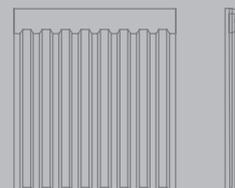


CSV R

Forced circulation system

Vacuum solar collectors



SOLAR THERMAL POWER

Vacuum solar collectors for vertical installations

CSV R

PRODUCT DESCRIPTION

CSV 25 R and CSV 35 R solar collectors consist of 14 and 20 double-walled glass vacuum pipes, Sydney type, containing a U-bent copper pipe connected to an aluminium circumferential absorber, whose outer wall is coated with the selective absorbing layer. Copper pipes are connected in parallel and the heat-transfer liquid runs through them going downwards and then rising back again while absorbing heat from the direct solar irradiation reflected by a parabolic CPC mirror (Compound Parabolic Concentrator).

The glass pipe contains a vacuum thermal insulation called "thermos", which ensures high efficiency even in case of sudden temperature drops between the average operating temperature of the heat-transfer liquid and the room temperature, especially in those areas where there is cold (or severe) weather or process applications.

The solar collector has been provided with screw hydraulic connections to \varnothing 18 pipes; it is possible to connect up to a maximum of 6 collectors in series.

The glass pipes and the CPC reflecting mirrors are easy to replace without having to drain the solar circuit.

Wide range of accessories and fastening systems to provide the utmost installation flexibility.



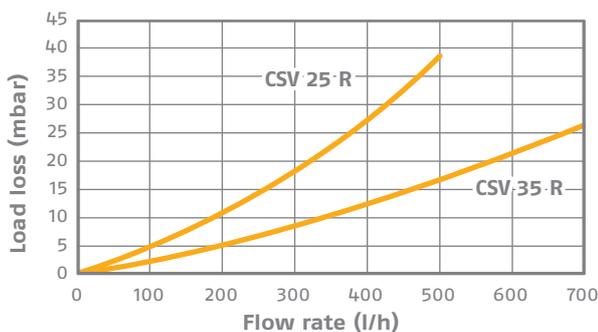
TECHNICAL DATA

| SOLAR COLLECTOR | | CSV 25 R | CSV 35 R |
|---|----------------|---|----------|
| Total frame area | m ² | 2,77 | 3,91 |
| Exposed area | m ² | 2,40 | 3,43 |
| Effective absorption area | m ² | 2,69 | 3,84 |
| Connections | | 18 | 18 |
| Empty weight | kg | 52 | 74 |
| Liquid content | l | 2,05 | 2,90 |
| Recommended flow rate per m ² of panel | l/h | 30 | 30 |
| Glass type - thickness | | Safety glass with anti-glare surface - 2 x 1,6 mm | |
| Absorption (α) | % | >94 | >94 |
| Emissions (ε) | % | <7 | <7 |
| Maximum permitted pressure | bar | 10 | 10 |
| Stagnation temperature | °C | 268 | 268 |
| Heat capacity (*) | kJ/K | 27,6 | 27,6 |
| IAML=IAMT (50°) | | 0,96 | 0,96 |
| Peak capacity (**) | W | 1686 | 2410 |
| Maximum number of panels connectable in series | n° | 6 | 6 |

(*) Specific heat capacity C of the collector without liquid, according to par. 6.1.6.2 of the standard EN12975-2 :2008.

(**) Peak capacity in compliance with EN 12975. According to INAIL the heat capacity will be determined by the engineer after assessing the climatic area, the orientation and angle of the collector, the temperature drop, etc.

PRESSURE DROP IN SOLAR COLLECTORS



33.3% / 67.7% antifreeze/water mix and heat-transfer liquid temperature = 20°C.

| CSV 25 R | Optical efficiency (η°) | Thermal dispersion factor | |
|-----------------|-------------------------|---------------------------|---------------------------------------|
| | | a1 W/(m ² K) | a2 W/(m ² K ²) |
| Absorption area | 0,627 | 1,027 | 0,010 |
| Exposed area | 0,700 | 1,150 | 0,011 |
| Gross area | 0,606 | 0,996 | 0,0095 |

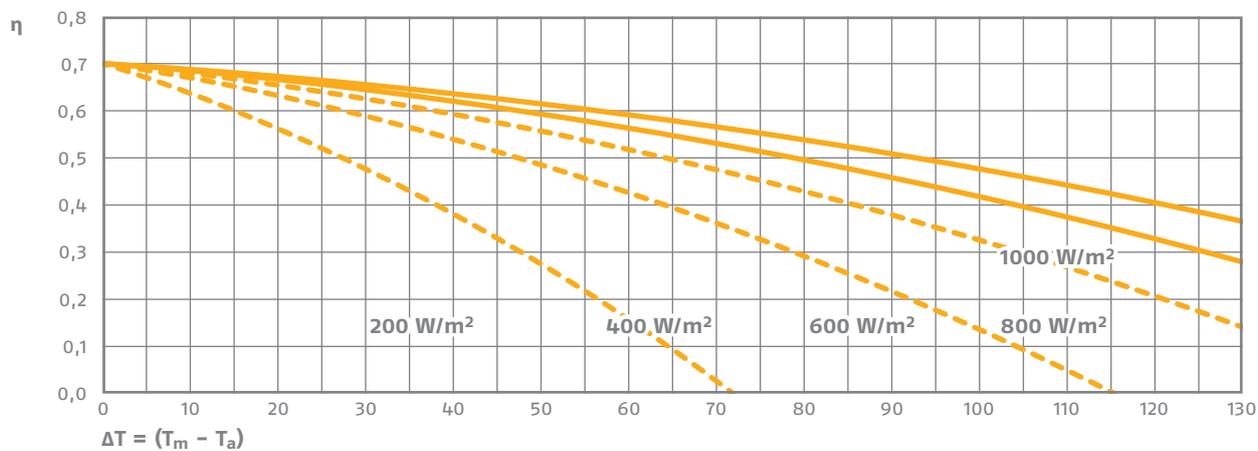
Test according to EN 12975, referred to a 33.3% water-glycol mix and flow rate of 75 l/h.

| CSV 35 R | Optical efficiency (η°) | Thermal dispersion factor | |
|-----------------|-------------------------|---------------------------|---------------------------------------|
| | | a1 W/(m ² K) | a2 W/(m ² K ²) |
| Absorption area | 0,627 | 1,027 | 0,010 |
| Exposed area | 0,700 | 1,150 | 0,011 |
| Gross area | 0,614 | 1,009 | 0,0097 |

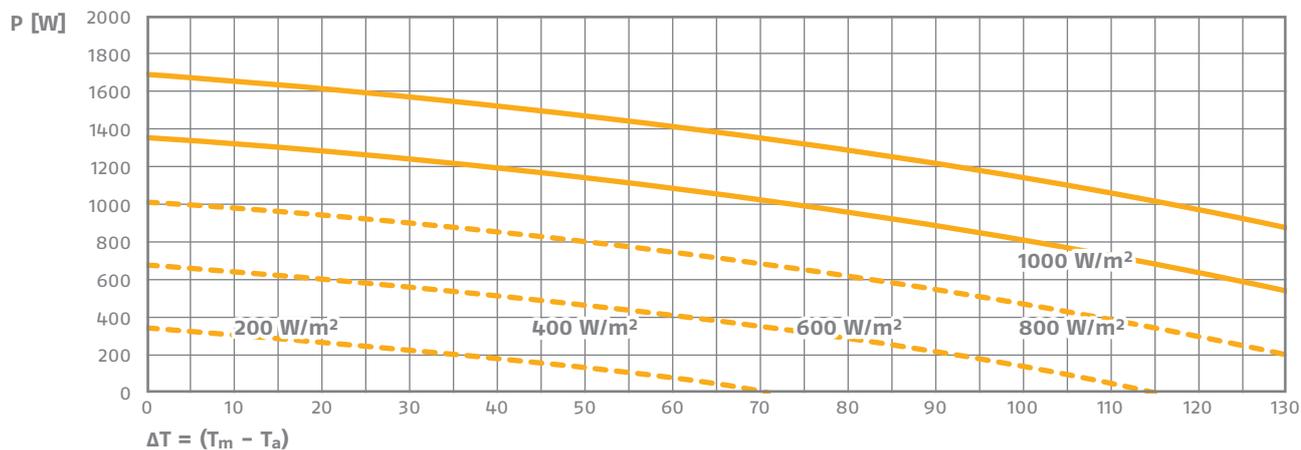
Test according to EN 12975, referred to a 33.3% water-glycol mix and flow rate of 75 l/h.

CSV 25 R

EFFICIENCY CURVE

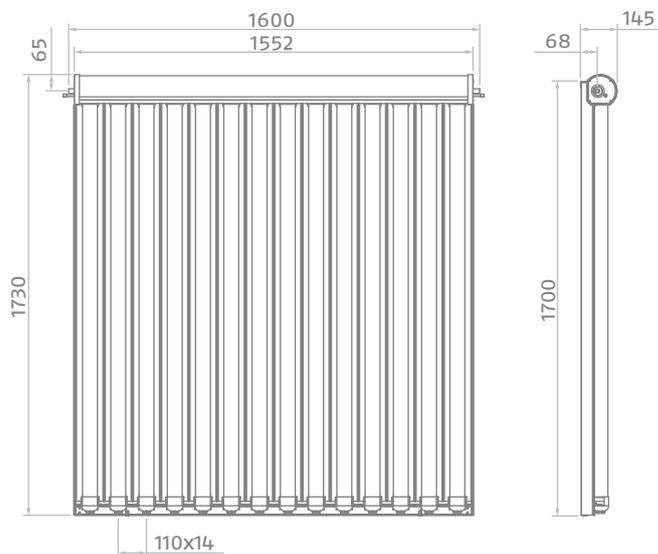


OUTPUT POWER CAPACITY CURVE



The rated power capacity curve referred to 800 W/m², while the peak capacity is calculated according to the relevant standard and irradiation of 1000W/m².

STRUCTURE AND OVERALL DIMENSIONS

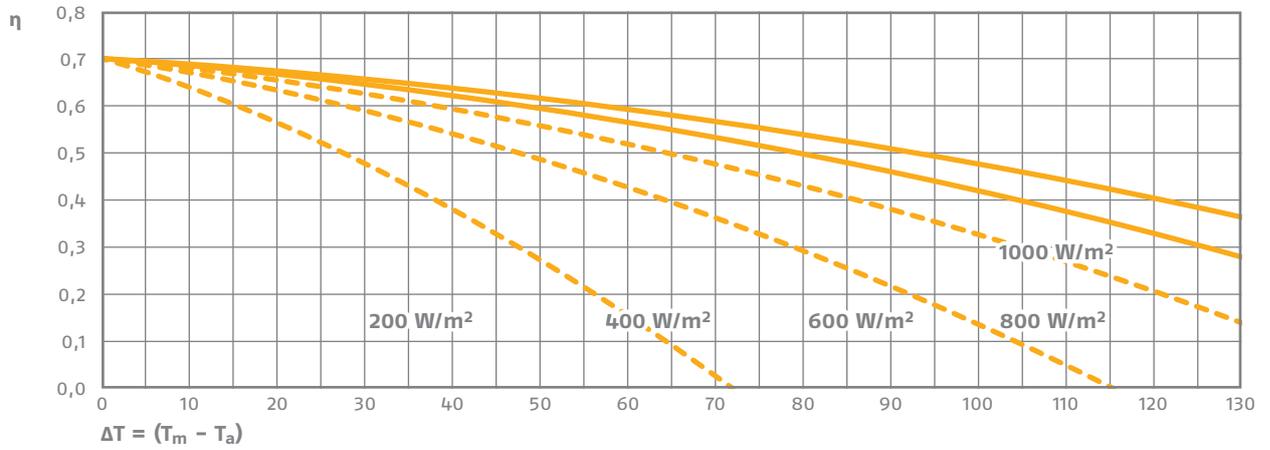


SOLAR THERMAL POWER

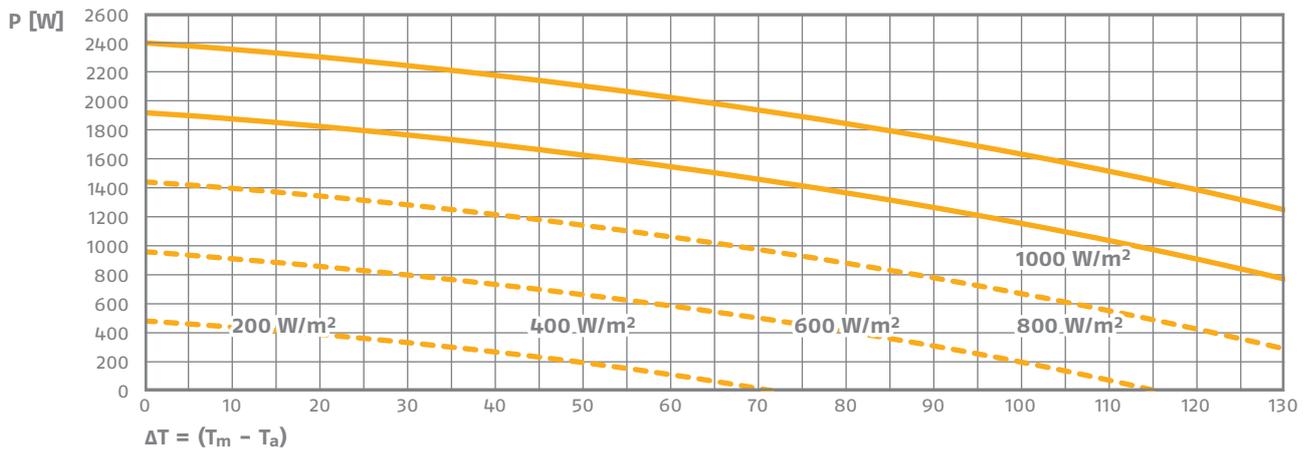
Vacuum solar collectors for vertical installations

CSV 35 R

EFFICIENCY CURVE

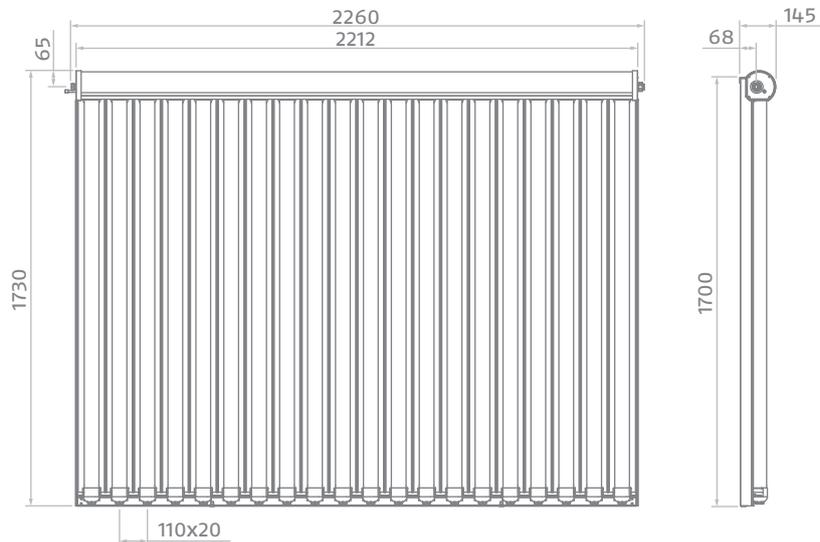


OUTPUT POWER CAPACITY CURVE



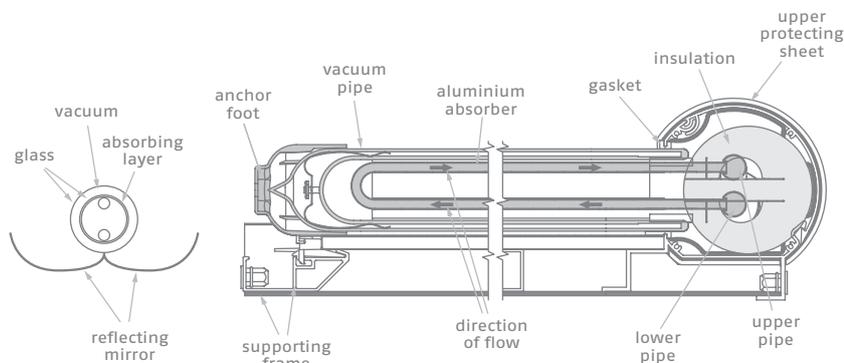
The rated power capacity curve referred to 800 W/m², while the peak capacity is calculated according to the relevant standard and irradiation of 1000W/m².

STRUCTURE AND OVERALL DIMENSIONS



DETAILED DRAWING OF COLLECTORS CSV R

The two collectors CSV 25 R and CSV 35 R have the same internal layout and differ for the number of vacuum pipes (14 pipes for the CSV 25 R collector and 20 pipes for the CSV 35 R).

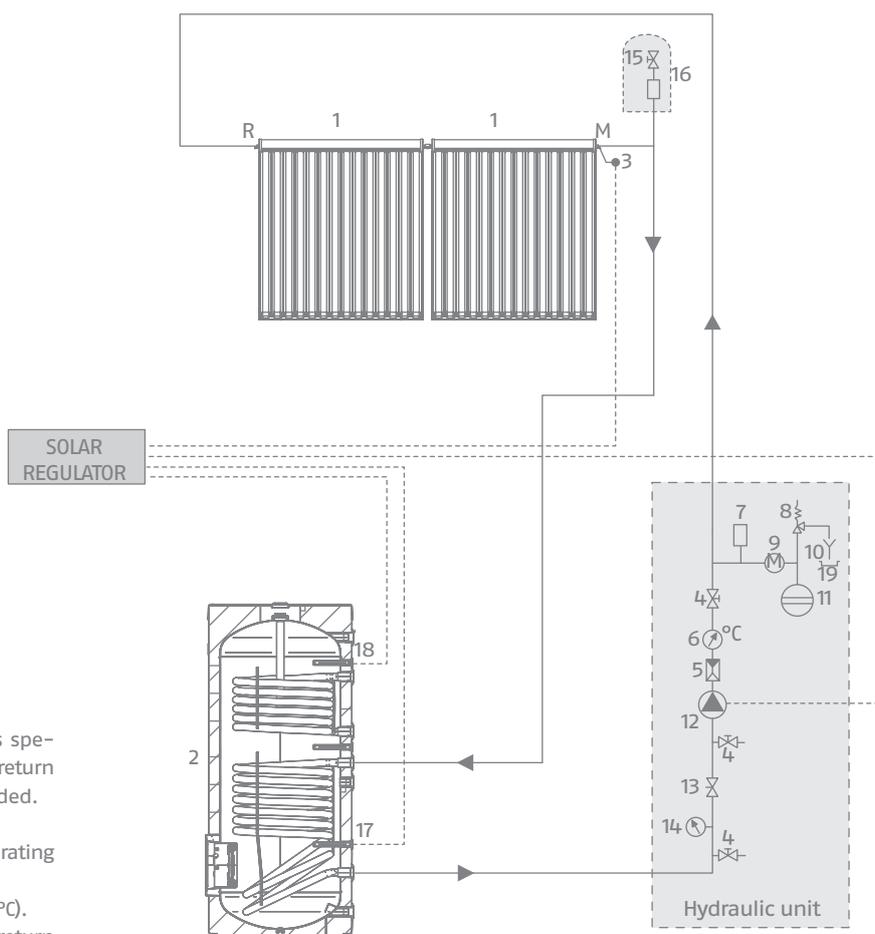


LOCATION OF PROBES

Locate the temperature sensor in the closest socket to the collector outlet pipe. To install the sensor use only materials capable of resisting high temperatures (beyond 268°C for sensor, contact paste, cables, seals, insulation).

1. Solar collector
2. Solar tank
3. Collector probe
4. Shut-off valve
5. Non-return valve
6. Temperature gauge
7. Vent valve
8. Safety valve
9. Pressure gauge
10. Drain
11. Expansion vessel
12. Circulator pump
13. Flow regulator
14. Flow meter
15. Vent cock
16. Manual bleed valve (accessory)
17. Solar tank lower probe
18. Solar tank upper probe
19. Heat-transfer liquid recovery

- M Collector outlet
R Collector return



Do not connect more than 6 collectors in series.
It is recommended to use stainless steel pipes specially made for solar system collectors (outlet, return and probe pipes). The probe cable is to be shielded. If you use copper pipes, joints must be brazed.
Do not use plastic or multilayer pipes: the operating temperature may exceed 180°C.
Pipe lagging must resist high temperatures (180°C).
In order to avoid useless heat losses, a non-return valve is to be installed on the solar collector return, close to the solar tank.

SOLAR THERMAL POWER

Vacuum solar collectors for vertical installations

ASSEMBLY OF SOLAR COLLECTORS

STATIC LOAD

Assembly is to be carried out only on roofs or frames that are strong enough to support its weight. The strength of roof or frame should be verified on site by an expert in static loading before installing the collector. During such process it is important to make sure the supporting frame is suitable enough to hold the screw fasteners that fasten the solar collectors in place. An expert in static loading should verify whether the entire frame structure complies with relevant standards, especially in areas that are often liable to snow or exposed to high winds. Therefore carefully assess the conditions of location where the collectors are going to be installed (gusts of wind, wind vortices, etc.) since they may increase the loads on the supporting structure.

EFFECTS OF WIND AND SNOW ON COLLECTORS (indicative values)

| Distance from the ground | Wind speed | Weight in kg to prevent collector from being lifted by the wind | | Load of the roof structure protecting from wind, snow, and supporting the weight of a collector | |
|--------------------------|------------|---|--------------|---|--------------|
| | | angle of 45° | angle of 20° | angle of 45° | angle of 20° |
| 0 - 8 m | 100 km/h | 80 kg | 40 kg | 320 kg | 345 kg |
| 8 - 20 m | 130 km/h | 180 kg | 90 kg | 470 kg | 430 kg |
| 20 - 100 m | 150 km/h | 280 kg | 150 kg | 624 kg | 525 kg |

LIGHTNING PROTECTION

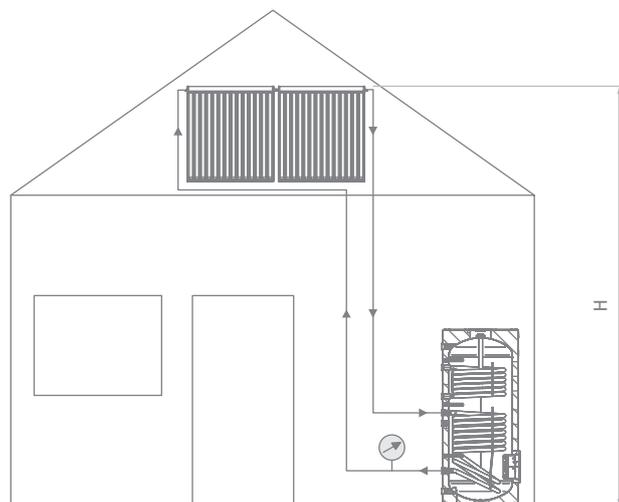
Metal pipes of solar heating circuit will be connected to the main potential compensation bar by a (yellow-green) conductor of at least 16 mm² Cu (H07V-U or R). If a lightning conductor is already installed, collectors can be connected to the existing system. Alternatively, the system can be grounded by a ground wire sunk in the earth. The ground wire must be sunk outside the house. The ground wire must also be connected to the compensation bar through a wire of the same diameter.

ANGLE OF COLLECTORS / GENERAL

It is recommended to install collectors at an angle of min. 15°C, so that glass can be easily cleaned and snow removed. Make sure bleed and vent valves remain open during the collector assembly. Take care to protect all connections, bleed and vent holes from dirt and dust, etc.

In areas where collectors serve mainly in summer (to produce domestic hot water), adjust the collector east to west at a variable angle of 20 to 60°. The ideal orientation is southwards at an angle equal to the latitude of the place -10°. In areas where collectors serve mainly in winter (combining the production of domestic hot water with central heating), adjust the collector southwards (south-east, south-west) at an angle greater than 35°C. The ideal orientation is southwards at an angle equal to the latitude of the place +10°C.

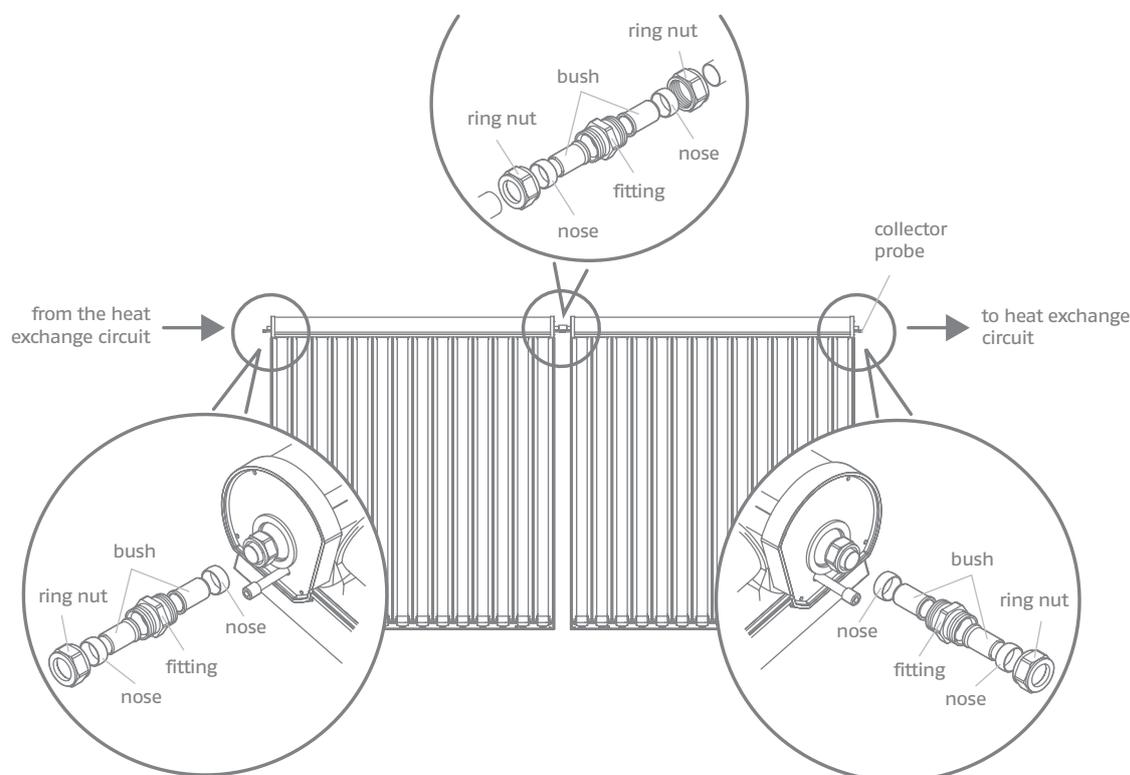
PREFILLING PRESSURE DIAGRAM



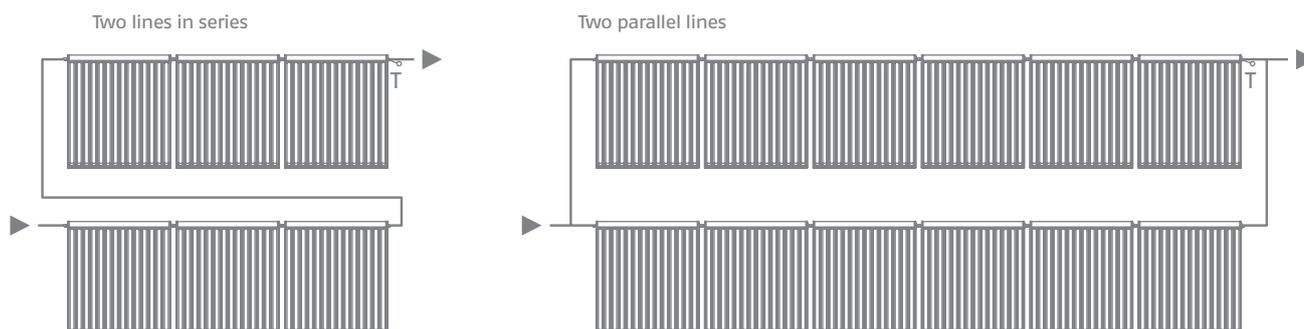
Recommended prefilling (cold) pressure of the system: $p \text{ [bar]} = 1,5 + H \text{ [m]} / 10$.

CONNECTIONS

The following diagram shows the connections between solar collectors.



Collectors are connected in a way so that the heat-transfer liquid runs through them in series. The connection to heat exchange circuit going to the exchanger will be carried out on the probe side of the last collector of the array (see figure). More than one array of solar collectors can be connected both in series (on condition that each array consists of no more than 6 collectors) and in parallel. Always make sure the circuit is hydraulically balanced (take the following diagrams as an example).



PREMIXING WATER + GLYCOL

Glycol is supplied separately in standard packages and will be mixed with water in a suitable tank before being used to fill the system (e.g. a mix of 40% glycol and 60% water offers anti-freeze protection down to a temperature of -21°C).

The propylene glycol supplied is specially formulated for solar applications, as it maintains its efficiency through the $-32\div 180^{\circ}\text{C}$ range. It is non-toxic, biodegradable and biocompatible. Do not fill the circuit with pure glycol and then add water later. Do not use manual or automatic filling devices. If the chlorine content is very high, use distilled water to prepare the mix.

| Anti-freeze | Temperature | Density |
|-------------|-----------------------|--------------------------|
| 50% | -32°C | 1,045 kg/dm ³ |
| 40% | -21°C | 1,037 kg/dm ³ |
| 30% | -13°C | 1,029 kg/dm ³ |

This collector is affected by the irradiation of the celestial vault, which causes a temperature drop of even 7°C below ambient temperature in winter by night.

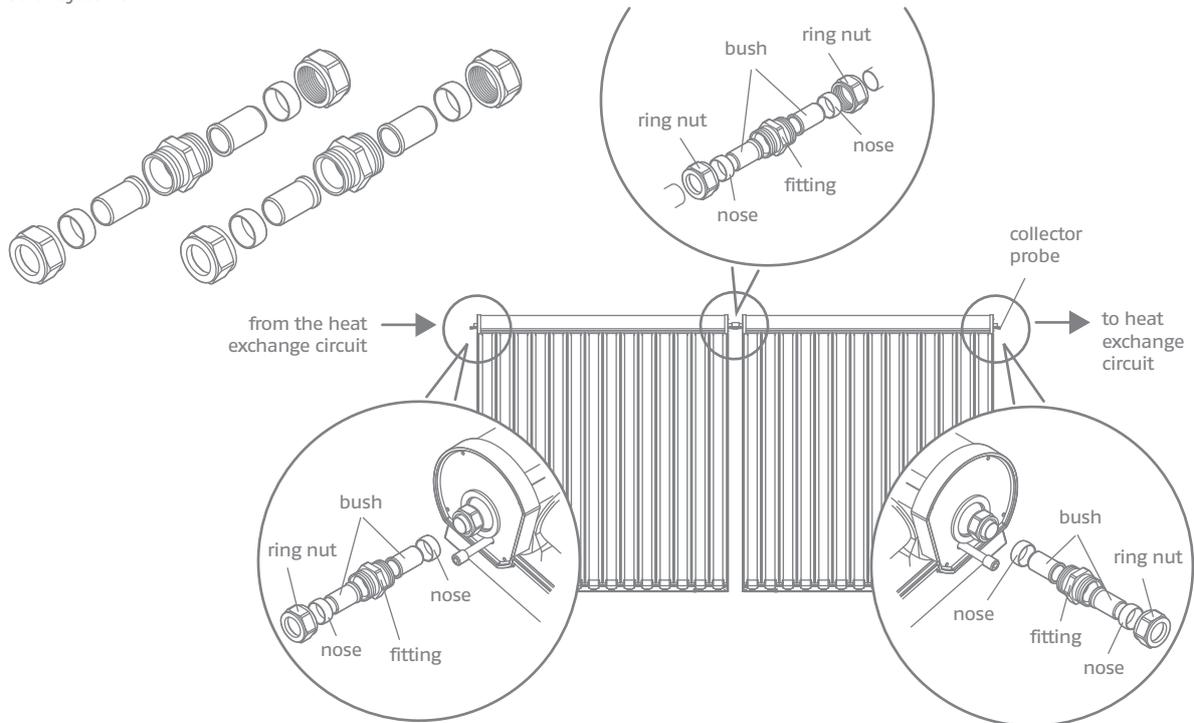
SOLAR THERMAL POWER

Vacuum solar collectors for vertical installations

ACCESSORIES

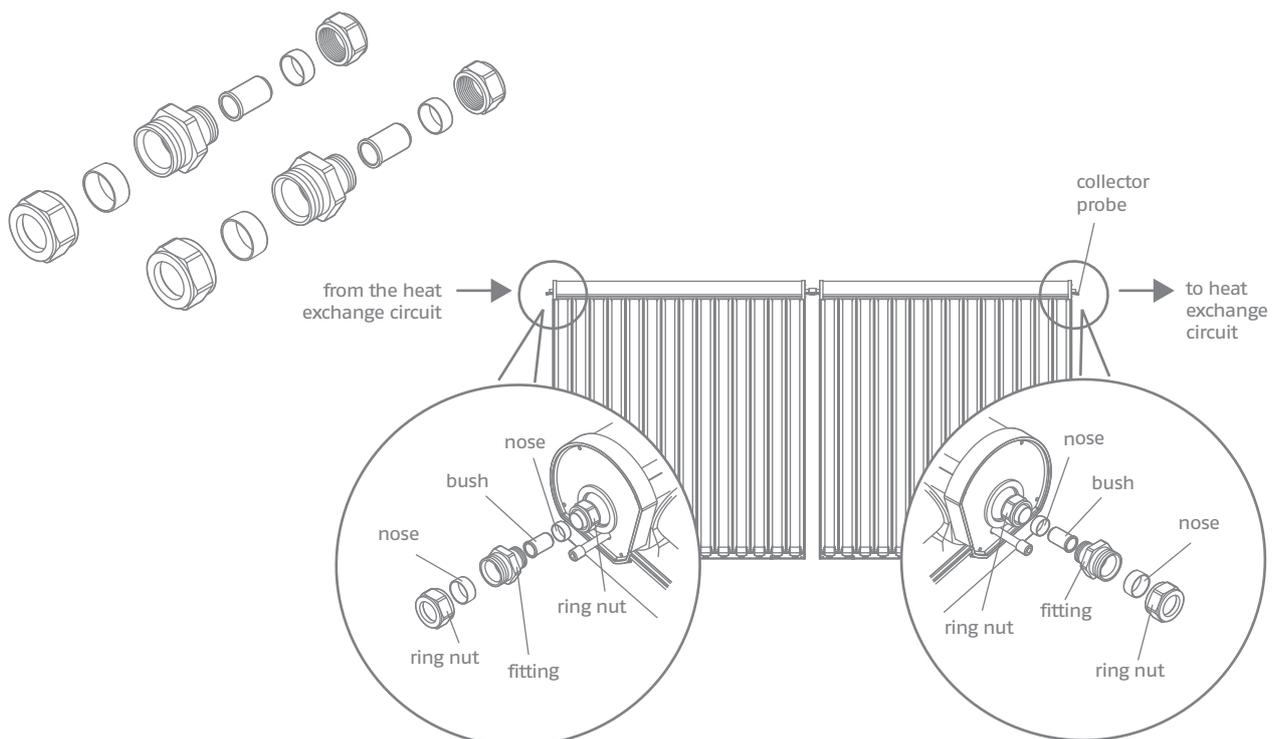
Kit of screw fittings for copper pipe DN 18

This kit includes 2 fittings for the intermediate connection of the vacuum collectors and the connection of their ends to the copper pipes DN 18 of the solar system.



Kit of screw fittings for stainless steel pipe DN 16

This kit includes 2 fittings for the connection to the flexible stainless steel pipes DN 16 of the solar system.



Fastening kit for roof-parallel installation

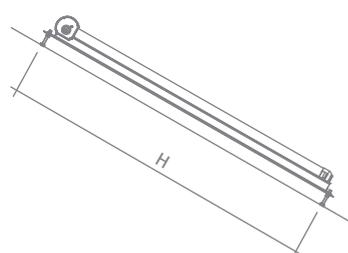
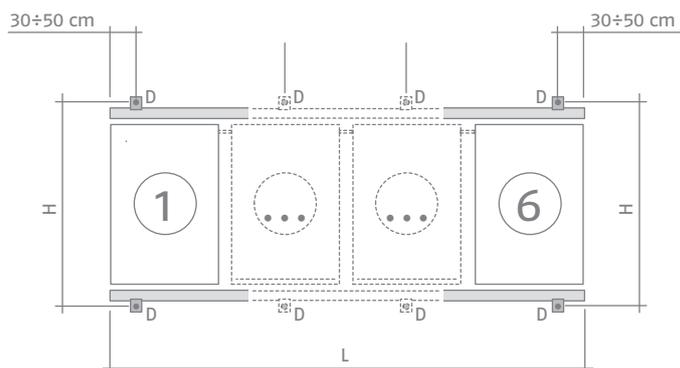
Installation parallel to a single pitch roof using screw studs

DISTANCE BETWEEN FASTENING POINTS (D)

Always drill the tile or pantile in its ridge.

If bars are kept together by a compensating fitting, make sure there is a fastening point close to the fitting.

Evenly locate the other fastening points along the whole surface.



| | Length L (in cm) Number of vertical collectors | | | | |
|----------|---|-----|-----|------|------|
| | 2 | 3 | 4 | 5 | 6 |
| CSV 25 R | 320 | 480 | 640 | 800 | 960 |
| CSV 35 R | 452 | 678 | 904 | 1130 | 1356 |

| | Height H (in cm) |
|------------------------------|------------------|
| Vacuum collector 14/20 pipes | 177 |

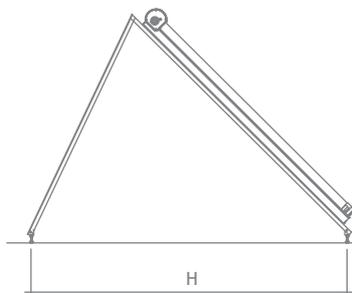
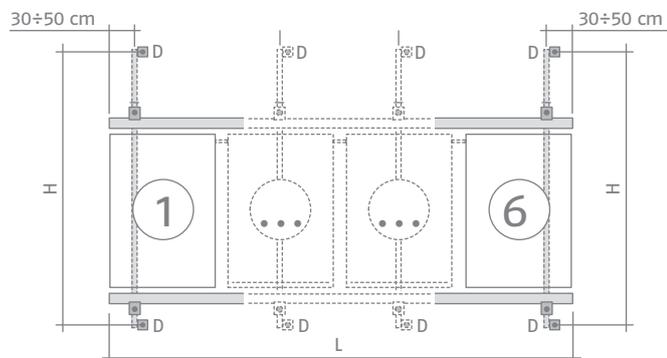
Fastening kit at 45°

Installation at 45° onto a flat roof using screw studs

DISTANCE BETWEEN FASTENING POINTS (D)

If bars are kept together by a compensating fitting, make sure there is a fastening point close to the fitting.

Evenly locate the other fastening points along the whole surface.



| | Length L (in cm) Number of vertical collectors | | | | |
|----------|---|-----|-----|------|------|
| | 2 | 3 | 4 | 5 | 6 |
| CSV 25 R | 320 | 480 | 640 | 800 | 960 |
| CSV 35 R | 452 | 678 | 904 | 1130 | 1356 |

| | Height H (in cm) |
|------------------------------|------------------|
| Vacuum collector 14/20 pipes | 219 |

SOLAR THERMAL POWER

Vacuum solar collectors for vertical installations

SOLAR COLLECTOR CSV 25 R

CONSTRUCTIVE DESCRIPTION FOR SYNTHETIC TENDER SPECIFICATIONS

This solar collector consists of 14 double-walled glass vacuum pipes, Sydney type, each one containing a U-bent copper pipe, for vertical installations, having a gross area of 2.77 m² and an exposed area of 2.40 m². Energy absorption > 94% and emissions <7% provided with thermal insulation called "thermos", the outer wall of the internal pipe is lined with a black absorbing coat. Maximum temperature of 268°C and recommended water flow rate per m² of panel of 30 litre/hour.

CONSTRUCTIVE DESCRIPTION FOR TENDER SPECIFICATIONS

The vacuum solar collector, for vertical installations, consists of:

- Gross area: 2.77 m².
- Exposed area: 2.40 m².
- Effective absorption area: 2.69 m².
- Energy absorption > 94%.
- Emissions < 7%.
- Exposed area data: $\alpha=0,7$ $\alpha_1=1,15$ $\alpha_2=0,011$.
- Supporting frame entirely made of aluminium alloy Anticorodal 6060 (EN AW 6060) complying with the standard EN UNI 573-3 (aluminium alloy belonging to the 6000 series, that is Al – silicon and magnesium alloys) providing high resistance to corrosion, ideal aptitude to anodic oxidation, colour oxidation and mechanical polishing, good mechanical properties and good weldability, great machinability by machine tools. The alloys can undergo a thermal treatment for precipitation hardening and are mostly used in the naval and rail industry or for the manufacture of aluminium frames of bikes, doors and windows.
- Collector cover made of aluminium alloy Anticorodal 6060 (EN AW 6060), whose colour is RAL 7024 complying with the standard UNI 573-3.
- Internal hydraulic circuit including two copper collectors DN 18 being the outlet and the return, to which 14 U-bent copper pipes DN 7 are connected, in order to form a total thermal length of approx. 45 m.
- Absorber made of aluminium Anticorodal 6060 (EN AW 6060) complying with the standard EN UNI 573-3, having a thickness of 0.8 mm and a Brinell hardness of HB 65 ±5 (T6). It has been artificially solubilized, tempered and aged according to EN UNI 755-2. The outer wall of the internal pipe is lined with an absorbing coat.
- 14 double-walled glass vacuum pipes, Sydney type, each one including a U-bent copper exchanger containing a vacuum insulation, easy to replace without having to drain the solar circuit; the vacuum absolute pressure may exceed 0.05Pa thanks to a thermal treatment called "thermos".
- The rock wool insulation of collectors DN 18 has a density of 60kg/m³.
- Aluminium CPC mirror (Compound Parabolic Concentrator) with double parabolic bending to reflect the solar irradiation and enhance absorption. It has a thickness of 0.5mm, has undergone the Weatherproof 85 treatment and is coated with a protective layer, in order to maintain long-lasting reflection and cleaning properties.
- Hydraulic copper screw connections DN 18 (kit of fittings not included in the collector supply).
- Maximum temperature: 268°C.
- Maximum pressure: 10 bar.
- It is possible to connect up to 6 collectors in series.
- In compliance with standards EN 12975-1.
- In compliance with Solar Keymark.
- ICIM Certification for collectors CSV 25 R.

SOLAR COLLECTOR CSV 35 R

CONSTRUCTIVE DESCRIPTION FOR SYNTHETIC TENDER SPECIFICATIONS

This solar collector consists of 20 double-walled glass vacuum pipes, Sydney type, each one containing a U-bent copper pipe, for vertical installations, having a gross area of 3.91 m² and an exposed area of 3.43 m². Energy absorption > 94% and emissions <7% provided with thermal insulation called "thermos", the outer wall of the internal pipe is lined with a black absorbing coat. Maximum temperature of 268°C and recommended water flow rate per m² of panel of 30 litre/hour.

CONSTRUCTIVE DESCRIPTION FOR TENDER SPECIFICATIONS

The vacuum solar collector, for vertical installations, consists of:

- Gross area: 3.91 m².
- Exposed area: 3.43 m².
- Effective absorption area: 3.84 m².
- Energy absorption > 94%.
- Emissions < 7%.
- Exposed area data: $\alpha=0,7$ $\alpha_1=1,15$ $\alpha_2=0,011$.
- Supporting frame entirely made of aluminium alloy Anticorodal 6060 (EN AW 6060) complying with the standard EN UNI 573-3 (aluminium alloy belonging to the 6000 series, that is Al – silicon and magnesium alloys) providing high resistance to corrosion, ideal aptitude to anodic oxidation, colour oxidation and mechanical polishing, good mechanical properties and good weldability, great machinability by machine tools. The alloys can undergo a thermal treatment for precipitation hardening and are mostly used in the naval and rail industry or for the manufacture of aluminium frames of bikes, doors and windows.
- Collector cover made of aluminium alloy Anticorodal 6060 (EN AW 6060), whose colour is RAL 7024 complying with the standard UNI 573-3.
- Internal hydraulic circuit including two copper collectors DN 18 being the outlet and the return, to which 20 U-bent copper pipes DN 7 are connected, in order to form a total thermal length of approx. 64 m.
- Absorber made of aluminium Anticorodal 6060 (EN AW 6060) complying with the standard EN UNI 573-3, having a thickness of 0.8 mm and a Brinell hardness of HB 65 ±5 (T6). It has been artificially solubilized, tempered and aged according to EN UNI 755-2. The outer wall of the internal pipe is lined with an absorbing coat.
- 20 double-walled glass vacuum pipes, Sydney type, each one including a U-bent copper exchanger containing a vacuum insulation, easy to replace without having to drain the solar circuit; the vacuum absolute pressure may exceed 0.05Pa thanks to a thermal treatment called "thermos".
- The rock wool insulation of collectors DN 18 has a density of 60kg/m³.
- Aluminium CPC mirror (Compound Parabolic Concentrator) with double parabolic bending to reflect the solar irradiation and enhance absorption. It has a thickness of 0.5mm, has undergone the Weatherproof 85 treatment and is coated with a protective layer, in order to maintain long-lasting reflection and cleaning properties.
- Hydraulic copper screw connections DN 18 (kit of fittings not included in the collector supply).
- Maximum temperature: 268°C.
- Maximum pressure: 10 bar.
- It is possible to connect up to 6 collectors in series.
- In compliance with standards EN 12975-1.
- In compliance with Solar Keymark.
- ICIM Certification for collectors CSV 35 R.

DOCUMENTS SUPPLIED IN THE KIT

- Warranty certificate.
- Installation, user's and maintenance guide.

ATTENTION

It is recommended to use the glycol-free solar liquid, which is resistant to high temperatures and provides long-lasting service; alternatively, use the non-toxic, biodegradable and biocompatible propylene glycol supplied together with the collector, in order to avoid corrosion and residues at high temperatures; the liquid is already mixed and offers an anti-freeze protection down to a temperature of -28°C . Always use the suitable fastening systems provided with screws, gaskets, nuts and washers to perform proper installation. The kits of fittings should be ordered separately (even between collectors).

ACCESSORIES

The following available accessories can be ordered separately:

Premixed glycol 20kg for CSV R

Glycol-free solar liquid

Manual bleed valve kit (1)

Kit of screw fittings for connection of CSV R collectors with copper pipes DN18 and connection between collectors

Kit of screw fittings for connection of CSV R collectors with flexible stainless steel pipes (do not use them between collectors)

Double stainless steel pipe with solar insulation and integrated probe cable (no fittings) having a length of 15 metres

Double stainless steel pipe with solar insulation and integrated probe cable (no fittings) having a length of 20 metres

Installation parallel to a single pitch roof using screw studs for CSV 25 R

Kit of brackets for collectors in // 1 ÷ 6

Installation at 45° onto a flat roof using screw studs for CSV 25 R

Kit of brackets for collector at 45° on flat roof 1 ÷ 6

Installation parallel to a single pitch roof using screw studs for CSV 35 R

Kit of brackets for collectors in // 1 ÷ 6

Installation at 45° onto a flat roof using screw studs for CSV 35 R

Kit of brackets for collector at 45° on flat roof 1 ÷ 6

(1) Use one for each "upper" array of collectors.

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Since the company is constantly committed to continuously perfecting its products, the aesthetic and dimensional characteristics, the technical data, the equipment and accessories may be subject to change.

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