System Design
Membrane System Design Guidelines for Midsize FilmTec™ Elements

Membrane System Design Guidelines for Midsize FilmTec™ Elements

The following tables show the recommended guidelines for designing RO systems with 2.5- and 4-inch FilmTec™ Elements in light industrial, small commercial, and institutional applications, or for piloting large systems.

Light industrial systems in Table 1 have the same requirements as for large systems, requiring stable performance over several years. They are sometimes used for piloting large systems with continuous operation, CIP facilities, and no (or minimal) concentrate recirculation. The expected membrane lifetime is more than 3 years.

Table 1: Design guidelines for FilmTec™ Elements in light industrial and small seawater applications

Feed Source	RO Permeate	Well Water	Softened Municipal	Surface	Wastewater (filtered tertiary effluent)		Seawater	
					MF[1]	Conventional	Well or MF[1]	Open Intake
Feed Silt Density Index (%/min)	SDI < 1	SDI < 3	SDI < 3	SDI < 5	SDI < 3	SDI < 5	SDI < 3	SDI < 5
Typical Target Flux, gfd (lmh)	22 (37)	18 (30)	16 (27)	14 (24)	13 (22)	11 (19)	13 (22)	11 (19)
Maximum Element Recovery (%)	30	19	17	15	14	12	15	13
Element Diameter	**Maximum Permeate Flowrate, gpd (m^3/d)**							
2.5-inch	800 (3.0)	700 (2.6)	600 (2.3)	500 (1.9)	500 (1.9)	400 (1.5)	700 (2.6)	600 (2.3)
4.0-inch (except fullfits and LC products)	2,200 (8.4)	1,800 (6.8)	1,600 (6.0)	1,400 (5.4)	1,300 (4.8)	1,100 (4.1)	1,600 (6.0)	1,500 (5.7)
4.0-inch diameter (LC products)	2,600 (10.1)	2,100 (8.2)	1,900 (7.2)	1,700 (6.5)	1,500 (5.7)	1,300 (5.0)	-	-
Fullfit 4040	2,500 (9.7)	2,000 (7.8)	1,800 (6.9)	1,600 (6.2)	1,400 (5.5)	1,300 (5.0)	-	-
Element Type	**Minimum Concentrate Flowrate, gpm (m^3/h)**							
2.5-inch diameter	0.7 (0.16)	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)
4.0-inch diameter (except fullfits)	2 (0.5)	3 (0.7)	3 (0.7)	3 (0.7)	4 (0.9)	5 (1.1)	3 (0.7)	4 (0.9)
Fullfit 4040	6 (1.4)	6 (1.4)	6 (1.4)	6 (1.4)	6 (1.4)	6 (1.4)	-	-

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Membrane System Design Guidelines for Midsize FilmTec™ Elements (cont.)

Element Type	Maximum Feed Flowrate gpm (m^3/h)	Maximum Pressure Drop per Element psig (bar)	Maximum Feed Pressure psig (bar)
Tape-wrapped 2540	6 (1.4)	13 (0.9)	600 (41)
Fiberglassed 2540	6 (1.4)	15 (1.0)	600 (41)
Seawater 2540	6 (1.4)	13 (0.9)	1,000 (69)
Tape-wrapped 4040	14 (3.2)	13 (0.9)	600 (41)
Fiberglassed 4040	16 (3.6)	15 (1.0)	600 (41)
Seawater 4040	16 (3.6)	15 (1.0)	1,000 (69)
Fullfit 4040	18 (4.1)	15 (1.0)	600 (41)

[1] MF: Microfiltration – continuous filtration process using a membrane with pore size of < 0.5 micron.
[2] We recommend that the pressure drop for new/clean elements be at least 20% below the maximum.
Note: The limiting values listed above have been incorporated into the WAVE software. Designs of systems in excess of the guidelines results in a warning on the WAVE report.

In Table 2, the small commercial systems typically contain 1 – 6 elements that are either regularly replaced or cleaned (every half year or year) or performance loss is acceptable. The expected element lifetime is not more than 3 years. This is a low-cost, compact solution for intermittently operated systems.

Table 2: Design guidelines for FilmTec™ Elements in small commercial applications

Feed Source	RO Permeate	Softened Municipal	Well Water	Surface or Municipal Water
Feed Silt Density Index (%/min)	SDI < 1	SDI < 3	SDI < 3	SDI < 5
Typical Target Flux, gfd (lmh)	30 (51)	30 (51)	25 (42)	20 (34)
Maximum Element Recovery (%)	30	30	25	20
Maximum Permeate Flowrate, gpd (m^3/d)				
2.5-inch diameter	1,100 (4.2)	1,100 (4.2)	900 (3.4)	700 (2.7)
4.0-inch diameter	3,100 (11.7)	3,100 (11.7)	2,600 (9.8)	2,100 (7.9)
Minimum Concentrate Flowrate, gpm (m^3/h)				
2.5-inch diameter	0.5 (0.11)	0.5 (0.11)	0.7 (0.16)	0.7 (0.16)
4.0-inch diameter	2 (0.5)	2 (0.5)	3 (0.7)	3 (0.7)

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Membrane System Design Guidelines for Midsize FilmTec™ Elements (cont.)

Element Type	Maximum Feed Flowrate U.S. gpm (m^3/h)	Maximum Pressure Drop per Element psig (bar)	Maximum Feed Pressure psig (bar)
Tape-wrapped 2540	6 (1.4)	13 (0.9)	600 (41)
Fiberglased 2540	6 (1.4)	15 (1.0)	600 (41)
Seawater 2540	6 (1.4)	13 (0.9)	1,000 (69)
Tape-wrapped 4040	14 (3.2)	13 (0.9)	600 (41)
Fiberglassed 4040	16 (3.6)	15 (1.0)	600 (41)
Seawater 4040	16 (3.6)	15 (1.0)	1,000 (69)

[1] We recommend that the pressure drop for new/clean elements be at least 20% below the maximum.

Note: The limiting values listed above have been incorporated into the WAVE software. Designs of systems in excess of the guidelines results in a warning on the WAVE report.

Excerpt from FilmTec™ Reverse Osmosis Membranes Technical Manual (Form No. 45-D01504-en), Chapter 3, "System Design."

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