


# **MANUFACTURER'S INSTRUCTIONS**

## **For Defrosting of Finned Heat Exchangers, III. Brine or Glycol Defrosting (for Evaporators and Air Coolers)**

	<b>manufacturer's instructions</b>	02.12.2020 – Version 1.2
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### **Original version**

This manual was created in several languages. The German version is an installation instruction in its original version. All other languages are translations of the original version.

### **Disclaimer**

If problems arise in connection with the assembly and / or operation of the unit, which are not described in these instructions, the operator / installer is obliged to contact thermofin® immediately. Further assembly and / or operation of the unit is not permitted until the facts have been completely clarified.


thermofin® declines liability for any damage resulting from its non-observance. Furthermore, thermofin® reserves the right to reject any further warranty claims on this unit that can be attributed to this.

If you have any further questions, please contact thermofin GmbH.

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 <b>thermofin</b> <sup>®</sup> heat exchangers - Germany	<b>manufacturer's instructions</b>	02.12.2020 – Version 1.2
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## 1. EVAPORATOR DESIGNS

The following manufacturer's instructions show the typical structure of an evaporator and provide information about working principle, structure and operation of defrosting systems.

**The following accessories are important for defrosting:**

- damper combined with Shut-up (Figure 1)
- suction hood combined with Shut-up (Figure 2)
- Shut-up (Figure 3)



Figure 1: damper combined with Shut-up (recommended design)

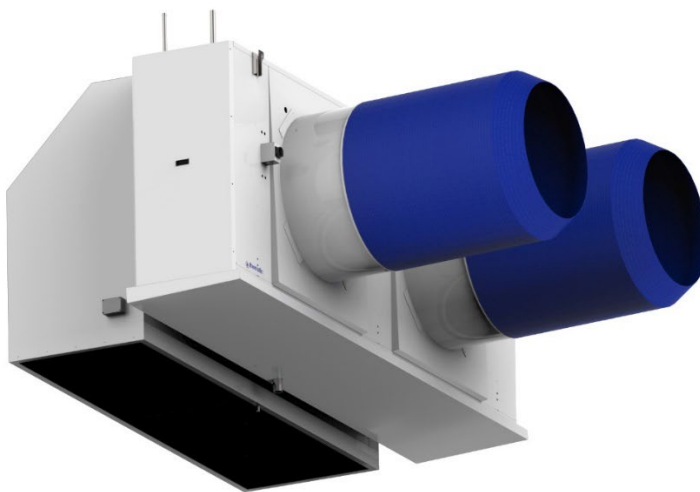


Figure 2: suction hood combined with Shut-up

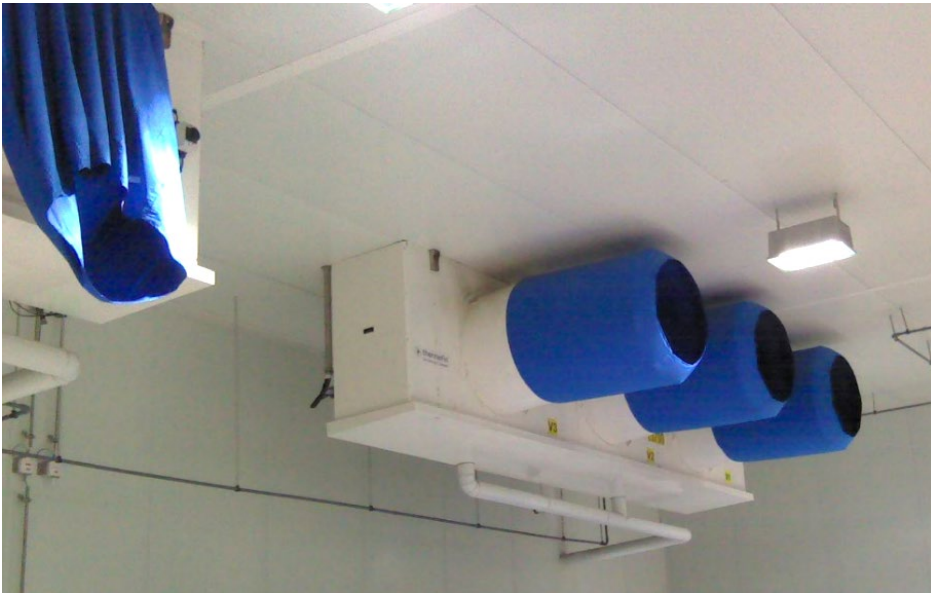



Figure 3: Shut-up (left: fan out of operation; right: fan in operation)

Table 1: disadvantages and advantages of the individual accessories

accessory	advantage	disadvantage
<b>damper</b>	low heat loss and faster defrosting	damper drive motors with integration in the control are necessary
	avoidance of icing on the ceiling which is near the air outlet	additional heating on the multi-leaf necessary
	very reliable, even under high moisture condition in the cold room	additional Shut Up recommended
<b>Shut-up</b>	low heat loss and faster defrosting	increasing pressure drop on air side
	avoidance of icing on the ceiling which is near the air outlet	risk of contamination
<b>suck-in hood</b>	low heat loss and faster defrosting	icing in the hood possible, due to high moisture condition in the cold room, or high defrosting temperature
	avoidance of icing on the ceiling which is near the air inlet	additional Shut Up necessary

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## 2. WORKING PRINCIPLE

- additional tubing in the heat exchanger for glycol between the refrigerant tubes (see **red marking** in Figure 4)
- tubing for glycol in the drip tray

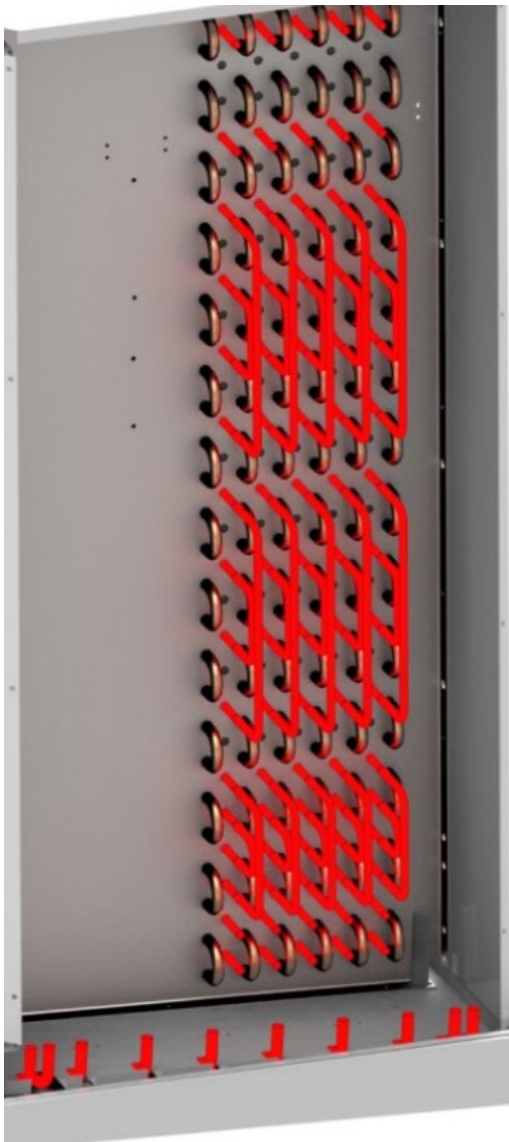


Figure 4: defrosting tubes for glycol (**red marking**)

- difference between parallel and series connection of coil and drip tray
- a pollution filter must be provided in the feed line of glycol supply

**Series connection:**

- application: air inlet temperature > -10 °C
- glycol inlet in drip tray; outlet coil (Figure 5)
- line regulator valve necessary if several evaporators are defrosted at the same time, it can also be installed at the outlet

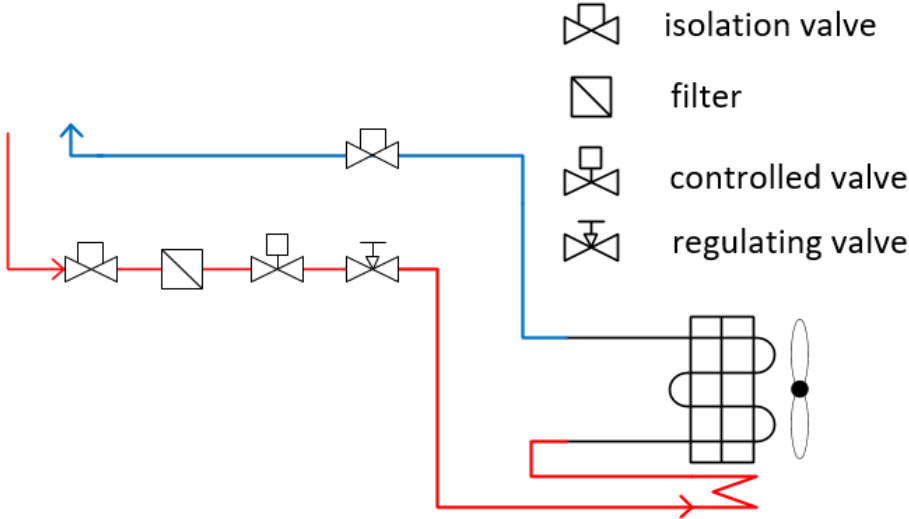


Figure 5: series connection glycol defrosting

**Parallel connection:**

- application: air inlet temperature ≤ -10 °C
- separate inlet tubing for coil and tray, common outlet tubing (Figure 6)
- separate control of tray and coil over time
- line regulator valve for both circuits necessary

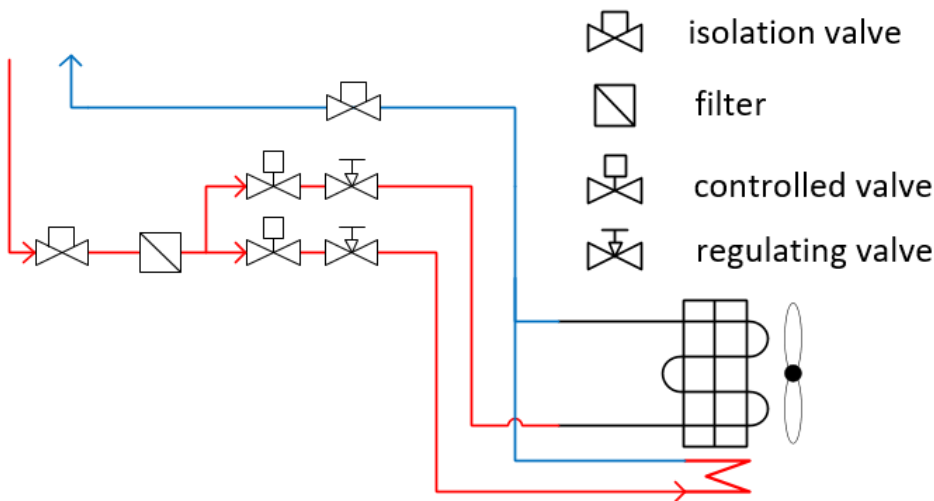


Figure 6: parallel connection glycol defrosting

Setting of line regulator valve: The information about mass flows and pressure drop of the glycol from the tray and coil can be taken from the evaporator data sheet.

### 3. EXECUTION

#### Complete defrosting:

- no ice residues in the heat exchanger coil and in the condensate tray
- minimization of the water steam generated in order to avoid condensation and subsequent icing on unheated surfaces

#### Recommendations from thermofin®:

- all recommendations given refer to normal frost thickness from a cold cycle (2-3 times defrosting one day)
- previous defrosting must have been completed (see above)
- refrigerant valves must close tightly during the defrosting process → filters **required** in front of each solenoid valve (
- Figure 7); Attention of trapped liquid when the valves are shut off!

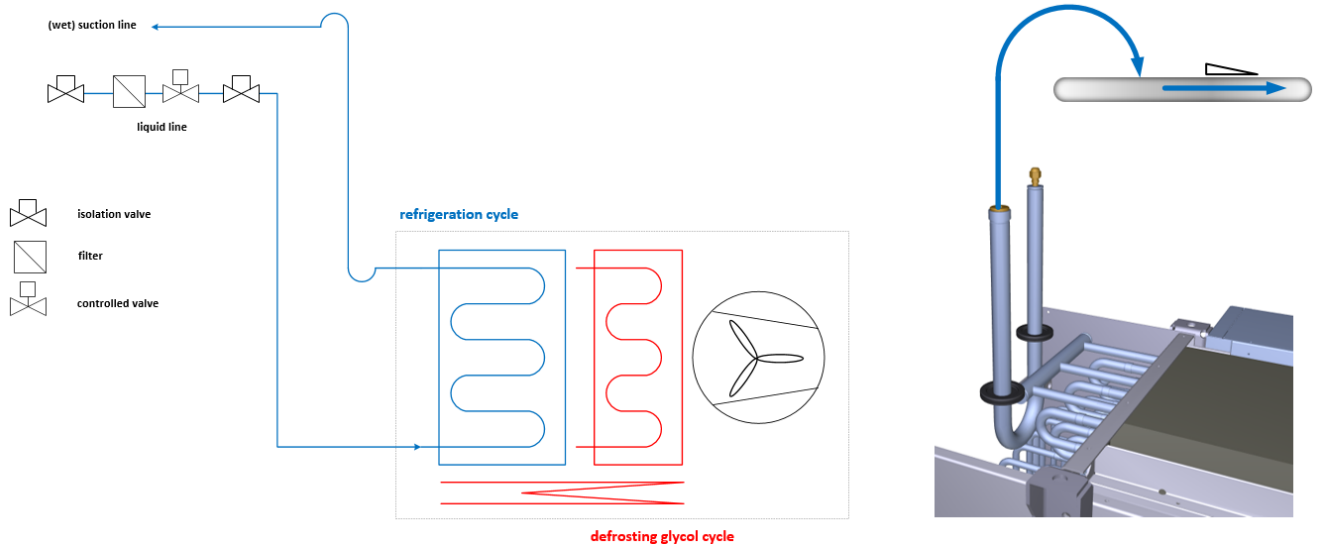



Figure 7: fittings and design, supply and return refrigerant



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### Suction tubing (Figure 8):

- correct execution of the suction gas tubing with loop and slope
- correct dimensioning of the riser

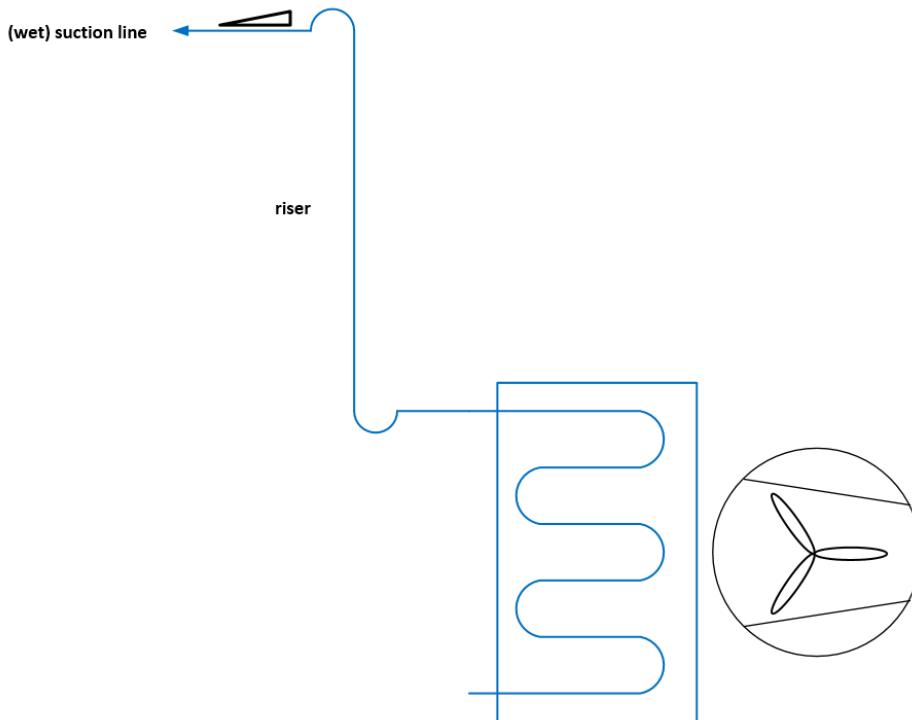


Figure 8: suction gas tubing

- gates and doors must be closed if possible
- fluctuating loads, changes between summer and winter months and other local conditions must be taken into account; the recommendations below do not apply to all conditions, but may need to be adapted to the local circumstances

The frequency of the defrosting is to be judged by the system designer. The following aspects of the evaporator need to increase the defrosting frequency:

- high moisture input into the cold room due to:
  - opened access gates and doors
  - a high air exchange between docking stations, pre-cold rooms and deep-freeze rooms
  - lack of dehumidification of the air in the pre-cooling room
  - goods with increased perspiration

Defrosting can start at fixed time or as required. The highest energy efficiency values are achieved with a defrosting requirement (e.g. frost thickness, monitoring of cooling capacity loss, air temperature difference or similar condition).

### 3.1 Arrangement of defrost sensors

I. **Two defrost sensors – recommendation – (Figure 9)**

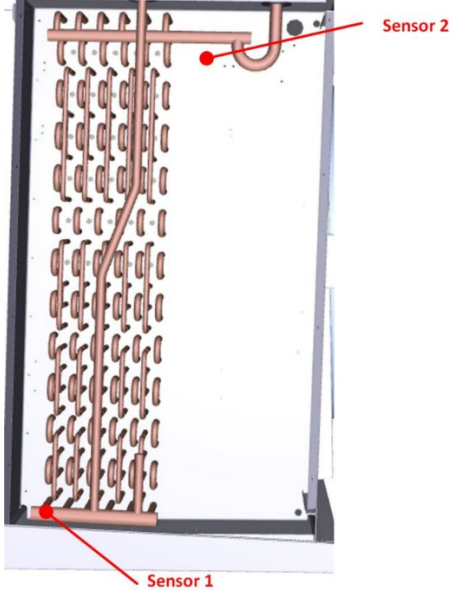


Figure 9: arrangement of defrost sensors, recommended execution with 2 sensors

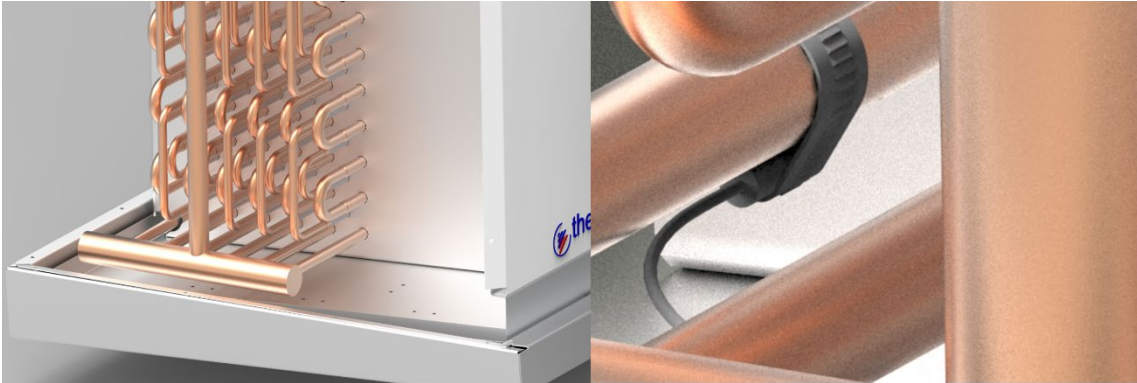



Figure 10: position sensor 1; case flooded evaporation



Figure 11: position sensor 1; case dry expansion

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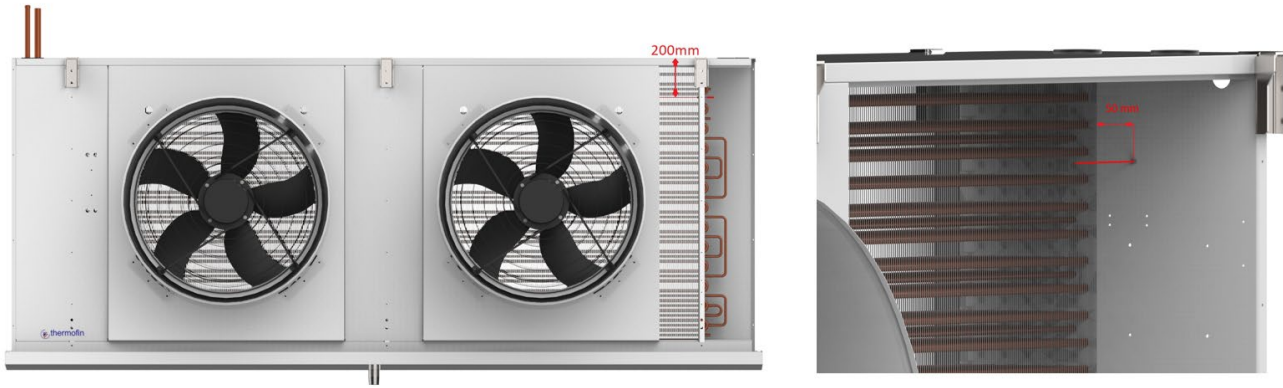


Figure 12: Position Sensor 2

**Sensor 1 (Figure 10 and Figure 11):**

- positioning: bottom of the lowest coil tube where the refrigerant flows through; connection side of refrigerant; sensor must be equipped with insulation in order to prevent failure measurements
- function: monitoring the rest of refrigerant during the defrost phase
  - during pump down, the temperature at the sensor must rise to the level of the air temperature; if the temperature remains close to the evaporation temperature, some measures must be taken (see "S1-a" Table 4)
  - the sensor must reach a minimum temperature during the defrost phase; this must be kept for a specific time (see „S1-b“ Table 4)

**Sensor 2 (Figure 12):**

- positioning: upper area of the heat exchanger (air temperature measurement)
- function: monitoring the air temperature during the defrost phase (see S2-a Table 4)
  - monitoring and limiting the air temperature during the defrost phase to prevent icing
  - pulsating glycol flow (if necessary because air gets too warm)

**II. One defrosting sensor**

- recommendation only for cold room temperature higher than 0 °C

Use of sensor 1 (Figure 10 and Figure 11)

**Sensor 1 (Figure 10 and Figure 11):**

- positioning: bottom of the lowest coil tube where the refrigerant flows through
- function: monitoring the rest of refrigerant during the defrost phase
  - during pump down, the temperature at the sensor must rise to the level of the air temperature; if the temperature remains close to the evaporation temperature, measures must be taken. (see "S1-a" Table 4)
  - the sensor must reach a minimum temperature during the defrost phase; this must be kept for a known time (see „S1-b“ Table 4)

- risk of freezing of casing parts, fan and cold room ceiling due to lack of sensor 2 at cold room temperature < 0 °C
- if ice grows on unheated surfaces, the following measures must be taken (taking sensor 1 into account):
  - temperature of the glycol inlet to max. 20 °C
  - pulsating glycol flow, to control the air temperature in the casing to max.12 °C.
  - different settings between summer and winter if necessary
- increased maintenance probably, so 2 sensors are preferred

### 3.2 Defrosting control

**Recommended flow temperature glycol: 20 °C ± 3 °C**

**Case 1: series connection (Figure 5): inlet air temperature > -10 °C**

Table 2: defrosting control with series connection

measure	duration [min]	control
close the refrigerant supply valve	-	
fans run on – suck off refrigerant (Pump Down)	10 ... 20	S1-a
fans switch off	-	
glycol flows through the drip tray and the coil	15...40	S1-b S2-a
draining phase	1...2	
open the refrigerant supply valve; freezing phase	1...2	
start fans	-	

**Case 2: Parallel connection (Figure 6): inlet air temperature ≤ -10 °C**

Table 3: defrosting control with parallel connection

measure	duration [min]	control
close the refrigerant supply valve	-	
fans run on – suck off refrigerant (Pump Down)	10...20	
fans switch off	-	
glycol flows through the drip tray	5...10	S1-a
glycol flows through the coil (defrosting in drip tray will be finished later)	15...40	S1-b S2-a
draining phase	1...2	
open the refrigerant supply valve; freezing phase	1...2	
start fans	-	

**The defrosting time will be increased under the following conditions:**

- flooded evaporating
- big evaporator
- lower glycol flow temperature
- high refrigerant charge due to e. g. long rising suction lines

**Check defrosting sensors:**

Table 4: check defrosting sensors

sensor	check	consequence if fails
S1-a	temperature at sensor 1 must achieve approximate the cold room temperature (or be significantly above the evaporation temperature), otherwise liquid refrigerant is still present in the evaporator	create error message and shut down → the message can only be confirmed on site (not by remote access) after controlling the evaporator; further measures: <ul style="list-style-type: none"> <li>– extending fan run-on time</li> <li>– check the refrigerant inlet valve for leak</li> <li>– check suction tubing, refrigerant return tubing, if necessary (Figure 8)</li> </ul>
S1-b	temperature at sensor 1 must be at least reach > 5 °C in 10 min, otherwise no complete defrosting is guaranteed	create error message and shut down → the message can only be confirmed on site (not by remote access) after controlling the evaporator; further measures: <ul style="list-style-type: none"> <li>– check the refrigerant inlet valve for leak</li> <li>– check suction tubing, refrigerant return tubing, if necessary (Figure 8)</li> <li>– increase defrosting time → observe of the temperature sensor 2</li> <li>– check line regulation valve</li> </ul>
S2-a	temperature at sensor 2 should not be over +12 °C, otherwise pulsating glycol flows and checking the glycol flow temperature	create warning message when the temperature of sensor 2 is exceeded; monthly checking of icing on the evaporator