



GOLDEN SOLAR

# Installation Manual For Photovoltaic Module

Make Solar Energy More Efficient!



GOLDEN SOLAR

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## Applicable Products

Module Type	Code
Bifacial	JGDN132- XXX-YY
	JGDN120- XXX-YY
	JGDN144- XXX-YY
	JGDN108-XXX-YY
	JGDN108B-XXX-YY

Note: XXX = nominal power output, YY = cell size and number of busbar.



# 1 Introduction

Thank you for choosing HJT PV modules from Suzhou Golden Solar Technology Co., Ltd. (hereinafter referred to as "Golden Solar"). To ensure the safe and proper installation of your Golden Solar PV modules, please read this installation manual carefully before beginning the installation process. We strongly recommend that only qualified professionals with the necessary knowledge and experience perform the installation, operation, and maintenance of your PV modules. These tasks require expertise in both mechanical and electrical systems. For further information or if you have any questions, please do not hesitate to contact the Golden Solar After-service Department (aftersales@goldensolarcorp.com) or your local Golden Solar representative.

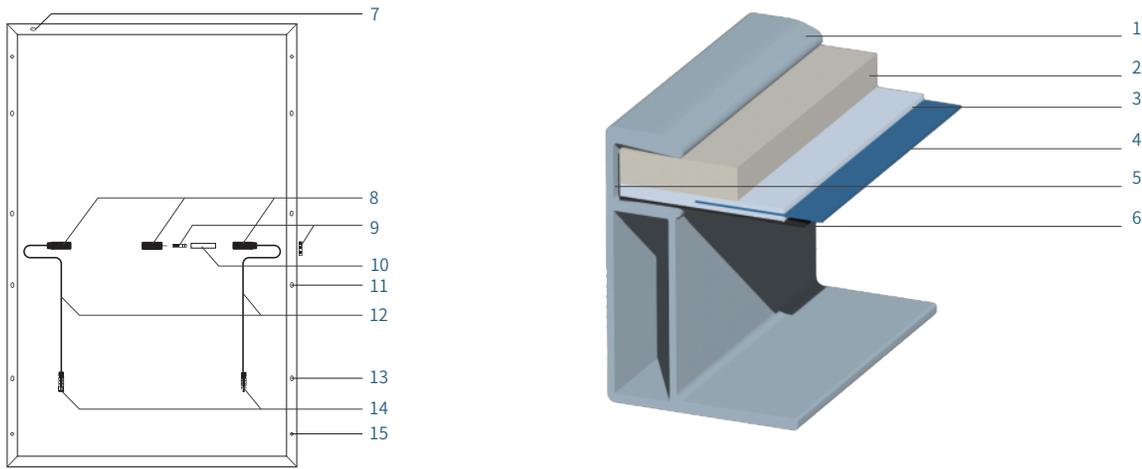
# 2 Disclaimer

This installation manual is not a warranty document and does not have any warranty meaning. Golden Solar reserves the right to change this installation manual without notice in advance. Golden Solar is not responsible for any damages of any kind, including but not limited to any product damages, personal injury, or any other property losses, resulting from any improper operations or faults by the customers during the handling of the products as failure to follow the instructions in this installation manual.

# 3 Product Identification

- Each piece of product is affixed with 2 labels containing the following information:
1. Nameplate: Contains company logo, product model, rated power, rated current, rated voltage, module size, module weight, certification mark, maximum system voltage, and other information. The nameplate is affixed to the back of the module between the cable boxes.
  2. Barcode: The three barcodes are placed inside the module before lamination, on the back glass of the module, and on the B-side of the frame.
  3. The uniqueness of the barcode serial number can be queried in Golden Solar's MES system.

Modules' mechanical drawing



Bifacial modules (with frame)

1. Aluminium frame	4. Solar cell	7. Drain holes	10. Nameplate	13. Mounting holes
2. PV glass	5. Sealing	8. Junction box	11. Mounting holes	14. Connectors
3. EPE/POE	6. PV glass	9. Series number	12. Connection cable	15. Grounding holes

## 4 Safety Precautions

### 4.1 General safety

Only authorized and trained personnel should have access to or perform work on the modules or solar system.

Potentially lethal DC voltages can be generated whenever PV modules are exposed to a light source, avoid contact with electrically active parts and be sure to isolate live circuits before attempting to make or break any connections.

When working on electrical connections, remove all metallic jewellery, use properly insulated tools, and wear appropriate personal protective equipment to reduce the risk of electric shock.

Protect the electrical plug contacts against corrosion and soiling. Make sure that all connectors are corrosion-free and clean before making the connection.

Ensure that all connections are securely made with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.

Make sure that the polarity of each module or a string is not reversed considering the rest of the modules or strings.

Broken modules cannot be repaired and contact with any module surface or frame can lead to electrical shock.

Do not stand or step on, damage, or scratch the front or backside surfaces of the module.

Do not use a module with broken glass or torn substrate.

Do not disassemble the modules or remove any part of the module.

Do not install or handle modules during dampness or strong winds.

Do not artificially concentrate sunlight on these solar modules.

Do not use water to extinguish fires of an electrical origin.

Do not use modules if exposed flammable gases are present in the vicinity.

### 4.2 Fire safety

Avoid installation or usage of modules in close proximity to open flames or materials that are flammable and explosive.

Before installing modules on the rooftop, it is essential to consult local laws and regulations to ensure compliance. Adhere strictly to building fire protection requirements. The roof should be covered with a layer of fireproof materials possessing suitable fire protection ratings. Ensure adequate ventilation between the backsheet and mounting surface. Note that the fireproof performance of buildings may vary depending on roof structures and installation methods. Improper installation poses a significant fire risk. Therefore, please always use proper module accessories such as fuses, circuit breakers, and grounding connectors in accordance with local regulations.

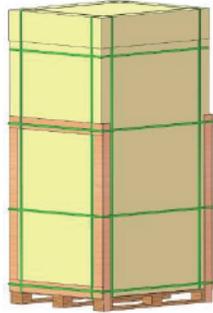


## 5 Unloading, Transportation, Storage

### 5.1 Unloading

When PV modules are carried to the project site, they must be transported in the packing box provided by Golden Solar, and should be stored in the original packing box before installation, please protect the packaging from damage. When unloading, especially when lifting to the roof, it is necessary to protect the safety of PV modules, it is forbidden to lift the sling directly on the pallet, and the PV modules should be placed in the protection device and then lifted to the roof (When lifting to the roof, it is necessary to consider the roof load and avoid centralized placement. If it is a colour steel tile roof, it needs to be split in advance, and the modules should be placed at the beams, and there should not be more than 5 pieces of modules in each place.) so as not to bump into the wall during the lifting process. There are two types of packaging for PV modules: long-side vertical package and short-side vertical package, and the two types of packaging correspond to different requirements for unloading and unpacking.

Packaging types:



Long-side vertical package



Short-side vertical package

#### Notes when unloading by crane:

1. When modules are unloaded by crane (as shown in the picture), please use the special tooling; before lifting, according to the weight and size of modules, choose the lifting tools with sufficient tension and size; adjust the position of the sling to ensure the stable centre of gravity and operate the crane at a constant speed; when approaching to the ground, hold the package upright and place it lightly on the flat ground.
2. Strictly prohibit lifting when the weather has a wind speed exceeding a Beaufort scale of 6 or during rain or snow.
3. Long-side vertical packages can be lifted to 2 pallets of modules at one time, and short-side vertical packages can be lifted up to 2 pallets of modules horizontally at one time, and the stacking straps of modules should be cut off before lifting.



#### Notes when unloading by forklift:

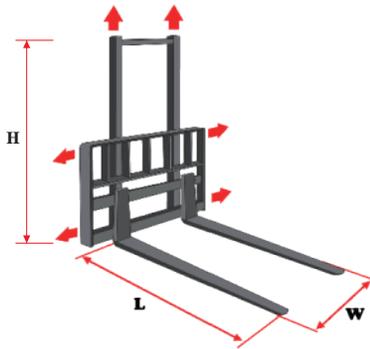
1. When modules are unloaded by forklift, unloading should be done from both sides of the vehicle.
2. Choose the appropriate tonnage of forklift, forklift tine spacing adjustable, as close as possible to the pallet on both sides of the foot pier, forklift tines deep into the bottom of the pallet L  $\geq$  3/4 position, the forklift gantry height  $\geq$  1.7m, forklift gantry width  $\geq$  1.5m.
3. Place EPE (Expandable Polyethylene) or rubber pads and other cushioning materials in front of the forklift gantry, and strictly prohibit the forklift from directly contacting the package e of modules to prevent the modules from being broken due to external impact.
4. During the unloading process, if the package blocks the driver's line of sight, it is recommended to drive in reverse and arrange for personnel to direct the process to prevent the driving process from hitting the personnel or items, resulting in personnel injury or items falling.



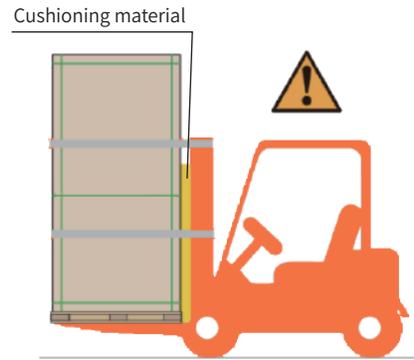
Unloading long-side vertical package by forklift



Unloading short-side vertical package by forklift



Forklift gantry: height  $\geq 1.7\text{m}$ , width  $\geq 1.5\text{m}$



Cushioning material such as EPE or rubber mats in front of the forklift gantry

### Special instructions

Due to the limitation of the container height, when the PV modules are moved out from the container, the forklift lifts up the modules, the bottom surface of the package should be less than 50mm away from the bottom surface of the container, otherwise the product package and the door frame of the container are prone to collision, which will cause damage to the PV modules, and the products are unloaded from the container after each row is completed, and then pick up the previous row of the modules, and unload the cabinets in turn.

### Notes when transporting:

1. Long-side vertical package in the handling, the box against the forklift gantry, the gantry needs to be perpendicular to the forks, the gantry structure should be strong (can withstand the pressure  $\geq 1.5\text{tonnes}$ ), when the whole pallet of modules leaning against the gantry, the gantry will not be deformed due to pressure, the tensile strength of  $\geq 2000\text{kgf}$  two safety ropes tightly fastened on the forklift truck, forklift front on both sides of the installation of the safety rails.
2. Forklift transport straight line travelling speed control  $\leq 5\text{km/h}$ , cornering speed  $\leq 3\text{km/h}$ , to avoid emergency stops and rapid start.
3. When using a hydraulic forklift, the upper surface of fork tines should be  $\leq 75\text{mm}$  away from the ground.

### 5.2 Transportation

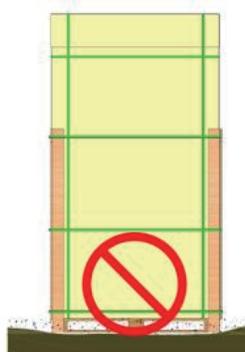
1. If modules need to be transported over long distances or stored for a long time, please do not remove the original package.
2. Packaged finished products can be transported by land, sea, or air. During transport: please fix the packing box on the transport platform to make sure the package will not roll over. (Take land transport as an example).

### 5.3 Secondary transportation

1. Do not unpack the original package when transferring modules at the project site, please fix the packing box on the transport platform to ensure that the packing box is fixed firmly.
2. Do not use a pedicab for the transshipment of the unpacked modules.
3. Do not use rope to carry the modules.
4. Do not carry the modules by one person, ensure that the modules are carried by two or more persons.

### 5.4 Storage

1. When PV modules are taken out from the packing box, cardboard should be laid on the ground first to avoid the PV modules being scratched by collision and friction with the concrete surface/hard objects on the ground or coloured steel tiles, corrugated metal sheets, etc.
2. When stacking PV modules, they should be neatly and smoothly stacked on the horizontal surface, with the bottom piece of module facing upwards and the back facing downwards, and the rest of modules stacked with the front facing downwards and the back facing upwards, and at the same time, there should be a cardboard pad underneath the PV modules, and the number of stacked modules should not be more than 14 pieces, and the objects such as mounting tools placed on the surface of the PV modules should be avoided.
3. Golden Solar modules have adopted the current classification, the handling personnel should place them separately and mark them according to the identification on the power list of the PV modules' outer package, and the current classification required by other customers is similar; according to the system design requirements, the same current class is usually required in the same array during installation.
4. If the customer requires the PV modules to be colour differentiated, the outer packing box should be marked accordingly, and the PV modules should be marked when they are taken out of the packing box and stacked to prevent confusion. According to the system design requirements, the colours of PV modules in the same row or array should be the same.
5. Do not store modules in soft geological areas or where there is stagnant water, and do not place them on inclined slopes of  $>4^\circ$ .
6. If the modules need to be stored for a long time, it is recommended that they be stored in a standard warehouse and regularly inspected, and any abnormally tilted packages in the warehouse should be reinforced on time.



Soft ground, waterlogged



Inclined slopes of  $>4^\circ$

## 6 Unpacking

Before unpacking, please make sure the outer package is intact, we suggest using an utility knife to remove the packing tape and winding film. Don't unpack it violently so as not to scratch the modules inside the box, and don't unpack it when the weather has a wind speed exceeding a Beaufort scale of 6, or during rainy or snowy conditions.

If the unpacking is not to be installed immediately, it should be fixed on the rack with a safety rope; if it is not to be unpacked for a long time, the modules should be placed on two pallets of suitable size, and it is recommended that the single pallet should not exceed 14 pieces modules.

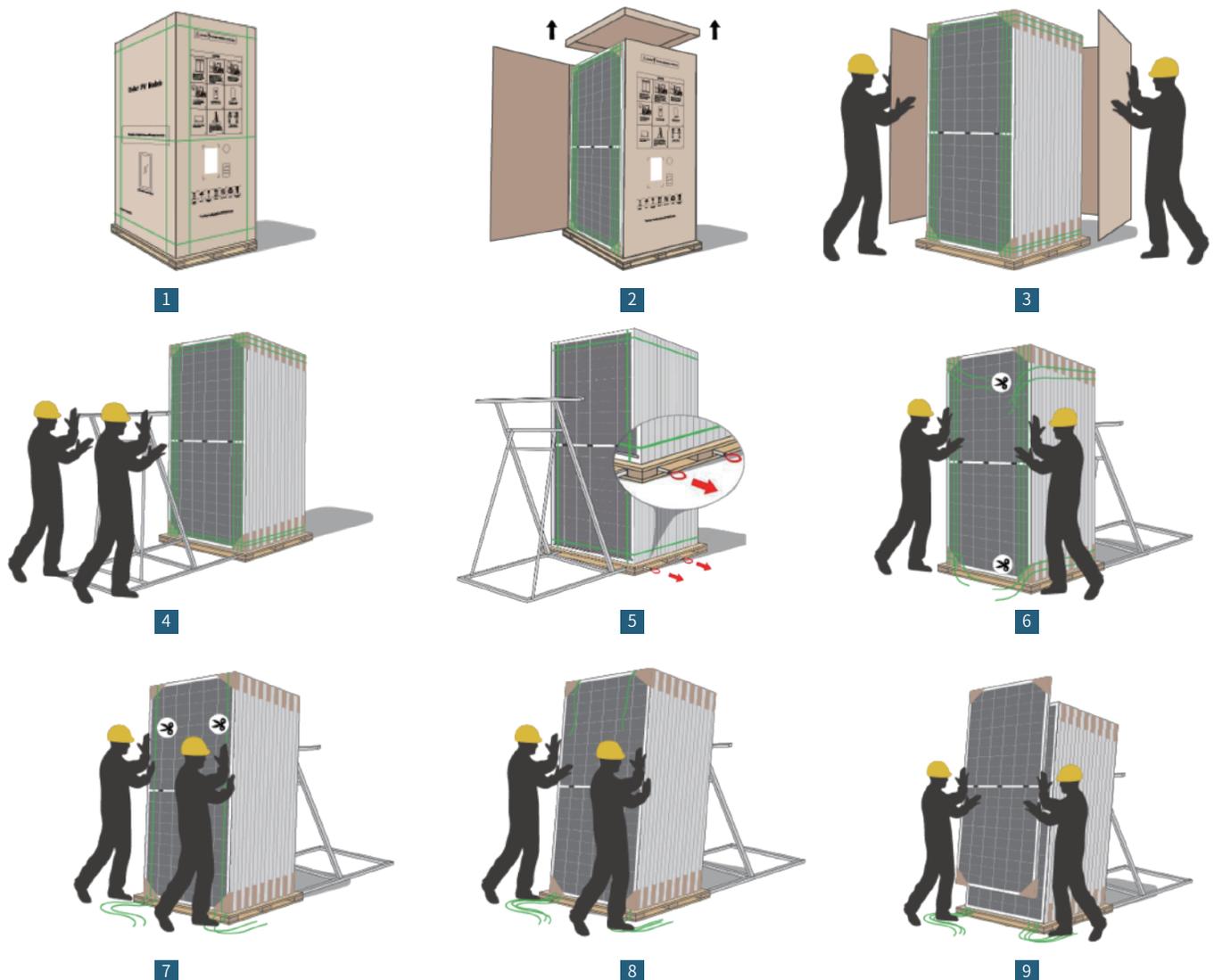
Prepare tools before unpacking: safety helmet, hobby knife (scissors), anti-fall bracket, safety shoes, insulated gloves, etc.



Follow the recommended steps below to unpack the modules. When unpacking, have  $\geq 2$  people work together and wear insulated gloves when handling.

**Long-side vertical package unpacking:** anti-fall supporters must be used.

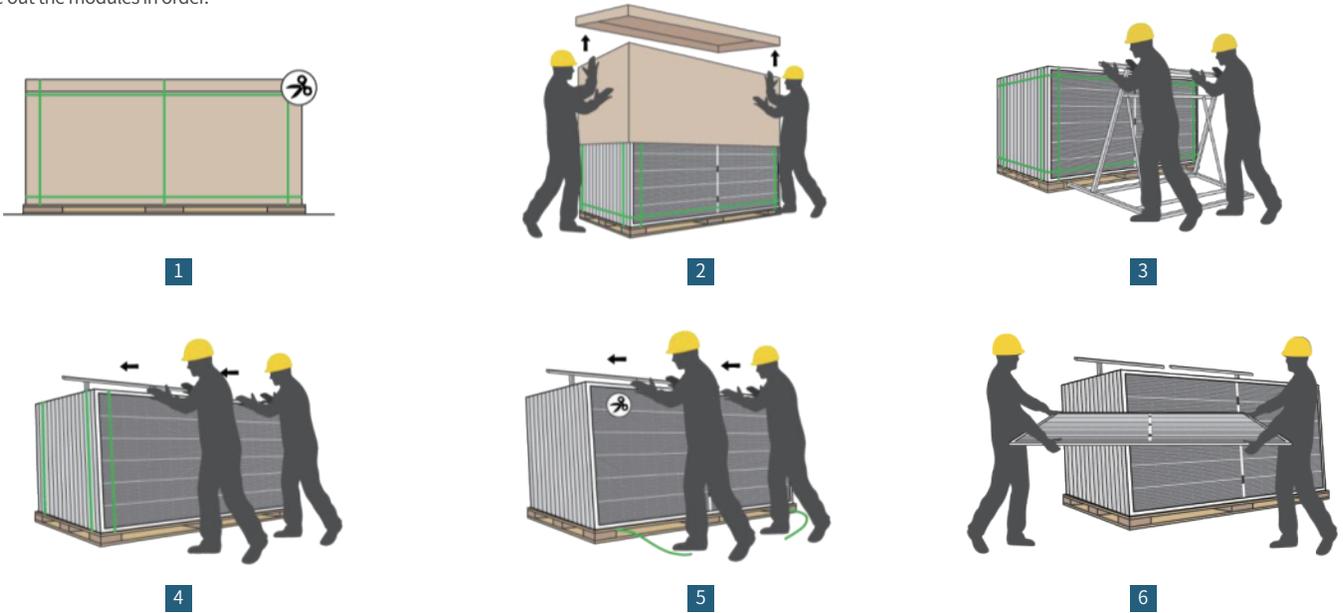
1. Unwrap the protective film, cut off the packing belts.
2. Remove the top cover and sealing tape.
3. Remove the carton box.
4. Position the stand supporter on either the glass or backsheet side.
5. Withdraw the 4 levers located on both sides of the pallet.
6. Cut off all horizontal packing belts.
7. As there remain 1-2 vertical packing belts, push the module gently to tilt toward the stand supporter.
8. Cut off the remaining packing belts so that the modules rest on the stand supporter.
9. Take out the modules in order.



Long-side vertical package unpacking steps

Short-side vertical package unpacking: modules need to have fixed supports (walls, stands, unpacked modules, etc.)

1. Unwrap the protective film, cut off the packing belts.
2. Remove the top cover and the carton box.
3. Ensure the stand supporter is positioned above or wider than the module to prevent any contact that could potentially damage the glass.
4. Cut off all the horizontal packing belts, when 1 or 2 vertical packing belts are remaining, push the module gently to tilt toward the stand supporter.
5. Cut off the remaining packing belts.
6. Take out the modules in order.



Short-side vertical package unpacking steps

## 7 Installation

### 7.1 Environmental conditions

Golden Solar advises installing the module in an operational environment where the ambient temperature ranges from  $-20^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ , ensuring it does not surpass the temperature limits of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Application altitude of Golden Solar modules:  $< 2000\text{m}$ .

The mechanical load described in this manual are the test load. The maximum test load of module is  $5400/2400\text{Pa}$ , the design load of module is  $3600/1600\text{Pa}$ , and the safety factor is 1.5. The calculation formula is:

Test load = Design load  $\cdot$  1.5

The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that the installation methods used meet these requirements and any local codes and regulations.

### 7.2 Site selection and angle

Position the modules to minimize the chances of shading at any time of the day. Shading can normally be minimized by ensuring that the distance between the obstruction and the solar array is greater than three times the obstruction's height.

Different roof configurations and installation methods can affect the fire safety performance of a building, and a fire may start if the modules are not installed properly. To meet the fire rating of the roof, the minimum clearance between the module and the roof is 115mm.

When all solar modules are mounted in the same elevation and azimuth angles, then all can be expected to have similar performance throughout the day and can be connected to the same inverter channel.

If solar modules on the same installation are mounted at different elevation and azimuth angles, then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPTs (Maximum Power Point Trackings) if the inverter has more than one MPPT). Refer to inverter manufacturers for further guidelines.

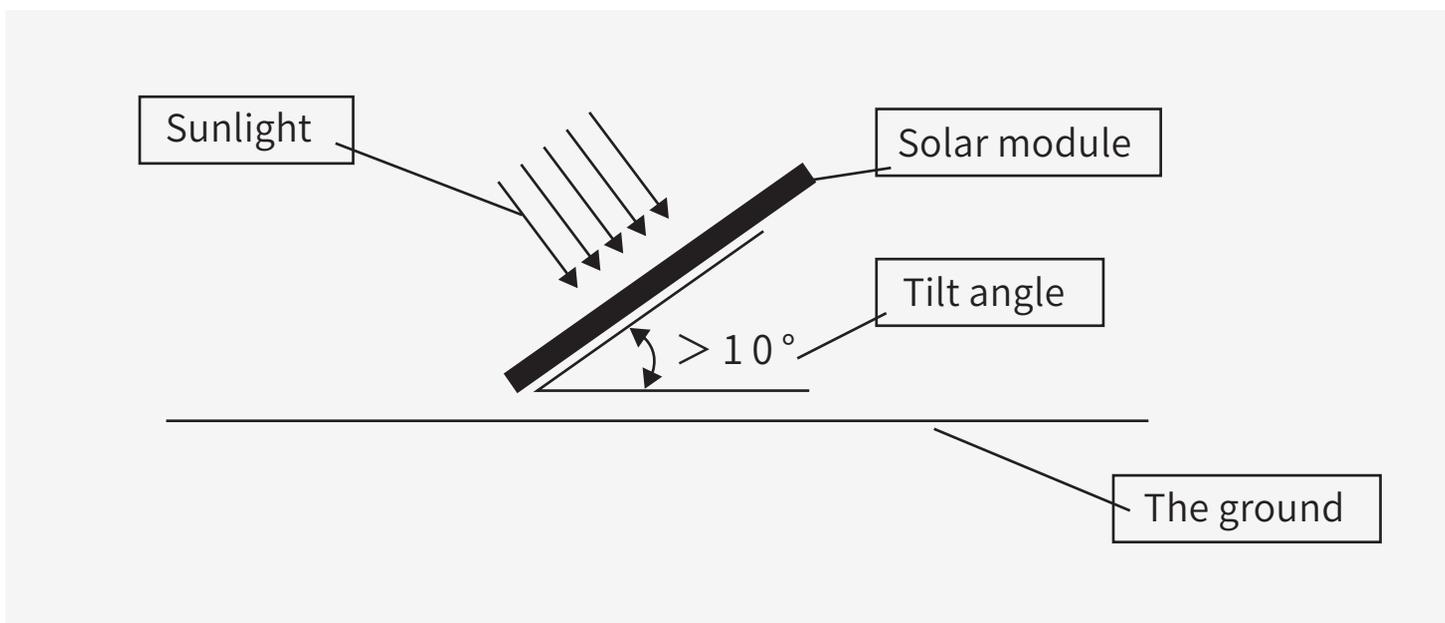
Do not install modules in a location where they will be immersed in or continually exposed to water.

Golden Solar modules have passed the test of PV modules' salt mist corrosion and can be safely installed in corrosive salt areas within proximity of the ocean or sulfurous areas.

Golden Solar modules have passed the test of PV modules' ammonia corrosion and can be safely installed in ammonia-heavy environments, such as farmhouses.

Golden Solar modules can be mounted in landscape and portrait orientation however the impact of dirt shading the solar cells can be minimized by orienting the product in portrait.

For optimum energy production, solar modules should normally be mounted facing the equator. For different projects, different mounting tilt angles should be chosen according to local conditions, and Golden Solar recommends a module tilt angle of not less than  $10^{\circ}$ . The specific tilt angle selection can be based on the local implementation of the design procedures, norms, regulations, or follow the PV module installer's recommendations.



For installations in the northern hemisphere, it is recommended that modules should preferably face south, and for installations in the southern hemisphere, it is recommended that modules should preferably face north. If solar modules are mounted at a different elevation and azimuth angles, the annual energy production may potentially be adversely impacted.

### 7.3 Installation methods

#### 7.3.1 Installation with clamps

Golden Solar has tested its modules with a number of clamps from different manufacturers, please select the appropriate clamps. Module with frame clamps meet the following requirements: thickness:  $\geq 3\text{mm}$ , length:  $\geq 50\text{mm}$ , material: aluminium alloy, bolts: M8, tightening torque:  $16\sim 20\text{N}\cdot\text{m}$ . The clamp must overlap the module frame by at least 7mm but no more than 10mm.

Use at minimum 4 clamps to fix modules on the mounting rails.

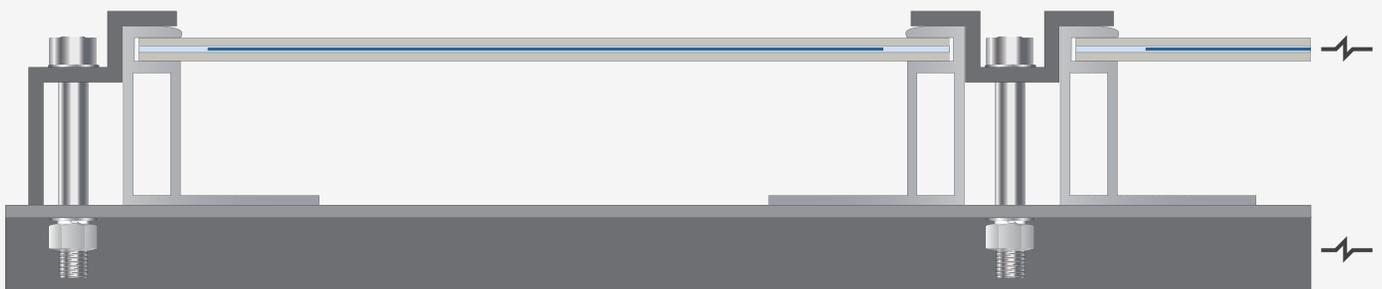
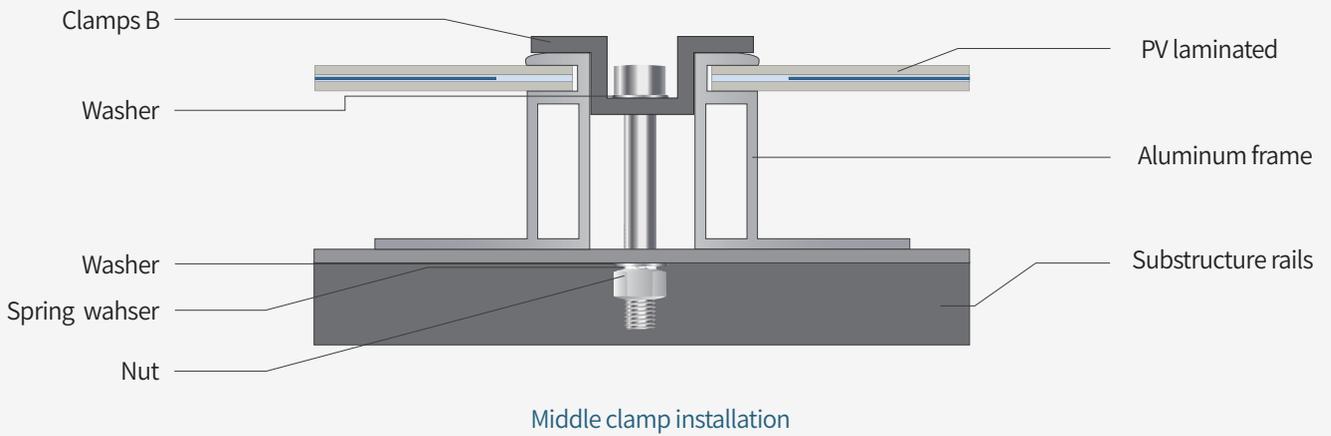
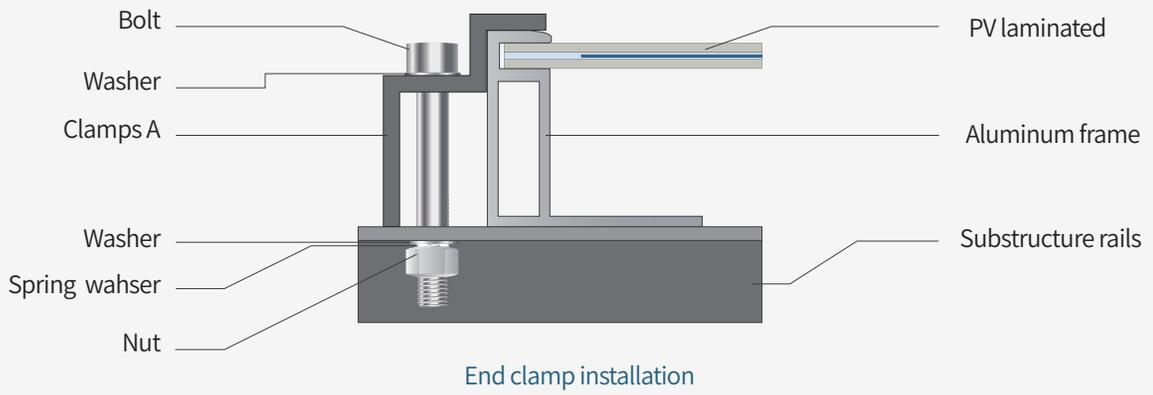
Module clamps should not come into contact with the front glass and must not deform the frame.

Be sure to avoid shadowing effects from the module clamps.

The module frame is not to be modified under any circumstances.

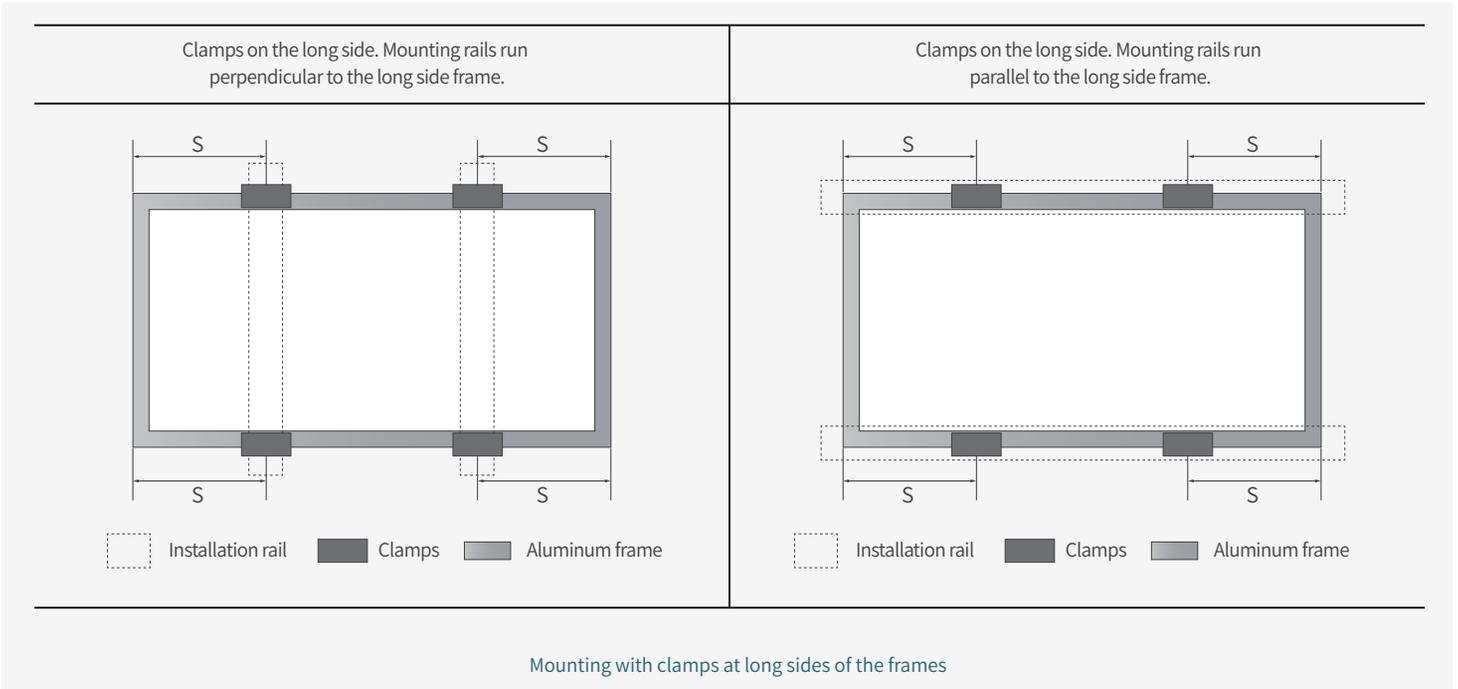
When choosing this type of clamp-mounting method, use at least four clamps on each module. Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.

Module installed with clamp fitting method:



### Clamp installation position:

Clamp positions are of crucial importance for the reliability of the installation. The clamp centerlines must only be positioned within the ranges indicated in table below, depending on the configurations and loads.



Module type	A*B	Clamp mounting distance (S)	Mechanical loads
JGDN132- XXX-YY	2384*1303	A/4	Uplift load $\leq 2400\text{Pa}$ Downforce Load $\leq 5400\text{Pa}$
JGDN120- XXX-YY	2384*1303	A/4	Uplift load $\leq 2400\text{Pa}$ Downforce Load $\leq 5400\text{Pa}$
JGDN144- XXX-YY	2278*1134	A/4	Uplift load $\leq 2400\text{Pa}$ Downforce Load $\leq 5400\text{Pa}$
JGDN108- XXX-YY	2278*1134	A/4	Uplift load $\leq 2400\text{Pa}$ Downforce Load $\leq 5400\text{Pa}$
JGDN108B- XXX-YY	2278*1134	A/4	Uplift load $\leq 2400\text{Pa}$ Downforce Load $\leq 5400\text{Pa}$

Remark: A=module length, B=module width

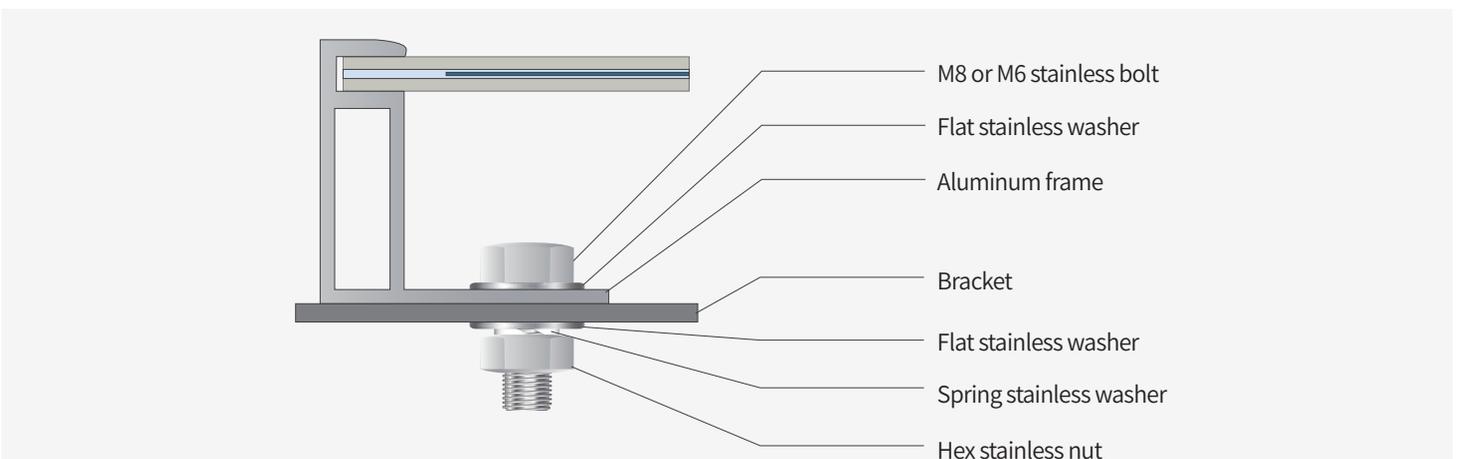
### 7.3.2 Installation with bolts

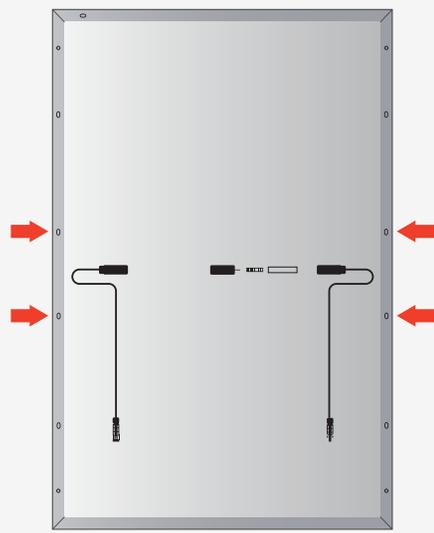
The frame of each module has 8 mounting holes used to secure the module to support structure. The module frame should be attached to a mounting rail using 4 M6 bolts or 4 M6 bolts and 4 M8 bolts together with spring washers and flat washers in symmetrical locations on the PV module. Golden Solar recommends to use corrosion proof (stainless steel) fixings.

The hole size for M8 bolt is 9\*14mm and M6 bolt is 7\*10mm. The torque value for M8 bolt is 16~20N·m and M6 bolt is 8N·m. For special racking systems or systems with special installation requirements, please reconfirm with the supplier for the appropriate torque value.

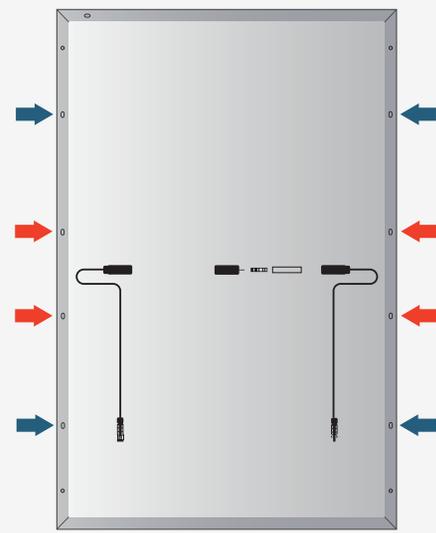
The maximum test load of module is 5400/2400Pa (including safety factor of 1.5).

Module installed with bolt fitting method:





Installation with 4 mounting holes  
in most environmental conditions



Installation with 8 mounting holes  
in harsh environmental conditions

## 7.4 Installation precaution and instruction

PV modules can be mounted to the substructure using specially designed module clamps.

Regardless of the fixing method, the final installation of the modules must ensure that:

A clearance of at least 115mm is provided between the module's frame and the surface of the wall or roof.

The minimum distance between two modules is 10mm.

The mounting method does not block the module drainage holes.

Panels are not subjected to wind or snow loads exceeding the maximum permissible loads and are not subject to excessive forces due to the thermal expansion of the support structures.

Consult local laws and regulations before installing modules and comply with building fire requirements. According to the IEC 61730-2 standard, the fire rating of our modules is Class C, which is suitable for the roof of application Class A.

At the time of roof installation, the roof must be covered with a layer of fireproof material suitable for this grade, and sufficient ventilation between the back plate and the installation surface must be ensured.

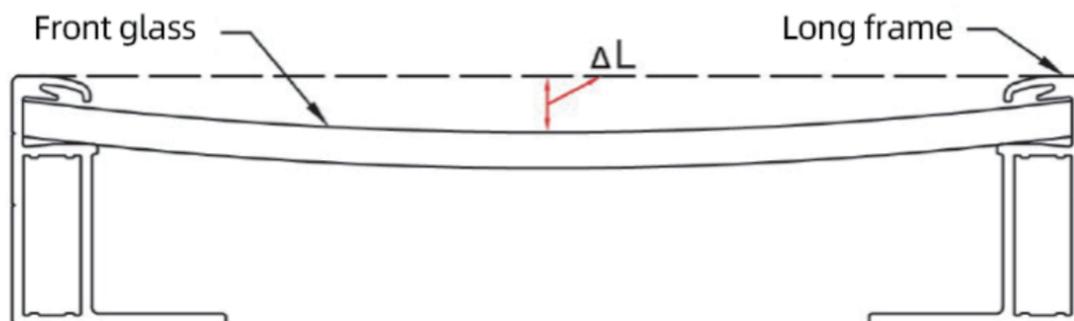
The structure and installation of the roof will affect the fire safety performance of the building. Improper installation may result in a fire. To ensure the fire rating on the roof, the minimum distance between the frame of the module and the roof surface is 115mm.

Use appropriate modules and accessories such as fuses, circuit breakers, and grounding connectors as required by local regulations.

Golden Solar modules are certified for operating in Class II installations at voltages below 1500Vdc. This maximum voltage should not be exceeded at any time and, as the voltage of the module increases, above data sheet values, at operating temperatures below 25°C, then these need to be taken into account when designing a PV system.

Under normal conditions, a solar photovoltaic module is likely to produce more current and /or voltage than reported under standard test conditions. Accordingly, the value of  $I_{sc}$  (Short-circuit Current) marked on this module should be multiplied by a factor of 1.25 when determining the conductor current ratings, fuse sizes, and size of controls connected to the SPV (Solar Photovoltaic) output.

Due to gravity, the glass surface of the module will sink to varying degrees, with the greatest amount of sinking occurring at the center of the module. The maximum permissible deflection ( $L$  in the diagram below) is 20mm when using a bolt mounting, block mounting or tracking bracket mounting system that is not subject to external forces such as wind or snow loads. Please note that when storing, transporting and installing the module, the application of external weight on the surface of the module may result in a greater amount of subsidence of the glass surface.



## 8 Electrical Installation

### 8.1 Wiring

All wiring should be performed, by qualified installers, in accordance with the local codes and regulations.

Modules can be connected in series to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion-free, clean, and dry.

A product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings, then check the string configuration before making the connection.

Golden Solar modules are provided with stranded copper cables with a cross-sectional area of 4mm<sup>2</sup> which are rated for 1500Vdc, 90°C, and are UV resistant. All other cables used to connect the DC system should have a similar (or better) specification. Golden Solar recommends that all cables are run in appropriate conduits and sited away from areas prone to water collection.

The maximum voltage of the system must be less than the maximum certified voltage (1500V typically) and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done using the following formula:

$$\text{System voltage} \geq N \times \text{Voc} \times (1 + \text{TCvoc} \times (\text{Tmin} - 25))$$

\*Notes:

N: Number of modules in series.

Voc: Open circuit voltage of each module (refer to product label or datasheet).

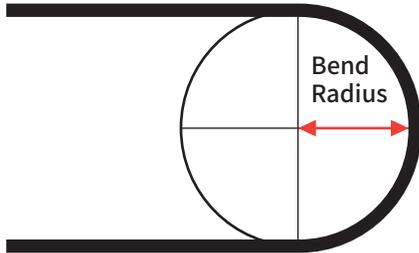
TCvoc: Thermal coefficient of open circuit voltage for the module (refer to table (add)).

Tmin: Minimum ambient temperature.

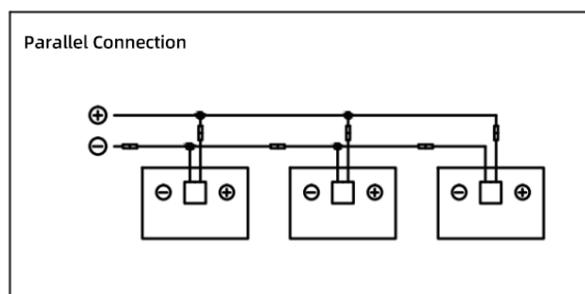
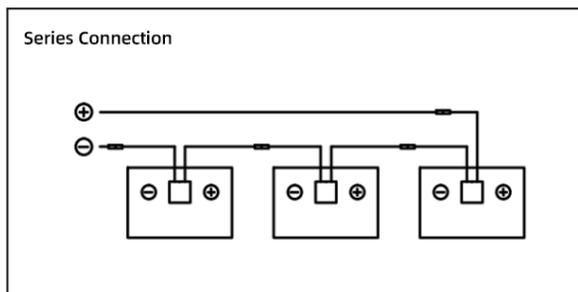
The minimum and maximum outer diameters of the cable are 5 to 7mm<sup>2</sup>.

For field connections, use at least 4mm<sup>2</sup> copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV Wire.

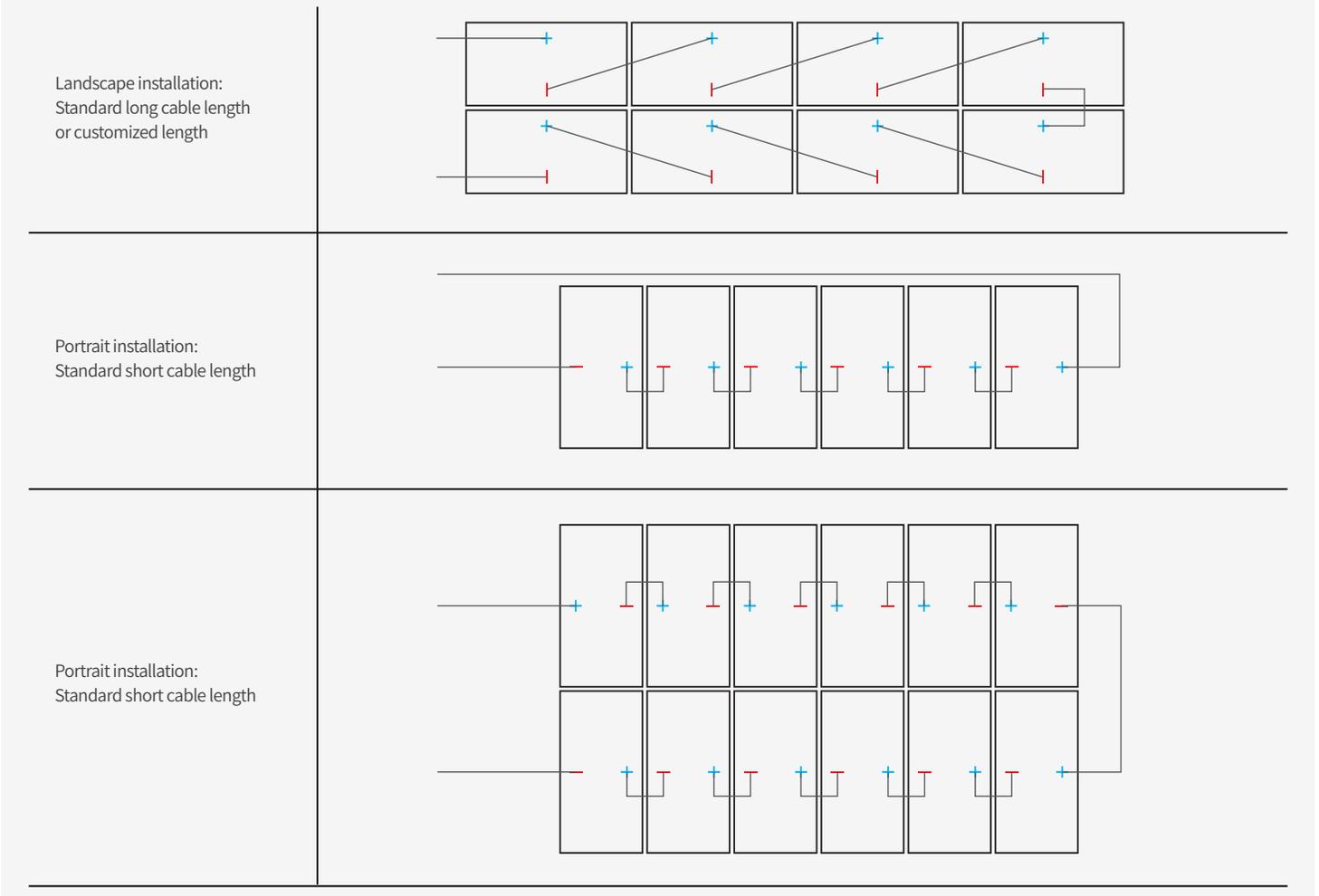
The minimum bending radius cables should be 43mm.



To ensure the system operates correctly, it is important to observe and confirm that the polarity of the cables is correctly connected when connecting modules or loads such as inverters, batteries, etc. If the modules are connected incorrectly, the bypass diodes may be damaged. The diagram below illustrates the series and parallel connections of the modules. PV modules can be connected in series to increase voltage. Series connection involves connecting the wire from the positive terminal of one module to the negative terminal of the next module. PV modules can be connected in parallel to increase current. Parallel connection involves connecting the wire from the positive terminal of one module to the positive terminal of the next module. If the modules are connected incorrectly, the bypass diodes may be damaged.



## Series and parallel connection circuit diagram



### 8.2 Connector

The male and female connectors should correspond one to another and should not be mismatched.



Connector type of module

Connector type (female)	Allowable mating connector type (male)
MC4 EVO2 compatible (female)	MC4 EVO2 compatible (male)

### 8.3 Blocking diode

In a system that uses a battery, blocking diodes are typically placed between the battery and the module output to prevent battery discharge at night and in rainy weather.

Diodes that are used as blocking diodes must have a:

1. Rated Average Forward Current [IF(AV)] above the maximum system current at the highest module operating temperature.
2. Rated Repetitive Peak Reverse Voltage [VRRM] above the maximum system voltage [Vmax] at the lowest module operating temperature (IEC: Vmax=1500V).

### 8.4 Bypass diode

Partial shading of an individual module can cause a reverse voltage across the shaded module. Current is then forced go through the shaded area by the other modules. When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses.

## Diode type of module

Connector type (female)	GFT5050CT
	40SQ045
	MK5045D
	QCM5045B
	TM3045-30
	TM3045-25
	40SQ050A
	GFT4050SM

## 8.5 Fusing

When fuses are fitted, they should be rated for the maximum DC voltage and connected in each, non-grounded pole of the array (i.e. if the system is not grounded then fuses should be connected in both the positive and negative poles).

The maximum rating of a fuse connected in series with an array string is typically 20A but the actual module specific rating can be found on the product label and in the product datasheet.

This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings in parallel. Parallel module configurations: fuse rating/Isc.

## 8.6 Inverter compatibility

When installed in systems governed by IEC (International Electrotechnical Commission) regulations, Golden Solar modules normally do not need to be electronically connected to the earth and therefore can be operated together with either galvanically isolated (with transformer) or transformer-less inverters.

Potential Induced Degradation (PID) is sometimes observed in PV modules due to a combination of high humidity, high temperature, and high voltage. PID is most likely to cause degradation under the following conditions:

1. Installations in warm and humid climates.
2. Installation close to a source of continual moisture, such as bodies of water.

Golden Solar recommends the use of an inverter that includes a transformer as well as proper grounding of the negative DC leg of the PV array.

Choose inverters with isolation transformers in hot and wet areas (such as shores, wetlands), to ensure proper module function under positive voltage.

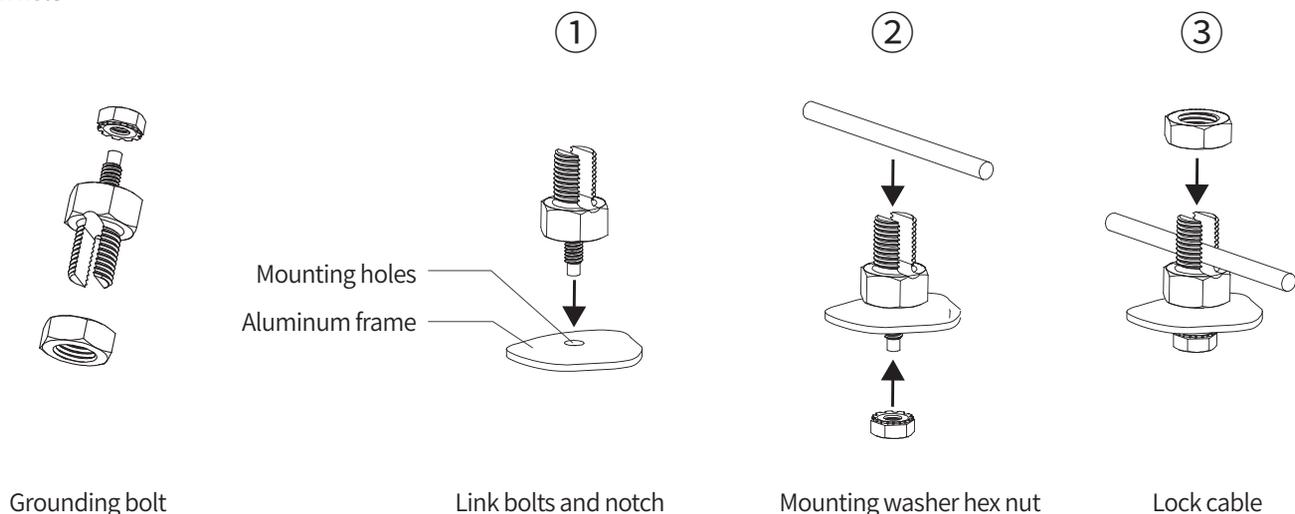
## 9 Grounding

All module frames and mounting racks must be properly grounded in accordance with the appropriate respective National Electrical Code.

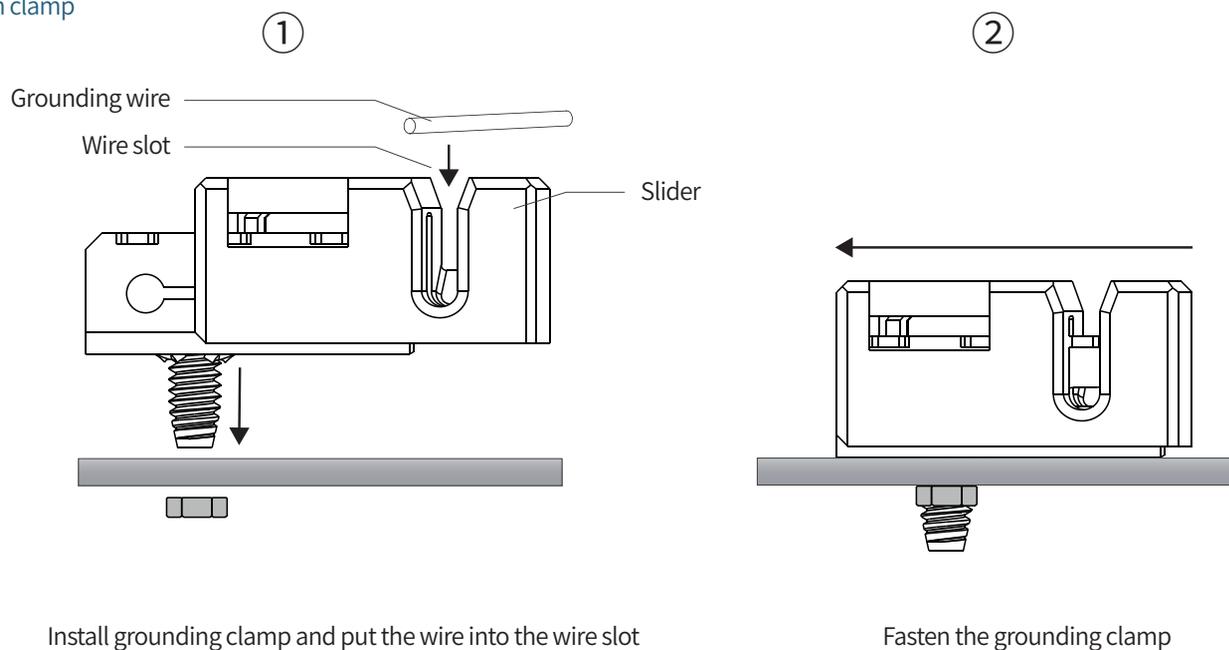
Proper grounding is achieved by bonding the module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor per respective National Electrical Codes. The grounding conductor must then make a connection to the earth using a suitable earth-ground electrode.

### Recommended grounding method:

#### With hole



#### With clamp



Golden Solar modules can be installed with the use of third-party listed grounding devices for grounding the metallic frames of PV modules. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions.

For roof, utilize 40\*4mm galvanized flat steel to create a 24m\*16m grounding grid firstly. Modules and rails are securely connected through grounding bolts. Between each string of modules, and via the rails and 16mm<sup>2</sup> equipotential bonding wires, equipotential bonding is achieved. This is then reliably connected to the roof's flat steel grounding grid. The roof's grounding grid is further connected to the original roof grounding strip. This serves as a pathway for lightning protection and discharge.

The connections between modules and rails, between rails, between rails and equipotential bonding wires, between rails and flat steel, and between flat steel and grounding grid must be securely connected to ensure safety. The positions of connection points and flat steel can be adjusted slightly according to the actual construction situation. The grounding grid passing through expansion joints must be bent into a U-shape. The grounding resistance should be less than 4 Ω.

## 10 Maintenance and Care

Modules must be inspected and maintained on a regular basis, which is a responsibility of the user.

### 10.1 Inspection and replacement

Performing a preventive inspection every six months is advisable, and refrain from replacing module components without proper authorization. Should there be a need for electrical or mechanical performance inspection or maintenance, it is strongly advised to enlist the services of qualified professionals to conduct the operation, thus mitigating the risk of electric shock or personal injury.

Disconnect the circuit breaker before inspection. Damage to modules, such as broken glass, cables, or junction boxes, can lead to functional and safety issues. In case of damage, replace the affected module with a new one of identical type. Avoid contact with live cables or connectors.

Inspect that the mounting hardware is properly tightened.

Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.

Inspect that all string fuses in each non/earthed pole are operating.

Inspect if vegetation is obscuring modules.

Inspect if there is any breakage of modules' glass.

Inspect if there are burn marks on the back of modules.

### 10.2 Cleaning

The electricity output of a solar module depends on the amount of sunlight it receives. Modules with shaded cells produce less energy, underscoring the importance of maintaining clean PV modules. Regular cleaning is necessary to remove dirt, such as bird droppings, leaves, and dust.

Golden Solar recommends using a soft cloth together with a mild detergent and clean water to clean modules.

To avoid severe thermal shocks which might damage the module by cleaning modules with water that has a similar temperature to the modules being cleaned. The temperature difference between the water and the module is in the range of -5°C to 10°C.

To minimize the risk of potential electric shock or burns, Golden Solar recommends cleaning modules during the early morning or evening when sunlight is weaker and module temperatures are lower, especially in areas with higher temperatures.

It is strictly prohibited to attempt cleaning modules that exhibit characteristics such as damaged glass or back surface, or exposed wires, as these pose a risk of electric shock.

The back surface of the module normally does not need to be cleaned but, in the event, this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.



# GOLDEN SOLAR

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