ET 400

Refrigeration circuit with variable load

Learning objectives/experiments

- design and components of a refrigeration system
  - compressor
  - condenser
  - thermostatic expansion valve
  - evaporator
  - pressure switch
- representation of the thermodynamic cycle in the log p-h diagram
- determination of important characteristic variables
  - coefficient of performance
  - refrigeration capacity
  - compressor work
- operating behaviour under load

Description

- **refrigeration circuit with water circuit as load**
- **defined cooling load via controlled water temperature**
- **display of all relevant values at the location of measurement**

ET 400 examines a refrigeration circuit under an adjustable load. The refrigeration circuit consists of a compressor, a condenser with fan, a thermostatic expansion valve and a coaxial coil heat exchanger as evaporator. A water circuit serves as load, consisting of a tank with a heater and a pump. The temperature in the tank is adjusted at a controller.

The purpose of this refrigeration circuit is the production of cold water. The water flows through the jacket of the coaxial coil heat exchanger, transfers heat to the refrigerant and thereby cools down.

All relevant measured values are recorded by sensors. Displays at the respective locations of measurement indicate the measured values. This makes it easy to assign the measured values to the process. The simultaneous transmission of the measured values to a data recording software enables easy analysis and the representation of the process in the log p-h diagram. The software also displays the key characteristic variables of the process, such as the compressor pressure ratio and the coefficient of performance.

The clearly arranged components aid understanding.

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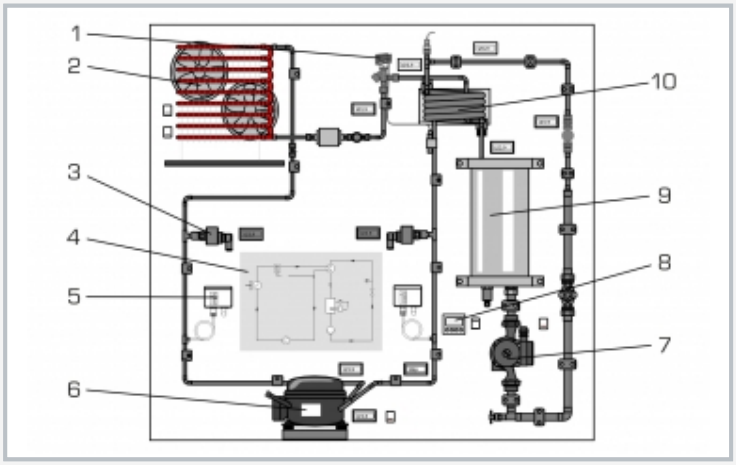
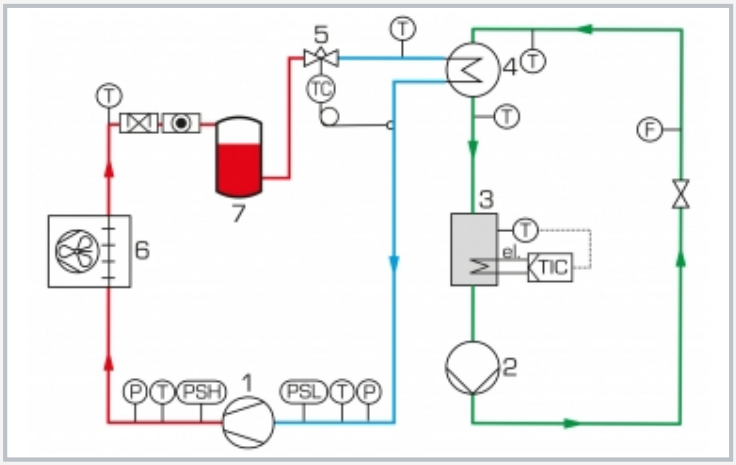
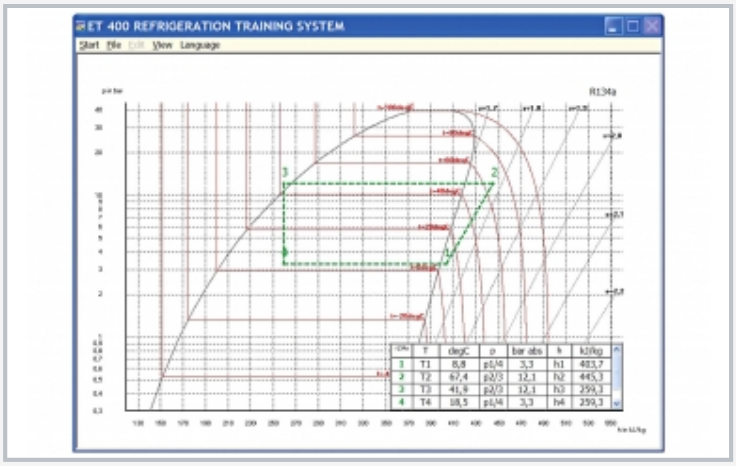


1 expansion valve, 2 condenser with fan, 3 pressure sensor, 4 process schematic, 5 pressure switch, 6 compressor, 7 pump, 8 heater controller, 9 warm water tank with heater, 10 evaporator



1 compressor, 2 pump, 3 warm water tank with heater, 4 evaporator, 5 expansion valve, 6 condenser, 7 receiver; T temperature, P pressure, F flow rate, TIC temperature controller, PSH, PSL pressure switch; blue-red: refrigeration circuit, green: water circuit



Software screenshot: log p-h diagram

Specification

[1] investigation of a refrigeration circuit with water circuit as load
[2] refrigeration circuit with compressor, condenser with fan, thermostatic expansion valve and coaxial coil heat exchanger as evaporator
[3] water circuit with pump, tank with heater as cooling load at the evaporator
[4] heater with controller to adjust the tank temperature
[5] record of all relevant measured values and display directly at the location of measurement
[6] GUNT software for data acquisition via USB under Windows Vista or Windows 7
[7] refrigerant R134a, CFC-free

Technical data

Compressor
- refrigeration capacity: approx. 380W at 5/40°C

Evaporator
- refrigerant volume: 0,4L
- water volume: 0,8L

Condenser
- transfer area: approx. 1,25m^2
- fan power consumption: 4x 12W

Pump
- max. flow rate: 1,9m^3/h
- max. head: 1,4m

Tank
- volume: approx. 4,5L
- heater: approx. 450W

Measuring ranges
- pressure:: 2x -1...15bar
- power: 1x 0...750W
- temperature: 6x 0...100°C
- flow rate (water): 1x 0,05...1,8L/min

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 1400x560x1800mm
Weight: approx. 138kg

Required for operation

PC with Windows recommended

Scope of delivery

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