

Installation Manual for Photovoltaic Module

PC8 Model Version 1.1 / 2013

S-ENERGY

Introduction

- 1) This installation manual (“Manual”) contains important precautions, as well as methods of installation and maintenance of solar photovoltaic (PV) modules manufactured by S-Energy Co., Ltd. (“Module(s)”) to ensure safe installation. Please read this Manual carefully prior to installing the Solar Modules.
- 2) Failure to follow the instructions and guidelines of this Manual in strict compliance will most likely cause various problems with installation, use, operation, maintenance of the Modules. Please keep in mind that such problems will not be covered by the limited warranty of S-Energy Co., Ltd (“S-Energy”).
- 3) All installation and operation procedures must be in strict compliance with this Manual. The Modules should be installed by qualified personnel only.
- 4) Please refer to the S-Energy limited warranty of the Modules for more detail concerning warranty issues of the Modules.
- 5) Should there be any discrepancy between this Manual and the limited warranty, the limited warranty takes precedence over this Manual.
- 6) The contents of this Manual are subject to change without prior notice.

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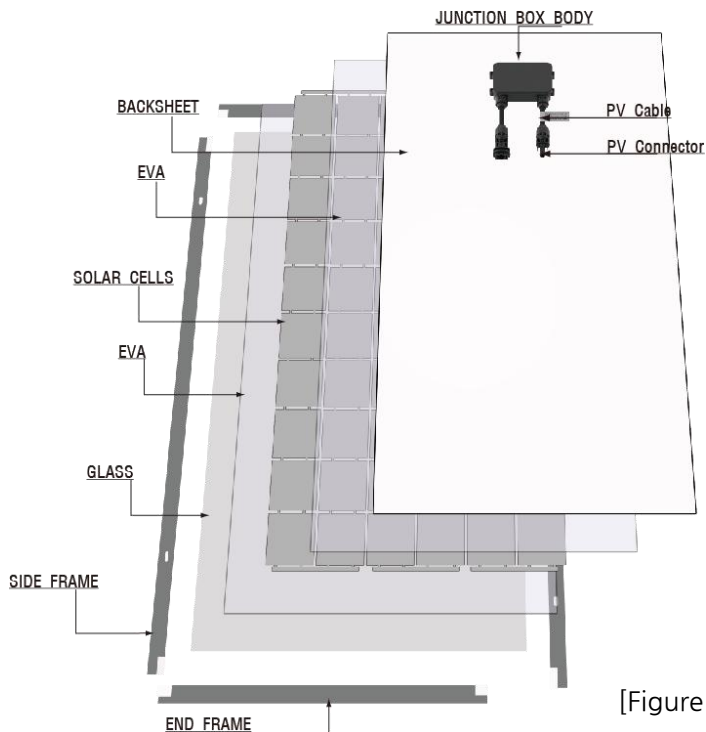
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1. Company Information

S-Energy was established as the first company specializing in solar energy in Korea, a wasteland of solar industry. With more than 20 years of technological advancements and thorough quality control, it has been manufacturing and distributing solar PV modules throughout the world. S-Energy is now recognized as one of the best solar manufacturers in the world for its excellent technology and quality.

S-Energy will continue to reward its customers for their selection of S-Energy modules by developing more efficient and reliable PV modules that will exceed the expectations of the most demanding customers around the world.

2. Materials



[Figure 1]

- ✓ The Names of the major parts/components of the solar module are shown in Figure 1.
- ✓ When contacting us for maintenance services, please tell us the parts and their conditions by referring to the names of the parts listed in Figure 1.

3. Safety and Cautions

Please read the 'Safety and Precautions' section carefully before installing.



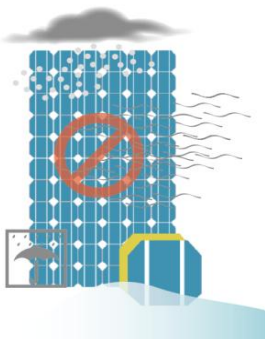
Danger

When connecting the '+' and '-' terminals of the Module, direct current (DC) must flow through the cables. Do not connect or disconnect the Module, while electric current is flowing in the cable. Inappropriate or bad connection can cause direct current spark and injury.

※The installation of the Modules must be performed by a qualified personnel.



Warning



|Warning|

Do not install the Module in snowy, rainy, or extremely windy conditions.
Do not install the Module in a wet place.

|Recommendation|

Be sure to install on a dry day.

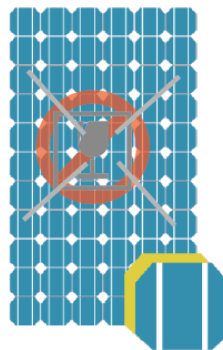


|Warning|

Be sure to wear protective equipment.

|Recommendation|

Installation must be performed wearing protective equipment and in the presence of a qualified personnel, in compliance with the applicable regulations and codes.

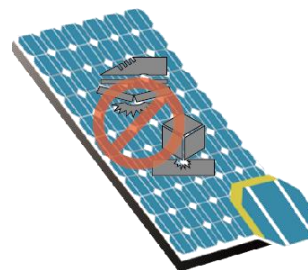


|Warning|

Use the frame when moving/installing the Module because the frame is the strongest part of the Module. Avoid direct shock or impact on the Module.

|Recommendation|

Be sure to install and move the Module with two people; any shock to the module may impair or reduce the performance of the Module.



|Warning|

Do not place heavy objects on the Module.

Stepping on or dropping something on the Module will seriously impair the overall performance of the entire system.



|Warning|

Do not scratch the frame or surface of the Module with a sharp object.

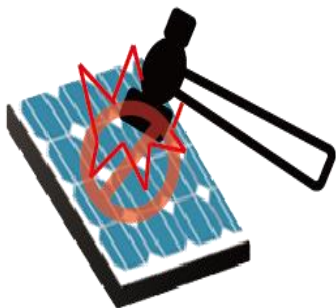
The wear of the coated surface can corrode the frame and reduce the performance of the Module. Scratches on the surface, too, can reduce the power output and performance of the Module.



[Warning]

Avoid intentional, forceful direct sunlight on the surface of the Module, as the cells of the Module may be burned by such sunlight.

Burned out cells will greatly reduce the efficiency of the Module.



[Warning]

Avoid any impact on the front, rear and the junction box of the Module. Do not remove the label.

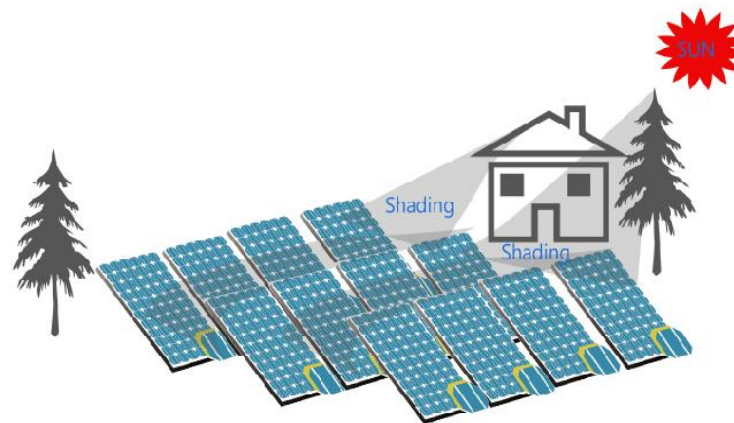


[Warning]

Do not touch the Module with wet hands or tools to avoid electric shock.



Points to consider when installing



[Recommendation]

Avoid any shadow cast by geographies and objects when arranging the Modules for installation at the installation site. There should be no shadowing of any kind during the power generation hours because the shadowing on the surface of the Module will create hot spots that would greatly reduce the efficiency of the Modules.

Also, arrange the Modules so that they would not create any shading on each other.

Be sure to install the Modules where a good drainage system is available.

4. Points to remember prior to installation

Be sure to read this Manual thoroughly before installing the Modules.

- 1) Installation of the Modules must be performed by qualified personnel.
- 2) Be sure to wear protective equipment during installation [Danger of electric shock and injury by a fall during installation].
- 3) Do not step or place heavy objects on the Modules.
- 4) The Modules must be inspected and commissioned by qualified personnel after installation.
- 5) Disassembling or replacing any part of the Module without the manufacturer's permission is strictly prohibited. Should you require assistance, please contact us.
- 6) Upon receipt of manufacturer's permission, only qualified personnel may disassemble or replace parts of the Module with certified replacement parts.
- 7) For installation permits, please check with the appropriate governing agencies and applicable laws and regulations.
- 8) If the Module is damaged or does not work, no one should attempt to fix the Module unless he or she is qualified to do so. Failure to follow this instruction will cause a severe injury for which the manufacturer is not responsible.
- 9) Do not install the Modules horizontally.
- 10) Horizontal installation may cause deposit of excessive dust on the surface of the Module, as well as collection of white powder caused by wind both of which would reduce the power output of the Module.
- 11) Electric voltage is still being generated even though the Modules are not connected; therefore, an electric spark may occur when assembling/disassembling the Modules.
- 12) The Modules are designed for ground or rooftop installation. Should you wish to install the Modules on moving vehicles (car, train etc.) or vessels, please inquire about our special Modules for those purposes.

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- 13) Snow, water, dirt and other foreign objects on the surface increase the reflection of sunlight, which would decrease the output of the Modules [cleaning of Modules' surface on a regular basis may increase the power generation].
- 14) The Industry Standard Rated Specifications are measured under the conditions of 1000 W/m² of irradiance and 25 °C of solar cell temperature. Low temperatures increase the power output of the Modules.
- 15) Please keep the Modules in the original packaging until installation.
- 16) Whether or not the Modules are connected, burns and sparks can cause fatal electric shock, if come in contact.
- 17) Shadows on the surface of the Module can cause module burnout and will decrease the lifespan of the Module.
- 18) Wiring of the Module must be laid on cable trays to avoid contact with the roof or ground.

5. Cautions after Installation

- 1) Check the wiring, insulation and waterproofing of the connectors to ensure correct installation.
- 2) Check if there are any scratches on the frame and/or the front glass [Scratches cause module oxidation and weaken the strength of the Module].
- 3) Use water when cleaning on a regular basis; if the surface cannot be cleaned with water, please contact us [Regular cleaning increases the power output].
- 4) Do not use any abrasive cleaning liquids or chemicals for cleaning purposes because the front glass has been specially treated.
- 5) Regular inspections should be performed by qualified personnel wearing safety equipment.
- 6) Regular weeding is required to prevent shading by the surrounding vegetation.

6. Electrical Installation

Caution

- 1) Throughout the installation, wiring, operation, and maintenance of the Module, utmost care must be taken to prevent any electrical hazards.
- 2) When configuring a solar system, do not exceed the system voltage [UL 600V/IEC 1000V].
- 3) When configuring a solar system, use the same grade modules. [When the modules of different electrical or physical types are connected, the power output may decrease, or the system may cause burnout.]
- 4) Match the line polarity when connecting the wires. Incorrect polarity causes abnormal function and burnout of the Module.
- 5) Refer to the fuse rating indicated on the back label of the Module for reverse current and install an overcurrent protection device in accordance with the applicable regulation.
- 6) The junction box on the backside of the Module is an important component, thus, must not be opened in the field under any circumstance [The warranty clause will be automatically voided if the junction box is opened].
- 7) A defective Module must be returned to S-Energy in order for it to be repaired or replaced pursuant to the limited warranty provided by S-Energy.

▪Materials :

Wires used for solar module wiring should be a PV dedicated cable.
 [PV dedicated: double insulation, UV resistant, temperature resistant at least over 90 °C]
 All wiring must use copper conductors.

▪Diameter :

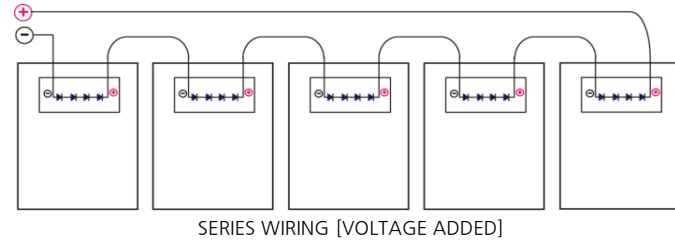
Minimum 12AWG [4mm]
 [Wire diameter must be in compliance with local laws and regulations. S Energy Co., Ltd. recommends wires larger than the above diameter.]

▪Number of modules [in series]

$$[(\text{Min Temp } ^\circ\text{C} - 25^\circ\text{C}) \times (\text{Voc} \times \text{-Temperature coefficient of Voc}) + \text{Voc}] \times \text{Panels per string} = \text{Maximum system Voltage}$$

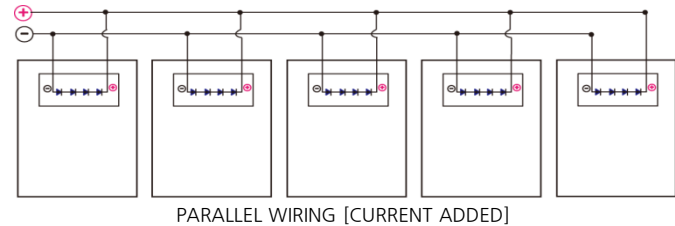
 [To ensure the maximum voltage constraints, check the status of the general temperature condition in accordance with the National Electric Code (690.7).]

▪Series Wiring



- To produce system design's required power output, the Modules can be connected in series.
- Series Wiring: must be composed of the Modules of the same rating (current).

▪Parallel Wiring



- To produce system design's required power output, the Modules can be connected in parallel.
- Even if the Modules are connected in parallel, the magnitude of the voltage of the inverter must be taken into consideration.
- All Modules must be connected to the fuse before connecting with another Module. In addition, the fuse and the maximum number of Modules connected in parallel should be in compliance with the regional or local regulations.

In normal conditions, PV modules may produce larger current and/or voltage than reported in the standard test conditions. Therefore, when voltage evaluations for components, capacity of conductors, size of fuses, and size of control systems connected to the module output are determined, multiply the values of short-circuit current (Isc) and open-circuit voltage (Voc) that are marked in SM series modules by the NEC, 1.25 (Source: American National Electrical Code)

7. Mechanical Installation

1) **Class A** : This Module is a 'Class A' rating.

[Class A: The rating is for the product, which is operated over DC 50V or 240 W or more and is expected to be accessible by any layperson.

The safety rating is in accordance with the IEC 61730-1 and IEC 61730-2.]

2) **Place of Installation** : Module should be installed at the place where the following are met

※ **Load-Bearing**

The 60 series are designed to withstand wind loads of 5400pa (back side) and snow loads of 8400pa (front side), and the 72 series are designed to withstand wind loads of 2400pa (back side) and snow loads of 5400pa (front side) When the maximum wind load or snow load is exceeded, the structure supporting the Module must be designed to satisfy the local mechanical load standards.

※ **Operating Temperature**

The lowest and highest limits of the ambient temperature are as follows:

*Maximum Operating Temperature: +85 °C [In a hot environment, ventilation should be considered.]

*Minimum Operating Temperature: -40 °C

[Considerations on Temperature Rise: The output will be reduced due to the characteristics of the module.]

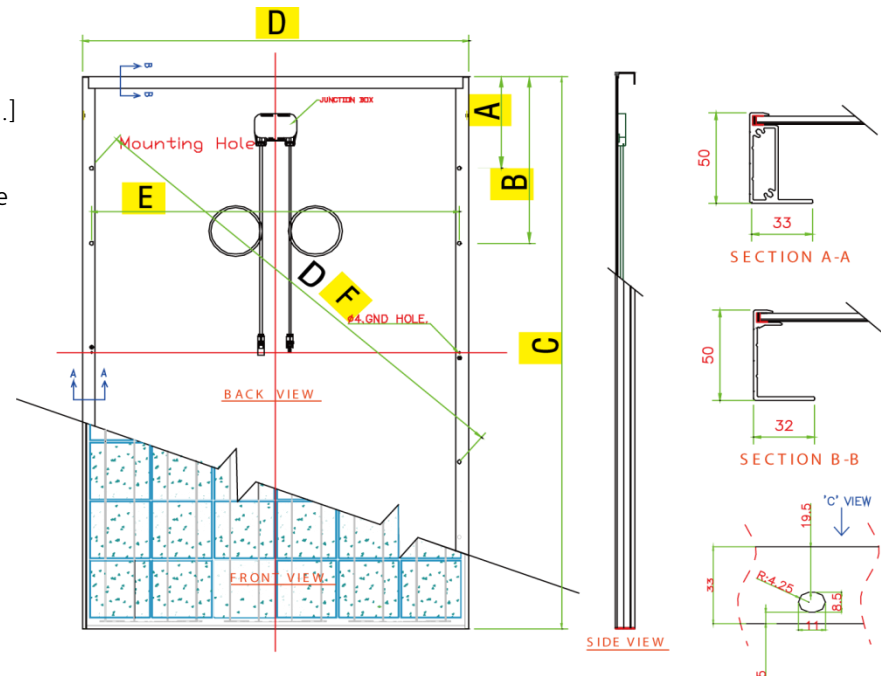
※ **Locations Prohibited for Installation**

Areas subject to contact with salt.

Areas without adequate draining [The lifespan of the Module can be shortened if the draining is poor].

Areas shaded by the surroundings.

Areas prone to flying stones or debris. [May damage the front glass of the Module.]



POSITION	60SERIES	72SERIES
A	300	350
B	505	555
C	1665	1985
D	999	999
E	950	950
F	1427.1	1598.1

① How to Use the Frame Installation Holes

1) Angle of Installation

The angle of the Modules must be determined according to the greatest annual cumulative solar radiation in the area.

2) Checklist

In order to improve the electrical insulation and durability of the Module, protect the backside [Junction Box] from prolonged exposure to moisture. Wiring of the Modules should be installed in consideration of the thermal expansion according to the ambient temperature and vibration caused by wind. When installing the Modules on the roof of a building, sufficient clearance between the back of the Module and the roof must be maintained for good ventilation. Depending on local regulations, they can be installed on a fire resistant roof. The fire rating of the Modules is Class C.

3) Installation Hole

The installation method using the frame holes has passed the mechanical load test based on the IEC61215 and UL1703.

S-Energy recommends the method of installation using the frame holes as follows:

Installation hole is formed into the frame as shown in Fig. 1. Processing the frame or changing the installation hole(s) by the installer can destroy the Module or decrease the strength of the frame.

| Installation Method using the Holes |

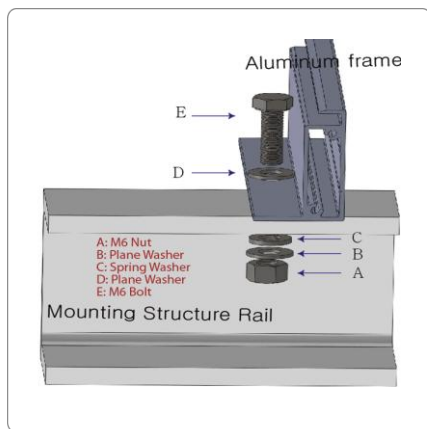


Fig.1 [Installation Design]

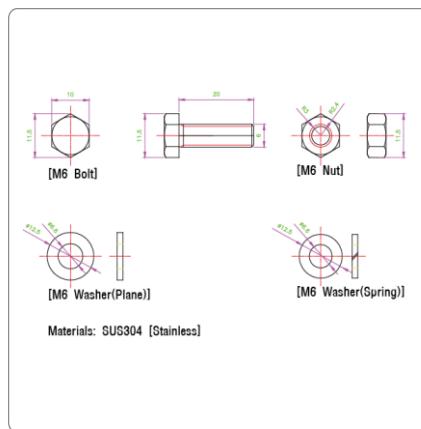


Fig.2 [Sub Materials]

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

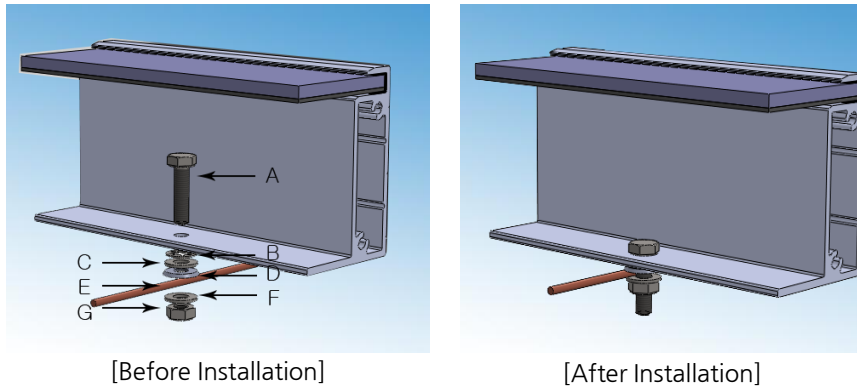
Caution

- 1) Sufficient ventilation between the Modules and structures must be achieved, so the space must not be blocked. Insufficient ventilation can deteriorate the performance and/or life of the Module.
- 2) Module expansion/contraction can occur depending on the ambient temperature. Leave a gap between the Modules.
- 3) Using unauthorized materials or not recommended by S-Energy can affect the long-term reliability of the Modules for which S-Energy is not responsible.

8. Grounding Method

To prevent electrical shock and fire in the solar module, the frame must be grounded.

[The aluminum frame of the solar module is coated by anodizing. Remove the coating for grounding.]



Configuration	Size and Material	Remarks
A	M4 Bolt	16mm
B	M4 Star washer	
C	M4 Flat washer	
D	M4 Cup washer	
E	Grounding wire	12AWG
F	M4 Flat washer	
G	M4 Nut	

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

✓Torque: 0.9Nm ~ 1.1Nm

✓Refer to the grounding PV arrays for special requirements of NEC (National Electric Code) 690 for the details of grounding.

9. Specifications of Solar Module

① Electrical Specifications [72 Cells]

Electrical Characteristics

STC (irradiance 1000W/m ² , module temperature 25°C, AM=1.5)	SM-285PC9	SM-290PC9	SM-295PC9	SM-300PC9
Rated power (P _{max})	285W	290W	295W	300W
Voltage at P _{max} (V _{mp})	35.9V	35.9V	36.3V	36.3V
Current at P _{max} (I _{mp})	7.95A	8.08A	8.14A	8.27A
Short-circuit current (I _{sc})	8.56A	8.63A	8.67A	8.85A
Open-circuit voltage (V _{oc})	44.5V	44.9V	45.0V	45.1V
Module efficiency	14.37%	14.62%	14.87%	15.12%
Operating module temperature	-40°C to +85°C			
Maximum series fuse rating	15A			
Maximum reverse current	20.25A			

② Electrical Specifications [60 Cells]

Electrical Characteristics

STC (irradiance 1000W/m ² , module temperature 25°C, AM=1.5)	SM-235PC9	SM-240PC9	SM-245PC9	SM-250PC9
Rated power (P _{max})	235W	240W	245W	250W
Voltage at P _{max} (V _{mp})	29.8V	29.8V	30.4V	30.8V
Current at P _{max} (I _{mp})	7.89A	8.08A	8.08A	8.14A
Short-circuit current (I _{sc})	8.51A	8.63A	8.63A	8.67A
Open-circuit voltage (V _{oc})	37.1V	37.4V	37.4V	37.5V
Module efficiency	14.12%	14.42%	14.72%	15.03%
Operating module temperature	-40°C to +85°C			
Maximum series fuse rating	15A			
Maximum reverse current	20.25A			
Power tolerance	0 - +5 W			

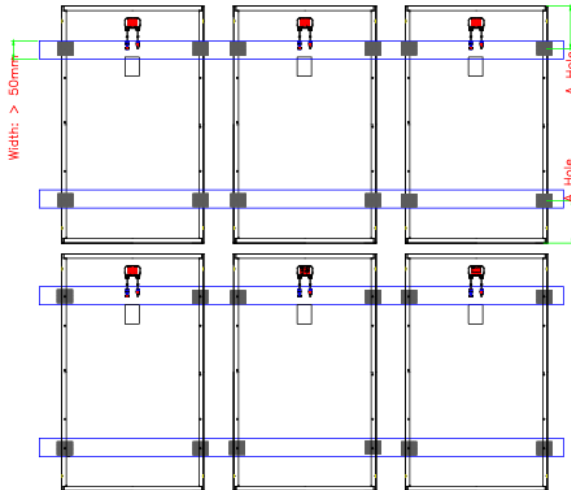
③ Temperature Characteristics

Item	Value
Temperature coefficient of I _{sc}	0.052%/°C
Temperature coefficient of V _{oc}	-0.312%/°C
Temperature coefficient of power	-0.429%/°C
NOCT (Air 20 : Sun 0.8kW/m ² : Wind 1m/s)	45±3°C

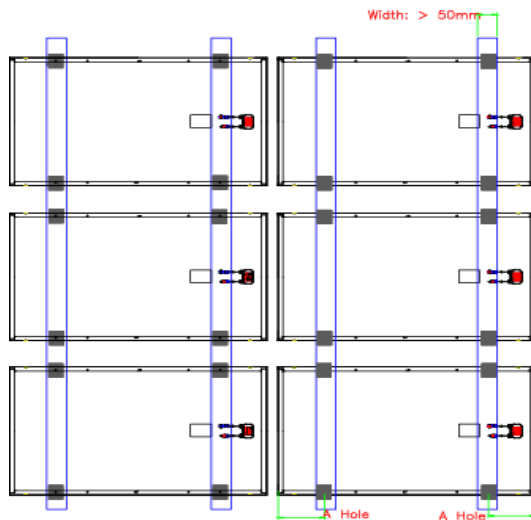
| Note

1) Hole Installation Method

① General Installation [Short-Axis]

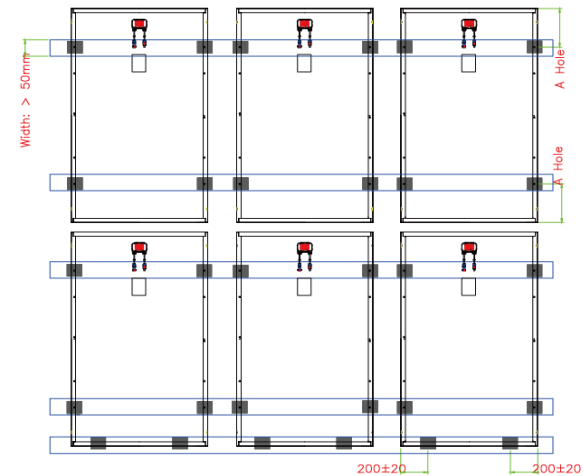


② General Installation [Long-Axis]



③ Special installation [Short-Axis]

The following installation method is recommended when installing modules in heavy snow areas:



In case of extreme snow build-up, the weight of the snow may cause the module's frame to deform. It is recommended to secure module by installing additional supporting parts



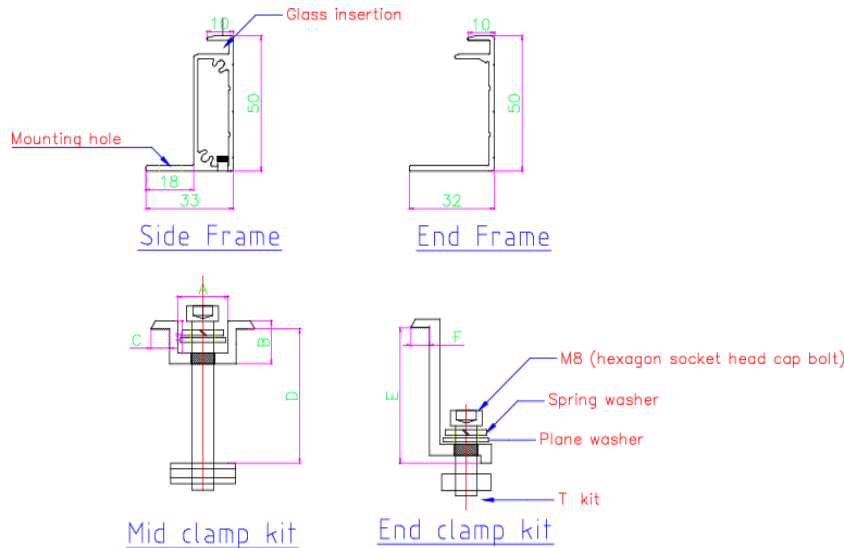
Caution

Long periods of snow cover on PV arrays adversely reduce energy production

| Note

2) Clamp Installation Method

| Recommended Clamp Specifications |



A	B	C	D	E	F	G
Size [unit: mm]						
Point	A	B	C	D	E	F
size	19	16	7 ≤ C ≤ 10	50	50	7 ≤ C ≤ 10

*Remarks:

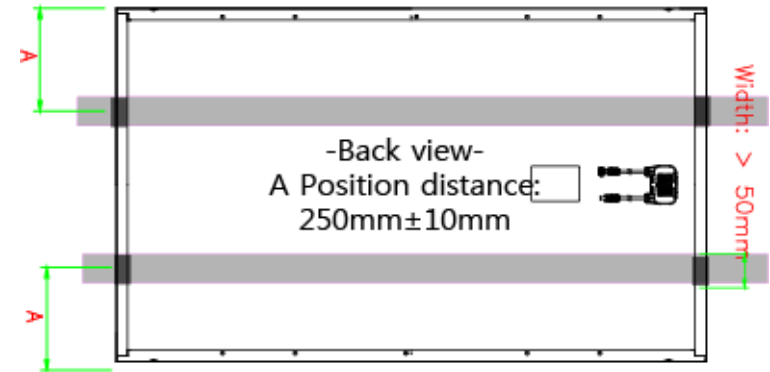
- Material: AL-6005-T5 & SUS 304
- Surface Treatment: Anodized
- End/Mid Clamp Kit 50mm

① Installation on Long Frame

Apply the same method as the hole installation.

SIDE	60SERIES	72SERIES
FRONT SIDE	5400Pa	5400Pa
BACK SIDE	2400Pa	2400Pa

② Installation on Short Frame



*Load Limit

SIDE	60SERIES	72SERIES
FRONT SIDE	5400Pa	5400Pa
BACK SIDE	2400Pa	2400Pa



Caution

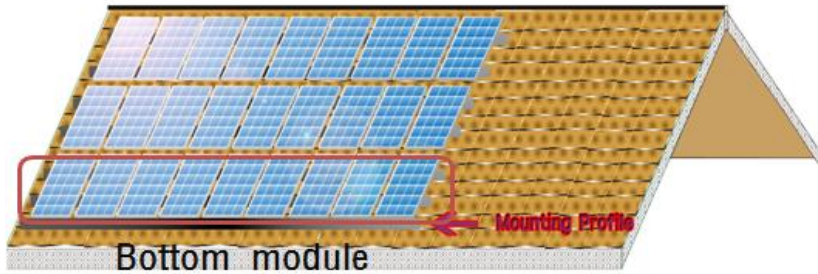
S-Energy and its subsidiaries are not liable for any damages caused by Improper installation, handling, use, or maintenance

10. Remark

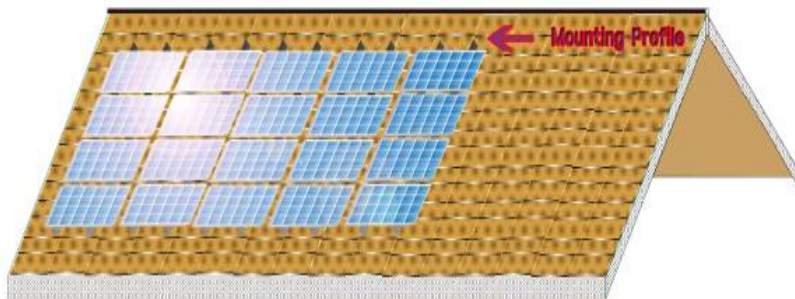
3) Installation on a roof

To install the Modules on a roof in regions where heavy snowfalls occur, the following methods shown below are recommended.

| Installation in short axis |

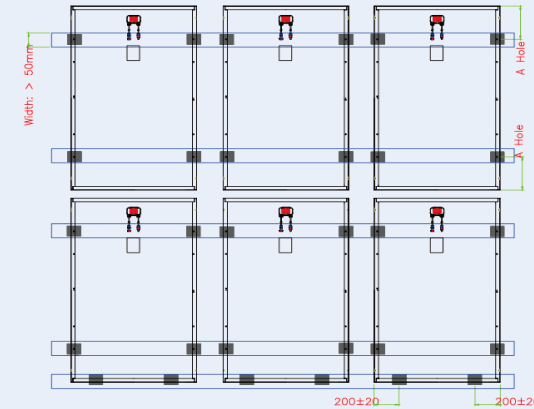


| Installation in long axis |



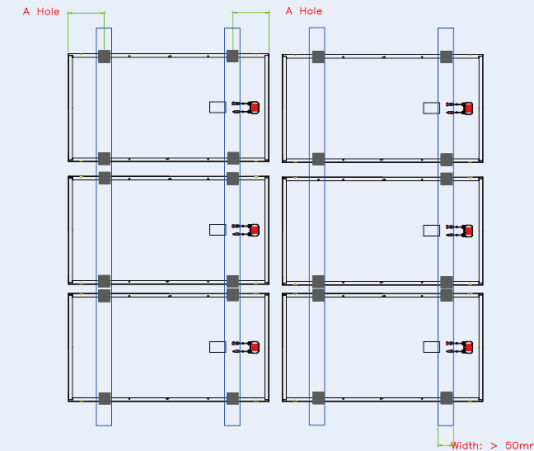
Snow left on the Modules must be removed immediately because the snow may cause reduction in power output

| Layout for a short axis installation |



In order to prevent or alleviate the excessive load toward the bottom of the Modules, additional axis must be used to secure the Modules on the roof.

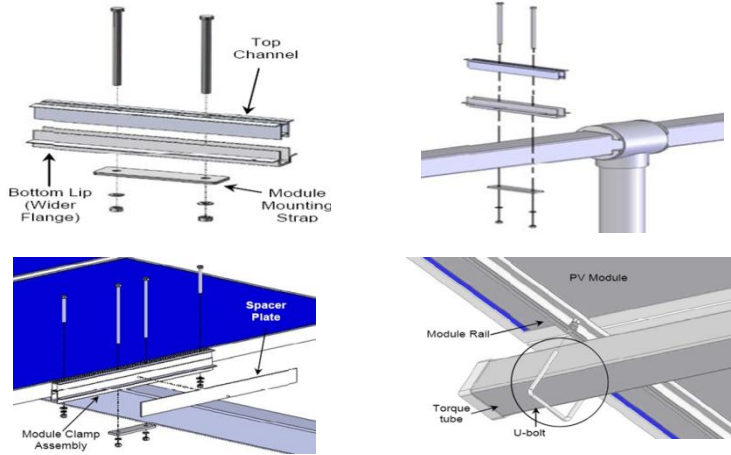
| Layout for a long axis installation |



10. Remark

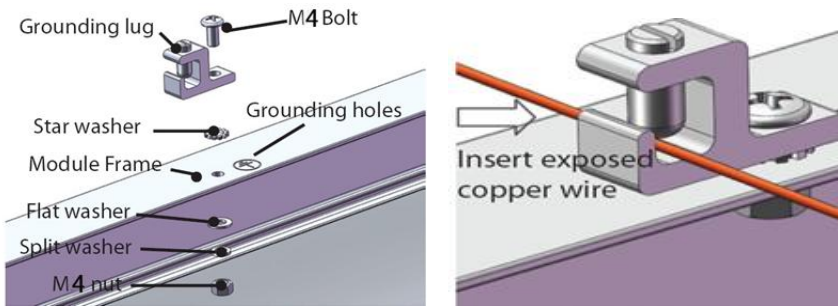
4) Additional Mounting Method

| Module Clamp Assembly |



5) Additional Grounding Method

| Grounding lug |



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