

Installation Manual of CECEP SOLAR's Crystalline Silicon PV Module Product

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Part 1 Manual Use Instructions

1-1 About This Manual

First of all, thank you very much for choosing CECEP SOLAR's PV module product.

This Manual is prepared elaborately based on the long-term practice and tests of CECEP Solar Energy Technology (ZhenJiang) Co., Ltd. (hereinafter referred to as "CECEP SOLAR") and describes in detail the installation, application, maintenance, etc. of crystalline silicon PV module (hereinafter referred to as "the module") produced by CECEP SOLAR. To enhance safety during module installation, please provide the buyer of PV power generation system with this Manual for reference. Please be familiar with and understand the contents of this Manual before installation of PV module. On the premise that necessary protective measures are taken and local safety regulations are followed, installation shall be performed as per this Manual and the operation procedures. After installation, please give this Manual to the operation or maintenance personnel of the module.

In case of any suggestions or doubts during application, please contact us.

Revision History

Version	Revision Page	Revised Section/Content and Reason	Revised on
A/0	First version	New version compiled	March 1, 2015
A/1	15-18	Update content	October 1, 2019
A/2	9-13	Update content	September 20, 2022

1-2 Disclaimer

This Manual does not have any meaning of warranty. CECEP SOLAR will not be responsible for any loss resulting from void product warranty resulting from failure of the customer to operate according to the requirements listed in this Manual during module installation.

The designer of PV power generation system and module installation personnel must be familiar with mechanical and electrical requirements of the module. CECEP SOLAR has the right to refuse to compensate for any product damage caused by design defect or fault of the installation personnel.

This Manual will be updated depending on product development without any notice. We appreciate your understanding.

Part 2 Safety Precautions

In this Manual, safety precautions fall into [Caution] and [Danger].

 **Caution**: A misuse will bring danger and may lead to minor injury and moderate personal injury or equipment damage, or major accident. Please pay attention to and follow such precautions.

 **Danger**: A misuse will bring danger and may lead to irreversible equipment damage or personal injury/death.

2-1 About Unpacking

 Caution
● Unpacking shall be conducted in a dry, ventilated, shaded area with moisture-proof and water-proof measures taken. ● Check serial number or specification/model of modules. Modules of different models shall be stored separately and marked to avoid influence on the overall generating capacity of the system due to the combination of different models of modules during installation. ● Any damaged or deformed module shall be kept separately and completely and returned to the factory for handling. No disassembling or movement of any accessory is allowed. ● Uneven shadow on the module surface shall be prevented because shaded cells may generate heat and hot spot effects, thus causing permanent module damage.

2-2 About Installation



Caution

- The installation of PV power generation system requires professional skills and knowledge and must be completed by professional engineers.
- Do not wear metal jewelry such as rings and watches during module installation to prevent electric shock.
- Before installation, check the bracket for parallelism, evenness, firmness, and normal grounding.
- Protective equipment (e.g. safety helmets, safety shoes, safety belts and other necessary safety protection appliances) shall be worn. The safety protection measures shall be taken.
- During installation, guarantee the levelness and perpendicularity of modules. With light, do not touch any metal accessory at any connection with hands or other parts of the body to prevent possible electric shock.
- After the installation of modules, protect installed modules from contamination by paint or adhesive to prevent influence on the generating capacity of the system.
- The solar PV modules shall not be installed in case of such adverse weather conditions as wind, rain and snow.



Danger

- During module installation, do not step on the module, or irreversible damage to the module and personal injury may be caused.
- Wear insulating gloves of the corresponding grade during installation of connecting wires between modules, or electric shock may occur.
- During module installation or wiring, cover the front face of each module with opaque materials, or personal injury may occur due to electric shock.
- During module installation, do not conduct drilling or cutting at any place of a module, or the warranty will become void.
- No module exposure to manually concentrated light, or irreversible damage to the module and personal injury may be caused.
- During wiring, please connect the ground wire, or electric shock and fire may occur.
- Please arrange professional electrical personnel with required qualifications to conduct wiring, or electric shock and fire may occur.

2-3 About Operation and Maintenance

 Caution	● The operation and maintenance of PV power generation system requires professional skills and knowledge and must be completed by professional engineers. ● Protective equipment (e.g. safety helmets, safety shoes, safety belts and other necessary safety protection appliances) shall be worn. The safety protection measures shall be taken. ● With light, do not touch any metal accessory at any connection by hands or other parts of the body to prevent possible electric shock. ● Remove contaminants from the module surface in time, or generating capacity of the system may be influenced.
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 Danger	● With light, do not disconnect any module connector, or electric shock may occur.
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2-4 Safety Instructions and Warnings

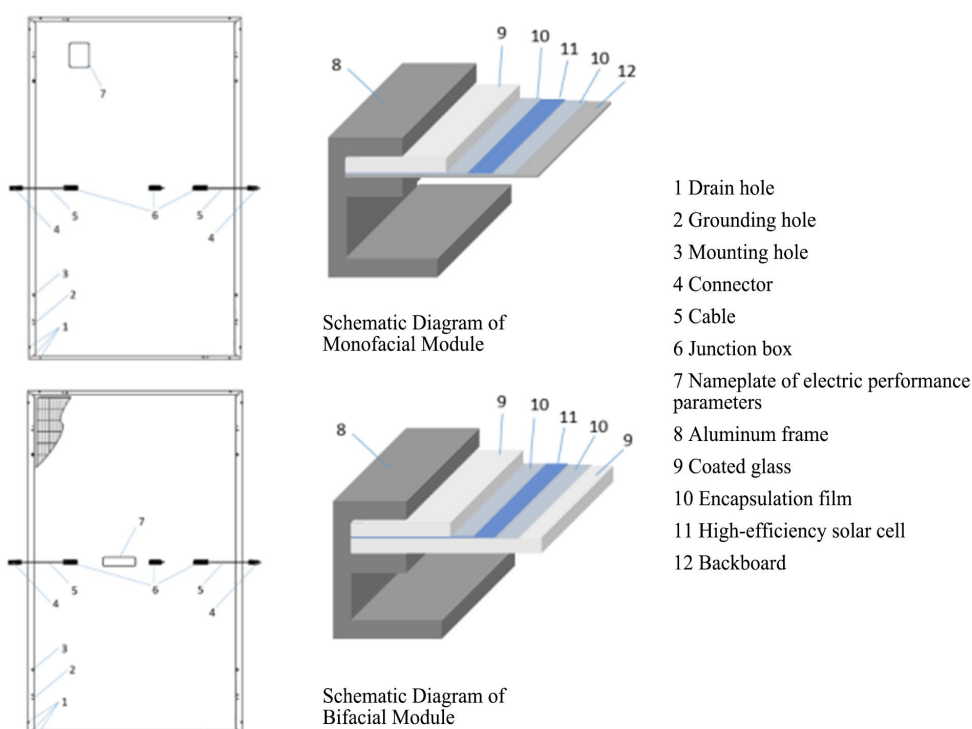
	Do not step on the module
	Do not touch a module or terminal with bare hands

	Keep away from dangerous items
	Keep away from children
	Do not disassemble a module
	No module exposure to concentrated light
	Do not touch a module with a sharp device
	Handle with care

Part 3 Appearance Introduction and Information

Identification of Solar PV Modules

3-1 Outline



3-2 Identification of Module-related Information

Identification of barcode number

Part 1: production workshop. The numbers 1, 2 and 3 stand for the workshops I, II and III of CECEP SOLAR respectively. For codes of foundries, please refer to the Attachment Codes of Production Workshops of Foundries;

Part 2: type of cell. M stands for monocrystalline, and P polycrystalline;

Part 3: H stands for half-cell process, and default full-cell process;

Part 4: type of module. D stands for double-glass module, and default single-glass module;

Part 5: number of cells, for example, 726,660;

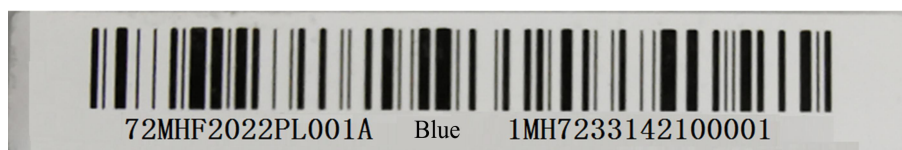
Part 6: production year. The year is represented by the production year +11, for example, 2021 is represented by 32;

Part 7: production month. The month is represented by the production month +13, for example, June is represented by 19;

Part 8: production date. The date is represented by the production date +15, for example, Day 21 is represented by 36;

Part 9: serial number. Start from 00001 every day, increase up in turn;

Example diagram of barcodes on front and back of module:



The task form number is located on the left side of barcode, in bold font (6th Song typeface). Color is located between the task form number and barcode, in bold font (6th Song typeface). The barcode is located on the right side, in bold font (8th Song typeface).

The barcode at the module frame is divided into three parts: the first

Part 4 Product

4-1 Installation Conditions

To ensure the safe, stable and efficient operation of installed module products, the following conditions are suggested by CECEP SOLAR to be met for installation.

4-1.1 Orientation and Inclination

A module shall be installed with its front face (glass face) facing the sun, i.e. facing south in the Northern Hemisphere and north in the Southern Hemisphere, and with no shadow on it from 9:00 to 15:00 on the winter solstice to ensure sufficient light.

The installation inclination angle of modules can be adjusted based on the latitude.

Also, the optimum installation inclination angle can be obtained through comparison of total mean sun radiation of each month and day on inclined plane of different angles over years calculated based on solar radiation data provided by the local meteorological department.

4-1.2 Bracket Requirements

The bracket installer must guarantee that the module installation method and the bracket system comply with the design requirement, and the bracket is firm enough to withstand all the predetermined loading conditions. The installed bracket system must pass inspection and test of a third-party test institution capable of conducting static mechanical analysis and comply with local national or international standards.

The mounting bracket for the module must be made of durable, corrosion-resistant, anti-ultraviolet material with sufficient strength, such as aluminum alloy, stainless steel and galvanized steel.

In places with heavy snow in winter, a higher mounting bracket shall be selected to prevent the lowest point of the module from being covered by snow. As the lowest point of the module is guaranteed to be high enough after installation, the module can be prevented from plant and tree blocking or being damaged by sand and stones.

4-1.3 Others

Before rooftop installation of modules, please make sure that the building meets the necessary installation conditions. In addition, any fixing point on the roof must be sealed to prevent seepage. When the module is mounted on a bracket parallel to the roof or the wall, the

minimum clearance between the frame of the module and the roof or wall is 10 cm, so that air is circulated to prevent damage to the module wiring.

Two modules are suggested to be installed with an interval of at least 1cm in consideration of thermal expansion and contraction of the module frame.

4-2 Product Installation Instructions

Installation procedures of boxes of module products transported to the project site: unloading and acceptance inspection, handling and temporary storage, unpacking and inspection, and laying and fixing. For the sake of module safety, corresponding operating requirements must be referred to for each link.

4-2.1 Unloading and Acceptance Inspection

When module products are transported to the installation site, pay attention to the safety of modules and personnel. Correctly use a forklift to unload and transfer products. If forklift operation is not suitable due to the site condition, please use a hoist for unloading and take effective protective measures. Do not adopt any unloading method that may hurt modules or personnel, or unload modules without any effective protective measure.



For the convenience of inspection by the buyer, CECEP SOLAR will arrange professional personnel to coordinate with the buyer on sampling test and inspection of modules after unloading.

4-2.2 Handling and Temporary Storage

Modules shall be stored on even ground to prevent squeezing of module boxes against each other or module damage due to pallet damage during forklift transportation on uneven ground. During temporary storage, rain-prevention measures (such as coverage with waterproof cloth) shall be taken for unpacked boxes to prevent water accumulation on the backside of modules.



4-2.3 Unpacking and Inspection

Before unpacking, please prepare necessary tools such as scissors, flexible rule and wood pallet, and arrange two persons to help to raise the plate for inspection.

During module unpacking, make sure that the carton is placed with the open side up, cut the packing belt with scissors, take out modules from the carton one by one and place them on the wood pallet flatly for inspection. Unpacking inspection items include the following: glass breakage, backboard damage, frame deformation, compliance of module dimensions with design requirements, and consistency of module current range with the current range indicated on the outer packaging box. Modules with abnormality shall be placed separately and handled in a centralized manner at the end.

Unpacking based on the installation schedule, i.e. unpacking the number of carton as required by installation, is suggested by CECEP SOLAR. In case of scattered modules during installation, put such modules flatly on a wood pallet with a paperboard pad with the glass face down, to prevent possible scratches or damage to module glass. Module connectors and cables cannot be pressed between frames or exposed to prevent cable and connector damage.

Modules shall be installed immediately after unpacking. Scattered modules shall be covered with waterproof materials to prevent rain and snow and also prevent electric leakage or corrosion of module connectors due to water.

4-2.4 Module Laying

Modules shall be laid as per the design drawing after acceptance inspection. Installation personnel shall handle and lay modules by grasping the aluminum frame and touching any part of a module except the aluminum frame is not allowed.



Modules in the same array shall guarantee to have the same power and current range, or the generating capacity of the system may be affected. In the event that this requirement cannot be met, module within a certain current range and with that with a higher current within the adjacent range can be installed in an array.

4-2.5 Fixation of Double-glass Modules with Frames

There are generally two module fixing methods: one is to use the mounting holes reserved along the frame, and the other is to use pressing pieces.

1. Use mounting holes reserved along the module frame for installation

- Each module shall be fastened by at least 4 points on two opposite sides.

Bolts and nuts of M8×1.25 (5/16") shall be used.

The yield strength of bolts and nuts shall not be less than 450 MPa.

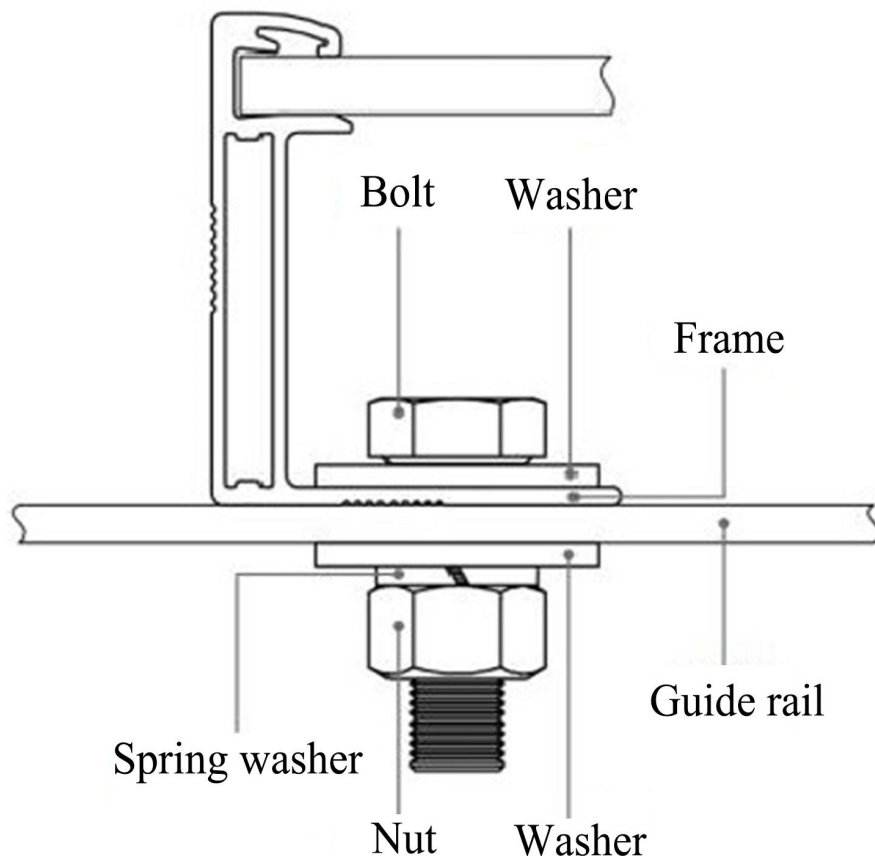
- The appropriate length of bolts shall be selected based on the frame size in the specification. For double-glass modules with a frame height of 30 mm, in order to ensure that bolts can be inserted into mounting holes accurately, the bolt length shall not exceed 20 mm, and the length recommended by us is 16 mm. The assembler must check the specific bolt length to ensure that the modules can be correctly installed.

- According to the bolt grades, the tightening torque of M8 coarse-thread bolts shall be 17-23 Nm respectively.

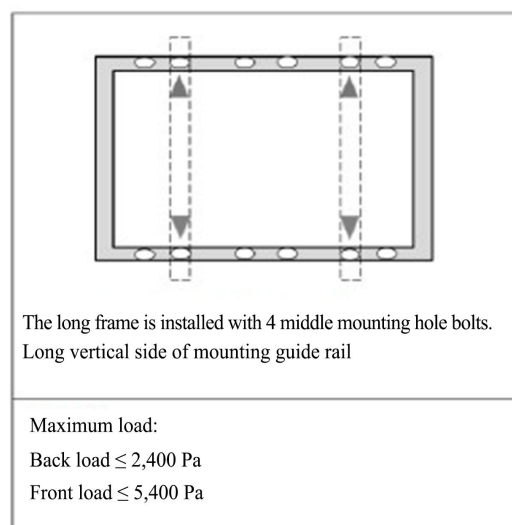
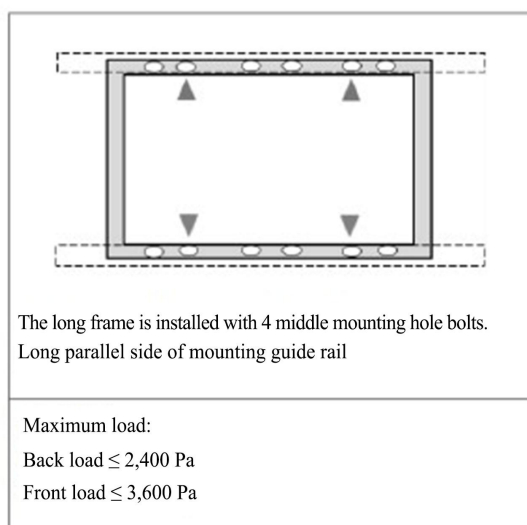
- For the installation schemes to be used in areas with high wind load and heavy snow, additional mounting points shall be used. The system designer and installer have the responsibility to calculate the loads and

ensure that the supporting structures meet the requirements.

Bolt installation method

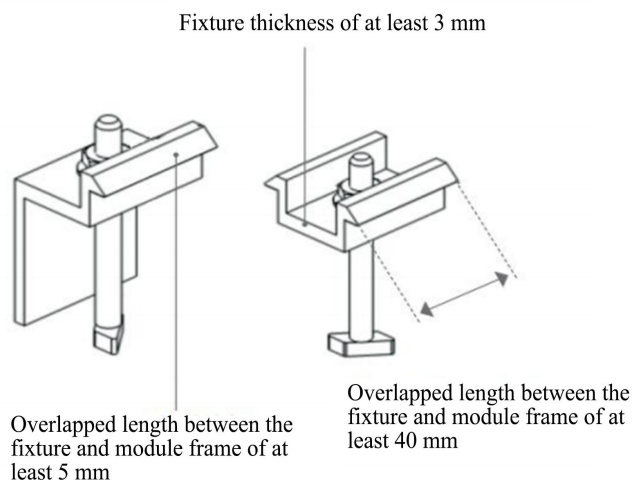


Modules shall be bolted at the lower mounting holes according to the structure and load requirements.



2. Use pressing pieces (fixtures) for installation

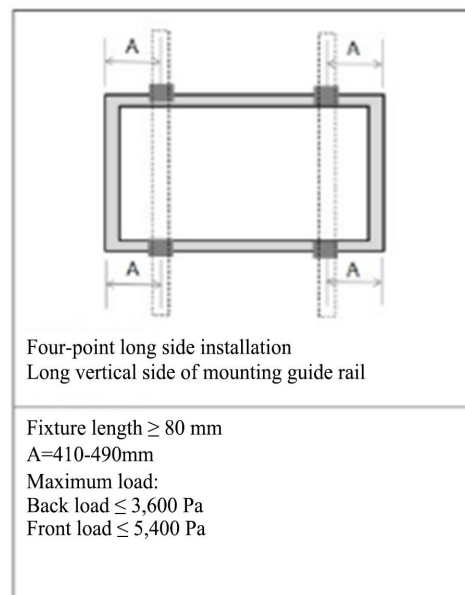
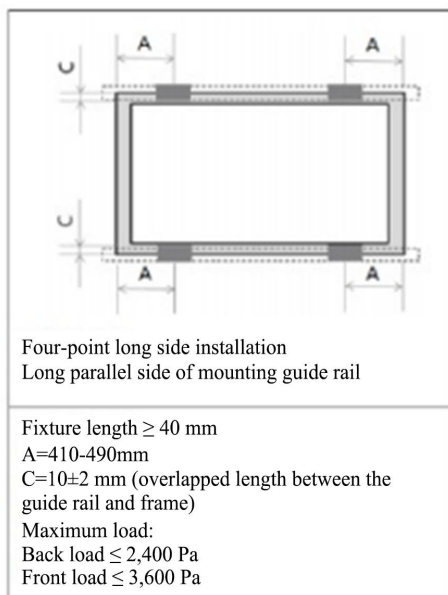
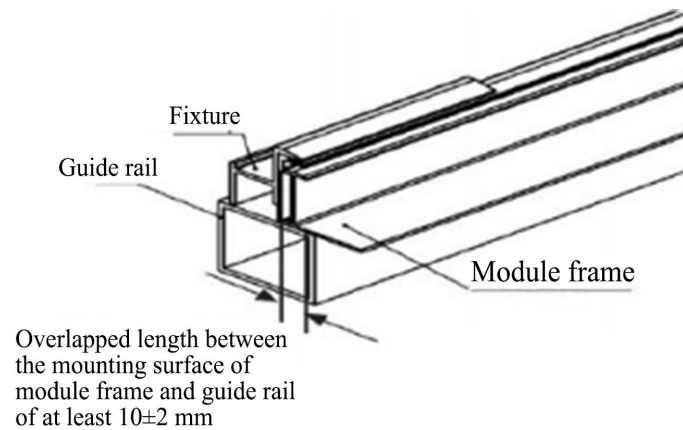
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- Each module shall be fastened by at least 4 points on two opposite sides. Fixtures shall be symmetrically arranged in pairs, and installed in the position range specified in Table A.
 - Modules shall be installed and fastened on the mounting guide rails with the torque specified by the manufacturer of the installation hardware. The bolts and nuts of M8×1.25 shall be used to install the fixtures. For M8 coarse-thread bolts, the tightening torque shall be 17-23 Nm according to the bolt grades. For bolt grades, the technical guidelines of fastener suppliers shall be followed. Suggestions from the corresponding fixture suppliers shall be preferred.
 - The system designer and installer shall calculate the loads and select the appropriate supporting structures.
 - The mounting guide rail shall be designed to avoid blocking the back cells as much as possible.
 - If improper fixtures or wrong installation methods are used, the Limited Warranty will be invalid.
 - When the intermediate modules or end fixtures are installed, the following aspects must be noted for the fixtures:



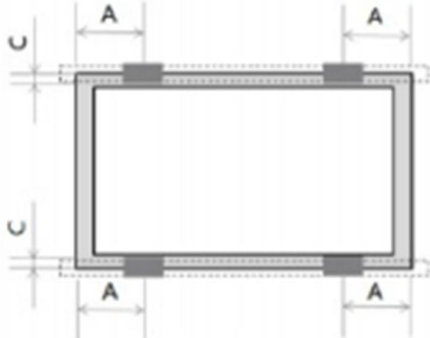
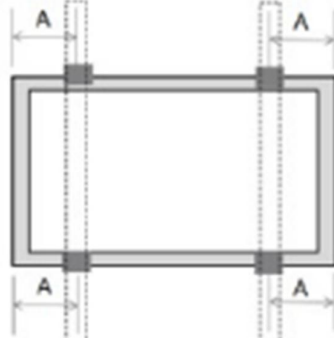
- 1) Do not bend the module frame.
 - 2) Do not touch the glass surface of the module or project shadows on it.
 - 3) Do not damage the surface coating of the frame (except the fixture with grounding puncturing function).
 - 4) Make sure that the overlapped length between the fixture and the module frame is at least 5 mm.
 - 5) Ensure that the overlapped length of fixtures is at least 80 mm and 40 mm when the back load is $\geq 2,400$ Pa and $\leq 4,000$ Pa, and $\leq 2,400$ Pa respectively.
 - 6) Ensure that the thickness of fixture is at least 3 mm.
- The fixture shall be made of anodized aluminum alloy or stainless steel.
 - The position of fixture is crucial to the reliability of installation. The center line of fixture must be installed within the range indicated in the

table below according to the requirements related structure and load.

· For the structure with its mounting guide rail parallel to the frame, precautions shall be taken to ensure that the mounting surface of the module frame overlaps with the guide rail by 10 ± 2 mm or more, and the back cells shall be avoided from being blocked.



(Type 72 Modules)

 Four-point long side installation Long vertical side of mounting guide rail Fixture length ≥ 40 mm $A=270-380\text{mm}$ $C=10\pm 2$ mm (overlapped length between the guide rail and frame) Maximum load: Back load $\leq 2,400$ Pa Front load $\leq 3,600$ Pa	 Four-point long side installation Long vertical side of mounting guide rail Fixture length ≥ 80 mm $A=270-380\text{mm}$ Maximum load: Back load $\leq 3,600$ Pa Front load $\leq 5,400$ Pa
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(Type 60 Modules)

4-3 Electrical Connection between Products

4-3.1 Connection Method

Modules can be connected in series or in parallel.

1. Connection in Series

If modules are connected in series, the "+" connector of a module is connected to the "-" connector of another one. A module string consists of a certain amount of modules having the same electrical performance and connected in series.



The final voltage of a module string is the sum of voltage of each single module, while the final current is that of a single module. The maximum number of modules in series that form a module string must be calculated as per related requirements, and the maximum final voltage of the string shall not exceed the maximum system voltage of the module.

2. Connection in Parallel

If modules are connected in parallel, the "+" connector of a module is connected to the "+" connector of another one, and the "-" connector of a module to the "-" connector of another one.



4-3.2 Connecting Wire and Connector

The connecting wires used for modules at the site must meet the maximum short-circuit current requirement. A PV system only uses

light-resistant cables meeting PV direct current requirements. The wire diameter shall not exceed 4mm^2 . Connecting wires must be connected with a dedicated PV connector firmly and reliably. When installed on a bracket, connecting wires must be prevented from mechanical damage, direct sunlight or water soaking.

Connectors must be correctly connected. Incorrect connection may cause electric arc or shock. Connectors must be kept dry and clean and prevented from direct sunlight or water soaking.

4-4 Grounding Protection

Since the module frame is made of aluminum alloy, for the purpose of safe use and avoiding lightning stroke or static electricity, the aluminum frame must be reliably grounded. Grounding and mounting holes are reserved and marked in the frame. But these holes can only be used for connection of the ground wire but not for module installation.

Although there are many grounding methods of modules, for no matter which method, the grounding must be safe and reliable and the grounding device must meet related national requirements.

Part 5 Product Maintenance

To ensure safe, stable, and efficient module operation, modules must be regularly checked and maintained after installation, especially during the warranty period. This is a responsibility that shall be borne by the user. The main focus of daily maintenance of modules and the array formed by the modules is maintenance of power generation system accessories and peripheral facilities.

5-1 Maintenance of Module Array

1. Cleaning of module surface:
 - a. Daily maintenance: remove bird droppings and dust from module surface;
 - b. Special maintenance: in the event of frequent long-time snow coverage in local rainy and snowy season, clean off the snow on modules if necessary;
 - c. Clean modules when the irradiance is lower than $200\text{W}/\text{m}^2$. Do not clean modules with liquid having great temperature difference with modules;
2. Check module connectors for electric leakage and perform corresponding handling to prevent electric leakage.

3. Maintenance of stability of bracket: as the bracket bolts may get loose in case of relatively strong wind, pay attention to check the bracket stability regularly and timely tighten bracket bolts and nuts.
4. Anti-corrosion treatment: regularly perform anti-rust and anti-corrosion treatment for bracket.
5. Modules shall be regularly checked, and immediately adjusted and replaced in any of the following cases:
 - a. Broken glass, scorched backboard and obvious color change;
 - b. Bubbles in modules;
 - c. Deformation, cracking, degumming, or burn-down of junction box, and connection failure of terminals.
6. The aluminum alloy frame and bracket of a module shall be well combined, the contact resistance between them should not be greater than 4Ω , and the frame must be reliably grounded.
7. When a module works in a no-shade condition with a solar irradiance of greater than $500\text{W}/\text{m}^2$ and a wind speed of not higher than $2\text{m}/\text{s}$, the temperature difference of its front face (glass face) shall be less than 20°C .
8. The deviation of the input current of module strings connected to the same DC combiner box measured with a DC clamp ampere meter under basically the same solar radiation intensity shall not exceed 5%.

5-2 Maintenance of Peripheral Facilities of Module Array

1. To prevent damage from human activities: a module array and its peripheral facilities shall be provided with fences to prevent livestock and man-made sabotage.
2. Maintenance in terms of natural disasters:
 - a. Foundation protection: take necessary protective measures in the periphery of a module array to protect the array foundation and peripheral facilities from water corrosion in the rainy season;
 - b. Areas with high incidence of lightning: effective lightning measures to prevent lightning stroke shall be provided.

Attachment:

CECEP SOLAR KA Series Bracket System

Patent No.: 201520149632.4

The generating capacity and operation of the power station may be influenced due to complex installation of large ground power station PV modules, quite low installation efficiency, and quite possible damage (such as subfissure) to modules during installation. To solve this problem, CECEP SOLAR has developed a quick module installation system based on the characteristics of modules and years of installation experience. This system is an improvement of the original bracket by changing the fastening method of crossarm and module on the original bracket, to realize quicker and safer module installation, basically with no increase in material expense. The specific effects are as follows:

1. Saving of installation labor costs. After bracket improvement, the installation of a 10KWp module (40 Pcs.) can be completed by 2 persons within 2.5H. The installation efficiency can be improved by over 50%.
2. Improve the power generation and increase the revenue. This installation method can significantly reduce the risk of module subfissure during installation, increase the generating capacity of stations, and guarantee the revenue of station investors.

If you are interested in this module installation method, please call

us.