



Solar Module Installation Manual

GENERAL INFORMATION

This is the general installation, maintenance and use manual for the CS-Series Solar Modules. The word "module" or "PV module" as used in this manual refers to one or more CS-Series Solar Modules. This manual provides important safety information regarding the installation, maintenance and use of the modules that the user and the professional installer should read carefully and follow. Failure to follow these instructions may result in death, bodily injury or damage to property. The installation of solar modules requires specialized skills and should only be performed by qualified, licensed professionals. *Please retain this manual for future reference.*

DISCLAIMER OF WARRANTIES

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LIMITATION OF LIABILITY

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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 the module is 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. To the maximum extent permitted by applicable law, the installer assumes the risk of all personal injury or property damage that might occur during the installation and handling of modules.

General safety

- Do not connect or disconnect modules when current from the modules or an external source is present.
- 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. Wear suitable protection (non-slip gloves, clothes, etc.) to prevent direct contact with 30V DC or greater.
- 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.
- There are no user serviceable parts within the PV module. Do not attempt to repair any part of the module.
- Do not disassemble the module or remove any part installed by the manufacturer.
- Remove all metallic jewellery prior to installing this product to reduce the chance of accidental exposure to live circuits.
- Use electrical insulated tools to reduce your risk of electronic shock.
- If the front glass is broken, or the back sheet is torn, contact with any module surface or the frame can cause electric shock.
- Do not install or handle the modules when they are wet or during periods of high wind.
- Do not use or install broken modules.
- Do not artificially concentrate sunlight on a module.
- Keep the junction box cover closed at all times.

MECHANICAL / ELECTRICAL SPECIFICATIONS

Under certain conditions, a module may produce more current or voltage than its Standard Test Conditions (STC) rated power. Accordingly, 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.

Lowest Expected Ambient Temperature (°C/°F)	Correction Factor
25 to 10 / 77 to 50	1.05
9 to 0 / 49 to 32	1.10
-1 to 10 / 31 to 14	1.15
-11 to 20 / 13 to -4	1.20
-21 to 40 / -5 to -40	1.30

Table 1. Low Temperature Correction Factors Table for Open-Circuit Voltage

Table 2 presents the electrical and mechanical characteristics of Canadian Solar Inc. crystalline silicon PV modules, and the major electrical characteristics at STC appear on each module label.

Model Number	Open Circuit Voltage (Voc) <V>	Short Circuit Current (Isc) <A>	Operating Voltage (Vmp) <V>	Current at Rated Operating Voltage (Imp) <A>	Rated Power (Pmax) <W>	Overall Dimension <mm>	Weight <Kg>
CS4C-90	43.2	2.85	34.4	2.62	90	1320X664X40	10.5
CS4C-100	43.2	3.2	34.4	2.92	100		
CS4D-30	21.6	1.94	17.2	1.75	30	1006X454X35	7
CS4D-40	21.6	2.58	17.2	2.33	40		
CS4D-50	21.6	3.2	17.2	3	50		
CS4D-60	21.6	3.79	17.2	3.49	60		
CS5A-150	43.2	4.74	34.8	4.31	150	1595X801X40	15.5
CS5A-155	43.4	4.86	34.8	4.45	155		
CS5A-160	43.6	4.97	34.9	4.58	160		
CS5A-165	43.8	5.08	35.2	4.69	165		
CS5A-170	44.1	5.19	35.5	4.79	170		
CS5A-175	44.3	5.29	35.8	4.89	175		
CS5A-180	44.5	5.40	36.1	4.99	180		
CS5A-185	44.7	5.50	36.4	5.09	185		
CS5A-190	44.9	5.60	36.6	5.18	190		
CS5B-130	43.2	4.11	34.4	3.78	130		
CS5B-140	43.2	4.42	34.4	4.07	140		
CS5B-150	43.2	4.74	34.4	4.36	150		
CS5B-160	43.2	5.06	34.4	4.66	160		
CS5B-170	43.2	5.38	34.4	4.95	170		
CS5B-180	43.2	5.7	34.4	5.24	180		
CS5B-190	43.2	6.02	34.4	5.52	190		
CS5C-75	21.6	4.74	17.4	4.31	75	1213X547X35	8
CS5C-80	21.8	4.97	17.5	4.58	80		
CS5C-85	22	5.19	17.7	4.79	85		
CS5C-90	22.2	5.40	18	4.99	90		
CS5C-95	22.5	5.60	18.3	5.18	95		
CS5E-13	21.3	0.87	17.2	0.76	13	620×284×25	2.5
CS5E-14	21.3	0.92	17.2	0.81	14		
CS5E-15	21.4	0.97	17.3	0.87	15		
CS5E-18	21.5	1.15	17.4	1.04	18		

Model Number	Open Circuit Voltage(Voc) <V>	Short Circuit Current(Isc) <A>	Operating Voltage (Vmp) <V>	Current at Rated Operating Voltage (Imp) <A>	Rated Power (Pmax) <W>	Overall Dimension <mm>	Weight <Kg>
CS5E-20	21.8	1.24	17.5	1.15	20	446 X284 X 25	1.6
CS5E-22	22.1	1.33	17.7	1.24	22		
CS5F-8	21.3	0.54	17.2	0.47	8		
CS5F-10	21.4	0.66	17.3	0.58	10		
CS5F-12	21.5	0.78	17.3	0.69	12		
CS5F-13	21.5	0.83	17.4	0.75	13		
CS5F-14	21.8	0.88	17.5	0.80	14		
CS5F-15	22	0.92	17.8	0.84	15		
CS5P-200	57.4	4.78	46.4	4.31	200	1602X1061X40	20
CS5P-205	57.6	4.86	46.5	4.41	205		
CS5P-210	57.9	4.94	46.6	4.51	210		
CS5P-215	58.1	5.02	46.7	4.61	215		
CS5P-220	58.4	5.10	46.9	4.69	220		
CS5P-225	58.6	5.18	47.2	4.76	225		
CS5P-230	58.8	5.25	47.5	4.84	230		
CS5P-235	59.1	5.33	47.8	4.92	235		
CS5P-240	59.3	5.40	48.1	4.99	240		
CS5P-245	59.6	5.47	48.4	5.06	245		
CS5P-250	59.8	5.54	48.7	5.14	250		
CS6A-140	28.7	6.72	23	6.08	140	1324X982X40	16
CS6A-145	28.8	6.92	23	6.29	145		
CS6A-150	28.8	7.12	23.1	6.50	150		
CS6A-155	28.8	7.32	23.1	6.71	155		
CS6A-160	28.9	7.51	23.1	6.92	160		
CS6A-165	29	7.69	23.1	7.13	165		
CS6A-170	29.2	7.85	23.2	7.33	170		
CS6A-175	29.3	8.03	23.4	7.49	175		
CS6A-180	29.4	8.20	23.6	7.62	180		
CS6A-185	29.5	8.37	24	7.71	185		
CS6A-190	29.6	8.54	24.2	7.84	190		
CS6A-195	29.6	8.72	24.4	7.98	195		
CS6C-105	21.5	6.74	17.3	6.08	105	1485X666X40	12
CS6C-110	21.6	7.01	17.3	6.36	110		
CS6C-115	21.6	7.28	17.3	6.64	115		
CS6C-120	21.7	7.52	17.3	6.92	120		
CS6C-125	21.8	7.75	17.4	7.20	125		
CS6C-130	22	7.96	17.5	7.43	130		
CS6C-135	22	8.20	17.7	7.62	135		
CS6C-140	22.1	8.42	18	7.76	140		
CS6C-145	22.2	8.65	18.3	7.93	145		
CS6D-55	21.6	3.45	17.3	3.18	55	783X666X35	12
CS6D-60	21.7	3.72	17.4	3.46	60		
CS6D-65	22	3.96	17.6	3.70	65		
CS6D-70	22.1	4.21	18	3.88	70		
CS6P-175	35.9	6.80	28.7	6.10	175	1638X982X40	20
CS6P-180	35.9	6.98	28.7	6.26	180		
CS6P-185	36	7.16	28.8	6.43	185		
CS6P-190	36	7.33	28.8	6.60	190		
CS6P-195	36.1	7.51	28.8	6.76	195		
CS6P-200	36.2	7.68	28.9	6.93	200		
CS6P-205	36.2	7.80	28.9	7.10	205		
CS6P-210	36.4	7.91	28.9	7.26	210		
CS6P-215	36.5	8.01	29	7.43	215		

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CS6P-220	36.6	8.09	29.3	7.52	220		
CS6P-225	36.7	8.19	29.5	7.63	225		
CS6P-230	36.8	8.34	29.8	7.71	230		
CS6P-235	36.9	8.47	30.1	7.82	235		
CS6P-240	37	8.61	30.4	7.91	240		
CS6P-245	37	8.75	30.7	7.99	245		

Table 2. Specifications for CS-series photovoltaic modules.

Standard Test Conditions are: irradiance of 1 kW/m², AM 1.5 spectrum, and cell temperature of 25°C. Pmax, Voc and Isc of any individual module will be ±2.5% of these specified values. Specifications are subject to change without notice.

UNPACKING THE MODULES AND STORAGE



Precautions and General Safety

- The utmost care is required when handling the modules. Be careful when unpacking, transporting and storing the modules.
- Do not allow children and unauthorized persons near the installation site or storage area of modules.
- Do not transport modules in an upright position.
- Carry a module by its frame with two or more people. Do not use the connection cables as handles.
- Do not drop or place objects on the modules (such as tools.)
- Do not carry a module by its wires or junction box.
- Ensure modules do not bow under their own weight.
- Do not stand on, step on, or scratch the modules.
- Do not place modules on top of each other.
- Do not subject the modules to load.
- Do not mark the modules using sharp implements.
- Never leave a module unsupported or unsecured.
- Do not change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry.
- If it is necessary to store the modules temporarily, a dry, ventilated room should be used.

INSTALLING THE MODULES



Precautions and General Safety

- Before installing modules, contact the appropriate authorities to determine permissions, installation and inspection requirements to follow that apply to your site and installation.
- Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) where the modules are being installed has enough strength.
- When installing the modules, please ensure the assembly is mounted over a fire resistant roof covering rated for the application and required a slope less than 5in/ft (127mm/305mm) to maintain a fire class rating.

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.

- The module must not be installed in the proximity of highly flammable gases and vapours (e.g., filling stations, gas containers, paint equipment).
- The module must not be installed near naked flames or flammable materials.
- Do not expose modules to artificially concentrated light sources.
- The module must not be immersed in water (either fresh or salt) or constantly be exposed to water (either fresh or salt) (i.e. from fountains, sea spray).
- If there is exposure to salt (i.e., marine environments) and sulphur (i.e., sulphur sources, volcanoes); there is a risk of 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. The modules must not be connected together to create a voltage higher than the permitted system voltage.
- In order to avoid (or minimize) mismatch effects in arrays, it is recommended that similar electrical performance of modules should be connected in same series.
- The recommended maximum series fuse rating is tabulated in table 2.
- To minimize risk in the event of an indirect lightning strike, avoid forming loops when designing the system.
- Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads.
- Precipitation can run out through small openings on the underside of the module. Make sure that these openings are not obstructed after mounting.

Optimum orientation and tilt

- To achieve the maximum annual yield, determine the optimum orientation and tilt of the PV modules. 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 between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. This also allows any condensation or moisture to dissipate. Clearance of 1/4 of an inch or more between modules is required to allow for thermal expansion of the frames.

Grounding

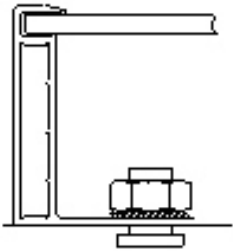
- Although the modules are certified to safety class II, it is recommended that they be grounded. Ensure to comply with all local electrical codes and regulations.
- The earth grounding connection should be made by a qualified electrician.
- Connect module frames to each other using cables with cable lugs. Holes provided for this purpose are identified with a green label. Use a serrated washer or a self-tapping screw to create the conductive connection.
- All the junctions on the conductive connection must be fixed. Metal containing iron in the conductive connection should be treated against corrosion by anodization, spray-painting, or galvanization to prevent rusting and corrosion. Stainless steel does not need to be treated.

MOUNTING INSTRUCTIONS

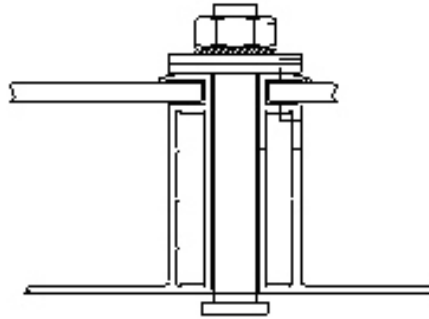
- Modules should be bolted to support structures through mounting holes located in the frame's back flanges only (see Example A). Do not drill additional holes. Doing so will void the warranty. Each module must be securely fastened at a minimum of 4 points. If additional wind or snow loads are anticipated for this installation, additional mounting points should be used. System designer and installer are responsible for load calculations and for proper design of support structure.
- Use appropriate corrosion-proof fastening materials.

- Top or bottom clamping methods will vary (see Example B) and are dependent on the mounting structures. Follow mounting guidelines recommended by the PV mounting supplier.
- The mounting design must be certified by a registered professional engineer. The mounting design and procedures shall comply with local codes and all authorities having jurisdiction.

Example A:
Bolting



Example B:
Clamping on



- Use a torque wrench for installation. The above figure shows methods of fastening module to support structure. In Example B, the tightening torque (using stainless steel M8 bolts) is 17 Nm.

MODULE WIRING

Correct wiring scheme

- When designing the system, avoid forming loops (to minimize risk in the event of an indirect lighting strike). Check that wiring is correct before starting up the system. If the measured open circuit voltage (V_{oc}) and short-circuit current (I_{sc}) 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. Wiring should be placed in conduit that is sunlight-resistant or, if exposed, should be sunlight-resistant type UF cable, 8-14 AWG (9-3mm², 90°C wet rated in accordance with local fire, building and electrical code) and suitable plugs only. Ensure that they are in perfect electrical and mechanical condition. Use only single-wire cables. 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 using suitable precautions (e.g. locate them within plastic conduit). Avoid exposure to direct sunlight.

MAINTENANCE

- Do not change the PV components (diode, junction box, plug connectors).
- Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dust and dirt spots.
- Given a sufficient tilt (at least 15°), it is not generally 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 using water without cleaning agents and a gentle cleaning implement (a sponge), during the cool 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 inspection or maintenance to avoid hazards of electric shock or injury.



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