



Principles of Reverse Osmosis

Reject Water

A percentage (50-80%) of the feed water does not pass through the membrane but flows across the membrane surface, constantly cleaning it and carrying the inorganic and organic solids to drain. This water is called “reject” or “concentrate.”

Barnstead Membranes

Barnstead offers the following three reverse osmosis membrane materials:

- Cellulose acetate
- Polyamide
- Thin film

Feed Water Factors

Feed water factors affecting membrane performance and life include the following:

Pressure

Feed water pressure affects both the quantity, and to a lesser degree, the quality of reverse osmosis product water. Lower feed water pressure causes lower product flow rates and slightly lower product purity.

pH

Feed water pH range is important and Barnstead recommends using wider pH range membranes when feed water is basic, acidic, or unstable.

Langlier Saturation Index (LSI)

The LSI indicates the tendency for scale to form on a membrane surface. It requires feed water testing for temperature, total inorganic solids, calcium hardness, alkalinity, and pH. If the LSI calculation is positive, Barnstead recommends installing a water softener (cation exchange) or MPS (membrane protection system) prior to the reverse osmosis system. A water softener exchanges scale forming ions with sodium. The MPS envelopes the membrane surface and prohibits scale build up.

Free Chlorine and Bacteria

Cellulose acetate membranes requires feed water containing free chlorine to prevent bacterial growth and membrane damage. In contrast, polyamide and thin film membranes are damaged by the presence of free chlorine in the feed water. Activated carbon is used to remove free chlorine when polyamide and thin film membranes are chosen.

Temperature

Reverse osmosis product volume ratings are based on feed water temperatures of 25°C. For every 1°C below 25°C product water quantity is reduced by 3%. When feed water temperature is regularly below 25°C, Barnstead recommends a hot and cold water mixing valve to increase the temperature to 25°C. Feed water which is greater than 35° will damage most membranes.

Silt Density Index

The SDI is a measurement of particles and their tendency to block membranes. To determine SDI, flowing water at specific pressure is filtered through a membrane disc and collected for a fixed period of time. The speed of water flow and total volume collected determine the index value.

Turbidity

Turbidity is a measurement of suspended particles that obscure light rays.

Selecting a System

Prior to choosing a reverse osmosis system, a Barnstead W.A.T.E.R.™ analysis is highly recommended.

MEMBRANE FEED WATER REQUIREMENTS

	Cellulose Acetate Membrane	Polyamide Membrane	Thin Film Composite Membrane
pH	4-8	1-11	1-11
Langlier Index	Negative	Negative	Negative
Free Chlorine	0.2 - 1.0 ppm of free	Damaged by free chlorine; requires carbon pretreatment	Damaged by prolonged exposure to free chlorine requires carbon pretreatment
Bacteria	Damaged by bacteria; requires free chlorine	Not affected	Not affected
Temperature	4°C - 30°C	4°C - 30°C	4°C - 50°C
Still Density Index	< 5%	< 5%	< 5%
Turbidity	< 1 NTU	< 1 NTU	< 1 NTU