Drinking Water Reverse Osmosis and Nanofiltration Spiral Wound Membranes

CUSTOMER BENEFITS

Veolia offers a wide range of membranes which are well suited for all types of drinking water applications

Application

Many drinking water plants are faced with balancing multiple priorities and stakeholders in their mission to provide a healthy, safe, and sustainable water supply for their communities. In some areas, plants have concerns about pollutants and micropollutants. This includes more widely present compounds such as nitrate and also emerging contaminants. In other areas, energy is not just an important factor in operating cost but is only available in limited quantities. In addition, water quality remains unique to each plant and each intake. Drinking water plants regularly turn to trusted experts at Veolia to ensure they can provide reliable, high-quality drinking water in an increasingly challenging environment while operating effectively and efficiently. Veolia spiral wound membranes are a critical part of many solutions.

Product Offering Overview

Veolia has a full portfolio of spiral wound reverse osmosis and nanofiltration spiral wound membranes that can be used in drinking water applications all over the world. For treating brackish waters, Veolia offers multiple combinations of flow, energy consumption, and rejection that can be chosen from to find the best fit for each specific opportunity. These range from the highest rejecting AG H Series to the low energy AK and AK H Series and the ultra-low energy AL Series. In some brackish waters where hardness removal is the primary objective, the best solution is a nanofiltration membrane such as the HL Series, HM Series, or HN Series. Veolia also offers elements capable of seawater desalination with the AC, AD, AE, and AE LE Series.

The list in Table 1 reflects Veolia's clear priority in providing technology that promotes the health, safety, and sustainability of our partner communities.

Table 1: Veolia spiral wound membranes with use in drinking water applications

Type of Water	Type of Spiral Wound Element	Product Name
Bracking Water	Standard Pressure	AG Series, AG FR Series, and Durafoul RO1 Series
	Standard Pressure with High Rejection	AG H Series and AG FR H Series
	Balanced Low Energy & Rejection	AG LE H Series
	Low Energy	AK Series
	Low Energy and High Rejection	AK H Series
	Ultra-Low Energy	AL Series and AP Series
	Nanofiltration	HL Series, HM Series, and HN Series
Seawater	Very High Rejection, High Rejection, Low Energy, Ultra-Low Energy	AC Series, AD Series, AE Series, and AE LE Series

Low and Ultra-Low Energy Membranes

To the advantage of our partner communities, Veolia's low energy membranes are known to deliver high-quality water with reduced pressure and energy demand that lowers operating costs, and is a step forward in the ongoing sustainability journey. The AK H Series of low energy spiral wound membranes is a high-performance series with high rejection of salts (Table 2), micropollutants, and low molecular weight organics while further reducing operating costs through longer product lifetimes. The membrane used in these elements was designed with a very hydrophilic surface which combats fouling by reducing

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the adsorption of organics and minimizes cleaning frequency, thereby enabling the already high rejection of the AK H Series to remain more stable for the life of the element. Further, the 400 square feet active area membranes include an optimized 34 mil feed spacer to improve pressure drop and provide another fouling-resistant feature.

AK H Series membranes have been tested on various contaminants and micropollutants with excellent results. A list of some important compounds is included in Table 3.

Additionally, Veolia offers the standard low energy AK Series to realize many of the low energy benefits listed above but at a lower price than the AK H Series.

Table 2: Fact sheet specifications for AK Series and AK H Series

Model	Average permeate flow gpd (m^3/day)	Typical NaCl rejection	Minimum NaCl rejection
AK-400 H	11,000 (41.6)	99.65%	99.50%
AK-440 H	12,000 (45.4)	99.65%	99.50%
AK8040F-400	11,000 (41.6)	99.0%	98.0%
AK8040F-440	12,000 (45.4)	99.0%	98.0%

Testing conditions: 500 ppm NaCl solution at 115 psi (793 kPa) operating pressure, 77°F (25°C), pH 7 and 15% recovery.

Table 3: Measured rejection of a few contaminants and micropollutants

Tested contaminant	Measured rejection
Nitrate	97.0%
1,4-dioxane	95.8%
Gen X	97.3%
Iomeprol	98.7%
Acesulfam	90.4%
Carbamazepine	99.3%
Mecoprop	99.0%
Diclofenac	99.6%
Ibuprofen	99.6%

Testing conditions varied, including 500 ppm NaCl solution at 115 psi (793 kPa) operating pressure at 77°F (25°C), pH 7 and 15% recovery with 200 mg/L NO3 and 5 µg/L iomeprol, acesulfam, carbamazepine, mecoprop, diclofenac, and ibuprofen. Gen X and 1,4-dioxane were tested at approximately 25°C, 95 psi (660 kPa), feed conductivity 125 µS/cm, and 92% recovery with 0.2 ng/L 1,4-dioxane and < 5 ng/L Gen X.

For customers with low salinity feedwater, or when energy savings and associated operating costs are most important, Veolia also offers the AL Series and AP Series spiral wound membranes. In combination with the prioritized ultra-low energy performance, these products are designed to provide a strong reverse osmosis quality barrier to many salts and micropollutants that accomplishes the goals of safe and healthy drinking water.

Higher Rejection Brackish Water Products

In municipalities where very high removal of micropollutants is a primary concern, other high rejection brackish water reverse osmosis spiral wound membranes are the more ideal fit than low and ultra-low energy membranes. Several other product series present interesting options for a drinking water plant to consider.

First, AG H Series offers the highest typical and minimum rejection of all Veolia brackish water RO products and can be used in many applications, but was designed for cleaner RO feed water. Table 4 lists the specifications for AG H with more information available in the fact sheet.



If the water source has more fouling potential, such as a surface water source, then Veolia's second option is the AG FR H Series of membrane shown in Table 5, that has only a very small reduction in rejection while optimizing the design to be more fouling resistant. Veolia also offers the Durafoul RO1 Series when more severe fouling conditions are expected. The Durafoul RO1 Series reduces the frequency of clean-in-place operations, enables more effective cleanings, and generates energy savings through a significant reduction in pressure drop.

The third option with higher rejection (normalization must be accounted for) than the low energy membranes is the AG LE H Series shown in Table 6, that was developed to provide intermediate energy

savings between the AG H or AG FR H Series and the low energy AK H Series. This AG LE H product gets used most often when energy savings is an important consideration, but fouling potential of the water source requires lower flux than the AK H Series.

When small reductions in the rejection of the membranes is acceptable to meet local treatment goals, Veolia also offers the standard AG Series and AG FR Series spiral wound membranes. Both of these deliver high rejection, but at a lower price than the AG H Series and AG FR H Series.

Table 4: Fact sheet specifications for AG H Series and AG Series

Model	Average permeate flow gpd (m^3/day)	Typical NaCl rejection	Minimum NaCl rejection
AG-400 H	11,000 (41.6)	99.8%	99.65%
AG-440 H	12,000 (45.4)	99.8%	99.65%
AG8040F-400	11,000 (41.6)	99.65%	99.4%
AG8040F-440	12,000 (45.4)	99.65%	99.4%

Testing conditions: 2,000 ppm NaCl solution at 225 psi (1,550 kPa) operating pressure, 77°F (25°C), pH 7 and 15% recovery

Table 5: Fact sheet specifications for AG FR H Series, Durafoul RO1 Series, and AG FR Series

Model	Average permeate flow gpd (m^3/day)	Typical NaCl rejection	Minimum NaCl rejection
AG-400 FR H	11,000 (41.6)	99.8%	99.5%
Durafoul RO1	11,000 (41.6)	99.6%	99.3%
AG8040F-400 FR,34	11,000 (41.6)	99.65%	99.3%

Testing conditions: 2,000 ppm NaCl solution at 225 psi (1,550 kPa) operating pressure, 77°F (25°C), pH 7 and 15% recovery

Table 6: Fact sheet specifications for AG LE H Series

Model	Average permeate flow gpd (m^3/day)	Typical NaCl rejection	Minimum NaCl rejection
AG-400 LE H	10,000 (37.9)	99.65%	99.2%
AG-440 LE H	11,000 (41.6)	99.65%	99.2%

Testing conditions: 2,000 ppm NaCl solution at 150 psi (1,034 kPa) operating pressure, 77°F (25°C), pH 7 and 15% recovery

Nanofiltration Products

Nanofiltration spiral wound membranes are increasing in global usage in drinking water applications due to the ability to remove hardness, organics, and some micropollutants. Further, nanofiltration operations can help plants manage sometimes complicated brine discharge regulations. As a result, communities are finding that nanofiltration can provide balanced, healthy drinking water operations. Veolia offers several different product series depending on the relative importance of rejection and energy savings from the HL Series and HM Series, to the low energy HN Series.

Seawater Products

Veolia also offers a full range of reverse osmosis elements designed to desalinate seawater for drinking water consumption. This includes the very high rejection AC Series, the high rejection AD Series, the low energy AE Series, and the ultra-low energy AE LE Series.

Contact Information

If you would like to learn more about how Veolia can provide an RO or NF solution for your drinking water needs, contact your Veolia representative, or visit our

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