S-Energy

INSTALLATION MANUAL

PV Module Installation

SN Model Version 1.0 / 2015

| Before use

1) This installation manual (hereinafter referred to as “this manual”) includes installation and maintenance methods, and important safety instructions for the PV module(hereinafter referred to as “PV module”) produced and sold by S-Energy. Please store this manual in the visible area for future reference after installation.

2) Any troubles caused by failure to comply with these instruction during the installation, use, operation, maintenance of the module may be excluded for warranty.

3) All installation, operation shall be based on this manual, and the actual installation, use, operation and maintenance should be performed by qualified personnel with electrical license.

4) For the detailed quality warranty policy of the product, please refer the quality assurance provided by S-Energy Co., Ltd..

5) When the contents of this manual conflict with the quality assurance, the quality assurance takes precedence.

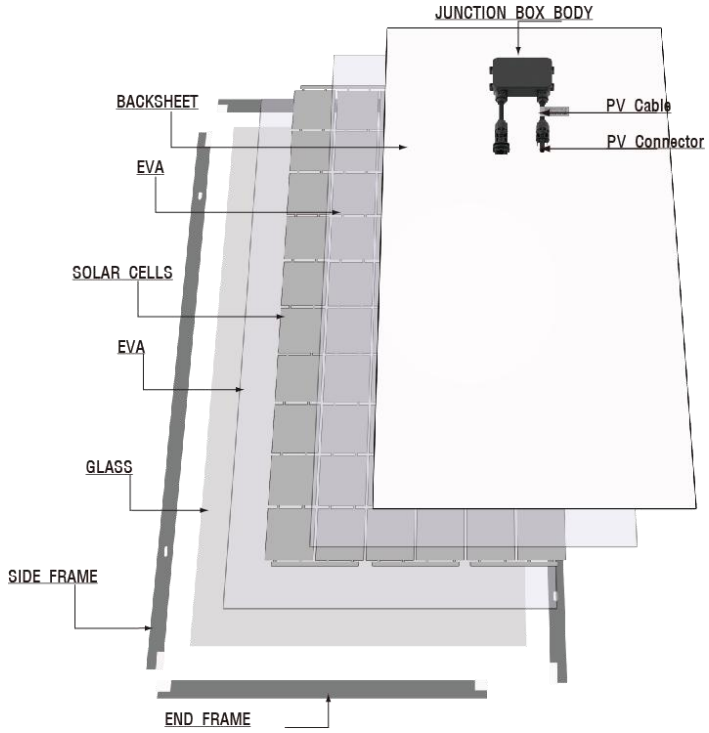
6) In order to provide better service, the information included in this manual is subject to change without prior notice.

1. Company Introduction

S-Energy Co., Ltd., started as the first specialized company of solar module maker in Korea, where solar industry was unexplored. The company has been acknowledged for its technology and quality as it has sold PV module worldwide based on the experience of 20 year's manufacturing technology and thorough quality management.

We, S-Energy Co., Ltd. will reward our customers by continuing to develop and produce good quality of product, and consistently challenge ourselves to develop the solar energy industry in Korea as well.

2. Accessories



[Fig. 1]

✓ The name of each part of solar module is presented as 'Fig. 1'

✓ When requesting maintenance, please inform malfunction part and its performing status including the name of each part by referencing the left figure.

3. Safety Precautions

These “Safety Precautions” should be thoroughly understood before installing.

Danger

When connecting with ‘+’, ‘-‘ in module, the cable shall be equipped with direct current, and shall not connect or disconnect with module when electricity flows. If an abnormal or old electrode is connected, you may get injured by sparks arising from direct current.

※ PV module installation should be performed by qualified person only.

Caution

|Caution|

The utmost care is required for preventing corrosion/contamination/deterioration due to mishandling when you load/outdoor load/installation.

|Recommendation|

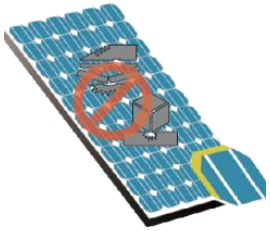
Store a module in an indoor warehouse before installing.

| Caution |

Always wear protective equipment while working with PV modules.

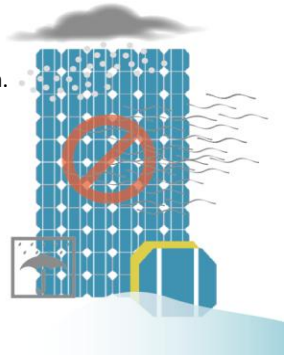
|Recommendation|

Working on a PV system requires following all applicable local codes and wearing protective equipment, and must be performed by appropriately qualified and authorized personnel only.



[Caution]

Do not place heavy objects on the module.
Stepping on or allowing objects to fall on the module may damage certain parts of the product and slow down the performance significantly, or causes risks to the whole system.

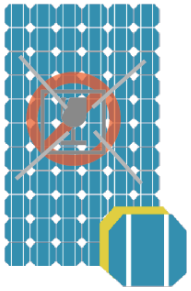


[Caution]

Do not install when snowy, rainy, and windy days.
Do not install where water remains on the ground.

|Recommendation|

Install when the weather is clear.



| Caution |

All surfaces except frames are fragile, so touch only the frame areas when moving/installing. And do not allow direct shock or hit to the module.

|Recommendation|

PV module should be installed by a two person team. Be careful when handling because the shock may cause damage or low performance.

| Caution |

Do not scratch by a sharp tool on the module frame and surface.

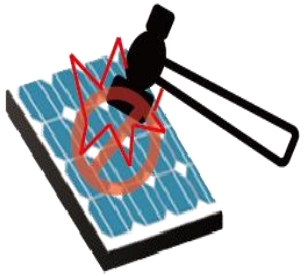
Abrasion of the coated surface may lead to oxidize frames or reduce their strength.

The scratch of the surface may be the main cause of the module output degradation and decrease in strength.

| Caution |

The front surface of the module shall not be exposed to sunlight artificially.

[It can cause performance degradation due to solar cell degradation]



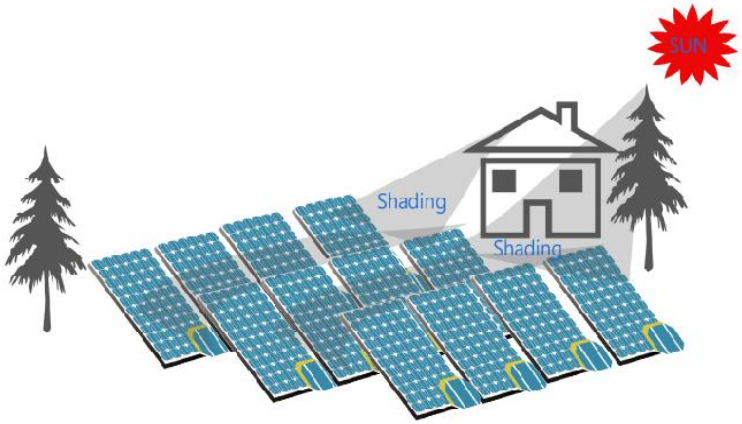
| Caution |

Do not touch or give shocks to the Junction box as well as front and rear surface of module, and do not remove the label.

| Caution |

Do not touch with wet hands or equipment, which can result in electric shock.

Environmental considerations



|Recommendation|

The shading of the front surface is the main cause of hot spot or performance reduction of power generation.

The ground should have well drained soil.

4. Caution before installation

Please read this instruction before installing PV module.

1) The installation of PV module should be performed by qualified personnel only.
2) When installing PV module, you should wear protective equipment.(electric shock or falling accident risk)
3) When installing PV module, do not step up onto the PV module or place the object on it.
4) After installation, qualified person shall check whether it operates properly or not.
5) Disassembling or replacing of the PV module part is not allowed without permission by manufacturer, and if you disassemble or replace anything, please inform the PV module manufacturer.
6) When disassembling or replacing the part with manufacture's permission, it should be performed by qualified person only, and use the certified accessories.
7) For the permission or regulation for installation, please contact the local authority.
8) When the PV module is damaged or stopped, anyone, even who has useful knowledge for the PV module, should not approach to the PV module. Touch or approach may cause serious injury, in which case manufacturer is not responsible for the damage therefrom.
9) PV module's orientation shall be at equator direction, and be installed at the same angle as the latitude of the installation location for the optimal generation performance. If it is installed at a different angle or direction, it may adversely affect an annual generation capacity. In case of horizontal installation, S-Energy recommends regular cleaning to remove dust on the surface.
10) PV module generates the voltage even without load connection. So, be careful for sparks especially when assembling/disassembling PV module.
11) PV module is intended to be installed on the ground or building.
If you need to install on the vehicle(car, train, etc.) or ship, please request special modules.
12) Snow, water, dust, or other foreign substance on the surface may increase reflection of the light and eventually reduce the PV module's output.(Regular cleaning of module surface can improve performance).
13) Standard rating specification is measured at the STC AM1.5 condition, and the performance can significantly improve in the low temperature.
14) Before installation, modules should be stored under packing condition.
15) Irrespective of module connection, contacting current carrying part may cause a burn or fatal electrical shock from sparks.
16) The shading of the front surface of the module can cause the module degradation by fire or reduce its lifecycle.
17) When working with the PV module wire, connect the wire with a hanger to avoid contact on the roof or ground.
18) Potential Induced Degradation [PID] may be caused by ambient high temperature, humidity, and high system voltage. S-Energy's PV module equipped with Enhanced PID module can endure these degradation, but a long term exposure may also cause PID. To completely prevent PID, trans inverter and Negative GND should be connected to the (-) GND with the module frame.

5. Caution when installed

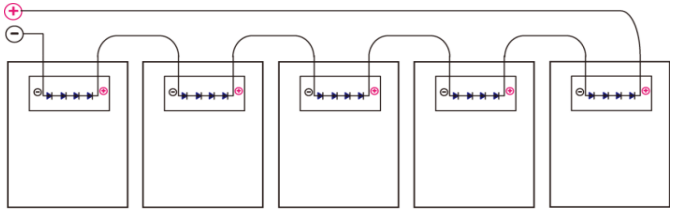
1) Please make sure that installed module wire distribution is correct, and insulation and waterproof performance of connect part is suitably installed.
2) Check if there are any scratches on the frame and front surface of the glass(The scratch may lead oxidation and reduce the strength)
3) Regularly clean the module with water, and if the module is not cleaned with water, request to the manufacturer.(*Regular cleaning can significantly improve the output capacity)
4) The front surface of glass is specially treated, so do not apply any abrasive cleaning product or chemicals.
5) Periodic inspection should be performed only by qualified personnel with protective equipment.
6) To avoid shade by the vegetation environment, regular weeding is needed.

6. Electrical Installation

Caution

1) Electrical risks must be prevented during installation, distribution, generation, and maintenance of PV module.
2) During installation of PV module, system voltage should not exceed [IEC1000V].
3) When installing the system, use same rate of model [If you use a electrically and physically different type of module, output capacity or system performance may be reduced due to fire].
4) When wiring, you should connect polarity appropriately, and if not, it can cause abnormal generation performance and PV module degradation by fire.
5) For the reverse current value, refer the Fuse rating value specified in “9. Detailed module specification’. If exceed its value, connect the rated overcurrent protective device(permitted by local regulation) to the module string in series wiring.
6) Junction box is in the rear surface of the module. This box is an important device for the module generation, and never unpack it in any circumstance in the field.
   [Once the junction box is opened, warranty will be invalidated.]
7) If the PV module have any electrical problem, you should inspect the module according to the warranty term provided by S-Energy, and return it to S-Energy for repair and replacement.

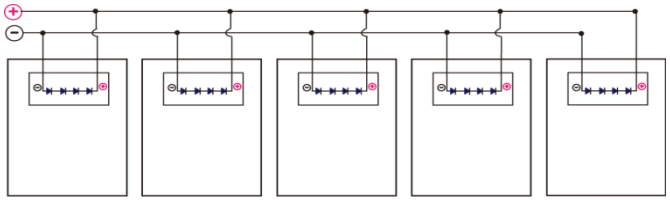
| Series Wiring|



SERIES WIRING [VOLTAGE ADDED]

- Wires may be connected in series to generate the required voltage output.
- Series wiring should be configured at the same rate(current)

| Parallel Wiring |



PARALLEL WIRING [CURRENT ADDED]

- Wires may be connected in parallel to generate the required current output.
- Even when wires are connected in parallel, the intensity of voltage in inverter should be considered.
- Before connected to other modules, all modules should be wired with a fuse. For the number of additional fuses and maximum number of module should refer and follow the related local regulations.

▪Material :
All the wire for the PV module connection should be configured with PV cable only.
[Cable for PV : double insulation, UV resistance, temperature resistant for more than minimum 90℃] Use copper wire for all wiring.
▪Diameter: At least larger than minimum 12AWG [4㎟]
[wiring diameter should confirm the local regulation, and S-Energy Co., Ltd. recommends the customer use wires with a diameter larger than the above number at minimum.]
▪Module configuration[Series wiring]
[((Min Temp ℃– 25℃) x (Voc x -Temperature coefficient of Voc)) + Voc] x Panels per string = Maximum system Voltage
[To guarantee the maximum voltage limitation condition, ensure the general temperature condition according to the National Electric Code (690.7)

7. Mechanical Installation

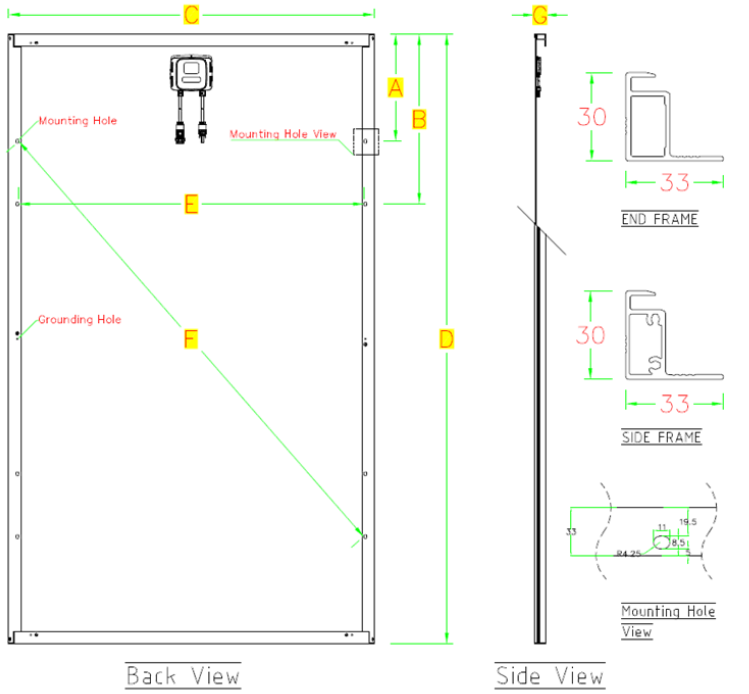
1) Grade[Class A]: The module is a 'Class A' grade.
[Class A: This grade is regarded as a device operated above
50V or above 240W and a product where an ordinary person's approach is expected.
It acquired the safety standard under IEC 61730-1 and IEC 61730-2]

2) Installation site: The module should be installed at a place satisfying the following Respect.

※ Safety load
A 60 series product was designed to tolerate the wind load(the back side) of 2400Pa, snow load(the front side) of 5400pa, and a 72 series product was designed to tolerate the wind load(the back side) of 2400pa, snow load(the front side) of 5400pa.
When the maximum snowfall and wind load on the site are above the standard, a structure to install the module on should be designed to satisfy the mechanical load of the site.

※ Operating temperature
A ambient temperature of module installation site is limited by the minimum and maximum temperature as shown below.
* Maximum operating temperature: +85℃[Under the hot temperature, ventilation should be considered.]
* Minimum operating temperature: -40℃
[Considerations when temperature rises: output is reduced due to characteristics of the module]

※ Places where the installation is prohibited
A site directly contacting salt injury
A site having poor drainage [Poor drainage can shorten the module life]
A site having a shade caused by the geographic features of the surrounding area.
A site where stones and foreign matters are often thrown near to the modules.
[There are concerns for damage to the front window of the module.)



POSITION	60SERIES	72SERIES
A	290	345
B	460	550
C	990	990
D	1650	1970
E	942.5	942.5
F	1425.9	1589.6
G	30	40

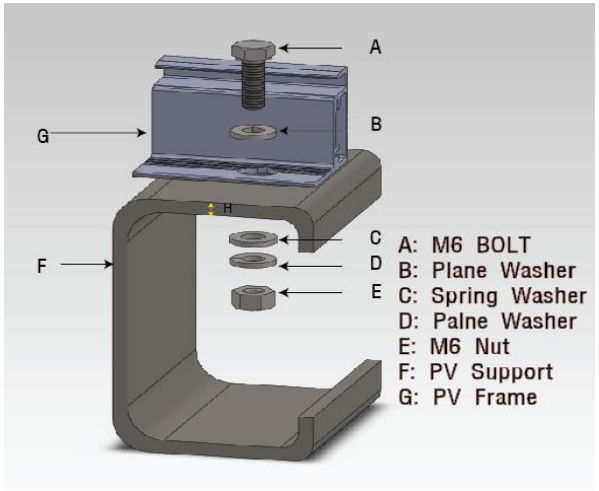
① How to use a frame installation hole

1) Installation angle
Please install the module at the angle having the most annual cumulative amount of solar radiation in the applicable site.

2) Confirmation matter
To improve module's electrical insulation and durability, the back side [Junction Box] of module should be protected to avoid exposure to moisture, and PV module wiring should be installed considering thermal expansion due to ambient temperature and vibration due to wind. When a PV module is installed on a roof, between the back side of the PV module and roof is maintained at a sufficient distance(minimum above 2 inch) to be well ventilated. According to the laws of the applicable site, the PV module can be installed on a fire resistance roof. The PV module's fire rating is "C".

3) Installation hole
The method of installing a frame hole passed a mechanical load test item in accordance with the IEC61215 standard, and S-Energy Co., Ltd. recommends the following method of installing a frame hole. As described in figure 1, an installation hole is inserted in the frame, if the frame is randomly processed or the installation hole is changed, the module will be damaged or the strength of frame will be declined.

| Hole Installation |



Bolt Torque: 16Nm ~ 20Nm [Newton-meters]

60series Bolt size: M6 L16 Bolt, [PV Support T: ≤4mm]
72series Bolt size: M6 L20 Bolt

Caution

1) Be careful to avoid sealing the gap between the module and the structure, because the area should be well ventilated. The module of power performance and life can be affected, if the space between the module and structure is sealed.

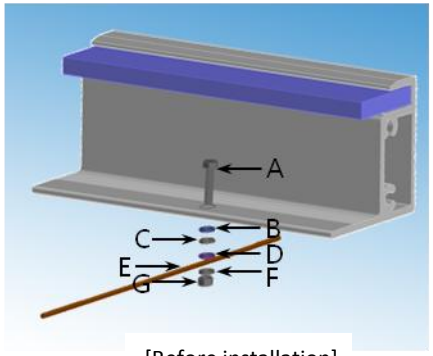
2) Please leave a space between the modules because the module can be expanded or be shrink depending on the ambient temperature.

3) In case of failure to use the accessories recommended by S-Energy Co., Ltd., it may affect the long term reliability of the module, and S-Energy Co., Ltd. do not take any responsibility for life-shortening of the module resulting from such use.

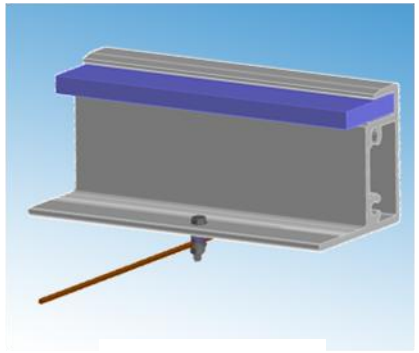
S-Energy

8. Grounding Method

For preventing electric shock and fire, the frame of PV module shall be grounded properly. [Please be sure to remove a coated portion when grounding, because the PV module aluminum frame is coated with anodizing.]



[Before installation]



[After installation]

Configuration	Size and material	remarks
A	M4 Bolt	16mm
B	M4 Star washer	
C	M4 Plat washer	
D	M4 Cup washer	
E	Grounding wire	12AWG
F	M4 Plat washer	
G	M4 Nut	

✓Materials
*SUS304: Bolt, Nut, Washer (Steel Use Stainless)
*Grounding wire: Copper

✓Torque: 0.9Nm ~ 1.1Nm

✓For the detail of Earth, refer to NEC(National Electric Code) 690 grounding PV arrays for special requirements.

9. Detailed module specification

① Electrical Specifications

■ 60cells

STC (Irradiance 1000W/m2 ,Module temperature 25℃, AP-1.5)	SN245P-10	SN250P-10	SN255P-10
Rated power(Pmax)	245 W	250 W	255 W
Voltage at Pmax(Vmp)	29.2 V	29.7 V	30.0 V
Current at Pmax(Imp)	8.39 A	8.42 A	8.50 A
Warranted minimum Pmax	245 W	250 W	255 W
Short-Circuit Current (Isc)	8.85 A	8.86 A	8.93 A
Open-Circuit Voltage (Voc)	37.3 V	37.3 V	37.6 V
Module Effeciency	15.00%	15.30%	15.61%
Operating module temperature	-40℃ to +85℃		
Maximum System Voltage	1000VDC (IEC)		
Maximum Series Fuse Rating	15A		
Maximum Reverse Current	20.25A		
Measurement tolerance	±2.5%		

■ 72cells

STC (Irradiance 1000W/m2 ,Module temperature 25℃, AP-1.5)	SN300P-10	SN305P-10	SN310P-10
Rated power(Pmax)	300 W	305 W	310 W
Voltage at Pmax(Vmp)	35.6 V	36.0 V	36.3 V
Current at Pmax(Imp)	8.44 A	8.47 A	8.54 A
Warranted minimum Pmax	300 W	305 W	310 W
Short-Circuit Current (Isc)	8.88 A	8.90 A	8.96 A
Open-Circuit Voltage (Voc)	44.9 V	45.1 V	45.4 V
Module Effeciency	15.38%	15.64%	15.89%
Operating module temperature	-40℃ to +85℃		
Maximum System Voltage	1000VDC (IEC)		
Maximum Series Fuse Rating	15A		
Maximum Reverse Current	20.25A		
Measurement tolerance	±2.5%		

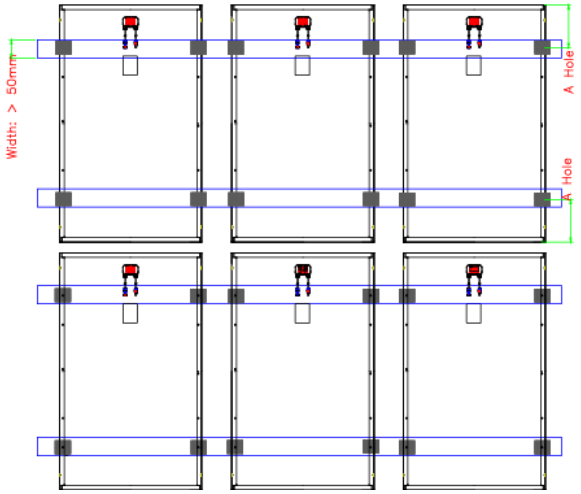
③ Temperature Characteristics

Item	Value
Temperature coefficient of Isc	0.052%/℃
Temperature coefficient of Voc	-0.312%/℃
Temperature coefficient of power	-0.429%/℃
NOCT (Air 20 ; Sun 0.8kW/m2 ; Wind 1m/s)	45±3℃

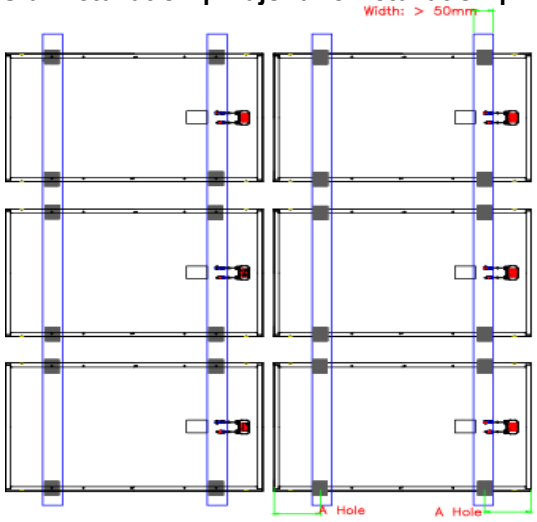
| Remarks

1) Hole installation method

① General installation | minor axis installation |

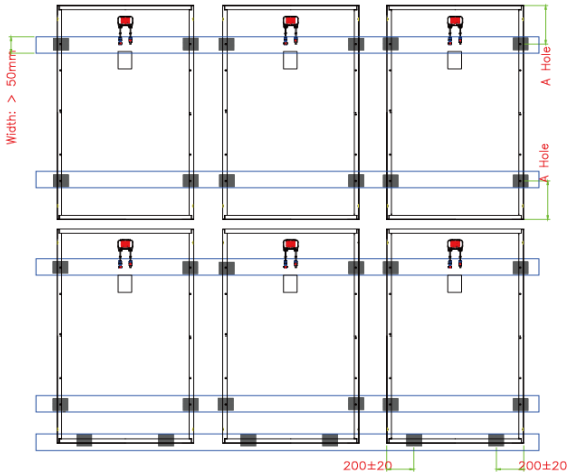


② General installation | major axis installation |



③ Special installation | minor axis installation |

The following installation method is recommended by S-Energy for the installation of the PV module on a roof in heavy snow regions



-Perform additional fastenings at the bottom of the module's minor axis frame

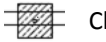
[Preventing load concentration due to the installation slope]

Caution

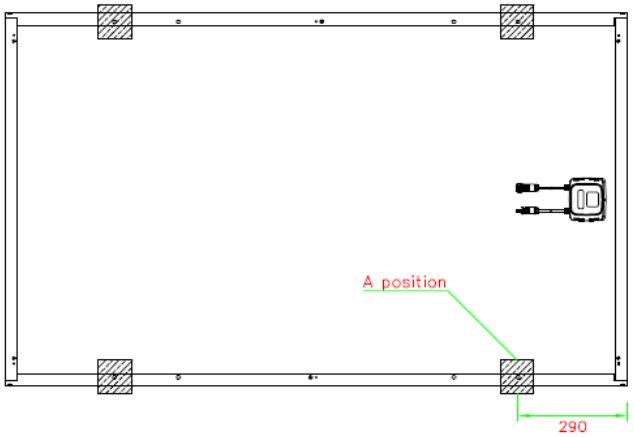
Failure to remove accumulated snow on the PV module for long time may cause long-term power reduction

| Remarks

2) Location and method of clamp installation

-  Clamp installation location (A position Confirm "7 mechanical installation" module drawing)
- Clamp width : 50mm or wider

< 60SERIES>



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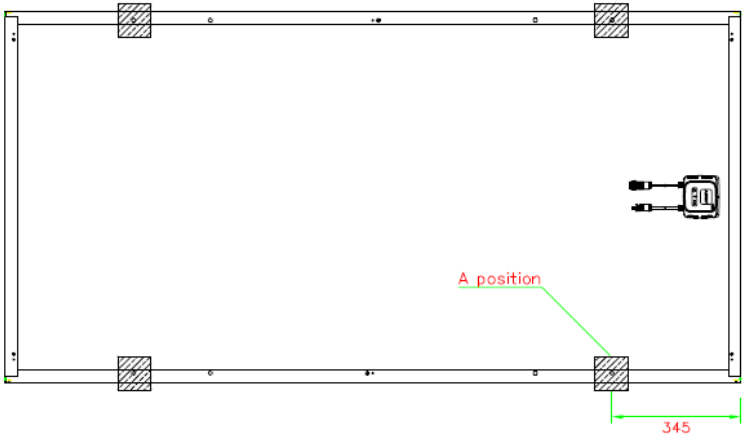
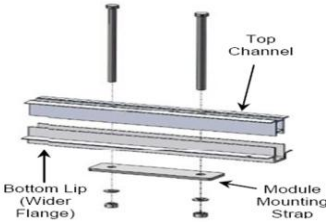
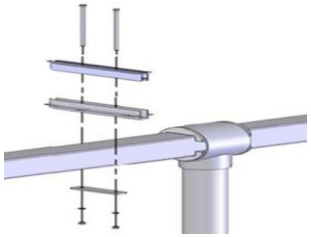
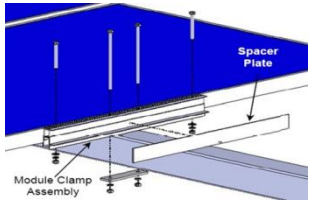
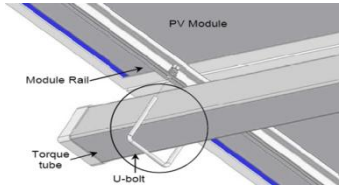


| Module Clamp Assembly |



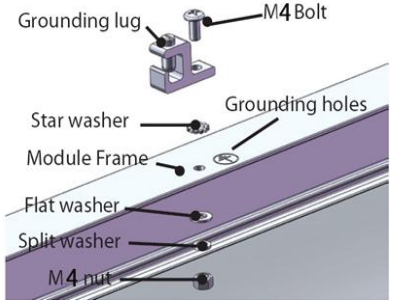


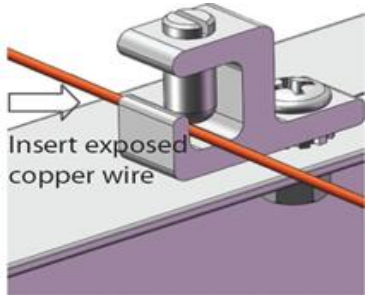




3) Additional Grounding Methods

| Grounding lug|





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