

INSTALLATION MANUAL



Crystalline Silicon PV Modules

S4Axxx-60MH5 / S4Axxx-72MH5



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1 General Information

This manual contains information regarding the installation and safe handling of the photovoltaic module (hereafter is referred to as “module”) which are produced by Solar4America Technology Inc., or its affiliates (hereinafter is referred to as “S4A”).

Installers must read and understand the manual before installation. Any questions, please contact S4A for further explanation or guidance. The installer should conform to all safety precautions in the manual and local laws & regulations when installing modules; before installing a solar photovoltaic system, installers should become familiar with the mechanical and electrical requirements for such a system. S4A has the right to refuse warranty and other obligations because of installer not following this manual or from product damage due to construction or design defects of the solar photovoltaic system.

Keep this manual in a safe place for future reference (care and maintenance) and in case of sale or disposal of the modules.

2 Disclaimer of Liability

Installers shall strictly follow this installation manual. If the conditions or methods of the installation, handling, use and maintenance of the installer are beyond the range specified in this manual and cause damage, S4A does not assume responsibility for any loss, damage or expense thus caused. No responsibility is assumed by S4A for any infringement of patent right or other rights of third parties, which may result from the installer or customer’s use of these modules. No patent license or patent rights is granted to installer or customer, express or implied, due to its use of S4A’s modules.

3 Safety Precaution

3.1 General Safety

The installation of the modules should abide by the relevant local and federal laws/regulations. Installer shall obtain the required certificates in advance when necessary, such as any building and/or electrical permits or other required permits.

Installing solar photovoltaic systems requires specialized skills and knowledge. Installation should be performed only by qualified persons. Installers should assume the risk of all injuries that might occur during installation, such as electric shock.

Photovoltaic modules are designed for outdoor use. Modules may be mounted on ground or rooftops. Proper design of support structures is the responsibility of the system designers or installers. Mounting holes or clamp range and numbers suggested in this manual shall be used.

A single module may produce direct current (hereafter is referred to as DC) voltage of above 30 volts in sunlight and it is extremely dangerous. Do not touch or lean on an operating module.

Do not disconnect under load. Do not apply paint or adhesive to module surface.

Keep all electrical contacts and connectors clean and dry. Do not change the wiring of the bypass diodes. Do not disassemble the modules or remove any attached nameplates or components from the modules.

Do not use mirrors or other magnifiers to artificially concentrate sunlight on the modules. Do not expose the backside of modules directly to sunlight for a prolonged period of time.

Modules should be stored in a dry and ventilated environment. In the storage and handling process, in case of inclement weather (rain, snow, wind, etc.), materials such as plastic film and waterproof cloth will need to cover the packing boxes.

During normal operation, materials such as plastic film and waterproof cloth are forbidden to cover the glass surface of modules.

Unpack modules with packing box on the ground. Unpacking when modules are superposed is forbidden.

3.2 Handling Safety

Keep children and unauthorized persons away from the modules while transporting and installing them. Improper transportation and placing may lead to glass breakage or power loss of the modules, resulting in the loss of the use value of modules.

Handle modules with care. Lift and put down modules gently. Do not drop modules or drop objects on the modules. Pay special attention not to collide, scratch or press the module backside when transporting and installing the modules. The double glass module should be handled more carefully. Non-slip gloves are required when handling and during installation.

Do not stack the modules for transportation. Do not set the modules down on any hard surface, which may cause the glass to break.

To avoid module damage, do not place heavy objects or tools on the modules, and do not stand or step on the modules.

Inappropriate transport and installation may damage the module. Reduce vehicle speed when the road condition is relatively poor and/or excessive bumps or undulations occur in the roadway.

3.3 Installation Safety

Installer shall abide by safety regulations for all other components used in the PV system, including wiring and cables, connectors, charge controllers, inverters, storage batteries, etc. Use suitable equipment, wiring connectors, wiring, and mounting system for a PV system. Use the same type modules and ensure color grade consistency as much as possible in one system.

Do not install or handle the modules when they are wet or during strong wind.

Modules are constructed with tempered glass, which shall be handled with care. Improper operations may cause the tempered glass to break. If the glass is broken or if the back-sheet is burned-out, making contact with module surface or the aluminum frame can produce electrical shock, particularly when the module is wet. Broken or damaged modules must be disposed properly. Contact local recycling or disposal company for more information. **DO NOT ATTEMPT TO SERVICE OR OPERATE SUCH PANEL YOURSELF AS THERE IS A BODILY INJURY AND/OR PROPERTY LOSS DANGER.**

The maximum system voltage is indicated in the nameplate. During system installation, the maximum open circuit voltage in series cannot exceed the maximum system voltage.

Completely cover the module with an opaque material during installation to keep electricity from being generated. In high temperature and high humidity environment, prevent glass surface from pollution, such

as rubber glue splotch, oil, printing, and dyeing, etc. Contacting glass surface with bare hands is prohibited.

Do not place the glass surface or the back-sheet surface of the modules directly on the ground at the installation site (mud, sandy, dirt, etc.).

Modules not in use should be stored and transported with manufacturer's packaging.

Do not wear metallic rings, watchbands, ear, nose, lip rings or other metallic devices while installing or troubleshooting photovoltaic systems. Use insulated tools that are approved for working on electrical installations and always keep them dry.

The triangle hole on the backside of the frame of the module is the drain hole which should not be blocked.

When connecting modules, maintain proper wire management to the module frame or mounting rail to minimize wire slack. Proper wire management shall not add tension to the wire, connectors, and module junction box.

Conform to the allowable minimum bending radius of the wire (Definition: Minimum bending radius is 12 times the wire's external diameter). For the wire connected to the junction box, the allowable minimum bending radius is 12 times OD (outer diameter). With regards to other minimum bending radius, please seek help from a professional installer.

Always protect the wire with conduit or other approved means where animals or children can touch it.

Please use the connector which is specially designed for photovoltaic systems and assemble it with the tools recommended or specified by the manufacturer. Please contact your supplier for procuring connectors applicable to solar photovoltaic systems.

Make sure that the polarity is correct when connecting the module to inverter, storage battery or combiner box to avoid unrecoverable damage of bypass diodes in the modules.

4 Product Identification

4.1 Product Identification

Each module has labels providing the following information:

Nameplate: Describes the product model, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all are measured at STC; weight, dimension, maximum system voltage and the fuse rating are also shown on the nameplate.

Barcode: Each module has a unique serial number. It contains the relevant production information of the module.

5 Electrical Property and Parameters

Under Standard Test Conditions (1000W/m², AM1.5 and 25°C (77°F)) the electrical characteristics, including I_{sc} and V_{oc}, the deviation between the measured value and nominal value is within ±3.5%.

Under normal outdoor conditions, a module is likely to produce different current and voltage than the values measured under STC in the specification of S4A module products. Therefore, when determining the parameters related to the power output of the module, for example, nominal voltage, conductor capacity, fuse capacity and controller capacity, etc., refer to the values of short-circuit current and open circuit voltage of the modules, and take 125% of those values during design and installation.

The maximum nominal voltage for all series connected modules is 1000V or 1500V according to IEC standards. Please check it according to the nameplate.

6 Installation Instructions

6.1 Installation Environment

In most applications, PV modules should be installed in a location where they will receive maximum sunlight throughout the year.

The module shall be installed in a place where the sunshine is adequate. The module should not be shaded at any time during its operation. During installation, the module surface shall not be partly shaded by clothes, tools, packaging materials, etc.

Install the module in a well-ventilated place and guarantee that adequate natural air heat dissipation channels are provided at the back and sides of the module.

Never place the module in locations where flammable gases may be easily generated or collected.

S4A suggests installing the module in dry areas where the climate is moderate. The modules shall not be installed at a location with excessive hail, snow, sand, near golf courses, smoke, dust and so on.

S4A modules have passed the certification of IEC 61701 with 5% NaCl. Corrosion may occur where the

modules contact mounting brackets. Without approval of S4A, modules should not be installed at a site which is within 500 feet from the sea.

Modules connected in series should be at the same tilt and azimuth. Differing orientations or angles may cause a loss of power output due to differing amount of sunlight exposure for each module. Typically, the optimal tilt angle for a module is roughly the same as the latitude of the installation location.

When unpacking the modules, they should be installed as soon as possible and connected to the combiner box to avoid connection failure. Protecting covers are advised to be used if modules are installed in a location with heavy sand or salt mist.

6.2 Selection of Mounting Structure

Always conform to the installation manual and safety rules of selected mounting system.

The entire PV system consisting of modules and mounting system must be able to withstand anticipated loads from local wind, snow, etc.

Drilling holes on the surface of the module glass is prohibited.

Drilling additional mounting holes into module frames may void the warranty.

The mounting system structure must be made of high quality, durable, corrosion-resistant, and UV-resistant materials.

Forces generated during thermal expansion and contraction of the mounting structure shall not influence the performance and use of the module.

The bearing surface of the mounting structure must be smooth without any twist or deformation, and the connected support frames shall be at the same height.

6.3 Installation Locations

(A) Roof Mount

It is necessary to provide a special support frame for the roof mounting. When installing a module on a roof or building, ensure that it is securely fastened and cannot fall or be damaged because of strong winds or heavy snows. During roof mounting, check the local building code being used to ensure that the building and its structure where the module is installed have adequate bearing capacity. The roof may need to be penetrated during module installation and fixing shall be sealed to avoid water intrusion.

To be suitable for operation, reduce steam condensation and facilitate the ventilation & heat dissipation of the module during tile installation, the module shall be parallel to the wall or roof surface of the building, and the clearance between module and surface of the wall or roof shall be at least 115mm (4.53inches) to prevent wiring damage and to allow air circulation, ventilation, and heat dissipation behind the module. During stacking type installation, the module shall be installed on the fire-resistant roof. The modules Fire Resistance Rated Class of the modules is Class C, and the modules are suitable for mounting on an above Class A roof. Do not install modules on a roof or building during strong winds.

(B) Pole Mount

When installing a module on a pole, choose a pole and module mounting structure that will withstand the anticipated wind load of the local area. The support rod must be constructed on a solid foundation.

(C) Ground Mount

Select the height of the mounting structure to prevent the lowest edge of the module from being covered by snow for a long time in winter in areas that experience snowfall. The module shall be installed on the mounting system with appropriate height and not directly laid on the ground. In addition, assure the lowest portion of the module is placed high enough, so that it is not shaded by plants or trees, and the module is not damaged by sand, tree branches or rock driven by wind, and the module surface is not shaded by soil.

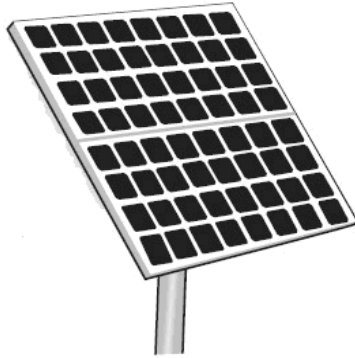


FIG 2 Pole Mount



FIG 3 Ground Mount

Notice: For roof systems installed in areas that can experience relatively heavy snowfall or snow cover, customer shall reinforce the mounting system at bottom frame of the module where it is located near the roof edge. The mounting system reinforcement prevents the bottom frame from being pressured and damaged due to snow load or ice cumulation when melted snow freeze at nighttime. S4A suggests selecting the support reinforcing mechanism shown in Figure 4.

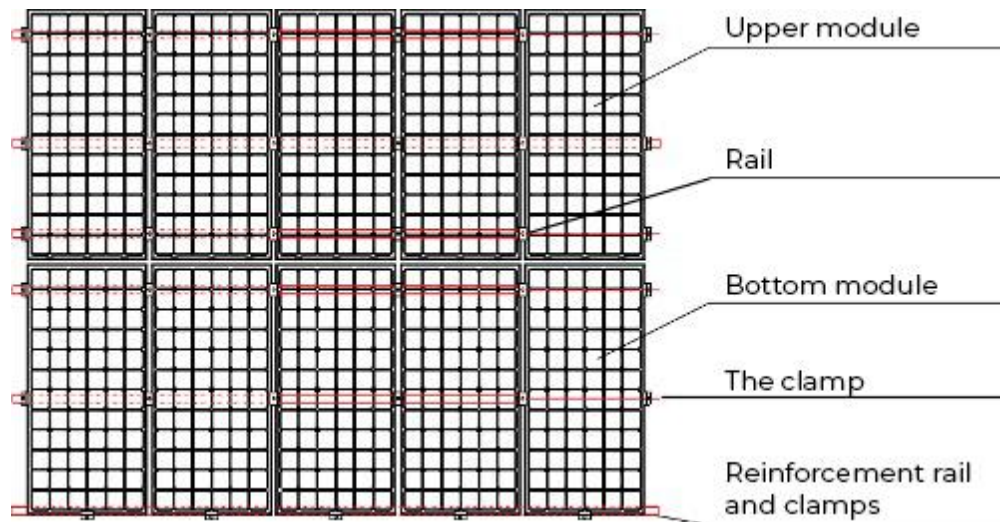


FIG 4 Bottom frame reinforcement mounting

6.4 Bolt and Clamp Methods

Modules can be installed using mounting holes or clamps. Modules must be installed according to the following instructions. Not following these instructions may void the warranty.

The modules have been evaluated by IEC61215 standard for mechanical load design (testing load). According to the requirements of IEC61215, a 1.5 times safety factor should be considered while calculating corresponding maximum design load.

Normal load is suitable for the most environmental conditions: the front side can sustain 5400Pa static load and the back side can sustain 3600Pa static load.

According to the requirements of IEC61215, with regards to dynamic loads, like wind gust, a 3 times safety factor should be considered. 800Pa dynamic wind gust load equates 2400Pa static wind load (wind speed ≤ 130 km/h).

The mounting system and other components required (such as screws) shall be made of durable, corrosion-resistant, and UV-resistant materials.

6.4.1 Bolt Method

Use stainless steel bolts (M8) at the existing mounting holes on the module frame. The torque range is from 16-20 N-m while tightening the nut.

Do not attempt to drill holes in the glass surface or add mounting holes on the frame.

The frame of each module has 4 mounting holes used to secure the module to the support structure. As shown in Figure 5, four mounting holes are used. To sustain a higher load condition, or when install larger 72 cell modules, or in the condition of sustaining higher load, eight mounting holes are needed.

The module frame must be attached to the mounting system using M8 stainless steel hardware together with spring washers and flat washers in four places symmetrical on the module, as shown in Figure 6.

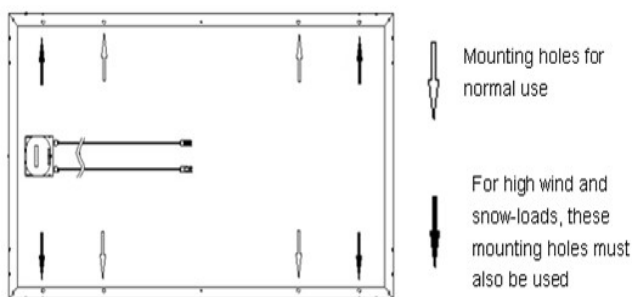


FIG 5 Mounting holes

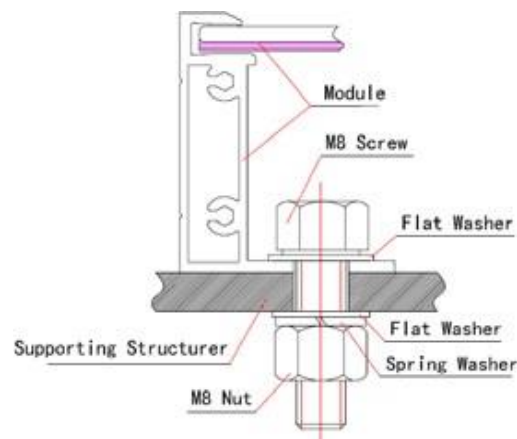


FIG 6 Bolt method

6.4.2 Clamp Method

Use suitable module clamps on the module frame to fasten the modules, as shown in FIG7. The thickness of the clamp should be no less than 3mm, the length should be no less than 40mm and the length of the overlap should be no less than 5mm.

At least 4 clamps should be used on each module, with 2 clamps on each side.

Modules should be mounted according to the mounting system manufacturer's specifications. The clamp should be mounted in a symmetric position with respect to the center, as shown in FIG7. The torque should be determined by the mechanical design standard of the bolt or as specified by the mounting manufacturer. For instance, M8, 16-20 N-m.

The clamp cannot touch the glass of the module and needs to keep the shape of the frame throughout the life of the module.

Avoid shading effects created by clamps on the cells of modules' front side.

If the customer has special clamping and installation schemes which are not included in this manual, please contact a professional for support.

If relatively heavy snow load or strong wind pressure exist at the installation area, S4A suggests the customer to ask help from a professional installer to determine whether additional clamps should be used to improve the local carrying capacity.

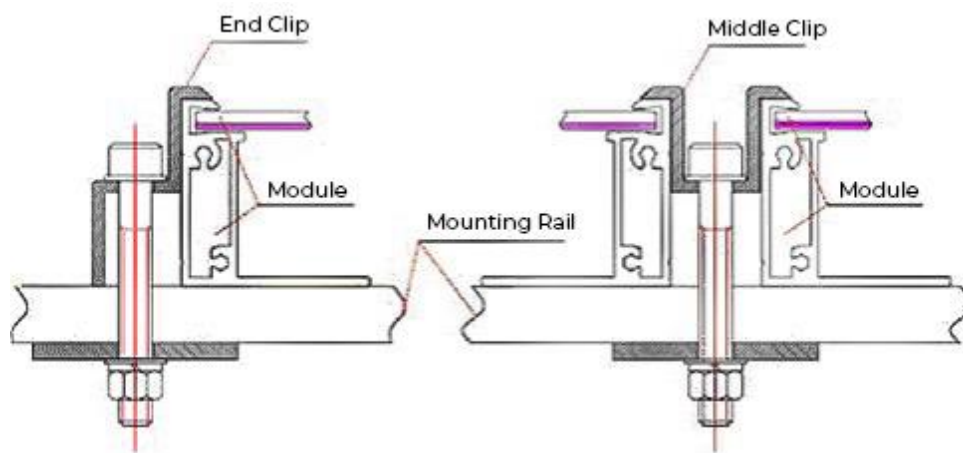
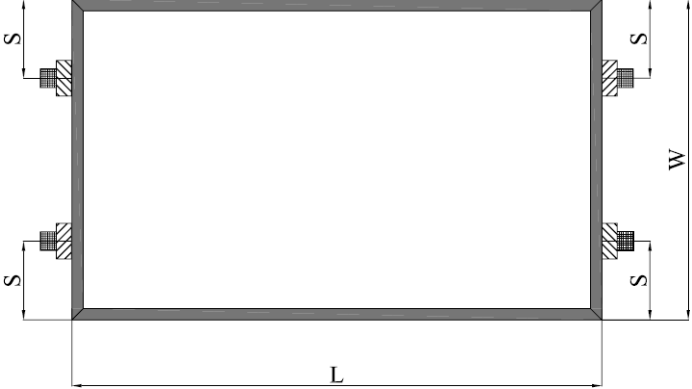
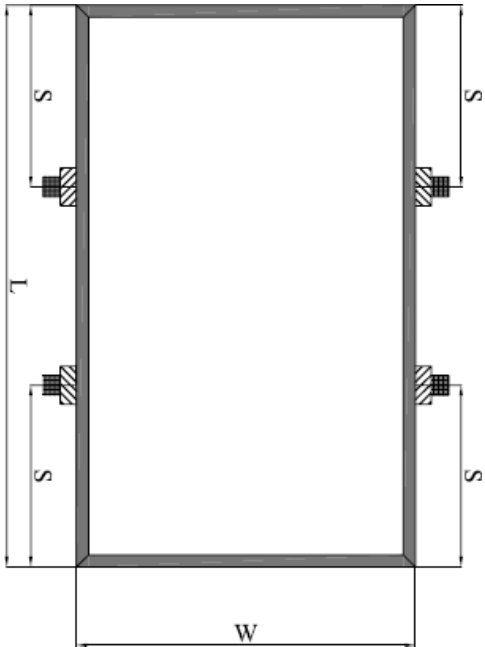


FIG 7 Clamp mount method

Short Side	Long Side
	
Front static load $\leq 2000\text{Pa}$ 、Back static load $\leq 2000\text{Pa}$: $0 \leq S \leq (W/4)$	Front static load $\leq 2000\text{Pa}$ 、Back static load $\leq 2000\text{Pa}$: $0 \leq S \leq (W/4)$
Front static load $\leq 2400\text{Pa}$ 、Back static load $\leq 2400\text{Pa}$: $(W/20) \leq S \leq (W/5)$	Front static load $\leq 2400\text{Pa}$ 、Back static load $\leq 2400\text{Pa}$: $(L/8) \leq S \leq (L/4)$
----	Front static load $\leq 5400\text{Pa}$ 、Back static load $\leq 3600\text{Pa}$: $(L/4-50) \leq S \leq (L/4+50)$

*** NOTES:**

S4A's limited warranty will be voided in cases where improper clamps or installation methods deviating from this manual are used. When installing inter-modules or end type clamps, take measures so as:

Do not bend the module frame.

The clamps must fasten the modules through contact with module frame only. Clamps are not allowed to contact module glass.

Do not damage the surface of the frame.

When mounting, be sure that the module's drain holes are not blocked. For matters concerning installation not mentioned in this section, contact a solar professional for support.

7 Electrical Installation

7.1 General Recommendations

Try to use the modules with the same configuration in the same photovoltaic system. If the modules are connected in series, the total voltage is the sum of voltages of all series connected modules, and the maximum number of the series modules $(N) = V_{\max}(\text{System}) / V_{\text{oc}}(\text{at STC})$.

If the system requires installation of high current, several photovoltaic modules can be connected in parallel, and total current is the sum of the current of each parallel module string. The maximum number of the parallel module strings $(N) = I_{\max}(\text{fuse rating}) / I_{\text{sc}}(\text{at STC})$.

When connecting modules, the connectors of the modules shall come from the same manufacturer or be completely compatible with each other. The connectors of the different manufacturers may not be compatible which may lead to connector mismatch and/or system performance issues.

The cross-section and connector rating of the cable selected must satisfy the maximum short-circuit current of the system (It is recommended that the cross-section of the cable used for the single module is 4mm²(12 AWG) and the rated current of the connector is not less than 30A. Please note that the upper temperature limit of the cable and connector is 85°C and 105°C respectively).

When placing the module, keep the side with junction box on top and try to avoid exposure to rain.

Do not carry out installation in rainy weather, the humidity will void insulation protection, thus causing safety concern.

7.2 Grounding

All module frames and mounting racks must be properly grounded. As shown in FIG 9-a. The grounding wire must be properly fastened to the module frame to assure good electrical contact. Use the recommended type, or an equivalent, connector for ground wire.

Proper grounding is achieved by connecting the module frame(s) and structural members contiguously using a suitable grounding conductor.

The grounding conductor must then make a connection to earth using a suitable earth ground electrode. Recommend using the ground wire accessories (lugs) connected to ground Cable. Welding ground cable to the jack of lugs, and then with the M4 bolts inserted into the wiring nose ring and the grounding hole of the module frame, fastening with nuts. Star spring washers should be used to prevent the bolts from loosening and lead to poor grounding (as shown in FIG9).

The module frame to EARTH resistance must be less than 10 ohms.

S4A recommends installing modules at the temperature from -40°C to 50°C, and the relative humidity should be less than 85RH%. The operating temperature range is from -40°C to 85°C. If the modules are used in high-temperature and high-humidity environment, S4A requires the customer to ground the negative end of the inverter (as shown in FIG10). Offset Box or PID Box can also be used instead to apply a positive voltage to the module arrays at night to avoid PID.

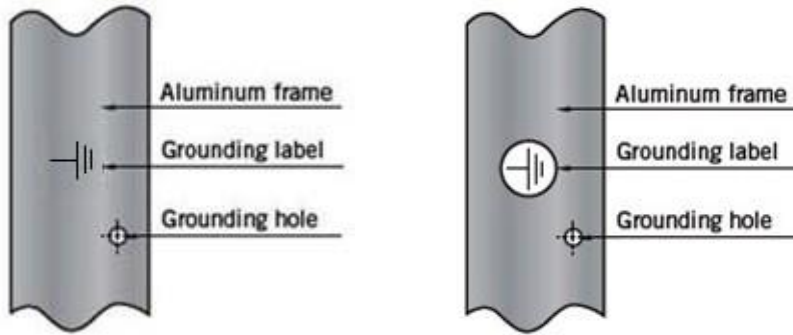


FIG 9-a Grounding hole

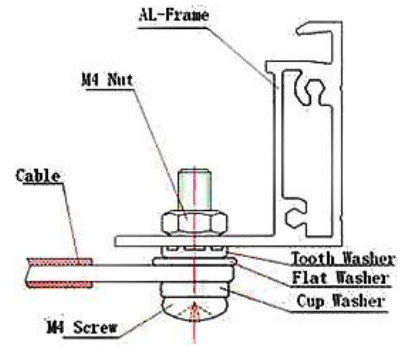


FIG 9-b Grounding method

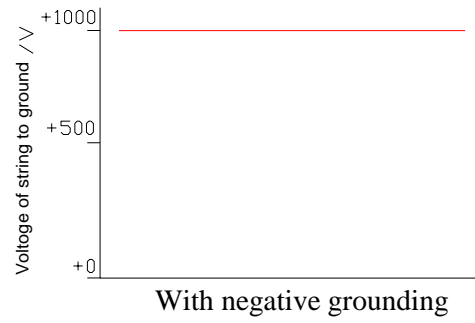
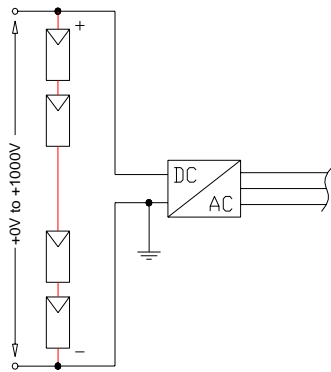


FIG 10 Schematic diagram for grounding potential of the inverter

8 Maintenance and Care

Clean the module glass surface on a regular basis. Avoid the hotspot risk caused by bird droppings, leaves and dead insects covering the glass surface.

In general, use water and clean soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used to remove stubborn dirt.

Avoid pressure to the module during cleaning, such as by pressure washer. The strength of the module is less than 690kPa. Excess pressure may cause glass deformation, cell damage and service life reduction. Clean snow coverage on the module in time to avoid damage caused by long-term accumulation of snow cover and freezing of melted snow. Remove tree branches and/or plants surrounding the modules to prevent shading.

Examine the PV module(s) for signs of deterioration. Check all wiring for possible rodent damage, weather damage and inspect all connections are tight and corrosion free. Check electrical leakage to ground. Adjust and tighten all mounting fixtures as necessary.

Never clean the electrical connectors, including cable, connectors and junction box with cleaning agents that contain organic matters such as alkane. If any problem arises, have it investigated by a specialist.

If any maintenance questions arise, please contact the local dealer for professional support.

9 PV Recycling

Do not dispose of any PV modules as unsorted municipal waste in accordance with WEEE Directive (Waste from Electrical and Electronic Equipment Directive), EN50419 and all the other applicable laws. Contact a PV module recycler or similar professional for disposal assistance.



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