SOLAR HEATING SYSTEMS

FORCED CIRCULATION

Vacuumm collectors

SKY 8 CPC 58
SKY 12 CPC 58
SKY 18 CPC 58
SKY 21 CPC 58

Reg. no. 011-7S124R

Kloben®
Solar Evolution

INDEX

Introduction

MAKING USE OF SOLAR ENERGY

Solar energy is among the most abundant and available free renewable energies on the earth's surface. To have an idea of the energy that the sun radiates onto the earth, according to the latitude, the average daily solar radiation in Italy varies from 4 to 5.5 kWh on a surface of 1 square metre.
The use of a solar heat collector with vacuum technology is accredited, as shown by the experts in the solar sector and by laboratory tests carried out according to EN European Standards, to be the most technically efficient system for capturing the energy released by the sun through the entire year.
Considering the daily heat energy request per person for domestic hot water use, the use of solar collectors with vacuum technology with CPC reflector, combined with a standard state-of-the-art designed system, allows energy saving regarding domestic hot water of up to 80%. While, considering the global load of heat energy requested for domestic hot water and heating, the total saving can exceed 40%.
This considerable energy saving constitutes an important contribution to the reduction of the emissions of noxious substances, deriving from combustion, into the atmosphere and particularly to the reduction of CO2, the main reason for environmental heating due to the greenhouse effect.
The functioning principle of a solar heating system can be described simply.
The solar vacuum collector with CPC reflector captures solar radiation and heats up. The heat gathered is transferred by heat exchage to a water tank, which acts as a storage tank. The amount of solar energy that the collector can transfer to the tank depends on its capacity to absorb solar radiation and on the level of insulation, which reduces the loss of energy captured by the collector.
The creation of the vacuum by removing the air from the gap in the glass tube achieves a layer of the best heat insulating material existing in nature. The principle has been known about for a century and is appreciated in the form of the thermos.
Using this arrangement, the collectors optimise the use of solar energy also during the change of seasons and during the winter.

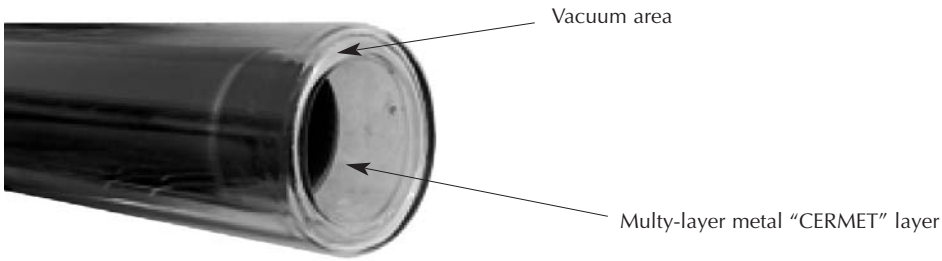
ADVANTAGES OF CPC DIFFUSION VACUUM TECHNOLOGY

- High temperatures and yields even in unfavourable atmospheric conditions, e.g. with low external temperatures.
- High absorption even with diagonal light thanks to the circular shape of the absorbing device.
- Top quality and high efficiency solar vacuum tube, of our own production and with high level of forced vacuum.
- Duration through time: no delicate glass-metal couplings that degenerate the level of vacuum in the glass pipe through time.
- Duration through time: high resistance and duration of the selective capturing layer also thanks to the protection of the vacuum.
- Loss of load contained thanks to the circulation of the flow in parallel in the circuit with "U"-shaped pipes.
- Maximum yield with less requirement for surfaces (half of the absorbant surfaces are normally necessary with respect to a traditional absorbing panel).
- Treated spacial aluminium concentrator reflector, with double CPC paraboloidal section (Compound Parabolic Concentrator) with optimised optics for the solar collector, to convey the sun's non-incident rays onto the vacuum tube.
- High efficiency all year round.
- Low assembly costs: collector already assembled and easy to fix.
- Easy and immediate tube replacement with the EASY CHANGE system.
- Excellent heat insulation performance of the heat-carrying circuit also at low temperatures.
- Modern and elegant design.

THE VACUUM TUBE

AN OLD PRINCIPLE APPLIED TO AN INNOVATIVE TECHNOLOGY

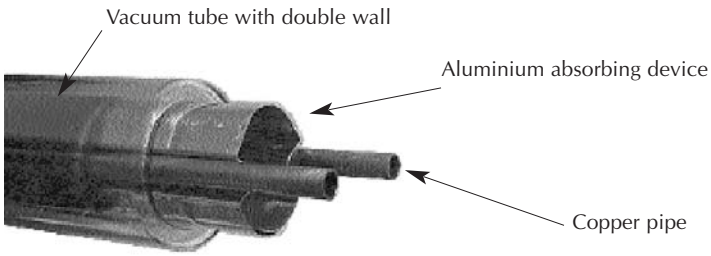
The creation of the vacuum by removing the air from the gap in the glass tube achieves the best heat insulating material possible. The principle has been known about for a century and is appreciated in the form of the thermos.
Using this arrangement, the collectors optimise the use of solar energy also during the change of seasons and during the winter.



The internal surface of the vacuum gap is made selective to the absorption of the solar radiation by means of the laying, by sputtering, of multiple metal layers with a micro-metric thickness, which is called CERMET and which cover the absorption of the entire spectrum of electro-magnetic radiation of the sun.
The selective layer is designed especially to resist the high temperatures that are generated, through time. The presence of the vacuum ensures the protection against infiltrations of humidity and atmospheric agents, thus guaranteeing unlimited duration and the maintenance of the capturing perfomance.

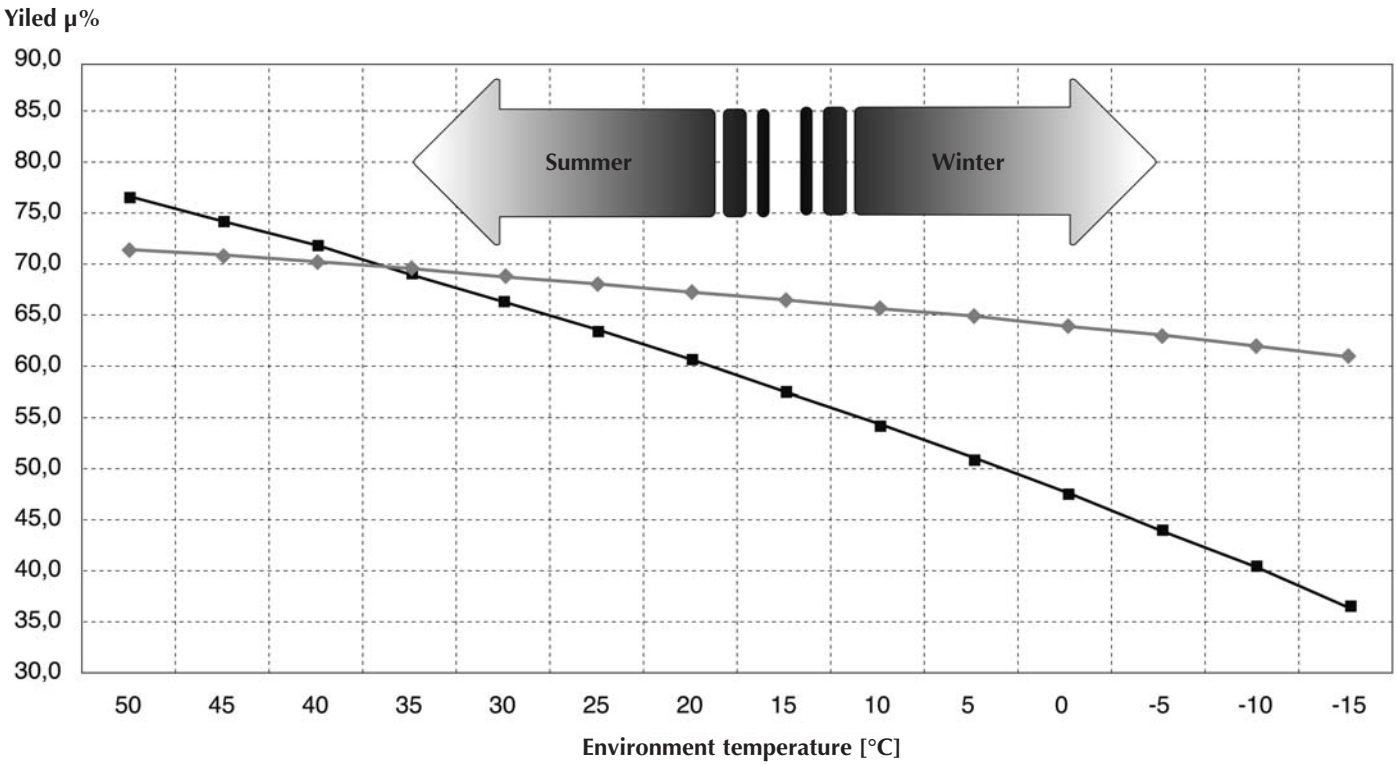
TRANSMISSION OF HEAT TO THE HEAT-CARRYING FLUID

The exchange of the heat collected takes place by a relevant absorbing device in aluminium, which on contact with a “U” -shaped copper pipe transfers the heat to a heat-carrying fluid present in the solar collector circuit.



WHY CHOOSE KLOBEN

The research carried out to increase the yield of the Kloben solar collectors have allowed to discover efficient and innovative solutions to make the best of the sun and its diffused light. For this reason particular direct and diffused light capturers, with CPC, Compound Parabolic Concentrator, geometry have been studied and realised using materials able to supply optimal yields in total reflection (> 90%) and in reflection with diffused light.
The combination of vacuum tube technology and CPC reflectors applied to the solar collectors, guarantee the best yields, most of all in situations of little radiation and low external temperatures. The advantage of the Kloben system therefore has an immediate effect also at an economical level.



- Efficiency curve with radiation at 800 W and average temperature inside heat-carrying fluid of 50°C of the Kloben SKY CPC 58 DIFFISION model (Test Report no. 07COL623/1 (according to EN 12975-2:2006), ITW Institute, Stuttgart - Solar Keymark certification).
- Efficiency curve with radiation at 800 W and average temperature inside heat-carrying fluid of 50°C of a Solar Keymark certified flat solar panel (data from Solar Keymark Database - Estif site, (European Solar Thermal Industry Federation))

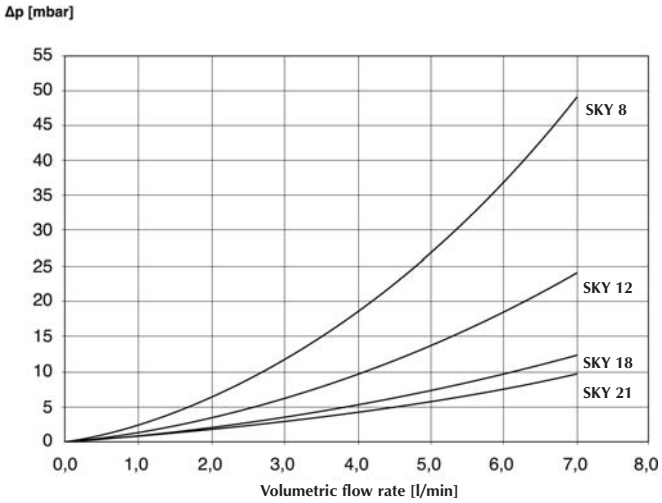
From the comparison it was seen that for an average T of heat-carrying fluid of 50°C, the Kloben SKY CPC 58 Diffusion vacuum collector has greater efficiency that the flat collector, up to 35°C of environment T. The difference in efficiency increases even more on the decrease of the external temperature.

Solar collectors technical data

MODEL	SKY 8 CPC 58	SKY 12 CPC 58	SKY 18 CPC 58	SKY 21 CPC 58
AMOUNT OF VACUUM TUBES (pc):	8	12	18	21
GROSS SURFACES (m^2):	1.48	2.16	3.22	3.75
NET SURFACES (m^2):	1.27	1.89	2.84	3.31
EMPTY WEIGHT (kg):	29	43	65	76
DIMENSIONS (mm)				
Height:	1603	1603	1603	1603
Width:	920	1358	2018	2348
Thickness:	140	140	140	140

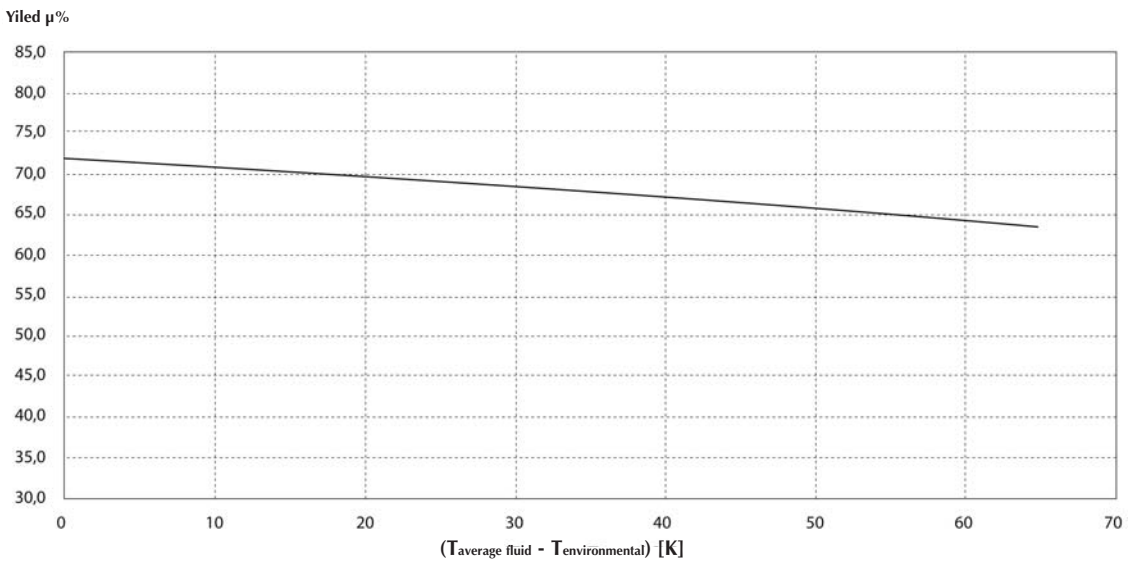
FEATURES

Circuit of the solar collector with "U"-shaped copper pipes with circulation in parallel
Maximum working pressure: 6.0 bar
Load loss:



Optimal flow rate: 1 l/min per m^2
Maximum working inclination: 90°
Minimum working inclination: 0°
Attachments: to tighten using soinner DN 18 mm

Yield (square interpoling)*:
$\eta_0 = 0.718\%$
$a_1 = 0.974$ [$W \cdot m^{-2} \cdot K^{-1}$]
$a_2 = 0.005$ [$W \cdot m^{-2} \cdot K^{-2}$]



*Test Report no. 07COL623/1 (according to EN 12975-2:2006), ITW, Universität Stuttgart - **SOLAR KEYMARK, Reg. no. 011-7S124R**

Dimensioning

Kloben makes use of a complex software that allows quick, precise and customised calculation of the enrgy requirements requested, the number of panels necessary and the solar integration supplied, in relation to the destination of use of the solar system, the details of the structure on which it is to be applied and the climatic data referring to the area of installation.

For the dimensioning of all components, it is recommended to contact Kloben-authorised staff. However, it is possible to perform approximate dimensioning of the components necessary for small solar systems (systems up to max 10 m² of solar collector surface, optimal exposure of collectors max 20° from South and inclination at 45°, average daily consumption per person of about 60 litres at 45°C), using the data shown below:

MAXIMUM DIMENSIONING OF SOLAR PANELS

	NORTH ITALY	CENTRAL ITALY	SOUTH ITALY
Water at 45°C produced per m² of solar surface (litres)	80	90	100
Heatable radiant surface (laying distance 10 cm) for every m² of solar	from 10 to 15 m²	from 12 to 16 m²	from 14 to 18 m²
Relation between solar and swimming pool sup. (for summer use - water 26°C - night cover use)	ca. 35%	ca. 30%	ca. 25%

MAXIMUM DIMENSIONING OF SYSTEM COMPONENTS

Expansion vessel: An approximate measurement consists in considering 6 l for every m² of solar surface installed. For more accurate dimensioning refer to the solar calculation software of the vessel available in the Kloben Intranet area.

Anti-freeze liquid: add the following parameters **(A + B + C + D)**

A. 1/2 of the capcity of the expansion vessel installed

B. 10 l for every 40 m of line (20 delivery + 20 return)

C. 1.17 l for every SKY 8 CPC 58
1.74 l for every SKY 12 CPC 58
2.60 l for every SKY 18 CPC 58
3.07 l for every SKY 21 CPC 58

D. about 15 l for storage from 300 to 500 l
about 20 l for storage from 500 to 750 l
about 30 l for storage from 750 to 1000 l

Solar Station: LOW FLOW for the management of systems with flow rate from 2 to 16 l/min

BIG FLOW for the management of systems with flow rate from 10 to 80 l/min
For more accurate dimensioning refer to the solar calculation software available in the Kloben Intranet area.

Flow rate adjuster: 1 l/min for every m² of solar surface installed.

Checks and parameters indispensable for dimensioning

In order to start with a correct design, aimed at the realisation of the solar system that is the most suitable for maximising the benefits of the final customer, some important preliminary checks must be carried out and indispensable data must be gathered for correct dimensioning:

PROJECT LOCALITY:

The locality where the system is to be installed supplies precious indications for dimensioning, such as: average monthly radiation, average monthly external temperature, mains water average monthly temperature, average relative humidity temperature, average monthly wind speed.

METHOD OF CONSUMPTION AND PERIOD OF USE OF THE SYSTEM:

Consider the daily requirement of the family; an approximate consumption of hot water at 45°C variable from 50 to 70 l/day per person. Identify any simultaneous requests for the use of domestic hot water. Check the period of use of the system (seasonal or months of use).

TYPE OF SYSTEM USE:

heating domestic hot water: identify the consumption and temperature of the water requested and the capacity of the existing storage tank. For maximum dimensionimg of the capacity of the storage tank to be envisioned, it is possible to refer to about the double of the daily consumption envisioned for the family or inhabitants.

heating non-domestic hot water: hotel, gym etc.-indicating that stated previously regarding the methods of consumption and periods of use. For this type of system, therefore, an ad hoc design by designers or Kloben tech nical staff is always necessary.

room heating: only radiating - identify surfaces to be heated, space between tubes and type of insulation.

swimming pool: specifies if covered or outdoor, any night cover use, requested temperature, period of use.

FEATURES OF THE INSTALLATION STRUCTURE:

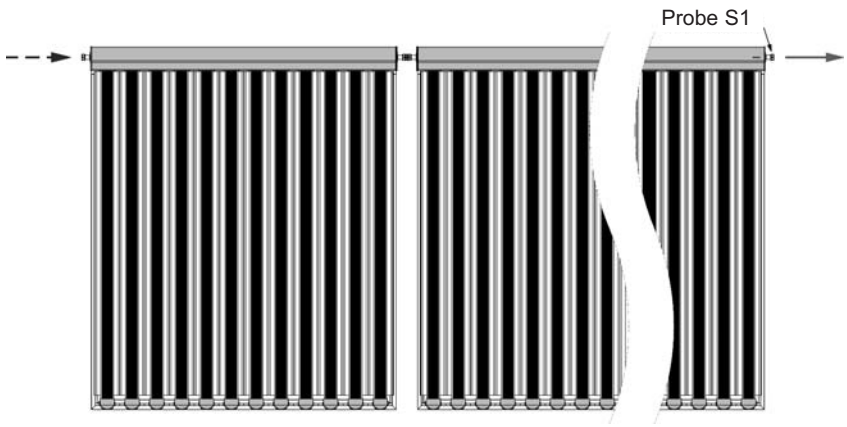
The surfaces that house the field of solar collectors are an important restriction of the design, which must be considered as the positioning of the solar collector affects the capturing efficiency of the sun's radiation. The checks to be carried out are: possibility of assembly on flat or sloped roof, availability of roof pitch with orientation towards the south or alternatively with orientation towards east or west, inclination of the pitch, presence of obstacles, etc.

From the existing Standard, **UNI 9182**, the data inherent to flow rates and requirement of domestic hot water according to the activity in question and the single appliances, are gathered.

The dimensioning indications stated above refer to maximum dimensioning and are relative to homes with the standard consumtion of an average family. However, for the correct dimensioning of all parts of the system, it is necessary to consider the preliminary checks indicated along with all of the details of use of the final user to then proceed with the definition of the energy requested, the modes of distribution (flow rates, temperatures, period of request) and successively with the correct dimensioning of all system components on the basis of powers and exchange yields of the various components: solar surface, solar heat exchanges, storage, etc.
For this reason and for accurate dimensioning refer to Kloben specialised technical staff.

N.B. IF THE SOLAR INSTALLATION IS INTRODUCED ONTO SYSTEMS THAT ALREADY FUNCTION, IT IS INDISPENSABLE TO HAVE THE DETAILED LAYOUT OF THE EXISTING HEATING STATION, WITHOUT WHICH IT WILL NOT BE POSSIBLE TO SUPPLY ANY PERFORMANCE GUARANTEE.

Example of connection of the collectors in series

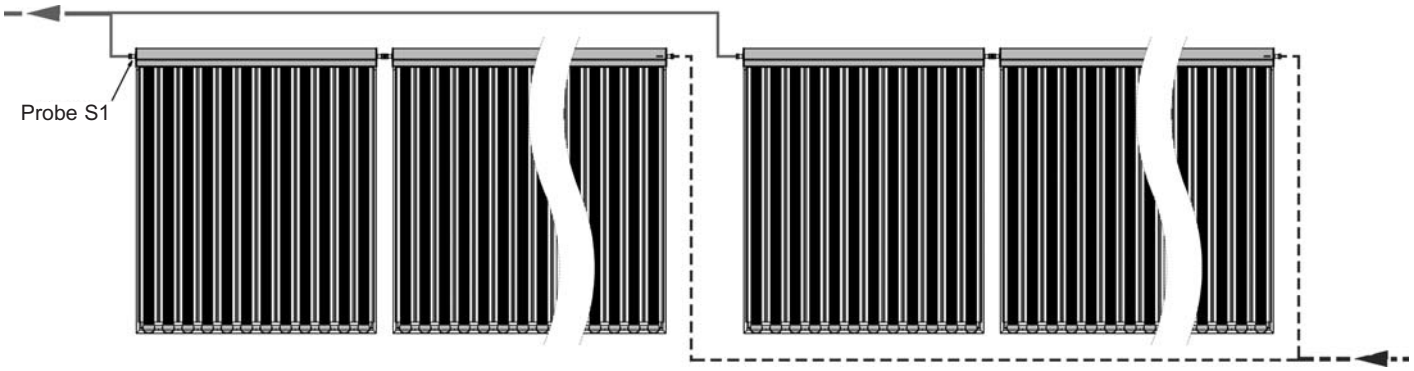


ATTENTION: do not connect more than n° 4 collectors in series

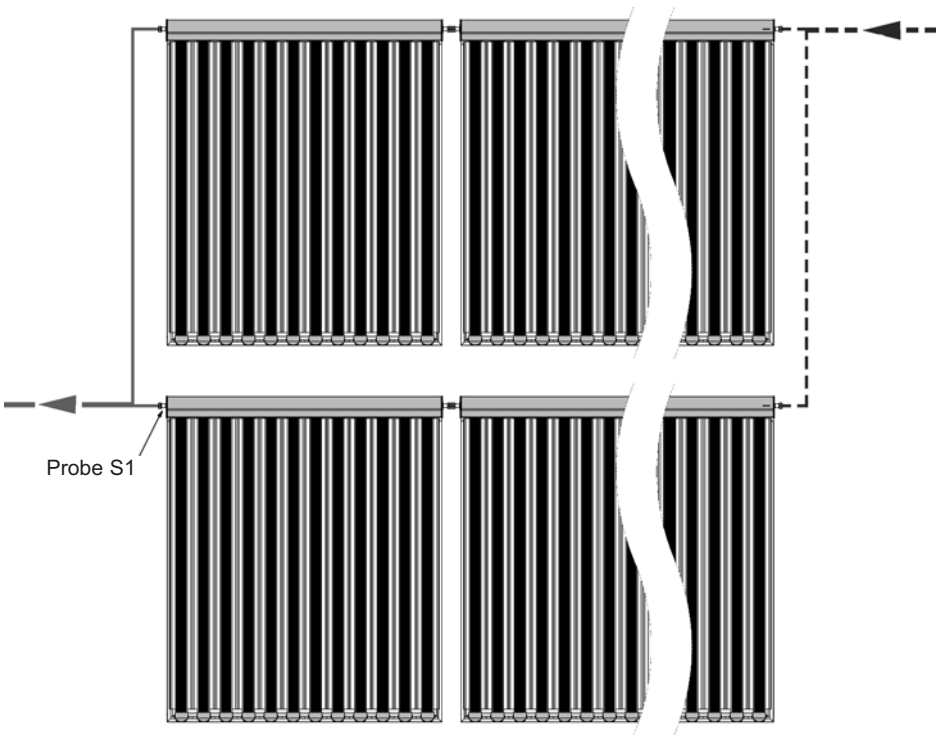
Example of connection of the collectors in parallel

TICHELMAN SYSTEM: consists in the hydraulic balancing of the collector coils.

EXAMPLE 1



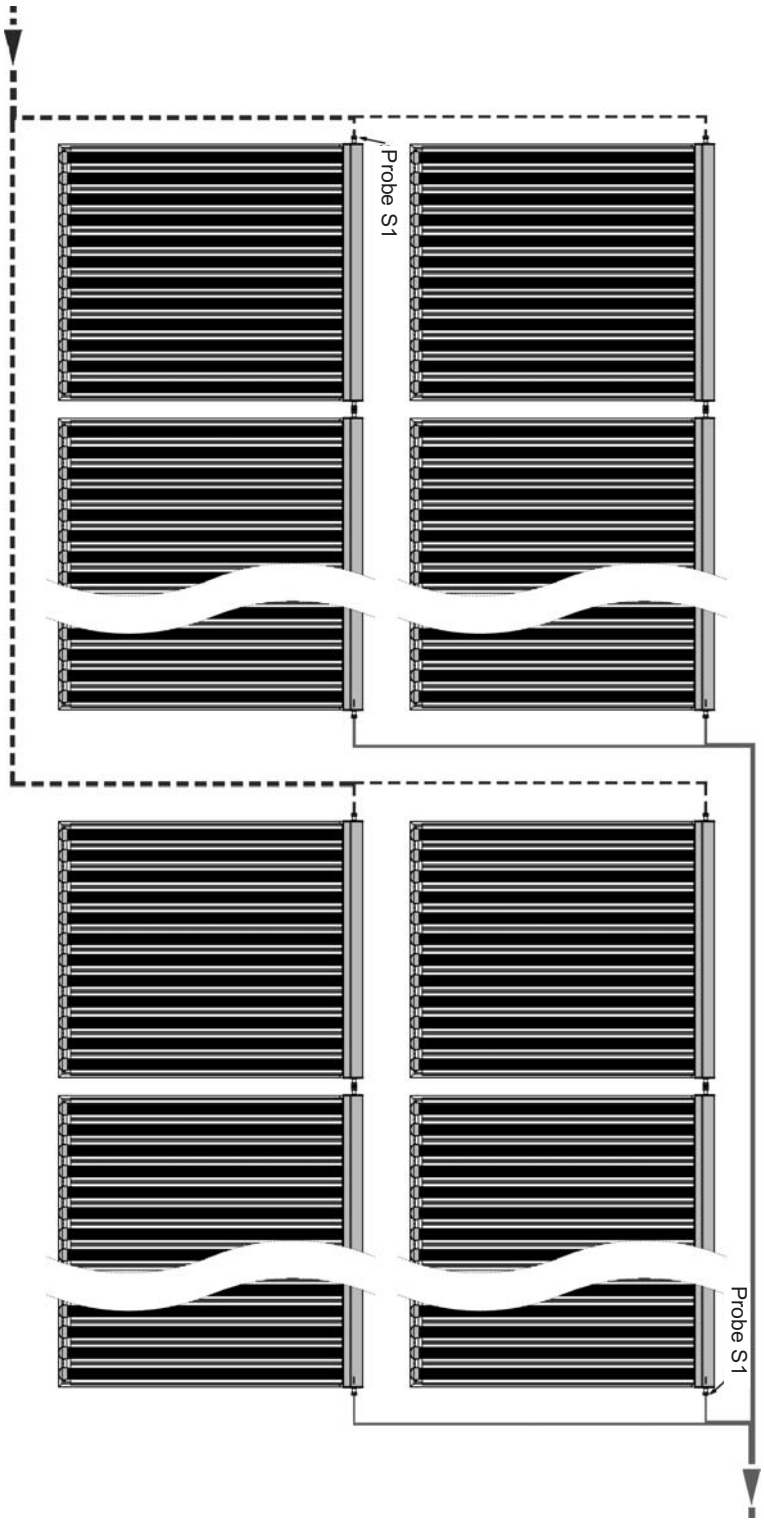
EXAMPLE 2



Example of connection of the collectors in parallel

EXAMPLE 3

TICHELMAN SYSTEM



Warnings and preliminary checks

The installer is asked to carefully follow the recommendations and indications that are listed successively; as well as performing all controls requested before system start-up.

ANTI-FREEZE HEAT-CARRYING FLUID:
The heat-carrying fluid used and supplied consists in a special liquid with anti-freeze properties, TYFOCOR LS. This fluid is specially for use in solar plants with high heat yield like vacuum tube collectors. It is totally pre-mixed and ready for use. It guarantees protection from freezing to -28°C.
It contains corrosion inhibitors that guarantee efficient protection and duration of the copper pipes, (and all other metals and alloys used) in particular from corrosion and deposits.

Warnings: In order to maintain the protective features of TYFOCOR LS unaltered, it must not be mixed with other heat-carrying fluids and anti-freeze or diluted with water. Any top-up owing to the loss of fluid must be compensated exclusively with TYFOCOR LS. Before loading always check that there is no water in the circuit.
The use of deposited metals is advised for soldering. For welding points the use of deposited metals is recommended for brazing in silver and copper.
TYFOCOR LS does not attack the sealing materials normally used in solar systems. However, attention must be paid that all sealing materials are resistant to the maximum temperature of the heat-carrying fluid. Failure to comply with these checks can lead to the warranty of the solar collector becoming void.

LOADING:
- Before starting the system loading operation, make sure that the solar collectors are at low temperature. The panels must be covered at least 3 hours before loading.
- The system must be loaded by carefully following the instructions given on page 25 of this manual. The use of the supplied system loading pump is also recommended (code 101010045). Correct loading allows the complete elimination of air in the solar circuit and its correct functioning.
- The system's optimal functioning pressure, to be calibrated in the loading phase is 3/3.5 bar in the heating station and at least 2/2.5 bar at the panels, with the system at a standstill.

DIMENSIONING:
- Before starting the solar system it is good practice to check that dimensioning and the adjustment of the individual components (panels, expansion vessel, glycol, flow rate adjuster, solar station) are in compliance with that indicated on page 5 of this manual.
- It is indispensable that the diameter of the copper pipes making up the solar circuit are in compliance with that indicated on page 11 of the following manual. If in doubt, refer to Kloben authorised staff or our technical dept.

INSTALLATION AND RESISTANCE TO LOADING STRESS, WIND AND SNOW:
The installation of solar collectors on flat and sloped roofs envisions indispensable preliminary checks that clarify the following critical aspects:
- Static stability of the roof for assembly of the collectors
- Accessibility of the roof housing the system and sufficient access and freedom of movement in safety
- Fixing quality of the structure connections and support devices of the solar collectors to the building support (loft structure, flat roof structure, etc.).

On the basis of the place of installation selected, the locality, the height from the ground, exposure, topography of the land, the climatic conditions of the areas, etc. preliminary checks must be made of the loading conditions owing to the wind (average, peaks due to gusts and the presence of storms) and snow on the basis of that envisioned by the "Departmental Circular dated 4 July 1996, n. 156" regarding implementation "technical standards relative to the general criteria regarding the safety checks of the constructions and loads and overloads", Legislative Decree dated 16 January 1996.

In the calculations regarding the evaluation of stress of individual and combined loads owing to wind and snowfall, a maximum sustainable load must be considered, normal to the surface of the collector of 0.90 kN/m2.
The solar collector has been designed to suitably resist combined conditions of wind and snow, the most serious features of the Italian territory. However, if phenomena of an exceptional nature should occur or situations or loads exceeding the maximum load of the panel it is good practice to prepare additional protections, such as tie-rods and

reinforcements for stabilisation.

MATERIALS:

- **All pipes making up the solar circuit must be in copper. The use of other materials such as zinc, stainless steel, plastic, brass and similar is not recommended. If materials different from copper are used, it will be impossible to guarantee correct functioning of the system.**
- **All joints must be welded or with tightening connections for copper pipes. The use of any other materials can jeopardise the sealing of the joints through time.**
- **To prevent sealing problems of the hydraulic joints of the solar circuit owing to heat stress, always check the distance at which the field of solar collectors is found with respect to the storage tanks. In all cases it is recommended always to make the joints with high temperature Teflon.**
- **The copper pipes must be insulated using a sheath for high temperatures such as the Kloben Solare.**

CHECKS:

- Check that, with the system unloaded, the expansion vessel is calibrated at 2 bar.
- Check the correct connection of the probes to the solar control unit.
- Check that the solar control unit is connected correctly to the mains.
- Check that the setting of the solar control unit parameters is in compliance with that prescribed in the design phase.

N.B.: The solar collectors cannot remain exposed to solar radiation for long periods of time without being loaded (ten days).

Practical table for the choice of piping

FLOW RATE AND PIPING SECTION

(WITH MAXIMUM LENGTH OF 20 METRES FOR DELIVERY AND 20 METRES FOR RETURN)*

* IF THE CIRCUITS HAVE A LONGER LENGTH OR A CONSIDERABLE NUMBER OF BENDS, PLEASE CONTACT KLOBEN AUTHORISED STAFF.

Cylinder [litres]	Type and number collector	Flow rate [l/min]	Ø Piping [mm]
150	1 x SKY 8	1.27	Copper 14
150	1 x SKY 12	1.89	Copper 16
200	1 x SKY 12	1.89	Copper 16
200	1 x SKY 18	2.84	Copper 16
300	1 x SKY 18	2.84	Copper 16
300	1 x SKY 21	3.31	Copper 16
300	2 x SKY 12	3.78	Copper 18
500	1 x SKY 12 + 1 x SKY 18	4.73	Copper 18
500	2 x SKY 18	5.68	Copper 18
600	2 x SKY 21	6.62	Copper 18
750	3 x SKY 18	8.52	Copper 22
800	3 x SKY 18	8.52	Copper 22
1000	4 x SKY 18	11.36	Copper 22
1500	6 x SKY 18	17.04	Copper 28
2000	8 x SKY 18	22.72	Copper 35
3000	12 x SKY 18	34.08	Copper 35

For further indications regarding the choice of piping combinations refer tot he Kloben calculation software, present in the intranet area at: http://solar.kloben.it/impianto

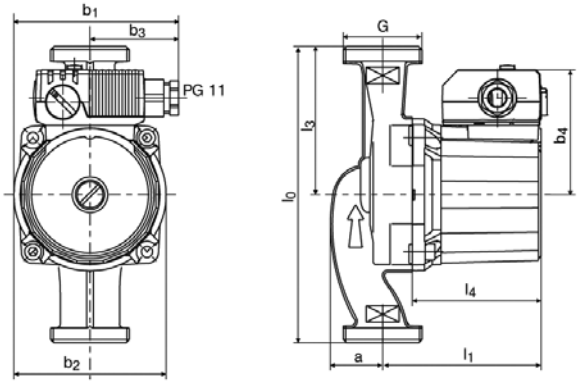
N.B.: As well as the choice of piping, for correct functioning of the solar system correct dimensioning of all components is necessary (page 5 of this manual).

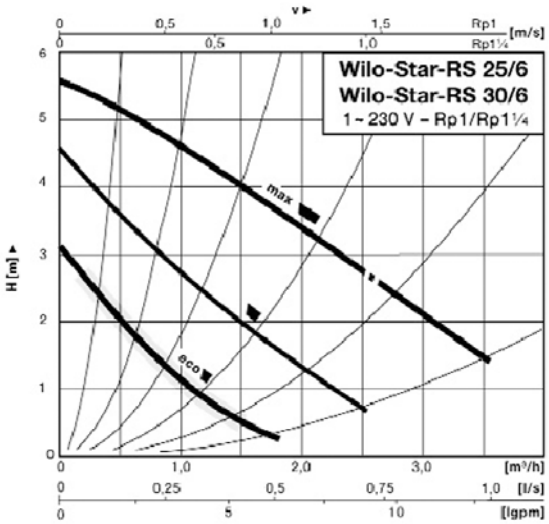
N.B.: Page 12 of this manual must be consulted for the choice of the solar station.

N.B.: If a greater solar surface is required, more parallel rows will be constituted, each with the same surface area, connected to each other using the **TICHELMAN** method (page 8 and 9 of this manual).

N.B.: For systems with particular dimensions and non-standard features, specific calculations must be made to determine loss of load, pipe diameter, etc.

LOW - FLOW STATION PUMP FEATURES Flow rate 2-16 l/min





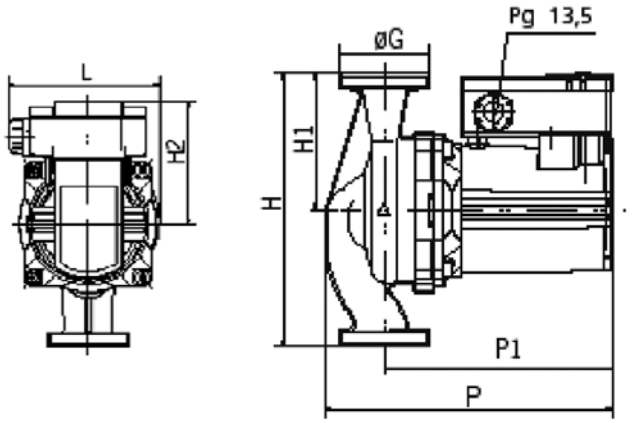
Measurements - Weight

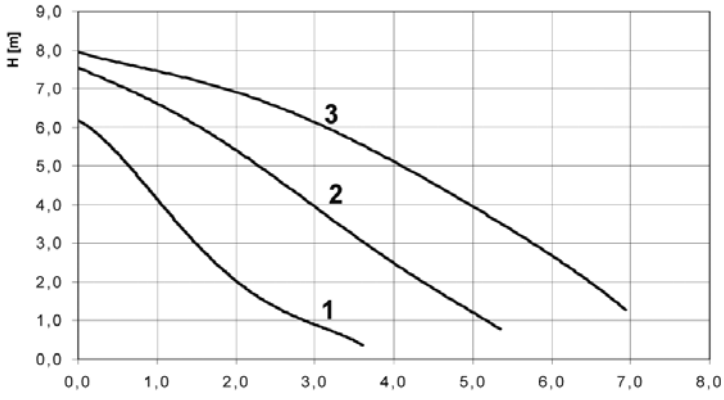
Wilo-Star-RS	Rp	G	l_0	l_1	l_3	l_4	a	b_1	b_2	b_3	b_4	Peso ca. Kg
			mm									PN 10
RS 25/6	1	1"½	180	97	90	79	33	100	92,5	54	76	4,2

Motor Data
Single-phase motor (EM) 2 poles - 1 ~ 230 V, 50 Hz

Wilo-Star-RS	Nom. Power P.max W	Speed/N. of revs. n. 1/min.	Absorbed power P. W	Current I A	Condenser µF/VDB	Motor Protection
RS 25/6	37 22 12	max 2200 1900 eco 1200	77 - 99 56 - 75 41 - 50	0,41 0,31 0,24	2,6/400	1)

BIG - FLOW STATION PUMP FEATURES Flow rate 10-80 l/min





Measurements - Weight

SXM	DN	G	H	H_1	P	P_1	L	H_2	flange PN	Peso ca. Kg
			mm							PN 10
SXM 32-55	Rp1"	2	180	90	189	150	110	90	10	4,2

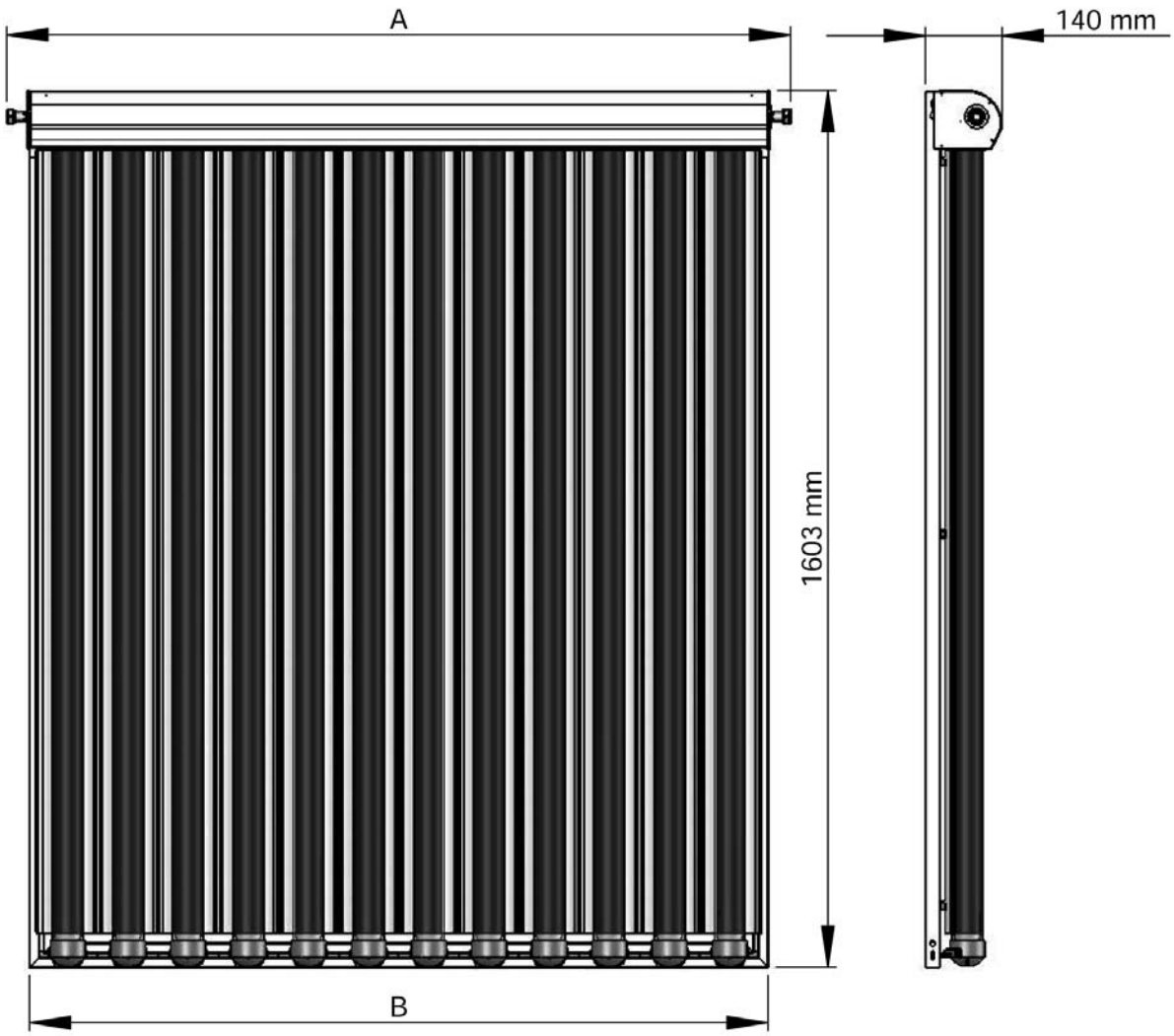
Motor Data
Single-phase motor (EM) 2 poles - 1 ~ 230 V, 50 Hz

SXM	P_2 MAX [W]	Steps/Speed n [1/min]	Power input P, max. [W]	Current I [A]	Capacitor µF/VDB	Cable Gland size PG
SXM 32-55	100	1 2000 2 2320 3 2570	120 175 200	0,65 0,90 0,95	5/400	1 x 13,5

Current I: Onside thermal overload settings.

For more accurate dimensioning, refer to the solar calculation software available in Intranet.

Clearance

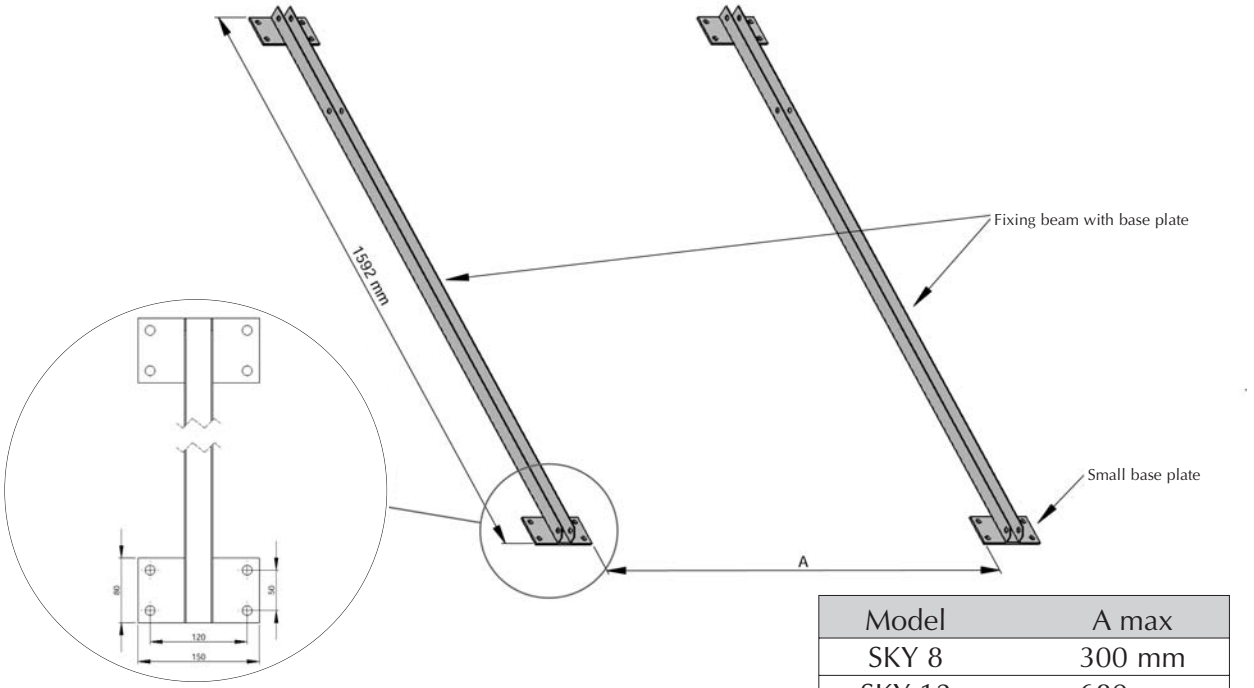


Model	A	B
SKY 8	983 mm	910 mm
SKY 12	1424 mm	1350 mm
SKY 18	2084 mm	2010 mm
SKY 21	2414 mm	2340 mm

Flat roof kit assembly layout

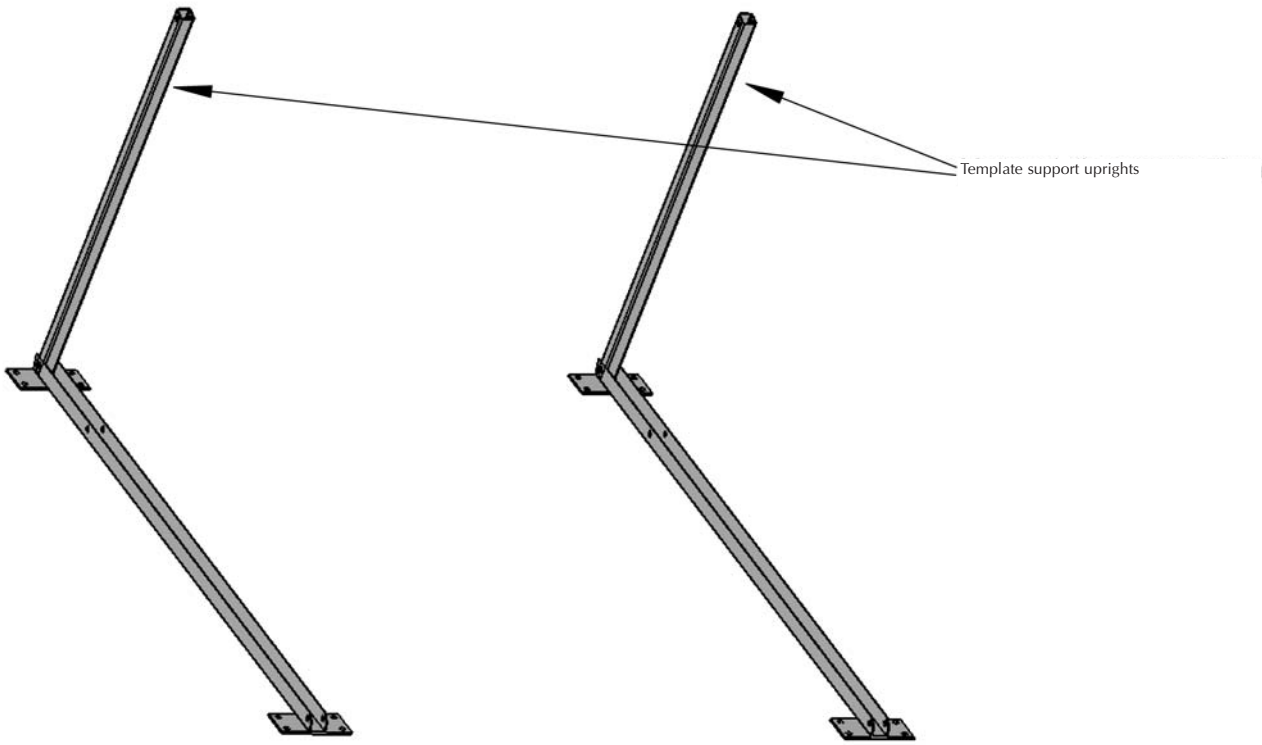
ASSEMBLY LAYOUT FOR 1 SKY CPC 58 PANEL: 8 - 12 - 18 - 21

Position the fixing beams complete with base plate onto the ground,
taking care to respect the maximum distances indicated in the following figure.



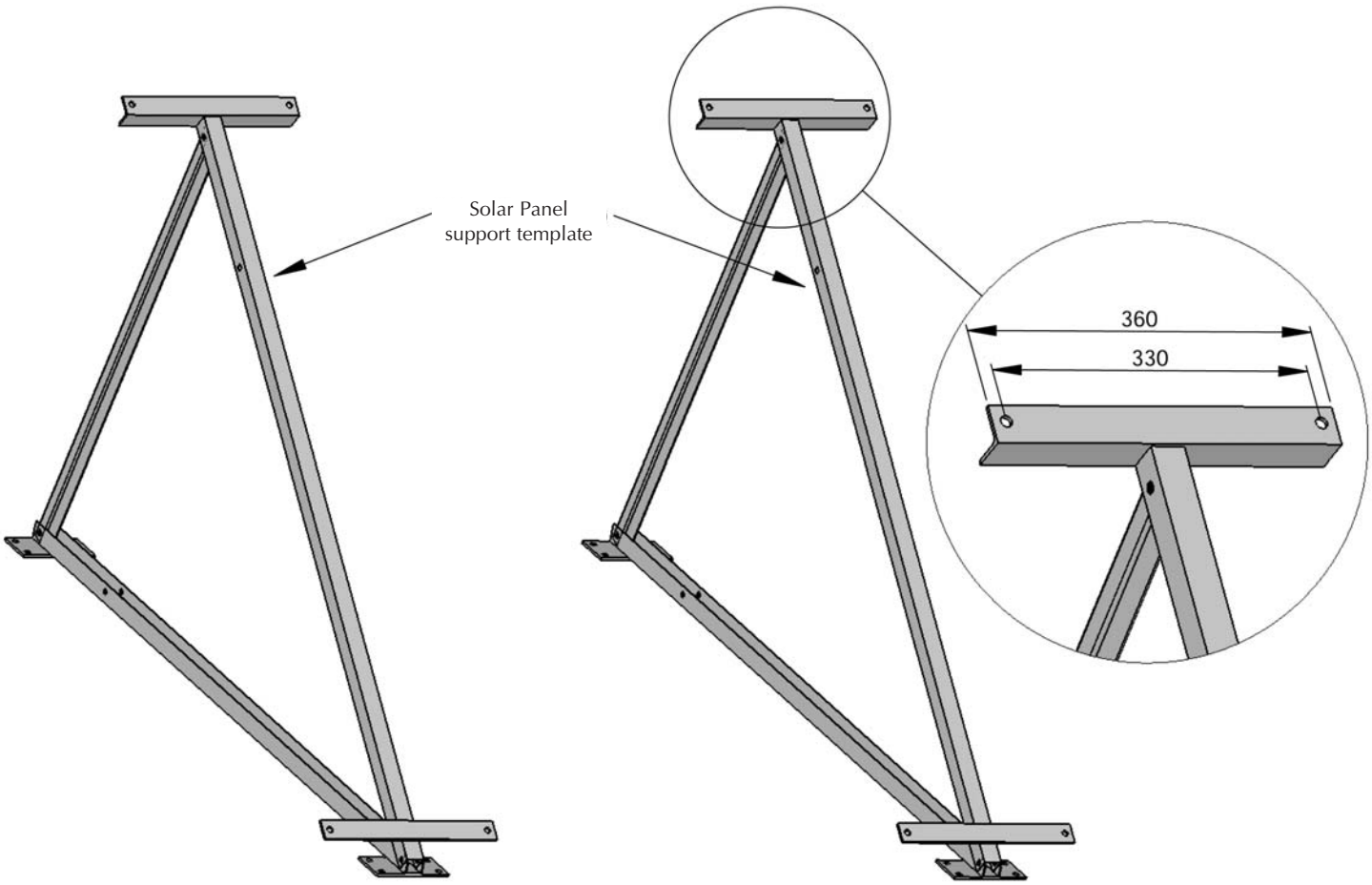
Model	A max
SKY 8	300 mm
SKY 12	680 mm
SKY 18	1300 mm
SKY 21	1500 mm

Bolt the template support uprights to the fixing beams (see figure below)



Flat roof kit assembly layout

Position and fix the support templates according to that indicated in the figure

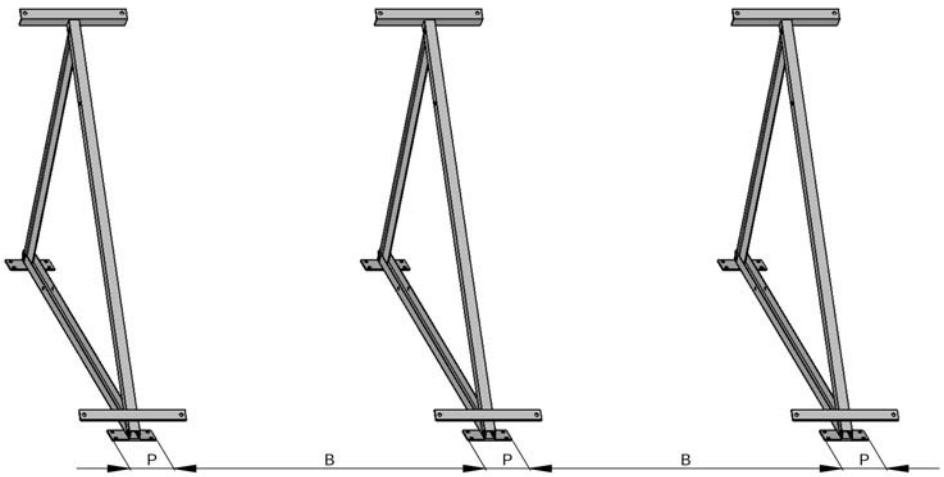


Fix the frame to the loft suitably. The nuts and bolts to use must be made in relation to the sub-base material. Each base plate has 4 holes measuring 12 mm.

Flat roof kit assembly layout

ASSEMBLY LAYOUT FOR 2 SKY CPC 58 PANELS: 8 - 12 - 18

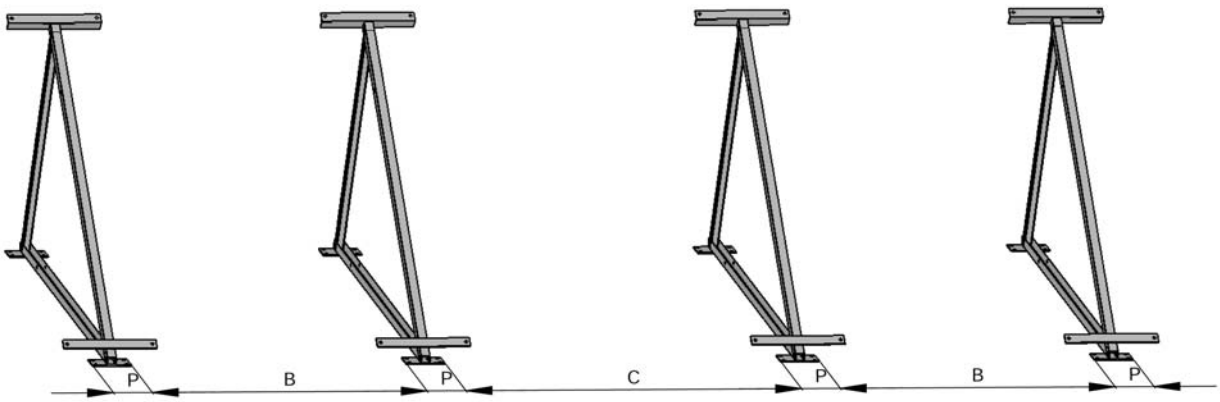
In the case of installation in series of 2 SKY CPC 58 8, 12, 18 panels, respect the distances indicated in the figure, where P (support plate width) is a fixed measurement.



Model	P	B max
SKY 8	150 mm	535 mm
SKY 12	150 mm	970 mm
SKY 18	150 mm	1500 mm

ASSEMBLY LAYOUT FOR 3 AND MORE SKY CPC 58 PANELS: 8 - 12 - 18

In the case of installation in series of 3 or more SKY CPC 58 8, 12, 18 panels, rrespect the distances indicated in the figure where P (support plate width) and C are fixed measurements.

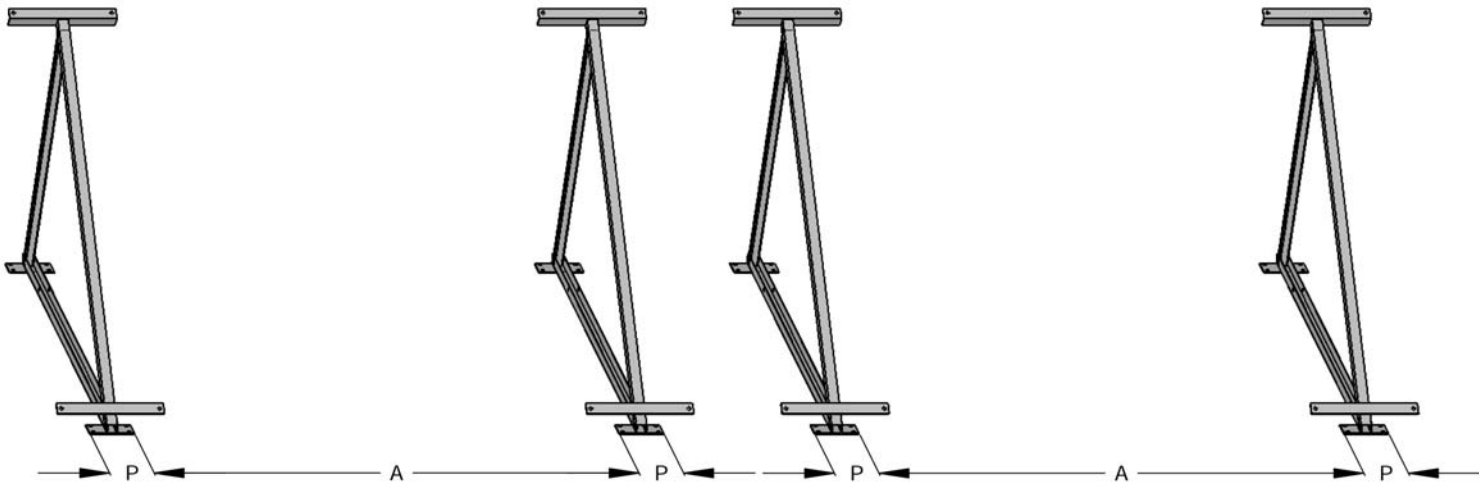


Model	P	B max	C
SKY 8	150 mm	535 mm	840 mm
SKY 12	150 mm	970 mm	1280 mm
SKY 18	150 mm	1500 mm	1940 mm

Flat roof kit assembly layout

ASSEMBLY LAYOUT FOR 2 AND MORE SKY CPC 58 PANELS: 21

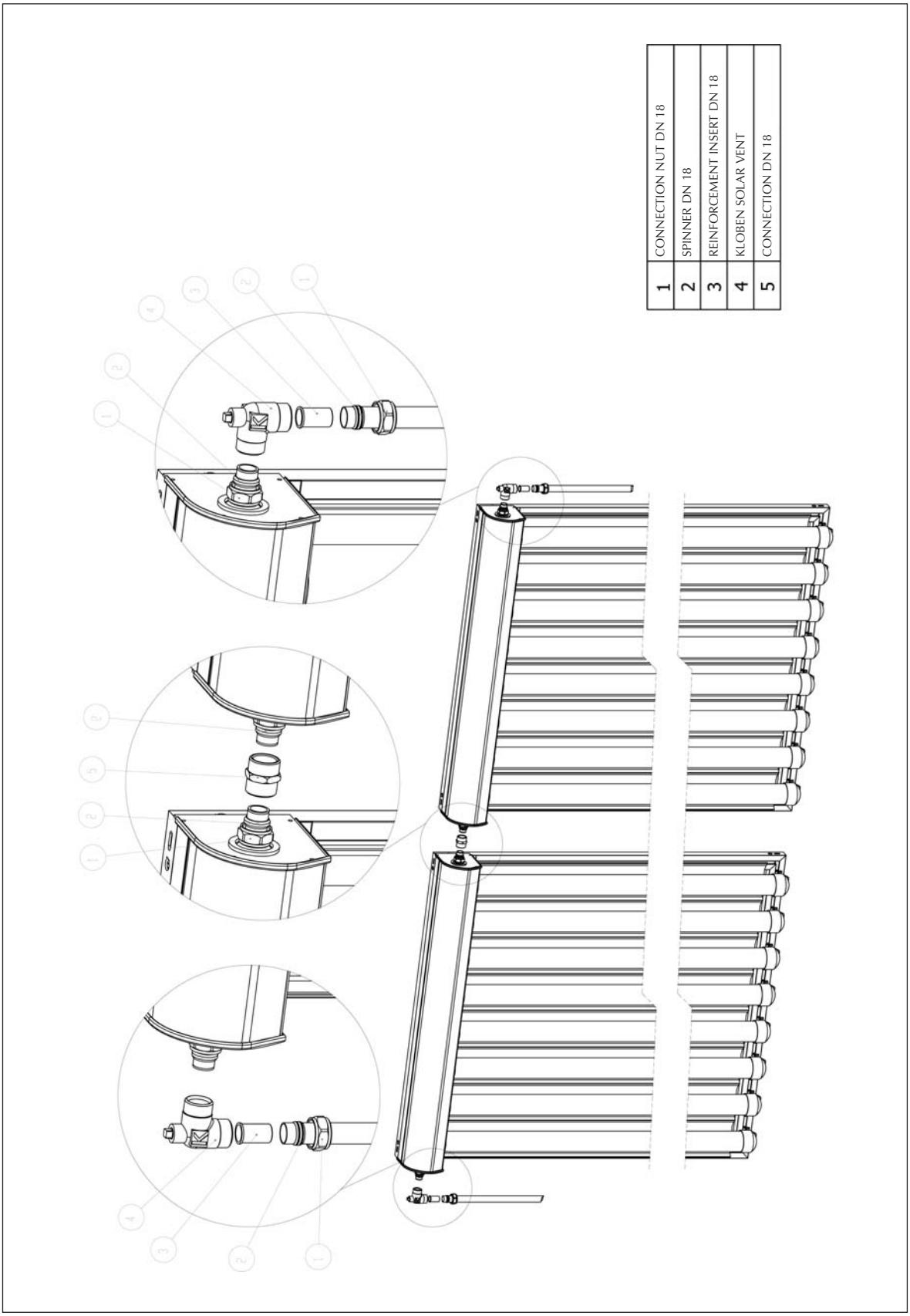
In the case of installation in series of 2 or more SKY CPC 58 21 panels, 2 support brackets for each collector are necessary, as described in the figure. Respect the maximum distance A as indicated in the figure where P is the width of the support plate.



Model	P	A
SKY 21	150 mm	1500 mm

Flat roof kit assembly layout

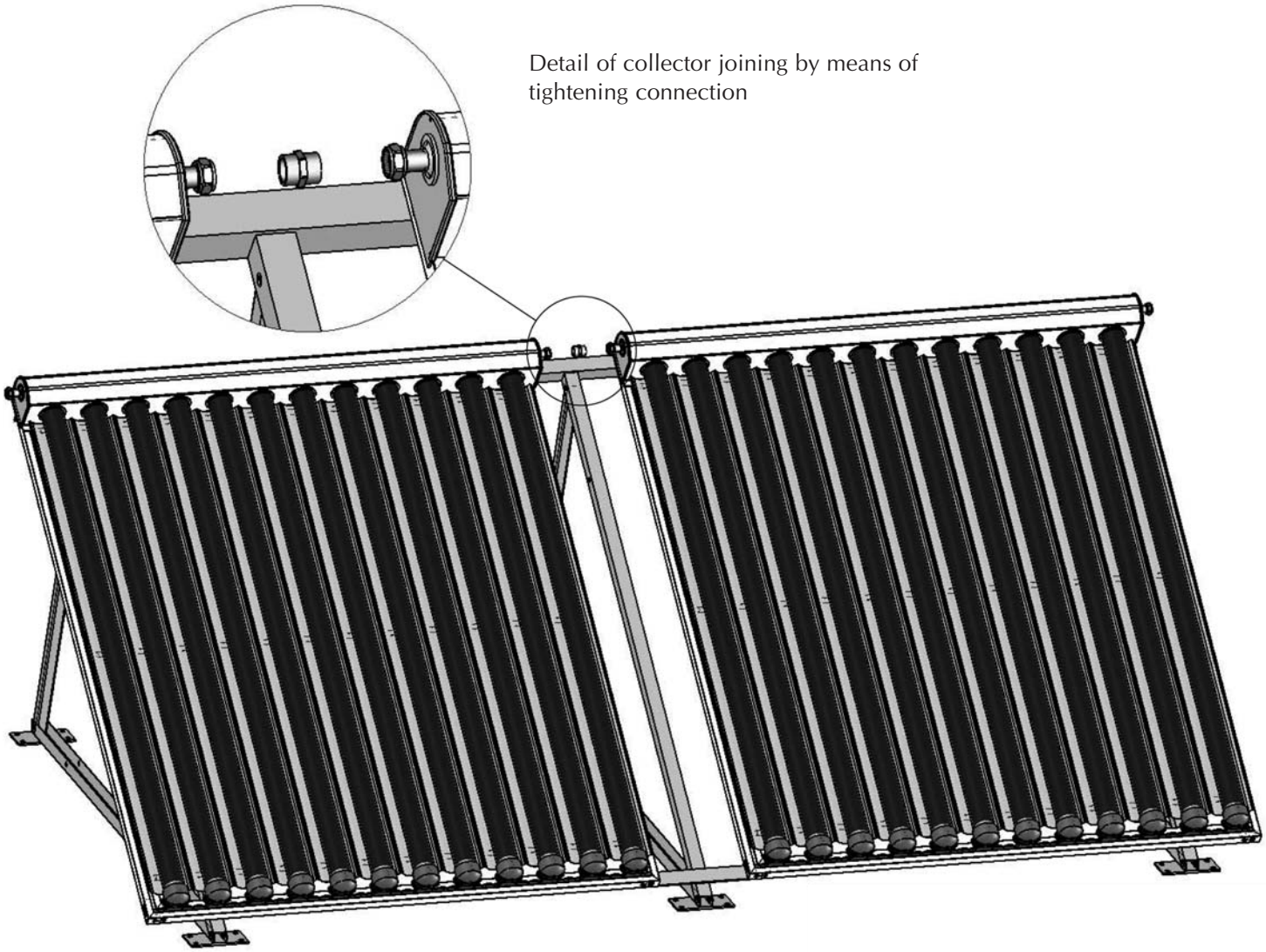
CONNECTIONS AND VENT KIT



Flat roof kit assembly layout

Position the collectors near to each other and bolt them (without tightening) to the support templates in the holes already prepared (Figure 4), by means of the screws present on the panels (there are 4 screws for each collector).

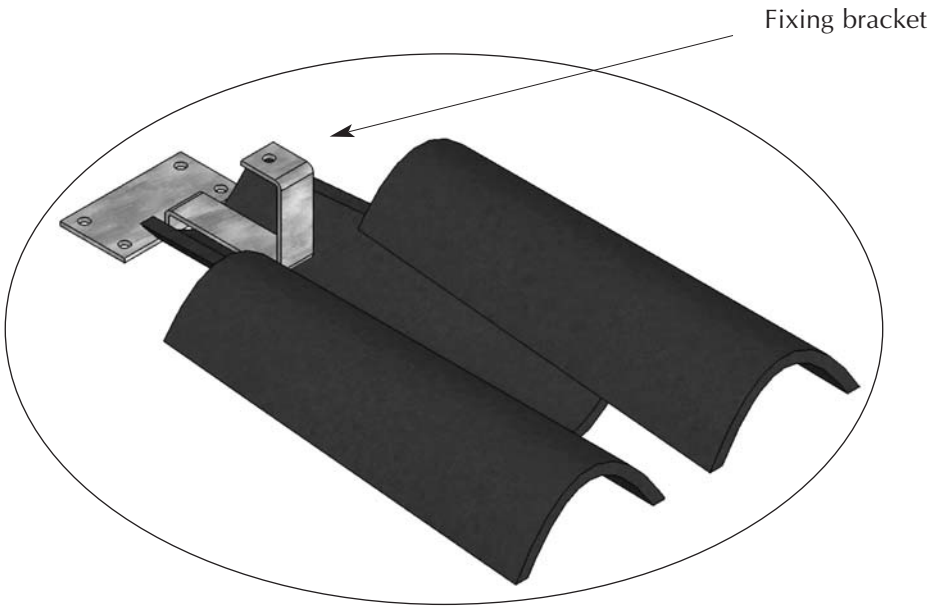
Then join the panels using the tightening connections supplied and already positioned on the collector (Figure 6). After this operation tighten the panels onto the templates.



Detail of collector joining by means of tightening connection

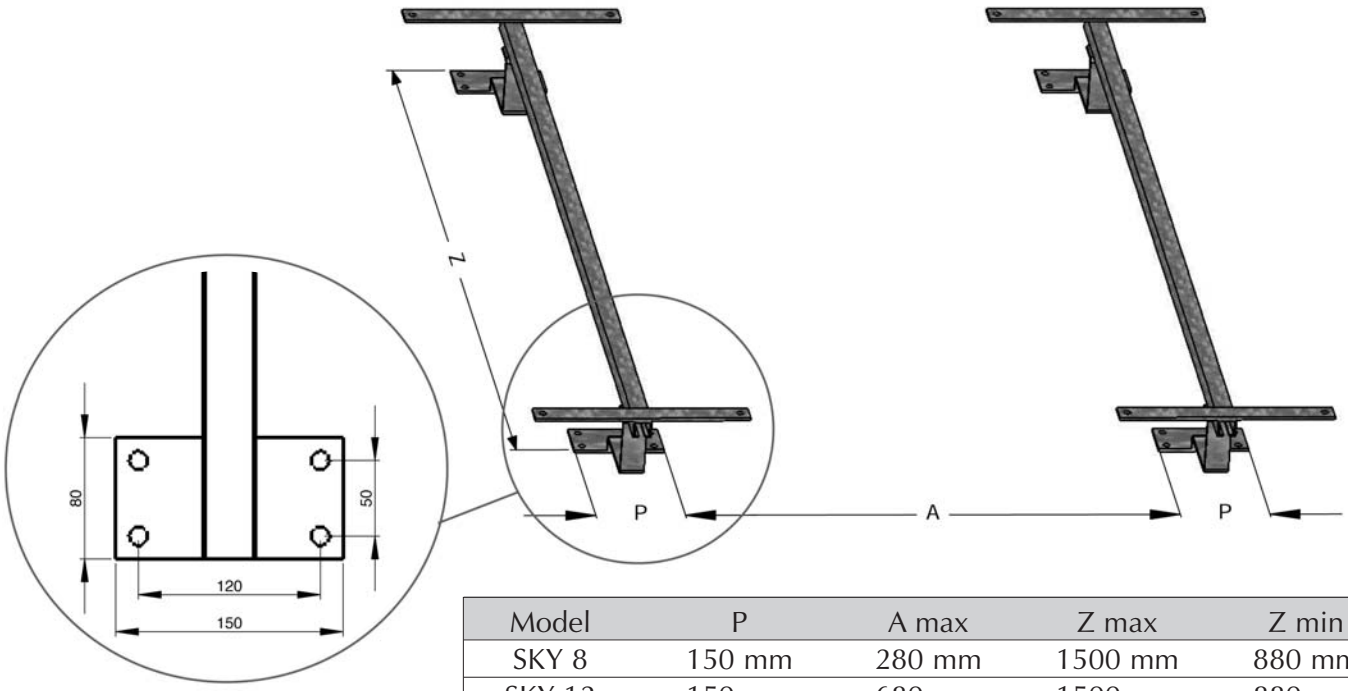
Sloped roof kit assembly layout

Position the fixing brackets, supplied in the kit, onto the sub-base as shown in the figure.
Each fixing bracket has 4 holes measuring 12 mm. the choice of nuts and bolts must be made keeping in mind the structure and material of the sub-base.



ASSEMBLY LAYOUT FOR 1 SKY CPC 58 PANEL: 8 - 12 - 18 - 21

In the case of installation of 1 SKY CPC 58 8, 12, 18 or 21 panel, respect the distances indicated in the figure, where P (support plate width) is a fixed measurement and A and Z are variable.



Model	P	A max	Z max	Z min
SKY 8	150 mm	280 mm	1500 mm	880 mm
SKY 12	150 mm	680 mm	1500 mm	880 mm
SKY 18	150 mm	1300 mm	1500 mm	880 mm
SKY 21	150 mm	1500 mm	1500 mm	880 mm

Sloped roof kit assembly layout

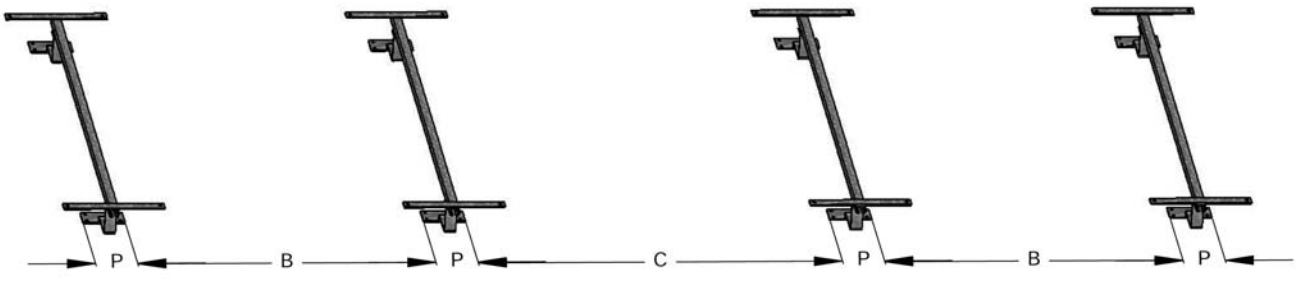
ASSEMBLY LAYOUT FOR 2 SKY CPC 58 PANELS: 8 - 12 - 18 IN SERIES

In the case of installation in series of 2 SKY CPC 58 8, 12, 18 panels, respect the distances indicated in the figure, where P (support plate width) is a fixed measurement and B is variable.

Model	P	B max
SKY 8	150 mm	530 mm
SKY 12	150 mm	970 mm
SKY 18	150 mm	1500 mm

ASSEMBLY LAYOUT FOR 3 AND MORE SKY CPC 58 PANELS: 8 - 12 - 18 IN SERIES

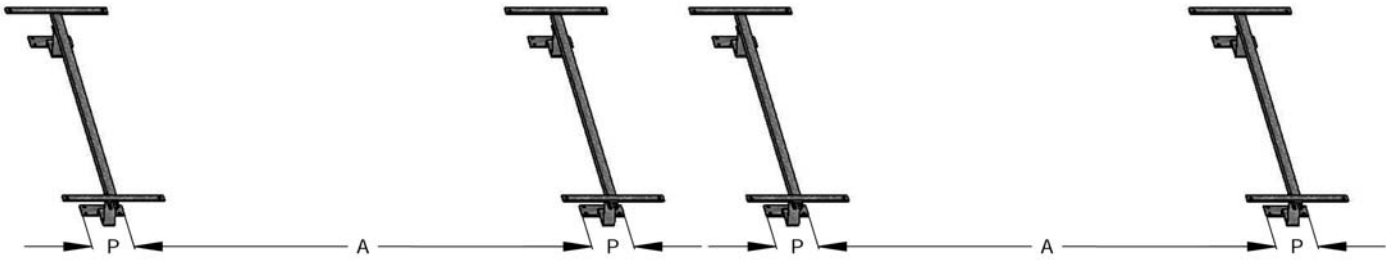
In the case of installation in series of 3 or more SKY CPC 58 8, 12, 18 panels, respect the distances indicated in the figure where P (support plate width) and C are fixed measurements, while B is variable



Model	P	B max	C
SKY 8	150 mm	530 mm	840 mm
SKY 12	150 mm	970 mm	1280 mm
SKY 18	150 mm	1500 mm	1940 mm

ASSEMBLY LAYOUT FOR 2 AND MORE SKY CPC 58 PANELS: 21

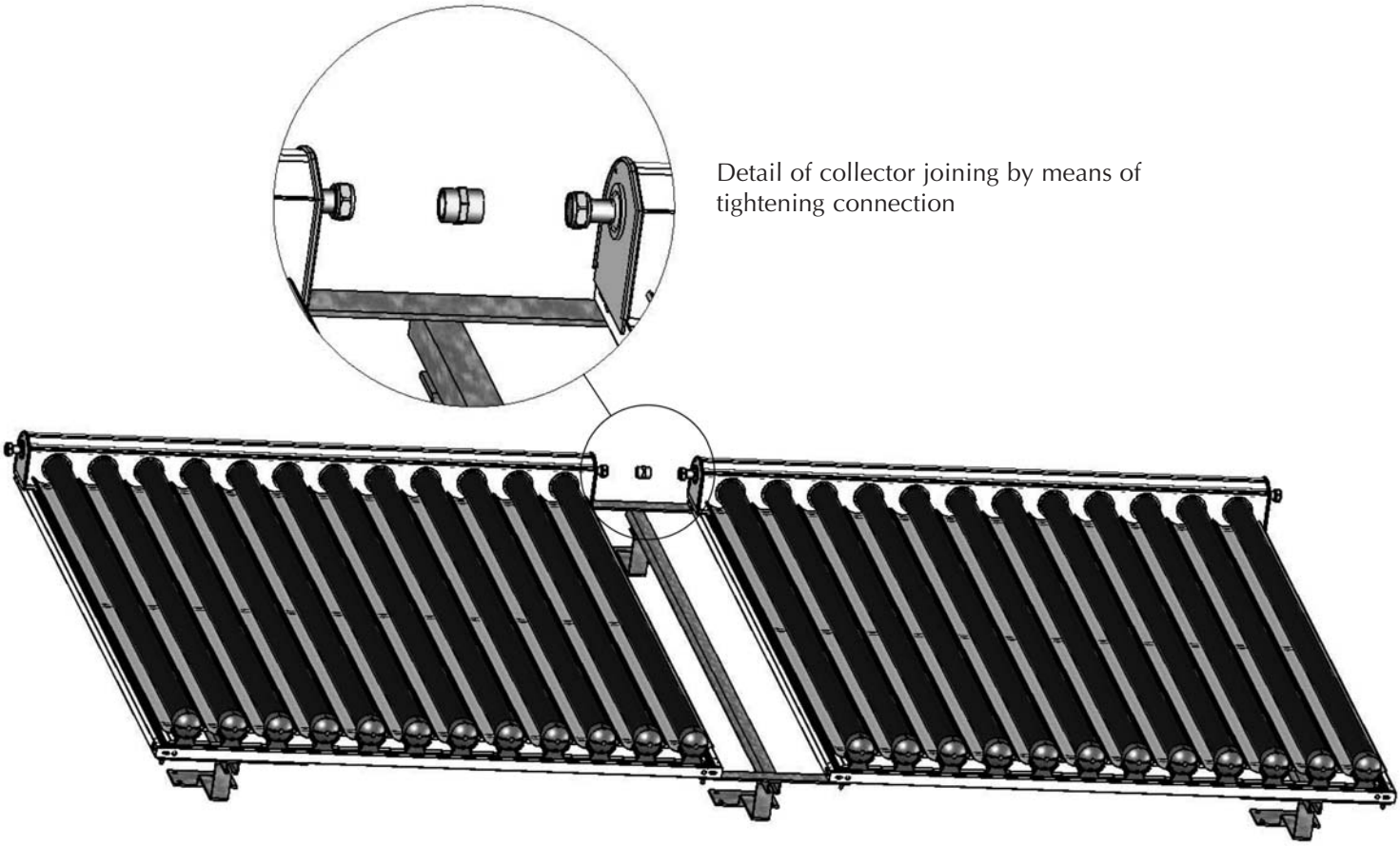
In the case of installation in series of 2 or more SKY CPC 58 21 panels, 2 support brackets for each collector are required as described in figure 2. Respect the maximum distance A as indicated in the figure, where P (support plate width) is a fixed measurement, while A is variable.



Model	P	A max
SKY 21	150 mm	1500 mm

Sloped roof kit assembly layout

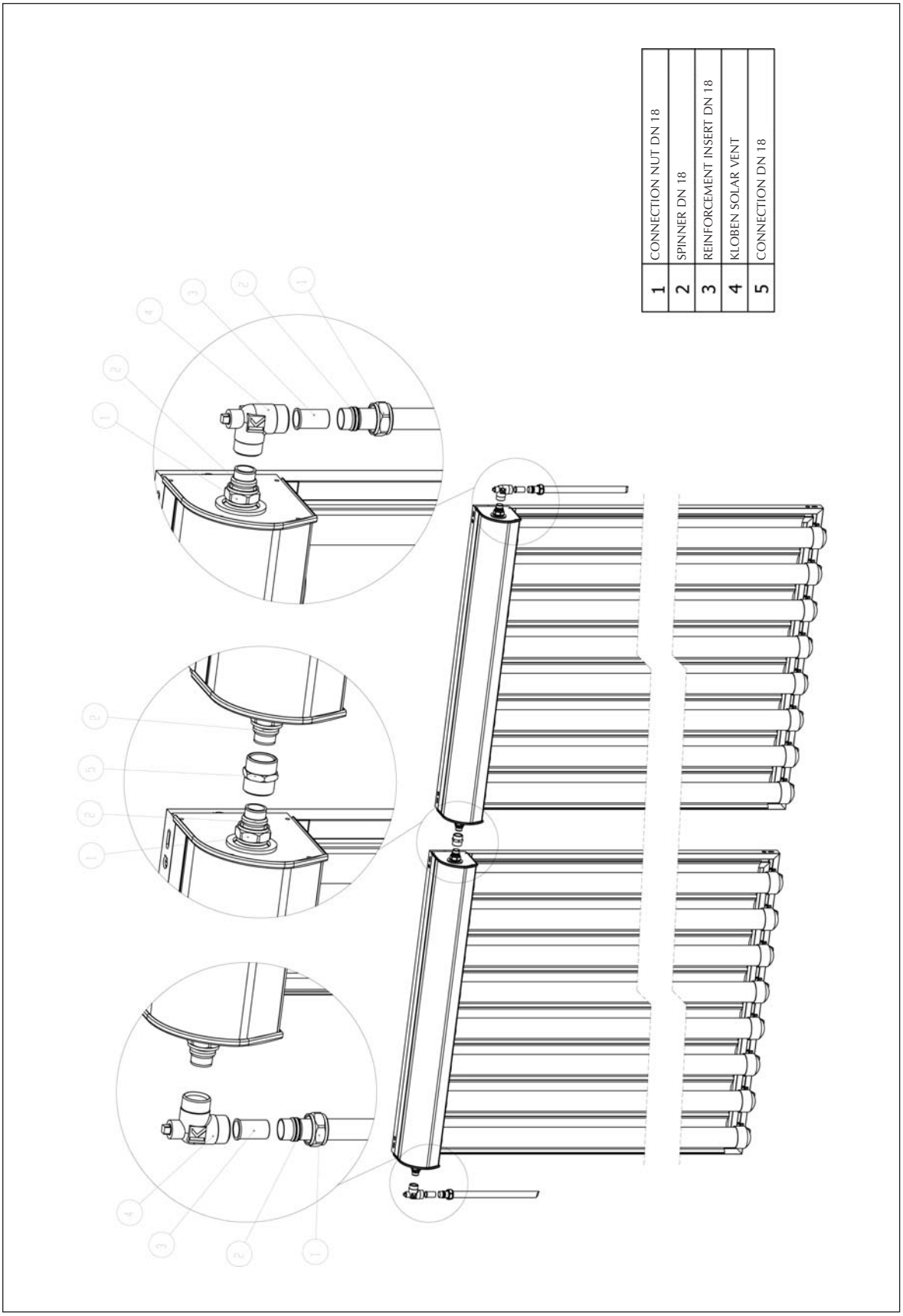
Position the collectors near to each other and bolt them (without tightening) to the support templates in the holes already prepared (Figure 4), by means of the screws present on the panels (there are 4 screws for each collector).
Then join the panels using the tightening connections supplied and already positioned on the collector (Figure 12). After this operation tighten the panels onto the templates.



Detail of collector joining by means of tightening connection

Sloped roof kit assembly layout

CONNECTION AND VENT KIT

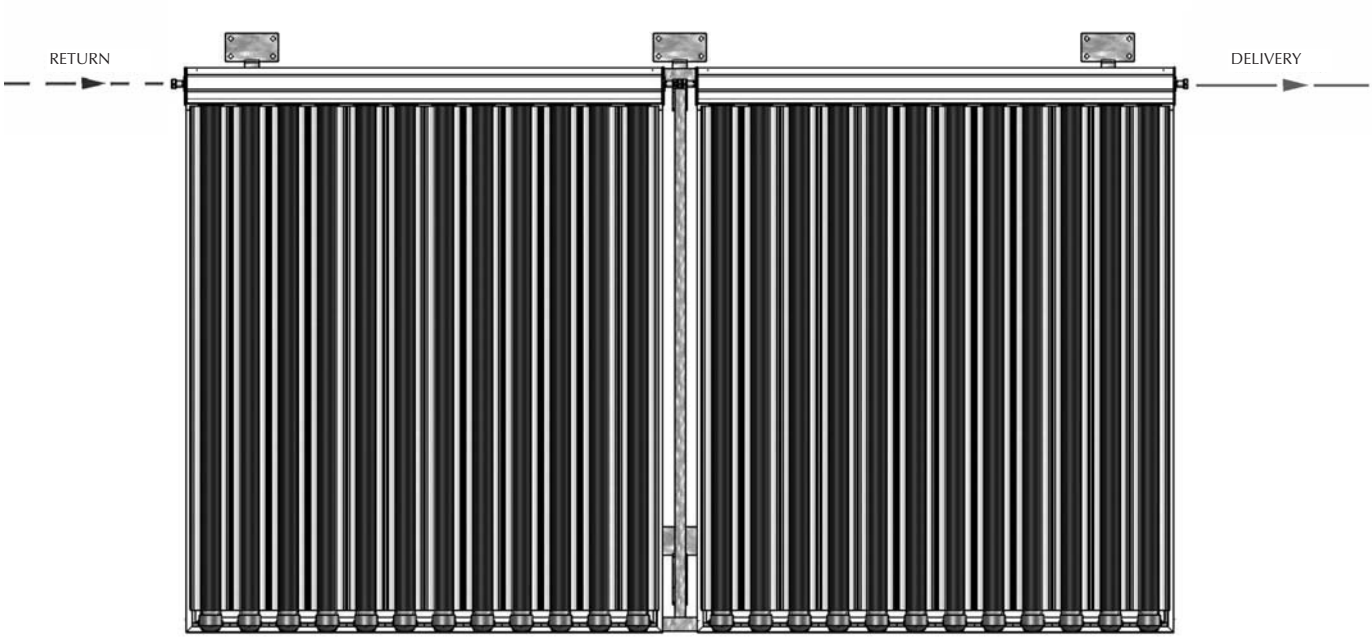


Hydraulic connections

ATTENTION

Once the hydraulic connections have been made, load the solar plant by means of the solar station, scrupulously following the instructions given on page 25.
It is also fundamental to eliminate all air present in the circuit (to prevent system malfunctioning). Regarding this, the use of the supplied loading pump is recommended (code art. 101010045).
When loading has been performed another check must be carried out that deaeration has been performed, using the manual air vent valves mounted on the solar collector.

Position probe F1 **ALWAYS ON THE DELIVERY**.
For correct introduction of the probe follow the instructions given on page 24



Instructions for assembly of the F1/PT 1000 probe

For correct introduction of the F1 probe (recognisable by the grey silicone cable) follow the indications given below:

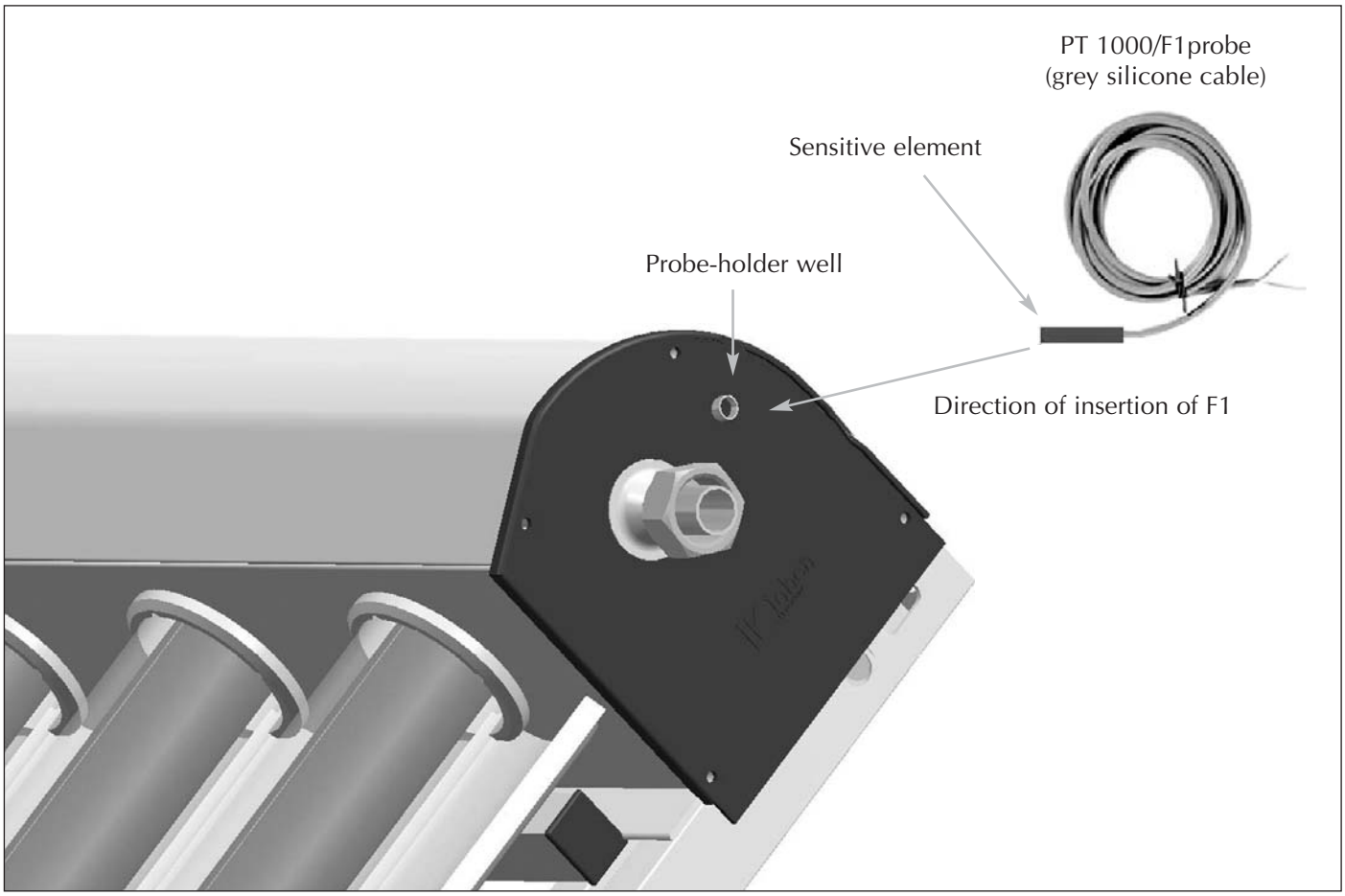
1) Insert the sensitive element of the probe F1 into the relative probe-holder well mounted on the panel, in the direction indicated in the figure above.

2) Leave the cable to run to the bottom of the well, making sure not to block it completely.

3) Successively, make the electric connections with the solar control unit, carefully following the instructions attached to the same.

4) Connect the probe electrically to the control unit.

It is advised to wear work gloves and protective goggles in order to prevent injury if the vacuum tube should accidentally break.

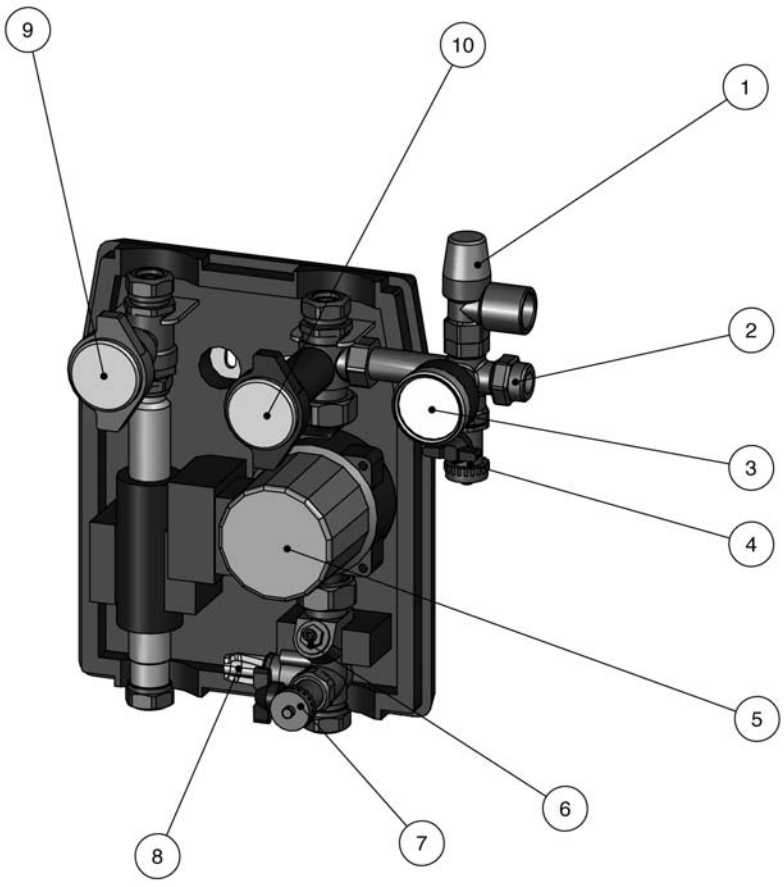


System loading using the solar station

SOLAR STATION: DISPLAY AND DESCRIPTION OF COMPONENTS

LOADING THE SYSTEM

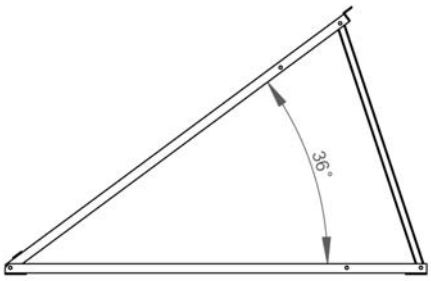
1. Before starting loading, check that the panels have been covered for at least 5 hours.
2. Connect the loading pump delivery pipe to the ball valve (7).
3. Connect the loading pump return pipe to the ball valve (4).
4. Open the ball valves (7 and 4).
5. Close the non-return valve (10) (turning in a clockwise direction).
6. Switch the loading pump on in a way that the anti-freeze circulates in the opposite direction with respect to normal functioning.
7. If there is a diverter valve on the solar line, check that it is open (manual) to allow the circulation of anti-freeze in both circuits. At the end of this operation take the valve to its original position (automatic).
8. Leave the pump to function for the time neecessary to allow the perfect deaeration of the system.
9. Quickly open and close the non-return valve for a few seconds (10). At the end of this operation leave the valve in the “open” position.
10. Close the ball valve (4).
11. Take the system to a pressure of 3 bar (pressure displayed on the manometer (3)).
12. Close the ball valve (7).
13. Switch the loading pump off.
14. Switch the solar control unit on and check the correct settings and functioning.
15. Set the flow rate adjuster on the value suitable for dimensioning of the system (Page 14 of this manual).
16. Uncover the previously-covered panels.



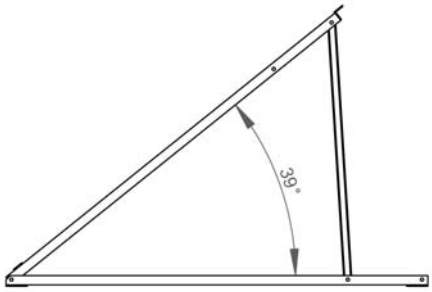
1	Safety valve
2	Flexible pipe connction for expansion vessel
3	Manometer
4	Ball valve
5	Pump
6	Flow adjuster
7	Ball valve
8	Flow gauge
9	Non-return valve
10	Non-return valve

Inclinations of the solar collectors

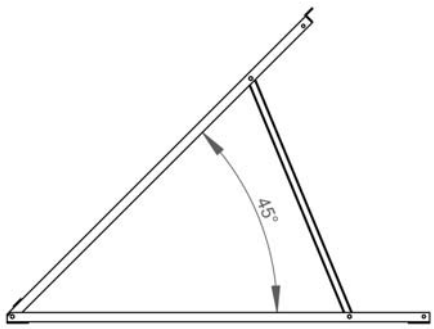
On the basis of the way of fixing the rear template support upright of the bracket kit for flat roofs it is possible to obtain 3 different inclinations of the solar collector. The figure shows the 3 different configurations allowed by the brackets.
A larger inclination is used o favour the integration in the winter period. The choice of inclination is made in the design phase on the basis of user requirements and by evaluating the surplus energy in the summer period.
Consult the Kloben technical dept. for inclinations different to those envisioned.



INCLINATION 36°



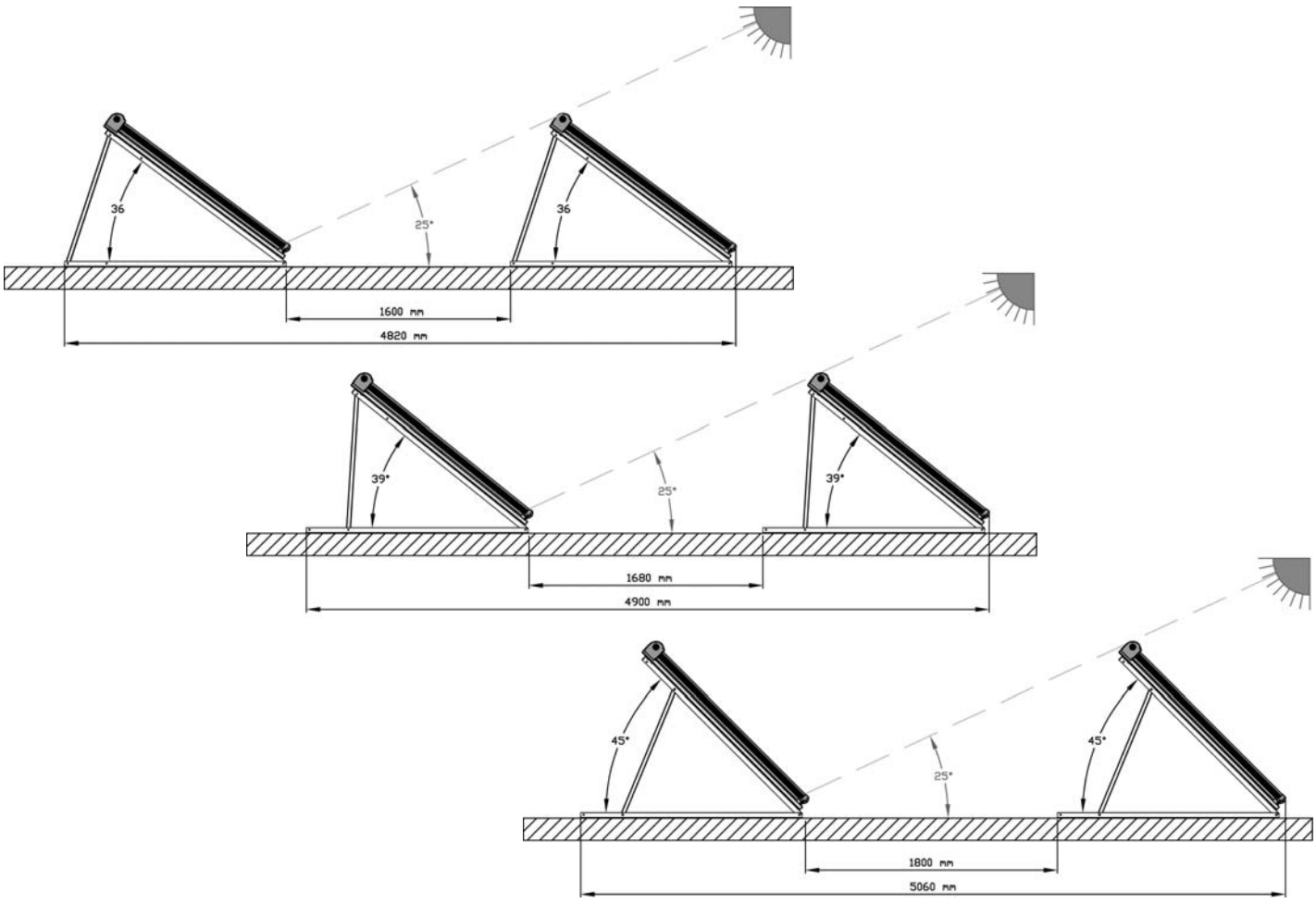
INCLINATION 39°



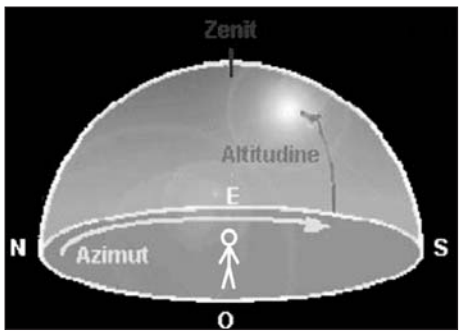
INCLINATION 45°

DISTANCE BETWEEN THE SETS OF COLLECTORS

The figure indicates, for every inclination configuration of the collectors, the minimum distances to be respected between one string of solar collectors in series and another to prevent shadows.
The calculation has been carried out for the inclination of solar rays at the latitude of Rome. For installations in areas with considerably different latitudes, contact the Kloben technical dept.

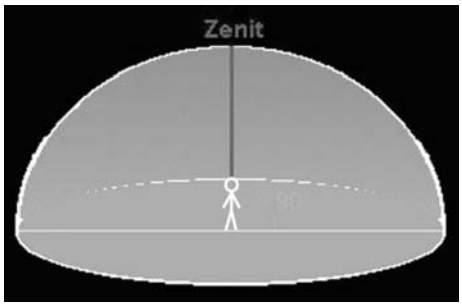


Orientation of the collectors



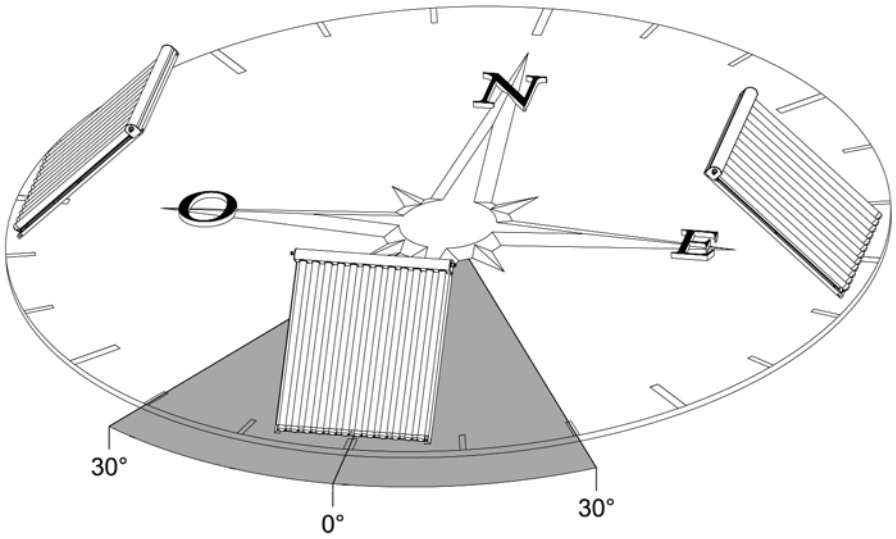
Azimuth

The distance of a celestial object from the north of the horizon of th observer. It is measured in degrees, starting from north (that = 0°) in a clockwide direction.



Zenith

The point of the celestial sphere directly above the head of the observer. In the altazimuth system it is the meeting point of the straigth line, perpendicular to the ground, passing through the observer and the celestial sphere. The opposite point is called nadir.



Optimal orientation = 0° South

Maximum orientation recommended = 30° South/East -- 30° South/West

It is very important to check that there are no obstructions on the horizon that may jeopardise the radiation of the collector during transit of the sun.
If obstacles are present they must be signalled as this information conditions the dimensioning of the necessary solar collectors.

ANY ORIENTATION OF THE PANELS THAT IS DIFFERENT FROM THOSE STATED IN THIS MANUAL DOES NOT GUARANTEE THE OPTIMAL PERFORMANCE OF THE SYSTEM

Maintenance and repairs

A yearly inspection is recommended to check the general state of the collector and the solar system in order to determine the necessity of any repair interventions.

In particular, the following periodic controls must be performed:

Yearly check of system pressure.

If pressure is lower than the optimal working pressure (cf."WARNINGS AND PRELIMINARY CHECKS") the causes that determined the loss must be checked. Only a Kloben authorised after-sales centre can restore optimal working conditions.

Yearly check of anti-freeze protection efficiency.

The anti-freeze heat-carrying liquid must be checked yearly, before the winter. The Kloben authorised after-sales centres can check and restore the optimal anti-freeze protection conditions of the solar system.

Yearly check of corrosion protection.

A periodical check of the anti-corrosive properties of the heat-carrying fluid must be implemented. TYFOCOR LS has a pH that varies from 9.0 to 10.5. If, using litmus paper, sensitively lower pH values should be detected, generally < 7, it is good practice to replace the TYFOCOR LS heat-carrying fluid.

Check regarding the operational efficiency of the vacuum tube collectors.

For efficient functioning of the vacuum glass tube it is necessary that the vacuum conditions in the gap remain unaltered through time. An evident test that can be seen with the naked eye regarding the loss of vacuum conditions is the presence of a white powder deposit on the reflecting area in the lower "pointed" part of the tube.
In the presence of damaged tubes the fragments of glass present in the housing of the vacuum tube in the solar collector box and in the small cup that supports the tube, must be removed.
In order to replace a tube, first loosen the small cup following the OPEN arrow indicated on the back of the same. Slide the vacuum tube delicately out of the housing in the solar collector box, keeping a more or less inclined position with respect to the panel in order to prevent damage to the circuit U-shaped copper pipe. Recover the silicone gasket present on the upper part of the extracted tube. Insert the gasket onto the upper part of the new vacuum tube, after having lubricated the part with soapy water to ease insertion. Then house the tube in the collector, repeating the extraction operation in reverse order and delicately inserting the U-shaped copper pipe with relative combined absorbing device. Make sure, as previously, that the direction of insertion is not too inclined with respect to the solar collector panel. Push the open head of the vacuum tube into the box housing of the solar collector until it is fully home. Position and fix the tube-support cup into the lower part, screwing in a clockwise direction towards the CLOSE arrow. Accomodate the vacuum tube and attach the gaskets well to the collector box.

Safety systems

PASSIVE SAFETY

In a closed circuit with a pressure of 3-3.5 bar, the evaporation point of the heat-carrying fluid is about 130°C. During the summer period and in particular in periods when hot water is not used, when the heat storage inertial unit, the cylinder, reaches the maximum set temperature, the solar circuit pump is switched off by the control unit. In these conditions, the temperature of the fluid in the solar collector circuit starts to rise until the collector is taken into the so-called stagnation condition where evaporation of the fuid takes place at around 130°C. The expansion caused by the vapour formed forces the content of heat-carrying fluid of the solar collectors into the prepared venting volume, contained in the expansion vessel that has been dimensioned especially to house this amount (cf.DIMENSIONING - Expansion vessel). At this point only vapour will be present in the solar collectors. This stall situation guarantees that the temperature does not rise further. When there is a withdrawal of heat from the boiler, this will determine the decrease of temperature in the collectors and the condensation of the vapour will leave room for heat-carrying fluid, recalling it from the expansion vessel.

SAFETY VALVE

Each solar station with circulation pump has a safety valve with threshold pressure of 6 bar. This device is used to fix the maximum theoretical pressure that can be reached inside the solar circuit.

SAFETY LOGIC

Every solar system functioning control and management control unit has safety logic control functions set itop revent any damage to the system components and for the safety of the user:

- circulation block with T > 80-90°C to the solar collector (measured using PT 1000 probe);
- circulation block with T > 130°C to the storage tank (measured in the cylinder using NTC probe);
- start of the safety ANTI-FREEZE circulation with T < T minimum that can be set (measured in the piping using NTC probe);
- start of boiler integration for ANTI-LEGIONELLA safety with T < 65°C to the cylinder for more than a week (measured in the cylinder using NTC probe or boiler probe).

PROTECTION AGAINST LIGHTENING

The solar collector must have a potential balancing device for protection against lightening, in compliance with the Standard in force. An equipotential connection between the solar collector frame and the earth can be performed. An earth conductor connection must be envisioned that is particularly efficient, with copper cable with minimum section of 10 mm^2. If a lightening conductor is already available, connect the frame to the existing equipotential conductor. The connection must intercept the delivery or return conductor as well as the frame.
For large solar systems consider a connection to the equipotential conductor every 200 m^2.

PROTECTION AGAINST BURNS

The temperatures in the storage unit or cylinders can reach high levels. For this reason, the Kloben hydraulic layouts always state the use of a mixer thermostatic valve to be inserted at the exit of the cylinder on the delivery for the DHW utility. This valve guarantees a maximum T to the utility of 48°C + 5°C tolerance (cf. “FOR THE USER”).

Indications regarding transport and handling

There are no specific warnings regarding the handling and transport of the solar collectors, if not the usual cautions to consider when handling fragile objects.

The packaged panel must be loaded onto lorries or any other means of transport in a vertical position.

Wear rubber or PVC gloves during handling, installation and maintenance of the panels, so as to prevent injury due to the accidental breakage of fragile material, such as glass.

The use of protective glasses is also recommended.

There are no particular measures for the use and handling of the heat-carrying liquid TYFOCOR LS. Just follow the normal safety and hygiene measures relative to the use of chemical substances. Also refer to the information contained in the TYFOCOR LS safety sheet.

For the user

The management of the Kloben solar system does not require particular interventions by the user if not for the normal periodic maintenance checks stated below. Once the plant is started by the installer it operates automatically and completely autonomously, even when the user is not present.

The regulations contained in the **Presidential Decree dated 26 August 1993, n. 412 (GU 14 October 1993, n. 96)** lay down the Standards for design, installation, working and maintenance of building heating systems in order to contain energy consumption, in implementation of art.4, paragraphs 4, stated in Art.5 (sub 7):
In new heat plants and those undergoing restructuring, the heat generators destined for the centralised production of domestic hot water for multiple utilities of the housing type must be dimensioned according to the UNI 9182 technical standards, must have a hot water storage system with suitable capacity, be insulated depending on the diameter of the tanks according to the indications valid for piping stated in the last column of attachment B and must be designed and run in a way that the temperature of the water, measured at the emission point of the distribution network, does not exceed 48°C, + 5°C tolerance.

Regarding this, we recommend the installation of a thermostatic mixer at the exit of the cylinder, as also indicated in our layouts.

Kloben guarantees the products or materials for a period of five years, plus another five years after audit, with the following exceptions regarding time:
- Electric motors, every electrical part and every part subject to wear (e.g.: diverter valves, circulation pumps, safety thermostats, control unit) traded are covered by a warranty of two years, against construction or material defects.
- The cylinder test anode is subject to the warranty of two years, against construction or material defects.

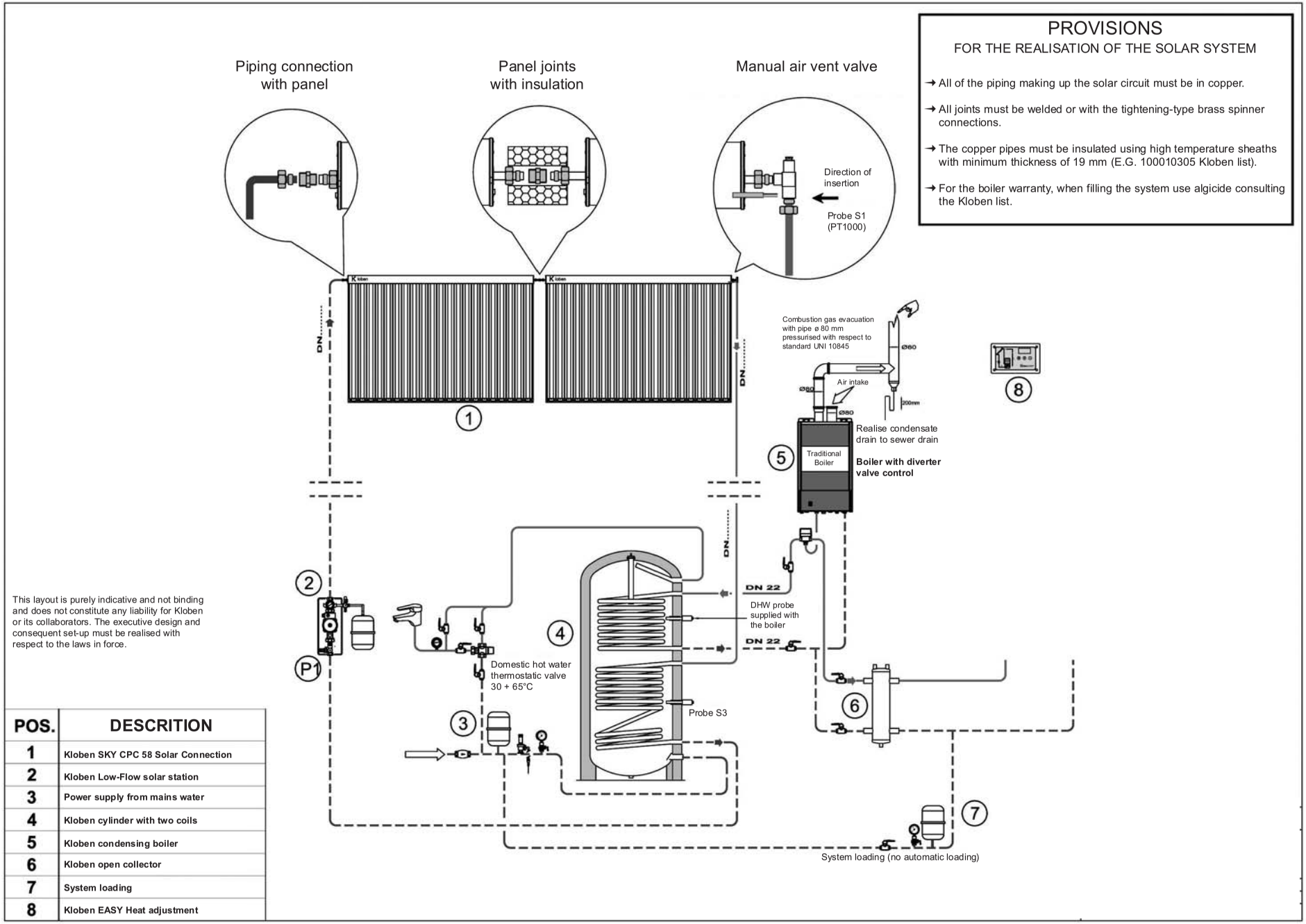
The warranty terms come into force from the date of installation of the materials

Anti-freeze protection
It is indispensable that an efficient anti-freeze protection is guaranteed through time. In the basis of experience, the TYFOCOR LS heat-carrying liquid keeps its anti-freeze and anti-corrosion properties unaltered for at least 5 years. It is however indispensable that the user has Kloben authorised staff check the operational conditions of the heat-carrying fluid every year in order to evaluate the status and integrate it or replace it if necessary.

Preventive measures in the case of non-use
In the case of long periods of inactivity of the solar system during the summer, it is good practice, where possible, to cover the solar collectors with tarpaulin or similar material. If energy is not withdrawn from the storage unit the temperatures of the solar collectors can reach high levels to about 300°C. In these situations the normal measures for facing these conditions are more than sufficient to prevent damage to the solar collector. In fact the expansion vessel acts as a vent, housing the collector's liquid.
Failure to comply with this measure does not jeopardise normal functioning of the solar collector. On the other hand, this however can contribute to lengthening the lifespan.

Anomalous functioning
If evident functioning anomalies are detected, such as falls in system pressure, lack of sealing, malfunctioning of the system control and ajustment appliances, contact a Kloben authorised after-sales centre.

The executive design and consequent set-up, both electrical and hydraulic, must be realised with respect to the laws in force.



PROVISIONS

FOR THE REALISATION OF THE SOLAR SYSTEM

- All of the piping making up the solar circuit must be in copper.
- All joints must be welded or with the tightening-type brass spinner connections.
- The copper pipes must be insulated using high temperature sheaths with minimum thickness of 19 mm (E.G. 100010305 Kloben list).
- For the boiler warranty, when filling the system use algicide consulting the Kloben list.

This layout is purely indicative and not binding and does not constitute any liability for Kloben or its collaborators. The executive design and consequent set-up must be realised with respect to the laws in force.

POS.	DESCRITION
1	Kloben SKY CPC 58 Solar Connection
2	Kloben Low-Flow solar station
3	Power supply from mains water
4	Kloben cylinder with two coils
5	Kloben condensing boiler
6	Kloben open collector
7	System loading
8	Kloben EASY Heat adjustment

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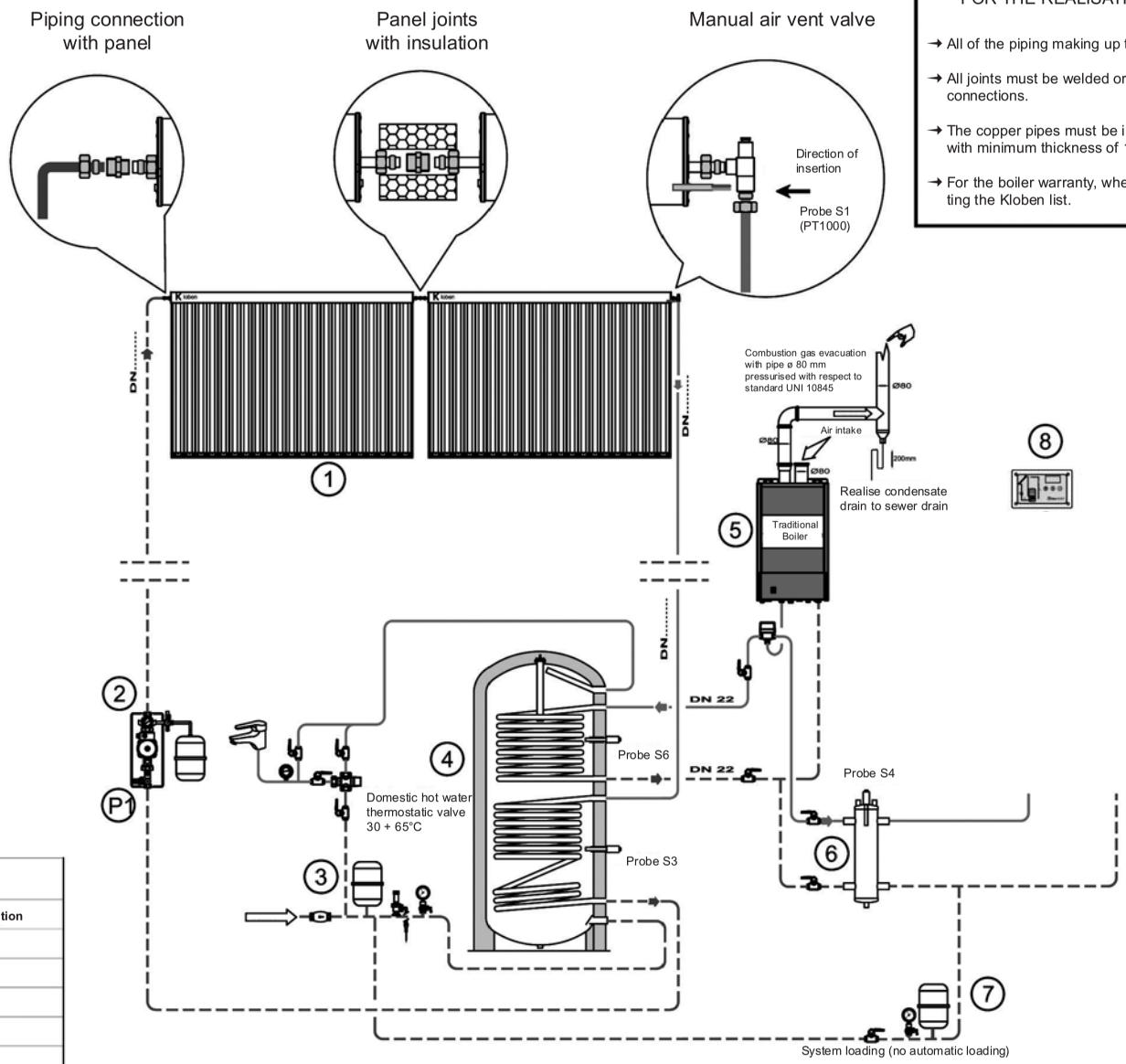

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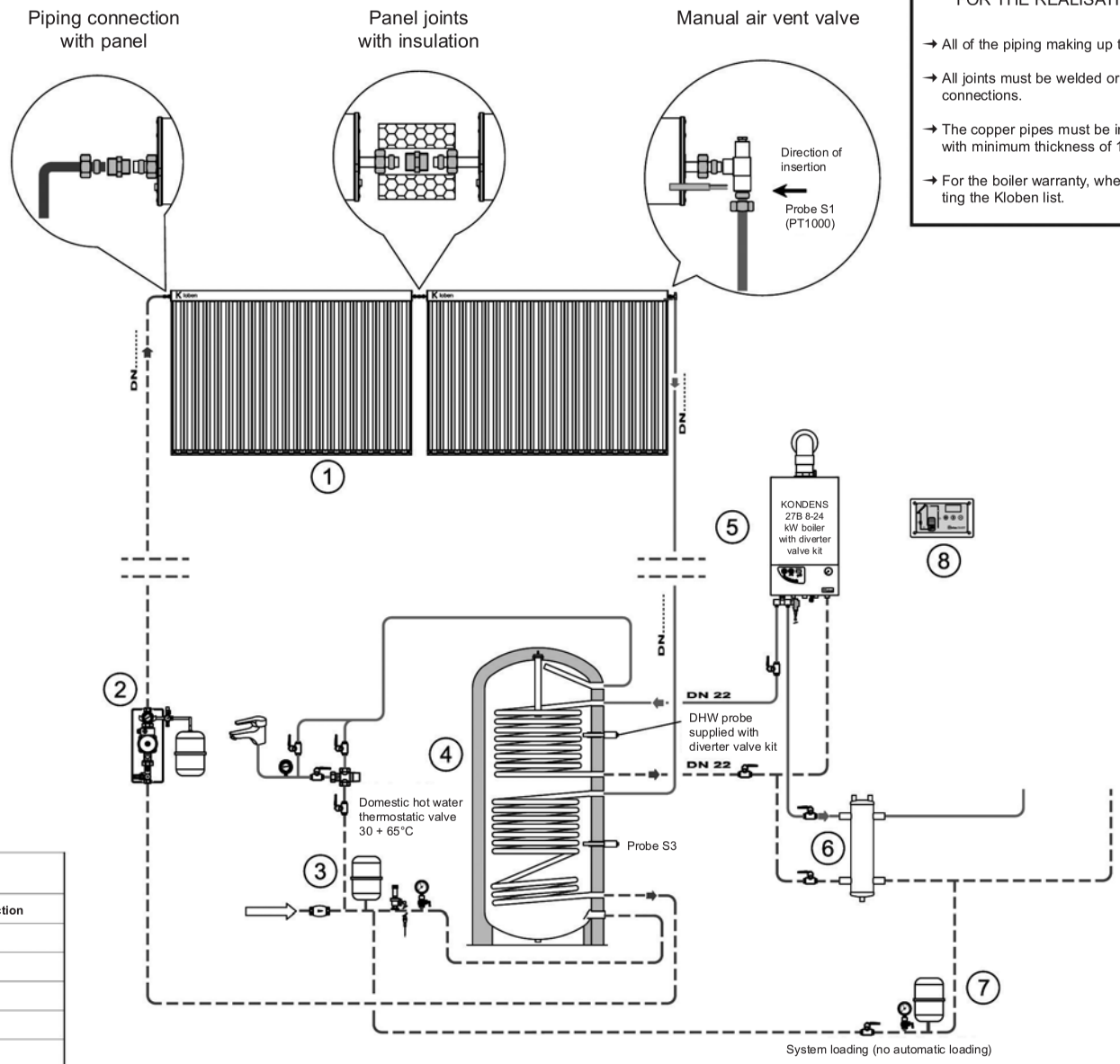


PROVISIONS

FOR THE REALISATION OF THE SOLAR SYSTEM

- → All of the piping making up the solar circuit must be in copper.
- → All joints must be welded or with the tightening-type brass spinner connections.
- → The copper pipes must be insulated using high temperature sheaths with minimum thickness of 19 mm (E.G. 100010305 Kloben list).
- → For the boiler warranty, when filling the system use algicide consulting the Kloben list.

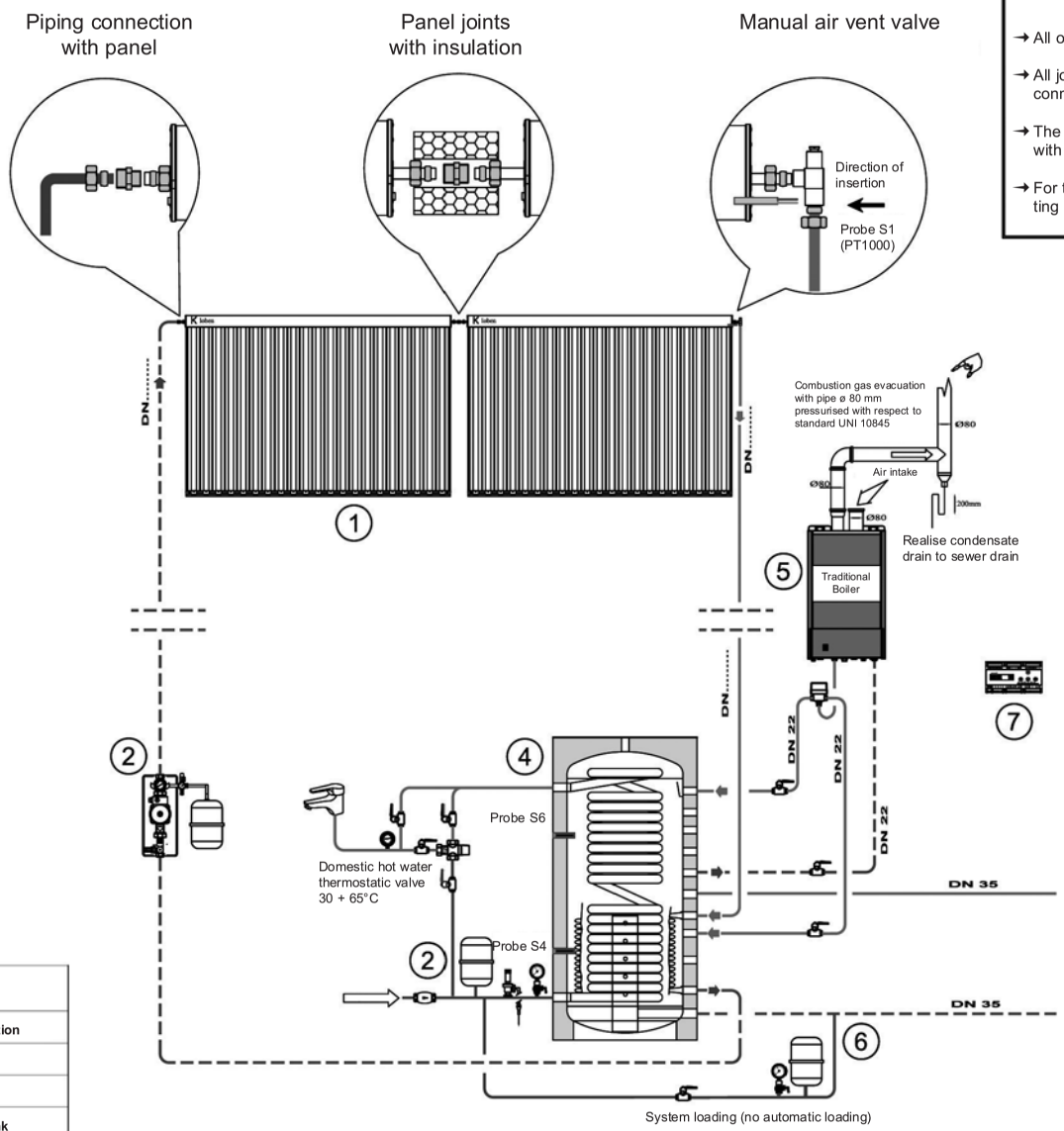
This layout is purely indicative and not binding and does not constitute any liability for Kloben or its collaborators. The executive design and consequent set-up must be realised with respect to the laws in force.

POS.	DESCRITION
1	Kloben SKY CPC 58 Solar Connection
2	Kloben Low-Flow solar station
3	Power supply from mains water
4	Kloben cylinder with two coils
5	Kloben condensing boiler
6	Kloben open collector
7	System loading
8	Kloben EASY Heat adjustment

PROVISIONS

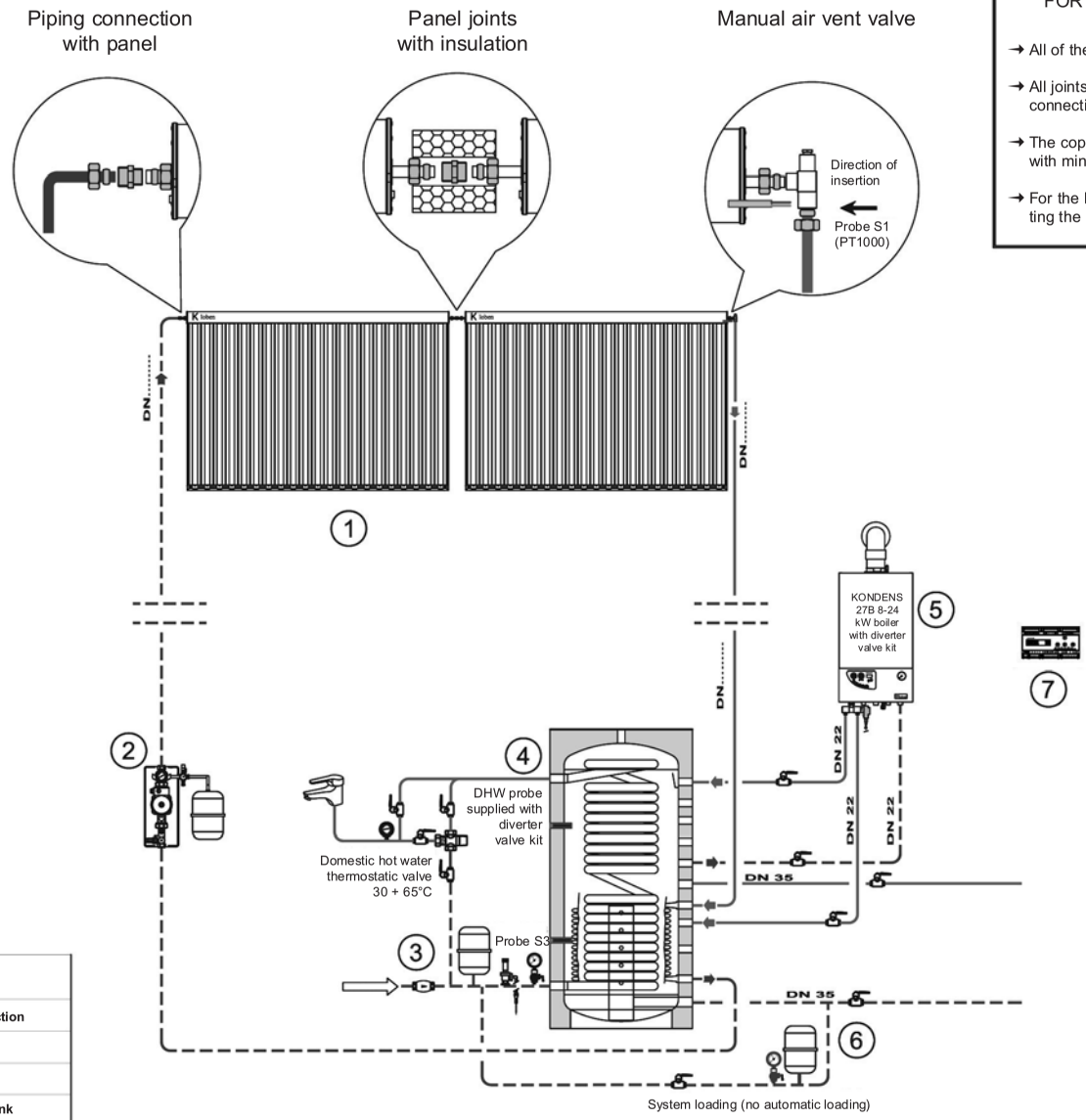
FOR THE REALISATION OF THE SOLAR SYSTEM

- → All of the piping making up the solar circuit must be in copper.
- → All joints must be welded or with the tightening-type brass spinner connections.
- → The copper pipes must be insulated using high temperature sheaths with minimum thickness of 19 mm (E.G. 100010305 Kloben list).
- → For the boiler warranty, when filling the system use algicide consulting the Kloben list.



This layout is purely indicative and not binding and does not constitute any liability for Kloben or its collaborators. The executive design and consequent set-up must be realised with respect to the laws in force.

POS.	DESCRITION
1	Kloben SKY CPC 58 Solar Connection
2	Kloben Low-Flow solar station
3	Power supply from mains water
4	Kloben boiler with SSP stroage tank
5	Kloben condensing boiler
6	System loading
7	Kloben Cosmet 4 Heat adjustment



PROVISIONS

FOR THE REALISATION OF THE SOLAR SYSTEM

- All of the piping making up the solar circuit must be in copper.
- All joints must be welded or with the tightening-type brass spinner connections.
- The copper pipes must be insulated using high temperature sheaths with minimum thickness of 19 mm (E.G. 100010305 Kloben list).
- For the boiler warranty, when filling the system use algicide consulting the Kloben list.

This layout is purely indicative and not binding and does not constitute any liability for Kloben or its collaborators. The executive design and consequent set-up must be realised with respect to the laws in force.

POS.	DESCRITION
1	Kloben SKY CPC 58 Solar Connection
2	Kloben Low-Flow solar station
3	Power supply from mains water
4	Kloben boiler with SSP stroage tank
5	Traditional condensing boiler
6	System loading
7	Kloben COSMET Heat adjustment

Data detection card for solar heating systems

Agency: _____

Reference: _____ Customer: _____

Project locality: _____

TYPE OF BUILDING:

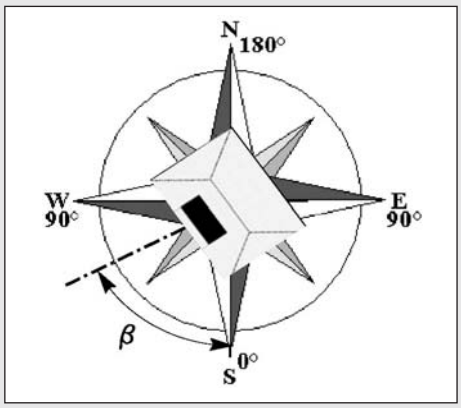
☐ single family ☐ multi family

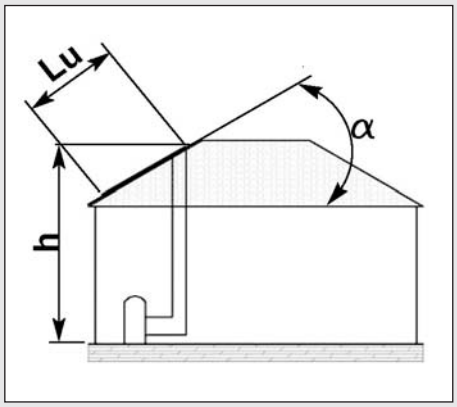
☐ existing ☐ under construction ☐ in design phase

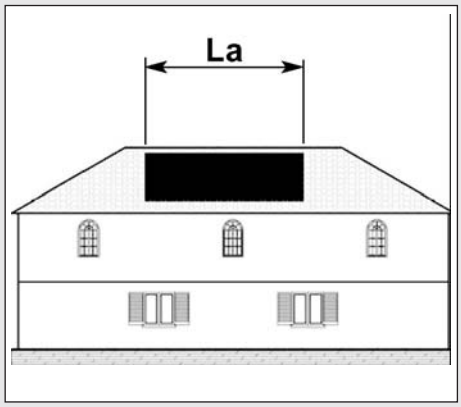
TYPE OF ROOF:

☐ flat ☐ sloped

SHAPE AND DIMENSIONING OF THE BUILDING:







ORIENTATION OF THE SLOPE

S	ß = 0°
SSW/SSE	ß = 22.5°
SW/SE	ß = 45°
WSW/ESE	ß = 67.5°
W/E	ß = 90°

Lu (length of pitch usable): _____

h (height of the system): _____

α (inclination of the roof): _____

ß (orientation of the roof): _____

La (width of the pitch usable): _____

Shadowing (obstacles which, during sunlight hours, pcast shadows on the panels) _____

OTHER IMPORTANT DATA:

Technical room:

Height available m: _____

Height and width of the access door m: _____

Total length of cylinder/panels connection piping m: _____

USES

DOMESTIC HOT WATER

☐ low cons. (30l day per person) x n° ___ persons = _____

☐ average cons. (50l day per person) x n° ___ persons = _____

☐ high cons. (80l day per person) x n° ___ persons = _____

☐ washing machine connection

☐ diswasher connection

☐ average daily cons. of hot water: l/day _____

☐ pump functioning hours: h/day _____

☐ any other cons.: _____

SWIMMING POOL

☐ indoor ☐ outdoor

suraces: _____ m²

depth: _____ m

volume: _____ m³

☐ use of the cover: _____ h/day

(if not indicated, assume 8 h/day)

☐ period of use _____

☐ obstacles which, during sunlight hours, cast shadows on the panels

☐ **Integration to radiant heating (fill in the relative form)**

HEATING STATION

Boiler type: ☐ heating only ☐ diverter valve ☐ with integrated storage tank

☐ with quick production ☐ water heater ☐ with external storage tank

Type of system offered: ☐ HeatPipe ☐ Grand Soleil ☐ Grand Soleil Plus ☐ Totalenergy ☐ Totalenergyplus

NOTE:

DIN CERTCO
Gesellschaft für Konformitätsbewertung mbH

CERTIFICATE

The company

KLOBEN SUD s.r.l.
Loc. Terziere
84061 OGLIASTRO CILENTO (SA)
ITALY

with its production site in

Ogliastro Cilento

hereby receives the confirmation that the product/s

Solar collectors

of the type

SKY 8 CPC 58, SKY 12 CPC 58,
SKY 18 CPC 58, SKY 21 CPC 58

conforms to

DIN EN 12975-1:2006-06
DIN EN 12975-2:2006-06
Specific CEN KEYMARK Scheme Rules for Solar Thermal Products

and is granted the licence to use the marks

in conjunction with the Registration No. below.

Registration No.: 011-7S124 R

This certificate remains valid as long as the required surveillance conditions will be passed with a positive result for the assessment.

Deutscher Akkreditierungs Rat
DAR
DAP-ZE-2460.00
See annex for further information.

DIN CERTCO Gesellschaft für
Konformitätsbewertung mbH
Alboinstraße 56, 12103 Berlin

GESELLSCHAFT FÜR KONFORMITÄTSBEWERTUNG MBH
DINCERTCO

2008-01-31

Dipl.-Ing. Dipl.-Wi.-Ing. Sören Scholz
- Acting Head of Certification Body -

FORSCHUNGS- UND TESTZENTRUM FÜR SOLARANLAGEN
Institut für Thermodynamik und Wärmetechnik
Universität Stuttgart
Professor Dr. Dr.-Ing. habil. H. Müller-Steinhagen

in Kooperation mit SWT TECHNOLOGIE

Nachweis des jährlichen Kollektorertrags

für die Vergabe des Umweltzeichens nach RAL-UZ 73

entsprechend den Richtlinien des Bundesministeriums für Wirtschaft zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien vom 1. August 1995

Für Sonnenkollektoren mit der Vertriebsbezeichnung:	**SKY 8 CPC 58**
und die baugleiche Typen:	**SKY 12 CPC 58, SKY 18 CPC 58, SKY 21 CPC 58**
der Vertreiberfirma:	**Kloben Sud s.r.l. - KT Solar Località Terzerie 84061 Ogliastro Cilento Salerno, Italien**

wurde eine Nachweisrechnung entsprechend der beim Deutschen Fachverband Solarenergie hinterlegten "Empfehlung zum Nachweis eines Kollektormindestertrages" durchgeführt bzw. eine entsprechende Nachweisrechnung anerkannt, die für einen baugleichen Kollektor durchgeführt wurde.

Der Nachweis basiert auf der Auswertung des Prüfberichts: 06COL623/1 vom 14.01.2008 nach EN 12975-2: 2006 des Forschungs- und Testzentrums für Solaranlagen Stuttgart.

Der erforderliche Kollektorertrag* von 525 kWh/m²a wird erreicht.

*am Standort Würzburg bei einem solaren Deckungsanteil von 40%

Zusätzliche Feststellungen:

keine

Dieser Nachweis ist registriert unter der Nummer: 06COL623/1

Stuttgart, den 15.01.2008

Prof. Dr. Dr.-Ing. habil H. Müller-Steinhagen

Institut für Thermodynamik und Wärmetechnik (ITW) • Pfaffenwaldring 6 • 70550 Stuttgart
Tel. 0049(0)711/685-63536 • Fax 0049(0)711/685-63503 • e-mail: tzs@itw.uni-stuttgart.de

Notes

Kloben Solar Evolution

Kloben
Solar Evolution

Rev. 0 del 19-02-2008