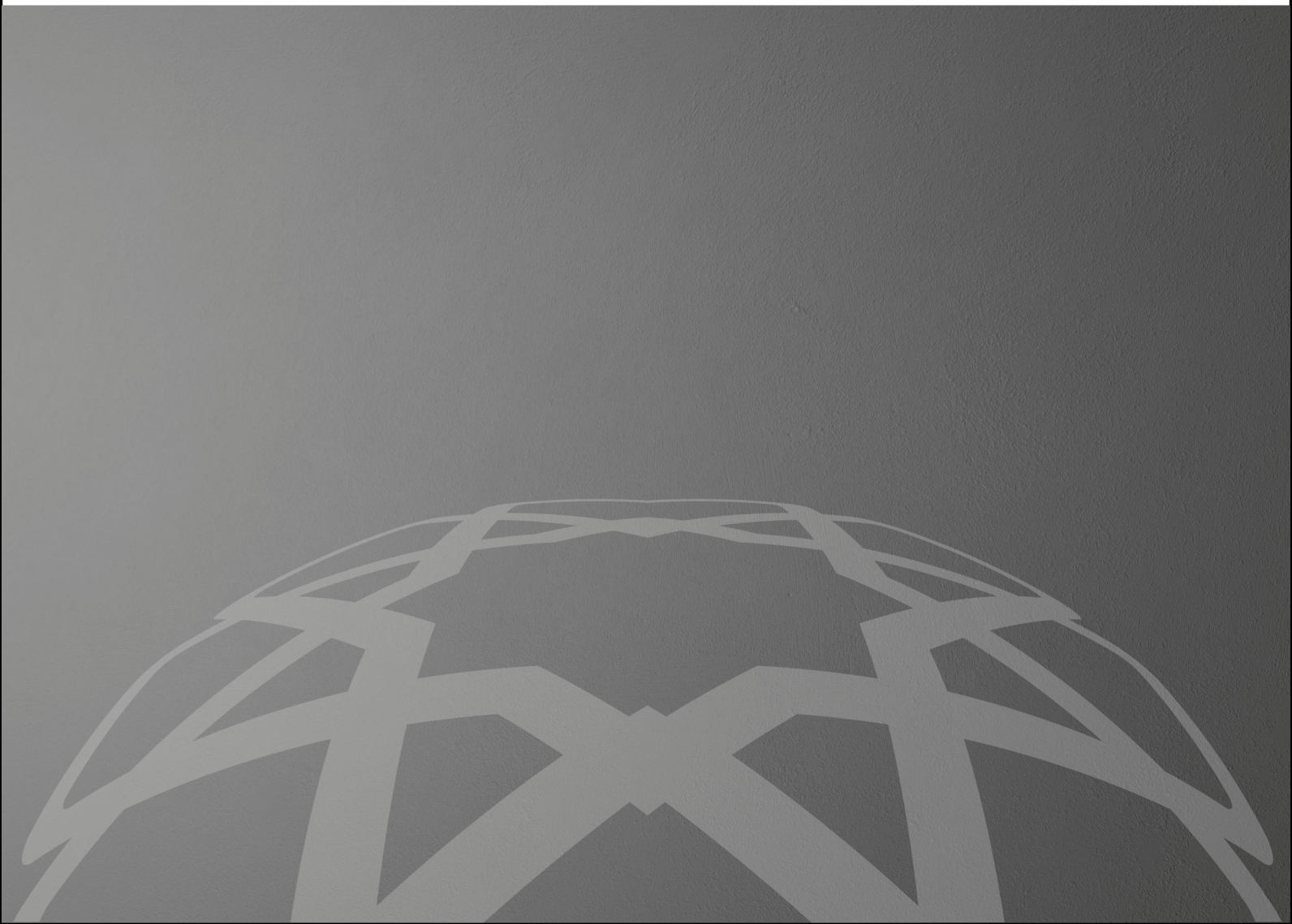




PV-T Hybrid Panel



Basics of Solar Energy Technique

Solar Energy

Benefits Of Solar Energy

The Sun has been providing the Earth with its light and heat for billions of years and has facilitated life on Earth. We have been utilising its energy and heat for many centuries. It heats up our living areas efficiently during the summer. But in the winter alternatives for heat and energy production are used such as wood, coal, liquid and solid fuel. Utilising the Sun's energy will mean that the Earth has a huge stock of potential energy. Consistent steps have been taken by the heat engineering industry to use these resources sparingly. One of the most important of these studies is to make direct use of solar energy with collectors. Using high quality collectors and a system technique compatible with them, making use of solar energy economically is no longer a dream today, but a proven fact in daily use. The investment in the solar energy system is a "real" investment made prospectively. We at Solimpeks believe that investing in solar energy is the most useful investment both for today and for our future generations.

As the sun's rays pass through the atmosphere, dust particles and gas are reflected, deflected and absorbed by the molecules. This causes the rays to weaken. The component of the sun's rays, which passes the atmosphere without any obstacle and falls directly to the earth, is defined as direct radiation. The part of the sun's rays reflected or absorbed by dust particles and gas molecules and reflected again and reaching the earth without direction is defined as diffuse radiation.

Benefitting from Solar Energy by Using Solar Collectors

The amount of useful energy that can be obtained by a collector depends on several factors. The most important of these factors is the solar energy available. In addition, the types, slopes and directions of the collectors also play an important role. In order to operate the solar system economically, the elements of the system must be carefully dimensioned.

Sol-Titan coating copper absorber forms the basis of Solimpeks collectors. This absorber provides a high level of absorption of the sun's rays and thermal radiation emission is low. The heat carrier fluid flows through the copper tube attached to the absorber sheet by laser welding. The heat of the absorber is transmitted through the copper tube to the heat carrier fluid. Absorber is covered with a highly heat insulated collector body. The heat losses of the collector are reduced to a minimum. High quality heat insulation is resistant to heat. Heat insulation is gas-free. Heat insulation consists of glass wool / rock wool. The collector is covered with a special solar-glass. Reflection losses are very low due to the low iron content of the glass used in Solimpeks collectors. The glass collector body is surrounded by EPDM glass edge wick inside and is also fixed on the wick with aluminum lath on the frame. With the system we call flexible, the collectors have the opportunity to be easily installed in the solar circuit. A collector temperature sensor can be mounted on the flow of the solar circuit via a set of sensor covers. There are ventilation holes on the collectors. These ventilation holes are opened to prevent condensation inside the collector. Thanks to the existing air holes, it is aimed to discharge the steam and water that may arise from condensation in the collector.

Introduction of Photovoltaic Material

The age we live in is called the age of solar energy. Converting sunlight into electricity with solar photovoltaic (PV) cells is an ideal source of power for environmentally responsible homes, businesses or public institutions. In order to draw a perspective on the size of solar energy; We can say that a solar cell power generation facility that covers only 1% of the Sahara Desert can meet all the electricity consumed on our planet.

Solar energy falling to the United States in 40 minutes is more than fossil fuels in one year. Photovoltaic cell science began in 1838 by two French physicists working on electricity production through chemical reactions. These physicists have determined that when the apparatus is exposed to sunlight, sunlight increases the electrical energy output. In 1954, Bell Laboratories announced the development of a single crystalline silicon cell, which allows photovoltaics to be moved to the practical daily practice outside the laboratory.

“Photovoltaic cells are semiconductor materials that directly generate electrical energy from sunlight. Although the sizes and forms of photovoltaic cells, also known as solar cells, vary according to their production characteristics, they are generally 125-125 or 156x156 mm and their thickness is thin enough to be measured by micrometer. By combining more than one of these, photovoltaic modules are created.” Photovoltaic cells have types called mono-crystalline, polycrystalline and thin-film-amorphous- silicon, which are formed depending on their production. The most important feature of photovoltaic material in terms of architecture is that it transformed buildings from energy consuming structures to energy producing structures.

The main ingredient of photovoltaic material is silicon, which is abundant on earth. After a number of special processes, it appears as a photovoltaic cell with a thickness at the micrometer level. However, since they are very fragile, they cannot be used as such. Therefore, a base is absolutely required for ease of use. This is either a metal layer or glass is used. The top of the material should also be protected against external influences. However, this coating should not prevent the material from absorbing sunlight. For this, special glasses or similar transparent materials are used. And ultimately, the photovoltaic material becomes the photovoltaic element / component ready for use in the structure.

Electricity generation with photovoltaic material has many advantages. We can list them as follows:

Since electricity will be produced where you need it, transmission costs and losses will decrease. The photovoltaic material does not harm the nature, produce noise while generating electricity, does not require an additional energy source, has no moving parts, no maintenance costs - it is sufficient to clean the dust accumulated on it at regular intervals with water.

Technical Information

Structure of Hybrid Collector

A hybrid collector is a product can supply both electricity and usable thermal hot water at the same time from one panel. Extra much electricity production per year with cooled monocrystalline cells.

COLLECTOR CASE

The collector case is produced from aluminium by Solimpeks solar energy systems. The aluminium used as raw material is 6603-60 (AlMgSi05) (AA-USA). The collector case is produced with a frame which is a user friendly both in terms of mounting and dismounting the system of Volther Hybrid Collectors. Wall thicknesses both for the case and frame are all according to DIN EN 12975 -1 and 2. Collector case is made of aluminium which is electrostatic painted with Ral 9005 matt black powder paint and then oven baked. The use of this technique ensures the system is highly protected against all natural conditions. Also taken into consideration is the possible thermal expansions that could occur on the glass, hence the glass is set up with an optional space during casing and the collectors are produced to be able to work properly in all regions of the world.

CASE TECHNICAL FEATURES

Specific Gravity	: 2,70 gr/cm ³
Gravitation Endurance	: 15,5 (at24C ⁰)
Flow endurance	: 12 (Kg/mm ²)
Hardness	: 60-65 Brinell (HB) Kg/mm ²)
Expansion Coefficient	: 23*10(200-100C ⁰)/C ⁰
Profiles	: DIN 1748 Tolerance
Elasticity Particle	: 6900 Kg/mm ²
Extension	: %8 Delta L/L*100 (50 mm Length)
Cutting Endurance	: 11,5 Kg/mm ²
Paint Thickness	: 60-80 Microns

TRANSPARENT COVER (GLASS)

Hybrid collectors are produced in two different styles. These are in the form of a system that is used directly with Pv glass and which is produced with extra protection afterwards.

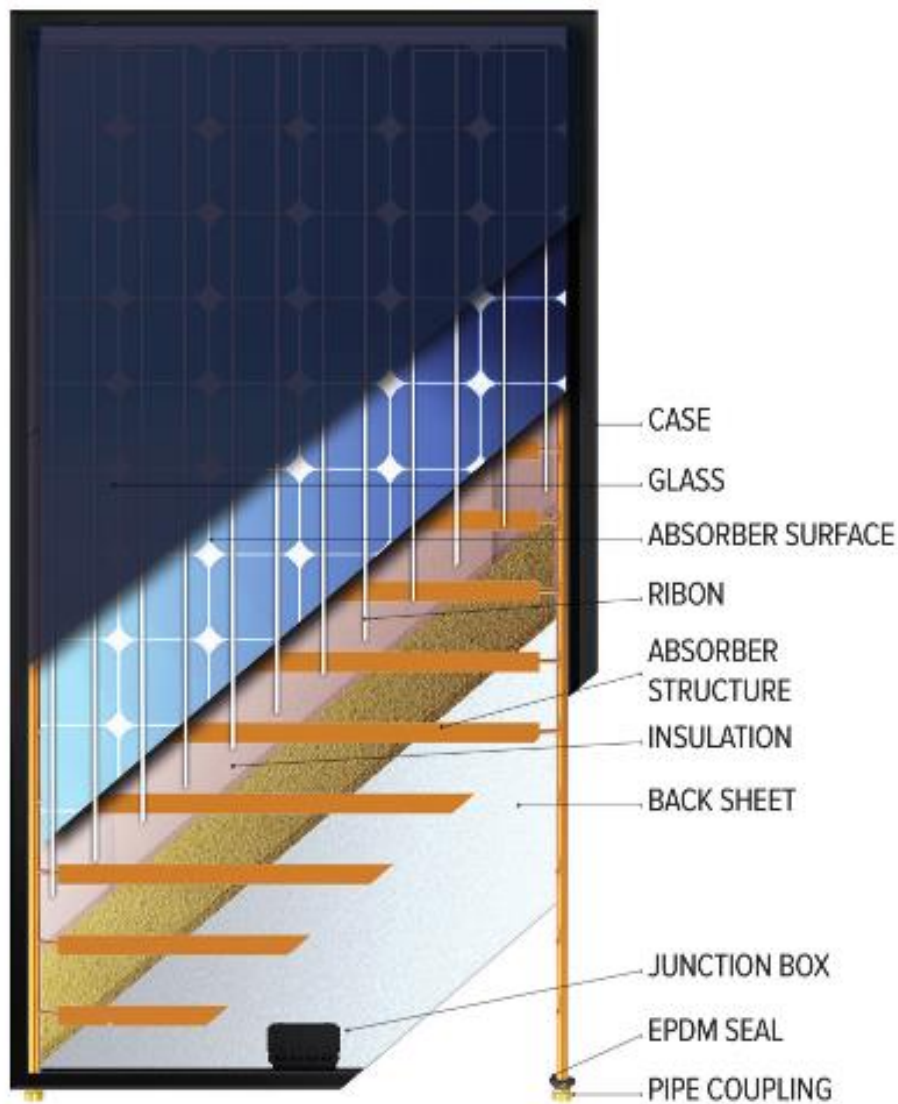
Glasses used as extra protection are produced in 4 mm thickness and within ± 0.2 mm tolerance range. The glass has a density of 2.5 gr / cm². While the direct permeability rate of normal iron oxide glass is 82.5%, the permeability rate of low iron oxide glass is 91%. Iron oxide ratio was kept low in order to increase the solar permeability of the glass. Prismatic patterned glass is the glass pattern that breaks the inclined rays of the sun in the morning and evening and drops it perpendicularly to the absorber surface, thus increasing the efficiency. Another feature desired from glass is high strength. Tempering is carried out on glasses in order to provide strength in order not to break glass during shipment or assembly and outside conditions.

Tempered glass (low iron) has started to be used in many collectors because of its mechanical strength, safety and higher collector efficiency. It has higher solar permeability than normal glass, rarely breaks and when broken, it is broken into very small, harmless pieces, such as automobile windows.

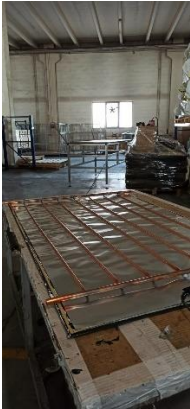
COMBINING GLASS WITH CASE

Silicone material is used as sealing material. The resistance of the sun to aging effects is high. Support is made between the glass using silicon. The thermal expansion of the glass should be taken into consideration when mounting the collector case. For this reason, all problems that may arise from the thermal expansion of the glass in the metal case have been removed by leaving sufficient space at all edges of the glass. It cleans itself during normal rains in glass contamination due to existing environmental pollution. It does not hold dust on it. In case of low or no precipitation, the glass surface of the collector should be cleaned. It is possible to do this cleaning with normal soapy water or glass cleaning products that we use at home. It should not be forgotten that the clean glass surface will ensure the full operation of the collector.

HYBRID COLLECTOR MODEL CROSS-SECTION













Assembly Steps Part PV + Part TH

<p>Step 1</p> <p>Double sided tape application on PV back surface</p> 	<p>Step 2</p> <p>Applying grease to the PV back surface</p> 
<p>Step 3</p> <p>Placing the th part on the greased surface</p> 	<p>Step 4</p> <p>Silicon application to frame channels</p> 
<p>Step 5</p> <p>Long side of frame insertion</p> 	<p>Step 6</p> <p>Short side of frame insertion</p> 

Technical Specifications of HybridCollectors

Test Pressure Values: Thrust 2400 Pa/ Traction 2400 Pa

Specifications / Product Code	VOLTHER EXCELL PVT
Dimensions	1670 x 1005 x 60 mm
Weight	28,44 kg
Gross area	1,673 m ²
Number of cells	60 (6x10)
Cell dimensions (mm)	158,75x158,75
Nominal Power (Wp)	325 W
Glazing	Pv glass
Absorber Surface (PV)	Mono
Absorber Surface (T)	Copper
Safety Class	II
Maximum over current protection rating	15A  
Power tolerance, current tolerance and voltage tolerance	± 3%
Volume of heat transfer fluid	0,85 L
Imp(A) Nominal Current	9.62A  
Isc(A) Short Curcuit Current (± 5%)	10.17A  
Vmp(A) Nominal Voltage	34.30V  
Voc(V) Open Curcuit Current (± 5%)	41.67V  
Welding Type	Laser
Absorber Tube Diameter	8,0 mm
Absorber Tube Thickness	0,45 mm
Manifold Tube Diameter	18 mm
Manifold Tube Thickness	0,70 mm
Tube Number	7
Tube Distance	130 mm
Max. Operation Pressure	8,6 bar
Test Pressure	13 bar

*All electrical data shall be shown as relative to standard test conditions (STC) (1 000 W/m², (25 ± 2) °C, AM 1,5 according to IEC 60904-3 and IEC TS 61863).

*Stagnation temperature at 1000W/m² and 30°C -> 70°C

Photovoltaic Module Technical Specifications

Typical Electrical Parameters	Unit	MR325M-60C/M
Nominal power at STC, P _{max}	W	325
Power Tolerance at STC	%	± 3
Voltage at P _{max} , V _{mp}	V	34,30
Current at P _{max} , I _{mp}	A	9,62
Open Circuit Voltage, V _{oc} (± 3%)	V	41.67
Short Circuit Current, I _{sc} (± 3%)	A	10.17
Maximum System Voltage	V DC	1000
Temperature Coefficient of P _{mp}	%/°C	0.048
Temperature Coefficient of V _{oc}	%/°C	-0.255
Temperature Coefficient of I _{sc}	%/°C	-0.0331
Class of Protection		II
Maximum Series Fuse	A	15

Mechanical Parameters		MRwwwM-60C/M	MRwwwM-72C/M
Cell Type		Mono Crystalline	
Cell Size	mm	158.75 x 158.75	
No. Of Cells (Matrix)	pcs	60	72
Module Overall Dimensions (LxWxT)	mm	1665x1002x35	1982x1002x40
Weight (Approx.)	Kg	19	23.5
Design Load	Pa	1600	
Fire Performance Type		1	

*Under normal conditions, a photovoltaic module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc}. marked on this PV module should be multiplied by a factor of 1,25 when determining component voltage ratings, conductor current ratings, and size of controls (e.g. inverter) connected to the PV output.

* Type or model number designation for PV: MIR310-335W

*Nominal module operating temperature (NMOT). **36.9 °C**

*Performance at NMOT (MQT 06.2). **242.5 W**

*Performance at low irradiance (MQT 07) is specified. **63.2 W**

*Temperature coefficient for voltage at open-circuit; Beta [%/°C] -0.255 V_d = **-0.28%/°C**

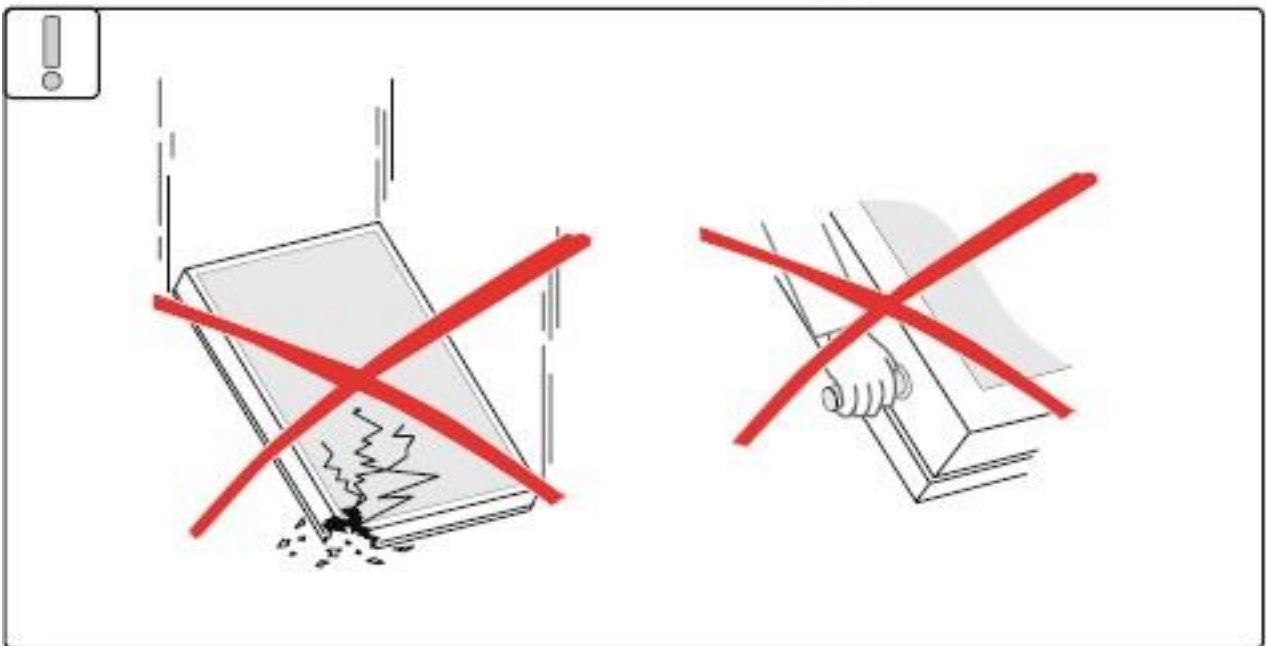
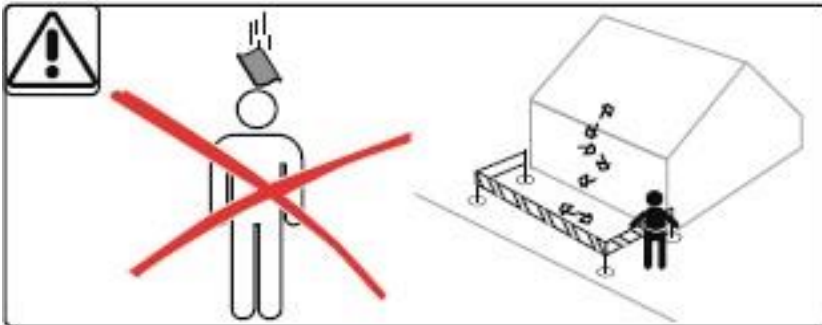
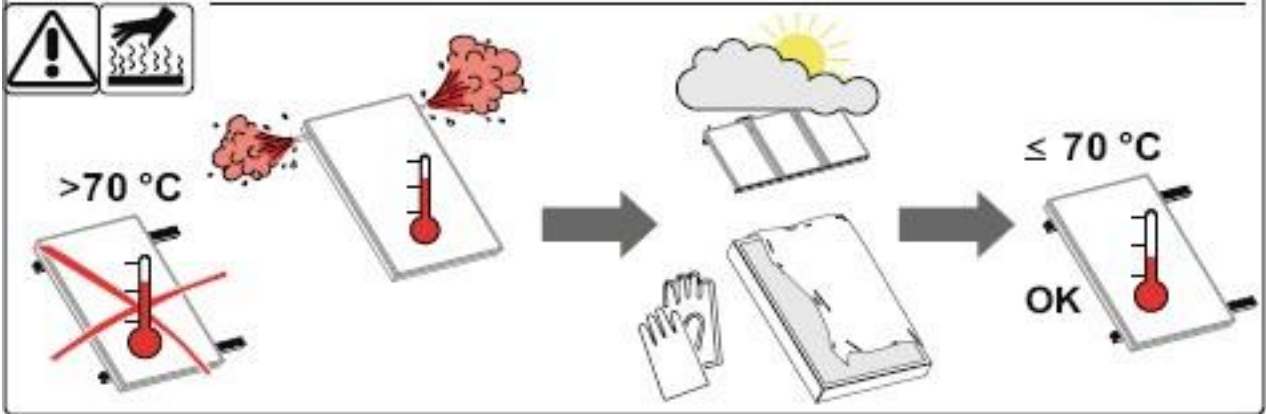
*Temperature coefficient for maximum power; alpha [%/°C] 0.048 V_d = **-0.37%/°C**

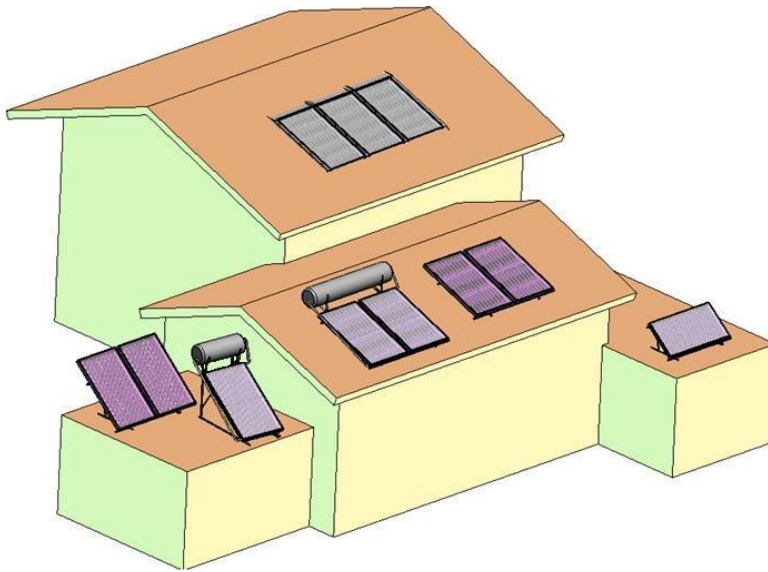
*Temperature coefficient for short-circuit current; Gamma [%/°C] -0.331 V_d = **+0.048%/°C**

*The type and ratings of bypass diode to be used (if applicable); = **15A, IP68**

*Fire rating: **Class C**

General Assembly Rules





Inclination and Directions of Collector

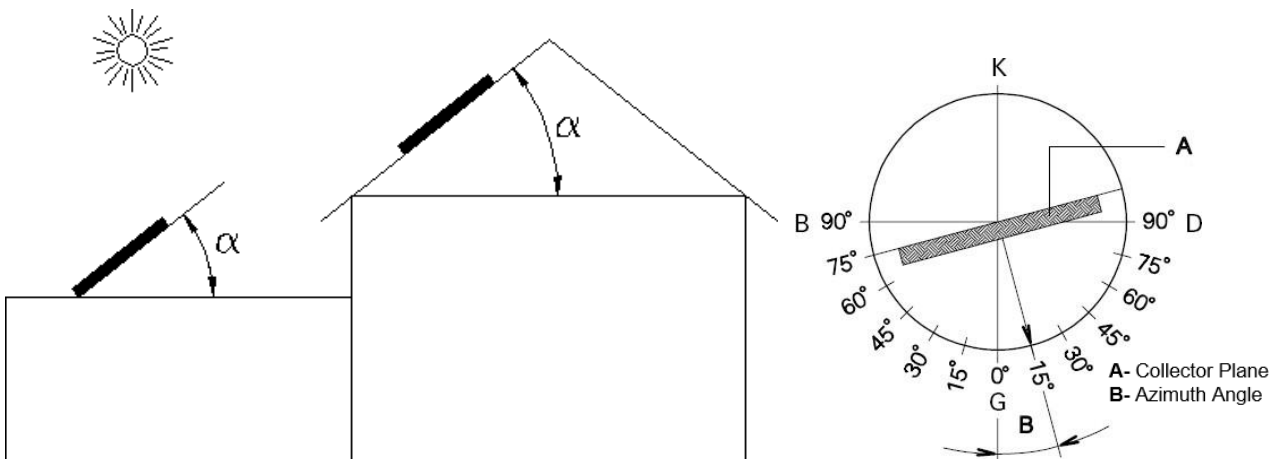
In order to make optimum use of solar energy with the collectors, their directions must be towards the sun. Inclination angle and azimuth angle are used as a measure in guiding the collectors.

Inclination Angle(α)

The tilt angle is the angle between the collector α and the horizontal plane. This angle is opened by the roof slope when installing on pitched roofs. The absorber in the collector can draw the most energy at right angles to the sun's rays. Since the beam angle varies depending on the time and season, the collector plane is because the sun will give the most energy. It has been tried in practice where tilt angles between 30° and 45° are ideal. for Turkey, an inclination angle between 15° and 60° are suitable


Azimuth Angle

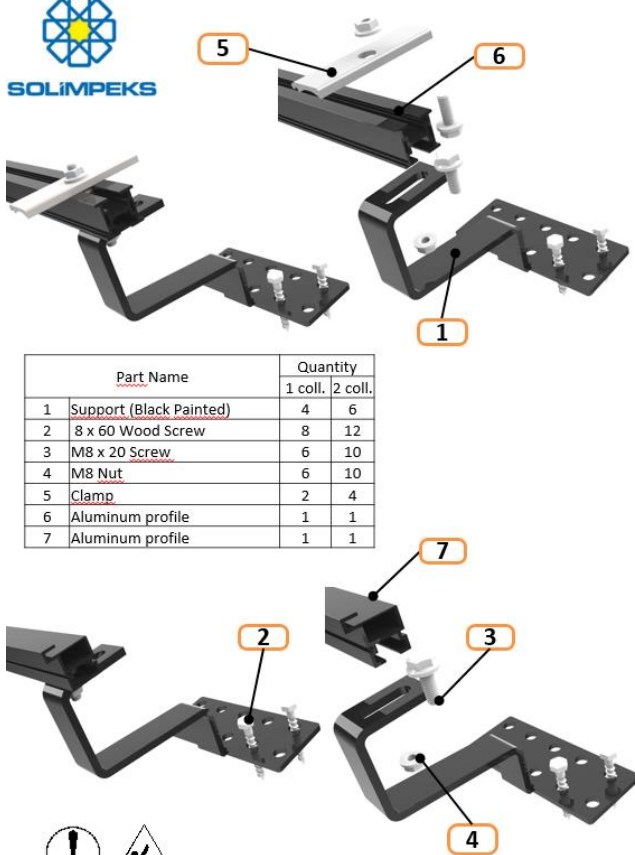
The azimuth angle indicates the deviation of the collector plane from the south direction; The azimuth angle of a collector directed to the south is $= 0^\circ$. Since the sun's rays are most intense at noon, the direction of the collector plane should be turned as far south as possible. Deviations up to 45° to the south are also acceptable.




Onto - Roof Mounting Kit











Aluminum profile dimensions (mm)		
1 Excell PVT	2 Excell PVT	
1150 x 30 x 30	2300 x 30 x 30	

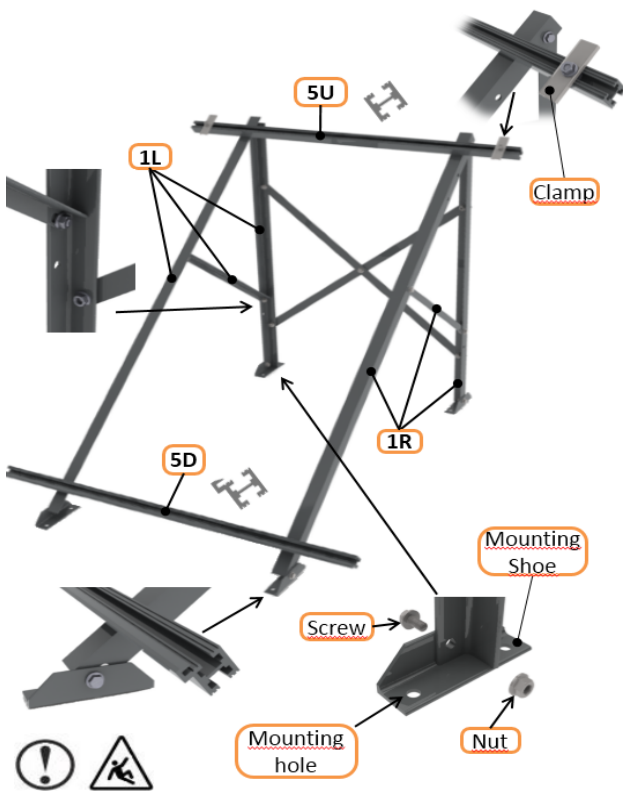
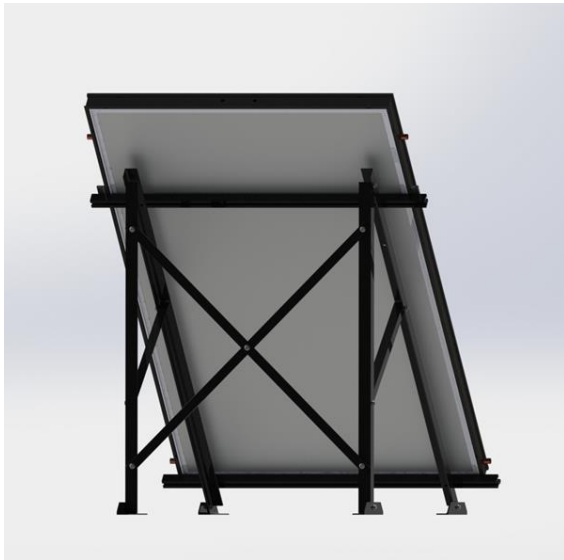


Part Name	Quantity	
	1 coll.	2 coll.
1 Support (Black Painted)	4	6
2 8 x 60 Wood Screw	8	12
3 M8 x 20 Screw	6	10
4 M8 Nut	6	10
5 Clamp	2	4
6 Aluminum profile	1	1
7 Aluminum profile	1	1

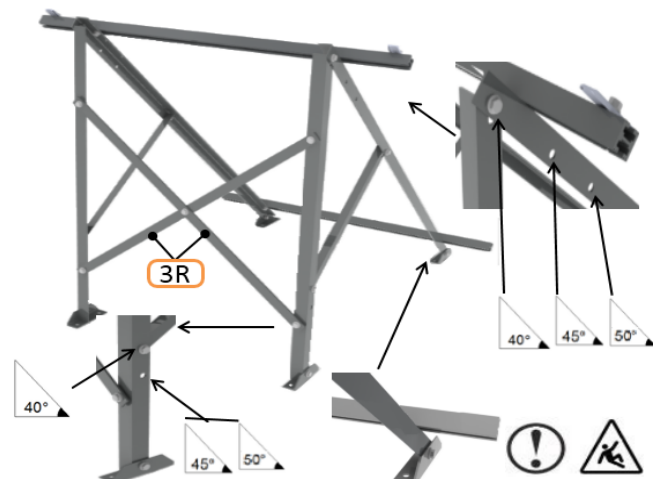



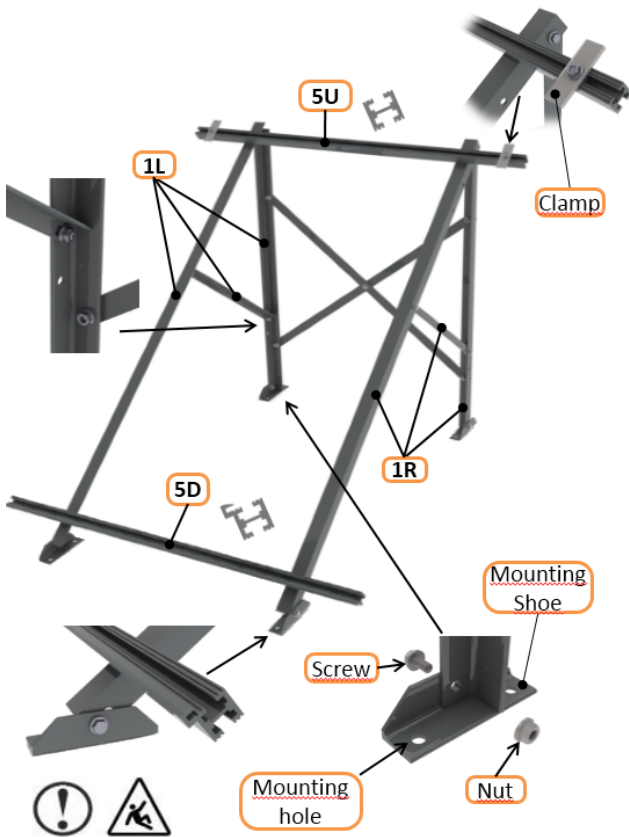
Flat - Roof Mounting Kit



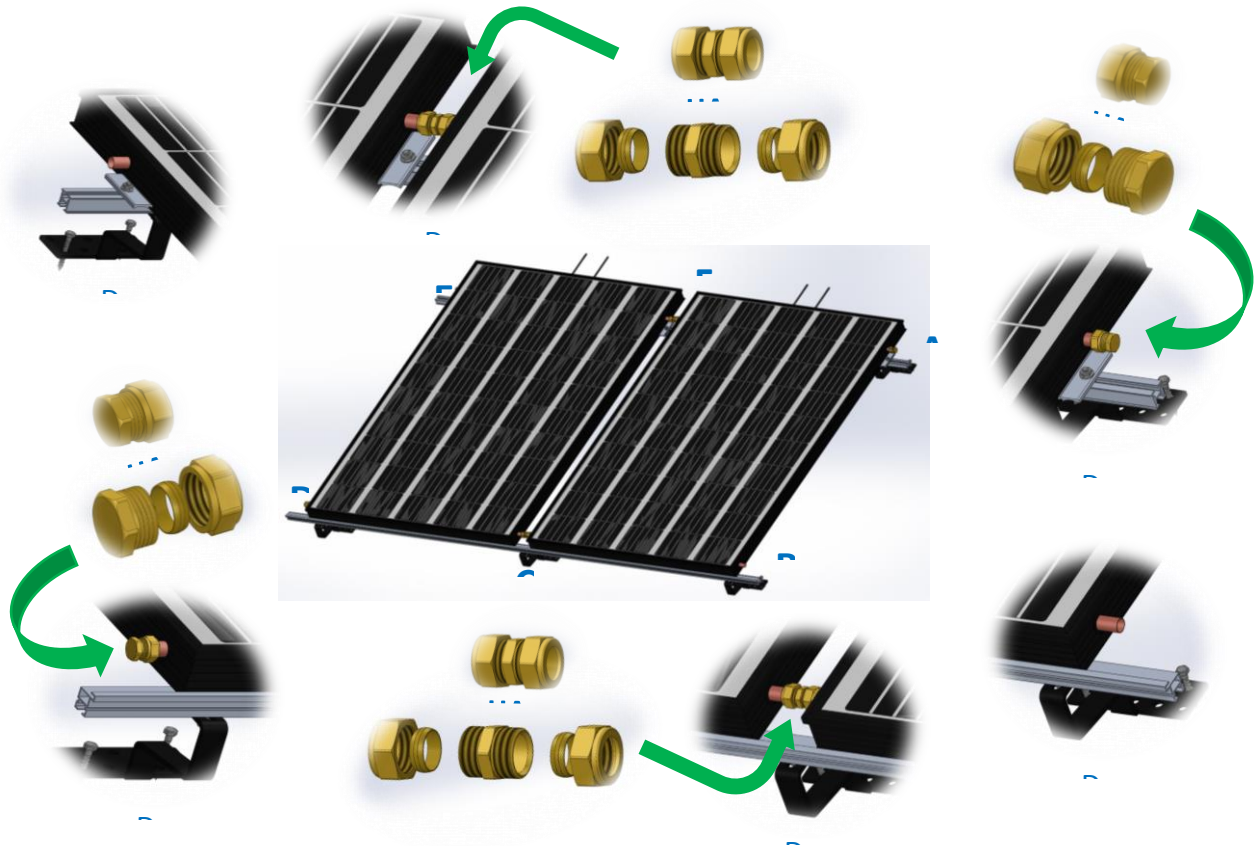
1 Excell PVT Collector		
No	Unit	Dimensions
1L	1	1620 X 30 X 30 mm
	1	1040 X 30 X 30 mm
	1	590 X 25 X 25 mm
1R	1	1620 X 30 X 30 mm
	1	1040 X 30 X 30 mm
	1	590 X 25 X 25 mm
3R	1	2 screwed pieces of 980 X 30 X 5 mm
5U	1	1150 X 30 X 30 mm
5D	1	1150 X 30 X 30 mm
Screw	21	M10 X 20
Nut	21	M10
Clamp	2	90 X 30
Mounting Shoe	4	150 X 40 X 40



Flat - Roof Mounting Kit For 2 x PVT Hybrid Collectors



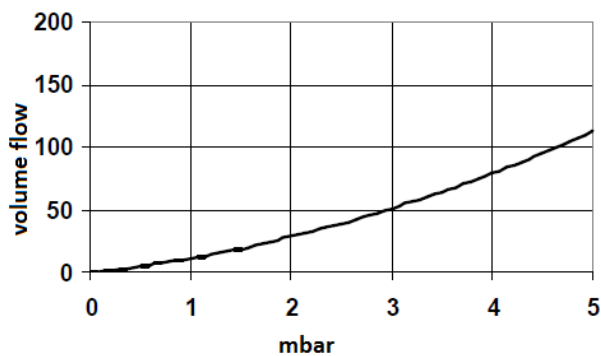
2 Collector Excell PVT		
No	Unit	Dimensions
1L	1	1620 X 40 X 40 mm
	1	1040 X 40 X 40 mm
	1	590 X 25 X 25 mm
1R	1	1620 X 40 X 40 mm
	1	1040 X 40 X 40 mm
	1	590 X 25 X 25 mm
3R	1	2 screwed pieces of 1670 X 30 X 5 mm
5U	1	2300 X 30 X 30 mm
5D	1	2300 X 30 X 30 mm
Screw	23	M10 X 20
Nut	23	M10
Clamp	4	90 X 30
Mounting Shoe	4	150 X 40 X 40



PERMISSIBLE (maximum) WIND AND SNOW LOAD

The maximum snow load (s_k) and main wind speed (v_m) values the solar collector-support unit can withstand with the sloping roof supports are $s_k = 0.66$ and $v_m = 1.75$, and so the system may only be installed in areas with values lower than these. With combined snow and wind loads the maximum strain for Wunder collectors is 2000 N/m^2 .

Pressure Drop Chart



General Care Rules

Draining and filling collector water:

By opening the ball valve at the bottom of the collector, the water in the system is drained. Then the water should be refilled as described in the section on Preparing and pressing the water with antifreeze and bleeding the system. While doing this, it should be preferred in the morning or evening hours when the sun is not active and the collector should be cold. Otherwise, hot water in the system can cause injuries.

Avoid calcification of the safety valve, have it cleaned once a year. Cleaning the collector:

It is important for the collector glasses to be clean for the efficient operation of the system. Dust, dirt, snow etc. on the glass. clean the elements.

Winter maintenance and checks:

The collectors are not covered by the freeze warranty. For this reason, the system measures the antifreeze degree in autumn.

if necessary, add antifreeze. On very cold days, leave the hot water tap open a little. In this way, you prevent the installation from freezing.

Periodically check that the electrical and mechanical connections are intact and undamaged. Clean the glass surface of the module with warm water and a soft cloth or sponge suitable for the temperature of the module.

If necessary, use a mild (neutral) cleaner. Never use a cleaner that contains abrasives.

WARNING!

- Danger from DC voltage!
- Risk of electric shock!
- Do not touch open fittings
- Cover the module with a matte material before closing electrical connections.
- Make sure the entire photovoltaic system is voltage free.
- The system is now disabled and can be dismantled.
- In doing so, follow the safety instructions as during installation

Practical information

- If you find that it is warmer than it should be when you put your hand on the collector under the sun, fluid circulation in the collector has stopped. A possible reason for this is that a foreign body is clogged pipes or the system is blowing air.
- If there is a leak anywhere in the system, check the water here. If your hand feels slightly greasy and lightly colored, the leak is switched off, if it feels normal water, there is a leak in the line of use.
- If there is a marked accumulation of water on the collector glass other than normal condensation, your collector may have been splashed with water or a crack has occurred in the collector panel.
- If your collector is not heating sufficiently, check whether your collector glass is clean.

What To Do In A Possible Failure

<u>Fault</u>	<u>Cause</u>	<u>To do</u>
The water does not heat enough	Dirty collector glass	Clean the glass
Hot water does not flow	Collector pressure is insufficient	Complete the antifreeze
	Hot / cold water valve closed	Open the hot / cold water valve
	Mains pressure is insufficient	Install booster
Safety valve leaking water	Valve is calcified	Clean the valve
	Mains pressure is high	Use pressure reducer

Assembly / Safety Instruction

Solar module user instructions

Please read the assembly and safety instructions below carefully. Failure to follow these instructions could void the module warranty.

- General safety instructions

- Check the mechanical stability of the module before installation.
- Install only undamaged modules.
- If the module falls, its glass may break. A module with a broken glass cannot be repaired and used.
- Keep children away during transporting systems, mechanical and electrical installation.
- Do not drop anything on the module, do not step on the module.
- Do not hold the module by the connector socket or electrical connections when lifting, moving or installing.
- Use the module only for its intended purpose.
- Do not disassemble the module, do not remove the mounted plate and its parts.
- Do not apply paint or adhesive to the back of the module.
- Do not drill holes in the module frame or glass surface, do not weld on the module.
- Do not concentrate sunlight on the module.
- Keep the instructions for use near the photovoltaic system.
- Before making electrical connections, cover the module with a matte cover.
- Remove all metal jewelry and watch before installing the module.
- Mounting frame and parts should be made of durable, corrosion and UV resistant materials.

- Assembly

- Follow all local standards, manufacturing regulations and accident prevention regulations during assembly.
 - Only personnel with basic electrical engineering, electronic and mechanical knowledge should assemble. The installer should consider all accident risks, including electric shock, during installation.
 - The grounding requirement must be checked against local electricity regulations.
 - The additional loads caused by the PV system installation must be checked by an engineer.
 - Mount the system using a mounting system recommended by the manufacturer.
 - Use only a mounting system that can withstand possible additional loads (snow, wind, etc.).
 - Make sure that other system parts do not create mechanical or electrical obstructions to the module.
 - Use only equipment (cable, connector, etc.) suitable for photovoltaic systems. When installing the module, use the mounting holes in the frame and the clamps in the specified clamp areas.
 - Work only in a dry environment with a dry module and dry tools.
- Do not install the module next to flammable gases and vapors, as sparking can occur.

- **ATTENTION !**

- Make sure there is enough insulation to avoid contact with electrical parts.
- Use only insulated / insulated tools.
- If there are drain holes on the module, they should not be closed by the mounting system.
- Select a mounting place with maximum sun in all seasons, avoid shade.
- Place modules facing north in the northern hemisphere and modules facing south in the southern hemisphere.
- Determine the optimum angle of inclination according to the latitude of the assembly site. For this information, consult your expert solar energy dealer.

- Cabling

WARNING!

- Risk of fire connected to the back! Do not disconnect any connections under load!
- Make all wiring in accordance with current local standards.
- Protect the cables from damage. The connections must be electrically and mechanically intact.
- When the modules are connected in series, the total voltage is equal to the sum of the individual voltages. In this way, the desired voltage is produced. Only connect modules with the same current in series.
- When the modules are connected in parallel, the total current is equal to the sum of the individual currents. In this way, the desired current is produced. Only connect modules with the same voltage in parallel.
- Check the correctness of the poles.

Considerations for Transport

- The materials should never be removed from their original packaging during transportation.
- Collectors should never be transported upright or transversely by imposing them somewhere in the vehicle.
- The collectors should be placed parallel to the ground, without damaging the side fittings.
- No load should be placed on the collectors and they should be fixed so that they do not swing in the vehicle during shipment.
- The collector should not be transported by dragging on the floor.
- It should be ensured that the components required for the collector assembly and the system are not removed from the packaging until the moment of assembly.
- If the collector is pulled to the roof with a rope, it must be pulled one by one.
- When carrying the collector to the roof, it should be fixed in a way that it will not be damaged.
- When the place where the collector is to be installed is a roof or a terrace, the risk of accidents will be high and precautions should be taken against the accident.
- The place where the system will be installed must be determined before assembly.
- During installation, construction conditions, technical conditions and regional regulations must be observed.
- If the collector is to be mounted on the roof; As far as possible, a distance away from the chimney should be preferred. In this way, the smoke coming out of the chimney will pollute the collector glass will be minimized.
- Trees, tall buildings, chimneys etc. Factors such as should not shade the collector surface during the day.
- In the building where the system will be installed, the appropriate place should be chosen that will not spoil the visual pollution and architectural structure.
- Workers who pull the collector to the roof must secure themselves with at least two safety points with a seat belt.
- Anyone who does not ensure his own safety should not be assembling on the roof.

-
- In snow, rain and strong windy weather, it should never be mounted on the roof.
 - The worker who will assemble on the roof must wear shoes with rubber soles.

!!PV Manufacturer Notices!!

Introduction

This User Manual refers to the installation, wiring, handling, maintenance and general administration of PV-T panels. Please read this manual accurately and completely before configuration and installation of the plant. All advices given in this document are to be handled by a qualified person, who has due to his professional qualification the necessary technical know-how. Attention should also be paid to the live threatening risk, which may occur because of the tension in conjunction with a grid-feeding plant. In case of an improper installation of the module there is a danger of fire risk.

This User Manual refers to the on-roof mounting, on flat-roof bracing and on land installations with or without tracker.

In case of divergence towards this user manual manufacturer does not incur liability for personal damages or property damages, which arise because of improper utilization, maintenance or incorrect assembly of the panel. Manufacturer furthermore does not provide warranty for utilisability and functional capability of the panels in that case of divergence towards the in this user manual given advices.

Notice:

-The module is considered to be in compliance with this standard only when the module is mounted in the manner specified by the mounting instructions. A module with exposed conductive parts is considered to be in compliance with this standard only when it is electrically grounded in accordance with the manufacturer's instructions and the requirements of the National Electrical Code, ANSI/NFPA 70 (2014-2017).

- All details given in this document are corresponding to the technical condition on production date.

- Subject to modifications and amendments.

- It has been evaluated for use at ambient temperature between -40°C and +40°C.

Basic safety instructions



Risk of death by electric shock!

- The solar modules generate electricity under sunlight and even energize at a light level. A series connection of modules leads to an accumulation of voltage. A parallel connection addition leads to an accumulation of current. The wiring of several modules to a generator control panel is only to be handled by authorized specialized staff.

- The network plug of the photovoltaic-panel has to be handled by a franchised certified electrician.
- During the assembly and handling of the plant, all local legal norms, technical building regulations and accident safety regulations, especially concerning activity on the roof have to be kept.
- The safety instructions of all plant components as well as all regulations of the respective energy provider to the grid feeding operation of the plant are to be considered.
- Also during low temperatures the maximum admissible open circuit voltage of the modules must not be exceeded.
- Never open the junction box of the photovoltaic module.
- Only use inspected safety equipment and tools for the installation.
- Risk of death by electric arc! The solar modules have to be disconnected through DC switch before the beginning of any operation on any current-carrying part of the plant.
- Do never disconnect the solar power generator from the inverter or the assembly of the solar modules under load current. First turn off the DC switch.
- Examine all tools for damage before the installation.
- Please protect the panel, plug and jack against damage.
- The tools that you use for the installation have to be dry. Do not establish a connection with dirty or wet plugs or jacks.
- Do never introduce conductive parts in the connection box and joining pieces and never try to touch the plugs on the inside.
- Do not modify or decompose the solar panel. And do not remove any from the manufacturer attached notches or type plates.
- Avoid any contact of the PV-element with metal parts.
- Pay attention to all warning notices and safety indications that are attached to the panel.

Transport and storage

During transport and interim storage the following points are to be observed:

- The handling with the modules should always be handled with due care.
- Any operation of the photovoltaic panel is to be made with clean and soft protective gloves.
- The panels are very shock-sensitive. Therefore during transport, charging and discharging, storing temporarily and mounting of the PV-elements you have to be extremely careful with the handling. Never lay down the solar panels rough or on the corners and use a correspondingly soft surface. Enter the modules with both hands. Do not drop the modules.
- Never use the junction box as a handle bar.
- For panels storage use a dry, ventilated room.

- Do not use the photovoltaic panels as a support.
- Keep all parts clean, which may come in contact with the PV-element.

Installation options

Installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installation, Canadian Electrical Code, Part1.

Environmental condition and asset location

The panels are intended for application in temperate zones. To avoid damaging of the module by corrosion, a minimum distance of 500m to the bordering of sea is suggested. It is also required to install at a maximum height of 2000 m above sea level. It's not allowed to make an installation in locations with an abnormally high chemical loading, e.g. pollution by industrial enterprises. The solar modules are not supposed to be exposed by concentrated light e.g. by mirrors bundled sunlight. The module must neither be plunged nor come in touch with a constantly water inflow like a fountain.

Alignment and slope

The ideal arrangement of the photovoltaic module may vary according to the location. The module surface should stay vertically to the sun to get the best possible earnings. In addition you should pay attention on the following points:

- The collector slope of the module should be at least 10°, based on the rain- conditioned self-purification.
- Please avoid a partial or completely shading of the module.
- All module connected together in series should have the same slope in order to prevent losses in gain.

Installation of a Photovoltaic Module

PV modules can be mounted to the substructure using specially designed module clamps.

Regardless of the fixing method the final installation of the modules must ensure that:

- A clearance of at least 150mm is provided between modules frame and the surface of the wall or roof.
- The minimum distance between two modules is 20 mm.
- The mounting method does not block the module drainage holes.
- Panels are not subjected to wind or snow loads exceeding the maximum permissible loads, and are not subject to excessive forces due to the thermal expansion of the support structures.
- The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.

-
- A module with exposed conductive parts is considered to be in compliance with the certification requirements only when it is electrically grounded in accordance with the instructions presented below and the requirements of the Canadian Electrical Code.

Further advices for installation

- Solar modules are certified for operating at voltages up to 1000Vdc. This maximum voltage should not be exceeded in designing a PV system or array configuration. Under normal operating conditions, a solar photovoltaic module is likely to produce more current and /or voltage than the reported values in the datasheet under standard test conditions. In the event of connections are not securely made with gap between the contacts there is a likely chance electrical arcing that can cause a fire hazard and/or an electric shock. So, it is recommended to always use a suitably rated isolator (DC switch) to interrupt the current flow before disconnecting the connectors.
- When fuses are fitted, they should be rated for the maximum DC voltage and connected in each, non-grounded pole of the array (i.e. if the system is not grounded then fuses should be connected in both the positive and negative poles). The maximum rating of a fuse connected in series with an array string is 15A.
- This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings in parallel.
- The clamps should not loom into the cell area of the module.
- If different metals are used with the mounting system, pay attention to possible contact corrosion due to different fastening material.
- During operation of the plant it could be that the given technical values of voltage and current are in real higher than calculated before under STC. In order to prevent a possible disproportion between theoretic al and real values it is recommended to add a security margin of 1,25 on all technical values including cable cross sect i on, invert er power, etc.
- It has to be taken into consideration that the load of the plant into the grid is balanced on all three phases of the public power grid. All technical standards for grid- feeding inverters have to be respected. In every case during development the technical data-sheet of the inverter has to be taken into account.
- All inverters have to respect the national and local grid-feeding standards including EMC regulations.
- Depending on the local wind and snow loads, additional module clamps may be required. (All panels are designed for 1600 Pa load. Test load is 2400 Pa, safety factor 1.5)
- PV module connect in parallel should have similar voltage. As reference the maximum number of modules in parallel can be easily calculated by dividing the maximum rated current (indicated in the electrical specification below) by I_{sc} value of the module, and then plus 1. Please always take into consideration the variation of the current under different temperatures, the I_{sc} of the modules will be rise when the temperature goes up.

- Plugs for installing the PV system and make sure that all connections are safe and tight. The cable should be minimum 4mm², and able to withstand the maximum possible system open-circuit voltage.
- Manufacturer uses one types of junction boxes in the panels it produces. PV-Junction Box *model is PV-ZH011-3D (Manufacturer: Zhejiang Zhonghuan Sunter)* PV-Connector model is PV-JM601 (*Manufacturer: Zhejiang Jiaming Tianheyuan*) 4mm², the connector cables size = 1 x 4mm² Temperature Rating = 90°C, 1000VDC (according to IEC 62852:2014)

Wiring

All wiring should be performed by qualified installers, in accordance with the local codes and regulations.

- A series connection can only be effected if all modules have the same current rating. In doing so attention should be paid to the tension of the module in series, the maximum voltage must not exceed 1000V.
- For the parallel connection only modules with the same voltage are to be used. If three or more strings per MPP-Tracker of the inverter are interconnected in parallel, you have to revert to a stringbox. The reverse current load capacity of the panel is 15A. Accordingly the string-box has to be equipped with string fuses with a maximum of 15A.
- Modules can be connected in series to increase the operating voltage by plugging the positive connect or of a module to the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry. Opening of the connection is not allowed during operation.
- Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. Check the string configuration before making the connection.
- Modules are provided with stranded copper cables with a cross sectional area of 4mm² which are rated for 1000Vdc, 90°C and are UV resistant. All other cables used to connect the DC system should have a similar (or better) specification. The manufacturer recommends that all cables are run in appropriate conduits and sited away from areas prone to water collection.
- The maximum voltage of the system must be less than the maximum certified voltage (1000V typically) and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location using the following formula

$$1000 \text{ V} \geq \text{System Voltage} = N \times \left[\left(\frac{TCVoc \times (T_{min} - 25) \times Voc}{100} \right) + Voc \right]$$

Where;

N–Number of modules connected in series

Voc–Open circuit voltage (V)

TCVoc–Temperature coefficient of Voc (% / °C)

Tmin–Minimum ambient temperature at installation location (°C)


- The minimum and maximum outer diameters of the cable are 5 to 7mm

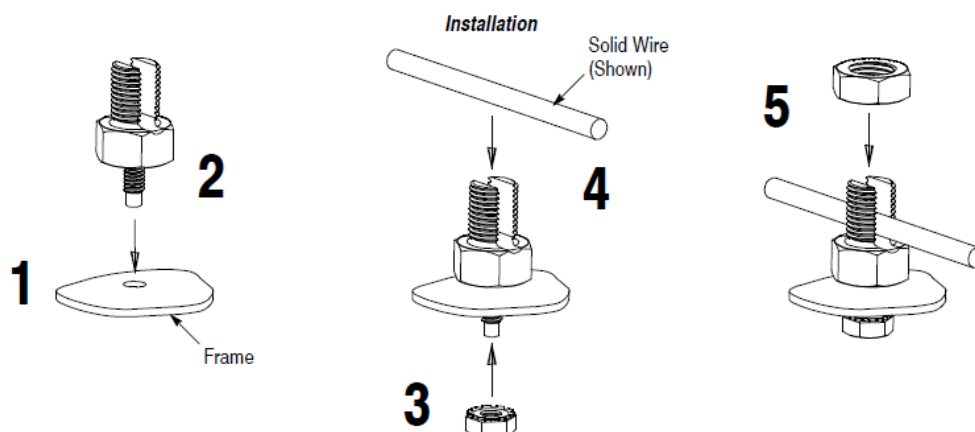
- For field connections, use at least 4 mm² copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV Wire
- The minimum bending radius cables should be 43mm.



Grounding

- All module frames must be properly grounded.
- Observe all local electric codes and regulations.
- Use aluminum grounding and bonding device type 2106831- 1 manufactured by, TE CONNECTIVITY LTD. COMPANY (TYCO ELECTRONICS CORP) (https://www.te.com/commerce/DocumentDelivery/DDEController?Action=showdoc&DocId=Specification+Or+Standard%7F40810262%7FC%7Fpdf%7FEnglish%7FENG_SS_408-0262_C.pdf%7F2106831-1)
- Then proceed as follows:

1. Locate the grounding hole "  " on PV module frame.
2. Insert the thread post end of the wire bolt into the hole.
3. Thread the mounting hex washer nut onto the threaded post end of the wire bolt. Fingertighten.
4. Position the wire into the wire slot.
5. Thread the wire binding hex nut onto the wire slot end of the wire bolt. Fingertighten until the wire is compressed.
6. Using a 9/16 in. open end wrench, hold the hex body of the wire bolt, and using a socket wrench (3/8 in. socket wrench), tighten the mounting hex washer nut to a torque of 2.82 Nm [25 in.lbs.].
7. Continue holding the hex body, and using a socket wrench (3/8 in. socket wrench), tighten the wire binding hex nut to a torque of 5.08 Nm [45 in.lbs.].



Maintenance and cleaning

In general it is not necessary to clean the modules if the inclination is >10°. In case of persistent dirt use only classic glass cleaner or cleaning alcohol. Do not use galling or chemical cleaners, do not scrape the module.

All modules are maintenance free, but it could be useful to verify the PV-installation regularly against following criteria's:

- Integrity of the cables
- Fastening elements against e.g. loose brackets
- Cleanness, stainlessness and safe connection of all cables connections

Warranty Certificate

In accordance with the Law No. 6502 on the Protection of Consumers and the Regulation on the Principles of Implementation of the Guarantee Certificate enacted based on this law, the use of this document is issued by T.C. Permission has been given by the Ministry of Industry and Trade, General Directorate of Protection of Consumers and Competition.

Document No and Permission Date:

MANUFACTURER'S

Title : Solimpeks Enerji Sanayi Ve Ticaret A.Ş.
Head Office : Fevzi Çakmak Mahallesi 10753. Sok. No:3/3a Karatay /Konya
Telephone&Fax : +90 332 444 06 02 & +90 332 444 06 08

COMPANY AUTHORITY'S
Signature And Stamp

SELLER'S

Title :
Head Office :
Telephone&Fax :

Invoice Date And No :

COMPANY AUTHORITY'S
Signature And Stamp

Type :
Brand :
Model :
Serial Number :

Delivery Date And Location :

Warranty Time :

Maximum Repair Time :

1. Manufacturer's Warranty

Solimpeks Solar Energy Systems (hereafter "Solimpeks") warrant that the Volther Hybrid PVT modules manufactured by them will be free of :

- defects and/or failures due to manufacturing;
- defects and/or failures due to materials;
- cracking of the front glass surface due to foreign objects inside the glass¹; or non-conformity to specifications due to faulty manufacturing and/or inspection processes.

For a term of ten (10) years as from the delivery of the modules by Solimpeks, or Solimpeks representative, to the customer.

Should a module be defective, Solimpeks will, in accordance with the provisions of the purchase, either repair the defect or supply a module with no defects at its sole discretion and at no cost to the customer

In cases where a defect cannot be removed, the customer will be required to accept a replacement module. In the event that the replacement module is defective and cannot be repaired, the customer will be required to accept a further replacement module before he/she makes any further statutory warranty claims. If a warranty claim is made, Solimpeks is to be informed immediately and the defective module is to be sent to Solimpeks on request and at Solimpeks' cost.

Reasonable costs for module removal and re-installation will be paid by Solimpeks, subject to such costs being agreed prior to modules being removed or installed

Terms Related to the Manufacturer's Warranty Certificate:

The product Warranty Certificate provided by Solimpeks Solar Energy Systems does not cover damages caused by usage of the collector in inappropriate conditions.

It is the end customer's responsibility to obtain the Warranty Certificate from the Authorised Agent. The Warranty Certificate is valid for a period of ten years from the date of signature and approval by an Authorised Agent.

The Warranty Certificate will be deemed invalid if:

1. The Certificate is not signed, dated and approved by an Authorised Agent
2. The Certificate is damaged, defaced or deformed to the point of being illegible and/or the serial number is erased
3. The Product has not been installed and/or used and/or maintained in exact accordance with installation, operation and maintenance manuals provided by or approved by Solimpeks
4. Damage to the Product has been caused after installation
5. Maintenance work on the product has been carried out by non-Authorised Service Agents
6. A visual inspection has not been carried out annually, and a service carried out every two years by an Authorised Service Agent
7. Damage has been caused to the Product due to evacuation of the solar fluid as a result of over-pressure in the system

2. Limited Power Output Warranty:

Subject to Solimpeks determining, in its sole discretion, that any power loss is due solely to defects in materials or workmanship, Solimpeks warrants the power output of the Volther PVT Module(s) as follows:

- (a) Within the first ten (10) years from the date of sale to the Customer, the PVT Module(s) exhibits a power output of less than ninety percent (90%) of the original minimum rated power specified at the time of sale, or
- (b) if a Module performs at less than 80% of the original minimum rated power specified at the time of sale within a period of twenty (20) years as from the date of sale by Solimpeks or its Authorised Agents and provided the loss of output is attributed to the ageing of glass, the cell or EVA foil following investigation under standard industry test conditions (2), Solimpeks will either repair or replace the Volther PVT Module(s). This applies only to land-based modules, or modules mounted on land-based buildings or installations. The Limited Power Output Warranty applies only to the ageing process of glass, the cell or the EVA foil selected for processing by Solimpeks itself, not for such items processed at the request of the customer.

The repair or replacement of modules neither renews nor extends the Warranty period or the period of the Limited Power Output Warranty. Solimpeks is entitled to deliver another type of module of similar or better output if at the time of the claim the modules which are the subject of the complaint are no longer manufactured. The modules which have been removed for exchanging will become the property of Solimpeks.

Non-Recourse

The Limited Power Output Warranty shall not apply in cases of the reduced output of a module if it is attributable to a cause other than the ageing of the materials listed under 2 above. Recourse shall not be possible if major effects on the material of the module cause increased ageing symptoms due to the special circumstances of use.

The Limited Power Output Warranty shall not cover defects and/or failures of the Volther PVT Module(s) from the following causes even though such defects and/or failures are discovered within the applicable Warranty period:

a) defects and/or failures caused by devices and/or parts other than the Volther PVT Module(s) or by mounting methods of such devices and/or parts;

The power output values shall be those measured under standard measurement conditions as follows: (a) light spectrum of AM 1.5; (b) irradiance of 1,000w per m²; and (c) a cell temperature of 25 degrees

b) defects and/or failures caused by defective wiring, installation, or handling;

c) defects and/or failures caused by installations not in conformance with Volther PVT Module(s) specifications, installation manuals, operation manuals, or labels attached to the Volther PVT Module(s);

d) defects and/or failures caused by unauthorized maintenance, operation or modification;

e) defects and/or failures caused by removal from the original place of instalment;

f) defects and/or failures caused by repairs not in accordance with Solimpeks instructions;

g) defects and/or failures caused by inappropriate handling during transportation or storage;

h) defects and/or failures caused by use on a mobile unit including, but not limited to, vehicles, vessels, etc.;

i) defects and/or failures caused by external accidents such as fire, explosion, and civil disorder;

j) defects and/or failures caused by natural forces, acts of God or force majeure events and other unforeseen

circumstances or causes beyond Solimpeks' reasonable control including, but not limited to, earthquakes, typhoons,

hurricanes, tornadoes, volcanic action, floods, tsunamis, lightning, snow damage, etc.; or

k) defects and/or failures caused by smoke and/or other pollution, salt damage, acid rain, etc.

The Limited Power Output Warranty will not be valid if the type or serial number of the module has been altered, deleted, removed or made illegible.

Limitation of the Power Output Warranty

The Limited Power Output Warranty shall not form the basis for further claims against Solimpeks, in particular for compensation claims due to lost revenue, compensation for loss of use, indirect damage and claims for replacement due to damage occurring exterior to the product.

Recourse of the Limited Power Output Warranty

If a customer believes he/she has a justified claim in respect of the Limited Power Output Warranty, Solimpeks or an Authorised Agent should be informed immediately upon discovering the decrease in output. The original invoice or sales slip (showing the date of delivery, module type, and serial number) is to be presented at the same time.

The Manufacturer's Warranty and Limited Power Output Warranty shall apply to modules delivered as from 1st Jan 2009.

Both the above warranties are applicable only to Customers who have purchased the Volther PVT Module(s) either directly from Solimpeks or from an Authorized Agent of Solimpeks. To qualify for this warranty, a Customer must prove that the Volther PVT Module(s) was purchased from Solimpeks or such Authorized Agent.

When applying for warranty coverage, Solimpeks or Solimpeks' Authorised Agent must be supplied with the Volther PVT Module(s) model name, a description of the defect and/or failure, and the serial number located on the Volther PVT Module(s) label attached to the side of the Volther PVT Module(s) at the time of manufacture.

Warranty Limitations:

THE LIMITED WARRANTY SET FORTH HEREIN IS EXPRESSLY IN LIEU OF AND EXCLUDES ALL OTHER EXPRESS OR IMPLIED WARRANTIES INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF SOLIMPEKS, UNLESS SUCH OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES ARE EXPRESSLY AGREED TO IN WRITING BY SOLIMPEKS.

SOLIMPEKS SHALL HAVE NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR DAMAGES OR INJURY TO PERSONS OR PROPERTY, OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATING TO THE PVT MODULE(S) INCLUDING, WITHOUT LIMITATION, ANY DEFECTS AND/OR FAILURES IN THE VOLTHER PVT MODULE(S) OR FROM USE OR INSTALLATION.

SOLIMPEKS SHALL NOT BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, INDIRECT, CONSEQUENTIAL OR SPECIAL DAMAGES, HOWSOEVER CAUSED. IN NO EVENT SHALL SOLIMPEKS' AGGREGATE LIABILITY EXCEED THE VALUE OF THE VOLTHER PVT MODULE(S) WHICH IS THE SUBJECT OF A CLAIM OR DISPUTE. SOME JURISDICTIONS DO NOT ALLOW LIMITATIONS ON WARRANTIES OR EXCLUSIONS OR LIMITATION OF DAMAGES. ACCORDINGLY, THE ABOVE EXCLUSIONS OR LIMITATIONS MAY NOT APPLY. THESE WARRANTIES GIVE A CUSTOMER SPECIFIC LEGAL RIGHTS, AND A CUSTOMER MAY HAVE OTHER RIGHTS THAT VARY FROM JURISDICTION TO JURISDICTION.