PHONO

INSTALLATION MANUAL

Photovoltaic Module

Version: EN-IM-20240911

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PHONO

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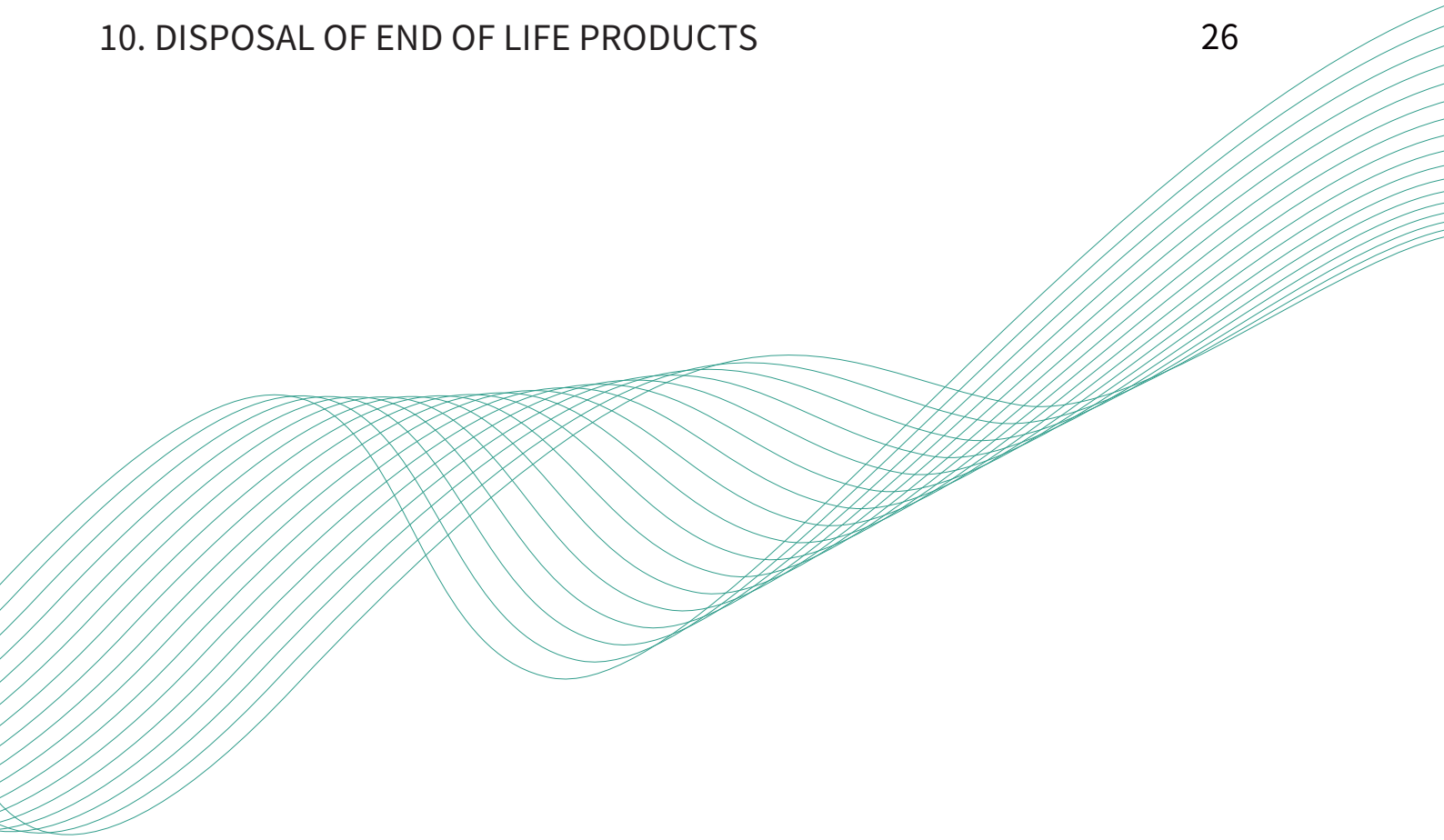
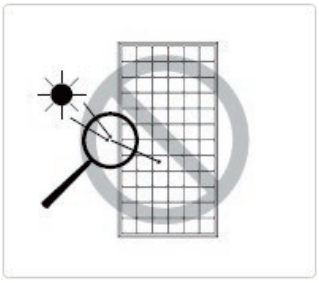
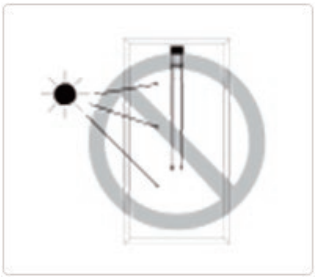




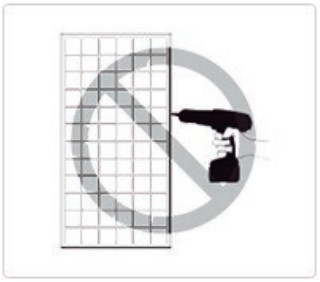
DO NOT use mirrors or magnifiers to concentrate sunlight onto the module.

DO NOT paint the module or attach anything on to the back of the module.

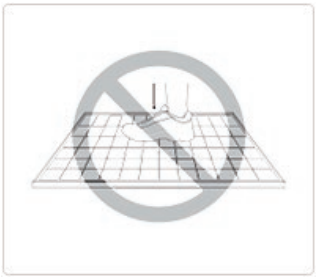
DO NOT lift or move the module by holding the junction box or cable.



DO NOT expose the back of the module to direct sunlight.

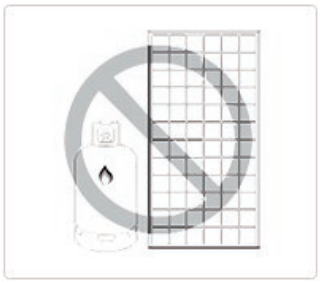


DO NOT drill holes in the frame.

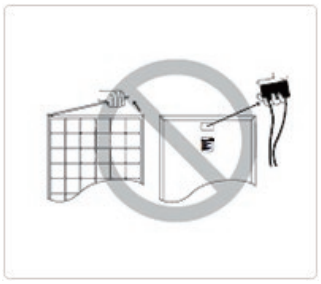


DO NOT place anything on the module or press on the module surface.

DO NOT install or handle module in wet or strong windy conditions.

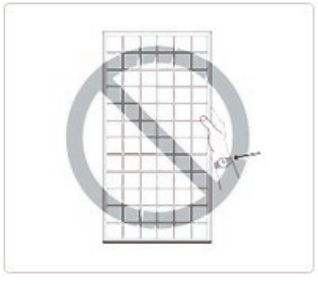


DO NOT use module near equipment or in places where flammable gases may be generated or collected.



DO NOT attempt to disassemble the modules, and do not remove any attached nameplates or modules from the module.

DO NOT drop the module or allow objects to fall on the module.



DO NOT wear metal ornaments while handling the module or during the installation.

Insulated gloves must be worn while handling the module and during the installation.

1 IMPORTANT SAFETY GUIDE

First, thank you for choosing our products. This manual contains information regarding product identification and the safe installation and maintenance of photovoltaic modules (hereafter referred to as “module”) supplied by PHONO SOLAR TECHNOLOGY Co., LTD. (hereafter referred to as “PHONO”). The term “module” can be interpreted as a single module or multiple modules depending on the context.

Installers must already be familiar with the mechanical and electrical requirements for a photovoltaic system. Installers must also read this manual carefully prior to installation. We recommend that you keep this manual in a safe place for future reference and in case of future sale or disposal of the module.

1.1 General Safety

- The installation of a photovoltaic system requires specialized skills and knowledge and must only be carried out by licensed/qualified persons.
- Installers should assume all risks of injury and do everything to avoid potential damages and risks that might occur during installation, including but not limited to, the risks of electric shock.
- PHONO modules do not need special cables for connection. All of the modules have permanent junction boxes, cables and connectors.
- The modules generate DC electrical energy from sunlight. Any contact of exposed metal at module's wiring parts may result in electrical shock or burn. Any contact of 30 V or larger DC Voltage can be fatal.
- The modules are designed for outdoor use and can be mounted onto frames on rooftops or in the ground etc.

1.2 Handling safety

- When handling the module insulated gloves must be worn. Inappropriate transportation and installation may break the module.
- Do not lift or move the module by holding the junction box or cable.
- Do not place anything on the module or press on the module surface.
- Do not drop the module or allow objects to fall on the module.

- Do not carry modules with ropes.
- Do not carry modules on your back.
- During the transportation and storage of modules, do not open packaging unless the modules arrive at the installation site.
- Do not stand or walk on modules.

1.3 Installation safety

- Local, regional and state laws and regulations must be adhered to while installing a photovoltaic system. For example, any necessary licenses must be obtained prior to the installation commencing. Regulations around vehicles and ships must also be observed during the installation.
- Observe all safety rules for the other system modules, including the cables, connectors, charging controllers, inverter and storage battery etc.
- The safety class protection rating of the module is clas II .
- Insulated gloves must be worn during the installation.
- Do not drill holes on the frame of module, which may reduce frame loading capacity and lead to frame corrosion and invalidation of the limited warranty provided for customers.
- Under normal conditions, a module is likely to produce more current and/or voltage than reported under Standard Test Conditions (STC). Accordingly, the values of Isc and Voc marked on the module nameplate should be multiplied by a factor when determining the module voltage ratings, conductor current ratings, fuse sizes, and the size of controllers connected to the photovoltaic system. The exact factor value should be suggested by a licensed/qualified person.
- The live connector may cause fire. spark or lethal shocks even when the modules are not connected.
- Electricity can be generated when the modules are exposed to sunlight, even if they are not connected. It is dangerous to touch 30V DC or higher, so never open the electrical connectors or unplug the electrical connectors while the circuit is under load, and do not touch the live connectors during the installation when the modules are exposed to sunlight.
- Children should be kept away from the photovoltaic system.

- In order to prevent current and voltage generation during installation an opaque board can be used to cover the modules.
- Only use licensed/qualified insulated tools.
- The frame of the modules may be grounded according to local, regional and state safety and electrical standards.
- Only Balance of System (BOS) modules that conform with local, regional and state safety electricity standards should be used to avoid affecting module performance and/or module damage.
- Modules shall not be permanently shaded under any circumstances. Permanent shading means cells are continuously shaded for extended periods of time, such as installing modules behind a pipe or a chimney, etc. If a defect (such as a hot spot) is caused due to a panel being improperly installed in the shade or due to poor maintenance, it will void PHONO' s warranty. Power dissipated in fully or partially shaded cells will result in power loss, reduced yield and can cause localized overheating, which in turn may negatively impact the module service lifetime. Permanent shading may cause accelerated aging of the encapsulation material and place thermal stress on the bypass diodes and this would void the module' s warranty.

1.4 Fire Safety

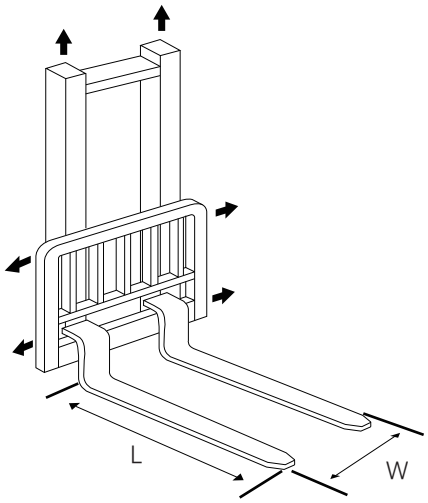
- Consult your local authority for guidelines and requirements for building or structural fire safety.
- Roof constructions and installations may affect the fire safety of a building; an improper installation may create a hazard in the event of a fire.
- Use modules such as ground fault circuit breakers and fuses as required by the local authorities.
- Do not use the modules near a location where flammable gases are either generated or collected.

2 UNLOADING AND STORAGE

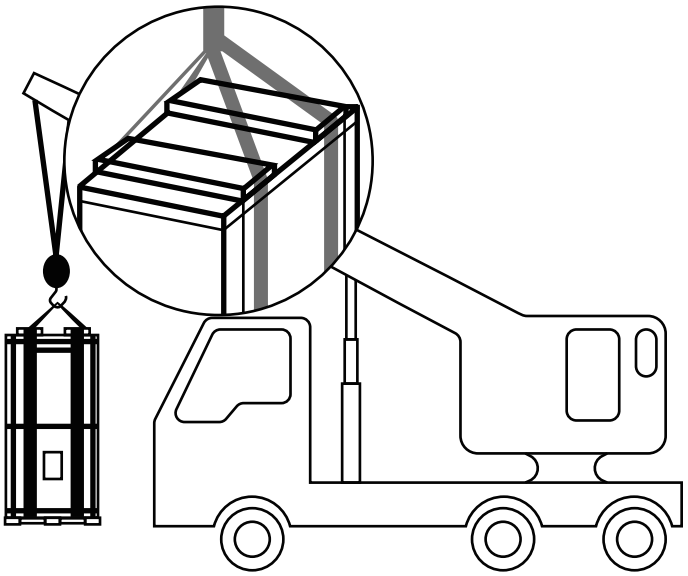
2.1 Unloading

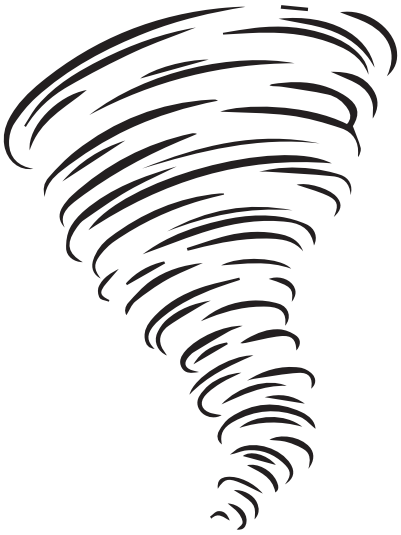
- Upon arrival of modules at the project site, the transport vehicle should park for unloading in an area that is flat, level, and open.
- Employ a forklift with appropriate load-bearing capacity to unload modules from the transport vehicle and place them on a level surface.
- The height of the loading and unloading platform should be as level as possible with the bottom of the forklift carriage. The straight travel speed of the forklift transportation should be controlled at 5 km/h, and the turning speed should be 3 km/h to avoid sudden stops and starts.

- Forklifts are strictly prohibited from hitting cardboard boxes or pallets with their forks. Please place cushioning and protective materials in advance (highlighted in yellow in the diagram, it is recommended to choose silicone, rubber, or EPE materials) to prevent damage to modules inside the packaging box due to external forces.



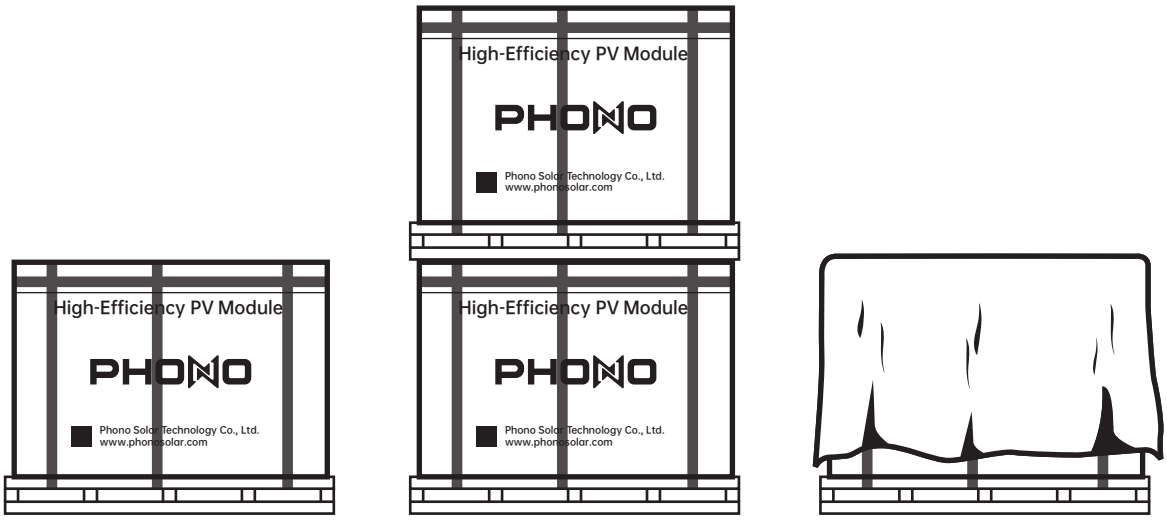
- Prior to hoisting, verify the condition of pallets and crates for any damage and ensure the integrity of hoisting ropes. When gently landing the lifted cargo, two individuals should delicately place the crates on a relatively level area of the project site.
- It is strictly prohibited to lift modules in meteorological conditions with wind speeds greater than Beaufort level 6, heavy rain or snow.





2.2 Storage

- Prohibition of stacking modules at the project site.
- Place the modules in a well-ventilated, dry location to avoid stacking, and use a rain cloth to prevent moisture.
- It is prohibited to soak trays in water. The storage area should first take floor drainage measures to prevent a large amount of water accumulation on the ground after rain, which may cause the ground to become soft or sink. Unauthorized personnel are strictly prohibited from accessing the module storage area, and modules should be stored in a centralized manner as much as possible.



3 UNPACKING

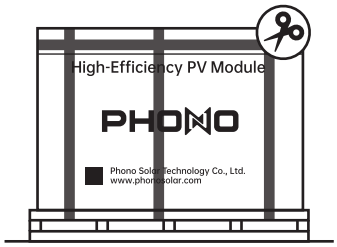
3.1 Notes

- Before unpacking, please check the product model, power level, serial number, and relevant suggestions on the A4 paper (marking) of the outer box, and carefully read the unpacking guide. Customized unpacking methods are prohibited.
- Before unpacking, please confirm that the outer packaging box is intact and undamaged. It is recommended to use an art knife to remove the packaging tape and wrapping film. Violent dismantling is prohibited to avoid scratching the modules inside the box.

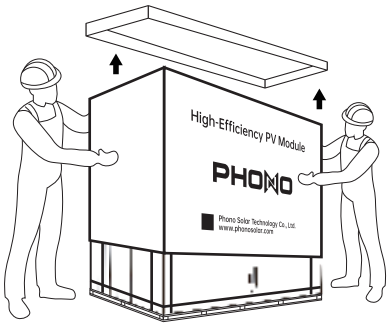
- Please verify whether the number of modules inside the box and the barcode information on the border are consistent with the label.
- Open the module packaging according to the recommended unpacking steps. When unpacking, it must be operated by two or more people simultaneously, and insulated gloves should be worn when handling modules.

3.2 Unpacking method

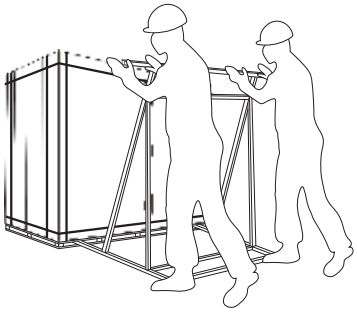
Method 1: Horizontal Packaging Unpacking: Suitable for module based on 156/158/166/182 mm cells



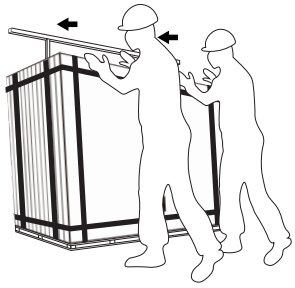
1. Remove the wrapping film and packing belts.



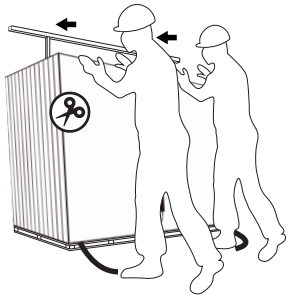
2. Remove the top cover and the cartons.



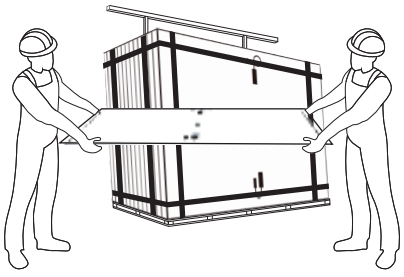
3. Place the stand supporter that is higher or wider than the module in order to avoid hitting and damaging the glass.



4. Cut off all the horizon tapacking belts,when there are 1or2 vertical packing belts remaining,push the module gently to tilt toward the stand supporter.

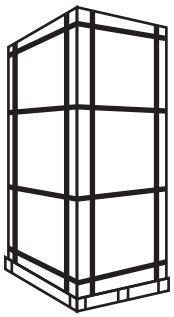


5. Cut off the remaining packing belts.

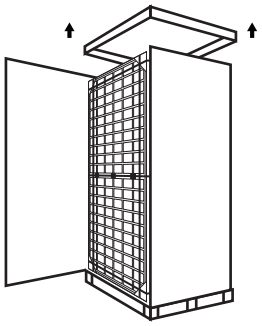


6. Take out the modules in order.

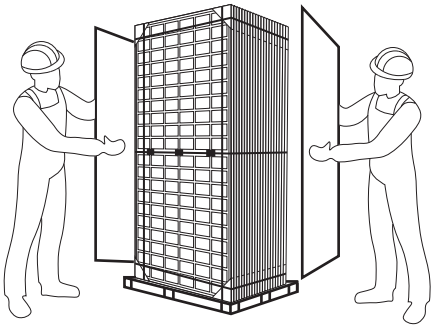
Method 2: Vertical packaging unpacking: suitable for module based on 210 mm cells



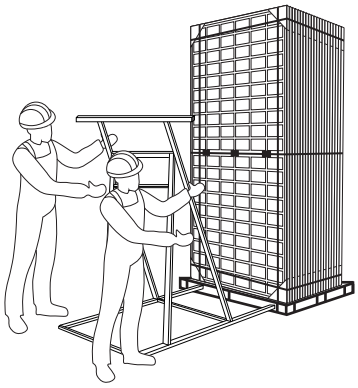
1. Remove the wrapping film and packing belts.



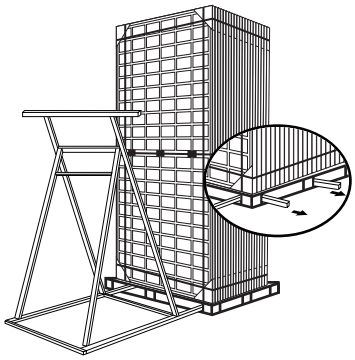
2. Remove the top cover and sealing tape.



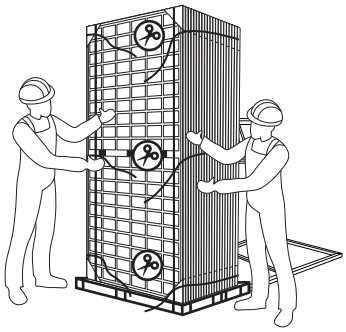
3. Remove the carton box.



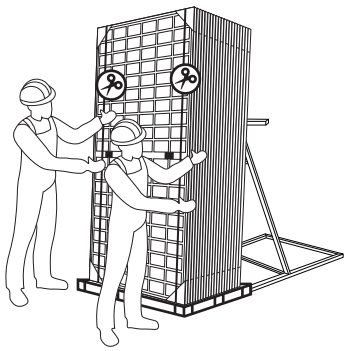
4. Place the stand supporter from the qlass or back-sheetside.



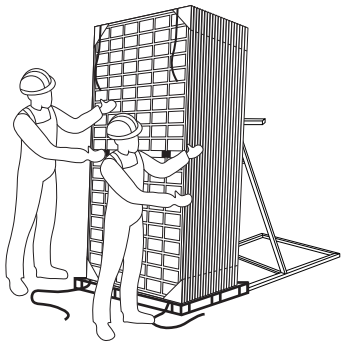
5. Pull out the 4 levers from both sides of the pallet.



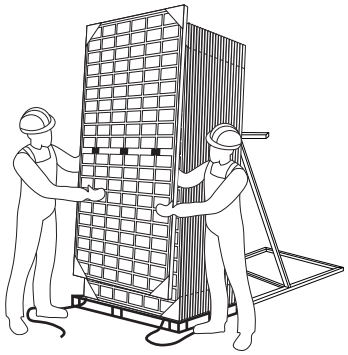
6. Cut off all the horizontal packing belts.



7. When there are 1-2 vertical packing belts remaining,push the module gently to tilt toward the stand supporter.



8. Cut off the remaining packing belts so that the modules rest on the stand supporter.



9. Take out the modules in order.

4 PRODUCT IDENTIFICATION

On the back of each module there are 2 labels that provide the following information:

Nameplate: Describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all as measured under STC; weight, dimensions etc.; the maximum system voltage of 1000V/1500V DC.

Warning: The value of Voc multiplied by the number of modules in series should not be bigger than the maximum system voltage marked in the nameplate.

Barcode: This is used to identify each module. Each module has a unique and traceable serial number in the form of barcode. The barcode of each PHONO module has 15 letter/digits.

Warning: Do not remove the nameplate or barcode. The PHONO product warranty will be void if either the module nameplate or barcode is removed.

5 MECHANICAL INSTALLATION

(Note: All instructions here after are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.. PV module installations must comply with the requirements of the National Construction Code.)

5.1 Select suitable locations for installation

- Select a suitable location for installing the modules.
- PHONO recommends that to achieve the best performance the modules should face south in northern latitudes and north in southern latitudes. The exact tilt angle and orientation of mounted modules should be recommended by a licensed/qualified installer.

- Serial connected PHONO modules should be installed in the same orientation and Angle. If the direction or Angle is different, the connected modules may receive different amounts of solar radiation, resulting in a loss of output power.
- Ensure that the installation height is such that the lowest modules will not be covered by accumulated snow or shaded by the surroundings.
- Ensure that there is adequate ventilation under the modules, conforming to local, regional and state standards and regulations.
- A minimum distance of 10cm, between the roof plane and the frame of the module is generally recommended.
- Observe the linear thermal expansion of the module frames. A minimum distance of 1cm between two modules is generally recommended.

Note1: Saline environments can accelerate the processes of electrical insulation losses and galvanic corrosion, especially when different metals with high electrochemical potential come into contact each other.

In saline environments, based on the distance to seashore, PHONO generally classifies coastal PV installation into three different levels:

- From 0 up to 50 meters, PHONO does not recommend any installation due to concerns for salt-mist corrosion.
- From 50 to 500 meters, PHONO regards this as “Near-Coast” installation requiring adherence to salt-mist corrosion prevention.
- From 500 meters and onwards, PHONO estimates standard mounting holes corrosion is minor and only requires annual preventive maintenance. In “Near-Coast” installation, PHONO modules must be installed under the following conditions.
- During the installation, do not scratch or break the corrosion-resistant coating (e.g. electroplated layer, oxidized coating, etc.) on the modules and mounting systems.
- Use corrosion-resistant materials for modules (nut, bolt, gasket, etc.) to fixing the modules and mounting systems.

- To avoid possible galvanic corrosion between the aluminum frame and the support structure, mica lamination, or other silicone, or fluoride made gasket shall be interposed between the two metals.
- When grounding the module frames, stainless steel hardware must also be used. To prevent salt corrosion to grounding block, fluorocarbon varnish could be sprayed on the grounding block thoroughly to form an anti-corrosion coating (at least 40um thick) or a pad of butyl plaster covering could be placed on the grounding block completely.
- To ensure optimum module performance for near-coast installation, a system maintenance service of every three months is generally recommended and additionally the following maintenance measures shall be taken.
- Check the frame, mounting system, grounding block and other junction areas for potential signs of corrosion.
- Clean the frame, mounting system, grounding block and other junction areas from salt and dust accumulation.
- To repair the rusty areas, apply butyl plaster or fluorocarbon varnish spray to cover the area thoroughly after clean the salt and other dust accumulations around the rusty areas.

Note2: If you are planning to use the PV modules where the water damage (Humidity:> 85RH%) may be possible, please consult with PHONO technical support first to determine an appropriate installation method and module type, or to determine whether the installation is possible.

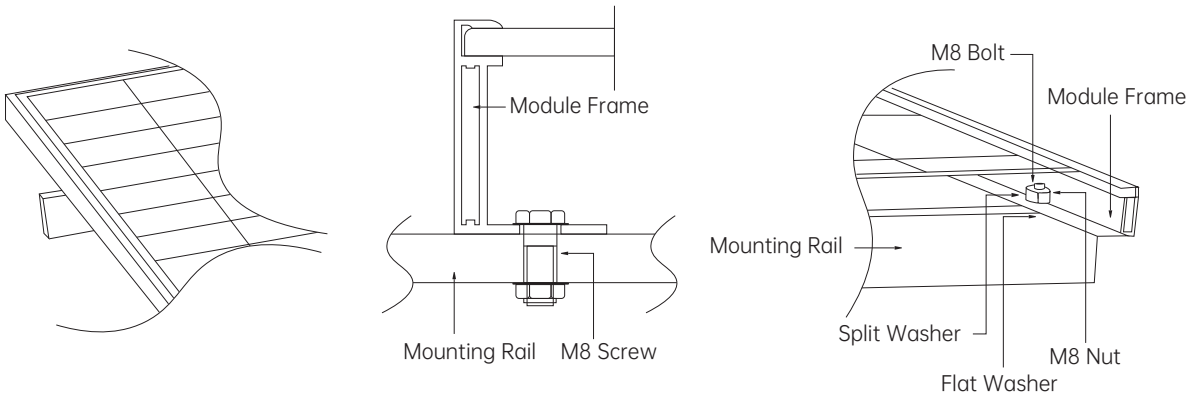
5.2 Select suitable mounting rails

Please observe the safety regulations and installation instructions included with the mounting rail. If necessary, please contact the supplier directly for further information.

- The modules must be safely set onto the mounting rail. The whole rail supporting the photovoltaic system must be strong enough to resist potential mechanical pressures caused either by wind or snow, in accordance with local, regional and state safety (and other associated) standards.
- Make sure that the mounting rail will not deform or affect the modules when it expands as a result of thermal expansion.
- The mounting rail must be made of durable, anti-corrosive and UV-resistant materials.

PHONO modules can be mounted using two methods:

Screw fitting: Use corrosion-proof screws in the existing installing holes in the module frame. Each module has 8 mounting holes for securing the module on the mounting rail. The module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in symmetrical locations on the module. The applied torque should be 16~20Nm.Pleasefind detailed mounting information in the below illustration:



Module installed using Screw Fitting method

Figure 1

Clamp fitting: Using suitable module clamps on the LONG side of the module frame to mount the modules is “portrait orientation” mode, while on the SHORT side of the module frame is “landscape orientation” mode.

The module clamps should not come into contact with the front glass and must not deform the module frame. Avoid any shadowing effects from the module clamps. The module frame cannot be modified under any circumstances. Regardless of the orientation chosen, at least 4 clamps must be used on each module. Depending on the local wind and snow loads, additional clamps may be required. It is recommended to use the clamps under the following condition or approved by system installation:The length of the clamp is no less than 50mm. Overlap of the frame of the module is no less than 10mm. The wall thickness of the clamp is no less than 3mm. The type of bolt is M8. The applied torque should be about 16~20NmPlease find detailed mounting information in the below illustration:

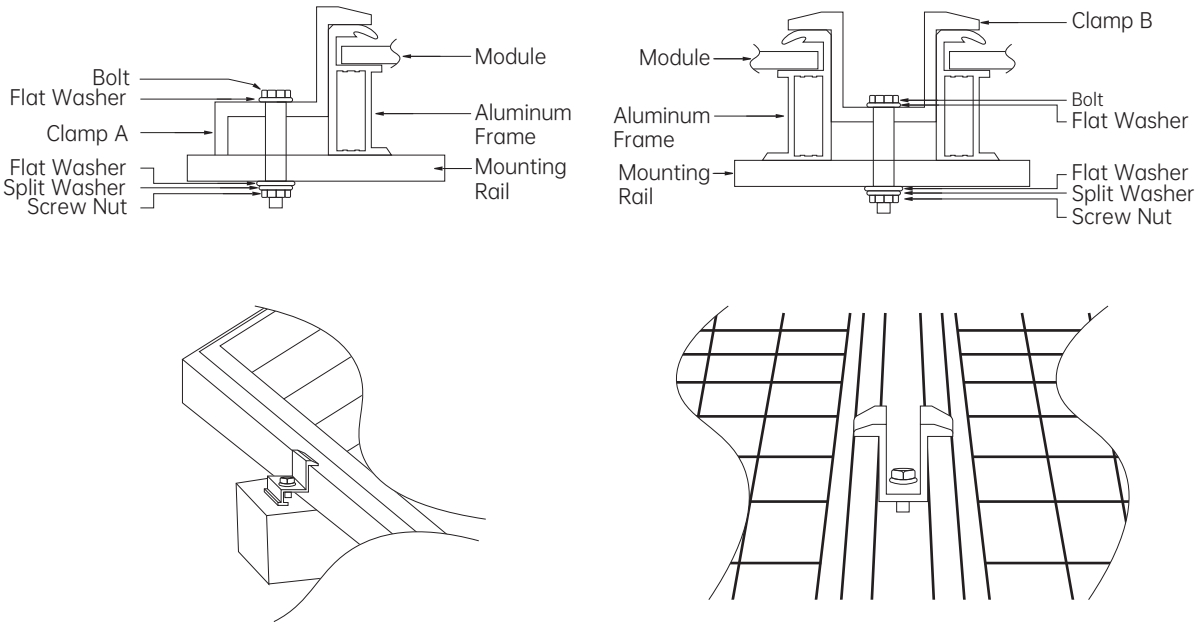


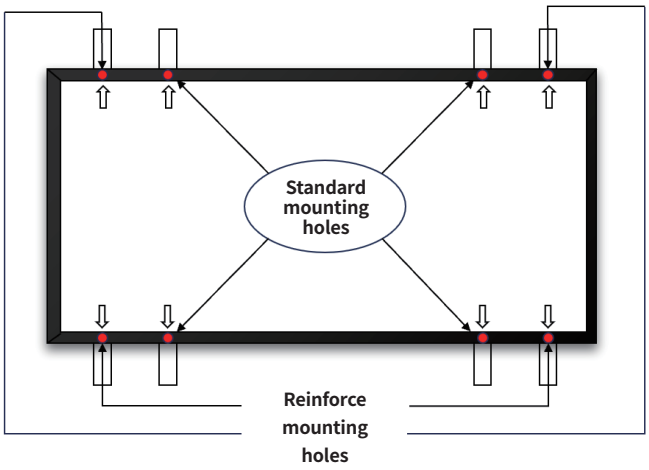
Figure 2

Select the appropriate installation method depending on the load (see below for more detailed information).

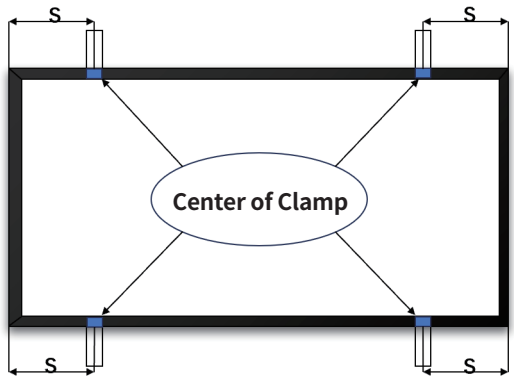
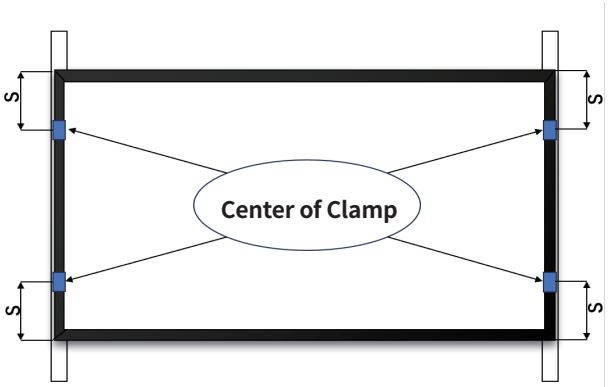
Installation

Screw System

Use standard mounting holes and reinforce mounting holes



Clamping System

Mount on long side using four clamps	Mount on short side using four clamps
	

The guide rail should be installed perpendicular to the long side of the frame.

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(156.75mm, 158.75mm)	U type 60 cell	PSXXXP(H)-20/U	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXP(H)-20/UH	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXM(H)-20/U	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXMGF(H)-20/UH	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXMGF(H)-20/U	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXM(H)-20/UH	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXM1(H)-20/U	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
		PSXXXM1(H)-20/UH	5400Pa, -2400Pa	/	/	205mm≤S≤455mm	5400Pa, -2400Pa
	T type 72 cell	PSXXXP(H)-24/T	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXP(H)-24/TH	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXM(H)-24/T	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXM1(H)-24/T	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXM(H)-24/TH	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXM1(H)-24/TH	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa
		PSXXXMGF(H)-24/TH	5400Pa, -2400Pa	/	/	300mm≤S≤350mm	5400Pa, -2400Pa

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(166mm)	U type 60 cell	PSXXXM4(H)-20/UH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	390mm≤S≤490mm	5400Pa,-2400Pa
		PSXXXM5(H)-20/UH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	390mm≤S≤490mm	5400Pa,-2400Pa
	UG type 60 cell	PSXXXM5GF(H)-20/UH	5400Pa,-2400Pa	/	/	390mm≤S≤490mm	5400Pa,-2400Pa
		PSXXXM5GFH-20/USH	5400Pa,-2400Pa	/	/	390mm≤S≤490mm	5400Pa,-2400Pa
	W type 66 cell	PSXXXM4(H)-22/WH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	430mm≤S≤530mm	5400Pa,-2400Pa
		PSXXXM5(H)-22/WH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	430mm≤S≤530mm	5400Pa,-2400Pa
	WG type 66 cell	PSXXXM5GFH-22/WSH	5400Pa,-2400Pa	/	/	435mm≤S≤535mm	5400Pa,-2400Pa
	T type 72 cell	PSXXXM4(H)-24/TH	5400Pa,-2400Pa	/	/	475mm≤S≤575mm	5400Pa,-2400Pa
		PSXXXM5(H)-24/TH	5400Pa,-2400Pa	/	/	475mm≤S≤575mm	5400Pa,-2400Pa
	TG type 72 cell	PSXXXM5GF(H)-24/TH	5400Pa,-2400Pa	/	/	475mm≤S≤575mm	5400Pa,-2400Pa
		PSXXXM5GFH-24/TSH	5400Pa,-2400Pa	/	/	475mm≤S≤575mm	5400Pa,-2400Pa

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(182mm)	V type 54 cell	PSXXXM6(H)-18/VH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
	VG type 54 cell	PSXXXM7GF(H)-18/VH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-18/VH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
		PSXXXM7GFH-18/VNH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-18/VNH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-18/VNHB	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
		PSXXXM8GFH-18/VSH	5400Pa,-2400Pa	0mm≤S≤200mm	2000Pa,-1600Pa	380mm≤S≤480mm	5400Pa,-2400Pa
	U type 60 cell	PSXXXM6(H)-20/UH	5400Pa,-2400Pa	/	/	420mm≤S≤520mm	5400Pa,-2400Pa
	UG type 60 cell	PSXXXM8GF(H)-20/UH	5400Pa,-2400Pa	/	/	420mm≤S≤520mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-20/UNH	5400Pa,-2400Pa	/	/	420mm≤S≤520mm	5400Pa,-2400Pa
	W type 66 cell	PSXXXM6(H)-22/WH	5400Pa,-2400Pa	/	/	420mm≤S≤520mm	5400Pa,-2400Pa
	WG type 66 cell	PSXXXM8GF(H)-22/WNH	5400Pa,-2400Pa	/	/	420mm≤S≤520mm	5400Pa,-2400Pa

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(182mm)	T type 72 cell	PSXXXM6(H)-24/TH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM8(H)-24/TH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM8(H)-24/THB	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
	TG type 72 cell	PSXXXM7GF(H)-24/TH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-24/TH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM8GF(H)-24/TNH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM8GFH-24/TSH	5400Pa,-2400Pa	/	/	520mm≤S≤620mm	5400Pa,-2400Pa
		PSXXXM7GF(H)-24/TNH	5400Pa,-2400Pa	/	/	400mm≤S≤500mm	5400Pa,-2400Pa
						500mm≤S≤600mm	2400Pa,-2400Pa
	R type 78 cell	PSXXXM8GFH-26/RNH	5400Pa,-2400Pa	/	/	450mm≤S≤550mm	5400Pa,-2400Pa

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(182R)	VG type 54 cell	PSXXXL7GF(H)-18/VNH	5400Pa, -2400Pa	/	/	400mm≤S≤500mm	5400Pa, -2400Pa
	TG type 72 cell	PSXXXL7GF(H)-24/TNH	5400Pa, -2400Pa	/	/	550mm≤S≤650mm	5400Pa, -2400Pa
(210mm)	UG type 60 cell	PSXXXM13GFH-20/UH	5400Pa, -2400Pa	/	/	360mm≤S≤460mm	5400Pa, -2400Pa
		PSXXXM13GFH-20/USH	5400Pa, -2400Pa	/	/	360mm≤S≤460mm	5400Pa, -2400Pa
		PSXXXM13GFH-20/USHW	5400Pa, -2400Pa	/	/	360mm≤S≤460mm	5400Pa, -2400Pa
	WG type 66 cell	PSXXXM13GF(H)-22/WH	5400Pa, -2400Pa	/	/	440mm≤S≤540mm	5400Pa, -2400Pa
		PSXXXM13GF(H)-22/WNH	5400Pa, -2400Pa	/	/	440mm≤S≤540mm	5400Pa, -2400Pa
		PSXXXM13GFH-22/WSH	5400Pa, -2400Pa	/	/	440mm≤S≤540mm	5400Pa, -2400Pa
		PSXXXM13GFH-22/WSHW	5400Pa, -2400Pa	/	/	440mm≤S≤540mm	5400Pa, -2400Pa
		PSXXXM14GFH-22/WSHW	5400Pa, -2400Pa	/	/	440mm≤S≤540mm	5400Pa, -2400Pa
(210R)	Q type 48 cell	PSXXXL8(H)-16/QMH	/	/	/	350mm≤S≤450mm	2400Pa,-1800Pa
	QG type 48 cell	PSXXXL8GF(H)-16/QNH	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL12GFH-16/QSH	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL12GFH-16/QSHW	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL12GFH-16/QSHB	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL14GFH-16/QSH	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL14GFH-16/QSHW	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa
		PSXXXL14GFH-16/QSHB	5400Pa, -2400Pa	/	/	350mm≤S≤450mm	5400Pa, -2400Pa

Comparison table of bracket installation model

Classification		Module model	Screw System	Clamping System			
			Pressure Range	Short side installation		Long side installation	
				Installation distance	Pressure Range	Installation distance	Pressure Range
(210R)	VG type 54 cell	PSXXXL8GF(H)-18/VNH	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL12GFH-18/VSH	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL12GFH-18/VSHW	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL12GFH-18/VSHB	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL14GFH-18/VSH	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL14GFH-18/VSHW	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
		PSXXXL14GFH-18/VSHB	5400Pa, -2400Pa	/	/	390mm≤S≤490mm	5400Pa, -2400Pa
	WG type 66 cell	PSXXXL8GF(H)-22/WNH	5400Pa, -2400Pa	/	/	480mm≤S≤580mm	5400Pa, -2400Pa
		PSXXXL12GFH-22/WSH	5400Pa, -2400Pa	/	/	480mm≤S≤580mm	5400Pa, -2400Pa
		PSXXXL12GFH-22/WSHW	5400Pa, -2400Pa	/	/	480mm≤S≤580mm	5400Pa, -2400Pa
		PSXXXL14GFH-22/WSHW	5400Pa, -2400Pa	/	/	480mm≤S≤580mm	5400Pa, -2400Pa

Note: "XXX" in the module model refers to the nominal power of the module, such as "PS400M6-18/VH" and "PS440M6-20/UH". The term "(H)" in the module model refers to two types of modules that cover two maximum system voltages of 1000V and 1500V, respectively. The corresponding relationship is as follows: "PS400M6-18/VH" with a maximum system voltage of 1000V, and "PS400M6H-18/VH" with a maximum system voltage of 1500V.

6 ELECTRICAL INSTALLATION

(Note1: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.

Note2: Instructions for installations to comply with local regulations/electrical codes.)

6.1 Cable lines and connections

- Any hardware used must be compatible with the mounting material to avoid galvanic corrosion.
- PHONO recommends that the same type of modules are connected together in order to avoid any system power loss.
- The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions.
- The module frame may be grounded according to local, regional and state safety and electrical standards. Ensure that a recommended connector or equivalent is used for the grounding cable. The grounding cable must be properly fastened to the module frame.
- Voltages are additive when modules are connected directly in series, and modules currents are additive when modules are connected in parallel, as illustrated in Figure3.Modules with different electrical characteristics must not be connected directly in series. If quantity of parallel connection is more than 2, there must be an overcurrent protection device on each string of module.

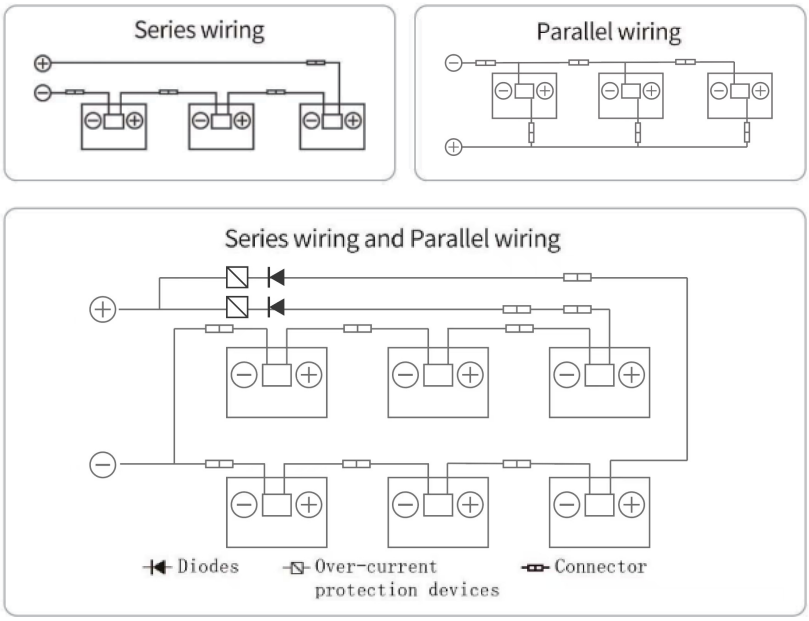
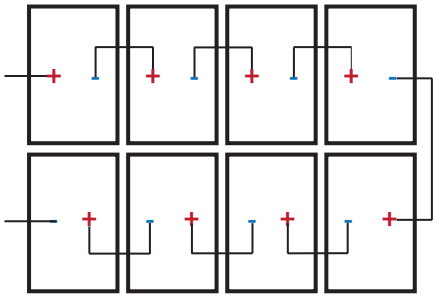
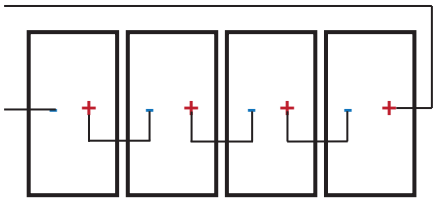
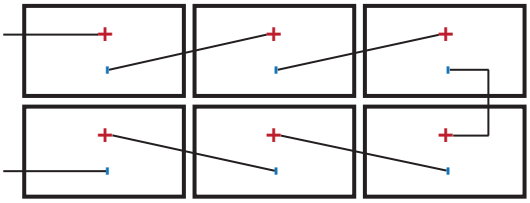


Figure 3

- The rated voltage of the cable chosen must be appropriate to the overall maximum voltage of the system.
- Select insulated cables that are able to resist to ultraviolet radiation and extreme weather conditions.
- PHONO recommends using the following two wiring methods (choose long or short cables based on the installation method of the modules). Please refer to the product data sheet for the relevant cable standard length.

Recommended wiring	Diagram
Vertical installation (standard short cable)	
Vertical installation (standard short cable)	
Horizontal installation (standard long cable or custom)	

Warning: The minimum bending radius of the cable after installation should be 43mm.

Figure4

6.2 Connector

- Only use connectors that are designed for photovoltaic systems and that match PHONO modules.
- When working with the connectors only use tools as recommended by the connector manufacturer.

6.3 Bypass diode

- The battery string in the PHONO module is protected in parallel by a bypass diode and is packaged in a junction box. When a hot spot occurs locally in the module, the diode will start to work, so that the main current no longer flows through the hot spot battery, thus limiting the module heat and performance loss. Note that bypass diodes are not overcurrent protection devices.
- Installers or system maintainers should contact PHONO when a diode failure is known or suspected. Do not attempt to open the junction box of the module yourself.

6.4 Anti-PID

- In order to reduce the risk of potential induced degradation (PID), PHONO strongly recommends to use anti-PID solar modules in wet regions (i.e. shores, wetlands), or to use the system negative grounding where the negative polarity of the PV modules array (i.e. negative grounding at the DC bus bar level) is connected to the ground. Failure to comply with this recommendation may reduce the module performance and will invalidate the limited power warranty of the module.

7 GROUNDING

• For grounding and bonding requirements, please refer to regional and national safety and electricity standards. If grounding is required, use a recommended connector type for the grounding wire.

• The grounding between modules must be confirmed by a qualified electrician, and the grounding device must be manufactured by a qualified electrical manufacturer.

• For grounding, this guide refers to module frame grounding. If grounding is required, make sure module frames (metal exposed to touch) are always grounded.

• System grounding is not mandatory for PHONO modules, however negative system grounding may be required by local authorities and can therefore be recommended.

• Please refer to relevant connector specifications for instructions, The grounding conductor must be connected to the ground through a suitable grounding electrode. The holes marked with grounding markings on the border can only be used for grounding and cannot be used for module installation.

• Place star washers, flat washers, and ground cables in sequence, thread screws through the ground holes, and tighten them to secure adjacent modules. PHONO recommends the grounding method shown below.

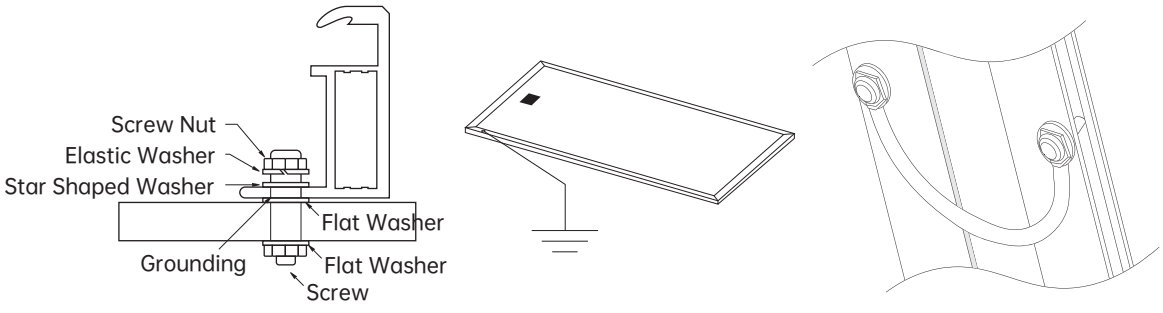


Figure5

8 MAINTENANCE

8.1 The amount of electricity generated by a solar module is proportionally correlated with the light absorbed by the module with a factor equivalent to module conversion efficiency. Cells shaded by leaves and dust accumulated on the surface will reduce the light absorption and power generation, and therefore it is important to keep modules unshaded and clean. To ensure the optimum module performance, PHONO recommends the following:

- In order to reduce the potential electric shock or burn, it is recommended to clean the PV module in the morning or evening when the light is weak and the module temperature is low, especially in the area with high temperature; Cleaning water or solution with a large temperature difference from the modules shall not be used for cleaning the modules.
- It is forbidden to clean PV modules under the weather conditions of heavy rain, heavy snow or wind grade higher than 4.
- If pressurized water is employed in cleaning, the water pressure applied on the glass surface of the module shall not exceed 4MPa(40bar); the module is prohibited to bear the extra force.
- 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 a steam cleaner.
- When cleaning the modules, use soft cloth and clean water together with a mild detergent. The temperature of the water applied shall be close to that of the module being cleaned.
- Use dry or wet soft clean cloth to clean the PV modules; Corrosive solvents hard objects are strictly prohibited.

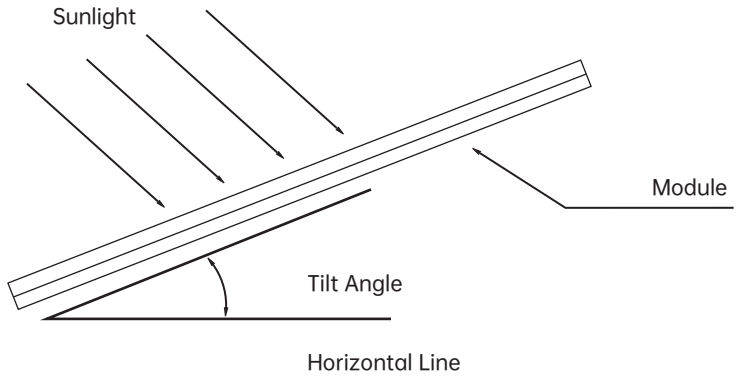
Water

Dust-free gloves

Wet and soft cleaning cloth

- If there are greasy dirt and other substances on the surface of the PV module which are difficult to clean, conventional household glass cleaning agents can be used.

- Do NOT use the alkaline and strong acid solvents.
- PHONO recommends a minimum tilt angle of 10 degrees for performance and self-cleaning purposes. If the installer chooses to install at an inclination<10 degrees they should make the end user aware that more regular cleaning of the panels will be required to avoid the accumulation of dust and debris.



- The back surface of the module normally does not need to be cleaned, but in the event, this is deemed necessary, avoid the use of any sharp objects that might damage or penetrate the substrate material.
- Check the electrical and mechanical connections routinely and make sure they are clean, safe, complete and secure.
- In the event of a problem, please consult with a licensed/qualified person.

8.2 Requirements for Water Quality

- PH:5~7.
- Chloride and Salinity:0-3,000 mg/L.
- Turbidity:0-30 NTU.
- Conductivity:1500~3000μs/cm.
- Total dissolved solids (TDS): ⩽1000 mg/L.
- Water Hardness-calcium and magnesium ions:0-40 mg/L.
- Non-alkaline water must be used; demineralized water shall be used if the condition permits.

8.3 Safety Warning

- Cleaning work might impose the risk of damaging the module or a series of modules, and might also increase the risk of electric shock.
- Broken or damaged modules may present a risk of electric shock due to current leakage, and this risk may be exacerbated by the moisture in the modules. Before cleaning, ensure to check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free.
- During the day, the voltage and current present in the array are sufficient to cause a fatal electric shock. Before cleaning, make sure the array is disconnected from live parts (such as inverters, etc.).
- Wear protective equipment (clothes, insulated gloves, etc.) while cleaning.
- Do not immerse modules partially or completely in water or any kind of liquid.

9 DISCLAIMER OF LIABILITY

Since it is impossible for PHONO to control installation, operation, application and maintenance of the photovoltaic system according to this instruction, PHONO does not accept responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

PHONO will not take any responsibilities for any possible violation of patent rights and third party rights that are related to application of the solar energy system. No permission of patents is given through implication.

The information of this instruction is from knowledge and experience of PHONO, and so it is reliable. However, the instructions and suggestions of this instruction do not make an external or internal of guarantee. PHONO reserves the right to revise this instruction, products and all the information about products without prior notification to customers.

Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of the PHONO product warranty.

10 DISPOSAL OF END OF LIFE PRODUCTS

PHONO is a member of PV CYCLE, a European non-profit association managing a collection and recycling scheme for end-of-life solar modules throughout Europe. Please visit the website: http://www.pvcycle.org/for further information.

PHONO

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