FILMTEC™ Membranes

Success with FILMTEC SW30HR LE-400 Elements

Results from field trials in a number of piloting sites and industrial-scale installations validate the performance of, and cost reductions available with FilmTec's high-rejection, low-energy seawater reverse osmosis (SWRO) membrane elements.

Table 1. Projects using FILMTEC™ SW30HR LE-400 (partial listing)

Location	Country	Enduser/OEM	Application	No. of elements	Element	Feedwater	Year installed
Terneuzen	Netherlands	Dow Chemical	Process	528	SW30HR LE-400	Sea, open	2002
Belize	Belize	Consolidated Water	Potable	48	SW30HR LE-400	Sea, well	2002
Galdar	Spain	Agragua	Irrigation	360	SW30HR LE-400	Sea, well	2003
North Sea	Germany	Kaercher	Unknown	48	SW30HR LE-400	Sea	2003
Lanzarote	Spain	INALSA	Potable	18	SW30HR LE-400	Sea, well	2003
Dhekhelia	Cyprus	Caramondani	Potable	6	SW30HR LE-400	Sea, open	2003
Mediterranean	Italy	Epuro	Unknown	12	SW30HR LE-400	Sea	2003
Mediterranean	Undisclosed	Undisclosed	Potable	48	SW30HR LE-400	Sea, open	2003
Lanzarote	Spain	INALSA	Potable	560	SW30HR LE-400	Sea, well	2004
Ummluj	Saudi Arabia	SWCC	Potable	6	SW30HR LE-400	Sea, open	2004
Mediterranean	Undisclosed	Undisclosed	Potable	800	SW30HR LE-400	Sea, open	2004
Boudjour	Morocco	Proagua	Potable	238	SW30HR LE-400	Sea, well	2004
Fuerteventura	Spain	La Oliva	Potable	154	SW30HR LE-400	Sea, well	2004
Caribbean	Curacao	ONDEO	Potable	1,932	SW30HR LE-400	Sea, well	2004
Rambla Morales	Spain	Tecnicas	Potable	5,040	SW30HR LE-400*i*	Sea, well	2007
Ashkelon	Israel	OTID	Potable	25,280	SW30HR LE-400	Sea, open	2005

FILMTEC SW30HR LE-400 elements were previously named FILMTEC SW30HR LE-380 until June, 2004.

Field Results Using FILMTEC™ SW30HR LE-400

Many test sites, delivered projects and systems are currently using FILMTEC™ SW30HR LE-400 elements; operation data from six of them are presented below. Today this element is also available with the performance enhancing *iLEC*™ interlocking endcap technology and is named FILMTEC SW30HR LE-400*i*.

Dhekhelia, Cyprus – A plant operated by Caramondani to produce potable water treats a 40,700 mg/L (40,500-41,000), 28 °C (24-31), pH 6.7 (6.4-7.0) open intake feed with salt density index (SDI) of 2.7 (2.1-2.9) and boron of 5.7 mg/L (5.1-6.2), and also uses Dupont hollow fine fiber membranes. A test vessel in the plant is equipped with FILMTEC SW30HR LE-400 elements. With a feed pressure of about 72.5 bar (72-73), permeate back pressure of 2.5 bar (1.5-3.5) and the feed flow is 8.0 m^3/h (7.5-8.5), the resulting performance is as follows: at a recovery of 52% (49-55%), the vessel of six elements produces 4.0 m^3/h (3.4-4.6 m^3/h) permeate with a salinity of 230 mg/L (180-280) and the permeate contains boron at 1.1 mg/L (0.75-1.35), which corresponds to a normalized performance of 7,500 gpd, 99.69% NaCl rejection and 90% boron rejection at start. During operation, a flux reduction has been observed while NaCl and boron rejection improved.

Field Results Using FILMTEC™ SW30HR LE-400 (cont.)

Lanzarote, Spain – A plant operated by Inalsa to produce potable water includes a sand beach well having an SDI around 1, and a salinity of 38,500 mg/L with a temperature range between 20 to 22°C. The tests were carried out with six elements in a single pressure vessel. With the FILMTEC™ SW30HR LE-400 elements, the flow per pressure vessel under these conditions was 4.7 m^3/h, which is equivalent to a flux of 22 L/m^2h, while the recovery was 34%. Feed pressure was 63.5 bar and the permeate pressure was 1.5 bar, corresponding to a normalized flow rate of 7,200 gpd. The permeate TDS is 100 mg/L versus the projected 120 mg/L, which corresponds to a normalized rejection of 99.78%. With a feed boron content of 5.6 mg/L and a pH of 7, the permeate boron concentration is 0.60 mg/L, which corresponds to a normalized boron rejection of 92.0%.

Mediterranean – A plant in an undisclosed location uses a feed of 40,700 mg/L (40,500-41,000), at 18-21 °C, with the pretreatment of the open intake feed consisting of flocculation (multi-media filtration that results in the RO feed having an SDI continuously below 3). Six pressure vessels were installed in the normal plant. Operating at 70-71 bar (back pressure 0.8 bar) and a recovery of 49-50%, a typical eight-element pressure vessel produces 4.6-4.8 m^3/h with a permeate TDS of 220 mg/L. This corresponds to a normalized performance of 7,200 gpd and 99.73% NaCl rejection. At a pH of of 7.0, and a feed boron content of 5.5 mg/L, the permeate contains 0.85-1.01 mg/L boron which corresponds to a normalized boron rejection of 90.7%.

Terneuzen, Netherlands – A two-pass plant to produce process water is operated with estuary North Sea open intake water and pretreated with microfiltration membranes. The feed salinity is between 15,000 and 20,000 mg/L and the temperature variation, due to seasonal changes, is between 12 to 17°C. The configuration of the plant is two stages with 44 pressure vessels and six FILMTEC SW30HR LE-400 elements per vessel (264 elements). The recovery is 55% at a flux of 22 L/ m^2h. The pressure is 36.9 bar, corresponding to an average standard element performance of 7,860 gpd. The TDS in the permeate was 47 mg/L corresponding to 99.79% rejection. With a feed boron concentration of 2.55 mg/L and a pH of 7.3 the permeate concentration was 0.21 mg/L corresponding to a normalized boron rejection of 91%. Five to 10 days after start-up the flow decreased to 90-95% of original value (7,100-7,500 gpd) and is performing at this level. The salt passage came down to about 90% as well, corresponding to an average standard element rejection of 99.81%.

Galdar, Spain – A plant operated by Agragua produces water for agricultural purposes and was originally designed for Dupont hollow fine fiber RO elements. One train was retrofitted for spiral wound RO elements using 60 vessels, each with six FILMTEC SW30HR LE-400 elements. These have allowed the operators to reduce pressure and increase water production at reduced pressure. With a 39,000 mg/L feed at 21 °C and a recovery of 45%, the plant now produces 207 m^3/h of 170 mg/L permeate at a feed pressure of 63.2 bar and a permeate pressure of 3.2 bar. This corresponds to a normalized flow rate of 7,200 gpd and a normalized rejection of 99.79%.

How Much Can You Save?

FILMTEC™ membrane elements can be used across the entire range of seawater applications to lower your total desalination costs. These field examples show some of the significant productivity and cost advantages of using FILMTEC HR LE-400 elements. Consult your Dow representative to determine which elements can provide the greatest economic benefit for your specific case.

For More Information

More details about the performance and economic advantages of FILMTEC seawater RO membrane elements are available on our website, www.filmtec.com/sw:

- "*Strategies for Using FILMTEC Elements to Lower Your Total Cost of Desalination*", Form No. 609-00471
- "*How to Achieve the Lowest Energy Desalination with FilmTec's New High-Flow, High-Rejection Seawater Element*", Form No. 609-00472
- "*Solutions from FilmTec – Improve Your Desalination Economics*", Form No. 609-00475
- "*Solutions from FilmTec – High-Flow, High Rejection Membranes for the Lowest Total Cost of Desalination*", Form No. 609-00476
- "*How FilmTec's New High-Rejection, Low-Energy Seawater Element Can Reduce Your Desalination Costs*", Form No. 609-00437

Learn more about the economic and performance benefits of *¡LEC*™ interlocking endcaps:

- "*Say 'Goodbye' to the Weakest Link*", Form No. 609-00447
- "*How to Improve Permeate Quality Using FilmTec's Interlocking Endcaps*", Form No. 609-00446
- "*¡LEC Interlocking Endcaps Make Sea Water Desalination Processing Easier, Less Expensive*", Form No. 609-00466
- "*¡LEC Interlocking Endcaps Solve Leakage Problems and Improve Energy Efficiency in Semiconductor Plant*", Form No. 609-00467
- "*¡LEC Interlocking Endcaps Withstand Severe Treatment at Reverse Osmosis Facility*", Form No. 609-00468

FILMTEC Membranes
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