

# WL 230

## Condensation process



### Description

#### ■ visualisation of different condensation processes

Condensation forms when steam meets a medium with a lower temperature than the saturation temperature for the existing partial pressure of the steam. Factors such as the material and surface roughness of the medium influence the heat transfer and thus the type of condensation. In practice, it is usually film condensation. Dropwise condensation only forms when the cooling surface is very smooth and poorly wettable, e.g. Teflon. Knowledge of condensation processes is applied e.g. in steam power plants or at distillation processes.

The WL 230 experimental unit can be used to demonstrate the different condensation processes using two tubular shaped water-cooled condensers made of different materials. Dropwise condensation can be demonstrated by means of the condenser with a polished gold-plated surface. Film condensation forms on the matt copper surface of the second condenser, thus making it possible to examine film condensation.

The tank can be evacuated via a water jet pump. The boiling point and the pressure in the system are varied by cooling and heating power. Sensors record the temperature, pressure and flow rate at all relevant points. 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 heat transfer coefficient is calculated from the measured values. The influence of non-condensing gases, pressure and the temperature difference between the surface and steam can be examined in further experiments.

### Learning objectives/experiments

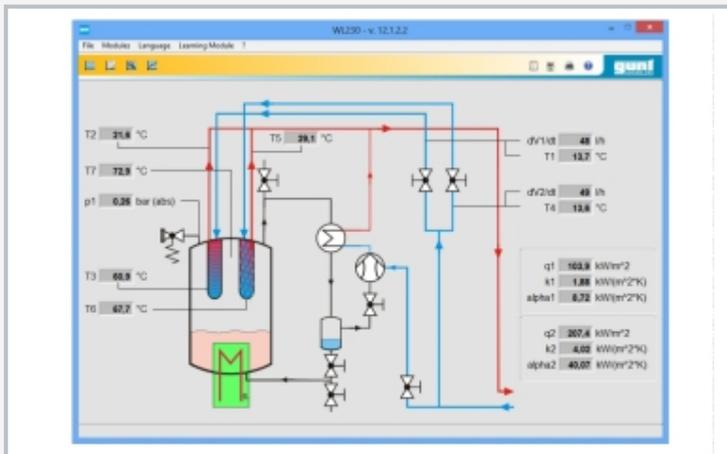
- dropwise and film condensation
- determination of the heat transfer coefficient
- effect of pressure, temperature and non-condensable gases on the heat transfer coefficient

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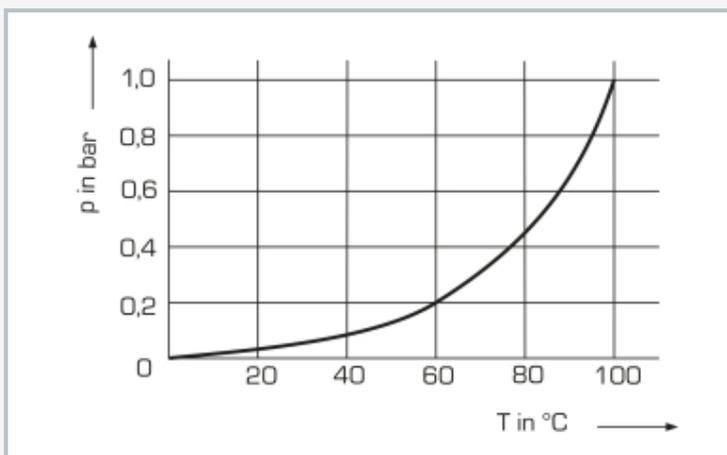
## Condensation process



1 condensers, 2 heat exchanger, 3 steam trap, 4 displays for temperature, flow rate and pressure, 5 heater, 6 cooling water connections, 7 water jet pump, 8 temperature sensor, 9 valve for adjusting the cooling water, 10 cooling water flow rate sensor



Software screenshot



Vapour pressure curve for water: p pressure, T temperature

### Specification

- [1] visualisation of the condensation process of water in a transparent tank
- [2] two water-cooled tubes as condensers with different surfaces to realise film condensation and drop-wise condensation
- [3] controlled heater to adjust the boiling temperature
- [4] water jet pump to evacuate the tank
- [5] pressure switch and safety valve for safe operation
- [6] sensors for temperature, pressure and flow rate with digital display
- [7] GUNT software for data acquisition via USB under Windows 10

### Technical data

#### Heater

- output: 3kW, freely adjustable

#### Condenser

- 1x tube with matt copper surface
- 1x tube with a polished gold-plated surface

#### Water jet pump

- flow rate: 4...12L/min
- pressure: 16mbar

Safety valve: 2200mbar absolute

#### Measuring ranges

- pressure: 0...10bar abs.
- flow rate: 0,2...6L/min
- temperature: 4x 0...100°C, 3x 0...200°C

230V, 50Hz, 1 phase  
 230V, 60Hz, 1 phase  
 230V, 60Hz, 3 phases  
 UL/CSA optional  
 LxWxH: 1000x550x790mm  
 Weight: approx. 85kg

### Required for operation

water connection: 1bar, max. 1000L/h, drain  
 PC with Windows recommended

### Scope of delivery

- 1 experimental unit
- 5L distilled water
- 1 GUNT software + USB cable
- 1 set of hoses
- 1 set of instructional material

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Optional accessories

for Remote Learning

GU 100            Web Access Box

with

WL 230W            Web Access Software

Other accessories

WP 300.09            Laboratory trolley