

3M Purification Inc.
LifeASSURE™ BNA045 & BNA065 Series

Filter Cartridges for Beverage Microbiological Stability



LifeASSURE™ BNA Series Filter Cartridges

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 cartridge 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 filter cartridges 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 filter cartridges employ a 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 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 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 filter cartridges, allowing a user to employ fewer LifeASSURE BNA filter cartridges for any given flow rate.

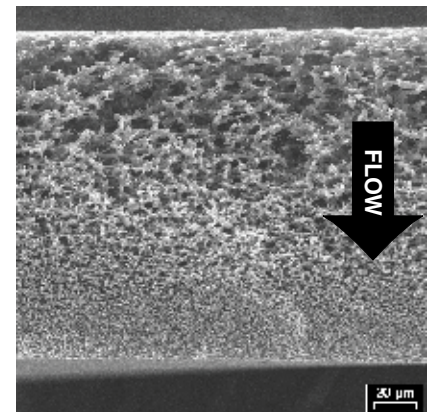


Figure 1. LifeASSURE BNA SEM

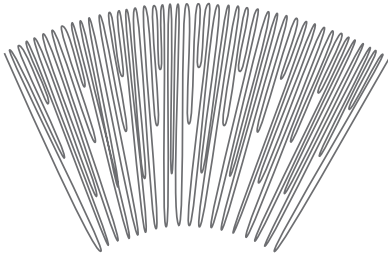


Figure 2.
Advanced Pleat Technology

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.

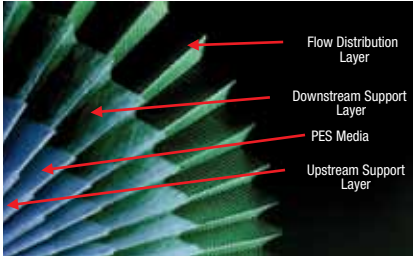


Figure 3.
LifeASSURE BNA Support Design

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.

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.

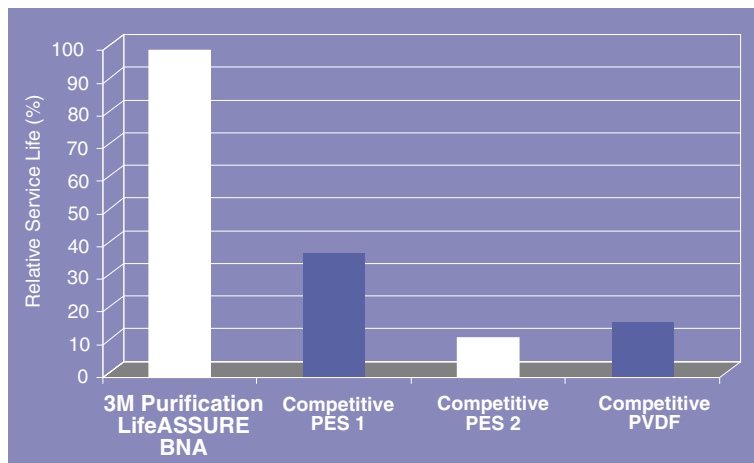


Chart 1. Comparative Service Life

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:

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

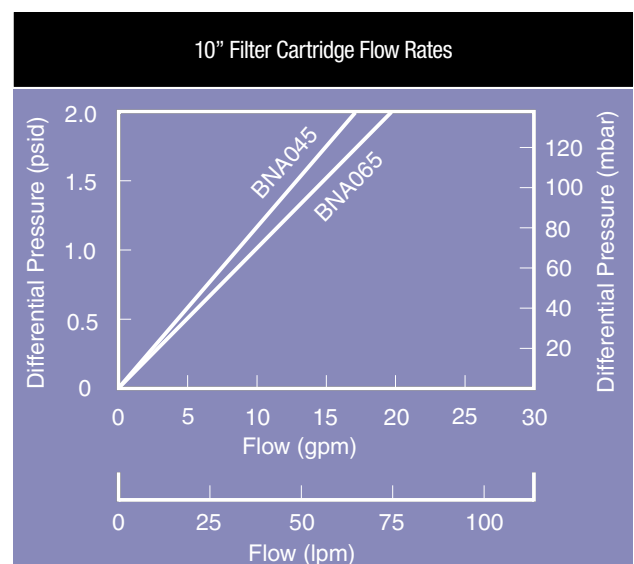
For additional information, consult the LifeASSURE BNA Technical Support Guide, 70-0201-8839-0.

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.

Consider the following example:

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

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.

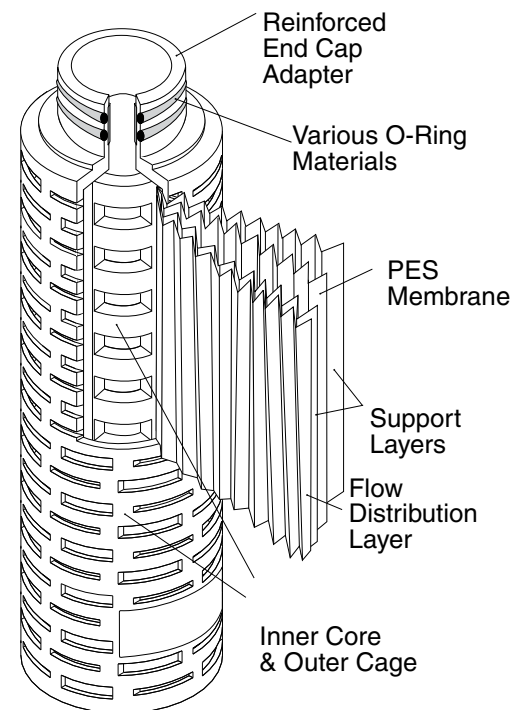
As the example above illustrates, the nearest competitor requires more than twice as many filter cartridge elements to provide the same flow rate and pressure drop.

Durable Design

The LifeASSURE BNA filter membrane and filter cartridge design innovations result in a highly 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 - 121 °C. Filter cartridges are manufactured under an ISO 9001:2008 certified quality system using the most advanced thermoplastic welding techniques to ensure filter cartridge integrity. LifeASSURE BNA filter cartridges are 100% integrity tested after manufacture to ensure quality.



Materials of Construction	
Membrane	Polyether sulfone
Support layers	Polypropylene
Outer Cage, Inner Core, End Caps	Polypropylene
Adaptor	Polypropylene with polysulfone reinforcing ring
O-rings	Various

Nominal Filter Cartridge Dimensions	
Effective Filtration Area (EFA)	8.5 ft ² (0.79 m ²)
Filter Cartridge Diameter	2.75" (70 mm)
Filter Cartridge 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)A	
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 cartridge is installed correctly and ready for operation.

LifeASSURE™ BNA filter cartridges 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 3M Purification Inc.	Consult 3M Purification Inc.

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

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 LifeASSURE™ BNA cartridges. For more information, see 3M Purification Inc. document 70-0201-8692-3.

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 two premium prefilter cartridge choices: Zeta Plus™ H Series depth filter cartridges and LifeASSURE™ BLA series membrane filter cartridges. Zeta Plus™ MH series dual zone H Series filter cartridges (Literature 70-0201-8864-8) have long been used in clarifying fine wine 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.

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 ensure that LifeASSURE™ BNA 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. 3M Purification Inc. 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.

BM Purification Inc. Scientific Applications Support Services (SASS)

The cornerstone of 3M Purification Inc.'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. 3M Purification Inc.'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 3M Purification Inc. and users of 3M Purification Inc. filter cartridge systems. SASS can carry out projects on-site, or in 3M Purification Inc.'s extensive state-of-the-art laboratory facilities. 3M Purification Inc.'s considerable experience with countless beverage installations provides the knowledge and insight to resolve problems promptly and efficiently in a cost-effective manner.



LifeASSURE™ BNA Filter Cartridge Ordering Guide

Catalog Number	Rating	Configuration	Length	End Modification	O-Ring/Gasket Material
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 J - 226 O-rings bayonet lock with flat cap T - 222 with spear (Sartorius code 28, not available with support ring)	A - Silicone B - Fluorocarbon C - EPR D - Nitrile

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