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**
- **dynamic recording of the refrigerant mass flow rate**

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 quantitiy 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. Periodic defrosting is carried out manually at set times. 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 defrosting process can be performed 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. The refrigerant mass flow rate is calculated in the software from the recorded measured values.

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

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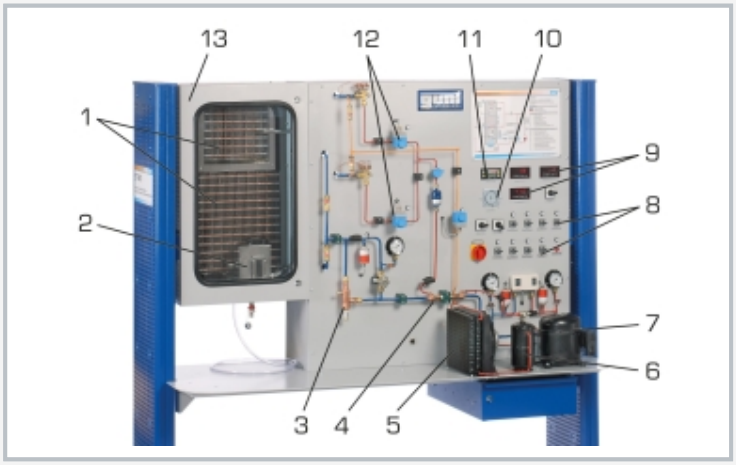
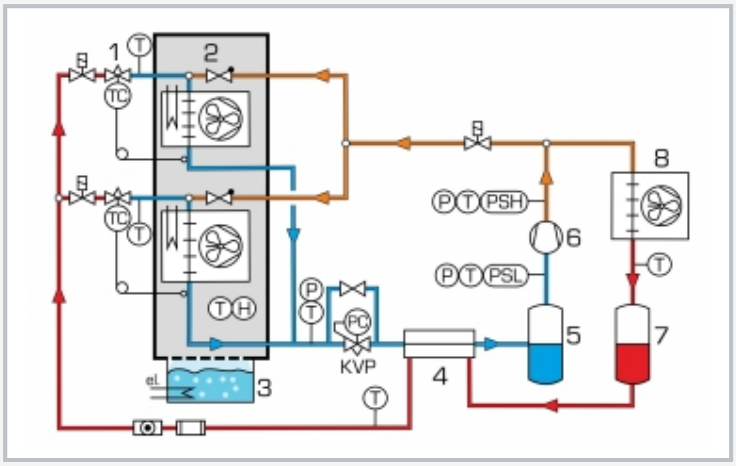
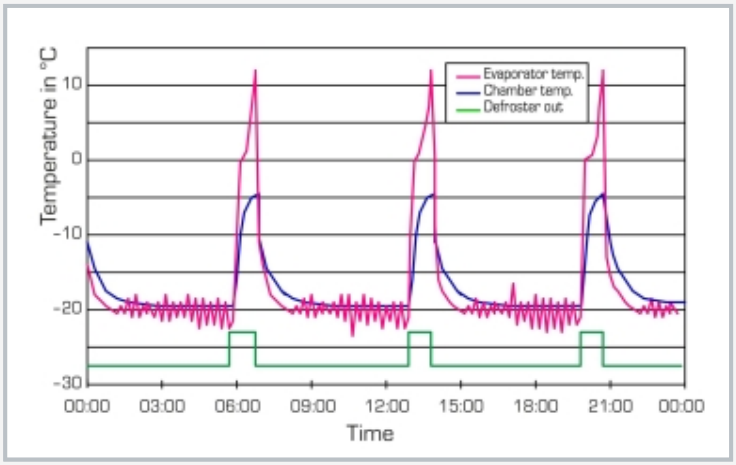


1 evaporator, 2 humidifier, 3 evaporation pressure controller, 4 heat exchanger, 5 condensing unit, 6 receiver, 7 compressor, 8 controls, 9 temperature and humidity displays, 10 defrost timer, 11 ventilator control, 12 solenoid valves to select the evaporators, 13 refrigeration chamber



Process schematic with hot gas defrosting (orange); 1 expansion valve, 2 refrigeration chamber with 2 heat exchangers of different size, 3 steam humidifier, 4 heat exchanger, 5 liquid separator, 6 condenser, 7 receiver, 8 condenser; T temperature, P pressure, H humidity, PSH, PSL pressure switch



Time progression of a defrost control

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 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] refrigerant mass flow rate calculated in the software from recorded measured values
[11] GUNT software with online representation of the h-x diagram
[12] GUNT software for data acquisition via USB under Windows 10
[13] refrigerant R513A, GWP: 631

Technical data

Compressor
- power consumption: 565W at 7,2/54,4°C
- refrigeration capacity: 1363W at 7,2/54,4°C

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

Refrigerant
- R513A
- GWP: 631
- filling volume: 1,3kg
- CO_2-equivalent: 0,8t

Measuring ranges
- pressure: 2x 0...16bar, 1x 0...25bar
- temperature: 7x -50...150°C; 1x -25...125°C
- rel. humidity: 0...100%
- mass flow rate: refrigerant, calculated 0...39kg/h

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 230V, 60Hz, 3 phases
UL/CSA optional
LxWxH: 2000x790x1900mm
Weight: approx. 250kg

Required for operation

PC with Windows recommended

Scope of delivery

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

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Optional accessories

for Remote Learning

GU 100	Web Access Box
with	
ET 441W	Web Access Software