

安装说明书

Installation Instructions

(适用于海泰系列光伏组件)
(Applicable to Haitai Solar's series PV modules)

网址/ Website: <http://www.htsolar.com>

电话/ Tel: 0315-5052066

地址: 河北省唐山市玉田县玉泰工业区豪门路 88 号

Add: No.88 Haomen Road, Yutai Industrial Zone, Yutian County, Tangshan City,
Hebei Province

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1. 概述 Overview

本手册包含关于唐山海泰新能科技股份有限公司生产的光伏组件的安装、维护和安全操作的信息。安装之前需要阅读和理解本说明。专业安装者在安装组件的时候需要遵从手册中的说明。如果存在任何问题请联系我司的销售部门寻求帮助。

This manual contains information on the installation, maintenance, and safe operation of PV modules produced by the Tangshan Haitai New Energy Technology Co., Ltd. Read and try to understand this note before installation. Professional installers are required to follow the instructions in the manual when installing the modules. If there is any problem please contact our sales department for help.

在安装太阳能光伏系统之前，安装者需要熟悉系统在机械和电气方面的要求。请妥善保管此手册以备后期使用。

Before installing solar PV system, the installers need to familiarize with the requirements of mechanical and electrical aspects. Please keep this manual for later use.

2. 免责声明 Disclaimer Notices

- ◇ 安装、操作和使用海泰新能系列组件已超出公司的控制，因此，海泰新能不承担因不当安装、操作、使用和维护所带来的任何损失、损害、伤害及由此产生的费用。

The installation, operation and use of Haitai New Energy series modules are beyond Haitai's control. Thereby, Haitai New Energy does not undertake any loss, damage, injury and consequent costs caused by improper installation, operation, use and maintenance.

- ◇ 海泰新能不承担对违反专利，第三方权力等使用光伏产品带来的责任。

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Any modification towards any patent or patent right is not allowable if there is no authorization.

- ◇ 本手册基于海泰新能的科技与可靠的经验。但是包括产品规格的这些信息和建议并不构成任何保证。
This manual is made based on Haitai New Energy's technology and reliable experience, but the information and recommendations including product specifications do not constitute any warranty.

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3. 安全防范 Safety Precautions

- ◇ 安装太阳能光伏系统需要专业的技术和知识，安装必须由专业人士施行。
The installation of solar photovoltaic systems requires professional skills and knowledge, thus the installation must be carried out by professionals.

- ◇ 安装者承担安装过程中可能发生的受伤风险，包括但不限于触电的风险。
In the process of installation, the installers assumes the risk of injuries, including but not limited to the risk of electric shock.

- ◇ 当暴露在直射日光下的时候，单个组件可能产生大于 30V 的直流电压。接触 30V 或者更高的直流电压存在潜在风险。
When exposed to direct sunlight, a single module may produce more than 30V DC voltage. The exposure with 30V or higher DC voltage has potential risks.

- ◇ 当断开或链接暴露在日光下的光伏组件的连线时，可能产生电弧。这个电弧可能造成烧伤，引起火灾或者引发其它问题。
The electric arcs may occur when disconnecting or linking the photovoltaic modules exposed to the sunlight. This arc may cause burns, a fire or other problems.

- ◇ 不要在有负载的情况下断开组件之间或组件与逆变器等设备之间的连接线。

Do not disconnect the linking between the modules or between the modules and inverters in case of the load.

- ◇ 光伏电池组件把光能转换成直流电能。组件应用于地面、屋顶、车辆或船只等户外环境。合理设计支撑结构是系统设计者或安装者的责任。

The photovoltaic modules could convert the power energy into DC power. The modules could be applied for the ground, roofs, vehicles or boat and other outdoor environment. It is system designer and installers' responsibility to reasonably design the support structure.

- ◇ 请不要拆卸组件，也不要摘除其它附带铭牌或者部件。

Do not disassemble the modules or remove other attached brands or parts.

- ◇ 不要在组件的上下表面喷涂或者涂胶。

Do not spray or glue on the upper and lower surfaces of the modules.

- ◇ 不要利用反射镜或者其它放大镜设备人为的集中阳光到组件上。

Do not use the mirror or other magnifying glass equipment to concentrate the sunlight artificially to the modules.

- ◇ 在安装系统的时候，需要遵守所有的地方，区域和国家法令规定。必要的时候需要获得施工许可证。

It needs to comply with all the local, regional and national laws and obtain a construction permit when necessary in the process of installing the system.

- ◇ 在运输和安装机械与电气部件的时候，需要保持儿童远离系统。

It needs to keep the children away from the system when transporting and installing mechanical and electrical components.

- ◇ 在安装的时候需要用不透明的材料完全遮挡组件，以免产生超出人体安全范围的电压,可能造成触电的危险。

During installation, it is necessary to completely block the modules with opaque materials so as not to generate voltages that exceed the safety range of the human body which may cause electric shock.

- ◇ 在安装或者检修光伏系统的时候，不要佩戴金属戒指，手表带，耳，鼻，唇环或者其它金属器件。

Do not wear metal rings, watch straps, ear, nose, lip rings or other metal parts when installing or inspecting the photovoltaic system.



- ◇ 电气安装工作只能使用合格的绝缘工具。

The qualified insulating tools are the only choice for the electrical installation work.



- ◇ 遵从系统中使用的所有其它部件的安全规定，包括线路和电缆，连接器件，充电控制器，逆变器，蓄电池和充电电池等。

Comply with the safety requirements of all other modules used in the system, including wiring lines and cables, connection devices, charging controllers, inverters, batteries and rechargeable batteries.

- ◇ 只使用适合太阳能电力系统使用的设备，连接器件，线路和支撑架。在特定光伏系统中尽可能只使用一种型号的组件，同一光伏阵列中必须使用同一种型号的组件。

Use the equipment suitable for solar power system, connection device, wiring lines and support frame only. In a particular photovoltaic system, use a type of module as much as possible and use the same type of the module in the same PV

array only. Each input voltage of the same tracking system of each inverter must be equal and the same type of modules must be used.

- ◇ 在普通室外条件下，组件产生的电流和电压与参数表中列出的有所不同。参数表是在标准测试条件（1000W/m² 的辐照度，AM 1.5 光谱，25°C 温度）下测得，所以在确定光伏发电系统中其它部件的额定电压、导线容量、保险丝容量、控制器容量等和组件功率输出有关联的参数时，参照标在组件上的短路电流和开路电压的值，并按 125% 的值设计和安装。

Under normal outdoor conditions, the current and voltage generated by the module are different from those listed in the parameter table. The parameter table is measured under the standard test conditions (1000w/m² irradiance, AM 1.5 spectrum, 25°C temperature), so when determining other modules' rated voltage, conductor capacity, fuse capacity, controller capacity and other parameters correlated to module output power, it should refer to the value of short-circuit current and open circuit voltage marked on the module and design and install the module according to the value of 125%.

- ◇ 应在组件适用的环境温度（-40°C~+85°C）地域使用组件。

The modules should be used in the ambient temperature (-40°C~+85°C) area where the component is applicable.

4. 拆箱及储存.Unpacking and Storage

- ◇ 在收货时，应检查交付的货物是否确实是订购的货物：每个包装箱的外面均标有产品名称、箱号、组件条形码。

When receiving the goods, you should check whether the goods delivered are indeed ordered goods: the outside of each box are marked with the product name, packaging box number, module barcode.

- ◇ 包装箱应存储在干净、干燥区域，避免阳光直射和潮湿。

The packaging carton should be stored in a clean, dry area, away from direct sunlight and moisture.

- ◇ 在安装现场，注意保持组件，尤其是电气连接处的清洁干燥。如果接头的电缆潮湿，连接处可能会腐蚀，不得使用任何连接处腐蚀的组件。

At the installation site, pay attention to keep clean and dry for the components, especially the electrical connections. If the connector cable is wet, the

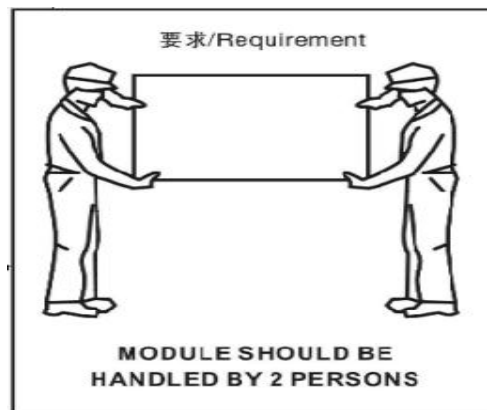
connections may be corroded, and the components that be corroded at any connections should not be used.

- ◇ 如果托盘临时存储在外，请铺上一层防护罩，以防止其受到天气的直接影
响。

If the tray is temporarily stored outside, please put a protective cover to prevent it from being directly affected by the weather.

- ◇ 需要两名工作人员一起拆箱，取出组件时务必使用双手，禁止通过提拉组
件的导线和接线盒搬运组件。

Two staff members are required to unpack the packaging carton. Be sure to use both hands when removing the modules. Do not carry the modules through the wires and junction boxes.



- ◇ 组件取出若需临时外放，需要保护好组件边缘。

If the modules needed to be temporarily stored outside, please protect the edge of the module well.

- ◇ 禁止任何情况下在组件上站立或者行走。

It is forbidden to stand or walk on modules in any case.

- ◇ 禁止掉落或堆放物品在组件上。

It is forbidden to drop or stack items on the modules.

5. 环境条件 Environment Conditions

- ◇ 组件可在下列环境中安装 25 年以上

The modules can be installed in the following environment for more than 25 years

环境温度 Ambient temperature:	-40°C to +85°C
运行温度 Operating Temperature:	-40°C to +85°C
存储温度 Storage Temperature:	-20°C to +85°C
湿度 Humidity:	<85%RH
机械载荷设计强度:	3600Pa 雪压, 1600Pa 风压。
Mechanical load design strength:	3600Pa positive snow pressure, 1600Pa back wind pressure.
载荷安全系数 Mechanical load Safety factors:	1.5

***注意 Note:**

-TUV 根据 IEC61215 评估组件的设计荷载最大值为 3600Pa。

According to IEC61215, the maximum design load of the TUV evaluation module is less than 3600Pa.

-安装方法对于机械承载很重要，未能遵循本手册的安装，会有不同的雪压和风压荷载能力。

The installation method is very important for the mechanical load. Failure to follow the installation of this manual will result in different snow pressure and wind pressure load capacity.

-系统安装商需要确保安装方式符合当地法律法规。

The system builder needs to ensure that the installation is in accordance with local laws and regulations.

6. 机械安装 Mechanical Installation

6.1 选址 Site Selection

- ◇ 在北纬地区组件最好面向南，而在南纬地区组件最好面向正北。组件正面与正午太阳光线方向垂直为最佳。

In north latitude area it is best to face south for the module, while in south latitude area, it is best to face north. It is best that the front of the module is perpendicular to the direction of the midday sun light.

- ◇ 固定支架安装，组件建议安装在一个最佳倾角，可以最大限度捕获太阳光。根据右手螺旋定律，基本上与安装地点的纬度相同，面向赤道。设计时务必要根据当地情况，选出最优的倾角。

Fix bracket installation, the module is recommended to be installed at an optimum angle of inclination for maximum capture of sunlight. According to the right hand helical law, basically the same latitude as the installation site, facing the equator. The design must be based on local conditions and choose the best inclination.

- ◇ 跟踪支架安装，安装方式同样为压块和螺栓安装 2 种，具体安装方法参考本安装说明，此时组件没有固定的安装倾角，也不会面向赤道，而是跟踪太阳的角度从东向西转动。

Track bracket installation, installation methods are also two kinds of block and bolt installation, specific installation methods refer to the installation instructions, at this time the module does not have a fixed installation inclination, nor will it face the equator, but the angle of tracking the sun from east to west.

- ◇ 当在屋顶安装太阳能电池组件时，务必在屋顶的边缘和太阳能电池阵列之间保持一个安全的工作区域。大型电站的阵列之间要有一定的安全距离,方便对阵列里面的组件进行清理，检测和维修。

When installing solar modules on the roof, be sure to maintain a safe working area between the edge of the roof and the solar arrays. There must be a certain safety distance between arrays of large power stations in order to facilitate the cleaning, inspection, and maintenance of the modules inside the array.

- ◇ 组件应安装在阳光可以充分照射的位置并确保在任何时间不能被遮挡。

The modules should be installed in the place where the sunlight can be fully irradiated and ensure that it can not be blocked at any time.

- ◇ 组件不能在产生或者存放可燃气体的设备或者地点附近使用。

The modules can not be used in the vicinity of the equipment or place where the flammable gas is generated or stored.

- ◇ 组件不能安装于因各种化学反应导致组件缺陷的环境区域内，如酸雨、碱性气体、盐雾等。

The modules can not be installed in the environmental area where module defects are caused by various chemical reactions, such as acid rain, alkaline gas, salt mist, etc.

- ◇ 组件不能安装在超出组件最大系统电压的环境区域内，如高压电线旁，组件的安装位置与高压电保持一定的安全距离，安全距离根据高压电等级而定。

The modules can not be installed in the environmental area that exceeds the maximum system voltage of the modules, such as high-voltage power lines. The module's position should be maintained at a safe distance from the high-voltage power while the safe distance is determined by the high voltage level.

- ◇ 若在住宅地面安装组件，需要遵守当地法规比如使用栅栏。（栅栏要与阵列保持一定的距离，避免栅栏的阴影对阵列产生影响）。

If the modules are to be installed on the floor of a dwelling, local regulations such as fences should be complied with (the fences should be kept at a certain distance from the array to avoid shading impact of the fence on the array).

- ◇ 请勿将光伏组件安装在可能浸入水中或持续暴露于洒水车或喷泉的位置。

Do not install the PV modules in places that may be immersed in water or continuously exposed to sprinklers or fountains.

6.2 安装支架选择 Mounting Bracket Options

- ◇ 在支架上安装组件时，选择能够承受当地预期地震等级的支柱和组件安装结构。

When installing the modules on the bracket, the pillar and module installation structure should be chosen those can withstand the local expected earthquake level.

- ◇ 支架结构必须由耐用、防腐蚀、抗紫外线的材料制成。

The bracket structure must be made of a durable, anti-corrosion, anti-ultraviolet materials.

6.3 组件安装 Module Installation

- ◇ 搬运时两人双手抓住组件，并保持水平稳定状态，禁止剧烈晃动，禁止单人搬运组件，禁止拖拉组件，禁止扯拉接线盒连接线，禁止搬运两板及以上数量组件等。

When carrying the modules, two hands are required to grasp the modules and keep a level of stability. It is forbidden to shake severely, carry the module by one person, drag the module, pull the connecting lines of junction box and handle two and more modules.

- ◇ 放置组件时放置于平整的地面上，下面垫纸板，禁止玻璃面直接接触地面。

Place the modules on a flat ground, place the cardboard in the bottom and the glass surface is forbidden to directly touch the ground.

- ◇ 组件放置与地面时严禁堆放杂物，踩踏，坐卧等造成组件变形的动作。

When the module is placed on the ground, it is forbidden to stack debris, step on, sit down and have other actions that may cause deformation for the module.

- ◇ 安装时禁止踩踏组件，禁止在支架上拖曳组件。

Do not step on the module during installation. Do not drag the module on the bracket.

- ◇ 组件在建筑物或屋顶上安装时，要确保它被安全的固定并且不会因为强风或大雪而损坏。

When the modules is installed on buildings or roofs, it needs to ensure that they are securely fastened and will not be damaged by strong wind or snow.

- ◇ 组件背面要确保通风流畅以便组件的散热。

Ensure that the back of the modules good ventilation for cooling the modules.

- ◇ 在屋顶安装组件时，要保证屋顶结构合适。此外，安装固定组件时所必要穿透的屋顶必须适当密封，以防屋漏。

When installing the modules on the roofs, make sure the roof structure is suitable. In addition, the roofs must be properly sealed to prevent leakage.

- ◇ 组件框架和墙面或屋面之间的空隙建议至少保持 115 毫米。如果有其他安装方式，就可能影响防火等级的评估。

The gap between the module frame and the wall or roof should be at least 115mm. If there are other installation methods, it may affect the assessment of fire rating.

- ◇ 两个组件最小间距为 10 毫米。

The spacing between two modules should be at least 10mm.

- ◇ 安装方式不能阻塞组件排水孔。

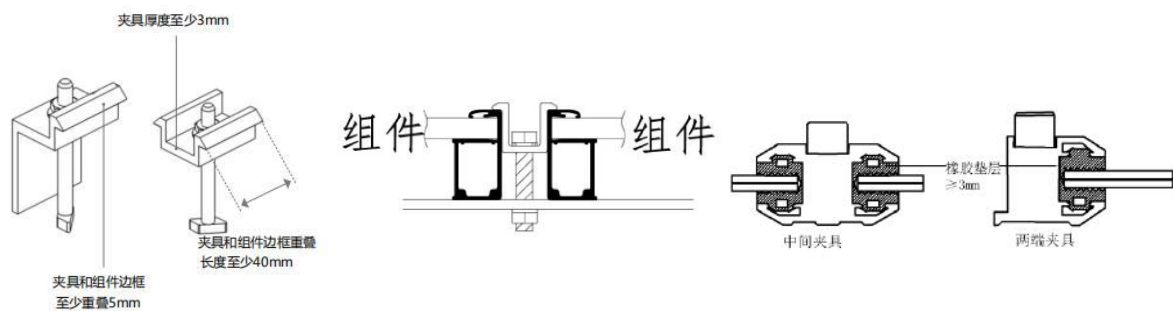
The installation can not block the module' drain hole.

6.4 安装方式 Installation Method

这里介绍的所有安装方式只供参考，本公司不负责提供相关的安装部件。组件系统的设计、安装、机器载荷和安全性必须由专业的系统安装商或者有经验的人来完成。

All installation methods described here are for reference only, and our company is not responsible for providing relevant installation parts. The design, installation, mechanical load and safety of module system must be completed by professional system installers or experienced personnel.

6.4.1 夹具安装 Fixture installation



图A 有框组件夹具

图B 有框组件夹具

图C 无框组件夹具

Figure A Fixture of module with frame

Figure B Fixture of module with frame

Figure C Fixture of module without frame

注意事项 Cautions

- ◆ 请根据组件有/无铝合金边框选择合适的夹具进行安装

Please select the appropriate fixture for installation according to the module with / without aluminum alloy frame

◆ 有框组件夹具应满足以下要求

Module with frame fixtures meet the following requirements

厚度: ≥ 3 mm	长度: ≥ 40 mm	材质: 铝合金
thickness: ≥ 3 mm	Length: ≥ 40 mm	Material: Aluminum alloy
螺栓: M8	扭紧力矩: 18-24 N.m	
Bolts: M8	Tightening torque: N.m 18-24	

◆ 无框组件夹具应满足以下要求

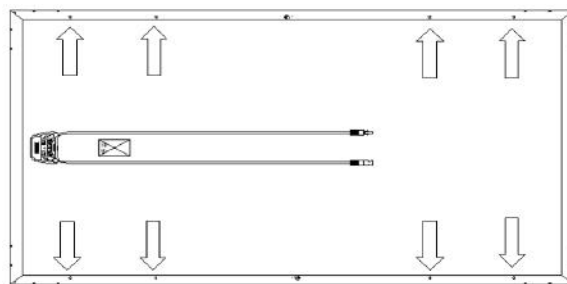
Module without frame fixtures meet the following requirements

厚度: ≥ 3 mm	长度: ≥ 150 mm	材质: 铝合金
Thickness: ≥ 3 mm	Length: ≥ 150 mm	Material: Aluminum alloy
螺栓: M8	橡胶: 三元乙丙橡胶	扭紧力矩: 16-20 N.m
Bolts: M8	Rubber: EPDM	Tightening torque: 16-20 N.m

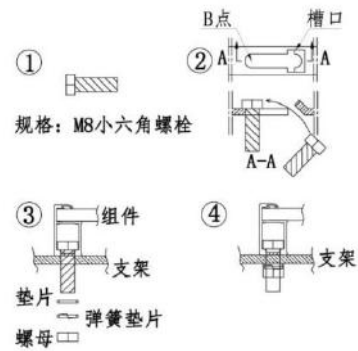
◆ 夹具不能使组件发生形变; 安装导轨和夹具应避免遮挡电池片; 夹具与边框接触面必须平整光滑, 防止边框损坏伤害组件; 排水孔不可被夹具遮挡。

The fixture can not deform the module; the installation guide rail and fixture should avoid blocking the cells; the contact surface between the fixture and the frame must be smooth to prevent the frame damage from damaging the modules; the drainage hole should not be blocked by the fixture.

6.4.2 安装孔安装 Installation holes



箭头标注为安装孔位置



注意事项 Cautions

- ◆ 使用组件背面的安装孔，将组件固定在支架上。
Use the mounting hole on the back of the module to fix the module on the bracket.
- ◆ 螺栓、螺母和垫片应满足以下要求
Bolts, nuts and gaskets shall meet the following requirements
材质: 不锈钢
Material: Stainless steel
尺寸和长度: M8
Dimensions and lengths: M8
扭紧力矩: 14-20 N.m
Tightening torque: N.m 14-20

6.5 安装点位置说明 Installation Point Location Description

正常水平的载荷设计适用于大部分环境：组件背面承受的最大载荷为 1600pa（相当于风压），正面承受的最大载荷为 1600pa（相当于风压）。

The normal level load design is suitable for most environments: the maximum load on the back of the module is 1600 pa(equivalent to wind pressure) and the maximum load on the front is 1600 pa(equivalent to wind pressure).

较高载荷设计适用于苛刻的环境条件（如风暴、大雪等）：组件背面承受的最大载荷为 1600pa（相当于风压），正面承受的最大载荷为 3600pa（相当于风压和雪压）。选择不同的夹具数量、尺寸和安装范围可以获得不同的载荷承受力。

The higher load design is suitable for harsh environmental conditions (such as storm, heavy snow, etc.): the maximum load on the back of the module is 1600 pa(equivalent to wind pressure), and the maximum load on the front is 3600 pa(equivalent to wind pressure and snow pressure). Different load bearing can be obtained by selecting different fixture quantity, size and installation range.

6.5.1 夹具安装位置 Fixture Installation Position

无框组件: Module without frame

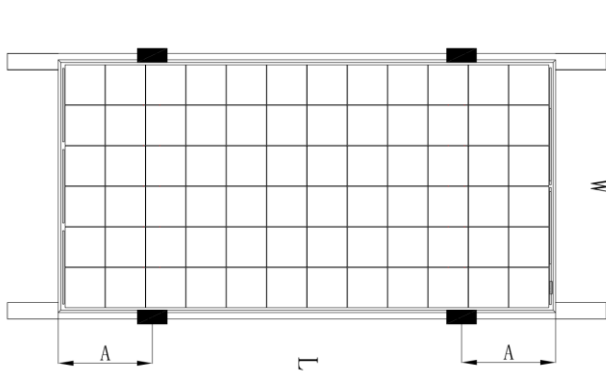


图 A 四点长边安装 导轨平行长边

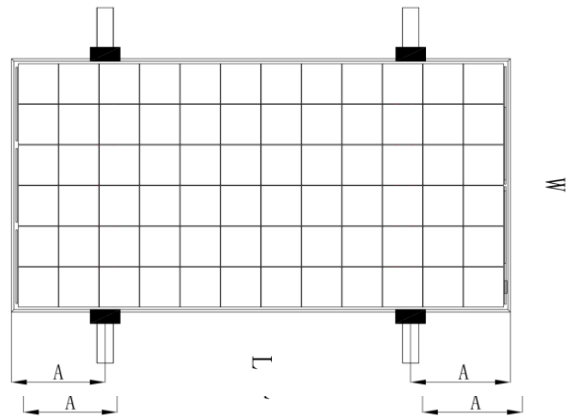


图 B 四点长边安装 导轨垂直长边

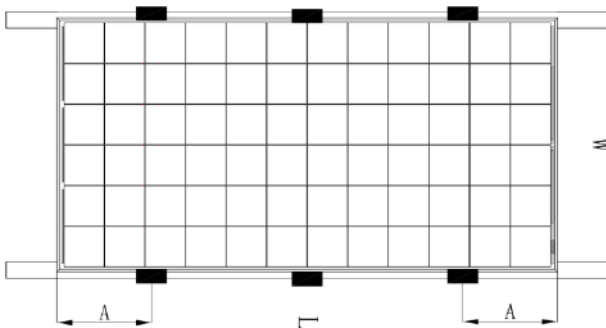


Figure A guide rail parallel long side
 图 C 六点长边安装 导轨平行长边
 Figure C guide rail parallel long side

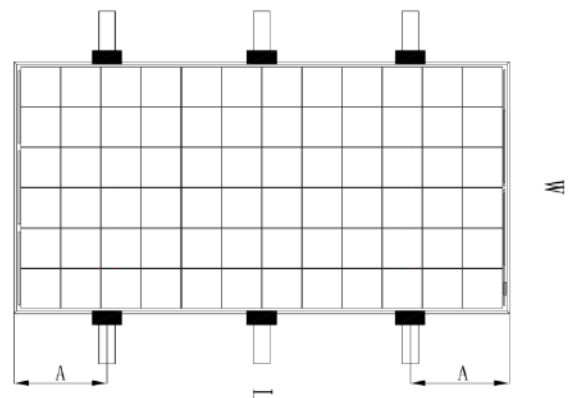
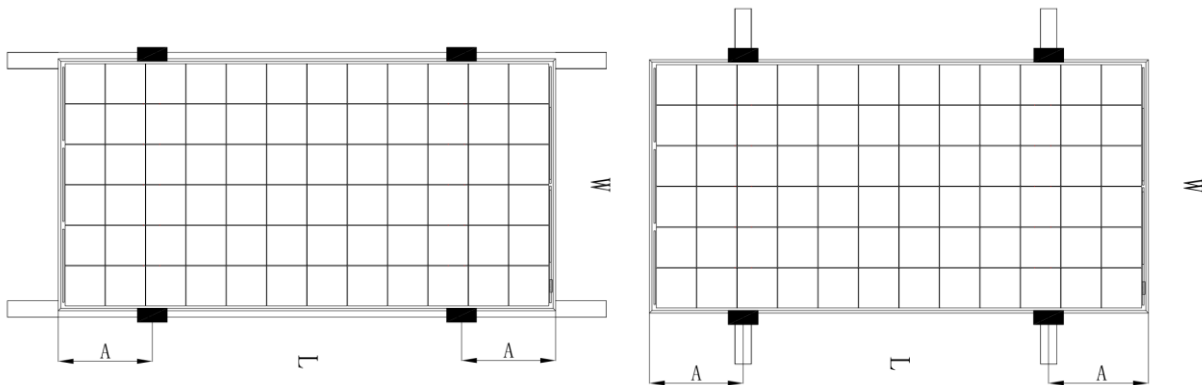


Figure B guide rail is vertical to long side
 图 D 六点长边安装 导轨垂直长边
 Figure D guide rail is vertical to long side

无框组件可承受的载荷强度如下表(L 为组件长度, 中间压块位于组件 L/2 处) :
 The load strength of module without frame is shown in the following table (L is the module length, and the middle pressing block is located at 1/2 point of L)

图示 Drawing	版型 Type	夹具数量 Number of fixtures	夹具长度 Fixture Length	夹持距离 A Clamping A distance	正面载荷 Positive load	反面载荷 Negative loads
A	60~66pcs	4	≥150mm	L/5±50 mm	1600pa	1600pa
B	60~66pcs	4	≥150mm	L/5±50 mm	3600pa	3600pa
C	72~80pcs	6	≥150mm	L/5±50 mm	1600pa	1600pa

D	72~80pcs	6	≥150mm	L/5±50 mm	3600pa	3600pa
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有框组件 Module with frame:

图 E 四点长边安装 导轨平行长边
 Figure E guide rail parallel long side

图 F 四点长边安装 导轨垂直长边
 Figure F guide rail is vertical to long side

有框组件可承受的载荷强度如下表(L 为组件长度)：

The load strength of module with frame is shown in the table below (L is the length of the module)

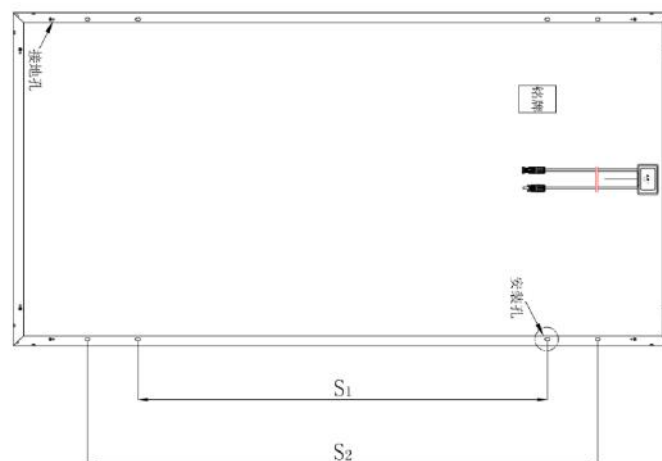
图示 Drawing	版型 Type	夹具数量 Number of fixtures	夹具长度 Fixture Length	夹持距离 A Clamping A distance	正面载荷 Positive load	反面载荷 Negative load
E	60~66pcs	4	≥40mm	L/5±50 mm	1600pa	1600pa
F	60~66pcs	4	≥40mm	L/5±50 mm	3600pa	1600pa
E	72~80pcs	4	≥40mm	L/5±50 mm	1600pa	1600pa
F	72~80pcs	4	≥40mm	L/5±50 mm	3600pa	1600pa

6.5.2 安装孔安装位置 Installation Position

使用安装孔安装组件情况下，请同时采用 8 个安装孔来加强固定。

When mounting a component through mounting holes, use eight mounting holes to secure the component.

可承受的载荷强度如下表：



The load strength to be sustained is as follows:

安装方式 Installation Method	正面载荷 Positive load	反面载荷 Negative load
8 个安装孔螺栓安装 Installation of 8 mounting hole bolts	3600pa	1600pa

7. 电气安装 Electrical Installation

7.1 接地 Grounding Connection

- ◇ 组件需要进行接地，尽管已确认组件满足安全等级 II 级，并确保其满足当地电气指令和法规。

The modules needs to be grounded, although it has been confirmed that the module meets the security level II and it meets local electrical directives and regulations.

- ◇ 应由有资质的电工人员进行接地连接操作。

The grounding connection operation should be carried out by qualified electrician.

- ◇ 使用合适的接地导线将组件边框相互连接起来，推荐使用 4-14（建议使用 10mm²） mm² 的铜导线（AWG 6-12）作为接地导线。组件的接地孔使用接地标识。所有的导电连接点必须牢固连接。

Use the suitable grounding wire to connect the modules' frame to each other and it is recommended to use 4-14 (the 10mm²) mm² copper conductor (AWG 6-12) as the grounding conductor. The grounding hole of the module uses grounding identification. All conductive connection points must be securely connected.

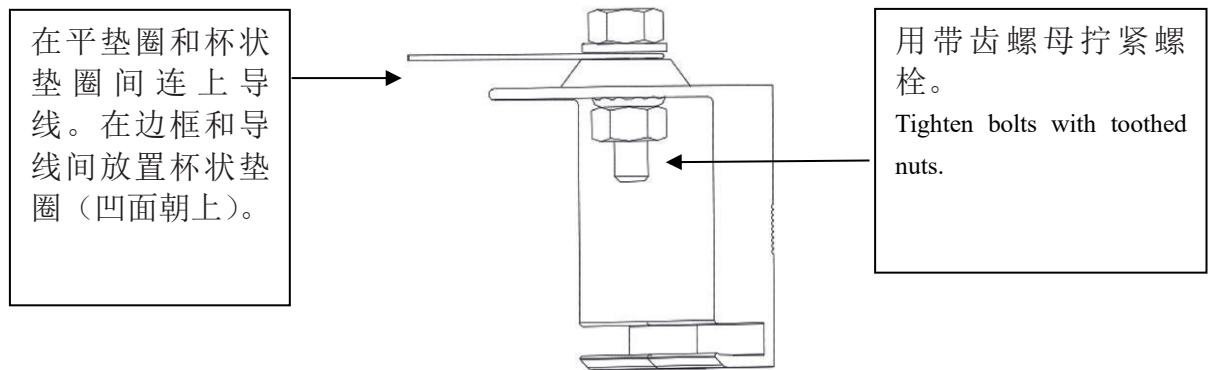
- ◇ 螺栓、螺母、平垫圈、锁紧垫圈或其他相关零部件要使用不锈钢材质，除非另外规定。

Stainless steel material shall be used for bolts, nuts, washers, lock washers or other related parts unless otherwise specified.

- ◇ 推荐以下一种接地方式。

The following grounding method is recommended.

螺栓+带齿螺母+杯装垫圈



- ◇ 按照上图所示，将铜导线用接地部件（M5 不锈钢盖螺栓、M5 不锈钢平垫圈、M5 不锈钢杯状垫圈、M5 不锈钢带齿螺母）连接到组件边框上的接地孔，在平垫圈和杯状垫圈间连上导线。确保杯状垫圈在边框和导线间，并且凹面朝上，防止电流腐蚀。用不锈钢带齿螺母牢固的拧紧螺栓。在安装过程中可能会用到扭矩扳手。螺母的拧紧力矩是 3~7Nm。

In accordance with the above diagram, the copper conductor is connected to the grounding hole of the module frame through grounding parts (M5 stainless steel cover bolts, M5 stainless steel flat washers, M5 stainless steel cup-shaped washers, M5 stainless steel toothed nut) and connect flat washer and cup-shaped washers by the wire. Ensure that the cup-shaped washers are between the frame and the wire and concave faces up to prevent current corrosion. Tighten the bolts securely by stainless steel toothed nuts. Torque wrenches may be used during installation. The tightening torque of the nut is 3~7nm.

- ◇ 组件的安装可以使用第三方注册的接地装置将组件金属框接地。设备必须按照接地设备制造商的安装说明予以安装。

The modules' installation could use grounding device registered by the third-party to ground the metal frame of the modules. The device must be installed in accordance with the installation instructions of grounding device manufacturer.

7.2 测试，调试，与故障排除 Test.Debugging and Troubleshooting

- ◇ 串联组件连接到系统前的测试，使用数字万用表(推荐 fluke 170 系列或 DC 量程可以达到 1000V 的数字万用表)检查串联组件的开路电压。测量值应等于单个组件开路电压的总和。您将在所用类型组件的技术说明书中找到额定电压。

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 1000V) 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.

- ◇ 低电压故障排除。鉴别正常的低电压和故障低电压。这里提到的正常低电压是指组件开路电压的降低，它是由太阳能电池温度升高或辐照度降低造成的。故障低电压通常是由于终端连接不正确或旁路二极管损坏引起的。

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.

7.3 阻塞二极管和旁路二极管故障排除 **Blocking Diode and Bypass**

Diode Troubleshooting

- ◇ 阻塞二极管能够在组件没有电流生成时阻止电流从蓄电池流向组件。如果没有使用充电控制器，则推荐使用阻塞二极管。关于充电控制器请咨询专业经销商。

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.

- ◇ 在系统中，当组件的一部分被遮挡而其它部分暴露在阳光下时，会发生热斑效应，导致电池过热甚至会损坏组件。在组件中使用旁路二极管可以保护组件不受这种过高的反向电流影响。所有额定功率大于 55 瓦的组件都已在接线盒中集成了旁路二极管。

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.

7.4 并网电气系统 **On-grid Electrical System**

- ◇ 在一个光伏发电系统中尽量使用相同的组件，组件串联数量 $(N) \leq V(\max) / [Voc(atSTC)]$ 。V (max) 为组件最大系统电压，Voc(atSTC)为组件标称状态下开路电压。

Try to use the same components in a photovoltaic power generation system, the number of modules in series $(N) \leq V(\max) / [Voc(atSTC)]$. V (Max) is the

maximum system voltage of the component, and $V_{oc}(atSTC)$ is the open-circuit voltage under the nominal state of the component.

- ◇ 几个组件串联，然后并联形成光伏阵列，这特别适用于电压较高的情况下。如果组件串联，总电压等于各个组件电压的总和。

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.

- ◇ 需要使用高电流的情况下，可以将几个光伏组件并联，总电流等于各个组件电流的总和。

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.

- ◇ 组件可提供预制连接器，用于系统的电气连接。电缆线尺寸、类型和温度等参数的选择请参考相关的规程。

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.

- ◇ 电缆横截面和连接器大小必须满足最大系统短路电流。否则电缆线和连接器会因为电流过大而过热！有烧坏的危险！

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!

- ◇ 安装时有接线盒一端朝上避免被雨水淋到。

When installing, the junction box's one end to be upward to avoid being rained.

- ◇ 在调试或维修太阳能系统时要保护自己免遭电击，戴好绝缘手套和绝缘鞋等防护用品使用专用的电工工具进行维修。

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.

8. 维护 Maintenance

- ◇ 为保证电池板最佳性能，海泰新能提交以下维护措施。

To ensure the best performance of the solar panels, Haitai New Energy provide the following maintenance measures.

- ◇ 应在早晨或傍晚发电功率低或没有功率时进行电池板清洁。

The solar panel should be cleaned in the morning or evening when the power is low or no power is processing.

- ◇ 必要时清洗玻璃表面，清洁玻璃表面应使用清水和软质物体擦洗，可使用中性洗涤剂，切不可使用酸性或碱性或加研磨剂洗涤剂。

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.

对于大型系统而言，当权衡是否应清洁电池阵列上的所有灰尘和沉积物时，应考虑清洁成本、清洁后增加的能量产出以及组件在清洁后再次变脏的时间等因素。如果不确定阵列或其截面是否需要清洁，首先应选择污染严重的阵列串，然后从该串测量并记录逆变器的输入电流。

For large-scale systems, when considering whether all of the dust and deposits on the solar cell array should be cleaned or not, factors such as cleaning costs, increased energy output after cleaning, and the time it takes to get dirty again after cleaning need to be taken into consideration. If you are not sure whether the array or its sections need to be cleaned or not, you should firstly select the heavily polluted array string and then measure and record the inverter's input current from that string.

- 1) 清洁串内的所有组件。

Clean all the modules within a string.

- 2) 再次测量逆变器的输入电流，并计算清洁后的而改善程度百分比。

Measure the input current of the inverter again and calculate improvement percentage after the cleaning.

- 3) 如果改善程度小于 5%，通常不值得花成本来清洁。

If the improvement degree is less than 5%, it is usually not worthy to pay the cost for cleaning.

- ◇ 在下雨天气时如果出现逆变器或其他电器设备断电不要进行送电，等待下雨天气过后对线路进行检查确保没有问题后再进行送电。

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.

- ◇ 清洗电池板时不能用高压水枪进行冲洗，以免电池板接头处因冲洗压力过大进水导致线路漏电。

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.

- ◇ 每六个月进行一次机械和电器检查，确保表面清洁及连接可靠。

Conduct a mechanical and electrical inspection for every six months and ensure that the surface is clean and the connection is reliable.

- ◇ 如有任何其它异常情况出现，请咨询厂家或有经验的工程师。

If any other abnormal situation occurs, please consult factory or experienced engineer.

- ◇ 注意，遵守系统使用的所有部件，如支架、充电控制器、逆变器、电池等的维护说明。

Observe the maintenance instructions for all parts used in the system, such as bracket, charge controller, inverter, solar cell, etc.