

ET 431

Heat exchangers in the refrigeration circuit



Description

- typical heat exchangers from refrigeration
- different media: air / refrigerant, refrigerant / refrigerant and water / refrigerant
- effect of superheating and supercooling of the refrigerant on the cyclic process

Heat exchangers are an elementary part of refrigeration systems. During cooling they are used to absorb the energy of the refrigerant by evaporation. During heating they discharge the energy set free during the condensation of the refrigerant. They are also used for internal energy transfer during superheating or supercooling of the refrigerant.

Dependent on the media, a difference is made between air / refrigerant, water / refrigerant and refrigerant / refrigerant heat exchangers. Dependent on the constructive design, a difference is also made between coaxial, finned tube, plate or shell and tube heat exchangers.

The refrigeration circuit of the trainer ET 431 includes as evaporator an air cooling finned tube heat exchanger and a water-heated plate heat exchanger, as superheater a tubular heat exchanger, and as condenser a water-cooled coaxial coil heat exchanger. These heat exchangers are the ones used most commonly in refrigeration and fulfil different functions dependent on the system type. A finned tube heat exchanger can e.g. also be used as a condenser.

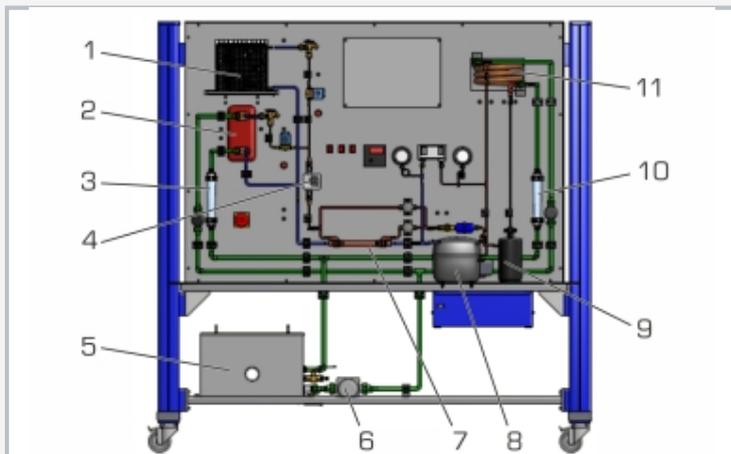
The components are arranged clearly at the front. By measuring the mass flow rates and the inlet and outlet temperatures the transferred energy fluxes can be determined.

Learning objectives/experiments

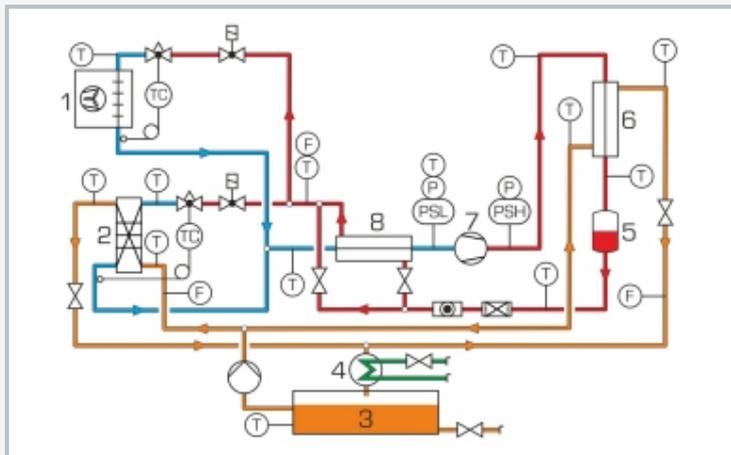
- different heat exchangers and their use in refrigeration
 - ▶ coaxial coil heat exchanger
 - ▶ finned tube heat exchanger
 - ▶ tubular heat exchanger
 - ▶ plate heat exchanger
- find out the correct installation position
- determine energy fluxes
- effect of superheating and supercooling of the refrigerant on the cyclic process
- design of a compression refrigeration system
- representation of the cyclic process in the log p-h diagram

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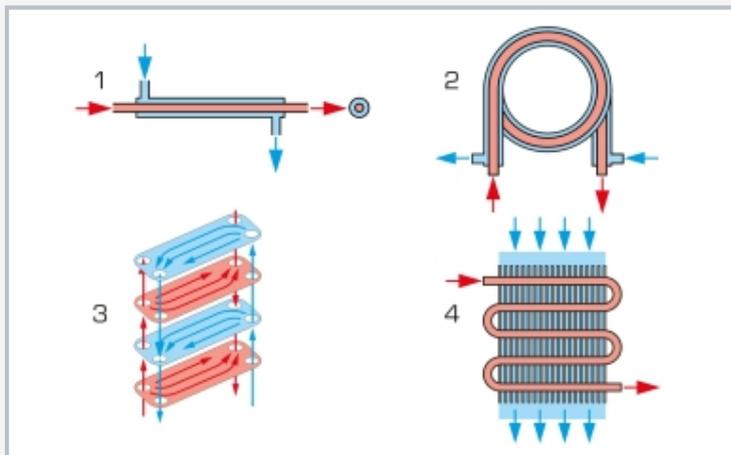
Heat exchangers in the refrigeration circuit



1 finned tube heat exchanger as evaporator, 2 plate heat exchanger as evaporator, 3 heating water flow meter, 4 refrigerant flow meter, 5 water tank, 6 water pump, 7 tubular heat exchanger as superheater, 8 compressor, 9 receiver, 10 cooling water flow meter, 11 coaxial coil heat exchanger as condenser



1 finned tube heat exchanger, 2 plate heat exchanger, 3 tank, 4 water cooler, 5 receiver, 6 coaxial coil heat exchanger, 7 compressor, 8 tubular heat exchanger; T temperature, P pressure, F flow rate



1 tubular heat exchanger, 2 coaxial coil heat exchanger, 3 plate heat exchanger, 4 finned tube heat exchanger

Specification

- [1] refrigeration system with 4 different heat exchangers: coaxial coil heat exchanger, finned tube heat exchanger, tubular heat exchanger, plate heat exchanger
- [2] combinations of different media: water / refrigerant, refrigerant / refrigerant, air / refrigerant
- [3] water circuit with tank and pump to cool the condenser and heat the evaporator
- [4] superheater can be disabled via bypass
- [5] flow meter and thermometer in the water circuit to determine the exchanged energy fluxes
- [6] flow meter for measuring the refrigerant flow
- [7] thermometers at all relevant points
- [8] refrigerant R513A, GWP: 631

Technical data

Compressor

- refrigeration capacity: 1308W at 7,2/54,4°C
- power consumption: 514W at 7,2/54,4°C

Receiver

- 1,3L

Refrigerant

- R513A
- GWP: 631
- filling volume: 1,3kg
- CO₂-equivalent: 0,8t

Measuring ranges

- pressure: -1...9bar / -1...24bar
- temperature: 12x -5...105°C, 1x 0...60°C
- flow rate: 2x 20...250L/h (water)
- flow rate: 1x 2...29L/h (refrigerant)

230V, 50Hz, 1 phase

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

UL/CSA optional

LxWxH: 1900x800x1900mm

Weight: approx. 255kg

Required for operation

water connection, drain

Scope of delivery

- 1 trainer
- 1 set of accessories
- 1 set of instructional material