ClearVue Technologies Ltd
ACN 071 397 487

CLEARVUE TECHNOLOGIES LIMITED

DOUBLE GLASS PV PANELS INSTALLATION MANUAL

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Suite 9 / 567 Newcastle Street, West Perth, Western Australia 6005
P: +61 8 9220 9020 F: +61 8 9220 9029 E: hello@clearvuepv.com W: www.clearvuepv.com

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Document Information	
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Modules covered in this Manual

CPV-SP-PERC-108H-xxxW (xxx= 350-365, in steps of 5)
CPV-SP-PERC-90H-xxxW (xxx= 290-300, in steps of 5)
CPV-SP-PERC-72H-xxxW (xxx= 230-240, in steps of 5)
CPV-SP-PERC-60H-xxxW (xxx= 190-200, in steps of 5)
CPV-SP-SHG-S460-xxxW (xxx= 345-360, in steps of 5)
CPV-SP-SHG-S368-xxxW (xxx= 275-285, in steps of 5)
CPV-SP-SHG-F380-xxxW (xxx= 365-395, in steps of 5)
CPV-SP-SHG-F296-xxxW (xxx= 285-310, in steps of 5)

Table of Contents

1 The Purpose

This installation manual provides installation instructions for the double glass solar modules (hereinafter referred to as PV modules) of ClearVue Technologies Ltd (hereinafter referred to as "ClearVue" or “CPV”), and describes the installation and maintenance related to the modules. The installation of the modules shall be strictly carried out by professional technicians. Please read this manual carefully before installation.

2 Disclaimer

This Installation Manual contains critical information regarding electrical and mechanical installation and safety information which you should know before starting installation.

This manual does not list all precautions needed for safe work. Be sure to follow local Occupational Safety and Health (OSH) guidelines. ClearVue is not responsible for any form of injury, including but not limited to module installation and operation, and physical injury and property damage caused by whether it is in accordance with the instructions in this manual.

The information in this manual is based on ClearVue’s knowledge and experience, however, the information and suggestions do not constitute a warranty.

ClearVue Technologies Ltd reserves the right to make changes to the product, specifications and installation manual without prior notice.

This manual provides guidelines for installation, but it does not guarantee the quality of installation work. Please complete all work in a responsible and professional manner. Electrical work should be performed by a qualified electrician. The installer should comply with safety precautions listed in this manual and local law regulations when installing the modules.

According to IEC61730 standard, the safety class of solar module is class II; the fire protection grade of solar module is class A.

Please email us via hello@clearvuepv.com or call at +61 (8) 9220 9020 if there are any questions.

3 Safety Considerations

3.1 General Safety Considerations

1) When design a PV system, be sure to take the voltage changes at different temperature into consideration (Please check the temperature coefficient of each module in the product specifications. The variable output voltage of the module shall increase when the temperature drops).

2) We require that each string of PV modules be fused before connected to other modules strings. For the maximum fuse rating, please refer to the parameters in the product specifications.
3) The PV modules generate electricity under exposure to the light source. Array of solar modules can cause fatal electric shock or burns. Personnel who are not authorized or trained should not touch PV modules.
4) Use a properly insulated tool and appropriate protective equipment to reduce the risk of electric shock.
5) Do not tread or stand on the modules.
6) Do not damage or scratch the front or back of the modules.
7) It is strictly forbidden to use a module with damaged glass or top substrate. Do not try to repair the damaged modules, otherwise touch the surface of the modules may cause electric shock.
8) Do not disassemble the modules or remove any component of the modules.
9) Keep the plug connectors clean and do not use stained or damaged plugs.
10) Do not install or operate the modules when wet or in windy days.
11) Do not connect the positive end of a single PV module to the positive end of the cable.
12) Make sure there is no gap between the individual insulation washers of the connectors. Otherwise it may cause fire or electric shock.
13) Make sure that the polarity of each module or module string is not opposite of the other modules or module strings.
14) Do not artificially gather sunlight on these solar modules.
15) The maximum system voltage shall not exceed 1000V DC according to the National Electrical Code for roof and facade applications.
16) Under normal circumstances, the current or voltage produced by the PV Modules may be higher than those in standard tests under certain conditions. Please follow the relevant requirements of the United States National Electrical Code (NEC) Article 690 to handle the situations where the output value is higher than the standard report value. If the installation conditions do not meet NEC's requirements, multiply the I_{sc} and V_{oc} values marked by this module by a coefficient of 1.25, to determine the module's voltage rating, the conductor current carrying capacity, the overcurrent protector's rating, and the size of the control device connected to the PV module's output terminal.
17) The installation should be carried out in accordance with the Canadian Electrical Code Part I: Electrical Installation Safety Standards CSA C22.1 for applications in Canada.
18) The exposed components of the conductive parts should be grounded in accordance with the instructions below and the United States National Electrical Code, or as a violation of UL 1703 for applications in North America.
19) For the Australian market, Building Integrated PV module installation must comply with the requirements of the National Construction Code and AS/NZS 5033.

20) T98max rating: 70°C. The module is designed to operate safely up to this temperature under 98% exposure conditions (IEC 61730/61215). Installers must ensure that the installation environment and method do not expose modules to sustained operating temperatures exceeding this limit.

3.2 Fire Safety

1) Follow the local guidelines, codes and requirements for fire safety.
2) The installation of a PV system on a building may affect fire safety of the building.
3) Do not install or use the PV modules near hazardous locations where flammable gases or vapors can be generated or collected.
4) PV modules mounted on buildings will continue to produce hazardous DC voltage in case of a fire, even in the following cases
    - Low-light density
    - Disconnected line between PV modules and inverter
    - Partly or entirely damaged modules
    - Damaged DC cabling
5) Stay away from the PV system during and after a fire
6) Inform the fire fighters about the particular hazards from the PV system
7) After the fire, have your installer bring the PV system in a safe mode (if possible)
8) The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.

3.3 Recommended tools and equipment for safe installation

The below tools and equipment are recommended but not limited to: Vacuum suction cups

1. Measuring tape
2. Spirit level
3. Marker or pencil
4. Cordless drill with bits
5. Torque wrench
6. Screwdrivers (assorted sizes)
7. Rubber mallet
8. Utility knife

9. Safety glasses
10. Slip-proof gloves
11. Hard hat
12. High-visibility vest
13. Safety harness (if working at heights)
14. Wall-mount brackets (aluminium or rust-proof materials)
15. Multimeter
16. Cable stripper and cutter
17. Crimping tool
18. Insulated screwdrivers
19. Ladders or scaffolding
20. Soft cloth and water (for cleaning panels)

It is always the PV installer's responsibility to select required tools and equipment subject to local OHS policies on a case-by-case basis.

3.4 Risk assessments

Risk Category	Potential Risk	Mitigation Measures
Electrical Risks	Electric shock during handling or installation	Use insulated tools and wear rubber gloves. Ensure all wiring is de-energized before work.
	Faulty polarity connections causing damage	Double-check polarity (positive-to-positive, negative-to-negative) before energizing the system.
Mechanical Risks	Panel damage due to improper handling or dropping	Use vacuum cups and have two people handle panels for stability.
	Loose or poorly mounted brackets	Tighten all fasteners to specified torque and inspect mounting structures.
Environmental Risks	Water ingress due to insufficient sealing	Apply weatherproof sealant to all panel edges and inspect for gaps post-installation.
	Overheating due to inadequate ventilation	Maintain a minimum clearance of 100mm between the panel and the mounting surface.
Fire Risks	Electrical arcing or short circuits	Use certified connectors and check cable insulation. Perform electrical testing after installation.
General Safety Risks	Falls or injuries during installation at height	Use safety harnesses and comply with local workplace safety regulations.

4 Unpacking and Storage Considerations

1) The storage place should be flat and indoor warehouse, not exposed to rain.
2) The boxes can be stacked for 2 layers. But do not place unpacked boxes in the lower layer.
3) When stored, modules can't be bent and should be kept in the same flatness. And do not stack multiple modules horizontally.
4) Modules shall keep indoors. When modules have to be placed outdoors in particular cases, please cover modules with waterproof to avoid soaking or damage.
5) When unpacking, please use both hands to move modules.
6) Be careful when double glass PV modules are moved. Slip-proof gloves are required for moving and installation.

5 Environmental Conditions and Site Selection

5.1 Climate Environment

ClearVue double glass PV modules should be installed in the following conditions:

- Ambient temperature: - 40 ℃ to +40 ℃
- Operational temperature: - 40 ℃ to +70℃
- Storage temperature: - 20 ℃ to +40 ℃
- Humidity: < 85%
- Mechanical load: The mechanical load capacity of modules (including wind load and snow load) depends on the installation methods of the modules. And it should be approved by professional structural or façade engineer in accordance with local building standards.

5.2 Site Selection

1) In most of use conditions, ClearVue modules should be installed at the location with a full irradiation of sunshine and will not be blocked at any time.
2) Please do not install under corrosive environment.
3) Do not install modules in the position where may be soaked or constantly exposed to sprinklers or the fountain.
4) Do not install modules near open flame or flammable objects.
5) Do not install modules directly on the wall or the wall. The fixed bracket must be used and the edges of modules or the gap between the surface and the wall or the wall shall not less than 100mm.

6 Installation

6.1 General Rules of Installation

1. Use a building framing (or mullion) system made of durable, rust-proof, and UV-resistant materials to ensure longevity and reliability.
2. Ensure modules are firmly secured on the brackets to prevent movement or damage.
3. Position the PV system at a height that prevents from being shaded by adjacent buildings, plants, traffic or any other obstructs.
4. Verify the modules are properly fixed to withstand strong winds and heavy snow. Allow a minimum 50mm clearance (to be designed by architect or façade engineer) between the module back and the installation surface for proper ventilation and cooling. This gap dissipates heat generated during sunlight, reducing thermal stress and maintain energy efficiency.
5. Account for thermal expansion of the brackets by maintaining a typical gap of 16mm between adjacent modules.
6. Allow for installation tolerance between aluminium mounting system and structural members.
7. Follow the manufacturer's instructions and safety guidelines included with the framing system.
8. Avoid drilling holes on the module's glass surface to preserve the warranty and ensure safety.
9. Evaluate the structural suitability of the wall before installation and seal any penetrations to prevent potential water leakage.
10. Select framing and mounting structures designed to resist local design loads, adhering to structural safety standards.
11. Adhere to the Glass Association of North America (GANA) Glazing Manual for all glazing mounting practices related to the PV glass panels for applications in North America. The manual is available from ClearVue at no charge.
12. Mounting Limitations
    - **Permissible Slope (Tilt Angle) Standard Range**: Modules are designed for installation between **[0° – 90°] tilt** from horizontal.
        - Minimum Slope of 5°is required for adequate drainage and self-cleaning to prevent water pooling, soiling, and potential PID (Potential Induced Degradation).
        - Maximum Slope of vertical (90°) installation is permissible for façade applications when ventilation and drainage are maintained.
    - **Permissible Orientation:** Modules are compatible with any azimuth between 0° – 360°.
    - **Limitations & Prohibited Configurations**
        - Do not install modules in a manner that creates **permanent shading**, water traps, or obstructed airflow.

- Avoid installations where slope is below **3°** without additional drainage or cleaning provisions.
- Modules must not be mounted at orientations or slopes that result in **temperature rise exceeding T98max** under expected site conditions.

- **Special Considerations for BIPV**

  When integrated into façades, ensure the building envelope design includes:

  - Drainage paths for vertical or low-slope areas, unless otherwise
  - Maintenance access for cleaning and inspection.
  - Thermal and structural assessment to prevent stagnation zones.

- **Installer Responsibility**

  - Verify compliance with project-specific design documentation and local standards (AS/NZS 5033, NCC).
  - Record installed slope and orientation in the handover report for CEC compliance auditing.

6.2 Installation

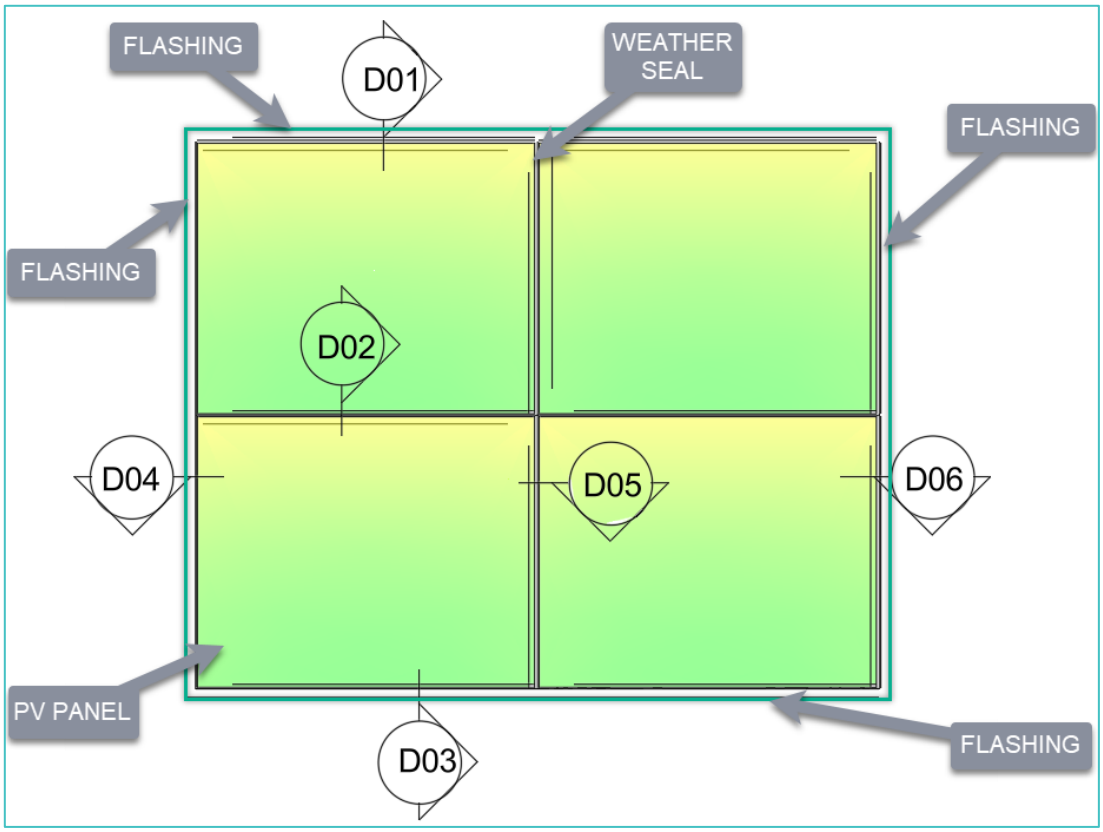
6.2.1 Installation Considerations

ClearVue PV panels are recommended to have a four-sided support to provide a robust structural capacity against design loads.

Design load – max. +3600 Pa / -1600 Pa

6.2.2 Installation process

The below image shows the configuration of panels with a typical view of a 2 x 2 (4 panels) elevation.



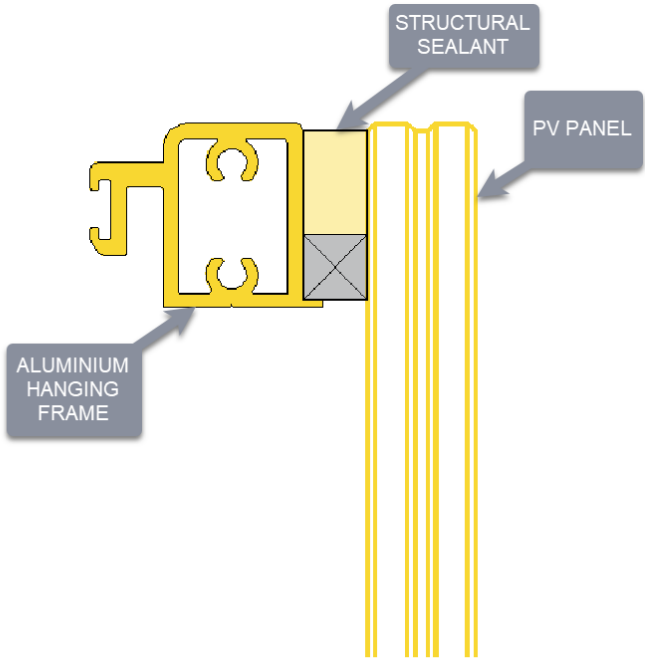
Four Panel Layout (TYP 2 x 2 Façade)

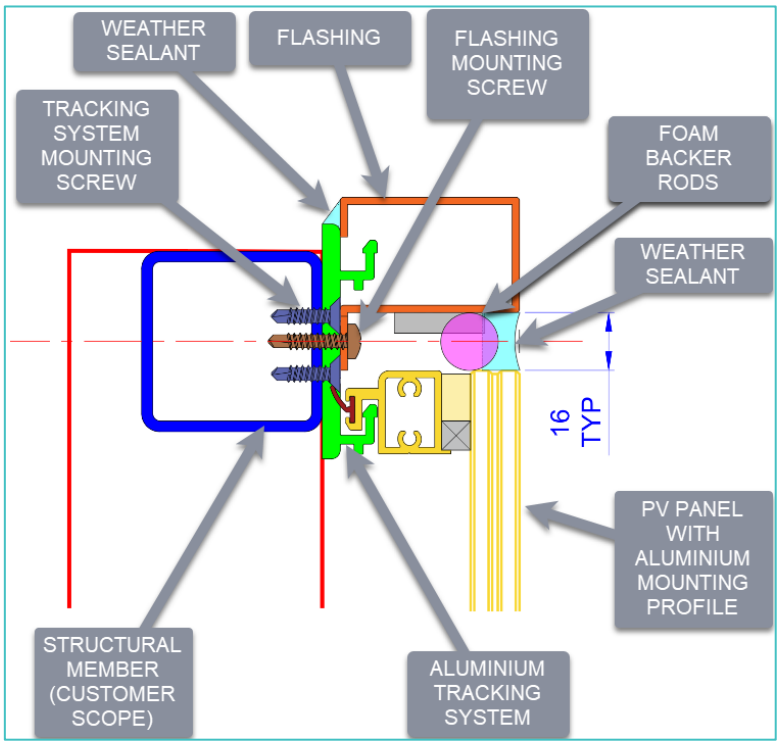
The followings section shows the details of the installation. The section diagrams below are colour coded to differentiate the different assembly components. The table below shows the purpose and additional details related to each of the components in the assembly.

NO.	Name	Purpose	Note
1	Tracking system	Positioned on the exterior side of PV panel for connection to structural members	TYP. 5mm thick Alum plate
2	Safety footing	Provide additional structural support to PV panels	Nos. of the aluminum footing plates are subject to engineer's approval
3	PV panel	Architectural PV glass to generate power	Min. 3mm+3mm laminated. Glass composition and thickness are subject to engineer's approval
4	Weather sealant (Black)	Applied to both exterior and interior edges of PV	

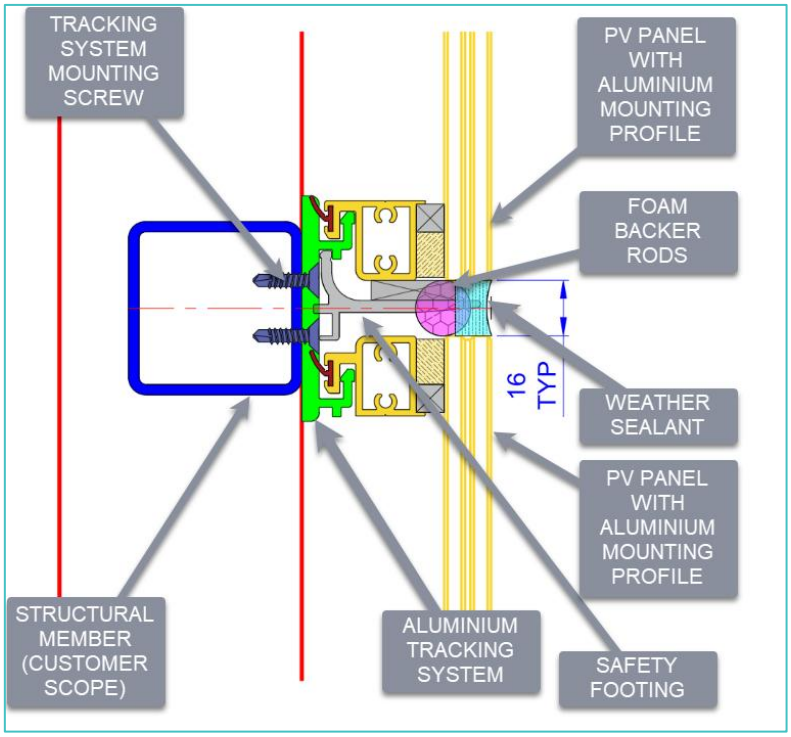
		panel for waterproofing and weather protection.	
5	Flashing	Decorative plat layer for façade finish, edge seal and aesthetics	TYP 2mm thick aluminum plate
6	Foam backer rods	Fill the gaps between PV panels that are needed to be joined for construction and control weather sealant depth.	

The framed panel received from factory will have following parts preinstalled.





Section D01



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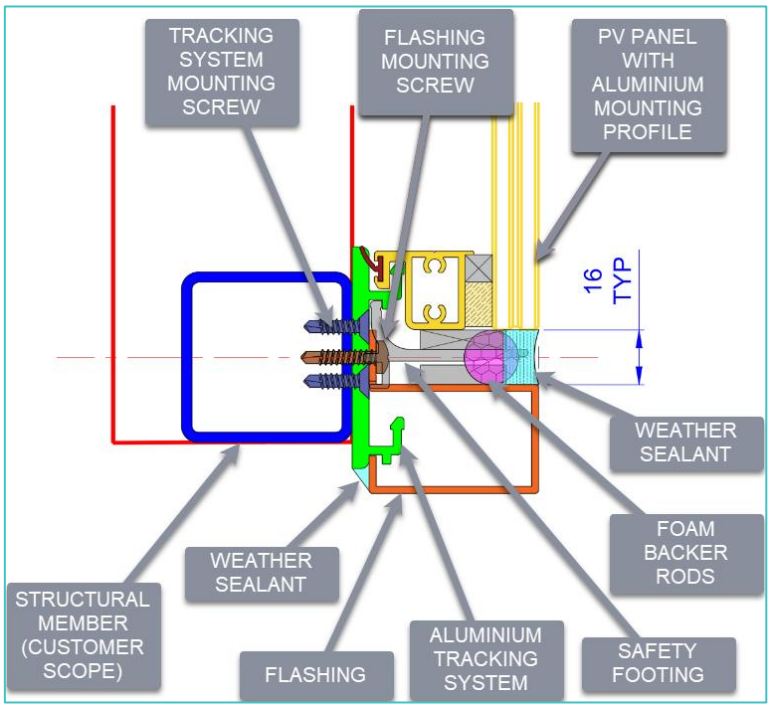

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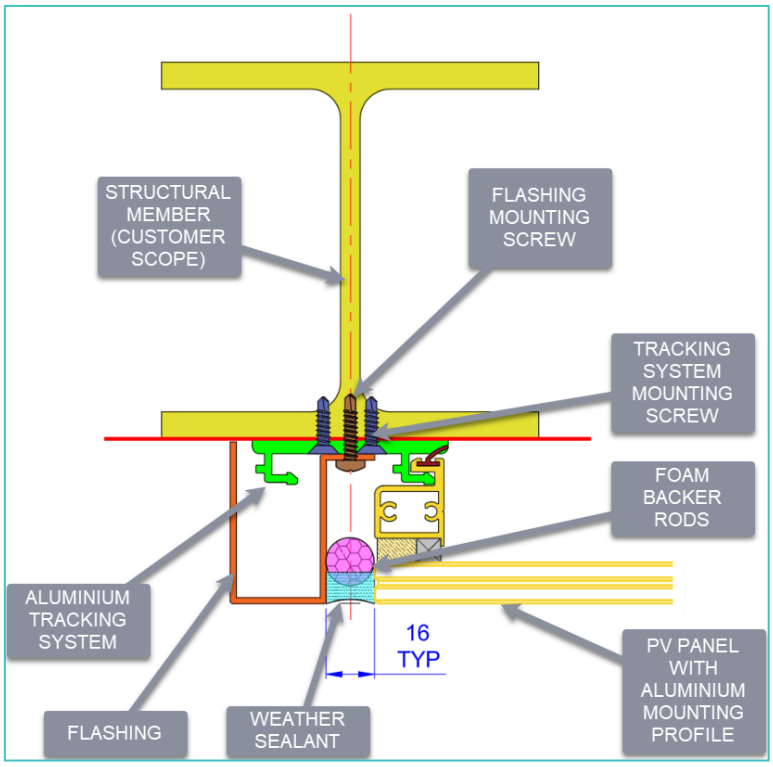
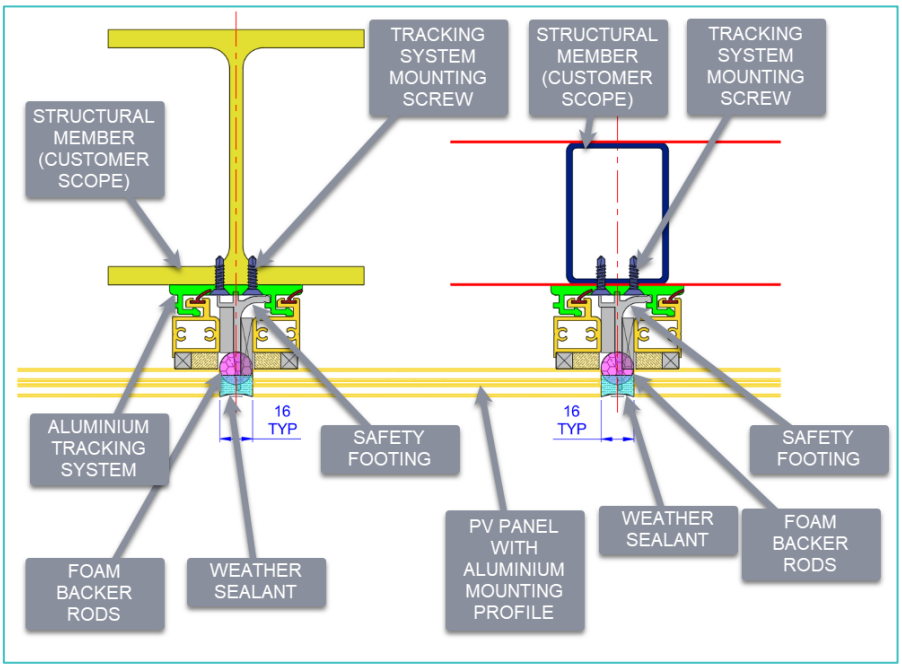
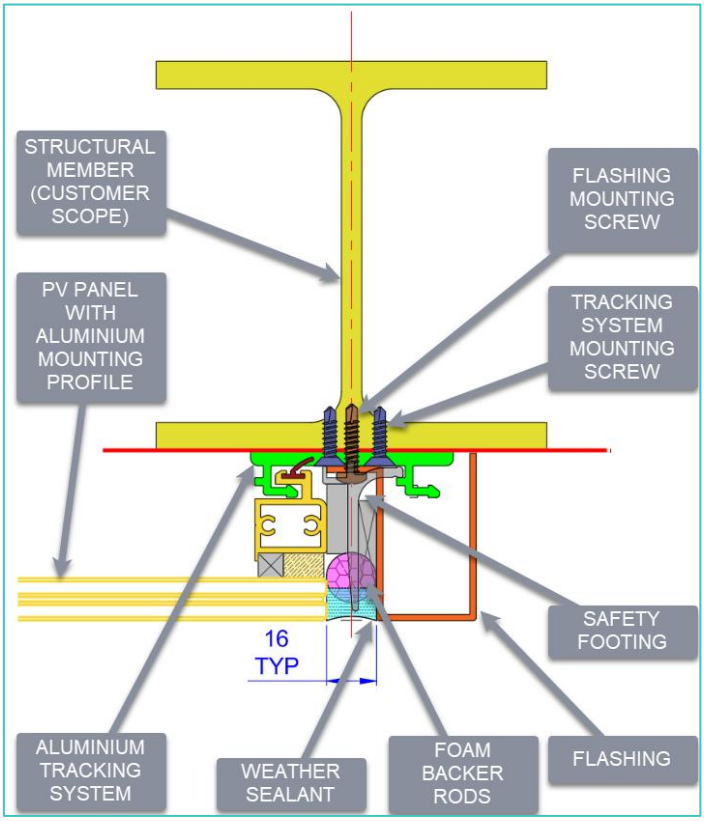


Section D04



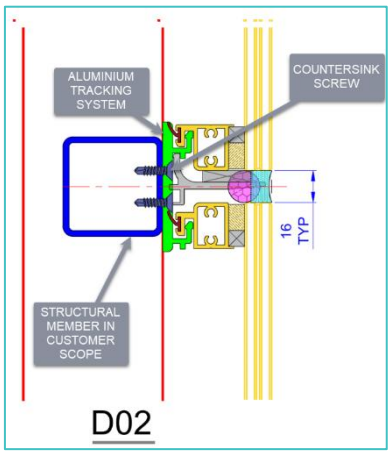
Section D05



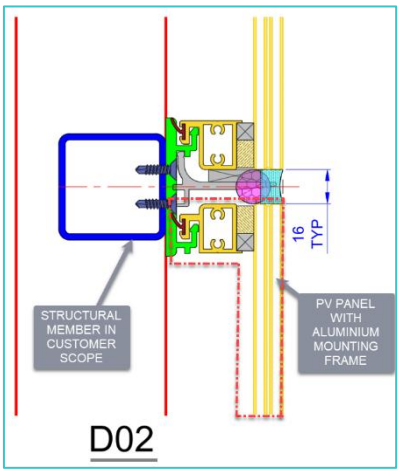
Section D06

The following nine steps outline the installation process. For simplicity, these steps are demonstrated on section D02; however, the process is identical for all other sections.

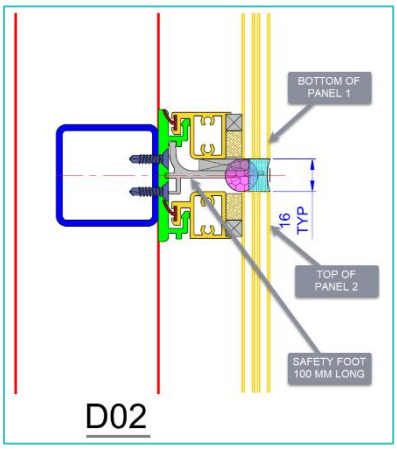
1. Qualified electrician shall perform 100% site inspection to make sure each individual panel is functional prior to panel installation.
2. The **aluminium tracking system** is first fixed to the structural members (steel, aluminium, timber or concrete, etc) of a façade, curtainwall or roof. Proper alignment and support ensure the frame can bear the weight of the PV panel.



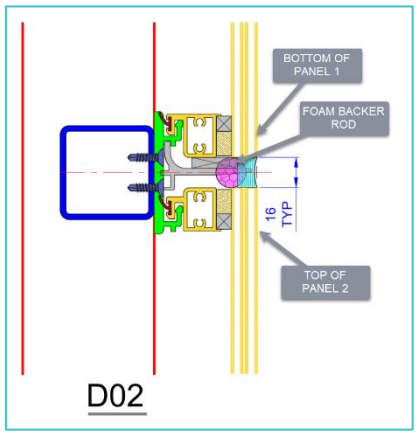
3. Fasteners secure the mounting system directly to the wall. The mounting system is a TYP. 5 mm aluminium extrusion plate also called tracking system.
4. This plate is fixed using countersink SS screws horizontally and vertically as per the size of the panel.
5. Ensure waterproofing at penetration points to prevent leakage
   The PV panel with the aluminium mounting frame (structural sealant applied between PV panel and mounting system during manufacturing) is mounted and aligned. The panel is lifted using vacuum cups or machinery by technician and placed on the mounting slot of the mounting system as shown in the section D02.



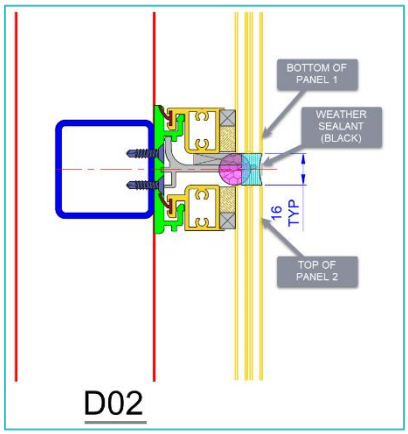
6. Once secured vertically they are slided to get in to position and this get constrained horizontally.
7. Cabling and wiring – details are stated in Section 8.
8. An aluminium plate called safety foot is inserted at bottom of the panel for support. This plate is TYP 100 mm long and generally 3 per panel is used for a 1500 long panel. However, the quantity used shall be approved by a qualified engineer as per the size of the panel, weight and local design conditions.



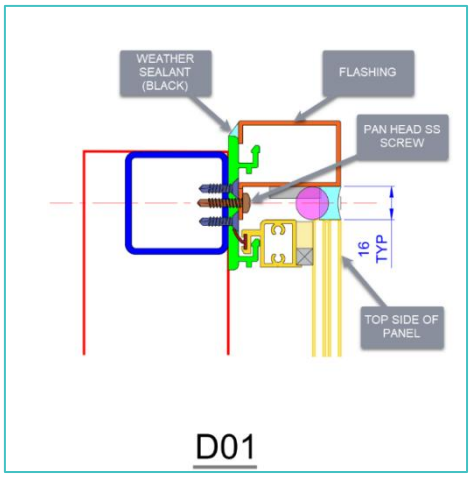
9. Foam backer rod are placed to fill the gap between PV panels.



10. Weather sealant (black) is applied on both the inner and outer edges of the panel to prevent water ingress. A gap of approximate 16 mm must be completely filled and sealed with this sealant.



11. After all the panels are installed, for the panel that are at the end of the walls. Flashing is installed for closing the ends and for edge seal and presence of aesthetic appearance. The flashing is fixed in the structure using SS pan head screws. Weather sealant is applied between flashing and tracking system.



6.2.2.1 Frame less Panel Installation using clamps – Option 2

Use long clamps (or similar structure) to clamp all four sides of the modules and secure it to the bracket, as showed in figure 2:

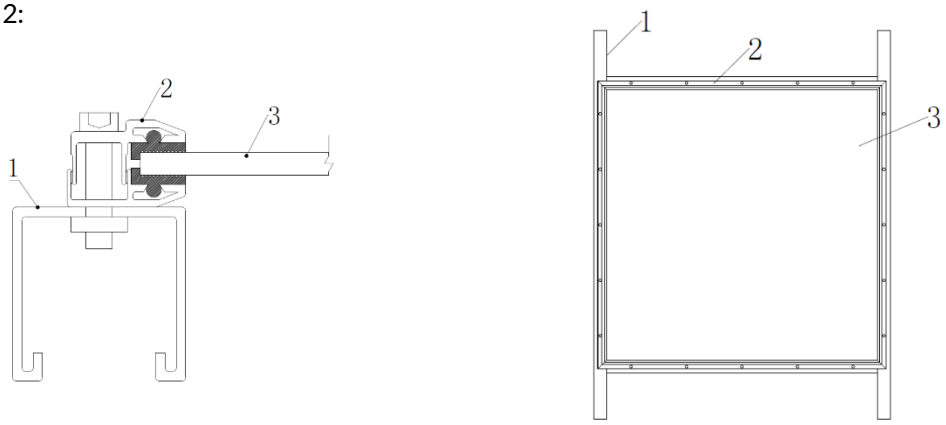


Figure 2: Installation diagram

No.	Name	Purpose	Note
1	Bracket	Support and fix modules	Specifications and types should be determined according to local wind, snow, earthquake and constant load calculation.
2	Clamps	Fix and connect modules	Similar structure can be used
3	PV module	——	——

More description:

Mechanical loading	**Safety factor**	**Installation direction**
+3600Pa /-1600Pa	1.5	**Note: The brackets must be mounted to four sides of the solar panel continuously**
Minimum frame biting		**20 mm**

1. **Bracket Installation**:

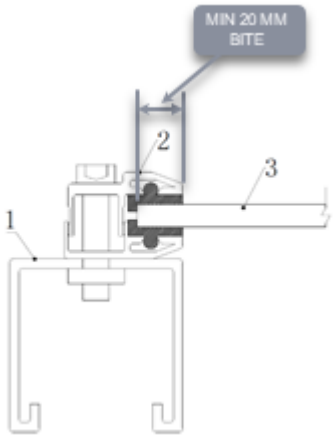
- Attach the bracket (1) to the main structure or mounting surface using suitable screws or fasteners.
- Ensure the bracket is properly aligned and securely fixed.
- Align the brackets vertically and horizontally with the mounting structure.
- Use a spirit level to confirm proper alignment.

2. Clamp Installation:

- Position the clamp (2) on the bracket (1). Ensure it is correctly aligned and locked into place.
- Install the clamps (2) along the edges of the PV module to hold it in place.
- Tighten the clamps securely to prevent any movement or instability.

3. PV Module Placement:

- Slide the PV module (3) into the slot of the clamp (2).
- Make sure the PV module is securely held and there are no gaps or misalignments between the clamp and the module.
- Keep minimum 20 mm bite of the clamp (2) on PV module (3)



4. Final Inspection:

1) Verify that all brackets, clamps, and the PV module are tightly secured and properly aligned.
2) Ensure the PV module is firmly held in place and all components are stable.

6.2.2.2 Post installation Verification

After installing ClearVue's wall-mount PV modules, perform the following checks to ensure proper setup and functionality:

1. Physical Inspection

- Verify all panels are securely mounted, with no loose brackets, screws, or bolts.
- Ensure the panels are properly aligned, level, and free from visible cracks, scratches, or damage.

- Check the weatherproof sealant along all panel edges for continuity and ensure no gaps are left unsealed.

2. Ventilation

- Recommend to have a gap between the back of the panels and the mounting surface to provide proper airflow for prevention of overheating.

3. Electrical Connections

- Verify all cable connections are secure, clean, and free from corrosion.
- Check polarity to ensure proper wiring (positive-to-positive, negative-to-negative).
- Test for electrical continuity and functionality using a multimeter.

4. Safety Measures

- Inspect grounding connections to ensure the frame and metallic components are securely bonded and grounded.
- Confirm compliance with local electrical codes and safety standards (e.g., IEC 61730).

5. Aesthetic Finishing

- Ensure aluminium flashing is correctly installed for edge finishing and aesthetics.
- Clean panels to remove any dust or debris that may affect performance.

6. Functional Testing

- Measure the output voltage and current of the panels to confirm they meet expected performance values.
- Monitor for any abnormal readings or signs of malfunction during initial operation.

7. Documentation

- Record all observations and measurements during the post-installation check.
- Provide the client with maintenance and troubleshooting guidelines.

7 Electrical Specifications

Each module has an industrial standard nameplate label providing the product's information. It describes product model number, product dimensions and weight, protection class, standard rated power, rated current, rated voltage, open circuit voltage, short circuit current under standard testing conditions, maximum system voltage, etc.

Each nameplate may have a unique QR code which allows the customers to trace the product serial number, manufacturer location, manufacturing date and the other information as listed above.

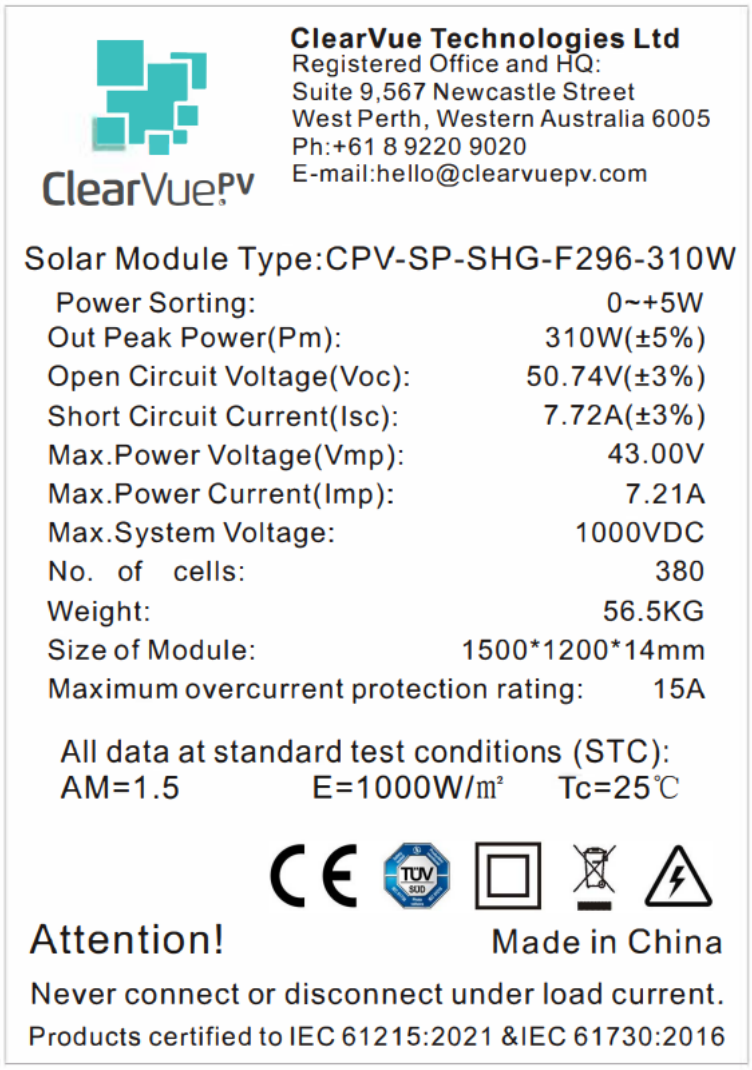


Fig 5-1: Example of a nameplate for a CPV PV module

The rated electrical characteristics are within 5 percent of measured values at Standard Test Conditions (STC) of "1000 W/m2, 25°C cell temperature and solar spectral irradiation of AM 1.5 spectrum".

Under normal conditions, a photovoltaic 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 NEC, the values of I_{sc} and V_{oc} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and size of controls connected to PV output.

IMPORTANT: It is the manufacturer and user's responsibility to fully understand the specifications on the product's nameplate.

The below table gives **ELECTRICAL RATINGS** of several typical models which have been evaluated by TUV

SUD.

7.1 Model Family & Electrical Ratings Form

Model family series for shingled products (example below provided for reference)

Model Name	Rated Power [Wp]	Dimensions [length x width x height]	Number of cells in module	Number of cell per bypass diode
CPV-SP-SHG-S460-xxxW (xxx= 345-360W, in step of 5)	345~360	1800*1200*14mm	460	2
CPV-SP-SHG-S368-xxxW (xxx= 275-285W, in step of 5)	275~285	1500*1200*14mm	368	2
CPV-SP-SHG-F380-xxxW (xxx= 365-395W, in step of 5)	365~395	1800*1200*14mm	380	2
CPV-SP-SHG-F296-xxxW (xxx= 285-310, in step of 5)	285~310	1500*1200*14mm	296	2

Model family series for PERC products (example below provided for reference)

Model Name	Rated Power [Wp]	Dimensions [length x width x height]	Number of cells in module	Number of cell per bypass diode
CPV-SP-PERC-108H-xxxW (xxx= 350-365W, in step of 5)	350~365	1800*1200*14mm	108	3
CPV-SP-PERC-90H-xxxW (xxx= 290-300W, in step of 5)	290~300	1500*1200*14mm	90	3
CPV-SP-PERC-72H-xxxW (xxx= 230-240, in step of 5)	230~240	1200*1200*14mm	72	3
CPV-SP-PERC-60H-xxxW (xxx= 190-200, in step of 5)	190~200	1000*1200*14mm	60	3

Electrical rating (example below provided for reference)

Product Electrical Ratings at STC:							
Module	CPV-SP-PERC-108H-350W	CPV-SP-PERC-108H-355W	CPV-SP-PERC-108H-360W	CPV-SP-PERC-108H-365W	CPV-SP-PERC-90H-290W	CPV-SP-PERC-90H-295W	CPV-SP-PERC-90H-300W
Open-circuit voltage with tolerance ±3% [V]:	73.25	73.62	73.91	74.33	60.65	61.18	61.59
Short-circuit current with tolerance ±3% [A]:	6.21	6.27	6.33	6.38	6.21	6.27	6.33
Voltage at max. power with [V]:	59.03	59.37	59.61	59.94	48.91	49.34	49.67
Current at max. power with [A]:	5.93	5.98	6.04	6.09	5.93	5.98	6.04
Max. power (tolerance ±5%) [W]:	350	355	360	365	290	295	300
Maximum system voltage [V]	1000	1000	1000	1000	1000	1000	1000
Series Fuse Rating [A]	15	15	15	15	15	15	15

Product Electrical Ratings at STC:							
Module	CPV-SP-PERC-72H-230W	CPV-SP-PERC-72H-235W	CPV-SP-PERC-72H-240W	CPV-SP-PERC-60H-190W	CPV-SP-PERC-60H-195W	CPV-SP-PERC-60H-200W	CPV-SP-SHG-S460-345W
Open-circuit voltage with tolerance ±3% [V]:	48.09	48.74	49.28	39.74	40.44	41.07	60.70
Short-circuit current with tolerance ±3% [A]:	6.21	6.27	6.33	6.21	6.27	6.33	7.40
Voltage at max. power with [V]:	38.79	39.30	39.74	32.05	32.61	33.12	52.12
Current at max. power with [A]:	5.93	5.98	6.04	5.93	5.98	6.04	6.62
Max. power (tolerance ±5%） [W]:	230	235	240	190	195	200	345
Maximum system voltage [V]	1000	1000	1000	1000	1000	1000	1000
Series Fuse Rating [A]	15	15	15	15	15	15	15

Product Electrical Ratings at STC:							
Module	CPV-SP-SHG-S460-350W	CPV-SP-SHG-S460-355W	CPV-SP-SHG-S460-360W	CPV-SP-SHG-S368-275W	CPV-SP-SHG-S368-280W	CPV-SP-SHG-S368-285W	CPV-SP-SHG-F380-365W
Open-circuit voltage with tolerance ±3% [V]:	60.82	60.94	61.06	60.82	60.94	61.06	51.38
Short-circuit current with tolerance ±3% [A]:	7.48	7.56	7.64	5.97	5.97	6.06	9.06
Voltage at max. power with [V]:	52.24	52.36	52.48	52.24	52.36	52.48	43.44
Current at max. power with [A]:	6.70	6.78	6.86	5.27	5.35	5.44	8.41
Max. power (tolerance ±5%) [W]:	350	355	360	275	280	285	365
Maximum system voltage [V]	1000	1000	1000	1000	1000	1000	1000
Series Fuse Rating [A]	15	15	15	15	15	15	15

Product Electrical Ratings at STC:							
Module	CPV-SP-SHG-F380-370W	CPV-SP-SHG-F380-375W	CPV-SP-SHG-F380-380W	CPV-SP-SHG-F380-385W	CPV-SP-SHG-F380-390W	CPV-SP-SHG-F380-395W	CPV-SP-SHG-F296-285W
Open-circuit voltage with tolerance ±3% [V]:	51.50	51.62	51.74	51.86	51.98	52.10	50.14
Short-circuit current with tolerance ±3% [A]:	9.14	9.22	9.30	9.38	9.46	9.54	7.32
Voltage at max. power with [V]:	43.56	43.68	43.80	43.92	44.04	44.16	42.40
Current at max. power with [A]:	8.50	8.59	8.68	8.77	8.86	8.95	6.76
Max. power (tolerance ±5%） [W]:	370	375	380	385	390	395	285
Maximum system voltage [V]	1000	1000	1000	1000	1000	1000	1000
Series Fuse Rating [A]	15	15	15	15	15	15	15

Product Electrical Ratings at STC:							
Module	CPV-SP-SHG-F296-290W	CPV-SP-SHG-F296-295W	CPV-SP-SHG-F296-300W	CPV-SP-SHG-F296-305W	CPV-SP-SHG-F296-310W	—	—
Open-circuit voltage with tolerance ±3% [V]:	50.26	50.38	50.50	50.62	50.74	—	—
Short-circuit current with tolerance ±3% [A]:	7.40	7.48	7.56	7.64	7.72	—	—
Voltage at max. power with [V]:	42.52	42.64	42.76	42.88	43.00	—	—
Current at max. power with [A]:	6.85	6.94	7.03	7.12	7.21	—	—
Max. power (tolerance ±5%) [W]:	290	295	300	305	310	—	—
Maximum system voltage [V]	1000	1000	1000	1000	1000	—	—
Series Fuse Rating [A]	15	15	15	15	15	—	—

Refer to Section 690-8 of the National Electric Code for an additional multiplying factor of 1.25 which may be applicable.

8 Module wiring

8.1 Conductor Specification

Each module has two standard 90 ℃ wet rated, light resistant output cables of diameter 4 mm^2, which are all connected to connectors & movable joint. These cables can be used in direct sunlight. It is recommended for all wiring and electrical connections to comply with the relevant national electrical code.

1) For field connections, use a copper wire with a diameter of no less than 4 mm^2 and a temperature resistance of no less than 90℃. The cables used should be IEC 62930: 2017 approved.
2) Only copper conductors shall be used for all field connections to ensure compatibility and safety.
3) Cable outer diameter should between 5mm and 7mm. For the maximum electrical rating of the serial fuse, refer to the Specifications section.
4) Cables should be secured to the mounting system using UV-resistant cable ties to prevent damage from movement.
5) Although the cables are UV resistant, it is recommended that exposed cables be protected from environmental damage or direct sunlight by placing them in a suitable conduit or metallic raceway.
6) A minimum bending radius of 60 mm (2.36 in) is required when securing the junction box cables to the racking system.

8.2 Connector Specification

1) The connectors supplied are MC4 connectors. The connectors may be of type:
    a. ZhonghuanSunterPV, Model: PV-ZH202B
    b. Staubli Electrical PV-KST4-EVO 2/xy_UR, 1500VDC, 45A(4mm^2), 53A(6mm^2)
    c. Staubli Electrical PV-KBT4-EVO 2/xy_UR, 1500VDC, 45A(4mm^2), 53A(6mm^2)
    d. Staubli Electrical PV-KST4-EVO2A/xy, 1500VDC, 45A(4mm^2), 53A(6mm^2)
    e. Staubli Electrical PV-KBT4-EVO2Axy, 1500VDC, 45A(4mm^2), 53A(6mm^2)
2) The panel shall not be mated to connectors from different manufacturers, or with Staubli connectors outside of the MC4 and MC4-Evo product family and suitable lead as these may not be compatible. MC4 and MC4-Evo are registered trademarks owned by Stäubli.
3) Mismatched connectors can lead to poor connections, fire hazards, and voided warranties.
4) Unmated connectors are not waterproof and should be connected promptly or protected with endcaps to prevent moisture and dust ingress.

8.3 Wiring Configuration

1) Do not use different configuration in the same PV system components.
2) In order to ensure the normal running of the system, the modules connected to the battery or other modules, please observe the polarity of the cable. If the connection is not correct, the bypass diode may be damaged.
3) Modules can be connected in series (Figures 3 & 5) to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry.
4) Modules can be connected in parallel (Figures 4 & 5) to increase the current by connecting the positive plug of one module to the positive plug of the next.
5) Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.

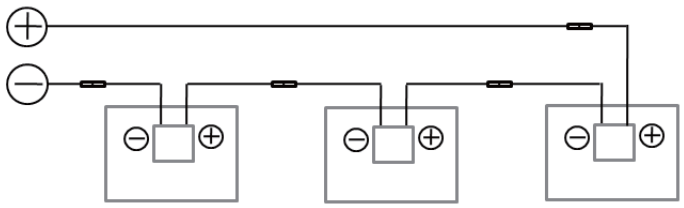


Figure 3: Connected in series

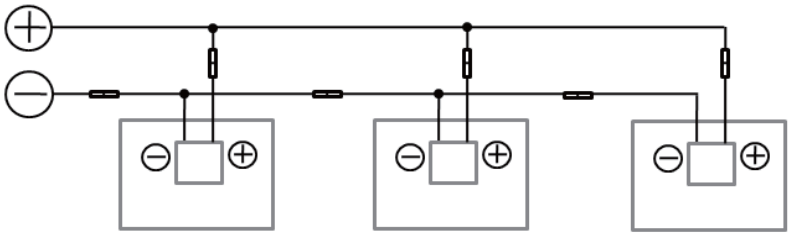


Figure 4: Parallel connection

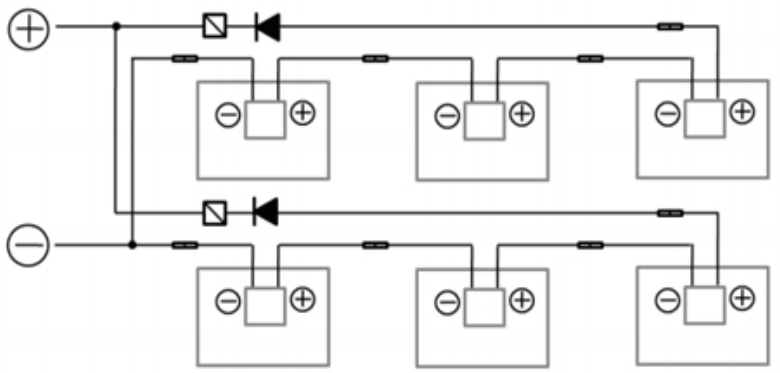


Figure 5: parallel connection after series

6) Each string of components can be connected in series, largest amount must be calculated according to relevant regulations and requirements. The open circuit voltage at a local minimum temperature expected value under the condition of no more than maximum system voltage value of the component the value of the dc electrical components and other requirements. If there may be higher than the component's largest fuse current reverse current through the component, must use the same specifications of the over current protection device to protect the components. If parallel or equal number greater than two series, on each string components must have an over current protection device.

8.4 Grounding

Panels are of a glass-glass construction with no exposed conductive material. The panel itself does not require grounding, but the aluminium frame must be bonded to metallic structural members to create a grounding path.

8.4.1 Module Frame Bonding

1) Proper grounding is achieved by bonding the module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor per respective National Electrical Codes. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.
2) All grounding hardware, including bolts, nuts, and washers, should be made of stainless steel to prevent corrosion.
3) The grounding hole with a diameter of 4mm is on the frames of solar modules. The aluminum frame of the solar module should be connected with an M4 stainless steel cap bolt, flat washer, cup washer, and

a toothed nut. The toothed washer/nut ensures a secure electrical bond by penetrating any anodized coating on the frame.

4) For installations in North America, all grounding components should be certified to UL 467 and UL 2703.

8.4.2 Module Frame Bonding Steps

Required Hardware (per module):

- M4 Stainless Steel Cap Bolt
- Stainless Steel Flat Washer
- Stainless Steel Cup Washer
- Stainless Steel Toothed Nut (or Toothed Washer)
- Grounding Conductor (Copper)

Installation Steps:

1. Locate the 4mm grounding hole on the module frame.
2. Insert the M4 bolt through the grounding conductor's lug and the washers.
3. Secure the assembly using the toothed nut on the inside of the frame. The toothed component must bite into the frame to penetrate the anodized coating.
4. Ensure all components are tightened securely to form a continuous grounding path.

Alternative mounting systems may use their own certified bonding systems (e.g., grounding clips or WEEBs). If such systems are used, the installer must follow the mounting system manufacturer's instructions in compliance with local codes.

8.5 Bypass Diodes

1) The module includes integrated bypass diodes to manage shading and protect the module. The quantity of bypass diodes included may vary depending on the exact model used. Do not make modifications to the internal components such as the integrated bypass diodes.
2) If external bypass diodes are used, ensure they meet the following specifications:
    1) **Rated Average Forward Current (IF [AV])**: Must exceed the maximum system current at the highest operating temperature.

2) **Rated Repetitive Peak Reverse Voltage (VRRM)**: Must be higher than the maximum system voltage at the lowest operating temperature.

9 Maintenance

9.1 Shading

- Partially blocking a single module can cause reverse voltage, affecting current flow through other modules and increasing the risk of damage.
    - Ensure modules are free from obstructions (e.g., dirt, shading, or debris) to prevent reverse voltage build-up.

9.2 Electrical Safety

- Do not disassemble the junction box or modify internal components. Wiring methods must maintain the factory settings to avoid damage or safety risks.
- Never leave junction box connectors in a short-circuit condition.
- During maintenance, use appropriate safety devices such as:
    - **Insulated Tools and Gloves**: To prevent electric shocks.
    - **Shading Materials**: Cover the module's glass surface to reduce voltage production under sunlight.
- Be cautious when working on modules exposed to sunlight, as they can produce high voltage. Always observe proper safety protocols to avoid electric shocks.

9.3 Regular Inspections

- Conduct **annual inspections** to ensure the following:
    - Joints and connectors are secure and free from wear or corrosion.
    - Grounding connections are intact and effective.
    - Installation brackets are stable and free from loosening.
    - Modules are clean and free of obstructions like dirt, leaves, or snow.

9.4 Cleaning Guidelines

- For modules installed at an angle greater than 10 degrees, natural rainfall often suffices to clean the surface. If additional cleaning is required:
    - Use a soft cloth or sponge with water to clean the glass surface gently.
    - Avoid using abrasive materials or tools to prevent scratches that could impact power output.
    - If using high-pressure cleaners, follow these guidelines:
        1. **Cleaning Fluid**: Use clean water at ambient temperature; avoid chemical cleaners.
        2. **Water Pressure**: ≤ 13.1 MPa.
        3. **Flow Rate**: ≤ 7 L/min.
        4. **Nozzle Distance**: Maintain a distance of ≥ 30 cm from the module surface.
        5. **Spraying Angle**: Keep the angle ≥ 15° to avoid damage.
        6. **Timing**: Clean during low-light conditions, such as at night or early morning, to reduce the risk of thermal stress.

10 Adherence to Standards

- Follow all relevant building and electrical standards, including IEC 61730 and IEC 61215, for maintenance and safety practices.
- Australian installations should be in accordance to AS/NZS 3000 and AS/NZS 5033.

Suite 9/ 567 Newcastle Street
West Perth, Western Australia 6005
+61 8 9220 9020
hello@clearvuepv.com
www.clearvuepv.com
facebook.com/clearvue
linkedin.com/company/clearvuepv

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