CE 579
Depth filtration

The illustration shows: supply unit (left) and trainer (right), screen mirroring is possible on different end devices

Description

- **filtration and backwash**
- **pressure conditions in a filter**
- **system controlled via integrated PLC with data acquisition**

Depth filtration is a key unit operation in water treatment. CE 579 enables this process to be demonstrated.

Raw water contaminated with solids is pumped from above into a filter. The solids are captured and retained as the raw water flows through the filter bed. The water itself passes through the filter bed and emerges at the bottom end of the filter. The treated water (filtrate) flows into a tank. Over time, more and more solids are deposited in the filter bed which increases its flow resistance. This process is detectable by the increasing pressure loss between the filter inlet and outlet. The flow through the filter decreases. Backwashing with treated water cleans the filter bed and reduces the pressure loss again.

The filter is equipped with a differential pressure gauge. The pressure along the filter bed is recorded with several pressure sensors. This can be used to plot Micheau diagrams. The flow rate, temperature, differential pressure and system pressure are also recorded. The flow velocity in the filter bed can be adjusted. Samples can be taken at all relevant points. The height of the filter bed can be read on a scale.

The trainer is controlled via the integrated PLC with touch screen. By means of an integrated router, the trainer can alternatively be operated and controlled via an end device. The user interface can also be displayed on additional end devices (screen mirroring). Via the PLC, the measured values can be stored internally. Access to stored measured values is possible from end devices via WLAN with integrated router/LAN connection to the customer's own network.

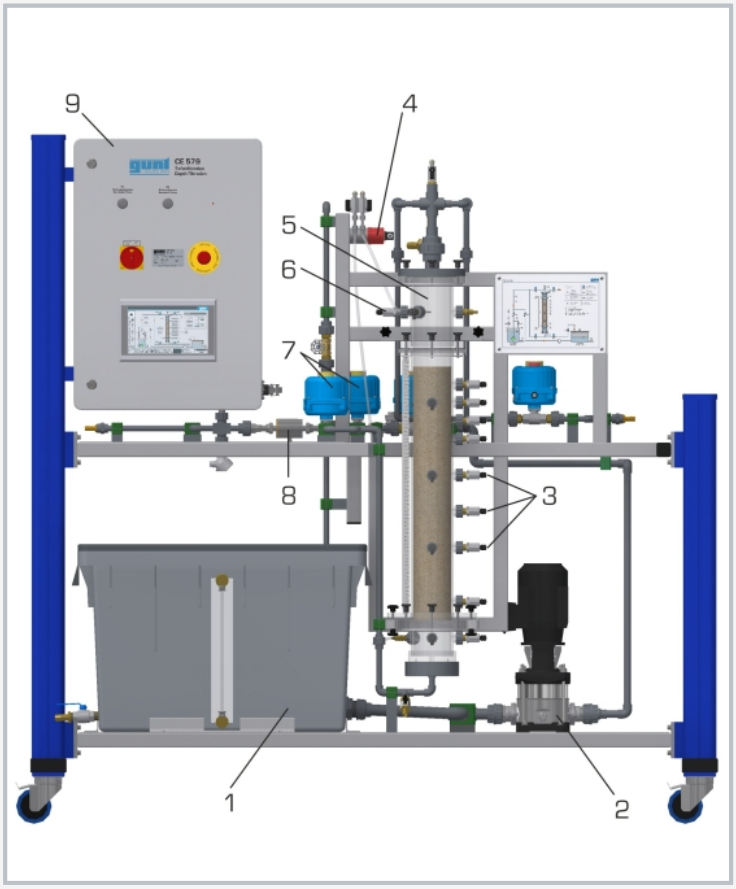
E.g. diatomite can be used to produce the raw water.

Learning objectives/experiments

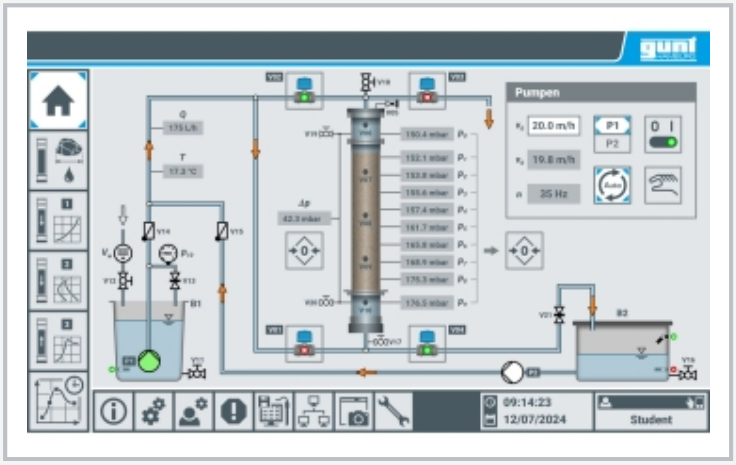
- pressure conditions in a filter
- factors influencing the pressure loss (Darcy's law)
  - flow rate
  - height of the filter bed
  - permeability of the filter bed
- determine the pressure in the filter bed (Micheau diagram)
- backwash of filters
  - observe the fluidisation process
  - determine the expansion of the filter bed
  - determine the required flow velocity (fluidisation velocity)

- screen mirroring: mirroring of the user interface on end devices
  - menu navigation independent of the user interface shown on the touch screen
  - different user levels available on the end device: for observing the experiments or for operation and control

CE 579
Depth filtration



1 treated water tank, 2 bachwash pump, 3 pressure sensors along the filter bed, 4 differential pressure sensor, 5 filter, 6 system pressure sensor, 7 ball valve with motor, 8 flow rate sensor, 9 switch cabinet



PLC screenshot

Specification

[1] depth filtration and backwash
[2] separate supply unit with tank and pump for raw water
[3] pump for backwashing the filter
[4] pressure sensors along the filter bed
[5] plotting of Micheau diagrams
[6] electromagnetic flow rate sensor
[7] 4 ball valves with motor
[8] recording of pressures, flow rate, differential pressure, system pressure and temperature
[9] control of flow velocity
[10] control of the experimental plant using a PLC, operated by touch screen
[11] data acquisition via PLC on internal memory, access to stored measured values via WLAN/LAN with integrated router/LAN connection to customer's own network or direct LAN connection without customer network

Technical data

Filter
- inside diameter: 106mm
- total height: 1125mm
- max. filter bed height: approx. 700mm

Raw water pump
- max. flow rate: 150L/min
- max. head: 9m

Backwash pump
- max. flow rate: 40L/min
- max. head: 10m

Tanks for raw water and treated water
- capacity: each 180L

Measuring ranges
- flow rate: 0...1300L/h
- pressure sensor: 10x 0...0,6bar
- manometer: 0...1bar
- differential pressure: -1...1bar
- temperature: 0...100°C
- filter bed height: 0...720mm

230V, 50Hz, 1 phase, 230V, 60Hz, 1 phase
230V, 60Hz, 3 phases, UL/CSA optional
LxWxH: 1900x790x1900mm trainer
LxWxH: 1200x790x1200mm supply unit
Total weight: approx. 370kg

Required for operation

water connection, drain

Scope of delivery

1 trainer, 1 supply unit, 1 set of hoses
1 packing unit of gravel, 1 packing unit of diatomite
1 sieve with collecting pan, 5 measuring cups
1 set of instructional material