

Gokin Solar

Installation manual for Photovoltaic Module

Contents

01 Introduction ---------- 1

02 Laws and Regulations ---------- 1

03 Safety Guidelines ---------- 1

3.1 General Safety ---------- 1

3.2 Electrical Safety ---------- 2

3.3 Handling Safety ---------- 2

3.4 Fire Safety ---------- 4

3.5 Chemical Safety ---------- 4

04 Installation Condition ---------- 5

4.1 Place and Environment ---------- 5

4.2 Selection of Tilt Angles ---------- 5

05 Product Identification ---------- 6

06 Mechanical Installation ---------- 7

6.1 Fixed installation-mounting with bolts ---------- 8

6.2 Fixed installation-mounting with clamps ---------- 10

07 Grounding ---------- 12

08 Electrical Installation ---------- 13

8.1 Safety Instruction ---------- 13

8.2 Wiring ---------- 14

8.3 Fusing ---------- 15

09 Maintenance ---------- 16

9.1 Visual Inspection ---------- 16

9.2 Cleaning ---------- 16

Appendix: Electrical Parameter & J-BOX and connectors -------- 19

APPLICABLE PRODUCT LIST

Category	Module Type
Single-glass TOPCon products	GK-2-66HT
	GK-2-60HT
	GK-1-72HT
	GK-1-60HT
	GK-1-54HT
Single-glass PERC products	GK-2-66HP
	GK-2-60HP
	GK-1-72HP
	GK-1-60HP
	GK-1-54HP
Double-glass TOPCon products	GK-2-66HTBD
	GK-2-60HTBD
	GK-4-66HTBD
	GK-4-48HTBD
	GK-3-72HTBD
	GK-3-54HTBD
	GK-1-78HTBD
	GK-1-72HTBD
	GK-1-60HTBD
	GK-1-54HTBD
Double-glass PERC products	GK-2-66HPBD
	GK-2-60HPBD
	GK-1-72HPBD
	GK-1-60HPBD
	GK-1-54HPBD

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For the latest document please refer to Gokin Solar official website: www.gokinsolar.com

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01 Introduction

First of all, thank you very much for choosing Gokin Solar Co., Ltd. 's photovoltaic modules (hereinafter referred to as "modules").

This installation manual contains important electrical and mechanical installation information as well as safety information that you must be familiar with, providing important safety instructions for the installation, use and maintenance of solar modules. Users, installation, and maintenance personnel must read this manual carefully and strictly abide by it. Failure to comply with these safety guidelines may result in death, injury or property damage.

The installation and operation of solar modules requires professional skills, and only qualified professionals can perform this work. Please read the safety and installation instructions before operating, installing and maintaining the modules, and keep this manual in a safe place for future reference (maintenance and maintenance), and the installer must inform the end customer (or consumer) of the above matters accordingly.

Gokin reserves the right to change this installation manual without prior notice. You are advised to visit the Gokin official website **www.gokinsolar.com** for the latest version installation manual.

This installation manual does not have any warranty meaning, either express or implied. Gokin shall not be liable for any product defect or destruction, personal injury or property damage caused by any operation during the disposal of modules (including but not limited to disassembly/packaging, loading and unloading, handling, transportation, storage, installation, connection, disassembly, operation and maintenance, etc.). Failure by the customer to follow the requirements set forth in this manual in the installation of modules may result in the invalidation of the limited warranty provided to the Customer. Gokin shall not be liable for any infringement of patent rights or rights of third parties caused by the use of modules. At the same time, the suggestions in this manual are tested and verified by practice, and the purpose is to improve the security and stability of the module during installation and operation.

02 Laws and Regulations

Mechanical and electrical installation of photovoltaic modules should refer to the corresponding regulations, including electrical law, construction law and electrical connection requirements. These regulations vary depending on the installation location, and requirements may vary depending on the voltage, current nature (AC or DC) of the installed system. Please contact your local authority for specific terms.

03 Safety Guidelines

3.1 General Safety



Read and understand all safety rules before installing, wiring, operating, or maintaining modules. When the module is exposed to sunlight or other light sources, direct current (DC) is generated. Whether the modules are connected or not, direct contact with live parts of the modules, such as terminal blocks, may result in injury or death.

Gokin Solar modules comply with IEC61215 and IEC61730 standards, meet the requirements of safety Class II, and its application class rating is Class A: The module can be used in public exposure, voltage greater than 50V or power greater than 240W systems.

For your safety, please do not perform installation and maintenance work without safety precautions, including but not limited to fall protection, ladders or stairs, and personal protective equipment.

For your safety, do not install or handle modules in dangerous or harsh environments, including but not limited to strong winds, rain, snow, or dust storms.

Please ensure that you install or handle the integrity of the modules, do not use or install damaged modules, including but not limited to the surface (back) glass is not damaged, the backplane is not broken, the junction box lid is kept closed, the cables and connectors are not broken, and there is no bare metal.

All installation work must be in full compliance with local regulations and corresponding national or international electrical standards.

3.2 Electrical Safety



No matter whether the module is connected to the system or not, appropriate protective measures should be taken when touching the module or entering the power station, such as: insulation tools, safety hats, insulation gloves, safety belts and insulation shoes, etc., to avoid direct contact with 30V or higher DC voltage, 30V or higher DC voltage is potentially fatal.

The module has no switch and can only be stopped by removing the module from light (for example, by shielding it with cloth, cardboard, or a completely opaque material).

In some cases, the open circuit voltage or short circuit current generated by the module exceeds the corresponding values tested under its standard test conditions (STC: irradiance 1000W/m2, module temperature 25 ° C, atmospheric mass 1.5). Therefore, the electrical design and calculation of the system need to be determined by a qualified electrical engineer, and reasonable coefficients should be multiplied when calculating the module rated voltage, rated current, safety fuse and control specifications connected to the PV output.

Use dry tools to install or maintain modules in dry conditions. Do not touch modules when they are wet unless wearing appropriate anti-electric shock equipment; When cleaning modules, follow the instructions in this manual.

To avoid the risk of arcing and electric shock, do not disconnect the module from any electrical appliance while in operation. A faulty connection can also cause arcing and electric shocks. Connectors must be kept dry and clean to ensure they are in good working order. Do not insert other metal objects into the connector or make electrical connections in any other way.

When a grounding alarm occurs in the system, wear protective devices and disconnect the system from the faulty module under safe conditions. Do not touch other parts of the module to avoid potential electric shock.

Only use compatible connectors to connect modules or connect modules to other devices. Removing the connector will result in loss of product warranty.

3.3 Handling Safety



To ensure the safety of modules during transportation and storage, unpack modules after they arrive at the installation site.

When stacking modules, strictly comply with the upper limit on the number of layers printed on the packing

case. Do not stack more than two layers of vertical packages on the short side, but allow stacking of vertical packages on the long side.

During the storage process, protect the package from damage, and store the module in a dry and ventilated environment to avoid direct sunlight and humidity. If the modules are stored in an uncontrolled environment, they shall not be stored for more than 3 months and additional measures shall be taken to protect the modules from moisture or sunlight.

If the modules will not be installed within a short time after unpacking, the remaining modules should be placed horizontally on the tray in the form of border alignment, and the number of stacked pieces should not exceed 12. This temporary storage method does not allow secondary transfer; If a secondary transfer is required, place scattered modules of the same version together according to the number and placement of the whole package before unpacking, and secure the modules in the manner before unpacking with a packing tape (recommended pulling force: 2100N). Finally, apply moisture-proof and dustproof measures before the secondary transfer.

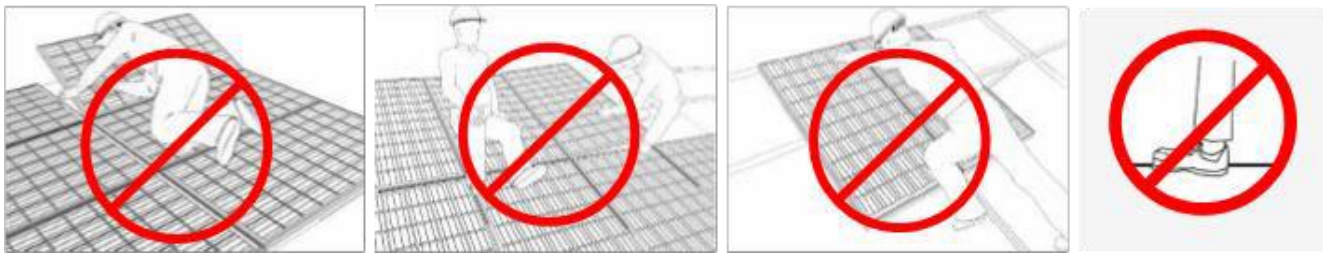
When unpacking the modules, please follow the Gokin official packing and unpacking instructions.

Do not wear metal rings, watches, earrings, nose rings, lip rings or other metal materials when installing or repairing the photovoltaic system.

In any case, do not carry a module by lifting its wires and junction boxes. You can hold the frame of the module while carrying it.

Do not deform or bend modules due to factors other than their own weight during transportation or installation.

Do not stand, sit, trample, walk or jump on the assembly.



Do not apply excessive loads to modules or twist modules.

Disassemble or remove any part of the assembly, including but not limited to nameplates, labels, junction boxes, connectors, frames, etc.

Do not paint or apply any other adhesive to the surface of the module.

Drilling in the frame of the module is prohibited, which will result in a reduced load resistance of the module and will lose the limited warranty of the module.

Do not damage or scratch the front or back of the module, which may affect the safety of the module. If the front or back of the module is damaged, do not use the module.

Do not drop or stack heavy objects, tools or sharp objects equal to modules.

Do not pull hard. Scratch or bend the cable too much, otherwise the insulated part of the cable will be damaged, resulting in leakage or electric shock. (The minimum bending radius of a cable is 43mm.)

Do not insert any conductive material into the connector of the module.

Do not use mirrors or other magnifying glasses to artificially focus sunlight on the modules.

It is prohibited to carry and secure modules by supporting them with the front or back of the modules, such as overhead modules, back modules, etc.

Do not repair modules by yourself.

Do not use damaged modules.

Do not expose modules or junction box connectors to unauthorized chemical substances. Including but not limited to gasoline, white flower oil, activating oil, mold temperature oil, motor oil (e.g. KV46), lubricating grease (e.g. Molykote EM series), lubricating oil, rust prevention oil, stamping oil, butter, diesel oil, cooking oil, acetone, alcohol, air essence, bone-setting water, Tena water, release agent (e.g. Pelicoat) S-6, etc.), board adhesives and potting adhesives that can produce oxime gas (such as KE200, CX-200, Chemlok, etc.), TBP (plasticizer), cleaning agent, herbicide, paint remover, binder, rust inhibitor, scale remover, emulsifier, cutting oil and cosmetics, etc. For more information, please contact Gokin Technical Support.

3.4 Fire Safety



Before installing modules, consult local laws and regulations and comply with the installation or building fire safety guidelines and requirements. Gokin modules have passed the IEC61730 standard fire rating test.

During roof installation, the roof must be covered with a layer of fire-resistant material suitable for this grade, and adequate ventilation between the back of the module and the mounting surface must be ensured. The minimum distance between the modules and the roof surface is 10 cm.

The different structure and installation methods of the roof will affect the fire safety performance of the building, and if the installation is not appropriate, it may cause fire.

The fire rating is valid only if the module is installed in the manner required by the installation instructions. For fire safety requirements and guidance for buildings and structures and support systems at the project site, please consult the relevant local agencies and support suppliers.

Use appropriate modules such as fuses, circuit breakers, and ground connectors according to local regulations.

Do not install or use modules near open flames or flammable or explosive objects.

Do not use water to extinguish the fire when the power supply is not disconnected.

3.5 Chemical Safety

In some coastal installation scenarios, the modules of corrosion protection products have certain properties that may pose a safety risk to the personnel installing the modules. Gokin urges anyone involved in or close to corrosion protection solutions to obtain a Material Safety Data Sheet (MSDS) for the selected corrosion protection application.

Whether you choose a fluorocarbon solution or a butyl tape product, read this user manual carefully and strictly follow it. Special protective equipment may be required before or during operation. Please refer to the Material safety data sheet of the product.

04 Installation Condition

4.1 Place and Environment

The modules cannot be used in space.

Do not manually focus sunlight with mirrors or magnifying glass onto modules.

Gokin modules shall be installed on proper buildings or other appropriate places (such as ground, garage, building outer wall, roof, PV tracking system) but shall not be installed on any vehicles.

Do not install modules at places that are possible to be flooded.

Gokin suggests that modules be installed in the working environment with the temperature of -40 ℃ to 40 ℃ of which is the monthly average highest and lowest temperature of the installation sites. The extreme working environment temperature for modules is -40 ℃ to 85 ℃.

Make sure that installed modules do not suffer wind or snow pressure that exceeds the permissible maximum load limit.

Modules shall be installed in places free from shadows throughout the year. Make sure there are no light-blocking obstacles in the installation sites.

Carry out lightning protection for modules installed in places with frequent lightning and thunder.

Do not install modules in places with possible inflammable gases.

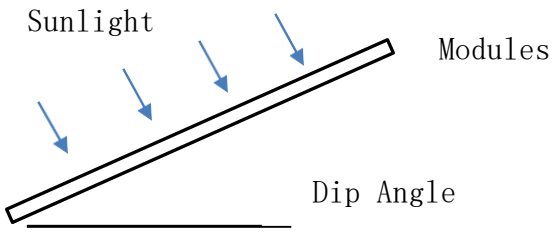
Modules cannot be used in environments with too much hails, snows, flue gas, air pollution and soot or in places with strong corrosive substances such as salt, salt mist, saline, active chemical steam, acid rain, or other corrosive substances modules, affecting modules' safety or performance.

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

the corrosion may still occur where the modules frame is connected to the bracket or where the grounding is connected. Gokin modules can be installed ≥50 m away from the ocean side, and related parts and components should be protected with anti-corrosion measures.

4.2 Selection of Tilt Angles

Tilt angle of PV modules refer to the included angle between module surface and horizontal ground. The module will obtain the maximum power output when directly facing the sunlight.



Modules are preferred to be south-facing in the north hemisphere and north-facing in the south

hemisphere.

Please refer to standard modules installation guideline or suggestions from experienced PV module installer, for the specific installation angle.

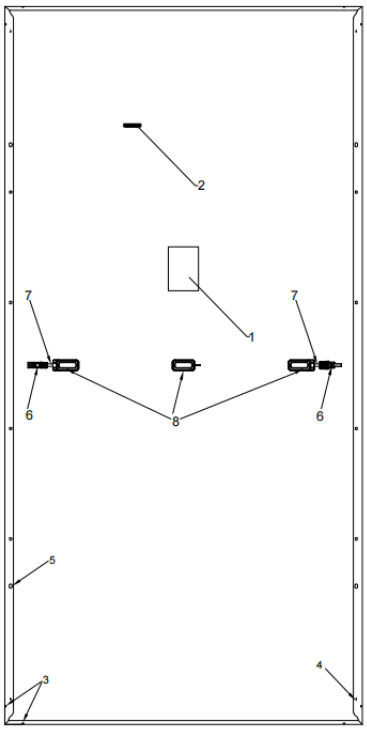
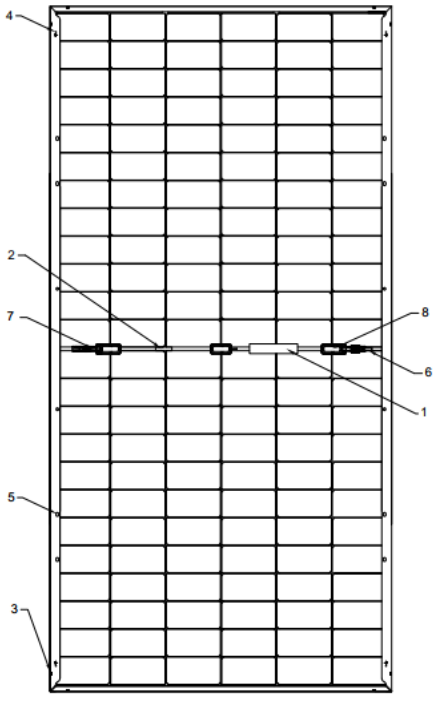
Gokin suggests that the modules be installed at a large angle, so module surface dust can be washed away easily by rainfall and frequency of cleaning can be reduced; For small Angle installation, it is recommended to increase the cleaning frequency according to the actual situation to avoid long-term accumulation of large amounts of dust, which will affect the appearance and performance of the modules.

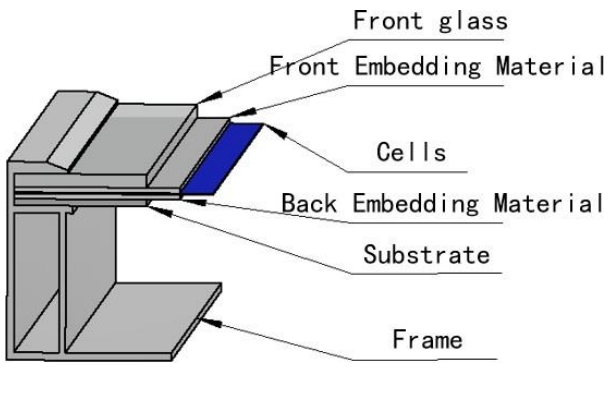
Gokin modules connected in string should be installed with the same orientation and tilt angle. Different module orientation and tilt angle may result in different levels of solar irradiation and also power generation. In order to achieve the maximum annual generating capacity, the optimal orientation and inclination of PV modules in the installed area should be selected to ensure that sunlight can still reach to modules even on the shortest day of the year.

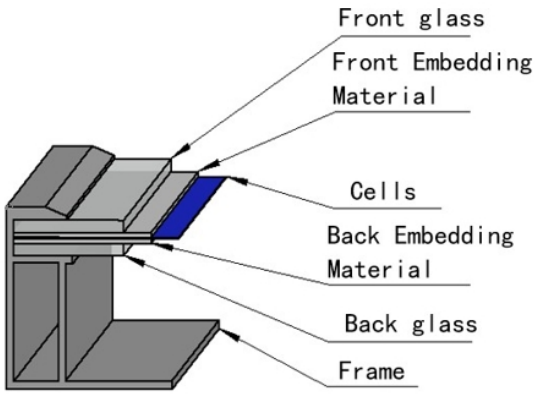
If Gokin modules are used in off-grid System, the tilt angle should be calculated based on seasons and irradiation to maximize the output power. If the modules output power meets the acquired load under the period of the worst irradiation in the year, the modules should be able to meet the load of the whole year. If the Gokin modules are used in grid-connected system, the tilt angle should be calculated based on the principle to maximize the yearly output power.

05 Product Identification

Module Diagram

Single-glass module	Double-glass module
	





1-Module Nameplate	2-Module Barcode
3-Dewatering Hole	4-Ground Hole
5-Mounting Hole	6-Connector
7-Cable	8-Junction Box

Three labels on the module contain the information below:

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

2.Current classification label: Rated working current. (H indicates High, M indicates Medium, L indicates Low)

3.Serial Number label: A unique serial number which is laminated inside the module permanently which can be found in the front of the module. There is another same serial number beside the module nameplate.

Note: Do not remove any labels. Removing any of these will void the Gokin warranty.

06 Mechanical Installation

Installation safety instructions:： recommend 2 people to handle the PV modules during the installation.

Modules can usually be mounted by using the following methods: fixed installation-mounting with bolts, fixed installation-mounting with clamps and tracker installation.

Note:

All installation methods herein are only for reference, and they are based on the test results from third-party tests and Gokin internal tests;

1.Gokin will not provide related mounting accessories, the system installer or trained professional personnel must be responsible for the PV system’s design, installation, and mechanical load calculation and system security.

2.Before installation, the following items shall be addressed:

a) Visually check the module for any damage. Clean the module if any dirt or residue remains;
b) Check if module serial number stickers match.

3.The maximum loads that different types of modules can withstand on the front side and back side are dependent on installation methods, which can be referred to Table 2, Table 3 and Table 5. If there is heavy snow and strong wind on the module installation site, take special protection to meet the actual requirements.

Note: Maximum Test Load = 1.5 (Safety factor) x Design load

4.The module must be mounted on the bracket according to the following installation. If there are other installation, please consult Gokin and obtain approval, otherwise the warranty will be invalid.

5.Under the mounting method of the fixed bracket as specified in this manual, the modules will be concave to varying degrees due to the gravity, which is a normal physical phenomenon and does not affect the normal use and performance of the modules. Any other external forces will cause additional sinking of the modules, so any operation of the modules should comply with this manual.

6. Minimum installation distance instructions：During installation, the distance between each PV modules should not be less than 1cm.

6.1 Fixed installation-mounting with bolts

Install the module on the rack using anti-corrosion bolts, elastic washers and flat washers with sufficient torque to allow the module to be properly secured. The reference value of tightening torque for M8 bolt is 16-20 Nm, and for M6 bolt is 9-12 Nm. If special mounting system or special installation method is required, please reconfirm with the supplier of the racking system regarding the torque value. See Figure 1 for detailed installation information.

See Figure 2 for the module models with corresponding installation positions for bolt installation (using 4 inner holes), Figure 3 for the module models with corresponding installation positions for bolt installation (using 4 outer holes) and Table 1 lists different sizes of bolts for different mounting holes.

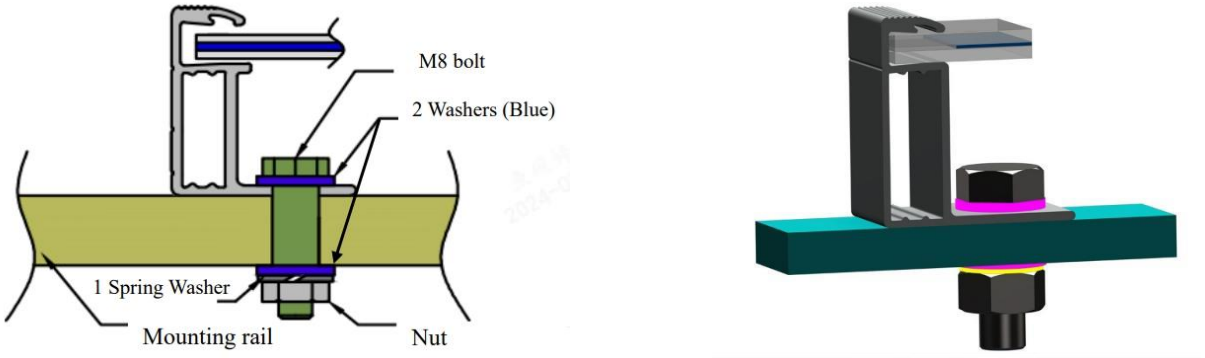


Fig.1 Mounting with bolts

Mounting hole (mm)	Recommended bolt size
14 x 9	M8
10 x 7	M6

Table 1 Bolts for different mounting holes

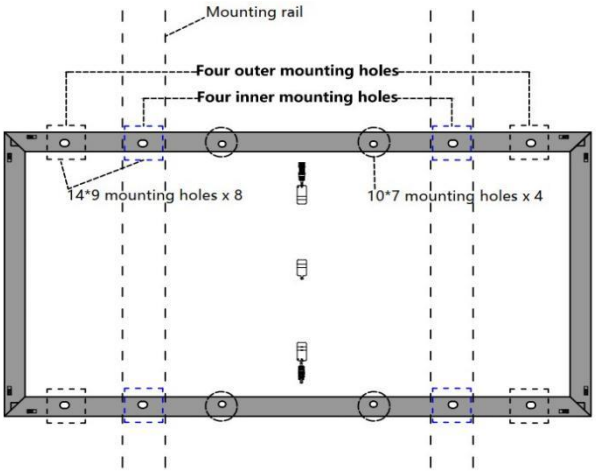


Fig.2 Installation with bolt (Four inner mounting holes)

Module type	Bolt installation (Test Load Pa)
	Four inner mounting holes
GK-1-54HT、GK-1-54HTBD GK-1-54HP、GK-1-54HPBD GK-1-72HT、GK-1-72HTBD GK-1-60HT、GK-1-60HTBD GK-1-72HP、GK-1-72HPBD GK-1-60HP、GK-1-60HPBD GK-4-48HTBD GK-4-66HTBD、GK-3-72HTBD GK-3-54HTBD、GK-1-78HTBD	+5400/-2400

Table 2 Test loads under four inner bolt installation methods for different module types

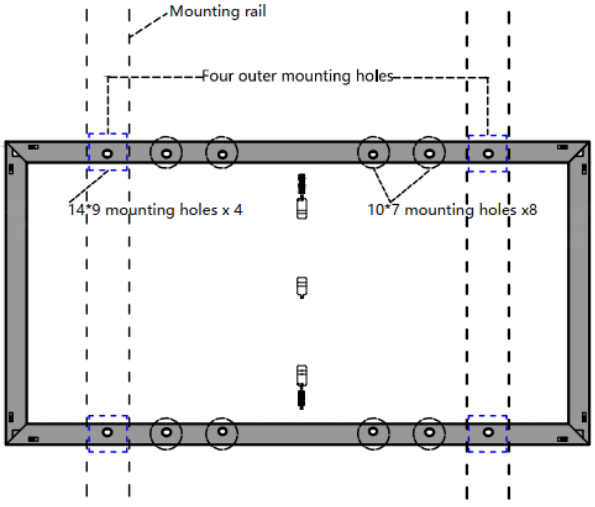


Fig.3 Installation with bolt (Four outer mounting holes)

Module type	Bolt installation (Test Load Pa)
	Four outer mounting holes

GK-1-72HT、GK-1-72HTBD GK-1-60HT、GK-1-60HTBD GK-1-72HP、GK-1-72HPBD GK-1-60HP、GK-1-60HPBD GK-4-66HTBD、GK-3-72HTBD GK-3-54HTBD GK-2-66HP、GK-2-66HPBD GK-2-60HP、GK-2-60HPBD GK-2-66HT、GK-2-66HTBD GK-2-60HT、GK-2-66HTBD	+5400/-2400

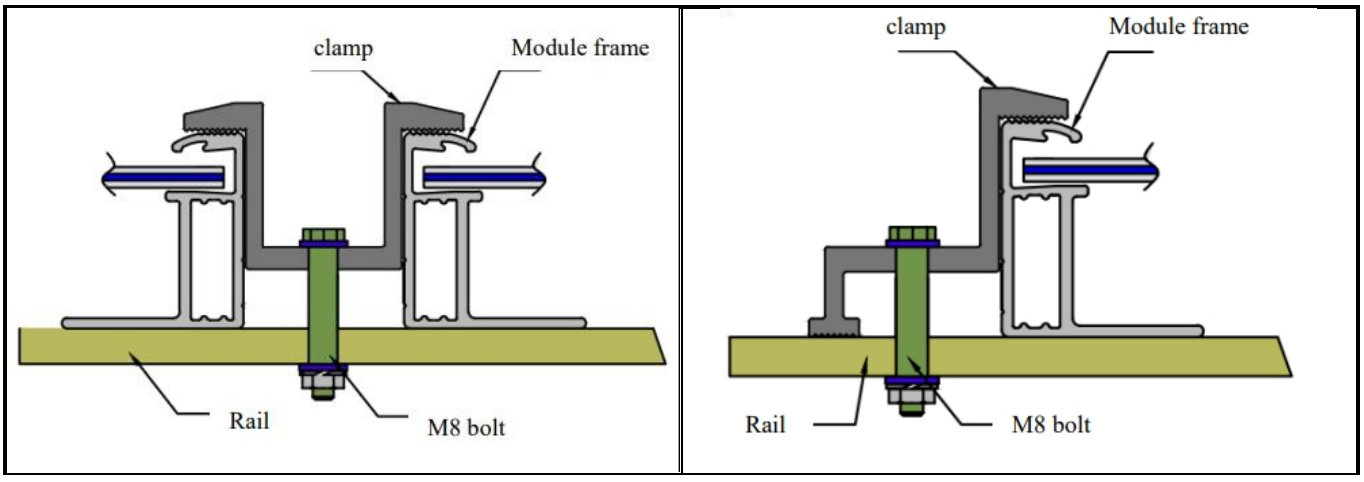
Table 3 Test loads under four outer bolt installation methods for different module types

6.2 Fixed installation-mounting with clamps

The clamps must not be installed in contact with the front glass of the module and must not deform the module frame. Ensure that the clamps do not create a shadow on the module. Under no circumstances may the frame be altered. When choosing the mounting method for the clamps, make sure that there are at least four clamps on each module. The different mounting positions of the clamps determine the maximum load capacity of the module. Figures 5 - 9 show the different mounting methods and the positions of the clamps for the different mounting methods. Depending on the local wind and snow loads, if there is a possibility of excessive load combinations, additional clamps are required to ensure that the module has enough load carrying capacity. The torque value applied during installation of the clamps should be high enough to securely hold the module (consult installer or bracket supplier for exact torque value). Clamp dimensions and contact area must follow the values shown in Table 4.

length of the clamp	**≥50mm**
Overlap of the frame of the module	**≥10mm**
thicknesses	**≥3.0mm**

Table 4 Size of clamp



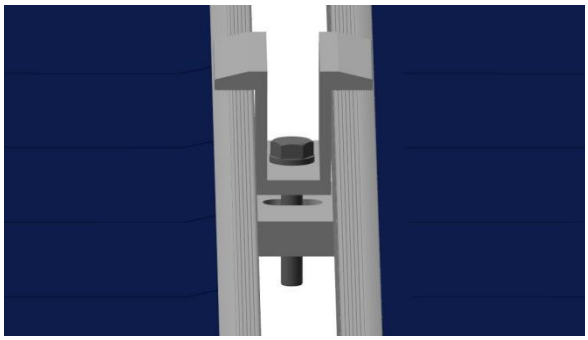
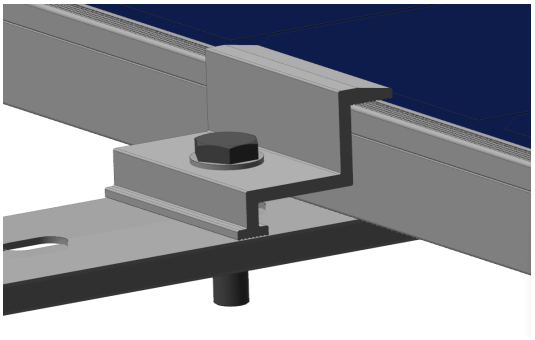
	
Middle modules installation	Fringe modules installation

Fig.4 PV module installed at the side with Clamp mounting

Different methods of clamp installation

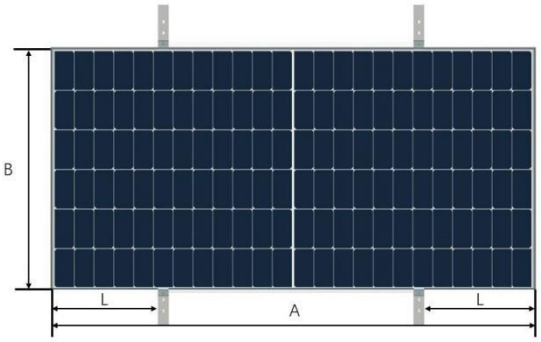


Fig.5

Long side clamp installation

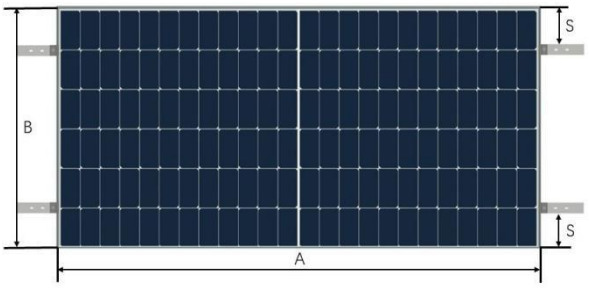


Fig.6

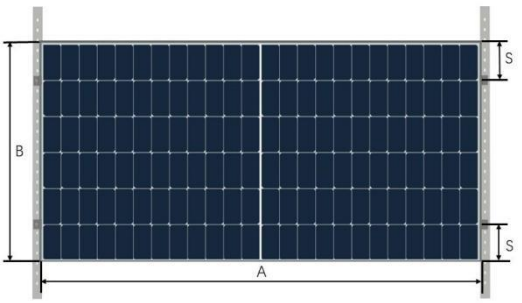


Fig.7

Short side clamp installation

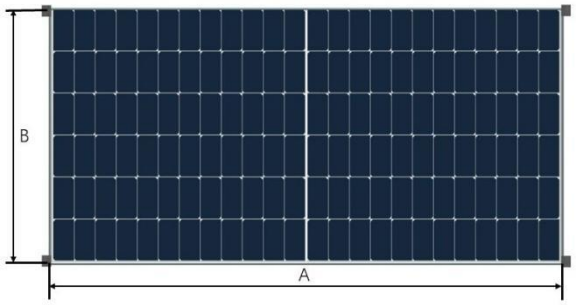
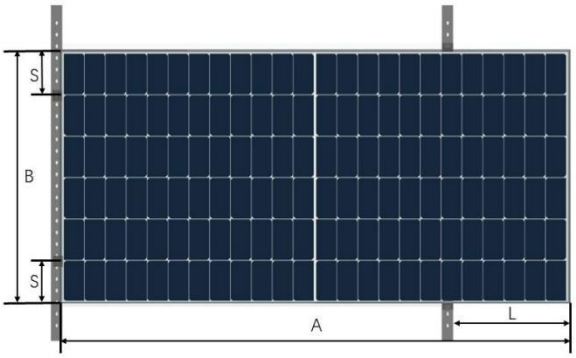
 **Fig.8**	 **Fig.9**
Corner clamp installation(S=0)	**Long & short side clamp installation**

Table 4 Clamp Installation

Mechanical loads for different clamp installation

The installation position under different installation methods for different module types	Clamp installation on long side (+5400Pa, -2400Pa) L in Fig.5	
Frame height	**30**	**33**
GK-1-54HT、GK-1-54HTBD GK-1-54HP、GK-1-54HPBD GK-1-72HT、GK-1-72HTBD GK-1-78HTBD、GK-4-48HTBD GK-1-60HT、GK-1-60HTBD GK-1-72HP、GK-1-72HPBD GK-1-60HP、GK-1-60HPBD GK-3-72HTBD、GK-4-66HTBD	A/4±50mm	/
GK-2-66HP、GK-2-66HPBD GK-2-60HP、GK-2-60HPBD GK-2-66HT、GK-2-66HTBD GK-2-60HT、GK-2-60HTBD	/	A/4±50mm
NOTE	A is the length of the long side of the module, B is the length of the short side. For details, please refer to Datasheet.	

Table5 Installation dimensions of different module types for clamp mounting

(Note: for the maximum loads that do not appear in Table 5 for certain installation methods, and for the other installation methods that doesn't appear in Table 5, please contact Gokin for more details.)

07 Grounding

To ensure safety and protect modules from lightning strikes and static electricity, ensure that the module frame is grounded.

Gokin recommends always referring to local and national codes and requirements for grounding photovoltaic modules. If local authorities allow it, Gokin strongly recommends using negative grounding.

The support grounding hardware and wiring must be installed to the appropriate grounding mark on the support to ensure proper electrical connections.

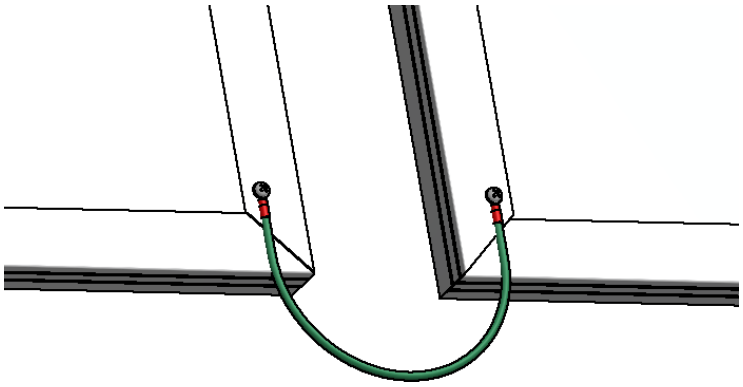
There is a ground hole with a diameter of Φ4.0mm at both ends of the back frame of the module. The ground hole on the frame is identified by the typical ground symbol (⏚) according to the IEC61730-1 standard. It can only be used for grounding, not for module installation.

The grounding connection should be performed by qualified electricians, and the grounding device must be made by a qualified electrical manufacturer. All conductive connection points with the PV module frame need to penetrate the insulation layer to ensure reliable grounding.

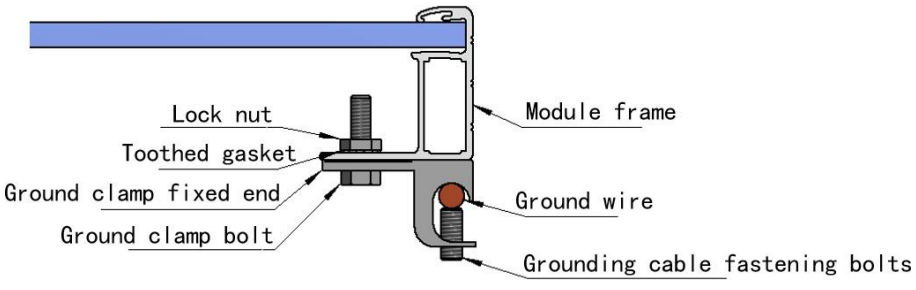
Do not add any additional ground holes to the assembly frame.

Gokin recommends grounding resistance < 1Ω.

Use a 4 mm² copper core wire to ground modules. Place the star washer, flat washer, and ground cable one by one, thread a screw through the ground hole, and then tighten the screw to connect the adjacent ground holes on the module frame. The modules can also be grounded safely.



Gokin recommends the following grounding methods:



The nuts and washers are made of stainless steel. The material and size of the ground cable should meet the requirements of the local national, regional or international regulations, laws and standards. 4 to 14 mm² (AWG6-12) exposed copper cable is recommended.

Gokin PV modules can be grounded using a third-party grounding device, but the grounding must be proven reliable.

08 Electrical Installation

8.1 Safety Instruction

All wiring installation should be carried out by qualified installers in accordance with local electrical construction codes, procedures, and regulations.

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

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

The standard copper cables applied in Gokin Solar modules are UV resistant and with a crosssectional area of ≥4 mm^2 (12 AWG). All other cables applied to connect the DC system should be provided with a similar or larger wire cross section. Gokin Solar recommends that all cables are routed in appropriate conduits or rails where water does not accumulate.

The string voltage must not be higher than the maximum system voltage, as well as the maximum input voltage of the inverter and the other electrical devices installed in the system. In order to ensure this, the open circuit voltage of an array needs to be calculated at the lowest expected local ambient temperature, which can be determined using the following formula:

$$\text{Max System Voltage} \geq N \times Voc \times [1 + TCVOC \times (Tmin - 25)]\text{where}$$

N Number of modules in series
Voc Open circuit voltage (refer to product label or data sheet)
$TCVOC$ Temperature coefficient of open circuit voltage (refer to data sheet)
$Tmin$ The minimum ambient temperature

The number of modules that can be connected shall be determined by a qualified institution or person in accordance with the design specifications of the photovoltaic system and the local electrical design specifications. The calculation formula recommended by Gokin Solar shall be for reference only.

Every module is provided with two standard output cables, and each terminated with a plug-and-play connector. All wiring and electrical connections must be installed in accordance with the electrical design and construction specifications, procedures and regulations at the place of installation. The minimum and maximum outer diameters of the cable are 5 to 7 mm (0. 20 to 0.28 in).

For wiring connections, please use standard PV copper wires with a cross-section area of at least 4 mm^2 (12 AWG), and should be light-resistant and temperature-resistant at a minimum of 90 °C.

Do not bend the cables less than 43 mm (1.69 inch) radius. PV cables will be damaged if bending radius less than 43 mm.

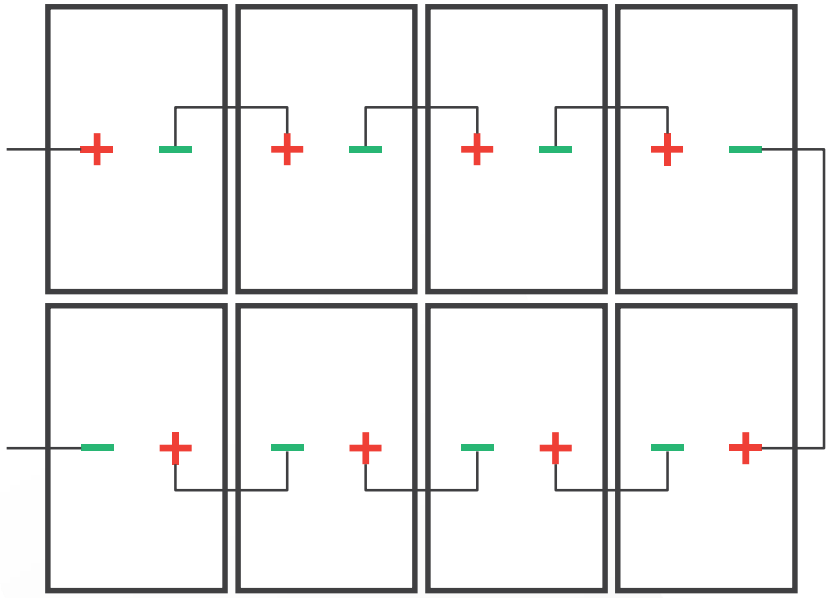
8.2 WIRING

In order to ensure the normal operation of the system, when connecting the module or loads (such as inverters, batteries, etc.), observe to ensure that the polarity of the cable is connected correctly. If modules are not connected correctly, the bypass diode could be damaged. PV modules can be connected in series to increase the voltage and connected in parallel to increase the current.

Before connecting the module, please make sure using the connector approved by Gokin. Otherwise, Gokin does not responsible for any potential problem.

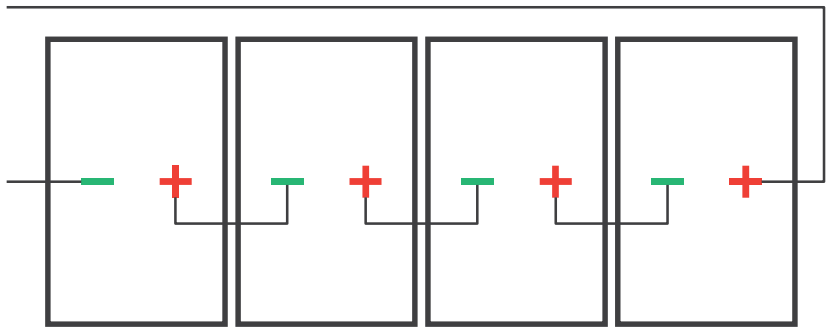
Gokin recommends the following two wiring methods for portrait and landscape installations with short and long cable lengths, respectively. For specific standard cable lengths, please refer to the datasheets of the products.

Portrait installation:
Standard short cable length



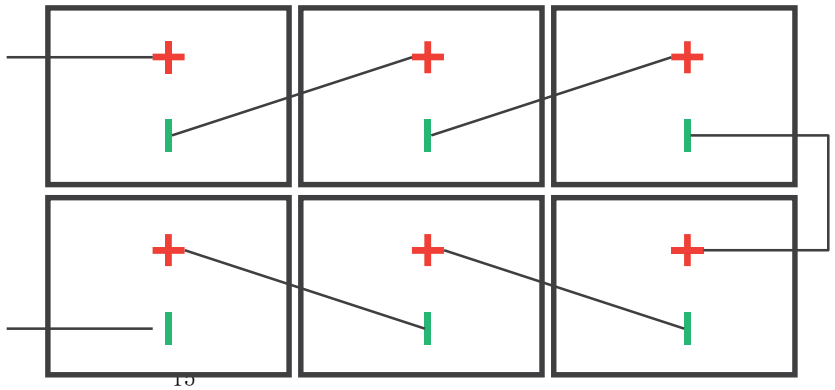
C-type Wiring (Note: One end of the single row needs to be extended)

Portrait installation:
Standard short cable length



Linear Wiring (Note: One end of the single row needs to be extended)

Landscape installation:
Standard long cable length
or customized length



8.3 FUSING

The correction factor of a fuse shall be determined by an authorized professional electrical engineer in accordance with the relevant design regulations and system simulation results. Gokin Solar does not responsible for determining the minimum rating of fuse.

The fuse rated current should be chosen depending on different standards, as follows:

1.5 $K_f \cdot I_{SC} \leq I_n \leq Max\ Series\ Fuse\ Rating\ (IEC\ standard)$

1.56 $K_f \cdot I_{SC} \leq I_n \leq Max\ Series\ Fuse\ Rating\ (NEC\ standard)$

where

I_n Fuse rated current [A]

I_{SC} Short circuit current of the module [A]

K_f Temperature correction factor [-]

A correction factor (K_f) should be applied for determining the fuse rated current working at different temperatures. Please confirm the final fuse selection with the qualified design institutes and fuse manufacturer. The maximum series fuse rating value on the products' datasheet provided by Gokin Solar should be used for reference only.

09 Maintenance

Please be sure to check and maintain the modules regularly, especially during the warranty period, which is the user's responsibility, and notify Gokin customer service within two weeks if the modules are found to be damaged or other significant anomalies.

9.1 Visual Inspection

Please carefully check the modules for appearance defects, focusing on the following points:

1. Module glass cracks.

2. Corrosion at welding parts of the cell main grid (caused by moisture into the module due to damage of sealing materials during installation or transportation).

3. Check whether there are traces of burning mark on the module back sheet.

4. Check PV modules if any signs of aging including rodent damage, climate aging, connectors tightness, corrosion and grounding condition.

5. Check if any sharp objects in contact with PV modules' surface

6. Check if any obstacles shading the PV modules

7. Check if any loose or damage screws between the modules and mounting system. If so, adjust and fix in time.

9.2 Cleaning

The power generation of photovoltaic modules is related to the solar radiation received by their cells. Dirt blocking the glass surface of the module will reduce its power output and may even cause regional heat spots, so it is important to keep the surface of the module clean, usually need to clean the surface of the module dirt such as: bird droppings, leaves, ash layer, etc. Gokin recommends that modules be cleaned at least once a year, and modules installed in dusty environments or at low angles should be cleaned appropriately to ensure the cleanliness of the module surface. Uncontrolled contamination and failure to clean modules in a timely manner will void the warranty.

This section contains Gokin PV module cleaning requirements, system users and professional installers should carefully read and strictly follow. Failure to follow these instructions may result in personal injury or property damage. Gokin is not responsible for any damage caused by improper cleaning methods and will lose the limited warranty of the product.

Warning

Cleaning can cause damage to modules and a range of modules, as well as increasing the risk of electric shock.

Cracked or damaged modules pose a risk of electric shock due to leakage of current, and damp modules increase this risk. It is necessary to thoroughly inspect the modules for cracks, damage, and loose joints before cleaning.

During the day, the voltage and current present in the array is sufficient to cause a fatal electric shock accident, and the photovoltaic module should be cleaned under low irradiance conditions.

Before cleaning, make sure the circuit is disconnected.

Please wear suitable protective clothing (clothing, insulating gloves, insulating shoes, etc.) when cleaning.

Do not immerse the module in part or in whole in water or any kind of cleaning solution.

Generally, the back of the module does not need to be cleaned. If it is necessary to clean the back of the double-sided module, be careful to avoid damage to the back of the module. It is recommended to carefully clean the stain with your hand or sponge.

Please use the solvent specified by Gokin in the cleaning method.

Cleaning Method

1. High pressure water cleaning

Water quality requirements: PH6~8
Water hardness: calcium carbonate concentration ≤600mg/L (Soft water cleaning is recommended)
Water pressure: ≤4MPa(40bar)

2. Compressed air cleaning

Air pressure cleaning is recommended when cleaning soft stains (like dust) on modules.

3. Wash by hand

If there are too many stains on the surface of the module, carefully use an insulating brush, sponge, or other soft cleaning tool.

Make sure any brushes or agitating tools are made of insulating material to minimize the risk of electric

shock, and that the tools do not scratch or scratch the glass or aluminum frame.

If oil stains are present, they can be carefully cleaned with an environmentally friendly cleaner.

4. Robot cleaning

If robot cleaning is used, the brush is required to be soft plastic, the cleaning process and cleaning will not cause scratches to the glass surface of the module and the aluminum alloy frame, the weight of the cleaning robot should not be too large, and the module damage caused by improper cleaning of the cleaning robot and power attenuation are not within the scope of Gokin warranty.

To ensure optimum module performance, Gokin recommends the following maintenance measures:

Inspect electrical, grounding, and mechanical connections every 6 months to ensure they are clean, safe, undamaged, and free of rust. Otherwise, the warranty will be void.

In the event of a ground fault, do not use water to clean or spray the modules until corrected by an authorized solar inverter service person and until the inverter is fully operational, which could result in a click accident or serious safety issue.

If you have any questions, please consult a professional solar service provider for advice.

Note: Please follow the solar manufacturer's maintenance instructions for all modules used in the system, such as brackets, charge regulators, inverters, batteries, etc.

Appendix 1:Electrical Parameter

MODULE TYPE/S	GK-2-66HT-670M	GK-2-66HT-675M	GK-2-66HT-680M	GK-2-66HT-685M	GK-2-66HT-690M	GK-2-66HT-695M	GK-2-66HT-700M
Voc-STC (±3%) [V]	46.50	46.70	46.90	47.10	47.30	47.50	47.90
Isc-STC (±3%) [A]	17.90	17.93	17.96	17.99	18.02	18.05	18.08
VPmax-STC [V]	39.90	40.10	40.30	40.50	40.70	40.86	41.10
IPmax-STC [A]	16.86	16.89	16.92	16.95	16.98	17.01	17.04
Pmax (±3%) [W]	670	675	680	685	690	695	700
Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ

MODULE TYPE/S	GK-2-60HT-610M	GK-2-60HT-615M	GK-2-60HT-620M	GK-2-60HT-625M	GK-2-60HT-630M	GK-2-60HT-635M	
Voc-STC (±3%) [V]	42.66	42.84	43.01	43.19	43.36	43.54	
Isc-STC (±3%) [A]	17.83	17.96	17.99	18.02	18.05	18.08	
VPmax-STC [V]	36.46	36.66	36.88	37.06	37.24	37.42	
IPmax-STC [A]	16.73	16.78	16.82	16.87	16.92	16.97	
Pmax (±3%) [W]	610	615	620	625	630	635	
Vsys [V]	1500	1500	1500	1500	1500	1500	
Maximum series fuse [A]	30	30	30	30	30	30	
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	

MODULE TYPE/S	GK-1-72HT-560M	GK-1-72HT-565M	GK-1-72HT-570M	GK-1-72HT-575M	GK-1-72HT-580M	GK-1-72HT-585M	GK-1-72HT-590M
Voc-STC (±3%) [V]	50.67	50.87	51.07	51.27	51.47	51.67	51.87
Isc-STC (±3%) [A]	14.13	14.19	14.25	14.31	14.37	14.43	14.49
VPmax-STC [V]	41.95	42.14	42.29	42.44	42.59	42.74	42.89
IPmax-STC [A]	13.35	13.41	13.48	13.55	13.62	13.69	13.76
Pmax (±3%) [W]	560	565	570	575	580	585	590
Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	25	25	25	25	25	25	25
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ

MODULE TYPE/S	GK-1-60HT-465M	GK-1-60HT-470M	GK-1-60HT-475M	GK-1-60HT-480M	GK-1-60HT-485M	GK-1-60HT-490M	
Voc-STC (±3%) [V]	42.22	42.38	42.54	42.71	42.86	43.02	
Isc-STC (±3%) [A]	14.07	14.15	14.23	14.31	14.39	14.48	
VPmax-STC [V]	34.89	35.05	35.21	35.38	35.54	35.70	
IPmax-STC [A]	13.33	13.41	13.49	13.57	13.65	13.73	
Pmax (±3%) [W]	465	470	475	480	485	490	
Vsys [V]	1500	1500	1500	1500	1500	1500	
Maximum series fuse [A]	25	25	25	25	25	25	
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	

MODULE TYPE/S	GK-1-54HT-420M	GK-1-54HT-425M	GK-1-54HT-430M	GK-1-54HT-435M	GK-1-54HT-440M	GK-1-54HT-445M	

Voc-STC (±3%) [V]	38.11	38.30	38.49	38.68	38.87	39.06	
Isc-STC (±3%) [A]	14.07	14.15	14.23	14.30	14.37	14.44	
VPmax-STC [V]	31.51	31.70	31.88	32.07	32.26	32.45	
IPmax-STC [A]	13.33	13.41	13.49	13.57	13.65	13.73	
Pmax (±3%) [W]	420	425	430	435	440	445	
Vsys [V]	1500	1500	1500	1500	1500	1500	
Maximum series fuse [A]	25	25	25	25	25	25	
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	

MODULE TYPE/S	GK-2-66HP-650M	GK-2-66HP-655M	GK-2-66HP-660M	GK-2-66HP-665M	GK-2-66HP-670M		
Voc-STC (±3%) [V]	45.20	45.40	45.60	45.80	46.00		
Isc-STC (±3%) [A]	18.46	18.50	18.55	18.60	18.65		
VPmax-STC [V]	37.40	37.60	37.80	38.00	38.20		
IPmax-STC [A]	17.38	17.42	17.46	17.50	17.54		
Pmax (±3%) [W]	650	655	660	665	670		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	30	30	30	30	30		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		

MODULE TYPE/S	GK-2-60HP-590M	GK-2-60HP-595M	GK-2-60HP-600M	GK-2-60HP-605M	GK-2-60HP-610M		
Voc-STC (±3%) [V]	41.24	41.44	41.64	41.84	42.04		
Isc-STC (±3%) [A]	18.36	18.41	18.46	18.52	18.57		
VPmax-STC [V]	34.15	34.35	34.55	34.75	34.95		
IPmax-STC [A]	17.28	17.32	17.37	17.41	17.46		
Pmax (±3%) [W]	590	595	600	605	610		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	30	30	30	30	30		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		

MODULE TYPE/S	GK-1-72HP-540M	GK-1-72HP-545M	GK-1-72HP-550M	GK-1-72HP-555M	GK-1-72HP-560M		
Voc-STC (±3%) [V]	49.42	49.52	49.62	49.72	49.82		
Isc-STC (±3%) [A]	13.85	13.94	14.03	14.12	14.21		
VPmax-STC [V]	40.70	40.80	40.90	40.99	41.09		
IPmax-STC [A]	13.27	13.36	13.45	13.54	13.63		
Pmax (±3%) [W]	540	545	550	555	560		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	25	25	25	25	25		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		

MODULE TYPE/S	GK-1-60HP-450M	GK-1-60HP-455M	GK-1-60HP-460M	GK-1-60HP-465M			
Voc-STC (±3%) [V]	41.18	41.33	41.48	41.63			
Isc-STC (±3%) [A]	13.85	13.93	14.01	14.09			
VPmax-STC [V]	33.91	34.06	34.20	34.37			
IPmax-STC [A]	13.27	13.36	13.45	13.53			
Pmax (±3%) [W]	450	455	460	465			

Vsys [V]	1500	1500	1500	1500			
Maximum series fuse [A]	25	25	25	25			
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ			

MODULE TYPE/S	GK-1-54HP-405M	GK-1-54HP-410M	GK-1-54HP-415M	GK-1-54HP-420M			
Voc-STC (±3%) [V]	37.06	37.14	37.22	37.31			
Isc-STC (±3%) [A]	13.85	13.92	14.01	14.10			
VPmax-STC [V]	30.52	30.62	30.79	30.88			
IPmax-STC [A]	13.27	13.39	13.48	13.60			
Pmax (±3%) [W]	405	410	415	420			
Vsys [V]	1500	1500	1500	1500			
Maximum series fuse [A]	25	25	25	25			
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ			

MODULE TYPE/S	GK-2-66HTBD-670M	GK-2-66HTBD-675M	GK-2-66HTBD-680M	GK-2-66HTBD-685M	GK-2-66HTBD-690M	GK-2-66HTBD-695M	GK-2-66HTBD-700M	GK-2-66HTBD-705M	GK-2-66HTBD-710M	GK-2-66HTBD-715M	GK-2-66HTBD-720M	GK-2-66HTBD-725M
Voc-STC (±3%) [V]	46.50	46.70	46.90	47.10	47.30	47.50	47.90	48.68	48.91	49.14	49.36	49.55
Isc-STC (±3%) [A]	17.90	17.93	17.96	17.99	18.02	18.05	18.08	18.11	18.15	18.19	18.24	18.32
VPmax-STC [V]	39.90	40.10	40.30	40.50	40.70	40.86	41.10	41.29	41.50	41.69	41.91	42.10
IPmax-STC [A]	16.86	16.89	16.92	16.95	16.98	17.01	17.04	17.07	17.11	17.15	17.18	17.22
Pmax (±3%)-STC [W]	670	675	680	685	690	695	700	705	710	715	720	725
Voc-BNPI (±3%) [V]	46.55	46.75	46.95	47.15	47.35	47.55	47.90	48.73	48.94	49.15	49.36	49.57
Isc-BNPI (±3%) [A]	19.72	19.75	19.77	19.80	19.83	19.85	19.88	19.92	19.96	20.00	20.04	20.08
VPmax-BNPI [V]	39.99	40.18	40.37	40.55	40.74	40.91	41.11	41.29	41.50	41.69	41.91	42.10
IPmax-BNPI [A]	18.57	18.60	18.62	18.65	18.68	18.70	18.73	18.77	18.81	18.85	18.89	18.93
Pmax (±3%)-BNPI [W]	740	745	750	755	760	765	770	775	780	785	790	795
Isc-BSI (±3%) [A]	21.95	22.03	22.05	22.08	22.10	22.18	22.21	22.25	22.29	22.33	22.37	22.41
Pmax (±3%)-BSI [W]	825	835	840	845	850	860	865	870	875	880	885	890
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	35	35	35	35	35	35	35	35	35	35	35	35
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%											

MODULE TYPE/S	GK-2-60HTBD-610M	GK-2-60HTBD-615M	GK-2-60HTBD-620M	GK-2-60HTBD-625M	GK-2-60HTBD-630M	GK-2-60HTBD-635M	GK-2-60HTBD-640M	GK-2-60HTBD-645M	GK-2-60HTBD-650M	GK-2-60HTBD-655M
Voc-STC (±3%) [V]	42.66	42.84	43.01	43.19	43.36	43.54	43.72	43.90	44.08	44.26
Isc-STC (±3%) [A]	17.83	17.96	17.99	18.02	18.05	18.08	18.11	18.14	18.17	18.21
VPmax-STC [V]	36.46	36.66	36.88	37.06	37.24	37.42	37.60	37.79	37.97	38.15
IPmax-STC [A]	16.73	16.78	16.82	16.87	16.92	16.97	17.02	17.07	17.12	17.17
Pmax (±3%)-STC [W]	610	615	620	625	630	635	640	645	650	655
Voc-BNPI (±3%) [V]	42.75	42.91	43.07	43.23	43.39	43.57	43.75	43.93	44.11	44.29
Isc-BNPI (±3%) [A]	19.66	19.80	19.82	19.85	19.87	19.90	19.95	19.99	20.03	20.07
VPmax-BNPI [V]	36.61	36.78	36.97	37.14	37.31	37.47	37.64	37.81	37.97	38.15

IPmax-BNPI [A]	18.44	18.49	18.53	18.58	18.63	18.67	18.73	18.78	18.83	18.88
Pmax (±3%)-BNPI [W]	675	680	685	690	695	700	705	710	715	720
Isc-BSI (±3%) [A]	21.92	22.06	22.08	22.10	22.12	22.21	22.18	22.21	22.24	22.27
Pmax (±3%)-BSI [W]	755	760	765	770	775	780	785	790	795	800
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	35	35	35	35	35	35	35	35	35	35
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%									

MODULE TYPE/S	GK-3-72HTBD-590M	GK-3-72HTBD-595M	GK-3-72HTBD-600M	GK-3-72HTBD-605M	GK-3-72HTBD-610M	GK-3-72HTBD-615M	GK-3-72HTBD-620M
Voc-STC (±3%) [V]	51.30	51.47	51.64	51.81	51.98	52.15	52.32
Isc-STC (±3%) [A]	14.55	14.62	14.69	14.76	14.83	14.90	14.97
VPmax-STC [V]	43.28	43.43	43.58	43.73	43.88	44.02	44.16
IPmax-STC [A]	13.64	13.71	13.78	13.85	13.92	13.99	14.06
Pmax (±3%)-STC [W]	590	595	600	605	610	615	620
Voc-BNPI (±3%) [V]	51.30	51.47	51.64	51.81	52.09	52.26	52.43
Isc-BNPI (±3%) [A]	16.01	16.08	16.15	16.22	16.35	16.42	16.49
VPmax-BNPI [V]	43.33	43.46	43.59	43.73	44.02	44.15	44.27
IPmax-BNPI [A]	15.00	15.08	15.15	15.22	15.35	15.42	15.49
Pmax (±3%)-BNPI [W]	650	655	660	665	675	680	685
Isc-BSI (±3%) [A]	17.88	17.95	18.02	18.10	18.23	18.30	18.37
Pmax (±3%)-BSI [W]	730	735	740	745	755	760	765
Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%						

MODULE TYPE/S	GK-3-54HTBD-440M	GK-3-54HTBD-445M	GK-3-54HTBD-450M	GK-3-54HTBD-455M	GK-3-54HTBD-460M	GK-3-54HTBD-465M	GK-3-54HTBD-470M
Voc-STC (±3%) [V]	38.50	38.67	38.84	39.01	39.18	39.35	39.52
Isc-STC (±3%) [A]	14.60	14.67	14.74	14.81	14.88	14.95	15.02
VPmax-STC [V]	32.42	32.58	32.73	32.89	33.04	33.19	33.34
IPmax-STC [A]	13.60	13.68	13.76	13.84	13.93	14.02	14.11
Pmax (±3%)-STC [W]	440	445	450	455	460	465	470
Voc-BNPI (±3%) [V]	38.51	38.69	38.86	39.03	39.20	39.37	39.60
Isc-BNPI (±3%) [A]	16.07	16.14	16.21	16.27	16.34	16.41	16.56
VPmax-BNPI [V]	32.46	32.61	32.74	32.89	33.04	33.19	33.45
IPmax-BNPI [A]	14.96	15.04	15.12	15.20	15.30	15.39	15.55
Pmax (±3%)-BNPI [W]	485	490	495	500	505	510	520
Isc-BSI (±3%) [A]	17.87	18.02	18.09	18.15	18.22	18.37	18.43
Pmax (±3%)-BSI [W]	540	550	555	560	565	575	580
Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%						

MODULE TYPE/S	GK-4-66HTBD-590M	GK-4-66HTBD-595M	GK-4-66HTBD-600M	GK-4-66HTBD-605M	GK-4-66HTBD-610M	GK-4-66HTBD-615M	GK-4-66HTBD-620M	GK-4-66HTBD-625M
Voc-STC (±3%) [V]	47.32	47.49	47.66	47.83	48.00	48.17	48.34	48.51
Isc-STC (±3%) [A]	15.79	15.86	15.93	16.00	16.07	16.14	16.21	16.28
VPmax-STC [V]	39.67	39.81	39.95	40.09	40.22	40.35	40.48	40.63
IPmax-STC [A]	14.88	14.96	15.03	15.10	15.18	15.25	15.33	15.41
Pmax (±3%)-STC [W]	590	595	600	605	610	615	620	625
Voc-BNPI (±3%) [V]	47.32	47.49	47.66	47.83	48.10	48.27	48.44	48.61
Isc-BNPI (±3%) [A]	17.37	17.44	17.51	17.58	17.72	17.79	17.97	18.05
VPmax-BNPI [V]	39.71	39.84	39.96	40.09	40.35	40.47	40.58	40.73
IPmax-BNPI [A]	16.37	16.45	16.52	16.59	16.74	16.81	16.89	16.97
Pmax (±3%)-BNPI [W]	650	655	660	665	675	680	685	690
Isc-BSI (±3%) [A]	19.41	19.48	19.55	19.62	19.75	19.82	20.02	20.09
Pmax (±3%)-BSI [W]	730	735	740	745	755	760	765	770
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	35	35	35	35	35	35	35	35
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%							

MODULE TYPE/S	GK-1-78HTBD-610M	GK-1-78HTBD-615M	GK-1-78HTBD-620M	GK-1-78HTBD-625M	GK-1-78HTBD-630M	GK-1-78HTBD-635M	GK-1-78HTBD-640M	GK-1-78HTBD-645M	GK-1-78HTBD-650M
Voc-STC (±3%) [V]	56.27	56.44	56.61	56.78	56.95	57.12	57.29	57.47	57.63
Isc-STC (±3%) [A]	13.65	13.71	13.77	13.83	13.89	13.95	13.01	14.06	14.11
VPmax-STC [V]	47.00	47.15	47.30	47.45	47.60	47.75	47.90	48.06	48.22
IPmax-STC [A]	12.98	13.05	13.12	13.19	13.25	13.31	13.37	13.42	13.48
Pmax (±3%)-STC [W]	610	615	620	625	630	635	640	645	650
Voc-BNPI (±3%) [V]	56.68	56.81	56.94	57.07	57.20	57.33	57.46	57.59	57.72
Isc-BNPI (±3%) [A]	15.02	15.08	15.14	15.20	15.26	15.32	15.38	15.44	15.50
VPmax-BNPI [V]	47.23	47.35	47.50	47.65	47.80	47.95	48.09	48.23	48.38
IPmax-BNPI [A]	14.30	14.36	14.42	14.48	14.54	14.60	14.66	14.72	14.78
Pmax (±3%)-BNPI [W]	675	680	685	690	695	700	705	710	715
Isc-BSI (±3%) [A]	16.78	16.84	16.90	16.96	17.02	17.14	17.16	17.22	17.28
Pmax (±3%)-BSI [W]	755	760	765	770	775	785	790	795	800
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%								

MODULE TYPE/S	GK-1-72HTBD-560M	GK-1-72HTBD-565M	GK-1-72HTBD-570M	GK-1-72HTBD-575M	GK-1-72HTBD-580M	GK-1-72HTBD-585M	GK-1-72HTBD-590M	GK-1-72HTBD-595M	GK-1-72HTBD-600M
Voc-STC (±3%) [V]	50.67	50.87	51.07	51.27	51.47	51.67	51.87	52.07	52.27
Isc-STC (±3%) [A]	14.13	14.19	14.25	14.31	14.37	14.43	14.49	14.55	14.61
VPmax-STC [V]	41.95	42.14	42.29	42.44	42.59	42.74	42.89	43.04	43.19
IPmax-STC [A]	13.35	13.41	13.48	13.55	13.62	13.69	13.76	13.83	13.90
Pmax (±3%)-STC [W]	560	565	570	575	580	585	590	595	600
Voc-BNPI (±3%) [V]	50.68	50.97	51.17	51.37	51.57	51.77	51.97	52.17	52.37
Isc-BNPI (±3%) [A]	15.52	15.64	15.70	15.76	15.82	15.88	15.94	16.00	16.06
VPmax-BNPI [V]	41.95	42.29	42.42	42.56	42.70	42.80	42.94	43.07	43.20
IPmax-BNPI [A]	14.66	14.78	14.85	14.92	14.99	15.07	15.14	15.21	15.28
Pmax (±3%)-BNPI [W]	615	625	630	635	640	645	650	655	660

Isc-BSI (±3%) [A]	17.33	17.39	17.51	17.57	17.63	17.69	17.81	17.87	17.93
Pmax (±3%)-BSI [W]	690	695	705	710	715	720	730	735	740
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%								

MODULE TYPE/S	GK-1-60HTBD-465M	GK-1-60HTBD-470M	GK-1-60HTBD-475M	GK-1-60HTBD-480M	GK-1-60HTBD-485M	GK-1-60HTBD-490M	GK-1-60HTBD-495M	GK-1-60HTBD-500M
Voc-STC (±3%) [V]	42.22	42.38	42.54	42.71	42.86	43.02	43.18	43.34
Isc-STC (±3%) [A]	14.07	14.15	14.23	14.31	14.39	14.48	14.56	14.64
VPmax-STC [V]	34.89	35.05	35.21	35.38	35.54	35.70	35.84	36.00
IPmax-STC [A]	13.33	13.41	13.49	13.57	13.65	13.73	13.81	13.89
Pmax (±3%)-STC [W]	465	470	475	480	485	490	495	500
Voc-BNPI (±3%) [V]	42.23	42.47	42.60	42.75	42.88	43.04	43.20	43.36
Isc-BNPI (±3%) [A]	15.45	15.60	15.68	15.76	15.84	15.93	16.01	16.09
VPmax-BNPI [V]	34.89	35.18	35.33	35.48	35.62	35.74	35.88	36.02
IPmax-BNPI [A]	14.63	14.78	14.86	14.94	15.02	15.11	15.19	15.27
Pmax (±3%)-BNPI [W]	510	520	525	530	535	540	545	550
Isc-BSI (±3%) [A]	17.29	17.37	17.45	17.53	17.68	17.78	17.86	17.94
Pmax (±3%)-BSI [W]	575	580	585	590	600	605	610	615
Vsys [V]	1500	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%							

MODULE TYPE/S	GK-1-54HTBD-420M	GK-1-54HTBD-425M	GK-1-54HTBD-430M	GK-1-54HTBD-435M	GK-1-54HTBD-440M	GK-1-54HTBD-445M	GK-1-54HTBD-500M
Voc-STC (±3%) [V]	38.11	38.30	38.49	38.68	38.87	39.06	39.25
Isc-STC (±3%) [A]	14.07	14.15	14.23	14.30	14.37	14.44	14.51
VPmax-STC [V]	31.51	31.70	31.88	32.07	32.26	32.45	32.59
IPmax-STC [A]	13.33	13.41	13.49	13.57	13.65	13.73	13.81
Pmax (±3%)-STC [W]	420	425	430	435	440	445	450
Voc-BNPI (±3%) [V]	38.12	38.37	38.54	38.71	38.90	39.09	39.28
Isc-BNPI (±3%) [A]	15.44	15.60	15.68	15.75	15.82	15.88	15.95
VPmax-BNPI [V]	31.51	31.80	31.97	32.13	32.30	32.48	32.61
IPmax-BNPI [A]	14.62	14.78	14.86	14.94	15.02	15.10	15.18
Pmax (±3%)-BNPI [W]	460	470	475	480	485	490	495
Isc-BSI (±3%) [A]	17.21	17.38	17.45	17.52	17.59	17.74	17.81
Pmax (±3%)-BSI [W]	515	525	530	535	540	550	555
Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	30	30	30	30	30	30	30
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%						

MODULE TYPE/S	GK-2-66HPBD-650M	GK-2-66HPBD-655M	GK-2-66HPBD-660M	GK-2-66HPBD-665M	GK-2-66HPBD-670M		
Voc-STC (±3%) [V]	45.20	45.40	45.60	45.80	46.00		
Isc-STC (±3%) [A]	18.46	18.50	18.55	18.60	18.65		

VPmax-STC [V]	37.40	37.60	37.80	38.00	38.20		
IPmax-STC [A]	17.38	17.42	17.46	17.50	17.54		
Pmax (±3%)-STC [W]	650	655	660	665	670		
Voc-BNPI (±3%) [V]	45.28	45.46	45.65	45.83	46.02		
Isc-BNPI (±3%) [A]	20.20	20.24	20.29	20.34	20.39		
VPmax-BNPI [V]	37.51	37.69	37.87	38.08	38.26		
IPmax-BNPI [A]	18.93	18.97	19.01	19.04	19.08		
Pmax (±3%)-BNPI [W]	710	715	720	725	730		
Isc-BSI (±3%) [A]	22.37	22.40	22.45	22.49	22.54		
Pmax (±3%)-BSI [W]	785	790	795	800	805		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	35	35	35	35	35		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		
Bifaciality coefficient	ϕPmax=70±5%,ϕIsc=70±5%,Voc=100±5%						

MODULE TYPE/S	GK-2-60HPBD-590M	GK-2-60HPBD-595M	GK-2-60HPBD-600M	GK-2-60HPBD-605M	GK-2-60HPBD-610M		
Voc-STC (±3%) [V]	41.24	41.44	41.64	41.84	42.04		
Isc-STC (±3%) [A]	18.36	18.41	18.46	18.52	18.57		
VPmax-STC [V]	34.15	34.35	34.55	34.75	34.95		
IPmax-STC [A]	17.28	17.32	17.37	17.41	17.46		
Pmax (±3%)-STC [W]	590	595	600	605	610		
Voc-BNPI (±3%) [V]	41.33	41.51	41.70	41.88	42.07		
Isc-BNPI (±3%) [A]	20.10	20.15	20.20	20.26	20.30		
VPmax-BNPI [V]	34.25	34.45	34.64	34.83	35.00		
IPmax-BNPI [A]	18.83	18.87	18.91	18.95	19.00		
Pmax (±3%)-BNPI [W]	645	650	655	660	665		
Isc-BSI (±3%) [A]	22.21	22.25	22.29	22.43	22.47		
Pmax (±3%)-BSI [W]	710	715	720	730	735		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	35	35	35	35	35		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		
Bifaciality coefficient	ϕPmax=70±5%,ϕIsc=70±5%,Voc=100±5%						

MODULE TYPE/S	GK-1-72HPBD-540M	GK-1-72HPBD-545M	GK-1-72HPBD-550M	GK-1-72HPBD-555M	GK-1-72HPBD-560M		
Voc-STC (±3%) [V]	49.73	49.92	50.11	50.30	50.49		
Isc-STC (±3%) [A]	13.89	13.95	14.01	14.07	14.13		
VPmax-STC [V]	41.13	41.32	41.51	41.70	41.89		
IPmax-STC [A]	13.13	13.19	13.25	13.31	13.37		
Pmax (±3%)-STC [W]	540	545	550	555	560		
Voc-BNPI (±3%) [V]	49.82	49.99	50.16	50.34	50.51		
Isc-BNPI (±3%) [A]	15.20	15.26	15.32	15.38	15.44		
VPmax-BNPI [V]	41.26	41.43	41.61	41.78	41.95		
IPmax-BNPI [A]	14.30	14.36	14.42	14.48	14.54		
Pmax (±3%)-BNPI [W]	590	595	600	605	610		
Isc-BSI (±3%) [A]	16.80	16.86	16.92	17.04	17.10		
Pmax (±3%)-BSI [W]	650	655	660	670	675		
Vsys [V]	1500	1500	1500	1500	1500		
Maximum series fuse [A]	30	30	30	30	30		
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ		
Bifaciality coefficient	ϕPmax=70±5%,ϕIsc=70±5%,Voc=100±5%						

MODULE TYPE/S	GK-1-60HPBD-450M	GK-1-60HPBD-455M	GK-1-60HPBD-460M	GK-1-60HPBD-465M			
Voc-STC (±3%) [V]	41.18	41.33	41.48	41.63			
Isc-STC (±3%) [A]	13.85	13.93	14.01	14.09			
VPmax-STC [V]	33.91	34.06	34.20	34.37			
IPmax-STC [A]	13.27	13.36	13.45	13.53			
Pmax (±3%)-STC [W]	450	455	460	465			
Voc-BNPI (±3%) [V]	41.19	41.34	41.49	41.64			
Isc-BNPI (±3%) [A]	15.13	15.21	15.30	15.38			
VPmax-BNPI [V]	33.96	34.09	34.22	34.38			
IPmax-BNPI [A]	14.43	14.52	14.61	14.69			
Pmax (±3%)-BNPI [W]	490	495	500	505			
Isc-BSI (±3%) [A]	16.73	16.81	16.97	17.05			
Pmax (±3%)-BSI [W]	540	545	555	560			
Vsys [V]	1500	1500	1500	1500			
Maximum series fuse [A]	30	30	30	30			
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ			
Bifaciality coefficient	ϕPmax=70±5%,ϕIsc=70±5%,Voc=100±5%						

MODULE TYPE/S	GK-1-54HPBD-405M	GK-1-54HPBD-410M	GK-1-54HPBD-415M	GK-1-54HPBD-420M			
Voc-STC (±3%) [V]	37.06	37.14	37.22	37.31			
Isc-STC (±3%) [A]	13.85	13.92	14.01	14.10			
VPmax-STC [V]	30.52	30.62	30.79	30.88			
IPmax-STC [A]	13.27	13.39	13.48	13.60			
Pmax (±3%)-STC [W]	405	410	415	420			
Voc-BNPI (±3%) [V]	37.07	37.16	37.25	37.34			
Isc-BNPI (±3%) [A]	15.12	15.19	15.28	15.37			
VPmax-BNPI [V]	30.53	30.62	30.79	30.88			
IPmax-BNPI [A]	14.41	14.54	14.63	14.75			
Pmax (±3%)-BNPI [W]	440	445	450	455			
Isc-BSI (±3%) [A]	16.71	16.86	16.95	17.04			
Pmax (±3%)-BSI [W]	485	495	500	505			
Vsys [V]	1500	1500	1500	1500			
Maximum series fuse [A]	30	30	30	30			
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ			
Bifaciality coefficient	ϕPmax=70±5%,ϕIsc=70±5%,Voc=100±5%						

MODULE TYPE/S	GK-4-48HTBD-425M	GK-4-48HTBD-430M	GK-4-48HTBD-435M	GK-4-48HTBD-440M	GK-4-48HTBD-445M	GK-4-48HTBD-450M	GK-4-48HTBD-455M
Voc-STC (±3%) [V]	34.38	34.55	34.72	34.89	35.06	35.23	35.40
Isc-STC (±3%) [A]	15.73	15.80	15.87	15.94	16.01	16.08	16.15
VPmax-STC [V]	29.00	29.18	29.36	29.54	29.72	29.90	30.08
IPmax-STC [A]	14.66	14.74	14.82	14.90	14.98	15.05	15.13
Pmax (±3%)-STC [W]	425	430	435	440	445	450	455
Voc-BNPI (±3%) [V]	34.41	34.58	34.75	34.92	35.09	35.26	35.43
Isc-BNPI (±3%) [A]	17.37	17.44	17.51	17.58	17.65	17.72	17.79
VPmax-BNPI [V]	29.00	29.18	29.36	29.54	29.72	29.90	30.08
IPmax-BNPI [A]	16.10	16.19	16.27	16.35	16.43	16.50	16.55
Pmax (±3%)-BNPI [W]	465	470	475	480	485	490	495
Isc-BSI (±3%) [A]	19.02	19.10	19.18	19.26	19.34	19.42	19.48
Pmax (±3%)-BSI [W]	515	520	525	530	535	540	545

Vsys [V]	1500	1500	1500	1500	1500	1500	1500
Maximum series fuse [A]	35	35	35	35	35	35	35
Class of Protection	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ	Class Ⅱ
Bifaciality coefficient	ϕPmax=80±5%,ϕIsc=80±5%,Voc=100±5%						

Appendix 2:J-BOX and connectors

J-box		Connector	
Manufacture	Type	Manufacture	Type
Ningbo Minghe New Energy Technology Co.,Ltd	MH2z	Ningbo Minghe New Energy Technology Co.,Ltd	PV-MH5
		Stäubli Electrical connectors AG	PV-KST4-EVO2/xy_UR&PV-KBT4-EVO2/xy_UR, 1500VDC
QC Solar(Suzhou)Corporation	Type: 3Qxy	QC Solar(Suzhou)Corporation	QC4.10-cds
		QC Solar(Suzhou)Corporation	QC4.10-ab
		QC Solar(Suzhou)Corporation	QC4
		Changshu Tlian Co.,Ltd.	T4-PPE-1； T4-PC-1
		Tyco Electronics Austria GmbH.	PV4-Syx&PV4-Slyx
		Stäubli Electrical connectors AG	PV-KST4-EVO2/xy&PV-KBT4-EVO2/xy
		Stäubli Electrical connectors AG	PV-KST4-EVO2A/xy&PV-KBT4-EVO2A/xy
Jiangxi Jinko PV Material Co., Ltd.	PV-JK09Exy	Jiangxi Jinko PV Material Co., Ltd.	PV-JK03M/xy
		Jiangxi Jinko PV Material Co., Ltd.	PV-JK03M1/xyz
		Jiangxi Jinko PV Material Co., Ltd.	PV-JK03M2/xy
		Stäubli Electrical connectors AG	PV-KST4-EVO2/xy_UR&PV-KBT4-EVO2/xy_UR
		Stäubli Electrical connectors AG	PV-KST4-EVO2A/xy&PV-KBT4-EVO2A/xy
Suzhou Xtong Photovoltaic Technologies Co.,Ltd	PV-XT1609Nxyz	Suzhou Xtong Photovoltaic Technologies Co.,Ltd	PV-XT101.1;PV-XT101.2;XT2
		Stäubli Electrical connectors AG	PV-KST4-EVO 2/xy_UR&PV-KBT4-EVO2/xy_UR PV-KST4-EVO2A/xy&PV-KBT4-EVO2A/xy
Gokin Solar Co., Ltd.	GKxy	Gokin Solar Co., Ltd.	PV-GK01
		Stäubli Electrical connectors AG	PV-KST4-EVO2/xy_UR&PV-KBT4-EVO2/xy_UR, 1500VDC,
		Stäubli Electrical connectors AG	PV-KST4-EVO2A/xy &PV-KBT4-EVO2/xy, 1500VDC