NUUKO

INSTALLATION MANUAL

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USER MANUAL

1. INTRODUCTION FOR USER MANUAL

This Manual applies to the installation, maintenance and use of the framed series solar modules manufactured by Nuuko power Co., Ltd. (hereinafter referred to as “Nuuko power”). Failure to follow these safety instructions could result in personal injury or property damage.

Installation and operation of solar modules require specialized skills, and only professional personnel can engage in the work. Please read the “Safety and Installation Instructions” carefully before using and operating the modules. The installer must inform the end customer (or consumer) of the above matters accordingly.

The term “Module” or “PV Module” in this Manual refers to one or more framed series solar modules. Please keep this Manual for future reference.

1.1 DISCLAIMER

Nuuko power reserves the rights to change this User Manual without prior notice. Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of product's limited warranty.

1.2 LIMITATION OF LIABILITY

Nuuko power is not responsible for any form of damage, including but not limited to module operation and system installation error, and personnel injury, hurt, and property loss resulted from failure to follow the instructions in this Manual.

2. SAFETY PRECAUTIONS

2.1 WARNING

Before installing, wiring, operating, or maintaining Nuuko modules, you should read and understand all safety precautions. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not .

2.2 GENERAL SAFETY

All installation work must comply with the local codes and the relevant international electrical standards.

Nuuko recommends that PV module installation is conducted by personnel with experience in PV system installation. Operation by personnel who are not familiar with the relevant safety procedures will be very dangerous.

Do NOT allow unauthorized persons to access the installation area or module storage area.

Do NOT install modules with damaged glass or damaged backsheet.

Do NOT disassemble or move any part of the module.

Do NOT artificially focus light on the module.

Do NOT connect or disconnect the module when it is energized or connected with an external power supply

2.3 HANDLING SAFETY

Do NOT stand, walk on or lean on the module directly.

Do NOT damage or scratch the front or backside surfaces of the module.

Do NOT scratch the output cable or bend it with force. The insulation of output cable can break and may

result in electricity leakage or shock.

Do NOT use water to extinguish fires of an electrical origin.

Do NOT install or handle modules when they are wet or during periods of high wind. At the installation site, take care to keep modules and in particular their electrical contacts, clean and dry before installation. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used.

Do NOT loosen or unscrew the PV module bolts. This may lead to a reduction of the module's load rating and potential damage from a fall.

Do NOT drop PV modules or allow objects to fall down on the PV modules.

Do NOT touch the terminal box or the ends of the output cables (connectors) with bare hands under sunlight, regardless of whether the PV module is connected to or disconnected from the system.

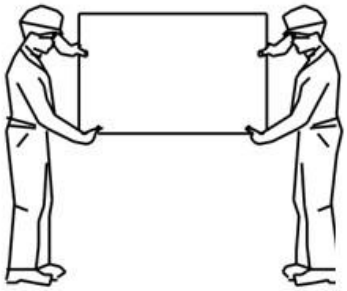
3. UNLOAD/TRANSPROTATION/STORAGE

Precautions and general safety rules

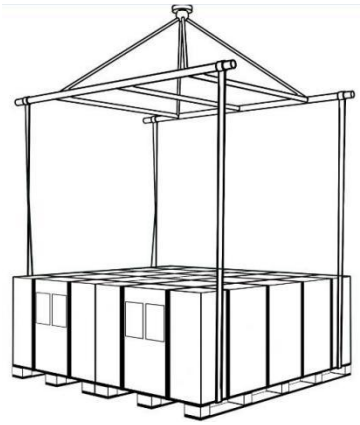
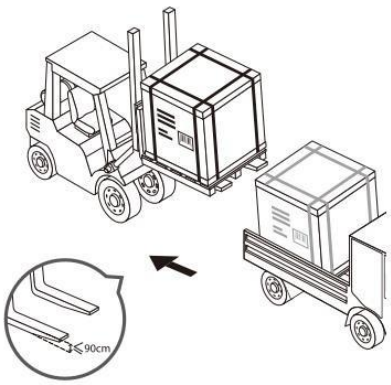
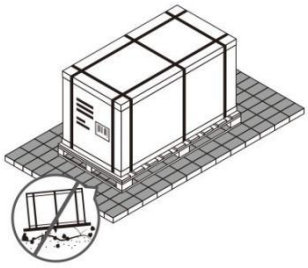
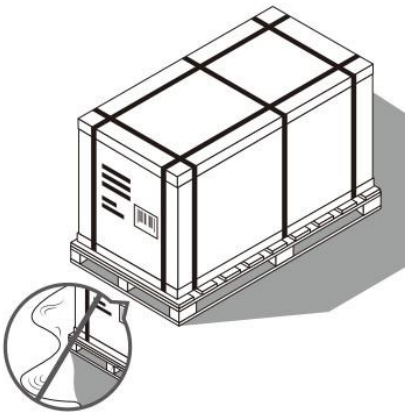
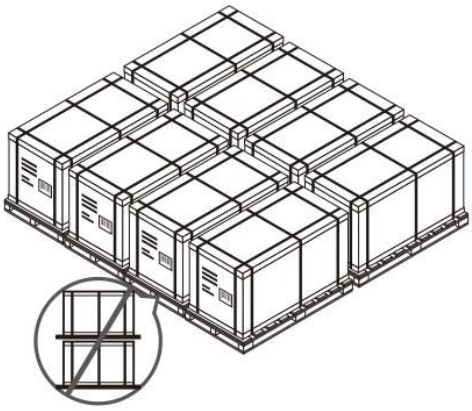
- The modules should be stored in the Nuuko original package before installation. Protect the package from damage. Unpack the modules as per the recommended unpacking procedures. The whole process of unpacking, transport and storing should be handled with care;
- Do NOT stand, climb, walk or jump on unpacked pallets of modules;
- Before installation, ensure that all modules and electrical contacts are clean and dry;
- If the modules are required to be stored temporarily, they should be stored under dry and ventilated conditions;
- Unpacking must be carried out by two or more persons at the same time. It is forbidden to use the wires or junction boxes of the modules to carry the modules. Handling the modules requires two or more people with non-slip gloves; Do NOT handle the modules over-head or stack the modules;
- Do NOT put the modules in a place that is not supported or stable;
- Do NOT allow the modules to come in contact with sharp-pointed objectives to prevent them from scratches, avoiding a direct impact on the safety of modules.

3.1 MAKERS ON OUTER PACKAGING

3.1.1 Do NOT discard the modules at will; special recycling is required  	3.1.2 Modules must be kept dry, not expose to rain or moisture 

3.1.3 Modules in carton are fragile, which must be handled with care 	3.1.4 The packaging must be transported upright 
3.1.3 Do NOT step on the package and module 	3.1.6 The carton can be recycled 
3.1.7 Modules shall be stacked as required, not exceeding the maximum number of layers printed on the outer packaging. (n = 2 means no more than two layers and n = 3 means no more than three layers) 	3.1.8 One module shall be handled by at least two persons together 

3.2 UNLOADING WARNING

<table>
<tr>
<td>3.2.1
Use the correct (as picture) lifting fixture to handle, no more than 2 pallets per lift. Before lifting, please confirm the tray and the carton are NOT damaged and the hoisting rope is firm and solid. Before lowering the carton back on the ground, two persons must support the two sides of the carton gently to put it on a relatively flat place.
  </td>
<td>3.2.2
If the condition permits, use a fork lift to remove the module pallets from the truck
 
Put the modules on level ground
  </td>
</tr>
<tr>
<td>3.2.3
Store the module in a dry and ventilated place
  </td>
<td>3.2.4
Do Not stack the modules at the project site.
  </td>
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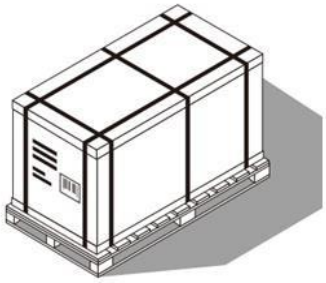
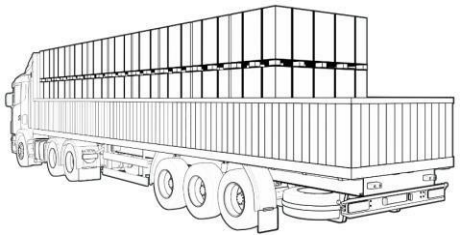
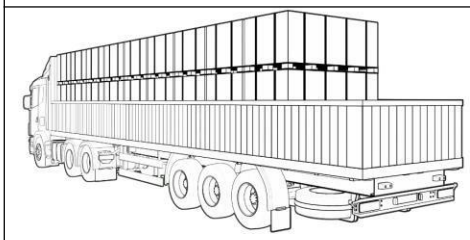
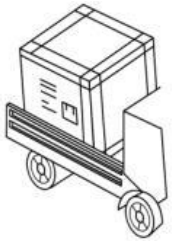
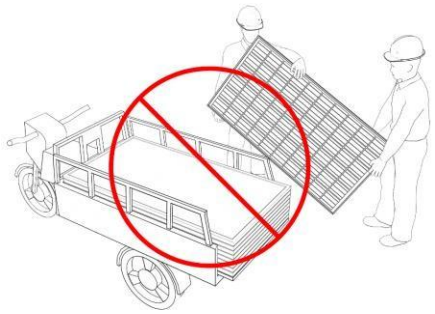
</table>

3.2.5
Cover the module with waterproof material to prevent it from moisture

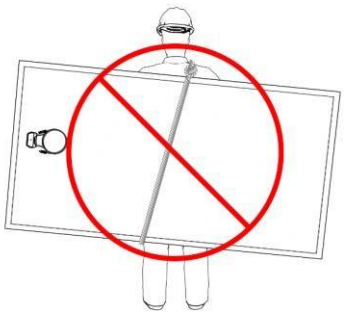
3.3 SECONDARY TRANSPORT AND WARNNING

3.3.1 Do NOT remove the original packaging if the modules require long-distance transport or long-term storage. 	3.3.2 The finished package can be transported by land, sea or air. During transport, make sure that the package is fixed securely to the shipping platform without movement. 
3.3.3 Transport: Do Not stack more than two layers on a truck; 	3.3.4 Only one layer stacking is only allowed for transport at the project site 

3.3.5
No transport or handling by pedi-cab as shown below;



3.3.6
Do Not transport the module with rope as shown below:



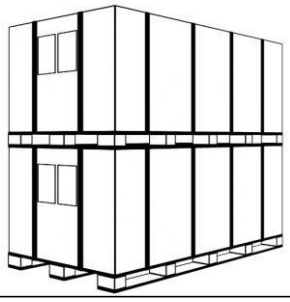
3.3.7
Do Not carry the modules on the back of one person as shown below;

3.4 STORAGE

Do NOT expose the modules to rain or moisture. Store the finished product in a well ventilated, waterproof and dry place.

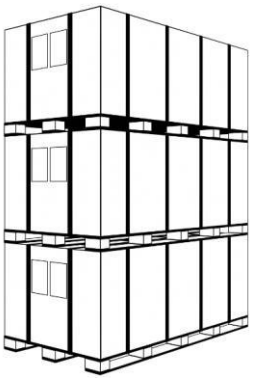
Do NOT remove the original packaging if the module requires long-distance transport or long-term storage.

3.4.1
Storage in project site warehouse (moisture＜85%, temperature range from -20°C to + 50 °C): 60-cell frame module and 72-cell frame module to be stacked separately in two groups

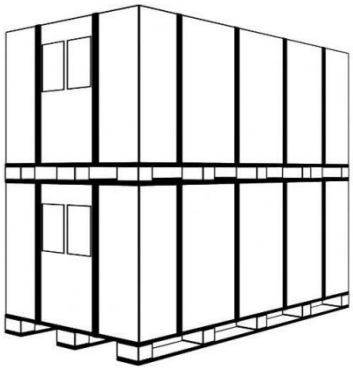


3.4.2
Normal warehouse storage (moisture＜85% and temperature range from -20°C to + 50 °C): 60-cell frame module to be stacked no more than three layers and 72-cell frame module to be stacked no more than two layers (take 72-cell frame module for example)

60 cell



72 cell



4. UNPACKING INTRODUCTION

4.1 UNPACKING SAFETY

For unpacking outdoors, it is prohibited to operate in rainy conditions. Because the carton will become soft and damaged after it gets wet in the rain. The stacked PV modules (hereinafter referred to as "modules") may tip over, which may cause damage or injury to personnel.

For a windy site, it is necessary to pay special attention to safety. Especially, it is NOT recommended to transport the modules in high wind conditions. The unpacked modules must be tied down to avoid any unwanted movement.

The work surface is required to be level to ensure that the package can be placed stably, avoiding sliding.

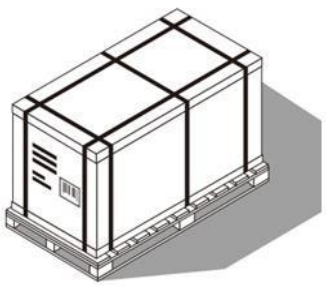
Wear protective gloves during unpacking to avoid hand injury and fingerprints on the glass surface.

Module information and unpacking instructions can be found on the outside of each package. Please read the instructions before unpacking.

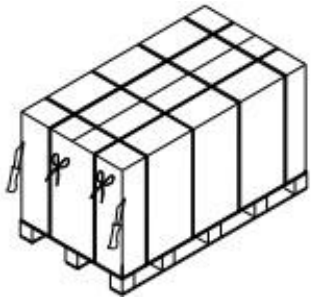
Each module shall be handled by two persons. It is forbidden to use the wires or junction boxes of the modules to carry the module. Do NOT take the module out of the carton by pulling on the long side frame.

4.2 UNPACKING STEP

4.2.1Before unpacking, please check the product name, serial number and related suggestions on the A4 paper. Please read the unpacking instructions carefully. NO other customized unpacking method is allowed.



4.2.2Cut the two packing belts at shorter sides of the tray with blade or scissors, and unpack the side surface of the carton along the vertical direction.



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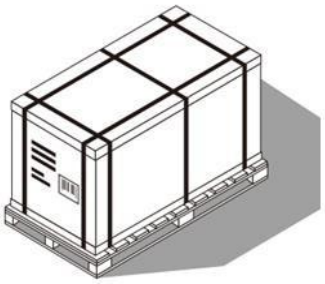

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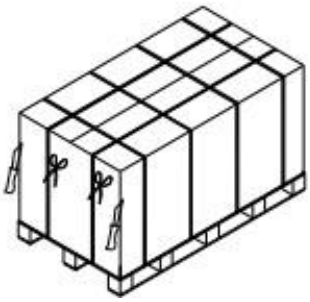
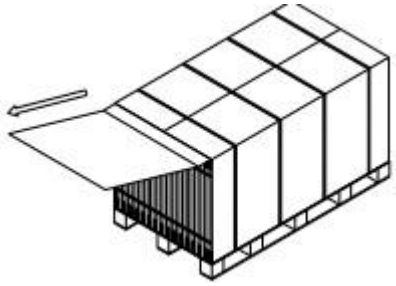
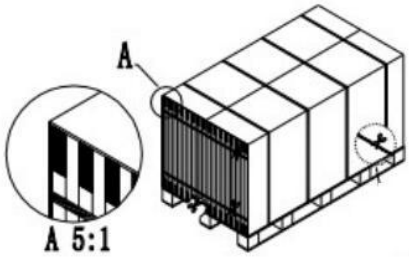


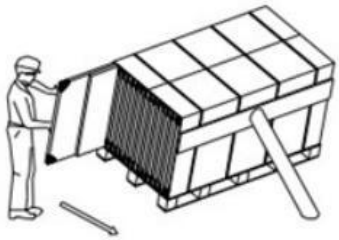
4.2.3
Cut the tape at shorter edge and hold it up by 90° from the bottom; and pull out the cardboard to expose the modules.



4.2.4
Cut the two horizontal packing belts in the carton and cut the two packing belts near the bottom of the tray, and remove the packing belts

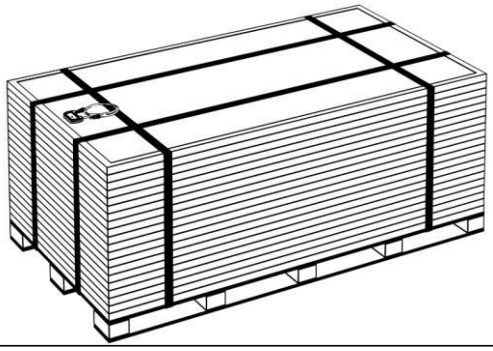


4.2.5
When unpacking on a level surface, take out the module from one side of package to the other, and then carry it with two persons (Please refer to 3.1.8)
When unpacking on a sloping surface, please protect the modules from tipping over or sliding. As shown below



4.2.6
Do NOT lean the module on the mounting posts

4.2.7 If all the modules are NOT removed after unpacking and some of them are left in the package, the remaining modules shall be laid flat and repackaged to prevent from falling down. Must be placed by horizontal.The stacked number of modules: 60-cell frame modules to be stacked NOT more than 20 pieces, 72-cellframe modules NOT more than 16 pieces



5. SITE SELECTION

Solar modules are recommended to be installed at an optimized tilt angle to maximize the energy output. It is roughly equal to the latitude of the project site as a rule of thumb, facing toward the equator. Optimized system designs incorporate other local requirements.

When installing solar modules on a roof, the roof must be covered with a layer of fireproof material applicable to this class, and adequate ventilation must be ensured between the back sheet and the installation surface. A safe working area also must be left between the edge of the roof and the external edge of the solar array

In the case of residential installations on the ground, modules shall be installed following local regulations, e.g. using fence.

Position the modules to minimize the chances of shading at any time of the day.

If the module is installed in an area with frequent lightning and thunder, the module must be protected against lightning strikes.

Make sure flammable gases are NOT generated near the installation site.

In locations that are 50m ~ 500mm from the ocean, stainless steel or aluminum materials must be used to contact the PV modules, and the installation position must be processed with anti-corrosion treatment.

6. TILT ANGLE

The tilt angle measurement of the PV module refers to measuring the angle between the module and the horizontal ground surface. For different projects there are different mounting angles. Nuuko power recommends that the mounting tilt angle should be NOT less than 10°, or in accordance with local regulations or follow the recommendations of experienced PV module installers.

The tilt angle of the PV module is measured between the PV module and a horizontal ground surface.

In the Northern Hemisphere, the PV modules should typically face south, and in the Southern Hemisphere,

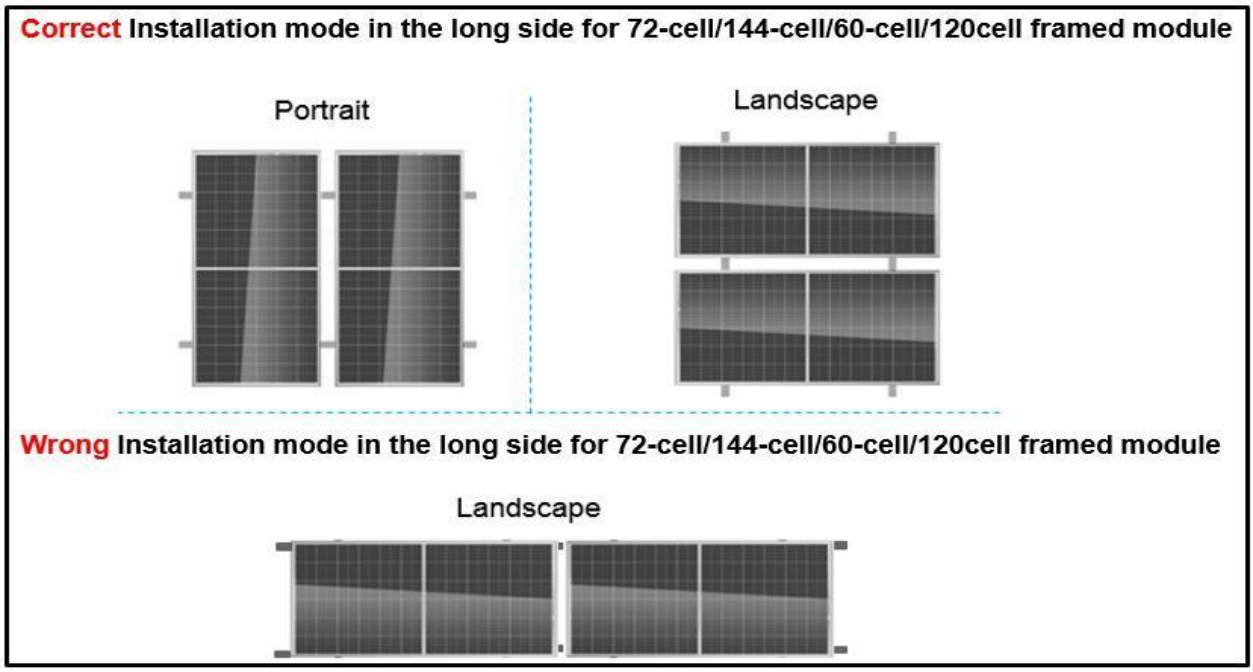
the PV modules should typically face north.

7. INSTALLATION

Nuuko power Framed series modules may be installed in the following conditions to produce energy for more than 25 years.

7.1 INSTALLATION SAFETY

Nuuko power Modules can be mounted in landscape or portrait orientation (the distance between the racking and the long side is 150-250mm), and however the impact of dirt shading the solar cells can be minimized by orienting the product in landscape. Please pay attention that 72-cell/144-cell framed modules can only be installed in the long side frame on vertical racking not horizontal racking when customers choose landscape mode, and they cannot be installed in the short frame side. 60-cell/120-cell framed modules can be installed in both long side frame and short side frame, but 60-cell/120-cell framed modules cannot installed in the long frame shared with the same horizontal racking when customers choose landscape mode. Details as shown picture below.



Always wear dry insulation protection equipment: insulated tools, head gear, insulated gloves, safety belt and safety shoes (with rubber soles).

Do NOT wear metallic jewelry which can cause electric shock during installation.

Do NOT install modules under rain, snow or windy conditions.

Please keep the connector dry and clean during installation to avoid the risk of electric shock. It is recommended to install it immediately after unpacking.

Due to the risk of electrical shock, do NOT perform any work if the terminals of PV module are wet. Please install immediately after you unpacking.

The application level of Nuuko power module is Class A, which can be used in systems operating at greater than 50 V DC or 240 W, where general public contact access is anticipated

Keep the PV module packed in the Nuuko carton until installation.

Please use an opaque material to completely cover the PV module surface during PV module installation and wiring.

Do NOT unplug the connector if the system circuit is connected to a load.

Do NOT stand on the module glass while installing. There is a risk of injury or electric shock if glass is broken.

Do NOT work alone (always work as a team of 2 or more people).
Do NOT damage the back sheet of PV modules when fastening the PV modules to a support with bolts.

Do NOT damage the surrounding PV modules or mounting structure when replacing a PV module.

Cables shall be located and secured so that they will not be exposed to direct sunlight after installation to prevent degradation of cables. Low drooping of cables from the terminal box must be avoided. Low hanging cables could cause various problems such as animal biting, electricity leakage in water, and fire.

7.2 INSTALLATION METHOD

7.2.1 MECHANICAL INSTALLATION AND WARNING

The connection of the module to the racking system can be created through the mounting holes, with clamps, or an embedded system on the frame. The modules must be installed according to the following examples and recommendations or the modules will not continue to have a valid warranty.

The minimum distance between two modules is 10mm (0.4in).

Panels must not be subjected to wind or snow loads exceeding the maximum permissible loads, and must not be subjected to excessive forces due to the thermal expansion of the support structures.

The module frame drain holes cannot be blocked in any situation during installation or use.

***Notes:**

The design loading of modules have been evaluated by TUV according to IEC61215 with 1.5 times safety factor;The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads;The system installer must ensure that the installation methods used meet these requirements and any local codes and regulations.

The modules depicted are mounted on continuous rails that extend beneath the modules.

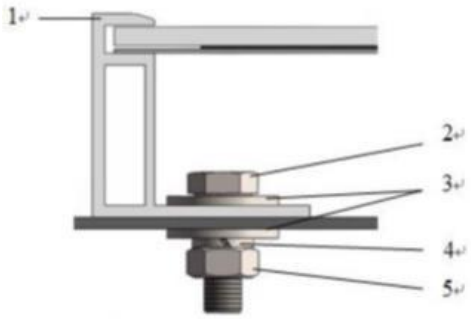
A. Mounting with Bolts(4-φ9*14mm mounting holes)

Modules can be attached using the mounting holes on the back of the module frame, by fixing the module to the support rails with bolts. The mounting details are shown in the following figures.

The frame of each module has 4-φ9*14mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to the supporting structure. Installation holes of 4-9*14 mm are used for routine installation, as shown in Figure 1 ,

Secure the module in each mounting location with an M8 bolt and a flat washer, spring washer and nut and tighten to a torque of 16~20 N.m(140-180lbf.in.).

All parts in contact with the modules should use flat stainless steel washers of minimum 1.8mm thickness with an outer diameter of 20-24mm (0.79-0.94in).



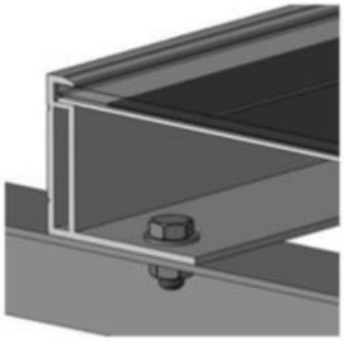
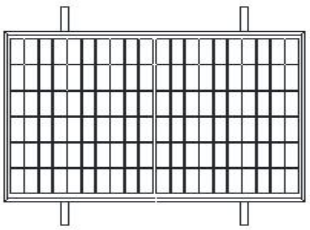
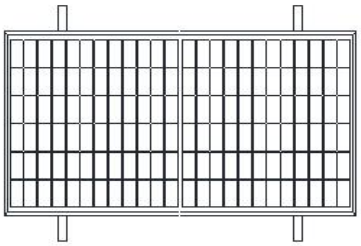


Fig.1 Backsheet-Glass module

1) Aluminum Frame
2) M8 Stainless Bolt
3) Flat Stainless Washer
4) Spring Stainless Washer
5) HEX Stainless Nut

Module	Mechanical Load Pressure	Safety factor	Mounting Direction
60/120 pcs **Backsheet-Glass**	**+**3600 Pa /-1600Pa	1.5	
72/144 pcs **Backsheet-Glass**	+3600 Pa /-1600Pa	1.5	

B. Mounting with Single-axis Tracking System(4-φ7*10mm mounting holes)

Modules can be attached using the mounting holes on the back of the module frame, by fixing the module to the support rails with bolts. The mounting details are shown in the following figures.

The frame of each module has 4-φ7*10mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure. 4 installation holes of 7*10 mm are used for Single-axis tracking system installation, as shown in Figure 2

Secure the module in each mounting location with an M6 bolt and a flat washer, spring washer and nut and tighten to a torque of 16~20 N.m(140-180lbf.in.).

Flat stainless steel gaskets with a minimum thickness of 1.5mm and an external diameter of 16-20mm (0.63-0.79 inches) shall be used in all parts of the components connected to the Single-axis tracking system.

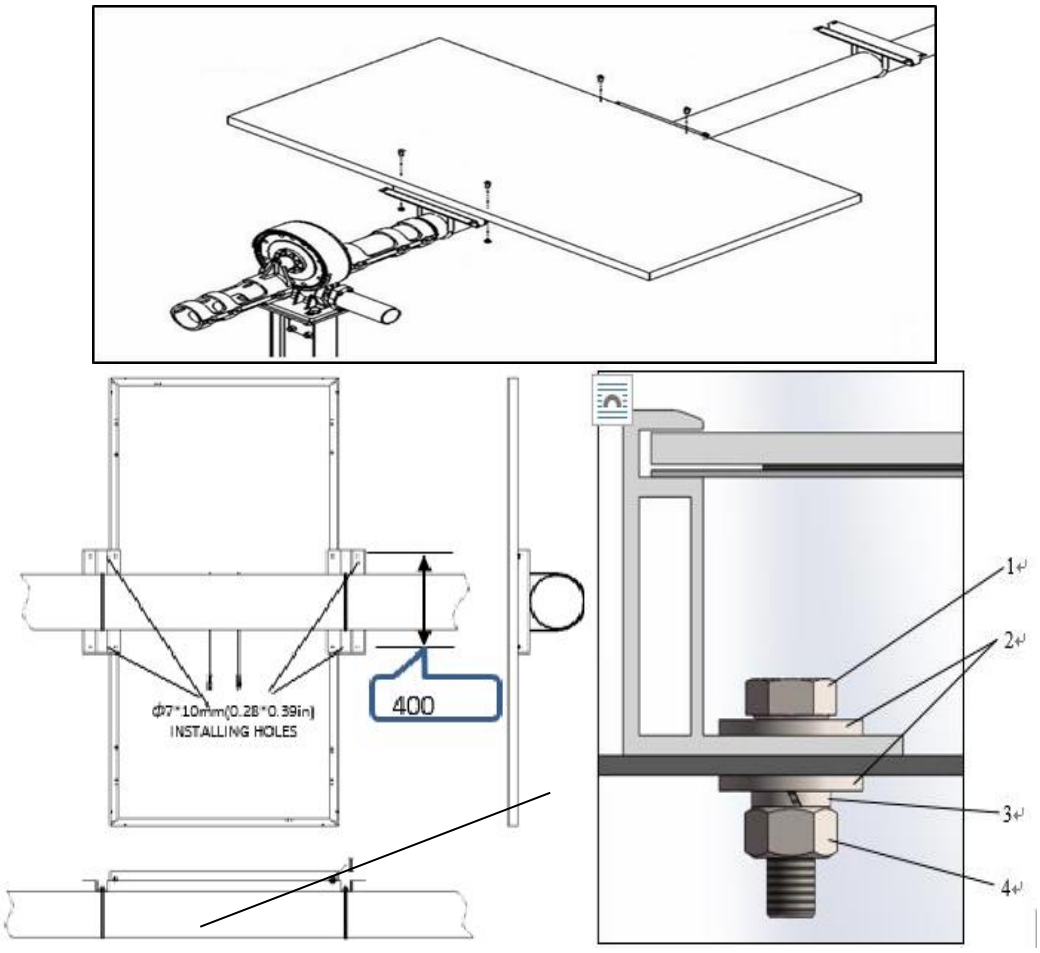
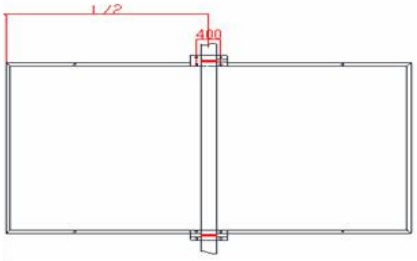


Fig 2. Backsheet-Glass module with Single-axis Tracing System

1) M6 hex bolt M6 2) flat stainless washer
3) spring stainless washer 4) hex stainless nut

Module	Mechanical Load Pressure	Safety factor	Mounting Direction
72/144 pcs **Backsheet-Glass**	+1600 Pa /-1600 Pa	1.5	

C. 2V Installation Method

The single module is installed with two φ7*10mm mounting holes and two φ9*14mm mounting holes, as shown in figure 3. The overall installation method is shown in the table below.

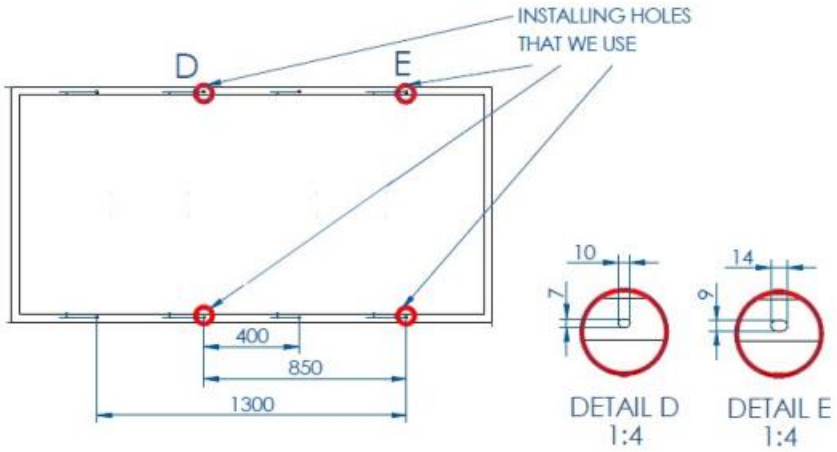
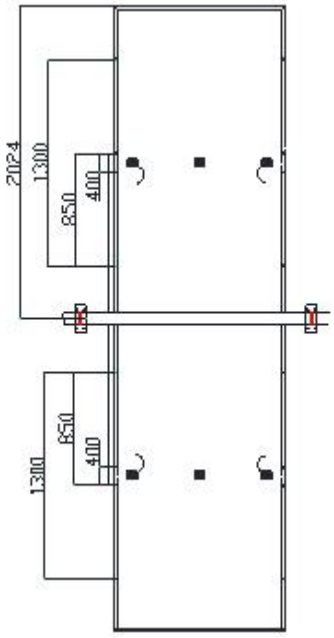


Figure 3： Mounting holes schematic of the single module for the 2V installation method

Module	Mechanical Load Pressure	Safety factor	Mounting Direction
72/144 pcs **Backsheet-Glass**	+1600 Pa /-1600 Pa	1.5	

D. Mounting with Clamps

Nuuko power has tested its modules with a number of clamps from different manufacturers, mounting bolt of at least M8. The length of clamp ≥40mm (1.57in).

The clamp must overlap the module frame by at least 7mm (0.28in) but no more than 10mm (0.39in).

Use at minimum 4 clamps to attach modules to the mounting rails.

Modules clamps should not come into contact with the front glass and must not deform the frame.

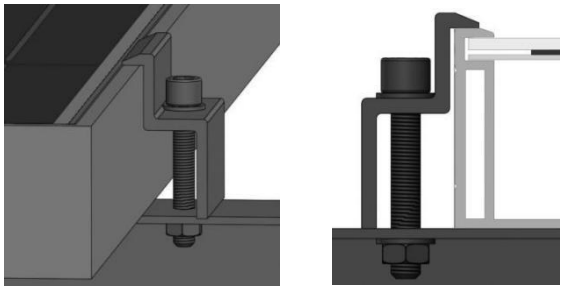
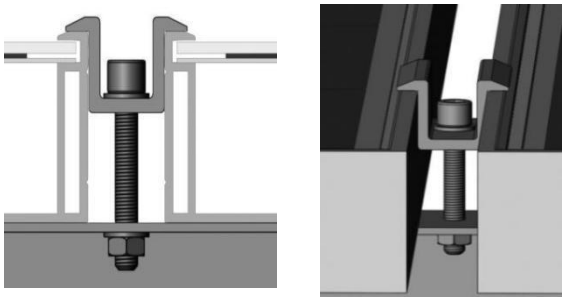
Be sure to avoid shadowing effects from the module clamps.

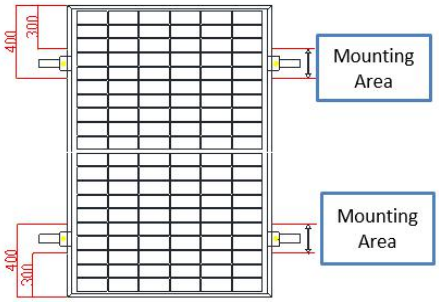
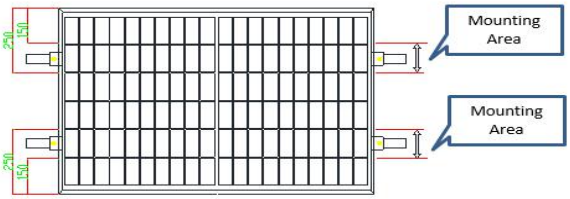
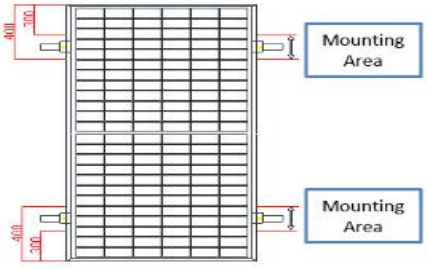
The module frame is not to be modified under any circumstances.

When choosing this type of clamp-mounting method, use at least four clamps on each module, two clamps should be attached on each long sides of the module (for portrait orientation) or each short sides of the module (for landscape orientation). Depending on local wind and snow loads, additional

clamps may be required to ensure that modules can bear the load.

Applied torque should refer to mechanical design standard according to the bolt customer is using, ex: M8 ---- 16-20N.m(140-180lbf.in)

End Clamp installation	**Middle Clamp installation**
	

Module	**Mechanical Load Pressure**	**Safety factor**	**Mounting Direction**
60/120 pcs **Backsheet-Glass**	**+**3600 Pa /-1600Pa	1.5	
	+1600Pa /-1600 Pa	1.5	
72/144 pcs **Backsheet-Glass**	+3600 Pa /-1600 Pa	1.5	

7.2.2 GROUNDING

All module frames and mounting racks must be properly grounded in accordance with local and national electrical codes. Attach the equipment grounding conductor to the module frame using 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.

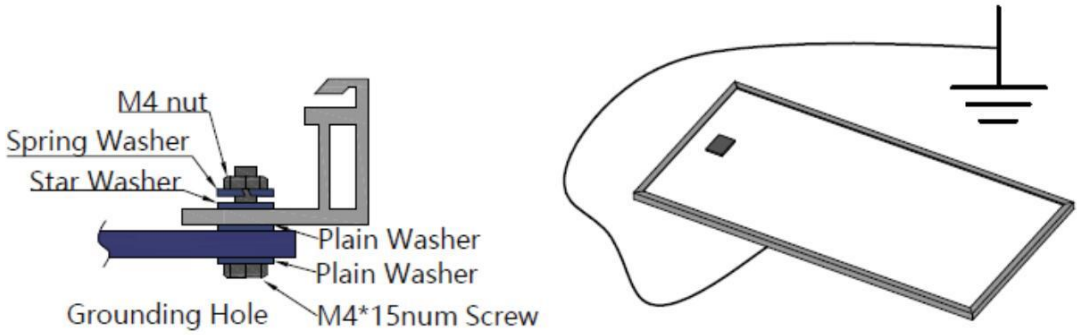


Figure 10：Ground installation of PV modules

7.2.3 ELECTRICAL INSTALLATION

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

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

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

The maximum voltage of the system must be less than the maximum certified voltage and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done using the following formula.

Max System voltage ≥ N * Voc * [1 + TCvoc x (Tmin-25)]

Where

N	Number of modules in series
Voc	Open circuit voltage of each module (refer to product label or data sheet)
TCvoc	Thermal coefficient of open circuit voltage for the module (refer to data sheet)
Tmin	The lowest expected ambient temperature

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

The minimum and maximum outer diameters of the cable are 5 to 7mm (0. 038 to 0.076in2).

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

The minimum bending radius cables should be 43mm (1.69in).

7.2.3.1WIRING

To ensure proper system operation the correct cable connection polarity (Figures 1 & 2) should be observed when connecting the modules to each other or to a load, such as inverter, a battery etc. If modules were not connected correctly, the bypass diode could be destroyed. PV modules can be wired in series to increase voltage. A series connection is made when the wire from the positive terminal of one module is connected to the negative terminal of the next module. Figure 1 shows modules connected in series. PV modules can be connected in parallel to increase current (Figure 2). A parallel connection is made when the wire from the positive terminal of one module is connected to the positive terminal on the next module.

The number of modules in series and in parallel shall be designed reasonably according to the system configuration.

All instructions above have to be obeyed to maintain Nuuko power's limited warranty

Connecting in series

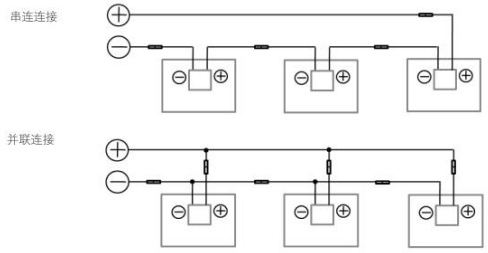


Figure 1

Connecting in parallel after connected in series

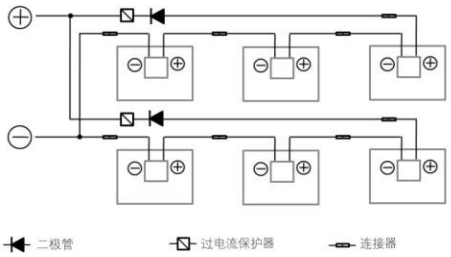


Figure 2

8. MODULE MAINTENANCE FOR PV MODULE PV

8.1 PANEL VISUAL INSPECTION AND REPLACEMENT

The modules in a PV array should be regularly checked for damage. Factors such as glass breakage, cable breakage, and junction box damage may lead to function and safety problems. In the case of a damaged module, replace it with the same type of module. Refer to the appropriate Product Installation Manual for installation and dis-assembly of module.

Trim any vegetation which may shade the solar array, thus impacting performance.

Check that mounting hardware is properly tightened.

Replacement modules must be of same type. Do NOT touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when handling modules.

Cover the front surface of modules by an opaque material when repairing. Modules when exposed to sunlight generate high voltage and are dangerous.

Nuuko power PV modules are equipped with bypass diodes in the junction box. This minimizes module heating and current losses.

- Do NOT open the junction box to change the diodes even if they malfunction.

In the event that a module is damaged (broken glass or a scratch on back sheet) and needs to be replaced

- Observe the safety precautions listed earlier in this Manual
- Isolate the impacted array string to prevent current flow before attempting to remove the module.
- Check the open circuit voltage of the array string and verify that this is within 10V of the other strings to be connected in parallel.
- Turn the breaker back on.

8.2 CONNECTOR AND CABLE INSPECTION

Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.

It is recommended to check the torque of terminal bolts and the general condition of wiring at least once a year. Also, check that mounting hardware is properly torqued. Loose connections will result in damage to the array.

8.3 CLEANING

Clean PV modules when the irradiance is below 200W/m2; liquid with a large temperature difference from the modules must not be used for cleaning the modules;

It is forbidden to clean PV modules under the weather conditions of wind more than 4 grades, heavy rain or heavy snow;

When cleaning PV modules, do NOT step on the modules; do NOT spay water on the backside of the module or the cables; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use as steam cleaner;

Use dry or wet soft clean cloth to clean the PV modules; non-corrosive solvents or hard objects are strictly prohibited

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