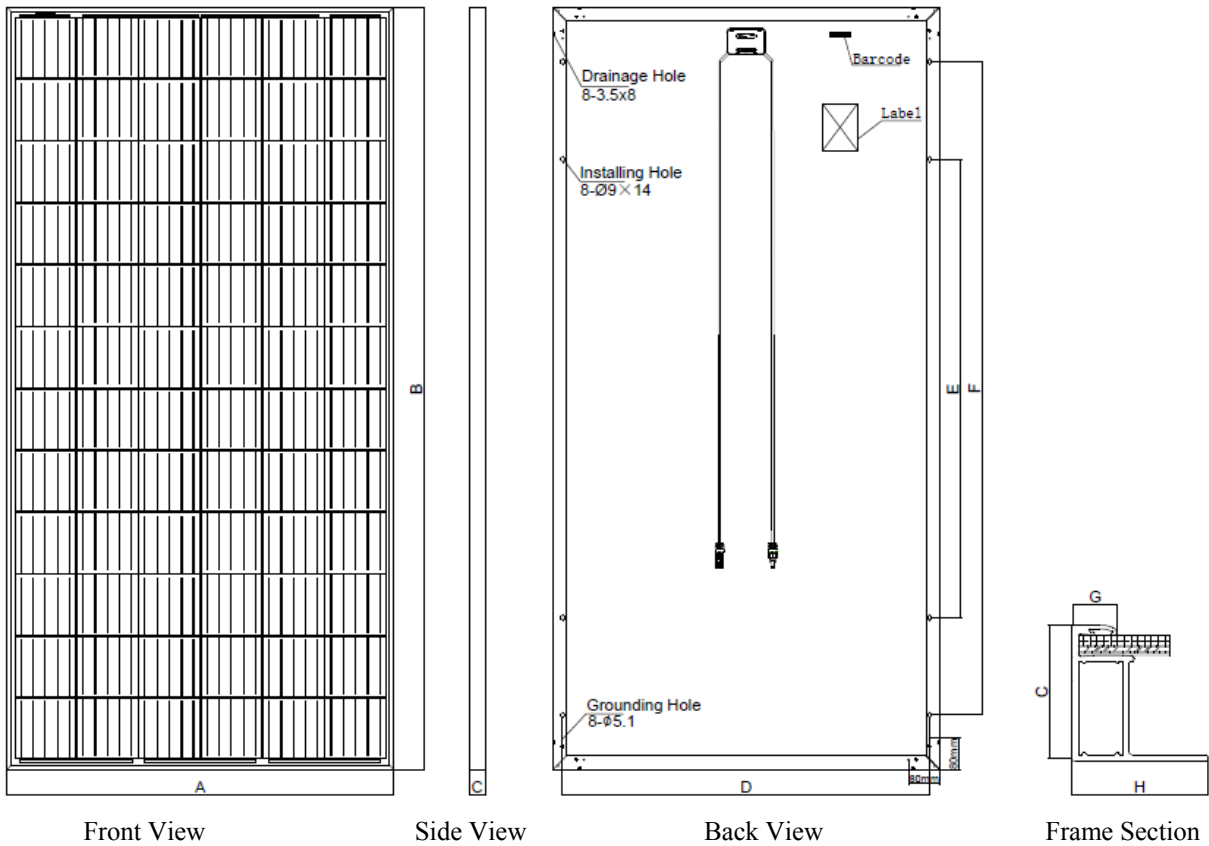


Figure 4 Schematics for the Module Specification

MECHANICAL INSTALLATION

Table 2 Detailed Module Mounting Dimension Contrast Table

Unit:mm

No	Module Type	A	B	C	D	E	F	G	H	Weight (KG)
1	GCL - P6/60XXX	992	1640	40/35	941	990	1350	11/11.5	35	18.5/18.1
	GCL - P6/60H XXX	992	1650	35	943	990	1350	11.5	35	18.2
	GCL - M6/60XXX	1000	1666	35	951	860	1360	11.5	35	18.5
	GCL - M6/60HXXX									
2	GCL - P6/72XXX	992	1956	40/35	941	1176	1676	11/11.5	35	22.5/22.2
	GCL - P6/72H XXX	992	1970	35	943	1300	1676	11.5	35	22.5
	GCL - M6/72XXX	1000	1980	35	951	860	1360	11.5	35	22.7
	GCL - M6/72HXXX									
3	GCL - P3/60XXX	992	1670	35	941	990	1350	11.5	35	19.1
	GCL - M3/60XXX	992	1665	35	943	990	1350	11.5	35	18.8
	GCL - P3/60H XXX	1000	1686	35	951	860	1360	11.5	35	19.2
	GCL - M3/60HXXX									
4	GCL - P3/72XXX	992	1993	40	941	1176	1676	11	35	22.8
	GCL - M3/72XXX	992	1986	35	943	1300	1676	11.5	35	22.6
	GCL - P3/72H XXX	1000	2010	35	951	860	1360	11.5	35	23.1
	GCL - M3/72HXXX									
5	GCL - P6/96XXX	1008	2568	40	958	1428	1928	11	35	36.5
6	GCL - M3/27XXX	281	1483	40	NA	NA	NA	NA	NA	5.7
7	GCL - P3/60G(W)FXXX GCL - M3/60G(W)FXXX	998	1681	35	949	990	1350	11.5	35	26
8	GCL - P3/72G(W)FXXX	998	1982	35	949	1300	1676	11.5	35	30.5
	GCL - M3/72G(W)FXXX	1006	2036	30	970	860	1360	12	30/12	31.2
9	GCL - P6/60G(W)FXXX	998	1664	30	962	990	1300	12	30/12	25
	GCL - M6/60G(W)FXXX	1006	1686	30	970	860	1360	12	30/12	25.5
10	GCL - P6/72G(W)FXXX	998	1974	30	962	990	1300	12	30/12	29
	GCL - M6/72G(W)FXXX	1006	2006	20	970	860	1360	12	30/12	29.7

Note: "XXX" refers to Module Power Index.

MECHANICAL INSTALLATION

➤ High-density module

1、Installation with the mounting hole

- Choose the proper installation method according to the loading requirement, the detailed information is shown in Fig. 5.

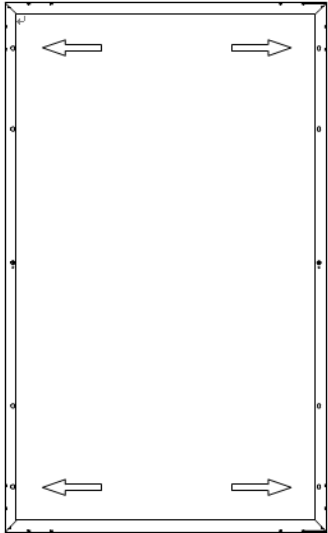
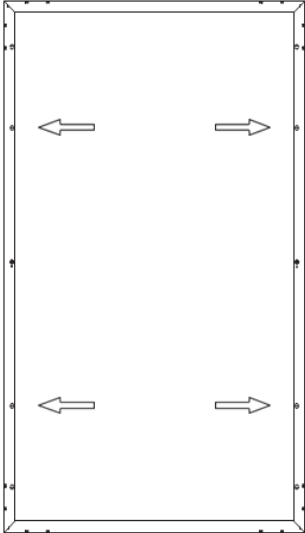
Snow loading/ Wind loading	2400Pa/2400Pa	5400Pa/2400Pa
Installation with the mounting hole	 Use 4 mounting holes	 Use 4 mounting holes

Figure 5. Installation method

MECHANICAL INSTALLATION

Module Specification (as shown in Figure 6 and Table 3)

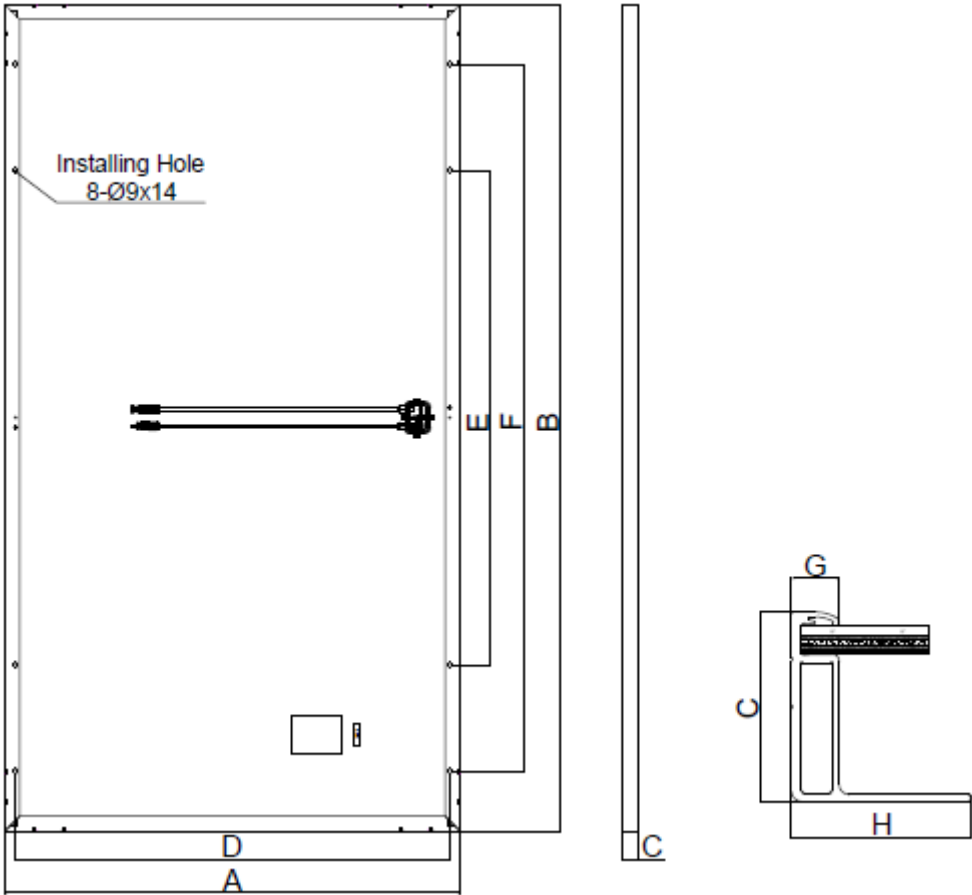


Figure 6 Schematics for the Module Specification

Table 3 Detailed Module Mounting Dimension Contrast Table

Unit:mm

No	Module Type	A	B	C	D	E	F	G	H
1	GCL-P2/60(H)XXX	1048	1624	40	998	990	1350	11	35
	GCL-P2/60B(H)XXX								
	GCL-M2/60(H)XXX								
	GCL-M2/60B(H)XXX								
2	GCL-P2/72(H)XXX	1048	1936	40	998	1176	1676	11	35
	GCL-P2/72B(H)XXX	1069	1942	40	1019	1162	1662	11	35
	GCL-M2/72(H)XXX								
	GCL-M2/72B(H)XXX								

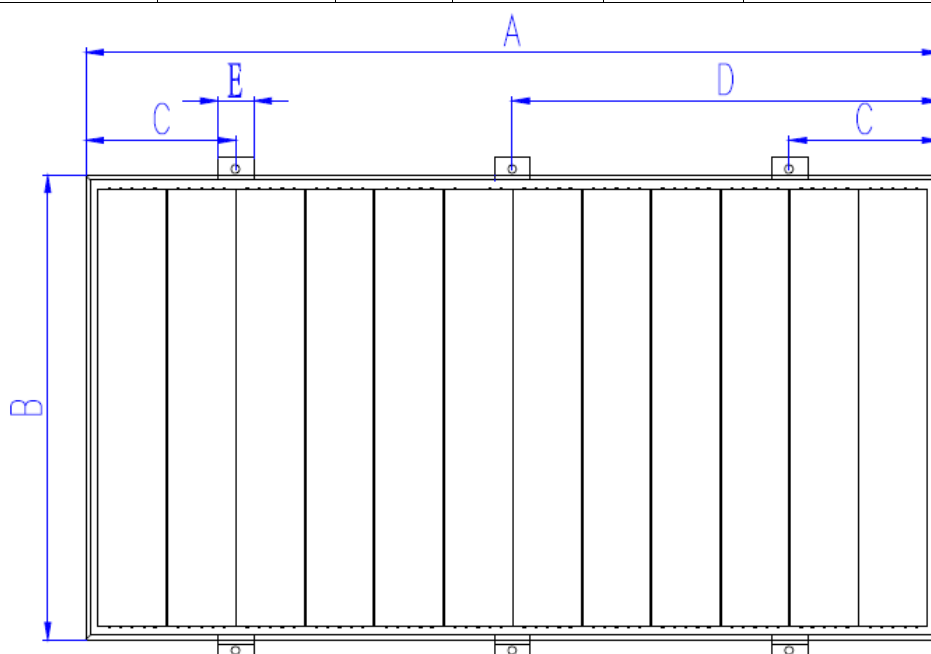
Note: "XXX" refers to Module Power Index.

MECHANICAL INSTALLATION

2、Installation with the mounting clamp

Table4 Permissible clamp zone

Module Type	Load/Pa	A/mm	B/mm	C/mm	D/mm	E/mm
GCL-P2/72(H)XXX	2400/2400	1936/ 1942	1048/ 1069	0~484±50/ 330±50	/	≥50
GCL-P2/72B(H)XXX	5400/2400			484±50/ 330±50	-/ 971±50(1942*1069)	
GCL-M2/72(H)XXX		2400/2400	1624	1048	0~406±50	/
GCL-M2/72B(H)XXX	5400/2400				406±50	
GCL-P2/60(H)XXX	2400/2400	1624	1048	0~406±50	/	≥50
GCL-P2/60B(H)XXX	5400/2400			406±50		
GCL-M2/60(H)XXX		1624	1048	0~406±50	/	≥50
GCL-M2/60B(H)XXX	406±50					



MECHANICAL INSTALLATION

➤ Mounting with Single-axis Tracking System

- This installation is only for 72 cells framed modules.
- It is a Single-axis Tracking System; the module is fixed on the axis by bolting long frame.
- The frame of each module has 4- $\phi 7 \times 12$ mm mounting holes with specific location shown in Figure 7.
- Secure the module in each fixing location with an M6 bolt, two flat washers, a spring washer and nut as shown in Figure 7, torque: 9~12 N.m.
- Mechanical Load Pressure under this method: 2400Pa (snow) max from the front side & 2400Pa (wind) max from the rear.

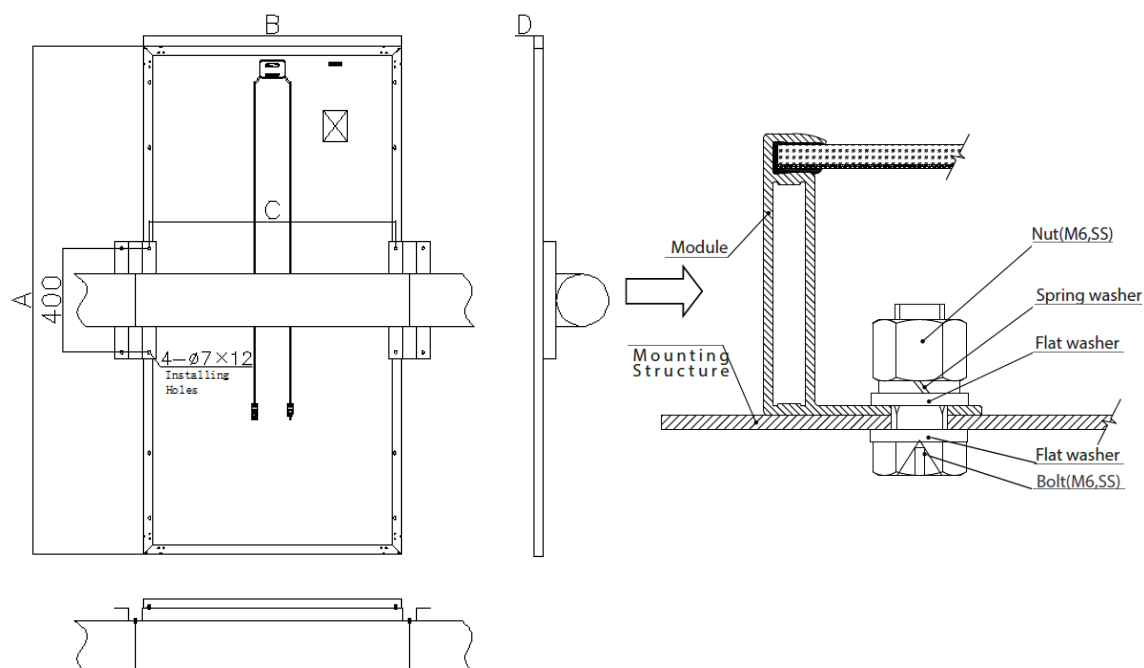


Figure 7

unit:mm

NO.	Module Type	A	B	C	D
1	GCL-P6/72(H)XXX GCL-M6/72(H)XXX	1956	992	946	35
		1970	992	946	35
		1980	1000	954	35
2	GCL-P3/72(H)XXX GCL-M3/72(H)XXX	2010	1000	954	35
3	GCL-P6/72G(W)FXXX GCL-M6/72G(W)FXXX	1974	998	962	30
		2006	1006	970	30
4	GCL-P3/72G(W)FXXX GCL-M3/72G(W)FXXX	2036	1006	970	30

Note: "XXX" refers to Module Power Index.

ELECTRICAL INSTALLATION

DC power generated by the photovoltaic system can be converted into AC power and fed into the grid. Policies on connecting renewable energy system to the grid vary from region to region. Consult senior system designer before designing the system. Generally, the system installation shall be formally approved by the local public sector.

General Installation

- Installation structure should be compatible with aluminum frame of module, in order to avoid galvanic corrosion. Any defects caused by such corrosion will void the warranty.
- The DC-side system potential of the photovoltaic array includes the practice of floating ground, positive-pole grounding and negative-pole grounding according to the system requirements; and different cell technologies have different adaptability. In a power-station project, particularly the module of the crystalline silicon photovoltaic cells, too large an absolute value of the negative to the ground might cause potential induced degradation (PID). Consequently, it is appropriate to use the negative grounding system so that the potential of the circuit is positive. Consult the inverter manufacturer for details.
- It is forbidden for non-professionals to open the lock nuts of the connector. Make sure that the connectors are clean, dry and fully connected (A click sound should be heard when fully connected), otherwise it may lead to electric arc sparks which will damage the connector or cause a fire.
- Under normal conditions, a Module may produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of ISC and VOC marked on the Module should be multiplied by a factor of 1.25 when determining component voltage ratings, current ratings, fuse sizes, and size of controls connected to the PV output.
- Completely cover the Modules with an opaque material to prevent electricity from being generated during disassembling the conductors.
- It is not allowed to use the Modules in different models in the same solar photovoltaic system. When the Modules are connected in series, the voltage of every string shall not be higher than the maximum voltage of the system (as shown in Figure 7). Reference equation of the maximum number of the Modules in serial connection: $\text{maximum system voltage of the module} / (1.25 * \text{open-circuit voltage})$.
- When connected in parallel, the current output is equal to the sum of each string's current (as shown in Figure 8). Fuse is necessary for each module string. Please take reference to the local regulation. Recommended maximum parallel Modules configurations: $\text{Fuse rating} / (1.25 * \text{short-circuit current})$.

ELECTRICAL INSTALLATION

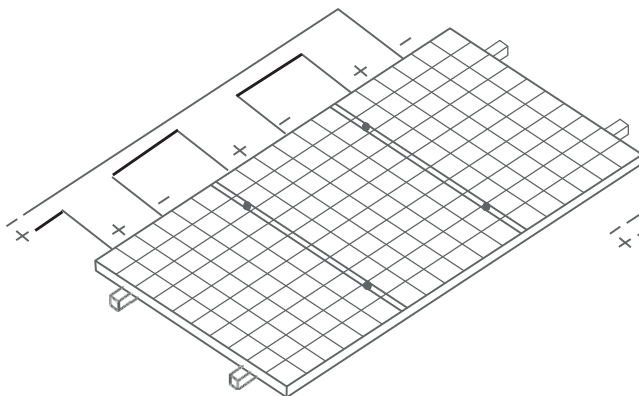


Figure 7 Connection in Series

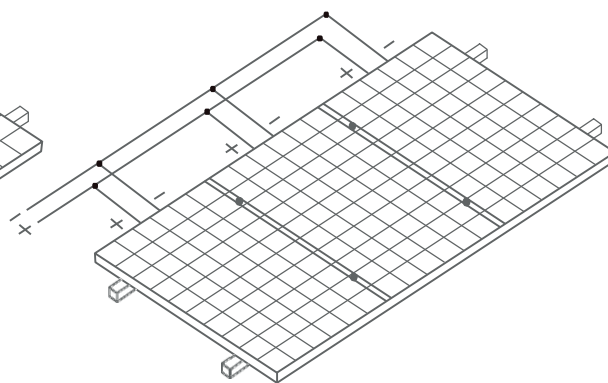


Figure 8 Connection in Parallel

- Please refer to the local regulations to determine the system wire size, types and temperatures.
- The cross section of the cables and the capacity of the connectors must be selected to suit the maximum system short circuit current (The recommended section area for a single piece of Module is 4 mm^2 , and the recommended rated current for the connector is greater than 15A), otherwise the cables and connectors shall be overheated under large current. Caution: The maximal temperature of the cable is 85°C while the upper limited temperature of the connector is 105°C .
- Make sure the electric components such as the connectors and inverters are off-state during the installation. To reduce lightning damage, the loop area should be kept as small as possible when laying cables. It is recommended to use fuses in each string.

GROUNDING

➤ Grounding by cable

- The grounding bolts must be made of stainless steel and be used in the specified grounding holes. First, make the M3.5 stainless steel bolt pass through the spring washer, flat washer, cup washer (copper conductor with a diameter of 2.1 mm) and star washer, and then insert through the grounding hole, flat washer and spring washer on the frame. Finally, tighten with a M3.5 nut. Caution: The upper limited temperature of the conductor is 85°C. As for the installation, refer to Figure 9.

➤ Grounding by lugs

- All the module frames and mounting structures shall be grounded according to regional and national electricity regulations. Use recommended hardware to connect grounding cables and fasten to the Module frames.
- While using the metal structure, make sure the surface of the system have been electroplated to keep a good conducting circuit.
- Use suitable grounding conductors to connect the Module frame to the mounting structure. This can achieve proper grounding effects.
- The grounding conductor must be connected to ground via an appropriate grounding electrode. It is recommended to use lugs to connect the grounding cables. If it is only mechanically connected to a grounded module without bolts and nuts, the mounting system should be grounded as well.
- First, peel the grounding cable to a proper length without damage to the metal core. Then insert the peeled cable into the lug, tighten the screw. As shown in Figure 10, connect the lug to the aluminum frame with stainless steel bolts and connection components. The recommended tightening torque for M3 bolts is 2.3N•m.

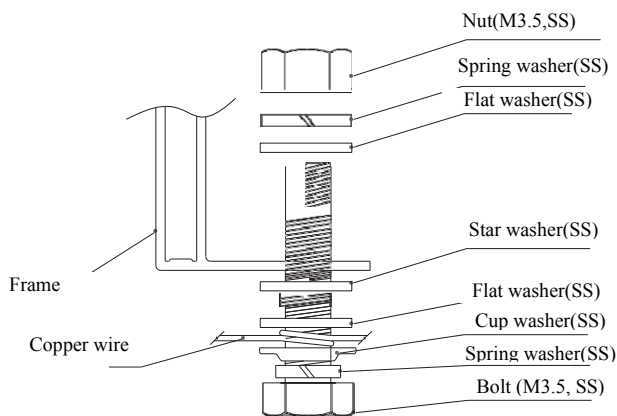


Figure 9

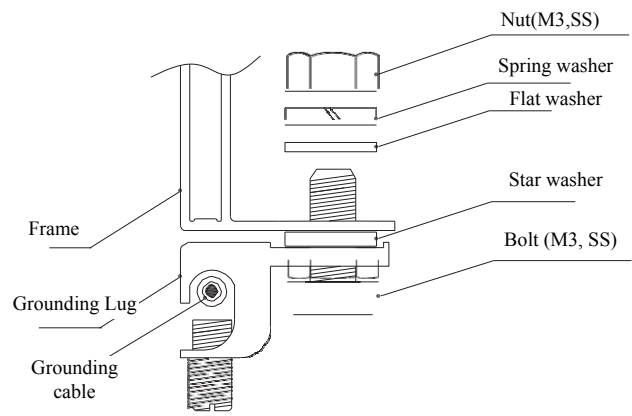


Figure 10

BYPASS DIODES AND BLOCK DIODES

In a system with two or more Modules connected in series, if part of a Module is shaded while the other part is exposed to the sun, a very high reverse current will go through the cells which have been partly or entirely covered and it will cause overheat on the cells, which may damage the Module. Using bypass diodes can protect Modules from this kind of risk. There are bypass diodes in junction boxes, which can reduce the effects of partial shadows. Do not privately disassemble the junction box to replace the diodes, even when the diodes are broken. This should be processed by the professionals.

In a system with batteries, if the controller doesn't have the function of backswing protection, block diodes installed between the battery and the Module can prevent the reverse current from damaging the Module.

MAINTENANCE

Normally, the Modules do not need repair. Follow the maintenance methods below to ensure the best performance of the Modules:

- In most conditions, the normal rainwater can keep the module glass clean. Clean the glass surfaces with wet soft sponge or cloth if necessary. Use mild non-abrasive cleaning agent to remove stubborn dirt.
- Do not try to clean a Module with broken glass or perforated backsheet. It will cause serious electrical shock. Take a regular inspection on grounding, mechanical and electrical connections every 6 months. Make sure all the Module connectors are connected, clean and without damage or corrosion.
- When disassembling the connectors, must make sure all the components are working well; otherwise the connectors shall be replaced. Damage on the connector will cause electronic leakage. The tightening torque of the nut should be $1.5 \text{ N} \cdot \text{m}$ - $3 \text{ N} \cdot \text{m}$.
- Use opaque material to completely cover the Modules during repair to avoid electric shock. When exposed to the sunshine, the Modules will produce high voltage. The repair work must be carried out by professionals.



Warning: Shut down the system before any electric repair.
Improper maintenance may cause electric shock or fire.



Bring Green Power to Life

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