Water Treatment – Membrane Systems and Ion Exchangers

Water is precious - and we provide the technology for sustainable use.

In many water treatment applications, the removal of particles and dissolved solids is the key component to provide clean water for subsequent use. A micro or ultrafiltration system (MF or UF) effectively removes particles up to a size of 0.01 µm, such as bacteria, suspended matter, etc., nanofiltration and reverse osmosis systems (NF or RO) eliminate dissolved substances including mono- and divalent ions. With ion exchange, the water hardness is reduced and divalent ions are exchanged for monovalent ones or completely removed in what is known as polishing.

The pressure range used in the MF or UF is between 0.2 and 6 bar. With the NF or RO, the operating pressure can be up to 80 bar, depending on the salt concentration. Membrane systems can vary in size from small plants, e.g. water supply for a few consumers, to large industrial parks treating industrial water or large water suppliers for thousands of people.

Water Main Uses

Process water treatment	Ultra pure water treatment	Industrial water treatment for water reuse
Boiler feed water Chemical solutions Heating and cooling circuits Washing and rinsing water	Deionized water Water for Injection Ultrapure water	Waste water from the wafer industry/ electroplating/food industry/textile industry

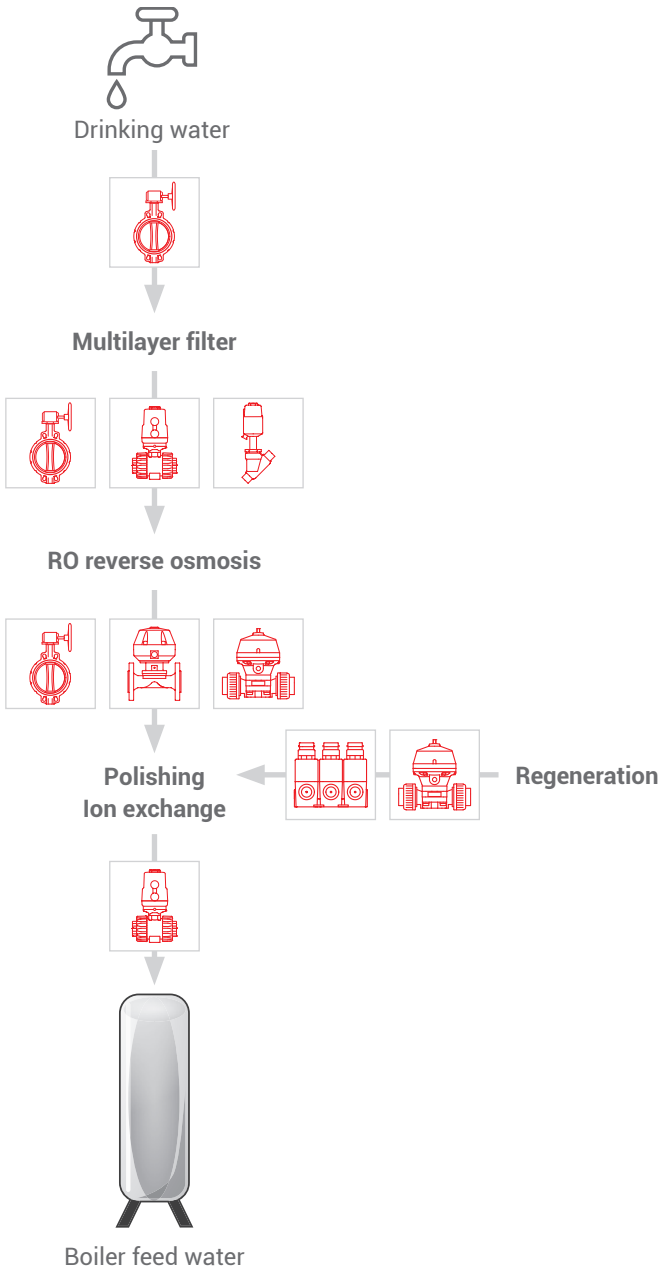
The purification of process water and wastewater is of great importance in the production processes, since hardly anyone can do without water

Technologies in the Applications

Ion exchange for treatment of process water (e.g. boiler feed water)

A low content of dissolved salts, such as lime, NaCl, etc., is important for boiler feed water. For the production of boiler feed water, the water is first pre-filtered. Depending on the source, this can be a simple bag filter or a more complex multi-layer filter. Most of the dissolved salts are then removed in reverse osmosis. For fresh water, the pressures of reverse osmosis are usually < 20 bar. Ball valves and butterfly valves are often used for the fittings. Stainless steel globe valves can be used to regulate pressure.
The subsequent ion exchangers are usually designed as mixed-bed exchangers. However, it is also possible to build cation and anion exchangers separately. The remaining dissolved salts are absorbed in the ion exchanger and regularly regenerated. The regeneration takes place using diluted acids such as hydrochloric acid and sulfuric acid in the cation exchanger. With anion exchangers, caustic soda is usually used for regeneration. Since moderate pressures below 6 bar usually prevail here, diaphragm valves or shut-off flaps can be used here. EPDM or PTFE can be used as a seal here. PVC, PP or coatings made of hard rubber, PP, Halar or PFA can be selected as the body.

DI-Water



Suitable GEMÜ products

Diaphragm valves
- GEMÜ R690, GEMÜ R620

Butterfly valves
- GEMÜ R480

Solenoid valves
- GEMÜ M75

Flow meters
- GEMÜ 800

Process Data

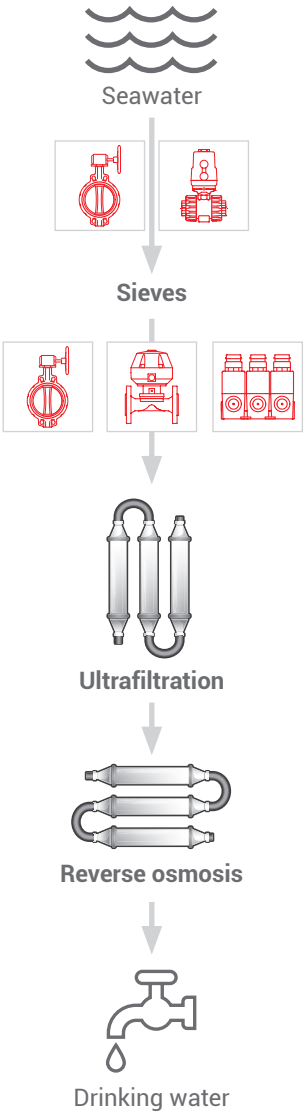
- Operating medium: water, diluted acids and alkalis for regeneration
- Pressure: < 20 bar

Ion exchange for process water preparation (e.g. boiler feed water)

Pre-treatment for Reverse Osmosis in Seawater Desalination

Modern seawater desalination plants work in several process steps. In the first step, larger particles are screened out. In the second filtration stage, even the finest particles and organic matter such as algae are removed. The actual desalination takes place using high-pressure reverse osmosis systems. The ultrafiltration filter stage is usually operated at low pressures below 6 bar. A special feature is the frequent backwashing processes to avoid blocking of the membranes. In addition, the UF membranes are regularly cleaned using diluted chemicals. Acids such as citric acid, hydrochloric acid or sulfuric acid remove the inorganic dirt. Organic impurities are removed using alkaline media. This often takes place in combination with disinfection with sodium hypochlorite solution. Butterfly valves are mostly used in ultrafiltration due to the size of the systems. Depending on the chemicals used, discs coated with Rilsan or Halar can be used. EPDM is usually used as the sealing material. Solenoid valves or membrane valves can be used for dosing chemicals.

Seawater Desalination



Suitable GEMÜ products

Diaphragm valves
- GEMÜ R690

Butterfly valves
- GEMÜ 480 Victoria, GEMÜ D450

Ball valves
- GEMÜ 717

Solenoid valves
- GEMÜ M75

Process Data

- Operating medium: cleaning with diluted chemicals, salty raw water, acid/lye/sodium hypochlorite as a cleaning agent
- Pressure: < 10 bar

Pre-treatment for reverse osmosis in seawater desalination

Valve Technology Overview/ Valve Finder

Media	Systems	Type, Characteristics	Valves & Materials
Surface water	MF, UF	Solids, organics	Butterfly valve EPDM+stainless steel, Rilsan, plastic diaphragm valves, polymer-coated diaphragm valves
Ground water	UF, NF	Precipitation of solved compounds	Butterfly valve EPDM+stainless steel, Rilsan, plastic diaphragm valves, polymer-coated diaphragm valves
Brackish water	UF, RO	Increased salt content <2000 mg/l	Butterfly valve EPDM, Rilsan, Halar, PVC, PP
Sea water	UF, RO	Increased salt content >2000 mg/l	Butterfly valve EPDM, Rilsan, Halar, PVC, PP
Process water in gen.	UF, RO	Depending on feed water	Butterfly valve EPDM, diaphragm valves
DI process water	UF, NF, RO	Extreme low salt content	Butterfly valve, diaphragm valves (EPDM+stainless steel, PTFE+PFA)
Wastewater for reuse	MF, UF, RO	Often aggressive water	Metal butterfly valve (NBR+stainless steel, FKM+Halar), diaphragm valves (polymer coated)

Certifications for GEMÜ products

Valve selection

Butterfly valves made of metal and plastic	Diaphragm valves made of metal and plastic	Globe valves made of metal
		
Ball valves	**Solenoid valves**	**Check valves**
		
Measurement and control systems	**Modular and customized M-block solutions**	**Add-on components and accessories**
		

Why GEMÜ?

GEMÜ supplies almost all the components required for membrane filtration, ion exchangers and reverse osmosis. Advantage: You only need one contact person and can thus fully equip your system. We would be happy to advise you in the planning phase when selecting the valve. Thanks to our modular system, there are many possible combinations, regardless of whether you want to operate your system electrically or pneumatically. The butterfly and diaphragm valves can be manufactured with different material coatings/ linings and are therefore equipped for every process.

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