# Clarification Portfolio Guide

Single and multi-use products for the successful development and implementation of robust clarification processes

MilliporeSigma is the U.S. and Canada Life Science business of Merck KGaA, Darmstadt, Germany.

Millipore®

Expert Pharm/BioPharm Products & CTDMO Services

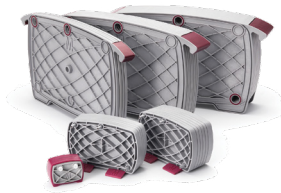
## Single-use

### Millistak+® and Millistak+® HC Pro Depth Filters

Available in a wide range of media grades and device formats in both single and multi-layer configurations for primary and secondary clarification applications, including mammalian cell culture, yeast, inclusion body refolds, vaccines and plasma proteins.

### Clarisolve® Depth Filters

Available in a variety of media grades and device formats. Developed to address the needs of challenging high cell density mammalian feed streams where pretreatment, including pDADMAC polymer flocculation, is implemented.



### Polygard® and Clarigard® Capsule Filters

Available in a variety of media grades and device formats. Designed for clarification and pre-filtration of liquids and gases in pharmaceutical, biological, fine chemical and industrial applications.

### Polysep™ II Pre-filters*

Combining the dirt-holding capacity of a depth filter with the retention efficiency of a membrane filter, Polysep™ II filters provide multiple filtration stages in a single, compact configuration for critical prefiltration applications.

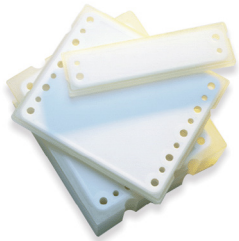
## Multi-use

### Prostak™ Open-channel Modules*

Tangential flow stacked plate membrane devices with open feed channels for convenient and economical clarification and concentration applications.

### Pellicon® 2 Cassettes*

High-performance tangential flow filters for biopharmaceutical process development, scale-up/ scale-down and concentration, purification, cell harvesting applications.



* For information on Polysep™ II pre-filters, Prostak™ modules, or Pellicon® cassettes, please reference the data sheet available at SigmaAldrich.com or contact your local sales representative.

# Millistak+® and Clarisolve® Depth Filters

Depth filters are proven technology that can be used in a broad range of applications at many different process steps. These depth filters remove particles, protect downstream unit operations and can improve capacity of sterilizing-grade filters.

## Millistak+® HC Pro Series (Synthetic High Capacity)

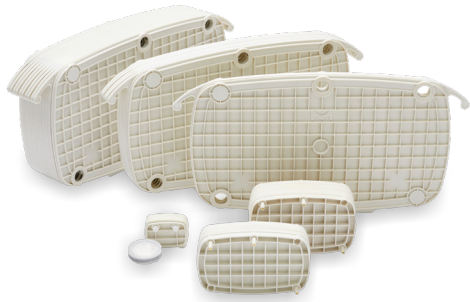
A family of synthetic depth filters in modular Pod format that provides a cleaner and more consistent depth filtration media over current diatomaceous earth (DE) and cellulose (CE) based filter media. Multiple media grades are available for primary and secondary clarification, as well as for applications further downstream.

## Millistak+® DE Series (Diatomaceous Earth)

Composed of select grade cellulose fiber and DE, which increases contaminant retention. Available in grades ranging from DE 25–75 in 12 in. and 16 in. lenticular disc and modular Pod formats. This media series is suitable for primary or secondary clarification.

## Millistak+® CE Series (Cellulose)

Composed of a single-layer media with cellulose fibers that are suitable for coarse filtration applications such as primary clarification. Available in grades ranging from CE 15–50 in both 12 in. and 16 in. lenticular disc and modular Pod formats.



## Millistak+® HC Series (High Capacity)

Two layers of diatomaceous earth or cellulose media enable improved productivity with enhanced filter capacity. These filters are ideal for primary clarification of cell culture harvest as multiple filtration stages are compressed into one efficient step. Several grades are available for a variety of applications in both 12 in. and 16 in. lenticular disc and modular Pod format.

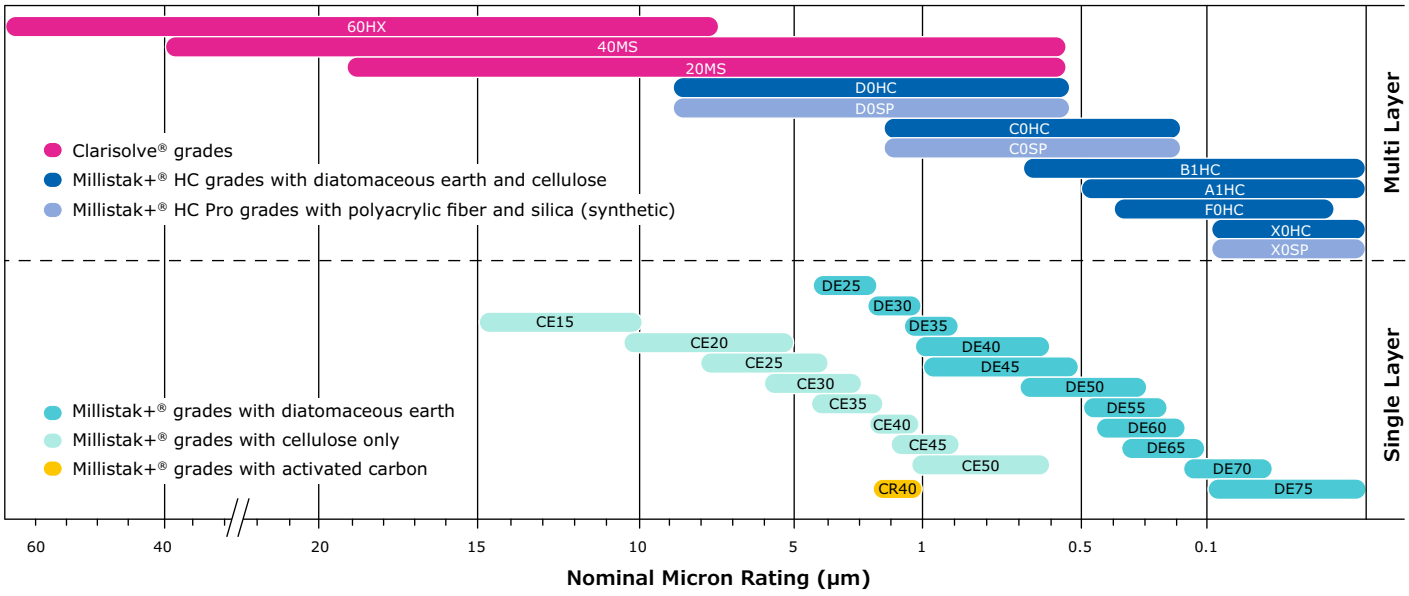
## Millistak+® CR40 Filters

Formulated with activated carbon retained in a rigid structure by a cellulose matrix, creating a tortuous flow path that maximizes impurity contact with the surface and pores of the activated carbon for optimum impurity adsorption. These modular Pod format filters are utilized for the removal of color and trace contaminants, and to reduce HCP and other impurities in Protein A elution pools.

## Clarisolve® Depth Filters

Developed to address the needs of challenging high cell density feed streams where pretreatment is being implemented. These modular Pod format filters are available in three distinct grades designed for different pretreatment methodologies including polymer flocculation and acid precipitation.

# Media Grades



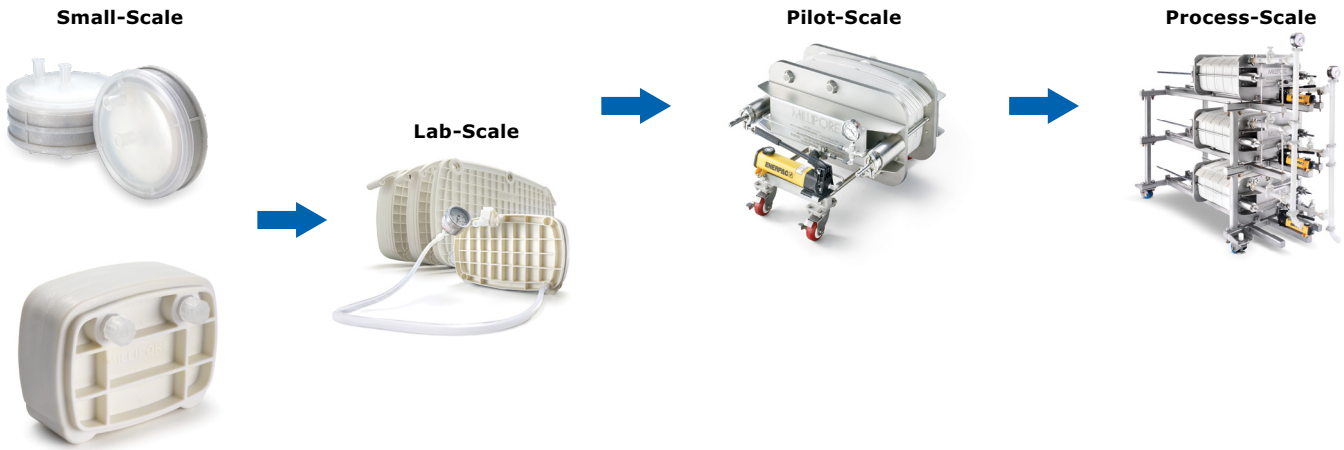

| | | Target Step | Media Grade |
|---|---|---|---|
| Clarisolve® | Pre-treated Feed – High Cell Density | Single stage clarification of mAb pre-treated feed streams with particle size distribution of 60 µm. Utility in some bacterial, viral and polysaccharide vaccine applications. | **60HX** |
| | | Single stage clarification of mAb pre-treated feed streams with particle size distribution of 40 µm (as produced by cationic polymers such as pDADMAC). Utility in some bacterial and viral vaccine applications. | **40MS** |
| | | Single stage clarification of mAb pre-treated feed streams with particle size distribution of 20 µm (as produced by acid precipitation). Utility in some bacterial and viral vaccine applications. | **20MS** |
| Millistak+®, Millistak+® HC, Millistak+® HC Pro | Primary Clarification | Primary clarification. In some cases, can be used as a single stage clarification step going directly onto a membrane filter. | **C0HC**<br>**C0SP (synthetic)** |
| | | Primary (coarse) clarification for products that bind to silica or strong +ve charges. | **CE** |
| | | Primary clarification. | **D0HC**<br>**D0SP (synthetic)** |
| | | Primary or secondary clarification. | **DE** |
| | Secondary Clarification | Secondary clarification post depth filtration or centrifugation. Can also be utilized in downstream processing steps to protect chromatography columns. | **X0HC**<br>**X0SP (synthetic)** |
| | DSP | CR40 for removal of small molecular weight impurities and phenolic/aromatic chemicals.<br>X0SP for effective removal of aggregates post viral inactivation or before virus filtration. | **Carbon (AC) CR40**<br>**X0SP (synthetic)** |

# Device Formats

## Pod Filter Systems (Millistak+®, Millistak+® HC, Millistak+® HC Pro and Clarisolve®)

The pod filter system is a single-use, modular format designed for linear scalability from laboratory to process scale. The system's holder design makes it easy to configure for a specific application and quickly reconfigure to scale up or down as capacity requirements change. This flexible format offers scalability to 12,000 L process volume.

- Patented, single use design provides flexibility and eliminates the need for CIP or cleaning validation.
- Enables use of multiple grades in a single holder.
- Smaller footprint.




## Lenticular Discs (Millistak+® media only)

The Millistak+® 16 in. lenticular format is available in multiple stacked-cell configurations for installation into steel housings.

- Full range of Millistak+® and Millistak+® HC media available.
- Capable of sterile operations via steam-in-place.

The Millistak+® 316L stainless steel filter housings are designed for high-capacity liquid clarification. The housings' versatile design and a wide offering of accessories allow users to operate the system with as few as one or as many as eight stacked cartridges installed. These options make it easy to configure for a specific application and conveniently reconfigure it as process capacity requirements scale-up or down.

# Polygard® and Clarigard® Filter Media

Polygard® and Clarigard® filter media are available in a broad range of micron ratings to match an array of particle removal applications. These versatile, multi-use filters can be utilized in pharmaceutical, biological, fine chemical and industrial applications.

## Polygard® CR Series

Nominally rated filters designed for particle removal applications in liquids and gases. The graded-density depth structure of Polygard® CR filter media provides maximum filtration capacity, and the all-polypropylene construction offers low extractable levels and broad chemical compatibility. Available in pore sizes ranging from 0.1 µm to 100.0 µm.

## Polygard® CN Series

Nominally rated filters designed for particle removal applications in liquids and gases. The pleated structure of Polygard® CN filter media minimizes pressure differentials during the filtration process, and the all-polypropylene construction offers low extractable levels and broad chemical compatibility. Downstream filter performance is enhanced due to efficient particle and microorganism reduction. Available in pore sizes ranging from 0.3 µm to 30.0 µm.

## Polysep™ II

Composed of a glass fiber (Lifegard®) primary layer over a cellulose acetate (Milligard®) surface membrane. Designed for plugging, viscous or challenging feedstreams, particularly those heavy in colloids like certain vaccines. Available in pore sizes ranging from 0.1 µm to 2 µm.

## Clarigard® Series

Composed of graded-density polypropylene for clarification and pre-filtration of process fluids. The 99.99% retention characteristic makes them ideal for the protection of critical downstream process steps such as membrane filters or chromatography columns. The graded-density depth structure provides maximum filtration capacity, and the polypropylene construction offers low extractable levels and broad chemical compatibility. Available in pore sizes ranging from 0.2 µm to 3.0 µm.

# Device Formats

A wide range of filter formats and sizes are available to fit all your application needs for easy scale-up of your small-volume filtration steps to larger, process-scale filtration processes.

## OptiScale® Capsule Filters

A convenient, small-volume, “drop in” filters for process development and screening. These devices support speed-to-market strategies for efficiently developing compounds and biotherapeutics. OptiScale® capsules are faster and easier to set up than conventional 47 mm discs.

## Small-Scale Capsule Filters

Available as a selection tool when evaluating several media configurations to clarify process fluids. These devices have been developed to minimize hold-up volume when screening these multiple media configurations.



## Cartridge Filters

Robust, strong, resilient cartridge filters designed to withstand multiple steam-in-place cycles. A full range of filter sizes are available to suit your application requirements. A variety of connection options are offered for easy adaptation to existing housings.

## Opticap® XL Capsule Filters

Available in multiple filtration sizes, providing an optimal choice for every application. The patented Opticap® XL capsule design allows unparalleled thermal and hydraulic stress resistance in an autoclavable disposable filter, resulting in reliability and high confidence in the sterility process, as well as improved cleanliness. The unique capsule design also minimizes hold-up volume and reduces production losses.

| | OptiScale® Capsule Filters | Small-Scale Capsule Filters | Cartridge Filters | Opticap® XL Capsule Filters |
|---|---|---|---|---|
| Polygard® CR filter media | | ● | ● | ● |
| Polygard® CN filter media | ● | | ● | ● |
| PolySep™ II filter media | ● | | ● | ● |
| Clarigard® filter media | | ● | ● | ● |

# Clarification Selection Guide for Monoclonal Antibodies, Recombinant Proteins, and Fc-fusion Proteins

The following decision trees are focused on batch and fed-batch feeding strategies for mammalian cell bioreactors. The selection matrices are created for reference only, based on historical experience and process development data.

The decision trees cover direct harvest, pretreatment, and centrifugation at various scales. The following information should be considered as general guidance and it is highly recommended that performance should be confirmed by experimental studies before implementation.

- Primary direct harvest: Bioreactor volume <2,000 L.
- Centrifugation: Bioreactor volume >2,000 L.
- Pretreatment: Appropriate for high cell density material (>$10^7$ cells/mL) or for cell lines that are challenging to clarify like CHO DG44. Requires a specialized Clarisolve® filter post-pretreatment.

## Direct Harvest and Clarification of Cell Culture Media

Monoclonal antibodies, recombinant proteins, and Fc-fusion proteins behave similarly with respect to capacity. If product yield is an issue, reach out to your local Account Manager or Process Development Specialist.

For mAb, recombinant and fusion proteins, there is a clear recommendation for direct harvest.

Most high producing feeds will rapidly foul any depth filter capable of generating a filtrate suitable for membrane filtration. Consequently, two stage depth filtration using a coarse, followed by a fine, depth filter is recommended.

* Process Cost and Facility Considerations in the Selection of Primary Cell Culture Clarification Technology, Felo et al., Biotechnol. Prog., 2013, Vol. 29, No. 5.

| Cell Density | | Low (≤$10^7$ cells/mL) | | | |
|---|---|---|---|---|---|
| Cell Viability | | Low Viability | | High Viability | |
| Depth Filter Train | | Two-stage | | Two-stage | |
| Millistak+® Media Grade | | HC Pro D0SP/X0SP† | D0HC/X0HC | HC Pro D0SP/X0SP† | D0HC/X0HC |
| Approx. Expected Filter Loading Capacity | | D0SP: 240 L/m² X0SP: 120 L/m² | D0HC: 120 L/m² X0HC: 120 L/m² | D0SP: 120 L/m² X0SP: 250 L/m² | D0HC:120 L/m² X0HC: 250 L/m² |
| Scale‡ | 1 L |  | Micro-20 or µPod® device format | | |
| | 10 L |  | Lab-scale Pod (LSP) device format | | |
| | 100 L<br>1,000 L<br>2,000 L |  | Process-scale Pod (PSP) device format | | |
| | 2,000 L+ | See centrifuge | | | |

| Cell Density | | High (>$10^7$ cells/mL) | | | |
|---|---|---|---|---|---|
| Cell Viability | | Low Viability | | High Viability | |
| Depth Filter Train | | Two-stage | | Two-stage | |
| Millistak+® Media Grade | | HC Pro D0SP/X0SP† | C0HC/X0HC | HC Pro D0SP/X0SP† | D0HC/X0HC |
| Approx. Expected Filter Loading Capacity | | C0SP: 100 L/m² X0SP: 120 L/m² | C0HC: 50 L/m² X0HC: 120 L/m² | D0SP: 140 L/m² X0SP: 150 L/m² | D0HC: 70 L/m² X0HC: 150 L/m² |
| Scale‡ | 1 L |  | Micro-20 device format | | |
| | 10 L |  | Lab-scale Pod (LSP) device format | | |
| | 100 L<br>1,000 L<br>2,000 L |  | Process-scale Pod (PSP) device format | | |
| | 2,000 L+ | See centrifuge | | | |

Recovery should be considered during the small-scale tests. Low-titer feeds historically have slightly lower recovery values. This could be due to low levels of binding, hold-up volume losses during recovery (blow-down or buffer flush), and/or dilution from pre-use flushing and post-use recovery.

Filter choices marked in blue are the primary recommendations for this application.

Cell density is a critical parameter in the consideration for filter selection and capacity. High-cell-density cultures contain a high level of cells and with that cell debris, both soluble and insoluble. When the viability is high, most of the cells are intact and the particle size distribution shifts towards larger particles. When the viability is low, the particle size shifts towards the smaller particles and insoluble (unmeasured) particles.

Process scales are typically 1 L – 20,000 L bioreactor volume. Direct harvest is economically practical and feasible for manufacturing, depending on the cell density, up to approximately 2,000 L. Centrifuge is recommended at scales ≥2,000 L for direct harvest.

† As a general guideline, the filter loadings for Millistak+® HC Pro Media grades (D0SP and C0SP only) are at least double (2X) the equivalent Millistak+® HC D0HC and C0HC grades. The X0 grades for both have similar filter loadings.

## High Cell Density

High cell density mammalian cell culture harvests can result in low capacity and high levels of breakthrough using standard clarification approaches. By pretreating high density cell harvest material with novel chemical flocculants or acid, the efficiency of clarification over Clarisolve® depth filters can be markedly improved. Pretreatment, via flocculation or precipitation, is recommended at cell densities greater than or equal to $10^7$ cells/mL. However, flocculation can be implemented at any cell density if the process requires such a step. The type of pretreatment and dosing requirements (e.g., pH adjustment, polymer addition) depends on the cell culture and product characteristics. The Clarisolve® family of filters can effectively separate impurities from high-cell-density pretreated feed streams; filter grade selection will be determined by the type of pretreatment and particle size distribution of the feed stream. pDADMAC residual quantitation services (VSPDADMAC) are available to support process validation.

| **Cell Density** | **$10^7$ cells/mL (volumes ≤2,000 L)** | |
|---|---|---|
| | ↓ **Acid treatment** | ↓ **pDADMAC cationic polymer** |
| Clarisolve® 20MS* filter | 1st choice | 2nd choice |
| Clarisolve® 40MS* filter | 2nd choice | 1st choice |
| Clarisolve® 60HX* filter | — | 3rd choice |

* If the filtrate turbidity is greater than 15–20 NTU or sterile filter filtration area does not meet your target directly after the primary depth filter, consider additional polishing via Millistak+® HC Pro X0SP media.

## Centrifugation for Large Volume Processing

Centrate quality may differ depending on the cell density/viability and the centrifuge optimization/operation. Centrate turbidity is a good indicator as to which depth filter will have the highest capacity and best membrane filter protection. Pretreatment with polymer flocculation greatly improves centrifuge capacity.

| **Cell Density** | **<$10^7$ cells/mL (low) untreated** | | **or** | **>$10^7$ cells/mL (high) pretreated** | |
|---|---|---|---|---|---|
| | ↓ | | | ↓ | |
| **<2,000 L bioreactor volume** | | | | | |
| | Recommend two stage depth filtration | | | | |
| **>2,000 L** | | | | | |
| | **High centrate turbidity (>100 NTU)** | **Low centrate turbidity (<100 NTU)** | | **High centrate turbidity (>100 NTU)** | **Low centrate turbidity (<100 NTU)** |
| Millistak+® filter HC Pro X0SP | Approx. filter loading capacity 100 L/m² | Approx. filter loading capacity 300 L/m² | | Approx. filter loading capacity 100 – 200 L/m² | Approx. filter loading capacity 300 – 500 L/m² |

# Clarification Selection Guide for Non mAb Expression Systems

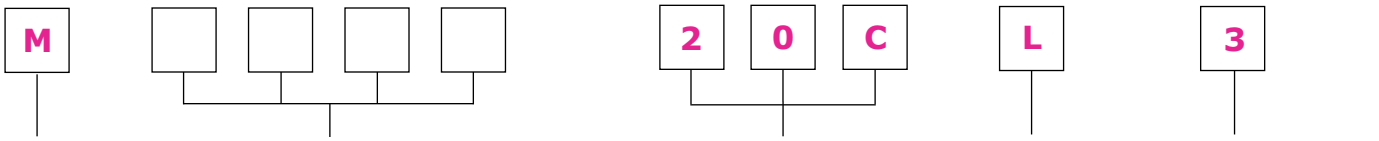
The following recommendations are focused on non mAb expression systems. These typically require more process development due to processing differences as particle size distribution can vary greatly between molecules/processes – loading capacities stated in the table below should be taken with that in mind. The recommendations are based on historical experience and data. If filtrate turbidity is greater than 15–20 NTU or membrane filtration area does not meet your target directly after the primary depth filter, consider additional polishing via Millistak+® X0SP filters.

| Expression System | Molecule Type | Application | Batch Type | Pretreatment Options/ Method of Cell Lysis | Primary Clarification | Secondary Clarification |
|---|---|---|---|---|---|---|
| Mammalian | Enzyme (binds to DE) | Harvest | Perfusion | NONE | Millistak+® CE50 | Polysep™ II 1.0/0.5 µm |
| | | | | | Polygard® CR 0.5 µm | Polysep™ II 1.0/0.5 µm |
| | Enzyme (does not bind to DE) | Harvest | Perfusion | NONE | Millistak+® C0SP | Millistak+® X0SP |
| | | | | | Millistak+® F0HC | — |
| Microbial: Bacterial | Secreted Protein | Harvest | Batch | NONE | Millistak+® C0SP | Millistak+® X0SP |
| | | | | | Prostak™ 0.22 µm or 0.1 µm | — |
| | Intracellular – Soluble | Lysate Clarification | Batch | Mechanical | Pellicon® 2 1000 kD Biomax® V-screen | — |
| | | | | | Clarisolve® 20MS | Millistak+® C0SP |
| | | | | Chemical or Enzymatic | Call Technical Service | |
| | Intracellular – Inclusion Body | Lysate Clarification/ IB Wash | Batch | Mechanical | Prostak™ MF 0.1 µm | — |
| | | | | | Pellicon® 2 1000 kD Biomax® V-screen | — |
| | | | | Chemical or Enzymatic | Call Technical Service | |
| | | Lysate Clarification/ Refold Pool | Batch | NONE | Clarisolve® 20MS | (Millistak+® X0SP – if needed)* |
| | | | | | Clarisolve® 60HX | (Millistak+® X0SP – if needed)* |
| Microbial: Yeast | Intracellular – Inclusion Body | Lysate Clarification | Batch | Mechanical | Clarisolve® 60HX | Millistak+® C0SP |
| | | | | | Pellicon® 2 1000 kD Biomax® V-screen | — |
| Vaccines | Egg-based Influenza | Centrate Clarification | Batch | NONE | Polygard® CN 5.0 µm | — |
| | | | | | Polygard® CR 5.0 µm | — |
| | Cell-based Influenza | Centrate Clarification | Batch | NONE | Clarisolve® 20MS | — |
| | | | | | Polygard® CR 5.0 or 3.0 µm | Clarigard® 1.0 or 0.5 µm |
| | AAV/AV viral vector | Lysate clarification | Batch | Chemical | Millistak+® D0SP/ C0SP | Millistak+® X0SP (if required) |
| | LV viral vector | Harvest | Batch | NONE | Millistak+® 60HX (if required) | Millistak+® CE35 |
| | pDNA | Harvest Clarification | Batch | NONE | Pellicon® 2 0.1 µm Durapore® V-screen | — |
| | | | | | Pellicon® 2 1000 kD Biomax® V-screen | — |
| | | Precipitate Clarification | Batch | NONE | Clarisolve® 60HX | — |
| | Virus-like Particle | Lysate Clarification | Batch | Mechanical | Prostak™ 0.65 µm Durapore® | — |
| | | | | | Clarisolve® 20MS | — |
| | | | | | Polygard® CN 5.0 µm | — |
| | Conjugated Polysaccharide | — | Batch | NONE | Prostak™ 0.1 µm Durapore® | — |

# Ordering Information

## Millistak+® Pod Depth Filters Screening and Scaling Devices

### Micro 20




**Millistak+® HC Filter**

**Media Type and Grade**

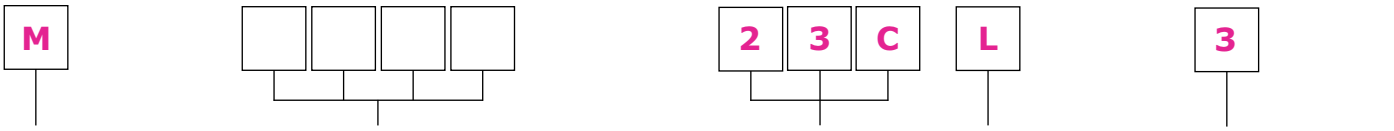
| | |
|---|---|
| C0HC | C0SP |
| D0HC | D0SP |
| X0HC | X0SP |

**Size**
20C = 20 cm²

**Connection**
L = Luer Fitting

**Package Quantity**
3 = 3/pack

### µPod® Filter




**Millistak+® depth filter**

**Media Type and Grade**

| | | | |
|---|---|---|---|
| A0HC | CE25 | CR40 | DE50 |
| A1HC | CE30 | DE25 | DE55 |
| B1HC | CE35 | DE30 | DE60 |
| F0HC | CE40 | DE35 | DE65 |
| CE15 | CE45 | DE40 | DE70 |
| CE20 | CE50 | DE45 | DE75 |

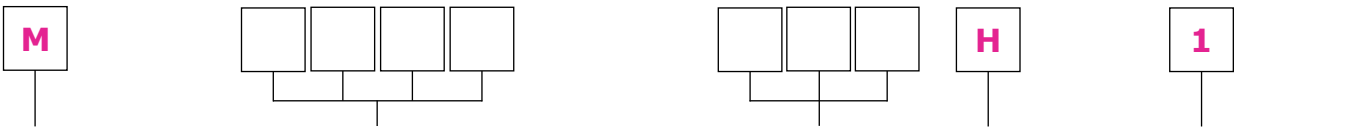
**Size**
23C = 23 cm²
micro 20

**Connection Type**
L = Luer Fitting

**Quantity per Package**
3 = 3/pack

| µPod® Filter Accessories | |
|---|---|
| µPod® Tubing Kit | **MTUBEKITL1** |
| Gauge 0–60 psi and Connection Fittings | **XXPXLGAGE** |

### Multi-layer Lab-Scale Pod Filters




**Millistak+® Filter**

**Media Type and Grade**
D0SP = Silica filter aid/polyacrylic fiber/ non-woven material
X0SP = Silica filter aid/polyacrylic fiber
C0SP = Silica filter aid/polyacrylic fiber

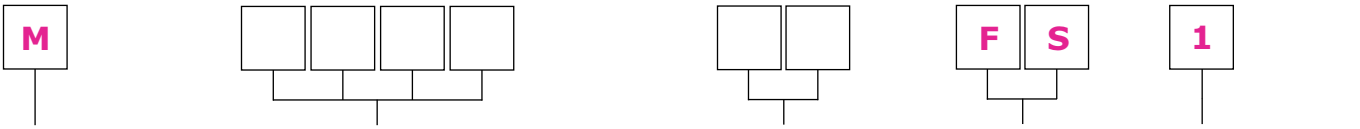
**Size**
014 = 0.0135 m² (0.15 ft²)
027 = 0.027 m² (0.29 ft²)

**Connection**
H = ¼ in. (6 mm) Hose Barb

**Package Quantity**
1 = 1/Pack

## Millistak+® HC Pro Pod Depth Filters

### Multi-layer Pilot and Process-scale Pod Filters




**Millistak+® Filter**

**Media Type and Grade**
D0SP = Silica filter aid/polyacrylic fiber/ non-woven material
X0SP = Silica filter aid/polyacrylic fiber
C0SP = Silica filter aid/polyacrylic fiber

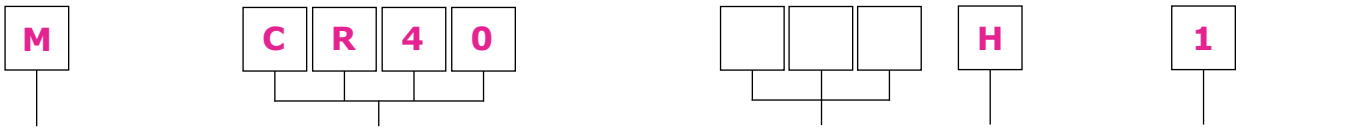
**Size**
01 = 0.11 m² (D0SP/C0SP/X0SP)
03 = 0.33 m² (D0SP/C0SP only)
05 = 0.55 m² (X0SP only)
07 = 0.77 m² (D0SP/C0SP only)
10 = 1.1 m² (X0SP only)

**Connection**
FS = Flat Seal

**Package Quantity**
1 = 1/Pack

## Millistak+® Carbon Pod Depth Filters

### Lab-Scale Pod Filters




**Millistak+®**

**Media Type and Grade**

**Size**
027 = 0.027 $m^2$
054 = 0.54 $m^2$

**Connection**
H = ¼ in. (6 mm) Hose Barb

**Package Quantity**
1 = 1/Pack

### Pilot- and Process-Scale


**Millistak+® depth filter**

**Media Type and Grade**
CR40

**Size**
01 = 0.11 $m^2$
05 = 0.55 $m^2$
10 = 1.1 $m^2$

**Connection Type**
FS1 = 1/pack

## Millistak+® Single Layer Pod Depth Filter

### Single-layer Process Scale[1]


**Millistak+® depth filter**

**Media Type and Grade**

| | | | |
|---|---|---|---|
| CE15 | CE40 | DE35 | DE60 |
| CE20 | CE45 | DE40 | DE65 |
| CE25 | CE50 | DE45 | DE70 |
| CE30 | DE25 | DE50 | DE75 |
| CE35 | DE30 | DE55 | |

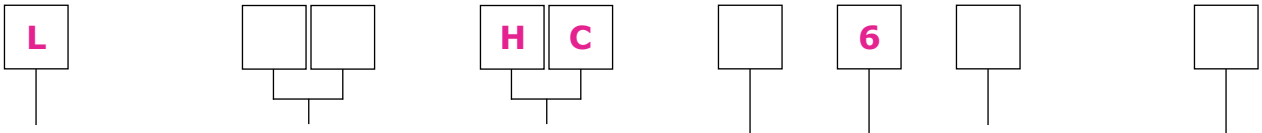
**Size**
01 = 0.11 $m^2$
07 = 0.77 $m^2$
13 = 1.4 $m^2$

**Connection Type**
FS1 = 1/pack

[1] Note: Pod filters require the use of flow adaptors, which are sold separately (MP0DADAPT or MP0DADPTF). See the Millistak+® Pod disposable depth filter hardware Data Sheet (DS3388EN00) for information on Pod filter holders.

# Millistak+® Lenticular Disc Filters

## Multi-layer




**Lenticular**

**Grade**
A1
B1
C0
D0
X0
F0

**Series**
HC

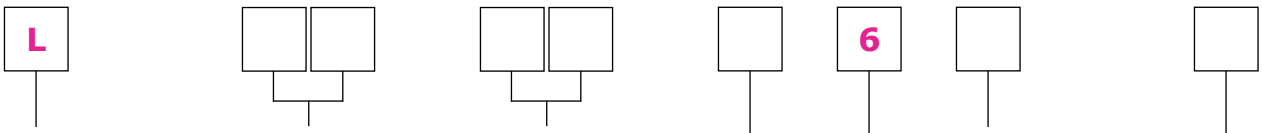
**Stack Design**
(Surface Area)
H = 2-cell (0.44 $m^2$)
I*= 7-cell (1.6 $m^2$)
G = 8-cell (1.8 $m^2$)
*D0HC, X0HC and F0HC only

**Diameter**
6 = 16 in.

**Flat Seal Elastomer**
S = Silicone (standard)
E = EPR
N = Nitrile
P = Neoprene
F = Fluorocarbon
T = PTFE Encapsulated

**Quantity per Package**
2 = 2/pack (7 and 8-cell)
6 = 6/pack (2-cell)

## Single-layer




**Lenticular**

**Grade**
CE: 15, 20, 25, 30, 35, 40, 45, 50
DE: 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75

**Series**
CE
DE

**Stack Design**
(Surface Area)
V = 4-cell (0.88 $m^2$)
T = 16-cell (3.4 $m^2$)

**Diameter**
6 = 16 in.

**Flat Seal Elastomer**
S = Silicone (standard)
E = EPR
N = Nitrile
P = Neoprene
F = Fluorocarbon
T = PTFE Encapsulated

**Quantity per Package**
1 = 1/pack (16-cell)
3 = 3/pack (4-cell)

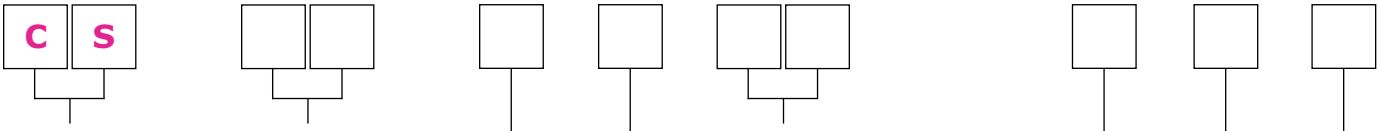
## Millistak+® Lenticular Housings

| Number of Cartridges* | Inlet/Outlet Connections | Cat. No. |
|---|---|---|
| **CE Marked** | | |
| **Millistak+® Housings†** | | |
| **For 12 in. Diameter Millistak+® (DE, CE, A) Cartridges** | | |
| 1 × 12 in. 13- or 16-cell/6- or 9-cell | 1 in. TC, ISO DN32 | **WM21 SET ET** |
| 2 × 12 in. 13- or 16-cell/6- or 9-cell | 1 in. TC, ISO DN32 | **WM22 SET ET** |
| 3 × 12 in. 13- or 16-cell (4 × 12 in. 6- or 9-cell) | 1 in. TC, ISO DN32 | **WM23 SET ET** |
| 4 × 12 in. 13- or 16-cell (5 × 12 in. 6- or 9-cell) | 1 in. TC, ISO DN32 | **WM24 SET ET** |
| **For 16 in. Diameter Millistak+® (DE, CE, A) Cartridges** | | |
| 1 × 16 in. 16-cell | 2 in. TC, ISO DN40 | **WM61 SFT FT** |
| 2 × 16 in. 16-cell (3 × HC 16 in. 8-cell) | 2 in. TC, ISO DN40 | **WM62 SFT FT** |
| 3 × 16 in. 16-cell (4 × HC 16 in. 8-cell) | 2 in. TC, ISO DN40 | **WM63 SFT FT** |
| 4 × 16 in. 16-cell (6 × HC 16 in. 8-cell) | 2 in. TC, ISO DN40 | **WM64 SFT FT** |
| **Millistak+® HC Housings†** | | |
| **For 16 in. Diameter Millistak+® HC Cartridges** | | |
| 2 × 16 in. 8-cell (1 × DE, CE, A 16 in. 16-cell) | 2 in. TC, ISO DN40 | **HC62 SFT FT** |
| 4 × 16 in. 8-cell (2 × DE, CE, A 16 in. 16-cell) | 2 in. TC, ISO DN40 | **HC64 SFT FT** |
| 6 × 16 in. 8-cell (3 × DE, CE, A 16 in. 16-cell) | 2 in. TC, ISO DN40 | **HC66 SFT FT** |
| 8 × 16 in. 8-cell (5 × DE, CE, A 16 in. 16-cell) | 2 in. TC, ISO DN40 | **HC68 SFT FT** |
| **ASME® Stamped** | | |
| **Millistak+® Housings†** | | |
| **For 12 in. Diameter Millistak+® (DE, CE, A) Cartridges** | | |
| 1 × 12 in. 13- or 16-cell/6- or 9-cell | 1 in. TC | **UM21 SET ET** |
| 2 × 12 in. 13- or 16-cell/6- or 9-cell | 1 in. TC | **UM22 SET ET** |
| 3 × 12 in. 13- or 16-cell/4 × 12 in. 6- or 9-cell | 1 in. TC | **UM23 SET ET** |
| 4 × 12 in. 13- or 16-cell/5 × 12 in. 6- or 9-cell | 1 in. TC | **UM24 SET ET** |
| **For 16 in. Diameter Millistak+® (DE, CE, A) Cartridges** | | |
| 1 × 16 in. 16-cell | 2 in. TC | **UM61 SFT FT** |
| 2 × 16 in. 16-cell (3 × HC 16 in. 8-cell) | 2 in. TC | **UM62 SFT FT** |
| 3 × 16 in. 16-cell (4 × HC 16 in. 8-cell) | 2 in. TC | **UM63 SFT FT** |
| 4 × 16 in. 16-cell (6 × HC 16 in. 8-cell) | 2 in. TC | **UM64 SFT FT** |
| **Millistak+® HC Housings†** | | |
| **For 16 in. Diameter Millistak+® HC Cartridges** | | |
| 2 × 16 in. 8-cell (1 × DE, CE, A 16 in. 16-cell) | 2 in. TC | **UC62 SFT FT** |
| 4 × 16 in. 8-cell (2 × DE, CE, A 16 in. 16-cell) | 2 in. TC | **UC64 SFT FT** |
| 6 × 16 in. 8-cell (3 × DE, CE, A 16 in. 16-cell) | 2 in. TC | **UC66 SFT FT** |
| 8 × 16 in. 8-cell (5 × DE, CE, A 16 in. 16-cell) | 2 in. TC | **UC68 SFT FT** |

* Millistak+® Housings are also compatible with many other commercially available lenticular cartridges.

† The compression tool must be ordered separately (Compression kit assembly, Catalogue No.: 1 WM00 CAK 01).

## Clarisolve® Depth Filters




**Clarisolve® depth filters**

**Feed Particle Size**
(Nominal)

20 = 20 µm
40 = 40 µm
60 = 60 µm

**Media Combination**

M = Mixed
H = Homogenous (60 µm only)

**Media Extractables**

S = Standard
X = Low (60 µm grade only)

**Filter Surface Area**

**Clarisolve® depth filters in µPod® format**

01 = 23 $cm^2$ (0.025 $ft^2$)

**Clarisolve® depth filters in Lab-Scale Pod format**

01 = 0.014 $m^2$ (0.15 $ft^2$)
02 = 0.027 $m^2$ (0.29 $ft^2$)

**Clarisolve® depth filters in Process-Scale Pod format**

01 = 0.11 $m^2$ (1.18 $ft^2$)
03 = 0.33 $m^2$ (3.55 $ft^2$)
05 = 0.55 $m^2$ (5.92 $ft^2$)

**Connection**

**Clarisolve® depth filters in µPod® format**

L = Luer Fitting

**Clarisolve® depth filters in Lab-Scale Pod format**

H = ¼ in. (6 mm) Hose Barb

**Clarisolve® depth filters in Process-Scale Pod format**

F = Flat Seal

**Quantity per Package**

**Clarisolve® depth filters in µPod® format**

3 = 3/pack

**Clarisolve® depth filters in Lab-Scale Pod format**

1 = 1/pack

**Clarisolve® depth filters in Process-Scale Pod format**

1 = 1/pack

**-X (For process-scale only)**

## Flocculation Agents

| | | |
|---|---|---|
| pDADMAC solution 10% flocculation reagent | 100 mL | **1.37069.0100** |
| | 1 L | **1.37069.1000** |
| | 10 L | **1.37069.9010** |

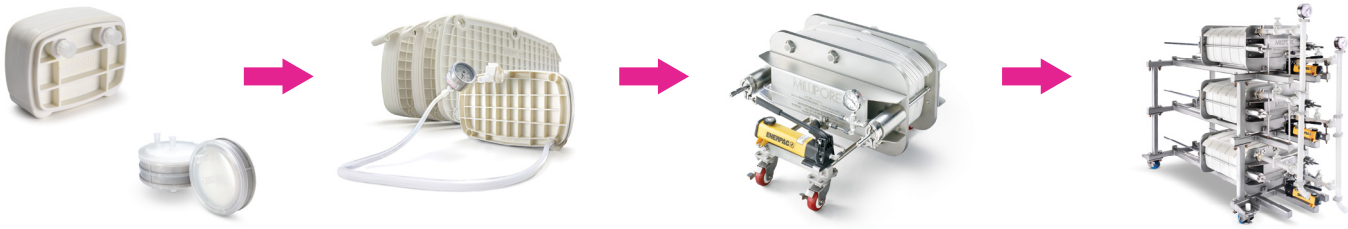
## Millipore® Validation Services

| | |
|---|---|
| Quantitation of residual pDADMAC | **VSPDADMAC** |

## Millistak+® and Clarisolve® Pod Holders

| Description | | Qty/Pk | |
|---|---|---|---|
| Pilot-Scale Holder | For Pod configurations from 1 to 2 filters | 1 | **MP0DPIL0T** |
| | For Pod configurations up to 5 filters | 1 | **MP0DPILOTX** |
| Process-Scale Holder | 1-rack holder; Gemu® valves | 1 | **MP0DSYS1A** |
| | 1-rack holder; ITT valves | 1 | **MP0DSYS1B** |
| | 1-rack holder; no valves | 1 | **MP0DSYS1N** |
| | 1-rack expansion kit; no valves or casters | 1 | **MP0DSYS1X** |
| | 2-rack holder; Gemu® valves | 1 | **MP0DSYS2A** |
| | 2-rack holder; ITT valves | 1 | **MP0DSYS2B** |
| | 2-rack holder; no valves | 1 | **MP0DSYS2N** |
| | 3-rack holder; Gemu® valves | 1 | **MP0DSYS3A** |
| | 3-rack holder; ITT valves | 1 | **MP0DSYS3B** |
| | 3-rack holder; no valves | 1 | **MP0DSYS3N** |

**Small-Scale** **Lab-Scale** **Pilot-Scale** **Process-Scale**



## Disposable Adapter Kit[1]

| | |
|---|---|
| 3 through adapters, 3 blind adapters | **MP0DADAPT** |
| 6 through adapters, required if using Disposable Diverter Plate (MP0DDIVERTR) | **MP0DADPTF** |

[1] Note: Pod filters require the use of flow adaptors, which are sold separately (MP0DADAPT or MP0DADPTF). See the Millistak+® Pod disposable depth filter hardware data sheet (DS3388EN00) available at sigmaaldrich.com for information on Pod filter holders.

A retrofit kit may be required in order to accommodate the new Clarisolve® depth filters in the Pod pilot- and process-scale holders. Please contact your local sales representative for details.

## Bulk Packaging

To improve sustainability of the packaging and shipping of filter products, we have developed a bulk pack solution for Millistak+® and Clarisolve® Process-Scale Pods with the aim to optimize transport and reception processes as well as to reduce waste.

Bulk packaging configuration includes various amount of pods distributed in 3 boxes on one regional standardized pallet size.

**The key benefits are:**

- 24% reduction in corrugated packaging waste to recycle or dispose.
- 94% reduction of paper documentation.
- 12% decrease in number of deliveries which will further reduce energy use and emissions.
- 70% reduction in operator time to open and manage the product and packaging.

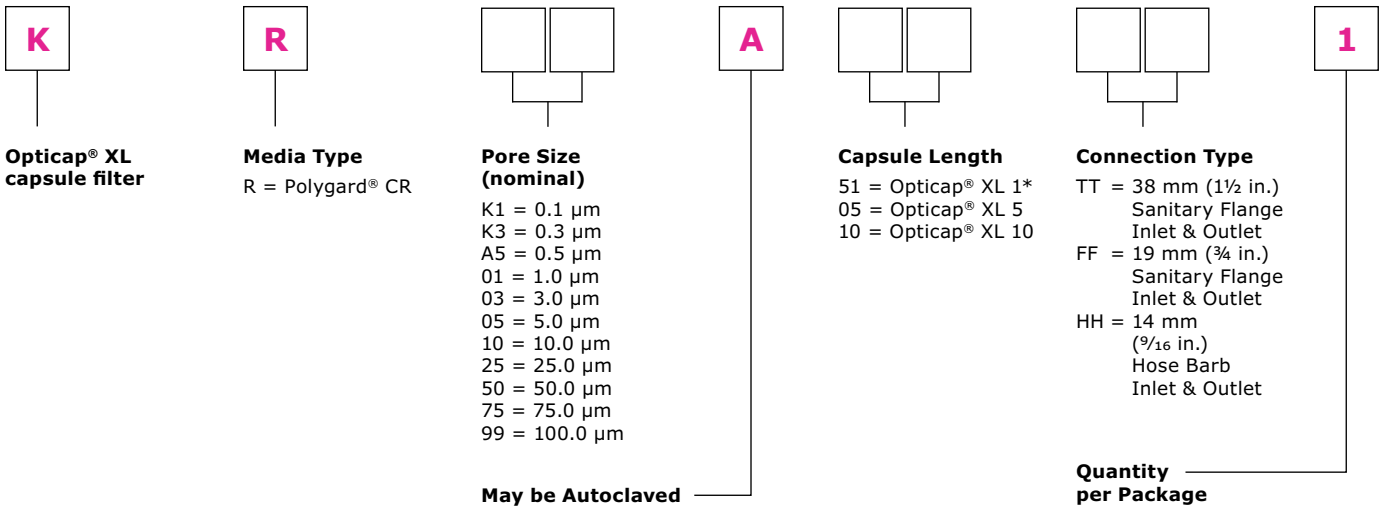
## Millistak+® and Clarisolve® Bulk Packaging

| Description | Item Description | Qty/Pk | |
|---|---|---|---|
| US Pallet format | Millistak®+ Pod A0HC 1.1 m² | 30 | **MA0HC10FS30** |
| HDPE black pallet | Millistak®+ Pod A1HC 1.1 m² | 30 | **MA1HC10FS30** |
| 40″ × 48″ × 5.9″ | Millistak®+ Pod B1HC 1.1 m² | 30 | **MB1HC10FS30** |
| | Millistak®+ Pod C0HC 1.1 m² | 30 | **MC0HC10FS30** |
| | Millistak®+ Pod D0HC 1.1 m² | 30 | **MD0HC10FS30** |
| | Millistak®+ Pod F0HC 1.1 m² | 30 | **MF0HC10FS30** |
| | Millistak®+ Pod X0HC 1.1 m² | 30 | **MX0HC10FS30** |
| | Millistak®+ HC Pro Pod C0SP 0.77 m² | 24 | **MC0SP07FS24** |
| | Millistak®+ HC Pro Pod D0SP 0.77 m² | 24 | **MD0SP07FS24** |
| | Millistak®+ HC Pro Pod X0SP 1.1 m² | 36 | **MX0SP10FS36** |
| | Millistak®+ Carbon Pod CR40 1.1 m² | 30 | **MCR4010FS30** |
| | Clarisolve® Process-Scale Pod 20MS Media 0.55 m² | 24 | **CS20MS05FS24** |
| | Clarisolve® Process-Scale Pod 40MS Media 0.55 m² | 24 | **CS40MS05FS24** |
| | Clarisolve® Process-Scale Pod 60HX Media 0.55 m² | 24 | **CS60HX05FS24** |
| | | | |
| Euro Pallet format | Millistak®+ Pod A0HC 1.1 m² | 27 | **MA0HC10FS27EU** |
| EU Modified Heat treated (EU) Wooden | Millistak®+ Pod A1HC 1.1 m² | 27 | **MA1HC10FS27EU** |
| CP2 1200 × 800 mm | Millistak®+ Pod B1HC 1.1 m² | 27 | **MB1HC10FS27EU** |
| | Millistak®+ Pod C0HC 1.1 m² | 27 | **MC0HC10FS27EU** |
| | Millistak®+ Pod D0HC 1.1 m² | 27 | **MD0HC10FS27EU** |
| | Millistak®+ Pod F0HC 1.1 m² | 27 | **MF0HC10FS27EU** |
| | Millistak®+ Pod X0HC 1.1 m² | 27 | **MX0HC10FS27EU** |
| | Millistak®+ Carbon Pod CR40 1.1 m² | 27 | **MCR4010FS27EU** |

The PODs provided in bulk packaging will all be from one catalog item, all from one lot.

# Polygard® CR Filters

## Opticap® XL Capsule Filters




**Opticap® XL capsule filter**

**Media Type**
R = Polygard® CR

**Pore Size (nominal)**
K1 = 0.1 µm
K3 = 0.3 µm
A5 = 0.5 µm
01 = 1.0 µm
03 = 3.0 µm
05 = 5.0 µm
10 = 10.0 µm
25 = 25.0 µm
50 = 50.0 µm
75 = 75.0 µm
99 = 100.0 µm

**May be Autoclaved**

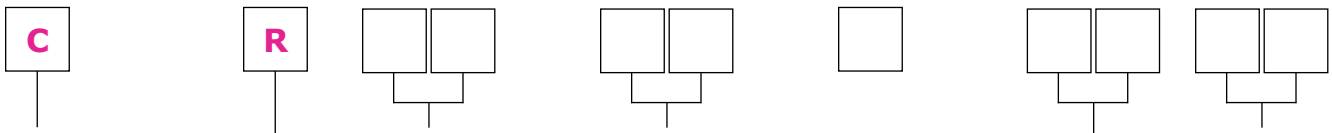
**Capsule Length**
51 = Opticap® XL 1*
05 = Opticap® XL 5
10 = Opticap® XL 10

**Connection Type**
TT = 38 mm (1½ in.) Sanitary Flange Inlet & Outlet
FF = 19 mm (¾ in.) Sanitary Flange Inlet & Outlet
HH = 14 mm (9/16 in.) Hose Barb Inlet & Outlet

**Quantity per Package**
1 = 1/pack

* 1 in. filter element in a 5 in. capsule housing.

## Cartridge Filters*




**Cartridge filter**

**Media Type**
R = Polygard® CR

**Pore Size (nominal)**
K1 = 0.1 µm
K3 = 0.3 µm
A5 = 0.5 µm
01 = 1.0 µm
03 = 3.0 µm
05 = 5.0 µm
10 = 10.0 µm
25 = 25.0 µm
50 = 50.0 µm
75 = 75.0 µm
99 = 100.0 µm

**Cartridge Code**
O = (2-222) O-ring
5 = (2-222) O-ring w/spear
7 = (2-226) O-ring w/locking tab and spear
F = Double open-end flat gasket
M = (2-118) O-ring (2 in. cartridge only)

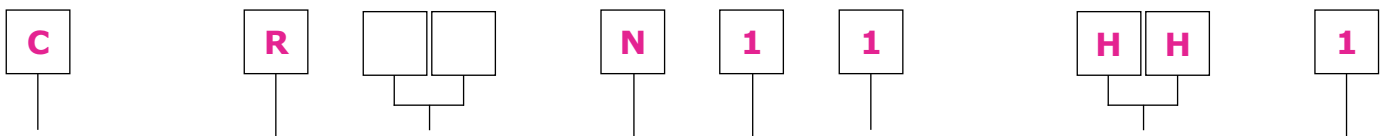
**Cartridge Length**
1 = 10 in.
2 = 20 in.
3 = 30 in.
4 = 40 in.
0 = 2 in. (Cartridge Code M only)

**O-ring Material**
0 = Silicone (std)
E = EP gasket
V = Fluoroelastomers
T = PTFE encapsulated fluoroelastomers
P = Extended length version with polypropylene end caps and cage, silicone gaskets (Cartridge Code F only)
C = Short length version with polypropylene end caps and cage, silicone gaskets (Cartridge Code F only)
2 = Silicone (Cartridge Code M only)

**Quantity per Package**
03 = 3/pack (2 in. only)
06 = 6/pack (10, 20, 30 and 40 in.)

* Not all configurations are available.

## Small-scale Capsule Filters




**Cartridge filter**

**Media Type**
R = Polygard® CR

**Pore Size (nominal)**
K1 = 0.1 µm
K3 = 0.3 µm
A5 = 0.5 µm
01 = 1.0 µm
03 = 3.0 µm
05 = 5.0 µm
10 = 10.0 µm
25 = 25.0 µm
50 = 50.0 µm
75 = 75.0 µm
99 = 100.0 µm

**Not Autoclavable**

**Capsule Length**
1 = 1 in.

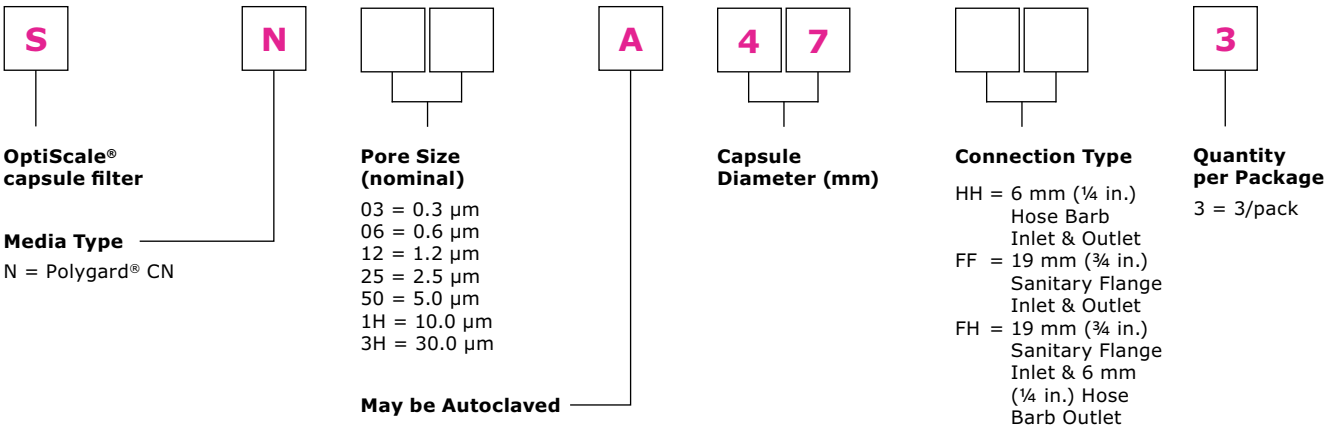
**Filter Length**
1 = 1 in.

**Connection Type**
HH = Hose Barb

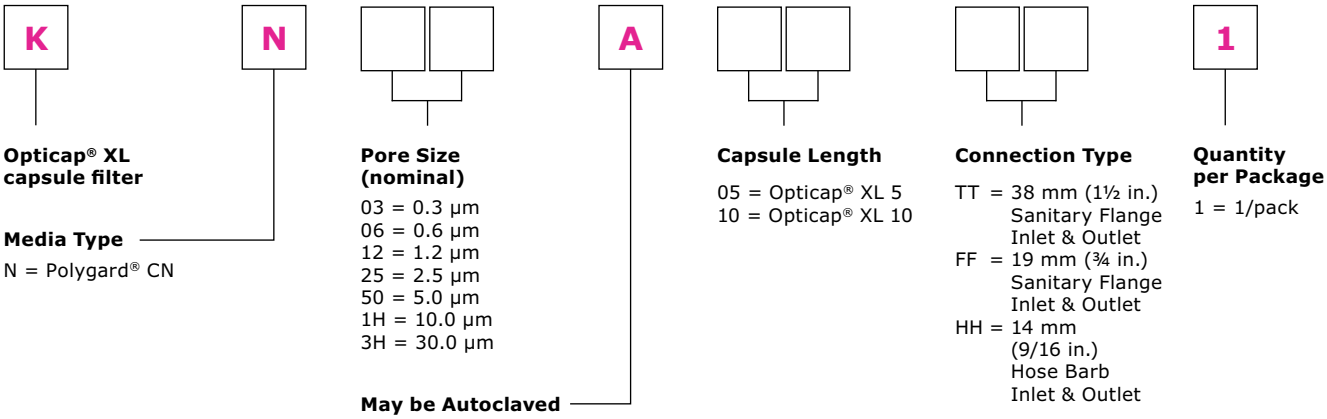
**Quantity per Package**
1 = 1/pack

# Polygard® CN Filters

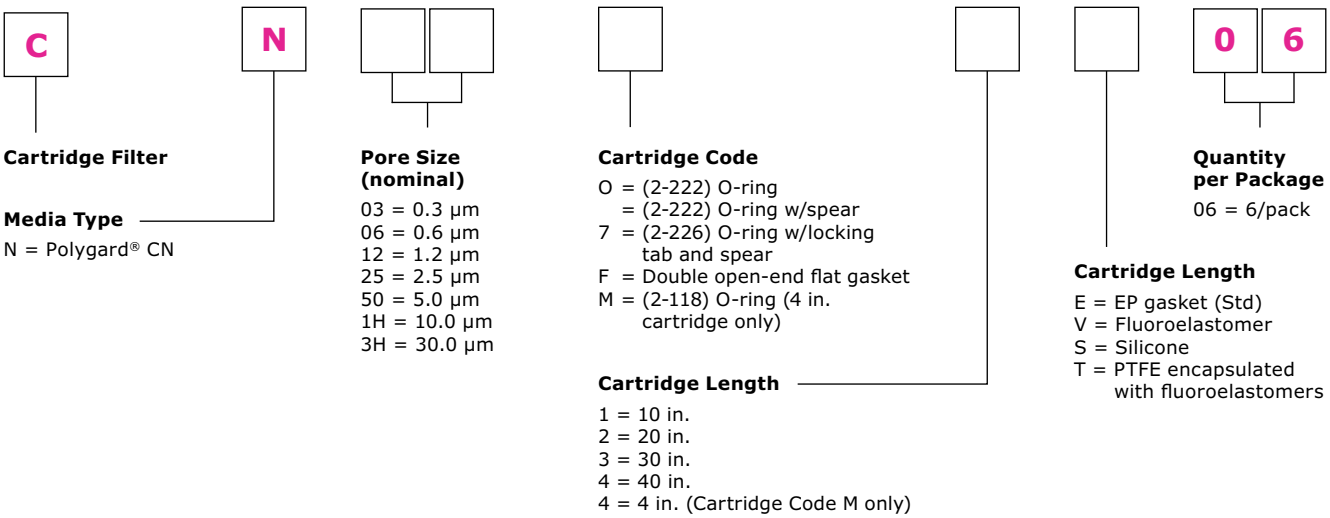
## OptiScale® Capsule Filters




## Opticap® XL Capsule Filters



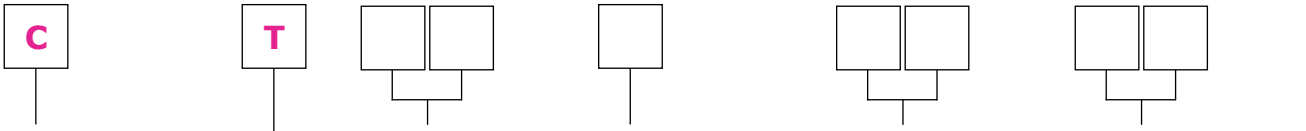

## Cartridge Filters*




* Not all configurations are available.

# Polygard® CT Filters

## Cartridge filters*




**Cartridge Filter**

**Media Type**
T = Polygard® CT

**Pore Size (nominal)**
01 = 1.0 µm
05 = 5.0 µm
10 = 10.0 µm
25 = 25.0 µm
50 = 50.0 µm
75 = 75.0 µm
99 = 100.0 µm
C5 = 150.0 µm

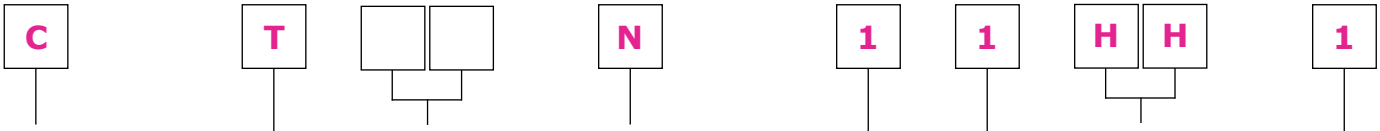
**Cartridge Code**
F = Double open-end flat gasket

**Cartridge Length**
10 = 10 in.
20 = 20 in.
30 = 30 in.
40 = 40 in.

**Quantity per Package**
25 = 25/pack (20 in., 30 in., 40 in.)
50 = 50/pack (10 in.)

* Not all configurations are available.

## Small-scale Capsule Filters




**Cartridge Filter**

**Media Type**
T = Polygard® CT

**Pore Size (nominal)**
01 = 1.0 µm
05 = 5.0 µm
10 = 10.0 µm
25 = 25.0 µm
50 = 50.0 µm
75 = 75.0 µm
99 = 100.0 µm
C5 = 150.0 µm

**Not Autoclavable**

**Capsule Length**
1 = 1 in.

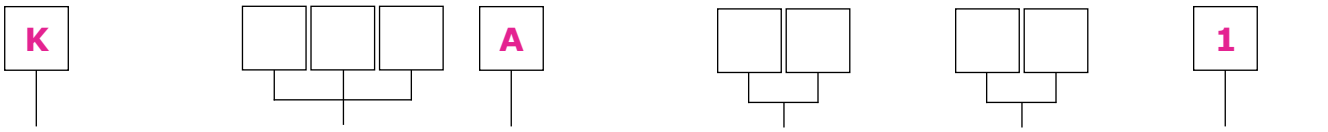
**Filter Length**
1 = 1 in.

**Connection Type**
HH = Hose Barb

**Quantity per Package**
1 = 1/pack

# Clarigard® Filters

## Opticap® XL Capsule Filters




**Opticap® XL capsule filter**

**Pore Size (nominal)**
002 = 0.2 µm
003 = 0.3 µm
005 = 0.5 µm
010 = 1.0 µm
030 = 3.0 µm

**May be Autoclaved**

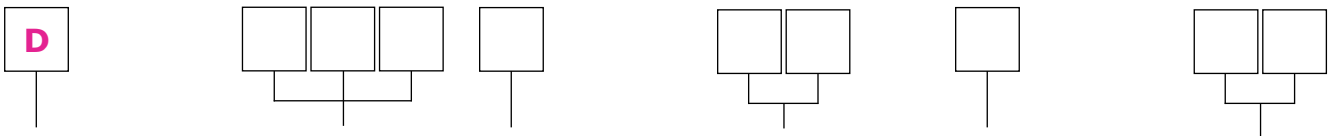
**Capsule Length**
51 = Opticap® XL 1*
05 = Opticap® XL 5
10 = Opticap® XL 10

**Connection Type**
TT = 38 mm (1½ in.) Sanitary Flange Inlet & Outlet
FF = 19 mm (¾ in.) Sanitary Flange Inlet & Outlet

**Quantity per Package**
1 = 1/pack

* 1 in. filter element in a 5 in. capsule housing.

## Cartridge Filters*




**Media Type**
**D = Clarigard®**

**Pore Size (nominal)**
002 = 0.2 µm
003 = 0.3 µm
005 = 0.5 µm
010 = 1.0 µm
030 = 3.0 µm

**Cartridge Code**
O = (2-222) O-ring
5 = (2-222) O-ring w/spear
7 = (2-226) O-ring w/locking tab and spear
N = (2-226) O-ring (2 in. cartridge only)
F = Double open-end flat gasket
P = Double open-end silicone flat gasket

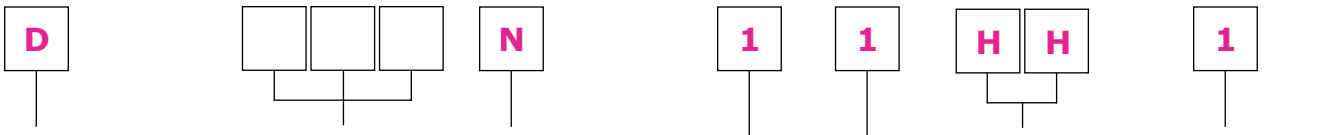
**Capsule Length**
1 = 10 in.
2 = 20 in.
3 = 30 in.
4 = 40 in.
0 = 2 in. (Cartridge Code N only)

**O-ring Material**
S = Silicone (std)
E = Ethylene propylene
V = Fluoroelastomers
T = PTFE encapsulated fluoroelastomers
P = Polyethylene flat seal (Cartridge Code F only)

**Quantity per Package**
01 = 1/pack
03 = 3/pack (2 in. only)

* Not all configurations are available.

## Small-scale Capsule Filters




**Media Type**
**D = Clarigard® filter**

**Pore Size (nominal)**
002 = 0.2 µm
003 = 0.3 µm
005 = 0.5 µm
010 = 1.0 µm
030 = 3.0 µm

**Not Autoclavable**

**Capsule Length**
1 = 1 in.

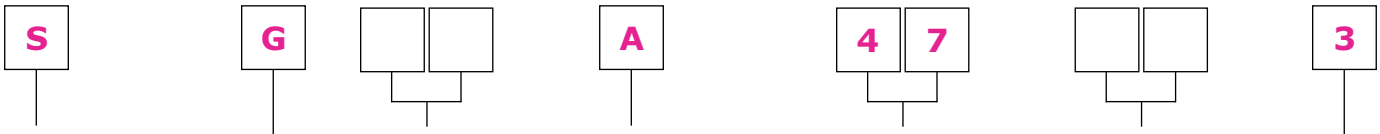
**Filter Length**
1 = 1 in.

**Connection Type**
HH = Hose Barb

**Quantity per Package**
1 = 1/pack

## Polysep™ II Filters

### OptiScale® 47 Capsule Filters




**OptiScale® capsule filter**

**Media Type**
G = Polysep™ II

**Pore Size (nominal)**
W1 = 1.0 µm/ 0.2 µm/ 0.1 µm
W3 = 1.0 µm/ 0.2 µm
W6 = 1.0 µm/ 0.5 µm
W2 = 1.0 µm/ 1.2 µm
W9 = 2.0 µm/ 1.2 µm

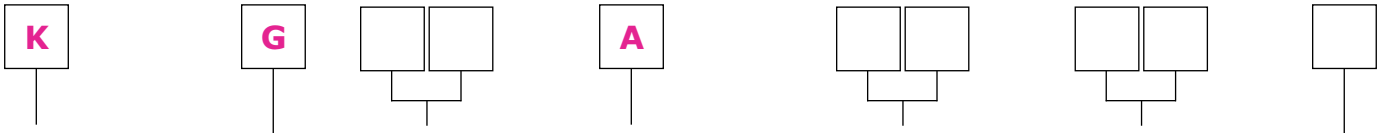
**May be Autoclaved**

**Capsule Diameter (mm)**

**Connection Type**
HH = 6 mm (¼ in.) Hose Barb Inlet & Outlet
FF = 19 mm (¾ in.) Sanitary Flange Inlet & Outlet
FH = 19 mm (¾ in.) Sanitary Flange Inlet & 6 mm (¼ in.) Hose Barb Outlet

**Quantity per Package**
3 = 3/pack

### Opticap® XL Capsule Filters




**Opticap® XL capsule filter**

**Media Type**
G = Polysep™ II

**Pore Size (nominal)**
W1 = 1.0 µm/ 0.2 µm/ 0.1 µm (Opticap® XL 5 and XL 10 only)
W3 = 1.0 µm/0.2 µm
W6 = 1.0 µm/0.5 µm
W2 = 1.0 µm/1.2 µm
W9 = 2.0 µm/1.2 µm

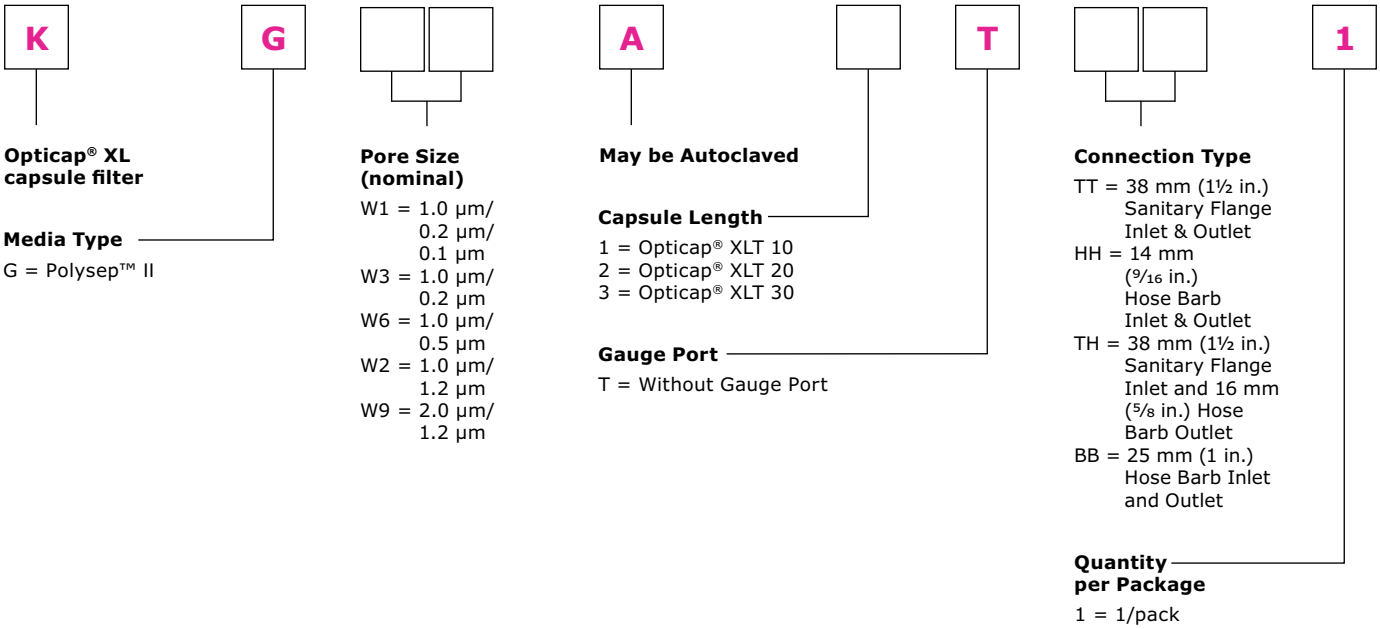
**May be Autoclaved**

**Capsule Size**
02 = Opticap® XL 2
04 = Opticap® XL 4
05 = Opticap® XL 5
10 = Opticap® XL 10

**Connection Type**
TT = 38 mm (1½ in.) Sanitary Flange Inlet & Outlet
FF = 19 mm (¾ in.) Sanitary Flange Inlet & Outlet
HH = 14 mm (9/16 in.) Hose Barb Inlet & Outlet
FH = 19 mm (¾ in.) Sanitary Flange Inlet and 14 mm (9/16 in.) Hose Barb Outlet (2 and 4 only)

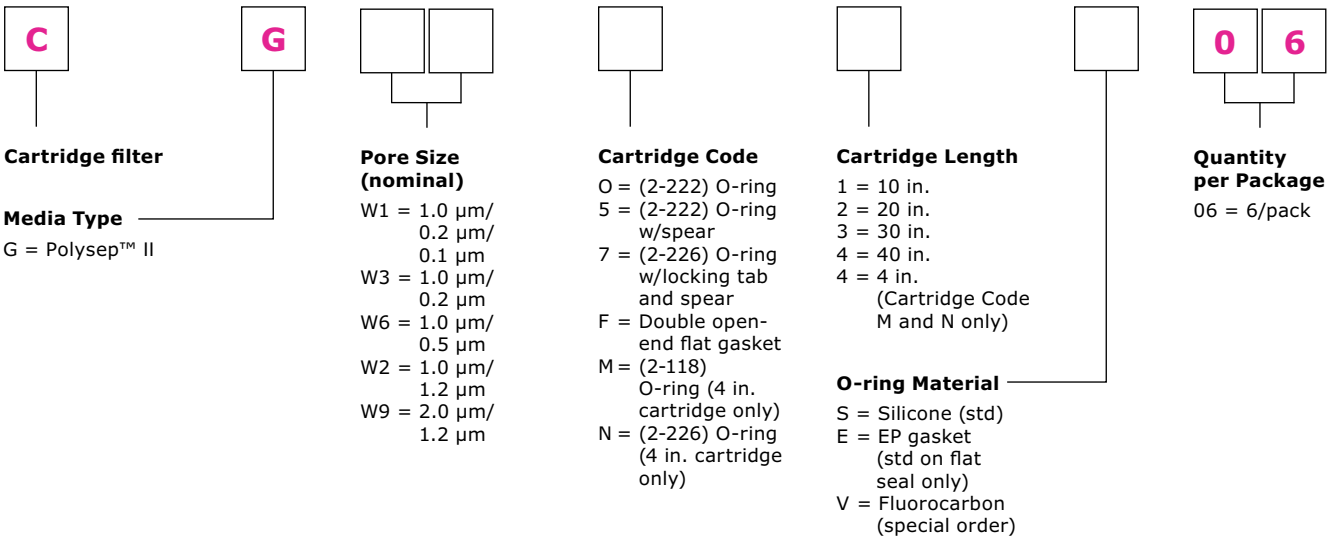
**Quantity per Package**
1 = 1/pack (5 and 10)
3 = 3/pack (2 and 4)

## Opticap® XLT Capsule Filters*




* Not all configurations available as standard product.

## Cartridge Filters



Millipore®

Expert Pharm/BioPharm
Products & CTDMO Services

**SigmaAldrich.com**

We make no warranties of any kind or nature, express or implied, including any implied warranty of merchantability or fitness for any particular purpose, with respect to any technical assistance or information that we provide. Any suggestions regarding use, selection, application or suitability of the products shall not be construed as an express or implied warranty unless specifically designated as such in a writing signed by an officer or other authorized representative of our company. Customer is responsible for and must independently determine suitability of our products for customer's products, intended use and processes, including the non-infringement of any third parties´ intellectual property rights.

## To place an order or receive technical assistance

Order/Customer Service: **SigmaAldrich.com/order**
Technical Service: **SigmaAldrich.com/techservice**

**SigmaAldrich.com**

MilliporeSigma
400 Summit Drive
Burlington, MA 01803

We have built a unique collection of life science brands with unrivalled experience in supporting your scientific advancements.

Millipore® Sigma-Aldrich® Supelco® Milli-Q® SAFC® BioReliance®



PB1241EN00 Ver. 5.0
10/2024