GE
Water & Process Technologies

Fact Sheet

Duratherm HWS Series

Hot Water Sanitization Pure Water Elements

Description and Use

The Duratherm HWS Series includes RO, NF and UF 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 standard.

Separation system sanitization protocol is performed via periodic exposure to temperature as high as 90°C at minimum feed pressure to kill microorganisms by denaturation and coagulation of the proteins chains.

The Duratherm HWS RO and HWS NF are suitable for separation systems purifying water at temperature up to 122°F (50°C) in low crossflow environment and no suspended solids. The Duratherm HWS UF can be selected for operation with feed stream temperature up to 158°F (70°C).

This Series includes a variety of size 8", 4" and 2.5" diameters. All element constructions include Durasan Cage* outer wrap, Polysulfone ATD and central tube.

Features and benefits

- Certified for Bottled Water in the EU[b,c]
- Kills 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

Table 1: Element Specification

Membrane	A-Series, Thin-film membrane (TFM*)[a,b] D-Series, Thin-film membrane (TFM*)[c] P-Series, Polyethersulfone[d]

a=HWS RO-HR, b=HWS RO, c=HWS NF, d=HWS UF

Model	Maximum Crossflow gpm (m3/h)	Average permeate flow gpd (m3/day)	Average salt rejection / MWCO
Duratherm HWS RO 2540 HR[1,4]	4 (0.9)	620 (2.3)	99.5%
Duratherm HWS RO 4040 HR[1,4]	20 (4.5)	2,300 (8.7)	99.5%
Duratherm HWS RO 8040 HR[1,4]	65 (14.8)	9,900 (37.5)	99.5%
Duratherm HWS RO 2540[2,4]	4 (0.9)	760 (2.9)	99.0%
Duratherm HWS RO 4040[2,4]	20 (4.5)	2,200 (8.3)	99.0%
Duratherm HWS RO 8040[2,4]	65 (14.8)	9,200 (34.8)	99.0%
Duratherm HWS NF 2540 HF[3,4]	4 (0.9)	680 (2.6)	98.6%
Duratherm HWS NF 4040 HF[3,4]	20 (4.5)	2,100 (7.9)	98.6%
Duratherm HWS NF 8040 HF[3,4]	65 (14.8)	8,500 (32.2)	98.6%
Duratherm HWS UF 2540 HF	4 (0.9)	--	6,000Da
Duratherm HWS UF 4040 HF	20 (4.5)	--	6,000Da
Duratherm HWS UF 8040 HF	65 (14.8)	--	6,000Da

[1] Testing conditions: 2,000ppm NaCl solution at 225psig (1,550kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization.
[2] Testing conditions: 500ppm NaCl solution at 115psig (790kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization.
[3] Testing conditions: 2,000ppm MgSO4 solution at 110psig (760kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization
[4] Average salt rejection after 24 hours operation. Individual flow rate may vary +25%/-15%. Final permeate flow rate is subject to variations in the heat treatments. In most cases, the permeate flow rate after heat treatments will stabilize at 30-50 percent below the nominal flowrate before heat treatment. For a conservative design, consider a permeate flow reduction of 50%.

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Model	Active area ft² (m²)	Outer wrap	Part number
Duratherm HWS RO 2540 HR	25 (2.3)	Cage	1263600
Duratherm HWS RO 4040 HR	88 (8.2)	Cage	1263435
Duratherm HWS RO 8040 HR	355 (33.0)	Cage	1263599
Duratherm HWS RO 2540	25 (2.3)	Cage	1228430
Duratherm HWS RO 4040	85 (7.9)	Cage	1228459
Duratherm HWS RO 8040	355 (33.0)	Cage	1228481
Duratherm HWS NF 2540 HF	25 (2.3)	Cage	1263452
Duratherm HWS NF 4040 HF	88 (8.2)	Cage	1263437
Duratherm HWS NF 8040 HF	355 (33.0)	Cage	1262377
Duratherm HWS UF 2540 HF	25 (2.3)	Cage	1233601
Duratherm HWS UF 4040 HF	88 (8.2)	Cage	1263698
Duratherm HWS UF 8040 HF	380 (35.3)	Cage	1263602

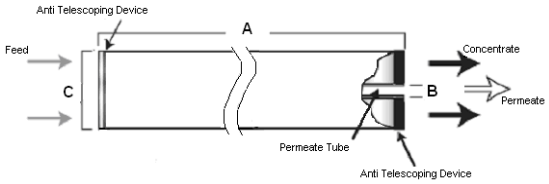

Figure 1a: Element Dimensions Diagram (Female)

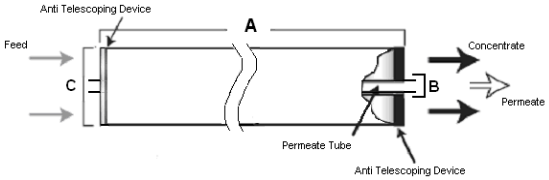

Figure 1b: Element Dimensions Diagram (Male)

Table 2: Dimensions and Weight

Model[1]	Dimensions, inches (cm)			Boxed
	A	B[2]	C[3]	Weight lbs (kg)
HWS 2540 Models	40.0 (101.6)	0.75 (1.90) OD	2.4 (6.1)	4 (1.8)
HWS 4040 Models	40.0 (101.6)	0.75 (1.90) OD	3.9 (9.9)	9 (4.1)
HWS 8040 Models	40.0 (101.6)	1.125 (2.86)	7.9 (20.1)	29 (13.2)

[1] These elements are dried and bagged before shipping.
[2] Internal diameter unless specified OD (outside diameter).
[3] The element diameter (dimension C) is designed for optimum performance in GEWater & Process Technologies pressure vessels. Other pressure vessel dimension and tolerance may result in excessive bypass and loss of capacity

Table 3: Temperatures

Do not exceed 20 GFD (34LMH) in any circumstances

Model	Maximum operating temperature	Maximum cleaning temperature	Maximum sanitization temperature
Duratherm HWS RO HR	122°F (50°C)	122°F (50°C)	194°F (90°C)
Duratherm HWS RO	122°F (50°C)	122°F (50°C)	194°F (90°C)
Duratherm HWS NF HF	122°F (50°C)	113°F (40°C)	194°F (90°C)
Duratherm HWS UF HF	158°F (70°C)	122°F (50°C)	194°F (90°C)

Table 4: Pressures and operating parameters

Model	Max operating pressure		Typical applied pressure	Rec. element recovery	Typical operating flux
	41–122°F (5–50°C)	124–158°F (51–70°C)			
Duratherm HWS RO HR	600psi (4,137kPa)	Do not operate at T>50°C (Sanitizing only)	225psi (1,551kPa)	<15%	10-18GFD (17-31LMH)
Duratherm HWS RO	600psi (4,137kPa)		225psi (1,551kPa)	<15%	10-18GFD (17-31LMH)
Duratherm HWS NF HF	600psi (4,137kPa)		110psi (760kPa)	<15%	10-18GFD (17-31LMH)
Duratherm HWS UF HF	600psi (4,137kPa)	300psi (2,068kPa)	80psi (552kPa)	<15%	10-25GFD (17-40LMH)

Table 5: Operating and CIP parameters

Model	pH range		Chlorine tolerance	Feed water
	Continuous Operation	Clean-in-Place (CIP)		
Duratherm HWS RO HR	4.0-11.0	2.0-11.5	500 ppm-hours, dechlorination recommended	NTU < 1 SDI < 5
Duratherm HWS RO	4.0-11.0	2.0-11.5		
Duratherm HWS NF HF	3.0-9.0	2.0-10.5		
Duratherm HWS UF HF	4.0-11.0	2.0-11.5	5,000+ ppm-days	

Hot Water Sanitization Recommendations:

For optimal performance, Duratherm HWS 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/minute. Maximum sanitization temperature is 90°C.

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, 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 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.

Salt Rejection

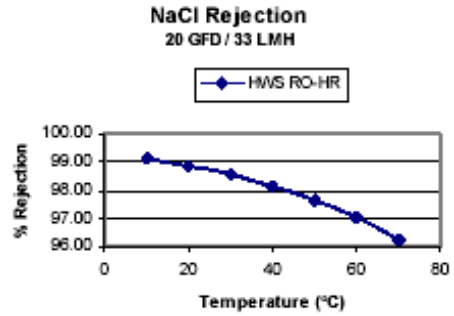

Figure 2: NaCl rejection for HWS RO HR element

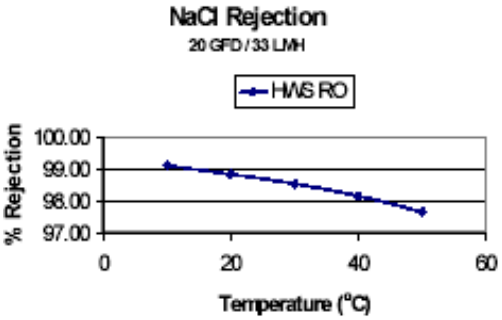

Figure 3: NaCl rejection for HWS RO element

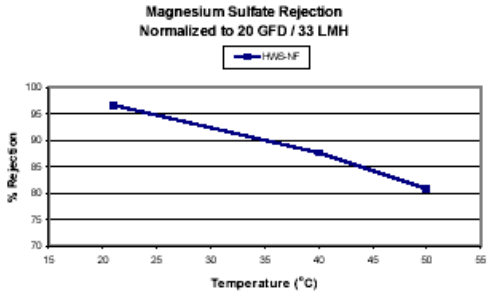

Figure 4: MgSO4 rejection for HWS NF HF element

Pressure Drop

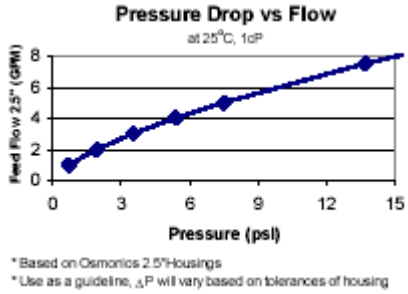

Figure 5: Pressure drop for HWS 2540 elements

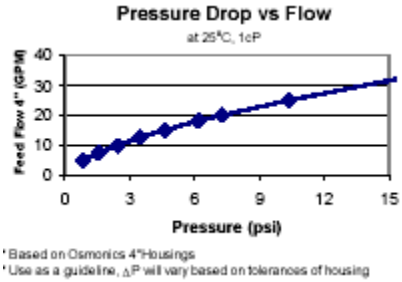

Figure 6: Pressure drop for HWS 4040 elements

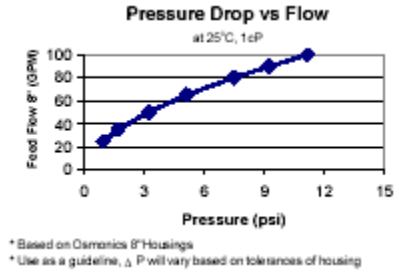

Figure 7: Pressure drop for HWS 8040 elements

Net Driving Pressure

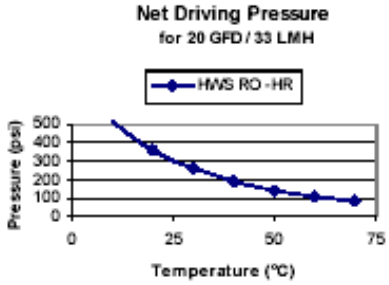

Figure 8: Net Driving Pressure for HWS RO HR elements

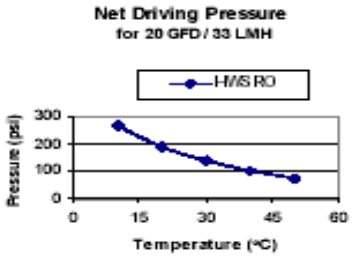

Figure 9: Net Driving Pressure for HWS RO elements

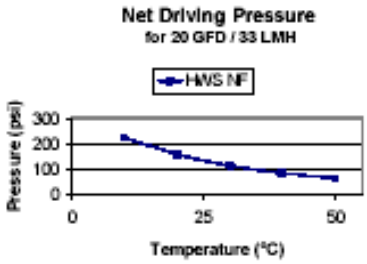

Figure 10: Net Driving Pressure for HWS NF HF elements