

**INVITAIC**  
Invisible Photovoltaic

# Installation Manual

# 1. General Information

## 1.1 Overview

Thanks for choosing INVITAIC modules. In order to ensure the BIPV modules are installed correctly, please read the following installation instructions carefully before modules are installed and used. Please remember that these products generate electricity and certain safety measures need to be taken to avoid danger.

Make sure the module array is designed in such a way not to exceed the maximum system voltage of any system component such as connectors or inverters and only use compatible connectors of the same type.

The assembly is to be mounted over a fire resistant roof covering rated for the application. Before mounting the module, please consult your local building department to determine approved roofing materials.

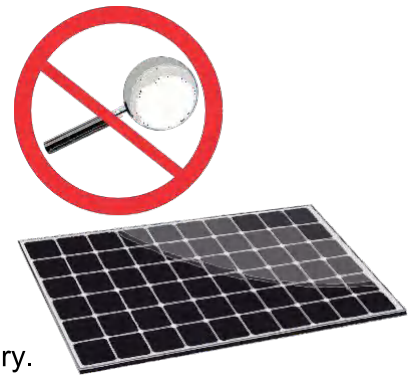
The modules are qualified for Class II: which can be used in systems operating at 50 V DC or >240W.

Where general contact access is anticipated; When the modules are for rooftop application, it is necessary to take the overall fire rating of the finished structure as well as operation and maintenance into account. The roofing BIPV system shall be installed after being evaluated by construction experts or engineers and with official analysis results for the entire structure. It shall be proved capable of supporting extra system bracked pressure, including BIPV module weight.

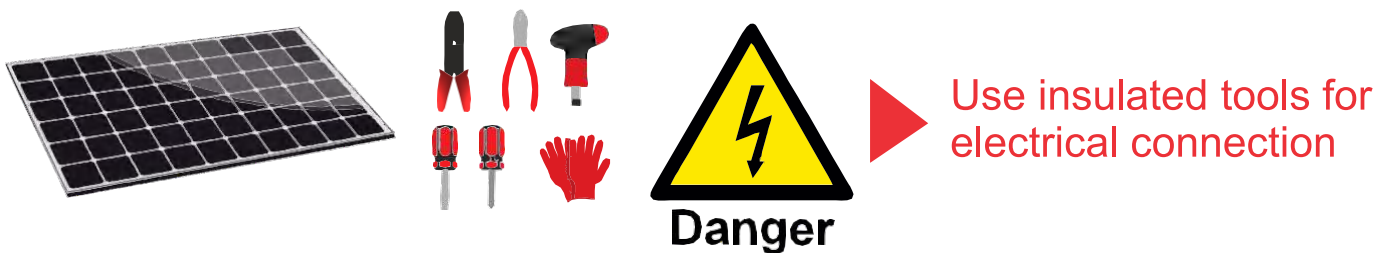
## 1.2 Warnings



- BIPV modules generate DC electrical energy when exposed to sunlight or other light sources. Active parts of module such as terminals can result in burns, sparks, and lethal shock.
- Artificially concentrated sunlight shall not be directed on the module or panel.
- Front protective glass is utilized on the module. Broken solar module glass is an electrical safety hazard (may cause electric shock or fire). These modules cannot be repaired and should be replaced immediately.
- To reduce the risk of electrical shocks or burns, modules may be covered with an opaque material during installation to avoid injury.
- The installation work of the BIPV array can only be done under the protection of sun-sheltering covers or sunshades and only qualified person can install or perform maintenance work on this module.
- Follow the battery manufacture's recommendations if batteries are used with modules.
- Do not use this module to replace or partly replace roofs and walls of living buildings.
- Do not install modules where flammable gas may be present.
- Do not remove any part installed by INVITAIC or disassemble the module.



- All instructions should be read and understood before attempting to install, wire, operate and maintain the module.
- Don't lift up BIPV modules using the attached cables or the junction box.
- Do not touch live terminals with bare hands. Use insulated tools for electrical connections.



- All BIPV systems must be grounded to earth. If there is no special regulation, please follow the National Electrical Code or other national code.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the value of  $I_{sc}$  and  $V_{oc}$  marked on the module should be multiplied by 1.25 when determining BIPV system component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the BIPV output.
- Once the BIPV module has been shipped to the installation site, all of the parts should be unpacked properly with care.
- Only the modules with the same type and the capacity should be connected in series inside the string.
- During transporting modules, please attempt to minimize shock or vibration to the module, as this may damage the module or lead to cell micro cracks.
- During all transportation situations, never drop the module from a vehicle, house or hands. This will damage module.
- Do not clean the glass with chemicals. Only use tap water. Make sure the module surface temperature is cool to the touch. Cleaning modules with cool water when module surface temp is high may result in glass breakage.
- Do not stand or step on the BIPV module like below pictures show. This is prohibited and there is a risk of damage to the module and cause injury for you.



- Do not disconnect modules from the circuit, when they are operating in the system and deriving electrical load.
- When looking at BIPV modules with anti-reflection (AR) coating technology, it will be normal to see some cells with a slight color difference at different angles. Modules with LRF(light reflective film) and without LRF should not be built in the same array or roof.
- Connector of junction box can not be contacted with oily substances, for example, lubricant, rust inhibitor etc.
- The maximum altitude the BIPV module is designed for  $\leq 2000\text{m}$ .
- Do not carry a module on your head, with the backsheet facing towards to your helmet, if it is not avoidable, please make sure that, the module is facing with the glass side to your helmet.
- The maximum irradiance is  $1300\text{W}/\text{m}^2$  for module with transparent and white backsheet rear.
- Meaning of crossed –out wheeled dustbin:  
Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.  
Contact your local government for information regarding the collection systems available.  
If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the foodchain, damaging your health and well-being.  
When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.



## 2. Installation

### 2.1 Installation Safety

- Always wear protective head gear, insulating gloves and safety shoes (with rubbersoles).
- Keep the BIPV module packed in the carton until installation.
- Do not touch the BIPV module unnecessarily during installation. The glass surface and the frame may be hot. There is a risk of burns and electric shock.
- Do not work in rain, snow or windy conditions.
- Due to the risk of electrical shock, do not perform any work if the terminals of the BIPV module are wet.
- Use insulated tools and do not use wet tools.
- When installing BIPV modules, do not drop any objects (e.g., BIPV modules or tools).
- Make sure flammable gasses are not generated or present near the installation site.
- Insert module connectors fully and correctly. An audible "click" sound should be heard. This sounds confirms the connectors are fully seated. Check all connections.
- The module leads should be securely fastened to the module frame, Wire Management should be

done in a way to avoid the connector from scratching or impacting the back sheet of the module.

- Do not touch the junction box and the end of the interconnect cables (connectors) with bare hands during installation or under sunlight, regardless if the BIPV module is connected to or disconnected from the system.
- Do not expose the BIPV module to excessive loads on the surface of the BIPV module or twist the frame.
- Do not hit or put excessive load on the glass or back sheet, this may break the cells or cause micro cracks.
- During the installation or operation, don't use sharp tools to wipe the back sheet and glass. Scratches can appear on the module.
- Do not drill holes in the frame. It may cause corrosion of the frame.
- When installing modules on roof mounted structures, please try to follow the "from top to bottom" and/or "from left to right" principle, and don't step on the module. This will damage the module and would be dangerous for personal safety fire tested according ANSI-UL-790:2004.

## 2.2 Installation Condition

### 2.2.1 Climate Condition

Please install the modules in the following conditions:

- a) Operating temperature: within  $-40^{\circ}\text{C}(-40^{\circ}\text{F})$  to  $85^{\circ}\text{C}(185^{\circ}\text{F})$
- b) Humidity:  $< 85\text{RH}\%$

\* Note: The mechanical load bearing (include wind and snow loads) of the module is based on the approved mounting methods. The professional system installer must be responsible for mechanical load calculation according to the system design.

### 2.2.2 Site Selection

In most applications, INVITAIC solar BIPV modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the module should typically face south, and in the Southern Hemisphere, the modules should typically face north. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 percent. When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the solar photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the BIPV module will minimize any such loss.

Do not install the BIPV module near open flame or flammable materials.

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. Follow the battery manufacturer's

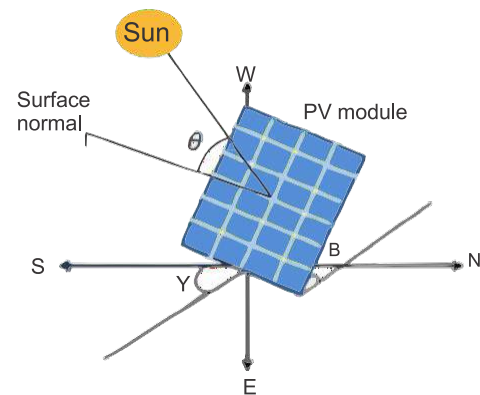
guidelines concerning installation, operation and maintenance recommendations. In general, the battery (or battery bank) should be away from the main flow of people and animal traffic. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which can be 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.

Do not install the BIPV module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

### 2.2.3 Tilt Angle Selection

The tilt angle of the BIPV module is measured between the surface of the BIPV module and a horizontal ground surface (Figure 1). The BIPV module generates maximum output power when it faces the sun directly.

For standalone systems with batteries where the BIPV modules are attached to a permanent structure, the tilt angle of the BIPV modules should be selected to optimize the performance based on seasonal load and sunlight. In general, if the BIPV output is adequate when irradiance is low (e.g., winter), then the angle chosen should be adequate during the rest of the year. For grid-connected installations where the BIPV modules are attached to a permanent structure, BIPV modules should be tilted so that the energy production from the BIPV modules will be maximized on an annual basis.



## 2.3 Mechanical Installation Introduction

Solar BIPV modules usually can be mounted by using the following methods: bolts and clamps.

### Note:

- 1) All installation methods herein are only for reference, and INVITAIC will not provide related mounting components, the system installer or trained professional personnel must be responsible for the BIPV system's design, installation, and mechanical load calculation and security of the system.
- 2) Before installation, the following items should be addressed:
  - a) Visually check the module for any damage. Clean the module if any dirt or residue remains from shipping .
  - b) Check if module serial number stickers match.
- 3) INVITAIC modules are designed to meet a maximum positive (or downward) pressure of 3600Pa (Only

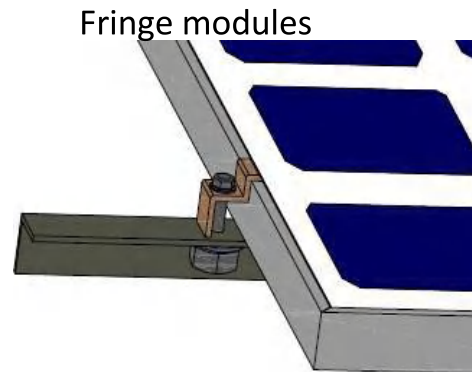
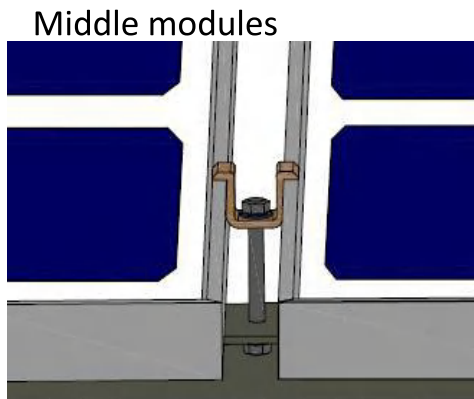
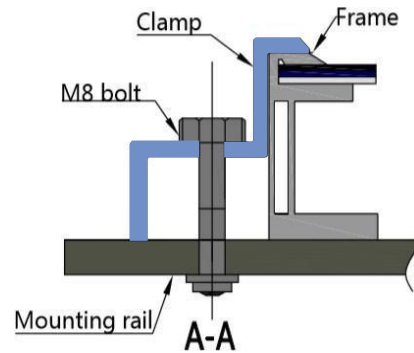
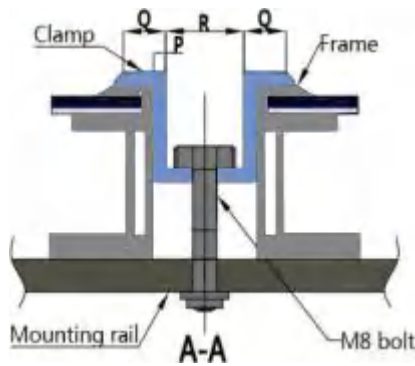
referring to the mentioned module type in this manual) and negative (or upward) pressure of 1600Pa. This design load was then tested with a safety factor of 1.5 times. INVITAIC modules are tested under a maximum downward pressure of 5400Pa and upward pressure of 2400Pa. When mounting modules in snow-prone or high-wind environments, special care should be taken to mount the modules in a manner that provides sufficient design strength while meeting local code requirements.

Please take in note, that the limitation of Tilt angle / slope is maximum 60 °. According to IEC61215, solar modules are rated as a class C Flame-Spread Ratings product according to NSF/ANSI342 standards

### 2.3.1 Mounting with clamps

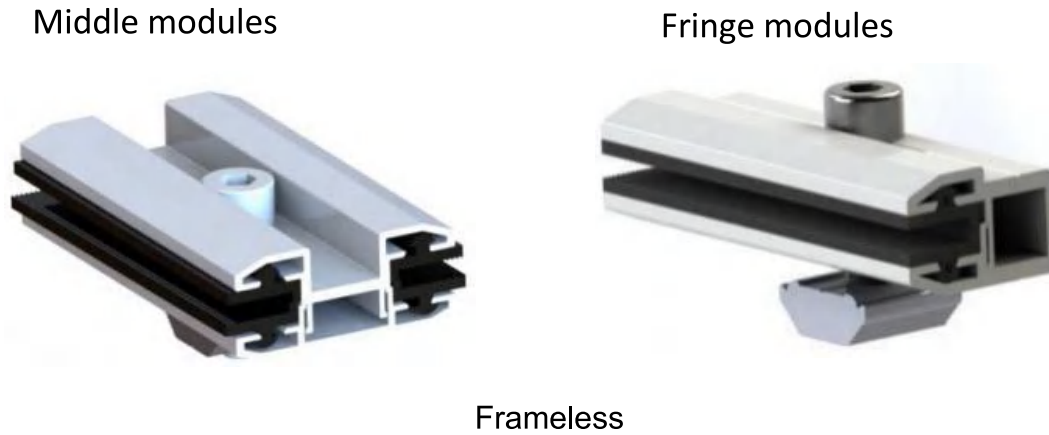
The module clamps should not come into contact with the front glass and must not deform the frame. Be sure to avoid shadowing effects from the module clamps. The module frame is not to be modified under any circumstances. When choosing this type of clamp-mounting method, please be sure to use at least four clamps on each module, two clamps should be attached on each long sides of the module. Depending on the local wind and snow loads, if excessive pressure load is expected, additional clamps or support would be required to ensure the module can bear the load. The applied torque value should be big enough to fix the modules steadily (Please consult with the clamp or support's supplier for the specific torque value). Please find detailed mounting information in the below illustration, the mounting place distance is suggested bigger than J and less than K. The installation diagram of clamp is shown in figure 5.

Note: The Movement of the mounting rail and the clamps center line are recommended to be within the black arrow area.



Frame





**Figure 5: BIPV module installed at the side with Clamp fitting method**

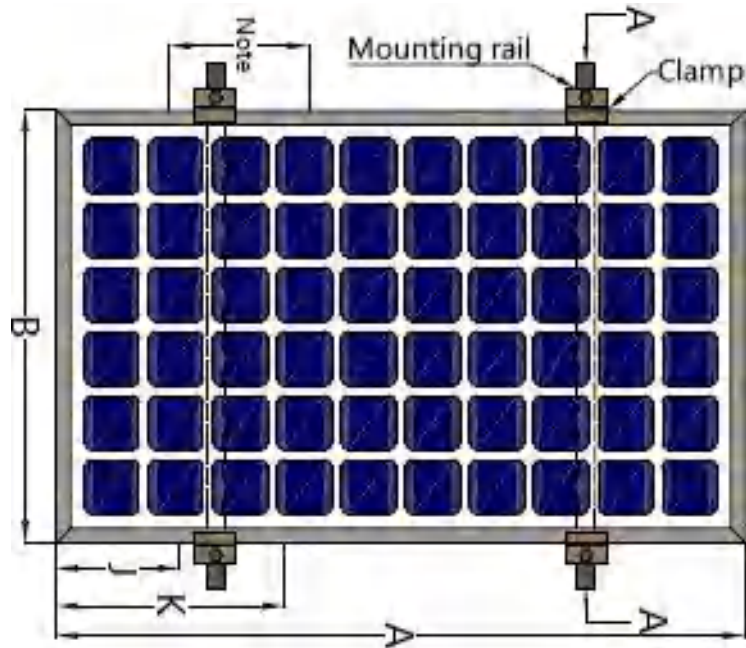
When installing modules using clamps on the long side of the frame, the applicable product types and installation locations are shown in figure 6 and table 4.

When installing modules using clamps on the short side of the frame, the applicable product types and installation locations are shown in figure 7 and table 5.

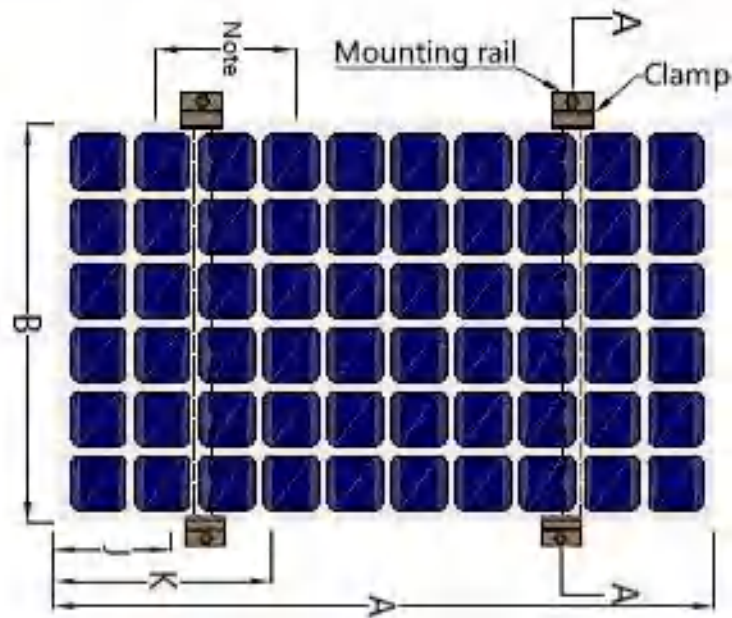
When installing modules using clamps on the long side & short side of the frame, the applicable product types and installation locations are shown in figure 8 and table 6.

When installing modules using clamps on the long side of the frame, the applicable product types and installation locations (The without C transparent backsheet series module) are shown in figure 9 and table 7.

### 2.3.1.1 Clamp Mounting on Long Sides of the Frames



Frame



Frameless

Figure 6: Installation of clamps on long side of frames

Module type		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in INVITAIC	
		Module dimensions(mm) A*B		J	K
		Height of the frame ( mm)	35		
60 cells	P	SP270P6-60	1560*992	145	395
		SP275P6-60	1560*992	145	395
		SP280P6-60	1560*992	145	395
		SP285P6-60	1560*992	145	395
		SP290P6-60	1560*992	145	395
		Height of the frame ( mm)	40		
72 cells	P	SP325P6-72	1956 *992	140	390
		SP330P6-72	1956 *992	140	390
		SP335P6-72	1956 *992	140	390
		SP340P6-72	1956 *992	140	390
		SP345P6-72	1956 *992	140	390
		SP350P6-72	1956 *992	140	390
		SP355P6-72	1956 *992	140	390
		Height of the frame ( mm)	35		
60 cells	M	SP310M6-60	1665 *1002	152	402
		SP315M6-60	1665 *1002	152	402
		SP320M6-60	1665 *1002	152	402
		SP325M6-60	1665 *1002	152	402
		SP330M6-60	1665 *1002	152	402
		SP335M6-60	1665 *1002	152	402
		Height of the frame ( mm)	40		
72 cells	M	SP380M6-72	1979 *1002	151	401
		SP385M6-72	1979 *1002	151	401
		SP390M6-72	1979 *1002	151	401
		SP395M6-72	1979 *1002	151	401
		SP400M6-72	1979 *1002	151	401

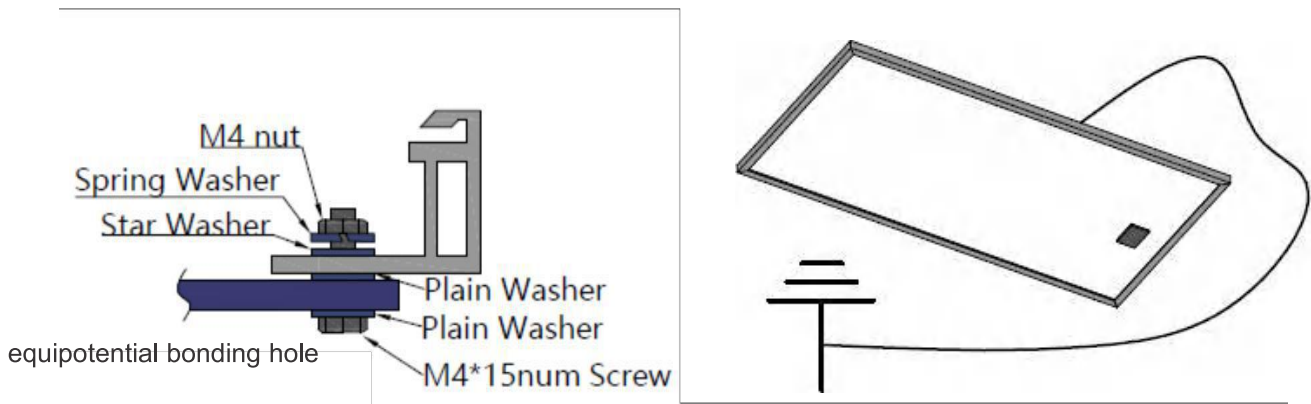
Module type		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in INVITAIC	
		Module dimensions(mm) A*B		J	K
		Height of the frame( mm)	6		
60 cells	M	SP290BDM6-60	1658 *992	149	399
		SP295BDM6-60	1658 *992	149	399
		SP300BDM6-60	1658 *992	149	399
		SP305BDM6-60	1658 *992	149	399
		SP310BDM6-60	1658 *992	149	399
		SP315BDM6-60	1658 *992	149	399
		SP315BDM6-60	1658 *992	149	399
		Height of the frame( mm)	6		
72 cells	M	SP355BDM6-72	1985 *992	312	562
		SP360BDM6-72	1985 *992	312	562
		SP365BDM6-72	1985 *992	312	562
		SP370BDM6-72	1985 *992	312	562
		SP375BDM6-72	1985 *992	312	562
		SP380BDM6-72	1985 *992	312	562
		SP385BDM6-72	1985 *992	312	562
		SP390BDM6-72	1985 *992	312	562
		Height of the frame( mm)	6		
60 cells	M	SP315DGHM6-60	1680 *1002	160	410
		SP320DGHM6-60	1680 *1002	160	410
		SP325DGHM6-60	1680 *1002	160	410
		SP330DGHM6-60	1680 *1002	160	410
		SP335DGHM6-60	1680 *1002	160	410
		Height of the frame( mm)	6		
72 cells	M	SP380DGHM6-72	2002 *1002	321	571
		SP385DGHM6-72	2002 *1002	321	571
		SP390DGHM6-72	2002 *1002	321	571
		SP395DGHM6-72	2002 *1002	321	571
		SP400DGHM6-72	2002 *1002	321	571

Module type		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load	Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in INVITAIC		
			Module dimensions(mm) A*B	J	K
		Height of the frame ( mm)	35		
120 cells	M	SP315HM6-60L	1684 *1002	162	410
		SP320HM6-60L	1684 *1002	162	410
		SP325HM6-60L	1684 *1002	162	410
		SP330HM6-60L	1684 *1002	162	410
		SP335HM6-60L	1684 *1002	162	410
		SP340HM6-60L	1684 *1002	162	410
		SP345HM6-60L	1684 *1002	162	410
		Height of the frame ( mm)	35		
144 cells	M	SP380HM6-72L	2008 *1002	169	459
		SP385HM6-72L	2008 *1002	169	459
		SP390HM6-72L	2008 *1002	169	459
		SP395HM6-72L	2008 *1002	169	459
		SP400HM6-72L	2008 *1002	169	459
		SP405HM6-72L	2008 *1002	169	459
		SP410HM6-72L	2008 *1002	169	459
		SP415HM6-72L	2008 *1002	169	459
		Height of the frame ( mm)	35		
120 cells	M	SP355HM6-60L	1755 *1038	197	447
		SP360HM6-60L	1755 *1038	197	447
		SP365HM6-60L	1755 *1038	197	447
		SP370HM6-60L	1755 *1038	197	447
		SP375HM6-60L	1755 *1038	197	447
		SP380HM6-60L	1755 *1038	197	447
		SP385HM6-60L	1755 *1038	197	447
		Height of the frame ( mm)	35		
144 cells	M	SP425HM6-72L	2094 *1038	397	552
		SP430HM6-72L	2094 *1038	397	552
		SP435HM6-72L	2094 *1038	397	552
		SP440HM6-72L	2094 *1038	397	552
		SP445HM6-72L	2094 *1038	397	552
		SP450HM6-72L	2094 *1038	397	552
		SP455HM6-72L	2094 *1038	397	552
		SP460HM6-72L	2094 *1038	397	552
		SP465HM6-72L	2094 *1038	397	552

Module type		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive ) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in INVITAIC	
		Module dimensions(mm) A*B		J	K
		Height of the frame ( mm)	35		
108 cells	M	SP395HM6-54L	1724*1135	182	432
		SP400HM6-54L	1724*1135	182	432
		SP405HM6-54L	1724*1135	182	432
		SP410HM6-54L	1724*1135	182	432
		SP415HM6-54L	1724*1135	182	432
		Height of the frame ( mm)	35		
132 cells	M	SP485HM6-66L	2094 *1135	212	502
		SP490HM6-66L	2094 *1135	212	502
		SP495HM6-66L	2094 *1135	212	502
		SP500HM6-66L	2094 *1135	212	502
		SP505HM6-66L	2094 *1135	212	502
		Height of the frame ( mm)	35		
144 cells	M	SP525HM6-72L	2278 *1135	304	594
		SP530HM6-72L	2278 *1135	304	594
		SP535HM6-72L	2278 *1135	304	594
		SP540HM6-72L	2278 *1135	304	594
		SP545HM6-72L	2278 *1135	304	594
		SP550HM6-72L	2278 *1135	304	594
		SP555HM6-72L	2278 *1135	304	594
		SP560HM6-72L	2278 *1135	304	594
		Height of the frame ( mm)	35		
120 cells	M	SP490HM6-60L	2176 *1098	408	658
		SP495HM6-60L	2176 *1098	408	658
		SP500HM6-60L	2176 *1098	408	658
		SP505HM6-60L	2176 *1098	408	658

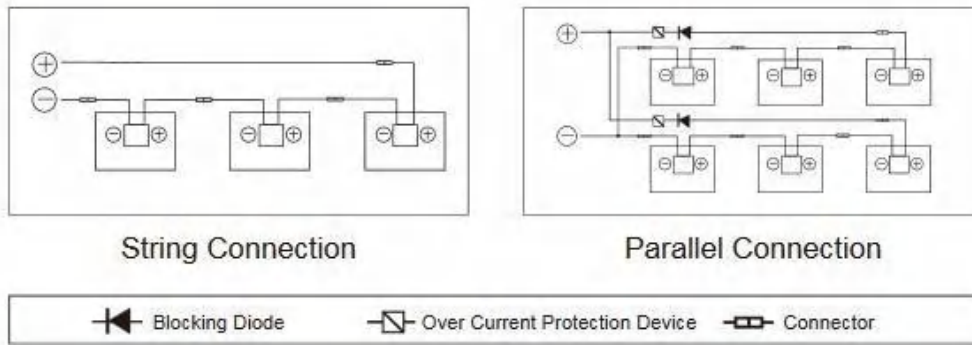
### 3. Wiring and Connection

- a) Before this procedure, please read the operation instructions of the BIPV system carefully. Make wiring by Multi-connecting cables between the BIPV modules in series or parallel connection, which is determined by user's configuration requirement for system power, current and voltage.
- b) BIPV modules connected in series should have similar connectors of identical type current, and modules must not be connected together to create a voltage higher than the permitted system voltage. The maximum number of modules in series depends on system design, the type of inverter used and environmental conditions.
- c) The maximum fuse rating value in an array string can be found on the product label or in the product datasheet. The fuse rating value is also corresponding to the maximum reverse current that a module can withstand, i.e. when one string is in shade then the other parallel strings of modules will be loaded by the shaded string and the current will pass through to create a current circuit. Based on the maximum series fuse rating of module and local electrical codes and standards, make sure the modules strings in parallel are protected with the appropriate in-line string fusing.
- d) Open the combiner box of the control system and connect the conductor from the BIPV arrays to the combiner box in accordance with the design and local codes and standards. The cross-sectional area and cable connector capacity must satisfy the maximum short-circuit of the BIPV system (for a single component, we recommended that the cross-sectional area of cables current will be  $4\text{mm}^2$  and the rated current of connectors be more than 10A), otherwise cables and connectors will become overheating for large current. Please pay attention to the temperature limit of cables is  $85^\circ\text{C}$ .
- e) All module frames and mounting racks must be properly equipotentially bonded in accordance with module frame using the local and national electrical codes. Attach the equipment equipotential bonded conductor to the hole and hardware provided. Note that a stainless steel star washer is used between the ground wire and module frame (see Figure 10 below). This washer is used to avoid corrosion due to dissimilar metals. Tighten the screw securely.



**Equipotential bonding installation of BIPV modules**

When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module. Modules with different electric performance models can not be connected in one string.



The maximum allowed quantity of modules in string connection shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts (maximum system voltage is DC1000V/DC1500V— actually system voltage is designed based on the selected module and inverter model.)

The VOC factor can be calculated by the following formula.  $C_{Voc} = 1 - \beta V_{oc}(25 - T)$

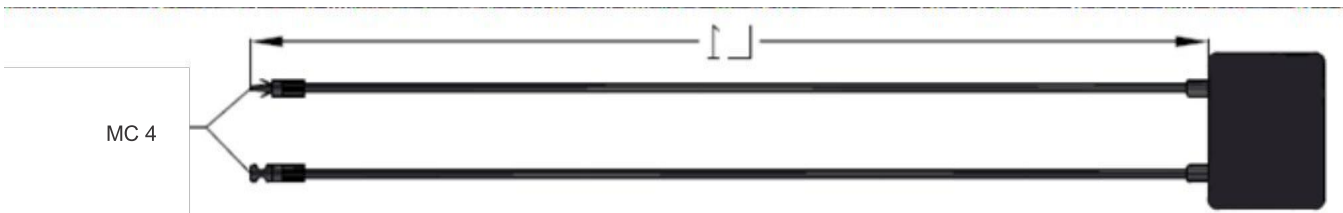
T: The expected lowest temperature of the installation site,

$\beta$ ; VOC temperature coefficient (%/C)(refer to modules data sheet for further detail)

if there is reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module; if the parallel connection are more than 2, there must be an overcurrent protection device on each string of module.



- f) Follow the requirements of applicable local and national electrical codes.
- g) These modules contain factory installed by pass diode .If these modules are incorrectly connected to each other, the bypass diodes, cable or junction box may be damaged.
- h) The cable of the junction box is defined as L, as showed below in Figure 11. For INVITAIC standard full cell module, L is 900/1200mm; for INVITAIC standard half cell module, L is 350mm; and for customized module, L can be based on your condition. Please take the cable length into consideration before



designing the wiring layout.

- i) It is recommend to use negatively grounded inverters to avoid the PID effect for non-PIDfree modules.
- j) If modules are connected in series, the total voltage is equal to the sum of individual voltages.The recommended as below,

$$\text{System voltage} \geq N * \text{Voc} [1 + \text{TCVoc} * (\text{Tmin} - 25)]$$

Where

N module numbers in series

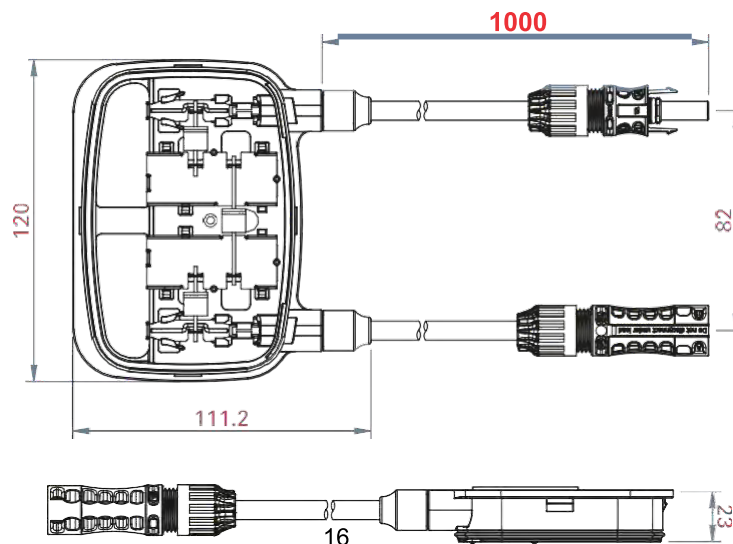
Voc Open circuit voltage (refer to product label or data sheet)

TCVoc Temperature coefficient of open circuit voltage (refer to product label or datasheet)

Tmin Minimum ambient temperature

## 4. Maintenance and Care

It is required to perform regular inspection and maintenance of the modules, especially during the warranty period. To ensure optimum module performance, INVITAIC recommends the following maintenance measures:



## 4.1 Visual Inspection

Inspect the modules visually to find if there are any visual defects, If there are, the following items should be evaluated:

- a) If modules are observed having slight cell color differences at different angles, this is a normal phenomenon of modules with anti-reflection coating technology.
- b) Whether the glass is broken.
- c) No sharp objects are in contact with the BIPV module surfaces.
- d) BIPV modules are not shaded by unwanted obstacles and; or foreign material.
- e) Corrosion along the cells' bus-bar. The corrosion is caused by moisture intrusion through the module back sheet. Check the back sheet for damage.
- f) Check whether the back sheet is burn out.
- g) Check if screws and mounting brackets are tight, adjust and tighten as necessary.

## 4.2 Cleaning

- a) A build up of dust or dirt on the module(s) front face will result in a decreased energy output. Clean the panel(s) preferably once per annum if possible (depend on site conditions) using a soft cloth dry or damp, as necessary. Water with high mineral content may leave deposits on the glass surface and is not recommended.
- b) Never use abrasive material under any circumstances.
- c) In order to reduce the potential for electrical and thermal shock, INVITAIC recommends cleaning BIPV modules during early morning or late afternoon hours when solar radiation is low and the modules are cooler, especially in regions with hotter temperatures.
- d) Never attempt to clean a BIPV module with broken glass or other signs of exposed wiring, as this presents a shock hazard.
- e) Never use chemicals when cleaning modules as this may affect the module warranty and energy output.

## 4.3 Inspection of Connector and Cable

It's recommended to implement the following preventive maintenance every 6 months:

- a) Check the sealing gels of the junction box for any damage.
- b) Examine the BIPV module(s) for signs of deterioration. Check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free. Check electrical leakage to ground.

## 5. Electrical Specification

The module electrical rating are measured under Standard Test Conditions, which are 1000W/m<sup>2</sup>, irradiance with AM 1.5 spectrum and 25 deg (77F°) ambient temperature. The module might produce more or less voltage or current than rated value in uncertainty condition.

## 6. Disclaimer of Liability

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (BIPV) product are beyond INVITAIC's control, INVITAIC does not accept responsibility and expressly disclaims liability for loss ,damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

No responsibility is assumed by INVITAIC for any infringement of patents or other rights of third parties, which may result from use of the BIPV product. NO license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on INVITAIC's knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. INVITAIC reserve the right to change the manual, the BIPV produce, the specifications, or product information sheets without prior notice.

## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (Imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	P	SP270P6-60	270	30.72	8.79	37.92	9.28
		SP275P6-60	275	30.94	8.89	38.18	9.36
		SP280P6-60	280	31.19	8.98	38.43	9.44
		SP285P6-60	285	31.43	9.07	38.69	9.53
		SP290P6-60	290	31.70	9.15	38.95	9.62
72 cells	P	SP325P6-72	325	36.90	8.81	45.56	9.28
		SP330P6-72	330	37.18	8.88	45.83	9.35
		SP335P6-72	335	37.45	8.95	46.10	9.42
		SP340P6-72	340	37.74	9.01	46.39	9.48
		SP345P6-72	345	38.04	9.07	46.68	9.55
		SP350P6-72	350	38.42	9.10	47.20	9.58
		SP355P6-72	355	38.80	9.14	47.66	9.62
Maximum system voltage		(V)	1000/1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.38				
Temp. coefficients of Voc		(% /C°)	-0.33				
Temp. coefficients of Isc		(% /C°)	0.05				

## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	SP310M6-60	310	32.60	9.51	40.30	10.04
		SP315M6-60	315	32.89	9.58	40.53	10.11
		SP320M6-60	320	33.17	9.65	40.78	10.18
		SP325M6-60	325	33.44	9.72	41.04	10.25
		SP330M6-60	330	33.75	9.78	41.30	10.32
		SP335M6-60	335	33.68	9.89	41.50	10.43
72 cells	M	SP380M6-72	380	39.59	9.60	48.75	10.12
		SP385M6-72	385	39.90	9.65	49.04	10.17
		SP390M6-72	390	40.21	9.70	49.35	10.22
		SP395M6-72	395	40.48	9.76	49.64	10.27
		SP400M6-72	400	40.66	9.84	49.89	10.31
Maximum system voltage		(V)	1000/1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.38				
Temp. coefficients of Voc		(% /C°)	-0.33				
Temp. coefficients of Isc		(% /C°)	0.05				

## Eectrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	SP290BDM6-60	290	33.82	8.57	38.61	9.14
		SP295BDM6-60	295	34.37	8.58	38.72	9.79
		SP300BDM6-60	300	34.91	8.59	38.80	9.86
		SP305BDM6-60	305	35.45	8.60	39.26	9.93
		SP310BDM6-60	310	36.01	8.61	39.34	10.00
		SP315BDM6-60	315	36.42	8.64	39.80	10.11
		SP315BDM6-60	320	36.74	8.69	39.92	10.36
72 cells	M	SP355BDM6-72	355	39.66	8.95	46.82	9.72
		SP360BDM6-72	360	39.78	9.04	47.14	9.79
		SP365BDM6-72	365	40.24	9.07	47.46	9.86
		SP370BDM6-72	370	40.53	9.13	47.77	9.93
		SP375BDM6-72	375	40.81	9.19	48.08	10.00
		SP380BDM6-72	380	41.08	9.25	48.38	10.07
		SP385BDM6-72	385	41.35	9.31	48.68	10.14
		SP390BDM6-72	390	41.62	9.37	49.29	10.21
Maximum system voltage		(V)	1000/1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.35				
Temp. coefficients of Voc		(% /C°)	-0.30				
Temp. coefficients of Isc		(% /C°)	-0.05				

## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	SP315DGHM6-60	315	33.20	9.49	40.70	10.04
		SP320DGHM6-60	320	33.40	9.59	40.90	10.15
		SP325DGHM6-60	325	33.61	9.68	41.10	10.20
		SP330DGHM6-60	330	33.81	9.76	41.31	10.37
		SP335DGHM6-60	335	34.02	9.85	41.49	10.49
72 cells	M	SP380DGHM6-72	380	40.50	9.39	48.90	9.75
		SP385DGHM6-72	385	40.80	9.44	49.10	9.92
		SP390DGHM6-72	390	41.10	9.49	49.30	10.12
		SP395DGHM6-72	395	41.40	9.55	49.50	10.23
		SP400DGHM6-72	400	41.62	9.61	49.70	10.32
Maximum system voltage		(V)	1000/1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.35				
Temp. coefficients of Voc		(% /C°)	-0.30				
Temp. coefficients of Isc		(% /C°)	0.05				

## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (Imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
120 cells	M	SP315HM6-60L	315	33.33	9.45	40.70	10.04
		SP320HM6-60L	320	33.61	9.52	40.90	10.15
		SP325HM6-60L	325	33.89	9.59	41.10	10.20
		SP330HM6-60L	330	34.17	9.66	41.30	10.31
		SP335HM6-60L	335	34.44	9.73	41.50	10.36
		SP340HM6-60L	340	34.69	9.80	41.70	10.55
		SP345HM6-60L	345	34.95	9.87	41.90	10.64
144 cells	M	SP380HM6-72L	380	40.25	9.44	48.10	10.17
		SP385HM6-72L	385	40.53	9.50	48.30	10.21
		SP390HM6-72L	390	40.79	9.56	48.50	10.25
		SP395HM6-72L	395	41.06	9.62	48.70	10.29
		SP400HM6-72L	400	41.32	9.68	48.90	10.33
		SP405HM6-72L	405	41.59	9.74	49.10	10.37
		SP410HM6-72L	410	41.85	9.80	49.30	10.41
		SP415HM6-72L	415	42.09	9.86	49.50	10.45
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.3538				
Temp. coefficients of Voc		(% /C°)	-0.2769				
Temp. coefficients of Isc		(% /C°)	0.0400				



## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
120 cells	M	SP355HM6-60L	355	33.80	10.50	40.70	11.30
		SP360HM6-60L	360	34.00	10.59	40.90	11.40
		SP365HM6-60L	365	34.20	10.67	41.10	11.50
		SP370HM6-60L	370	34.40	10.76	41.30	11.60
		SP375HM6-60L	375	34.60	10.84	41.50	11.70
		SP380HM6-60L	380	34.80	10.92	41.70	11.80
		SP385HM6-60L	385	35.00	11.00	41.90	11.90
144 cells	M	SP425HM6-72L	425	40.40	10.52	48.20	11.12
		SP430HM6-72L	430	40.60	10.60	48.40	11.18
		SP435HM6-72L	435	40.80	10.67	48.70	11.24
		SP440HM6-72L	440	41.00	10.74	48.90	11.30
		SP445HM6-72L	445	41.20	10.80	49.20	11.36
		SP450HM6-72L	450	41.40	10.87	49.50	11.42
		SP455HM6-72L	455	41.60	10.94	49.70	11.48
		SP460HM6-72L	460	41.80	11.00	49.90	11.53
		SP465HM6-72L	465	42.00	11.07	51.10	11.58
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.370				
Temp. coefficients of Voc		(% /C°)	-0.286				
Temp. coefficients of Isc		(% /C°)	0.050				

## Eectrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
108 cells	M	SP395HM6-54L	395	31.08	12.71	37.36	13.47
		SP400HM6-54L	400	31.35	12.76	37.69	13.52
		SP405HM6-54L	405	31.62	12.81	38.02	13.57
		SP410HM6-54L	410	31.88	12.86	38.35	13.62
		SP415HM6-54L	415	32.12	12.92	38.67	13.67
132 cells	M	SP485HM6-66L	480	38.10	12.74	45.20	13.54
		SP490HM6-66L	485	38.30	12.80	45.40	13.60
		SP495HM6-66L	490	38.50	12.86	45.60	13.66
		SP500HM6-66L	500	38.70	12.91	45.80	13.72
		SP505HM6-66L	505	38.90	12.97	46.00	13.78
144 cells	M	SP525HM6-72L	525	41.47	12.66	49.50	13.42
		SP530HM6-72L	530	41.70	12.71	49.65	13.47
		SP535HM6-72L	535	41.93	12.76	49.78	13.52
		SP540HM6-72L	540	42.15	12.81	49.90	13.57
		SP545HM6-72L	545	42.38	12.86	50.01	13.62
		SP550HM6-72L	550	42.61	12.91	50.12	13.67
		SP555HM6-72L	555	42.76	12.98	51.79	13.74
		SP560HM6-72L	560	42.88	13.06	51.91	13.83
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	25				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.350				
Temp. coefficients of Voc		(% /C°)	-0.275				
Temp. coefficients of Isc		(% /C°)	0.050				

## Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
120 cells	M	SP490HM6-60L	490	42.40	11.56	51.30	12.14
		SP495HM6-60L	495	42.60	11.63	51.50	12.21
		SP500HM6-60L	500	42.80	11.69	51.70	12.28
		SP505HM6-60L	505	43.00	11.75	51.90	12.35
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.34				
Temp. coefficients of Voc		(% /C°)	-0.25				
Temp. coefficients of Isc		(% /C°)	0.04				

