



**Roth Solar Systems
HelioStar 252
Certified Installers Handbook
2009**



SOLAR SYSTEMS

Installers Handbook 2009

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1. SAFETY INFORMATION

Read these installation instructions carefully before beginning installation and comply with the safety instructions contained therein.

Industrial safety regulations and OSHA requirements are to be observed, particularly when working on roofs. All regional safety requirements should be followed when installing Roth Industries solar products. All tools and equipment located on the roof should be secured to avoid falling object hazards. All equipment/tools should be properly maintained and inspected prior to use. Any exposed studs should be protectively capped to help avoid injury.

This installation manual is intended for use of certified Roth Industry professional installers. It may be prudent to partner with a professional roofing contractor. The roofing contractor can determine the viability of the existing roof. A roofing contractor is better qualified in locating the underlying roof structure and the installation of the anchoring system. They also have the proper safety equipment and insurance for this type of work.

Because of weight considerations, please contact the Roth Technical Dept for situations subject to excessive snow loads for installation sites that exceed 2000 ft. (600 m) above sea level.

Important: do not remove the plastic film prior to commissioning the solar panel. This plastic cover blocks the solar energy and prevents damage to the panel when dry.

It is possible that the collectors cannot be completely emptied with this installation version. Consequently, the solar installation may not be filled with anything other than Roth approved water/antifreeze mixtures, which means that it is absolutely necessary to fill with antifreeze, after pressure or function tests!

1.1 Anchor Disclaimer

The Installer is solely responsible for providing proper anchoring of the collectors outdoors or on roofs, particularly where there are strong winds. The weight specifications contained in the installation instructions for anchoring the panel system are arbitrary and do not cover high winds or storm damage, weather related damage is expressly understood as not covered by any guarantee on the part of Roth Industries.

1.2 Grounding

The metallic pipelines of the solar circuit are to be grounded to the house circuit. If a lightning protection installation is present, then the collectors can also be linked to it. Grounding can also take place by means of a ground rod. The ground cable is to be laid outdoors against the house.

1.3 Electrical

The sensor is to be mounted in the last flooded collector on the side of the Supply (hot outlet). The rubber sleeve is to be removed for this purpose, the sensor is to be threaded through and the rock wool in the interior of the collector is to be pushed a little to the side. Then apply some heat conduct-

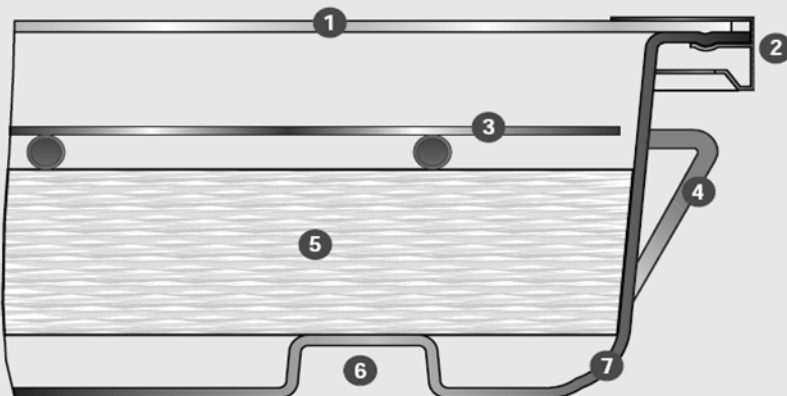
paste to the sensor and insert it as far as possible into the immersion sleeve. To complete the process, push the rubber sleeve back in until the counter lip engages with the collector frame. A wire of 18-2 gauge is sufficient for extending the sensor cable up to 164 feet (50 m). If longer distance is required 16-2 wire is to be used. It is important to protect the connected control unit and the sensor against overvoltage by lengthening the collector sensor to include a fuse protection (optional) immediately after the collector.

Important: When storing collectors prior to installation, make sure that they are neither left outdoors nor stored lying on their glass surfaces and/or uncovered. Moisture could make its way into the ventilation holes located in the frame.

Roth assumes no liability whatsoever in cases of damage. The warranty in accordance with the conditions of guarantee that apply to the material supplied by Roth remains unaffected by this. The pertinent standards and guidelines apply, in particular DIN 1055-T4 in terms of minimum weight loads with various building height.

2. OVERVIEW AND QUICK FACTS HELIOSTAR 252

■ Cut of collector



- ① highly transparent safety glass
- ② revolving aluminium frame
- ③ high selectively coated full area absorber
- ④ attachment points
- ⑤ 2 1/2" thick thermal insulation
- ⑥ grooves for easy installation
- ⑦ collector case made of polycarbonate

Technical specifications Roth flat collector Heliostar ®

Length	82 5/8" (2100 mm)
Width	47 1/4" (1200 mm)
Height	4 1/4" (109 mm)
Gross surface area	27.13 ft ² (2,52 m ²)
Aperture surface area	24.76 ft ² (2,30 m ²)
Weight	94.8 lbs (43 kg)
Collector case	highly stressable polycarbonate case construction, tight all around due to deep-drawn manufacturing process of one piece, permanently corrosion resistant
Glass cover	low-iron solar safety glass transmission factor = 91 %
Absorber vacuum,	high selectively coated full area absorber
Absorption	95 %
Emission	5 %
Fluid capacity	0.39 G (1,46 l)
Heat transfer medium	solar fluid Heliostar® and F2
Operation pressure	217.6 psi (15 bar)
Solar sensor sleeve inside	1/4" (Ø= 6 mm)
Collector connection	1 / 2 " MT flat sealing
Collector yield, per annum	over 166,460 Btu/ft ² An. (525 kWh/m ² a)
Area of application	domestic water heating and heating support



- **Quality Case** unbreakable polycarbonate case (high impact, temperature, wind and UV-resistant), light weight, no leakage due to construction (one seamless piece), permanently corrosion resistant
- **High performance absorber** High selectively coated full area absorber guarantees highest performance, perfect connection of the pipes to the absorber plate
- **Optimal insulation** Thick walled polycarbonate case, back wall insulation 2 1/2" (60 mm)
- **Safety glass** Low-iron, double sealed solar safety glass
- **Modern Design** Rounded case form without edges, dark color for appearance
- **Installation advantages** Low weight, easy installation with few tools, optimal stability, attachment system not visible, installation friendly accessories
- **Flexible usage** On-roof, free installation or installed on facades
- **Comprehensive Roth guarantee** 10 year Roth system guarantee
- **Collector yield annually**

3. DESIGN AND MOUNTING

3.1 Influence of alignment, inclination and shade on performance

In North America, the solar heating system provides the highest yield over an annual average when facing south with an inclination of approx. 30 to 45 degrees to the horizontal plane. *For example: In Madison, WI, the average incidence angle of sunlight is 19.5° from the southern horizon on the winter solstice (December 21) and 43° on the summer solstice (June 21). The annual average declination angle is 31.25°.*

However, the installation of a solar heating system is still viable even when the installation deviates quite significantly from the above (southwesterly to south-easterly alignment, 25 to 70 degrees inclination). A lower angle is more favorable if the collector surface cannot be pointed south. A solar collector system with a 30 degree inclination and an alignment of 45 degrees southwest still achieves almost 95% of its optimum yield. Even with an east or west alignment, you can still expect up to 85% with a roof slope between 25 and 40 degrees (typical North American roofs). A steeply angled collector surface offers the advantage of a balanced energy provision all the year round. On the other hand, an angle of inclination less than 20 degrees should be avoided with flat-plate collectors; otherwise the self-cleaning effect will be reduced. Morning and late afternoon shading is not as important as mid-day shading. There should be no shading of the collector array between 9:00 am thru 3:00 pm.

On special applications, Roth Industries representatives have available a Solmetric Sun Eye to calculate the exact solar altitude and azimuth angles for the installation location for special projects. The Sun Eye allows us to assess the potential shading effects of nearby buildings, trees and other objects that may affect the overall efficiency of our panel array. It has an integrated fish-eye lens and digital camera that captures a 360-degree image of the sky. The image shows obstructions that cause shading. Then the daily and annual sun paths are superimposed on the Skyline image, and solar exposure is plotted automatically. We can even edit the images to simulate the removal or addition of obstructions such as trees or structures. We use it to evaluate your site for solar energy potential. Solar access shading percentages, including monthly, seasonal, and annual data can be determined in the field and uploaded for further analysis



For Domestic Hot Water applications (DHW) the ideal slope angle is equal to your projects Latitude. Typically it makes sense to mount the panels to your existing roof angle. The difference between your roof angle and your latitude should be no more than 10°. If the degree is greater, it may become necessary to use Roth Industries adjustable mounting system. This of course is dependent on the number of panels and the solar application. In areas with a large snow load it may be advised to angle the panels to a minimum of 40°. When DHW and space heating are the desired application it is necessary to maintain a steeper angle. This is necessary to provide correct solar collection in the heating season shoulder times of early spring, and late fall. The angle should be increased a minimum of 10° to 20° from local latitude. This increased angle actually reduces DHW efficiencies in the summer. This should have little effect on the systems DHW capacities due to the larger panel area necessary for the heating load.

3. DESIGN AND MOUNTING

3.2 Angle of inclination

The angle of inclination is the angle between the horizontal and the solar collector. For pitched roof installations, the angle of inclination is determined by the slope of the roof. The largest amount of energy can be captured by the collector's absorber when the collector pane is aligned at right angles to the sun. In North America the pitch, angle or slope of the roof is the ratio of the rise over the run and usually measured in inches with the run being 12". So we will note the slope as 4 in 12, that is 4 inches in 12 inches.

The ideal slope and angle are determined by Latitude as well as by the intended function of the array.

3.3 Angle of azimuth

The angle of azimuth describes the deviation of the collector pane from the polar (true) south; with the collector pane aligned to polar south, the angle of azimuth = 0° . In North America, the ideal collector array would have a compass azimuth angle of 180° or directly south. This is because the sun's heat is most intense at midday, when the sun's position is closest to polar south. However, deviations from south of up to 45° southeast or southwest are also acceptable. The resulting reduction in annual solar energy collected is less than 3%. Higher deviations can be compensated for through the addition of more panels.

3.4 Selection and installation options for HelioStar 252 collector

The HelioStar 252 Panels are offered as vertical or horizontal versions for installation on pitched roofs, flat roofs, free standing ground installations, flat on walls and balconies

For flat walls or balconies please increase the collector area a minimum of 20%.

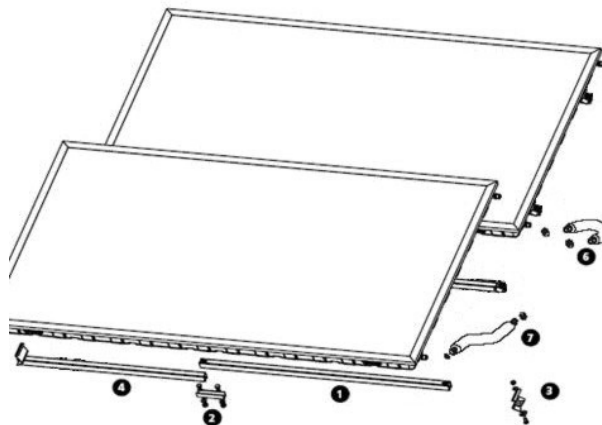


Fig. 3.4.1 Horizontal

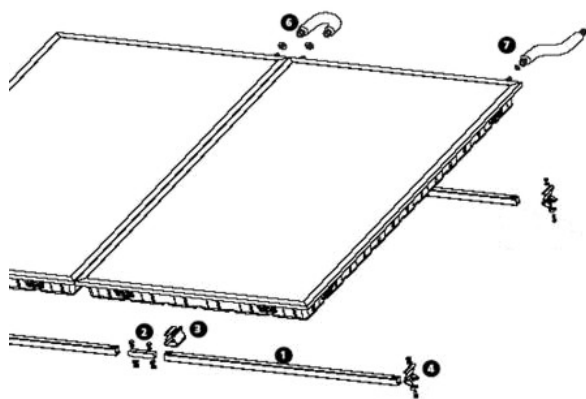


Fig 3.4.2 Vertical

4. INSTALLATION FOR ROOF

4.1 Vertical and Horizontal mounted Heliostar Solar Panels

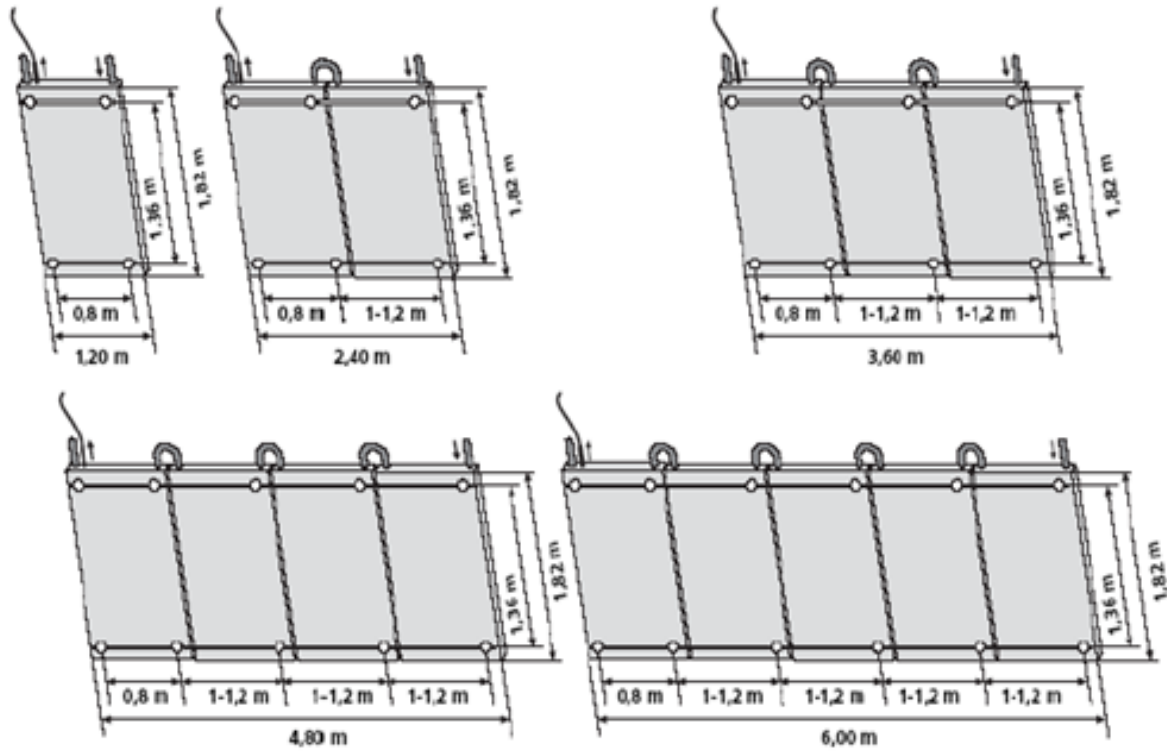


Fig. 4.1.1 Vertical No more than 5 panels to single array of panels.

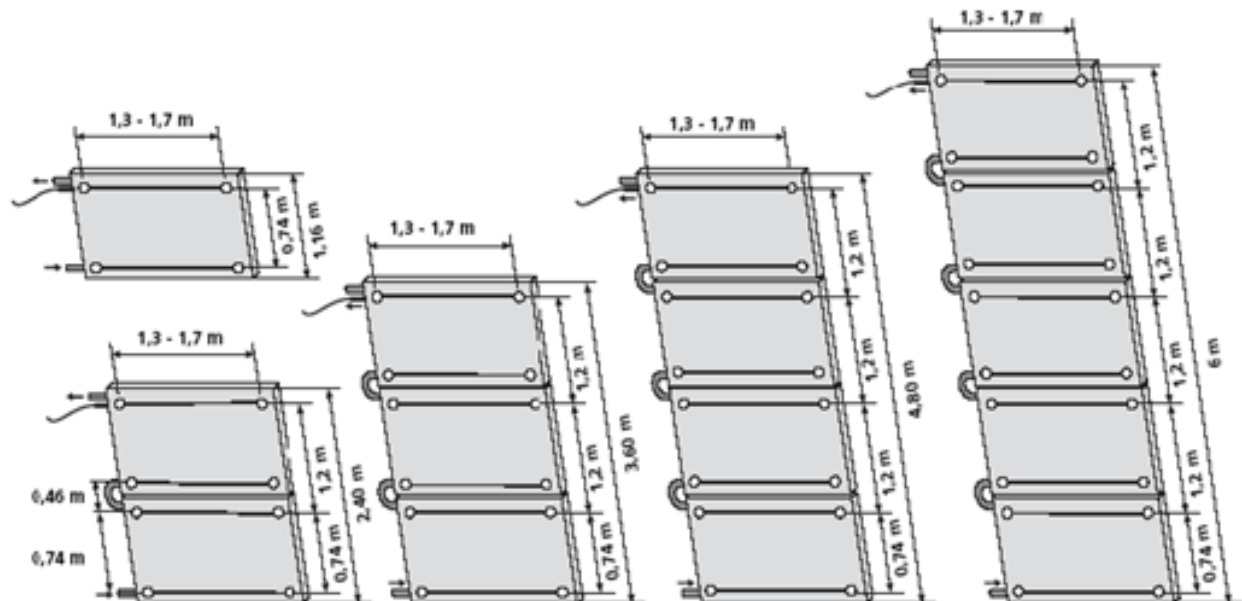


Fig. 4.1.2 Horizontal No more than 5 panels to single array of panels.

4. INSTALLATION FOR STANDARD ROOF

4.2 Roof Installation Shingled Roof with Jack Stand



Fig. 4.2.1 Roof Rafter spacing's of 12", 16" or 24" on center are typical. It may be necessary to remove the fascia board to determine the rafter spacing. If visible, the nailing pattern along fascia board (board attached to ends of rafters) may also indicate the rafter location at the bottom edge of the roof eave (bottom edge of the roof). Once determined, reference the centers of the roof rafter ends and use a chalk line to mark the rafter location up the roof. Another trick is to look at the gutters if available. The support nails should be centered on the roof rafter. Determine where on the roof the panels are to be located. The center distance between the upper and lower (vertical) anchor points is **64 5/8"**. Mark the intersection of the chalk lines. This will be your anchor point on the rafter centers.

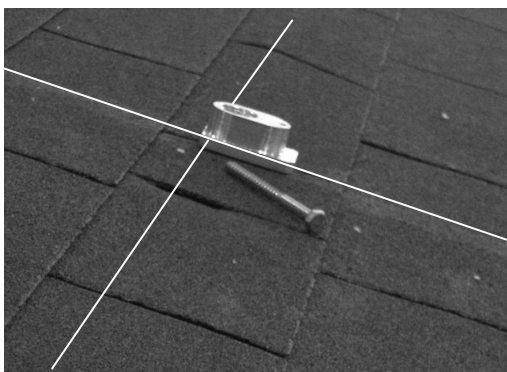


Fig. 4.2.2 line up bracket to center line of the stud.

Make sure the anchor base is centered on the rafter or truss. Using a 3/8" masonry bit, break through the composition shingle over the rafter in the center of the shingle. Position Fast Jack® drill guide over the hole location and drill your pilot hole using a standard 3/16" drill bit.



Fig. 4.2.3 Drill pilot hole in rafter using integrated drill guide to align the hole to center of roof truss. Insert the 5/16" stainless steel lag bolt and washer through the Fast Jack® base. Tighten bolt slightly to stabilize base, allowing for a secure template placement.



Courtesy of ProSolar

Fig. 4.2.4 Cut through shingles for flashing using template guide. The use of a hook blade in the utility knife is recommended. Cut carefully using the template centered on the base. Remove base and dispose of cut shingle.



Fig. 4.2.5 Insert the 5/16" stainless steel lag bolt and washer through the Fast Jack® base. Install the lag bolt through the Fast Jack® using a 1/2" socket and drive or an electric impact wrench.

4. INSTALLATION FOR STANDARD SHINGLE ROOF



Fig. 4.2.6 Thread post into base. Using the adjustable pliers, tighten post into base by turning clockwise.

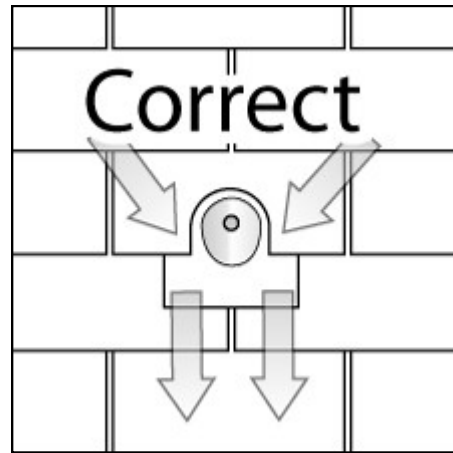


Fig. 4.2.7 Post and base complete.



Fig. 4.2.8 gently lift shingle and slide flashing over the post and up under shingle. It may be necessary to use a putty knife to break the adhesive bond on the back of shingle to allow for the insertion of the flashing.

It may also be necessary to use a flat bar to remove roofing nails that may obstruct the insertion of the flashing. Care must be used in older roofing material so not to damage the surrounding shingles. With fragile roof material it may be necessary to insert the flashing over the base and to then thread the post into the base. It will require the use of a small screw driver to properly set the rubber seal.



Courtesy of ProSolar

Fig. 4.2.9 Illustration above shows proper installation of the cut-in flashing. The lag bolt is located inside the cut-in area of the shingle. This ensures water will not flow under the flashing where the lag bolt is located. Provides top & side water protection helping to prevent roof-leaks and dry rot. A small tab of roof cement should be used under the leading edge of the flashing to guarantee a water resistant seal.

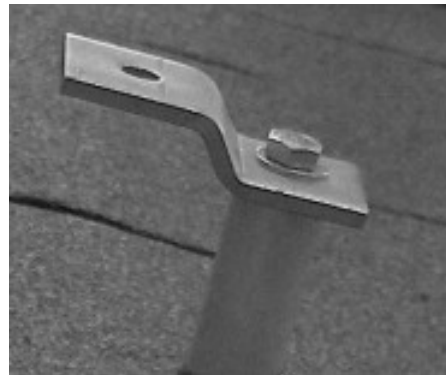


Fig. 4.2.10 Now attach offset Bracket with a Stainless steel 3/8" hex bolt and 3/8" washer

4. INSTALLATION FOR STANDARD SHINGLE ROOF



Fig. 4.2.11 Repeat the procedure for the six required anchor points. The center brackets should be on 48" horizontal centers. The last set of brackets should be on 24" centers or 32" centers (horizontal) depending on the rafter centers. The Roth frame will not accommodate a 48" on center configuration for the final set of brackets. The combination of the offset brackets and the unique adjustability of the horizontal rail will allow for this combination.

Make sure all installation crew members on the roof are mindful of installed roof attachments to prevent tripping. All installation crew members should utilize proper safety equipment when installing a solar system. (Harnesses, hardhats, gloves, proper no-slip footwear, etc.)

Fig. 4.2.13 Heliostar On-roof attachment basic frame
Please assemble the frame on the ground and then transport the finished lengths to the roof. The procedure is to insert the splice adaptor into the two rails while inserting the center panel anchor bracket. Bolt the splice adaptor together. Once assembled, slide the "u" bracket nut assembly(s) into each side of the frame corresponding to the location of the anchor points on the roof. Lightly thread on the lock nuts to hold the assembly into the rail. Transport the rail to the roof and using the adjustable "u" bolt assembly connect to the offset bracket on the Fast Jack® anchors. Once the frames are in place measure the distance between the inside of the upper and lower frame assemblies. This distance should be 63.5". Adjust the offset brackets to attain this measurement. There should be a minimum of 2" from the frame end to the offset bracket. This distance allows for the installation of the single anchor bracket on the frame.

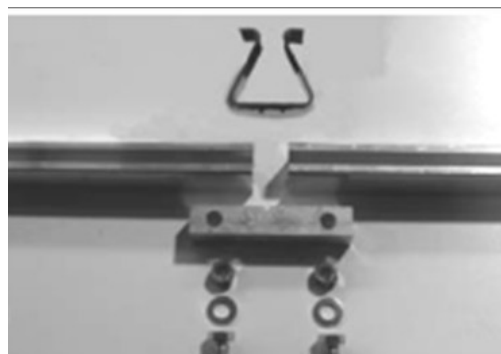
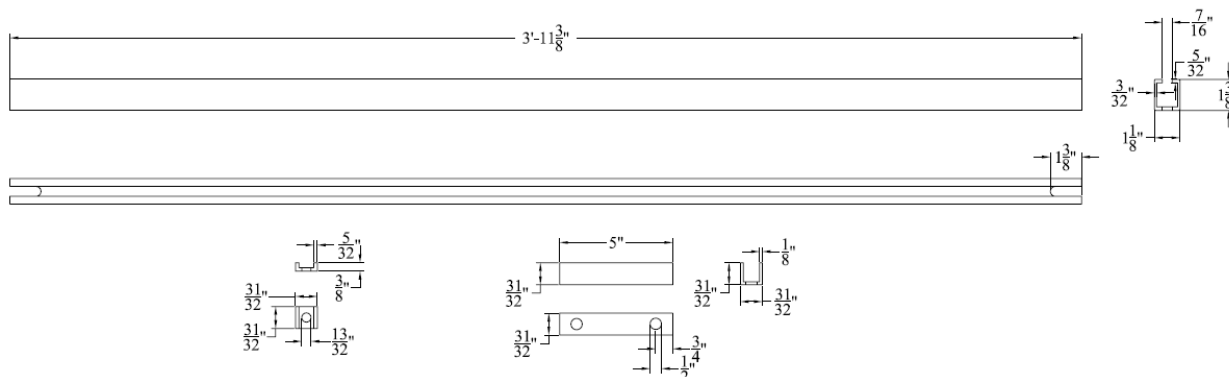


Fig. 4.2.14 Splice adaptor for the second panel assembly

Fig. 4.2.12 Heliostar On-roof attachment basic 2315007446



4. INSTALLATION FOR STANDARD SHINGLE ROOF

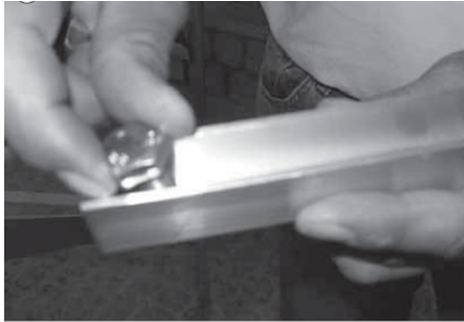


Fig 4.2.15 Both M12 x 20 screws have to be inserted in the connection rails for the upper and below horizontal rail as shown.



Fig 4.2.16 On the opposite side the u-washer and nut have to be inserted and have to be tightened easily by hand.

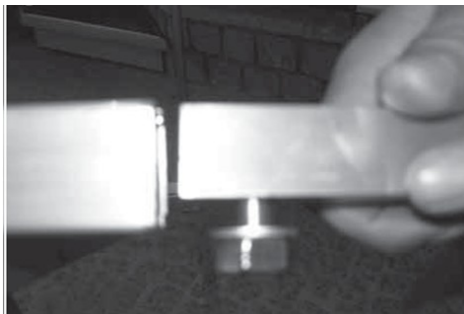


Fig 4.2.17 Slide connection piece into both the upper and lower primary rail and second rail and be sure to put the double connector in place prior to tightening bolts (repeat as necessary for added panels).

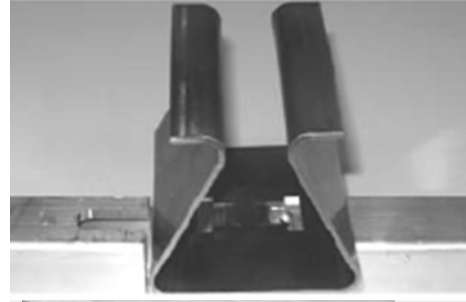


Fig. 4.2.18 Center panel anchor bracket



Fig. 4.2.19 assemble U bolt assembly



Fig. 4.2.20 Slide nut assembly in to frame

4. INSTALLATION FOR STANDARD SHINGLE ROOF

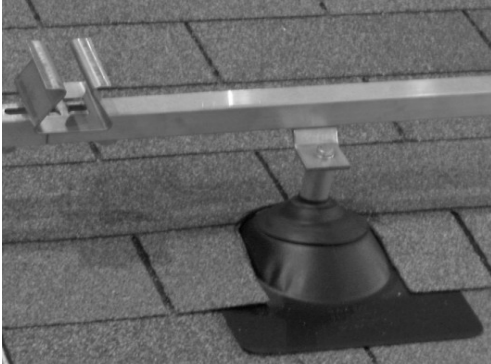


Fig. 4.2.21 mount frame to Fast Jack® with off-set bracket and U bolt assembly and lock nut.

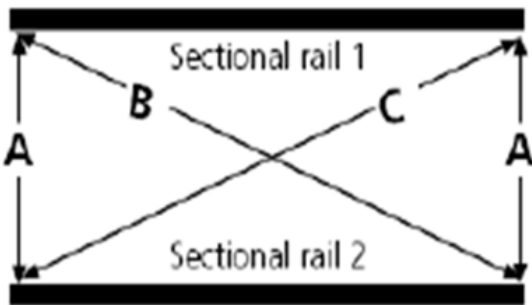


Fig. 4.2.22
A dimension is **63.5 inches (161.3 cm)**. B & C need to be equal in length. Fine tune the adjustment by moving offset bracket.



Fig 4.2.23 Finished roof rack for two panel array

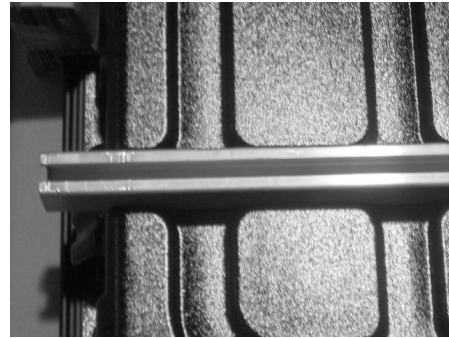
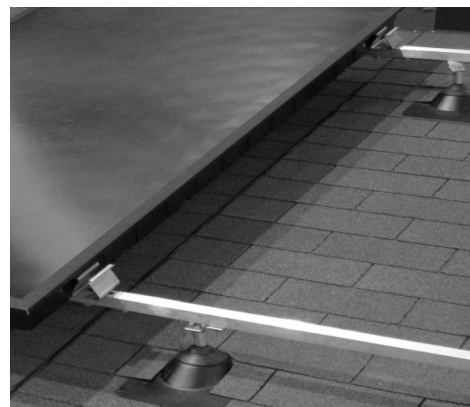


Fig 4.2.24 The Heliostar panels polycarbonate body is indented to accept the rail assembly. This allows the panel to be slid on the rack. It also allows for hands free support of the panel during final anchoring. This makes for easier and safer installations on steep roofs.



Fig 4.2.25 Slide Heliostar panel on rail using indents provided on back of panel until the anchor point meets the center bracket. If necessary make adjustments on offset brackets to square up panels.



4. INSTALLATION FOR STANDARD SHINGLE ROOF

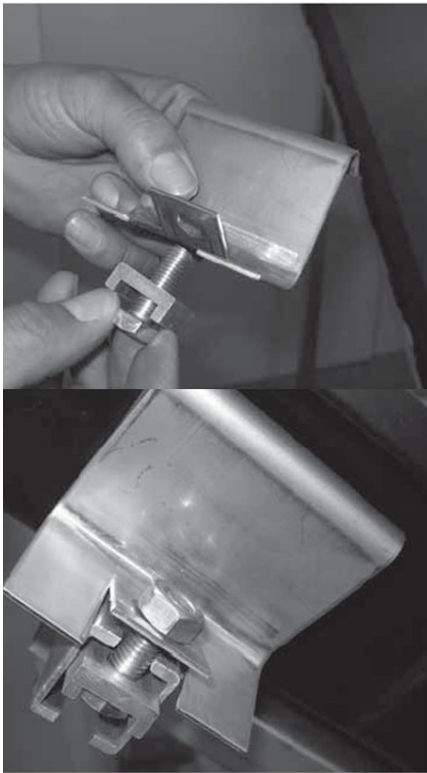


Fig 5.1.18 The lateral attachment clamps have to be fixed by M10 x 30 bolt, u-washer and nut in the lateral long hole of the horizontal rail.

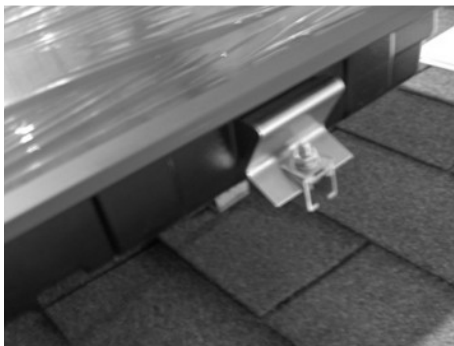
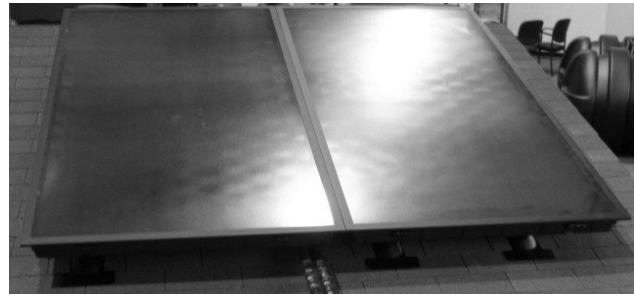


Fig. 4.2.26 Bolt the lateral attachment clamps in place to complete the roof frame installation.



All explained steps up to now are useful for the fixing of two Heliostar® solar panels in vertical position by using the Roth Basic Set. **2315007446**

When you are installing more than two Heliostar® solar panels in line, you have to substitute on one side of the rack the lateral attachment clamps with the double attachment clamps in the On-roof attachment extension set **2315007448**

4. INSTALLATION FOR STANDARD SHINGLE ROOF



Fig 4.2.27 Remove the grommet next to the pipe on the return of the collector field and slide it over the cable of the temperature sensor: insert temperature sensor into the immersion sleeve as far as possible and remount the rubber grommet in the collector.

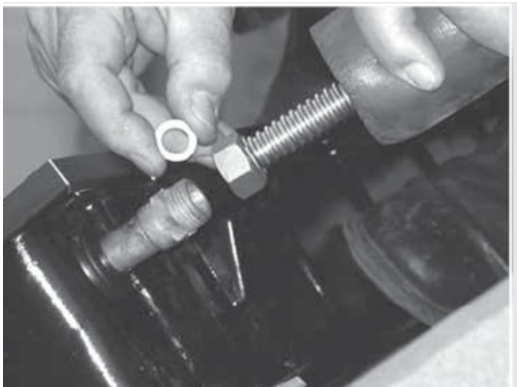


Fig 4.2.28 The collectors are connected with one another by means of the short corrugated tube. Gasket rings and insulation are included.

Place provided gasket to the inside of crossover pipe.

Each Basic Rack Kit comes with the necessary flexible insulated crossover pipe and short flexible insulated supply and return piping. Each additional Extension Rack Set comes with additional flexible insulated cross over pipes



Fig 4.2.29 Use the supplied gasket and two wrenches to tighten the fitting. Repeat process as necessary. Use of a single wrench will cause internal damage to the collector piping.

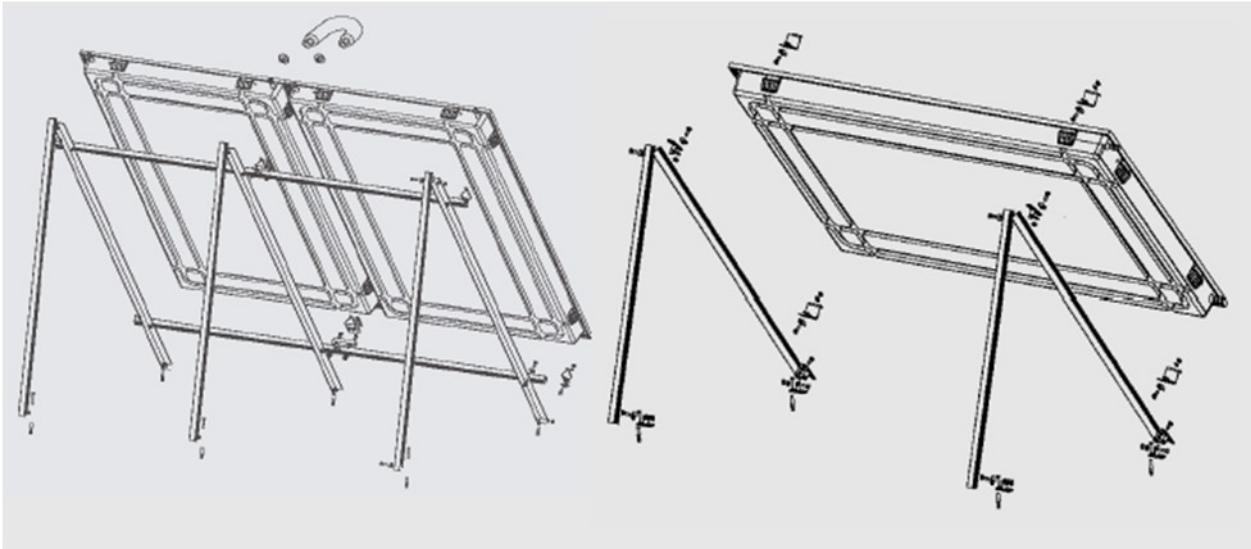


Fig 4.2.30 We have completed the basic roof installation. Now we must determine how we are to get our solar piping to the mechanical space. This can be as simple as running Roth 2 in 1 piping down the side of the roof and through the wall into the mechanical room, another penetration through the roof with flashing. Whatever is the least evasive piping requirement and still meets our customers required aesthetics.

Turn to section 7.0 for details on the 2 in 1 piping and pump station.

5. INSTALLATION FREE STANDING

5.1 Installation Free Standing High and Low profile



The free standing rack system is designed for ground mounted solar arrays. This rack system can also be utilized for flat roof applications. It is designed to be used with concrete pedestals, poured concrete supports, I beam or metal framework on the roof. It requires a weighted anchoring system.

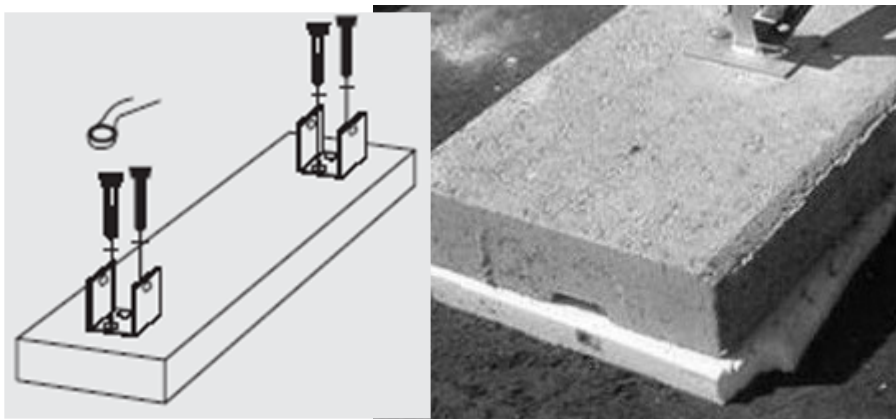


Fig 5.1.1 Ground anchoring

System variants:

- With concrete pedestal

Minimum weight load in accordance with DIN 1055-4:

Up to 26'-3" (8 m) of building height 15.4 lbs/ft² (75 kg/m²) of collector surface.

Up to 65'-6" (20 m) of building height 26 lbs/ft² (127 kg/m²) of collector surface.

Distance to the edge of the roof at least 6'-6" (2 m).

5. INSTALLATION FREE STANDING



Fig 5.1.2 M10 x 60 screw to be fixed with U-profile in the installation rail.



Fig 5.1.3 Attach with washer and nut to vertical installation rail. (Insert until end of long whole)

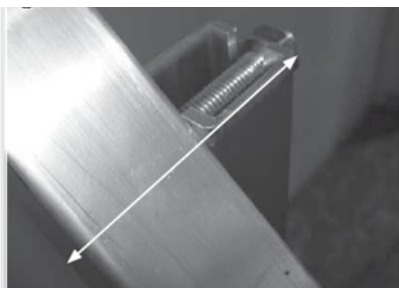


Fig 5.1.4 Important: vertical installation rail must be inserted until it creates one level (see line in the picture)



Fig 5.1.5 Now we created a triangle for the side. The delivered T-pieces will be installed



Fig 5.1.6 M10 x 30 screw to be inserted in the U-profile and through the boring above in the T-piece. It is softly fixed with washer and nut.



Fig 5.1.7 The prepared connection is inserted in the installation rail and afterwards fixed to the anchor. This procedure is carried out on the lower end of the vertical and slope rail.

5. INSTALLATION FREE STANDING

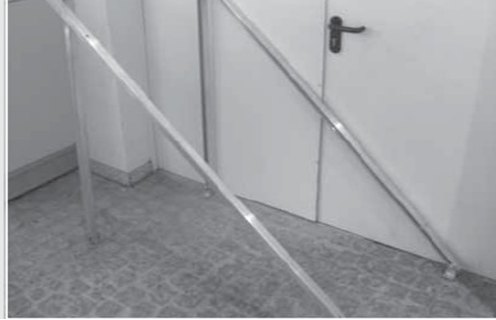


Fig 5.1.8 This procedure is carried out for the installation of the second triangle.

The installation of both horizontal rails is carried out as follows:



Fig 5.1.9 Important: For the installation of horizontal rails you will find pre-installed holes. In the upper area of the shown installation rails there are 2 holes, the upper holes are to position the horizontal rail for the installation of the Heliostar® 252



Fig 5.1.10 The horizontal rails are inserted with M10 x 60 screws in the U-shaped cut and completely pushed in the installation rail.

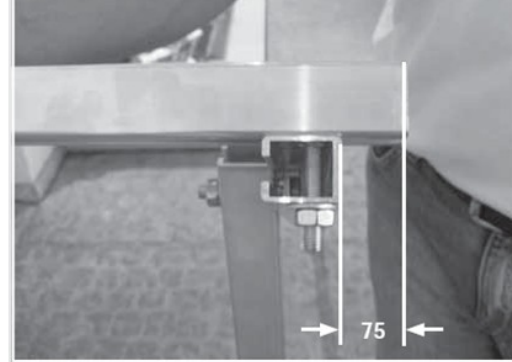


Fig 5.1.11 The distance of the outer edge slope rail compared to outer edge horizontal rail should be 2 15/16" (75 mm).



Fig 5.1.12 After the upper horizontal rail is fixed, the rail will be mounted in the same way

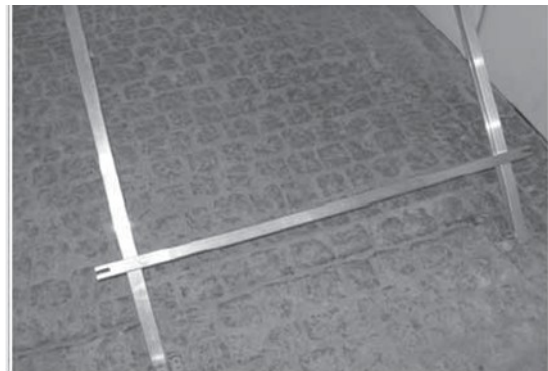


Fig 5.1.13 Finished installation of the horizontal rail.

5. INSTALLATION FREE STANDING

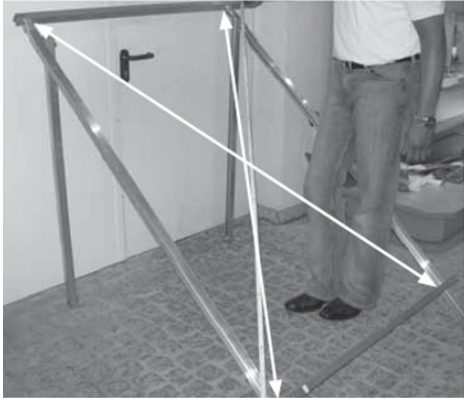


Fig 5.1.14 Measure corner to corner for the assembly to be square. The measurements should be the same



Fig 5.1.15 After completing the holding rack, you have to anchor it on the bottom. For doing that, you have to mark on each T-piece two boreholes. You have to move the rack aside and the boreholes have to be made by a 12 mm masonry drill bit. Following the 12 mm plugs have to be inserted in the holes, the rack has to be centered on the boreholes and it has to be bolted on the bottom with the 8 x 60 mm -screws.



Fig 5.1.16 If the rack is anchored on the bottom, the solar panel Heliostar® has to be applied on the rack

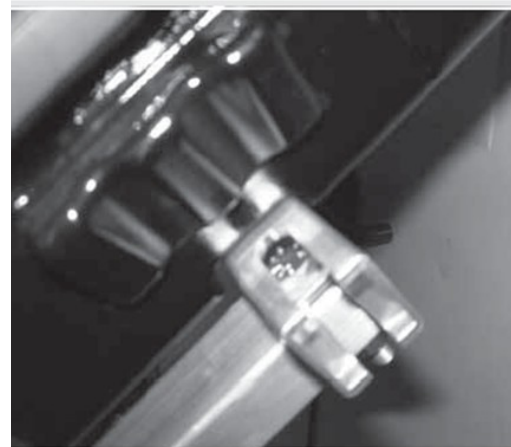


Fig 5.1.17 The solar-panel will be fixed by lateral attachment clamps on the rack (4 lateral attachment clamps for the first solar-panel).

5. INSTALLATION FREE STANDING

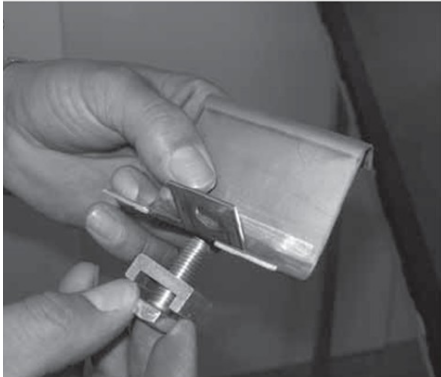


Fig 5.1.18 The lateral attachment clamps have to be fixed by M10 x 30 screw, u-washer and nut in the lateral long hole of the horizontal rail.

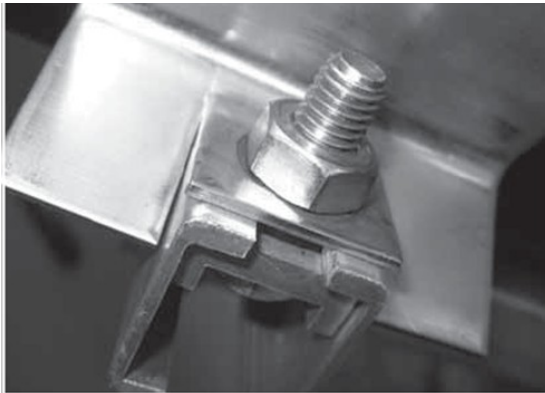


Fig 5.1.19 Double attachment clamps



Fig 5.1.20 Both M12 x 20 screws have to be inserted in the connection rails for the upper and below horizontal rail as shown.



Fig 5.1.21 On the opposite side the u-washer and nut have to be inserted and have to be tightened easily by hand.



Fig 5.1.22 The connection rails have to be inserted on half into the rail and have to be tightened.

5. INSTALLATION FREE STANDING

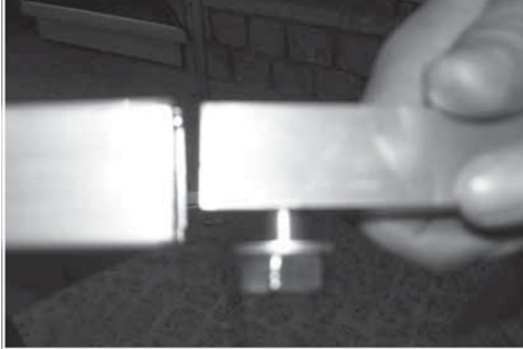


Fig 5.1.23 Slide connection piece into both the upper and lower primary rail and extension rail and be sure to put the double connector in place prior to tightening bolts (repeat as necessary for added panels).

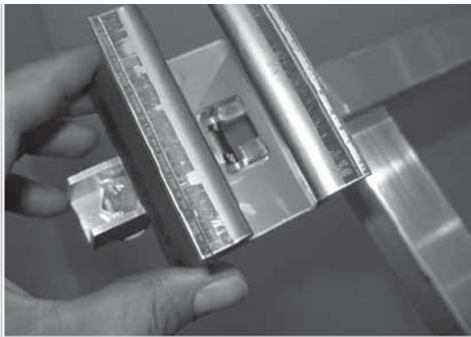


Fig 5.1.24 The attachment clamp double has to be attached on the upper and below rail.



Fig 5.1.25 Depending on the number of solar panels Heliostar® to install, you have to assemble the next triangle as explained before.

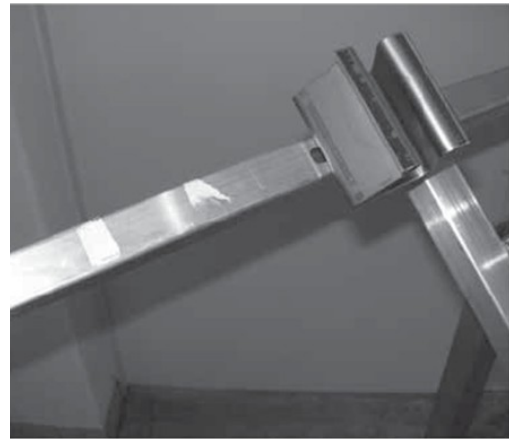


Fig 5.1.26 The upper and below horizontal rail has to be attached and fixed



Fig 5.1.27 The repetition of this procedure depends on the number of solar-panels Heliostar

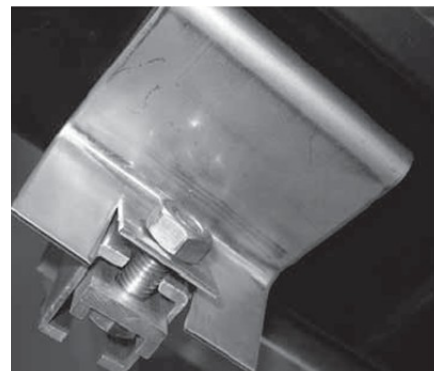


Fig 5.1.28 The first and the last solar panel Heliostar has to be fixed with the attachment clamp sideways.

5. INSTALLATION FREE STANDING

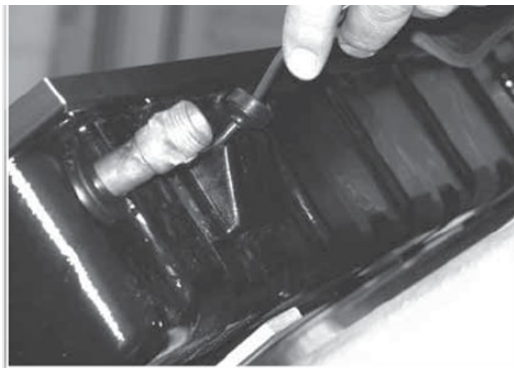


Fig 5.1.29 Remove the cable that leads at the return of the collector field and slide it over the cable of the temperature sensor: temperature insert sensor into the immersion sleeve as far as possible and remount the cable lead in the collector.

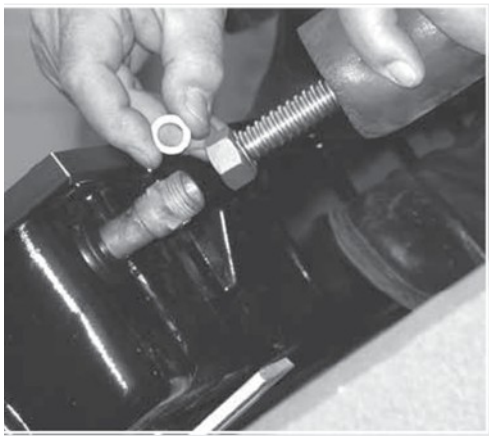
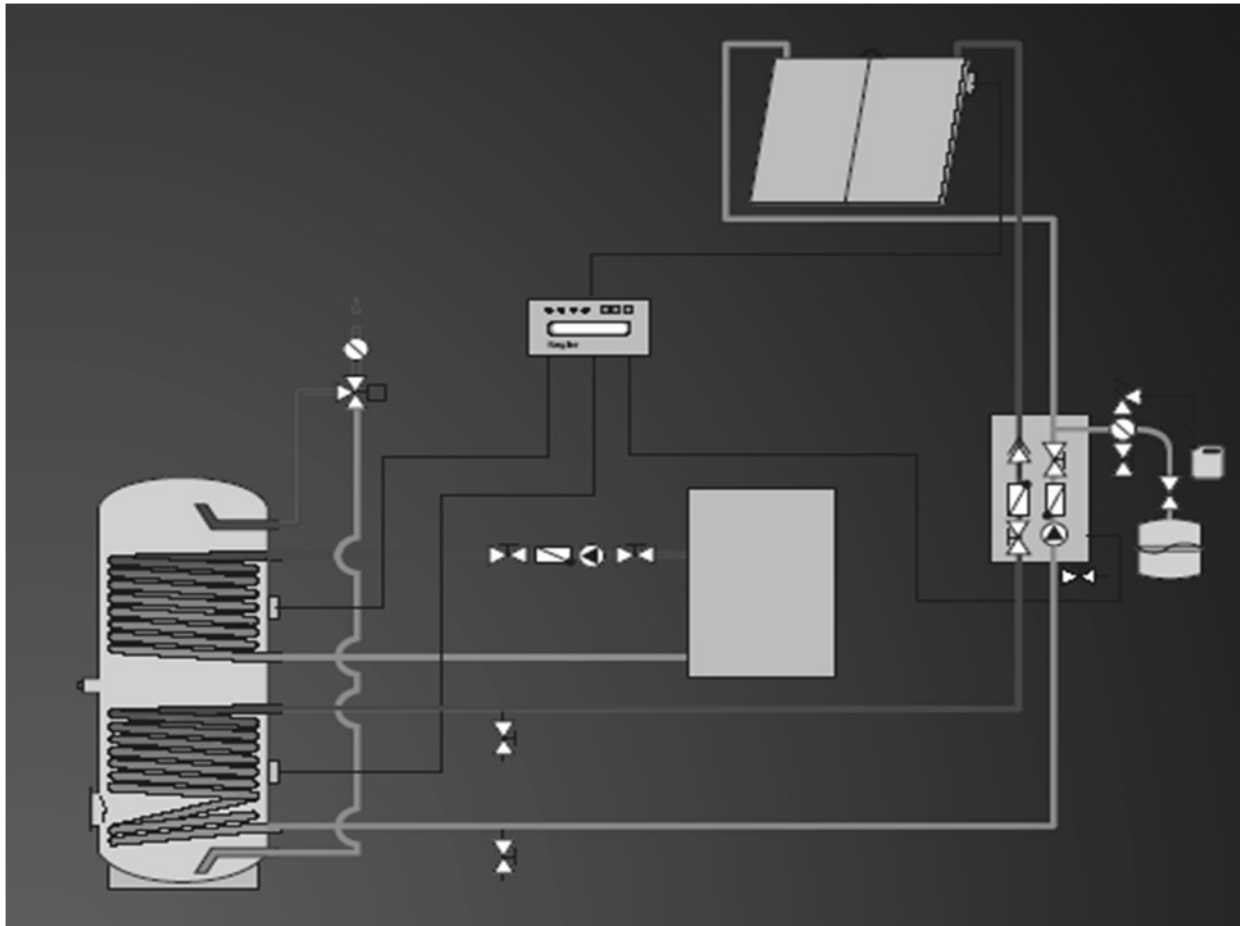


Fig 5.1.30 The collectors are connected with one another by means of the short corrugated tube. Gasket rings and insulation are included. Ventilation of the corrugated tube is not required at this point.

All explained steps up to now are useful for the fixing of one solar-panel Heliostar® in vertical position by using the Roth Basic Set.
if you want to install more than one solar-panel Heliostar® in line, you have to substitute on one side of the rack the lateral attachment clamps by the double attachment clamps. You'll find these double attachment clamps in the Roth Extension Set.

6.0 INSTALLATION 2 IN 1 PIPE SYSTEM AND SOLAR PUMP STATION



6. INSTALLATION SYSTEM PIPING & PUMP STATION



Fig 6.0.1 Roth 2 in 1 Flexible quick-installation pipe made of stainless steel, pressure resistant. Solar system supply and return line in a high temperature resistant insulation sleeve. 49' (15m) to a box.

DN-16 (1/2") **2335004131**

DN-20 (3/4") **2335004132**

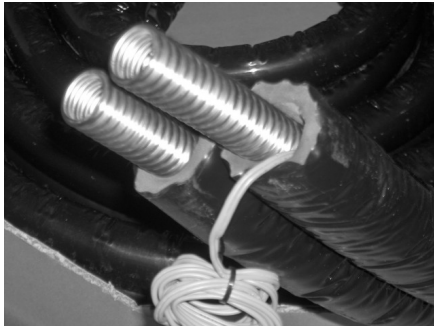


Fig 6.0.2 The tightly fitting insulation is of synthetic rubber, the insulation layer is 14 mm thick, for a temperature range of -40°C (-40°F) to 150°C (302°F) ($+175^{\circ}\text{C}$). The insulation is weatherproof and UV-resistant. The sensor line, is a non-halogen, temperature-resistant silicone insulation, 2 wire, enclosed in the return line.



Fig 6.0.3 The pipe can easily be cut using a standard tube cutter. Once the proper length has been determined an cut. The connections are made with oval clip collar set. The nut is slipped over the pipe and the oval clip is pressed over the pipe to form the assembly.

Oval clip collar set DN 16 **2335002621**

Oval clip collar set DN 20 **2335002622**

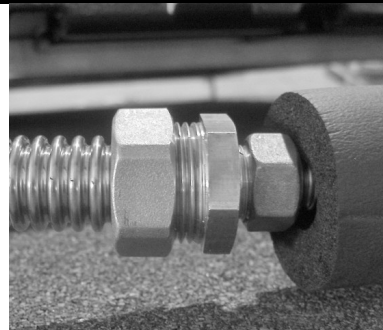


Fig 6.0.4 Connection using Roth basic fitting set for 2 in 1 flexible tube. This is the 3' flexible pipe from the collector to the 2 in 1 pipe. The adaptor (above) goes from the DN 20, 2 in 1 pipe to the G 1/2" Heliostar insulated flexible pipe.

Roth basic fitting set DN 16-set **2335002623**

Roth basic fitting set DN 20-set **2335002624**



Fig 6.0.5 the solar panel flexible piping connected to the 2 in 1 piping.

Roth sells the fitting sets separately allowing for multiple pipe runs from a single box of 2 in 1 piping.

Roth 2 in 1 piping system is commonly used between the solar collector array at the roof, into the attic and then run in a pipe chase to the solar pump station and storage tank area. By using a continuous run insulated flexible piping through the attic; the installer does not have to solder any fittings on the roof or in the attic. Roth 2 in 1 piping goes from the solar array through a flashed roof penetration (supplied by others) into the attic space. The 2 in 1 piping should penetrate the roof sheathing perpendicular to the plane of the roof. The installer feeds the 2 in 1 piping through the attic. Pipe hangers are used every 3', where the elevated piping runs require that the piping be secured. See our anchor kit # **2335002621** 1/2" or Part # **2335002622** 3/4"

6. INSTALLATION SYSTEM PIPING & PUMP STATION

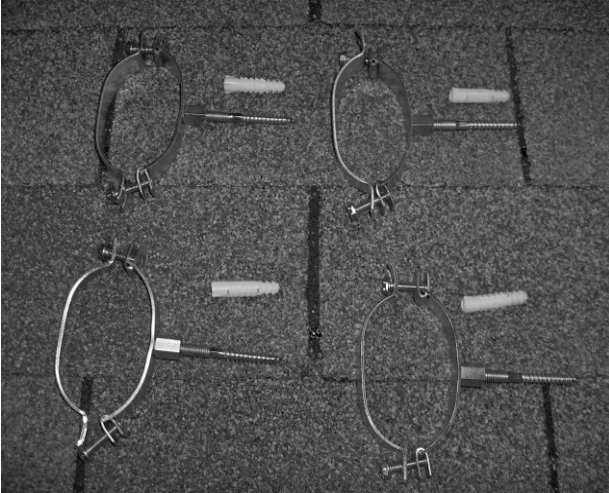


Fig 6.0.6
Roth oval clip collar set DN 16-set **2335002621** (1/2")
Roth oval clip collar set DN 20-set **2335002622** (3/4")



Fig 6.0.7
The integral insulation of the 2 in 1 piping system prevents heat losses on the roof and in the attic spaces.



Fig 6.0.8 Roth Solar Pump Station

Pre-assembled unit with all required fittings in a highly efficient multipart insulation box of EPP.

Consisting of shutoff ball valves with integrated gravity brakes for flow and return, air vent pipe fill and drain ball valve in the pump line, two thermometers 248 F (120 C), 0.52 - 4.22 g/min (2 -16 l/min) flow indicator, including shutoff and lateral ball valve, wall holder, safety group with 87psi. (6 bar) safety valve, 145 psi (10 bar) pressure gauge, fill and drain ball valve, including mounting parts and a 3 speed pump, Grundfoss UPS 15-58, wired and tested, integrated manual air vent set.

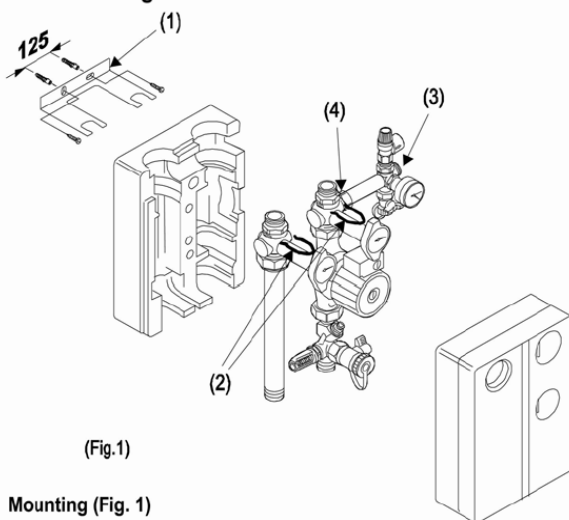
Additional expansion tank connection set with steel wall racket, , MEV quick coupling and 19" (480 mm) flexible hose as well as a set of clamp ring connections for 5/8" x 7/8" (18 and 22 mm) copper pipes.

6. INSTALLATION SYSTEM PIPING & PUMP STATION

Installation instructions FlowBox Solar



Wall mounting



(Fig.1)

Mounting (Fig. 1)

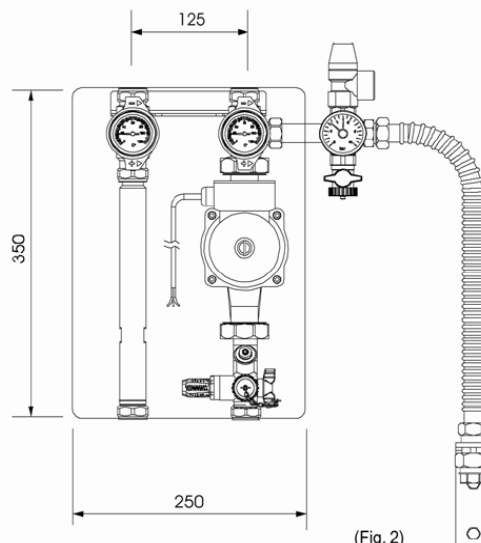
- Fasten the wall bracket (1) with a center spacing of 125 mm using plugs and screws that are suitable for the surface in question.
- Push the FlowBox Solar module from the front into the slots provided on the wall bracket. Then secure the module in place by attaching the supplied clamping rings (2) beneath the retainer plate.
- After mounting, it must not be possible to easily pull the module towards you and off the bracket. Removal is described below.
Ensure the correct mounting orientation of the flow fitting!
- Connect the safety assembly (3) (supplied separately with the module) to the outlet of the return flow fitting (4) above the pump using the G 3/4" union nut. The package accompanying the module contains a suitable Gasket.
- Mount the wall bracket for the expansion tank at the side of the module. Ensure that the corrugated hose is long enough for connection of the expansion coupling and the 3/4" male thread of the safety assembly!
- Connect the system up to the solar energy circuit.
- After the system has been filled and a complete seal-tightness check performed, attach the front section of the heat insulation.
- **Removing the module from the wall bracket:** use a screwdriver or similar tool to pull the clamping rings off towards you.
N.B.: the FlowBox Solar module is now loose! Make sure that it does

Torque for connections with flat seals

Torque values when tightening the screw connections using Reinz AFM 34 gaskets, thickness 2mm:

- 3/4" Screw connection 35 Nm
- 1" Screw connection 55 Nm
- 1 1/4" Screw connection 90 Nm
- 1 1/2" Screw connection 130 Nm

As the gasket may settle over time, it may be necessary for the customer To re-tighten the screw connections.



(Fig. 2)

Mounting the clamping ring screw connections

- Cut off the copper pipe at a right angle using a pipe cutter and debur the edges of the pipe.
- First push the clamping ring nut over the pipe, then the clamping ring.
- Insert the pipe with clamping ring nut and clamping ring into the screw connection and push up to the stop.
- Tighten the clamping ring nut by hand.
- If necessary, tighten the clamping ring screw connection further using a Sw30 fork/open-end spanner (approx. 45 Nm).

Connection safety valve

- A blow-off line leading to a collection container (e.g. empty canister of the solar heating medium) must be fitted to the safety valve. This permits collection and reuse of any heating medium which escapes in the event of malfunction.

Heat insulation cladding

- The heat insulation cladding is for thermal insulation and protection during transport.

Connection plug for filling and draining

- Both the safety assembly and the FlowGuard are fitted with a fill-and-drain valve for filling and draining the system.

Safety assembly

- Consisting of safety valve, pressure gauge, fill-and-drain valve, and an expansion tank connection. In order to reduce the thermal load, the safety assembly is installed in the return flow line.

6. INSTALLATION SYSTEM PIPING & PUMP STATION



Fig 6.0.11 Connection using Roth basic fitting set for 2 in 1 flexible tube. This is the 3' flexible pipe from the collector to the 2 in 1 pipe. The adaptor (above) goes from the DN 20, 2 in 1 pipe to the G 3/4" connection on the pump station.

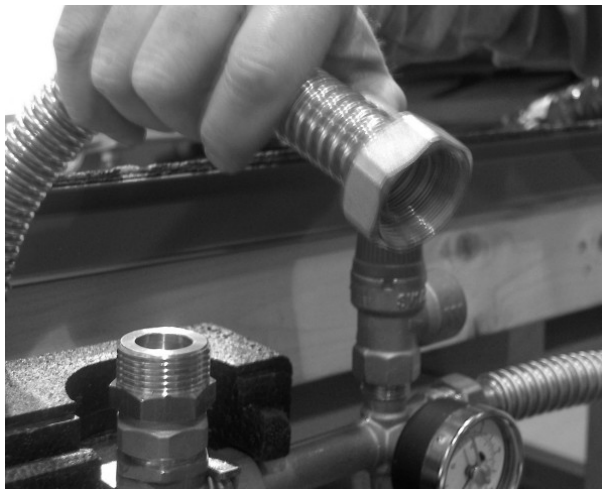


Fig 6.0.12 2 in 1 pipe connection
Please see Fig 6.0.03 for installation

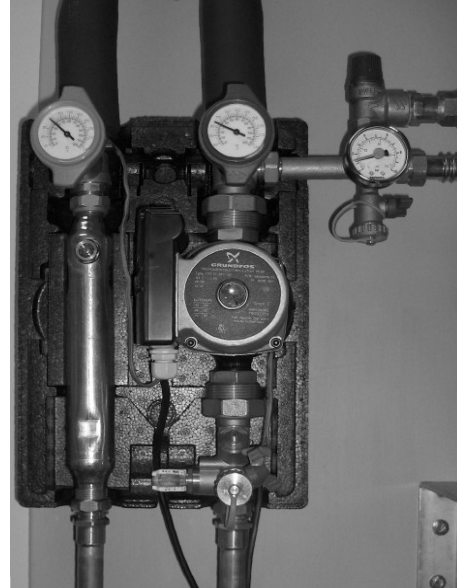


Fig 6.0.13 Roth Solar Pump Station
Without cover



Fig 6.0.14 Roth Solar Pump Station
Shown with completed piping and expansion tank

6. INSTALLATION SYSTEM PIPING & PUMP STATION

WARNING

Hotter water associated with Solar System assisted domestic water applications increases the risk of scald injury.

Temperatures at which injury occurs vary with the person's age and the length of exposure. The slower reaction time of children, elderly, and physically or mentally challenged persons increases the scalding hazard to them. It is recommended that lower water temperatures be used where these exposure hazards exist. Such households may require a temperature setting less than 120°F to prevent accidental contact with hot water.



Fig 6.0.11 installation of anti-scald device on the storage tank is recommended. potentially high domestic water temperatures involved with solar systems could cause a possible safety issue.

The Roth solar storage water heaters are designed with internal coil(s) and optional backup electric heating element.

Some models are designed with a second internal coil and an electric heating element.

The pump station pumps the Solar fluid it is passed through the solar panels and internal coil of the storage tank as long as the BW control senses an adequate temperature difference between the heating medium and stored water in the tank.

The internal solar coil is located as close to the bottom of the storage tank as possible to facilitate the transfer of energy even at lower solar panel temperatures.

During periods of water flow through the water heater, hot water is drawn from the top of the heater and cold water is delivered to the bottom of the tank (by a diptube or bottom inlet). If the hot water demand should exceed the solar heat output or there is an insufficient temperature difference between the heating medium and stored water, the heating element thermostat will activate the electrical heating element for backup heat. When an additional internal coil is used for backup heating, an aquastat should be used for flow control in the backup heating loop. An aquastat immersion well is supplied on all models.

Solar heat output from the internal coil will vary depending on outside conditions and the temperature of the stored water

Please refer to our Roth Storage Tank installation instructions for further details, and piping diagrams

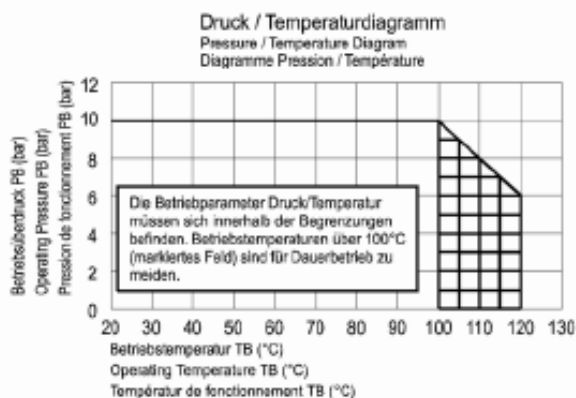
6. INSTALLATION SYSTEM PIPING & PUMP STATION

Flow volume adjustment (Fig. 2)

- The flow volume is set on the regulating valve using an SW 4 Allen key.
- The set volume can be directly read on the scale.
- The valve stroke is spread over several spindle revolutions, thereby permitting a high level of setting precision.
- The setting values are based on the calculations for the system.

Gravity flow stops (Fig. 3)

- The gravity flow stop in the collector flow line must be open for filling, venting and rinsing of the system. It is open when the ball valve in question is in the 45° position. The ball of the ball valve presses the gravity flow stop open.
- The ball valves must be fully open for operation of the system.



Technical data

Fittings	: hot-pressed brass, Ms58
Pipe systems	: precision pipes
Flowmeter	: high-grade impact-proof and temperature-resistant plastic
Spring - flowmeter	: stainless steel
Heat insulation cladding	: EPP

Materials

Max. adm. operating temperature	: see Pressure/Temperature Diagram
Min. adm. operating temperature	: 20°C
Max. adm. operating pressure	: see Pressure/Temperature Diagram
Indicating accuracy - FlowGuard	: ±10% of the meter reading

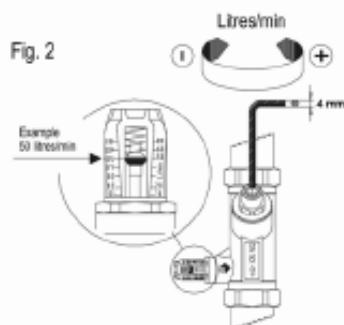
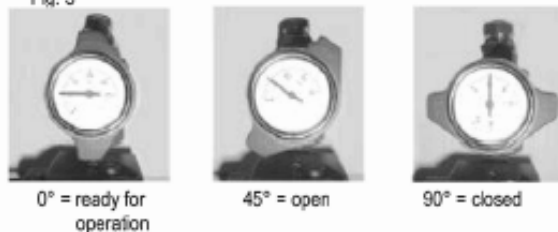


Fig. 3



Hinweis

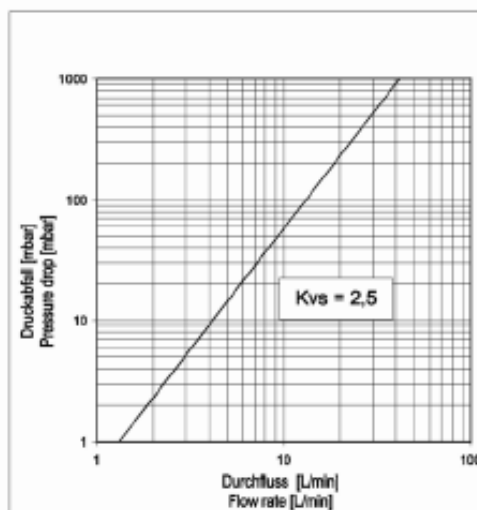
Caution

Attention

Die Betriebsparameter Druck/Temperatur müssen sich innerhalb der Begrenzungen befinden. Betriebstemperaturen über 100°C sind für Dauerbetrieb zu meiden!

Pressure and temperature should be kept within the limits shown in the adjacent diagram. Avoid temperatures higher than 100°C during continuous operation!

Il faut bien maintenir pression et température entre les limites et éviter des températures de fonctionnement au-dessus de 100°C pour service continu!



7.0 FILLING THE SYSTEM & COMMISSIONING

The following procedures and diagrams show the Roth Solar Filling pump part #

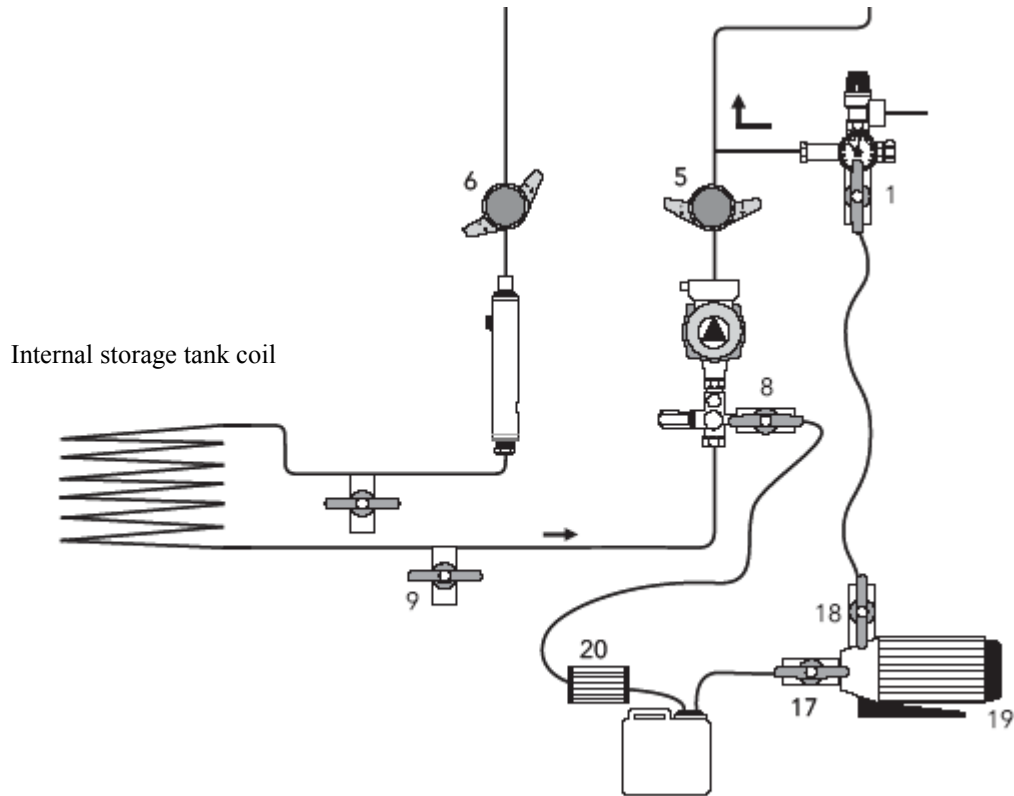
The pump comes with all the necessary hoses and attachments to perform the commissioning of the Solar Pump Station.

STEP 1 Flushing the Solar Circuit

- Flat plate collectors: Flush with water
- Flushing direction: Always from the collector to the tank (see arrows)
- Fluctuations in pressure can occur due to changes in the level of solar radiation. Commissioning should be completed in the morning or late afternoon. When the fluid temperature is high in the solar circuit (collector > 140°F (60 °C) there is the risk of scalding! With a high level of solar radiation it is possible that steam vapor will build up in the collectors. Possible damage to the panel as well as personal will occur.
- Do not use the filling pump when dry!
- Use filter (20)! There may be debris in the piping that can damage the solar pump station or cause flow restriction in the panels.

Procedure

- Open valves (1) and (8)
- Set ball valve (6) to 45°
- Set ball valve (5) to horizontal
- Turn on the pump



7.0 FILLING THE SYSTEM & COMMISSIONING

STEP 2 Pressure Test

- Fill the system with water
- Bring system up to pressure
- Check all connections for leakage.
- Drain system

• There will still be some water in the collector even after the system has been emptied. To protect the absorber from frost damage it should always be filled with the heat transfer medium after pressure test!

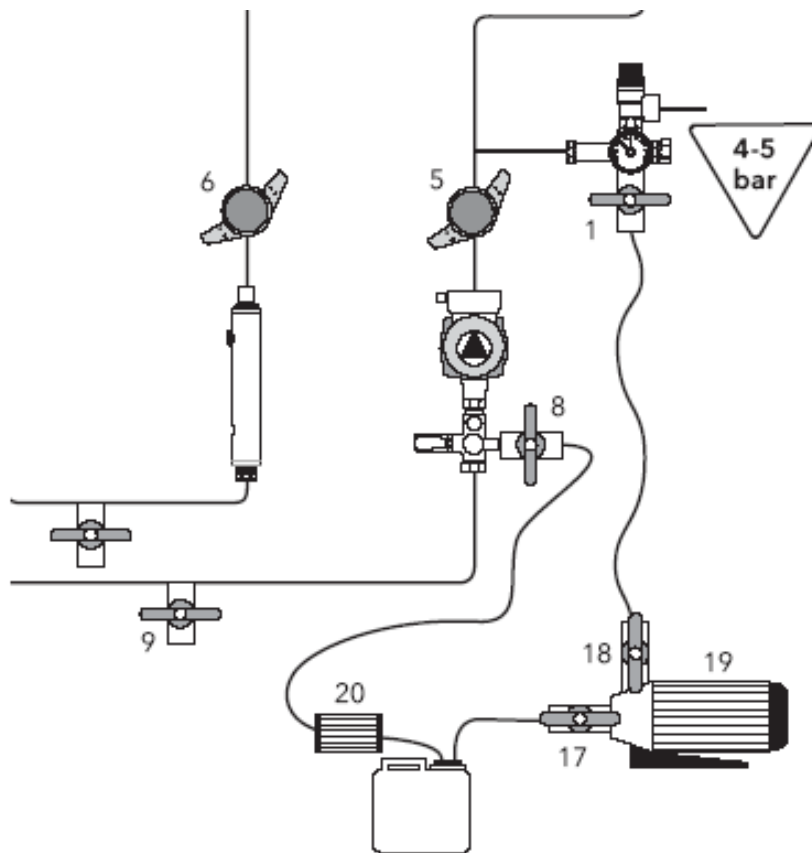
Never leave the system empty.

Always keep the plastic cover on the panels prior to, and during the commissioning process.

- Test pressure up to 70 psi (5 bar)
- Fluctuations in pressure can also occur due to changes in the level of solar radiation. Commissioning should be completed in the morning or late afternoon.
- The expansion vessel must be removed or isolated from the solar circuit before the pressure test can be completed.

Procedure

- Shut off the filler valve (8)
- After reaching the test pressure shut off the filler valve (1)
- Set ball valves (5) and (6) to 45°



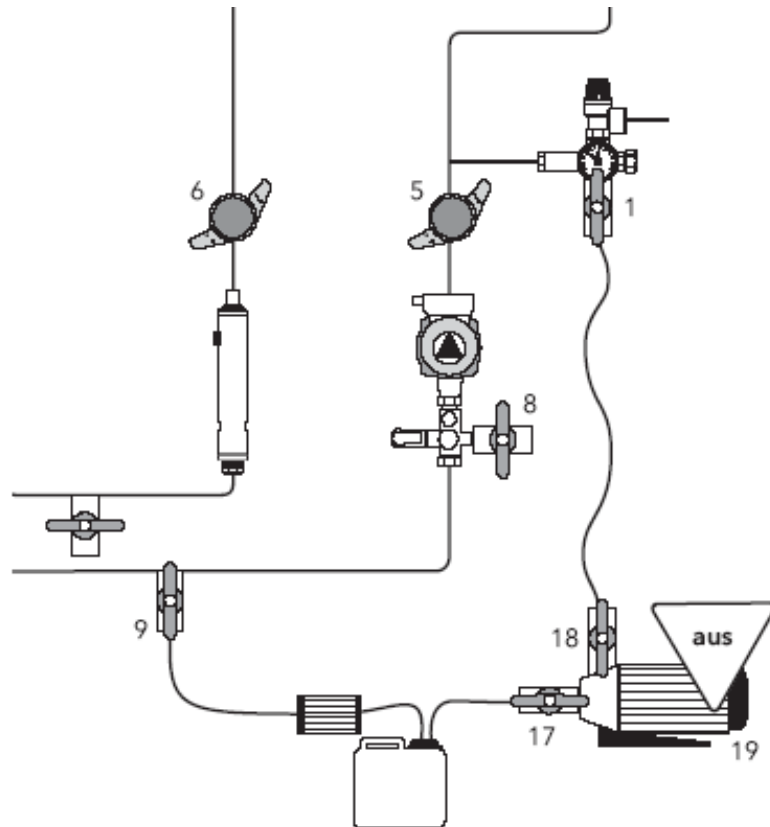
7.0 FILLING THE SYSTEM & COMMISIONING

STEP 3 Draining

- This is not necessary when it has already been filled with the heat transfer medium

Procedure

- The filling pump (19) must be turned off.
- Disconnect suction hose from filler valve (8) and connect to filler valve (9)
- Open valve (9)
- Open valve (1)

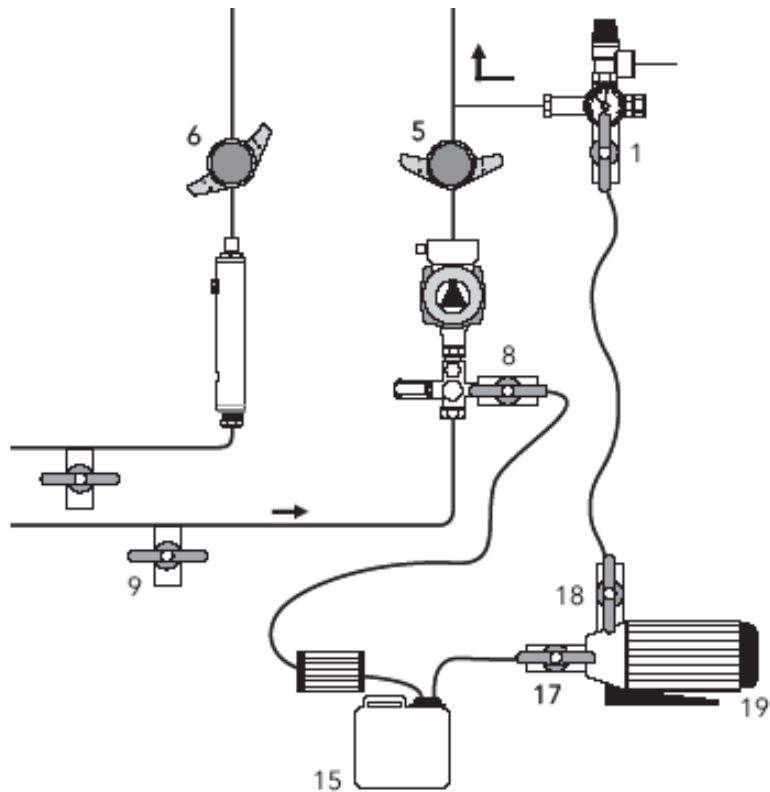


7.0 FILLING THE SYSTEM & COMMISSIONING

STEP 4 Filling and Purging

Procedure

- Disconnect suction hose from filler valve (9) and connect to filler valve (8)
- Shut off valve (9)
- Open filler valves (8) and (1)
- Set ball valve (5) to horizontal
- Close shut-off valve (11)
- Switch on filling pump (19)
- Use the filling pump until no more air bubbles can be seen in the liquid container (15)
- Vent the pump line and if necessary the solar circuit pump
- Shut off the filler valve (8)
- When the desired pressure has been reached shut off the filler valve (1)



7.0 FILLING THE SYSTEM & COMMISSIONING

STEP 4 Venting the pump line

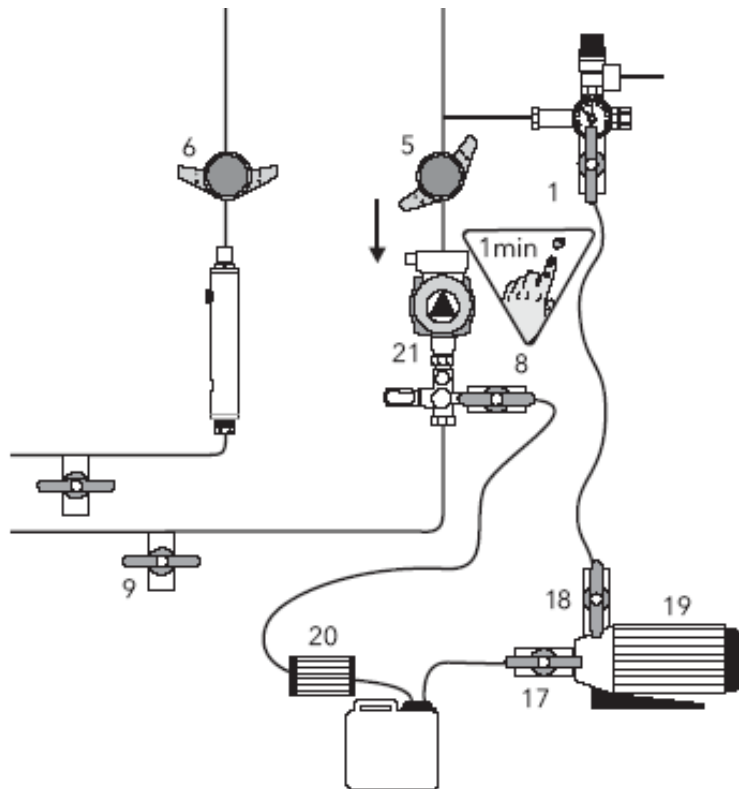
- Set the ball valve (6) horizontal and the ball valve (5) to 45°
- Run the filling pump (19) for approximately 20 seconds
- Close the filler valves (8) and (1) and turn off the filling pump (19)

Vent the solar circuit pump if necessary

- Turn on the solar circuit pump (21) (choose the maximum speed) and vent through the bronze screw at the front of the pump. Please observe the instructions of the pump manufacture.(1)

Tip:

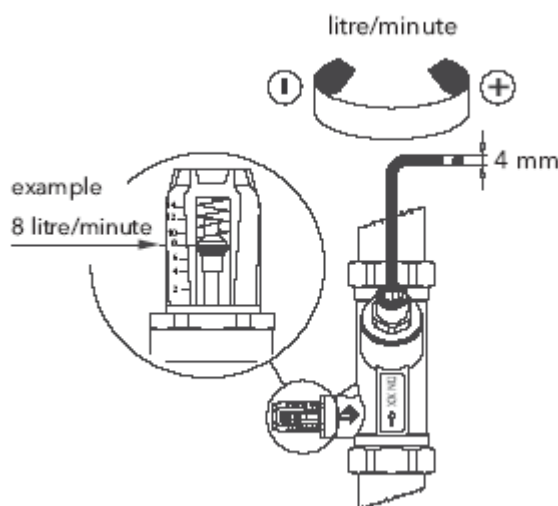
- Flush with high pressure e. g. 3 -4 bar
- If necessary turn the pump on and off several times in order to accelerate air extraction.
- If necessary turn off the valve (8) – the pressure of the system will increase – then open again to get rid of any air pockets.
- If necessary the flow direction can be changed to completely purge the heat exchanger in the storage tank.



7.0 FILLING THE SYSTEM & COMMISSIONING

STEP 5 Setting the Volume Flow

- Set the flow meter in the solar station to maximum. If necessary turn the 4 mm socket screw completely to the left.
 - Set pump to the lowest speed (speed 1)
 - Set the pump speed of solar controls with variable speed to 100 %
 - Recommended volume flow (except for low-flow systems): 40 liter/m² collector area and per hour
- Example: Collector surface area 12 m²
Flow volume [liter/min]=40 l/ m²h x 12 m²: 60 min/h = 8 l/min
- Chose the pumps speed so as to achieve the recommended flow rate.



Setting the pressure of the system

- Prerequisite: The expansion vessel must have the correct design pressure when it is installed. In pre-filled systems the design pressure can only be determined if the expansion vessel is isolated and pressure less (through an optimal capped shut-off valve).
- Within a few days of being filled the pressure of the system can decrease further due to separation of air.

Tip:

When filling the system the pressure should be set at 0.1—0.2 bar higher than value given in the table.

Recommended pressure levels for the system		
Height of system [m]	Expansion vessel admission pressure [bar]	System pressure* [bar]
5	0.6 - 0.7	0.7 - 0.8
8	0.9 - 1	1.0 - 1.2
10	1.2	1.2 - 1.3
15	1.7	1.7 - 1.8
20	2.3	2.3 - 2.5
* When the system is cold		

8.0 TROUBLE SHOOTING

Fault	Cause	Solution
The pump is not running – no noise or vibrations	No electrical supply	Check the electric circuit
	The temperature difference set at the control is not reached	Check the settings of the control
	The maximum tank temperature has been reached	If permitted > increase the maximum tank temperature
The pump is not running but noise can be heard	The pump shaft is stuck	<ul style="list-style-type: none"> Set the maximum pump level (on the pump) and pump speed (on the control) Loosen the ventilation screw and and carefully move the pump shaft with a screw driver
The pump is running but there is no circulation	There is a block in the solar circuit:	
	<ul style="list-style-type: none"> Flow meter Ball valve in the solar circuit unit 	Open the block
	There is air in the solar circuit	Remove air with the ventilation components or pump it again with the filling pump and if necessary fill it up with heat transfer medium
Very noisy pump	The pump has not been properly bled	Bleed the pump
	Air in the solar circuit	See “The pump is running but there is no circulation”
Pump clogging	Flow and return flow pipes of the solar circuit have been mixed up	Change connections
	Delta T is set too low at the control	Increase Delta T
	The sensor is faulty	<ul style="list-style-type: none"> check the cable connections compare the resistance of the sensor with the table
The difference in temperature between flow and return flow is too high	Pump level is too low	Increase pump level
	Air in the solar circuit	See “The pump is running but there is no circulation”
	Non-return valve is turned open	Set the correct operation
	Non-return valve is dirty	Use the pump at the maximum rotations per minute and switch the non-return valve on and off several times.

8.0 TROUBLE SHOOTING

The storage tank is cooling down	Non-return valve is turned open	Set the correct operation
	Non-return valve is dirty	Use the pump at the maximum rotations per minute and switch the non-return valve on and off several times.
	Non-return valve is faulty	Replace the non-return valve
	Gravitation force circulation in the warm water circulation	Install a flap trap or check the existing one
	Long operation time of the hot water circulation pump	Reduce the operation time or adjust the time and temperature settings
Drop in pressure at the pressure gauge	The storage tank sensor of the solar control is fixed too low	Correct the position of the sensor between the lower third and the middle of the heat exchanger
	Air was released by air separator or release valves	Fill up with heat transfer medium
	The solar circuit is not watertight	Check all connections

Maintenance solar circuit

Protection from frost	Protection from corrosion of the heat transfer medium	Protection from corrosion of the storage tank
<ul style="list-style-type: none"> Recommended frost protection temperature of heat transfer medium -19 °C. Test at time of commissioning Then test at least every 2 years. Check the DC40 annually 	<ul style="list-style-type: none"> pH > 6.6 - otherwise exchange the heat transfer medium Check the pH every 2 years Check DC40 annually Any remaining heat transfer medium in an emptied system can result in corrosion through contact with air. 	<ul style="list-style-type: none"> Magnesium anode: protective current > 0.3 mA, test at least every 2 years External current anode: observe control lamp
Pressure of the system	Volume flow in solar circuit	Visual check
<ul style="list-style-type: none"> Observe the system pressure For correct value see chapter 2.6 When refilling several times with water check the frost protection temperature 	<ul style="list-style-type: none"> Recommended volume flow: per m² collector surface = 0.5-0.8 l/min 	<ul style="list-style-type: none"> Collectors, connections and pipes and their insulation Check the sensor cables



SOLAR SYSTEMS

Installers Handbook 2009

9. CERTIFIED INSTALLER PROGRAM

Terms and Conditions

Roth Industries is pleased to announce the launch of our new Roth Solar Systems-complete from one source.

In order to qualify for being a Roth Solar System certified installer, you acknowledge the special terms and conditions of this agreement by filling out the Registration Form on the next page.

1. In order to be a certified installer for the Roth Solar Systems, the installing contractors must be certified by a certified Roth employee or certified Roth Representative. The certified installer expressly agrees to adhere to the methods and practices described in this handbook when installing the Roth Flat Panel HelioStar 252.
2. The installing contractor must fill out the registration form and submit it to Roth Industries. Once received, a certificate will be send out to the installer.
3. By submitting a form for certification after training, the installer expressly agrees to install the solar systems exactly as instructed and only for their intended purpose.
5. Certified installers agree to appropriately train/educate their crews, laborers and other staff members and are fully responsible for proper system installation. The certification is not transferable or assignable.
6. Certified installers will have direct access to the factory for technical questions, supplemental installation instructions and other guidance as necessary to ensure a proper installation.
7. If failure of a system is due to improper installation, Roth will not take any responsibility for any damage or product replacements.

Welcome to the Roth Certified Solar Installer Network!



SOLAR SYSTEMS Installers Handbook 2009

9. CERTIFIED INSTALLER PROGRAM

Roth Solar Systems Certified Installer Registration Form

(to be filled out AFTER certification training)

Date: _____ Instructor: _____

Name: _____ Business Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

Email address: _____

Website: _____

Business Profile (check all that apply):

- ☐ Design/Engineering
- ☐ Service
- ☐ Installation
- ☐ Other (please specify) _____
- ☐

Other Information:

Approximate number of installations per year _____

Do you work in multiple states? (if so, please specify) _____

Certified Installer Acknowledgement

By virtue of the signature below, the above named party acknowledges that they have received the necessary training and training aids to properly install the Roth Solar System and agrees to do so without exception.

Acknowledged by: (print name) _____

Signature: _____

Roth Certified Installer Trainer Signature: _____

FACTORY USE ONLY BELOW LINE – FACTORY USE ONLY BELOW LINE

Date received: _____ Received by: _____

Solar System Certified Installer Number Assigned: _____



SOLAR SYSTEMS Installers Handbook 2009

9. CERTIFIED INSTALLER PROGRAM

Sample!

Limited Warranty **WARRANTY CERTIFICATE** ROTH Solar Systems

Flat collectors F2, Heliostar 218, 252 and Tube collectors R1

Within 10 years following installation, we will provide, in accordance with our preference, either free-of-charge product replacement or repair in the event that damage appears in the system components which we have supplied that were caused by faults in materials or production and which significantly impair the function of the solar system as well as roof impermeability and stability. Excluded from this are mechanical moving parts as well as electrically-powered parts and electronic system components for which we have provided the guarantee services in the event of faults in materials or production listed above within a time period of 12 months following installation.

Prerequisites for this guarantee are:

- a. that the time between the delivery and the installation of the system is not more than six months,
- b. exclusive use and installation of all system components belonging to the respective Roth Solar System components, especially the use of the prescribed heat transfer fluid,
- c. documented adherence to the planning, installation and operating instructions respectively valid at the time of the installation,
- d. that neither glass breakage nor the effects of frost were responsible for the damage,
- e. adherence to the standards and regulations valid for this work type and for the relevant adjacent work types in connection with the respective Roth Solar System,
- f. that the installation company and the companies are respectively recognized and authorized certified companies and that these companies have verified their confirmations with names and signatures on this certification document,
- g. that a completely filled-out copy of this certificate is sent back to us without delay,
- h. that damages are immediately reported to us with simultaneous forwarding of the certificate, and
- i. that claims are made within the guarantee period.

The preceding guarantee bond affects the following:

Product: _____

Type of Application (Residential/

Commercial): _____

Serial numbers of the collectors: _____

Date of Installation: _____

Name and Address of Installation: _____

Purchased from: _____

The system components belonging to the respective Roth Solar System were delivered and installed completely on the respective date of installation.

Certified Roth Solar Contractor: _____

Signature

Stamp

Date of Installation

Roth Industries

268 Bellew Ave South

Watertown, NY 13601

Call 888-266-7684 US/ 800-969-7684 CAN



SOLAR SYSTEMS

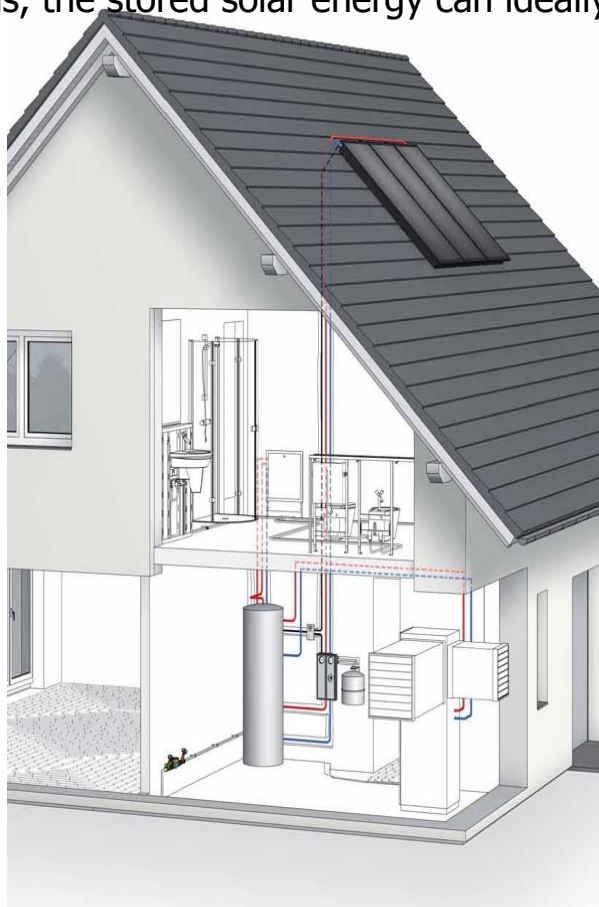
Installers Handbook 2009

10. SRCC Data



SUPERIOR PRODUCTS.
ENVIRONMENTALLY-FRIENDLY PROCEDURES,
MATERIALS AND INNOVATIONS.
YOUR ENVIRONMENT IS OUR BUSINESS.

Using the sun with the latest technologies, Roth is taking a step into the future with new solar thermal systems, an optimal complementation to the company's proven heat distribution systems. Solar Systems from Roth are complete, high-performance, reliable systems. When combined with Roth floor heating systems, the stored solar energy can ideally be used for heating support.



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