eterbright®

eterbright solar corp.

INSTALLATION AND SAFETY MANUAL for CdF Solar Photovoltaic Modules

CdF-1000 Series

CdF-0950E1, CdF-1000E1, CdF-1050E1, CdF-1100E1, CdF-1150E1,

CdF-1200E1, CdF-1250E1, CdF-1300E1

CdF-0950A1, CdF-1000A1, CdF-1050A1, CdF-1100A1, CdF-1150A1,

CdF-1200A1, CdF-1250A1, CdF-1300A1

Contents

1. Introduction

This manual provides information regarding the installation and safe handling of the ETERBRIGHT SOLAR CORPORATION CdF solar photovoltaic module. ALL of the instructions in this manual should be read carefully before attempting installation. If there are any questions, please contact ETERBRIGHT SOLAR CORPORATION Technical Service department for further explanation. Please retain this manual for your future reference.

2. Disclaimer of Liability

Because the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic product are beyond ETERBRIGHT SOLAR CORPORATION's control, ETERBRIGHT SOLAR CORPORATION does not accept responsibility, and expressly disclaims liability for loss, damage, or expense arising out of, or in any way connected with, such installation, operation, use or maintenance.
No responsibility is assumed by ETERBRIGHT SOLAR CORPORATION for any infringement of patents or other rights of third parties, which may result from the use of the PV product. No license is granted by implication or otherwise under any patent or patent rights.
If you do not adhere to the instructions given in this manual, your rights under the ETERBRIGHT SOLAR CORPORATION warranty may be forfeited.
ETERBRIGHT SOLAR CORPORATION reserves the right to change the manual, the PV product, the specifications, or product information sheets without prior notice.

3. General Information

Installation should be performed only by qualified persons. Before installation, installers should assume the risk of all injuries that might occur during installation, including, but not limited to, the risk of electric shock. Installers must conform to all safety precautions in the manual when installing modules.

4. Warnings and Cautions

4.1 Warnings

- One individual module may generate DC voltages greater than 30 volts when exposed to direct sunlight. Contact with a DC voltage of 30V or more is potentially hazardous.
- Installers should know in advance that the risk of injury may occur during the installation, including electric shock.
- All PV modules should be installed according to all local and national applicable

standards, codes and regulations.

- Rooftop installations should be placed over fire resistant roofs ONLY.

4.2 Cautions

- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.
- Do not apply paint or adhesive to module top surface.
- Do not use mirrors or other magnifiers to artificially concentrate sunlight on the modules.

5. Safety

5.1 Handling Safety

- Wear non-slip gloves to prevent the modules from falling while handling the modules.
- Keep children/pets away in the process of handling and installing the modules.
- Do not stand or step on the module.
- To avoid glass breakage, do not place any heavy objects on the module.
- Do not drop the module heavily.

5.2 Installation Safety

- DO NOT DISCONNECT UNDER LOAD.
- COMPLETELY cover the module with an opaque material during installation to prevent electricity from being generated.
- Use ONLY insulated tools and insulated gloves that meet the electrical installation standards.
- Abide by the safety regulations for all other components used in the system, including wiring and cables, connectors, charging regulators, inverters, storage batteries and rechargeable batteries, etc.
- Do not wear metallic rings, watchbands, ear, nose, lip rings or other metallic objects while installing or maintaining photovoltaic systems.
- The parts of installation CANNOT cover the drainage holes.

6. Product Characteristics

The power rating of ETERBRIGHT SOLAR CORPORATION CdF solar photovoltaic module are measured under standard test conditions (Irradiance 1000W/m^2, module temperature of 25℃(77℉), AM 1.5G), so that the power output of module will vary under actual operating conditions.

The amount of DC power generated by the solar photovoltaic module is proportional to the radiation intensity, but the voltage will vary depending on the temperature.

6.1 Electrical Characteristics

A. At Standard Test Conditions(STC)*1

Module models	CdF-0950E1	CdF-1000E1	CdF-1050E1	CdF-1100E1	CdF-1150E1
Minimum power (P_{MPP}) [W]	95	100	105	110	115
Power tolerance [%]	+5/-3	+5/-3	+5/-3	+5/-3	+5/-3
Open circuit voltage (V_{OC}) [V]	73.4	74.1	74.7	75.4	76.1
Short circuit current (I_{SC}) [A]	2.13	2.15	2.16	2.17	2.18
Voltage at P_{MPP} [V]	52.2	53.7	55.3	56.8	58.4
Current at P_{MPP} [A]	1.81	1.85	1.89	1.93	1.96

Module models	CdF-1200E1	CdF-1250E1	CdF-1300E1
Minimum power (P_{MPP}) [W]	120	125	130
Power tolerance [%]	+5/-3	+5/-3	+5/-3
Open circuit voltage (V_{OC}) [V]	76.8	77.4	78.1
Short circuit current (I_{SC}) [A]	2.19	2.19	2.20
Voltage at P_{MPP} [V]	59.9	61.4	63.0
Current at P_{MPP} [A]	2.00	2.03	2.06

Module models	CdF-0950A1	CdF-1000A1	CdF-1050A1	CdF-1100A1	CdF-1150A1
Minimum power (P_{MPP}) [W]	95	100	105	110	115
Power tolerance [%]	+5/-3	+5/-3	+5/-3	+5/-3	+5/-3
Open circuit voltage (V_{OC}) [V]	75.1	75.2	75.3	75.4	75.5
Short circuit current (I_{SC}) [A]	2.14	2.16	2.18	2.20	2.21
Voltage at P_{MPP} [V]	53.8	54.7	55.6	56.5	57.4
Current at P_{MPP} [A]	1.76	1.82	1.88	1.94	2.00

Module models	CdF-1200A1	CdF-1250A1	CdF-1300A1
Minimum power (P_{MPP}) [W]	120	125	130
Power tolerance [%]	+5/-3	+5/-3	+5/-3
Open circuit voltage (V_{OC}) [V]	75.6	75.8	75.9
Short circuit current (I_{SC}) [A]	2.23	2.25	2.26
Voltage at P_{MPP} [V]	58.3	59.2	60.1
Current at P_{MPP} [A]	2.05	2.10	2.16

Remark*1 STC: Irradiance 1000W/m^2, Module Temperature 25℃, Air Mass1.5

- The electrical characteristics are within ±10% of the indicated values of Isc and Voc under STC. Pmax Tolerance after Light Soaking (IEC) is +5/-3%.
- Under normal conditions, the current and voltage generated by the solar photovoltaic module are different from those listed in the specification. The value of Isc (short circuit current) and Voc (open circuit voltage) listed in the specification are measured at standard test conditions; therefore, the value of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the module output. An additional 1.25 multiplier for a total of 1.5625 may be required by certain codes for sizing fuses and conductors.

B. At Nominal Operating Cell Temperature(NOCT)*2

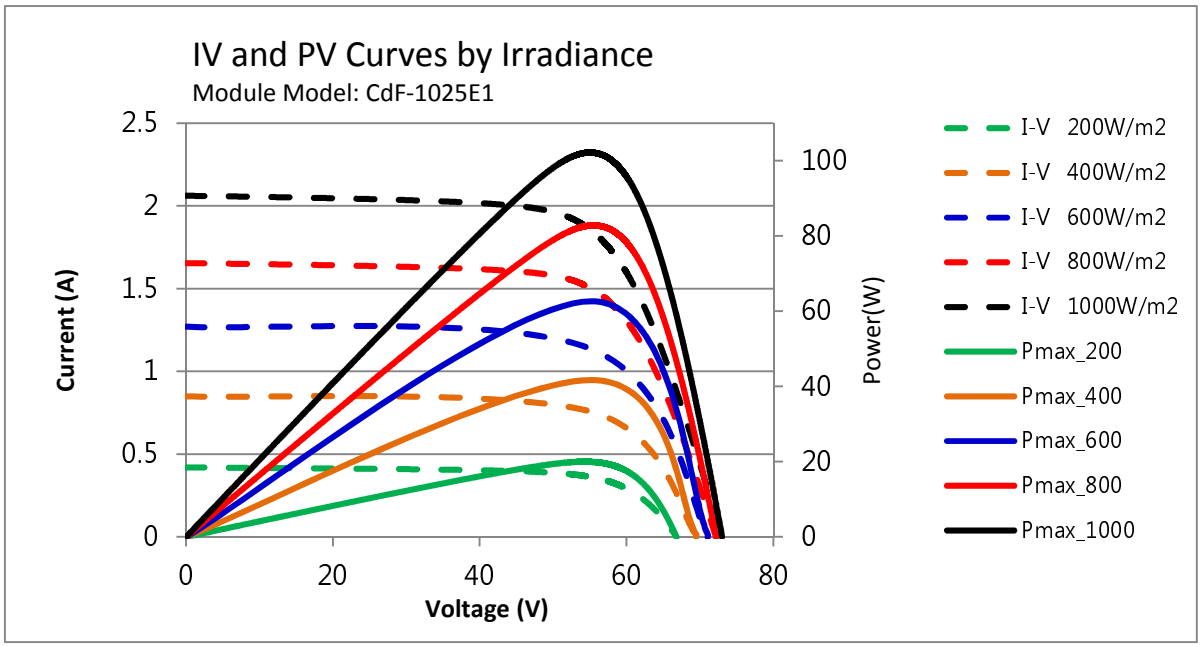
Module models	CdF-0950E1	CdF-1000E1	CdF-1050E1	CdF-1100E1	CdF-1150E1
Minimum power (P_{MPP}) [W]	73.1	77.0	81.1	84.9	88.7
Open circuit voltage (V_{OC}) [V]	70.6	71.7	71.9	72.6	73.2
Short circuit current (I_{SC}) [A]	1.71	1.72	1.73	1.74	1.75
Voltage at P_{MPP} [V]	50.1	51.5	52.8	54.3	55.9
Current at P_{MPP} [A]	1.45	1.49	1.53	1.56	1.58

Module models	CdF-1200E1	CdF-1250E1	CdF-1300E1
Minimum power (P_{MPP}) [W]	92.4	96.4	100.4
Open circuit voltage (V_{OC}) [V]	73.8	74.4	75.1
Short circuit current (I_{SC}) [A]	1.75	1.76	1.77
Voltage at P_{MPP} [V]	57.5	58.0	59.4
Current at P_{MPP} [A]	1.60	1.64	1.67

Module models	CdF-0950A1	CdF-1000A1	CdF-1050A1	CdF-1100A1	CdF-1150A1
Minimum power (P_{MPP}) [W]	73.0	77.1	81.0	84.9	88.7
Open circuit voltage (V_{OC}) [V]	72.2	72.3	72.5	72.6	72.6
Short circuit current (I_{SC}) [A]	1.71	1.73	1.75	1.76	1.77
Voltage at P_{MPP} [V]	50.7	51.7	52.8	54.0	55.2
Current at P_{MPP} [A]	1.43	1.49	1.53	1.57	1.60

Module models	CdF-1200A1	CdF-1250A1	CdF-1300A1
Minimum power (P_{MPP}) [W]	95.2	98.1	102.3
Open circuit voltage (V_{OC}) [V]	72.7	72.8	72.9
Short circuit current (I_{SC}) [A]	1.79	1.8	1.82
Voltage at P_{MPP} [V]	56.4	57.3	58.4
Current at P_{MPP} [A]	1.68	1.71	1.75
Remark*2 NOCT: Irradiance 800W/m², Ambient Temperature 20℃, Wind Speed 1m/s, Open Circuit			

6.2 I-V and P-V Curves at Different Irradiance Level



6.3 Thermal Characteristics

NOCT		46.2±2℃
Temperature Coefficient of Isc	α	+0.01%/K
Temperature Coefficient of Voc	β	-0.31%/K
Temperature Coefficient of Pmax	δ	-0.23%/K

6.4 Characteristics for System Design

Maximum System Voltage	Vsys	**1000V DC (UL 600V DC)**
Limiting Reverse Current	Ir	8A
Maximum Series Fuse Rating	Isf	5A
Maximum Number of PV Module Connection*3	Series*1	10 (UL 6)
	Parallel*2	4

- Remark*1 Calculated under condition of +10% tolerance of Voc at STC.
  The sum of Voc of series modules MUST NOT exceed the maximum system voltage of the module under any condition, even at low temperature.
- Remark*2 Calculated under condition of +10% tolerance of Isc at STC.
  Under any condition, reverse current applied to the modules SHOULD NOT exceed 8A.
- Remark*3 The number of series and parallel MUST CONSIDER the capabilities of inverter.

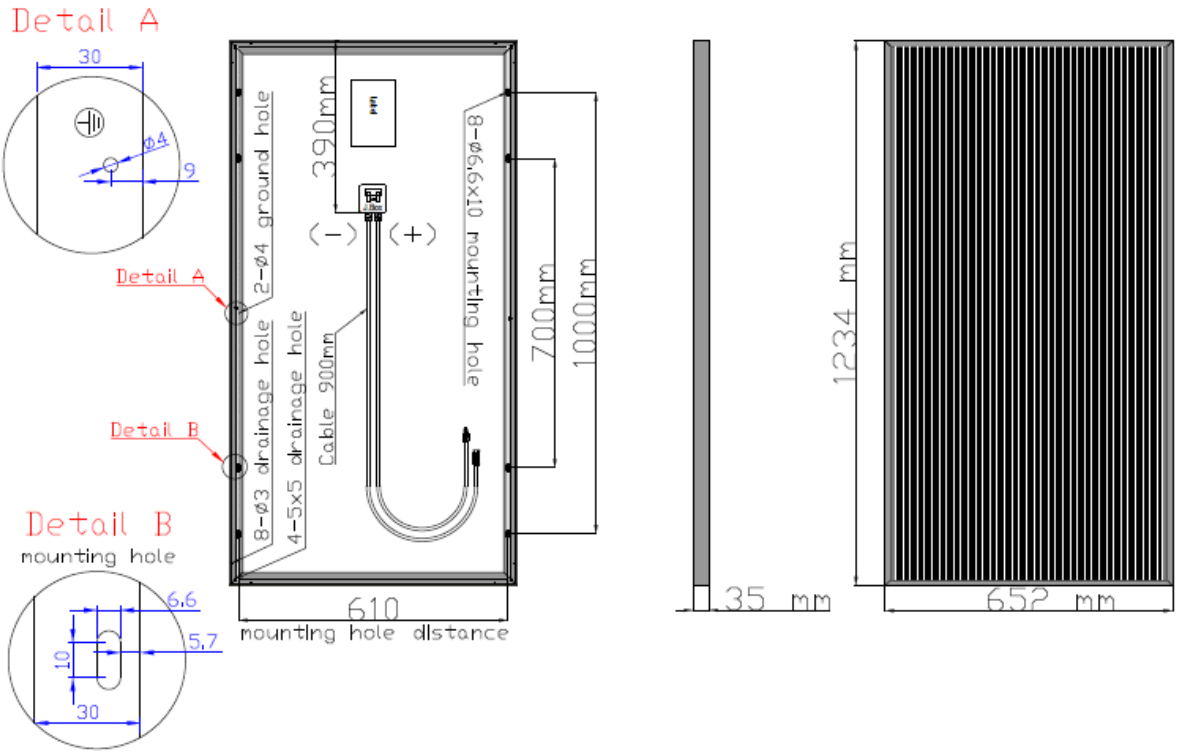
6.5 Mechanical Data

Dimension(L*W*H)	1,234*652*35mm
Weight	12.9Kg
Module Operating Temperature	-40℃~85℃
Application Class on 61730	Class A
Fire Safety Class on 61730	Class C
Snow Load	≤2400 Pa
Wind Load	≤2400 Pa
Type of Solar Cell	CIGS (Cd Free)
Front Cover	Tempered Glass (3.2mm)
Encapsulation	EVA (Ethylene Vinyl Acetate)
Back Cover	Waterproof Film
Frame	Anodized Aluminum Alloy
Edge Sealing	Butyl Rubber
IP Rating of Junction Box	IP67
Adhesive of Junction Box	Silicone Gel
Connectors	MC4 or Compatible Connectors
Cables	Section: 2.5mm^2(14AWG) / Length: 900mm

6.6 Bypass Diode

Type	Voltage Rating	Current Rating
P1000M	1000V	10A
P0600MS	1000V	10A
10A10G	1000V	10A

6.7 Module Physical Specifications



7. General Installation

7.1 Site Selection

- In most applications, the solar photovoltaic module should be installed in a location where it will receive maximum sunlight throughout the year.
- For the best results, in the Northern Hemisphere, the module should typically face south, and in the Southern Hemisphere, the module should typically face north. The appropriate angle of the installation can ensure obtaining the maximum amount of sunlight. To understand the best local tilt angle of the information for the installation, refer to the 'Tilt Angle Selection' or consult a reliable solar systems integrator.
- Do not install the module in a location where it would be easy to produce or gather flammable gases.
- The choice of location SHOULD CONFORM to all the requirements of electrical and fire regulations.

7.2 Support Selections and Requirements

To observe the instructions manual and safety practices regarding the attached supports.

- Supports and other necessary spare parts, materials (such as bolts, etc.) should be made of durable, corrosion-resistant and UV-resistant material.
- When installing a module on a pole, choose a pole and module mounting structure

that will withstand the anticipated winds for the area.

- DO NOT attempt to drill holes in the glass surface of the modules as this will void the warranty.
- DO NOT drill additional mounting holes in the module frames of the modules as this will void the warranty.
- For standard installation, use the four symmetry mounting holes close to the inner side on the module frame to fix the module onto the support. In strong winds or heavy snow areas, use additional symmetry holes which are on the outer side of module frame for enhancing fixation. For details, please refer to module installation method.

7.3 Floor Installation

- Select the appropriate mounting height when installing the solar photovoltaic module, in order to clean up the snow, dust and other coverings on the module surface. In addition, prevent the lower half of the module being covered by snow for a long time in the winter.
- Ensure that the lowest portion of the module is placed high enough so that it is not shaded by plants or trees or damaged by flying sand.

7.4 Installed on Roof or Building

- The modules have been rated Fire Class C (UL).
- When installed on a roof, check building codes to ensure that the required modules installed in buildings and structures (roofs, appearance, bearing, etc.) have sufficient loading capacity. When installing the module, ensure that the module is installed in a fireproof roof, and the slope of the roof is less than 5in/ft to ensure maintaining a fire class rating.
- When installing a module on a roof or building, ensure that it is securely fastened and cannot fall as a result of wind or snow loads.
- Leave sufficient space at the back of the module to ensure proper ventilation for the cooling module (a minimum distance of 10 cm between the module and the mounting surface).
- When installing a module on a roof, any roof penetration required to mount the module must be properly sealed to prevent leaks.
- When the wind is strong, DO NOT work on the roof or building to prevent accidents.
- In some conditions, you may need to use special brackets; please consult a reputable solar installer or systems integrator.

8. Mechanical Installation

8.1 Mounting with Bolts

- Use the four symmetry mounting holes (6.6*10mm) close to the inner side on module frame, and with four sets of M6 bolt, spring washer, flat washer and nut. Then use torque of 8 Nm (70.8 lb-in) to secure the module to the support structure. The position of standard installation can withstand of 2400 Pa (IEC) from wind and snow loads.
- In strong winds or heavy snow areas, use additional symmetry holes which are on the outer side of module frame for enhancing fixation to withstand 2400 Pa (IEC) of wind and snow loads.
- See Figure 8.1.

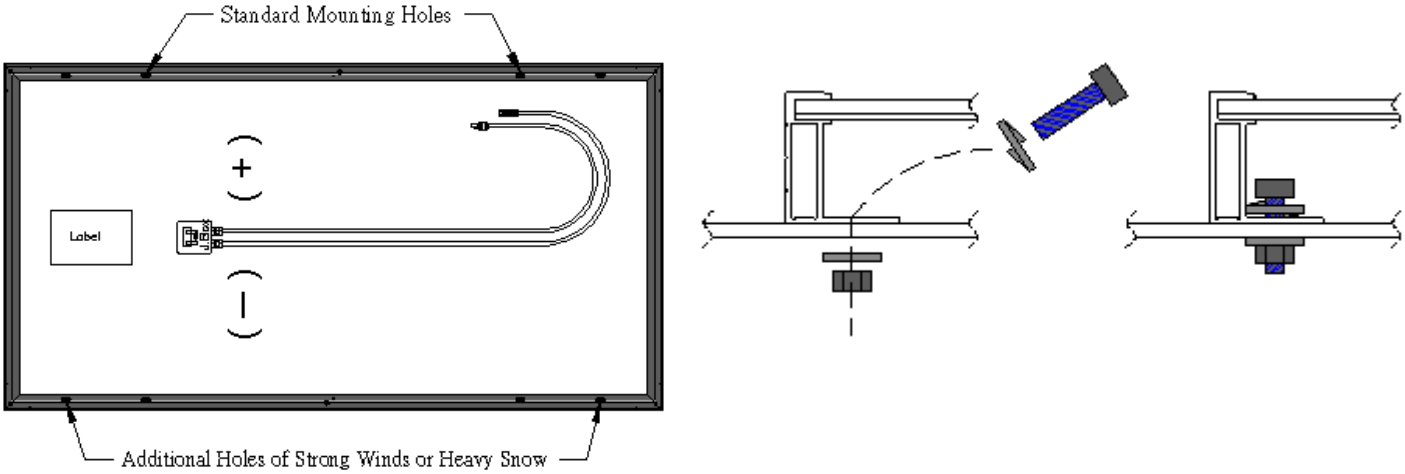


Figure 8.1: Additional Holes for Strong Winds or Heavy Snow Condition

8.2 Mounting with Clamp

- On the long frame of module, the modules use the clamps to mount onto the support structure. The positions of installation must be located according to the four symmetry mounting holes close to the inner side on module frame, to withstand 2400 Pa (IEC) of wind and snow loads.

- For the positions of the mounted clamps, refer to the following Figure 8.2.

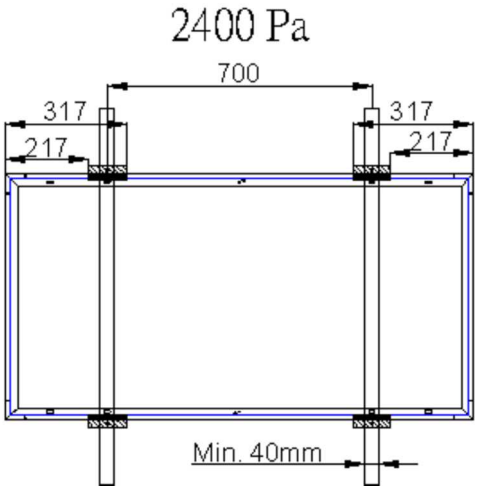
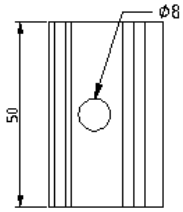
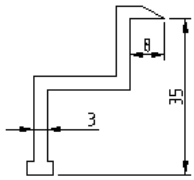
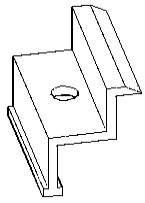
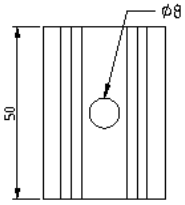
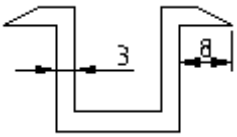
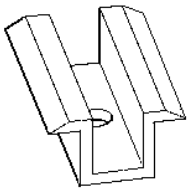
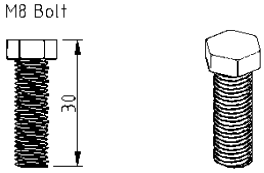
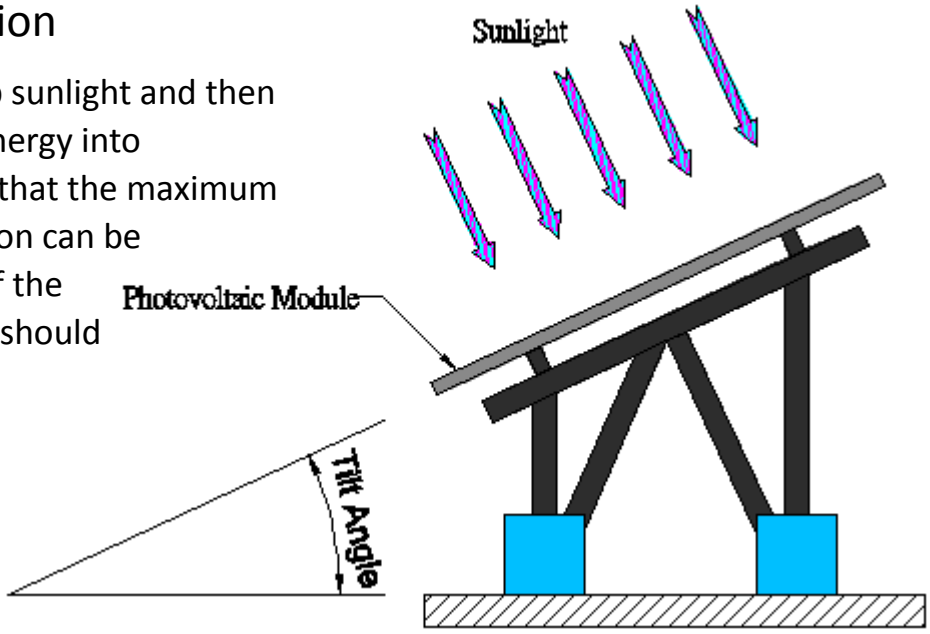


Figure 8.2 The positions of the mounted clamps

- Clamps required with M8 (5/16 in) bolts. Selected clamps, bolts, nuts and other parts must be corrosion-resistant materials.
- Use torque of 16 Nm (141.6 lb-in) to secure the module to the support structure, and pay attention as the clamps CANNOT touch the glass.
- Recommended minimum clamp dimension (mm), as in following diagrams.

	Top	Section	Three-dimensional
End Clamp			
Mid Clamp			
M8 Bolt			

8.3 Tilt Angle Selection



- The solar cells absorb sunlight and then transform the light energy into electricity. To ensure that the maximum efficiency of absorption can be obtained, the front of the photovoltaic module should face the sunlight vertically as much as possible.
- For this reason, the optimal tilt for the photovoltaic module is roughly the same as the latitude of installation location.
- We recommend installing the modules with a tilt angle of at least 10°. To make it easier for dust to be washed off by rain and reduce the dirt or other materials that accumulate on the surface of photovoltaic modules.

9. Electrical Installation

Under normal conditions, a photovoltaic module is likely to produce more current and /or voltage than reported under standard test conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes and size of controls connected to the photovoltaic module output.
In the United States, refer to Section 690-8 of the National Electrical Code to determine the appropriate specification of wire and fuse, which should add a multiplying factor of 1.25 (80% de-rating) from Isc.

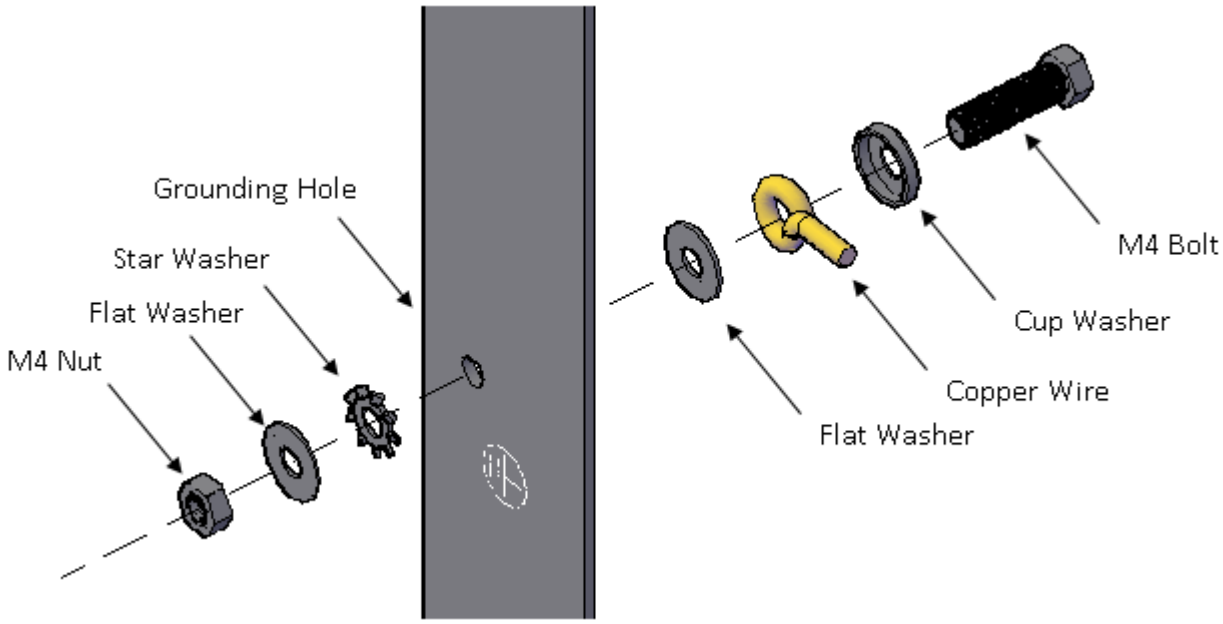
9.1 Electrical Installation Precautions

- The sum of Voc of series modules MUST NOT EXCEED the maximum system voltage of the module under any condition. Reverse current applied to the modules must not exceed 8A.
- The cross section of the cables and the capacity of the connectors must be selected to suit the maximum system short circuit current.
- Do not carry out installation when PV modules, installation tools or installation area are exposed to water.

- The system requires confirmation that the wiring is correct.

9.2 Grounding

- The ground wire must not be smaller than No.14 AWG (2.5 mm²), and insulation resistance must be at least 90°C, or according to local regulations, e.g. the NEC (National Electric Code) in the United States.
- If the building is already equipped with an exterior lightning protection system, the PV installation must be integrated into the protection system against direct effects of lightning.
- There are two 4mm [Φ4mm] grounding holes with earth symbols ⏚ each on the long frame of module; the module frame MUST BE properly grounded.
- Use an M4 stainless steel bolt and pass through a diameter M4 stainless steel cup-washer, use the 14AWG (2.5 mm²) copper wire wound on the bolt, then pass it through the M4 stainless steel flat washer, and place the bolt through the grounding hole of the frame, M4 stainless star washer, M4 stainless steel flat washer, and finally with a M4 nut use about 3 ~ 4Nm (22.1 ~ 22.6 lb-in) of torque to lock onto the frame.

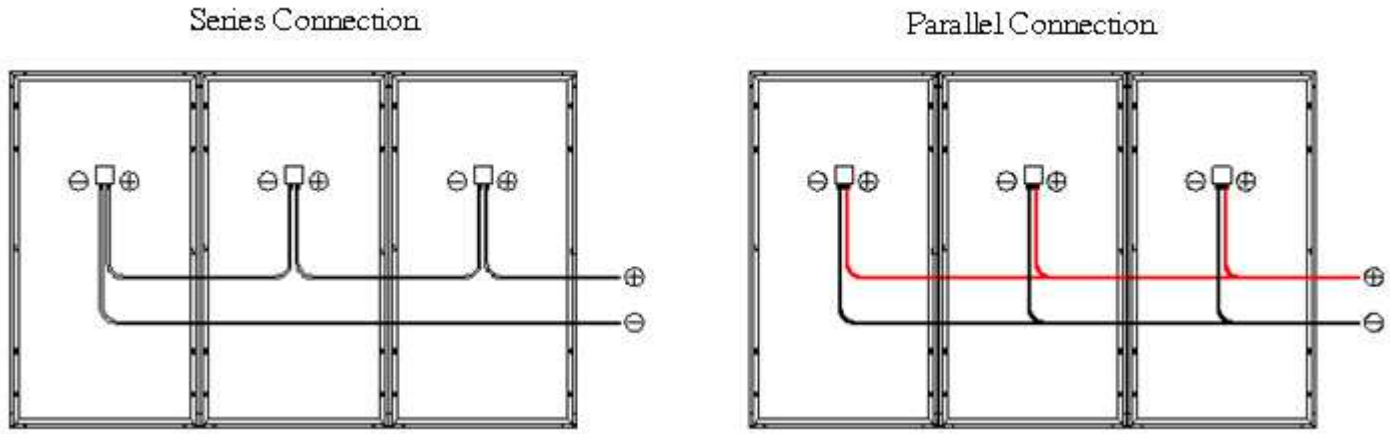


9.3 Electrical Wiring

- The cables have connectors for an electrical connection system.
- The module cables should be fixed onto the module frame or support in order to avoid any stress to the connector.
- The cables should avoid exposure to direct sunlight.
- The junction box CANNOT be opened or destroyed, and the place of installation

should avoid rain.

- Recommended number of installed modules:
  - ✓ Series connection: 10 modules (UL 6 modules)
  - ✓ Parallel connection: 4 modules
  - ✓ Calculated under condition of +10% tolerance of Voc at STC. The sum of Voc of series modules must NOT exceed the maximum system voltage under any condition.
  - ✓ Calculated under condition of +10% tolerance of Isc at STC. Under any condition reverse current applied to the modules should NOT exceed 8A.
  - ✓ The number of series and parallel MUST CONSIDER the capabilities of inverter.



⚠ Warning: Electrical hazard, DON'T TOUCH bare conductors, wire or other energized parts.

9.4 Start Generation System

- For a photovoltaic generation system connected to the power grid, you MUST CONFIRM that the system has passed the inspection, testing and shall comply with regulatory requirements.

10. Maintenance

- Clean the glass surface of the module when required. Always use clean water and a soft sponge or cloth for cleaning.
- Check the electrical, grounding and mechanical connections every six months to verify that they are clean, secure, undamaged and free of corrosion.
- When replacement parts are required, the installer or servicer should ensure that parts uses are specified by the manufacturer, with the same characteristics as the original parts. Unauthorized substitutions may result in fire, electric shock, or other hazard.
- At the suitable moment, maintain the parts used in the system, such as brackets, charging rectifiers, inverters, batteries, etc.

11. Shut Down Generation System

- To prevent the generation of electricity during disassembly of the conductor, an opaque material must be used to COMPLETELY cover the photovoltaic module.
- In disconnecting the system from the power grid, each component used in the system must comply with the operating instructions.
- After the system stops running, it then can be disassembled. During operation, comply with ALL applicable safety of installation guides.