Alfa Laval NF and RO spiral membranes

Sanitary spiral membranes for nanofiltration and reverse osmosis

Introduction

Cross-flow membrane filtration by Alfa Laval separates out the different components in a feed stream on the basis of the size and the shape of the micro-particles within it.

Alfa Laval spiral membranes for nanofiltration (NF) have pore sizes down to 300 dalton. Operating at pressures of up to 55 bar small ions pass through the membrane, whereas larger ions and most organic components do not.

Alfa Laval spiral membranes for reverse osmosis (RO) have pores so minute that only small fractions of salts and very low molecular compounds can pass through the membrane, along with the water that is the prime component of the permeate.

The Alfa Laval RO98 pHt™ spiral membrane is characterized by its tolerance to high temperatures and pH values.

Applications

Alfa Laval spiral membranes for nanofiltration and reverse osmosis are used for a wide range of high-sanitary processes in the food, beverage, dairy, biotech and pharmaceutical industries such as:

- concentration and purification
- fractionation
- extraction
- product recycling and recovery
- product and effluent upgrading

Benefits

- sanitary and compact full-fit design
- low initial investment and replacement costs
- cost-effective operation thanks to low energy consumption
- tolerance to high pH and temperature
- operation at low temperature possible
- different types and sizes available
- the same basic membranes available in spiral and flat sheet configurations
- developed and manufactured by Alfa Laval
- all materials in compliance with EU Regulation (EC) 1935/2004, EU Regulation 10/2011, EU Regulation (EC) 2023/2006 and FDA regulations (CFR) Title 21
- Halal certified
- can be USDA approved upon request

Spiral membrane data

Alfa Laval NF and RO spiral membranes are based on a unique construction of a thinfilm composite polyamide membrane with either polyester (PET) or polypropylene (PP) support material that provides optimum cleaning conditions.

Membrane type	Support material	Characteristics	Rejection
NF	Polyester	Thinfilm composite	≥ 99%[1]
NF99HF	Polyester	Thinfilm composite	≥ 99%[2]
RO90	Polyester	Thinfilm composite	≥ 90%[3]
RO99	Polyester	Thinfilm composite	≥ 98%[4]
RO98 pHt™	Polypropylene	Thinfilm composite	≥ 98%[4]

[1] measured on 2000 ppm MgSO4, 5 bar, 25°C

[2] measured on 2000 ppm MgSO4, 9 bar, 25°C

[3] measured on 2000 ppm NaCl, 9 bar, 25°C

[4] measured on 2000 ppm NaCl, 16 bar, 25°C

Spiral membrane designation

Example: **Alfa Laval RO90-8038/30**		
Alfa Laval RO90	=	Membrane type
80	=	Outer diameter of spiral (8.0")
38	=	Length of spiral (38") without ATD system
30	=	Thickness of feed spacer (30 mil)

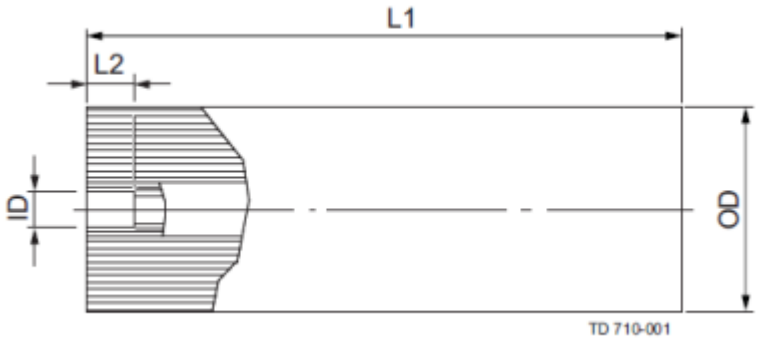
Standard configurations

Size[1]		Membrane type and code number[2]				
Spiral	**Spacer**	**NF**	**NF99HF**	**RO90**	**RO99**	**RO98 pHt™**
2517	48	519770	522311	525507	522318	517592
2538	48	534807	533928	540855	540094	533929
3838	30	530979	522292	525508	523570	516645
	48	521231	521681	525509	522319	516646
	65	527936	—	—	522320	522333
3938	48	—	—	—	527938	—
8038 (id 28.58 mm)	30	522314	523488	534782	522363	525469
	48	522315	—	—	522322	525470
	65	522316	528043	—	522323	529633
8038 (id. 28.9 mm)	30	521183	524261	526003	534784	517314
	48	522163	524310	534785	—	518424
	65	524263	537519	531629	534786	522332

[1] For other sizes, please contact Alfa Laval

[2] Please specify code number when ordering

Dimensions



OD = outer diameter of spiral membrane
HD = nominal inner diameter of housing[1]
L1 = total length of spiral membrane without ATD
ID = diameter of ATD socket
L2 = depth of ATD socket

[1] For specific measurements of Alfa Laval housings please see the product specification

Standard sizes

Size[1]	Outer diameter (OD)		Housing diameter (HD)		Spiral length (L1)[2]		ATD socket diameter (ID)		ATD socket depth (L2)	
	mm	**inches**	**mm**	**inches**	**mm**	**inches**	**mm**	**inches**	**mm**	**inches**
2517	64.0– 65.0	2.52– 2.56	66	2.6	432	17.01	21.1	0.831	50	1.97
2538	64.0– 65.0	2.52– 2.56	66	2.6	965	37.99	21.1	0.831	50	1.97
3838	95.0– 96.5	3.74– 3.80	97.55	3.84	965	37.99	21.1	0.831	50	1.97
3938	98.5–99.0	3.88–3.90	101.00	4.00	965	37.99	21.1	0.831	50	1.97
8038	198.5–201.5	7.82– 7.93	204.14	8.04	965	37.99	28.58	1.125	76	2.99
8038	198.5–201.5	7.82– 7.93	204.14	8.04	965	37.99	28.9	1.138	76	2.99

[1] For other sizes, please contact Alfa Laval

[2] Without ATD system

Cross-flow and pressure drop

Typical cross-flow (m^3/h) and max. pressure drop (bar) at cP 1:

Outer diameter:	2.5”		3.8”/3.9”		8.0”	
Spacer thickness:	m^3/h	bar	m^3/h	bar	m^3/h	bar
30 mil	—	—	6	1.1	18	0.9
48 mil	1.5	0.6	8	1.1	29	0.9
65 mil	—	—	10	1.1	32	0.9

Note: Calculated at tight fit of spiral membrane and housing by use of standard ATD system

Maximum pressure drop across the entire housing not to exceed 4.1 bar

Recommended operating limits

Production	NF / NF99HF	RO90 / RO99	RO98 pHt™
pH range (reference temperature 25°C)	3 — 9	3 — 10	2 — 10
Typical operating pressure, bar	15 — 35	15 — 40	15 — 40
Maximum operating pressure at 30°C, bar	55	55	55
Maximum operating pressure at 60°C, bar	—	—	27
Temperature, °C	5 — 50	5 — 50	5 — 60
Free chlorine concentration, ppm	<0.1	<0.1	<0.1
Hydrogen peroxide, continuous operation at 25°C, ppm	<20	<20	<20

Cleaning[1] (3 hours per day)	NF	NF99HF	RO90 / RO99	RO98 pHt™
pH range (reference temperature 25°C)	1.5 — 11	1.5 — 10	1.5 — 11	1 — 12.5
Typical pressure, bar	1 — 5	1 — 5	1 — 5	1 — 5
Temperature, °C	30 — 50	30 — 45	30 — 50	25 — 60

[1] Please consult the Alfa Laval cleaning instructions and water quality specifications

Sanitization (1 hour per week)	NF / NF99HF	RO90 / RO99	RO98 pHt™
Hydrogen peroxide at 25°C, ppm	<1000	<1000	<1000

OPTION: Hot water sanitization (only for RO98 pHt™ spiral membranes)[1]			
Max. sanitization temperature (<1.7 bar), °C	—	—	80

[1] Please see the guidelines overleaf

Note:

- Washing procedure indicated on the cover of each spiral membrane package must be strictly followed. Please consult the Alfa Laval cleaning instructions and water quality specifications.
- The use of oxidation agents and similar chemicals might influence the membrane performance over time. Agents such as chlorine are not allowed. Any contamination with chlorine must be avoided!

Important information

- New spiral membranes must be cleaned prior to first use. Please see detailed instructions on the packaging of the product.
- The customer is fully responsible for the effects that any incompatible chemicals may have on the spiral membranes.
- After initial wetting, the spiral membranes must be kept moist at all times.
- If the operating specifications provided in this product description are not strictly followed, the limited warranty will be null and void.
- To prevent biological growth during system shutdowns, Alfa Laval recommends that spiral membranes should be immersed in a protective solution.
- Avoid permeate-side back pressure at all times.
- Alfa Laval recommends using a rigid stainless steel ATD end device at the housing outlet end.
- Alfa Laval recommends that the inner diameter of the housing should be approx. 2 mm (0.08”) bigger than the outer diameter of the spiral membrane.
- For storage conditions, please see Shelf Life and Storage document.
- For warranties, please see spiral membrane warranty document.

Operating guidelines

Alfa Laval recommends the following start-up procedure from standstill to operating condition:

- The unpressurized plant should be refilled with water.
- Feed pressure should be gradually increased over a 30–60 second time scale.
- Before initiating cross-flow at high permeate flux condition (start-up with high-temperature water) the set feed pressure should be maintained for 5–10 minutes.
- Cross-flow velocity at the set operating point should be gradually achieved over a period of 15–20 seconds.
- Temperature variations should be implemented gradually over a period of 3–5 minutes.
- Avoid any abrupt pressure or cross-flow variations on the membranes during start-up, shutdown, cleaning or other sequences in order to prevent possible damage.

OPTION: Hot water sanitization guidelines (only for RO98 pHt™ spiral membranes)

Cleaning (CIP) of the plant to be performed prior to sanitization for optimum result. The cleaning procedure should be in accordance with the instructions provided in the Alfa Laval product leaflet for the spiral membrane concerned and available on alfalaval.com.

A safe sanitizing procedure comprises of:

1. Flush the plant to drain using above type water quality.
2. Start recycling and heating the water to max. 80°C (176°F) while maintaining a very low pressure of <1.7 bar (<25 psig) feed inlet pressure when 4 elements per housing, <1.3 bar (<19 psig) when 3 elements per housing, <0.9 bar (<13 psig) when 2 elements per housing and <0.5 bar (<7 psig) when 1 element per housing; permeate pressure being at 0 bar. Temperature changes should be gradual with not more than 5°C (9°F) change per minute.
3. Maintain the max. temperature for 60–90 minutes. Maintain the very low pressure as stated in point 2.
4. Cool down the water / the plant gradually (not more than 5°C (9°F) change per minute) until 40°C (104°F).
5. Flush to drain with new suitable good water quality using the same very low pressure as stated in point 2.

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How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com