SepraPor® Filters

MEISSNER

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SepraPor® Filters

SepraPor® filters are tangential flow filtration (TFF) devices containing hollow fiber membranes (HFM). SepraPor® filters are ideal for use in a variety of biopharmaceutical applications, including cell concentration, continuous cell culture perfusion, and protein concentration and diafiltration. SepraPor® filters are available in a range of sizes in both capsule and cartridge configurations. Cartridges are designed to fit inside stainless steel housings for steam-in-place (SIP) sterilization and operation. SepraPor® capsules are available as standalone filters or as part of single-use assemblies.

Materials of Construction

SepraPor® filters are manufactured using high quality components, which are all animal component free (ACF), nontoxic, and biologically inert. The materials are listed for food contact use in the Code of Federal Regulations (CFR), Title 21, or meet Commission Regulation (EU) No 10/2011, as below:

Components

All devices:		
Hollow fibers:	Polysulfone	CFR Title 21, 177.1655
Fiber bundle netting:	Polypropylene	CFR Title 21, 177.1520
Capsule housing/cartridge sleeve	Polysulfone	CFR Title 21, 177.1655
Fiber encapsulation:	Epoxy	CFR Title 21, 175.300
Cartridges:		
O-rings:	Silicone	CFR Title 21, 177.2600
Capsules:		
Permeate ports:	Polysulfone	CFR Title 21, 177.1655
Retentate ports:	Polysulfone	CFR Title 21, 177.1655

The SepraPor® filters meet the requirements as specified in the USP 43 Biological Reactivity Tests, *in vitro* <87> (cytotoxicity) and *in vivo* <88> (Class VI Plastics) and/or current USP <87> Cytotoxicity MEM elution test.

Configurations

SepraPor® XFC capsule and XFM cartridge filters are manufactured in a variety of configurations and lengths. Figures 1 and 2 below show standard configurations of capsules and cartridges, respectively. See SepraPor ordering tables at the end of this document for configuration part numbers.

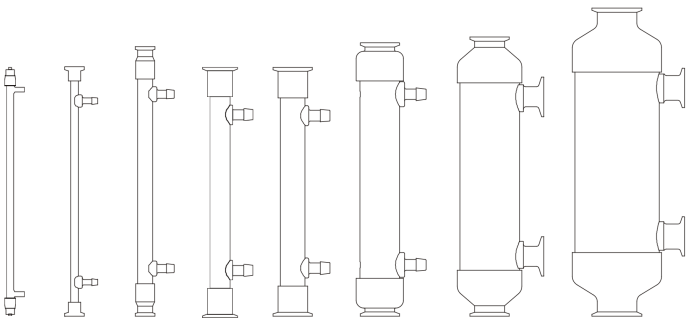

Figure 1: Standard configurations for SepraPor® hollow fiber capsule filters with 30 cm path length capsules shown.

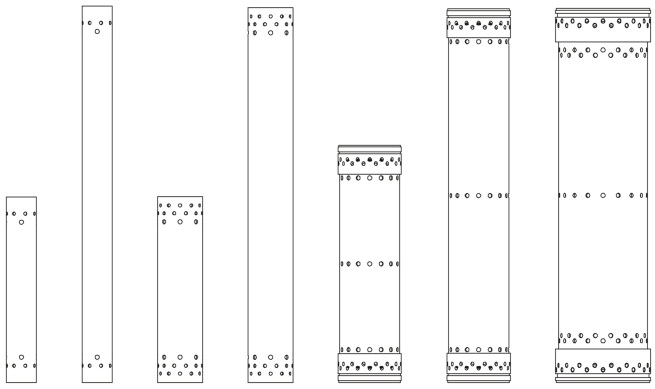

Figure 2: Standard configurations for SepraPor® hollow fiber cartridge filters for steam-in-place (SIP) use.

Dimensions & Capacities

Microfiltration SepraPor® hollow fiber membranes have a nominal lumen (inner diameter) of 1.0 mm and are available in porosities of 0.1, 0.2 and 0.4 µm. Ultrafiltration SepraPor® hollow fiber membranes are available with nominal lumen of 0.5 mm or 1.0 mm and are available in retention ratings of 10, 30, 50, 100, 300, 500, 750 kDa.

Minimum Hold-up volume: Fluid in membrane pores and unrecoverable shell volume
Void volume: Retentate volume of filter including volume inside HFMs and filter end caps

Table 3: Microfiltration SepraPor® capsules filters

Filter Diameter	*Fibers*	*Lumen*	*Fluid Path Length (Nominal)*	*Filter Length*	*Effective Filtration Area*	*Min. Hold-up Volume*	*Void Volume*
3/8" (0.95 cm)*	3	1 mm	6" (15 cm)	6.9" (17.4 cm)	0.012 ft^2 (12 cm^2)	0.3 mL	0.7 mL
3/8" (0.95 cm)*	3	1 mm	12" (30cm)	13.1" (33.4 cm)	0.029 ft^2 (27 cm^2)	0.7 mL	1 mL
3/8" (0.95 cm)*	3	1 mm	24" (60 cm)	25.6" (65.1 cm)	0.061 ft^2 (57 cm^2)	1.5 mL	2 mL
3/8" (0.95 cm)*	13	1 mm	6" (15 cm)	6.9" (17.4 cm)	0.054 ft^2 (50 cm^2)	1.5 mL	2 mL
3/8" (0.95 cm)*	13	1 mm	12" (30cm)	13.1" (33.4 cm)	0.12 ft^2 (0.012 m^2)	3 mL	3.5 mL
3/8" (0.95 cm)*	13	1 mm	24" (60 cm)	25.6" (65.1 cm)	0.26 ft^2 (0.025 m^2)	6.5 mL	6.5 mL
3/8" (0.95 cm)	13	1 mm	12" (30 cm)	12.6" (32.0 cm)	0.11 ft^2 (0.010 m^2)	2.5 mL	4 mL
3/8" (0.95 cm)	13	1 mm	24" (60 cm)	25.1" (63.8 cm)	0.25 ft^2 (0.023 m^2)	6 mL	7 mL
3/4" (1.9 cm)	55	1 mm	12" (30 cm)	13.5" (34.3 cm)	0.44 ft^2 (0.041 m^2)	10 mL	15 mL
3/4" (1.9 cm)	55	1 mm	24" (60 cm)	26.0" (66.0 cm)	1.0 ft^2 (0.096 m^2)	25 mL	30 mL
1" (2.5 cm)	115	1 mm	12" (30 cm)	13.2" (33.5 cm)	0.84 ft^2 (0.078 m^2)	20 mL	30 mL
1" (2.5 cm)	115	1 mm	24" (60 cm)	25.7" (65.3 cm)	2.1 ft^2 (0.19 m^2)	50 mL	60 mL
1 1/4" (3.2 cm)	150	1 mm	12" (30 cm)	13.2" (33.5 cm)	1.2 ft^2 (0.11 m^2)	30 mL	55 mL
1 1/4" (3.2 cm)	150	1 mm	24" (60 cm)	25.7" (65.3 cm)	2.8 ft^2 (0.26 m^2)	70 mL	90 mL
2" (5.1 cm)	520	1 mm	12" (30 cm)	13.5" (34.3 cm)	4.4 ft^2 (0.41 m^2)	110 mL	160 mL
2" (5.1 cm)	520	1 mm	24" (60 cm)	26.1" (66.3 cm)	10 ft^2 (0.93 m^2)	250 mL	290 mL
3" (7.6 cm)	1,250	1 mm	12" (30 cm)	14.0" (35.6 cm)	11 ft^2 (1.0 m^2)	270 mL	390 mL
3" (7.6 cm)	1,250	1 mm	24" (60 cm)	26.6" (67.6 cm)	24 ft^2 (2.3 m^2)	600 mL	700 mL
4 1/4 " (10.8 cm)	2,600	1 mm	12" (30 cm)	19.7" (50.0 cm)	29 ft^2 (2.7 m^2)	710 mL	1,200 mL
4 1/4" (10.8 cm)	2,600	1 mm	24" (60 cm)	28.8" (73.2 cm)	49 ft^2 (4.5 m^2)	1,200 mL	1,700 mL

* *Luer Lock Connectivity*

Table 4: Microfiltration SepraPor® cartridge filters

Filter Diameter	*Fibers*	*Lumen*	*Fluid Path Length (Nominal)*	*Filter Length*	*Effective Filtration Area*	*Void Volume*
2" (5.1 cm)	520	1 mm	12" (30 cm)	12.3" (31.2 cm)	4.1 ft^2 (0.38 m^2)	130 mL
2" (5.1 cm)	520	1 mm	24" (60 cm)	24.9" (63.2 cm)	9.8 ft^2 (0.91 m^2)	260 mL
3" (7.6 cm)	1,250	1 mm	12" (30 cm)	12.3" (31.2 cm)	9.9 ft^2 (0.92 m^2)	310 mL
3" (7.6 cm)	1,250	1 mm	24" (60 cm)	24.9" (63.2 cm)	23 ft^2 (2.2 m^2)	620 mL
4" (10.2 cm)	2,400	1 mm	12" (30 cm)	15.5" (39.4 cm)	24 ft^2 (2.2 m^2)	740 mL
4" (10.2 cm)	2,400	1 mm	24" (60 cm)	24.5" (62.2 cm)	43 ft^2 (4.0 m^2)	1,200 mL
5.9" (15 cm)	5,200	1 mm	24" (60 cm)	24.6" (62.5 cm)	87 ft^2 (8.1 m^2)	2,600 mL

Dimensions & Capacities

Table 5: Ultrafiltration SepraPor® capsule filters.

Filter Diameter	Fibers	Lumen	Fluid Path Length (Nominal)	Filter Length	Effective Filtration Area	Min. Hold-up Volume	Void Volume
3/8" (0.95 cm)*	7	0.5 mm	6" (15 cm)	6.9" (17.4 cm)	0.015 ft^2 (13 cm^2)	0.4 mL	0.5 mL
3/8" (0.95 cm)*	7	0.5 mm	12" (30 cm)	13.1" (33.4 cm)	0.033 ft^2 (31 cm^2)	1 mL	0.8 mL
3/8" (0.95 cm)*	7	0.5 mm	24" (60 cm)	25.6" (65.1 cm)	0.071 ft^2 (66 cm^2)	2 mL	1 mL
3/8" (0.95 cm)*	30	0.5 mm	6" (15 cm)	6.9" (17.4 cm)	0.062 ft^2 (58 cm^2)	2 mL	1 mL
3/8" (0.95 cm)*	30	0.5 mm	12" (30 cm)	13.1" (33.4 cm)	0.14 ft^2 (0.013 m^2)	4 mL	2 mL
3/8" (0.95 cm)*	30	0.5 mm	24" (60 cm)	25.6" (65.1 cm)	0.30 ft^2 (0.028 m^2)	9 mL	4 mL
3/8" (0.95 cm)	30	0.5 mm	12" (30 cm)	12.6" (32.0 cm)	0.12 ft^2 (0.012 m^2)	3.5 mL	2.5 mL
3/8" (0.95 cm)	30	0.5 mm	24" (60 cm)	25.1" (63.8 cm)	0.29 ft^2 (0.026 m^2)	8 mL	4.5 mL
3/4" (1.9 cm)	140	0.5 mm	12" (30 cm)	13.5" (34.3 cm)	0.56 ft^2 (0.052 m^2)	15 mL	10 mL
3/4" (1.9 cm)	140	0.5 mm	24" (60 cm)	26.0" (66.0 cm)	1.3 ft^2 (0.12 m^2)	40 mL	20 mL
1" (2.5 cm)	320	0.5 mm	12" (30 cm)	13.2" (33.5 cm)	1.2 ft^2 (0.11 m^2)	35 mL	20 mL
1" (2.5 cm)	320	0.5 mm	24" (60 cm)	25.7" (65.3 cm)	2.9 ft^2 (0.27 m^2)	85 mL	40 mL
1 1/4" (3.2 cm)	520	0.5 mm	12" (30 cm)	13.2" (33.5 cm)	2.1 ft^2 (0.19 m^2)	60 mL	50 mL
1 1/4" (3.2 cm)	520	0.5 mm	24" (60 cm)	25.7" (65.3 cm)	4.9 ft^2 (0.45 m^2)	140 mL	80 mL
2" (5.1 cm)	1,300	0.5 mm	12" (30 cm)	13.5" (34.3 cm)	5.5 ft^2 (0.51 m^2)	170 mL	110 mL
2" (5.1 cm)	1,300	0.5 mm	24" (60 cm)	26.1" (66.3 cm)	13 ft^2 (1.2 m^2)	370 mL	200 mL
3/8" (0.95 cm)	3	1 mm	6" (15 cm)	6.9" (17.4 cm)	0.012 ft^2 (12 cm^2)	0.3 mL	0.7 mL
3/8" (0.95 cm)	3	1 mm	12" (30 cm)	13.1" (33.4 cm)	0.029 ft^2 (27 cm^2)	0.7 mL	1 mL
3/8" (0.95 cm)	3	1 mm	24" (60 cm)	25.6" (65.1 cm)	0.061 ft^2 (57 cm^2)	1.5 mL	2 mL
3/8" (0.95 cm)	13	1 mm	6" (15 cm)	6.9" (17.4 cm)	0.054 ft^2 (50 cm^2)	1.5 mL	2 mL
3/8" (0.95 cm)	13	1 mm	12" (30 cm)	13.1" (33.4 cm)	0.12 ft^2 (0.012 m^2)	3 mL	3.5 mL
3/8" (0.95 cm)	13	1 mm	24" (60 cm)	25.6" (65.1 cm)	0.26 ft^2 (0.025 m^2)	6.5 mL	6.5 mL
3/8" (0.95 cm)	13	1 mm	12" (30 cm)	12.6" (32.0 cm)	0.11 ft^2 (0.010 m^2)	2.5 mL	4 mL
3/8" (0.95 cm)	13	1 mm	24" (60 cm)	25.1" (63.8 cm)	0.25 ft^2 (0.023 m^2)	6 mL	7 mL
3/4" (1.9 cm)	55	1 mm	12" (30 cm)	13.5" (34.3 cm)	0.44 ft^2 (0.041 m^2)	10 mL	15 mL
3/4" (1.9 cm)	55	1 mm	24" (60 cm)	26.0" (66.0 cm)	1.0 ft^2 (0.096 m^2)	25 mL	30 mL
1" (2.5 cm)	115	1 mm	12" (30 cm)	13.2" (33.5 cm)	0.84 ft^2 (0.078 m^2)	20 mL	30 mL
1" (2.5 cm)	115	1 mm	24" (60 cm)	25.7" (65.3 cm)	2.1 ft^2 (0.19 m^2)	50 mL	60 mL
1 1/4" (3.2 cm)	150	1 mm	12" (30 cm)	13.2" (33.5 cm)	1.2 ft^2 (0.11 m^2)	30 mL	55 mL
1 1/4" (3.2 cm)	150	1 mm	24" (60 cm)	25.7" (65.3 cm)	2.8 ft^2 (0.26 m^2)	70 mL	90 mL
2" (5.1 cm)	520	1 mm	12" (30 cm)	13.5" (34.3 cm)	4.4 ft^2 (0.41 m^2)	110 mL	160 mL
2" (5.1 cm)	520	1 mm	24" (60 cm)	26.1" (66.3 cm)	10 ft^2 (0.93 m^2)	250 mL	290 mL
3" (7.6 cm)	1,250	1 mm	12" (30 cm)	14.0" (35.6 cm)	11 ft^2 (1.0 m^2)	270 mL	390 mL
3" (7.6 cm)	1,250	1 mm	24" (60 cm)	26.6" (67.6 cm)	24 ft^2 (2.3 m^2)	600 mL	700 mL

* *Luer Lock Connectivity*

Dimensions & Capacities

Table 6: Ultrafiltration SepraPor® cartridge filters

Filter Diameter	*Fibers*	*Lumen*	*Fluid Path Length (Nominal)*	*Filter Length*	*Effective Filtration Area*	*Void Volume*
2" (5.1 cm)	1,300	0.5 mm	12" (30 cm)	12.3" (31.2 cm)	5.1 ft^2 (0.48 m^2)	80 mL
2" (5.1 cm)	1,300	0.5 mm	24" (60 cm)	24.9" (63.2 cm)	12 ft^2 (1.1 m^2)	160 mL
2" (5.1 cm)	520	1.0 mm	12" (30 cm)	12.3" (31.2 cm)	4.1 ft^2 (0.38 m^2)	130 mL
2" (5.1 cm)	520	1.0 mm	24" (60 cm)	24.9" (63.2 cm)	9.8 ft^2 (0.91 m^2)	260 mL
3" (7.6 cm)	1,250	1.0 mm	12" (30 cm)	12.3" (31.2 cm)	9.9 ft^2 (0.92 m^2)	310 mL
3" (7.6 cm)	1,250	1.0 mm	24" (60 cm)	24.9" (63.2 cm)	23 ft^2 (2.2 m^2)	620 mL

Operating Characteristics

Cartridges and Capsules

Operating Temperature Range: 39 °F to 100 °F (4 °C to 38 °C)

Maximum Operating Temperature: 122 °F (50 °C) for short-term operation such as cleaning

Table 7: Operating pressures for SepraPor® microfiltration porosities.

Retention Rating (µm)	*Maximum Transmembrane Pressure (TMP)*	*Maximum Feed Pressure*
0.4	10 psig @ 77 °F (0.7 bar @ 25 °C)	15 psig @ 77 °F (1.0 bar @ 25 °C)
0.2	15 psig @ 77 °F (1.0 bar @ 25 °C)	25 psig @ 77 °F (1.7 bar @ 25 °C)
0.1	20 psig @ 77 °F (1.4 bar @ 25 °C)	30 psig @ 77 °F (2.1 bar @ 25 °C)

Table 8: Operating pressures for SepraPor® ultrafiltration retention rating

Retention Rating (kDa)	*Maximum Transmembrane Pressure (TMP)*	*Maximum Feed Pressure*
750	45 psig @ 77 °F (3.1 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
500	45 psig @ 77 °F (3.1 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
300	45 psig @ 77 °F (3.1 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
100	45 psig @ 77 °F (3.1 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
50	45 psig @ 77 °F (3.1 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
30	50 psig @ 77 °F (3.5 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)
10	50 psig @ 77 °F (3.5 bar @ 25 °C)	65 psig @ 77 °F (4.5 bar @ 25 °C)

Cartridge Installation

Meissner SepraPor® cartridge filters are designed to fit inside stainless steel cartridge housings with O-ring seals. The filter cartridge fits snugly in the housing. Improper installation can impair filtration efficiency and compromise system sterility.

1. Verify that the correct filter part number for the application has been selected.
2. Assemble the stainless steel filter housing.
3. Remove the SepraPor® filter from its packaging and install into the stainless steel housing. SepraPor® filters are symmetrical so there is no top or bottom orientation.
4. Ensure that the filter is securely and evenly seated in the base of the housing.
5. To assist with proper installation, see Meissner's Cartridge Insertion Tool instructions document at www.meissner.com.
6. Install the filter upper support of the housing, ensuring that it sits snugly and evenly around the top of the filter.
7. Ensure that all O-rings are seated evenly.
8. Proceed with housing assembly and rinsing of the SepraPor® filter per the instructions below.

Rinsing Procedure for New Filters

Fully rinsing new filters is essential for filtration performance prior to integrity testing, sterilization, sanitization, or direct use.

Ultrafiltration

Non-sterile ultrafiltration membranes contain glycerol to preserve pore structure and maintain flux. An Isopropanol (IPA) or ethanol soaking step is recommended, particularly for membranes with a molecular weight cut-off (MWCO) lower than 100 kDa or to ensure all glycerol is removed prior to autoclave or steam-in-place.

Alcohol Recirculation

1. Install the cartridge or capsule filter. Connect the retentate and permeate lines to a feed reservoir with 60% vol. IPA/40% vol. DI water for recirculation.
2. Start the feed pump at a slow flow rate, then slowly close the retentate outlet valve until only a trickle flows from the retentate outlet.
3. Recirculate at the recommended pressure and time (Table 9).
4. Drain the filter and system and dispose of the alcohol solution.

Water Flush

5. Connect permeate and retentate line to waste.
6. Fill the feed reservoir with DI water (room temperature or up to 50 °C [122 °F]).
   a. *Warm water is most effective and recommended if alcohol soak was not performed*
7. Start the feed pump at a slow flow rate and then slowly close the retentate outlet valve until only a trickle flows from the retentate outlet.
8. Set TMP and continue to refill the feed vessel with clean water and dump the waste from the permeate and retentate. Flush for the time recommended in Table 9.

MWCO (kDa)	TMP (psig)	IPA Recirculation Time (min.)	Water Flush Time (min.)
10	10	60	30
300	5	10	15
750	5	10	5

Table 9. Recommended recirculation and water flush times based on ultrafiltration membrane MWCO. Longer rinsing times may be necessary for larger filters.

Microfiltration

Microfiltration membranes are shipped dry without preservatives. Complete wetting is necessary prior to heat sterilization and to avoid false defects in integrity testing.

Water Rinse

1. Install cartridge or capsule filter. Connect permeate line to waste and the retentate line to clean feed reservoir.
2. Fill the feed reservoir with DI water (room temperature or up to 50 °C [122 °F]). Warm water is most effective.
3. Start the feed pump at a slow flow rate and adjust feed pressure to 5 psig (0.3 bar). Slowly close the retentate outlet valve until only a trickle flows from the retentate outlet, increasing the permeate flow.
4. Rinse for at least 5 minutes, refilling the reservoir with clean DI water as needed. Longer rinsing times may be necessary for larger filters.

Water conservation option:

- Perform 1-minute DI water flush with permeate connected to waste.
- Recirculate permeate and retentate to feed reservoir for a minimum of 4 minutes.
- Finish with a final 1-minute flush to waste.

This rinsing procedure is provided only as an example of a reduced water usage rinsing scheme. Final rinsing parameters must be validated by each user. The water conservation rinsing procedure is recommended only if the standard rinsing procedure presented above is not possible due to water supply constraints.

Total Organic Carbon (TOC) Rinsing Data

Microfiltration Autoclave Flush Results

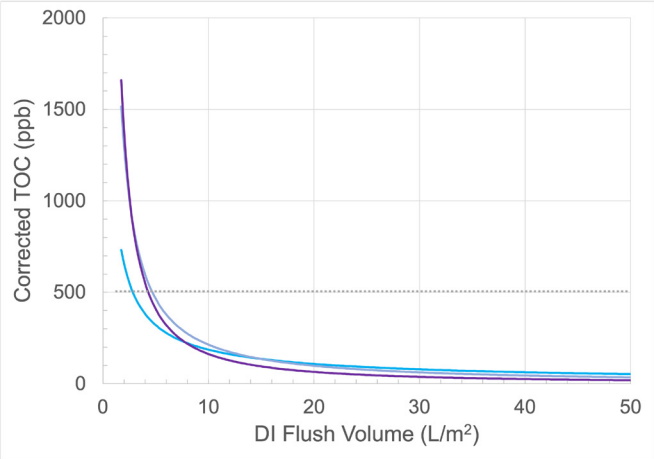

Figure 3. Typical TOC flush results for an autoclaved SepraPor® hollow fiber microfiltration capsule filter (Part No. XFCM20C024–7711; EFA 0.023 m²) showing the power function curve fit for the three lots tested.

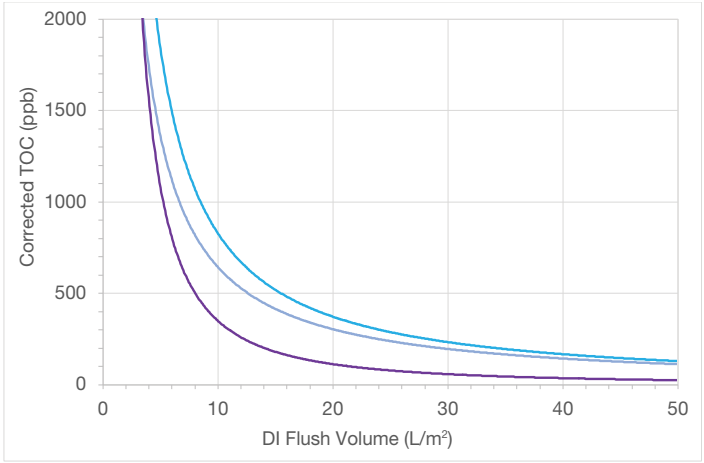

Figure 4. Typical TOC flush results for an autoclaved SepraPor® hollow fiber microfiltration capsule filter (Part No. XFCM20C124–7722; EFA 0.085 m²) showing the power function curve fit for the three lots tested.

Microfiltration Irradiation Flush Results

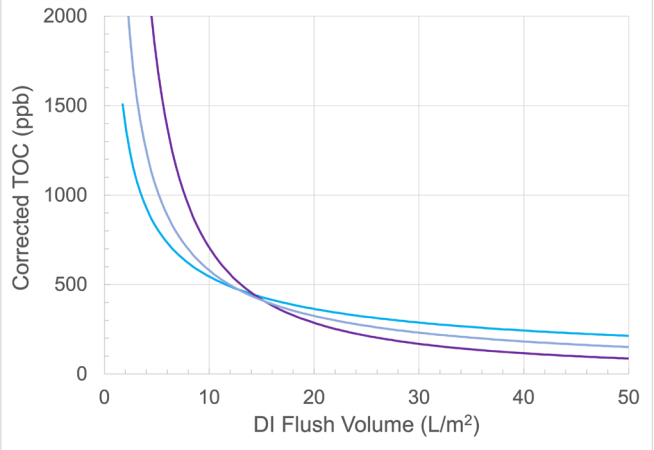

Figure 5. Typical TOC flush results for a irradiated SepraPor® hollow fiber microfiltration capsule filter (Part No. XFCM20C024–7711; EFA 0.023 m²) showing the power function curve fit for the three lots tested.

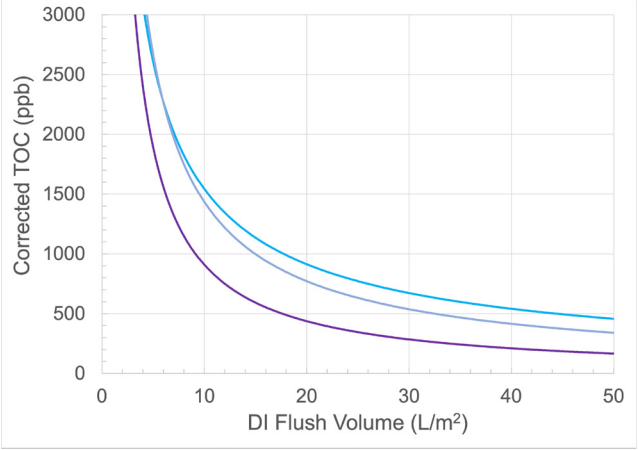

Figure 6. Typical TOC flush results for a irradiated SepraPor® hollow fiber microfiltration capsule filter (Part No. XFCM20C124–7722; EFA 0.085 m²) showing the power function curve fit for the three lots tested.

Ultrafiltration Irradiation Flush Results

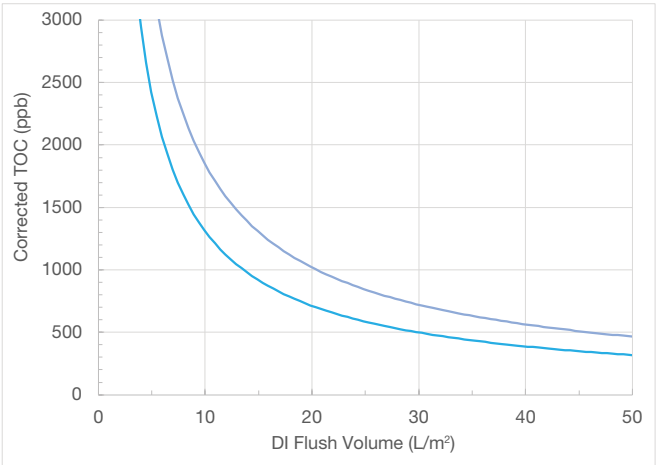

Figure 7. Typical TOC flush results for a irradiated SepraPor® hollow fiber ultrafiltration capsule filter (Part No. XFP300C024–7711; EFA 0.023 m²) showing the power function curve fit for the three lots tested.

Integrity Testing

The bubble point and diffusive flow tests are industry accepted nondestructive methods for verifying the integrity of a membrane filter. These tests may be performed manually as described in this section or with the use of an automated integrity tester such as Meissner's AccuFlux® Integrity Tester. In each method, the test pressure varies directly with the surface tension of the wetting fluid. For test values using wetting fluids other than those used in the procedures below, please contact Meissner.

Bubble Point Test Procedure

This procedure outlines the steps required to perform a bubble point test on SepraPor® filter cartridges or capsules. The manual bubble point test requires a wetted filter, a calibrated pressure gauge, a regulated gas pressure source (usually compressed air or nitrogen), narrow diameter downstream tubing, and a beaker of water in which the tubing outlet is submerged. Air pressure is applied to the wetted filter and gradually increased until a steady stream of bubbles is observed to come from the submerged tubing.

Nominal Pore Size	Bubble Point
0.4 µm	9 – 17 psi (0.6 – 1.2 bar)
0.2 µm	18 – 25 psi (1.2 – 1.7 bar)
0.1 µm	26 – 38 psi (1.8 – 2.6 bar)

Table 10: Bubble point for SepraPor® microfiltration porosities In 60%/40% IPA Water (v/v).

Procedure:

1. A system setup for performing the bubble point test is shown below in Figure 8.
2. Ensure hollow fiber membrane is fully wetted out with 60%/40% IPA/Water (v/v).
3. Close all valves.
4. Open V_1 and V_2. Thoroughly wet the filter with the wetting solution by opening V_4 and slowly closing off V_2, letting the wetting solution permeate through the fibers and fill the housing.
5. Open V_5 to allow trapped air to escape, then close V_5. The complete wetting of the filter is crucial to the accuracy of the test. An incompletely wetted filter will fail. Once the housing is filled with the solution, the fibers should be sufficiently wetted.
6. Close V_1.
7. Drain excess solution from the housing shell using V_5 and V_2. If using an air flow meter, ensure the shell is sufficiently drained of solution such that displaced solution does not enter into the flow meter.
8. Close V_5 and V_2.
9. Open V_3 and apply air pressure of 5 psi to the inlet side to push the upstream volume of wetting solution through the filter.
10. Increase the air pressure slowly at about 1 psig/second until the first bubble followed immediately by others is observed. Alternatively, a more accurate method of carrying out the measurement is to use a digital flow meter with a low volume range.
11. The initial stream of air is usually entrapped air and may produce a large amount of bubbling that will decrease rapidly and be replaced by regularly spaced bubbles produced by air diffusing through the filter membrane. Larger filters will have more diffusive flow than smaller filter assemblies. Slowly increase the pressure while observing for *continuous bubbling* from the bubble point tube. Do not confuse the additional bubbles produced by a rapid increase in air pressure with the bubble point. Observe the bubbles when the air pressure has stabilized. The bubble point is the pressure at which a marked change in the rate of bubbling occurs.
12. When a *steady* stream of bubbles is detected, the bubble point pressure has been reached.

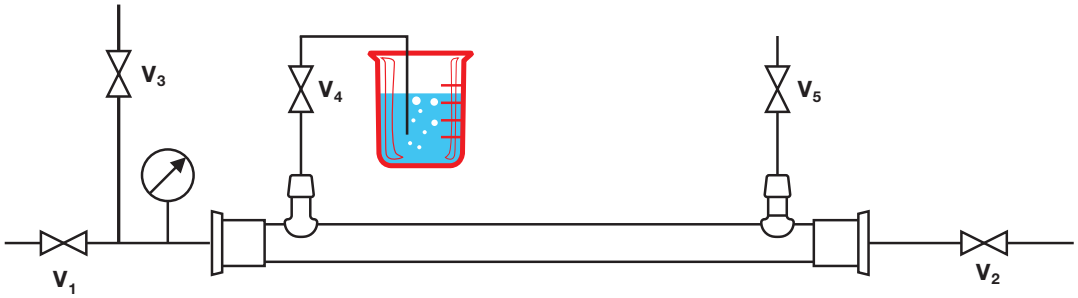

Figure 8: Bubble Point Test Schematic.

Diffusive Flow Test Procedure

The Diffusive Flow Test may be performed on SepraPor® hollow fiber filter cartridges or capsules. Ensure filter is wetted with 100% H_2O, drained, and a constant air pressure is applied. Diffusive air flow through the membrane is measured.

Procedure:

1. A system setup for performing the Diffusive Flow Test is shown in Figure 9.
2. Close all valves.
3. Open V_1 and V_2. Thoroughly wet the filter with water, opening vent V_4 to allow trapped air to escape. The complete wetting of the filter is crucial to the accuracy of the test. An incompletely wetted filter will fail. Slower flow rates can be used for longer periods. Back pressure should be applied by partially closing V_2 while flowing wetting solution through the filter. Do not exceed the recommended maximum transmembrane pressure rating of the retention rating of the filter being tested.
4. Drain excess water from the housing shell using V_5 and V_2. If using an air flow meter, ensure the shell is sufficiently drained of water such that displaced water does not enter the flow meter.
5. Close V_1, V_5, and V_2.
6. Open V_3 and apply air pressure of 15 psi (1.0 bar) for microfiltration filters or 30 psi (2.1 bar) for ultrafiltration filters to the inlet side of the system. This will push the upstream volume of water through the filter.
7. If necessary, open V_5 to drain the downstream volume of water. Water remaining downstream of the filter may cause an inaccurate diffusion reading by interfering with the air flow in the outlet tube. Close V_5.
8. Open V_4.
9. Verify the test pressure and adjust as necessary. Allow the air flow to stabilize.
10. Fill a graduated cylinder with water and invert into a container of water. Place the outlet tubing from V_4 underneath the opening of the cylinder and measure the volume of air diffused per minute. The recorded flow rate must not exceed the normalized flow rate related to filter surface area.

SepraPor ® Hollow Fiber	Maximum DF (mL/min/f²)	Maximum DF (mL/min/m²)
Microfiltration: 0.1, 0.2, 0.4 µm	≤ 2.79 @ 15 psi	≤ 30 @ 15 psi
Ultrafiltration: 10 – 750 kDa	≤ 2.97 @ 30 psi	≤ 32 @ 30 psi

Table 11: Diffusive flow values for integral SepraPor® hollow fiber filters, wetted with 100% water.

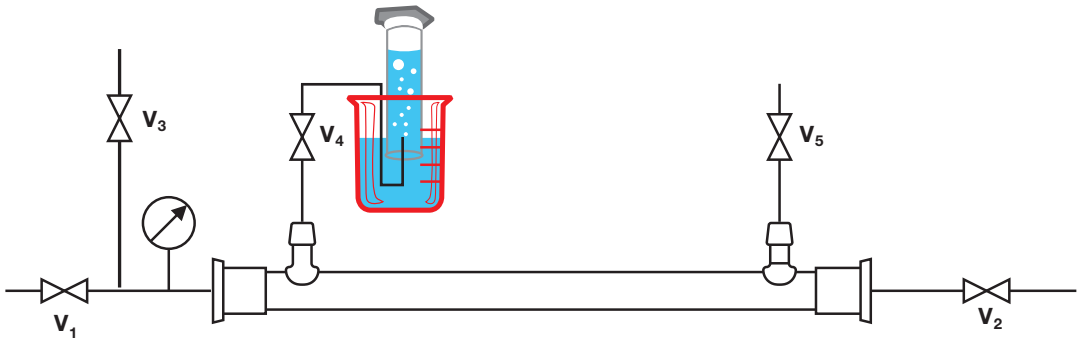

Figure 9: Diffusive Flow Test Schematic using the graduated cylinder method.

Measuring Clean Water Flux

After establishing integrity of the filter and system, the next step with a new SepraPor® filter is to obtain baseline clean water flux data. Water flux is important to correlate with bubble point data to confirm the desired porosity of the HFM. Baseline water flux also allows post-use, post-cleaning flux to be compared for cleanability and reusability of the HFM. Baseline data should be generated under easily repeatable conditions so comparisons with water flux data after cleaning cycles can be made directly. Parameters to control for reproducibility are:

- Water temperature
- Cartridge inlet pressure
- Cartridge outlet pressure
- Permeate flow rate
- System piping

"Clean" water, defined as ≤10 kDa ultrafiltration permeate, or water for injection (WFI), is required to ensure contaminants are not present, which could negatively impact membrane performance.

Water flux is measured most reliably at low pressure. Minimal crossflow is required, and the retentate valve only needs to be slightly cracked open to ensure elimination of air trapped on the lumen side of the HFM. Care should be taken not to restrict permeate flow, such as with small diameter tubing or long fluid path lengths.

Procedure:

1. Fully open the permeate valve.
2. Crack open the retentate valve.
3. Start the feed pump, increasing flow to a feed pressure of 2 – 3 psig (0.1 – 0.2 bar) for microfiltration filters. The objective is to attain a consistent, measurable permeate flow at low inlet pressure. For ultrafiltration membranes, increase pressure to 5 – 0 psig (0.3 – 0.7 bar) to attain a measurable permeate flow. Record the outlet pressure as well.
4. Start the measurement with the outlet valve cracked open to vent the air. Then close the outlet valve until only a trickle of water is observed.
5. Measure the permeate flow in mL/min and calculate the flux in L/m²/hr/bar (LMH/bar) per the following equation: flux needs to be in LMH/bar.

$$Normalized\ Flux\ (LMH/bar) = \frac{Permeate\ flow\ (mL/min)}{Filtration\ area\ (m^2)}\ x\ 0.06\ /\ TMP\ (bar)$$

$$TMP = \left(\frac{P_{inlet} + P_{outlet}}{2}\right) - P_{permeate}$$

NOTE: $P_{permeate}$ *is assumed to be 0 psi at low* P_{inlet}

6. Measure the temperature of the water.
7. Record inlet and outlet pressures, permeate flow rate, and temperature into a data log form or spreadsheet.
8. Normalize the flux temperature to 25 °C per the following equation:

$$Temperature\ Corrected\ Flux = Flux\left(\frac{T_1}{T_2}\right)$$

Where T_1 *= Reference temperature (e.g., 25 °C) and* T_2 *= Actual temperature (°C)*

Typical Clean Water Flux Ranges

Porosity (µm)	Normalized Clean Water Flux (LMH/bar @ 25 °C)
0.4	≥ 7,500
0.2	≥ 3,300
0.1	≥ 1,800

Table 12: Minimum flux for SepraPor® microfiltration porosities.

MWCO (kDa)	Normalized Clean Water Flux (LMH/bar @ 25 °C)
750	840 – 1,300
500	465 – 1,200
300	325 – 600
100	215 – 550
50	100 – 480
30	70 – 265
10	50 – 165

Table 13: Typical flux ranges for SepraPor® ultrafiltration MWCO.

Ultrafiltration Characterization: Passage

Molecular weight cut-off values are assigned using a rigorous characterization method with a minimum of three molecular weight (Mw) markers. Each MWCO has a designated passage band based on three Mw markers, which a lot of membrane must perform within to be assigned that MWCO. These passage bands are distinct to minimize overlap between membranes of different MWCO and improve membrane lot-to-lot consistency.

Passage is calculated using the following formula:

$$Passage\ \% = \frac{Permeate\ concentration}{Retentate\ concentration}\ x\ 100$$

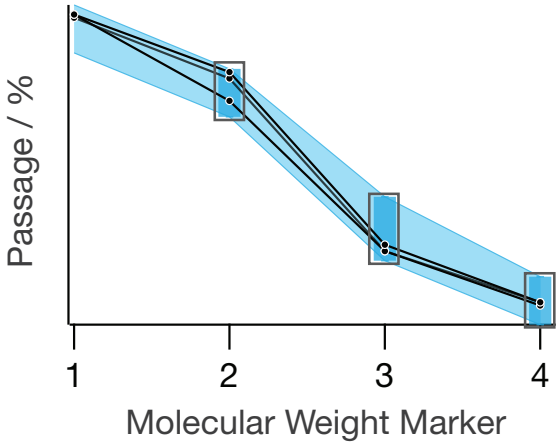

Figure 10: MWCO passage bands of three different lots of 300 kDa SepraPor® (Meissner) UF membranes.

Rejection Coefficient – Ultrafiltration Membrane Characterization

MWCO/kDa	Typical Rejection/%						
	Vitamin B12 1.2 kDa	Inulin 5 kDa	Cytochrome C 12.4 kDa	BSA 67 kDa	BgG 170 kDa	Dextran 500 500 kDa	Dextran 2M 2,000 kDa
10	< 5	< 35	40 – 65				
30		< 10	< 40	> 90			
50			< 35	> 90	> 95	> 65	
100				30 – 65	> 90	< 50	> 60
300					> 85	< 30	50 – 75
500					> 50	< 20	< 5
750					< 50		< 5

Table 14: SepraPor® ultrafiltration membrane MWCO rejection coefficients of common reference molecules.

Sterilization Instructions

For critical pharmaceutical and biotechnology applications, the sterility of the SepraPor® filter must be ensured prior to process use. Steam-in-place (SIP) and autoclaving are commonly used methods for sterilization of SepraPor® filters.

When using steam to sterilize SepraPor® filters, it is important to use gentle and gradual temperature and pressure gradients to heat and cool the filter and to not exceed 121 °C (250 °F). The recommended rate of heating and cooling is 1 °C/minute.

The longevity of a hollow fiber filter is correlated to steam sterilization cycle, cycle time, temperature, and number of sterilization cycles.

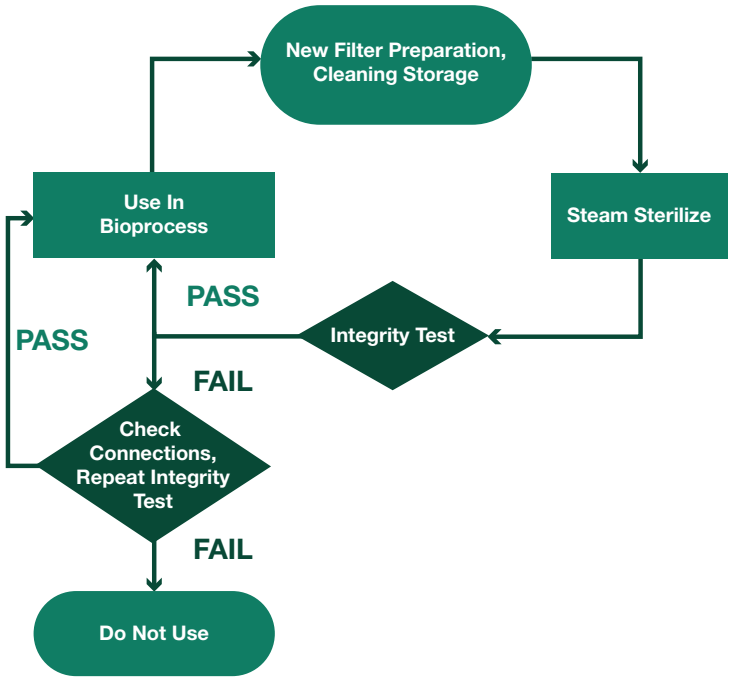

Figure 11: Flow chart for sterilization, integrity testing, and use of SepraPor® filters.

Steam-In-Place (SIP) Sterilization

SIP sterilization should be performed at 121 °C (250 °F) for a minimum of 30 minutes. A validated procedure that ramps temperature and pressure slowly to and from final sterilization temperature and pressure is required.

The procedure outlined below is intended as an initial starting point for developing an SIP process, and is specific to the 5.9-inch diameter SepraPor® cartridge in a stainless steel housing. Users may carry out their own proprietary SIP procedures, but in all cases, users should validate their SIP cycle parameters and equipment used to perform SIP sterilization.

1. Prepare filter for steaming by rinsing according to the new filter rinsing and preparation instructions.
2. Close the feed inlet valve (V1), retentate outlet valve (V2), permeate outlet valve (V3), low-point permeate drain (V4), and air inlet/vent valve (V5).
3. Open the retentate steam inlet valve (V6) and permeate steam inlet valve (V7).
4. Open the feed steam trap bypass valve (V8).
5. Close steam trap isolation valves (V9 and V10).
6. Introduce steam by cracking open the steam inlet valve (V11) or adjusting steam regulator to 1 psig (0.069 bar). Steam and water should trickle from the feed steam trap bypass valve (V8). Adjust the steam inlet valve so that the system outlet temperature heats up to 100 °C (212 °F) at a rate of 1 °C (1.8 °F)/minute.
7. Once outlet temperature reaches 100 °C (212 °F), wait 5 minutes and open the permeate steam trap bypass valve (V4). Wait 5 more minutes, then close both steam trap bypass valves (V4 and V8).
8. Open the steam trap isolation valves (V9 and V10), maintaining steam flow into both the retentate and permeate sides of the filter. Condensate will drain from the steam traps.
9. Open the retentate valve (V2) slightly and slowly open the steam inlet valve (V11). Adjust the steam inlet valve so that the system outlet temperature heats up to 121 °C (250 °F) at a rate of 1 °C (1.8 °F)/minute.

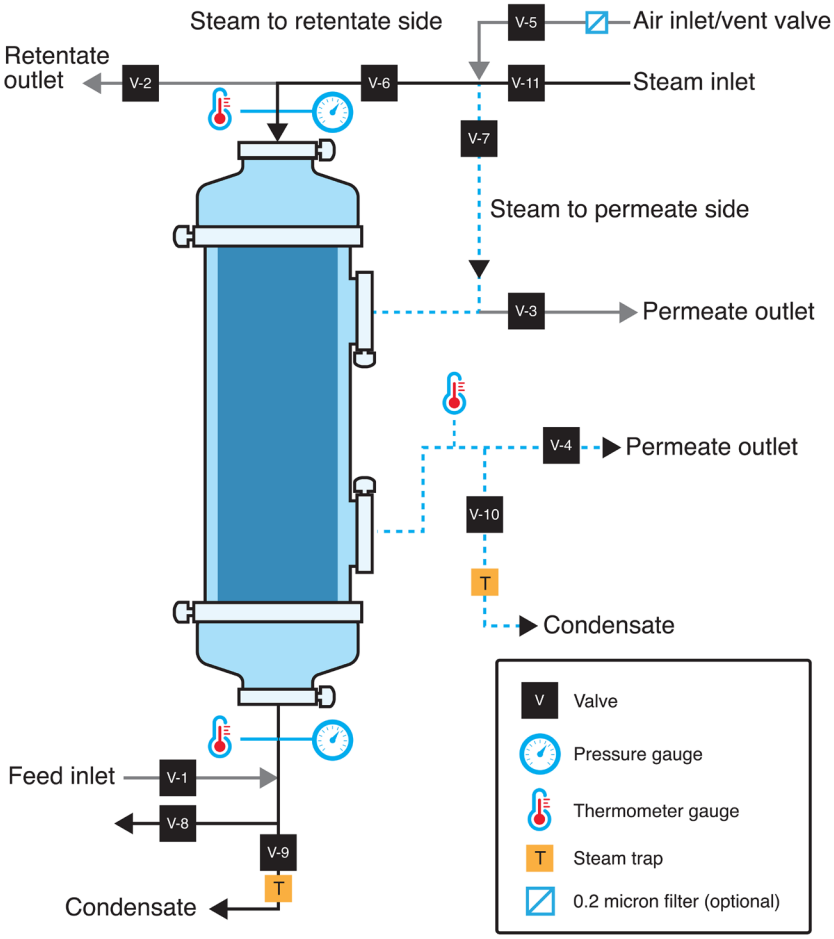

Figure 12: Typical configuration for SepraPor® SIP.

10. Open the feed inlet valve (V1), retentate outlet valve (V2), and permeate outlet valve (V3) slightly.
11. If introducing steam to the remainder of the process system, slowly open the feed inlet valve (V1) and retentate outlet valve (V2), ensuring steam pressure does not drop. When the remainder of the process system comes up to pressure, fully open valves V1 and V2.
12. Steam for a minimum of 30 minutes at the specified pressure.
13. To cool the cartridge and housing, close all valves starting with those furthest from the steam source and working toward the source. Finish by closing the steam inlet valve (V11).
14. Pressurize the system to 15 psi (1.03 bar) by opening the air inlet/vent valve (V5). Crack open one of the steam trap bypass valves (V4 or V8) to release pressure and maintain air flow through the filter assembly.
15. Allow the cartridge and system to cool gradually to ambient temperature for at least 4 hours. To help preserve filter integrity, do not exceed a cool down rate of -1 °C (-1.8 °F)/minute.

16. Integrity test the filter post-sterilization is optional but recommended and sometimes required in critical applications. If performing an integrity test, close all valves except the air inlet/vent valve (V5), retentate steam inlet valve (V6), and permeate steam trap bypass valve (V4). See Figure 13.
17. Attach flexible tubing to the permeate steam trap bypass valve (V4) and immerse in a beaker of water.
18. Perform pressure hold integrity test by introducing air at approximately 5 psig (0.3 bar) through the air vent. Watch for bubbles coming from the permeate outlet. If only small bubbles form, the cartridge is integral.
19. To configure the filter system for processing, close the air inlet/vent valve (V5), retentate steam inlet valve (V6), permeate steam inlet valve (V7), steam trap bypass valves (V4 and V8), and steam trap isolation valves (V9 and V10).
20. Open feed inlet valve (V1), permeate outlet valve (V3), and retentate outlet valve (V2).
21. The filter system is now ready for processing.

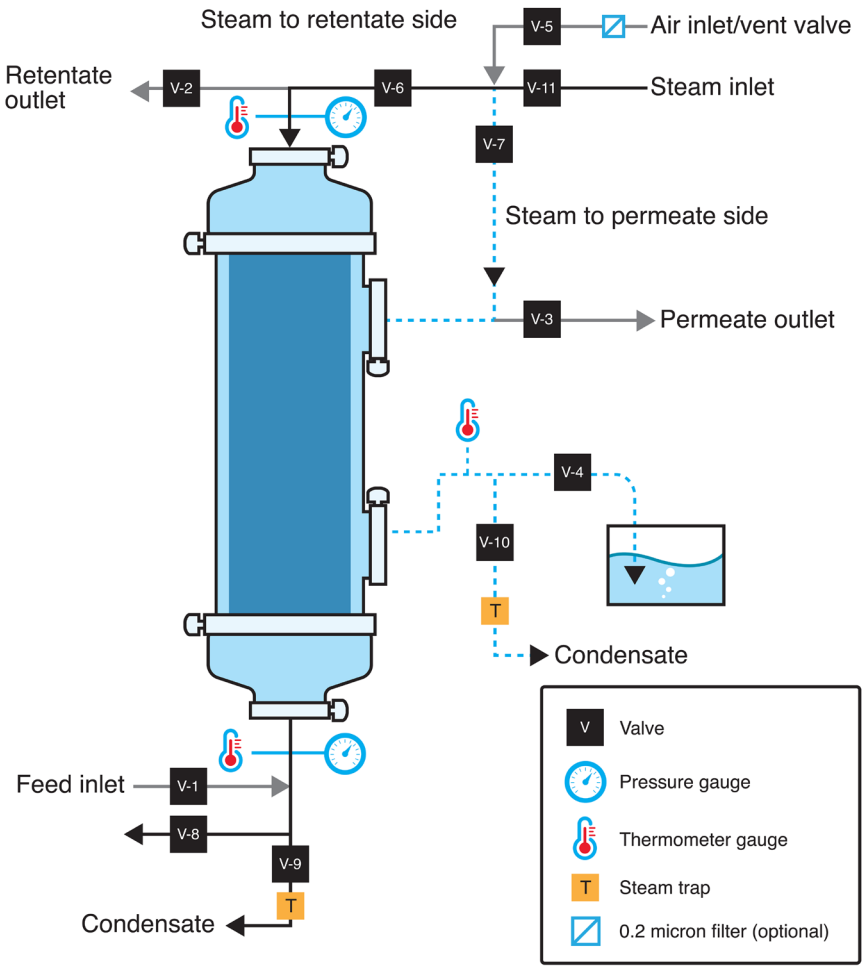

Figure 13: Typical configuration for integrity testing SepraPor® post-SIP.

General SIP Recommendations:

Meissner offers the following recommendations and techniques to help ensure efficient and effective operation of the filter system.

- Do not shock or expose the filter cartridge to pressure surges, as this can compromise filter integrity.
- Ensure that temperature increases and decreases are gradual, approximately 1 °C/minute during the heating and cooling cycles.
- Fully wet the filter membrane before performing autoclave or steam sterilizations.
- Ensure differential pressure across the membrane does not exceed 5 psid (0.3 bar).
- Introduce steam simultaneously through both the retentate and permeate sides of the filter to prevent filter damage.

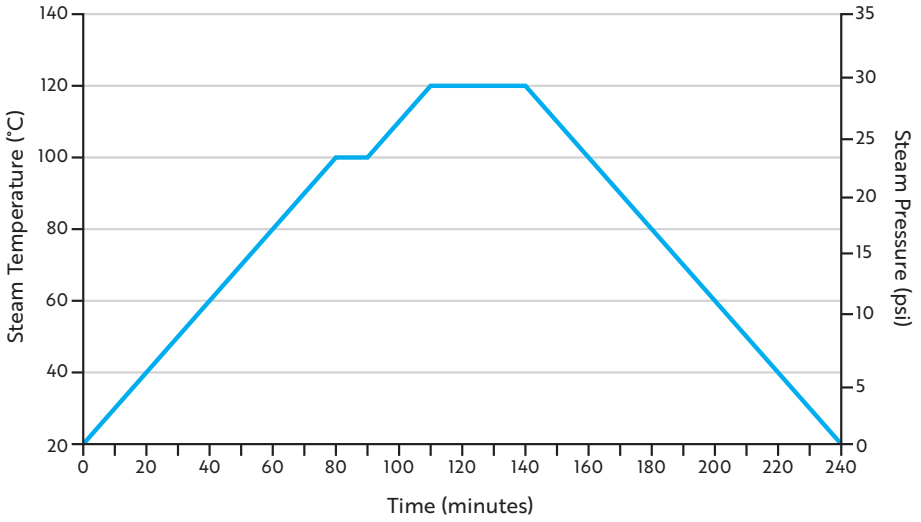

Figure 14: Recommended SIP sterilization cycle for the 6" SepraPor® cartridge at a temperature change rate of 1 °C/minute.

- Monitor steam temperature and pressure to ensure effective sterilization without compromising filter integrity.
- Steam must be free of rust and other particulates.
- Filter housing should be clean before the cartridge is installed.
- To ensure thorough sterilization, steam pressure in the system must be maintained at ≥ 15 psi.
- Establish a sterilization procedure that provides consistent sterilization results, and validate the procedure.
- Superheated steam can overheat the filter, causing damage to the cartridge and affecting membrane performance. Maintain sterilization temperature at 121 °C (250 °F), or as close to this temperature as possible.
- Always check valve positions before operating or steaming the filter.
- Do not apply back pressure on the membrane.

Autoclave Sterilization

Sterilize the SepraPor® filter at 121 °C (250 °F) and 15 psi (1.0 bar) for a minimum of 30 minutes, using a temperature ramp of no more than 1 °C/minute above 121 °C (250 °F). A validated procedure that ramps temperature and pressure slowly to final sterilization temperature and pressure is required.

For users who do not have access to a programmable autoclave, instructions are provided below solely as a guide, and the user is ultimately responsible for properly validating their sterilization process.

1. Wet the filter following the new filter rinsing and preparation instructions on Pages 8 – 9.
2. Warm the module in an oven at 100 °C (212 °F) for at least 90 minutes.
3. Transfer the warmed SepraPor® filter into the autoclave and sterilize at 121 °C (250 °F) for at least 30 minutes.
4. Allow the unit to cool to room temperature slowly for a minimum of 3 hours before use.

Irradiation

SepraPor® microfiltration capsule filters are designed for irradiation and can be included as part of a OneTouch® single-use assembly. Irradiated SepraPor® ultrafiltration filters are wetted and integrated into a closed assembly for aseptic connection.

Sterility validation is completed for microfiltration and ultrafiltration offerings. SepraPor® hollow fiber filter capsules may be irradiated with 25 – 40 kGy once. It is not recommended to autoclave or SIP an irradiated filter.

Process Start-Up

Start-up occurs after rinsing the filter and ensuring complete wetting of the hollow fiber membrane to avoid "entrapped" air within the pores. Improper start-up of high-flux microfiltration membranes can result in rapid gel layer formation leading to a decline in flux. During start-up, close both permeate valves to establish the cross flow velocity as needed. If possible, circulate water or buffer solution initially to obtain the proper cross flow velocity before introducing your product solution.

During processing, aim to maintain an inlet pressure of less than 10 psig (0.7 bar) for microfiltration membranes and less than 50 psi (3.5 bar) for ultrafiltration membranes. Please refer to the maximum operating condition for additional details on Page 6. Low inlet pressures will help prevent pore plugging by small particulates or cell fragments in microfiltration applications. Ultrafiltration processes can be operated at higher pressures from the beginning given the typically lower bioburden load of these solutions. Retentate pressure should be approximately 0 psi (0 bar) at start-up before applying any type of back pressure.

After establishing the desired cross flow rate, begin permeate withdrawal by fully opening the permeate tubing valve. If you observe rapid flux decline, throttle the permeate tubing valve on subsequent trials to create back pressure in the permeate line. Controlling permeate flow rate can stabilize flux and improve long-term system productivity. This technique, called permeate flow control, is recommended for all microfiltration separations, particularly when using membrane rated at 0.4 µm.

Post-Use Cleaning

Following is a general guideline for cleaning SepraPor® hollow fiber filters.

Reasons for Cleaning

- Remove residual product to prevent possible cross-contamination
- Remove fouling materials to maintain and/or recover filtration efficiency
- Prevent microorganism growth and remove metabolites to maintain a sanitary system

An insufficiently cleaned filter will have reduced flux and shortened usable life. Using such filters may lead to extended manufacturing times and reduced processing capacity, resulting in process interruption and filter replacement.

Cleaning effectiveness may be influenced by process solutions, process conditions, cleaning chemicals, and cleaning methods. Different membranes may require different cleaning strategies, such as stronger or more concentrated cleaning chemicals, higher temperatures, longer cleaning durations, and higher cross flow rates. Due to different process requirements and fouling conditions, users should study and develop the most effective cleaning methods for their particular processes. For particularly difficult to clean processes, it may be most efficient to forego cleaning and begin each process with a new filter.

Key Factors for Cleaning

- Time: Typical cleaning durations are from 30 – 120 minutes; longer cleaning times generally lead to better cleaning results.
- Cleaning agent type and concentration: HFMs are typically cleaned with NaOH from 0.1 – 1.0 N. However, users should determine the most effective cleaning agent and the minimum effective concentration per cleaning time for their application due to differences in process conditions, contaminants, and cleanability.
- Temperature: Typical cleaning temperatures are between 25 °C to 50 °C; the higher temperatures are usually more effective, especially for lipids and other oily contaminants, though care should be taken not to exceed the maximum operating temperature of the HFM.
- Cross flow rate: Higher cross flow rates produce better cleaning results. Carefully monitor inlet-, outlet-, and transmembrane pressures when cleaning at elevated cross flow rates.
- Water: It is recommended to use deionized water (DIW) or water for injection (WFI); poor quality water should not be used.

Common Cleaning Agents

Type	Agents	Foulant	Conditions
Alkalies	NaOH	Proteins, vaccines, bacterial cells, pyrogens, etc.	0.1 – 0.5 N 20 °C – 50 °C 30 – 60 min.
Alkalies	NaOH – NaOCl	Nucleic Acids	0.1 – 0.5 N NaOH 100 – 300 ppm NaOCl 30 – 60 min.
Acids	HNO_3 H_3PO_4 H_2SO_4	Nucleic Acids, inorganic, etc.	0.1 N 20 °C – 50 °C 30 min.
Surfactants*	SDS Triton X – 100 Tween 80	Precipitated proteins, lipids, oils, antifoams, lipopolysaccharides	0.1%, pH 4 – 9 30 – 60 min.

Table 15: Recommended cleaning agents for various foulants of SepraPor® filters.

**Cleaning with surfactants is commonly performed in industry. However, the end user is ultimately responsible to validate their cleaning procedure.*

Evaluation of Cleaning Effectiveness

Determining the effectiveness of a cleaning protocol is usually done by water flux recovery (%), comparing the water flux rate of a filter after cleaning against its initial water flux rate:

$$WF\ recovery\ \% = \frac{WF_{after\ cleaning}}{WF_{initial}}\ x\ 100$$

Water flux recovery may vary widely (65% – 95%) after the first use, but subsequent recovery values should be near 90%. Lower recovery may indicate the need for cleaning method optimization. If cleaning has been optimized, membranes with low recovery should be replaced.

Although the most common assessment of cleaning efficiency, water flux is not the only criterion available. Certain applications may see low water flux recovery, but consistent sample flux.

Water flux is temperature sensitive and should be normalized to 25 °C. See the “Measuring Clean Water Flux” in this document for more information.

Used Membrane Storage

Filters must be stored appropriately to prevent membranes from drying out or developing microbial growth. Typical storage solutions and conditions are listed below, and filters should be sanitized before next use to ensure cleanness. Note: Storage conditions are based on industry standards.

Storage Solutions	Maximum Recommended Storage Time
NaOH (0.05 – 0.1 N)	< 6 months
NaOH (0.05 – 0.1 N) at 4 °C	< 1 year
Deionized H_2O + bactericide	< 1 month

Table 16: Recommended SepraPor® storage conditions.

Storage and Shelf Life

Meissner manufactures a complete line of filter products and One-Touch® single-use assemblies that can be integrated with SepraPor® capsule filters. Assemblies are suitably bagged and boxed for shipping and may be stored in the original packaging in a clean dry area at room temperature. The following gives the minimum shelf life expectancies for SepraPor® products. Filters may be used beyond their minimum shelf life if stored in original packaging and shown by integrity testing to meet specifications.

Filter product age can be determined from the date of manufacture on the product label, or the original Certificate of Conformance. For irradiated filters, shelf-life starts from the date of irradiation and are distinguished with part numbers XFG for microfiltration and XFP for Ultrafiltration.

Microfiltration

Non-sterile and irradiated SepraPor® microfiltration filters are validated for a 2-year shelf life in cartridge and capsule configurations.

Ultrafiltration

Irradiated SepraPor® ultrafiltration filter shelf-life studies are ongoing with real-time data up to 1 year.

Quality Assurance

SepraPor® filters comply with the Food and Drug Administration Code of Federal Regulations, Title 21, Parts 210 and 211. Product is manufactured and packaged in a cleanroom facility that, through voluntary compliance, meets or exceeds FDA Good Manufacturing Practice Standards. To ensure product reliability, Meissner's Quality Assurance staff continually audits the manufacturing process for conformance to its Quality Management System. Each SepraPor® filter is labeled with filter type, lot number, and unique serial number. The serial number for all cartridge filters can be found on the product packaging.

Microfiltration Capsule Ordering Information

Part Number[1]	Filter Diameter	Lumen	Fibers	Fluid Path Length (Nominal)	Effective Filtration Area	Retentate Ports	Permeate Ports
XFC _ _ _ CA06-EEEE	3/8" (0.95 cm)	1.0 mm	3	6" (15 cm)	0.012 ft² (12 cm²)	Female luer lock	Female luer lock
XFC _ _ _ CA12-EEEE			3	12" (30 cm)	0.029 ft² (27 cm²)		
XFC _ _ _ CA24-EEEE			3	24" (60 cm)	0.061 ft² (57 cm²)		
XFC _ _ _ C006-EEEE			13	6" (15 cm)	0.054 ft² (50 cm²)		
XFC _ _ _ C012-EEEE			13	12" (30 cm)	0.12 ft² (0.012 m²)		
XFC _ _ _ C024-EEEE			13	24" (60 cm)	0.26 ft² (0.025 m²)		
XFC _ _ _ C012-7711			13	12" (30 cm)	0.11 ft² (0.010 m²)	¾" sanitary flange	¼" hose barb
XFC _ _ _ C024-7711			13	24" (60 cm)	0.25 ft² (0.023 m²)		
XFC _ _ _ C112-7722	¾" (1.9 cm)		55	12" (30 cm)	0.44 ft² (0.041 m²)		3/8" hose barb
XFC _ _ _ C124-7722			55	24" (60 cm)	1.0 ft² (0.096 m²)		
XFC _ _ _ C212-00CC	1" (2.5 cm)		115	12" (30 cm)	0.84 ft² (0.078 m²)	1" sanitary flange	½" hose barb
XFC _ _ _ C224-00CC			115	24" (60 cm)	2.1 ft² (0.19 m²)		
XFC _ _ _ C312-FFCC	1¼" (3.2 cm)		150	12" (30 cm)	1.2 ft² (0.11 m²)	1½" sanitary flange	
XFC _ _ _ C324-FFCC			150	24" (60 cm)	2.8 ft² (0.26 m²)		
XFC _ _ _ C412-FFCC	2.0" (5.1 cm)		520	12" (30 cm)	4.4 ft² (0.41 m²)		
XFC _ _ _ C424-FFCC			520	24" (60 cm)	10 ft² (0.93 m²)		
XFC _ _ _ C512-FF00	3.0" (7.6 cm)		1,250	12" (30 cm)	11 ft² (1.0 m²)		1" sanitary flange
XFC _ _ _ C524-FF00			1,250	24" (60 cm)	24 ft² (2.3 m²)		
XFC _ _ _ C712-HH00	4¼" (10.8 cm)		2,600	12" (30 cm)	29 ft² (2.7 m²)	2" sanitary flange	
XFC _ _ _ C724-HH00			2,600	24" (60 cm)	49 ft² (4.5 m²)		

Retention Rating
M10 = 0.1 µm
M20 = 0.2 µm
M40 = 0.4 µm

To specify the correct part number, please choose a Retention Rating from the chart at left and insert the code in the spaces indicated with underscore marks in the Part Number field above, as needed. For ordering assistance, please contact your Meissner representative.

[1] *Irradiated capsule part numbers begin with XFG.*

Ultrafiltration Capsule Ordering Information

Part Number	Filter Diameter	Lumen	Fibers	Fluid Path Length (Nominal)	Effective Filtration Area	Retentate Ports	Permeate Ports
XFC _ _ _ AA06-EEEE	3/8" (0.95 cm)	0.5 mm	7	6" (15 cm)	0.015 ft² (13 cm²)	Female luer lock	Female luer lock
XFC _ _ _ AA12-EEEE			7	12" (30 cm)	0.033 ft² (31 cm²)		
XFC _ _ _ AA24-EEEE			7	24" (60 cm)	0.071 ft² (66 cm²)		
XFC _ _ _ A006-EEEE			30	6" (15 cm)	0.062 ft² (58 cm²)		
XFC _ _ _ A012-EEEE			30	12" (30 cm)	0.14 ft² (0.013 m²)		
XFC _ _ _ A024-EEEE			30	24" (60 cm)	0.30 ft² (0.028 m²)		
XFC _ _ _ A012-7711			30	12" (30 cm)	0.12 ft² (0.012 m²)	¾" sanitary flange	¼" hose barb
XFC _ _ _ A024-7711			30	24" (60 cm)	0.29 ft² (0.026 m²)		
XFC _ _ _ A112-7722	¾" (1.9 cm)		140	12" (30 cm)	0.56 ft² (0.052 m²)		3/8" hose barb
XFC _ _ _ A124-7722			140	24" (60 cm)	1.3 ft² (0.12 m²)		
XFC _ _ _ A212-00CC	1" (2.5 cm)		320	12" (30 cm)	1.2 ft² (0.11 m²)	1" sanitary flange	½" hose barb
XFC _ _ _ A224-00CC			320	24" (60 cm)	2.9 ft² (0.27 m²)		
XFC _ _ _ A312-FFCC	1¼" (3.2 cm)		520	12" (30 cm)	2.1 ft² (0.19 m²)	1½" sanitary flange	
XFC _ _ _ A324-FFCC			520	24" (60 cm)	4.9 ft² (0.45 m²)		
XFC _ _ _ A412-FFCC	2.0" (5.1 cm)		1,300	12" (30 cm)	5.5 ft² (0.51 m²)		
XFC _ _ _ A424-FFCC			1,300	24" (60 cm)	13 ft² (1.2 m²)		
XFC _ _ _ CA06-EEEE	3/8" (0.95 cm)	1.0 mm	3	6" (15 cm)	0.012 ft² (12 cm²)	Female luer lock	Female luer lock
XFC _ _ _ CA12-EEEE			3	12" (30 cm)	0.029 ft² (27 cm²)		
XFC _ _ _ CA24-EEEE			3	24" (60 cm)	0.061 ft² (57 cm²)		
XFC _ _ _ C006-EEEE			13	6" (15 cm)	0.054 ft² (50 cm²)		
XFC _ _ _ C012-EEEE			13	12" (30 cm)	0.12 ft² (0.012 m²)		
XFC _ _ _ C024-EEEE			13	24" (60 cm)	0.26 ft² (0.025 m²)		
XFC _ _ _ C012-7711			13	12" (30 cm)	0.11 ft² (0.010 m²)	¾" sanitary flange	¼" hose barb
XFC _ _ _ C024-7711			13	24" (60 cm)	0.25 ft² (0.023 m²)		
XFC _ _ _ C112-7722	¾" (1.9 cm)		55	12" (30 cm)	0.44 ft² (0.041 m²)		3/8" hose barb
XFC _ _ _ C124-7722			55	24" (60 cm)	1.0 ft² (0.096 m²)		
XFC _ _ _ C212-00CC	1" (2.5 cm)		115	12" (30 cm)	0.84 ft² (0.078 m²)	1" sanitary flange	½" hose barb
XFC _ _ _ C224-00CC			115	24" (60 cm)	2.1 ft² (0.19 m²)		
XFC _ _ _ C312-FFCC	1¼" (3.2 cm)		150	12" (30 cm)	1.2 ft² (0.11 m²)	1½" sanitary flange	
XFC _ _ _ C324-FFCC			150	24" (60 cm)	2.8 ft² (0.26 m²)		
XFC _ _ _ C412-FFCC	2.0" (5.1 cm)		520	12" (30 cm)	4.4 ft² (0.41 m²)		
XFC _ _ _ C424-FFCC			520	24" (60 cm)	10 ft² (0.93 m²)		
XFC _ _ _ C512-FF00	3.0" (7.6 cm)		1,250	12" (30 cm)	11 ft² (1.0 m²)		1" sanitary flange
XFC _ _ _ C524-FF00			1,250	24" (60 cm)	24 ft² (2.3 m²)		

Retention Rating

010 = 10 kDa	**300** = 300 kDa
030 = 30 kDa	**500** = 500 kDa
050 = 50 kDa	**750** = 750 kDa
100 = 100 kDa	

To specify the correct part number, please choose a Retention Rating from the chart at left and insert the code in the spaces indicated with underscore marks in the Part Number field above, as needed.

For irradiated options, please see the SepraPor® Process Ready Assemblies for Ultrafiltration brochure at www.meissner.com/seprapor-assemblies.

MEISSNER

Microfiltration Cartridge Ordering Information

Part Number	Filter Diameter	Lumen	Fibers	Fluid Path Length (Nominal)	Effective Filtration Area	Housing Seal Configuration[1]	O-rings
XFM _ _ _ C412-AAS	2" (5.1 cm)	1.0 mm	520	12" (30 cm)	4.1 ft² (0.38 m²)	AA	Silicone
XFM _ _ _ C424-AAS				24" (60 cm)	9.8 ft² (0.91 m²)		
XFM _ _ _ C512-AAS	3" (7.6 cm)		1,250	12" (30 cm)	9.9 ft² (0.92 m²)		
XFM _ _ _ C524-AAS				24" (60 cm)	23 ft² (2.2 m²)		
XFM _ _ _ C612-CCS	4" (10.2 cm)		2,400	12" (30 cm)	24 ft² (2.2 m²)	CC	
XFM _ _ _ C624-CCS				24" (60 cm)	43 ft² (4.0 m²)		
XFM _ _ _ C824-AAS	5.9" (15 cm)		5,200	24" (60 cm)	87 ft² (8.1 m²)	AA	

Retention Rating
M10 = 0.1 µm
M20 = 0.2 µm
M40 = 0.4 µm

To specify the correct part number, please choose a Retention Rating from the chart at left and insert the code in the spaces indicated with underscore marks in the Part Number field in the chart above.

[1] AA and CC configured cartridges are fitted with an O-ring at each open-face end that engage and seal the cartridge in the filter housing.

Ultrafiltration Cartridge Ordering Information

Part Number	Filter Diameter	Lumen	Fibers	Fluid Path Length (Nominal)	Effective Filtration Area	Housing Seal Configuration[1]	O-rings
XFM _ _ _ A412-AAS	2" (5.1 cm)	0.5 mm	1,300	12" (30 cm)	5.1 ft² (0.48 m²)	AA	Silicone
XFM _ _ _ A424-AAS				24" (60 cm)	12 ft² (1.1 m²)		
XFM _ _ _ C412-AAS		1.0 mm	520	12" (30 cm)	4.1 ft² (0.38 m²)		
XFM _ _ _ C424-AAS				24" (60 cm)	9.8 ft² (0.91 m²)		
XFM _ _ _ C512-AAS	3" (7.6 cm)		1,250	12" (30 cm)	9.9 ft² (0.92 m²)		
XFM _ _ _ C524-AAS				24" (60 cm)	23 ft² (2.2 m²)		

Retention Rating	
010 = 10 kDa	**300** = 300 kDa
030 = 30 kDa	**500** = 500 kDa
050 = 50 kDa	**750** = 750 kDa
100 = 100 kDa	

To specify the correct part number, please choose a Retention Rating from the chart at left and insert the code in the spaces indicated with underscore marks in the Part Number field in the chart above.

[1] AA configured cartridges are fitted with an O-ring at each open-face end that engage and seal the cartridge in the filter housing.

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