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

**Description**

- discontinuous and continuous rectification
- comparison of packed and sieve tray columns
- 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).

**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
Continuous rectification

**Specification**

1. Continuous and discontinuous rectification with packed and sieve tray columns
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: approx. 5L
- Bottom product: 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

**Requirements**
- 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
2. GUNT software CD + USB cable
3. Set of instructional material