

# 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 195°F (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.

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.

Some Duratherm elements comply with:

- FDA Regulations relevant sections of 21CFR
- EU Framework 1935/2004/EC
- Halal & Kosher certification
- NSF/ANSI 61

Please contact your SUEZ representative for further information.

### features and benefits

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

### markets

- Food / Beverage
- BioPharm
- Electronics
- Chemical

**Table 1: Element Specification**

Membrane	HWS RO, HWS RO HR: Thin-film membrane (TFM*) HWS NF: Thin-film membrane (TFM*) HWS UF: Polyethersulfone
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Model	Average permeate flow gpd (m <sup>3</sup> /day)	Average salt rejection / MWCO
Duratherm HWS RO2521 (2) (4)	270 (1.0)	99.0%
Duratherm HWS RO2540 (2) (4)	760 (2.9)	99.0%
Duratherm HWS RO4040 (2) (4)	2,300 (8.7)	99.0%
Duratherm HWS RO8040 (2) (4)	9,000 (34.1)	99.0%
Duratherm HWS RO2540HR (1) (4)	620 (2.4)	99.5%
Duratherm HWS RO4040HR (1) (4)	2,300 (8.7)	99.5%
Duratherm HWS RO8040HR (1) (4)	9,000 (34.1)	99.5%
Duratherm HWS NF4040 (3) (4)	2,400 (9.1)	96.0%
Duratherm HWS NF8040 (3) (4)	10,200 (38.6)	96.0%
Duratherm HWS UF4040	-	20,000 Da
Duratherm HWS UF8040	-	20,000 Da

(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 MgSO<sub>4</sub> solution at 110psig (760kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization

(4) Average salt rejections after 24 hours of operation. Individual flow rate may vary ±20%.

Final permeate flow rate is subject to variations in the heat treatments. In most cases, the permeate flow rate after heat treatments will stabilize below nominal flow rate before heat treatment at:

- 25% for the Duratherm HWS RO HR
- 30-50% for the Duratherm HWS RO, NF and UF.

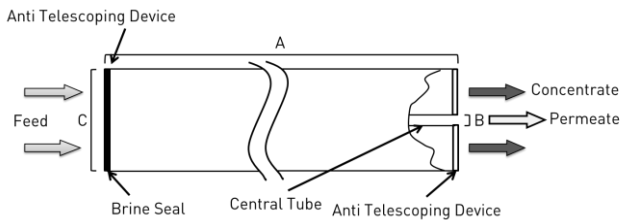
This is taken into consideration in Winflows Database 3.07 and later.

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

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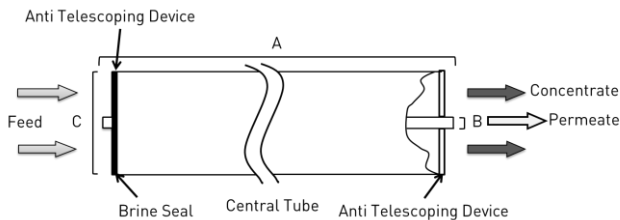
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Model	Active area ft <sup>2</sup> (m <sup>2</sup> )	Outer wrap	Part number
Duratherm HWS RO2521	10 (1.0)	Cage	1229607
Duratherm HWS RO2540	25 (2.3)	Cage	1228430
Duratherm HWS RO4040	90 (8.4)	Cage	1228459
Duratherm HWS RO8040	375 (34.9)	Cage	1228481
Duratherm HWS RO2540HR	25 (2.3)	Cage	1263600
Duratherm HWS RO4040HR	90 (8.4)	Cage	1263435
Duratherm HWS RO8040HR	375 (34.9)	Cage	1263599
Duratherm HWS NF4040	90 (8.4)	Cage	1263437
Duratherm HWS NF8040	375 (34.9)	Cage	1262377
Duratherm HWS UF4040	90 (8.4)	Cage	3165135
Duratherm HWS UF8040	350 (32.5)	Cage	1263602



Note: 4040 elements do not feature brine seal.

**Figure 1a: Element Dimensions Diagram (Female) - 4040 & 8040**



**Figure 1b: Element Dimensions Diagram (Male) - 2540**

**Table 2: Dimensions and Weight**

Model	Type	Dimensions, inches (cm)			Boxed Weight lbs. (kg)
		A	B	C	
HWS 2521 Models	Male	21.0 (53.3)	0.75 (1.90)	2.4 (6.1)	1.3 (0.6)
HWS 2540 Models	Male	40.0 (101.6)	0.75 (1.90)	2.4 (6.1)	4 (1.8)
HWS 4040 Models	Female	40.0 (101.6) (1)	0.625 (1.59)	3.9 (9.9)	11 (5.0)
HWS 8040 Models	Female	40.0 (101.6)	1.125 (2.86)	7.9 (20.1)	35 (15.9)

(1) Includes the interconnector. Refer to TB1206 for further information.

**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	122°F (50°C)	113°F (40°C)	194°F (90°C)
Duratherm HWS UF	122°F (50°C)	122°F (50°C)	194°F (90°C)

**Table 4a: Pressures and operating parameters**

Do not operate at T>50°C (Sanitizing only)

Model	Max operating pressure	Typical applied pressure	Element recovery	Typical operating flux
Duratherm HWS RO HR	600psi (4,137kPa)	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	600psi (4,137kPa)	110psi (760kPa)	<15%	10-18GFD (17-31LMH)
Duratherm HWS UF	600psi (4,137kPa)	80psi (552kPa)	<15%	10-25GFD (17-40 LMH)

**Table 4b: Pressures and operating parameters**

Model	Recommended Crossflow gpm (m <sup>3</sup> /h)	Maximum Pressure Drop per Element T < 122F (50°C)	Maximum Pressure Drop per Housing T < 122F (50°C)
Duratherm HWS **2521	4 (0.9)	15 psig (1.0 bar)	60 psig (4.0 bar)
Duratherm HWS **2540	4 (0.9)	15 psig (1.0 bar)	60 psig (4.0 bar)
Duratherm HWS **4040	20 (4.5)	15 psig (1.0 bar)	60 psig (4.0 bar)
Duratherm HWS **8040	65 (14.8)	15 psig (1.0 bar)	60 psig (4.0 bar)

**Table 5: Operating and CIP parameters**

Model	pH range		Chlorine tolerance	Feed water
	Continuous Operation	Clean-in-Place (CIP)		
Duratherm HWS RO HR	2.0 - 11.0	1.0 - 13.0 (1)	1,000 ppm-hours (2)	NTU < 1 SDI < 5
Duratherm HWS RO	2.0 - 11.0	1.0 - 13.0 (1)	1,000 ppm-hours (2)	NTU < 1 SDI < 5
Duratherm HWS NF	3.0 - 9.0	2.0 - 11.0 (1)	500 ppm-hours (2)	NTU < 1 SDI < 5
Duratherm HWS UF	2.0 - 11.0	1.0 - 13.0 (1)	5,000+ ppm-days	NTU < 1 SDI < 5

(1) Refer to Cleaning Guidelines Technical Bulletin TB1194.

(2) Dechlorination recommended

## 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 (9°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:

- 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, a loss of flow is observed before the element performance had stabilized after repeated heat treatments (over 90% of this flow reduction occurred during the first heat treatment). This loss of flow represents:

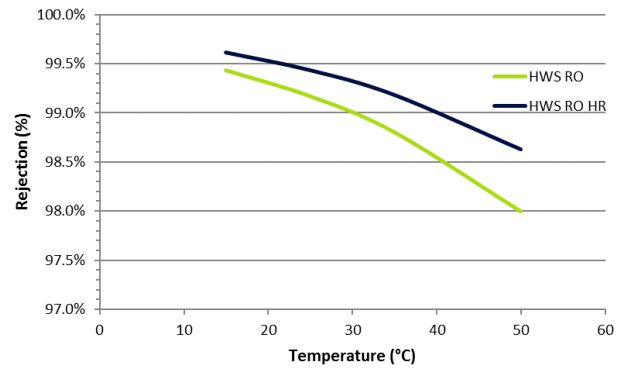
- maximum 25% for Duratherm HWS RO HR
- between 30% and 50% for Duratherm HWS RO, HWS NF, and HWS UF

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.

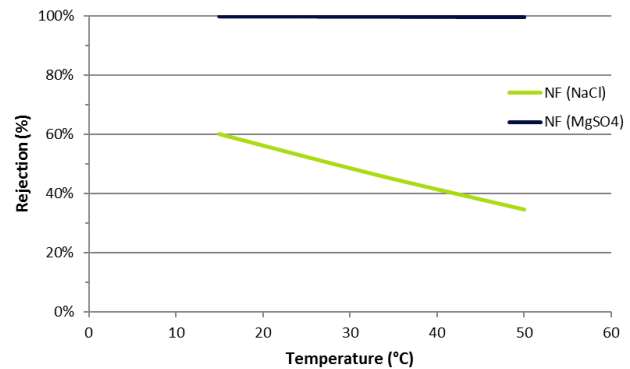
Pilot testing based on the criteria noted above will give the best operating parameters for any specific application.

All the graphs below are RO Winflows simulations (Winflows 3.2.1 Database 3.07) which consider a 50% permeate flow loss for the HWS RO and 25% for HWS RO HR.

## salt rejection



**Figure 2: Simulated NaCl rejections with 2000 ppm NaCl at 15% recovery and 33 LMH**



**Figure 3: Simulated rejections for HWS NF with: 2000 ppm NaCl at 15% recovery and 33 LMH, 2000 ppm MgSO<sub>4</sub> at 15% recovery and 33 LMH**

## Pressure Drop

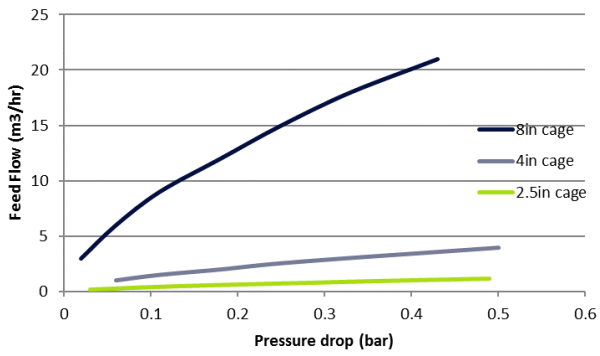


Figure 4: Simulated pressure drop

## Net Driving Pressure

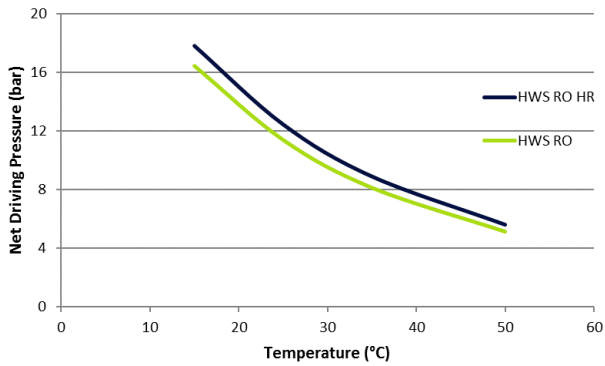


Figure 5: Simulated Net Driving Pressure for HWS RO HR with 2000 ppm NaCl and HWS RO elements with 500 ppm NaCl at 15% recovery and 33 LMH