

Application Note

Vent Filter Sizing for Mobius® Single-use Mixing Solution

Introduction

The Mobius® Single-use Mixing Solution delivers advanced technology for mixing pharmaceutical ingredients from intermediate to final drug products and for the preparation of process solutions, such as buffers and media. Each single-use mixing container includes a proprietary magnetically-driven levitating impeller for improved mixing consistency and efficiency. The Mobius® Single-use Mixing Solution includes a powder delivery system, and 10 L, 50 L, 100 L, 200 L, 500 L, or 1000 L single-use mixers. For optimal system performance, it is critical to prevent over inflation or pressure build-up inside the single-use mixer assembly. A Mobius® mixer assembly can be equipped with Durapore® filters, which contain phobic PVDF membrane, or Millipore Express® SPG filters, which contain phobic PES membrane. All of these filter capsules are compatible with gamma sterilization and are available in a variety of sizes.

Abstract

For large Mobius® MIX Systems (500 L and 1000 L) or for critical applications, inflating the single-use container prior to installation in the carrier is recommended. During the filling step, pressure accumulation in the fully inflated mixer bags should be minimized. For open processes an open tube on top of the single-use container is enough to release the air or nitrogen used to expand the bag, but, for closed processes, there is a need to identify the appropriate vent filter. Several tests have been performed to quantify the performance of different gamma stable vent filters placed on vent lines of different inner diameters (ID) and at different filling flow rates. The objective is to maintain a bag pressure below 0.30 psig

(21 mbar) during filling. Filters are identified enabling water filling at up to 70 L/min. Some of the best results [i.e. the higher flow rate that was tested while maintaining a bag pressure below 0.30 psig (21 mbar) during filling] are presented in Table 1.

Test method

1. The Mobius® single-use container was positioned in the carrier.
2. The pressure gauge was connected to an available vent/filling line on top of the single-use container.
3. The vent filter of interest was connected to the desired vent/filling line. In some cases a narrower ID tubing of the same length was connected to the tubing on the bag. Then the filter was connected to the additional tubing.
4. The RODI (reverse osmosis deionized water) line was connected to the bottom inlet line via the mass flow meter and the pump (if needed).
5. With RODI and vent filter lines clamped, the single-use container was inflated completely with compressed air until firm, 0.05 psig (0.003 bar).
6. The RODI and vent lines were opened and the water flow rate adjusted to the desired value.
7. Pressure was monitored while air was displaced via the vent line/filter for a minimum of several minutes or until the single-use container was filled.
8. The test endpoint was a stable pressure below 0.3 psig (0.02 bar), which is a very firm bag.
9. The bag was emptied in preparation for another test.
10. The filling test was repeated as in steps 1–9 for various vent tubing internal diameter (ID), vent filters and flow rates.

Results and discussion

Table 1: Results of testing vent filters with various tubing IDs and liquid flow rates

Mobius® MIX System	Vent filter	Vent tubing ID (inch)	Flow rate (L/min)	Elapsed time (min)	Final pressure (psig)	Stabilization
200	Opticap® XL50 capsule with Millipore Express® SPG membrane, ¼"	¼	1	60	0.20	Stable
200	Opticap® XL50 capsule with Millipore Express® SPG membrane, ¼"	¼	2	13	0.31	Increasing
200	Opticap® XL50 capsule with Millipore Express® SPG membrane, ¼"	¼	4.2	6	0.31	Increasing
1000	None	¾	24-29	7	0.29	Increasing
500	Opticap® XL300 capsule with Millipore Express® SPG membrane	¾	10	46	0.1	Stable
500	Opticap® XL300 capsule with Millipore Express® SPG membrane	¾	20	25	0.2	Stable
1000	Millipak® barrier filter	½	26.5	5	0.37	Increasing
500	Millipak® barrier filter	1	10	35	0.13	Stable
500	Millipak® barrier filter	1	20	25	0.28	Stable
500	Opticap® XL4 capsule with Durapore® membrane	1	26	10	0.15	Stable
1000	Opticap® XL4 capsule with Durapore® membrane	¾	10	10	0.07	Stable
1000	Opticap® XL4 capsule with Durapore® membrane	¾	25	10	0.14	Stable
1000	Opticap® XL4 capsule with Durapore® membrane	½	25	8	0.15	Stable
500	Opticap® XL5 capsule with Millipore Express® SPG membrane	1	35	14	0.05	Stable
500	Opticap® XL5 capsule with Millipore Express® SPG membrane	¾	35	14	0.05	Stable
500	Opticap® XL10 capsule with Durapore® membrane	1	26	10	0.03	Stable
500	Opticap® XL10 capsule with Durapore® membrane	1	33.5	13.5	0.04	Stable
1000	Opticap® XL10 capsule with Durapore® membrane	¾	25	10	0.03	Stable
1000	Opticap® XL10 capsule with Durapore® membrane	½	48	10	0.19	Decreasing
1000	Opticap® XL10 capsule with Durapore® membrane	½	25	12	0.07	Stable
1000	Opticap® XL10 capsule with Durapore® membrane	1	35	5	0.09	Stable
1000	Opticap® XL5 capsule with Millipore Express® SPG membrane, 1"	1	50	7	0.12	Stable
1000	Opticap® XL5 capsule with Millipore Express® SPG membrane, 1"	1	70	10	0.15	Increasing ¹

The results show that both vent filter and tubing diameter may have an impact on the build-up pressure in the bag. The impact depends on the area of flow restriction: filter or tubing. Depending on flow rate, a suitable vent filter can be found in most cases. All tested filters are gamma compatible and can be proposed on single-use assemblies. When possible, Millipore Express® SPG membrane and Millipak® barrier filters should be preferred since they are

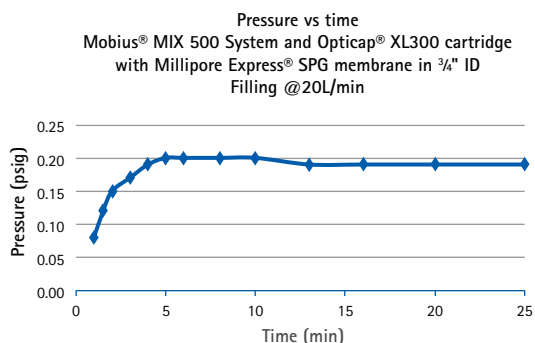
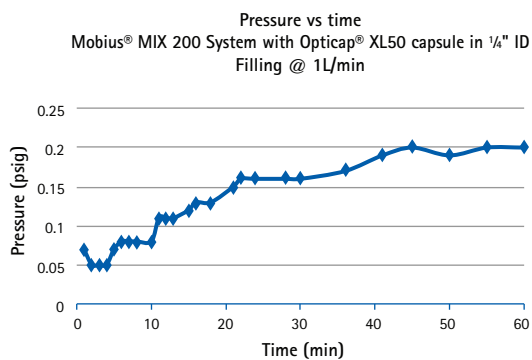
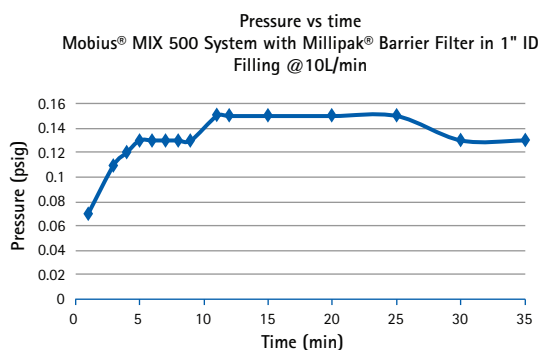
hydrophobic filters, as opposed to Durapore® hydrophilic filters. During the study, gamma compatible hydrophilic and hydrophobic filters have been tested. If a hydrophilic filter has been installed on an assembly, it is important to ensure no liquid enters the vent line during the course of normal operation. Elevation of the filter and the vent line is always recommended.

Table 2 summarizes the best results reached during this study. Not all filter/flow rate combinations were tested with each tubing ID, so extrapolation from the data may be necessary. As an example, the Opticap® XL10

capsule with Durapore® membrane achieved 48 LPM with ½ inch ID tubing but was only tested up to 35 LPM with 1 inch tubing. Figure 1 provides examples of results with Millipak® Barrier Filters and Millipore Express® SPG filters.

Vent tubing ID (inch)	Flow rate (L/min)	Vent filter	Max pressure
¼	1	Opticap® XL50 capsule with Millipore Express® SPG membrane	0.20
½	25	Opticap® XL4 capsule with Durapore® membrane	0.15
½	48	Opticap® XL10 capsule with Durapore® membrane	0.19
¾	20	Opticap® XL300 capsule with Millipore Express® SPG membrane	0.20
¾	25	Opticap® XL4 capsule with Durapore® membrane	0.14
1	10	Millipak® Barrier Filter	0.13
1	26	Opticap® XL4 capsule with Durapore® membrane	0.15
1	35	Opticap® XL10 capsule with Durapore® membrane	0.09

Table 2: Recommended vent filters for various tubing IDs and liquid flow rates



Conclusion

For minimizing the internal pressure accumulation when filling a Mobius® Single-use Mixing Solution, tests have been performed with different vent filters at different filling flow rates. The study identified a suitable vent filter could limit the pressure below 0.3 psig (20 mbar) for flow rates up to 70 L/min. As not all filter/flow rate combinations have been tested with each tubing ID, extrapolation from the data may be necessary.

Ordering information

The following datasheets provide additional product and ordering information:

DS1175EN00	Mobius® Single-Use Mixing Solution
DS3214EN00	Gamma Stable Opticap® XL Capsule Filters with Millipore Express® SPG Hydrophobic Membrane
DS8932EN00	Sterilizing-grade Durapore® 0.22 um Hydrophobic Filters
DS1300EN00	Millipak® Barrier Filter

Figure 1: Examples of Results of Study with Millipak® Barrier and Millipore Express® SPG Filters

To Place an Order or Receive Technical Assistance

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