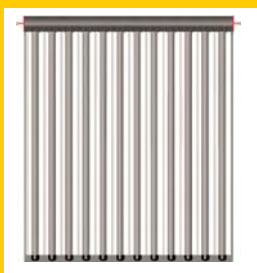
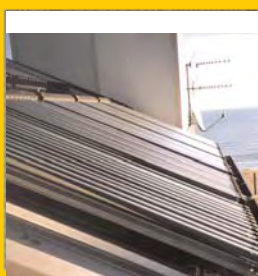


# TECHNICAL MANUAL

## FORCED CIRCULATION SYSTEM





## First Italian manufacturer of vacuum solar collectors



# Solar collector Kloben “C.P.C. Diffusion”



## I N D E X

<b>Advantages of KLOBEN technology</b>	<b>page 4</b>
<b>Basic components of a KLOBEN system</b>	<b>page 6</b>
<b>Installation examples</b>	<b>page 9</b>
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<b>Selection of pipe diameters</b>	<b>page 13</b>
<b>Model description and efficiency</b>	<b>page 14</b>
<b>Pump data of the solar stations</b>	<b>page 15</b>
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# Solar collector Kloben "C.P.C. Diffusion"

## UTILISING SOLAR ENERGY

The working principle of a solar heating system can be easily explained.

A collector receives the solar radiation, and as a result heats up. This heat produced is channelled in the greatest possible quantity to a hot water tank. No fuel is used during this process, and so there are no CO2 emissions, thus no environmental pollution. The quantity of solar energy that the collector is able to transfer into the house depends mainly on its capacity to absorb light, but also on its insulation from the external environment, which prevents the dispersion of energy from the collector itself. The creation of a vacuum by removing the air from a glass container achieves excellent insulation, a principle which has been known for a century now and applied in the form of the thermos.

By using this type of insulation, the collectors can improve the conversion of solar energy even in between seasons and in the winter period.

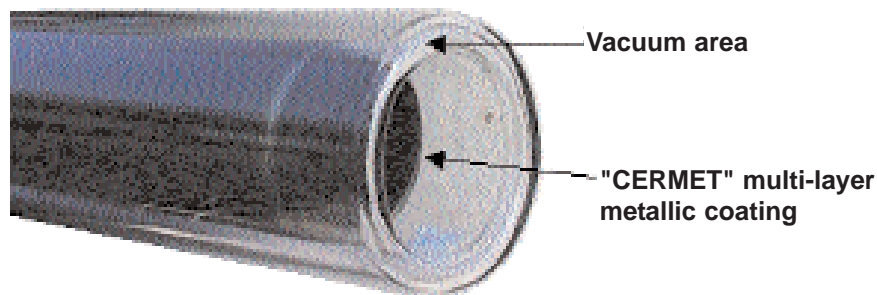
## ADVANTAGES OF THE VACUUM TECHNOLOGY

- High temperatures and high efficiency even in unfavourable atmospheric conditions, such as an overcast sky, or in case of low temperatures.
- High solar absorption even from oblique light, thanks to the circular shape of the absorber.
- Excellent heat exchange capacity.
- Long life, as there are no metallic passages interrupting the glass pipe and compromising the vacuum.
- Long life, as the selective surface is protected by the vacuum.
- Maximum efficiency from a small surface area (the surface area required is half that of a normal absorption panel).
- Very high year-round output.
- Attractive shape and design
- Low assembly costs: the collector is already pre-fitted and easy to mount.
- Replacement of the pipes without having to drain the solar circuit.

## THE VACUUM TUBE

### AN ANCIENT PRINCIPLE, APPLIED ON AN ADVANCED TECHNOLOGY

The creation of a vacuum by removing the air from a glass container achieves excellent insulation, a principle which has been known for a century now and applied in the form of the thermos. By using this type of insulation, the collectors can improve the conversion of solar energy even in between seasons and in the winter period.



A special multi-layer metallic paint, made from recyclable products, called CERMET, is applied to make the internal space especially selective to infra-red refraction for the absorption of solar energy.

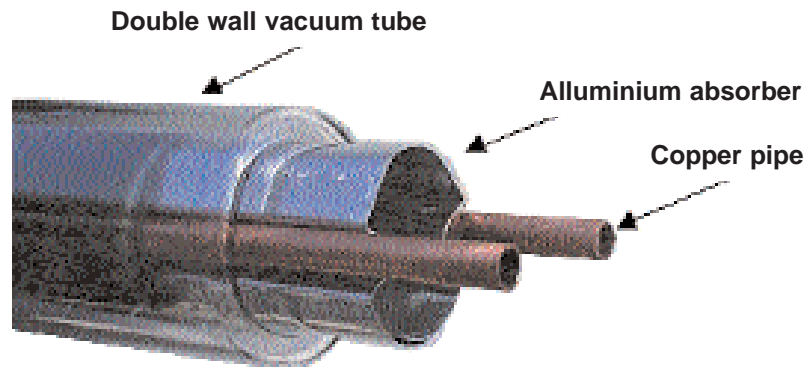
The vacuum protects the selective coating from any outer agent, preserving its long life.



# Solar collector Kloben "C.P.C. Diffusion"

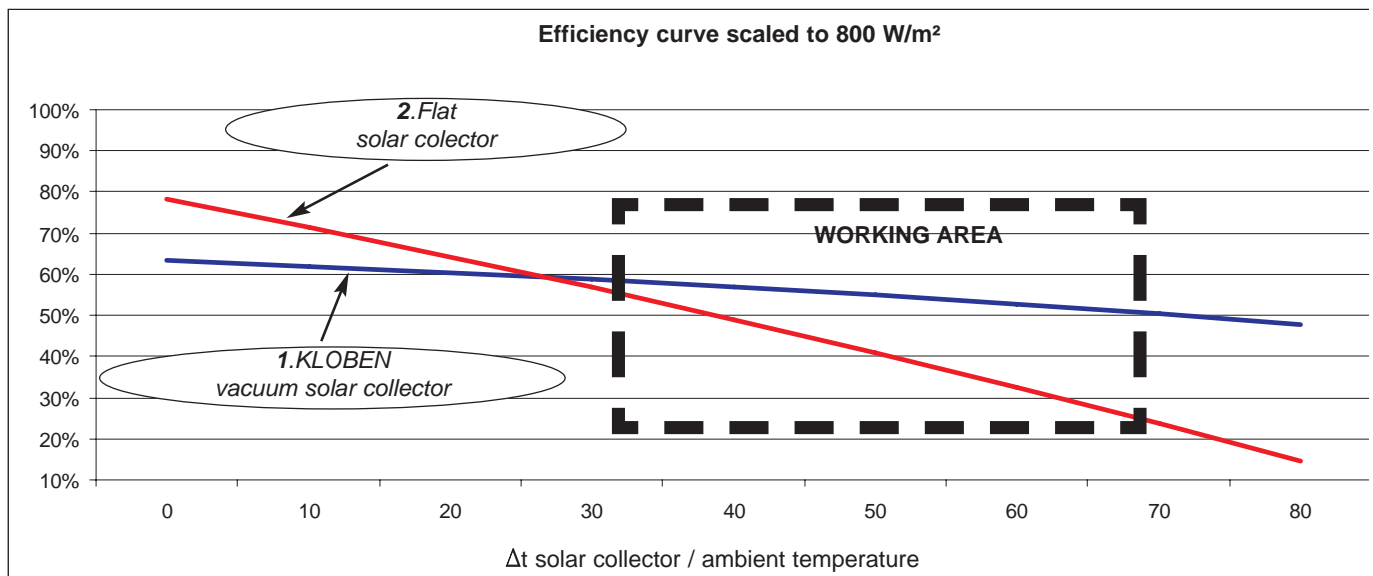
## CROSS SECTION OF A VACUUM TUBE

Inside the glass tube lies a copper pipe folded into a U-shape with aluminium thermal conductors, to transfer the solar energy from the inside wall of the glass pipe to the collector case. The heat transfer fluid flows into each copper pipe, then connected in parallel to the upper part of the panel to a single collector



## WHY PREFER KLOBEN?

Based on studies on capturing the sun's rays, Kloben has improved the methods for transferring energy from the devices which capture the radiation, to the supplied systems, by means of a reflective, specular aluminium sheeting fixed underneath the vacuum tubing (EN 573/3 - 485/2 - EN 485/4 plus text for anodic oxidation DIN 50943), with characteristics of low iridescence, and a total reflective coefficient higher than 90%, called C.P.C. (Compound Parabolic Concentrator). The combination of both these innovative technologies (vacuum + CPC) applied on the solar collectors, offers the higher efficiency, emphasized during unfavourable weather periods or in less favourable climatic areas.



1. Efficiency curve of a KLOBEN vacuum solar collector  
(Test Report KTB Nr. 2003-28 - I.S.E. Freiburg)
2. Efficiency curve of a generic flat solar collector

# Solar collector Kloben "C.P.C. Diffusion"

## BASIC COMPONENTS OF A KLOBEN SOLAR SYSTEM

CODE	DESCRIPTION
<b>SOLAR COLLECTORS</b>	
- 101010007	Solar collector SP 7 C.P.C. Diffusion (for quantity see page 7)
- 101010014	Solar collector SP 14 C.P.C. Diffusion (for quantity see page 7)
- 101010021	Solar collector SP 21 C.P.C. Diffusion (for quantity see page 7)
<b>INSTALLATION SET</b>	
- 101010030	Installation set for SP 7 / 14 / 21 on inclined roofs (for quantity see page 20)
- 101010031	Installation set for SP 7 / 14 / 21 on flat roofs (for quantity see page 23)
<b>SENSOR F1</b>	
- 101030010	Solar sensor PT1000 / KBF 300 (sensor F1).
<b>SOLAR STATIONS</b>	
- 101010032	Solar station LOW-FLOW with insulation / up to ca. 15 m <sup>2</sup> of installed solar surface
- 101010033	Solar station HIGH-FLOW / up to ca. 25 m <sup>2</sup> of installed solar surface
- 101010034	Solar station BIG-FLOW / more than 25 m <sup>2</sup> of installed solar surface
<b>FLOW GAUGE/BALANCING VALVE</b>	
- 101010035	Flow gauge / balancing valve from 0,6 up to 2,4 l / min - connection 3/4"
- 101010036	Flow gauge / balancing valve from 2 up to 8 l / min - connection 3/4"
- 101010037	Flow gauge / balancing valve from 3 up to 12 l / min - connection 3/4"
- 101010038	Flow gauge / balancing valve from 8 up to 30 l / min - connection 1"
- 101010039	Flow gauge / balancing valve from 30 up to 120 l / min - connection 1 1/2"
- 101010040	Flow gauge / balancing valve from 50 up to 200 l / min - connection 2"
<b>EXPANSION VESSELS</b>	
- 100010291	Expansion vessel 18 l / 10 bar
- 100010292	Expansion vessel 24 l / 10 bar
- 100010293	Expansion vessel 35 l / 10 bar
- 100010294	Expansion vessel 50 l / 10 bar
- 100010295	Expansion vessel 80 l / 10 bar
- 100010296	Expansion vessel 105 l / 10 bar
<b>HEAT TRANSFER / ANTIFREEZING FLUID</b>	
- 101010041	Heat transfer and antifreezing fluid for vacuum solar collectors
<b>SOLAR CONTROLS</b>	
- 101030007	Solar control KB1P (for 1 circuit)
- 101030008	Solar control KB2P (up to 2 circuits)
- 101030009	Solar control KB3P (up to 3 circuits)
- 101030012	Solar control KB5P (up to 5 circuits)
<b>CYLINDERS</b>	
- 101040031	Vitrified cylinder 300 l with 1 coil
- 101040032	Vitrified cylinder 400 l with 1 coil
- 101040033	Vitrified cylinder 500 l with 1 coil
- 101040034	Vitrified cylinder 750 l with 1 coil
- 101040035	Vitrified cylinder 1000 l with 1 coil
- 101040036	Vitrified cylinder 1500 l with 1 coil
- 101040037	Vitrified cylinder 2000 l with 1 coil
- 101040020	Vitrified cylinder 200 l with 2 coils
- 101040021	Vitrified cylinder 300 l con 2 coils
- 101040022	Vitrified cylinder 400 l con 2 coils
- 101040023	Vitrified cylinder 500 l con 2 coils
- 101040024	Vitrified cylinder 750 l con 2 coils
- 101040025	Vitrified cylinder 1000 l con 2 coils
- 101040038	Vitrified cylinder 1500 l con 2 coils
- 101040039	Vitrified cylinder 2000 l con 2 coils
- 101040026	Comby cylinder SSP SOLAR 500 l with rapid sanitary coil
- 101040027	Comby cylinder SSP SOLAR 800 l with rapid sanitary coil
- 101040028	Comby cylinder SSP SOLAR 1000 l with rapid sanitary coil
- 101040029	Comby cylinder SSP SOLAR 1500 l with rapid sanitary coil
- 101040030	Comby cylinder SSP SOLAR 2000 l with rapid sanitary coil

# Solar collector Kloben "C.P.C. Diffusion"

## SOLAR PLANT DIMENSIONING

The Kloben's calculations are supported by a complex software, that allow an easy and exact estimate of the required energy, the necessary solar collector's amount and the solar fraction, considering the use of the solar plant, the characteristics of the building and the climatic data referred to the area in which the solar plant is going to be installed.

It is advisable to contact the nearest authorized Kloben staff for the sizing of the whole plant's components.

Nevertheless there is the possibility to effect an approximate sizing of the required solar components efficient for small solar plants (up to max 10 m<sup>2</sup> of solar surface), making use of the following suggestions:

### Approximate solar collector's sizing (considering SOUTH ENGLAND area)

<b>SANITARY WATER</b>	Water at 50°C produced by each m <sup>2</sup> of installed solar surface	<b>80 l</b>
<b>RADIANT HEATING</b>	Radiant heating surface (laying distance of tube 10 cm) for each m <sup>2</sup> of installed solar surface	<b>from 10 up to 15 m<sup>2</sup></b>
<b>SWIMMING POOL</b>	Ratio between installed solar surface and swimming pool's area (for summer use - water temp 26°C - use of night cover)	<b>ca. 35%</b>

### Component's sizing:

<u>Expansion vessel:</u>	6 l each m <sup>2</sup> of installed solar surface
<u>Heat transfer fluid:</u>	add these parameters <b>(A + B + C + D)</b>
	<b>A.</b> 1/2 of the total amount of installed expansion vessel
	<b>B.</b> 10 l each 40 m of copper line (20 supply + 20 return)
	<b>C.</b> 0,75 l each collector model SP 7 1,5 l each collector model SP 14 2 l each collector model SP 21
	<b>D.</b> ca. 15 l for cylinder from 300 up to 500 l ca. 20 l for cylinder from 500 up to 750 l ca. 30 l for cylinder from 750 up to 1000 l
<u>Solar station:</u>	LOW FLOW for installed solar surface up to 15 m <sup>2</sup> HIGH FLOW for installed solar surface up to 25 m <sup>2</sup> BIG FLOW for installed solar surface bigger than 25 m <sup>2</sup>
<u>Flow gauge / balancing valve:</u>	0,6 l/min each m <sup>2</sup> of installed solar surface.

# Solar collector Kloben “C.P.C. Diffusion”

## INDISPENSABLE DATA FOR SOLAR PLANT SIZING

There are some indispensable parameters, necessary for the exact dimensioning of a solar plant. Without them it were not possible to proceed to an estimation of the energy required by a system.

### Project's location:

it is necessary to know the climatic area, and consequently the monthly average irradiation, the monthly average temperature, the relative humidity and the average wind's speed.

### Period of plant's use:

Specifying if annual, monthly, seasonal or each single month of use.

### Type of plant's use:

Domestic water heating (specifying the required quantity and temperature, the capacity of the existing or required storage)

Non-domestic water heating (hotel, industry, fitness centre ecc.-specifying the capacity of the existing or required storage)

Ambient heating (only radiant systems - specifying the surfaces to heat, laying distance of the tube and the type of insulation)

Swimming pool (specifying if indoor or outdoor, possible use of cover, required temperature, period of use.)

### Building's characteristics:

Inclined or flat roof (if possible specifying the inclination), orientation from the south, if there are some obstacles between the sun and the collectors during the day.

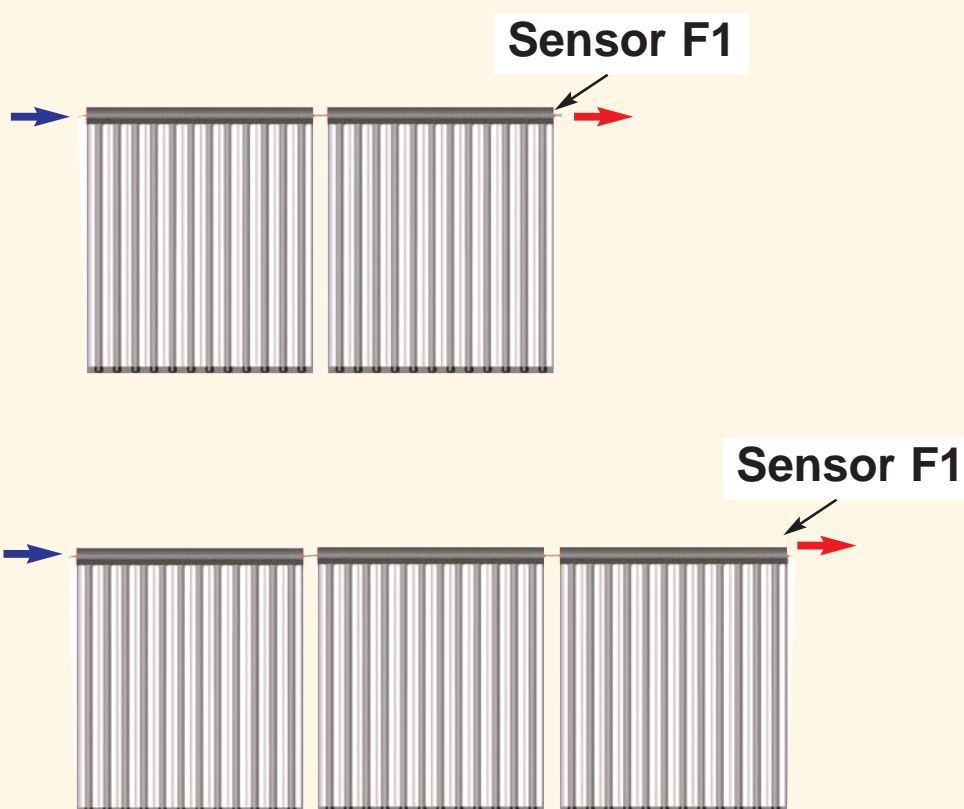
From the existing norm, UNI 9182, it is known the data about flows and requirements of hot water, depending on the type of use

**N.B. IN CASE OF INSTALLATION OF THE SOLAR SYSTEM ON ALREADY WORKING PLANTS, IT IS NECESSARY TO RECEIVE THE DETAILED SCHEME OF THE EXISTING THERMAL CENTRAL. WITHOUT IT WOULD NOT BE POSSIBLE TO PREDICT THE EFFICIENCY.**



# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLES OF SERIES INSTALLATION

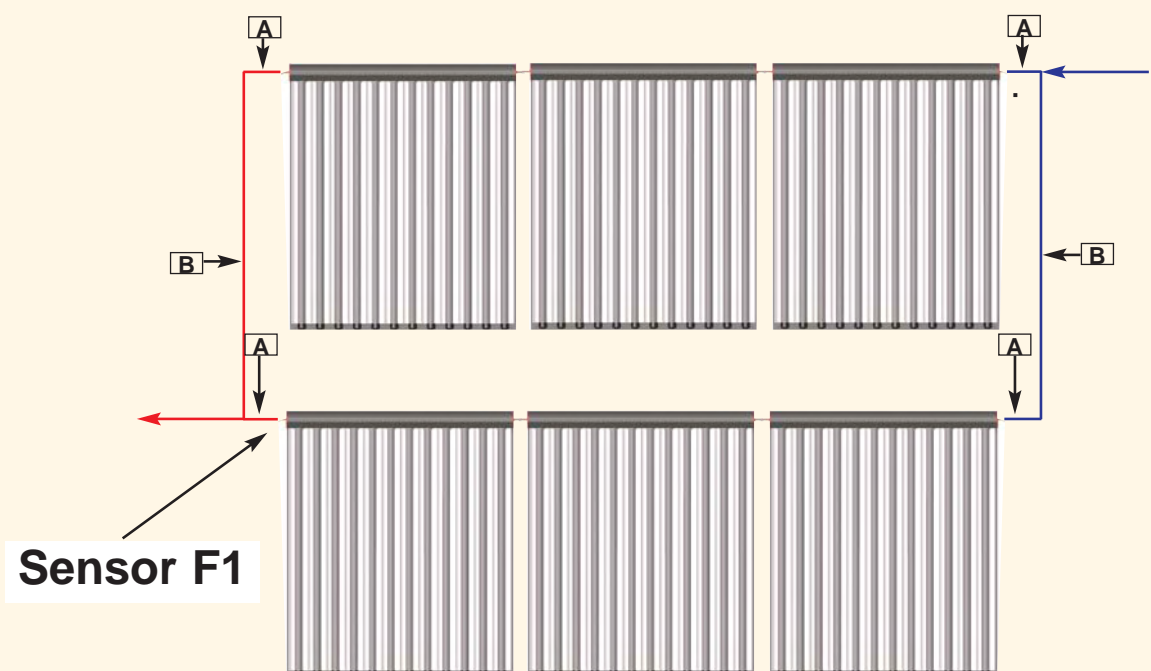


**The connection of more than 3 collectors in series is not recommended**

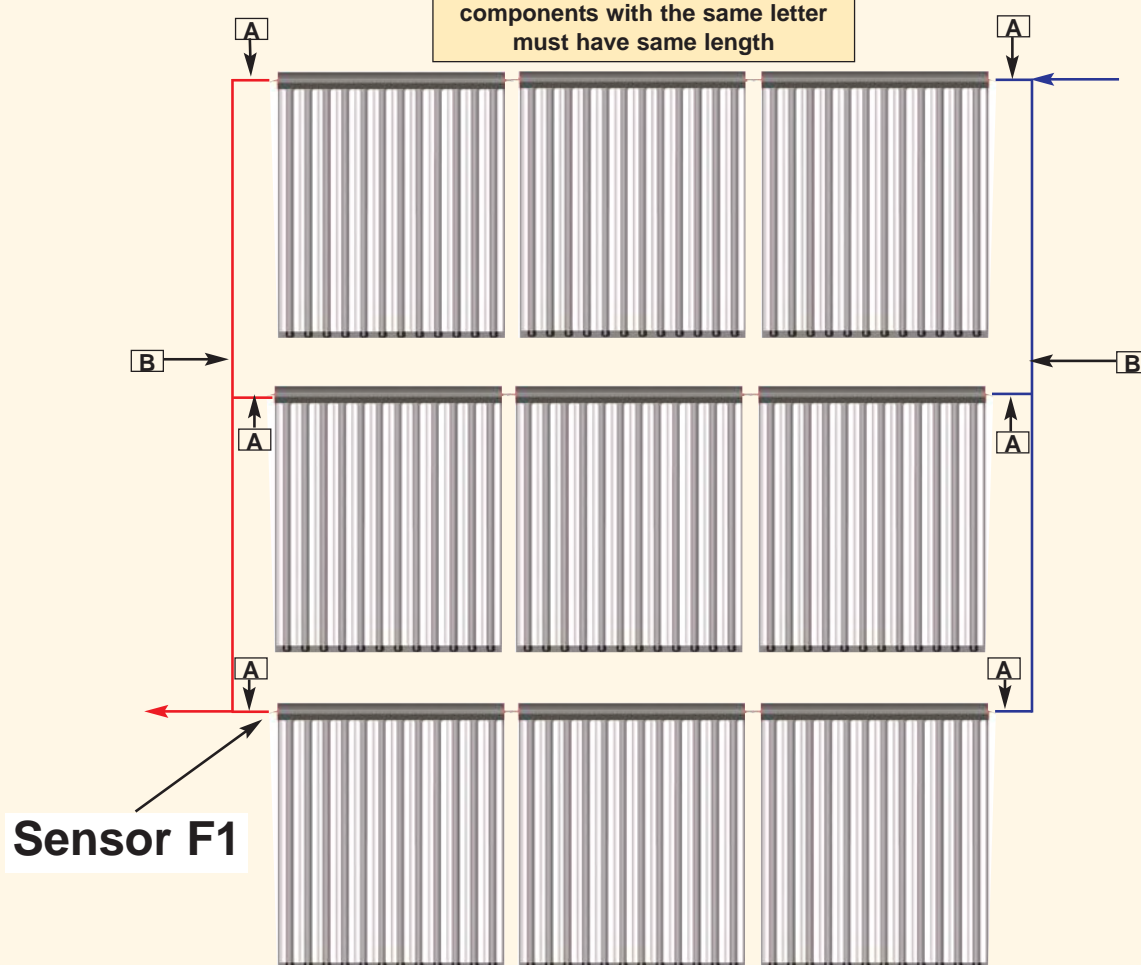
# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLE OF PARALLEL INSTALLATION

**TICHELMAN SYSTEM:** consists in the collector's battery balancing

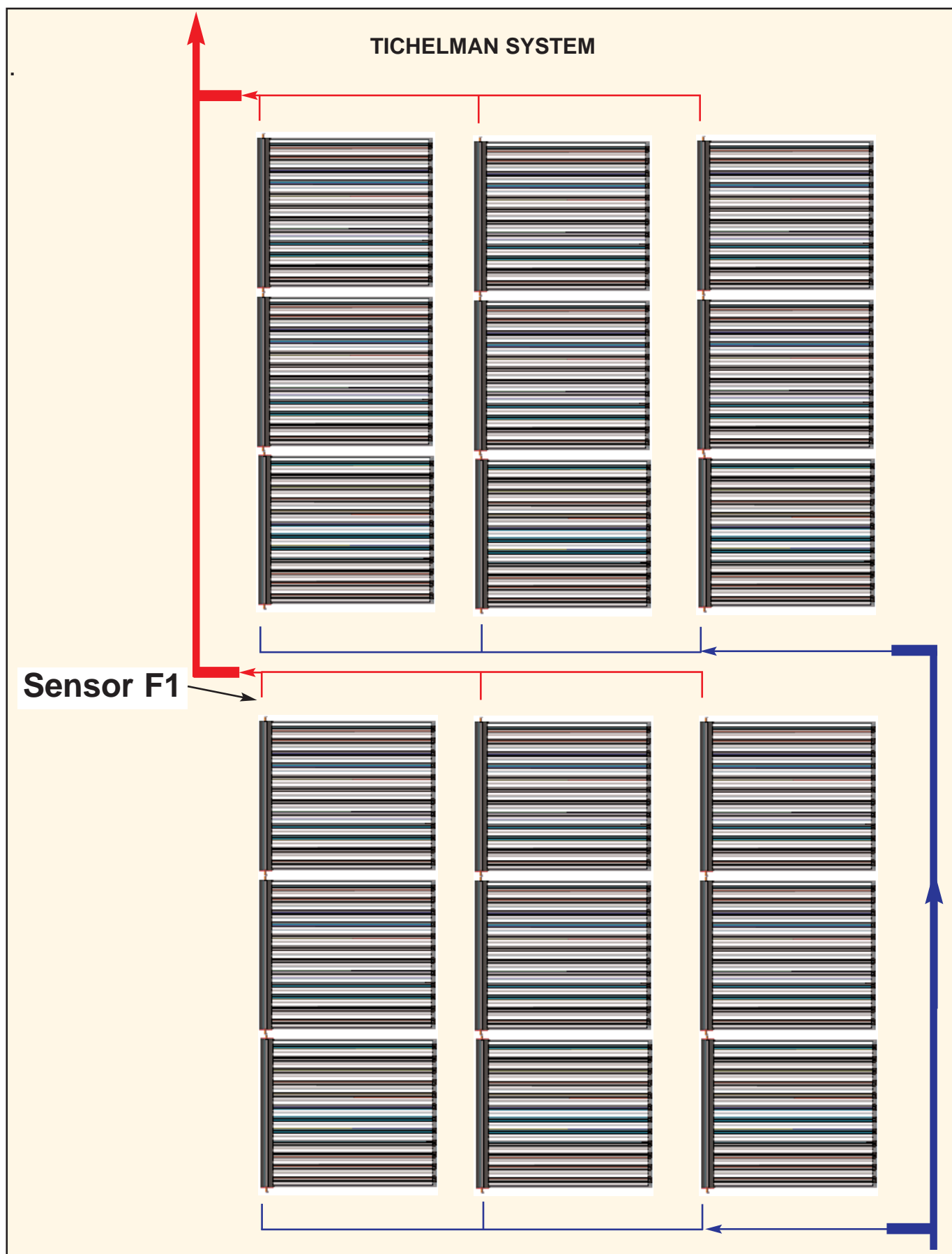


Using the system TICHELMAN the components with the same letter must have same length



# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLE OF PARALLEL INSTALLATION



# Solar collector Kloben "C.P.C. Diffusion"

## REMARKS AND PRELIMINARY CONTROLS

**The following obligatory procedures must be carried out on the single solar plant components, before charging the system.**

### PLANT FILLING:

- Before beginning the solar plant filling, it is necessary to verify that the solar collectors are at low temperature.
- It is obligatory to cover the solar collectors at least 3 hours before beginning the filling.
- The solar plant filling must be effected following in detail the instructions on page 27 of the present manual. It is suggested the use of the supplied loading pump (cod. 101010045). A correct plant filling allows the complete air removal from the solar circuit, and consequently assures its good functioning
- The optimal suggested pressure for the plant's efficient functioning is 3 / 3,5 bar. The pressure must be set during charging of the system.

### SIZING:

- Before the solar plant is fitted, it is necessary to control that the sizing and setting of each component has been effected following the instructions on page 7 of the present manual (solar collectors, expansion vessel, heat transfer fluid, flow gauge and solar station)
- It is necessary to verify that the copper piping's diameter conforms to the instructions on page 13 of the present manual. In case of any doubt persisting, it is suggested contacting authorized Kloben personell or our technical office.

### MATERIALS:

- **The whole piping forming the solar circuit must be in copper.**

It is inadvisable to use different materials, for example plastic, zinc, brass or similar. In case of use of material different than copper, no warranty of correct working could be issued.

- All the connections of the piping and between the collectors must be made using hemp, vapour teflon or copper fittings. The use of any different material could damage the sealing after short time

### CONTROLS:

- Verify that with empty plant, the expansion vessel is set at pressure 2 bar
- Verify the correct connection between the sensors and the solar control..
- Verify the correct connection between the electric mains and the solar control
- Verify that the solar control's parameters are set according to desired requirements
- Verify that, where foreseen, inside the solar control be inserted the electrical resistance with power 1500 Ohm in the F5 position (GRAND SOLEIL and TOTALENEGy), or in position F7 (WANDEL). This resistance is necessary to simulate the temperature inside the boiler.

**N.B.: The solar collectors can not be exposed to the solar irradiation for long periods, without being (max 15 days).**

# Solar collector Kloben “C.P.C. Diffusion”

## SELECTING THE COPPER PIPING DIAMETER

### WATER FLOWS AND PIPING DIAMETER

(WITH MAX LENGTH OF SUPPLY AND RETURN OF 20 m EACH) \*

\* IN CASE OF LONGER RUNS, PLEASE CONTACT OUR TECHNICAL OFFICE FOR THE CALCULATIONS.

Collector's model	Water flows l/min	Ø Pippings
1 x SP 14	1,3	Copper 16 mm
1 x SP 21	2,0	Copper 16 mm
2 x SP 14	2,6	Copper 18 mm
1 x SP 14 + 1 x SP 21	3,3	Copper 18 mm
2 x SP 21	4,0	Copper 18 mm
2 x SP 14 + 1 x SP 21	4,6	Copper 18 mm
3 x SP 21	6,0	Copper 18 mm
2 x SP 14 + 2 x SP 21	6,6	Copper 22 mm
1 x SP 14 + 3 x SP 21	7,3	Copper 22 mm
4 x SP 21	8,0	Copper 22 mm
2 batteries of 3 x SP 21	12,0	Copper 28 mm

N.B.: Besides selecting the right diameter pipe, it is necessary to verify the correct sizing of the whole components (page 7 of the present manual)

N.B.: For the size of solar station please consult page 15 and 16 of the present manual

N.B.: In case of installation of bigger solar surfaces, it is necessary to plan more parallel lines (batteries), all of them with the same solar surface, connected to each other with the **TICHELMAN** system (as explained on page 10 and 11 of the present manual)

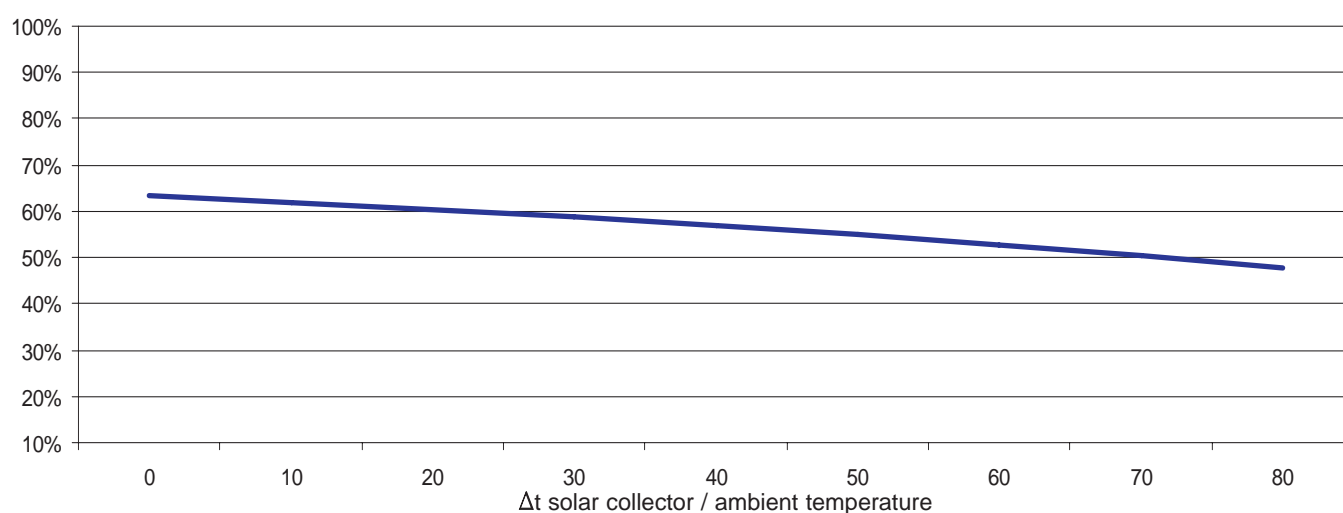


# Solar collector Kloben "C.P.C. Diffusion"

## SOLAR COLLECTOR TECHNICAL DATA

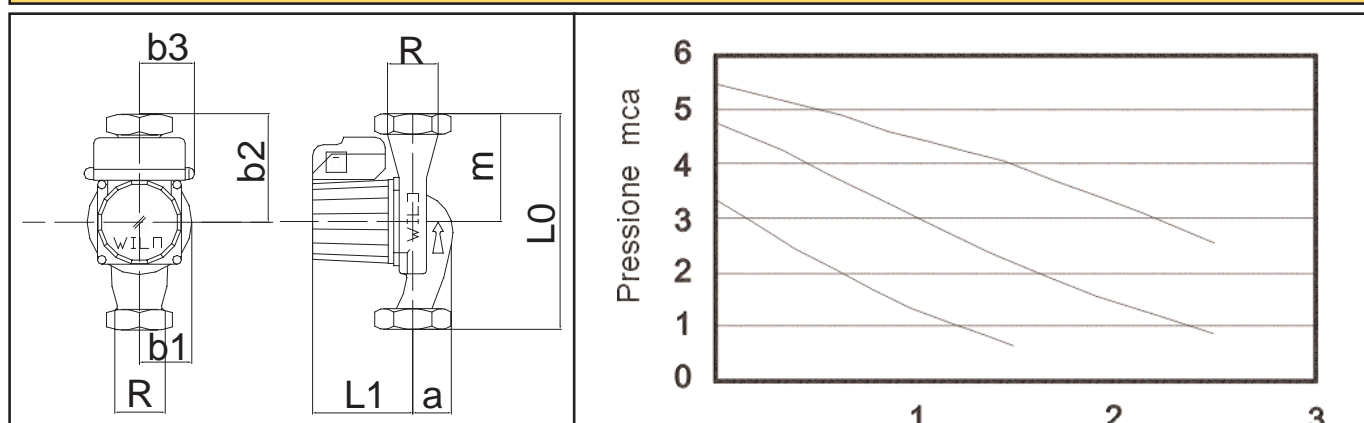
MODEL	SP 7	SP 14	SP 21
VACUUM TUBES (pcs.):	7	14	21
BRUTTO SURFACE (m <sup>2</sup> ):	1,29	2,53	3,76
NET SURFACE (m <sup>2</sup> ):	1,10	2,20	3,30
WEIGHT (when empty - kg) :	22,5	45	67,5
DIMENSIONS (mm)			
Height:	1.605	1.605	1.605
Width :	808	1.580	2.348
Thickness:	140	140	140
Efficiency (quadratic interpolation)* :			
$\eta_0 = 63,20\%$			
$a_1 = 0,936 \text{ W/m}^2 \text{ K}$			
$a_2 = 0,0076 \text{ W/m}^2 \text{ K}^2$			
*Test Report: KTB Nr. 2003-28 - I.S.E. Fraunhofer Institut Solare Energiesysteme			

Efficiency



# Solar collector Kloben "C.P.C. Diffusion"

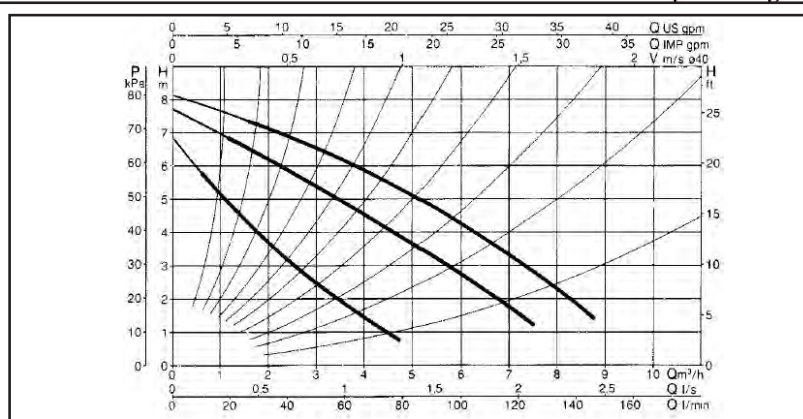
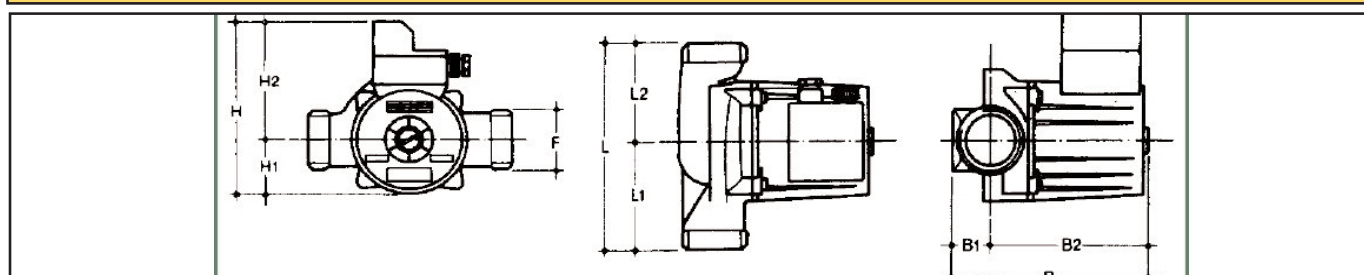
## TECHNICAL DATA OF THE LOW FLOW PUMP



MODEL	L0	L1	a	b1	b2	b3	b4	WEIGHT
RS 25/6 - 3P	180	97	33	100	92,5	54	76	2,3 Kg

MODEL	VOLTAGE 50 Hz	CONNECTING LENGTH mm	FLANGE CONNECTION	ELECTRICAL DATA			
				SPEED	RPM	P1 MAX W	In A
RS 25/6 - 3P	1 x 220 V	130	1" F	3	2200	93	0,40
				2	1900	67	0,30
				1	1450	46	0,20

## TECHNICAL DATA OF THE BIG FLOW PUMP

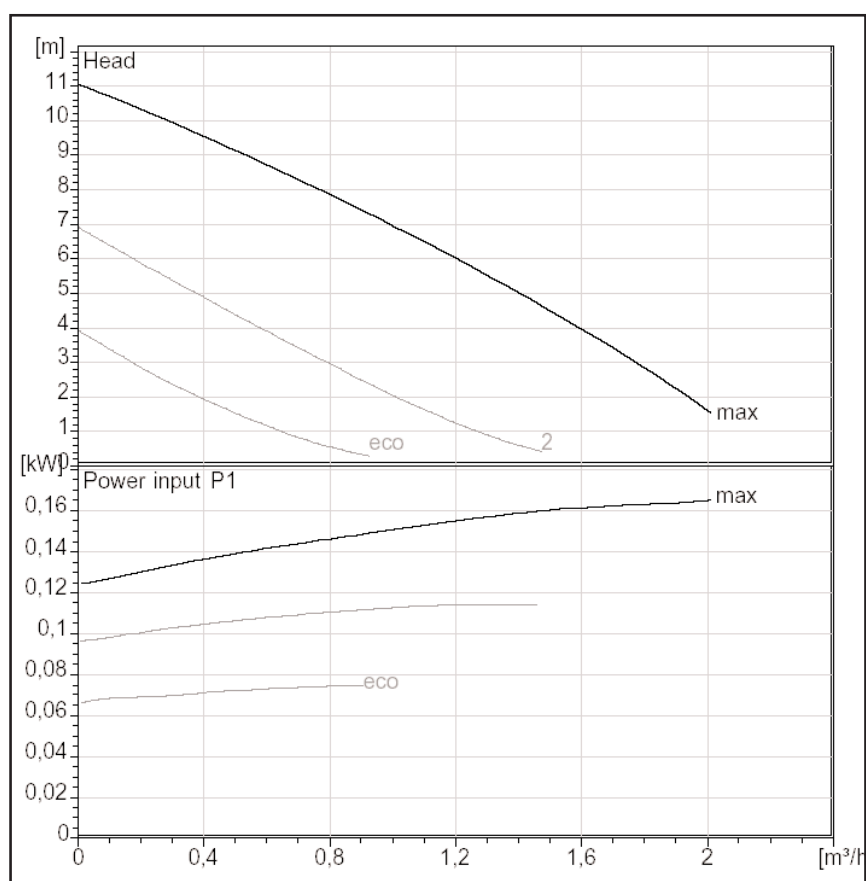
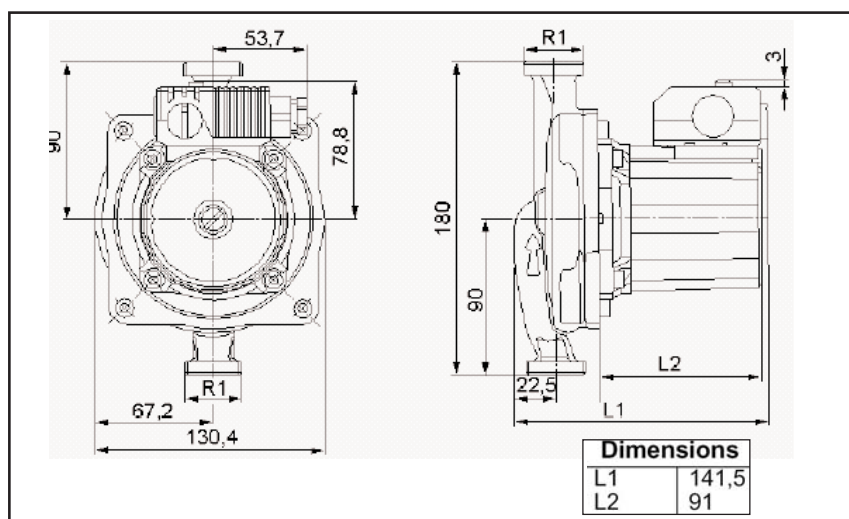


MODEL	L	L1	L2	A	B	B1	B2	D	D1	D2	D3	D4	H	H1	H2	F	PESO
A 80/180 XM	180	90	90	-	175	34	180	141	-	-	-	-	165	52	113	2°G	4,8 Kg

MODEL	VOLTAGE 50 Hz	CONNECTING LENGTH mm	FLANGE CONNECTION	ELECTRICAL DATA				MINIMUM WORKING PRESSURE
				SPEED	RPM	P1 MAX W	In A	
A 80/180 XM	1 x 220 V	180	1 1/4" F	3	2710	236	1,00	t° + 90 °C m.c.a. 2,5
				2	2420	226	0,98	
				1	1620	190	0,91	

# Solar collector Kloben "C.P.C. Diffusion"

## TECHNICAL DATA OF THE HIGH FLOW PUMP

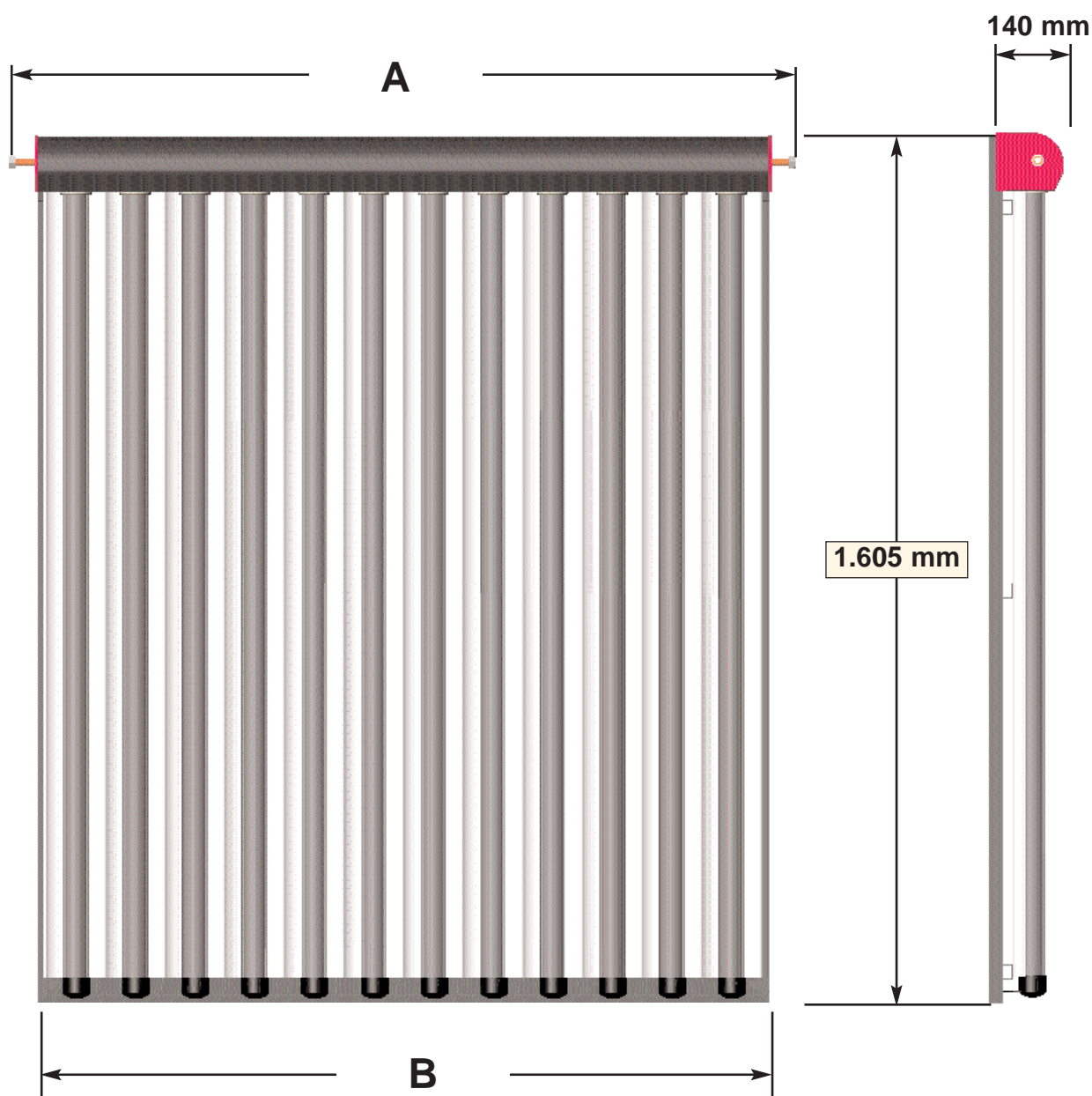


MODEL	VOLTAGE 50 Hz	CONNECTING LENGTH mm	FLANGE CONNECTION	ELECTRICAL DATA				NOMINAL PRESSURE
				SPEEDS	RPM MAX	MAX ABSORBED POWER	PROT.	
STAR ST 20/11	1 x 220 V	180	3/4"	3	2500	0,72	IP 44	10 bar

# Solar collector Kloben "C.P.C. Diffusion"

## COLLECTOR DIMENSIONS

Fig. 1

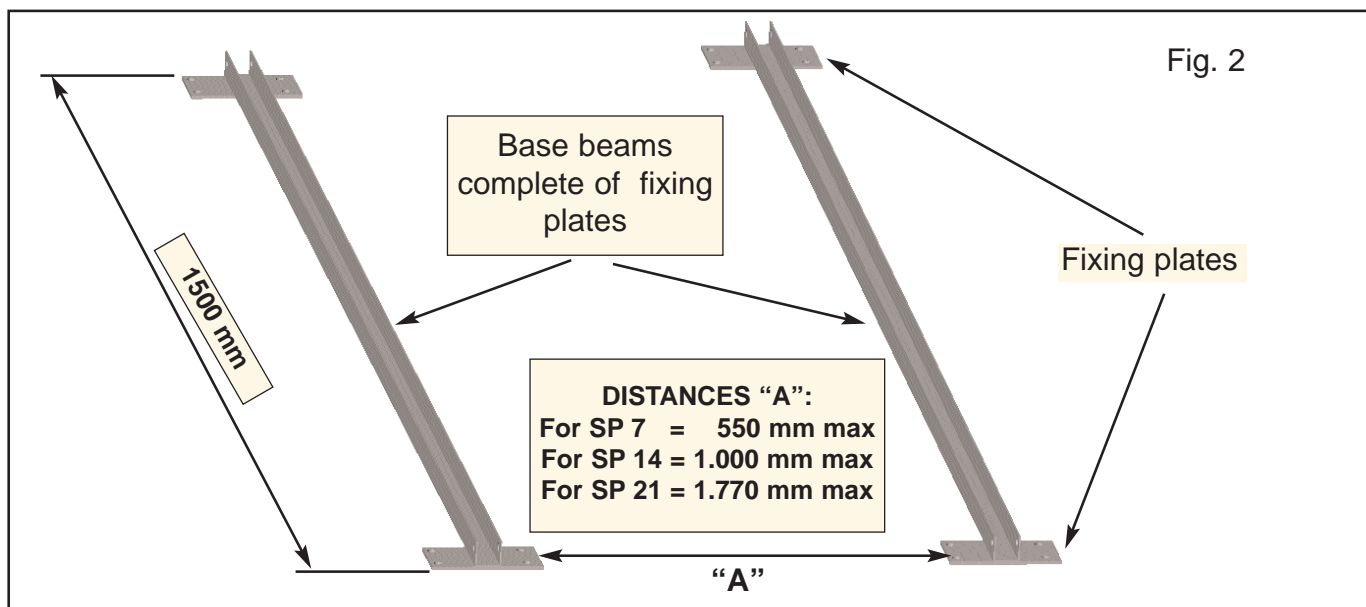


A	B
SP 7 = 888 mm SP 14 = 1.660 mm SP 21 = 2.428 mm	SP 7 = 808 mm SP 14 = 1.580 mm SP 21 = 2.348 mm

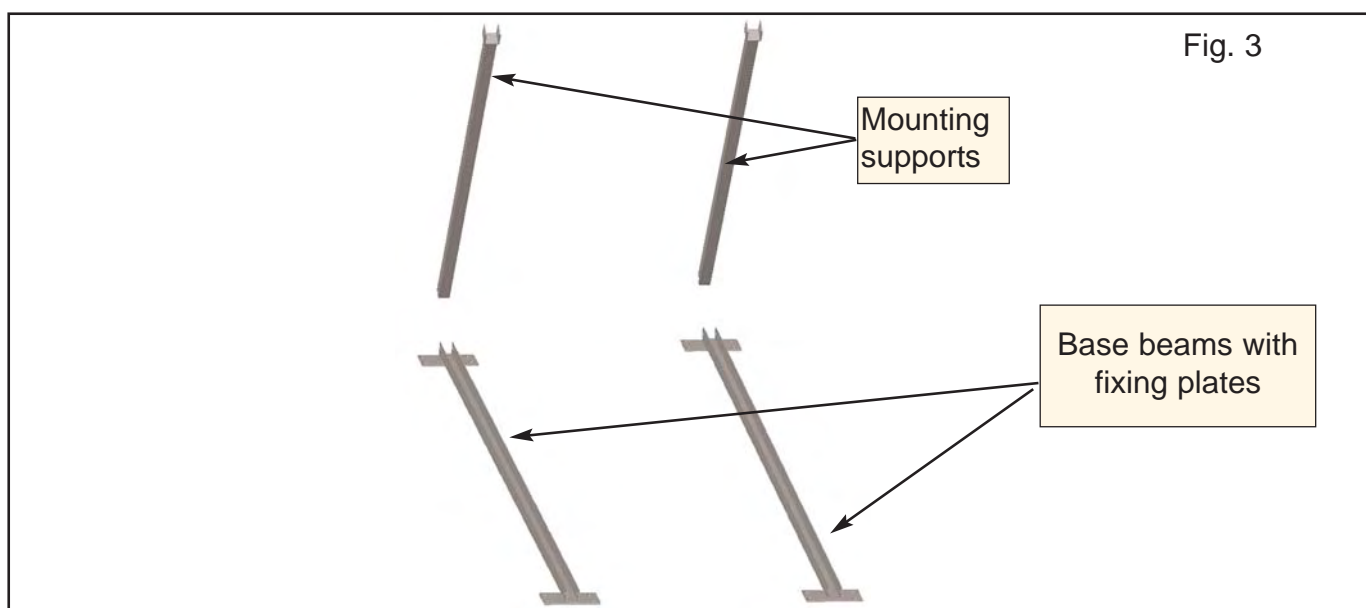
# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR FLAT ROOFS ASSEMBLY

Place the base beams with fixing plates on the roof or ground, paying attention to observe to the distances as indicated in ( Fig. 2)



Fix the mounting supports to the base beams, using the the supplied bolts (Fig. 3)





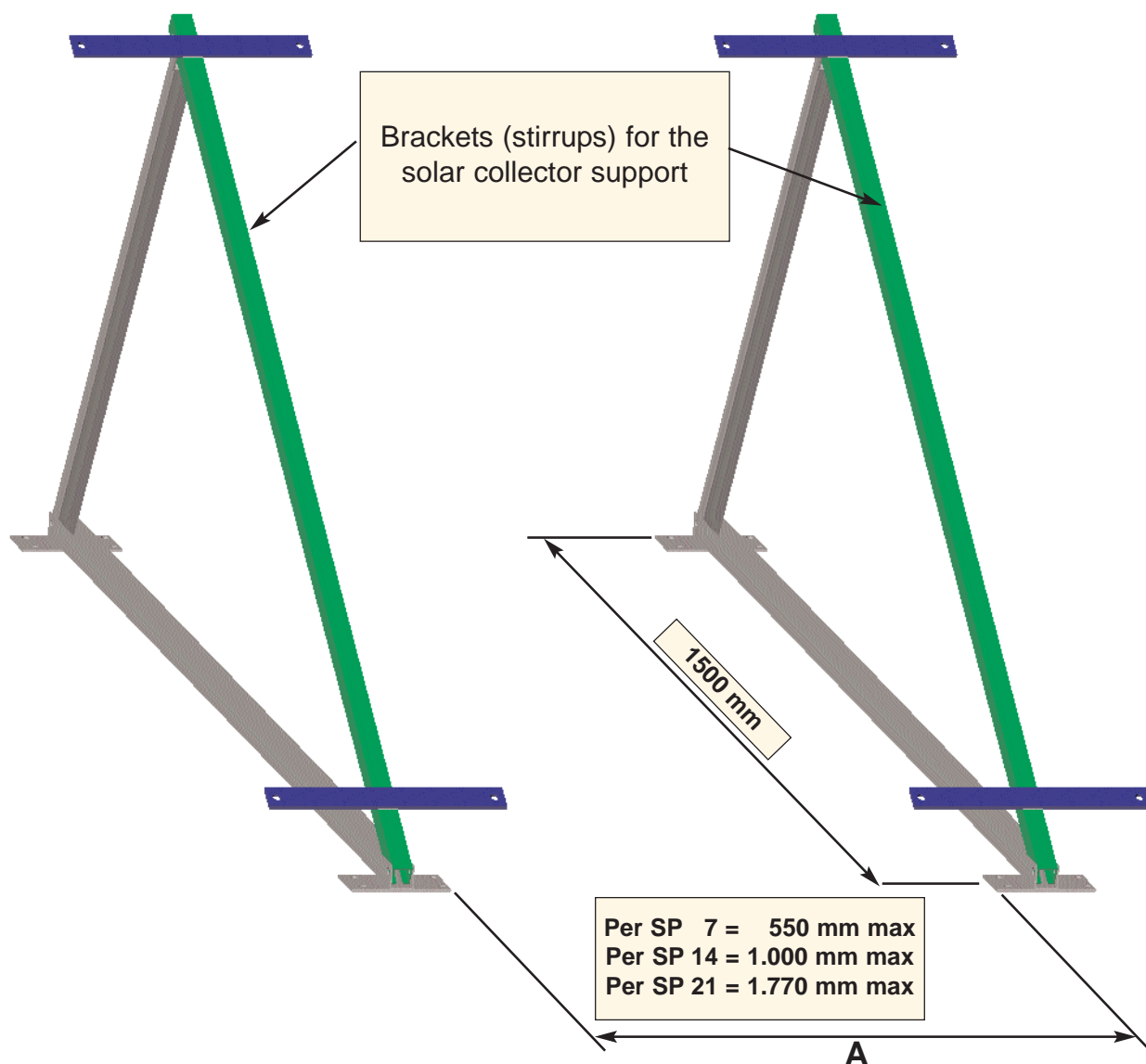
# Solar collector Kloben “C.P.C. Diffusion”

## MOUNTING INSTRUCTION FOR FLAT ROOFS ASSEMBLY

Place the brackets (stirrups) on the obtained structure, paying attention to the distances as indicated in Fig. 4.

**N.B.:** the distances indicated in Fig. 4 refer to a single solar collector installation

Fig. 4

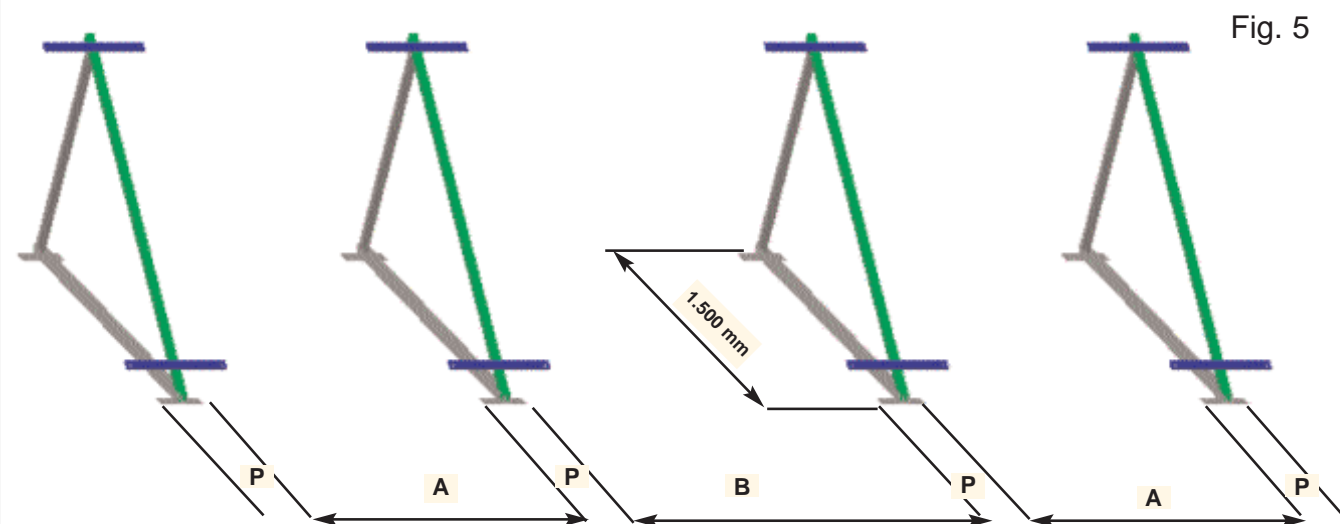


Fix properly the obtained frame to the ground floor. The choice of the pressure stoppers to use has to be made in relation to the typology of ground floor.  
Each fixing plate is supplied with 4 holes of 11 mm diameter.

# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR FLAT ROOFS ASSEMBLY

When installing more than one collector in series, observe the distances indicated in Fig. 5 (the example shows the scheme of 3 solar collectors in series)



The table indicates the distances to observe for the different models, using the flat roof's mounting set.

P (base plate) = 150 mm

Solar collector SP 7:

- A max = 600 mm
- B = 730 mm (constant distance)

Solar collector SP 14:

- A max = 1.250 mm
- B = 1.470 mm (constant distance)

Solar collector SP 21:

- A max = 2.020 mm
- B = 2.270 mm (constant distance)

The table shows the overall space taken up when installing a series of collectors using the flat roof assembly set.

Room for N° 2 collectors =	$P + A + P + B + P$
Room for N° 3 collectors =	$P + A + P + B + P + A + P$
Room for N° 4 collectors =	$P + A + P + B + P + B + P + A + P$
Room for N° 5 collectors =	$P + A + P + B + P + B + P + B + P + A + P$

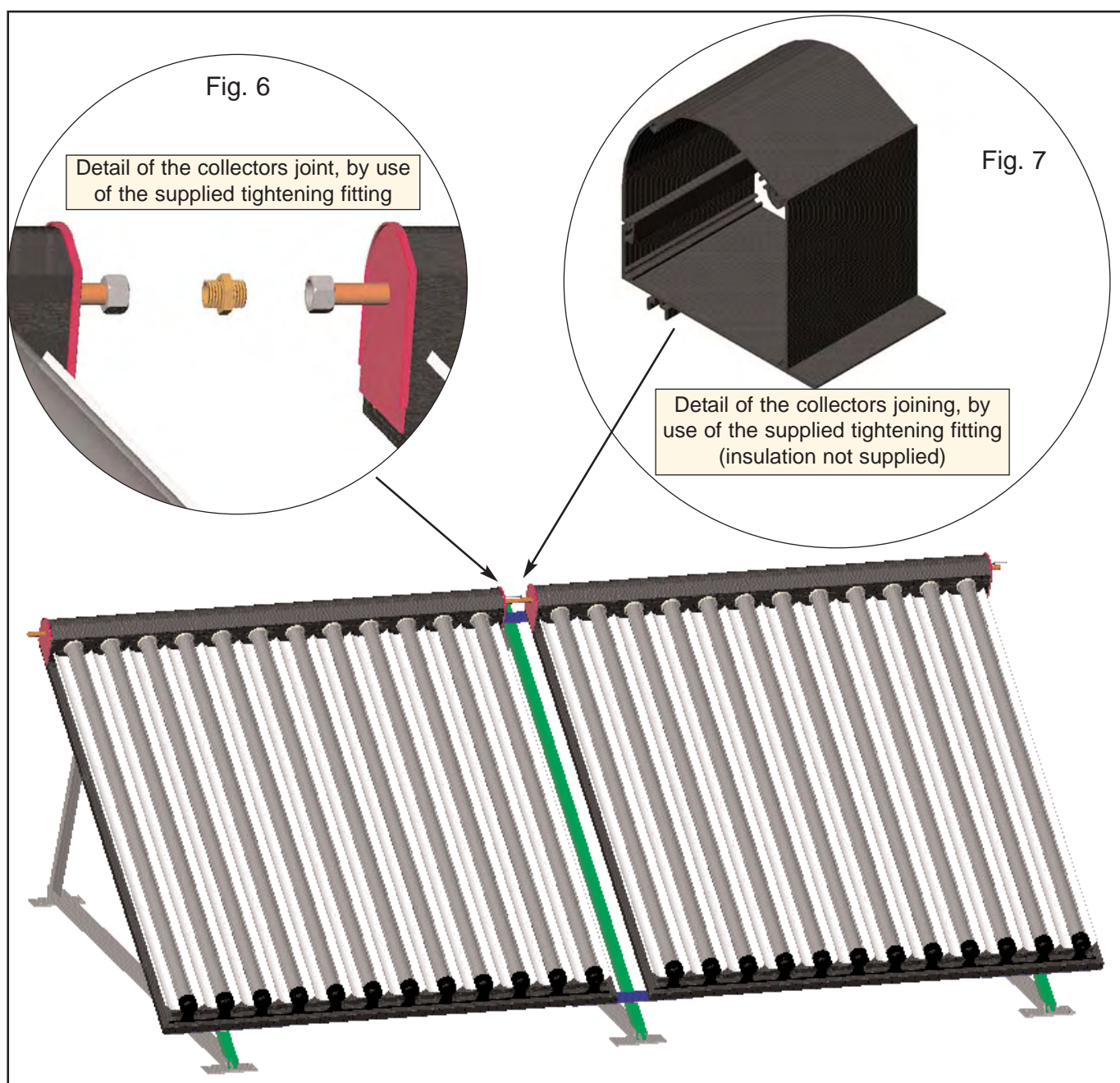
# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR FLAT ROOFS ASSEMBLY

Position the collectors and bolt them (without tightening) to the support brackets (stirrups) using the holes as shown in Fig. 4, and the sliding screws (each solar collector is supplied with 4 sliding screws, already mounted on it).

Afterwards join the solar collector, using the supplied compression fittings, already positioned on the collectors (Fig. 6).

After that it is possible to tighten the collectors to the support brackets (stirrups)



# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR INCLINED ROOF ASSEMBLY

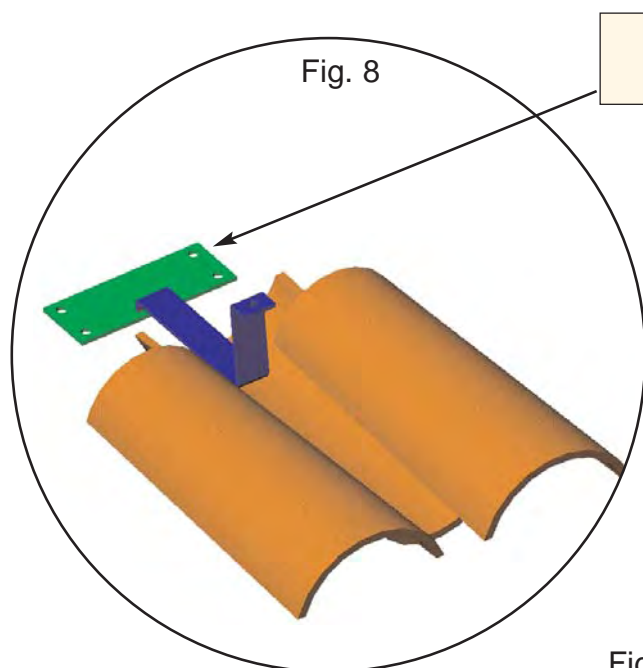
**N.B.= Fig. 9 shows the space taken up by 2 solar collectors connected in series, using the inclined roof assembly**

Properly fasten the fixing plates on the roof (Fig. 8), paying attention to the distances indicated in Fig. 9 or 11 (in relation to the amount of installed collectors).

The choice of the bolts to use has to be made in relation to the typology of ground floor.

Each fixing plate is supplied with 4 holes of 11 mm diameter

Afterwards place the support brackets (stirrups) on the fixings plates, checking each bolt is tight.



Fixing plates

### Installation of 2 collectors

The table indicates the distances to observe for the different models, using the inclined roofs mounting assembly.

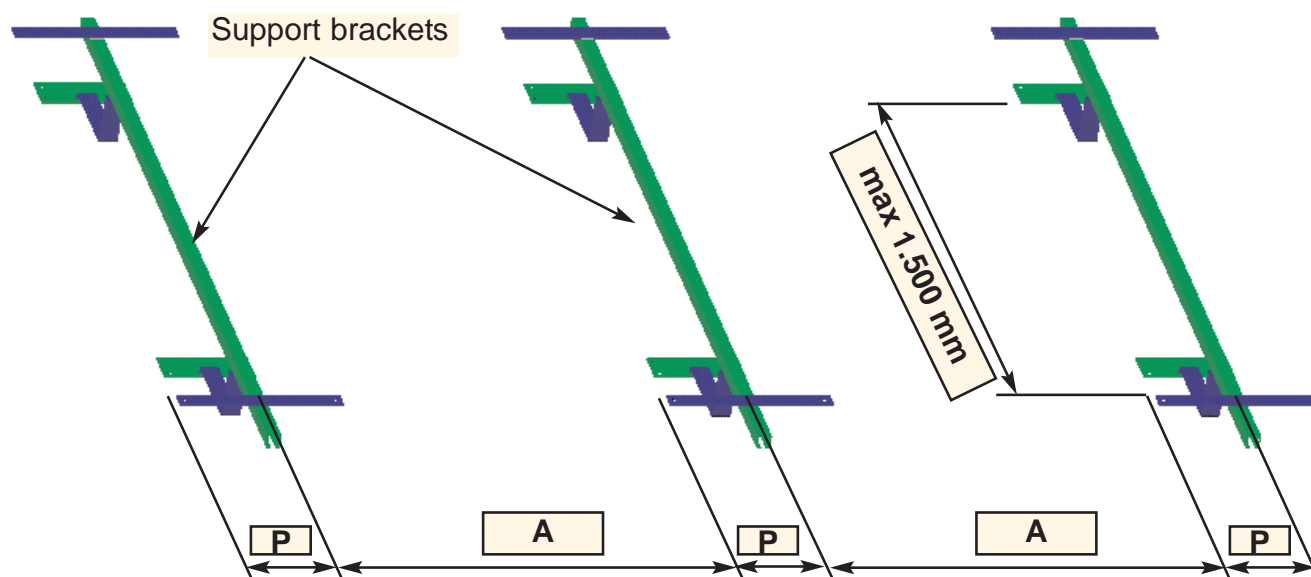
$P = 200 \text{ mm}$

Solar collector SP 7:  
 $A = \text{max } 540 \text{ mm}$

Solar collector SP 14:  
 $A = \text{max } 1.230 \text{ mm}$

Solar collector SP 21:  
 $A = \text{max } 1.970 \text{ mm}$

Fig. 9

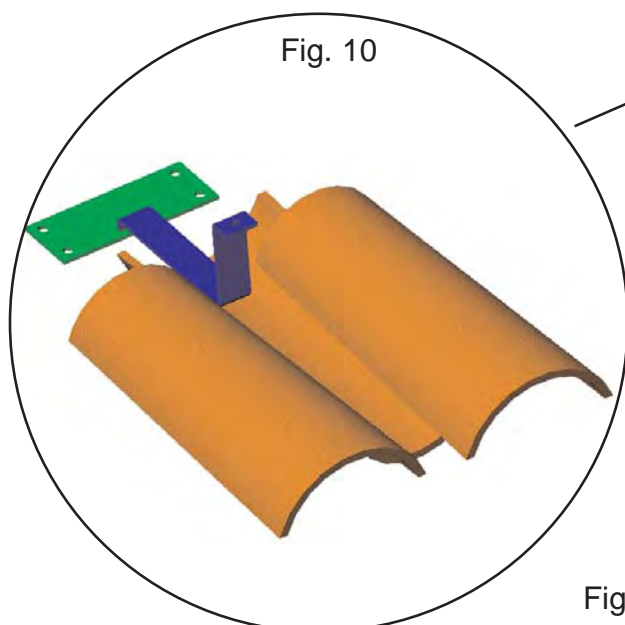


# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR INCLINED ROOF ASSEMBLY

**N.B.= Fig. 11 points out the space taken up by the installation of 3 or more solar collectors in series, using the inclined roof mounting assembly.**

For the correct installation of 3 or more collectors follow the distances pointed out in the following tables.



Detail of the fixing plate's placing on tile roofs.

### Installation of 3 or more solar collectors

P = 200 mm

Solar collector SP 7:

A = 540 mm max.

B = 680 mm

Solar collector SP 14:

A = 1.230 mm max.

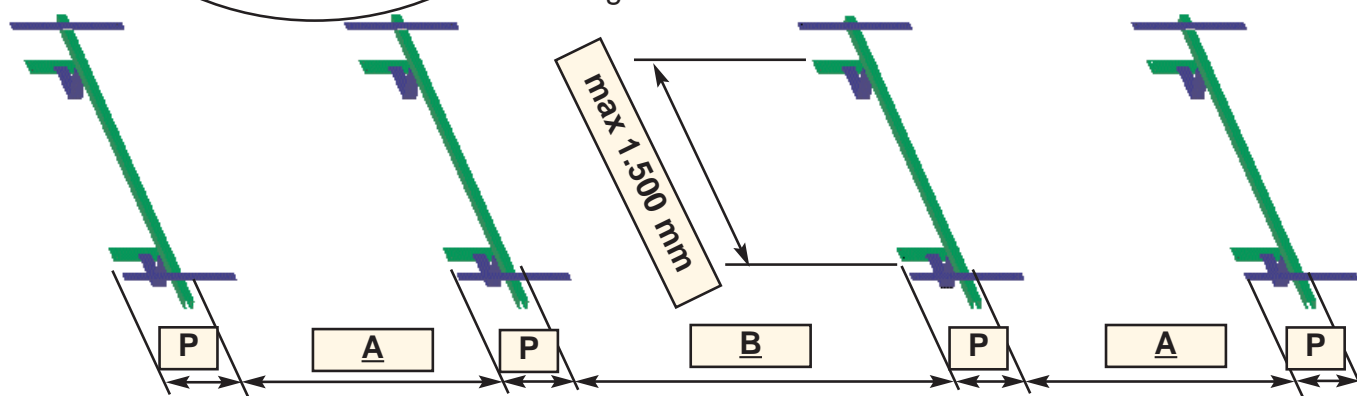
B = 1.450 mm

Solar collector SP 21

A = 1.970 mm max

B = 2.220 mm

Fig. 11



The table shows the overall space taken up by the connection of 3 or more solar collectors using the inclined roof mounting assembly.

Room for N° 3 collectors = P + A + P + B + P + A + P

Room for N° 4 collectors = P + A + P + B + P + B + P + A + P

Room for N° 5 collectors = P + A + P + B + P + B + P + B + P + A + P



# Solar collector Kloben "C.P.C. Diffusion"

## MOUNTING INSTRUCTION FOR INCLINED ROOF ASSEMBLY

**Position the collectors and bolt them (without tightening) to the support brackets (stirrups) using the bolt holes, and the sliding screws (each solar collector is supplied with 4 sliding screws, already mounted on it).**

**Next start the connection of the solar collector, using the supplied tightening fittings, already positioned on the collectors (Fig. 12).**

**Then it is possible to start tightening the collectors to the support brackets (stirrups)**

Fig. 12

Detail of the collectors joint, by use of the supplied tightening fitting

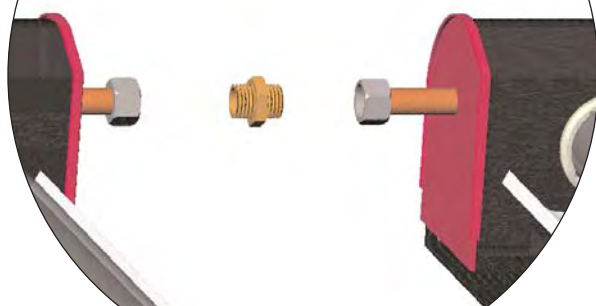
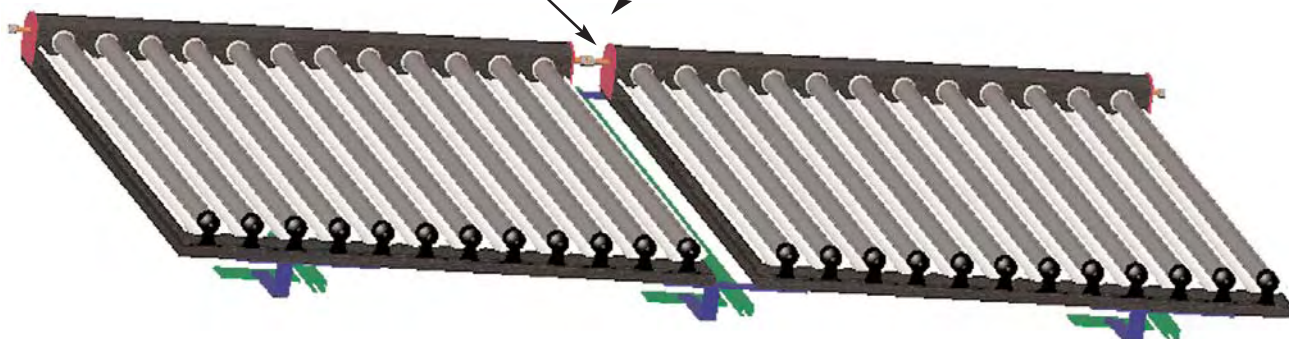
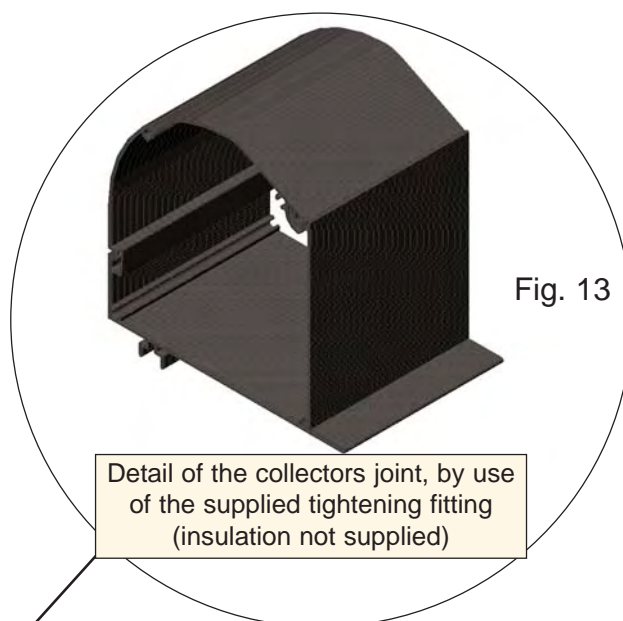


Fig. 13

Detail of the collectors joint, by use of the supplied tightening fitting (insulation not supplied)



# Solar collector Kloben "C.P.C. Diffusion"

## HYDRAULIC CONNECTION

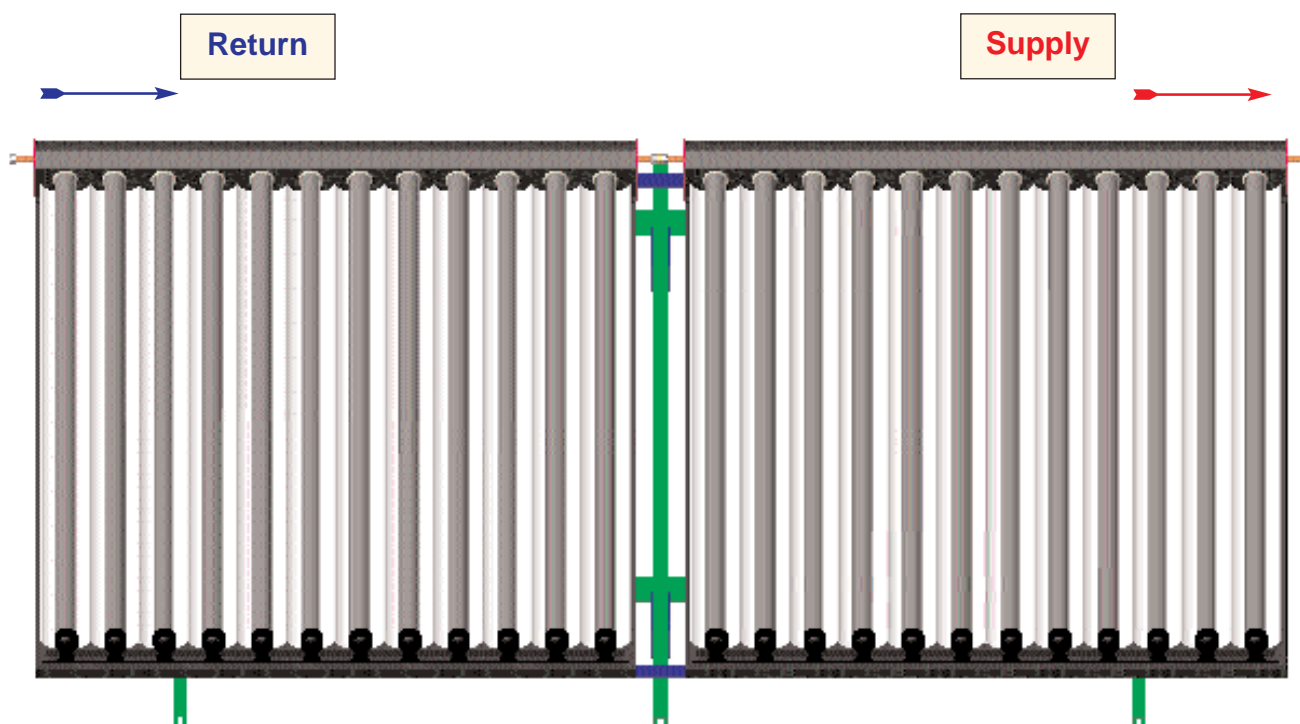
### ATTENTION

When the hydraulic connections are completed, it is possible to start filling the system, using the solar station, carefully following the instructions pointed out on page 27.

The main purpose of the instructions, is to allow the complete air elimination from the solar circuit. It is suggested also the use of our filling pump supplied by Kloben (code 101010045).

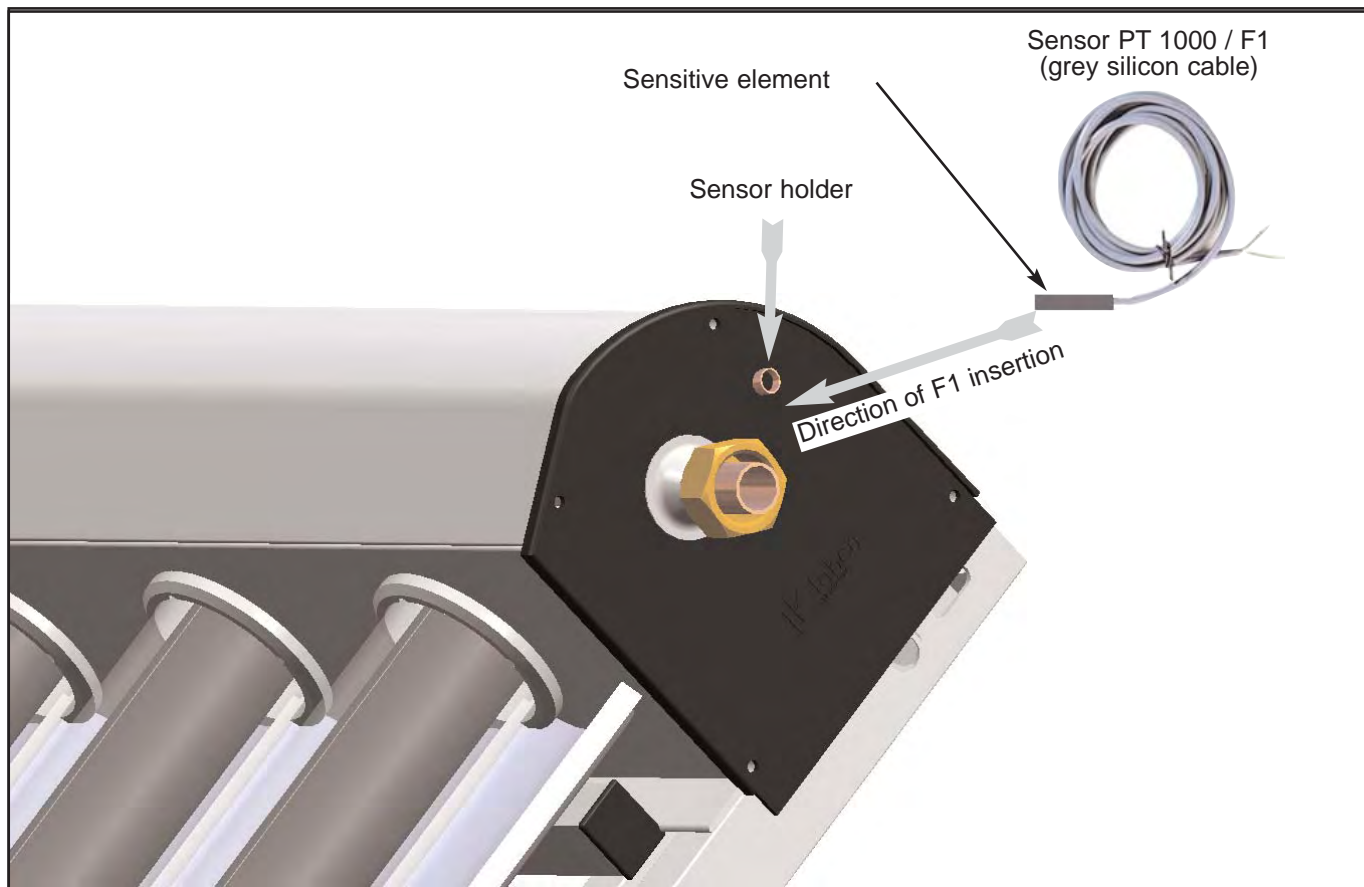
When the plant filling is completed, it is also necessary to make a further control to assure the complete air elimination, by use of the manual air vent already mounted on the collector.

It is obligatory to install sensor F1 (solar sensor) always on the supply.  
For the correct solar sensor insertion, follow the instructions on page 26 of the present manual.



# Solar collector Kloben “C.P.C. Diffusion”

## INSERTION OF SOLAR SENSOR F1



For the correct solar sensor F1 insertion (grey silicon cable), respect the following instructions :

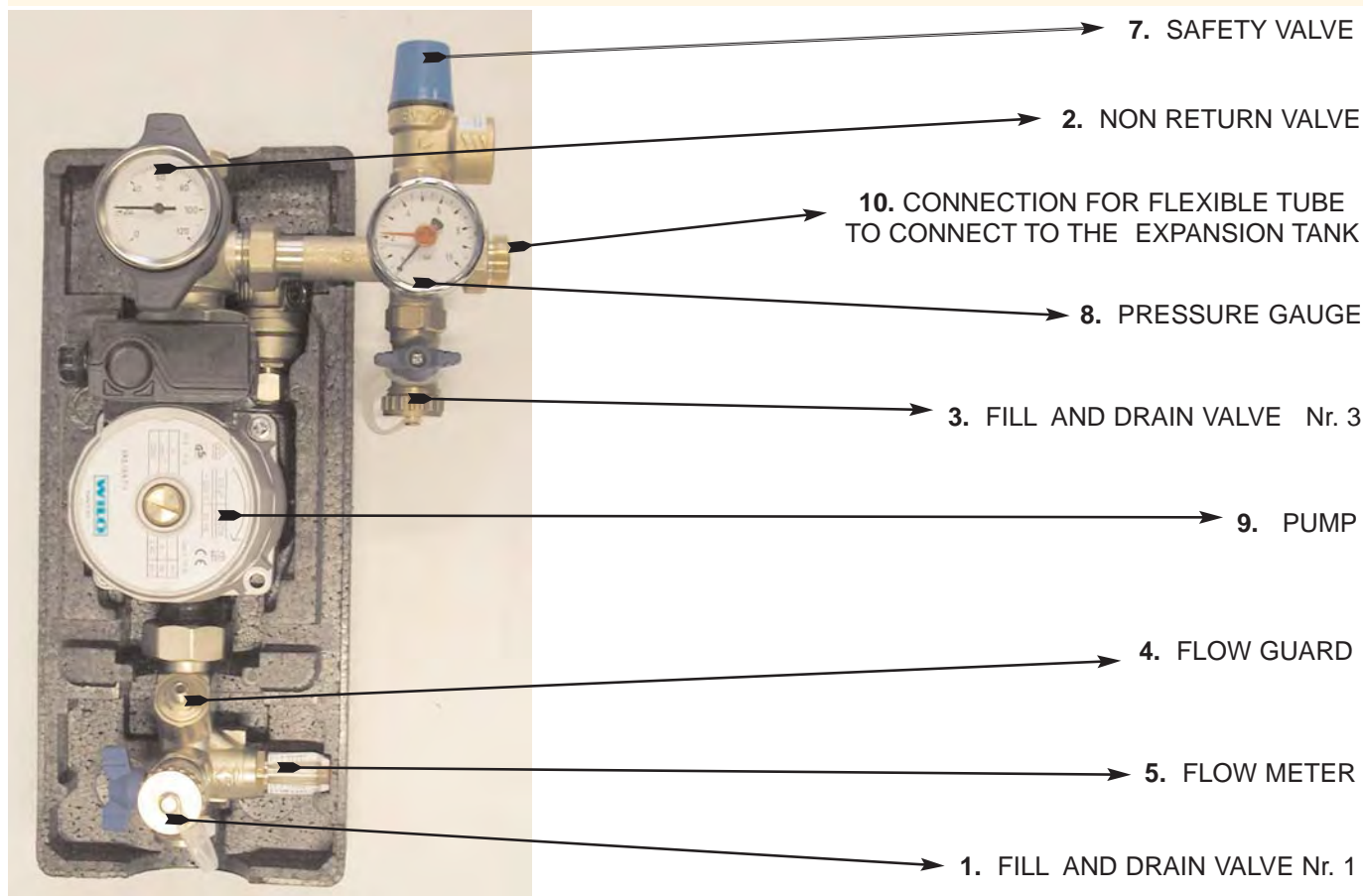
- 1) - Insert the sensitive element of the sensor inside the sensor holder mounted on the collector, observing the direction of inserting pointed up in the above Fig.
- 2) - Let the cable glide up to the end of the sensor holder, without to completely embedding it.
- 3) - Afterwards it is possible to effect the electrical connections with the solar control, following the supplied instructions

It is suggested using working gloves and protective glasses, to avoid injures in case of glass breaking.

# Solar collector Kloben "C.P.C. Diffusion"

## SOLAR PLANT FILLING USING THE SOLAR STATION

### Solar station: components and description



### SOLAR SYSTEM FILLING

1. Before starting the solar system filling, the solar collectors must be covered for at least 3 hours.
2. Connect the flexible plastic pipe of the filling pump supply with the fill and drain valve Nr. 1
3. Connect the flexible plastic pipe of the filling pump return with the fill and drain valve Nr. 3
4. Open the fill and drain valves Nr. 1 and Nr. 3
5. Close the non return valve Nr. 2 (turning clockwise), and at the same time, close the flow guard Nr. 4 (using a 4 mm allen key).
6. Switch on the pump. The antifreezing fluid will flow in the opposite direction than normal, expelling the air present inside the circuit.
7. In case of installed 3 way valve, verify it's opening (on manual position), to allow the antifreezing fluid circulation through all the circuits.
8. To allow the total air expulsion, let the pump work for at least 10 minutes.
9. During this time open and close quickly and for a few seconds the non return valve Nr. 2 and the flow guard Nr. 4, to expel the air from inside the pump. When the operation is over, both valves must be in the "open" position
10. Close the fill and drain valve Nr. 3.
11. Let the solar circuit filling up to 3-3,5 bar pressure (the pressure is displayed on the pressure gauge Nr. 8)
12. Close the filling and drain valve Nr. 1
13. Switch off the filling pump.
14. Uncover the solar collectors
15. Switch on the solar control and verify its correct setting and functioning
16. Set the flow meter on the suggested flow, in relation to the solar plant dimensions.(page 14 of the manual).

# Solar collector Kloben "C.P.C. Diffusion"

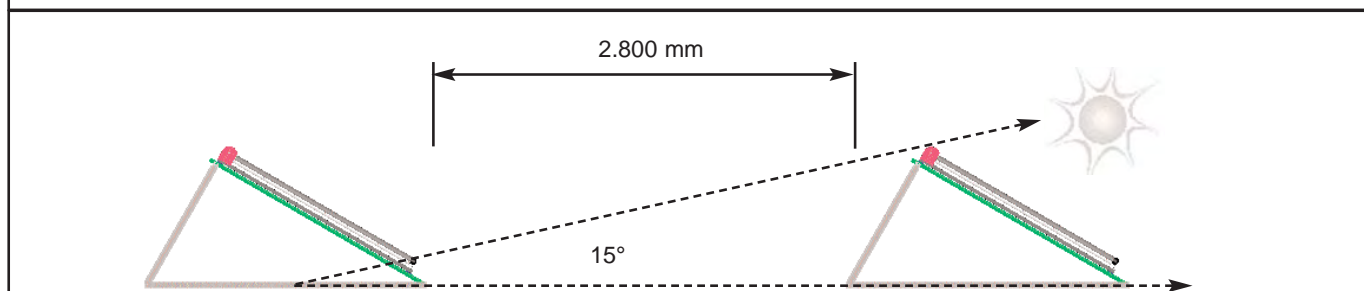
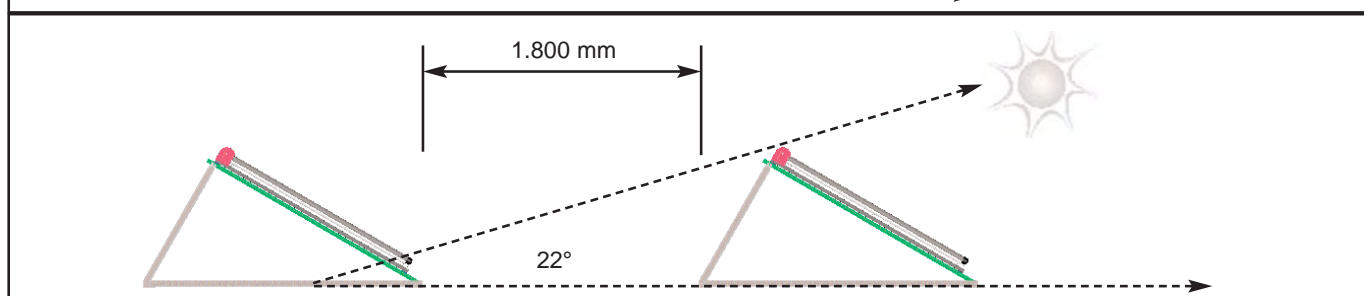
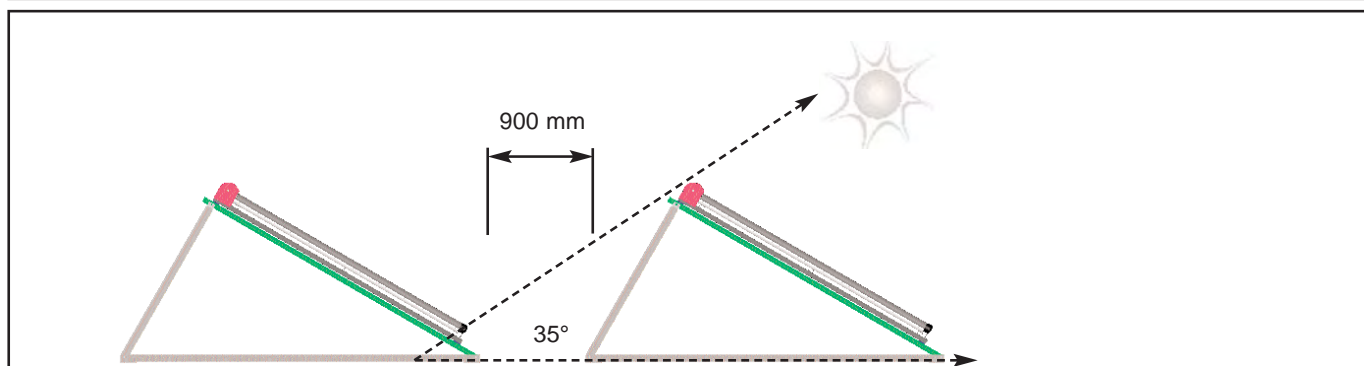
## SOLAR COLLECTOR INCLINATION



From 15° up to 60°  
(for different inclinations, please contact our technicians)



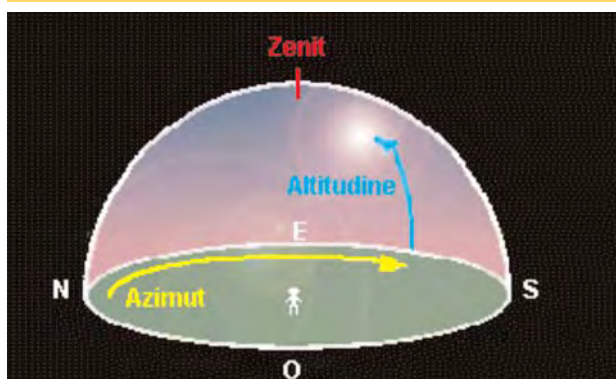
## SPACING BETWEEN THE COLLECTOR'S BATTERY





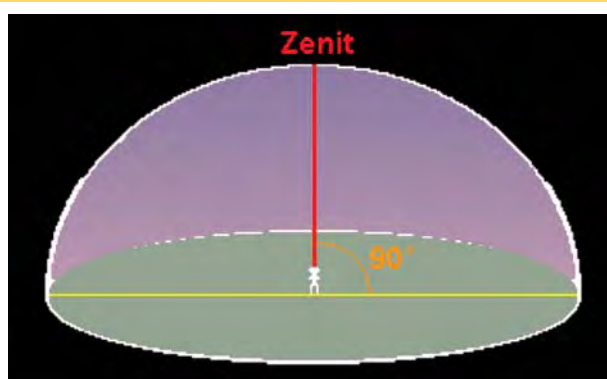
# Solar collector Kloben “C.P.C. Diffusion”

## SOLAR COLLECTOR ORIENTATION



### Azimuth

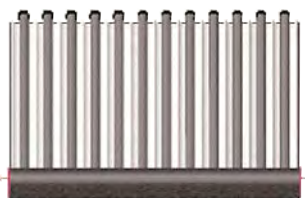
The azimuth of a celestial body is the angle between the vertical plane containing it and the plane of the meridian; a magnetic bearing sighted from your position to know landmark. It is measured starting from north (= 0°) proceeding in clockwise direction.



### Zenith

That point in the visible celestial hemisphere which is vertical to the spectator; the point above the observer that is directly opposite the nadir on the imaginary sphere against which celestial bodies appear to be projected.

**Optimal orientation = 0° South**



**Max suggested orientation = 30° South / East**

**Max suggested orientation = 30° South / West**

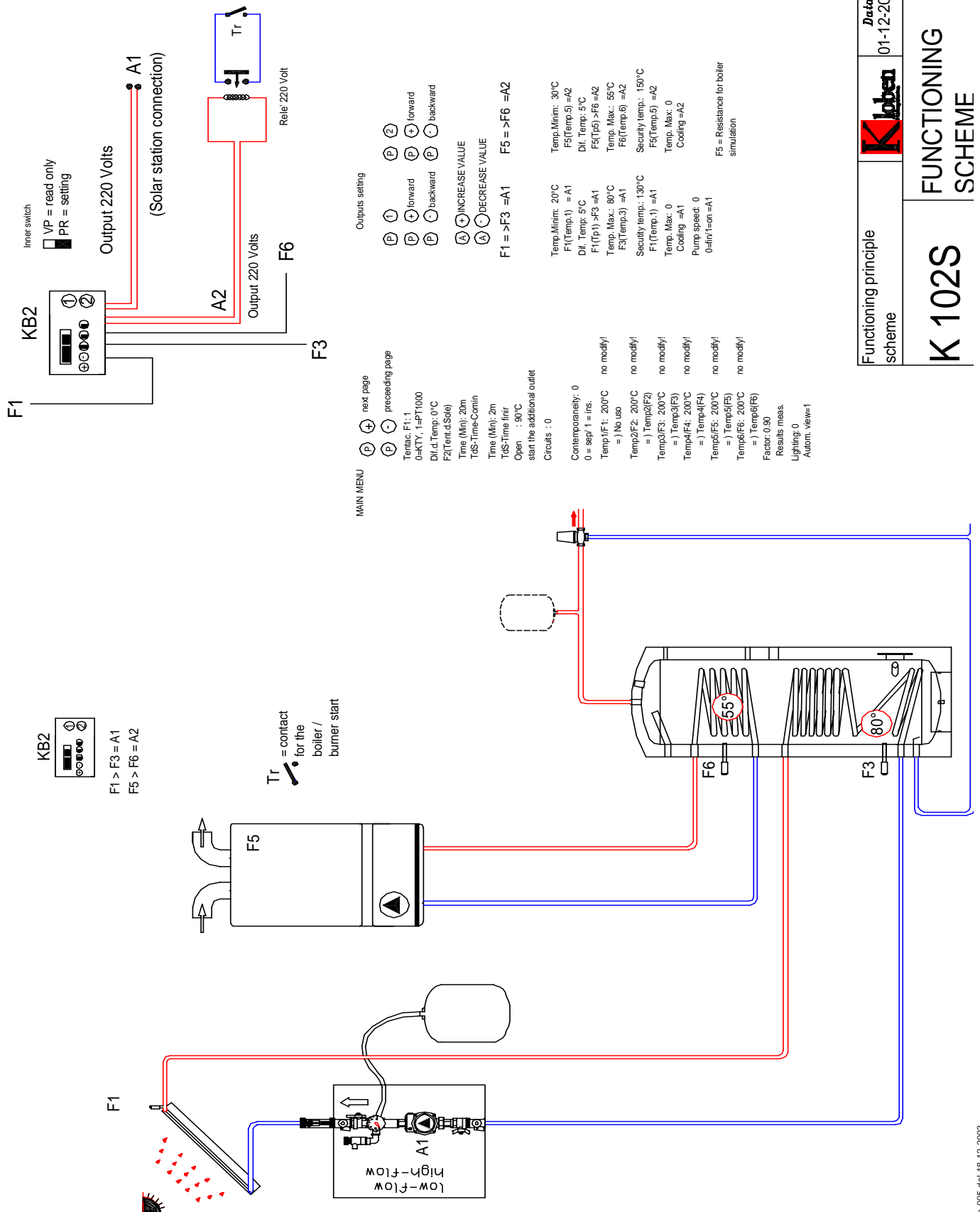
It is very important to verify that there are not objects (houses, trees...) that could compromise the irradiation on the solar collector during the sunshine.  
In case of obstacles it is necessary to point them out, because they could modify the solar collector's requirements.

**ANY SOLAR COLLECTOR ORIENTATION NOT INCLUDED IN THE PRESENT MANUAL  
WILL NOT ASSURE THE OPTIMAL SYSTEM WORKING.**

# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLES OF SOLAR PLANTS

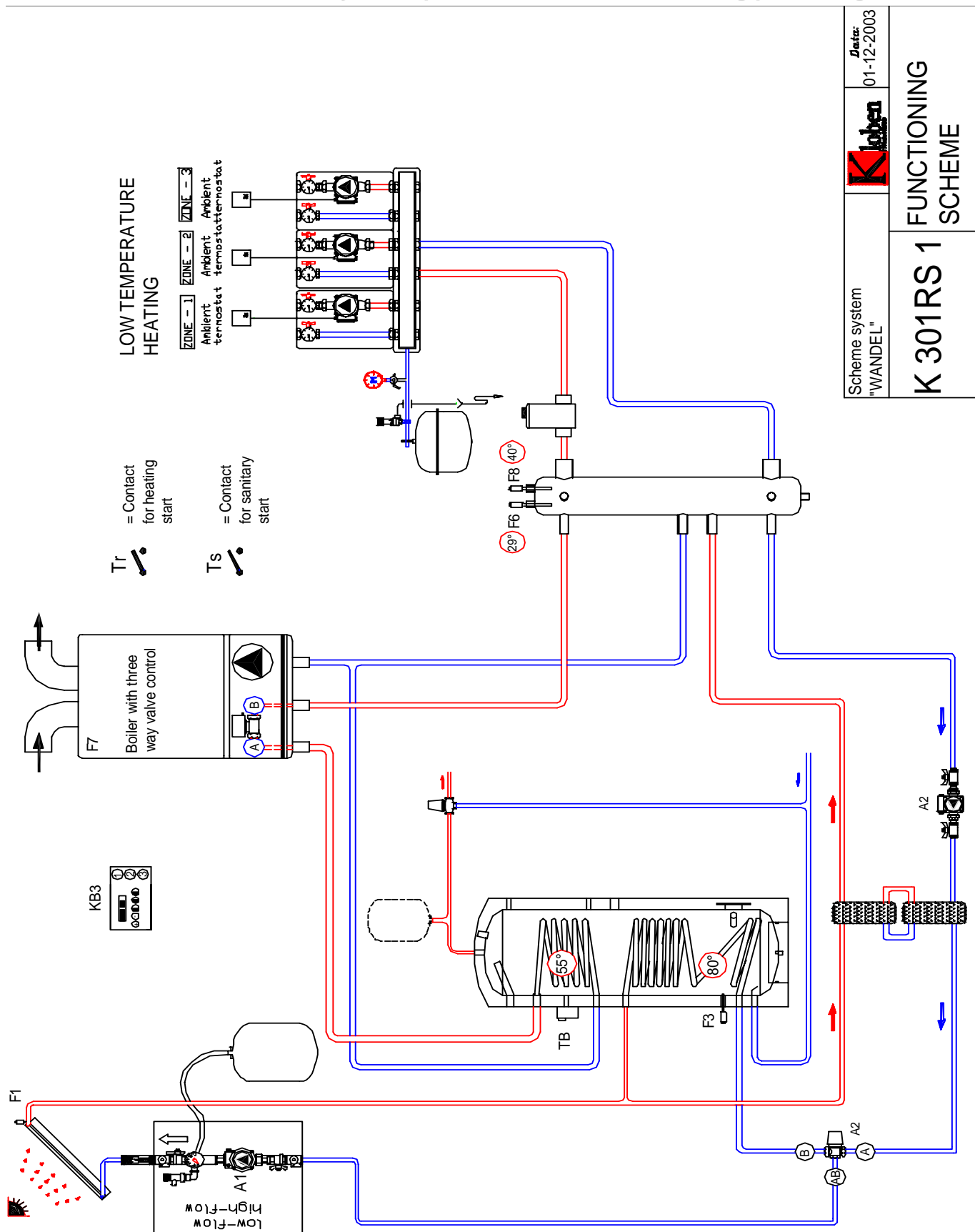
### SYSTEM GRAND SOLEIL - Sanitary water production -



# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLES OF SOLAR PLANTS

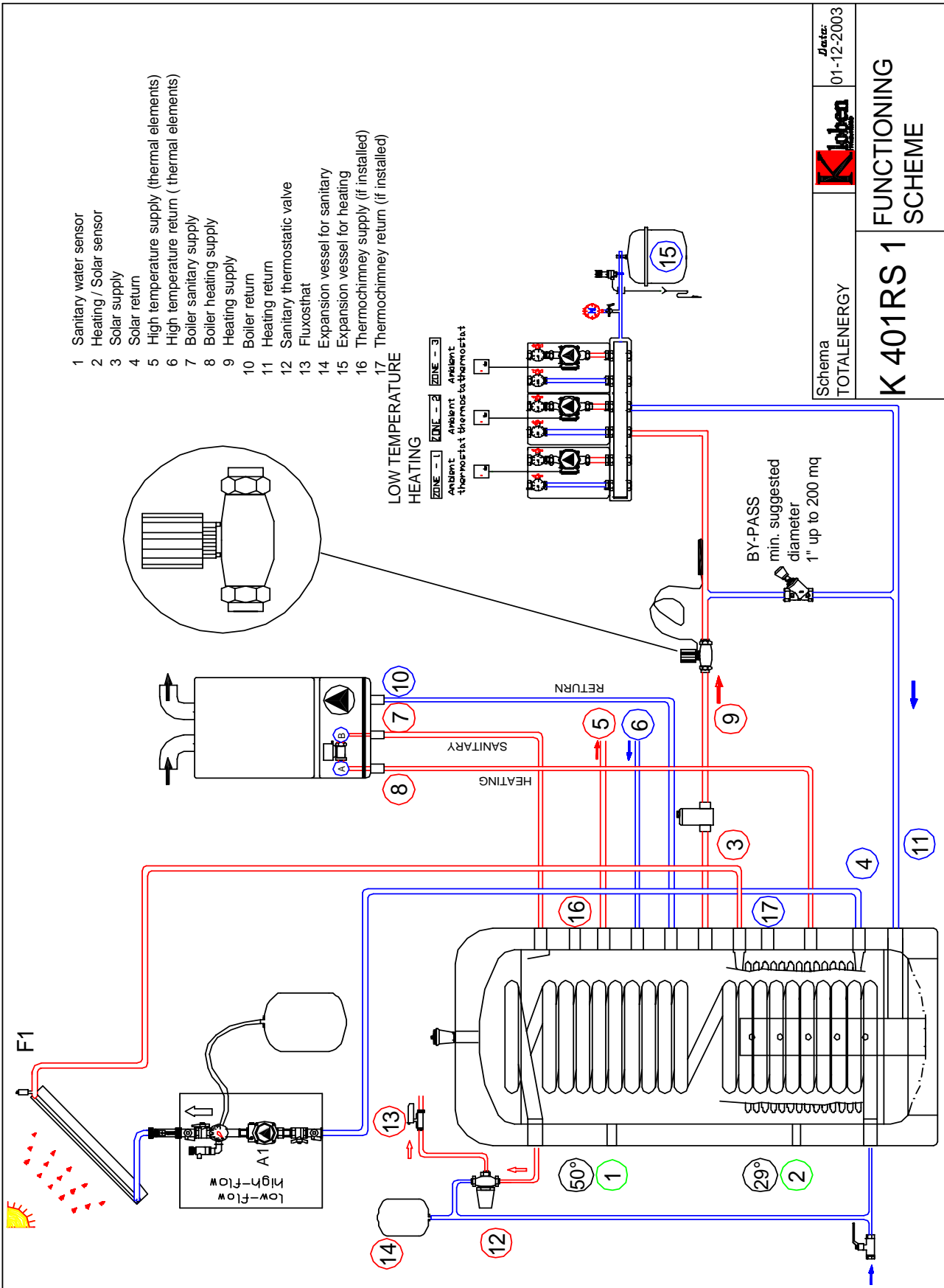
### SISTEM WANDEL -Sanitary water production and radiant heating plant integration -



# Solar collector Kloben "C.P.C. Diffusion"

## EXAMPLES OF SOLAR PLANTS

### SYSTEM TOTALENERGY -Sanitary water production and radiant heating plant integration-




La ditta kloben si riserva il diritto di apportare modifiche anche senza preavviso

versione 005 del 18-12-2003

# Solar collector Kloben "C.P.C. Diffusion"

## CERTIFICATION

  
**Fraunhofer** Institut  
 Solare Energiesysteme

Test Report: KTB Nr. 2003-28

Efficiency test according to EN 12975-2


for:  
Kloben

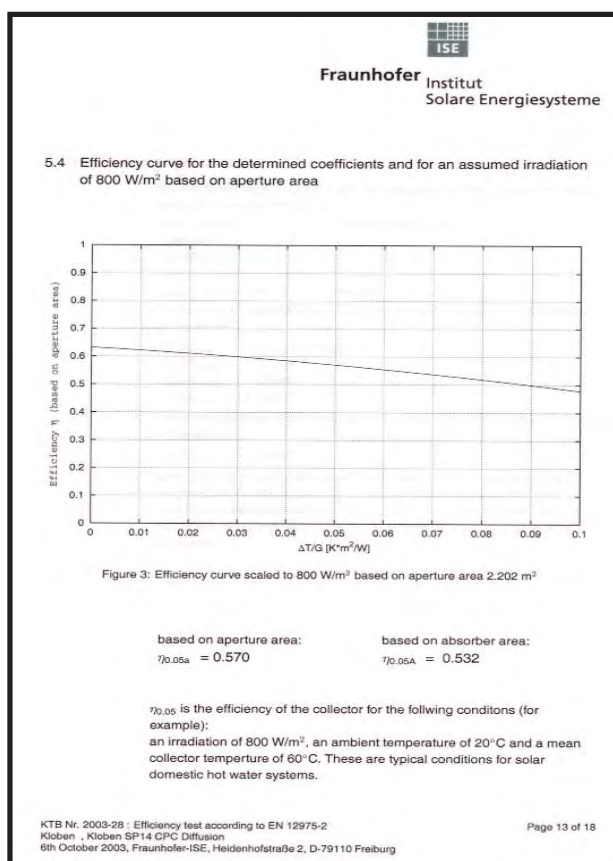
Brand Name:  
Kloben SP14 CPC Diffusion


Responsible for Testing:  
Dipl.-Ing. A. Schäfer

Date:  
6th October 2003

Address:  
Fraunhofer-Institute for Solar Energy Systems ISE  
Heidenhofstraße 2  
D-79110 Freiburg  
Tel.: +49-761-4588-5354; Fax.: +49-761-4588-9000  
E-mail: arim.schaefer@ise.fhg.de  
Test facility certified by DIN CERTCO





  
**Fraunhofer** Institut  
 Solare Energiesysteme

Firma: Kloben      Typ: Kloben SP7 CPC Diffusion, Kloben SP14 CPC Diffusion, Kloben SP21 CPC Diffusion

Prüfbericht-Nr.: KTB-2003-28      Zertifikat-Nr.: Z-3-2003-04

Prüfbericht-Datum: 06.10.03      Zertifikat-Datum: 06.10.03

Kollektoretragsvorhersage (3 m<sup>2</sup>) nach ITW Randbedingungen

Die Vorhersage beruht auf der Berechnung des Jahresenergieertrags des Kollektors (ohne Wärmeverluste der Rohrleitungen und des Speichers) in einer Referenzanlage zur Brauchwassererwärmung. Die Anlage ist für einen Vierpersonenhaushalt dimensioniert. Die Berechnung erfolgt mit meteorologischen Daten des Testreferenzjahres Würzburg. Die Kollektoretragsvorhersage basiert auf einer Aperturfläche von 3 m<sup>2</sup>.

Kollektorkennwerte (Bezug A<sub>s</sub> - Aperturfläche)

Konversionsfaktor:  $\eta_0 = 0,632$       effektiver Wärmedurchgangskoeffizient:  
 $a_{s,0} = 0,936 \text{ W/(m}^2\text{K)}$   
 $a_{s,1} = 0,0076 \text{ W/(m}^2\text{K}^2)$

Wärmekapazität: (nach EN 12975-2, Anhang J3)  $C = 39,9 \text{ kJ/(m}^2\text{K)}$       Einstrahlwinkel-Korrekturfaktor (IAM):  
 transversal 20°: 1,02      IAM-diffus: 0,96  
 40°: 0,99  
 60°: 1,06  
 longitudinal 50°: 0,96

Systemdaten

Dachausrichtung: Süd; Anstellwinkel entspricht Breitengrad (49,8° n. Br.)  
 Kollektoranbindung: Je 15 m Vor- und Rücklauf; Nennweite DN 16; Dämmstärke 25mm,  $\lambda = 0,04 \text{ W/mK}$ ; Vor- und Rücklauf befinden sich je zur Hälfte im Innen- und Außenbereich

Speicher: Volumen 300 l; Wärmeverluste 2,2 W/K; Umgebungstemperatur im Innenbereich 15°C; Volumen des Bereitschaftsteils 135 l; Solltemperatur 60°C

Wärmeübertrager: eingetauchter Wärmeübertrager;  $(kA)_{WT} = 9 \text{ W/m}^2\text{K} \cdot \Theta^{0,8}$   
 $\Theta$  = Mittelwert aus WT-Eintrittstemperatur und lokaler Speichertemperatur in °C

Warmwasserverbrauch: 200 l/Tag (7°/80 l; 12°/40 l; 19°/80 l) Kaltwassertemperatur 10°C, Warmwassertemperatur 45°C, Jahresverbrauch 2936 kWh/a

Berechnungsergebnis

Standort: Würzburg, Einstrahlung: 1212 kWh/m<sup>2</sup>a

Jährlicher Kollektoretrag: 590 kWh/m<sup>2</sup>a

A. Schäfer      D. Rommel  
 Dipl.-Ing. (FH) A. Schäfer      Dipl. Phys. M. Rommel  
 Bearbeiter      Leiter des PZTS

Prüfzentrum für Thermische Solaranlagen des Fraunhofer ISE, Heidenhofstraße 2, 79110 Freiburg, Tel.: +49-761-4588-5354