Viresolve® NFP Filters

User Guide

CVPV
KVPV

MILLIPORE

Introduction

Specifications

The serial number of the cartridge is embossed on the side of the cartridge near the spear.

Refer to the Certificate of Quality or Validation Guide for additional specifications.

Table 1: Viresolve NFP Filter Specifications

Maximum operating pressure is 80 psig forward and 50 psig reverse at 25°C.

Catalogue Number	Description	Diffusion Specification (cc/min) at 50 psig and 23°C	Filtration Area (m^2)
KVPV04 _ _ 3	4 in. Opticap® Capsule	≤ 2	0.085
KVPV01 _ _ 1	10 in. Opticap Capsule	≤ 10	0.42
KVPVA1 _ _ 1	10 in. Opticap XL Capsule	≤ 10	0.42
KVPVA1 _ _ _ 1	10 in. Opticap XLT Capsule	≤ 10	0.42
KVPVA2 _ _ _ 1	20 in. Opticap XLT Capsule	≤ 20	0.84
KVPVA3 _ _ _ 1	30 in. Opticap XLT Capsule	≤ 30	1.26
CVPV71TP1	10 in. Code 7 Cartridge	≤ 10	0.42
CVPV72TP1	20 in. Code 7 Cartridge	≤ 20	0.84
CVPV73TP1	30 in. Code 7 Cartridge	≤ 30	1.26

Unpacking the Filter

Note: Wear gloves when handling the filters.

1. Inspect packaging for physical damage such as holes or punctures in the double bag.
2. Remove the Certificate of Quality from the package.
3. Remove the filter from the packaging.
4. Inspect the filter for physical damage; return any damaged devices to Millipore.

Opticap Capsule Filter Installation

Locate the inlet and outlet of the capsule. Connect the inlet and outlet tubing to the capsule.

Cartridge Filter Installation

Install the cartridge filters without displacing the O-rings. Wet the O-rings with water for injection (WFI) to reduce friction between the O-rings and the steel housing base.

1. Align the tabs of the filter adapter with the tab sockets on the housing baseplate. Insert the filter into the baseplate and turn the cartridge filter ¼ turn to lock it in place. Repeat this operation for the rest of the cartridge filters.
2. Install the filter restraint plate if applicable.
3. Install the dome on top of the housing baseplate.
4. Seal the dome with the appropriate gasket and clamp.
5. Locate the inlet and outlet of the filter housing and connect the inlet and outlet tubing to the filter housing.

Wetting the Filter

1. Flush WFI through the filter to drain at a differential pressure of 5 psid. Open the vent valve to remove air from the upstream of the filter. Ensure that a steady stream of water is exiting the vent valve. Close the vent valve. Flush approximately 75 L/m^2 WFI through the filter to drain at a differential pressure of 30 to 50 psid. (Or wet at 50 psid for a minimum of 5 minutes.)
2. Measure and record the water flow rate, inlet and outlet pressures, and water temperature. Typical normalized water permeability (NWP) range (normalized to 25°C) is between 8 and 18 LMH/psi (116 to 261 LMH/bar). Actual NWP value depends on factors such as housing configuration, parasitic pressure drops in the pipes, etc. Use calibrated pressure gauges and measuring equipment. To calculate NWP, use this equation:

   $NWP = Q_p * 60 * F / (\Delta P * A)$

   Where:
   Q_p is the filtrate flow rate in L/min
   F is the temperature correction factor (Table 2)
   ΔP is the differential pressure
   (ΔP= inlet pressure – outlet pressure) in psi or bar
   A is the area per device in m^2 (Table 1)

   When using multiple filter elements, multiply the area per element by the number of filter elements being used. NWP is expressed in units of LMH/psi [liters/(m^2·h·psi)] or LMH/bar [liters/(m^2·h·bar)].

   If the NWP value for the filter assembly is outside the recommended range, ensure that the filter is fully vented, check the water temperature and pressure differential, ensure that there are no flow restrictions on the downstream side of the filter assembly (such as narrow bore tubing/piping, sticky valves, etc.), and repeat the NWP measurement.

   If the assembly still does not meet specifications, it may be necessary to test each device separately and develop an NWP range for the multi-filter assembly. Contact Millipore for assistance with this.

Table 2: Temperature Correction Factor (F) for NWP Calculation

T (°F)	T (°C)	F	T (°F)	T (°C)	F	T (°F)	T (°C)	F
125.6	52	0.595	96.8	36	0.793	68.0	20	1.125
123.8	51	0.605	95.0	35	0.808	66.2	19	1.152
122.0	50	0.615	93.2	34	0.825	64.4	18	1.181
120.2	49	0.625	91.4	33	0.842	62.6	17	1.212
118.4	48	0.636	89.6	32	0.859	60.8	16	1.243
116.6	47	0.647	87.8	31	0.877	59.0	15	1.276
114.8	46	0.658	86.0	30	0.896	57.2	14	1.310
113.0	45	0.670	84.2	29	0.915	55.4	13	1.346
111.2	44	0.682	82.4	28	0.935	53.6	12	1.383
109.4	43	0.694	80.6	27	0.956	51.8	11	1.422
107.6	42	0.707	78.8	26	0.978	50.0	10	1.463
105.8	41	0.720	77.0	25	1.000	48.2	9	1.506
104.0	40	0.734	75.2	24	1.023	46.4	8	1.551
102.2	39	0.748	73.4	23	1.047	44.6	7	1.598
100.4	38	0.762	71.6	22	1.072	42.8	6	1.648
98.6	37	0.777	69.8	21	1.098	41.0	5	1.699

3. If flushing the device to meet established TOC/ conductivity specifications, follow standard operating procedure for flush volume or flush time specifications.

4. After flushing and measuring NWP, drain the filter by opening the vent and drain valves. Close the valves when draining is complete.

Pre-use Integrity Testing

Test Viresolve NFP filters manually, or with the aid of an automated integrity tester or a downstream flow meter. Filters must be properly wetted prior to integrity testing.

Manual or Downstream Flowmeter Test

1. Connect the process air line to the inlet side of the capsule or filter housing (Figure 1).

2. Adjust the upstream pressure to 50±1 psi.

3. Drain water through the filtrate line. When filtrate flow is reduced to slow dripping allow the system to stabilize for 15 minutes.

4. Wait until a few air bubbles exit the filtrate tubing.

5. Start measuring the diffusion air flow rate using a downstream mass flow meter or an inverted graduated cylinder (Figure 1) for 1 to 5 minutes. Protect the mass flow meter from water ingress by using a barrier filter.

5. Compare the test results to the specifications provided in Table 1.

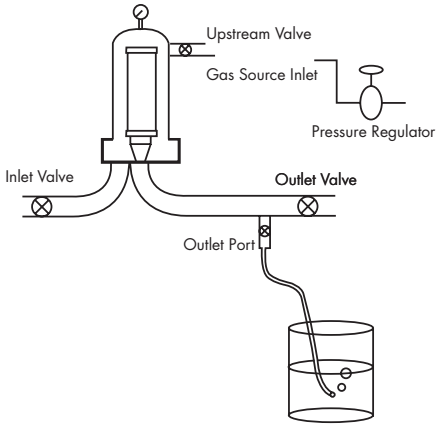

Figure 1: Diffusion Integrity Test

Automated Integrity Test

When using an automated integrity tester, refer to the integrity tester user guide. Millipore recommends the Integritest® 4 Integrity Test Instrument because its enhanced software produces accurate diffusion values for Viresolve NFP filters. When using the instrument, program the diffusion stabilization time for 15 minutes. For all other automated integrity testers, contact Millipore for advice on optimizing test protocols. Upstream measurements are subject to environmental effects (e.g. pressure and thermal fluctuations), which reduce the reliability and accuracy of diffusion flow measurements.

If the diffusion flow rate is equal to or less than the specification, the system has passed the integrity test.

If the flow rate is higher, retest:

1. Repeat the wetting procedure.
2. Check the test pressure, temperature, and integrity of the cartridge filter O-rings and dome seal.
3. Check calibration of pressure gauges and measuring equipment.
4. Check the program settings and ensure that a 15 minute diffusion stabilization time is included.

If a filter fails a second diffusion test, retain the filter for investigation by Millipore.

Autoclaving

USE A LIQUID CYCLE WITH SLOW EXHAUST. Autoclave fully wet Viresolve NFP filters for one cycle of 60 minutes at 123°C. Cover filter inlets, outlets, and vents with autoclave barrier paper if necessary, but do not otherwise obstruct them.

1. Fully wet Viresolve NFP filters before autoclaving.
2. Open the filter housing vents.
3. Ensure that the tubing attached to the filter inlets and outlets is not longer than 1.2 m (4 ft) long.
4. Millipore recommends three-piece sanitary triclamps for stress distribution purposes.
5. Position the filter upright and discharge down in the autoclave for maximum drainage.
6. Autoclave the filters for up to 60 minutes at 123°C using a liquid cycle with slow exhaust.

Steam-in-Place (SIP)- Cartridge Filters

DO NOT SIP CAPSULE FILTERS.

SIP the Viresolve NFP filter dry to avoid damage.

The Viresolve NFP filter has smaller pores than a sterilizing grade filter, resulting in a higher bubble point (air/water bubble point is approximately 400 to 500 psi). Steaming a wetted filter in the forward direction may result in high differential pressures across the filter and cause damage to the filter. SIP the Viresolve NFP filter dry to avoid potential damage. If a cartridge has been wetted (during pre-SIP integrity testing), dry it completely in a circulating air oven at 60 ±5 °C for at least 8 hours before SIP. Thoroughly purge the steam line of condensate before introducing steam to the upstream side of the filter housing.

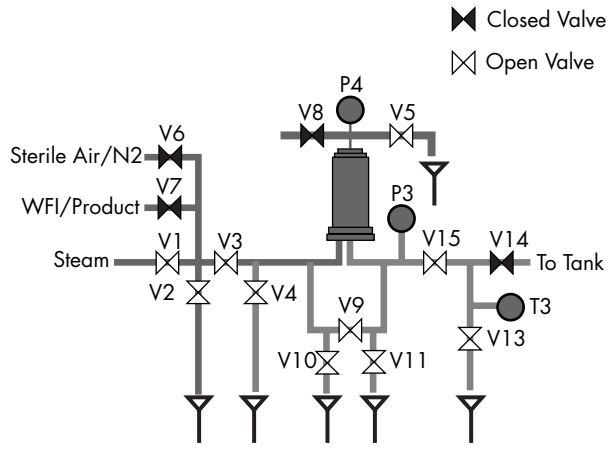

Fig 2: SIP Configuration

1. Check that the steam supply and the compressed gas source are set up at the required valves.
2. Open valve V1 and valve V2 (Figure 2) and purge the steam line to remove all condensate.
3. Fully open valves V4, V5, V9, V10, and V11 to facilitate subsequent air and condensate evacuation (valve V9 acts as SIP bypass loop.)
4. Slowly open valve V3 to introduce steam and heat the filter.
5. Partially close valves V2, V4, V5, V10, and V11 until a wisp of steam and a continuous drip of water exits the valves.
6. Open Valve V15 and crack open bleed valve V13 to establish a steady flow of steam and facilitate drainage of condensate and removal of air from the filter housing.

   NOTE: Control the difference between pressure gauges P3 and P4 and to keep the ΔP across the filter at or under 350 mbar (5 psid).
7. Continue to ensure all air and condensate are removed by keeping V2, V4, V5, V10, V11 and V13 cracked open so that a wisp of steam and a continuous drip of water exits the valves.
8. Start the timer when the temperature gauge downstream of the product filter (T3) reaches over 123°C. SIP for 30 minutes. Record temperature and pressure regularly.
9. Close V9 prior to wetting, buffer rinse and filtration. Remove condensation to prevent a "water hammer" from forming and damaging the filter. (Trapped air or condensate acts as a barrier to heat transfer and inhibits effective steam penetration. Flowing steam can accelerate the accumulation of condensate. Too much condensate creates a water hammer.)

SIP Cooling

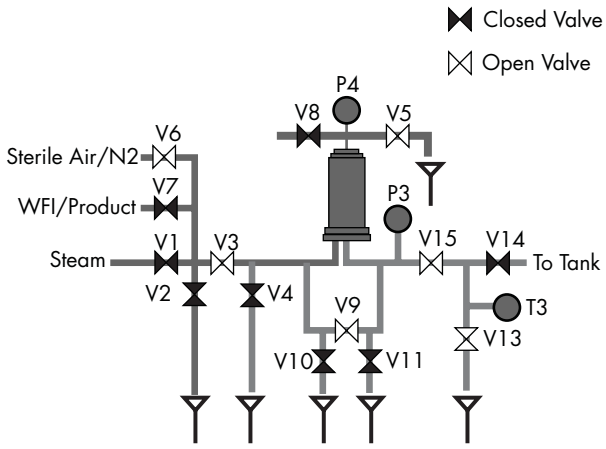

Fig 3: SIP Cooling Configuration

1. When sterilization is complete, close the steam supply valve V1 and introduce compressed sterile gas into the system by slowly opening valve V6.

   CAUTION: Keep the system under positive pressure (refer to pressure gauges P3 and P4). Ensure that the ΔP across the filter does not exceed 350 mbar (5 psid).

2. Allow steam to purge from all bleed valves. Increase the flow of gas through the system by closing valves V2, V4, V10, and V11 (Figure 3). Maintain the sterile gas flow until temperature gauge T3 reads approximately 30°C.
3. Maintain a positive pressure into the sterile filtration system when it is not in use by closing valves V5 and V15, and keeping V6, V3, and V9 open.
4. Close V9 prior to wetting, buffer rinse and filtration. NOTE: Dynamic cooling creates pressure differentials across the filter membrane at elevated temperatures. This may cause damage to the filter. To avoid pressure differentials, ensure continuous low air flow through the housing inlet and out the housing vent valves during cooling. This also maintains sterility of the cartridge on the downstream side of the membrane.

Post-Autoclave or SIP Flushing

1. After autoclaving or SIP, flush WFI through the filter to drain at a differential pressure of 5 psid. Open the vent valve to remove air from the upstream of the filter. Ensure that a steady stream of water is exiting the vent valve. Close the vent valve. Flush approximately 75 L/m^2 WFI through the filter to drain at a differential pressure of 30 to 50 psid. (Or wet at 50 psid for a minimum of 5 minutes.)
2. Millipore recommends a buffer flush to displace WFI with buffer. Use the same pressure and flow rate used during the process. The recommended flush volume is 10 L/m^2.
3. Drain buffer from the filter if necessary.

Processing

1. Process according to validated viral clearance operating parameters (inlet pressure, volume-to-area ratio, etc). For information on process optimization using Viresolve NFP contact a Millipore Applications Specialist.
2. Vent air from the upstream vent to ensure full usage of the membrane area.
   Millipore recommends no process interruption and no depressurization during viral clearance processing.

Recovering Product

At the end of the filtration process, a buffer rinse may enhance product recovery. Recover product according to validated viral clearance operating parameters (buffer flush, air blow down, buffer volume to area ratio, etc.). Follow the process conditions (pressure/flow rate) used during processing. Recommended flush volume is 10 L/m^2.

Post-use Integrity Testing

1. Open the downstream valve to drain.
2. Introduce WFI to the filter at 5 psig.
3. Vent the dome of the filter housing or the capsule.
4. Flush the filter at a differential pressure between 30 and 50 psid for at least 5 minutes.
5. Close off the WFI supply.
6. Perform the integrity test.

Removing Cartridges

1. Remove cartridges from the housing.
2. Handle and discard used cartridges/capsule per standard operating procedure.

Technical Assistance

For more information, contact the Millipore office nearest you. In the U.S., call **1-800-MILLIPORE** (1-800-645-5476). Outside the U.S., see your Millipore catalogue for the phone number of the office nearest you or go to our web site at www.millipore.com/offices for up-to-date worldwide contact information. You can also visit the tech service page on our web site at http://www.millipore.com/techservice.

MILLIPORE

AN1051EN00 Rev A 09/2007