WL 203

Fundamentals of pressure measurement

Description

- **comparison of different pressure measurement methods**
- **measuring positive and negative pressure**
- **calibration device with Bourdon tube pressure gauge for calibrating mechanical manometers**

Measuring pressure is important in the engineering industry, e.g. in plant, turbomachine and aircraft construction and in process engineering. Other fundamental factors such as flow rate or flow velocity can also be determined based on a pressure measurement.

The WL 203 experimental unit enables the user to measure the pressure with two different measuring methods: directly by measuring the length of a liquid column (U-tube manometer, inclined tube manometer) and indirectly by measuring the change of shape of a Bourdon tube (Bourdon tube pressure gauge).

In a U-tube manometer, the pressure causes the liquid column to move. The pressure difference is read directly from a scale and is the measure for the applied pressure. In inclined tube manometers, one leg points diagonally up. A small height difference therefore changes the length of the liquid column significantly.

The principle of the Bourdon tube pressure gauge is based on the change in cross-section of the bent Bourdon tube under pressure. This change in cross-section leads to an expansion of the Bourdon tube diameter. A Bourdon tube pressure gauge is therefore an indirectly acting pressure gauge where the pressure differential is indicated via a transmission gearing and a pointer.

In experiments, pressures in the millibar range are generated with a plastic syringe and displayed on the manometers. The experimental unit is equipped with two Bourdon tube pressure gauges for measuring positive and negative pressure. The U-tube manometer, inclined tube manometer and Bourdon tube pressure gauges at the experimental unit can be combined using tubes. A calibration device enables calibration of an additional Bourdon tube pressure gauge using a weight-loaded piston manometer.

Learning objectives/experiments

- familiarisation with 2 different measuring methods:
  - direct method with U-tube manometer and inclined tube manometer
  - indirect method with Bourdon tube pressure gauge
- principle of a Bourdon tube pressure gauge
- calibrating mechanical manometers

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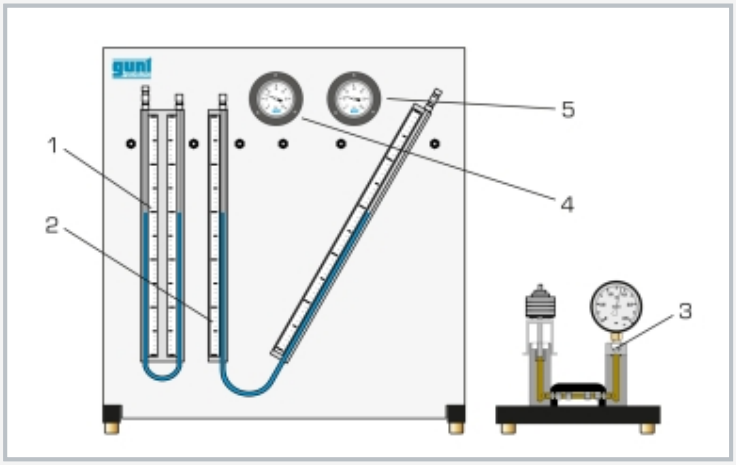
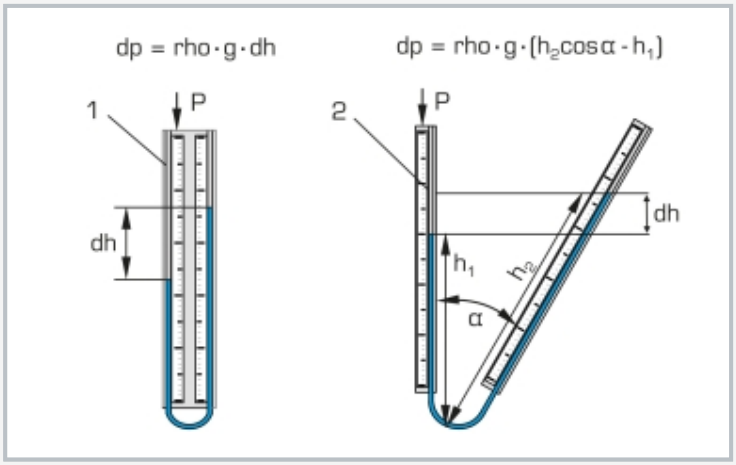
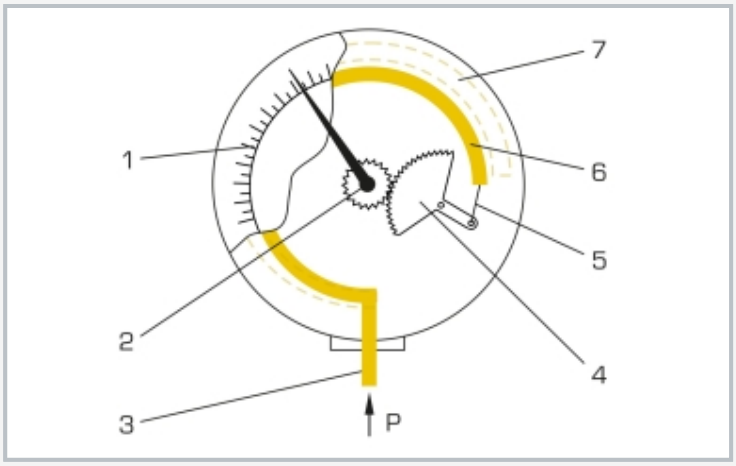


1 U-tube manometer, 2 inclined tube manometer, 3 calibration device with Bourdon tube pressure gauge, 4 Bourdon tube pressure gauge for positive pressure, 5 Bourdon tube pressure gauge for negative pressure



Principle of operation of liquid column manometers
1 U-tube manometer, 2 inclined tube manometer; dp pressure difference, dh height difference, rho density of measuring fluid, g acceleration of gravity



Principle of operation of a Bourdon tube pressure gauge
1 scale, 2 pointer, 3 Bourdon tube fixed in place, 4 gearing, 5 tie rod, 6 Bourdon tube without pressure, 7 Bourdon tube expanded under pressure

Specification

[1] basic experiments for measuring pressure with three different measuring instruments
[2] U-tube and inclined tube manometer
[3] one Bourdon tube pressure gauge each for positive and negative pressure
[4] plastic syringe generates test pressures in the millibar range
[5] calibration device with Bourdon tube pressure gauge for calibrating mechanical manometers

Technical data

Inclined tube manometer
- angle: 30°

Measuring ranges
- pressure:
  - 0...±60mbar (Bourdon tube pressure gauge)
  - 0...500mmWC (U-tube manometer)
  - 0...500mmWC (inclined tube manometer)

LxWxH: 750x610x810mm
LxWxH: 410x410x410mm (calibration device)
Total weight: approx. 28kg

Scope of delivery

1 experimental unit
1 calibration device
1 set of weights
1 oil, 500mL
1 ink, 30mL
1 funnel
1 syringe
1 set of hoses
1 set of instructional material

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Optional accessories

WP 300.09	Laboratory trolley