

DOUBLE GLASS PHOTOVOLTAIC MODULES INSTALLATION MANUAL

VERSION NUMBER : QZR-MP0-024

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1. GENERAL INFORMATION

Thanks for choosing Unimacts Solar PV modules!

This guide contains information regarding the installation and safe handling of the Unimacts photovoltaic module (hereafter is referred to as "module").

During module installation and routine maintenance, operators should follow all safety precautions in this manual and local safety regulations. If you have any questions, please contact our sales department for clarification.

Read this manual carefully before installing the module. Installers should be familiar with the mechanical and electrical requirements of this system prior to beginning any installation work. Keep this manual safe for future maintenance, sale or disposal of the module.

2. REGULATIONS

Mechanical and electrical installations must comply with all local, regional and national regulations. Installers are responsible for understanding the requirements for licensing, if any, and obtaining the proper licenses if needed. Keep in mind that regulations can vary depending on the installation location, such as building roof installation, vehicle-mounted applications, etc. Requirements may also vary with the voltage and current nature of the installed system (DC or AC) so make sure you understand and comply with your code and licensing regulations.

3. PRODUCT IDENTIFICATION

Each Module has three labels that provide the following information:

1. Nameplate:

- Describes the product type, standard rated power, rated current, rated voltage, open circuit voltage, short circuit current, weight, size, certification mark, maximum system voltage and other information under test conditions.
- Attached to the back of each module.

2. Barcode:

- Each individual module has its own serial number.
- The serial number contains the component's model number, manufacturing time, corresponding serial number (unless specified by the customer), and is embedded in the barcode on top of each module.

3. Current grade mark:

Some orders require the module to be graded according to rated current and pasted on the side of the long frame together with the barcode.

4. SAFETY PRECAUTIONS

Unimacts Solar PV modules are designed in accordance with the IEC 61215 and IEC 61730 standards. The application grade rating is Class A. The module can be used for systems with DC greater than 50 V or 240 W, according to IEC 61730-1 and IEC 61730-2 standards. The module meets the safety requirements for safety level IS II.

4.1 General Safety :

- The installation of photovoltaic systems requires professional skills and knowledge.
- The installation can only be carried out by qualified personnel.
- Installation personnel must understand all risks that may occur during the installation process, including but not limited to electric shock risks.
- Modules can be installed on the ground or on the roof but the installer/customer is responsible for the proper design of any supporting structure
- Photovoltaic power generation systems should only use matching equipment, connectors, wiring and support
- Fall protection must be provided when working at heights.
- Comply with Occupational Safety and Health Act (OSHA) and local safety regulations proper protections including, but not limited to, fall and electric shock.
- Do not sit, stand, step on, or walk on any modules.



- Do not allow any part of the modules to be submerged in water or continuously exposed to water, except for natural rainfall and periodic module cleaning.

4.2 Electrical Safety:

- A single module can generate a DC voltage of more than 30 V in direct sunlight.
- Therefore, contact with the DC is potentially risky. Avoid contact with the DC under any circumstances.
- Modules generate voltage when no load or external circuit is connected.
- When operating modules in the sun, use insulating tools and wear rubber gloves.
- Modules don't have a switch on or off, so they can only be stopped by moving them out of the light or blocking them with cloth, cardboard, or a completely opaque material, or by placing them front on a smooth, flat surface.

NOTE: Bifacial modules can produce power even when faced down.

- Do not open the electrical connection or pull out the connector when the circuit is loaded.
- You should only work in a dry environment and use dry tools.
- Do not work in a wet environment without taking protective measures.
- Connectors must be kept dry and clean to ensure they are in good working condition.
- Do not insert other metal objects into the connectors or make electrical connections in any other way.
- If modules glass or other packaging material is damaged, wear a personal protective equipment while attempting to separate the module from the circuit.

4.3 Operating Safety:

- Do not open the package unless the module arrives at the installation location.
- To avoid glass breakage, do not apply excessive loads or distort components on modules.
- Before unpacking modules, put the packing case in a ventilated, rain-proof and dry place.
- Do not hold the modules junction box or the lead wire to lift the modules.
- Do not drop the modules or make objects fall on them.
- Do not place anything heavy or sharp on the modules.
- Do not disassemble modules or modify any nameplates or attached parts.



- Do not use mirrors or lenses to focus sunlight on modules;
- Do not paint or apply any other adhesive on the modules surface;
- Do not scratch or hit modules which will be most likely to permanently damage the modules.
- Modules that are damaged cannot be repaired and may cause electric shock. Do not use modules that are damaged;
- Do not drill holes in the frame, which may damage the strength of the frame, lead to rust and nullify of the warranty;
- Do not scratch the anodized layer of the stand (except the ground connection on the back of the modules) as this may cause rust or break the strength of the frame;
- If you want to store the uninstalled modules outdoors for a period of time, always cover the modules and ensure that the front glass is downward and placed on a soft plane to prevent water inside the modules and damage to the connectors.
- Do not repair modules by yourself.

4.4 Installation Safety:

- When connecting modules, only use the connector of the same model to connect to other devices.
- Removing the connector will void the warranty.
- Do not touch modules unnecessarily during installation. Glass surfaces and supports may generate high temperatures, and may be hazardous to burns and electric shocks.
- Touching modules live parts, such as connectors, whether or not the panel is connected can cause burns, sparks, and a fatal electric shock.
- To prevent deterioration of modules' insulation, avoid scraping, cutting cables and connectors, or exposing them to the sun for a long time.
- Do not install modules in rainy, snowy, or windy weather.
- Keep children away from the system when installing modules.
- Use only insulation tools that comply with related electrical installation standards.
- Comply with local and national safety regulations when installing any system components, including wiring and cables, connectors, charge regulators, inverters, batteries, rechargeable batteries, etc.;

- Do not wear metal rings, wristwatches, earrings, nose rings, lip rings or other metal substances when installing or repairing the Photovoltaic (PV) system.



- Normally, a module may generate more current and voltage than under standard test conditions. Therefore, when calculating the modules rated voltage, rated current, safety fuses, and control specifications connected to the PV output, multiply the Isc and Voc values marked on the modules by a factor of 1.25.

4.5 Fire Safety:

- According to IEC 61730-2 standard, Unimacts dual-glass modules fire rating is Class A.
- Consult local authorities for installation or building fire safety guidance and requirements prior to installation.
- The structure of the roof and the way it is installed can affect the fire safety of the building and improper installation can lead to fire hazards.
- When installing a module on the roof, the roof must be covered with a layer of fireproof material appropriate to Class A rating, and ensure adequate ventilation between the backplane and the installation surface.
- To ensure fire rating on the roof, the modules frame should be at least 10 cm away from the roof surface.
- Use modules accessories such as fuses, circuit breakers, and grounding connectors according to local regulations.
- Do not use modules in an environment or near a device where flammable gas may be generated.

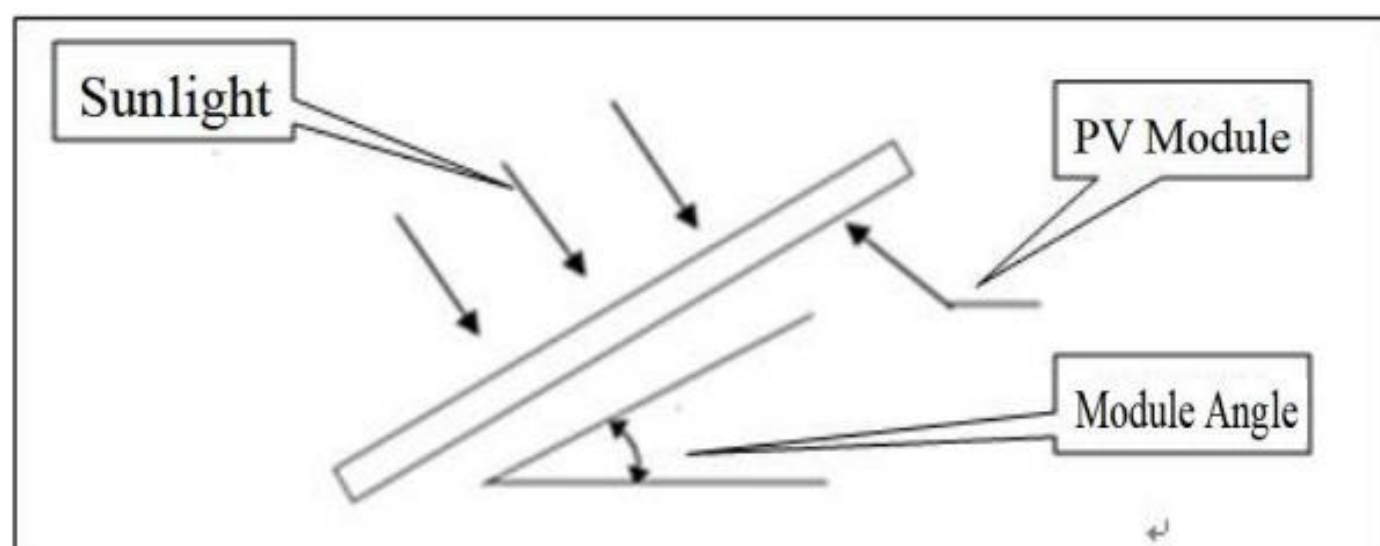
5. MECHANICAL INSTALLATION

5.1 Selecting the Location

- Install modules in the right position to receive the maximum light intensity.
- In the Northern hemisphere, it's best to face south, and in the Southern hemisphere, it's best to face north.
- Modules should be installed in a position where the sun can fully shine and ensure that it is not blocked at any time.
- Modules should be protected against lightning if installed in an area with frequent lightning activity.
- Modules limit the operating temperature ranges from -40°C to 85°C. Unimacts recommends modules be installed in an operating temperature range from -20°C to 45°C, which is the monthly average minimum and maximum temperature of the installation site.
- Do not install modules where they might be flooded.
- Do not install modules in places where combustible gases are likely to be generated or gathered.
- Do not install modules in hail, snow, sand, dust, air pollution, soot and other excessive environmental conditions.
- Do not install modules where there are strong corrosive substances such as salt, salt spray, salt water, active chemical vapors, acid rain, or anything else that will corrode modules, affecting their safety and/or performance.
- In severe environment such as heavy snow, extreme cold, strong wind, near water, island, desert, close to salt and fog, please use appropriate protection measures to ensure the reliable and safe installation and operation of modules and ensure that the maximum allowable tolerances are not exceeded.
- Unimacts Solar PV modules pass the IEC 61701 salt spray corrosion test, but corrosion may occur where the frame is connected to the bracket, or where the ground is connected.
- Unimacts recommends modules to be installed at least 500 m from the coastline.
- For offshore installation, you need to confirm your installation plans with Unimacts and install the modules only after obtaining approval.

5.2 Tilt Angle Selection

- The tilt angle of PV modules refers to the angle between the modules' surface and the ground plane.



- The modules get maximum output power when facing directly into the sun.
- For optimal installation inclination, refer to the standard Solar PV installation guide or consult a reliable solar system installation company.
- Unimacts recommends that modules be installed at an angle of no less than 10°, so that when it rains, the dust on the surface is easily taken away by the rain. This reduces the cleaning frequency of modules, and helps the water flow away from the surface, so as to avoid long-term massive water leaving traces on the glass, which affects the appearance and performance of components.
- Serially-connected modules should be installed in the same orientation and angle.
- If the orientation or angle is different, different modules may receive different amounts of solar radiation, resulting in output power loss.
- In order to achieve maximum annual power generation, you should choose the optimal orientation and tilt of PV modules in the installed area to ensure that sunlight can still reach the modules on the shortest day of the year.
- If connected to an independent photovoltaic system, the modules should be installed at an angle that maximizes the power output depending on the season and light conditions.
- If the output of the modules can be met even with the lowest light intensity during the year, then the selected angle of the modules' power output should be sufficient for the whole year.
- For grid-connected systems, the installation angle of modules should be chosen based on the basic principle of maximizing output throughout the year.

5.3 General Requirements

- Module support structures must be made of durable, rust-resistant and UV resistant materials.
- Ensure that the module mount and stand system is robust enough to withstand the intended load conditions and use support structures that have been tested and approved.
- Modules must be firmly placed on the support structure.
- If using entrainer fixture installation method, please follow the fixture system supplier's instructions. The recommended maximum pressure for each fixture is 20 Mpa, to prevent damage to modules support.
- In areas where there is a lot of snow in winter, choose the height of the support system so that the lowest edge of the modules will not be covered with snow at any time.
- Make sure the lowest parts of modules are placed high enough so that plants and trees don't block out the sun.
- For ground-mounted systems, we recommend that the minimum distance between the ground and the bottom of modules be at least 60 cm.
- Before installing modules on the roof, make sure the roof is properly structured.
- Any roof on which modules are to be installed must be sealed to prevent leakage and not allow modules to overlap or exceed the roof permanent load tolerance.
- Provide adequate ventilation clearance at the base of modules according to your local regulations. A minimum of 10 cm is usually recommended between the roof plane and the supports of modules.
- The distance between two modules is recommended to be at least 1 cm to prevent damage caused by extrusion caused by thermal expansion.
- Avoid side tension and pressure to the frame to avoid warping of the frame or crushed glass.
- When installing modules on columns, select columns and module support structures that can withstand local wind and snow loads.
- Make sure that the back of the module does not touch any support or structures that can affect the modules, especially if there is external pressure on the modules surface.
- Modules can be installed horizontally or vertically.
- When installing modules, ensure that the water drain hole in the frame is not blocked.

5.4 Installation Guide

Low/normal load conditions, for most environmental conditions:

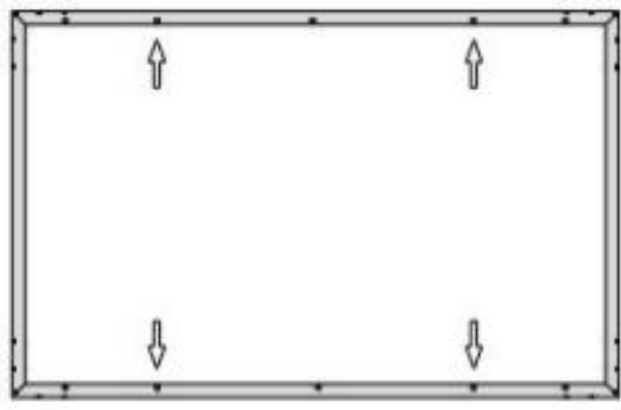
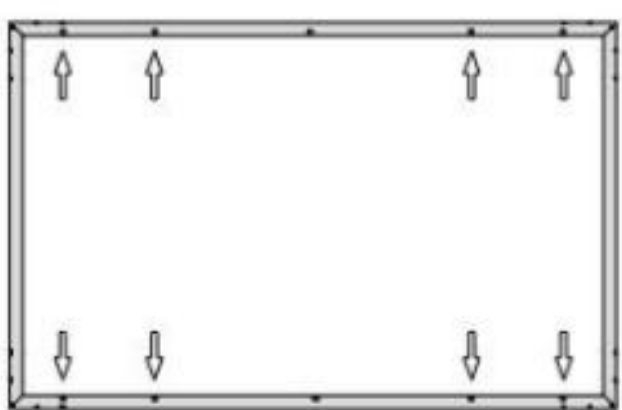


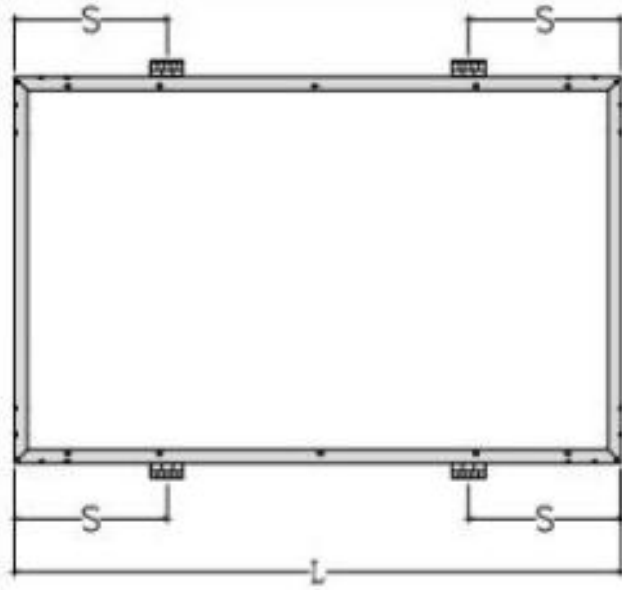
- The modules can withstand a maximum load of 2400 Pa on the front and 2400 Pa on the back.
- The modules can withstand a maximum design pressure of 1600 Pa on the front and 1600 Pa on the back with a safety factor of 1.5.

High load conditions, for harsh environmental conditions:

NOTE: The modules have been tested for snow weight loads from ETL. And, ETL does not test for wind loads.

- The module can withstand a maximum load of 5400 Pa on the front and 2400 Pa on the back.
- The module can withstand a maximum design pressure of 3600 Pa on the front and 1600 Pa on the back, with a safety factor of 1.5.

5.4.1 Framed Module Bolt and Clamp Installation

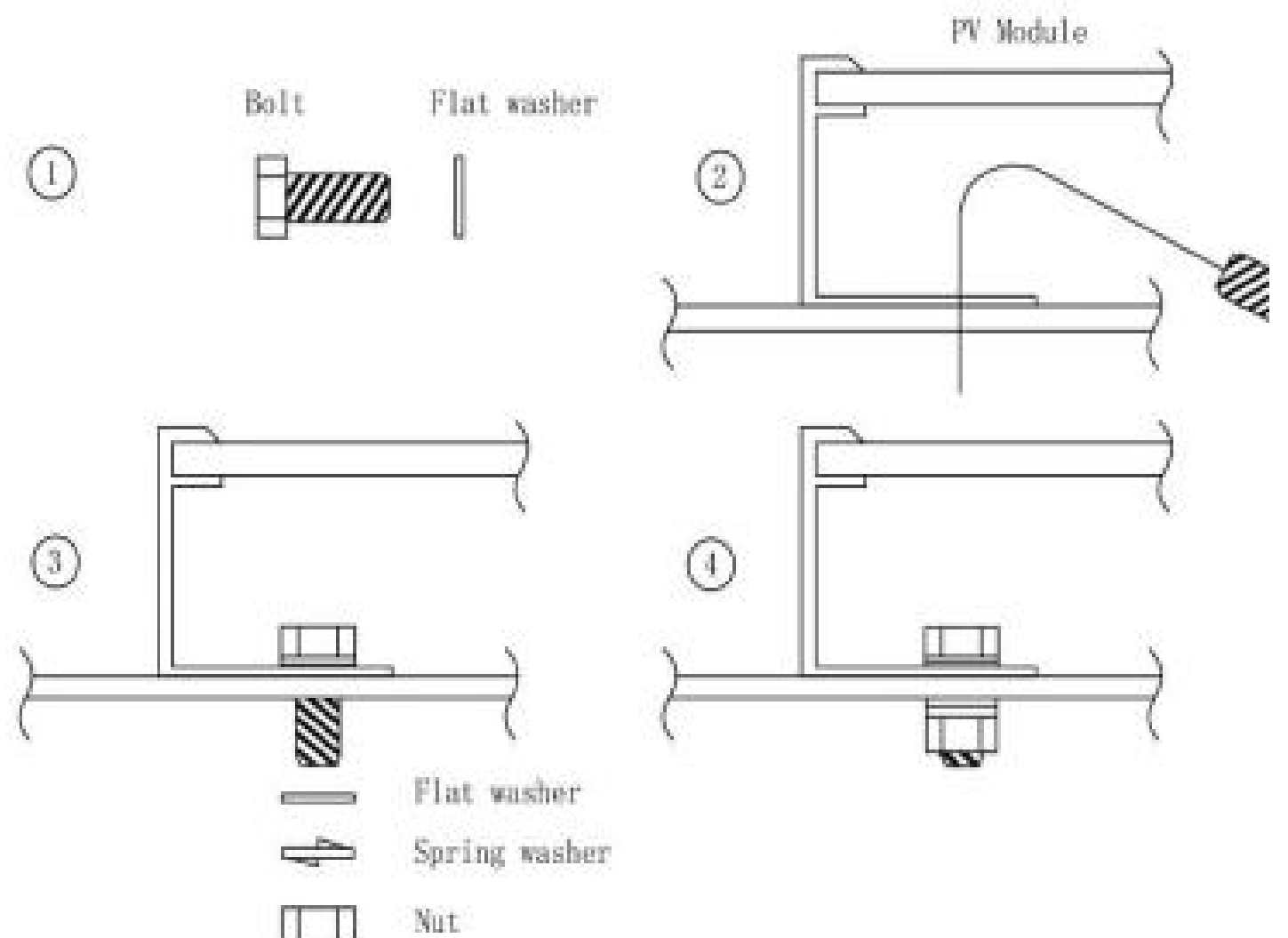
Installation manual	Test Load: positive2400Pa/negative2400Pa Design Load: positive1600Pa/negative1600Pa		Test Load: positive5400Pa/negative2400Pa Design Load: positive3600Pa/negative1600Pa
Mounting with Bolts	 use 4 mounting holes	Mounting with Bolts	 use 8 mounting holes
	 Allowed assembly with clamp (1/4L-50)<S<(1/4L+50)		 Allowed assembly with clamp (1/4L-50)<S<(1/4L+50)
Assemble on the long side with clamp		Assemble on the long side with clamp	

5.5 Installation Guide

5.5.1 Mounting with Holes

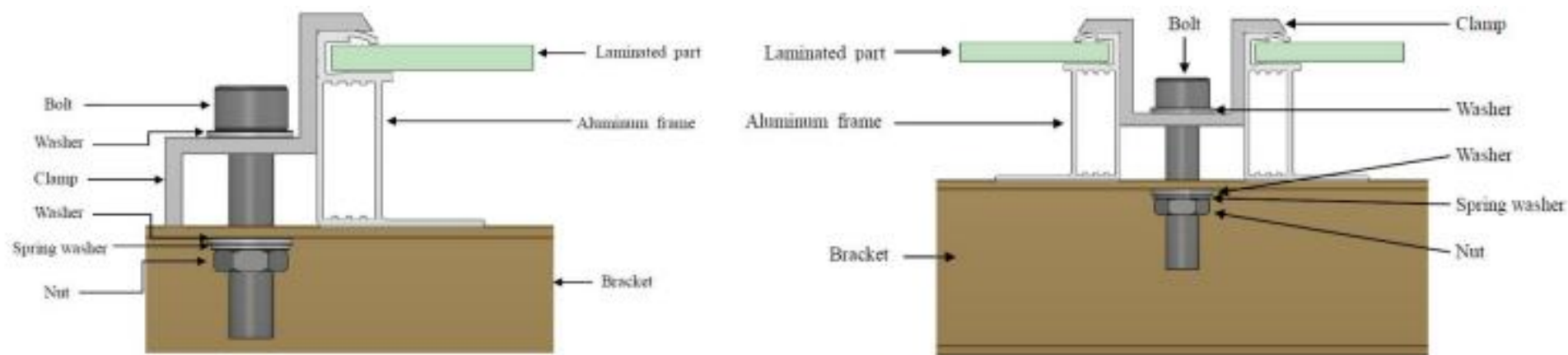
- Bolt the modules to the stand through the mounting hole in the rear border of the modules.
- Each module has four mounting holes in its border, which are recommended for attaching modules to support structures to optimize load tolerance.
- To maximize installation life, it is strongly recommended to use corrosion resistant (stainless steel) fasteners, with torque recommended to be maintained at 15-20 Nm when tightening, as shown in the following installation details:

Bolt Material : Stainless Steel Size: M8*20 mm	Flat Washer Material : Stainless Steel Size: M8 Thickness: : ≥1.6 mm
Spring Washer Material : Stainless Steel Size: M8 Thickness: ≥ 2 mm	Nut Material : Stainless Steel Size: M8

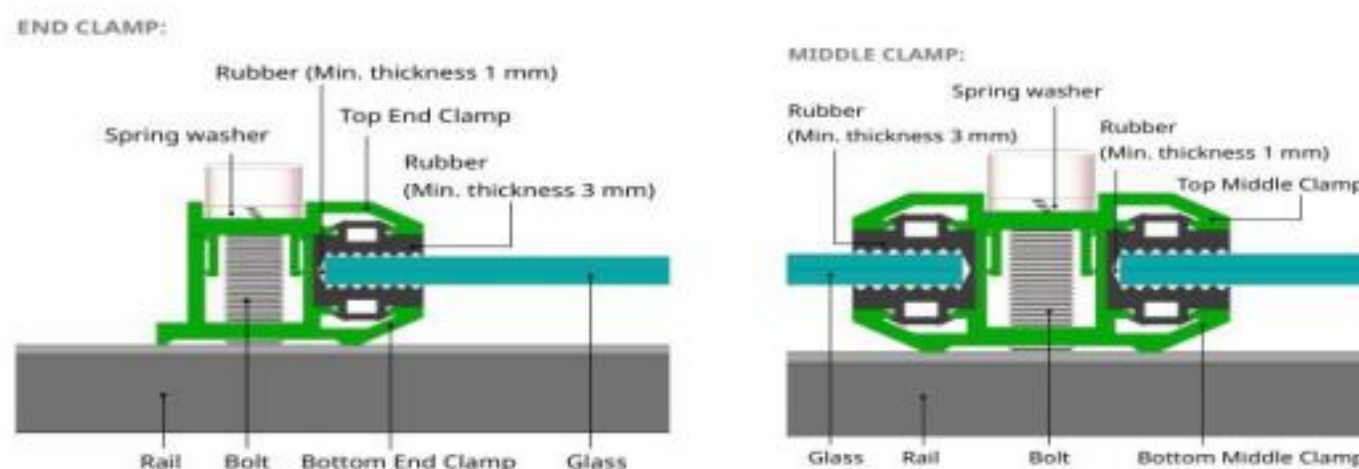


5.5.2 Mounting with Clamps

- When selecting a fixture installation method, at least four fixtures should be used on each Module.
- Install two fixtures on each long (vertical) or short (horizontal) side of the modules.
- Depending on the local wind and snow conditions, determine if additional fixtures are needed to make sure the modules can handle the load.
- The minimum recommended length for each fixture is 50 mm and the torque applied shall be in accordance with the mechanical design standards of the bolts used by the customer, e.g. M8 -- 18-24 Nm.
- The jig must keep at least 7 mm but no more than 10mm of overlap with the modules frame.
- In any case, the modules jig should not contact the front glass and should not deform the frame.
- Please be sure to avoid the shading effect of modules jig:



Framed module clamp



Frameless module clamp

6. ELECTRICAL INSTALLATION

NOTE: For modules under standard test conditions, the nominal electrical performance parameters of the nameplate deviate from the actual value by $\pm 3\%$. (Irradiance 1000 W/m², AM1.5 spectrum, cell temperature 25°C (77 °F)).

- It is not recommended to use modules with different configuration on the same system.
- Any mounting accessories used must be compatible with each other in material and design in order to avoid electrochemical corrosion. Failure due to corrosion will result in a voided warranty.
- Excess cables must be organized or adequately secured such as the use of non-metallic binding to secure cables to the bracket
- Cables, connectors and junction boxes should not be exposed to water, rain or snow for long periods of time, or soaked in water (IP 65/67/68).
- For applications requiring high operating voltage, multiple components can be connected in series to form a component string; System voltage is equal to the sum of the voltages of each component.
- For applications requiring high operating current, multiple components can be connected in series and parallel; System current is equal to the sum of the current of each component string.

NOTE: Maximum system voltage would be 1500 V, as per the market standard. It can be optimized as per customer requirements but it should be in the range of 600, 1000 & 1500 V.

- The maximum number of modules connected in series depends on the system design, the type of inverter used, and environmental conditions.
- Based on the modules maximum series fuse rating and local electrical installation specifications, if modules are in parallel, a suitable series fuse should be fitted. There is no special limit to the number of modules that can be connected in parallel. The number of modules is determined by system design parameters such as current or power output.
- To prevent overheating of cables and connectors, select cables and connectors suitable for the maximum short-circuit current of the system. Recommended cables are pv cables with a cross section of at least 4 mm².

NOTE: Do not let the cable remain under excessive pressure; any damage caused by cable connection is not covered by Unimacts quality assurance.

- Please refer to local regulations to determine the wiring size, type and temperature requirements of your system design.
- Unimacts Solar modules are supplied with connectors for electrical connections to various systems. Unimacts strongly recommends using genuine connectors of the models specified in the Unimacts product data sheet.
- To ensure a reliable electrical connection and prevent possible entry of moisture when two connectors are interfacing, they must be locked until a "click" is heard.
- Long-term exposure to moisture may result in poor connector connectivity, resulting in leakage and poor conductivity, which will nullify the warranty.

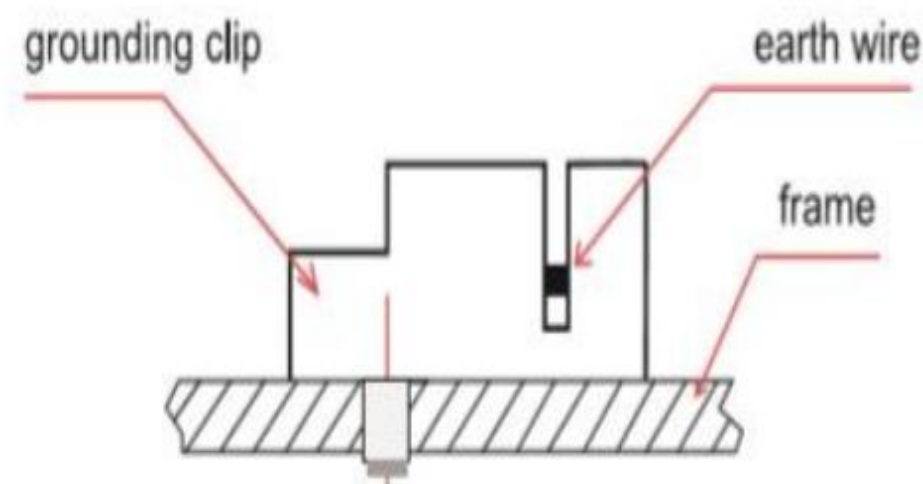
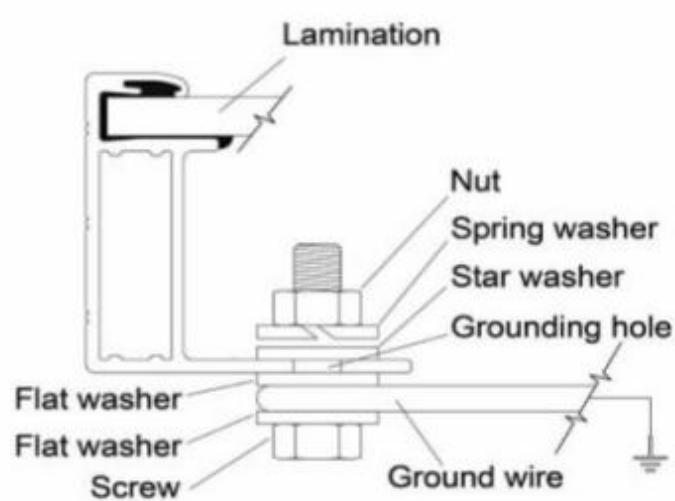
- Unimacts recommends proper management of connectors/cables/wiring to prevent moisture from entering.
- Depending on the severity of moisture, Unimacts recommends checking your installation system periodically to ensure that modules are performing well.
- The direct current generated by photovoltaic systems can be converted into alternating current and used in the public grid.
- As policies for connecting renewable energy systems to the grid vary from region to region, always consult a qualified system designer or integrator for advice.
- Installation permits and inspection and approval by local authorities are usually required.
- Unimacts recommends using lightning protection methods that meet local requirements and regulations.

7. GROUNDING

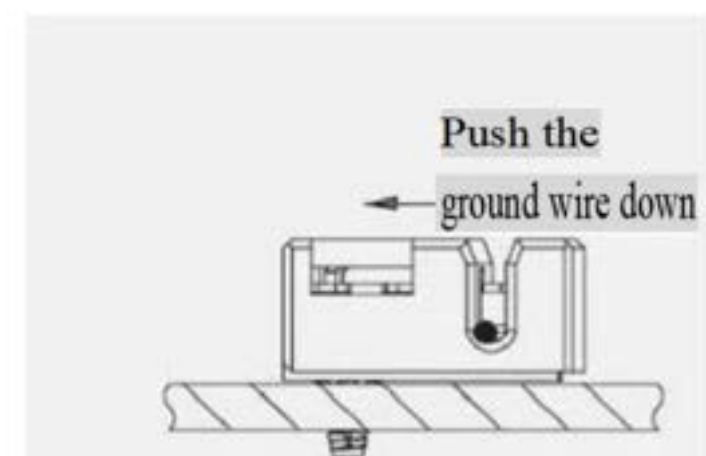
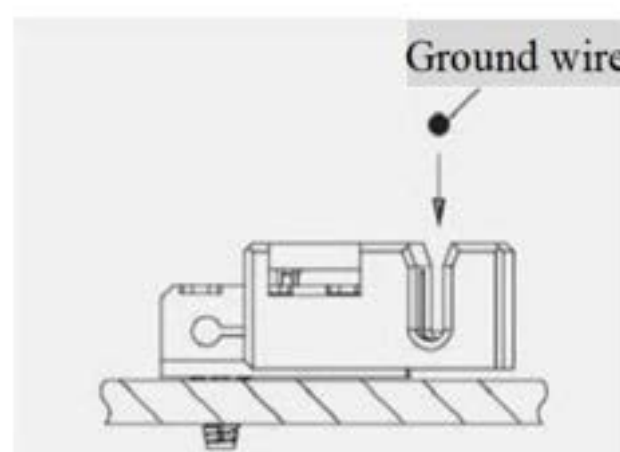
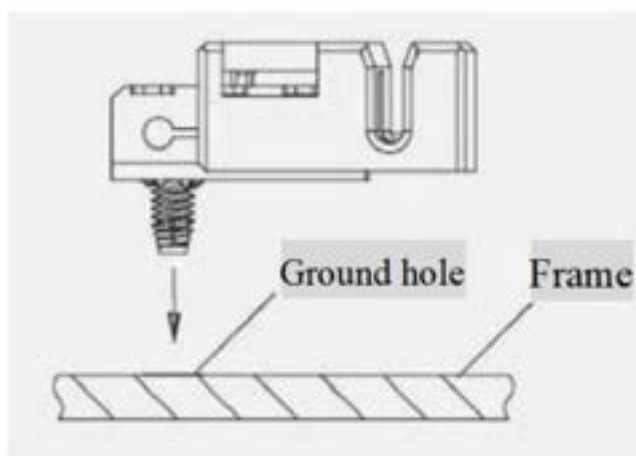
- It is recommended that mounting structures be designed of of anodized corrosion resistant aluminum alloy frame as a rigid support to avoid damage to the modules by lightning and static damage.
- All module frames must be grounded with grounding devices fully in contact with the aluminum alloy, through the oxide film on the surface of the frame.
- The border should be pre-drilled and marked with a grounding mark. These holes are for grounding only, not for installing modules.
- Unimacts recommends always referring to local and national codes and requirements for pv module grounding.
- Unimacts recommends negative grounding if local agencies allow it.
- The ground conductor or ground wire may be copper, copper alloy, or any other material used as an electric conductor that meets the requirements of the corresponding electrical code.
- The ground conductor must be connected to the earth by a suitable ground electrode.

Unimacts recommends using the following grounding parts:

1. Use the ground hole to ground the ground cable, as shown in the following figure.
2. Use M8 bolts and washers to connect the ground cable to the ground hole reserved in the frame to enable the ground cable.
3. Tighten the nut with a torque of 3-7 Nm.
4. Nuts and washers are made of stainless steel.
5. It is recommended that exposed copper wires of 4-14 mm² (AWG 6-12) be used for ground cables.



6. Ground using a grounding clamp, as shown below, containing a sliding contact, base and turning tapping screw or 8-32 bolt and hex nut. The grounding clip can hold bare copperwire in the range of 10-12 AWG.



7. Other third party grounding devices, Unimacts Solar PV modules can be grounded using third party grounding devices, but their grounding must be reliable and proven and installed and operated according to the manufacturer's requirements.

8. MAINTENANCE AND CARE

Modules need to be checked and maintained regularly, especially during the warranty period. To ensure the modules are performing at their best, Unimacts recommends the regular cleaning of the modules' glass surfaces with a soft sponge or cloth dipped in water.

8.1 Visual Inspection

Please check the modules regularly and carefully for any appearance defects, focusing on the following points:

- Modules use antireflection film technology. If there is a color difference between components observed at different angles, it is a normal phenomenon.
- Any broken, cracked or chipped glass.
- Sharp edges or protrusions when touching the module.
- Blocking by vegetation or new construction.
- Corrosion near the grid line of the battery cells, which is caused by water vapor penetrating into the modules due to the damage of the modules surface packaging material during installation or transportation.
- Check for loose or damaged screws between modules and support, and adjust or repair them as needed.
- Structure soundness and stability.

8.2 Cleaning

- If necessary, clean the modules' glass surfaces with a soft sponge or cloth soaked in water. Under no circumstances should you use rough-faced materials for module cleaning.
- Use a mild, non-abrasive cleaning agent to remove stubborn scale.
- Do not use chemicals to clean modules, which may affect modules maintenance and power output.
- To reduce potential electric shocks or burns, Unimacts recommends cleaning modules in the early morning or late afternoon when the light is low and modules are cool, especially in warmer areas.
- Do not attempt to clean modules with features such as broken glass or bare wires, as there is a risk of electric shock.

8.3 Inspection of Connector and Cable

It is recommended to perform the following preventive maintenance every 6 months:

- Check the sealant of the junction box to ensure no cracks or gaps.
- Check the tightness of the connector and cable connection is firm.
- Check the modules are well grounded.
- If there is any concerns, contact qualified personnel to inspect and resolve any issues.
- Observe the maintenance instructions for all components used in the system including, but not limited to, supports, charging rectifiers, inverters, and batteries.

9. DISCLAIMER OF LIABILITY

Unimacts shall not be liable for any loss, damage or expense incurred in connection with the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) products.

Unimacts is not liable for any infringement of third party patents or other rights that may result from the use of photovoltaic (PV) products. Customer does not obtain any license, express or implied, to use Unimacts' products or any patent rights.

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