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上迈（镇江）新能源科技有限公司

Sunman（Zhen jiang）Co, Ltd

SMF-G Installation Manual

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Contens

1.0 Summary

Thank you for purchasing SunMan photovoltaic modules.

This guide contains important information for the installation, maintenance, and safe use of SunMan (Zhenjiang) Company Limited, referred to as “SunMan”, SMF-G series solar PV modules, referred to as “modules”. Please read and understand this manual before installing or handling the modules.

Users and installers must complete a specific site engineering review to ensure the proposed methodology is fit for purpose. The installation and operation of solar modules require specialized skills, and must only be carried out by qualified personnel. Failure to follow these safety guidelines can result in personal injury or property damage.

1.1 Disclaimer

Sunman reserves the right to modify this manual without prior notice. Any changes will be published on the official SunMan website**.** Customers should regularly check for updates.

Failure to operate in accordance with the requirements in this manual (including the updates published on the official SunMan website), the limited product warranty shall be void.

This manual does not constitute any warranty, expressed or implied. Users and installers must complete their own project-specific engineering assessments to ensure compliance with local laws and construction standards.

1.2 Responsibility

Regardless of whether the installation follows this manual (including changes announces on the official SunMan website at the time of installation), SunMan shall not be held legally liable for any damages arising during installation, including but not limited to personal injury or property loss resulting from the operation of the modules and the installation of the system.

This manual is for installation guidance only and does not constitute any form of warranty, whether explicitly stated or implied.

1.3 Copyright and Trademark Information

1.4 Warranty Information

If non-approved hardware is connected to the SunMan module, the warranty shall be void.

1.5 For Further Information

For additional technical support or information please visit the support page of the official SunMan website:

www.sunman-energy.com。

2.0 Safety Precautions

Warning: Prior to the installation, wiring, operation, or maintenance of the modules, read and understand all safety instructions. Failure to adhere to these instructions may result in property damage, injury, or death. DC electricity is generated when the module is exposed to sunlight or other light sources. Direct contact with live parts of the module, such as the terminals, whether connected or not, may result in serious harm.

Safety Rules:

- All installation work must strictly comply with local regulations and applicable national or installation electrical standards.
- Use insulated tools to reduce the risk of electric shock.
- Wear protective gear (non-slip gloves, work clothing, etc.) to avoid direct contact with voltages above 30 VDC and also protect from sharp edges during installation.
- Do not install or handle modules in rain, strong winds, or mornings with heavy dew without proper safety precautions.
- Keep children and unauthorized personnel are not allowed to access the installation or storage areas.
- If the inverter or its breaker cannot be turned off, cover the array of modules with an opaque material before wiring to stop power output.
- Do not use or install damaged modules.
- Avoid scratching the backsheet of the module.

- Damaged surfaces may cause electric shock.
- Do not attempt to repair any part of the module. There are no user-serviceable components as part of the module.
- Keep the junction box closed at all times.
- Do not disassemble or modify any part of the module.
- Do not connect or disconnect the module while there is currently flowing.

3.0 Storage and Unpacking

Precautions and general safety rules

- The modules must be transport in the package provided by SunMan and stored in the original package before installation. Please protect the packaging from damage. Open the packaging according to the recommended unpacking steps. Cure must be taken during unpackaging, shipping, and storage.
- Store modules in a dry and ventilated environment. For long term storage, keep the modules in the original packaging.
- Follow the guidelines on the limitations of stacking as marked on the packaging.
- Do not unpack the modules outdoors in rain. Wet packaging may collapse, causing damage to modules in personnel.
- Please wear gloves while unpacking.
- Follow steps in Appendix B for unpacking.

Module Identification

- Barcode: each individual module has a unique serial number. The serial number has 21 digits. The 1st to 7th digits are the module type for internal use.

The 8th to 11th digits are the year code. The 12th and 13th digits are the month code. The 14th and 15th are the week code. The 16th to 17th digits are the order number. The 18th to 21st digits are the sequence codes. For example, SMSxxxxxxx20210415xxxxxx means the module was made in the 15th week of 2021.

- Each module has a unique barcode, shown twice. (The first is permanently fixed to the interior of the module and is visible from the front of the module at the top. This barcode is inserted prior to lamination. The second is fixed to the rear of the module.)
- Every module has a nameplate fixed to the back. The nameplate on the back shows the model, key electrical performance specifications, safety specifications, and certifications.

4.0 Module Installation

Precautions and general safety rules

- Prior to installing modules, complete a site-specific engineering review to ensure the proposed methodology complies with local laws, regulations, and construction standards.
- Check applicable building and construction codes to confirm the building is suitable for SunMan module installation.
- When installing modules, ensure they are mounted on a fire-resistant roof. According to UL 790 standards, SunMan modules are rated Class C for fire resistance.
- SunMan solar modules comply with Application Class A (equivalent to Safety Class II, IEC 61730-1). Such modules may be used in systems accessible to

the public, with voltages exceeding 50V or power greater than 240W.

- The mounting structure must be strong enough to withstand site-specific loads. This is the responsibility of the mounting structure supplier.
- In accordance with IEC 61215-2:2021, the maximum test load is calculated from a corresponding maximum design load with a safety factor of 1.5 applied. (Test Load=Design Load × 1.5).

4.1 Operating Environment

The modules are suitable for general climate conditions, as referenced in IEC 60721-2-1 – Classification of environmental conditions, Part 2-1: Environmental conditions appearing in nature – temperature and humidity.

- If the modules are to be installed in special environments (such as altitudes above 2000m), SunMan technical support must be consulted in advance.
- Do not install modules near flames or flammable materials.
- Do not expose modules to artificial concentrated light sources.
- Modules must not be installed or used in environments with excessive hail, snow, sand, smoke, air pollution, coal dust, etc., nor in environments with highly corrosive substances (such as volatile chemical vapors, acid rain, or salt mist).
- SunMan recommends installing modules in environments with working temperatures between -40°C and 40°C (monthly average maximum and minimum). The absolute working temperature range is -40°C to 70°C.
- Do not install modules in locations where they may be submerged in water or continuously exposed to sprinklers or fountains.

- **Failure to comply with the above requirements will void the SunMan warranty。**

4.2 Installation Requirements

- Ensure that neither the front nor back surfaces of the modules come into direct contact with the mounting structure, building surfaces, or foreign objects (such as stones), as external force may damage the encapsulation structure and void the product warranty.
- Modules must be securely installed on the mounting structure.
- To reduce mismatch losses in the array, it is recommended to connect modules with similar electrical performance in the same string.
- Ensure that wind or snow loads on installed modules do not exceed the maximum allowable load.
- When modules are installed on rooftops, provisions for long-term maintenance must be considered. The roof structure must be evaluated by an engineer, with a formal structural analysis proving it can withstand the additional system load, including the weight of PV modules.
- Due to thermal expansion and contraction, maintain a minimum spacing of 5mm between adjacent module frames.
- Suman recommends the installation angle of modules should no less than 5 degrees, so that surface dust on the modules can be easily washed away by rainwater during rainy days, thereby reducing the frequency of module cleaning. When installed in the Northern Hemisphere, modules should face towards the south; when installed in the Southern Hemisphere, modules should face towards the north.

- Modules must be installed in areas free of year-round shading. Ensure there are no obstructions (e.g., trees, poles) that could block sunlight. Frequent shading will reduce the service life of modules.
- **Failure to follow the installation specifications in this manual may result in micro-cracks, fire, or other damage.**

5.0 Installation Guide

5.1 Module

Applicable module model number:

SMFxxxN-6X18DW-G, SMFxxxR-6X16DW-G

5.2 Construction Materials

- Structural adhesive, cleaning tools, tape measure, thread release tool, etc.
- Structural adhesive: In Western markets, we recommend Sika Sikasil SG-20s or Dow DowSil 995. Please contact Sunman and the adhesive manufacturer directly for more information.

- Glue gun

5.3 Module Handling

- Do not apply excessive loads or twist modules.
- Do not stand, climb, walk, or jump on the modules.
- Do not place modules in an environment without reliable support or fastening.
- Do not lift the panels via the junction box or cables.
- Handle modules with care during transport, avoiding impacts of module edges against the ground or other sharp, hard objects.

5.4 Construction Precautions

- Before commencing construction, please ensure you have read the adhesive manufacturer's manual to ensure that all the adhesive application requirements are followed. The construction can proceed normally within a temperature range of 5 to 40℃ and a humidity level below 80% (The specific construction temperature range should be based on the information provided by the adhesive manufacturer).
- The installation surface must be cleaned or wiped dry, free of floating soil, oil, etc. In order to achieve the required adhesion, the roof shall be cleaned using the cleaning agent specified in Annex A or SunMan approved cleaning agent. Please refer to adhesive manufacturer's substrate preparation.
- After initial installation, the panel and adhesive shall not be disturbed for a minimum of 24 hours.
- The roof angle is within 15 degrees. If slippage occurs, appropriate measures must be taken.
- The paste surface needs to be flat and free of pits or bumps.

- When storing installation materials, it should comply with the storage requirements for the materials.
- Ensure substrate(s) have been tested and paired to compatible adhesives or bonding procedure. If unsure, please seek clarification from the adhesive manufacturer or SunMan.

5.5 Timps and Precautions for Gluing Modules

- Before commencing construction, please ensure you have read the adhesive manufacturer's manual to ensure that all the adhesive application requirements are followed. Please make sure the surface is cleaned and there is no moisture present before applying adhesive.
- After applying the adhesive, the width shall be no less than 10mm and the height no less than 5mm. After bonding, the height of the adhesive should be between 3-10mm. It should not be too high or too flat; if too high, the curing time of the structural adhesive will be excessively long; if too flat, the adhesive bond may fail. Do not use feet or any non-designated tools to press down the adhesive.
- The application of the adhesive should be a continuous and even movement preferable from a caulking gun, using the weight of the module itself to spread the adhesive.
- Ensure the time between applying the adhesive and installing the panel does not exceed 5 minutes.
- Silicone sealant will cure to a depth of 2-3mm in 48 hours. Do not apply any force, move the module, or perform any tests before the adhesive is fully cured.

不同环境温度下专用胶固化表 Special glue curing table at different ambient temperatures			
环境温度Ta Ambient Temperature	-10≤Ta≤0	0＜Ta＜20	20≤Ta≤45
完全固化时间（Day） Full Solidification Time	21	14	7
标准固化条件：温度（23±2）℃、湿度（50±5）%条件下7天可完全固化 Standard solidification conditions: temperature (23±2) ° C, humidity (50±5) % conditions can be completely solidified in 7 days			

Table 1. Adhesive curing time

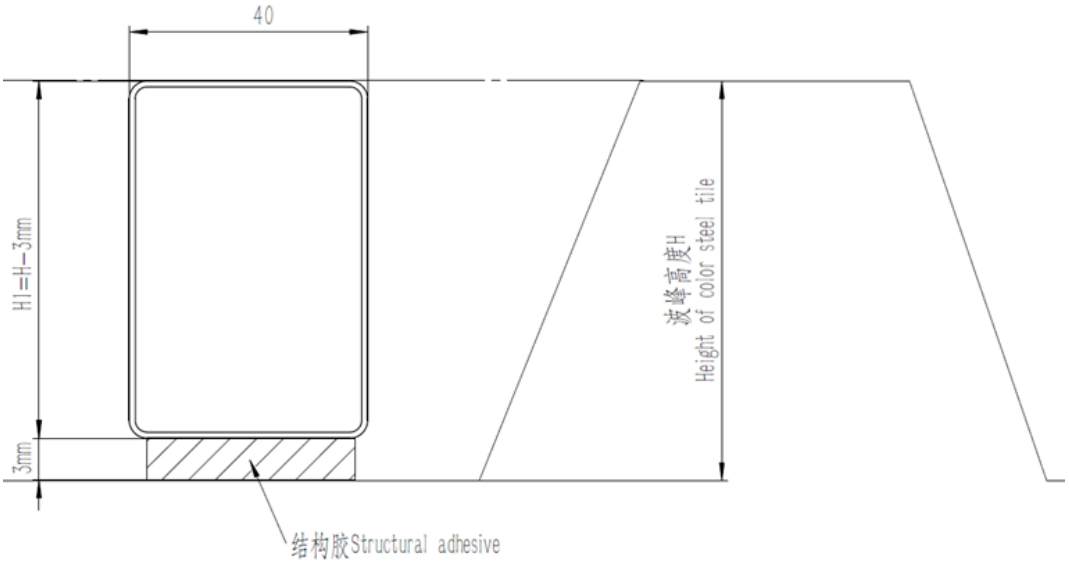
(This table is provided solely as a reference for the curing time of TONSAN 1527 adhesive. The specific curing time is subject to the information of the glue manufacturer)

5.6 Trapezoidal Metal Roof Quick Bonding Installation Method

5.6.1 Clean the roof surface

Remove debris from the roof base and use a designated or approved cleaning agent (Annex A) to clean the roof. If the roof is very dirty, use a low-pressure water spray or power washer before using the cleaner.

5.6.2 Aluminum tube selection



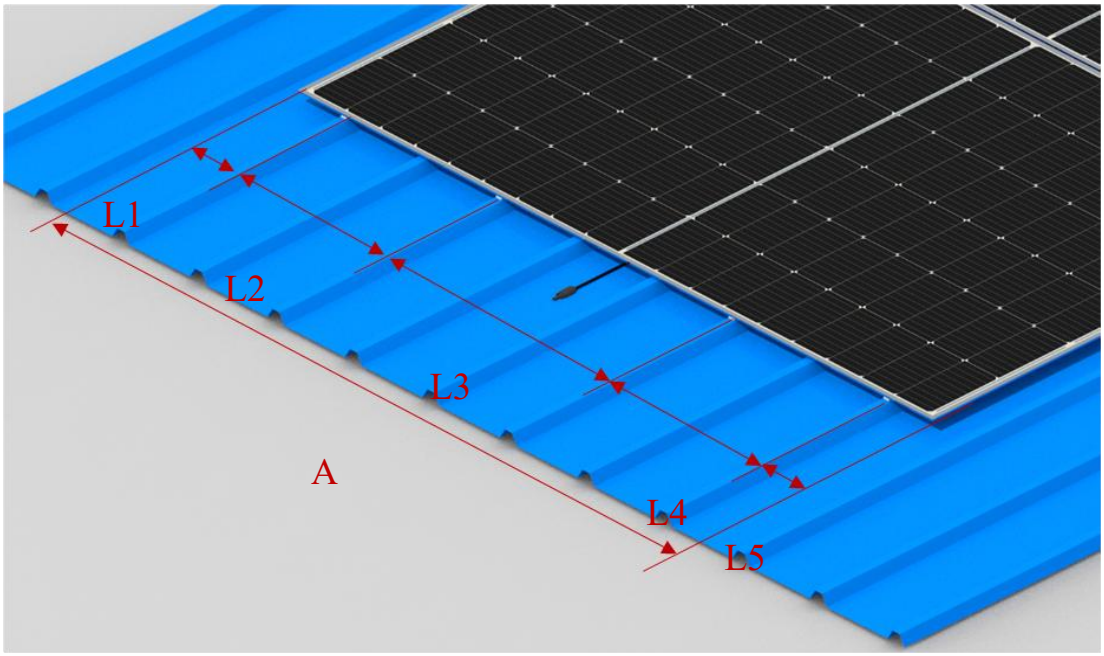
- Material: Aluminum 6000 Series-T5/T6.
- Surface treatment: Anodic oxidation AA10 and above.
- Please confirm with SunMan if other materials will be used for the supporting structure.

5.6.3 Positioning and marking out

- Determine the installation location of the module. Mark out and place string line as needed.

■ Design consideration: Panels should not be placed where it will be subject to the roof's thermal expansion and contraction and other movement.

5.6.4 Installation Layout Plan

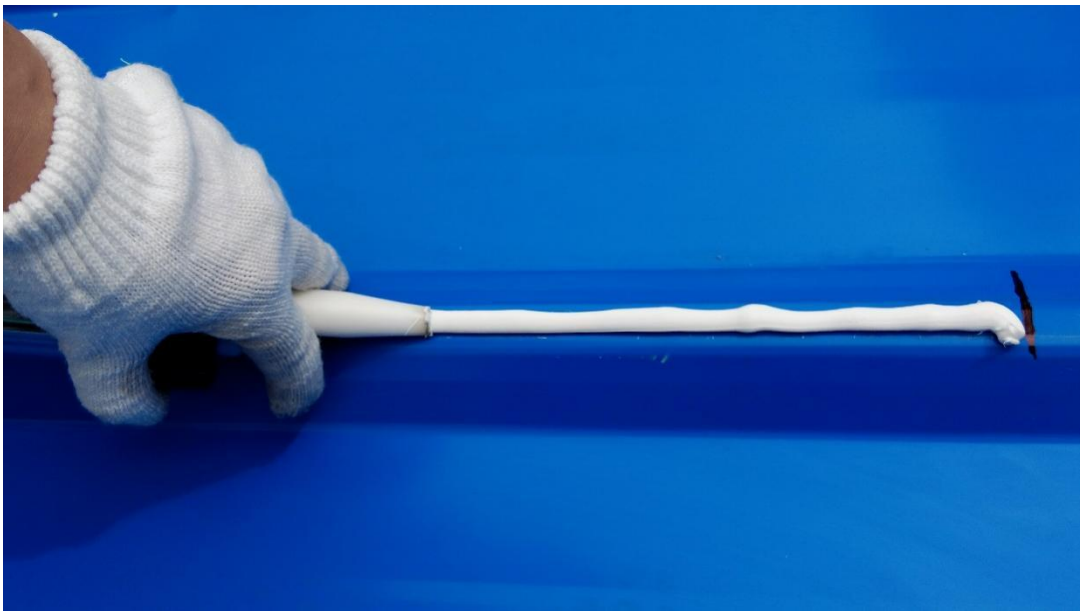


- Select appropriate roof peaks, apply adhesive, and fix modules. Module positioning and peak selection must meet the following requirements.
- The distance between the junction box and peak must be ≥20mm。

- The peak closest to the outer edge of the muddle must be fixed with adhesive.
- The spacing between adjacent adhesive strips (L2, L3, L4) shall be ≤680mm. If not met, increase the number of adhesive strips to comply.
- The unsupported span at both ends of the module (L1, L5) shall be ≤280mm. If not met, add supporting structures at the module edges.

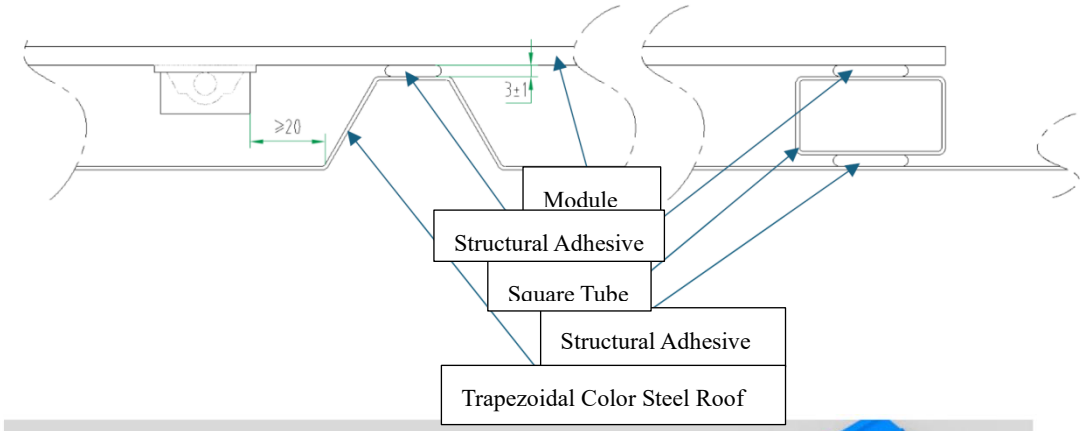
5.6.5 Gluing Method

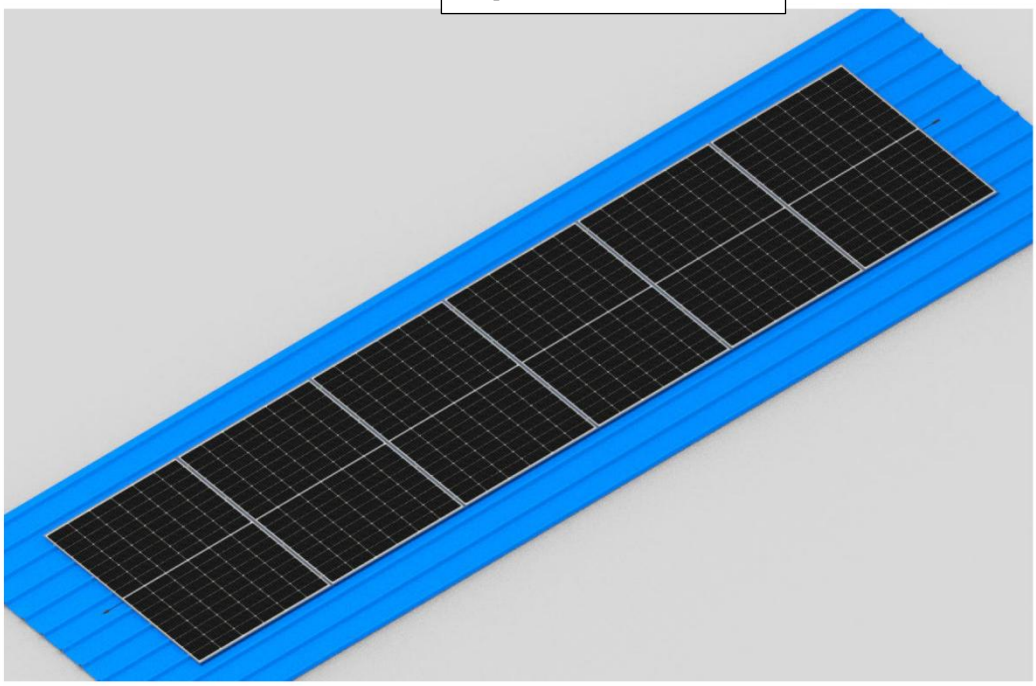
- The application of the adhesive on the roof sheet peak shall be a continuous and even movement preferable from a caulking gun.



- The length of the adhesive shall be the same as the width of the module.

5.6.6 Adhering modules.





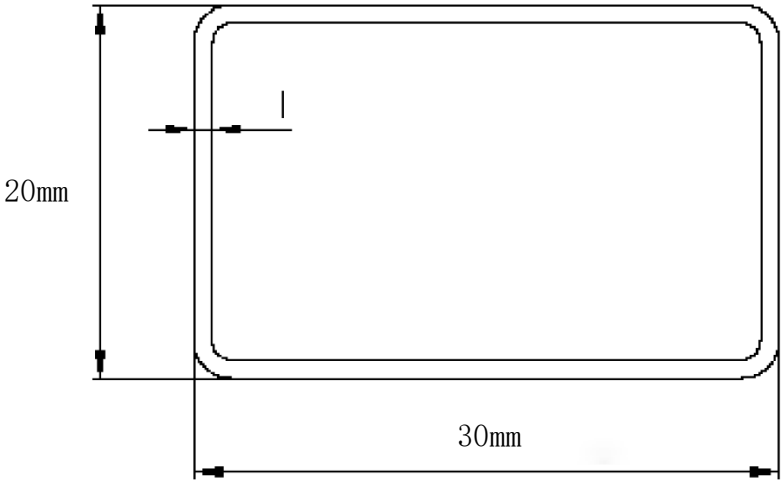
- Avoid excessive twisting of modules during installation. When installing the modules, ensure they are perfectly level. Do not reposition after initial adhesion.
- After modules are laid, use a roller to press the module if need to ensure contact between the adhesive and the module.

- Minimum spacing between modules is 5mm. Maintain a 500-800mm walkway between arrays (this spacing is for reference only).
- This installation plan applies to most environmental conditions. Maximum static load on the module backside is -2400Pa, and maximum static pressure on the frontside is +2400Pa.

5.7 Flat Roof Installation Method

After cleaning the roof surface, bond aluminum square tubes to the roof. Components are then affixed to the aluminum square tubes. For certain types of roof substrates, apply a primer coat to the adhesive application area prior to structural adhesive installation to enhance adhesion.

5.7.1 Aluminum rail requirements



- Material: Aluminum 6000 Series-T5/T6.
- Surface treatment: Anodic oxidation AA10 and above.
- Please confirm with SunMan if other materials will be used for the supporting structure.

5.7.2 Roof cleaning

Remove debris from the roof substrate. Clean the roof using a specified or approved cleaning agent. If the roof is heavily soiled, pre-clean with low-pressure water spray or a power washer before applying the cleaning agent.

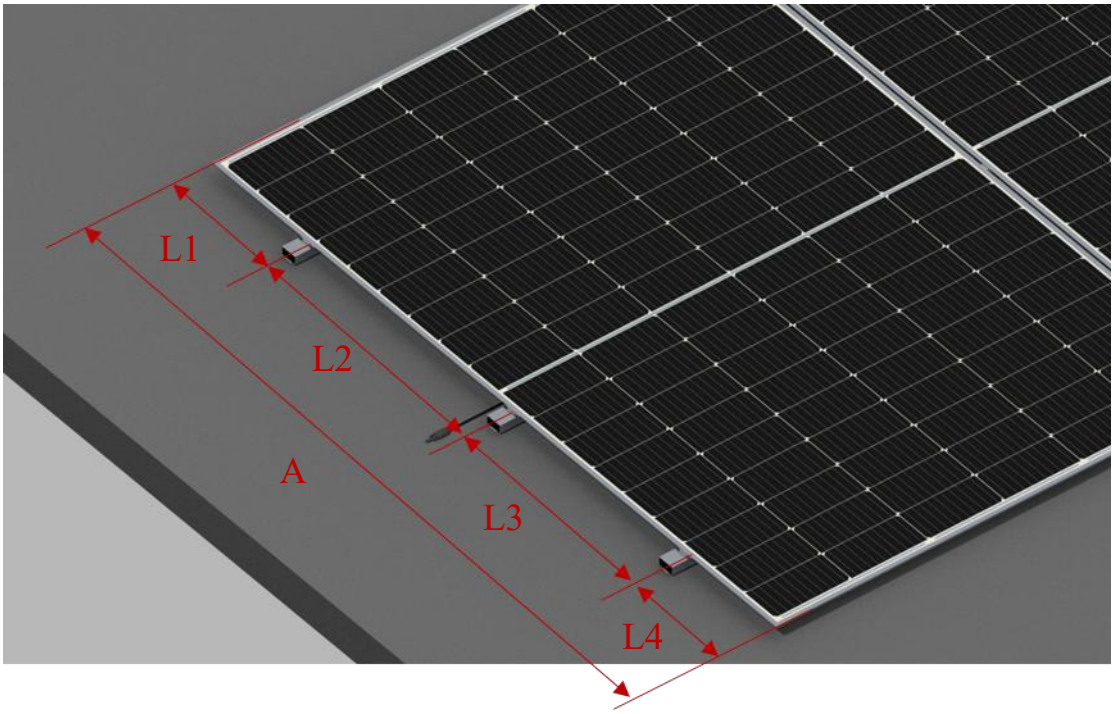
5.7.3 Positioning and layout

- Determine the spacing of aluminum tubes according to the design drawings. Contact Sunman for drawings.

- Use no fewer than three aluminum tubes for support under each panel.

5.7.4 Installation Layout Plan

Each individual module requires at least three rail supports, which should be evenly distributed throughout the array.

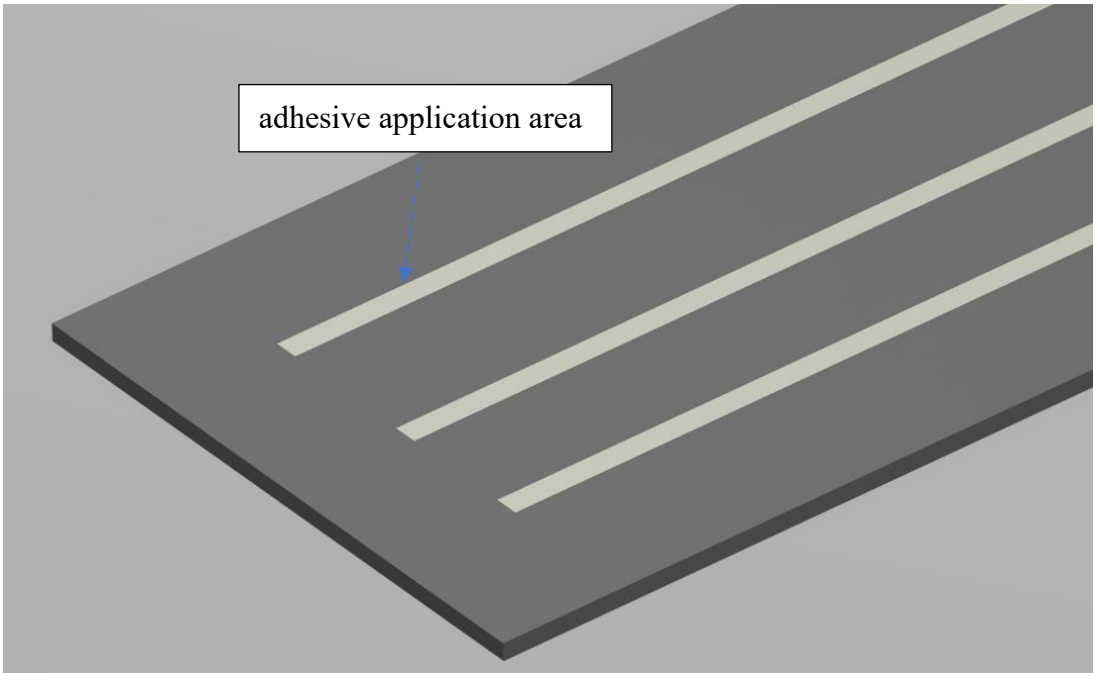


- 480≤L2, L3 ≤680mm, L1, L4≤280mm.
- Note: Individual modules must not span across the joints of the aluminum tubes.

5.7.5 Applying primer to substrate

If the substrate does not require a primer, this step may be omitted.

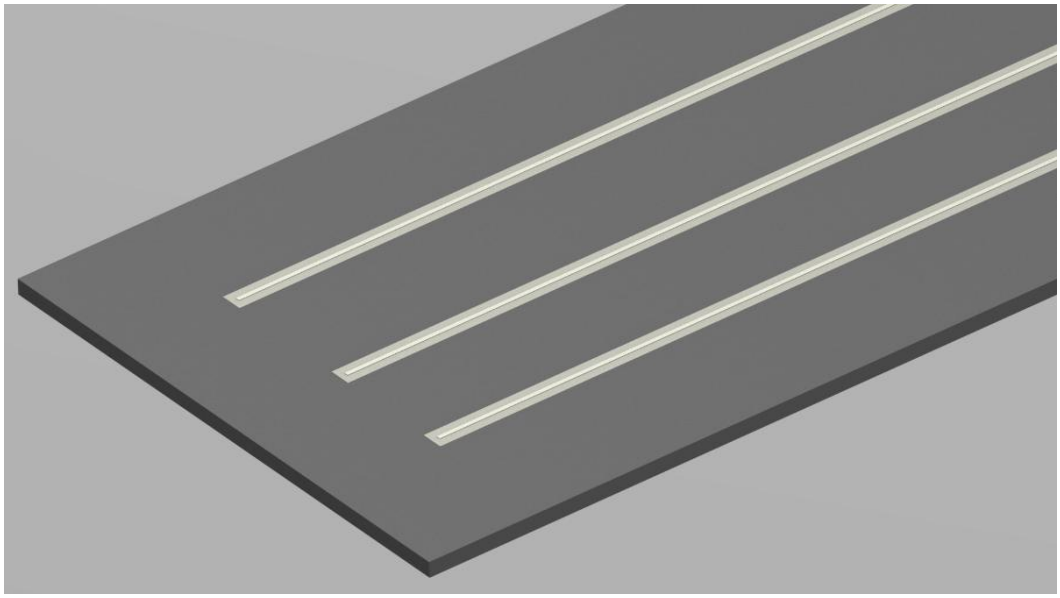
- Determine the adhesive application areas for the modules on the cleaned roof surface (refer to the design drawing for specific dimensions).



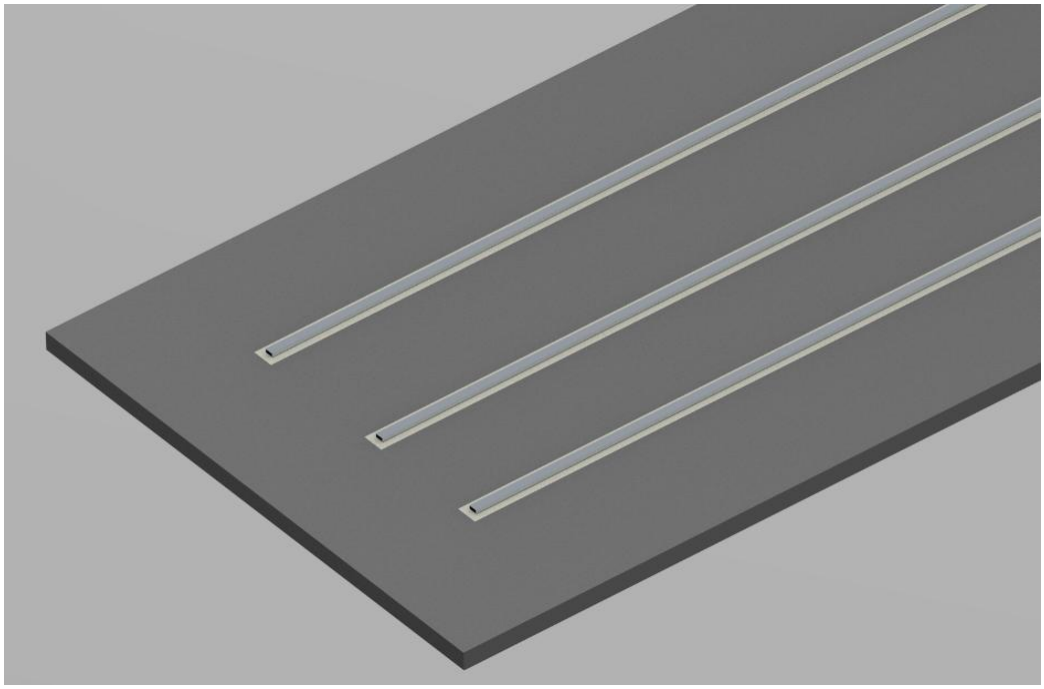
- Perform secondary cleaning of the adhesive application area by wiping it down with the dedicated cleaner specified in Appendix A.
- Apply a primer coat to the adhesive application area prior to structural adhesive application to enhance adhesion.

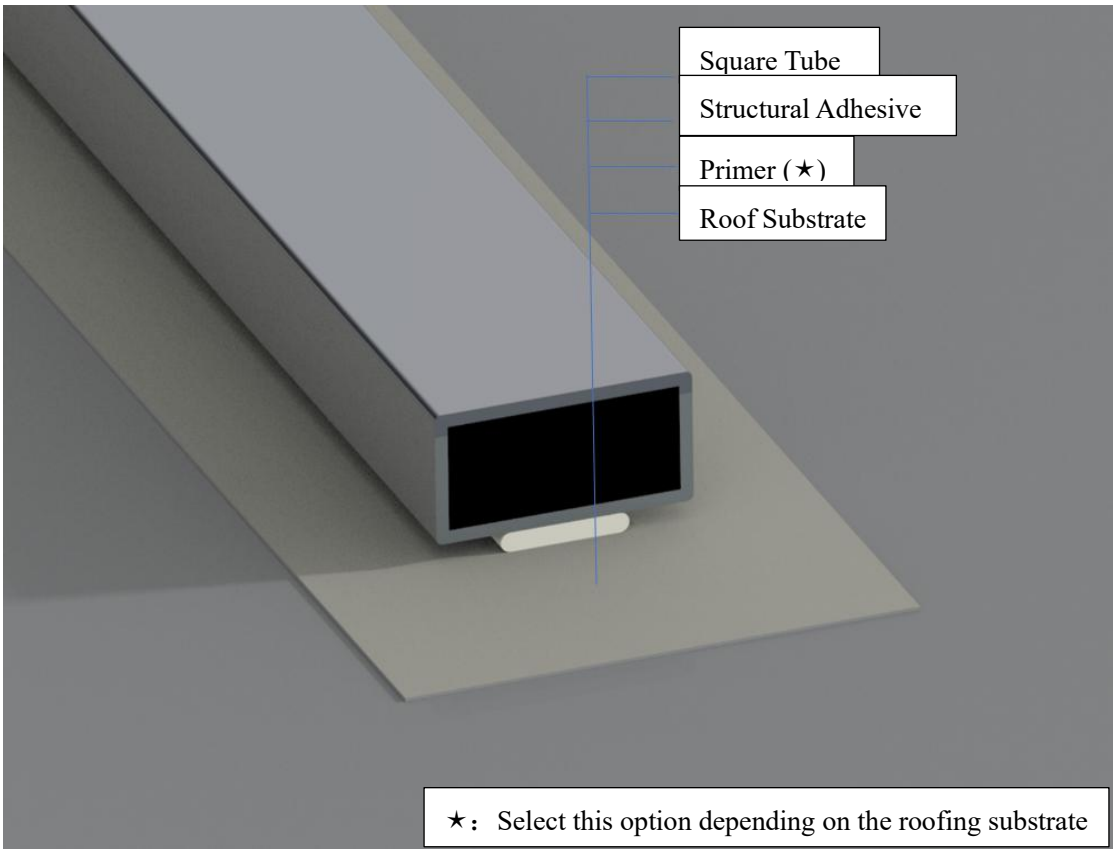
5.7.6 Adhering aluminum tubes

- Apply sealant in the designated area according to the adhesive specifications, ensuring continuous and uniform application.



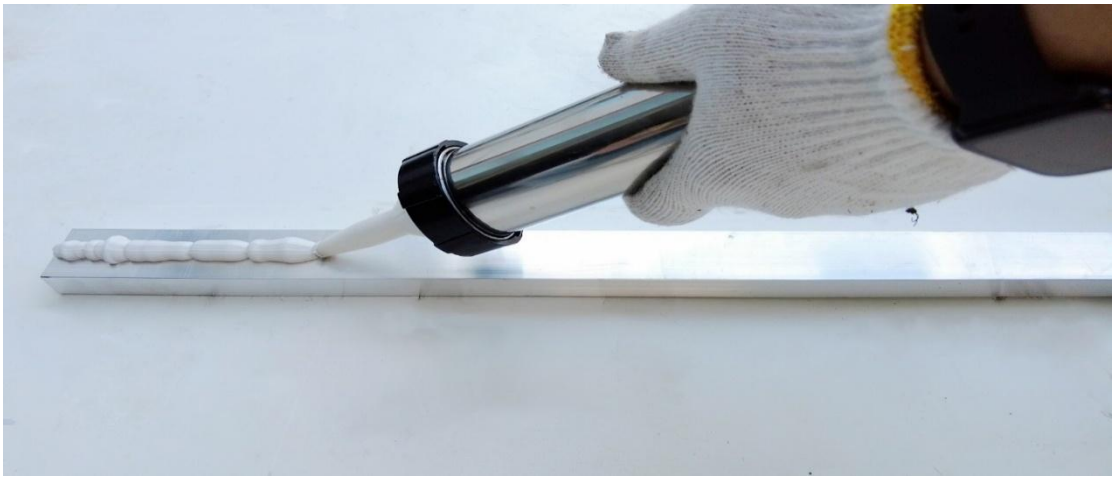
■ Apply the square tube along the adhesive path, pressing it firmly into place to ensure the adhesive layer maintains a thickness of no less than 3mm.

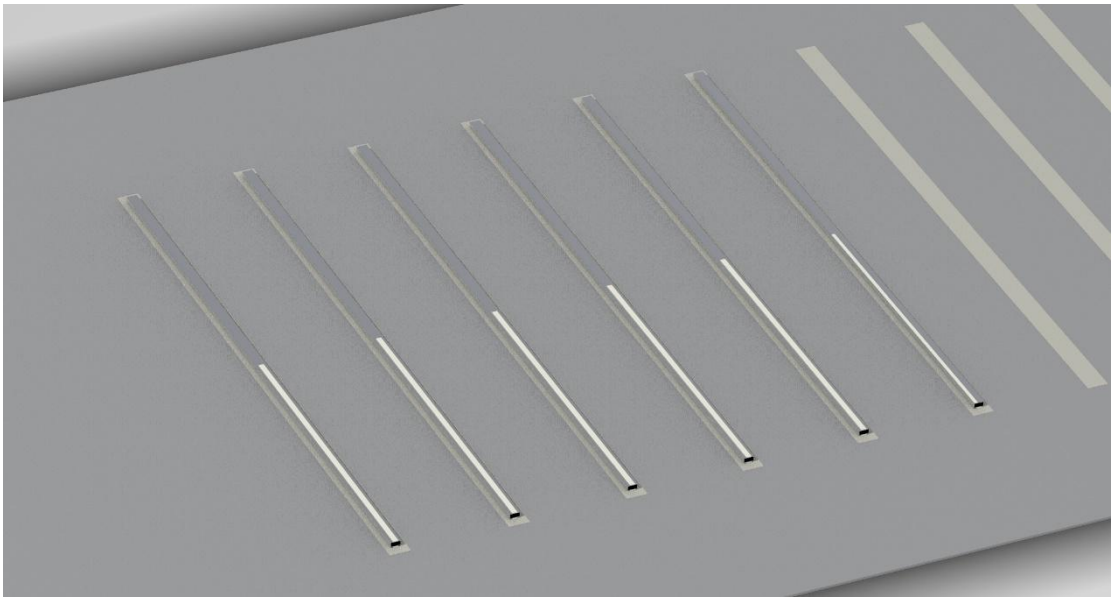




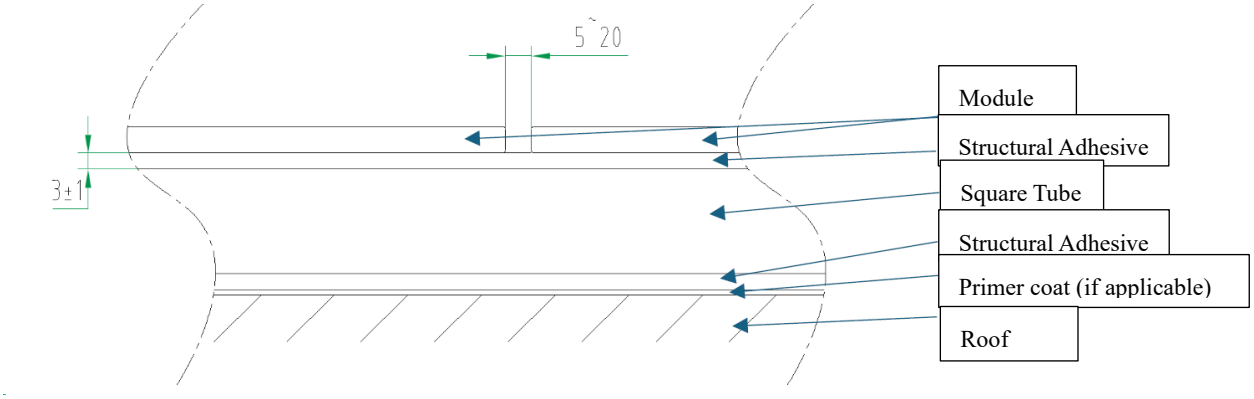
5.7.7 Adhering modules

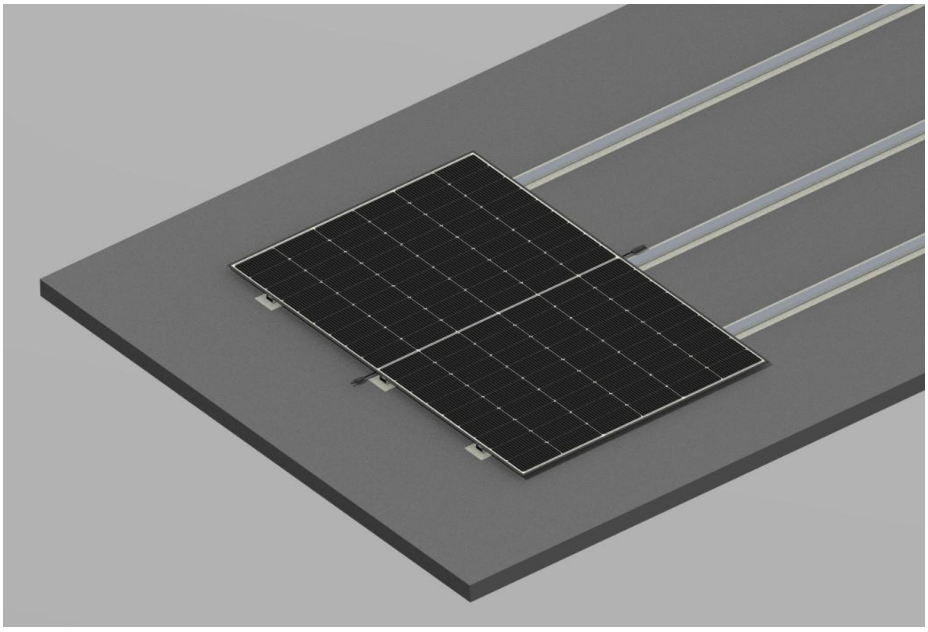
- Apply sealant in the designated area according to the adhesive specifications, ensuring continuous and uniform application.
- The length of the adhesive shall be the same as the width of the module.

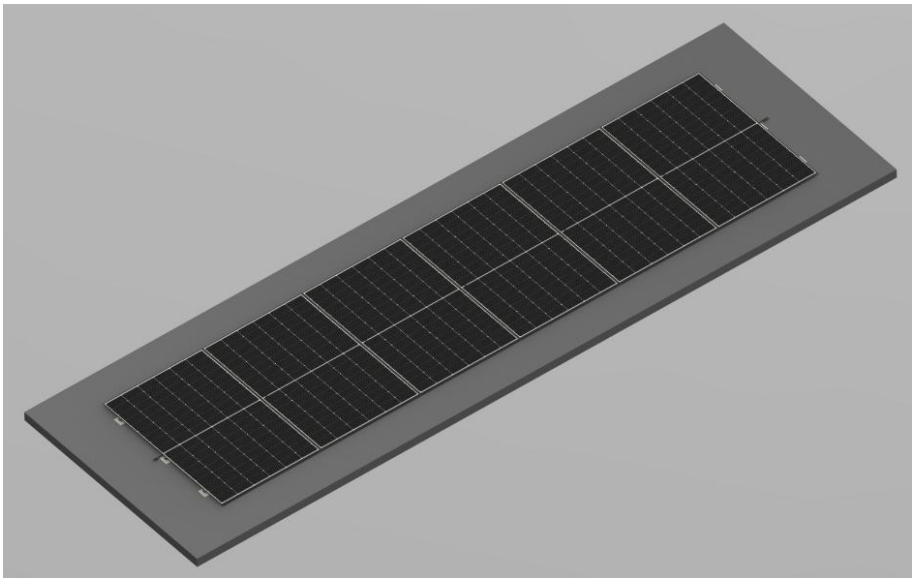




- Avoid excessive twisting of modules during installation. When installing the modules, ensure they are perfectly level. Do not reposition after initial adhesion.
- Minimum spacing between modules is 5mm. Maintain a 500-800mm walkway between arrays (this spacing is for reference only).





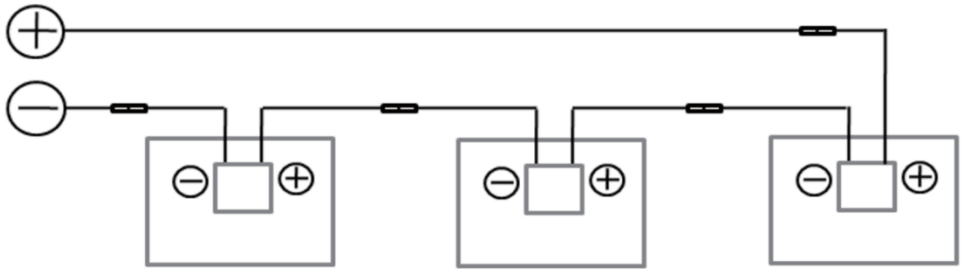


- This installation plan applies to most environmental conditions. Maximum static load on the module backside is -2400Pa, and maximum static pressure on the frontside is +2400Pa.

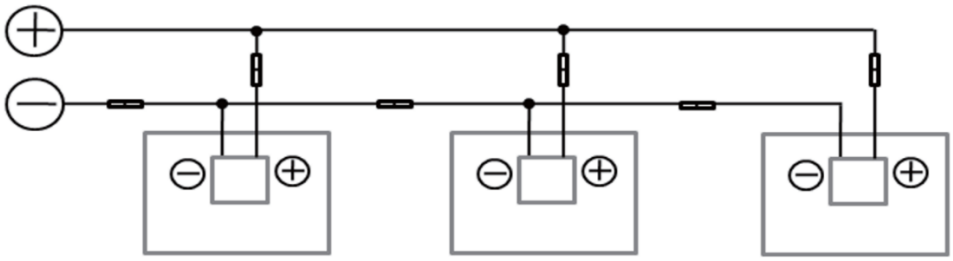
5.8 Electrical Characteristics

- When modules are connected in series, the total voltage is equal to the sum of the voltages of individual modules. When modules are connected in parallel, the total current is equal to the sum of the currents of individual modules. Modules of different electrical characteristics must not be connected within the same string.
- The maximum number of series-connected single-string modules must be calculated in accordance with the requirements of relevant regulations. The open-circuit voltage of the module under the local expected minimum temperature conditions must not exceed the maximum system voltage value specified for the module (the maximum system voltage of the Summan module is DC1000V/DC1500V --- the actual system voltage is designed based on the selected module model and inverter) and the values required by other DC electrical components.
- The open-circuit voltage correction factor can be calculated using the following formula:$C_{Voc}=1-\beta_{Voc}\times(25-T)$. Here, T is the expected minimum ambient temperature at the system installation site, and β (%/°C)is the temperature coefficient of the open-circuit voltage (Voc)for the selected module.
- The total voltage must not exceed the allowable maximum system voltage or the maximum inverter input voltage. The maximum number of modules per string must be calculated by qualified professionals in accordance with relevant regulations.

- If the number of parallel connections ≥ 2, there must be an over-current protection device on each string. The system designer shall design in accordance with local standards and requirements.
- Under normal conditions, modules may experience emitting more power than under standard conditions. When determining the accessories of the PV power generation system, such as the rated voltage, rated current, wire capacity, fuse specifications and other parameters related to the module power output, Isc and Voc marked on modules should be multiplied by 1.25.



- Series connection



- Parallel connection

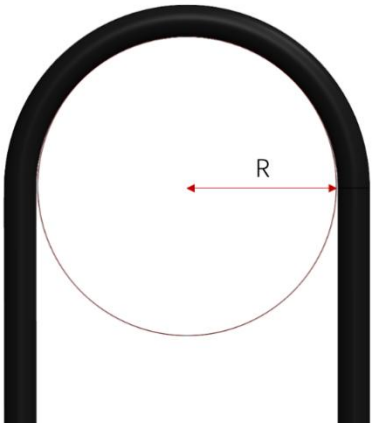
5.9 Wiring and Testing

- Module connections must use junction boxes with IP68 protection rating. This

provides protection for wires and connectors, and shielding accessible non-insulated live parts.

- Connector connections must be kept dry and clean, and protected from rain and moisture. Avoid direct sunlight and water immersion of connectors。
- Each module has two cables connected to the junction box: one positive, one negative. By inserting the positive connector of one module into the negative connector of the adjacent module, the two modules are connected in series.
- For applications requiring high operating voltage, multiple modules may be connected in series to form a string, in which case the array voltage equals the sum of voltages of the individual modules.
- For applications requiring high operating current, multiple module strings may be connected in parallel, in which case the array current equals the sum of currents of the strings.
- Excess cables must be organized and secured properly, and must not cover the cells.
- Permitted solar cables must be single-core cables, at least 4 mm^2 (12 AWG), 90°C rated, and with insulation adequate to withstand the maximum system open-circuit voltage. Select appropriate wire size to minimize voltage drop.
- Before starting the system, check the wiring. If the measured open-circuit voltage (Voc) and short-circuit current (Isc) differ from specifications, a wiring fault may exist.
- According to local fire, building, and electrical codes, use dedicated solar cables and connectors of the same brand and model as those used with SunMan modules, ensuring good electrical and mechanical performance.

- The maximum system voltage is 1500VDC.
- Ensure connectors are securely fastened and properly connected. Connectors must not bear external pressure. Use a dedicated wrench to tighten the connector nut, applying a torque matching the photovoltaic cable used. Typical values range between 1Nm and 3Nm (refer to the connector supplier's information for specific connection steps). Connectors must not bear external pressure. Connectors are intended solely for circuit connection functions and must not be used to open or close circuits. Do not insert other metal objects into the connector or attempt electrical connections by any other means.
- To ensure reliable electrical connection and prevent possible moisture ingress, connectors must be fully engaged and locked until a click is heard. Otherwise, arcing and electric shock may occur. Verify all electrical connections are firm and connectors are fully engaged..
- The minimum cable bending radius R shall be 42 mm.



The electricity generated by the photovoltaic system can be converted into AC electricity and connected to the grid. Local policies may vary region by region. Please acquire the necessary permissions, inspections, and approvals from your local electrical utility department.

5.10 Bypass Diode

The Sunman module has junction boxes which contain bypass diodes connected in parallel with the solar cells. When hot spots occur locally within the module, the diodes are used to bypass the current flow away from the affected cells, limiting module heating and performance reduction. Note: bypass diodes are not current protection devices.

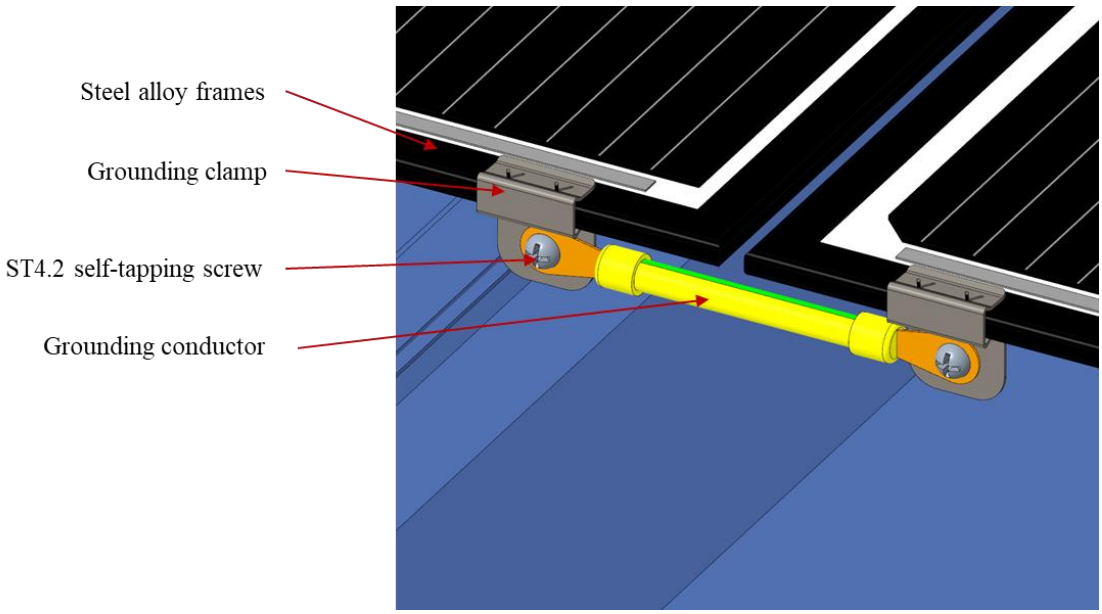
If a diode is confirmed or suspected to be faulty, the installer or system maintenance provider must contact Sunman customer service. Do not attempt to open or modify the module's junction box.

Connector: Stäubli Electrical Connectors AG，PV-KST4-EVO2A/xy / PV-KBT4-EVO2A/xy.

5.11 Grounding

- The module design incorporates anodized, corrosion-resistant aluminum alloy frames as rigid supports. For safe use and to prevent damage from lightning or static electricity, steel-framed modules must be grounded.
- Grounding conductors may be copper, copper alloys, or other materials permitted as conductors, depending on local rules and regulations. Grounding conductors must be connected to earth via suitable grounding electrodes.
- It is recommended to use the copper wire (4-14 mm2 or AWG 6- 12) as the grounding wire. The ground wire must also be connected to ground through a suitable ground electrode. The tight connection of all the joint point should be ensured.
- Grounding clamps are mounted on the steel frame, at the bottom of the clamp, there is a Ø3.7 mm grounding hole, marked with the typical grounding symbol per IEC 61730-1 (⏚).

- Using self-tapping screws to connect the frame of the solar PV module and connect the grounding wire to the ground. The grounding uses the ST4.2 x 10mm self-tapping screws, this ensures that the modules are firmly grounded, the torque applied to ground fixation is 4N· m~8N ·m.



- Grounding between modules must be verified by a qualified electrician, and grounding devices must be manufactured by certified electrical suppliers.

6.0 Operation & Maintenance

To ensure modules perform optimally and maximize system output, the following maintenance measures are recommended:

1. Module appearance inspection

a) Whether there any visible damage to the module.

b) Whether there any sharp objects in contact with the module surface.

c) Whether modules are obstructed by objects (e.g., trees, poles).

d) Whether corrosion is present near cell busbars, which may result from encapsulation material damage during transport, which allows moisture ingress.

2. Module cleaning – dust or dirt accumulation on the surface reduces power output. Clean regularly to maintain a clean surface. Cleaning frequency may depend on site-requirements. Cleaning guidelines:

a) Rinse first with clean water, then wipe dry with a soft cloth. Do not use corrosive solvents or abrasive tools.

b) Clean when irradiance is below 200 W/m², preferably at night, early morning, or evening.

c) Do not clean modules under strong wind (>grade 4), heavy rain, or snow conditions

Note: Do not walk, stand, or sit on modules while cleaning.

3 **Connector and cable inspection**

a) Inspect modules for signs of aging. This includes potential rodent damage, weathering, and whether all connectors are securely fastened and free from corrosion.

Appendix A

Cleaning agent

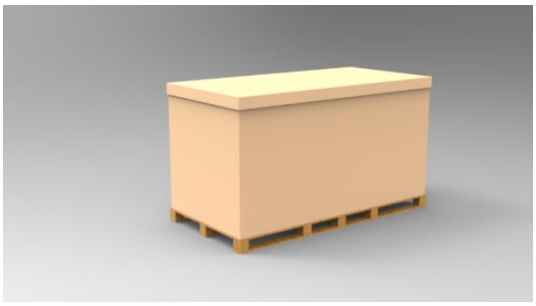
Roof type	**Cleaning agent recommended by Sunman**
TPO, PVC, Asphalt, EPDM, etc. membrane roof material	Membrane cleaner China: RA-1033 Overseas: Use the cleaning agent recommended by the roofing material supplier
Color metal tile, glass roof, metal roof	90% isopropanol + 10% water

Use the cleaners listed above or those recommended by the roofing material supplier.

Appendix B

Unpacking

Standard unpacking steps for light weight PV modules

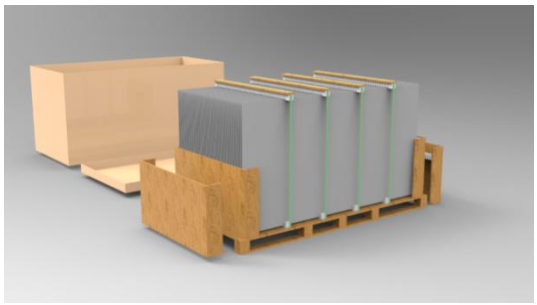


1. Remove all wrapping film and packing tape outside the package.

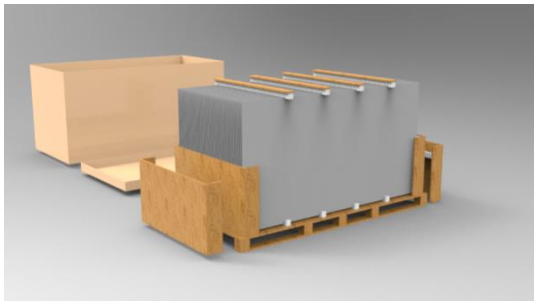
2. Remove packing box cover (keep well for another purpose).

3. Remove the outer packaging.

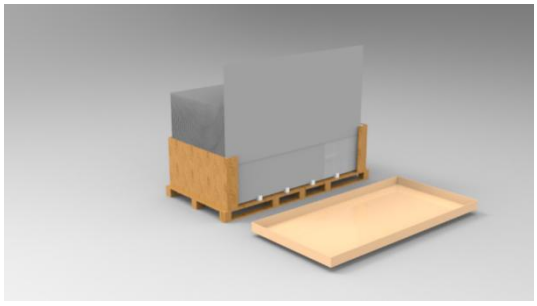
4. Remove the upper half of the wooden box.



5. Keep the lower half of the package.



6. Use scissors or a hobby knife to cut off the packing tape used to secure the module (do not cut the module).



7. With two people carrying the module, remove each module one at a time.