PV Module Installation Instructions

1 Basic Information

1.1 Preface Introduction

1.1.1 Thanks for purchasing PV modules of Nanjing Saiko renewable energy Co.Ltd. This manual refers to PV modules manufactured or sold by our company.

This manual contains the information of installation and safe handling of PV modules (hereafter is referred to as “module”).

1.1.2 All instructions shall be carefully read before installation. Please contact our sales department for further information if you have any question.

1.1.3 The installer shall be familiar with the mechanical and electrical requirement of PV system. The installer shall comply with safety precautions listed in this manual and local law regulations when installing the modules.

Our company does not take the responsibility for the loss, damage, or expense arising that caused by any violation of this manual.

1.1.4 Our company reserves the rights for modifying product manual or installation manual without noticing in advance.

1.1.5 This manual shall be properly kept for future reference (care and maintenance) and in case of sale or disposal of the module at the end of its useful life.

1.1.6 Our company reserves the right of final interpretation of this installation manual.

1.2 Warnings

1.2.1 It requires specialized skills and knowledge for installation of solar photovoltaic systems. It should be operated by professional installation personnel who have qualified licensed.

1.2.2 When the modules are exposed to sunlight or other light sources, DC current is generated in the modules. At this time, if touching the electrical part of the modules, it may happen electric shock hazard.

1.2.3 Apply modules to such as ground, roofs etc. outdoor environment. If the modules are installed on the roof, they must be installed on the roof with a certain fire protection capability. Consult the local construction department to decide which roof material to use. Appropriate rack structure shall be designed by system designer or installer. When the module is installed on a bracket parallel to the roof or wall. The minimum gap between the module frame and the roof or wall is 10cm, and air circulation is required to prevent damage to the wiring.

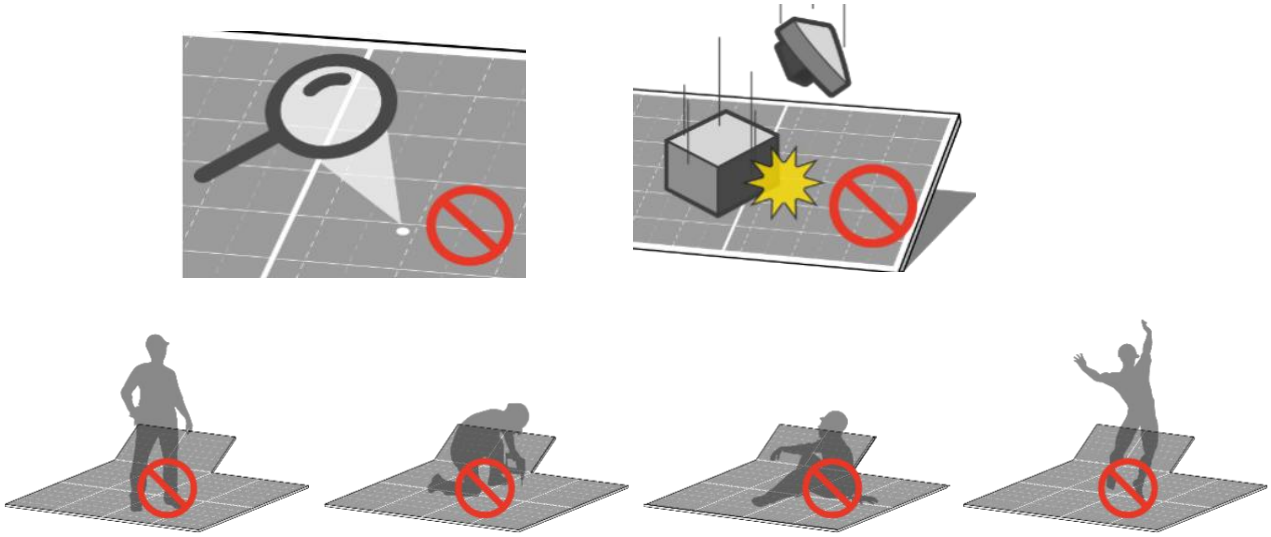
1.2.4 Do not disconnect the cables of modules when modules are on operation.

1.2.5 Do not disassemble modules or move nameplate or any adhesion parts of modules.

1.2.6 Do not place the modules where it is easy to produce or gather combustible gases.

1.2.7 Do not use Artificially concentrated sunlight on the module. Do not expose the back of the module to sunlight for a long time.

1.2.8 Avoid dropping or covering on the modules. Do not tread, stand or walk on modules, because there is a risk of damage to the module and harm to person.

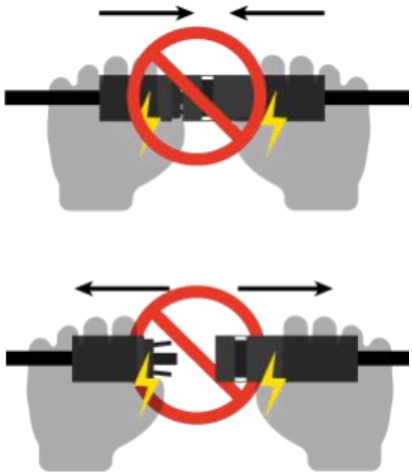


1.2.9 Avoid moving the modules by pulling cables or the junction box.

1.2.10 Keep children away from modules during transportation and installation.

1.2.11 Avoid wearing metal rings, bracelet, earrings, nose rings, lip rings or any metal accessories during transportation and installation of the modules. Do not touch electrical part of the modules by hand without

any insulated protection. Use insulated tools which satisfy electrical requirement to connect electrical parts of the modules.



1.2.12 During transportation of the modules, please make sure that any impact and strenuous vibration should be avoid. The impact and strenuous vibration have possible to lead cracks of solar cell in the modules. When the modules arrive the destination, before installation, the module should be placed on the flat ground with protection which has ability to avoid moisture, wind, rain and snow. Please unpack carefully.

1.2.13 Avoid any damage of the glass of the module, which can protect the modules. Avoid any damage of the seal on the edge of the modules. Without seal protection, the modules have risk of destroy. The damage modules have risk of electric shock or fire. The damage module can’t be repaired. If there is any damage on the modules, please replace the modules immediately.

1.2.14 In order to reduce the risk of electric shock or combustion, it is possible to cover the surface of the modules with opaque material when installing modules.

1.2.15 Installers should make sure firm connections between the rack and PV module without loose connections.

1.2.16 All modules system must be grounded. If there is no special requirement, please comply with the International Electrical Standards or other international standards.

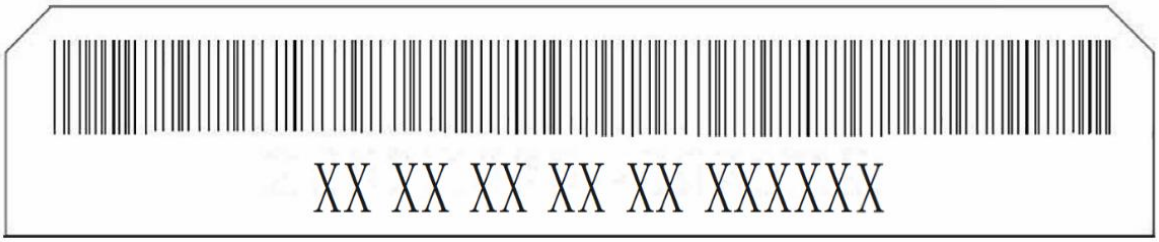
1.2.17 Do not clean the modules with corrosive chemicals.

1.2.18 It is possible to affect fire resistance of the house if roof-mounted. According to IEC61730, the level of fire resistance of modules, which is installed on roof, is class A for Single Glass solar module, and is class C for Dual-glass solar module. For roof application, the estimate of fire control level of module system should combine module and roof condition. Only correct installation, which accords to installation instruction, the fire resistance of module system is effective.

1.2.19 During the storage, transportation, installation and maintenance of modules, it is strictly prohibited to contact with any form of oil stain or corrosive chemical reagent.

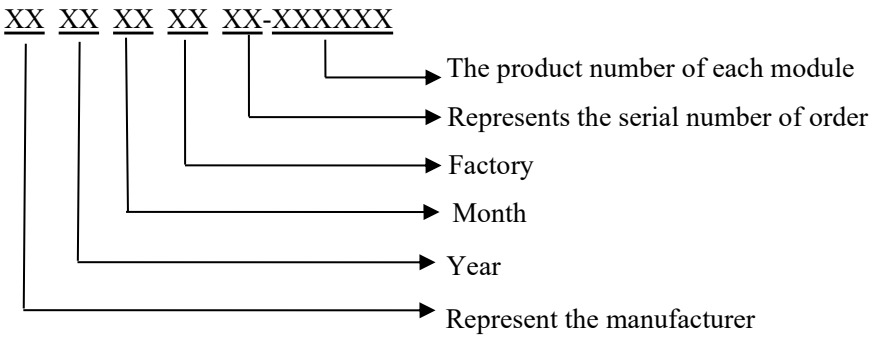
1.3 Product Identification

1.3.1 Each module has a label on the back, generally containing following information: product type, weight, size, fuse current, the system max voltage, rated power measured under standard test conditions, rated current, rated voltage, open circuit voltage, short circuit current.

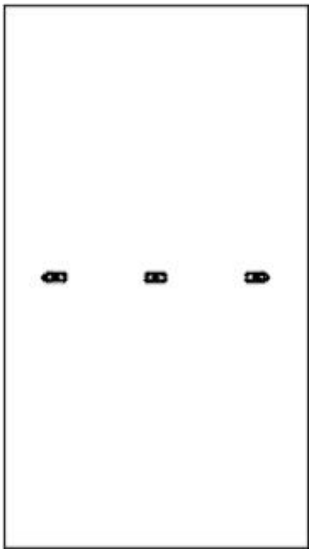
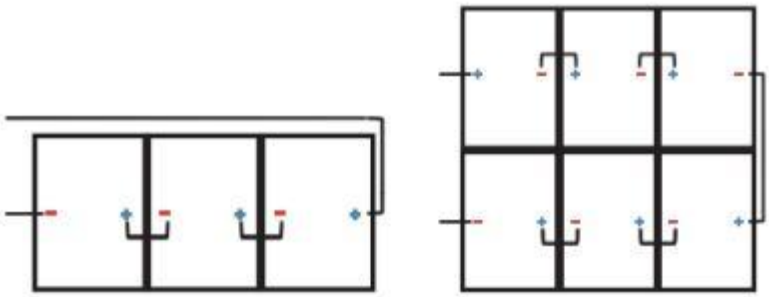
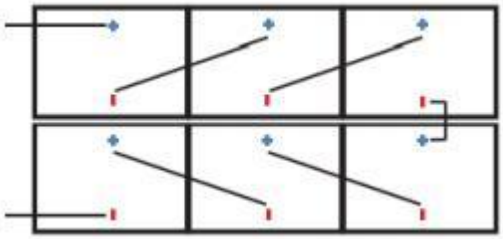


1.3.2 Bar code (serial number): each module is registered with a unique serial number. It is fixed in the module permanently. It can see the barcode in front of the module.

1.3.2.1 The bar code (serial number) of the module is unique, and consists of 16 bits and a line. The first eight digits of serial number are composed of two manufacture codes, three date codes and three order serial Numbers. The line is followed by six numbers of module production. The number of modules each order will not exceed 999999.



1.4 Junction box style and wiring method

Junction Box Location Icon	Recommended Wiring Method
	Vertical Installation: Standard Cable length ： (Note: An extension cord is required at the rotor head of the double row assembly and at the end of the single row.) 
	Horizontal Installation: 60 type PV module cable length ≥1.2m, 72 type PV module cable length≥1.4m, 78 type PV module cable length ≥1.4m 

2 System Design

2.1 Installation Safety

2.1.1 Wear protective headgear, insulating gloves and rubber shoes when modules are installed.

2.1.2 During installation, avoid unnecessary touching of modules. The surface and frame of modules maybe very hot, and there maybe burns or electric shocks.

2.1.3 Do not install in rainy, snowy or windy weather.

2.1.4 Due to the danger of electric shock, if the junction box connectors are wet, please do not install it.

2.1.5 When installing, do not throw anything, including modules and installation tools.

2.1.6 Correct connection junction box, check wiring status, all wiring must not be separated from the modules, and take certain ways to make the wiring will not scratch or extrude the back glass of the modules.

2.1.7 Whether or not the module is connected to the photovoltaic system, during installation or when there is light on the module, please do not connect the junction box or connectors.

2.1.8 Do not overweight luggage or objects on the surface of modules, or distort the frame of modules.

2.1.9 It is forbidden to place heavy objects on the glass of modules or to impact them, which may damage or cause cracks in the solar cells.

2.1.10 It is forbidden to use sharp tools to scrub the glass of the modules, which will leave scratches on the modules.

2.1.11 The module frames can appear thermal expansion and cold contraction so the frame interval between two adjoining modules shall be no less than 10mm.

2.2 Installation Conditions

2.2.1 The module should be installed at an ambient temperature of –40° C to +40° C. The module's limit working ambient temperature range is from –40° C to +85° C.

2.2.2 The maximum altitude for PV module is 2000m.

2.2.3 Under standard test conditions (1000W/m^2 irradiance, AM 1.5 spectrum, 25° C (77° F) ambient

temperature), the electrical performance parameters of modules, such as Isc, Voc, and Pmax. Tolerance of rating Pmax is ±3%, Voc and Isc is ±5%.

2.2.4 A suitable installation location shall be carefully selected for modules.

2.2.5 In the northern hemisphere, modules had better be installed facing south direction; in the southern hemisphere, modules had better be installed facing north.

2.2.6 The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface (as shows in Figure 1). The PV module generates maximum output power when it faces the sun vertical. If you want the specific information of best install tilt angle, please consult the local authoritative solar system construction company.

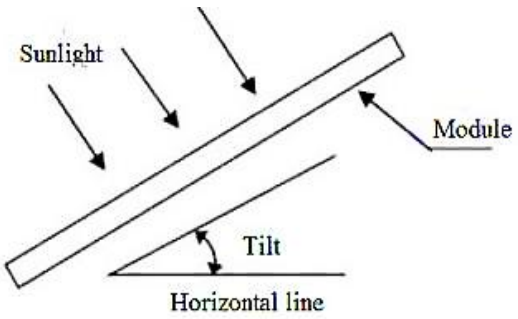


Figure 1 PV module tilt angle

2.2.7 Modules shall be installed in the position of full sun exposure and not be obscured at any time.

2.2.8 All modules are compliant with the salt mist test optional, therefore the modules can be installed as below:

Item	From the sea	Installation	Maintenance
1	Distance≥500m	Standard	Standard
2	50m<Distance<500m	Corrosion protection	Generally and additionally
3	Distance ≤50m	Not recommended	----

2.2.9 When the battery is used in the photovoltaic system, the battery must be installed correctly so as to protect the safe operation of the photovoltaic system. Battery installation, use and maintenance shall be carried out in accordance with battery manufacturer's instructions.

2.2.10 It is recommended that the height of the module is 0.3- 1m higher than actual environment.

2.3 Installation Inclination Angle Selection

2.3.1 PV modules connected in series should be installed in the same orientation and angle.

2.3.2 If connected to an independent photovoltaic system, the installation angle of the module should be based on the season and light conditions to achieve the maximum power output. At the lowest illumination intensity, if the power generated by module with certain angle can satisfy the lowest power generation, it is think that the modules with the certain angle can satisfy the power generation all year around. For grid-connected system, the installation angle of modules depends on the max power generation all year around.

2.4 Choose the Photovoltaic Support

2.4.1 The system designer or installer have responsible for calculation the system load to make sure all module can support the estimated load. The module support manufactures should supply qualitied module supports. The support, which is used for photovoltaic system, should has the third test institution certification about static mechanical analysis ability.

2.4.2 To maximize the utilization of the power generated by the back of the double-sided photovoltaic module, obstacles on the back should be avoided from obstructing the back of the double-sided photovoltaic module.

2.5 Choosing the Photovoltaic Inverter

When choosing photovoltaic inverter, it needs consider the power, open-circuit voltage, short-circuit current of PV modules array. The minimum voltage of the module array should be higher than the threshold voltage of inverters to guarantee the inverters regular work.

2.5.1 Calculation of modules' number in series array Please use the suitable equipment, connectors, wires and rack which match with solar power system. Please make sure the type of the modules is same in a single PV system. When determining rated voltage, wire capacity, fuse, the controller capacity and module output power of relevant parts of PV system, please accord to the short-circuit current (Isc) and open circuit

voltage (Voc) showing on modules' label to determine suitable parameters. In normal outdoor conditions, the current and voltage generated by module maybe different from the parameters listed in Table. The parameter list in table is measured under standard test conditions (STC). Indifferent outside climate surrounding, because of different power generation coefficient, the actual parameters, including rated voltage, wire capacity, fuse, the controller capacity and module power output, is different if modules working in different area. In order to get the actual module's electrical parameters, usually, the photovoltaic system designers or installers can use short-circuit current (Isc) and open circuit voltage (Voc) noted on modules' label multiply by 1.25 (redundant value). If the bifacial modules are installed at high reflective surrounding, the redundant value can increase suitably.

2.5.2 Please make sure the system voltage of each modules' array is lower than the maximum voltage of photovoltaic system, rated voltaic of inverter and controller. The system current of each modules' array is less than maximum current of photovoltaic system, rated current of inverter and controller.

The connection of modules: According to the system requirement of output voltage and current, modules are connected in series or parallel. The maximum number of modules in series (N) is equal to the number of the maximum system voltage (Vmax) divided by the open circuit voltage (Voc) of each module. The number of modules in parallel has relate to the parameters of electrical equipment (such as inverter and controller) in STC.

$$N \leq \frac{Vmax}{Voc * [1 + Tc(voc) * (Tmin - 25)]}$$

N: Number of modules in series.

Vmax: Maximum system voltage

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

Tc(voc): Thermal coefficient of open circuit voltage for the module (refer to data sheet).

Tmin: The lowest ambient temperature.

2.6 Bifacial Module Arrangement and Layout Optimization

Generally, for normal modules' array, there are 2 methods of module connection. The first method connects the upper module and the under module in series. The second method separates the upper and the under modules. All upper modules connect in series, and all under modules connect in series separately. There is significant height difference between upper and under modules. The significant height difference lead to light illumination difference between upper and under modules. The light illumination difference lead different working current of the module. If choosing the first method, the under module, which has lower working current, will decrease the working current of the upper module. The decreasing of upper modules' working current will reduce the whole power generation of photovoltaic system. When choosing the second method, the upper modules and the under modules have different working current. It can decrease power loss due to working current mismatch, which improves the advantage of bifacial modules and increases whole power generation of photovoltaic system. The light illumination rises with height increasing at the same outside surrounding. Therefore, the upper modules have higher light illumination than the under modules. In order to declining the current mismatch, we advise the second modules connection method. At the same time, please connect the upper/under modules' array to the different MPPTs of the inverter individually. This is the best method of modules' array connection for photovoltaic system.

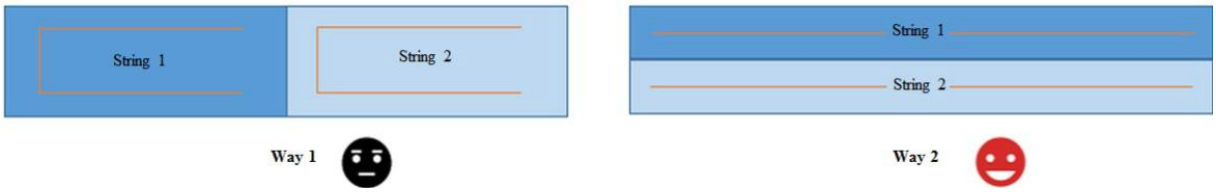


Figure 2 Optimization of modules' array connection

3 Installation

3.1 Installation Safety

3.1.1 Wear protective headgear, insulating gloves and rubber shoes when modules are installed.

3.1.2 During installation, avoid standing on the modules, which will lead to damage of modules, or hazard human safety. Avoid unnecessary touching of modules. The surface and frame of modules may be very hot,

which may lead to burn or electric shock.

3.1.3 Don’t unpack the outside packing of modules except to install immediately. Avoid installing in rainy, snowy or windy weather.

3.1.4 In order to reduce hazard of electric shock, if the junction box connecters are wet, stop installing.

3.1.5 During installing, do not throw anything, including modules and installation tools.

3.1.6 Please make sure connecting junction box correctly. Checking wiring status to ensure that all strong connection without broken. Take adequate measure to avoid any scratch which may damage the cables or pressure which may damage the module.

3.1.7 During installation or sunshine, avoid touching the junction boxes or connectors no matter what the modules are connecting with photovoltaic system or not.

3.1.8 Avoid pressing or putting something heavy on the module’s surface or distorting the module’s frame.

3.1.9 Avoid setting overweight things or hitting on the module’s surface glass, which may lead damage or microcrack of the solar cell.

3.1.10 Avoid cleaning the modules with sharp tools, which may lead to scratch on the surface of modules.

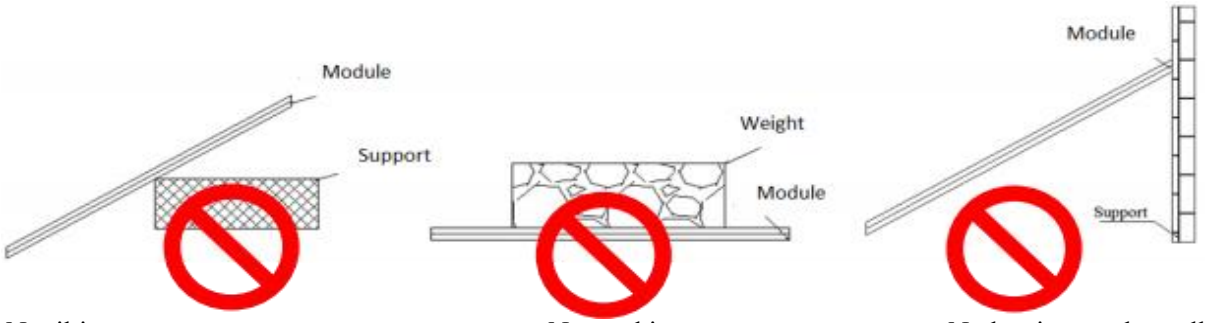
3.1.11 Avoid digging holes on the module’s frame without permission.

3.1.12 For BIPV or roof application, please installing in plan. Please follow the installation rules of "from top to bottom" or / and "from left to right" as much as possible.

3.2 Modules Unpacking

3.2.1 When the modules arrival to destination, avoid unpacking modules in humid and rainy weather.

3.2.2 After unpacking, the modules should be placed horizontally. Avoid tilt, pressure, leaning on the wall of the modules.



No tilting No stacking No leaning on the wall

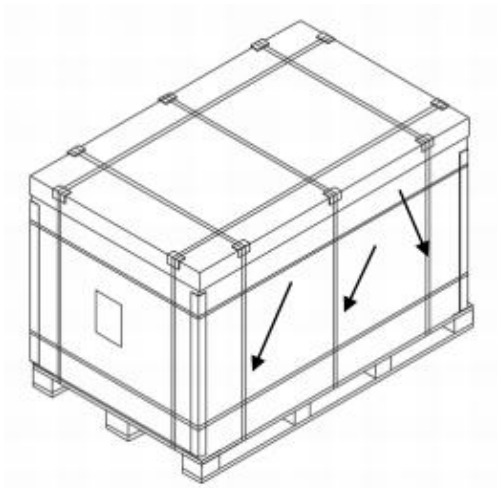
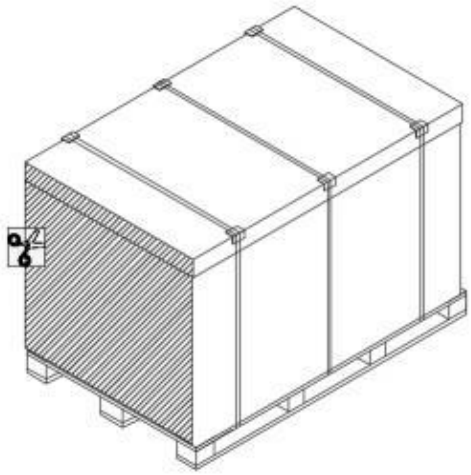
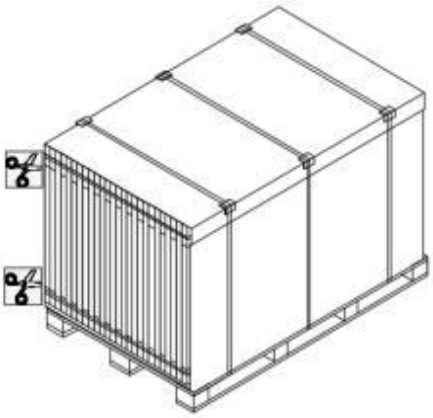
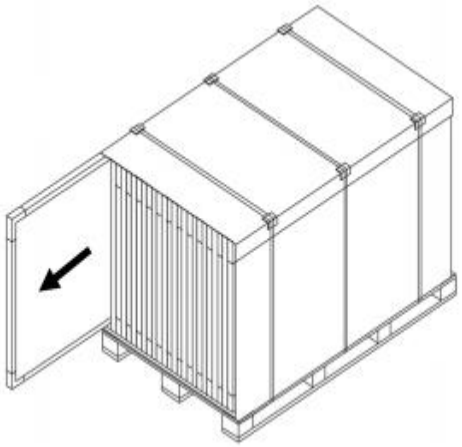
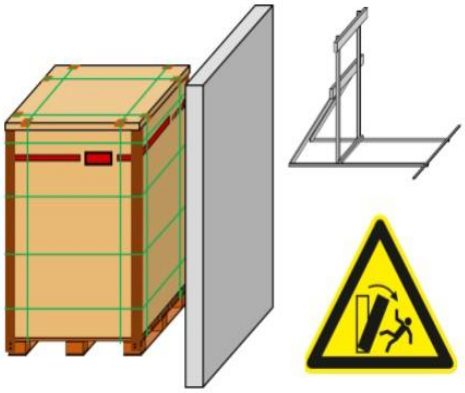
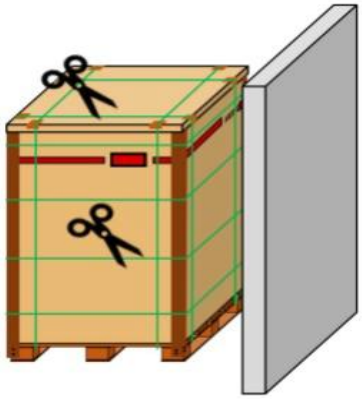
Figure 3 Modules stack illustration

3.2.3 The modules of two batches are separated and stacked neatly. The weight of modules' stack should not exceed 20kg. The number of modules per stack is less than 24pcs. If the weight of module exceeds 20kg, the number of modules per stack is less than 20pcs.

3.2.4 Unpacking process should follow the instructions as the figure below. Avoid rude operation or using crowbar to open the boxes. Pay attention to person and modules safety during unpacking.

3.2.5 After unloading, the modules' box should be placed on dry and flat ground, without wet, muddy and uneven ground condition.

3.2.6 After arriving the destination, the upper and lower modules' boxes should be separated and placed separately without stack. If the modules cannot be installed immediately, it should be care to protect the package of modules' boxes. Avoid any packing damage from natural disasters such as rain, snow, hail, typhoon, etc.

Unpacking process（type1）	
	
1.Do not remove the 3 packing belts indicated by the arrow, and remove the other packing belts of the package.	2.Remove one side of the package (shaded part).
	
3.Cut the two horizontal packing belts in the carton.	4.Disassembly modules from side. According actual surrounding, avoid tipping over or sliding of unpacking modules.
Unpacking process（type2）	
	

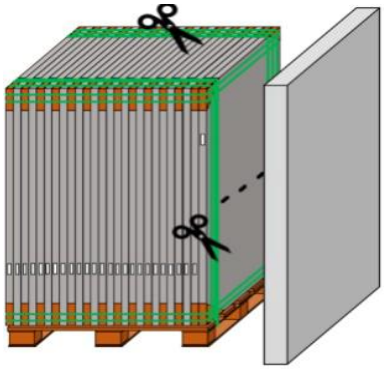
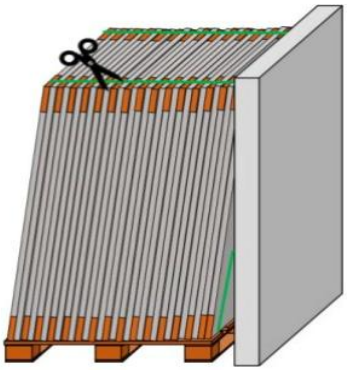
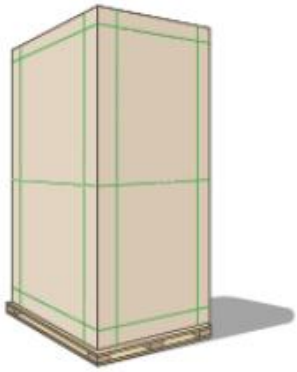
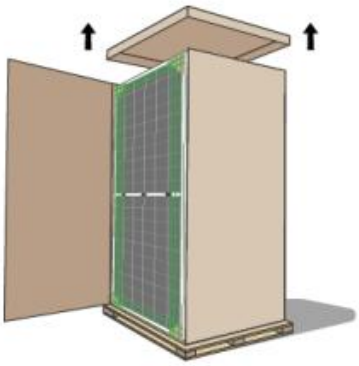
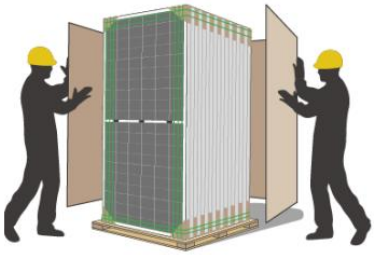
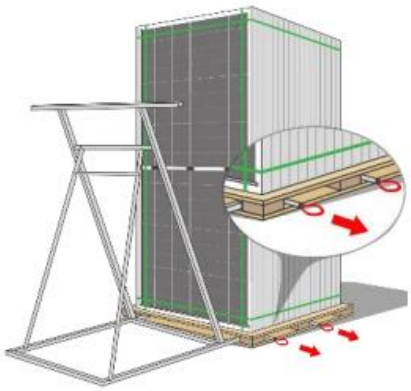
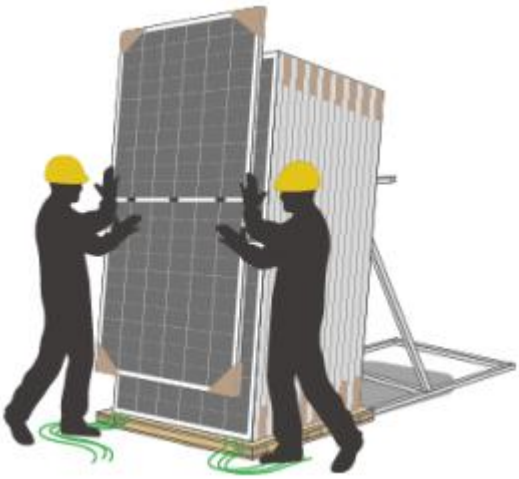
1. Place the pallet on a flat ground next to a solid wall or other support possibility.	2. Remove strapping and packaging box (There are Velcro strips on the diagonal of the packing case to facilitate quick unpacking).
	
3. Remove strapping from modules (leave two straps on the module package, see next picture).	4. Lean the banded module package against the support / wall. Remove last strapping. Modules can be taken individually from the pallet.

Figure 5 Unpacking process

Unpacking process（type3）	
	
1. Cut the packing tape and remove the wrapping film	2. Remove the top cover and remove the sealing tape
	

3. Remove the cardboard box	4. Insert the unpacking bracket into the bottom of the tray from the module glass surface or back panel surface
	
5. Pull out 4 anti retreat bars from the foot support positions on both sides of the tray.	6. Cut off all horizontal packing straps
	
7. When there are 1-2 remaining vertical packing belts, slowly push the modules towards the support frame; Cut off the remaining packing tape and lean against the support frame	8. Transport modules in order

3.3 Introduction of Installation Method

The modules can be installed in the following methods: clamp installation and bolt installation.

3.3.1 All installation methods described in this instruction are only for reference. Our company is not responsible for providing relevant installation parts, design and installation of module system. Mechanical loading and safety should be finished by a professional photovoltaic system installer or PV system technicians.

3.3.2 Before installation, the following important items need to be confirmed:

a) Before installation, it is necessary to check than if there is any defects or other foreign matter which is related with appearance and the safety performance of the junction box. If there is any problem, please solve the problem.

b) Please make sure that the serial number of the module is correct.

3.3.3 If the modules are installed in harsh environments, such as snowy or windy, extra measures are needed to protect the modules.

3.3.4The safety factor of mechanical load is 1.5 times. payload = design load * mechanical load safety factor multiple (1.5).

3.3.5 Modules may have thermal expansion and contraction effects, and the spacing between adjacent modules during installation should not be less than 10mm.

3.4 Installation of Clamps

It suggests to use M8 bolts for module installation. The clamp or belt used for module installation should overlap the aluminum frame. The width of overlap is at least 10 mm (0.4 in) and the clamp thickness is at least 3 mm (0.12 in). All the installation methods described here are only for reference. We are not responsible for the design of installation part and photovoltaic system installation. Mechanical load and safety of photovoltaic system must be performed by a professional system installer or someone with special certification.

• Use more than 4 clamps to fix modules on the support.

• Modules' clamps, which used for module installation, can't shadow the front surface glass and distort module's frame.

• Avoid shadow on the surface of modules.

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

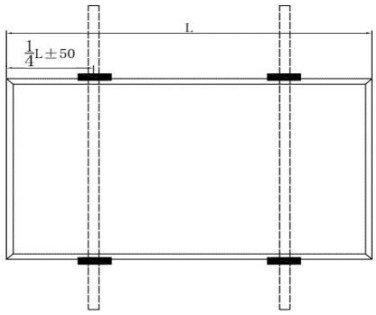
• The mounting bracket shall not be installed directly below the junction box.

When choosing this type of clamp-mounting method, each module needs 4 clamps at least. Depending on

local weather, such as wind and snow condition, additional clamps maybe required to ensure that modules have enough support. (In case of severe environment such as storm and heavy snow, it is recommended to use at least 6 clamps for installation. Please contact with our technical support for further information.)

• Under no circumstances should the fixture come into contact with glass or deform the module's frame. The torque applied during fixture installation should be large enough to firmly secure the module. The applied torque should refer to mechanical design standards and depend on the bolts used by the customer (please consult the installer or support supplier for specific torque values), such as:M8-16-20 N · m (reference value).

Method 1:
Installation of long side pressing block, payload ≤5400 Pa (front), 2400 Pa (back)
(Use 4 clamps- length of blocks≥50mm)



NO.	Module Types
1	166mm Series
FE66/60-166M	
2	18Xmm Series
FE60/54-18X FE60/54-18X (N) FE60/54-18X (ND)	

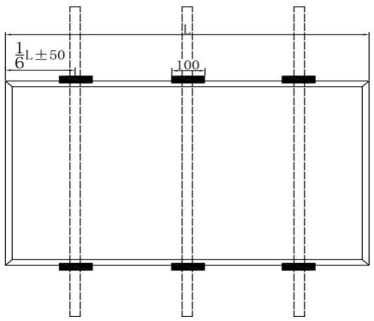
Notes:
1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.

Method 2:

Installation of long side pressing block, payload ≤5400 Pa (front),2400 Pa (back) for Single glass module

Installation of long side pressing block, payload ≤5400 Pa (front),3600 Pa (back) for Dual-glass module

(Use 6 clamps- length of blocks≥50mm)

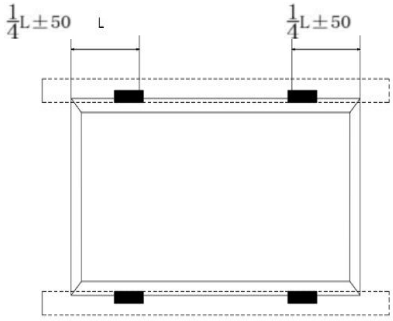


NO.	Module Types
1	166mm Series
FE72-166M	
2	18Xmm Series
FE78/72-18X FE78/72-18X (N) FE78/72-18X (ND)	
3	18X+mm Series
FE66/54-18X+(N) FE66/54-18X+(ND)	
4	210mm Series
FE66/60-210 FE66/60-210(N) FE66/60-210(ND)	

Notes:

1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.

Method 3:
Installation of long side pressing block, payload ≤3000 Pa (front),2400 Pa (back)
(Use 4 clamps- length of blocks≥50mm)

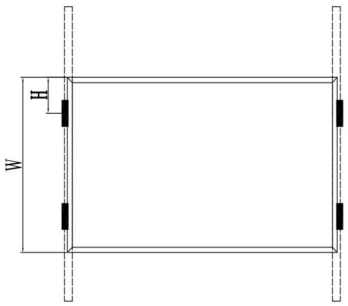


NO.	Module Types
1	18Xmm Series
FE72-18X FE72-18X(N) FE72-18X (ND)	

Notes:
1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.

Method 4:

Installation of short side pressing block, payload ≤2400 Pa (front), 2400 Pa (back) for Single glass module (Use 4 clamps- length of blocks≥50mm)



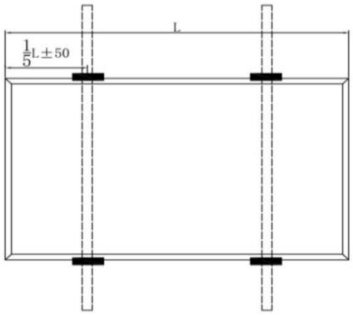
0<H<1/4W

NO.	Module Types
1	166mm Series
FE66/60-166M	
2	18Xmm Series
FE60/54-18X FE60/54-18X (N)	

Notes:
1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.

Method 5:

Installation of long side pressure block, payload ≤3600 Pa(front),2400 Pa (back) for Dual-glass module (Use 4 clamps- length of blocks≥50mm)

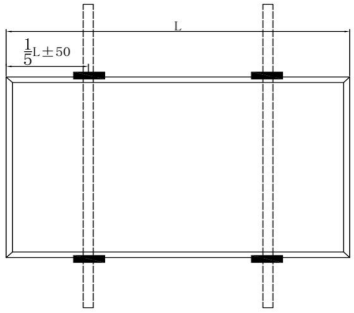


NO.	Module Types
1	18Xmm Series
FE78/72-18X (ND)	
2	18X+mm Series
FE66/54-18X+(ND)	
3	210mm Series
FE66/60-210(ND)	

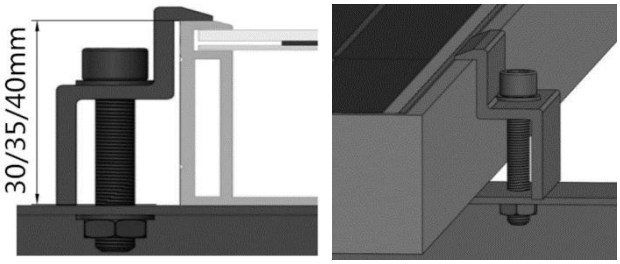
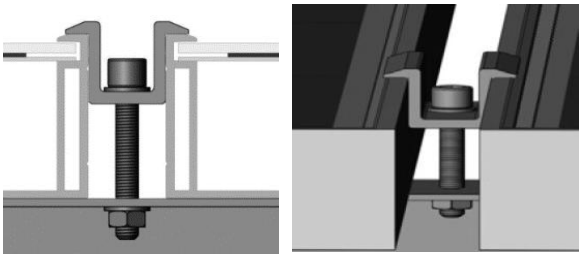
Notes:
1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.

Method 6:

Installation of long side pressure block , payload ≤3600 Pa (front), 2400 Pa (back) for Single glass module (Use 4 clamps- length of blocks≥50mm)



NO.	Module Types
1	166mm Series
FE72-166M	
2	18Xmm Series
FE78/72-18X FE78/72-18X (N)	
3	18X+mm Series
FE66/54-18X+(N)	
4	210mm Series

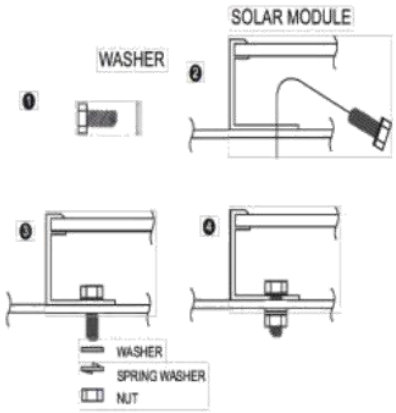
	FE66/60-210 FE66/60-210(N)
Notes: 1.L is the length of PV module. W is the wide of module. The black shadow is the area of installation.	
End clamp installation (40/35/30mm optional)	Middle clamp installation
	
PV module installed with clamp fitting method.	

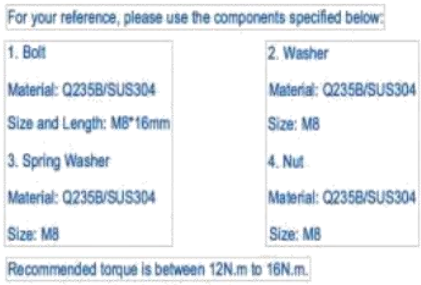
3.5 Installation of Bolts

The frame of each module has several 14×9mm mounting holes. Ideally, the position of holes have ability to optimize the load distribution, to achieve great and strong module support structure.

In order to extend the life of module support, we advise to use anti-corrosion bolts or clamps (stainless steel) strongly.

Use M8 bolt and flat washer, spring washer and nut as shown in Figure 2 in each block. Tighten the bolts until the torque reaching 16-20 N·m. (This is the reference value, and the applied torque should refer to the mechanical design standards. Please consult the installer for specific torque values).

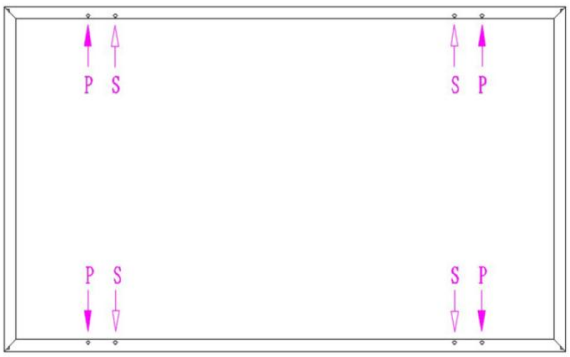




Method 1:

payload≤2400Pa (front), 1800 Pa (back) Use 4 installation holes with S or P holes

payload≤5400Pa (front), 3600 Pa (back) Use 8 installation holes with S and P holes



NO.	Module Type
1	166mm Series
FE72/66/60-166M	
2	18Xmm Series
FE78/72/66/60/54-18X FE78/72/66/60/54-18X (N) FE78/72/66/60/54-18X (ND)	
3	18X+mm Series
FE66/54/48-18X+(N) FE66/54/48-18X+(ND)	
4	210mm Series
FE66/60-210 FE66/60-210(N) FE66/60-210(ND)	

3.6 Installation of Single-axis Tracking System

The bolts and clamps used in this section should follow the requirements in 3.4 and 3.5.

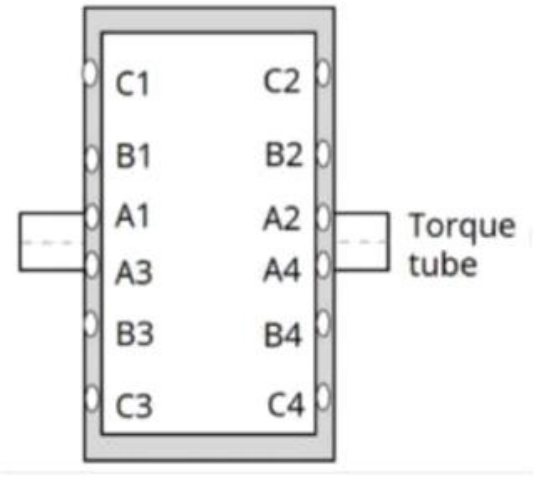
Under any conditions the junction box should not become in contact with the subjacent racking structure except for the torque tube under high loading. For any single axis tracker installation method with portrait one row, bearing house cannot be allowed to locate injunction box position.

If any racking structures, especially bearing house, have to be located under the modules, any racking structure shall not higher than frame C side If your tracker design cannot meet the above distance requirement, please contact the technical department in writing for advices.

Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer. M6 or M8 bolt and nut are used for this bolting method. Tighten the bolts until the torque reach 16-20N.m (0.63-0.79 inches). The modules connected with single-axis tracking system needs special stainless-steel washers with a minimum thickness of 1.5mm and an external diameter of 16-20mm (0.63-0.79 inches).

Method 1：1P bolting method (Single-axis Tracking):

Installation of long side pressing block, payload ≤2000 Pa (front),1800 Pa (back)



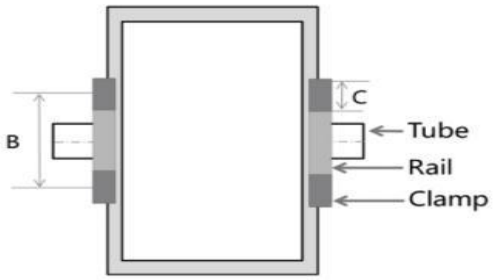
NO.	Module Type
1	166mm Series
FE72/66/60-166M	
2	18Xmm Series
FE78/72/66/60/54-18X FE78/72/66/60/54-18X (N) FE78/72/66/60/54-18X (ND)	
3	18X+mm Series
FE66/54/48-18X+(N) FE66/54/48-18X+(ND)	
4	210mm Series
FE66/60-210 FE66/60-210(N) FE66/60-210(ND)	

Notes:
1. Using 4 installation holes(400mm holes)
2. Test load =γm * design load γm =1.5
3.Mounting hole space（A1-A3）：400mm

Method 2: 1P clamp method（Single-axis Tracking）:

Installation of long side pressing block, payload ≤2400 Pa (front),1800 Pa (back) for Single glass module

Installation of long side pressing block, payload ≤2400 Pa (front),2400 Pa (back) for Dual-glass module (Use 4 clamps- length of blocks≥50mm)

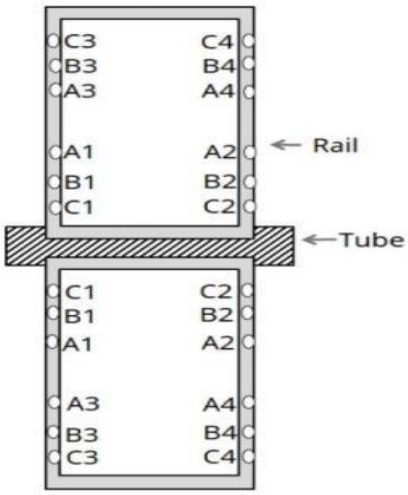


NO.	Module Type
1	166mm Series
FE72/66/60-166M	
2	18Xmm Series
FE78/72/66/60/54-18X FE78/72/66/60/54-18X (N) FE78/72/66/60/54-18X (ND)	
3	18X+mm Series
FE66/54/48-18X+(N) FE66/54/48-18X+(ND)	
4	210mm Series
FE66/60-210 FE66/60-210(N) FE66/60-210(ND)	

Notes:
1. Using 4 clamps installation method. B is the module installation distance≥400mm. The black shadow is the area of installation （C）.
2. Test load =γm * design load γm =1.5
3. Overlap width between clamp and frame:
Frame topside ≥ 10mm
Frame bottom side ≥ 15mm

Method 3: 2Pbolt method（Single-axis Tracking）:

Installation of short side pressing block, design load ≤1800 Pa (front), 1800 Pa (back)
(Use 4 clamps- length of blocks≥50mm)



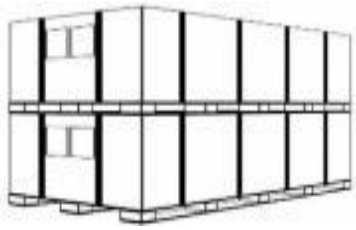
NO.	Module Type
1	166mm Series
FE72/66/60-166M	
2	18Xmm Series
FE78/72/66/60/54-18X FE78/72/66/60/54-18X (N) FE78/72/66/60/54-18X (ND)	
3	18X+mm Series
FE66/54/48-18X+(N) FE66/54/48-18X+(ND)	
4	210mm Series
FE66/60-210 FE66/60-210(N) FE66/60-210(ND)	

Notes:
1. Using 4 installation holes, Mounting hole location;(B1B2A3A4)/(B1B2B3B4)
2. Test load =γm * design load γm =1.5
3.Mounting hole space（A1-A3）：400mm （B1-B3）：990mm

3.7 Storage

Do not remove the original packaging if the module requires long-distance transport or long-term storage. Do not expose the modules to rain or moisture. Store the finished product in a ventilated, waterproof and dry place.

3.7.1. Storage in project site warehouse (moisture＜85%, temperature in the range from -20°C to +50 °C). Different photovoltaic modules to be stacked separately in two groups;



4 Electrical Connection

4.1 Precautions for Electrical Connection

4.1.1 Please read the electrical wiring drawings carefully before wiring. The wiring should accord to local

law and program and be operated by certificated electricians. The maximum voltage of the system must be lower than the maximum certified voltage and the maximum input voltage of the inverter and other electrical devices installed in the system.

4.1.2 The connection between module and junction box: the module is connected with junction box by the dc cable. The cross-sectional area of cable and the connector capacity must be satisfied with the system's short circuit current. The cable's cross-sectional area for a single module is recommended to be 4mm2. The fuse current and the rated current of the connector should be higher than 20A (18X series modules and double-sided modules should be ≥ 25A， 182*210 series modules and 210*210 modules should be ≥ 35A). Otherwise, the cables and connectors will overheat due to high current. Please note that the highest temperature of cable is 90 ℃, and the highest temperature of connector is 125 ℃.

4.1.3 The aluminum frame and support of the module must be grounded, as shown in Figure 9. Each module has a grounding hole and is marked on the frame (it is recommended that the series / parallel connection of each module must be grounded once). The installation method of grounding bolt is shown in Figure 10. The grounding wire and frame can be reliably grounded by the prepared grounding hole. And the flat washers, spring washers and nuts are matched by installing bolts M5 ×10 ~ 15. The modules and the earth wire shall be perfectly connected by connecting plugs. Negative grounding inverter can be installed to prevent PID phenomenon.

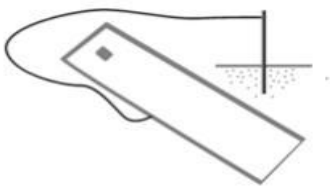


Figure 9 Module grounding circuit

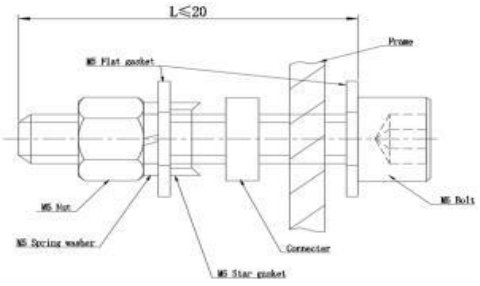


Figure 10 Installation diagram of grounding bolt

4.1.4 Common hardware parts, such as nuts, bolts, star washers, lock washers, flat washers, are used for grounding/connecting. The installation of such hardware parts should comply with instructions of manufacturers.

4.1.5 The common grounding parts, such as nuts, bolts, star washers, lock washers, which have not been evaluated for electrical conductivity, are only to use for mechanical connection. And the grounding parts of the module should keep suitable conductivity. These grounding parts, which supply the evaluation of UL 1703 as the same as modules, can use for module's installation according to installation instruction.

4.1.6 The electrical connection shall conform to local electrical laws and regulations. Avoid "Y" type electrical connection mode in module system electrical connection.

4.1.7 Modules are equipped with bypass diodes（rated voltage 45V, rated current 20A/25A）. The improper installation may damage diodes, cables or junction box.

4.1.8 If the modules unpack without installation immediately, please protect module connectors in order to avoid damage due to wind or rain. Avoid lubricant on module's connectors, because it may lead fail of connectors.

4.1.9 Avoid removing the waterproof rubber rings out from the junction box or connectors.

4.1.10 Avoid using diesel oil to keep warm in installation site, because the gas generated by diesel oil or other petroleum products may destroy module's connector.

4.1.11The minimum bending radius cables should be 43mm (1.69in).

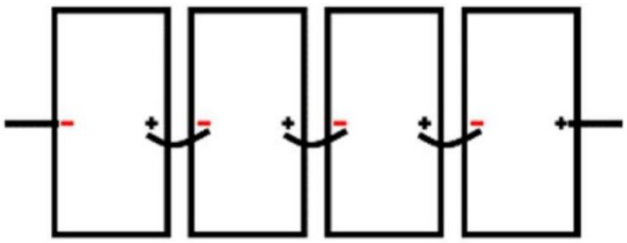
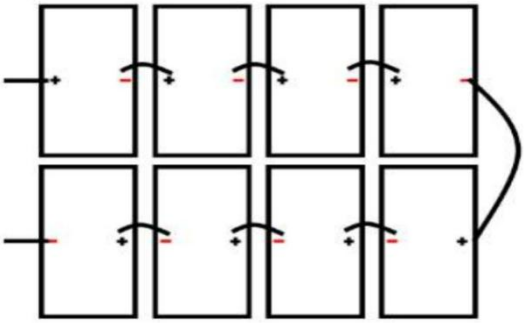
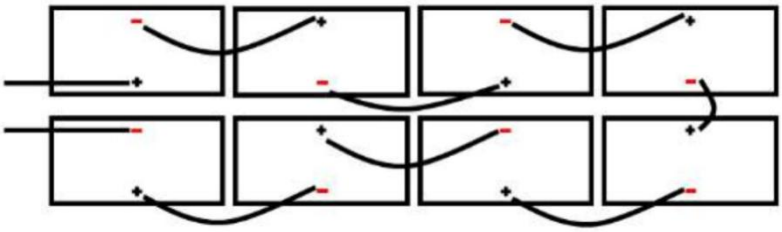
4.1.12Please keep connectors clean and dry. Make sure connector caps are fastened before connection. Do not connect connectors under improper conditions of damp, dirty or other exceptional situations.Avoid connectors from direct sun light and water immersion or falling onto ground or roof.

4.2 Wiring and Connections

Ensure that the wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, this indicates that there is a wiring fault.

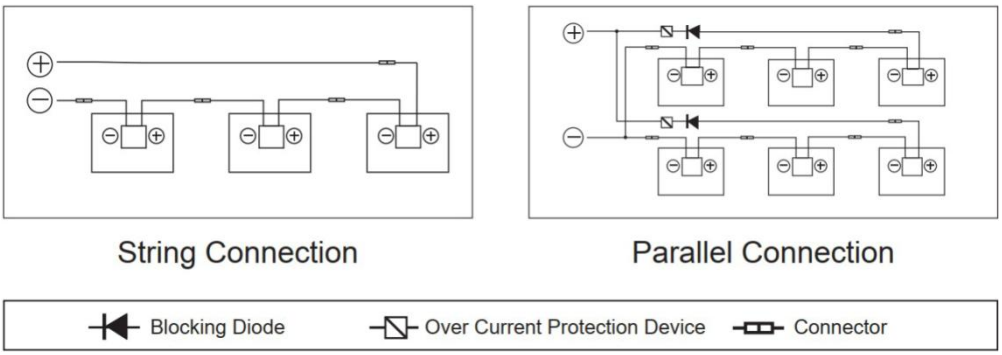
When modules have been installed, but the system has not been connected to the grid yet, each module string should be kept under open-circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.

Recommended wiring method：

Single Portrait Installation

Double Portrait Installation

Landscape Installation （Need to customize cable length or add extension cable）


When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module. Modules with different electric performance models cannot be connected in one string.

If there has reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module. If quantity of parallel connection is more than 2, there must be an overcurrent protection device on each string of module.



Series connection and parallel connection circuit diagram

4.3 Structure of PV station

The following figure shows the structure of a simple PV station. The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with all applicable local codes and requirements from all relevant authorities.

5 Maintenance

The modules need to be inspected and maintained regularly, including visual inspection and all electrical connections to ensure that there is stable connection without any broken.

• Check the open circuit voltage of each module:

• Cover the front surface of modules with an opaque material. There is hazard voltage if modules exposed in light illumination.

• Disconnect the wires from both sides of the module.

• Remove the non-transparent material off the modules; check and measure the open circuit voltage of the modules.

• If the measured voltage is reduced by 1/4, it supposed to be bypass diode damaged. Please test the bypass

diode performance.

• It's recommended that adopt the following maintenance to ensure the modules maintain the best performance: Check whether the modules have any appearance defect: such as surface damage, abnormal or shadow. Make sure that the module support system is stable without any loose part. If finding any abnormal situation, please contact professionals to adjust or repair.

• Clean modules at least one time each year, depending on local conditions. If the surface of the module becomes dirty, the power generation of the modules reduces. In this situation, you can use soft sponge or water to clean the surface glass of the module. Mild, non-abrasive chemical cleaners can be used to help washing modules. Avoid using any corrosion chemical cleaners. In order to reduce electric shock or burns, it is recommended to clean modules in the morning or evening.

• Check mechanical and electrical property of modules every six months to ensure the modules' connectors clean and reliable. And ensure good electrical connection and no corrosion.

• If you have any questions, please contact with professionals and arrange further check.

• Please note that all maintenance instructions, such as brackets, charging rectifier, inverters and batteries, should be complied.

• Meaning of crossed –out wheeled dustbin:

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.

Contact your local government for information regarding the collection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.

When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals.

6 Disclaimer of Liability

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond the control of Nanjing Saiko Renewable Energy Co.Ltd. We do not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

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