HYDRANAUTICS
High Performance Membrane Products
A NITTO DENKO CORPORATION

Hydranautics Design Limits

The Following System Design Limits should be observed when designing a Reverse Osmosis system.

Average flux rates and expected % decrease in flux per year:

Water Type	SDI	Flux	% Flux Decline/year
Surface water	(SDI 2 - 4)	8 - 14 GFD	7.3 - 9.9
Well water	(SDI < 2)	14 - 18 GFD	4.4 - 7.3
RO Permeate	(SDI < 1)	20 - 30 GFD	2.3 - 4.4

Expected % Salt Passage Increase per year:

MembraneType	Abbreviation	% SP Increase/year
Cellulosic membrane	CAB1, CAB2, CAB3	17 - 33
Composite Membrane		
Brackish, Low Pressure	ESPA1, ESPA2, ESPA3	3 -- 17
Brackish, High Rejection	CPA2, CPA3, CPA4	3 -- 17
Low Fouling	LFC1, LFC2	3 -- 17
Seawater	SWC1, SWC2, SWC3	3 -- 17
Softening, PolyVinyl Deriv.	PVD1, ESNA1, ESNA2	3 -- 17

Maximum Feed Flow and Minimum Concentrate Flow Rates per Vessel:

Membrane Diameter (in)	Max (GPM)	Max (m^3/hr)	Min (GPM)	Min (m^3/hr)
4	16	3.6	3	0.7
6	30	8.8	7	1.6
8	75	17.0	12	2.7
8.5	85	19.3	14	3.2

Saturation Limits for Sparingly Soluble Salts in the Concentrate:

Salt	Saturation %
$CaSO_4$	230
$SrSO_4$	800
$BaSO_4$	6000
SiO_2	100

Limits of Saturation Indices (Langelier and Stiff & Davis Saturation Indices):

Condition*	LSI Value
LSI and SDSI without scale inhibitor	$\leq$ -0.2
LSI & SDSI with SHMP	$\leq$ 0.5
LSI & SDSI with organic scale inhibitor	$\leq$ 1.8