



Planning and Commissioning Instruction for AkoTec Full Vacuum Tube Collectors

General regulations and safety remarks:

The mounting must be performed by qualified staff.

The following regulations must be observed:

- Legal regulations for accident prevention
- Legal regulations for environment protection
- Professional association regulations
- Safety conditions of DIN, EN, DVGW, TRGI, TRF and VDE.
- ÖNORM, EN, ÖVGW-TRF and ÖVE
- SEV, SUVA, SVGW, SVTI, SWKI and VKF
- Ground: the piping system of the solar circuit in the lower part of the building must be connected electrically conductive according to VDE with potential equalization. The potential equalization must be performed by authorized staff only.

Planning:

The expansion vessel must be approved according to DIN 4807. Membranes and sealings of expansion vessel and safety valves must be suitable for the heat transfer medium.

All connections must be pressure and temperature-resistant (note max. stagnation temperature of collector).

The generated heat by the solar panels can be harvested when the required flow is achieved only. In order to achieve this, the pipe network and the pressure loss must be calculated.

The solar system must be equipped with MAG, safety valve and circulation pump according to EN 12975.

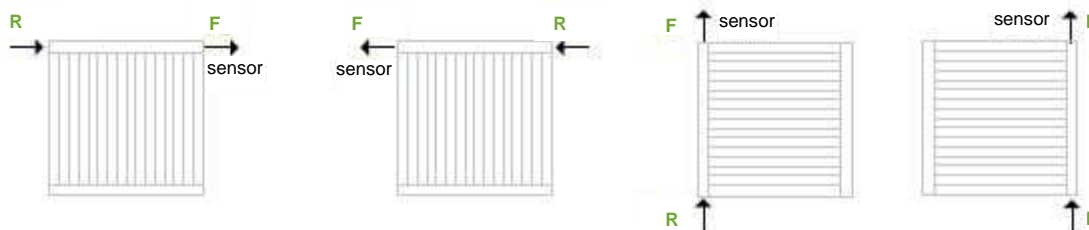
The solar circuit flow must be provided with an air separator to ensure an uninterrupted operation. It should be used safety valves that are designed for max. 6 bar and include the Letter "S" (Solar) in the designation only.



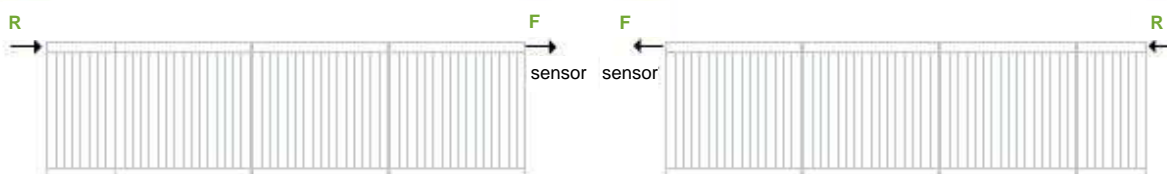
Collector Wiring: Attention!

Install the sensor at the flow side always.

Connection options for one collector:

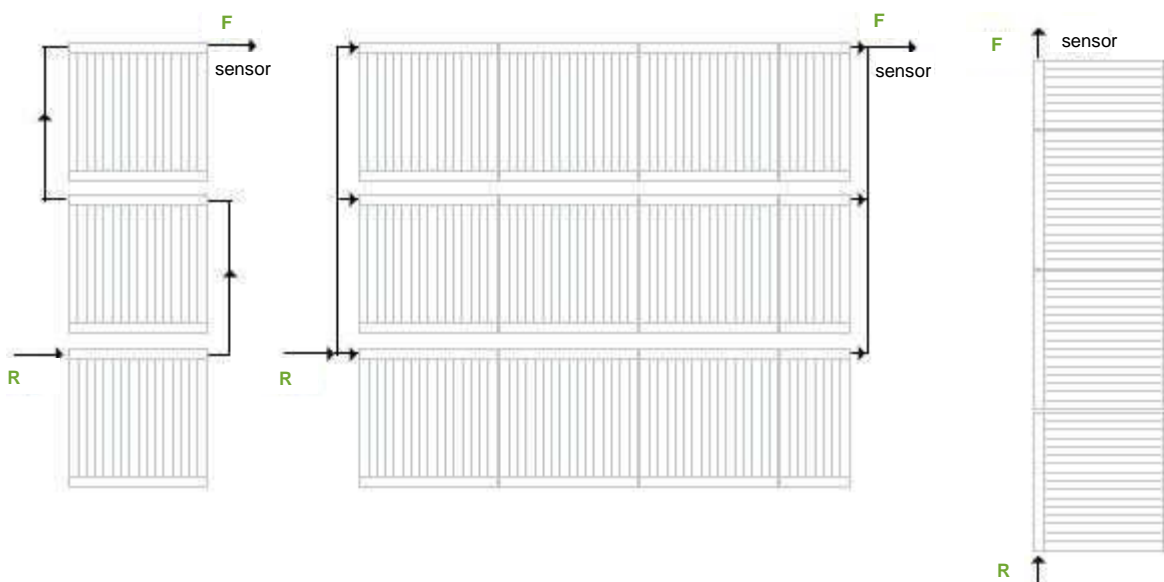


Connection options for several horizontal collectors in series (max. 70 tubes):



Connection options for several horizontal collectors in series (max. 70 tubes):

When collectors run parallel to one-another, equal subfields (number of vacuum tubes) and the right interconnection must be considered according to the Tichelmann principal.

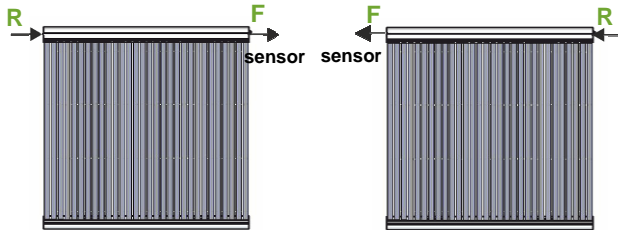




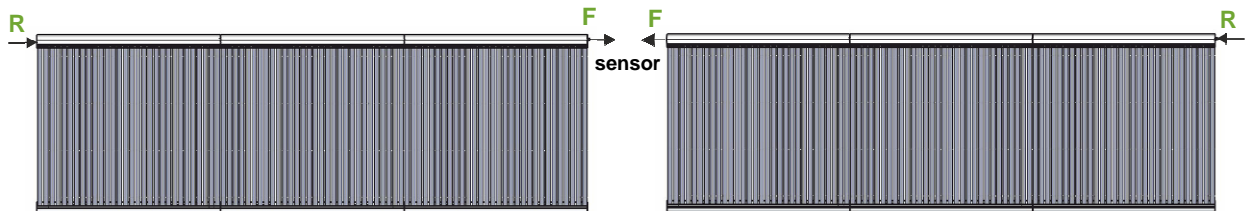
Collector Wiring: Attention!

Always install the sensor at the forward side.

Connection options for one collector:

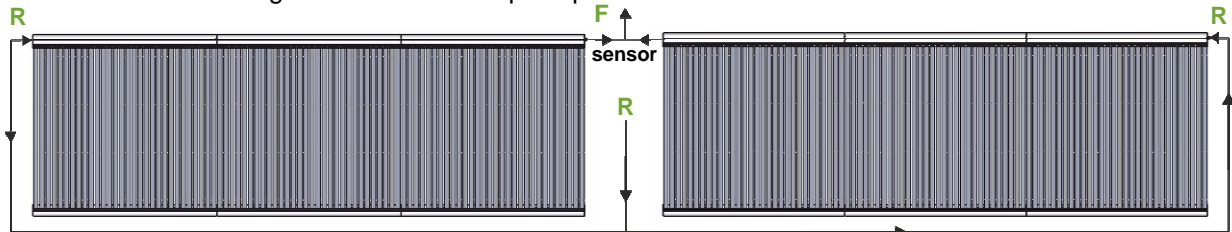


Connection options for several collectors horizontal in series (max. 90 tubes):



Connection options for several collectors horizontal in series (max. 90 tubes):

When collectors run parallel to one-another, equal subfields (number of vacuum tubes) and the right interconnection according to the Tichelmann principal must be considered.



Connection options for several collectors vertical in series (max. 90 tubes):

When collectors run parallel to one-another, equal subfields (number of vacuum tubes) and the right interconnection according to the Tichelmann principal must be considered.

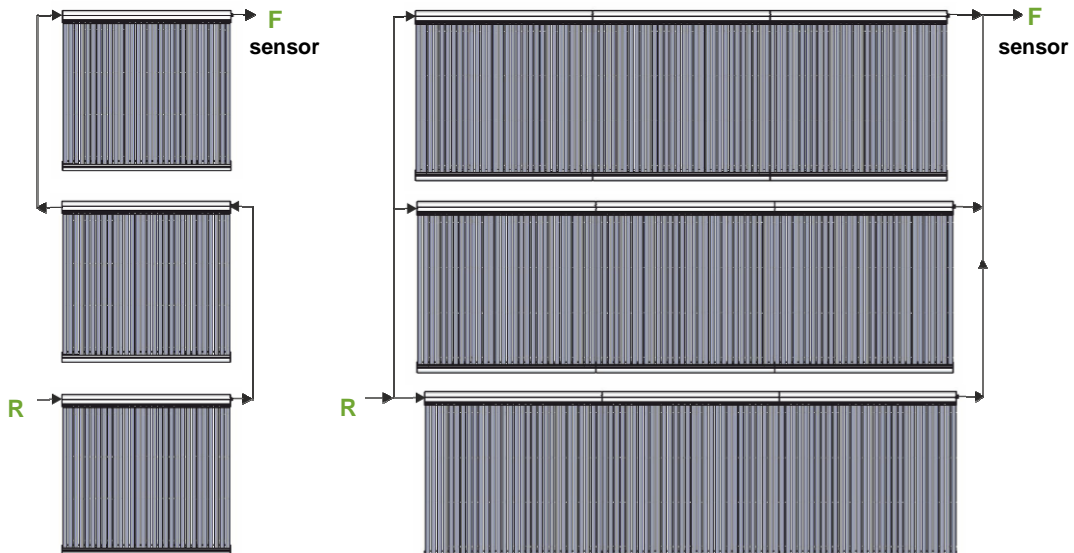




Chart number of tubes

Number of tubes	20	30	40	50	60	80	100	120	140
Heat transfer medium Volumetric flow*	1,0- 1,5 l/min.	2,0- 2,5 l/min.	2,5- 3,0 l/min.	3,0- 4,0 l/min.	4,0- 4,5 l/min.	5,5- 6,0 l/min.	7,0- 7,5 l/min.	8,0- 9,0 l/min.	9,5- 10,5 l/min.
Heat transfer medium VT51(aprox.)	15 kg	20 kg	30 kg	35 kg	40 kg	45 kg	50 kg	60 kg	65 kg

*volumetric flow 36 – 45 l/m²/h (aperture area)

Estimation expansion vessel dimensioning

Because of different expansion vessel for direct flow or heat pipe collectors, we suggest to calculate it separately for each system.

To determine the correct expansion- and auxiliary vessel for your system, please request our easy-Anlagenplaner: <http://akotec.eu/produkte/easy-anlagenplaner/>

With tool it is easy to calculate the complete solar system and you get information about the needed expansion vessel.

Tank volume

The tank should be dimensioned between 50l/m² and 70l/m² gross collector area.

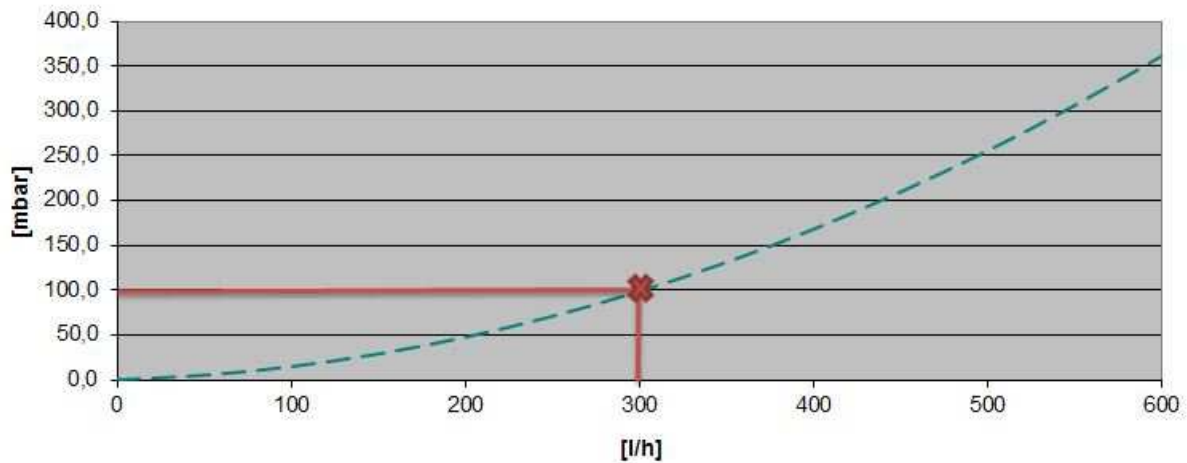
If heat pipe 100°C collector is selected the volume of the tank can dimensioned less, because the shutdown function of the collector is with 100°C. Damaging of the solar fluid because of overheating is not possible with 100°C heat pipe tubes!

For calculation of the optimal tank volume is a simulation software available. As needed please let the tank volume calculate from one of our technical experts.



Pressure drop df

Druckverlust / pressure drop OEM Vario 1000 df & OEM Vario 800-10 df



The values refer to the 10 - tube collector.
With 20 or 30 tubes the values must be
multiplied with 2 or 3.

— DF-10

measurement TÜV Rheinland 04/2011

Example:

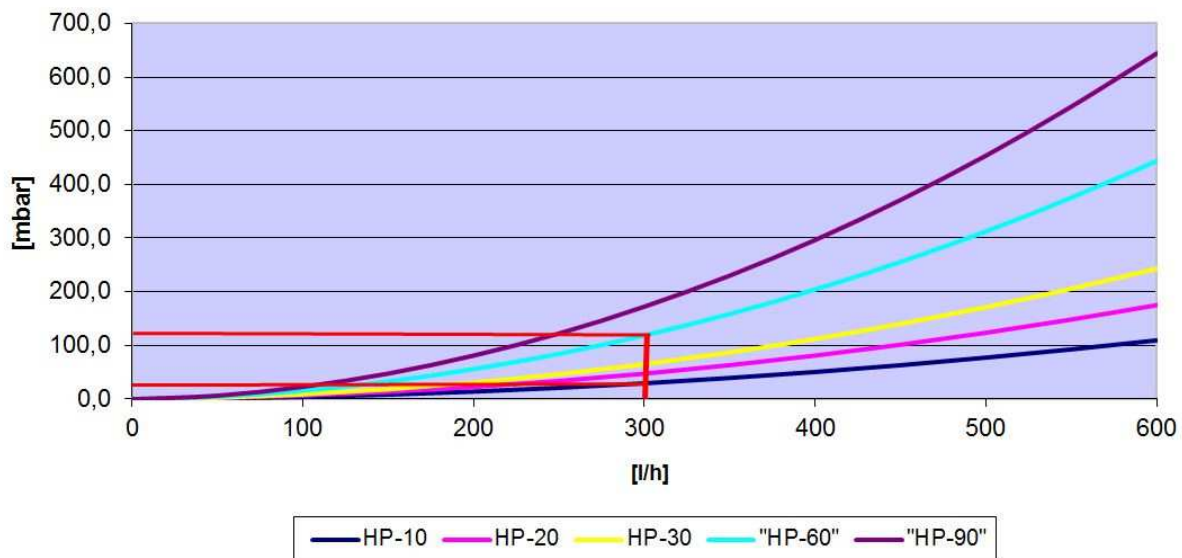
- Collector field with 70 Tubes
- Set volume flow 70 Tubes = 5 l/min
- Convert to l/h = 300 l/h
- Reading Diagram: 10 Tubes and 300 l/h = 100 mbar pressure drop
- Calculate for 70 Tubes: $7 \times 100 \text{ mbar} = 700 \text{ mbar}$ pressure drop

The pressure drop at a 70 – Tubes-system is 700 mbar.



Pressure drop hp

Druckverlustkurve / pressure drop
OEM Vario 1000-10 hp / OEM Vario 2000-20 hp / OEM Vario 3000-30 hp



measurement TÜV Rheinland 04/2011

Example:

- Collector field with 70 Tubes
- Set volume flow 70 Tubes = 5 l/min
- Calculate to l/h = 300 l/h
- Reading Diagram: 10 Tubes und 300 l/h = ca. 30 mbar Pressure drop
- Reading Diagram: bei 60 Tubes und 300 l/h = 120 mbar Pressure drop
- Calculate for 70 Tubes: 30 mbar + 120 mbar = 150 mbar Pressure drop



The Pressure drop at a 70 – Tubes System is 150 mbar.

The system must be operated in order to avoid high temperatures and steam strokes even while stagnation. A maximum pressure of 1.5 bar in the collector layer must be set. Please mind the following calculation method:

Mind the operating pressure!

The operating pressure (minimum operating pressure) of the plant P₀ should be set in cold state (20 ° C) so that there is at the level of the collectors (manifold) a pressure of 1.5 bar.

Example:

The collector is mounted at a height of 10 m above the membrane expansion vessel.

$$\begin{aligned}P_0 &= (h \times 0,1) + 1,5 \text{ bar} \\P_0 &= (10 \times 0,1) + 1,5 \text{ bar} \\P_0 &= 2,5 \text{ bar}\end{aligned}$$

The prepressure of the membrane expansion vessel should be set 0,3 – 0,5 below the system pressure.

Mounting:

The following points must be noted to avoid burn injury and thermal burdening of the collector material. The mounting of the collectors must be conducted while low sun radiation.

Danger: Treat the full vacuum tubes careful, they can break.
Thereby a risk of injury is given.



Direct flow tubes: When dismantling a solar system or exchange a tube, the tubes must be emptied and kept out of the sun. Fluid rests in the system can lead to sudden steam strokes. Durch Fluidreste kann es sonst zu plötzlichem Dampfausstoß kommen. Risk of injury!

Heat pipe tubes: Keep the tubes out of the sun. Risk of injury!

Standard tubes: Turn the coated side towards the sun. Turn the absorber to the sun if the roof has southern deviation and is vertical mounted.

Improper installation can cause damage to the collectors.
Use gunmetal or brass fittings and copper pipes for the installation only.
Use hemp only in conjunction with specific pressure and temperature solar sealant.

Do not solder in the area of the collector! The construction of the collector must not be changed!



When mounting with press fitting the O-ring must be suitably temperature resistant. When mounting with compression fittings all pipes must be square and deburred. Push the union nut and the locking ring onto the pipe and wet the threads with a bit of oil. Push the pipe into the compression fitting all the way to the stop. Tighten the nut by hand only. After that, tighten the nut with spanner by a further $\frac{3}{4}$ turn.

Do not use annealed copper pipes on compression fittings. When mounting mind that an entire vent is ensured. The sensor cable must not come into contact with the hot tubes.

Commissioning:

The calculated prepressure must be set in unfilled solar system at the expansion vessel. The solar system must be checked with air concerning pressure leaks. This prevents unnecessary antifreeze loss at large leakages.

Filling of the system

The heat transfer fluid must be replenished with an electric irrigation pump / solar filling station. Mind the minimum flushing duration of 30 minutes always to prevent air pockets. The capacity depends on the number of collectors and the installed pipe lengths.

The proper flow rate is set on the pump.

It's possible to make fine adjustment on the flow limiter.

Make controller settings. It should be paid particular attention to the tube collector function. This must be operated. It's possible to adjust existing thermostatic mixer in the drinking water circuit.

Attention

The collectors must be filled immediately with liquid to avoid damages to the collector.

The collectors must be protected by cover against sunlight. Large systems can be commissioned field by field. Please provide suitable isolating equipment.



Attention

The solar circuit must be exclusively filled with the heat transfer fluid from AkoTec (frost protected to -28 °C). The heat transfer fluid must not be watered down. If the system shall be installed in climate zones where the frost protection is not enough, please contact AkoTec.

If the system is operating with water, you have to mind VDI 2035 and to deal with measures against frost damages.

The maximum temperature must be set at 120 °C.

The hot water temperature must be limited with a scald protection.