Schlumberger

Polymem UF

Seawater ultrafiltration system

APPLICATIONS

- Sea, river, and aquifer water filtration
- Water injection systems
- Reverse osmosis (RO) pretreatment
- Sulfate removal (SR) pretreatment

BENEFITS

- Significant reduction in operating weight compared with traditional media and cartridge filters
- Consistently high water quality
- Simple maintenance procedures
- No process chemicals required to aid the filtration unlike media filtration
- Reduced frequency of cleaning and replacement of RO or nanofiltration (NF) SR membranes
- Membrane element life up to 5 years, providing opex savings compared with traditional filtration

FEATURES

- Compact packaging of the ultrafiltration (UF) membrane within engineered modules is included
- Modular design provides simple access for bundle installation and replacement
- 0.01-um filtration threshold retains bacteria and viruses as well as inorganic (mineral) particles
- Automated membrane backwash system design does not require separate backwash tank and pumps
- The UF membrane is chlorine tolerant, so conventional prechlorination can be used for control of biofouling

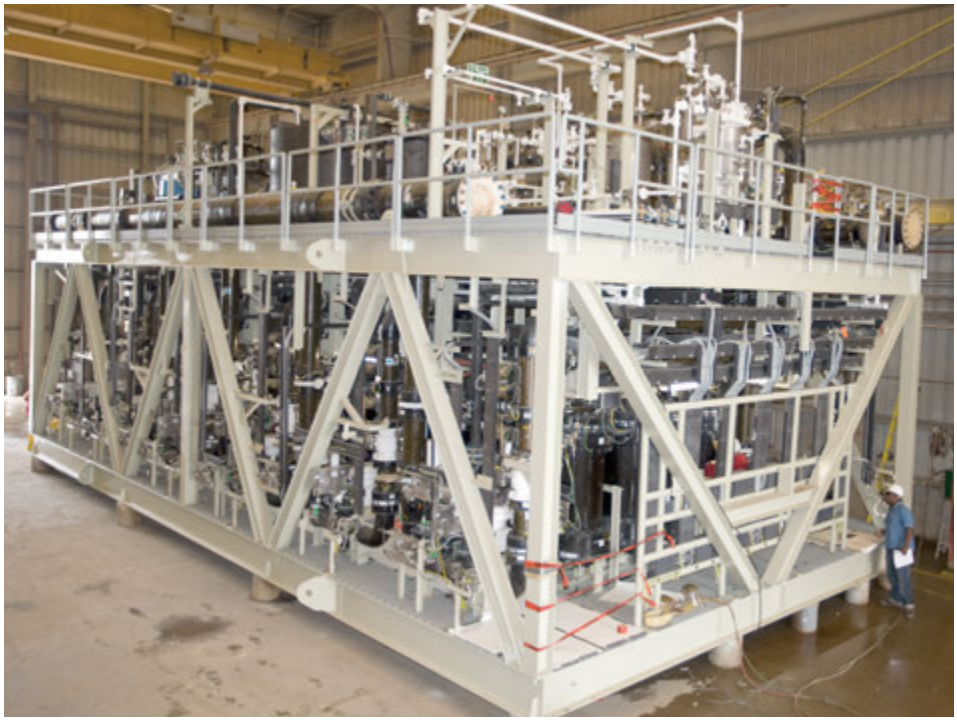
Managing water quality for oil and gas production and processing is a complicated industry issue. With an emphasis on technology and R&D, Schlumberger continues to develop technologies that reduce weight and space as well as provide performance improvements and reductions in both operating costs and capex. High-quality, cost-effective, reliable, and environmentally acceptable water solutions are mandatory to the successful operation of facilities worldwide. We work closely with operators to engineer solutions for various water-quality treatment issues.

To complement our current membrane technologies in sulfate reduction and seawater RO, Schlumberger offers UF membrane technology systems to the oil and gas industry. We are the exclusive provider of Polymem® UF system to the oil and gas industry, for which Polymem SA, France, is the developer and manufacturer of the UF membrane elements.

Design

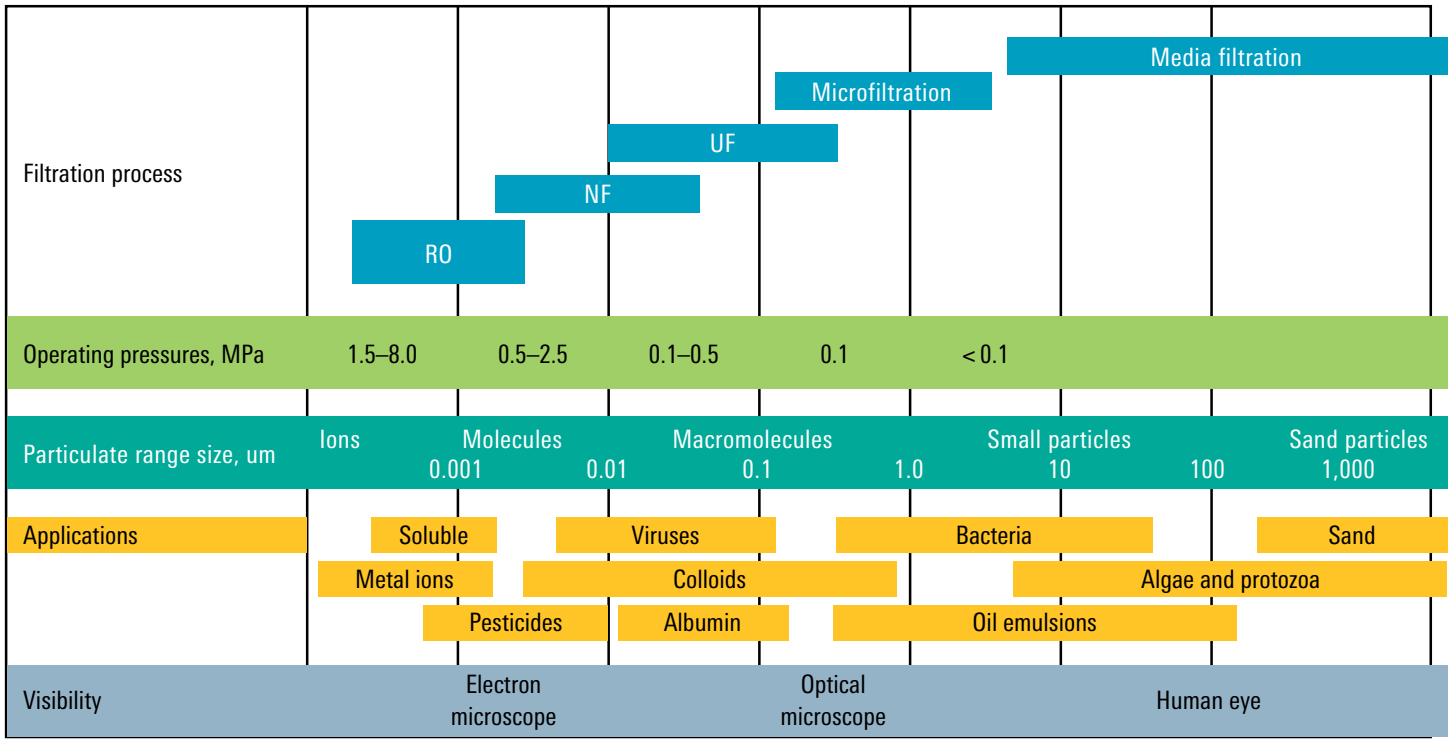
The Polymem UF system provides operators with significant weight savings compared with conventional filtration technologies, independent of varying feedwater quality. Particles greater than 0.01 um are removed.

The membrane is a double-skinned hollow fiber membrane (approximately 0.72-mm OD) constructed from polysulfone, which has superior mechanical strength and chemical resistance and is nonbiodegradable. Its high pH tolerance permits effective cleaning. Construction in polyvinylidene fluoride (PVDF) is also available.



Total Ofon 2 Polymem UF system ready for shipment.

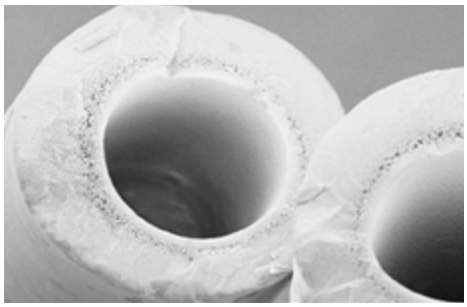
Polymem UF



Filtration spectrum.

The membrane operates in dead-end mode with flow from outside to inside and with the following benefits compared with inside-to-outside designs:

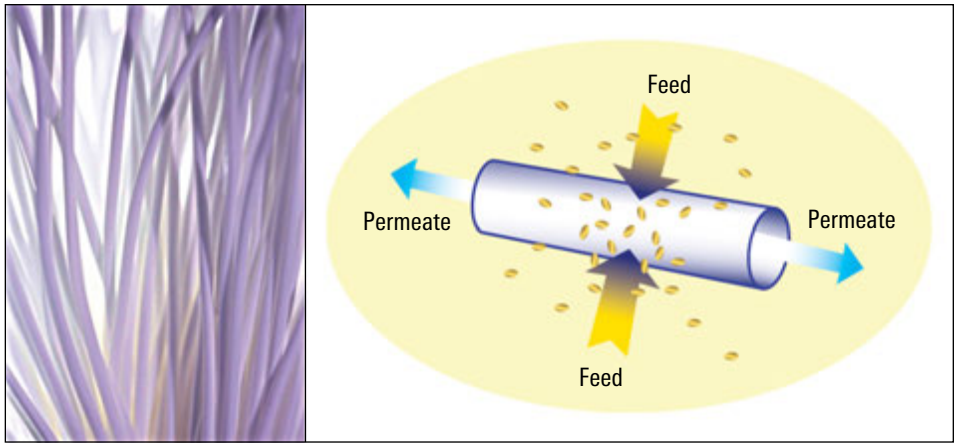
- less susceptible to plugging by suspended matter
- simple cleaning of the membrane surface with air and water
- high area-to-volume ratio for compact packaging.



Each membrane module consists of a pressure vessel that houses a number of membrane bundles, with each bundle comprising hundreds of hollow membrane fibers. Feedwater flows from the outside of the membrane to the inside before exiting the vessel. The module is installed in a vertical position.

The Polymem UF system typically is divided into a number of parallel streams (or racks), with each rack comprising several membrane modules operating simultaneously and in parallel. The system design flux is selected following evaluation of the feedwater quality and temperature.

The system can be supplied as a complete module or as a number of separate skids, offering flexibility to suit project needs.



Close view of a UF membrane fiber.

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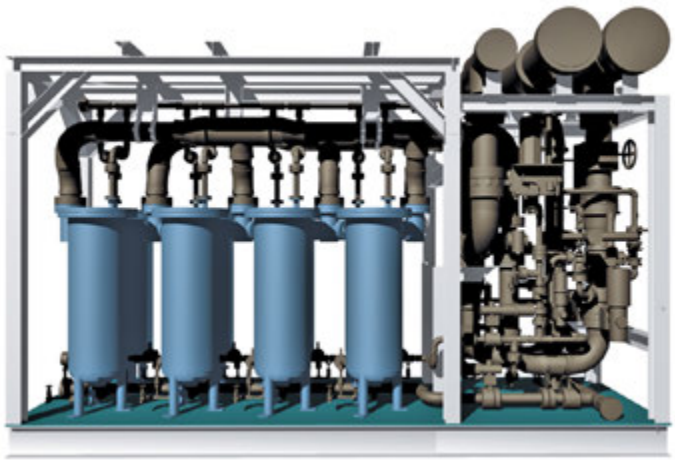
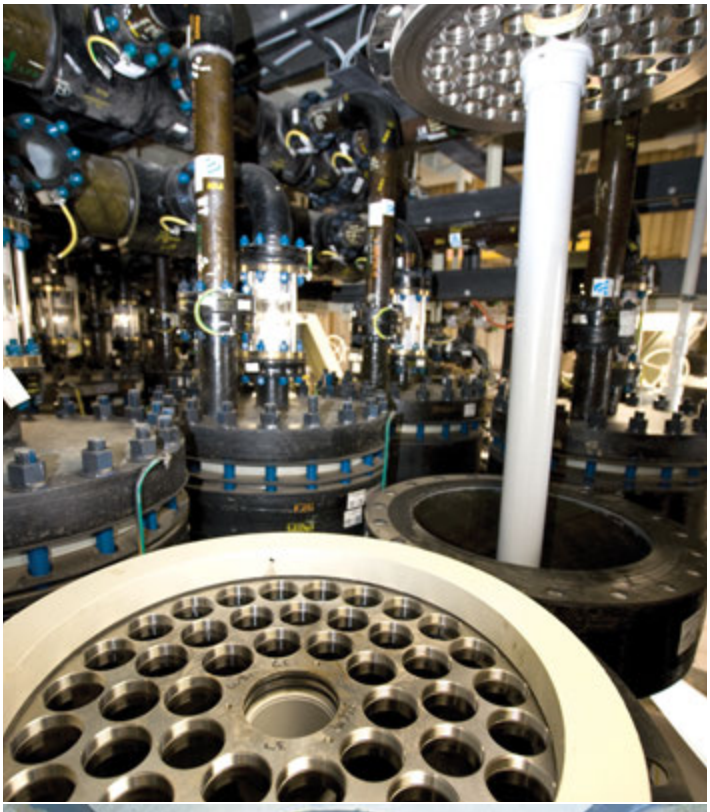


Membrane modules on a single skid.

UF membrane housing vessels.

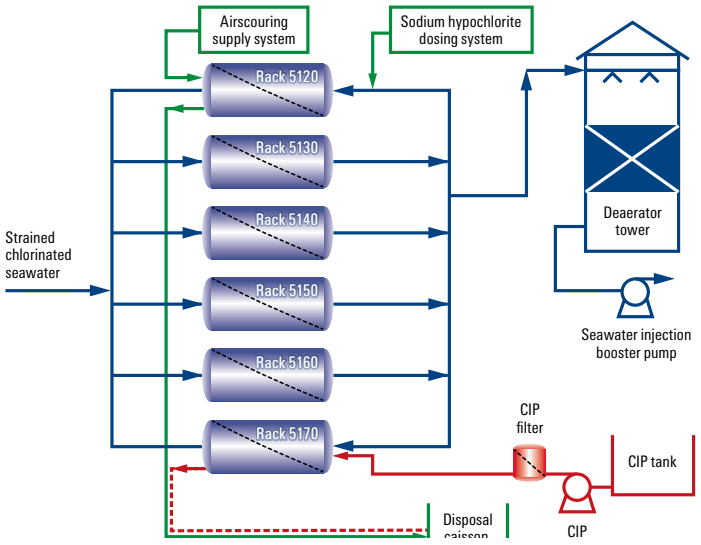


There are 49 bundles contained in a 24-in diameter module. Pictured (bottom) is one bundle filled with hollow membrane fibers.

Operation

During normal operation, the suspended material in the feedstream is retained on the membrane surface as a cake. At a predetermined interval, automatic cleaning procedures are performed to remove the cake and restore clean performance. Offline cleaning-in-place (CIP) packages are also provided.

CIP packages typically are designed with redundancy so that the specified design permeate output can be maintained during backwashing, cleaning, and routine maintenance. For deepwater intakes where suspended solids content is very low, the normal system flux is around 1.96 galUS/ft^2/h [80 L/m^2/h] when data are normalized at 68 degF [20 degC]. Normal operation assumes that one rack is offline and another rack is in backwash mode.



Process flow schematic.

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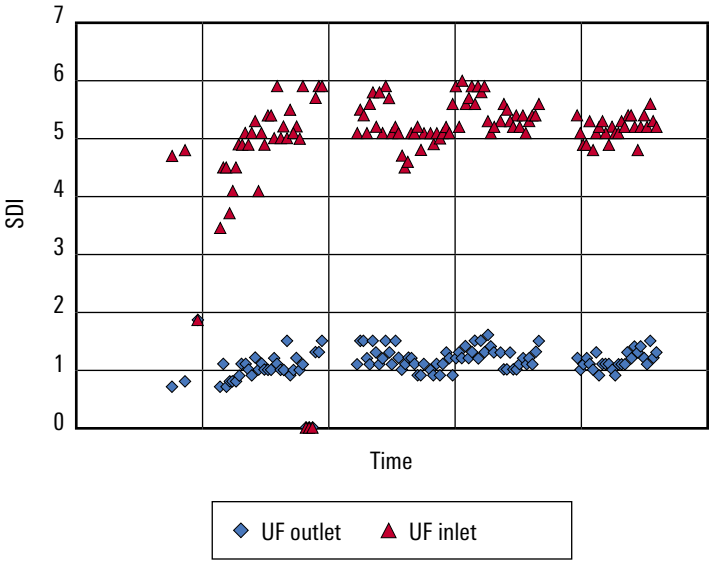
Efficiency and environmental consciousness

Membrane separation is an efficient method of removal, which is intrinsically safe and environmentally sound. The high-quality seawater product typically has a silt density index (SDI) of less than 2. The system operates with approximately 95% water recovery with losses due to membrane cleaning operations.

Cost savings

Overall, the efficient removal of particulates by membrane separation can reduce the risk of lost and deferred production. Considerable weight is saved when UF is used compared with media filtration systems. The operational costs are reduced due to the elimination of cartridge filter replacement.



Operational data from an offshore facility.

System with UF (top) and RO (bottom).

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