

Installation Manual



1. General Information and Safety Warnings.

A. General Information

This manual contains information on the correct installation and safe handling of Kaseel Solar photovoltaic modules.

Ensure that the installation, operation and maintenance of your photovoltaic system are carried out only by qualified personnel capable of carrying out the technical procedures described in this manual, and that they are carried out in accordance with all safety precautions in this manual and all applicable local codes. If you do not possess this qualification, you will not be able to perform the work described in this document. Remember that these products generate electricity so you must take certain safety measures to avoid hazards.

Read the instructions carefully and follow the instructions strictly before handling and installing the modules. The installer must properly inform the end customer of the above issues.

This manual and the instructions given here are part of the product and must therefore be kept for the entire lifetime of the solar system. We recommend that you insure your solar system against natural risks (e.g. lightning).

B. Disclaimer of Liability

The information included in this manual is based on Kaseel Solar's knowledge and experience and is believed to be reliable; but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. Kaseel Solar reserves the right to change the manual.

If during the installation, the instructions given here regarding handling, installation or maintenance are not followed, the limited warranty of the product will become void.

Kaseel Solar is not responsible for any type of damage, including but not limited to, the operation of the module and a system installation error, personal injury, injury and property loss resulting from failure to follow the instructions in this manual. This manual is for reference only.

No responsibility is assumed by Kaseel Solar for any infringement of patents or other rights of third parties, which may result from use of the product. No license is granted by implication or otherwise under any patent or patent rights.

C. Applicable Products

This document applies to the solar module series listed below:

- KSP-60 XXX (XXX=270-295, in steps of 5).
- KSP-72 XXX (XXX=325-350, in steps of 5).
- KSPM-60 PERC XXX (XXX=285-310, in steps of 5).
- KSPM-72 PERC XXX (XXX=360-385, in steps of 5).
- KSPM-60 F XXX (XXX=285-310, in steps of 5).

- KSHC-120PERC XXX (XXX=355-380, in steps of 5).
- KSHC-144 PERC XXX (XXX=435-465, in steps of 5).

D. Safety Warnings

- The modules are qualified for use in application class A: dangerous voltage (IEC 61730: greater than 50 V DC; EN 61730: greater than 120 V), dangerous power (greater than 240 W) in which access with general contact is provided (modules classified as safe according to EN IEC 61730 within this application class are considered to meet the requirements of safety class II).
- Ensure that the PV module array does not exceed the system voltage limits or the current and rated voltage of secondary equipment such as regulators and inverters. The installation must be carried out on a fire resistant roof covering suitable for the application.
- Do not install the module in the rain, snow or in windy conditions.
- All installations must be performed in compliance with all local and national applicable standards, codes and regulations.
- Installers should assume all risks of injury that might occur during installation, including, but not limited to, the risk of electric shock.
- The cables must not be used as a carrying aid.
- Always wear a helmet, insulating gloves and safety shoes (with rubber soles).
- Use electrical insulated tools and appropriate protective equipment to reduce risk of electric shock.
- The glass surface and module frame can become hot when exposed to sunlight and there is a risk of burns.
- Do not stand on the modules or module frames.
- The solar module must not be compressed along its sides.
- Do not use mirrors or other magnifiers to artificially concentrate sunlight on the modules.
- Do not attempt to disassemble the modules or remove any components from the modules.
- The electrical connection of the individual modules with each other and the connection to the inverter must be made with the same type of plug-in connectors that are pre-installed on the modules
- Cover the module with an opaque material during installation to keep electricity from being generated.
- Do not disconnect under load.
- Modules should only be installed in such a way that sufficient back ventilation is ensured.
- If the modules are assembled near the sea, a minimum distance of 200 m to the coastline must be ensured.



2. Storage and unpacking

Inappropriate transport and storage may break the module. To prevent damage of the modules:

- Do not unpack the photovoltaic module until it has been installed.
- Store the modules securely in cool and dry rooms. The packaging is not weather-resistant.
- Do not stack packing cartons more than two layers high.
- Do not place modules on top of each other.
- Transport the modules in their original packaging until installation.
- Do not rest a module unprotected on its edges. This can damage the module and the frame
- Do not drop or place objects on the modules.

3. Installation conditions.

A. Climate Condition

Kaseel Solar modules should be installed in the following conditions:

- Operating temperature: -40°C to $+85^{\circ}\text{C}$
- Storage temperature: -40°C to $+40^{\circ}\text{C}$
- Humidity: below 85RH%

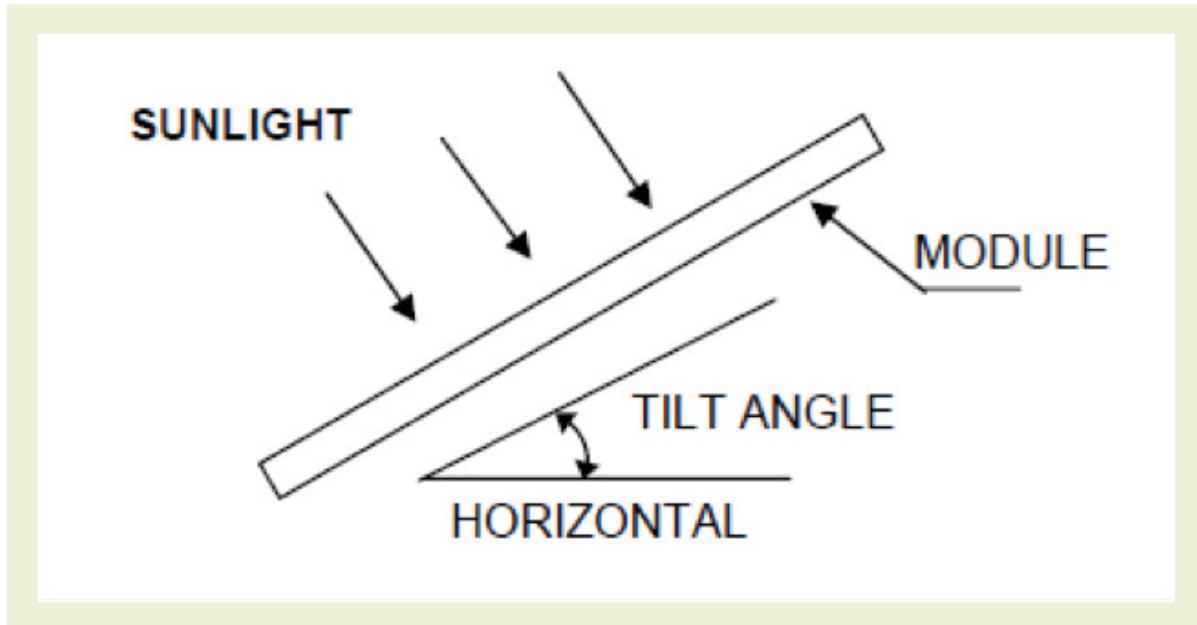
Note: The mechanical load (including wind and snow loads) that the module is able to support depends on the mounting methods. The professional installer should be responsible for calculating the mechanical load based on the design of the system.

B. Site Selection

Kaseel Solar modules should be installed in a location where they will receive maximum sunlight throughout the year. In the northern hemisphere, the modules should typically face south, and in the southern hemisphere, the modules should typically face north.

If the orientation of the modules moves 30 degrees away from the geographic south (or north), they will lose between 10 and 15 % of their power. If the modules are oriented 60 degrees away from the geographical south (or north), the power loss will be 20 to 30 %.

The modules produce the greatest amount of energy when pointed directly at the sun. For installations where the modules are fixed to a permanent structure, an angle of inclination should be chosen that maximizes yield depending on the seasons and solar radiation. In general, if the photovoltaic yield is acceptable when irradiance is low (e.g. in winter), the chosen angle should also be appropriate for the rest of the year. For grid-connected photovoltaic installations in which the modules photovoltaic modules are subject to a fixed structure, the inclination of the modules must encourage maximum energy production per year.



Modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of output power due to difference of amount of sunlight exposed to the module.

When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though bypass diodes have been fitted in the junction box of the module to minimize any such loss.

Kaseel Solar modules have a Class C fire resistance rating in accordance with IEC61730-2 standard. For roof installation, modules should be mounted over a fire resistant covering, with adequate ventilation between the module backsheet and the mounting surface. In order to maintain the fire class rating, the distance between the modules frame and the roof surface shall be at least 120mm.

Do not install the module near naked flame or flammable materials. Do not install the module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

ing) of 5400 Pa (only for the type of module mentioned in this manual) and negative (ascending) of 3600 Pa. When mounting modules in areas where it is usually snowy or there are strong winds, it is important to assemble the modules in such a way that they offer sufficient strength and, in turn, comply with local regulations.

C. Introduction to Mechanical Installation

The following methods are generally used for mounting photovoltaic modules: screws and clamp.

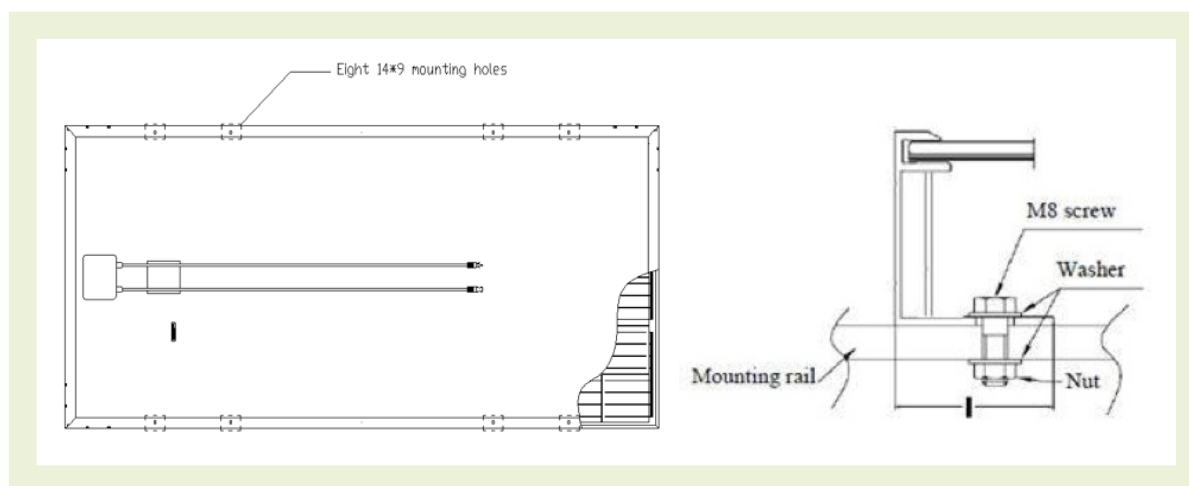
1. All installation methods mentioned here are for reference only, and Kaseel Solar does not supply the related components. The installer or qualified professional staff are responsible for the design, installation, the calculation of the mechanical load and the safety of the photovoltaic system.

2. Before proceeding with the installation, it is advisable to check several important aspects:

- Carry out a visual inspection before installation to ensure that there are no insects on the packaging, the junction box and the surface of the module. If so, remove it and clean it.
- Check if the serial number is correct.
- Kaseel Solar modules are designed to withstand maximum pressure. positive (descending) of 5400 Pa (only for the type of module mentioned in this manual) and negative (ascending) of 3600 Pa. When mounting modules in areas where it is usually snowy or there are strong winds, it is important to assemble the modules in such a way that they offer sufficient strength and, in turn, comply with local regulations.

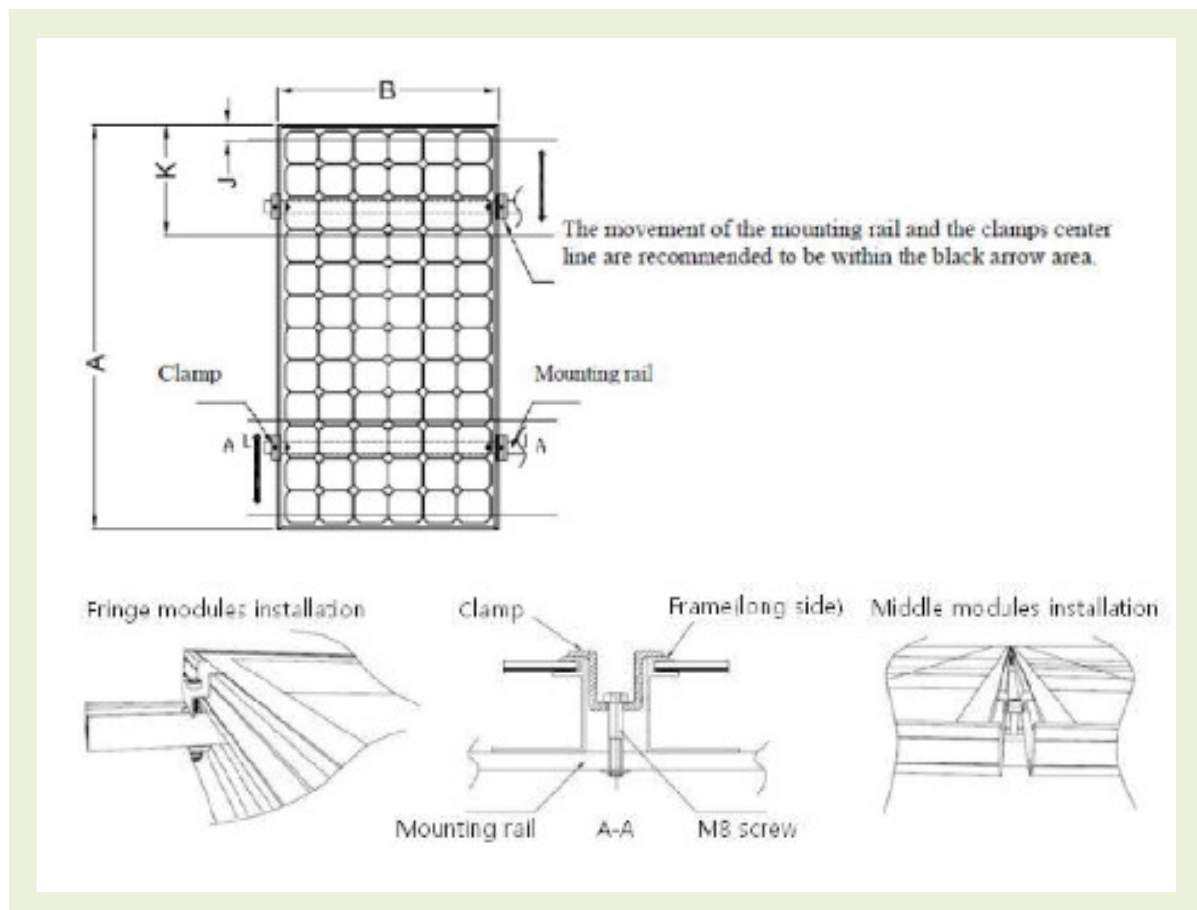
I. Screw Mounting

The frame of each module has eight mounting holes used to secure the modules to the support structure. If the wind or snow load is less than 3600Pa, you can use the four symmetry holes close to the inner side on module frame (as shown in Fig.2). If the wind or snow load exceeds 3600Pa, you must use all the eight mounting holes. The module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in eight symmetrical locations on the module. The applied torque should be 16~20 N.m(140-180 lbf.in.).



II. Clamp Mounting

- The modules can be installed in both landscape (clamping on the short frame) and portrait (clamping on the long frame) modes by clamp mounting.
- The module clamps should not come into contact with the front glass and must not deform the frame.
- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- When choosing this type of clamp mounting method, please be sure to use at least four clamps on each module, two clamps should be attached on each frame of the module. Depending on the local wind and snow loads, if the pressure load exceeds 3600Pa, additional clamps or support would be required to ensure the module can bear the load.



4. Electrical Installation.

A. Module Wiring

Modules are supplied with cables and connectors to be used for system electrical connections. It is not recommended to use modules with different configurations and electrical characteristics in the same system.

The photovoltaic modules connected in series must have a similar current, and must not be connected together to generate a voltage higher than that permitted by the system. The maximum number of modules that can be connected in series depends on the design of the system, the type of inverter and the environmental conditions.

Under normal conditions, a module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions.

The suggested fuse must be used for overcurrent protection. The maximum rating of the fuse in a chain of modules can be found on the label or in the product data sheet. The maximum rating of the fuse also corresponds to the maximum inverse current that a module can withstand; i.e. if a chain is in the shadow, it represents a load on the other parallel chains of modules and the current generated by these flows through the shadow chain to create a current circuit. Taking into account the maximum fuse rating of the series modules and local criteria for electrical installation, be sure to connect the module strings in parallel with appropriate fuses to protect the circuit.

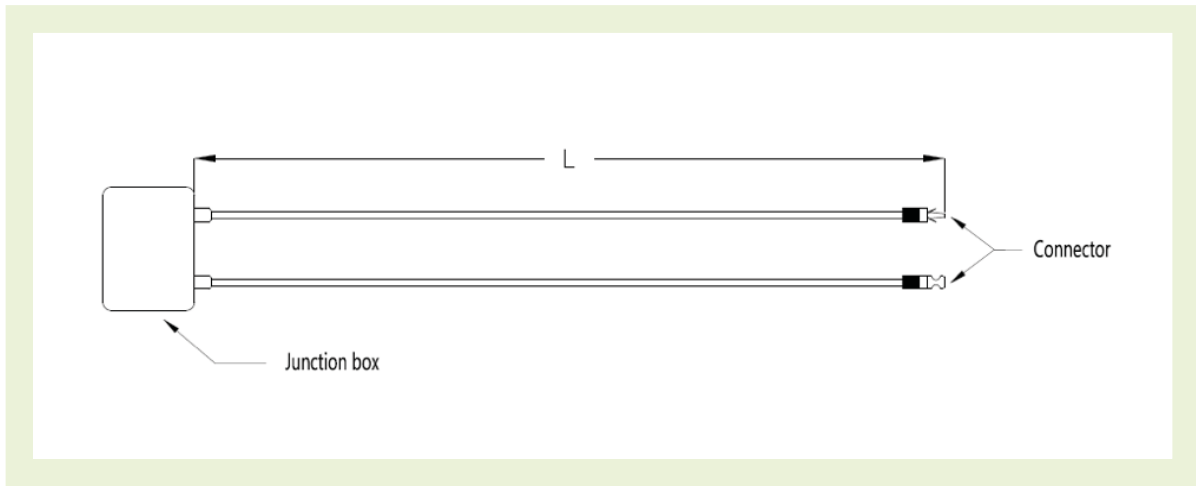
Accordingly, the values of I_{sc} and V_{oc} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.

The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions. It should be noted that modules must not be connected together to create a voltage higher than the permitted system voltage. There is no limitation on the number of modules that can be connected in parallel; the number of modules is determined by system design parameters such as current or power output.

The modules are fitted with step diodes at the factory. If the modules are not correctly connected to each other, the step diodes, the cable or the junction box may be damaged.

The cross-section of the cables and the capacity of the connectors must be adequate to withstand the maximum short-circuit current of the photovoltaic system (for a single component, a cable cross-section of 4 mm is recommended). Otherwise, cables and connectors will overheat with strong currents. Please note that the cable temperature limit is 85 °C.

The junction box cable is identified as L, as shown in the figure below. For standard Kaseel Solar modules, L is 1100/1200 mm while for custom modules, the size of L will depend on the particular conditions. Consider the length of the cable before designing the wiring configuration.



The maximum voltage supported on an installation (V_{max} . System), with Kaseel Solar’s photovoltaic modules is 1000 V.

B. Grounding

Grounding modules is necessary to reduce or eliminate shock and fire hazards. All module frames and mounting racks must be properly grounded in accordance with local and national electrical codes. Proper grounding is achieved by connecting the module frames and mounting racks continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or other material acceptable for use as an electrical conductor.

1. Grounding by using grounded clamp

There are two grounding holes with 4.0 mm diameter in the middle of the long frames of the modules. The grounding between modules must be approved by qualified electrician. And the grounding device must be produced by qualified electrical manufacture. The recommended twist torque value is 2.3 N.m. A copper core in size of 12 AWG can be used as grounding clamp. The copper wire should not be compressed during the installation.

Note: The figure above is using TYCO. 1954381-1 (recommended).

2. Grounding by using unused grounding hole

The existing grounding holes which have not been used can be used for grounding.

- 1) Direct the grounding clamp to the mounting hole on the frame. Thread the grounding clamp and the frame with grounding bolt.

- 2) Put the toothed gasket into the other side, then tighten and lock the nut. The recommended torque of locking the nut is 2.0 N.m ~2.2 N.m.

- 3) Thread the grounding clamp with grounding wire. The materiel and size of grounding wire should

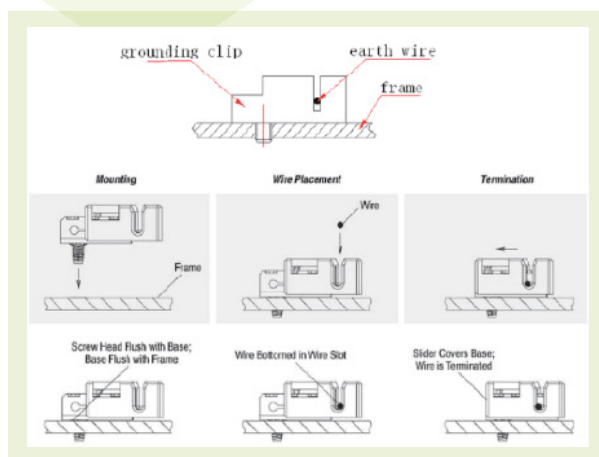
meet the relevant requirements of the national, regional and local rule, law and standard.

- 4) Finish the mounting with tightening the binding bolt of the grounding wire.

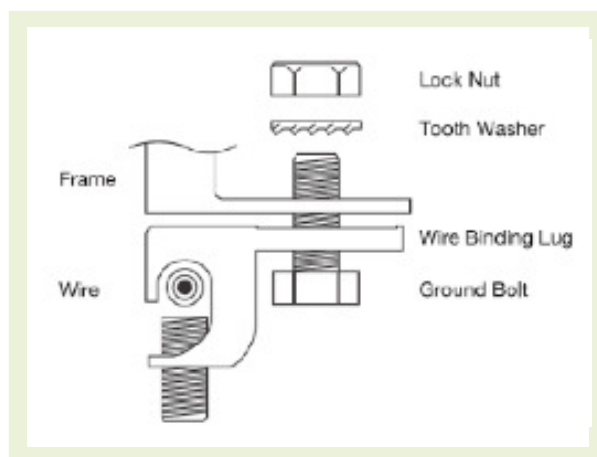
3. Additional third-party grounding devices

The modules can be grounded using third party grounding devices so long as they are certified for grounding modules and the devices are installed according to the manufacturer’s specified instructions.

1 Grounding by using grounded clamp



2. Grounding by using unused grounding hole



C. Inverters configuration

When installed in PV systems, Kaseel Solar modules normally do not need to be connected to earth and therefore can be operated together with either galvanically isolated (with transformer) and transformerless inverters. However, if the system is located in a hot, humid climate and the maximum voltage is greater than 600Vdc, then galvanically isolated inverters incorporating a transformer are recommended to be used and the negative pole of the array should be connected to earth.

4. Electrical Installation.

Modules must be inspected and maintained regularly, especially during the warranty period. In order to ensure optimum performance of the modules, Kaseel Solar recommends the following maintenance measures:

A. Visual Inspection

- Visually inspect the modules completely every 6 months for external defects, paying particular attention to the following:
- Check whether there are visual defects in the components of the modules.
- Check whether the front side of the modules is shaded by vegetation and other foreign materials, and trim the vegetation and remove other foreign materials when shading on modules occurs.
- Check whether mounting hardware is properly tightened, and adjust and tighten as necessary.
- In the event that the tempered glass of modules is broken, the affected modules need to be replaced. Only qualified professionals can perform the replacement of modules.
- Do not try to change the components of modules (Junction box, bypass diode and connector).

B. Cleaning

- Dirt and dust may accumulate on the glass surface of the modules and reduce the power output of the modules. It is recommended to clean the modules regularly to ensure maximum power output, especially in low rainfall areas.
- In order to reduce the potential for electrical and thermal shock, the modules should be cleaned during early morning or late afternoon when solar radiation is low and the modules are cooler, especially in regions with high temperatures.
- Use a soft sponge or cloth together with a mild detergent and clean water when cleaning the modules. Take care to avoid severe thermal shocks which may damage the modules by using water which has a similar temperature with the modules being cleaned.
- It is not allowed to use metal tools such as blades, knives, steel wool and other abrasive materials.
- For greasy dirt or other substances on the surface of the modules which are difficult to clean, conventional household glass cleaning agents can be used. Do not use the alkaline and strong acid solvents which may cause corrosion of glass.
- The pressure of the cleaning water should be less than 690KPa. It is not recommended to use water with high mineral content as it may deposit on the glass surface when the water is dry. Most municipal water is suitable to clean the modules.
- Do not use steam or corrosive chemicals to speed up the cleaning.
- Do not try to clean broken glass or modules with broken lines or exposed wires, as it may cause electric shock.
- When cleaning the modules, do not step on the modules; do not spray water on the backside of the modules or the cables; do not clean the backside of the modules; keep the connectors clean and dry; prevent fire and electrical shock.
- Kaseel Solar modules are designed to be able to withstand high snow pressure. If you need to clear snow to improve output power of the modules, use a hair brush to gently remove the snow, and use the gas to blow the snow too. Do not try to remove frozen snow or ice on the modules which may cause damage to the modules.

C. Connector and Cable Inspection

- Check the electrical connections between connectors and cables to make sure that all connections are tight, secure, intact and free of corrosion.
- Check the torque of terminal bolts at least once a year, and tighten them as necessary.
- In the event that the connectors and cables are damaged, the damaged parts need to be replaced by qualified professionals.



