

CE 600

Continuous rectification



The illustration shows the CE 600 with built in sieve tray column. The packed column can be seen in the foreground.

Learning objectives/experiments

- investigation and comparison of sieve tray and packed columns
 - ▶ in continuous mode
 - ▶ in discontinuous mode
 - ▶ in vacuum mode
 - ▶ with different reflux ratios
 - ▶ with different numbers of trays and inlet heights for the feed flow (sieve tray column)
- energy efficiency increase due to feed preheating
- determination of concentration profiles
- determination of temperature profiles
- pressure loss over the column

Description

- **discontinuous and continuous rectification**
- **comparison of packed and sieve tray column**
- **feed preheating using bottom product**
- **vacuum mode possible**
- **trays in sieve tray column removable**
- **GUNT software with control functions and data acquisition**

Distillation is used to separate liquid mixtures made up of individual liquids that are soluble in one another. Rectification refers to distillation in a counterflow. Ethanol/water is recommended as the liquid mixture for the CE 600. It is fed into the column. It partially evaporates on its way to the bottom of the column where it is heated to boiling. The mixed vapour produced then moves upwards in the column.

The mixed vapour contains a higher concentration of the component with the lower boiling point (ethanol). It leaves the top of the column and is condensed using a condenser and a phase separation tank. Part of this condensate is collected in a tank as product while the rest is fed back into the column. Here, on its way downwards, it undergoes further heating and material exchange with the rising mixed vapour. This exchange causes the vapour phase to become richer in ethanol and the liquid phase to become richer in water. The liquid phase moves to the bottom and can be collected in two tanks.

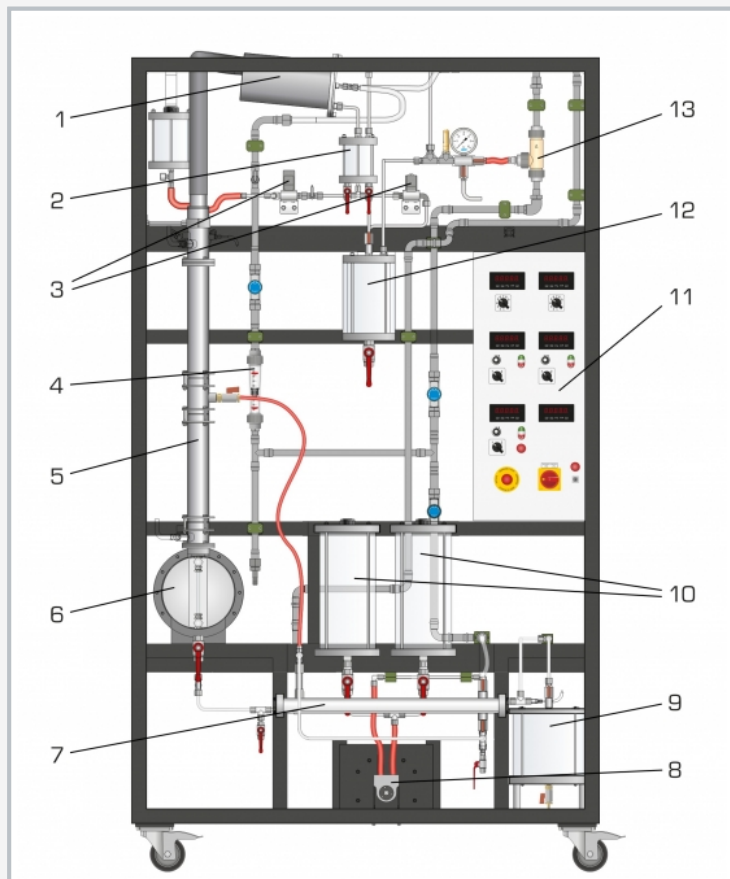
A heat exchanger allows the feed to be preheated by the bottom product carried away from the column. A sieve tray column and a packed column are available.

The sieve tray column has three connections at different heights for the feed. The packed column is filled with Raschig rings. The reflux ratio is adjusted using valves.

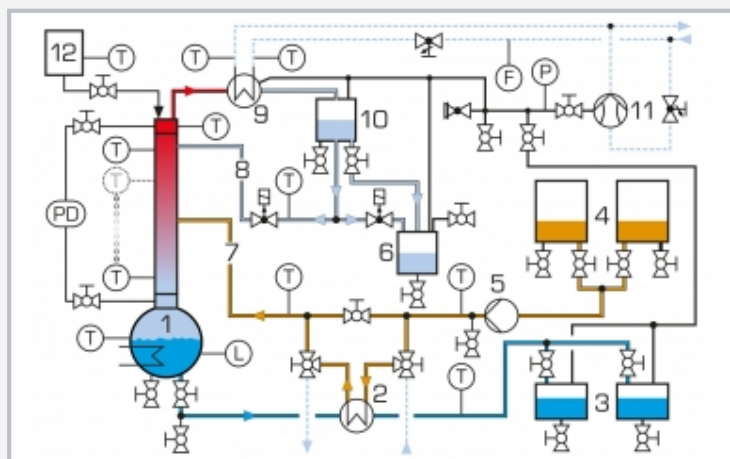
Relevant measured values are recorded by sensors, displayed and can be processed on a PC. The software also allows controlling the temperature at the top of column or at the bottom of column (evaporator).

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1 top product condenser, 2 phase separation tank, 3 valves (reflux ratio), 4 cooling water flow meter, 5 sieve tray or packed column, 6 evaporator, 7 bottom heat exchanger, 8 feed pump, 9 bottom product tank, 10 feed tank, 11 switch cabinet with displays and controls, 12 top product tank, 13 water jet pump



1 evaporator with column, 2 bottom heat exchanger, 3 bottom product tank, 4 feed tank, 5 feed pump, 6 top product tank, 7 feed, 8 reflux, 9 condenser, 10 phase separation tank, 11 water jet pump, 12 solvent tank; F flow rate, L level, P pressure, PD differential pressure, T temperature; dotted, blue line: cooling water

Specification

- [1] continuous and discontinuous rectification with packed and sieve tray column
- [2] interchangeable columns
- [3] sieve tray column with 8 trays, 3 feed inlets
- [4] packed column with Raschig rings
- [5] vacuum mode possible with water jet pump
- [6] electrically heated evaporator
- [7] tanks for feed, bottom and top product
- [8] heat exchanger for bottom product cooling due to feed preheating or cooling water
- [9] condenser and phase separation tank for top product
- [10] all tanks made of DURAN glass and stainless steel
- [11] adjustment of reflux ratio using valves
- [12] 8 temperature sensors per column
- [13] GUNT software with control functions and data acquisition via USB under Windows 7, 8.1, 10

Technical data

Columns

- height x inner diameter: 780x50mm

Feed pump

- max. flow rate: 200mL/min

Water jet pump: final vacuum: approx. 200mbar

Tanks

- feed: 2x approx. 5L
- bottom product: 2x approx. 4L
- top product: approx. 1,5L
- phase separation: approx. 0,5L

Heat transfer surfaces

- feed preheating/bottom cooling: approx. 0,03m²
- top product condenser: approx. 0,04m²

Measuring ranges

- temperature: 16x 0...150°C
- reflux ratio: 0...100%
- power: 0...4kW (heater)
- differential pressure: 0...250mbar (column)
- flow rate: 30...320L/h (cooling water)
- manometer: -1...0,6bar

400V, 50Hz, 3 phases

400V, 50Hz, 3 phases; 230V, 60Hz, 3 phases

UL/CSA optional

LxWxH: 1300x760x2400mm

Weight: approx. 295kg

Required for operation

cold water connection: 500...1000L/h, drain
PC with Windows

Scope of delivery

- 1 trainer, 1 column, 1 set of accessories
- 1 GUNT software CD + USB cable
- 1 set of instructional material