

SolarBox

Thermodynamic Solar System for DHW

Installation Manual

SYMBOLS

The entire process the supplier believes may imply danger of personal injury and/or material damage shall be marked with a DANGER SIGN.

As a means of further classifying the danger, the symbol will be accompanied by one of the following words:

- **DANGER:** when the operator and/or people in the vicinity of the equipment are subject to personal injury.
- **WARNING:** when the equipment and/or nearby materials are subject to material damage.

All the information the supplier believes may contribute to the enhanced performance and conservation of the equipment shall be marked with the information sign.

PRE-INSTALLATION

- The electrical installation of the equipment should comply with national regulations on electrical installations in force.
- **SolarBox** will only work after receiving the respective cooling load.
- The maximum admissible water pressure at the input to the hydraulic circuit is 300 kPa.
- Electrical power: 230V, 50 Hz
- If the power cable is damaged, it should be replaced by the manufacturer, the post-sales service or similar qualified personnel in order to avoid danger.
- **SolarBox** will only work if the tank has been filled with water.
- This appliance should not be used by persons (including children) with physical, sensorial or mental disabilities, or with a lack of experience or expertise, unless supervised by someone liable for their safety, or in the event the same have been trained in relation to how the equipment works.

SAFETY

The installer should notify the customer of how the equipment works, the inherent dangers, and the rights and obligations of the customer.

The installation of thermodynamic equipment geared to heating sanitary water should be performed by personnel who are qualified and skilled in relation to the same.

The appliance should not be installed in locations subject to the risk of impact or explosion.

Keep the equipment in its packaging until the time of installation.

Ensure all hydraulic connections are duly watertight prior to turning on the electrical power.

The gas used in the entire process is R134a, free of CFCs, non-flammable and harmless to the ozone layer. Thus, the gas present when this equipment is used may not be released into the atmosphere by law.

The gas present when this equipment is used should be handled by a qualified technician.

SAFETY (cont.)

Maintenance of the equipment should be carried out by the support service, performing the general and continuous cleaning operations, which may/should be executed by the users themselves.

The electrical power of the equipment should always be turned off during maintenance operations.

The supplier recommends the equipment be inspected at least once a year by a qualified technician.

The operating principles of this equipment are directly associated with high temperatures and pressures, thus all the processes involved with the equipment should be designed to avoid the risk of burns and explosion.

OPERATING PRINCIPLE

The **SolarBox** Thermodynamic Solar System is a piece of equipment based on the principle of cooling by compression – the Carnot principle – which we have named **Thermodynamic Solar Systems:** Solar Panel and a Heat Pump. The **solar panel**, which is the main component, placed outdoors, ensures the capture of energy from:

- ✓ Direct and diffuse solar radiation
- ✓ Outdoor air, via natural convection
- ✓ The effect of the wind (almost always existent)
- ✓ Rainwater

The temperature difference caused by the aforementioned external agents ensures the Klea (ecological refrigerant fluid) evaporates inside the solar panel.

The absence of glass in the panel ensures increased heat exchange via convection.

After passing through the panel, the Klea is sucked in by the mechanical component of the system, the **compressor**, raising the temperature and pressure of the same; which in turn is transferred to the water circuit by means of the **panel heat exchanger**.

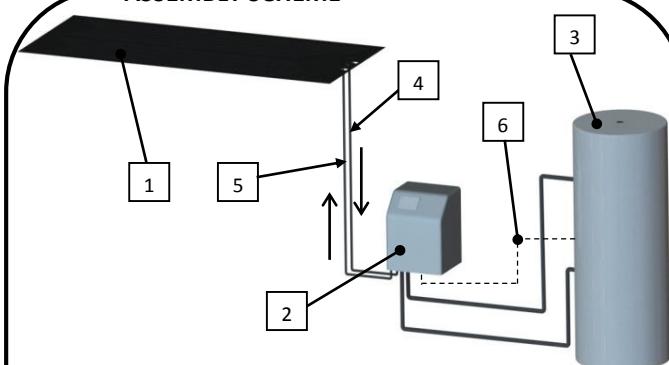
Before the Klea returns to the solar panel the pressure needs to be reduced to guarantee it attains its liquid state once again, thereby completing the cycle.

The ease with which we combine technology and the laws of nature (alteration of the state of a fluid), demonstrates the veracity and potential of **SolarBox**.

COMPONENTS

- 1 Thermodynamic Solar Panel
- 1 SolarBox
- 4 Silentblocks with M6 thread
- 1 "Y" filter
- 4 Screws + 4 Bushings
- 6 Brackets + 6 Screws M6x40 + 6 Bushings + 6 Screws M6x20 + 6 Nut M6 + 12 Washers M6

ASSEMBLY SCHEME



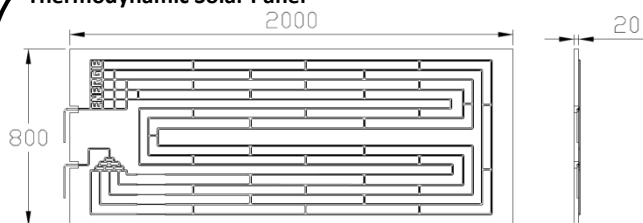
- | | |
|-----|---------------------------|
| [1] | Thermodynamic solar panel |
| [2] | SolarBox |
| [3] | Cylinder |
| [4] | 3/8" suction line |
| [5] | 1/4" liquid line |
| [6] | Temperature Probe |

TECHNICAL FEATURES

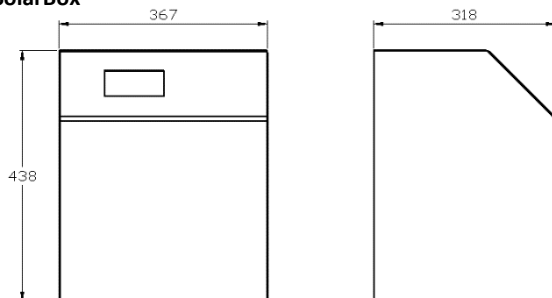
SolarBox		
Thermal power supplied (med-max)	W	1690 - 2900
Power absorbed (med-max)	W	390 - 550
Electrical power	V/Hz	230/50-60
Operating temperature	°C	-2 to 42
Cooling fluid / Load	-/Kg	R134a / 0.8
Maximum water temperature	°C	55
Maximum operating pressure (water)	bar	7
Weight	Kg	23,5
Size of the packaging	a x l x p	470 x 400 x 400
Hydraulic connections (input output)	Inches	1/2" 1/2"
Refrigerant connections (input output)	Inches	3/8" 1/4"
Thermodynamic Solar Panel		
Weight	Kg	8
Size of the packaging	a x l x p	2200 x 810 x 30
Refrigerant connections (input output)	Inches	1/4" 3/8"
Tank Requirements		
Maximum Tank Capacity	lts	300
Minimum Coil Area (when using backup connections)	m²	1,5

DIMENSIONS

Thermodynamic Solar Panel



SolarBox



INSTALLATION

Thermodynamic Solar Panel

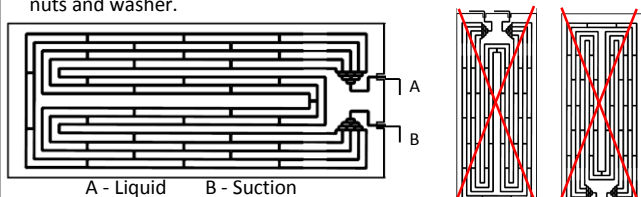
The location and the angle at which the panels are installed must be taken into account. In order to take full advantage of the solar radiation in question, the panels should be set at an angle of between 10° - 85° to the ground, and preferably pointing south.

The panel comes with six M8 holes on the side flaps. The distance between the holes at the location where the panel is to be placed should coincide with the holes in the panel.

The equipment comes with 3 small and 3 large brackets which should be fixed in order to give the panel the desired angle.

The brackets should be fixed to the base (e.g. a tile) using the plastic nut and self-threading M6 screw supplied.

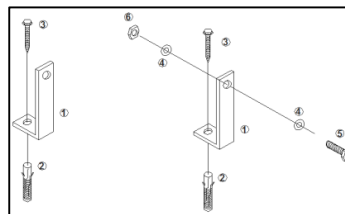
The panel is fixed to the brackets using the M6 screws and respective nuts and washer.



WARNING

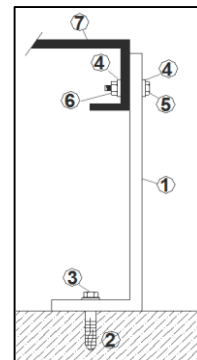
The panel should always be installed downwards, with the connections facing down.

INSTALLATION (cont)



Fixing the brackets

- [1] Aluminium bracket
- [2] Bushing
- [3] Self threading screw M6x4
- [4] Washer M6
- [5] Screw M6x20
- [6] Nut M6
- [7] Panel



Fixing the bracket to the panel

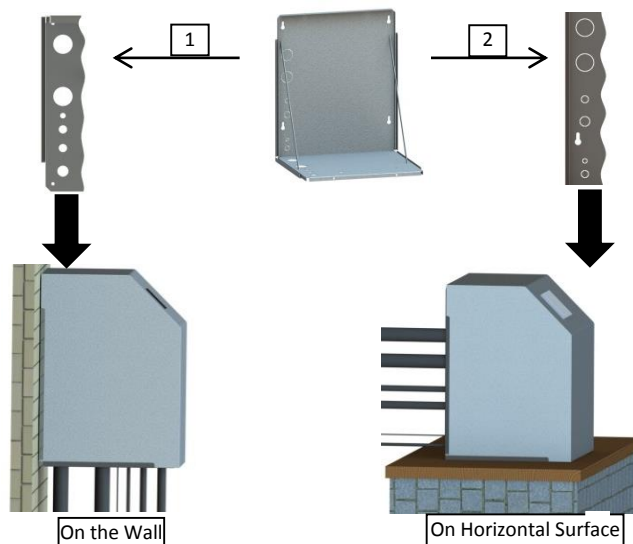
SolarBox

SolarBox may be fixed to a wall using the four holes in the back or placed on a horizontal surface using the four silentblocks. In either case, the device should be correctly levelled. SolarBox has holes at the bottom (1) and half-holes in the back (2).



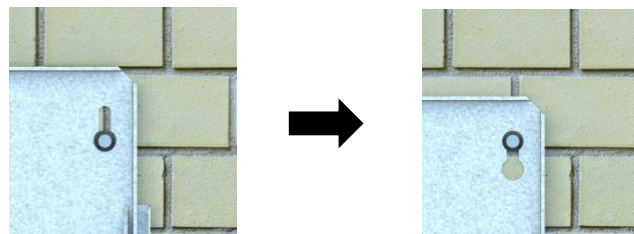
WARNING

When installing SolarBox, ensure the wall in question is capable of supporting the weight of the same.



Fixing SolarBox to the Wall

- 1 – Make four holes to receive the nuts corresponding to the four M6 flanged screws included in the packaging.
- 2 – Screw in the screws leaving a distance of approximately 3mm between the wall and the flange of the screw.
- 3 – Align the SolarBox and rest the same gently on the 4 screws.



- 4 – Tighten the screws until they are in contact with the structure.
- 5 – Secure the connections underneath the structure.

Placing the SolarBox on a horizontal surface

- 1 – Lay the structure on a level and stable surface, checking the four anti-vibratory brackets have been duly mounted.
- 2 – Remove the half holes from the rear of the structure by twisting the metal part you wish to remove.
- 3 – Secure the connections on the rear of the structure.

INSTALLATION (cont.)

Refrigerant Connections – Thermodynamic Panel



WARNING

The refrigerant connections should be dealt with by a qualified technician holder of a professional skills certificate for the purpose.



The thermodynamic unit holds a pre-load of R134a fluid.

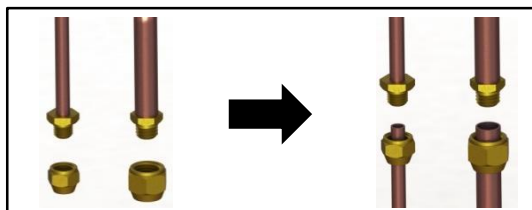


WARNING

The refrigerant connections should be thermally insulated in order to avoid burns and to ensure the maximum performance of the equipment.

PIPE DIAMETER			
VAPOUR (suction)		LIQUID (to the panel)	
mm	inch	mm	inch
9,52	3/8"	6,35	1/4"

- Prepare the copper tube, removing the protective caps from the ends.
- Place the end of the tube face-down, cut the tube at the desired distance and clean any frayed edges.
- Remove the nuts from the connections and place them on the side of the tube.

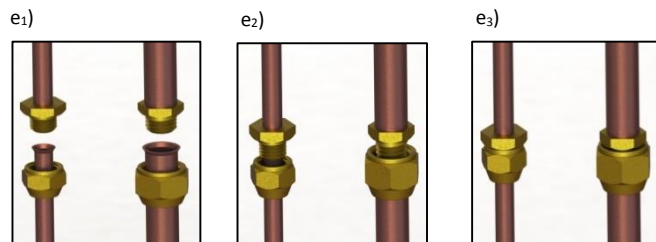


- Flange the tube with an appropriate tool, forming a cone, ensuring there are no frayed edges or imperfections and the lengths of the walls are the same.

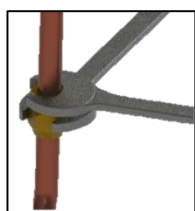


WARNING

- Tighten the nut a few turns with your hand, and then execute the final tightening by twisting in accordance with the values illustrated in the table



e4)



Diâmetro do Tubo (polegadas)	Binário Aplicado (Nm)	Chave nº
1/4"	14 a 16	19
3/8"	33 a 42	21

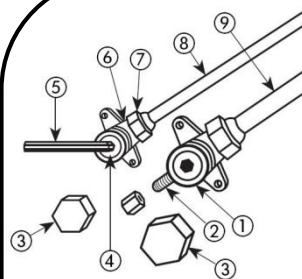
Refrigerant Connections - SolarBox

Some of the steps involved here are exactly the same as the procedures followed to connect the panel.

Cut the tube at the desired point with the end facing down. Clean any frayed edges.

Flange the tube not forgetting to place the nut on the side of the tube

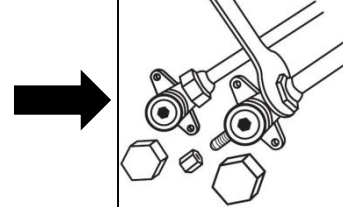
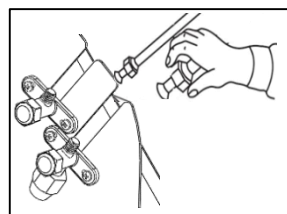
INSTALLATION (cont.)



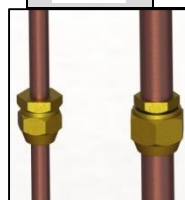
Legend:

1	3-way valve
2	Pressure tap
3	Valve sleeve
4	Valve needle
5	Hexagonal spanner
6	2-way valve
7	Conical nut
8	Liquid line (1/2")
9	Gas line (1/2")

Tighten the nut a few turns with your hand and then use an appropriate spanner to fully tighten the same as described above.



All connections should be insulated!



NITROGEN LOAD

Once the connections have been concluded the user needs to check there are no leaks. To this end, a load of nitrogen at a pressure of 10 bar should be injected via the pressure tap (3-way valve).

Cover all the connections in soap foam to check the pressure on the gauges is constant.

VACUUM

- Always use connections, vacuum pump and gauges duly adapted for R134a fluid.
- Only use a vacuum pump to remove the air and moisture existing in the tube.
- Never use the system coolant to bleed the connection tubes.
- Keep the stop valves completely closed.
- Connect the hose from the vacuum pump to the 3-way valve.
- Create a vacuum with the pump connected to the pressure tap to the 3-way valve (for 30 minutes) until a value of -1bar has been attained.
- Once the vacuum process has been concluded (30 minutes), turn off the pump and the gauge should always display the same value.
- Turn off the gauge taps.
- After this vacuum process has been concluded, the two valves should be opened to enable the coolant to circulate throughout the system.



After creating the vacuum, do not remove the hoses until the system has been fully pressurised by the coolant.



The use of a thread sealant is recommended for all existing thread connections.

HYDRAULIC CONNECTIONS



The water used may contain impurities and/or substances which are harmful to the system and to the health. Check the water being used is of an acceptable quality for domestic consumption. The table below illustrates certain parameters beyond which the water should be subjected to chemical treatment.

Hardness (°dH)	pH	Treatment
3.0 to 20.0	6.5 to 8.5	No
3.0 to 20.0	<6.5 or >8.5	Yes
<3.0 or >20.0	-----	Yes

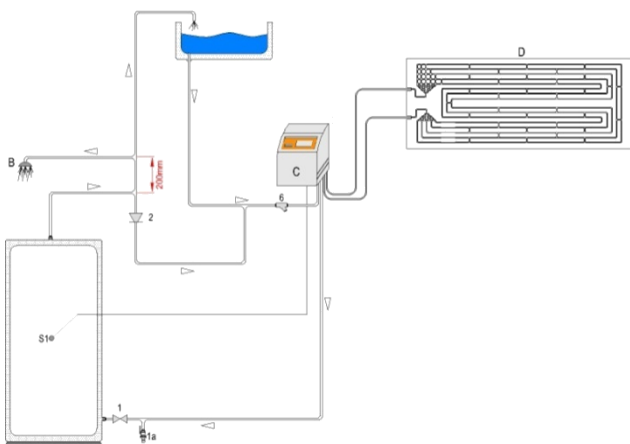
Procedures for the hydraulic connection of the circuit:

- Connect the water inflow and outflow of the equipment with tubing or joints capable of supporting a combined temperature/pressure of a constant 75°C / 7 bar. For such we recommend the use of tubing which is resistant to high temperatures and pressures, such as PEX, PPR, MULTICAMADA, among others.
- A safety valve needs to be installed at the cold water inflow of the equipment. The safety device should comply with standard EN 1487:2002, maximum pressure of 7 bar (0.7 MPa)
- In addition to this device other components need to be installed to guarantee the interruption of the hydraulic load, in the following order:
 - Reflux valve
 - Pressure reducing valve (in the event the pressure of the cold water inflow is greater than 4.5 bar)
 - Safety/exhaust valve
 - Expansion vessel

The safety/exhaust valve should be connected by tubing with a diameter which is never less than the cold water inflow connection. The part of the exhaust should be connected to an interceptor, or, in the event this is inviable, raised at least 20mm above the floor to allow for visual inspection. All the above recommendations are to guarantee the safety of people, animals and others.

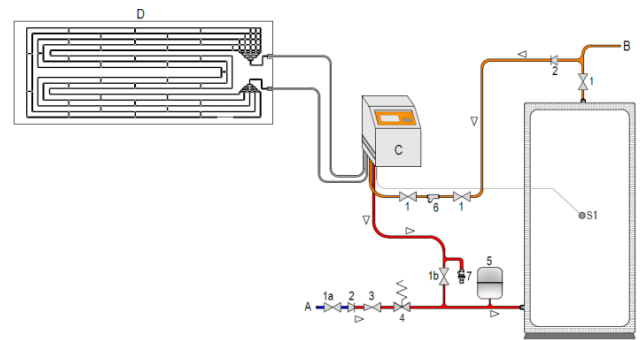
SolarBox may be installed in tanks with two or more connections. The diagrams below illustrate two types of connection to a tank:

Vented Installation

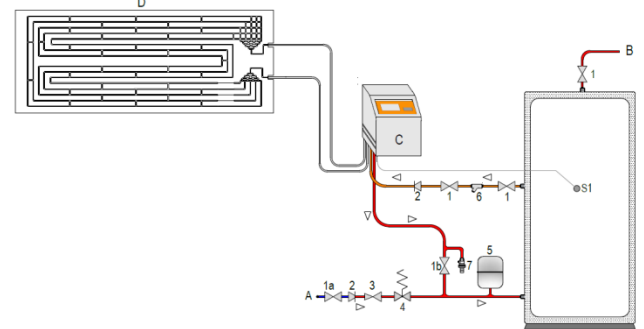


HYDRAULIC CONNECTIONS

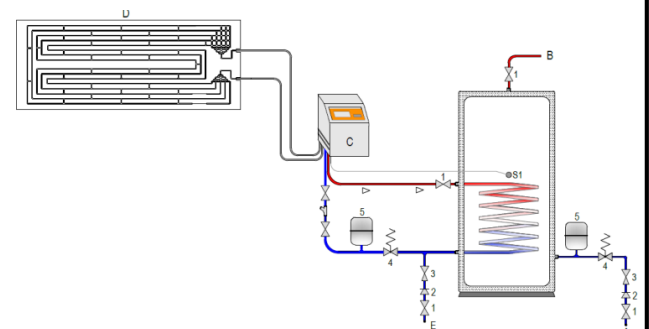
Tank with two connections



Tank with more than two connections



Tank with backup connections



Legend:

1	Open/closed Valve	7	Drain
2	Non return Valve	A	Mains Water
3	Pressure Reducing Valve	B	Hot Water Outlet
4	Security Group	C	SolarBox
5	Expansion Vessel	D	Thermodynamic Panel
6	Filter	S1	Temperature Probe

"Y" FILTER



The equipment is supplied with a "Y" filter placed on the SolarBox hydraulic return line, at the entrance of the heat exchanger.



PURGE HYDRAULIC CIRCUIT

After doing the correct installation of the system, the installer must purge all the hydraulic circuit before turning on the Solar Box.

- Ensure that the valve 1a is closed
- Close de valve 1b
- Open the bleed valve inside the Solar Box
- Open the discharge valve (drain) 7
- Open valve 1a
- Close the bleed valve inside the Solar Box (only when there is water with no bubbles leaving the valve)
- Close the valve 1c (only when there is water with no bubbles leaving the valve)
- Open the valve 1b
- Turn-on the Solar Box

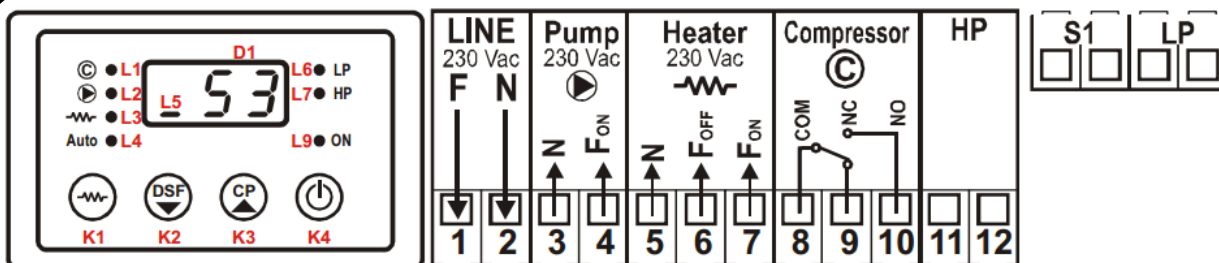
ELECTRICAL CONNECTIONS




Check the following conditions before implementing the electrical connections:

- The thermodynamic equipment should only be powered electrically after the tank has been filled.
- The thermodynamic equipment should be connected to monophasic voltage (230 VAC / 50 or 60Hz)
- Connections should always comply with the installation regulations in force in the country in which the thermodynamic equipment is installed.
- The equipment must be connected to an electrical socket which has been grounded.

NOTE: The Solar Box equipment have a relay to allow the connection of a backup electric resistance with **maximum power of 3kW**.

ELECTRONIC PANEL (EXTERNAL ASPECT AND CONNECTIONS DIAGRAM)



	Code	Connectors		Device	Characteristics	
INPUTS	S1	S1		Water Probe	Sensor NTC10K@25°C Functioning temperature 0÷120°C Misure Range 0÷99°C	
	LP	LP		Low Pressure Contact	Contact Open/Closed	
	HP	11		High Pressure Contact	Contact Open/Closed	
		12				
OUTPUTS		3	N	Pump	Power 230 Vac Max 3A 230Vac	
		4	FON			
		5	N	Electrical Heater	Power 230 Vac Max 3A 230Vac	
		6	FOFF			
		7	FON			
		8	COM	Compressor	Free contact Max 8A 230Vac	
		9	N.C.			
		10	N.O.			
	LINE		1	F	Input Line	230 Vac ±10% 50 Hz; Protection Fuse T3,15 A
			2	N		
Absorbed Power:				2VA		
Applied rules:				EN 60730-1 50081-1 EN 60730-1 A1 50081-2		
1 - ON/OFF						
The ON/OFF of the controller is performed by the extended pressure of the button K4						
<ul style="list-style-type: none">The OFF state is signaled by OFF of the display and all ledsThe ON state is signaled by the led L9 ON.						
2 - START/STOP operations in ON state						
<ul style="list-style-type: none">Fill the tank with water and expel any existing air, opening a hot water tap.The START/STOP of the operations is through the extended pressure of the button K3 (CP).The STOP is signaled by the led L9 blinking.						
3 - Visualizations:						
The display shows:						
<ul style="list-style-type: none">L4 ON >> C01=1 Auto mode ON (configuration)L1 Blinking >> when timer T01 run (compressor timer)L6 Blinking >> when timer T02 run (error LP timer)L7 Blinking >> when timer T03 run (error HP timer)D1>>Currently the Probe TemperatureD1>> Damages or Alarms signaling<ul style="list-style-type: none">❖ Lo: out of range to the low temperature (under 0°C): Probe broken❖ Hi: out of range to the high temperature (over 100°C): Probe in short circuit						

ELECTRONIC PANEL (EXTERNAL ASPECT AND CONNECTIONS DIAGRAM) cont.

4 - Alarm Function

If the temperature read by the Probe is over the value Alarm Thermostat **P04**

- The acoustic and visual signal is activated
- **SILENCE** Function: the acoustic signal could be deactivated for 5 minutes pushing any button. After this time, if the alarm condition remains the acoustic signal starts again.

5 - Pump anti block Function

If the Pump is OFF for a time over Anti block Timer **T04**

- The output PUMP is activated for **T05** seconds and the display shows **bLP**. The function is enabled also in **OFF**.

6. K1 Manual Heater Function (BOOST)

Through the extended pressure of the K1 button the heater is activated/deactivated the Manual Heater Function. The activated condition is showed by the Led L5.

7. Disinfect Function

The disinfect function has 3 modality configurations:

- C02=0: the function is activated only manually pushing K2 (DSF) button for about 5 seconds;
- C02=1: the function is activated 1 time per week;
- C02=2: the function is activated 1 time per month.

If the disinfect function is activated:

- Heater ON while the S1 Temperature < P05;
- The display shows dSF.

8- Installer Menu

- Enter the MENU pushing together K1 and K4 buttons for about 5 seconds;
- Scroll and visualize the parameters' code through K3 or K2 buttons;
- Visualize the parameter's current value through K4 button;
 - ❖ Modify the value through the K2 (decrease) / K3 (increase);
 - ❖ Press K4 to memorize the new value or press K1 to go back without memorize;

Press K1 button to go back to the code visualization.

Exit from MENU

- Wait about 5 seconds or push the K1 button.

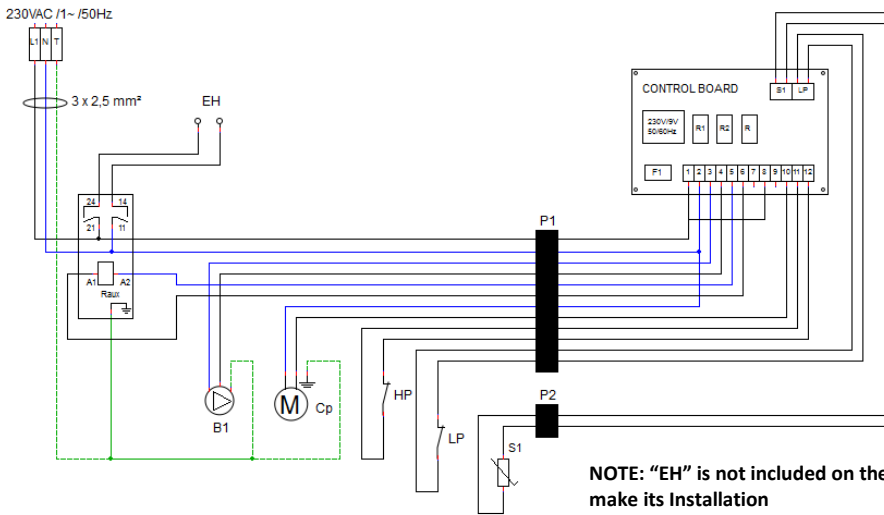
WARNING:

The admission to this Menu is only for **INSTALLERS** or **EXPERT PERSONNEL**, because parameters' changes could damage the product or could make the product not fit for the applications.

INSTALLER MENU PARAMETERS

Installer parameters	U.m.	Code	Min	Default	Max
Thermostat of ON/OFF Compressor and Pump	°C	P01	10	53	55
Hysteresis thermostat P01	°C	H01	1	3	10
Thermostat of ON/OFF Electrical Heater	°C	P02	5	53	65
Hysteresis thermostat P02	°C	H02	1	3	20
Thermostat of ON/OFF Electrical Heater In Auto Mode	°C	P03	5	18	25
Hysteresis thermostat P03	°C	H03	1	2	5
Thermostat of activation ALARM Function	°C	P04	70	75	80
Thermostat of ON/OFF Disinfect Function	°C	P05	60	65	75
Timer delay to turn ON Compressor	min	t01	1	1	10
Timer delay to turn ON Compressor after error LP	min	t02	3	10	20
Timer delay to turn ON Compressor after error HP	min	t03	3	10	20
Timer of ANTI BLOCK	h	t03	1	168	255
Tempo of activation pump ANTI BLOCK	sec	t05	0	10	99
Timer protection continuous operation of the compressor	h	t06	6	12	24
Auto Modality Configuration	***	C01	0	0	1
Disinfect Modality Configuration	***	C02	0	0	2
Outputs' Test	***	t0	***	***	***
Outputs' Test: <ul style="list-style-type: none"> ▪ Enter in Installer Menu and scroll until the code t0 ▪ Press the K1 button to enter in the Test ▪ Press the K1 button to activate the Heater corresponding Led ON display shows tSt ▪ Press the K2 button to activate the Compressor corresponding Led ON display shows tSt ▪ Press the K3 button to activate the Pump corresponding Led ON display shows tSt <p>The selected output will be activate until you release the button Exit from MENU</p> <ul style="list-style-type: none"> ▪ Wait about 5 seconds 					

WIRING DIAGRAM



Legend:

Cp	Compressor
B1	Circulator Pump
Raux	Auxiliar Relay
EH	Backup Electric Heater
LP	Low Pressure Switch
HP	High Pressure Switch
S1	Temperature Probe

NOTE: "EH" is not included on the equipment. It's the responsibility of the installer to make its installation

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	REMARK
Fault in the electronic panel	Lack of power	Check for the presence of electrical power Check the corresponding circuit breaker is turned on
	Disconnected or damaged cabling	Check the electric or electronic circuit Check the electrical protection (RES fuse)
	Equipment disconnected	Press the ON/OFF button
	Absence of electrical current or damaged cabling	Check the equipment is connected to the socket Check the corresponding circuit breaker is turned on Check the cabling Check the power cable is disconnected from the electronic cable Check the electrical protection (RES fuse)
Low water temperature	Error in the performance of the components	Check for errors on the electronic panel and consult the error table
	Temperature programmed on Setpoint low	Adjust the Setpoint temperature
	Compressor disconnected	Turn on the compressor using the "COMP" button
	Hot water returning to the cold water circuit (damaged or incorrectly installed safety valve)	Close the cold water inflow valve to turn off the safety group. Open a hot water tap. Wait for 10 minutes and if hot water is available replace the defective pipe and/or correct the position of the safety group. Clean the safety group filter
	Excessively hot water	Faulty gauge
	Low hot water flow	Loss or blockage of the hydraulic circuit
Water leaking from the safety valve	Absence of or incorrectly-sized expansion tank (if the leak is intermittent)	Installation and/or correct sizing of expansion tank
	High network temperature (if leak is continuous)	Check the pressure reduction valve (if present) Install a pressure reduction valve (if absent)
	Abnormally high constant consumption of electricity	Check the tubing for damage Use the appropriate equipment to check for leaks in the circuit
Others	Loss or blockage in the cooling circuit	
	Adverse weather conditions	
		Contact customer service

ERRORS

Error	Description	Possible Causes
LO	Probe	Disconnected or damaged probe
LP	Protection system activated (low pressure)	Insufficient load of refrigerant fluid
		Refrigerant fluid leakage
		Low outdoor temperature
		Low water inlet temperature
		Damaged low-pressure switch
		Disconnected or damaged cabling
		Damaged electronic panel

Error	Description	Possible Causes
HP	Protection system activated (high pressure)	Presence of air in the refrigerant circuit
		Lack of water in the circuit
		Damaged circulator pump
		Dirty condensor/filter (if exists)
		Excess fluid
		Damaged high-pressure switch
		Disconnected or damaged cabling
		Damaged electronic panel

Warranty

This warranty covers all defects to the confirmed materials, excluding the payment of any type of personal damage indemnity caused directly or indirectly by the materials.

The periods indicated below start from the purchase date of the apparatus, 6 months at the latest from the leaving date from our storage warehouses.

Water Cylinder (domestic use)

5 Years: Stainless Steel (2 + 3 years)

5 Years: Enamelled or Polywarm (2 + 3 years)

Manufacturer Warranty

Thermodynamic solar panel

10 Years

Against Production Defects and corrosion

Electrical components

Moving parts

Thermodynamic Block

Solarbox

Split

Monobloc (except cylinder)

2 Years

Water Cylinder (industrial)

5 Years: Stainless Steel (2 + 3 years)

5 (cinco) Anos: Polywarm (2 + 3 years)

Manufacturer Warranty

The warranty extension of 3 years is conditioned to the submission of:

- Warranty and Check Sheet at maximum 15 days after the installation.
- Documental evidence of the magnesium anode replacement.
- Pictures of the installation where it's shown safety group, expansion vessel, hydraulic and electrical connections

In case of warranty, the parts replaced are property of the manufacturer.

A repair under the warranty is not reason for an extension of its term.

Warranty Exclusions

The warranty ceases to be effective when the apparatus is no longer connected, used or assembled in accordance with manufacturer instructions, or if there has been any form of intervention by unauthorized technicians, has the appearance of modifications and/or if the series number appears to have been removed or erased. The equipment should be installed by qualified technicians according to the rules in effects and/or the rules of the trade, or the instructions of our technical services. Further exclusions from warranty:

- Hot water tanks have been operating in water with the following indexes:
 - Active chlorine > 0.2 ppm
 - Chlorides > 50 mg/l (Inox)
 - Hardness > 200 mg/l
 - Conductibility > 600 μ S/cm (20 °C)
 - 5,5 > PH and PH > 9 (Sorensen at 20°C).
 - If one of the water parameters has a greater value than stipulated by directive 236/98 (Portugal) or equivalent standard in the costumer's country
- Parts are subject to natural wear and tear – levers, switches, resistances, programmers, thermostats, etc.
- Breakdown due to incorrect handling, electrical discharges, flooding, humidity or by improper use of the apparatus.
- The warranty lapses if it is transferred to another owner, even if within the guarantee period.
- The warranty lapses if this certificate is incorrectly filled in, if it is violated or if it is returned after more than 15 days have passed since the purchase date of the apparatus.

ATTENTION: Technical assistance costs even within the warranty period shall be supported by the customer (Km and assistance time). In cases where there is no justifiable breakdown and subsequent need for technical assistance, the client will pay for lost technical assistance time.

NOTE: This sheet must be properly filled, signed and stamped by the installer / reseller and returned to ENERGIE est, Lda., otherwise the warranty will not be validated.