

# ET 412C

## Refrigeration system with refrigeration and freezing chamber



### Description

- refrigeration system with 2 different evaporation pressures
- simulation of 18 faults

Identifying faults in refrigeration systems requires comprehensive knowledge. This knowledge also includes the design and purpose of the individual components. ET 412C helps to acquire this knowledge.

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.

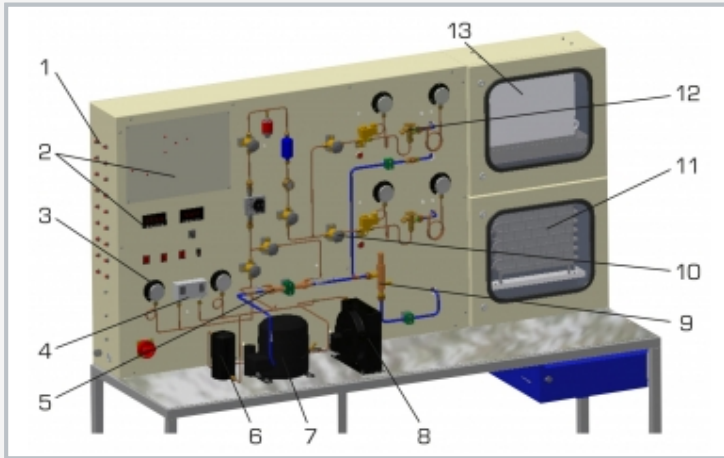
The most important pressures are additionally indicated with manometers directly at the trainer. The software enables the representation of the cyclic process in the log p-h diagram.

### Learning objectives/experiments

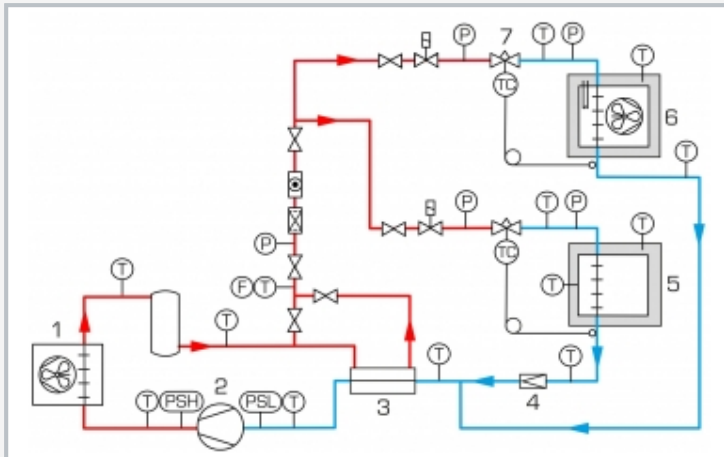
- design and components of a refrigeration system with 2 evaporators
- components and their functions
  - ▶ compressor, condenser, evaporator
  - ▶ thermostatic expansion valve
  - ▶ evaporation pressure controller
  - ▶ pressure switch
  - ▶ electric defrost heater
- thermodynamics of the refrigeration 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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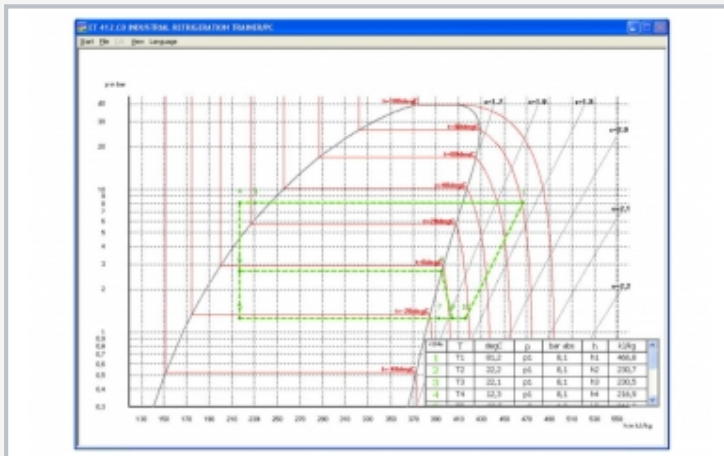
## Refrigeration system with refrigeration and freezing chamber



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] simulation of 18 faults
- [8] GUNT software for data acquisition via USB under Windows Vista or Windows 7
- [9] refrigerant R134a, CFC-free

### Technical data

#### Compressor

- power consumption: 491W at 5/40°C
- refrigeration capacity: 1104W at 5/40°C

#### Condenser with fan

- volumetric air flow rate: 290m<sup>3</sup>/h
- transfer area: 1,5m<sup>2</sup>

#### Refrigeration chamber

- evaporator transfer area: 1,06m<sup>2</sup>

#### Freezing chamber

- evaporator transfer area: 2,42m<sup>2</sup>
- volumetric air flow rate, fan: 135m<sup>3</sup>/h
- electric defrost heater: approx. 150W

Evaporation pressure controller: 0...5,5bar

#### Measuring ranges

- temperature: 12x -50...120°C
- pressure: 1x -1...15bar, 3x -1...9bar, 3x -1...24bar
- power: 0...1125W
- flow rate: 1,5...23,5L/h

230V, 50Hz, 1 phase

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

UL/CSA optional

LxWxH: 2000x670x1900mm

Weight: approx. 210kg

### Required for operation

PC with Windows recommended

### Scope of delivery

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