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1 About these instructions

These instructions contain information about safe handling of KYOCERA solar modules of the KK-series. They are directed at personnel with electro-technical qualifications and contain safety-relevant instructions for the assembly, connection and maintenance of the solar modules.

IMPORTANT

The solar modules may only be mounted by personnel with electro-technical qualifications. Appropriately qualified technicians must always be deployed to service the units or remedy faults during operation.

Please read these instructions carefully before handling the solar module and familiarise yourself with the safety information. After the module has been installed, hand over these instructions to the operator of the solar modules for safekeeping.

2 Description of the solar modules

2.1 Proper use

The solar modules use the photovoltaic principle to turn light into electricity. The solar modules are primarily designed for connection to an inverter to feed the energy into the public power grid. When connecting to a charge controller, please observe the instructions of the manufacturer of the charge controller and accumulator. Several solar modules can be connected in series or in parallel.

The solar modules may not be directly connected to electrical consumers.

2.2 Description

The solar modules have an aluminium assembly frame with assembly and grounding holes. The solar modules have a junction box and solar cables with plugs for the electrical connection. **Appendix 1** of these instructions contains an illustration of a solar module.

	Designation
①	Grounding holes
②	Junction box
③	Assembly holes
④	Module frame
⑤	Solar cable

The solar modules are equipped with bypass diodes. In the event of clouding, these minimise the losses and help to prevent damage to the solar modules. The solar modules are not equipped with blocking diodes preventing battery discharging at night. Most PV charge regulators incorporate nighttime disconnect feature. The solar modules comply with the application class A in accordance with IEC 61730-1.

2.3 Technical data

Type designation	KK270P-3CD3CG	KK275P-3CD3CG	KK280P-3CD3CG
Electrical data (at standard test conditions: Irradiation 1000 W/m ² ; air mass AM 1.5; module temperature 25°C)			
P _{max} [W]	270	275	280
V _{oc} [V]	38.3	38.6	38.9
I _{sc} [A]	9.43	9.48	9.53
V _{pm} [V]	31.0	31.3	31.5
I _{pm} [A]	8.71	8.79	8.89
Bypass diode (pre-installed)			
Number	3		
Temperature properties: Temperature coefficient			
V _{oc} [V/°C]	-1.36*10 ⁻¹	-1.37*10 ⁻¹	-1.38*10 ⁻¹
I _{sc} [A/°C]	5.53*10 ⁻³	5.56*10 ⁻³	5.59*10 ⁻³
P _{max} [W/°C]	-1.23	-1.25	-1.28
Physical properties:			
Length [mm]	1662		
Width [mm]	990		
Height [mm]	46		
Weight [kg]	19.0		
Assembly holes	Diameter 9 mm, 4 units		
Grounding holes	Diameter 7 mm, 4 units		
Application class	Class A		
Fire class	Class C		
Series fuse rating [A]	15		

3 Safety

Solar modules generate power, producing voltage and current as soon as they are exposed to light. A single solar module generates a voltage of below 50 VDC; if several modules are connected in series, the voltages of the individual modules accumulate and can pose a hazard.

Hazard!



Potentially fatal risk due to electrical shock if damaged solar modules are touched.



- Only touch solar modules with fractured or broken front glass or a damaged rear foil if you are wearing rubber gloves.
- Only touch damaged solar modules if it is absolutely necessary.

Warning!



Risk of falling when working on roofs.

- Use suitable fall protection equipment.
- Observe the accident prevention regulations.

Warning!



Risk of injury from falling objects.

- Cordon off a safe distance around the hazardous zone when working on roofs.

Caution!



To avoid damage to the solar module, please observe the following points:

- Do not apply paint or any adhesives to the rear side of the solar module.
- Never use the junction box or the solar cable to carry the unit.
- When handle the modules, do not hold them by supporting only one side of the long frame.
- Do not expose the solar module to concentrated light.
- Do not allow any objects to fall upon the solar module.
- Avoid scratches to the front glass.



Caution!



Risk of breaking the solar module.

- Do not walk across or step on the solar module.



Caution!



Risk of injury by the solar module frame.

- Do not touch the solar module with bare hands.

NOTE

The frame of the solar module may have sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and finger areas.

4 Assembly



Assembly work may only be performed by trained and qualified personnel.

4.1 Safety information relating to assembly

Caution!



KYOCERA solar modules are “non-explosion-protected operating equipment”.

- Do not install the solar module close to flammable gases or vapours.

Hazard!



Potentially fatal risk if live parts are touched.

- Cover the solar module with opaque foils or materials during assembly.

Warning!



Risk of falling when working on roofs.

- Use suitable fall protection equipment.
- Do not perform assembly work in strong winds.
- Only perform assembly work in dry weather conditions.
- Observe the accident prevention regulations.

4.2 Select the location

NOTE

Before installing the PV system, contact local authorities to determine the necessary permits, installation and inspection requirements. During assembly, pay attention to the local building standards.

The solar modules can be installed on roofs or open space on support structures. To achieve maximum power yields for feeding into the public grid, the following should be observed when selecting the installation site: The solar irradiation should be as high as possible distributed throughout the year. To this end, the surface of the solar modules in the northern hemisphere must face south and the surface of the solar modules in the southern hemisphere must face north. The ideal module slope is approx. site latitude. While a bigger module slope leads to energy losses, smaller module slope can also lead to high accumulations of non-slipping snow on the module, which might cause damages to the module or its frame. Install the solar modules where they are not shaded by obstacles such as buildings or vegetation. Pay special attention to avoid partial shadowing of the solar modules by close-by objects. The solar modules should not be installed in the area with direct exposure to saltwater droplet (Guideline : within 50 m of a saltwater body). In the zone between 50 m and 200 m from a saltwater body, the PV modules should be installed as roof mounted only. For more information about the selection of the site, please contact the KYOCERA customer service.

4.3 Preparatory work for assembly

The solar module must be mounted to a support structure. Please observe the information provided by the mount manufacturer when selecting the support structure. If installed on a roof, the solar modules must be mounted on a fire-resistant surface.

4.4 Mounting the solar module

Please observe the following during assembly:

- A clearance of at least 50 mm needs to be kept between the module frame and the attachment surface. This allows the cool ambient air to circulate below the solar module. This is necessary for optimum performance in all application ranges.
- There should be a clearance of at least 3.2 mm between the individual module frames to allow heat-related expansion.
- The solar modules can be installed in either portrait or landscape position.
- If high accumulations of snow on the module array occur on site, the lower part of the module frames could be damaged when slipping snow is piled up there. This kind of damage needs to be avoided by an appropriate countermeasure e. g. attaching support parts at the lower side frames of the modules.
- When selecting the material for the support structure, pay attention to the electrochemical series in order to avoid galvanic corrosion between different kinds of metal.
- Fasten modules firmly to a support structure designed to withstand the local wind and snow loads
- The glass surface may have color variations depending on the viewing angle or installation circumstance. This is a normal characteristic of the glass and doesn't affect the quality of the solar module. Do not touch the glass surface with bare hand to avoid contamination. Clean the glass surface with a soft wet cloth without detergent if it is contaminated with oil or fingerprints. Do not rub the glass surface with something hard like a metal or sharp edge.

4.4.1 Bolting

Assembly material

- Stainless steel screws, diameter 8 mm (4 units)
- Screw body length is 25.4mm or less.
- Stainless steel nuts with locking teeth or stainless steel nuts, spring washers and flat washers. (4 units)

NOTE

No holes may be drilled into the module frame.

Procedure

- ✓ Please see the drawing in Appendix 1 of these instructions for the positions of the mounting holes.
- ✓ Drill the required assembly holes to the support structure.
- ✓ Tighten the screws with adequate torque (usually 12.5 Nm) to securely attach the solar module to the supporting frame. As adequate torque figure depends on selected bolt nuts, follow the manufacturers' recommended numbers.

4.4.2 Clamps

Assembly material

- Rustproof module clamps (at least 4 units).
- Please observe the information provided by the manufacturer when selecting the clamps.

Installation with long side of frame

- must be at least 24mm long respectively.
- must overlap the module frame by at least 5mm.

NOTE

The module clamps

- must not bend the module frame.
- must not touch the front glass.
- must not cast a shadow on the front glass.
- must not damage the surface of the frame.

Procedure

- ✓ Define the positions of the clamps based on the drawings in **Appendix 2**.
- ✓ Tighten the module clamps to the torque stated by the clamp manufacturer.
- ✓ Fasten modules firmly by clamps designed to withstand the local wind and snow loads.

5 Electrical connection



Only specially trained and qualified personnel may make the electrical connection.

5.1 Safety information relating to the electrical connection

Hazard!

Potentially fatal risk if live parts are touched.



- Never disconnect or connect electrical contacts when under load.
- Only use dry, insulated tools for the electrical assembly work.
- Never touch live parts with bare hands.
- Cover the solar module during installation with opaque foils or materials.
- Do not wear any metal jewellery.

5.2 Wiring of the solar modules

NOTE

The maximum system voltage of solar modules connected to each other may not exceed 1000 VDC. When designing the system, please note that the module voltage increases when the temperatures are low. Do not connect the modules in parallel without max. over current protection.

Under normal conditions, solar modules can supply higher currents and/or a higher voltage than reported at the standard test conditions (**see chapter 2.3 "Technical Data"**).

Therefore, when determining component voltage ratings, conductor current ratings, fuse sizes, and the size of controls connected to the output of the solar modules, the stipulated values of I_{sc} and V_{oc} should be multiplied with a factor of 1.25. Only interconnect modules of the same type within a system.

The solar modules are equipped ex-works with 4 mm²-solar cables. The solar cables have SMK PV-03 connectors. These connectors are designed for series wiring only. Always use special solar cables with a minimum conductor size of 4 mm² and suitable PV-connectors for further series or parallel wiring.

When wiring, proceed as follows:

- Ensure the poles are connected correctly and that the plugs are connected properly without gaps
- Observe the minimum bending radius of 29 mm of the solar cables that are used.

- Plug and socket connections shall only be mated with those of the same type from the same manufacturer.

5.3 Connection of the solar modules

Please observe the information provided by the manufacturer of the inverter when connecting the solar modules to an inverter.

5.4 Grounding of the solar modules

To minimise the risk of an electrical shock, the frames of the solar modules should be grounded.

Assembly material

- Stainless steel screw, diameter 6 mm with stainless steel serrated washer and stainless steel nut
- suitable grounding cable

NOTE

Ensure that the anodised layer of the frame is penetrated and a secure electrical contact is created with the frame.

Procedure

- ✓ Please see the drawing in **Appendix 1** of these instructions for the positions of the grounding holes.
- ✓ Screw the grounding cable firmly to one of the grounding holes using the stainless steel screw and a min. torque of 8 Nm.

6 Maintenance



Only specially trained and qualified personnel may service the solar system.

KYOCERA solar modules are designed for long-term service and are almost maintenance-free.

6.1 Safety information relevant for maintenance



Warning!

Risk of falling when working on roofs.

- Use suitable fall protection equipment.
- Observe the accident prevention regulations.

6.2 Cleaning the solar module

When the slope is adequate (> 15 degrees), the solar modules do not need to be cleaned thanks to the self-cleaning effect of the rain. If heavily soiled, clean with plenty of water, a mild detergent and a soft cloth/sponge.

6.3 Solar module maintenance

The system should be inspected once a year with regard to the following:

- Secure hold and no rust on any of the attachments
- Secure connection, cleanliness and that all cable connections are free of corrosion
- Soundness of cables and front glass

7 Disclaimer

KYOCERA's "Limited Warranty for Photovoltaic-Modules" does not apply if this assembly and maintenance instruction is not strictly observed. KYOCERA will not assume any liability for damage arising from improper use, wrong assembly, operation or maintenance.

8 Customer service / Contact

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159 Serm-Mit Tower 19th Floor, Sukhumvit 21 Road,

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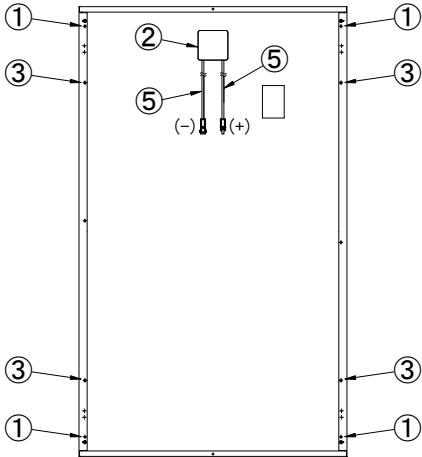
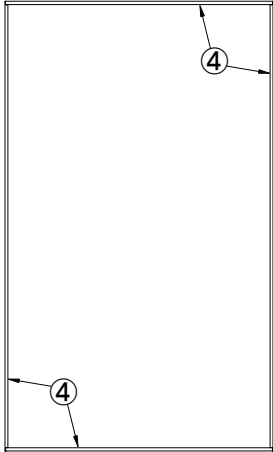
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- ① Grounding holes
- ② Junction box
- ③ Assembly holes
- ④ Module frame
- ⑤ Solar cable

		2400Pa	
<p>Bolting</p>			
<p>Clamping</p> <p> : Permissible clamping range</p>			



INSTALLATION MANUAL FOR KYOCERA PV MODULES

KUxxx-6MxA Series

Please read this manual carefully before installing the modules.

6C-215307

1. INTRODUCTION

As the world leader in the development and application of high technology ceramic/silica materials, Kyocera offers a wide range of highly efficient and reliable crystalline silicon solar photovoltaic (PV) power modules. Kyocera began to extensively research PV technology in 1975 and commenced manufacturing operations in 1978. Since then, Kyocera has supplied millions of cells and modules throughout the world. With years of experience and state-of-the-art technology, Kyocera provides the highest quality PV power modules in a range of sizes designed to meet the requirements of the most demanding energy users worldwide.

2. APPLICATIONS

Kyocera PV module (hereinafter referred to as “the PV module”) is a reliable, virtually maintenance-free direct current (DC) power source, designed to operate at the highest level of efficiency. The PV module is ideal for residential, commercial, or utility applications; grid-tie or off-grid applications and those with or without using storage batteries.

3. WARNINGS & SAFETY

PV modules generate electricity when exposed to light. Arrays of many modules can cause lethal shock and burn hazards. Only authorized and trained personnel should have access to these modules. To reduce the risk of electrical shock or burns, modules may be covered with an opaque material during installation. Do not touch live terminals with bare hands. Use insulated tools for electrical connections. Do not use these modules with solar concentration.

PERMIT

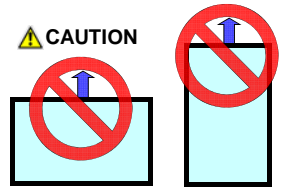
- Before installing your PV system, contact local authorities to determine the necessary permits, installation and inspection requirements.

INSTALLATION AND OPERATION

- The PV module is considered to be in compliance with UL1703 only when the PV module is mounted in the manner specified by the installation manual.
- Systems should be installed by qualified personnel only. The system involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.
- **Do not step on the module.**
- Although the PV module is quite durable, the glass can be broken if it is dropped or hit by tools or other objects. This will render the PV module inoperable.

- The module frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt-water environment and/or is in contact with another type of metal (galvanic corrosion). Pay attention to the above and take appropriate measures to prevent corrosion when selecting the installation environment, material of support structure, and clamping method.
- The PV module frame(s) must be attached to a support structure by one of the methods described in Section 6, INSTALLING PV MODULES.
- Module support structures used to support the PV module(s) should be wind rated and approved by the appropriate local and civil codes prior to installation.
- Do not expose the back of the module to direct sunlight
- In Canada, installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.

- When handling the modules, **DO NOT HOLD THEM BY SUPPORTING ONLY ONE SIDE OF THE FRAME BECAUSE IT CAN CAUSE SEPARATION OF THE GLASS AND FRAME.**



- Do not touch the PV module with bare hands. The frame of the PV module may have sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and finger areas.

FIRE RATING

- The PV module is comprised of a glass front surface and polyethylene terephthalate (PET) backsheet and has a Class C fire rating in IEC61730 and ULC1703.
- The fire rating of the PV module is valid only when mounted in the manner specified in the installation manual.
- For Fire Performance Test it is designated as Type 2.
- The PV system (PV module(s) combined with support structure) can attain Fire Class A when installed in a UL listed structure according to the structure manufacturers installation instructions.

GROUNDING

- The PV module with exposed conductive parts is considered to be in compliance with UL1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.
- Refer to “8.GROUNDING” section.

BATTERY

- When PV modules are used to charge batteries, the battery must be installed in a manner which will ensure the performance of the system and the safety of its users. **Follow the battery manufacturer’s safety guidelines concerning installation, operation and maintenance recommendations.** In general, the battery (or battery bank) should be kept away from people and animals. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging which can be explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for this purpose.

4. SITE SELECTION

In most applications, the PV 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. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 percent. Install the solar modules where they are not shaded by obstacles such as buildings and vegetation. Pay special attention to avoid partial shadowing of the solar modules by objects during the daytime.

The PV modules should not be installed in the area with direct exposure to saltwater droplet (Guideline : within 164'(50m) of a saltwater body). The PV modules should only be installed as roof mounted in the zone between 164' (50m) and 656' (200m) from a saltwater body.

5. MODULE TILT ANGLE

The PV modules produce more power when they are pointed directly at the sun.

For grid-tie installations where the PV modules are attached to a permanent structure, PV modules should be tilted at an angle equal to the site's latitude. This will typically result in the highest annual energy output.

6. INSTALLING PV MODULES

The glass surface may have color variations depending on the viewing angle or installation circumstance. This is a normal characteristic of the glass and doesn't affect the quality of the PV module. Do not touch the glass surface with bare hand to avoid contamination. Clean the glass surface with a soft wet cloth without detergent if it is contaminated with oil or fingerprints. Do not rub the glass surface with something hard like a metal or sharp edge.

The PV modules may be installed in various applications utilizing a variety of support structures and attachment methods as described below. For UL2703 certified attaching methods with these modules, please contact Kyocera. The structure should have enough strength to maintain the mounting span.

For optimal performance in all applications, clearance between the module frame and the mounting surface is required to allow cooler ambient air to circulate around the back of the module and to avoid module and/or wiring damage. A minimum spacing of 2" (50mm) is required between the PV module and the mounting surface around the perimeter of PV array. A minimum of .13" (3.2mm) spacing must also be maintained between module frames to allow for thermal expansion.

When installing modules in a highly snowy area, an appropriate countermeasure should be considered to prevent possible damage resulting from heavy snow accumulation and/or slippage. Any damage caused by snow or such countermeasures involving module frame modifications are not covered under warranty.

BOLTING: Use 5/16"(8mm) stainless steel (or equivalent in corrosion resistance) hardware through the existing .35" (9mm) diameter mounting holes in the module frame and then through the holes on the support structure. Tighten the screws with adequate torque (usually 132in-lb; refer structure manufacturer specifications). Refer to the module drawings (Section 12) for the position of mounting holes.

CLAMPING (Standard clamp / Long Clamp):

Fasten modules firmly using standard clamps or long clamps. Use 1/4" (6mm) or larger bolt and nut, made of stainless steel or equivalent in corrosion resistance. And tighten the screws with adequate torque specified by structure manufacturer.

Clamps must have enough strength to withstand snow/wind load etc, and must not damage the module frames. Clamps also must not shade the sunlight incidence on glass surface. Support structure should support the bottom of module at least .39" (10mm) width or overlap.

Take measures to prevent module from falling off clamps. If there is clearance between clamp and module side face when using insertion systems, take measures to prevent module from moving (e.g. put plastic parts into clearance). Refer to the 'CLAMPING AREA' (Section 12) for the clamping position and length of long clamp.

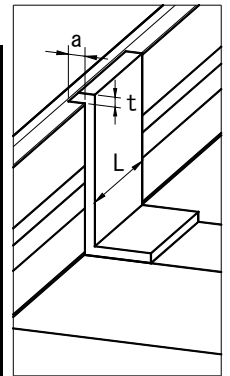
The clamp specification is below;

A- SUS304 or equivalent

t: thickness	L: width	a: overlap
0.079" (2.0mm) and over	min. 1.93" (49mm)	Long side clamping; min. 0.20" (5mm)
0.098" (2.5mm) and over	min. 1.34" (34mm)	
0.12" (3.0mm) and over	min. 0.94" (24mm)	short side clamping; min. 0.35" (9mm)

B-anodized aluminum AL6063-T5 or equivalent

t: thickness	L: width	a: overlap
0.079" (2.0mm) and over	frame length	min. 0.28" (7mm)
0.12" (3.0mm) and over	min. 1.50" (38mm)	Long side clamping; min. 0.20" (5mm)
0.14" (3.5mm) and over	min. 1.18" (30mm)	
0.16" (4.0mm) and over	min. 0.98" (25mm)	Short side clamping; min. 0.35" (9mm)



The clamp shape and dimensions above are for reference only, and any damage caused by clamps is not covered under warranty.

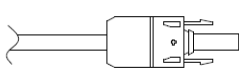
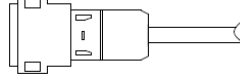
7. MODULE WIRING

The PV module comes pre-wired. Each module has two #12 AWG type PV-wire stranded sunlight resistant output cables each terminated with connectors. The positive (+) terminal has a male connector while the negative (-) terminal has a female connector. The module wiring is solely for series connections only, i.e. male (+) to female (-) interconnections. Refer to the following for details. Do not connect the different series.

For field wiring, follow the National Electric Code (NEC) Article 690 or local code.



1) Series: MC4

Made by Multi Contact (www.multi-contact.com)

Pole	Positive	Negative
Model	PV-KBT4/6 II-UR	PV-KST4/6 II-UR
Symbol	+	-
Figure		

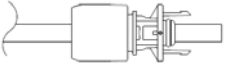
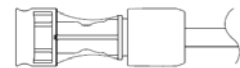
2) Series: MC4-EVO3

Made by Multi Contact (www.multi-contact.com)

Pole	Positive	Negative
Model	PVMC4PLS-XX	PVMC4PLS-XX
Symbol	+	-
Figure		

3) Series:H4 UTX

Made by Amphenol (www.amphenol.com)

Pole	Positive	Negative
Model	H4 UTX	H4 UTX
Symbol	+	-
Figure		

NOTE: When making connections with the connectors, make sure the array is disabled. **DO NOT MAKE CONNECTIONS WHILE UNDER LOAD.** Module output connections are marked "Do not disconnect under load".

NOTE: MAXIMUM SYSTEM VOLTAGE IS 1000 VDC.

The PV module and most PV system components have a maximum system voltage rating of 1000 volts DC. Some grid-tie systems operate at or near this voltage rating. Like other polycrystalline PV modules, the open-circuit voltage of the PV modules increases as the ambient temperature decreases. Maximum system voltage is computed as the sum of the open-circuit voltage of the series-connected PV modules for the lowest expected ambient temperature. Refer to the National Electrical Code Article 690-7(A) for determining the maximum number of the PV module that can be placed in series. Temperature coefficients, specific to the module of use, can be used to provide the most accurate prediction of module voltage under temperature extremes.

NOTE: Limit the maximum number of series connection of the PV module so that the system voltage is 1000V or less.

NOTE: Do not connect the modules in parallel without maximum over current protection.

NOTE: The minimum radius that the cable can be bent for the PV module is 1.14" (29mm).

NOTE: Under normal conditions, PV module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. The requirements of the National Electrical Code (NEC) in Article 690 shall be followed to address these increased outputs. In installations not under the requirements of the NEC, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and size of controls connected to the PV output.

8. GROUNDING

Before installation, consult the local codes and the authorities having jurisdiction to determine the necessary grounding requirements. When installing in the US market, attach all PV module frames to an earth ground in accordance with the National Electrical Code (NEC) Article 250. Proper grounding is achieved by connecting PV module frames and all metallic structural members contiguously to one another using a suitable grounding conductor. The grounding conductor shall be of copper, copper alloy or another material suitable for use as an electrical conductor per NEC. The grounding conductor must then make a connection to earth using a suitable earth grounding electrode. Ensure positive electrical contact through the anodizing on the module frame extrusion by utilizing one of the following methods.

Attach the grounding conductor:

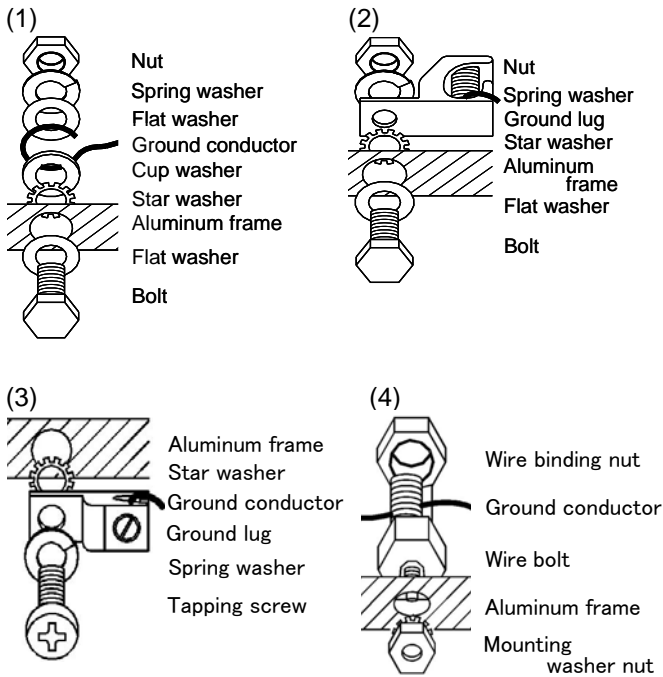
- (1) to one of the .28" (7mm) diameter holes marked "ground" using 1/4"(6mm) stainless steel bolt. Wrap conductor around bolt. Tighten the screws with adequate torque (62 in-lb: UL evaluation torque).
- (2) to a ground lug (manufacturer:ILSCO, model:GBL-4DBT). The lug is attached to one of the .28"(7mm) diameter holes marked "ground", using #10-32 stainless steel bolt with 40 in-lb torque.
- (3) to a ground lug (manufacturer:ILSCO, model:GBL-4DBT). The lug is attached to one of the .16"(4mm) diameter holes marked "ground", using #10-32 stainless steel tapping machine screw with 30 in-lb torque. Screw length should be 1/2"(12.7mm) or less.
- (4) to a wire bolt (manufacturer:Tyco, model:2058729-1) using 3/8"(10mm) wire biding nut with 45 in-lb torque. The bolt is attached to one of the .19"(4.7mm) diameter holes marked "ground", using #8-32 (4mm) mounting washer nut with 25 in-lb torque.

NOTE: A stainless steel star washer or mounting washer nut, having contact with anodized surface of the frame, must be employed to break through the anodized layer of the frame extrusion and electrically connect the grounding conductor to the conducting aluminum frame material.

NOTE: As a general rule, avoid direct contact of copper or copper alloy ground conductors with the aluminum frame to prevent galvanic corrosion. All ground bond securing hardware in contact with either the aluminum module frame and/or copper or copper alloy ground conductors must be stainless steel.

NOTE: Where common grounding hardware (nuts, bolts, star washers, spring-ring lock washers, flat washers and like that) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.

NOTE: Common hardware items such as nuts, bolts, star-washers, lock washers and the like have not been evaluated for electrical conductivity or for use as grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity. Such devices, where supplied with the module and evaluated through the requirement in UL 1703, may be used for grounding connections in accordance with the instructions provided with the module.



9. BLOCKING DIODES

In systems utilizing a battery, blocking diodes are typically placed between the battery and PV module output to prevent battery from discharging at night. The PV module is made of polycrystalline cells with high electrical "back flow" resistance to nighttime battery discharging. As a result, the PV modules do not contain a blocking diode when shipped from the factory. Most PV charge regulators and inverters incorporate a nighttime disconnect feature.

10. BYPASS DIODES

Partial shading of an individual module in a source circuit string (i.e. two or more modules connected in series) can cause a reverse voltage across the shaded cells within the module. Module output current is then forced through the shaded area by the remaining illuminated cells and other PV modules in series with the partially shaded module(s). The current forced through the shaded cells within the PV module(s) causes additional module heating and severe loss of power. All the PV modules are supplied with factory installed (non user serviceable) bypass diodes.

The purpose of bypass diodes is to provide a low-resistance current path around the shaded cells, thereby minimizing PV module heating and array current losses.

The PV module employs bypass diodes that have:

- Rated Average Forward Current [$I_{F(AV)}$] **Above** maximum system current at highest PV module operating temperature.
- Rated Repetitive Peak Reverse Voltage [V_{RRM}] **Above** maximum system voltage at lowest PV module operating temperature.

11. MAINTENANCE

The PV module is designed for long life and requires very little maintenance. Under most weather conditions, normal rainfall is sufficient to keep the module glass surface clean. If dirt build-up becomes excessive, clean the glass surface only with a soft wet cloth without detergent. **USE CAUTION WHEN CLEANING THE BACK SURFACE OF THE PV MODULE TO AVOID PENETRATING BACK SHEET.** The PV modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater. Once a year, check the general condition of the wiring and check to be sure that mounting hardware is tight. Loose connections may result in a damaged module or array.

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12. SPECIFICATIONS

Under certain conditions, a photovoltaic module may produce more voltage and current than reported at Standard Test Conditions (STC). Refer to Section 690 of the National Electrical Code for guidance in series string sizing and choosing overcurrent protection.

Module Specification

Electrical Characteristics: @ STC				
Module Type	KU255-6MCA KU255-6MPA	KU260-6MCA KU260-6MPA	KU265-6MCA KU265-6MPA	KU270-6MCA KU270-6MPA
Pmax	255W	260W	265W	270W
Voc	38.0V	38.3V	38.3V	38.3V
Isc	8.83A	9.09A	9.26A	9.43A
Vpm	30.8V	31.0V	31.0V	31.0V
Ipm	8.28A	8.39A	8.55A	8.71A
Factory installed Bypass Diode				
Number	3pcs.			
Series Fuse Rating	15A			
Thermal Characteristics: Temp. Coefficient				
Voc [V/°C] ([%/°C])	-1.35x10 ⁻¹ (-0.36)	-1.36x10 ⁻¹ (-0.36)	-1.36x10 ⁻¹ (-0.36)	-1.36x10 ⁻¹ (-0.36)
Isc [A/°C] ([%/°C])	5.18x10 ⁻³ (0.06)	5.33x10 ⁻³ (0.06)	5.43x10 ⁻³ (0.06)	5.53x10 ⁻³ (0.06)
Vpm [V/°C] ([%/°C])	-1.48x10 ⁻¹ (-0.48)	-1.49x10 ⁻¹ (-0.48)	-1.50x10 ⁻¹ (-0.48)	-1.50x10 ⁻¹ (-0.49)
Physical Characteristics:				
Length	65.43"(1662mm)			
Width	38.98" (990mm)			
Depth	1.81" (46mm)			
Weight	41.9 lb(19.0 kg)			
Mounting Hole	Diameter .35"(9mm), Quantity 4			
Grounding Hole (Back side hole)	Diameter .28"(7mm) , Quantity 4 / Diameter .19"(4.7mm), Quantity 4			
Grounding Hole (Side hole)	Diameter .16"(4mm), Quantity 4			
Application Class	Class A			

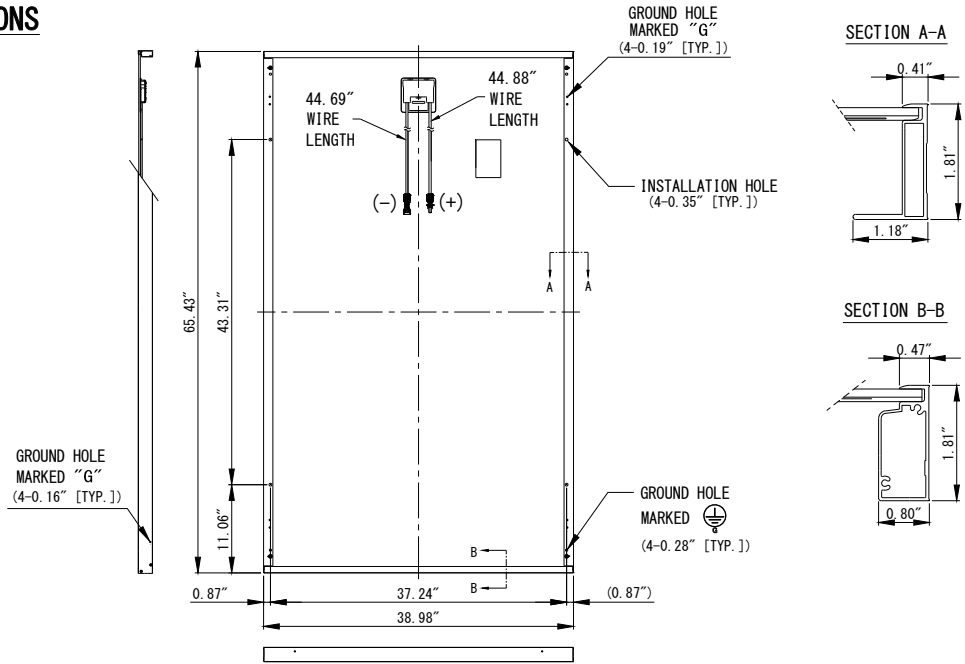
NOTES

- (1) The electrical characteristics are within +/-10% of the installed values of Pmax, Isc and Voc under standard test conditions (irradiance of 1000W/m², AM 1.5 spectrum, and a cell temperature of 25 deg C).
- (2) See module specification sheet for most recent electrical characteristics.
- (3) See module drawing for mounting and grounding holes locations.

REVISION RECORD

- August 26, 2015 The first edition
 July 28, 2016 The second edition
 October 14, 2016 The third edition
 December 12, 2016 The fourth edition

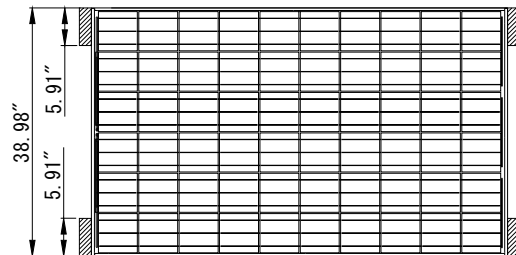
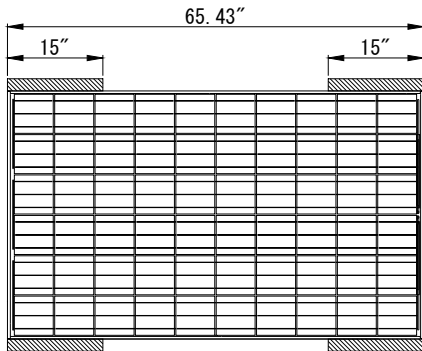
MODULE DIMENSIONS



CLAMPING AREA

1. Standard Clamp

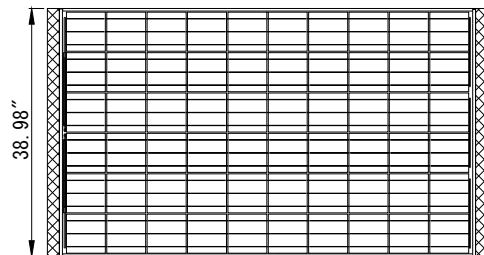
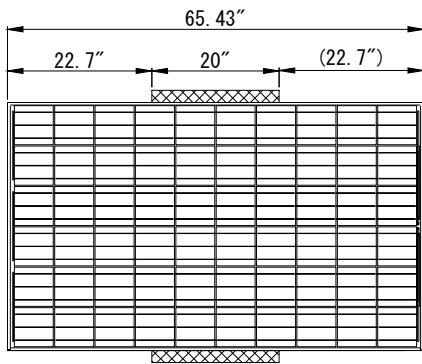
PERMISSIBLE CLAMPING RANGE



- The PV modules can be installed in either a portrait or landscape position.
- Use at least 4 clamps per module and must be located in each range shown above.

2. Long Clamp

MINIMUM CLAMP LENGTH & POSITION



- The PV modules can be installed in either a portrait or landscape position.