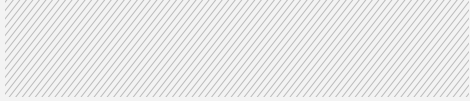


THERMOSLATE

byCUP4

INSTALLATION AND MAINTENANCE MANUAL | NATURAL SLATE SOLAR PITCHED ROOFING SYSTEM

October 2011



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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.

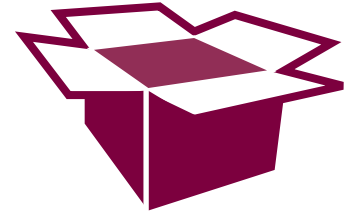


SAFETY WARNINGS

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 solar cell specifications

Empty weight (kg)	24.5
Fluid content (l)	0.45
Heat carrying fluid	Water + propylene glycol
Recommended flow (kg/s)	0.03-0.06*
Pipe configuration and diameter (mm)	Grille Ø 2.8 mm**
Recommended working pressure (bar)	2-4
Maximum working pressure (bar)	6
Maximum working temperature (°C)	100
Minimum installation angle	0°
Maximum installation angle	90°
Resistance to freezing (°C)	-38
Stagnation temperature at 1,000 W/m ² and 30°C (°C)	89.6

* Flow depends on load losses. Series or parallel connection.
**Equivalent diameters.

Mechanical details of modules

Dimensions (tolerance 3 ± 1 mm)	2,574 x 596 mm
Maximum height (tolerance 3 ± 3 mm)	46.7 mm
Pressure per unit of area	max. 0.3 MPa

Efficiency details

Efficiency tests	Inst. Giordano
Certification	Solar Keymark
Optical performance factor	0.861
Loss factors	a1 13.552 W/(m ² K) a2 0.054 W/(m ² K)

Reference areas

Absorber area (m ²)	1.24
Opening area (m ²)	1.12
Total area (m ²)	1.48

Working fluid

Type	Propylene glycol with anti-corrosion properties
Composition and additives	Propylene glycol and water
Density (g/cm ³)	1.06

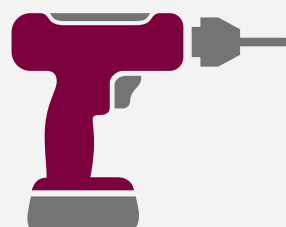
INSTALLATION

CONNECTION BETWEEN SOLAR CELLS

THERMOSLATE™ can be connected in series or in parallel, forming batteries. The number of solar cells connected in the two cases will depend on the installation site and conditions.

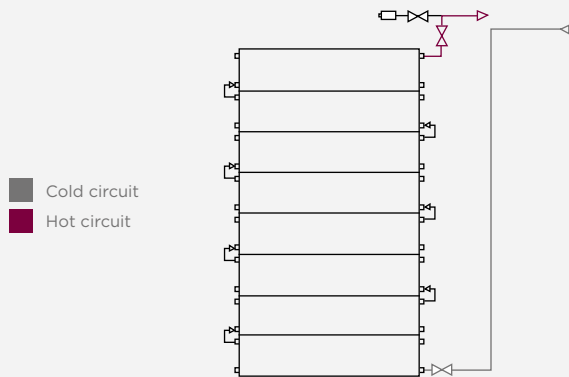
CONNECTION BETWEEN BATTERIES

The solar cell surface can be multiplied by connecting the solar cell batteries in parallel. Parallel connection of batteries increases the final performance of the system.

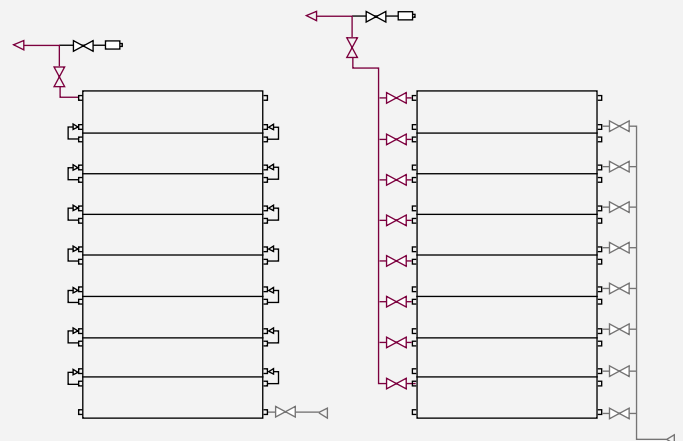


+ CUPA PIZARRAS advises against installing more than 8 panels in series.

+ Parallel connections can be made with internal connections between solar cells or by using external flow pipes.



CONNECTION IN SERIES



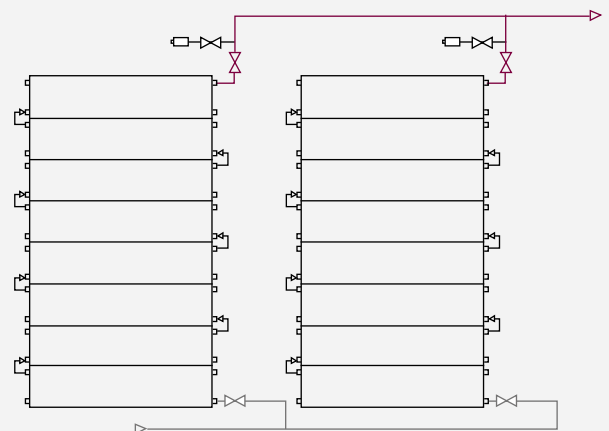
CONNECTION IN PARALLEL

+ For optimum operation of all batteries in the system, assembly must be carried out in such a way that they are hydraulically balanced. The hydraulic balance of a complete system is obtained in two different ways:

- Balancing valves.
- Connecting batteries with the same number of solar cells and using a reverse return pipe design. You will find an example for a solar field of 20m² below.

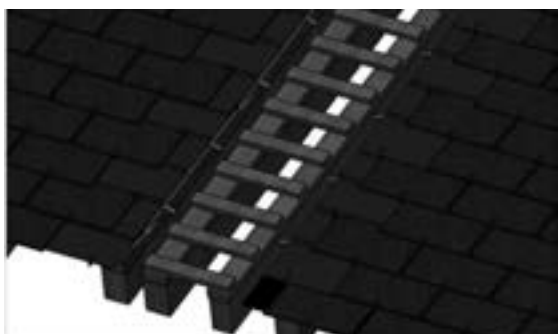
+ The example bellow also shows the minimum additional elements that must be included: pipe safety valve to prevent burns in the case of discharge, air release valve at the exit from each battery and shut-off valves at the entrance and exit to each battery to make maintenance and repair operations easier.

■ Cold circuit
■ Hot circuit

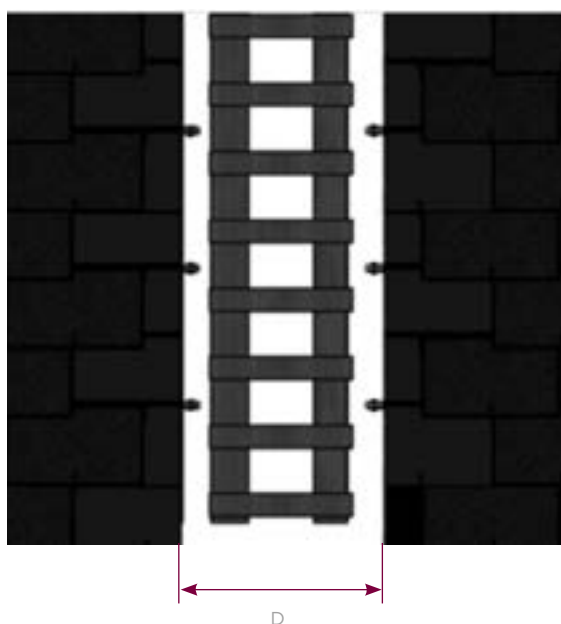


SPACE BETWEEN PARALLEL CONNECTED BATTERIES

+ In the case of installations requiring parallel battery connection, a distance must be determined between batteries to allow the whole solar cell system to be properly architecturally integrated. The space required is calculated depending on the length of the slates and the thickness of the hooks used. Below, you will find a simple rule to be applied to define the separation space properly.



+ CUPA PIZARRAS recommends never establishing a separation between parallel batteries of less than 670 mm (distance necessary for installing 3 slates). Using a smaller distance between batteries can lead to difficulties during installation and damage the strength of the slate in the integration area.



D = No. of slates between batteries x 225 mm

PIPE DIAMETER

+ The pipe diameter depends on the design flow of the installation. Applicable regulations must be followed.

+ The recommended design flow for this solar cell is between 42 and 84 l/hm² (find out about the possible series/parallel configurations from the technical department).

PIPE DIAMETER FOR SERIES CONNECTION OF BATTERIES OF PANELS:

Number of solar cells	Pipe diameter (mm)
1-4	12
5-8	14

For a flow of 30l/hm²

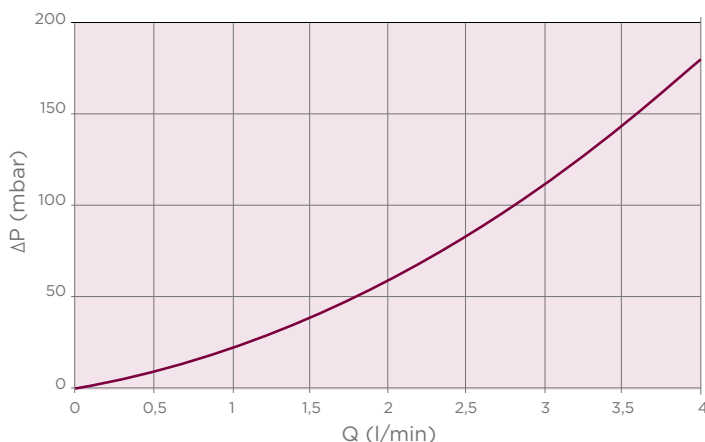
PIPE DIAMETER FOR PARALLEL CONNECTION BATTERIES OF PANELS:

Number of solar cells	Pipe diameter (mm)
1-4	14
5-8	18
9-12	20

For a flow of 60l/hm²

LOAD LOSS

+ The load loss of the solar cell at 3l/min t 25 °C is 130 mbar / 25kPa. See the graphic for load losses with flows of up to 4 l/min.



WORKING FLUID

- + The working fluid used in the primary circuit will consist of water and additives.
- + The additives are antifreezes with anti-corrosion properties.
- + They must not represent any risk to health or to the environment, they must not be toxic or irritate the skin or eyes or pollute water and they should be fully biodegradable. As an example, the use of additives such as **Tyfocor -LS** or **Antifrogen sol Ht** is recommended.
- + This additive must be used in the right proportions so that, depending on the climatic zone and based on the minimum historical temperature, the installation is protected against freezing.
- + Precautions must be taken to prevent any deterioration of the antifreeze fluid caused by high temperatures. These precautions must be reviewed in accordance with UNE-EN 12976-2.
- + The installation will be provided with the systems necessary to make refilling easy and to ensure that the antifreeze is properly mixed.
- + It is advisable to have an auxiliary reservoir to replace possible fluid losses in the circuit.

ORIENTATION AND INCLINATION

- + A southward orientation of the solar cell is recommended.
- + The solar cell can be installed at between 0° and 90°.

AUTHORIZED WIND AND SNOW LOADS

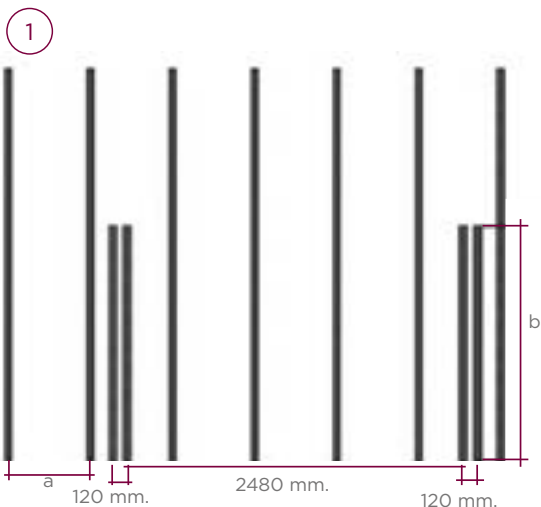
- + The solar cell allows maximum positive wind and snow loads equivalent to 0.3 MPa.
- + The maximum negative wind load authorized for the solar cell is equivalent to 3.6 KPa.



ASSEMBLY PROCEDURE



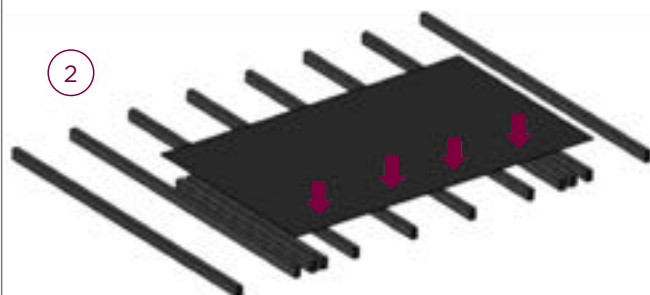
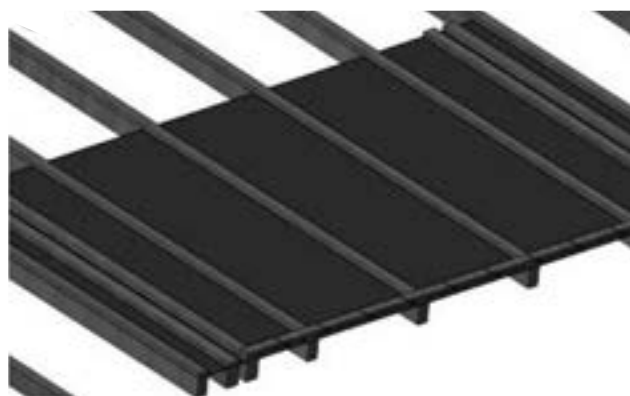
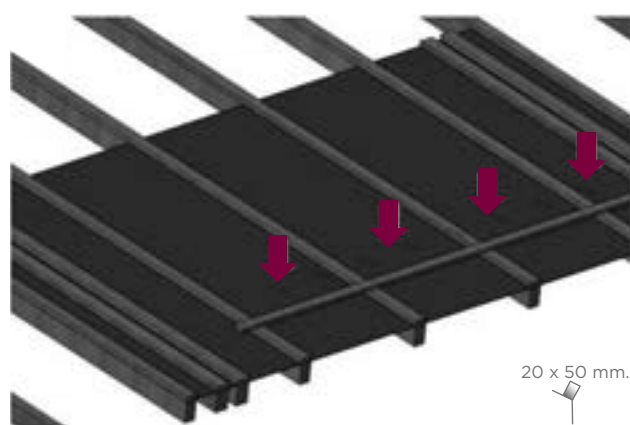
1 ORIENTATION AND INCLINATION



$a = 600 \text{ mm.}$

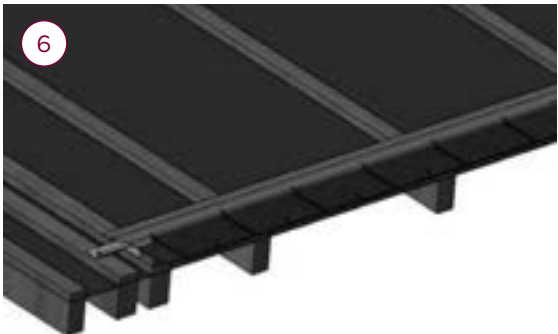
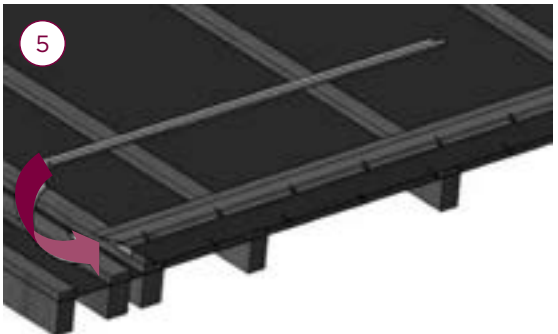
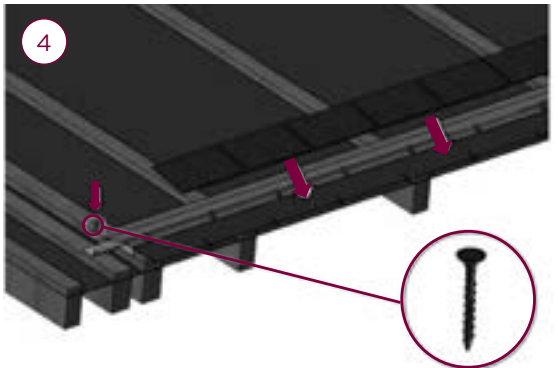
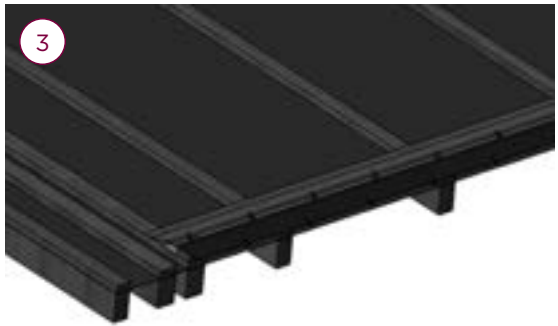
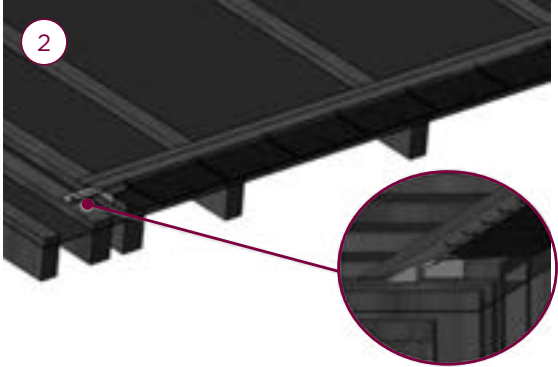
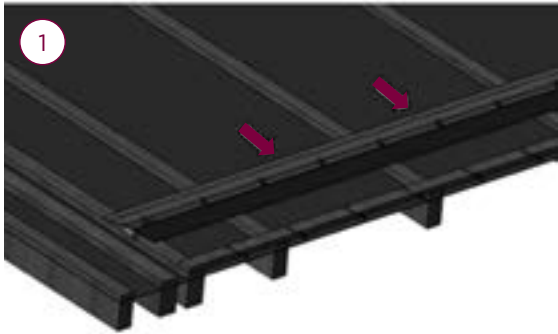
$b = \text{No. solar cells} \times 480 \text{ mm} + 200 \text{ mm.}$

2 FIRST BATTEN AND VERTICAL BATTENS



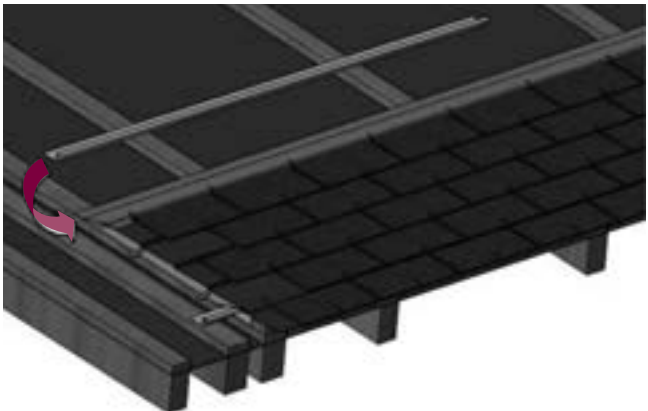
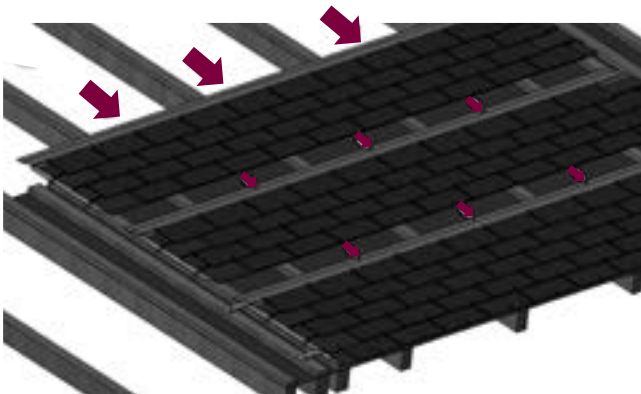
3

AUXILIARY INTEGRATION PIECE (BOTTOM)



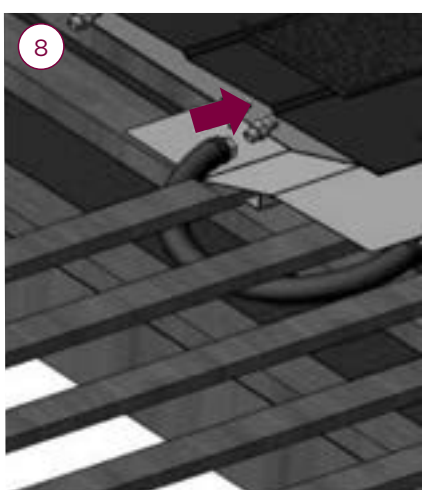
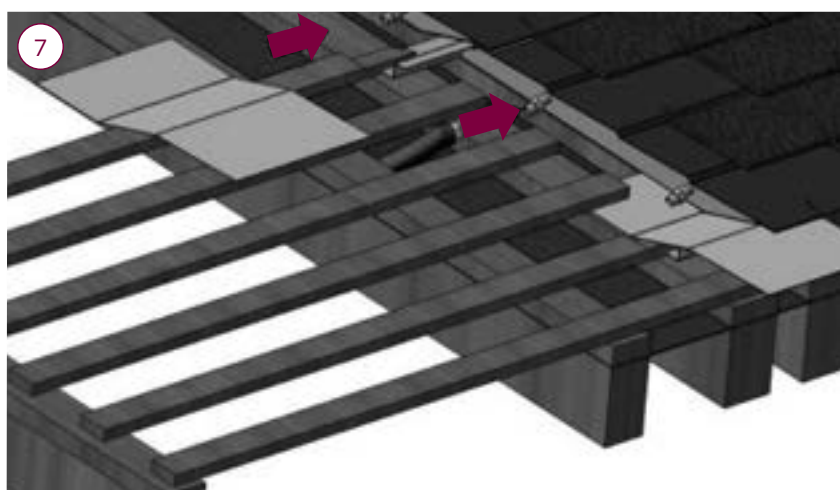
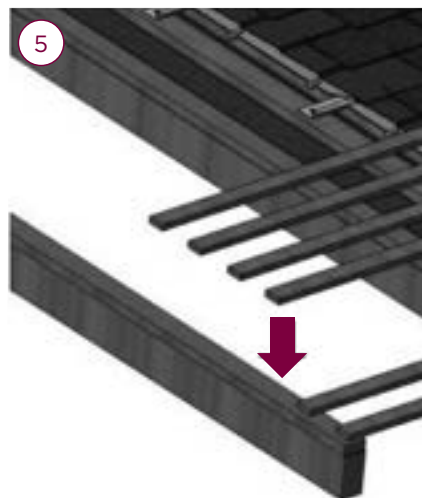
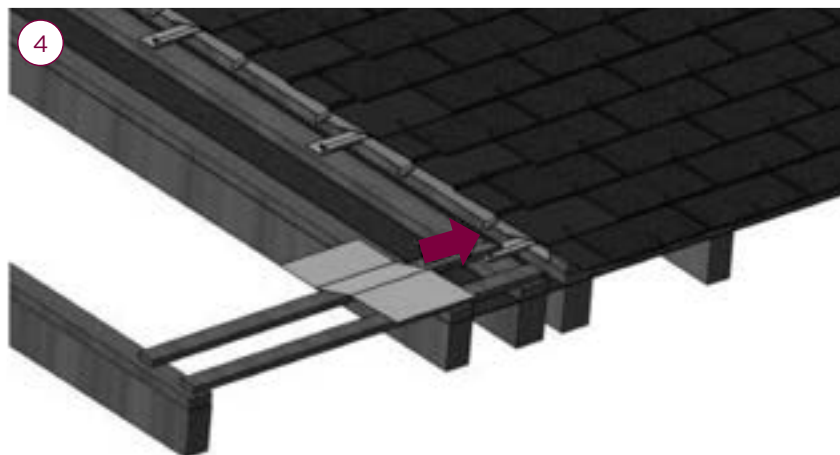
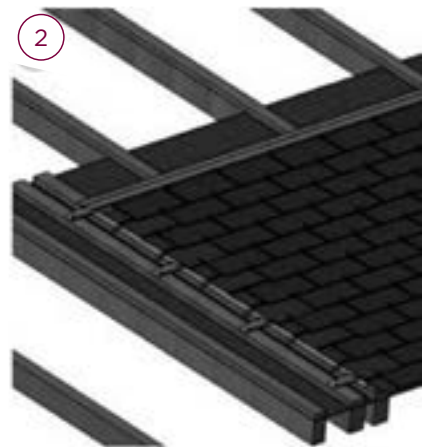
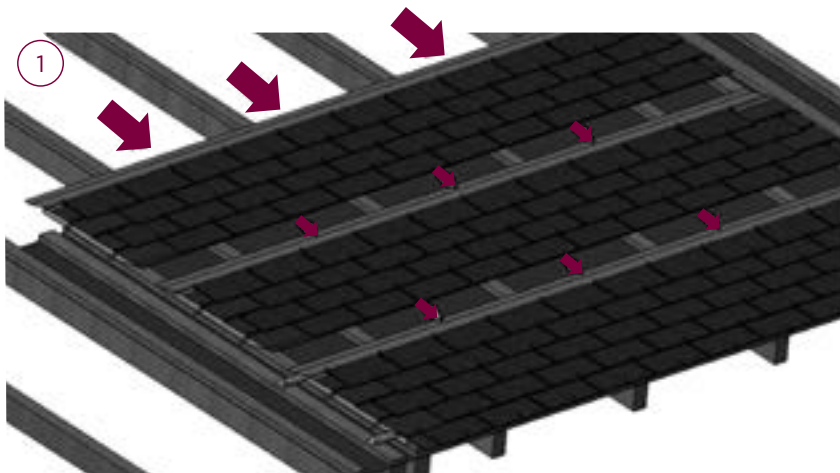
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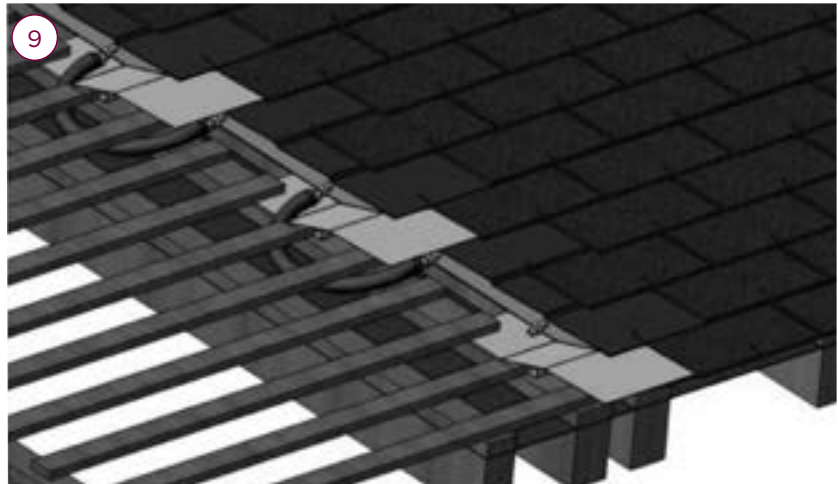
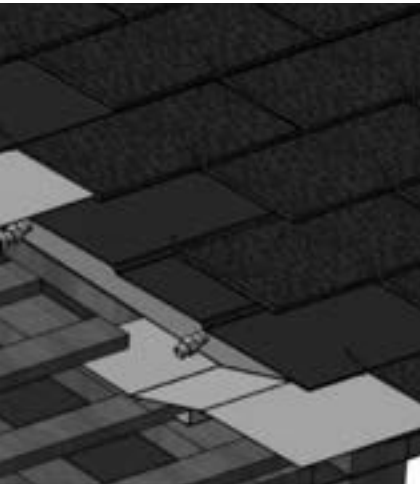
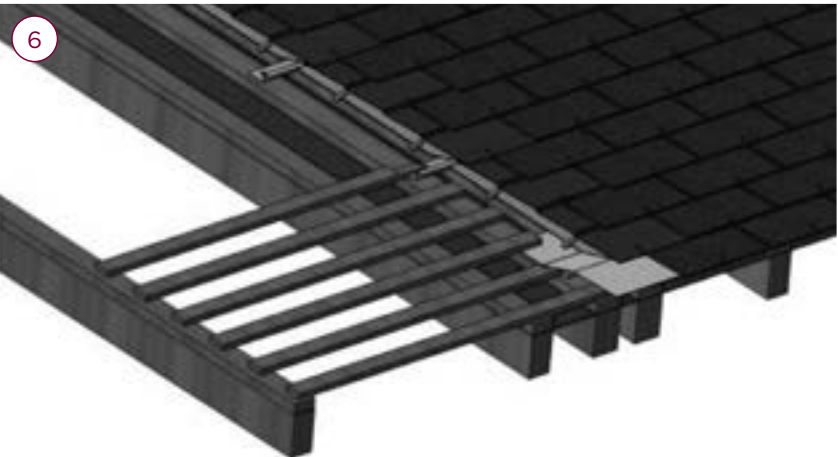
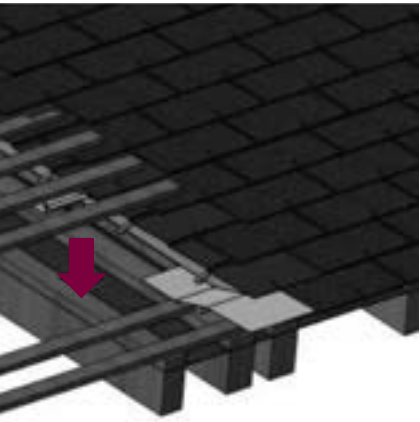
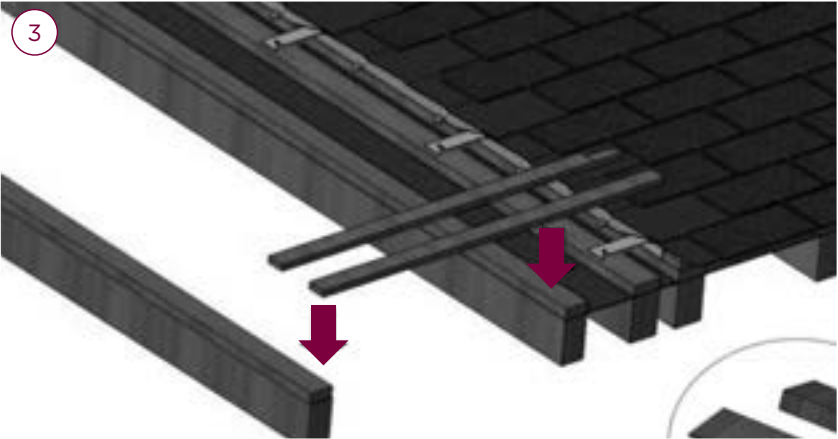
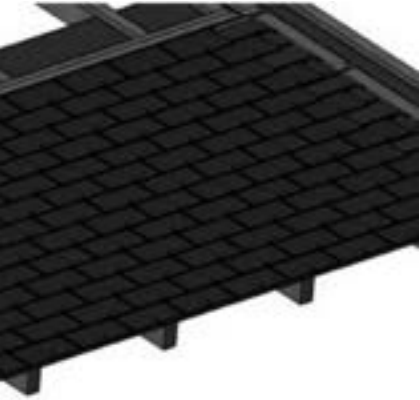
FIRST SOLAR CELL IN THE BATTERY



5

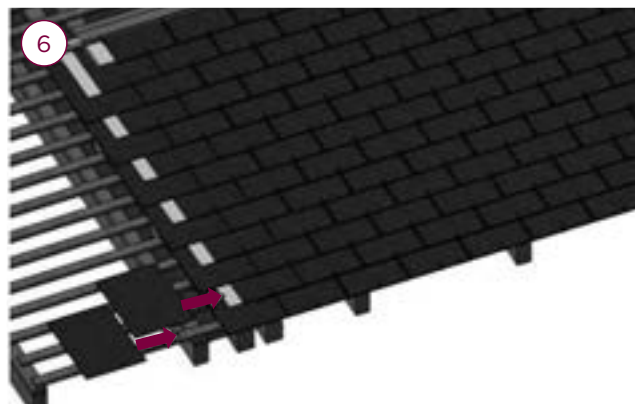
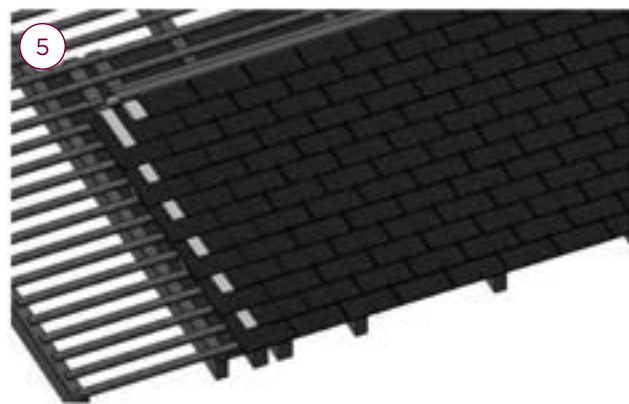
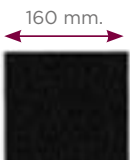
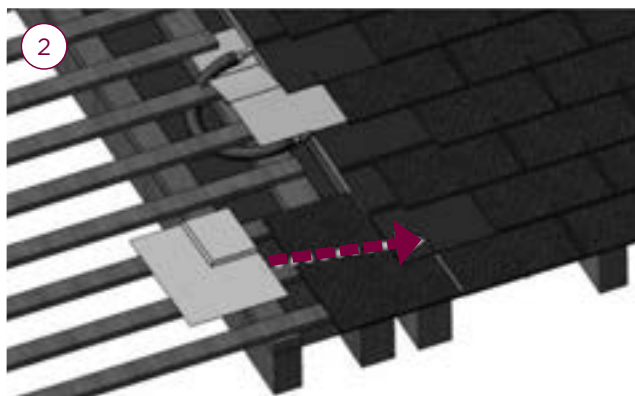
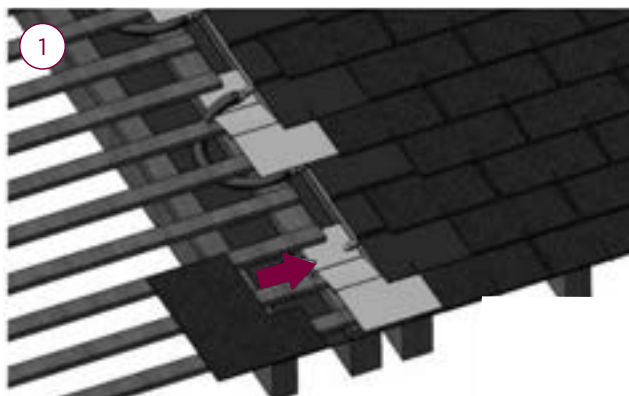
SECOND AND SUCCESSIVE SOLAR CELLS CONNECTION





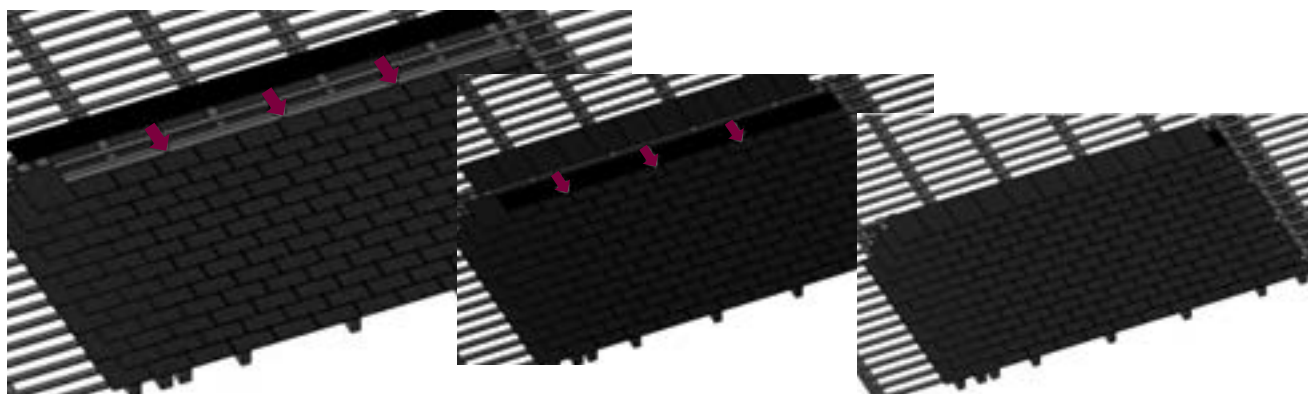
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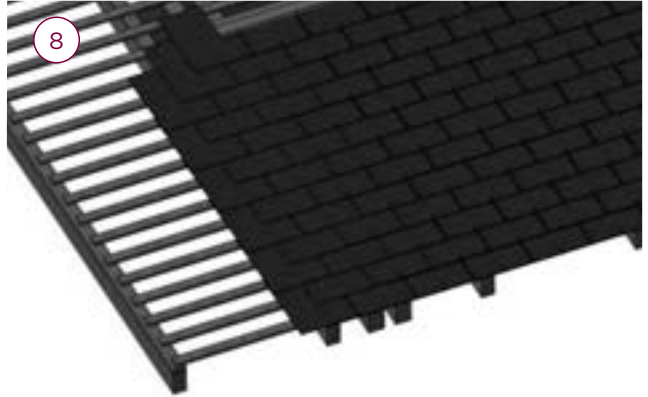
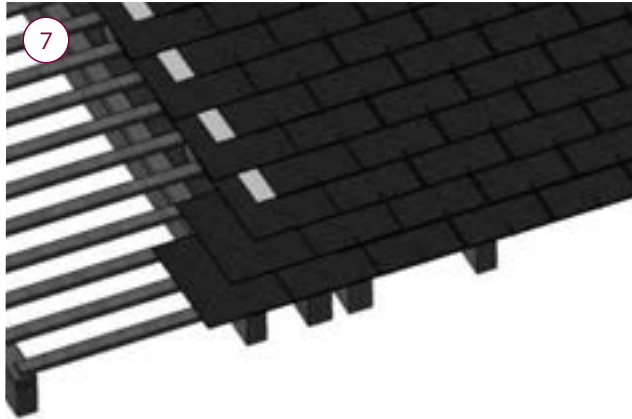
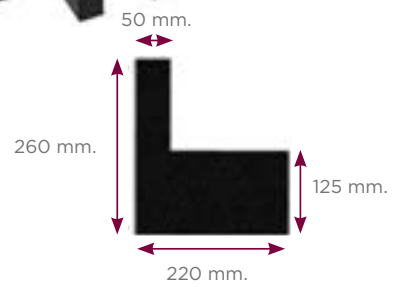
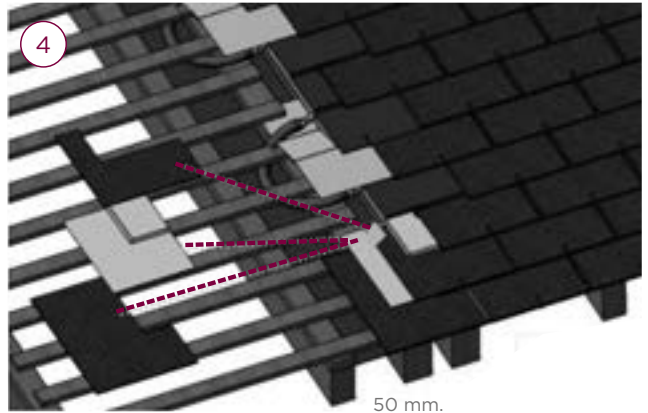
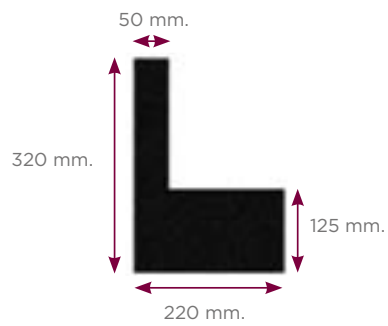
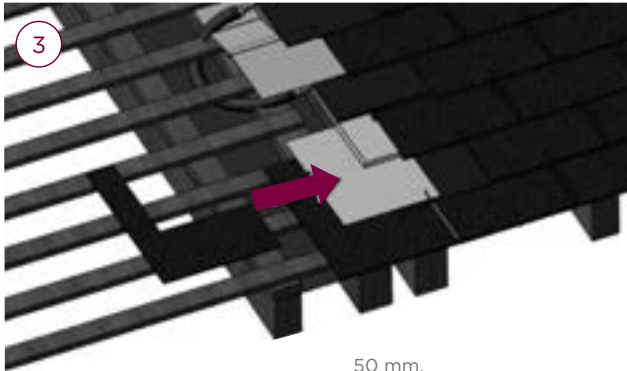
INTEGRATION WITH TRADITIONAL ROOF



7

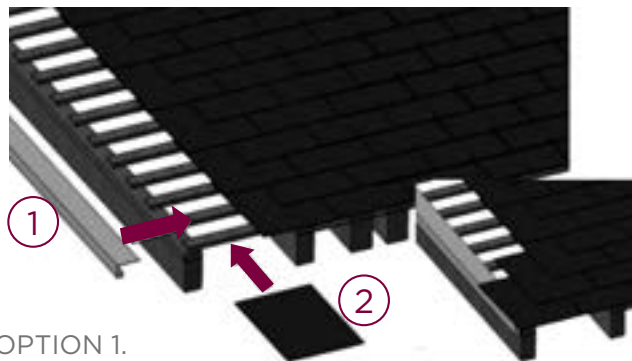
AUXILIARY COMPONENT TO ATTACH AT TOP



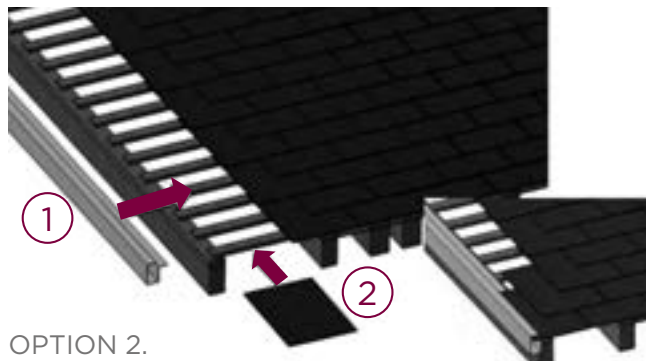


8

SIDE GUTTERING



OPTION 1.



OPTION 2.

RECOMMENDATIONS

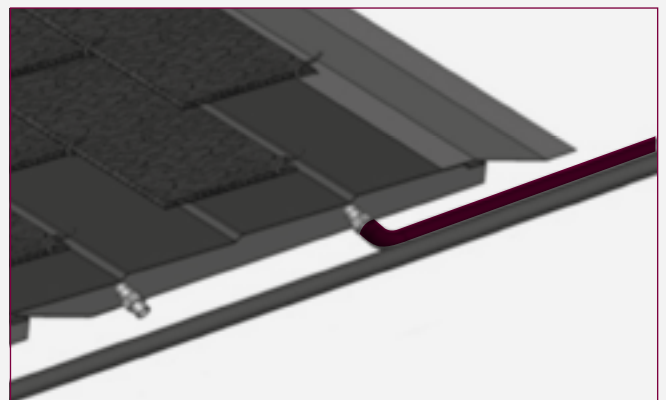
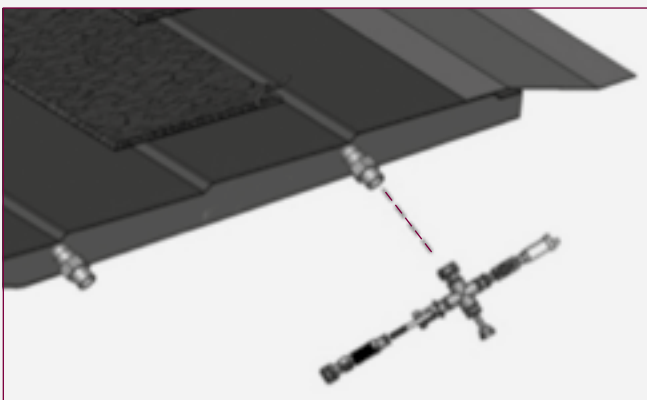
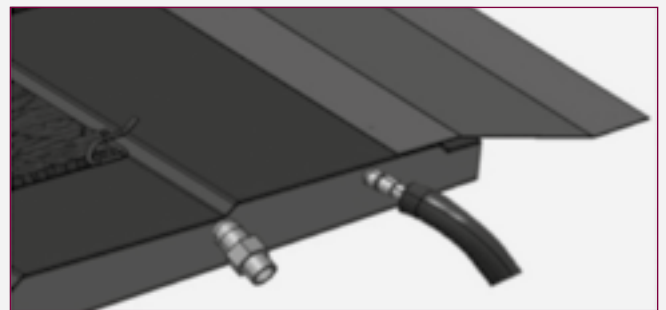
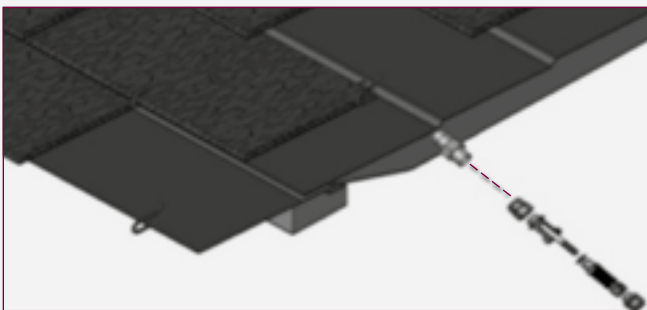
Several solar cells fitted in series or in parallel are called a “battery”.

Each battery of solar cells consists of a series of elements which must be installed for proper operation, maintenance and control.

+ At the entrance to the battery, a shut-off valve will be installed to isolate the battery from the rest of the installation.

+ At the exit from a battery, an air release valve to extract air and a shut-off valve to isolate the battery in case of malfunction or maintenance must be installed.

+ The installation will be controlled using a probe installed in the lateral line linking the isolation and the absorber of the highest panel in the battery. For proper operation, the existence of an effective contact with the absorber must be ensured.



+ You are recommended to install an extendible pipe to absorb possible thermal dilation at the exit from each battery.

+ The solar cells must be assembled in such a way as to prevent the installation becoming empty during the hours of maximum sunshine.

The installation must be refilled during hours of weak sunshine.

+ It is recommended to carry out a thermal solar installation study on the roof before starting work. The entry point of the primary circuit pipes on the roof must be taken into account so that this point does not interfere

with the panels installed. In the case of work on new buildings, you are recommended to study the position of the pipes at the design stage to avoid problems when the work is carried out. The passage under the roof must be entirely sealed after installation.

MAINTENANCE INSTRUCTIONS

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

PREVENTIVE MONITORING PLAN

+ This process includes all operations making it possible to ensure that the operational values of the solar cell are correct throughout the life of the installation. It is a simple

plan for observing the main operating parameters to ensure that the solar panels are in good condition. The user normally takes care of this process, following the installer's advice.

The user ensures that the elements are in good condition and working properly. The actions to be carried out and how often they should be done are indicated in the table below.

Operation	Frequency	Description
Cleaning	To be determined	Cleaning of the slate roof with water or any detergent
Slate	6 months	Checking visible cracks and/or slippage in the slates
Absorber	6 months	Checks on oxidization, deformation, etc.
Connections	6 months	Checks for possible leaks

CORRECTIVE MAINTENANCE

+ This involves operations that must be carried out to correct anomalies detected after the activities in the preventive

monitoring plan are carried out and to prevent deterioration or more serious problems with the panels. This maintenance

will be entrusted to approved personnel, in accordance with the regulations concerning this type of installation.



MANUFACTURE

THERMOSLATE™ is manufactured by CUPA PIZARRAS, S.A.

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THERMOSLATE™ solar roofing system is patented and manufactured by CUPA