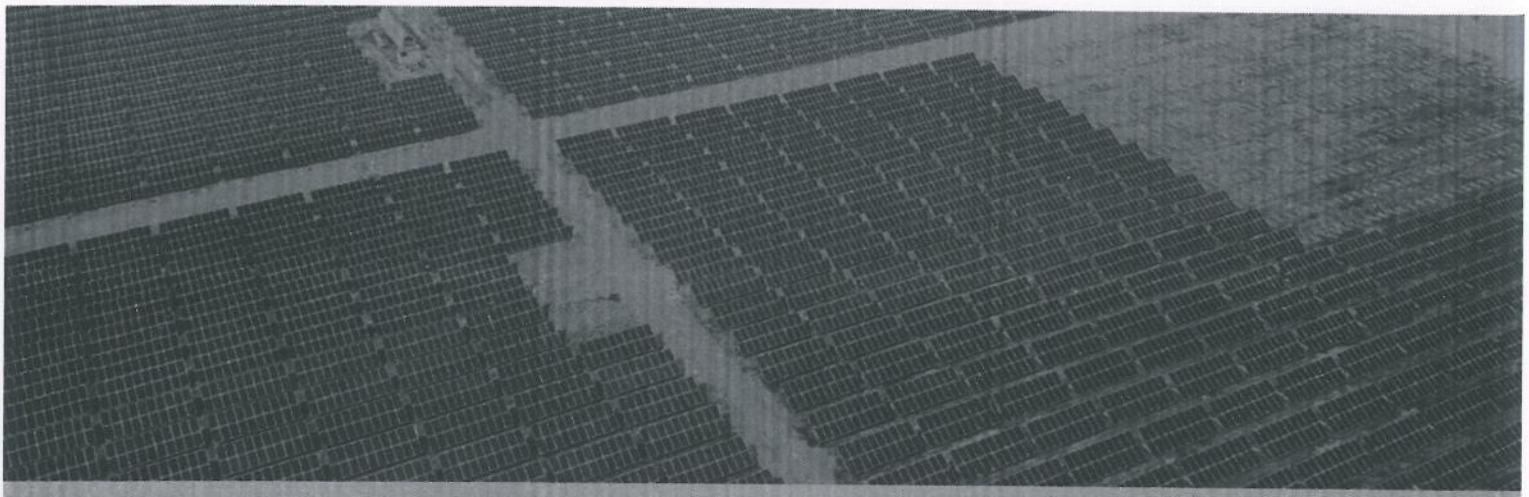
ZNSHINESOLAR



ZNSHINE PV MODULES INSTALLATION MANUAL

正信太阳能光伏组件安装说明书

Lightweight-Reinforced Modules

轻质强化组件

受控文本
Controlled Copy

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LIGHTWEIGHT-REINFORCED INSTALLATION MANUAL

轻质强化组件安装说明书

1. INTRODUCTION FOR INSTALLATION MANUAL 安装说明书介绍

This INSTALLATION MANUAL applies to ZNSHINE PV-Tech Co., Ltd and its cooperated or affiliated companies. Each cooperated or affiliated companies includes but not limited to [Zhengxin photoelectric technology (Suqian) Co., Ltd]. This INSTALLATION MANUAL applies to the installation, maintenance and using of the single glass solar modules manufactured by ZNSHINE PV-TECH Co., Ltd and its cooperated or affiliated companies. (hereinafter referred to as "ZNSHINE SOLAR"). Failure to follow these INSTALLATION MANUAL could result in personal injury or property damage. 本安装说明书适用于正信光电科技股份有限公司及其合作或关联公司，各合作或关联公司包括但是不限于【正信光电科技（宿迁）有限公司】。本安装说明书适用于正信光电科技股份有限公司及其合作或关联公司（以下简称 正信光电）生产的单玻系列太阳能组件的安装、维护和使用。如果不遵守，将可能导致人员伤亡或财产损失。

Installation and operation of PV modules requires professional skills and should only be performed by qualified professionals. Please read the "Safety and Installation Instructions" carefully before using and operating the modules. 安装和操作太阳能组件需要专业的技能，只有专业人员才可以从事该项工作。请在使用和操作组件之前仔细阅读安全和安装说明。

The word "module" or "PV module" used in this manual refers to one or more flexible solar modules. Please keep this manual for future reference. 本说明书中的"组件"或"PV组件"指的是一个或多个轻质强化太阳能组件。请保留此说明书以供将来参考。

1.1. DISCLAIMER 免责申明

1) ZNSHINE PV-TECH Co., LTD reserves the rights to change this installation manual without prior notice. Please refer to our product lists and documents published on our website at: https://www.znshinesolar.com as these lists are updated on a regular basis. 正信光电科技股份有限公司保留在没有预先通知的情况下变更本安装说明书的权利，最新版请参考正信光电网站（https://www.znshinesolar.com）上的产品和文件资料。
2) In the event of any inconsistency among different language versions of this document, the Chinese version shall prevail. 如果本说明书的不同语言版本有描述不一致的情况，以中文版为准。
3) Failure of the customer to follow the requirements outlined in this Manual during the installation (including without limitation to packing/unpacking, loading/unloading, transportation, storage, installation, use, operation or maintenance, etc.) of the module will result in the invalidity of product's limited warranty. 客户在安装组件过程中（包括但不限于产品拆/包装、装/卸货、运输、存储、安装、使用、运行或维护等）未按照本说明书中所列出的要求操作，会导致提供给客户的产品有限质保失效。
4) ZNSHINE SOLAR is not responsible for any infringement of third party patents or any other rights arising from the use of solar PV modules. 使用太阳能光伏组件过程中所产生侵犯第三方专利权或任何其他权利，正信光电概不负责。
5) The information in this manual is based on ZNSHINE SOLAR's 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. 本说明书的信息基于正信光电的被认为是可靠的知识和经验，但是包括但不限于如下的产品规格的这些信息和相关的建议并不构成任何保证条款，无论明示的或隐含的。

1.2. LIMITATION OF LIABILITY 责任范围

ZNSHINE SOLAR is not responsible for any damages of any kind, including but not limited to any product damages, personal injury or any other property losses, as resulting from any improper operations or faults by the customers during the handling of the products as failure to follow the instructions in this Manual. 正信光电对于客户未按照本安装说明书说明的任何不适当操作行为或者失误造成的任何损失不承担赔偿责任，包括但不限于由于组件操作过程中未遵循本说明书中的说明而造成的任何产品毁损、人身伤害或其他财产损失。

2. SAFETY PRECAUTIONS 安全措施

2.1. ARNING 警告

Before attempting to install, wire, operate and/or service the module and other electrical equipment, all instructions should be read and understood. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not. 对组件进行安装、接线、操作或维护前，应阅读并理解所有安全细则。当组件电池面直接暴露在阳光或其他光源下时，会产生直流电(DC)，无论是否连接组件，直接接触组件带电部分，例如接线端子等，将可能导致人员伤亡。

2.2. GENERAL SAFETY 通用安全

ZNSHINE SOLAR modules are designed to meet the requirements of IEC 61215 and IEC 61730, Safety Class: class II. Modules rated for use in this application class may be used in system operating at greater than 50V DC or 240W, where general contact access is anticipated. Modules qualified for safety through IEC 61730-1 and IEC 61730-2 and within this application class are considered to meet the requirements for safety class II equipment. 正信光电的组件设计符合国际IEC61215和IEC61730标准，其安全等级评级为Class II类；组件可用于公众可能接触的大于直流50V或240W 以上的系统。并且组件通过了IEC61730-1和IEC61730-2 两部分，满足安全II类的要求。

1) All installation work must comply with the local codes and the relevant international electrical standards. 所有的安装工作必须完全遵守当地法规和相应的国际电气标准。

2) ZNSHINE SOLAR recommends that PV module installation is conducted by personnel who have been professionally trained in PV system installation. Operation by personnel who are not familiar with the relevant safety procedures will be very dangerous. 建议由经过光伏系统安装专业培训的人员进行安装。如由不熟悉相应安全程序的人员操作将会非常危险。

3) Do not allow unauthorized persons to access the installation area or module storage area. 不允许未经授权的人员接近安装区域或者组件仓储区域。

4) Protective clothing (non-slip gloves, clothes, etc.) must be worn during installation to prevent direct contact with 30V DC or greater, and to protect hands from sharp edges. 使用恰当的防护措施（防滑手套、工作服等）以避免安装人员与30V直流或更高电压直接接触，同时避免在安装过程中手直接与组件锋利的边缘接触。

5) Prior to installation, remove all metallic jewelry to prevent accidental exposure to live circuits. 安装时请不要佩戴金属饰物，以免戳穿组件，引起触电危险。

6) When installing modules in light rain, morning dew, take appropriate measures to prevent water ingress into the connectors, f. e. using connector endcaps. 如果在阴雨、晨雾天气安装组件，需采取适当的措施避免水浸入连接器。

7) Use electrically insulated tools to reduce the risk of electric shock. 请使用绝缘工具以降低触电的风险。

8) Do not use or install broken modules. 不要使用或安装已损坏的组件。

9) External or artificially concentrated sunlight shall not be directed onto the front or back face of the PV module. 外部或人为聚焦的阳光不得直射到光伏组件的正面或背面。

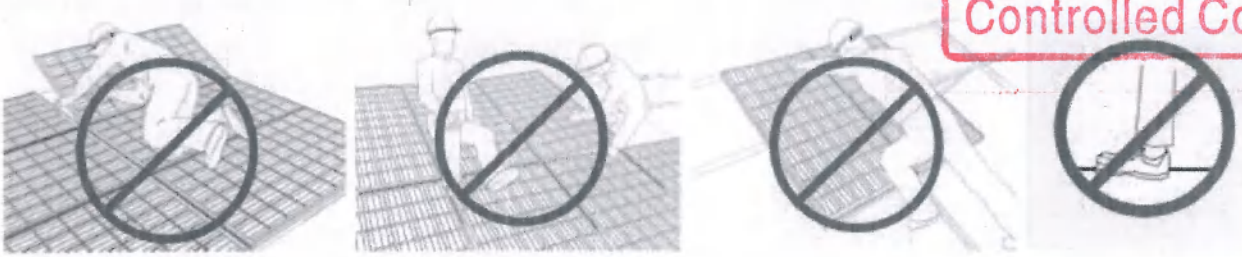
10) Do not contact module if the front or rear glass is broken. This action may cause electric shock. 组件的前板玻璃或后板玻璃发生破损时不要触摸组件，这个举动可能会导致触电。

11) Do not attempt to repair, disassemble, move any part of the PV module. The module does not contain any reusable parts. 不要试图修复、拆解或移动组件中的任何部分，组件内没有用户可二次利用的元件。

12) Do not connect or disconnect the module when it is energized or connected with an external power supply. 当组件有电流或外部电流出现时，不得连接或断开组件。

2.3. HANDLING SAFETY 操作安全

1) Do not stand, walk on or lean on the module directly. 禁止直接在组件上站立、踩踏、行走或跳跃。



2) Do not damage or scratch the front or backside surfaces of the module. 请不要损坏或划伤组件的前后表面。

3) Do not drag, scratch, bend the output cable with force or with too tight connection. The insulation of output cable can break and may result in electricity leakage or shock. 请不要拉扯、划伤、用力弯折或过紧安装输出线缆，否则线缆的绝缘部分会被损坏导致电流泄露或触电。

4) If there is an open fire, please extinguish it with a dry powder extinguisher after disconnecting the power supply, cannot use liquid such as water to extinguish the fire. 如有明火请在断开电源后用干粉灭火器扑灭，不可用水等液体扑灭。

5) Do not install or handle modules under wet, rain, snow or windy conditions. Place disassembled PV modules correctly.请勿在潮湿、下雨、下雪或大风的情况下安装或处理组件，并将已拆包组件进行妥善处置。

6) Take care to keep modules and in particular their electrical contacts, clean and dry before installation. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used. 安装前，请保持组件电器元件的清洁与干燥。如果线缆插头在潮湿条件下互相接触，会被腐蚀。任何被腐蚀的组件都不能被使用。

7) Please Do not loosen, unscrew or peel the PV module bolts and frame glue. This may lead to a reduction of the module's load rating and potential damage from a fall. 请不要松动、拧下、剥离，光伏组件的螺丝或边框胶，有可能导致组件载荷下降，甚至掉落。

8) Do not drop PV modules or allow objects to fall down on the PV modules. 请不要让物体直击组件或物体直接掉落在组件上。

9) During installation or under sunlight, it is forbidden to directly touch the junction box, connector, cable and other electrified bodies of the module without any protection, regardless of whether the PV module is connected with the system. There is a risk of scalding or electric shock. 在安装期间或阳光下，禁止在没有任何保护的情况下用手直接触摸组件的接线盒、连接器、线缆等带电体，无论光伏组件是否与系统连接。这会有烫伤或者电击的危险。

10) Do not discard the modules at will; special recycling is required. 禁止组件随意丢弃，需要专门回收。

3. UNLOAD/TRANSPROTATION/STORAGE 卸货、运输和存储

Precautions and general safety rules:

预防措施和通用安全细则：

1) Modules should be stored in a dry and ventilated environment to avoid direct sunlight and moisture and extra precautions should be taken to prevent connectors from being exposed to moisture or sunlight, like using connector endcaps. 应将组件储存在干燥且通风的环境中，同时需要采取措施避免连接器暴露在潮湿或者阳

光下，比如使用连接器端帽。

2) The modules should be stored in the original ZNSHINE SOLAR package before installation. Protect the package from damage. Unpack the modules as per the recommended unpacking procedures. The whole process of unpacking, transport and storing should be handled with care. 组件在安装前应存储在原包装箱内，请保护好包装不要使其受损。按照建议的拆包步骤打开组件包装。打开、运输和存储过程需小心操作。

3) Unpacking must be carried out by two or more persons at the same time. 拆包时，必须由2个或2个以上人员同时操作。

4) Handling the modules requires two or more people with nonslip gloves and both hands. 搬运组件时应由2个或以上的人带防滑手套同时双手手持组件搬运。

5) Do not pull the cables, junction boxes or frames to handle modules. 禁止拉扯组件的导线、接线盒或边框来搬运组件。

6) Do not handle the modules over-head or stack the modules. 禁止头顶组件搬运；禁止堆叠组件。

7) Do not place excessive loads on the module or twist the module. 禁止在组件上施加过度的载荷或扭曲组件。

8) Do not drop or place objects (such as tools) on the modules. 禁止掉落或堆放物品（如安装工具）在组件上。

9) Do not put the modules in a place that is not supported or stable. 禁止将组件置于无可靠支撑或未固定环境下。

10) Do not allow the modules to come in contact with sharp-pointed objectives to prevent them from scratches, avoiding a direct impact on the safety of modules. 禁止组件与尖锐物接触，以防划伤，避免直接影响组件的安全性。

11) Do not expose the modules and its connectors to any chemical substance (e.g., oil, lubricant, pesticide, etc.). 禁止将组件或者其电气接口暴露在化学物质下（比如油，润滑剂，杀虫剂等）。

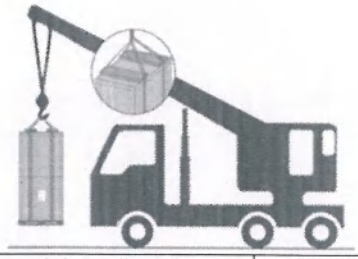
12) Before the secondary transportation vehicle is started, it should be bundled with net ropes. The rope should be fastened to prevent damage to the modules during the transportation. If the safety rope is used, the contact part between the safety rope and the carton shall be separated by paper corrugated or other cushioning materials. The speed of the vehicle carrying the modules should be ≤5 km/h and ≤ 3 km/h for turning, so as to avoid sudden stop and rapid start. 在二次搬运车辆启动前，应采用网绳捆绑，绳索应系牢，严防组件在运输过程左右晃动造成损坏。如果采用安全绳，则安全绳与纸箱接触部分用纸护楞或其他材质的缓冲材料隔开。搬运组件车辆行驶速度宜≤5公里/小时，拐弯速度≤3公里/小时，避免急停和急速启动。

3.1. MAKERS ON OUTER PACKAGING 包装标示说明

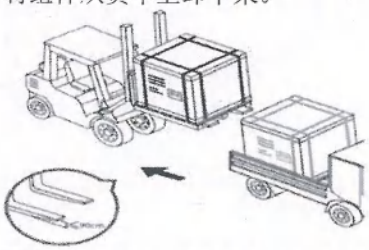
3.1.1. Need both hands to handle it carefully. 需要双手小心操作 	3.1.2. Uninstalled modules must be kept dry, not expose to rain or moisture. 禁止未安装的组件淋雨或者受潮 
3.1.3. Modules in carton are fragile, which must be handled with care. 纸箱中的组件为易碎物品，搬运时应小心轻放 	3.1.4. The packaging must be transported upright. 包装在运输时应竖直向上 
3.1.5. Do not step on the package and module. 禁止在包装箱和组件上面踩踏 	3.1.6. Modules shall be stacked as required, not exceeding the maximum number of layers printed on the outer packaging. (no more than two layers). 堆叠组件时请勿超过外包装箱上印刷标志的最高层数限 制（最多堆码2层） 

3.2. UNLOADING WARNNING 卸货注意事项

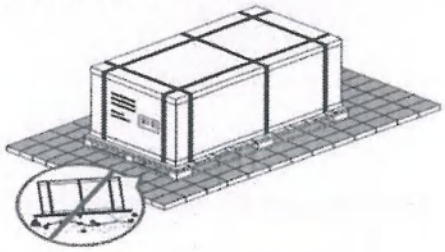
3.2.1. When crane is used to unload the modules, please choose and use specialized tooling according to the weight and size of the module. Before lifting, check whether the pallet and the carton are damaged and whether the hoisting ropes are strong and firm. Please adjust the position of the sling to keep the modules steady. To ensure the safety of the module, wooden sticks, boards or other fixtures of the same width as the outer packing cases should be used on the upper part of the box to prevent the sling from squeezing the pallet and damaging the modules. When placing the modules, do not lower the packing box too quickly. Two people shall support at the two sides of the righting carton gently to place it on a flat ground. **For vertical landscape packages, do not lift up more than FOUR pallets of modules at once. Do not unload modules under the weather conditions of wind more than 6 class (in Beaufort scale), heavy rain or heavy snow.**
采用吊车卸货时，请使用专用工装，吊装前请根据组件重量和尺寸选用足够拉力的吊装工具。吊装前应确认托盘和纸箱是否有破损及吊装的绳索是否结实、牢固。吊装时请调整吊带位置保持组件重心平稳，应在包装箱的顶部使用与其相同宽度的木板或其他固定装置，防止吊带挤压包装箱，导致组件破损。请匀速操作吊具，吊装接近地面时，两人一人一边扶正纸箱轻轻放在平坦位置上。**横式包装一次性最多允许吊装4托组件。严禁在风力大于6级（蒲福风级）、大雨或大雪的气象条件下吊装光伏组件。**



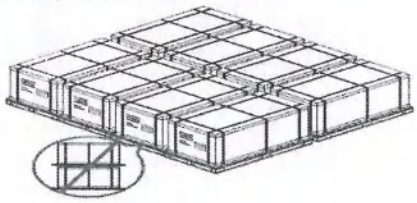
3.2.2. Use a forklift to remove the module pallets from the truck.
请使用叉车将组件从货车上卸下来。



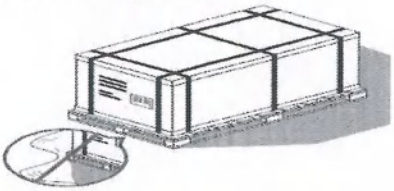
3.2.3. Put the modules on level ground.
将组件放置于水平地面上。



3.2.4. Do not stack the modules at the project site.
禁止在项目地将组件堆码。



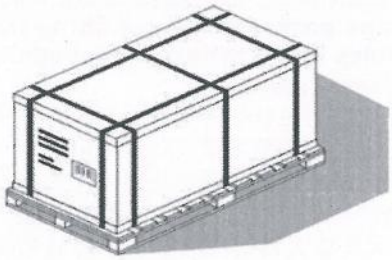
3.2.5. Store the module in a dry and ventilated place.
将组件放置在通风干燥处。



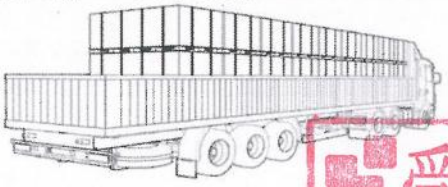
3.2.6. Cover the module with waterproof material to prevent it from moisture.
使用遮雨布盖住组件，防止组件受潮。

3.3. SECONDARY TRANSPORT AND WARNING 二次运输及注意事项

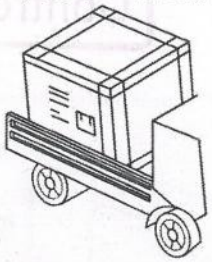
3.3.1. Do not remove the original packages if the modules require long-distance transport or long-term storage.
如果组件需长途运输或长期存储，请不要拆除原包装。



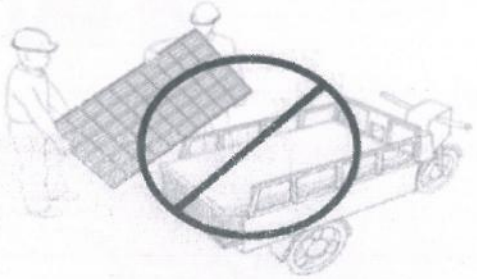
3.3.2. Packaged products can be transported by land, sea or air. During transportation, make sure that the package is fixed securely to the shipping platform without movement. Do not Stack more than two layers on truck.
包装完的成品可以通过陆运、海运、或空运进行运输。在运输过程中：请将包装箱固定在运输平台上，确保 包装不会倾倒、移位。正常卡车运输时，最多2层叠加后运输。（以陆运为例）



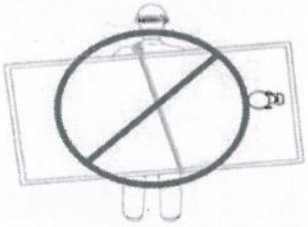
3.3.3. Only one layer stacking is only allowed for transport at the project site.
项目现场托运，只允许 1 层运输。



3.3.4. No transport or handling by pedi-cab or improper vehicle as shown below.
禁止三轮车，马车或其他不合理车辆转运。

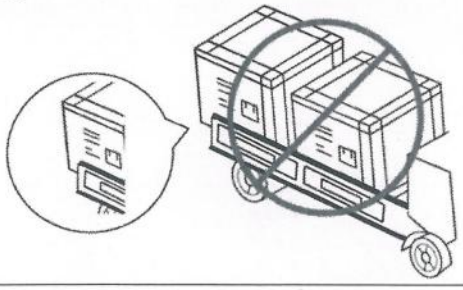


3.3.5. Do not transport the module with rope as shown below.
禁止用绳子背组件。



3.3.6. Do not carry the modules on the back of one person as shown below.
禁止单人背组件。

3.3.7. Do not allow pallets to exceed the loading area of the transport vehicle.
禁止托盘超出运输车辆的装载区。



3.4. STORAGE 存储

1) Do not remove the original package and keep the wrapping film and carton box in a good condition, if the modules require long-distance transport or long-term storage. 如果组件需要长途运输或长期存储，请不要拆除原包装，保持缠绕膜和包装纸箱完好。

2) For long-term storage, it is recommended to store the modules in a standard warehouse with regular inspection, and under confirming of your personal safety, reinforce the package in a timely manner if any anomalies are found. 组件长期存储建议存储在标准仓库中，定期巡检，一旦发现倾斜异常请在保证人身安全情况下及时加固处理。

3) Storage in project site warehouse or normal warehouse (moisture＜85%RH, temperature in the range from -40℃ to +50℃): Do not stack different types of PV modules together. 项目现场及常规仓库存储（湿度<85%RH；温度：-40℃~+50℃）：不同类型组件不允许堆叠在一起。

4) Do not expose the modules to rain or moisture. Store the finished product in a well ventilated, waterproof, dry and smooth place (for vertically portrait package, the inclination of ground needs to be less than 4°), to avoid damage or dumping of the modules due to ground deformation or collapse. The modules should be centrally stored with pallet spacing within 10cm. And the modules should be covered with waterproof material. 禁止淋雨或者受潮，请将包装的成品置于通风、防雨、干燥及平整的地方（立式包装存储区域若存在倾角，要求倾角≤4°），避免因地面变形或塌陷导致包装破损或倾倒。组件尽量集中存放，建议保持托盘间距在10cm之内。组件需使用防水材料盖住。

5) If you need to store the modules in the project site, do not choose soft ground and the ground that is easy to collapse, should choose a hard ground or a higher ground with flat surface to ensure the module packages not collapsing and tilting for long-term storage. 仓库的货架要有足够的承载能力和存放空间，定期巡检确保货物存放安全。如果需要在项目地存储组件，禁止选择松软、容易塌陷的地面，应选择硬质地面或地势较高的地面并对地面进行整平，保证组件长期存放不会塌陷、倾斜。

6) The module must be installed as soon as possible in the project site and must not be exposed to rain or damp. ZNSHINE SOLAR shall not be responsible for any damage or collapse of the modules caused by moisture in the packaging. 到项目地组件应尽快安装，禁止暴露在雨水和潮湿环境中，如因为包装受潮导致组件破损、倒塌等问题，正信光电不承担责任。

4. UNPACKING拆包

4.1. UNPACKING WARING 拆包注意事项

1) For unpacking outdoors, it is prohibited to operate in rainy conditions. Because the carton will become soft and damaged after it gets wet in the rain. The stacked PV modules (hereinafter referred to as "modules") may tip over, which may cause damage or injury to personnel. 在户外拆包时，禁止在雨中作业。因为外包装纸箱会受潮而变软或者损坏，包装箱里的组件有可能会发生倾斜，倾倒将导致组件损坏以及人员伤害。

2) For a windy site, it is necessary to pay special attention to safety. Especially, it is not recommended to transport or unpacking the modules in high wind conditions. The unpacked modules must be tied down to avoid any unwanted movement. 在有风的情况下，需要更加关注现场的安全管理，特别是在强风环境下，正信光电不建议在这种环境下运输及拆卸组件。已经拆包的组件需要采取恰当的方式固定起来。

3) The work surface is required to be level to ensure that the package can be placed stably, avoiding sliding. 作业地面需要保证包装箱能够水平稳定的放置，避免倾倒。

4) Wear protective gloves during unpacking to avoid hand injury and fingerprints on the glass surface. 拆包时，

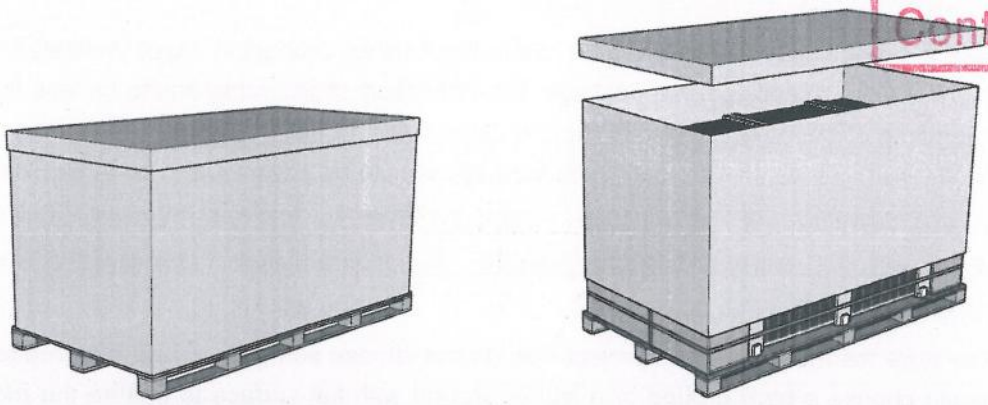
请佩戴劳保手套以避免手受伤，同时确保不会在组件玻璃表面留下手指印。

5) A maximum of six modules can be moved or stacked at a time.单次搬运和堆叠组件的数量不能超过6片。

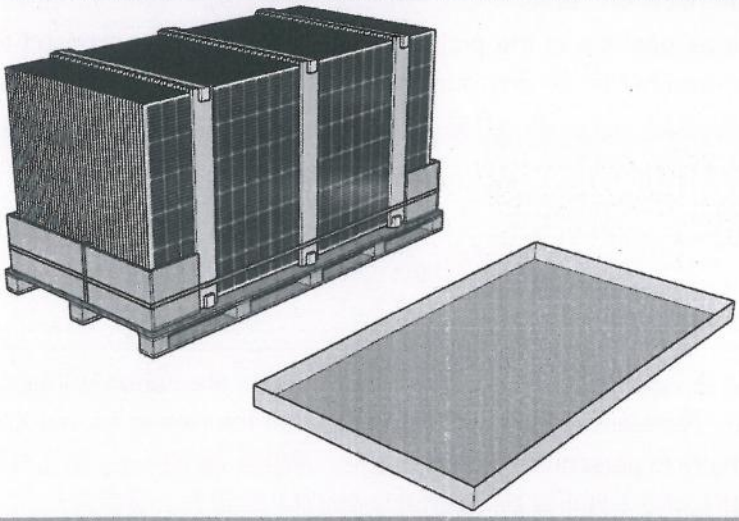
6) Do not move modules by holding the junction box or lifting the wire inside,禁止通过手抓接线盒或者里拎起导线来移动组件

In addition to the above points for attention, consider professional on-site unpacking, exception handling rules, please refer to ZNshine Solar "Spec. for PV Module Unloading, unpacking and Secondary Transferring". 除以上注意事项外，考虑专业性现场拆包、异常处理细则，请参考正信光电《光伏组件卸货、拆包、二次转运规范》。

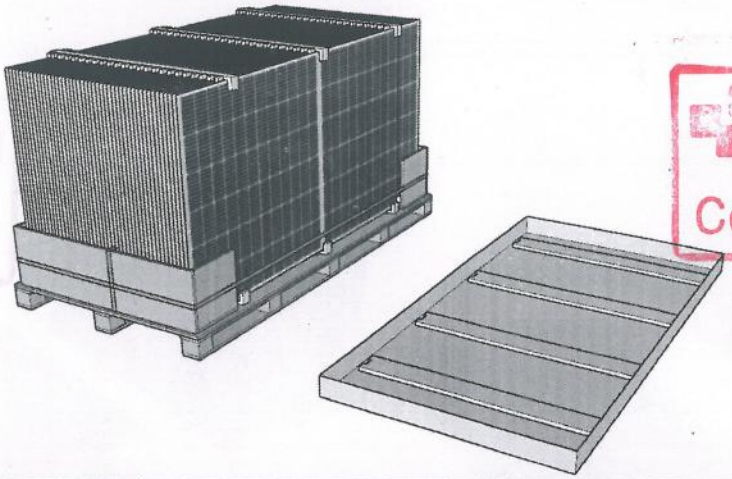
4.2. UNPACKING STEPS拆箱步骤:



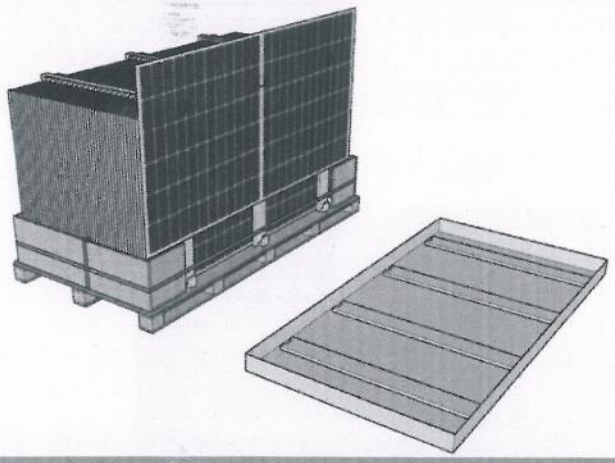
1、Remove all wrapping film and packing tape outside the package.
拆除包装外全部缠绕膜和打包带。

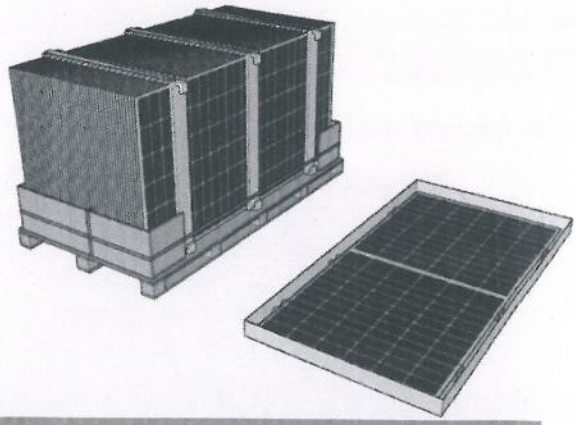


2、Remove packing box and box cover(Place the cover next to the box with the opening up).
拆除包装箱和箱盖（将箱盖放置包装箱旁，开口向上）。



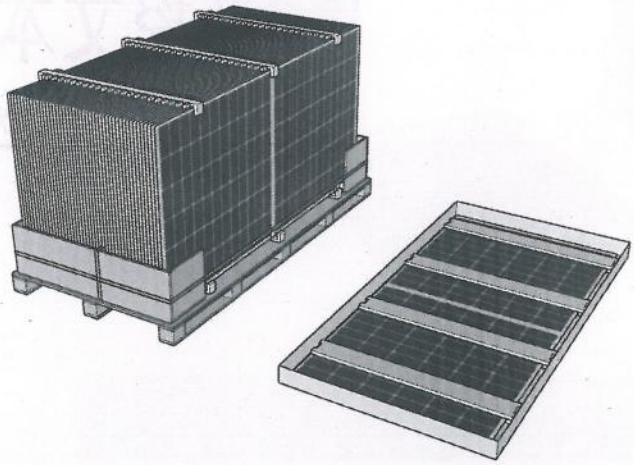
3、Remove the side support honeycomb panel from one side first and lay it in the box cover.
从一面先拆下侧边支撑蜂窝板，并铺在在纸箱盖中。

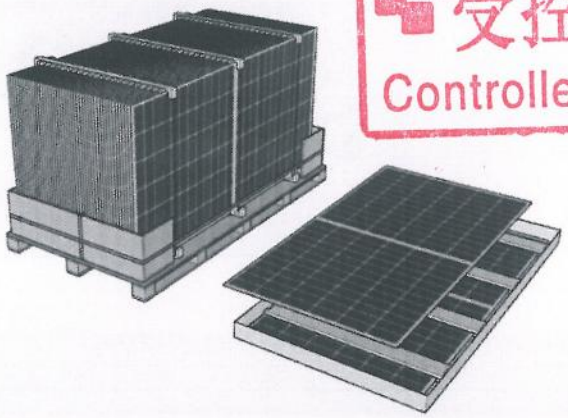




4、To pick up the module, please raise the module to the height of the lower C-shaped enclosure and move out the module When picking up the module, please grab the non-cell white area of the module. When picking up the module, grab the long side direction of the module, the short side direction of the module can only be short grabbed again when out of the box operation.

拿取组件，请将组件抬高至下部C型围挡高度，移出组件拿取组件时，请抓取组件非电池片留白区域. 拿取组件时，抓取组件长边方向，组件短边方向仅可再出箱操作时短抓取。

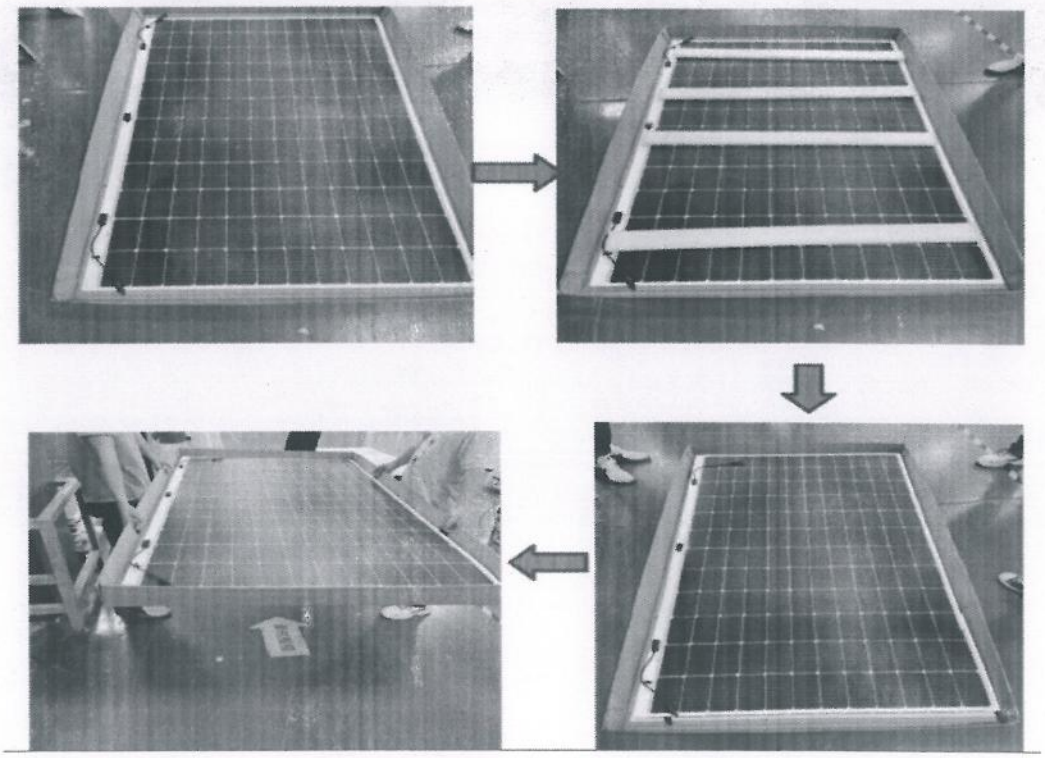




5、Place the box cover open side up and transport the module flat inside the cover to the project designated installation site Place a maximum of two modules in the cover, separated from each other with foam inside the box.Use a minimum of four foam strands, placed evenly between the stacked modules.

将纸箱盖开口朝上，组件平放至箱盖内运输至项目指定安装地点 纸箱内至多摆放两块组件，组件与组件之间使用包装箱内固定用泡棉隔开使用至少 4 根泡棉，泡棉均布摆放在堆叠组件之间；

Module stacking and handling operations are as follows组件堆叠搬运操作方法如下:



5. INSTALLATION 安装

5.1. PRECAUTIONS AND GENERAL SAFETY RULES预防措施和通用安全细则

1) Before installing the modules, please contact the relevant department to obtain information about the installation site and the construction permit, and also comply with the installation and inspection requirements. 安装组件前，应与相关部门联系，获取关于安装场地的信息和施工许可，同时应遵守安装和检查的要求。

2) Check the applicable building codes to ensure that the building to be installed and its structure (roof, facade, load-bearing, etc.) has sufficient load-bearing capacity.检查适用的建筑规范，确保组件所要安装的建筑及其结构(屋顶、外观立面、承重等)具有足够的承重能力。

3) During installation, make sure that the modules are installed on a fire-resistant roof. 安装组件时，应确保组件被安装在防火屋顶上。

4) The modules are compliant with application level A (equivalent to safety level II, IEC 61730-1). This type of modules can be used in systems where the public is likely to come into contact with voltages greater than 50V or power greater than 240W.组件是符合应用等级 A（相当于安全等级 II，IEC 61730-1）。该类组件可用于公众有可能接触的、电压大于 50V 或功率大于 240W的系统。

5.2. ENVIRONMENTAL CONDITIONS 环境条件

1) The modules are suitable for general climatic conditions, ie with reference to IEC 60721-2-1- Classification of environmental conditions Part 2-1: Environmental conditions occurring in nature - temperature and humidity. 组件适用于一般气候条件，即参照 IEC 60721-2-1- 环境条件分类 第 2-1 部分：自然界出现的环境条件—温度和湿度。

2) If the modules are used in a special installation environment, please consult the technical support department of Znshine in advance.如果组件使用在特殊的安装环境，需要提前咨询正信光电技术支持部门。

3) Before installation, ensure that the installation site or surface is free from aging, damage, dirt, and rust, and that the fixed connection is firm.If yes, repair, replace, clean, and rectify the installation only after the installation conditions are met.安装前确认安装场地或表面无老化，无破损，无脏污，无锈迹，固定连接牢固，如不满足，需进行修复，更换，清理，整改满足安装条件后才能安装

4) When installing modules for a rooftop application, it is necessary to consider the overall fire rating of the final structure. At the same time, it is also important to consider the overall maintenance in the future. The roofing PV system shall be installed after being evaluated by construction experts or engineers and with official analysis results for the entire structure. It shall be proved capable of supporting extra weight of system racking structures and PV modules. 当组件安装在屋顶上应用时，需要考虑最终结构的整体防火等级。同时，亦需要考虑后期的整体维护。安装光伏系统的屋顶必须经过建设专家或工程师评估，有正式的完整结构分析结果，并被证实能够承受额外的系统支架压力，包括光伏组件自身重量。

5) The installation surface should be flat without bumps or pits.安装表面应平整，无凹坑或凸起。

6) Even small shadows (such as dust) can cause a drop in power generation. If all surfaces of the module are uncovered throughout the year, the module is considered "no shadow". Ensure that the sun shines on the modules even on the shortest day of radiation all through the year.即使极少的阴影（例如灰尘）也会造成发电量的下降。如果组件整年中所有表面都未被遮挡，则可认为该组件为“无阴影”。保证即使在全年日照最短的一天，阳光仍可照射到组件上。

7) EVA aging caused by frequent occlusion of modules and long-term heating of the diode can affect the lifetime of the module组件经常性的被遮挡导致的 EVA 老化和二极管的长期发热会影响组件的使用寿命，因此请确保组件安装位置常年无阴影遮挡。

8) The modules must not be installed near flames or flammable objects.组件不得安装在火焰或可燃物体附近。

9) Do not expose modules to artificial condensing light sources.不得将组件暴露在人工聚光源下。

10) The modules should not be immersed in water (pure water or salt water), installed in long-term water environment (pure water or salt water) (eg fountains, sprays, etc.) or area prone to water accumulation (eg roof drain, low- lying areas, etc.).组件不得浸泡在水中（纯水或盐水），不得安装在长期沾水（纯水或盐水）的环境中（例如喷泉、浪花等）或容易产生积水的位置（例如坑洼、排水口等）。

11) Please consult SMF installation manual for Flat roofs if roof area has poor drainage or extended water pooling.如果组件置于盐雾（即海洋性环境）或者含硫（即含硫源、火山等）的环境中，会有腐蚀的风险。

12) When selecting the installation location, avoid areas with trees, buildings, or obstacles because these objects will form shadows on solar PV modules, especially when the sun is at the lowest position on the horizon in winter. The shadow will cause the loss of the output power of the solar photovoltaic system. Although the bypass diode installed in the PV module can reduce this loss to some extent, do not ignore the shadow factor. 选择安装位置时，避免有树木、建筑物或者是障碍物的区域，因为这些物体会在太阳能光伏组件上形成阴影，尤其是在冬季当太阳光处于地平线上最低的位置时。阴影会造成太阳能光伏系统输出功率的损失，尽管太阳能光伏组件装有的旁路二极管可以一定限度的减少这种损失，也不要忽视阴影的因素。

13) In an environment with frequent hail, perennial snow, or frequent wind sand, smoke, air pollution, soot, etc., which affects the safety or performance of modules; If installation is required, the installation plan must be evaluated by Znshine technical personnel在冰雹频繁、常年积雪或者经常有风沙、烟尘、空气污染、煤烟等影响组件安全或者性能的环境中；如需安装，需由正信技术人员评估安装方案后执行。

14) If the module is placed in a salt mist (ie marine environment) or in an environment containing sulfur (ie, sulfur sources, volcanoes, etc.), there is a risk of corrosion.如不遵守以上注意事项，正信光电质保将无效。

5.3. INSTALLATION REQUIREMENTS安装要求

1) Ensure the modules meet the overall technical requirements of the system.确保组件满足系统的整体技术要求。

2) Ensure that components of other systems do not cause damaging mechanical or electrical performance effects on the modules.确保其它系统的元部件不会对组件造成破坏性的机械或电性能影响。

3) Connect modules in series to increase voltage or in parallel to increase current. When connected in series, the positive pole of the module is connected to the next negative pole. When connected in parallel, the positive pole of the module is connected to the positive pole of the next module.允许串联组件以增加电压或并联增加电流。串联时，组件的正极与下一个组件的负极相连。并联时，组件的正极与下一个组件的正极相连。

4) The number of bypass diodes provided varies depending on the module model.提供的旁路二极管的数量根据组件型号的不同会有所不同。

5) Connect the appropriate number of modules according to the voltage specifications of the inverter used in the system. Even at the lowest local temperature conditions, the connected modules must produce no more than the voltage allowed by the system. If overcurrent protection devices (fuse) are not used in series within each string of modules, up to two strings of modules can be connected in parallel. If a suitable overcurrent protection device is connected in series with each string of modules, three strings or more modules can be connected in parallel.根据系统所使用的逆变器的电压规格连接适当数量的组件。即使在最差的当地温度条件下，连接在一起的组件产生的电压不得高于系统允许的电压值。在每串组件内如不串联使用过流保护装置（保险丝），最多两串组件可以并联在一起。如果每串组件上都串联一个适当的经验证的过流保护装置，三串或更多的组件可以并联连接。

6) In order to avoid (or reduce) the mismatch effect of the array, it is recommended to connect modules of similar electrical performance on the same string.为了避免（或减小）阵列的失配效应，建议将相似电性能的

组件连接在同一串上。

7) In order to reduce the risk of indirect lightning strikes, loops should be avoided when designing the system.为了减小间接雷击造成的风险，设计系统时应避免产生环路。

8) The modules should be securely fastened to withstand all possible loads, including wind and snow loads.组件应牢固固定，以便能承受所有可能的负载，包括风和雪荷载。

9) Do not open modules outer Package before installation.在运输过程中，为了保证组件的安全，请到达安装地点后，再打开组件包装箱；

10) Check the outer package for damage before unpacking.拆箱前，请检查包装箱有无破损；

11) Slip-Proof Gloves are recommended for unpacking and handling.拆箱人员建议事先佩戴好防滑手套；

12) Do not grab the modules by the junction box or cables during unpacking or handling.在任何情况下都严禁以接线盒或连接电缆为拉手来吊运或搬运组件；

13) Modules should be handled and lifted by at least two people. Do not touch the solar cell area during handling to avoid cell-cracks.为避免损坏电池片，需两人同时抬起组件的四个角（避开电池片位置） 来搬运组件；

14) Be careful while carrying the modules. Avoid hitting the modules on the ground or other sharp, hard objects. Scratches will affect the module's safe operation.在组件搬运过程中需谨慎作业，避免组件边缘磕碰到地面或其他尖锐、坚硬物体；

15) Check the surfaces of the modules, make sure there's no damage to the frontsheet and the backsheet.请检查组件表面有无破损，若组件表面材料存在损坏或磨损，请勿使用；

16) Check the junction box, connectors, and cables for any damage. Double check if the junction box cover is fixed securely.请检查接线盒、接头、线缆有无破损，盒盖是否盖紧，若存在损坏，请勿使用；

17) Do not paint or apply glue or label on the surface of the modules.严禁在组件表面进行刷油漆、涂粘贴剂、贴标签等操作。

18) Normal construction can be carried out in the temperature range of -10 to 45 Celsius degrees (5 to 40 Celsius degrees is the best), and the humidity is below 80 %Rh.需在-10 至 45℃温度范围（最佳温度范围 5 至 40℃），湿度在 80%以下可正常施工；

19) The surface of the roof must be cleaned or wiped dry, free of floating soil, oil, etc. In order to achieve the required adhesion, the roof shall be cleaned using the cleaning agent specified in Annex C .基层表面必须清理或擦拭干净，保持干燥、无浮土、油污等，为了达到所需的粘贴力，须使用附件 B 规定的清洗剂清洗屋顶；

20) After initial installation, the panel and adhesion shall not be disturbed for 24 hours.施工后 24 小时内粘结处不能撕裂、剥离；

21) The roof angle is within 45 degrees 屋面角度在 45 度以内；

22) The paste surface needs to be flat and free of pits or bumps.粘贴面需要平整，无凹坑或凸起；

23) When the laying direction of the support rail is perpendicular to the direction of the water flow, the rail and the roof should be pasted intermittently to ensure smooth drainage (not recommended).粘贴后的结构胶高度不低于 3mm，切勿使用脚或其它非指定工具压实结构胶。

5.4. INSTALLATION INSTRUCTIONS安装指南

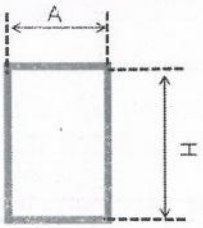
Modules can be installed in different ways according to different installation environments, including direct adhesive installation, support and fixture auxiliary installation, removable fixture installation, and replacement component installation. Flat roof, curved surface or trapezoidal color steel tile can be directly used adhesive

installation method; For uneven installation scenarios, such as angular flanging or vertical locking type color steel tiles, additional support systems are required for installation.组件根据不同的安装环境采用不同的安装方式，安装方式包括组件直接粘胶安装、支架和夹具辅助安装，可拆卸夹具安装、更换组件安装。 平整的屋面，曲面或者梯形彩钢瓦等可以直接采用胶粘的安装方式；对于不平整的安装场景，如角驰型或者直立锁边型彩钢瓦需额外的支架系统进行安装。

5.4.1. Installation with tube and Silicone使用导轨和结构胶安装

1) Tools施工工具

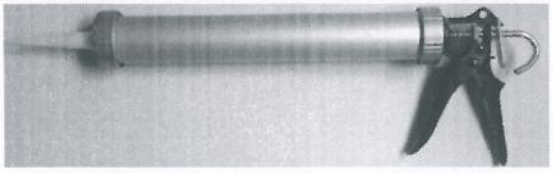
- **Aluminum support rail垫平铝方管**



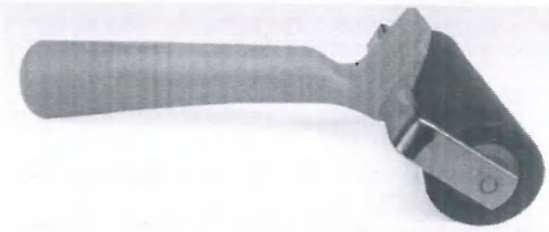
Material材质: Aluminum 6063-T5/T6 铝型材 6063-T5/T6
The recommended width A is 40mm, and the height is about the peak height of the steel tile (H±5mm).宽度A建议为20-50mm，高度约为彩钢瓦波峰高度（H±5mm）。

- **Silicone sealant结构胶Silicone Structural Sealant 硅酮单组分结构胶**

- **Gluing gun 胶枪**

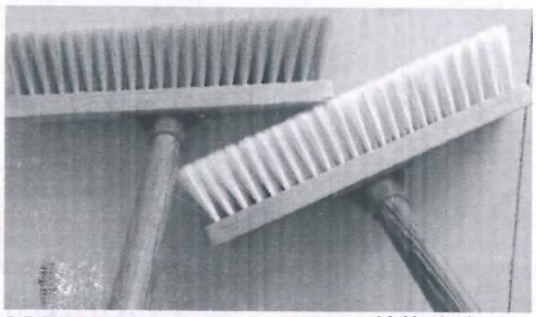


- **Plastic roller 滚轮**



To compact adhesive tape under the cell.粘贴组件时，用于压实组件。

- **Cleaning tool 清洁工具**



2) GLUING OPERATION SPECIFICATION结构胶施工规范

注意事项：

- Please make sure the surface is cleaned and there are no water pits before gluing清洁施工表面后，表面无水渍方可打胶；
- Glue along the middle line of the trapezoid or wave crest. Width of silicone glue strips should be 6-10 mm and height of the strips should be 3-5 mm.沿波峰中心处打胶，胶宽6-10mm，高3-5mm；
- Applying the silicone glue should be a continuous and even movement. Please use a roller to spread out the glue strips evenly. Do not smooth out the lines of glue to spread them out涂抹必须均匀，连续，粘贴前不允许刮平胶条，要靠挤压使胶蔓延；
- Make sure to complete the gluing and mounting over a duration that does not exceed 5 minutes打胶与组装时间要控制在最短时间内完成（不能超过 5 分钟）；
- Silicone sealant will cure to a depth of 2-3mm in 48 hours. Do NOT apply any force on the module before curing is complete.结构胶在 48 小时内，胶体将固化 2~3mm 的深度，未完全固化之前请勿受力。

INSTALLATION STEPS步骤

S1.1 Cleaning the roof surface清洗屋面

Remove debris from the roof base and use a designated or approved cleaning agent (Annex C) to clean the roof. If the roof is very dirty, use a low-pressure water spray or power washer before using the cleaner. Optionally, use a mixture of 1/4 cup of trisodium phosphate, 1/2 cup of liquid cleaner and 5 gallons of water for cleaning.去除屋面基层上的杂物，使用指定或认可的清洗剂（附件 D）清洗屋面基层，如果屋面基层非常脏，在使用清洁剂之前先用低压水喷淋或动力清洗机， 使用（1/4 杯磷酸三钠，1/2 杯的液体清洗剂（可选）和 5 加仑水）清洗。

S1.2 Positioning and securing the line放线定位

- Positioning and securing lines to determine the spacing of CS supports in accordance with the design drawings .根据设计图纸，确定组件在屋面上的位置，进行放线测量。
- The distance between two adhesives during component bonding installation should refer to 520+/-20mm.组件粘接安装时两根胶之间的间距参考 520+/-20mm。
- The assembly should not be glued to the joint of the two guide rails during the layout design.排布设计时禁止组件粘接在两根导轨的接缝处。

S1.3 Brush primer (ignore this step if no primer required for the roof material)基材涂刷底涂（如基材不需要底涂可忽略此步）

- Determine the gluing area of the modules after the roof cleaning (refer to the design drawing for specific dimensions)在清洁后的屋面上确定组件的涂胶区域（具体尺寸参照设计图纸）；
- Clean the gluing area again, wipe the area with the cleaning agent 对涂胶区域二次清洁，使用专用清洁剂对区域进行擦拭；
- For the gluing area, brush primer before gluing to increase adhesion 在涂胶区域，结构胶施工前涂刷一层底涂，增加附着力。

Roof type屋面基材类型	Primer needed屋面基材是否需要底涂	Primer type底涂型号
TPO	Yes	Contact Znshine
Concrete混凝土屋面	Yes	Contact Znshine
Glass 钢化玻璃	No	
PVC	No	

S1.4 Gluing打结构胶

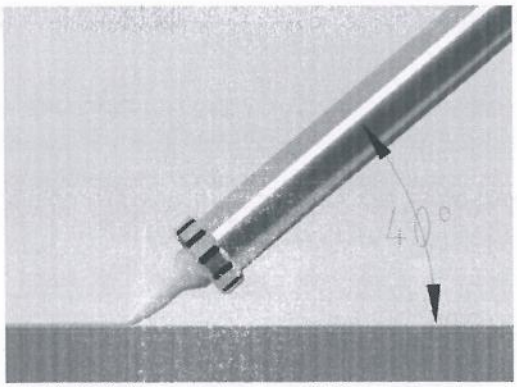
- Gluing parameters打胶参数：

  Gluing length: 10.8m/600ml on.打胶长度：平均 10.8m/600ml。

  Average Gluing speed: about10cm/s.打胶速度：约为 10cm/s。

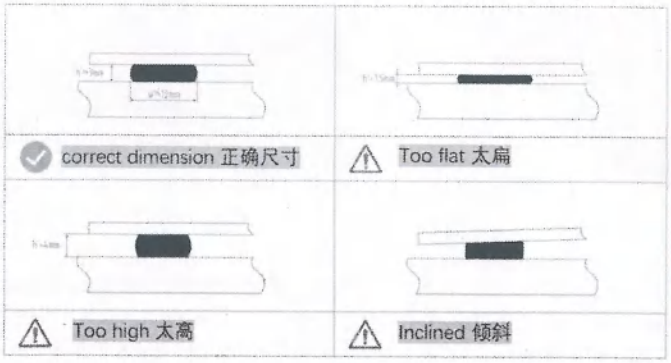
- Gluing angle打胶角度：

  The glue gun is at an angle of about 40° with the ground, as shown in the following figure.胶枪与地面呈约40°角度，如下图所示：



- Structural adhesive 结构胶形，打胶的胶宽 6～10mm，高约 3～5mm；

- The correct form of structural adhesive after pasting modules粘贴组件后结构胶正确的形式：



- Adhesive size and standard dosage: Adhesive size at least 10*5mm;胶尺寸及标准用量：胶条尺寸至少10*5mm；

S1.5 Paste rail 粘贴方管

- The application must be uniform and continuous, and it is not allowed to scrape the tape before pasting, and it is necessary to squeeze the glue to spread涂抹必须均匀，连续，粘贴前不允许刮平胶条，要靠挤压使胶蔓延；
- Paste the rail along the gluing path, lightly compress, keep the glue thickness is not less than 3mm粘贴方管，将方管沿着打胶路径粘贴，轻轻压实，保持胶厚不小于 3mm；

S1.6 Laying modules粘贴组件

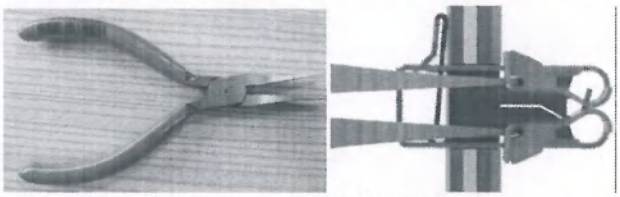
Glue the square pipe according to the above structural glue construction specifications.按上文结构胶施工规范要求在方管上打胶。

- Do not bend the module during installation. Two people should grasp the white edge of the module and place it onto the glue. Modules should be in a straight position during placement. Do not re-glue the modules.安装组件时禁止过分扭曲组件。需双人抓住组件白色边缘，缓缓放入涂胶区域。粘贴组件时，应做到横平竖直，切勿二次粘贴；
- Once modules are placed, avoid hand-pressing the cell-area to facilitate adhesion. Instead use a compaction roller to press the edge (non-cell area) of the module down. Also use a Plastic roller or Honeycomb panels in packaging to apply gentle force to the cell area to facilitate adhesion.组件贴平后，禁止用手按压电池片进行稳固，需使用压边滚轮压实组件非电池片区域，使用塑胶滚轮或者包装中的蜂窝板在组件表面滚压，以确保组件与屋面之间粘接良好；
- The minimum distance between the modules is 2mm，and the distance between each array is 500-800mm, which is used as a construction maintenance walkway. (refer to the pictures)组件之间最小距离为 2mm，阵列之间 500~800mm 施工检修通道（此间距仅供参考）；
- The junction box is placed on the side of the inspection channel to facilitate serial wiring and inspection将接线盒置于检修通道侧，便于组串接线以及检修检查；
- Install remaining modules according to the preceding steps.按照以上步骤安装其他组件。

5.4.2 Install using detachable guide rails and structural adhesive使用可拆卸导轨粘接安装

Detachable guide rail (figure below) is composed of left and right profiles and fixed by clamping. The left and right guide rails are glued to the back of the photovoltaic module and the mounting surface with structural adhesive, and the detachable profiles facilitate the flexible replacement of themodule or the mounting surface. For details, see 5.4.1.可拆卸导轨(左下图)由左右两根型材配合组成，通过卡夹固定。左右导轨用结构胶分别粘在光伏组件背面和安装面上，可拆卸型材便于光伏组件或安装面灵活更换。操作步骤参考5.4.1。

支架安装图



支架拆卸示意

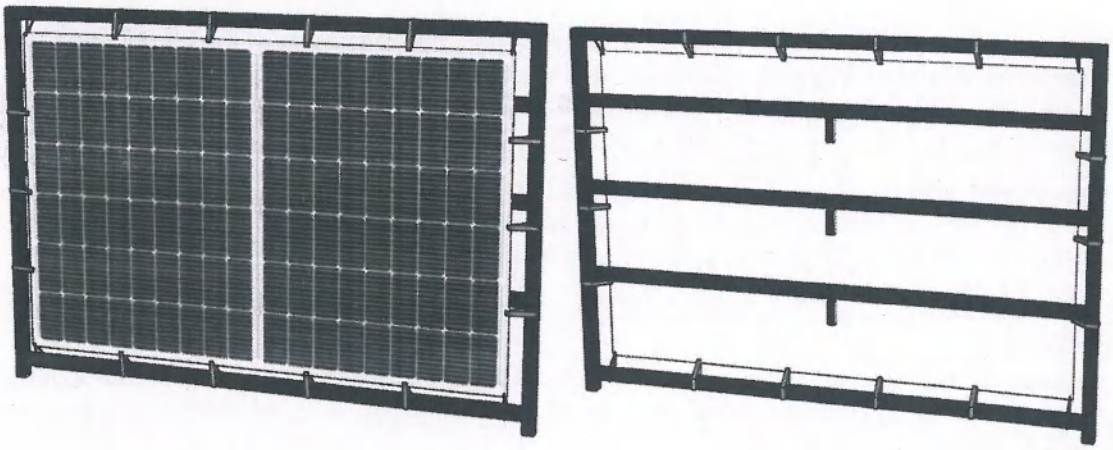
Align the two guide rails up and down, align the mounting holes on the two guide rails, and insert the card clips into the holes. The rails were assembled at the sound of a click将两根导轨上下对齐合并，对齐两根导轨的安装孔后，将卡夹插入孔内，听到咔哒声后导轨组装完成。

When disassembling the guide rail, use the pliers shown in the figure above. Reach inside the card clip to clamp the lock teeth inside and pull out the card clip to remove the guide rail.拆卸时使用上图钳子，伸入卡夹内部夹住内部的锁齿后可以拔出卡夹完成导轨的拆卸。

The structure of the detachable guide rail is composed of the left and right profiles, which are connected by the clamp. The left and right guide rail are respectively bonded to the back and mounting surface of the photovoltaic module with structural adhesive. Removable design, easier to install and disassemble modules. 可拆卸导轨的结构由左右两根型材组成，使用卡夹连接，左右导轨用结构胶分别粘接光伏组件背面和安装面上。可拆卸设计，更便于光伏组件安装拆卸。

5.4.3Install using cable ties 使用扎带安装

The Modules have holes on all sides and can be installed by binding them with cable ties.组件四周带有开孔，可使用扎带绑扎的安装方式.



- Use stainless steel cable ties or nylon cable ties to tie the modules to the railing to ensure that the modules are level, so that each cable tie is evenly stressed;使用不锈钢扎带或尼龙扎带将组件绑扎在栏杆上，确保组件水平，使每个扎带受力均匀；
- The cable ties should be tightened to ensure that the components do not shake.扎带需要拉紧，确保组件不会晃动；
- It is necessary to pay attention to the junction box behind the modules, which cannot be pushed against the railing and cause the component to protrude;需要注意组件背后线盒，不能被栏杆抵住导致组件突起；
- It is necessary to check the cable ties regularly and replace them in time when the tension is weakened or damaged.需要定期检查扎带情况，拉力衰减或破损时需要及时更换。

5.5. MODULE WIRING组件接线

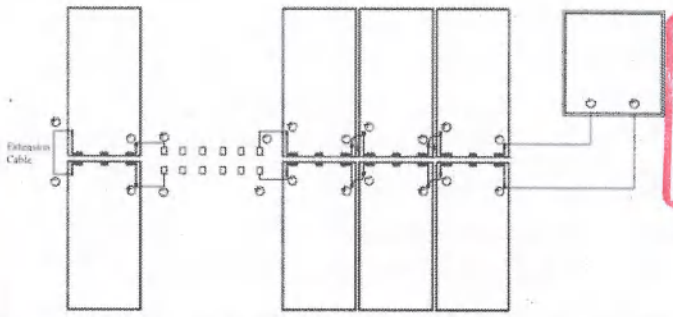


Fig. 5-5 Split J-Box at module side position for vertical direction

图5-5 接线盒在边缘的垂直安装方式

Precautions: To minimize risk in the event of an indirect lightning strike, avoid forming loops when designing the system. In order to avoid bad or damaged connection of the cable and connector, the cable and junction box caused by human factors, affecting the electrical safety or service life of the product, it is recommended that the force applied between the cable and connector, cable and junction box shall not be greater than 60N during the installation, dismantling, maintenance and any other related process of the Product. **安装需注意事项：**为了将间接雷击的风险降到最低，在设计系统时应避免形成回路。为避免人为因素造成线缆与连接器、线缆与接线盒连接不良或损坏，影响产品电气安全或使用寿命，建议产品在安装、拆卸、维护及任何其它相关过程中，施加在线缆和连接器、线缆和接线盒之间的作用力不得大于60N。

Pay attention to the direction of the wire when installing the modules. It should be connected along the wire direction to avoid bending the wire. 注意组件安装时的导线方向，应顺着导线方向连接，避免导线折弯。

5.6. ELECTRICAL CONNECTION 电气连接

1) Check that the wiring is correct before starting the system. If the measured open circuit voltage (Voc) and short circuit current (Isc) do not match the specifications provided, there may be a wiring fault.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。
2) The Direct Current (DC) generated by the PV system can be converted to Alternating Current (AC) and connected to the public power grid. Different regions may have different policies, laws and regulations to stipulate the installation and grid-connection requirements of PV systems. Therefore, during the design, installation and grid-connection of PV system, please comply with the local policies, laws and regulations. 光伏系统产生的直流电可以转换成交流电，并与公共电网相连。不同地区可能有不同的政策和法律法规来规定光伏系统的安装要求和并网要求，因此在光伏系统的设计、安装和并网过程中，请遵守当地政策和法律法规要求。
3) PV modules can obtain different current and voltage outputs through series connection and parallel connection. Read this installation manual carefully before electrical connection and installation. Please design and connect according to the current and voltage required by customers. Before connection, please ensure that the connection part is free from corrosion, and keep it clean and dry. 光伏组件通过串联和并联的连接方式可以获得不同的电流和电压输出，在进行电气连接和安装前，请仔细阅读本安装说明书，并依据客户所要求的电流和电压进行设计和连线。连接前请确保连接部分无腐蚀，保持清洁和干燥。
4) Different types of modules cannot be connected in series. Modules connected in series should ensure the consistency of their current (For the rest of modules with different current classes, the modules with adjacent current class can be installed in one given string.). The voltage of the module string should not exceed the allowable system voltage value, which can be found on the nameplate or datasheet of the module.The use of PV modules with different configurations in a PV system is prohibited. 不同类型的组件产品不能串联在一起，

串联在一起的组件产品要保证其电流的一致性（关于尾装的不同电流分档的组件，相邻电流分档的可安装在一个组串内。）。组件串的电压不能超过所允许的组件系统电压值，该电压值可以在组件的铭牌或者规格书里找到。禁止在光伏系统中使用具有不同配置的光伏组件。

5) The standard copper cables applied in ZNSHINE SOLAR modules are UV resistant and with a cross-sectional area of ≥4 mm² (12 AWG). All other cables used to connect the DC system should have a similar (or better) specification. 正信光电的光伏组件采用截面积≥4mm² 且防紫外的光伏专用电缆。用于连接直流系统的所有其他电缆应具有相似（或更高）规格。

6) The maximum number of modules in series depends on the system design, the type of converter used and the environmental conditions. In general, the maximum number (N) of PV modules in series can be calculated by dividing the maximum system voltage by the open circuit voltage of the relevant solar PV modules. When designing the solar PV system, it is necessary to take into account the characteristic that the voltage of the solar PV module changes with the temperature. Considering the voltage increase caused by temperature drop in extreme environment in winter, the maximum series connection number of solar PV modules can be calculated by the following formula. 串联组件的最大数目取决于系统设计、所用变频器的类型和环境条件。通常情况下，最大的串联太阳能光伏组件数量（N）可以通过系统最大电压除以相关太阳能光伏组件开路电压的方式计算而获得，但是在设计太阳能光伏系统时，一定要考虑到太阳能光伏组件的电压随着温度变化而变化的特性。考虑到冬季里极端环境下温度下降造成的电压升高，太阳能光伏组件最大串联数量可以使用以下公式计算：

Formula 公式	Maximum system voltage $V \geq N*Voc*[1+\beta*(Tmin -25)]$ 最大系统电压$V \geq N*Voc*[1+\beta*(Tmin -25)]$
V	Maximum system voltage 最大系统电压
N	The number of maximum solar PV modules in series 能串联在一起的组件的最大数量
V_{oc}	The open circuit voltage of each module (see product label or datasheet) STC 条件下组件的开路电压（可以查看组件的标签或者规格书）
β	Temperature coefficient of open circuit voltage of the module (refer to datasheet) 组件的开路电压的温度系数（请参考组件的规格书）
T_{min}	The lowest ambient temperature at installation site 组件安装地的最低环境温度

Table 5-5 maximum series connection number calculation 串联最大数量计算

7) The number of modules that can be connected shall be determined by a qualified institution or person in accordance with the design specifications of the photovoltaic system and the local electrical design specifications. The calculation formula recommended by ZNSHINE SOLAR shall be for reference only. 具体所能连接的组件数量，应按照安装地的光伏系统设计规范、电气设计规范，由具备设计资质的机构或人员确定，正信光电所建议的计算公式仅供参考。

8) If the modules are allowed to be installed in parallel electrically, each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified. For applications requiring high currents, several photovoltaic modules can be connected in parallel; the total current is equal to the sum of individual currents, each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified. The recommended number of modules in parallel is only one. The modules' electrical performance in a system is the same. When connected in series, all modules must have the same amperage. When connected in parallel, the modules must all have the same voltage. Connect the quantity of modules that match the voltage specifications of the devices used in the system. The modules must not be connected together to create a voltage that is higher than the permitted system voltage. 如果允许组件并联安装，则每个组件(或串联的组件串)应按规定配置最大串联保险丝。对于需要大电流的应用，多个光伏组件可以并联；总电流等于各电流之和，每个组件(或串联的组件串)应按规定配置最大串联保险丝。推荐

的组件并联数只有一个。组件在系统中的电气性能是相同的。串联时，所有组件必须具有相同的安培数。当并联时，所有组件必须具有相同的电压。连接组件的数量与系统中使用的设备的电压规格相匹配。组件不能连接在一起以产生高于允许的系统电压的电压。

9) Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings then check the string configuration before making the connection. 如果一组阵列以相反极性连接到另一个，则会对产品造成无法修复的损坏。在进行并联之前，请务必确认各列的电压和极性。 如果测量发现各列之间的极性相反或电压差值大于10V，则在进行连接之前检查其结构配置。

10) Before wiring the module, ensure that the contact points are corrosion resistant, clean, and dry; If a string of modules is reversed, irreparable damage can be caused. 在组件布线之前，请确保接触点是耐腐蚀、清洁和干燥的；如果一个组件串正负极反接，可能会造成无法弥补的损害。

11) During field wiring, only single-wire photovoltaic special copper cables with minimum temperature resistance of 90 ℃, sunlight resistance (UV) and cross-sectional area of no less than 4mm² can be used as photovoltaic connecting wires. The minimum and maximum outer diameters of the cable are 5 to 7mm. The minimum bending radius of the cables must be 43mm. Any cable damage caused by bending too much or cable management system is not covered under ZNSHINE SOLAR's warranty. When installing modules on the roof, it is recommended to use 4~6mm² special photovoltaic cable. Plug & Play connectors are included at the end of each cable. All other cables used to connect the direct current system shall have similar (or higher) specifications, and should have the suitable insulation ability which can suffer the possible maximum system Voc (as defined in TUV 2PfG1169 or EN50618 (H1Z2Z2-K)) or 62930 IEC 131 1x4mm². ZNSHINE SOLAR requires all cables and electrical connections to comply with the electrical regulations of the countries where the PV system is installed. 现场接线时，只能使用最低耐温90℃、耐阳光（紫外线）、横截面积不低于4mm²的单线光伏专用铜电缆作为光伏连接线。电缆的外径范围5～7mm。电缆的最小弯曲半径应为43mm。因过度弯曲或电缆管理系统造成的损坏不包括在正信光电的保修范围内。在屋面平铺安装组件时，建议使用4～6mm²的光伏专用电缆。每根导线端点都带有即插即用的连接器。用于连接直流系统的所有其他电缆应具有相似（或更高）规格。同时具备适当的绝缘性能以便承受可能的最大系统开路电压（如 TUV 2PfG1169 或者 EN50618（H1Z2Z2-K）或者 62930 IEC 131 1x4mm² 批准）。正信光电要求所有接线和电气连接符合该光伏系统安装地各国电工法规的规定。

12) Under normal conditions, a PV module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc . marked on this PV module should be multiplied by a factor of 1.25 at least when determining component voltage ratings, conductor current ratings, and size of controls (e.g. inverter) connected to the PV output. 在正常情况下，组件可能会遇到产生比标准测试条件下更高的电流或电压的情况。因此当确定组件额定电压、导体额定电流和连接到PV输出的控制装置(如逆变器)的尺寸时，标记在此组件上的Isc和Voc的值最低应乘以1.25的系数。

13) A maximum system voltage of 1000VDC is allowed最大系统电压为 DC1000V。

14) When selecting a cable, the minimum current-carrying capacity of the cable can be calculated by the following formula. 在选择电缆时，电缆的最小载流容量可以通过下面这个公式来计算：

Minimum current-carrying capacity of the cable =1.25*Isc*Np

电缆最小载流容量=1.25*Isc*Np

Isc: short-circuit current of PV module (unit: A)

Isc：光伏组件的短路电流（单位：A）

Np: the number of modules in parallel or module strings

Np：并联的组件数量或者组件串数量

15) To ensure proper system operation the correct cable connection polarity should be observed when connecting the modules to each other or to a load, such as inverter, a battery etc. If modules were not connected correctly, the bypass diodes could be destroyed. 为了确保系统正常运行，在连接组件或连接负载（如变频器、电池等）时，应观察确保电缆的极性连接正确。如果组件连接不正确，旁路二极管可能会损坏。

16) Before connecting the module, please make sure using the connector approved by ZNSHINE SOLAR. Otherwise, ZNSHINE SOLAR does not responsible for any potential defects or risks. When conducting

electrical connection of the modules, please use diagonal pliers to cut the cable tie. When cutting the tie, be careful not to scratch the cables or the backside of the module. According to the electrical requirements. The positive and negative connectors should be connected in turn, and confirm that you hear a "click" to indicate that the connection is successful. Otherwise, during the operation of the modules, this could lead to electric arc due to poor connections and can burn the connectors. It is not recommended to interconnect different types of connectors. Please pay attention that the unlock method of connectors is different according to local laws and regulations. 连接前请检查，确保使用正信光电认可的连接器相连接，否则正信光电将不承担任何由此造成的缺陷或风险。请使用斜口钳剪开电缆扎带，注意不要划伤电缆和组件背部。按电气要求将组件间正负极连接器依次对插，确认听到"咔"的一声表示连接到位，否则将来组件允许时，会由于虚接产生电弧而烧坏连接器。不同型号的连接器不建议互插连接使用。请注意连接器的打开方法各地法律法规要求不同。

17) When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module as shown in below figure 5-8. Modules with different electric performance models cannot be connected in one string. During there is no any protection for string due to suitable anti-reverse devices and fuse, do not connect two or more strings with Y or T connector. Do not connect fuse in Combiner Box or string inverter with two or more strings in parallel connection without any anti-reverse devices or function. 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，如图5-8所示。不同电性能型号的组件不能连接在一串内。禁止在无合适防返装置及熔丝进行组串级保护的情况下使用Y或T型连接器来连接两串或多串组件。禁止将组串接入无防返装置或功能的汇流箱或组串式逆变器中。

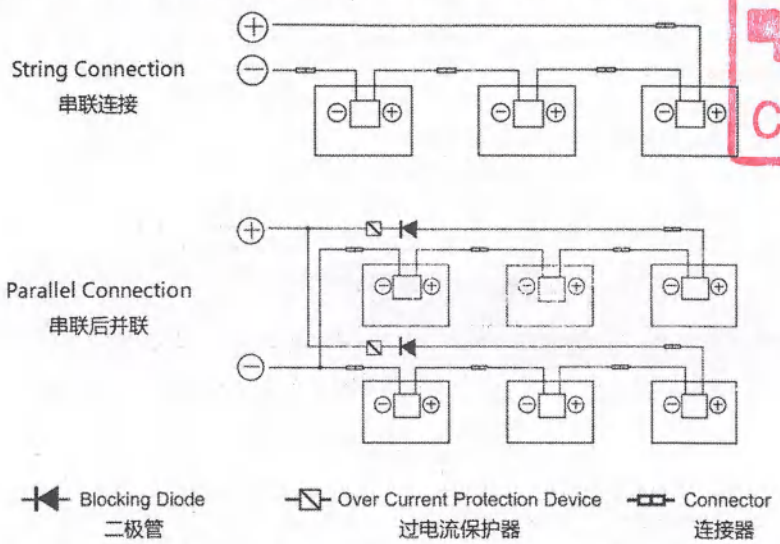


Fig. 5-8 Series Connection and Parallel Connection Circuit Diagram

图5-8 串联、并联线路电气图

18) Before the commissioning and operation of the power station, please check the electrical connection of modules and strings, making sure all connection polarity is correct and the open circuit voltage meets the requirements of the acceptance criteria. 电站调试允许前，需要对组件和组串进行电器检查，确认组串的极性正确，其开路电压符合验收规范要求。

19) The number of modules in series and in parallel shall be designed reasonably according to the system configuration. 组件串联、并联数量，需根据系统配置合理设计。

20) Make sure the MC4 connector is secure and properly connected. The MC4 connector must not be subjected to external pressure. The MC4 connector can only be used for circuit connection functions and should not be used to turn the circuit on and off.确保连接器紧固、正确连接。连接器不得承受外部压力。连接器只能用于电路连接功能，不得用于开启和关闭电路。

21) Depending on local fire, construction and electrical standard, use dedicated solar cables and suitable MC4 connectors to ensure the electrical and mechanical performance of the cable.依据本地的防火、建筑和电气规范，采用专用的太阳能电缆和合适的连接器，并确保电缆的电性能和机械性能良好。

22) Secure the cable to the mounting system with a cable tie that is UV resistant. Appropriate measures should be taken to protect the exposed cable from damage (eg. in a plastic sleeve with UV aging resistance). Avoid direct exposure of the cable to direct sunlight.使用具备抗UV性能的扎带将电缆固定在安装系统上。应采取适

当措施保护曝露的电缆免受损坏（例如置于具有抗UV老化性能的塑料套管 内）。避免电缆直接曝露在直射阳光下。

23) Excessive cables must be organized or fixed in the proper location.必须将多余的电缆整理或固定在适当的位置；

24) All the above instructions must be followed to meet ZNSHINE SOLAR warranty conditions. 须遵守上述所有说明以满足正信光电保修条件。

6. MAINTENANCE运维维护

To ensure optimal performance of modules and maximize system power generation, the following maintenance measures are recommended:确保组件能达到最佳性能，系统发电量最大化，建议采取以下维护措施：

6.1. APPEARANCE INSPECTION外观检查：

1) Whether the module is damaged组件是否有破损；

2) Whether there is a sharp object touching the surface of the module是否有尖锐物体接触组件表面；

3) Whether the modules are obstructed by obstacles and objects, avoiding new trees, new poles etc. to shielding the modules组件是否被障碍物、异物遮挡，避免新长的树木，新立的电线杆等遮挡组件；

4) Check for corrosion near the busbar. This kind of corrosion is caused by the damage of the module surface during transportation, which causes moisture to penetrate into the interior of the module电池片栅线附近是否有腐蚀情况。这种腐蚀情况是由于组件表面封装材料在运输过程中遭到破损，导致水汽渗透到组件内部所造成；

5) Check the adhesive between the module and the roof for looseness or damage and adjust or repair it in time 检查组件与屋面之间的专用胶是否有松动，并进行及时调整或修复；

Notice：Do not walk, stand or sit on the module when cleaning.注意：切勿在组件上走动、站或坐着进行组件清洗。

6.2. CLEAN THE MODULES组件清洁

The accumulation of dust or dirt on the surface of the modules will reduce the power output. It should be cleaned regularly to keep the surface clean. Generally, it should be cleaned at least once a month, appropriately increase the frequency in the harsh natural environment. Pay attention when cleaning PV modules:，组件表面的灰尘或污垢累积会减少发电输出，应定期清洗，保持表面清洁，一般应至少每月清洁一次，自然环境恶劣情况下适当增加频次。清洗光伏组件时应注意：

1) Rinse with water first, then dry the water with a soft cloth. Do not use corrosive solvents to clean or wipe the PV modules with hard objects.应先用清水冲洗，再用软布将水迹擦干，严禁使用腐蚀性溶剂清洗或用硬物擦拭光伏组件。

2) The PV module should be cleaned at an irradiance of less than 200 W/m2. It should be cleaned in the absence of sunlight or in the morning and evening.应在辐照度低于 200W/m2 的情况下清洁光伏组件，宜在没有阳光的时候或早晚进行清洗

3) It is strictly forbidden to clean PV modules under meteorological conditions where the wind is greater than grade 4, heavy rain or heavy snow.严禁在风力大于 4 级、大雨或大雪的气象条件下清洗光伏组件。

4) Do not attempt to remove frozen snow or ice from the module surface.不得尝试清除组件表面冻住的雪或冰。

6.3. CONNECTOR AND CABLE INSPECTION组件连接器和电缆线检查

1) It is recommended to conduct a preventive inspection every six months推荐每六个月进行一次预防式的检查。

2) Check for signs of aging of PV modules, including possible rodent damage, weathering, and whether all connectors are tightly connected or corroded.检查光伏组件的老化迹象。包括可能的啮齿动物破坏、气候老化，以及所有连接器是否连接紧密、有无腐蚀现象。