CanadianSolar

Solar Module Installation Manual (UL)

www.canadiansolar.com

1.0 GENERAL INFORMATION

This general manual provides important safety information relating to the installation, maintenance and handling of CS-series solar modules. System users and professional installers should read this manual carefully and strictly follow the instructions. Failure to follow these instructions may result in death, injury or property damage.

The installation of solar modules requires specialized skills and should only be performed by licensed professionals.

The word "module" or "PV module" used in this manual refers to one or more CS-Series solar modules.

Please retain this manual for future reference.

1.1 DISCLAIMER OF INSTALLATION MANUAL

The information contained in this manual is subject to change by Canadian Solar Inc. without prior notice. Canadian Solar Inc. makes no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.

1.2 LIMITATION OF LIABILITY

Canadian Solar Inc. shall not be held responsible for damages of any kind, including without limitation bodily harm, injury and property damage, relating to module handling, system installation, or compliance or non-compliance with the instructions set forth in this manual.

2.0 SAFETY PRECAUTIONS

Warning: All instructions should be read and understood before attempting to install, wire, operate and/or maintain the module. Module interconnects pass direct current (DC) when exposed to sunlight or other light sources. Contact with electrically active parts of the module, such as terminals, can result in injury or death, whether the module is connected or disconnected.

General Safety

- All installations must be performed in compliance with all applicable regional and local codes such as, the latest National Electrical Code (USA) or Canadian Electric Code (Canada) or other national or international electrical standards.
- Wear suitable protection (non-slip gloves, clothes, etc.) to prevent direct contact with 30VDC or greater, and to protect your hands from sharp edges during the installation.
- Use electrical insulated tools to reduce the risk of electric shock.
- Remove all metallic jewelry prior to installation to reduce the chance of accidental exposure to live circuits.
- Cover the front of the modules in the PV array with an opaque material to halt production of electricity when installing or working with a module or wiring.
- Do not install or handle the modules when they are wet or during periods of high wind.
- Do not use or install broken modules.
- If the front glass is broken, or the back sheet is torn, contact with any module surface or the frame can cause electric shock.
- Keep the junction box cover closed at all times.
- Do not attempt to repair any part of the module. There're no serviceable parts within the PV module.
- Do not disassemble a module or remove any module part.
- Do not artificially concentrate sunlight on a module.
- Do not connect or disconnect modules when current from the modules or an external source is present.

3.0 MECHANICAL / ELECTRICAL SPECIFICATIONS

The module electrical ratings are measured under Standard Test Conditions (STC) of 1 kW/m^2 irradiance with an AM1.5 spectrum, and cell temperature of 25℃. The detailed electrical and mechanical characteristics of Canadian Solar Inc. crystalline silicon PV modules can be found in table 4 of this manual (see Annex). Main electrical characteristics at STC also appear on each module label. The maximum system voltage for all module series is 600 V.

Under certain conditions, a module may produce more current or voltage than its Standard Test Conditions (STC) rated power. As a precaution, a module's open-circuit voltage and short-circuit current at STC should be multiplied by 1.25 when determining component ratings and capacities. An additional 1.25 multiplier for a short-circuit current (for a total of 1.56), and a correction factor for an open circuit (see Table 1 below) for sizing conductors and fuses is applicable, as described in section 690-8 of U.S. NEC.

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Table 1: Low temperature correction factors table for open-circuit voltage

Lowest Expected Ambient Temperature (℃/℉)	Correction Factor
24 to 20/76 to 68	1.02
19 to 15/67 to 59	1.04
14 to 10/58 to 50	1.06
9 to 5/49 to 41	1.08
4 to 0/40 to 32	1.10
-1 to-5/31 to 23	1.12
-6 to-10/22 to 14	1.14
-11 to-15/13 to 5	1.16
-16 to-20/4 to-4	1.18
-21 to-25/-5 to-13	1.20
-26 to-30/-14 to-22	1.21
-31 to-35/-23 to-31	1.23
-36 to-40/-32 to-40	1.25

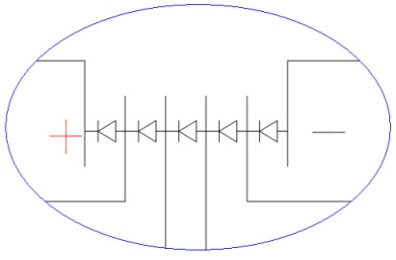
3.1 DIODES

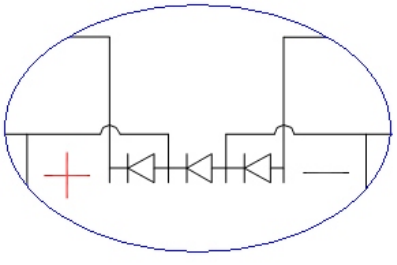
• Diodes inside the junction box should meet requirements below:

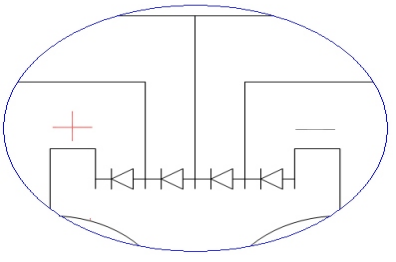
Module series	Number of bypass diodes	Number of cells by diodes	Diode ratings		Diode type
			Voltage	Current	
CS6P-PE	5	12	⩾40V	⩾12 A	Schottky diodes
CS6A-PE	5	10 (for 3 substrings) 9 (for 2 substrings)			
CS5P	4	24		⩾10A	
CS5A	3	24			
CS5T		20			
CS6A		16		⩾15 A	
CS6P		20			
CS6X		24			

• Diode configurations as below:

CS6P-PE /CS6A-PE ***CS5A/CS5T/CS6A/CS6P/CS6X*** ***CS5P***







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4.0 UNPACKING AND STORAGE

Precautions and General Safety

- Store modules in a dry and ventilated room .
- Do not allow children and unauthorized persons near the installation site or storage area of modules.

- Do not transport modules in an upright position.
- Unpacking module pallet with care and follow the unpacking steps marked on the pallet. Be careful when unpacking, transporting and storing the modules.
- Do not carry a module by its wires or junction box. Carry a module by its frame with two or more people.
- Do not place modules on top of each other.
- Do not place excessive loads on the module or twist the module frame.
- Do not bow modules under their own weight.
- Do not stand, step, walk and/or jump on the module.
- Do not drop or place objects on the modules (such as tools).
- Do not mark the modules with sharp instrument.
- Do not leave a module unsupported or unsecured.
- Do not change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry.

5.0 MODULE INSTALLATION

Precautions and General Safety

- Before installing modules, contact the appropriate authorities for site, installation and inspection permission and requirement.
- Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) can withstand the module system load.
- When installing the modules, please ensure the assembly is mounted over a fire resistant roof covering rated for the application. Canadian Solar modules have been listed as Class C according to UI790 standard.

Environmental conditions

- The module is intended for use in general open climates, as defined in IEC 60721-2-1: Classification of environmental conditions Part 2-1: Environmental conditions appearing in nature - temperature and humidity.
- Do not install modules near naked flames or flammable materials.
- Do not expose modules to artificially concentrated light sources.
- Do not immerse modules in water or constantly expose modules to water (either fresh or salt) (i.e. from fountains, sea spray).
- Exposing modules to salt (i.e. marine environments) and sulfur (i.e. sulfur sources, volcanoes) risks module corrosion.

Requirements of installation

- Ensure that the module meets the technical requirements of the system as a whole.
- Ensure that other systems components do not exert damaging mechanical or electrical influences on the modules.
- Modules can be wired in a series to increase voltage or in parallel to increase current. To connect in series, connect cables from the positive terminal of one module to the negative terminal of the next module. To connect in parallel, connect cables from the positive terminal of one module to the positive terminal on the next module.
- Quantity of bypass diodes provided can vary depending on model series.
- Connect the quantity of modules that match the voltage specifications of the inverters used in the system. Modules must not be connected together to create a voltage higher than the permitted maximum system voltage, even under the worst local temperature conditions (see table 1 for correction coefficients to apply for open-circuit voltage).
- Similar electrical performance modules should be connected in the same series to avoid or minimize mismatch effects in arrays.
- To minimize risk in the event of an indirect lightning strike, avoid forming loops when designing the system.
- The recommended maximum series fuse rating is tabulated in annex
- Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads. A minimum clearance of 6.5 mm (1/4 of an inch) or more between modules is required to allow for thermal expansion of the frames.

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• Small openings for water draining on the underside of the module should not be blocked after mounting.

Optimum orientation and tilt

• Find out the optimum orientation and tilt of the PV modules for your region to achieve the maximum annual yield. Generation of maximum power occurs when sunlight shines perpendicularly onto the PV modules.

Avoid shading

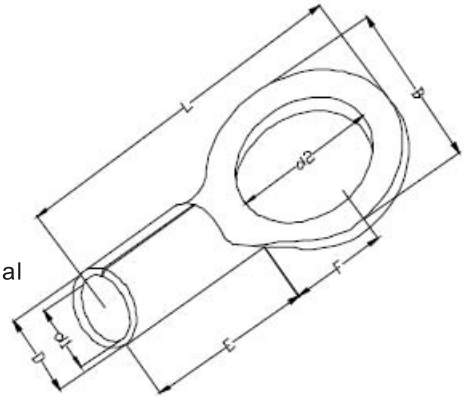
• Even the slightest partial shading (e.g., from dirt deposits) will cause a reduction in yield. A module is considered "shadow-free" if it is unobstructed across its entire surface for the whole year. Even on the shortest day of the year, unobstructed sunlight can reach the module.

Reliable ventilation

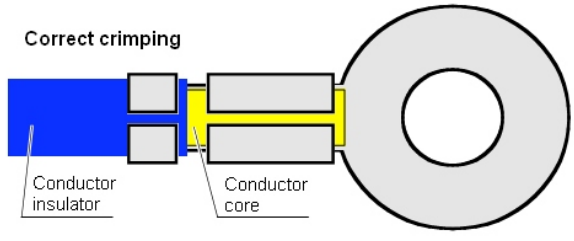
• Sufficient clearance (at least 10 cm) between the module frame and the mounting surface is required to allow for cooling air to circulate around the back of the module. This also allows for condensation or moisture to dissipate.

Grounding

• Although the modules are certified to safety class II, it is recommended that they be grounded. And the module installation complies with all local electrical codes and regulations.
• The earth grounding connection should be made by a qualified electrician.
• Connect module frames to each other using suitable grounding conductor with ring terminals (except for method D described hereafter). Holes provided for this purpose are identified with a green label.Use 6-12 AWG (4-14 mm^2) copper wire only. The bolts, nuts, flat washers, lock washers or other relevant hardware should be made of stainless steel, unless otherwise specified.
• All the junctions on the conductive connection must be fixed. Metal containing iron in the conductive connection should be made with stainless steel or be treated against corrosion by anodizing, spray-painting, or galvanization to prevent rusting and corrosion.
• Where required (method A and C), a copper terminal ring is recommended (please see the picture on the right). Thed2 in the picture is 5.3mm and the size of d1 is determined by the size of the grounding cable. Proper crimping tool and method should be used to crimp the terminal onto the grounding cable. Once crimped, each terminal should be visually checked according to the following points:
  1.The insulator jacket is correctly crimped in the first collar
  2.The conductor core is correctly crimped in the second collar
  3.The conductor core does not run over the functional part of the ring terminal
  4.The ring terminal should not be bent or deformed during the crimping operation

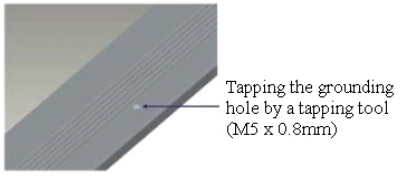


• Grounding hardware is not provided by Canadian Solar Inc..
• Four grounding methods are recommended for Canadian Solar modules, as described below.

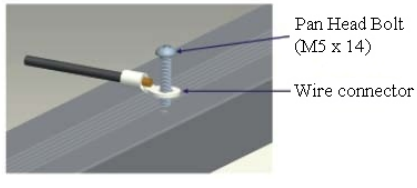


Method A: Tapping + Bolt + Ring terminal
For older modules, when diameter of the grounding holes is 4mm (ETL certified).

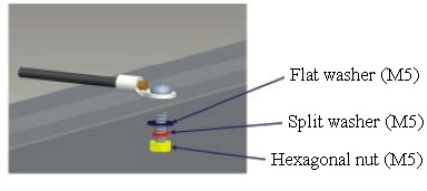
Step1:



Step2:



Step3:



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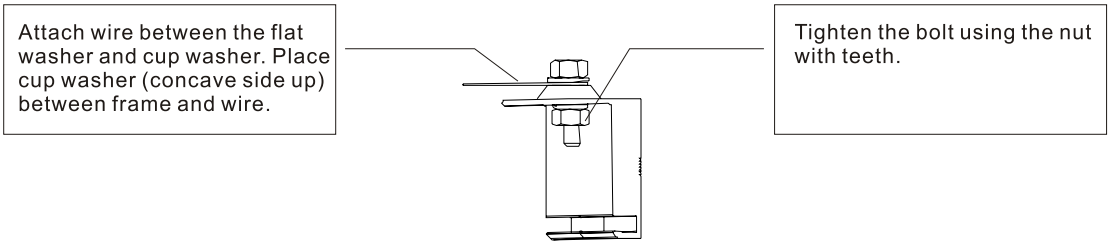
- The grounding hole should be pierced using an adequate tapping tool (M5x0.8mm).
- Secure to the the grounding hole the following: the lug with stainless steel hardware including a pan head bolt (M5x14mm), a flat washer, a split washer and an hexagonal nut. Two full threads of the bolt shall engage the metal.
- A torque moment of about 3Nm should be used to fasten the grounding parts to module frame.

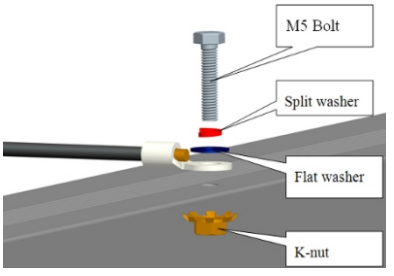
Method B: Bolt + Nut with teeth + Cup washer
When diameter of the grounding holes is 5mm (CSA and UL certified).

- A grounding kit with M5 size SS cap bolt, M5 size SS flat washer, M5 size SS cup washer, and M5 size SS nut (with teeth) is used to attach a copper grounding wire to grounding hole pre-drilled on the frame (see picture below).
- Attach the wire between the flat washer and the cup washer. Ensure the cup washer is between the frame and wire with concave side up to prevent corrosion due to dissimilar metal. Tighten the bolt securely using the SS nut with teeth. A wrench may be used in this application. The tightening torque is 1 Nm.



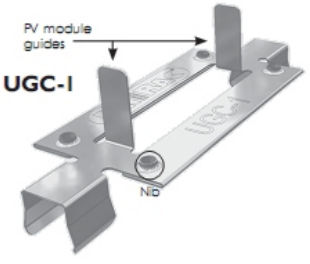
Method C: Bolt + K-nut + Ring terminal (copper)
When diameter of the grounding holes is 5mm (ETL and CSA certified).

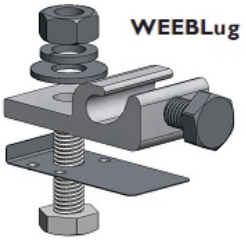
- Connect the grounding hardware to the grounding hole on the frame as shown in the picture.
- A K-nut is used to penetrate the frame's anodizing (protective coating) to create conductive connection.
- A torque moment of about 3Nm should be used to fasten the grounding parts to module frame.



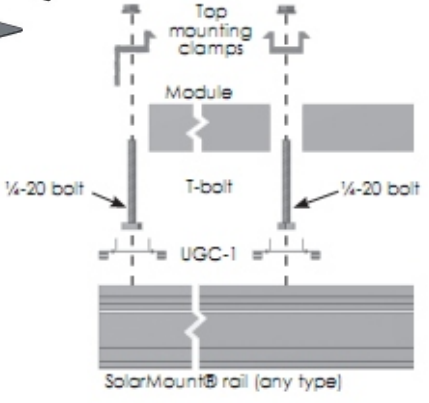
Method D: UGC-1 + WEEBlug 6.7
Used in conjonction with SolarMount® rails from UNIRAC, no hole is requested (ETL certified).

- UGC-1 grounding clips are used to create grounding path between the module frame and the UNIRAC rail. WEEBlug 6.7 assemblies are designed for use with size 6-12 AWG solid copper conductor wire, and allow connecting the system to equipment ground connector.



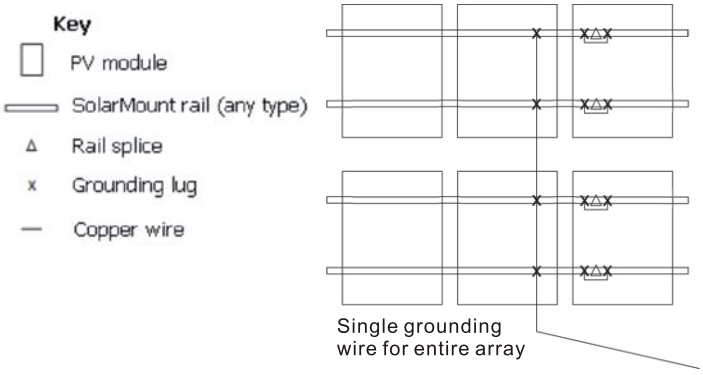


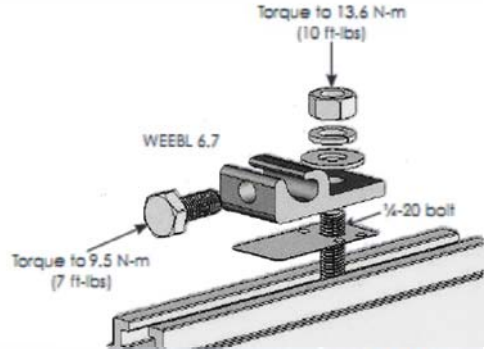
- UGC-1 grounding clips should be preassembled with top mounting clamps (refer to Mounting Instructions p12) in order to reduce the possibility of losing parts during installation. When installing the modules, slide the assemblies into the mounting slot of rails (UGC-1 nibs should be aligned under the edge of the module for proper installation and torque the modules in place on top of clip up right. Recommended torque moment of 13.6 Nm should be applied using general purpose anti-seize compound on threads. Nibs will penetrate rail anodization and create grounding path through rail.



• The layout for UGC-1 grounding clips depends on the number of modules by row. For an even number, two clips are used between each pair of modules (one for each rail). For an odd number, refer to the following picture where "X" denotes places to install the clips:

• At least one WEEBlug assembly should be installed on each rail (more will be required if rail splices are used). Slide a bolt in the mounting slot of rail to the desired position, and then place the special stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Slip the lug portion (tin-plated copper) on top of the washer and install standard flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug (recommended torque is 13.6 Nm).





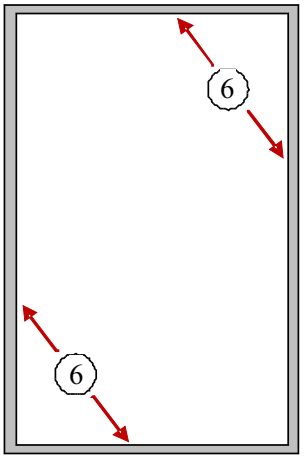
• Even with splice rails, one single wire grounding is enough. Lay the equipment conductor in the lug and torque bolt to 10 Nm (WEEBL 6.7 for use with conductor size 6 AWG 6-12 solid copper conductor wire). Then repeat the operation for other WEEBlug assemblies. Once grounded to an appropriate grounding electrode, the installation should look as above.

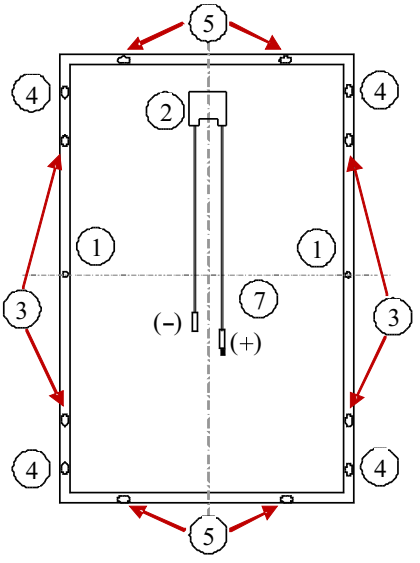
5.1 MOUNTING INSTRUCTIONS

Standard modules

• For a clear understanding of module, please refer to the illustration of a standard module shown below:

Reference	Designation
1	Grounding holes
2	Junction box
3	Standard mounting holes (long side)
4	Additional mounting holes (high wind or snow loads)
5	Standard mounting holes (short side)
6	Module frame
7	Cables and connectors





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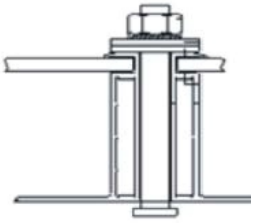
- The mounting design must be certified by a registered professional engineer. The mounting design and procedures shall comply with local electrical and building codes.
- Mounting hardware is not provided by Canadian Solar Inc..
- Canadian Solar modules can be mounted to a support structure by several approved methods, either using the mounting holes located on the back frame (see Example A), or by means of clamps (see Example B). Both mounting methods have been qualified during testing and listing of Canadian Solar modules according to UL1703 standard. For inlay-systems or other installation hardware, please contact your local representative for further information.

Example A:
Bolting (ETL, UL and CSA qualified)

Example B:
Clamping on (ETL qualified)

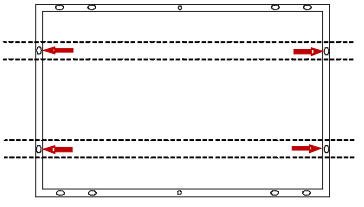
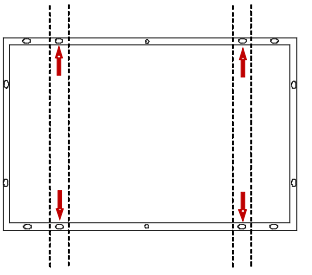


- Use appropriate corrosion-proof fastening materials. All mounting hardware (bolt/spring washer/flat washer/nut) should be made with stainless steel, M6 size for bolting method (A), and M8 size for clamping method (B).
- Use a torque wrench for installation. The above figure shows methods of fastening module to support structure. Tightening torques should respectively be within 4~6 Nm and 10~17 Nm for M6x1 (Example A) and M8x1.5 (Example B) coarse thread bolts, depending on bolt class. Different recommendations from specific clamping hardware suppliers should prevail.
- Canadian Solar modules can be installed in either landscape or portrait position, refer to the detailed instructions in table 2 for further guidance. Note that further countermeasures such as the use of additional support bars should be considered in heavy snow areas (> 2400 Pa), to avoid damage by the snow accumulating in the lowest row of modules.

Method A: Bolting

- Modules should be bolted to support structures through mounting holes located in the frame's back flanges only. Do not drill additional holes or modify the module frame. Doing so will void the warranty.
- Each module must be securely fastened at a minimum of 4 points on two opposite sides. If additional wind loads are anticipated for this installation, additional mounting points should be used. System designer and installer are responsible for load calculation and for proper support structure design.
- Modules should be bolted at the following hole locations depending on the configuration and load:

Table 2: Authorized attachments for bolting/clamping method

	Bolting/clamping on short side frame	Bolting/clamping on long side frame
	Use 4 standard mounting holes (short side)	Use 4 standard mounting holes (long side)
Uplift load ≤2400 Pa **Downforce load ≤5400 Pa**		

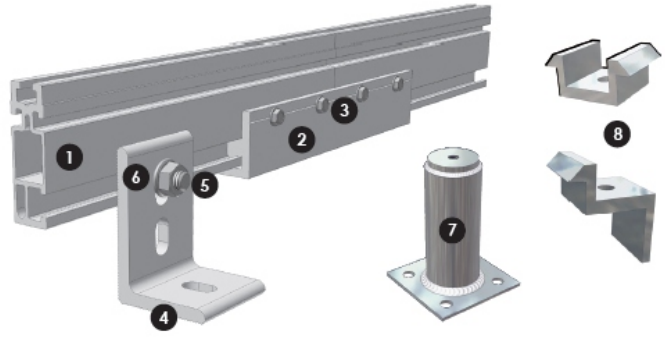
Method B: Clamping

- Top or bottom clamping methods will vary and are dependent on the mounting structures. Follow mounting guidelines recommended by the mounting system supplier.

- Each module must be securely fastened at a minimum of 4 points on two opposite sides. The clamps should be positioned according to table 2, using the mounting holes as reference locators then install and tighten the module clamps to the torque stated by the mounting hardware manufacturer. System designer and installer are responsible for load calculations and for proper design of support structure.
- Canadian Solar's limited warranty will be void in cases where improper clamps or installation methods deviating from this manual are used. When installing inter-modules or end type clamps, take measures so as:
  1.Not to bend the module frame
  2.Not to touch or cast shadow on the front glass
  3.Not to damage the surface of the frame
  4.To ensure the clamps overlap the module frame by at least 9 mm
- Clamp positions are of crucial importance for the reliability of the installation, the clamp centerlines must be only be positioned as indicated in table 2, depending on the configuration and load.

Installation using SolarMount® system

SolarMount® rail components (all units are mm unless otherwise noted):



1.Rail Supports PV modules. Use two per row of module 6105-T5 aluminum extrusion, anodized.
2.Rails splice-Joins and aligns rail sections into single length of rail. It can form either a rigid or thermal expansion joint, 8 inches long, predrilled. 6105-T5 aluminum extrusion, anodized.
3.Self-drilling screw—(No. 10 x 19.1 (3/4"))—Use 4 per rigid splice or 2 per expansion joint. Stainless steel.
4.L-foot—Use to secure rails either through roofing material to building structure or standoffs (note: Please contact UNIRAC for use and specification of double L-foot) Aluminum, anodized
5.L-foot bolt (9.5 (3/8") x 19.1 (3/4"))—Use one per L-foot to secure rail to L-foot. Stainless steel. Recommended torque 40.7 Nm (30 ft.lbs).
6.Flange nut (9.5 (3/8"))—Use one per L-foot to secure rail to L-foot. Stainless steel.
7.Optional: Flattop standoff 9.5 (3/8")—Use standoffs to increase the height of the array above the surface of the roof or to allow for the use of flashings. Use one per L-foot. One piece: Service Condition 4 (very severe) zinc-plated welded steel. Includes 9.5 (3/8") x 6.4 (1/4") bolt with lock washer for attaching L-foot. Flashings: use one per standoff (UNIRAC offers appropriate flashings for both standoff types). There is also a flange type standoff that does not require an L-foot.
8.Top Mounting Clamps, Aluminum. 6.4 (1/4") stainless steel bolts with lock washers are used to fasten the modules. Recommended torque 13.6 Nm (10 ft.lbs).

- All supplied hardware is specified in imperial units. Substitution of metric hardware is NOT PERMITTED and WILL VOID THE WARRANTY.
- The installer should supply the lag screws for L-feet or standoffs attachment to rafters (use stainless steel or zinc plated hardware depending on flashings used), as well as an appropriate roofing sealant.

Preliminary design

- Before installing any component of the system, refer to local building codes and authorities in order to determine specified wind and snow loads that may apply on the different roof zones of your project (you can contact a local professional engineer, UNIRAC or its local distributor for further assistance). Taking into account the dead load (modules and UNIRAC racking systems), calculate the Ultimate Limit States ULS-for the different load combinations defined in local building codes (both downforce and uplift), and consider the maximum absolute value as the Factored Design Load (noted Pf).

- Using the Factored Design Load determined in previous step, select the Rail Type and look up the allowable Rail Spans (L-foot Spacing) for your installation, using table 3:

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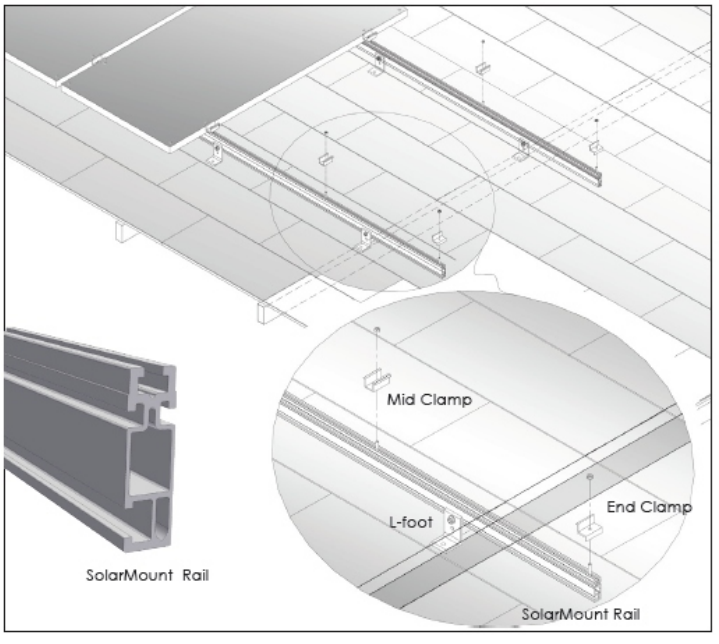
Span (m)	Factored Distributed Load on the rail , w_f (kN/m) = Pf * B / 2																	
	0.4	0.5	0.6	0.75	0.9	1.05	1.35	1.65	1.95	2.25	2.55	2.85	3.15	3.45	3.75	4.05	4.35	4.65
0.6	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
0.75	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
0.9	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM		
1.05	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD				
1.2	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD						
1.35	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD	HD							
1.5	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD								
1.65	SM	SM	SM	SM	SM	SM	HD	HD	HD									
1.8	SM	SM	SM	SM	SM	SM	HD	HD										
1.95	SM	SM	SM	SM	SM	HD	HD	HD										
2.1	SM	SM	SM	SM	HD	HD	HD	HD										
2.25	SM	SM	SM	HD	HD	HD	HD											
2.4	SM	SM	HD	HD	HD	HD												
2.55	SM	SM	HD	HD	HD	HD												
2.7	SM	HD	HD	HD	HD													
2.85	SM	HD	HD	HD														
3	HD	HD	HD	HD														
3.15	HD	HD	HD															
3.3	HD	HD	HD															
3.45	HD	HD	HD															
3.6	HD	HD																
3.75	HD	HD																
3.9	HD																	
4.05	HD																	
4.2	HD																	

Table 3: L-Foot SolarMount Series Rail Span
(SM-SolarMount, HD-SolarMount Heavy Duty)
Where B stands for the module length perpendicular to rails (m)

• Based on chosen Rail Span, calculate the corresponding downforce and uplift point loads at each connection. Use these results to select lag bolt model (embedment depth and diameter) and verify substructure will be strong enough.

Installing SolarMount with top mounting clamps

• solarMount system is used for flush mounting on pitched roofs. Clamp part quantities are summarized in the table below, along with an exploded view of a flush mount installation using L-feet.



Clamp part quantities

Modules	End clamps	Mid clamps	¼" module clamp bolts	¼" flange nuts
2	4	2	6	8
3	4	4	8	10
4	4	6	10	12
5	4	8	12	14
6	4	10	14	16
7	4	12	16	18
8	4	14	18	20

• In order to get full understanding of the installation procedure, refer to the regulatory installation manual from UNIRAC. The latest available version can be obtained from Canadian Solar Inc.. Failure to follow this installation manual will void the warranty.

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5.2 MODULE WIRING

Correct wiring scheme

• When designing the system, avoid forming loops (to minimize risk in the event of an indirect lighting strike). Make sure that wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, then there is a wiring fault.

Correct connection of plug connectors

• Make sure that the connection is safe and tight. The plug connector should not receive outer stress. The connector should only be used to connect the circuit. It should never be used to turn the circuit on and off.

Use of suitable materials

• Use special solar cable and suitable plugs only (wiring should be placed in conduit that is sunlight-resistant or, if exposed, should be sunlight-resistant) in accordance with local fire, building and electrical code. Ensure that they are in perfect electrical and mechanical condition.

• The permitted type of solar cable is single conductor cable listed and labeled as USE-2 or PV Wire , 2.5-10 mm^2 (8-14 AWG), 90℃ wet rated, with proper insulation to withstand the maximum possible system open-circuit voltage. The conductor material should use copper only. Select a suitable conductor gauge to minimize voltage drop.

Cable protection

• Secure the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage with appropriate precautions (e.g. locate them within plastic conduit). Avoid exposure to the direct sunlight.

6.0 MAINTENANCE

• Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots and dust.

• If a module has a sufficient tilt (at least 15^0), it generally is not necessary to clean the modules (rainfall will have a self-cleaning effect). When there is a noticeable buildup of soiling deposits on the module surface, wash the PV array with water and a gentle cleaning implement (a sponge) during the cool part of the day. Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratches.

• If snow is present, a brush with soft bristles can be used to clean the surface of the module.

• Periodically inspect the system to make sure all wiring and supports stay intact.

• If you need electrical or mechanical inspection or maintenance, it is recommended to have a licensed, authorized professional carry out the job to avoid hazards of electric shock or injury.

• Do not change the PV components (diode, junction box, plug connectors).

ANNEX: MECHANICAL AND ELECTRICAL RATINGS

Standard Test Conditions are: irradiance of 1 kW/m^2, AM1.5 spectrum, and cell temperature of 25℃. Pmax of any individual module will be within [0; +5W] of these specified values. Specifications are subject to change without notice.

Table 4: Specifications for CS-series photovoltaic modules under STC

Model Type	Maximum power Pmax<W>	Operating Voltage (Vmp) <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <Kg>	Certification body
CS5A-150M	150.0	35.0	4.29	43.3	4.69	10.00	1595X801X40 (standard Ed1) or 1580 X808X40 (standard Ed2)	15.80 (standard) or 17.50 (MX only)	ETL, UL (not included MX)
CS5A-155M	155.0	35.1	4.42	43.6	4.80	10.00			
CS5A-160M/MX	160.0	35.1	4.55	43.8	4.91	10.00			
CS5A-165M/MX	165.0	35.3	4.68	44.1	5.01	10.00			
CS5A-170M/MX	170.0	35.6	4.78	44.3	5.12	10.00			ETL, CSA (not included MX), UL (not included MX)
CS5A-175M/MX	175.0	35.8	4.89	44.4	5.23	10.00			
CS5A-180M/MX	180.0	36.1	4.99	44.6	5.34	10.00			
CS5A-185M/MX	185.0	36.4	5.09	44.6	5.46	10.00			
CS5A-190M/MX	190.0	36.6	5.19	44.8	5.52	10.00			ETL, CSA (not included MX)
CS5A-195M/MX	195.0	37	5.27	45	5.62	10.00			
CS5A-200M	200.0	37.4	5.35	45.3	5.71	10.00			CSA
CS5A-150P	150.0	34.6	4.33	43.0	4.76	10.00	1595X801X40 (standard Ed1) or 1580 X808X40 (standard Ed2)	15.80	ETL
CS5A-160P	160.0	34.8	4.60	43.4	4.99	10.00			
CS5A-165P	165.0	34.9	4.73	43.7	5.09	10.00			
CS5A-170P	170.0	35.2	4.83	43.9	5.20	10.00			
CS5A-175P	175.0	35.4	4.94	44.1	5.31	10.00			
CS5A-180P	180.0	35.7	5.04	44.2	5.41	10.00			

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Model Type	Maximum power Pmax<W>	Operating Voltage (Vmp) <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <Kg>	Certification body
CS5A-190P	190.0	36.2	5.25	44.4	5.61	10.00			
CS5P-200M	200.0	46.7	4.29	57.8	4.69	10.00	1602X1061X40	21.00	ETL
CS5P-205M	205.0	46.7	4.39	58.0	4.77	10.00			
CS5P-210M	210.0	46.8	4.49	58.2	4.86	10.00			
CS5P-215M	215.0	46.8	4.59	58.4	4.95	10.00			
CS5P-220M	220.0	47.0	4.68	58.8	5.01	10.00			
CS5P-225M	225.0	47.4	4.74	59.0	5.09	10.00			
CS5P-230M	230.0	47.5	4.84	59.1	5.18	10.00			
CS5P-235M	235.0	47.7	4.93	59.2	5.27	10.00			
CS5P-240M	240.0	48.1	4.99	59.4	5.34	10.00			
CS5P-245M	245.0	48.4	5.06	59.5	5.43	10.00			
CS5P-250M	250.0	48.7	5.14	59.6	5.49	10.00			
CS5P-255M	255.0	49.0	5.21	59.8	5.55	10.00			
CS5P-260M	260.0	49.3	5.27	60.0	5.62	10.00			
CS5P-200P	200.0	46.2	4.33	57.3	4.76	10.00	1602X1061X40	21.0	ETL
CS5P-205P	205.0	46.2	4.43	57.5	4.85	10.00			
CS5P-210P	210.0	46.3	4.53	57.7	4.93	10.00			
CS5P-215P	215.0	46.4	4.64	57.9	4.99	10.00			
CS5P-220P	220.0	46.6	4.73	58.3	5.05	10.00			
CS5P-225P	225.0	46.9	4.79	58.6	5.13	10.00			
CS5P-230P	230.0	47.0	4.89	58.7	5.22	10.00			
CS5P-235P	235.0	47.2	4.98	58.8	5.31	10.00			
CS5P-240P	240.0	47.6	5.04	58.9	5.38	10.00			
CS5T-130M	130.0	29.2	4.45	36.3	4.82	10.00	1638X982X40	20.0	CSA
CS5T-135M	135.0	29.3	4.60	36.6	4.95	10.00			
CS5T-140M	140.0	29.5	4.74	36.8	5.08	10.00			
CS5T-145M	145.0	29.8	4.87	37.0	5.21	10.00			
CS5T-150M	150.0	30.1	4.99	37.1	5.34	10.00			
CS6P-160M	160.0	27.9	5.74	35.8	6.46	15.00	1638X982X40	20.0	ETL
CS6P-165M	165.0	28.0	5.90	35.9	6.62	15.00			
CS6P-170M	170.0	28.3	6.01	36.0	6.74	15.00			
CS6P-175M	175.0	28.5	6.15	36.1	6.89	15.00			
CS6P-180M	180.0	28.5	6.31	36.1	7.05	15.00			
CS6P-185M	185.0	28.8	6.42	36.2	7.16	15.00			
CS6P-190M	190.0	28.9	6.57	36.3	7.31	15.00			
CS6P-195M	195.0	29.0	6.73	36.4	7.43	15.00			
CS6P-200M	200.0	29.2	6.86	36.5	7.56	15.00			ETL, CSA
CS6P-205M	205.0	29.2	7.02	36.5	7.66	15.00			
CS6P-210M	210.0	29.3	7.17	36.7	7.77	15.00			
CS6P-215M	215.0	29.3	7.33	36.8	7.89	15.00			
CS6P-220M	220.0	29.5	7.45	36.9	7.97	15.00			
CS6P-225M	225.0	29.7	7.58	37.0	8.07	15.00			
CS6P-230M	230.0	29.9	7.70	37.1	8.22	15.00			
CS6P-235M	235.0	30.1	7.82	37.2	8.34	15.00			CSA
CS6P-240M	240.0	30.2	7.95	37.3	8.46	15.00			
CS6P-245M	245.0	30.3	8.09	37.4	8.61	15.00			
CS6P-250M	250.0	30.4	8.22	37.5	8.74	15.00			
CS6P-255M	255.0	30.5	8.35	37.7	8.87	15.00			
CS6P-260M	260.0	30.7	8.48	37.8	8.99	15.00			
CS6P-160P/PE	160.0	27.6	5.81	35.5	6.56	15.00			ETL
CS6P-165P/PE/PX	165.0	27.7	5.96	35.6	6.73	15.00			
CS6P-170P/PE/PX	170.0	28.0	6.07	35.7	6.85	15.00			
CS6P-175P/PE/PX	175.0	28.2	6.21	35.8	7.00	15.00			ETL, UL (not included PX)
CS6P-180P/PE/PX	180.0	28.2	6.38	35.8	7.16	15.00			
CS6P-185P/PE/PX	185.0	28.5	6.49	35.9	7.27	15.00			

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Model Type	Maximum power Pmax<W>	Operating Voltage (Vmp) <V>	Operating current Imp <A>	Open Circuit Voltage Voc <V>	Short Circuit Current Isc <A>	Max. Series Fuse Rating <A>	Overall Dimension <mm>	Weight <Kg>	Certification body
CS6P-190P/PE/PX	190.0	28.6	6.64	36.0	7.42	15.00	1638X982X40	20.00 (standard) or 22.00 (PX only)	
CS6P-195P/PE/PX	195.0	28.7	6.80	36.1	7.54	15.00			
CS6P-200P/PE/PX	200.0	28.9	6.93	36.2	7.67	15.00			ETL, UL (not incl. PX), CSA (not incl. PE/PX)
CS6P-205P/PE/PX	205.0	28.9	7.09	36.2	7.78	15.00			
CS6P-210P/PE/PX	210.0	29.0	7.25	36.4	7.89	15.00			
CS6P-215P/PE/PX	215.0	29.0	7.40	36.5	8.01	15.00			ETL, UL (not incl. PE/PX), CSA (not incl. PE/PX)
CS6P-220P/PE/PX	220.0	29.2	7.53	36.6	8.09	15.00			
CS6P-225P/PE/PX	225.0	29.4	7.65	36.7	8.19	15.00			
CS6P-230P/PE/PX	230.0	29.6	7.78	36.8	8.34	15.00			
CS6P-235P	235.0	29.8	7.90	36.9	8.46	15.00			CSA, UL
CS6P-240P	240.0	29.9	8.03	37.0	8.59	15.00			
CS6P-245P	245.0	30.0	8.17	37.1	8.74	15.00			
CS6P-250P	250.0	30.1	8.30	37.2	8.87	15.00			
CS6P-255P	255.0	30.2	8.43	37.4	9.00	15.00			
CS6P-260P	260.0	30.4	8.56	37.5	9.12	15.00			
CS6A-160M	160.0	23.3	6.86	29.2	7.56	15.00	1324X982X40	16.00	ETL
CS6A-165M	165.0	23.4	7.06	29.2	7.71	15.00			
CS6A-170M	170.0	23.5	7.24	29.4	7.80	15.00			
CS6A-175M	175.0	23.6	7.41	29.5	7.92	15.00			
CS6A-180M	180.0	23.8	7.58	29.6	8.07	15.00			
CS6A-185M	185.0	23.9	7.74	29.7	8.26	15.00			
CS6A-190M	190.0	24.1	7.87	29.8	8.38	15.00			
CS6A-160P/PE	160.0	23.1	6.93	28.9	7.67	15.00	1324X982X40	16.00	ETL
CS6A-165P/PE	165.0	23.1	7.13	29.0	7.82	15.00			
CS6A-170P/PE	170.0	23.2	7.32	29.2	7.92	15.00			
CS6A-175P/PE	175.0	23.4	7.49	29.3	8.04	15.00			
CS6A-180P/PE	180.0	23.5	7.65	29.4	8.19	15.00			
CS6A-185P/PE	185.0	23.7	7.82	29.4	8.39	15.00			
CS6A-190P/PE	190.0	23.9	7.95	29.6	8.50	15.00			
CS6X-250P	250.0	34.7	7.21	43.6	7.85	15.00	1954X982X40	27.00	CSA
CS6X-255P	255.0	34.8	7.33	43.7	7.95	15.00			
CS6X-260P	260.0	34.9	7.45	43.8	8.04	15.00			
CS6X-265P	265.0	35.1	7.55	43.9	8.10	15.00			
CS6X-270P	270.0	35.3	7.65	44.1	8.19	15.00			
CS6X-275P	275.0	35.5	7.76	44.1	8.31	15.00			
CS6X-280P	280.0	35.6	7.86	44.2	8.42	15.00			
CS6X-285P	285.0	35.8	7.96	44.3	8.53	15.00			
CS6X-290P	290.0	35.9	8.08	44.4	8.64	15.00			
CS6X-295P	295.0	36.0	8.19	44.5	8.76	15.00			
CS6X-300P	300.0	36.1	8.30	44.6	8.87	15.00			
CS6X-305P	305.0	36.3	8.41	44.8	8.97	15.00			
CS6X-260M	260.0	35.3	7.37	44.1	7.92	15.00	1954X982X40	27.00	CSA
CS6X-265M	265.0	35.5	7.47	44.3	7.98	15.00			
CS6X-270M	270.0	35.6	7.58	44.4	8.07	15.00			
CS6X-275M	275.0	35.8	7.68	44.5	8.19	15.00			
CS6X-280M	280.0	36.0	7.78	44.6	8.30	15.00			
CS6X-285M	285.0	36.1	7.89	44.7	8.40	15.00			
CS6X-290M	290.0	36.3	8.00	44.7	8.51	15.00			
CS6X-295M	295.0	36.4	8.11	44.9	8.63	15.00			
CS6X-300M	300.0	36.5	8.22	45.0	8.74	15.00			
CS6X-305M	305.0	36.6	8.33	45.2	8.84	15.00			
CS6X-310M	310.0	36.7	8.44	45.3	8.95	15.00			

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