

# 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<sub>2</sub>/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.

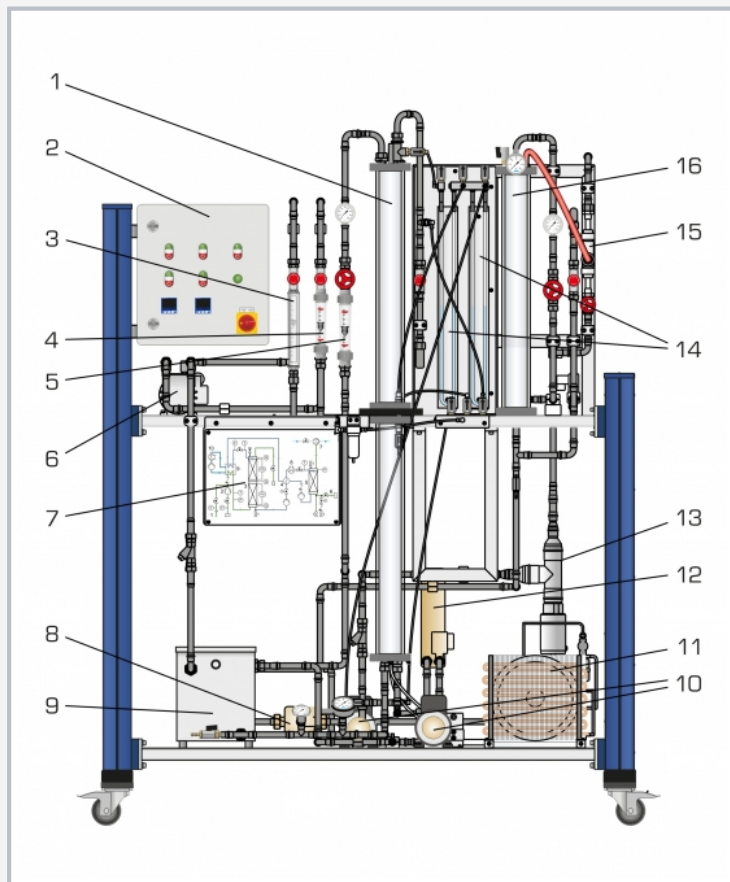
First of all, a CO<sub>2</sub> and air gas mixture is produced. It is possible to adjust the mixing ratio using valves. The flow rates of the gas components are displayed.

A compressor delivers the gas mixture into the lower section of the absorption column. In the column, part of the CO<sub>2</sub> is separated in the counterflow with the solvent. Water is used as the solvent. The CO<sub>2</sub> is absorbed by the downward flowing water. To separate the absorbed CO<sub>2</sub>, 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<sub>2</sub> falls. A heater heats the water. A water jet pump generates negative pressure in the desorption column and causes the CO<sub>2</sub> gas to be emitted from the water. A pump then delivers the regenerated solvent back into the absorption column.

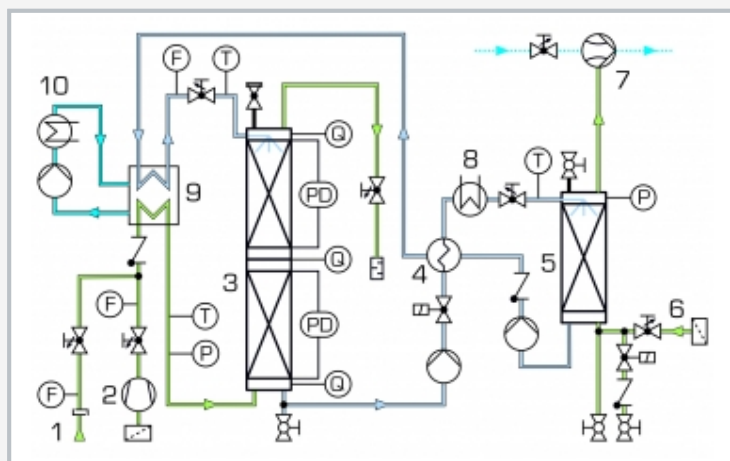
The water temperature can be controlled. Flow rate, temperature and pressure are continuously measured. The two-section column is equipped with connections to determine the pressure losses. The pressure loss in the respective sections can be displayed via two U-tube manometers. To evaluate the success 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.

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1 absorption column, 2 switch cabinet, 3 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub>/air mixture by absorption in counterflow with water
- [2] production of gas mixture using CO<sub>2</sub> 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
- [9] refrigerant R513A, GWP: 631

### Technical data

- Absorption column
- height: 2x 750mm, inner diameter: 80mm
- Desorption column
- height: 750mm, inner 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
- Refrigeration capacity: 1432W at 5/32°C
- Refrigerant: R513A, GWP: 631
- filling volume: 600g
  - CO<sub>2</sub>-equivalent: 0,4t
- Measuring ranges
- flow rate:
    - ▶ 0,2...2,4Nm<sup>3</sup>/h (air)
    - ▶ 50...600L/h (solvent)
    - ▶ 0,4...5,4L/min (CO<sub>2</sub>)
  - temperature: 1x 0...80°C, 2x 0...60°C
  - pressure: 1x 0...2,5bar, 1x -1...0,6bar
  - differential pressure: 2x 0...250mmWC
  - CO<sub>2</sub>-content: 0...100vol%

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

### Required for operation

CO<sub>2</sub> 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 hoses
- 1 set of instructional material