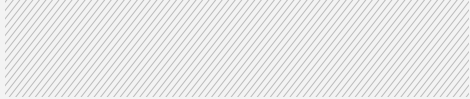


THERMOSLATE

byCUP/4

INSTALLATION AND MAINTENANCE MANUAL | NATURAL SLATE SOLAR PITCHED ROOFING SYSTEM

August 2011



INDEX

RECEIPT OF EQUIPMENT	3
SAFETY WARNINGS	3
HANDLING AND STORAGE	3
TECHNICAL DATA	4
INSTALLATION	4
MAINTENANCE	11



RECEIPT OF EQUIPMENT

It is VERY IMPORTANT to **check the equipment** on receipt.

Before dispatching its products, CUPA PIZARRAS carries out an exhaustive quality test and a complete check on their condition before they leave the factory. Despite packaging and protection, the solar cells can be damaged during transport. If you detect any damage to the solar cells, tell the haulier immediately.

CUPA PIZARRAS will not accept responsibility for damage caused during transport if it is not reported within the 48 hours following delivery.

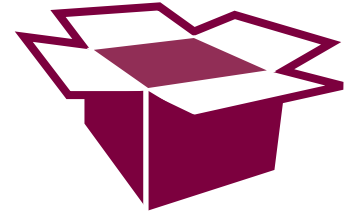


SAFETY WARNINGS

THERMOSLATE™ must be switched on and maintained by specialized personnel (approved installation company for thermal installations and hot water and heating systems).

The panels must be assembled by a specialist slate roofer.

Safety rules for installations established under the applicable regulations and others concerning the prevention of occupational risks must be applied.



HANDLING AND STORAGE

You are recommended to use the necessary protection measures for handling the solar cells and to store them in a covered place. If this is impossible, you must isolate them properly under a waterproof tarpaulin to prevent water leaking in.

The panels are arranged on pallets in a horizontal position and individually packaged. **Do not remove the packaging until installation.**

The slate covering of the panels must be on the top.

To prevent damage to the slate cover of the solar cell side do not place anything on top of the last panel in the pallet.

Manipulating the solar cells by raising them to make water connections is **strictly forbidden**.

TECHNICAL DATA

General module specifications

Empty weight (Kg)	30
Fluid content (l)	0.560
Heat-transfer fluid	Water + Anti-freeze
Recommended flow rate (Kg/s)	0.03 - 0.06
Pipe arrangement and diameter (mm)	Harp Ø 2.8 mm*
Recommended operating pressure (bar)	2 - 4
Maximum operating pressure (bar)	6
Maximum operating temperature (°C)	100
Maximum pressure supported by the absorber Mpa	0,3 Mpa
Minimum tilt angle	0°
Maximum tilt angle	90°
Frost resistance °C	-38
Stagnation temperature a 1000 W/m ² and 30°C (°C)	89.6

* Equivalent diameter

Module mechanical data

Measurements (tolerance 3 ± 1 mm)	2267 x 742 mm
Maximum height (tolerance 3 ± 3 mm)	37 mm
Pressure per surface area unit	máx. 3 KPa

Reference plane

Absorber area (m ²)	1,45
Aperture area (m ²)	1,36
Total area (m ²)	1,68

Rendimiento

Optical performance factor	0,82
Loss factors	a1 11,53 W/(m ² K) a2 0,044 W/(m ² K)

Operating fluid

Kind	Anti-freeze
Composition and Additives	Anti-freeze and water
Density (g/cm ³)	1,06

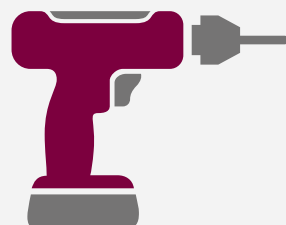
INSTALLATION

CONNECTION BETWEEN COLLECTORS

THERMOSLATE™ could be connected in series or in parallel. The number of collectors connected in both cases will depend on the installation site and conditions.

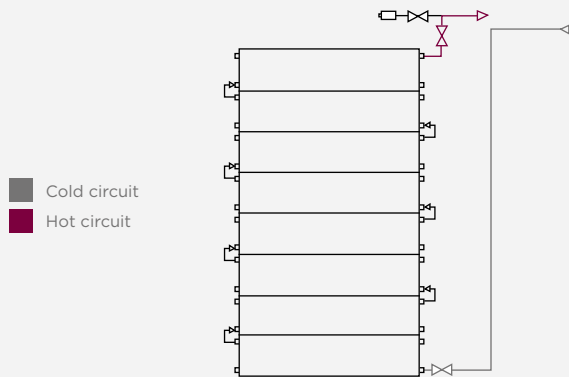
CONNECTION BETWEEN BATTERIES

When necessary, the collector surface can be increased by connecting parallel collector batteries. Parallel battery arrangement increases the system's performance.

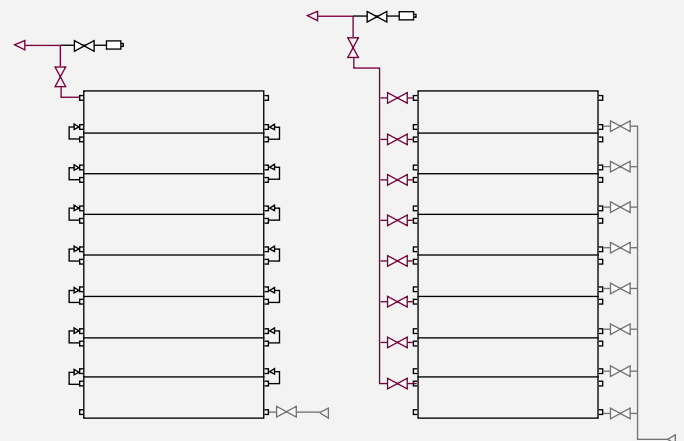


+ CUPA PIZARRAS does not recommend more than 8 panels mounted in series.

+ Parallel connection could be achieved through internal panel connection, as well as with external pipe.



SERIAL CONNECTION



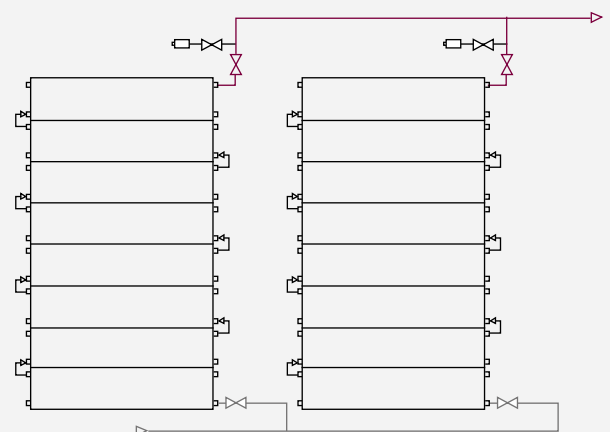
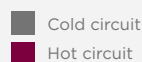
PARALLEL CONNECTIONS

+ CUPA PIZARRAS recommends installing batteries of 4 modules when feasible.

+ In order for all of the batteries to work efficiently, they should be arranged so that the whole system is hydraulically balanced. There are two ways of achieving this hydraulic balance:

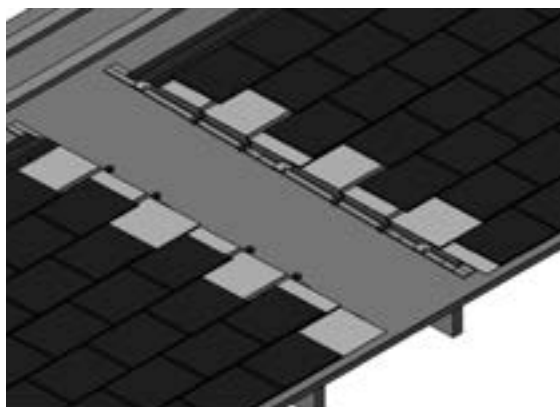
- Balancing valves.
- Connecting batteries with the same number of collectors and using the reversed return piping design. An example for a 20m solar field is given below.

+ This example also shows the minimum accessories that need to be included: safety valve to prevent burns in the event of discharges, air bleed valve at the outlet of each battery and shutoff valves at the inlet and outlet of each battery for maintenance and repair work.

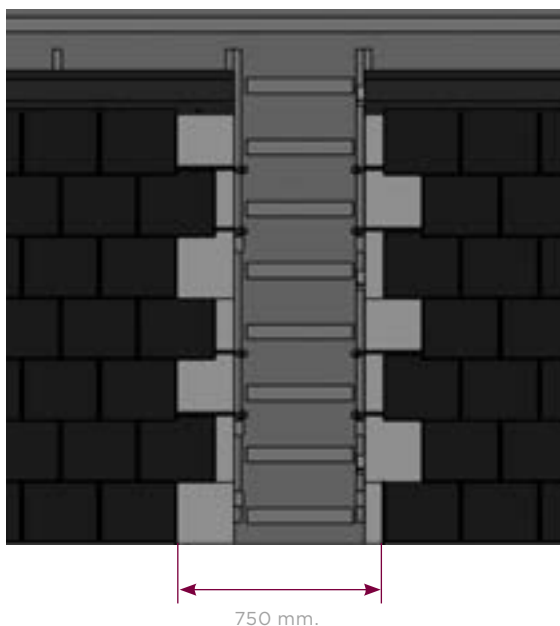


SPACE BETWEEN PARALLEL BATTERIES

+ When parallel batteries are necessary, a specific space between batteries must be left to integrate the complete system into the building. The space is calculated depending on the width of the slate panels and the thickness of the truss used. A simple rule to properly calculate this distance is given below.



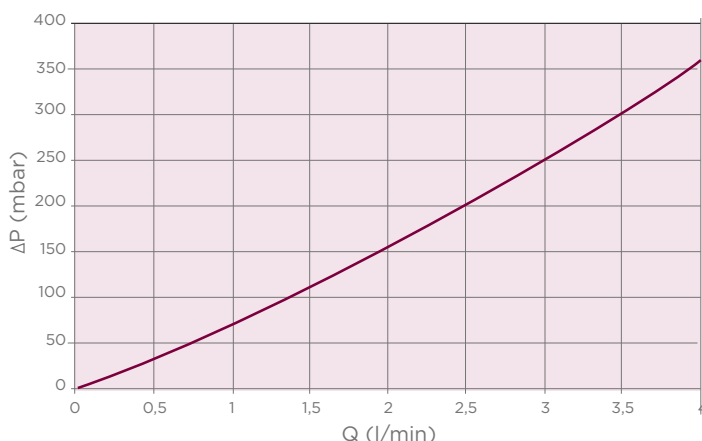
+ CUPA PIZARRAS does not recommend a minimum distance between parallel batteries of less than 750 mm. (distance required to install 3 slate panels). A smaller distance between the batteries could cause problems during installation and affect the slate's strength where it is integrated into the building.



PIPE DIAMETER

- + The pipe diameter depends on the installation's design flow rate. Regulations in force must be fulfilled.
- + The recommended design flow rate for this collector must be between 42 and 84 l/hm² (ask the technical department for possible series/parallel arrangements).

PRESSURE DROP INFORMATION

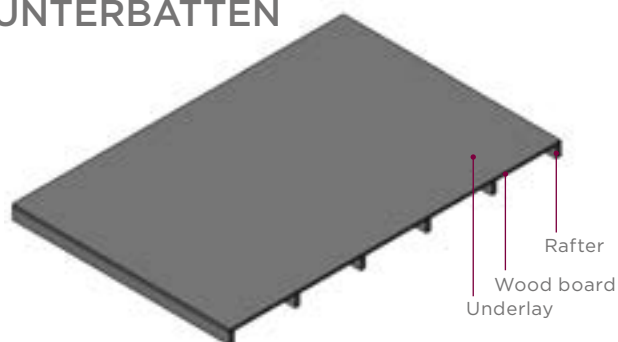


- + The pressure drop of the collector at 3L/min and 25°C is 130 mbar / 25kPa. See graph below for pressure drops at flow rates up to 4 l/min.

INSTALLATION PROCEDURE ON BOARDED ROOF

1

AUXILIARY BATTEN AND COUNTERBATTEN



OPERATING FLUID

+ Water with additives will be used as the operating fluid in the primary circuit. The additives must be anti-freeze with anti-corrosion properties.

+ They must not pose any health or environmental risks, in other words, they must not be toxic, irritate skin or eyes or contaminate water, and they must be completely

biodegradable. An example of a recommended additive is Antifrogen sol Ht.

+ This additive must be used in the right proportion to protect the system from frost, depending on the local climate and taking the minimum historic temperature as the basis. Precautions must be taken to prevent the anti-freeze fluid from deteriorating

due to high temperatures. These precautions must be checked in accordance with UNE-EN 12976-2.

+ The necessary systems to fill and ensure that the anti-freeze is properly mixed must be available.

+ There should be an auxiliary tank to replace fluid losses in the circuit.

DIRECTION AND GRADIENT

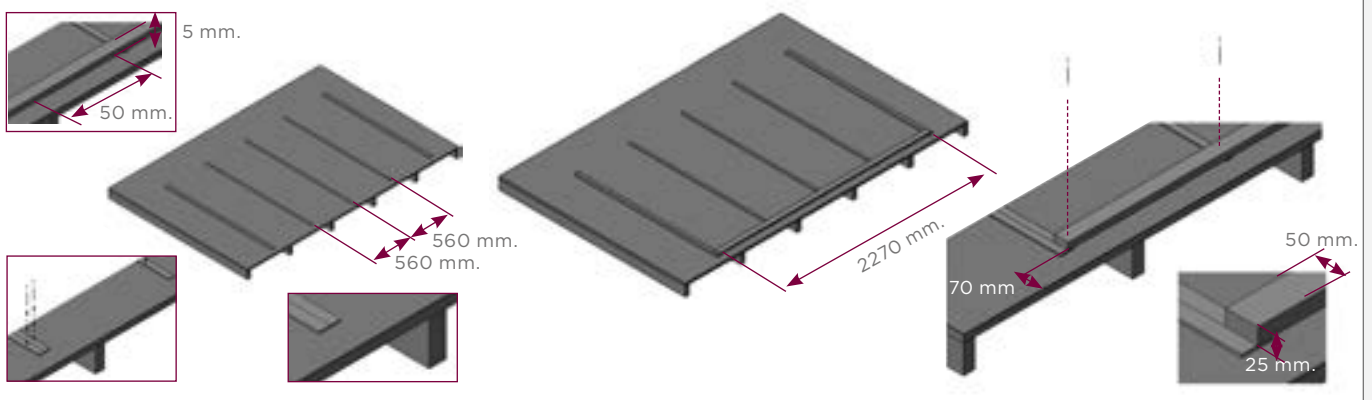
+ The collector should face south.

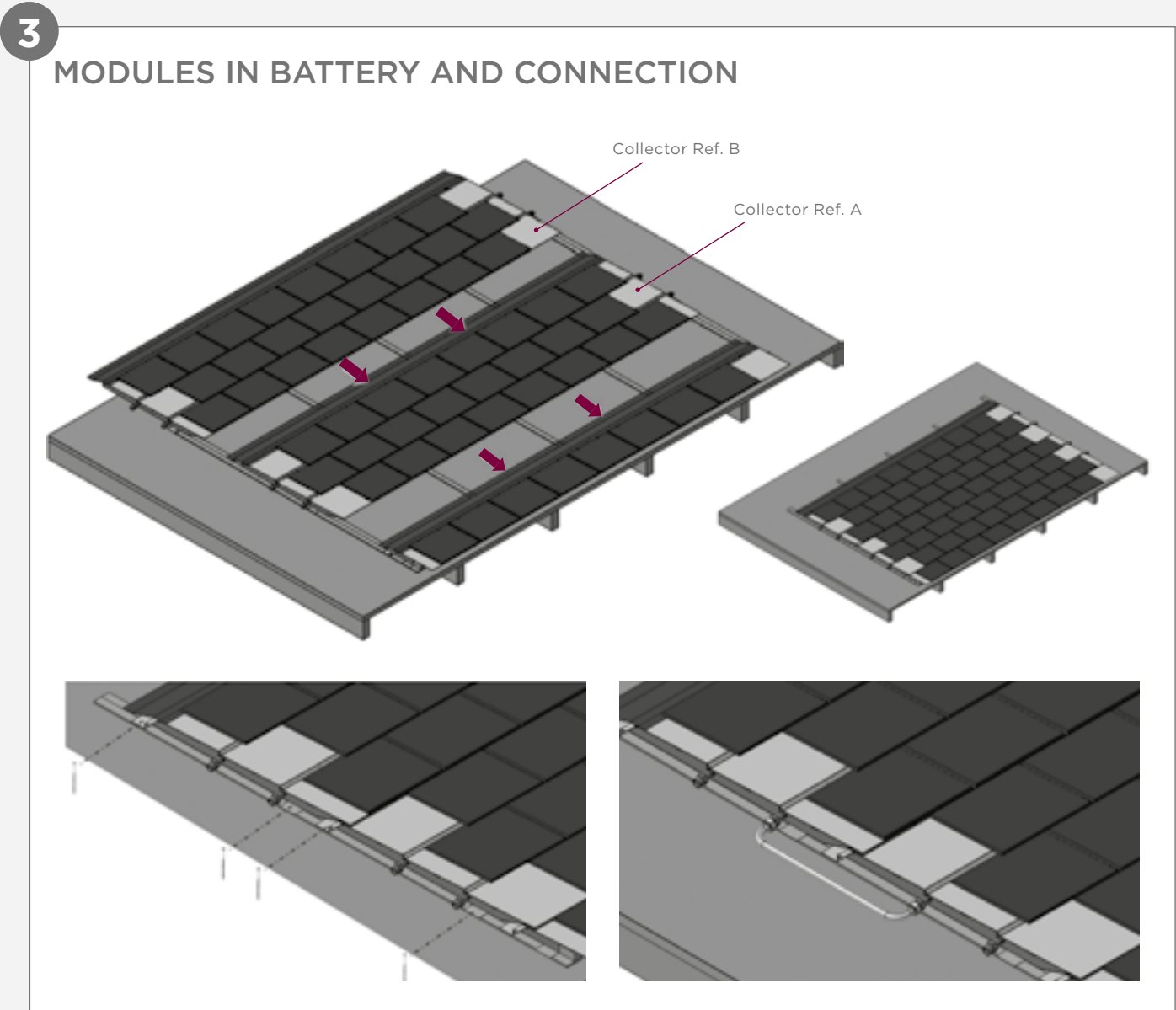
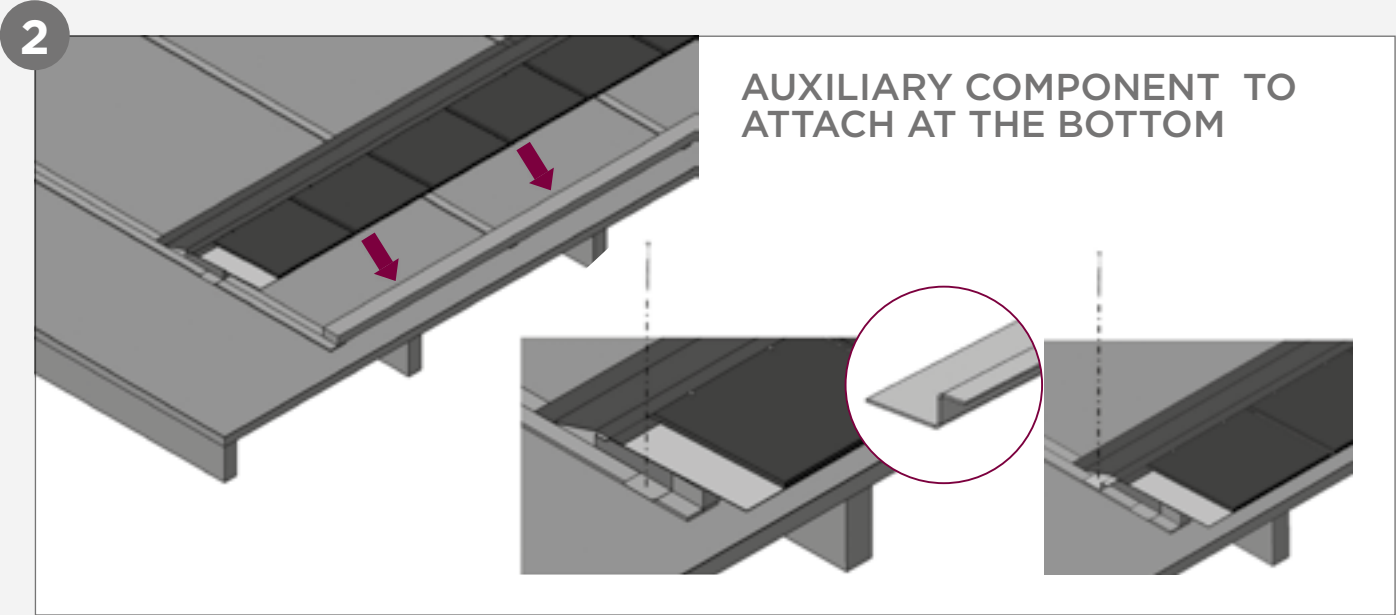
+ The available gradient is between 0° and 90°.

WIND AND SNOW LOADS

+ The collector can take maximum positive wind and snow loads of 3 KPa.

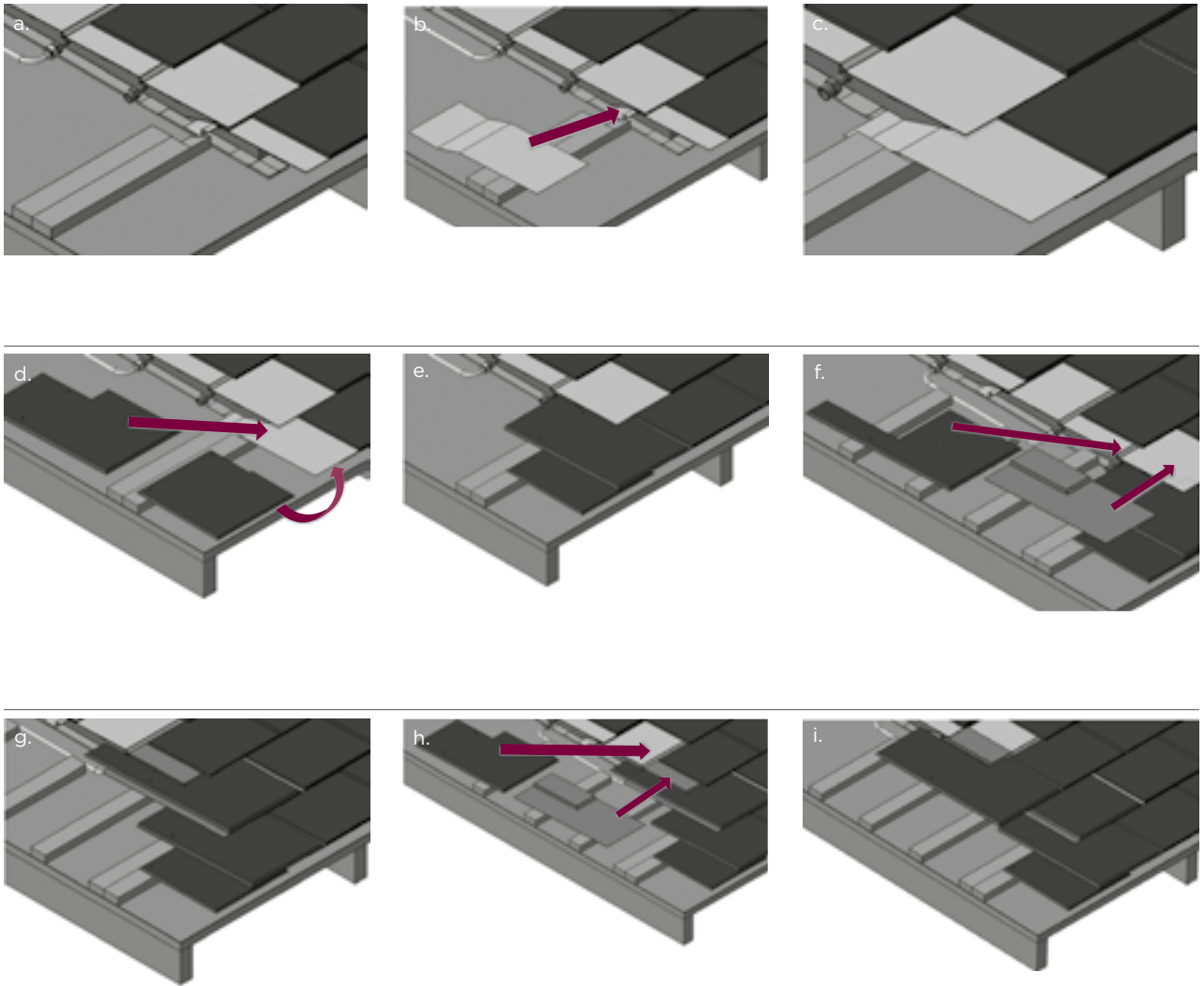
+ The maximum negative wind load that the collector can take is 3.5 KPa.





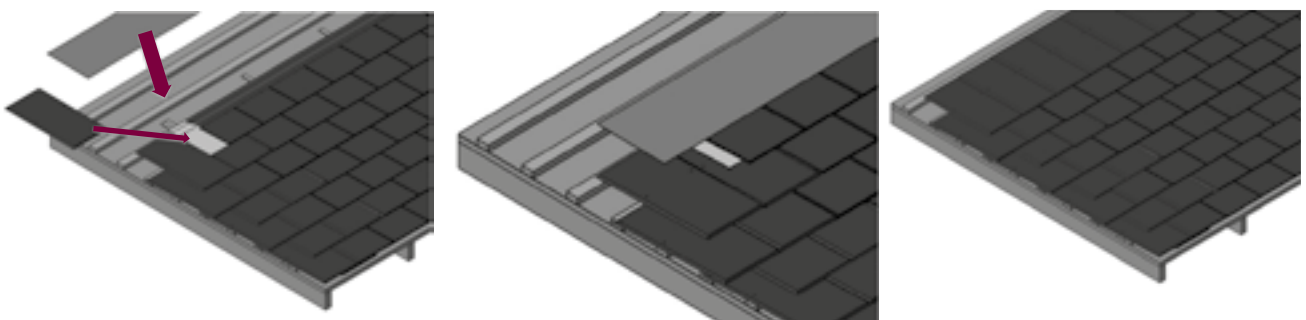
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INTEGRATION USING THE TRADITIONAL ARRANGEMENT



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AUXILIARY COMPONENT TO ATTACH AT TOP

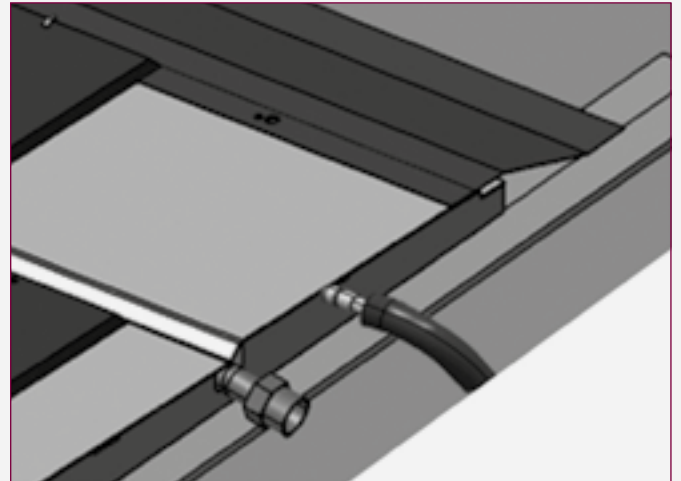
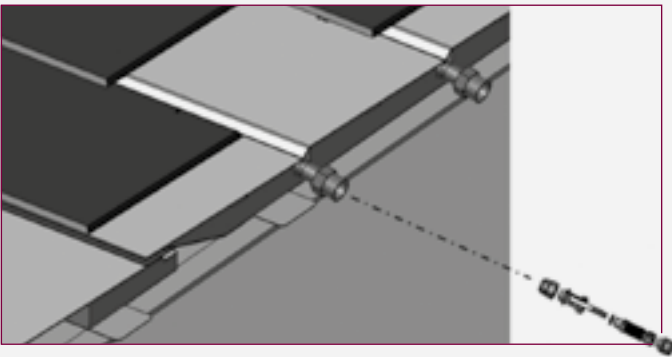


RECOMENDATIONS

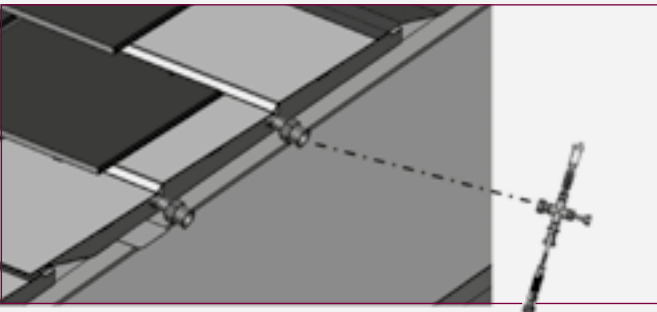
Several collectors arranged in series in parallel is called a battery. Each collector battery includes a series of elements that must be installed for proper operation, maintenance and checking.



+ A shutoff valve will be placed at the battery inlet to isolate the battery from the rest of the installation.



+ At each battery outlet an air bleed valve must be fitted to purge air and a shutoff valve to isolate the battery in the event of a failure or maintenance work.



+ An anti-vibration hose is recommended at the inlet and outlet of each battery to absorb possible thermal dilation.

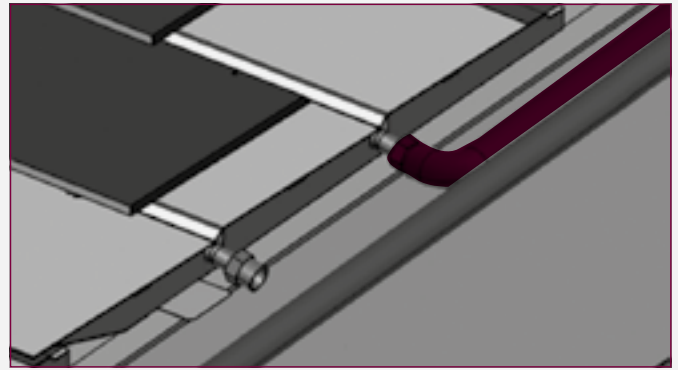
+ The collectors will be connected to each other using a mechanical compression fitting to ensure that the joint is sealed without the need for seals. Two wrenches will be required to tighten this joint, one to hold the fixed part and the other to tighten the loose nut into place.

+ The collectors must be mounted to avoid the system being empty during maximum solar radiation hours.

+ The system must be filled during low solar radiation hours.

+ The installation will be controlled by installing a probe at the point where the insulation and the absorber of the highest panel in the battery are joined laterally. Proper contact with the absorber must be ensured for efficient operation.

+ The solar thermal system should be laid out on the roof before the work commences. The point where the primary circuit pipes enter the loft must be taken into account to avoid this point interfering with the installed panels. In the case of new builds, the location of drainpipes must be considered during the design stage to avoid problems during the construction work. The point of entry into the loft must be completely sealed once installation is complete.



MAINTENANCE INSTRUCTIONS

To ensure that THERMOSLATE™ operates efficiently, overall maintenance is required, which can be divided into 2 different procedures.

+ This procedure includes all of the activities to ensure that the collector's operational values are correct throughout the system's service life. It consists in checking the main functional parameters to make sure that the collector panels are in a good state of repair. The user usually carries out this procedure. Advised by the fitter, he/she will check component performance and state of repair. The activities and schedule are described in the table below.

+ This refers to activities to repair flaws detected in the preventive supervision plan and to prevent major damages or incidents. Authorised workers must carry out this maintenance procedure in accordance with regulations for this type of system.



MANUFACTURE

The panel THERMOSLATE™ is manufactured by CUPA PIZARRAS S.A.

THERMOSLATE

byCUPA

La Medua, s/n 32330 Sobradelo de Valdeorras, Ourense - Spain

Phone +34 988 335 410 | Fax +34 988 335 599

info.cupa@cupagroup.com | www.cupapizarras.com



THERMOSLATE™ solar roofing system is patented and manufactured by CUPA