Millipore Express® Family Guide

MilliporeSigma is the U.S. and Canada Life Science business of Merck KGaA, Darmstadt, Germany.

Millipore®

Preparation, Separation, Filtration & Monitoring Products

Overview

Choosing the right membrane filter is critical to the success of your process. A trusted name in the industry, Millipore Express® filters contain hydrophilic polyethersulfone (PES) membranes that offer sterilizing-grade filtration with high flux and capacity. Filters containing Millipore Express® membranes provide broad chemical compatibility across a wide pH range, are easy to wet and integrity test, and are available in a range of formats to meet the specific needs of different biomanufacturing operations.

Our Millipore Express® filters can be used in a wide range of applications including filtration of cell culture media and feeds and for sterile filtration at different steps in monoclonal antibodies (mAbs), vaccine, plasma, viral vector and large and small volume parenteral production.

Our Millipore Express® Filter Family

Millipore Express® SHR Filters
Sterile, High Retention
Sterilizing-grade filters for efficient filtration of cell culture media and feeds.

An optional, integrated PES membrane prefilter protects the high flux sterilizing 0.1 µm membrane from premature plugging. These filters offer mycoplasma reduction.

Millipore Express® SHC Filters
Sterile, High Capacity
High capacity, sterilizing-grade filters for plugging streams. Contain two PES membrane layers; 0.5/0.2 µm.

Millipore Express® SHF Filters
Sterile, High Flux
High flow, sterilizing-grade filters for critical process steps. Contain one layer of 0.2 µm PES membrane.

Millipore Express® PHF Filters
Process Protection, High Flux
High flow filters for cost-effective sterile filtration of buffers and process intermediates. Contain one layer of sterilizing-grade 0.2 µm PES membrane.

Selection & Applications Guide

We offer a full portfolio of filters to meet the needs of different bioprocess applications.

The table below provides a high-level overview of key applications and our filtration solutions as a starting point for development or optimization.

	mAb & r-protein intermediates	Plasma	Vaccines & viral vectors	Ophthalmics	SVPs	LVPs	Cell Culture Media Filtration	Buffer Filtration	Final Filtration	Gas	Colloids	Lipid Removal
Particulate removal and sterile filter protection												
Milligard PES® filters	✔	✔	✔	✔	✔	✔	✔	✔			✔	
Milligard® filters	✔	✔	✔		✔		✔				✔	
Polysep™ II filters	✔	✔	✔				✔				✔	✔
Lifegard™ filters		✔					✔				✔	✔
Bioburden reduction												
Milligard PES® filters	✔	✔	✔		✔	✔		✔				
Durapore® 0.45 µm filters	✔	✔	✔		✔	✔		✔				
Sterile filtration												
Millipore Express® SHC filters	✔	✔	✔		✔	✔	✔	✔			✔	✔
Millipore Express® SHF filters			✔	✔	✔	✔			✔			
Millipore Express® PHF filters	✔	✔				✔		✔				
Durapore® 0.22 µm filters	✔	✔	✔	✔	✔	✔	✔	✔	✔			
Durapore® Multilayer filters			✔								✔	✔
Aervent® filters										✔		
Aerex® filters										✔		
Millipore Express® SPG filters										✔		
Mycoplasma removal and sterile filtration												
Millipore Express® SHR filters							✔					
Durapore® 0.1 µm filters							✔					
Viresolve® Barrier filters							✔					

Formats

Multiple formats offer flexibility and scalable solutions for both single-use and stainless steel operations.

	Format Size	Millipore Express® SHR Filters	Millipore Express® SHC Filters	Millipore Express® SHF Filters	Millipore Express® PHF Filters
Single-use capsule filters					
OptiScale® Capsules	25	**A**	**A**	**A**	**A**
	47	**A**	**A**	**A**	
Opticap® XL Capsules	150/300/600	**G, S**	**G, S**	**G, S**	**G, S**
	3/5/10	**G, S, A**	**G, S, A**	**G, S, A**	**G, S, A**
Opticap® XLT Capsules	10/20/30 Standard Area	**G, S, A**	**G, S, A**	**G, S, A**	**G, S, A**
	10/20/30 High Area	**G***	**G**		
Cartridge filters for stainless steel operations					
Cartridge	5	**A***	**A***	**A***	**A***
	10/20/30 Standard Area	**A***	**A***	**A***	**A***
	10/20/30 High Area	**A****	**A***		

Key

G = Gamma-compatible: product is gamma-compatible

G* = Gamma-compatibile: product is gamma-compatible and only available in Millipore Express® SHR with Prefilter capsules.

A = Autoclavable: product can be autoclaved

A* = Autoclavable: product can be autoclaved and is compatible with steam-in-place (SIP) sterilization methods

A** = Autoclavable, compatible with SIP, only available in Millipore Express® SHR with Prefilter capsules

S = Sterile: product has been presterilized by gamma irradiation

Regulatory Compliance

Filters with Millipore Express® membranes are designed, developed, and manufactured in accordance with a Quality Management System approved by an accredited registering body to an ISO® 9001 Quality Systems Standard. Each Millipore Express® filter is shipped with a Certificate of Quality. Millipore Express® SHR, Millipore Express® SHC and Millipore Express® SHF filters are integrity tested during manufacturing and are supported with an Emprove® documentation package or Validation Guide. For traceability and easy identification, each device is marked with the product name and identifying characteristics.

The Emprove® Program

Your fast track through regulatory challenges

Complementing our product portfolio, the Emprove® Program provides three types of dossiers to support different stages of development and manufacturing operations such as qualification, risk assessment and process optimization. The dossiers consolidate comprehensive product-specific testing data, quality statements and regulatory information in a readily-available format to simplify your compliance needs.

For more information, please visit:

EMDMillipore.com/Emprove
or SigmaAldrich.com/Emprove

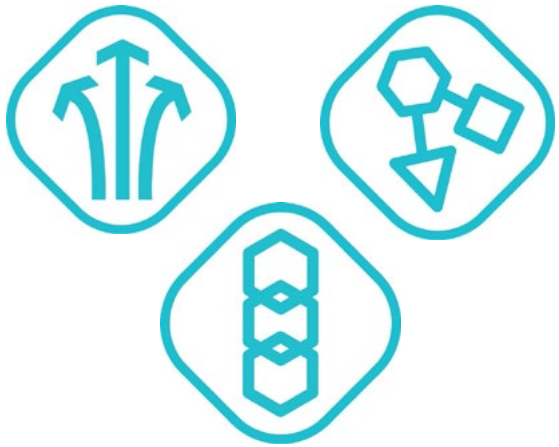
Mobius® Single-use Solutions

Millipore Express® filters are part of the Mobius® component library.

Whether you are looking to introduce single-use manufacturing components into your current process or investigating how you can implement a single-use process train, Mobius® products and solutions help meet your evolving process needs.

For more information, please visit:

EMDMillipore.com/singleuse-myway



OptiScale® Capsules

For Filter Screening and Scaling

Our OptiScale® disposable capsule filters provide a convenient small-volume option for process development screening and scaling. They are ideal for quickly evaluating performance of different filters with various process streams.

OptiScale® Capsules

Cartridge Filters

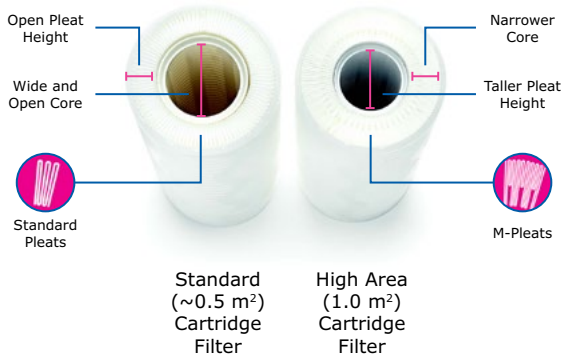
For Pilot and Production-Scale Processing

Our cartridge filters are designed for pilot and production-scale processing in stainless steel housings. These filters provide high flow rates and throughput with minimal differential pressure and are designed to withstand multiple steam-in-place cycles. A full range of filtration areas are available for maximum flexibility.

Standard area cartridge filters contain membrane with a conventional pleat pattern.

High area cartridge filters contain membrane with an M-pleat pattern which doubles the membrane area compared to standard area filters. High area filters are designed to maximize filtration area while minimizing filter footprint.

Cartridge Filters



Standard (~0.5 m²) Cartridge Filter

High Area (1.0 m²) Cartridge Filter

Capsule Filters

For Pilot and Production-Scale Processing

Opticap® XL and XLT Capsules

Opticap® XL and XLT capsule filters allow unparalleled hydraulic stress resistance in a single-use filter and are available from small-scale to 30-inch formats, enabling easy scale-up to pilot and production-scale processing. They are available with a range of inlet/outlet connections, and are offered in autoclavable, presterilized and gamma-compatible formats. These capsules minimize cleaning, assembly and validation requirements which translates to increased flexibility, more rapid turnaround and less downtime than maintaining stainless steel operations.

Opticap® XL 150, 300 and 600 capsule filters have the option to add a filling bell to protect an open container from airborne particles.

The T-line design of Opticap® XLT capsule filters accommodates series or parallel filtration, and a specially designed stand enables quick and easy integration into existing operations.

Standard area capsule filters contain membrane with a conventional pleat pattern.

High area capsule filters contain membrane with an M-pleat pattern which doubles the membrane area compared to standard area filters. High area filters are designed to maximize filtration area while minimizing filter footprint.

Opticap® XL and XLT Capsules

Opticap® XL 150, 300, and 600 capsules shown with optional filling bell attachment

Opticap® XLT Filters

Millipore Express® SHR Filters

Sterilizing-grade filters for efficient filtration of cell culture media and feeds

Filters containing Millipore Express® SHR (Sterile, High Retention) membrane provide sterilizing-grade performance and mycoplasma removal from cell culture media, media additives and other biological solutions. These filters contain a 0.1 µm polyethersulfone (PES) membrane that provides high sterility assurance, broad chemical compatibility, high flow rates and extended throughput.

Millipore Express® SHR with Prefilter (SHRP) filters contain an integrated PES 0.5 µm membrane prefilter that protects the sterilizing-grade 0.1 µm membrane from premature plugging and extends filtration capacity in fouling streams.

Benefits

- Reliable mycoplasma removal and sterilizing-grade performance
- Available with an on-board PES membrane prefilter for extended throughput in high-fouling solutions (SHRP)
- Broad chemical compatibility across a wide pH range
- 100% integrity tested during the manufacturing process

Filter Formats

- OptiScale® capsules
- Cartridge filters: standard and high area
- Opticap® XL and XLT capsule filters: sterile, gamma-compatible or autoclavable

Millipore Express® SHR Filters

Enhanced Sterility Assurance and Filter Capacity

Millipore Express® SHR filters are designed for the removal of mycoplasma and small microorganisms that could pass through 0.2 µm rated sterilizing-grade filters. These filters typically demonstrate Log Reduction Value (LRV) >7 with *Acholeplasma laidlawii* ATCC® 23206 using our validated test method.

Millipore Express® SHRP filters are designed to efficiently process cell culture media and feeds. The high permeability of these membranes minimizes filtration area requirements and their high capacity for particulates makes them an efficient option for plugging streams.

Mobius® Single-use Solutions

Millipore Express® SHR filters are part of the Mobius® library providing you with the flexibility to design single-use assemblies that meet your specific processing requirements.

For more information, please visit:

EMDMillipore.com/Singleuse-MyWay

The Emprove® Program – Your Fast Track through Regulatory Challenges

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High Retention

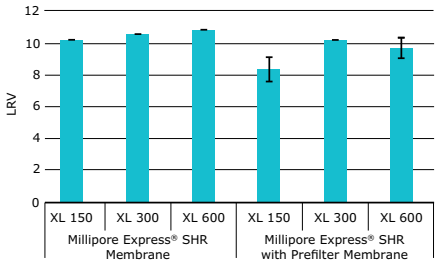


Figure 1. Retention of *Acholeplasma laidlawii* by Millipore Express® SHR and Millipore Express® SHR with prefilter filters (n=3) at a challenge level of 10^7 CFU/cm² of filter area.

High Permeability

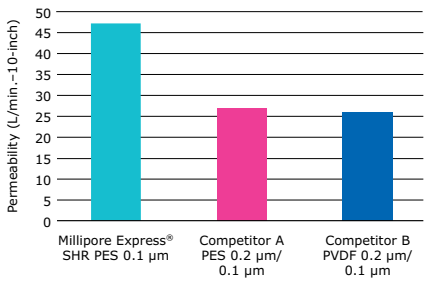


Figure 2. Permeability per 10-inch cartridge. Tested in duplicate 47 mm discs at 10 psi and scaled to 10-inch cartridge. PVDF: polyvinylidene fluoride; PES: polyethersulfone.

Superior Efficiency Reduces Filter Footprint

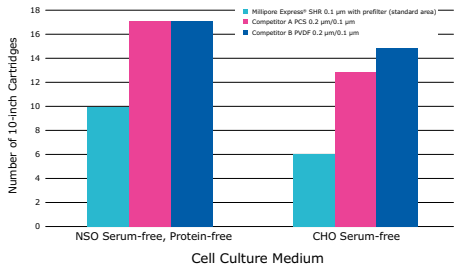


Figure 3. Number of standard 10-inch cartridges needed to filter 10,000 L of NS0 Serum-free, Protein-free, or CHO Serum-free Cell Culture Medium in 2 hours at 10 psi (n=2).

Millipore Express® SHR Filters

OptiScale® Capsule and Cartridge Filter Specifications

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Standard Area Cartridge	Per Standard 10-inch Cartridge	Per High Area 10-inch Cartridge*
Dimensions					
Diameter	31 mm (1.21 in.)	70 mm (2.75 in.)	6.9 cm (2.7 in.)	6.9 cm (2.7 in.)	7.1 cm (2.8 in.)
Maximum Length	39 mm (1.52 in.)	94 mm (3.70 in.)	12.7 cm (5 in.)	25.4 cm (10 in.)	25.4 cm (10 in.)
Filtration Area					
Millipore Express® SHR	3.5 cm²	17.7 cm²	0.29 m² (3.1 ft²)	0.60 m² (6.5 ft²)	-
Millipore Express® SHR with Prefilter	3.5 cm²	17.7 cm²	0.23 m² (2.5 ft²)	0.48 m² (5.3 ft²)	1.0 m² (10.8 ft²)
Materials of Construction					
Filter membrane	Hydrophilic polyethersulfone (PES)		Hydrophilic PES		Hydrophilic PES
Film Edge	—	—	Polypropylene		Polypropylene
Supports	Polypropylene		Polypropylene		Polypropylene
Vent Cap	Polypropylene	Polyvinylidene fluoride	—		—
Structural Components	Polypropylene	Polycarbonate	Polypropylene		Polypropylene
Core	—	—	Polysulfone		Polyethersulfone
O-Rings**	—	Fluoroelastomer	Silicone		Silicone
Maximum Inlet Pressure	4.1 bar (60 psi) at 25 °C	5.1 bar (80 psi) at 25 °C			
Maximum Differential Pressure					
Forward:	4.1 bar (60 psi) at 25 °C	5.5 bar (80 psi) at 25 °C	6.9 bar (100 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 1 bar (15 psi) at 135 °C		6.9 bar (100 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 300 mbar (5 psi) at 135 °C
Reverse:	0 bar (0 psi)	690 mbar (10 psi) at 25 °C	2.1 bar (30 psi) at 25 °C 69 mbar (1 psi) at 135 °C		2.1 bar (30 psi) at 25 °C 69 mbar (1 psi) at 135 °C
70/30 IPA/Water Bubble Point at 23 °C	—	—	≥ 2590 mbar (37.5 psi) with nitrogen		
Air Diffusion			**Through a water wet membrane at 3400 mbar (50 psi):**		
Millipore Express® SHR	—	—	≤ 15.9 cc/min.	≤ 33.3 cc/min.	-
Millipore Express® SHR with Prefilter	—	—	≤ 12.8 cc/min.	≤ 27.1 cc/min.	≤ 54.2 cc/min.
Bacterial Retention			Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.		
Mycoplasma Removal			Typical Log Reduction Value (LRV) > 7 using *Acholeplasma laidlawii* ATCC® 23206 and our validated test method.		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>. Specification not applicable to OptiScale® 47 capsules.				

OptiScale® Capsule and Cartridge Filter Specifications (cont.)

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Standard Area Cartridge	Per Standard 10-inch Cartridge	Per High Area 10-inch Cartridge*
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643> for Total Organic Carbon and USP <645> for Water Conductivity at 25 °C after a WFI flush of:				
Millipore Express® SHR	15 mL	—	5.5 L	10 L	—
Millipore Express® SHR with Prefilter	15 mL	—	9.5 L	20 L	20 L
Oxidizable Substances					
Millipore Express® SHR	—	100 mL	1 L		—
Millipore Express® SHR with Prefilter	—	100 mL	2 L		2 L
Sterilization					
Millipore Express® SHR					
Autoclave	1 cycle at 123 °C for 60 min.	3 cycles at 126 °C for 60 min.	25x, 60 min. cycles at 126 °C		—
In-line steam	—	—	25 forward cycles, 30 min., 135 °C at ≤ 300 mbar (5 psi) or, 22 forward cycles, 30 min., 135 °C at ≤ 300 mbar (5 psi) and 3 reverse cycles, 30 min. at < 69 mbar (1 psi)		—
Millipore Express® SHR with Prefilter					
Autoclave	1 cycle at 123 °C for 60 min.	3 cycle at 126 °C for 60 min.	25x, 60 min. cycles at 126 °C		5x, 60 min. cycles at 126 °C
In-line steam	—	—	25 forward cycles, 30 min., 135 °C at ≤ 300 mbar (5 psi) or, 22 forward cycles, 30 min., 135 °C at ≤ 300 mbar (5 psi) and 3 reverse cycles, 30 min. at < 69 mbar (1 psi) or, 3 forward cycles, 30 min., 135 °C at ≤ 1.0 bar (15 psi) or, 5 forward cycles, 30 min, 145 °C at ≤ 69 mbar (1 psi)		5x forward cycles, 30 min., ≤ 135 °C at ≤ 300 mbar (5 psi) or 2x forward cycles, 30 min., ≤ 145 °C at ≤ 69 mbar (1 psi)
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics.				
	—	—	This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals. Specification does not apply to OptiScale® 47 capsules.				
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).				
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.				

* High Area available in Millipore Express® SHR with Prefilter only

** Cartridge filters with ethylene propylene diene monomer (EPDM) or fluoroelastomer O-rings are available on request

Millipore Express® SHR Filters

Opticap® XL and XLT Autoclavable Capsule Filter Specifications

Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Opticap® XLT 10 Standard Area Capsules	Opticap® XLT 20 Standard Area Capsules	Opticap® XLT 30 Standard Area Capsules
Dimensions						
Body diameter:	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum width:	—	—	—	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)
Maximum length:	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	38.1 cm (15.0 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area						
Millipore Express® SHR	0.16 m² (1.7 ft²)	0.29 m² (3.1 ft²)	0.60 m² (6.5 ft²)	0.60 m² (6.5 ft²)	1.21 m² (13.0 ft²)	1.81 m² (19.5 ft²)
Millipore Express® SHR with Prefilter	0.13 m² (1.4 ft²)	0.23 m² (2.5 ft²)	0.49 m² (5.3 ft²)	0.49 m² (5.3 ft²)	0.98 m² (10.6 ft²)	1.48 m² (15.9 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polypropylene					
Supports	Polypropylene					
Core	Polysulfone					
Housing and Cage	Polypropylene					
O-Rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 23 °C 2.8 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C					
Maximum Differential Pressure						
Forward:	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 23 °C 1 bar (15 psi) at 80 °C					
Reverse:	2.1 bar (30 psi) intermittent at 25°C					
70/30 IPA/Water Bubble Point at 23 °C	≥ 2590 mbar (37.5 psi) with nitrogen					
Air Diffusion	**Through a water wet membrane at 3400 mbar (50 psi):**					
Millipore Express® SHR	≤ 8.7 cc/min.	≤ 15.9 cc/min.	≤ 33.3 cc/min.	≤ 33.3 cc/min.	≤ 66.6 cc/min.	≤ 99.9 cc/min.
Millipore Express® SHR with Prefilter	≤ 7.2 cc/min.	≤ 12.8 cc/min.	≤ 27.1 cc/min.	≤ 27.1 cc/min.	≤ 54.2 cc/min.	≤ 81.3 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.					
Mycoplasma Removal	Typical Log Reduction Value (LRV) > 7 using *Acholeplasma laidlawii* ATCC® 23206 and our validated test method.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					

Millipore Express® SHR Filters

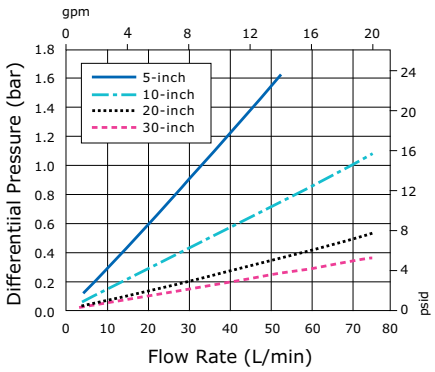
Opticap® XL and XLT Autoclavable Capsule Filter Specifications (cont.)

Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Opticap® XLT 10 Standard Area Capsules	Opticap® XLT 20 Standard Area Capsules	Opticap® XLT 30 Standard Area Capsules
Total Organic Carbon (TOC)/Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643> for Total Organic Carbon and USP <645> for Water Conductivity at 25 ºC after a WFI flush of:					
Millipore Express® SHR	3.0 L	5.5 L	10 L	10 L	20 L	30 L
Millipore Express® SHR with Prefilter	5.5 L	9.5 L	20 L	20 L	40 L	60 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:					
Millipore Express® SHR	1 L	1 L	1 L	1 L	2 L	3 L
Millipore Express® SHR with Prefilter	2 L	2 L	2 L	2 L	4 L	6 L
Sterilization	May be autoclaved for 3 cycles for 60 minutes at 126 °C. Cannot be steam sterilized in-line.					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

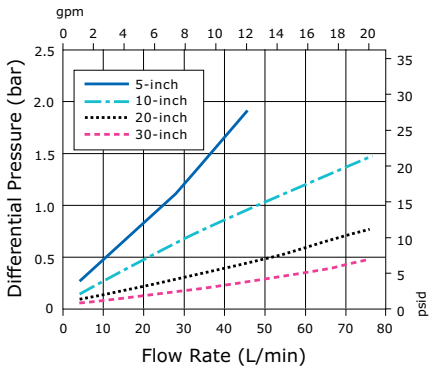
Millipore Express® SHR Filters

Typical Clean Water Flow Rates – Cartridge Filters

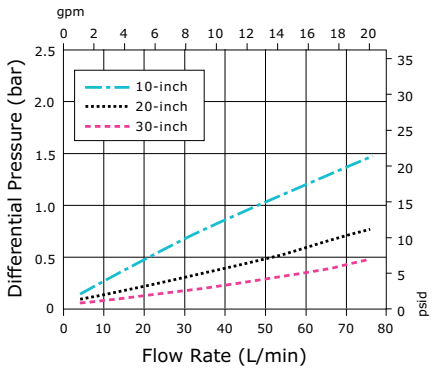
Standard Area Cartridge Filters with Millipore Express® SHR 0.1 µm Membrane



Standard Area Cartridge Filters with Millipore Express® SHR 0.5/0.1 µm Membrane with Prefilter

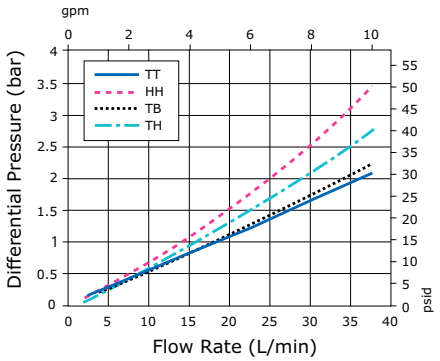


High Area Cartridge Filters with Millipore Express® SHR 0.5/0.1 µm Membrane with Prefilter

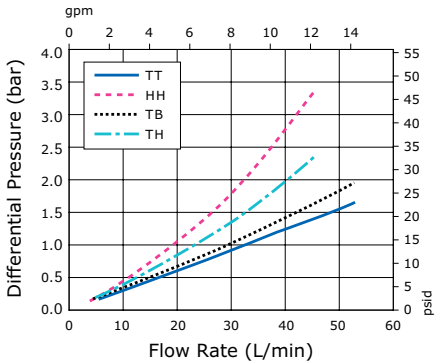


Typical Clean Water Flow Rates – Opticap® XL and XLT Autoclavable Capsules Containing Millipore Express® SHR Membrane

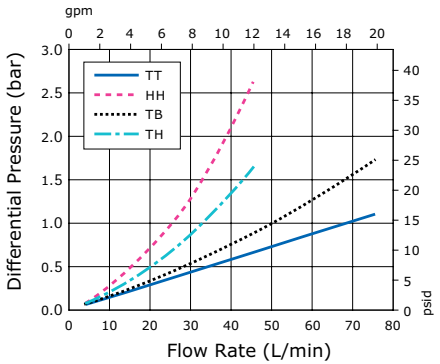
Opticap® XL 3 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



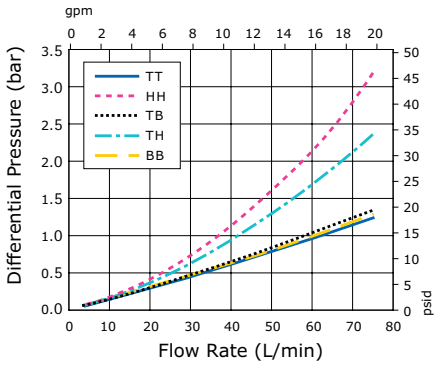
Opticap® XL 5 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



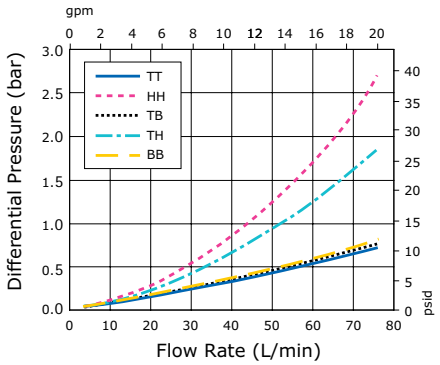
Opticap® XL 10 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



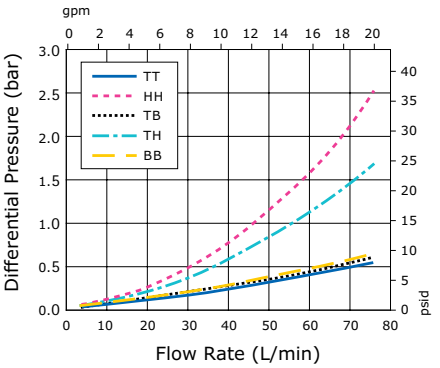
Opticap® XLT 10 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



Opticap® XLT 20 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



Opticap® XLT 30 Capsule Filters with 0.1 µm Millipore Express® SHR Membranes



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

HH = 14 mm (9⁄16 in.) hose barb inlet and outlet

TH = 38 mm (1½ in.) sanitary flange inlet and 14 mm (9⁄16 in.) hose barb outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

TH = 38 mm (1½ in.) sanitary flange Inlet and 16 mm (⅝ in.) hose barb outlet

HH = 16 mm (⅝ in.) hose barb inlet and outlet

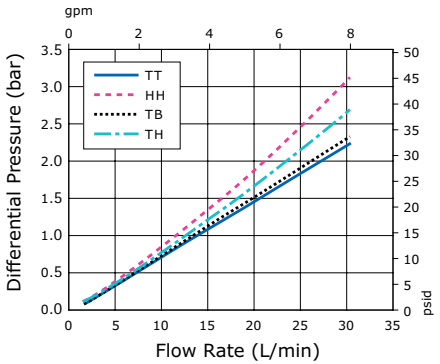
TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

BB = 25 mm (1 in.) hose barb inlet and outlet

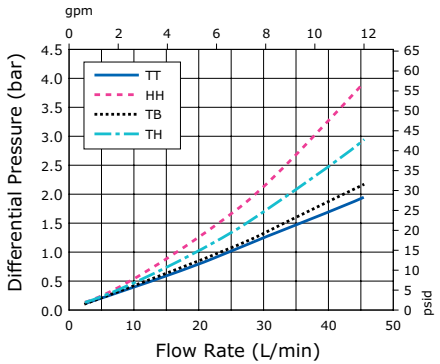
Millipore Express® SHR Filters

Typical Clean Water Flow Rates – Opticap® XL and XLT Autoclavable Capsules Containing Millipore Express® SHR Membrane with Prefilter

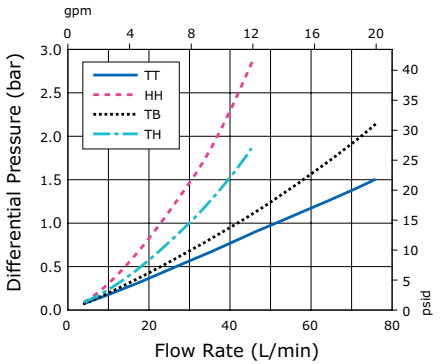
Opticap® XL 3 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



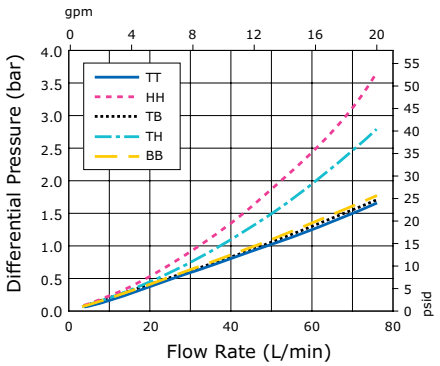
Opticap® XL 5 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



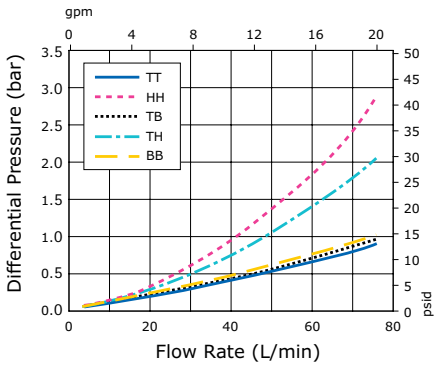
Opticap® XL 10 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



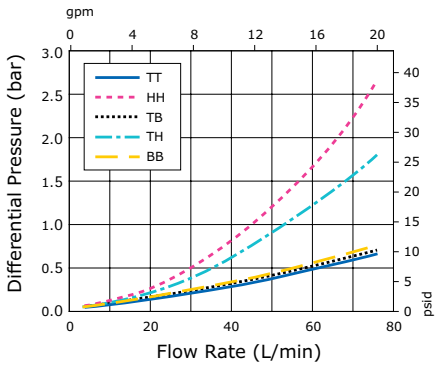
Opticap® XLT 10 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XLT 20 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XLT 30 Capsule Filters with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

HH = 14 mm (9⁄16 in.) hose barb inlet and outlet

TH = 38 mm (1½ in.) sanitary flange inlet and 14 mm (9⁄16 in.) hose barb outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

TH = 38 mm (1½ in.) sanitary flange Inlet and 16 mm (⅝ in.) hose barb outlet

HH = 16 mm (⅝ in.) hose barb inlet and outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

BB = 25 mm (1 in.) hose barb inlet and outlet

Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications

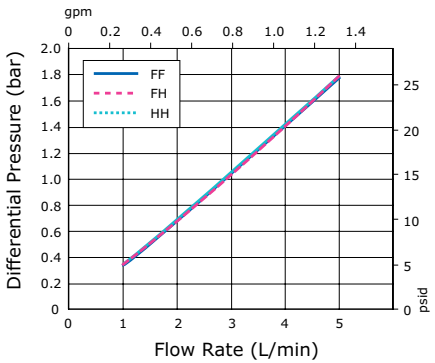
Description	Opticap® XL 150 Standard Area Capsules	Opticap® XL 300 Standard Area Capsules	Opticap® XL 600 Standard Area Capsules
Dimensions			
Body Diameter	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)
Maximum Length	9.7 cm (3.8 in.)	11.9 cm (4.7 in.)	16.5 cm (6.5 in.)
Maximum Length with Optional Bell	11.4 cm (4.5 in.)	13.7 cm (5.4 in.)	18.3 cm (7.2 in.)
Filtration Area			
Millipore Express® SHR	0.025 m² (0.268 ft²)	0.048 m² (0.517 ft²)	0.101 m² (1.090 ft²)
Millipore Express® SHR with Prefilter	0.015 m² (0.163 ft²)	0.028 m² (0.308 ft²)	0.062 m² (0.664 ft²)
Materials of Construction			
Filter membrane	Hydrophilic polyethersulfone (PES)		
Supports	Polyethylene		
Core	Polysulfone		
Housing and Cage	Gamma stable polypropylene		
O-Rings	Silicone		
Optional Bell	Polycarbonate		
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.		
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 2.8 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C		
Maximum Differential Pressure			
Forward:	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 25 °C 1 bar (15 psi) at 80 °C		
Reverse:	2.1 bar (30 psi) intermittent at 25 °C		
70/30 IPA/Water Bubble Point at 23 °C	≥ 2590 mbar (37.5 psi) with nitrogen		
Air Diffusion at 25 ºC	**Through a water wet membrane at 3400 mbar (50 psi):**		
	≤ 1.4 cc/min.	≤ 2.8 cc/min.	≤ 5.8 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.		
Mycoplasma Removal	Typical Log Reduction Value (LRV) > 7 using *Acholeplasma laidlawii* ATCC® 23206 and our validated test method.		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.		
Total Organic Carbon (TOC)/ Conductivity	Gamma-sterilized filter effluent meets the WFI requirement of USP <643> for Total Organic Carbon and for USP <645> for Water Conductivity at 25 ºC after a WFI flush of:		
Millipore Express® SHR	2 L	2.5 L	3 L
Millipore Express® SHR with Prefilter	1 L	2 L	3 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of 1 L.		
Sterilization			
Gamma-compatible Capsules	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterile Capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.		
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.		
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).		
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.		

Millipore Express® SHR Filters

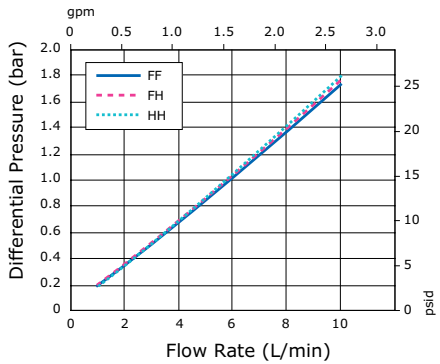
Typical Clean Water Flow Rates – Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsules Containing Millipore Express® SHR Membrane

Filters tested post gamma radiation at 25–45 kGy and autoclaved at 123 °C for 60 minutes

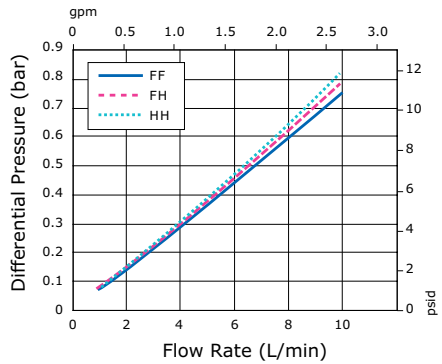
Opticap® XL 150 Capsule with 0.1 µm Millipore Express® SHR Membrane



Opticap® XL 300 Capsule with 0.1 µm Millipore Express® SHR Membrane



Opticap® XL 600 Capsule with 0.1 µm Millipore Express® SHR Membrane



Opticap® XL 150, 300 and 600 Capsule Connection Type

FF = 19 mm (¾ in.) sanitary flange inlet and outlet

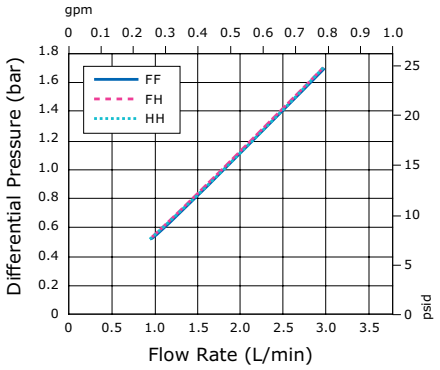
FH = 19 mm (¾ in.) sanitary flange inlet and 14 mm (⁹⁄₁₆ in.) hose barb outlet

HH = 14 mm (⁹⁄₁₆ in.) hose barb inlet and outlet

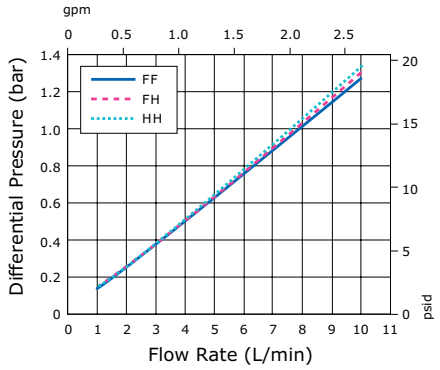
Typical Clean Water Flow Rates – Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsules Containing Millipore Express® SHR Membrane with Prefilter

Filters tested post gamma irradiation at 25–45 kGy and autoclaved at 123 °C for 60 minutes.

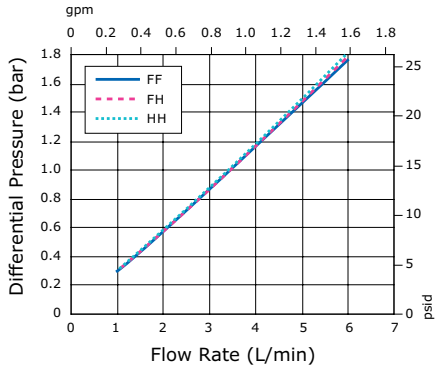
Opticap® XL 150 Capsule with 0.5/0.1 µm Millipore Express® SHR Membrane wtih Prefilter



Opticap® XL 300 Capsule with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XL 600 Capsule with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XL 150, 300 and 600 Capsule Connection Type

FF = 19 mm (¾ in.) sanitary flange inlet and outlet
FH = 19 mm (¾ in.) sanitary flange inlet and 14 mm (9/16 in.) hose barb outlet
HH = 14 mm (9/16 in.) hose barb inlet and outlet

Millipore Express® SHR Filters

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications

Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Per 10" Standard Area Opticap® XLT Capsules	Per 10" High Area Opticap® XLT Capsule*
Dimensions					
Body diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum width:	—	—	—	19.8 cm (7.8 in)	19.8 cm (7.8 in)
Maximum Length:	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	—	—
10 inch	—	—	—	38.1 cm (14.8 in.)	38.1 cm (14.8 in.)
20 inch	—	—	—	62.5 cm (24.6 in.)	62.5 cm (24.6 in.)
30 inch	—	—	—	87.1 cm (34.3 in.)	87.1 cm (34.3 in.)
Filtration Area					
Millipore Express® SHR	0.17 m² (1.8 ft²)	0.31 m² (3.3 ft²)	0.69 m² (7.4 ft²)	0.69 m² (7.4 ft²)	—
Millipore Express® SHR with Prefilter					
10 inch	0.13 m² (1.4 ft²)	0.24 m² (2.6 ft²)	0.54 m² (5.8 ft²)	0.54 m² (5.8 ft²)	1.0 m² (10.8 ft²)
20 inch	—	—	—	1.38 m² (14.8 ft²)	2.0 m² (21.6 ft²)
30 inch	—	—	—	2.06 m² (22.2 ft²)	3.0 m² (32.4 ft²)
Materials of Construction					
Filter membrane:	Hydrophilic polyethersulfone (PES)				Hydrophilic PES
Film edge:	Polyethylene				Polyethylene
Supports:	Polyester				Polyester
Core:	Polysulfone				Polyethersulfone
Housing and Cage:	Gamma-stable Polypropylene				Gamma-stable Polypropylene
O-Rings:	Silicone				Silicone
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing				
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 2.8 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C				
Maximum Differential Pressure					
Forward:	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 1 bar (15 psi) at 80 °C				
Reverse:	2.1 bar (30 psi) intermittent at 25 °C				
70/30 IPA/Water Bubble Point at 23 °C	≥ 2590 mbar (37.5 psi) with nitrogen				
Air Diffusion	Through a water wet membrane at 3400 mbar (50 psi):				
Millipore Express® SHR	≤ 9.4 cc/min.	≤ 17.3 cc/min.	≤ 38.8 cc/min.	≤ 38.8 cc/min.	—
Millipore Express® SHR with Prefilter	≤ 7.3 cc/min.	≤ 13.6 cc/min.	≤ 30.4 cc/min.	≤ 30.4 cc/min.	≤ 54.2 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.				
Mycoplasma Removal	Typical Log Reduction Value (LRV) > 7 using *Acholeplasma laidlawii* ATCC® 23206 and our validated test method.				
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL per 10-inch filter as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.				

Millipore Express® SHR Filters

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications (cont.)

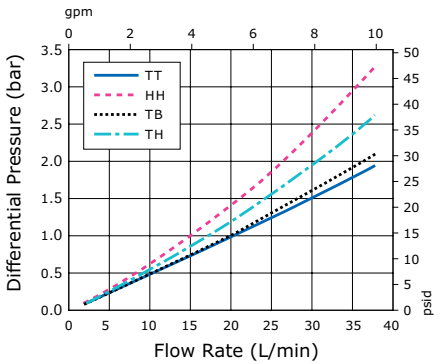
Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Per 10" Standard Area Opticap® XLT Capsules	Per 10" High Area Opticap® XLT Capsule*
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643> for Total Organic Carbon and for USP <645> for Water Conductivity at 25 °C after a WFI flush of:				
Millipore Express® SHR	3.5 L	6.0 L	11 L	11 L	—
Millipore Express® SHR with Prefilter	5.5 L	9.5 L	21 L	21 L	21 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:				
Millipore Express® SHR	1.0 L	1.0 L	1.5 L	1.5 L	—
Millipore Express® SHR with Prefilter	2 L	2 L	2 L	2 L	2 L
Sterilization					
Gamma-compatible:	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.				
Sterile:	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.				
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.				
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics.				
	This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.				
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.				
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).				
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.				

* Only available in Millipore Express® SHR with Prefilter gamma-compatible capsules

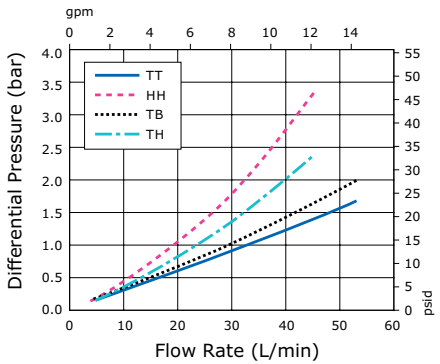
Typical Clean Water Flow Rates – Opticap® XL and XLT Sterile and Gamma-Compatible Capsules Containing Millipore Express® SHR Membrane

Filters tested post gamma radiation at 25–45 kGy and autoclaved at 123 °C for 60 minutes

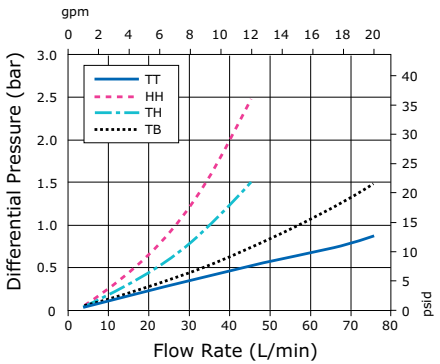
Gamma-compatible Opticap® XL 3 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



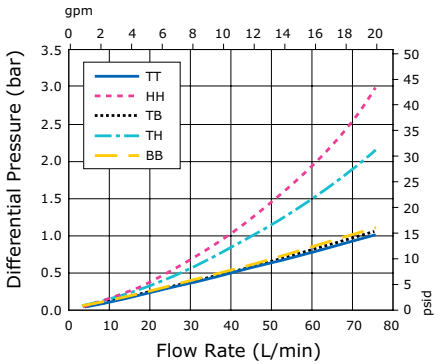
Gamma-compatible Opticap® XL 5 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



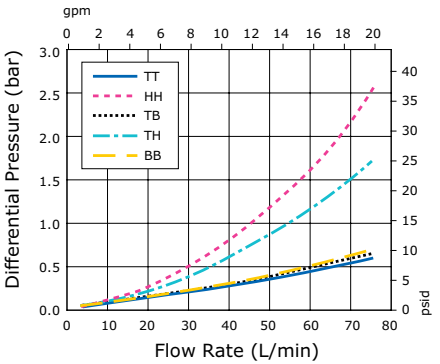
Gamma-compatible Opticap® XL 10 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



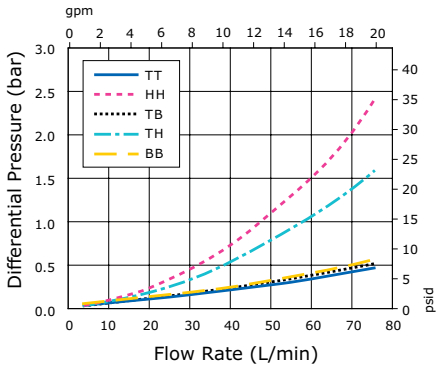
Gamma-compatible Opticap® XLT 10 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



Gamma-compatible Opticap® XLT 20 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



Gamma-compatible Opticap® XLT 30 Capsule Filters with 0.1 µm Millipore Express® SHR Membrane



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

HH = 14 mm (9⁄16 in.) hose barb inlet and outlet

TH = 38 mm (1½ in.) sanitary flange inlet and 14 mm (9⁄16 in.) hose barb outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

TH = 38 mm (1½ in.) sanitary flange Inlet and 16 mm (⅝ in.) hose barb outlet

HH = 16 mm (⅝ in.) hose barb inlet and outlet

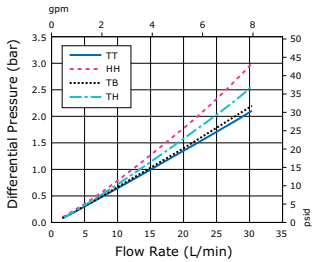
TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

BB = 25 mm (1 in.) hose barb inlet and outlet

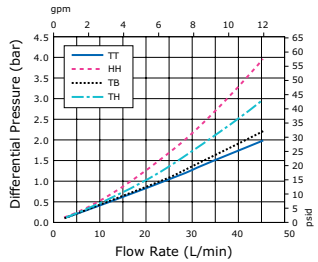
Opticap® XL and XLT Sterile and Gamma-Compatible Capsules Containing Millipore Express® SHR Membrane with Prefilter

Filters tested post gamma radiation at 25–45 kGy and autoclaved at 123 °C for 60 minutes

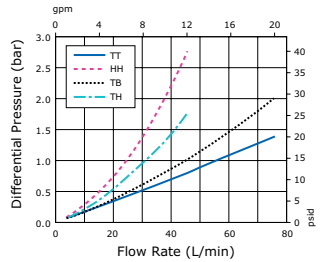
Gamma-compatible Opticap® XL 3 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



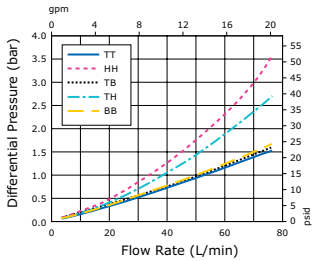
Gamma-compatible Opticap® XL 5 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



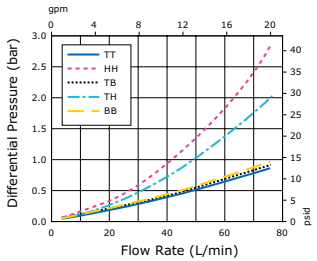
Gamma-compatible Opticap® XL 10 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



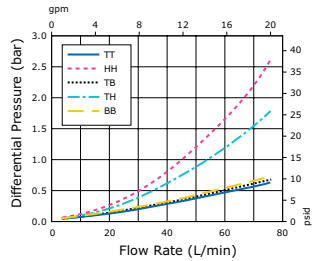
Gamma-compatible Standard Area Opticap® XLT 10 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



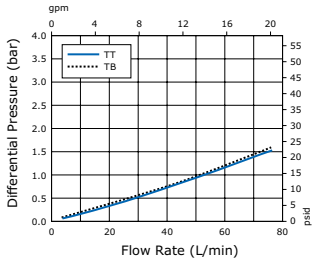
Gamma-compatible Standard Area Opticap® XLT 20 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



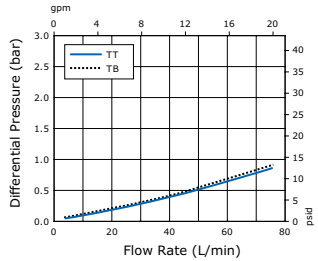
Gamma-compatible Standard Area Opticap® XLT 30 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



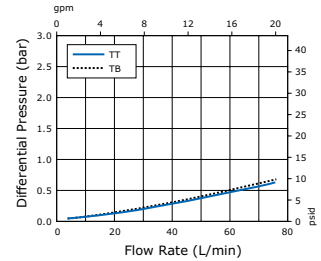
Gamma-compatible High Area Opticap® XLT 10 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Gamma-compatible High Area Opticap® XLT 20 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Gamma-compatible High Area Opticap® XLT 30 with 0.5/0.1 µm Millipore Express® SHR Membrane with Prefilter



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet
HH = 14 mm (9⁄16 in.) hose barb inlet and outlet
TH = 38 mm (1½ in.) sanitary flange inlet and 14 mm (9⁄16 in.) hose barb outlet
TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

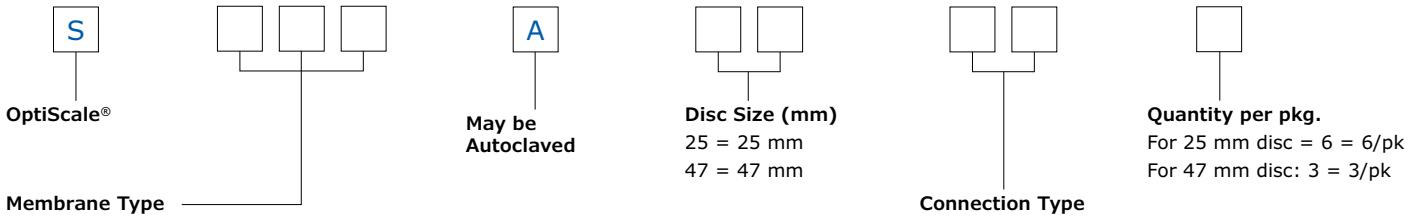
Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet
TH = 38 mm (1½ in.) sanitary flange Inlet and 16 mm (⅝ in.) hose barb outlet
HH = 16 mm (⅝ in.) hose barb inlet and outlet
TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet
BB = 25 mm (1 in.) hose barb inlet and outlet

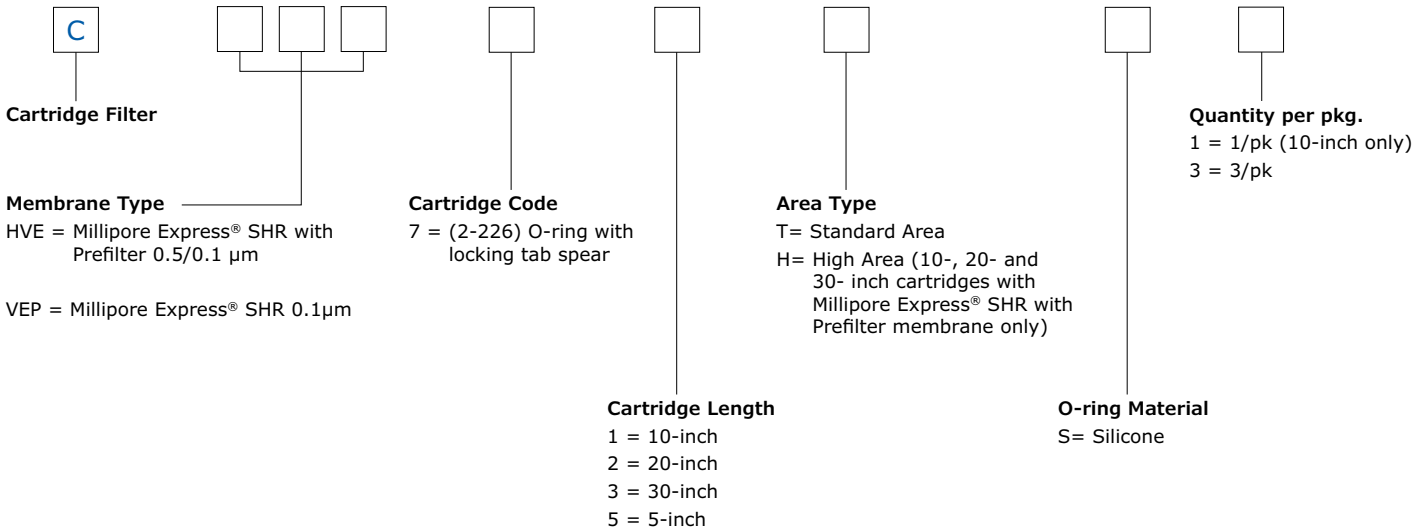
Millipore Express® SHR Filters

Ordering Information

OptiScale® Capsules



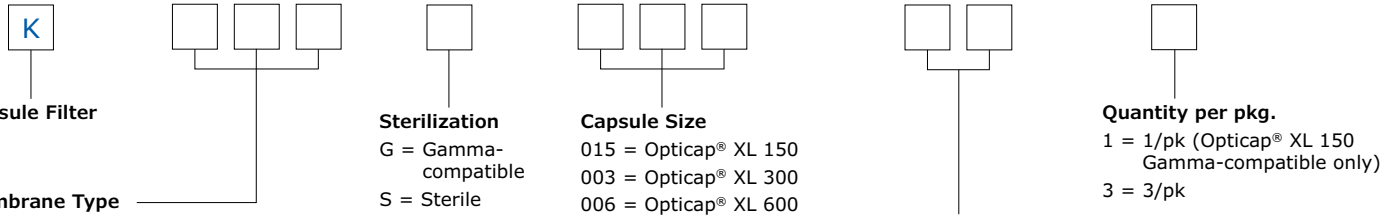
Cartridge Filters



Millipore Express® SHR Filters

Ordering Information

Opticap® XL 150, 300, 600 Capsule Filters



Capsule Filter

Membrane Type

HVE = Millipore Express® SHR with Prefilter 0.5/0.1 µm

VEP = Millipore Express® SHR 0.1 µm

Sterilization

G = Gamma-compatible

S = Sterile

Capsule Size

015 = Opticap® XL 150

003 = Opticap® XL 300

006 = Opticap® XL 600

Connection Type

FF = 19 mm (¾ in.) Sanitary Flange Inlet and Outlet

HB = 14 mm ($^{9}/_{16}$ in.) Sanitary Flange Inlet and 14 mm ($^{9}/_{16}$ in.) Outlet with filling bell

HH = 14 mm ($^{9}/_{16}$ in.) Hose Barb Inlet and Outlet

FH = 19 mm (¾ in.) Sanitary Flange Inlet and 14 mm ($^{9}/_{16}$ in.) Hose Barb Outlet

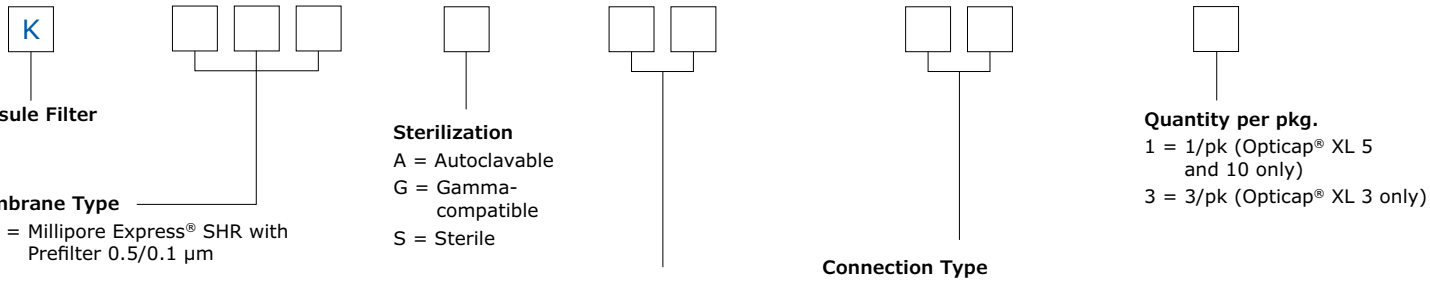
FB= 19 mm (¾ in.) Sanitary Flange Inlet and 14 mm ($^{9}/_{16}$ in.) Hose Barb Outlet with filling bell

Quantity per pkg.

1 = 1/pk (Opticap® XL 150 Gamma-compatible only)

3 = 3/pk

Opticap® XL Capsule Filters



Capsule Filter

Membrane Type

HVE = Millipore Express® SHR with Prefilter 0.5/0.1 µm

VEP = Millipore Express®SHR 0.1µm

Sterilization

A = Autoclavable

G = Gamma-compatible

S = Sterile

Capsule Size

03 = Opticap® XL 3

05 = Opticap® XL 5

10 = Opticap® XL 10

Connection Type

TT = 38 mm (1 ½ in.) Sanitary Flange Inlet and Outlet

HH = 14 mm ($^{9}/_{16}$ in.) Hose Barb Inlet and Outlet

TH = 38 mm (1 ½ in.) Sanitary Flange Inlet and 14 mm ($^{9}/_{16}$ in.) Hose Barb Outlet

TB = 38 mm (1 ½ in.) Sanitary Flange Inlet and 25 mm (1 in.) Hose Barb Outlet

Quantity per pkg.

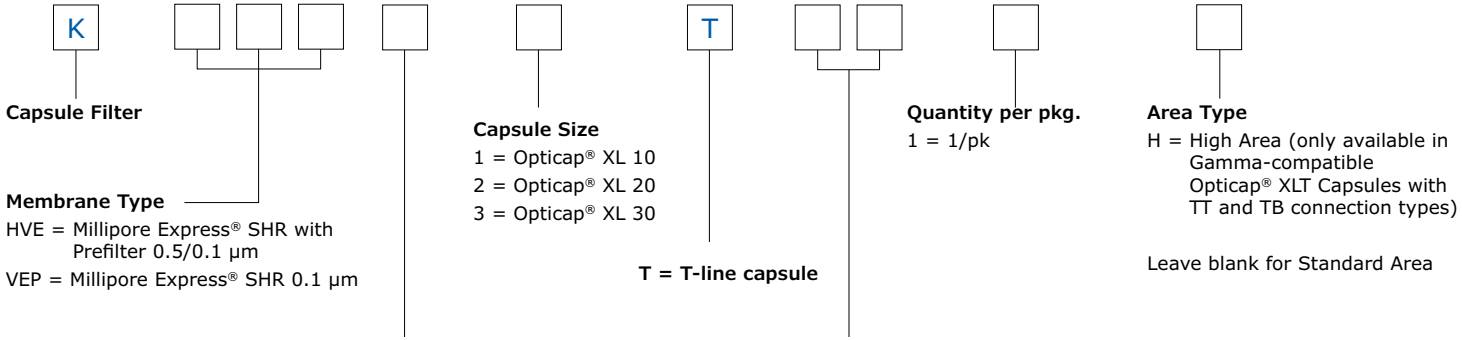
1 = 1/pk (Opticap® XL 5 and 10 only)

3 = 3/pk (Opticap® XL 3 only)

Millipore Express® SHR Filters

Ordering Information

Opticap® XLT Capsule Filters



Capsule Filter

Membrane Type
HVE = Millipore Express® SHR with Prefilter 0.5/0.1 µm
VEP = Millipore Express® SHR 0.1 µm

Capsule Size
1 = Opticap® XL 10
2 = Opticap® XL 20
3 = Opticap® XL 30

T = T-line capsule

Quantity per pkg.
1 = 1/pk

Area Type
H = High Area (only available in Gamma-compatible Opticap® XLT Capsules with TT and TB connection types)

Leave blank for Standard Area

Sterilization
A = Autoclavable
G = Gamma-compatible
S = Sterile

Connection Type
TT = 38 mm (1 ½ in.) Sanitary Flange Inlet and Outlet
HH = 16 mm ($^5/_8$ in.) Hose Barb Inlet and Outlet
TH = 38 mm (1 ½ in.) Sanitary Flange Inlet and 16 mm ($^5/_8$ in.) Hose Barb Outlet
TB = 38 mm (1 ½ in.) Sanitary Flange Inlet and 25 mm (1 in.) Hose Barb Outlet
BB = 25 mm (1 in.) Hose Barb Inlet and Outlet

Millipore Express® SHC Filters

High capacity, sterilizing-grade filters for plugging streams

Filters containing Millipore Express® SHC (Sterile, High Capacity) sterilizing-grade membrane provide superior throughput and capacity in applications where premature filter plugging is a concern. These filters contain two layers of polyethersulfone (PES) membrane (0.5 µm and 0.2 µm) that provide sterility assurance, broad chemical compatibility, high flow rates and capacity.

Benefits

- Sterilizing-grade membranes that are easy to wet and integrity test
- High flux, high capacity PES membrane that provides superior throughput in high fouling streams
- Broad chemical compatibility across a wide pH range
- 100% integrity tested during the manufacturing process

Filter Formats

- OptiScale® capsules
- Cartridge filters: standard and high area
- Opticap® XL and XLT capsule filters: sterile, gamma-compatible or autoclavable

Extended Capacity and Fewer Filter Change

Millipore Express® SHC filters are designed to maximize the capacity of constrained filtration systems. With their high flux and superior capacity, these filters can double your output without adding to your filter footprint, Figures 1 and 2.

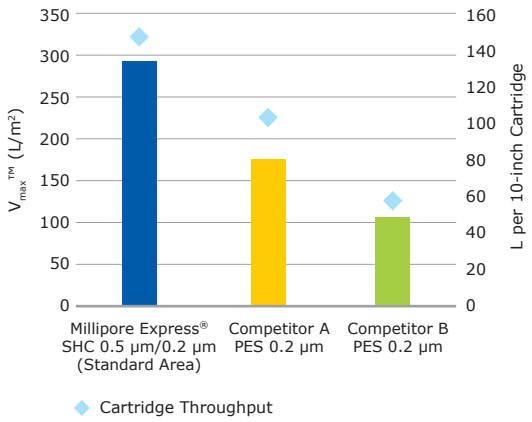


Figure 1. CHO Cell Culture Growth Media: No Prefiltration

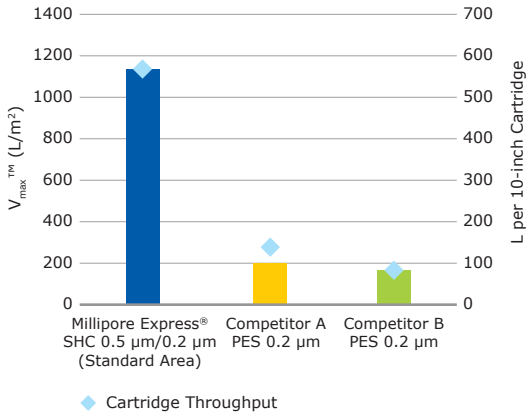


Figure 2. Protein Concentrate Post Ultrafiltration

Mobius® Single-use Solutions

Millipore Express® SHC filters are part of the Mobius® library providing you with the flexibility to design single-use assemblies that meet your specific processing requirements.

For more information, please visit:

EMDMillipore.com/singleuse-MyWay

The Emprove® Program – Your Fast Track through Regulatory Challenges

Complementing our product portfolio, the Emprove® Program provides three types of dossiers to support different stages of development and manufacturing operations such as qualification, risk assessment and process optimization.

For more information, please visit:

EMDMillipore.com or SigmaAldrich.com/Emprove

Millipore Express® SHC Filters

OptiScale® Capsule and Cartridge Filter Specifications

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Standard Area Cartridges	Per 10-inch Standard Area Cartridge	Per 10-inch High Area Cartridge
Dimensions					
Diameter:	31 mm (1.21 in.)	70 mm (2.75 in.)	6.9 cm (2.7 in.)	6.9 cm (2.7 in.)	7.1 cm (2.8 in)
Maximum Length:	39 mm (1.52 in.)	94 mm (3.70 in.)	12.5 cm (5 in.)	25.4 cm (10 in.)	25.4 cm (10 in.)
Filtration Area	3.5 cm²	17.7 cm²	0.23 m² (2.5 ft²)	0.48 m² (5.3 ft²)	1.0 m² (10.8 ft²)
Materials of Construction					
Filter membrane	Hydrophilic polyethersulfone (PES)		Hydrophilic PES		Hydrophilic PES
Film Edge	—	—	Polypropylene		Polypropylene
Supports	Polypropylene		Polypropylene		Polypropylene
Vent Cap	Polypropylene	Polyvinylidene fluoride	—		—
Structural Components	Polypropylene	Polycarbonate	Polypropylene		Polypropylene
Core	—	—	Polysulfone		Polyethersulfone
O-Rings*	—	Fluoroelastomer	Silicone		Silicone
Maximum Inlet Pressure	4.1 bar (60 psi) at 25 °C	5.1 bar (80 psi) at 25 °C			
Maximum Differential Pressure					
Forward:	4.1 bar (60 psi) at 25 °C	5.1 bar (80 psi) at 25 °C	6.9 bar (100 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 1 bar (15 psi) at 135 °C		6.9 bar (100 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 340 mbar (5 psi) at 135 °C
Reverse:	0 bar (0 psi)	690 mbar (10 psi) at 25 °C	2.1 bar (30 psi) at 25 °C 69 mbar (1 psi) at 135 °C		2.1 bar (30 psi) at 25 °C 69 mbar (1 psi) at 135 °C
Bubble Point at 23 °C	-	-	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture		
Air Diffusion at 23 °C	-	-	Through a water wet membrane at 2800 mbar (40 psi):		
	-	-	≤ 13.3 cc/min.	≤ 28.2 cc/min.	≤ 56.4 cc/min.
Bacterial Retention	-	-	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>. Specification not applicable to OptiScale® 47 capsules.				
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI criteria for USP <643>, Total Organic Carbon, and USP <645>, Conductivity at 25 °C after a WFI flush of:				
	15 mL	-	9.5 L	20 L	20 L
Oxidizable Substances	-	Meets the USP Oxidizable Substance Test requirements for sterile purified water after a water flush of:			
	-	100 mL	2 L	2 L	—

OptiScale® Capsule and Cartridge Filter Specifications (cont.)

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Standard Area Cartridges	Per 10-inch Standard Area Cartridge	Per 10-inch High Area Cartridge
Sterilization					
Autoclave	1 cycle at 123 °C for 60 min.	3 cycles at 126 °C for 60 min.	25 cycles at 126 °C for 60 min.		5 cycles at 126 °C, for 60 min.
In-line Steam	—	—	25x forward cycles, 30 min., 135 °C at ≤ 340 mbar (5 psi) or 22x forward cycles, 30 min., 135 °C at ≤ 340 mbar (5 psi) and 3x reverse cycles, 30 min., 135 °C at ≤ 69 mbar (1 psi) or, 3x forward cycles, 30 min., 125 °C at 1.0 bar (15 psi), or 3x forward cycles, 30 min., 145 °C at ≤ 69 mbar (1 psi)		5x forward cycles, 30 min., 135 °C at ≤ 340 mbar (5 psi), or 5x forward cycles, 30 min., 145 °C at ≤ 69 mbar (1 psi), or 1x reverse cycle, 30 min., 125 °C at ≤ 69 mbar (1 psi)
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics.				
	—	—	This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.				
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).				
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.				

* Cartridge filters with ethylene propylene diene monomer (EPDM) or fluoroelastomer O-rings are available on request

Millipore Express® SHC Filters

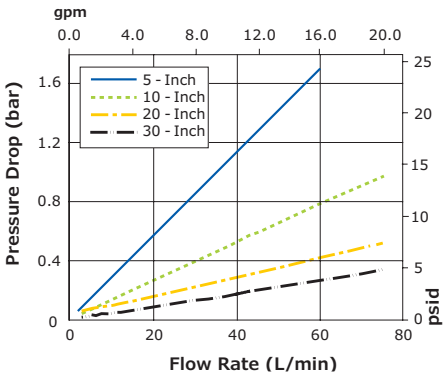
Opticap® XL and XLT Autoclavable Capsule Filter Specifications

Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Opticap® XLT 10 Standard Area Capsules	Opticap® XLT 20 Standard Area Capsules	Opticap® XLT 30 Standard Area Capsules
Dimensions						
Body Diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum Width	-	-	-	19.8 cm (7.8 in)	19.8 cm (7.8 in)	19.8 cm (7.8 in)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	38.1 cm (15.0 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area	0.13 m² (1.4 ft²)	0.23 m² (2.5 ft²)	0.49 m² (5.3 ft²)	0.49 m² (5.3 ft²)	0.98 m² (10.5ft²)	1.47 m² (15.8 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polypropylene					
Supports	Polypropylene					
Core	Polysulfone					
Housing and Cage	Polypropylene					
O-Rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 2.75 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C					
Maximum Differential Pressure						
Forward:	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 25 °C 1 bar (15 psi) at 80 °C					
Reverse:	2.1 bar (30 psi) intermittent at 25 °C					
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture					
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi).					
	≤ 7.3 cc/min.	≤ 13.3 cc/min.	≤ 28.2 cc/min.	≤ 28.2 cc/min.	≤ 56.3 cc/min.	≤ 84.5 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM® F838 methodology.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and USP <645> for Water Conductivity at 25 °C after a WFI flush of:					
	5.5 L	9.5 L	20 L	20 L	40 L	60 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:					
	2 L	2 L	2 L	2 L	4 L	6 L
Sterilization	May be autoclaved for 3 cycles for 60 minutes at 126 °C. Cannot be steam sterilized in-line.					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

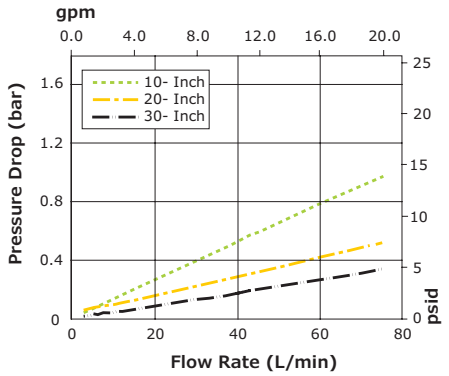
Millipore Express® SHC Filters

Typical Clean Water Flow Rates – Cartridge Filters

Standard Area Cartridge Filters with 0.5/0.2 µm Millipore Express® SHC Membranes



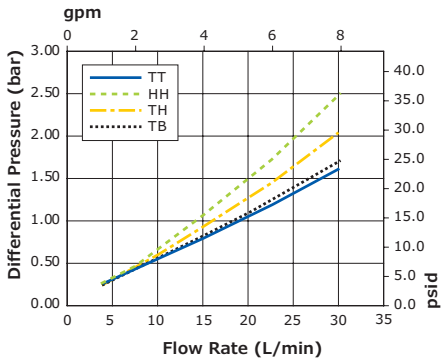
High Area Cartridge Filters with 0.5/0.2 µm Millipore Express® SHC Membranes



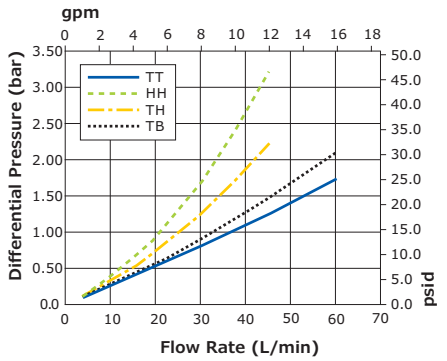
Millipore Express® SHC Filters

Typical Clean Water Flow Rates – Opticap® XL and XLT Autoclavable Capsules

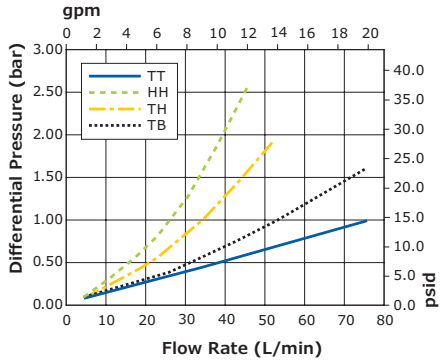
Opticap® XL 3 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



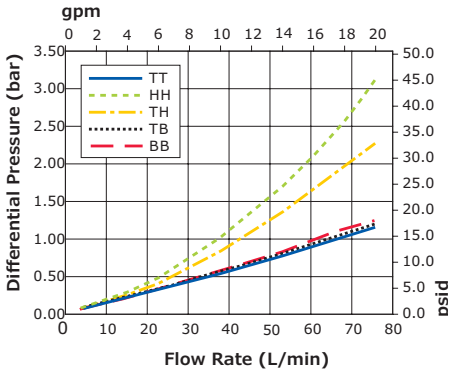
Opticap® XL 5 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



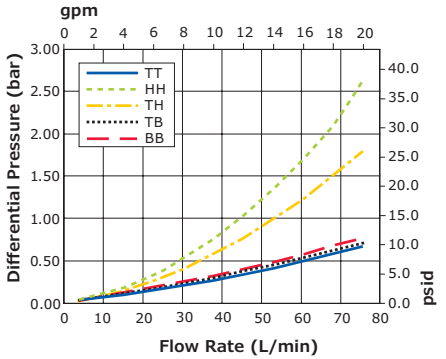
Opticap® XL 10 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



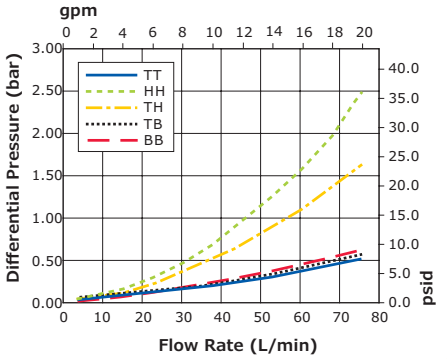
Opticap® XLT 10 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XLT 20 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XLT 30 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

HH = 14 mm (9/16 in.) hose barb inlet and outlet

TH = 38 mm (1½ in.) sanitary flange inlet and 14 mm (9/16 in.) hose barb outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1½ in.) sanitary flange inlet and outlet

TH = 38 mm (1½ in.) sanitary flange Inlet and 16 mm (5/8 in.) hose barb outlet

HH = 16 mm (5/8 in.) hose barb inlet and outlet

TB = 38 mm (1½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

BB = 25 mm (1 in.) hose barb inlet and outlet

Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications

Description	Opticap® XL 150 Standard Area Capsules	Opticap® XL 300 Standard Area Capsules	Opticap® XL 600 Standard Area Capsules
Dimensions			
Body Diameter	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)
Maximum Length	9.7 cm (3.8 in.)	11.9 cm (4.7 in.)	16.5 cm (6.5 in.)
Maximum Length with Optional Bell	11.4 cm (4.5 in.)	13.7 cm (5.4 in.)	18.3 cm (7.2 in.)
Filtration Area	0.014 m² (0.155 ft²)	0.029 m² (0.316 ft²)	0.059 m² (0.631 ft²)
Materials of Construction			
Filter membrane	Hydrophilic polyethersulfone (PES)		
Supports	Polyethylene		
Core	Polysulfone		
Housing and Cage	Gamma stable polypropylene		
O-Rings	Silicone		
Optional Bell	Polycarbonate		
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.		
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 2.75 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C		
Maximum Differential Pressure			
Forward:	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 25 °C 1 bar (15 psi) at 80 °C		
Reverse:	2.1 bar (30 psi) intermittent at 25 °C		
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture		
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi).		
	≤ 1.0 cc/min.	≤ 1.9 cc/min.	≤ 3.7 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM® F838 methodology.		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.		
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and for USP <645> for Water Conductivity at 25 °C after a WFI flush of:		
	1 L	2 L	3 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of 1 L.		
Sterilization			
Gamma-compatible Capsules	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterile Capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.		
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		

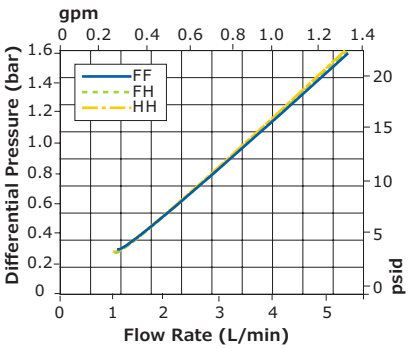
Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications (cont.)

Description	Opticap® XL 150 Standard Area Capsules	Opticap® XL 300 Standard Area Capsules	Opticap® XL 600 Standard Area Capsules
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.		
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).		
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.		

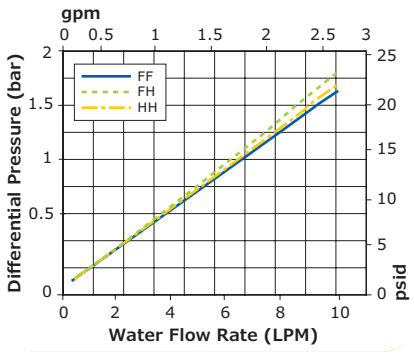
Millipore Express® SHC Filters

Typical Clean Water Flow Rates – Opticap® XL 150, 300, 600 Sterile and Gamma-Compatible Capsules

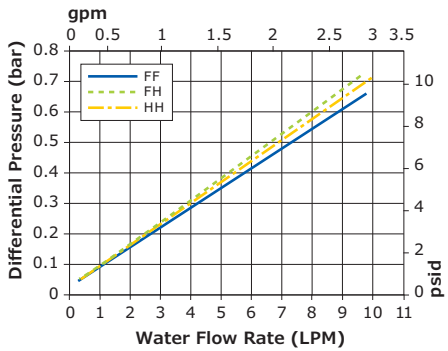
Opticap® XL 150 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XL 300 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XL 600 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XL 150, 300 and 600 Capsule Connection Type

FF: 19 mm (3/4 in.) sanitary flange inlet and outlet

FH: 19 mm (3/4 in.) sanitary flange inlet and 14 mm (9/16 in.) hose barb outlet

HH: 14 mm (9/16 in.) hose barb inlet and outlet

Millipore Express® SHC Filters

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications

Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Per 10" Standard Area Opticap® XLT Capsule	Per 10" High Area Opticap® XLT Capsule*
Dimensions					
Body Diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum Width	-	-	-	19.8 cm (7.8 in)	19.8 cm (7.8 in)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)		
10 inch				38.1 cm (15 in.)	38.1 cm (14.8 in.)
20 inch				62.5 cm (24.6 in.)	62.5 cm (24.6 in.)
30 inch				87.1 cm (34.3 in.)	87.1 cm (34.3 in.)
Filtration Area	0.13 m² (1.4 ft²)	0.24 m² (2.6 ft²)	0.54 m² (5.8 ft²)	0.54 m² (5.8 ft²)	1.0 m² (10.8 ft²)
Materials of Construction					
Filter membrane	Hydrophilic polyethersulfone (PES)				Hydrophilic PES
Film edge	Polyethylene				Polyethylene
Supports	Polyester				Polyester
Core	Polysulfone				Polyethersulfone
Housing and Cage	Gamma stable Polypropylene				Gamma stable Polypropylene
O-Rings	Silicone				Silicone
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.				
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent at 23 °C 5.5 bar (80 psi) at 23 °C 2.7 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C				
Maximum Differential Pressure					
Forward:	6.9 bar (100 psi) intermittent at 25 °C 5.5 bar (80 psi) at 25 °C 1 bar (15 psi) at 80 °C				
Reverse:	2.1 bar (30 psi) intermittent at 25 °C				
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture				
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):				
	≤ 7.6 cc/min.	≤ 14.0 cc/min.	≤ 31.2 cc/min.	≤ 31.2 cc/min.	≤ 56.4 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.				
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.				
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and for USP <645> for Water Conductivity at 25 °C after a WFI flush of:				
	5.0 L	9.5 L	21 L	21 L	21 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of 2 L.				
Sterilization					
Gamma-compatible capsules	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.				
Sterile capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.				
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.				

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications (cont.)

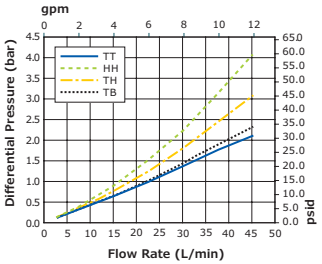
Description	Opticap® XL 3 Standard Area Capsules	Opticap® XL 5 Standard Area Capsules	Opticap® XL 10 Standard Area Capsules	Per 10" Standard Area Opticap® XLT Capsule	Per 10" High Area Opticap® XLT Capsule*
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.				
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.				
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).				
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.				

* Only available in Gamma-compatible capsules

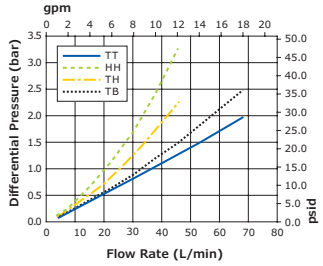
Millipore Express® SHC Filters

Typical Clean Water Flow Rates – Opticap® XL and XLT Sterile and Gamma-Compatible Capsules

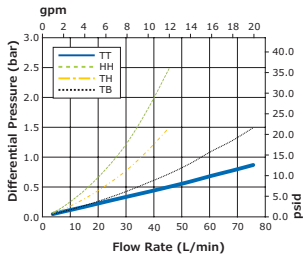
Opticap® XL 3 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



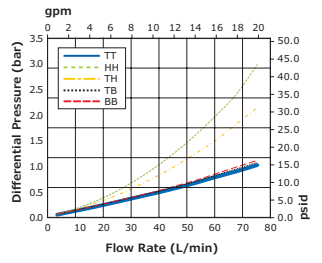
Opticap® XL 5 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



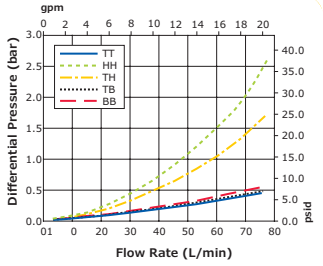
Opticap® XL 10 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



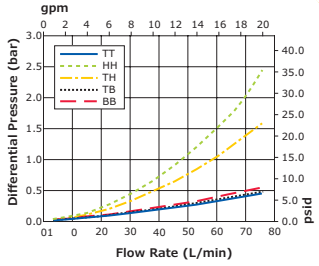
Standard Area Opticap® XLT 10 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



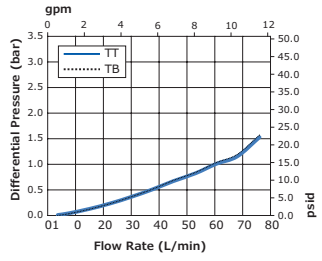
Standard Area Opticap® XLT 20 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



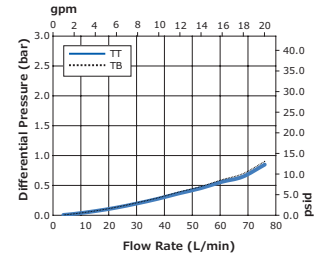
Standard Area Opticap® XLT 30 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



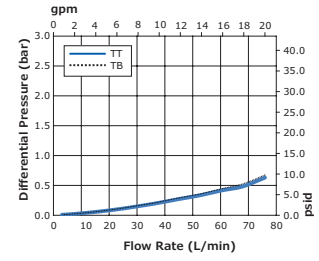
High Area Opticap® XLT 10 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



High Area Opticap® XLT 20 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



High Area Opticap® XLT 30 Capsules with 0.5/0.2 µm Millipore Express® SHC Membrane



Opticap® XL Capsule Legends Refer to Connection Type

FF = 19 mm (¾ in.) sanitary flange inlet and outlet

FF = 19 mm (¾ in.) sanitary flange inlet and 14 mm ($^{9}/_{16}$ in.) hose barb outlet

TT = 38 mm (1 ½ in.) sanitary flange inlet and outlet

HH = 14 mm ($^{9}/_{16}$ in.) hose barb intlet and outlet

TH = 38 mm (1 ½ in.) sanitary flange inlet and 14 mm ($^{9}/_{16}$ in.) hose barb outlet

TB = 38 mm (1 ½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1 ½ in.) sanitary flange inlet and outlet

TH = 38 mm (1 ½ in.) sanitary flange inlet and 16 mm ($^{5}/_{8}$ in.) hose barb outlet

HH = 16 mm ($^{5}/_{8}$ in.) hose barb intlet and outlet

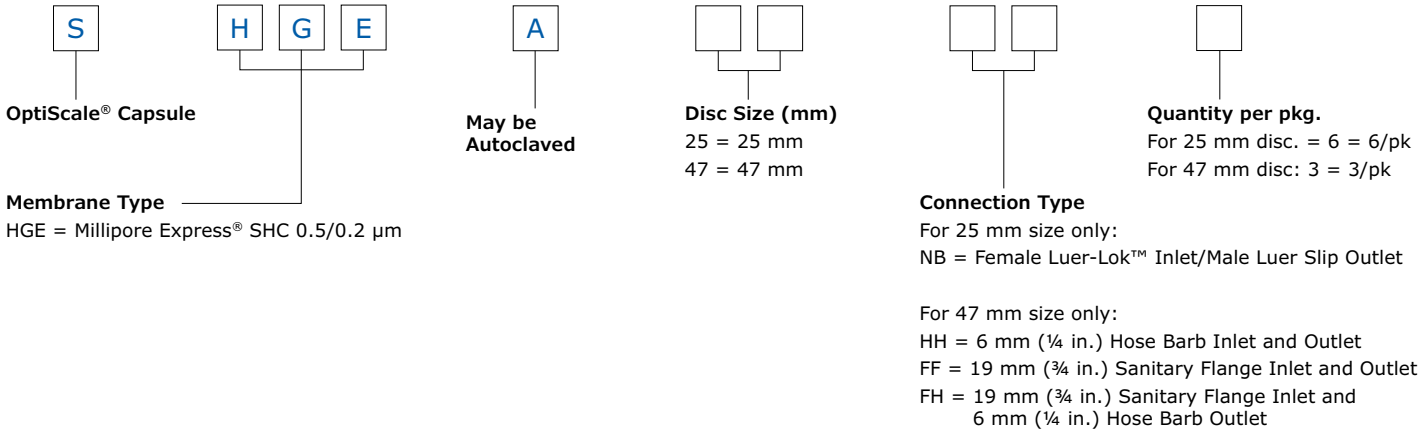
TB = 38 mm (1 ½ in.) sanitary flange inlet and 25 mm (1 in.) hose barb outlet

BB = 25 mm (1 in.) hose barb inlet and outlet

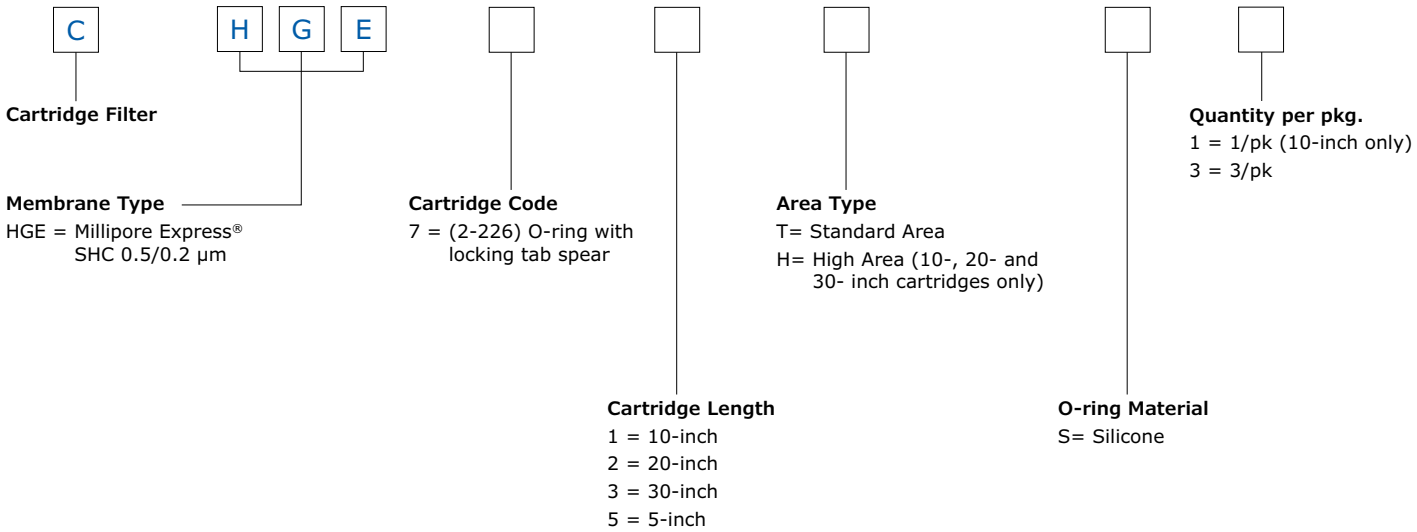
Millipore Express® SHC Filters

Ordering Information

OptiScale® Capsules



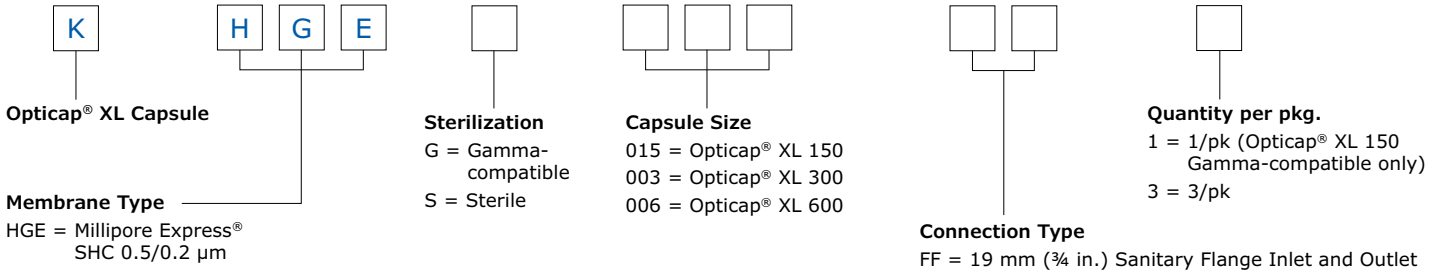
Cartridge Filters



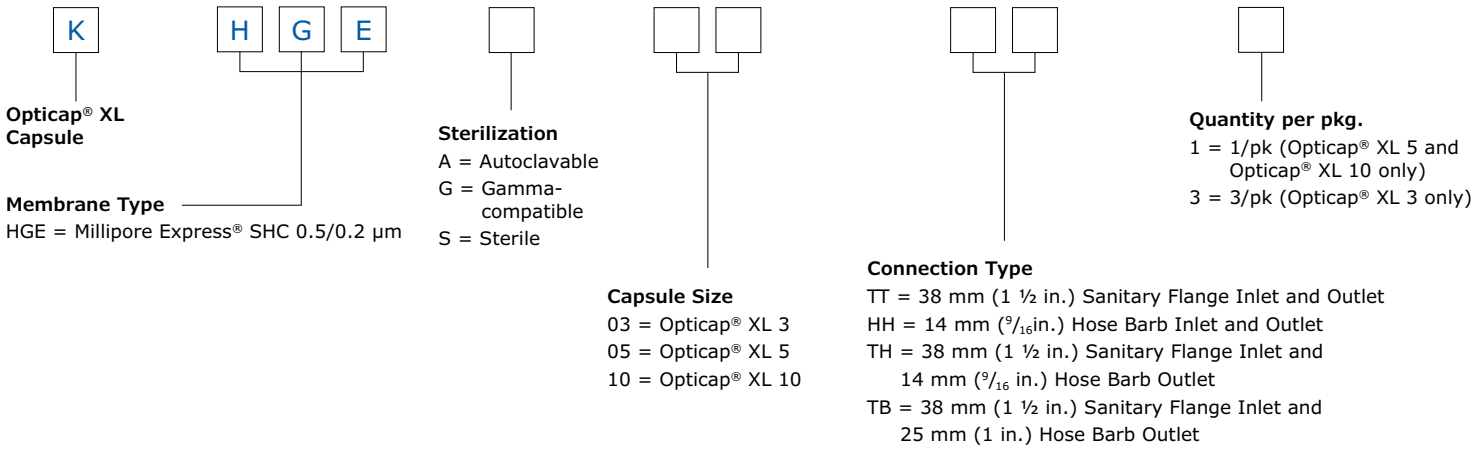
Millipore Express® SHC Filters

Ordering Information

Opticap® XL 150, 300, 600 Capsule Filters



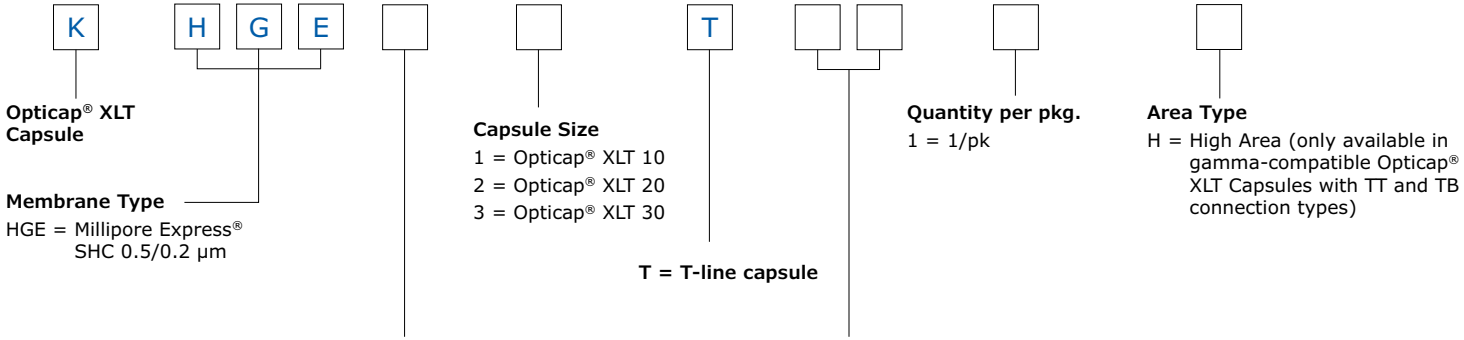
Opticap® XL Capsule Filters



Millipore Express® SHC Filters

Ordering Information

Opticap® XLT Capsule Filters



Millipore Express® SHF Filters

High flow, sterilizing-grade filters for critical process steps

Filters containing Millipore Express® SHF (Sterile, High Flux) sterilizing-grade membrane provide exceptionally high flow rates for low plugging streams. These filters contain a 0.2 µm polyethersulfone (PES) membrane that provides broad chemical compatibility for critical process steps that require validated sterility assurance.

Benefits

- Sterilizing-grade membranes that are easy to wet and integrity test
- High flux PES membrane that provides superior processing efficiency
- Broad chemical compatibility across a wide pH range
- 100% integrity tested during the manufacturing process

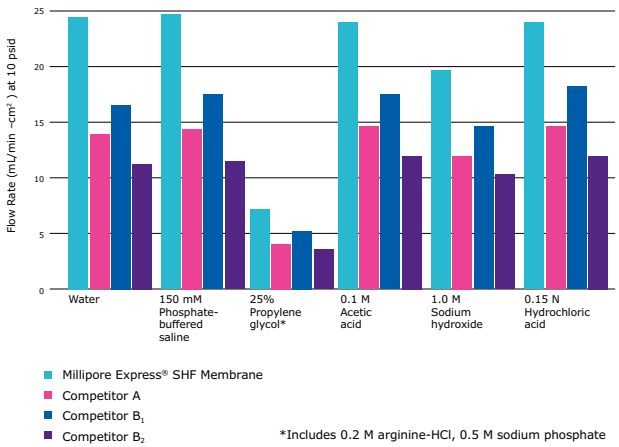
Filter Formats

- OptiScale® capsules
- Cartridge filters
- Opticap® XL and XLT capsule filters: sterile, gamma-compatible or autoclavable

Millipore Express® SHF Filters

Millipore Express® SHF filters provide faster flow rates allowing you to process equivalent volumes with reduced filtration area, thus delivering savings in filtration costs.

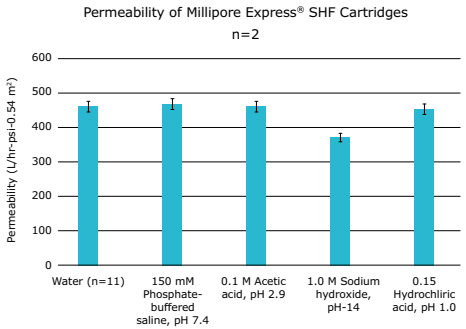
Millipore Express® SHF Membrane Flux Relative to Competitors

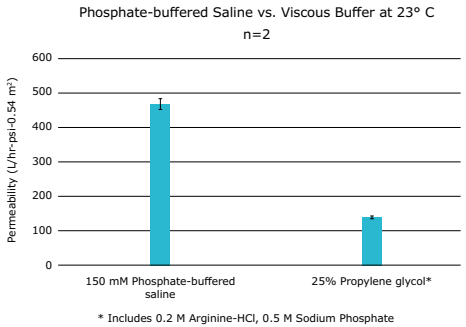


*Includes 0.2 M arginine-HCl, 0.5 M sodium phosphate

Filter Sizing

Testing with Millipore Express® SHF filters across a range of commonly used buffers and cleaning solutions (pH 1-14) showed an average permeability of 450 liters per hour per psi per 10-inch cartridge. Filters were tested after gamma irradiation at 25-37 kGy and autoclaved at 123° C for 60 minutes.





* Includes 0.2 M Arginine-HCl, 0.5 M Sodium Phosphate

Mobius® Single-use Solutions

Millipore Express® SHF filters are part of the Mobius® library providing you with the flexibility to design single-use assemblies that meet your specific processing requirements.

For more information, please visit:

EMDMillipore.com/Singleuse-MyWay

The Emprove® Program – Your Fast Track through Regulatory Challenges

Complementing our product portfolio, the Emprove® Program provides three types of dossiers to support different stages of development and manufacturing operations such as qualification, risk assessment and process optimization.

For more information, please visit:

EMDMillipore.com or SigmaAldrich.com/Emprove

Millipore Express® SHF Filters

OptiScale® Capsule and Cartridge Filter Specifications

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Cartridge	Per 10-inch Cartridge
Dimensions				
Diameter:	31 mm (1.21 in.)	69 mm (2.75 in.)	6.9 cm (2.7 in.)	6.9 cm (2.7 in.)
Maximum Length:	39 mm (1.52 in.)	94 mm (3.70 in.)	12.5 cm (5 in.)	25.4 cm (10 in.)
Filtration Area	3.5 cm²	17.7 cm²*	0.29 m² (3.1 ft²)	0.54 m² (5.8 ft²)
Materials of Construction				
Filter Membrane	Hydrophilic polyethersulfone (PES)			
Film Edge	-	-	Polypropylene	
Supports	Polypropylene		Polypropylene	
Structural Components	Polypropylene	Polycarbonate	Polypropylene	
Core	-	-	Polysulfone	
Vent cap	Polypropylene	Polyvinylidene fluoride	-	
O-Rings**	-	Fluoroelastomer	Silicone	
Maximum Inlet Pressure	4.1 bar (60 psi) at 25 °C	5.5 bar (80 psi) at 25 °C	-	-
Maximum Differential Pressure				
Forward:	4.1 bar (60 psi) at 25 °C	5.5 bar (80 psi) at 25 °C	6.9 bar (100 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 300 mbar (5 psi) at 135 °C	
Reverse:	0 bar (0 psi)	690 mbar (10 psi) at 25 °C	2.1 bar (30 psi) at 25 °C 69 mbar (1 psi) at 135 °C	
Bubble Point at 23 °C	-	-	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture	
Air Diffusion at 23 °C	-	-	Through a water wet membrane at 2800 mbar (40 psi):	
	-	-	≤ 16.4 cc/min.	≤ 30 cc/min.
Bacterial Retention	-	-	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.	
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>. Specification not applicable to OptiScale® 47 capsules.			
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and USP <645> for Water Conductivity at 25 ºC after a WFI flush of:			
	15 mL	-	5.5 L	10 L
Oxidizable Substances	-	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:		
	-	100 mL	1 L	1 L
Sterilization				
Autoclave	1 cycle at 123 °C for 60 min.	3 cycles at 126 °C for 60 min.	15 cycles of 60 minutes at 126 °C	
In-line Steam	-	-	Forward for 25x , 30 min cycles at 135 °C, or 22x (forward) and 3x (reverse), 30 min cycles at 135 °C	
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics.			
	-	-	This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.	

OptiScale® Capsule and Cartridge Filter Specifications (cont.)

Description	OptiScale® 25 Capsules	OptiScale® 47 Capsules	5-inch Cartridge	Per 10-inch Cartridge
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals. Specification does not apply to OptiScale® 47 capsules.			
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b) (6).			
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.			

*OptiScale® 47 is recommended for screening purposes only, please refer to OptiScale® 25 capsule for scaling

**Cartridge filters with ethylene propylene diene monomer (EPDM) or fluoroelastomer O-rings are available on request

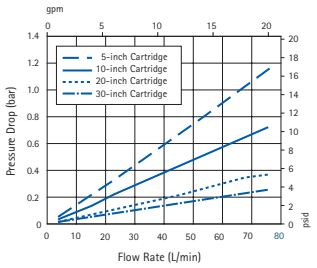
Opticap® XL and XLT Autoclavable Capsule Filter Specifications

Description	Opticap® XL 3 Capsules	Opticap® XL 5 Capsules	Opticap® XL 10 Capsules	Opticap® XLT 10 Capsules	Opticap® XLT 20 Capsules	Opticap® XLT 30 Capsules
Dimensions						
Body Diameter	10.7 (4.2 in)	10.7 (4.2 in)	10.7 (4.2 in)	10.7 (4.2 in)	10.7 (4.2 in)	10.7 (4.2 in)
Maximum Width	-	-	-	19.8 cm (7.8 in)	19.8 cm (7.8 in)	19.8 cm (7.8 in)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	37.6 cm (14.8 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area	0.16 m² (1.7 ft²)	0.29 m² (3.1 ft²)	0.54 m² (5.8 ft²)	0.54 m² (5.8 ft²)	1.08 m² (11.6 ft²)	1.62 m² (17.4 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polypropylene					
Supports	Polypropylene					
Core	Polysulfone					
Housing and Cage	Polypropylene					
O-Rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent 23 °C					
Maximum Differential Pressure						
Forward:	5.5 bar (80 psi) at 25 °C 6.9 bar (100 psi) intermittent 25 °C 1 bar (15 psi) at 80 °C					
Reverse:	2.1 bar (30 psi) intermittent at 25 °C					
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture					
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi) at:					
	≤ 9.1 cc/min.	≤ 16.4 cc/min.	≤ 30 cc/min.	≤ 30 cc/min.	≤ 60 cc/min.	≤ 90 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and USP <645> for Water Conductivity at 25 °C after a WFI flush of:					
	3.0 L	5.5 L	10 L	10 L	20 L	30 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:					
	1 L	1 L	1 L	1 L	2 L	3 L
Sterilization	May be autoclaved for 3 cycles for 60 minutes at 126 °C. Cannot be steam sterilized in-line.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b) (6).					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

Millipore Express® SHF Filters

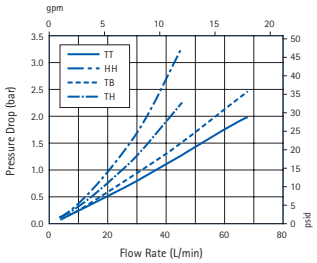
Typical Clean Water Flow Rates – Cartridge Filters

Cartridge Filters with Millipore Express® SHF Hydrophilic Membrane

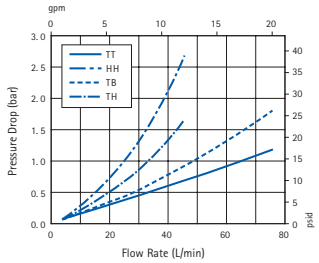


Typical Clean Water Flow Rates – Opticap® XL and XLT Autoclavable Capsules

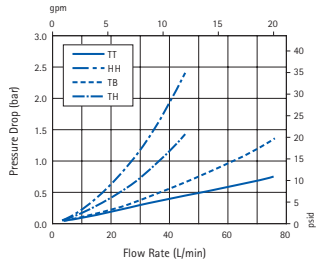
Opticap® XL 3 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



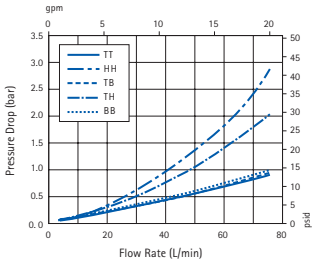
Opticap® XL 5 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



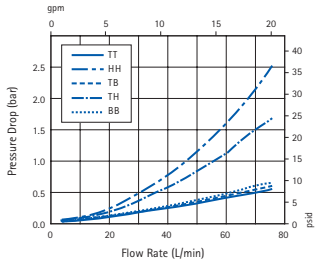
Opticap® XL 10 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



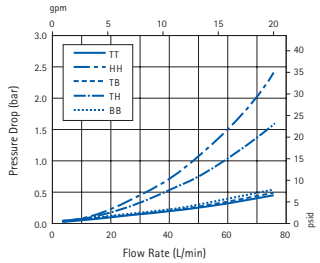
Opticap® XLT 10 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XLT 20 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XLT 30 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1 ½ in.) Sanitary Flange Inlet and Outlet
HH = 14 mm ($^{9}/_{16}$ in.) Hose Barb Inlet and Outlet
TH = 38 mm (1 ½ in.) Sanitary Flange Inlet and 14 mm ($^{9}/_{16}$ in.) Hose Barb Outlet
TB = 38 mm (1 ½ in.) Sanitary Flange Inlet and 25 mm (1 in.) Hose Barb Outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1 ½ in.) Sanitary Flange Inlet and Outlet
TH = 38 mm (1 ½ in.) Sanitary Flange Inlet and 16 mm ($^{5}/_{8}$ in.) Hose Barb Outlet
HH = 16 mm ($^{5}/_{8}$ in.) Hose Barb Inlet and Outlet
BB = 25 mm (1 in.) Hose Barb Inlet and Outlet
TB = 38 mm (1 ½ in.) Sanitary Flange Inlet 25 mm (1 in.) Hose Barb Outlet

Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications

Description	Opticap® XL 150 Capsules	Opticap® XL 300 Capsules	Opticap® XL 600 Capsules
Dimensions			
Body Diameter	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)
Maximum Length	9.7 cm (3.8 in.)	11.9 cm (4.7 in.)	16.5 cm (6.5 in.)
Maximum length with bell	11.4 cm (4.5 in.)	13.7 cm (5.4 in.)	18.3 cm (7.2 in.)
Filtration Area	0.022 m² (0.240 ft²)	0.048 m² (0.514 ft²)	0.097 m² (1.046 ft²)
Materials of Construction			
Filter membrane	Hydrophilic polyethersulfone (PES)		
Supports	Polyethylene		
Core	Polysulfone		
Housing and Cage	Gamma stable polypropylene		
O-Rings	Silicone		
Optional Bell	Polycarbonate		
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.		
Maximum Inlet Pressure	6.9 bar (100 psi) intermittent 25 °C 5.5 bar (80 psi) at 25 °C 2.8 bar (40 psi) at 60 °C 1 bar (15 psi) at 80 °C		
Maximum Differential Pressure			
Forward:	6.9 bar (100 psi) intermittent 25 °C 5.5 bar (80 psi) at 25 °C 1 bar (15 psi) at 80 °C		
Reverse:	2.1 bar (30 psi) intermittent at 25 °C		
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture		
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):		
	≤ 1.4 cc/min.	≤ 2.8 cc/min.	≤ 5.8 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.		
Total Organic Carbon (TOC)/ Conductivity	Gamma-sterilized filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and for USP <645> for Water Conductivity at 25 °C after a WFI flush of:		
	2 L	2.5 L	3 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:		
	1 L	1 L	1 L
Sterilization			
Gamma-compatible Capsules	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterile Capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.		
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		

Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications (cont.)

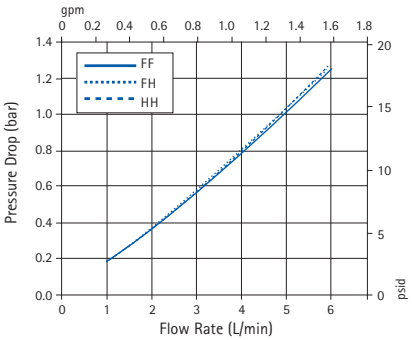
Description	Opticap® XL 150 Capsules	Opticap® XL 300 Capsules	Opticap® XL 600 Capsules
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.		
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).		
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.		

Millipore Express® SHF Filters

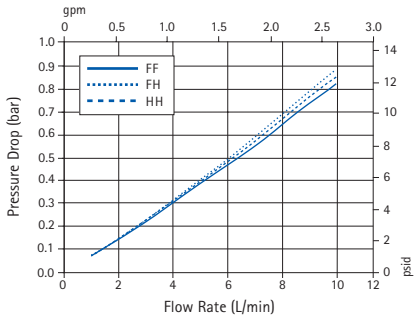
Typical Clean Water Flow Rates – Opticap® XL 150, 300, 600 Sterile and Gamma-Compatible Capsules

Filters tested post gamma radiation at 45–65 kGy and autoclaved at 123 °C for 60 minutes

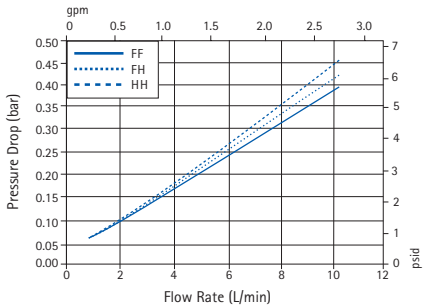
Opticap® XL 150 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XL 300 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XL 600 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XL 150, 300 & 600 Capsule Connection Type

FF = 19 mm (¾ in.) sanitary flange inlet and outlet

FH = 19 mm (¾ in.) sanitary flange inlet and 14mm ($^{9}/_{16}$ in.) hose barb utlet

HH = 14 mm ($^{9}/_{16}$ in.) hose barb inlet and outlet

Millipore Express® SHF Filters

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications

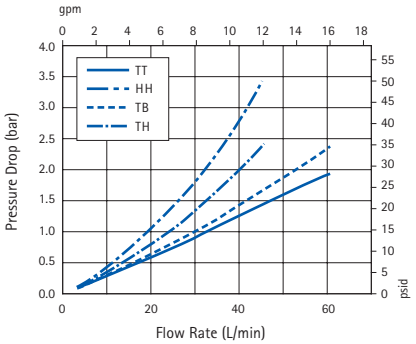
Description	Opticap® XL 3 Capsules	Opticap® XL 5 Capsules	Opticap® XL 10 Capsules	Opticap® XLT 10 Capsules	Opticap® XLT 20 Capsules	Opticap® XLT 30 Capsules
Dimensions						
Body Diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum Width	-	-	-	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	37.6 (14.8 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area	0.17 m² (1.8 ft²)	0.31 m² (3.3 ft²)	0.57 m² (6.1 ft²)	0.57 m² (6.1 ft²)	1.14 m² (12.3 ft²)	1.71 m² (18.4 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polyethylene					
Supports	Polyester					
Core	Polysulfone					
Housing and Cage	Gamma stable Polypropylene					
O-Rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Differential Pressure						
Forward:	5.5 bar (80 psi) at 25 °C 6.9 bar (100 psi) intermittent 25 °C 1 bar (15 psi) at 80 °C					
Reverse:	2.1 bar (30 psi) intermittent at 25 °C					
Bubble Point at 23 °C	≥ 4000 mbar (58 psi) air with water ≥ 1280 mbar (18.5 psi) nitrogen with 70/30% IPA/water mixture					
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):					
	≤ 9.5 cc/min.	≤ 17.4 cc/min.	≤ 32.7 cc/min.	≤ 32.7 cc/min.	≤ 65.5 cc/min.	≤ 98.2 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and for USP <645> for Water Conductivity at 25 ºC after a WFI flush of:					
	3.5 L	6.0 L	11 L	11 L	22 L	33 L
Oxidizable Substances	Meets the USP Oxidizable Substances Test requirements for sterile purified water after a water flush of:					
	1 L	1 L	1 L	1 L	2 L	3 L
Sterilization						
Gamma-compatible capsules	Gamma-compatible to 45 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.					
Sterile capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.					
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

Millipore Express® SHF Filters

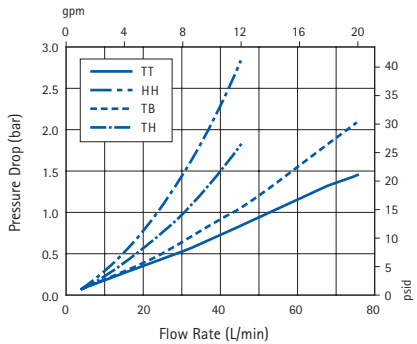
Typical Clean Water Flow Rates – Opticap® XL and XLT Sterile and Gamma-Compatible Capsules

Filters tested post gamma radiation at 25–45 kGy

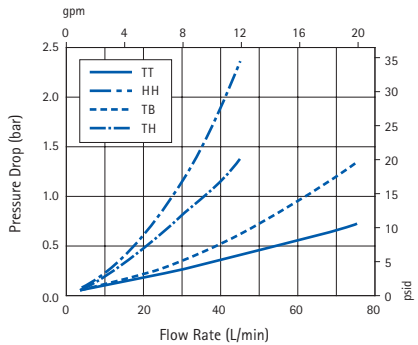
Opticap® XL 3 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



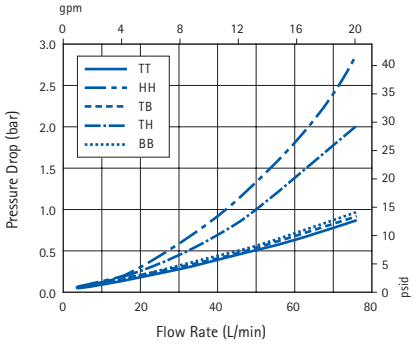
Opticap® XL 5 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



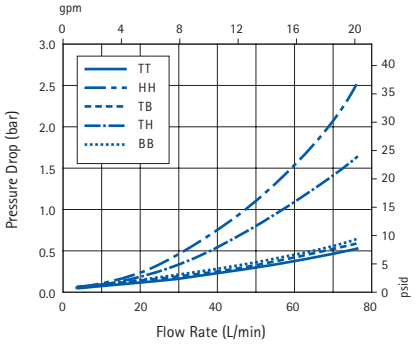
Opticap® XL 10 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



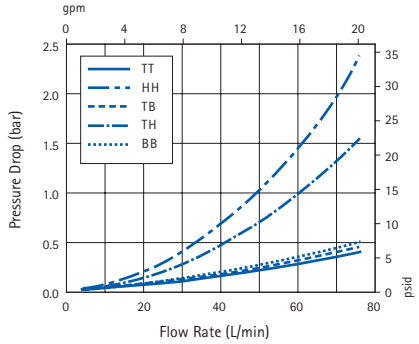
Opticap® XLT 10 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



Opticap® XLT 20 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



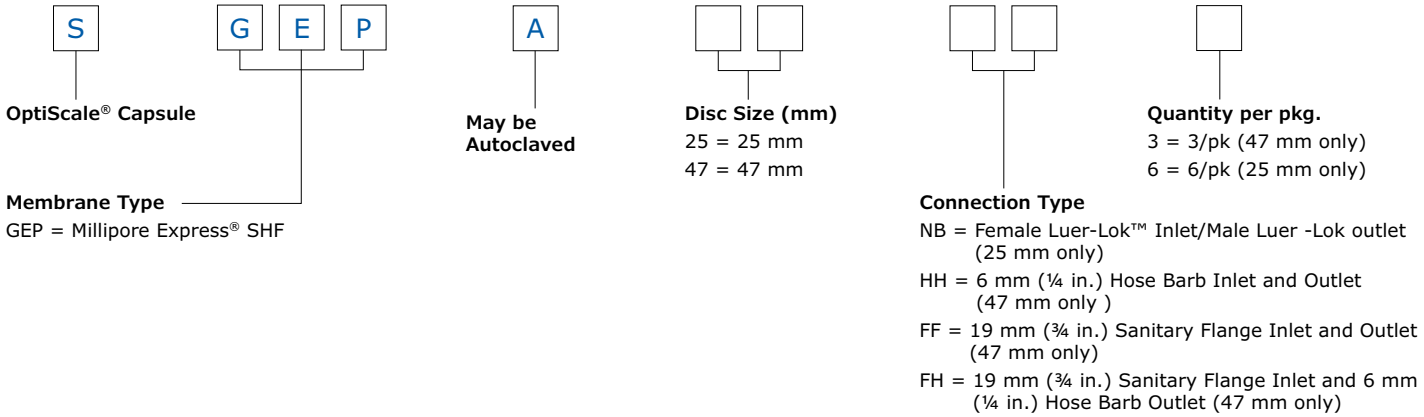
Opticap® XLT 30 Capsule Filters with 0.2 µm Millipore Express® SHF Membrane



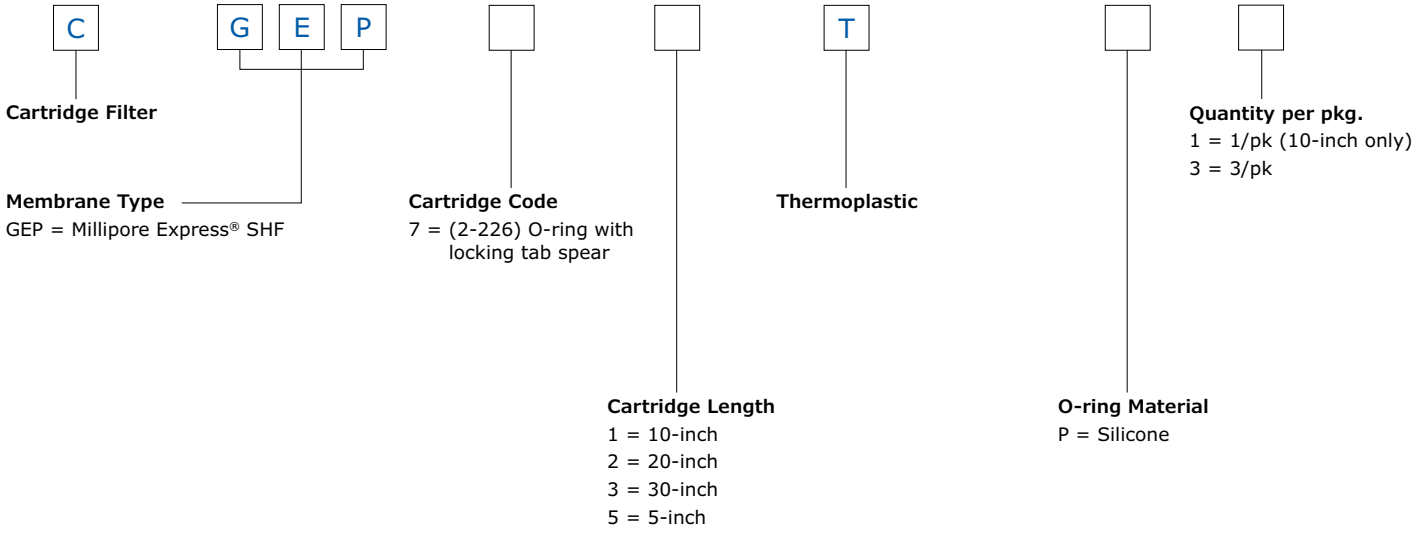
Millipore Express® SHF Filters

Ordering Information

OptiScale® Capsules



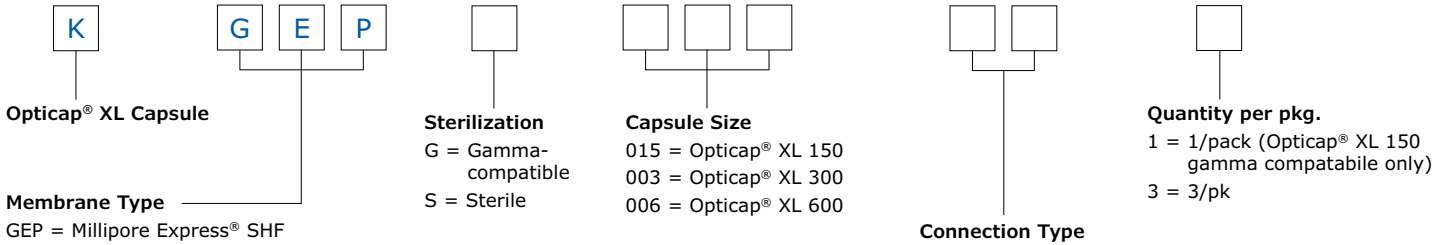
Cartridge Filters



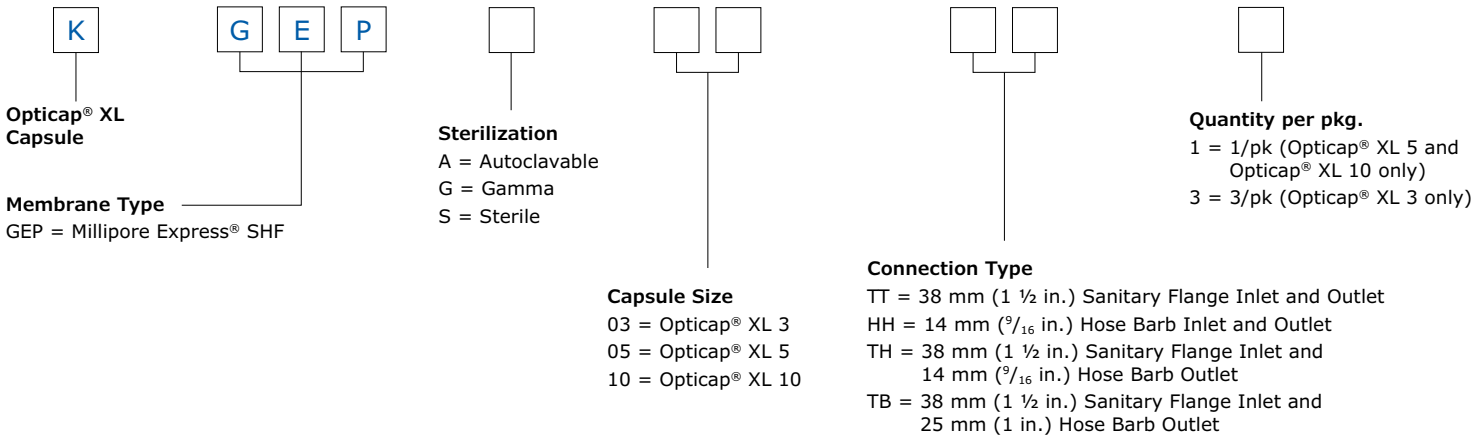
Millipore Express® SHF Filters

Ordering Information

Opticap® XL 150, 300, 600 Capsule Filters



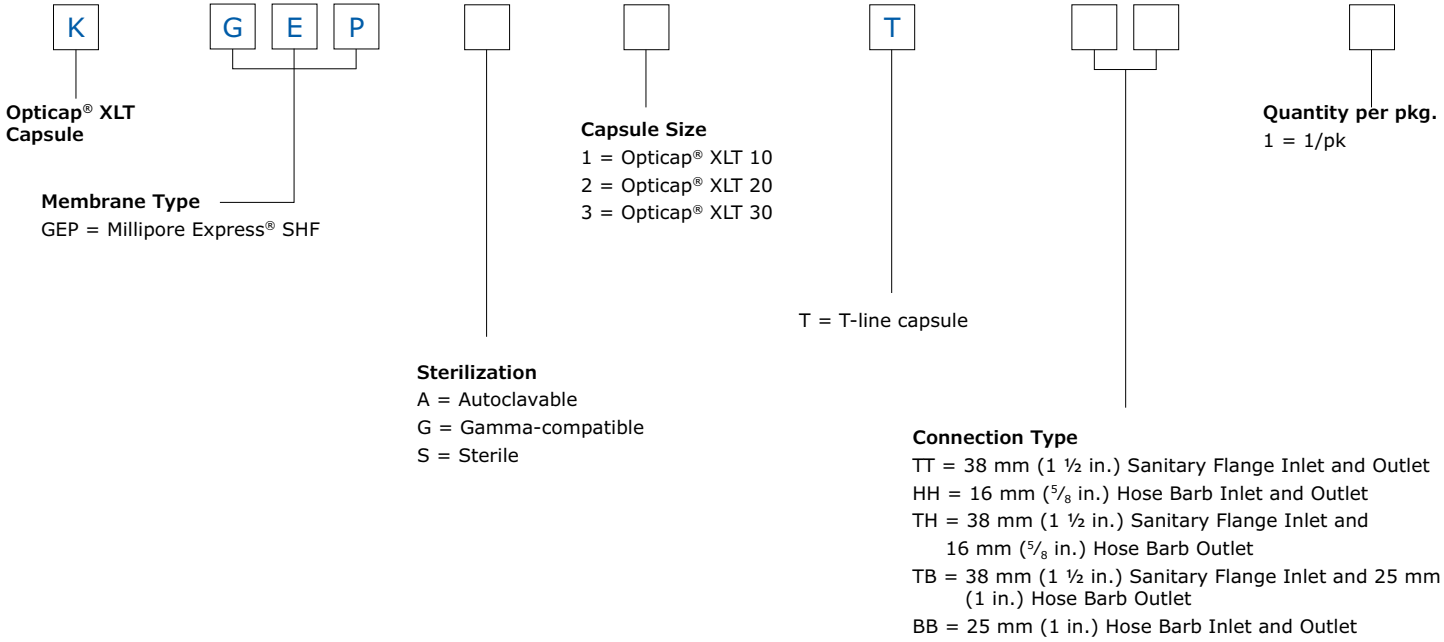
Opticap® XL Capsule Filters



Millipore Express® SHF Filters

Ordering Information

Opticap® XLT Capsule Filters



Millipore Express® PHF Filters

High flow filters for cost-effective filtration of buffers and process intermediates

Filters containing Millipore Express® PHF (Process protection, High Flux) membrane are a cost-effective option for sterile filtration of buffers and process intermediates. These filters contain a 0.2 µm polyethersulfone (PES) membrane and provide high flow rates and extended throughput for superior process efficiency.

Benefits

- High flux sterilizing-grade PES membrane that reduces process footprint
- Broad chemical compatibility across a wide pH range
- Fully scalable product offerings

Available Pore Sizes

- OptiScale® capsules
- Cartridge filters
- Opticap® XL and XLT capsule filters: sterile, gamma-compatible or autoclavable

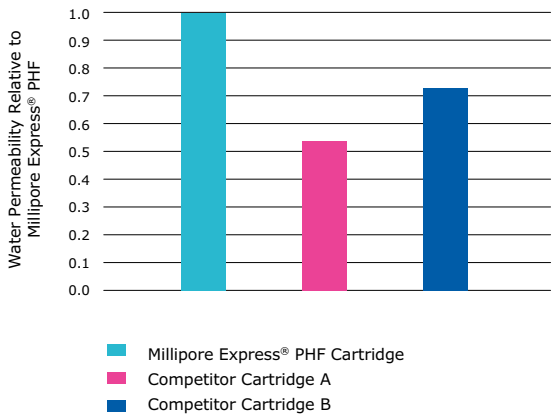
Mobius® Single-use Solutions

Millipore Express® PHF filters are part of the Mobius® library providing you with the flexibility to design single-use assemblies that meet your specific processing requirements.

For more information, please visit:

EMDMillipore.com/singleuse-myway

Relative Water Permeability of 10-inch Cartridges



Millipore Express® PHF Filters

OptiScale® Capsule and Cartridge Filter Specifications

Description	OptiScale® 25 Capsules	5-inch Cartridge	Per Standard Area 10-inch Cartridge
Dimensions			
Diameter:	31 mm (1.21 in.)	6.9 cm (2.7 in.)	6.9 cm (2.7 in.)
Length:	39 mm (1.52 in.)	12.5 cm (5 in.)	25.4 cm (10 in.)
Filtration Area	3.5 cm^2	0.29 m^2 (3.1 ft^2)	0.54 m^2 (5.8 ft^2)
Materials of Construction			
Filter membrane	Hydrophilic polyethersulfone (PES)		
Film edge	—	Polypropylene	
Supports	Polypropylene	Polypropylene	
Structural components	Polypropylene	Polypropylene	
Core	—	Polysulfone	
Vent Cap	Polypropylene	—	
O-Rings*	—	Silicone	
Maximum Inlet Pressure	4.1 bar (60 psi) at 25 °C	—	—
Maximum Differential Pressure			
Forward:	4.1 bar (60 psi) at 25 °C	5.5 bar (80 psi) at 25 °C 1.7 bar (25 psi) at 80 °C 300 mbar (5 psi) at 135 °C	
Reverse:	0 bar (0 psi)	1.4 bar (20 psi) at 25 °C 69 mbar (1 psi) at 135 °C	
Air Diffusion at 23 °C	—	Through a water wet membrane at 2800 mbar (40 psi).	
	—	≤ 16.4 cc/min.	≤ 30 cc/min.
Bacterial Retention	—	Quantitative retention of 10^7 CFU/cm^2 *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.	
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.		
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and USP <645>, for Water Conductivity at 25 °C after a WFI water flush of:		
	15 mL	5.5 L	10 L
Sterilization			
Autoclave	1 cycle at 123 °C for 60 min.	15 cycles of 60 minutes at 126 °C	
In-line Steam	—	Forward for 15x, 30 min. cycles at 135 °C, or 12x (forward) and 3x (reverse), 30 min. cycles at 135 °C	
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics.		
	—	This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.	
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.		
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).		
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.		

* Cartridge filters with ethylene propylene diene monomer (EPDM) or fluoroelastomer O-rings are available on request

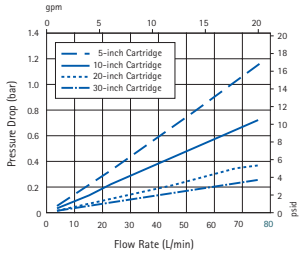
Opticap® XL and XLT Autoclavable Capsule Filter Specifications

Description	Opticap® XL 3 Capsules	Opticap® XL 5 Capsules	Opticap® XL 10 Capsules	Opticap® XLT 10 Capsules	Opticap® XLT 20 Capsules	Opticap® XLT 30 Capsules
Dimensions						
Body Diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum Width	-	-	-	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)	19.8 cm (7.8 in.)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	37.6 cm (14.8 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area	0.16 m² (1.7 ft²)	0.29 m² (3.1 ft²)	0.54 m² (5.8 ft²)	0.54 m² (5.8 ft²)	1.08 m² (11.6 ft²)	1.62 m² (17.4 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polypropylene					
Supports	Polypropylene					
Core	Polysulfone					
Housing and Cage	Polypropylene					
O-rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Inlet Pressure	5.5 bar (80 psi) at 25 °C					
Maximum Differential Pressure						
Forward:	5.5 bar (80 psi) at 25 °C					
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):					
	≤ 9.1 cc/min.	≤ 16.4 cc/min.	≤ 30 cc/min.	≤ 30 cc/min.	≤ 60 cc/min.	≤ 90 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					
Total Organic Carbon (TOC)/ Conductivity	Autoclaved filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and USP <645> for Water Conductivity at 25 ºC after a WFI flush of:					
	3 L	5.5 L	10 L	10 L	20 L	30 L
Sterilization	May be autoclaved for 3 cycles for 60 minutes at 126 °C. Cannot be steam sterilized in-line.					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

Millipore Express® PHF Filters

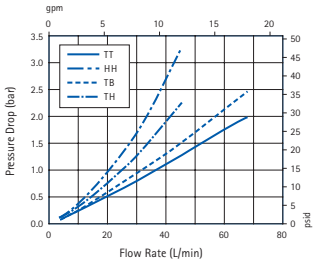
Typical Clean Water Flow Rates – Cartridge Filters

Cartridge Filters with 0.2 µm Millipore Express® PHF Hydrophilic Membrane

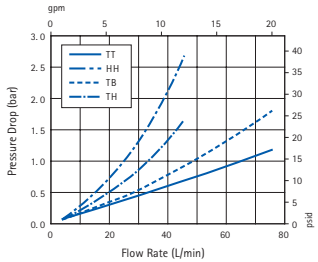


Typical Clean Water Flow Rates – Opticap® XL and XLT Autoclavable Capsules

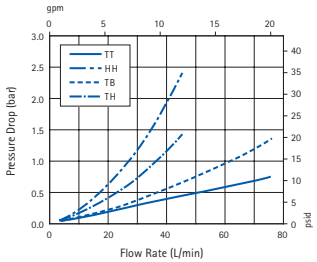
Opticap® XL 3 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL 5 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL 10 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL Capsule Legends Refer to Connection Type

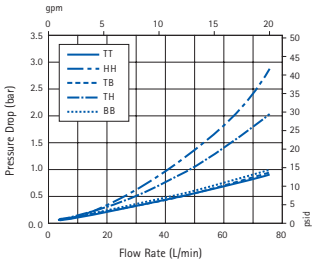
TT = 38 mm (1 in.) sanitary flange inlet and outlet

HH = 14mm ($^{9}/_{16}$ in.) hose barb inlet and outlet

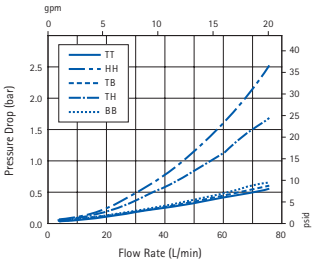
TH = 38mm (1 ½ in.) sanitary flange inlet and 14mm ($^{9}/_{16}$ in.) hose barb outlet

TB = 38mm (1 ½ in.) sanitary flange inlet and 25mm (1 in.) hose barb outlet

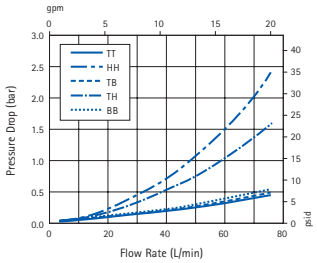
Opticap® XLT 10 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XLT 20 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XLT 30 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1 ½ in.) sanitary flange inlet and outlet

TH = 38mm (1 ½ in.) sanitary flange inlet and 16mm ($^{5}/_{8}$ in.) hose barb outlet

HH = 16mm ($^{5}/_{8}$ in.) hose barb inlet and outlet

BB = 25mm (1 in.) hose barb inlet and outlet

TB = 38mm (1 ½ in.) sanitary flange inlet and 25mm (1 in.) hose barb outlet

Opticap® XL 150, 300 and 600 Sterile and Gamma-Compatible Capsule Filter Specifications

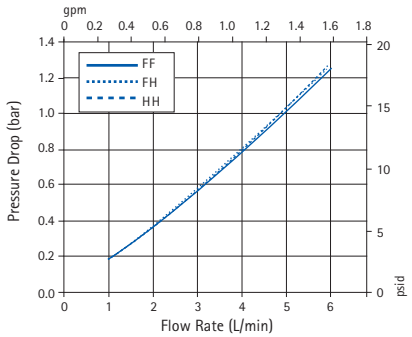
Description	Opticap® XL 150 Capsules	Opticap® XL 300 Capsules	Opticap® XL 600 Capsules
Dimensions			
Body Diameter	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)	5.6 cm (2.2 in.)
Maximum Length	9.7 cm (3.8 in.)	11.9 cm (4.7 in.)	16.5 cm (6.5 in.)
Filtration Area	0.022 m² (0.240 ft²)	0.048 m² (0.514 ft²)	0.097 m² (1.046 ft²)
Materials of Construction			
Filter membrane	Hydrophilic polyethersulfone (PES)		
Supports	Polyethylene		
Core	Polysulfone		
Housing and Cage	Gamma stable polypropylene		
O-Rings	Silicone		
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.		
Maximum Inlet Pressure	5.5 bar (80 psi) at 25 °C		
Maximum Differential Pressure			
Forward:	5.5 bar (80 psi) at 25 °C		
Reverse:	1.4 bar (20 psi) at 25 °C		
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):		
	≤ 1.4 cc/min.	≤ 2.8 cc/min.	≤ 5.8 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.		
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.		
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643>, for Total Organic Carbon and for USP <645> for Water Conductivity at 25 ºC after a WFI flush of:		
	2.0 L	2.5 L	3.0 L
Sterilization			
Gamma-compatible Capsules	Gamma-compatible to 40 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterile Capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.		
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.		
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.		
Particle Shedding	Effluent meets the acceptance criteria set forth in USP <788> for large volume parenterals.		
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).		
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR 177-182 based on information provided by raw material suppliers.		

Millipore Express® PHF Filters

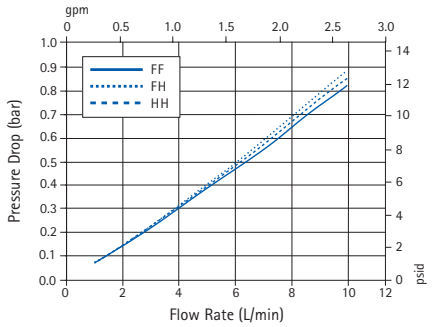
Typical Clean Water Flow Rates – Opticap® XL 150, 300, 600 Sterile and Gamma-Compatible Capsules

Filters tested post gamma radiation at 25–40 kGy and autoclaved at 123 °C for 60 minutes

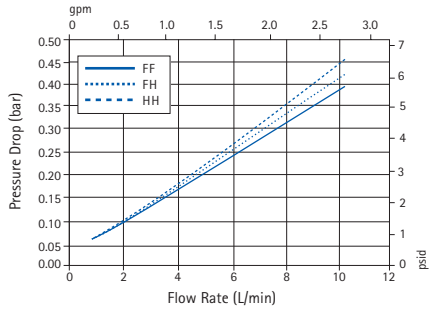
Opticap® XL 150 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL 300 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL 600 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL 150, 300 & 600 Capsule Connection Type

FF = 19 mm (¾ in.) sanitary flange inlet and outlet

FH = 19 mm (¾ in.) sanitary flange inlet and 14mm ($^{9}/_{16}$ in.) hose barb utlet

HH = 14 mm ($^{9}/_{16}$ in.) hose barb inlet and outlet

Opticap® XL and XLT Sterile and Gamma-Compatible Capsule Filter Specifications

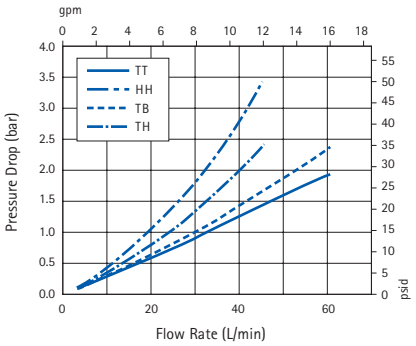
Description	Opticap® XL 3 Capsules	Opticap® XL 5 Capsules	Opticap® XL 10 Capsules	Opticap® XLT 10 Capsules	Opticap® XLT 20 Capsules	Opticap® XLT 30 Capsules
Dimensions						
Body Diameter	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)	10.7 cm (4.2 in.)
Maximum Width	-	-	-	19.8 cm (7.8 in)	19.8 cm (7.8 in)	19.8 cm (7.8 in)
Maximum Length	17.3 cm (6.8 in.)	21.6 cm (8.5 in.)	33.5 cm (13.2 in.)	37.6 (14.8 in.)	62.5 cm (24.6 in.)	87.1 cm (34.3 in.)
Filtration Area	0.17 m² (1.8 ft²)	0.31 m² (3.3 ft²)	0.57 m² (6.1 ft²)	0.57 m² (6.1 ft²)	1.14 m² (12.3 ft²)	1.71 m² (18.4 ft²)
Materials of Construction						
Filter membrane	Hydrophilic polyethersulfone (PES)					
Film edge	Polyethylene					
Supports	Polyester					
Core	Polysulfone					
Housing and Cage	Gamma stable Polypropylene					
O-Rings	Silicone					
Vent/Drain	6 mm (¼ in.) hose barb with double O-ring seal; connects to 1/8 in. tubing.					
Maximum Inlet Pressure	5.5 bar (80 psi) at 25 °C					
Maximum Differential Pressure						
Forward:	5.5 bar (80 psi) at 25 °C					
Air Diffusion at 23 °C	Through a water wet membrane at 2800 mbar (40 psi):					
	≤ 9.5 cc/min.	≤ 17.4 cc/min.	≤ 32.7 cc/min.	≤ 32.7 cc/min.	≤ 65.5 cc/min.	≤ 98.2 cc/min.
Bacterial Retention	Quantitative retention of 10^7 CFU/cm² *Brevundimonas diminuta* ATCC® 19146 per ASTM© F838 methodology.					
Bacterial Endotoxin	Aqueous extraction contains < 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test. This meets the requirements of USP <85>.					
Total Organic Carbon (TOC)/ Conductivity	Gamma sterilized filter effluent meets the WFI requirement of USP <643> for Total Organic Carbon and for USP <645> for Water Conductivity at 25 °C after a WFI flush of:					
	3.5 L	6.0 L	11 L	11 L	22 L	33 L
Sterilization						
Gamma-compatible capsules	Gamma-compatible to 40 kGy and may be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.					
Sterile capsules	May be autoclaved for 3 cycles of 60 minutes at 123 °C. Cannot be steam sterilized in-line.					
Sterility (Sterile capsules)	These capsules meet current USP and AAMI guidelines for sterility utilizing a validated sterilization cycle.					
Toxicity	Component materials meet the criteria for USP <88> Biological Reactivity tests for Class VI plastics. This product is non cytotoxic per USP <87>, Biological Reactivity *in vitro*.					
Non-fiber Releasing	Meets the criteria for a 'non-fiber releasing' filter as defined in 21 CFR 210.3 (b)(6).					
Indirect Food Additive	All component materials meet the FDA Indirect food additives requirement cited in 21 CFR177-182 based on information provided by raw material suppliers.					

Millipore Express® PHF Filters

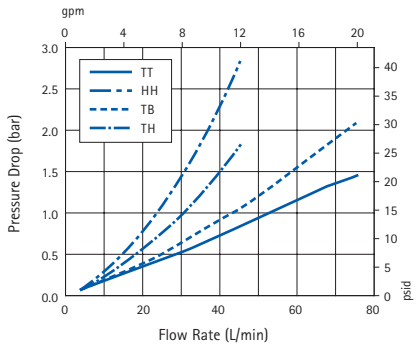
Typical Clean Water Flow Rates – Opticap® XL and XLT Sterile and Gamma-Compatible Capsules

Filters tested post gamma radiation at 25–40 kGy

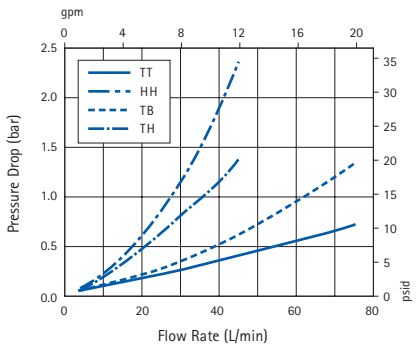
Opticap® XL 3 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



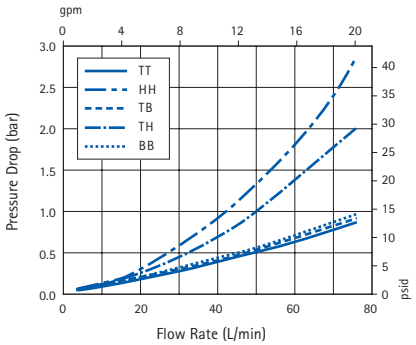
Opticap® XL 5 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



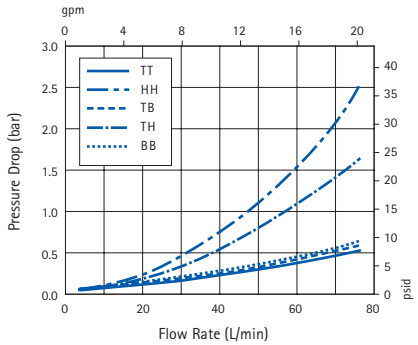
Opticap® XL 10 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



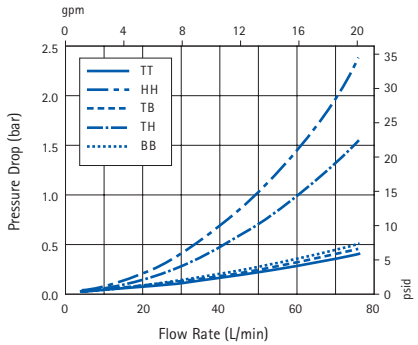
Opticap® XLT 10 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XLT 20 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XLT 30 Capsule Filters with 0.2 µm Millipore Express® PHF Membrane



Opticap® XL Capsule Legends Refer to Connection Type

TT = 38 mm (1 in.) sanitary flange inlet and outlet

HH = 14mm ($^{9}/_{16}$ in.) hose barb inlet and outlet

TH = 38mm (1 ½ in.) sanitary flange inlet and 14mm ($^{9}/_{16}$ in.) hose barb outlet

TB = 38mm (1 ½ in.) sanitary flange inlet and 25mm (1 in.) hose barb outlet

Opticap® XLT Capsule Legends Refer to Connection Type

TT = 38 mm (1 ½ in.) sanitary flange inlet and outlet

TH = 38mm (1 ½ in.) sanitary flange inlet and 16mm ($^{5}/_{8}$ in.) hose barb outlet

HH = 16mm ($^{5}/_{8}$ in.) hose barb inlet and outlet

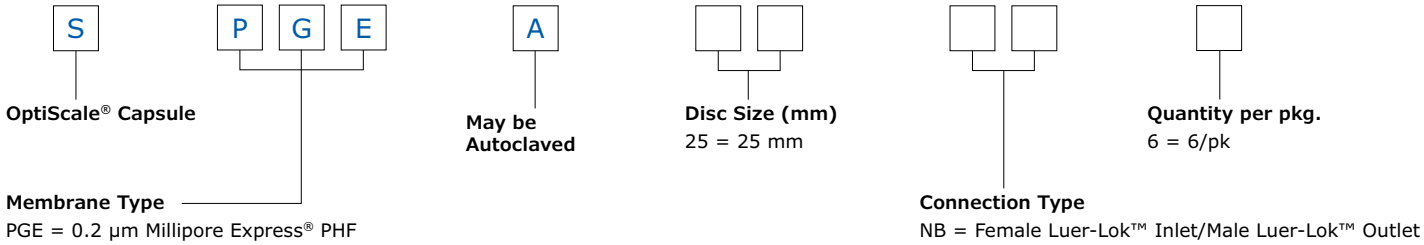
BB = 25mm (1 in.) hose barb inlet and outlet

TB = 38mm (1 ½ in.) sanitary flange inlet and 25mm (1 in.) hose barb outlet

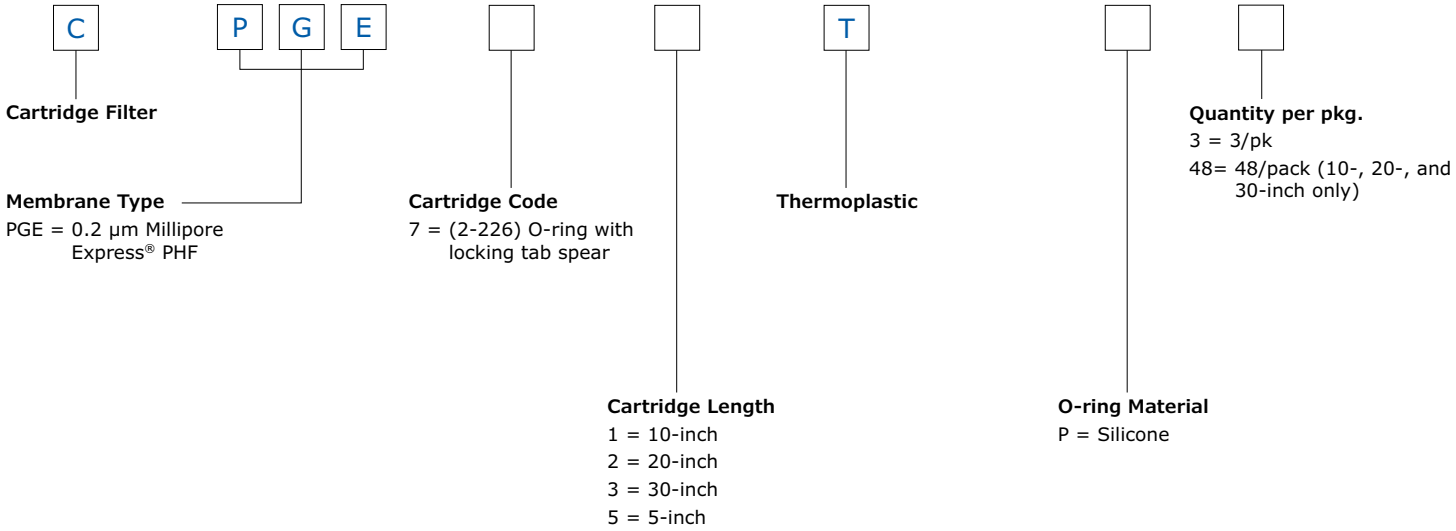
Millipore Express® PHF Filters

Ordering Information

OptiScale® Capsules



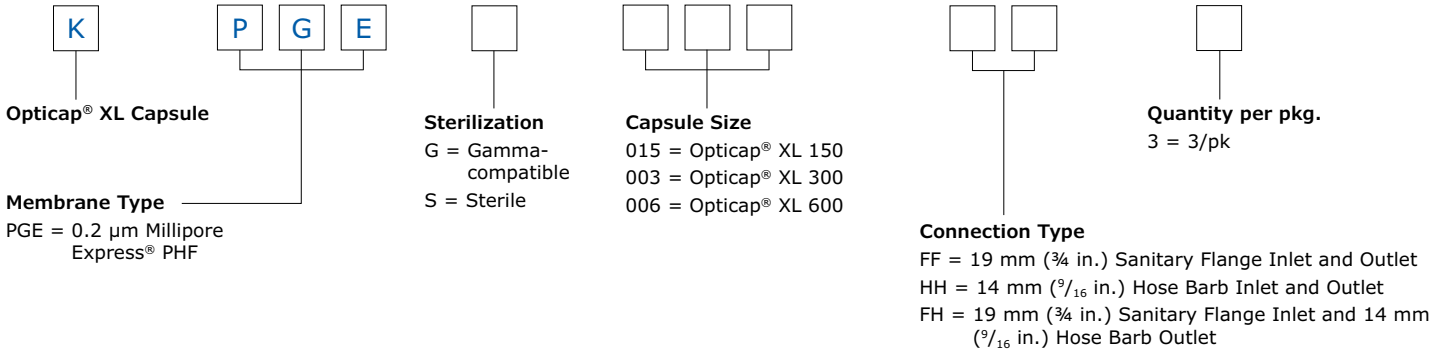
Cartridge Filters



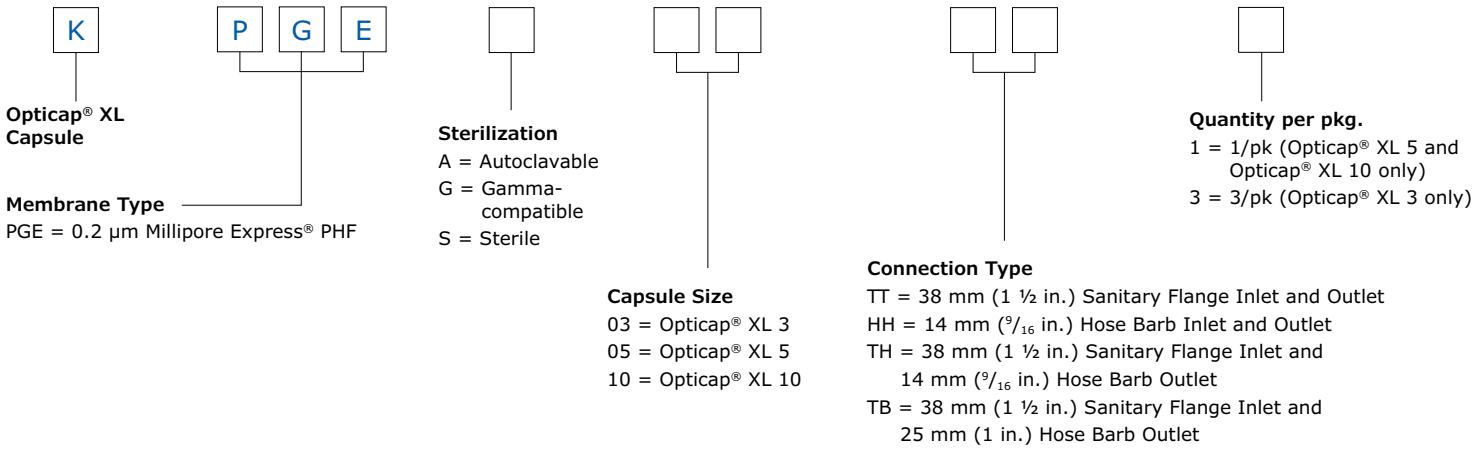
Millipore Express® PHF Filters

Ordering Information

Opticap® XL 150, 300, 600 Capsule Filters



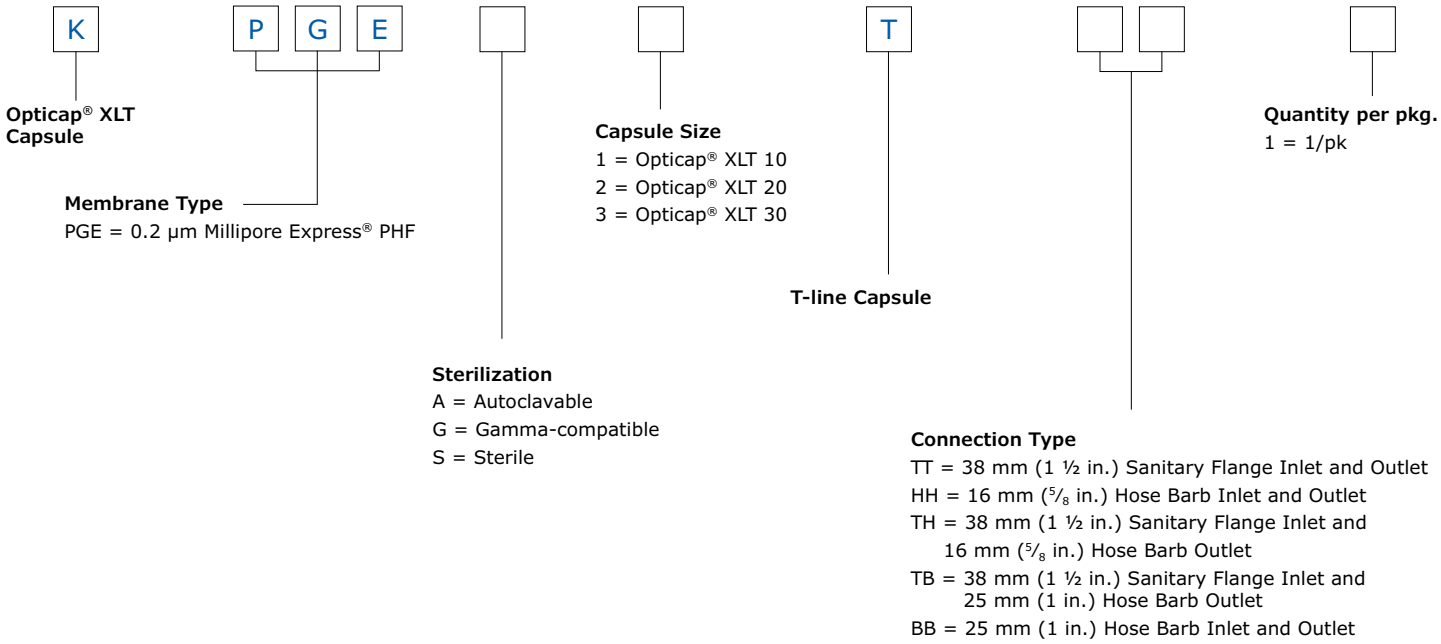
Opticap® XL Capsule Filters



Millipore Express® PHF Filters

Ordering Information

Opticap® XLT Capsule Filters



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