CUNO
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3M

PolyKLEAN®

All-Polypropylene Rigid Thermal Bonded Filters

Featuring:

- Consistent filtration throughout the life of the filter for superior quality effluent
- Up to ten or more times the service life of competitive filters
- Low operating pressure drop achieves the required flow using fewer filter elements

Applications Include:

- Industrial Processes
- Coatings
- Food & Beverages
- Oil & Gas Process Fluids
- Chemicals
- Electronics
- Pharmaceuticals

PolyKLEAN® Filter Cartridges

Advancing depth filtration through technological innovation

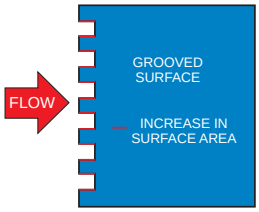
PolyKLEAN filters, manufactured using CUNO's rigid extrusion bonded technology, are all-polypropylene depth filter cartridges offering premium features including:

- consistent particle removal efficiencies throughout the filter's life,
- increased surface area for extended filter life,
- low initial pressure drop for enhanced flow, and
- high particle removal efficiencies at high flow rates (flux).

The filter's extended service life results in fewer filter change-outs while its enhanced flow characteristics can typically reduce the number of filters required to achieve a given flow rate. These combined features of PolyKLEAN filters can *significantly reduce total filtration cost*.

PolyKLEAN Filter Construction

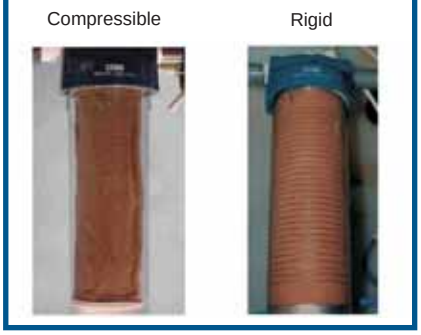
The unique PolyKLEAN filter manufacturing process combines the superior process control with the quality assurance enabled by an ISO 9001 certified quality system to provide consistent product performance. The CUNO exclusive manufacturing process provides a high degree of fiber-to-fiber thermal bonding, without the use of binders, to produce a rigid, core-less, filter structure with the following properties:



- does not unload contaminants with increasing differential pressure like typical meltblown filters,
- allows grooves to be machined into the upstream surface, without tearing or melting the filter structure, providing more than double the effective surface area, and
- exhibits exceptionally low differential pressure for a given filter rating.

Consistent filtration throughout the service life of a depth-style filter depends on how well the filter's structure tolerates fluctuations in operating conditions - including contaminant loading and differential pressure. Flexible structures, such as those found in typical meltblown and string-wound filters, tend to compress and change porosity with increased pressure, while rigid structures do not (Photo 1). Media compression can result in short filter life because the pores collapse and ultimately close.

Photo 1. - Compressible vs Rigid structures @ 35 psid



Feature	Benefit
♦ Rigid depth filter construction	♦ Eliminates unloading at high differential pressure ♦ Efficient removal of deformable materials ♦ Consistently superior particle removal throughout filter life and at high flow rates (flux).
♦ Enhanced contaminant holding capacity	♦ Fewer filter change outs ♦ Long filter life
♦ Grooved cartridge with extended surface area	♦ Promotes fuller utilization of the depth-matrix ♦ Long filter life
♦ All polypropylene construction	♦ Compatibility in a wide range of applications and operating conditions ♦ No adhesives, binders, surfactants, lubricants
♦ Materials of construction listed in FDA 21CFR and ANSI / NSF Standard 42 and 61 certified	♦ Complies with regulations for food and beverage contact ♦ Approved for use in potable water applications
♦ Core-less filter structure	♦ Ease of disposal via incineration or shredding
♦ Continuous integral length filter element (up to 40")	♦ No bond joints to break ♦ Easy to install

Media compression can also cause the filter to release already held particles. The robust PolyKLEAN filter captures and retains contaminant within its rigid filter matrix, even under increasing differential pressure. In addition, the unique depth filter structure of the PolyKLEAN filter provides a significant increase in contaminant holding capacity and provides greater flow capacity at a given pressure.

Unlike soft meltblown and string-wound filters that require core support, the PolyKLEAN filter is self-supporting and is grooved to provide greater than twice the surface area. The increase in surface area prevents premature blinding of the outer surface by large particles and gels and promotes fuller utilization of the depth-matrix. The result is significantly longer life than competitive cartridges.

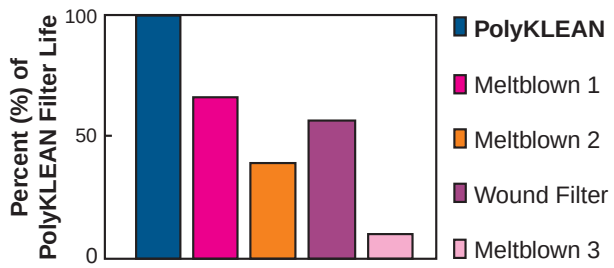
PolyKLEAN Filter Performance

PolyKLEAN filters exhibit superior filtration characteristics. The rigid construction allows for enhanced performance compared to other filter structures with equivalent removal ratings.

Superior Service Life

Extensive testing of PolyKLEAN filters has demonstrated an appreciable advantage in service life. Graph 1 compares rigid PolyKLEAN filters to typical meltblown and string-wound filters of equivalent efficiency. All filters were challenged under identical conditions. Comparison of test results, when test filters are subjected to the same contaminant load up to 20 psid, shows the relative life of the test filters. As depicted, PolyKLEAN filters typically provide nearly twice the life of its closest competitor, and up to10 times or more the life of some competitive filters.

Graph 1 . - Life Comparison of Filters Exhibiting Similar Efficiency

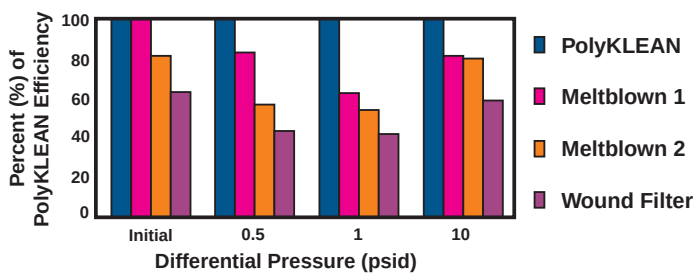


Consistent Removal Efficiency

The rigid PolyKLEAN structure resists deformation, filter by-pass, compression, and particle unloading. This allows PolyKLEAN filters to achieve excellent filtration efficiency up to its recommended change-out pressure (35 psid), while typical melt blown and wound structures exhibit significant drops in removal efficiency at much lower differential pressures (≤ 10 psid).

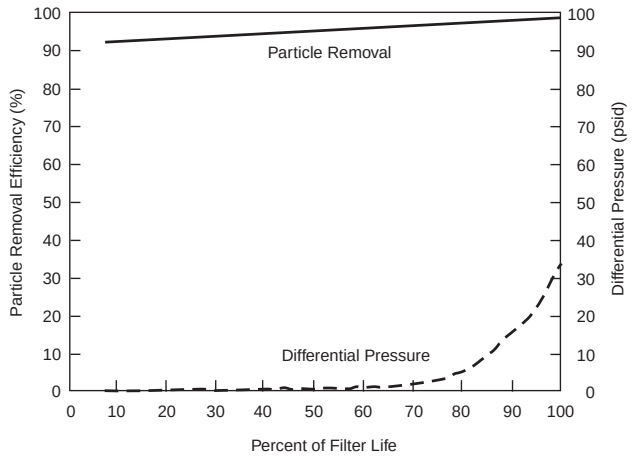
To demonstrate the PolyKLEAN filter's removal consistency, efficiency at four sampling points (initial, 0.5 psid, 1 psid, and 10 psid) was measured on PolyKLEAN filters and typical melt blown and wound structures. All equivalently rated filters were tested under the same conditions to enable direct comparison. As shown in Graph 2, PolyKLEAN filters display a stable, consistently higher contaminant removal throughout the duration of the test. Note that the other melt blown and string wound structures yield erratic removal and as such can not provide predictable performance even under controlled conditions of uniform contaminant loading and pressure.

Graph 2. - Efficiency Comparison of Filter Cartridges Rated at 5 Microns



PolyKLEAN filters are also capable of delivering consistent particle removal efficiencies at high fluid flux (flow rate per surface area). This capability is demonstrated in Graph 3 which shows both removal efficiency and differential pressure results from tests conducted with 25u PolyKLEAN cartridges at a fluid flux of 18 gpm per 10-inch length - *six times higher than typical design flux for cartridge filters*. Because of its rigid structure and high contaminant holding capability, PolyKLEAN cartridges are able to maintain high particle removal efficiencies throughout the life of the filter at this high flux.

Graph 3. - Particle Removal Efficiency at increased flux



This consistent performance capability at high fluid flux makes PolyKLEAN an effective solution for systems where smaller housing size is desirable because of physical limitations or budgetary constraints. Utilizing PolyKLEAN cartridges at higher flux can also be beneficial for low contaminant load systems.

Lower Initial Differential Pressure

The unique design and construction of the PolyKLEAN element allows for significantly lower pressure drop when compared to competitive elements. Graph 4 clearly demonstrates the PolyKLEAN flow advantage when compared to other 5µm rated competitive meltblown and wound cartridges. For a given differential pressure, PolyKLEAN filters yield flows up to ten times that of competitive filters. When sizing a system for a given process flow rate, this is a significant advantage and translates into lower capital investment for filter housings and fewer cartridges to purchase. For example, as shown in Table 1, in a process with a water flow rate of 180 gpm and a maximum clean pressure drop of 0.5 psid, a PolyKLEAN filter system requires significantly fewer cartridges and smaller filter vessels (compared to competitive filters) for greatly reduced capital costs.

Graph 4. - Flow vs. Differential Pressure
(see note * in table 1)

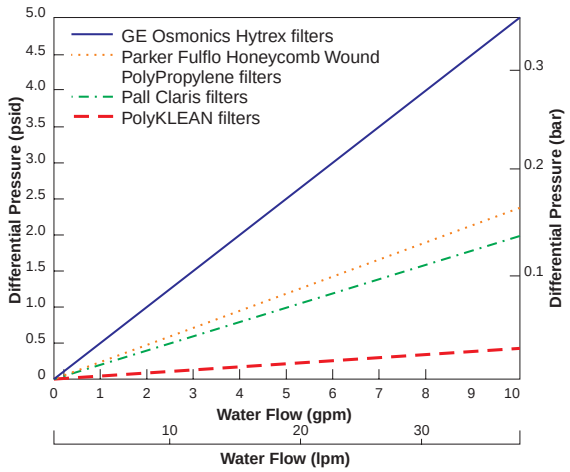


Table 1. - Comparison of 5 Micron Filters in a Water System

Filter	30" Filters Required for a 180 gpm flow rate*	Housing Diameter (Inches) Required for 30" Double Open End Filters
PolyKLEAN Filters	12	12
Parker Fulflo® Honeycomb™ Wound Polypropylene Filters	29	20
Osmonics Hytrex® Filters	60	30
Pall Claris® Filters	24	16

*Based on the manufacturers literature piece specifications

Fulflo and Honeycomb are trademarks of Parker Hannifin Corporation, Hytrex is a trademark of GE Osmonics , and Claris is a trademark of Pall Corporation

PolyKLEAN Filter System Sizing

To size a system of PolyKLEAN filters, flow vs. differential pressure data is provided in Table 2.

Table 2. - PolyKLEAN Filter Specific Pressure Drop (SPD)		
Nominal Rating (µm)	Specific Pressure Drop per 10" filter (psid/gpm-Cp)	Specific Pressure Drop per 10" filter (mbar/lpm-Cp)
1	0.073	1.330
5	0.042	0.765
10	0.025	0.455
25	0.015	0.273
50	0.010	0.182
75	0.006	0.109

To calculate filter's clean pressure drop for Newtonian fluids, use the following formula in conjunction with the Specific Pressure Drop Values. The Specific Pressure Drop values may be effectively used when three of the four variables (Viscosity, Flow, Differential Pressure, and Cartridge Grade) are set. Care must be taken when sizing PolyKLEAN filtration systems. Select a filter housing that will accept at least the required number of 10 inch filter elements, and ensure that the total system flow does not exceed the maximum housing flow rating.

$$\text{psid [mbar] clean} = \frac{(\text{Total system gpm [lpm]})(\text{Viscosity in Cp})(\text{SPD Value from Table 2})}{(\text{Equivalent number of 10 inch Cartridges in housing})}$$

PolyKLEAN Filter Applications

Industrial	
♦ Plating	♦ Process cooling water
♦ De-salination plants	♦ Parts washing
♦ Pulp & paper	♦ Peroxide
♦ Additives	♦ Mechanical seals
Coatings	
♦ Resin manufacturers (water & solvent)	♦ Ink
♦ Trade, architectural paint	
Food & Beverage	
♦ Bottled water	♦ Soft drinks
♦ Ready-To-Drink Beverages	♦ Juice
Oil & Gas	
♦ Amine & glycol	♦ Process cooling water
♦ Prefiltration in waterflood	♦ Completion fluid
Chemical	
♦ PE-PP	♦ PVC-VCM
♦ Intermediate grade chemicals	♦ Herbicides, pesticides
Electronics	
♦ Printed Circuit Boards	♦ Video Dispalys
♦ CMP slurries	♦ Pre-RO
♦ Electronic Capacitors	♦ CD/DVD
Pharmaceutical	
♦ Pre-RO	♦ Rinse water
♦ Bulk pharmaceutical chemicals	♦ Active pharmaceutical ingredients
♦ Particle control in WFI	

PolyKLEAN Filter Cartridge Specifications

Table 3. - PolyKLEAN Filter Specifications	
Construction	
Filter Media, End Connector	Polypropylene
Gaskets & O-ring Options (see ordering guide)	Silicone, Fluorocarbon, EPR, Nitrile, and Polyethylene
Operating Conditions	
Maximum Operating Temperature	176° F (80°C)
Maximum Differential Pressure	15 psid @ 176°F (1.0 bar @ 80°C) 25 psid @ 140°F (1.7 bar @ 60°C) 60 psid @ 68°F (4.1 bar @ 20°C)
Recommended Change-out Differential Pressure	35 psid @ 68°F (2.4 bar @ 20°C)
Cartridge Dimensions	
Inside Diameter (nominal)	1.1" (28 mm)
Outside Diameter (nominal)	2.6" (66 mm)
Length (nominal) see ordering guide	9 ¾" - 40" (248 - 1016 mm)
Regulatory	
PolyKLEAN filters meet the requirements of USP for the Biological Test for Plastics, Class VI-70°C. Materials used in the manufacture of PolyKLEAN filters meet the requirements of USFDA 21 CFR for food and beverage contact PolyKLEAN filters have been certified to ANSI/NSF Standard 42 and 61	

Chemical Compatibility

The 100% polypropylene construction provides excellent chemical compatibility in many demanding process fluid applications. Compatibility is influenced by process operating conditions. PolyKLEAN cartridges should be tested under actual conditions to determine compatibility.

Table 4. - Fluid Compatibility

Chemical	Temperature	Chemical	Temperature	Chemical	Temperature
Acetic Acid 20%	160°F (71°C)	Hydrogen Peroxide	100°F (38°C)	Sodium Carbonate	160°F (71°C)
Alkanolamines	140°F (60°C)	Methyl Ethyl Ketone	70°F (21°C)	Sodium Hydroxide 70%	160°F (71°C)
Ammonium Hydroxide 10%	160°F (71°C)	Mineral Oil	70°F (21°C)	Sulfuric Acid 20%	160°F (71°C)
Bleach 5.5%	120°F (49°C)	Nitric Acid 20%	120°F (49°C)	Sulfuric Acid 70%	160°F (71°C)
Ethylene Glycol	160°F (71°C)	Potassium Hydroxide	140°F (60°C)	Urea	160°F (71°C)

Scientific Applications Support Services (SASS)

Dedicated technical support teams comprised of CUNO scientists and engineers are available to provide application specific recommendations for the most effective and economical filtration system. In addition to comprehensive testing and analyses conducted in advanced laboratories at CUNO Incorporated, the SASS staff can also perform on site-testing at customer's facilities. Contact your CUNO Distributor for more information

Service Worldwide

CUNO is a U.S. based multinational company with distribution and manufacturing sites worldwide. Global manufacturing sites together with trained stocking distributors and state-of-the-art laboratory facilities bring quality solutions to challenging filtration applications.

CUNO Filter Housings

CUNO manufactures a full line of industry standard filter housings to meet most application requirements. Models are available for both gas and liquid service in a wide range of construction materials, from plastics to ASME Code with 316L stainless steel, to suit a variety of application needs. For more information about CUNO filter housings, consult your local CUNO distributor and ask for the literature listed below.

SD Housings (LITHSSD1)
- Available in a variety of sizes
- Accepts both single and double open end cartridges

CT Series (LITHSCT3)
- Available in a variety of sizes and materials
- Mounting bracket available

AL Series (LITHSAL1)
- Rugged economical design in cast iron and steel
- Easy assembly

CTG-Klean™(LITHSCK1)
- Enclosed System
- Uses disposable filter pack
- Easy to use - housing clean-up eliminated

Express Series® (LITHSES1)
- Maximum design flexibility for a wide variety of system requirements
- ASME Code
- Choice of carbon steel, 304L or 316L stainless steel

VC Series (LITHSVC1)
- Polyvinylchloride construction
- Available for 2 or 3 high cartridges

PC Housings (LITHSPC1)
- Features a removable cartridge pack for rapid change-out and easy cleaning
- ASME Code

DC Series (LITHSDC1)
- Available in a wide variety of sizes
- 304 stainless steel construction

1B Housing (LITHS1B1)
- Available in cast iron and steel, or 304 stainless steel
- Choice of 1 or 2 high cartridge models

1BD Housing (LITHSBD1)
- Available in cast iron and steel, or 304 stainless steel
- Built-in valve for duplex or single operation

1H Housing (LITHS1H1)
- Ideal for high pressure applications
- Durable steel construction

1M Housing (LITHS1M1)
- Lightweight plastic construction
- Choice of 1 or 2 high cartridge models

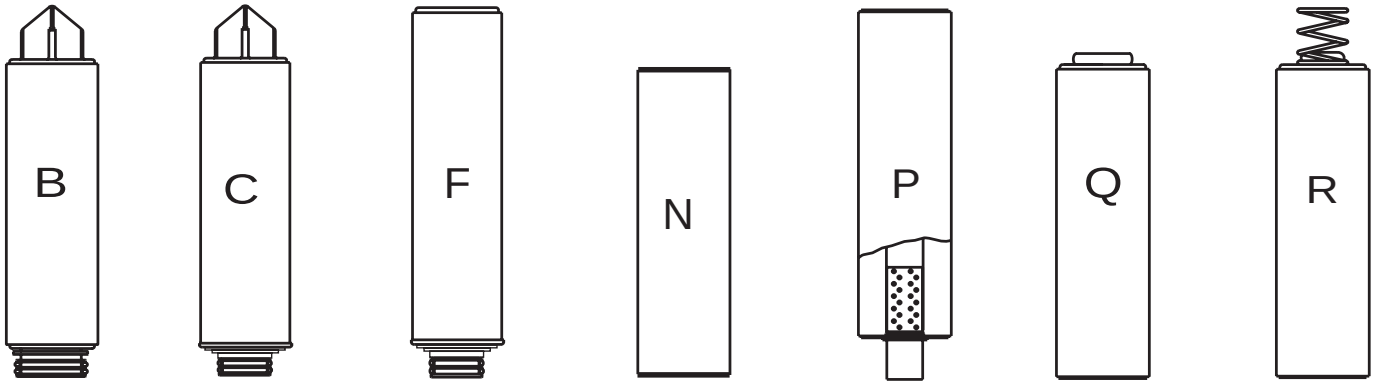
- ES Series housing – the ES series filter housing is a durable high volume filter housing constructed from 316L stainless steel or carbon steel. With a cartridge capacity from 12- to 480- 10 inch filter elements, the ES filter housing can accommodate a wide range of flow requirements. For more information, ask your local CUNO Distributor for brochure LITCHSES1
- AL and CT Filter Housings – AL and CT filter housings offer a wide range of sizes from one cartridge to eighteen cartridges. For more information, ask your local CUNO Distributor for brochure LITHSAL1 and LITHSCT3.
- DC & SD Filter Housings – DC and SD filter housings offer a low cost alternative for low volume filtration. Constructed from reliable 304Lstainless steel (Model DC) or 316L stainless steel (Model SD), these housings are available for a wide range of flow rates and applications. For more information, ask your local CUNO Distributor for brochure LITHSDC1 and LITHSSD1.
- PolyKLEAN filters are available for use in a CTG-Klean™ System. This unique system design provides a totally enclosed system using separate pressure vessel and filter pack to isolate process fluid from housing. This system generally reduces the clean-up costs involved with filter change-out while protecting the work environment and the operator from exposure to the process fluid. Ask your local CUNO distributor for brochure LITCCK001.

PolyKLEAN Filter Cartridge Ordering Guide

Ctg. Type	Length	Grade	Material	Surface	Packaging	Ring Support	End Modification	Gasket/O-Ring
RT - PolyKLEAN	09 - 9 ¾"*	Y - 1µm	16 - Polypropylene	G - Grooved	2 - Bulk	0 - None	B - 226 O-Ring & Spear	A - Silicone
	10 - 10"	B - 5 µm					C - 222 O-Ring & Spear	B - Fluorocarbon
	19 - 19 ½"*	C - 10 µm					F - 222 O-Ring & Flat Cap	C - EPR
	20 - 20"	F - 25 µm					N - None	D - Nitrile
	29 - 29 ¼"*	L - 50 µm					P -Polypropylene Core Extender	G- Polyethylene**
	30 - 30"	Q - 75 µm					Q - Cap without Spring	H - Clear Silicone
	39 - 39"*						R - Cap with Spring	N - None **
	40 - 40"							

* Available with N or P end modifications only

** Available with N, P, Q, or R end modifications only



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