

# 光伏组件安装说明书

## PV Module Installation Instructions



**上海航天汽车机电股份有限公司**

Shanghai Aerospace Automobile Electromechanical Co., Ltd.

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## 1 前言

感谢您选择上海航天汽车机电股份有限公司光伏组件。本手册所指的光伏组件是指由本单位所生产和销售的光伏组件。

本说明书提供了 HT 单玻光伏组件（以下简称组件）的安装和安全使用信息。

安装前，请仔细阅读和理解本说明书。如有任何问题，请联系我们的销售部门。

安装人员应熟悉太阳能光伏发电系统的机械和电气要求。安装组件时，安装者应遵守本手册和当地相关法律规定的安全注意事项。

本公司不承担任何由于未遵守本说明书引起的组件及系统损坏、人身伤害、财产或其他损失。

本说明书请妥善保管，以备将来系统维护、保养、出售或处理时参考。

本说明书最终解释权归本公司所有。

## 1 preface Introduction

Thanks for purchasing PV modules of Shanghai Aerospace Automobile Electromechanical Co., Ltd.. This manual refers to PV modules manufactured or sold by our company.

This manual contains the information of installation and safe handling of HT's PV modules (hereafter is referred to as "module").

All instructions shall be carefully read before installation. Please contact our sales department for further information if have any question.

The installer shall be familiar with the mechanical and electrical requirement of PV system. The installer shall comply with safety precautions listed in this manual and local law regulations when installing the modules.

Our company does not take the responsibility for the loss, damage, or expense arising that caused by any violation of this manual.

This manual shall be properly kept for future reference (care and maintenance) and in case of sale or disposal of the module at the end of its useful life.

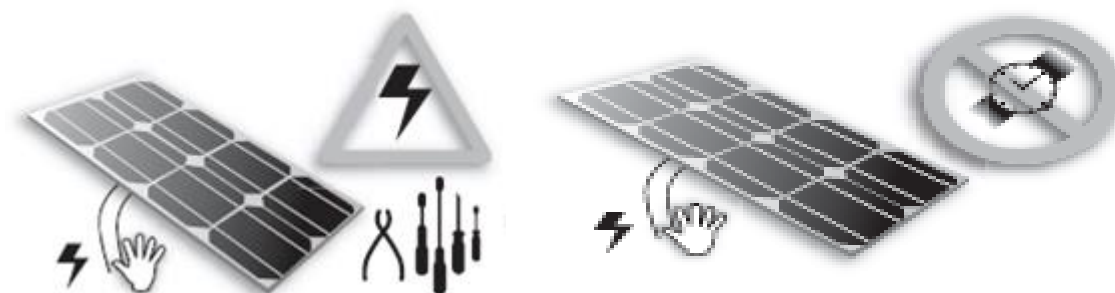
Our company reserves the right of final interpretation of this installation manual.

## 2 警告

- 2.1 安装太阳能光伏发电系统要求专业的知识和技能，必须由具备专业资格的工程师操作。
- 2.2 光伏组件暴露在阳光或其他光源下时产生直流电能。组件的活动部件，如接线盒会导致烧伤、火花和致命的电击。
- 2.3 将组件应用于地面、屋顶等室外环境。合理的支撑结构是系统设计人员或安装人员的责任。
- 2.4 不要在有负载的情况下断开连接线。
- 2.5 不要拆解组件、移动任何铭牌或黏附的部件。
- 2.6 不要将组件放置在容易产生或储存可燃气体的地方。
- 2.7 不得用人工聚集的阳光照射在组件上。
- 2.8 不能让任何物件掉落或覆盖在组件上，严禁在组件上踩踏、站立或行走。



- 2.9 禁止通过组件电缆线拉拽、拖行组件。
- 2.10 在运输和安装过程中严禁孩子接触组件。
- 2.11 禁止用手直接接触组件的电气部分，使用符合电力安装工作绝缘要求的工具进行电气连接。



- 2.12 在运输和安装过程中，操作员请勿佩戴金属环、手镯、耳环、鼻环、唇环或其他金属饰件。
- 2.13 不要在组件玻璃面钻孔，否则会导致组件失效。
- 2.14 不要损坏组件边缘的密封，否则将导致组件失效。
- 2.15 确保支架与光伏组件之间的连接牢固、无松动。
- 2.16 屋顶安装会影响房屋的防火性能；根据IEC61730: 2016的规定，组件的耐火等级为C级，应安装在C级以上的屋顶上。光伏系统的消防等级应与屋顶一起评估，只有按照安装说明书中规定的方式安装时，组件的防火等级才有效。

## 2 Warnings

2.1 It requires specialized skills and knowledge for installation of solar photovoltaic systems. It shall be performed by qualified licensed professional installation personnel.

2.2 PV modules generate DC electrical energy when exposed to sunlight or other light sources. Active parts of module such as terminals can result in burns, sparks, and lethal shock.

2.3 Apply modules to such as ground, roofs etc. outdoor environment. Appropriate rack structure shall be designed by system designer or installer.

2.4 Do not disconnect the cables of modules when modules are on operation.

2.5 Do not disassemble modules or move nameplate or any adhesion parts of modules.

2.6 Do not place the modules where it is easy to produce or gather combustible gases.

2.7 Artificially concentrated sunlight shall not be directed on the module.

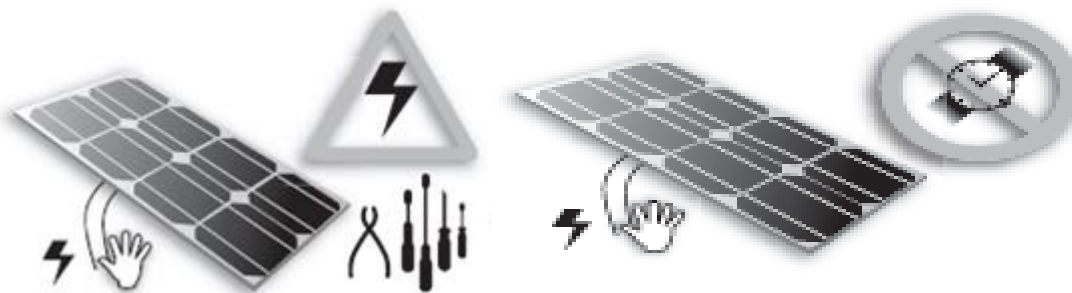
2.8 Any dropping or covering on modules is not allowed. Do not tread, stand or walk on modules.



2.9 Do not pull or drag the modules by cables or connectors.

2.10 Keep children away from modules during transportation and installation.

2.11 Do not touch live terminals with bare hands. Use insulated tools for electrical connections.



2.12 Do not wear metal rings, bracelet, earrings, nose rings, lip rings or other metal accessories during transportation and installation.

2.13 Do not drill on the glass surface of module which will void its warranty.

2.14 Do not destroy the modules edge seal which will void its warranty.

2.15 Make sure the connection between the rack and PV module is firmly and without loosen.

2.16 It may affect fire resistance of the house if roof-mounted; fire rating of the modules is rated as Class C according to IEC61730: 2016, which shall be installed on the roof fire-rated above Class C. The system fire rating should always be evaluated along with the roof cover and mounting system. The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.

### 3 产品标识

3.1 每个组件的背面都有标签，提供以下信息：

产品类型、重量、尺寸、熔丝电流、系统最高电压、标准测试条件下测得的额定功率、额定电流、额定电压、开路电压、短路电流。

3.2 条形码（序列号）：每个组件都有一个唯一的序列号。它被永久地固定在组件内部，从组件正面可以看到。



### 3 Product Identification

3.1 Each module has a label on the back containing following information:

Product type, weight, size, fuse current, the system max voltage, rated power measured under standard test conditions, rated current, rated voltage, open circuit voltage, short circuit current.

3.2 Bar code (serial number): each module is registered with a unique serial number. It is permanently fixed in the module, which can be seen in front of module.



### 4 安装工具及材料

4.1 螺丝刀

4.2 扳手

4.3 安装支架

4.4 不锈钢螺丝、螺帽、垫圈、压板等附件

## 4 Tools & Materials for Installation

4.1 Screwdriver

4.2 Wrench

4.3 Mounting bracket

4.4 Stainless steel screws, nuts, washers, clips and other accessories

## 5 系统设计

请使用与太阳能系统配套的设备、连接器、电线、支架。在特定的系统中，一定要使用相同类型的组件。在确定光伏系统相关部件的额定电压、导线容量、保险丝容量、控制器容量等和组件输出功率有关联的参数时，请参照组件标签上显示的短路电流(Isc)和开路电压(Voc)的值进行合理的设计。

在正常的室外环境下，光伏组件产生的电流和电压可能与参数表中的参数不同。参数表中的参数是在标准测试条件下(STC)测得，所以关于解决不同地区的光伏发电系统的参数，如额定电压、导线容量，保险丝容量，控制器容量和组件输出功率时，应使用组件标签上的 Isc 和 Voc 的值应乘以 1.25 倍的冗余值设计和安装。

确保每个阵列的系统电压不超过组件最大系统电压，以及控制器、逆变器等子设备的额定电流和电压。在欧洲销售的模块的最大允许系统电压(DC)为 1000V。

组件之间的连接：根据系统设计要求输出电压和电流，组件通过自身导线串联或并联起来；串联组件的最大数量 (N) 等于最大系统电压  $V_{max}$  除以单个组件的开路电压 Voc；并联组件的数量与标准测试条件下选择的电气设备（逆变器、控制器）有关。

最大系统电压  $\geq N * Voc * [1 + TC_{voc} * (T_{min} - 25)]$ 。

N 串联组件数量。

Voc 组件开路电压（见产品标签或数据表）。

TCvoc 组件开路电压温度系数(参见数据表)。

Tmin 最低环境温度。

Please use the the equipments, connectors, wires and rack which match with solar power system. In a particular system, be sure to apply the same type of modules. Please refer to the short-circuit current (Isc)

and open circuit voltage (Voc) showing on modules' label as proper value to install and design when determining settling parameters such as rated voltage, the wire capacity, fuse, the controller capacity and module output power of relevant parts of PV system.

In normal outdoor conditions, the generated current and voltage maybe different from the parameters listed in Table. Parameter table is measured under standard test conditions (STC), so concerning settling parameters of other parts of photovoltaic power generation system, such as rated voltage, the wire capacity, fuse, the controller capacity and module power output, it shall refer to the short-circuit current (Isc) and open circuit voltage (Voc) noted on modules' label, with the redundancy value of 125% for design and installation.

Make sure the array of modules installed within the Maximum permitted system voltage and the rating current and voltage of the sub-equipments such as regulators and inverters. The maximum permitted system voltage (DC) of the modules sold in Europe is 1000V.

The connection of modules: in accordance with system design, requirements of output voltage and current, modules can be series or parallel connected by their connecting wires; the maximum number of modules in series (N) is equal to the maximum system voltage Vmax divided by the open circuit voltage Voc of one single module; the number of modules in parallel is related to the selection of electrical equipment (inverters, controllers) under standard test conditions.

Max System voltage  $\geq N * Voc * [1 + TC_{voc} * (T_{min} - 25)]$ .

N No modules in series

Voc Open circuit voltage of each module(refer to product label or data sheet)

TCvoc Thermal coefficient of open circuit voltage for the module(refer to data sheet)

Tmin The lowest ambient temperature

## 5.1 位置选择

5.1.1 光伏组件常规工作环境温度为-40° C + 40° C。极限工作环境温度范围从-40° C 到+ 85° C。

5.1.2 HT 组件允许的最大安装高度是海拔 2000 米。

5.1.3 在标准测试条件下(1000 W / m<sup>2</sup> 的辐照度, AM 1.5, 25°C(77° F)环境温度), 组件的电气性能参数。

5.1.4 应选择适合的安装位置安装组件。

5.1.5 在北半球组件建议朝南, 在南半球建议朝北。

5.1.6 太阳能组件的倾斜角指的是组件表面与地平面之间的夹角，如下图 2 所示，组件表面与太阳光垂直的时候功率输出最大。要了解最佳的安装倾斜角的详细信息，请参考咨询当地可靠的太阳能系统安装公司。

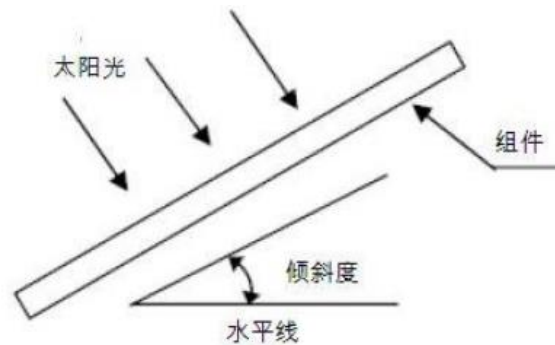


图 2 太阳能组件安装倾斜角

5.1.7 组件应安装在阳光充分照射的地方，不能在任何时间被遮挡。

5.1.8 一般来说，组件安装在距海边 3000 米以外的地方，可以保证 25 年的使用寿命。如果组件安装在距海边 500 米至 3000 米的地方，组件需要增加额外的保护（如增加铝合金边框的氧化膜厚度）。否则，组件在海边的盐雾环境中，容易发生腐蚀作用。

## 5.1 Location Selection

5.1.1 The module should be installed at an ambient temperature of  $-40\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$ . The module's limit working ambient temperature range is from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

5.1.2 The maximum altitude for HT PV module is 2000m.

5.1.3 Under standard test conditions ( $1000\text{W} / \text{m}^2$  irradiance, AM 1.5 spectrum,  $25\text{ }^{\circ}\text{C}$  ( $77\text{ }^{\circ}\text{F}$ ) ambient temperature), the electrical performance parameters of modules.

5.1.4 A suitable installation location shall be carefully selected for modules.

5.1.5 In the northern hemisphere, modules had better be installed facing south direction; in the southern hemisphere, modules had better be installed facing north.

5.1.6 The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface (as shows in Figure 2). The PV module generates maximum output power when it faces the sun vertical. If you want the specific information of best install tilt angle, please consult the local authoritative solar system construction company.



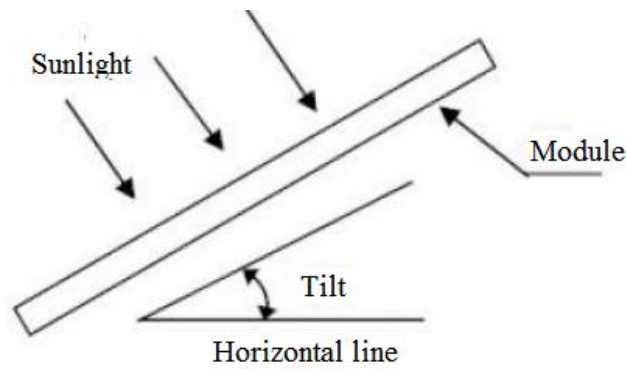


Figure 2 PV module tilt angle

5.1.7 Modules shall be installed in the position of full sun exposure and not be obscured at any time.

5.1.8 The modules, as a general rule, Can guarantee 25 years of useful life when it is installed in where 3 km away from the sea; if the installation site change to a place on a scale of 500m to 3000m from the sea, the modules need to increase the special protection(such as thickening the thickness of the oxide film of Aluminum metal alloy frame) 。 Otherwise, to the modules used in the seaside and sea salt fog environment, they are prone to corrosion.

## 5.2 选择合适的逆变器

在选择逆变器类型时，需要考虑光伏组件阵列的输出功率、开路电压、短路电流。组件阵列的最小电压应大于逆变器的开启电压，以保证逆变器的正常工作。

It need take the output power, open-circuit voltage, short-circuit current of PV modules array into consideration when choose inverter type. And the minimum voltage of the module array should be higher than the threshold voltage of inverters to guarantee the inverters proper functioning.

## 5.3 选择合适的支架

系统设计者或安装者负责载荷计算，使组件能够承受所有预定的载荷条件；这是支架安装商所必须要提供的保证。所选用的支架必须经过具有静态力学分析能力的第三方测试机构检验和测试。

The load calculation should be charged by system designers and installers to make sure all modules could bear predetermined load conditions. The choosing rack should pass all the inspection and test by third party test institution which possessing static mechanics analysis ability.

# 6 组件安装

## 6.1 组件拆箱

6.1.1 当组件被运到安装地，应避免在雨天对组件进行拆箱。

6.1.2 拆箱后的组件应水平放置，禁止倾斜、堆压重物、斜靠等堆栈方式。

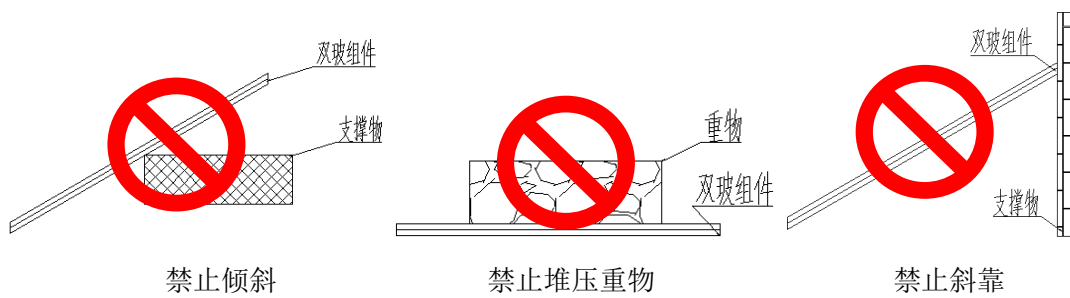
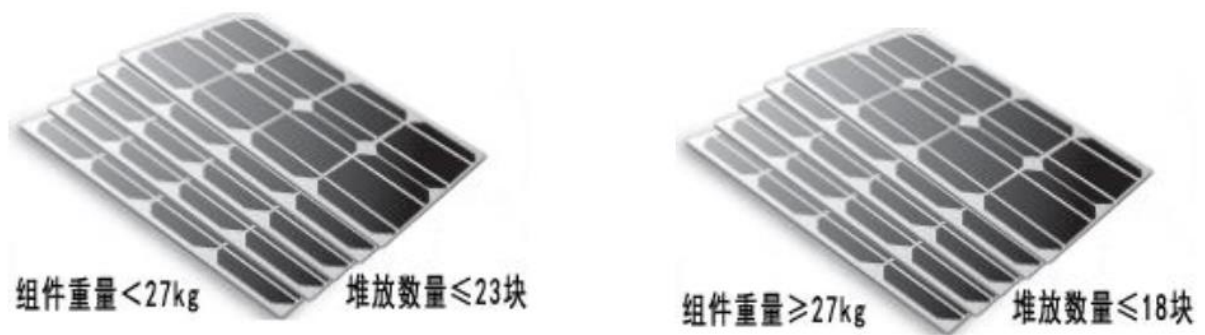


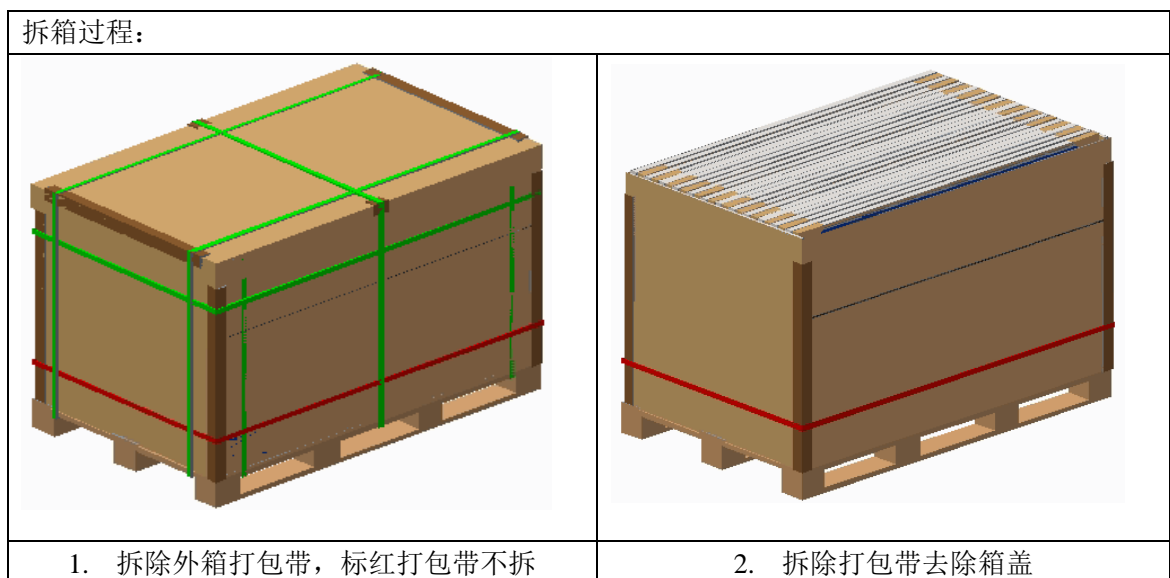
图3 组件堆放说明

6.1.3 打开组件包装后，不要取下盖子，组件应该放在粗糙表面或工作台上。

6.1.4 两个批次的组件之间分开堆放。组件重量不超过 23kg 的组件每托堆放数量不超过 23 块；组件重量不超过 27kg 的组件每托堆放数量不超过 18 块。



6.1.5 包装箱需按图 4 进行拆箱，禁止野蛮操作或用撬棍插入箱内撬开：



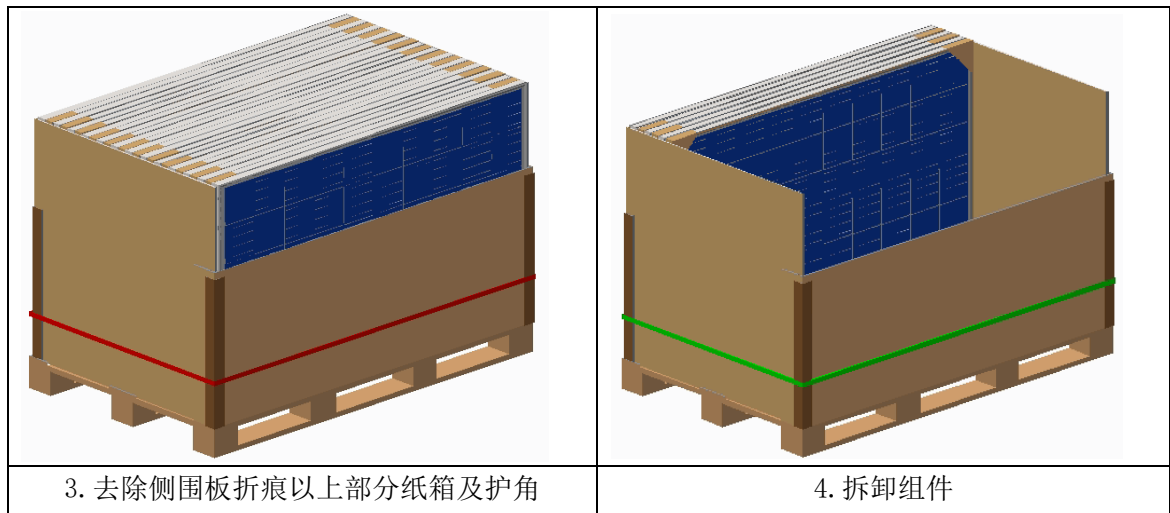


图 4 拆箱过程图

## 6 Modules Installation

### 6.1 Modules unpacking

6.1.1 When the modules are shipped to installation place, do not unpack modules in humid and rainy weather.

6.1.2 After being unpacked, the modules shall be placed horizontally; the tilt, heap pressure, leaning stack way are prohibited.

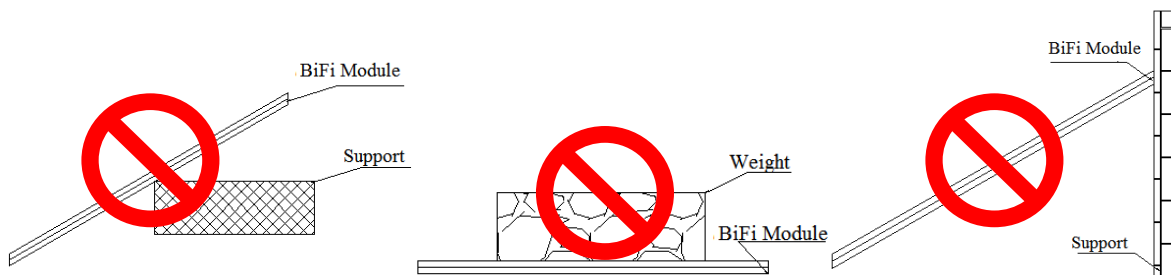


Figure 4 Modules stack illustration

6.1.3 After unpacking the modules, do not remove the cover, and modules shall be loaded on roughness surface or table.

6.1.4 Distance shall be kept between two batches of modules, no more than 23pcs modules shall be piled up together (it is recommended that no more than 23pcs modules whose weight is less than 27kg shall be piled up, and no more than 18pcs modules whose weight is no less than 27kg shall be piled up).



6.1.5 Unpacking the package should refer to the following instructions as Figure 4, Any rude operation or use crowbar unclench into the boxes are prohibited.

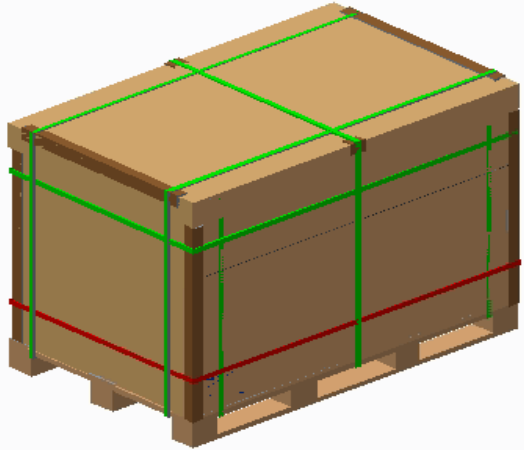
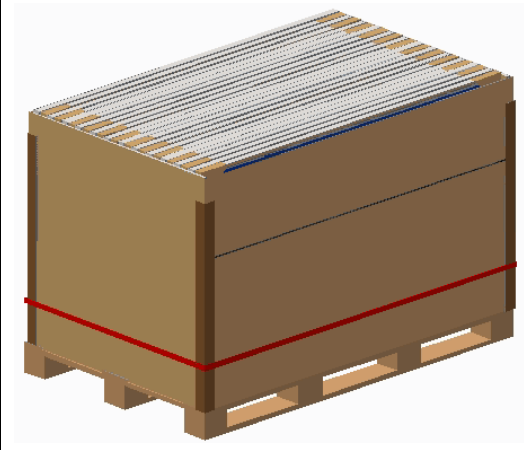
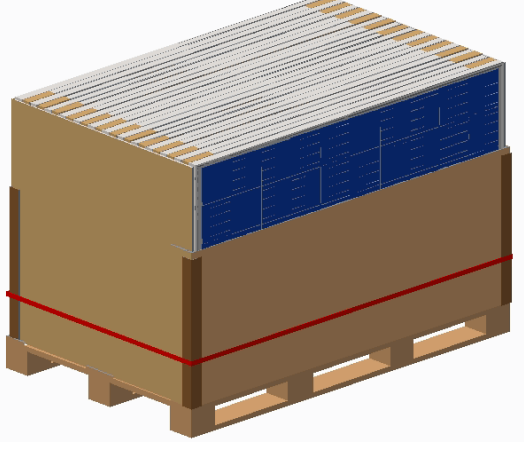
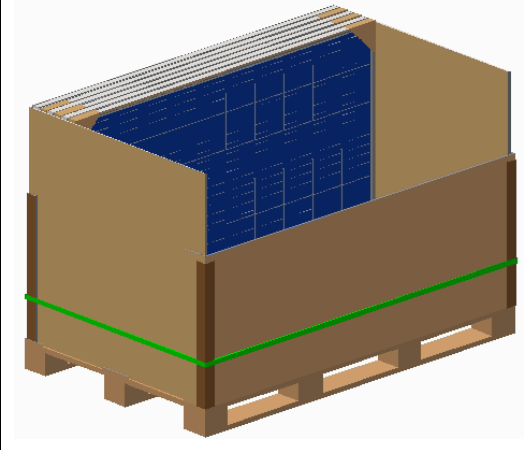
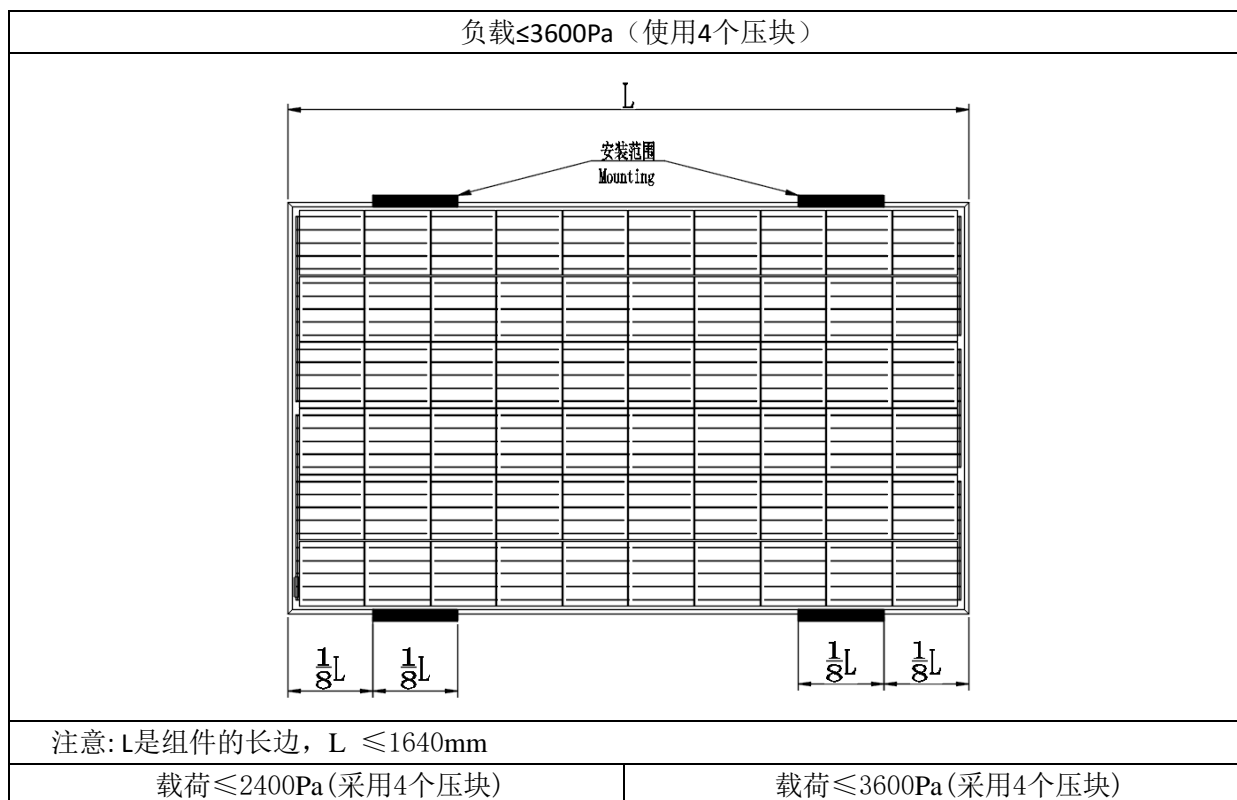
Unpacking paper boxes process	
	
1. dismantling the packing belt of the coaming, the red tape is not dismantled.	2. removal of packing belt to remove cover.
	
3. remove the cartons and corner protector above the crease of side panel.	4. disassembly modules

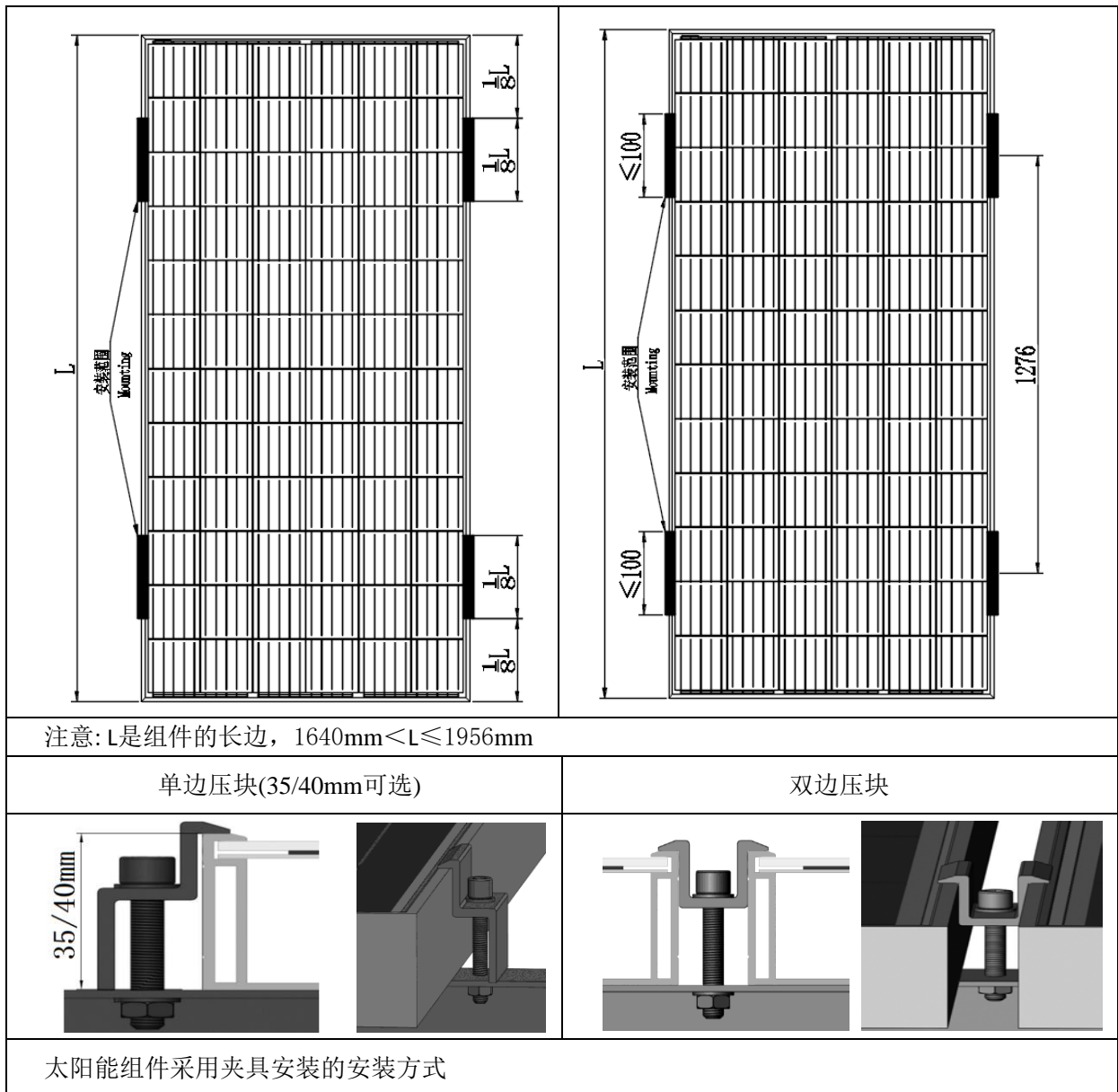
Figure 4 Unpacking process

## 6.2 夹具安装

我们使用不同制造商的多种夹具对组件进行了测试，建议使用带有 EPDM 或类似绝缘垫圈的夹具，固定至少 M6 的螺栓。 夹具必须与组件边框重叠至少 0.28 英寸但不超过 0.39 英寸。

- 在安装支架上至少使用 4 个夹具固定组件。
- 夹具不能遮挡组件正面玻璃，也不能使组件边框变形。
- 确保组件不会产生遮挡效应。
- 组件边框在任何条件下都不能被改变。
- 在选择使用夹具安装方式时，每个组件至少要使用 4 个夹具，每个组件的长边(用于纵向定位)或短边(用于横向定位)都要安装两个夹具。根据当地的风载和雪载，可能需要额外的夹具来确保组件能够承受负载。
- 应用扭矩应参考机械设计标准，根据客户使用的螺栓而定，例如：  
 M6 ---- 70 磅力以内；  
 M8 ---- 140 磅力以内；  
 组件设计负载 2400Pa，安全系数为设计值的 1.5 倍（风载/雪载）。





## 6.2 Mounting with Clamps

We have tested its modules with a number of clamps from different manufacturers and recommends the use of clamps which have an EPDM or similar insulating washer, fixing bolt of at least M6. The clamp must overlap the module frame by at least 0.28 in but no more than 0.39 in.

- Use at minimum 4 clamps to fix modules on the mounting rails.
- Modules clamps should not come into contact with the front glass and must not deform the frame.
- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- When choosing this type of clamp-mounting method, use at least four clamps on each module, two

clamps should be attached on each long sides of the module (for portrait orientation) and each short sides of the module (for landscape orientation). Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.

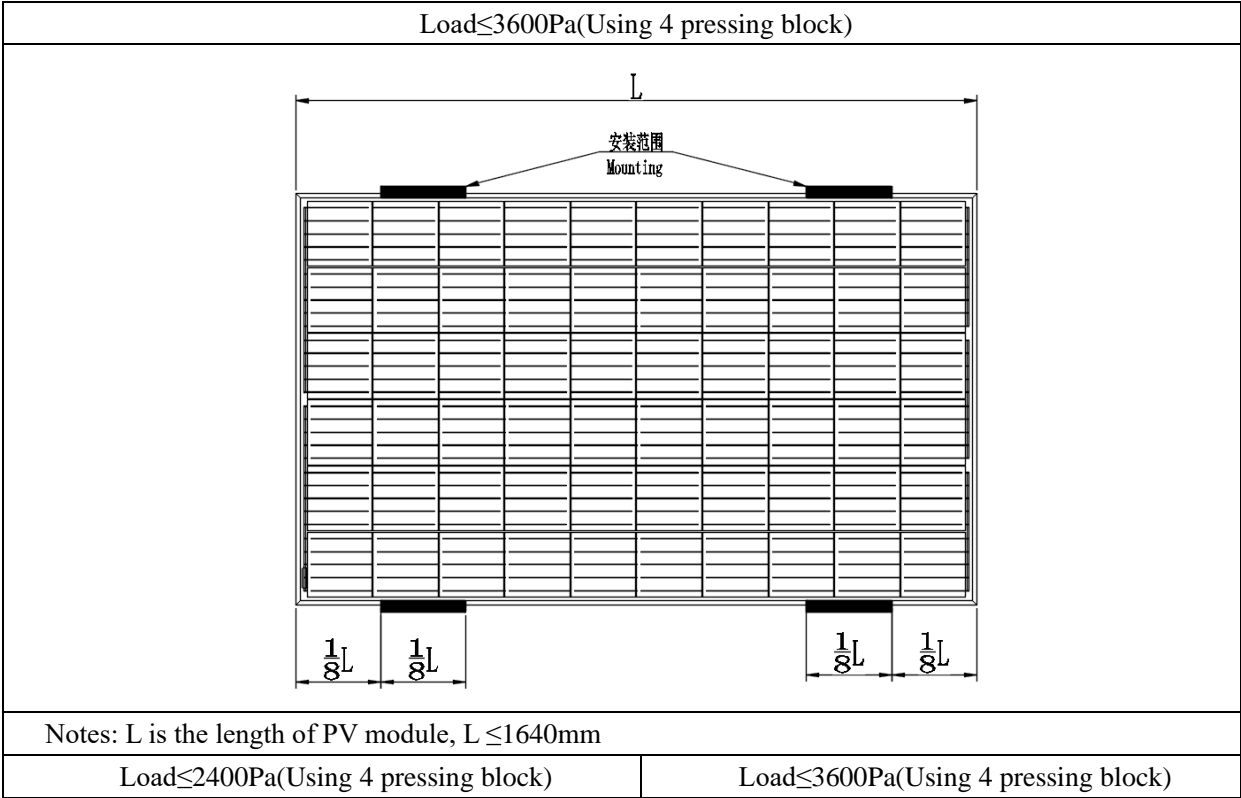
- Applied torque should refer to mechanical design standard according to the bolt customer is using,

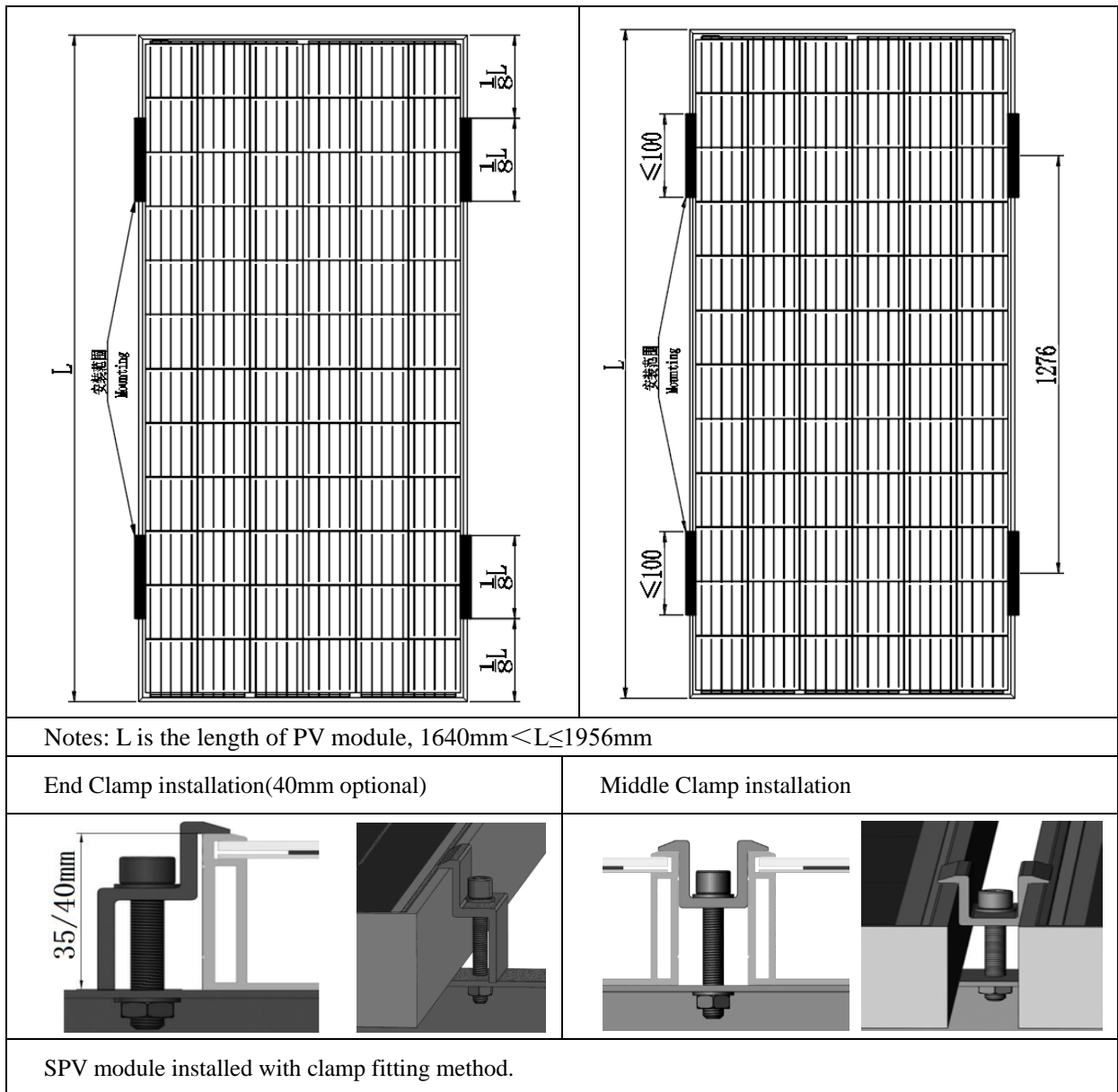
e.g:

M6 ---- 70 lbf\*in;

M8---- 140 lbf\*in.

The modules negative design loading 2400Pa, with 1.5 times safety factor(wind load/snow load).





### 6.3 螺栓安装

每个组件的边框上都有 14 x 9mm 的安装孔，理想情况下可以优化组件负载能力，从而将组件固定到支撑结构上。

- 为了延长组件安装寿命，我们强烈建议使用防腐蚀（不锈钢）固定件固定组件。
- 使用 M8 螺栓和平垫圈，弹簧垫圈和螺母（如图 5 所示）将组件固定在每个固定位置，然后拧紧至 180 磅的扭矩。



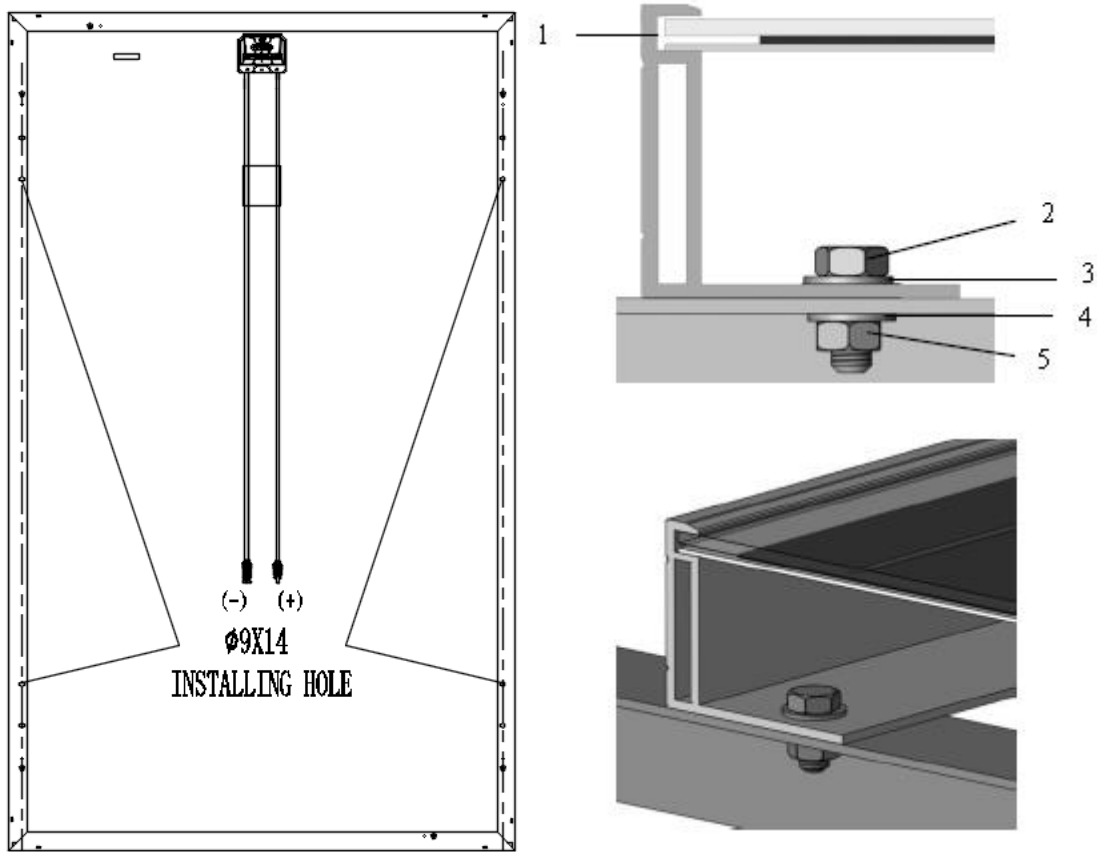


图 6 光伏组件的螺栓安装方式

- 1 铝边框
- 2 M8 不锈钢螺栓
- 3 平不锈钢垫圈
- 4 不锈钢弹簧垫圈
- 5 六角不锈钢螺母

L≤1640mm		1640mm<L≤1956mm	
载荷≤2400Pa	载荷≤3600Pa	载荷≤2400Pa	载荷≤3600Pa
使用4个带有S或P的安装孔	使用4个带有S的安装孔	使用4个带有S或P的安装孔	使用4个带有S的安装孔

### 6.3 Mounting with Bolts

The frame of each module has 14 x 9mm mounting holes, ideally placed to optimize the load handling

capability, to secure the modules to supporting structure.

- To maximize mounting longevity, our Solar strongly recommends using corrosion proof (stainless steel) fixings.

- Secure the module in each fixing location with an M8mm bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 180 in lb.

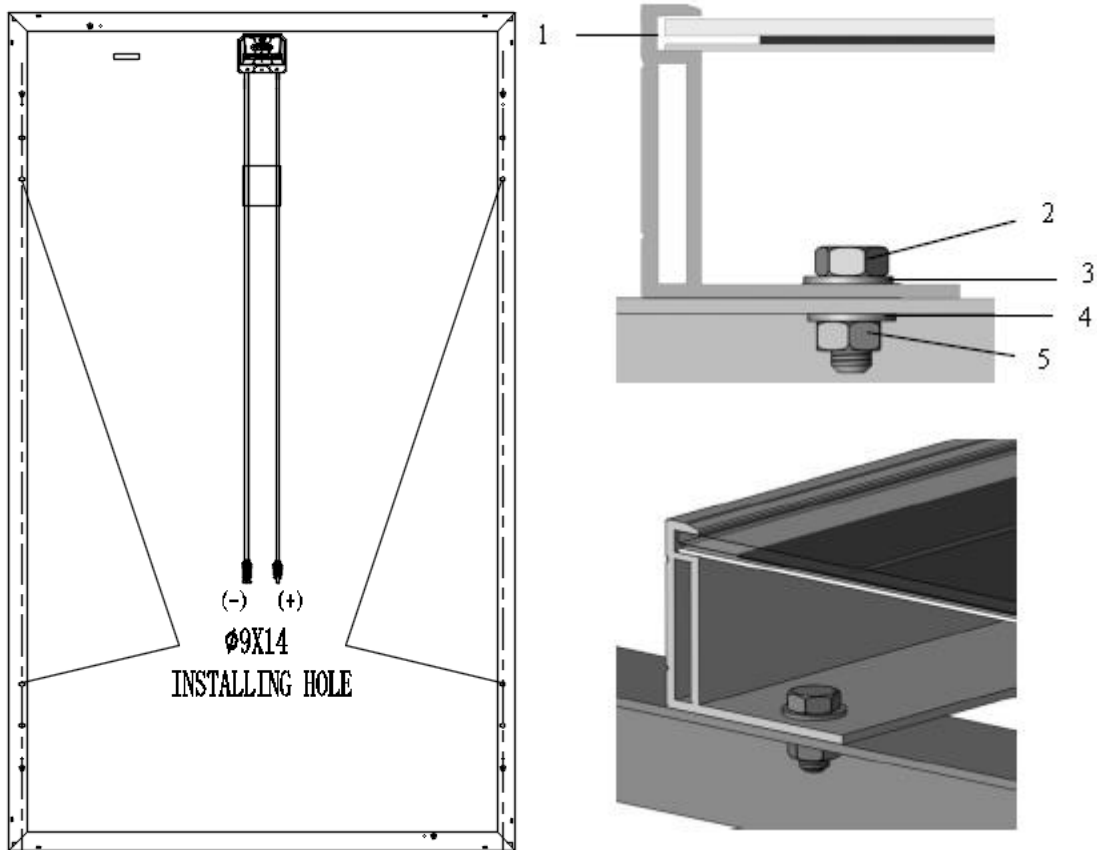
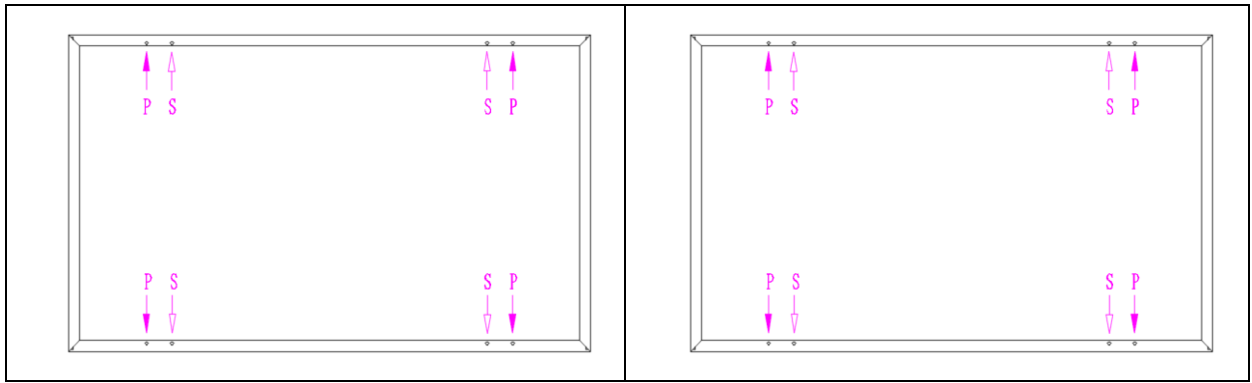


Figure1. SPV module installed with Bolt fitting method

- 1 Aluminum Frame
- 2 M8 Stainless bolt
- 3 Flat Stainless Washer
- 4 Spring Stainless Washer
- 5 HEX Stainless Nut

L≤1640mm		1640mm≤L≤1956mm	
Load≤2400Pa	Load≤3600Pa	Load≤2400Pa	Load≤3600Pa
Using 4 installation holes with S or P holes	Using 4 installation holes with S holes	Using 4 installation holes with S or P holes	Using 4 installation holes with S holes



## 7 电气连接

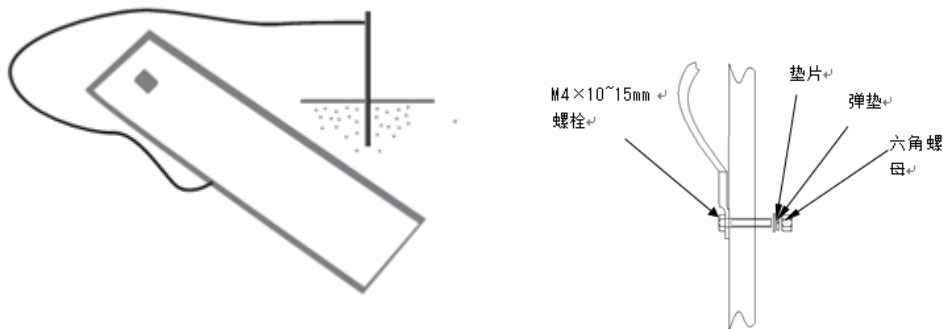
7.1 接线前请仔细阅读该光伏系统电气布线图纸,对于 IEC 标准组件最大系统电压不超过 DC1500V。

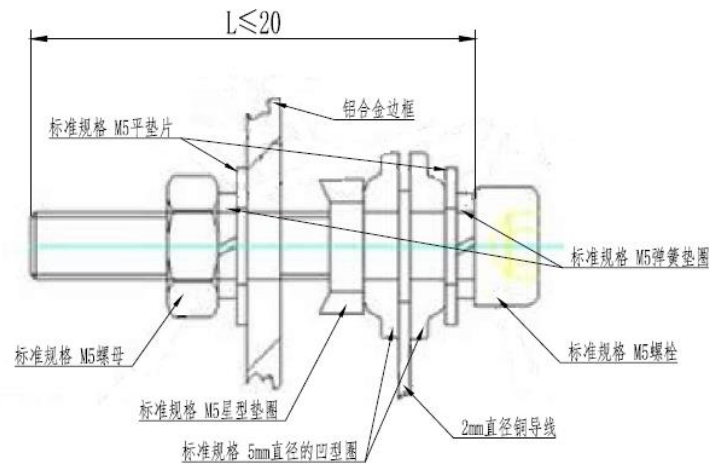
7.2 组件和接线箱的连接: 组件之间使用 PV-HT001-01 连接器连接, 接线盒内使用杨杰/强茂二极管。使用直流电缆将组件串与接线箱相连。电缆的横截面积和连接器容量必须满足系统的短路电流(用于单个组件的电缆线横截面积推荐为  $4\text{mm}^2$ , 电缆的最小直径和最大外直径是 5-7mm, 保险丝电流大于或等于 15A, 连接器的额定电流大于 15A), 否则电缆线和连接器会因为大电流而过热。请注意电缆承受温度的上限为  $90^{\circ}\text{C}$ , 连接器承受温度的上限为  $125^{\circ}\text{C}$ 。

7.3 组件铝边框和组件支架必须接地, 每个组件有四个接地孔, 并在边框上做标记(建议每个组件的串联/并联必须接地一次)。接地孔的具体位置如下图所示。接地线和边框将通过预留接地孔可靠接地, 通过安装螺栓 M4X10 ~ 15 匹配平垫圈、弹簧垫圈和螺母。组件和接地线应通过接线头完美连接。可安装负极接地逆变器, 防止 PID 现象。

7.4 如果使用常见的接地硬件(螺母、螺栓、星形垫圈、开环锁紧垫圈、平板垫圈等)用来连接接地/连接装置, 安装时必须按照接地配件制造商的说明进行。

7.5 常见的接地连接硬件项目如螺母、螺栓、星形垫圈、锁紧垫圈等还没被评估电导率的硬件, 只能用于维护机械连接, 并保持适当的接地装置的导电率。





7.6 电气连接应符合当地电气法规。

7.7 组件中装有旁路二极管（额定电压 45V，额定电流 20A）如出现不正确的安装，二极管、电缆和接线盒可能会受到破坏。

7.8 请在取出模块后，在不立即安装的情况下包装连接器，以免因风或雨造成损坏。禁止在连接器上使用润滑剂，因为它会导致连接器失效。

7.9 切勿将防水胶环从接线盒或连接器上拆下。

7.10 安装现场严禁使用柴油取暖。柴油和其他石油产品燃烧产生的气体可能导致接线盒破裂。

7.1 Please read the electrical wiring drawings carefully before wiring, when the modules followed the IEC standard, the maximum system voltage is 1500V DC.

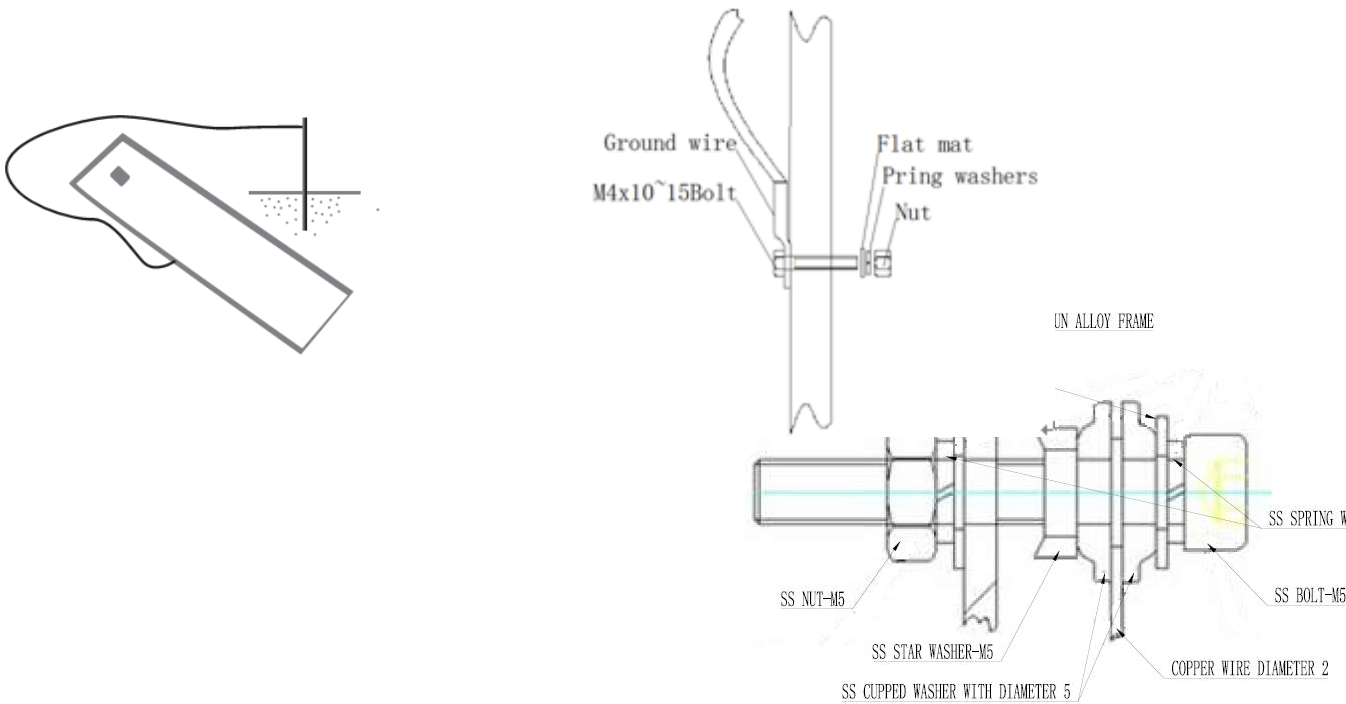
7.2 The connection of module and junction box: the module is connected with junction box by a dc cable. The cross-sectional area of cable and the connector capacity must be satisfied the system's short circuit current (the cable's cross-sectional area for a single module is recommended to be 4mm<sup>2</sup>, The outer diameter of the cable could be selected 5-7mm. The fuse current and the rated current of the connector should be higher than 15A.) Otherwise, the cables and connectors will overheat due to high current. Please note that the highest temperature of cable is 90 °C, and the highest temperature of connector is 125 °C. PV-HT001-01 connector is used to connect the module and Yang Jie/Qiangmao diode is used in the junction box.

7.3 Aluminum frame and brackets of modules must be grounded with four ground holes of each module, which is marked on frames (it is recommended that each series/parallel of modules should be grounded once). The specific location of the grounding holes can be seen as the figure below. The ground wire and

frame will be reliable grounding through the reserve grounding holes, by the installation bolts M4X10 ~ 15 matching plain washers, spring washers and nuts. Modules and ground cables shall be connected perfectly by wiring nose. Negative grounded inverters can be installed to prevent PID phenomenon.

7.4 Where common grounding hardware (nuts, bolts, star washers, split-ring lock washers, flat washers and the like) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.

7.5 Common hardware items such as nuts, bolts, star washers, lock washers and the like have not been evaluated for electrical conductivity or for use as grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity.



7.6 The electrical connection shall conform to local electrical laws and regulations.

7.7 Modules are equipped with bypass diodes (rated voltage 45V, rated current 20A); improper installation may damage diodes, cables or wiring box.

7.8 Please wrap the connectors after taking out the modules without immediate installation so as to prevent damage caused by wind or rain. Use of lubricant for connectors is prohibited, because it leads fracture of connectors.

7.9 Do not remove the waterproof rubber rings out of the junction box or connectors.

7.10 Use of diesel oil for heating is strictly prohibited at installation site, which may lead to connector failure because the gas after combustion of diesel and other petroleum products.

## 8 保养维护

检查所有的电气连接，确保没有开路，连接良好。

8.1.1 检查每个组件的开路电压：

8.1.2 用一块不透明的材料完全覆盖组件。

8.1.3 断开组件两端的导线。

8.1.4 取掉组件上的不透明材料，检查并测量终端的开路电压。

8.1.5 如果测量的电压减少 1/4 以上，可能是旁路二极管损坏，请测试旁路二极管性能。

8.2 推荐下列维护措施以确保组件的最佳性能：

8.2.1 必要时，使用软海绵或抹布沾水清洁组件的玻璃表面。可使用温和的，不加研磨剂的清洗剂去除顽垢。

8.2.2 每 6 个月进行机械和电气检查，确保组件接头清洁及连接可靠。

8.2.3 如有任何疑问，请具有资质的人员进行检查。

8.2.4 遵守系统使用的所有部件，如支架、充电整流器、逆变器、电池等的维护说明。

## 8 Maintenance

8.1 Check all electrical connections to ensure that there is no open circuit and well connected.

8.1.1 Check the open circuit voltage of each module:

8.1.2 Covered the modules completely by non-transparent material.

8.1.3 Disconnect the wire terminals

8.1.4 Remove the non-transparent material off the modules; check and measure the terminal open circuit voltage.

8.1.5 If the measured voltage is reduced by 1/4, it supposed to be bypass diode damaged. Please test the bypass diode performance.

8.2 It's recommend that adopt the following maintenance to ensure the modules maintain the best performance:

8.2.1 If necessary, Please clean the glass surface of modules by soft sponge or wiping cloth with water. A mild without abrasive cleaning agent can be used to remove stubborn dirt.

8.2.2 Mechanical and electrical checks are required every six months to ensure the modules' connectors clean and reliable connected.

8.2.3 It need ask qualified person to check the modules if have any doubt on the modules.

8.2.4 Please note that all maintenance instructions, such as brackets, charging rectifier, inverters and batteries, shall be complied.

#### 附录 A

标准的测试条件：辐照度  $1000\text{W}/\text{m}^2$ ，AM1.5，组件温度  $25^\circ\text{C}$ 。Isc、Voc 和 Pmax 的电性能如有变动，恕不另行通知。

#### Appendix A

Standard test conditions:  $A=1000\text{W}/\text{m}^2$ , AM=1.5,  $T_c=25^\circ\text{C}$ . The electrical properties of Isc, Voc and Pmax are subject to change without notice.

表 A：标准测试条件下机械和电器性能额定值。

Table A: Mechanical and electrical performance ratings under standard test conditions.

组件型号 PV Model	最大功率 Pmax (W)	开路电压 Voc (V)	短路电流 Isc (A)	工作电压 Vmp (V)	工作电流 Imp (A)	组件重量 weight (kg)	最大系统电压 Maximum system voltage (V)
HT72-156M-365	365	47.6	10.08	38.9	9.39	22.5	1000
HT72-156M-370	370	47.9	10.16	39.2	9.46	22.5	1000
HT72-156M-375	375	48.2	10.24	39.4	9.53	22.5	1000
HT72-156M-380	380	48.5	10.31	39.6	9.60	22.5	1000
HT72-156P-345	345	46.8	9.71	38.5	8.98	22.5	1000
HT72-156P-350	350	47.1	9.79	38.8	9.04	22.5	1000
HT60-156M-305	305	39.8	10.06	32.8	9.32	18.5	1000
HT60-156M-310	310	40.1	10.16	33.1	9.38	18.5	1000
HT60-156M-315	315	40.4	10.26	33.4	9.44	18.5	1000
HT60-156P-285	285	38.7	9.69	31.5	9.06	18.5	1000
HT60-156P-290	290	38.9	9.82	31.7	9.16	18.5	1000

温度系数:

类别	多晶	单晶
Pm	-0.41%	-0.39%
Voc	-0.32%	-0.29%
Isc	0.05%	0.049%