**CE 600**
Continuous rectification

The illustration shows the CE 600 with built-in sieve tray column. Screen mirroring is possible on numerous end devices.

### Description

- **Comparison of packed, sieve tray and bubble cap tray column**
- **Vacuum mode possible by diaphragm pump**
- **Device control using an integrated PLC**
- **Integrated WLAN router for operation and control via 1 end device and for screen mirroring on numerous end devices: PC, tablet, smartphone**

Distillation is used to separate liquid mixtures made up of individual liquids that are soluble in one another. Rectification refers to distillation in a countercurrent. Ethanol/water is recommended as the liquid mixture for the CE 600.

A sieve tray column, a bubble cap tray column, and a packed column are available. The packed column is filled with Raschig rings. Each column has three connections at different heights for the feed. The top product 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. The reflux ratio is adjusted using valves.

The bottom product can be collected in two tanks. A heat exchanger allows the feed to be preheated by the bottom product carried away from the column.

Relevant measured values are recorded by sensors. The composition of the feed and products is determined via an areometer based on the difference in density between ethanol and water.

The trainer is operated and controlled by the integrated PLC with touch screen. The measured values can be transmitted via USB to a PC where they can be analysed using the GUNT software. By means of an integrated WLAN router, the trainer can additionally be operated and controlled via one end device and the user interface can be displayed on numerous end devices (screen mirroring). Menu navigation is independent of the user interface shown on the touch screen of the trainer. Different user levels with different functions are available on the end device.

### Learning objectives/experiments

- **Investigation and comparison of sieve tray, bubble cap tray and packed columns**
  - in continuous mode
  - in discontinuous mode
  - in vacuum mode
  - with different reflux ratios
  - with different inlet heights for the feed flow
  - with different numbers of trays (sieve tray and bubble cap tray column)
- **Energy efficiency increase due to feed preheating**
- **Determination of temperature profiles**
- **Pressure loss over the column**

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Continuous rectification

**Specification**

1. continuous and discontinuous rectification
2. packed, sieve tray and bubble cap tray column, interchangeable
3. device control with PLC, operation via touch screen or an end device
4. screen mirroring; possible to mirror the user interface on numerous end devices
5. 3 feed inlets and 8 temperature sensors per column
6. sieve tray and bubble cap tray column with 8 trays
7. packed column with Raschig rings
8. vacuum mode possible with diaphragm pump
9. electrically heated evaporator
10. heat exchanger for bottom product cooling due to feed preheating or cooling water
11. condenser and phase separation tank for top product
12. closed cooling water circuit with water/air cooler
13. adjustment of reflux ratio using valves
14. GUNT software for data acquisition via USB under Windows 7, 8.1, 10

**Technical data**

**Columns**
- height x inner diameter: 780x50mm

**Feed pump**
- max. flow rate: 320mL/min

**Cooling water pump**
- max. flow rate: 10L/min

**Diaphragm pump:** final vacuum approx. 213mbar abs.

**Tanks**
- feed: 2x approx. 5L
- bottom product: 2x approx. 5L
- top product: approx. 1,9L

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

**Measuring ranges**
- temperature: 33x 0…150°C
- pressure sensor: 2x 0…2,5bar (column), 1x -1…1bar
- manometer: -1…0,6bar
- reflux ratio: 0…100%
- power: 0…4kW [heater]
- flow rate: 30…320L/h [cooling water]
- density: 0,7…1g/mL

**Power supply**
- 400V, 50Hz, 3 phases
- 400V, 60Hz, 3 phases; 230V, 60Hz, 3 phases

**UL/CSA optional**

**LxWxH:** 1905x790x2200mm

**Weight:** approx. 400kg

**Scope of delivery**

1. trainer, 1 set of accessories
2. GUNT software + USB cable
3. set of instructional material

User interface on the touch screen: start page with process schematic

The user interface contains the buttons:
1. start page with process schematic and all the latest measured values,
2. settings of operation and control,
3. time functions of the measured values, e.g. temperatures in the column.