

Xampler™ laboratory-scale hollow fiber cartridges

GE Healthcare Xampler ultrafiltration and microfiltration cartridges are designed for laboratory-scale cross flow filtration processes, with typical volumes ranging from a few hundred milliliters to about 10 liters of solution (Fig 1). Xampler hollow fiber filter cartridges are offered with nominal flow path lengths of 30 and 60 cm and membrane areas ranging from 110 to 1400 cm² (0.12 to 1.5 ft²). The cartridges are directly scalable to GE Healthcare Life Sciences 30 and 60 cm pilot- and process-scale hollow fiber filter cartridges.

Key benefits of Xampler hollow fiber cartridges

- Nominal flow path lengths of 30 and 60 cm facilitate optimization of process conditions and assist future scale-up
- Membrane areas from 110 to 1400 cm² (0.12 to 1.5 ft²) suit specific processing needs
- Low flow rate requirements allow use of smaller pumps
- Polysulfone membrane minimizes nonspecific protein binding and provides high product recovery
- Autoclavable devices address the need for small-volume sanitary processing
- Self-contained housings with translucent polysulfone shells allow ease of installation and enable visual observation of the membrane separation process

Xampler cartridges have fully self-contained housings and are well-suited for use with GE Healthcare's QuixStand™ bench-top system. When operated in a vertical orientation, optimized process fluid drainage and product recovery is achieved.

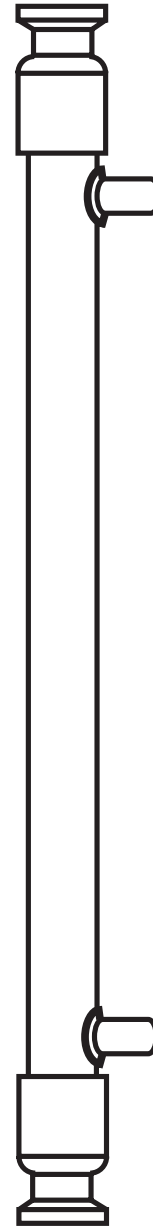
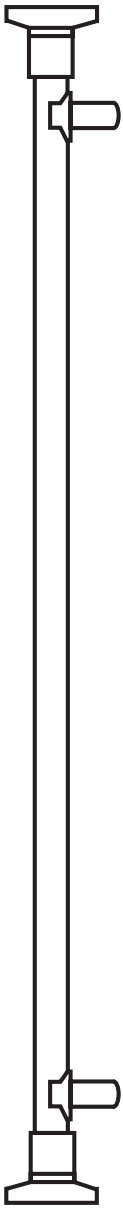


Fig 1. Xampler hollow fiber cartridges are available in two housing diameters and two flow path lengths, and are designed for use with QuixStand bench-top systems.

Xampler hollow fiber cartridges are offered with mini Tri-Clamp™ end fittings for quick and easy sanitary connection to your laboratory equipment (identified with an "M" in the suffix of the model number). A selected portion of the Xampler product line is also offered with barbed end fittings for simple and flexible tubing connection. Schematic diagrams showing the alternative cartridge sizes and end fittings are provided in Figure 2.

All GE Healthcare Xampler cartridges, except the 1000 nominal molecular weight cut-off (NMWC) ultrafiltration units, are autoclavable (identified with an "A" in suffix of the model number).





Housing 3M

Length = 31.7 cm (12.5 in)
 Diameter = 0.9 cm (0.375 in)
 Permeate ports = 0.25 in tubing nipple
 Feed/retentate ports = 0.5 in Tri-Clamp

Housing 3X2M

Length = 63.5 cm (25 in)
 Diameter = 0.9 cm (0.375 in)
 Permeate ports = 0.25 in tubing nipples
 Feed/retentate ports = 0.5 in Tri-Clamp

Housing 4

Length = 36.2 cm (14.25 in)
 Diameter = 1.9 cm (0.75 in)
 Permeate ports = 0.375 in tubing nipple
 Feed/retentate ports = 0.375 in tubing barb

Housing 4M

Length = 34.5 cm (13.6 in)
 Diameter = 1.9 cm (0.75 in)
 Permeate ports = 0.375 in tubing nipple
 Feed/retentate ports = 0.5 in Tri-Clamp

Housing 4X2M

Length = 66 cm (26 in)
 Diameter = 1.9 cm (0.75 in)
 Permeate ports = 0.375 in tubing nipples
 Feed/retentate ports = 0.5 in Tri-Clamp

Fig 2. Xampler laboratory cartridges (drawings not to scale)

GE Healthcare hollow fiber filter cartridges

The exceptional performance of GE Healthcare hollow fiber filter products is based on a proprietary manufacturing process that yields membrane with a structure free of macrovoids and pinhole defects commonly associated with conventional hollow fiber membranes (Fig 3). Separation processes that incorporate a high-quality membrane can use a broad range of operating parameters without compromising membrane performance or integrity.

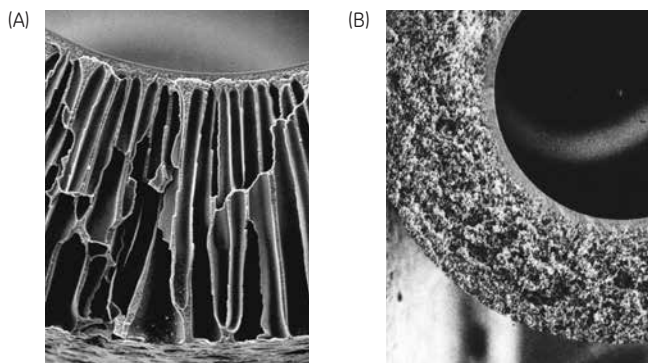


Fig 3. (A) Conventional hollow fiber ultrafiltration membrane and (B) GE Healthcare ultrafiltration membrane.

GE Healthcare QuixStand bench-top system

The QuixStand bench-top system is a compact, easy-to-use, laboratory-scale separations system that uses Xampler cartridges for quick and efficient concentration and diafiltration of a wide range of biological fluids (Fig 4). The QuixStand system is capable of rapid processing of volumes up to 10 liters.

QuixStand systems can be purchased with or without pumps and are available in non-sanitary, sanitary, and autoclavable versions.



Fig 4. Sanitary QuixStand bench-top system with peristaltic pump and Xampler size 4M hollow fiber cartridge

Specifications

Xampler cartridge specifications are listed in Table 1.

Table 1. Specifications for Xampler hollow fiber filter cartridges

Physical specifications

Cartridge diameter	
3M, 3X2M	0.9 cm (0.375 in)
4, 4M, 4X2M	1.9 cm (0.75 in)
Cartridge length	
3M	31.7 cm (12.5 in)
3X2M	63.5 cm (25 in)
4	36.2 cm (14.25 in)
4M	34.5 cm (13.6 cm)
4X2M	66 cm (26 in)
Path length	
3M, 4, 4M	30 cm (12 in)
3X2M, 4X2M	60 cm (24 in)
Feed/retentate connections	
3M, 3X2M, 4M, 4X2M	0.5 in Tri-clamp
4	0.375-in tubing barb
Permeate connections	
3M, 3X2M	0.25 in tubing nipple
4, 4M, 4X2M	0.375 in tubing nipple
Materials of construction	
Hollow fibers	Polysulfone
Housing components	Polysulfone
Potting	Epoxy
Support net (4, 4M, 4X2M)	Polypropylene
Fitting caps	Vinyl
Biological safety	
USP XXVII Class VI	Compliant

Surface area

Housing identifier	Nominal lumen i.d. (mm)	Membrane area (cm ²)	Membrane area (ft ²)
3M	0.5	140	0.15
	0.75	120	0.13
	1	110	0.12
3X2M	0.5	290	0.31
	1	230	0.24
4, 4M	0.5	650	0.70
	0.75	460	0.50
	1	420	0.45
4X2M	0.5	1400	1.5
	0.75	950	1.02
	1	850	0.91
	1.75	650	0.70

Operating specifications

	Ultrafiltration	Microfiltration	
Temperature range	Up to 80°C	0.1 to 0.2 µm: up to 80°C 0.45 to 0.65 µm: up to 50°C	
Maximum feed pressure	< 10°C: 5.2 barg (75 psig) 10°C to 25°C: 4.5 barg (65 psig) 25°C to 80°C: 3.4 barg (50 psig)	At 25°C: 0.1 µm: 2.1 barg (30 psig) 0.2 µm: 1.7 barg (25 psig) 0.45 µm: 1 barg (15 psig) 0.65 µm: 1 barg (15 psig)	
Maximum transmembrane pressure	3000 to 30 000 NMWC† < 10°C: 4.1 barg (60 psig) 10°C to 25°C: 3.4 barg (50 psig) 25°C to 50°C: 3.1 barg (45 psig) 50°C to 80°C: 2.4 barg (35 psig)	100 000 to 750 000 NMWC† < 10°C: 3.4 barg (50 psig) 10°C to 25°C: 3.1 barg (45 psig) 25°C to 50°C: 2.4 barg (35 psig) 50°C to 80°C: 1.7 barg (25 psig)	At 25°C: 0.1 µm: 1.4 barg (20 psig) 0.2 µm: 1 barg (15 psig) 0.45 µm: 0.7 barg (10 psig) 0.65 µm: 0.7 barg (10 psig)
Chlorine			
Sanitization	5 to 50 ppm	5 to 50 ppm	
Cleaning (30 min, 50°C)	100 ppm	300 ppm	
Continuous at 20°C	100 ppm	100 ppm	
pH range	2 to 13	2 to 13	

†Nominal molecular weight cut-off

Nominal feed stream flow rates (mL/min) for Xampler 3M and 3X2M hollow fiber cartridges

Nominal lumen i.d. (mm)	Shear rate* ~2000 s ⁻¹	Shear rate ~4000 s ⁻¹	Shear rate ~8000 s ⁻¹	Shear rate ~16 000 s ⁻¹
0.5	60	120	250	500
0.75	100	200	400	800
1	150	300	600	1200

* Shear rates based on a fluid viscosity of 1 cP

Nominal feed stream flow rates (mL/min) for Xampler 4, 4M, and 4X2M hollow fiber cartridges

Nominal lumen i.d. (mm)	Shear rate* ~2000 s ⁻¹	Shear rate ~4000 s ⁻¹	Shear rate ~8000 s ⁻¹	Shear rate ~16 000 s ⁻¹
0.5	300	600	1200	2400
0.75	400	800	1500	3000
1	600	1200	2500	5000
1.75	1500	3000	6000	12 000

* Shear rates based on a fluid viscosity of 1 cP

Applications

Typical applications for Xampler cartridges are:

- Clarification of lysates and cell cultures
- Concentration, diafiltration, and purification of monoclonal antibodies, plasmids, proteins, viruses, vaccines, colloids, and plasma
- Manufacturing material for early stage clinical trials
- Scale-up/scale-down studies

Ordering information

Ultrafiltration cartridges

Model number	Pore size (NMWC)	Fiber i.d. (mm)	Membrane area (cm ²) (ft ²)		Nominal flow path length (cm)	Code number
UFP-1-C-3M	1000	0.5	140	0.15	30	56-4101-20
UFP-3-C-3MA	3000	0.5	140	0.15	30	56-4101-22
UFP-5-C-3MA	5000	0.5	140	0.15	30	56-4101-24
UFP-5-E-3MA	5000	1	110	0.12	30	56-4101-25
UFP-10-C-3MA	10 000	0.5	140	0.15	30	56-4101-27
UFP-10-E-3MA	10 000	1	110	0.12	30	56-4101-28
UFP-30-C-3MA	30 000	0.5	140	0.15	30	56-4101-29
UFP-30-E-3MA	30 000	1	110	0.12	30	56-4101-30
UFP-50-C-3MA	50 000	0.5	140	0.15	30	56-4101-31
UFP-50-E-3MA	50 000	1	110	0.12	30	56-4101-32
UFP-100-C-3MA	100 000	0.5	140	0.15	30	56-4101-33
UFP-100-E-3MA	100 000	1	110	0.12	30	56-4101-34
UFP-300-C-3MA	300 000	0.5	140	0.15	30	56-4101-35
UFP-300-E-3MA	300 000	1	110	0.12	30	56-4101-36
UFP-500-C-3MA	500 000	0.5	140	0.15	30	56-4101-37
UFP-500-E-3MA	500 000	1	110	0.12	30	56-4101-38
UFP-750-C-3MA	750 000	0.5	140	0.15	30	29-0057-91
UFP-750-E-3MA	750 000	1	110	0.12	30	56-4101-39
UFP-3-C-3X2MA	3000	0.5	290	0.31	60	56-4101-45
UFP-5-C-3X2MA	5000	0.5	290	0.31	60	11-0005-77
UFP-10-C-3X2MA	10 000	0.5	290	0.31	60	56-4101-46
UFP-30-C-3X2MA	30 000	0.5	290	0.31	60	56-4101-47
UFP-50-C-3X2MA	50 000	0.5	290	0.31	60	56-4101-48
UFP-100-C-3X2MA	100 000	0.5	290	0.31	60	56-4101-49
UFP-100-E-3X2MA	100 000	1	230	0.24	60	56-4101-50
UFP-300-C-3X2MA	300 000	0.5	290	0.31	60	56-4101-51
UFP-300-E-3X2MA	300 000	1	230	0.24	60	56-4101-52
UFP-500-C-3X2MA	500 000	0.5	290	0.31	60	56-4101-53
UFP-500-E-3X2MA	500 000	1	230	0.24	60	56-4101-54
UFP-750-C-3X2MA	750 000	0.5	290	0.31	60	29-0110-51
UFP-750-E-3X2MA	750 000	1	230	0.24	60	56-4101-55
UFP-1-C-4	1000	0.5	650	0.70	30	56-4101-84
UFP-3-C-4A	3000	0.5	650	0.70	30	56-4101-87
UFP-5-C-4A	5000	0.5	650	0.70	30	56-4101-89
UFP-5-E-4A	5000	1	420	0.45	30	56-4101-90
UFP-10-C-4A	10 000	0.5	650	0.70	30	56-4101-91
UFP-10-E-4A	10 000	1	420	0.45	30	56-4101-92
UFP-30-C-4A	30 000	0.5	650	0.70	30	56-4101-93
UFP-30-E-4A	30 000	1	420	0.45	30	56-4101-94
UFP-50-C-4A	50 000	0.5	650	0.70	30	56-4101-95
UFP-50-E-4A	50 000	1	420	0.45	30	56-4101-96
UFP-100-C-4A	100 000	0.5	650	0.70	30	56-4101-97
UFP-100-E-4A	100 000	1	420	0.45	30	56-4101-98

Model number	Pore size (NMWC)	Fiber i.d. (mm)	Membrane area (cm ²)	Membrane area (ft ²)	Nominal flow path length (cm)	Code number
UFP-300-C-4A	300 000	0.5	650	0.70	30	56-4101-99
UFP-300-E-4A	300 000	1	420	0.45	30	56-4102-00
UFP-500-C-4A	500 000	0.5	650	0.70	30	56-4102-01
UFP-500-E-4A	500 000	1	420	0.45	30	56-4102-02
UFP-750-C-4A	750 000	0.5	650	0.70	30	29-0058-53
UFP-750-E-4A	750 000	1	420	0.45	30	56-4102-03
UFP-1-C-4M	1000	0.5	650	0.70	30	56-4101-59
UFP-3-C-4MA	3000	0.5	650	0.70	30	56-4101-61
UFP-5-C-4MA	5000	0.5	650	0.70	30	56-4101-63
UFP-5-E-4MA	5000	1	420	0.45	30	56-4101-64
UFP-10-C-4MA	10 000	0.5	650	0.70	30	56-4101-66
UFP-10-E-4MA	10 000	1	420	0.45	30	56-4101-67
UFP-30-C-4MA	30 000	0.5	650	0.70	30	56-4101-68
UFP-30-E-4MA	30 000	1	420	0.45	30	56-4101-69
UFP-50-C-4MA	50 000	0.5	650	0.70	30	56-4101-70
UFP-50-E-4MA	50 000	1	420	0.45	30	56-4101-71
UFP-100-C-4MA	100 000	0.5	650	0.70	30	56-4101-72
UFP-100-E-4MA	100 000	1	420	0.45	30	56-4101-73
UFP-300-C-4MA	300 000	0.5	650	0.70	30	56-4101-74
UFP-300-E-4MA	300 000	1	420	0.45	30	56-4101-75
UFP-500-C-4MA	500 000	0.5	650	0.70	30	56-4101-76
UFP-500-E-4MA	500 000	1	420	0.45	30	56-4101-77
UFP-750-C-4MA	750 000	0.5	650	0.70	30	29-0080-00
UFP-750-E-4MA	750 000	1	420	0.45	30	56-4101-78
UFP-1-C-4X2M	1000	0.5	1400	1.5	60	11-0004-97
UFP-3-C-4X2MA	3000	0.5	1400	1.5	60	56-4102-09
UFP-5-C-4X2MA	5000	0.5	1400	1.5	60	56-4102-10
UFP-5-E-4X2MA	5000	1	850	0.9	60	56-4110-17
UFP-10-C-4X2MA	10 000	0.5	1400	1.5	60	56-4102-11
UFP-10-E-4X2MA	10 000	1	850	0.9	60	56-4110-04
UFP-30-C-4X2MA	30 000	0.5	1400	1.5	60	56-4102-12
UFP-30-E-4X2MA	30 000	1	850	0.9	60	56-4110-18
UFP-50-C-4X2MA	50 000	0.5	1400	1.5	60	56-4102-13
UFP-50-E-4X2MA	50 000	1	850	0.9	60	56-4110-19
UFP-100-C-4X2MA	100 000	0.5	1400	1.5	60	56-4102-14
UFP-100-E-4X2MA	100 000	1	850	0.9	60	56-4102-15
UFP-300-C-4X2MA	300 000	0.5	1400	1.5	60	56-4102-16
UFP-300-E-4X2MA	300 000	1	850	0.9	60	56-4102-17
UFP-500-C-4X2MA	500 000	0.5	1400	1.5	60	56-4102-18
UFP-500-E-4X2MA	500 000	1	850	0.9	60	56-4102-19
UFP-750-C-4X2MA	750 000	0.5	1400	1.5	60	29-0110-52
UFP-750-E-4X2MA	750 000	1	850	0.9	60	56-4102-20

Microfiltration cartridges

Model number	Pore size (µm)	Fiber i.d. (mm)	Membrane area (cm ²) (ft ²)		Nominal flow path length (cm)	Code number
CFP-1-D-3MA	0.1	0.75	120	0.13	30	56-4101-40
CFP-1-E-3MA	0.1	1	110	0.12	30	56-4101-41
CFP-2-E-3MA	0.2	1	110	0.12	30	56-4101-42
CFP-4-E-3MA	0.45	1	110	0.12	30	56-4101-43
CFP-6-D-3MA	0.65	0.75	120	0.13	30	56-4101-44
CFP-1-E-3X2MA	0.1	1	230	0.24	60	56-4101-56
CFP-2-E-3X2MA	0.2	1	230	0.24	60	56-4101-57
CFP-4-E-3X2MA	0.45	1	230	0.24	60	56-4101-58
CFP-6-D-3X2MA	0.65	0.75	260	0.28	60	28-9913-84
CFP-1-D-4A	0.1	0.75	460	0.5	30	56-4102-04
CFP-1-E-4A	0.1	1	420	0.45	30	56-4102-05
CFP-2-E-4A	0.2	1	420	0.45	30	56-4102-06
CFP-4-E-4A	0.45	1	420	0.45	30	56-4102-07
CFP-6-D-4A	0.65	0.75	460	0.5	30	56-4102-08
CFP-1-D-4MA	0.1	0.75	460	0.5	30	56-4101-79
CFP-1-E-4MA	0.1	1	420	0.45	30	56-4101-80
CFP-2-E-4MA	0.2	1	420	0.45	30	56-4101-81
CFP-4-E-4MA	0.45	1	420	0.45	30	56-4101-82
CFP-6-D-4MA	0.65	0.75	460	0.50	30	56-4101-83
CFP-1-D-4X2MA	0.1	0.75	950	1.02	60	56-4102-21
CFP-1-E-4X2MA	0.1	1	850	0.9	60	56-4102-22
CFP-2-E-4X2MA	0.2	1	850	0.9	60	56-4102-23
CFP-2-G-4X2MA	0.2	1.75	650	0.7	60	11-0005-08
CFP-4-E-4X2MA	0.45	1	850	0.9	60	56-4102-24
CFP-6-D-4X2MA	0.65	0.75	950	1.02	60	56-4102-25

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