

ET 412C

Refrigeration system with refrigeration and freezing chamber



Description

- refrigeration system with two different evaporation pressures
- simulation of 18 faults

Identifying faults in refrigeration systems requires comprehensive knowledge. This includes knowledge of the structure and the task of the individual components. With ET 412C, the design and components of a refrigeration system can be examined. The simulation of typical errors extends the scope of the experiment.

The components of a refrigeration circuit with refrigeration and freezing chambers are arranged clearly in the trainer. Solenoid valves enable the individual or parallel operation of the evaporators in the two chambers. The circuit is equipped with a combined pressure switch for the delivery and intake side of the compressor. The refrigeration chamber features an evaporation pressure controller. The effect of the evaporation pressure controller on the overall process is being examined. An inner heat exchanger in the inlet of the two evaporators is used for supercooling the refrigerant to increase the efficiency of the process. At the same time the intake gas is superheated.

An electric defrost heater is available to defrost the freezing chamber. The simulation of 18 different faults, e.g. faulty solenoid valves or faulty relays, is provided for.

The process schematic at the trainer offers a quick overview. Signal lamps in the process schematic indicate the operating state of selected components.

Relevant measured values are recorded by sensors. 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 refrigerant mass flow rate is calculated in the software from the recorded measured values.

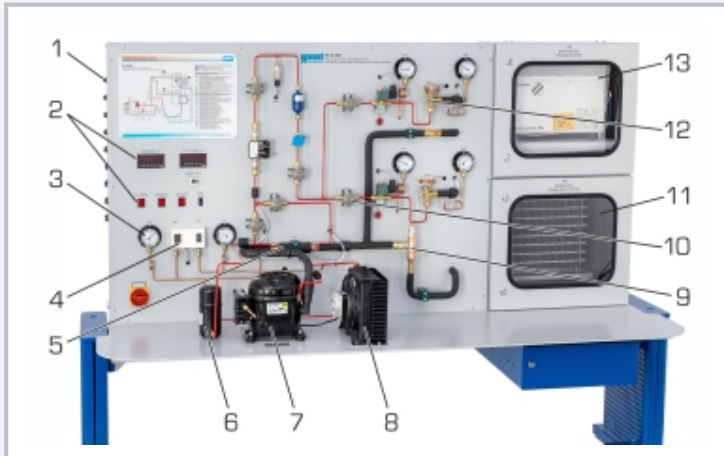
The most important pressures are additionally indicated with manometers directly at the trainer. The software enables the representation of the cyclic process in the log p-h diagram.

Learning objectives/experiments

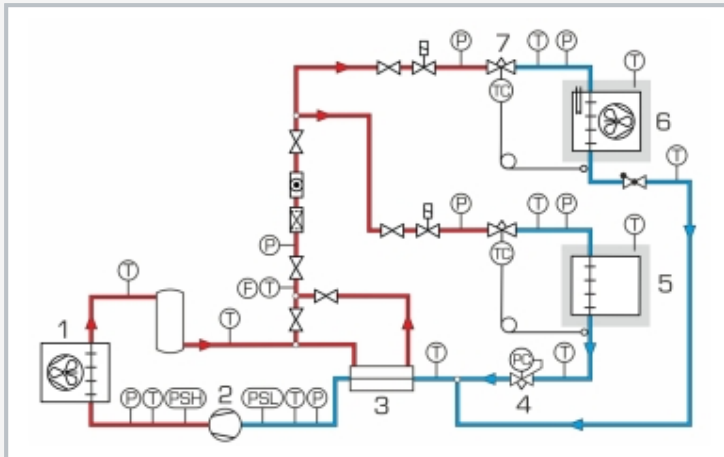
- design and components of a refrigeration system with 2 evaporators
- components and their functions
 - ▶ compressor, condenser, evaporator
 - ▶ thermostatic expansion valve
 - ▶ evaporation pressure controller
 - ▶ pressure switch
 - ▶ electric defrost heater
- thermodynamics of the refrigeration cycle
 - ▶ effect of refrigerant supercooling
 - ▶ representation of the thermodynamic cycle in the log p-h diagram
 - ▶ determination of important characteristic variables: coefficient of performance, refrigeration capacity, compressor work
- fault finding in refrigeration system components

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1 fault button, 2 displays and controls with process schematic, 3 manometer, 4 pressure switch, 5 heat exchanger, 6 receiver, 7 compressor, 8 condenser with fan, 9 evaporation pressure controller, 10 valve, 11 refrigeration chamber, 12 expansion valve, 13 freezing chamber



1 condenser, 2 compressor, 3 heat exchanger, 4 evaporation pressure controller, 5 refrigeration chamber, 6 freezing chamber with defrost heater 7 expansion valve;
T temperature, P pressure, F flow rate, PSH, PSL pressure switch



Software screenshot: log p-h diagram with 2 different evaporation pressures

Specification

- [1] investigation of a refrigeration system with refrigeration and freezing chambers
- [2] refrigeration circuit with compressor, condenser and 2 evaporators with thermostatic expansion valve and evaporation pressure controller
- [3] insulated freezing chamber with fan and electric defrost heater
- [4] insulated refrigeration chamber with evaporation pressure controller
- [5] heat exchanger for refrigerant supercooling
- [6] individual or parallel operation of the chambers via solenoid valves
- [7] sensors record pressure and temperature
- [8] refrigerant mass flow rate calculated in the software from recorded measured values
- [9] simulation of 18 faults
- [10] GUNT software for data acquisition via USB under Windows 10
- [11] 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

Condenser with fan

- volumetric air flow rate: 290m³/h
- transfer area: 1,5m²

Refrigeration chamber

- evaporator transfer area: 1,06m²

Freezing chamber

- evaporator transfer area: 2,42m²
 - volumetric air flow rate, fan: 135m³/h
 - electric defrost heater: approx. 150W
- Evaporation pressure controller: 0...5,5bar

Refrigerant: R513A, GWP: 631

- filling volume: 1,5kg
- CO₂-equivalent: 0,9t

Measuring ranges

- temperature: 12x -50...120°C
- pressure: 3x -1...15bar, 3x -1...9bar, 3x -1...24bar
- power: 0...1125W
- flow rate: 1...11,5L/h

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 2000x660x1900mm

Weight: approx. 219kg

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 412CW Web Access Software