

Please read this manual carefully before proceeding towards installation of solar modules.

## **NINGBO SUN EARTH EAST SOLAR INSTALLATION MANUAL 2024**

The full models covered by this installation manual are listed as following:

1. DXM8-54H 440W
2. DXM8-54H 450W
3. DXM8-54H 455W
4. DXM8-60H 490W
5. DXM8-60H 500W
6. DXM8-60H 505W
7. DXM8-66H 550W
8. DXM8-66H 555W
9. DXM8-72H 590W
10. DXM8-72H 600W
11. DXM8-72H 610W
12. DXM8-54HBG 440W
13. DXM8-54HBG 450W
14. DXM8-54HBG 455W
15. DXM8-60HBG 490W
16. DXM8-60HBG 500W
17. DXM8-60HBG 505W
18. DXM8-72HBG 590W
19. DXM8-72HBG 600W
20. DXM8-72HBG 610W

**Ningbo Sun Earth East Solar Co., Ltd.**

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# 1. Safety Note

- Before installation, please read this installation manual and all the instructions of the components carefully. This manual contains the important information for the installation and maintenance of solar systems.
- In order to avoid the potential risks of installing a solar system, this must be handled by a certified or specialized personnel.
- Before installation, the installation personnel should be an expert in the mechanical and electrical requirements of the PV system. During the installation, the installation personnel should obey the safety instructions.
- During the installation, the installation personnel should observe the local laws and the related certifications of a particular area.
- If you have any requirements or questions, please contact your local distributor or Ningbo Sun Earth East Solar Co., Ltd(Sun East Solar). Or you can visit on Sun Earth Power official website : <http://www.suneastsolar.com>
- Please keep this manual for future use.

## ■ Disclaimer

Due to the using of this manual, the PV system installation and maintenance are not under the control of Sun East Solar. Sun East Solar will not bear any legal liability of damage, breaking or extra charges caused by the using of this manual for the PV system installation.

Due to using the PV products possibly infringing on a third party patents, this is not an area of responsibility of Sun East Solar. The customer will not obtain any patent or any use authorization by using Sun East Solar products, no matter if it is expressed or implied.

The information of this manual is based on the knowledge and experience from Sun East Solar. But the information and advice (include the product specification) do not constitute any guarantee, no matter if it is expressed or implied. The rights of modifications of this manual, the PV products, the specification or products information are reserved by Sun Earth, without advanced notice.

## ■ Warning



1. Do not disassemble the module, move any label or any parts stacked on the module.
2. Do not paint or put any adhesive on the surface of the module.
3. Do not expose the artificially concentrated the sunlight to the modules or panels.
4. Do not expose the back sheet of the solar module to the sunlight
5. Do not damage the back sheet of the module.
6. Do not drop anything on the solar module. Lift and move the panel carefully.

7. Do not place heavy things on the solar module.
8. The improper freight and installation may damage the glass and the frame of the modules.
9. Do not stand on the solar module.
10. Keep children far away during the installation.
11. When any service of maintain is done, please ask the installation personnel or the service staff to do the routine inspection, so to ensure the PV module is in a safe and proper operating situation.
12. When there are component needs to be replaced, please ensure the replacement parts are specified by the manufacturer, or is the same standard of the original one. Unaccredited replacement may lead to fire, shock or other dangerous consequences.
13. During the installation, please consult with your local construction and safety department about the permission and proper regulations. The approval certificate should be gained when it is needed.
14. During the installation, the materials should cover the surface of the module to prevent it produce electric.

## 2. Instruction

### ■ Summary

Solar cells (also called PV cells) are semiconductors which convert sunlight directly into electricity. The solar module is the equipment that is assembled by the solar cell in certain ways, and sealed by special packaging material that provides DC power. Figure 1 Schematic drawing of a photovoltaic module section.

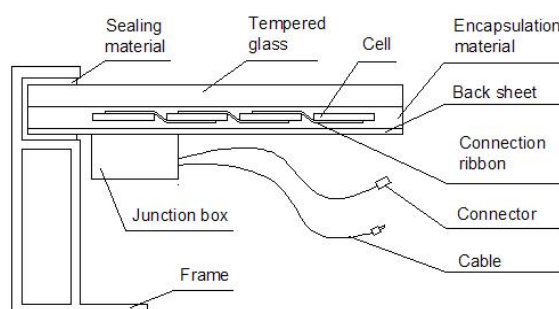


Figure 1 Schematic drawing of a photovoltaic module section

The solar module is designed for outdoor use, it should be equipped with proper support structures. Designing the proper support structures is the responsibility of the system designer and the installation personnel.

For easy to install, each solar module comes with a junction box, cables and connectors. Do not damage or drag the cable. Do not connect or disconnect the connector while it is connected with load. Otherwise, it may cause combustion or other safety problems.

During the installation, the installation personnel should obey the operating requirements and not touch the live end with bare hands. Use the insulated tool to connect the electric equipment. When hands on the solar module are wet, do not touch the surface of the module. Do not wear metal rings, watchbands, earrings, nose rings, lip rings or any other metal accessories during the PV system installation and maintenance.

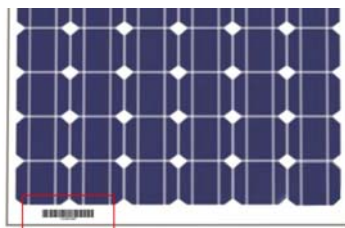
## **The application level of Sun East Solar modules is Safety Class II.**

### **■ Product Identification**

Every module has two identifications.

Label: Describes the information of the module description, including product type, rated power, voltage, and current, the weight, dimension; the fuse capacity, the maximum system voltage and other company information.

Bar code: every module has one unique serial number. It is sealed inside of the module, during the lamination process. There is another same bar code on the back sheet and the frame of the module for scanning.



## **3. Electrical Installation**

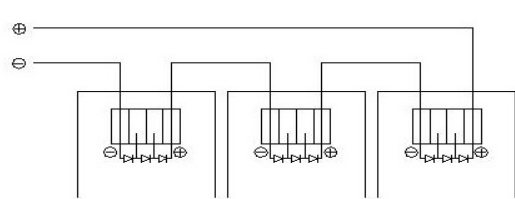
### **■ Electrical Connection**

When the sunlight is irradiated on the surface of a solar module, it will generate more than 45V DC voltage, it is dangerous to exposure the electric over 45V. The installation personnel should know the potential dangers associated with installing a solar system.

Electric performance parameters on the label of the solar panels are nominal value which is acquired under the STC standard(Irradiation:1000W/m<sup>2</sup>, AM:1.5, Tc: 25°C). Usually, the solar panel performance (current and voltage) under the outdoor environment will be different than the nominal value.

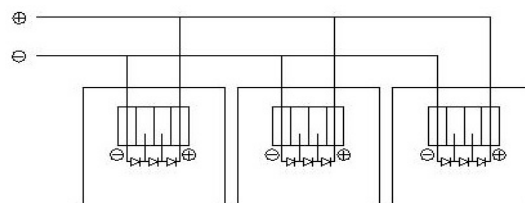
Under the normal use situation, the PV module may produce higher current/voltage than the STC value. During the system design, the system equipment's nominal value(ISC & VOC) such as the cable, fuse, and the control equipments, should be 1.25 times higher than the solar module nominal value. Please refer to the details of NEC chapter 690-8.

Modules in different quantities are connected in series or in parallel according to the voltage and current of the power system. For application with a high operation voltage, modules are connected in series, the total voltage is equal to the sum of individual voltages. For applications requiring high currents, several photovoltaic modules can be connected in parallel; the total current is equal to the sum of individual currents. Do not use modules of different configurations in the same system. Figure 2 shows modules connected in series while Figure 3 for modules connected in parallel.



Module Series Connection

Figure 2. Modules connected in series.



Module Parallel Connection

Figure 3. Modules connected in parallel.

In a circuit branch of modules connected in series, the maximum number of modules ( $N$ ) =  $V_{max. system} / V_{oc @STC}$ . In a circuit branch of modules connected in parallel, the maximum number of modules is ( $P$ ) = 2

### ■ Junction box with Cable and Connector

Modules are supplied with junction boxes, cables and connectors to use for system electrical connections. They are manufactured to be weather resistant, and water-tight, with IP68 grade, comply with the class II safety requirements. IP68 are indicated on the junction box and supplier's certificates which certifies the junction box is IP68 can be provided upon request.

On the cover of the junction box, there is a mark for inserting the screwdriver. Please insert a screwdriver with 3-5mm wide and pry it, then the cover will be opened. And if you want to close the cover, just insert the hook at the cover side into the fillister and press down with strength. If you heard a sound of "clicking", that means the cover has already been fastened.

When installing the modules on the mounting system, the junction box should not be pressed by the external force. And the rated voltage for the junction box of these modules should be the same.

The cross section area of cable must be larger than 12AWG or 4mm<sup>2</sup> for a single module. Both the plus and minus cables are black. Application temperature range is from -40°C to 90°C. The minimum bending radius is 34mm. Insulation material used for internal wiring must have a temperature rating of min. 90°C according to IEC 60189.

The connection polarity must be correct for module operation. Rated current of a connector is 16A and rated operating temperature is 100°C. Figure 4 shows modules connector.



Figure 4 . Modules connector.

The cross section area of cable and the capacity of connector must be selected to suit the maximum system short circuit current. Otherwise, the cable and connector will be overheated under large current. Consult local wiring regulations to determine system wire size, type, and temperature.

### ■ Blocking diodes

Blocking diodes is also called as isolation diodes. Blocking diodes are typically placed between the PV module and the power generation and thus able to conduct the current from the

solar cells, which are exposed to the sun, to the power generation. But it can prevent current conducted from the generation to solar cells when output voltage of the cell string is lower than the generated voltage.

Typical blocking diodes are highly reliable regular commutation diode with appropriate current rating value, which is usually installed in charging controller. It is recommended to use blocking diodes when a charging regulator is not used. Your specialist dealer can advise you on the suitable types.

### ■ Bypass diodes

Bypass diodes are also called shunt diodes. It is usually connected in parallel to solar cells or solar modules. Bypass diodes suffer back bias voltage when solar cells get illuminated.

When a cell string is shaded partially or broken or the open circuit model is ineffective, bypass diodes will automatically become forward biased. Thus this allows the other cells in this cell string exposed to the sun to deliver the current to the power generated through bypass diodes.

Schottky diode are also typical bypass diodes. All modules rated greater than 55 Watt have bypass diode already integrated in the junction box.

#### Typical Bypass Diodes Electrical Characteristics

##### Maximum Ratings and Electrical Characteristics

Maximum Ratings and Electrical Characteristics (TC=25°C unless otherwise noted)					
PARAMETER	TEST CONDITIONS		SYMBOL	GFT3050SM	UNIT
Maximum repetitive peak reverse voltage			V <sub>RRM</sub>	50	V
Working peak reverse voltage			V <sub>RWM</sub>	50	V
Maximum DC blocking voltage			V <sub>DC</sub>	50	V
Maximum average forward rectified current at Tc=105°C total device per diode			I <sub>F</sub> (AV)	30	A
Peak forward surge current 8.3ms single half sine-wave superimposed on rated load per diode			I <sub>FSM</sub>	300	A
Peak repetitive reverse current per leg at tp=2.0us , 1KHz			I <sub>RRM</sub>	3.0	A
Voltage rate of change ( rated VR )			DV/dt	10000	V/us
Operating junction temperature range (in DC forward mode operation without reverse bias)(t<=1h)			T <sub>J</sub>	-55~+200	°C
Storage temperature range			T <sub>STG</sub>	-55~+150	°C
Maximum instantaneous forward voltage per leg	IF=15A	Tc=25°C	VF	0.52	V
	IF=15A	Tc=125°C		0.46	
	IF=30A	Tc=25°C		0.57	
	IF=30A	Tc=125°C		0.52	
Maximum reverse current per leg at working peak Reverse voltage			I <sub>R</sub>	200	uA
				20	mA

##### Thermal Characteristics $T_a=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	TYP	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case per Leg	0.7	$^\circ\text{C}/\text{W}$

## Maximum Ratings and Electrical Characteristics

Maximum Ratings and Electrical Characteristics (TC=25°C unless otherwise noted)				
PARAMETER	TEST CONDITIONS	SYMBOL	GFT5050CT	UNIT
Maximum repetitive peak reverse voltage		$V_{RRM}$	50	V
Working peak reverse voltage		$V_{RWM}$	50	V
Maximum DC blocking voltage		$V_{DC}$	50	V
Maximum average forward rectified current at Tc=105°C total device per diode		$I_F(AV)$	50	A
Peak forward surge current 8.3ms single half sine-wave superimposed on rated load per diode		$I_{FSM}$	300	A
Peak repetitive reverse current per leg at tp=2.0us , 1KHz		$I_{RRM}$	3.0	A
Voltage rate of change (rated VR)		DV/dt	10000	V/us
Operating junction temperature range (in DC forward mode operation without reverse bias)(t<=1h)		$T_J$	-55~+200	°C
Storage temperature range		$T_{STG}$	-55~+150	°C
Maximum instantaneous forward voltage per leg	IF=25A	VF	0.51	V
	IF=25A		0.45	
	IF=50A		0.57	
	IF=50A		0.53	
Maximum reverse current per leg at working peak Reverse voltage	TJ=25°C	IR	150	uA
	TJ=100°C		20	mA

## Thermal Characteristics Ta=25°C unless otherwise noted

Symbol	Parameter	TYP	Unit
RθJC	Thermal Resistance, Junction to Case per Leg	0.7	°C /W

## ■ Grounding

Must abide by electrical regulations of the local country and region while installing modules to assure all the module frames and supports are grounded properly For detailed information on grounding, please turn to the related electrical regulation for installation or insult reliable solar system installation company.

Use electroplated support frame to assure good circuit break-over.

There are grounding holes on the frame of modules and all the frames should be properly grounded. Correct and reliable grounding connection of oxidation frames needs a reinforced or jagged gasket. Confirmed and listed equipment allows to be grounded as the metal framework of solar modules.

Chart. Grounded connection components

No.	Items	Specification	Requirement
1	Screw bolt	M4×20 mm	Stainless steel
2	Flat washer	M4×14 mm	Stainless steel
3	Double-color grounded cable	BVR 450/750V	2.5mm <sup>2</sup>
4	Star washer	M4 mm	Stainless steel
5	Flange nut	M4 mm	Stainless steel



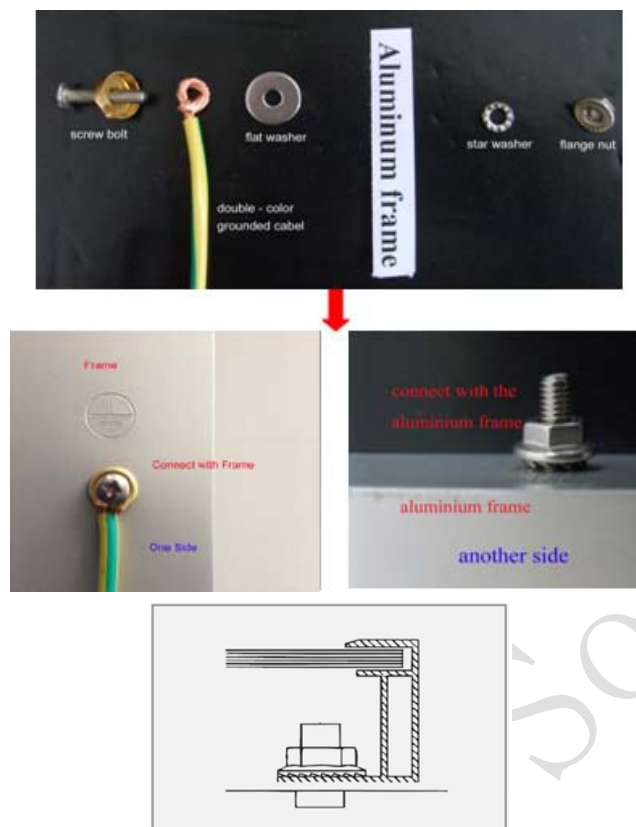


Figure 5. Grounded operation figure

The grounded cable should be multicore copper with colors of yellow and green. The wire across section area must be larger than 12AWG or 2.5 mm<sup>2</sup>

First strip 16mm insulating jacket from the end of the grounded wire carefully to avoid nicking or cutting conductors. Be careful not to damage the wire core. Wrap the stripped cable head to the shape as shown in the chart above. In order to resemble the chart above, successively insert the stainless M4 screw into the cup-shaped M4 copper washer, grounded wire and flat M4 stainless washer and then into star-shaped M4 stainless washer through the framework of the module. Finally screw in the stainless steel M4 butterfly-shaped nut. The recommended torque of stainless steel M4 butterfly-shaped nut is 1.5 Nm. Check the connection of grounded cable and support frame.

As for the grounding method and detailed requirements for arrangement of wires, please abide by the related regulation for installation, such as Australian AS/NZS 3000 and AS/NZS 5033, National Electrical Code, NEC Article 250, Canadian Electrical Code, CEC Part 1, International Electro technical Commission, IEC and CENELEC, etc.



## 4. System installation

### ■ Site selection

Choose a proper place for a system installation. One should consider the factors may affect

the solar panel, such as the terrain, sunlight radiation, wind speed, thunder, hailstone, drainage, snow accumulation, and corrosion.

The solar module should be installed in a proper place where the module can be fully exposed under the sunlight and couldn't be shaded. This is especially true for the winter.

The installation ground should be flat; the base should be 300mm higher than the surrounding area and easy to drain. It shouldn't be installed near corrosive material and dust.

### ■ Tilt angle

To let the solar panel gain more sunlight, the solar module should be installed in proper direction and tilt angle. For example, in the northern hemisphere, the module should face to south and in southern hemisphere, the module should face to north.

The tilt angle of the PV module is the measured between the PV module and a horizontal ground surface. The PV module generates the maximum output power it faces the sun directly. We recommend that the mounting tilt angle should not be less than 10° to avoid accumulation of water and dust on the panel surface.

Reference for installation dip angle in difference latitude:

Latitude of Installation position	0°-15°	15°-25°	25°-30°	30°-35°	35°-40°	Upon 40°
Dip Angle	15°	Same as the latitude	Latitude+5°	Latitude+5°	Latitude+5°	Latitude+5°

Please refer to the standard PV system installation guide or consult with a local PV system installation company.

### ■ Choose mounting

Usually the solar module is installed on the mounting system. The mounting system could be installed in fixed mode or tracking mode. The material of the mounting system should be durable, with high mechanical strength, anticorrosive and uv-resistant.

No matter what kind of installation mode, the mounting system should be able to bear the total weight of the solar panels, should be able to bear the local maximum wind speed, the maximum mechanical load pressure of the snow, should be fit for the local earthquake resistant requirement, should have proper lightening protection and grounding system, and the mounting system should have enough mechanical stiffness to prevent the effect of the vibration caused by external force.

The installation personnel should follow the installation guide and the safety standards of the mounting system, during the installation process.

When the solar panel is installed on the ground, there must be enough space from the ground to the bottom of the solar panel, to prevent the effects caused by accumulated snow or water.

When the solar panel is installed on the roof or the top of the building, one needs to ensure the roof and the building structures are proper for installation. If the installation structure needs to get through the roof or the top of the building, it must be sealed to prevent the leakage of water.

When the solar panel is installed on the roof, the slope of the square array shouldn't be more than 5in/ft(416mm/m) and the distance from the solar panel lower limb to the outer edge of the roof should be more than 10cm.

**Note: Minimum 100 mm spacing between the module frames and surface of the**

**mounting plate or ground is required to allow air to circulate behind the module.**

The fire rating of Sun Earth solar panel is C class. Please consider the local requirements, install the solar panel on the roof, which has proper fire rating. The roof fire rating may be affected by installed the solar panel, please consult with your local system design and installation company.

Other installation is also accepted if it is fit for the system requirement. The mounting system design suggestion is in Figure 6.

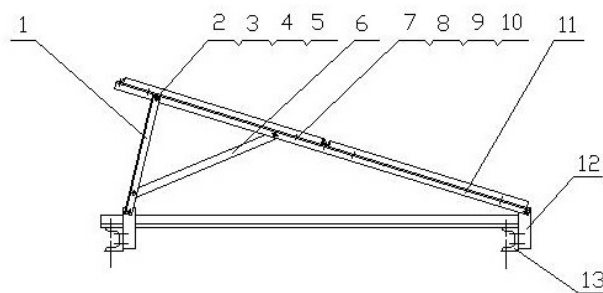


Figure 6. Suggestions for the mounting system

- |                         |                          |                          |
|-------------------------|--------------------------|--------------------------|
| 1. 40mm×40mm Angle iron | 2. M16×35 Screw          | 3. M16 Screw             |
| 4. M16 Flat Gasket      | 5. M16 Spring Gasket     | 6. 40mm×40mm Angle iron  |
| 7. M16×16 Screw         | 8. M6 Screw              | 9. M6 Flat Gasket        |
| 10. M6 Spring Gasket    | 11. 40mm×40mm Angle iron | 12. 40mm×40mm Angle iron |
| 13. 100mm channel bar   |                          |                          |

## ■ Module Installation

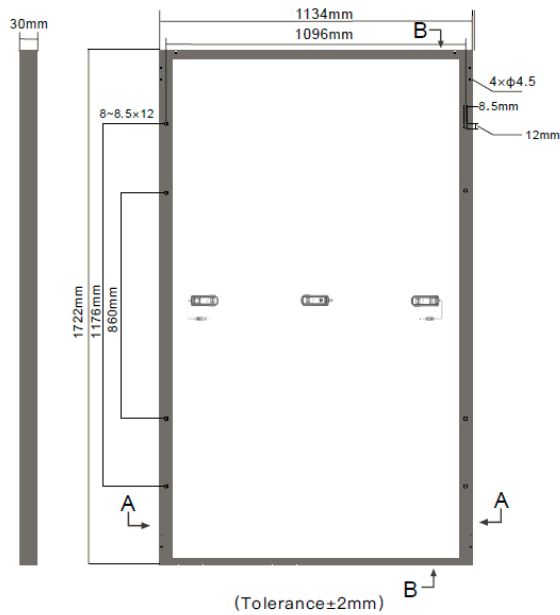
Module connection can be realized by mounting holes and clamps. Installation shall follow the demonstration and suggestions below.

### Mounting Hole Fixing

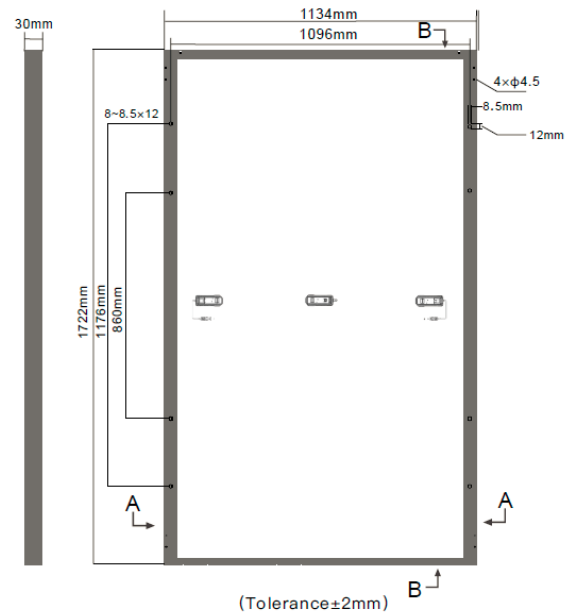
There are eight installation holes (hole size 8.5\*12mm) on the solar module frame, each side has 4 holes. The modules can be installed on the mounting system through these holes. Sun Earth's module has mounting holes matching M8 bolts. At least 4 bolts are required for each module, with 2 bolts on each side. 8 bolts are preferred. The module design load is +3600/-1600 and safety factor 1.5.

The figure 7 shows installation hole positions of our modules

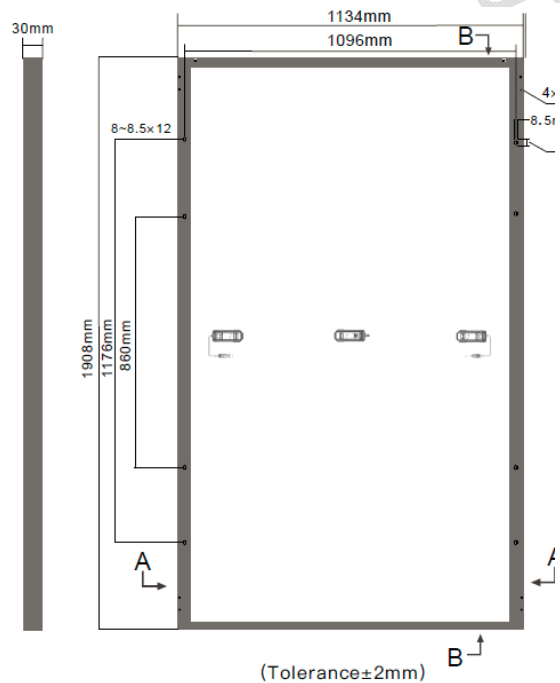
## M8 Half Cells Module Series:



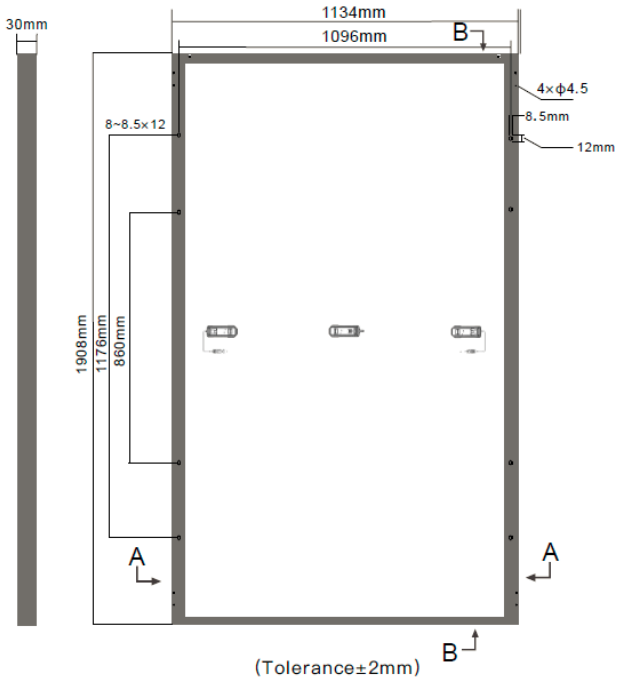
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DXM8-54H 450W  
DXM8-54H 455W



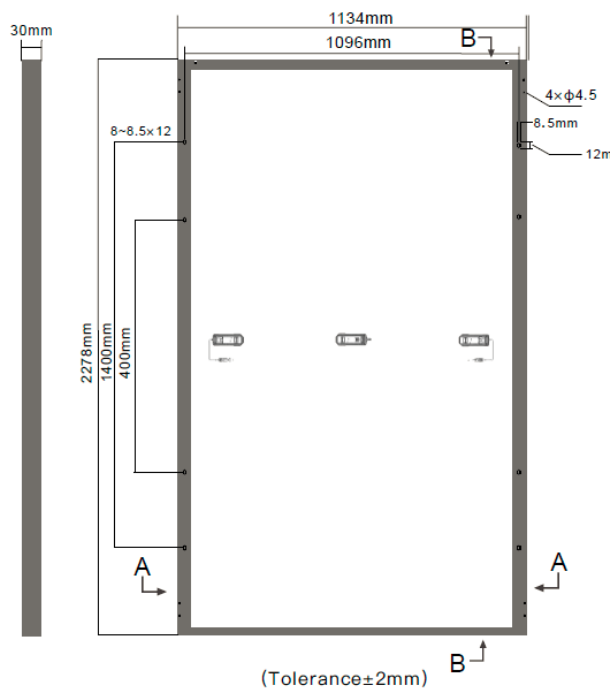
DXM8-54HBG 440W  
DXM8-54HBG 450W  
DXM8-54HBG 455W



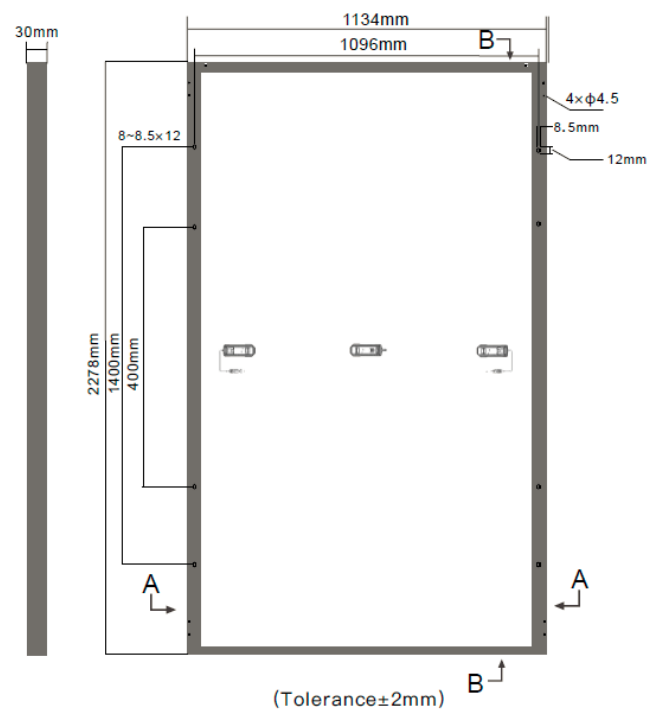
DXM8-60H 490W  
DXM8-60H 500W  
DXM8-60H 505W



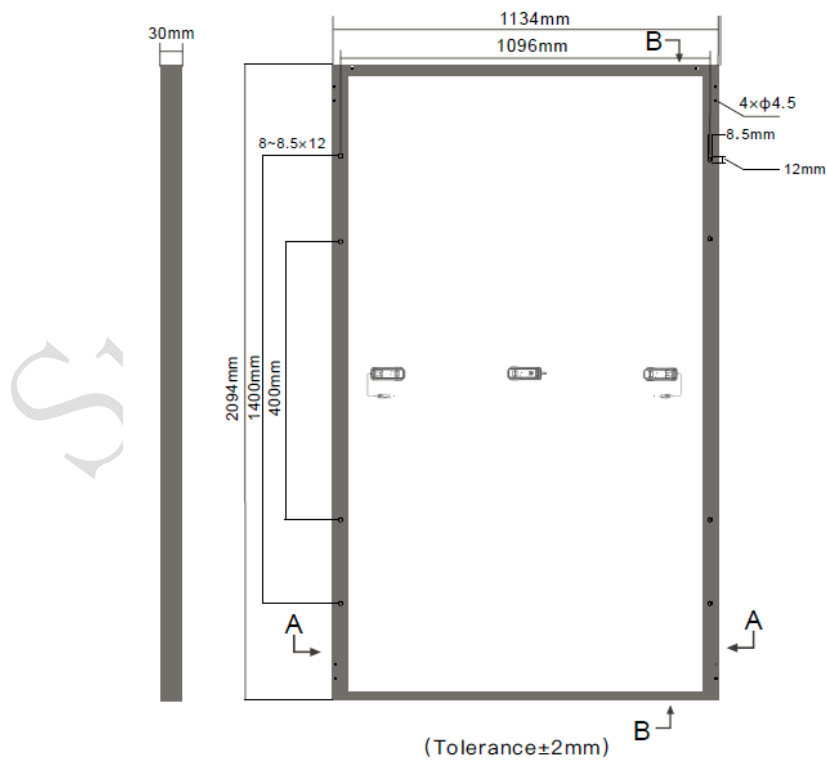
DXM8-60HBG 490W  
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DXM8-60HBG 505W



DXM8-72H 590W  
DXM8-72H 600W  
DXM8-72H 610W



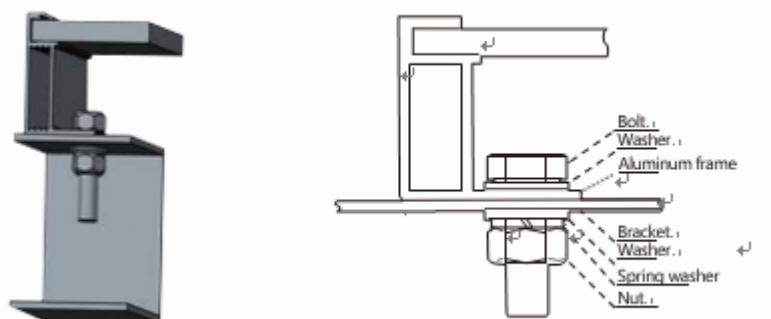
DXM8-72HBG 590W  
DXM8-72HBG 600W  
DXM8-72HBG 610W



DXM8-66H 550W  
DXM8-66H 555W

Figure 7. Panel Installation Hole Positions

Apply bolts to fix modules on the bracket through mounting holes on the back-side frame. See below picture.



Recommended accessories are as below:

Bolt: M8

Washer: 2pcs, thickness  $\geq 1.5\text{mm}$ , outside diameter 16mm

Spring Washer: 8

Nut: M8

Suggestion 1: M8 bolt tightening torque range: 12-16 N • m

Mechanical load for mounting hole fixing method is +5400Pa/-2400Pa

Mechanical load = Design load x safety factor (1.5)

### Clamps Fixing

If the mounting system applies, other installation method also accepted, such as fixing by compact clamps. See Figure 8.

Under no circumstances should the clamp touch the glass or deform the frame. The interface of the clamp to the front of the frame must be smooth and flat to prevent frame or other components from being damaged.

For framed PV module, the length of the clamp be at least 50mm and the clamp must maintain an overlap of 10-12 mm with the frame of the module. At least 4 clamps are required for each module.

Regarding to the reference value of tightening torque, it is suggesting that for M8 bolt is 12 -16 N m.

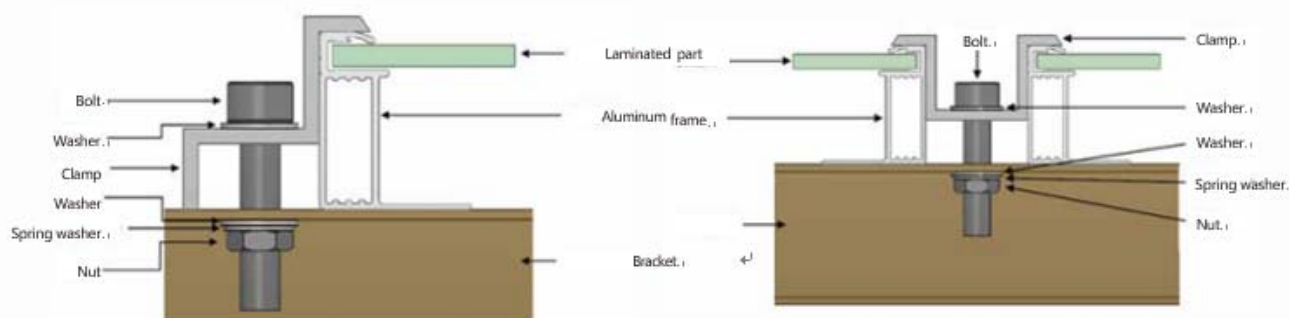


Figure 8. Position of the compact clamps

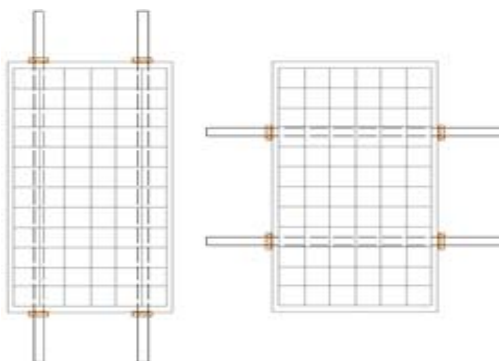


Figure 9. Fixing by proper compact clamps

Solar panel can be fixed from long side and short side by frame sharp compact clamps (but fixed from long side is the first proposal). See Figure 9. The maximum torque of the nut bolt M8 compatible to the compact clamp is 16Nm.

Under such circumstances, compact clamp much be fixed within the suitable area where will not bring the damage to the solar module.

Module Type	Fix from short side (Distance from edge to clamp center)	Fix from long side (Distance from edge to clamp center)	Mechanical load Mechanical load=Design load x safety factor (1.5)
DXM8-54H	100-240mm	$345 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-54HBG	100-240mm	$345 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-60H	100-240mm	$380 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-60HBG	100-240mm	$380 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-66H	100-240mm	$420 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-72H	100-240mm	$455 \pm 50\text{mm}$	+5400Pa/-2400Pa
DXM8-72HBG	100-240mm	$455 \pm 50\text{mm}$	+5400Pa/-2400Pa

Note: Make sure not to distort the frame of solar panels during fixing process.

And compact clamps are forbidden to contact glass.

- Do not drill holes on the glass surface of the module. Otherwise the product warranty will become invalid.
- Do not drill extra mounting holes on the framework of the module. Otherwise the product warranty will become invalid.
- Do not move modules by using the junction box or the cable.
- Do not stand or step on the modules.
- Do not drop module or allow objects to fall on module.
- Do not put any heavy objects on the modules.
- Inappropriate transport or installation may damage the glass or framework of modules.

## 5. Testing, commissioning and troubleshooting

Protect yourself from electric shock when troubleshooting or maintaining the solar system.

Test all electrical and electronic components of the system before using it. Follow the instructions in the guides supplied with the components and equipment.

### ■ Testing modules connected in series before they are connected to system.

Check the open-circuit voltage of every series module by a digital multimeter. The measured values should correspond to the sum of the open-circuit voltage of the individual module. You will find the rated voltage in the technical specifications of the type of the module used. If the measured value is significantly lower than the expected value, please proceed as described under "Troubleshooting an excessively low voltage."

Check the short-circuit current of every series circuit. It can be measured directly by a digital multimeter connected in the two terminals of series circuit or module. Attention, the rated scale of the rated current of load should more than 1.25 times of the rated short-circuit current of series module. You will find the rated current in the technical specifications of the type of module used. The measured value can vary significantly, depending on weather conditions, the time of day and shading of the module.

### ■ Troubleshooting low voltages

Identify the commonly low voltage and excessively low voltage. Typically, the low voltage mentioned here is the decrease of open-circuit voltage of the module, which is caused by the temperature rising of solar cells or lower irradiance. Excessively low voltage is typically caused by improper connections at the terminals or defective bypass diodes.

First, check all wiring connections to make sure it is not open-circuit or is not connection well.

Second, check the open-circuit voltage of each module.

Third, Fully cover the modules with an opaque material. Disconnect the wiring at both terminals of the modules. Remove the opaque material from the module to be checked and measure the open-circuit voltage at its terminals.

If the measured voltage is only half of the rated, this indicates a defective bypass diode. Refer to "Testing and replacing bypass diodes".

In the case of not very low irradiance, if the voltages across the terminals differ from the rated value by more than 5 percent, this indicates a bad electrical connection.

## 6. Maintenance

Sun Earth recommends the following maintenance in order to ensure optimum performance of the module:

Clean the glass surface of the module as necessary. Always use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used to remove stubborn dirt. Detergent for dishwasher is not recommended.

Check the electrical and mechanical connections every six months to verify that they are clean, secure and undamaged.



If any problem arises, have them investigated by a competent specialist. Should obey the maintenance instruction for related components as to the maintenance instructions for all components used in the system.

## 7. Demolishment of the system

When disassembling conductors, one must fully cover the modules with a material to avoid electricity.

When disconnecting the system from the power source, every single component used in the system should comply with the operating instruction.

Disassembling is allowed only when the system stops operating. In the process of operation, abide by all the safety operation instruction applicable to the installation,

## 8. Recycle of Solar Panels

Under no circumstance, solar panels can be disposed as common house rubbish.

## 9. Technical data of Solar Panels

### ■ Electrical Parameters

Standard Testing Condition(STC): AM1.5  $E_c=1000W/m^2$   $T_c=25^{\circ}C$  ;

#### M8 Half Cells Mono Module Series:

Model of the panel	Type of the cell	Quantity of the cells	Rated Max. Power (W)	Power Tolerance	Voltage at $P_{max}$ ( $V_{mp}$ )	Current at $P_{max}$ ( $I_{mp}$ )	Open-circuit Voltage ( $V_{oc}$ )	Short-circuit Current ( $I_{sc}$ )	Eff. of the panel (%)
DXM8-72H	Mono – Crystal Silicon	144 in Series	590	$\pm 5W$	42.7	13.82	51.7	14.52	22.8
			600		42.9	13.99	52.1	14.64	23.2
			610		43.1	14.15	52.5	14.76	23.6
DXM8-66H	Mono – Crystal Silicon	132 in Series	550	$\pm 5W$	39.3	13.99	47.8	14.62	23.2
			555		39.4	14.09	48.0	14.69	23.4
DXM8-60H	Mono – Crystal Silicon	120 in Series	490	$\pm 5W$	35.6	13.76	43.0	14.49	22.6
			500		35.8	13.97	43.4	14.63	23.1
			505		35.9	14.07	43.6	14.7	23.3
DXM8-54H	Mono – Crystal Silicon	108 in Series	440	$\pm 5W$	32.0	13.75	38.7	14.46	22.5
			450		32.2	13.98	39.1	14.62	23.0
			455		32.3	14.09	39.3	14.7	23.3

Model of the panel	Type of the cell	Quantity of the cells	Rated Max. Power (W)	Power Tolerance	Voltage at $P_{max}$ ( $V_{mp}$ )	Current at $P_{max}$ ( $I_{mp}$ )	Open-circuit Voltage ( $V_{oc}$ )	Short-circuit Current ( $I_{sc}$ )	Eff. of the panel (%)
DXM8-72HBG	Mono – Crystal Silicon	144 in Series	590	$\pm 5W$	42.7	13.82	51.7	14.52	22.8
			600		42.9	13.99	52.1	14.64	23.2
			610		43.1	14.15	52.5	14.76	23.6

DXM8-60HBG	Mono – Crystal Silicon	120 in Series	490	$\pm 5W$	35.6	13.76	43.0	14.49	22.6
			500		35.8	13.97	43.4	14.63	23.1
			505		35.9	14.07	43.6	14.7	23.3
DXM8-54HBG	Mono – Crystal Silicon	108 in Series	440	$\pm 5W$	32.0	13.75	38.7	14.46	22.5
			450		32.2	13.98	39.1	14.62	23.0
			455		32.3	14.09	39.3	14.7	23.3

### ■ Common Parameters

Model of the cell	M8 Half Cells	
Model of the panel	DXM8-72H DXM8-66H DXM8-60H DXM8-54H	DXM8-72HBG DXM8-60HBG DXM8-54HBG
Temperature Coefficients		
Open-Circuit Voltage ( $\beta_{Voc}$ )	-0.23%/°C	
Short-Circuit Current ( $\alpha_{Isc}$ )	+0.04%/°C	
Pmax ( $\gamma_{Pmp}$ )	-0.29%/°C	
NOCT	45°C	
Max. System Voltage	1500VDC	
Max. Over-Current Rating	25A	30A
Bypass Diodes	Three 30A, 50V	Three 50A, 50V
Junction Box	1500VDC; 30A; IP68	1500VDC; 30A; IP68
Output Cables	PV1-F 1×4mm <sup>2</sup>	
Connector	1500VDC;	
Safety Class	Class II	
Mechanical Load:	+5400Pa	
Mechanical Load:	-2400Pa	
Max. Hailstone Impact(diameter@ 23m/s)	25mm	
Operating Temperature	85% Rh, -40°C ~ +85°C	
Storage Temperature	85% Rh, -40°C ~ +50°C	
[T98] max value:	70 degrees Celsius	

### ■ Module Size and Weight

	Model of the panel	Dimension (mm×mm×mm)	Mounting dimensions (mm×mm)	Weight (Kg)
M8 Half Cells	DXM8-72H	2278 × 1134 × 30	1400×1096 400×1096	27.0 ± 3%
	DXM8-66H	2094 × 1134 × 30	1400×1096 400×1096	25.0 ± 3%
	DXM8-60H	1908 × 1134 × 30	1176×1096 860×1096	22.5 ± 3%
	DXM8-54H	1722 × 1134 × 30	1176×1096 860×1096	20.5 ± 3%
	DXM8-72HBG	2278 × 1134 × 30	1400×1096 400×1096	32.0 ± 3%

	DXM8-60HBG	1908 × 1134 × 30	1176×1096 860×1096	26.5 ± 3%
	DXM8-54HBG	1722 × 1134 × 30	1176×1096 860×1096	24.0 ± 3%

## 10. Unpacking/Transportation/Storage

### ■ Unpacking Safety

Before unpacking, please check the product type, power bins, serial number and relevant suggestions on the label of the packaging box, and read the unpacking instructions carefully. Custom unpacking methods are prohibited.

Before unpacking, please make sure that the packaging box is in good condition, it is recommended to use art knife to remove the packing belt and wrapping film. Violent removal is prohibited to avoid scratching the modules in the box.

Please check that the number of modules in the box and the barcode information on the module frame are consistent with the information on the label on the packaging box.

Please follow the recommended unpacking steps to unpack the modules. When unpacking, it must be operated by two or more people at the same time. Always wear insulating gloves when handling the modules.

If all the modules are not taken out after unpacking, the remaining modules shall be placed horizontally and repackaged to prevent them from tipping. When packaging, please note that the glass side of the bottom module should face up, the glass side of the middle modules should face down, and the glass side of the top module should face up.



In windy weather, it is recommended not to carry the modules, and the unpacked modules should be properly secured.

Do not unpack the modules outside under rain and snow conditions.

Do not carry the module by one person to prevent the module from slipping and hitting other modules, causing scratches, cracks, or deformation on the modules.

Do not lift modules by their cables or junction box.

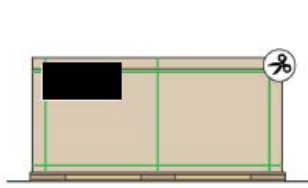
Before removing the inner packing belts, please take measures to protect the modules from dumping.

If unpacking the vertical landscape packages on non-horizontal ground, anti-tilting measures should be taken.

Do not stand on the pallet during unpacking, please carry the modules from sides of the pallet. Do not move the stand supporter during unpacking to prevent the modules being tilted.

Do not lean the module on any instable objects, such as poles or mounting columns. Do not support the back of the modules directly with materials such as wooden strips.

## ■ Unpacking Steps



1) Remove the wrapping film and packing belts.



2) Remove the top cover and the cartons.



3) Place the stand supporter that is higher or wider than the module in order to avoid hitting and damaging the glass.



4) Cut off all the horizontal packing belts; when there are 1 or 2 vertical packing belts remaining, push the module gently to tilt toward the stand supporter.



5) Cut off the remaining packing belts.



6) Take out the modules in order.

When unloading using a forklift, particular care should be taken to control the travel speed and prevent tilting during cornering.

In any circumstances, for vertical landscape packages, it shall not be stacked more than two layers.

The working ground needs to ensure that the packaging box can be placed horizontally and steadily to avoid tipping.

## ■ Unloading with a crane

When crane is used to unload the modules, please choose and use specialized tooling according to the weight and size of the module. Please adjust the position of the sling to keep the modules steady. To ensure the safety of the module, wooden sticks, boards or other fixtures of the same width as the outer packing cases should be used on the upper part of the box to prevent the sling from squeezing the pallet and damaging the modules. When placing the modules, do not lower the packing box too quickly and put it on a flat ground.

## ■ Unloading with a forklift

The loading dock should be as the same height as the underside of the carrier.

The forklift should be driven at a controlled speed of  $\leq 5$  km/h in straight, and  $\leq 3$  km/h for turning, so as to avoid sudden stop and rapid start.

Since the packing box will block the sight of the forklift driver, it is recommended to drive backwards during the forklifting, and arrange for special supervision and command to prevent bumping into people or items causing personal injury or damage to the modules.

Please choose a flat and solid ground to place the module package after transportation to the installation site.

## ■ SECONDARY TRANSPORTATION

The packaged modules can be transported by land, sea or air. During transportation, make sure that the package is fixed with packing belts securely on the shipping platform without any movement.

If the unpacked modules need to be transported to other places, it is recommended to pack the single module together in a package to the maximum number allowed, and fixed with inner packing belts (2100N force recommended). Finally, cover it with the packaging carton box and fix it with the same number of packing belts as before.

## ■ STORAGE

Modules should be stored in a dry and ventilated environment on a flat ground, to avoid damage or dumping of the modules due to ground deformation or collapse.

Storage requirements: relative humidity < 85% and temperature range of -40°C to 50°C.



Do not remove the original package and keep the wrapping film and carton box in a good condition, if the modules require long-distance transport or long-term storage.

For long-term storage, it is recommended to store the modules in a standard warehouse with regular inspection, and under confirming of your personal safety, reinforce the package in a timely manner if any anomalies are found.

The warehouse shelves should have sufficient carrying capacity and storage space, regular inspection is required to ensure the storage safety.

If you need to store the modules in the project site, do not choose soft ground and the ground that is easy to collapse, should choose a hard ground or a higher ground with flat surface to ensure the module packages not collapsing and tilting for long-term storage.

In rainy weather, please fully cover the modules and pallets with a rain protection and take moisture-proof measures on pallets and cartons to prevent collapse and moisture ingress. Under sun or wind, remove the rain cloth to allow the package to dry as soon as possible, prevent package collapse caused by the rain.

Do not allow the pallets to soak in water. The ground drainage measures should be done previously for the storage site to prevent a large amount of water accumulation on the ground after rain, causing the ground to soften, sink, etc.

Do not allow unauthorized persons to access the module storage area. The modules should be centrally stored.

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