



# Kinse Energy PV Modules Installation Manual

***Read this manual carefully before installing the PV Modules***

This installation manual provides information on the installation and safe use of PV Modules, and all safety precautions and local regulations shall be followed in the installation and routine maintenance of the modules.

Installation of the PV Modules system requires expertise and knowledge and can be installed only by qualified personnel. Installers shall be familiar with the mechanical and electrical requirements of this system. Please keep this manual for reference for future maintenance or PV Modules for sale or treatment.

This installation manual applies to all PV Module manufacturers by Kinse Energy.

The PV Modules available in this installation manual are the PV Modules with metal Frames.

## catalogue

1. Brief Introduction .....	1
2. Laws and Regulations .....	1
3. Description .....	1
3.1. About PV Modules .....	2
3.2. Regular Safety .....	2
3.3. Safety of Electrical Performance .....	3
4. Handling Safety .....	4
4.1. Fire Safety .....	5
5. Installation Conditions .....	6
5.1. Installation Location and Working Environment .....	6
5.2. Selection of Tilt Angles .....	7
6. Mechanical Installation .....	7
6.1. Conventional Requirements .....	7
6.2. Way to Install .....	9
6.2.1. Use the Clamps to Install the PV Modules .....	9
6.2.2. Mounting Holes Description .....	10
7. Electrical Installation .....	11
7.1. Behaviour of Electricity .....	11
7.2. Cable Lines and Connecting Lines .....	12
7.3. PV Connector .....	13
7.4. The Bypass Diode .....	14
8. Grounding .....	14
8.1. Use a Ground Clip for Ground .....	15
8.2. Other Third-party Grounding Devices .....	16
9. Operation and Maintenance .....	16
9.1. Cleaning .....	16
9.2. Appearance Inspection of the Modules .....	16
9.3. Inspection of the Connectors and Cables .....	17



Never foot on or sit on the PV Modules at any time.

## **1. Brief Introduction**

This installation manual contains important electrical and mechanical installation information, please read manual before installing PV Modules.

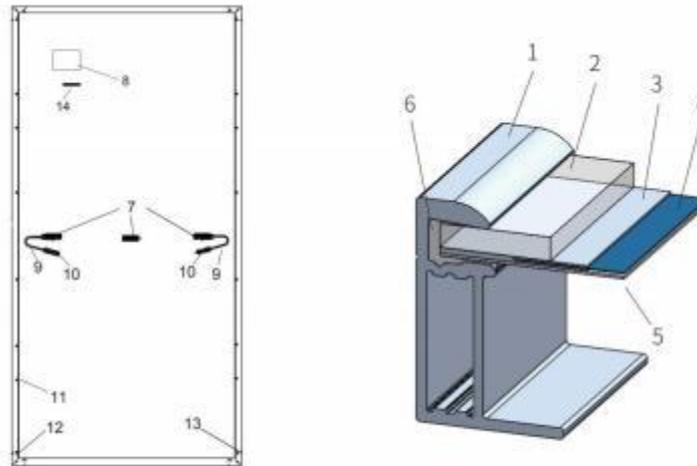
This installation manual does not have any warranty, either express or implied. No compensation scheme is specified for loss, PV Modules damage or other costs incurred or arising from or related to the installation, operation, use or maintenance of PV Modules. Our company shall not bear any liability for the rights of a third party caused by the use of the PV Modules.

Customer failure to install the PV Modules according to the requirements listed in this installation manual results in failure of the product limited warranty provided to the customer during sales. The recommended items in this manual are to improve the safety of the PV Modules during installation, which are tested and tested in practice. Please provide this manual to the owners of the PV system as their reference and inform them of all relevant safety, operation, maintenance requirements and suggestions.

## **2. Laws and Regulations**

Mechanical and electrical installation of PV Modules must fully comply with local regulations and the corresponding international electrical standards. These regulations vary with installation locations, such as installation of building roof, on-board application, etc., and may also vary with system voltage DC or AC required for installation.

## **3. Description**



1 Frame	2 Glass	3 EVA	4 Solar Cell
5 Backsheet	6 Silica Gel	7 Junction Box	8 Name Plate
9 Cable	10 Connector	11 Mounting Hole	12 Grounding Hole
13 Drain Hole	14 Bar Code		

### 3.1. About PV Modules

Each PV Module is labeled with the following information.

1. Nameplate: describes the product type, standard rated power, rated current, rated voltage, open circuit voltage, short circuit current, certification identification, maximum system voltage under test conditions.
2. Current Sorting: divide the PV Modules according to the best working current class of the PV Modules, divided into H\ M\ L three current classes. It is recommended that PV Modules with the same current class be installed in the same string.
3. Serial Number: each PV Module has a unique serial number that represents the full information of PV Modules production.

### 3.2. Regular Safety

Our PV Module design conforms to the international IEC 61215 and IEC 61730 standards, meets the requirement of safety Class II and its application rating is Class A which can be used in systems operating at > 50 V DC or >240W, where general contact access is anticipated. And the PV Modules pass the IEC 61730-1

and IEC 61730-2 two parts, the PV Modules meet the requirements of the safety class. The PV Module passes the fire rating Class C requirement.

The overall fire rating of the final structure is considered when applied on the roof. Overall maintenance also needs to be considered in the later stage. The rooftop photovoltaic system can only be installed as assessed by construction experts or engineers, with formal complete structural analysis results and proven to withstand additional system support pressure, including the weight of the PV Module itself.

For your safety, please do not work on the roof without safety protection measures including but not limited to fall protection, ladders or stairs and personal protection equipment.

For your safety, please do not install or process PV Modules in adverse environments, including but not limited to strong wind or wind gusts, damp or sandy roofs.

### 3.3. Safety of Electrical Performance

Photovoltaic products will produce DC electricity in light conditions, so touching the PV Modules connection wire will be in danger of electric shock or burns. A DC voltage of 30V or higher can be fatal.

The PV Module also generates a voltage without connecting load or external circuits. When operating the PV Module in the sun, use insulation tools while wearing rubber gloves.

The module does not switch and can only stop working by moving the module from light or with cloth, cardboard or completely opaque material, or placing the front on a smooth, flat surface.

To avoid arc and electric shock hazards, do not disconnect the electrical connection with a load. The incorrect connections can also cause arcs and shocks. Connectors must be kept dry and clean to ensure that they are in good

working condition. Do not insert other metal into the PV Module connector, or make electrical connections in any other way.

Once the PV Module is unpacking, it needs to be connected immediately and connect the array to the sink box to avoid the connection and safety problems caused by dust or water vapor entry. Ensure that the connector shall be dry and clean during the installation. For severe dust areas, large salt fog areas and serious pollution areas, it is recommended for customers to increase the connector protective cover, as supporting protective measures.

Snow and water in the surrounding environment will reflect light and increase the light intensity, causing an increase in current and output power. In addition, at the low temperature, the voltage and power of the PV Module will increase accordingly.

If the assembly glass or packaging material is damaged, wear personal protective devices and separate the assembly from the circuit.

Works only under dry conditions, and uses dry tools only. Do not operate the PV Module when the PV Module is wet unless a proper shock device is worn, and when cleaning the PV Module as required in this manual.

#### **4. Handling Safety**

Do not open the package during transportation and storage unless the PV Module arrives at the installation site;

Please protect the package from damage and prohibit the package to fall directly;

Do not exceed the maximum layer limit of the printed identification on the box when stacking the PV Module;

Place the box in a ventilated, rainproof and dry place before the PV Module opened;

In no case, lift the entire PV Module by grasping the junction box or wire;

Do not stand or walk on the PV Module;

Never drop one PV Module on another PV Module;

To avoid glass damage, please do not press any weight against the PV Module glass;

When placing a PV Module on the plane, it must be operated carefully, especially in the corners;

Do not try to remove the PV Module or tear up the nameplate on the PV Module;

Do not paint or apply any other adhesive on the surface of the PV Module;

Avoid damage to the PV Module back membrane, and do not scratch the PV Module back membrane with sharp tools;

No drilling in the assembly frame, which may reduce frame load capacity and cause frame corrosion;

Do not scratch the anodized oxide layer on the aluminum alloy frame surface, except for the ground connection. Scratch may cause frame corrosion to affect frame load capacity;

Do not repair the glass or back membrane damaged PV Modules by yourself.

#### 4.1. Fire Safety

Consult local laws and regulations to observe the requirements for building fire prevention. According to IEC 61730-2 standards, our PV Module fire rating is Class C for roofs of application rating Class A.

At the time of roof installation, the roof must be covered with a layer of fireproof material for this grade and to ensure adequate ventilation between the backplane and mounting surfaces.

Different structure and installation of the roof will affect the fire safety performance of the building. If improperly installed, it may cause a fire. To ensure the fire rating on the roof, the minimum distance of the assembly frame from the roof surface is 10 cm.

Please use appropriate PV Modules accessories such as fuses, circuit breakers, ground connectors according to local regulations.

Do not use the PV Modules if an exposed combustible gas occurs nearby.

## **5. Installation Conditions**

### **5.1. Installation Location and Working Environment**

Do not use a mirror or magnifying glass to manually focus the sunlight onto the PV Module.

Do not install the PV Modules where it is possible to be submerged.

The recommended assembly is installed in an operating ambient temperature of  $-20^{\circ}\text{C}$  to  $46^{\circ}\text{C}$ , the average monthly maximum and minimum temperature of the installation site, and the assembly limit operating ambient temperature of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

Make sure the wind or snow pressure after the assembly does not exceed the maximum allowable load.

The PV Modules need to be installed where there are no shadows. Make sure that there are no obstacles that may block light at the place where the PV Module is installed.

If the PV Module is installed with frequent lightning activity, the PV Module must be protected against lightning protection.

Do not install PV Modules where flammable gas may occur nearby.

PV Modules shall not be installed and used in excessive environments including

hail, snow, dust, soot, air pollution, soot, etc. PV Modules shall not be installed where there are strongly corrosive substances such as salt, salt mist, saline, active chemical vapor, acid rain, or any other substances that may affect the safety or performance of the PV Modules.

Use suitable protection in islands close to salt fog or desert with heavy snow, extremely cold, strong wind or near water to ensure the reliability and safety of PV Module installation.

## 5.2. Selection of Tilt Angles

Angle of the PV Module: the surface of the PV Module and the horizontal surface. The PV Module receives maximum output when the PV Module is facing sunlight.

In the Northern Hemisphere installation, the PV Modules preferably face south, in the southern hemisphere installation, and the PV Modules preferably face north.

For optimal installation tilt angle information, refer to local dealer data or an experienced PV Module installer.

It is recommended that the PV Module is not less than  $10^{\circ}$  when installed, so that the surface dust of the PV Module can easily be taken away by rain, so as to reduce the number of PV Module cleaning, facilitate the water flow on the PV Module surface, avoid a large amount of water on the glass surface for a long time, and then affect the appearance and performance of the PV Module.

## 6. Mechanical Installation

### 6.1. Conventional Requirements

Ensure that the PV Module is installed and the support system are strong enough to withstand all the predetermined load conditions and that the support

installation system must be inspected and tested by a third party testing facility with static mechanical analysis capability using local national or international standards such as DIN 1055 or equivalent.

The PV Module mounting bracket must be composed of durable, corrosion resistant, UV resistant material.

The PV Module must be firmly secured to the mounting bracket.

In areas with large snow in winter, higher mounting supports are selected so that the PV Module minimum will not be covered by long snow, and the minimum of the PV Modules is high enough to avoid being blocked by plants and trees, or damaged by flying sand and stones.

When the PV Module is mounted on a bracket parallel to the roof or wall, the minimum gap between the PV Module frame and the roof or wall is 10cm, requiring air circulation to prevent line damage of the PV Module.

Before the roof PV Module is installed, make sure the building is suitable for installation. In addition, any penetration of the roof must be properly sealed and waterproof to prevent leakage.

PV Modules metal Frame will have a thermal expansion and cold contraction effect, and the frame interval between the two adjacent PV Modules cannot be less than 10mm during installation.

Make sure the back plate of the PV Module does not touch a bracket or building structure that can access inside the PV Module, especially when there is external pressure on the PV Module surface.

The maximum static load that the PV Module passes is back 2400Pa (equivalent to wind pressure) and front 5400Pa or 2400Pa (equivalent to snow and wind pressure), depending on the type of installation of the PV Module.

The method of PV Module installation does not cause electrochemical corrosion between the aluminum frame of the PV Module and the different metals.

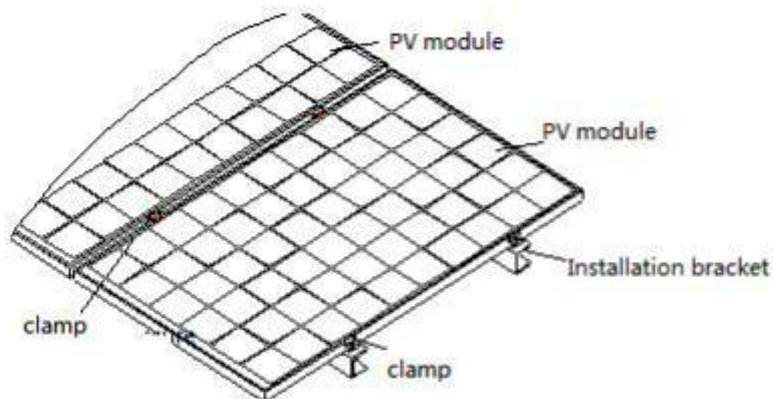
The PV Module can be installed either horizontally or vertically.

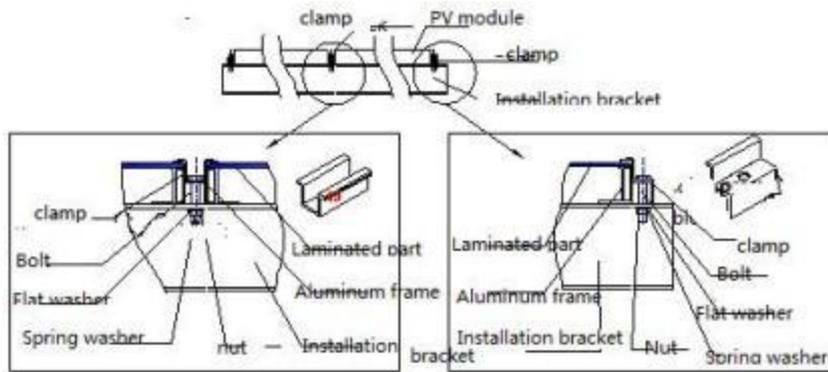
## 6.2. Way to Install

Installation PV Modules must be installed according to the following example. If installation is different from below, please consult us and obtain our consent to damage the PV Modules and cause warranty failure.

### 6.2.1. Use the Clamps to Install the PV Modules

The PV Module can be installed with clamps, as shown:





- 1) The PV Module will need to be secured to a bracket with metal compression clamps, as recommended or approved by the PV Module system installer.

Width: 38mm, thickness: 3mm, material: aluminum alloy, bolt: M8

- 2) Size of torque torque of screw tightening: 18N.From m to 24N.m .
- 3) In no case, the clamp can contact the glass or deform the frame of the PV Module, and the surface contacting the front of the frame must be flat and smooth. Be sure to avoid the shadow clamping effect. Drainage holes cannot be crushed clamps.

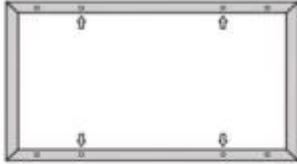
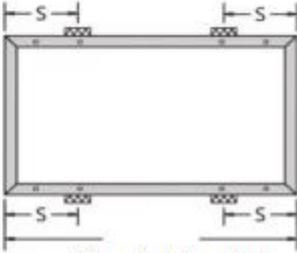
#### 6.2.2. Mounting Holes Description

Low / normal load conditions, suitable for most environmental conditions.

Higher load conditions for harsh environmental conditions (e. g. storm, snow, etc.): the maximum static load of the PV Module is 2400Pa (equivalent to wind pressure) and the maximum static pressure is 5400 Pa (equivalent to wind and snow pressure), which is also the highest standard on pressure requirements in the IEC standard.

For dynamic loads, such as gusts, a triple safety factor is required, with a maximum wind tolerance of 800Pa, or a wind speed of less than 130Km/h.

### Mounting Holes requirements:

	Low/normal level load conditions, suitable for most environmental conditions	Higher loading conditions, suitable for harsh environmental conditions such as storms, snow
Mounting with screws through mounting holes	<p>◦ Mounting hole</p>  <p>Use four mounting holes</p>	<p>◦ Mounting hole</p>  <p>Use eight mounting holes</p>
Installation with clips on the long side		<p>Permissible range of clamp installation  <math>(\frac{1}{4}L-50) &lt; S &lt; (\frac{1}{4}L+50)</math></p>  <p>PV module length L</p>

## 7. Electrical Installation

### 7.1. Behaviour of Electricity

The nominal values of PV Module electrical performance parameters such as  $I_{sc}$ ,  $V_{oc}$  and  $P_{max}$  are with 3% error under standard test conditions. PV Module standard test conditions: 1,000 W / m<sup>2</sup>, ambient temperature is 25 °C, atmospheric mass AM1.5.

When determining the photovoltaic power generation system accessories, such as rated voltage, wire capacity, fuse capacity and PV Module power output, the related parameters shall be applied before enlarging the corresponding short circuit current and open circuit voltage by 1.25 times.

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 array

current is the sum of the individual string currents. Different models of PV Modules cannot be connected within a string.

The maximum number of PV Modules in series must be calculated according to the relevant requirements. The open circuit voltage under the local expected minimum temperature conditions shall not exceed the maximum system voltage value specified by the PV Module (the maximum system voltage of the PV Module is DC1500V according to the IEC 61730 safety test) and other DC PV Modules.

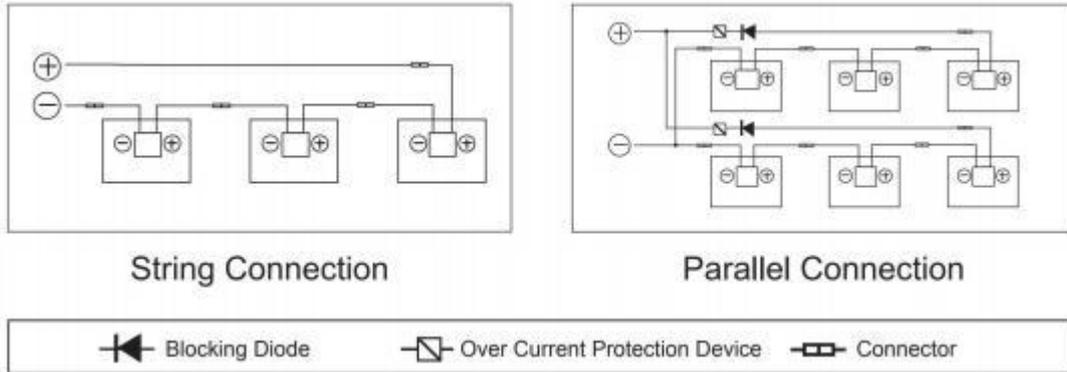
The open-circuit voltage correction factor can be calculated as C according to the following formula  $V_{oc} = 1 - \beta_{voc} f (25 - T)$ , T is the minimum ambient temperature expected at the system installation location, and ( $\% / ^\circ C$ ) is the temperature coefficient of the selected PV Module Voc (see corresponding PV Module parameter Table).

If there may be a reverse current exceeding the maximum fuse current of the PV Module, the PV Module must be protected using equal specification overcurrent protection through the PV Module. If the number of parallel connections is greater than or equal to two strings, there must be an overcurrent protection device on each string of PV Module.

## 7.2. Cable Lines and Connecting Lines

The electrical characteristics are within  $\pm 3\%$  of the indicated values of Isc, Voc and Pmax under STC (1000 W/m<sup>2</sup> Irradiance, ambient temperature of 25°C and an AM1.5 spectrum).

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 as shown in below figure 10. Modules with different electric performance models can not be connected in one string.



The maximum allowed quantity of modules in string connection shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts. (Kinse Energy modules maximum system voltage is DC1500V---actually system voltage is designed based on the selected module and inverter model.)

The correction value of VOC can be calculated by the following formula.  $C_{Voc} = 1 - \beta \times (25 - T)$

T: The expected lowest temperature of the installation site.

$\beta$  : VOC temperature coefficient (% /C) (Refer to module datasheet for further detail)

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

The maximum allowed quantity of modules in string connection shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts. (Kinse Energy modules maximum system voltage is DC1500V---actually system voltage is designed based on the selected module and inverter model.)

The correction value of VOC can be calculated by the following formula.

$$CV_{oc}=1-\beta V_{oc}\times(25-T)$$

T: The expected lowest temperature of the installation site.

$\beta$  : VOC temperature coefficient (% /C) (Refer to module datasheet for further detail)

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.

### 7.3. PV Connector

Please keep the connector dry and clean, make sure the connector is tightened and do not connect the connector if it is wet, dirty or otherwise. Avoid connector from direct sunlight and soaking into water. Avoid connectors from falling on the ground or roof.

The incorrect connection may generate arcs and shocks. Please check that all the electrical connections are secure. Make sure that all the connectors with a lock are completely locked.

#### 7.4. The Bypass Diode

The junction box contains bypass diodes, connected in parallel to the cell string within the PV Module. The diodes will work when the PV Module has a local hot spot effect, allowing the main current no longer flowing through the hot spot cell sheet, thus limiting the PV Module heat and performance loss. Note that the bypass diode is not an overcurrent protection device.

When you know or suspect a diode failure, please contact us by the installer or the system maintainer, and please do not try to open the junction box of the PV Module yourself.

### 8. Grounding

The PV Module design an anodized corrosion-resistant aluminum alloy frame is used as a rigid support, grounded to be safe and avoid lightning and electrostatic damage.

When grounding, the grounding device must be fully in contact with the aluminum alloy to penetrate the oxide film on the bezel surface.

Do not drill any additional ground holes on the PV Module metal Frame.

The grounding method of the PV Module does not lead to electrochemical corrosion between the aluminum frame of the PV Module and the different metals. The recommended metal electrochemical potential difference of phase contact in the UL1703 standard Appendix to Flat Plate Photovoltaic Modules and Panels》 does not exceed 0.6V.

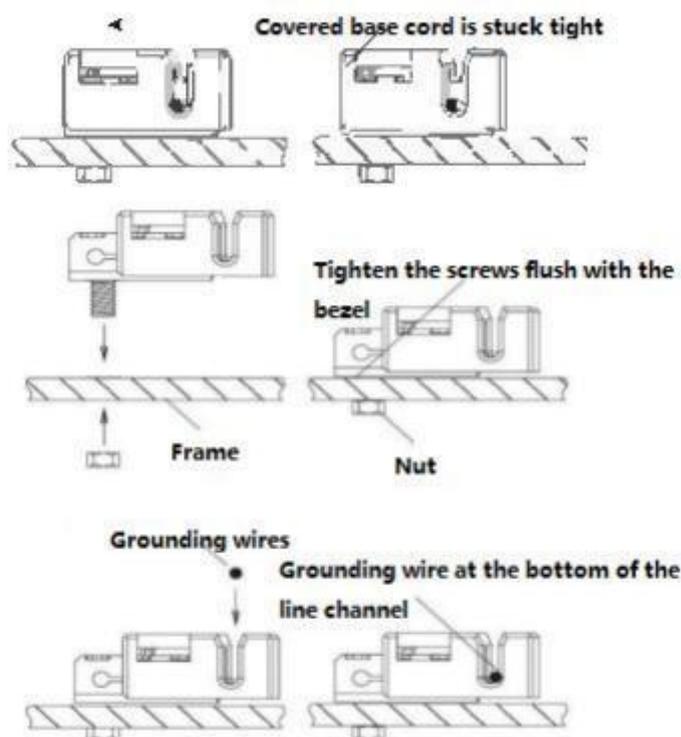
PV Modules metal Frame has been pre-drilled and marked only for grounding and not for installing the PV Module.

### 8.1. Use a Ground Clip for Ground

There is a grounding hole of diameter 4 in the center edge of the back frame of the PV Module.

The grounding between the PV Modules must be confirmed by a certified electrician, and the grounding device must be manufactured by a qualified electrical manufacturer. The recommended torque value is 2.3 N.m. The ground grips use a 12AWG sized copper core wire. Copper wire cannot be damaged when installed.

Installation mode of the ground clip



## *Ground clip use Tyco Electronics1954381- 1*

### 8.2. Other Third-party Grounding Devices

The PV Module may be grounded using a third party grounding, but must be reliable and proven in accordance with the manufacturer's requirements.

## 9. Operation and Maintenance

Regular inspection of the PV Modules must be performed and maintained, especially during the warranty period, which is the responsibility of the user and notified to the supplier within two weeks when the PV Module is damaged.

### 9.1. Cleaning

Accumulation of dust on the glass surface of the PV Module will reduce its power output and may cause regional thermal spots such as guano. The degree of impact depends on the transparency of the waste, a small amount of dust on the glass affects the sunlight intensity and uniformity absorbed, but not dangerous, and the power is usually not significantly reduced.

During operation of modules, there are no environmental influences that cast shadows on the PV Modules and block some or all of the PV Modules, such as other modules, module system supports, bird stay, large amounts of dust, dirt or plants, etc., which can cause a significant reduction in output power. It is recommended that no occlusion at any time.

As for the frequency of cleaning, it depends on how quickly the dirt accumulates. Under normal circumstances, the surface of the PV Module will reduce the frequency of cleaning. It is recommended to use the wet sponge or the soft cloth. It is strictly forbidden to clean the module surface using a cleaner containing acid and alkali.

### 9.2. Appearance Inspection of the Modules

Appearance defects of the visually inspected modules, particularly:

- 1, Module glass cracks.

- 2, Check the module backplane for burning marks.

### 9.3. Inspection of the Connectors and Cables

A preventive inspection is recommended every 6 months, as follows:

- 1, Check the sealing of the connector and cable connection.

- 2, Check the sealant at the junction box for cracking and cracks.