



Future-proof heating systems

PRODUCT INFORMATION

Flat-plate collector **Silversun 2.02**



Mounting instruction

– Please read carefully before installation –

Safety regulations

Carefully read the safety instructions before commencing the installation. It's for your own safety.

Please follow the structural instructions if the installation location of the solar system is above 600m sea level or possibly exposed to large amounts of snow (higher than zone 4). The installation needs to be carried out on a roof that is capable of bearing that load. The static bearing capacity needs to be checked on site before the installation.

The collectors can either be transported vertically or horizontally. Attention: Breakage of glass. Store the collectors in a dry and shadowy place. The protections of the manifolds have to be removed before the solar collectors are exposed to the sun and heat themselves.

Working on the roof

Appropriate safety measures have to be arranged. Familiarize yourself with the general regulations of accident prevention for construction work of your professional association or let yourself be instructed by an appropriate person. The following aspects have to be respected to achieve a secure installation of the solar system:

- always use fall protection while working on a roof
- respect safety regulations when using a ladder
- while working on roof coverings with corrugated sheets the risk of breaking through exists
- secure workplaces on steep roofs
- safety clearances have to be met if an aerial pipeline leads across the roof
up to 1.000 V >1m, more than 1.000 V to 11.000 V >3m, with unknown voltage >5m.
- always wear safety goggles and gloves while working with an angle grinder
- Flat plate collectors can achieve a stationary temperature of over 200°C due to incident light. The risk of burns exists at the connections of flow and return. Always cover the collectors on sunny days during the installation
- Even regular daylight might cause the fluid in the collector to vaporize. This vapor leaks from the collector connections. Possible risk of scalding

Attention: glass

- Don't exert mechanical pressure on the glass covering. Glass splinters might evoke cuts
- Wear safety goggles and gloves while installing the solar system to avoid injuries due to possible damages

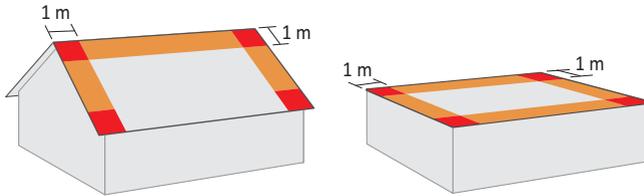
Electric connections

Electric installations have to be accomplished by a licensed tradesman subject to the German regulations VDE 0100 and to those of the local power company.



Caution frost damage:

The installation needs solely to be filled with solar fluid not with water only. This is also necessary in summer. Due to the special high selective coating temperature drops into the sub-zero area could occur during night time which can lead to the destruction of your solar system!

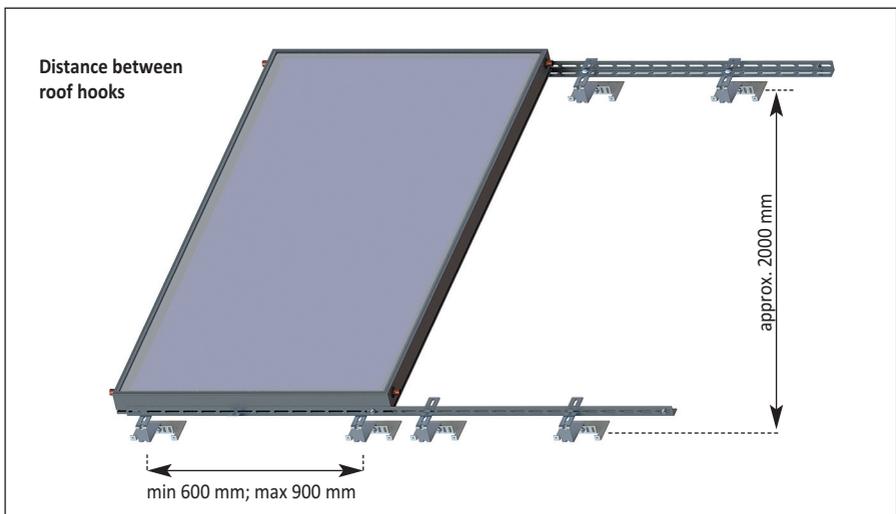
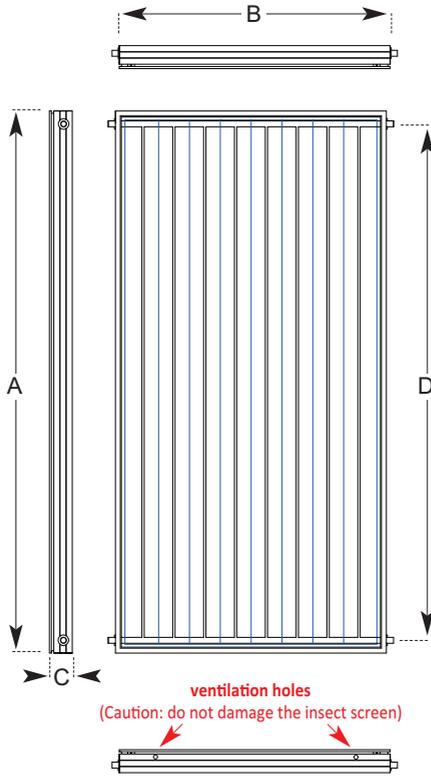
**Minimum distance from roof edge:**

Minimum distance of collector array from roof edge: 1 meter (except: eaves with pitched roofs)

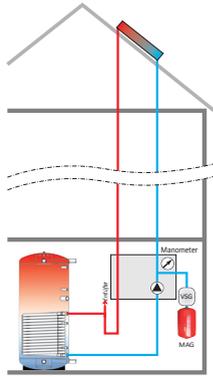
With existing lightning protection system: minimum distance from this device: 1 meter

Technical specifications

Flat-plate collector SilverSun 2.02		SilverSun 2.02
type of mounting		on roof (pitched/flat roof)
gross surface area m ²		2,02
aperture surface area m ²		1,83
height mm	A	2006
width mm	B	1007
depth mm	C	85
interval flow and return line mm	D	1890
weight unfilled kg		27
collector capacity Liter		1,6
max. operating pressure bar		6
stationary temperature °C		199
peak output per module $W_{\text{peak}} (G^*=1000\text{W}/\text{m}^2, \eta_0)$		1398
conversion factor η_0		0,764
thermal conductivity $a_1 \text{ W}/(\text{m}^2\text{K})$		3,953
thermal conductivity $a_2 \text{ W}/(\text{m}^2\text{K}^2)$		0,008
incident angle modifier IAM50		0,92
connections		copper 22 x 0,7 mm
absorber material		aluminum plate and copper register
absorber coating		Microtherm
absorber design		laser welded
frame profile		aluminum, anodized
back wall		aluminum, alloyed
insulation bottom		rock wool, 30 mm
insulation at the side		rock wool, 15 mm
collector glazing		Solar safety glass, 3,2 mm
norm		DIN EN 12975
hydraulic interconnection		max. 6 collectors in a row
interval between collectors		approx. 55 mm
permissible collector tilt		25°-65° (stand-kit available)
recommended storage tank dimension		50 Liter per m ² collector surface



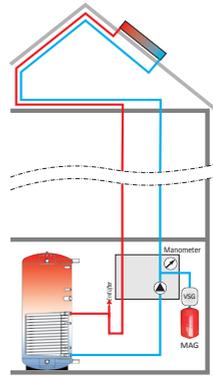
Hydraulic connection



Right

Self-draining possible.

The solar medium will be ejected almost completely when the system is in stagnation.

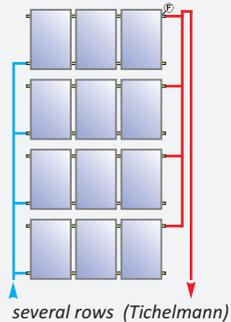
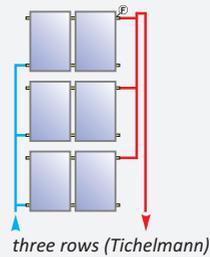
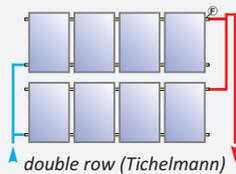
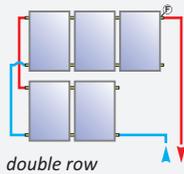


Wrong

Self-draining not possible.

Solar medium is left in the collector. Heavy steam formation in, high thermal stress of the system components.

Connection example



These schemes are only an installation example and do not replace technical planning!

Installing the roof hooks on standard tiles



roof hooks (4 hooks per collector)

M8x20 with self locking nuts

(8 pcs per collector)



torx screws
5 x 60 mm



The pictures illustrate the mounting on the roof battens. You probably need longer wood screws, depending on the constructional circumstances of your roof, to guarantee a stable connection between rafter and hook.

With possible higher snow loads (grade el. over 600 m sea level, > 2,3 kN/m²) the tiles underneath the hook should be replaced by metal tiles!

1

Determine the position of the roof hooks.
For 1 collector 4 roof hooks are necessary.



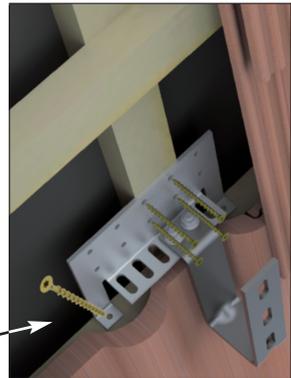
Adjust the roof hooks to the middle of the collector.

2

Pre-mount the roof hook and the base plate, do not yet fasten the bolts.

Unroof the rafters and mount the base plate with the torx screws **onto the rafter**. Always make sure that the roof hook is seated in the tile's bulge.

The base plate should additionally be fixed with the roof batten when the bearing surface seems to be problematic.



3

Make sure that the roof hook has approx. 2-3 mm too much play to the tile. There happen to be tiles that ask for a log of wood as distance piece. Now screw the roof hook solidly onto the base plate with a 13mm flat wrench or ring wrench.

4

Grind off as much material from the tile as needed, with the help of an angle grinder, so that the roof hook perfectly fits underneath the tile. Afterwards retile the roof.



No grind works on the roof (risk of falling)

Special solution: Installing the plain tile hooks

These parts are necessary:



roof hook for plain tiles
(special equipment)

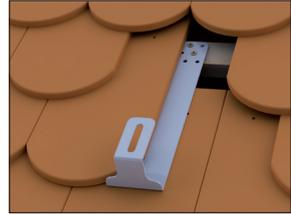


torx screws
5 x 60 mm

Expose the rafters and screw the plain tile roof hook onto the rafter with the torx screws.

This kit can generally be used for most types of tiles that are plainly seated.

When necessary contact a roofer before installing plain tile hooks.



See also note on the load-bearing capacity of the substructure

Special solution: Installation of the on-roof modules

These parts are necessary:



On-roof module
(special equipment)



torx screws
5 x 60 mm

Uncover roof rafter and screw the batten rail of the module onto the rafter.



Depending on the constructional circumstances of your roof, to guarantee a stable connection between rafter and hook.

With possible higher snow loads (grade el. over 600 m sea level, > 2,3 kN/m²) the tiles underneath the hook should be replaced by metal tiles!

Special solution: installing the hanger bolts

**These parts
are necessary:**



self-locking nut M12



mounting
rail
supporter



self-locking nut M12



self-locking nut M12



sealing



hanger bolt

hanger bolts
(special equipment)

1

Define the intervals of the drill holes according to the dimensions of the collector. Drill them in a straight row using a plumb-line.

Drill only on stable substructure

Pre-drill with 10mm afterwards use 16mm for the tiles (roof covering).

Screw the hanger bolt through the tiles onto the pre-drilled rafter. Fix the sealing together with the hexagon nut with flange. Adjust the interval for the mounting rail supporter by means of the nuts.

The hanger bolt has a hexagon head (wrench size 8 mm), it can be screwed in by means of a drill chuck. By this a safe installation of the hanger bolt can be guaranteed.



Position of the hanger bolt always on the wave crest not in the wave trough.

ATTENTION:

Note on special solutions on page 8 and 9!



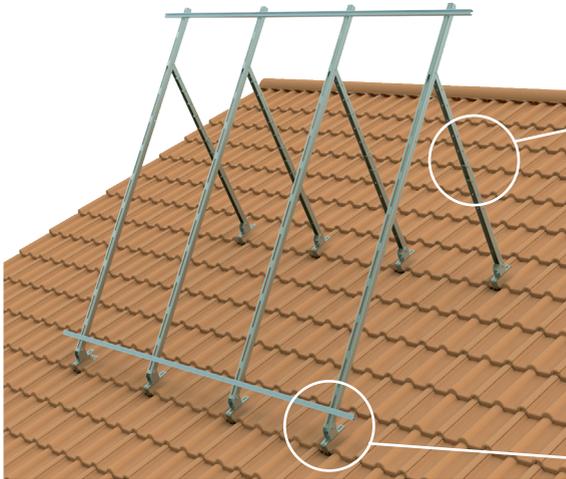
Maybe additional collector bearing rails are necessary in order to create the distance of the mounting rails (order n° 420050100 / length 2450 mm). 2 rails per collector are need if necessary.

Next step: „Installing the collector bearing rails“

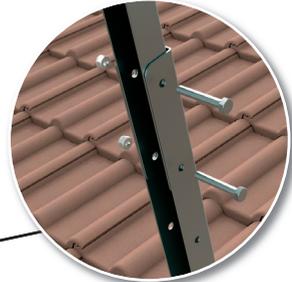
Special solution: Installation with stand-kit

recommended tilt angle (guide value for Germany):

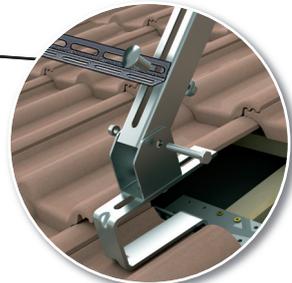
- supplementary heating 60°
- heating up DHW (all year) 45°
- heating up DHW (summer) 25°



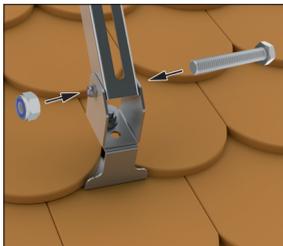
Stand-kit for the installation on standard roof hooks



Telescopic U-profile to adjust the collector inclination. The U-profiles can be telescoped if the collector should be inclined in a weaker way. Two stainless steel screws (M8x50) and self-locking nuts are used as locking device.

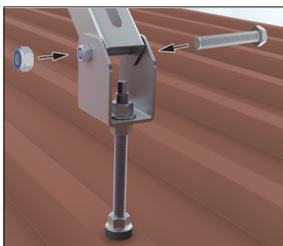


The figure shows the ready installed base frames on **standard roof hooks** (with collector bearing rails). Each basic hoop is fixed with a screw M8x55 and a self-locking nut.



Special solution: plain tile hooks

Installing the basic hoop on plain tile hooks



Special solution: hanger bolts

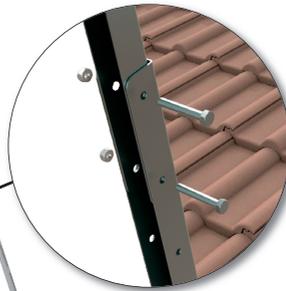
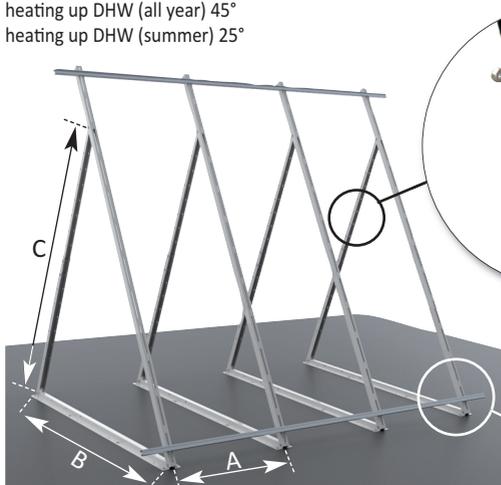
Installing the basic hoop on hanger bolts

Next step:
„Installing the collector mounting rails“

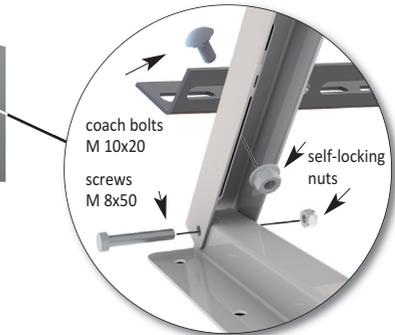
Special solution: Installation with a flat roof stand-kit

recommended tilt angle (guide value for Germany):

- supplementary heating 60°
- heating up DHW (all year) 45°
- heating up DHW (summer) 25°



Telescopic U-profile to adjust the collector
Two stainless steel screws (M8x50) and self-locking nuts are used as locking device.



Dimensions of the flat-roof stand-kit

		SilverSun 2.02
distance	A	approx. 600 bis 900 mm
depth	B	1600 mm
telescope height	C	extendable to approx. 65° collector inclination

Calculating the clouding for flat roof installation (example: vertical angle of the sun 17° on 21.12. (Germany))

		collector inclination (α)		
		min. 25°	45°	min. 65°
SilverSun 2.02	distance (a)	3,65	4,85	5,40



Instruction for the installation/fastening of the stand-kits:

- the best solution is to screw the stand-kit onto the subsurface
- it would be possible to use ballast in order to protect the panels against wind load

Due to the different local conditions it is impossible for Solarbayer to make a general statement on the connection of the stand-kit to the subsurface (advice on demand)

Next step:
„Installing the collector mounting rails“

Installing collector mounting rails

Fix **upper rail** only loosely at first.
The upper rail is only fastened with the roof hooks after the mounting of the collectors.

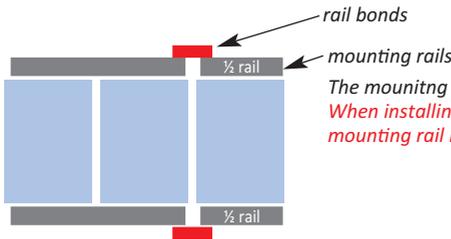
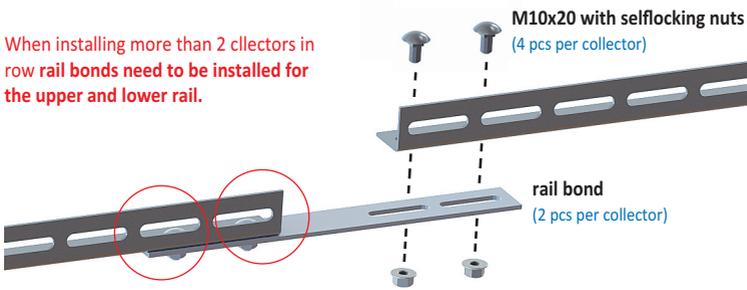


Mounting example for one collector

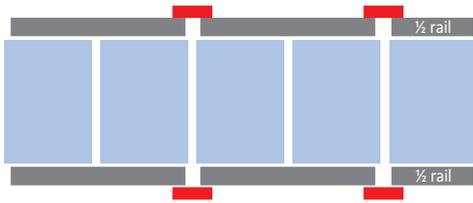


Installing the rail bonds

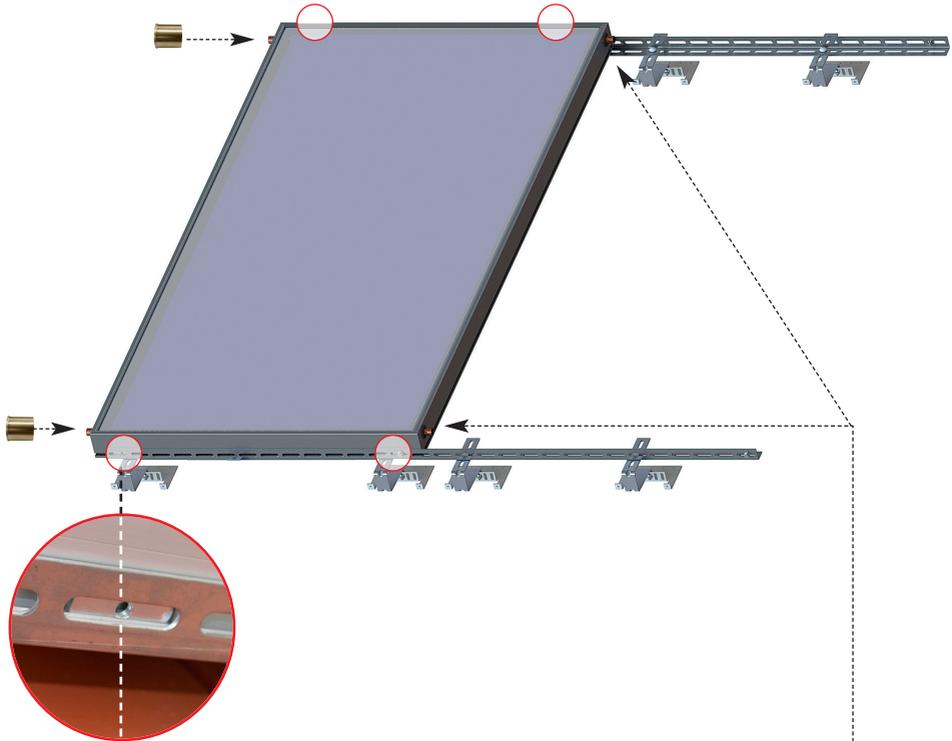
When installing more than 2 collectors in row rail bonds need to be installed for the upper and lower rail.



The mounting rail has a length of 2000 mm.
When installing an uneven number of collectors the mounting rail needs to be split into half.



Installing the collector

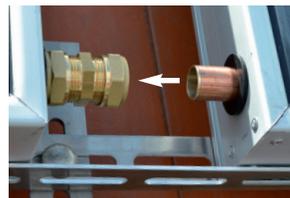


Put the **tube support sleeves** over the collector connection and push completely inside.
(4 pcs per collector)

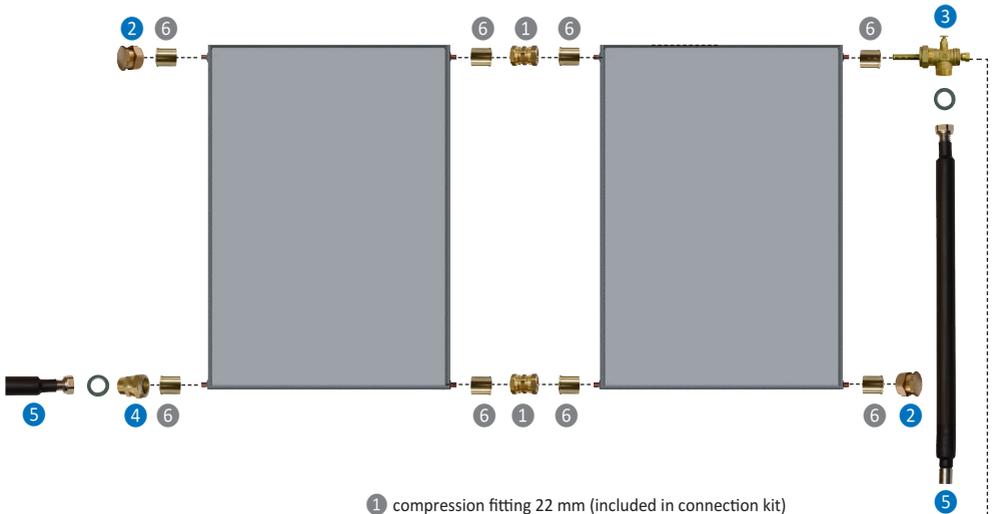


Put **compression fitting** onto the collector connection.

Place further collectors on the aluminum rail and connect with the compression fitting.



Connecting the collector



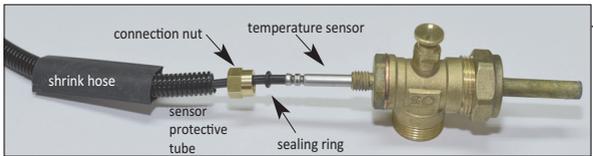
- ① compression fitting 22 mm (included in connection kit)
- ② sealing plug 22 mmsdf
- ③ sensor-T-piece 22 mm x 3/4" AG
- ④ Klemmringübergang 22 mm x 3/4" AG
- ⑤ corrugated stainless steel hose 22 mm x 3/4" IG, length approx. 1 m, incl. flat sealing
- ⑥ support bushing (included in connection kit)

!

*Caution:
The correct sensor installation is always at the outlet (hot flow line) with this collector type, at the upper tight socket*

!

Grease all compression fittings before installation (e.g. with Fermit).
Check the proper and safe installation of the collectors and the correct installation of the collector connections

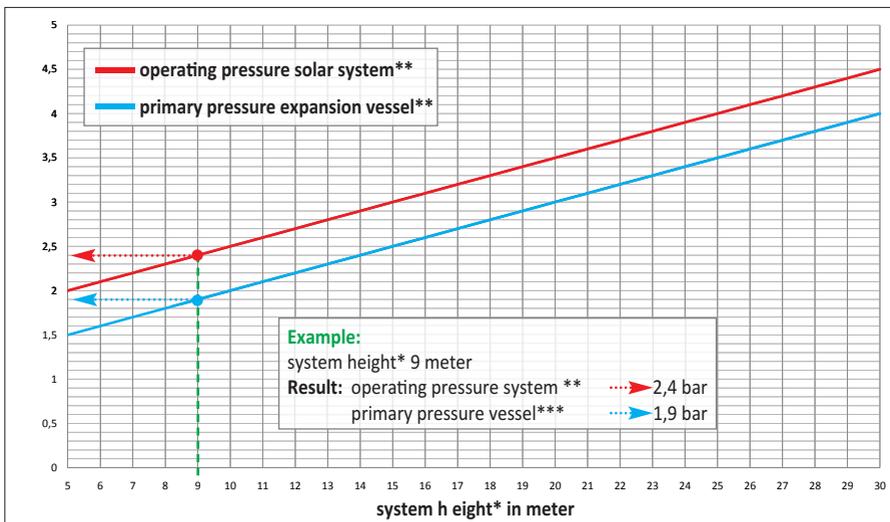


Put sensor completely, as far as it goes, into the flow line connection and tighten connection nut. Afterwards shrink-on the shrink hose with hot air gun or lighter.

Initial operation

Determine the system's operating pressure and primary pressure of the expansion vessel

The professional adjustment of the solar expansion vessel's primary pressure and the operating pressure is the premise for a trouble-free operation of the solar system as well as for a long operating life of the solar fluid.



* The system height is the measured height from the manometer of the solar station to the highest position in the collector array

** The system's operating pressure has to be created with a filling unit - after professional de-airing of the system - and can be checked on the manometer of the solar station

*** The primary pressure of the expansion vessel is pre-set to 2,5 bar (caution: der Ethe set pressure is to be adjusted according to the determined value of the chart)

Mixing the solar fluid (if not ready-mixed)

The mixing ratio of solar fluid concentrate/water has to guarantee proper frost protection and is to be adjusted to the local temperature conditions. We recommend a frost protection up to -24°C . Up to this temperature the fluid has a low viscosity. With lower temperatures a kind of „ice slush“ occurs without blasting power. In extreme areas (lofty mountains, Eastern Europe, etc.) the mixing ratio has to be adjusted.

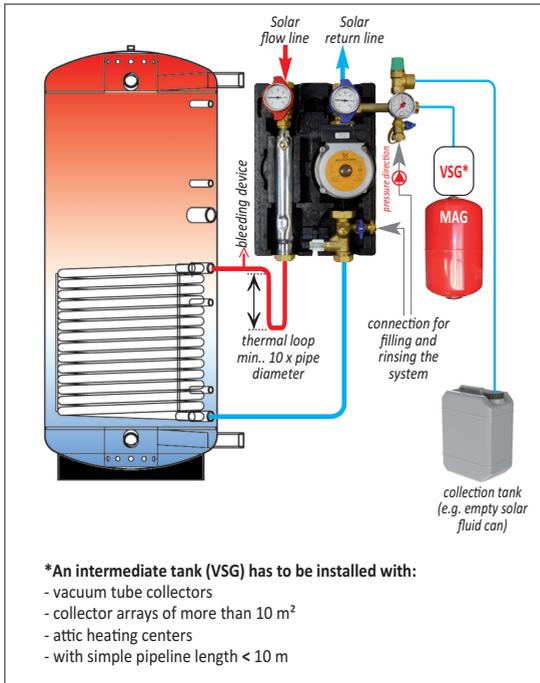
Please observe the mixing chart on the solar fluid can.

The frost protection has to be checked with a refractometer (optional accessory) and documented.

The fluid has to be mixed before filling the system.

The collectors have to be operated with antifreeze fluid even when the outside temperature is above freezing.

Do only use solar fluid approved from Solarbayer.



Remains of liquid might stay in the system depending on hydraulic connection resp. system. Hence, it is necessary to rinse the collectors with solar fluid because steam jets or freezing might lead to damages. Our flat-plate collectors are only to be used with solar fluid L.

Pay attention to possible separate guidelines of the manufacturer of the solar pump concerning the rinsing process.

Rinse

The solar system has to be rinsed with the ready mixed heat transfer fluid

Course of action:

- check if all screwed connections are tightened
- check the primary pressure of the solar expansion vessel at zero pressure, if necessary adjust to 2,5 bar
- switch the solar station's ball valves of flow and return to 45° - that will open the gravity brakes
- close hex key of flow regulator
- connect the hoses of the filling station with the corresponding valves
- open any other valve (if existing)
- adjust the inversion valve (if existing) to "manual"; convert the exits one after the other during the rinsing (if possible control them electrically with the control unit)
- the solar system can now be flushed in both directions; keep an eye on the manometer
- **don't** rinse/fill the solar system when it is under direct exposure to light or when the storage tank temperature is > 60°C
- the rinsing has been successful when the fluid returns clean and without air bubbles into the container
- operating pressure has to be at least 3 bar
- close the filling and draining valves and completely open the flow regulator
- open the ball valves and put the switching valves (if existing)
- the solar system is now ready for operation

Adjusting the flow rate

Solar pump RPM controlled:	Solar pump without RPM control:
<p>e.g. when using the solarbayer multi-loop controller</p> <p>Turn the hex key at the regulation valve as far as possible to the left, it is now completely open.</p> <p>The flow rate is controlled yield-optimized by the control unit.</p> <p>Activate RPM control („ON“)</p> <p>Please read carefully the controller manual.</p>	<p>Adjust pump function to manual on the controller.</p> <p>Turn the hex key at the regulation valve as far as possible to the left, it is now completely open.</p> <p>Adjust pump to power stage II and meter the flow rate at the flow meter. If necessary boost the power stage until the calculated flow rate is achieved (cf. adjusting flow rate).</p> <p>Hint: always reduce the power stage before throttling the flow rate for electricity saving reasons! The regulator valve stays completely open.</p> <p>Recommended minimum flow rate Solarbayer flat plate collectors: 25 l/m²h</p> <p>Example: 6m² x 25l/m²h = 150l : 60 min. = 2,5 l/min.</p> <p>Adjust the calculated flow rate at the screw-in bolt of the regulation valve (display shows l/min.) while pump is running (turning the screw right reduces flow).</p>

Pay attention to the guidelines of the pump manufacturer concerning the flow rate adjustment.

Piping

Flow and return lines

Guiding value:

collector surface in m ²	copper pipe mm	Solarpipe
up to 14	15-18	DN 16
up to 28	22	DN 20
from 28 on	28	DN 25

Attention:

determine bigger dimensions if the pipelines are longer than 10m.

Pipeline connections:

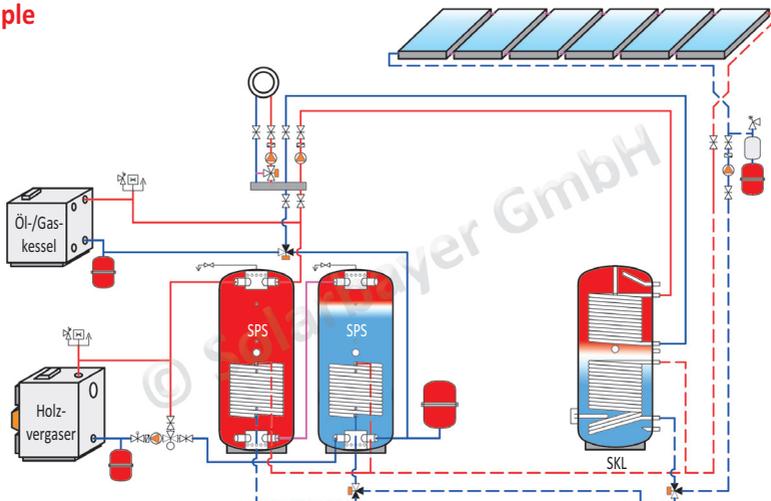
- hard soldering (flux free hard solder according to DIN 8513)
- pressing (only with fittings that are authorized for permanent temperatures >150°C and an operation with propylene glycole by the manufacturer)

Thermal insulation of the pipelines

the pipeline insulations have the following characteristics:

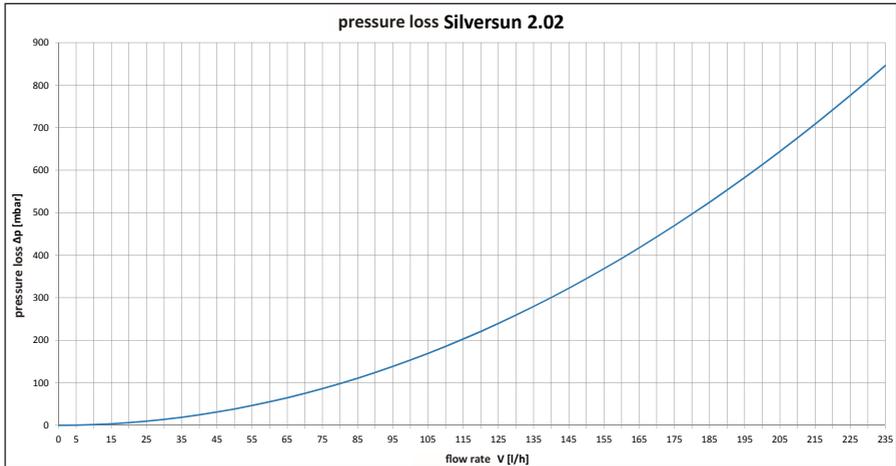
- short time temperature resistance > 150°C (e.g. fiberglass, rubber)
- outdoor parts must be UV-resistant and weatherproof (e.g. sheet metal jacket)
- insulation thickness = pipeline diameter (Minimum) (based on a K-value of 0,04 W/mk)

Example



This scheme is only an installation example and does not replace technical planning!

Pressure loss



Maintenance

In order to keep your high quality Solarbayer solar system in constant and perfect operating state we recommend an annual maintenance and check of the complete system by a specialist.

Minimum requirement for a professional check/maintenance:

- check the solar fluid with a refractometer (can be bought at our company)
- check pH value of heat transfer medium. Note: when the pH value is < 7 the fluid needs to be changed
- leakage test as well as rinse and clean the system by the aid of the Solarbayer professional filling unit
- check the tightness of all connections and mounting elements
- sight check all collectors for probable defects
- pressure check of the expansion vessel, as well as a check of all safety devices
- check all moveable and electrical components
- check the tanks according to their reliability and security
- local conditions (e.g. hydraulic systems, electronics, etc.) might necessitate further checks

Further applicable regulations for solar thermal systems

The general and special quality and test regulations are only applicable in combination with the applicable laws, regulations and norms and their sections that refer to the scope of application of quality regulations for solar systems. The most recent version is to be kept as basis for the quality regulations:

BGI 656 Personal protective equipment against falls – correct use,
BGR 203 - Working on roofs,
BGV A1 *Accident-Prevention Regulation - Principles of Prevention*,
BGV A2, A3 Electrical Installations and Equipment,
BGV C22 Construction work,
Chemicals Act (ChemG),
DIN 1055 Actions on structures,
DIN EN 1057 Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications,
Technical rules of DVGW,
DIN EN 12449 Copper and copper alloys - Seamless, round tubes for general purposes,
DIN EN 1652 Copper and copper alloys - Plate, sheet, strip and circles for general purposes
DIN EN 12735-1 Copper and copper alloys - Seamless, round copper tubes for air conditioning and refrigeration - Part 1: Tubes for piping systems,
DIN 1988 Codes of practice for drinking water installations (TRWI); general information,
DIN 1988-4 Codes of practice for drinking water installations (TRWI); drinking water protection and drinking water quality control,
DIN EN 806 - 1-3 Specification for installations inside buildings conveying water for human consumption,
DIN EN 1717 Protection against pollution of potable water installations and general requirements of devices to prevent pollution by backflow,
DIN 4753 - 1 Water heaters, water heating installations and storage water heaters for drinking water,
DIN 4753 - 11 Water heaters and hot water systems for drinking and service water; indirect heat exchangers; requirements, testing and marking,
DIN EN 1991 Teil 1-3 Eurocode 1,
DIN EN 1991 Teil 1-4 Eurocode 1,
DIN 1946 Ventilation systems (VDI ventilation code),
DIN 4102 Fire behaviour of building materials and building components,
DIN 4807 Expansion vessels,
DIN 53384 Testing of plastics; artificial weathering or exposure in laboratory apparatus; exposure to UV-radiation,
pr DIN EN 12897 Water supply - Specification for indirectly heated unvented (closed) storage water heaters,
DIN EN 12975-1 Thermal solar systems and components - Solar collectors - Part 1: General requirements,
DIN EN 12975-2 Thermal solar systems and components - Solar collectors - Part 2: Test methods (including corrigendum AC:2002),
DIN EN 12976-1 Thermal solar systems and components - Factory made systems - Part 1: General requirements,
DIN EN 12976-2 Thermal solar systems and components - Factory made systems - Part 2: Test methods,
DIN V ENV 12977-1 Thermal solar systems and components - Custom built systems - Part 1: General requirements for solar water heaters and combisystems,
DIN V ENV 12977-2 Thermal solar systems and components - Custom built systems - Part 2: Test methods,
BDH Information sheet n° 34: Operational safety of solar thermal systems,
DIN V ENV 12977-3 Thermal solar systems and components - Custom built systems - Part 3: Performance test methods for solar water heater stores,
DVGW – worksheet GW2 Connecting copper pipes for gas and water installations
KfW – recommendation 1-6,
DVGW – worksheet W 270 Reproduction of microorganisms on materials for drinking water – Test methods and rating,
DVGW – worksheet W 551 „Potable water heating systems; technical measures for the decrease of legionella growth; planning, formation, operation and restoration of potable water systems”,

EU Pressure equipment directive PED 97/23/EC,
EEC directive 89/336/EEC Electromagnetic compatibility,
EEC directive 73/23/EEC Low voltage,
EEC directive 89/292/EEC Machinery,
EU directive 67/548/EEC classification, packaging and labelling of dangerous substances,
EU directive 91/155/EEC safety documents,
Ordinance on Hazardous Substances (GefStoffV),
RAL-GZ 429, Roof construction,
RAL-RG 641/1, Copper pipe,
RAL-RG 641/2, brazing solder and brazing flux and solder paste for copper,
RAL-RG 641/3, soft solder, solder flux and solder paste for copper,
RAL-RG 641/4, Capillary soldered fittings made of copper pipes,
RAL-GZ 655, Pipe supports,
Regulation guideline of the ZVDH (German Central Association of the Roofing Trade),
Technical Rule for Hazardous Substances (TRGS 519),
Energy Saving regulation EnEV on energy saving thermal insulation and on energy efficiency in buildings,
VDI 2067 Economic efficiency of building installations,
VDI 6002 Solar heating for potable water,
VDI 2035-1 Prevention of damage in water heating installations - Scale formation in domestic hot water supply installations and water heating installations,
VDI 2035-2 Prevention of damage in water heating installations - Water-side corrosion,
Regulation on the classification on substances hazardous to water (VwVwS),
Drinking water Ordinance (TrinkwV).

Instructions for lightning protection

The general principles for protection against lightning are stated in DIN EN 62305 part 3 / VDE 0185-305-3 (protection against lightning, physical damage to structures and life hazard) and in supplementary sheet 2 (Photovoltaic and solar thermal systems).

If a lightning protection system is installed on a structure as external lightning protection the collectors and its installation rails have to be connected to the protection system. A specialist for lightning protection has to check if either the solar system is within the range of a lightning protection system or what arrangements have to be met. Attention: It is not allowed to draw a conductive connection between the collector and the existing lightning protection system (danger of launching the lightning into the house!) A safety clearance of approx. 0.5 m from the collector array to the conductive parts of the lightning protection system has to be maintained to all sides. The exact calculation of the safety clearance is stated in DIN EN 62305 part 3. If it is impossible to keep up the safety clearance a specialist for lightning protection has to realize the necessary regulations.

Furthermore it has to be considered: If the lightning protection is outdated and no longer in accordance with the norm, the right of continuance expires due to the mounting of the collectors. In this case the lightning protection system has to be revised.

Source: information sheet no. 34, march 2009, Operating Reliability of Solar Thermal Systems. For further information see: www.BDH-Koeln.de

Overload protection: In order to protect the collector sensor and the control unit against overload you can install an overload arrester. Nearby lightning might induce voltage peaks which can destroy the sensor or the control unit. Protective diodes limit the damage caused by overload to a minimum. Solarbayer control units are regularly equipped with an overload protection.

Potential equalization: The solar system is to be connected to the structure's existing potential equalization by a specialist.

It is always the most recent version of these regulations that has to be regarded when planning and installing such systems

Possible problems and trouble shooting

Problem	Cause	Solution
Pump is not working although the collector temperature is at least 10K warmer than that of the tank. No sounds from the pump can be heard	No power	Check all pipelines and fuses
	Either temperature difference is adjusted too big or the controller does not switch	- check controller - check temperature sensor - diminish temperature difference
	Maximum temperature is achieved.	Check settings
	Pump shaft is blocked by deposits in the bearings	Either switch to maximum rotation speed for a short time or unblock rotor. Put screwdriver into slot and turn manually
	Pump is broken	Exchange pump.
Pump is operating, but flow and return have the same temperature. Pump is very hot	There is air in the system. Valves are closed	- check system's pressure - flush complete solar system with Solarbayer filling station - open valves
The tank cools down during the night; flow and return have different temperatures after the pump has been turned off.; during the night collector temperature is higher than outside temperature	gravity brakes do not close 100% (particles of dirt)	Check the position of the red and blue handle. Probably, jammed cuttings or particles of dirt on the sealing surface. Uninstall and clean
The solar gain is unusually low	The pipe insulation is too thin, high heat loss; circulation is neither temperature nor time controlled. The system may have been designed incorrectly	Check the layout of the system (collector size, shading, pipe length, clock timer, hot water consumption)



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Solarbayer GmbH
Preith, Am Dörrenhof 22
85131 Pollenfeld
Telefon +49(0)8421/93598-0
Telefax +49(0)8421/93598-29
info@solarbayer.de
www.solarbayer.de

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