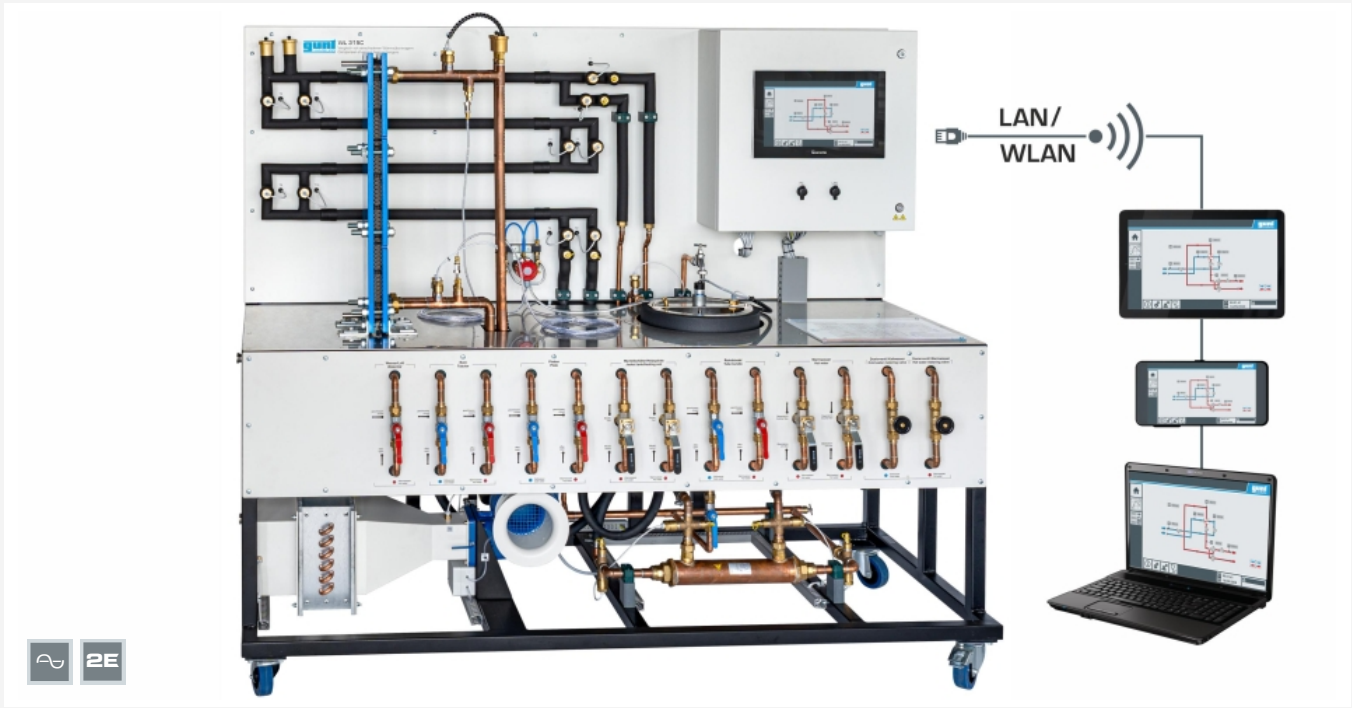
WL 315C

Comparison of various heat exchangers



screen mirroring is possible on up to 10 end devices

Description

- **use of industrial components**
- **five different heat exchangers in comparison**
- **control of the experimental plant using a PLC, operated by touch screen**

In practice, different types of heat exchanger are used depending on requirements in order to ensure efficient heat transfer and avoid losses.

The WL 315C trainer is used to study and compare five different heat exchangers. Both parallel flow and counterflow operation are demonstrated, with their different temperature curves.

In the plate, tubular and shell & tube heat exchangers, heat is transferred between hot and cold water in tubes or between plates. In the finned tube heat exchanger, the air flows around pipes with hot water in crossflow.

In the stirred tank with double jacket and coiled tube, either the outer jacket or the inner coiled tube can be filled with hot water.

A stirring machine ensures that the water inside the tank is mixed to achieve an even heat distribution.

The air volume flow for studying the finned tube heat exchanger is adjusted via a throttle valve at the fan outlet. Valves are used to switch between cross parallel flow and cross counterflow. The flow rate in the hot water or cold water circuit can also be adjusted by means of valves.

The air volume flow is measured with a fixed differential pressure sensor. The water pressure can be measured at different points using a portable differential pressure sensor. Temperatures and flow rates are also measured.

The trainer is controlled by a PLC via touch screen. With an integrated router, the trainer can alternatively be operated and controlled via an end device. The user interface can also be displayed on additional end devices (screen mirroring). Via the PLC, the measured values can be stored internally.

Learning objectives/experiments

- familiarisation with heat transfer processes
  - heat transfer
  - heat conduction
- determination of the heat transfer coefficient
- creation of temperature curves for the different heat exchangers
  - parallel flow
  - counterflow
  - cross parallel flow
  - cross counterflow
- comparison of the different heat exchangers between each other
  - plate heat exchanger
  - tubular heat exchanger
  - shell & tube heat exchanger
  - finned tube heat exchanger
  - stirred tank with double jacket and coiled tube

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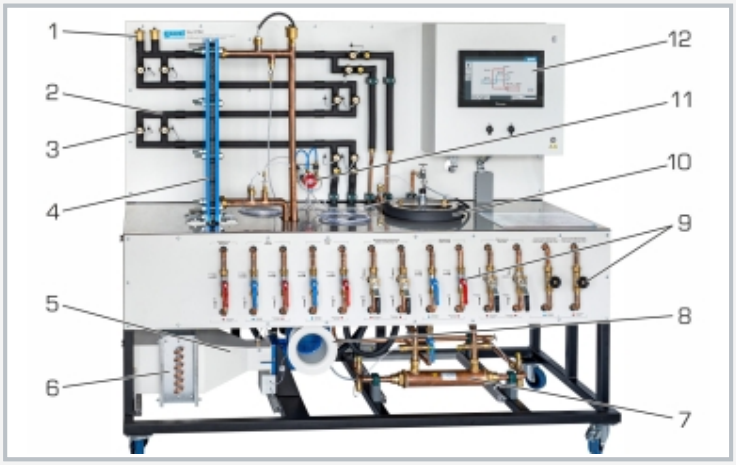
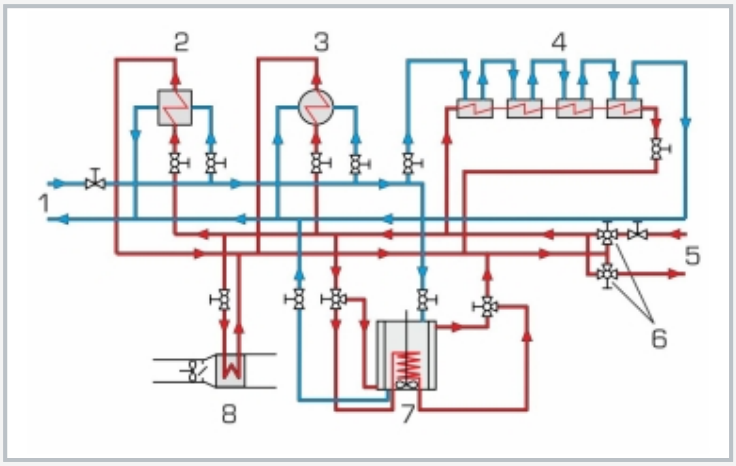
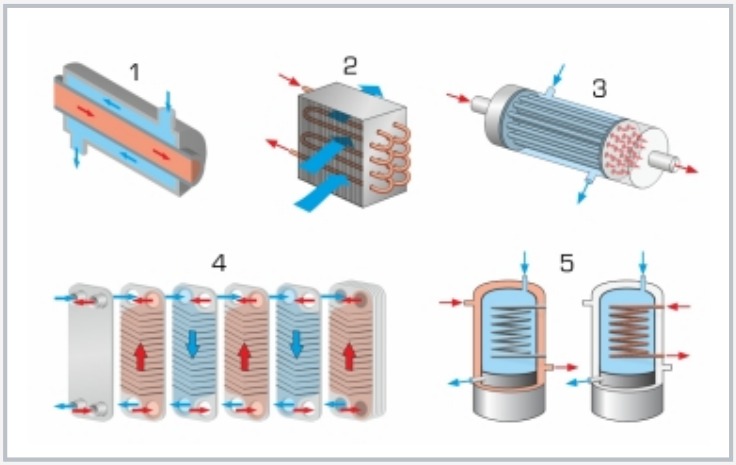
Comparison of various heat exchangers



1 bleed valve, 2 tubular heat exchanger, 3 temperature sensor, 4 plate heat exchanger, 5 air duct, 6 finned tube heat exchanger, 7 shell & tube heat exchanger, 8 fan, 9 adjustable fittings, 10 stirred tank with double jacket and coiled tube, 11 pressure sensor (water), 12 PLC with touch screen



1 cold water connection (laboratory or via WL 312.11), 2 shell & tube heat exchanger, 3 plate heat exchanger, 4 tubular heat exchanger, 5 hot water connection (laboratory or via WL 312.10), 6 valves for setting the operating mode, 7 stirred tank with double jacket and coiled tube, 8 finned tube heat exchanger



Funktionsprinzipien der verschiedenen Wärmeübertrager: 1 Doppelrohr-Wärmeübertrager, 2 Rippenrohr-Wärmeübertrager, 3 Rohrbündel-Wärmeübertrager, 4 Platten-Wärmeübertrager, 5 Rührbehälter mit Doppelmantel und Rohrschlange

Specification

[1] investigation and comparison of five different heat exchanger types
[2] parallel flow or counterflow can be set via valves
[3] flow rates can be adjusted via valves
[4] electromagnetic flow meter for hot and cold water
[5] portable differential pressure sensor for water
[6] fixed differential pressure sensor for air, to determine the volumetric flow rate
[7] hot water generator and water chiller available (WL 312.10 and WL 312.11)
[8] control of the experimental plant using a PLC, operated by touch screen
[9] screen mirroring: possible to mirror the user interface on up to 10 end devices
[10] data acquisition via PLC on internal USB memory, access to stored measured values via WLAN/LAN with integrated router/LAN connection to customer's own network or direct LAN connection without customer network

Technical data

PLC: Weintek cMT3162X

Plate heat exchanger, (water-water)
- number of plates: 10
- heat transfer area: approx. 0,26m^2
- output: 15kW

Tubular heat exchanger (water-water)
- heat transfer area: 0,1m^2

Shell & tube heat exchanger (water-water)
- output: 13kW

Finned tube heat exchanger (water-air)
- heat transfer area: approx. 2,8m^2
- fan max. flow rate: 350m^3/h
- fan max. pressure difference: 430Pa

Stirred tank with double jacket and coiled tube (water-water)
- double jacket heat transfer area: 0,16m^2
- coiled tube heat transfer area: 0,17m^2

Measuring ranges
- differential pressure: 0...10mbar (air)
- differential pressure: 0...1000mbar (water)
- flow rate: 2x 0...3m^3/h
- temperature: 10x 0...100°C

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 2050x820x1710mm; Weight: approx. 325kg

Required for operation

cold and hot water connection: 400L/h, drain

Scope of delivery

trainer, set of instructional material

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Optional accessories

WL 312.10	Hot water generator
WL 312.11	Water chiller