Duracid Series

FACT SHEET

Industrial acid stable nanofiltration elements

Description and Use

The Duracid NF membrane element is engineered to operate continuously under extreme acid conditions where pH is at or below zero.

The family of Duracid proprietary thin-film nanofiltration membrane elements is characterized by an approximate molecular weight cut-off of 150-200 Dalton for uncharged organic molecules. Divalent and multivalent ions are preferentially rejected by the membrane while monovalent ions and mineral acids commonly have full transmission through the membrane (transmission can vary depending upon feed concentration and composition). Since mineral acids and monovalent ions have high passage through the membrane, these substances have a minor contribution to the osmotic pressure.

Among other applications, Duracid NF Elements are used for acid purification and metals concentration in low pH streams. They feature patented feed spacers, polysulfone parts, and a fiberglass outer wrap. All materials of construction are low pH tolerant.

Features and Benefits

- Extreme low pH stability
- 100% wet testing Quality Assurance
- Durable construction
- High temperature compatibility

Markets

- Metal Surface Treatment / Coating / Galvanic
- Heap Leaching Process in Mining
- Phosphate-based Chemical Production
- Spent Acid Recovery

Application Data

Table 1: Membrane Metal Rejection

Metal Ion	Feed Concentration	Rejection in 5% H_2SO_4 (1)	Rejection in 5% H_3PO_4 (1)
Fe^{2+}	2000 ppm	>90%	>85%
Al^{3+}	2000 ppm	>90%	>85%
Cu^{2+}	2000 ppm	>90%	>85%
Cd^{2+}	100 ppm	>90%	>85%
Ni^{+}	2000 ppm	>90%	>85%

(1) Based on flat sheet test conducted at 25°C (77°F) under 400 psig operating pressure in a dead-end filtration mode. A single acid feed solution was dosed with a mixture of all metals listed in Table 1 for each type.

Table 2: Typical Process Streams

Acid	Concentration
HCl	5-37%
H_2SO_4	5-20%
H_3PO_4	5-20%

Pre-conditioned Elements

To optimize flow and rejection performance of Duracid membranes, a pre-conditioning step is required. Element pre-conditioning consists of a 5min pure water flush at a minimum pressure of 500 psig (3447kPa) at ambient temperature.

Table 3: Element Specification

Membrane	Duracid, Thin-film membrane (TFM*)

Model	Average permeate flow, gpd (m^3/day) (1,2)	Average permeate flow, gpd (m^3/day) (1,3)	Maximum crossflow gpm (m^3/hr)	Average $MgSO_4$ rejection (1,2)
Duracid NF2540F30	155 (0.6)	560 (2.1)	7 (1.6)	98 %
Duracid NF4040F35	525 (2.0)	1,900 (7.2)	18 (4.1)	98 %
Duracid NF8040F35	2,050 (7.8)	10,400 (39.4)	70 (15.9)	98 %

(1) Average permeate flow and salt rejection measured on pre-conditioned elements after 24 hours operation. Individual flow rate may vary ±25%.
(2) Testing conditions: 2,000ppm $MgSO_4$ solution at 110psi (760kPa) operating pressure, 77 °F (25°C), 15% recovery.
(3) Testing conditions: 3% glucose solution at 440psi (3034kPa) operating pressure, 77ºF (25ºC), 15% recovery.

Model	Spacer mil (mm)	Active area ft^2 (m^2)	Outer wrap	Part number
Duracid NF2540F30	30 (0.76)	28 (2.6)	Fiberglass	1231058
Duracid NF4040F35	35 (0.89)	77 (7.1)	Fiberglass	3050564
Duracid NF8040F35	35 (0.89)	333 (30.9)	Fiberglass	1231068

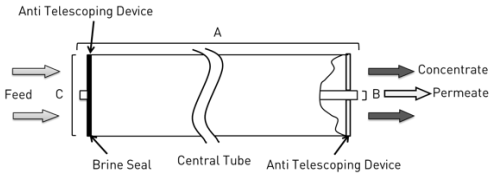

Figure 1: Element Dimensions Diagram (Male) – 2540 & 4040

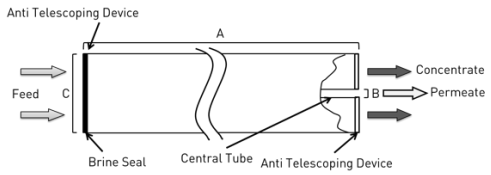

Figure 2: Element Dimensions Diagram (Female) – 8040

Table 4: Dimensions and Weight

Model	Fig.	Dimensions, inches (cm)			Boxed
		A	B	C	Weight lbs (kg)
2540F30	1	40.0 (101.6)	0.75 (1.9)	2.4 (6.1)	4 (1.8)
4040F35	1	40.0 (101.6)	0.75 (1.9)	3.9 (9.9)	11 (5.0)
8040F35	2	40.0 (101.6)	1.125 (2.86)	7.9 (20.0)	35 (15.9)

Table 5: Operating and CIP parameters

Typical Operating Pressure	400 – 800psi (2758 – 5516kPa)
Typical Operating Flux	5 – 14 GFD (9 – 24 LMH)
Clean Water Flux (CWF) (1)	10-19 GFD (17-32 LMH) @ 225psi (1551kPa)
Maximum Operating Pressure	1200psi (8,273kPa) @ T < 77°F (25°C) 800psi (5,515kPa) @ T < 122°F (50°C) 600psi (4,137kPa) @ T < 158°F (70°C)
Maximum Temperature	Continuous operation: 158°F (70°C) Clean-In-Place (CIP): 158°F (70°C)
Continuous pH	Continuous operation: < 10 (up to 70°C)
CIP pH	< 11.0 @ T < 113°F (45°C) < 10.5 @ T < 131ºF (55°C) < 10.0 @ T < 158°F (70°C)
Chlorine Tolerance	500 ppm x 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%

Table 6: Maximum Pressure Drops

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

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