thermofin®
heat exchangers·Germany

MANUFACTURER´S INSTRUCTIONS

For Defrosting of Finned Heat Exchangers,

I. Electrical Defrosting

(for Evaporators and Air Coolers)

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.

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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)

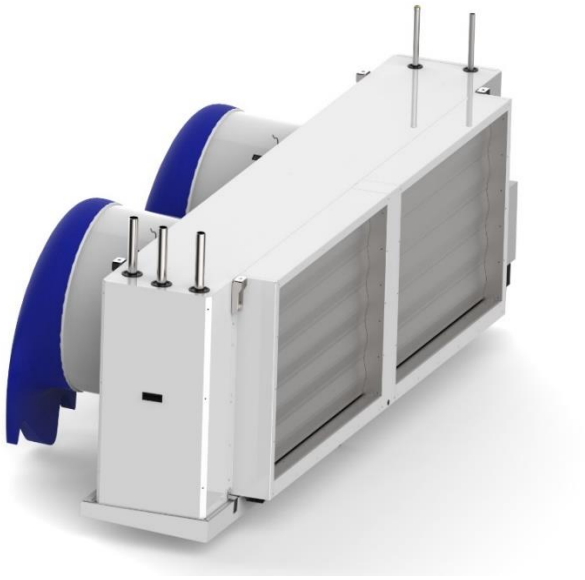

Figure 1: damper combined with Shut-up (recommended design)

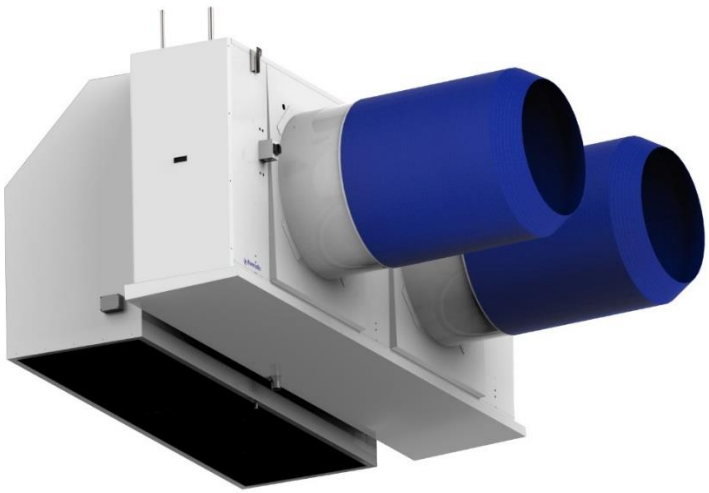

Figure 2: suction hood combined with Shut-up

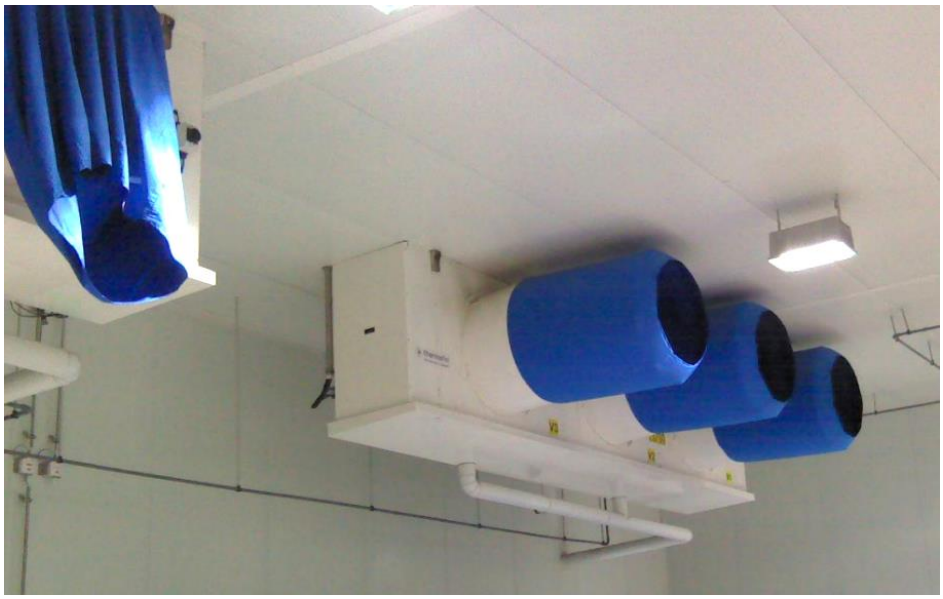

Figure 3: Shut-up (left: fan out of operation; right: fan in operation)

Table 1: disadvantages and advantages of the individual accessories

accessory	advantage	disadvantage
damper	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
Shut-up	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
suck-in hood	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

2. WORKING PRINCIPLE

- additional installation of the electric heating rods between the refrigerant-carrying pipes (see red marking in Figure 4).
- Use of electric heating rods in the tub
- Mixed forms possible: e.g. electric defrosting tub in combination with hot gas defrosting in block

Figure 4: Electric heating rods (red marking)

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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 4); Attention of trapped liquid when the valves are shut off!

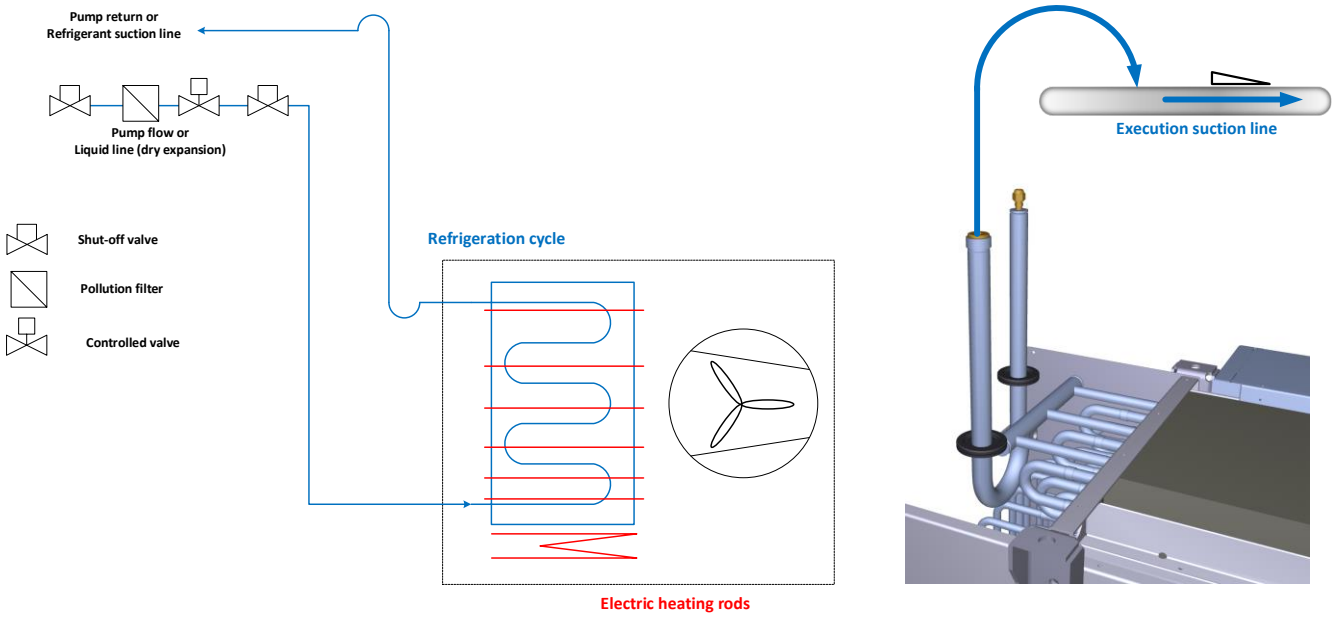

Figure 4: fittings and design, supply and return refrigerant

Suction tubing (Figure 6):

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

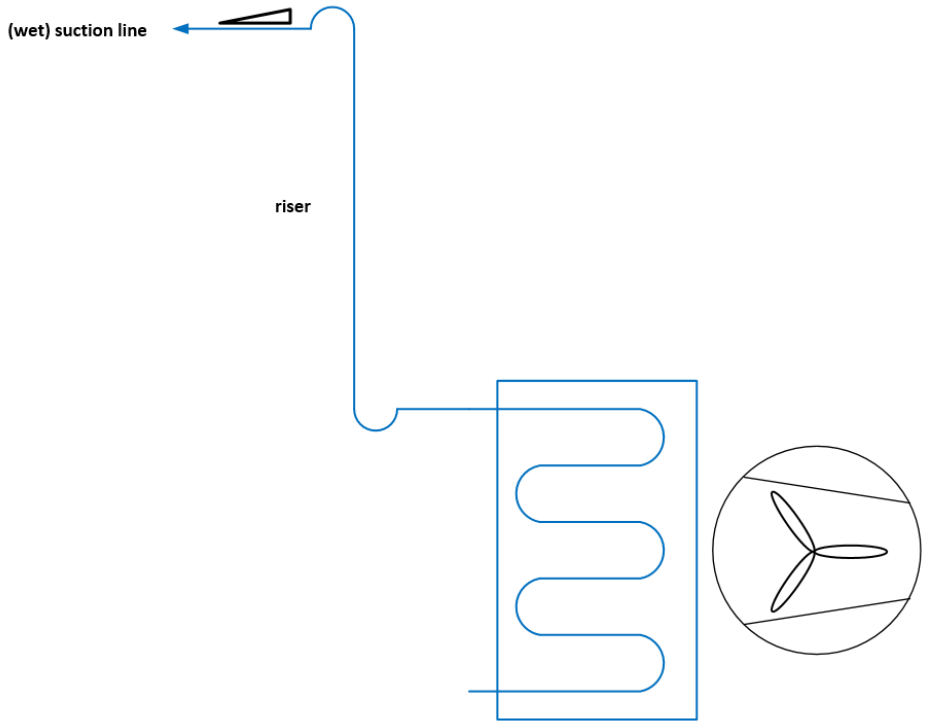

Figure 6: suction gas tubing

- 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 – (Fehler! Verweisquelle konnte nicht gefunden werden.**)**

Figure 5: position sensor 1

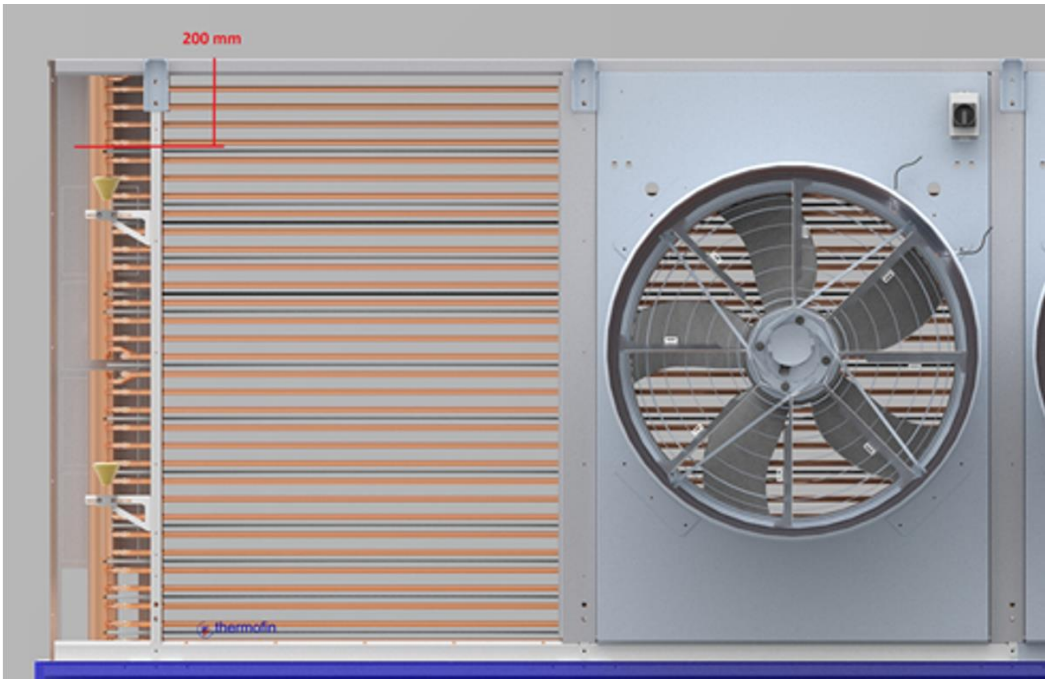

Figure 6: position sensor 2

Sensor 1 (Figure 7**):**

- 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 3)
  - the sensor must reach a minimum temperature during the defrost phase; this must be kept for a specific time (see „S1-b“ Table 3)

Sensor 2 (Figure 6):

- positioning: upper area of the heat exchanger (air temperature measurement)
- function: monitoring the air temperature during the defrost phase (see S2-a Table 3)
  - monitoring and limiting the air temperature during the defrost phase to prevent icing
  - Pulsing (start / stop) Electric defrosting (if necessary)

II. One defrosting sensor

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

Use of Sensor 1 (Figure 7)

Sensor 1 (Figure 7**):**

- 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 3)
  - the sensor must reach a minimum temperature during the defrost phase; this must be kept for a known time (see „S1-b“ Table 3)

- 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):
  - Pulsing (start / stop) Electric defrosting to limit air temperature in the housing to max. +12 °C
  - different settings between summer and winter if necessary

- increased maintenance probably, so 2 sensors are preferred

3.2 Defrosting control

<u>Case 1:</u> Air inlet temperature > -10 °C

Table 2: Defrost control at inlet air temperature > -10 °C

measure	duration [min]	control
Closing of valves - refrigerant supply	-	
Fan run-down - Exhaust refrigerant (Pump Down); Start fan ring heating and heating Multi-leaf dampers (if present)	10 … 20	S1-a (not applicable if cooling circuit is charged with glycol)
Fan shutdown; close louver dampers (if present)	-	
Initiate electric defrost tub and block	10…30	S1-b S2-a
Defrost phase; stop fan ring heating; open louver damper and stop heating (if present)	1…2	
Open refrigerant supply valve; freezing phase	1…2	
Start fan	-	

<u>Fall 2</u>: Eintrittslufttemperatur ≤ -10 °C

Tabelle 2: Abtausteuerung bei Eintrittslufttemperatur ≤ -10 °C

measure	duration [min]	control
Closing of valves - refrigerant supply	-	
Fan run-down - Exhaust refrigerant (Pump Down); Start fan ring heating and heating Multi-leaf dampers (if present)	10…20	S1-a
Shutdown fan; Close louver dampers (if present)	-	
Initiate electric defrost tub	5…10	S1-a
Start electric defrosting of block (defrosting of tub continues)	10…30	S1-b S2-a
Dripping phase; stop fan ring heating; open louver damper and stop heating (if present)	1…2	
Open valve flow cold operation; freezing phase	1…2	
Start fan	-	

The defrosting time will be increased under the following conditions:

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

Check defrosting sensors:

Table 3: check defrosting sensors

sensor	check	consequence if fails
S1-a	Temperature at sensor 1 must reach approx. the cold store temperature (or be significantly above the evaporating temperature), otherwise there is still liquid refrigerant still present in the evaporator	Ausgabe Fehlermeldung und Abschaltung → Quittierung darf nur vor Ort (nicht per Fernzugang) nach Kontrolle des Verdampfers erfolgen; weitere Maßnahmen: – Ventilatornachlauf verlängern – Ventil Kältemitteleintritt auf Dichtheit prüfen – Ausführung Saugleitung prüfen, ggf. zurücklaufendes Kältemittel (Figure)
S1-b	Temperature at sensor 1 must reach > + 5 °C for at least 10 min, otherwise complete defrosting is not guaranteed.	Ausgabe Fehlermeldung und Abschaltung → Quittierung darf nur vor Ort (nicht per Fernzugang) nach Kontrolle des Verdampfers erfolgen; weitere Maßnahmen: – Ventil Kältemitteleintritt auf Dichtheit prüfen – Ausführung Saugleitung prüfen, ggf. zurücklaufendes Kältemittel (Figure) – Abtauzeit verlängern → Beachtung Temperatur Sensor 2
S2-a	The temperature at sensor 2 should not exceed + 12 °C, otherwise the electric defrosting block will be switched on in cycles.	Ausgabe Warnmeldung bei Überschreitung der Temperatur von Sensor 2; monatliche Kontrolle der Vereisung am Verdampfer