

# WL 110.01

## Tubular heat exchanger



### Description

- tubular heat exchanger for connection to WL 110 supply unit
- visible flow channel due to transparent outer tube

Tubular heat exchangers represent the simplest type of heat exchangers and are the preferred solution for transferring heat with high pressure differences or between high viscosity media (e.g. sludge). An advantage is the uniform flow through the tube space. This space is free of flow dead zones.

The WL 110.01 is part of a series of units enabling experiments to be performed on different heat exchanger types. The experimental unit is ideally suited for investigating the functioning and behaviour of a tubular heat exchanger in operation.

The WL 110.01 is connected to the supply unit WL 110 using quick-release couplings. Hot water flows through the inner tube and cold water through the outer tube. Part of the thermal energy of the hot water is transferred to the cold water. Valves on the supply unit are used to adjust the flow rates of hot and cold water. The supply hoses can be re-connected using quick-release couplings, allowing the flow direction to be reversed. This allows parallel flow or counterflow operation. Temperature sensors for measuring the inlet and outlet temperatures are located at the supply connections on the WL 110. There are two additional temperature sensors on the tubular heat exchanger for measuring the temperature after half of the transfer section.

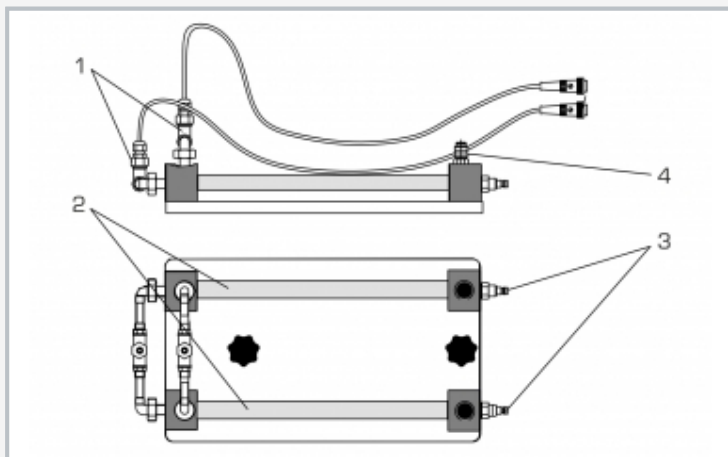
During experiments, temperature curves are plotted and displayed graphically. Additionally, the measured values can be recorded and processed using data acquisition software. The mean heat transfer coefficient is then calculated as a characteristic variable.

### Learning objectives/experiments

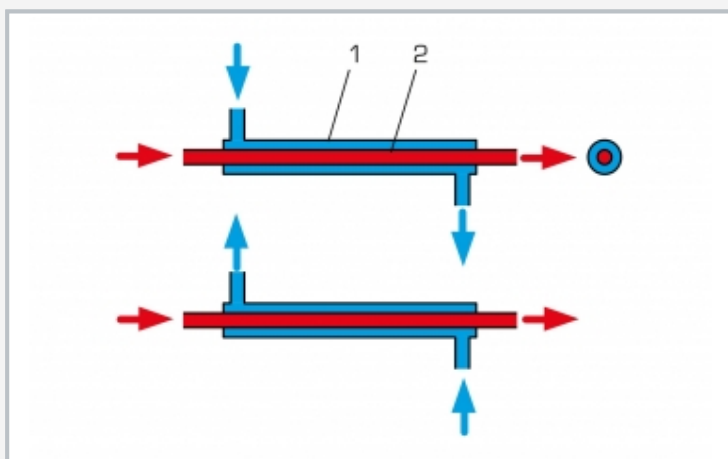
- in conjunction with WL 110 supply unit
  - ▶ function and behaviour during operation of a tubular heat exchanger
  - ▶ plotting temperature curves:
    - in parallel flow operation
    - in counterflow operation
  - ▶ calculation of mean heat transfer coefficient
  - ▶ comparison with other heat exchanger types

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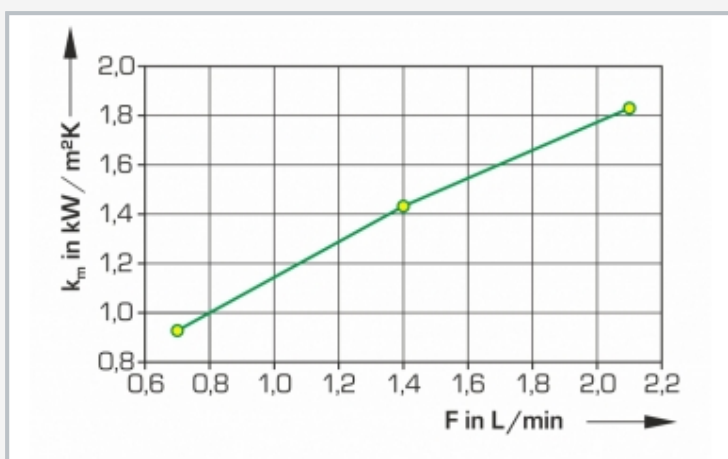
## Tubular heat exchanger



1 temperature sensor, 2 concentric tubes, 3 hot water connections, 4 cold water connections



Functional principle of tubular heat exchanger  
1 outer tube with cold water, 2 inner tube with hot water; red: hot water, blue: cold water



Mean heat transfer coefficient  $k_m$  as function of flow rates cold water and hot water

### Specification

- [1] tubular heat exchanger for connection to WL 110
- [2] hot and cold water supply from WL 110
- [3] parallel flow and counterflow operation possible
- [4] recording of temperature using WL 110 and two additional temperature sensors for measuring the central temperature

### Technical data

Heat transfer areas

- mean transfer area: 250cm<sup>2</sup>

Inner tube, stainless steel

- outer diameter: 12mm
- wall thickness: 1mm

Outer tube, transparent (PMMA)

- outer diameter: 20mm
- wall thickness: 2mm

Measuring ranges

- temperature: 2x 0...100°C

LxWxH: 480x230x150mm

Weight: approx. 4kg

### Scope of delivery

- 1 tubular heat exchanger

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Required accessories

060.11000      WL 110      Heat exchanger supply unit