

INSTALLATION INSTRUCTION

1. INTRODUCTION

Ningbo Ulica Solar Co.,Ltd is a leading manufacturer of PV cells and modules, delivering reliability and competitive pricing on a global scale. We provide world-class PV technology, streamlined manufacturing, and local customer support.

We are committed to providing technical and installation support for our worldwide customers,.

This Installation Guide covers installation of the following Ulica modules

2. Applicable Module

UL-440M-96DDGN,UL-450M-96DDGN, UL-460M-96DDGN, UL-450M-108BDGN
UL-455M-108BDGN,UL-500M-108DDGN,UL-510M-108DDGN,UL-515M-108DDGN,
UL-520M-108DDGN ,UL-505M-120BDGN, UL-595M-144ADGN,
UL-620M-132DDGN,UL-625M-132DDGN,UL-630M-132DDGN, UL-635M-132DDGN,
UL-710M-132DGN, UL-720M-132DGN, UL-725M-132DGN, UL-730M-132DGN,
Above model can be found on Nameplate , And Nameplate is placed on rear side of the module with junction box

3. Mechanical Installation

3.1 Select a suitable location for installing the modules.

3.1.1 The modules should face south in northern latitudes and north in southern latitudes.

3.1.2 For detailed information on the best installation angle, refer to standard solar photovoltaic installation guides or consult a reputable solar installer or systems integrator.

3.1.3 Modules should not be shaded at any time. If a module is shaded or even partially shaded, it will fail to perform at ideal conditions and result in lower power output.

3.1.4 In general, we do not recommend to installing the PV system with a distance of less than 500 meters close to the coastline. If you plan to do so, please contact Ulica's Global Customer Service Department and/or refer to the Near-coast Installation Guide for Ulica Photovoltaic Module.

3.1.5 Do not use modules near equipment or in locations where flammable gases may be generated or collected.

3.1.6 In general, we do not recommend to installing the PV panel with a tilt angle less than 10 degree. In that case, the PV's generation will difficult to guarantee.

3.1.7 The modules should fixed 15cm from ground or roof .

3.1.8 Modules should be installed in locations where the altitude is less than 2000m.

3.2 Mounting and Notes

- 3.2.1** Systems should be installed by qualified professionals only. The process involves electricity and can be dangerous if the installing personnel are not familiar with the appropriate safety procedures.
- 3.2.2** The modules are qualified for application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (Modules qualified for safety through EN IEC 61730-1 and -2 within this application class are considered to meet the requirements for Safety Class II)”
- 3.2.3** Do not use modules of different configurations in the same system. When the modules connect in series, the voltage of the string cannot exceed the max system voltage, as reference the maximum number of modules (N) can be easily calculated by dividing the Maximum System Voltage of the modules by the respective Voc value of the module. When designing the PV system, please always take into consideration the variation of the voltage under different temperatures (please check the respective temp. coefficients of the modules, the Voc of the modules will be rise when the temperature drops); For example: with UL-715M-132DGN modules (Max. System voltage is 1500V) the maximum series modules configuration number should NEVER can exceed $N = 30$ ($1500V/39.54V/1.25 = 30.35$), taking into consideration the possible variation of the voltage due to the lowest temperature in winter at specified location can reach -40°C.
- 3.2.4** When PV modules connect in series, the voltage output of the whole string will be equal to the sum of all modules; when the PV modules connect in parallel, the output current will be equal to the sum of each branch current. We suggest that every series PV module string should be fused prior to be connected with other strings. Please refer to the applicable regional and local codes for additional fuse requirements. When necessary, please install blocking diodes to protect PV module or PV system been damaged by reverse current.
- 3.2.5** The module frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt water environment with contact to a rack of another type of metal (Electrolysis Corrosion). If required, PVC or stainless steel washers can be placed between the PV module frame and support structure to prevent this type of corrosion. Module support structures that are to be used to support PV modules at correct tilt angles should be rated for wind and snow loads and comply with local and civil codes prior to installation.

3.3 Mounting methods

3.3.1 Generally, Ulica Solar modules had been passed the static mechanical load test (Design load :front side : 3600 pa ; back side :1600 pa ;safe factor:1.5) by the qualified third party institution , Also can be mounted using the following methods base following descriptions:

Note: All installation methods herein are only for reference, and Ulica solar will not provide related BOS components, the system installer or trained professional personnel must be responsible for the PV system's design, installation, and

mechanical load calculation and security of the system.)

- Using corrosion-proof screws (M8) in the existing installing holes in the module frame.
- Using suitable module clamps on the long side of the module frame to mount the modules (“portrait orientation”).
- Using suitable module clamps on the short side of the module frame to mount the modules (“landscape orientation”).
- Generally, the positive and negative load capacity of each clamping positions should be over 900Pa and 400Pa respectively. And the positive and negative load capacity of each bolting positions should be over 450Pa and 200Pa respectively.

3.3.2 Bifacial Module Mechanical Installation

Modules and mounting system can be connected by bolts, clamps or embedded systems. Installation shall follow the demonstration and suggestions below. If installation mode is different, please consult Ulica and obtain approval. Otherwise, modules could be damaged and quality warranty will be invalid.

3.3.2.1 Bolts Mounting.

Apply bolts to fix modules on the bracket through mounting holes on the back frame. See details in Figure 1. A is the overlapping size of module frame and bracket.

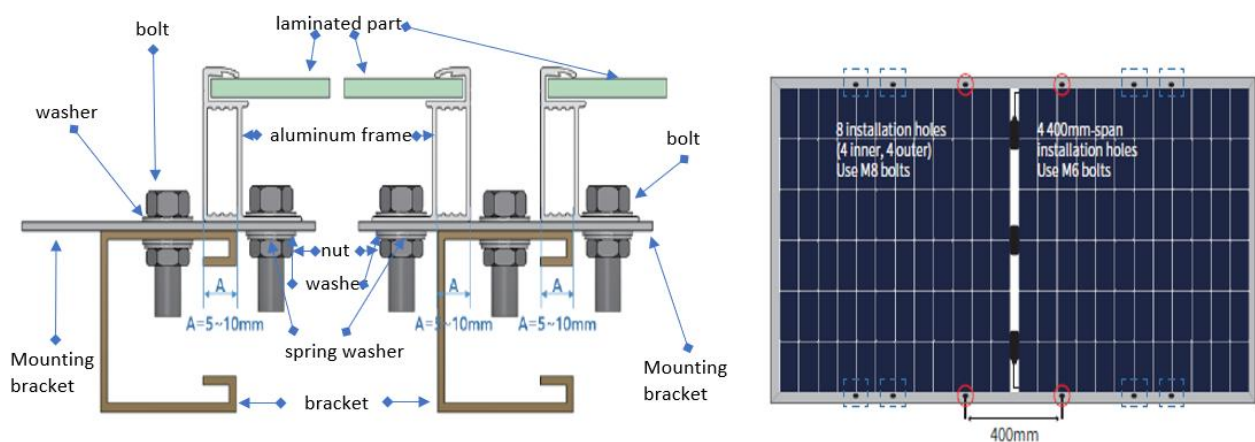


Figure 1 Bolt Installation of Bifacial Module



Figure 2 Sketch Map of Installation of Bifacial Module

Recommended accessories are as below :

Accessories	Model	Material	Note
Bolt	M8 (full thread recommended)	M6 (full thread recommended)	Accessories material selection should be based on application environment.
Washer	2*8	2*6 (6.4*18-1.6 ISO 7093)	
Spring Washer	8	6	
Nut	M8	M6	

Table 1 Recommended accessories for installation of Bifacial Module

Suggestions :

- (1) M8 bolt tightening torque range: 14N•m-18N•m; M6 bolt tightening torque range: 8N•m-12N•m;
- (2) When using Ulica 30mm (30H) height frame module, it is recommended to select $L \leq 20\text{mm}$ length fasteners. (If there is a special model, consult Ulica customer service).

3.3.2.2 Clamps Installation

See details in Figure 3.

The clamp shall not be in touch with glass or deform module frame in any case. The interface of the clamp and frame front side shall be flat and smooth to prevent frame and module being damaged.

Avoid the shadow blocking effect of the clamp.

The drain hole cannot be blocked by the clamp. For framed PV module, the clamp must maintain an overlap of at least 8 mm but no more than 11 mm with the frame of the module (you can change the cross section of the fixture if the module is securely installed). For frameless PV module, the clamp must maintain an overlap of 15 mm at maximum with the module.

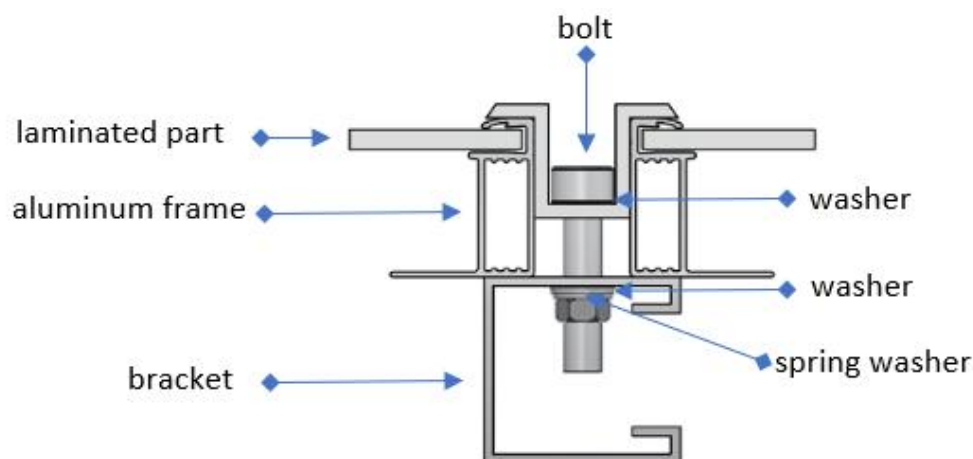


Figure 3 Clamp Installation of Bifacial Module

3.3.2.3 Installation and Mechanical Load of Bifacial Module

Bifacial modules can be installed with bolts into 4 outer installation holes, bolts into 4 inner installation holes, bolts into 400mm-span installation holes, and fixtures. Detailed installation positions and corresponding load capacities are shown in the table below.

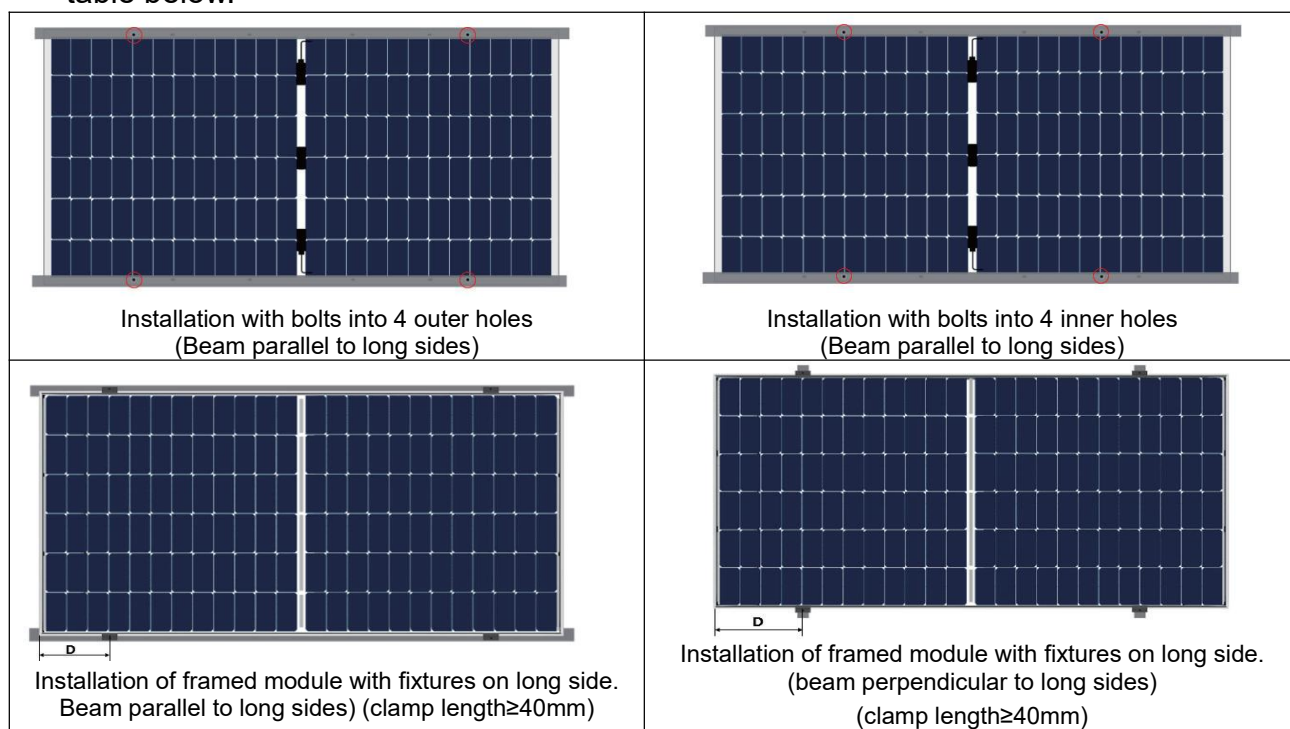


Figure 4

Load capacities of Dual-Glass modules:

Installation Method Module Type	Installation with bolts		Installation with fixtures	
	Installation with bolts into 4 outer holes (Beam parallel to long sides)	Installation with bolts into 4 inner holes (Beam parallel to long sides)	Installation of framed module with fixtures on long side. Beam parallel to long sides) $1/4L-50 \leq D \leq 1/4L+50$ (Beam parallel to long sides)	Installation of framed module with fixtures on long side. (beam perpendicular to long sides) . $1/4L-50 \leq D \leq 1/4L+50$ (beam perpendicular to long sides)
UL-440M-96DDGN UL-450M-96DDGN UL-460M-96DDGN UL-450M-108BDGN UL-455M-108BDGN UL-500M-108DDGN UL-510M-108DDGN UL-515M-108DDGN UL-520M-108DDGN UL-505M-120BDGN	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa

UL-595M-144ADGN				
UL-620M-132DDGN	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa	static mechanical load test on front side : 5400Pa on back side : 2400Pa
UL-625M-132DDGN				
UL-630M-132DDGN				
UL-635M-132DDGN				
UL-710M-132DGN				
UL-720M-132DGN				
UL-725M-132DGN				
UL-730M-132DGN				

3.4 roof mounting

Consult your local authority for guidelines and requirements for building or Structural fire safety.

3.4.1 Roof constructions and installations may affect the fire safety of a building; improper installation may create hazards in the event of a fire.

3.4.2 Use components such as ground fault circuit breakers and fuses as required by local authority.

3.4.3 Do not use panels near equipment or in places where flammable gases may be generated.

3.4.4 The modules have been rated Fire Class C, and are suitable for mounting on to a Class A roof.

4. Electrial Installation-Wiring And Notes

4.1 Bypass Diodes

When modules in series are partially shaded, it may cause reverse voltage across cells or modules, this may cause undesirable heating to occur. The use of a diode to bypass the shaded area can minimize both heating and array current reduction.

All Ulica modules are equipped with factory installed bypass diodes. The factory installed diodes provide proper circuit protection for the system.

When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses. Diodes that are used as bypass diodes must:

Have a Rated Average Forward Current above maximum system current at highest module operating temperature.

Have a Rated Repetitive Peak Reverse Voltage above maximum system voltage at lowest module operating temperature.

4.2 Correct wiring scheme

To minimize the risk of indirect lighting strike, avoid forming closed loops when designing the system. Check that wiring is correct before starting the generator. If the measured open circuit voltage (Uoc) and short-circuit current (Isc) differ from the specifications, there may be a wiring fault.

4.3 Correct connection plug connectors

4.3.1 The area of the cable matched with the connector is recommended to be 4~6 mm² , length: 900mm ,temperature range:-40℃-90℃. Connectors should only be used to connect the circuit, but never used to turn the circuit on or off.

4.3.2 PV modules have a pair of male and female waterproof connectors. For a series electrical connection, connect positive (+) connector of first PV module to the negative (-) connector of the following module.

4.3.3 Do not short the positive and the negative of a single PV module. Do not disconnect under load. Be sure connectors have no gap between the insulators. A gap can cause fire hazard and/or danger of an electrical shock. Make sure that the connection is safe and tight. The plug connector should not receive external stress

4.3.4 Field-wiring connectors shall only be mated with connectors of the same manufacturer, type and rating

4.3.4 , Reference to page 11 of this instruction for designated mating connectors

4.4 Use of proper components

Use cable extensions and plugs that are designed for outdoor applications. Ensure that they are in good electrical and mechanical condition. Only cables with one conductor are to be used. The wires are connected to the connector provided by crimped connection

Ensure that all materials meet the requirements of the systems' maximum voltage, current, moisture, and temperature when they are exposed to sunlight.

Under normal conditions, a photovoltaic module is likely to produce more current and/or voltage than that reported under Standard Test Conditions. Accordingly, the values of Isc and Voc marked on the module should be multiplied by a factor of 1.25 when selecting electrical components voltage ratings, conductor capacities, fuse type, and type of control components connected to the PV output. Refer to Section 690-8 of the U.S.National Electric Code for an additional multiplying factor of 1.25 which may be applicable.

The maximum series fuse rating is 25A (modules with ulica 182x91 cells) or 25A (modules with ulica 182.2x94 cells) or 25A (modules with ulica 182.2x105 cells) or 30A (modules with ulica 210x105 cells). And the maximum reverse current is known as series fuse rating multiplied by a factor of 1.35.

Each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified.

4.5 Connect between wire and connector

4.5.1 Use wire stripper to peel off the wire jacket. The length of wire stripping is 7.0±1.0mm. There is no copper break .Detail as following left two figures



wire stripper



crimping plier

4.5.2 The first put the pin (or socket) U shape on the crimping pliers jaw, the cable peeled on the pin (or socket) u, put in the end, the line of skin tight U shaped opening, and then pressed until the crimping pliers crimping pliers can be free to loosen.(Or use the precision press), Crimping Force $\geq 310\text{N}$.

4.5.3 Push the pin into the negative plastic part (Push the socket into the positive plastic part)which will a voice of clicking. The cable will not take off when pull out lightly. Turn a half circle clockwise. The positive and negative parts can move without obstacles and freely rotate in place. Details as following figures



Pin



socket

4.5.4 The tool 1 is fixed to the negative pole plastic part and Using the tool 2 clockwise to tighten the nut. Torque is $2.0\sim 3.0\text{Nm}$.



Tool 1

Tool 2



4.5.5 Reference distance as following



4.6 Others

During installation, be sure to tie the cable from the junction box to the mounting substructure with nylon line, etc. to avoid direct contact of the cable with the back surface of the module.

5. GROUNDING METHOD

Adopting the grounding hole method (as Fig 5); the peripheral electrophoresis coating of grounding hole is wiped off. When mounting, you can select 8# stainless steel screw to well connect copper wires (diameter 4mm) and modules. The torque rating of screw is 1.2N·m at least. Then, copper wires should be connected with grounding wires.

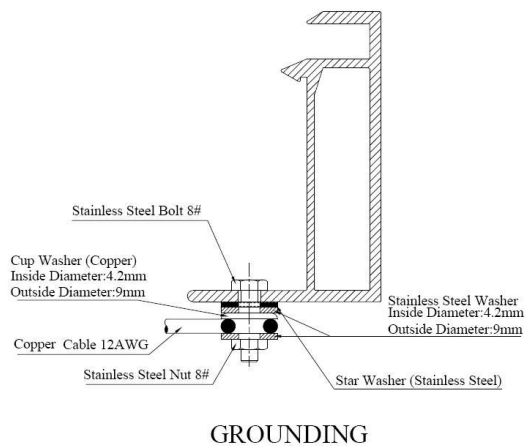


Fig 5

Declarations:

- ① Each module has two grounding holes . The symbol is located adjacent to the terminal () . The grounding point must be installed separately from the mechanical mountings.
- ② We apply a highly visible warning label regarding electrical shock hazard (see Fig. 6) near the means of connection on every single module.



Figure 6

- ③ The following mentioned are the conditions of the application class A:
The modules are qualified for Application Class A: Hazardous voltage (IEC 61730: higher than 50VDC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (Modules qualified for safety through EN IEC 61730-1 and -2 within this application class are considered to meet the requirements for Safety Class II.)

6. Figure 7 shows a schematic diagram of a cross-section of a photovoltaic module.

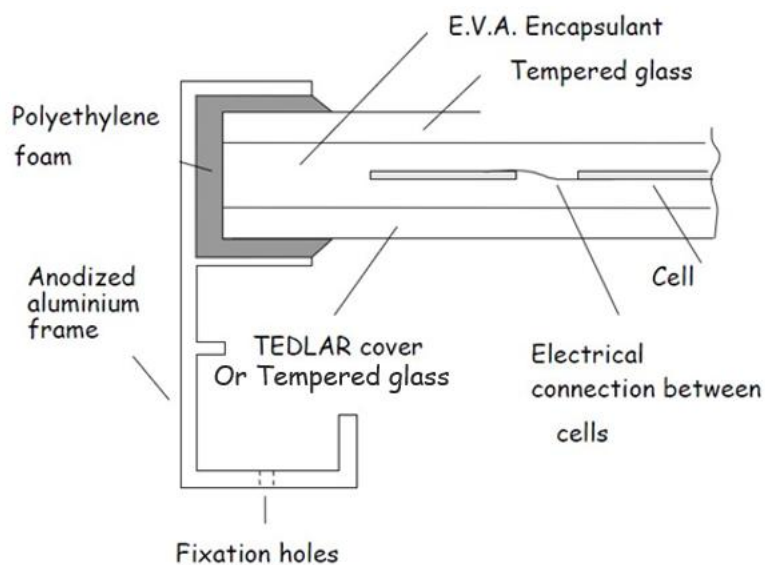


Figure 7

7. Electrical parameter

Type	Pmax (W) ±3%	Vm	Im	Voc (V) ±3%	Isc(A) ±3%	Module dimension (mm)	Cell dimension (mm)	Array (pcs)	Wei ght (kg)	Junction box type/supplier	Bypass Diode Model	Connector type/Supplier	Cable type/supplier
UL-440M-96DDGN	440	29.21	14.89	34.70	15.95	1762x1134x30	182.2x94	6x8x2	24.6	JM07w	RT3550	PV-JM608	62930 IEC 131
UL-450M-96DDGN	450	29.61	15.20	35.14	16.10	1762x1134x30	182.2x94	6x8x2	24.6	Zhejiang		Zhejiang	1×2,5...6mm2
UL-460M-96DDGN	460	29.85	15.41	35.36	16.23	1762x1134x30	182.2x94	6x8x2	24.6	Jiaming		Jiaming	Zhejiang
UL-450M-108BDGN	450	33.22	13.55	39.78	14.38	1762x1134x30	182x91	6x9x2	24.8		35SQ045/ MK3045/ MK4045/ MK5045	PV-ZH202B	Zhejiang
UL-455M-108BDGN	455	33.42	13.61	39.98	14.45	1762x1134x30	182x91	6x9x2	24.8	PV-ZH011C-5		Zhejiang	62930 IEC 131
UL-500M-108DDGN	500	33.17	15.08	39.83	15.96	1961x1134x30	182.2*105	6x9x2	27.6	ZH011C-5M		Zhonghuan	1×4.0mm2
UL-510M-108DDGN	510	33.47	15.24	40.16	16.08	1961x1134x30	182.2*105	6x9x2	27.6	Zhejiang			Zhejiang
UL-515M-108DDGN	515	33.57	15.34	40.22	16.12	1961x1134x30	182.2*105	6x9x2	27.6	Zhonghuan			Zhonghuan
UL-520M-108DDGN	520	33.67	15.44	40.26	16.16	1961x1134x30	182.2*105	6x9x2	27.6			PV-CY20L	
UL-505M-120BDGN	505	37.18	13.58	43.98	14.54	1952x1134x30	182x91	6x10x2	27.5	PV-CY21xyz	30SQ045-SL	Zhejiang	62930 IEC 131
UL-595M-144ADGN	595	44.55	13.36	52.92	14.06	2278*1134*30	182x91	6x12x2	31.2	Zhejiang		Chuangyuan	1×4.0mm2
UL-620M-132DDGN	620	40.90	15.16	49.08	16.08	2382*1134*30	182.2*105	6x9x2	33.6				Zhejiang
UL-625M-132DDGN	625	40.98	15.25	49.12	16.10	2382*1134*30	182.2*105	6x9x2	33.6	Chuangyuan		PV-JM608	Chuangyuan
UL-630M-132DDGN	630	41.08	15.34	49.15	16.15	2382*1134*30	182.2*105	6x9x2	33.6		GF2045A GF3045B GF4045BPD	Ningbo Ulica	
UL-635M-132DDGN	635	41.21	15.41	49.18	16.18	2382*1134*30	182.2*105	6x9x2	33.6	RT-00X			62930 IEC 131
UL-710M-132DGN	710	40.84	17.38	48.82	18.40	2384*1303*33	210x105	6x11x2	38.3	Jiangsu Ruitu			1×4.0mm2
UL-720M-132DGN	720	41.20	17.48	48.98	18.44	2384*1303*33	210x105	6x11x2	38.3				Zhejiang
UL-725M-132DGN	725	41.30	17.55	49.03	18.50	2384*1303*33	210x105	6x11x2	38.3				Changzhou
UL-730M-132DGN	730	41.40	17.63	49.13	18.58	2384*1303*33	210x105	6x11x2	38.3	PV-XT1609Nx yz	XT4050M-B XT4550M-B XT5050M-B	PV-XT101.2 Suzhou Xtong	Ruiyuan
										Suzhou Xtong		PV-KST4-EVO2A/xy, PV-KBT4 EVO2A/xy Stäubli Electrical connectors AG	62930 IEC 131
													1×4.0mm2
													Suzhou Xtong

Note:

The electrical characteristics above are within ± 3 percent of the indicated values of I_{sc} , V_{oc} and P_{max} under standard test conditions (irradiance of 100 mW/cm^2 , AM1.5 spectrum, and a cell temperature of 25°C)

- Safety Standard for Electrical Installations, please refer to national building codes and safety requirements.

8. Suggested maximum number of modules in parallel and in series

When designing the system, we recommend that the maximum number of modules in parallel should be no more than two while the maximum number of modules in series no more than the quantity

Cell quantity /module	Maximum number of modules in series (1500V)
UL-440M-96DDGN	34
UL-450M-96DDGN	34
UL-460M-96DDGN	33
UL-450M-108BDGN	30
UL-455M-108BDGN	30
UL-500M-108DDGN	30
UL-510M-108DDGN	29
UL-515M-108DDGN	29
UL-520M-108DDGN	29
UL-505M-120BDGN	27
UL-595M-144ADGN	33
UL-620M-132DDGN	24
UL-625M-132DDGN	24
UL-630M-132DDGN	24
UL-635M-132DDGN	24
UL-710M-132DGN	24
UL-720M-132DGN	24
UL-725M-132DGN	24
UL-730M-132DGN	24

9. Battery

When solar modules are used to charge batteries, the battery must be installed in a manner which will protect the performance of the system and the safety of its users. The battery should be away from the main flow of people and animal traffic. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which is explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for the purpose.

10. Maintenance and cleaning

- Do not replaced the PV components (diode, junction box, plug connectors) by user or Non-professionals
- Given a sufficient tilt (at least 15°), it is not generally necessary to clean the modules (rainfall will have a self-cleaning effect). In case of heavy soiling (which will result in output reductions), we recommend cleaning the modules using plenty of water (from a hose) without cleaning agents and using a gentle cleaning implement (a sponge). Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratched. We recommend that the system be inspected at regular intervals.
- All fastenings are tight and secure and free of corrosion.
- All cable connections are secure, tight, clean and free of corrosion.
- Cables are not damaged in any way.
- Checking the earthing resistively of metals.
- Module T98 max rating is 70°C , be careful of your body during maintenance

11. Danger of death from electric shock!

Solar modules generate electricity as soon as they are exposed to light. One module on its own is below the safety extra low volt level, but multiple modules connected in series (summing the voltage) or in parallel (summing the current) represent a danger. The following points must be observed when handling the solar modules to avoid the risk of fire, sparking and fatal electric shock.

- **Do not insert electrically conducting parts into the plugs or sockets!**
- **Do not fit solar modules and wiring with wet plugs and sockets!**
- **Exercise utmost caution when carrying out work on wiring and safety equipment (use insulated tools, insulated gloves, etc.)!**
- **Do not use damaged modules! Do not dismantle modules! Do not mark on the rear of the module using sharp objects!**
- **Exercise utmost caution when working on wiring and the inverter. Be sure carefully to follow manufacture's installation instructions!**

Danger of death from arcing !

Modules generate direct current when light shines on them. An arc may be produced when connections are separated. We therefore recommended covering modules with a lightproof cloth during installation. When breaking a connected string of modules (e.g. when disconnecting the DC line from the inverter under load), a lethally strong arc can occur:

- **Never disconnect the solar generator from the inverter while the inverter is connected to the mains grid—remove the fuse from the AC side on the inverter first!**
- **Ensure cable connections in perfect condition (no splitting, soiling or other contamination)!**

Remark: all size are based in mm unit, and the tolerance is +/- 2 mm

12.Handle safety and Transport

12.1 Do not lift the module by grasping the module's junction box or electrical leads.

12.2 Do not stand, step or walk on any side of the module.

12.3 Do not drop the module or allow objects to fall on the module.

12.4 Do not place any heavy objects on the module.

12.5 Be cautious when placing the module down onto a surface, particularly when placing it in a corner.

12.6 Inappropriate transport and installation may break the module and void the warranty.

12.7 Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.

12.8 Do not apply paint or adhesive to the module top surface or backsheet.

12.9 Don't hit the module or it's package during handle and transport.

12.10 Do not drill holes in the frame. This may compromise the frame strength, cause corrosion of the frame and void the warranty.

12.11 Do not scratch the anodized coating of the frame (except for grounding Connection) . It may cause corrosion of the frame or compromise the frame strength.

12.12 Do not stamp on the front and back of the modules.

12.13 A panel with broken glass or torn backsheet cannot be repaired and must not be used since contact with any panel surface or the frame can cause an electric shock.

12.14 Work only under dry conditions, and use only dry tools. Do not handle panels under wet conditions unless wearing appropriate protective equipment.

12.15 When storing uninstalled panels outdoors for any period of time, always cover the panels and ensure that the glass faces down on a soft flat surface to prevent water from

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