

# Duratherm\* Excel Series

## Industrial High Temperature Elements

### Description and Use

The Duratherm\* Excel Series includes RO and NF membrane elements. This Series is specifically designed to maximize the benefits of hot water sanitization for industries relying on chemical-free sanitization for product quality and/or industry compliance standards.

The separation system sanitization protocol is performed via periodic exposure to temperatures as high as 90°C (194°F) at minimum feed pressure to kill microorganisms by denaturation and coagulation of the proteins chains.

The Duratherm Excel elements are also suitable for separation systems at temperatures up to 80°C (176°F).

All element constructions include polysulfone ATD & central tube and a patented Durasan\* cage outer wrap.

### Features and benefits

- Kill bacteria
- Prevent bio-fouling development
- No disposal costs
- 100% wet testing Quality Assurance
- Durable construction
- Sanitization on the permeate side

### Markets

- Food / Beverage
- BioPharm
- Medical / Dialysis
- Electronics
- Chemical

a product of  
**ecomagination**<sup>SM</sup>



**Table 1: Element Specification**

Membrane	Thin-film membrane (TFM*)
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Model	Maximum crossflow gpm (m3/hr)	Recommended crossflow	Salt rejection
Duratherm Excel RO 4040 HR	40 (9.1)	Figure 6	Figure 2
Duratherm Excel RO 4040 HF	40 (9.1)	Figure 6	Figure 2
Duratherm Excel RO 8040 HR	100 (22.7)	Figure 7	Figure 2
Duratherm Excel RO 8040 HF	100 (22.7)	Figure 7	Figure 2
Duratherm Excel NF 4040 HR	40 (9.1)	Figure 6	Figure 3, 4 & 5
Duratherm Excel NF 4040 HF	40 (9.1)	Figure 6	Figure 3, 4 & 5
Duratherm Excel NF 8040 HR	100 (22.7)	Figure 7	Figure 3, 4 & 5
Duratherm Excel NF 8040 HF	100 (22.7)	Figure 7	Figure 3, 4 & 5

Model	Spacer mil (mm)	Active area ft <sup>2</sup> (m <sup>2</sup> )	Part number
Duratherm Excel RO 4040 HR	50 (1.27)	62 (5.8)	1229334
Duratherm Excel RO 4040 HF	50 (1.27)	62 (5.8)	1228969
Duratherm Excel RO 8040 HR	50 (1.27)	257 (23.8)	1228840
Duratherm Excel RO 8040 HF	50 (1.27)	257 (23.8)	1207524
Duratherm Excel NF 4040 HR	50 (1.27)	64 (5.9)	1206950
Duratherm Excel NF 4040 HF	50 (1.27)	64 (5.9)	1207032
Duratherm Excel NF 8040 HR	50 (1.27)	252 (23.4)	1206982
Duratherm Excel NF 8040 HF	50 (1.27)	261 (24.2)	1207045

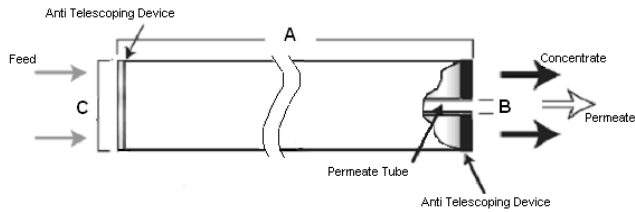
**Table 2: Maximum Pressure Drops**

Range	0°C-50°C psig (kPa)	51°C-70°C psig (kPa)	71°C-80°C psig (kPa)
Over an element	15 (103)	7 (48)	4 (28)
Per housing	60 (414)	30 (207)	15 (103)

Find a contact near you by visiting [www.ge.com/water](http://www.ge.com/water) and clicking on "Contact Us".

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**Figure 1: Element Dimensions Diagram - Female**

**Table 3: Dimensions and Weight**

Model <sup>2</sup>	Dimensions, inches (cm)			Boxed Weight lbs (kg)
	A	B <sup>1</sup>	C <sup>3</sup>	
Duratherm Excel ** 4040 **	40.0 (101.6)	0.625 (1.59)	3.9 (9.9)	9 (4.1)
Duratherm Excel ** 8040 **	40.0 (101.6)	1.125 (2.86)	7.9 (20.1)	29 (13.2)

<sup>1</sup> Internal diameter.

<sup>2</sup> These elements are dried then bagged before shipping.

<sup>3</sup> The element diameter (dimension C) is designed for optimum performance in GE pressure vessels. Others pressure vessel dimension and tolerance may result in excessive bypass and loss of capacity.

**Table 4: Operating and CIP parameters**

Do not exceed 20 GFD (33 LMH) or 2,000 Wagner units under any circumstance.

Typical Operating Pressure	Figures 9 & 10	
Maximum Operating Pressure	1,200 psi (8,273 kPa)	32 – 77°F (0 – 25°C)
	600 psi (4,137 kPa)	78 – 122°F (26 – 50°C)
	400 psi (2,758 kPa)	123 – 158°F (51 – 70°C)
	300 psi (2,068 kPa)	159 – 177°F (71 – 80°C)
	Hot Water Sanitizing	178 – 194°F (81 – 90°C)
Maximum Temperature	Continuous Operation: 177°F (80°C) Clean-In-Place (CIP): 104°F (40°C) Hot Water Sanitizing: 194°F (90°C)	
pH range	Continuous Operation: 3 – 9 clean-In- Place (CIP): 2 – 10.5	
Chlorine Tolerance	500 ppm hours dechlorination recommended	
Feedwater	NTU < 1 SDI < 5	

## Hot Water Sanitization recommendations:

For optimal performance, Duratherm Excel elements should always be cleaned using approved CIP procedures and flushed with fouling free water before the sanitization process. Feed pressure during sanitization should not exceed 40psi (275kPa) and the crossflow should not incur a pressure drop greater than 2psi (14kPa) per element. Heating rate to sanitizing temperature and cool down should not be faster than 5°C (41°F)/minute. Maximum sanitization temperature is 90°C (194°F).

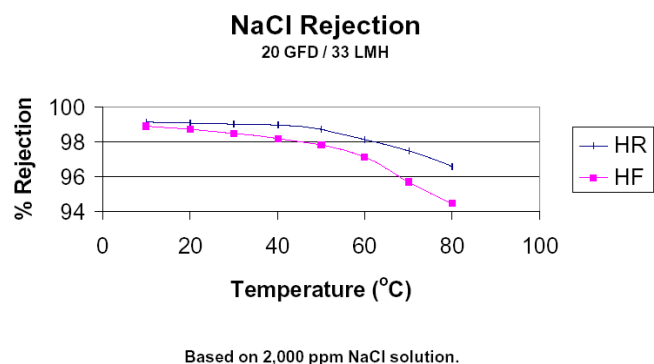
## Loss of permeate flow after repeated 90°C (194°F) sanitization cycles:

It is almost impossible to exactly predict the percentage of permeate flow rate lost from the high temperature sanitations, which among other factors depends on:

- The rate of temperature increase and decrease.
- The presence of other species like organics, ionic and metallic compounds that could locally decrease or increase the temperature at the surface of the membrane.
- The feed flow rate and specifically the heat transfer rate to the membrane surface.
- The thickness and geometry of the feed spacer used.

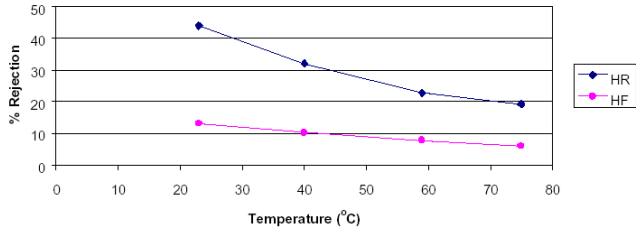
At optimum conditions measured in controlled environment with deionized water, between 30% and 50% of the original permeate flow rate was lost before the element performance had stabilized after repeated heat treatments (over 90% of this flow reduction occurred during the first heat treatment). With the loss of permeate flow rate, the salt rejection increases. The rate of cooling and heating was not more than 5°C (41°F) per minute, and the differential pressure drop per element did not exceed 2 psi.

Pilot testing based on the criteria noted above will give the best operating parameters for any specific application.



**Figure 2: Typical NaCl Rejection dependence on Temperature of Duratherm Excel RO Element**

**Sodium Chloride Rejection**  
Normalized to 20 GFD / 33 LMH

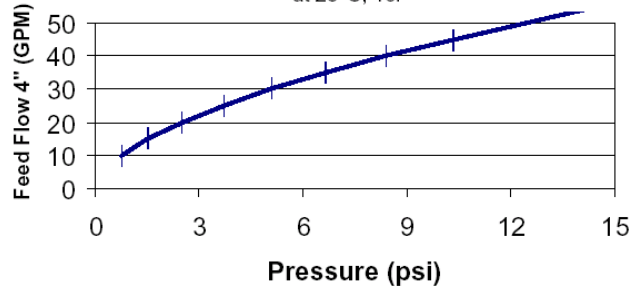


Based on 2,000 ppm NaCl solution.

**Figure 3: Typical NaCl Rejection dependence on Temperature of Duratherm Excel NF Element**

**Pressure Drop vs Flow**

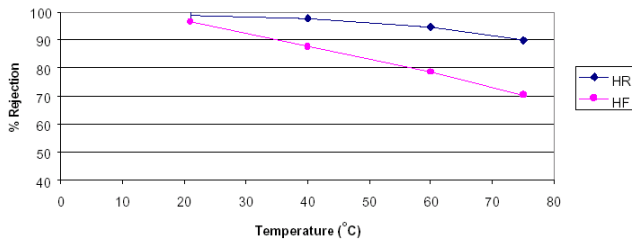
at 25°C, 1cP



\* Based on Osmonics 4" Housings  
\* Use as a guideline, delta P will vary based on tolerances of housing

**Figure 6: Pressure Drop for 4in Element**

**Magnesium Sulfate Rejection**  
Normalized to 20 GFD / 33 LMH

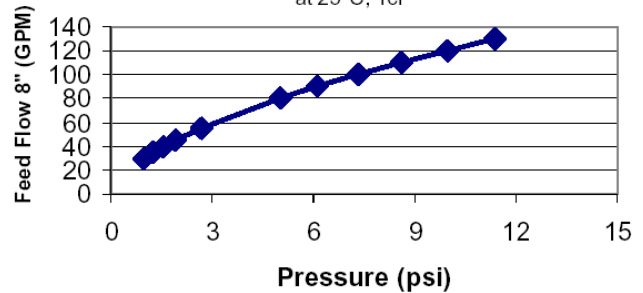


Based on 2,000 ppm MgSO<sub>4</sub> solution.

**Figure 4: Typical MgSO<sub>4</sub> Rejection dependence on Temperature of Duratherm Excel NF Elements**

**Pressure Drop vs Flow**

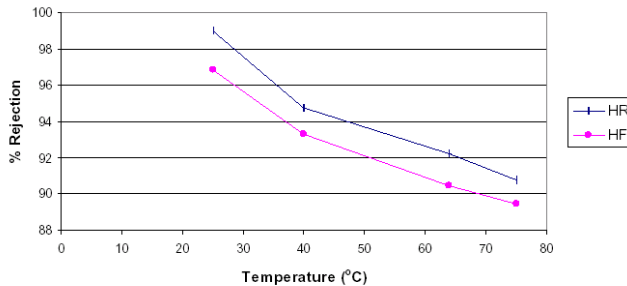
at 25°C, 1cP



\* Based on Osmonics 8" Housings  
\* Use as a guideline, delta P will vary based on tolerances of housing

**Figure 7: Pressure Drop for 8in Element**

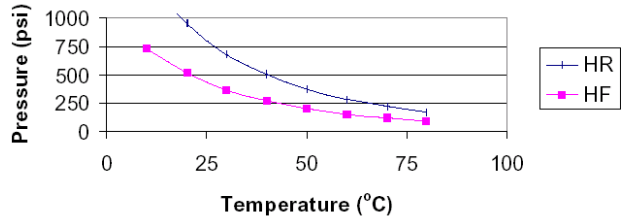
**Disaccharide Rejection**  
Normalized to 20 GFD / 33 LMH



Based on 3.5% disaccharide solution.

**Figure 5: Typical Disaccharide Rejection dependence on Temperature of Duratherm Excel NF Elements**

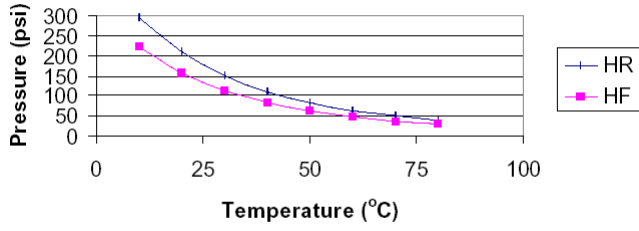
**Net Driving Pressure**  
for 20 GFD / 33 LMH



Based on 2,000 ppm NaCl solution.

**Figure 9: Net Driving Pressure for Duratherm Excel RO Element**

**Net Driving Pressure  
for 20 GFD / 33 LMH**



Based on 2,000 ppm MgSO<sub>4</sub> solution.

**Figure 10: Net Driving Pressure for Duratherm Excel NF Element**

**Wagner Diagram**

Wagner Unit = Temperature (°C) × Pressure (bar)

