

WL 204

Vapour pressure of water - Marcet boiler



Learning objectives/experiments

- recording the vapour pressure curve of water
- presentation of the relationship between pressure and temperature in a closed system
- temperature and pressure measurement

Description

- recording the vapour pressure curve of water
- saturation pressure of water vapour as a function of the temperature

In a closed system filled with fluid, a thermodynamic equilibrium sets in between the fluid and its vaporised phase. The prevailing pressure is called vapour pressure. It is substance-specific and temperature-dependent.

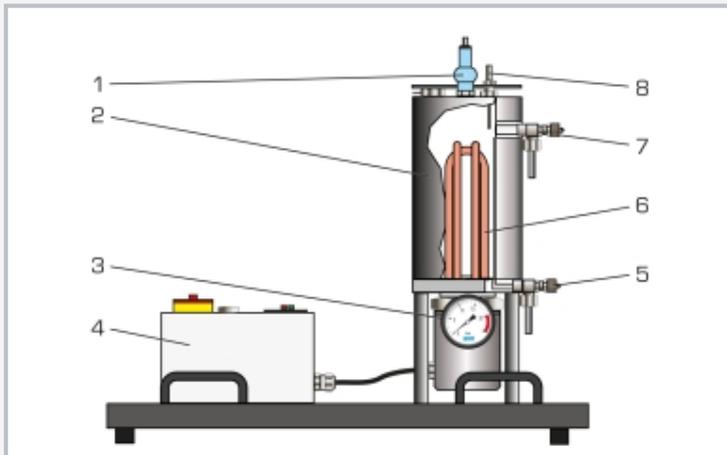
When a fluid is heated in a closed tank, the pressure increases as the temperature rises. Theoretically, the pressure increase is possible up to the critical point at which the densities of the fluid and gaseous phases are equal. Fluid and vapour are then no longer distinguishable from each other. This knowledge is applied in practice in process technology for freeze drying or pressure cooking.

The WL 204 experimental unit can be used to demonstrate the relationship between the pressure and temperature of water in a straightforward manner. Temperatures of up to 200°C are possible for recording the vapour pressure curve. The temperature and pressure can be continuously monitored via a digital temperature display and a Bourdon tube pressure gauge.

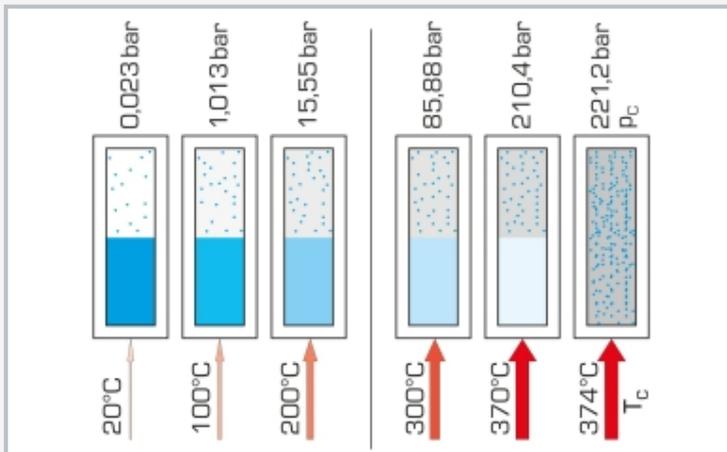
A temperature limiter and pressure relief valve are fitted as safety devices and protect the system against overpressure.

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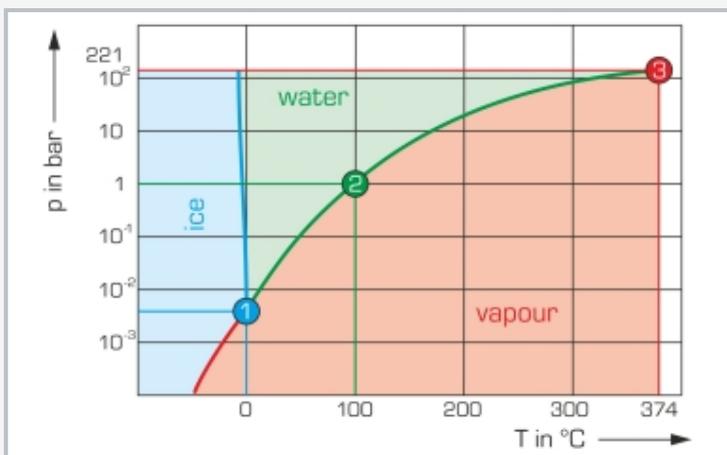
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1 safety valve, 2 pressure boiler with insulating jacket, 3 Bourdon tube pressure gauge, 4 switch cabinet with temperature display, 5 drain valve, 6 heater, 7 overflow, 8 temperature sensor



Heating up water in a closed tank: the pressure and temperature increase proportionally up to the critical point, at which fluid and vapour are no longer distinguishable from each other; critical point at $T_c=374^\circ\text{C}$, $p_c=221\text{ bar}$, line: temperature limit of the experimental unit



Temperature-pressure diagram of water
red: sublimation curve, green: boiling point curve, blue: melting point curve; 1 triple point, 2 boiling point, 3 critical point

Specification

- [1] measuring a vapour pressure curve for saturated vapour
- [2] pressure boiler with insulating jacket
- [3] temperature limiter and safety valve protect against overpressure in the system
- [4] Bourdon tube pressure gauge to indicate pressure
- [5] digital temperature display

Technical data

Bourdon tube pressure gauge: -1...24bar
 Temperature limiter: 200°C
 Safety valve: 20bar
 Heater: 2kW
 Boiler, stainless steel: 2L

Measuring ranges

- temperature: 0...200°C
- pressure: 0...20bar

230V, 50Hz, 1 phase
 230V, 60Hz, 1 phase
 120V, 60Hz, 1 phase
 UL/CSA optional
 LxWxH: 600x400x680mm
 Weight: approx. 35kg

Scope of delivery

- 1 experimental unit
- 1 funnel
- 1 set of tools
- 1 set of instructional material

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Optional accessories

WP 300.09

Laboratory trolley