Perovskite conventional photovoltaic module Installation Work Instruction

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光晶能源
PHOTON CRYSTAL ENERGY

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1. Objective

This manual is designed to assist customers or contractors purchasing and authorized to use the 120*60cm perovskite standard PV modules (abbreviated as 'modules') from Photon Crystal Technology Co., Ltd. (abbreviated as 'Photon Crystal') in their accurate installation, operation, and maintenance.

2. Scope of Application

This manual is intended solely to demonstrate the installation of Photon Crystal modules using specialized photovoltaic clamps on existing ground or roof supports provided by clients or contractors. It does not include installation design guidance for support structures or rails beneath the modules, nor does it cover power station circuitry, energy storage design, or installation instructions.

3. Definition

3.1. Standard PV modules: These are standard-frame, double-glass, non-BIPV modules (non-BIPV) manufactured by Photon Crystal, with specifications of 1200 × 600 × 7mm, suitable for general applications.

3.2. Clamping Block: A fixture designed to secure components onto specific brackets or rails. Typically made of metal, it features rubber or silicone pads to cushion the contact between the clamping block and the component's glass surface.

4. Rights and Responsibilities

4.1. Photon Crystal develops installation operation manuals for products of various specifications and application types, covering both standard conditions and environmental scenarios.

4.2. The client and contractor shall implement operations in accordance with this manual, considering the actual site conditions, environmental and climatic factors, as well as local regulations and standards, to ensure operational safety and reliable installation.

5. Component Specifications, Features, and Schematic Diagram

5.1. Component Specifications and Related Parameters

Length*Width (mm)	1200*600 (±2)	weight (kg)	12.0±0.5
Thickness (excluding junction box) (mm)	7.0mm (±0.2)	cheek	not have
area (m^2)	0.72	Work environment temperature (°C)	-40°C~+85°C
Open-circuit voltage Voc (V)	84~90	Maximum system voltage Vsys (V)	1500

Length*Width (mm)	1200*200（±2）	weight （kg）	4.0±0.5
Thickness (excluding junction box) (mm)	7.0mm（±0.2）	cheek	not have
area （m^2）	0.24	Work environment temperature (℃)	-40℃~+85℃
Open-circuit voltage Voc (V)	26~30	Maximum system voltage Vsys (V)	1500

5.2. Relevant Material Manufacturers

Product Detailed Information	Model 1	working temperature
Connector:.....	Supplier: Zhejiang Boneng NewEnergy Technology Co., Ltd. Model:PV-BN101B,30A	-40℃~+40℃
Bypass diode:.....	Supplier:Yangzhou HY Technology Development Co., Ltd. Model:6A10	-40℃~+40℃

5.3. Product Features

5.3.1. High conversion efficiency: Perovskite materials exhibit exceptionally high light absorption coefficients, with a bandgap width of approximately 1.4 eV—close to the optimal bandgap for solar cells. This enables efficient absorption of sunlight, as well as the excitation, transport, and separation of photogenerated carriers.

5.3.2. Low temperature coefficient: The maximum power temperature coefficient of perovskite solar cells is approximately-0.06%/℃, meaning a 1℃ temperature rise results in only a 0.06% decrease in power output. In contrast, crystalline silicon cells exhibit a temperature coefficient of about-0.30%/℃.

5.3.3. Excellent low-light performance: The low-light effect of perovskite refers to its ability to maintain high photoelectric conversion efficiency even under low light intensity conditions.

5.4. Component Outline Diagram

Figure 1: Three-view component

6. Installation Regulations

6.1. Installation personnel or system integrators shall ensure compliance with all applicable local electrical regulations. Prior to initiating the design and installation of photovoltaic systems, coordination with relevant local government authorities is required to confirm local regulations, licensing requirements, and inspection standards.

6.2. Our company's perovskite photovoltaic modules meet the safety class2 and combustion class A2 standards. They have been tested and certified under IEC61730 (Application Class A) and IEC 61215/UL 1703, ensuring a maximum system voltage of 1500V and a rated overload protection current of 4.0A.

7. Safety Preventive Measures

7.1. When exposed to sunlight, solar panels generate direct current (DC) output after connection. Even without connected circuits or loads, the panels maintain open-circuit voltage. They can produce over 36V at low light intensity, with current and output power increasing proportionally to light intensity. When working with solar panels in sunlight, use insulated tools and rubber gloves, and remove all metal accessories to reduce risks of injury or accidental electric shock.

7.2. The module lacks a switch mechanism; its operation can only be stopped by isolating the light source. To prevent the generation of high voltage and current, the module can be fully covered with an opaque material. In photovoltaic systems, only equipment compatible with photovoltaic systems is permitted, including connectors, wires, inverters, etc.

7.3. All electrical parameters on the nameplate are measured under standard test conditions (radiant intensity 1000W/m², AM1.5G spectrum, cell temperature 25°C), with short-circuit current, open-circuit voltage, and rated power deviations within ±5%. In practical applications, the actual current or voltage generated by the module may exceed the data under standard conditions. When calculating the module's maximum voltage, current, fuse current capacity, and control element specifications under these conditions, the short-circuit current and open-circuit voltage marked on the module should be multiplied by a factor of 1.25 for design and installation purposes.

8. Component Installation

8.1. Location Selection

8.1.1. Select a suitable location for component installation. Ensure the components are not shaded at any time of day.

8.1.2. Select the optimal installation direction and tilt angle for components to maximize direct sunlight exposure. For specific tilt angle recommendations, consult the supplier or construction team.

8.1.3. Do not place components in areas prone to generating or accumulating flammable gases, nor near flammable or explosive materials.

8.1.4. When selecting installation locations, ensure components and connectors are not exposed to prolonged water immersion or snow accumulation.

8.2. General Requirements for Installation

8.2.1. Installation personnel must wear protective gloves to prevent cuts from sharp glass.

8.2.2. Handle components with care during installation. Avoid placing heavy objects on the surface or back of components, and personnel must not sit or stand on them. Physical damage, such as glass breakage, may cause grounding faults or pose electrical safety hazards, especially when components are exposed to moisture or water. Therefore, damaged components should be disposed of properly.

8.2.3. After removing the factory packaging, avoid stacking or moving multiple components to minimize the risk of damage.

8.2.4. Avoid pulling components with leads or junction boxes to minimize cable and junction box damage. After installation, connected wires must not be under tension or stretched. During installation, do not touch the live ends of component cables.

8.2.5. Avoid installing components in windy or humid conditions to minimize the risk of personnel injuries.

8.2.6. The installation method of components must not obstruct airflow on their backside. During operation, components generate heat and require adequate air circulation for cooling.

8.2.7. The components are designed and tested for a maximum uniform load capacity (pressure) of 2400Pa. Support brackets must be used that provide sufficient design strength while complying with local regulations, ensuring the system can withstand foreseeable mechanical pressures from local wind and snow conditions. These brackets must be constructed from durable, corrosion-resistant, and UV-resistant materials. Without additional support, the maximum allowable uniform load pressure on the components shall not exceed 2400Pa.

8.2.8 Other Installation Requirements

Design load (Pa):	2400 (front) / 2400 (back)
factor of safety ：	1.5
Test load (Pa):	3600 (front) / 3600 (back)
Module grounding	The system grounding is connected to the bracket througha fixture, and then transmitted to the ground through the bracket.
Installation altitude	<2000 meters

8.3. Component Installation Method

8.3.1. Components must be installed using specialized clamps. The installation point with a load capacity of 2400Pa is shown in Figure 2. The clamps should be positioned along the 1200mm length of the component, with the center points of the two clamps at each end located 250± 50mm inward from the short edge of the component, as illustrated in Figure 2.

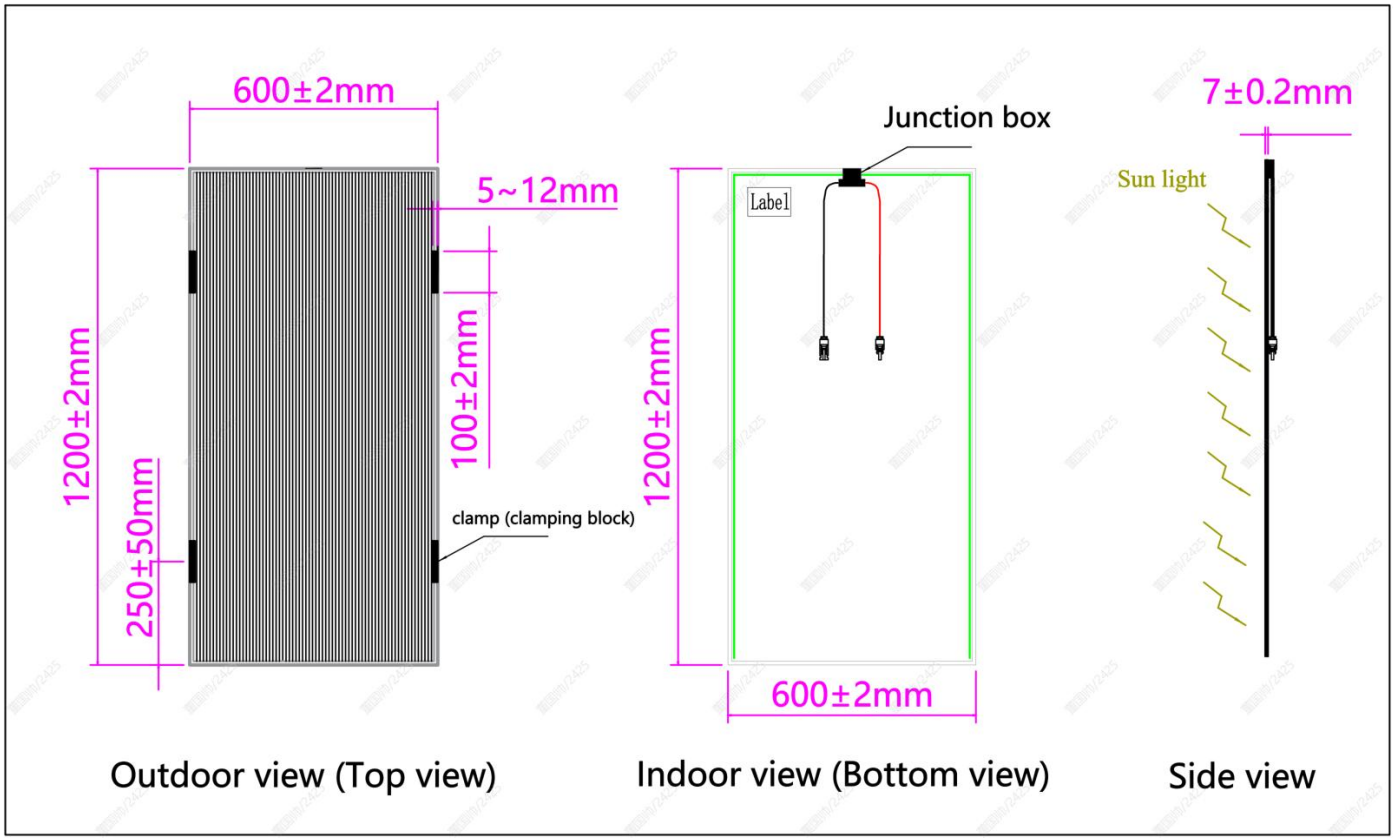

Figure 2 Component Installation Diagram

8.3.2. Fixture (Block) Structure

(1) Fixture specifications: Each fixture must maintain a minimum contact length of 100mm with the component surface and a contact width of 5-12mm on the front side (aiming to avoid obstructing the effective area while ensuring secure fixation), as illustrated in Figure 3.

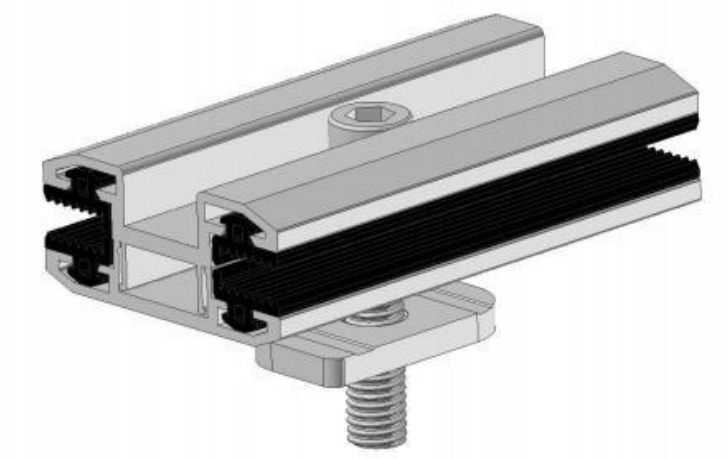

Figure 3 Schematic diagram of the fixture

(2) Insulation and cushioning material specifications: EPDM rubber gaskets or silicone materials must be used between the component and (metal) fixtures or mounting structures to provide adequate protection. Direct contact between rigid structures and the glass surface or edges of the component is prohibited, as shown in Figure 4.

Figure 4 Insulation and Buffering Materials

(3) Installation diagram of the fixture (block) and standard C-type guide rail (support):

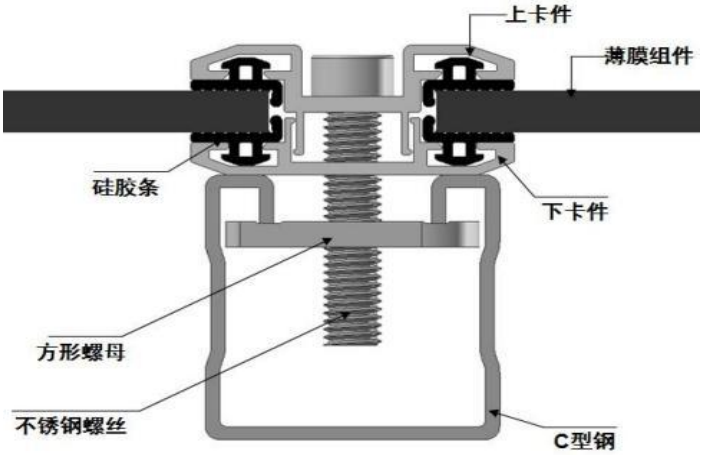

Figure 5 Assembly Diagram

8.3.4. Installation Recommendations

(1) The bracket must provide sufficient support for the component and, in special environments, must withstand certain gusts. All bracket structures must have a flat surface for component installation and must not apply any torque or pressure to the component. The flatness of the fixture position on the bracket should not exceed 2 mm.

(2) Note: The recommended torque range is 10N·m to 15N·m. Use a torque wrench set to 10N·m to ensure the component does not detach and to prevent glass damage from excessive clamping force.

9. Electrical Safety

9.1. After installing the solar panels, ensure electrical connections are made promptly. If connections cannot be made immediately or if rain or snow is expected, secure the male/female connectors of the solar panel output cables, or apply insulating tape to the connector ends to protect the metal parts effectively.

9.2. Cables with suitable cross-sectional area and insulation rating above 1000V, along with connectors designed for the array's maximum short-circuit current, should be selected. Otherwise, the cables and connectors may overheat under high-current conditions.

9.3. Never disconnect photovoltaic modules under load. Do not disconnect module connectors during sunlight exposure unless the module is in an open-circuit state or all series/parallel modules are covered with shading materials such as canvas or blankets.

9.4. For the same system, use modules with identical parameters. Under all conditions, the open-circuit voltage of the photovoltaic array must remain below 1500V (DC). When determining the maximum number of modules in series, account for measurement errors and the temperature coefficient of the open-circuit voltage. Adjust the open-circuit voltage for different temperature conditions based on the temperature coefficient and STC (Standard Test Conditions) data. The recommended series/parallel configurations are listed in Appendix 1.

9.5. Do not operate the components or system when they are in a damp state.

9.6. Do not direct light onto the components to increase electrical output. Ensure that unqualified personnel cannot access any wiring in the array.

9.7 If a component's reverse current exceeds the maximum limit (reverse current overload), it may cause component failure, including damage. Prolonged exposure to maximum reverse current overload can lead to fire hazards or electric shock risks.

9.8. To prevent reverse current overload, the following precautions should be taken: Install equal numbers of components in each battery string of the same source circuit to maintain voltage balance across parallel strings. Failure to install voltage-balanced components in parallel battery strings will result in voltage imbalance.

10. Maintenance

10.1. When necessary, clean the surface glass of the component. Use a soft sponge or cloth dipped in water for cleaning. A mild, non-abrasive cleaning agent can remove stubborn deposits. Wear rubber gloves during cleaning.

10.2. Regularly inspect components for signs of damage or broken glass. Damaged components should be replaced immediately. Damaged wires should be repaired or replaced immediately.

10.3. Check all electrical connections for tightness and absence of rust.

10.4. Components should not operate continuously for more than 90 days under open-circuit or short-circuit conditions to prevent reduced energy output during their service life.

10.5. The most common reasons for photovoltaic system power output being lower than expected include:

10.5.1 Inverter malfunction.

10.5.1 Improper or defective on-site wiring connections.

10.5.1 The fuse blows or the circuit breaker trips.

10.5.1 The component is heavily coated with dust and debris.

10.5.1 The component is permanently obstructed by trees, utility poles, or buildings.

11. Disclaimer

10.1. The use of this specification and the conditions or methods for installation, operation, use, and maintenance of photovoltaic products are beyond our control, and our company shall not be liable for any related responsibilities. We hereby expressly disclaim liability for any losses, damages, or additional costs incurred in connection with installation, operation, use, or maintenance.

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