CE 222
Comparison of fluidised beds

Learning objectives/experiments

- fundamentals of the fluidisation of fixed beds
- fluidised bed formation with air
- pressure losses as a function of
  - empty pipe velocity
  - particle size
  - particle density
  - fixed bed height
- determination of fluidisation velocity and comparison with theoretically calculated values (Ergun equation)
- how fluidised bed height depends on flow velocity
- verification of the Carman-Kozeny equation

Description

- **two transparent columns with different diameters for observation of fluidised bed formation in gases**
- **pressure loss in fixed and fluidised beds**

Bulk layers can transition from a fixed bed into a fluidised bed when gases flow through them. The fields of application for fluidised beds include, for example, drying solids, in furnaces and coating particles.

This trainer was developed in cooperation with the **University of Greenwich, UK**. The CE 222 unit contains two transparent columns with different diameters to form a fluidised bed using compressed air as the gas. A scale on the columns indicates the height of the fixed or fluidised bed. Solenoid valves supply compressed air to the column being studied.

One column can be operated at a time. The columns can be removed to allow the fixed bed to be changed. Glass beads in different particle sizes are supplied as the packing.

At the start of the experiments, a fixed bed rests on a sinter plate at the bottom of the column. Compressed air flows upwards through the column and exits at the air filter. If the velocity of the air is lower than the fluidisation velocity, the flow simply passes through the fixed bed. At higher velocities, the fixed bed is loosened to such an extent that the particles are put into a state of suspension. The fixed bed transitions into a fluidised bed. If the velocity is further increased, particles are discharged from the fluidised bed (transportation). The air filter at the head of the column retains these particles.

The volumetric flow rate of the compressed air is measured and controlled using two measuring ranges. Both columns are equipped with measuring points, to which differential pressure sensors can be connected. These record the pressure loss in the fixed and fluidised bed. The measured values are transmitted directly to a PC via USB where they can be displayed using the GUNT software included. The trainer is also operated using the GUNT software. An external compressed air supply is required for operation.

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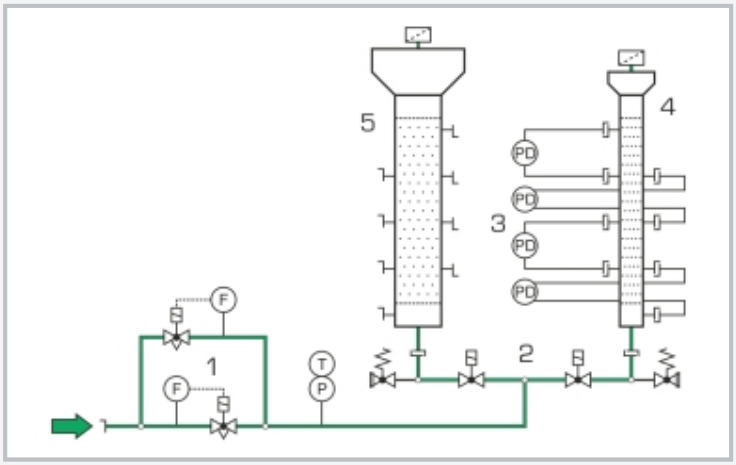
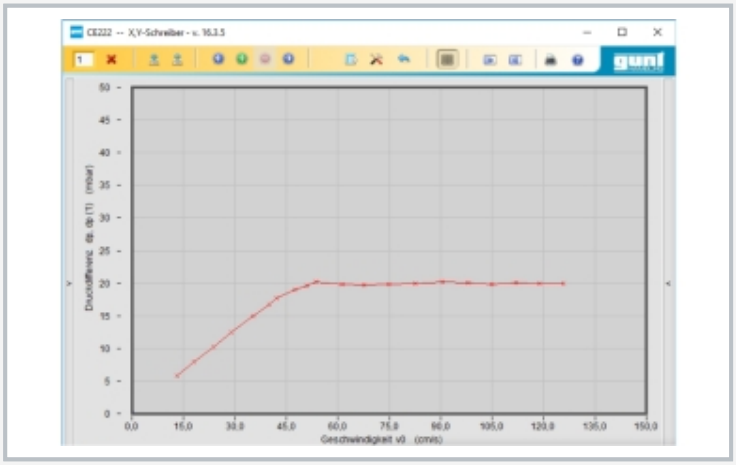
1 column K1 with Ø 100mm, 2 column K2 with Ø 50mm, 3 differential pressure measuring points of K1, 4 gas supply for K1, 5 gas supply to the trainer, 6 flow measurement for 2 measuring ranges, 7 air filter



1 flow rate measurement, 2 column changeover, 3 differential pressure measurement, 4 column K2 with Ø 50mm, 5 column K1 with Ø 100mm



Software screenshot: Measurement results in the X,Y recorder

Specification

[1] investigation of the fluidised bed formation of solids in gas
[2] 2 removable, transparent columns with different diameters
[3] solenoid valves to select the column being studied
[4] each column has a sinter plate, scale, air filter
[5] each column has 4 differential pressure measuring points in fixed and fluidised bed to determine the pressure losses
[6] volumetric flow rate control with 2 measuring ranges
[7] glass beads in different particle sizes as packing
[8] GUNT software with control functions and data acquisition via USB under Windows 11

Technical data

2 columns
- length: 500mm
- Ø 1x 50mm, 1x 100mm
- material: glass
- scale, graduation: 1mm

Measuring ranges
- flow rate: 1x 1,8...18L/min, 1x 15...150L/min
- differential pressure: 4x 0...50mbar
- pressure: 0...2,5bar
- temperature: 0...60°C

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 1400x800x1700mm
Weight: approx. 132kg

Required for operation

compressed air (1,8...150L/min, 5bar)
PC with Windows

Scope of delivery

1 trainer
1 packing unit of glass beads (180...300µm; 2kg)
1 packing unit of glass beads (420...590µm; 2kg)
1 set of accessories
1 GUNT software + USB cable
1 set of instructional material

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Optional accessories

for Remote Learning

GU 100	Web Access Box
with	
CE 222W	Web Access Software