

ET 441

Refrigeration chamber and defrosting methods



Description

- combined refrigeration and freezing chamber with temperature and humidity measurement
- evaporators of different sizes
- different defrosting methods

The climate in the cold storage room has a significant effect on the quality of the products stored there. This climate depends on different influences, such as the surface temperature of the evaporators, cold storage room temperature, degree of evaporator icing, quantity and type of refrigerated goods etc.

The icing of the evaporators depends on the evaporator and room temperatures and the quantity of humidity introduced by the refrigerated goods. Icing of the evaporators significantly reduces the refrigeration capacity and must therefore be prevented as much as possible by periodic defrosting, i.e. heating the evaporator surfaces. In addition to the periodic defrosting at set times, there is defrosting performed as required by measuring the actual ice coating. The evaporator surface can be heated from the outside by electric heating or from the inside by hot gas directly from the refrigerant compressor.

The trainer features a large refrigeration chamber. Two evaporators allow for an investigation of the effect of different evaporator sizes on the cold storage room climate and the icing. An electric defrost heater and hot gas defrosting are available. The defrost process can be performed as required using a defrost controller or at set intervals using a defrost timer.

Two adjustable heat sources in the refrigeration chamber simulate the cooling load. One of these heat sources generates water steam to simulate the introduction of humidity into the refrigeration chamber.

The measured values can be read on digital displays. At the same time, the measured values can also be transmitted directly to a PC via USB.

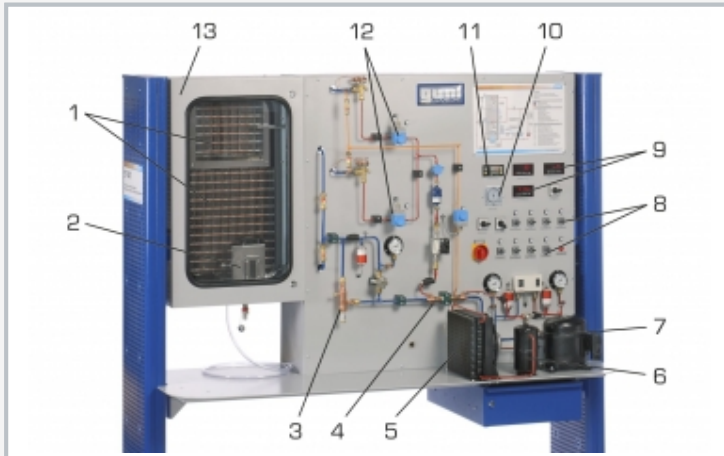
The data acquisition software is included. The data acquisition enables e.g. the recording of the defrosting process over time and the online representation of the climate in the refrigeration chamber in the h-x diagram.

Learning objectives/experiments

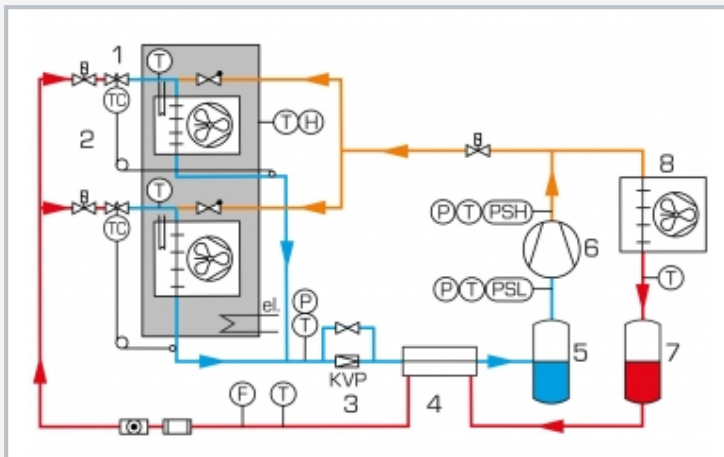
- effect of the evaporator size and temperature on the climate in the refrigeration chamber
- frosting and icing under different operating conditions
- difference between latent and sensitive cooling load
- different defrosting methods (electric heater, hot gas)
- configuration of defrost controls such as defrost timer or defrost controller

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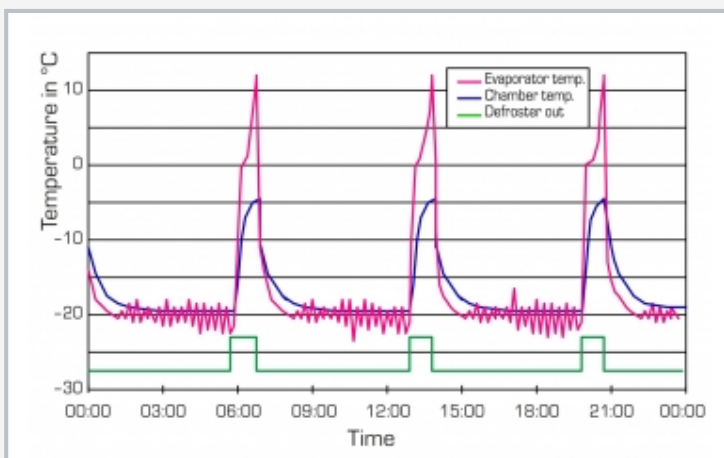
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1 evaporator, 2 humidifier, 3 evaporation pressure controller, 4 heat exchanger, 5 condensing unit, 6 receiver, 7 compressor, 8 controls, 9 temperature and humidity displays, 10 defrost timer, 11 defrost controller, 12 solenoid valves to select the evaporators, 13 refrigeration chamber



Process schematic with hot gas defrosting (orange); 1 expansion valve, 2 refrigeration chamber with 2 heat exchangers of different size, 3 evaporation pressure controller, 4 heat exchanger, 5 suction line receiver, 6 condenser, 7 receiver, 8 condenser; T temperature, P pressure, H humidity, F flow rate, PSH, PSL pressure switch



Time progression of a defrost control (green) with temperature of evaporator (red) and refrigeration chamber (blue)

Specification

- [1] refrigeration system to investigate the climate in the refrigeration chamber and different defrosting methods
- [2] 2 evaporators, separately switchable via solenoid valves
- [3] electric defrost heater
- [4] hot gas defrosting
- [5] defrost controller and defrost timer
- [6] latent and sensitive cooling load
- [7] evaporation pressure and temperature adjustable
- [8] heat exchanger as superheater and for refrigerant supercooling
- [9] digital display for temperature and humidity in the refrigeration chamber
- [10] GUNT software with online representation of the h-x diagram
- [11] GUNT software for data acquisition via USB under Windows 7, 8.1, 10
- [12] refrigerant R134a, CFC-free

Technical data

Compressor according to CECOMAF
 ■ refrigeration capacity at -5/55°C: 999W
 ■ power consumption: 565W

Latent cooling load: 2x 0...250W
 Sensitive cooling load: 1x 0...200W, 1x 0...250W
 Receiver: 1,3L

Measuring ranges

- pressure: 2x 0...16bar, 1x 0...25bar
- temperature: 7x -50...150°C, 1x -25...125°C
- humidity: 0...100% r.h.
- flow rate: 2...27L/h

230V, 50Hz, 1 phase
 230V, 60Hz, 1 phase
 LxWxH: 2000x790x1900mm
 Weight: approx. 250kg

Required for operation

PC with Windows recommended

Scope of delivery

- 1 trainer
- 1 GUNT software CD + USB cable
- 1 set of instructional material