CUNO®

*a 3M company*

**Longer lasting for fewer cartridge changeouts**

**Faster flowing for smaller assemblies**

**Higher retention for added security**

# BevASSURE® PES

## *Cartridge Filters for Beverage Microbiological Stability*

3M *Innovation*

# BevASSURE® PES

## Cartridge Filters for Beverage Microbiological Stability

Controlling the spoilage microorganism population prior to packing is critical for many beverage processors. Eliminating these microorganisms, while keeping other beverage properties unchanged, is of vital importance. Of equal importance, however, is attaining long on-stream filter service life and driving down operating costs associated with filtration. CUNO has solved this demanding problem with the creation of the BevASSURE PES series of filter cartridges. BevASSURE PES filters encompass new, leading-edge technologies that not only provide the highest degree of microorganism control, but do so in an extremely durable and long-lasting design.

BevASSURE PES filters employ a new, highly-asymmetric polyether sulfone (PES) membrane that delivers excellent spoilage microorganism retention while greatly minimizing any organoleptic interference. This highly durable membrane/cartridge design withstands repeated exposure to hot water sanitation and steam sterilization as well as common chemical cleaning and sanitizing agents.

Complementing this high-performance membrane are CUNO's patented* Advanced Pleat Technology (APT) design and a patent pending upstream and downstream support design. All three work in concert to provide an increased flow rate at a lower pressure drop, resulting in smaller filter assemblies with extended service life and a lower overall operational costs.

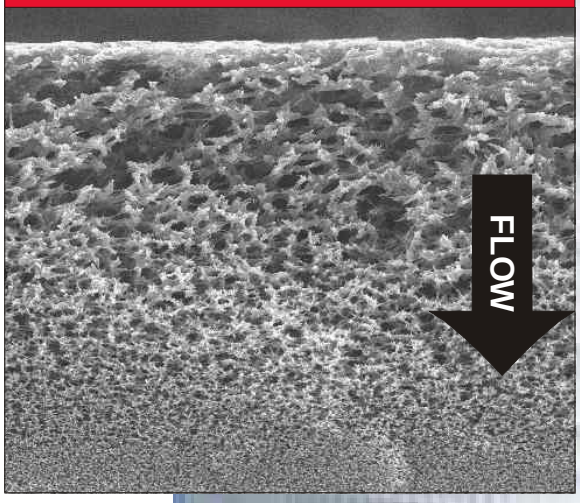
| Features | Benefits |
|---|---|
| ■ Highly asymmetric PES membrane | ■ Longer service life<br>■ Lower operating costs |
| ■ High spoilage organism retention | ■ Reliable microbiological control<br>■ Performance matched to industry standards |
| ■ Advanced Pleat Technology (APT) | ■ Increased accessible surface area<br>■ Longer service life<br>■ Lower operating costs |
| ■ Novel upstream/downstream supports | ■ Increased flow per cartridge<br>■ Reduced housing costs |
| ■ Broad chemical compatibility | ■ Stable with most cleaning and sanitation regimes |
| ■ FDA 21CFR compliant materials | ■ Safe for food contact |

# ADVANCED TECHNOLOGIES

## Highly Asymmetric PES Membrane

BevASSURE PES filters incorporate a novel PES membrane with a high degree of asymmetry (Figure 1). When viewed in cross-section, the membrane contains larger pores on the upstream surface that gradually taper to smaller pores towards the downstream surface. Compared to conventional membranes with a symmetric pore structure, this structure provides greater contaminant capacity, since it presents greater open spaces (void volume) in which to retain these contaminants. This increase in capacity leads directly to longer service life. In addition, the asymmetric structure provides less resistance to flow, resulting in a lower pressure drop when compared at a constant flow rate to competitive filters, allowing a user to employ fewer BevASSURE PES filters for any given flow rate.

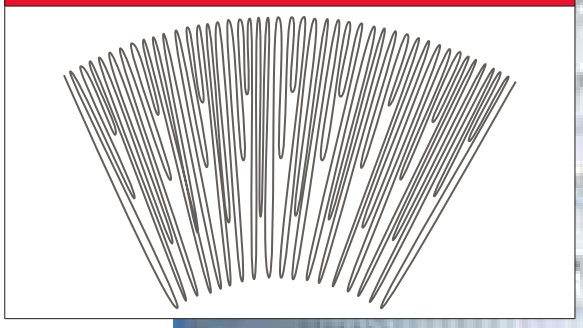
**Figure 1. BevASSURE PES SEM**




## Advanced Pleat Technology (APT)

BevASSURE PES filters feature patented* Advanced Pleat Technology (APT) design for extended service life. This design technology maximizes the useful surface area of the filter while maintaining open flow paths between the media pleats (refer to Figure 2). By employing the APT design, the BevASSURE PES filter provides lower pressure drops, longer service life, and lower overall operational costs.

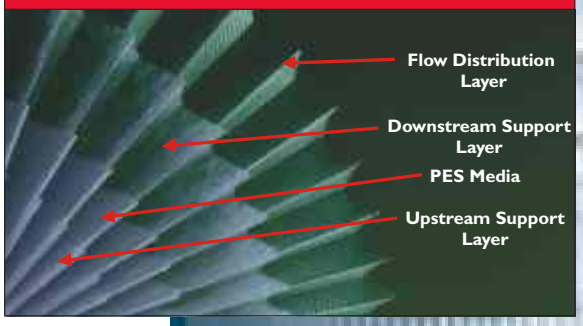
**Figure 2. Advanced Pleat Technology**



## Novel Upstream/Downstream Support Design

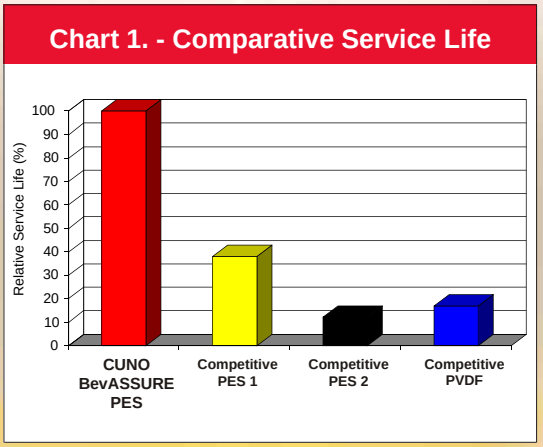
BevASSURE PES filters employ a patent pending design that results in higher beverage flow versus pressure drop compared to competitive filters. This unique CUNO development combines the high flowing PES membrane with special support layers upstream and downstream of the membrane. When combined with the previously mentioned Advance Pleat Technology, this feature greatly increases flow per cartridge, and results in lower overall operational costs.

**Figure 3. BevASSURE PES Support Design**




* US Patent 6,315,130 and other patents pending

# ADVANCED PERFORMANCE




## Extended Service Life

In the majority of beverage applications, the final membrane filter is used in a continuous (as opposed to a batch) operation. Its service life is measured either by the volume filtered, or the number of days in service, before becoming permanently blocked. Filters that provide longer service life not only reduce direct operational costs, but also reduce indirect filter costs as well (filter change-out/installation labor, downtime between change-outs, filter flushing, etc.). The BevASSURE PES filter's unique combination of highly asymmetric PES membrane, Advanced Pleat Technology design, and novel upstream/downstream supports all work together to maximize the volume of beverage that can be processed. The chart at left (Chart 1) depicts the service life performance of the BevASSURE PES filter compared to various competitive filters. A surrogate solution was employed to mimic beverage plugging characteristics at an increased rate.

As the chart demonstrates, the BevASSURE PES filter's unique design provided more than ***twice*** the throughput of the nearest competitor, greatly reducing overall filtration costs.

## Reliable Microbiological Control

The primary purpose of a membrane filter cartridge in beverage processing is to effectively control spoilage microorganisms. BevASSURE PES 0.45 micron and 0.65 micron rated filters provide superior retention of common spoilage microorganisms, even at challenge concentrations that far exceed those experienced by most beverage producers (typically 1,000,000 to 10,000,000 cells per $cm^2$ of membrane area).

| BevASSURE PES | Microorganism | Typical Log Reduction Value (LRV) |
|---|---|---|
| BNA045 | *Serratia marcescens* | 8 |
| BNA045 | *Oenococcus oeni* | 9 |
| BNA045 | *Lactobacillus brevis* | 10 |
| BNA045 | *Dekkera intermedia* | 9 |
| BNA065 | *Lactobacillus brevis* | 7 |
| BNA065 | *Dekkera intermedia* | 9 |

Log Reduction Values are calculated using the following formula:

$$LRV = \log_{10}\left(\frac{\text{total number of organisms entering the filter}}{\text{total number of organisms exiting the filter}}\right)$$

For additional information, consult the BevASSURE PES Technical Support Guide, LITTDTSGBAPES.

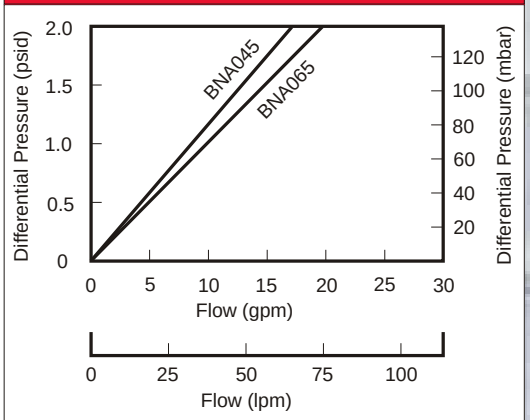
## Fast Flow Rates at Low Pressure Drops

CUNO has combined three key technological advances to provide the fastest flow rate per unit of pressure drop. These three technologies, Advanced Pleat Technology (APT) design, a novel patent-pending upstream and downstream support design, and a unique, highly asymmetric microporous membrane, afford users with faster process flow rates using fewer filters.

Consider the following example:

| Initial clean pressure drop (water) for a 30" cartridge flowing at 20 GPM (76 lpm) | |
|---|---|
| CUNO BevASSURE PES BNA045 | 0.75 psid (52 mbar) |
| Pall OenoPure® "GB" * | 1.92 psid (132 mbar) |
| Millipore Vitipore® II * | 7.5 psid (517 mbar) |
| Sartorius Vinosart® PS * | 2.5 psid (172 mbar) |

**10" Cartridge Flow Rates**




As the example above illustrates, BevASSURE PES filters have a considerably lower pressure drop at a given flow rate when compared to competitive filters. Since filter change-out is usually tied to a terminal differential pressure drop (typically between 20 and 35 psid), employing filters that exhibit a ***lower*** initial pressure drop can result in ***longer*** filter service life.

Alternatively, in a new system when determining the number of filters needed to provide a desired flow rate at a given pressure drop, faster flowing filters will result in smaller, more economical systems.

Consider the following example:

| Number of 10" filters† needed to provide a 20 GPM flow with a clean pressure drop of 1 psid (76 lpm flow at 69 mbar) | |
|---|---|
| CUNO BevASSURE PES BNA045 | 2 |
| Pall OenoPure "GB" | 5 |
| Millipore Vitipore II | 24 |
| Sartorius Vinosart PS | 5 |

† rounded to nearest 10" filter length.

As the example above illustrates, the nearest competitor requires ***more than twice as many*** filter elements to provide the same flow rate and pressure drop.

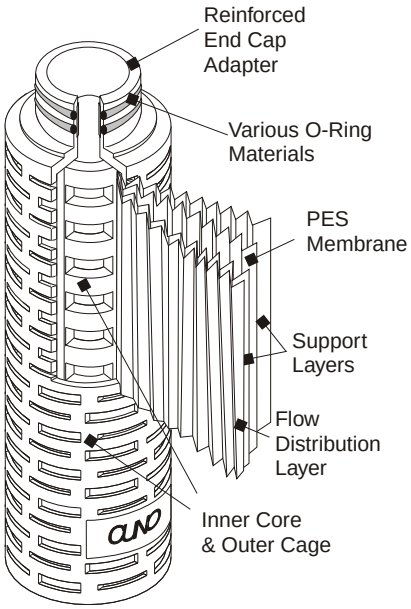
## Durable Design

The BevASSURE PES filter membrane and cartridge design innovations result in a highly durable filter cartridge, capable of secure operation through numerous cycles of hot water sanitation, steam sterilization, and chemical based cleaning and sanitation.

* Data from published product literature

## BevASSURE PES Cartridge Construction

BevASSURE PES filter cartridges are constructed of single-layer, highly asymmetric, polyethersulfone (PES) microporous membrane pleated with polypropylene upstream and downstream support materials. The cage, core and end-cap adapters are made of polypropylene. Multiple length cartridges, with industry standard connection styles, are produced to fit the most widely used housing designs and system sizes. No resin or binder compounds are added. All materials used in manufacturing are traceable and 21CFR compliant for direct food contact. Materials of construction meet USP Biological Reactivity for Class VI Plastics test. Cartridges are manufactured under an ISO 9001:2000 certified quality system using the most advanced thermoplastic welding techniques to ensure filter integrity. BevASSURE PES filters are 100% integrity tested after manufacture to ensure quality.




| Materials of Construction | |
|---|---|
| Membrane | Polyether sulfone |
| Support layers | Polypropylene |
| Cage, Core, End Caps | Polypropylene |
| Adaptor | Polypropylene with polysulfone reinforcing ring |
| O-rings | Various |
| **Nominal Filter Dimensions** | |
| Effective Filtration Area (EFA) | 8.5 $ft^2$ (0.79 $m^2$) |
| Filter Diameter | 2.75” (70 mm) |
| Filter Lengths | 10” (254 mm), 20” (508 mm), 30” (762 mm), 40” (1016 mm) |

| Operating Parameters | | |
|---|---|---|
| Recommended Flow Rate (10” element) | Beer | 1-2 GPM (3.8 – 7.6 lpm) |
| | Wine | 2 – 3 GPM (7.6 – 11.4 lpm) |
| | Maximum | 9 GPM per psid ( 34 lpm per 68.9 mbar) |
| Max. Differential Pressure (Forward) | 80 psid @ 77°F (5.5 bar @ 25°C) | |
| | 35 psid @ 194°F (2.4 bar @90°C) | |
| Max. Differential Pressure (Reverse) | 50 psid @ 77°F (3.44 bar @ 25°C) | |
| Max. Hot Water Sanitation Temperature | 194°F (90°C) - 150, 30 minute cycles | |
| Max. Steam Sterilization Temperature | 275°F (135°C) - 75 cycles, 30 minute cycles | |
| NaOH cleaning duration (conc. 1M @ 65°C) | 100 hours | |
| Peracetic acid sanitation (conc. 1 % @ 21°C) | 100 hours | |

## Integrity Testing Parameters

The Integrity Test is a non-destructive test that can be performed by the user to ensure the filter is installed correctly and ready for operation. BevASSURE PES filters can be Integrity Tested either manually, or with the automated CUNOCheck® 2 tester, by one of three methods: the Forward Flow Test, the Bubble Point Test, or the Pressure Hold Test.

| | BNA045 (0.45 µm) | BNA065 (0.65 µm) |
|---|---|---|
| Forward Flow Test Pressure | 22 psi (1.52 bar) | 15 psi (1.03 bar) |
| Max. Diffusion (10” element) | ≤ 35 cc/min | ≤ 25 cc/min |
| Minimum Bubble Point | ≥ 24 psi (1.65 bar) | ≥ 17 psi (1.17 bar) |
| Pressure Hold Test | Consult CUNO | Consult CUNO |

For additional information regarding filter wetting and integrity testing, please refer to Technical Brief LITTDBAPESINT.

## Automated Integrity Testing - CUNOCheck® 2

A full range of non-destructive integrity tests can be easily and automatically performed with the CUNOCheck 2 integrity test instrument. The CUNOCheck 2 and MiniCheck integrity test instruments provide fast, reliable and accurate automated integrity testing of BevASSURE PES cartridges. For more information, see CUNO document LITCCC2.

## Prefiltration Selections

Many bottling applications employ a prefilter and final filter in series to achieve maximum performance and economy. Prefilters are used to protect and extend the life of more expensive final filters. CUNO offers two premium prefilter choices: Zeta Plus® Maximizer™ H Series depth filter cartridges and LifeASSURE® FlexN™ membrane filter cartridges. Zeta Plus Maximizer H Series filters (Literature LITZPMH) have long been used in clarifying fine wine in both cellar operation and in-line to the bottler. Customers preferring cylindrical prefilters can select from CUNO's LifeASSURE prefilter family (LITCLAFB1). Containing a dual-zone FlexN membrane, LifeASSURE filters are designed to deliver excellent throughputs with high flow rates, while providing the ultimate in final membrane protection.

## CUNO Filter Housings

A specialized range of filter housings is available to meet the needs of the food & beverage industry. They provide easy access for filter change-out and they ensure that BevASSURE PES filter cartridges are sealed securely to eliminate the possibility of fluid bypass. All housings are constructed using 316L stainless steel to maximize corrosion resistance. Internal surfaces of the housings are polished to 20 micro-inch Ra to limit microbial adhesion and provide easy cleaning.  CUNO also offers custom-design, fully automated filtration skids and mobile units. These units can incorporate membrane housings, prefilter housings, SIP and CIP systems along with all necessary piping, valves, monitoring devices and computer controls for reliable, hands-free operation.

## CUNO Scientific Applications Support Services (SASS)

The cornerstone of CUNO's philosophy is service to customers, not only in product quality and prompt service, but also in problem solving, application support and in the sharing of scientific information. CUNO's Scientific Applications Support Services group is a market-oriented group of scientists and engineers who work closely with customers to solve difficult separations problems and aid in the selection of the most effective and economical filtration systems. SASS provides a vital link between CUNO and users of CUNO filter systems. SASS can carry out projects on-site, or in CUNO's extensive state-of-the-art laboratory facilities. CUNO's considerable experience with countless beverage installations provides the knowledge and insight to resolve problems promptly and efficiently in a cost-effective manner.

# BevASSURE PES Filter Cartridge Ordering Guide

| Catalog Number | Rating | Configuration | Length | End Modification | O-ring/Gasket Material |
|---|---|---|---|---|---|
| **BNA** | **045** - 0.45 µm<br>**065** - 0.65 µm | **F** - APT Pleat | **01** - 10"<br>**02** - 20"<br>**03** - 30"<br>**04** - 40" | **B** - 226 O-rings bayonet lock with & spear<br>**C** - 222 O-rings & spear<br>**F** - 222 O-rings & flat cap<br>**D** - Double open end, flat gasket (10" multiples)<br>**E** - Double open end, flat gasket (9 ¾" multiples)<br>**J** - 226 O-rings bayonet lock with flat cap<br>**T** - 222 with spear (Sartorius code 28, not available with support ring) | **A** - Silicone<br>**B** - Fluorocarbon<br>**C** - EPR<br>**D** - Nitrile |

Example; The part number for a 30" BevASSURE PES Filter, 0.45 micron retention rating, 226 silicone O-ring connector with locating spear, would be: **BNA045F03BA.**

**WARRANTY**

Seller warrants its equipment against defects in workmanship and material for a period of 12 months from date of shipment from the factory under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by Seller and for purposes disclosed in writing at the time of purchase, if any. Any unauthorized alteration or modification of the equipment by Buyer will void this warranty. Seller's liability under this warranty shall be limited to the replacement or repair, F.O.B. point of manufacture, of any defective equipment or part which, having been returned to the factory, transportation charges prepaid, has been inspected and determined by the Seller to be defective. THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER. Under no circumstances shall Seller be liable to Buyer or any third party for any loss of profits or other direct or indirect costs, expenses, losses or consequential damages arising out of or as a result of any defects in or failure of its products or any part or parts thereof or arising out of or as a result of parts or components incorporated in Seller's equipment but not supplied by the Seller.

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