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Applied to Life.™

**LifeASSURE™
BNA045 & BNA065 Series**

**Filter Cartridges for Beverage
Microbiological Stability**

LifeASSURE™ BNA Series Filters

Filter Cartridges for Beverage Microbiological Stability

Controlling the spoilage microorganism population prior to bottling 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. 3M Purification Inc. has solved this demanding problem with the creation of the LifeASSURE™ BNA series of filter cartridges. LifeASSURE BNA series filters encompass leading-edge technologies that not only provide the highest degree of microorganism control, but do so in an extremely durable and long-lasting design.

LifeASSURE BNA series filters employ a highly-asymmetric polyether sulfone (PES) membrane that delivers excellent spoilage microorganism retention while greatly minimizing any organoleptic interference. This 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 3M Purification Inc.'s Advanced Pleat Technology (APT) design and an 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 cartridge assemblies with extended service life and a lower overall operational costs.

Features & Benefits

Highly asymmetric PES membrane

- Longer service life than competitive filter cartridges
- Lower operating costs than competitive filter cartridges

High spoilage organism retention

- Reliable microbiological control
- Performance matched to industry standards

Advanced Pleat Technology (APT)

- Increased accessible surface area
- Longer service life than competitive filter cartridges
- Lower operating costs than competitive filter cartridges

Novel upstream/downstream supports

- Increased flow per cartridge
- Reduced housing costs

Broad chemical compatibility

- Stable with most cleaning and sanitation regimes

Meets requirements for food contact

- Complies with requirements of the Pure Food, Drug and Cosmetic Act for food contact

Advanced Technologies

Highly Asymmetric PES Membrane

LifeASSURE BNA filter cartridges 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 extends the filter's 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 filter cartridges, allowing a user to employ fewer LifeASSURE BNA filter cartridges for any given flow rate.

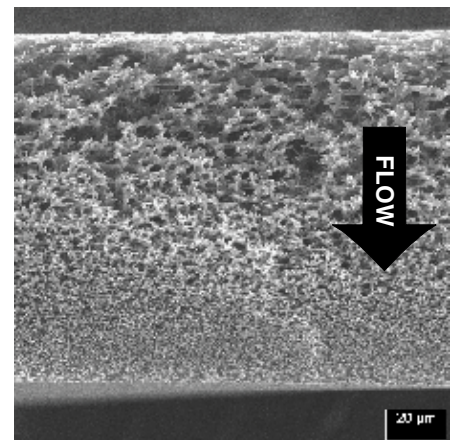


Figure 1. SEM of LifeASSURE™ BNA Series Filter

Advanced Pleat Technology (APT)

LifeASSURE™ BNA filter cartridges feature Advanced Pleat Technology (APT) design for extended service life. This design technology maximizes the useful surface area of the filter cartridge while maintaining open flow paths between the media pleats (refer to Figure 2). By employing the APT design, the LifeASSURE BNA filter cartridge provides lower pressure drops, longer service life, and lower overall operational costs than competitive filter cartridges.

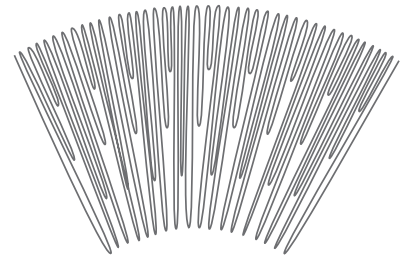


Figure 2. Advanced Pleat Technology

Novel Upstream/Downstream Support Design

LifeASSURE BNA filter cartridges employ a design that results in higher beverage flow versus pressure drop compared to competitive filter cartridges. This unique 3M Purification Inc. development combines the high flowing PES membrane with special support layers upstream and downstream of the membrane. When combined with the previously mentioned Advanced Pleat Technology, this feature greatly increases flow per filter cartridge, and results in lower overall operational costs than competitive filter cartridges.

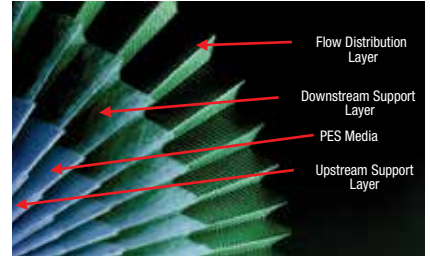


Figure 3. LifeASSURE™ BNA Series Filter Support Design

Advanced Performance

Extended Service Life

In the majority of beverage applications, the final membrane filter cartridge 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. Filter cartridges that provide longer service life not only reduce direct operational costs, but also reduce indirect filter cartridge costs as well (filter cartridge change-out/installation labor, downtime between change-outs, filter cartridge flushing, etc.). The LifeASSURE BNA filter cartridge’s unique combination of highly asymmetric PES membrane, Advanced Pleat Technology design, and novel upstream/downstream support design, all work together to maximize the volume of beverage that can be processed. Chart 1 depicts the service life performance of the LifeASSURE BNA filter cartridge compared to various competitive filter cartridges. A surrogate solution was employed to mimic beverage plugging characteristics at an increased rate.

As the chart demonstrates, the LifeASSURE BNA filter cartridge’s unique design provided more than twice the throughput of the nearest competitor, greatly reducing overall filtration costs.

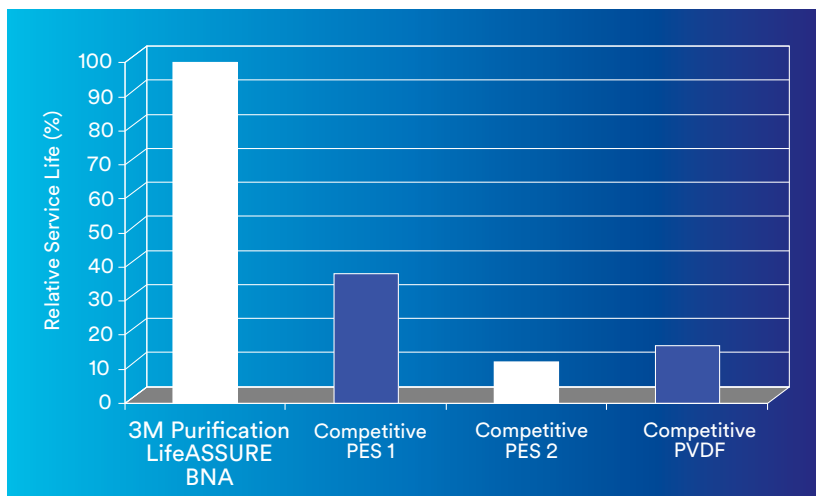


Chart 1. Comparative Service Life

Reliable Microbiological Control

The primary purpose of a membrane filter cartridge in beverage processing is to effectively control spoilage microorganisms. LifeASSURE™ BNA 0.45 micron and 0.65 micron rated filter cartridges 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 cm² of membrane area).

| LifeASSURE BNA | Microorganism | Typical Log Reduction Value (LRV) |
|----------------|-----------------------------|-----------------------------------|
| BNA045 | <i>Serratia marcescens</i> | 8 |
| BNA045 | <i>Oenococcus oeni</i> | 9 |
| BNA045 | <i>Lactobacillus brevis</i> | 10 |
| BNA045 | <i>Dekkera intermedia</i> | 9 |
| BNA065 | <i>Lactobacillus brevis</i> | 7 |
| BNA065 | <i>Dekkera intermedia</i> | 9 |

Log Reduction Values are calculated using the following formula:

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

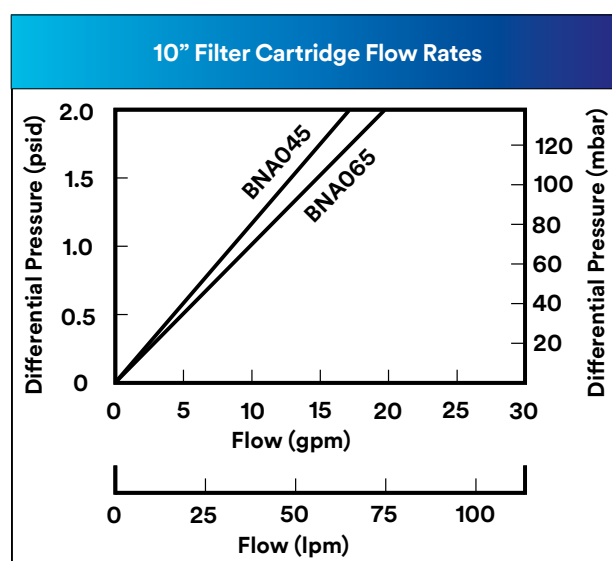
For additional information, consult the LifeASSURE BNA Technical Support Guide, 70-0201-8839-0.

Fast Flow Rates at Low Pressure Drops

3M Purification Inc. has combined three key technological advances to provide the fastest flow rate per unit of pressure drop. These three technologies, a highly asymmetric microporous membrane, Advanced Pleat Technology (APT) design, and an upstream and downstream support design, afford users with faster process flow rates using fewer filter cartridges.

| Initial clean pressure drop (water) for a 30" filter cartridge flowing at 20 gpm (76 lpm) | |
|---|----------------------|
| 3M Purification Inc. LifeASSURE 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) |

* Data from published product literature



LifeASSURE™ BNA 045 and BNA065 Series Filters

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

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

Consider the following example:

| Number of 10" filter cartridges† needed to provide a 20 gpm flow with a clean pressure drop of 1 psid (76 lpm flow at 69 mbar) | |
|--|----|
| 3M Purification Inc. LifeASSURE BNA045 | 2 |
| Pall OenoPure "GB" | 5 |
| Millipore Vitipore II | 24 |
| Sartorius Vinosart PS | 5 |

† rounded to nearest 10" filter cartridge length.

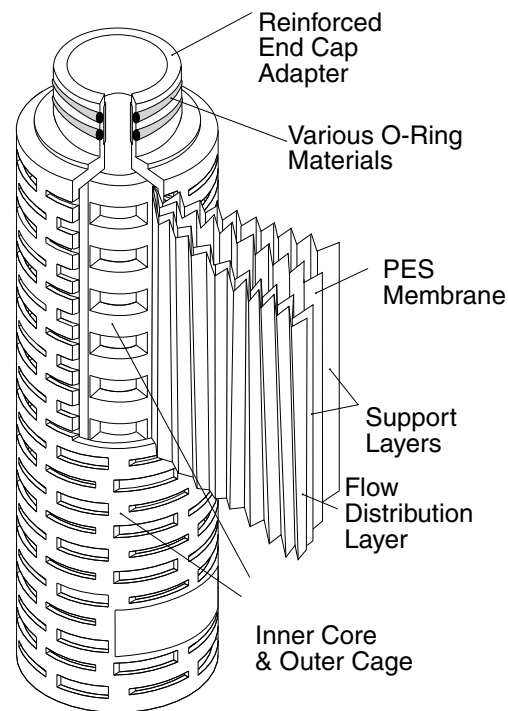
As the example above illustrates, the nearest competitor requires more than twice as many filter cartridge elements to provide the same flow rate and pressure drop.

Durable Design

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

LifeASSURE™ BNA Filter Cartridge Construction

LifeASSURE BNA filter cartridges are constructed of single-layer, highly asymmetric, polyethersulfone (PES) microporous membrane pleated with polypropylene upstream and downstream support materials. The outer cage, inner core and reinforced end-cap adapters are made of polypropylene. Multiple length filter 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 are approved for direct food contact. Materials of construction meet the requirements of the USP Biological Reactivity Test for Plastics, Class VI. Filter cartridges are manufactured under an ISO 9001:2008 certified quality system using the most advanced thermoplastic welding techniques for filter cartridge integrity. LifeASSURE BNA filter cartridges are 100% integrity tested after manufacture to verify quality.



| Materials of Construction | |
|----------------------------------|--|
| Membrane | Polyethersulfone |
| Support layers | Polypropylene |
| Inner Core, Outer Cage, End Caps | Polypropylene |
| End Cap Adaptor | Polypropylene with polysulfone or stainless steel reinforcing ring |
| O-rings | Various |

| Nominal Filter Cartridge Dimensions | | Operating Parameters | |
|-------------------------------------|---|--|---|
| Effective Filtration Area (EFA) | 8.5 ft ² (0.79 m ²) | Recommended Flow Rate (10" element) | Wine 2 – 3 gpm (7.6 – 11.4 lpm) |
| Filter Cartridge Diameter | 2.75" (70 mm) | | Maximum |
| Filter Cartridge Lengths | 10" (254 mm), 20" (508 mm), 30" (762 mm), 40" (1016 mm) | Max. Differential Pressure (Forward) | 80 psid @ 77 °F (5.5 bar @ 25 °C) |
| | | Max. Differential Pressure (Reverse) | 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 |

| | BNA045 (0.45 µm) | BNA065 (0.65 µm) |
|------------------------------|------------------------------|------------------------------|
| Forward Flow Test Pressure | 22 psi (1.5 bar) | 15 psi (1 bar) |
| Max. Diffusion (10" element) | ≤ 35 cc/min | ≤ 25 cc/min |
| Minimum Bubble Point | ≥ 24 psi (1.7 bar) | ≥ 17 psi (1.2 bar) |
| Pressure Hold Test | Consult 3M Purification Inc. | Consult 3M Purification Inc. |

For additional information regarding filter cartridge wetting and integrity testing, please refer to Technical Brief 70-0202-6597-4

Integrity Testing Parameters

The Integrity Test is a non-destructive test that can be performed by the user to make sure the filter cartridge is installed correctly and ready for operation. LifeASSURE™ BNA filter cartridges can be Integrity Tested either manually, or with an automated integrity tester, by one of three methods: the Forward Flow Test, the Bubble Point Test, or the Pressure Hold Test.

Automated Integrity Testing - 3M™ 101 Series Integrity Tester

A full range of non-destructive integrity tests can be easily and automatically performed with the 3M™ 101 Series integrity test instrument. The 3M™ 101 series integrity tester provides fast, reliable and accurate automated integrity testing of LifeASSURE™ BNA series filters. For more information, see 3M document 70020341049.

Prefiltration Selections

Many bottling applications employ a prefilter and final filter cartridge in series to achieve maximum performance and economy. Prefilter cartridges are used to help protect and extend the life of more expensive final filter cartridges. 3M Purification Inc. offers three premium prefilter cartridge choices: Zeta Plus™ MH Series depth filter cartridges Betafine™ XL series pleated polypropylene filters, and LifeASSURE™ BLA series membrane filter cartridges. Zeta Plus™ MH series dual zone Series filter cartridges (Literature 70-0201-8864-8) have long been used in clarifying beverages in both cellar operation and in-line to the bottler. Customers preferring cylindrical prefilter cartridges can select from 3M Purification Inc.'s LifeASSURE BLA series prefilter cartridge family (Literature 70-0201-8712-9). Containing a dual-zone membrane, LifeASSURE BLA series filter cartridges are designed to deliver excellent throughputs with high flow rates, while providing the ultimate in final membrane protection. Betafine™ XL series filters (Literature 70-0201-8686-5), containing pleated polypropylene microfiber, are a third prefilter option.

3M Purification Inc. Filter Cartridge Housings

A specialized range of filter cartridge housings is available to meet the needs of the food & beverage industry. The housings provide easy access for filter cartridge change-out and confidence that LifeASSURE™ BNA filter cartridges are sealed securely to avoid the possibility of fluid bypass. All housings are constructed using 316L stainless steel to maximize corrosion resistance. 3M Purification Inc. also offers custom-design, fully automated filtration skids and mobile units.

Application Engineering

3M has a global team of market-focused scientists and engineers who excel in supporting and collaborating with end-users. Our technical teams are skilled in either performing on-site bench-scale or in-house tests and relating results to full scale manufacturing operations and optimizing cost of purification. When unique processing problems are encountered, our product and application specialists are equipped to identify solutions using either 3M's broad array of existing products or potentially develop a custom solution for your application.

LifeASSURE™ BNA Series Filter Ordering Guide

| Catalog Number | Rating | Configuration | Length | End Modification | O-Ring/Gasket Material | Adapter Insert |
|----------------|-----------------------------|---------------|--|--|-------------------------|--|
| BNA | 045-0.45 µm 065- 0.65 µm | F - APT Pleat | 01 - 10" 02 - 20" 03 - 30" 04 - 40" | B - 226 O-rings bayonet lock with & spear C - 222 O-rings & spear F - 222 O-rings & flat cap | A - Silicone C - EPR | 1 = stainless steel blank = polysulfone |

PLEASE NOTE: The Order Guide above is for reference only. Not all combinations are available. Please consult with your 3M representative to determine the appropriate part number for your application.

Product Selection and Use:

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

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