



# Commissioning a Solar Thermal Installation

## Contents

- 1. Solar Circuit . . . . . 1
- 2. Commissioning . . . . . 3
- 3. Service Information . . . . . 8
- 4. Maintenance . . . . . 8

## 1. Solar Circuit

### Components

- Pipework
- Pipework connections (screw joints, solder/pressfittings, etc.)
- Piping insulation
- Built-in components (CIRCO solar circulation unit, heat meter, de-aerator etc.)

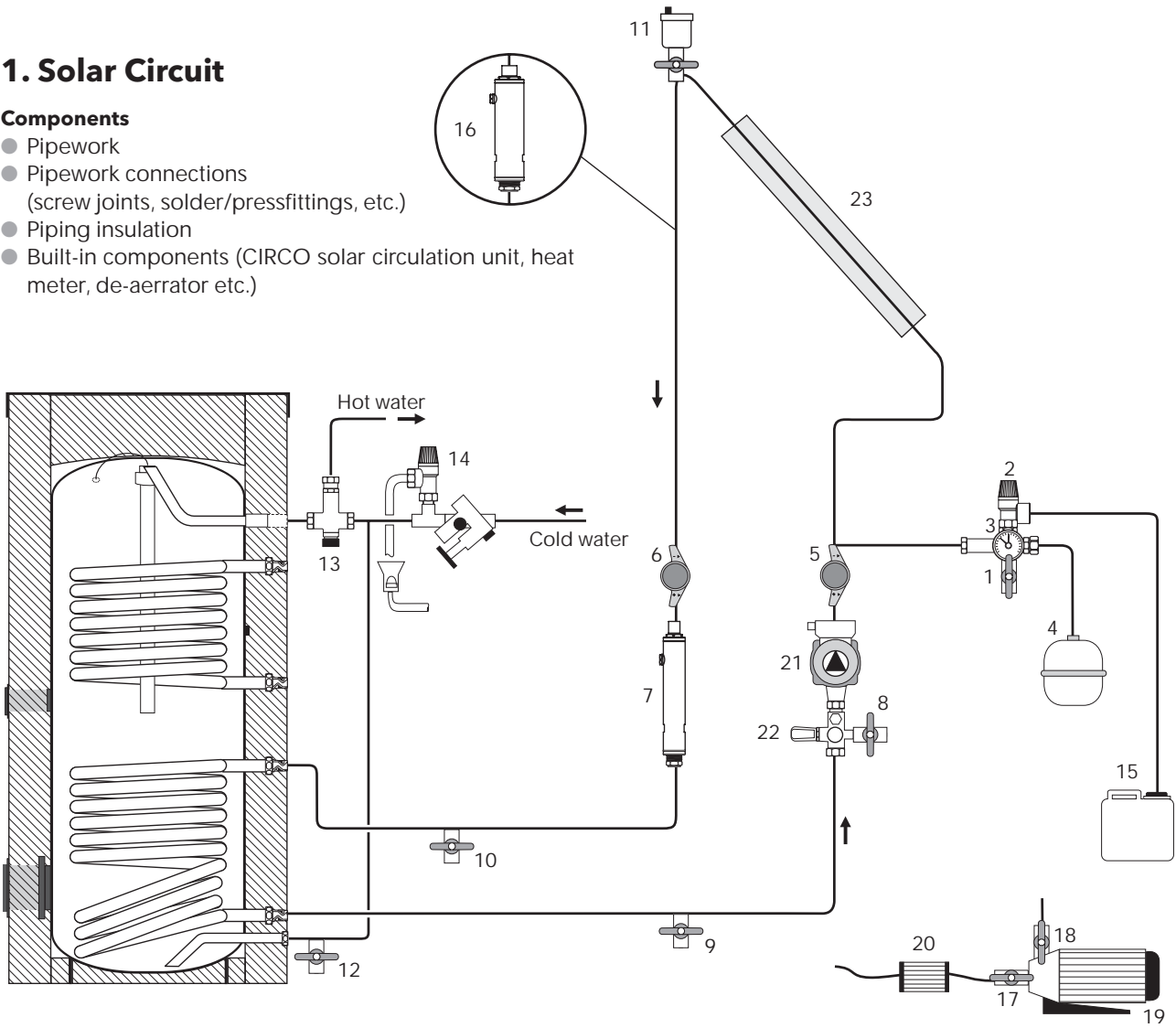


Figure 1 The components of the solar circuit

1 Filler and drain valve in the CIRCO safety unit 2 Safety valve with exhaust line 3 Pressure gauge 4 Expansion vessel 5 Non-return ball valve in the return flow line 6 Non-return ball valve in supply flow line 7 CIRCO air separator pipe 8 CIRCO flow meter valve 9 solar circuit return flow valve 10 Solar circuit filler and drain valve 11 Automatic air release valve with shut-off valve - if air vent pipe (7) not present or insufficient 12 Drinking water drain valve 13 Thermostatic mixer 14 Safety unit of the cylinder 15 Catchment tank (e.g. empty solar fluid container) 16 Air separator in the supply pipe - if air vent pipe (7) not present 17 Shut-off valve at the suction side of the filling pump 18 Shut-off valve at the pumping side of the filling pump 19 High performance filling pump KS 20 Filter 21 Solar circuit pump 22 Flow meter 23 Collector.

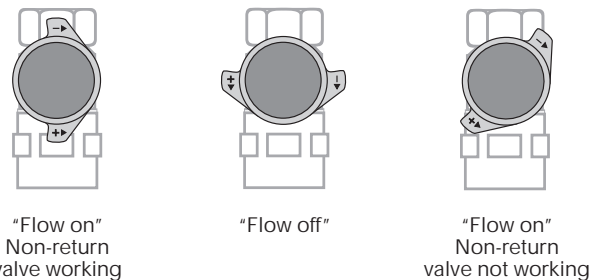


Figure 2 The functions of the non-return valves (5) and (6) in the solar circulation station CIRCO.

The solar circuit must always be composed of material appropriate to the temperature and pressure as well as the heat transfer medium (propylene glycol).

**Pipework and connections**

- Hard or soft copper piping.
- Twinflex TVA stainless steel corrugated tube (figure 4).
- Hard soldering, pressfittings with approved sealing material, soft soldering with Sn Cu3.
- You should use a suitable sealant e.g. hemp and a pipe sealing compound. Teflon tape is not suitable.



**Insulating material**

- Temperature resistant EPDM insulation hose.
- Mineral wool cover for dry areas (figure 5).
- Outside insulation must be protected against UV radiation (e.g. metal cladding).



Figure 3 Pipe assembly kit for the solar circuit.



Figure 4 Twinflex TVA - quick assembly piping system.



Figure 5 Mineral wool insulation.

**Components for the solar circuit**

- Automatic air release valve (figure 6) with a temperature resistant shut-off valve (max. 200 °C). This is not necessary when a deaerator and an efficient filling pump is being used.
- Air separator e.g. Wagner LA 180 for vertical installation in pipes (no picture).
- An air vent pipe (figure 7), which is integrated in the CIRCO solar circuit unit. Layout may differ depending on the model.

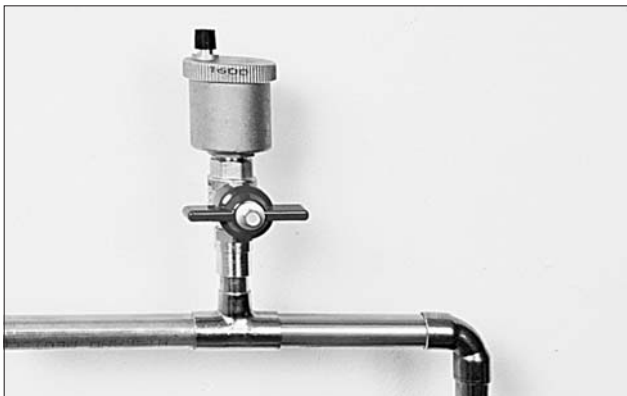


Figure 6 Automatic air release valve with possibility to shut off.



Figure 7 Air vent pipe.



## 2.2 Test Tightness



- Check all connections for leakage.
- Even after emptying the system, some liquid remains in the collectors. If it was previously filled with water, it must be filled with solar liquid, otherwise the absorbers can be damaged by frost.
- Test pressure up to 5 bar.
- Fluctuations in pressure can also occur due to changes in the level of solar radiation.
- The expansion vessel must be shut off from the solar circuit before the drop in pressure can be measured.

### Procedure

- Shut off the filler valve (8).
- After reaching the test pressure shut off filler valve (1).
- Set ball valves (5) and (6) to 45°.
- Shut-off valve (11) must be closed (otherwise a drop in pressure from air separation is possible).

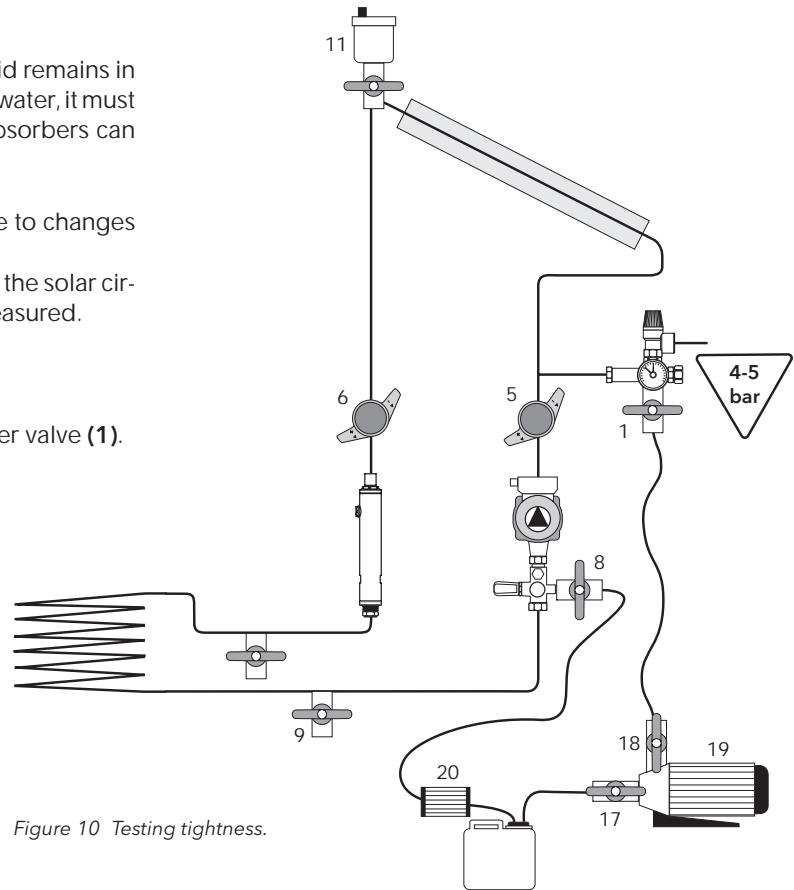


Figure 10 Testing tightness.

## 2.3 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)

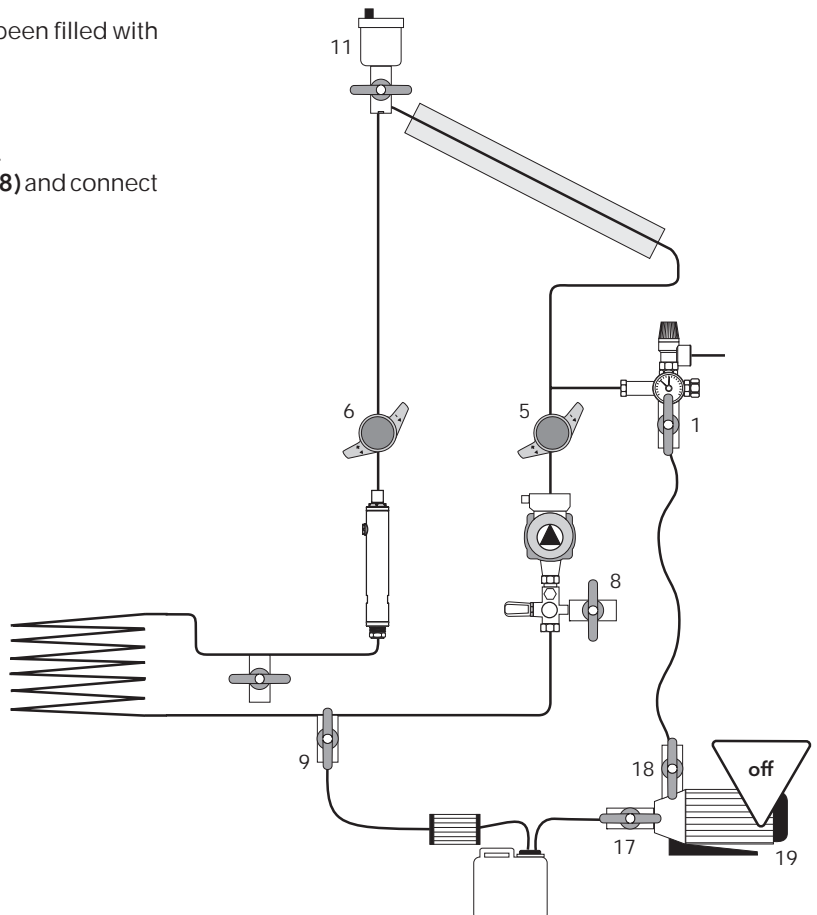


Figure 11 Draining.

## 2.4 Mixing the Heat Transfer Medium

According to the danger of frost the heat transfer medium DC20 should be diluted with water with at least 30% DC20 and this should be well mixed. Observe references in the data sheets.

Table 1 Mixing ratios for concentrate DC20.	
Volume percentage DC 20 [%]	Freezing point [°C]
30	- 14
40	- 21
50	- 32
100	- 50

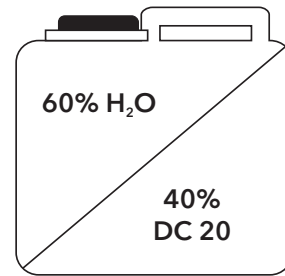


Figure 12 DC20 for flat plate collectors.



Figure 13 Frost protection tester.

Table 2 Volume of different components of the system for the calculation of the filling volume *					
Collectors [litre]		Tank / heat exchanger [litre]		Pipes [Litre/metre]	
EURO C20 HTF / C20 AR	1.3	ECOplus 300	8.5	Cu 28x1 mm	0.52
EURO C22	1.0	ECOplus 400	10.0	Cu 22x1 mm	0.31
LB 5	2,6	TERMO 700	12,9	Cu 15x1 mm	0,13
LB 6,4	3,0	TERMO 1000	14,1	Twinflex TVA DN 16	0,28
LB 7,6	3,5	ECObasic 300	7,5	Twinflex TVA DN 20	0,44
LBM 67	4,9	ECObasic 400	9,4		
LBM 100	7,5				

\* without fluid content of the expansion vessel

## 2.5. 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 (figure 16)
- Shut off the filler valve (8)
- When the desired pressure has been reached shut off the filler valve (1) (see chapter 2.6)
- Open the shut-off valve (11) under the automatic air release valve to purge the remaining air.

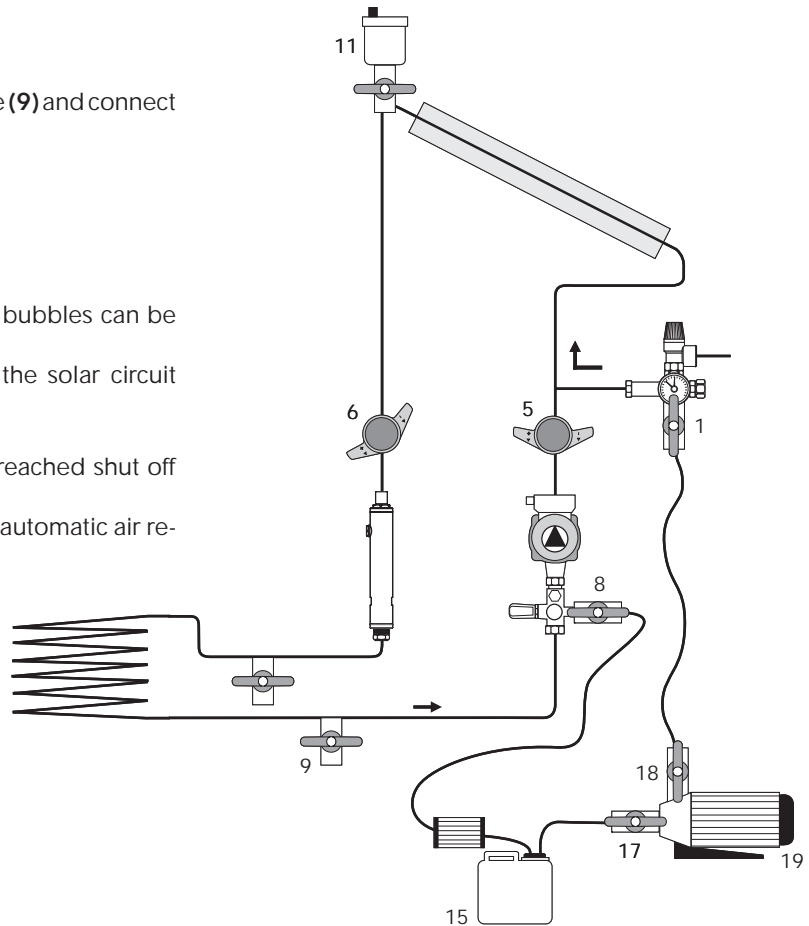


Figure 14 Filling and purging.

### 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.

### Vent the solar circuit pump if necessary

- Turn on the solar circuit pump (choose the maximum speed) and vent through the bronze screw at the front of the pump. Please observe the instructions of the pump manufacturer.
- Final deaeration: vent air at air vent valve of the CIRCO station several days after installation.

### 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.

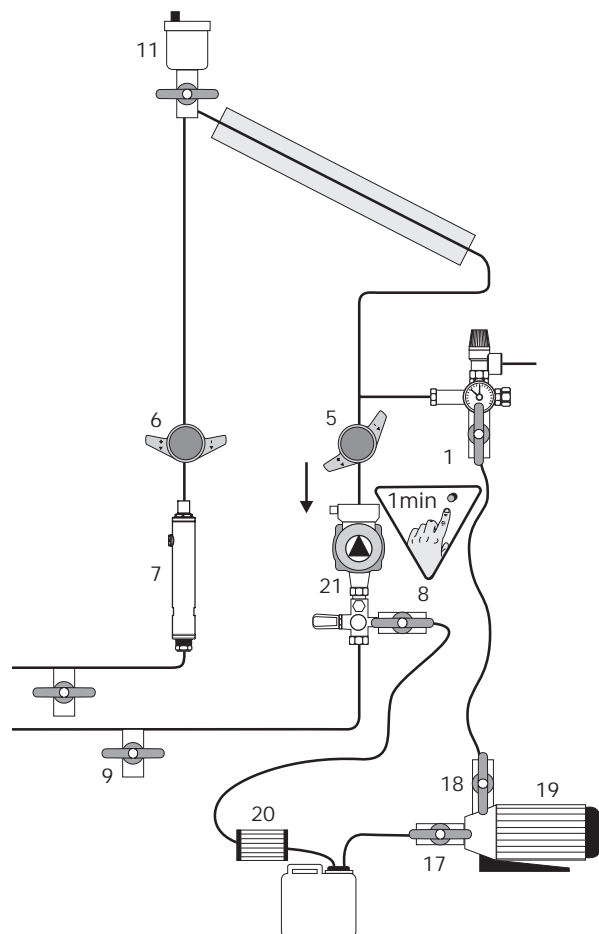
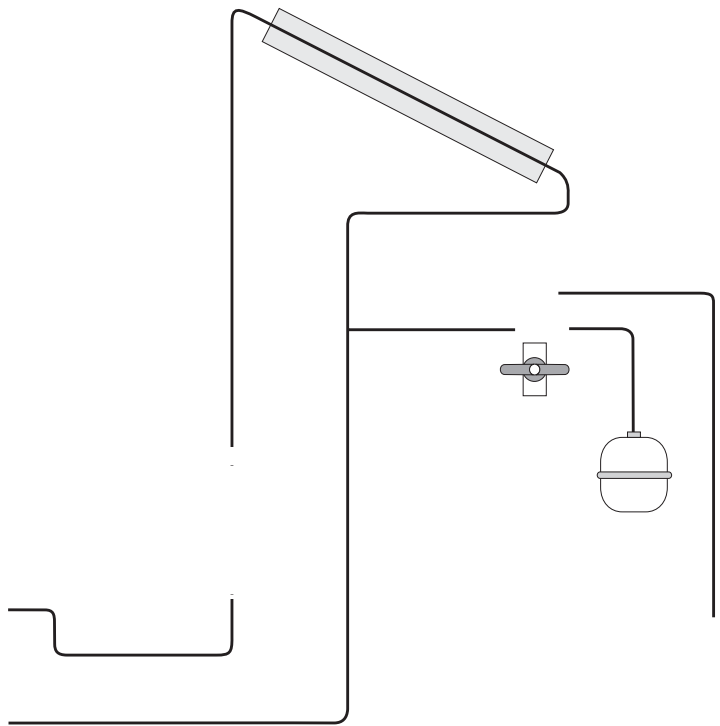


Figure 15 Venting the pump line.



### 3. Service Information

Table 4 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"> <li>● Set the maximum pump level (on the pump) and pump speed (on the control)</li> <li>● Loosen the ventilation screw and carefully move the pump shaft with a screw driver</li> </ul>
The pump is running but there is no circulation	There is a block in the solar circuit: <ul style="list-style-type: none"> <li>● Flow meter</li> <li>● Ball valve in the solar circuit unit</li> </ul>	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 pump keeps running	The sensor is faulty	<ul style="list-style-type: none"> <li>● check the cable connections</li> <li>● compare the resistance of the sensor with the table</li> </ul>
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"
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
	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
Drop in pressure at the pressure gauge	Air was released by air separator or release valves	Fill up with heat transfer medium
	The solar circuit is not watertight	Check all connections

### 4. Maintenance

Table 5 Protection from frost	Protection from corrosion of the heat transfer medium	Protection from corrosion of the storage tank
<ul style="list-style-type: none"> <li>● Recommended frost protection temperature of heat transfer medium -19 °C. Test at time of commissioning</li> <li>● Then test at least every 2 years.</li> </ul>	<ul style="list-style-type: none"> <li>● pH &gt; 6.6 – otherwise exchange the heat transfer medium</li> <li>● Check the pH every 2 years</li> <li>● If the solar fluid is black or smells bad it has to be changed and the solar circuit has to be rinsed.</li> <li>● Any remaining heat transfer medium in an emptied system can result in corrosion through contact with air.</li> </ul>	<ul style="list-style-type: none"> <li>● Magnesium anode: protective current &gt; 0.3 mA, test at least every 2 years</li> <li>● External current anode: observe control lamp</li> </ul>
<b>Pressure of the system</b>	<b>Volume flow in solar circuit</b>	<b>Visual check</b>
<ul style="list-style-type: none"> <li>● Observe the system pressure</li> <li>● For correct value see chapter 2.6</li> <li>● When refilling several times with water check the frost protection temperature</li> </ul>	<ul style="list-style-type: none"> <li>● Recommended volume flow: per m<sup>2</sup> collector surface = 0.5-0.8 l/min</li> </ul>	<ul style="list-style-type: none"> <li>● Collectors, connections and pipes and their insulation</li> <li>● Check the sensor cables</li> </ul>