

Zeta Plus™ H Series

Depth Filter Cartridges & Capsules

Zeta Plus™ H Series is a charge-modified depth filter constructed with high-tensile strength media to perform efficiently even under operating conditions requiring elevated operating temperatures or repeated hot water sanitation cycles. Zeta Plus H series filters are available in either standard sheet or easy to use, labor saving cartridges.

Zeta Plus Cartridges and Housings to Fit Every Need

Zeta Plus H Series filters are available in 8, 12 and 16 inch diameter cartridges, providing filtration surface areas from 2.8 ft² to 39.7 ft² (0.26 m² to 3.7 m²) per cartridge. This broad range of cartridge configurations allows for easy scale-up from the bench top to pilot scale to full production. A wide variety of industrial and sanitary Zeta Plus housings are available to provide totally enclosed liquid filtration. Refer to 3M Purification Inc. literature number 70-0201-8762-4 and 70-0201-8857-2.

Zeta Plus Cartridge System Vs. Plate & Frame Filter Economics

The Zeta Plus cartridge system has a number of advantages over conventional plate and frame filters. Since the cartridge system utilizes a totally enclosed housing, there is no product leakage and no exposure of the filter media to external contamination allowing for effective use of the media, higher throughputs, and low operating costs. The plate and frame filter press design is open to the environment making both filter media and product susceptible to external contamination. The “open” design requires more frequent media change-out cycles, typically every few days. This results in lower throughputs and higher operating costs.

Plate and frame filters are labor intensive, requiring two people four to eight hours to change out the media. Zeta Plus cartridges are easy to install and remove, usually taking about 15 minutes, resulting in significant labor cost reductions. Coupled with the floor space reduction of the vertical Zeta Plus housing design and a typical 50% or greater decrease in initial capital cost when compared to a comparable plate and frame filter, the savings become substantial.

Features & Benefits

More than three times the strength of competitive media to withstand multiple steaming and hot water sanitization cycles.

- Extended filter life resulting in high throughputs, fewer cartridge change-outs, and reduced operating costs.

Combined depth filtration and electrokinetic adsorption.

- Efficient haze and particle removal at micron ratings smaller than the mechanical rating alone.

Easy-to-install cartridges for rapid change-out.

- Reduced labor cost.

Totally enclosed, sanitary systems and housings.

- Zero edge leakage and external contamination.

Variety of cartridge sizes and filtration surface areas.

- Flexible options for all flow requirements.

All components FDA CFR Title 21 listed.

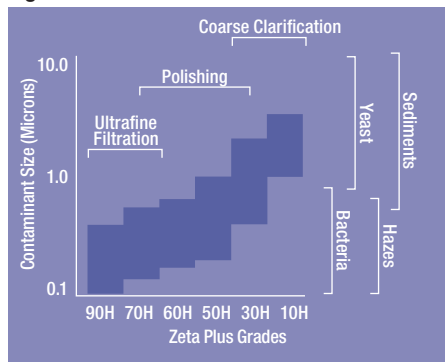
- Safe for all food & beverage filter applications.



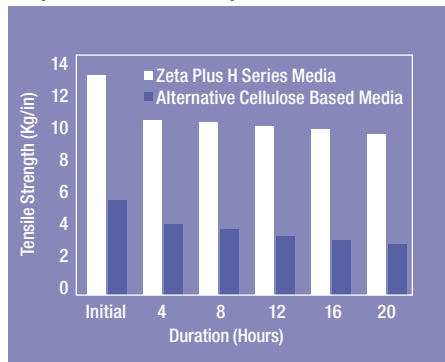
Applications

The Zeta Plus H Series is ideally suited for clarification and pre-filtration in food and beverage, cosmetic, and general applications where the exceptional high wet-tensile strength media provides extended service life. These include aqueous, alcoholic, proteinaceous, and acidic solutions.

Figure 1: Grade Selection



Graph 1: 90°C Water Exposure



Graph 2: 135°C Steam Exposure

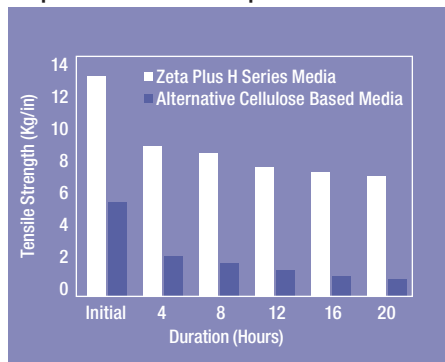


Table 1 highlights the economic advantages in capital and operating costs that the Zeta Plus system provides over conventional sheet filtration using a plate and frame filter. To complete this analysis, a generic process line running at 350 HI/hr (1,000,000 HI/yr) was used. A two stage Zeta Plus configuration is compared to a standard plate and frame system. Discounted cash flow was determined using a 10-year life period.

Superior Particle Removal

Zeta Plus filter media offers unique advantages in contamination removal because of its electrokinetic properties. In addition to the mechanical exclusion of particles by its depth loading feature, Zeta Plus filter media adsorbs contaminants too small for removal by mechanical straining alone. Since most particles in suspension have been shown to exhibit a negative charge, virtually all contaminants can be removed with proper grade selection.

Grade Selection

Zeta Plus H Series filter media are available in a broad range of grades. Mechanical straining alone, as determined by mean-flow pore analysis, is indicated in Figure 1. Particles smaller than the rated pore size will be removed by Zeta Plus H Series filter media because of electrokinetic adsorption. Actual operating conditions and the product to be filtered should be considered in grade selection. Technical support in optimal grade selection is provided by your local Master Representative/Distributor or by the 3M Purification Inc. Scientific Applications Support Services (SASS) team.

Superior Strength and Resistance

Zeta Plus H Series filters are specifically designed for applications requiring numerous hot water sanitization cycles or extended exposure to high service temperatures. The superior wet tensile strength of Zeta Plus H Series media combined with a highly durable cartridge design ensures integrity under flow and pressure variations where poorly designed competitive products suffer media erosion, deformation and bypass.

High Performance in Microbial Reduction

Zeta Plus H Series media demonstrate excellent microbial reduction as noted in Table 2. No organisms were detected downstream of the Zeta Plus media after filtration. This confirms the effectiveness of Zeta Plus H Series media in protection of final membrane filters and in producing a microbiologically stable product when used alone.

Low Extractables

Calcium and iron extractable concentrations of Zeta Plus H media in a variety of solutions are shown in Table 3. The data represent a static soak of the media in the listed fluid at a ratio of 10 ml of fluid/1 gram of media (approximately 1.2 liter/ft²). Even at this high ratio

Table 1: Zeta Plus Cartridges vs. Plate & Frame Filters

	Plate & Frame Filter (U.S. Cents/HL)	Zeta Plus Cartridge System (U.S. Cents/HL)
Capital Cost	8.5	1.3
Media Cost	6.8	12.2
Labor-Media Change-out	1.1	0.1
Loss-Leakage	1.3	-
Regeneration & Sanitization Costs	2.8	0.4
Spare Parts & Maintenance	1.5	0.2
Total Costs/HL	22.0	14.0

**Table 2: Zeta Plus H Series
Microbial Reduction**

Media Grade	Microorganism used for challenge	Removal (CFU/cm ² of media)	Organisms in Filtrate
30H	<i>Saccharomyces cerevisiae</i> (ATCC-36026)	4.1 x 10 ⁸	0
50H		6.8 x 10 ⁸	0
60H		6.0 x 10 ⁸	0
60H	<i>Oenococcus oeni</i> (ATCC-23279)	5.5 x 10 ⁸	0
90H		7.2 x 10 ⁸	0

Challenge conditions used in these tests: microbial concentration: 10⁹ - 10⁷ organisms/ml flow rate: 0.25 gpm/ft² (10 lpm/m²)

Table 3: Extractables

		10H	30H	Media Grade		70H	90H
				50H	60H		
D.I. Water	Calcium (ppm)	<0.05	0.1	0.12	0.13	0.011	0.15
	Iron (ppm)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
8% Ethanol	Calcium (ppm)	<0.05	0.9	<0.08	<0.08	<0.08	0.09
	Iron (ppm)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
50% Ethanol	Calcium (ppm)	<0.05	<0.08	<0.08	<0.08	<0.08	<0.08
	Iron (ppm)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015

Table 4: H Series Cartridge Configurations

Catalog Number	Nominal Diameter	Height	Effective Filtration Area	Number of Cells
45109	8 in (203 mm)	6 11/16 in (170 mm)	2.8 ft² (0.26 m²)	8
45167	8 in (203 mm)	6 5/8 in (168 mm)	2.5 ft² (0.23 m²)	7
45237	12 in (304 mm)	10 3/4 in (273 mm)	12.3 ft² (1.1 m²)	12
45245	12 in (304 mm)	10 3/4 in (273 mm)	16.4 ft² (1.5 m²)	16
Z16P	16 in (406 mm)	10 3/4 in (273 mm)	34.7 ft² (3.2 m²)	14

of media weight to soak volume, the results show extremely low extractable levels. As a Good Manufacturing Practice, 3M Purification Inc. recommends a 1.25 gallon/ft² (50 l/m²) flush of Zeta Plus H Series media with either filtered water or product prior to use. Moreover, specific rinsing procedures can be developed on-site for special applications to reduce these levels even further.

Cartridge Construction

A single Zeta Plus cartridge is composed of an assembly of Zeta Plus cells. Each cell is composed of two Zeta Plus H Series media discs on either side of a polypropylene “stiff cell” separator. The stiff-cell separator, as depicted in Figure 2, is a 3M Purification Inc. innovation. It provides a more durable cartridge with enhanced flow characteristics resulting in longer service life. The discs are sealed together at the circumference by an injection molded polypropylene edge seal. The cells are then unitized into a cartridge using set compression that results in a rugged, durable cartridge (Figure 2). The cells are held in place by three stainless steel bands in the core of the cartridge. All components of Zeta Plus H Series filter cartridges are listed in CFR 21 by the US Food and Drug Administration as safe for food contact.

Cartridge Configurations

Zeta Plus cartridges are available in a variety of size and number of cell combinations. Table 6 lists information about Zeta Plus H Series configurations.

Flow Characteristics

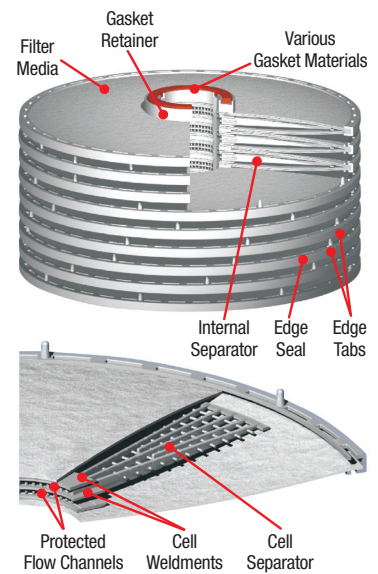
Graphs 3 and 4 show initial differential pressure values for Zeta Plus H Series media versus specific flow rates in water and a 10 cst viscosity oil, respectively.

Recommended Operating Parameters

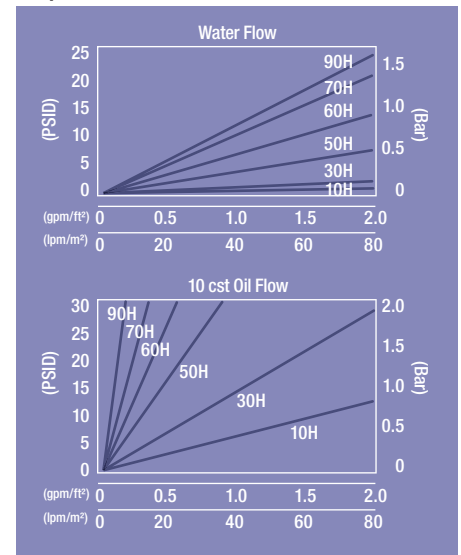
Cartridge Max. Temp.	180°F (80°C)
BC25 Max. Temp.	100°F (40°C)
Change-out Pressure	35 psid (2.4 bar)
Rec. Flow Rate*	0.25-0.5 gpm/ft² (10-20 lpm/m²)
Max. Flow Rate	1.0 gpm/ft² (40 lpm/m²)
Rinse Volume	1.25 gallons/ft² (50 liters/m²)

*Consult 3M Purification Inc. for the best flow rate for your application.

Figure 2: Cartridge Construction



Graph 3: Zeta Plus Flow Characteristics



Zeta Plus™ H Series Ordering Guide

BC25 Disposable Cartridges

Catalog Number	Nominal Filter Area	Packaging Options	Media Grade	Media Formulation
BC Capsule	0025 3.9 in ² (25 cm ²)	L (Luer) S (Sanitary)	05, 07, 10, 20, 30, 40, 50, 60, 70, 90	H - Inorganic Filter Aid & Cellulose

BC1000/2000 Disposable Cartridges

Catalog Number	Nominal Filter Area	Packaging Options	Media Grade	Media Formulation
BC Capsule	1000 0.7 ft ² (650 cm ²) 2000 1.4 ft ² (1300 cm ²)	A - Single Pack B - 3 Pack (same media)	05, 07, 10, 20, 30, 40, 50, 60, 70, 90	H - Inorganic Filter Aid & Cellulose

8" Diameter Cartridges

Catalog Number	Gasket	Media Grade	Media Formulation
45109 (8" 8 cell)	11 - Nitrile 13 - Fluorocarbon 14 - EPR	05, 07, 10, 20, 30, 40, 50, 60, 70, 90	H - Inorganic Filter Aid & Cellulose
45167 (8" 7 cell O-ring Plug in)	01 - Nitrile 02 - EPR 03 - Fluorocarbon 04 - Silicone		

12" Diameter Cartridges

Catalog Number	Geometric Variation	Gasket	Media Grade	Media Formulation
45237 (12" 12 cell) 45245 (12" 16 cell)	01 - Standard Polypropylene Talc Filled Polypropylene 02 - EPR	A - Silicone B - Fluorocarbon C - EPR D - Nitrile	05, 07, 10, 20, 30, 40, 50, 60, 70, 90	H - Inorganic Filter Aid & Cellulose

16" Diameter Cartridges

Catalog Number	Gasket	Media Grade	Media Formulation
Z16P (16" 14 cell)	A - Silicone B - Fluorocarbon C - EPR D - Nitrile	05, 07, 10, 20, 30, 40, 50, 60, 70, 90	H - Inorganic Filter Aid & Cellulose

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