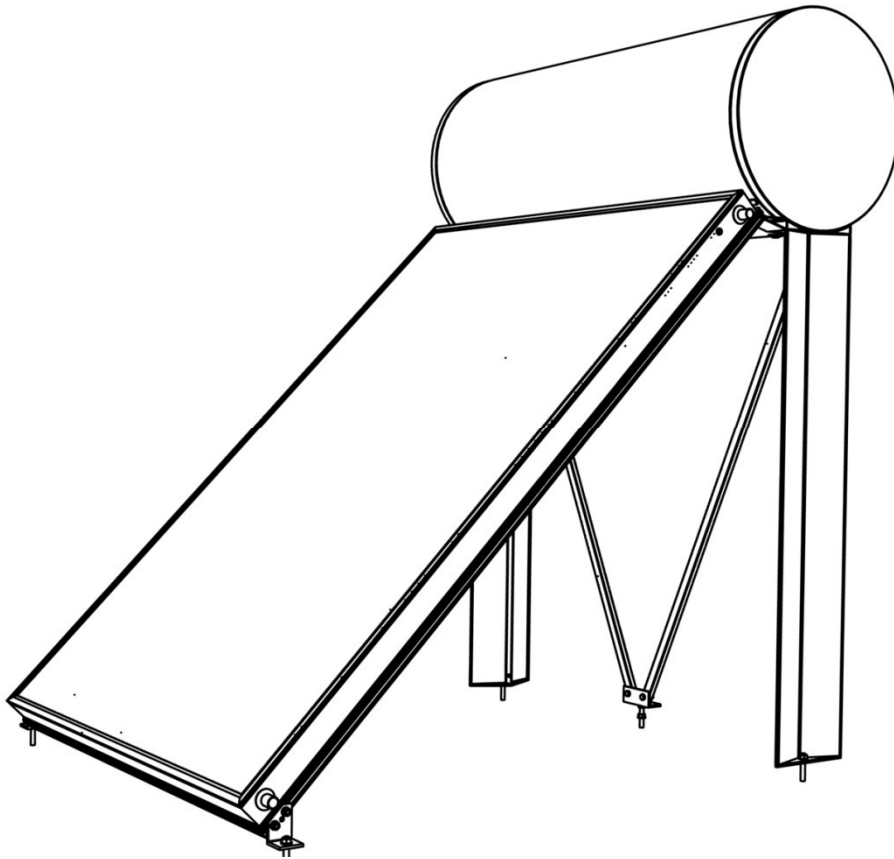


Calpak

MARK4



TECHNICAL DOCUMENTATION

THERMOSIPHONIC SOLAR WATER HEATERS Mark4

Thank you for placing your trust in our products. Calpak solar systems have been designed and manufactured according to the strictest quality standards so that they may offer many years of top of the range performance. For any clarifications regarding our products or this manual you may contact one of our dealers, visit our website www.calpak.gr or contact us directly.

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I. INTRODUCTION

SAFETY MEASURES

- Always use certified installation tools and full protection devices.
- In case you need to work near electrical wires, turn the electricity off.
- Always wear protective goggles, protective boots, gloves and masks in compliance with the respective safety regulations.

TRANSPORT & HANDLING

The tanks and the collectors come packed in expanded polystyrene frames and stretch films, where they must remain during all transportation and storage. The collectors must be transported in vertical position, in order to avoid any damage. During installation keep the collector covered until the closed circuit is filled with thermal fluid.

LIGHTING PROTECTION

Connect the metal part of the collector with the lightning protection system, if available or otherwise connect them to an earth rod. For further information consult a specialist.

Thermal effects due to lightning currents are considered negligible (Annex E, paragraph E 5.10 standard EN 12976-2).

The mechanical loads on the components of the solar system due to lightning charges are too low and the effect on durability and stability is considered negligible (Annex E, paragraph E 5.11 standard EN 12976-2).

The solar thermal system can be connected to the existing lightning protection at the roof of a building, in order to be protected against any form of damage due to lightning. Additionally, please note that the solar system is a natural circulation system and its electrical resistance is fed from the main building switchboard, provided that there is always possibility of connecting the electrical resistance of the storage tank to the building's central earth. The electrical resistance is tested according to standards EN 60335-1 and EN 60335-2-21.

THERMAL FLUID

Nox fluid is a propylene glycol based thermal fluid, non toxic to the skin. It must be used diluted in water in order to provide anti-freezing and anti-corrosive properties. The advisable percentage is 33% of water volume. In case of very low environmental temperatures, increase the volume percentage according to the following table:

Temperature (°C)	-10	-15	-20	-25	-30	-35
Percentage in water solution (%)	23	31	37	43	48	53

PERMISSIBLE SNOW LOAD AND MEAN WIND VELOCITY

The collectors are tested according to the standards EN 12975-2. Through these tests, it is admitted that they can resist without any failure to a mechanical load up to 2400 Pa.

SYSTEM COMPONENTS

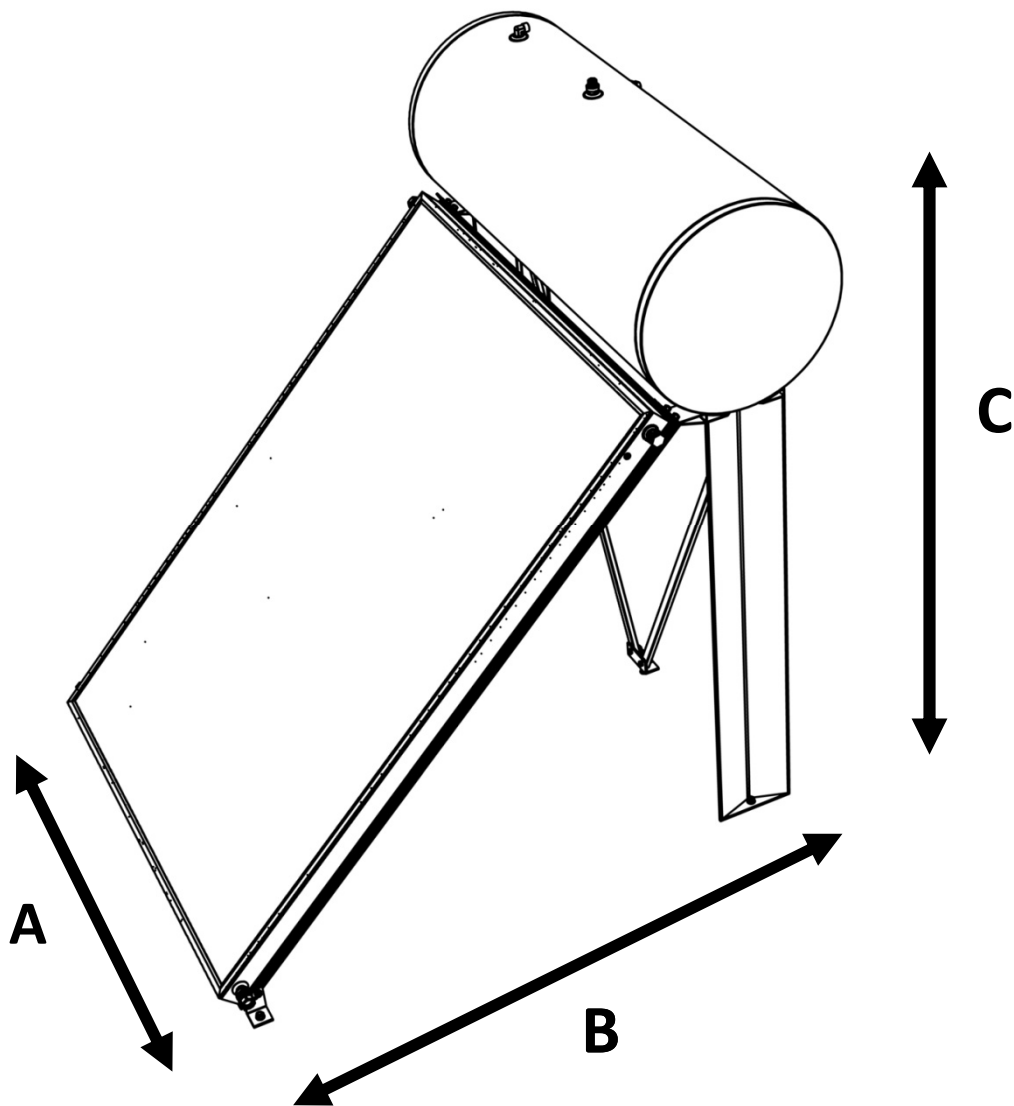
1. Collector
2. Tank
3. Support Base System
4. Nox fluid (propylene glycol)
5. 1 pressure relief valve for the closed circuit
6. 1 safety valve for the domestic cold water line
7. Insulated connecting pipes
8. Pipe fittings

SYSTEM IDENTIFICATION

The tank and the collector/s which form a solar system are appropriately marked with metalized item plates. These plates include the technical characteristics of the system and the unit serial number according to paragraph 4.7 of EN 12976-1 and are placed on each part of the system (tank and collector/s)

II) TECHNICAL CHARACTERISTICS

Technical data	M4 flat plate selective collectors					
Type	M4-200	M4-210	M4-260	M4-260H	M4-300	M4-300H
Gross area (m ²)	2.04 m ²	2.13 m ²	2.64 m ²	2.64 m ²	3.00 m ²	3.00 m ²
Absorber area (m ²)	1.83 m ²	1.92 m ²	2.40 m ²	2.40 m ²	2.80 m ²	2.80 m ²
Aperture area (m ²)	1.87 m ²	1.96 m ²	2.44 m ²	2.44 m ²	2.83 m ²	2.83 m ²
W x L x H (mm)	986*2071*86	1244*1711*86	1244*2121*86	2121*1244*86	1502*1996*86	1996*1502*86
Weight (kg)	34,5	36	48	49	50	51
Absorber capacity (l)	1,6	1,6	1,8	2,2	2,1	2,4
Housing	aluminum frame					
Absorber	Selective aluminum					
Absorption	95 ± 2					
Emission (%)	4 ± 2					
Number of tubes	9	11	11	18	14	18
Absorber tube Dia.	8 mm					
Glass	3.2 mm low iron mistlite tempered glass					
Transmittance of glass (%)	>0,90					
Insulation	40 mm Rockwool, density 50kgr/m ³					
Stagnation temp at 1000 W/m ² and 30°C	177,6 °C					
Max.operating pressure (bar)	10					



Collector

- Aluminum multifin selective absorber
- Ultrasonic welded on copper harp
- Rock wool insulation
- Aluminum profile frame
- Low iron tempered glass

Tank

- Enameled tank according to DIN 4753/3
- Insulation with expanded polyurethane
- Magnesium anode cathodic protection according to DIN 4753/6
- Electrical resistance 3,5 KW
- Heat exchanger to connect to a boiler (model TRIEN)

Model		M4 125/ 2.1	M4 160/ 2.1	M4 160/ 2.6	M4 160/ 2.6H	M4 200/ 2.1	M4 200/ 2.6	M4 200/ 2.6H	M4 200/ 3	M4 200/ 3H	M4 200/ 4.2	M4 300/ 3H	M4 300/ 4.2
Dimensions [45/30 degree inclination]	Length (mm) A	1244	1244	1244	2121	1520	1520	2121	1520	1996	2553	1996	2553
	Depth (mm) B	1684/ 1892	1684/ 1892	1973/ 2247	1324/ 1488	1654/ 1892	1945/ 2247	1324/ 1488	1867/ 2152	1515/ 1722	1654/ 1978	1515/ 1722	1684/ 1978
	Height (mm) Γ	1700/ 1326	1700/ 1326	1989/ 1531	1370/ 1093	1700/ 1326	1989/ 1531	1370/ 1093	1904/ 1476	1552/ 1228	1700/ 1326	1552/ 1228	1700/ 1326
System weight empty (kg)		87	94	106	107	109	121	122	123	124	145	147	168
System weight full (kg)		210,6	251,6	263,8	265,2	312,6	324,8	326,2	327,1	328,4	350,2	424,4	446,2
Optional electrical resistance (kW)		3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5
Tank	Tank volume (l)	122	156	156	156	202	202	202	202	202	202	275	275
	Tank weight empty (kg)	51	58	58	58	73	73	73	73	73	73	96	96
	Tank weight full (kg)	173	214	214	214	275	275	275	275	275	275	371	371
	Length (mm)	1230	1230	1230	1230	1520	1520	1520	1520	1520	1520	1980	1980
	Diameter	500 mm											
Collectors	Dimensio ns of collector (mm)	1244*1 711*86	1244*1 711*86	1244*2 121*86	2121*1 244*86	1244* 1711* 86	1244*2 121*86	2121* 1244* 86	1502* 1996* 86	1996*1 502*86	1244*1 711*86	1996*1 502*86	1244*1 711*86
	Number of collector s	1	1	1	1	1	1	1	1	1	2	1	2
	Gross area per collector (m ²)	2.13	2.13	2.64	2.64	2.13	2.64	2.64	3.00	3.00	2.13	3.00	2.13
	Weight per collector empty (kg)	36	36	48	49	36	48	49	50	51	36	51	36
	Max. working temp.	177 °C											
	Thermal liquid per absorber (l)	1,6	1,6	1,8	2,2	1,6	1,8	2,2	2,1	2,4	1,6	2,4	1,6
	Max. collector circuit working pressure	1 MPa											

III) POSITIONING OF THE SYSTEM

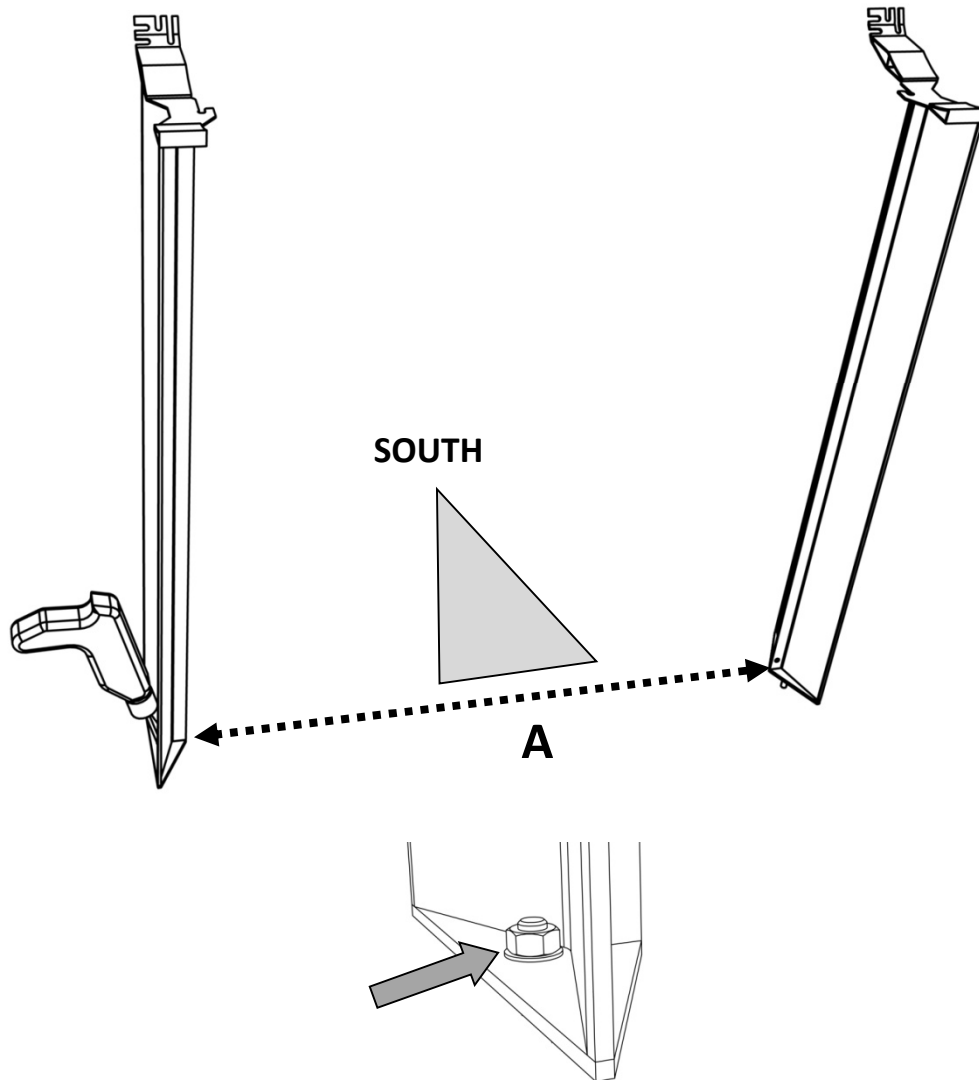
The installation area of the solar water heater must fulfill the following requirements:

1.1 The solar water heater **must face the SOUTH (or NORTH in case the installation takes place in the South hemisphere)**, and it is strongly recommended to use a compass to ensure this. Deviations of up to 10-15° does not affect substantially the system's efficiency, but larger deviations may seriously affect the performance.

1.2 In countries situated in latitude of 40°, the collectors must be installed at an angle of 45° against the horizontal level. The collectors must be generally placed at an angle of 5° over the latitude of the installation area. Any decrease in this angle entails considerable decrease of the solar heater's annual performance.

1.3 In no case are the solar heaters to be placed in the shade, especially during winter time, when the sun is lower in the sky. The minimum distance between the solar heater and any obstacle that causes shadow should be no less than twice the height of the obstacle.

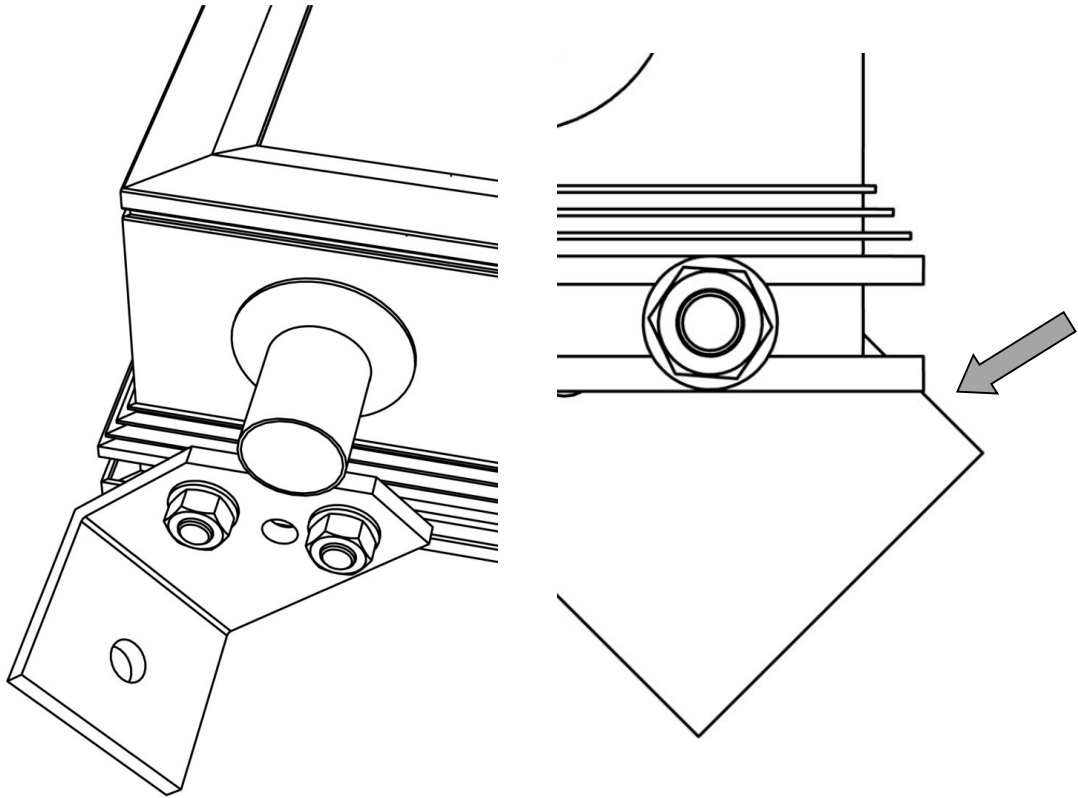
IV) INSTALLATION OF SYSTEM ON A FLAT ROOF [All models except 300/4.2]



STEP 1

Install the tank support pillars at a distance A according to Table A. To ease installation, drill the roof floor at an angle of approximately 10-15 degrees. Follow the instructions for positioning the system in Chapter III. Use fasteners of appropriate length and type to ensure that the pillars and all base components are secured onto the structural layer of the roof and not on the insulation. Use an appropriate sealing material to prevent moisture from penetrating the roof material.

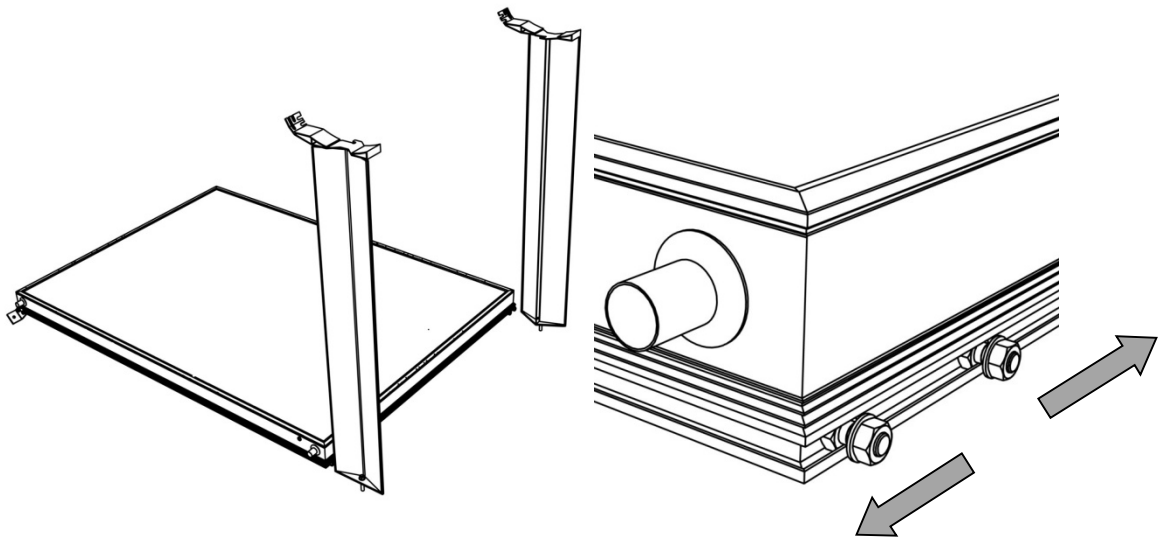
TABLE A			
TANK	125/160 L	200 L	300 L
DISTANCE A [mm]	1192	1480	1944



STEP 2

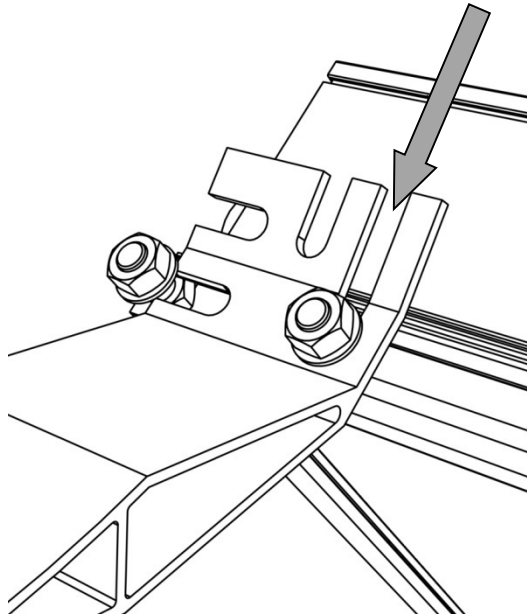
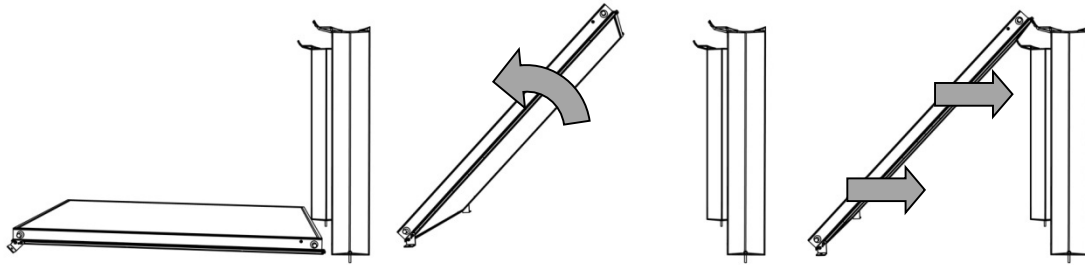
Attach the two feet at the lower part of the collector. Consult the drawing above for their positioning relative to the collector as it affects the accuracy of the installation.

IMPORTANT: DO NOT REMOVE COLLECTOR COVER SHEET BEFORE CONNECTING THE SYSTEM!

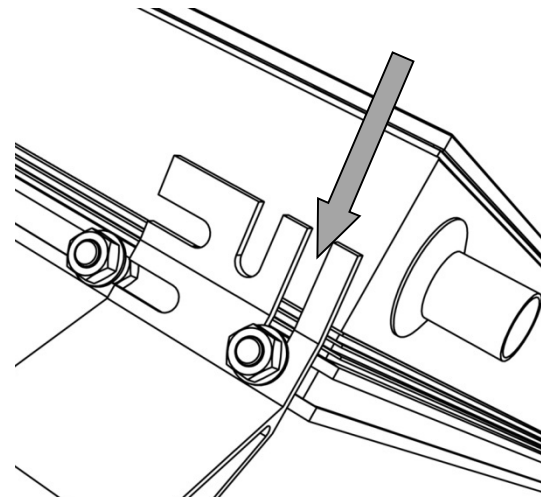


STEP 3

Place the collector on the roof floor in front of the pillars as shown above. To ease next step slide the collector securing bolts so that they are approximately in line with the slots on the pillars.



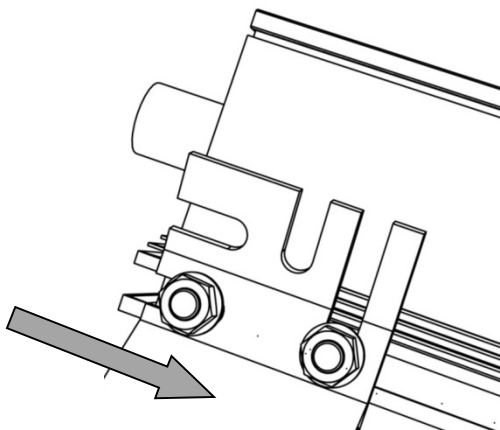
Upper right side of the collector



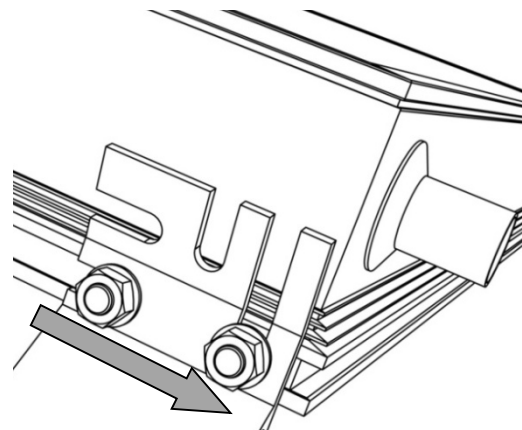
Upper left side of the collector

STEP 4

Lift the collector from the side close to the pillars at an angle of approximately 45 degrees. Move the collector towards the pillars. Insert the securing bolts into the vertical slots of the pillars.



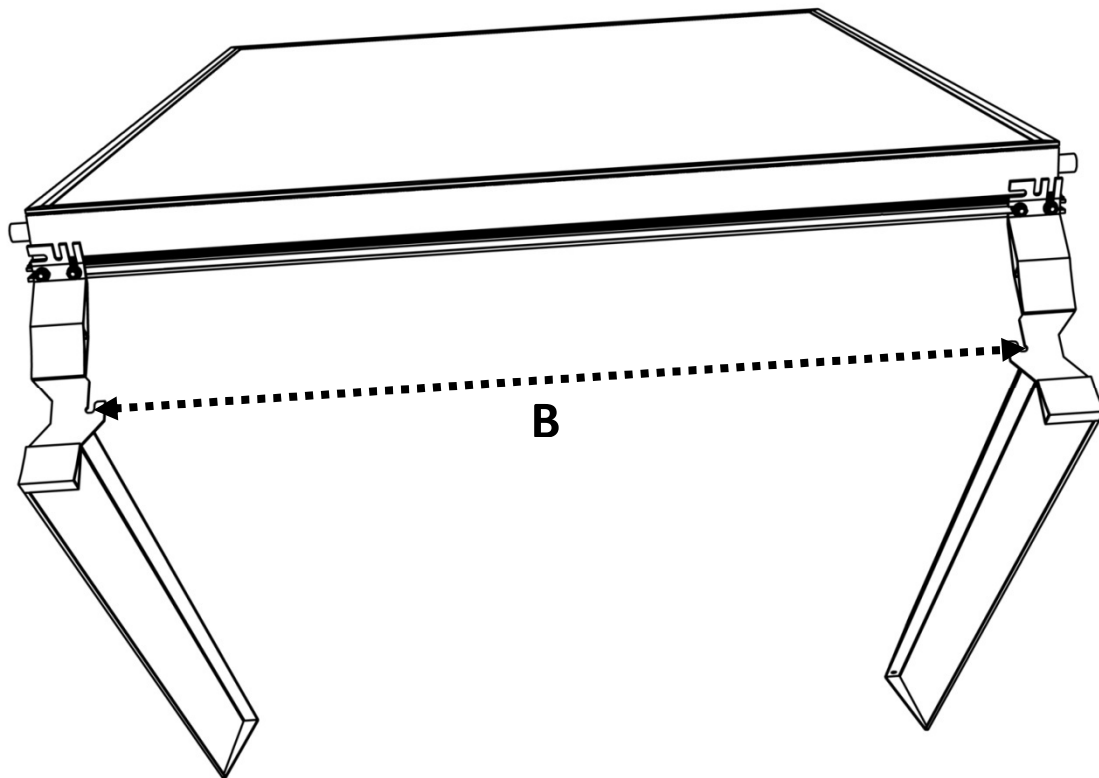
Upper right side of the collector



Upper left side of the collector

STEP 5

Slide the remaining two securing bolts into the horizontal slots of the pillars.



STEP 6

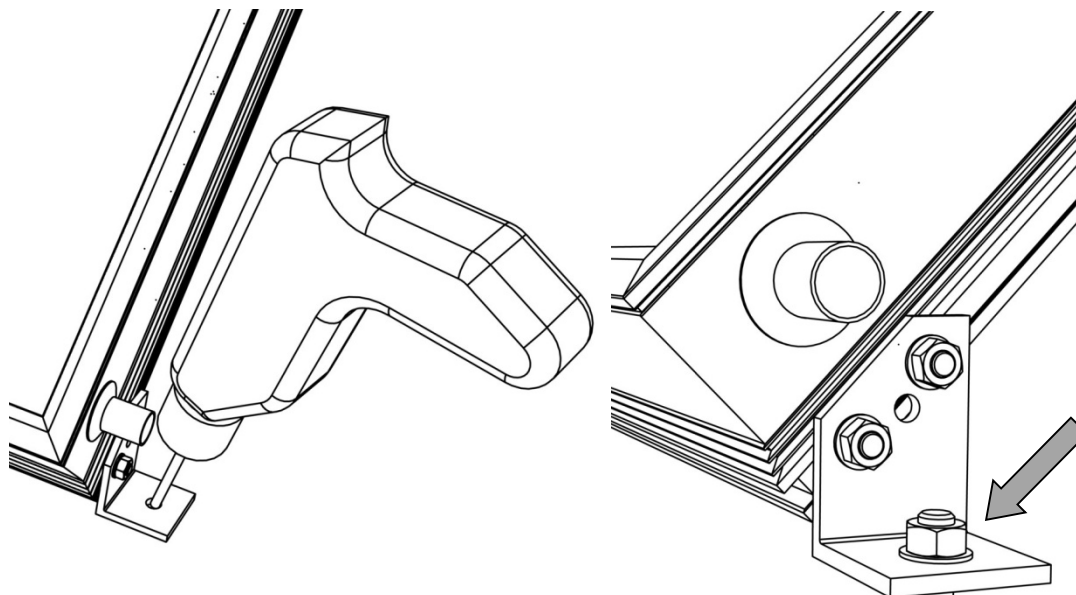
Ensure that the distance B between the centres of the tank support holes is in accordance with Table B. If there is deviation you may make small adjustments ensuring that both pillars are vertical and that the collector is centered between them.

TABLE B			
TANK	125/160 L	200 L	300 L
DISTANCE B [mm]	1090	1378	1842



STEP 7

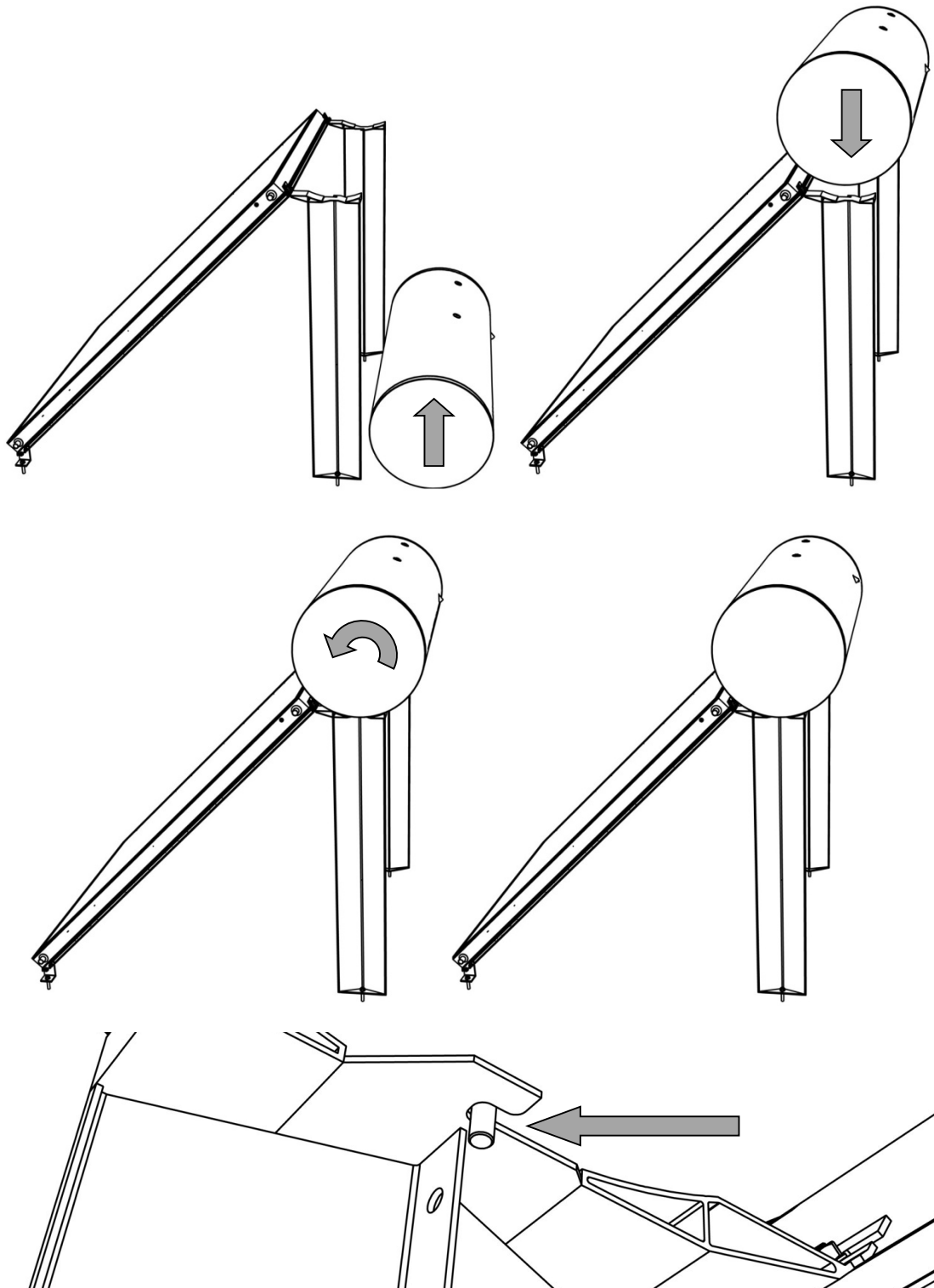
Tighten the 4 collector securing bolts.



STEP 8

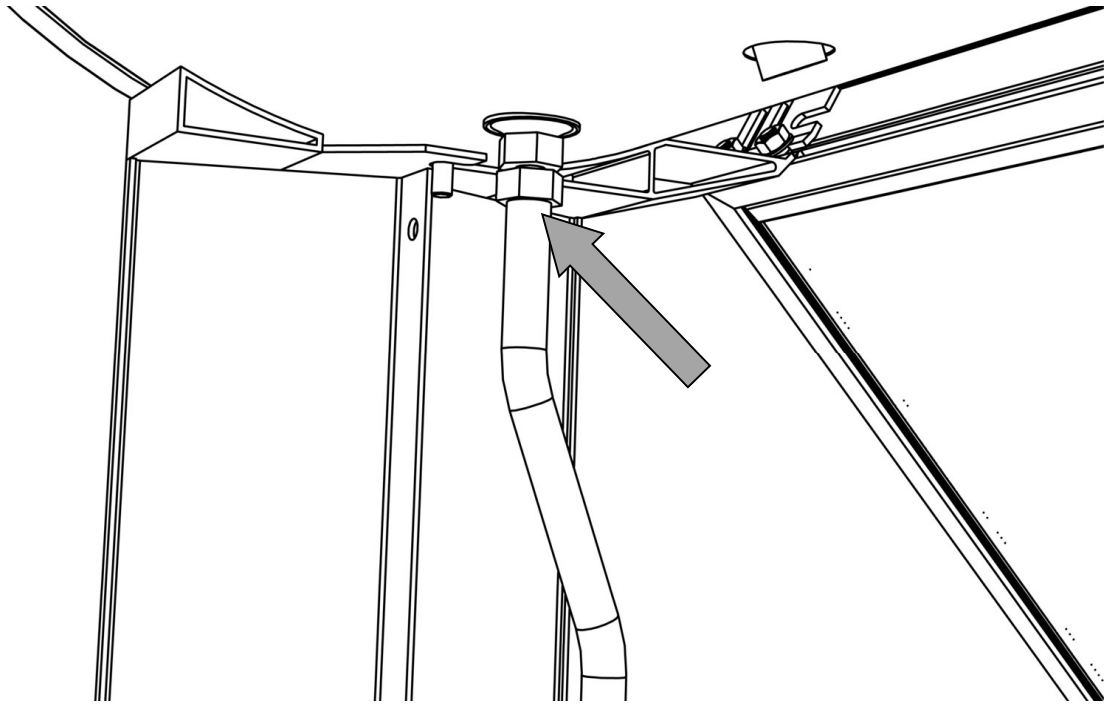
Using the holes in the collector feet as a guide, drill the roof floor and install the appropriate fasteners to secure them. Alternatively you can use the below table. Use fasteners of appropriate length and type to ensure that the collector feet are secured onto the structural layer of the roof and not on the insulation. Use an appropriate sealing material to prevent moisture from penetrating the roof material.

TABLE C										
SYSTEM	125/2,1	160/2,1	160/2,6	160/ 2,6H	200/2,1	200/2,6	200/ 2,6H	200/ 3	300/ 3H	300/4,2
DISTANCE C [mm]	1304	1304	1304	2181	1304	1304	2181	1574	2071	2617



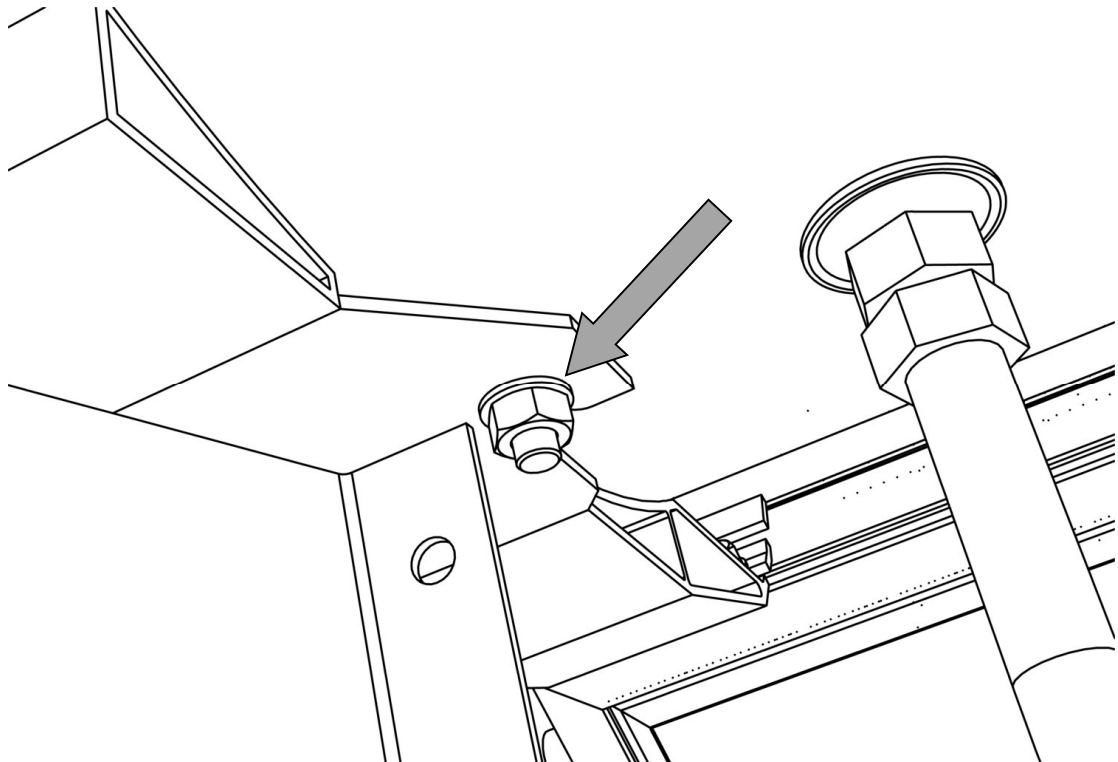
STEP 9

Place the tank on the roof floor with a small rotation backwards. Ensure that the securing bolts of the tank do not touch the floor. Lift the tank and place it on the circular seats on top of the pillars. Rotate the tank so that the tank securing bolts are inserted into the pillar slots.



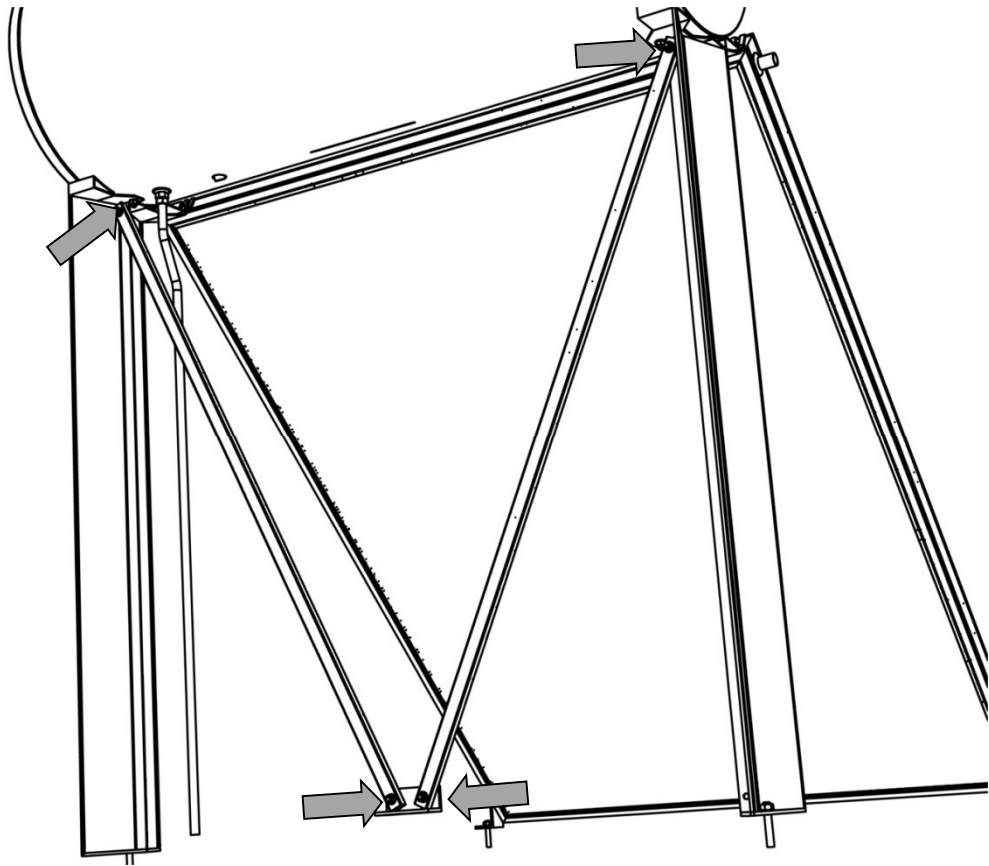
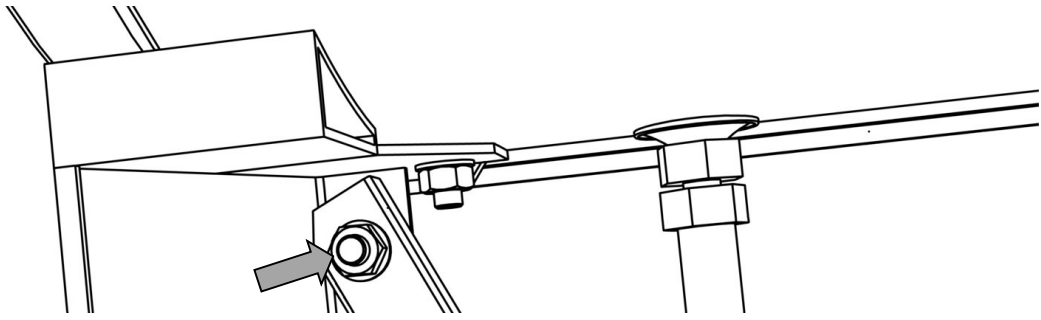
STEP 10

For ease of installation you may attach the cold water supply tube.



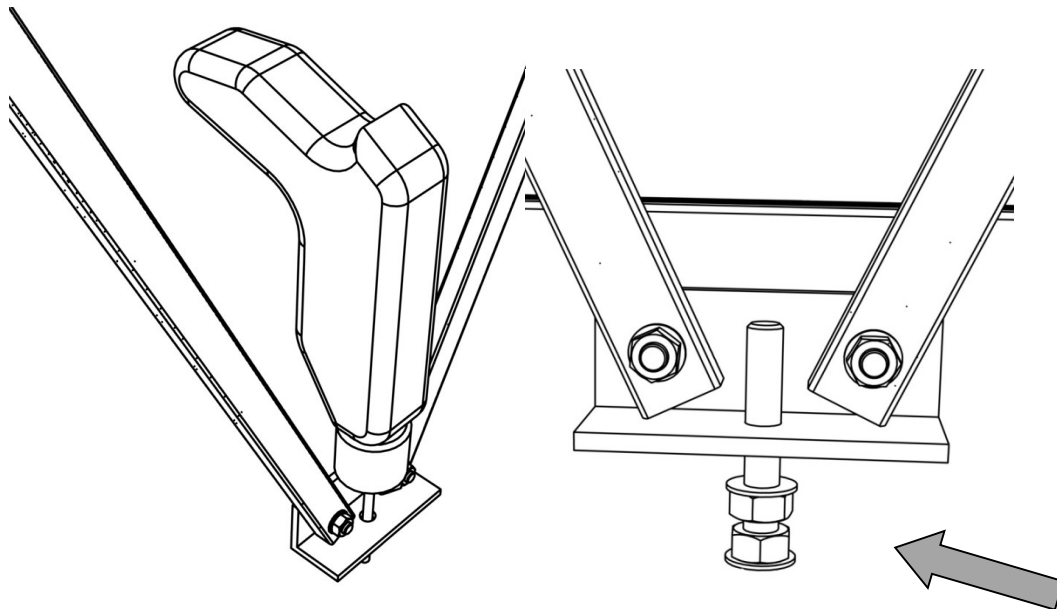
STEP 11

Install washers and the nuts on the tank securing bolts.



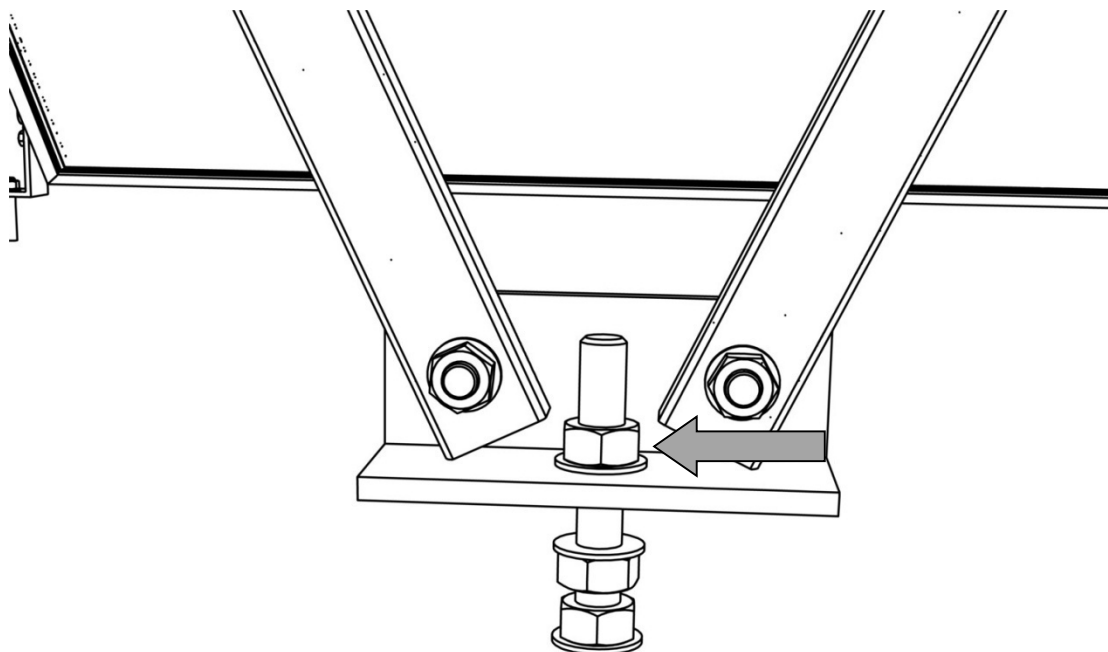
STEP 12

Connect the brace system with the pillars. Do not tighten the bolts, ensure however that they are not very loose.



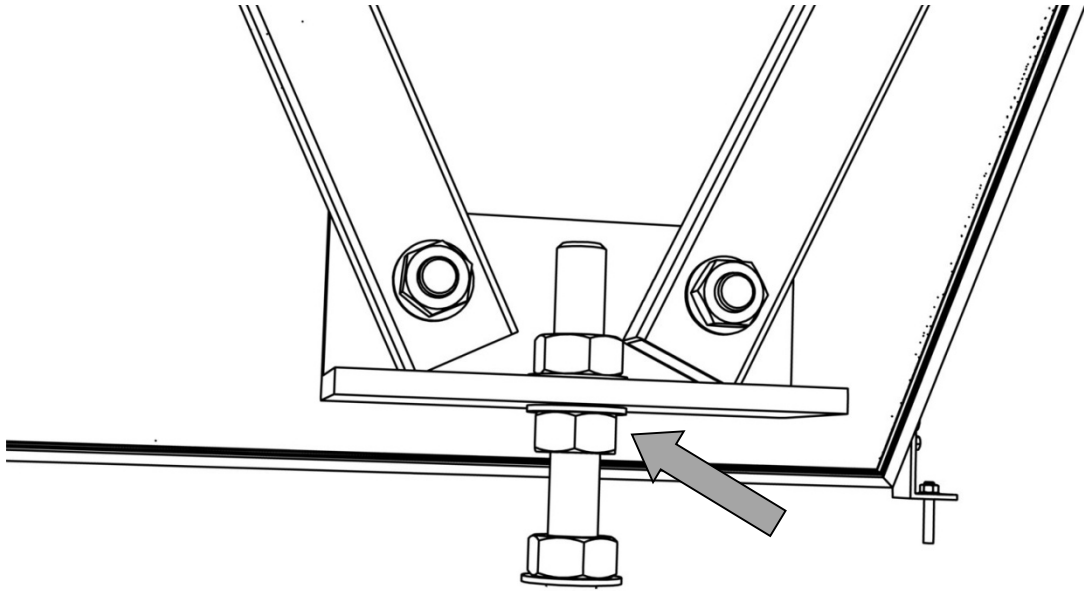
STEP 13

Using the hole of the brace foot as a guide drill the roof floor and install the securing bolt of the brace foot by tightening the bottom nut. Use fasteners of appropriate length and type to ensure that the collector feet are secured onto the structural layer of the roof and not on the insulation. **The fastener must protrude 7 cm** from the roof floor to allow for adjustments.



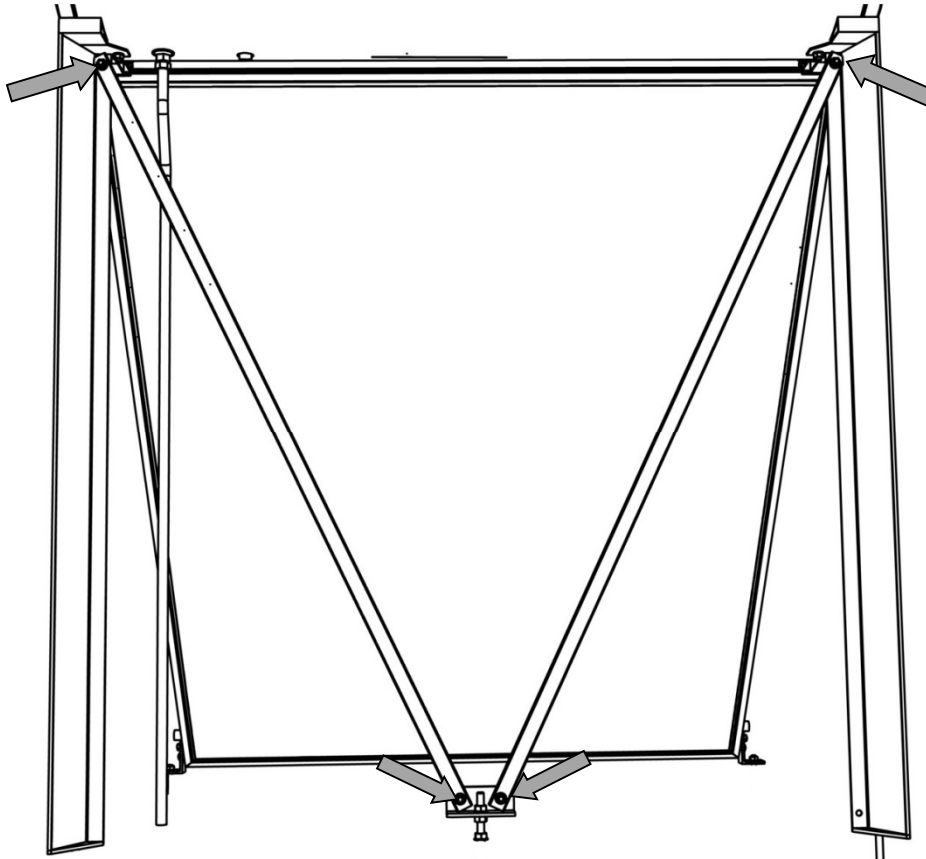
STEP 14

Install the top washer and nut of the brace foot. Tighten until it is not loose. The middle nut must be in contact with the brace foot.



STEP 15

Tighten the middle bolt against the brace foot.



STEP 16

Tighten the 4 brace strut bolts. Make sure that all bolts are tight and that bolts are not loose on the base system.

V) INSTALLATION OF SYSTEM ON A FLAT ROOF [300/4.2 model]

The procedure for installing the 300/4.2 model with the dual collectors is identical to the procedure in the previous chapter except for Step 2 which must be replaced with the following.

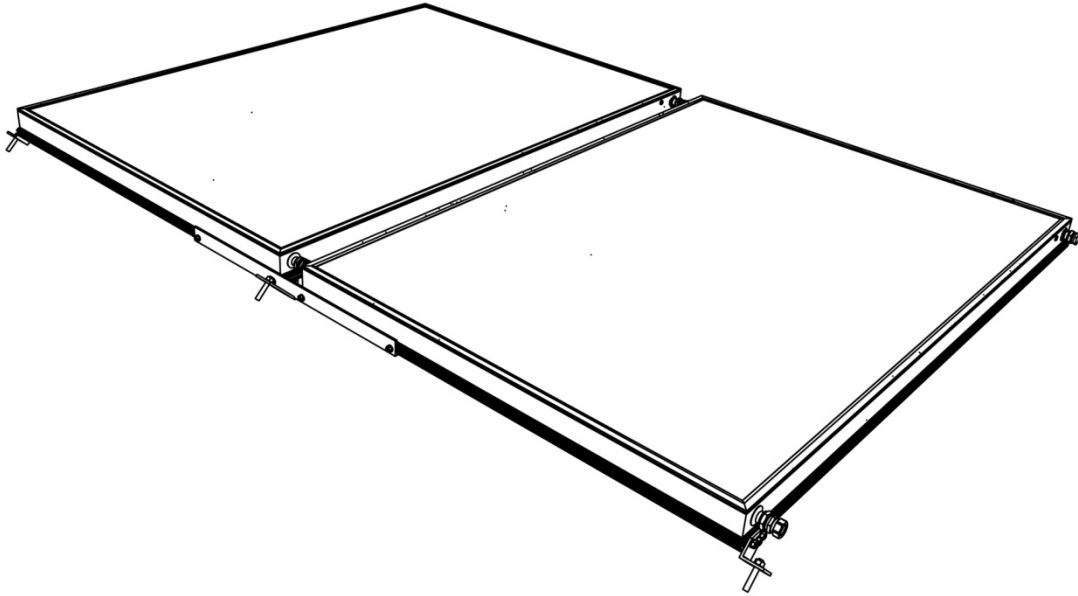


Figure 1: The two collectors ready for installation with top and bottom braces and collector feet installed.

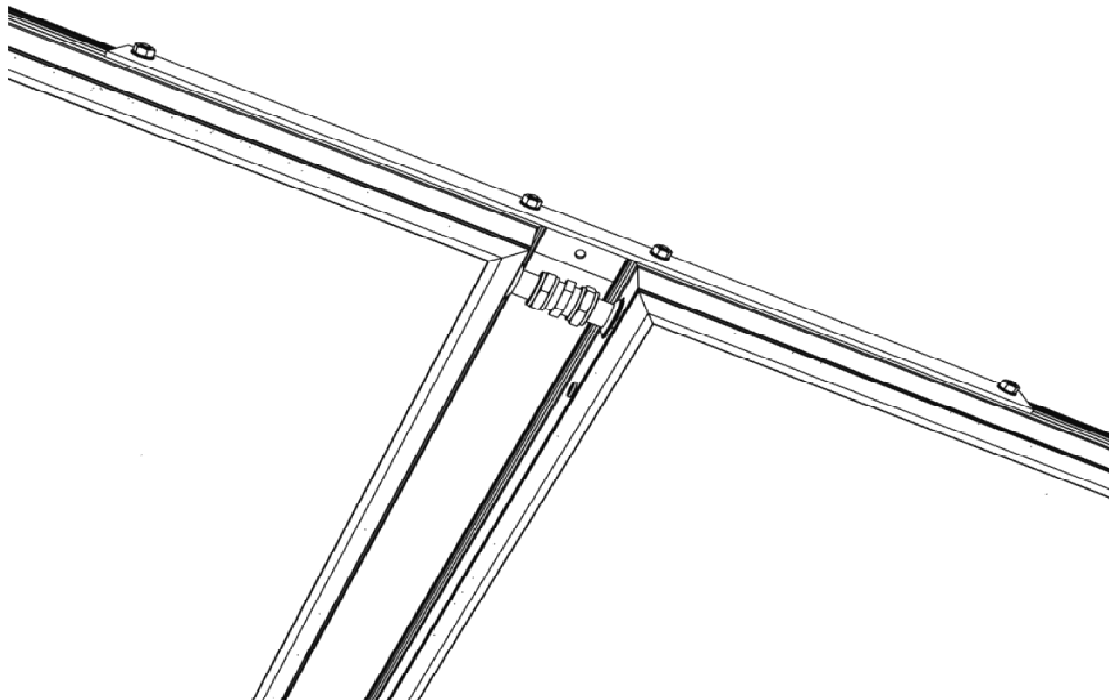


Figure 2: Top brace and hydraulic connection between the collectors

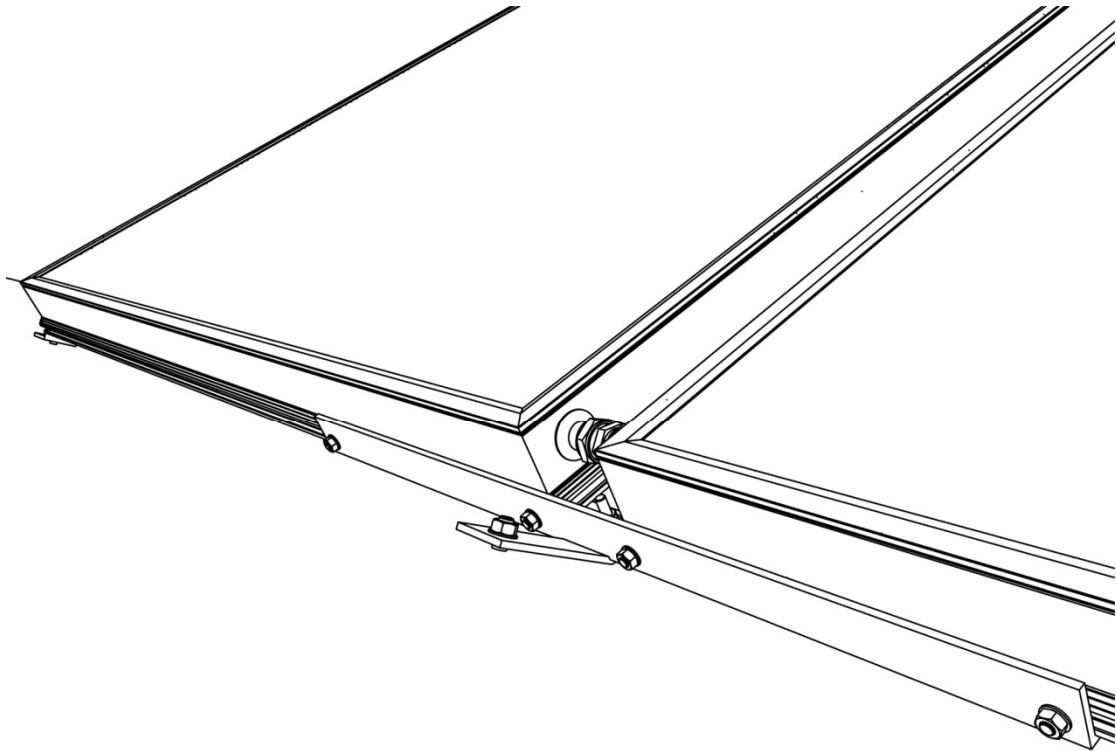


Figure 3.Bottom Brace

Follow Step 1 of Chapter IV to install the tank support pillars to the correct orientation and distance for the 300L tank.

Place the two collectors side by side on the roof floor.

IMPORTANT: DO NOT REMOVE COLLECTOR COVER SHEET BEFORE CONNECTING THE SYSTEM!

Install the top and bottom braces between the collectors. The bolts should be tight enough to prevent excessive free play while allowing sliding of the collectors towards each other.

Connect the absorber tubes between the collectors by the appropriate fittings. Ensure that the collectors are parallel and as close to each other as possible. Tighten the fittings.

IMPORTANT: DO NOT MOVE THE DUAL COLLECTOR ASSEMBLY BEFORE ALL SECURING BOLTS ARE TIGHTENED. FAILURE TO DO SO MAY RESULT IN DAMAGE TO ABSORBERS!

Centre the top and bottom braces and tighten the 4 securing bolts.

Ensure that the dual collector assembly is one body.

Install the collector feet according to Step 2 in Chapter IV.

Follow Steps 3-16 of Chapter IV to complete the installation.

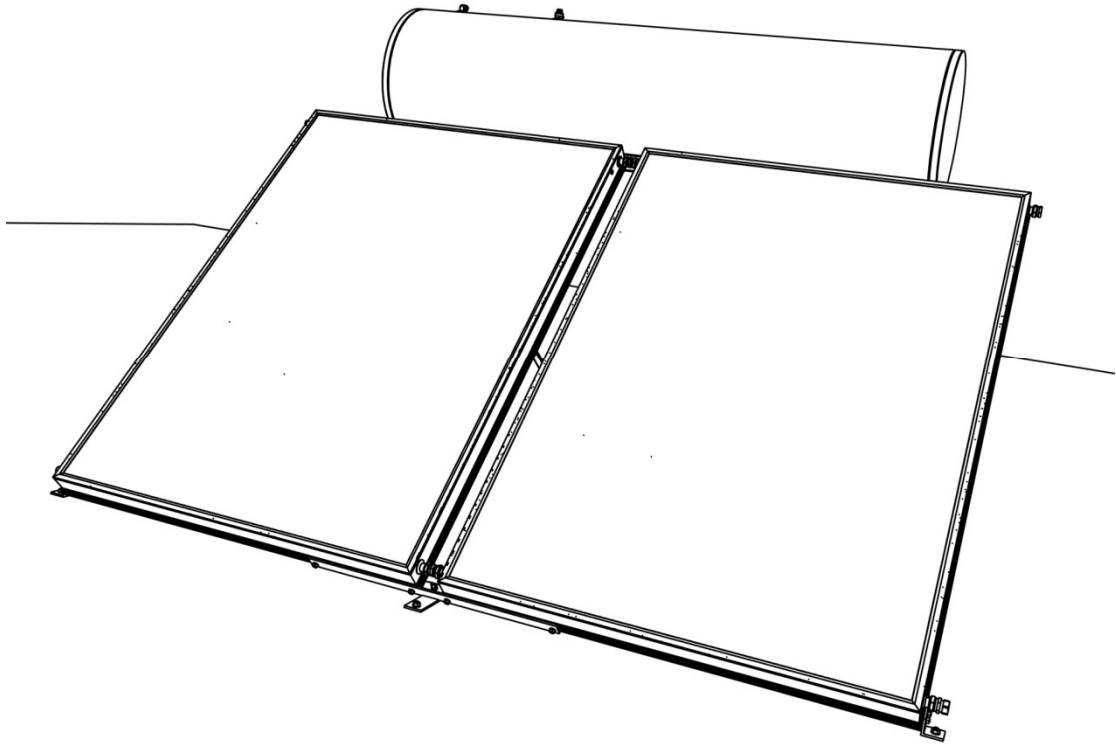


Figure 4. Front view of installed 300/4.2 system.

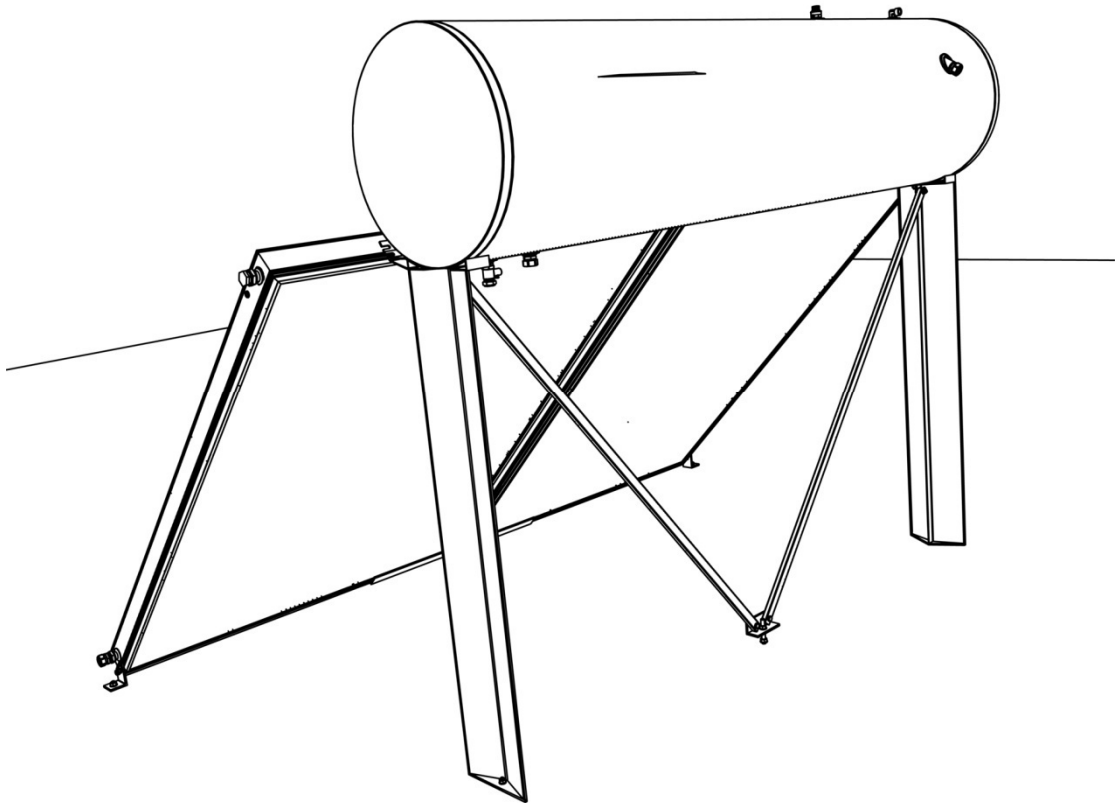
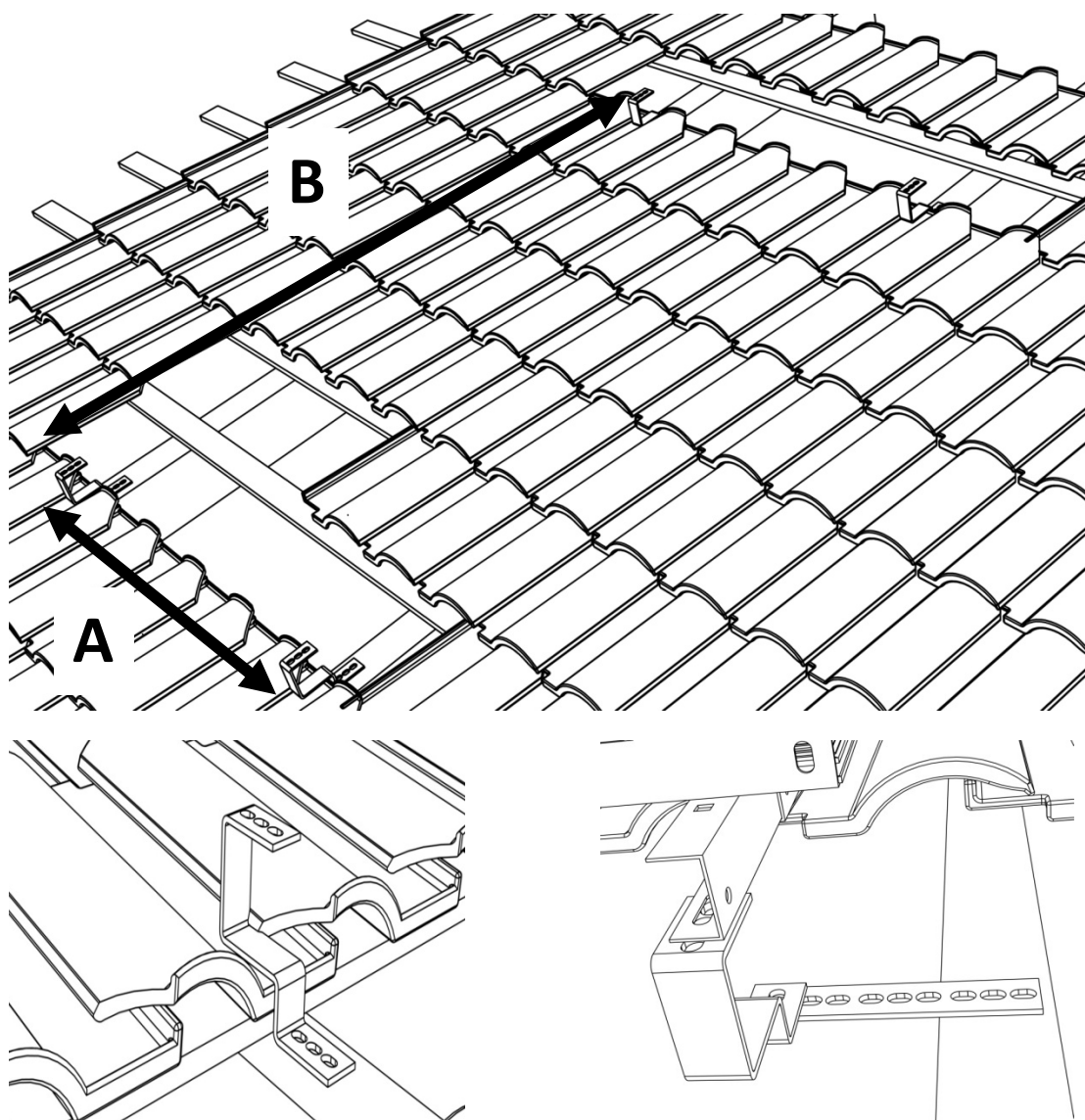


Figure 5. Rear view of installed 300/4.2 system.

VI) INSTALLATION OF SYSTEM ON INCLINED ROOF [All systems]

CAUTION: Check the capacity of the roof structure to bear the solar heater load in operation with the constructor of the building or contact the local authorities.

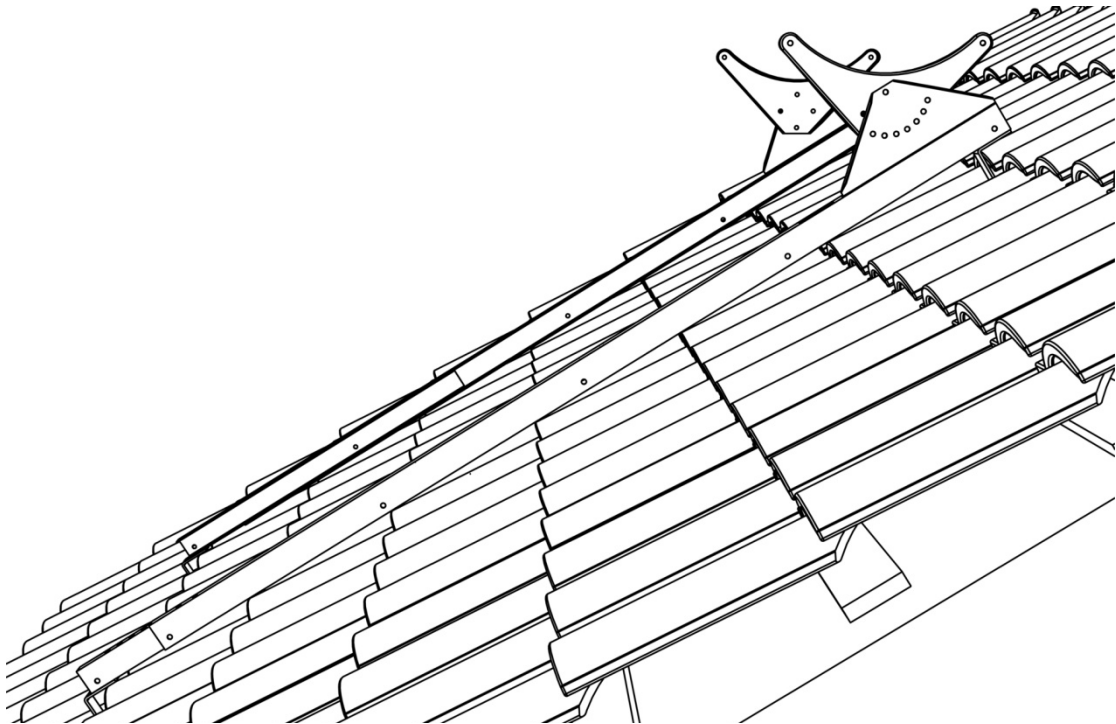
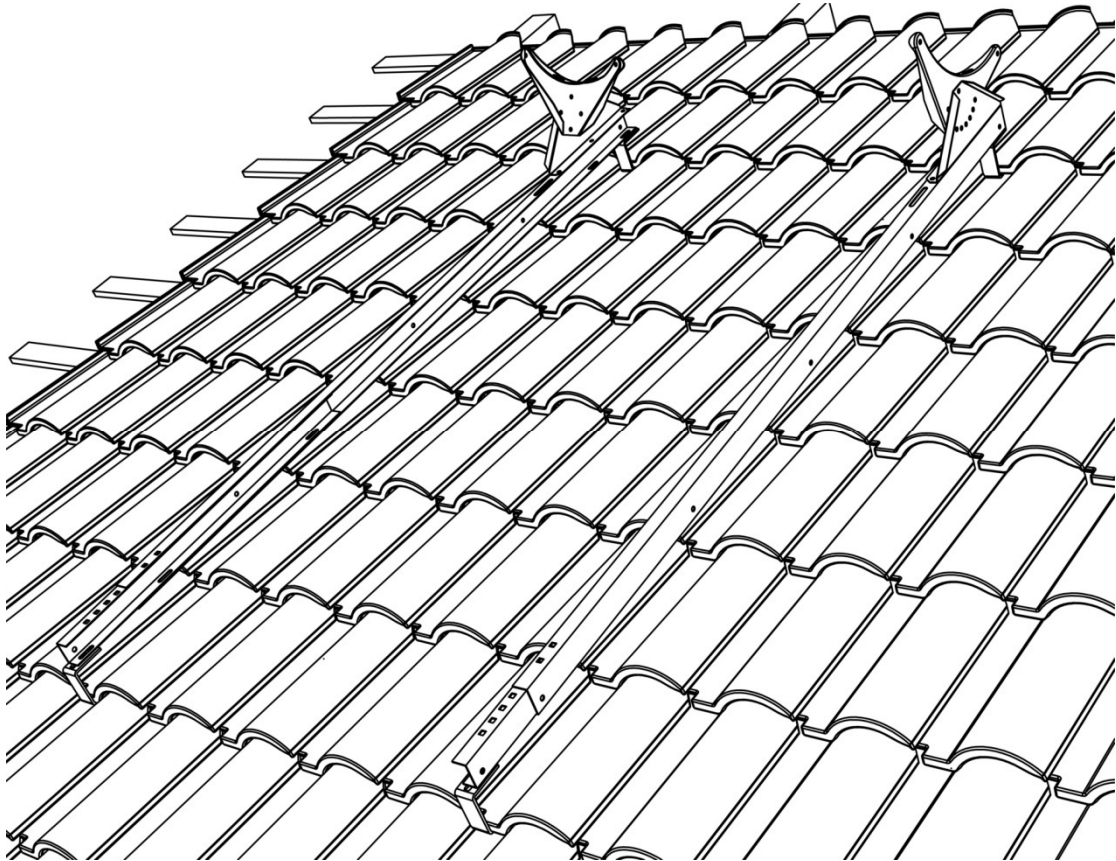


STEP 1

Uncover the roof tiles at the lowest and the highest part of the area where the thermosiphonic system will be installed. Install the 4 AGG brackets (or the AT – triangular type or the AR – special screw, if needed) on the vertical, load bearing beams with appropriate screws, as shown on the drawing above. Make sure that the distances A and B between any of the top holes on each bracket are set according to Table 1. You may take advantage of the fact that there are 3 holes on the top of each bracket to accommodate for different tile sizes. In case the AGG brackets do not coincide with the roof beams, use the additional 20 cm extension piece for AGG brackets [right drawing].

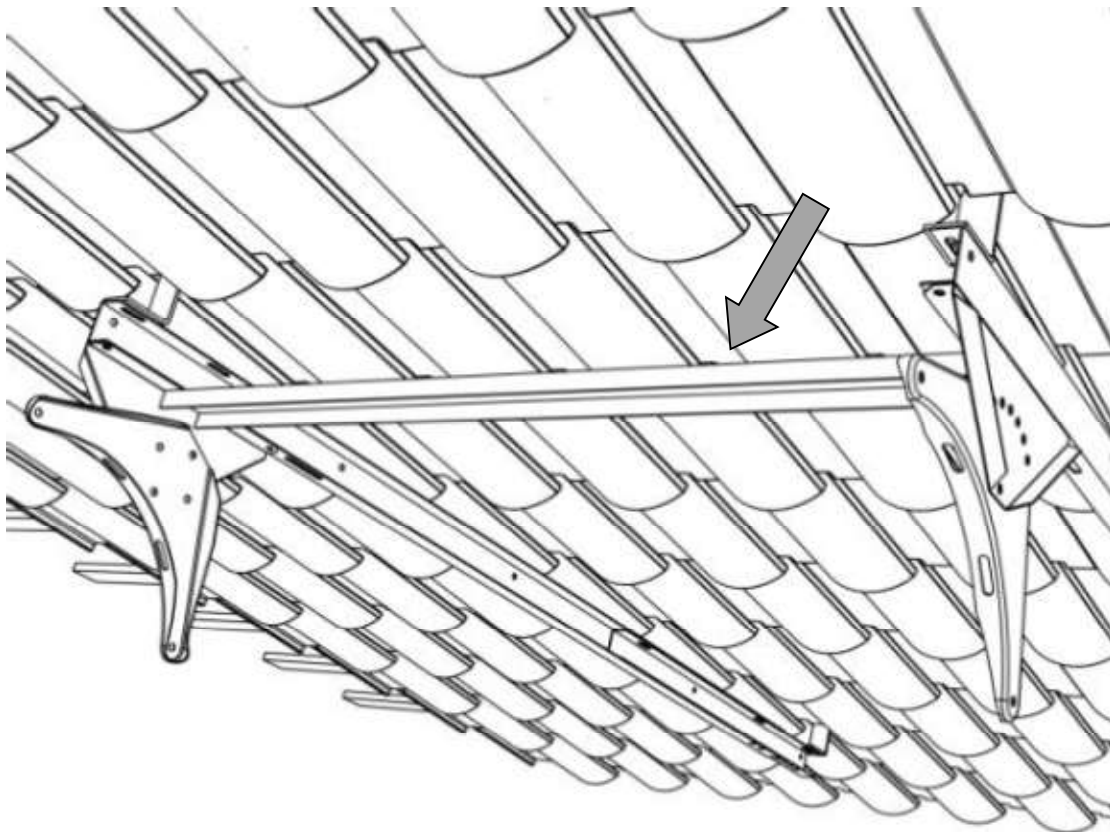
TABLE 1

SYSTEM	125/2.1	160/2.1	160/2,6	160/2,6H	200/2,1	200/2,6	200/2,6H	200/3	300/3H	300/4.2
DIMENSION A (mm)	1082	1082	1082	1082	1370	1370	1370	1370	1834	1834
DIMENSION B (mm)	2120	2120	2475	1765	2120	2475	1765	2475	2120	2120



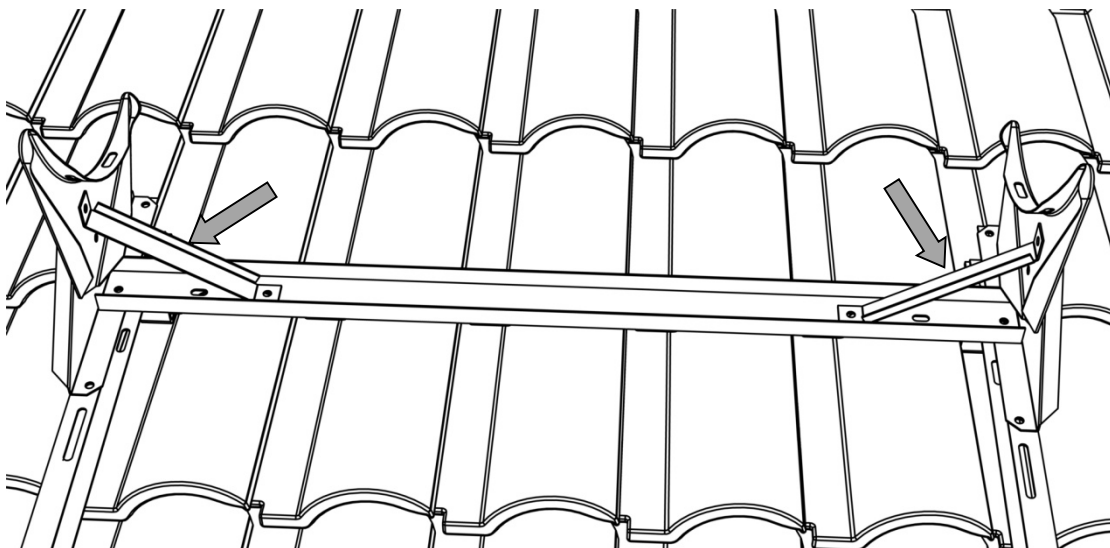
STEP 2

Replace the roof tiles and install the two longitudinal base sections onto the AGG brackets. Make use of the telescopic feature of the sections to adjust them to the appropriate length.



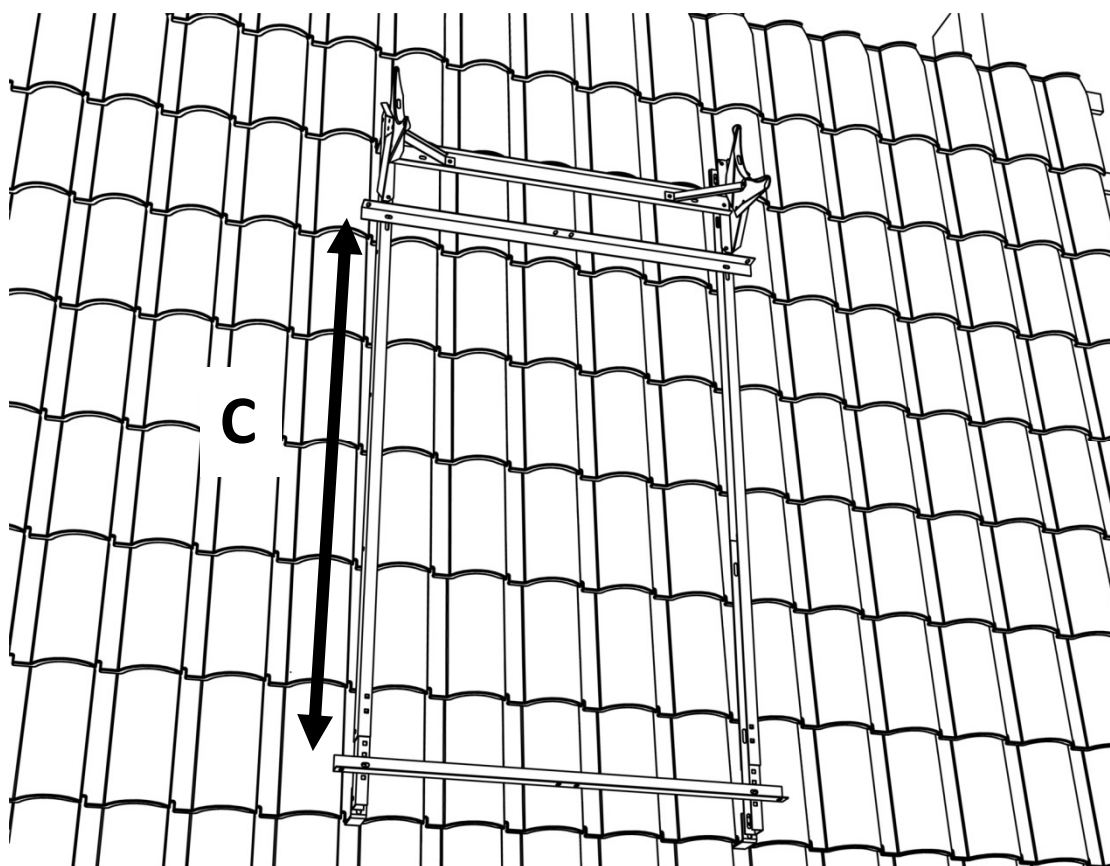
STEP 3

Install the transverse beam joining the two longitudinal sections.



STEP 4

Install the two support struts joining the transverse beam with the two longitudinal sections.

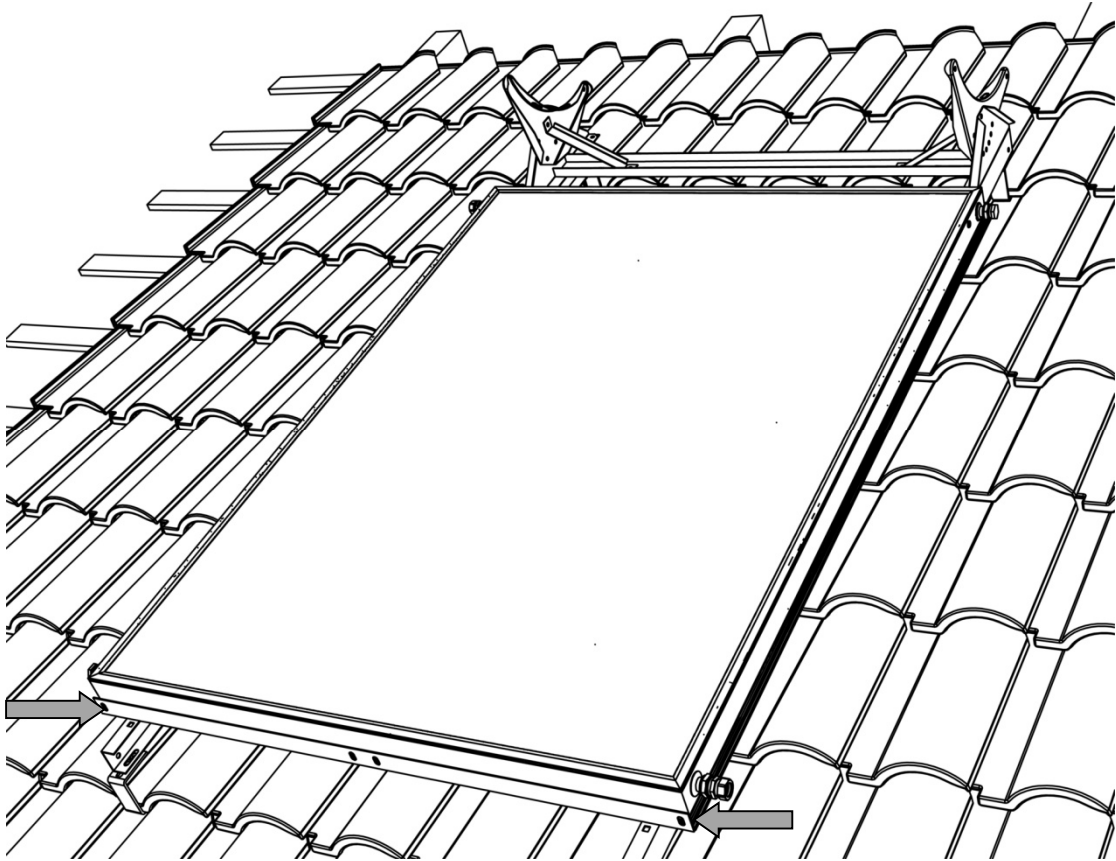


STEP 5

Install the two L beams supporting the collector. The distance C between the vertical mounting faces of two beams should be set according to Table 2 to fit the height of the collector. Secure only the bottom beam and slide the top beam upwards to ease collector installation.

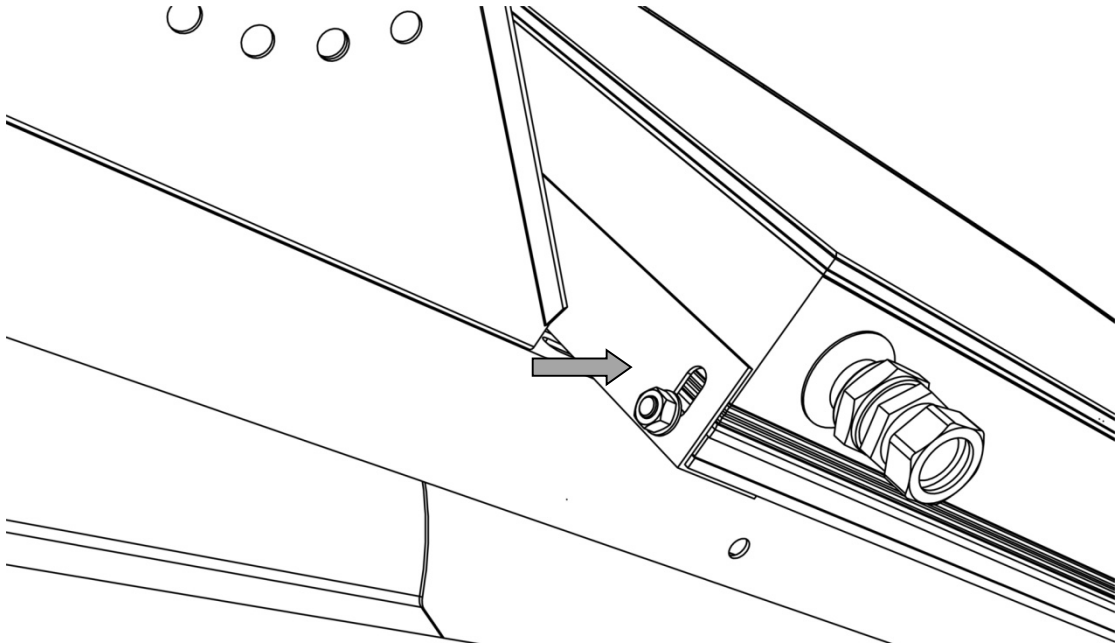
TABLE 2

SYSTEM	125/2.1	160/2.1	160/2,6	160/2,6H	200/2,1	200/2,6	200/2,6H	200/3	300/3H	300/4.2
DIMENSION C (mm)	1711	1711	2025	1244	1711	2025	1244	2011	1514	1711



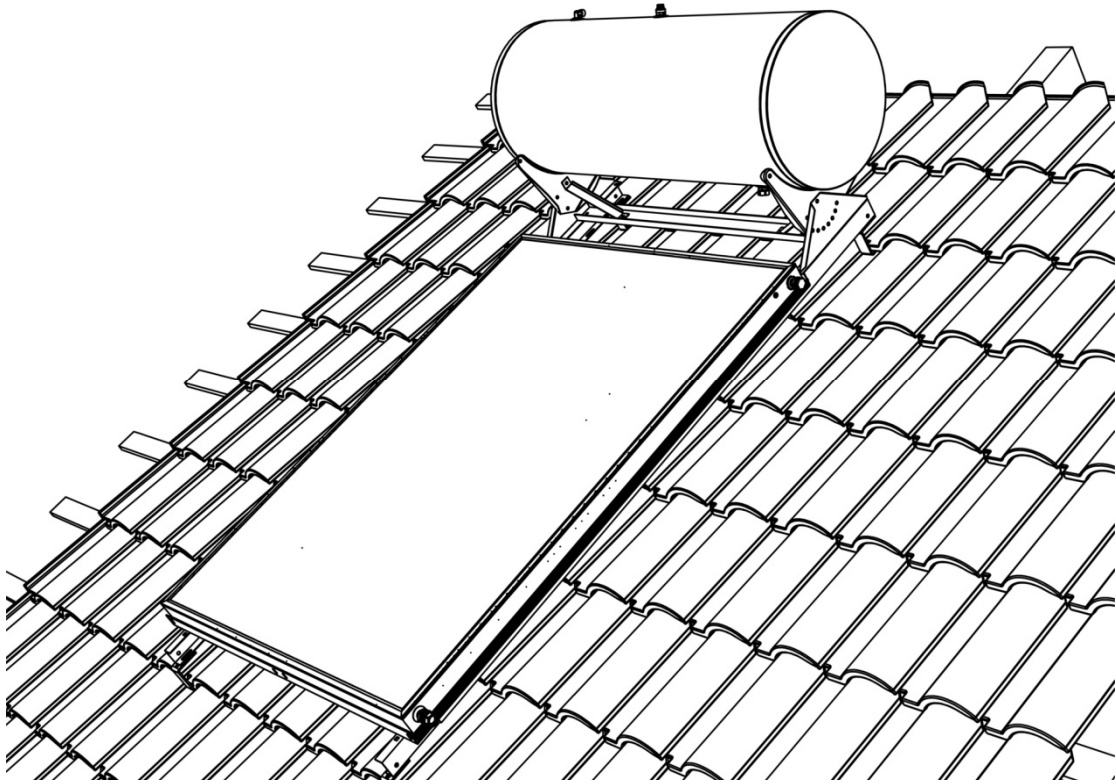
STEP 6

Place the collector(s) on the base assembly. Tighten the bottom securing bolts against the bottom support beam.



STEP 7

Slide the top support beam against the collector and tighten the support bolts. Tighten the support beam onto the longitudinal base sections.



STEP 8

Adjust the tank support to a horizontal position and install the tank.

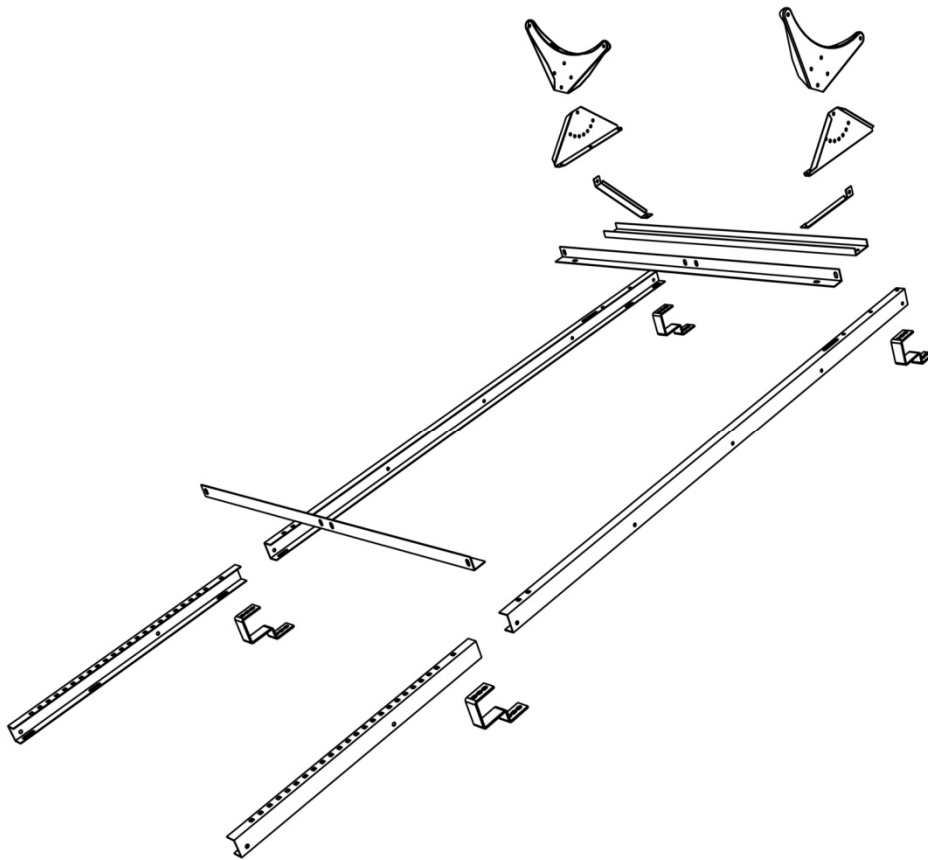


Figure 1: Components of the inclined roof base system.

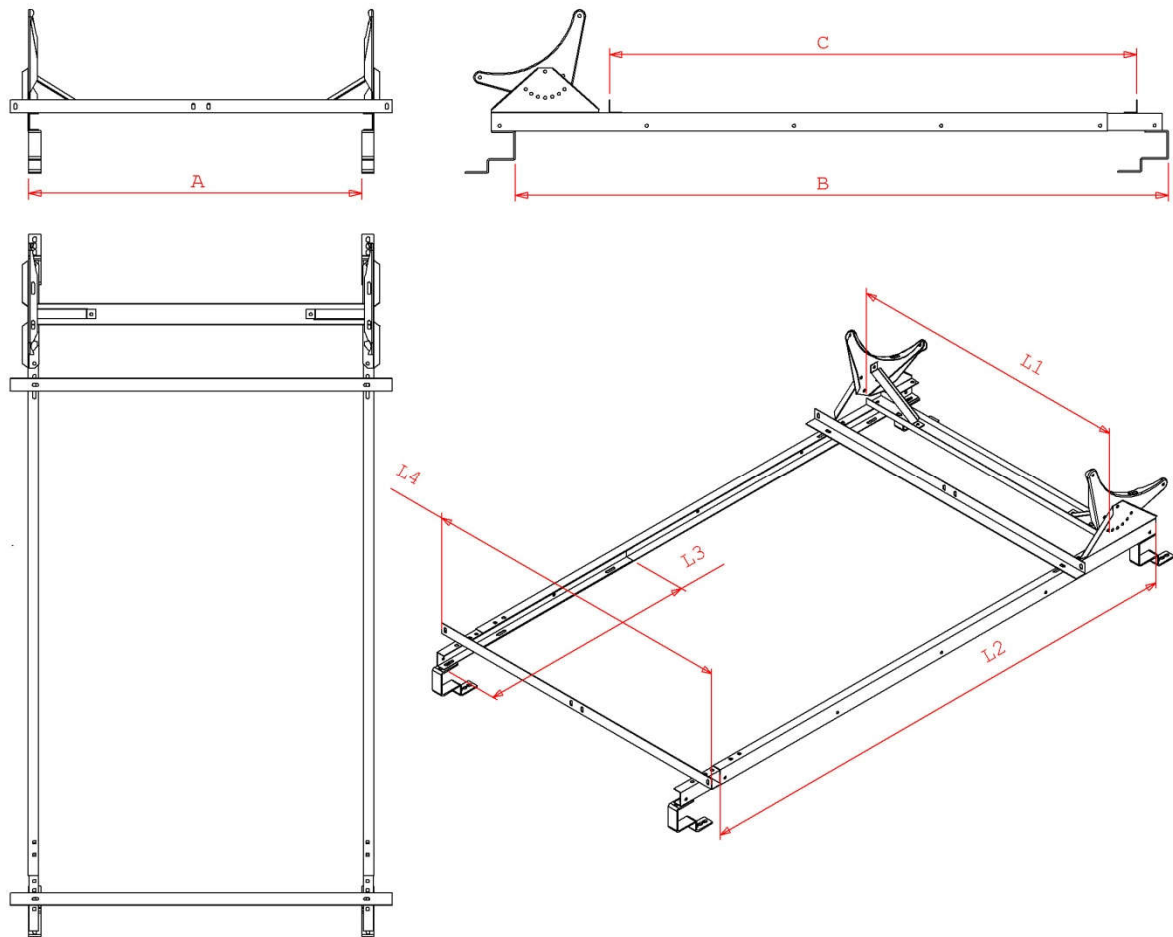
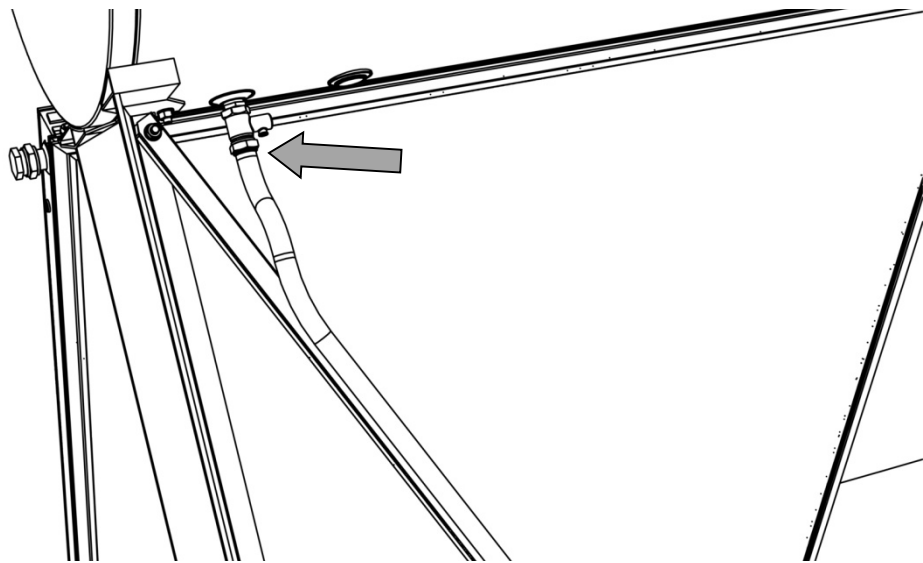


Figure 2: Installation and base system dimensions.

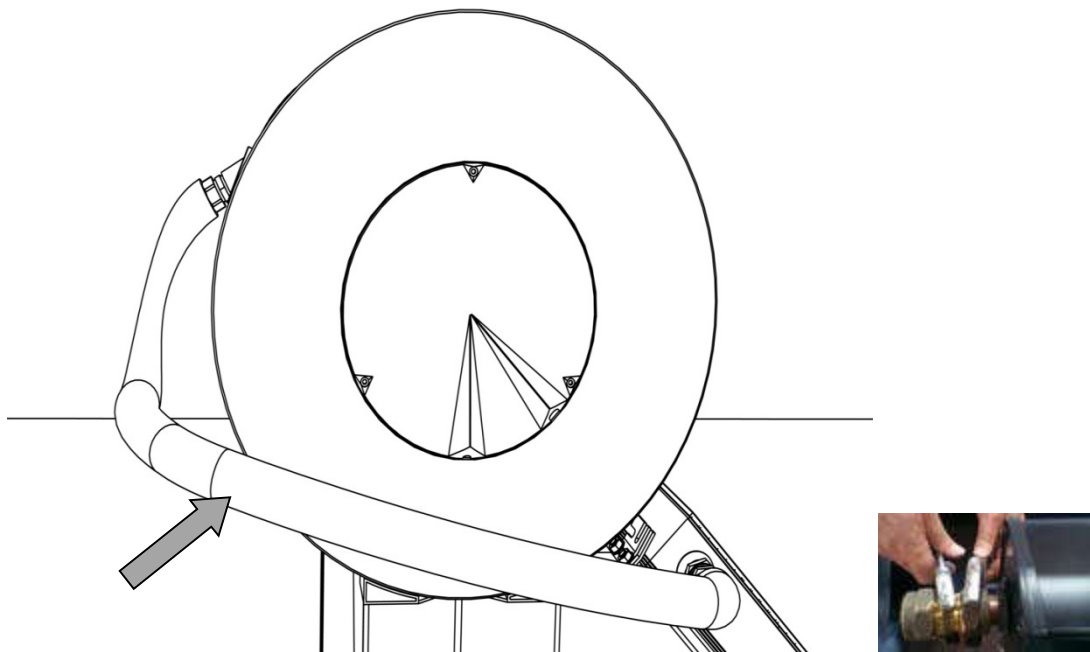
SYSTEM	INSTALLATION DIMENSIONS /			
	A	B	C	
125/2,1	1082	2120	1711	
160/2,1	1082	2120	1711	
160/2,6	1082	2475	2025	
160/2,6H	1082	1765	1244	
200/2,1	1370	2120	1711	
200/2,6	1370	2475	2025	
200/2,6H	1370	1765	1244	
200/3	1370	2475	2011	
300/3H	1834	2120	1514	
300/4,2	1834	2120	1711	
SYSTEM	BASE DIMENSIONS			
	L1	L2	L3	L4
125/2,1	1116	1600	866	1240
160/2,1	1116	1600	866	1240
160/2,6	1116	2000	866	1240
160/2,6H	1116	1200	866	1560
200/2,1	1404	2000	866	1240
200/2,6	1404	2000	866	1240
200/2,6H	1404	1720	866	1560
200/3	1404	2000	866	1560
300/3H	1868	1600	866	2000
300/4,2	1868	1600	866	2000

VII) HYDRAULIC CONNECTION OF SYSTEM [All systems]



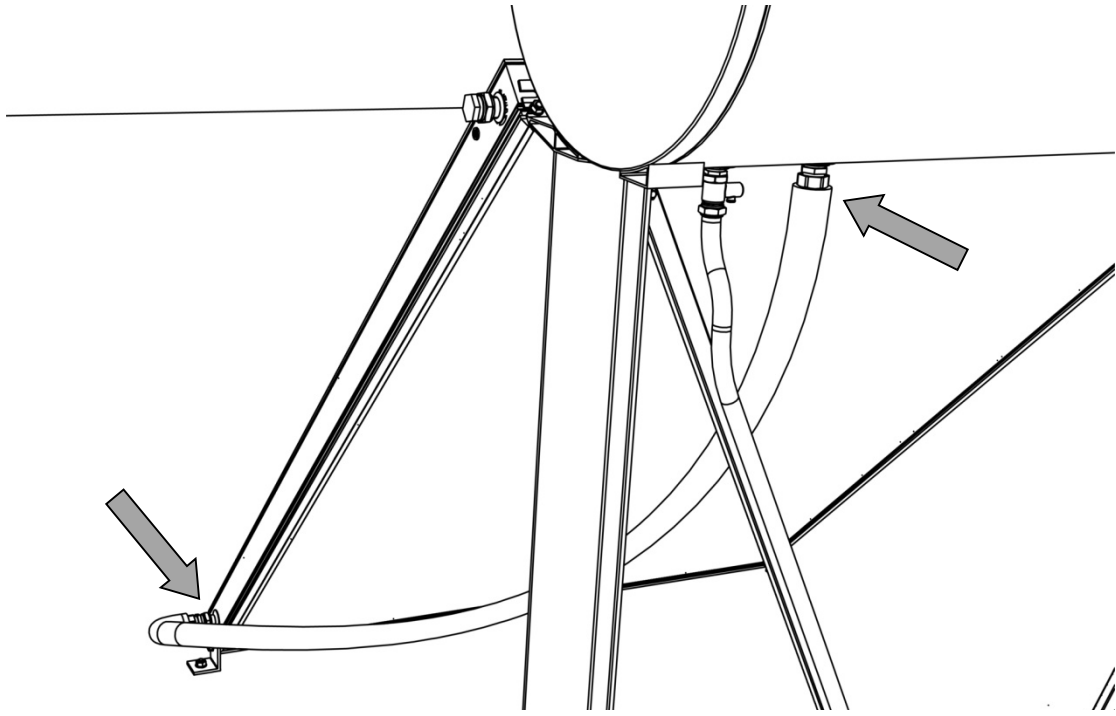
STEP 1

Connect the cold water supply tube and the safety and non return valve onto the tank. To save time you may start filling the tank at this point. When water starts overflowing from the hot water open circuit outlet close the water supply.



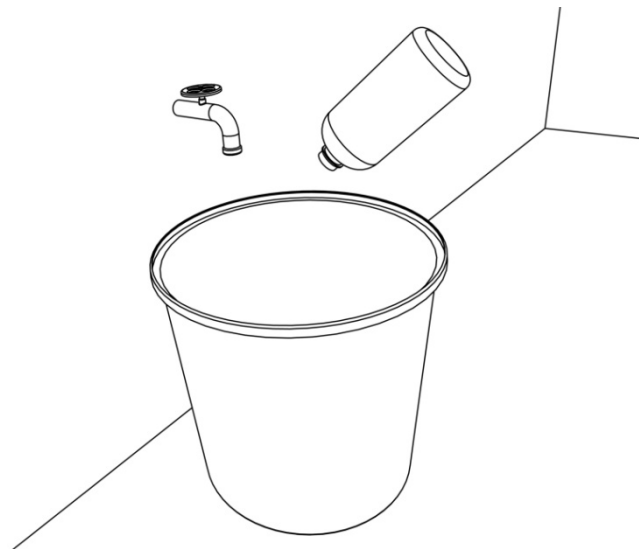
STEP 2

Connect the hot water closed circuit tube between the collector and the tank. Ensure that the tube follows an upwards route towards the tank. When tightening the fittings on the collector exit make sure you use 2 spanners, 1 for tightening and 1 against to avoid damaging the absorber.



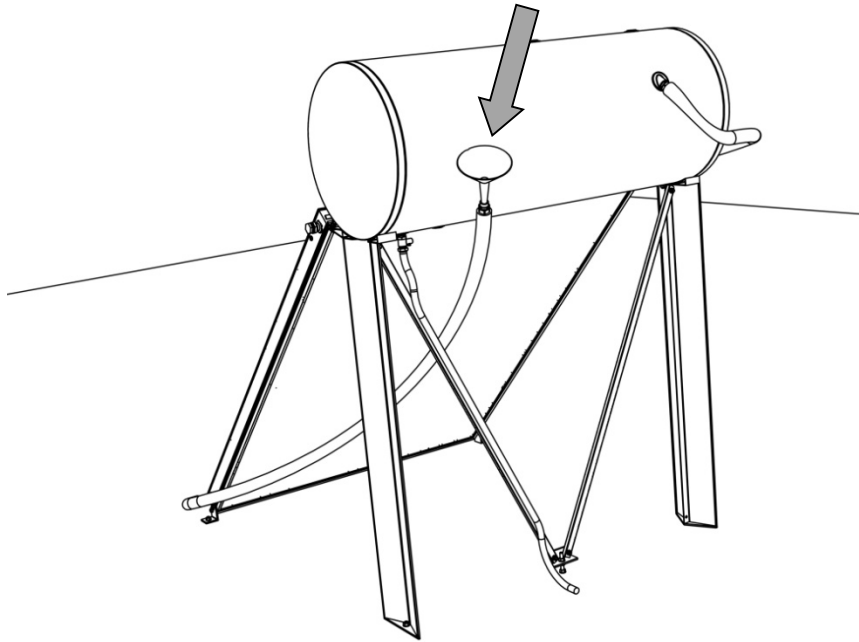
STEP 3

Connect the cold water closed circuit tube between the collector and the tank. Ensure that the tube follows an upwards route towards the tank. When tightening the fittings on the collector inlet make sure you use 2 spanners, 1 for tightening and 1 against to avoid damaging the absorber. Make sure the length and shape of the tube is appropriate. Do not tighten the tube on the tank side.



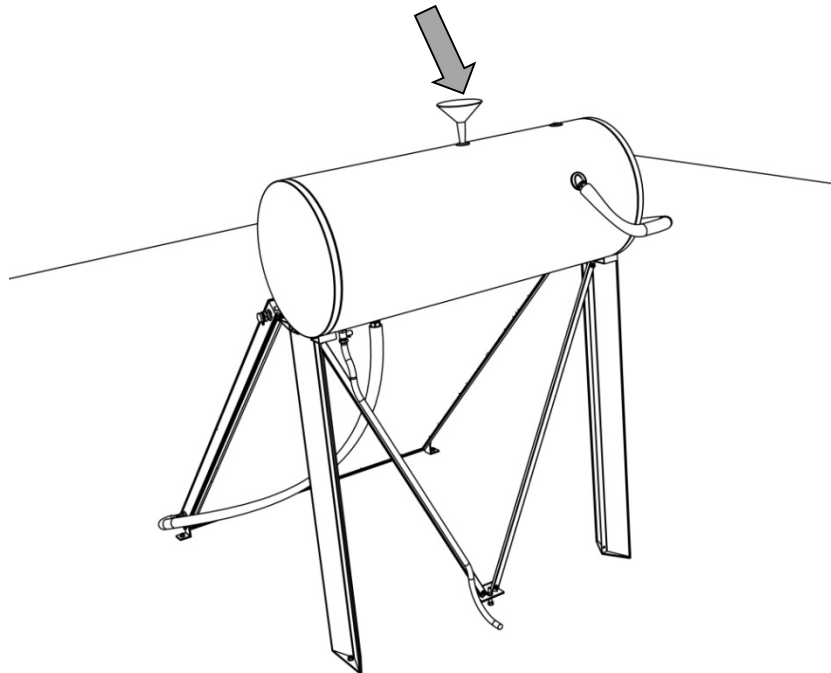
STEP 4

Mix water and NOX fluid in a bucket according to the table in Chapter 1.



STEP 5

Detach the cold water closed circuit tube from the tank. Pour the solution slowly into the tube in order to fill the collector. Let the liquid overflow through the outlet of the tank until no air bubbles come out and then attach and tighten the cold fluid union to the tank. You may need to attach an auxiliary tube to the cold water closed circuit tube so as to pour the solution from a point higher than the closed circuit hot water inlet of the tank.



STEP 6

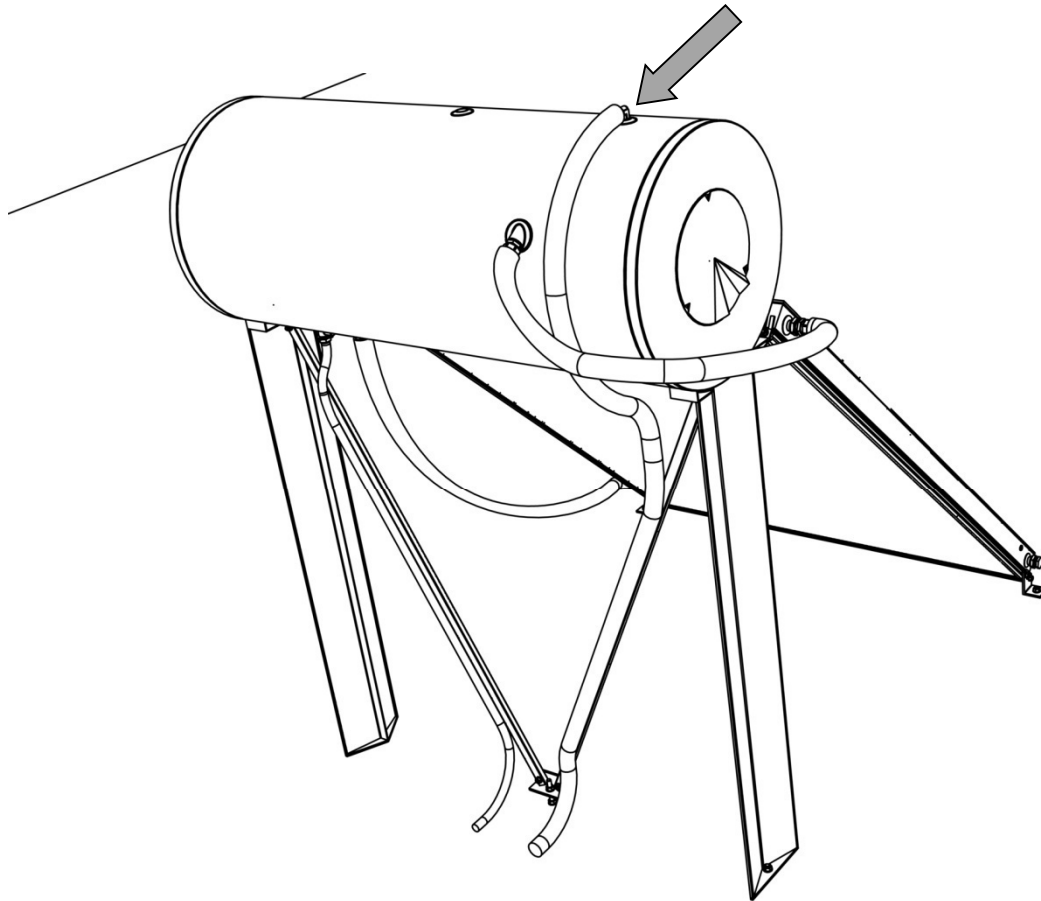
Complete filling the closed circuit with the solution from the safety valve outlet at the top of the tank.

STEP 7

Assuming the tank is filled with water and the closed circuit is filled with solution you may remove the cover sheet from the collector at this point. If it is a sunny day the solution will start overflowing from the safety valve outlet at the top of the tank as it heats up. If there is no overflow check that:

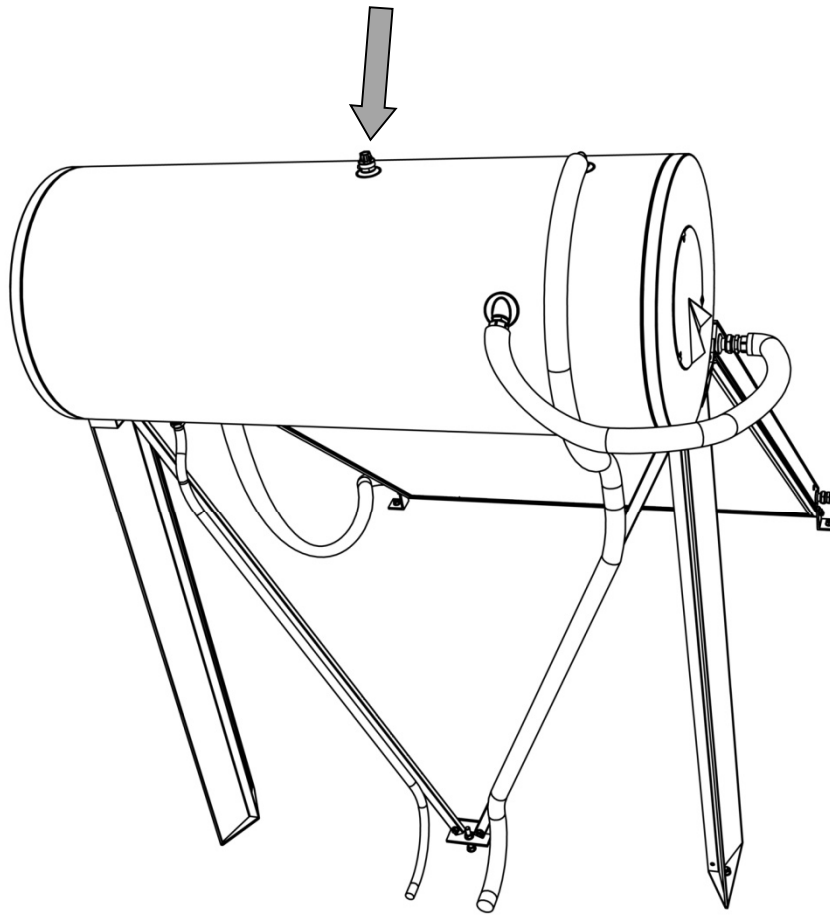
1. The closed circuit is filled.
2. There is no air in the closed circuit.
3. There are no leaks in the closed circuit connections.

Take the appropriate action until there is overflow.



STEP 8

Connect the domestic hot water tube. Turn on the domestic cold water supply and check for leaks. The domestic water pressure should cause the closed circuit solution to overflow from the safety valve outlet at the top of the tank. If there is no overflow perform the diagnostic tests of Step 7.

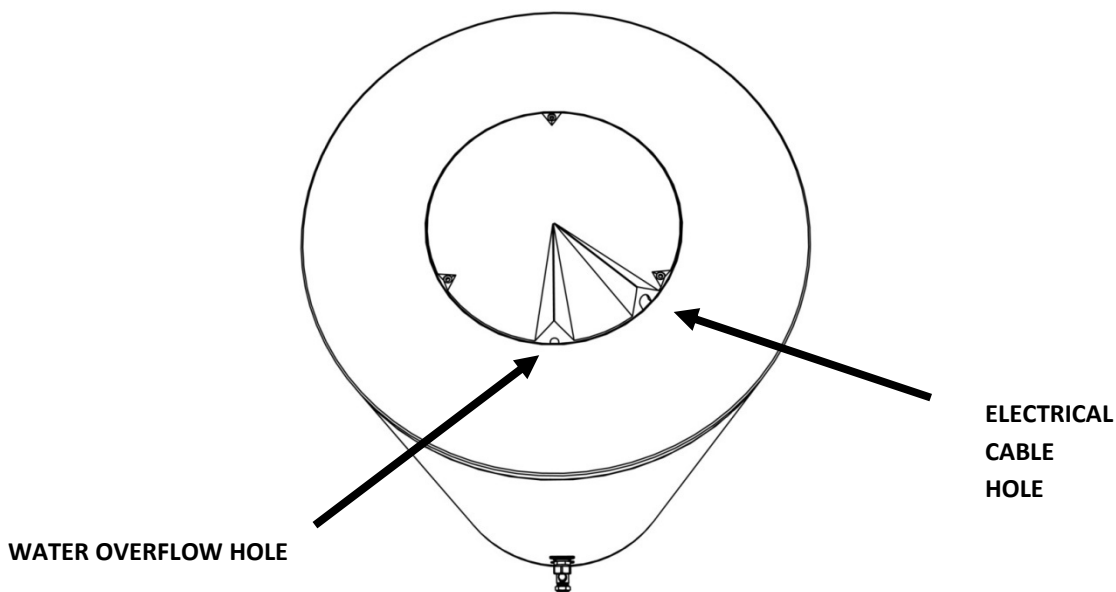
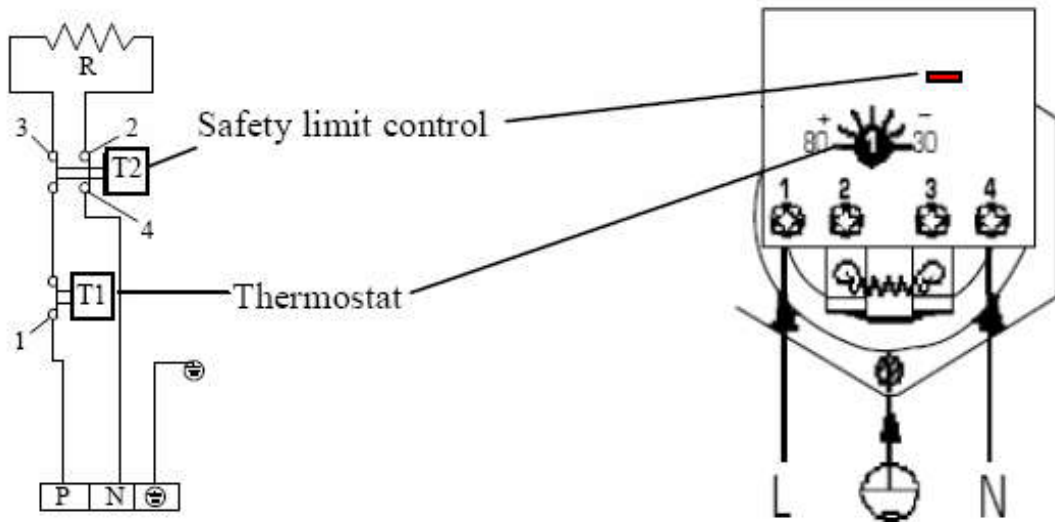


STEP 9

After approximately 20 minutes you may install the closed circuit safety valve at the top of the tank.

VIII) ELECTRICAL CONNECTIONS

The electrical connections must be in compliance to the regulations applied in the country of installation and must always be realized by a certified electrician. Below is a diagram of how the power supply is connected to the heating element through the thermostat.



IMPORTANT: The electrical connections plastic cover on the side of the water tank should be installed as shown in the drawing above. The smaller hole is for the overflow of any water leaking into the electrics cavity and should be placed at the lowest point of the cover. The electrical cable hole is larger to accommodate for the diameter of the cable and protective sheath.

CAUTION: If you **DO NOT** connect the electrical resistance with the electrical panel of your house, you need to earth the anode with the roof's slab or with elsewhere made of concrete or wood and certainly **NOT** with the electrical earthing in order to fulfill the warranty conditions of your solar water heater.

XIII) FUNCTION AND MAINTENANCE

In order to protect the system from overheating, during high irradiation periods, it is highly recommended to install a T-P valve at the domestic hot water outlet, allowing the direct evacuation of the overheated sanitary water to the sewerage system. This T-P valve shall be set up to 60 °C. Otherwise cover the surface of the collector partially when there is low consumption or fully when there is no consumption at all (long period of absence). For this purpose choose the specialized covers for Calpak M4 collectors.

It is also possible to install an expansion vessel at the upper part of the tank, which will store the liquid of the closed circuit when expanding and prevent it from spreading in the atmosphere. In this case the safety valve is installed above the expansion vessel.

In case the solar heater's performance drops, check that:

1. Orientation to the south is correct (or North for the South hemisphere)
2. The collector is at the appropriate angle, free of shadow and obstacles
3. All the connections are tight, with no leaks
4. The tubes of the closed circuit have the correct angle and do not generate siphoning
5. There are not any air bubbles in the closed circuit
6. The closed circuit is full of thermal fluid
7. There is no leakage or a mixing mistake in the domestic hot water supply.

For proper system maintenance a specialist should check every year (preferably September or October):

1. The magnesium rod of the tank, which should be free from salt deposits and to a size larger than 50% of its initial state. Otherwise must be replaced.
2. If the closed circuit of the tank needs to be filled with Nox Fluid (see page 1 for correct proportion) to ensure both the corrosion and antifreeze protection of the tank as well as the good performance of the heat exchanger.
3. The proper operation of the electrical resistance
4. If the safety valve at the cold water inlet is normally operating (if there are accumulated salts and is not possible to be cleaned, it must be replaced).
5. If the collector's glass is clean
6. Any other possible damage