组 件 用 户 手 册

Installation Manual for ERA PV Modules

常规组件

Standard PV Modules

浙江公元新能源科技股份有限公司

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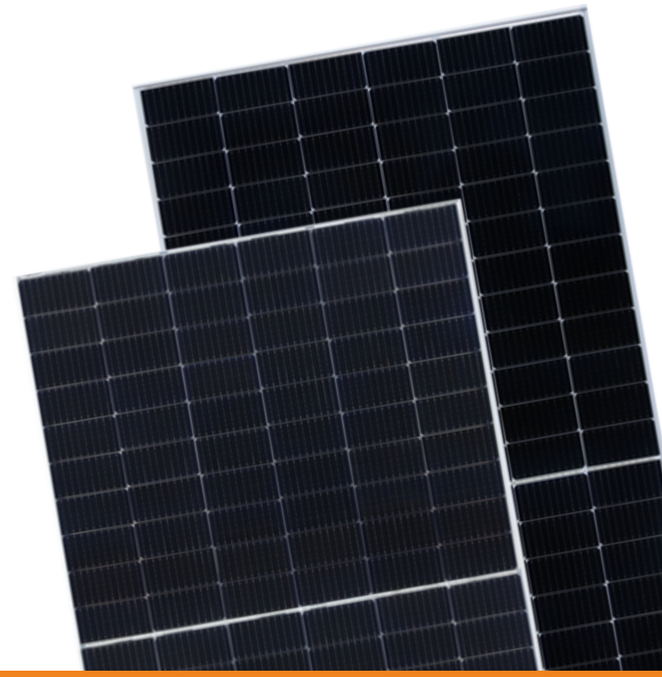
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常 规 组 件

Standard PV Modules

文内图片仅供参考

Images for reference only



20250808 版

20250808 Version

重要安全须知 Safety Instructions

本安装手册提供了公元新能源科技股份有限公司（以下简称“公元”）光伏发电组价模块（以下称为“组件”）的安装和安全使用信息。在组件安装和日常维护中，应遵守本指南的所有安全防范措施和当地法规。

安装组件系统需要有专业技能和知识，并且只有有合格的人员进行安装。在安装和使用组件之前，请仔细阅读本安装手册。安装人员应熟悉此系统的机械和电气要求。请妥善保管本手册，以备将来维护与保养或组件需出售或处理时参考。

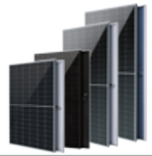
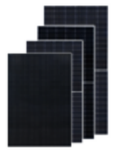
如有任何疑问，请联系公元全球质量及客户服务部，请他们做进一步解释。

The manual provides information on the installation and safe use of photovoltaic modules(the "module") produced by Zhejiang ERA SOLAR TECHNOLOGY CO.,LTD is hereinafter referred to as "ERA SOLAR". During module installation and routine maintenance, all safety precautions specified in this guide and applicable local regulations shall be strictly observed.

Installing module systems requires professional skills and knowledge, and must be carried out by qualified personnel only. Installer must read and understand the manual before installing and familiar with the mechanical and electrical requirments of system. Please keep this manual properly as reference for future maintenance and upkeep, resales or iposal of modules.

If you have any questions, please contact the Quality and Customer Service Department of ERA SOLAR Global for further explanation.

适用产品列表

常规 单玻 / 双玻 组件 Monofacial / Double Glass Module	ERA-RA/RC Series (N-type Rectangle182*94mm/182*105mm)	
	Eagle Pro Series (N-type Topcon 210*105mm)	
	ERA Pro Series (182mm N-Type)	
	ERA Series (182mm PERC)	
	Poly & Small sized Series	

* 该文件不适用于轻质组件 This instruction is not applicable to lightweight modules.

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一、用户手册介绍 User Manual Introduction

首先，感谢您选择我们的产品！
Firstly, thank you for choosing our product!

本手册包含有关公元组件的安装方式和安全操作的相关信息。如果不遵守这些安全指南，将可能导致人员伤亡或财产损失。

安装人员在安装前必须阅读并理解该指南。如有任何问题请联系公元客服部门或我司当地代表获得更详细的信息。安装人员必须遵循本手册中说明的所有安全预防措施、当地要求和法律或授权机构的规定。在安装太阳能光伏系统前，安装人员应当熟悉其机械和电气要求。光伏系统的运转需要相关的专业知识。

请将本指南存放于安全处，作为运维和保养的依据，或在转售、处理组件时使用。公元组件通过了全球检测和认证机构的测试，在遵循本安装手册要求条款的前提下可以安全使用。组件安装商必须将上述事项告知终端客户（消费者）。

This manual contains relevant information on the installation method and safe operation of ERAS SOLAR modules. If these safety guidelines are not followed, it may result in personal injury or property damage.
Installation personnel must read and understand this guide before installation. If you have any questions, please contact our customer service department or our local representative for more detailed information. Installation personnel must follow all safety precautions, all local laws and regulations of the relevant authorities in this manual. Before installing a solar photovoltaic system, the installer should be familiar with its mechanical and electrical requirements. The operation of photovoltaic systems requires relevant professional knowledge.
Please keep this guide in a secure location as future reference for operation and maintenance, or resale and diposal. ERA SOLAR have been tested and certified by internationally recognized institutions. and can be safely used while complying with the requirements of this installation manual. The module installer must inform the end customer (consumer) of the above matters.

1.1 适用范围 Scope of Application

单玻组件系列
Monofacial Modules:

Eagle Pro-66HC
Eagle Pro-66HC(BK)
Eagle-66/60HC
Eagle-66/60HC(BK)
ERA-RC72/66/60/54/48HC
ERA-RC72/66/60/54/48HC(BK)
ERA-RA72/60/54HC
ERA-RA72/60/54HC(BK)
ERA Pro-78/72/66/60/54HC
ERA Pro-78/72/66/60/54HC(BK)
ERA-78/72/66/60/54HC
ERA-78/72/66/60/54HC(BK)
ESPHSC
ESPHSC(BK)

双面透明组件系列
Bifacial Transparent Modules:

Eagle Pro-66HCB
Eagle-66/60HCB
ERA-RC72/60/54/48HCB
ERA-RC66HCB
ERA-RA72/60/54HCB
ERA Pro-78/72/66/60/54HCB
ERA-78/72/66/60/54HCB
ESPHSC(Bifacial)

双面双玻组件系列
Double Glass Modules:

Eagle Pro-66HD
Eagle Pro-66HD(BK)
Eagle-66/60HD
Eagle-66/60HD(BK)
ERA-RC72/66/60/54/48HD
ERA-RC72/66/60/54/48HD(BK)
ERA-RA72/60/54HD
ERA-RA72/60/54HD(BK)
ERA Pro-78/72/66/60/54HD
ERA Pro-78/72/66/60/54HD(BK)
ERA-78/72/66/60/54HD
ERA-78/72/66/60/54HD(BK)

* ERA-RC72/66/60/54/48HC 为 (ERA-RC72HC/ERA-RC66HC/ERA-RC60HC/ERA-RC54HC/ERA-RC48HC)。

1.2 免责申明 Disclaimer

公元新能保留在没有预先通知的情况下变更本安装手册的权利。客户在安装组件过程中未按照本手册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。本安装手册不具备任何质保书的意义，不论是明示或者暗示。未规定在组件安装、操作、使用或者维护过程中产生或者由此引起的或与此有关的损失、组件损坏或者其它费用的赔偿方案。如果由于使用组件造成的侵害专利权或者第三方的权利，公元新能不承担相关责任。

ERA SOALR reserves the right to modify the manual without prior notice. Failure to follow the requirements specified in this manual during the installation of modules by the customer may result in the invalidation of the limited warranty provided to the customer. This installation manual does not have any significance as warranty , whether expressed or implied. There is no any compensation terms for losses, module damages, or other costs incurred during or related to the installation, operation, use, or maintenance of modules.
Due to the use of photovoltaic modules may lead to the infringement of third party patent or other rights,does not belong to the responsibility of ERA SOLAR range.

1.3 责任范围 Scope of Responsibility

对于以下任何形式的伤害及损失，包括但不限于因组件操作、系统安装失误以及未按照本手册的指示产生的身体伤害和财产损失，公元新能不为此负任何责任。

For any form of injury or loss, including but not limited to bodily injury and property damage caused by module operation, system installation errors, and failure to follow the manual instructionsl, ERA SOLAR shall not be held responsible.

1.4 产品标识 Product Marking

每个组件的背面都有 2 个标签，提供了以下信息 There are two labels on the back of each module, providing the following information:

铭牌：描述产品型号，包括额定功率、额定电流、额定电压、开路电压、短路电流等所有在标准测试条件下测得的值的中位数；重量，尺寸等；最大的保险丝容量以及系统最高电压。

Nameplate: describe the product model, including rated power, rated current, rated voltage, open circuit voltage, short circuit current and other values measured under standard testing conditions(STC), weight, size, etc; The maximum fuse capacity and the maximum system voltage.

条形码：每个组件都有一个唯一的序列号，每块组件上有 3 个相同的条形码（正面条形码被永久的固定在组件内部。）

Barcode: Each module has a unique serial number, and each module has 3 identical barcodes (the front barcode is permanently fixed inside the module)

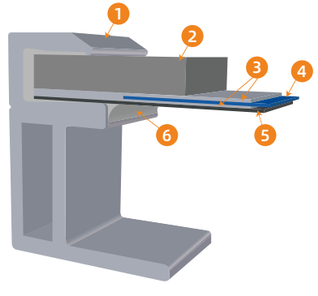
不要撕掉任何标签，如果标签被撕掉，本公司将不再提供产品质保。
Do not tear off any labels. If the labels are torn off, ERA SOLAR will no longer provide product warranty.

二、法规和条例 Laws and Regulations

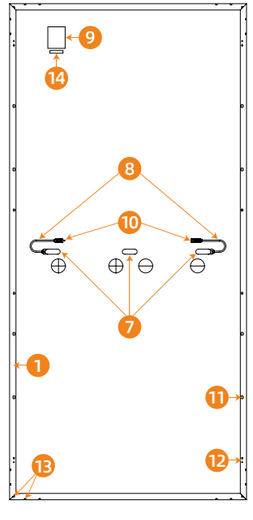
光伏组件的机械安装和电气安装应该参照相应的法规，包括电气法，建筑法和电力连接要求。这些条例随着安装地点的不同而不同，例如，建筑屋顶安装，车载应用等。要求也可能随着安装系统电压，使用直流或交流的不同而不同。具体条款，请联系当地权威机构。

The mechanical and electrical installation of photovoltaic modules should refer to corresponding regulations, including electrical laws, building codes, and electrical connection requirements. These regulations vary depending on the installation location, such as building rooftop, vehicle applications, etc. The requirements may also vary depending on the installation system voltage and whether the system is DC or AC. For specific terms, please contact the local regulatory authorities.

三、预防安全措施 Safety Precautions



组件剖面结构及部件说明
Modules Cross-Section Structure & Component Description



1. 边框 Frame
2. 光伏钢化玻璃 Low -iron tempered glass
3. 封装胶膜 EVA
4. 电池片 Solar Cell
5. 背板 Backsheet
6. 硅胶 Silicone Gel
7. 接线盒 Juncation Box
8. 电缆线 Cable
9. 铭牌 Nameplate
10. 连接器 Connector
11. 安装孔 Mounting Hole
12. 接地孔 Grounding Hole
13. 漏水孔 DrainHole
14. 条码 Barcode

3.1 警告 Warning

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。光伏组件在暴露于光源环境中时会产生电力，多个组件组成的光伏阵列会造成致命电击或灼伤危险，未经过授权或相关培训的人员请勿接触光伏组件及接线端子等。

Before installing, wiring, operating, or maintaining module, all safety instructions should be read and understood. Modules generate electricity when exposed to sunlight, and photovoltaic arrays composed of multiple modules can pose a fatal risk of electric shock or burns. Do not touch the modules and wiring terminals unless properly trained and authorized.

强制 Caution

否则可能会造成产品损坏或者危及使用者的人身安全 Otherwise, it may cause product damage or personal injury

绝对禁止 Strictly forbidden

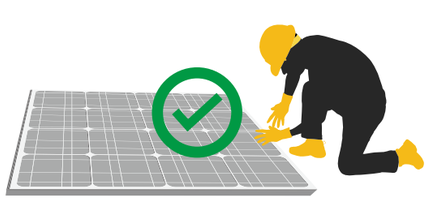
否则可能会造成产品损坏或者危及使用者的人身安全 Otherwise, it may cause product damage or personal injury

3.2 通用安全 General Safety

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。无论光伏组件是否与系统连接，接触组件时均应使用适当的防护措施，如：绝缘工具、安全帽、绝缘手套、安全带和安全绝缘鞋等。当您需要对组件进行安装、接地、接线、清洗等操作时，请务必使用恰当的电气安全防护工具。避免与组件直接接触，造成触电或割伤。

Before installing, wiring, operating, or maintaining modules, all safety instructions should be read and understood. Whether or not the photovoltaic modules are connected to the system, always take appropriate protective measures when handling PV modules including insulated tools, safety helmets, insulated gloves, safety harnesses, and dielectric shoes. When performing installation, grounding, wiring, or cleaning operations on modules, always employ proper electrical safety equipment. Avoid direct contact with modules to prevent electric shock or cuts.

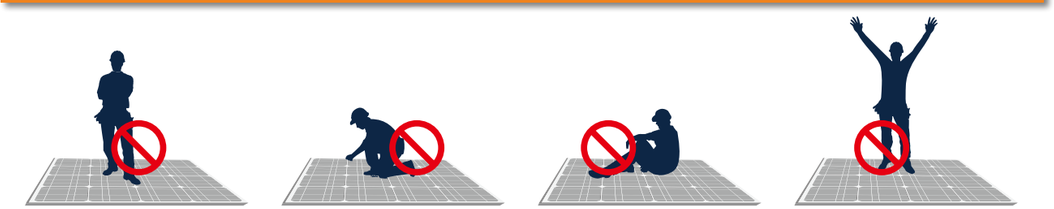




通常情况下，光伏组件实际产生的开路电压和短路电流值会超过在标准测试条件下测试的相应数值，在确定组件额定电压，导体额定电流，熔丝及其它连接到组件输出端的控制器的规格时，应考虑将标注在该组件铭牌上的开路电压和短路电流值乘以不低于 1.25 倍的安全系数计算。

Under field operating conditions,the actual open-circuit voltage (Voc) and short-circuit current (Isc) generated by PV modules may exceed values measured under Standard Test Conditions (STC). When specifying rated voltage, rated current, fuse capacity, and controllers connected to module outputs, apply a minimum safety factor of 1.25 to the nameplate-stated Voc and Isc values.

3.3 常规安全 Regular Safety



- 建议由具备光伏系统安装的专业人员进行安装。必须由熟悉相应安全程序的人员进行操作，避免安装隐患发生。Installation shall be performed by qualified personnel. All operations must be conducted by individuals who are thoroughly familiar with applicable safety procedures to avoid installation hazards.

- 禁止直接在组件包装或组件上站立、踩踏、行走。Do not stand, step on, or walk directly on PV module packaging or modules surface.
- 当组件有电流或外部电流出现时，禁止连接或断开组件。Never connect or disconnect modules when energized or under external current flow.
- 禁止在电源未断开的情况下，使用水来灭火。Never use water to extinguish fires on energized electrical equipment.
- 禁止用力拉扯、划伤或弯曲输出电缆，否则电缆的绝缘部分会被损坏导致漏电或触电。Never subject output cables to forceful pulling, abrasion, or sharp bending. Damaged cable insulation may cause electric leakage or electric shock.
- 禁止将任何导电材料插入组件的连接器。接线盒的盖子应一直保持关闭状态。Never insert conductive objects into module connectors. Junction box covers must remain closed at all times.
- 禁止将组件安装于可能有可燃性气体的区域。Never install PV modules in areas where flammable gases may be present.
- 禁止在组件上堆放重物或尖锐物体。防止组件跌落或让物体直击组件或物体直接掉落在组件上。Never stack heavy or sharp objects on PV modules. Prevent modules from falling and avoid direct impacts from dropped objects on modules.
- 禁止损坏或划伤组件的正面或背面，影响组件的安全性，若发现组件正面或背面有划痕或割伤，请勿使用或安装已损坏的组件。Never scratch or damage front/back surfaces of PV modules, as this may affect its safety. If scratches or cuts are found, do not use or install the damaged module.
- 组件阵列的安装工作必须在具有隔离太阳光装置的情况下进行，并且由有资质的专业人员才能进行组件的安装和维护，使用绝缘工具降低触电的风险。PV array installation and maintenance must be performed by qualified personnel under sunlight isolation conditions, utilizing insulated tools to reduce the risk of electric shock.
- 如果光伏系统用到蓄电池，应遵循组件的配套蓄电池厂家的意见，验证合格方可实行。If the PV system is equipped with batteries, installation must comply with the integration specifications provided by the battery manufacturer and undergo validation testing prior to commissioning.
- 在雷电活动频繁的地方，必须为光伏系统安装避雷装置。PV systems in high lightning frequency areas shall be equipped with Lightning Protection Systems (LPS) .
- 建议由具备光伏系统安装的专业人员进行安装。必须由熟悉相应安全程序的人员进行操作，避免安装隐患发生。Installation shall be conducted by the qualified personnel who familiar with the safty instructions to avoid installation hazards.
- 禁止使用镜子或透镜聚焦阳光照射到太阳电池组件上。组件在正常运行使用过程中，严禁被建筑物、树木、烟囱等或易造成杂物堆积 / 沉积的遮挡。Never concentrate sunlight onto PV modules by mirrors or lenses. During normal operation, modules shall remain unobstructed by buildings, trees, chimneys, or objects prone to debris accumulation or deposition.
- 太阳能电池组件的前玻璃具有保护组件的作用，破损的太阳能电池组件具有电危险性（电击和着火），这样的组件不能修复和维修，应该立即更换掉。The front glass serves to protection for PV modules. Damaged modules present electrical hazards (electric shockand fire risks), and such modules must not be repaired and should be replaced immediately.
- 所有的安装工作必须完全遵守地方和当地法规和相应的国内或国际电气标准。All installation activities shall fully comply with local regulations, and applicable national and international electrical standards.
- 所有的组件系统都需接地，如没有特殊规定的话，请遵照国际电工标准或者其它的国际标准。All module systems must be grounded. Unless otherwise specified, please comply with the International Electrotechnical Standards or other applicable international standards.



3.4 操作安全 Operation Safety



- 严禁自行修复玻璃损坏的组件。Do not attempt to repair glass-damaged modules.
- 严禁拆分组件或者移动组件的任何部分。Do not disassemble modules or move any modules parts.
- 严禁让物体直击组件或物体直接掉落在组件上。Do not subject modules to direct impacts or allow objects to fall onto them.
- 严禁在任何情况下通过抓住接线盒或者导线来拎起整个组件。Never lift modules by grasping the junction box or cables under any circumstances.
- 严禁使用尖锐的工具去擦洗组件的玻璃，这样会在组件上留下划痕。 Do not clean module glass with sharp tools, as this may cause scratches.
- 严禁在潮湿下雨，下雪或者大风期间安装或处理组件。Do not install or handle modules during rain, snow, high winds, or wet conditions.
- 严禁错误的连接公母连接头，检查接线状况，所有的连接线不得脱离组件。Do not mismatch male/female connectors. Verify all wiring connections are secure and no cables are detached from the module.
- 严禁在安装过程或者是有光照在组件上的时候，裸手接触接线盒或者公母头。Do not touch junction boxes or connectors with bare hands during installation or when modules are exposed to light.
- 严禁在包装或组件上站立或者走动；禁止将一块组件跌落在另外一块组件上。Do not stand or walk on packaging or modules. Never fall one module onto another.

3.5 消防安全 Fire Safety Requirements

在屋顶上安装组件时，请在安装前参考当地法律法规并遵守建筑物防火要求。屋顶应覆盖一层合适等级的防火材料，以进行屋顶安装，并确保组件和安装表面完全通风。不同的屋顶结构和安装方式会影响建筑物的防火性能。不正确的安装方式可能引发火灾。根据当地法规，使用合适的组件配件，例如保险丝，断路器和接地连接器。

请勿在明火或易燃易爆物体附近安装或使用组件。

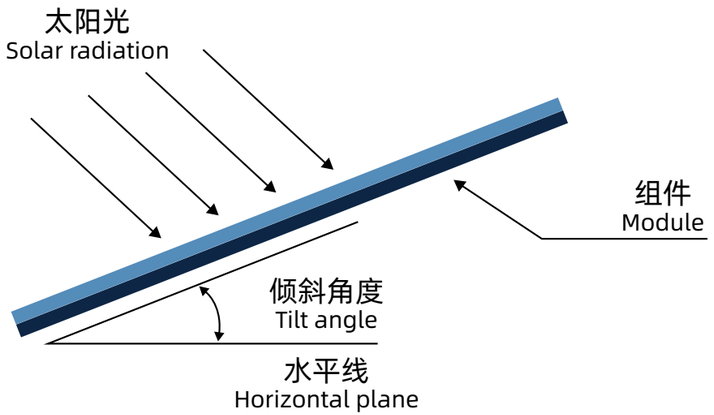
When installing modules on rooftops, please refer to local laws and regulations before installation and comply with building fire safety requirements. The roof should be covered with fire-resistant material of appropriate grade for installation, and maintain unobstructed airflow between the modules and roof surface. Different roof structures and installation methods may affect the building's fire resistance performance. Incorrect installation methods may cause fire hazards. Use appropriate module accessories such as fuses, circuit breakers, and grounding connectors in compliance with local electrical codes and safety standards.
Do not install or operate modules near open flames or flammable/explosive materials.

四、安装条件 Installation Conditions

4.1 安装地点和工作环境 Installation Site and Working Environment

- 公元新能电池组件的设计仅适用于陆地，所以，不能在太空、海洋或聚光环境使用。ERA solar modules are designed for terrestrial use only and must not be used in space, marine, or concentrated solar environments.
- 不能安装在烟雾、冰雹、积雪、风沙、烟尘、空气污染、活跃的化学蒸汽、酸雨、烟煤、硫磺等过量的环境下。Do not install in environments with excessive smoke, hail, snow accumulation, sandstorms, dust, air pollution, active chemical vapors, acid rain, soot, sulfur, or similar contaminants.
- 在有大风、极寒、强风或者近水，接近易于盐雾的海岛上或沙漠等环境中时，请采用合适的保护措施，确保组件安装的可靠性和安全。In areas with strong winds, extreme cold, near water, coastal salt spray, or desert conditions, appropriate protective measures must be taken to ensure installation reliability and safety.
- 公元组件必须安装在合适的建筑上，或者其它适合组件安装的地方（如地面，车库，建筑物外墙，屋顶，光伏追踪系统）。ERA modules must be installed on suitable structures or approved locations (such as ground mounts, carports, building facades, rooftops, or solar tracking systems).
- 不要将组件安装在有可能会被水淹没的地方。Do not install modules in areas prone to flooding.
- 公元推荐组件安装在工作环境温度为 -20℃到 46℃的环境下，该工作环境温度为安装地点月平均最高温度和最低温度。组件极限工作环境温度为 -40℃到 85℃。The recommended operating temperature range for ERA modules is -20° C to 46° C (based on monthly average extreme temperatures). The absolute operating temperature limits are -40° C to 85° C.
- 确保组件安装后所受到的风或者雪的压力不超过最大允许负荷。Ensure wind and snow loads on installed modules do not exceed maximum load capacity.
- 组件需要安装在常年没有阴影的地方。确保在组件安装的地点没有可能阻挡光线的障碍物。Modules must be installed in permanently shadow-free locations. Ensure no potential obstructions that could block sunlight exist at the installation site.
- 如果组件安装在有频繁雷电活动的地方时，必须对组件进行防雷击保护。Lightning protection is required when installing in areas with frequent lightning activity.
- 不要在附近可能有可燃性气体出现的地方安装组件。Do not install modules near areas where flammable gases may be present.
- 公元组件不能安装在有强烈腐蚀性物质，如盐，海水，或者其它任何会腐蚀组件，影响组件安全或者性能的地方。ERA modules must not be installed in environments with highly corrosive substances such as salt, seawater, or any other materials that could corrode the modules or affect their safety and performance.
- 公元的组件通过了 IEC61701 的盐雾腐蚀测试，但是腐蚀可能发生在组件边框与支架连接的部位，或者接地连接的部位。公元推荐采用不锈钢或者铝的材料来与光伏组件接触，并且需要对安装部位做好防锈蚀处理。ERA modules meet IEC 61701 Salt Mist Corrosion Test, but may corrode junctions between the module frame and mounting brackets. ERA recommends using stainless steel/aluminum material to come into contcat with modules and requires proper anti-corrosion treatment.

4.2 倾角的选择 Selection of Tilt Angles

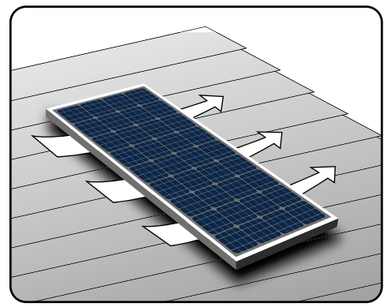


- 组件的倾角：组件表面与水平面形成的夹角。当组件正对阳光时，组件会获得最大的功率输出。Module Tilt Angle is the angle between the module andhorizontal plane. For maximum power output, modules should be perpendicular to sunlight.
- 在北半球安装，组件最好朝南，在南半球安装，组件最好朝北。Modules should face south in the Northern Hemisphere and north in the Southern Hemisphere.
- 根据当地法律法规如果光伏组件安装在北美或者适用于 UL 标准的其他国家，光伏组件（背板面）到墙体或屋顶表面之间至少应留有 155mm（建议值）的间隙。如果使用其他安装方法，则可能会影响光伏组件的 UL 认证或防火等级。In North America or UL-compliant regions, maintain at least 155mm (recommended) clearance between module backsheet and wall/roof surfaces. Alternative installation methods may void UL certification or fire ratings.
- 对于详细的安装角度，请依据标准组件安装指南或者有经验的光伏组件安装商给出的建议。Refer to standard installation guidelines or consult professional PV installers for detailed tilt angle recommendations.

4.3 安装常规要求 General Installation Requirements

- 确保组件安装方式和支架系统足够坚固，使得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。安装支架系必须经过有静态力学分析的第三方检测机构进行检验和测试，采用当地国家或国际标准如 DIN1055 或等同的标准。Ensure that the mounting methods and mounting systems are sufficiently stable to withstand all expected load conditions. This is a guarantee that must be provided by the mounting system installer. Mounting structures must undergo static mechanical testing by third-party agencies in compliance with national/international standards such as DIN 1055 or equivalent.
- 组件安装支架必须由耐用、耐腐蚀、防紫外线的材料构成。Mounting brackets shall be constructed from durable, corrosion-resistant andUV-resistant materials.
- 组件必须牢固的安装在支架上。Modules must be securely fastened on mounting brackets.
- 在冬天有较大积雪的地区，选择较高的安装支架。这样组件最低点不会被积雪长时间覆盖，此外，组件的最低点足够高，这样可以避免组件被植被和树木遮挡，或者是被飞沙走石伤害。In areas with heavy snow accumulation, select higher mounting brackets to ensure the lowest edge of modules remains clear of prolonged snow accumulation. Additionally, sufficient ground clearance prevents shading from vegetation and trees while offering protection against damage from windblown debris.

- 当组件安装在平行于屋顶或墙面的支架上时，组件边框与屋顶或者墙面的最小间隙为 12.5cm，需要让空气流通，防止组件的线路损坏。When modules are mounted on brackets parallel to roof /wall surfaces, a minimum clearance of 12.5cm must be maintained between module frames and the surface to enable airflow ventilated to prevent wiring damage.
- 禁止在组件的玻璃或边框上打洞，否则组件的质保失效。Never drill in glass or frames. Violations will void product warranty.
- 在屋顶安装组件之前，请确保建筑是适合安装的。此外，屋顶的任何渗透都必须要进行适当的密封，以防止渗漏。Confirm structural suitability of the building before installating. All roof penetrations must be properly sealed to prevent water leakage.
- 当灰尘落在组件表面后，将影响组件的功率输出性能，公元建议组件安装的时候夹角不小于 10°，这样组件在下雨的时候灰尘容易被雨水带走。Dust accumulation on the module surface will affect power output.Install modules at ≥ 10° tilt angle to facilitates natural cleaning by rainwater.



- 组件边框会有热胀冷缩效应，建议两块组件之间的最小距离为 5mm。Allow ≥ 5mm clearance between adjacent modules to accommodate frame thermal expansion and contraction.
- 确保组件的背板是不会碰触到能进入组件内部的支架或建筑结构，特别是当组件表面有外部压力的时候。Prevent contact between module backsheets and internal structures, especially under external pressure.
- 组件安装方法不能导致组件的铝边框与不同种金属之间发生电化学腐蚀。UL1703 标准《Flat Plate Photovoltaic Modules and Panels》的附录中推荐相接触的金属电化学电势差不能超过 0.5V。Installation methods must not cause electrochemical corrosion between aluminumframes and dissimilar metals; UL 1703 Standard Flat Plate Photovoltaic Modules and Panels specifies that the electrochemical potential difference between contacting metals shall not ≥ 0.5V.
- 公元组件的安装方向可以是水平安装也可以垂直安装。ERA Modules may be installed horizontally or vertically.

五、装卸、存储、运输注意事项 Safety Precautions for Handling, Storage, and Transfer

5.1 周转注意事项 Transfer Precautions

- 请使用叉车将组件从货车上卸下来，叉车一次性最多允许 2 托组件，将组件放置于水平地面上。Use forklifts to unload modules from trucks. Maximum 2 pallets of modules per forklift operation. Place modules on level ground.
- 禁止在项目地将组件堆码，防止组件磕碰损伤。Strictly prohibited to stack modules at project sites to prevent impact damage.
- 如果组件长期周转时需使用遮雨布盖住组件，防止组件受潮，且请不要拆除包装。For long-term handling, cover modules with weatherproof tarpaulins or do not remove packaging temporarily to prevent moisture ingress.
- 包装的成品可以通过陆运、海运、货物空运进行运输，在运输过程中，需确保包装不会翻滚。Packaged products may be transported via road/sea/air freight. Ensure is not subjected to rolling or overturning during transit.
- 周转：正常卡车运输最多 2 层叠加后运输。Handling: Maximum 2 pallets stacked for standard truck transportation.

- 在搬运或者安装组件的时候，不要靠背板支撑组件，以及单人背组件，禁止使用绳子背件。When handling or installing modules, never support modules by loading force on backsheets, never carry modules on one's back, and prohibited to use ropes for carrying.

- 禁止三轮车周转，项目现场周转时，只允许 1 层运输。Tricycle transport strictly prohibited. On-site transfer limited to 1 pallet unstacked handling.

5.2 存储注意事项 Storage Precautions



- 组件应该被存放在干燥和通风的环境下，存储要求：湿度 < 85%，温度范围为 -40℃ ~ 50℃，以避免阳光直射和潮湿。如果组件被存放在不受控的环境下，则存放时间不能多于 3 个月，且需要采取额外的措施来防止连接器受潮或组件被阳光曝晒。Modules should be stored in dry and ventilated environments. Storage requirements: relative humidity < 85%, temperature range from -40° C to 50° C, avoiding direct sunlight and moisture conditions. If stored in uncontrolled environments, the storage duration must not exceed 3 months, with additional measures required to prevent connector moisture ingress and module exposure to sunlight.

- 任何情况下，禁止在组件上站立、攀爬、行走或跳跃。局部重载可能在电池上产生微裂纹，进而会使组件可靠性降低。Under any circumstances, standing, climbing, walking, or jumping on modules surfac is prohibited. Localized overloading may cause microcracks in solar cells, reducing module reliability.

- 组件长期存储建议存储在标准仓库中，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。For long-term storage, modules should be kept in standard warehouses. Warehouse racks must have sufficient load-bearing capacity and storage space, with regular inspections to ensure safe storage.

- 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塌陷、不倾斜。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。When storing modules at project sites, soft or collapsible ground is prohibited. Choose hard surfaces or elevated terrain, leveling the ground to prevent sinking or tilting during long-term storage. Reinforce immediately if abnormal tilting is observed while ensuring personal safety.

- 阴雨天气请使用遮雨布完全覆盖组件和托盘，并对托盘和纸箱采取防雨防潮措施，在有阳光或有风时除去防雨布 使外包装尽快干燥，避免因受潮变形导致倒塌。 During rainy weather, completely cover modules and pallets with waterproof tarpaulins, and take rainproof and moisture-proof measures for pallets and cartons; remove waterproof tarpaulins during sunny or windy conditions to facilitate rapid drying of outer packaging, preventing deformation-induced structural collapse due to moisture absorption.

- 禁止托盘泡水，存放地应先做好地面排水措施，防止雨后地面大量积水引起地面松软、下沉等现象。严禁未经授权 的人员接近组件存储区域，组件应尽量集中存放。Immersing pallets in water is prohibited. Implement ground drainage measures at storage sites to prevent post-rain water accumulation causing ground softening or subsidence. Unauthorized personnel access is strictly forbidden. Modules should be stored centrally.

- 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，打开包装、运输和贮存过程需小心操作。Maintain packaging integrity. Open module packaging strictly according to recommended unpacking procedures. Handing carefully during unpacking, transportation, and storage.

- 禁止组件与尖锐物接触，尤其需要避免组件的背板被尖锐物体划伤，划痕会直接影响组件的安全性。Contact between modules and sharp objects is prohibitedto prevent backsheet scratches from sharp objects, as scratches directly affect module safety.

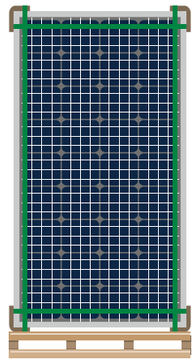
5.3 卸货方式及注意事项 Unloading Procedures&Precautions

- 任何情况下，短边包装请勿堆叠超过 2 层，请在叉车作业过程中预留足够的安全距离，禁止两侧人员站立或经过。 叉车卸货时注意控制行驶速度，防止转弯时组件倾倒对人员造成伤害。Under no circumstances shall short-edge packaging be stacked beyond 2 layers. Maintain enough safety clearance during forklift operations; personnel standing or passing on both sides is prohibited. Control travel speed during forklift unloading to prevent module tipping over during turns that may cause personnel injury.

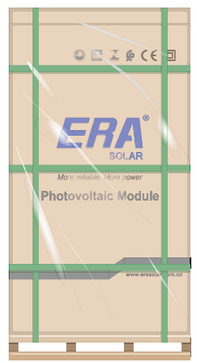
- 作业地面需要保证包装箱能够水平稳定的放置，避免倾倒。The operating surface must ensure packaging can be placed horizontally and stablely to avoid tipping over.

- 组件到货时请及时检查包装外箱是否完好，并核对组件外包装上的组件型号和数量是否与送货单一致，如果发现异常请在开箱前立即联系物流人员及公元销售人员。Upon module arrival, immediately check outer packaging integrity and module quantity against delivery documentation. Notify logistics personnel and ERA sales before unpacking if discrepancies are found.

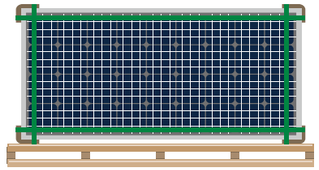
包装样式如下 Packaging Specifications as follows:



210 组件内包
210 Inner Packaging



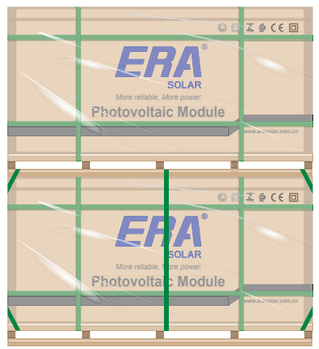
210 组件外包
210 Outer Packaging



常规组件内包
Standard Module Inner Packaging



常规组件外包
Standard Module Outer Packaging



常规组件叠托
Standard Module 2 Pallets Stacked

吊装装卸 Crane Lifting Operations：

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，吊装时请调整吊带位置保持组件重心平稳，底部是钢筋，箱子的左中右均有一根绳子拖住，规避边缘挤压导致爆件。请匀速操作吊具，当吊装接近地面时，扶正纸箱轻轻放在相对平坦的位置。

用吊车最多只能吊装 1 托，吊装的时候要根据操作台面的承重压强决定，是否拆包分批次吊装。

When unloading with cranes, use dedicated lifting tools. Select lifting tools with enough load capacity based on module weight and dimensions prior to hoisting. Adjust sling positions to maintain balance and keep the center of gravity stable, ensuring steel reinforcement at the base and sling support at left, center and light to prevent edge compression fractures. Operate crane at constantly steady speed. Upon nearing ground level, align the carton upright and position it gently on a relatively flat surface.

Crane Lifting Operations are strictly limited to 1 pallet of modules per lift. Whether to unpack and hoist in batches should be determinedby the load-bearing capacity of the operating surface.







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，横式包装一次性最多允许吊装 2 托组件。竖式包装一次性最多允许吊装 1 托组件。

Crane Lifting Operations are strictly prohibited under meteorological conditions such as strong winds exceeding Beaufort scale 6, heavy rain and snow.Horizontal-oriented packaging shall no more than 2 pallets stacked of modules per lift. Vertical-oriented packaging is restricted to 1 pallet of module per lift.

叉车装卸 Forklift Handling Operations：

装卸平台高度尽量与车厢底面持平，叉车运输直线行驶速度控制 5km/h, 拐弯速度 3km/h, 避免急停和急速启动。 若包装箱遮挡叉车驾驶员视线，建议叉运过程中倒车行驶，并安排专人监护指挥，防止撞到人员或物品导致发生人员伤害事故或包装箱摔落组件破损。运输到安装地点后请选择平整的硬质地面放置。

Ensure the loading/unloading platform should be level with the truck bed plane. Operate forklifts at maintained speeds of 5 km/h during straight-line transit and 3 km/h when turning, and strictly avoid abrupt stops or rapid acceleration. When packaging obstructs forklift operator visibility, transport shall be conducted in reverse travel direction with dedicated spotters providing guidance and monitoring to prevent collisions causing personnel injuries or module damage from falling cartons.Upon reaching the installation site, place the modules on a flat, hard surface.





请根据叉运组件的重量选择合适吨位的叉车。货叉插入托盘的深度不得小于托盘的四分之三（货叉的长度 LN3/4 托盘长度）。建议延长叉车挡货架的高度或宽度，防止叉车直接触碰组件玻璃。

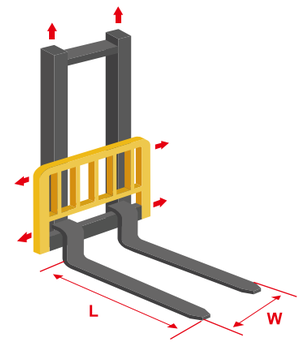
为保证叉运时更好的稳定性，避免进出托盘剧蹭角墩的情况下货叉间距尽量调节到最大。

请缓慢操作严禁货叉顶撞纸箱或托盘。请提前放置缓冲防护材料（图示黄色部分，材料建议选择硅胶、橡胶、EPE）防止因外力作用导致包装箱内组件破损。

Select forklifts with appropriate load capacity based on module weight. The forks must be inserted to a depth of at least three-quarters of the pallet length(i.e., fork length ≥ 3/4 of pallet length). Extend the forklift backrest height/width to prevent direct contact with module glass.

To optimize transport stability and prevent frictional abrasion during pallet handling, maximize the fork spread distance to its operational limit.

Operate slowly. Forks must never strike cartons or pallets. Place cushioning protective material in advance (refer to the yellow areas in the illustration; silicone, rubber, or EPE materials are recommended) to prevent modules from being damaged by external forces.





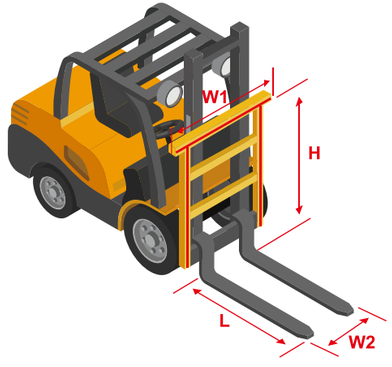
5.4 项目地转运 On-site Transfer

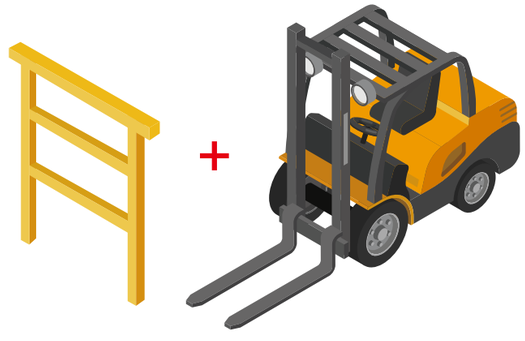
项目地转运是指成托组件在到达项目存储地后，在存储地及施工现场之间的装载运输。

叉车规格要求：请统一使用额定起重量 N3.5 吨的叉车对组件进行装载运输，请勿使货叉的凸起部分直接与纸箱或组件接触，防止顶撞组件导致组件破损。

On-site transfer refers to the loading and transportation of palletized modules between the storage site and the construction site after their arrival at the storage location.

Forklift specification requirements: unified use of forklifts with a rated lifting capacity of N3.5 tons is required for loading and transporting modules. Ensure the protruding parts of the forks do not come into direct contact with cartons or modules to prevent impact damage.





货叉长度（L）N1.0m，间距（W2）调整到尽量靠近托盘两边角墩。

门架高度（H）N1.5m，或宽度（W1）N2.5m

门架需与货叉垂直，门架结构要坚固（可承受压力 N1.5 吨），当整托组件斜靠在门架上时门架不会因受压而变形。

门架顶端横梁与组件包装接触位置使用缓冲材料固定（建议缓冲材料选择硅胶、橡胶、EPE），避免叉车撞破组件和型材。

叉车规格及操作规范包括但不限于以上所述内容。

Fork length (L) N1.0m; Spacing (W2) must be adjusted as close as possible to the corner blocks on both sides of the pallet. Height (H) N1.5m or Width (W1) N2.5m.
The mast must be perpendicular to the forks and strong enough (with a load-bearing capacity of N1.5 tons). When a full pallet of modules leans against the mast, the structure must not deform under pressure.
Use cushioning material(silicone, rubber, or EPE are recommended) to the contact interface between the top beam of the mast and modules packaging, to prevent impact damage to the modules or aluminum frames.
The forklift specifications and operation standard include but are not limited to the above-mentioned content.



货叉从托盘长边方向缓慢进入托盘底板和面板之间，不要碰撞组件，门架两侧同时靠紧托盘。叉车运输时将包装箱倾斜抵靠在叉车门架上，必须用抗拉强度 N2000kgf 的安全绳将组件固定。叉车卸货时，将包装箱平稳放在地面，无倾倒风险在解开安全绳。叉车转运过程控制车速，叉车缓慢退出，以防止倾倒。

Operators must slowly insert the forks along the pallet's long side into the gap between the pallet baseboard and modules, strictly avoiding any contact with modules, while ensuring both mast sides firmly contact the pallet edges. During transport, tilt the packagingsecurely braced against the forklift mast and fasten modules with load straps rated for minimum N2000kgf tensile strength. When unloading, place packaging flat on stable ground and only release straps after confirming no risk of tip-over. Throughout transit, maintain controlled speed and retract forks gradually to prevent tipping over.

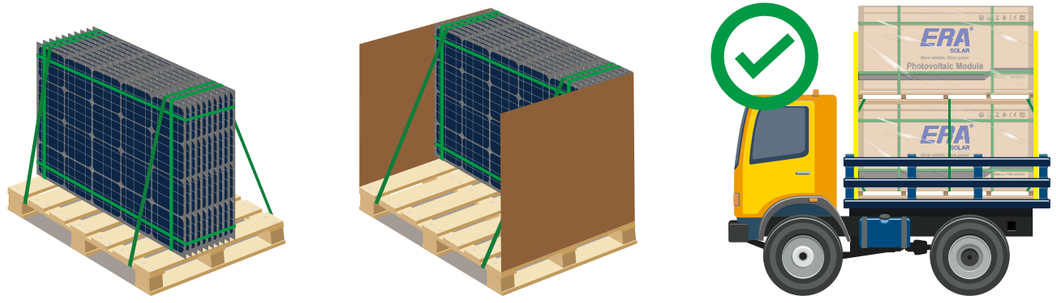
5.5 二次运输 Secondary Transport

包装的成品可以通过陆运、海运、或空运进行运输。在运输过程中：请将包装箱紧固在运输平台上，确保不会倾倒或移位。

如已拆包的组件需要转运至其它项目地，建议按照拆箱前单托组件数量将零散组件合并，打内部打包带（拉力建议 2100N）。最后套上外包装纸箱再用打包带把组件和托盘打包固定，打包带数量参考拆箱前。

如组件不满一个托盘，参考以下图左将组件居中摆放（分销包装参照下图右靠侧边摆放），打内部打包带（拉力建议 2100N）。最后套上外包装纸箱再用打包带把组件和托盘打包固定，打包带数量参考拆箱前。不满托组件运输时禁止放下层。

Modules can be shipped by road, sea, or air. During transport, secure the modules tightly to the transport platform to prevent tipping or sliding.
If unpacking modules need to be transferred to another site, consolidate loose parts to match the original quantity per pallet before unpacking and apply internal strapping (recommended tension 2100N). Finally, cover with outer cartons and secure both modules and pallet with strapping, matching the original strapping configuration.
If the number of modules is less than one full pallet, place modules in centered placement as shown in the left image below (distribution packaging shall be positioned in side-aligned orientation as shown in the image below) and apply internal strapping (recommended tension2100N). Finally, cover with outer cartons and secure both modules and pallet with strapping, matching the original strapping configuration.Strictly prohibit placing any goods atop partial-pallet modules during transport.



请使用恰当的运输工具转运组件，禁止使用三轮车进行运输或搬运，禁止对水平方式打包的单玻组件进行二次运输。使用小型卡车运输时，横式包装仅允许单层摆放，同时包装四周用安全绳固定在车辆上，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，根据路况控制行驶速度。

箱式及非箱式货车运输组件时，托盘与托盘之间要紧密摆放不留空隙，车厢尾部空位需进行填充加固，预防运输中组件向车尾部移动。当使用非箱式货车运输时，每托组件都需要用绳索与运输车辆进行固定。

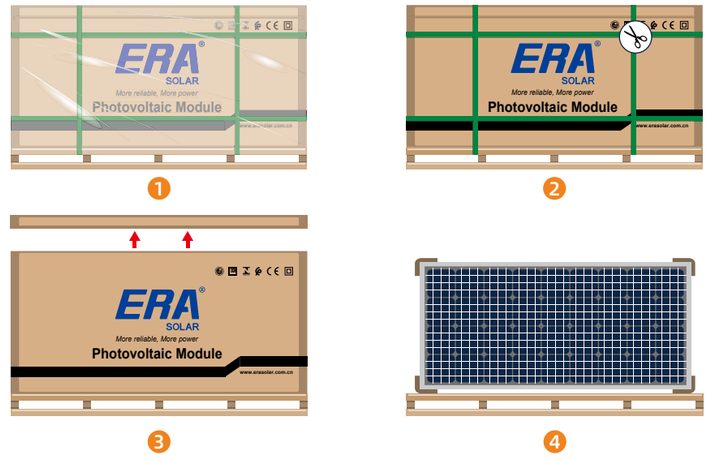
禁止托盘超出运输车辆的装载区。

Utilize appropriate transport equipment for module transfer. Motorized tricycles are strictly prohibited for handling or transferring. Secondary transport of mono-facialmodules in horizontal packaging configurations is forbidden. When using light-duty trucks, horizontally packed modules must be placed in a single layer stacking only, and immobilize all packages to the truck with lashing straps. Insert corrugated paper pads or equivalent cushioning materials at strap-to-carton interfaces. Controll transit speed according to road conditions.
During module transport in box trucks or other trucks, place pallets tightly without gaps in between. Fill the remaining space at the back of the truck so the modules don't slide toward the rear during transport.When using other trucks, immobilize all packages to the truck with lashing straps.
Do not let pallets stick out from the vehicle loading area.

六、拆包方式 Unpacking Methods

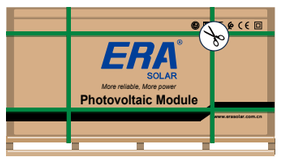
包装放置水平、干燥、平整地面，依次拆除缠绕膜、打包带、上盖、纸箱。如果组件需要堆放，托盘放置在水平地面上，组件必须堆放在托盘上；组件数量≤ 10pcs，堆码时间≤ 4 天，两块组件之间必须使用隔离材料，隔离材料高度大于组件突出物最高点尺寸 15mm（接线盒），如果没有隔离材料，不建议水平叠放。

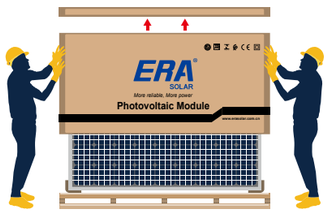
Place the packaging on level, dry, and flat ground. Remove stretch film, packing strapping, top cover and cartons in sequence. If stacking modules, place pallets on level ground and stack modules only on pallets. For stacks of 10 modules or fewer, the stacking duration shall not exceed 4 days. Insert protective spacers between each module where spacer height must exceed the highest protrusion (e.g. junction box) by 15mm. Horizontal stacking is not recommended without spacers.

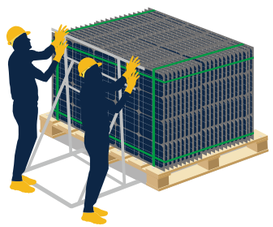


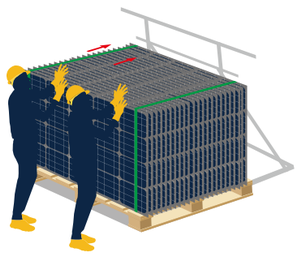
6.1 围板式拆包 Collar-Type Unpacking

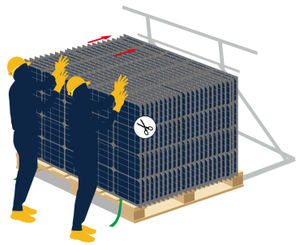
- 拆包前，请核对外箱 A4 纸（唛头）上的产品型号、功率档位、序列号及相关建议，并请仔细阅读拆包指导书，禁止自定义式的拆包方式。Before unpacking, check the product model, power, serial number, and notices on the A4 shipping mark affixed to the outer carton. Read the unpacking instructions carefully—custom unpacking methods are strictly forbidden.
- 拆箱前请确认外包装箱完好无损，建议使用美工刀来拆除打包带和缠绕膜。禁止暴力拆除以免划伤箱内组件。Before unpacking, make sure the packaging is undamaged. Use a box cutter to remove straps and stretch film. Never use brute force—this may scratch interna modules.
- 拆箱后请核对箱内组件数量和边框上的条码信息是否与唛头一致。After unpacking, check that the module quantity and barcodes match the shipping marks.
- 请将组件置于可靠支撑或固定的环境下，按照建议的拆包步骤打开组件包装。Place modules on a stable surface, then unpack according to recommended steps.
- 根据不同版型，包装方式有轻微差异，如下为拆包方式的注意事项。Packaging varies slightly by module type—key points are below.

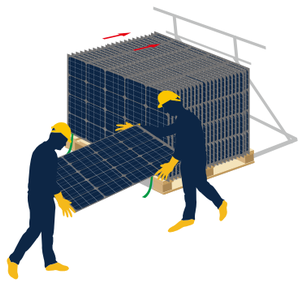




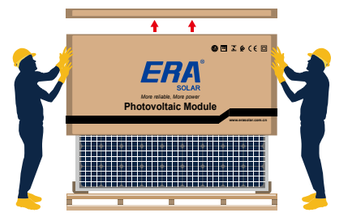


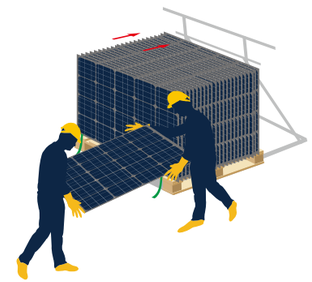


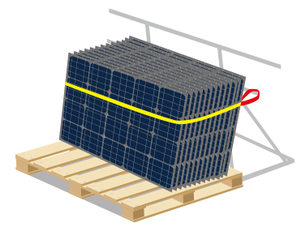




- 拆包时，必须由 2 人或 2 人以上同时操作，搬运组件时应佩戴绝缘保护手套，避免伤手和在玻璃面留下指印。When unpacking, must be operated by two or more people simultaneously. Always wear insulated protective gloves while handling modules to prevent hand injuries and avoid leaving fingerprints on the glass surface.
- 如果拆包后没有将组件全部取出，则将剩余的组件水平放置后重新打包，防止倾倒（打包时，最下层组件玻璃面朝上，其他组件的玻璃面朝下，最上层的组件需玻璃面朝上放置）。组件的最大堆叠数量不超过 16 片。If not all modulesare removed after unpacking, the remaining modules must be repacked horizontally with the bottom module placed glass face up, all middle modules glass face down, and the top module glass face up. The maximum stacking height must not exceed 16 modules.
- 如果组件拆包后短时间内不进行安装，6 级以内的大风天气（组件少于 12 片），则需要使用安全绳将立放的组件与靠架进行固定并做好防护（如图所示）。If unpacked modules are not installed immediately, securely fasten the vertically placed modules to the support racks using safety straps and implement protective measures (as illustrated) under wind conditions not exceeding Beaufort scale 6 (fewer than 12 modules).







- 大风天气情况下，不要搬运组件，并请妥善固定好已拆开包装的组件。Do not transfer modules in strong wind conditions, and ensure all unpacked modules are properly secured.
- 严禁拆包过程中移动靠架，防止组件倾倒。Do not move the support racks during unpacking to prevent module tipping.
- 严禁在下雨、下雪的条件下进行户外拆箱作业。Outdoor unpacking operations are strictly prohibited nder rainy or snowy conditions.
- 拆除内部打包带前，请做好防护，防止整箱组件倾倒。Before removing internal packing straps, ensure proper protective measures are taken to prevent modules from tipping over.
- 作业地面需要保证包装箱能够水平稳定的放置，避免倾倒。The working surface must ensure horizontal and stable placement of packaging carton to prevent tipping.
- 禁止将组件斜靠在安装柱子上。禁止使用木条等直接支撑在组件背面上。Do not lean modules against mounting posts. Do not use wooden supports on module backs.
- 禁止单人搬运组件，以免组件滑落撞击其他组件，导致组件划伤、变形或隐裂。抬组件时，禁止拉扯接线盒或电缆取出组件。Do not carry modules alone to prevent slipping and collisions that may cause scratches, deformation, or microcracks. Do not remove modules by pulling junction boxes or cables.
- 请严格按照拆箱说明的要求进行操作。横式包装拆除打包带时，注意防护，避免划伤脸部或眼睛等重要部位，拆箱过程中托盘上严禁人员站立，请从托盘两边搬运组件。Strictly follow unpacking instructions. Cut straps with caution to avoid facial or eye injuries. Do not stand on pallets. Always operate from both sides of the pallet.

七、安装方法介绍 Installation Methods Introduction

7.1 安装环境介绍 Installation Environment

组件的安装可以采取以下的方式：螺栓安装和夹具安装，组件应严格按照本手册的操作说明来进行安装以满足 IEC 认证。在安装组件前，请您阅读本章节内容熟悉完整的安装过程。

组件和支架系统的连接可以使用边框上的安装孔、夹具或者嵌入式系统来安装。组件安装必须依照安装要求执行，如果安装方式与公元新能公示不同，请咨询公元新能当地技术支持、代理商或售后，并取得公元同意，否则会损坏组件并导致质保失效。

Modules can be installed using the following methods: bolt mounting or clamp mounting. All installations must strictly follow the operation instructions in this manual to comply with IEC certification. Before installation, please read this section to familiarize with the complete installation process.

The connection between modules and the mounting system can be implemented using mounting holes on the frame, clamps, or embedded systems. Module installation must strictly comply with the specified requirements. If the installation method differs from ERA Solar's published guidelines, please consult ERA Solar's local technical support, authorized distributors, or after-sales service department, and obtain written approval from ERA Solar. Violations will damage the modules and void product warranty.

本手册提到的载荷对应测试载荷。对于符合当地法律法规要求的安装方式，在计算许可的最大设计载荷时，需要考虑 1.5 的安全系数。项目设计载荷取决于结构，应用标准，安装地点与当地气候。设计载荷由专业的供应商或者专业工程师确定，详细信息，请遵照当地建筑法规或者联系专业的建筑工程师。

所描述的组件被安装在模块下方延伸的连续的支架上。如果组件被安装在没有连续的支架的情况下，其最大允许载荷将会降低，需由公元新能重新进行评审。

两个组件之间的最小间距为 5mm, 如使用特殊支架可遵照支架供应商的技术要求选择合适的间距。

The loads mentioned in this manual refer to test loads. When calculating the permitted maximum design load for installation methods compliant with local regulations, a safety factor of 1.5 must be applied. The project design load depends on the structure, applicable standards, installation site, and local climate conditions. Design loads shall be determined by qualified suppliers or professional engineers. For detailed requirements, always adhere to local building codes or consult a licensed structural engineer.
The described modules are mounted on continuous mounting brackets beneath the array. If installed without continuous brackets support, the maximum permitted load capacity will be reduced and must be re-evaluated by ERA Solar.
A minimum 5mm spacing is required between adjacent modules. For installations utilizing specialized mounting systems, spacing may be adjusted in accordance with the technical specifications provided by the mounting system supplier.

注意: 这里介绍的所有安装方式只供参考，公元新能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。

Note: All installation methods described herein are for reference only. ERA Solar assumes no responsibility for the provision of installation components, system design, or installtion operation. Mechanical load validation and safety compliance must be performed by qualified system installers or certified professionals.

安装前，还需要确认以下重要的几项 Prior to installation, verify the following critical items:

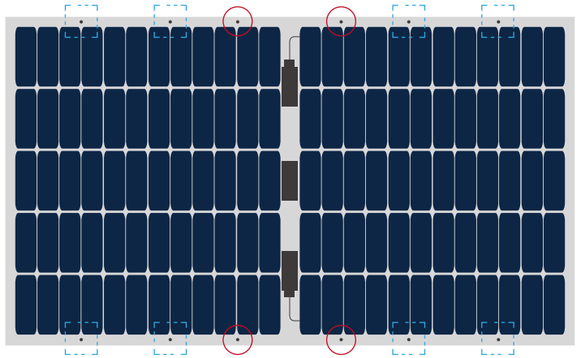
- 安装之前需检查一下外观是否有缺陷或其它杂物以及接线盒的安全性能，如果有的话，需清除。Prior to installation, conduct a visual inspection to check any physical defects, foreign debris, or compromised junction box integrity. All identified issues must be remediated before proceeding.
- 检查组件的序列号是否正确。Verify the module serial number for accuracy.
- 公元新能源太阳能组件正面能够承受的最大压力为 5400Pa（只针对本说明书中涉及到的组件型号），背面为 2400Pa。正面能够承受的最大设计压力为 3600Pa，背面为 1600Pa。安全系数为 1.5。如果组件安装地环境为多雪和强风，在组件安装时应采取特殊的防护，来满足实际要求。ERA Solar photovoltaic modules (models specified in this manual) are rated for a maximum test pressure of 5,400 Pa on the front side and 2,400 Pa on the back side, with corresponding design pressures of 3,600 Pa (front) and 1,600 Pa (back) incorporating a 1.5 safety factor. For installations in snow-prone or high-wind regions, additional protective measures must be implemented to ensure structural integrity under these demanding environmental conditions.

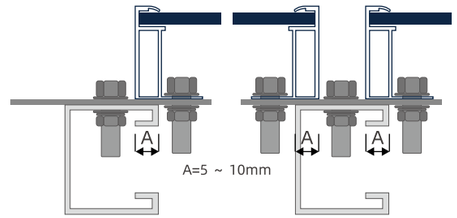
7.2 螺栓安装 Bolt Mounting

每个组件的边框上都有 4 对 9*14mm 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。Each module frame is equipped with four pairs of 9×14 mm mounting holes, designed to securely fasten the modules to supporting structures to optimize load-bearing capacity.

为了最大限度地延长安装寿命，公元新能强烈建议使用抗腐蚀（不锈钢）固定件。To maximize installation longevity, ERA Solar strongly recommends using corrosion-resistant (stainless steel) fasteners.

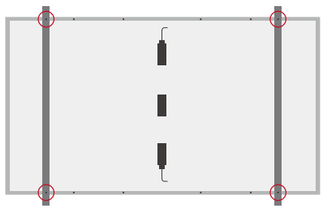
组件安装使用 M8/M6 螺栓、平垫圈、弹簧垫圈和螺母在每个固定位置固定组件，并拧紧至 14N•m-18N•m/5N•m-12N•m 的扭矩。螺栓和螺母的屈服强度应不小于 450MPa。与边框接触的所有部位应采用最小厚度为 1.8mm 且外径为 16mm 的扁平不锈钢垫圈。Modules must be secured at each mounting hole with M8/M6 bolts, flat washers, spring washers, and nuts, torqued to 14-18 N•m or 5-12 N•m. All fasteners shall have a minimum yield strength of 450 MPa. Flat stainless steel washers with a thickness ≥ 1.8 mm and outer diameter ≥ 16 mm must be installed between all frame contact surfaces.





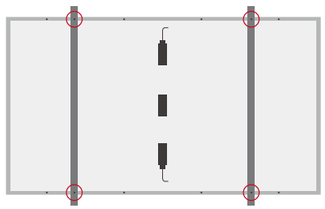
共 8 个安装孔，使用 M8 螺栓
8 installation holes, using M8 bolts

共 4 个安装孔，使用 M6 螺栓
4 installation holes, using M6 bolts



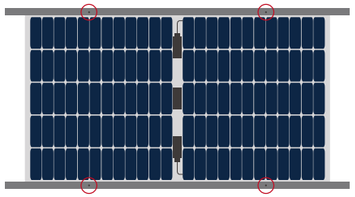
外四孔螺栓安装
（横梁垂直于长边框）

Installation of 4 external bolt holes
(Beam perpendicular to long sides)



内四孔螺栓安装
（横梁垂直于长边框）

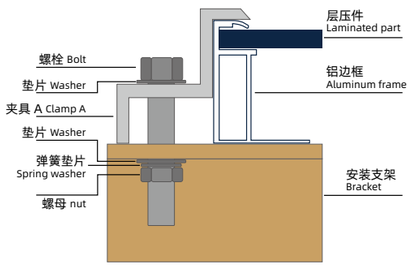
Installation of 4 internal bolt holes
(Beam perpendicular to long sides)

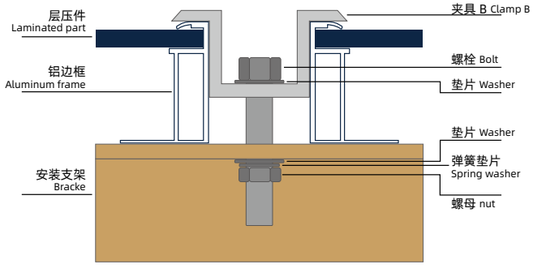


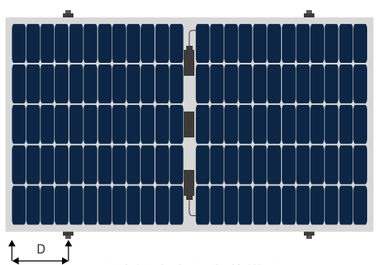
内四孔螺栓安装
（横梁平行于长边框）

Installation of 4 internal bolt holes
(Beam parallel to long sides)

7.3 夹具安装 Clamp Mounting

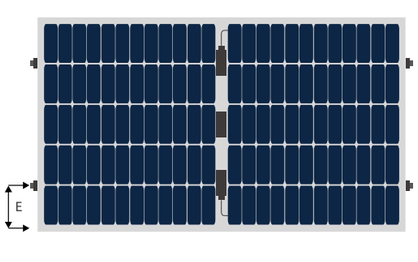






组件长边夹具安装横梁
垂直于长边框（压块长度≥ 40mm)

Installation of framed module with fixtures on long sides
Beam perpendicular to long sides(clamp length ≥ 40mm)



组件短边夹具安装横梁
垂直于短边框（压块长度≥ 40mm)

Installation of framed module with fixtures on short sides
Beam perpendicular to short sides(clamp length ≥ 40mm)

- 当选择了压块安装的方法，确保在每个组件上面至少有 4 个压块。在组件的每个长边（纵向）上或每个短边(横向)上各安装两个,夹具用多少个压块决定于当地的风和雪的压力强度,如果压力超过预期估计时，需要另外的压块或者支架以保证组件能承受此压力。For clamp installation, secure each module with at least four clamps - two per long (longitudinal) or short (lateral) side. The required number depends on local wind/snow loads. If the actual load exceeds the expected design values, additional clamps or support brackets must be used to ensure the module can withstand the pressure.

- 公元新能在用多家制造商的不同夹具测试过其组件后，紧固件材质选型根据当地环境选择建议使用 M8/M6(建议全螺纹)。Based on cross-manufacturer clamp testing, it is recommended to use M8/M6 fasteners (preferably full-thread), with the fastener material selected according to local environmental conditions.

- 夹具必须夹住组件边框超过 7mm 但不能超过 10mm，两个组件之间的最小间距为 5mm。Clamps must engage 7-10mm of the module frame, while maintaining a minimum 5mm clearance between adjacent modules.

- 组件夹具不能和前侧的玻璃接触，且不得使边框变形，请务必避免组件夹具的遮光效应。Module clamps must avoid contact with the front glass and prevent frame deformation, while ensuring no shading effect on active solar cells.

- 组件边框在任何情况下都不能调整；安装或使用过程中，排水孔在任何情况下不能堵塞。Under no circumstances shall module frames be modified, nor drainage holes obstructed during installation or operation.

- 施加的扭矩应按照客户所用螺栓的机械设计标准来定：
  M8 螺栓拧紧的扭力矩大小范围：14N•m - 18N•m；
  M6 螺栓拧紧的扭力矩大小范围：5N•m - 12N•m；
  Applied torque must comply with the mechanical design standards of the bolts used by customers.
  The tightening torque range for M8 bolts is 14N•m to 18N•m,
  The tightening torque range for M6 bolts is 5N•m to 12N•m.

- 如果客户需要其他尺寸的压块，需有公元新能源进行充分评估。
  Custom clamp sizes require thorough evaluation by ERA Solar prior to implementation.

八、组件接线 Module Wiring

8.1 接线要求 Wiring Requirements

- 组件的电性能参数是在标准测试条件下，即光照强度 1000W/m²，AM1.5 以及电池温度为 25℃测试出来的。某些情况下，组件可能产生比额定值更高或更低的电压或电流值。当光伏系统的其它部件额定电压、导体额定电流、保险丝规格，连接至太阳能组件输出的控制元件的规格确定时，需将标在组件上的短路电流和开路电压值乘以 1.25 的系数。The electrical parameters of modules are measured under Standard Test Conditions (STC) with an irradiance of 1000W/m², AM1.5 spectrum, and a cell temperature of 25 ° C. In actual operating conditions, modules may generate voltage or current values exceeding or falling below rated values. When determining the rated voltage of system components, conductor current ratings, fuse specifications, or control device parameters connected to the module output, the labeled short-circuit current (Isc) and open-circuit voltage (Voc) must be multiplied by a safety factor of 1.25.

- 所有接线应由合格的安装人员按照当地法规和程序进行。建议使用与组件产品相对应的连接器型号进行连接，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。All wiring must be performed by qualified installers in compliance with local regulations and procedures. It is recommended to use connector models compatible with the modules, ensuring tight and proper connections without external pressure. Connectors shall only be used for circuit connectivity and must never function as circuit switches.

- 连接器连接应保持干燥和干净，防止雨淋受潮。避免连接器受到阳光直射以及水的浸泡。Connectors must be kept dry and clean at all times to prevent moisture ingress from rain.Direct sunlight exposure and water immersion should be strictly avoided.

- 连接器在对接前并不具备任何防水功能，组件在安装时需尽快对接连接器或者采取防水措施，避免连接器接触水分和灰尘。Connectors are not waterproof prior to mating. During installation, they must either be promptly interconnected or protected with waterproof measures to exclude moisture and dust contamination.

- 串联时必须选择相同档位电流的太阳能组件进行连接，串联在一起的组件产生的电压不能高于系统允许的最高电压。When connecting solar modules in series, ensure all modules share identical current ratings. The combined voltage of the series string must not exceed the system's maximum allowable voltage.

- 每串组件的数量由系统设计，逆变器类型及环境情况而定。The number of modules per string is determined by system design requirements, inverter specifications, and environmental conditions.

- 每串组件最大额定熔丝电流值标识在产品标签及规格参数表中。额定熔丝电流对应的是组件最高能承受的反向电流值，基于最大熔丝电流及当地电性能安装要求，请匹配合适的熔丝以保护电路中的串并联的组件。The maximum rated fuse current for each string of modules is indicated on the product label and specifications. This value represents the maximum reverse current the modules can withstand. To ensure circuit protection in series/parallel connections, select appropriate fuses based on both the rated fuse current and local electrical installation requirements.

- 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。If an array string is connected with reverse polarity to another, it may cause irreversible damage to the products. Prior to parallel connection, verify the voltage and polarity of each string. If measurements indicate opposite polarity or a voltage difference exceeding 10V between strings, inspect the system configuration before proceeding with interconnection.

- 公元新能的太阳能组件采用截面积大于等于 4mm² 且防紫外线的光伏专用电缆。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。公元新能建议所有电缆应布设在适当的管道或线槽中、连接线路应紧固可靠不得与其它部件等产生摩擦损伤等且应远离易积水的地方。ERA Solar's modules utilize UV-resistant photovoltaic cables with a minimum 4mm² cross-section. All other DC system cables must meet equivalent or higher specifications. ERA Solar recommends installing cables in appropriate conduits, ducts, or cable trays, ensuring secure fastening to prevent abrasion, and avoiding water-prone areas.

- 组串的电压不得高于系统所能承受的最高电压，以及安装系统中的逆变器及其他电气设备的最高输入电压。为了确保这种情况，阵列的开路电压需要在该位置的最低预期环境温度下计算。The string voltage must not exceed both the system's maximum allowable voltage and the highest input voltage rating of connected inverters or electrical equipment. To ensure compliance, calculate the array's open-circuit voltage at the site's lowest expected ambient temperature.

- 设计系统时应避免形成环路。System designs must prevent the formation of electrical loops.

- 电缆的外径范围为 5-7mm。The cable outer diameter must be maintained within the 5-7mm range.

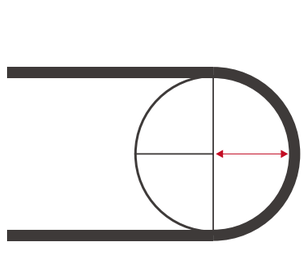
- 现场接线应使用最低 90° C 耐温、耐光且横截面不低于为 4mm² 的光伏专用电缆作为光伏连接线。All field wiring connections must use PV cables with a minimum temperature rating of 90° C and 4mm² cross-section, and UV-resistant property for PV interconnections.

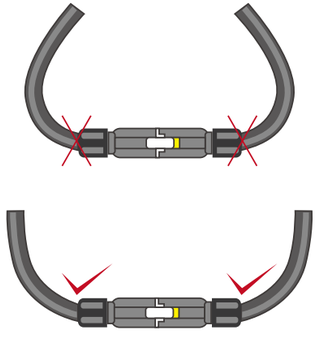
- 在屋面平铺安装组件时，建议使用 4-6mm² 的光伏专用电缆。电缆的最小弯曲半径应为 43mm。For flat rooftop installations of modules, it is recommended to use PV cables with a cross-sectional area of 4-6 mm²and a minimum bending radius of 43mm to ensure mechanical durability and electrical performance.

- 在同一个光伏发电系统中，尽量使用相同配置的组件。Within the same photovoltaic generation system, it is recommended to use modules with identical specifications and configurations.

- 几个组件串联，然后并联形成光伏阵列，这特别适用于电压较高的情况下。Modules are first connected in series to form strings, and then multiple series strings are connected in parallel to form a PV array.Such connection is particularly suitable for high-voltage applications.

- 组件串列的最大串联数量（N）=Vmax 系统 /｛Voc（atT）｝，T 为实际使用环境温度，单个组串组件开路电压之和应在组件设计系统电压之内。The maximum number of modules in series (N) is calculated as:（N）=Vmax system /｛Voc（atT）｝, where T is the actual operating ambient temperature. Ensure the total open-circuit voltage (Voc)per string does not exceed the system's design voltage limits.





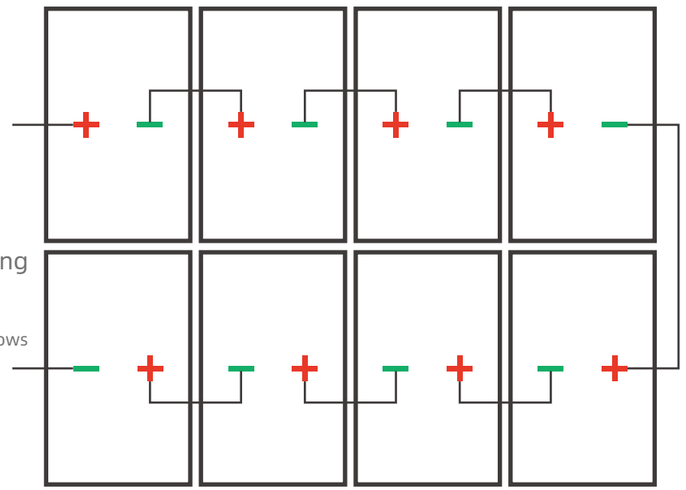
8.2 布线方式 Wiring Methods

三分体线盒推荐布线方式（竖装：标准线长即可（注：单排的一端需增加线）。For triple-part split junction boxes, the recommended wiring methods are as follows(vertical installation: standard cable length is sufficient. (Note：One end of the single row needs to be extended.)

组件竖装 Vertical Installation：
选择标准短电缆
Use standard short cables

短线顺接法 C 型
Type-C shortcable daisy-chaining

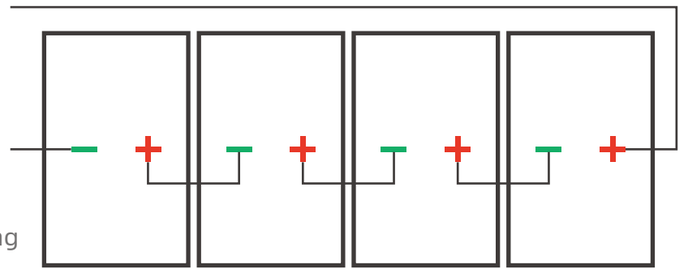
注意：上下两排的一端需要串接
Note:One end of both upper and lower rows requires series connection.



组件竖装 Vertical Installation：

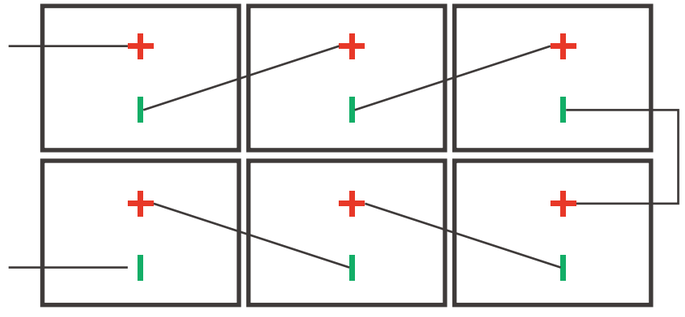
选择标准短电缆
Use standard short cables

短线顺接法一型
Type-I shortcable daisy-chaining



组件横装 Horizontal Installation：

选择标准长电缆或定制
Use standard long cables or custom lengths



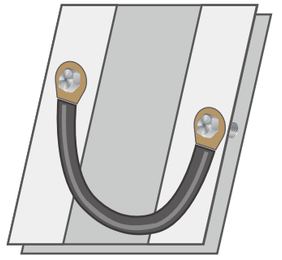
8.3 接地连接 Grounding Connection

组件需要进行接地，已确认组件满足安全等级 II 级，并确保接地方式满足当地的电气指令和法规。应由有资质的电工人员进行接地连接操作。

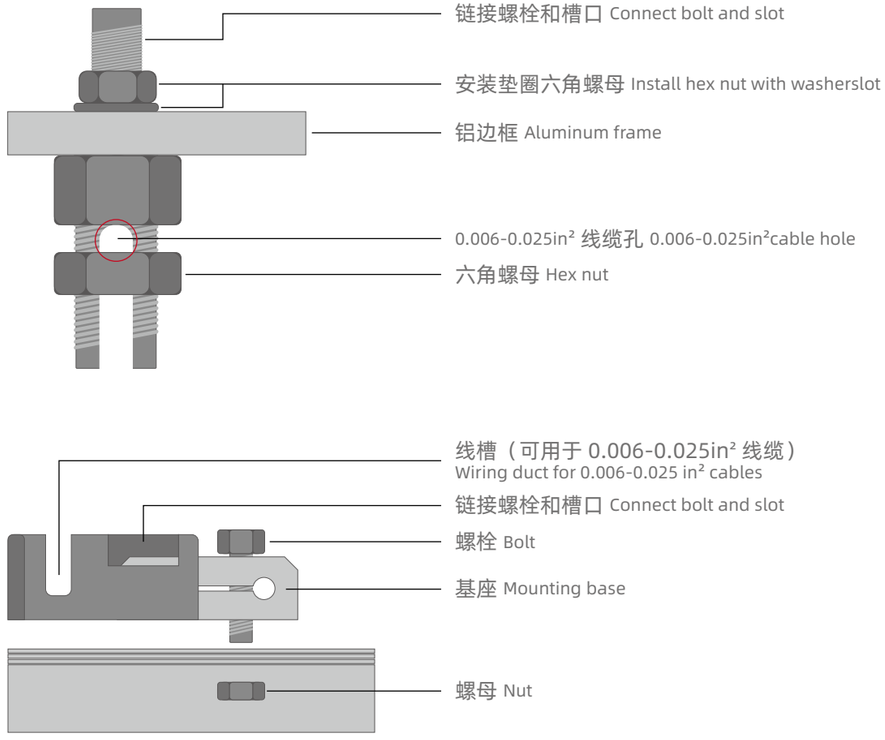
组件的设计中，使用了阳极氧化的抗腐蚀的铝合金边框作为刚性支撑，为了使用安全、避免组件受到雷电和静电伤害，组件边框必须接地。接地时，必须将接地装置与铝合金内部充分接触，穿透边框表面的氧化膜。严禁在组件的边框上添加任何附加的接地孔。接地导体或接地线可以是铜、铜合金或任何其他符合相应的《国家电气规范》要求的用作电导体的材料，接地导体必须通过合适的接地电极连接到大地。边框上已标记接地标识的孔，只可用于接地，不可用于组件安装。无框双玻组件因为没有裸露的导体，所以按照规定不需要接地。

Modules must be grounded, with verification that they meet Safety Class II requirements. Grounding methods must comply with local electrical codes and regulations. All grounding connections shall be performed by qualified electricians.

In the module design, anodized corrosion-resistant aluminum alloy frames are used as rigid structural supports. To ensure operational safety and protect against lightning/electrostatic damage, the module frames must be grounded. During grounding, the grounding device must establish full contact with the internal aluminum frame by penetrating the surface oxide layer. Drilling additional grounding holes on the frame is strictly prohibited.The grounding conductor (e.g., copper, copper alloy or other materials compliant with the National Electrical Code) must connect to the earth via an appropriate grounding electrode. Pre-marked grounding holes on the frame are exclusively for grounding purposes and must not be used for module installation. Frameless double-glass modules, lacking exposed conductors, do not require grounding as per regulations.

零件 Components	示图 Diagram	连接方式 Connection Method
		将星形垫圈、平垫圈和接地线依次放置，使用螺钉穿过接地孔，再将其拧紧来固定相邻组件。Assemble the star washer, flat washer, and grounding wire in sequence. Insert the screw through the grounding hole, and then tighten it to secure adjacent modules.

我们建议使用以下方法正确接地，如图所示。We recommend using the following method for proper grounding, as illustrated below.



光伏组件接地方法（适用于 IEC）
PV module grounding method (IEC Compliant)

以下为建议采用接地方法 Suggested grounding methods are as follows :

使用接地夹具接地 Ground using a ground clamp

在组件背面边框的中间靠边缘部分有一个直径为 Ø4mm 的接地孔。接地标识的中位线和孔的中位线重合与边框长度方向一致。

组件之间的接地必须经过有资质的电工确认，且接地装置必须是由有资质的电气厂商制造。建议的扭力矩值为 2.3N•m。接地夹具使用 12AWG 尺寸的铜芯线。铜线安装时候不能被压损。使用未被使用的安装孔接地。组件上已有的但未被使用的安装孔可以被用来安装接地装置。

A Ø4mm grounding hole is located near the edge at the center of the module's rear frame. The centerline of the grounding mark aligns with the hole's and parallel to the frame's longitudinal direction.
The grounding connection between modules shall be confirmed by a licensed electrician, and grounding devices must be manufactured by qualified electrical suppliers. The recommended torque value is 2.3 N•m. Grounding clamps shall use 12AWG copper core wires. During installation, copper wires must not be crushed. Unused mounting holes on modules shall be utilized for grounding. Existing but unused mounting holes on modules may be repurposed for grounding device installation.

- 把接地夹对准边框安装孔。使用接地螺栓穿过接地夹和边框。Align the grounding clamp with the frame's mounting hole. Insert the grounding bolt through both the clamp and frame.
- 把带齿垫片放入另一面，并且拧上锁紧螺母。Place the serrated washer on the opposite side and secure with a lock nut.
- 将接地线穿过接地夹，接地线的材质和大小应该满足当地国家、地区或国际的有关规定、法律和标准要求。Route the grounding conductor through the grounding clamp, ensuring its material and dimension comply with applicable national, regional, or international regulations, codes, and standards.
- 拧紧接地线紧固螺栓，然后安装结束。Tighten the grounding conductor fastening bolt to complete the installation.

其他的第三方接地装置：公元新能组件可以使用第三方的接地装置接地，但其接地必须是被证明可靠的，接地装置是根据制造商要求的规定操作。

Other third-party grounding devices: The ERA Solar's modules may utilize third-party grounding devices, provided that such grounding is proven reliable and the installation strictly complies with the manufacturer's specified requirements.

九、组件维护 Module Maintenance

组件需要进行定期的检查和维护，特别是在保修期间内。为了确保组件能达到最佳性能建议采用以下维护措施 PV modules require periodic inspection and maintenance, especially during the warranty period. To ensure optimal performance, the following maintenance measures are recommended：

9.1 外观检查 Appearance Inspection

- 组件安装后，前期建议多巡查，确定环境造成组件脏污，后续按情况清理。After module installation, frequent inspections are recommended during the early stage to monitor potential contaminants caused by environmental conditions, with subsequent cleaning performed as needed.
- 建议 6 个月执行一次预防性检查，不要擅自更换组件的元部件。如果需要进行电性能或机械性能的检查或维护，建议让具有电气资质的专业人员进行操作，以免发生触电或人员伤亡。It is recommended to perform preventive inspections every 6 months. Do not replace module components without authorization. If electrical or mechanical performance inspections or maintenance are required, qualified electricians must perform the operations to prevent electric shock or personal injury.
- 边框护角作为运输保护部分，不做外观管控，客户自行选择拆卸或者保留。Corner protectors are designed solely for transportation protection and are not part of the product's appearance quality requirements. Customers may choose to remove or retain them as needed.
- 组件玻璃是否有破损。Check for glass breakage on the PV module.
- 是否有尖锐物体接触组件表面。Check for sharp objects in contact with the module surface.
- 组件是否被障碍物、异物遮挡。Check for obstructions or foreign objects shading the PV module.
- 组件接线端子是否有脱落的现象等。Check for loose or detached terminals on the PV module.
- 组件表面无人为造成的破裂现象。Check for no human-induced cracks exist on the module surface.
- 检查组件与支架间的固定螺栓是否有松动或损坏，并进行及时调整或修复。Check and tighten any loose or damaged bolts between PV modules and mounting structures, and perform immediate adjustment or repair.

9.2 连接器和线缆检查 Connectors and Cables Inspection

- 所有接线工作应由合格的安装人员按照当地电气施工规范、规程、手册和程序进行。All wiring shall be performed by qualified installers in compliance with local electrical codes, regulations, manuals, and procedures.
- 建议每 6 个月执行一次预防性检查，检查所有电缆以验证其连接是否牢固；避免电缆受阳光直射且使其远离积水区域。并保持连接器的干燥和清洁，在连接前请确保连接器的螺帽是处于拧紧状态。在连接器是潮湿、弄脏的或者其他状态下请不要连接连接器。Preventive inspections shall be conducted every 6 months to verify all cable connections are secure. Cables must be shielded from direct sunlight and kept away from water accumulation areas. Maintain connectors dry and clean, ensuring threaded caps are tightened before mating. Do not connect connectors if they are wet, contaminated, or in abnormal conditions.
- 检查接线盒处密封胶是否开裂，是否有缝隙，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。检查组件是否接地良好，始终确保触点无腐蚀、清洁并且干燥。Inspect sealant of the junction box for cracks or gaps. Check PV modules for aging signs including rodent damage and climatic degradation. Verify all connectors are tightly mated without corrosion. Ensure the modules are properly grounded, and that all contact points remain clean, dry, and free from corrosion.
- 建议至少每年检查一次端子螺栓的扭矩和接线的各方面情况。此外，检查安装的硬件是否紧固到位。连接松动可能会产生电弧和电击导致阵列损坏。Theterminal bolts' torque and wiring conditions shall be inspected at least annually. Additionally, verify all mounting hardware is properly tightened. Loose connections may cause arcing or electric shock, resulting in array damage.

9.3 清洗要求 Cleaning Requirements

灰尘堆积在组件的玻璃表面会减少它的功率输出甚至可能引起区域热斑，如工业废水和鸟粪。其影响程度取决于废弃物的透明度，玻璃上的少量尘埃会影响吸收的太阳光强度及均匀性，但并不危险，而且功率通常也不会显著降低。Dust accumulation on the glass surface of PV modules reduces power output and may induce localized hot spots, particularly from industrial waste or bird droppings. The severity depends on the contaminant's transparency. Small amounts of dust may slightly affect sunlight absorption intensity and uniformity without significant power loss or safety risks.

组件在工作的时候，严禁遮挡部分或全部组件的环境影响因素存在，如：其它组件，组件系统支架，鸟类停留、大量的灰尘、泥土或植物等，这些都会导致输出功率显著降低。公元新能建议，在任何有光照时候组件表面都不能有遮挡。空气中的灰尘堆积在组件的玻璃表面会减少它的发电输出，尽可能定期进行一次清洁工作。During operation, photovoltaic modules must not be partially or fully shaded by environmental factors such as adjacent modules, mounting structures, bird perching, heavy dust, mud, or vegetation, as these will cause significant power output reduction. ERA Solar recommends that module surfaces should remain completely unobstructed under any lighting conditions. Dust accumulation on the glass surface will reduce power generation output, necessitating regular cleaning.

为了减少潜在的电击或灼伤，公元新能建议在光照较弱且组件温度较低的清晨或傍晚时进行光伏组件的清洁工作，特别是对于气温较高的地区。To minimize risks of electric shock or burns, ERA Solar recommends cleaning PV modules during early morning or evening with low irradiance and low modules temperature, especially in high-temperature areas.

清洗的频率取决于安装现场污垢积累的速度。在正常情况下，雨水会对组件的表面进行清洁，这样能减少清洗的频率。公元新能建议使用含清水的海绵或者柔软的布擦拭玻璃表面。严禁使用含有碱，酸的清洁剂清洗组件。任何情况下不得使用表面粗糙的材料进行组件清洁。The cleaning frequency depends on the rate of dirt accumulation at the installation site. Under normal conditions, rainfall can clean the module surface, thereby reducing the need for manual cleaning. ERA Solar recommends using a sponge or soft cloth with clean water to wipe the glass surface. The use of alkaline or acidic detergents is strictly prohibited. Under no circumstances should abrasive materials be employed for module cleaning.

组件的背面通常不需要清洁，但在认为确实有必要对其进行清洗时，应避免使用可能引起损坏或穿透基底材料的一切尖锐物体。The backside of PV modules generally requires no cleaning. If cleaning is deemed necessary, avoid using any sharp objects that may cause damage or puncture the substrate material.

不要试图清理有玻璃破损或存在裸露电线等特征的光伏组件，这都将有受到电击的危险。Do not attempt to clean PV modules with broken glass or exposed wiring, as this poses a risk of electric shock.

9.4 清洁方法 Cleaning Methods

方法 A: 高压水流清洗 Method A:High-Pressure Water Cleaning



- 水质要求 Water Quality Requirements：pH:5 ~7；
- 氯化物或盐分含量 Chloride/Salt Content：0 - 3,000 mg/L
- 浑浊度 Turbidity：0-30 NTU
- 电导率 Conductivity：1500~3000 μs/cm
- 总溶解固体 Total Dissolved Solids (TDS)：≤ 1000 mg/L
- 水硬度 Water Hardness：0-40 mg/L
- 必须采用非碱性水，具备条件时使用软化水高压水流清洗（推荐的最大水压是 4MPa [40bar]。）Only non-alkaline water should be used; Softened water is preferred when available for on high-pressure water cleaning method. (Recommended maximum water pressure: 4MPa [40bar]).

方法 B: 压缩空气清洗 Method B: Compressed Air Cleaning

推荐清洗组件上的软质污渍（像灰尘）时，使用气压清洗方式。只要现场清洗效果足够好，这种技术就可以被应用。This technique is recommended for removing soft stains (e.g., dust) from modules via pneumatic cleaning. It can be applied if on-site cleaning effectiveness meet required standards.

方法 C: 湿试清洗 Method C: Wet Trial Cleaning

如果组件表面存在过多的污渍，那可以小心地使用绝缘刷，海绵或别的软质的清洗工具。确保任何刷子或搅动工具由绝缘材料构成，使触电的风险降到最低，且这些工具对玻璃或铝合金边框不会产生划痕。如果有油渍存在，那可以谨慎地使用一种环境友好型清洁剂。If excessive stains exist on the module surface, carefully use insulated brushes, sponges, or other soft cleaning tools. Ensure all brushes or agitation tools are made of insulating materials to minimize electric shock risks and prevent scratching the glass or aluminum frame. If oil stains are present, an environmentally friendly detergent may be cautiously applied.

方法 D: 清洗机器人清洗 Method D: Robotic Cleaning

如果采用清洗机器人进行干洗，要求毛刷材质为软性塑料，清洗过程及清洗后不会对组件玻璃面和铝合金边框造成划伤，清洗机器人的重量不易过大，对采用清洗机器人清洗不当造成的组件损坏，功率衰减，不在公元质保范围内。If a cleaning robot is employed for dry cleaning, the brush material must be soft plastic to ensure no scratches on the glass surface or aluminum alloy frame during and after cleaning. The robot's weight shall not exceed permissible limits.Module damage or power degradation caused by improper robotic cleaning is excluded from warranty coverage.

9.5 清洗后检查 Inspection after Cleaning

目视组件整体外观清洁、明亮，无污渍，抽样检查组件表面是否有积灰存在，组件表面无明显的刮伤痕迹，组件表面无人为造成的破裂现象。Visually confirm the modules are clean and bright with no stains. Conduct spot checks for dust accumulation and ensure no visible scratches or human-induced cracks exist on the surface.

清洗后组件支架有无倾斜、弯曲现象，组件接线端子是否有脱落的现象等。光伏组件清洗完后，完成光伏组件清洗记录。如果安装后无法正常工作等问题，请立即通知安装商。After cleaning, inspect the mounting structure for any tilting or bending, and check the module terminals for disconnection. Complete the PV module cleaning record upon finishing the cleaning process. Immediately notify the installer if any operational failure are detected after installation.

十、发布与执行 Release and Execution

该文件最终执行与解释由公元新能管理负责。ERA Solar reserves the final right of execution and interpretation of this document.