

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	1 / 56

## 210 PV Module Installation Instructions



**Shanghai Aerospace Automobile Electromechanical Co., Ltd.**

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	2 / 56

## Contents

1. Basic Information.....	3
1.1 Preface Introduction .....	3
1.2 Warnings.....	3
1.3 Product Identification .....	5
2 System Design.....	6
2.1 Climatic Conditions.....	6
2.2 Location Selection.....	6
2.3 Installation Inclination Angle Selection .....	8
2.4 Choose the Photovoltaic Support .....	8
2.5 Choosing the Photovoltaic Inverter .....	9
2.6 Bifacial Module Arrangement and Layout Optimization .....	10
3 Installation.....	11
3.1 Installation Safety.....	11
3.2 Modules Unpacking .....	12
3.3 Introduction of Installation Method .....	15
3.4 Installation of Bolts .....	16
3.5 Installation of Clamps .....	19
3.6 Dual-glass Installation of Single-axis Tracking System.....	21
4 Electrical Connection .....	22
4.1 Precautions for Electrical Connection.....	22
4.2 Wiring and Connections .....	24
4.3 Structure of PV station .....	26
5 Maintenance .....	27
6 Disclaimer .....	29

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	3 / 56

## 1. Basic Information

### 1.1 Preface Introduction

Thanks for choosing PV modules of Shanghai Aerospace Automobile Electromechanical Co., Ltd..

The PV modules in this manual means 210 series which were manufactured or sold by our company.

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

All instructions should be read carefully before installation. Please contact our sales department for more information if you have any question.

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

According to IEC61730 standard, the safety class of solar module is class II; the fire protection grade of single glass solar module is class C , the fire protection grade of Dual-glass solar module is class A(refer to UL790).

### 1.2 Warnings

1.2.1 It requires specialized skills and knowledge for installation of solar photovoltaic systems. It should be operated by professional installation personnel who have qualified licensed.

1.2.2 When the modules are exposed to sunlight or other light sources, DC current is generated in the modules. At this time, if touching the electrical part of the modules, it may happen electric shock hazard.

1.2.3 The modules could be installed in outside environment, such as ground, roofs etc. If the modules are installed on the roof, the roof should have a certain fire protection capability. It can consult the local construction department to decide the roof material. Do not use this module to replace the whole or partial roofs/walls of living buildings. The system designer or installer have responsible for reasonable support structure.

1.2.4 Do not disconnect any of the modules connector during work.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	4 / 56

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

1.2.6 Do not place the modules near a supply/storage of combustible gases.

1.2.7 Do not use Artificially concentrated sunlight on the module. Do not expose the back of the module to sunlight for a long time.

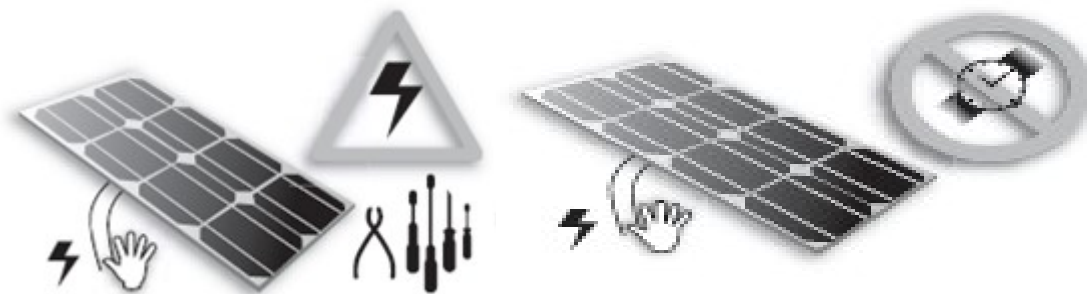
1.2.8 Avoid dropping or covering on the modules. Do not tread, stand or walk on modules, because there is a risk of damage to the module and harm to person.



1.2.9 Avoid moving the modules by pulling cables or the junction box.

1.2.10 Keep children away from modules during transportation and installation.

1.2.11 Avoid wearing metal rings, bracelet, earrings, nose rings, lip rings or any metal accessories during transportation and installation of the modules. Do not touch electrical part of the modules by hand without any insulated protection. Use insulated tools which satisfy electrical requirement to connect electrical parts of the modules.



1.2.12 During transportation of the modules, please make sure that any impact and strenuous vibration should be avoid. The impact and strenuous vibration have possible to lead cracks of solar cell in the modules. When the modules arrive the destination, before installation, the module should be placed on the flat ground with protection which has ability to avoid moisture, wind, rain and snow. Please unpack

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	5 / 56

carefully.

1.2.13 Avoid any damage of the glass of the module, which can protect the modules. Avoid any damage of the seal on the edge of the modules. Without seal protection, the modules have risk of destroy. The damage modules have risk of electric shock or fire. The damage module can't be repaired. If there is any damage on the modules, please replace the modules immediately.

1.2.14 In order to reduce the risk of electric shock or combustion, opaque material can be used to cover the front surface of the modules during installation.

1.2.15 Installers should make sure firm connections between the rack and PV module without loose connections.

1.2.16 The frame and support of all modules should be grounded correctly, according to “National Electrical Code”.

1.2.17 Do not clean the modules with corrosive chemicals.

1.2.18 It is possible to affect fire resistance of the house if roof-mounted. For roof application, the estimate of fire control level of module system should combine module and roof condition. Only correct installation, which accords to installation instruction, the fire resistance of module system is effective.

1.2.19 During the storage, transportation, installation and maintenance of components, it is strictly prohibited to contact with any form of oil stain or corrosive chemical reagent.

### 1.3 Product Identification

1.3.1 Each module has a label on the back, generally 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.

1.3.2 Bar code (serial number): each module is registered with a unique serial number. It is fixed in the module permanently. It can see the bar code in front of the module.



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	6 / 56

Figure1 Bar Code

1.3.2.1 The barcodes of the conventional modules consist of 14 characters and underlines with unique module numbers, whose definition is as below: the first 8 characters are made up of factory code with 2 characters, date code with 3 characters and order serial number with 3 characters and followed by a dash. The 6 characters after dash are module production serial numbers. The module number of one work order cannot exceed 999,999 pieces.

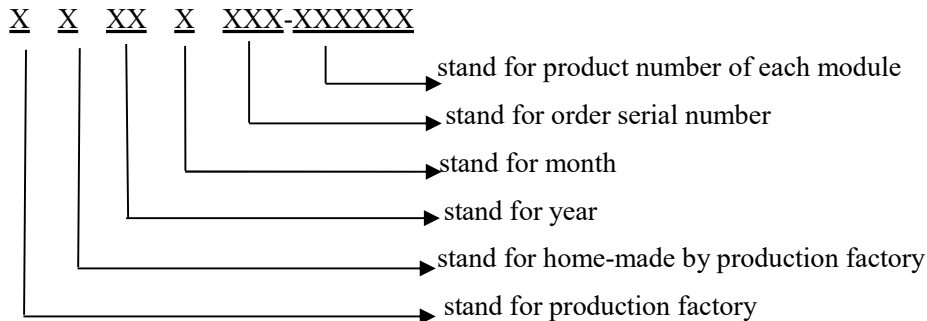


Figure2 Bar code meaning

## 2 System Design

### 2.1 Climatic Conditions

2.1.1 Relative humidity: < 85%.

2.1.2 The operating temperature of the module is - 40 °C - 85 °C.

Note: When calculating the mechanical load of components (including the pressure of wind and snow), the installation method and installation site should be considered. The calculation of mechanical load must be carried out by professional personnel according to the design requirements of the system.

### 2.2 Location Selection

2.2.1 The maximum altitude for PV module is 2000m.

2.2.2 At standard test conditions (1000W / m<sup>2</sup> irradiance, AM 1.5 spectrum, 25 ° C (77 ° F) ambient temperature), the test error of module electrical performance parameters of modules, such as I<sub>sc</sub>, V<sub>oc</sub>, and P<sub>max</sub>, is ±3% for P<sub>max</sub> and ±5% for V<sub>oc</sub> and I<sub>sc</sub>.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	7 / 56

2.2.3 In the northern hemisphere, it advises that the modules face to south direction. In the southern hemisphere, it advises that modules face to north direction.

2.2.4 The tilt angle of the PV module is the angle between the surface of the PV module and a horizontal ground surface (as shows in Figure). The PV module generates maximum output power when it faces the sun vertically. It is recommended that the installation angle of the module is bigger than 10 degrees. If you want the specific information of the best install tilt angle, please consult reliable local photovoltaic system installation companies.

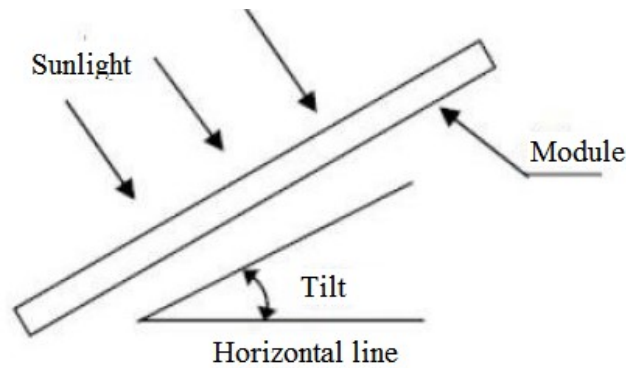



Figure 3 PV module tilt angle

2.2.5 The modules should be installed in the position where is full of sun exposure without shadow at any time.

2.2.6 All modules are compliant with the salt mist test, (Optional) therefore the modules can be installed as below:

Item	From the sea	Installation	Maintenance	Quality power guarantee
1	Distance $\geq$ 500m	Standard	Standard	Under standard warranty

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	8 / 56
2	50m<Distance<500 m	Corrosion protection	Generally and additionally	Under standard warranty
3	Distance ≤50m	Not recommended	——	——

2.2.7 When a storage battery is used in the photovoltaic system, the battery must be installed correctly. Therefore, it can protect the safety of photovoltaic system. The installation of the storage battery should follow the instructions of storage battery manufacturer.

2.2.8 It is recommended that the height of the module is 0.3-1m higher than actual environment.

## 2.3 Installation Inclination Angle Selection

2.3.1 PV modules connected in series should be installed in the same orientation and angle.

2.3.2 If connected to an independent photovoltaic system, the installation angle of the module should be based on the season and light conditions to achieve the maximum power output. At the lowest illumination intensity, if the power generated by module with certain angle can satisfy the lowest power generation, it is think that the modules with the certain angle can satisfy the power generation all year around. For grid-connected system, the installation angle of modules depends on the max power generation all year around.

## 2.4 Choose the Photovoltaic Support

The system designer or installer have responsible for calculation the system load to make sure all module can support the estimated load. The module support manufactures should supply qualified module supports. The support, which is used for photovoltaic system, should has the third test institution certification about static mechanical analysis ability.



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	9 / 56

## 2.5 Choosing the Photovoltaic Inverter

When choosing photovoltaic inverter, it needs consider the power, open-circuit voltage, short-circuit current of PV modules array. The minimum voltage of the module array should be higher than the threshold voltage of inverters to guarantee the inverters regular work.

### 2.5.1 Calculation of modules' number in series array

Please use the suitable equipment, connectors, wires and rack which match with solar power system. Please make sure the type of the modules is same in a single PV system. When determining rated voltage, wire capacity, fuse, the controller capacity and module output power of relevant parts of PV system, please accord to the short-circuit current ( $I_{sc}$ ) and open circuit voltage ( $V_{oc}$ ) showing on modules' label to determine suitable parameters.

In normal outdoor conditions, the current and voltage generated by module may be different from the parameters listed in Table. The parameter list in table is measured under standard test conditions (STC). In different outside climate surrounding, because of different power generation coefficient, the actual parameters, including rated voltage, wire capacity, fuse, the controller capacity and module power output, is different if modules working in different area. In order to get the actual module's electrical parameters, usually, the photovoltaic system designers or installers can use short-circuit current ( $I_{sc}$ ) and open circuit voltage ( $V_{oc}$ ) noted on modules' label multiply by 1.25 (redundant value). If the bifacial modules are installed at high reflective surrounding, the redundant value can increase suitably.

Please make sure the system voltage of each modules' array is lower than the maximum voltage of photovoltaic system, rated voltaic of inverter and controller. The system current of each modules' array is less than maximum current of photovoltaic system, rated current of inverter and controller.

The connection of modules: According to the system requirement of output voltage and current, modules are connected in series or parallel. The maximum number of modules in series (N) is equal to the number of the maximum system voltage ( $V_{max}$ ) divided by the open circuit voltage ( $V_{oc}$ ) of each module. The number of modules in parallel has relate to the parameters of electrical equipment (such as inverter

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	10 / 56

and controller) in STC.

$$N \leq \frac{V_{max}}{V_{oc} * [1 + T_c(voc) * (T_{min} - 25)]}$$

N Number of modules in series.

V<sub>max</sub> Maximum system voltage

V<sub>oc</sub> Open circuit voltage of each module(refer to product label or data sheet).

T<sub>c</sub>(voc) Thermal coefficient of open circuit voltage for the module(refer to data sheet).

T<sub>min</sub> The lowest ambient temperature.

## 2.6 Bifacial Module Arrangement and Layout Optimization

Generally, for normal modules' array, there are 2 methods of module connection. The first method connects the upper module and the under module in series. The second method separates the upper and the under modules. All upper modules connect in series, and all under modules connect in series separately. There is significant height difference between upper and under modules. The significant height difference lead to light illumination difference between upper and under modules. The light illumination difference lead different working current of the module. If choosing the first method, the under module, which has lower working current, will decrease the working current of the upper module. The decreasing of upper modules' working current will reduce the whole power generation of photovoltaic system. When choosing the second method, the upper modules and the under modules have different working current. It can decrease power loss due to working current mismatch, which improves the advantage of bifacial modules and increases whole power generation of photovoltaic system. The light illumination rises with height increasing at the same outside surrounding. Therefore, the upper modules have higher light illumination than the under modules. In order to declining the current mismatch, we advise the second modules connection method. At the same time, please connect the upper/under modules' array to the different MPPTs of the inverter individually. This is the best method of modules' array connection for photovoltaic system.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	11 / 56

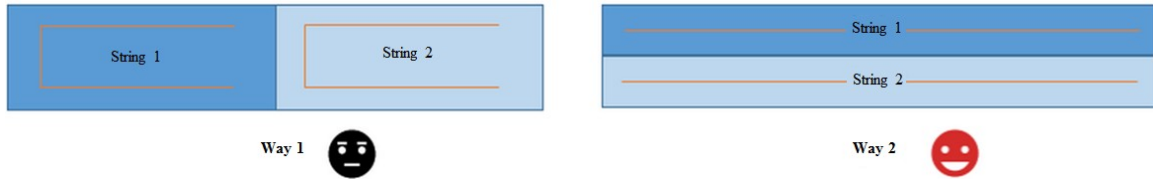


Figure 4 Optimization of modules' array connection

### 3 Installation

#### 3.1 Installation Safety

3.1.1 Wear protective headgear, insulating gloves and rubber shoes when modules are installed.

3.1.2 During installation, avoid standing on the modules, which will lead to damage of modules, or hazard human safety. Avoid unnecessary touching of modules. The surface and frame of modules may be very hot, which may lead to burn or electric shock.

3.1.3 Don't unpack the outside packing of modules except to install immediately. Avoid installing in rainy, snowy or windy weather.

3.1.4 In order to reduce hazard of electric shock, if the junction box connectors are wet, stop installing.

3.1.5 During installing, do not throw anything, including modules and installation tools.

3.1.6 Please make sure connecting junction box correctly. Confirm that you hear a "click" to indicate that the connection is successful. Checking wiring status to ensure that all strong connection without broken. Take adequate measure to avoid any scratch which may damage the cables or pressure which may damage the module.

3.1.7 During installation or sunshine, avoid touching the junction boxes or connectors no matter what the modules are connecting with photovoltaic system or not.

3.1.8 Avoid pressing or putting something heavy on the module's surface or distorting the module's frame.

3.1.9 Avoid setting overweight things or hitting on the module's surface glass, which may lead damage or microcrack of the solar cell.

3.1.10 Avoid cleaning the modules with sharp tools, which may lead to scratch on the surface of

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	12 / 56

modules.

3.1.11 Avoid digging holes on the module's frame without permission.

3.1.12 For BIPV or roof application, please installing in plan. Please follow the installation rules of "from top to bottom" or / and "from left to right" as much as possible.

3.1.13 Anti-tilting measures should be taken. It is prohibited to unpack on nonhorizontal or soft grounds to avoid personal injury or even death.

### 3.2 Modules Unpacking

3.2.1 When the modules arrival to destination, avoid unpacking modules in humid and rainy weather.

3.2.2 After unpacking, the modules should be placed horizontally. Avoid tilt, pressure, leaning on the wall of the modules.

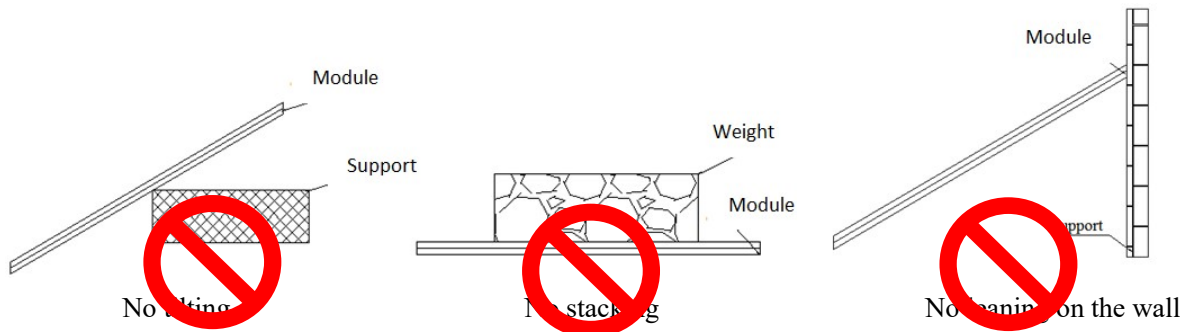


Figure 5 Modules stack illustration

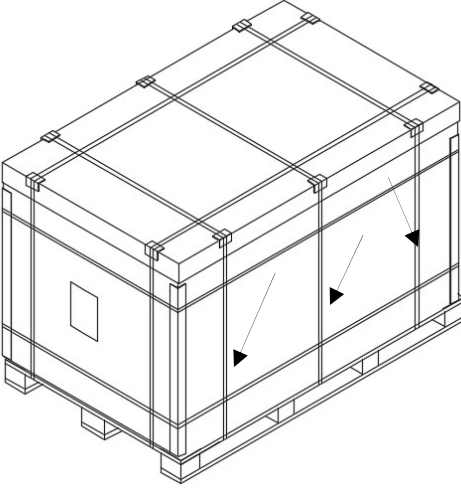
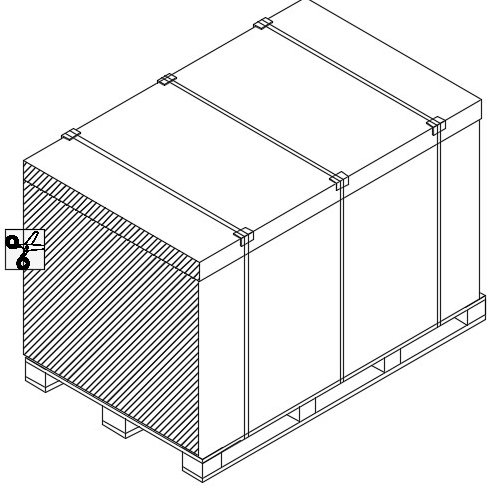
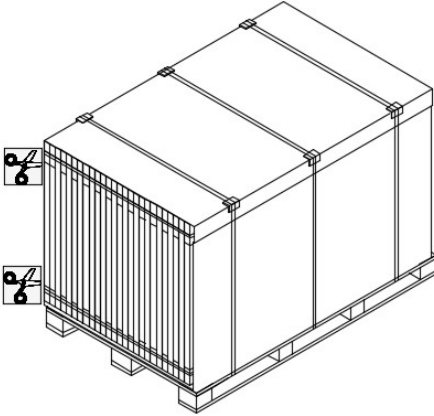
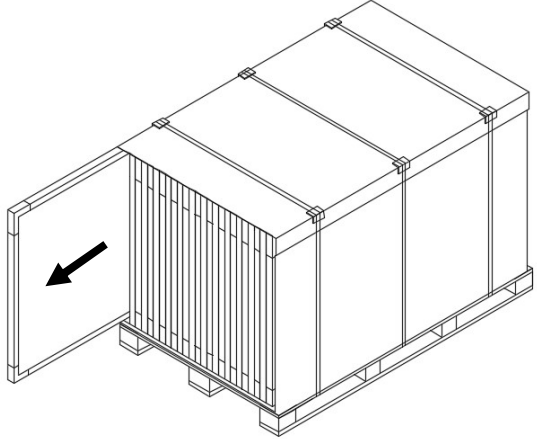
3.2.3 The modules of two batches are separated and stacked neatly. Stacking of modules should be limited to no more than 12 modules and frames should be aligned with one another on the pile.

3.2.4 Unpacking process should follow the instructions as the figure below. Avoid rude operation or using crowbar to open the boxes. Pay attention to person and modules safety during unpacking.

3.2.5 After unloading, the modules' box should be placed on dry and flat ground, without wet, muddy and uneven ground condition.

3.2.6 After arriving the destination, the upper and lower modules' boxes should be separated and placed separately without stack. If the modules cannot be installed immediately, it should be care to protect the package of modules' boxes. Avoid any packing damage from natural disasters such as rain, snow, hail, typhoon, etc.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	13 / 56

Unpacking process(Horizontal type)	
	
1. Do not remove the 3 packing belts indicated by the arrow, and remove the other packing belts of the package.	2. Remove one side of the package (shaded part).
	
3. Cut the two horizontal packing belts in the carton.	4. Disassembly modules from side. According actual surrounding, avoid tipping over or sliding of unpacking modules.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	14 / 56

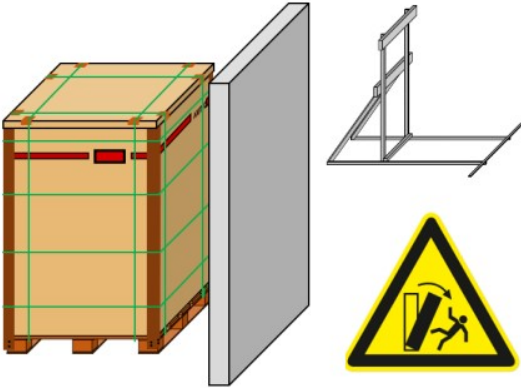
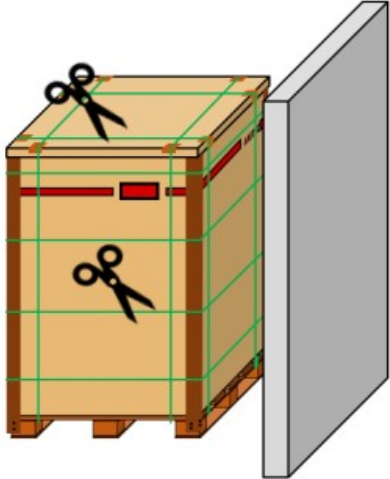
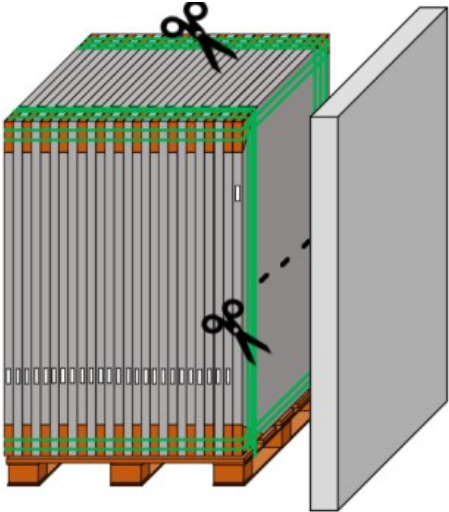
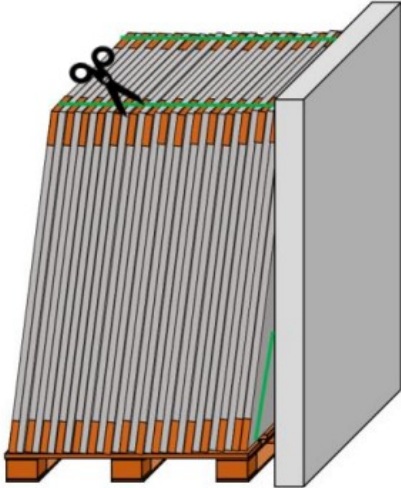
Unpacking process(Vertical type)	
	
1. Place the pallet on a flat ground next to a solid wall or other support possibility.	2. Remove strapping and packaging box(There are Velcro strips on the diagonal of the packing case to facilitate quick unpacking).
	
3. Remove strapping from modules( leave two straps on the module package, see next picture).	4. Lean the banded module package against the support / wall. Remove last strapping. Modules can be taken individually from the pallet.

Figure 6 Unpacking process

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	15 / 56

### 3.3 Introduction of Installation Method

The modules can be installed in the following methods: bolt installation and clamp installation.

3.3.1 All installation methods described in this instruction are only for reference. Our company is not responsible for providing relevant installation parts, design and installation of component system.

Mechanical loading and safety should be finished by a professional photovoltaic system installer or PV system technicians.

3.3.2 Before installation, the following important items need to be confirmed:

a) Before installation, it is necessary to check than if there is any defects or other foreign matter which is related with appearance and the safety performance of the junction box. If there is any problem, please solve the problem.

b) Please make sure that the serial number of the module is correct.

3.3.3 The applicable regulations pertaining to work safety, accident prevention and securing the construction site must be observed. Workers and third party personnel shall wear or install fall arrest equipment. Any third party need to be protected against injuries and damages.

3.3.4 The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with all applicable local codes and requirements from all relevant authorities. Incorrect installation will void the limited warranty.

3.3.5 Use appropriate corrosion-proof fastening materials. All mounting hardware (bolts, spring washers, flat washers, nuts) should be hot dip galvanized or stainless steel.

3.3.6 Use a torque wrench for installation.

3.3.7 Do not drill additional holes or modify the module frame. Doing so will void the warranty.

3.3.8 Depending on local weather, such as wind and snow condition, additional clamps may be required to ensure that modules have enough support. (In case of severe environment such as storm and heavy snow, it is recommended to use extra clamps for installation. Please contact with our technical support for further information.)

3.3.9 The loads described in this manual correspond to test loads. For installations complying with UL

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	16 / 56

61730 and IEC 61215-2:2016, a safety factor of 1.5 should be applied for calculating the equivalent maximum authorized design loads. Project design loads depend on construction, applicable standards, location and local climate. Determination of the design loads is the responsibility of the racking suppliers and/or professional engineers. For detailed information, please follow local structural code or contact your professional structural engineer.

### 3.4 Installation of Bolts

The mechanical load test with these mounting methods were performed according to IEC 61215.

Modules should be bolted to supporting structures through the mounting holes in the rear frame flanges only.

Each module must be securely fastened at a minimum of 4 points on two opposite sides. According to the diagram below, spring washers, flat washers must be used. The size and thickness must be no less than the standard size of the national standard.

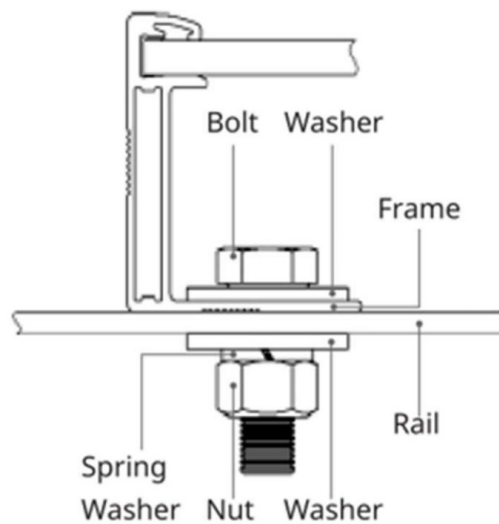


Figure7 Schematic diagram

M8 × 1.25 - Grade 8.8 (5/16"-18 Grade B7) galvanized or A2-70 stainless steel bolt and nut should be used.

The yield strength of bolt and nut should not be less than 450MPa.

Tightening torques should be within 16~20 Nm (11.8~14.75 ft-lbs) for M8 (5/16") coarse thread bolts,



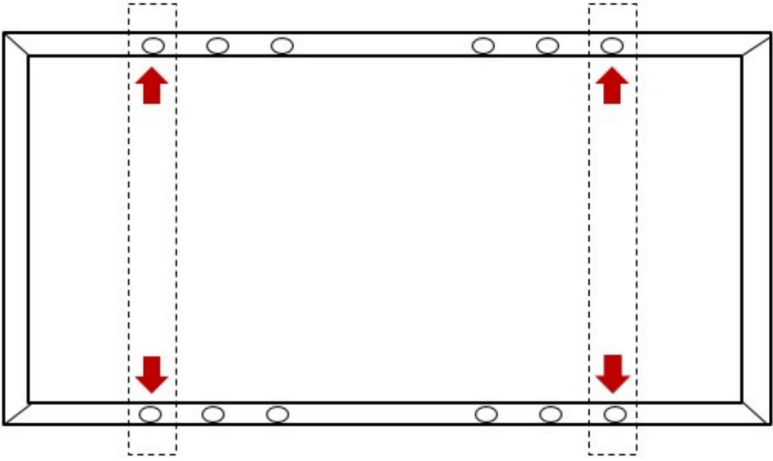
	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	17 / 56

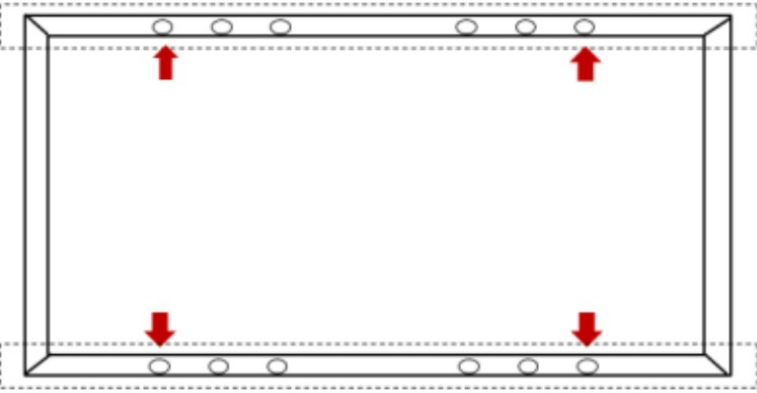
depending on bolt class.

In areas with heavy wind loads, additional mounting points should be used. The system designer and the installer are responsible for correctly calculating the loads and ensuring that the supporting structure meets all the applicable requirements.

Modules should be bolted at the following hole locations depending on the configuration and loads:

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	18 / 56

Installation of Bolts method A		
NO.	Module Types	Outer four holes installation
		Test Load $\leq$ 5400Pa (front), 2400 Pa (back)
1	HT66-210	
2	HT60-210	
3	HT66-210(PD)-F	
4	HT60-210(PD)-F	

Installation of Bolts method B		
NO.	Module Types	Outer four holes installation
		Test Load $\leq$ 3600Pa (front), 2400 Pa (back)
1	HT66-210(PD)-F	
2	HT60-210(PD)-F	

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	19 / 56

### 3.5 Installation of Clamps

The mechanical load test with these mounting methods were performed according to IEC 61215.

Each module must be securely fastened at a minimum of four points on two opposite sides. The clamps should be positioned symmetrically. The clamps should be positioned according to the authorized position ranges defined in table below.

Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer. M8 X 1.25 - Grade 8.8 (5/16"-18 Grade B7) galvanized or A2-70 stainless steel bolt and nut should be used. Tightening torques should be within 16~20 Nm (11.8~14.75 ft-lbs) for M8 (5/16"-18 Grade B7) coarse thread bolts, depending on the bolt class. For the bolt grade, the technical guideline from the fastener suppliers should be followed. Different recommendations from specific clamping hardware suppliers should prevail. The system designer and installer are responsible for load calculations and for proper design of support structure.

When installing inter-modules or end-type clamps, please take the following measures into account:

1. Do not bend the module frame.
2. Do not touch or cast shadows on the front glass.
3. Do not damage the surface of the frame (to the exception of the clamps with bonding pins).
4. Ensure the clamps overlap the module frame by at least 10 mm (0.4 in).
5. Overlap in length by at least
  - a) 80 mm (3.15 in) when  $2400 \text{ Pa} < \text{uplift load} \leq 4000 \text{ Pa}$  is required.
  - b) 40 mm (1.57 in) when  $\text{uplift load} \leq 2400 \text{ Pa}$  is required.
6. Ensure the clamp thickness is at least 3 mm (0.12 in). Clamp material should be anodized aluminum alloy or stainless steel.

Clamp positions are of crucial importance for the reliability of the installation. The clamp centerlines must only be positioned within the ranges indicated in table below, depending on the configuration and load.

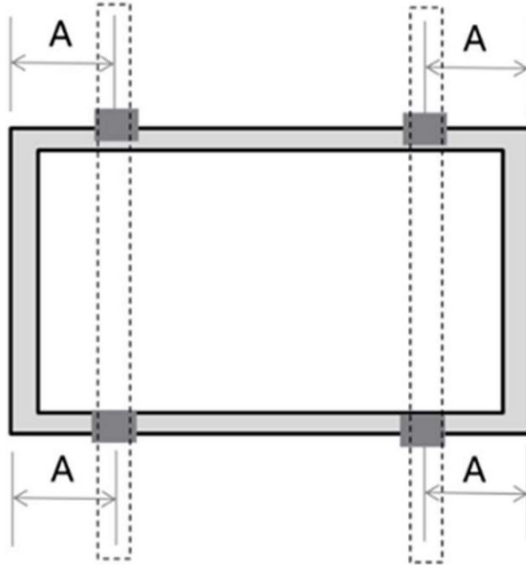
For configurations where the mounting rails run parallel to the frame, precautions should be taken to

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	20 / 56

ensure the bottom flange of the module frame overlaps the rail by at least 15 mm (0.59 in).

Improper clamps or unsuitable installation methods will void the limited warranty.

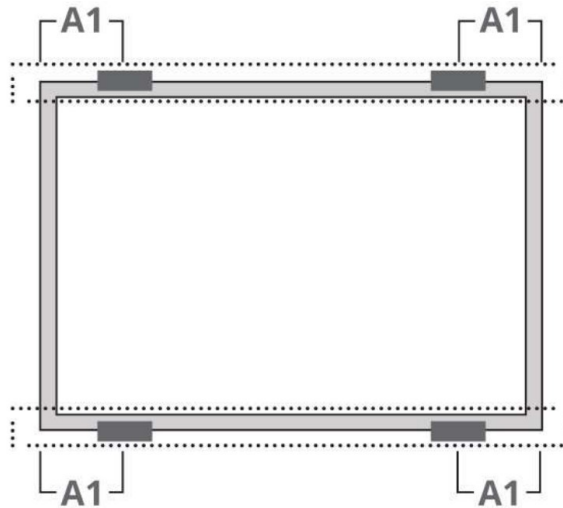
3.5.1 Four clamps on long side of frame and rails perpendicularly to the long side frame



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	21 / 56

NO.	Module Types	Max Mechanical Load (Pa)	
		front 2400 back2400	front 5400 back2400
		A Range (mm)	
1	HT66-210	300-600	400-500
2	HT60-210	300-600	400-500
3	HT66-210(PD)-F	/	400-500
4	HT60-210(PD)-F	/	400-500

3.5.2 Four clamps on long side of frame and rails parallel to the long side frame.



NO.	Module Types	Max Mechanical Load (Pa)	
		front 3000 back 2400	front 3600 back 2400
		A1 Range (mm)	
1	HT60-210	365-435	/
2	HT66-210(PD)-F	/	400-500
3	HT60-210(PD)-F	/	400-500

### 3.6 Dual-glass Installation of Single-axis Tracking System

Dual-glass modules have installation holes on the frame, which use for installation of single-axis tracking system. These installation holes, including normal holes and single-axis tracking holes, is good for

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	22 / 56

press distribution and achieve strong support structure. With help of installation holes on the aluminum frame of the module, bolts can be used to connect module and support. The detail of installation is showed in follow figure. Use M6 bolt and flat washers, spring washer and nut for connection between modules and supports. Tighten the bolts until the torque reach 16-20N.m (0.63-0.79 inches). The modules connected with single-axis tracking system needs special stainless-steel washers with a minimum thickness of 1.5mm and an external diameter of 16-20mm (0.63-0.79 inches). In this install method, the maximum test load of the front is 2400pa, the test load of the back is 2400pa.

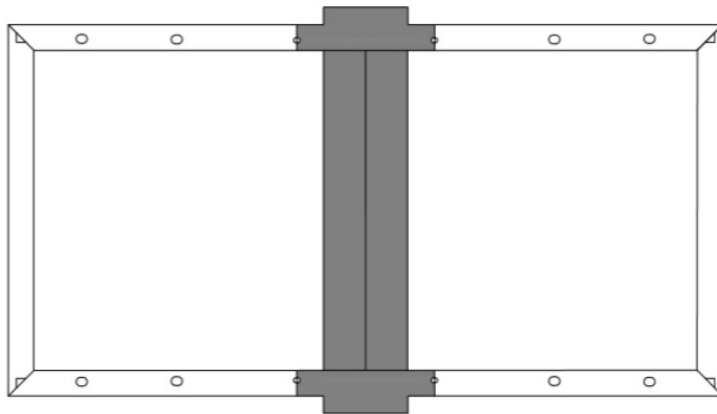


Figure 8 Installation diagram of module with single-axis tracking system

## 4 Electrical Connection

### 4.1 Precautions for Electrical Connection

4.1.1 Please read the electrical wiring drawings carefully before wiring. The wiring should accord to local law and program and be operated by certificated electricians. The maximum voltage of the system must be lower than the maximum certified voltage and the maximum input voltage of the inverter and other electrical devices installed in the system.

4.1.2 The connection between module and junction box: the module is connected with junction box by the dc cable. The cross-sectional area of cable and the connector capacity must be satisfied with the system's short circuit current. The cable's cross-sectional area for a single module is recommended to be  $6\text{mm}^2$  ( $4\text{mm}^2$  at least) . The fuse current and the rated current of the single glass solar module's connector should be higher than 30A (35A for dual- glass solar module). The correction factor of a fuse shall be

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	23 / 56

determined by an authorized professional electrical engineer in accordance with the relevant design regulations and system simulation results. The maximum series fuse rating value provided by our company is for reference only. We do not responsible for determining the minimum rating of fuse. 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.

4.1.3 The aluminum frame and support of the module must be grounded, as shown in Figure 9. Each module has a grounding hole and is marked on the frame (it is recommended that the series / parallel connection of each module must be grounded once). The installation method of grounding bolt is shown in FIG. 10. The grounding wire and frame can be reliably grounded by the prepared grounding hole. And the flat washers, spring washers and nuts are matched by installing bolts M5 × 10 ~ 15. The modules and the earth wire shall be perfectly connected by connecting plugs. Negative grounding inverter can be installed to prevent PID phenomenon.

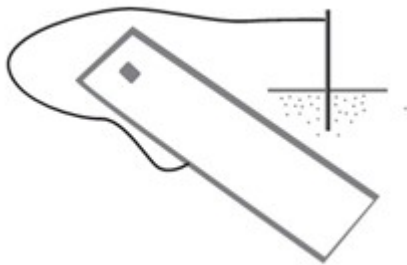


Figure 9 Module grounding circuit

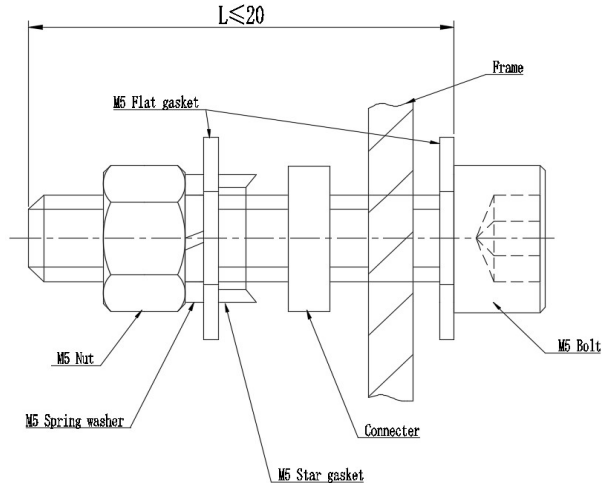


Figure 10 Installation diagram of grounding bolt

4.1.4 Common hardware parts, such as nuts, bolts, star washers, lock washers, flat washers, are used for grounding/connecting. The installation of such hardware parts should comply with instructions of manufacturers.

4.1.5 The common grounding parts, such as nuts, bolts, star washers, lock washers, which have not been evaluated for electrical conductivity, are only to use for mechanical connection. And the grounding

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	24 / 56

parts of the module should keep suitable conductivity. These grounding parts, which supply the evaluation of UL 1703 as the same as modules, can use for module's installation according to installation instruction.

4.1.6 The electrical connection shall conform to local electrical laws and regulations. Avoid "Y" type electrical connection mode in module system electrical connection.

4.1.7 Modules are equipped with bypass diodes (single glass solar module rated voltage 50V, rated current 30A; dual-glass solar module rated voltage 50V, rated current 35A). The improper installation may damage diodes, cables or junction box.

4.1.8 If the modules unpack without installation immediately, please protect module connectors in order to avoid damage due to wind or rain. Avoid lubricant on module's connectors. The connectors shall not be exposed to the sun

4.1.9 Avoid removing the waterproof rubber rings out from the junction box or connectors.

4.1.10 Avoid using diesel oil to keep warm in installation site, because the gas generated by diesel oil or other petroleum products may destroy module's connector.

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

## 4.2 Wiring and Connections

Ensure that the wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, this indicates that there is a wiring fault.

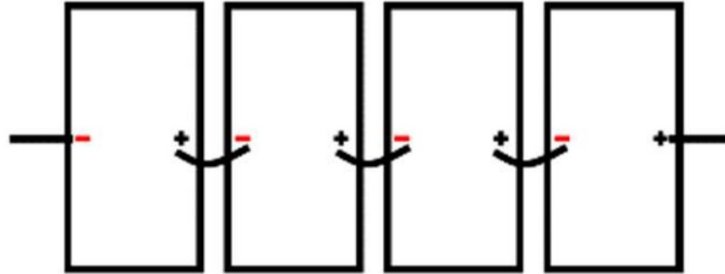
When modules have been installed, but the system has not been connected to the grid yet, each module string should be kept under open-circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.

Recommended wiring method:

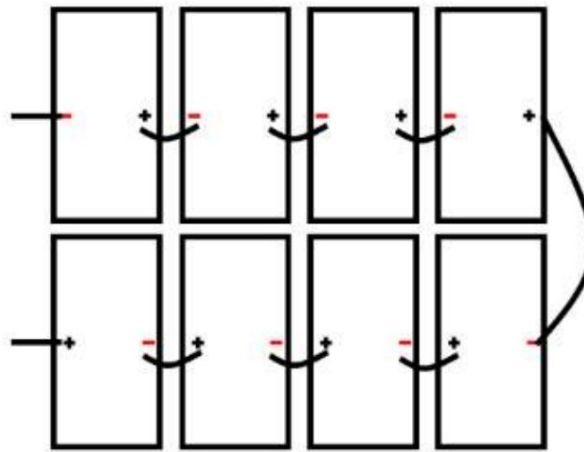


	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	25 / 56

Single Portrait Installation

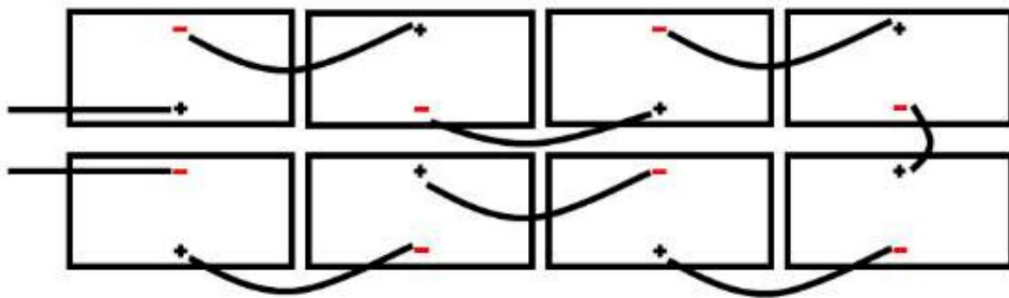


Double Portrait Installation



Landscape Installation

(Need to customize cable length or add extension cable)



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. Modules with different electric performance models can not be connected in one string.

If there has reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module. If quantity of parallel

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	26 / 56

connection is more than 2, there must be an overcurrent protection device on each string of module.

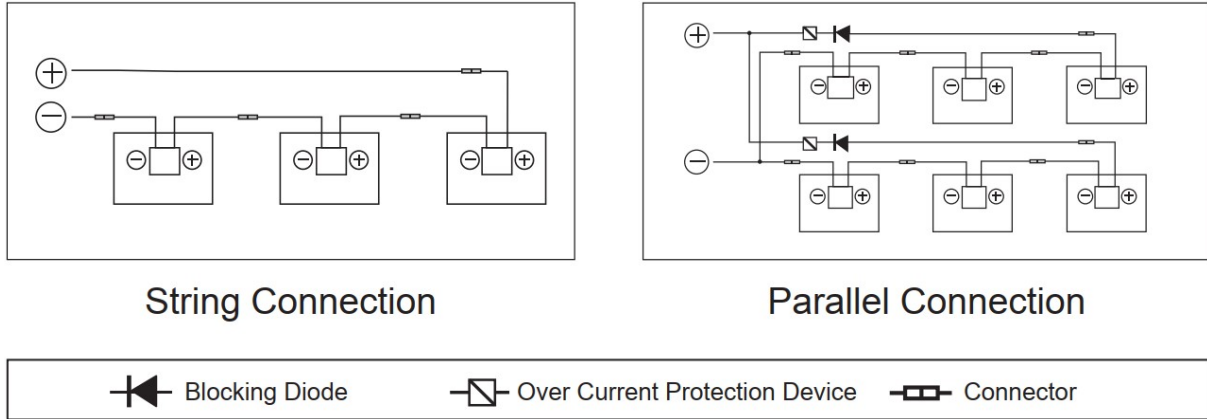
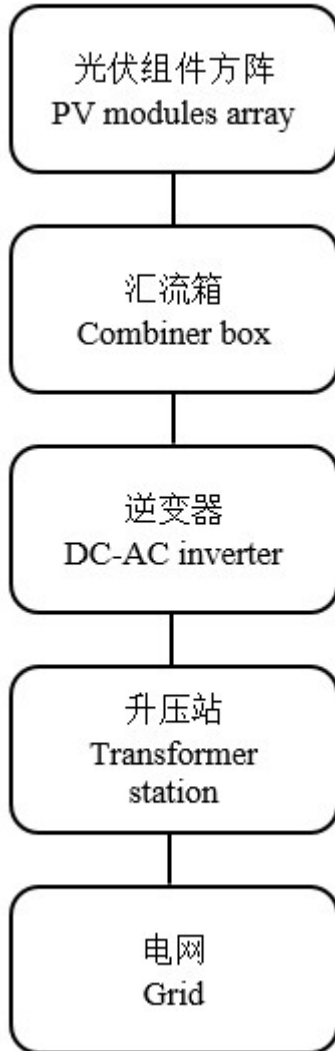


Figure 11 Series connection and parallel connection circuit diagram

### 4.3 Structure of PV station

The following figure shows the structure of a simple PV station. The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with all applicable local codes and requirements from all relevant authorities.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	27 / 56



## 5 Maintenance

The modules need to be inspected and maintained regularly by qualified personnel only, Wearing safety protection articles. including visual inspection and all electrical connections to ensure that there is stable connection without any broken.

Do not make modifications to any component of the PV module (diode, junction box, connectors or others).

Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots, and dust.

Modules with sufficient tilt (at least 15°), generally may not require cleaning (rain will have a

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	28 / 56

self-cleaning effect). If the module has become soiled, wash with water and a non-abrasive cleaning implement (sponge) during the cool part of the day. Do not scrape or rub dry dirt away, as this may cause micro scratches.

Periodically inspect the system to check the integrity of all wiring and supports.

To protect against electric shock or injury, electrical or mechanical inspections and maintenance should be performed by qualified personnel only. • It's recommended that adopt the following maintenance to ensure the modules maintain the best performance:

Check whether the modules have any appearance defect: such as surface damage, abnormal or shadow. Make sure that the module support system is stable without any loose part. If finding any abnormal situation, please contact professionals to adjust or repair.

Clean modules at least one time each year, depending on local conditions. If the surface of the module becomes dirty, the power generation of the modules reduces. In this situation, you can use soft sponge or water to clean the surface glass of the module. Mild, non-abrasive chemical cleaners can be used to help washing modules. Avoid using any corrosion chemical cleaners. In order to reduce electric shock or burns, it is recommended to clean modules in the morning or evening.

Check mechanical and electrical property of modules every six months to ensure the modules' connectors clean and reliable. And ensure good electrical connection and no corrosion.

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

Meaning of crossed-out wheeled dustbin:



Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.

Contact your local government for information regarding the collection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	29 / 56

When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals.

## 6 Disclaimer

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond the control of Shanghai Aerospace Automobile Electromechanical Co., Ltd. We do not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

No responsibility is assumed by Shanghai Aerospace Automobile Electromechanical Co., Ltd. for any infringement of patents or other rights of third parties, which may result from use of the PV product. NO license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on our knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. We reserve the right to change the manual, the PV produce, the specifications, or product information sheets without prior notice.

### Importer information

Company: ASC Energy Pty Ltd.

ABN: 99156499133

Web: [ascenergy.com.au](http://ascenergy.com.au)

Email: [info@ascenergy.com.au](mailto:info@ascenergy.com.au)

Tel: 1300 309 008

Address: 82/330 Wattle St, Ultimo NSW 2007

Shanghai Aerospace Automobile Electromechanical Co., Ltd.

Address: 222 Caoxi Rd, 8th Floor, Spaceflight Building, Shanghai, P.R. China

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	30 / 56

Website: [www.ht-saae.com](http://www.ht-saae.com)

Email: [pvmarketing@ht-saae.com](mailto:pvmarketing@ht-saae.com)

Tel: +86 21-64828990

Note:

The above terms are written in both Chinese and English if there is any discrepancy between the Chinese version and English version, the company reserves the right of final interpretation if there is any discrepancy.

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	31 / 56

## 210 光伏组件安装说明书



上海航天机电股份有限公司

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	32 / 56

## 目录

1 基本信息.....	33
1.1 前言.....	33
1.2 警告.....	33
1.3 产品标识.....	35
2 系统设计.....	35
2.1 气候条件.....	36
2.2 安装地点选择.....	36
2.3 倾斜角选择.....	37
2.4 支架选择.....	37
2.5 逆变器选择.....	37
2.6 双面组件排布与布局优化.....	38
3 安装.....	39
3.1 安装安全.....	39
3.2 组件拆箱.....	40
3.4 螺栓安装.....	43
3.5 夹具安装.....	46
4 电气连接.....	49
4.1 电气连接注意事项.....	49
4.2 组件接线.....	51
4.3 光伏电站结构.....	53
5 保养维护.....	54
6 免责声明.....	55



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	33 / 56

## 1 基本信息

### 1.1 前言

感谢您选择 上海航天汽车机电有限公司 光伏组件。本手册的光伏组件是指由本单位所生产和销售的 210 系列光伏组件。

本说明书提供了航天机电光伏组件（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。

根据 IEC61730 标准：太阳能组件安全等级为 Class II；单玻太阳能组件防火等级为 C 级、双玻太阳能组件防火等级为 A 级（参考 UL790）。

### 1.2 警告

1.2.1 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。

1.2.2 当组件暴露在太阳光或者其他光源下，组件内有直流电流产生，此时与组件的电气部分接触可能会发生触电危险。

1.2.3 将组件应用于地面、屋顶等室外环境。如果组件安装在屋顶的话，必须安装在具有一定防火能力的屋顶上，可以咨询当地的建筑部门来决定使用何种屋顶材料。组件不能替代屋顶及墙体材料，部分替代也不允许。合理的支撑结构是系统设计人员或安装人员的责任。

1.2.4 当负载工作时，不要擅自断开组件的连接。

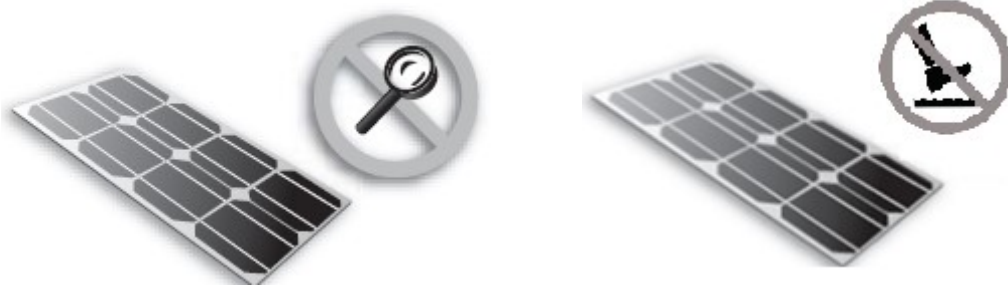
1.2.5 不要拆解组件、移动任何铭牌或黏附的部件。

1.2.6 不要将组件放置在容易产生或储存可燃气体的地方。

1.2.7 不得用人工聚集的阳光照射在组件上，不能将组件背面直接长时间暴露在阳光下。

1.2.8 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，因为这样会损坏组件，并有可能对人造成伤害。

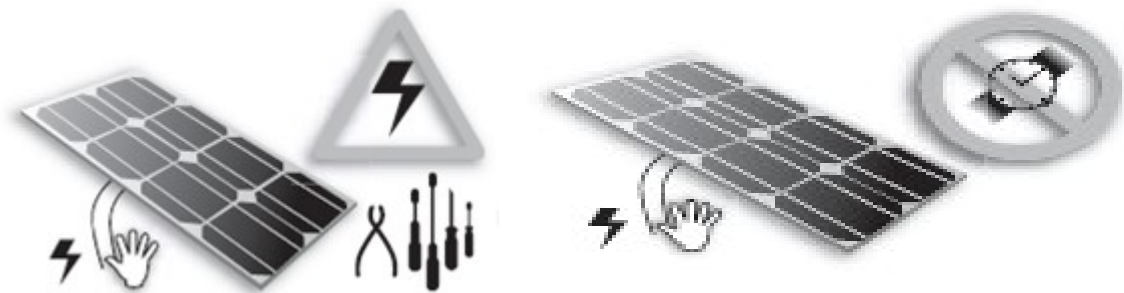
	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	34 / 56



1.2.9 禁止通过拉拽组件接线盒电缆的方式移动组件。

1.2.10 在运输和安装过程中严禁孩子接触组件。

1.2.11 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、唇环或其他金属饰品。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。



1.2.12 在运输过程中，确保组件不会受到撞击、剧烈震动。因为撞击、剧烈震动有可能造成组件内的电池片隐裂。组件运到安装地以后，如果不能及时安装，需放置在平整的地面，并且增加防潮、防风、防雨雪的防护措施。所有的包材都应该小心拆包。

1.2.13 不能损坏组件的玻璃，玻璃具有保护组件的作用。不要损坏组件边缘的密封，否则将导致组件失效。破损的太阳电池组件具有危险性（电击和着火），这样的组件不能修复或维修，应该立即换掉。

1.2.14 为降低发生电击或燃烧的风险，可以在安装太阳电池组件时用不透光材料覆盖在组件表面。

1.2.15 安装人员需确保支架与光伏组件之间的连接牢固、无松动。

1.2.16 所有组件边框和安装架必须按照相应的《国家电气规程》正确接地。

1.2.17 不要用具有腐蚀性的化学药剂来擦拭组件。

1.2.18 屋顶安装会影响房屋的防火性能。光伏系统的消防等级应与屋顶一起评估，只有按照安

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	35 / 56

装说明书中规定的方式安装时，组件的防火等级才有效。

1.2.19 组件在储存、运输、安装、维护过程中，严禁与任何形式的油污、具有腐蚀性的化学试剂接触。

### 1.3 产品标识

1.3.1 每个组件的背面都有标签，一般提供以下信息：

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。

1.3.2 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。



图 1 条形码

1.3.2.1 组件条码由 14 位数码及划线组成。其含义为：前八位为两位生产工厂码、三位日期码和三位订单流水号组成，八位后为一划线，划线后六位即为组件生产流水号，一个工单的组件数量不得超过 999999 块。

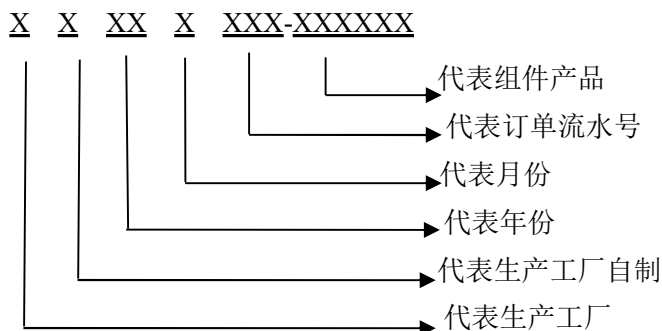


图 2 条码含义

## 2 系统设计

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	36 / 56

## 2.1 气候条件

2.1.1 相对湿度：<85%。

2.1.2 组件运行的温度在-40°C-85°C。

注意：计算组件机械载荷（包括风和雪的压力）时给考虑安装方法和安装地点，计算机械载荷时必须由专业的人员根据系统的设计要求进行计算。

## 2.2 安装地点选择

2.2.1 组件允许的最大安装高度是海拔 2000 米。

2.2.2 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如 Pmax 的标称值与标准测试条件下存在±3%的误差, Isc、Voc 的误差为±5%。

2.2.3 在北半球组件建议朝南, 在南半球建议朝北。

2.2.4 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, 如下图所示, 组件表面与太阳光垂直的时候功率输出最大。建议组件安装角度不小于 10 度。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。

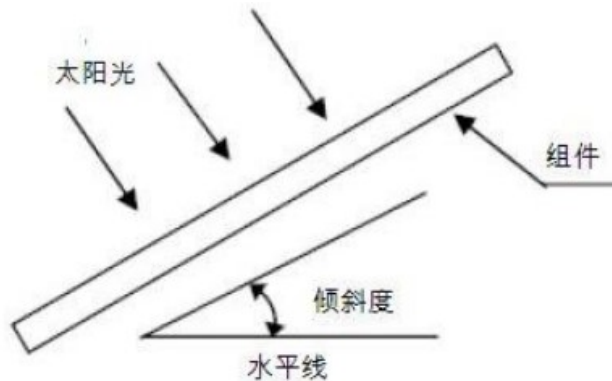


图 3 太阳能组件安装倾斜角

2.2.5 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。

2.2.6 安装参考如下:

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	37 / 56

编号	离海距离	安装	运维保养措施	质量功率保障
1	Distance $\geq$ 500m	常规安装	一般保养维护	正常质保
2	50m < Distance < 500m	需要做防腐保护	一般保养维护+ 额外保养清洗等 维护	给予质保，但是 功率首年衰减平 均 $\leq$ 3%，以后每 年平均衰减 $\leq$ 0.7%。
3	Distance $\leq$ 50m	不推荐	——	——

2.2.7 当组件发电系统用到蓄电池时，蓄电池必须正确安装，这样可以保护组件发电系统的安全运行。蓄电池的安装使用维护需按照蓄电池生产商说明书进行。

2.2.8 建议组件离地高度根据实际环境可选择在 0.3-1m 之间。

## 2.3 倾斜角选择

2.3.1 串联连接的光伏组件应按照相同的朝向和角度进行安装。

2.3.2 如果连接到独立光伏系统，组件的安装角度应该根据季节和光照的情况来获得最大化的功率输出，一般来讲，如果组件的输出在一年内光照强度最低的情况下也可以满足的话，那所选择这个角度的组件输出就能满足全年的需求；对于并网连接的系统，组件的安装角度应该基于全年的输出最大化这个基础原则来选择。

## 2.4 支架选择

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。

## 2.5 逆变器选择

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	38 / 56

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。

### 2.5.1 阵列串联组件数量计算

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。若双面发电的组件安装在背面环境反射条件好的地方，需适当增加冗余值。

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。

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 Vmax 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。

$$N \leq \frac{V_{max}}{V_{oc} * [1 + T_c(voc) * (T_{min} - 25)]}$$

N 串联组件数量。

Vmax 最大系统电压（见产品标签或数据表）。

Voc 组件开路电压（见产品标签或数据表）。

Tc(voc) 组件开路电压温度系数(参见数据表)。

Tmin 最低环境温度。

## 2.6 双面组件排布与布局优化

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	39 / 56

对于标准方阵而言，一般的接线方式是两种，第一种上下串联，第二种上下分开串联。下面一行的距地高度和上面一行的距地高度是远远不同的（尤其是在组件竖向布置时）。而此时，在进行组串接线时，如果选择方式 1，受下面一行组件低电流的影响，上面一行组件的电流也会降低，从而使得整体的输出功率有所降低。而如果采用方式 2，此时上下两行单独成串，互不影响，充分的利用的双面组件的性能，提高了发电量。上下排组件的增益效果是不同的，上排的组件增益相对较高，下排的组件增益相对较低，为了降低组串的失配，我们还是建议有条件的选择方式 2 的组串形式，同时将上下两串接入逆变器的不同 MPPT 下，这就是目前最优的接线方式。

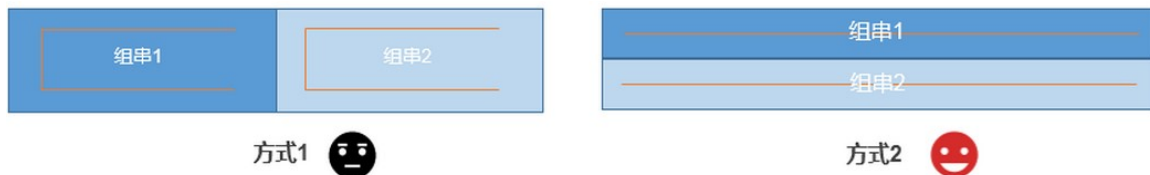


图 4 组串接线优化

### 3 安装

#### 3.1 安装安全

3.1.1 组件安装的时候要戴上防护头盔、绝缘手套，穿上橡胶鞋。

3.1.2 在安装的过程中，不能站到组件上，那样行为会损坏组件，也会危及人身安全。避免不必要地去触摸组件，组件表面和边框可能很热，会有烧伤或者电击的危险。

3.1.3 安装的时候再拆开组件包装。不要在下雨，下雪或者大风的天气条件下安装。

3.1.4 由于有电击的危险，如果组件的接线盒端子是湿的，请不要进行安装作业。

3.1.5 安装时，禁止乱摔任何东西，包含组件和安装工具。

3.1.6 正确无误的连接接线盒连接器，对插时听到“咔”的一声表示连接到位，检查接线状况，所有的连接线不得脱离组件，并采取一定的方式使连接线不会擦伤或者挤压组件。

3.1.7 不管组件有没有连接到光伏系统，在安装过程或者是有光照照在组件上的时候，请不要裸手接触接线盒或者连接器。

3.1.8 不要在组件表面加过重力或者物体，或扭曲组件的边框。

3.1.9 禁止在组件的玻璃上放过重的物体或者进行撞击，这可能会损坏电池片或者造成电池片隐裂。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	40 / 56

3.1.10 禁止使用尖锐的工具去擦洗组件的玻璃，这会在组件上留下划痕。

3.1.11 不要擅自在组件边框上钻孔。

3.1.12 对于 BIPV 或安装在屋顶的结构，需要有计划的施工，请尽量遵循“从上到下”或/和“从左到右”的安装规则。

3.1.13 请务必做好防倾倒措施，禁止在非水平或松软地面拆包，以免造成人身伤害甚至死亡。

### 3.2 组件拆箱

3.2.1 当组件被运到安装地，应避免在雨天对组件进行拆箱。

3.2.2 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。

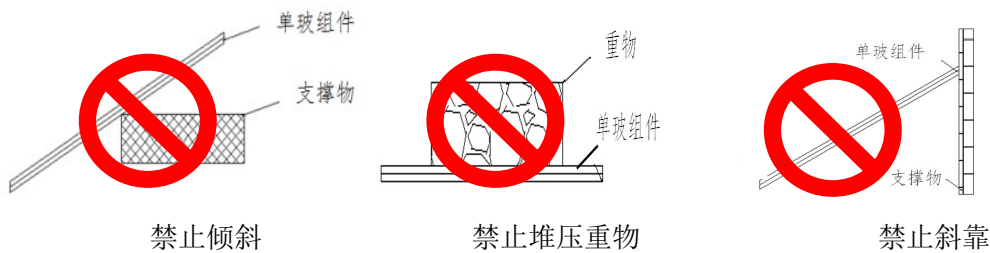


图 5 组件堆放说明

3.2.3 两个批次的组件之间分开，整齐堆放。组件叠放的数量不能超过 12 件，边框需要对齐放置。

3.2.4 包装箱拆箱需按下图进行拆箱，禁止野蛮操作或用撬棍插入箱内撬开，使用工具时注意人身安全与组件安全。

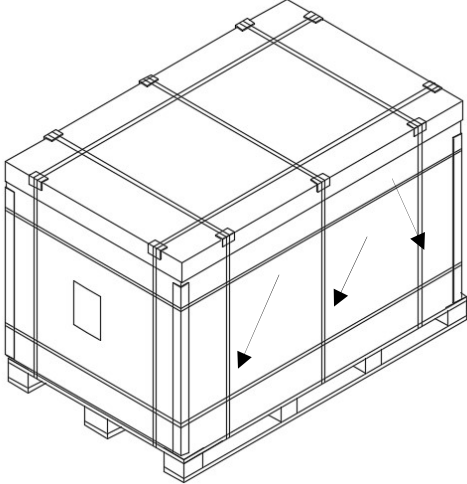
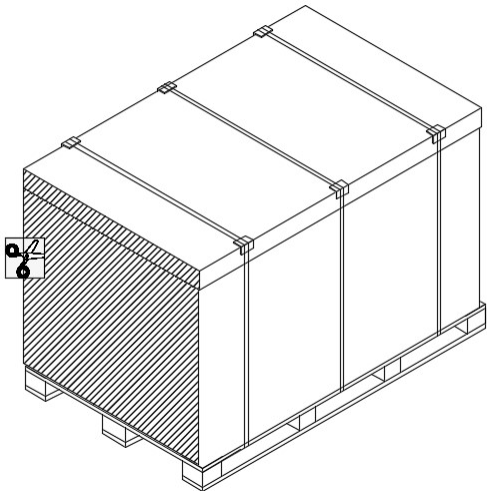
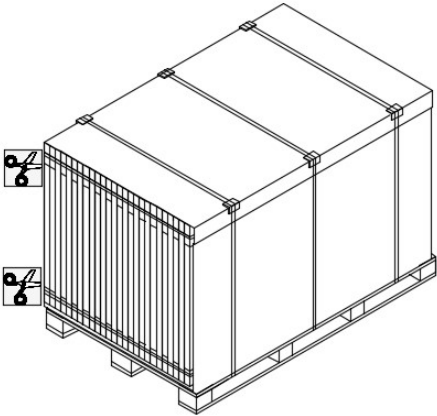
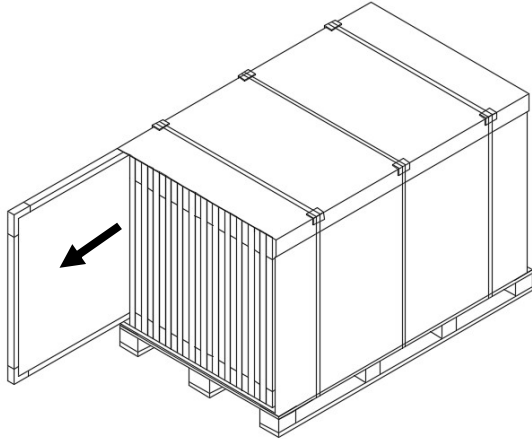
3.2.5 包装箱卸车后，需放置在干燥、平整的地面上，不得放置在潮湿、泥泞、凹凸不平的地面上。

3.2.6 组件运抵施工项目地后，需要将上下箱拆开单独放置，不得将两箱组件摞托放置；如组件无法及时安装，需注意组件及包装箱的保护，防止雨水、大雪、冰雹、台风等自然灾害的破坏。

拆箱过程（横式）：



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	41 / 56

	
<p>1. 箭头所指 3 根打包带不拆, 拆除其余外箱打包带</p>	<p>2. 去除包装侧面 (阴影部分)</p>
	
<p>3. 剪断纸箱内部的上下两根横向打包带</p>	<p>4. 拆卸组件, 根据现场环境做好防倾斜措施</p>

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	42 / 56

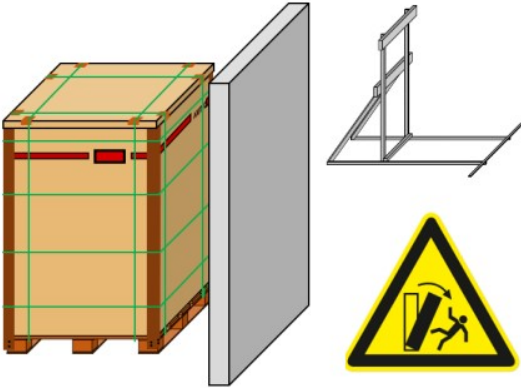
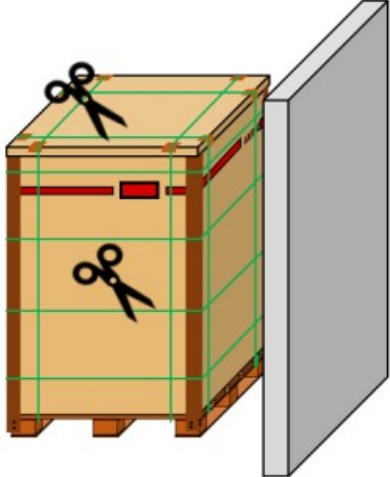
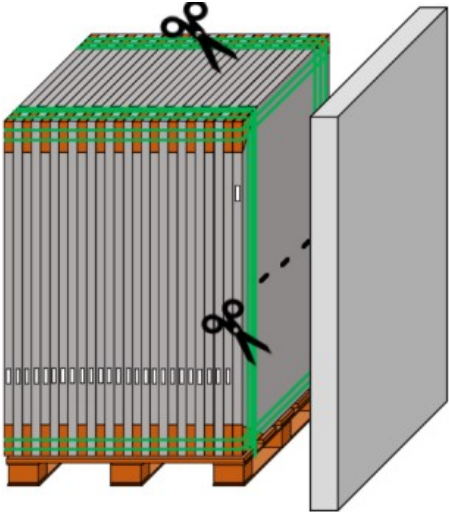
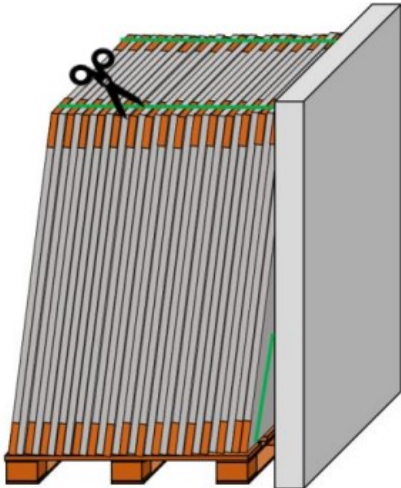
拆箱过程（立式）：	
	
1. 将整托组件放置在靠近稳固的墙壁或其他可能的支撑物的平坦地面上。	2. 移除外打包带和包装箱（包装箱的斜对角有魔术贴可以方便快捷拆箱）
	
3. 移除内打包带（保留 2 根纵向的打包带，见步骤 4）。	4. 将组件斜靠在墙壁或其他可能的支撑物上，剪断最后的打包带。根据现场环境做好防倾斜措施后，可以搬运组件。

图 6 拆箱过程图

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	43 / 56

### 3.3 安装方法介绍

组件的安装可以采取以下的方式：螺栓安装和夹具安装。

3.3.1 本说明书介绍的所有安装方式只供参考，我司不负责提供相关的安装部件，组件系统的设计、安装。机械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。

3.3.2 安装前，还需要确认以下重要的几项：

a) 安装之前需检查一下外观是否有缺陷或其它杂物以及接线盒的安全性能，如果有的话，需清除。

b) 检查组件的序列号是否正确。

3.3.3 必须遵守安全作业，事故预防，施工现场安全相关的适用法律法规。操作人员和第三方工作人员须佩戴或安装防止高空坠落击打的安全措施。应防止任何的第三方人员伤亡或财产损失。

3.3.4 安装设计必须由注册的专业工程师进行验证。安装设计和安装过程必须完全符合所有适用的当地的法规和电气标准要求。不正确的安装方式将使有限质保无效。

3.3.5 使用合适的具有抗腐蚀性能的紧固件。所有安装的紧固件（如螺栓、弹性垫圈、平垫圈、螺母等）应是热镀锌或不锈钢材质。

3.3.6 使用扭矩扳手进行安装。

3.3.7 禁止在组件边框上钻孔或改变边框结构，否则有限质保将会无效。

3.3.8 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（如对于风暴、大雪等严苛的环境导致超出我司列出的安装方式，建议增加额外的夹具进行安装，请咨询我司技术支持）。

3.3.9 本手册中所述的载荷为测试载荷。依据 IEC 61215-2:2016 的安装要求，在计算相应的最大设计载荷的时候，需要除以至少 1.5 倍的安全系数。项目的设计载荷需要依据项目地点、当地气候、支架结构以及相关的规范。支架供应商和专业工程技术人员负责确定设计载荷。对于更详细的信息，请遵守当地的法律法规以及结构工程师的指导。

### 3.4 螺栓安装

这些机械载荷都是按照 IEC61215 标准测试的。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	44 / 56

组件应该使用边框背面的安装孔用螺栓安装在支撑结构上。

每个组件至少需要由两个对边上的 4 点进行紧固。根据下面示意图，必须使用平垫圈和弹性垫圈，垫圈尺寸及厚度需要执行不低于国家标准的标准尺寸。

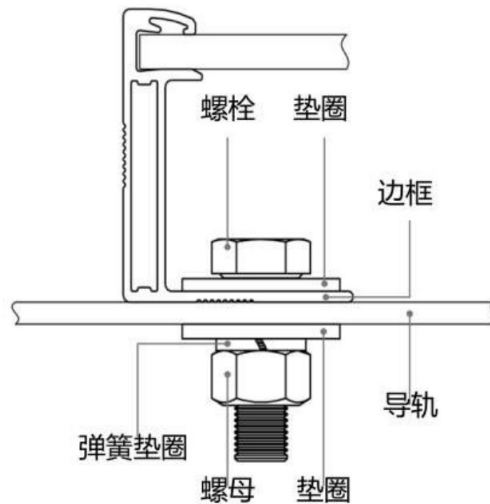


图 7 示意图

应使用 M8 × 1.25 - Grade 8.8 热镀锌或 A2-70 不锈钢材质的螺栓和螺母。

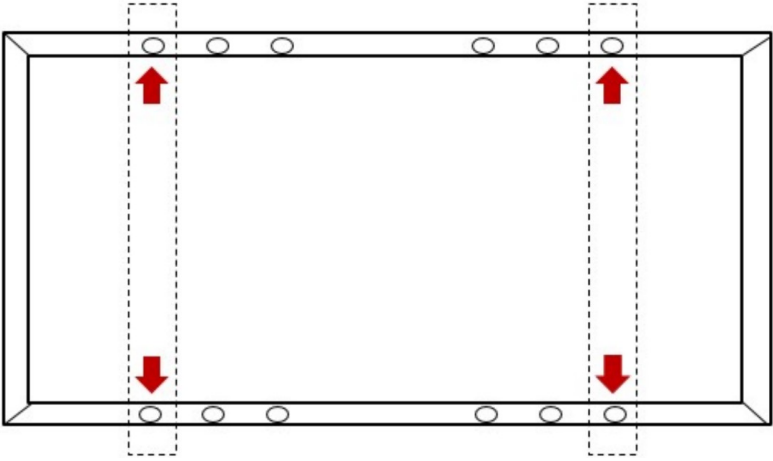
螺栓和螺母的屈服强度不能小于 450MPa。

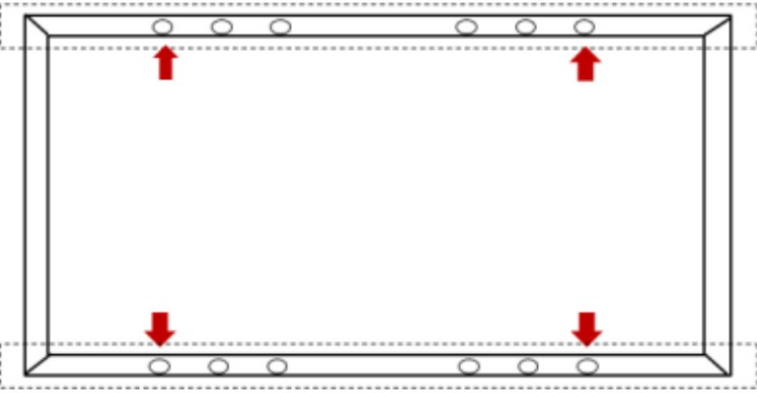
根据螺栓等级，M8 粗牙螺栓拧紧力矩为 16~20Nm。

在大雪或高风载地区的安装方案，要使用额外的安装点。系统设计者和安装者有责任去计算载荷并确保支撑结构满足要求。

组件应该根据结构和载荷要求在下面安装孔的位置上用螺栓安装：

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	45 / 56

螺栓安装方式 A				
NO.	组件型号	外侧四孔安装		
		测试载荷 $\leq$ 5400Pa (正面)、2400Pa (背面)		
1	HT66-210			
2	HT60-210			
3	HT66-210(PD)-F			
4	HT60-210(PD)-F			

螺栓安装方式 B				
NO.	组件型号	外侧四孔安装		
		测试载荷 $\leq$ 3600Pa (正面)、2400Pa (背面)		
1	HT66-210(PD)-F			
2	HT60-210(PD)-F			

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	46 / 56

### 3.5 夹具安装

这些机械载荷都是按照 IEC61215 标准测试的。

依据安装结构的不同，夹具安装方式有所不同，请遵循安装系统供应商推荐的安装指南。

每个组件至少需要由两个对边上的 4 点进行紧固。夹具需要两两对称排布。夹具应该安装在下表所规定的位置范围。

用安装硬件制造商规定的扭矩在安装导轨上进行安装和紧固。夹具安装使用 M8X1.25 螺栓和螺母。对于 M8 粗牙螺栓，根据螺栓等级，紧固扭矩应该在 16~20Nm 之间。对于螺栓等级应该遵循紧固件供应商的技术指南。来自于对应的夹具供应商的建议需要优先考虑。系统设计者和安装商负责载荷计算和选择合适的支撑结构。

夹具安装方式需要注意如下几点：

1. 不要弯曲组件边框。
2. 夹具不要接触组件的玻璃面或投射阴影在上面。
3. 不要损坏边框的表面涂层（除了带接地刺破功能的夹具）。
4. 确保夹具和组件边框重叠宽度部分至少重叠 10mm。
5. 确保夹具重叠长度：
  - a) 当反面载荷 > 2400Pa 时，夹具重叠长度至少 80 mm。
  - b) 当反面载荷 ≤ 2400 Pa 时，夹具重叠长度至少 40 mm。
6. 确保夹具厚度至少 3mm。

夹具材料应该是阳极氧化铝合金或不锈钢。

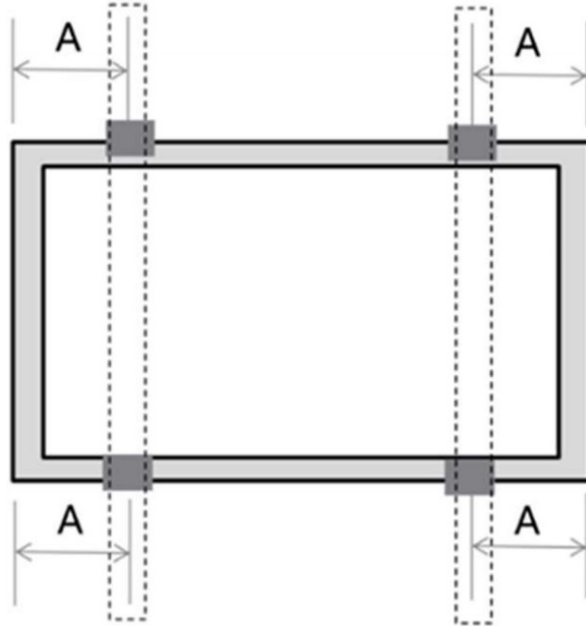
夹具位置对安装的可靠性至关重要，夹具中心线必须根据结构和载荷的要求安装在下表的范围内。

对于安装导轨平行于边框的结构，需采取预防措施确保组件边框安装面和导轨重叠 15mm 或更多。

如果使用不合适的夹具或不正确的安装方式，将使有限质保无效。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	47 / 56

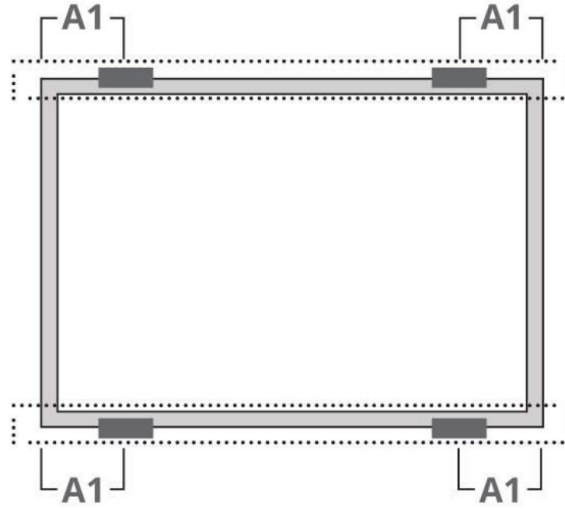
### 3.5.1 长边使用四个夹具，安装导轨与长边框垂直



NO.	组件型号	最大机械载荷 (Pa)	
		正面 2400 背面 2400	正面 5400 背面 2400
		A 范围(mm)	
1	HT66-210	300-600	400-500
2	HT60-210	300-600	400-500
3	HT66-210(PD)-F	/	400-500
4	HT60-210(PD)-F	/	400-500

### 3.5.2 长边使用 4 个夹具，安装导轨与长边框平行

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	48 / 56



NO.	组件型号	最大机械载荷 (Pa)	
		正面 3000 背面 2400	正面 3600 背面 2400
		A1 范围(mm)	
1	HT60-210	365-435	/
2	HT66-210(PD)-F	/	400-500
3	HT60-210(PD)-F	/	400-500



	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	49 / 56

### 3.6 双玻组件单轴跟踪系统安装

双玻组件边框上有用于单轴跟踪系统安装的安装孔，通过这些安装孔可以很好地将组件固定到支撑结构上以优化其负载承受能力。通过组件背面边框上的安装孔，使用螺栓把组件固定在支架上，安装细节下图所示。使用 M6 螺栓、两个平垫圈、一个弹簧垫圈和一个螺母在每个固定位置固定组件，并拧紧至 16-20 N.m (140-180lb.in) 的扭矩。与单轴跟踪系统连接的组件的所有部位应采用最小厚度为 1.5mm 且外径为 16-20mm (0.63-0.79 英寸) 的扁平不锈钢垫圈。此安装方式的正面最大测试载荷为 2400Pa，背面测试载荷为 2400Pa。

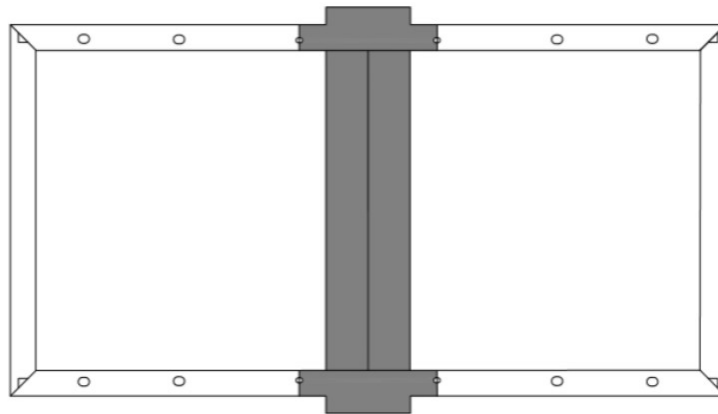


图 8 单轴跟踪系统安装图示

## 4 电气连接

### 4.1 电气连接注意事项

4.1.1 接线前请仔细阅读该光伏系统电气布线图纸，所有接线应由合格的安装人员按照当地法规和程序进行。系统的最高电压必须低于最高认证电压以及安装中系统中的变频器及其他电气设备的最高输入电压。

4.1.2 组件和接线箱的连接：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不低于 4mm<sup>2</sup>，建议使用 6 mm<sup>2</sup>。单玻组件保险丝和连接器的电流≥30A，双玻组件保险丝和连接器的电流≥35A（额定电流值需根据不同工作环境温度进行修正，适当的修正系数须由授权许可的专业电气工程师根据相关设计法规和系统模拟结果确定。我司提供的额定电流值仅供参考，不对最小保险丝规格的确定负责），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°C，连接器承受温度的上限为

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	50 / 56

125°C。

4.1.3 组件铝边框和组件支架必须接地，如图 9 所示，每个组件均有接地孔，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)。接地螺栓安装方式如图 10 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 M5×10~15 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。

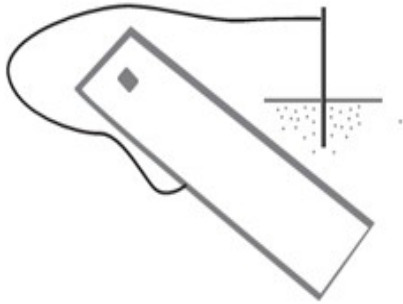


图 9 组件接地图

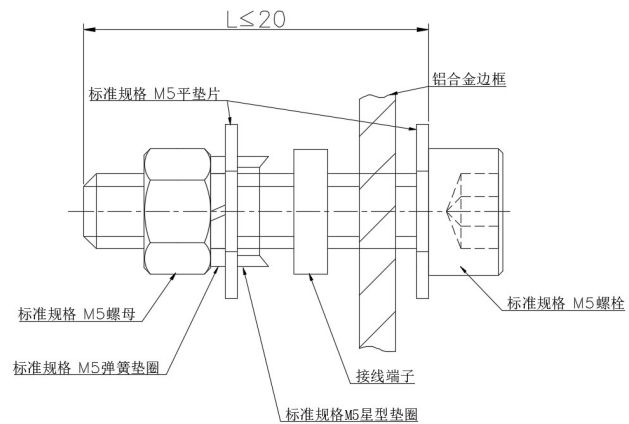


图 10 接地螺栓安装示意图

4.1.4 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。

4.1.5 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。这些硬件随组件一起提供并按要求通过 UL 1703 中的评估，可用于根据组件安装说明进行接地连接。

4.1.6 电气连接应符合当地电气法规，组件系统电气连接不允许出现“Y”型电气连接方式。

4.1.7 组件中装有旁路二极管（单玻组件的额定电压 50V，额定电流 30A；双玻组件的额定电压 50V，额定电流 35A）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。

4.1.8 组件从包装内取出后，在不立即安装的情况下需保护好连接器，以免因风或雨造成损坏。禁止在连接器上使用润滑剂，连接器不得被太阳暴晒。

4.1.9 切勿将防水胶环从接线盒或连接器上拆下。

4.1.10 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损坏连接器。

4.1.11 电缆的最小弯曲半径应为 43mm（1.69 英寸）。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	51 / 56

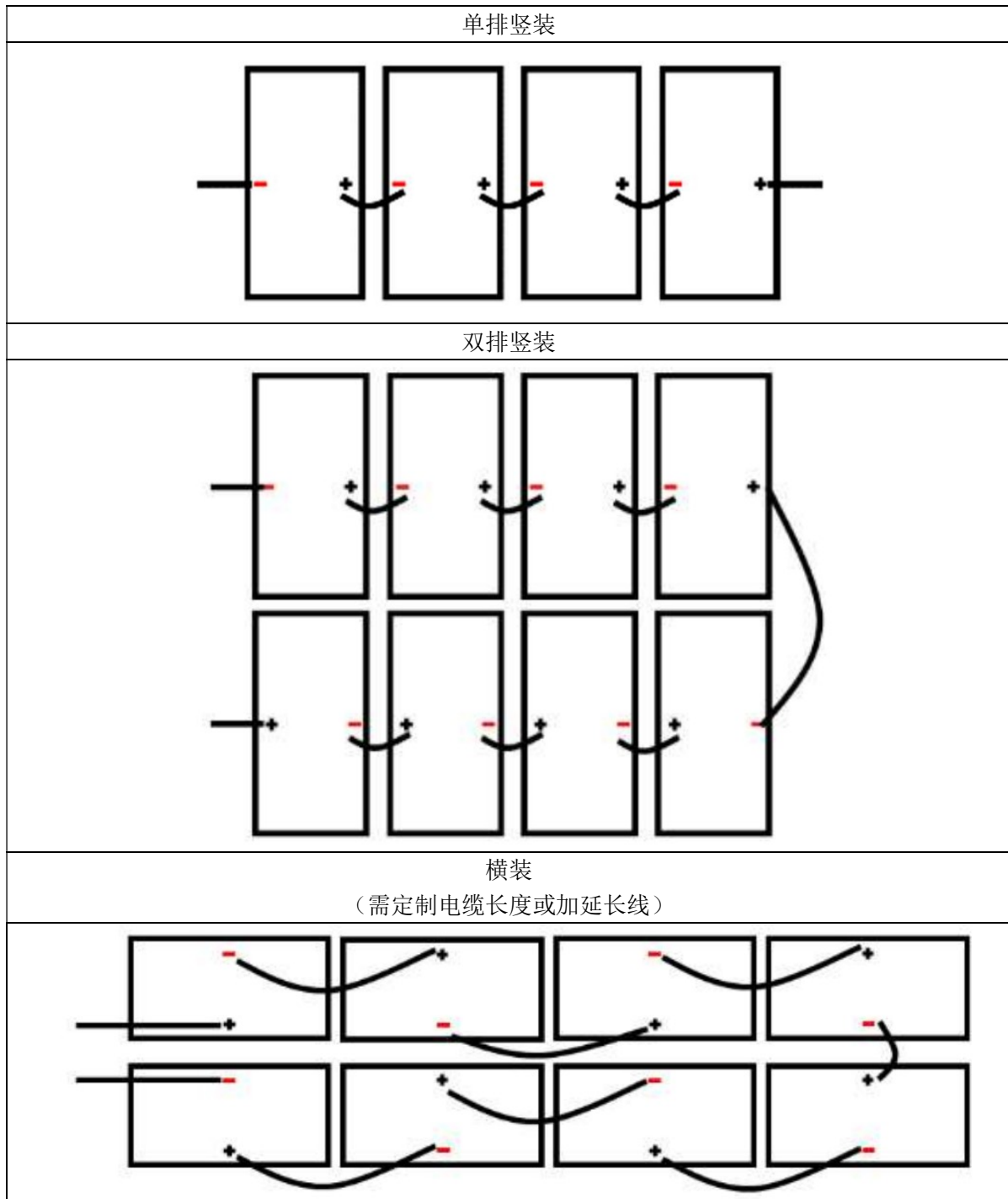
## 4.2 组件接线

启动系统前应检查接线是否正确。如果测得的开路电压(Voc)和短路电流(Isc)与提供的规格不一致，则可能存在接线故障。

在组件安装后系统并网前，每个组串应保持开路状态，需要采取适当的保护措施避免水汽和灰尘渗入。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	52 / 56

推荐的布线方式：



当组件连接成一串的时候，最终电压为单块组件之和，当组件是平行并联在一起的时候，最终电流为单块组件之和，不同电性能型号的组件不能连接在一串内。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	53 / 56

如果可能有超过组件最大保险丝电流的反向电流通过组件，必须使用相同规格的过电流保护装置来保护组件。如果并联数量大于等于 2 串，在每串组件上必须有一个过电流保护装置。

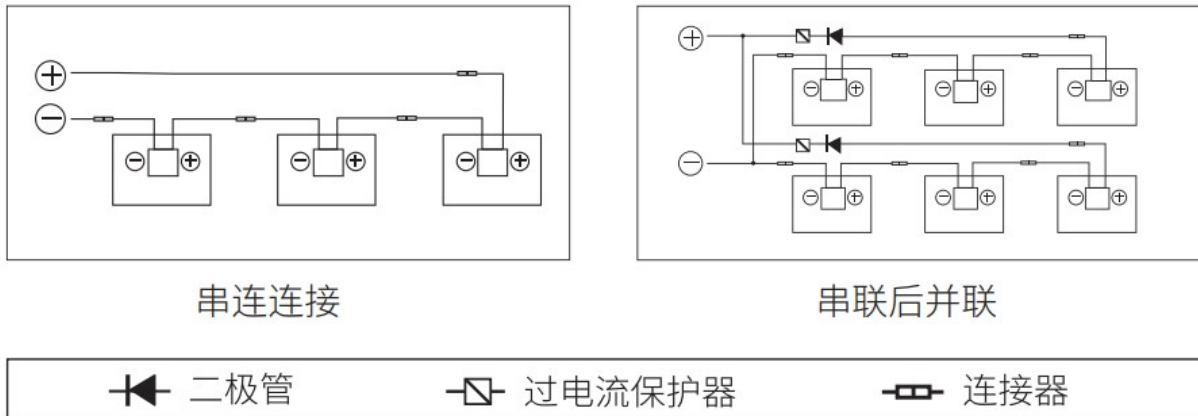
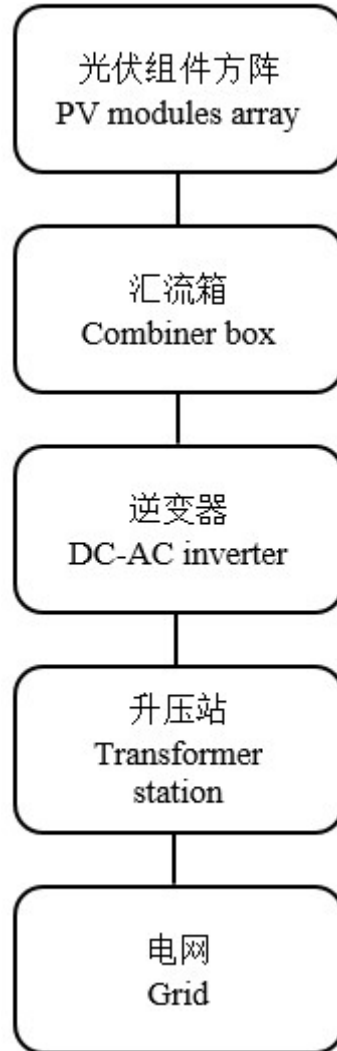


图 11 串联、并联电气图

### 4.3 光伏电站结构

下图给出一种简单的光伏电站的结构组成，实际的安装设计必须由注册的专业工程师进行。安装设计和安装过程必须完全符合所有适用的当地的法规和电气标准要求。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	54 / 56



## 5 保养维护

组件需要定期进行检查和维护，请具有资质的人员佩戴好安全防护用品进行检查，包括组件的外观、所有的电气连接，确保没有开路，连接良好。

不要擅自更换组件的元部件(二极管、接线盒、连接器等)。

应采取适当的维护措施以保持组件没有积雪、鸟粪、种子、花粉、树叶、树枝、灰尘和污点等。

如果组件有足够的倾斜角度（至少 15°），一般情况下，不需要清理（通过降雨可以实现组件表面清洁）。如果组件表面有较多的污物堆积，在一天中较凉爽的时间，使用清水和柔软的清洁工具(如海绵)来清洗组件阵列。不得在干燥的情况下刮擦组件表面灰尘，否则会导致划痕。

应定期检查光伏系统，确保接线和支撑结构完好无损。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	55 / 56

如果需要进行电性能或机械性能的检查或维护，建议让具有资质的专业人员进行操作，以免发生触电或人员伤亡。

推荐下列维护措施以确保组件的最佳性能：

检查组件是否存在外观缺陷：组件表面是否有破损、异常，组件是否被物品等遮挡，组件与支架之间的固定是否存在松动，发现异常后需联系有资质或经验的维护人员进行调整或修复。

尽可能每年清洁一次组件，可根据当地具体情况而定。组件表面出现脏污时，会减少发电量。清洁时，可以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。严禁使用具有腐蚀性的化学清洁剂。为减少电击或灼伤，建议在清晨或傍晚进行组件清洁工作。

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、确保组件电气连接良好，无腐蚀现象。

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。

交叉轮式垃圾箱的意义：



不要将电器作为未分类的城市垃圾处理，使用单独的收集设施。有关可用的收集系统的信息，请与当地政府联系。如果电器是在垃圾填埋场或垃圾场处理的，有害物质会渗入地下水，进入食物链，损害你的健康。当用新电器替换旧电器时，零售商在法律上有义务收回旧电器进行处置，至少是免费的。

## 6 免责声明

由于本手册的使用及组件安装、操作、使用和维护条件超出了我们的控制范围，我们不承担任何因安装、操作、使用或维护中所引起的损失、破坏或费用责任。

我们不承担任何由于使用组件产品可能导致的侵犯专利和第三方权利的责任。客户并不因使用我们产品而获得任何专利或者专利权利的使用授权，无论是明示的或隐含的。

	文件名称 Document name	210 光伏组件安装说明书 210 PV Module Installation Instructions		
	文件编号 Document number	HTL-TR-I097 (V1.1)		
上海航天机电股份有限公司 Shanghai Aerospace Automobile Electromechanical Co., Ltd.	文件版本号 Document version	V1.1	页码 Page	56 / 56

本手册的信息基于我们的被认为是可靠的知识和经验，但是包括但不限于如上的产品规格的这些信息和建议并不构成任何保证条款，无论明示的或隐含的。我们保留修改手册、PV 产品、规格或产品信息的权利，无需提前通知。