



Pellicon® 2 Filters and Holders

High-performance tangential flow filters for biopharmaceutical process development, scale-up/scale-down and concentration/purification/cell harvesting applications

- ▶ *Leading-edge void-free membranes to match virtually any separation challenge*
- ▶ *Short flow path for higher flux and higher resolution separation capability*
- ▶ *Choice of flow channel configuration providing process optimization capability*
- ▶ *Predictable, fast, scale-up*
- ▶ *True linear scalability from laboratory size modules to industrial assemblies for processing thousands of liters*

Typical Applications

Concentration, desalting or buffer exchange of:

- Protein solutions
- Polysaccharide solutions
- Virus suspensions

Harvest, washing or clarification of:

- Cell cultures and lysates
- Colloidal suspensions
- Viral cultures

Superior TFF Performance

For research, process development, scale-up and production, Pellicon 2 filters and holders offer the following benefits:

Consistent High Flux and High Product Recovery

Millipore's Biomax® polyethersulfone and Ultracel® PLC-composite regenerated cellulose membranes have void-free structures that guard against leakage of solutes through microdefects normally associated with voids beneath the thin skins of conventional UF membranes (Figures 1 and 2).

These void-free membranes are more permeable, resulting in high-flux with equivalent or superior product retention (Figure 3). These void-free membranes provide the advantages of fast, high yield processing and smaller systems.

The long established Durapore® hydrophilic PVDF microfiltration membrane is well known for its exceptional combination of high flux, low protein binding and high product recoveries.

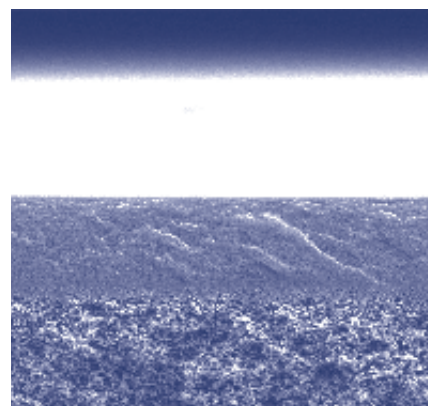


Figure 1. Void-free Biomax 10 modified polyethersulfone membrane

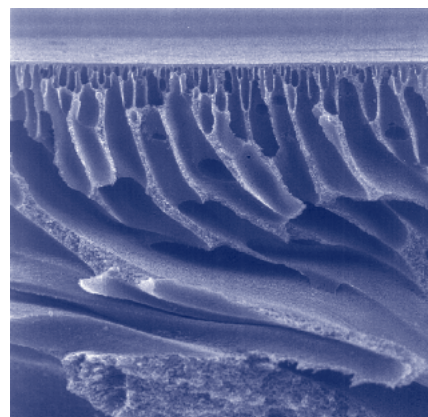


Figure 2. Conventional 10 kD polyethersulfone membrane with sub-surface voids

Easy, Reliable Linear Scale-Up from the Lab to the Production Plant

Pellicon 2 Mini filters scale-up easily and reliably from the laboratory to the production plant (Figures 4 and 5). By ensuring every flow channel has the same length, height and turbulence promoter as well as flow direction and materials of construction, we maintain the same ultrafilter/microfilter performance at all scales. Thus, rapid and reliable translation of processes from lab to manufacturing scale is easily achieved.

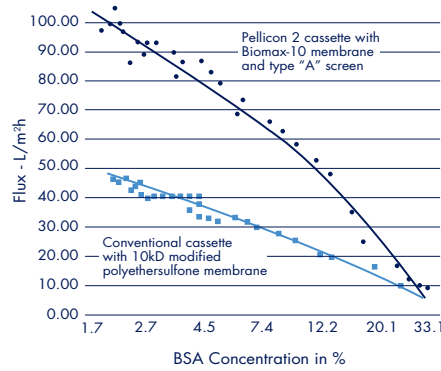
Linear Scale-Up

Mini filters (0.1 m²/1.1 ft²) and holders are designed for laboratory ultrafiltration/microfiltration of 100 mL to 10 L volumes, yet scale up linearly to Pellicon 2 Cassette (0.5 m²/5.4 ft²) and Maxi (2.5 m²/26.9 ft²) filters used in the pilot or manufacturing plant to process volumes from one liter to thousands of liters.

Thus, whether you operate 0.1 m² or 100 m² of installed area, every Pellicon 2 filter operates with the same pressure drop, flow velocity and concentration profile for true, rapid and simple linear scale-up.

Pellicon 2 Filters Proof of Performance

Improved Flux



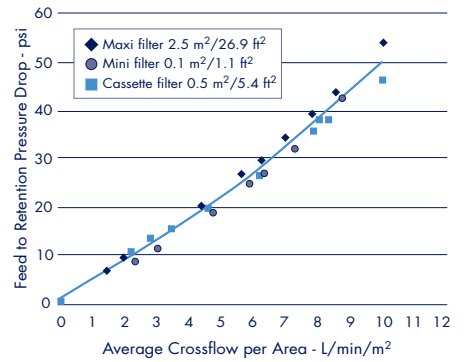
Feed pressure: 5.6 bar/80 psi
Retentate pressure: 2.1 bar/30 psi
Temperature: 10 – 13.5 °C
Initial volume: 28 L
Final volume: 2 L

Conclusion

Pellicon 2 filters with Biomax membranes provide up to two-times the process flux of conventional cassettes resulting in faster processing and smaller systems.

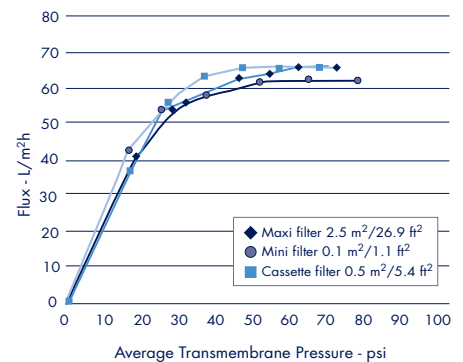
Figure 3. Flux versus BSA concentration

Linear Scalability



Temperature: 8 °C

Figure 4. Feed to retentate pressure drop versus average crossflow on a 10% BSA solution



Temperature: 8 °C

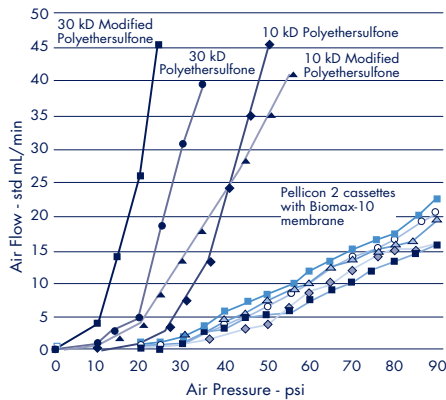
Feed to retentate pressure drop: 2.8 bar/40 psi

Conclusion

(Figures 4 and 5) Pellicon 2 family of cassette filters scale linearly from 0.1 to 0.5 to 2.5 m² (1.1 to 5.4 to 26.9 ft²) sizes for rapid, accurate and safe process scale-up and transfer.

Figure 5. Flux versus average transmembrane pressure on a 10% BSA solution.

Improved Reliability



Conclusion

The void-free structure of Biomax membranes is demonstrated by low, linear air diffusion values. This performance ensures better process reliability and safety and better product retention for higher yields.

Figure 6. Integrity test comparison-air flow through wetted cassettes

Greater Process Reliability and Reproducibility

The combination of defect-free membranes with Millipore's highly reliable manufacturing processes, offers greater consistency of process parameters.

The high quality of Millipore's ultrafiltration membranes is further ensured by our pioneering multiple-solute mixed-dextran retention profile test. Unlike the single solute protein retention test, Millipore's retention profile test measures and ensures reproducible retention performance of our UF membranes over the entire range of molecular weights retained by the membrane, not just at one or two molecular weights.

Low Product Loss

Pellicon 2 filters have a low minimum working volume – as low as 175 mL of retentate volume per square meter of membrane area. This low retentate volume permits high concentration factors to be reached with low starting volumes and maximizes the recovery of small sample volumes.

To prevent product loss, Pellicon 2 filters are 100% tested in manufacturing to ensure that every filter is integral.

In addition, Biomax and Ultracel membranes are exposed to a new high-pressure integrity test that provides greater sensitivity. The integrity test procedure and specifications are supplied so users can confirm integrity at high pressure when the filter is installed (Figure 6).

Biocompatibility

All wetted parts have been tested and meet the requirements of the USP Class VI biological test for plastics.

Superior Filter Quality

Pellicon cassettes are subjected to a complete array of quality control release tests.

A Certificate of Quality is included with every cassette.

Each cassette is identified with a unique serial number.

Validatable

Since 1973, Pellicon filters and systems have been successfully used for development and scale-up of processes for manufacturing injectable protein and polysaccharide drugs, in the serum fractionation, biotechnology, vaccine and pharmaceutical industries.

Pellicon 2 filters and systems were developed based upon Millipore's experience serving these applications, and are supported by an extensive Validation Support Data Package proving performance claims and demonstrating the suitability of these filters for drug manufacturing in validated processes. This package is available upon request.

Millipore can further assist your validation efforts through:

- Design and fabrication of standard and custom turnkey TFF systems for drug manufacturing facilities
- Installation and operational qualification services for these systems
- Validation support services for tangential flow filter use in drug manufacturing processes.
- Training on TFF process scale-up, optimization and development.

A Choice of Feed Channel Screens

For optimal performance in a range of applications Pellicon 2 filters incorporate three types of feed-channel screens:

- *Type A screen (tight screen)* is optimized to operate Biomax membranes with maximum flux with low-viscosity solutions.
- *Type C screen (coarse screen)* is optimized to operate PLC series membranes with maximum flux. The Type C screen is also available with Biomax-50, 100, 300, 500 and Biomax 1000 membranes for concentration and diafiltration of viscous solutions.
- *Type V screen (open channel)* is optimized for very viscous solutions or solutions with higher levels of suspended solids.



For More Detailed Information

Request literature number P17512 – User Guide for Pellicon Filters.

Normalized Recirculation Rates

Parameter	Unit	Typical ΔP		
		A	C	V
Screen Type		A	C	V
Recirculation Rate	L/min/m ²	4/6	5/35	
Differential Pressure	bar/psi	1.4/20	0.4/6	

Screen Selection Guidelines

Solution Type	Screen Type
Dilute protein solution or low viscosity solutions (MAbs, interferons)	A screen (tight screen)
Concentrated protein solutions or high viscosity solutions (IgG, biopolymers)	C screen (course screen)
High viscosity solutions (polysaccharides, certain microfiltration or clarification applications)	V screen (loose screen)

Specifications

Temperature Range

Mini, Cassette and Maxi:
4 to 50 °C

Maximum Forward Transmembrane Pressure

Device Size (m ²)	Biomax	Ultracel
0.1	6.8 bar (100 psi) Max	6.8 bar (100 psi) Max
0.5	6.8 bar (100 psi) at 30 °C	3.4 bar (50 psi) at 30 °C
2.5	6.8 bar (100 psi) at 30 °C	3.4 bar (50 psi) at 30 °C

Maximum Reverse Transmembrane Pressure

Device Size (m ²)	Biomax	Ultracel
0.1	0.33 bar (5 psi)	0.33 bar (5 psi)
0.5	0.33 bar (5 psi)	0.33 bar (5 psi)
2.5	0.33 bar (5 psi)	0.33 bar (5 psi)

Prefiltration Required

Mini, Cassette and Maxi:
100 μ m

Dimensions

Device	Width	Length	Thickness
Mini	5.6 cm	21 cm	1.5 cm (V screen-2.16 cm)
Cassette	17.8 cm	21 cm	1.5 cm (V screen-2.16 cm)
Maxi	17.8 cm	21 cm	7.6 cm (V screen-9.0 cm)

Membrane Selection Guideline

Membrane Type	Materials	Benefits
Biomax	Modified polyethersulfone	Highest flux ultrafiltration membrane Excellent chemical resistance Void-free structure for higher yield and reliability
Ultracel PLC	Regenerated cellulose (ideal for protein solutions < 20 g/L) PLC membranes are composite membranes cast on a microporous substrate for defect-free membranes with superior adhesion. Brings higher resolution, improved yields and superior back-pressure resistance	Extremely low protein binding hydrophilic membrane Highest product recovery and improved performance with difficult to process streams (antifoams, lipids, protein transmission applications)
Durapore	Hydrophilic PVDF	Very hydrophilic microporous membrane for cell harvest or clarification applications

Pellicon 2 Membrane Selection Chart

Approximate Molecular Weight (range of solutes retained >99%, kD)	Membrane	NMWL (kD) or Microns	Membrane Material	pH Range
High Flux Biomax Membranes – Void-free for Higher Yield and Reliability				
12 – 25 (growth factors, hormones)	Biomax-5	5	modified polyethersulfone	1 – 14
25 – 50 (growth factors, hormones)	Biomax-8	8	modified polyethersulfone	1 – 14
50 – 100 (albumin, hemoglobin)	Biomax-10	10	modified polyethersulfone	1 – 14
100 – 140 (enzymes)	Biomax-30	30	modified polyethersulfone	1 – 14
140 – 300 (IgG's)	Biomax-50	50	modified polyethersulfone	1 – 14
300 – 500 (small viruses and antigens)	Biomax-100	100	modified polyethersulfone	1 – 14
>500 (IgM's, large viruses)	Biomax-300	300	modified polyethersulfone	1 – 14
>0.03 µm (large viruses, colloids, particulates)	Biomax-500	500	modified polyethersulfone	1 – 14
>0.03 µm (large viruses, cells, colloids, particulates)	Biomax-1000	1000	modified polyethersulfone	1 – 14
Ultracel PLC Series – for High Recoveries				
8 – 18 (proinsulin, hematopoietic factors)	PLCCC	5	regenerated cellulose	2 – 13
18 – 60 (hemoglobin, enzymes)	PLCGC	10	regenerated cellulose	2 – 13
60 – 200 (monoclonal IgG's)	PLCTK	30	regenerated cellulose	2 – 13
200 – 500 (small viruses, viral antigens)	PLCHK	100	regenerated cellulose	2 – 13
>500 (large viruses, IgM's)	PLCMK	300	regenerated cellulose	2 – 13
>0.03 µm (large viruses, cells, colloids, particulates)	PLCXX	1000	regenerated cellulose	2 – 13
Durapore Membranes – for Microporous Applications				
Clarify cell lysates and protein solutions, clarify viral cultures	VVPP	0.1 µm	hydrophilic PVDF	2 – 11
Harvest & wash colloidal suspensions, bacterial cells; clarify protein solutions and viral cultures	GVPP	0.22 µm	hydrophilic PVDF	2 – 11
Harvest & wash colloidal suspensions, cell & viral cultures, clarify protein solutions & viral cultures	HVMP	0.45 µm	hydrophilic PVDF	2 – 11
Harvest cell cultures or colloidal suspensions	DVPP	0.65 µm	hydrophilic PVDF	2 – 11

Ordering Information

Pellicon 2 Filters

Membrane	Filters with A Screens (Tight Screen)			Filters with Type C Screens (Coarse Screen)		
	0.1 m ² /1.1 ft ²	0.5 m ² /5.4 ft ²	2.5 m ² /26.9 ft ²	0.1 m ² /1.1 ft ²	0.5 m ² /5.4 ft ²	2.5 m ² /26.9 ft ²
Biomax Series – Modified Polyethersulfone						
Biomax 5	P2B0 05A 01	P2B0 05A 05	P2B0 05A 25	+	+	+
Biomax 8	P2B0 08A 01	P2B0 08A 05	P2B0 08A 25	+	+	+
Biomax 10	P2B0 10A 01	P2B0 10A 05	P2B0 10A 25	+	+	+
Biomax 30	P2B0 30A 01	P2B0 30A 05	P2B0 30A 25	+	+	+
Biomax 50	P2B0 50A 01	P2B0 50A 05	P2B0 50A 25	P2B0 50C 01	P2B0 50C 05	P2B0 50C 25
Biomax 100	P2B1 00A 01	P2B1 00A 05	P2B1 00A 25	P2B1 00C 01	P2B1 00C 05	P2B1 00C 25
Biomax 300	+	+	+	P2B3 00C 01	P2B3 00C 05	P2B3 00C 25
Biomax 500	+	+	+	P2B5 00C 01	P2B5 00C 05	P2B5 00C 25
Biomax 1000	+	+	+	P2B0 1MC 01	P2B0 1MC 05	P2B0 1MC 25
Ultracel PLC Series – Regenerated Cellulose, Composite Construction						
5 kD	NA	NA	NA	P2C0 05C 01	P2C0 05C 05	P2C0 05C 25
10 kD	NA	NA	NA	P2C0 10C 01	P2C0 10C 05	P2C0 10C 25
30 kD	NA	NA	NA	P2C0 30C 01	P2C0 30C 05	P2C0 30C 25
100 kD	NA	NA	NA	P2C1 00C 01	P2C1 00C 05	P2C1 00C 25
300 kD	NA	NA	NA	P2C3 00C 01	P2C3 00C 05	P2C3 00C 25
1000 kD	NA	NA	NA	P2C0 1MC 01	P2C0 1MC 05	P2C0 1MC 25
Durapore – Hydrophilic PVDF						
0.1 µm	+	+	+	P2VV PPC 01	P2VV PPC 05	P2VV PPC 25
0.22 µm	+	+	+	P2GV PPC 01	P2GV PPC 05	P2GV PPC 25
0.45 µm	+	+	+	P2HV MPC 01	P2HV MPC 05	P2HV MPC 25
0.65 µm	+	+	+	P2DV PPC 01	P2DV PPC 05	P2DV PPC 25

Each Pellicon filter is packed one per box and includes Operating Instructions. A Certificate of Quality is included in every box.

Silicone intercassette gaskets are required for use with Pellicon 2 filters. Two gaskets are packed in the box with every Pellicon 2 filter.

+ = On request (custom order)

NA = not available

Filters with V Screens (Loose Screen)

0.1 m²/1.1 ft² 0.5 m²/5.4 ft² 2.0 m²/21.5 ft²

P2B0 05V 01 P2B0 05V 05 P2B0 05V 20

P2B0 08V 01 P2B0 08V 05 P2B0 08V 20

P2B0 10V 01 P2B0 10V 05 P2B0 10V 20

P2B0 30V 01 P2B0 30V 05 P2B0 30V 20

P2B0 50V 01 P2B0 50V 05 P2B0 50V 20

P2B 100V 01 P2B1 00V 05 P2B1 00V 20

P2B3 00V 01 P2B3 00V 05 P2B3 00V 20

P2B5 00V 01 P2B5 00V 05 P2B5 00V 20

P2B0 1MV 01 P2B0 1MV 05 P2B0 1MV 20

P2C0 05V 01 P2C005V 05 P2C0 05V 20

P2C0 10V 01 P2C0 10V 05 P2C0 10V 20

P2C0 30V 01 P2C0 30V 05 P2C0 30V 20

P2C1 00V 01 P2C1 00V 05 P2C1 00V 20

P2C3 00V 01 P2C3 00V 05 P2C3 00V 20

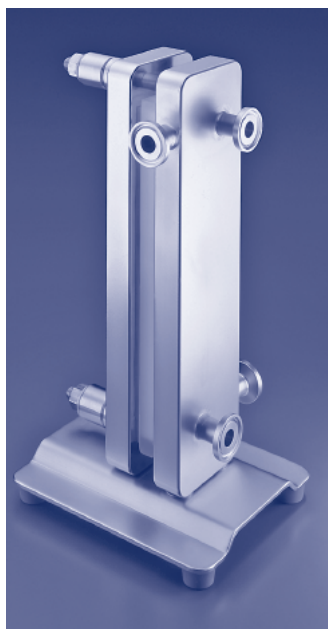
P2C0 1MV 01 P2C0 1MV 05 P2C01MV 20

P2VV PPV 01 P2VV PPV 05 P2VV PPV 20

P2GV PPV 01 P2GV PPV 05 P2GV PPV 20

P2HV MPV 01 P2HV MPV 05 P2HV MPV 20

P2DV PPV 01 P2DV PPV 05 P2DV PPV 20



Pellicon 2 Mini Holder

Pellicon 2 Mini holder operates one to three Mini filters in parallel for total areas of 0.1 to 0.3 m² (1.1 – 3.3 ft²). This sanitary holder is tightened with a small torque wrench to compress the filters between a manifold plate that conveys fluids in and out of the filters and an end plate that seals the filters together. The Mini holder is designed for process development and small volume pharmaceutical manufacturing.

Materials of Construction

Manifold and End Plates:

316 L stainless steel

Base, Tie Rods, Spacers and Washers:

304 stainless steel

Feet:

Thermoplastic rubber

Gaskets:

Silicone

Nuts:

Silicone bronze

Separator Plates

An optional separator plate allows processing simultaneously with up to three 0.1 m²/1.1 ft² cassettes to determine the best molecular weight cut-off in a single study on the same feed material.

Connections

All manifold connections are standard ½-inch sanitary clamp type.

Operating Parameters

Temperature Range:

4 to 50 °C. The Mini holder can be autoclaved without filters installed. The filters themselves cannot be autoclaved.

Maximum Pressure:

6.8 bar

Dimensions

Height: 260 mm; *Width:* 114 mm

Length: 140 mm; *Weight:* 5 kg

Holder Manifold Volume:

Feed plus retentate: 5.3 mL

Permeate: 6.4 mL

Stainless Steel Pellicon Holder XX42P0080

The stainless steel Pellicon filter holder, designed for sanitary applications, can be used alone or to expand existing cassette ultrafiltration (CUF) systems or to replace existing holders.

It requires only to be connected to an existing sanitary pump and piping for tangential flow microporous filtration or ultrafiltration.

It can accommodate up to 5 m²/55 ft² filter area as shipped with long tie rods or 0.5 to 2.5 m² (5.4 – 26.9 ft²) with accessory short tie rods.

Materials of Construction

Wetted Surfaces:

316 L stainless steel

Non-wetted Surfaces:

Silicon bronze nuts

Dimensions

Length: 28 cm; *Width:* 19 cm

Height: 25 cm

Operating Parameters

Operating Temperature Range:

4 to 50 °C. The Pellicon holder can be autoclaved without pressure gauges and filters; holder with gauges cannot be steamed. Pellicon filters cannot be steamed or autoclaved.

Connections

Sanitary 3/4" TC connections;

1 1/2" TC connections for gauges.

Shipping Weight

24 kg

To Place an Order or Receive Technical Assistance

For additional information call your nearest Millipore office:

In the U.S. and Canada,
call toll-free **1-800-MILLIPORE
(1-800-645-5476)**

In the U.S., Canada and Puerto Rico,
fax orders to **1-800-MILLIFX
(1-800-645-5439)**

Outside of North America contact your
local office. To find the office nearest
you visit www.millipore.com/offices.

Internet: www.millipore.com

Technical Service:

www.millipore.com/techservice

MILLIPORE

Process-scale Pellicon Holder

The Pellicon Process-scale Holder is a unique innovation for production scale Pellicon systems. This holder, vertically mounted, can hold up to 80 m²/880 ft² of membrane area.

Benefits

- Extremely compact footprint
- Easy to change cassettes
- Easy to vent and fully drain
- Simple connections
- Up to 4 levels. Can be easily extended in levels for simple membrane area expansion
- Each level up to 20 m²/220 ft²

- Uses standard and Maxi Cassettes
- Can be adapted for series or parallel configurations
- Simplifies pipework connection
- Hydraulic closure systems are available for the stainless-steel Pellicon holder and the process-scale Pellicon holder. These systems are convenient, reliable and easy to use to enable rapid and repeatable loading operation and storage of Pellicon 2 cassettes.

Materials of Construction

Manifold segment, fitting blocks and end plate 316 L stainless steel; tie rods 304 and 304 L stainless steel.

Ordering Information

Pellicon 2 Filter Holders

Description	Catalogue No.
Pellicon 2 Mini filter holder	XX42 PMI NI
Pressure gauges One diaphragm-protected digital pressure gauge, 0 – 7 bar, 3/4-inch fittings	XX42 PSG 01L
Pressure gauge adapters	XX42 PMO 01
Fitting kit Contains all tees, clamps, gaskets and a valve to connect tubing and pressure gauges to the Pellicon 2 Mini holder	XX42 PFK 01
Pellicon filter holder (for cassettes and Maxi filters)	XX42 P00 80
Pellicon 2 double thick gasket	PSSP 2XC 10
Pellicon Process-scale holder support and plate	XX42 SSP LT
Pellicon Process-scale holder	On request

A Typical Pellicon Production Processing System

Millipore supplies a range of standard and custom engineered systems. These systems can contain from 1 m²/11 ft² to several hundred m² of membrane area, with Clean-in-Place (CIP) or Steam-in-Place (SIP) integrated as appropriate. Systems can also be supplied with integrated process vessels in manual or fully automatic versions.

All systems are designed, engineered and manufactured in ISO® 9001 registered facilities, and are supplied with extensive validation data support packages.

Please contact us to discuss your specific application and process requirements.

Pellicon XL Devices for Process Development

For process development of volumes from 50 mL to 1 liter, Millipore offers Pellicon XL devices. This small volume TFF filter is designed for true scalability by providing the same flow path, channel length, and channel height as the Pellicon 2 cassettes. Based on proven TFF membrane technology, Pellicon XL devices ensure reliable, consistent and predictable performance.

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