

CE 400

Gas absorption



Learning objectives/experiments

- investigation of the absorption process when separating gas mixtures in a packed column
- determination of pressure losses in the column
- representation of the absorption process in an operating diagram
- investigation of the variables influencing the effectiveness of absorption

Description

- separating a CO_2 /air mixture by absorption in counterflow
- DURAN glass column with packed bed
- safe operation due to use of water as the solvent and non-hazardous gases
- regeneration of solvent by vacuum
- gas analysis with hand-held measuring unit

Absorption is used to remove one or more gaseous components from a gas flow using a solvent.

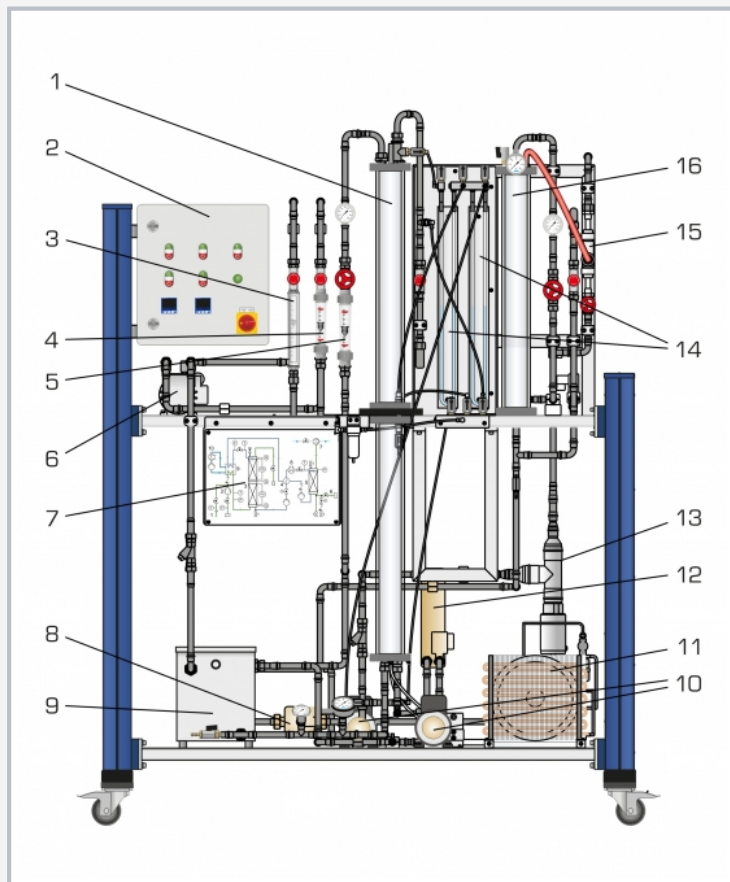
First of all, a CO_2 and air gas mixture is produced. It is possible to adjust the mixing ratio using valves. The flow rates of the gas components are displayed.

A compressor delivers the gas mixture into the lower section of the absorption column. In the column, part of the CO_2 is separated in the counterflow with the solvent. Water is used as the solvent. The CO_2 is absorbed by the downward flowing water. To separate the absorbed CO_2 , the charged water is then fed from the lower section of the absorption column into a desorption column. As the pressure is reduced and the temperature is increased, the solubility of the CO_2 falls. A heater heats the water. A water jet pump generates negative pressure in the desorption column and causes the CO_2 gas to be emitted from the water. A pump then delivers the regenerated solvent back into the absorption column.

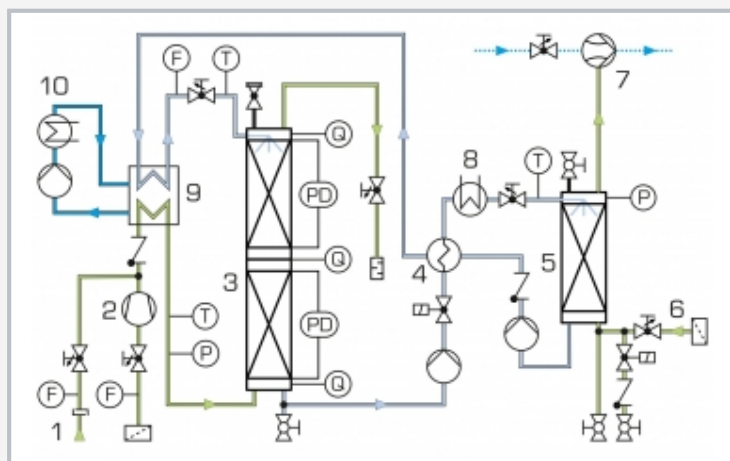
The water temperature can be controlled. Flow rate, temperature and pressure are continuously measured. The two-section column is equipped with connections to determine the pressure losses. The pressure loss in the respective sections can be displayed via two U-tube manometers. To evaluate the success of the process, the trainer includes outlets for taking gas and liquid samples. The gas samples can be analysed using the hand-held measuring unit supplied.

CE 400

Gas absorption



1 absorption column, 2 switch cabinet, 3 CO₂ flow meter, 4 air flow meter, 5 solvent flow meter, 6 compressor, 7 process schematic, 8 pump (cooling), 9 cooling tank, 10 pumps (absorption/desorption), 11 refrigeration system, 12 heat exchanger, 13 heater, 14 U-tube manometer, 15 water jet pump (vacuum), 16 desorption column



1 external CO₂ compressed gas cylinder with pressure reducing valve, 2 compressor (air), 3 absorption column, 4 heat exchanger, 5 desorption column, 6 air for desorption, 7 water jet pump (vacuum), 8 heater, 9 cooling tank, 10 refrigeration system; F flow rate, P pressure, PD differential pressure, T temperature, Q sampling point (gas)

Specification

- [1] separation of CO₂/air mixture by absorption in counter-flow with water
- [2] production of gas mixture using CO₂ from compressed gas cylinder and ambient air
- [3] adjustment of mixing ratio using valves
- [4] compressor for delivering the gas mixture into the absorption column
- [5] DURAN glass absorption column (packed bed) and desorption column
- [6] continuous solvent regeneration in circuit with desorption column under vacuum
- [7] 1 pump for desorption column and 1 pump for returning solvent to absorption column
- [8] water temperature control with heater and refrigeration system

Technical data

Absorption column
 ■ height: 2x 750mm, internal diameter: 80mm

Desorption column
 ■ height: 750mm, internal diameter: 80mm

2 pumps (absorption/desorption)
 ■ max. flow rate: 17,5L/min
 ■ max. head: 47m

1 pump (cooling)
 ■ max. flow rate: 29L/min
 ■ max. head: 1,4m

Compressor
 ■ max. positive pressure: 2bar
 ■ max. flow rate: 39L/min

Measuring ranges
 ■ flow rate:
 ▶ air: 0,2...2,4Nm³/h
 ▶ solvent: 50...600L/h
 ▶ CO₂: 0,4...5,4L/min
 ■ temperature: 1x 0...80°C, 2x 0...60°C
 ■ pressure: 1x 0...2,5bar, 1x -1...0,6bar
 ■ differential pressure: 2x 0...250mmWC
 ■ CO₂-content: 0...100vol%

230V, 50Hz, 1 phase
 230V, 60Hz, 1 phase
 230V, 60Hz, 3 phases
 UL/CSA optional
 LxWxH: 1920x790x2300mm
 Weight: approx. 290kg

Required for operation

CO₂ gas cylinder with pressure reducing valve
 water connection, drain

Scope of delivery

- 1 trainer
- 1 hand-held measuring unit for gas analysis
- 1 set of weights
- 1 set of instructional material