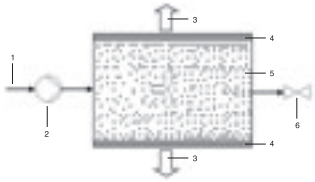
5 Membrane Technology

5.2 Performance Overview Of ProMaqua® Ultrafiltration



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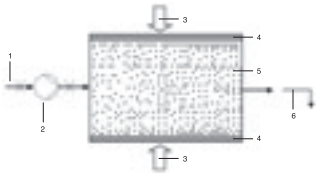
1 Feed
2 Pump
3 Filtrate
4 Membrane
5 Capillaries
6 Valve

Schematic diagram of dead-end operation, filtration



pk_7_rueckspuelen

1 Feed
2 Pump
3 Backwash water
4 Membrane
5 Capillaries
6 Backwash water

Schematic diagram of dead-end operation, backwashing

Ultrafiltration is a membrane process which is increasingly used in water treatment to separate undesired water components. Parasites, bacteria, viruses and high-molecular organic substances as well as other particles are retained.

The applications of ultrafiltration are wide spread and may include different types of water.

Typical applications include drinking water, river water, process water, swimming pool water, seawater and waste water.

The tasks range from drinking water purification to meet physical and microbiological limit values in accordance with the German Drinking Water Ordinance up to the pre-treatment of seawater for desalination by reverse osmosis.

The systems are matched to a specific task by individually selecting the membrane type and the operating mode. ProMinent ProMaqua® uses extremely robust and resistant UF membranes and the dead-end principle to facilitate an optimisation with regard to investment costs, required space and operating costs. With this selection, all raw waters with the exception of waste water can be filtered largely without using chemicals.

The dead-end operation represents the standard operating mode. The raw water flows into the capillaries. The pure water (filtrate) passes through the membrane while the other constituents are retained on the surface of the membrane.

The constituents form a layer on the membrane. The membrane is backwashed fully automatically in regular intervals to remove the layer.

Ultrafiltration systems basically consist of:

- Stainless steel rack
- Pre-filter to protect the membranes, if required. This filter can be designed as a backwashing filter optionally.
- UF membrane modules
- Pneumatically controlled valves made of high-quality materials
- Electronic pressure measurement
- Filtration pump and backwash pump with frequency converter made of suitable high-quality materials
- Magnetically inductive flow metering to control the flow rates for filtration and backwashing.
- Integrated filling system for the backwash water tank. The backwash water tank can be integrated in small systems.
- PCL control with touch screen panel or microprocessor control unit for Dulcoclean® UF eco systems. The PLC control simultaneously monitors all important parameters as e.g. pressure, pressure difference and flow rates. This ensures that the membranes are optimally protected. The control of pre- and post-treatment processes can also be integrated, if required.

Advantages of ultrafiltration systems

- Filtrate values smaller than 0.01 NTU possible independent of raw water turbidity.
- Molecular weight cut off of the membranes (MWCO) approx. 100 kDa (kilodalton).
- Excellent retention rate for bacteria and viruses (99.999 % for bacteria and 99.99 % for viruses referred to MS2 phages).
- Very easy to use and easy to combine with other systems thanks to PLC control with touch screen.
- Optimal operating processes thanks to modern measuring and control technology.
- Complete solutions with perfectly matched pre- and post-treatment are also available on request.

Ultrafiltration systems are available with a filtration capacity ranging from 1 to 90 m^3/h at a water yield of > 96 %/h.

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5.5 Dulcoclean® Ultrafiltration Systems

5.5.1 Ultrafiltration Systems Dulcoclean® UF eco Range

This range is the compact ProMaqua® ultrafiltration system for residential water supply, hotels, recreation centres, restaurants, or industrial facilities. In connection with a storage tanks, even smaller districts or villages can be supplied with clean drinking water. Dulcoclean® UF eco systems are suitable for the removal of turbidity, particles and microbiological contaminations (bacteria, viruses, parasites). Even for changing raw water composition, the systems provide a consistently turbidity-free filtrate quality - free from pathogens. The retention rate for bacteria and viruses (referred to MS2 phages) is at least 99.999 % or 99.99 % respectively.

An intelligent microprocessor control ensures the fully automatic operation of the system and guarantees minimum energy and water consumption. The intervals and duration of backwashings automatically adapt to the membrane fouling and the water quality. In addition, further peripheral components of your water treatment system can be controlled centrally. A regularly conducted integrity test offers maximum safety.

Plant	Filtration capacity* at 15 °C	Number of membranes	Connected load filtration/ backwashing	Dimensions H x W x D
	l/h	No.	W	mm
Dulcoclean® eco 1	<1000	1	5 / 8	786 x 149 x 149
Dulcoclean® eco 2	<2100	1	5 / 8	1,268 x 149 x 149
Dulcoclean® eco 3	<2100	2	5 / 35	868 x 267 x 358
Dulcoclean® eco 4	<3900	2	5 / 35	1,368 x 267 x 358

* Filtration performance depends on the water quality and the water pressure upstream of the system. The filtration performance reduces with increasing filtration duration.

Electrical connection	230/115 V, 50/60 Hz, 12/24V DC on request
Operating pressure	2.5 – 5.0 bar
Trans-membrane pressure max.	2.5 bar
Operating temperature	4–40 °C
Membrane type	Robust single bore PES UF membrane
Nominal pore size	15 nm

Complete solutions with perfectly matched pre- and post-treatment are also available on request.

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5.5.2 Ultrafiltration Systems Dulcoclean® UF Range

This range is the universal compact ProMaqua model for modern drinking water treatment. These systems are equipped with a very robust ultrafiltration membrane and operated in an economic dead-end principle. Compared to the cross-flow mode, this process requires significantly less water and energy. Backwashing processes are performed in regular intervals to prevent a blocking of the modules. Matched to the existing raw water quality, the backwashing is supported by chemicals as required. Thanks to the alternating supply of raw water from the top and the bottom, the capillary is evenly flushed at all points during backwashing. This ensures a particularly effective cleaning. The system is controlled by a PLC and operated via a user-friendly touch panel. Frequency-controlled filtration and backwash pumps ensure the flow-controlled operation at minimum energy consumption. Thanks to the numerous different control options, the system offers a high level of flexibility and operating safety. Variations and changes in the raw water quality can thus be easily compensated for. All relevant operating parameters are detected electronically.

The Dulcoclean® UF range is suitable for the following values in the feed water:

pH range	3.0 … 12.0
Free chlorine	max. 1.2 mg/l
Turbidity	0.5 ... 30 NTU
DOC	0.5 ... 12 mg/l
Solid matter content	50 mg/l

Deviating values influence the performance data and require a separate design of the system. Please contact our experts.

Plant	Filtration capacity* at 15 °C	Number of 2.5" and 4" membranes	Connected load	Dimensions H x W x D
	l/h	No.	kW	mm
Dulcoclean® UF 2	5.4 - 9.0	2	6	2,250 x 600 x 2,600
Dulcoclean® UF 3	8.1 - 13.5	3	8	2,300 x 650 x 3,300
Dulcoclean® UF 4	10.8 - 18.0	4	8	2,300 x 650 x 4,000
Dulcoclean® UF 5	13.5 - 22.5	5	10	2,300 x 650 x 4,500

* Filtrate performance depends on the water quality

Systems with filtration capacity up to 90 m^3/h are designed on a project basis. Offers are available on request. Please contact us.

Optionally available are a fully automatic neutralisation system for the treatment of acid and alkaline backwash water, an integrity test as well as customized data logging.