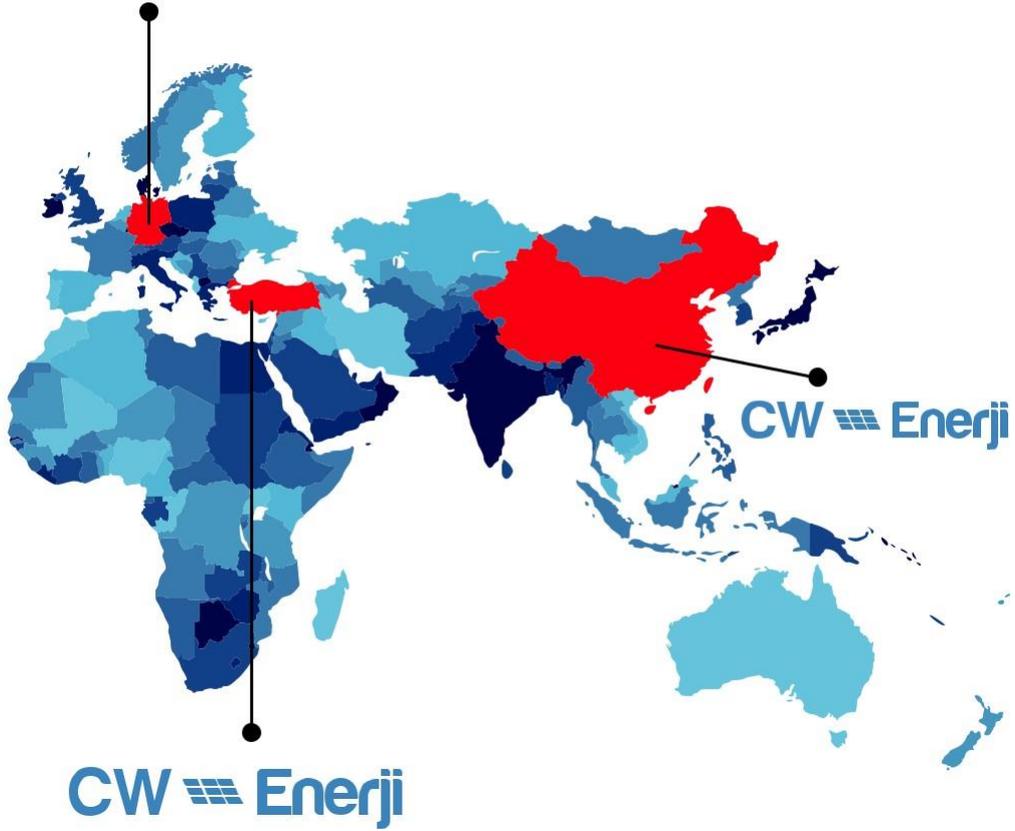


CW  Enerji



ADDRESS IN TURKEY

Antalya Organize San. Bölgesi 1. Kısım
Atatürk Blv. No:20 Döşemealtı
Antalya / TÜRKİYE
Tel: +90 242 229 00 54 / +90 242 229 60 54
Fax: +90 242 229 00 74
Website: www.cw-enerji.com
E-mail: info@cw-enerji.com

**WATER PROOF,
SUITABLE FOR
ROOFTOP SOLAR
PANEL
INSTALLATION
MANUAL**



CONTENTS

1. INTRODUCTION	4
2. CODES AND REGULATIONS	4
3. GENERAL	4
3.1 Product Identification	5
3.2 Conventional Safety	5
3.3 Electrical Performance Safety	5
3.4 Operating Safety	6
3.5 Fire Safety	6
4. INSTALLATION CONDITION	7
4.1 Installation Position and Working Environment	7
4.2 Tilt Angle Selection	8
5. MECHANICAL INSTALLATION	8
5.1 Conventional Requirement	8
5.2 Installation Method	9
5.3. Description of the installation position	9
6. ELECTRICAL INSTALLATION	10
6.1 Electrical Property	10
6.2 Cables and Wiring	11
6.3 Connectors	12
6.4 Bypass Diodes	12
7. GROUNDING	13
7.1 Grounding by Using Grounded Clamp	13
8. OPERATION AND MAINTENANCE	14
8.1 Cleaning	14
8.2 Visual Inspection of Modules	14
8.3 Inspection of connector and cable	14
9. APPLICABLE PRODUCTS	15

1. INTRODUCTION

CW Enerji Mühendislik Ticaret ve Sanayi Co. Ltd. is a hi-tech company engaged in the development, research, production, sales and service of crystalline silicon wafers, solar cells, solar panels, and photovoltaic systems. (Hereafter referred to as “CW Enerji”)

CW Enerji has in the photovoltaic field stable and reliable partnerships in Europe and in Far East that value quality and good production.

Purchasing of products as well as turnkey projects we will support you with our strong and experienced team with a wide product range and variety of methods of procedure. Our mission is a personal best quality and customer satisfaction.

2. CODES AND REGULATIONS

The mechanical and electrical installation of PV systems should be performed in accordance with all applicable codes, including electrical codes, building codes and electric utility interconnect requirements.

Such requirements may vary for mounting location, such as building rooftop or motor vehicle applications.

Requirements may also vary with system voltage, and for DC or AC application. Contact local authorities for governing regulations.

3. GENERAL

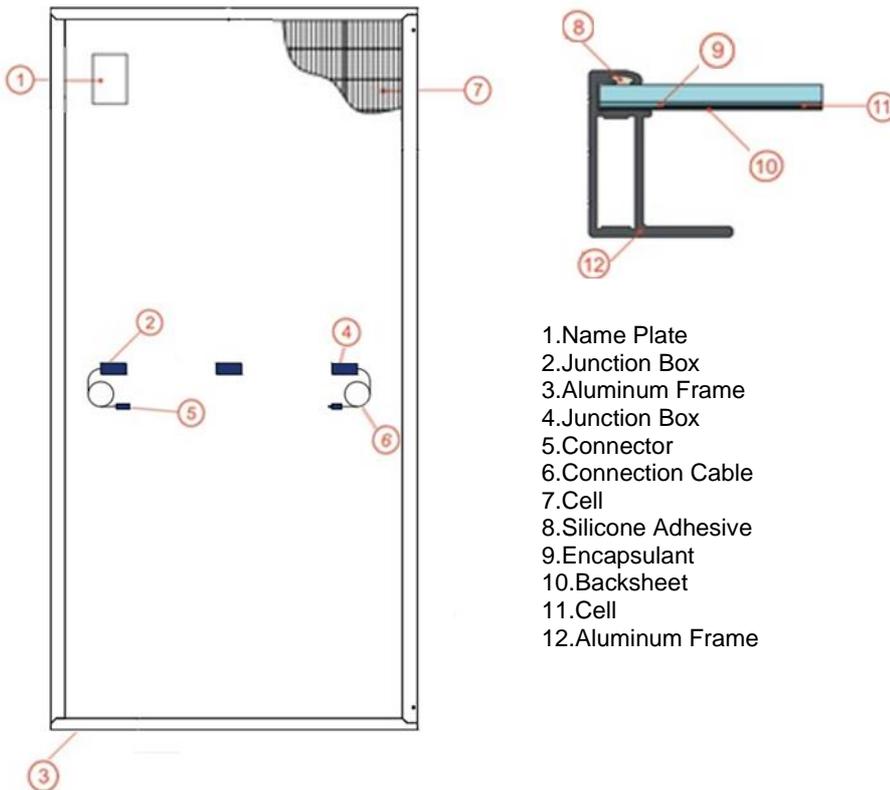


Figure 1: Module components and cross-section of the laminate assembly

3.1 Product Identification

Each module has three labels providing the following information:

1. Nameplate: describes the product type; Peak power, Max. power current, Max. power voltage, open circuit voltage, short circuit current, all as measured under standard test conditions; Certification marks, the maximum system voltage etc.
2. Current Classes. Solar panels are divided into three classes according to the maximum power current: 1, 2 or 3 (3 means the highest current). This class is marked as a number on the pallets of the solar panels. To achieve an optimal performance of the solar panels, it is recommended to only connect solar panels with the same current class in a string.
3. Barcode: Each individual module has a unique serial number. The serial number has 12 digits. From 1st to 2nd digits are the solar cell size code, and the 3rd and 4th are the corrected year code, from 5th and 6th are the corrected month codes, from 7th is the optional serial number and from 8th and 12th are the serial number of a module. For example, 133414000001 means the Module was assembled and tested in the January of 2021. It is permanently attached to the interior of the Modules and is visible from the top front of the Module. This barcode is inserted prior to laminating. In addition, you can find a same barcode beside the nameplate and two sides of frame surfaces.

3.2 Conventional Safety

CW Enerji Modules are designed to meet the requirements of IEC 61215 and IEC 61730, PV module classification: Class II

Modules rated for use in this PV module classification may be used in system operating at greater than 50V DC or 240W, where general contact access is anticipated. Modules qualified for safety through IEC 61730-1 and IEC 61730-2 and within this PV module classification are considered to meet the requirements for safety class II equipment.

When Modules are mounted on rooftops, the roof must have a fire-resistant covering suitable for this application. Rooftop PV systems should only be installed on rooftop that can handle the additional weighted load of PV system components, including Modules, by a certified building specialist or engineer and have a formal structure of the complete analysis result.

For your safety, do not attempt to work on a rooftop until safety precautions have been identified and taken including without limitation fall protection measures, ladders or stairways, and personal protective equipment.

For your safety, do not install or handle Modules under adverse conditions, including without limitation strong or gusty winds, and wet or frosted roof surfaces.

3.3 Electrical Performance Safety

Photovoltaic Modules can produce DC electricity when exposed to light and therefore can produce an electrical shock or burn. DC voltage of 30 Volts or higher is potentially lethal.

Modules produce voltage even when not connected to an electrical circuit or load. Please use insulated tools and rubber gloves when working with Modules in sunlight.

Modules have no on/off switch. Modules can be rendered inoperative only by removing them from sunlight, or by fully covering their front surface with cloth, cardboard, or other completely opaque material, or by working with Modules face down on a smooth, flat surface.

In order to avoid arcs and electrical shock, please do not disconnect electrical connections under load. Faulty connections can also result in arcs and electrical shock. So please keep connectors dry and clean, and ensure that they are in proper working condition. Never insert metal objects into the connector or modify them in any way to secure an electrical connection.

Also, to avoid the sand or water vapor entering which may cause the connection and safety issue, the modules need to be installed and connected to the combiner box once they are taken out from the carton box; keep the connectors dry and clean during the installing. Note that the pollution from sand, dust and water will result in arcs and electrical shock of connectors.

Reflection from snow or water can increase sunlight and therefore boost current and power. In addition, colder temperatures can substantially increase voltage and power.

If the glass or other material is damaged, please wear personal protection equipment and separated the Modules from the circuit.

Work only under dry conditions and use only dry tools. Do not handle Modules when they are wet unless wearing appropriate protective equipment. If you need to clean the Modules, please follow the cleaning requirements mentioned in the manual.

3.4 Operating Safety

Do not open packages of CW Enerji modules during transportation and storing until they are ready to be installed.

At the same time please protect the package from damage. Do not make the pallets of modules falling over directly.

Do not exceed the maximum height of pallets to be stacked, as indicated on the pallet packaging. Store pallets in a ventilated, rain-proof, and dry location until the modules are ready to be unpacked. Do not lift the modules by grasping the module's junction box or electrical cable under any condition. Do not stand or step on the modules.

Do not drop the modules on another module.

Do not place any heavy objects on the modules to avoid damaging the glasses.

Be cautious when setting the modules down on to a surface, especially on the corner of the Modules. Inappropriate transportation and installation may break the Modules.

Do not attempt to disassemble the Modules, and do not remove any attached nameplates or components from the modules.

Do not apply paint or adhesive to the Modules top surface.

To avoid damage to the backsheet, do not scratch or hit the backsheet.

Do not drill holes in the frame. This may compromise the frame strength and cause corrosion of the frame.

Do not scratch the anodized coating of the frame (except for bonding connection). It may cause corrosion of the frame or compromise the frame strength.

Do not attempt to repair the modules with damaged glass or backsheet.

3.5 Fire Safety

Consult your local authority for guidelines and requirements for building or structural fire safety. CW Enerji Modules have been listed as Class C according to IEC 61730-2 standard.

For roof installations, Modules should be mounted over a fire-resistant covering suitable for this application, with adequate ventilation between the Modules backsheet and the mounting surface. Roof constructions and installations may affect the fire safety of building. Improper installation may create hazards in the event of a fire.

Consult your local authority for guidelines and requirements for building or structural fire safety. CW Enerji modules are listed as Class C according to the IEC 61730-2 standard.

For roof installations, Solar panels should be mounted over a fire-resistant covering suitable for this application, with adequate ventilation between the modules backsheet and the mounting surface. Roof constructions and installations may affect the fire safety of building. Improper installation may create

hazards in the event of a fire.

Solar panels should not be installed on structures and products made of transparent plastic, plastic and similar materials that are resistant to fire risk and not protected.

In order to maintain the fire class rating, the distance between the modules frame surface and the roof surface shall be at least 8 cm.

Regulations, communiqués, decrees, specifications, etc., put into effect by the relevant official institutions and organizations in the region where the installation will take place. Appropriate components such as fuses, circuit breakers, surge arresters and grounding connectors must be used to meet the requirements specified in all legislation. Any string or optimizer connector to be connected with the solar panel connector must be the same brand and model as the connector on the solar panel.

Do not install solar panels in places where flammable-explosive chemical products, gases and similar products can be found.

Panels that have not been installed in accordance with these standards and conditions will be out of warranty, the installation will be installed contrary to the installation manual, and the manufacturer will not be responsible for any risks or problems that may occur. In this context, the manufacturer does not have any responsibility, including compensation for damages, for any use contrary to the installation and assembly manual and for the consequences of such use.

4. INSTALLATION CONDITION

4.1 Installation Position and Work Environment

CW Enerji Modules are intended for use in terrestrial applications only-no for outer space use. Do not use mirrors or other magnifiers to concentrate sunlight onto the Modules.

Modules must be mounted on appropriate mounting structures positioned on suitable buildings, the ground, or other structures suitable for Modules (e.g., carports, building facades or PI/ trackers). Modules must not be installed in locations where they could be submerged in water.

The recommended ambient temperature should be within -20°C (-4°F) to 46°C (115°F). The temperature limits are defined as the monthly average high and low of the installation site. The limit operating temperature should be -40°C (-40°F) and 85°C (185°F).

Ensure Modules are not subject to wind or snow loads exceeding the maximum permissible loads. The Modules should be installed in a location where there is no shading throughout the year. Ensure there is no obstacle to block light near the installation site.

Lightning protection is recommended for PV systems that are to be installed in locations with high probability of lightning strikes.

Do not use Modules near equipment or in locations where flammable gasses may be generated or collected.

This module application can be made maximum 2000m altitude.

Modules must not be installed nor operated in areas where hail, snow, sand, dust, air pollution, soot, etc., are excessive. Modules must not be sited in locations where aggressive substances such as salt, salt mist, saltwater, chemically active vapors, acid rain, any other type of corrosive agent, could affect the safety and/ or performance of the Modules.

Please adopt appropriate measures to ensure the performance and safety of the Modules when they are installed or operated in the areas where produces heavy snow, extremely cold, strong wind, or near the island or desert where is prone to produce salt fog, or near water.

4.2 Tilt Angle Selection

The tilt angle of the Modules is measured between the surface of the Modules and a horizontal ground surface. The Modules generates maximum power output when it faces the sun directly.

In the northern hemisphere, Modules should typically face south, and in the southern hemisphere, Modules should typically face north.

For detailed information on the best installation angle, please refer to standard solar photovoltaic installation guides or consult a reputable solar installer or systems integrator.

Dust building up on the surface of the Modules can impair with Modules performance. CW Enerji recommends installing the Modules with a tilt angle of at least 10 degrees, making it easier for dust to be washed off by rain.

5.MECHANICAL INSTALLATION

5.1 Conventional Requirement

Ensure that the installation method and supporting system of Modules is strong enough to make the Modules to able to withstand all the load conditions. The Installer must provide the guarantee. The installation supporting system must be tested by the third-party organization with the analysis ability of Static Mechanical, according to the local national or international standards such as DIN1055 or equivalent standards.

The Modules mounting structure must be made of durable, corrosion-resistant, and UV-resistant material.

Modules must be securely attached to the mounting structure.

In regions with heavy snowfall in winter, select the height of the mounting system. So that the lowest edge of the Modules is not covered by snow for any length of time. In addition, ensure that the lowest portion of the Modules is placed high enough so that it is not shaded by plants or trees or damaged by flying sand.

When the Modules are supported parallel to the surface of the building wall or roof, a minimum clearance of 10 mm between the Modules frame and the surface of the wall or the roof is required to allow air to circulate behind the Modules and to prevent wiring damage.

Do not attempt to drill holes in the glass surface and the Modules frames of the Modules.

Before installing Modules on a roof, ensure that the roof construction is suitable. In addition, any roof penetration required to mount the Modules must be properly sealed to prevent leaks.

Observe the linear thermal expansion of the Modules frames, must ensure that the minimum distance between neighboring frames is 10 mm.

Always keep the backsheet of the panel free from foreign objects or structural elements, which could come into contact with the panel, especially when the panel is under mechanical load.

Modules have been certified for a maximum static load on the back-side of 2400 Pa (i.e. wind load) and a maximum static load on the front side of 2400 Pa (i.e. wind and snow load), depending on the Modules type (please refer to Figure 4 for detailed installation method). These load values are maximum. The design load for 2400 Pa is 1600 Pa. The safety factor is 1,5.

The mounting method must not result in the direct contact of dissimilar metals with the aluminum frame of the Modules that will result in galvanic corrosion.

Modules can be mounted in landscape or portrait orientation.

5.2. Installation Method

Modules can be installed on the frame using mounting holes. Modules must be assembled from bottom to top and from right to left. For the installation of the first module, first the starting structure should be screwed to the supporting structure at the bottom row, then the first panel should be inserted into the starting structure. Modules must be installed according to the following examples and recommendation. If not mounting the Modules according to these instructions, please in advance consult CW Enerji and must be approved by CW Enerji, otherwise may damage modules, and void the warranty.

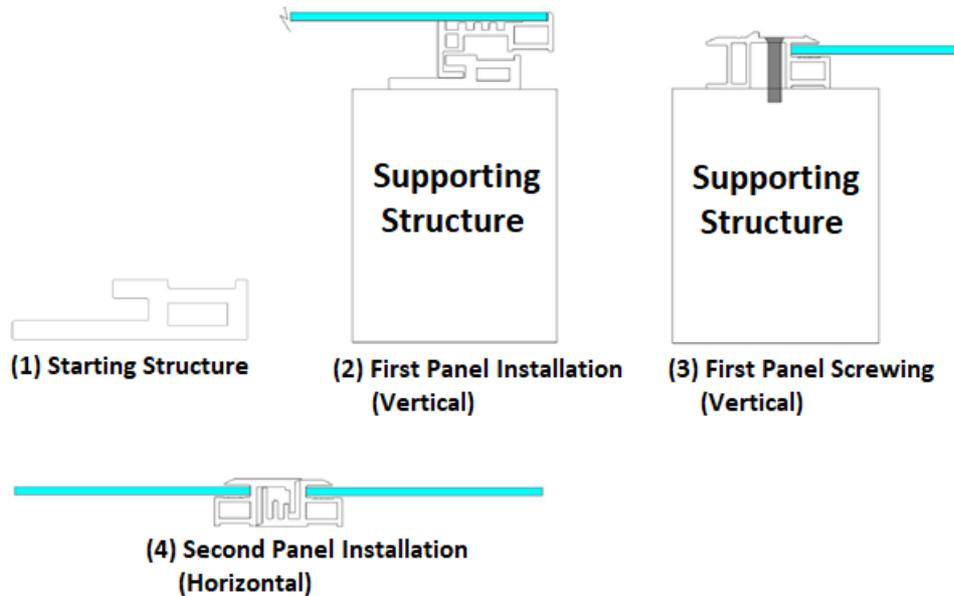


Figure 2: Installation Details

Modules should be screwed to the support structure with self-tapping screws through mounting holes located on the upper edge of the frames to the support structure at the bottom as shown in Figure 2. Panels should only be mounted horizontally.

5.3 Description of the installation position

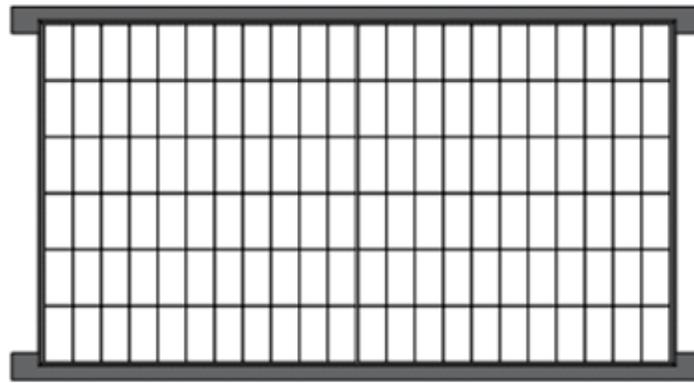
The low/normal level of load condition is applicable to the installation in most of environmental conditions: the maximum static test load on the back of the Modules is 2400 Pa (i.e., wind load), and the maximum static test load on the front of the Modules is 2400 Pa (i.e., wind and snow load).

The high level of load condition is applicable to the installation in harsher environmental conditions such as storm, heavy snow, etc. the maximum static test load on the back of the Modules is 2400 Pa (i.e., wind load) and the maximum static test load on the front of the Modules is 2400 Pa (i.e., wind and snow load), depending on the pressure level that it would endure according to IEC standard.

For the dynamic loads, such as wind, the safety factor needs to be increased by 3 times. It means that the maximum dynamic load is 800 Pa when the wind speed is less than 130 km/h.

The mechanical load tests carried out within the certification were made in the form of a red marked assembly. It must be installed in this way for warranty coverage.

(Design load: 1600 Pa for wind load, 2400 Pa for snow load, safety factor $\gamma_m = 1.5$)



STATIC LOAD
+3600Pa/-2400Pa

Figure 3: Installation Methods

6. ELECTRICAL INSTALLATION

6.1 Electrical Property

Rated electrical characteristics such as I_{sc} , V_{oc} and P_{max} are measured within +/- 3% of Measurement uncertainty at Standard Test Conditions. Standard Test Conditions: 1000 W/m² irradiance, 25°C Cell Temperature and 1.5 Air Mass.

Under normal conditions, photovoltaic Modules may produce higher current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of short circuit current, I_{sc} , and open circuit voltage, V_{oc} , marked on Modules should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fusing sizes, and size of controls connected to the solar panels.

Voltages are additive when Modules are connected directly in series, and Modules currents are additive when Modules are connected directly in parallel, as illustrated in Figure 5.

The maximum number of stringing is calculated according to the voltage of the junction box of the panels, the NOCT value of the panel, the DC input voltage of the inverter to be used, and the ambient temperature of the location of the plant. Modules with different electrical characteristics should not be connected directly in series.

$$\text{System Voltage} \geq N * V_{oc} [1 + TC_{Voc} * (T_{min} - 25)]$$

N = Number of panels in the series

V_{oc} = Open Circuit Voltage (data on product label or datasheet)

TC_{Voc} = Temperature coefficient of open circuit voltage (data on product label or datasheet)

T_{min} = Minimum ambient temperature

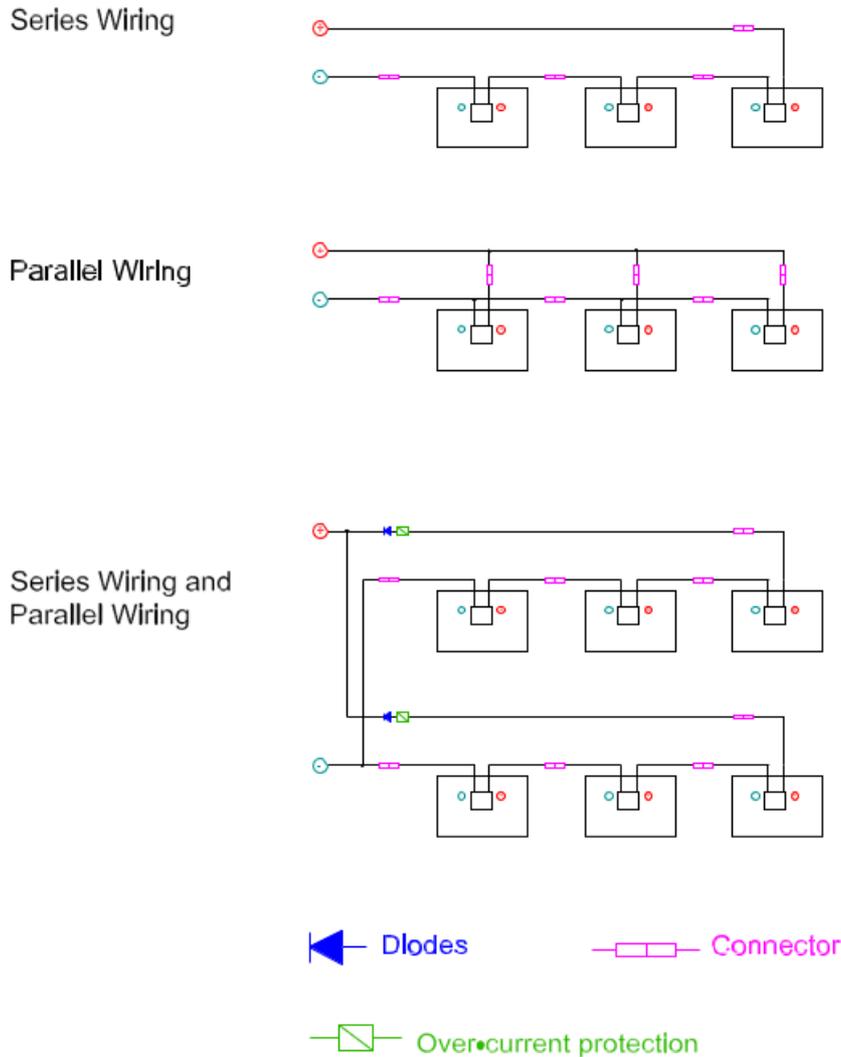


Figure 4: Electrical diagrams of series and parallel wiring

The maximum number of Modules that can be connected in a series string must be calculated in accordance with applicable regulations in such a way that the specified maximum system (The maximum system voltage of CW Enerji Modules is DC 1000V according to the safety appraisal of the IEC61730) of the modules and all other electrical DC components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system location.

An appropriately rated over-current protection device must be used when the reverse current could exceed the value of the maximum fuse rating of the Modules. An over-current protection device is required for each series string if more than two series strings are connected in parallel, as illustrated in Figure 4.

6.2 Cables and Wires

These junction boxes have been designed to be easily interconnected in series for their well-connected cable and the connector with IP67 protection grade. Each Modules has two single-conductor wires, one positive and one negative, which are pre-wired inside the junction box. The connectors at the opposite end of these wires allow easy series connection of adjacent Modules by firmly inserting the positive connector of a Module into the negative connector of an adjacent Module until the connector is fully seated.

Use field wiring with suitable cross-sectional areas that are approved for use at the maximum short-circuit current of the Modules. CW Enerji recommends installers use only sunlight resistant cables qualified for direct current (DC) wiring in PV systems. The minimum wire size should be 4mm². For example, a solar cable according to the specifications on the next page is recommended.

The minimum required cable cross-section value is given in the table below.

Testing Standard	Wire size	Temperature rating
EN 50618:2014	4 mm ²	-40 °C ile +90 °C

The cable of the junction box is in Figure 5 below.

L: Cable Length

L for CW Enerji standard module is 1000/1200 mm, L for half-cut module is 300/1200 mm and L for bifacial module is 300/1200 mm. L for special modules may vary depending on the situation. Please consider the cable length before designing the wiring layout.



Figure 5: Junction Box Cable

Cables should be fixed to the mounting structure in such a way that mechanical damage of the cable and/or the Modules is avoided. Do not apply stress to the cables. For fixing, use appropriate means, such as sunlight resistant cable ties and/or wire management clips specifically designed to attach to the Modules frame. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.

6.3 Connectors

Keep connectors dry and clean and ensure that connector caps are hand tight before connecting the Modules. Do not attempt to make an electrical connection with wet, soiled, or otherwise faulty connectors. Avoid sunlight exposure and water immersion of the connectors. Avoid allowing connectors to rest on the ground.

Faulty connections can result in arcs and electrical shock. Check that all electrical connections are securely fastened. Make sure that all locking connectors are fully engaged and locked. The connector can be locked in conformity with NEC 2011 by an integrated snap-in lock for maximum dependability, and can be unlocked only with the tool PV-MS-PLS. Only the same type of connectors can be used for installation.

6.4 By-pass Diodes

The junction boxes used with CW Enerji Modules contain bypass diodes wired in parallel with the PV cell strings. In the case of partial shading, the diodes bypass the current generated by the nonshaded cells, thereby limiting Modules heating and performance losses. Bypass diodes are not over-current protection devices.

Bypass diodes divert current from the cell strings in the event of partial shading. In the event of a known or suspected diode failure, installers or maintenance providers should contact CW Enerji. Never attempt to open the junction box by yourself.

7. GROUNDING

CW Enerji Modules use an anodic oxidized aluminum frame to resist corrosion. So, the frame of Modules must be connected to the equipment bonding conductor to prevent thunder and static injury. The bonding device must fully contact with the inside of the aluminum alloy and must penetrate the surface of the frame oxidation film.

Please do not drill any additional bonding hole on the frame of the Modules.

For optimal performance, CW Enerji recommend the DC cathode of the Modules array is connected to ground, Failure to comply with this requirement may reduce the performance of the system.

The bonding method must not result in direct contact of dissimilar metals with the aluminum frame of the Modules that will result in galvanic corrosion.

The frame rails have pre-drilled holes marked with a bonding sign. These holes should be used for bonding purposes and must not be used for mounting the Modules.

The following bonding methods are available.

7.1. Grounding by Using Grounded Clamp

The bonding between Modules must be approved by qualified electrician. And the bonding device must be produced by qualified electrical manufacture. As the holes drilled for installation in the module frame are drilled after anodized coating, the screws to be used for module installation will ensure grounding conduction when they contact this point. As shown in Figure 6, at least 12 AWG copper grounding cable must be mounted with a cable lug suitable for the module construction feature where it will contact the screw used for mounting, this installation must cover all modules between the modules. It must be ensured that the construction material in which the module is mounted is grounded in accordance with the standards and after installation, it must be measured with a grounding device in accordance with the standards whether the grounding is done correctly from the frame of the module.

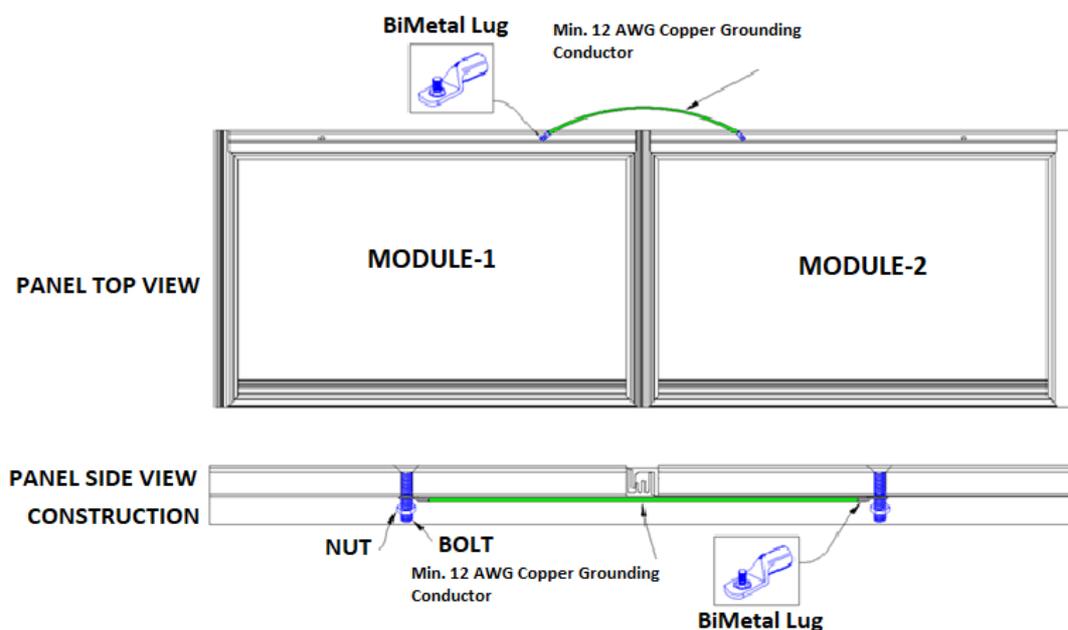


Figure 6: Grounding Method

8. OPERATION AND MAINTENANCE

It is required to perform regular inspection and maintenance of the Modules, especially within warranty scope. It is the user's responsibility to report to the supplier regarding the damages found within 2 weeks.

8.1 Cleaning

The dust accumulated on the front transparent substrate may reduce the power output and may even cause regional hot-spot effect. The industrial effluents or bird drops may be serious, and the extent of the severity depends on the transparency of the foreign objects. It is usually not dangerous for the accumulated dust to reduce the sunshine, because the light intensity is still homogeneous, and the power reduction is not usually obvious.

When Modules are working, there should not be environmental influence factors to cast shadows and cover part or even all the Modules, such as other Modules, system support, bird drops and a lot of dust, clay, or plant and so on, these may distinctly reduce the power output. CW Enerji advises that there should be no obstructed object over the Modules surface at any time.

The frequency of cleaning depends on dirt accumulation speed. In normal situations, rainwater will clean the module surface and reduce the cleaning frequency. It is suggested to use damp clean water sponge or soft cloth to wipe the glass surface. In any case, do not use acid and alkaline detergents to clean the solar panels.

In order to avoid potential risk of electrical shock or burn, CW Enerji suggests cleaning the solar panels during early morning or in the evening with less solar irradiation and lower surface temperature. In order to avoid potential risk of electrical shock, do not try to clean the solar panels with glass damages or exposed wires.

8.2 Visual Inspection of Modules

Inspect the Modules visually to find whether there are appearance defects, the following need particularly special attention:

- A) Whether the glass is broken,
- B) Corrosion along the cells' busbar.

The corrosion is caused by the dampness infiltrated into the Modules because that the surface encapsulation materials are damaged during the installation or transportation.

- C) Whether there is burning vestige on the backsheet.
- D) Check PV solar panels for signs of aging including rodent damage, weather damage, connection tightness, corrosion, and grounding condition.
- E) Check for any shape objects in contact with PV solar panels' surface
- F) Check for any obstacles shielding the PV solar panels
- G) Check for any loose or damage screws between the solar panels and brackets. If so, adjust or fix them on time.

8.3 Inspection of connector and cable

It is suggested to carry out the following preventive inspection once every 6 months:

- A) Check connector sealings and cable connections.
- B) Look for gaps on the sealant of the terminal box and confirm whether it is cracking

9. APPLICABLE PRODUCTS

GROUP	MODULE TYPE	CELL TYPE	POWER RANGE (IN 5W INTERVALS)	NUMBER OF CELLS	PANEL DIMENSIONS (mm)	MOUNTING DISTANCE (Purlins spacing) (mm) [L ₂ -L ₁]
GROUP 1	CWT-108PMCK12	PERC MONO	530W-550W	54 PCS FULL CELL	2005*1334.1	1122 mm
GROUP 2	CWT-108PMBCK12	PERC MONO BIFACIAL	530W-550W	54 PCS FULL CELL	2005*1334.1	1122 mm
GROUP 3	CWT-108PMFBCK12	PERC MONO FULL BLACK	530W-550W	54 PCS FULL CELL	2005*1334.1	1122 mm
GROUP 4	CWT-108TNCK10	TOPCON	435W-450W	54 PCS FULL CELL	1762*1165.1	1122 mm
GROUP 5	CWT-108TNBCK10	TOPCON BIFACIAL	435W-450W	54 PCS FULL CELL	1762*1165.1	1122 mm
GROUP 6	CWT-108TNFBCK10	TOPCON FULL BLACK	435W-450W	54 PCS FULL CELL	1762*1165.1	1122 mm
GROUP 7	CWT-144TNCK10	TOPCON	570W-595W	72 PCS FULL CELL	2318*1165.1	1291 mm
GROUP 8	CWT-144TNBCK10	TOPCON BIFACIAL	570W-595W	72 PCS FULL CELL	2318*1165.1	1291 mm
GROUP 9	CWT-144TNFBCK10	TOPCON FULL BLACK	570W-595W	72 PCS FULL CELL	2318*1165.1	1291 mm

GROUP 1

CWT-108PMCK12					
Peak Power (Pmax)	530Wp	535 Wp	540 Wp	545 Wp	550 Wp
Maximum Power Voltage (Vmp)	30,7V	30,9V	31,1V	31,3V	31,5V
Maximum Power Current (Imp)	17,27A	17,31A	17,36A	17,42A	17,46A
Open Circuit Voltage (Voc)	37,00V	37,20V	37,50V	37,70V	37,90V
Short Circuit Current (Isc)	18,28A	18,33A	18,38A	18,45A	18,49A

GROUP 2

CWT-108PMBCK12 - BIFACIAL					
Peak Power (Pmax)	530Wp	535 Wp	540 Wp	545 Wp	550 Wp
Maximum Power Voltage (Vmp)	30,70V	30,90V	31,10V	31,30V	31,50V
Maximum Power Current (Imp)	17,27A	17,31A	17,36A	17,42A	17,46A
Open Circuit Voltage (Voc)	37,00V	37,20V	37,50V	37,70V	37,90V
Short Circuit Current (Isc)	18,28A	18,33A	18,38A	18,45A	18,49A

GROUP 3

CWT-108PMFBCK12 – FULL BLACK					
Peak Power (Pmax)	530Wp	535 Wp	540 Wp	545 Wp	550 Wp
Maximum Power Voltage (Vmp)	30,70V	30,90V	31,10V	31,30V	31,50V
Maximum Power Current (Imp)	17,27A	17,31A	17,36A	17,42A	17,46A
Open Circuit Voltage (Voc)	37,00V	37,20V	37,50V	37,70V	37,90V
Short Circuit Current (Isc)	18,28A	18,33A	18,38A	18,45A	18,49A

GROUP 4

CWT-108TNCK10				
Peak Power (Pmax)	435Wp	440 Wp	445 Wp	450 Wp
Maximum Power Voltage (Vmp)	32,54V	32,74V	32,94V	33,14V
Maximum Power Current (Imp)	13,37A	13,44A	13,51A	13,58A
Open Circuit Voltage (Voc)	38,51V	38,91V	38,91V	39,11V
Short Circuit Current (Isc)	14,17A	14,31A	14,31A	14,38A

GROUP 5

CWT-108TNBCK10				
Peak Power (Pmax)	435Wp	440 Wp	445 Wp	450 Wp
Maximum Power Voltage (Vmp)	32,54V	32,74V	32,94V	33,14V
Maximum Power Current (Imp)	13,37A	13,44A	13,51A	13,58A
Open Circuit Voltage (Voc)	38,51V	38,91V	38,91V	39,11V
Short Circuit Current (Isc)	14,17A	14,31A	14,31A	14,38A

GROUP 6

CWT-108TNFBCK10				
Peak Power (Pmax)	435Wp	440 Wp	445 Wp	450 Wp
Maximum Power Voltage (Vmp)	32,54V	32,74V	32,94V	33,14V
Maximum Power Current (Imp)	13,37A	13,44A	13,51A	13,58A
Open Circuit Voltage (Voc)	38,51V	38,91V	38,91V	39,11V
Short Circuit Current (Isc)	14,17A	14,31A	14,31A	14,38A

GROUP 7

CWT-144TNCK10						
Peak Power (Pmax)	570Wp	575 Wp	580 Wp	585 Wp	590 Wp	595 Wp
Maximum Power Voltage (Vmp)	42,55V	42,75V	42,95V	43,15V	43,35V	43,55V
Maximum Power Current (Imp)	13,40A	13,46A	13,51A	13,56A	13,62A	13,67A
Open Circuit Voltage (Voc)	50,58V	50,78V	50,98V	51,18V	51,38V	51,58V
Short Circuit Current (Isc)	14,17A	14,23A	14,31A	14,38A	14,45A	14,53A

GROUP 8

CWT-144TNBCK10 - BIFACIAL						
Peak Power (Pmax)	570Wp	575 Wp	580 Wp	585 Wp	590 Wp	595 Wp
Maximum Power Voltage (Vmp)	42,55V	42,75V	42,95V	43,15V	43,35V	43,55V
Maximum Power Current (Imp)	13,40A	13,46A	13,51A	13,56A	13,62A	13,67A
Open Circuit Voltage (Voc)	50,58V	50,78V	50,98V	51,18V	51,38V	51,58V
Short Circuit Current (Isc)	14,17A	14,23A	14,31A	14,38A	14,45A	14,53A

GROUP 9

CWT-144TNFBCK10 – FULL BLACK						
Peak Power (Pmax)	570Wp	575 Wp	580 Wp	585 Wp	590 Wp	595 Wp
Maximum Power Voltage (Vmp)	42,55V	42,75V	42,95V	43,15V	43,35V	43,55V
Maximum Power Current (Imp)	13,40A	13,46A	13,51A	13,56A	13,62A	13,67A
Open Circuit Voltage (Voc)	50,58V	50,78V	50,98V	51,18V	51,38V	51,58V
Short Circuit Current (Isc)	14,17A	14,23A	14,31A	14,38A	14,45A	14,53A