Dragonfly
Installation Manual

SMH430F-12X12UW

SMH520J-12X12UW

Contents

1.0 Summary

Thank you for purchasing SunMan PV modules. This guide contains information regarding the installation and safe handling of SunMan (Zhenjiang) Company Limited PV system on Roofs. SunMan (Zhenjiang) Company Limited referred to as "SUNMAN". Users and installers have the responsibility to read and understand the installation methodology. Users and installers must complete their own specific site engineering review to ensure the proposed methodology is fit for purpose. Failure to follow these safety guidelines can result in personal injury or property damage. The installation and operation of solar modules require specialized skills, and only professionals can do the job. Please read the safety and installation instructions before using and operating the modules. The installer and distributor must inform the end customer (or consumer) of the above matters accordingly.

1.1 Disclaimer

SunMan reserves the right to change this installation manual without prior notice. The changes and the latest installation manuals after the changes will be published in the resource center of the official SunMan website. Customers should always pay attention to the above changes. SunMan will not provide further notice.

Failure in operating according to instructions in this manual during installation (Including the changes announced on the official website of SunMan at the time of installation) will cause the warranty to be invalid.

SunMan does not guarantee any expressed or implied information contained in this manual. Users and installers must complete their own specific site engineering review to ensure the proposed methodology complies with local laws and construction standards.

1.2 Responsibility

Whether or not the installation of the modules is carried out in accordance with the instructions in the installation manual (Including the changes announced on the official website of SunMan at the time of installation), SunMan shall not be held legally responsible for any damages incurred during the installation process, including but not limited to personal and property damage 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 Warnings

WARRANTY VOID IF NON-SUNMAN-CERTIFIED HARDWARE IS ATTACHED TO SUNMAN PV MODULE.

1.5 For Further Information

For additional technical support documentation, please visit the Support page of the SUNMAN website at ‘www.sunman-energy.com’.

2.0 Safety precautions

WARNING: Prior to the installation, wiring, operation, or maintenance of the modules, it is imperative to thoroughly read and comprehend all safety instructions. Failure to adhere to these instructions may result in property damage or pose serious risks, including injury or death. DC power is generated when the module is exposed to sunlight or other light sources. Direct contact with live parts of the module, such as terminals, whether connected or not, may result in personal injury or death.

Safety rules

- All installation work must be in full compliance with local regulations and corresponding national or international electrical standards.
- Use insulated tools to reduce the risk of electric shock.
- Use appropriate protective measures (slip gloves, overalls, etc.) to avoid direct contact with workers at 30V DC or higher, while avoiding direct contact with sharp edges during installation to protect the operator's hands.
- Do not wear metal ornaments when installing, to avoid puncturing the modules and causing electric shock.
- If modules are installed or operated on rainy days, strong winds or dew mornings, appropriate protective measures should be taken to avoid injury to modules and workers.
- When working in rooftop applications, it is imperative not to engage in any activities on the roof without proper safety precautions. Such precautions include, but are not limited to, fall protection measures, the use of ladders or stairs, and the utilization of personal protective equipment.
- Children or unauthorized personnel are not allowed to access the installation area or module storage area.
- If the circuit breaker and overcurrent protection circuit breaker cannot be opened, or if the inverter cannot be turned off during the module installation or wiring, cover the array modules with opaque material to stop the power output.
- Do not use or install damaged modules.
- If the module surface is damaged or worn, direct contact with the surface of the module may result in electric shock.

- Do not attempt to repair any part of the module, there are no user-accessible components within the module.
- The cover of the junction box shall remain closed at all times.
- Do not split the modules or alter any part of the module.
- Do not artificially condense light on modules.
- Do not connect or disconnect modules when there is current in the module or external current.

3.0 Mechanical / electrical properties

The rated electrical performance data for the modules is measured under standard test conditions (STC) of irradiance of 1000 W/m^2, AM 1.5, and cell temperature of 25 °C. The specific electrical and mechanical performance parameters of SunMan modules are included in Annex A of this installation manual. The main electrical performance parameters under STC conditions are also marked on the nameplate of each module. The maximum system voltage for all modules is 1500V.

In some cases, the current or voltage generated by the module may be greater than the optimal operating current or voltage of its standard test condition (STC). Therefore, when determining the component rating and load value, the module open circuit voltage and short circuit current at STC should be multiplied by 1.25. Please check with your local rules and regulations.

4.0 Storage and unpacking

Precautions and general safety rules

- Store modules in a dry and ventilated environment.
- The modules must be transported in the package provided by SunMan and stored in the original package before installation. Please protect the packaging from damage. Open the package according to the recommended unpacking steps. Care must be taken during unpacking, shipping, and storage.
- Do not apply excessive loads on the modules or twist the modules.
- Do not carry the modules by the wires or junction boxes of the modules.

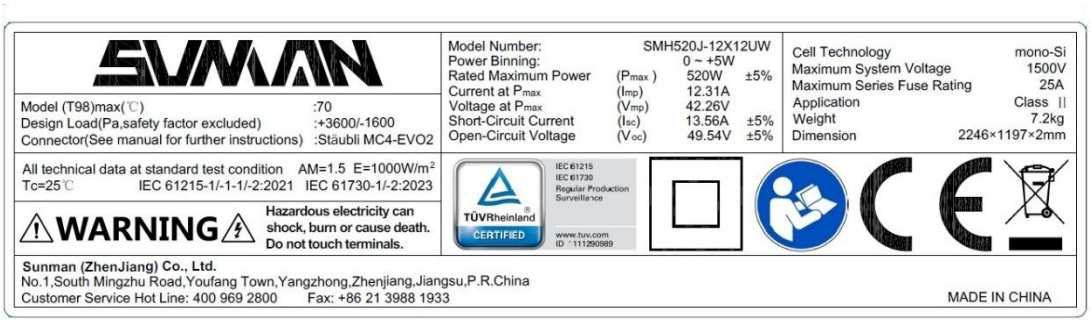
- Do not stand, climb, walk or jump on modules.

- Do not allow sharp objects to touch the modules. Scratches can directly affect the safety of the modules.
- Do not leave the modules unsupported or unsecured.
- Do not change the wiring method of the bypass diode.
- Keep all electrical connections clean and dry.

Product identification

- Barcode: each individual module has a unique serial number. The serial number has 21 digits. The 1st to 4th digits are the module type for internal use, and 5th to 8th digits are the year code, and the 9th and 10th digits are the month code, and the 11th and the 12th digits are the week code, and the 13th and 14th digits are the month code, and the 15th to 17th digits are order number, and the 18th to 21th digits are the sequence codes. For example, xxxx20210415xxxxxxxxx means the module was made in the 15th week of 2021. Each module has only one bar code. It is permanently attached to the interior of module and is visible from the top front of module. This bar code is inserted prior to lamination.

- There is a nameplate, which shows the model number, main electrical properties, safety specifications and certification indicator, on the back of each module.



5.0 Installation

Precautions and general safety rules

- Before installing the modules, please complete a specific site engineering review to ensure the proposed methodology complies with local laws, regulations and or constructions standards.
- Check the applicable building codes to ensure that the building is suitable for SunMan installation.
- During installation, make sure that the modules are installed on a fire-resistant roof. According to UL790 standards, SunMan modules are rated as fire rating C.
- The modules are compliant with application level A (equivalent to safety level II, IEC 61730-1). This type of modules can be used in systems where the public is likely to come into contact with voltages greater than 50V or power greater than 240W.

Environmental conditions

The modules are suitable for general climatic conditions, ie with reference to IEC 60721-2-1- Classification of environmental conditions Part 2-1: Environmental conditions occurring in nature - temperature and humidity.

- If the modules are used in a special installation environment, please consult the technical support department of SunMan in advance.
- The installation surface should be flat without bumps or pits.
- The modules must not be installed near flames or flammable objects.
- Do not expose modules to artificial condensing light sources
- The modules should not be immersed in water (pure water or salt water), installed in long-term water environment (pure water or salt water) (eg fountains, sprays, etc.) or area prone to water accumulation (eg roof drain, low-lying areas, etc.).
- If the module is placed in a salt mist (ie marine environment) or in an environment containing sulfur (ie, sulfur sources, volcanoes, etc.), there is a risk of corrosion.
- **Failure to follow the above precautions, SunMan Warranty will be voided.**

Installation requirements

- Ensure the modules meet the overall technical requirements of the system.

- Ensure that components of other systems do not cause damaging mechanical or electrical performance effects on the modules.
- Connect modules in series to increase voltage or in parallel to increase current. When connected in series, the positive pole of the module is connected to the next negative pole. When connected in parallel, the positive pole of the module is connected to the positive pole of the next module.
- The number of bypass diodes provided varies depending on the module model.
- Connect the appropriate number of modules according to the voltage specifications of the inverter used in the system. Even at the lowest local temperature conditions, the connected modules must produce no more than the voltage allowed by the system. If overcurrent protection devices (fuse) are not used in series within each string of modules, up to two strings of modules can be connected in parallel. If a suitable overcurrent protection device is connected in series with each string of modules, three strings or more modules can be connected in parallel.
- In order to avoid (or reduce) the mismatch effect of the array, it is recommended to connect modules of similar electrical performance on the same string.
- In order to reduce the risk of indirect lightning strikes, loops should be avoided when designing the system.
- The modules should be securely fixed to withstand all possible loads, including wind and snow loads.
- When installing modules for rooftop applications, it is crucial to consider long-term maintenance. Roofs designated for PV system installation must undergo assessment by construction experts or engineers. Formal and thorough structural analysis results must be obtained in accordance with local requirements, including verifying the roof's capacity to withstand additional loads from the system supports and the weight of the modules.
- Movement of the substrate should be taking into consideration when plannin g the panel layout. Example areas of installation which may cause damage in clude but are not limited to: different sections of rail and ends of roof sheets.
- **Design consideration : Panels should not be placed where it will be subject to the roofs thermal expansion, contraction and other movement.**
- **Non-compliance with the installation specifications outlined in this manual may lead to damages such as microcracks in modules or potential fire hazards.**

Optimal orientation and inclination

- In order to achieve maximum annual power generation, the optimal orientation and inclination of the PV module should be determined first. The maximum amount of power is typically generated when the sun is directly above the PV module.
- In the Southern Hemisphere, the modules should generally face north to attain the maximum energy yield.
- The module is required to be mounted at a minimum inclination of 5 degrees. In the event that the mounting angle is excessively small, there may be a significant accumulation of dust and water on the surface of the module.

Avoid shadows

- Even small shadows (such as dust) can cause a drop in power generation. If all surfaces of the module are uncovered throughout the year, the module is considered "no shadow". Ensure that the sun shines on the modules even on the shortest day of radiation all through the year.
- EVA aging caused by frequent occlusion of modules and long-term heating of the diode can affect the lifetime of the module.

5.1 Module wiring

Correct electrical wiring

- Check that the wiring is correct before starting the system. If the measured open circuit voltage (Voc) and short circuit current (Isc) do not match the specifications provided, there may be a wiring fault.

Correct connection of the MC4 connector

- Make sure the MC4 connector is secure and properly connected. The tightening torque must be appropriate for the solar cables used. Typical values are between 3.4 Nm and 3.5 Nm (refer to the connector supplier information for specific connection steps). The connector should not be subjected to external pressure. It is solely intended for electrical circuit connections and should not be used to open or close circuits. Do not insert other metal objects into the connector or attempt any other electrical connections.
- The MC4 connector should be kept dry and clean to prevent rain and moisture. Avoid water soaking of the MC4 connector.
- The junction box and the connector shall not be in contact with organic solvents, oily substances and other corrosive materials that may cause

functional failure, to avoid damage to the junction box and the connector. If the junction box and connector are contaminated, they are forbidden to use.

Use appropriate materials

- In accordance with local fire, building, and electrical regulations, it is essential to use specialized solar cables and connectors of the same brand and model as those used by SunMan. Additionally, ensure that the electrical and mechanical performance of the cables is excellent.
- The solar cable licensed for use is a single-wire cable, 4-10mm2 (8-11 AWG), 90°C grade, with appropriate insulation to withstand the maximum possible system open circuit voltage. The appropriate wire size needs to be chosen to reduce the voltage drop. The wire should be made of copper.

Cable protection

- Secure the cable with a cable tie that is UV resistant. Appropriate measures should be taken to protect the exposed cable from damage (eg. in a conduit with UV aging resistance).

5.2 Grounding

- The module does not involve any metallic conductor for the module, so there should not be a need to set up a grounding system for the panel. Please reference to local standards.

6.0 Installation instructions

6.1 Module and tools

6.1.1 Module

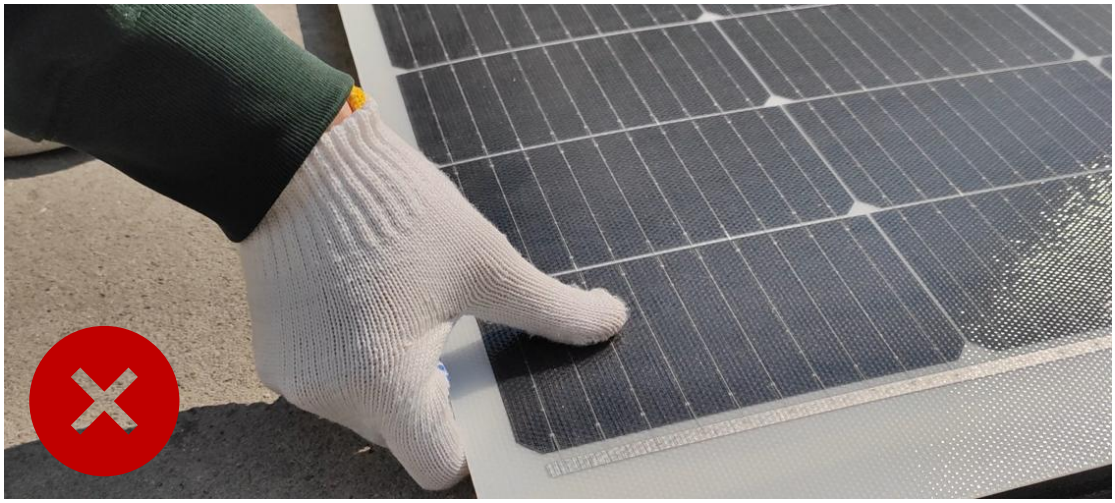
Applicable module model: SMH430F-12X12UW, SMH520J-12X12UW

The electrical performance parameters are detailed in Annex A.

6.2 Unpacking, Handling and Checking Precautions

- Do not open modules outer Package before installation.
- Check the outer package for damage before unpacking.
- Slip-Proof Gloves are recommended for unpacking and handling.
- Do not grab the modules by the junction box or cables during unpacking or handling.
- When transporting, both horizontal and vertical transport are allowed, but the handheld position must be on the long side of the DF frame.

- Under any circumstances, avoid contact with the cells.



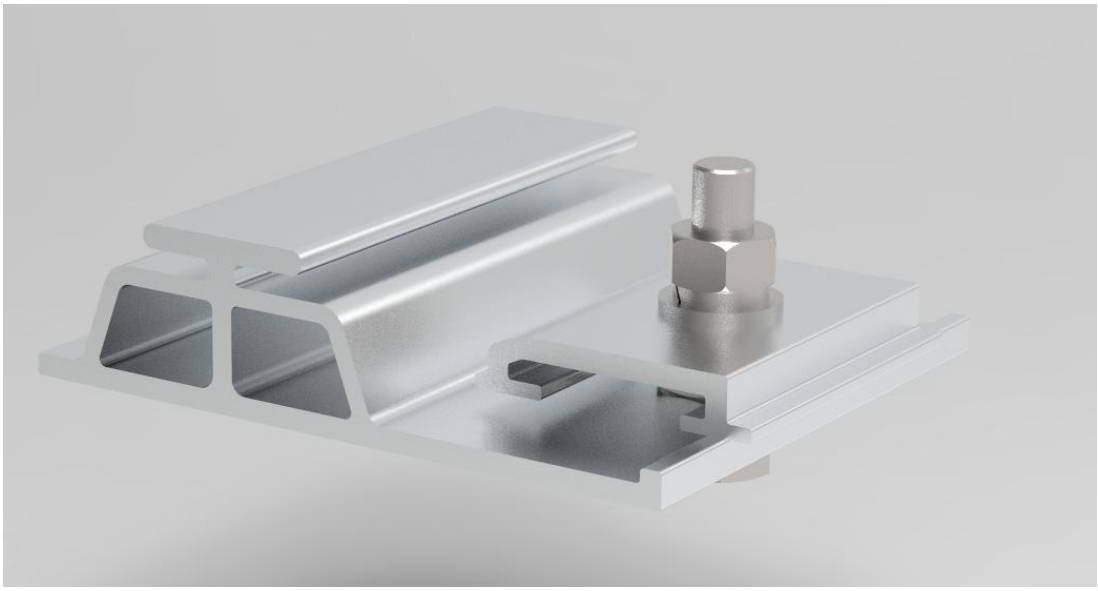
- Be careful while carrying the modules. Avoid hitting the modules on the ground or other sharp, hard objects.
- Check the surfaces of the modules, make sure there is no damage to the frontsheet and the backsheet.

- Check the junction box, connectors, and cables for any damage. Double check if the junction box cover is fixed securely.
- Do not paint or apply glue or label on the surface of the modules.
- Place the junction box on the maintenance walkway side for easy string wiring and maintenance inspection.
- The minimum distance between the modules is 5mm, and the distance between each array is 500-800mm, which is used as a construction maintenance walkway. (This spacing is for reference only)

6.3 Mechanical Installation Plan

Special Accessories

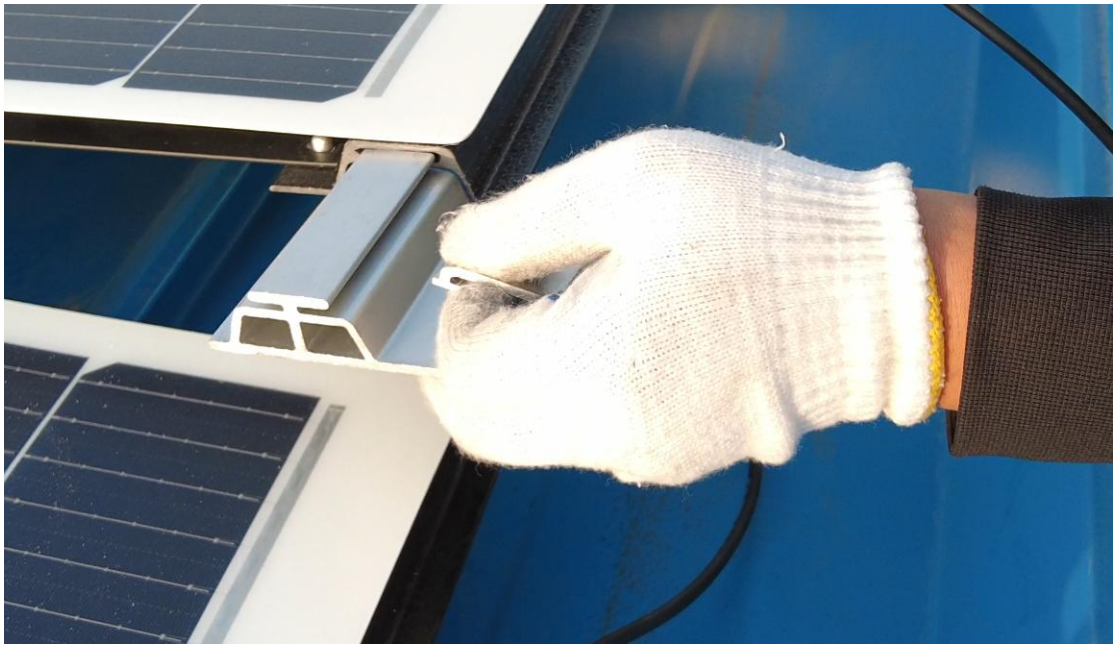
- DF Clamp



Installation Steps

6.3.1 Install DF Clamp

- Place the DF module in the installation area.
- Lift one corner of the module and slide the prefabricated unit into the DF module support from both long sides. Avoid excessive twisting of the module when lifting.



■ The position of the DF clamp is as follows.

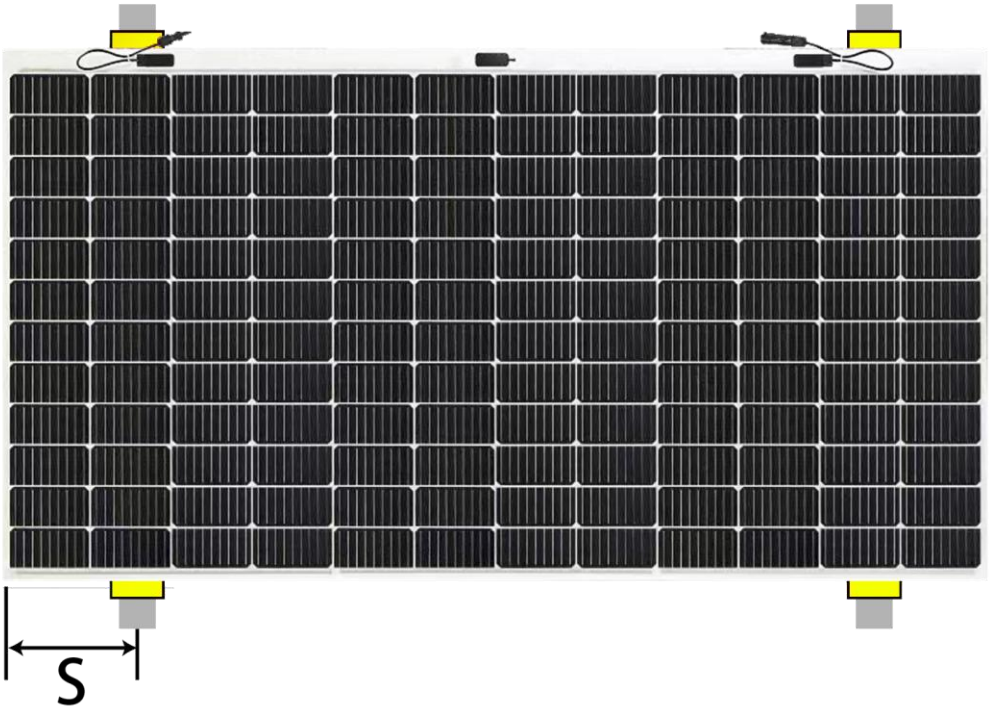


Diagram for four-point DF clamp installation

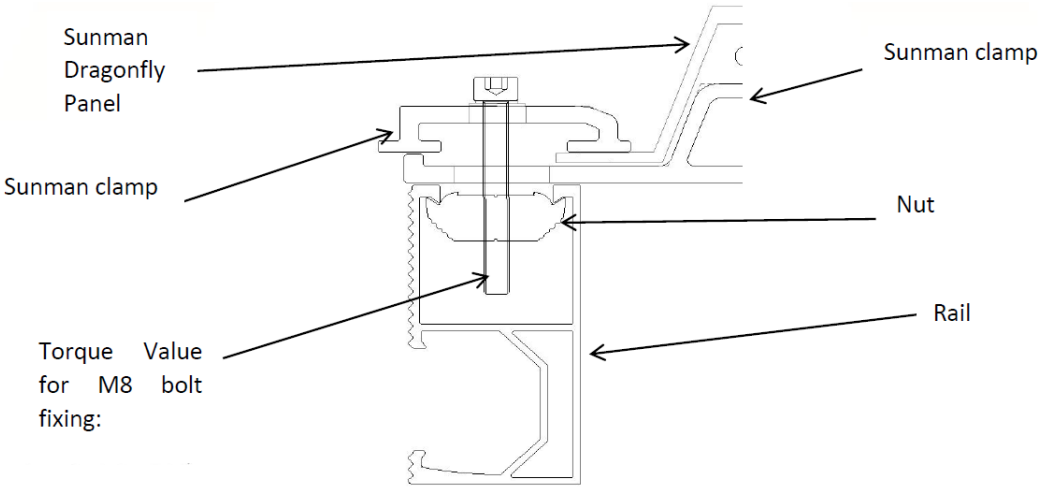
Installation Method	DF Clamp Position	Mechanical load
Four-point DF clamp installation	S = 473±100mm (It must not overlap with the short side of the DF frame.)	+5400/-2400 Pa

Table 1. DF Clamp Position

- For the installation of one single module, there should be no fewer than 4 DF clamps. The number of DF clamps can be increased based on the actual project requirements. EPCS / installers responsibility to conduct their own site specific engineering assessment and to cross check local wind and substructural codes and standards.

6.3.2 Install the module

- Finely adjust the position of the modules and prefabricated units to ensure the arrangement of the module strings is neat and orderly.
- Use M8 bolts made of A2-70 （304 SS）material along with spring washers and flat washers to secure the DF clamp and fasten it to the bracket/rail/other support structure. Tighten the nuts using an electric wrench to achieve a torque of 12-16Nm, ensuring the module is securely fixed.

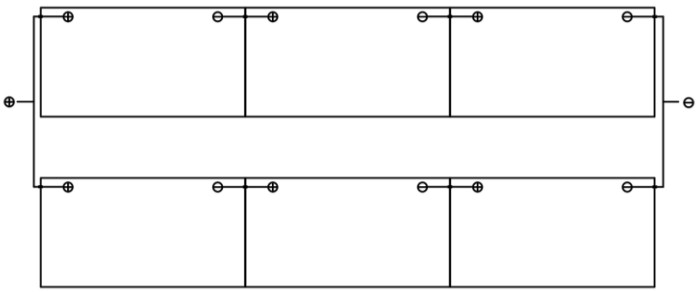


- If there is no walkway between two rows of modules, installation personnel must use construction bridge to fasten the prefabricated units.
- Follow the steps above to install the other modules.

6.4 Wiring and testing

- The use of PV modules with different electrical characteristics in a PV system is prohibited.
- Excessive cables must be organized or fixed in the proper location, do not cover the cell area.
- For applications requiring high operating voltages, several PV modules may be connected in series to form a PV string, then the system voltage is equal to the sum of the voltages of each PV module
- For applications requiring high operating currents, several strings of PV modules can be connected in parallel to form a PV string, then the system current is equal to the sum of the currents of each PV module string.

Series connection



Parallel connection

- A maximum system voltage of 1500VDC is allowed.
- The maximum number of PV modules in series depends on the system design, the type of inverter used and the environmental conditions.
- Depending on the maximum series fuse rating of the PV module and local electrical installation codes, if the PV module does not have any fuses or blocking diodes, make sure to connect no more than two strings in parallel.
- There is no limit to the number of PV modules that can be connected in parallel (fuses per string should be considered), the number of PV modules is determined by system design parameters such as current or power output.

- Please refer to local regulations to determine the size, type and temperature of the system conductors.
- PV modules are equipped with connectors for system electrical connections, please refer to local regulations and data sheets that allow the use of connectors.
- To ensure a reliable electrical connection and to prevent possible moisture ingress, connectors must fit and lock together until a click is heard.

The DC power generated by the PV system can be converted to AC power and connected to the public grid, as the local power company's policy for connecting renewable energy systems to the grid varies from region to region. You can ask your PV system design engineer or integrator for help in obtaining building permits, inspections, and approvals from your local power company's department.

7.0 Maintenance

To ensure optimal performance of modules and maximize system power generation, the following maintenance measures are recommended:

1. Module appearance inspection, focusing on the following points:

a) Whether the module is damaged.

b) Whether there is a sharp object touching the surface of the module.

c) Whether the modules are obstructed by obstacles and objects, avoiding new trees, new poles etc. to shielding the modules.

d) Check for corrosion near the busbar. This kind of corrosion is caused by the damage of the module surface during transportation, which causes moisture to penetrate into the interior of the module.

2. Clean the modules. The accumulation of dust or dirt on the surface of the modules will reduce the power output. It should be cleaned regularly to keep the surface clean. Generally, it should be cleaned at least once a month, appropriately increase the frequency in the harsh natural environment. Pay attention when cleaning PV modules:

a) Rinse with water first, then dry the water with a soft cloth. Do not use corrosive solvents to clean or wipe the PV modules with hard objects.

b) The PV module should be cleaned at an irradiance of less than 200 W/m^2. It should be cleaned in the absence of sunlight or in the morning and evening.

c) It is strictly forbidden to clean PV modules under meteorological conditions where the wind is greater than grade 4, heavy rain or heavy snow.

Note: Do not walk, stand or sit on the module when cleaning.

3. Connector and cable inspection. It is recommended to conduct a preventive inspection every six months:

a) Check for signs of aging of PV modules, including possible rodent damage, weathering, and whether all connectors are tightly connected or corroded.

Annex A

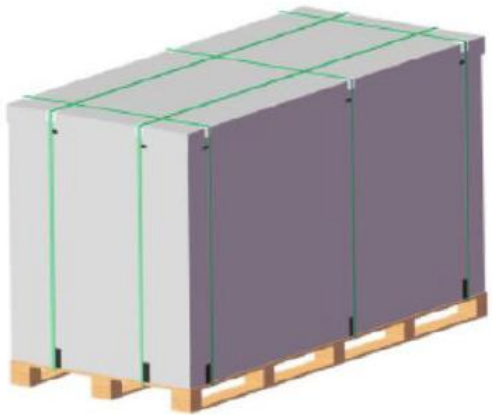
Electrical performance parameter

Series	Products	STC					Module size	Product size
		Pmp	Vmp	Imp	Voc	Isc		
	SMH430F-12X12UW	430	42.00	10.24	49.80	10.74	2054*1084*2	2054*1114.8*40.5
	SMH520J-12X12UW	520	42.26	12.31	49.54	13.56	2246*1197*2	2246*1223.8*40.5

Annex B

Unpacking

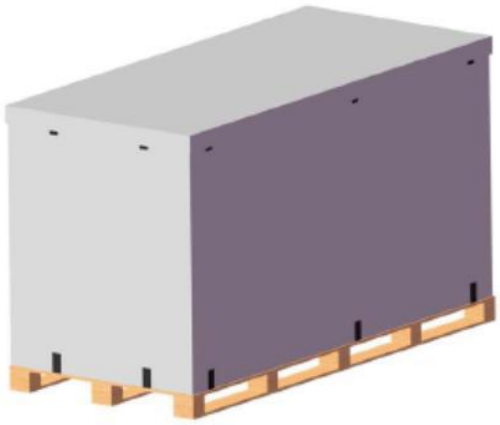
Standard unpacking steps for light weight PV modules.



1. **Check the condition of the goods and unload the truck:**

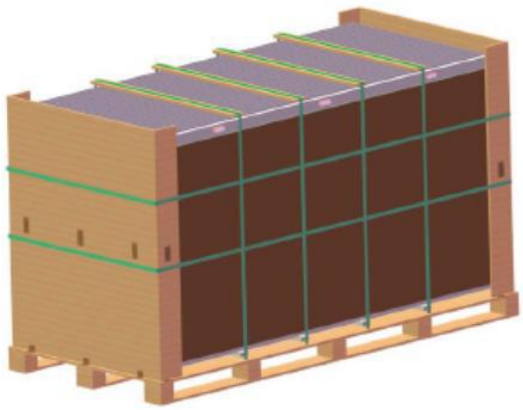
- Ensure the external strapping is intact and secure.
- Do not unload during rain. Cardboard boxes become soft and disintegrate when getting wet, posing a safety risk.
- Ensure the ground is level and stable for placing the packages to prevent tipping.
- Use a forklift to move palletized boxes to the work area, gently pulling modules to avoid rough jostling and vibrations during movement.
- When using the forklift, load and unload goods smoothly and securely. The weight of the goods must be evenly distributed on both forks. Keep the handle in the middle, stationary position, and do not operate both handles simultaneously.

- If the module needs to be hoisted for unboxing at a height, use a flat lifting strap to pass through and wrap around from both sides of the wooden pallet's bottom (as shown in the diagram).
- When wrapping with the flat lifting strap, spread it out so that it fully adheres to the surface of the wooden box, avoiding any folding or twisting.

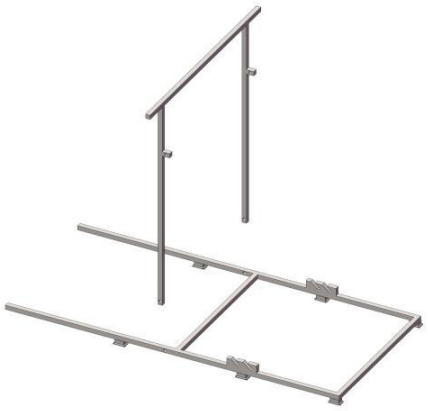


2. Remove the wrap and external strapping:

- When unboxing, ensure there is enough space on the side with the solar cell markings for inserting anti-tip brackets.
- Find a support, such as another box of modules or a wall, for pre-tilting during unboxing.
- Be extra cautious with safety if there is wind, especially strong winds. It is advised not to unpack or transport modules in such conditions, and securely fasten any unpacked modules.
- Locate the joint of the strapping. By pulling the ends of the joint in opposite directions with both hands, it can be easily separated.

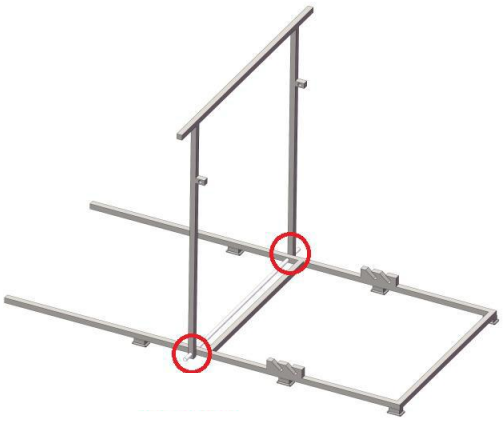


3. Remove the cardboard box lid and the cardboard surround.

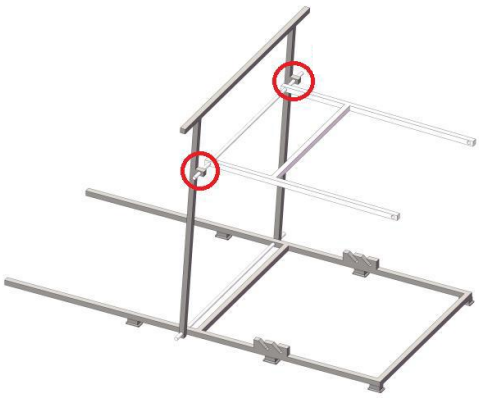


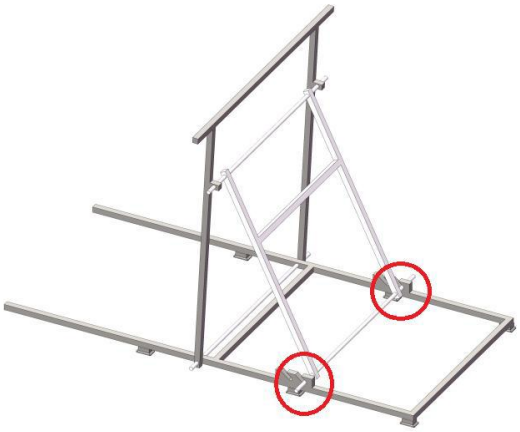
4. Assemble the anti-tip bracket:

- Take out the base and the anti-tip bracket.

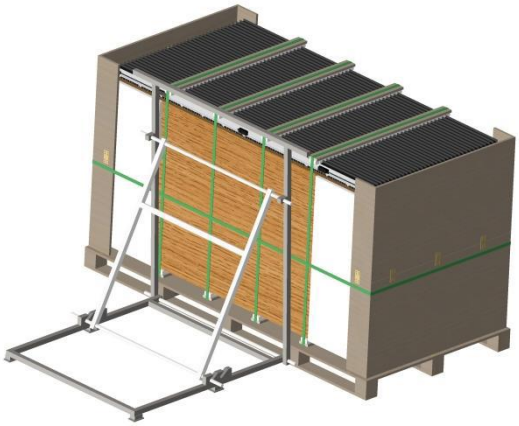


- Using the connecting axle and secure the position with a limit pin.





- Insert the connecting axle into the slot to form a suitable pre-tilted surface.
- Use the front and back slots to adjust the pre-tilt angle by inserting into different slots as needed.

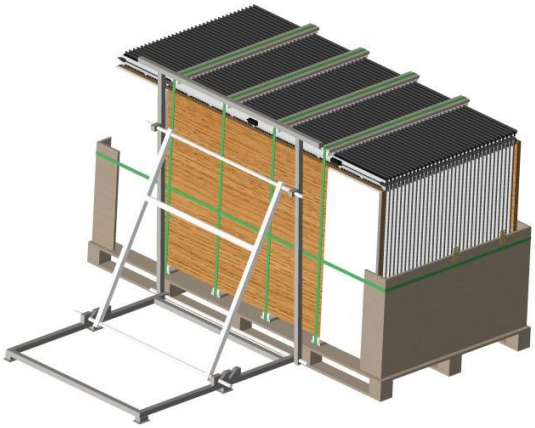


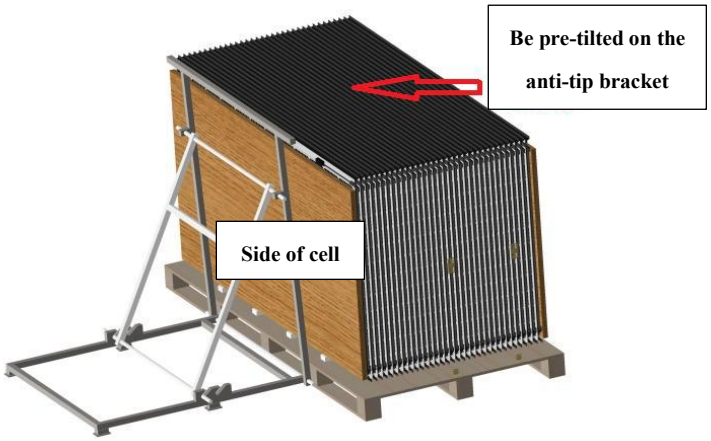
5. Insert the anti-tip bracket:

- The anti-tip bracket should be installed on the side with the solar cells.

6. Remove the internal packaging:

- Sequentially remove the upper foam molds and wooden side guards so that the module is pre-tilted on the anti-tip bracket.

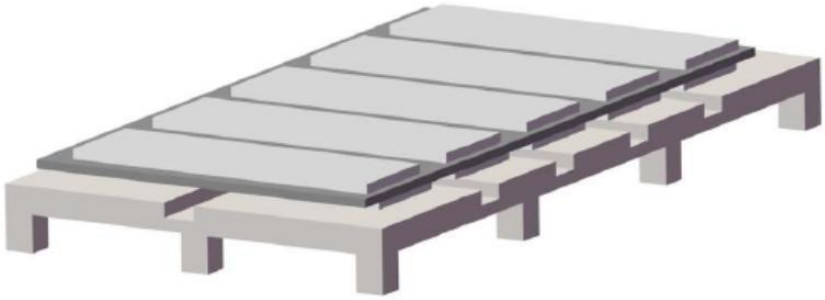


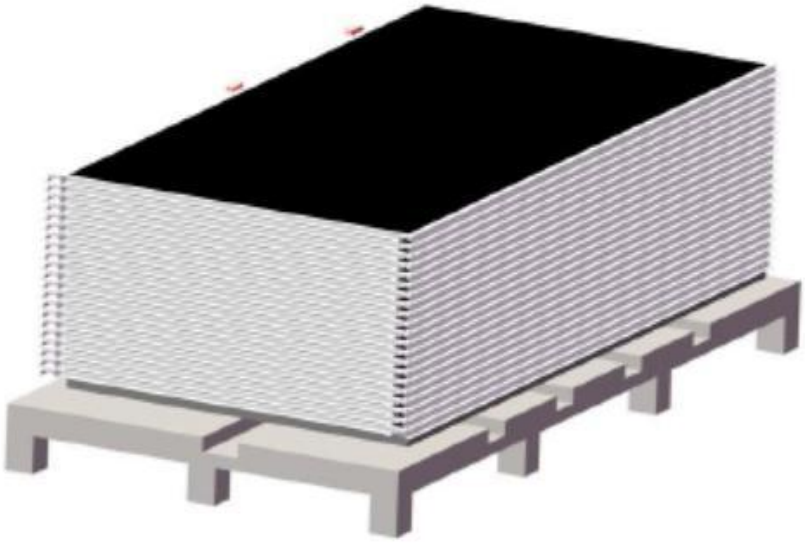


7. Sequentially remove the module.

8. Module Stacking and Transportation Method:

- If modules are not immediately installed after unpacking and need to be laid flat, place paper honeycomb pads on the pallet, followed by honeycomb separator strips, and then lay a single module flat on top (solar cell side up), with paper honeycomb pads on it. Stack the remaining modules in the same manner, with no more than 20 layers in height.
- The stacked modules must be aligned to prevent tilting and falling during transportation.
- When carrying individual modules, two people should operate together, handling them gently.





Unpacking precautions

- Avoid operating in rainy weather when opening cartons outdoors.
- Secure the modules when operating outdoors in windy conditions.
- Stack modules in a ventilated, rain-proof, and dry area before unpacking them.
- Do not to damage the front or back of the module when using scissors or hobby knife to cut the outer packing tape.
- Confirm the number of modules in the box promptly after unpacking.
- During unpacking and handling, please wear protective gloves properly to avoid scratches.
- Prohibit pulling on junction boxes or cables under any circumstances.
- When handle the modules, avoid touching the cell area with hands.
- Ensure pallet does not topple while unpacking panels.