Linyang Photovoltaic Module Installation Manual

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Content

1. Introduction

First of all, thank you very much for choosing Linyang photovoltaic modules. This installation manual contains important electrical and mechanical installation information. Please understand this information before installing Linyang modules. In addition, the manual also contains some other safety information that you must be familiar with. All the contents in the manual belong to Linyang's intellectual property, which is derived from Linyang's long-term technical exploration and experience accumulation.

This installation manual does not have any warranty meaning, whether express or implied. No compensation plan is specified for losses, module damage or other expenses arising from or related to the installation, operation, use or maintenance of the modules. Linyang Company does not assume any responsibility for infringement of patent rights or third party rights caused by the use of the modules. Linyang Company reserves the right to change the product manual and this installation manual without prior notice.

If the customer fails to follow the requirements listed in this manual when installing the modules, the limited warranty provided to the customer at the time of sale will be invalidated. At the same time, the suggestions in this manual are to improve the safety of the modules during installation and have been tested and verified in practice. Please provide this manual to the owners of the photovoltaic system as their reference and inform them of all relevant safety, operation, and maintenance requirements and suggestions.

2. Regulations and Ordinances

The mechanical and electrical installation of photovoltaic modules should refer to the relevant regulations, including electrical laws, building laws and power connection requirements. These regulations vary depending on the installation location, and the requirements may also vary depending on the installation system voltage, whether DC or AC is used. For specific terms, please contact the local authority.

3. General Information

3.1 Module Identification

Each module has three labels that provide the following information:

1.Nameplate: Module type, maximum power, open circuit voltage, short circuit current, maximum power point voltage, maximum power point current and maximum system voltage under standard test conditions, certification mark and other information.

2. Serial Number: Each module has a unique serial number. This serial number is printed on a barcode that is placed into the module before lamination and cannot be removed or smeared after lamination. In addition, an identical serial number can be found on or next to the module nameplate.

3. Current classification label: The modules are classified according to the rated current and the modules are marked accordingly for classification . The label is located on the barcode on the module frame and the module nameplate.

3.2 General safety

Linyang's module design complies with the international IEC 61215 and IEC 61730 standard, its application level rating is Class A: the modules can be used in systems that are likely to be exposed to the public and are greater than DC 50V or 240W. And the modules have passed both IEC 61730-1 and IEC 61730-2, and the modules meet the requirements of safety class II., the fire protection level of the modules is C.

When the modules are installed on the roof, the overall fire protection level of the final structure needs to be considered. At the same time, the overall maintenance in the later stage also needs to be considered. The photovoltaic system on the roof can only be installed on the roof after evaluation by construction experts or engineers, with formal complete structural analysis results, and proven to be able to withstand additional system support pressure, including the weight of the photovoltaic modules themselves.

For your own safety, do not work on the roof without safety precautions, including but not limited to fall protection, ladders or stairs and personal protective equipment.

For your safety, please do not install or handle modules in adverse conditions, including but not limited to strong or gusty winds, wet or sandy roofs.

3.3 Electrical performance safety

Do not open electrical connections or unplug connectors while the circuit is under load.

Touching live parts of the module, such as connectors, can cause burns, sparks, and fatal electric shock, whether the panel is powered on or not. Do not touch the module unnecessarily during installation. Glass surfaces and brackets may be hot; there is a risk of burns and electric shock. Do not install the module in rainy, snowy, or windy weather.

To prevent degradation of module insulation, avoid scratching, cutting, or exposing cables and connectors to sunlight for long periods of time. Only use insulated tools that comply with relevant electrical installation standards.

Keep children away from the system when transporting and installing related modules.

During installation, use opaque material to completely cover the modules to prevent electrical loss.

Do not wear metal rings, watches, earrings, nose rings, lip rings, or other metal objects when installing or repairing a PV system.

Observe local safety regulations (e.g. for operating power stations) and for other system components, including wiring and cables, connectors, charge regulators, inverters, batteries, rechargeable batteries, etc.

Under normal circumstances, a PV panel may produce more current and/or voltage than under standard test conditions. Therefore, when calculating the rated voltage, rated current, fuse and specifications of controls connected to PV output of the module, the electrical performance parameters labeled on the module should be multiplied by the corresponding factors specified in the IEC standard.

When connecting modules, use only mutually compatible connectors to connect to other devices. Removing the connector will void the warranty.

When connecting modules, use only mutually compatible connectors to other devices. Removing the connectors will void the warranty.

3. 4 Operational safety

Module installation must be performed under the guidance of a qualified electrician.

In any weather conditions, personnel entering the power station must wear safety helmets, insulating gloves and insulating shoes correctly and take personal safety protection measures.

During the transportation and storage of the modules, please do not open the Linyang packaging unless the modules arrive at the installation site; Please protect the packaging from damage. Do not let the modules packaged in pallets fall directly;

When stacking modules, please do not exceed the maximum number of layers printed on the packaging box; Before unpacking the modules, please place the packaging box in a ventilated, rainproof and dry place; When opening the Linyang packaging box, please follow the Linyang packaging box unpacking instructions;

Under no circumstances should you lift the entire module by grabbing the junction box or wires; Standing or walking on the module is prohibited;

Do not drop one module onto another;

To avoid glass breakage, please do not place any heavy objects on the module glass;

When placing a module onto a flat surface, you must be careful, especially in the corners;

Do not attempt to disassemble the module, or remove the nameplate or parts on the module; Do not paint or apply any other adhesive on the surface of the module;

Do not drill holes in the module frame. This may reduce the frame load capacity and cause frame corrosion;

Do not scratch the anodized layer on the surface of the aluminum alloy frame, except when grounding. Scratching may cause frame corrosion and affect the frame's load capacity;

It is prohibited to repair modules with damaged glass by yourself; scrapped modules must be recycled and disposed of by qualified institutions.

In dry climate areas, modules are easily affected by static electricity during installation. Installers need to wear anti-static equipment to ensure that the equipment and installers are free from the impact or harm of static electricity.

3.5 Fire safety

Please consult local laws and regulations before installing the modules and comply with the fire protection requirements for buildings. Linyang's modules have passed the IEC61730-2 standard test with a fire rating of C.

When the roof is installed, the roof must be covered with a layer of fireproof material suitable for this class and ventilation between the back of the module and the mounting surface. In order to guarantee the fire rating on the roof, a minimum separation of 20 cm between the components and the mounting surface is recommended.

The structure and installation of the roof can affect the fire safety of the building. If it is not installed properly, it may cause a fire.

Use appropriate module accessories such as fuses, circuit breakers, grounding connectors as required by local codes.

Do not use the module in the vicinity of exposed flammable gases.

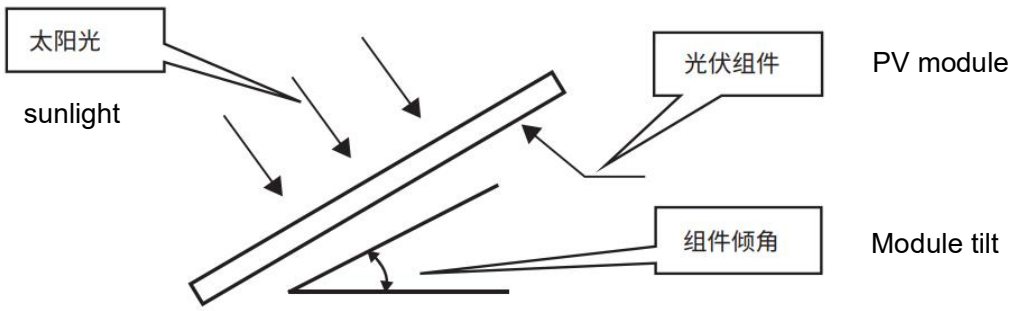
Linyang modules have not been tested for explosion-proof properties. Please consult local regulations to determine whether they can be used.

4. Installation conditions

4.1 Installation location and working environment

- In general, the modules should be installed in the location that can receive the most sunlight throughout the year. The module installation site should have sufficient sunlight. If the module is blocked or partially blocked, its power output will be reduced. The module damage caused by the module being blocked for a long time is not covered by Linyang's warranty.
- It is recommended that the modules be installed in an operating environment with a temperature of-20℃ ~ +50℃, the working environment temperature is the monthly average minimum and maximum temperature of the installation location. The extreme working environment temperature of the modules is -40℃~+85℃.
- The modules should be installed in suitable places (such as the ground, photovoltaic tracking system, roof, building exterior wall, etc.).
- The module can be installed on fishing lights and floating projects in freshwater environments, as well as on land 50-500m away from the sea. However, when installing the module in areas within this distance, the connector needs to be protected or a dust plug should be added. After removing the dust plug, the connection must be made immediately and other anti-corrosion measures must be taken to prevent related parts from rusting.
- It is strictly forbidden to install or use the modules in an environment with strong corrosive substances (such as salt, salt spray, salt water, active chemical vapor, acid rain, or any other substances that may corrode the modules or affect the safety or performance of the modules).
- Ensure that the wind or snow pressure on the modules after installation does not exceed the maximum allowable load. The mechanical load that the modules can withstand is determined by the installation method. When designing a photovoltaic system, the calculation of the mechanical load capacity requires professional personnel to be responsible for the design.
- Lin Yang recommends that the modules be used below 2000m above sea level.

4.2 Selection of tilt



Schematic diagram of module tilt

- Module tilt: The angle between the surface of the module and the horizontal plane. When the module is facing the sun, the module will obtain the maximum power output. It is recommended to place the module facing south in the northern hemisphere and north in the southern hemisphere.
- The same string of modules should be installed at the same angle. Modules installed at different angles will receive different amounts of radiation, resulting in reduced system operating efficiency.
- Linyang recommends that the module installation angle should be no less than 10 degrees, so that when it rains, the dust on the module surface can be easily washed away by rainwater, thereby reducing the number of times the module needs to be cleaned; at the same time, it is conducive to the flow of accumulated water on the module surface, avoiding long-term accumulation of large amounts of water leaving marks on the glass, which in turn affects the appearance and performance of the module.
- For detailed installation angles, please follow local regulations or the advice of experienced module installers.

5. Mechanical Installation

5.1 General requirements

The mounting bracket for photovoltaic modules must be made of durable, corrosion-resistant, and UV-resistant materials, and the mounting bracket must be inspected and tested by a third-party testing organization with static mechanical analysis capabilities to meet the national or regional or corresponding international standards of the country or region where it is used.

The PV module must be securely fastened to the mounting bracket. If the PV module is installed in a snowy area, the height of the bracket should ensure that the lowest point of the PV module is not covered by snow. In addition, make sure that the lowest point of the PV module is not obscured by surrounding trees or other plants.

When the PV module is installed on a bracket parallel to the roof, the minimum gap between the PV module frame and the roof is 10cm, which needs to allow air circulation to prevent damage to the PV module's wiring.

The frame of the photovoltaic module will have the effect of thermal expansion and contraction, and the interval between the frames of the two adjacent photovoltaic modules should not be less than 10mm during installation.

For special installation areas (such as high altitude, mountain tops, seaside, tuyere) and project sites with frequent winds, it is recommended that the components be installed and fixed by square gaskets, anti-loosening nuts, anti-loosening gaskets, thickened gaskets, etc.

For the specific installation method, please refer to the following installation specifications, if you use unsuitable fixtures or incorrect installation methods, Linyang Solar Limited Warranty will be invaid.

5.2 Installation method

The connection between the modules and the bracket system is installed using the module mounting holes or clamps. The modules must be installed in accordance with the following examples and suggestions. If the installation method is different from the following, please consult Linyang and obtain Linyang's consent, otherwise the modules will be damaged and the warranty will be invalid.

5.2.1 Installation of the clamp

The installation of the clamp must not contact the front glass of the module and must not deform the module frame. Make sure that the clamp does not cast a shadow on the module. The frame must not be changed under any circumstances. When choosing the clamp installation method, make sure that there are at least four clamps on each module. The different installation positions of the clamps determine the maximum load capacity of the module. Figures 7-11 show different installation methods and the positions of the clamps under different installation methods. Depending on the local wind load and snow load, if there is a possibility of excessive load combinations, additional clamps are required to ensure that the module has sufficient load bearing capacity. The torque value applied when installing the clamp should be large enough to firmly fix the module (please consult the installer or bracket supplier for the specific torque value). As shown in Figure 5, the length and width of the clamp are represented by a and b, the minimum length of a is 50mm, the minimum width of the contact width d between the clamp and the frame is 10mm, and the minimum wall thickness of the clamp is 3mm. The distance between the installation position of the clamp on the long side and the edge is represented by L in Figures 7 and 11. The distance between the installation position of the clamp on the short side and the edge is represented by S in Figures 8 to 11.

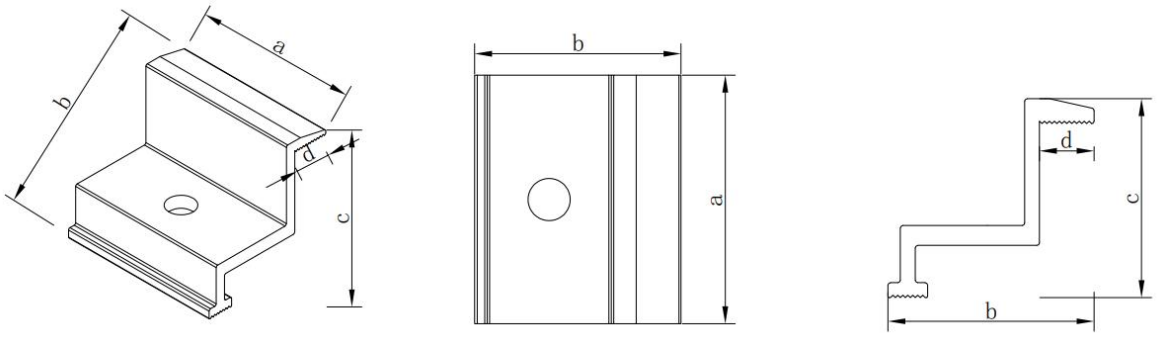


Figure 1 Clamp

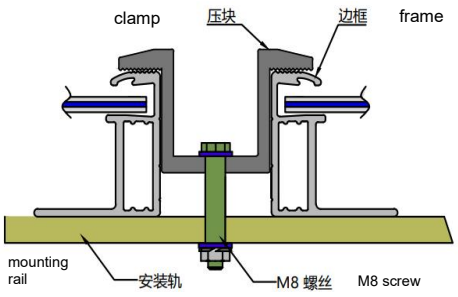
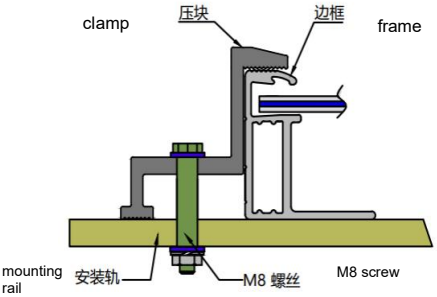
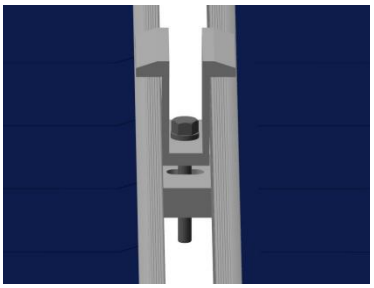
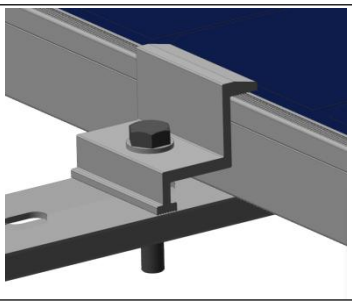
	
	
Intermediate clamp installation	**Side clamp installation**

Table 1 Schematic diagram of clamp installation

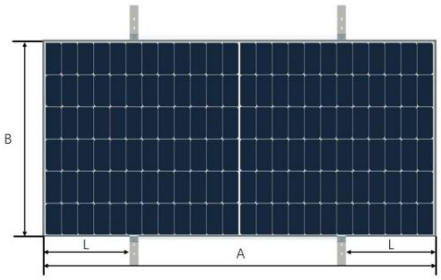


figure 2

Long side clamp installation

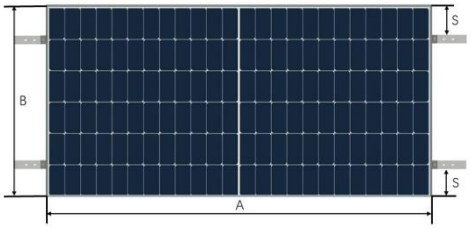


figure 3

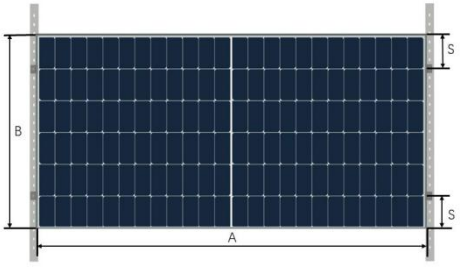


figure 4

Short side clamp installation

Table 2 Clamp installation method

5.2.2 Load capacity of different installation methods

Different installation methods	Long side clamp installation (+5400Pa, -2400Pa)L in Fig. 2	Short side clamp installation (± 1600Pa) S in Figures 3 and 4
Corresponding load value (Pa)	**+5400Pa, - 2400Pa**	**± 1600Pa**
SF-DN72G2-2/xxxW	A/4±50mm	100~250
SF-DN66G2-2/xxxW	A/4±50mm	100~250
SF-DN60G2-2/xxxW	A/5±50mm	100~250
SF-DN54G2-2/xxxW	A/5±50mm	100~250
SF-DN48G2-2/xxxW	A/5±50mm	100~250
SF-DN66G3-2/xxxW	A/4±50mm	100~250
SF-DN60G3-2/xxxW	A/5±50mm	100~250
SF-DN54G3-2/xxxW	A/5±50mm	100~250
SF-DN48G3-2/xxxW	A/5±50mm	100~250
SF-SN66G3-2B/xxxW	A/4±50mm	100~250
SF-SN60G3-2B/xxxW	A/5±50mm	100~250
SF-SN54G3-2B/xxxW	A/5±50mm	100~250
SF-SN48G3-2B/xxxW	A/5±50mm	100~250
Note: A is the total length of the long frame,the thickness of the frame is 30mm.		

5.2.3 Bolt Installation

The 14mm×9mm mounting hole of the module uses the M8 bolt kit, and the 10mm×7mm mounting hole of the module uses the M6 bolt kit.

When selecting the bolt installation method, ensure that there are at least four bolts on each module, and the bolts need to be arranged symmetrically. The different installation positions of the bolts will affect the maximum load capacity of the module (Table 3).

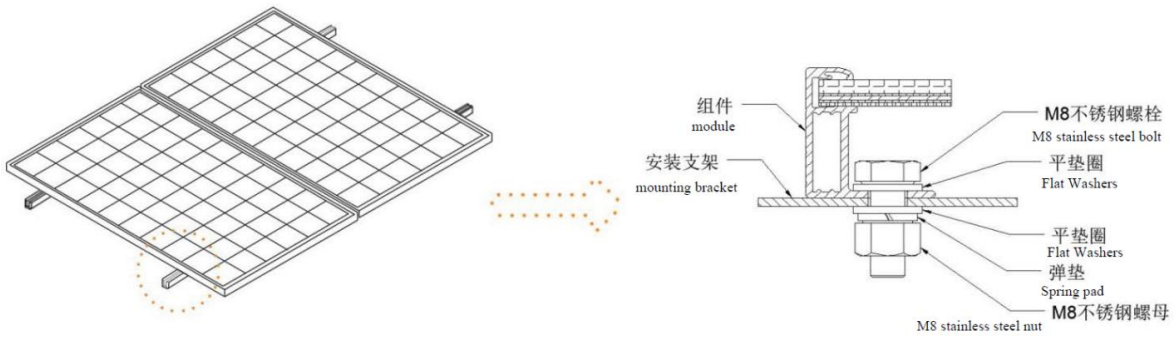
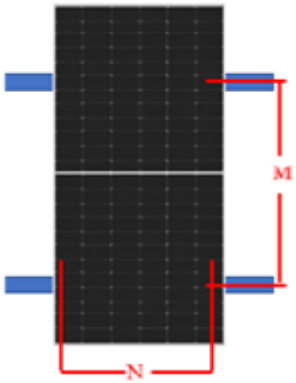
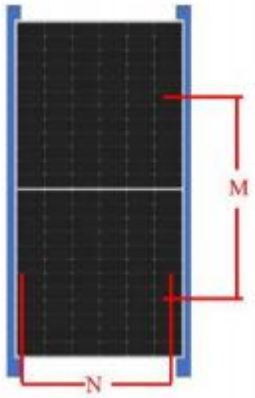


Figure 2 Aluminum Frame Module Bolt Hole Mounting

The recommended bolt kits are as follows:

Installation Fasteners	M8 Bolt Kit	M6 Bolt Kit	remark
Bolt	M8(Full thread recommended)	M6(Full thread recommended)	The material is hot-dip galvanized or stainless steel, and the material selection is based on the local environment.
Flat washers	2*M8， thickness ≥1.5mm ， outer diameter ≥16mm	2*M6， thicknesses ≥1.5mm ， outer diameter 12-16mm	
Spring pads	8mm	6mm	
nut	M8	M6	
Recommended torque (N·m)	16~20	8~12	

bolt installation	 Mounting method 4 Vertical four-bolt mounting on long side	 Mounting Method 5 Long side overlap four-bolt mounting

Installation mode of bolt

Module type	Module Model	Frame thickness (mm)	Installation hole spacing M (mm)	Installation hole spacing N (mm)	Installation method 4	Installation method 5
					Test load: front / back (Pa)	Test load: front / back (Pa)
Double Glass modules	SF-DN72G2-2/xxxW	30	1100	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN66G2-2/xxxW	30	1200	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN60G2-2/xxxW	30	1200	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN54G2-2/xxxW	30	1150	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN48G2-2/xxxW	30	1100	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN66G3-2/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN60G3-2/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN54G3-2/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-DN48G3-2/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
Single Glass modules	SF-SN54G3- 2B/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400
	SF-SN48G3-2B/xxxW	30	790	1093	5400/2400	3600/2400
			1400		5400/2400	3600/2400

Table 3 Installation method and load capacity

5.2.4 Tracking bracket

Linyang PV modules can be matched and installed with the industry's mainstream bracket systems, and the matching test load is shown in Table 4.

Module type	Module Model	Bracket type	Installation hole spacing M (mm)	Test load: front / back (Pa)
Double glass modules	SF-DN72G2-2/xxxW	NEXTracker	400	+2400/ -2400
	SF-DN66G2-2/xxxW		400	+2400/ -2400
	SF-DN60G2-2/xxxW		400	+2400/ -2400
	SF-DN54G2-2/xxxW		400	+2400/ -2400
	SF-DN48G2-2/xxxW		400	+2400/ -2400
	SF-DN66G3-2/xxxW		400	+2400/ -2400
	SF-DN60G3-2/xxxW		400	+2400/ -2400
	SF-DN54G3-2/xxxW		400	+2400/ -2400

	SF-DN48G3-2/xxxW		400	+2400/ -2400
Single glass modules	SF-SN66G3-2B/xxxW		400	+2400/ -2400
	SF-SN60G3-2B/xxxW		400	+2400/ -2400
	SF-SN54G3-2B/xxxW		400	+2400/ -2400
	SF-SN48G3-2B/xxxW		400	+2400/ -2400

6. Electrical Installation

6.1 Electrical performance

The electrical performance parameters of the modules, such as nominal value of Isc, have an error of ±5%, Voc has an error of ±3% and Isc has an error of ±5% from the standard test conditions. Module standard test conditions: irradiance 1000W/m², cell temperature 25°C, atmospheric mass AM1.5.

Under normal circumstances, the current and voltage values generated by a module product may be higher than those obtained under standard test conditions for the module. Therefore, when determining the accessories of a photovoltaic power generation system, such as rated voltage, conductor capacity, fuse capacity and parameters related to the power output of the module, the corresponding short-circuit currents and open-circuit voltages should be enlarged by a factor of 1.25 before application.

When the modules are connected in a string, the final voltage is the sum of the individual modules. When the modules are connected in parallel, the final current is the sum of the individual modules, as shown in the figure below. Modules with different electrical performance models cannot be connected in a string.

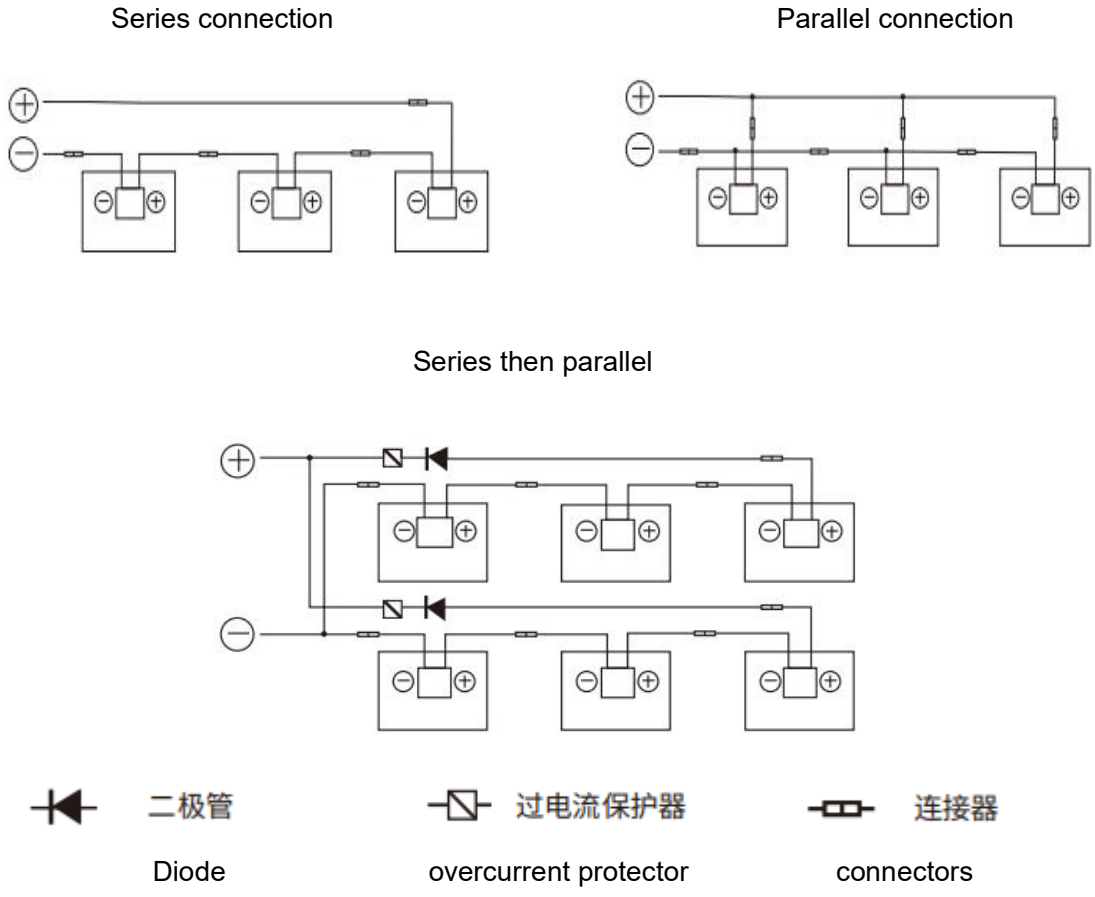


Figure 3 Electrical diagram of series and parallel circuits

The maximum number of modules that can be connected in series must be calculated in accordance with the requirements of the relevant regulations, and the open-circuit voltage of the modules under the local expected minimum temperature conditions must not exceed the maximum system voltage specified for the modules (the maximum system voltage of Linyang double-glazed modules is DC 1000V/DC 1500V according to the IEC 61730 safety test and qualification) and the values required for other DC electrical components.

The open circuit voltage correction factor can be calculated according to the following formula: $C = 1-\beta \times (25-T)$. T is the lowest ambient temperature expected at the system installation location, and β (%/C) is the temperature coefficient of the selected module Voc (refer to the corresponding module parameter table).

If there is a possibility that a reverse current exceeding the maximum fuse current of the module will pass through the module, an overcurrent protection device of equal specification must be used to protect the module. If the number of parallel connections is greater than 2 strings, an overcurrent protection device must be provided for each string, as shown in Figure 3.

6.2 Grounding Connection

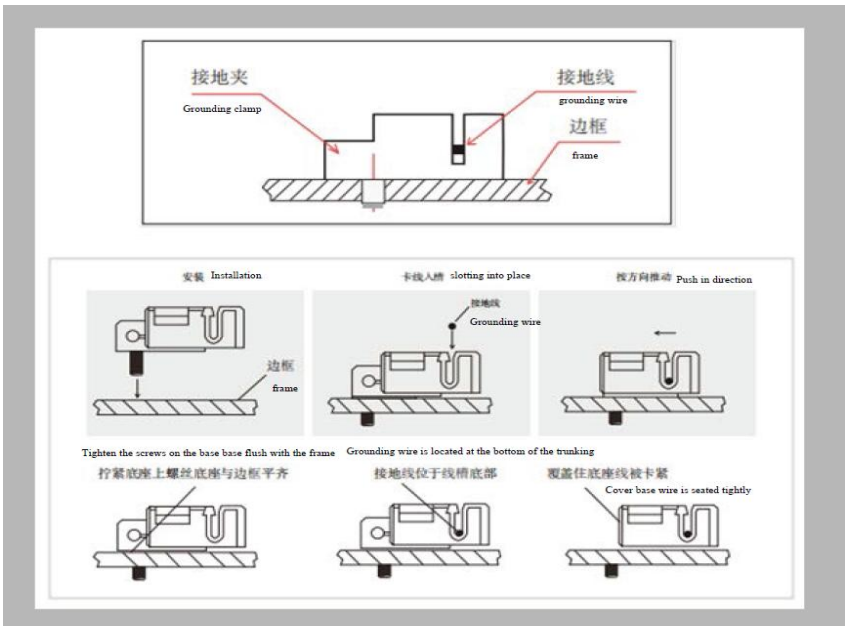
All solar photovoltaic module frames and mounting brackets must be aligned in accordance with the corresponding National Electrical Code or local electrical code regulations.

You are advised to use a 4-14mm^2 copper conductor (AWG 6-12) as the grounding conductor. The ground hole of the component is marked with " ".The groundwire must also be connected to the ground through a suitable ground electrode. All conductive connections must be securely connected.

The diameter of the ground hole is 4.2mm on the aluminum alloy frame at the rear of the photovoltaic module.Connect the ground cable and related accessories to the aluminum alloy frame of the solar photovoltaic module and connect the ground cable to the ground. It is recommended to use M4 x 12mm ground bolt with M4 nut, star washer and flat washer. This ensures that the component is securely grounded. You can learn about the number, size and position of the grounding holes in detail on the Product drawings of Lin Yang. The torsional torque for grounding fixation is 4-8N ・m.

In addition to using the ground hole for grounding, you can also use the following methods for grounding.Use unused mounting holes for grounding.

Other special grounding devices No matter which grounding method is adopted, all grounding electrical contacts with the aluminum alloy frame of the photovoltaic module need to penetrate the anodized coating of the aluminum frame. When grounding a third-party grounding device, such as a dedicated grounding device, ensure that the device is reliable and professionally certified. When installing the device, comply with the manufacturer's regulations.



Grounding clamp installation method

6.3 Test. Debugging and Troubleshooting

The serial modules are connected to the test before the system. Use digital multimeter (recommended Fluke 170 series or digital multimeter which DC range can reach 1500V) to check open-circuit voltage of the series modules. The measurement value should be equal to the sum of the open-circuit voltage of a single module and you will find the rated voltage in the technical specification of the type module you are using.

Low voltage troubleshooting. Identify the normal low voltage and fault low voltage. The normal low voltage mentioned here refers to the decrease of the open circuit voltage of the module caused by the temperature increase of the solar cell or the decrease of the irradiance. Fault Low voltage is usually caused by improper terminal connection or bypass diode damage.6.3 Blocking Diode and Bypass Diode Troubleshooting

Blocking diodes could prevent current from flowing from the battery to the module when the module is not generating current. If you do not use the charge controller, it is recommended to use blocking diodes. About charge controller, please consult a professional dealer.

In the system, hot spot effect occurs when part of the module is blocked and other parts are exposed to the sunshine and thereby lead to overheat of the battery and damage the module. Using bypass diodes in the module protects the module from being affected by this excessive reverse current. All modules those rated power are more than 55 watts have a bypass diode integrated in the junction box.

6.4 On-grid Electrical System

- Try to use the same components in a photovoltaic power generation system, the number of modules in series （N）≤V（max）/[Voc(at STC)].V (Max) is the maximum system voltage of the component, and Voc(at STC) is the open-circuit voltage under the nominal state of the component.
- Several modules in series, and then form a PV array in parallel, which is particularly suitable for high voltage situations. If the modules are connected in series, the total voltage is equal to the sum of the voltages of the individual modules.
- In the case of using high current, you can put several PV modules in parallel, the total current is equal to the sum of the current of each module.
- The module can provide prefabricated connectors for system's electrical connections. As for cable size, type and temperature and other parameters ' choice, please refer to the relevant rules.
- The cable cross-section surface and connector's size must meet the maximum system short-circuit current, otherwise the cables and connectors will overheat because of excessive current and has the danger of burning.
- Protect yourself from electric shock when debugging or repairing the solar system. Wear protective gloves and insulated shoes and other protective equipment. Use special electrician tools for repairs

7. Maintenance

- To ensure the best performance of the solar panels, Haitai New Energy provide the following maintenance measures.
- The solar panel should be cleaned in the morning or evening when the power is low or no power is processing.
- Cleaning the glass surface when necessary through clean water and soft objects. The neutral detergent should be used for cleaning while the acidic or alkaline or abrasive detergent is forbidden.
- In case of rainy weather, do not deliver the electricity if the inverter or other electrical equipment is power off. It is better to check and ensure that there is no problem in the lines before sending the electricity.
- When cleaning, the solar panel can not be washed with a high-pressure water gun for avoiding line leakage caused by excessive pressure in the connection place of the solar panel.
- Conduct a mechanical and electrical inspection for every six months and ensure that the surface is clean and the connection is reliable.
- If any other abnormal situation occurs, please consult factory or experienced engineer.
- Observe the maintenance instructions for all parts used in the system, such as bracket, charge controller, inverter, solar cell, etc

Product Addendum

The module models applicable to this installation manual are as follows. Due to the upgrading of product research and development, the models will be added or updated without further notice. "XXX" indicates the module's nameplate nominal power, with each 5W level.

Module Model	Module size (length*width*height)[mm]
SF-DN72G2-2/xxxW	2278*1134*30
SF-DN66G2-2/xxxW	2093*1134*30
SF-DN60G2-2/xxxW	1908*1134*30
SF-DN54G2-2/xxxW	1722*1134*30
SF-DN48G2-2/xxxW	1536*1134*30
SF-DN66G3-2/xxxW	2382*1134*30
SF-DN60G3-2/xxxW	2172*1134*30
SF-DN54G3-2/xxxW	1961*1134*30
SF-DN48G3-2/xxxW	1762*1134*30
SF-SN66G3-2B/xxxW	2382*1134*30
SF-SN60G3-2B/xxxW	2172*1134*30
SF-SN54G3-2B/xxxW	1961*1134*30
SF-SN48G3-2B/xxxW	1762*1134*30