

CE 220

Fluidised bed formation



Learning objectives/experiments

- fundamentals of the fluidisation of bulk solids
- observation and comparison of the fluidisation process in water and air
- pressure loss dependent on flow velocity
- pressure loss dependent on the type and particle size of the bulk solid
- determination of the fluidisation velocity and comparison with theoretically calculated values (Ergun equation)
- dependency of the height of the fluidised bed on the flow velocity
- verification of Carman-Kozeny equation

Description

- **experimental investigation of the fluidisation process**
- **comparison of fluidised bed formation in gases and liquids**
- **pressure loss in fixed beds and fluidised beds**
- **optimum observation of processes through transparent tanks**

Bulk solids can be transformed from a fixed bed into a fluidised bed when liquids or gases pass through them. The areas of application of fluidised beds include the drying of solids and a wide variety of chemical processes.

CE 220 features two transparent test tanks for fluidised bed formation in water and air. A diaphragm pump delivers water from a storage tank into the bottom of the left side test tank. The water flows upwards through a porous sintered-metal plate.

On the sintered-metal plate is a bulk solid. If the velocity of the water is less than the so-called fluidisation velocity, the flow merely passes through the fixed bed. At higher velocities the bed is loosened to such an extent that individual solid particles are suspended by the fluid. If the velocity is increased further, particles are carried out of the fluidised bed. A filter at the top of the test tank holds these particles back. The water flows back into the storage tank.

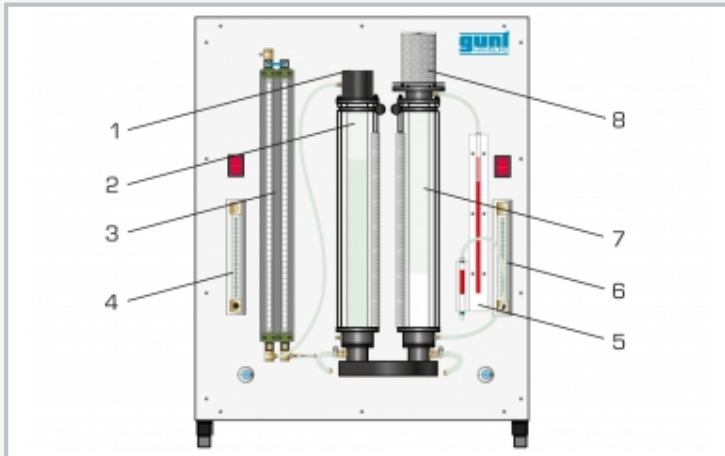
The right-side test tank is similar in construction to the left-side one. An air flow generated by a compressor flows through it.

Manometers are mounted on both test tanks to measure the pressure loss. The flow rates are adjusted by way of valves, and can be read from flow meters. The test tanks are removable. This makes it easy to change the bulk solid filling.

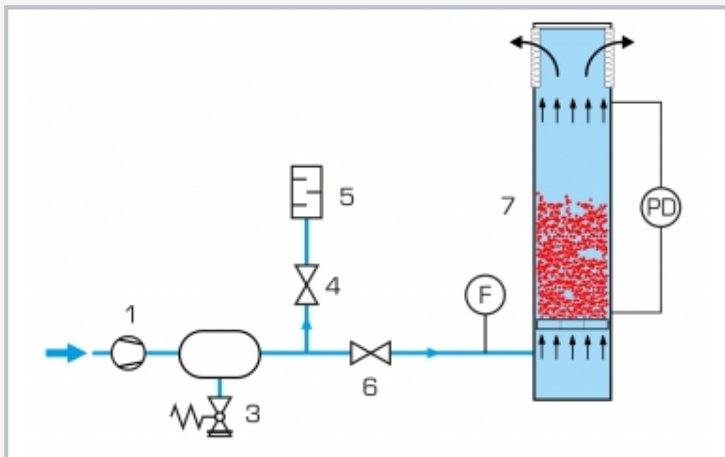
Glass-shot beads in a range of particle sizes are provided as the bulk solid filling.

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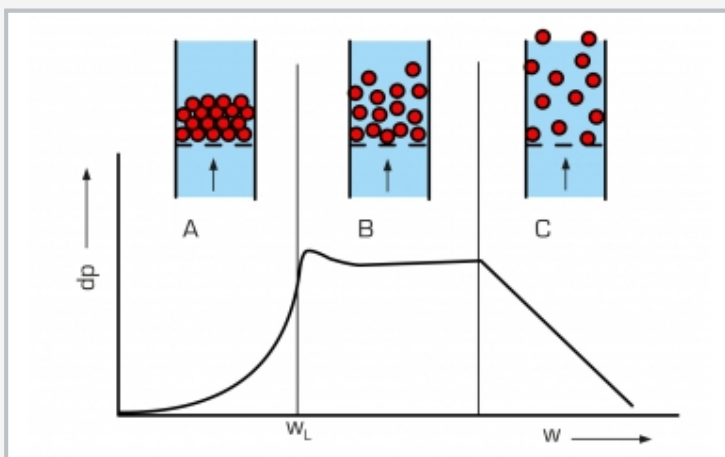
Fluidised bed formation



1 water overflow, 2 test tank for water, 3 twin tube manometers, 4 flow meter for water, 5 U-tube manometer, 6 flow meter for air, 7 test tank for air, 8 filter



Compressed air supply: 1 compressor, 2 compressed air accumulator, 3 safety valve, 4 bypass valve, 5 sound absorber, 6 needle valve, 7 test tank (air); F flow rate, PD differential pressure



Pressure loss characteristic on a homogeneous fluidising bed: dp pressure loss, w flow velocity, w_L fluidisation velocity; A fixed bed, B fluidised bed, C transport

Specification

- [1] investigation of fluidised bed formation of solids in air and water
- [2] 2 transparent test tanks to observe fluidised bed formation in air/water
- [3] 1 manometer per tank to measure the pressure loss through each test tank
- [4] 1 steel rule per tank to measure the change in height of the fluidised beds
- [5] both test tanks removable for filling
- [6] storage tank with diaphragm pump for water supply
- [7] diaphragm compressor with compressed air accumulator for compressed air supply
- [8] adjustment of flow rate for both media by valves and flow meter

Technical data

2 test tanks

- length: 550mm
- inside diameter: 44mm
- scale division: 1mm
- Material: PMMA

Diaphragm pump (water)

- max. flow rate: 1,7L/min
- max. head: 70m

Diaphragm compressor (air)

- max. volumetric flow rate: 39L/min
- max. pressure: 2bar

Tanks

- water storage tank: approx. 4L
- compressed air accumulator: 2L

Measuring ranges

- pressure (water): 0...500mmWC
- pressure (air): 0...200mmWC
- flow rate (water): 0,2...2,2L/min
- flow rate (air): 4...32L/min

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase

120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 750x610x1010mm

Weight: approx. 80kg

Scope of delivery

- 1 experimental unit
- 1kg glass-shot beads (180...300 μ m)
- 1kg glass-shot beads (420...590 μ m)
- 1 set of instructional material

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Optional accessories

020.30009 WP 300.09 Laboratory trolley