User Guide

Pod Depth Filters

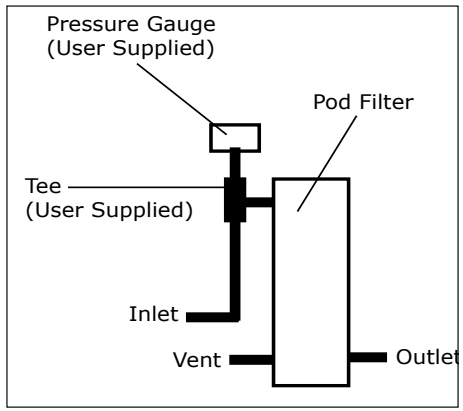
The life science business of
Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in
the US and Canada.

Set-Up

NOTE The process scale (filtration area 0.11, 0.33, 0.55, 0.77, 1.1 and 1.4 m^2) pod filters must be installed in a pod holder as described in the Holder User Guide.

Single Stage Depth Filtration

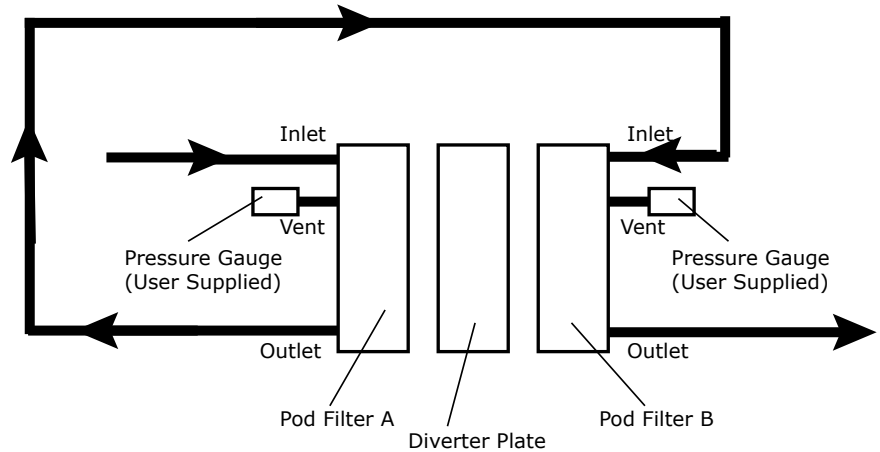
1. Connect the inlet port of the filter to the feed line.
2. Connect the outlet port of the filter to the collection line.
3. Connect the vent port of the filter to the vent line.
4. Install a pressure gauge on the inlet or vent line.
5. Attach a vent valve or clamp at the end of the vent tubing.



Two Stage Depth Filtration

In this example, a pod holder is configured for two stage depth filtration using two different grades of depth filter and a diverter plate.

1. Install the required filter area for Pod Filter A into the left side of the pod holder. Position pod adaptor (MPODADAPT) fittings at the inlet, vent, and outlet positions through the left pod holder plate.
2. Install the required filter area for Pod Filter B into the right side of the pod holder. Position pod adaptor (MPODADAPT) fittings at the inlet, vent, and outlet positions through the right pod holder plate.
3. Install the diverter plate (MPODDIVERTR) between Pod Filters A and B in the pod holder.
4. Clamp the pod holder to the recommended compression pressure.
5. Connect the inlet port for Pod Filter A to the feed line.
6. Connect the outlet port for Pod Filter A to the inlet port of Pod Filter B.
7. Connect the outlet port for Pod Filter B to the collection line.
8. Install pressure gauges onto each of the vent ports.



Flushing

Flush devices with buffer or purified water prior to use. To fully wet the media, flush the filter as listed in the following tables:

Clarisolve® Depth Filters

Clarisolve media is application dependent and can be run at a flux of 100, 300 or 600 LMH.

Media	Flux (LMH)	Lab Scale Pod (m^2)		Process Scale Pod (m^2)		
		0.014	0.027	0.11	0.33	0.55
		Flow rate (mL/min)				
20MS 40MS 60HX	600	140	270	1100	3300	5500
	300	70	135	550	1650	2750
	100	23	45	183	550	917

Millistak+® Depth Filters

Media	Flux (LMH)	Lab Scale Pod (m^2)		Process Scale Pod (m^2)				
		0.027	0.054	0.11	0.55	0.77	1.1	1.4
		Flow rate (mL/min)						
CR	600	270	540	1100	5500	--	11000	--
HC	600	270	540	1100	5500	--	11000	--
CE, DE	600	270	540	1100	--	7700	--	14000

Millistak+® HC Pro Depth Filters

Media	Flux (LMH)	Lab Scale Pod (m^2)		Process Scale Pod (m^2)				
		0.014	0.027	0.11	0.33	0.55	0.77	1.1
		Flow rate (mL/min)						
D0SP	300	70	135	550	1650	--	3850	--
C0SP	300	70	135	550	1650	--	3850	--
X0SP	300	70	135	550	--	2750	--	5500

Single Filter Flushing Procedure

1. Install new tubing on the inlet, outlet and vent lines of the filter.
2. Attach a pressure gauge to the vent or inlet port to monitor inlet pressure.
3. Attach a vent valve or clamp at the end of the vent tubing.
4. Start flushing the filter at the flow rate listed in the tables.
5. Open the vent to purge any air from the filter. Air purge may be assisted by temporarily clamping the outlet line closed.
6. Close the vent and open the outlet line to allow flow through the filter. For 100 and 300 LMH flow rates, back pressure is recommended to wet the device. To create the back pressure, partially close the outlet valve and completely close the vent valve. Increase the pressure in the device up to 10 psig by partially closing the outlet valve slowly, then vent slowly by opening the outlet to purge any air.
7. Flush until the desired target volume or the desired TOC level is reached (see Conductivity and TOC Test Results).
8. For optimal performance with a Pod filter, run the filtration process with product at a flux of 100 to 300 LMH and a max differential pressure of 2 bar (30 psi).

NOTE It is normal to observe an increase in the hydraulic pressure on the process scale pod holder during operation. **Hydraulic pressure should never exceed 124 bar (1800 psi).**

Optimal flux for CR media is application dependent. Flux should be optimized through testing.

9. When filtration is complete, perform a blow down to recover product held up in the device by connecting air supply tubing to the vent port.

Media		Blow Down Pressure bar (psi)	Time min
Clarisolve®		0.3 (4.4)	10
Millistak+®	CR CE DE	0.3 (4.4)	10
	HC	0.3 (4.4) increase pressure at a rate of 0.1 bar/min (2 psi/min) until 1 bar (15 psi) is reached	up to 5
Millistak+® HC Pro	D0SP C0SP X0SP	0.3 (4.4) increase pressure at a rate of 0.1 bar/min (2 psi/min) until 1 bar (15 psi) is reached	10

Two Filter Flushing Procedure

In this example, the two stage depth filter assembly is filled with water and the recommended pre-use flush is performed.

1. Clamp the tubing leading to the inlet port for Pod Filter B.
2. Open the vent port for Pod Filter A.
3. Fill Pod Filter A with water using a pump connected to the feed line. Continue filling Pod Filter A until a steady stream of water exits the vent port for Pod Filter A.
4. Close the vent port for Pod Filter A and stop the pump.
5. Remove the clamp on the tubing leading to the inlet port for Pod Filter B.
6. Clamp the collection line connected to the outlet port for Pod Filter B.
7. Open the vent port for Pod Filter B.
8. Fill Pod Filter B with water using a pump connected to the feed line. Continue filling Pod Filter B until a steady stream of water exits the vent port for Pod Filter B.
9. Close the vent port for Pod Filter B and stop the pump.
10. Remove the clamp on the collection line connected to the outlet port for Pod Filter B.
11. Flush the two-stage depth filtration devices at the recommended flow rate and pre-use flush volume.

Conductivity and TOC

Conductivity and TOC Test Results

Millistak+® HC and Clarisolve® filters were autoclaved for 60 minutes at 123 °C, then flushed with purified water at a flow rate of 600 LMH to a throughput of 100 L/m^2. The filter effluent was then tested for conductivity and TOC.

Millistak+ ® HC Pro devices were not autoclaved and were flushed at a flow rate of 300 LMH to a throughput of 50 L/m^2.

Media	Catalog Number (Lot Number)	Flux (LMH)	Test Results	
			Conductivity (µS/cm)	TOC Value (ppm)
Clarisolve® Depth Filters				
20MS	CS20MS01F1-X (Lot A)	600	2.38	1.12
	CS20MS01F1-X (Lot B)	600	3.24	1.42
	CS40MS01F1-X (Lot C)	600	3.52	1.49
40MS	CS40MS01F1-X (Lot A)	600	5.28	1.89
	CS40MS01F1-X (Lot B)	600	2.48	0.61
	CS40MS01F1-X (Lot C)	600	3.08	1.72
60HX	CS60HX01F1-X (Lot A)	600	1.18	0.96
	CS60HX01F1-X (Lot B)	600	1.10	0.79
	CS60HX01F1-X (Lot C)	600	1.36	0.13

Media	Catalog Number (Lot Number)	Flux (LMH)	Test Results	
			Conductivity (µS/cm)	TOC Value (ppm)
Millistak+® Depth Filters				
D0HC	MD0HC01FS1 (CP3NA24863)	600	1.75	0.80
	MD0HC01FS1 (CP3NA24864)	600	2.22	0.90
	MD0HC01FS1 (CP3NA24864)	600	2.48	1.20
C0HC	MC0HC01FS1 (CP3NA24866)	600	1.33	0.80
	MC0HC01FS1 (CP3NA24867)	600	1.85	0.90
	MC0HC01FS1 (CP3NA24868)	600	2.06	1.00
X0HC	MX0HC01FS1 (CP3NA24878)	600	43.9	0.90
	MX0HC01FS1 (CP3NA24879)	600	31.4	0.80
	MX0HC01FS1 (CP3NA24880)	600	52.3	0.90
A1HC	MA1HC01FS1 (CP3NA24860)	600	14.8	0.60
	MA1HC01FS1 (CP3NA24861)	600	21.9	0.60
	MA1HC01FS1 (CP3NA24861)	600	19.4	0.70
F0HC	MF0HC01FS1 (CP9JN75883)	600	40.3	1.20
	MF0HC01FS1 (CP9JN75884)	600	21.4	0.46
CR40	MCR4001FS1 (CP8SN71164-13)	600	4.36	1.70
	MCR4001FS1 (CP8SN71165-3)	600	4.57	1.80
	MCR4001FS1 (CP8SN71166-12)	600	4.56	1.60
	MCR4001FS1 (CP8SN71167-11)	600	4.24	1.40
	MCR4001FS1 (CP8SN71168-25)	600	4.51	1.30

Media	Catalog Number (Lot Number)	Flux (LMH)	Test Results	
			Conductivity (µS/cm)	TOC Value (ppm)
Millistak+® HC Pro Depth Filters				
D0SP	MD0SP23CL3 (W167597)	300	41.5	0.95
	MD0SP23CL3 (W167612)	300	27.5	1.09
	MD0SP23CL3 (W167613)	300	24.4	0.61
	MD0SP01FS1 (W177017-005)	300	9.0	0.47
	MD0SP01FS1 (W177016-011)	300	15.0	0.77
	MD0SP01FS1 (W177016-012)	300	16.7	0.69
	MD0SP01FS1 (W177016-013)	300	11.1	0.70
	MD0SP01FS1 (W177015-005)	300	8.9	0.78
C0SP	MC0SP23CL3 (W167602)	300	18.9	1.15
	MC0SP23CL3 (W167603)	300	23.4	2.01
	MC0SP23CL3 (W167604)	300	37.2	3.18
	MC0SP01FS1 (W177025-005)	300	19.2	1.24
	MC0SP01FS1 (W177024-011)	300	17.5	1.0
	MC0SP01FS1 (W177024-012)	300	14.2	0.88
	MC0SP01FS1 (W177024-013)	300	16.4	0.74
	MC0SP01FS1 (W177023-005)	300	11.3	0.71
X0SP	MX0SP23CL3 (W167607)	300	25.0	2.20
	MX0SP23CL3 (W167608)	300	32.8	2.90
	MX0SP23CL3 (W167609)	300	24.1	3.00
	MX0SP01FS1 (W177033-005)	300	10.4*	4.9*
	MX0SP01FS1 (W177032-014)	300	10.5*	2.95*
	MX0SP01FS1 (W177032-015)	300	11.1*	2.95*
	MX0SP01FS1 (W177032-016)	300	10.6*	3.39*
	MX0SP01FS1 (W177031-005)	300	8.1*	1.6*

*TOC and conductivity testing was performed after a 30 minute hold with pure water, followed by a 50 L/m² pure water flush at 300 LMH with 5 psi back pressure for these units.

Process Optimization

Measure inlet and outlet pressure, original process fluid turbidity, and filtrate turbidity over time to provide data to verify performance and calculate sizing estimates.

Specifications

Materials of Construction

Component	Material		
Clarisolve® Depth Filters			
Housing	Glass-filled polypropylene		
Adapters	Glass-filled polypropylene		
Gaskets and Plugs	Thermoplastic elastomer (TPE)		
Filter Media	20MS, 40MS		Polypropylene and cellulose fibers combined with an inorganic filter aid
	60HX		Polypropylene
Millistak+® Depth Filters			
Housing	Glass-filled polypropylene		
Adapters	Glass-filled polypropylene		
Gaskets and Plugs	Thermoplastic elastomer (TPE)		
Filter Media	CR		Activated carbon and cellulose fibers
	CE		Cellulose fibers
	DE		Cellulose fibers and inorganic filter aid
	HC	A0, C0, D0, F0, X0	Multiple layers of cellulose fibers, diatamaceuous earth and inorganic filter aid
		A1, B1	Multiple layers of cellulose fibers, diatamaceuous earth, inorganic filter aid, and 0.1 micron mixed esters of cellulose membrane
Millistak+® HC Pro Depth Filters			
Housing	Glass-filled polypropylene		
Adapters	Glass-filled polypropylene		
Gaskets and Plugs	Thermoplastic elastomer (TPE)		
Filter Media	D0SP		Nonwoven, Silica filter aid/Polyacrylic fiber pulp
	C0SP		Silica filter aid/Polyacrylic fiber pulp
	X0SP		Silica filter aid/Polyacrylic fiber pulp

Operating Parameters

Parameter		Lab Scale Pod	Process Scale Pod
Clarisolve® Depth Filters			
Effective Surface Area		0.014, 0.027 m^2	0.11, 0.33, 0.55 m^2
Inlet, Outlet and Vent Connections		¼ in. (6 mm) Hose barb	Flat seal
Operating Temperature Range		4 to 37 °C	4 to 37 °C
Sterilization		Autoclave for two cycles of 60 minutes at 123 °C	Autoclave for one cycle of 60 minutes at 123 °C
Typical Flush/Process Flux		100 to 600 LMH	
Maximum Differential Pressure	Forward	2.1 bar (30 psid) at ≤ 37 ºC	2.1 bar (30 psid) at ≤ 25 ºC 1.0 bar (15 psid) at ≤ 80 ºC
	Reverse	2.1 bar (30 psid) at ≤ 37 ºC	2.1 bar (30 psid) at ≤ 25 ºC
Housing Operating Pressure		2.1 bar (30 psig) at ≤ 37 ºC	3.5 bar (50 psid) at ≤ 25 ºC 1.0 bar (15 psid) at ≤ 80 ºC
Millistak+® Depth Filters			
Effective Surface Area	HC Media	0.027 m^2, 0.054 m^2	0.11, 0.55, 1.1 m^2
	DE, CE Media		0.11, 0.77, 1.4 m^2
Inlet, Outlet and Vent Connections		¼ in. (6 mm) Hose barb	Flat Seal
Operating Temperature Range		4 to 37 °C	4 to 37 °C
Sterilization		2 cycles of 60 minutes at 123° C	1 cycle of 60 minutes at 123° C
Typical Flush/Process Flux		100 to 600 LMH	
Maximum Differential Pressure	Forward	2.1 bar (30 psid) at 4-37 °C	2.1 bar (30 psid) at 25° C; 1.0 bar (15 psid) at 80° C
	Reverse	2.1 bar (30 psid) at 37 °C	2.1 bar (30 psid) at 25° C
Housing Operating Pressure		2.1 bar (30 psid) at 37 °C	3.5 bar (50 psig) at 25 ºC 1.0 bar (15 psid) at 80° C

Parameter		Lab Scale Pod	Process Scale Pod
Millistak+® HC Pro Depth Filters			
Effective Surface Area	D0SP, C0SP	0.0135 m^2	0.11, 0.33, 0.77 m^2
		0.027 m^2	
	X0SP	0.0135 m^2	0.11, 0.55, 1.1 m^2
		0.027 m^2	
Inlet, Outlet and Vent Connections		1/4 in (6 mm) hose barb	Flat seal
Operating Temperature Range		4 to 40 °C	4 to 40 °C
Sterilization		Integrity is maintained after 1 cycle of 60 minutes at 123 °C. Recommended for post-use decontamination only.	
Typical Flush/Process Flux		100 to 600 LMH	
Maximum Differential Pressure	Forward	2.1 bar (30 psid) at ≤ 40 °C	2.1 bar (30 psid) at ≤ 80 °C
	Reverse	2.1 bar (30 psid) at ≤ 25 °C	2.1 bar (30 psid) at ≤ 25 °C
Housing Operating Pressure		2.1 bar (30 psid) at 40 °C	3.5 bar (50 psid) at 80 °C

Pressure must be monitored at inlet or vent connections.

Typical Hold-up and Void Volumes

Clarisolve® Depth Filters

Parameter		Lab Scale Pod (m^2)		Process Scale Pod (m^2)		
		0.014	0.027	0.11	0.33	0.55
20MS Media						
Internal void volume (L)		0.302	0.549	3.20	8.44	13.6
Hold-up volume (L)	after gravity drain	0.22	0.32	0.86	2.74	4.66
	after blow down	0.16	0.32	0.61	2.29	3.87
40MS Media						
Internal void volume (L)		0.294	0.556	3.22	8.87	14.1
Hold-up volume (L)	after gravity drain	0.20	0.33	0.66	2.27	3.99
	after blow down	0.16	0.33	0.54	1.81	3.43
60HX Media						
Internal void volume (L)		0.324	0.577	3.36	7.80	13.0
Hold-up volume (L)	after gravity drain	0.16	0.35	0.70	3.67	6.83
	after blow down	0.14	0.29	0.36	1.23	3.11

Millistak+® Depth Filters

Parameter		Lab Scale Pod (m^2)		Process Scale Pod (m^2)				
		0.027	0.054	0.11	0.55	0.77	1.1	1.4
A1HC, B1HC, C0HC and D0HC Media								
Internal void volume (L)		0.31	0.54	1.5	5.3	–	10.3	–
Hold-up volume (L)	after gravity drain	–	0.41	0.5	2.5	–	5.7	–
	after blow down	0.1	0.18	0.4	1.7	–	3.8	–
X0HC Media								
Internal void volume (L)		0.34	0.61	1.3	5.1	–	9.8	–
Hold-up volume (L)	after gravity drain	0.26	0.52	1.1	4.1	–	7.8	–
	after blow down	0.12	0.23	0.5	2.1	–	4.2	–
F0HC Media								
Internal void volume (L)		0.36	0.59	1.36	5.39	–	10.02	–
Hold-up volume (L)	after gravity drain	0.25	0.44	0.76	3.15	–	5.90	–
	after blow down	0.13	0.26	0.40	2.21	–	4.01	–
CR Media								
Internal void volume (L)		0.37	0.67	1.44	5.75	–	11.14	–
Hold-up volume (L)	after gravity drain	0.23	0.43	0.72	3.27	–	6.45	–
	after blow down	0.13	0.23	0.47	2.38	–	4.76	–
CE and DE Media								
Internal void volume (L)		0.34	0.62	1.22	–	7.41	–	12.95
Hold-up volume (L)	after gravity drain	–	0.26	0.41	–	2.56	–	4.58
	after blow down	0.07	0.13	0.23	–	1.59	–	2.94

Millistak+® HC Pro Depth Filters

Parameter		Lab Scale Pod (m^2)		Process scale Pod (m^2)				
		0.0135	0.027	0.11	0.33	0.55	0.77	1.1
D0SP Media								
Internal void volume (L)		0.275	0.541	2.12	5.50	--	12.9	--
Hold-up volume (L)	after gravity drain	0.198	0.397	1.00	2.50	--	6.30	--
	after blow down	0.094	0.139	0.643	1.99	--	5.04	--
C0SP Media								
Internal void volume (L)		0.259	0.618	2.04	5.81	--	12.8	--
Hold-up volume (L)	after gravity drain	0.188	0.506	1.13	2.81	--	6.62	--
	after blow down	0.119	0.185	0.711	2.22	--	5.44	--
X0SP Media								
Internal void volume (L)		0.347	0.676	1.25	--	4.94	--	9.47
Hold-up volume (L)	after gravity drain	0.188	0.395	0.801	--	3.32	--	6.72
	after blow down	0.09	0.175	0.635	--	2.92	--	5.85

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