ADEPT
Pure Water Techniques

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A guide to Reverse Osmosis

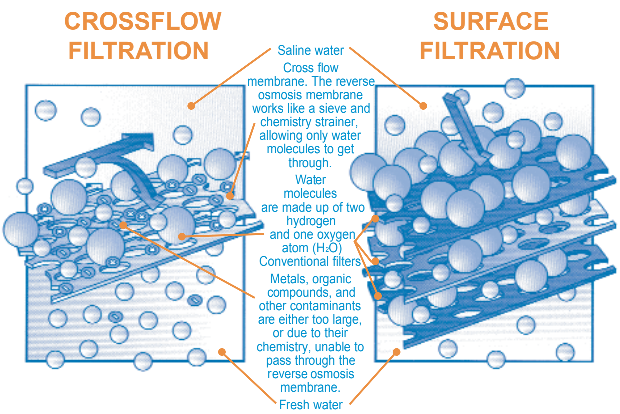
Why use Reverse Osmosis?

The major advantage of reverse osmosis is that impurities are captured on the membrane are constantly swept away by the concentrate stream, thus continually cleaning the membrane surface. This prolongs its life and reduces maintenance costs. In contrast, conventional filters accumulate the captured impurities on the filter medium and must be periodically cleansed and/or replaced, posing obvious economic and/or environmental disadvantages.

How Reverse Osmosis works

The Difference Between Membrane Separation and Conventional Filtration

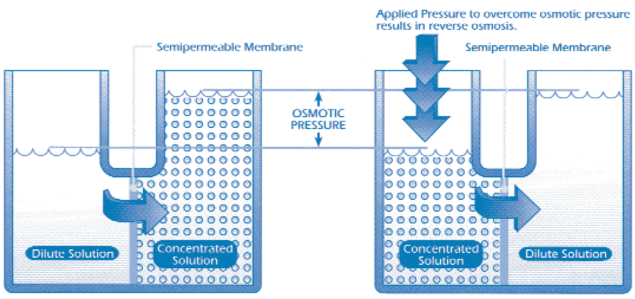
There are distinct differences between membrane separation technology and conventional filtration. Membrane separation technologies all combine pressure with unique membranes to remove impurities from water. The technology employs the concept of reverse osmosis whereby the fluid being filtered, the feed stream, is split into two streams: a permeate stream consisting of the filtered, pure water, and the concentrate stream containing the rejected impurities. In splitting this feed stream in two, flow is directed both through the membrane (creating the clean permeate stream), and across or parallel to the membrane, creating the impure concentrate stream, or reject. This reverse osmosis system is unlike conventional dead end filters which flow in one direction – through the filter.



The Difference Between Reverse Osmosis and Osmosis

In order to reverse the natural tendencies of water and salt movement and force clean water to flow from salty water, the osmotic pressure must be overcome, i.e. osmosis must be reversed. In order to reverse this flow of water, membrane systems, and Reverse Osmosis systems in particular, utilise a specially constructed semi-permeable membrane element enclosed inside a pressure vessel. Pressure is applied to reverse the flow of water, the source of which is usually an existing, pressurized line for smaller volumes, or the addition of a pump for larger installations. As pressure is applied to the feed stream, water molecules are passed through the membrane while salts are retained in the feed. Thus, utilising the principles of water and salt movement, and combining them with pressure and membrane technology, the natural osmotic flow is reversed.

OSMOSIS natural phenomenon | **REVERSE OSMOSIS with applied pressure**



The Difference Between RO, NF, UF and MF

The four classifications of membranes (RO, NF, UF and MF) look similar, but are physically and functionally unique. Their creation requires highly advanced polymer chemistry manufacturing techniques involving the coating of thin layers of various types of very porous polymers, or plastics, onto backing materials. Depending on the material, process and chemistry involved, either a reverse osmosis, nano-filtration, ultra-filtration or micro-filtration membrane will emerge.

The principal difference between each type of membrane is in the size of the pores, reverse osmosis membrane pores being the smallest, measuring between 1 and 15 angstroms. To visualise the scale, try imagining the entire Pacific Ocean as one square foot of membrane. In this scenario, the size of a reverse osmosis pore would be roughly the size of a five pence piece, a nano-filtration pore would be the size of a bottle cap, and an ultra-filtration pore the size of a compact disc. Membrane pores are small indeed!

Temperature Correction Factors

Temperature correction factors are listed for all reverse osmosis, nano-filtration and ultra-filtration elements.

Temperature (°C)	Correction factor (mulitply)
4	0.48
10	0.60
16	0.73
21	0.88
25	1.00
27	1.06
32	1.26