Duracon* NF1 Series

FACT SHEET

Sugar processing and acid removal– HWS compatible

The Duracon family of proprietary thin-film nanofiltration membrane elements is characterized by an approximate molecular weight cut-off of 150-300 Dalton for uncharged organic molecules.

Divalent and multivalent ions are preferentially rejected by the membrane while monovalent ions rejection is dependent upon feed concentration and composition. Since monovalent ions pass through the membrane, they do not contribute to the osmotic pressure, thus enabling Duracon nanofiltration membrane systems to operate at feed pressures below those of RO systems. Duracon D-Series membrane has a minimum rejection of 98% on 2,000ppm $MgSO_4$ at 25°C and 110psi operating pressure.

The Duracon NF1 Elements are typically used in food related processes requiring stringent sanitary procedures. This element is designed for daily CIP and periodic hot-water sanitation, while still maintaining element integrity. They are typically used for processing sugar solutions in food-related processes. Applications include demineralization, de-acidification, and sugar concentration.

The Duracon NF1 Elements feature a Durasan* Cage patented outerwrap, a selection of feed spacers, and polysulfone parts.

The Duracon NF1 elements comply with:

- FDA Regulations relevant sections of 21CFR
- EU Framework 1935/2004/EC
- Halal & Kosher certification

Table 1: Element Specification

Membrane	D-series, thin-film membrane (TFM*)

Model	Spacer mil (mm)	Active area ft^2 (m^2)	Part number
Duracon NF1 3840C50	50 (1.27)	55 (5.1)	1206941
Duracon NF1 8040C35	35 (0.89)	343 (31.9)	1229933

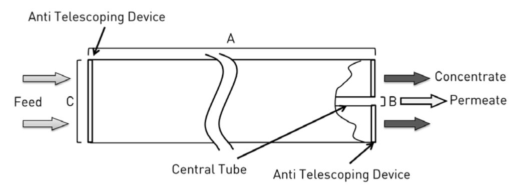

Figure 1 : Element Dimensions Diagram – 8040

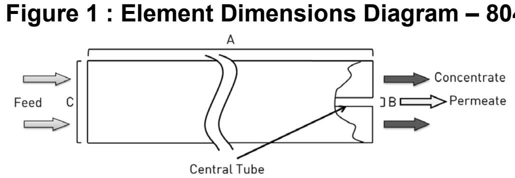

Figure 2 : Element Dimensions Diagram – 3840

Table 2: Dimensions and Weight

Model	Dimensions, inches (cm)			Boxed Weight lbs (kg)
	A	B	C	
Duracon NF1 3840C50	38.75 (98.4)	0.833 (2.12)	3.79 (9.6)	7 (3.2)
Duracon NF1 8040C35	40.00 (101.6)	1.125 (2.86)	7.91 (20.1)	35 (15.9)

Table 3: Operating Parameters

Typical Operating Pressure	140-800 psi (966-5,516 kPa)
Typical Operating Flux	5-20 GFD (8–34 LMH)
Clean Water Flux (CWF) (1)	14 GFD (24 LMH) @ 110 psi
Maximum Pressure (2)	1,200psi (8,273 kPa)
Maximum Temperature	150°F (65°C)
pH Range	3.0-9.0
Chlorine Tolerance	500ppm-hours dechlorination recommended

1) Clean water flux (CWF) is the rate of water permeability through the membrane after cleaning (CIP) at reproducible temperature and pressure. It is important to monitor CWF after each cleaning cycle to determine if the system is being cleaned effectively. CWF can vary ±25%.

(2) Operating pressure in bar multiplied by operating temperature in degree Celsius should not exceed 2000.

Table 4: CIP Parameters

Temperature	pH Minimum	pH Maximum
< 50°C (122°F)	2.0	10.5
< 45°C (113°F)	2.0	11
< 35°C (95°F)	1.5	11.5
< 25°C (77°F)	1.0	11.5

Table 5: Maximum Pressure Drops

Range	0°C-50°C psig (kPa)	51°C-65°C psig (kPa)
Over an element	15 (103)	7 (48)
Per housing	60 (414)	30 (207)

Hot Water Sanitization recommendations

Prior to first use, new elements must be flushed with clean water[1] to remove any residual chemicals for at least an hour, at a transmembrane pressure of not more than 45 psi (3 bar). The system must be started and in operation for minimum 24 hours prior to hot water sanitization.

If the new elements are to be hot water sanitized before first use, the system must be flushed at low transmembrane pressure (up to 45 psi (3 bar)), for minimum 24 hours prior to sanitization.

Transmembrane pressure during hot water sanitization should also be maintained as low as possible, not exceeding 45 psi (3 bar), while ensuring some permeate flow for effective sanitization on the permeate side.

The cross flow to the system should be monitored and adjusted so that the pressure drop is not more than 2 psi per element or 10 psi per housing.

The following procedure should be followed step by step for the hot water sanitization of Duracon elements.

1. The elements that have been in operation should be cleaned with approved Clean In Place (CIP) procedure to remove any mineral scales or organic foulants, and then be thoroughly flushed for at least an hour before sanitization.
2. Increase the temperature in the system from room temperature to target sanitization temperature[2] (up to 90°C/194°F) at a rate not higher than 5°C/9°F per minute. Maintain the target temperature for 30 to 60 minutes.
3. Cool the system to room temperature at a rate not higher than 5°C/9°F per minute.

[1] RO permeate is strongly preferred when available. Feedwater which does not foul or form scale on membrane can also be used but only after appropriate filtration. Note that the solubility of some inorganics, for example calcium carbonate and at least above 45°C calcium sulfate, decreases with increasing temperature.

[2] The effectiveness of heat sanitizing is a function of temperature and time. Duracon elements can withstand 90°C hot water sustained for over 60 minutes, but there is no gain by maintaining the high temperature for longer time than needed to deactivate the microbes that will be deactivated at the chosen temperature.

Loss of permeate flow after repeated 90°C 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:

1. Rate of temperature increase and decrease.

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

At optimum conditions measured in controlled environment with deionized water, around 30% 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 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.

Veolia Water Technologies
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