

3M Purification

Zeta Plus™ Single-Use Depth Filtration Product Brochure



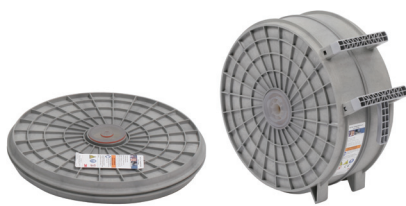
Zeta Plus™ Encapsulated Filter System

Innovative Filtration.
Fast, easy and clean.





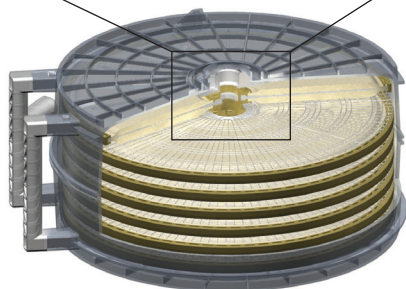
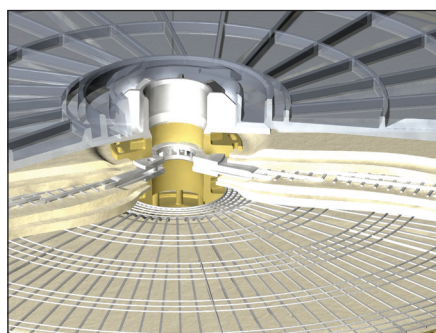
Zeta Plus™ Encapsulated standard capsule offering with translucent polycarbonate shells



Zeta Plus™ Encapsulated capsule offering with alkaline resistant* polyphenylene/polystyrene shells



Self guiding locking mechanism enables fast and robust capsule-to-capsule connection



The system of choice for single-use depth filtration

The Zeta Plus™ Encapsulated System is a single-use depth filtration system designed for the bioprocessing industry where upstream cell culture clarification and impurity removal or downstream impurity reduction is required. The Zeta Plus Encapsulated System consists of small and medium systems (model 16EZA) that are ideal for lab scale production or scale up studies and a large system that is designed for production scale biomanufacturing. Each system is comprised of a filter holder, top and bottom manifolds and the required number of capsules.

The Zeta Plus Encapsulated Systems for production scale biomanufacturing feature an ergonomically designed large holder (model 16EZB) that can be pivoted between horizontal and vertical positions, allowing for convenient loading and unloading, minimal footprint during filtration, minimal fluid spills during unloading and full utilisation of the filter media.

The capsule design features a translucent plastic shell (standard capsules) for easy liquid level detection. A self guiding locking mechanism enables fast and robust capsule-to-capsule connection and the industry leading 3M Purification Zeta Plus depth filter media provides superior filtration performance. If sanitation using NaOH solution is required, capsules with alkaline-resistant shells are available.

Features and benefits

Ergonomically designed holder system:

Large holder (model 16EZB) can be pivoted between horizontal and vertical positions

- Enables loading and unloading at waist height
- Minimal fluid spills when handling spent capsules
- Single or two-stage depth filtration within one filter holder

Vertical flow path

- Full utilisation of the filter media
- Small footprint during filtration

Innovative capsule/manifold design:

Translucent plastic shell (standard capsules)

- Easy detection of the liquid level inside, providing real time monitoring of the filtration process

Solid core design with fully encapsulated shell

- Eliminates the need for a stainless steel housing and the cleaning step after filtration
- Low hold-up volume

Self guiding locking mechanism

- Fast, reliable and robust capsule-to-capsule connectivity

Lenticular style capsule design

- Linear scalability from small to large system
- Consistency between single-use and conventional depth filtration

Zeta Plus™ filter media:

Both double-layer EXT and single-layer Zeta Plus™ filter media are available

Superior performance in throughput and filtration efficiency

* Based on testing with 1M NaOH and 5% NaClO (Bleach). Ask for Chemical Compatibility Guide for more information.



High performance filter media

The Zeta Plus Encapsulated System utilises the industry leading Zeta Plus depth filter media, including the double layer Zeta Plus EXT Series filter media and many popular single layer Zeta Plus media options including SP and ZA media grades. The Zeta Plus EXT Series is a family of advanced dual zone depth filters designed to provide optimal clarification of bioprocess and biological fluids. Most Zeta Plus products using EXT Series filter media consist of two distinct layers or “zones” of filter media with the upstream zone more open than the downstream one. This structure enhances the contaminant holding capacity of the filter media, reduces premature plugging and helps extend service life. All Zeta Plus EXT media grades are available in single-use format including a special grade (DEL108A) that is designed for lipid and surfactant removal (see page 9).

Applications

- Clarification of mammalian cell culture harvest
- Enhanced protection of downstream processes
- Clarification of bacteria, yeast and insect cell lysates
- Host Cell Proteins (HCPs) reduction
- Viruses and DNA reduction
- Protein aggregates reduction
- Endotoxin reduction
- Anti-foaming agents reduction

The primary application for the Zeta Plus Encapsulated System is the cell culture clarification after fermentation. The System can be employed alone or in combination with centrifugation or Tangential Flow Filtration (TFF). An alternative application for the Zeta Plus Encapsulated System is downstream impurity reduction. Taking advantage of its positive charge capacity, Zeta Plus filter media has been shown to be effective in removing contaminants such as host cell proteins (HCP), viruses, DNA, protein aggregates and endotoxins.

In monoclonal antibody production, Zeta Plus filter media is increasingly being used as a polishing step after Protein A column capture step, replacing traditional anion exchange chromatography.

Table 1: Recommended operating parameters

	Zeta Plus™ Encapsulated System	Zeta Plus™ Scale-Up capsules
Maximum operating pressure		
Inlet pressure	3.4 bar	3.1 bar
Differential pressure	2.4 bar	2.4 bar
Maximum operating temperature	40 °C	40 °C
Recommended pre-use rinse	54 L/m ²	54 L/m ²

Zeta Plus™
EZ16A
System



Zeta Plus™
EZ16B
System



Zeta Plus™
Multi-Round
bespoke
customised
system

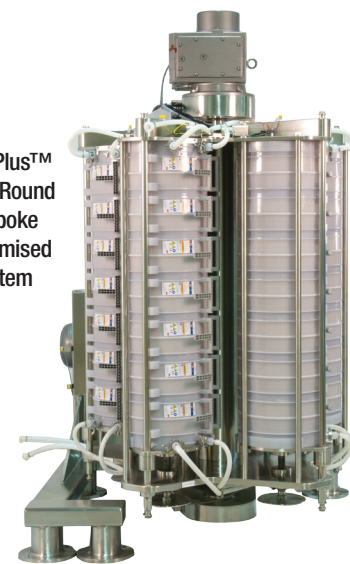


Figure 1: Zeta Plus™ Encapsulated large holder loading process



Ergonomically designed filter holders

Traditional depth filtration systems utilise lenticular style cartridge filters and a vertical filtration flow path to allow easy access to process liquids and efficient utilisation of filter media. However, stacking cartridges from bottom to top can be cumbersome and dismantling used cartridges is often labour intensive. Furthermore, fluid spills during the unloading process could be problematic and, in some instances, might expose the operators to the process fluids.

Recognising the need for a depth filtration system that is fast, easy and clean, 3M Purification designed filter holders (Model 16EZB) that can be pivoted between the horizontal position for loading and unloading the capsules and manifolds and the vertical position for filtration. Allowing loading and unloading at waist height eliminates the need for operators to lift capsules above their heads and reduces the risk of fluid spills when handling used capsules. The use of the vertical flow path allows for full media utilisation and a small system footprint during filtration.

Small and medium holders (models 16EZA)

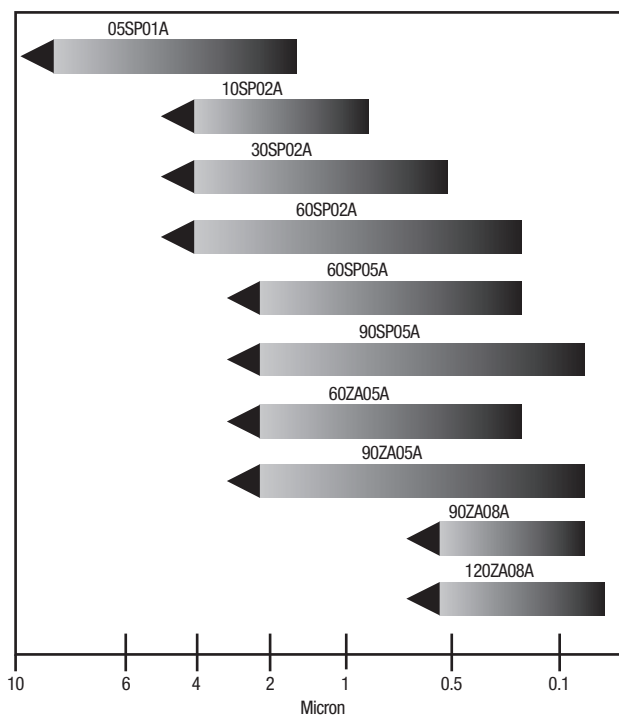
The small and medium holders are ideal for scale-up studies and lab-scale protein production. These holders give the flexibility to accommodate from one 0.23 m² capsule to three 1.6 m² (double-layer EXT) or 2.5 m² (single-layer) capsules. Depending upon the number of capsules required, either single-stage or two-stage depth filtration can be performed with the same holder. Spacers are available to provide greater flexibility when a smaller number of capsules are required. The standard small and medium holders have a built-in torque limiter that ensures that the correct sealing force has been properly applied. An option is available that allows the small and medium holders to be autoclaved.

Large holder (model 16EZB)

The large holder can accommodate up to 17.5 m² of single-layer Zeta Plus filter media (or 11.2 m² of double-layer Zeta Plus filter media) and is ideal for small to large production scale purification processes.

Figure 2: Nominal retention ratings for Zeta Plus™ EXT grades

(For reference only. Retention ratings may vary depending on use applications.)





Zeta Plus™ Encapsulated System

Innovative capsule/manifold design

Two capsule sizes are available, a small or a large capsule which can be used with the Zeta Plus Encapsulated System. The small capsule is designed for use with the small and medium holders in lab- and pilot-scale production and scale-up studies. It has 0.23 m² filtration area and it accommodates both single-layer and double-layer Zeta Plus filter media. The larger capsule is designed for use with all three holders. It accommodates 1.6 m² double-layer media or 2.5 m² single-layer media.

The larger capsule has a self guiding locking mechanism for a fast, easy and robust capsule-to-capsule connection and a solid core design that eliminates the need for stainless steel bands and centre post. In addition, this capsule also has two handles for convenient loading and unloading and a low capsule fill volume and post-blown down hold-up volume.

The capsule plastic shells are available in two different materials for a broad range of applications. The standard capsules use polycarbonate, thus have the translucent plastic shells that enables easy liquid level detection. The alkaline resistant capsules use polyphenylene/polystyrene which can be used in applications where NaOH is required for sanitisation. Correspondingly, the single use top and bottom manifolds are also available in these two materials. The manifold set ensures the entire filtration process is fast, easy and clean. An extra pair of manifolds is required to perform two-stage filtration within one holder assembly. Full operating instructions are provided with each system.

Top
Manifold



Bottom
Manifold



Small 0.23 m²
Capsule
(with double-layer or
single-layer media)



Large Capsule
• 1.6 m² with double-
layer media
• 2.5 m² with single-
layer media



Zeta Plus™ cartridge and capsule family



Figure 3:
16EZB holder with mechanical polish finish



Figure 4:
Zeta Plus™ Scale-Up capsules



Features and benefits

Zeta Plus™ Scale-Up capsules:

Translucency

- Easy detection of the liquid level inside

Capsule design

- Stand-alone unit
- Easy-to-use
- Ease to vent to remove air

Stackable

- In parallel and in sequence
- Reduced bench space

Minimal hold-up volume

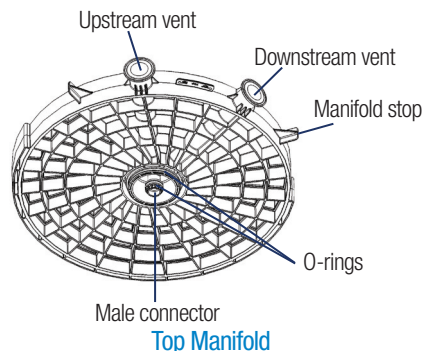
- Improved product yield

Zeta Plus™

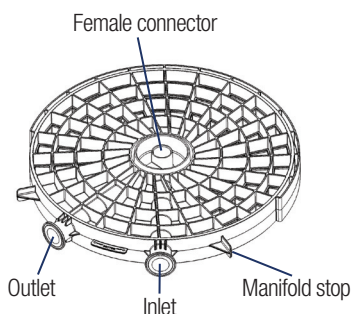
- Full range of double-layer EXT and single-layer media for your applications



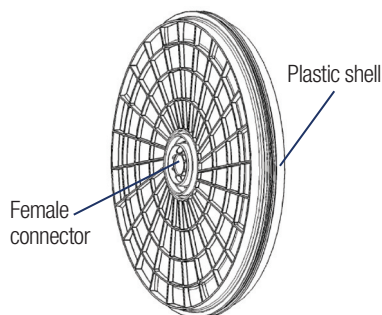
Figure 5: Single-use manifold and capsule filter schematics



Top Manifold

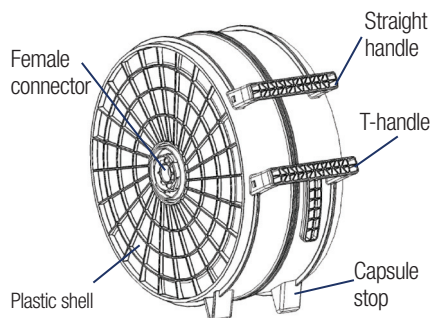


Bottom Manifold



E16 Single-Cell Capsule

0.23 m² capsule with double-layer or single-layer media



1.6 m² Capsule

1.6 m² capsule with double-layer media
2.5 m² capsule with single-layer media

Scalability

The Zeta Plus Encapsulated System retains the lenticular filter design and vertical flow path that are characteristics of traditional depth filtration systems, helping ensure consistent performance from bench-scale to production scale and from traditional non-disposable to disposable systems.

Four different surface area disposable scale-up devices are available for media grade selection and filter sizing. The BC25 capsule with 25 cm² filter is ideal for media grade screening. The scale-up capsule filters with 170 cm², 340 cm² and 1020 cm² are designed for intermediate scale-up studies and lab-scale protein production. Combined with these small-scale devices, the Zeta Plus Encapsulated System offers a completely single-use solution to process from 0.5 litre to over 5000 litres of liquid.

Table 2a: Zeta Plus™ Encapsulated System capsule filter and manifold specifications

Filter capsules	Configuration			
	Small capsule		Large capsule	
	Standard	Alkaline resistant ¹	Standard	Alkaline resistant ¹
Dimensions (height x diameter)	5.7 cm x 45.2 cm		20.3 cm x 45.2 cm	
Weight				
	Dry	3.3 kg	3.4 kg	10.0 kg
	Wet post blow-down	4.4 kg	4.8 kg	19.3 kg
Materials of construction				
Filter media	Filter aids, cellulose, binding resin		Filter aids, cellulose, binding resin	
Outer shell	Polycarbonate	Polyphenylene / Polystyrene	Polycarbonate	Polyphenylene / Polystyrene
O-rings	Silicone		Silicone	
Separators, spacers and connectors	Polypropylene		Polypropylene	
Edge seals	Thermoplastic elastomer		Thermoplastic elastomer	
Handles	N/A		Nylon	
Hold-up volume				
Capsule fill volume ²	Double layer	~ 1.1 litre		~ 5.2 litre
	Single layer	~ 2.6 litre		~ 4.2 litre
Post blow-down hold-up volume ³		< 100 ml		< 100 ml
Maximum operating line pressure		3.4 bar		3.4 bar
Maximum differential pressure forward		2.4 bar		2.4 bar
Sterilisation		1 cycle autoclave (30 min.) at 126 °C		1 cycle autoclave (30 min.) at 126 °C
Effective filtration area		0.23 m ²		Double layer: 1.6 m ² Single layer: 2.5 m ²
Top/Bottom manifold				
Dimensions (height x diameter)		5.2 cm x 45.2 cm		5.2 cm x 45.2 cm
Connector		1.5" sanitary style		1.5" sanitary style
Material	Polycarbonate	Polyphenylene / Polystyrene	Polycarbonate	Polyphenylene / Polystyrene
Weight	4.5 kg	4.5 kg	4.5 kg	4.5 kg
Hold-up volume		< 250 ml		< 250 ml

¹ Based on testing with 1M NaOH and 5% NaClO (Bleach). See Chemical Compatibility Guide for more information.

² Capsule fill volume is defined as the volume of liquid that is required to fill the portion of the capsule outside the filter media.

³ Post blown-down hold-up volume is defined as the volume of the residual liquid after nitrogen gas blown-down.

Table 2b: Zeta Plus™ Scale-Up Capsule specifications

Filter Capsules		Configuration		
		170 cm ²	340 cm ²	1020 cm ²
Dimensions				
Height x diameter		10.3 cm x 21.6 cm		15.2 cm x 21.6 cm
Weight				
Dry	Single layer	1.0 kg	1.0 kg	1.4 kg
	Double layer	1.0 kg	1.0 kg	1.6 kg
Wet post blow-down	Single layer	1.1 kg	1.1 kg	1.8 kg
	Double layer	1.2 kg	1.3 kg	2.4 kg
Materials of construction				
Capsule shells		Polysulfone		
Separator, spacer and vent cap		Polypropylene		
O-ring		Fluorocarbon		
End cap and edge seals		Thermoplastic elastomer		
Volume				
Capsule fill volume ¹	Single layer	0.48 litre	0.40 litre	0.91 litre
	Double layer	0.43 litre	0.34 litre	0.62 litre
Post blow-down hold-up volume ²	Single layer	< 40 ml	< 40 ml	< 40 ml
	Double layer	< 40 ml	< 40 ml	< 40 ml
Other				
Sterilisation		1 cycle autoclave (30 min.) at 126 °C		
Effective filtration area		170 cm ²	340 cm ²	1020 cm ²
Connector		1/2" sanitary style		
¹ Capsule fill volume is defined as the volume of liquid that is required to fill the portion of the capsule outside the filter media. ² Post blown-down hold-up volume is defined as the volume of the residual liquid after nitrogen gas blown-down. IMPORTANT NOTICE: Always operate the filter system within the maximum differential pressure of 2.4 bar.				

Figure 7: Scale-Up Capsule filter schematics

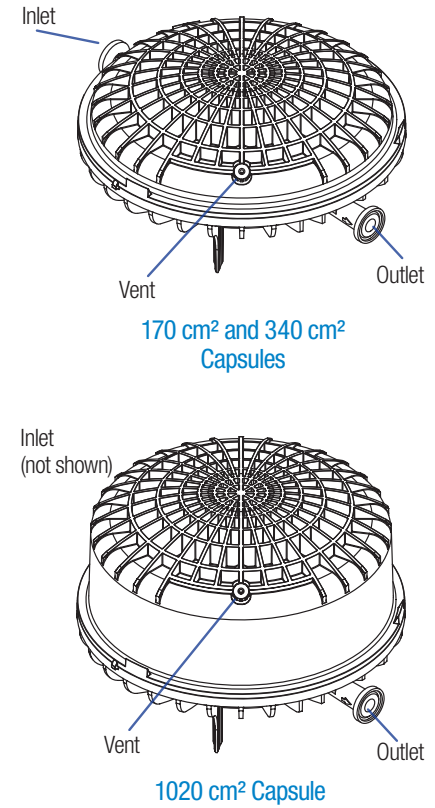


Figure 6: The Zeta Plus™ single-use depth filtration product portfolio

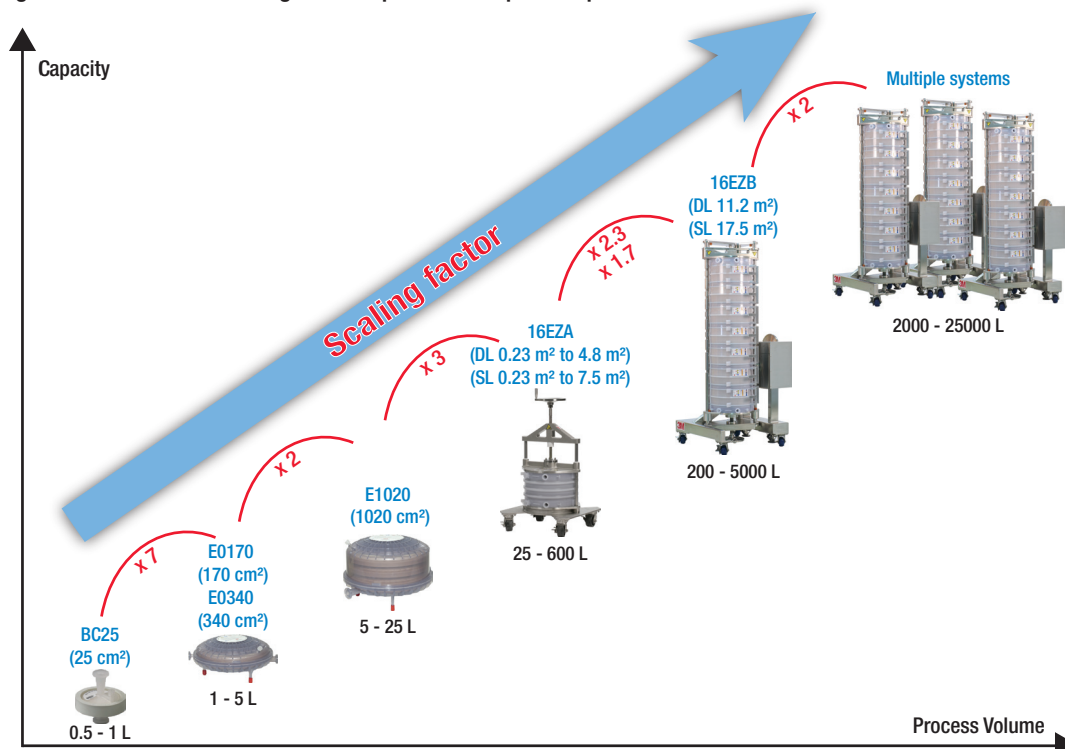




Table 3: Zeta Plus Encapsulated System holder capacity

Model	Single stage	
	E16 Single-cell capsule	E16 Multi-cell capsule
16 EZA	4	1
16 EZB	N/A	7
Model	Two-stage	
	E16 Single-cell capsule	E16 Multi-cell capsule
16 EZA	2	N/A
16 EZB	N/A	6

Table 4: Zeta Plus™ Encapsulated System holder specifications

	Holder model	
	Small and medium holders (Model 16EZA)	Large holder (Model 16EZB)
Maximum operating pressure	3.4 bar	3.4 bar
Materials of construction		
Frame	304 stainless steel	304 stainless steel
End plate	304 stainless steel	304 stainless steel
Support rods	440 stainless steel	316 stainless steel
Stand	304 stainless steel	304 stainless steel
Hand wheels	300 Series stainless steel	300 Series stainless steel
Gear box	N/A	Epoxy-coated cast iron cover
Locking bar	N/A	304 stainless steel
Casters	Stainless steel	Stainless steel
Wheels	Phenolic	Polyurethane
Surface finish		
Standard	1.0 µm	1.6 µm

Figure 8: Small and medium holders (model 16EZA) dimensions

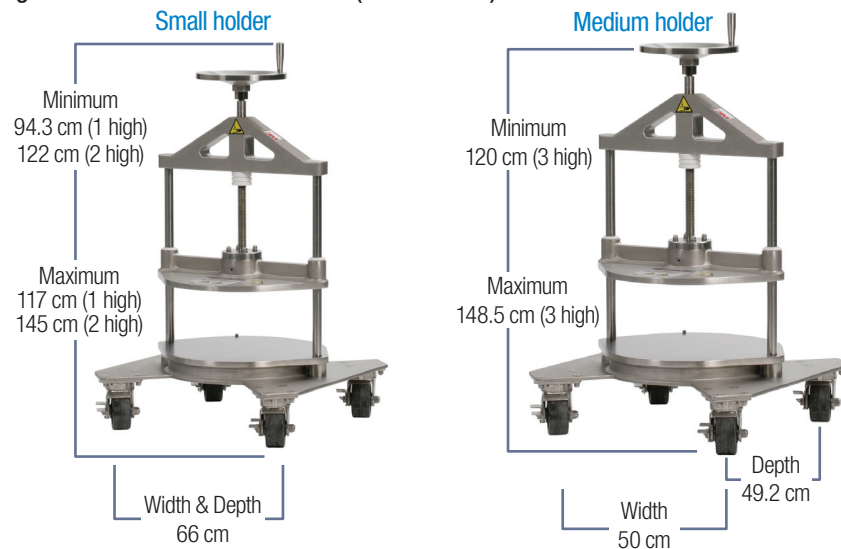
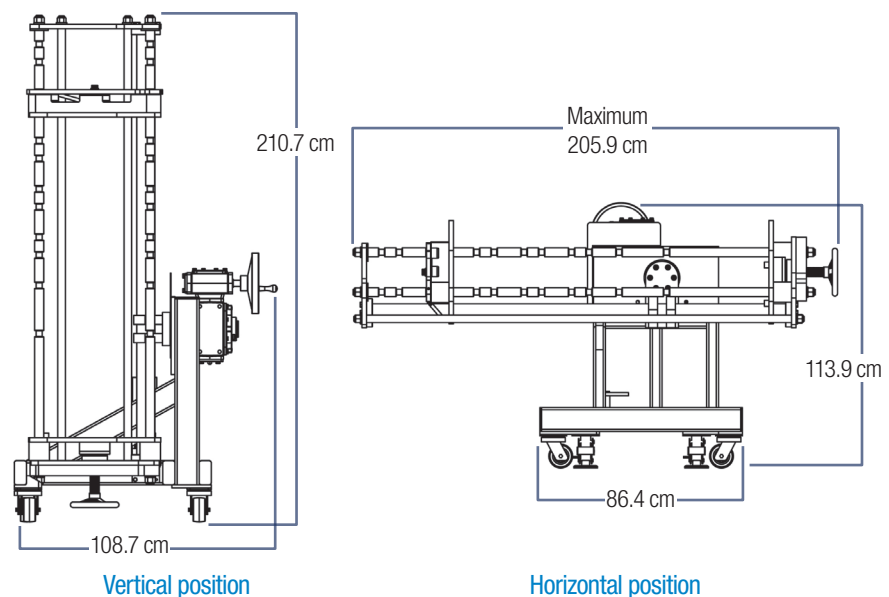


Figure 9: Large holder (model 16EZB) dimensions



Zeta Plus™ Encapsulated System - Ordering guide

A-1. Double-layer capsule filter description information

Catalogue number	Configuration	Number of cells	Gasket material	Grade		
E16	E - Standard R - Alkaline resistant*	01 - 1 Cell 07 - 7 Cell	A - Silicone	05SP01A	60ZA05A	90ZA08A
				10SP01A	60SP02A	120ZA08A
				10SP02A	90SP05A	DEL108A
				30SP02A	90ZA05A	

A-2. Single-layer capsule filter description information

Catalogue number	Configuration	Number of cells	Gasket material	Grade		
E16	E - Standard R - Alkaline resistant*	01 - 1 Cell 11 - 11 Cell	A - Silicone	30LA	30LP	DEL1
				50LA	50LP	
					60LP	
					90LP	

NOTES:

1. All Zeta Plus™ EXT grades are available for order.
2. For further information regarding Zeta Plus™ EXT Series filter media, please contact your local 3M Purification representative.
3. DEL108A is a Zeta Plus™ EXT grade with two single layers of Delipid (DEL1) media.
4. Single layer 05SP media is offered in 0.23 m² and 1.6 m² Capsule format. One part number example is E16E07A05SP.

A-3. Double-layer scale-up capsule filter description information

Catalogue number	Filter area	Material code	Grade			
E	0170	FSA	05SP01A	30SP02A	90SP05A	DELI08A
	0340		10SP01A	60SP02A	90ZA05A	DELP08A
	1020		10SP02A	60ZA05A	120ZA08A	

A-4. Single-layer scale-up capsule filter description information

Catalogue number	Filter area	Material code	Grade		
E	0170	FSA	30LA	30LP	DELI
	0340		50LA	60LP	
	1020			90LP	

B. Disposable manifold ordering information

Manifold part	3M ID number
Manifold set (Standard)	70020256221
Manifold set (Alkaline resistant*)	70020262369

* Based on testing with 1M NaOH and 5% NaClO (Bleach).
Ask for Chemical Compatibility Guide for more information.

C. Hardware (filter holder) ordering information

Model name	Description	3M ID number
16EZA	Small holder	70020233048
16EZA	Medium holder	70020283944
16EZB	Large holder	70020274455
N/A	Small holder spacer	FD999144960
N/A	Autoclave adaptor	70020296151



A-1a. Double-layer standard capsule filter ordering information

Single-cell capsules		Multi-cell capsules	
Product description	3M ID number	Product description	3M ID number
E16E01A05SP01A	70020239011	E16E07A05SP01A	70020236918
E16E01A10SP02A	70020239029	E16E07A10SP02A	70020236561
E16E01A120ZA08A	70020238526	E16E07A120ZA08A	70020236926
E16E01A30SP02A	70020238534	E16E07A30SP02A	70020236942
E16E01A60SP02A	70020239078	E16E07A60SP02A	70020236603
E16E01A60ZA05A	70020238542	E16E07A60ZA05A	70020236967
E16E01A90ZA08A	70020238559	E16E07A90ZA08A	70020236983
E16E01A90SP05A	70020239102	E16E07A90SP05A	70020236629
E16E01A90ZA05A	70020238559	E16E07A90ZA05A	70020236975

A-1b. Alkaline resistant* double-layer capsule filter ordering information

Single-cell capsules		Multi-cell capsules	
Product description	3M ID number	Product description	3M ID number
E16R01A05SP01A	70020262609	E16R07A05SP01A	70020262740
E16R01A10SP02A	70020262625	E16R07A10SP02A	70020262757
E16R01A120ZA08A	70020262641	E16R07A120ZA08A	70020262773
E16R01A30SP02A	70020262948	E16R07A30SP02A	70020262799
E16R01A60SP02A	70020262682	E16R07A60SP02A	70020262823
E16R01A60ZA05A	70020262708	E16R07A60ZA05A	70020262856
E16R01A90ZA08A	70020262732	E16R07A90ZA08A	70020262898
E16R01A90SP05A	70020262716	E16R07A90SP05A	70020262864
E16R01A90ZA05A	70020262963	E16R07A90ZA05A	70020262880



A-2a. Single-layer standard capsule filter ordering information

Single-cell capsules		Multi-cell capsules	
Product description	3M ID number	Product description	3M ID number
E16E01A30LA	70020288430	E16E11A30LA	70020288604
E16E01A30LP	70020288448	E16E11A30LP	70020288612
E16E01A50LA	70020288471	E16E11A50LA	70020288646
E16E01A50LP	70020288489	E16E11A50LP	70020288653
E16E01A60LP	70020288505	E16E11A60LP	70020288687
E16E01A90LP	70020288539	E16E11A90LP	70020288729
E16E01ADELI	70020256130	E16E11ADELI	70020288588

A-2b. Alkaline resistant* single-layer capsule filter ordering information

Single-cell capsules		Multi-cell capsules	
Product description	3M ID number	Product description	3M ID number
E16R01A30LA	70020288802	E16R11A30LA	70020289032
E16R01A30LP	70020288810	E16R11A30LP	70020289040
E16R01A50LA	70020288836	E16R11A50LA	70020289073
E16R01A50LP	70020288844	E16R11A50LP	70020289081
E16R01A60LP	70020288877	E16R11A60LP	70020289115
E16R01A90LP	70020288901	E16R11A90LP	70020289156
E16R01ADELI	70020288786	E16R11ADELI	70020289016

* Based on testing with 1M NaOH and 5% NaClO (Bleach). Ask for Chemical Compatibility Guide for more information.



A- 170 cm² Scale-up capsule filter ordering information

3a. Double-layer capsules	
Description	ID number
E0170FSA05SP01A	70020290170
E0170FSA10SP01A	70020290196
E0170FSA10SP02A	70020290204
E0170FSA30SP02A	70020290279
E0170FSA60SP02A	70020290378
E0170FSA90SP05A	70020290451
E0170FSA60ZA05A	70020290410
E0170FSA90ZA05A	70020290485
E0170FSA120ZA08A	70020290220
E0170FSADELI08A	70020290147
E0170FSADELP08A	70020290154

4a. Single-layer capsules	
Description	ID number
E0170FSA30LA	70020290246
E0170FSA50LA	70020290303
E0170FSA30LP	70020290253
E0170FSA60LP	70020290345
E0170FSA90LP	70020290436
E0170FSADELI	70020290139

A- 340 cm² Scale-up capsule filter ordering information

3b. Double-layer capsules	
Description	ID number
E0340FSA05SP01A	70020290543
E0340FSA10SP01A	70020290568
E0340FSA10SP02A	70020290576
E0340FSA30SP02A	70020290642
E0340FSA60SP02A	70020290741
E0340FSA90SP05A	70020290824
E0340FSA60ZA05A	70020290782
E0340FSA90ZA05A	70020290857
E0340FSA120ZA08A	70020290592
E0340FSADELI08A	70020290519
E0340FSADELP08A	70020290527

4b. Single-layer Capsules	
Description	ID number
E0340FSA30LA	70020290618
E0340FSA50LA	70020290675
E0340FSA30LP	70020290626
E0340FSA60LP	70020290717
E0340FSA90LP	70020290808
E0340FSADELI	70020290501

A- 1020 cm² Scale-up capsule filter ordering information

3c. Double-layer capsules	
Description	ID number
E01020FSA05SP01A	70020290915
E01020FSA10SP01A	70020290931
E01020FSA10SP02A	70020290949
E01020FSA30SP02A	70020291012
E01020FSA60SP02A	70020291111
E01020FSA90SP05A	70020291194
E01020FSA60ZA05A	70020291152
E01020FSA90ZA05A	70020291228
E01020FSA120ZA08A	70020290964
E01020FSADELI08A	70020290881
E01020FSADELP08A	70020290899

4c. Single-layer capsules	
Description	ID number
E01020FSA30LA	70020290980
E01020FSA50LA	70020291046
E01020FSA30LP	70020290998
E01020FSA60LP	70020291087
E01020FSA90LP	70020291178
E01020FSADELI	70020290873



Zeta Plus™ Encapsulated Depth Filter Platform - Scalability

Lab and R&D	Scale-Up	Pilot production	Large-scale production
Up to 1 litre	Up to 50 litres	Up to 400 litres	Up to 5000 litres



Important Notice

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**3M United Kingdom plc
3M Purification**

3M Centre, Cain Road
Bracknell, RG12 8HT
United Kingdom
Tel.: +44 (0)845 602 5237
Fax: +44 (0)1344 858559
E-mail: purification.uk@mmm.com

For more contact addresses visit our website www.3M.eu/purification.

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