

INSTALLATION MANUAL

(For AKCOME PV Modules)



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1. Safety Warning and Operation Notice



DANGER OF DEATH FROM ELECTRICAL SHOCK!

PV modules can generate electricity upon exposure to light. The voltage of a single module is less than 50 VDC, but the total voltage can be dangerously high when modules are connected together in series. The following must be fully understood and obeyed when handling the PV modules to avoid risk of arcing, fire and electric shock

- Carefully read through these installation instructions before installing, operating or maintaining PV system. Failure to follow these instructions may result in bodily injury or damage to property.
- PV systems can produce high voltage and current which could cause serious injury or even death.
- The installation of PV modules should only be performed by qualified personnel.
- Do not wear metallic jewelry when installing. Do not touch live terminals with bare hands. Use insulated tools for electrical connections.
- Do not install PV modules at wet conditions.
- Do not use damaged nor defective modules. Even damage or defective modules can produce electricity. Keep damaged or defective modules covered to avoid exposure to light.
- Contact with electrically active parts of a PV module such as terminals, can result in burns sparks and lethal shock whenever the PV modules are connected or not.
- Use appropriate safety equipments when working on any wiring.
- Never disassemble nor break any part of the PV module, including nameplate.
- Keep children and other unqualified people away from the PV system.



DANGER OF DEATH FROM ARCING!

- PV modules generate current under sunlight. A lethally strong arc may occur when breaking a connected module or a string of modules. Operation should be performed only by professional engineers equipped with professional tools.
- Never disconnect the PV module from the inverter when the inverter is still connected to the main grid, but remove the fuse from the AC side on the inverter before operation.
- Ensure cable and connectors are at perfect condition (no splitting, soiling, nor contamination).
- One should never touch the wet connectors, without using personal protective equipments or wearing insulating gloves.

1.1 General Safety

- All PV modules installation should be in accordance with applicable international and related local laws, codes and regulations.
- Artificial sunlight should not be concentrated upon the PV modules. Do not expose PV modules to sunlight concentrated with mirrors, lens or other means.
- The PV modules are rated as application class A. Modules rated for use in this application class may be used in systems operating at greater than 50V DC or 240W, where general contact access is anticipated. Modules qualified for safety through IEC 61730-1 and this part of IEC 61730 within this application class are considered to meet the requirements for safety class II.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.
- Only PV modules with the same cell type and size may be connected in series.
- Avoid any shade on the PV module surface. Shaded cells may become hot (hotspot phenomenon) resulting in permanent damage to the module or even fire hazard.
- Follow safety precautions of all other components used in the PV system.

1.2 Handling Safety

- Follow the unpacking instruction. Carry the module by at least two persons. Do not lay nor pile the PV module casually. Avoid any objects stacking or falling on the PV modules.
- Do not stand nor step on the PV module. The glass may be slippery, and there is a risk of injury or electric shock if glass is broken.
- Please handle PV modules with care, avoiding any bump or drop.
- Do not expose the PV module to excessive loads on the surface of the PV module nor twist the frame, otherwise, the glass and solar cells may break.
- Do not draw the cable of J-box excessively during installation. The cables should be in a relaxed state after connection.
- Do not touch the PV module with bare hands. The frame of the PV module has sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and finger areas.

1.3 Installation Safety

- Always wear protective helmet, insulating gloves and safety shoes (with rubber soles).
- Due to risk of electrical shock, never perform work when PV modules are wet.
- Do not install PV modules at rainy, snowy or windy conditions.

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- Ensure the connectors are fully and correctly connected. Connectors and cables should be fixed to the PV module frames, support structure or raceway to prevent movement. Keep connectors out of direct sunlight or water immersion.
 - Do not touch the J-box and the end of the cables with bare hands during installation, regardless of whether the PV module is connected to the system or not.
 - Do not unplug connectors if the system circuit has been connected to an operating load.
 - When installing PV modules on roofs or other structures, appropriate safety practices and safety equipments should be used at all times to avoid injury.

1.4 Fire Safety

- The PV modules should never be installed near inflammable gas, hazardous chemicals or fire source.
- The PV modules have been rated as Fire Class C (unless specified). For roof PV project, the PV modules are to be mounted over a fire resistant roof.
- There should be lightening protection devices in the PV system. The maximum fuse rating is 15A.

2. Mounting Instruction

2.1 Location Selection and Environment

- Do not install the PV module where could be flooded or immersed.
- Do not install the PV module in a flammable gas environment (such as gas station, storage tank etc.) nor near fire source.
- Temperature endurance range of the PV module is $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$, while the environmental temperature range of $-20^{\circ}\text{C} \sim 45^{\circ}\text{C}$ is recommended for module installation.
- Unless specified, the maximum bearing load of PV module is 5400Pa for front side, and 2400Pa for backside. The natural environment condition should be fully considered to not to exceed the maximum pressure. The accumulated snow should be removed in time to prevent causing any damage to the PV modules.
- The PV module should not be installed in the environment of excessive salt fog, hail, sand and dust, smoke, active chemical atmosphere, acid rain etc.
- The PV module should be installed at least 200m away from the sea side. Corresponding measure should be adopted to avoid module corrosion and grounding failure for the distance of 200m~1000m away from sea side. Installation of 1km away from sea side is recommended.

2.2 General Installation

- Condition of site should be fully investigated to ensure it is suitable for PV system. The installation should be designed by qualified engineer, conforming to all relevant construction/electrical laws, regulations and codes. PV installation should be approved by relevant authorities.
- The PV module should be mounted on supporting structures. Supporting structure and other components of the PV system should not have any undesirable mechanical or electrical influence on the PV module, otherwise the warranty would be invalid.
- Bearing ability of the supporting structure should be enough to sustain the modules weight and wind/snow pressure, as well as the pressure from installers and apparatus. Design of supporting structure should guarantee that there will be no affect on the modules when hot swell happens. The PV module should be firmly fixed with bolts or clamps on the supporting structure. The interval between modules should be at least 10mm.
- Do not cause any damage of the PV modules during mounting. Do not drill holes on the frame. Otherwise, the warranty is not valid any more.
- The junction box should not be at the downward end. Bending radius of the J-box cable should be more than 60mm.
- Module installation site should maintain good ventilation to facilitate the heat dissipation, which is in favor of the power generation and fire safety.

- For PV installation on the ground, the modules are expected to be at least one meter high from the ground to avoid soil, grass and snow covering the bottom part of the modules.
- For PV installation on the rooftop, the structure and bearing ability of roof must be suitable. The fastness of installation should be guaranteed to avoid the module falling off from rooftop. There should be a gap of at least 20cm between the module and roof.

CAUTION!

Roof structure will affect the fireproofing so it's necessary to earth ground fault circuit breaker, fuses and circuit breaker. Unsuitable installation will bring on extra damages!

CAUTION!

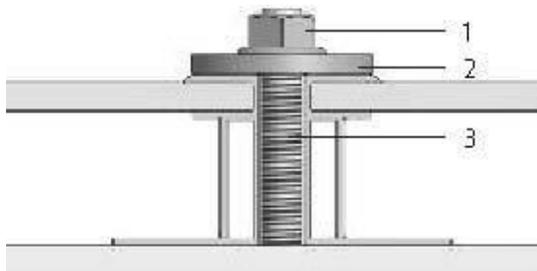
When installing the module on a roof or building, do so in calm winds. Installing a module during strong winds may cause accidents!

- For the project on water surface, installation conditions should be provided in advance, so that the module manufacturer can choose the suitable materials to be in accord with the water surface installation conditions.

2.3 Installation Methods

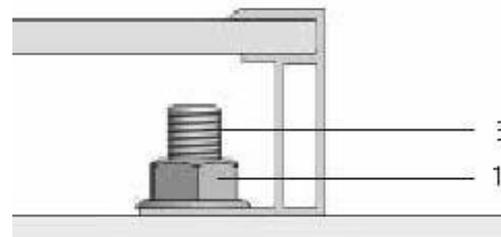
PV modules can be mounted to the substructure by screwing (Example A) at the back side.

Example A: Clamping

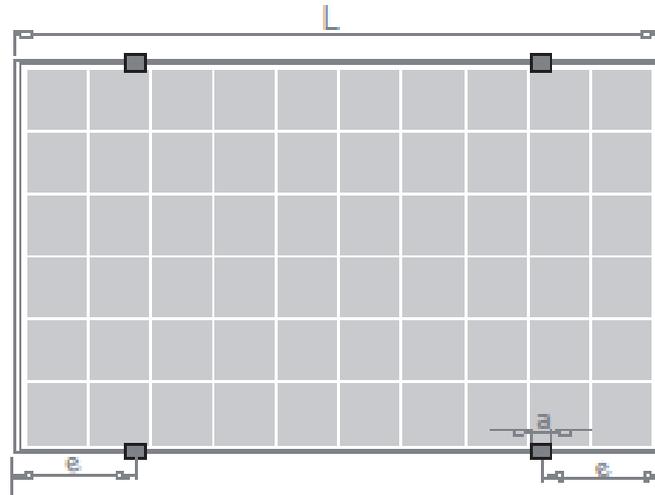


- 1) Stainless steel lock nut
- 2) Stainless steel washer
- 3) Stainless steel M8 bolt

Example B: Bolting



- Clamp fixing: Torque wrench is recommended for installation. The tightening torque (using stainless steel M8 bolts, stainless steel washer and stainless steel M8 nut) should be around 15-20N•m.

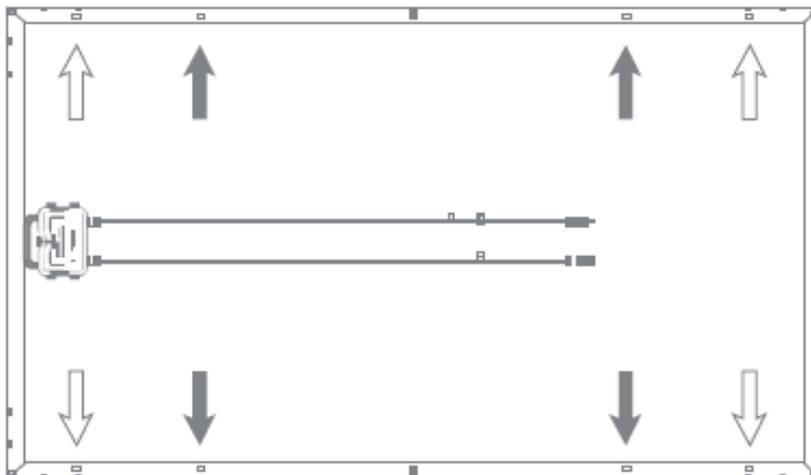


front and back side 2400 Pa: $L/8 \leq e \leq L/4$, $a \geq 6\text{cm}$

front side 5400 Pa, backside 2400Pa: $L/8 \leq e \leq L/6$, $a \geq 6\text{cm}$

Specially, for front and back side 10000Pa (only for Strengthened Module) $L/8 \leq e \leq L/6$, $a \geq 8\text{cm}$

- Bolt fixing: The installation should be fulfilled using the installation holes already on the frame. If the wind or snow pressure is not much, four installation holes may be used. When wind speed is higher than 130km/h or snow pressure is higher than 2400Pa, all the eight installation holes should be used.



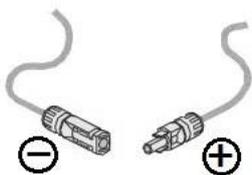
3. Electrical Installation

3.1 Cables and Wiring

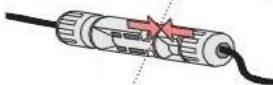
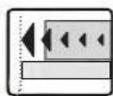
- When designing the system, avoid forming loops (to minimize risk in the event of an indirect lightning strike). Check that wiring is correct before starting up the generator. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, then there is a wiring fault.
- Use field wiring with suitable cross-sectional areas that are approved for use at the maximum short-circuit current of the PV module. Installer use only sunlight resistant cables qualified for direct current (DC) wiring in PV systems. The minimum wire size should be 4mm² and temperature rating is at -40°C to+85°C.
- Each module string should be equipped with fuse protector.

Cable standard	Test standard	Cable Size	Temperature Rating
	TÜV 2 PfG 1169	Min 4mm ²	-40°C to +90°C

- Correct connection of contact plug connectors



The plug connector has its own polarity. The terminals marked with "+" and "-" represent the positive and negative terminals of the power supply. Only those terminals indicated with "+" and "-" should be connected to the load. Make sure that the connection is safe and tight.



When integrated Junction box is adopted, no tool is necessary for wiring. Just connect modules in series according to "+" or "-". Complete complex series and parallel connection can be done easily and quickly using different electric connectors provided by supplier.

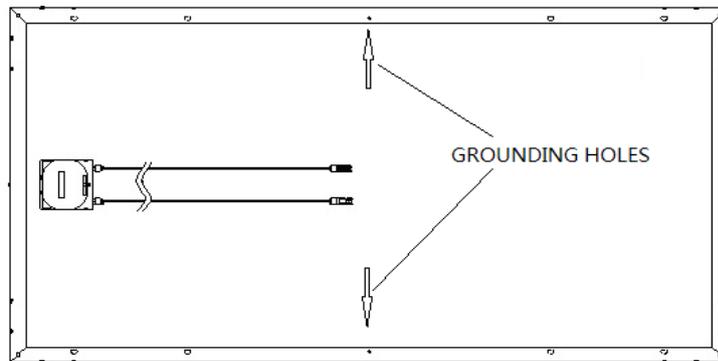
CAUTION!

Connectors provided by different suppliers will not mutual match up. Different connectors provided by one supplier will not match up either. Only one type of the same connector from one supplier shall be used to ensure the reliability of electrical connection. The plug connector should not receive outer stress. Otherwise, it is only used to connect the circuit!

- Use cable extensions and plugs that are designed for outdoor applications. Ensure that they are in perfect electrical and mechanical condition. Use only cables having one conductor. Select the appropriate cable diameter to minimize voltage drop (to calculate the minimum cable diameter, the fuse, and to calculate controls, multiply the Isc and Voc by a factor of 1.25).

3.2 Grounding

- Grounding PV modules is necessary to reduce or eliminate shock and fire hazards. The installer of a PV system is responsible for grounding each module frame. It is recommended to ground each module frame at the provided grounding holes (4 mm or 5/32 inch diameter, marked with the grounding symbol).



- PV module frame is made of anodized aluminum. Corrosion can occur if PV module is subject to a salt-mist environment and is in contact with another type of metal (electrolytic corrosion). If condition permits, PVC washers may be placed between PV module frame and support structure to prevent this type of corrosion. All bolts, nuts, washers for grounding should be made of stainless steel, unless otherwise specified.

3.3 Electrical Configuration

- PV modules with different electrical characteristics must not be connected directly in series. Unless specified, the maximum system voltage of module is 1000V. For example, if the module of SK6612M-315Wp is used, at most 21 modules can be connected in series in one string.

4. Cleaning and Maintenance

4.1 Cleaning

- Do not change the PV components optionally (diode, junction box, plug connectors)
- Given a sufficient tilt (at least 15°), it is not generally necessary to clean the modules (rainfall will have a self-cleaning effect). In case of heavy soiling (which will result in output reductions), we recommend cleaning the modules using plenty of water (from a hose) without cleaning agents and using a gentle cleaning implement (a sponge). Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratched.
- Do not use high pressure water spray nor chemicals to clean the PV modules.

4.2 Check

- Routinely check is necessary for PV system.
- All fastenings should be kept tight and secured free of corrosion..
- All cable connections should be secure, tight, clean and free of corrosion.
- Cables should be kept intact.
- Check the grounding resistivity routinely.
- PV module should not be discarded casually, but should be recycled by professional organization.

5. Disclaimer

- Akcome gives no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.
- Akcome have rights of modifying manual, PV products, specifications or the rights of the product information, without prior notice.
- This manual information based on reliable our knowledge and experience, including product specifications of the information and advice does not constitute any guarantee.

6. Electrical; Parameters for modules

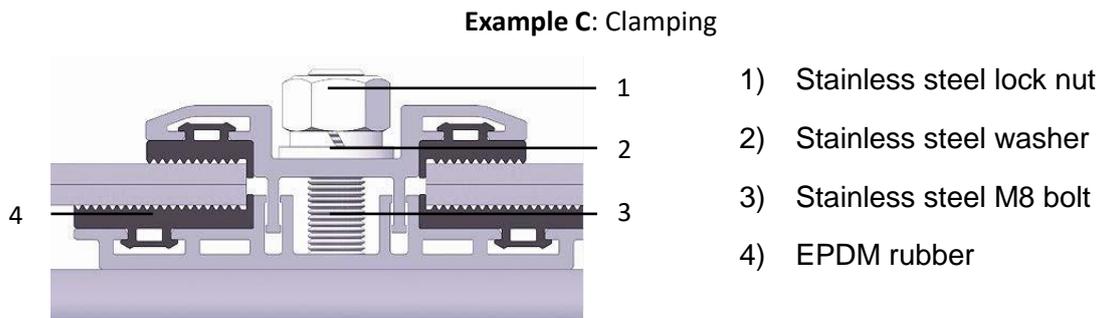
6.1 Parameters for different modules

- Electrical parameters on nameplate are typical values at standard test condition (STC, Irradiance of $1000 \text{ W} \cdot \text{m}^{-2}$, AM 1.5 spectrum, and a cell temperature of 25°C). The electrical characteristics are within ± 10 percent of the indicated values of I_{sc} , V_{oc} and P_{max} under STC. Refer to module datasheets for specific power output tolerances.

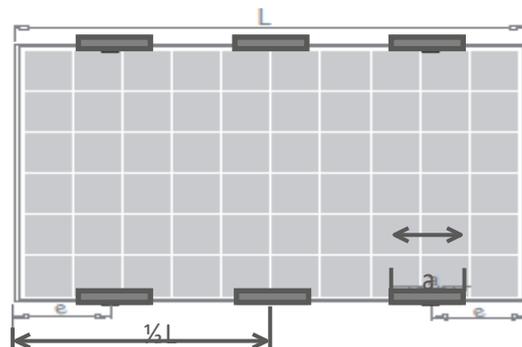
7. Appendix-Double Glass Module Installation supplement

7.1 Installation Methods

- Double glass modules can be mounted to the substructure by clamping (Example C) at the front and back side.



- Clamp fixing: Torque wrench is recommended for installation. The tightening torque (using stainless steel M8 bolts, stainless steel washer, stainless steel M8 nut and EPDM rubber) should be around 15-20N•m. Do not use clamp to block the surface of solar cells.



(Front and back side) 2400 Pa : $L/8 \leq e \leq L/4$, $a \geq 25c$

(Front side) 5400 Pa (Back side) 2400Pa: $L/8 \leq e \leq L/6$, $a \geq 25cm$, Add two clamps in the middle of the two long edges.

7.2 Double Glass Module Grounding

- EQUIPMENT GROUNDING: double glass modules do not present any exposed conductive parts, and therefore do not require to be electrically grounded for compliance to the National Electrical Code.
- Proper equipment grounding is still required for the racking system in compliance with all local electrical codes and regulations. Please refer to the racking system user instructions

7.3 Statement

- For the contents not mentioned in this appendix, please refer to clause 1-6