CRYSTALLINE SILICON PV MODULES

INSTALLATION MANUAL

LUXEN SOLAR

CONTENT

1. INTRODUCTION

This installation manual contains electrical and mechanical installation instructions, so please read it carefully before installing LUXEN SOLAR Modules (hereinafter referred to as LN Modules). In addition, it also contains safety instructions that should be strictly adhered to. LN Modules should be installed only by qualified personnel observing closely all instructions and recommendations in this manual, having necessary protective gear for safe installation and complying with local laws and regulations of the country where modules are installed. Please get familiar with respective laws before installation begin, since they may be different for various installation types and system voltage.

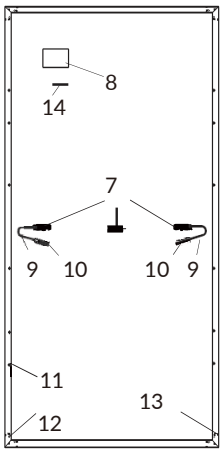
Luxen Solar shall bear no liability nor responsibility for damages during manual moving of LN Modules, installation, operation or maintenance due to improper handling. Any deviation from the instructions and non-compliance with recommendation given in this installation manual will result in invalid limited warranty. Luxen Solar shall not be held liable for any violation of any laws or third party rights nor for losses, damages, damage claims or expenses arising from the violation and related to the installation or use of LN Modules. This installation manual does not constitute any warranty, whether expressed or implied. This manual is compiled based on knowledge and experience of Luxen Solar teams and should be kept serving for future reference of the installation crew and the PV installation owner. In case of any doubt in the interpretation of this manual, please contact LUXEN SOLAR for further clarification.

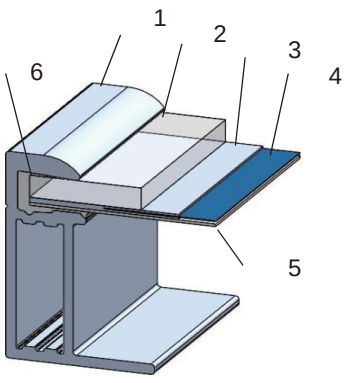
This installation manual is subject to change **at any time and can be amended or modified without prior notice.** Please verify with your contact person in Luxen Solar that you have the latest version.

1.1. MODULES IDENTIFICATION

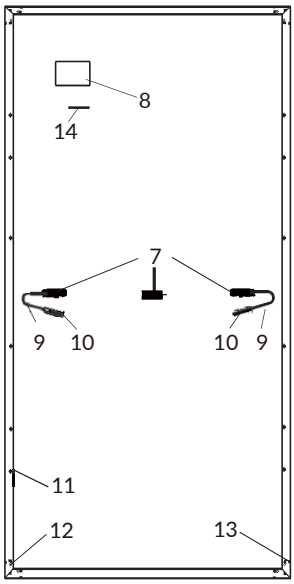
There are 3 labels on the modules that contain information below:

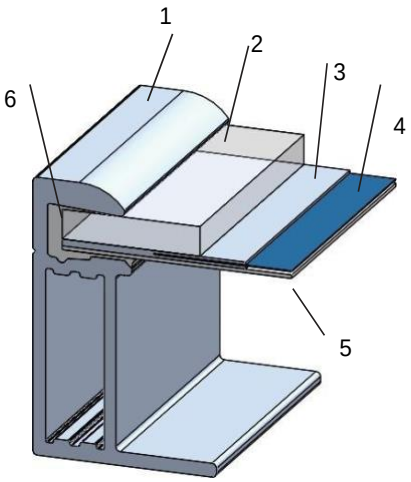
1. **Nameplate**: product type, rated power, power tolerance, open circuit voltage, maximum power voltage, short circuit current under testing conditions, maximum power current, maximum system voltage, weight, dimensions, certification labels, etc.
2. **Current classification label**: Rated working current. (H indicates High, M indicates Medium, L indicates Low)
3. **Serial Number label**: Unique serial number which is laminated inside the module permanently which can be found on the front of the module. The same serial number is also printed next to the module name plate.





1 Frame	2 Glass	3 EVA	4 Solar Cell
5 Back sheet	6 Silica Gel	7 Junction Box	8 Name Plate
9 Cable	10 Connector	11 Mounting Hole	12 Grounding Hole
13 Drain Hole	14 Bar Code		

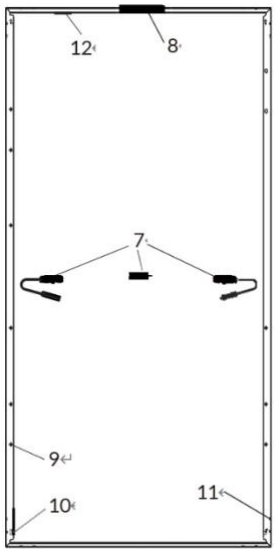


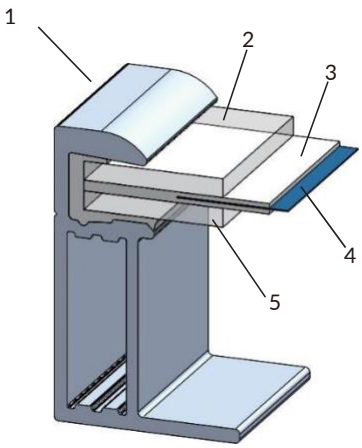


1 Frame	2 Glass	3 EVA	4 Solar Cell
5 Back sheet	6 Silica Gel	7 Junction Box	8 Name Plate
9 Cable	10 Connector	11 Mounting Hole	12 Grounding Hole
13 Drain Hole	14 Bar Code		

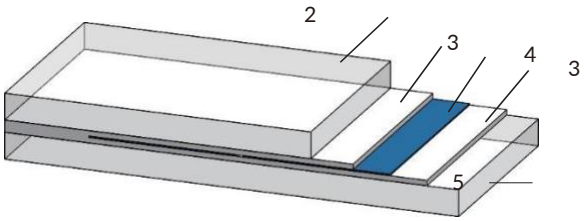
Figure 1 Regular Modules Mechanical Drawing

Please refer to section 1.2 for the location of the junction box.





Bifacial Modules (With Frame)

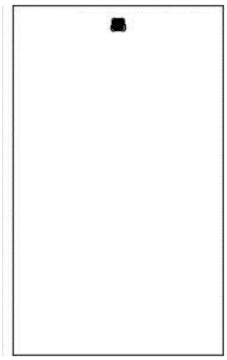
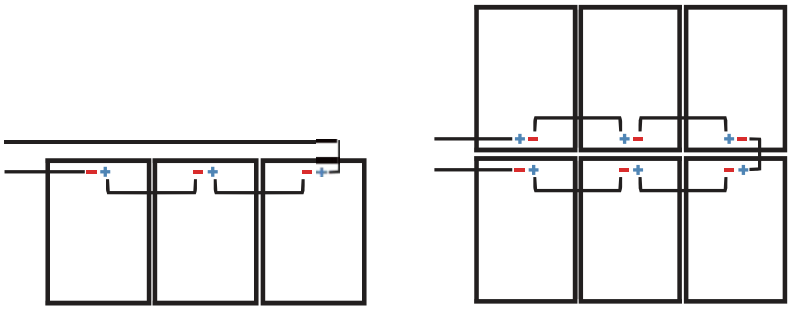
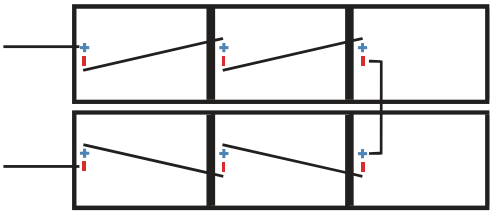
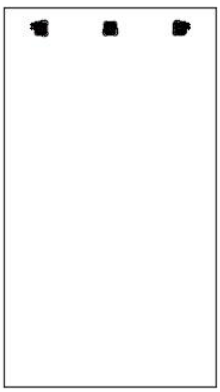
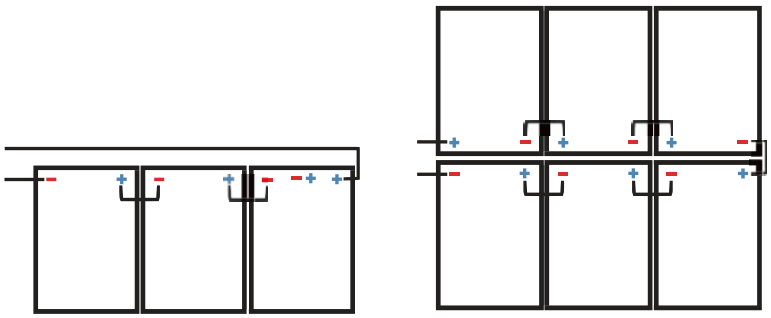
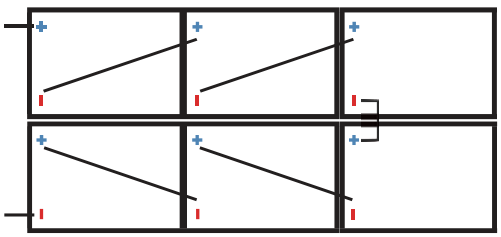


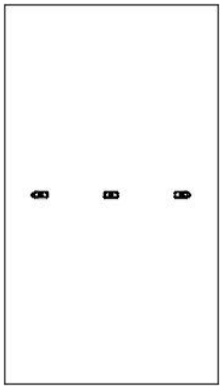
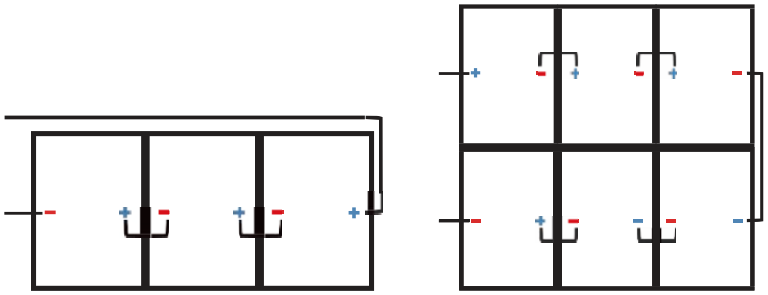
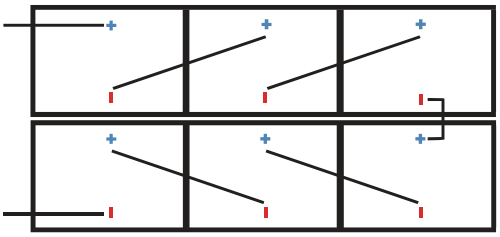
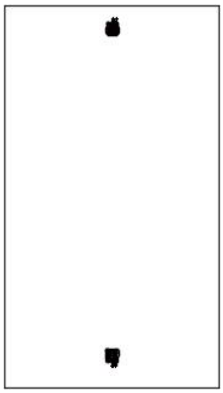
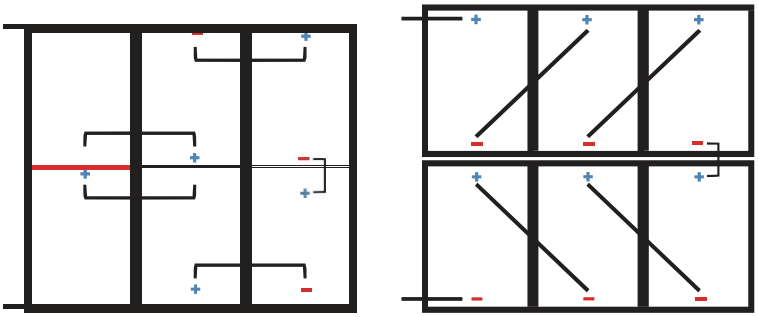
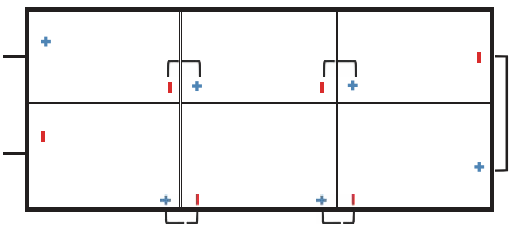
Bifacial Modules (Frameless)

1 Frame	2 Front Glass	3 EVA/POE	4 Solar Cell
5 Back Glass	6 Sealant	7 Junction Box	8 Nameplate
9 Mounting Holes	10 Grounding Holes	11 Drain Holes	12 Bar Code

Figure 2 Regular Modules Mechanical Drawing
(Please check the location of the junction box – section 1.2)

1.2. JUNCTION BOX AND WIRING

Junction Box Location	Recommended Wiring Method
	Vertical Installation: Standard Cable Length (Note: One end of the single row needs to be extended.)  Horizontal Installation: Standard Cable Length 
	Vertical Installation: Standard Cable Length (Note: One end of the single row needs to be extended.)  Horizontal Installation: 60 type PV module cable length ≥1.2m 72 type PV module cable length ≥1.4m 

Junction Box Location	Recommended Wiring Method
	Vertical Installation: Standard Cable length: (Note: An extension cord is required at the rotor head of the double row assembly and at the end of the single row.)  Horizontal Installation: 60 type PV module cable length ≥1.2m 72 type PV module cable length ≥1.4m 78 type PV module cable length ≥1.5m 
	Vertical Installation: Method 1: Standard cable length Method 2: Single component cable length ≥1.2m  Horizontal Installation: Standard cable length 

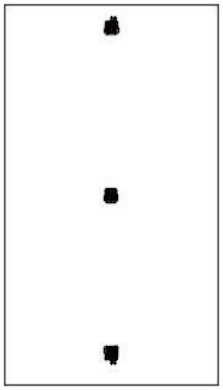
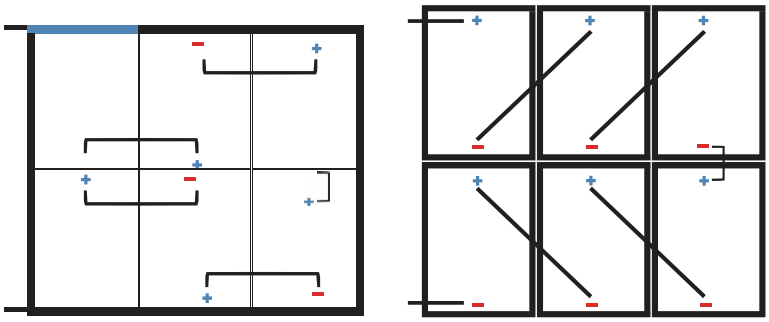
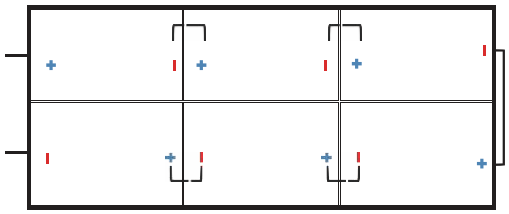
Junction Box Location	Recommended Wiring Method
	Vertical installation: Method 1: Standard cable length Method 2: Single component cable length ≥1.2m   Horizontal Installation: Standard cable length

Figure 3 Junction box And Wiring

1.3. SAFETY RECOMMENDATIONS

LUXEN SOLAR module meet requirement and are produced according to IEC 61215 and IEC 61730, application class A, thus meeting Safety Class II requirements. They can be used in systems operating at > 50 V DC or >240 W, where general contact access is anticipated.

For every installation of LN Solar modules, it is necessary to wear protective gear (PPE and equipment) to avoid electric shock and other injuries, such as, but not limited to, safety helmets, insulation gloves, safety belts, etc. especially during wiring, grounding and installation and maintenance in general.

Do not attempt to install or handle LN Modules in extreme weather situations, such as heavy rain, ice, strong winds, storms, heavy snow, etc. or any environment that is not dry and may lead to health and safety risks to people and equipment.

For rooftop applications, it is necessary to make sure that the rooftop construction is sturdy enough to support the additional weight of the mounting structure and PV modules. Experts and experienced engineers must be consulted to evaluate the rooftop structure before attempting the installation.

Any attempt to remove any parts of the LN Module, perform any changes on the Module, included but not limited to painting it, applying any adhesives, modify cables/junction box, drilling holes in the frame or widening the existing ones, shall render the warranties invalid.

Do NOT step on, walk over or stand on LN Modules, do not scratch the front or backside surfaces of the module or cause any other damage to its surfaces or parts.

During installation, make sure that all connections are with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.

1.4. ELECTRICAL PERFORMANCE SAFETY

Protective equipment and gear must be used for safety, since PV modules can produce DC current when exposed to sunlight, thus may cause electrical shock or burn. Any direct contact with 30V or higher DC Voltage can potentially lead to lethal consequences. Modules can still produce voltage in case of no connected load or external circuits, thus insulation tools and protective personal equipment is a must when handling modules exposed to the sunlight. Modules cannot be switched on and off and need to be covered by a hard board or ultra-violet shielding material to stop them from operating. Do not attempt to disconnect Modules under load to avoid arcs and electrical shocks.

Avoid in any case to break down electric connection in loaded conditions, because it can lead to electric shock hazard. Connector must be kept in proper operating condition and dry and clean. If the glass or other sealing materials are damaged, please wear PPE to isolate Module from the circuit. Do not bring connectors in contact with the following: gasoline, diesel, engine oil, grease, lubricants, rust-proof oil, cooking oil, acetone, alcohol, materials capable of generating oxime gas, household or other cleaning agent etc.

Any handling of operating LN Modules must be performed in dry conditions and by a qualified electrician. In general, only authorized and trained personnel may access and perform installation or maintenance related works.

Any person in the vicinity or working on an operating PV installation must wear safety gear and take all protective measures.

1.5. OPERATIONAL SAFETY

- Do not remove the packaging material of the pallet unless the Modules will be installed immediately after unwrapping.
- Handle the pallets with care, avoiding hitting the pallets with heavy object or dropping them on the ground.
- Handle LN Modules with care while taking them out of pallets avoiding dropping them on the ground
- Do not put heavy object or working gear and equipment on the glass surface to avoid damage and scratches to the glass
- Do not stack modules over the limit indicated as maximum
- Before unpacking, LN Modules must be in a dry environment
- Modules may be carried only by grasping the frame, not the junction box or cables.
- Do not sit, walk on, jump or stand on LN Modules, neither single or in pallets.
- Make sure LN Modules are not exposed to heavy vibrations, as they may cause micro-cracks in cells
- Any improper handling may lead to damages to the Module and diminish it's performance.
- It is recommended that 2 people grasp the frame of the Modules with both hands on opposite sides and gently transfer the Module to its installation place
- It is strictly forbidden to drill additional holes or widen the existing once as it may impact the frame loading capacity, lead to corrosion and render the limited warranty invalid.
- Do not attempt to install LN Modules in wet, windy or snow conditions.

- Make sure you handle LN Modules carefully, when placing them on flat surface.
- Do no install Modules if you have noticed cracked glass, cells, scratches on the back sheet, dislocated junction box, etc.
- Do not expose LN Modules to sunlight using magnifying glass.

1.6. FIRE SAFETY

- Please refer to local laws and regulations on fire safety before installing LN Modules and follow guidelines for fire protection in buildings. The fire rating of LN Modules is Class A (Double Glass Modules) and Class C (Single Glass Modules）.
- The roof should be coated by a layer of fireproof materials with suitable fire protection rating for roofing installation. Make sure that there is sufficient distance between the Module and the roof surface to ensure proper ventilation of the module and dissipation of the generated heat. To ensure roof fire rating, the distance between the LN Module and roof surface must be ≥10cm.
- It is strictly forbidden to use or install LN Modules in vicinity of flammable gases, furnaces with chimneys that may eject flammable material or near any other source that presents a fire potential or risk.
- Improper installation may increase the fire risk.
- Fuses, circuit breaker and grounding connector must be used compliant to local regulations.

2. STORAGE OF LUXEN SOLAR MODULES

2.1. HOW TO STORAGE LN MODULES IN A STORAGE FACILITY

The best way to storage LN Modules is inside or under a shelter to shield them from extreme weather conditions.

- LN MODULES should be left in the original package until they should be taken out of the pallets for installation. Store LN Modules in a clean and dry place with humidity below 85% and ambient temperature between -20°C and 50°C. Pallets are stackable, but only one of top of the other. Do not stack more than allowed. Take special care while unloading pallets for storage or loading pallets for transportation to the construction site.
- Don't rush the forklift, make sure the pallets are properly lifted and slowly transferred to the new location. Following basic forklift safety measures helps prevent damage to pallets.
- Pallets must be handled without sudden movements and without dropping them on the floor or land surface.
- Make sure that the storage place is clutter-free and free from debris, so there is no bouncing over it while moving pallets around. Any bounce can put stress on a pallet and cause vibrations increasing the risk of module damage.
- When pallets are staked, make sure the weight of the upper pallet is evenly distributed and centered compared to the pallet below. Evenly distributed weight prevents damage to the packaging and corners.
- Tynes of forklifts are major cause of damaged pallets. They should fit evenly into a pallet, without any contact until the pallet is lifted. If they hit pallet stringers, they can damage them. If stringers of the pallet are damaged, the weight capacity is diminished causing instability of the pallet and jeopardizing pallet collapse under it's load. One the pallet is set down on the ground, tynes must be fully removed, before turning the forklift.
- Make sure the load of the pallet does not rest on the tip of tynes: Tynes of forklifts must be fully inserted into the pallet before attempting lifting it. Otherwise, if the load of the pallet is resting on the tips of the tynes, called short-forking, a lot of stress is put on the pallet deckboards, the pallets may slip or fall during moving. This can lead to pallet damage and subsequently product damage.
- Make sure pallets are never pushed across the floor, but only lifted using forklifts. Pushing or pulling them may cause lateral stress on the pallet and the goods inside and it damages the pallet boards.

2.2. HOW TO STORAGE LUXEN SOLAR MODULES OUTSIDE

- Wooden pallets can change shape and structure, when exposed to extreme weather conditions, especially moisture, water or mud and especially for a long time. If you need to store pallets outside, make sure it's for a short time period.
- LN Modules outside, make sure that pallets are placed on an even ground to prevent leaning and falling.
- Pallets with modules should not be exposed to extreme weather conditions, such as heavy rain or show that can degrade the wood's quality.
- It is recommended **NOT** to stack one pallet on top of another in an open space. The ground is never as even as in a storage facility and the risk of pallets falling increases.
    - Make sure pallets are kept away from any fire source, flammable material or compressed gasses, since wooden pallets are highly flammable. Do not smoke cigarettes, have broken glass pieces that may act as a lens, because if the sunlight hits it and the rays are bounced to flammable material, a fire can start.
    - Make sure that personnel handling pallets are familiar with proper lifting procedures and techniques, that they wear appropriate PPE and follow rules for safe transfer of pallets (please see instructions above).

3. UNPACKING OF LUXEN SOLAR MODULES

- Use cutting pliers and not knife to cut the zip-ties.
- When taking LN Module out of the box, 2 people are required for the lifting.
- Use both hands and grab the Module by the frame, not cables or junction box.
- Move the module from the box to the installation place.
- Do not place the module on the ground, as the edges may be damaged and do not place one module directly on top of the other.

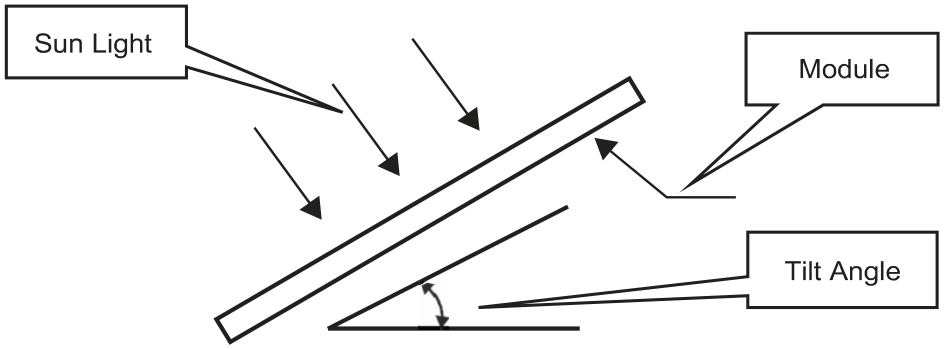
4. INSTALLATION CONDITIONS

4.1. INSTALLATION SITE AND OPERATIONAL ENVIRONMENT

- LN Modules should be installed outside, in locations with a lot of sunlight, avoiding shadows on LN Modules from surrounding objects, since the power output is reduced. LN Modules, that are exposed to repeated and regular shading for a long period of time, are not covered by the limited warranty, due to damages the Modules are exposed to in such an environment.
- It is recommended to install LN Modules in an operating environment with a temperature of -20℃ to +50.
- LUXEN SOLAR modules can be installed on the ground, buildings and structures with rooftops, but shall not be installed on any vehicles.
- Do not install modules in environment where the risk of floods is high.
- Do not install LN Modules in a location where they will be immersed in water.
- It is strictly prohibited to install LN Modules in environments where there are strongly corrosive substances present (such as chemicals, acid rain, or any other substance that would corrode the Module and affect its safety or performance).
- Make sure that installed modules do not suffer wind or snow pressure that exceeds the permissible maximum load limit.
- Make sure you have secured lightning protection for modules installed in places with frequent lightning and thunder.
- LN Modules should not be used in environments with frequent hail storms, heavy snow, heavy air pollution
- LN modules passed the IEC61701 salt spray corrosion test, but the corrosion may still occur over time. LN Modules should be installed **at least 50m** away from the ocean side. Use stainless steel material to contact the Module and make sure the connection point is protected with ant-corrosion measures.
- It is forbidden to use different models of LN Module in the same PV system installation.
- Make sure that when you connect LN Modules in series, the voltage of every string does not exceed than the maximum voltage of the system – check local regulations

4.2. SELECTION OF TILT ANGLES

The maximum power output is secured when the Module is facing the sun.



Modules are preferred to be south-facing in the north hemisphere and north-facing in the south hemisphere.
Please refer to standard modules installation guideline or suggestions from qualified expert, for the specific installation angle.
LUXEN SOLAR suggests that the angle of module installation is no less than 10°. This ensures that rainfall washes away the dust from the Module surface, reducing the need for frequent cleaning and water marks on the glass.
LUXEN SOLAR modules connected in string should be installed with the same orientation and tilt angle. Different orientations and tilt angles will receive different irradiation that results in lower efficiency. In order to achieve the maximum annual generating capacity, the optimal orientation and inclination of PV modules should be selected based on the shortest day of the year and the amount of sunlight reaching LN Modules on that day.
If LN Modules are used in off-grid System, the tilt angle should be calculated based on seasons and irradiation to maximize the output power. If the LN Modules are used in grid-connected system, the tilt angle should be calculated based on the principle to maximize the yearly output power.

5. MECHANICAL INSTALLATION

5.1. REGULAR REQUIREMENTS

• Make sure that module installation method and the mounting structure are perfectly matched to withstand to the loading conditions. The mounting structure shall be tested and inspected by the third party with static mechanical analysis compliant to local national standards or international standards.

• The mounting structure shall be made from durable, corrosion resistant, UV-proof materials.

• Modules shall be fixed on the structure according to manufacturer's instructions.

• The height of the structure must be adjusted to the environmental conditions to ensure the LN Modules are shadowed as less as possible in various weather conditions.

• On rooftops, proper ventilation of LN Modules must be ensured.

Due to the thermal expansion of physical properties of materials, that do not affect the installation, use and reliability of the Modules, yet the dissemination of the heat must be provided. The minimum distance between two Modules should not be less than 10 mm.

➢ Ensure that the Module backside will not be in contact with the support or building structure that can pierce into the inside of the modules, especially when the module surface is exposed to pressure.

• Certified maximum front load on LN modules is 5400pa and backload 2400pa.

• Note: on the basis of IEC61215 - 2016 installation requirements, when calculating the corresponding maximum design load, please consider the safety factor of 1.5 times.

• Modules can be installed horizontally or vertically. When installing the components, be careful not to block the drain hole of the frame.

Monofacial assembly mechanical installation

Module and mounting system connection can be realized by Mounting holes, clamps or embedded systems.
Installation shall follow the demonstration and suggestions below.
If installation mode is different, please consult LUXEN SOLAR and obtain approval.
Otherwise, modules may be damaged and limited warranty will be invalid.

5.2. BOLTS MOUNTING

Apply bolts to fix modules on the bracket through Mounting holes on the back frame. See details in Figure 4.

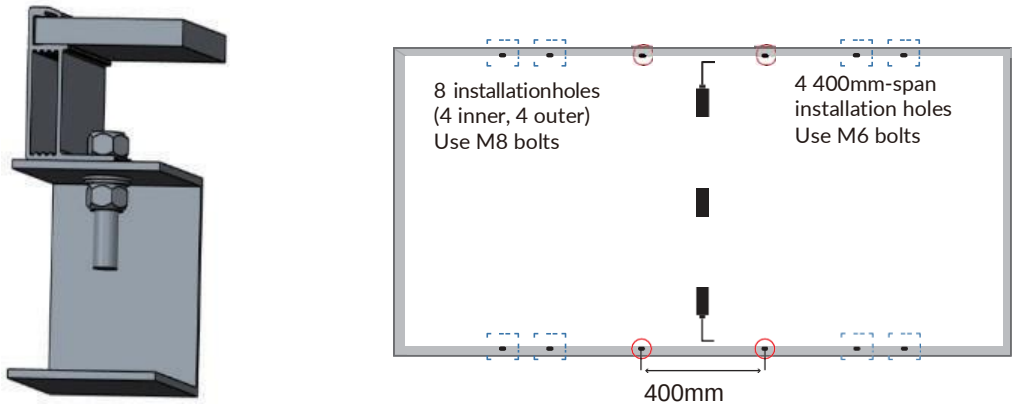


Figure 4 Bolt Installation of monofacial module

Torque tightening:

The torque size range of M8 bolt tightening: 14 -18 N·m ;
The torque size range of M6 bolt tightening: 10 -14 N·m.

5.3. CLAMP MOUNTING

The module can be mounted by a dedicated clamp, as shown in Figure 5.

Under no circumstances should the clamp touch the glass or deform the frame. The interface of the clamp to the front of the frame must be smooth and flat to prevent frame or other components from being damaged. The drain hole must not be blocked by the fixture.

For framed PV module, the clamp must maintain an overlap of 8-11 mm with the frame of the module (you can change the cross section of the clamp if the module is securely installed). For frameless PV module, the clamp must maintain an overlap of 15 mm at maximum with the module.

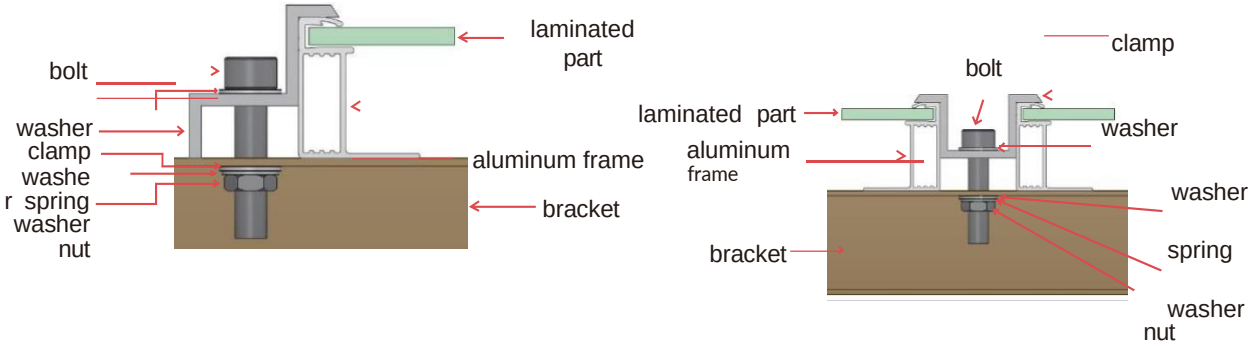


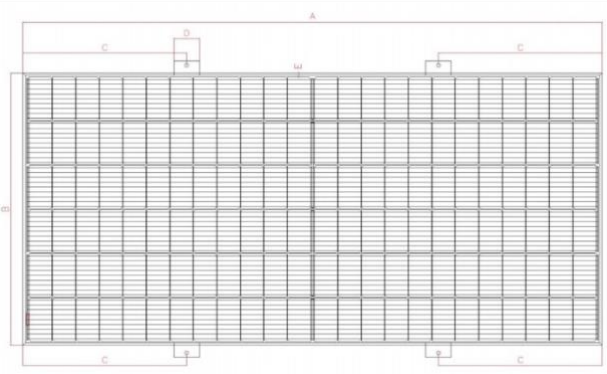
Figure 5 Clamp Installation Of Module

5.4. INSTALLATION AND MECHANICAL LOAD OF LN MODULES

Under normal circumstances, Luxen Solar suggests the installers to select the clamping methods of +5400Pa/-2400Pa mechanical loading to clamp the module (as shown in Table 2) to improve the bearing capacity for snow load at front side and wind pressure at back side, and enhance the system capacity.

Range of Clamp to fasten the module

Module type	Mechanical Loading/Pa	A/mm	B/mm	C/mm
LNVH-xxxN	+5400/-2400	2465	1134	1/4A±100
LNVH-xxxND	+5400/-2400	2465	1134	1/4A±100
LNVU-xxxN	+5400/-2400	2278	1134	1/4A±100
LNVU-xxxND	+5400/-2400	2278	1134	1/4A±100
LNVT-xxxN	+5400/-2400	2094	1134	1/4A±100
LNVT-xxxND	+5400/-2400	2094	1134	1/4A±100
LNVK-xxxN	+5400/-2400	1910	1134	1/4A±100
LNVK-xxxND	+5400/-2400	1910	1134	1/4A±100
LNVB-xxxN	+5400/-2400	1722	1134	1/4A±100
LNVB-xxxND	+5400/-2400	1722	1134	1/4A±100
LNAU-xxxN	+5400/-2400	2382	1134	1/4A±100
LNAU-xxxND	+5400/-2400	2382	1134	1/4A±100
LNCU-xxxN	+5400/-2400	2465	1134	1/4A±100
LNCU-xxxND	+5400/-2400	2465	1134	1/4A±100
LNCT-xxxN	+5400/-2400	2278	1134	1/4A±100
LNCT-xxxND	+5400/-2400	2278	1134	1/4A±100
LNDT-xxxN	+5400/-2400	2382	1134	1/4A±100
LNDT-xxxND	+5400/-2400	2382	1134	1/4A±100
LNDB-xxxN	+5400/-2400	1961	1134	1/4A±100
LNDB-xxxND	+5400/-2400	1961	1134	1/4A±100
LNDX-xxxN	+5400/-2400	1762	1134	1/4A±100
LNDX-xxxND	+5400/-2400	1762	1134	1/4A±100



Note:
A: Length of this type of module.
B: Width of this type of module.
C: The distance of clamp center from the edge of this type of module.

*** Notes:**

LN Solar's limited warranty will be void in cases where improper clamps or installation methods deviating from this manual are used. When using clamps to fasten the modules, pay attention to the following requirements:

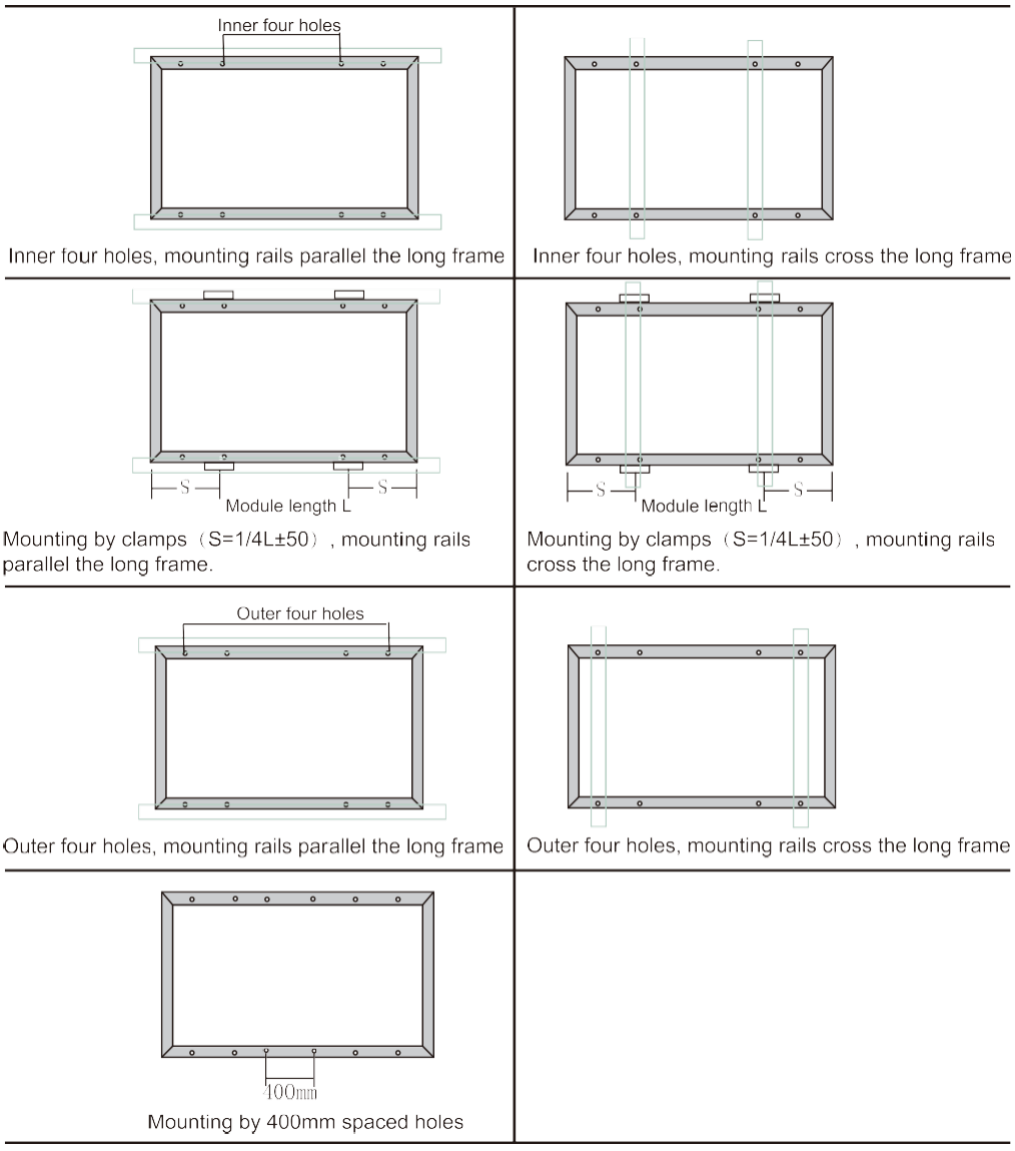
(a) Take care of the module frames, not to twist or deform them.

(b) Avoid the clamps' shading influence the module.

(c) Not to damage the surface of module frame.

(d) Make sure that the module's drainage holes not be plugged.

(e) For installation with 400mm mounting holes, please consult with tracker companies about the workable installation solution if required test load is over 2400Pa.



Module type \ Installation methods		Inner four holes, mounting rails parallel the long frame.	Inner four holes. Mounting rails cross the long frame.	Clamps, mounting rails parallel the long frame S=1/4L+50	Clamps, mounting rails cross the long frame S=1/4L+50	mounting by 400mm spaced holes	Outer four holes, mounting rails. parallel the long frame	Outer four holes, mounting rails cross the long frame
Framed bifacial double-glass modules	LNVT-×××M/N/NB(182)	2400	+5400/-2400	2400	+5400/-2400	2400	N/A	N/A
	LNVU-×××M/N/NB(182)	2400	+5400/-2400	2400	+5400/-2400	2400	2400	+5400/-2400
	LNVH-×××M/N/NB(182)	2400	+5400/-2400	2400	+5400/-2400	1800	2400	+5400/-2400
	LNVT-×××MD/ND(182)	2400	+5400/-2400	2400	+5400/-2400	2400	N/A	N/A
	LNVU-×××MD/ND(182)	2400	+5400/-2400	2400	+5400/-2400	2400	2400	+5400/-2400
	LNVH-×××MD/ND(182)	2400	+5400/-2400	2400	+5400/-2400	1800	2400	+5400/-2400

"N/A" means not applicable

*For installation with 400mm mounting holes, please consult with tracker companies about the workable installation solution if required test load is over 2400Pa.

6. ELECTRICAL INSTALLATION

6.1. ELECTRICAL PERFORMANCE

The reported performance measurements are subject to ±3% uncertainty at STC (1000 W/m2 Irradiance, a cell temperature of 25℃ and an AM1.5 spectrum) for power. For voltage and current, it is ±2% (Single Glass Modules) and ±5% (Double Glass Modules).

When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module as shown in below figure 6. Modules with diff erent electric performance models cannot be connected in one string.

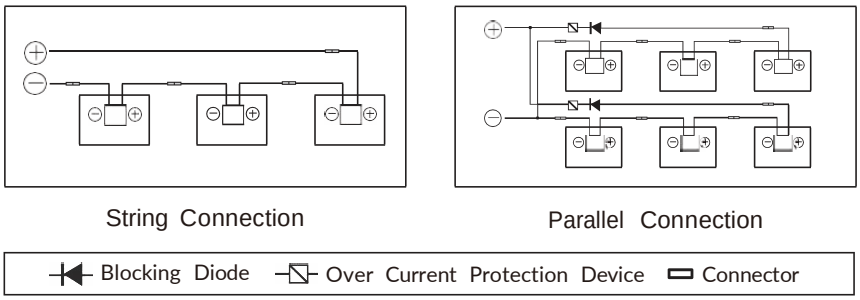


Figure 6 Series Connection and Parallel Connection Circuit Diagram

The maximum allowed quantity of modules in string connection shall be calculated according to respective regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts. (LN Modules maximum system voltage is DC1000V/DC1500V——actually system voltage is designed based on the selected module and inverter model.) The VOC factor can be calculated by the following formula:

CVoc=1-βVoc×(25-T)

T: The expected lowest temperature of the installation site

β: VOC temperature coefficient (%/℃) (Refer to modules data sheet for further detail)

If there is reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module; if parallel connection is more than 2, there must be an overcurrent protection device on each string of module.

6.2. CABLES AND WIRING

In module design, adopt junction boxes with the protective level of IP68 for on-site connection to provide environmental protection for wires and connections and contacting protection for non-insulating electric parts. The junction box performs the protective level of IP68 with well-connected cables and connectors. These designs facilitate parallel connection of modules. Each module has two individual wires connecting the junction box, one is negative pole and the other is positive pole. Two modules can be in series connection by inserting the positive pole at one end of wire of one module into the negative pole of the adjacent module.
Apply proper cable and connector according to local fire protection, building and electrical regulation; ensure the electrical and mechanical property of the cables (the cables should be put in a catheter with ant-UV aging properties, and if exposed to air, the cable itself should have ant-UV aging capability).

The installer can only use single-wire cable, 2.5-16mm2(5-14 AWG), 90℃, with proper insulation capability to withstand the maximum open circuit voltage (such as EN50618 approval). Make sure you select appropriate wire specifications to reduce voltage drop.

LUXEN SOLAR requires that all wiring and electrical connections comply with the appropriate 'National Electrical Code'. When cables are fixed on the bracket, avoid mechanical damaging cables or modules. Do not press cables by force. Adopt UV resistant cable and clamps to fix cables on the bracket. Though cables are UV resistant and water proof, it is still necessary to prevent cables from direct sun light and water immersion.

The minimum bending radius of cables should be 43mm. (1.69in)

6.3. CONNECTOR

Please keep connectors clean and dry. Make sure connector caps are fastened before connection. Do not connect connectors under improper conditions of damp, dirty or other extreme situations). Avoid connectors from direct sun light and water immersion or falling onto ground or roof.
Incorrect connection may lead to electric arc and electric shock. Please make sure that all electric connection is reliable. Make sure all connectors are fully locked.
Only compatible connectors can be mated, i.e. from the same vendor and model, shall be used;(If you need to use different types of connectors, please consult customer service of LUXEN SOLAR) .

6.4. BYPASS DIODE

LUXEN SOLAR module junction box contains bypass diode which is in parallel connection with the cell string. If hot spot occurred, the diode would come into operation to stop the main current from flowing through the hot spot cells in order to prevent module over-heated and performance loss. Notice, bypass diode is not the overcurrent protection device.

If the diode is definite or suspected to be defective, the installer or system maintenance supplier shall contact LUXEN SOLAR. Please do not try to open the module junction box on your own.

PID Protection and Inverter Compatibility

① PV modules may appear Potential Induced Degradation (PID) under high humidity, high temperature and high voltage condition. Modules may experience Potential Induced Degradation (PID) under the conditions below:

◇PV modules installed under hot and humid weather condition.

◇PV modules installation site is under long term humid condition such as floating PV system.

② To reduce the risk of PID, on the modules DC connection site, it is recommended to connect the negative to ground. The PID protection measures on system level are recommended as follow

◇For isolated PV inverter, the negative of the PV modules DC connection side can be directly grounded.

◇For non-isolated PV inverter, isolated transformer is needed to be installed before applying virtual grounding (grounding method guidance from the inverter manufactures is usually needed)

7. GROUNDING

All LN modules must be properly grounded compliant to respective electrical design, construction codes and regulations, as well as grounding requirements of the installation location.

The frame has pre-drilled grounding holes that should be used for grounding only and not for mounting LN Modules.

It is forbidden to drill additional grounding holes in the frame because the warranty of the Module will become invalid.

In design of modules, the anodized corrosion resistant aluminum alloy frame is applied for rigidity support. For safety utilization and to protect modules from lightning and static-electricity damage, the module frame must be grounded.
The grounding device must be in full contact with inner side of the aluminum alloy and penetrate surface oxide film of the frame. Do not drill additional grounding holes on module frame.
The grounding conductor or wire may be copper, copper alloy, or any other material acceptable for application as an electrical conductor per respective National Electrical Codes. The grounding conductor must then make a connection to ground with a suitable ground electrode. Holes marked with a grounding mark on the frame can only be used for grounding but not for mounting.
Frameless double glass modules have no exposed conductor, and therefore according to regulations it did not need to be grounded.

Grounding must be verified by a qualified expert - electrician and the grounding fixture must be manufactured by specialized electrical manufacturer.

7.1. ACCEPTABLE GROUNDING METHODS

Grounding by grounding clamp

There is a grounding hole with the diameter of Ø4.2 mm at the edge of the module back frame. The central line of the grounding sign also located on the edge of the module back frame overlaps with that of the grounding hole.
Grounding between modules shall be confirmed by qualified electricians and grounding devices shall be manufactured by qualified electric manufacturer. The torque of copper core wire used for the grounding clamp is recommended to be 2.3N - m. 12 AWG. And copper wires cannot be pressed during installation in case of damaging.

Grounding by unoccupied Mounting holes

Mounting holes on modules that are not occupied can be used for installing grounding components.

- ◆ Align grounding clamp to the frame Mounting hole. Use grounding bolt to go through the grounding clamp and frame.
- ◆ Put the tooth side of the washer on the other side and fasten the nuts.
- ◆ Put grounding wires through the grounding clamp and grounding wire material and dimension shall meet requirements in local national and regional law and regulations.
- ◆ Fasten bolts of grounding wires and then installation is completed.

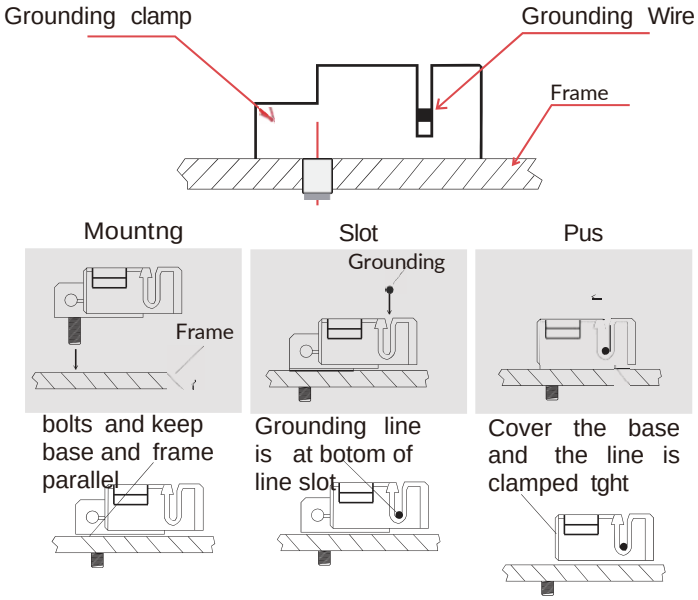


Figure 7 Clamp Grounding Method

Note: TYCO. 1954381-1 (Recommended) is used in figures above.

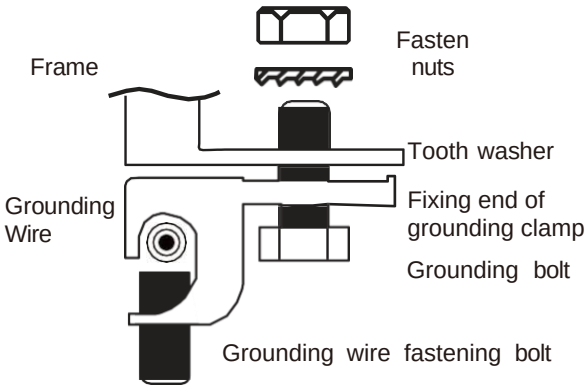


Figure 8 Bolt Grounding Method

7.2. THIRD PARTY GROUNDING DEVICES

The third party grounding device can be used for grounding of LN Modules, but you need to make sure that grounding is reliable. Grounding device shall be operated in line with instructions of the manufacturer.

8. MAINTENANCE OF LN MODULES

It is the users' responsibility to carry out regular inspection and maintenance for modules, especially during the period of limited warranty.

- During operation of modules, avoid environmental factors that shade modules fully or partially. These environment factors include, yet are not limited to adjacent buildings, items placed on the rooftop, in rooftop installations, chimneys, other modules, module mounting system, birds dwelling, dust, soil or plants, trees. These will significantly reduce output power. LUXEN SOLAR suggests that the module surface should not be shadowed in any case.
- Frequency of cleaning depends on dirt accumulation speed. In normal situations, rainwater will clean the module surface and reduce the cleaning frequency. It is suggested to use sponge dipped with clean water or soft cloth to wipe the glass surface or to use professional service providers. Do not use acid and alkaline detergents to clean modules. Do not use tool with rough surface to clean in any case.
- In order to avoid potential risk of electrical shock or burn, LUXEN SOLAR suggests cleaning the modules during early morning and evening with low irradiance and low modules temperature especially area with high average temperature. In order to avoid potential risk of electrical shock, do not try to clean the modules with glass damage or expose wires.
- Maintenance of LN Modules should be carried out at least once a year by qualified personnel.
- In case of ground-mounted installations, any vegetation which may shade the solar installation must be trimmed.
- All cables, string fuses, all mounting hardware should be checked. Any loose connections may damage the array.
- Do not attempt to open or repair broken or damaged junction boxes.
- Use appropriate safety equipment and gear while doing maintenance works.
- Modules should be covered by non-transparent material while maintenance since when exposed to sunlight, they generate high voltage and are dangerous.
- Shut down the system before attempting any electric repair.

8.1. MODULES APPEARANCE CHECK

Check module cosmetic defects with naked eyes, especially:

◆Module glass cracks.

◆Corrosion at welding parts of the cell main grid, caused by moisture into the module due to damage of sealing materials during installation or transportation.

◆Check whether there are traces of burning mark on the module back sheet.

◆Check PV modules for any signs of aging including rodent damage, climate aging, connectors tightness, corrosion and grounding condition.

◆Check if any sharp objects got in contact with PV modules' surface

◆Check if any obstacles cast shade on the PV modules

◆Check for any loose or damage screws between the modules and the mounting system

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9. CLEANING OF LN MODULES

- Make sure Modules are cleaned, if dirty, especially in very dusty environment with no rain fall.
  Cells shaded from dirt will produce less energy. The frequency of cleaning activities depends on weather conditions that may have influenced the dirt accumulation on the surface of modules and the tilt angle of installation. Modules may be cleaned solely using soft cloth and water (at similar temperature as the module surface) or professional cleaning companies specialized in cleaning of PV installations.

- Cleaning of Modules should be carried out in early morning or evening hours when the sunlight is weak, and the Modules' temperature is low. Before cleaning, make sure that the circuit is disconnected.

- The maximum water pressure for cleaning should not exceed 4 MPa. Soft water is recommended, with PH 6-8;

- Modules installed flat should be cleaned more often since they will not self-clean as modules installed at 10 degrees tilt or higher.

- Do not use any sharp objects while cleaning the modules, neither on the front or on the back side (back side usually doesn't need any cleaning).

- The cleaners should wear insulation gloves and other protective gear. It is strictly prohibited to clean the back panel, cables, and connectors of the Modules with water.

10.RELEASE

This manual document is implemented and managed by L N Product Management Department.

LUXEN SOLAR reserves the rights to modify this installation manual at any time without any prior notice.

LUXEN SOLAR will not take any responsibility if patent rights, or the third party rights are infringed by use of LN Modules.

AMENDED EDITIONS AND DATES

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