



Dehui Installation Manual

Introduction

This installation manual covers key electrical and mechanical installation information, so please be fully aware of the information before installing Dehui POWER (VIETNAM) CO.,LTD. (Dehui) modules. In addition, this manual also covers some safety information that you shall get familiar with. All contents in this manual are intellectual properties of Dehui which originates from long-term technical exploration and experience accumulated by Dehui.

This installation manual does not entail any explicit or implicit quality warranty and does not stipulate on compensation schemes for losses, module damages or other costs caused by or related to module installation, operation, utilization and maintenance process. If patent rights or the third-party rights are infringed by use of modules, Dehui will not take any responsibility. Dehui reserves the rights for modifying product manual or installation manual without notice in advance.

If customers fail to install modules as per requirements set forth in this manual, the quality warranty provided for customers during sales will become invalid. In addition, suggestions in this manual are to improve safety of module installation, which are tested and proved by practices. Please provide this manual to PV system users for reference and advise them of safety, operation and maintenance requirements and suggestions.

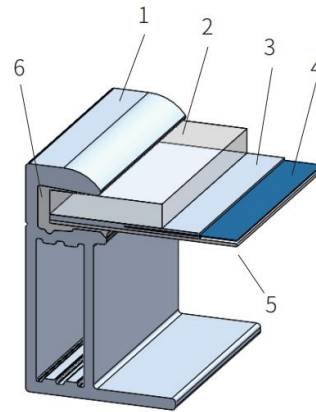
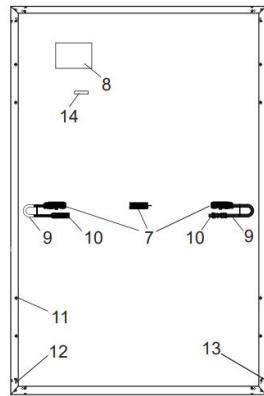
Modules identification

Each module is pasted with 3 labels providing information below:

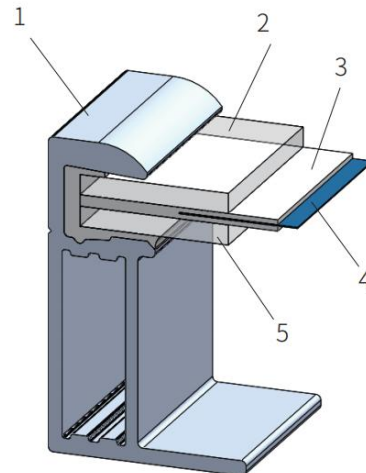
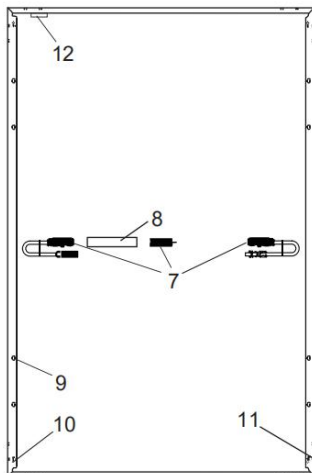
Nameplate: It describes product type, standard rated power, rated current, rated voltage, open circuit voltage, short circuit current under testing conditions, certification indicator, maximum system voltage, etc.

Current level label: It describes modules according to their optimal working current.

Serial No.: Each module has a unique serial number which is solidified inside the module permanently and it can be seen from front top of the module. Each serial number is put in before laminating of the module. In addition, you can find the same serial number on the module nameplate.


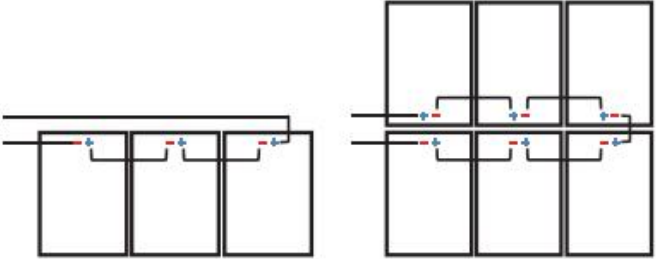
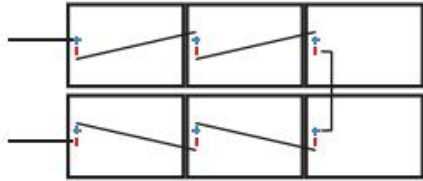

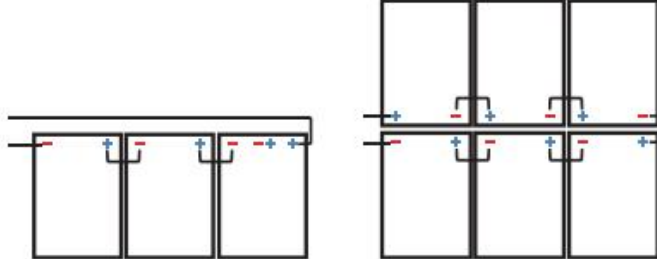
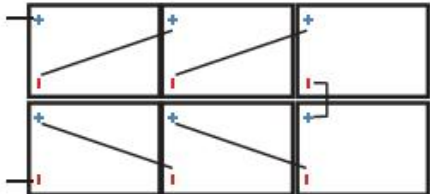


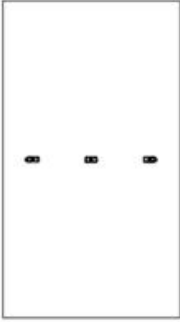
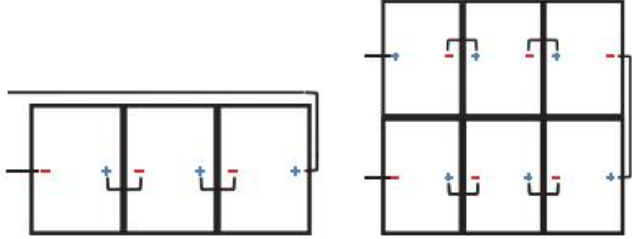
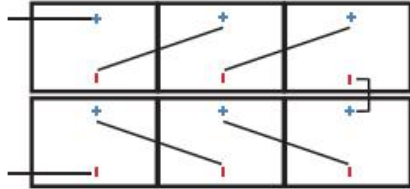

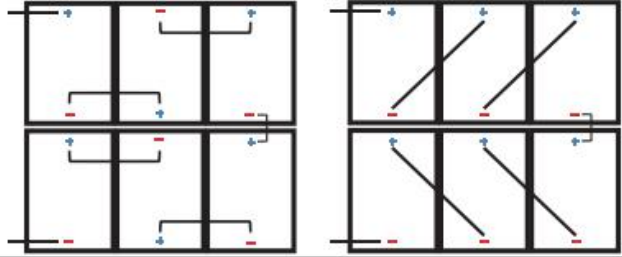
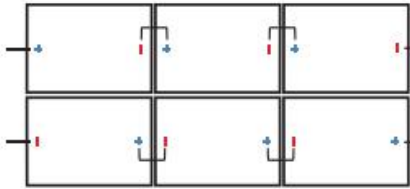
1 Frame	2 Glass	3 EVA	4 Solar Cell
5 Backsheet	6 Silica Gel	7 Junction Box	8 Name Plate
9 Cable	10 Connector	11 Mounting Hole	12 Grounding Hole
13 Drain Hole	14 Bar Code		

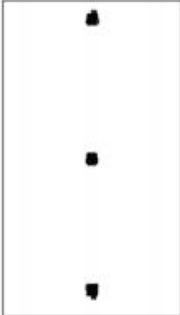
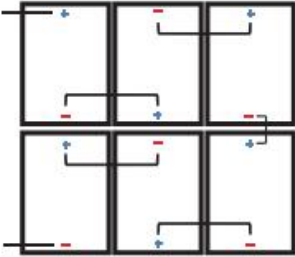
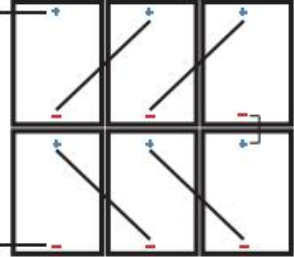
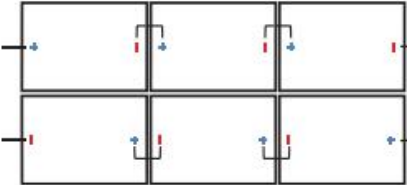


Bifacial Modules (With Frame)

Junction box style and wiring method

Junction Box Location Icon	Recommended Wiring Method
 <p data-bbox="248 936 451 1010">Standard line length: 60 PV module: 1m 72 PV module: 1.2m</p>	<p data-bbox="659 468 1177 517">Vertical Installation: Standard line length (Note: One end of the single row needs to be extended.)</p>  <p data-bbox="659 875 1054 902">Horizontal Installation: Standard line length</p> 
 <p data-bbox="248 1608 632 1709">Standard line length: 60 single glass PV module: 1m 72 single glass PV module: 1.2m 60 & 72 double glass PV module: 0.3m</p>	<p data-bbox="659 1158 1177 1207">Vertical Installation: Standard line length (Note: One end of the single row needs to be extended.)</p>  <p data-bbox="659 1552 1353 1601">Horizontal Installation: 60 type PV module line length $\geq 1.2\text{m}$, 72 type PV module line length $\geq 1.4\text{m}$</p> 

Junction Box Location Icon	Recommended Wiring Method
 <p data-bbox="256 909 491 936">Standard line length: 0.3m</p>	<p data-bbox="644 405 1311 472">Vertical Installation: Standard line length: (Note: An extension cord is required at the rotor head of the double row assembly and at the end of the single row.)</p>  <p data-bbox="644 763 1311 837">Horizontal Installation: 60 type PV module line length $\geq 1.2\text{m}$, 72 type PV module line length $\geq 1.4\text{m}$, 78 type PV module line length $\geq 1.5\text{m}$</p> 
 <p data-bbox="256 1547 475 1621">Standard line length: Positive electrode 0.8m Negative electrode 0.4m</p>	<p data-bbox="644 1099 1278 1173">Vertical Installation: Method 1: Standard line length Method 2: Single component line length $\geq 1.2\text{m}$</p>  <p data-bbox="644 1487 1034 1514">Horizontal Installation: Standard line length</p> 

Junction Box Location Icon	Recommended Wiring Method
 <p data-bbox="256 952 478 1025">Standard line length: Positive electrode 0.8m Negative electrode 0.4m</p>	<p data-bbox="651 495 925 539">Vertical installation: Method 1: Standard line length</p>  <p data-bbox="986 517 1276 562">Method 2: Single component line length $\geq 1.4\text{m}$</p>  <hr/> <p data-bbox="651 904 1029 927">Horizontal Installation: Standard line length</p> 

Operation Safety

- Do not open Dehui Package while in transportation or in and storage process unless the modules have arrived at the installation site.
- Do not damage the package and do not drop packaged modules.
- Do not exceed the highest layer limit indicated on the packaging carton when stacking modules up.
- Store packaging carton in ventilated, rain-proof and dry places before unpacking of modules.
- Open Dehui's packaging carton following unpacking instructions.
- Do not lift the module by holding the junction box or wires at any time.
- Do not stand or walk on modules.
- Do not drop one module onto another.
- To avoid glass damage, do not put heavy objects on module glass.



- Be careful when placing modules on a surface and at modules' corners in particular.
- Do not try to disassemble the modules or remove nameplate or parts of modules.
- Do not paint surface of modules or apply any glues.
- Do not damage or scratch back film of modules.
- Do not drill frame of modules, which may reduce frame loading capacity or lead to frame corrosion.
- Do not repair glass or modules, which backsheets are damaged, on your own.

Installation Site and Working Environment

- The modules can only be used on earth and not in outer space.
- Do not manually focus sunlight with mirrors or magnifying glass onto modules.
- Dehui modules shall be installed on proper buildings or other appropriate places (such as ground, garage, building outer wall, roof, PV tracking system) and shall not be installed on any vehicles.
- Do not install modules at locations that are subject to floods.
- Dehui suggests that modules be installed in the working environment with the temperature of -20°C to 50°C which is the monthly average highest and lowest temperature of the installation sites. The extreme working environment temperature for modules is -40°C to 85°C .
- Make sure that installed modules do not suffer wind or snow pressure that exceeds the permissible maximum load limit.
- Modules shall be installed at locations free from shadows throughout the year. Make sure there are no light-blocking obstacles at the installation sites.
- Carry out lightning protection for modules installed in places with frequent lightning and thunder.
- Do not install modules at locations with possible flammable gases.
- Modules cannot be used in environments with too much hail, snow, flue gas, air pollution and soot or in places with strong corrosive substances such as salt, salt mist, saline, active chemical steam, acid rain, or other substances that may corrode modules and affect module safety or performance.



- Please take protective measures to ensure reliable and safe installation of modules in severe environments such as heavy snow, extreme cold temperatures, strong winds, islands close to water and salt mist, or deserts.

Selection of Tilt Angles

Tilt angle of modules: Include angle between module surface and horizontal surface; the module will obtain the maximum power output if directly facing sunlight.

Modules are preferred to be south-facing in the northern hemisphere and north-facing in the southern hemisphere. Please refer to standard modules' installation guidelines or suggestions from experienced PV module installer, for the specific installation angle.

Dehui suggests that module installation tilt angle be no less than 10° so module surface dust can be washed away easily by rainfall and times of cleaning can be reduced, and so it is easy for ponding to flow away and avoid water print on the glass due to long durations of water ponding which may further affect module appearance and performance.

The Dehui modules connected in series should be installed with the same orientation and tilt angle. Different orientation and tilt angle may result in differences of solar irradiation received by the modules and result in output power loss.

If the Dehui modules are used in stand-alone systems, the tilt angle should be calculated based on seasons and irradiation to maximize the output power. If the modules output power meets the acquired load under the period of the worst irradiation in the year, the modules should be able to meet the load of entire year. If the Dehui modules are used in grid-connected systems, the tilt angle should be calculated based on the principle to maximize the yearly output power.

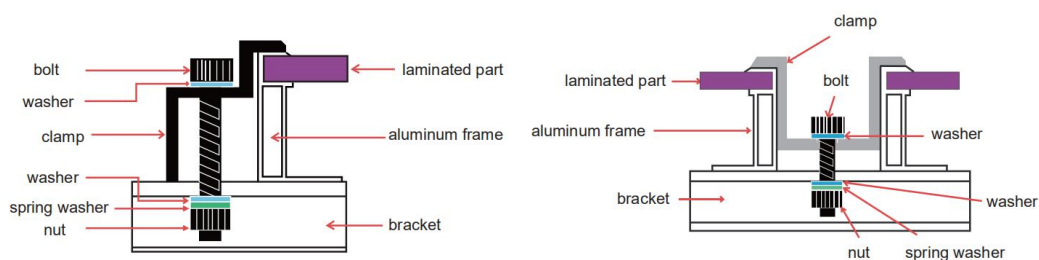
Regular Requirements

- Make sure that module installation mode and bracket system can meet the expected load, which is requisite assurance that the bracket installer must provide. Installation bracket system shall be tested and inspected by the third-party testing institution with static mechanical analysis capacity in accordance with local national standards or international standards.
- Module bracket shall be made from durable, corrosion resistant, ultraviolet proof materials.
- Modules shall be fixed on the bracket solidly.
- Use higher brackets in places with heavy snow accumulation so the lowest point of modules will not be covered by snow for long periods of time. In addition, make the lowest point of modules high enough so as to avoid shading by vegetation and woods or damage by sand and stone.

- If modules are installed on brackets parallel to the roof or wall, the minimum gap between the module frame and the roof/wall shall be 10cm for air ventilation so as to prevent module wire damage.
- It is forbidden to drill holes in the glass and frame of the component without the permission of Dehui.
- The module frames can appear thermal expansion and cold contraction so the frame interval between two adjoining modules shall be $\geq 10\text{mm}$.
- Make sure that back plate of modules will not in contact with bracket or building structures that can pierce into the inside of the modules, especially when the module surface is imposed by pressure.
- Maximum static load of the PV module by front 5400pa and back 2400pa, these values can vary depending on installation method of the modules (please refer to the following installation guidance), the described load in this manual is for the test load. Note: on the basis of IEC61215 - 2016 installation requirements, when computing the corresponding maximum design load, need to consider the safety factor of 1.5 times.
- Modules can be installed horizontally or vertically. When installing the components, be careful not to block the drain hole of the frame.

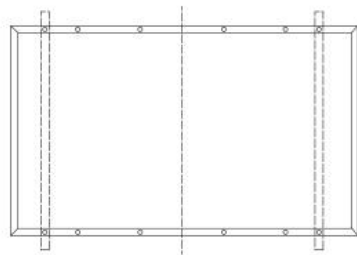
Use clamps to install modules

The assembly shall be mounted using a dedicated fixture, as shown below. Under no circumstances should the fixture touch the glass or deform the frame of the component. The surface of the fixture that is in contact with the front of the frame must be smooth and flat, otherwise the frame will be damaged, and the component will be damaged. Be sure to avoid the shadow blocking effect of the fixture. The drain hole cannot be blocked by the fixture. The fixture must maintain an overlap of at least 8 mm but no more than 11 mm with the frame of the assembly (you can change the cross section of the fixture if the assembly is securely installed).

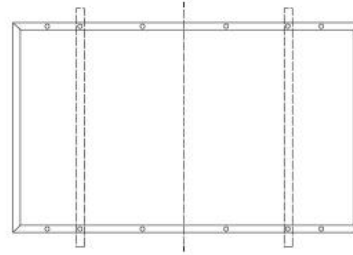


Monofacial component installation diagram and corresponding load

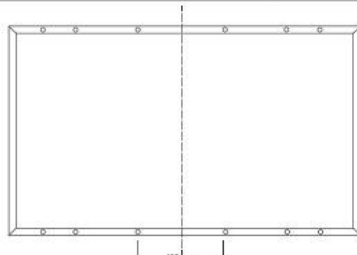
Screw mounting or clamp mounting: The static load on the largest back of the module is 2400pa (equivalent to wind pressure), and the maximum static pressure on the front is 5400pa (equivalent to wind pressure and snow pressure). Adopting 400mm pitch hole installation method, the mechanical load of the component is tested according to the corresponding certification standard. The maximum value of the front is 2400pa (snow pressure) and the maximum value of the back is 2400pa (wind pressure).



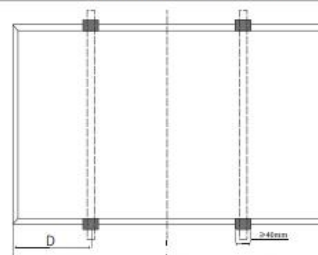
Outer four hole installation



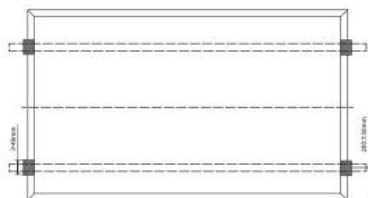
Inner four hole installation



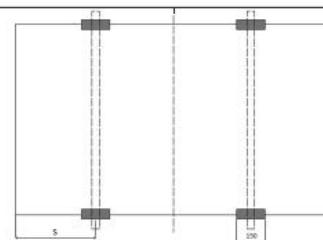
400mm pitch hole installation
(The distance of side C of the frame from the beam shall not be more than 10mm)



clamp installation
(clamp length $\geq 40\text{mm}$)



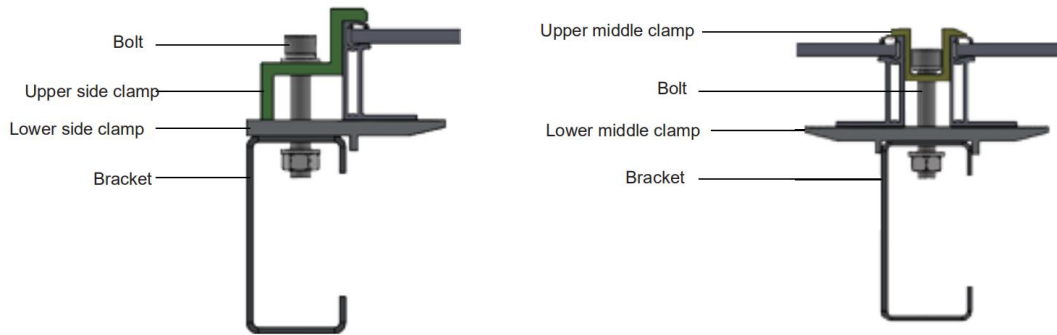
Short side clamp installation
(clamp length $\geq 40\text{mm}$)



Frameless component clamp installation
(clamp length $\geq 150\text{mm}$)

Use clamps to install modules

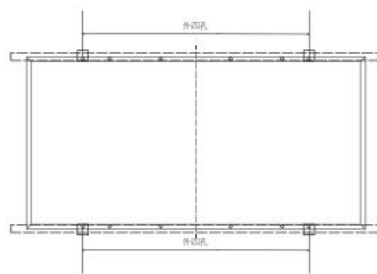
Use special clamps to install modules. The clamp shall not contact glass or cause module frame deformed in any case. The contacting surface of the clamp and frame front side shall be neat and smooth. Otherwise, frame and module may be damaged. Make sure that the clamp will not produce shading effect. Drain holes cannot be sheltered by the clamp. The clamp must overlap with module frame with no less than 8mm and no larger than 10mm.



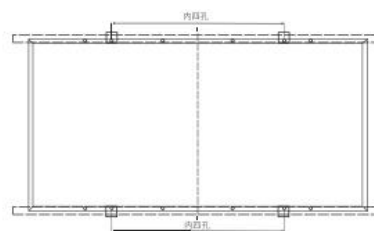
Bifacial double-glass PV module (frame)

Position of Installation Connecting Points

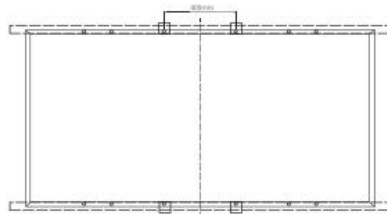
Screw mounting or clamp mounting: The static load on the largest back of the module is 2400pa (equivalent to wind pressure), and the maximum static pressure on the front is 5400pa (equivalent to wind pressure and snow pressure). Adopting 400mm pitch hole installation method, the mechanical load of the component is tested according to the corresponding certification standard. The maximum value of the front is 2400pa (snow pressure) and the maximum value of the back is 2400pa (wind pressure).



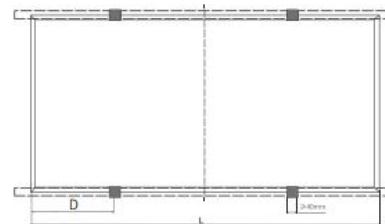
Outer four hole installation



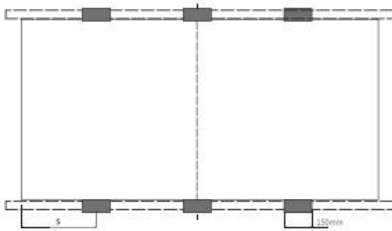
Inner four hole installation



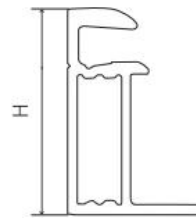
400mm pitch hole installation
(The height of side C of the frame from the beam shall not be less than 30mm)



clamp installation (clamp length \geq 40mm)



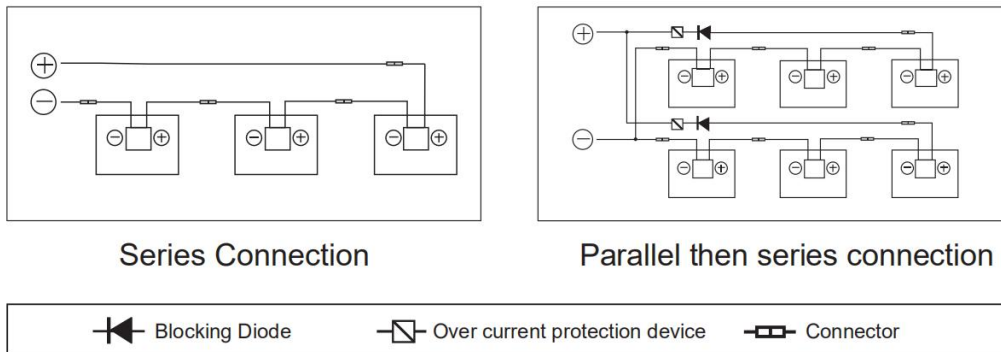
Short side clamp installation (clamp length \geq 40mm)



Aluminum frame height (H)

Electrical Performance

Module electric performance parameters such as I_{sc} , V_{oc} and P_{max} nominal values have $\pm 3\%$ error with those under standard testing conditions of: irradiance of 1000 W/m^2 , cell temperature of 25°C and air mass of AM1.5. When modules are in series connection, the final voltage is sum of that of the single module. When modules are in parallel connection, the final current is sum of the single module as below. Modules with different electric performance models cannot be connected in series.



The number of modules in series connection in each strand shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value stipulated for modules and other values required by DC electric parts. (Dehui modules maximum system voltage is DC1000V/DC1500V---actual system voltage is designed based on the modules model used and inverter.)

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

T: The expected lowest temperature of the installation site.

β : V_{oc} temperature coefficient ($\% / ^\circ\text{C}$) (Refer to modules manual for further detail)

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

Connector

Please keep connectors clean and dry. Make sure connector nuts are fastened before connection. Do not connect connectors that are damp or dirty or under any other improper conditions. Avoid connectors from direct sun light and water immersion or falling onto ground or roof.

Wrong connection may lead to electric arc and electric shock. Please make sure that all electric connection is reliable. Make sure all connectors with lock are fully locked.



Only connectors matching those installed on module, i.e., from the same vendor and model, shall be used; (If you need to use different types of connectors, please consult Dehui).

Bypass diode

Dehui module junction box contains bypass diode which is in parallel connection with the cell strands. If heat spot occurs locally with the module, the diode will come into operation to stop the main current from flowing through the heat spot cells in order to restrain module heating and performance loss. Notice, bypass diode is not the overcurrent protection device.

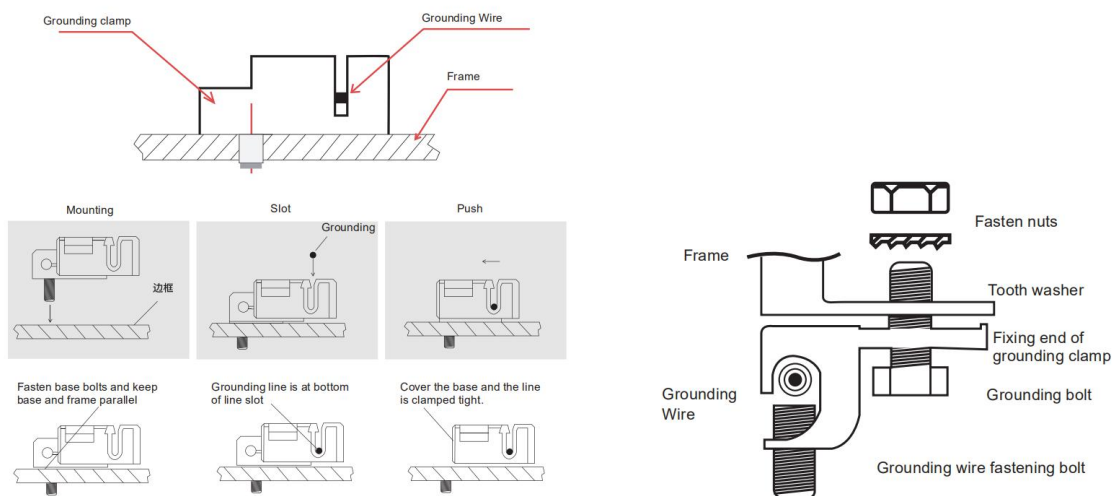
If the diode is found or doubted to be out of order, the installer or system maintenance supplier should contact Dehui. Please do not try to open the module junction box on your own.

Grounding

In design of modules, the anodized corrosion resistant aluminum alloy frame is used for rigidity support. For safety utilization and to protect modules from lightning and static-electricity damage, the module frame shall be grounded. The grounding device shall be in full contact with inner side of the aluminum alloy and penetrate the frame surface oxide film. Do not drill additional grounding holes on module frame.

The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor per respective National Electrical Codes. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.

Holes marked with a grounding mark on the frame can only be used for grounding and not for component mounting.





Cleaning

Accumulated contaminants, such as dust, industrial wastewater and birds' droppings on module surface glass will reduce the power output and lead to local hotspots. The degree of influence is determined by transparency of wastes. Small amounts of dust will affect the intensity of solar irradiation and evenness that modules receive but are not dangerous and power will not be reduced remarkably in general.

During operation of modules, there shall be no environmental factors projecting shades that shelter partial or the entire module. These environment factors include other modules, module system bracket, birds, dust, soil or plants. These will significantly reduce output power. Dehui suggests that the module surface should not be sheltered in any case. Frequency of cleaning depends on dirt accumulation speed. In normal situations, rainwater will clean the module surface and reduce the cleaning frequency. It is suggested to use damp clean water sponge or soft cloth to wipe the glass surface. Do not use acid and alkaline detergents to clean modules. Do not use tools with rough surfaces to clean in any case. In order to avoid potential risk of electrical shock or burn, Dehui suggests cleaning the modules during early morning and evening with less solar irradiation and lower modules temperature especially area with high average temperature. In order to avoid potential risk of electrical shock, do not try to clean the modules with glass damage or exposed wires.

Module Appearance Inspection

- ◆ Module glass cracks.
- ◆ Check whether there are traces of burning on the module back plate and grounding condition.
- ◆ Check for any shape objects in contact with PV modules' surface.
- ◆ Check for any loose or damage screws between the modules and bracket. If so, adjust and fix as soon as possible.

Inspection of connectors and cables

It is suggested to carry out the following preventive inspection once every 6 months:

Check connector sealing and cable connection.

Look for gaps on the sealant of the terminal box and confirm whether it is cracking.