

TM Series[®] Installation Manual



1 Purpose of this manual

First, thank you very much for choosing TM Series® PV modules (hereinafter referred to as "modules"). The purpose of this manual is to provide users with relevant information on how to use TM Series® PV modules correctly.

The installer must first read and understand the contents of this manual before installation and if in any doubt, please contact our technical department for further information. The contractor must observe the safety precautions in this manual as well as local laws and regulations during the installation of the modules.

Please keep this manual in a safe place for future a reference (maintenance and servicing) or for the possible sale and disposal of the modules.

1.1 Applicable products

This manual is applicable to the following model series of module products.

Type1	TM-525B-144HC-TM-545B-144HC
Type2	TM-480B-132HC-TM-500B-132HC
Type3	TM-435B-120HC-TM-455B-120HC
Type4	TM-395B-108HC-TM-410B-108HC
Type5	TM-420B-144HC-TM-450B-144HC
Type6	TM-375B-132HC-TM-410B-132HC
Type7	TM-340B-120HC-TM-375B-120HC
Type8	TM-380B-144HC-TM-415B-144HC
Type9	TM-315B-120HC-TM-345B-120HC
Type10	TM-525M-144HC-TM-545M-144HC
Type11	TM-480M-132HC-TM-505M-132HC
Type12	TM-435M-120HC-TM-460M-120HC
Type13	TM-395M-108HC-TM-415M-108HC
Type14	TM-440M-144HC-TM-455M-144HC
Type15	TM-405M-132HC-TM-415M-132HC
Type16	TM-365M-120HC-TM-380M-120HC

2. Security

2.1 General principles of safety

- Module application class A can be operated in systems with a total design access capacity of more than 50V DC or 240W. The modules comply with the relevant safety standards in IEC 61730 and IEC 61730-2 and meet the requirements of safety class 11 under this application class.

- Modules should be properly earthed in accordance with the requirements in this guide or the National Electrical Code. The installation of modules must be carried out by qualified personnel and the electrical connections must be carried out by a licensed electrician and in accordance with local legislation (e.g., NEC in the USA or CEC in Canada).
- The risk of injury to which installers may be exposed during installation includes, but is not limited to, the risk of electric shock.
- A single module in direct sunlight may generate a voltage of more than 30V, and exposure to a voltage of more than 30V is potentially dangerous.
- Designed for outdoor use, the modules convert light energy directly into DC electricity. Modules can be installed in a variety of locations such as on the ground, on a roof, in a vehicle or on a boat, and it is the responsibility of the system designer and installer to design a suitable support structure.
- Do not use a reflector or magnifying glass to focus sunlight on the modules.
- The installation of modules must comply with local land national laws and regulations and, if necessary, require a building permit.
- Only use equipment, connectors, cables and support brackets that are compatible with the modules.
- Do not use corrosive chemicals to wipe modules.

2.2 Handling safety

- Do not carry modules by means of holding module junction boxes or leads.
- Do not stand and walk or place heavy objects on the modules.
- Do not drop modules or allow objects to fall onto the module.
- Care must be taken during the movement, transport and installation of the modules.
- Do not attempt to disassemble the modules or remove any nameplates or accessories attached to the modules.
- Do not apply paint or adhesives to the upper surface of the module. Do not rub or tap on the back of the module.
- Do not drill holes in the module bezel as this will result in a reduction in the mechanical strength of the bezel and a hidden crack in the cell due to vibration.
- Do not damage the anodized surface of the bezel (except for grounding). This will lead to corrosion of the bezel.
- Do not use modules that pose a risk of electric shock due to broken glass or a torn back panel.
- Do not move modules in wet conditions unless proper protective measures have been taken.

- Do not expose modules to sunlight before installation to avoid unnecessary decay.
- During all handling and transport, ensure that the modules are not subjected to severe vibrations which may cause the cells inside the module to crack or damage the module.

2.3 Installation safety

- The installation should comply with IEC standards and safety standards for electrical installations.
- Do not disconnect modules with a load.
- Do not touch the conductive part of the module whether it is connected or not, as this may cause sparking burns and fatal electrical shocks.
- Do not touch modules during installation if not necessary.
- Do not carry out installation work in rainy, snowy or windy weather.
- Do not expose the module to artificial light and use an opaque material to completely cover the surface of the module during installation to prevent current generation.
- Do not wear metal rings, watch straps, ears, nose, lip rings or other metal objects during installation and maintenance.
- Use only insulated tools permitted for electrical installation.
- Observe safety regulations for all other system accessories including cables, connectors, load regulators, inverters, batteries, rechargeable batteries, etc.
- Under normal outdoor conditions, the currents and short-circuit currents generated by the modules may differ from the data in the product data sheet. When designing the system, the current and short circuit current should be multiplied by a factor of 1.25 for the selection of other accessories.
- Only use connectors that are compatible with the module connectors. Removal of the connectors without prior authorization will invalidate the terms of the warranty.
- Do not expose modules to sunlight before installation to avoid unnecessary decay.
- Do not install modules within 50m of the coastline.
- Components installed at an altitude of less than 2000m.
- Mechanical load tested: Positive 3600pa 1.5; Negative 1600pa 1.5.
- Temperature coefficient: Refer to third-party inspection reports.

2.4 Fire safety

- Do not expose modules to sunlight before installation to avoid unnecessary decay.
- Comply with local laws and regulations during the installation of modules.
- Fire Safety Class: Class A. Class B. Class C

3 Modules identification

- Each module has three bar code stickers, a unique serial number and a nameplate sticker.

Barcode 1: laminated inside the module.

Barcode 2: pasted on the back of the module.

Barcode 3: pasted in the center of the long side of the border.

- Name plate: Attached to the back of the module and contains the characteristics of the module.

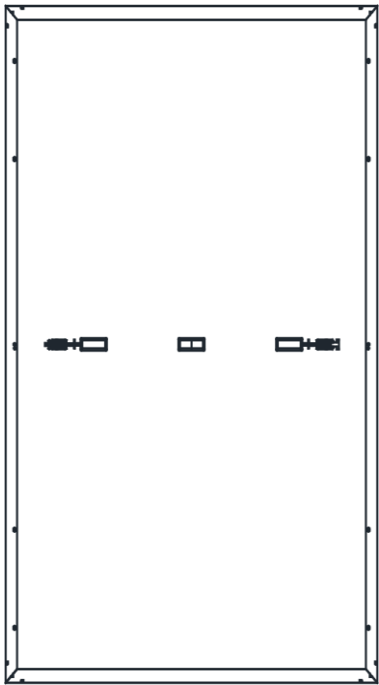
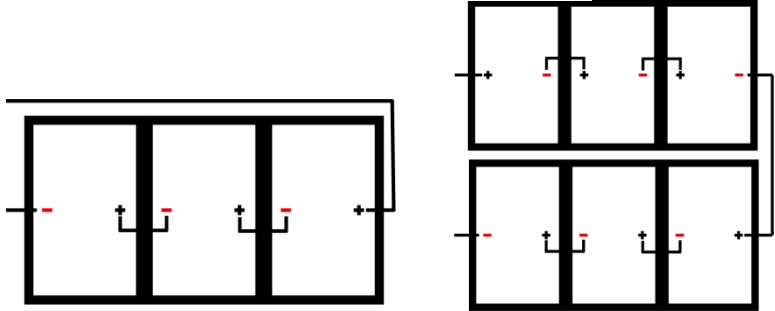
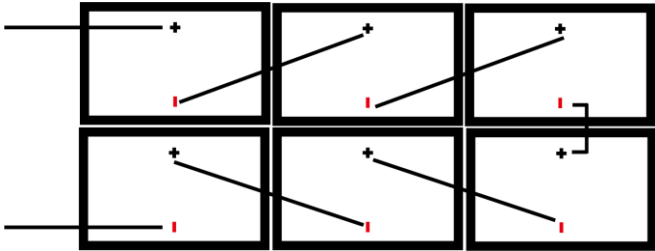
Please check that the serial number on the barcode corresponds to the packing list when opening

the box. When you require support from TAMESOL for a specific module, please provide the serial number of your module.

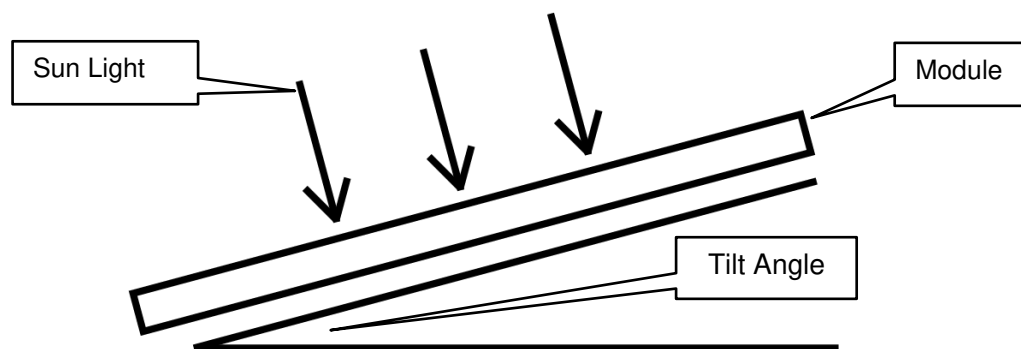
4 Mechanical installation

4.1 General rules for mechanical installation

- Modules support horizontal and vertical installation.

Junction Box Location Icon	Recommended Wiring Method
	<p data-bbox="735 1099 1018 1133">Horizontal Installation:</p>  <p data-bbox="715 1507 962 1541">Vertical Installation:</p> 

- It is recommended that modules of the same size and specification are used within the same PV array.
- Modules should be mounted at a sufficient height to keep them away from potential obstructions, flying sand, snow and water.
- It is recommended that the modules are installed at least 30cm above the ground to ensure ventilation. An appropriate mounting structure should be selected to meet the required mechanical loads.
- It is recommended to install the modules at a minimum inclination of 10 degrees to ensure that dust can be easily washed off.

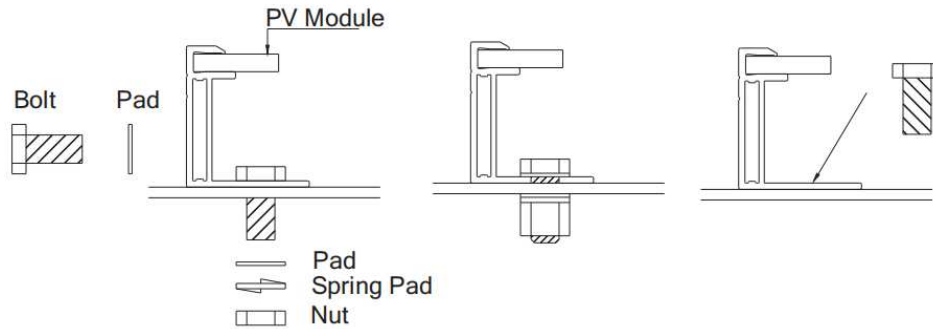


- It is recommended to leave a minimum of 10mm clearance between modules to prevent thermal expansion and contraction of the material.
- The modules should be properly installed according to the corresponding mechanical load requirements.

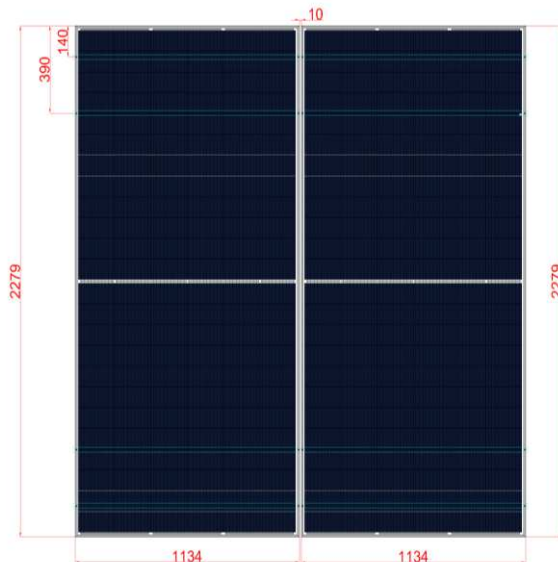
4.2 Selection of position and angle

- PV Modules can be mounted as following method:
- Using corrosion-proof screws (M8 or M6) on the existing installing holes in the Module frame, see drawing 1 and 4.
- Using insertion systems.
- The frame of each Module has 8 mounting holes (14mm*9mm or 10mm*6.5mm) used to secure the Modules to supporting structure.
- The Module frame must be attached to a supporting structure using M8(M6) stainless steel hardware together with spring washers and flat Washers in eight places symmetrical on the PV Module. The applied torque is about 14 Newton-meters ~ 20 Newton-meters.

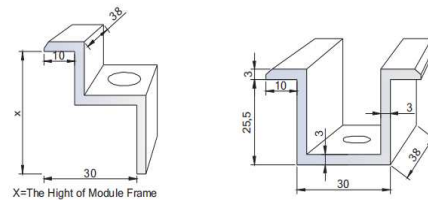
- Recommended distance between 2 Solar Modules is 1 cm considering linear thermal expansion of the Module frames.



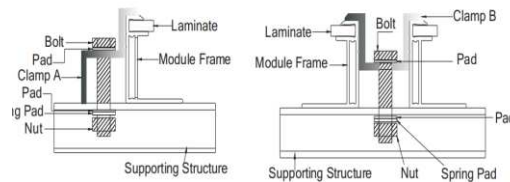
Drawing 1 Drawing of Cross Section of Screw Mounting



Drawing 2 Module Mounting Drawing (with screws)



Drawing 3 Clamp A & B Elevation



Drawing 4 Drawing of Cross Section of Clamp Mounting

PV Modules can be mounted as following method:

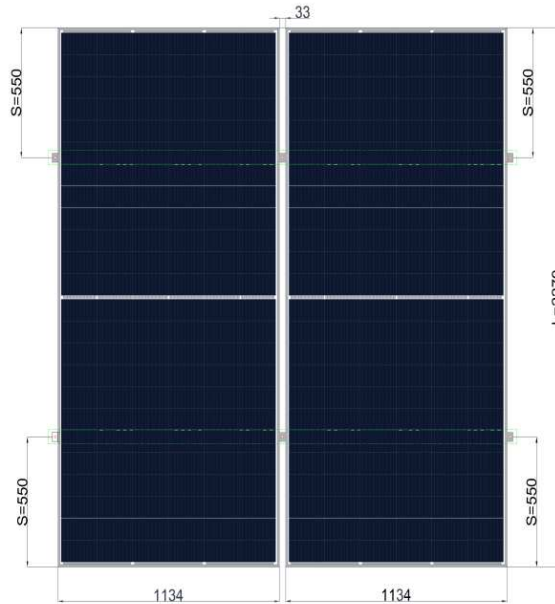
Using suitable Module clamps on the Module frame, see drawing 3,4 and 5.

-Using insertion systems.

The Module frame must be attached to a supporting structure by metal clamps. The applied torque is about 14 Newton-meters ~ 20 Newton- meters. The Module clamps must not meet the front glass and must not deform the frame. Avoid shadowing effects from the Module Clamps and the insertion systems. It is not permitted to modify the Module frame under any circumstances.

Notes (about clamp): Width: No less than 38mm; Thickness: No less than 3mm.

Material: Aluminium Alloy; Bolt: M8 or M6.



L=The Length of Module, $0 < S \leq 1/4L$

Drawing 5 Module Mounting Drawing (with clamping clips)

4.3 Electrical installation



Warning, electric shock hazard

This module will generate current when exposed to light. Please observe all applicable electrical safety measures.

All wiring should be performed, by qualified installers, in accordance with the local codes and regulations.

Modules can be connected in series to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules, always ensure that the contacts are corrosion free, clean and dry.

Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings, then check the string configuration before making the connection.

Solar modules are provided with stranded copper cables with a cross sectional area of 4 mm²(0.006in²) which are UV resistant. All other cables used to connect the DC system should have a similar (or better) specification. TAMESOL recommends that all cables are run in appropriate conduits and sited away from areas prone to water collection.

The maximum voltage of the system must be less than the maximum certified voltage and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To

ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done using the following formula.

Max System voltage $\geq N * Voc * [1 + TCvoc * (Tmin-25)]$

N Number of modules in series

Voc Open circuit voltage of each module (refer to product label or data sheet)

TCvoc Thermal coefficient of open circuit voltage for the module (refer to data sheet)

Tmin The lowest expected ambient temperature

If modules are connected in series, the total voltage is equal to the sum of individual voltages. The recommended max.

number of module (N) = $V_{max\ system} / [Voc\ (at\ STC) \times 1.25 \times 1.25]$

Each module has two industry standard 90°C sunlight resistant output cables, each terminated with plug & play connectors. The PV Wire cable are 12AWG in size. This cable is suitable for applications where wiring is exposed to direct sunlight. TAMESOL requires that all wiring and electrical connections comply with the appropriate National Electrical Code.

The minimum and maximum outer diameters of the cable are 5 to 7mm (0.038 to 0.076 in).

For field connections, use at least 4mm² copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV Wire.

The minimum bending radius of the cables must be 43mm (1.69in).

4.4 Grounding

Where universal grounding modules (nuts, bolts, star washers, lock washers, flat washers and similar parts) are used to connect the grounding/connection devices shown, the fittings used must be made in accordance with the requirements of the grounding equipment manufacturer.

Please refer to local and national safety and electrical codes for the required grounding and connection requirements. If grounding is required, please provide the recommended type of connector or equivalent for the earth wire.

If grounding is required, the grounding wire must be properly fixed on the assembly frame to ensure the required electrical connection (the grounding hole is shown in Figure 4).

5 Maintenance

Clean module glass surfaces regularly with water and a clean sponge or cloth, and use a mild, non-abrasive cleaner to remove stubborn dirt. It is not recommended to use water containing minerals to clean modules.

Check electrical, grounding and mechanical connections every six months to ensure they are clean, safe, undamaged and not corroded. If you have any questions, please consult a professional.

Pay attention to carefully read the introduction of all modules used in the system, such as bracket, regulator, inverter and battery.

6 Parameters

Module parameters will be updated from time to time. Please visit our website (www.tamesol.com) for accurate parameters or consult our technical support team by email.

Note: This version of TUV installation manual will take effect from Jan 2022 until the new version is updated

Annex 1

Jumpers are required when any of the following conditions are met:

1. When the DC input terminal of inverter or combiner box is original MC4.
2. When the inverter or combiner box manufacturer requires that the series DC input bus terminal must be MC4.

Inspection before use:

1. Confirm the original MC4 connector and compatible MC4 connector of the jumper.
2. Make sure that the connector on the jumper is free from falling off, loosening, and the metal core is free from deflection or water stain.
3. Confirm that the cable insulation layer of jumper is not damaged, and the cable is not seriously bent and twisted.

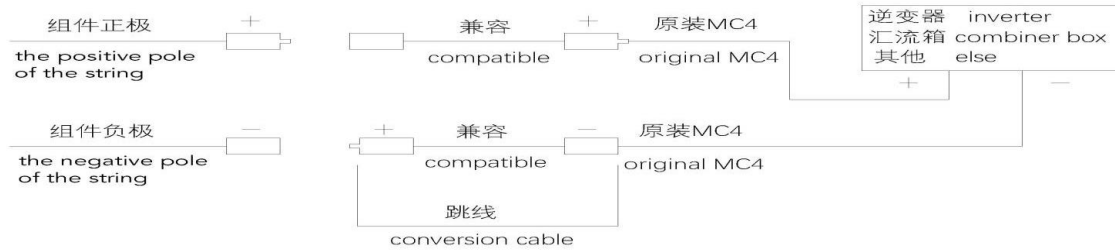
Jumper installation:

1. Installation position of jumper: the positive pole of the first piece of junction box cable in the string, the negative pole of the last piece of junction box cable in the string.
2. The positive end of the string is plugged into the negative end of the jumper (compatible) The other positive end of the jumper (original MC4) is connected to the positive DC input of the inverter or the busbar.
3. The negative terminal of the string is inserted into the positive terminal of the jumper (compatible). The other negative terminal of the jumper (original MC4) is connected to the negative DC input of the inverter or the busbar.

The schematic diagram is as follows:

Note:

1. Ensure that the polarity of the connected string is consistent with that of the inverter or combiner box.
2. When using, the installation and connection should be carried out strictly according to the schematic diagram, and the reverse operation should not be allowed.
3. Each set of strings on the DC side is limited to one pair of jumpers and must not be misused, e.g., as an extension cable for multiple connection.



Annex 2 Product Electrical Rating at STC

Module	Electrical Rating at STC				
	P _{max} (W)	V _{mp} (V)	I _{mp} (A)	V _{oc} (V)	I _{sc} (A)
TM-525B-144HC	525±3%	40.54	12.96	49.04±3%	13.40±3%
TM-530B-144HC	530±3%	40.69	13.03	49.19±3%	13.47±3%
TM-535B-144HC	535±3%	40.84	13.11	49.36±3%	13.55±3%
TM-540B-144HC	540±3%	41.03	13.17	49.47±3%	13.64±3%
TM-545B-144HC	545±3%	41.16	13.25	49.61±3%	13.72±3%
TM-480B-132HC	480±3%	37.25	12.89	45.02±3%	13.34±3%
TM-485B-132HC	485±3%	37.37	12.98	45.22±3%	13.40±3%
TM-490B-132HC	490±3%	37.50	13.07	45.29±3%	13.51±3%
TM-495B-132HC	495±3%	37.62	13.16	45.35±3%	13.62±3%
TM-500B-132HC	500±3%	37.76	13.25	45.52±3%	13.71±3%
TM-435B-120HC	435±3%	33.75	12.90	40.78±3%	13.35±3%
TM-440B-120HC	440±3%	33.88	12.99	40.95±3%	13.42±3%
TM-445B-120HC	445±3%	34.03	13.08	41.06±3%	13.53±3%
TM-450B-120HC	450±3%	34.18	13.17	41.21±3%	13.63±3%
TM-455B-120HC	455±3%	34.33	13.26	41.36±3%	13.73±3%
TM-395B-108HC	395±3%	30.37	13.01	36.74±3%	13.43±3%
TM-400B-108HC	400±3%	30.56	13.10	36.87±3%	13.55±3%
TM-405B-108HC	405±3%	30.73	13.19	37.07±3%	13.64±3%
TM-410B-108HC	410±3%	30.90	13.27	37.22±3%	13.74±3%
TM-420B-144HC	420±3%	40.24	10.45	48.39±3%	11.08±3%
TM-425B-144HC	425±3%	40.45	10.52	48.59±3%	11.15±3%
TM-430B-144HC	430±3%	40.65	10.59	48.78±3%	11.22±3%
TM-435B-144HC	435±3%	40.84	10.66	48.98±3%	11.30±3%
TM-440B-144HC	440±3%	41.02	10.73	49.19±3%	11.38±3%
TM-445B-144HC	445±3%	41.23	10.80	49.36±3%	11.47±3%
TM-450B-144HC	450±3%	41.39	10.88	49.49±3%	11.56±3%
TM-375B-132HC	375±3%	36.32	10.33	43.44±3%	11.13±3%
TM-380B-132HC	380±3%	36.52	10.42	43.64±3%	11.22±3%

TM-385B-132HC	385±3%	36.72	10.49	43.84±3%	11.29±3%
TM-390B-132HC	390±3%	36.92	10.57	44.04±3%	11.36±3%
TM-395B-132HC	395±3%	37.12	10.65	44.24±3%	11.43±3%
TM-400B-132HC	400±3%	37.17	10.77	44.46±3%	11.51±3%
TM-405B-132HC	405±3%	37.37	10.84	44.66±3%	11.57±3%
TM-410B-132HC	410±3%	37.55	10.93	44.86±3%	11.63±3%
TM-415B-132HC	415±3%	37.76	10.99	45.06±3%	11.69±3%

Module	Electrical Rating at STC				
	Pmax(W)	Vmp(V)	Imp(A)	Voc(V)	Isc(A)
TM-340B-120HC	340±3%	32.7	10.41	39.81±3%	10.92±3%
TM-345B-120HC	345±3%	32.93	10.51	40.01±3%	11.03±3%
TM-350B-120HC	350±3%	33.16	10.57	40.3±3%	11.08±3%
TM-355B-120HC	355±3%	33.39	10.65	40.54±3%	11.17±3%
TM-360B-120HC	360±3%	33.63	10.73	40.81±3%	11.25±3%
TM-365B-120HC	365±3%	33.87	10.79	41.09±3%	11.32±3%
TM-370B-120HC	370±3%	34.08	10.88	41.31±3%	11.41±3%
TM-375B-120HC	375±3%	34.26	10.95	41.54±3%	11.50±3%
TM-380B-144HC	380±3%	40.01	9.49	48.13±3%	10.17±3%
TM-385B-144HC	385±3%	40.24	9.57	48.5±3%	10.22±3%
TM-390B-144HC	390±3%	40.51	9.63	48.87±3%	10.27±3%
TM-395B-144HC	395±3%	40.81	9.68	49.17±3%	10.32±3%
TM-400B-144HC	400±3%	41.13	9.73	49.46±3%	10.37±3%
TM-405B-144HC	405±3%	41.42	9.78	49.77±3%	10.43±3%
TM-410B-144HC	410±3%	41.72	9.83	50.08±3%	10.48±3%
TM-415B-144HC	415±3%	41.98	9.88	50.32±3%	10.54±3%
TM-315B-120HC	315±3%	33.36	9.45	40.02±3%	10.08±3%
TM-320B-120HC	320±3%	33.58	9.53	40.23±3%	10.17±3%
TM-325B-120HC	325±3%	33.82	9.61	40.52±3%	10.24±3%
TM-330B-120HC	330±3%	34.1	9.68	40.8±3%	10.31±3%
TM-335B-120HC	335±3%	34.33	9.76	41.08±3%	10.39±3%
TM-340B-120HC	340±3%	34.59	9.83	41.32±3%	10.47±3%
TM-345B-120HC	345±3%	34.79	9.92	41.56±3%	10.55±3%

Module	Electrical Rating at STC				
	Pmax(W)	Vmp(V)	Imp(A)	Voc(V)	Isc(A)
TM-525M-144HC	525±3%	40.54	12.96	49.04±3%	13.40±3%
TM-530M-144HC	530±3%	40.69	13.03	49.19±3%	13.47±3%
TM-535M-144HC	535±3%	40.84	13.11	49.36±3%	13.55±3%
TM-540M-144HC	540±3%	41.03	13.17	49.47±3%	13.64±3%
TM-545M-144HC	545±3%	41.16	13.25	49.61±3%	13.72±3%

TM-550M-144HC	550±3%	41.29	13.33	49.72±3%	13.81±3%
TM-555M-144HC	555±3%	41.42	13.40	49.87±3%	13.88±3%
TM-480M-132HC	480±3%	37.25	12.89	45.02±3%	13.34±3%
TM-485M-132HC	485±3%	37.37	12.98	45.22±3%	13.40±3%
TM-490M-132HC	490±3%	37.50	13.07	45.29±3%	13.51±3%
TM-495M-132HC	495±3%	37.62	13.16	45.35±3%	13.62±3%
TM-500M-132HC	500±3%	37.76	13.25	45.52±3%	13.71±3%
TM-505M-132HC	505±3%	37.88	13.34	45.66±3%	13.80±3%

Module	Electrical Rating at STC				
	Pmax(W)	Vmp(V)	Imp(A)	Voc(V)	Isc(A)
TM-435M-120HC	435 ± 3%	33.75	12.90	40.78 ± 3%	13.35 ± 3%
TM-440M-120HC	440 ± 3%	33.88	12.99	40.95 ± 3%	13.42 ± 3%
TM-445M-120HC	445 ± 3%	34.03	13.08	41.06 ± 3%	13.53 ± 3%
TM-450M-120HC	450 ± 3%	34.18	13.17	41.21 ± 3%	13.63 ± 3%
TM-455M-120HC	455 ± 3%	34.33	13.26	41.36 ± 3%	13.73 ± 3%
TM-460M-120HC	460 ± 3%	34.48	13.35	41.51 ± 3%	13.83 ± 3%
TM-395M-108HC	395 ± 3%	30.37	13.01	36.74 ± 3%	13.43 ± 3%
TM-400M-108HC	400 ± 3%	30.56	13.10	36.87 ± 3%	13.55 ± 3%
TM-405M-108HC	405 ± 3%	30.73	13.19	37.07 ± 3%	13.64 ± 3%
TM-410M-108HC	410 ± 3%	30.90	13.27	37.22 ± 3%	13.74 ± 3%
TM-415M-108HC	415 ± 3%	31.07	13.36	37.34 ± 3%	13.86 ± 3%
TM-440M-144HC	440 ± 3%	41.02	10.73	49.19 ± 3%	11.38 ± 3%
TM-445M-144HC	445 ± 3%	41.23	10.80	49.36 ± 3%	11.47 ± 3%
TM-450M-144HC	450 ± 3%	41.39	10.88	49.49 ± 3%	11.56 ± 3%
TM-455M-144HC	455 ± 3%	41.55	10.97	49.62 ± 3%	11.65 ± 3%
TM-460M-144HC	460 ± 3%	41.69	11.05	49.75 ± 3%	11.76 ± 3%
TM-405M-132HC	405 ± 3%	37.37	10.84	44.66 ± 3%	11.57 ± 3%
TM-410M-132HC	410 ± 3%	37.55	10.93	44.86 ± 3%	11.63 ± 3%
TM-415M-132HC	415 ± 3%	37.76	10.99	45.06 ± 3%	11.69 ± 3%
TM-420M-132HC	420 ± 3%	37.94	11.07	45.26 ± 3%	11.75 ± 3%
TM-365M-120HC	365 ± 3%	33.87	10.79	41.09 ± 3%	11.32 ± 3%
TM-370M-120HC	370 ± 3%	34.08	10.88	41.31 ± 3%	11.41 ± 3%
TM-375M-120HC	375 ± 3%	34.26	10.95	41.54 ± 3%	11.50 ± 3%
TM-380M-120HC	380 ± 3%	34.43	11.06	41.77 ± 3%	11.61 ± 3%

Annex 3 Junction Box

Junction Box Module	Supplier
HTC-01	Qingdao Haitian Cheng Photovoltaic New Energy Co., Ltd.
LN-01	
Connector Type	Supplier
HTC-16	Qingdao Haitian Cheng Photovoltaic New Energy Co., Ltd
PV-KST4-EVO2/6II-UR (male)	Staubli Electrical Connectors AG
PV-KBT4-EVO2/6II-UR (female)	
Bypass Diode	Supplier
GFMK6045C	Yangzhou Yangjie Electronic Technology Co., Ltd.
GF5045	Panjit International Inc