



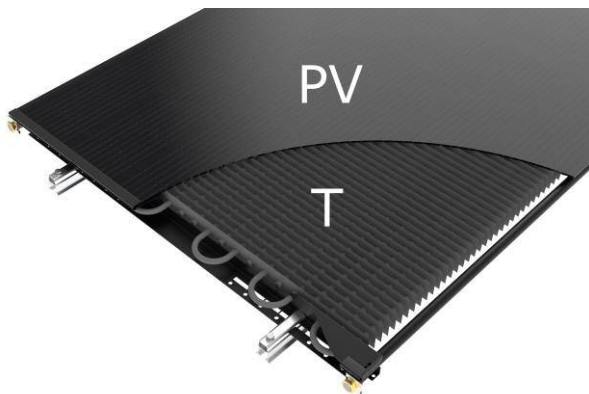
**triple solar**  
heat pump panels



product information  
**heat pump panels M3**

## USP's

- ▶ PVT heat pump panels for heat and electricity
- ▶ Brine system for water / water heat pump
- ▶ Gas-free and energy-neutral heating and hot water
- ▶ Quality certificate Solar Keymark
- ▶ Gas-free and energy-neutral heating and hot water
- ▶ SPF space heating up to 5.2
- ▶ SPF space cooling up to 6.7
- ▶ SPF tap water up to 3.9
- ▶ Modular system for large and small roofs
- ▶ Silent solution for when an outdoor unit is not an option



## Description

The Triple Solar® system consists of a set of PVT heat pump panels in combination with a brine/water or a PVT heat pump.

It's the ideal alternative to the less efficient air/water heat pump and the more expensive geothermal heat pump system. In addition, the solar panels supply electricity to be used for the heat pump. The total electricity yield is usually higher than the consumption of the heat pump.

## Application

The Triple Solar® heating system is used in residential housing, apartment complexes, care centres, swimming pools or other utility.

Especially when:

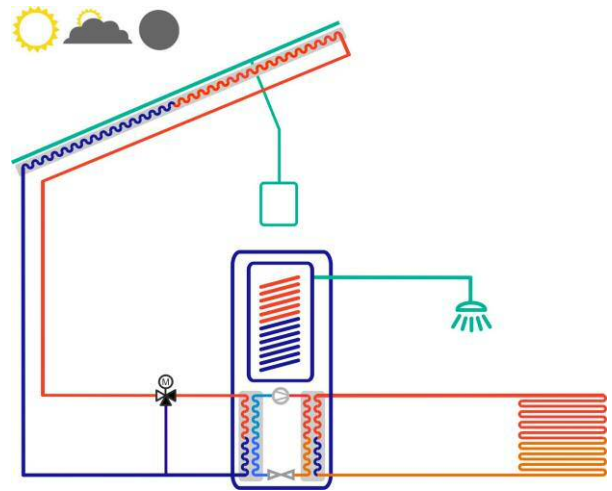
- ▶ Zero or low energy use is required
- ▶ No drilling is allowed
- ▶ Nuisance of the outdoor unit of the air / water heat pump is to be limited

Also suitable for:

- ▶ Regeneration of Heat and Cold Storage
- ▶ Too small dimensioned ground source
- ▶ Triple Solar® combined with a ground source

## Connecting the heat pump

Triple Solar® heat pump panels are connected to a brine/water heat pump, just like a ground source heat exchanger for geothermal energy.



### SUITABLE HEAT PUMPS

The Triple Solar® heat pump panels can only be used in combination with preselected heat pumps.

For high energy efficiency it is important to have a heat pump with a low permissible source temperature of at least -12 °C. In this case, minimal use is made of it's built-in electric back-up.

### LIMITING THE BRINE TEMPERATURE

The "Brine IN" temperature, also called the evaporator temperature, must be limited by a temperature controlled mixing valve. The maximum temperature setting depends on the selected heat pump.

*Triple Solar supplies the mixing valve as an accessory to the heat pump.*

### ACTIVE COOLING

The Triple Solar® heat pump system also provides space cooling. The heat pump must be equipped with an active cooling option. Hereby the source and the heating system are reversed by four valves through a corresponding control system. Space cooling is done via the underfloor heating, a convector or a separate exchanger in the ventilation system.

# Dimensioning

## PANEL SIZING

Starting point is the SPF (Seasonal Performance Factor), also called SCOP (Seasonal Coefficient of Power), the efficiency calculated over a year. In short: the amount of electricity the heat pump uses to supply the heat emand.

To get a SPF of 4,5 for combined heating and DHW by using a heat pump of 6 kW the required minimum amount is 16 m<sup>2</sup> of PVT panels.

This calculation is valid for the Netherlands.

For other capacities, the rule of thumb applies:

$$\text{Panel surface [m}^2\text{]} = 2.7 \times \text{heat pump capacity [kW]}$$

### Attention:

The SPF mentioned above is an estimate, this is depending on the under floor heating or convector, plus the annual required heat and hot water.

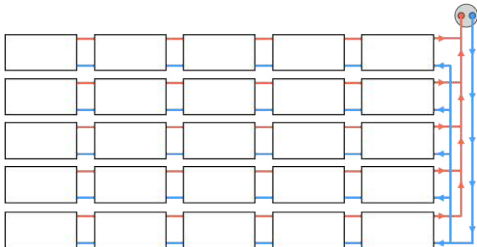
Further explanation about the conditions is mentioned in the declaration of equivalence.

## SETTING UP THE PANELS

The Triple Solar® heat pump panels can be linked together by using the supplied flexible connectors.

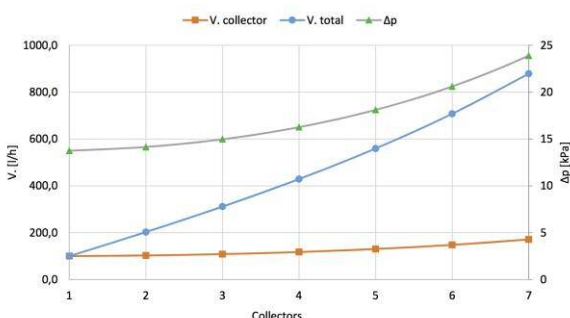
Maximum allowed amount of panels in one row:

- Connecting from one side: 5
- Connecting according Tichelmann: 7



One sided connection according Tichelmann

The graph below shows the flow distribution in the panels and the pressure loss with one-sided connection. When connecting more than 5 panels from one side the difference in flow between the individual panels will get unacceptably large.

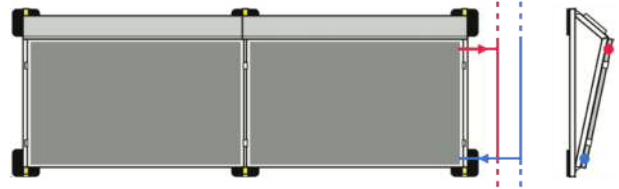


## SET-UP FOR PANELS ON A FLAT DAK

In the situation we have two fields of panels (e.g. for an east-west set-up), panels have to be connected in parallel with equal flow.

In case you use panels with different dimensions (model L and XL) the flow stays the same.

The hot side is always at the top.



## ORIENTATION

An orientation to the south with an angle of 10 to 30 degrees is optimal.

### Thermal:

For the thermal function as a brine source the orientation is less sensitive. The quality certificate shows same results for a large orientation window between east and west.

### Electric yield:

In case of deviations from the south orientation, the PV yield will be reduced. Standard online tools can help you calculate the annual yield for different orientations and angles.

## HYDRAULISCH DIMENSIONEREN

The chart below shows the pressure loss with the different configurations using ethylene glycol 40%. De tabel hieronder geeft het drukverlies weer van de verschillende velden bij gebruik van ethyleenglycol 40%.

### Example:

By connecting 5 panels, the pressure drop is 16 kPa. This applies for one sided connection as well as Tichelmann.

The loss of pressure in the supply and return piping needs to be added up and checked with the permissible pressure loss of the heat pump.

Amount of panels	Flow rate	pressure loss
1	100 l/h	14 kPa
2	200 l/h	15 kPa
3	300 l/h	15 kPa
4	400 l/h	16 kPa
5	500 l/h	16 kPa
6	600 l/h	17 kPa
7	700 l/h	18 kPa

Whenever there are two fields (for example, an East - West setup) these are to be connected in parallel and always with equal flow.

# Mounting material

## CONNECTING MATERIAL

Triple Solar® panels are supported with the following accessories:

### Mounting & hydraulic accessories basic:

- Mounting rails
- Clamps with bolts and nuts
- Flexible hoses for linking panels in a row
- Connecting plugs with 3/4" thread
- End plugs with and without bleeder
- Retainer clips for the plugs
- Roof gland with hoses
- Special accessories for the heat pump
- Glycol
- Cooling module (optional)

See for more extensive information the Triple Solar calculation tool and the Triple Solar design manual.



Standard package for a fat roof set-up



Standard package for a sloped roof set-up

## TUBING

The tubing between the heat pump panels and the heat pump can be installed in different ways. Outdoors on the roof the piping can be installed without insulation till the roof flange.

You can use copper, stainless steel or PEX tubing. If you use PEX or any plastic, take care of the UV protection.

Indoors all tubing has to be installed with vapour sealed insulation. This prevents condensation of the piping due to fluid temperatures of -15°C. This is also valid for the roof flange. Piping should be insulated past the roof flange. This prevents leakage of condensation water.

The chart below shows some guidelines for piping dimensions.

Heat pump	minimale required inner piping dimension (mm)
6 to 8 kW	26 mm
8 to 15 kW	32 mm
15 to 28 kW	41 mm
28 to 50 kW	51 mm

Correct diameters depending on the total length of the tubing including and all used additional fittings.

Brine liquid is mono propylene glycol of ethylene glycol mixture minimum 34% / -15°C.

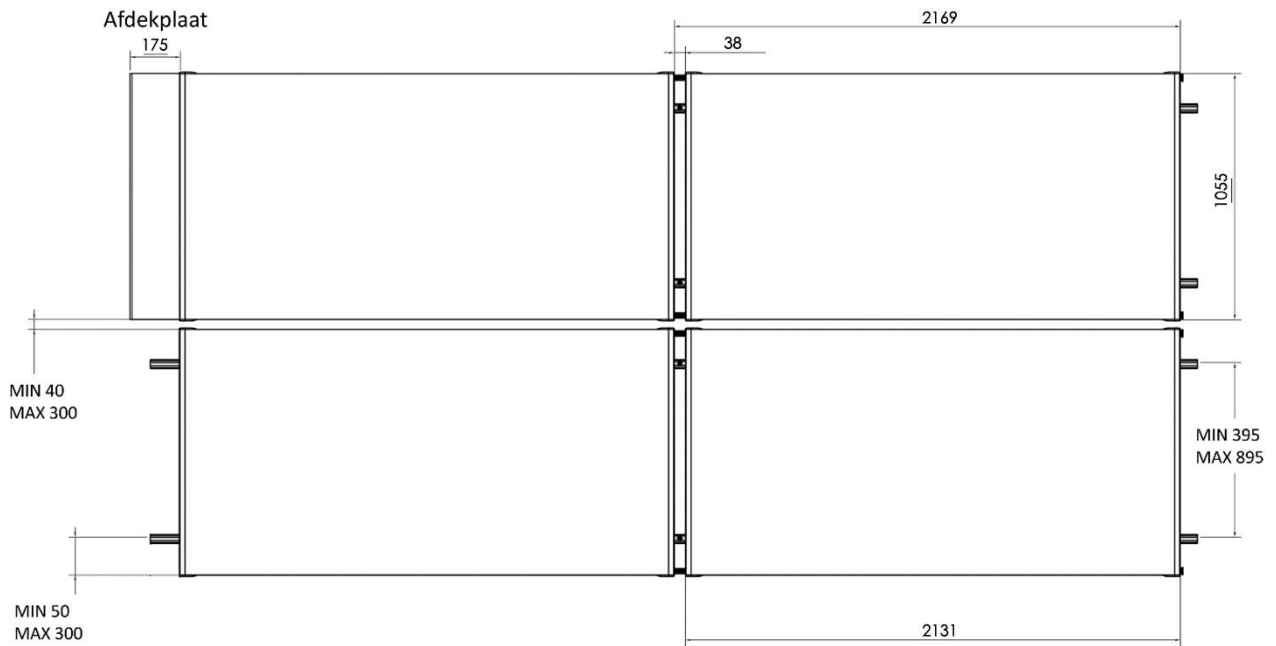
## MOUNTING SYSTEM

The Triple Solar® heat pump panels can be mounted on almost any standard PV-mounting system. The panels should be fixed on horizontal mounting rails with the supplied special Triple Solar clamps. The clamps are ready for M8 allen screws.

Triple Solar offers a wide range of mounting rails and triangles. See price list.

The wind load calculation for calculating the amount of ballast blocks is the responsibility of the installer with the advice of the supplier of the PV-mounting system.

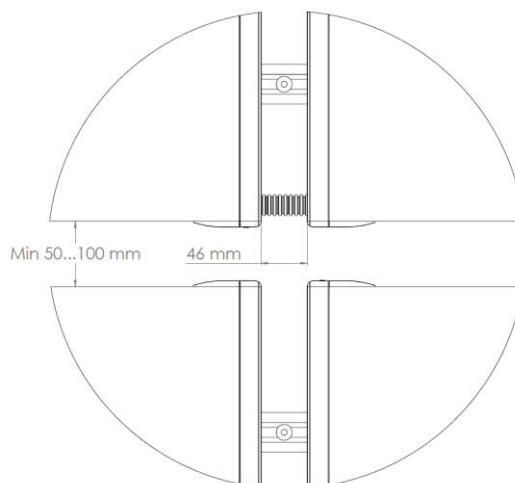
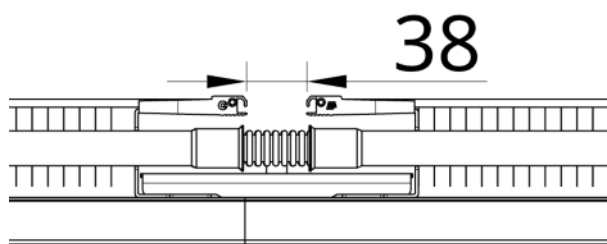
PANEL DIMENSIONS FOR A SLOPED ROOF



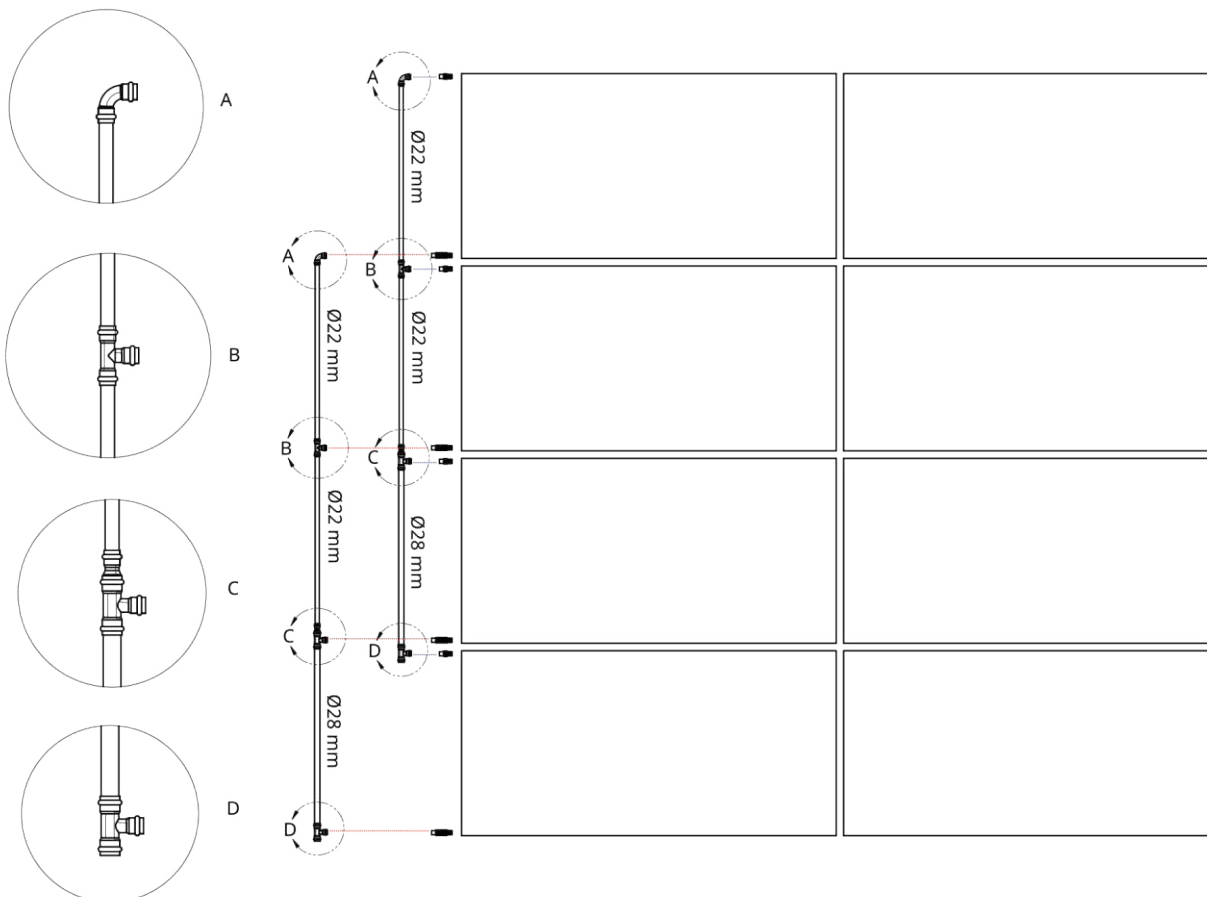
PANEL DIMENSIONS FOR A FLAT ROOF

paneelhoek	12 graden, zuidgericht				2x 10 graden, vrijwel richting-onafhankelijk	
rij-afstand	1300	1500	1700	mm	2300 mm	
schaduwhoek	33	22	16	graden	9 graden	
Opbrengst verlies	6	2	0	procent	n.v.t.	

DIMENSIONS IN BETWEEN THE PANELS



DIMENSIONS FOR TUBING ALONG THE PANELS



# Specifications

Dimensions	unit	M3 450 XL	M3 375 L	M3 375 P
		Landscape	Landscape	Portrait (Q1 2022)
Overall dimensions	mm	2131* x 1055 x 65	1791* x 1055 x 65	1057* x 1775 x 65
Aperture dimensions (T)	mm	2118 x 1043	1778 x 1043	1057 x 1763
Weight	kg	32	27	27
Overall surface	m <sup>2</sup>	2,25	1,89	1,88
Aperture surface (T)	m <sup>2</sup>	2,21	1,85	1,87
<b>Materials</b>	-			
PV panel	-		Glass	
Heat exchanger tube	-		Copper	
Heat exchanger fin	-		Aluminium	
Surface treatment	-		Black powder coating	

\* Length tolerance +/-4mm

PV panel	unit	M3 450 XL	M3 375 L	M3 375 P
Manufacturer	-		BISOL (EU)	
Type	-		Monocrystalline half cut cell Duplex	
Nominal power	W <sub>p</sub>	450	375	375
Short circuit current	A	11.35	11.40	11.40
Short circuit voltage	V	50.2	41.9	41.9
MPP current	A	10.75	10.75	10.75
MPP voltage	V	41.9	34.9	34.9
Solar cell efficiency	%	21.6	21.7	21.7
Module efficiency	%	20.3	20.2	20.2
Power output tolerance	W	0/+5 W	0/+5 W	0/+5 W
Maximum reverse current	A		20	
Max. system voltage	V		1500 (class A)	
Current temperature coefficient	%/K		0.06	
Voltage temperature coefficient	%/K		- 0.27	
Power temperature coefficient	%/K		- 0.35	
NOCT	°C		44	
Temperature range	°C		- 40 – + 95	

All unspecified tolerances are ± 5 %. Unspecified product properties remain under full discretion of BISOL.

Heat exchanger	unit	M3 450 XL	M3 375 L	M3 375 P
Meander tube	mm		12 x 0.3	
Header tube	mm		22 x 1.0	
Volume fluid	l	3.4	3.0	3.0
Heat exchanger tube	-		Copper	
Heat exchanger fin	-		Aluminium	
Thickness fin	mm		0.18	
Surface heat exchanger	m <sup>2</sup>		ca. 18	
Connectors	-		Plug in with double O-ring	
Length compensation	-		Flexible connectors	
Maximum pressure	bar		6	
Pressure loss Water-glycol mixture 40 % <sup>1)</sup>	mbar		140	
Specific flow	l/min		ca. 2 – 4 per panel	
Heat exchange capacity Air to liquid, U value <sup>2)</sup>	W/(m <sup>2</sup> K)		62 with parallel roof mounting	
Optical Efficiency <sup>2)</sup>	%		47	
Heat capacity <sup>2)</sup>	kJ/(m <sup>2</sup> K)		177	
Stagnation temperature	°C		62 °C at 1000W/m2 irradiation with an ambient temperature of 30 °C	

1) At 120 l/h, -15 °C 2) TNO-report 2017 R10903



# Quality and Subsidies

## SOLAR KEYMARK

Triple Solar heat pump panels are rewarded with the highest and internationally accepted standard, the Solar Keymark certificate. All tests (wind and snow load and yield) carried out by the University of Stuttgart (Germany) and certified by TÜV Rheinland and Dincerto.



## TNO TEST

The independent test institute TNO in Delft (the Netherlands) has tested the Triple Solar® heat pump panel according to the quasi dynamic test procedure described in NEN 12975-2 (report No. 2017 R10903).

To be able to test the full working range, a surface of 10 m<sup>2</sup> was tested by the institute for a period of several months.



## QUALITY CERTIFICATE

Triple Solar obtained a quality certificate by the independent institute BCRG.

The certificate of equivalence can be downloaded at the Bureau Central Registration Gelijkwaardigheidsverklaringen):

<https://mijn.bcrq.nl/media/20210277GG.pdf>

SPF space heating up to 5,2

SPF space cooling up to 6,7

SPF domestic hot water up to 3,9



## PATENT

Triple Solar obtained a worldwide patent WO-2018/033409.



## SUBSIDY

Most governments have a subvention program to stimulate gas free heating. Please check your local program. For the Netherlands:

*Investeringsubsidie duurzame energie (ISDE) of Rijksdienst voor Ondernemend Nederland (RVO).*

For example: the amount of subsidy for a 6 kW heat pump is € 2800 euro.

For more information check <https://triplesolar.eu/kosten-en-financiering/>



Example of a system on a flat roof of an apartment complex in Delft the Netherlands



Example of a system on a sloped roof of a housing block in Heerhugowaard the Netherlands



The Triple Solar team may 2021

**triple solar**   
verder zonder gas

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