

INSTALLATION MANUAL

Thin-Film Photovoltaic Module
NT-Series (AX)



NexPower Technology Corp.

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1. INTRODUCTION

The installation manual describes the installation and maintenance instructions for NT-Series (AX) PV module. This document also contains warning and safety information users should understand thoroughly. Please read this manual carefully before the installation. The installation of the PV module should only be performed by qualified specialists only. Before attempting to install, wire, operate, or maintain the PV module, please carefully read and completely understand the information described in this installation manual. This document does not constitute, express, or imply a warranty in any form.

2. SAFETY、PRODUCT WARRANTY NOTICE

2-1 Safety Notice

- ⚠ PV module converts sunlight to electricity, when sunlight or light other source illuminates the module surface. PV modules can produce high voltage and current which may cause serious injury or even death. Extra attention is required to avoid “Electric Shocks” during usage.
- ⚠ When connecting cables, push the plus and minus connectors against each other while twisting them until they are fully engaged.
- ⚠ Always wear electrical insulating gloves, protective head gear, suitable eye protection, and safety shoes while working on systems. Use only insulated tools during installation.
- ⚠ Do NOT work under rain, snow, or windy conditions.
- ⚠ Do NOT touch the junction box or the output cables connectors with bare hands during installation, regardless whether the PV module is connected to or disconnected from the system.
- ⚠ Do NOT store or move the modules with the cables connected.
- ⚠ Protect plug contacts against soiling and do NOT use soiled plug contacts to make any plug connections.

2-2 Product Warranty Reminders

Products have been inspected before shipment. Please confirm module condition before installation. Please obey the following reminders, or the warranty is NOT provided.

- ⚠ It must be made by two people moving when manual handling process. If caused by lack of fault, crack、break, it will be deemed negligent construction work.
- ⚠ Do NOT use PV modules near equipments or locations where flammable gases can be generated.
- ⚠ Do NOT disassemble the PV module or remove any component or label from the module.
- ⚠ Do NOT stand or step on the PV module, cables, connectors, or end caps.
- ⚠ Do NOT drop the PV module or allow objects to fall on PV module.
- ⚠ Do NOT artificially concentrate sunlight onto the PV module.
- ⚠ Do NOT connect the NT-Series (AX) PV module with any other type of PV module.
- ⚠ Do NOT cut the cable attached on PV module then connect to another type of cable or connector.
- ⚠ Do NOT drill holes in the frame or on the glass of PV module.
- ⚠ Do NOT use chemicals in cleaning the surface or back sheet of PV module. Do NOT let water remain on the glass surface of PV modules for an extended period of time.
- ⚠ Please note, the back surface of PV module is not protected by glass and is vulnerable to sharp objects.
- ⚠ Do NOT cover the water drain holes of the frame.

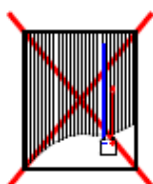
- ⚠ Do NOT hang or carry PV module by the cable.
- ⚠ Do NOT pull the cable, resulting in loose or damaged the junction box during handing and installing process.
- ⚠ Mount the PV module onto the structure member with specified mounting structure. Make sure to fasten bolts completely and lock in order not to loosen.
- ⚠ Do NOT damage the back sheet of PV modules while fastening the PV modules to a support rack.
- ⚠ Do NOT cause any course of partial shading that appears parallel to the longitudinal direction on the module.
- ⚠ Appropriate measures should be taken to prevent possible damage to lower edge of the PV module in snow condition and also take proper steps to maintain reliability and safety, in case the PV modules are installed in area such as cold areas/ strong wind areas.

3. LIMITATIONS ON USING NT-SERIES (AX) PV MODULE

Please read these limitations carefully before installing or using the modules.

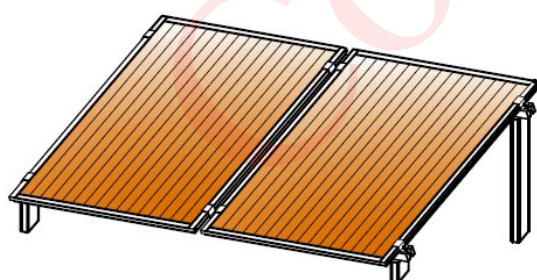
To stay within the warranty conditions of the NexPower NT-Series (AX) PV modules, it is essential to install the PV module with the following guidelines.

- Do NOT install PV module upside down (junction box downward). Otherwise it will void the warranty.

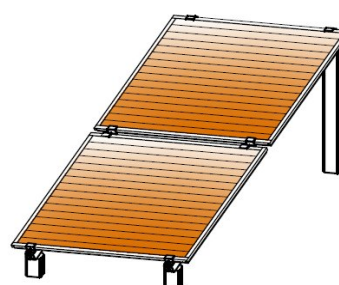


- The position of junction box should not overlap the mounting structure.
- Junction box, cables and/or connectors should not be stressed in any circumstances.
- The PV module is designed for vertical mount. Vertical mount is strongly recommended.
- The PV module can either be installed vertical or horizontal, but must conform the following conditions. Otherwise it will void the warranty.

- i) If the PV module is mounted vertically, the PV module should be installed in a manner which prevents shading effects (also partial shading). The PV module must be sited where no shading occurs between the hours of 10 AM and 2 PM.
- ii) If the PV module is mounted horizontally, the PV module should be installed in a manner which is free from shading, snow and other objects the whole year through.
- iii) For on-ground installation, make sure to leave sufficient distance between the PV module and the ground to avoid the module being covered by accumulated water, snow, grass or other objects.

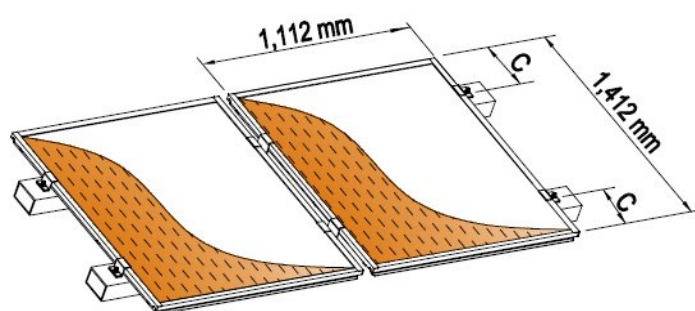


a. Vertical mount

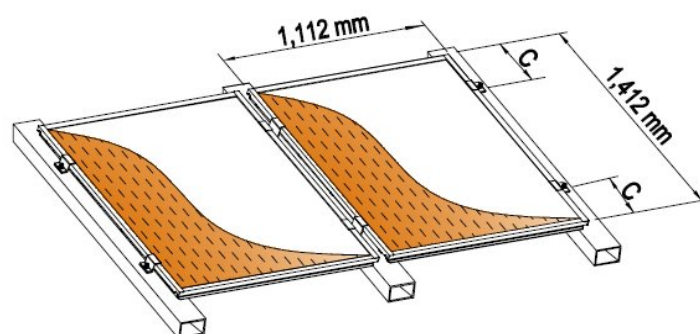


b. Horizontal mount

- Do NOT install the PV module where wind or snow exceeds its specified limit.



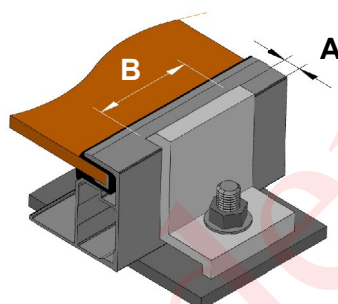
a. Mounting structure - A



b. Mounting structure - B

- To keep the warranty validated on NexPower NT-Series (AX) PV modules, it is essential to install the PV module according to the following guidelines.
 - The clamp position (C) is from the end of the module to the centerline of the clamp or fixing plate.
 - The clamp position (C) should be symmetrical at each side of PV module.
 - PV module can be mounted at various loading condition as desired in accordance with the instruction approved in Chapter 5-2-1.
- The mounting clamp and fixing plate must meet the dimensions requirements.
 - Length A: 17 mm A 7 mm
 - Length B: B 40 mm

The clamp commonly used for crystalline PV modules is compatible.



- The torque on the clamp bolt or fixing plate bolt should be 8~10 N-m. Otherwise it will void the warranty.
- It is not permitted to modify the module under any circumstances. Make sure the location and its surroundings are free from such locations where corrosion may occur due to exposure to sea water, salt breeze, corrosive matters (Ex. chemical factory, hot spring or volcano area emitting hydrogen sulfide or ammonia gas).
- Ensure the system design prevents a reverse current of no more than 4A will flowing through the PV module. Otherwise it will void the warranty.
- Grounding means with the PV module frames should comply with laws or electrical regulations of your regions or countries.
- It is essential to select inverters with the following features. Otherwise the warranty is not provided.
 - Transformer type inverters are required.
 - If transformerless inverters are selected, it is essential to add an external transformer.
 - Specifically-designed transformer-less inverters (e.g. Sunways AT series).
- Please refer to Chapter 4 ~ Chapter 7 for more detailed information.

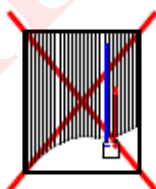
4. SITE SELECTION AND TILT ANGLE

- The PV module generates power when it is illuminated by sunlight. In order to gain maximum power, the PV module should face directly towards the sun. The PV module should be installed to typically face south in the northern hemisphere and north in the southern hemisphere.
- In most applications, the PV module should be installed in a location without shading throughout the year. It is necessary to choose a site where no trees, buildings, or obstructions could cast shadows on the PV module.
- If it is not possible to place the PV module in a shadow-free location, the PV module must be sited where no shading occurs between the hours of 10 AM and 2 PM. Otherwise, it will void the warranty.
- In systems that are configured with multiple rows of angled PV modules, the rows should be spaced far enough apart to minimize the impact of rows shading other rows during the course of the day. This distance is dependent on the latitude at which the system is installed.
- It is not permitted to modify the module under any circumstances. Make sure the location and its surroundings are free from such conditions.
 - i) Locations where corrosion may occur due to exposure to sea water, salt breeze, etc.
 - ii) Locations where the PV module may be exposed to corrosive matters (Ex. chemical factory, domestic animals hut, hot spring or volcano area emitting hydrogen sulfide or ammonia gas)
- In some installations, the PV module is mounted at a tilt angle which is measured between the PV module and the horizontal ground. For grid-connected installations where PV modules are attached to a permanent structure, it is recommended to tilt PV module at the angle equal to the site's latitude. Adjust the PV module orientation to face the sun directly so it will generate the maximum power.
- It is recommended to set the tilt angle above 10-15 degrees so that rain can flush away the accumulated dust on PV module surface. If lower, a periodic cleaning maintenance may be necessary.

5. INSTALLATION

5-1 Limitation of Installation

- The support structure for the PV module must be engineered to withstand the anticipated wind and snow loads. Additionally, other forces may need to be considered according to local standards and regulations.
- Do NOT install PV module upside down (junction box downward). Otherwise it will void the warranty.
- The position of junction box should not overlap the mounting structure.
- Junction box, cables and/or connectors should not be stressed in any circumstances.



- The PV module is designed for vertical mount. Vertical mount is strongly recommended.
- The PV module can either be installed vertical or horizontal (Fig. 1), but must conform the following conditions. Otherwise it will void the warranty.
 - i) For all conditions, partial shading parallel to the longitudinal direction is not permissible. Even in case of on-end assembly all shading parallel to the longitudinal direction must be avoided at all times especially during completion of installation when the modules are hooked on grid; such shading is also created by erecting scaffolds, masts, sticks etc.
 - ii) If the PV module is mounted vertically, the PV module should be installed in a manner which

prevents shadowing effects. The PV module must be sited where no shading occurs between the hours of 10 AM and 2 PM.

- iii) If the PV module is mounted horizontally, the PV module should be installed in a manner which is free from shading, snow and other objects the whole year through.
- iv) For on-ground installation, make sure to leave sufficient distance between PV module and the ground to avoid the module being covered by accumulated water, snow, grass or other objects.

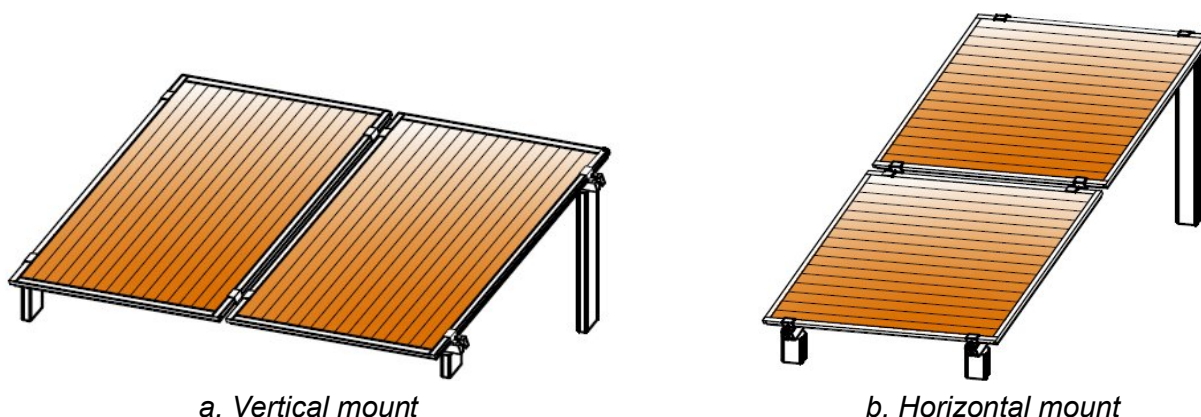


Fig. 1 PV Module mounting configuration

- Please refer to Chapter 2 (WARNING AND SAFETY) for more detailed limitation items.

5-2 Mounting Method

- PV modules can be mounted on ground, roof, and/or pole by using bolts, clamps, fixing plates, or sliding frames.
- For proper operation and to avoid damage from condensation, the PV module requires an adequate flow of air across the rear surface. While installing PV modules, ensure sufficient distance between the rear of PV module and the mounting surface to allow the air flow.
- In case of on-ground installation, be sure to leave sufficient distance between PV module and the ground to avoid the module being exposed to standing water or snow.
- The array racks must support the bottom of the modules and must be continuous pieces (no breaks in the rack).
- The frames of module should not be stressed by bending or twisting force during installation and operation.
- When selecting the material for the assembly system, pay attention to the electrochemical series (avoidance of contact corrosion between different materials).

5-2-1 Clamps & Fixing Plates

- The PV module can be mounted by using clamps and fixing plates (Fig. 2, 3).

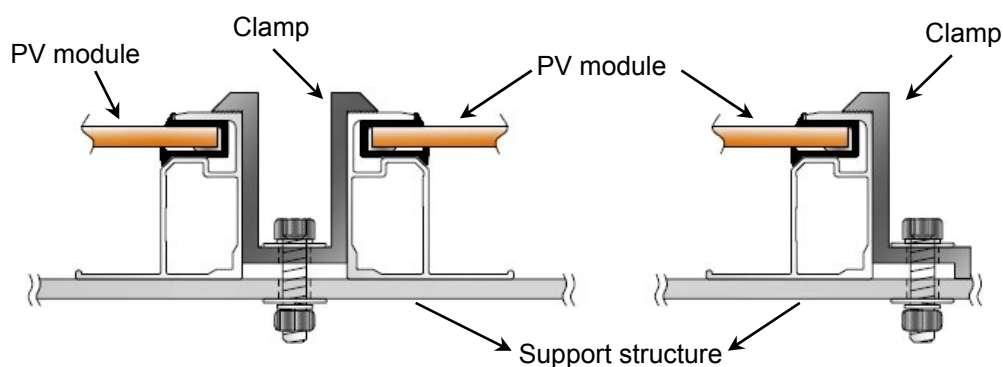


Fig.2 Mounting method - clamp

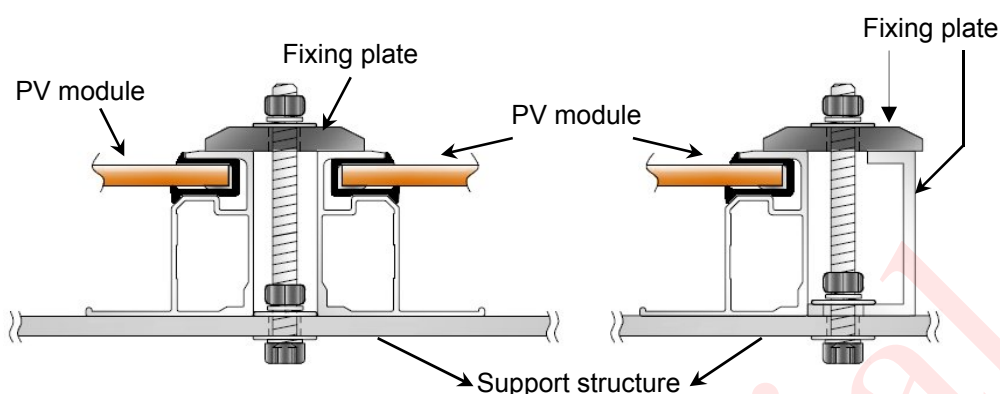


Fig.3 Mounting method - fixing plate

- The torque on the clamp bolt or fixing plate bolt should be 8~10 Nm. Otherwise it will void the warranty.
- The mounting clamp and fixing plate must meet the dimensions requirements (Fig. 4).
 - i) Length A: 17 mm A 7 mm
 - ii) Length B: B 40 mm

The common clamp used for crystalline PV modules is compatible.

- For more detailed or specific recommendations, please contact your PV system dealer or module provider.

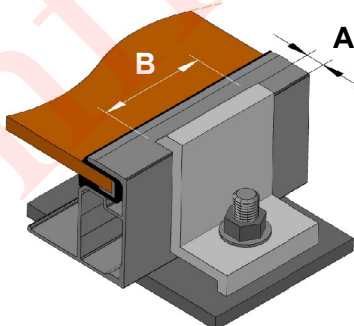
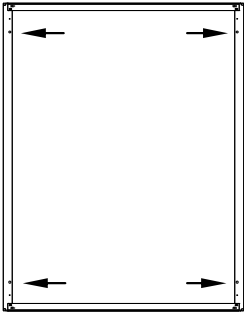
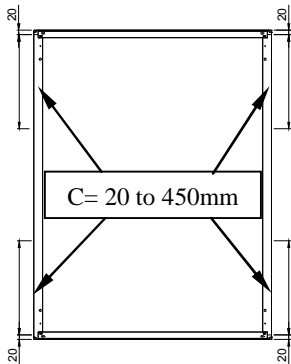
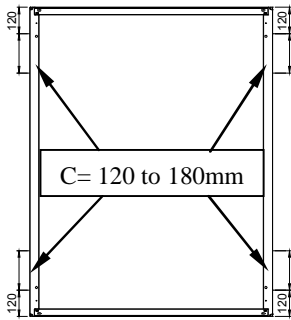
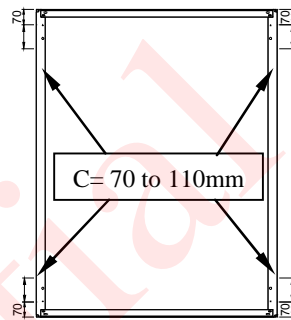
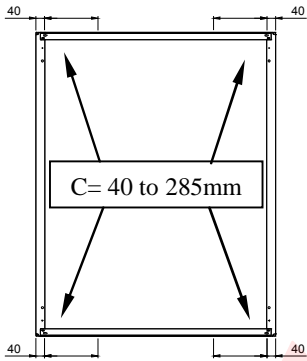


Fig.4 Clamp dimension definition

- The PV modules may be mounted by using clamps or fixing plates on long edge of PV module, which would be perpendicular (Fig. 5-a) or parallel to array racks (Fig. 5-b).
- To keep the warranty validated on NexPower NT-Series (AX) PV modules, it is essential to install the PV module according to the following guidelines.

- i) The clamp position (C) is from the end of the module to the centerline of the clamp or fixing plate.
- ii) The clamp position (C) should be symmetrical at each side of PV module.
- iii) PV module can be mounted as desired in accordance with the instruction approved in the attachment guidelines (Table 1).

	Snow/Wind load 2400 Pa	Wind load 3800 Pa	Snow load 5400 Pa
Mounting system Attach to the mounting holes	 <p>Use four mounting holes</p>		
Clamping system Attach to the long frame	 <p>Use four clamps*</p>	 <p>Use four clamps</p>	 <p>Use four clamps</p>
Clamping system Attach to the short frame	 <p>Use four clamps</p>		
Insertion system	<p>For insertion system, please consult with NexPower for further information.</p>		

* The mounting configuration is certified by the third party organization.

AI402-MI-B

Table 1 Attachment guidelines

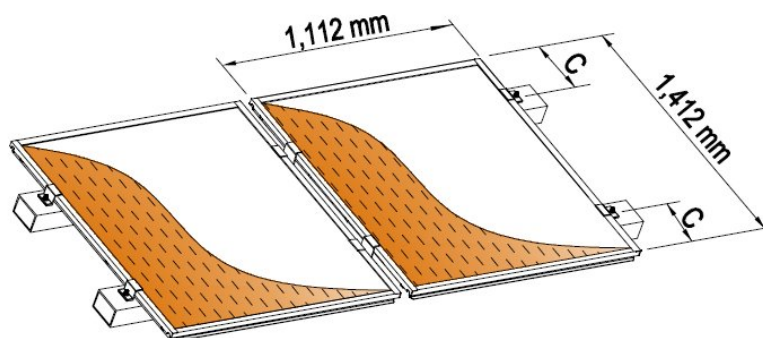
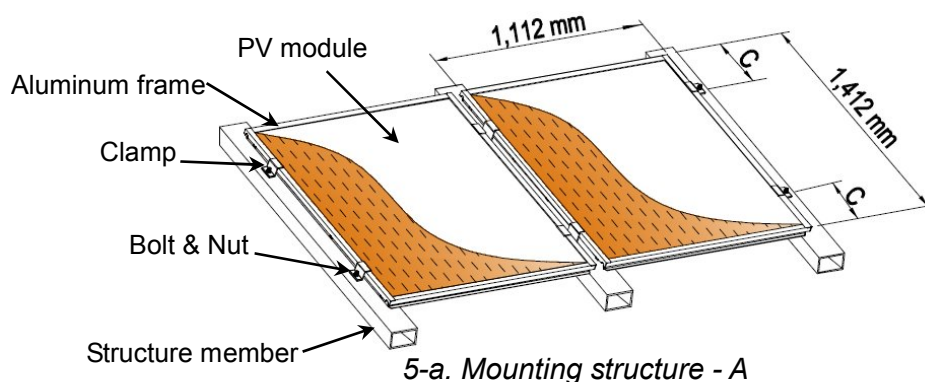


Fig.5 Mounting structure

- In most installations, a clearance of 5 mm at least between modules is necessary to accommodate thermal expansion.

5-2-2 Insertion system

- The PV module must be supported along the length of the short edge, it can be mounted by using support frame as following steps (Fig. 6):
 - i) Place the module into the upper fixing frame component.
 - ii) Slide the module upwards as far as possible, and place it into the lower fixing frame component.

5-2-3 Mounting Holes

- The PV module has four $\phi 10$ mm holes on the long edge of its frame (Fig. 7) for mounting purpose. Please refer to Appendix 1.
- PV modules may be fastened to a support by using bolt holes that are at the bottom of the frame with stainless M8 bolts, washers, spring washers, and nuts (Fig. 8).
- Do NOT damage the rear surface of PV modules while fastening PV modules by bolts.
- In most installations a clearance of 5 mm at least between modules is necessary to accommodate thermal expansion.

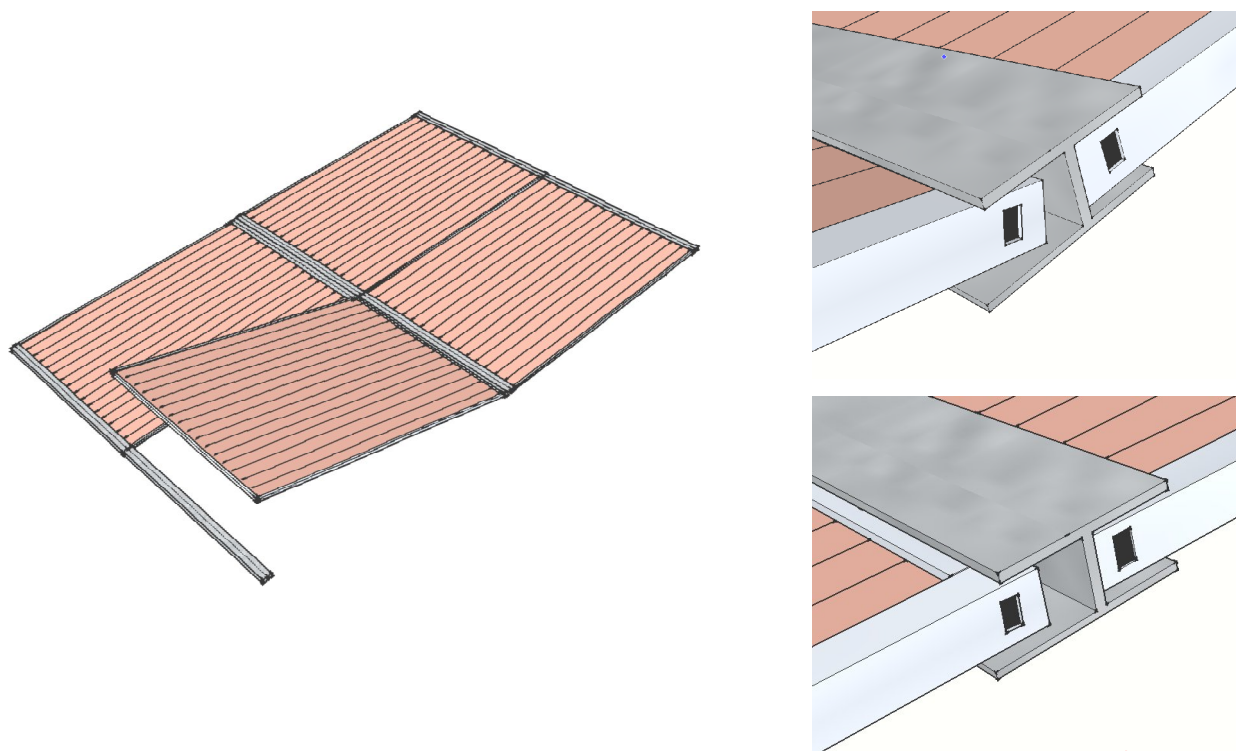


Fig.6 Mounting method - Insertion system

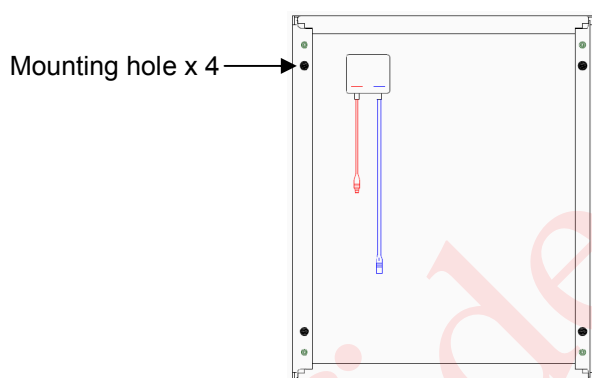


Fig.7 Mounting hole

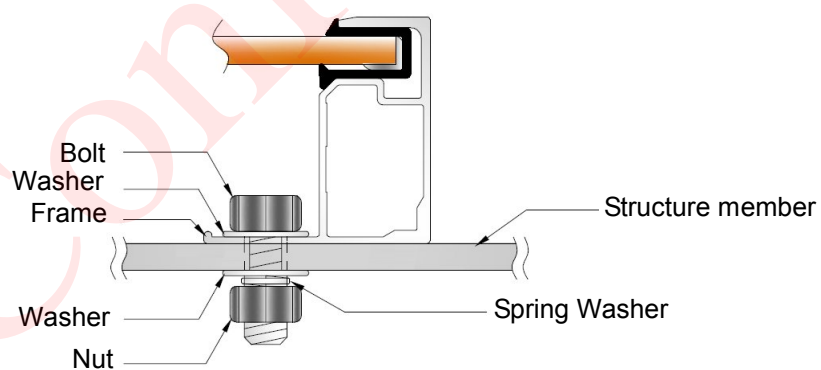


Fig.8 Mounting method - bolt

6. WIRING

- The PV module has two sunlight resistant output cables, and each is terminated with a Multi-Contact compatible connector. The positive terminal has a female connector, and the negative terminal has a male connector.
- Do NOT cut the cable attached to PV module in order to connect to another type of connector or cable.
- Connecting PV modules in series would increase voltage, while connecting in parallel would increase current. In order to design an adequate PV system, PV modules should be connected in series and/or in parallel depending on specifications of inverters or other pertinent equipments.
- While connecting several strings in parallel, it is necessary to keep equivalent quantity of PV modules to each parallel string.
- All system wiring must conform to local electrical codes.

6-1 Series Wiring

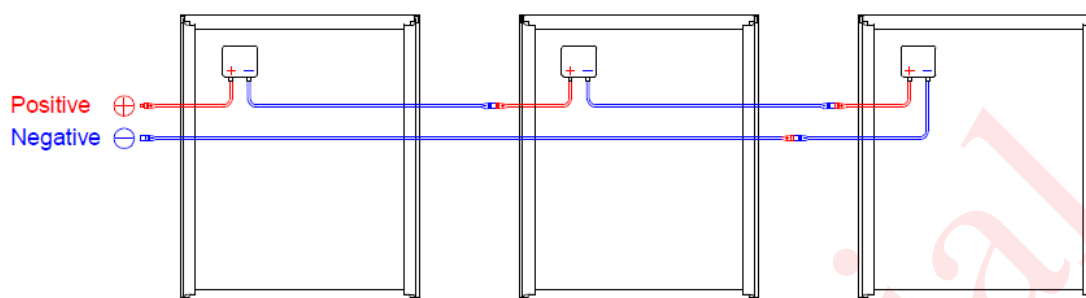


Fig.9 Series connections

- PV modules can be wired in series to increase voltage. Connect cables from the positive(+) / negative(-) terminal of one module to the negative(-) / positive(+) terminal of the next module (Fig. 9).
- When several PV modules are connected in series, the voltage and current are as below:

$$V_{\text{total}} = V_1 + V_2 + \dots + V_n$$

$$I_{\text{total}} = I_1 = I_2 = \dots = I_n$$

$$n : \text{number of series PV modules}$$
- It is recommended to multiply the V_{oc} listed on the module label by a factor of 1.25, and make sure the system voltage must not exceed a maximum of 1000V. Otherwise it will void the warranty.

6-2 Parallel Wiring

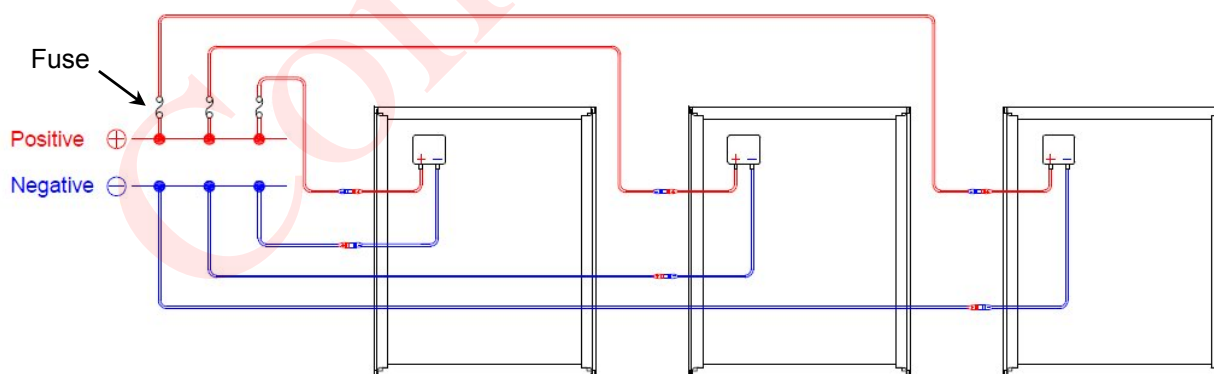


Fig.10 Parallel connections

- PV modules can be wired in parallel to increase current. Connect cables from the positive(+) / negative(-) terminal of one module to the positive(+) / negative(-) terminal of the next module (Fig. 10).
- When several PV module strings are connected in parallel, the voltage and current are as below:

$$V_{\text{total}} = V_1 = V_2 = \dots = V_n$$

$$I_{\text{total}} = I_1 + I_2 + \dots + I_n$$

$$n : \text{number of series strings}$$
- Please be noted that the short-circuit current of system is calculated by multiplying the I_{sc} listed on the module label by the number of source circuits operating in parallel. Use this value and multiply by 1.56 to determine the conductor capacities and fuse sizes connected to the module output.
- Ensure the system design prevents a reverse current of no more than 4A will flowing through the PV module. Otherwise it will void the warranty.
- Parallel configuration is not limited in case of taking proper measure (e.g. fuse for protection of module and cable from overcurrent, and/or blocking diode for prevention of unbalanced strings voltage) to block the reverse current flow.

6-3 Inverter Selection

- To stay within the warranty conditions of the NexPower NT-Series (AX) PV modules, it is essential to select inverters with the following features. Otherwise the warranty is not provided.
 - i) Transformer type inverters are required.
 - ii) If transformerless inverters are selected, it is essential to add an external transformer.
 - iii) Specifically-designed transformer-less inverters (e.g. Sunways AT series).
- For more detailed or specific recommendations, please contact your PV system dealer or module provider.

6-4 Cable Selection

- It is very important to use the proper cable with a minimum wire gauge approved for usage at the maximum short circuit current. Smaller gauge cables and connectors can become overheated under high currents.
- The cables selected should have a temperature rating higher than 90°C.
- Series and parallel wiring should use the same connectors as of the PV modules.

6-5 Bypass Diodes

- Buildings, trees, or obstructions around PV modules can cast shadows on PV modules. Current forced through shaded part of PV modules causes additional heating and severe loss of power.
- In order to avoid this condition which may impair PV module, NT-Series (AX) module is equipped with factory-installed bypass diodes.

	Rated value
Repetitive Peak Reverse Voltage	1000 V
Maximum Average Forward Current	5 A

6-6 Grounding

- Grounding method must comply with laws or electrical regulations. Please confirm electrical codes in the region where the PV system is installed. If the grounding should be completed in local codes, please conform to the following steps.

- Each PV module must be grounded using the grounding holes found on the frame. The PV module has four $\Phi 3.5\text{mm}$ holes in the frame for grounding purpose. Select at least one grounding hole according to PV module mounting mode.
- Must apply equipment grounding at the same electrical potential level to all PV modules.
- Grounding cables must be bolted or screwed with star washers (Fig. 11).

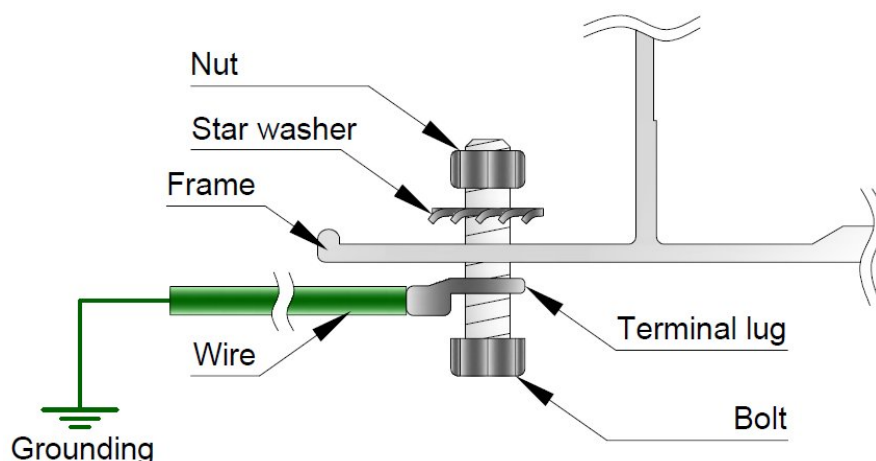
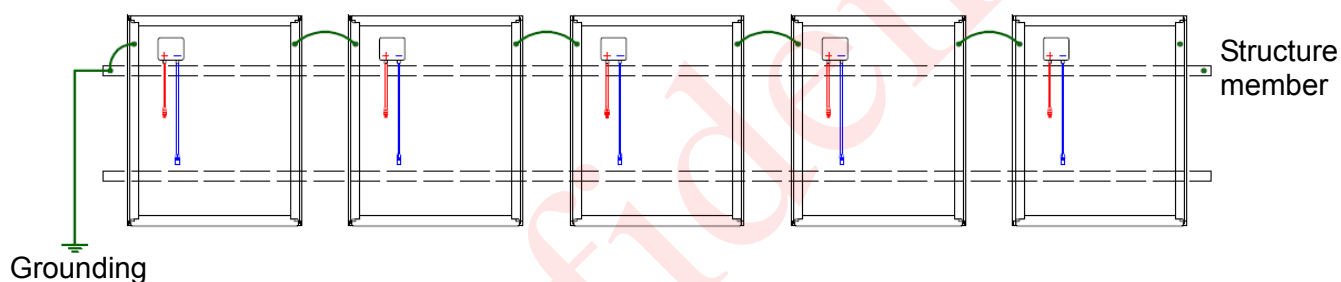
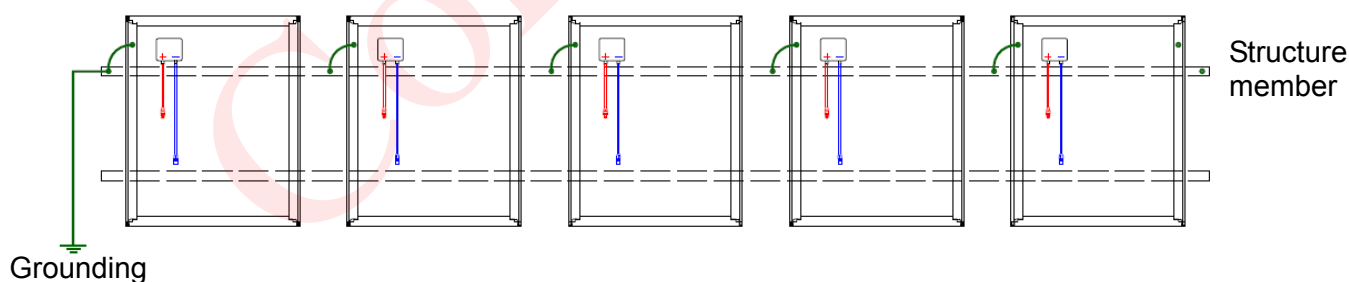


Fig.11 Grounding connection of the PV module

- When connecting in series, PV modules either connect to the structure members by attaching wires to the ground holes on the frames or directly bind with the structure member at adequate positions to deploy the grounding method at the designated equipment grounding spot. Grounding must be done on the first or the last PV module of each string (Fig. 12). Otherwise it will void the warranty.



Grounding method - A



Grounding method - B

Fig.12 Ground method of the PV array

- The negative pole of solar generator strings connected to the inverter must also be grounded (Fig. 13). Otherwise it will void the warranty.

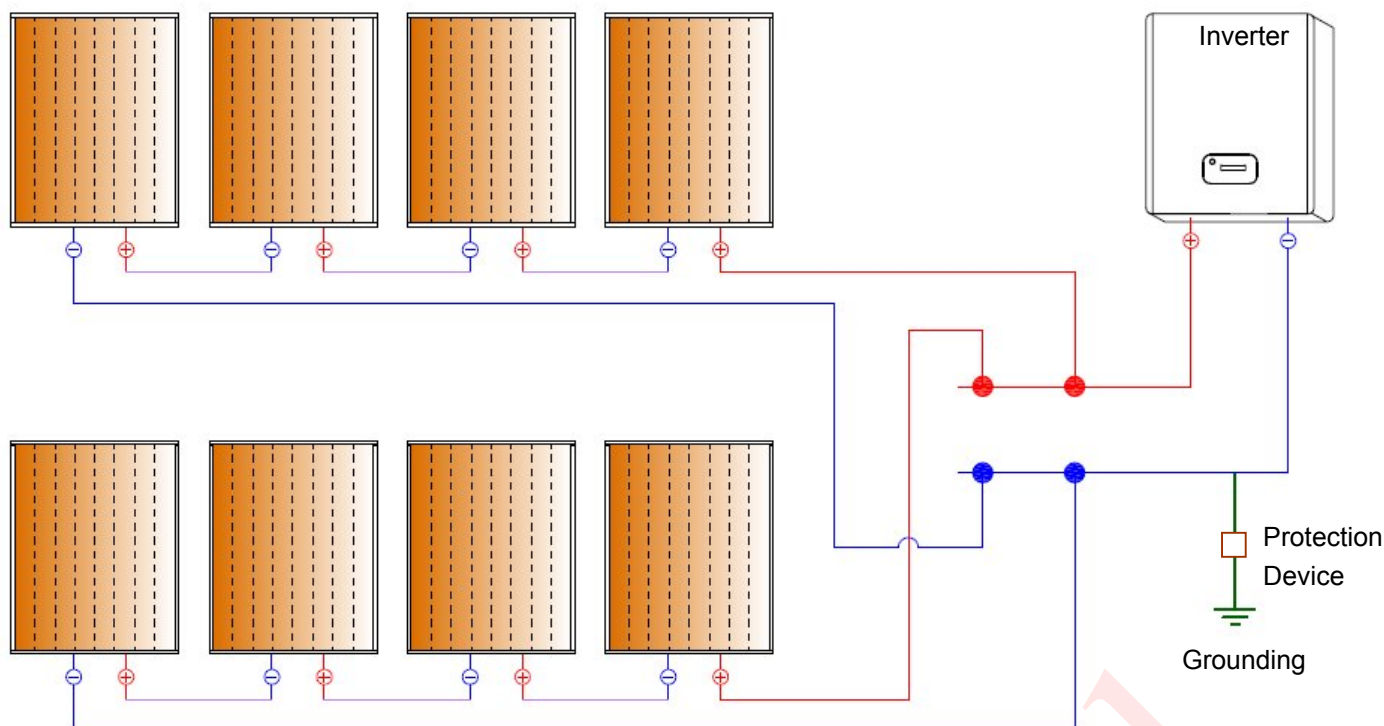


Fig.13 Negative pole grounding method

7. MAINTENANCE

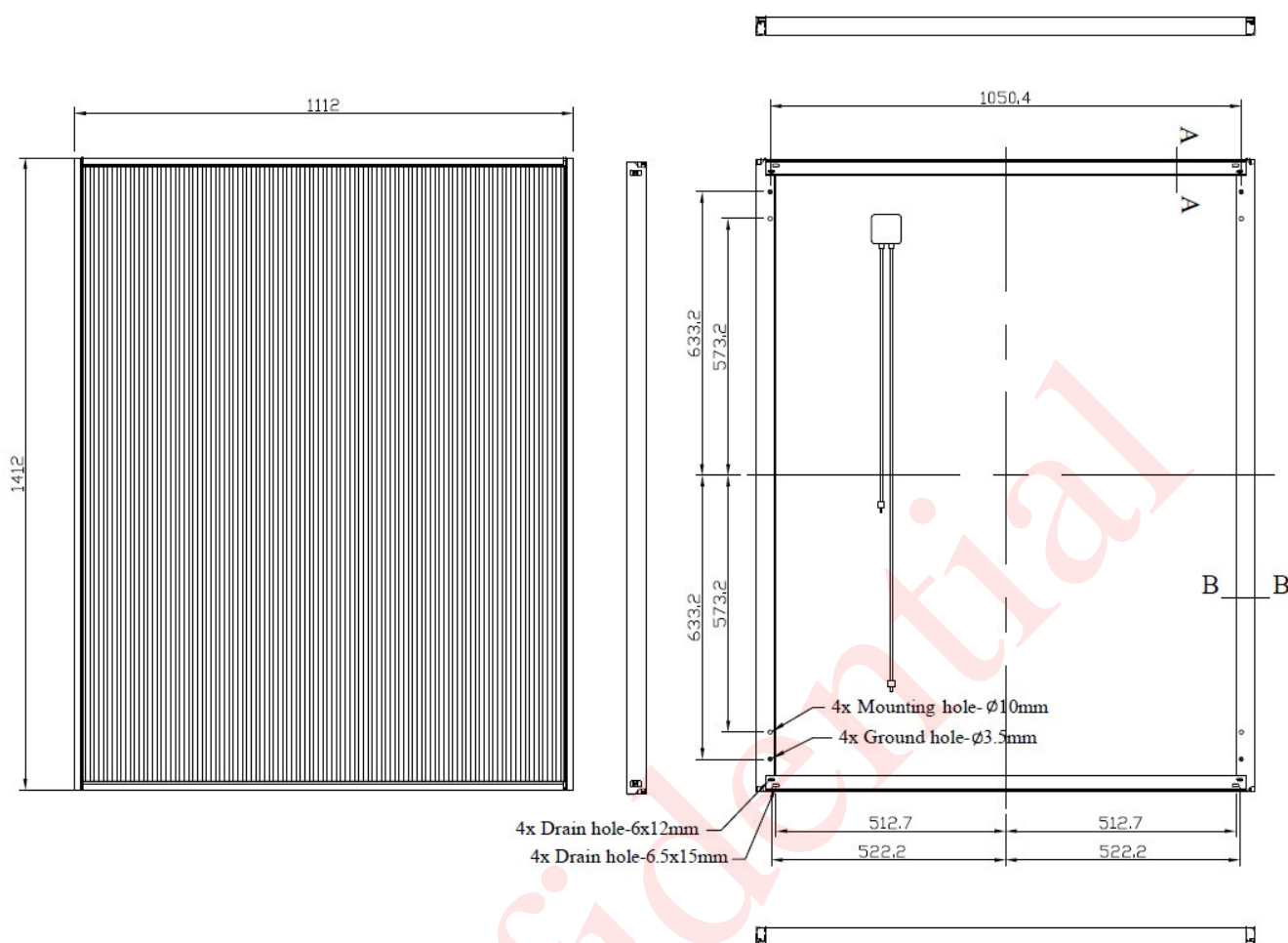
- The PV modules are designed to last for extended period of time thus require very little maintenance.
- When dirt accumulates on the surface of PV module and becomes excessively built-up, power output may decline. When this situation occurs, it is a good manner to use only lots of water to flush the dirt away. Moreover, cleaning the module surface is proper but only with a soft cloth and mild detergent water. Before washing, please wear electrical insulation gloves to avoid electrical accidents. Protect yourself against any possibility from accidents during maintenance. If cleaning the back of the module is required, take utmost care to avoid penetrating the back side materials.
- During the cleaning process, do NOT cause any partial shading parallel to the longitudinal direction of the module. For more information please refer to Chapter 5.
- Cleaning procedure shall be carried out when the ambient temperature is between 5 °C (41°F) and 25 °C (77°F). Cleaning in an hour after the first light or an hour before the last light is highly recommended.
- Check annually and carefully to ensure for fixed mounting hardware and tightened wiring. Any loose connections or parts may cause damages in modules or arrays.
- If any problem is found, please contact your local PV system dealer for professional service.

8. DISCLAIMER OF LIABILITY

NEXPOWER does not assume 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 of the PV module. No responsibility is assumed by NEXPOWER for any infringement of patents or other rights of third parties which may result from use of the module. NEXPOWER reserves the right to make changes to the product, specifications or installation manual without prior notice.

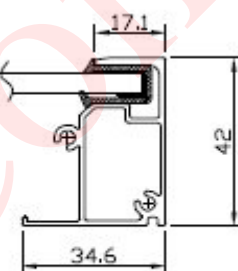
9. APPENDIX 1 - Mechanical Specifications

Items	Specification
Length [mm]	1412
Width [mm]	1112
Thickness [mm]	42
Weight [kg]	19.8

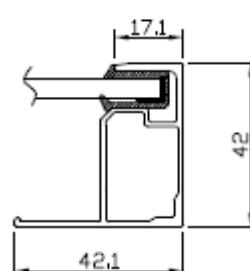


(Front View)

(Back View)



A-A Section



B-B Section

(Cross-section View)

10. APPENDIX 2 - Electrical Specifications

Grade	NT-150AX		NT-145AX	
Condition	Stable	Initial	Stable	Initial
Nominal Power ($\pm 5\%$) [W]	150	172.5	145	166.7
Open Circuit Voltage [V]	85.5	87	85.5	87
Short Circuit Current [A]	2.54	2.66	2.51	2.63
Maximum Power Voltage [V]	64.7	69	64.2	68.6
Maximum Power Current [A]	2.32	2.5	2.26	2.43
Maximum System Voltage [V]	1000			
Maximum Fuse Rating [A]	4			
<u>Temperature coefficients:</u>				
Nominal Power	-0.28 %/°C			
Open Circuit Voltage	-0.32 %/°C			
Short Circuit Current	0.07 %/°C			

- Data above represent stabilized values at Standard Test Conditions(STC) [Irradiance: 1000 W/m², Spectrum: AM1.5, Cell temperature: 25°C].
- All electrical ratings have a tolerance of $\pm 10\%$ unless specified otherwise. Specifications are subjected to change without notice.

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