1. General Information

This installation manual applies to the installation, maintenance and use of all Motech solar modules. Motech solar modules have passed EN/IEC-61730, and EN/IEC-61215 and other standards, and obtained third-party certification, in line with Class A, Safety Class II, fire rating class c requirements. Failure to follow the instructions in this manual may result in damage to modules or property, personal injury or death. Motech does not warrant the warranty of the relevant modules and does not recognize any liability.

2. Important Safety Information

Electric Shock and Burn Hazard
When the module is exposed to sunlight or other light sources, DC power is generated in the module. At this time, contact with the electrical part of the module may cause electric shock.
Do not use a mirror or lens to focus sunlight onto the solar module.

Fragile
Improper handling can easily damage solar modules, and do not bend or distort modules.
Do not stand or walk on the modules, puncture the front or rear sides of the assembly to avoid cracking of the solar cell. Do not lift or lift the module by grasping the cable on the junction box.

Application class

This module is rated as “Application class A” according to IEC61730.
class A applies to dangerous voltages and dangerous powers under normal conditions. Modules rated for use in this application class may be used in systems operating at greater than 50 V DC or 240 W, where general contact access is anticipated. Modules qualified as application class A in IEC 61730 are considered to meet the requirements for safety class II.

Fire rating

This module is rated as “Fire safety class C” according to IEC61730

Applicable height

modules are suitable for altitudes below 2000 metes. Nominal Module Operating Temperature is38℃to42℃.

For your safety and related considerations, please read this installation manual carefully before installing the modules and continue to use this information as a follow-up reference. There must be a professional knowledge of installing a solar system: the design of the system, the erection of modules, and wiring must be performed by trained, qualified, and authorized professionals.

3. Safe Work Practices

The weight range of solar modules ranges from 8.1 to 31.9 kg (the number of cells is 16 to 72). It requires multiple people or appropriate equipment to carry it to ensure safety and avoid injury.

Before installation, you should be knowledgeable with the principles of electricity and electrical equipment. Please use appropriate insulation tools and suitable protective equipment. When wiring, use the opaque material to completely block the front of the assembly and stop the power generation. When performing system work, disconnect the modules from other power sources: batteries, power grids, etc.

The front and the back of the solar module is semi-tempered glass. Although robust materials are used in the construction, the solar cells, glass, and backsheet may be damaged if the module is not properly handled and installed. Always use the container and stacking device provided for transportation and storage. Please store the modules before installation. Do not bend or distort solar modules. Do not step on or deliberately impact the module. Do not lift or lift the assembly by grasping the cable on the junction box. Do not drill holes in the frame without authorization from Motech, as it may cause corrosion or other negative effects.Do not use modules that have broken glass, which can cause electrical hazards (electric shock and fire). Broken modules cannot be repaired and must be replaced immediately. Wear gloves when handling to avoid injury from sharp objects or surfaces high temperature.

4. Unpacking and storage

4.1 Unpacking considerations

(1) Please read the Motech Unpacking Instructions carefully before the operation, and unpack the boxes in strict accordance with the requirements.

(2) It is forbidden to work under the rain when unpacking outdoors.

(3) If there is wind on the site, special attention should be paid to safety. Especially in the case of high winds, it is recommended not to carry the modules and properly fix the modules that have been unpacked.

(4) The working floor needs to ensure that the package can be placed horizontally and stably to avoid dumping.

(5) Wear protective gloves during unpacking to avoid injury and fingerprints on the glass surface.

(6) Each module requires two people to lift. When lifting the module, it is forbidden to pull the junction box, and it is forbidden to take the long edge to remove the module.

4.2 Storage considerations

(1) Modules should be stored in a dry and ventilated environment, protected from direct sunlight and moisture. If the modules are stored in an uncontrolled environment, the storage time should not exceed 3 months and additional measures are required to prevent the connectors from moisture or modules exposed to sunlight. it is recommended to store temperature: -20 ~ +40 ° C, relative humidity <85% RH.

(2) The packing box can be stacked in 2 layers, but please do not put the unpacked box on the lower layer; the box after removing several modules is not stable, please support or fix the module to prevent the package from rolling over.

(3) When storing the solar module, do not bend the solar module. Please keep the solar modules at the same flatness. Do not stack multiple modules horizontally.

(4) The place where the solar module is kept is basically indoor. If it has to be placed outdoors, please be careful to avoid water ingress or damage. It is recommended to protect it with tarpaulin.

5. Array Design Safety

Please confirm local licensing, installation and inspection requirements before installation. Need to comply with national electrical codes and regulations.

Implementation of the IEC-61730 standard: The maximum system voltage of the Motech solar modules connected in series is 1500 Vdc, and the 1500 V junction box can be selected. Do not exceed the specified maximum system voltage value.

Motech solar modules can produce the required output voltage and output current in series or in parallel. When the modules are connected in series, the output voltage of the whole series of modules is the sum of the voltages of each module; when the modules are connected in parallel, the output current of the whole series of modules is equal to the sum of the currents of each branch module or module string. When the maximum reverse current generated in parallel exceeds the maximum 15 amp fuse configured in the module string, each string of modules must be equipped with a fuse or overcurrent protection. It is then connected to other string modules to prevent the module string from being affected and damaged by reverse current. If necessary, install a blocking diode. Refer to local electrical regulations for parallel connection limits and overcurrent protection.

Under normal conditions, the current and voltage values generated by the module may be higher than the standard test conditions of the module. Therefore, when designing photovoltaic power system modules, such as rated voltage, wire capacity, fuse capacity or module power output related parameters, the corresponding short-circuit current and open circuit voltage should be amplified by 1.25 times. Restrictions on use: Do not install modules in an environment that is close to open flames or flammable materials, water immersion, salt spray corrosion, or any other corrosive environment; Do not use modules in systems without a system ground (i.e. floating or ungrounded systems) or in systems in which the positive string output (+) is tied to ground. Doing so will void the product warranty.

6. Electrical and Physical Ratings

The electrical and physical properties of the Motech solar modules are detailed in Appendix B and C, respectively. Under standard test conditions (irradiance 1000 W/m^2, air quality AM 1.5, cell temperature 25°C). Under normal use, the electrical performance parameters of the modules, such as Isc and Voc, are 5% to 10% deviation from those tested under standard test conditions.. The maximum output power range of the module is between -0% and +3% or ±3% of the rated value.

Bypass diodes is installed in the junction box of each module, and each bypass diode is connected to one-third of the cell string of each module. Bypass diodes are not user-maintainable materials. Do not remove them yourself or use modules without diodes.

In the array of charged solar modules, a blocking diode must be installed to prevent the solar module from being discharged from the battery bank that has been charged at night.

7. Equipment Ground

In order to use safety and protect modules from lightning and static electricity, all solar module frames and mounting brackets must be properly grounded in accordance with relevant national electrical codes. The ground wire can be copper, copper alloy or other material that can be used as a conductor and complies with electrical regulations. When grounding, the grounding device must be in full contact with the aluminum alloy inside the aluminum frame. The oxide film on the surface of the frame must be penetrated. Each grounding hole on the frame of the module is marked ⏚. All grounding devices must comply with relevant national regulations and usage requirements.

8. Module Mounting

Appendix D lists the fixed point locations, load levels, and their module models for reference; mechanical loads and safety must be completed by a professional system installer or experienced person.

The maximum power generated when the sun shines directly onto the solar module, in order to achieve the best output power of the module, first: choose an unobstructed location for a whole year, and secondly choose the appropriate installation angle. A rough estimate is that the installation of the optimal tilt angle is basically the same as the local latitude at the installation location. If the module is mounted on a roof or building wall, ,a fixed bracket must be used to keep the roof or wall at least 100 mm apart from the module for heat dissipation. Do not install directly on the roof or wall.

The mounting bracket is required to have sufficient strength to withstand all possible stress loads, including wind and snow.

Do not perform additional drilling on the frame of the module to avoid affecting the load carrying capacity of the module and the corrosion of the aluminum frame and the cracking of the module, thus affecting the service life of the module.。

9. wiring and connections

9.1 Wiring

a) Please read the operating manual of the solar system carefully before starting the installation. Use the multi-port connection line series or parallel solar modules according to the user's requirements for system power, voltage and current.
b) When connecting in series, the solar modules in the same gear position must be selected for connection. The total voltage generated by the modules connected in series cannot be higher than the maximum voltage allowed by the system. The maximum number of modules in series depends on the system design, inverter model and surrounding conditions.
c) Use special solar cables and suitable connectors according to local fire, construction and electrical codes (wires should be covered in ducts with UV aging resistance, and if exposed to air, they should have UV aging resistance) , and ensure that the electrical and mechanical properties of the cable are good.
d) Installation can only use single-wire solar cable, 2.5~16mm^2 (5~14AWG), 90°C grade, with proper insulation to withstand the maximum possible system open circuit voltage.

9.2 Connector connection

a）Make sure the connectors are tight and properly connected. The connector must not be subjected to external pressure. The connector can only be used for circuit connection functions and must not be used to turn the circuit on and off.

b）Connector connections should be kept dry and clean to prevent rain and moisture. Avoid direct sunlight and water soaking of the connector.

c）The connector does not have any waterproof function before docking. When installing the module, it is necessary to dock the connector as soon as possible or take waterproof measures to prevent the connector from being exposed to moisture or dust.

d) The cables on the connector and the junction box are not allowed to be bent or folded. The 20mm cable leading from the cable seal cannot be bent or compressed. The corner radius of the cable must be greater than 8 times the outer diameter of the cable to avoid the cable or connector remains taut.

10. Maintenance

The solar modules require periodic inspection and maintenance, especially during the warranty period. To ensure optimum performance of the modules, Motech recommends the following maintenance measures:

10.1 Visual inspection

Carefully check the modules for cosmetic defects, and focus on the following points:

a) Photovoltaic modules use anti-reflection coating technology. If you found color difference when observed the modules at different angles, it is normal;
b) Whether the module glass is damaged;
c) Whether there is a sharp object touching the surface of the module;
d) Whether the module is obstructed by obstacles or foreign objects;
e) Whether there is corrosion near the cell grid line. This corrosion is caused by damage to the surface encapsulation material of the module during installation or transportation, causing moisture to penetrate into the interior of the module;
f) Observing whether the backsheet of the module is burnt through;
g) Check the fixing screws of the modules and brackets for looseness or damage, and adjust or repair them in time.

10.2 Clean

a） Accumulation of dust or dirt on the surface of the module will reduce the power output, please perform regular cleaning as much as possible every year (depending on the conditions of the installation site). Use a soft cloth for cleaning, dry or wet.

b） It is forbidden to use a rough surface material for module cleaning under any circumstances.

c） In order to reduce potential electric shock or burns, it is recommended to clean the modules in the early morning or evening when the lighting is not strong and the temperature of the modules is low, especially in areas with high temperatures.

d） Do not attempt to clean PV modules that have broken glass or exposed wires, which pose a risk of electric shock.

e） Low-mineral water and pH-neutral water are recommended.

f） It is recommended that the maximum water pressure ⩽ 4MPa, the outlet should be ⩾ 30cm from the surface of the module, and the horizontal spray angle should be ⩾ 15°.

10.3 Connector and cable inspection

It is recommended that the following preventive maintenance be performed every six months:

a） Check the sealant of the junction box to ensure that there are no cracks or gaps;
b） Check for signs of aging of PV modules. This includes possible animal damage, weathering, and whether all connectors are tightly connected, with or without corrosion; check that whether the modules are well grounded.

·Appendix A: Module Model Number Scheme

Motech Model Number Format is ***AABBCD-EF-PPP*** for Bifacial module where:

AA is a code for the type of cell:
- ***XN*** for N-Type TOPCon cell

BB is the number of cells in the module, where NN can have the following values:
- ***72*** for a seventy-two cell module
- ***66*** for a sixty –six cell module
- ***60*** for a sixty cell module
- ***54*** for a fifty-four cell module
- ***44*** for a forty-four cell module
- ***40*** for a forty cell module
- ***36*** for a Thirty-six cell module
- ***32*** for a Thirty-two cell module
- ***28*** for a Twenty Eight cell module
- ***24*** for a Twenty four cell module
- ***16*** for a Sixteen cell module

C is a code for module combination, where C can have the following values:
- ***H*** for black back glass PV module
- ***K*** for white back glass PV module
- ***T*** for transparent back glass PV module

D is a code for type of cell
- ***F*** for 182.2mm*182.2mm±2mm half-cut cell

E is a code for module type
- ***blank*** for standard module
- ***S*** for Agricultural modules Series circuits ,P for Agricultural modules Series-parallel circuits

F is a code for module size
- ***1*** for 2278*1134mm or similar size
- ***2*** for 2384*1303mm or similar size
- ***3*** for 1906*1134mm or similar size
- ***4*** for 1722*1134mm or similar size

PPP is module output power in watts, see electrical ratings table for listing.

·Appendix B: Module Electrical Ratings

When the UL 1703/ ULC/ORD-C1703-01 standard area is installed, the maximum voltage of the system is 1000V or 600V depending on the junction box and connector. When the EN/IEC-61730 standard area is installed, the maximum voltage of the system is 1000/1500V. The following parameters are only part of the specification and module parameters. For the full version, please refer to the Motech product datasheet.

Model Number	Pmp/W	Voc/V	Isc/A	Vmp/V	Imp/A
XN72HF-xxx XN72KF-xxx XN72TF-xxx	560	51.08	13.38	44.06	12.71
	565	51.38	13.42	44.32	12.75
	570	51.68	13.45	44.64	12.77
	575	51.91	13.49	44.93	12.80
	580	52.21	13.52	45.15	12.85
	585	52.44	13.56	45.39	12.89
	590	52.66	13.59	45.65	12.93
	595	52.92	13.64	45.84	12.98
	600	53.13	13.68	46.09	13.02
XN66HF-xxx XN66KF-xxx XN66TF-xxx	515	46.90	13.40	40.47	12.73
	520	47.20	13.43	40.76	12.76
	525	47.53	13.46	41.06	12.79
	530	47.74	13.50	41.35	12.82
	535	48.01	13.55	41.54	12.88
	540	48.23	13.58	41.80	12.92
	545	48.48	13.63	42.02	12.97
	550	48.70	13.68	42.25	13.02
XN60HF-xxx	465	42.52	13.37	36.65	12.69
XN60KF-xxx	470	42.77	13.42	36.88	12.75

XN60TF-xxx	475	43.07	13.44	37.20	12.77
	480	43.30	13.49	37.48	12.81
	485	43.58	13.54	37.69	12.87
	490	43.82	13.58	37.97	12.91
	495	44.06	13.63	38.17	12.97
	500	44.27	13.68	38.41	13.02
XN54HF-xxx XN54KF-xxx XN54TF-xxx	420	38.31	13.38	33.03	12.72
	425	38.62	13.43	33.32	12.76
	430	38.91	13.47	33.63	12.79
	435	39.16	13.52	33.86	12.85
	440	39.40	13.57	34.11	12.90
	445	39.63	13.63	34.34	12.96
	450	39.85	13.68	34.54	13.03
XN32HF-xxx XN32KF-xxx XN32TF-xxx	250	22.76	13.41	19.64	12.73
	255	23.06	13.47	19.94	12.79
	260	23.32	13.56	20.18	12.89
	265	23.55	13.65	20.42	12.98
XN16HF-xxx XN16KF-xxx XN16TF-xxx	125	11.38	13.41	9.82	12.73
	130	11.65	13.56	10.08	12.90
XN44TF-P1	340	31.37	13.42	27.06	12.75
	345	31.68	13.46	27.37	12.79
	350	31.93	13.53	27.61	12.86
	355	32.16	13.59	27.87	12.92
	360	32.41	13.66	28.08	13.00
	365	31.37	13.42	27.06	12.75
XN40TF-P1	310	28.36	13.38	24.41	12.70
	315	28.61	13.43	24.69	12.76
	320	28.87	13.49	24.99	12.81
	325	29.14	13.56	25.22	12.89
	330	29.38	13.63	25.45	12.97
XN36TF-P1 XN36TF-P3	280	25.54	13.38	22.02	12.72
	285	25.84	13.44	22.32	12.77
	290	26.11	13.52	22.57	12.85
	295	26.33	13.59	22.82	12.93
	300	26.56	13.68	23.05	13.02
XN32TF-P1 XN32TF-P3 XN32TF-P4	250	22.76	13.41	19.64	12.73
	255	23.06	13.47	19.94	12.79
	260	23.32	13.56	20.18	12.89
	265	23.55	13.65	20.42	12.98
XN28TF-P3 XN28TF-P4	220	20.00	13.43	17.25	12.76
	225	20.27	13.51	17.54	12.83
	230	20.53	13.61	17.76	12.95
XN24TF-P4	185	16.98	13.35	14.59	12.69
	190	17.23	13.44	14.88	12.77
	195	17.48	13.56	15.13	12.89
	200	17.71	13.68	15.36	13.03

·Appendix C: Module Physical Properties

Model Number	Cells quantity	Width (mm)	Length (mm)	Frame Height (mm)	mass (kg)
XN72xF-PPP	72	1134	2278	30	31.3±5%
XN72xF-PPP	72	1134	2278	35	31.9±5%
XN66xF-PPP	66	1134	2094	30	29.3±5%
XN66xF-PPP	66	1134	2094	35	29.6±5%
XN60xF-PPP	60	1134	1906	30	27.1±5%
XN60xF-PPP	60	1134	1906	35	27.4±5%
XN54xF-PPP	54	1134	1722	30	24.5±5%
XN54xF-PPP	54	1134	1722	35	24.8±5%
XN32xF-PPP	32	766	1542	30	16.2±5%
XN32xF-PPP	32	766	1542	35	16.4±5%
XN16xF-PPP	16	766	810	30	8.1±5%
XN16xF-PPP	16	766	810	35	8.3±5%
XNxxTF-P1-PPP	44/40/36/32	1134	2278	30	31.3±5%
XNxxTF-P1-PPP	44/40/36/32	1134	2278	35	31.9±5%
XNxxTF-P3-PPP	36/32/28	1134	1906	30	27.1±5%
XNxxTF-P3-PPP	36/32/28	1134	1906	35	27.4±5%
XNxxTF-P4-PPP	32/28/24	1134	1722	30	24.5±5%
XNxxTF-P4-PPP	32/28/24	1134	1722	35	24.8±5%

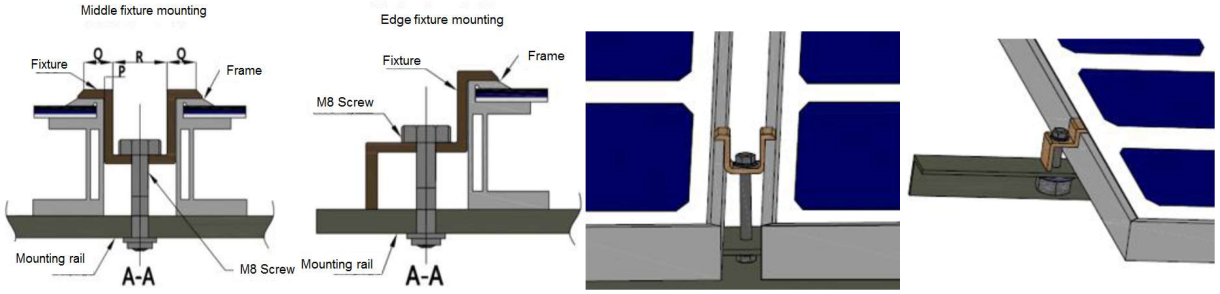
Remarks: The above are only some module sizes. For other specifications, please refer to the Motech technical specifications.

·Appendix D: Module Mounting Positions and Load Ratings

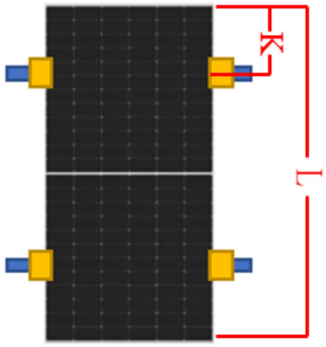
Please ensure proper module mounting and a robust mounting system that allows the assembly to withstand all predetermined loads, the bracket installer must provide its warranty. Each module has several drain holes to avoid water accumulation in the aluminum frame. When installing, please keep the drain hole unobstructed, and the drain hole can not be blocked by the clamp to avoid water or ice in the frame after the cover is blocked, which may cause the frame of the module to fail.

Each module must be secured to the mounting bracket by at least four points. The fixture can be used to mount the assembly. If the fixture is used to fix the module on a bracket, it is recommended that the contact area of the fixture and the frame be at least 50mm*4.5mm and the thickness of the fixture be ⩾3mm. It is required that the fixture can not touch the glass or deform the frame of the module. The surface of the fixture contact with the front surface of frame must be flat and smooth, otherwise the frame will be damaged and the module will be damaged. Use at least 4 fixtures to secure the module to the rails, two on each of the two long or short sides. How many fixtures are used depends on the local wind and snow pressure strength. If the pressure exceeds the expected estimate, additional fixtures or brackets are required to ensure that the module can withstand this pressure. The applied torque should be based on the mechanical design criteria of the bolts used by the customer. The fixture material is anodized aluminum or stainless steel.

Table 1 details the installation location and carrying capacity of the modules and has achieved certification standards. In areas where IEC-61730 is implemented, the IEC provides the maximum bearer verification as listed in Table 1, with a design safety factor of 1.5 times. The appropriate safety factor is determined and accounted for by the system designer or user.



Installation diagram of fixture



Module fixture fixing method

Table 1. module fixture installation method

Model Number	Model Size L*W*H（mm）	Installation method		
		Design load	Fixture position	
			K（mm）	L（mm）
XN72HF-xxx XN72KF-xxx XN72TF-xxx	2278*1134*30 2278*1134*35	+5400Pa -2400Pa	L/4±50	2278
XN66HF-xxx XN66KF-xxx XN66TF-xxx	2094*1134*30 2094*1134*35	+5400Pa -2400Pa	L/4±50	2094
XN60HF-xxx XN60KF-xxx XN60TF-xxx	1906*1134*30 1906*1134*35	+5400Pa -2400Pa	L/4±50	1906
XN54HF-xxx XN54KF-xxx XN54TF-xxx	1722*1134*30 1722*1134*35	+5400Pa -2400Pa	L/4±50	1722
XN32HF-xxx XN32KF-xxx XN32TF-xxx	1542*766*30 1542*766*35	+5400Pa -2400Pa	L/4±50	1542
XN16HF-xxx XN16KF-xxx XN16TF-xxx	810*766*30 810*766*35	+5400Pa -2400Pa	L/4±50	810
XN44TF-P1-xxx XN40TF-P1-xxx XN36TF-P1-xxx XN32TF-P1-xxx	2278*1134*30 2278*1134*35	+5400Pa -2400Pa	L/4±50	2278
XN36TF-P3-xxx XN32TF-P3-xxx XN28TF-P3-xxx	1906*1134*30 1906*1134*35	+5400Pa -2400Pa	L/4±50	1906
XN32TF-P4-xxx XN28TF-P4-xxx XN24TF-P4-xxx	1722*1134*30 1722*1134*35	+5400Pa -2400Pa	L/4±50	1722