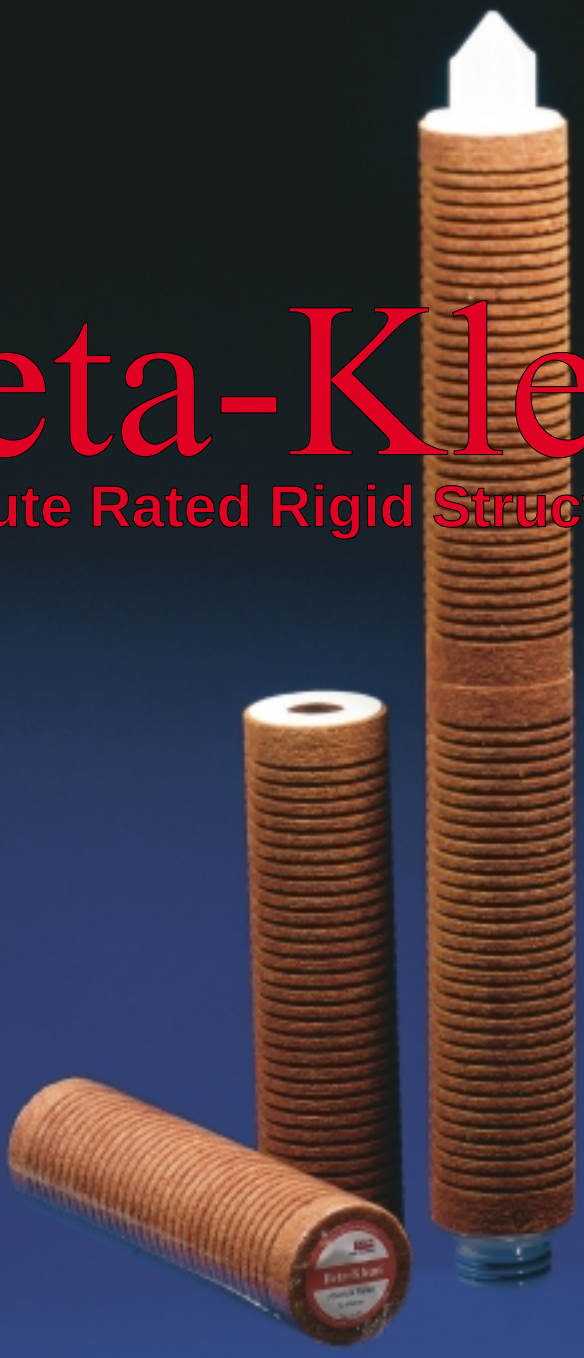
CUNO

Filter Systems

Beta-Klean™

Absolute Rated Rigid Structure Filter Cartridge



The Clear Solution

To Challenging Filtration Applications

BETA-KLEAN FEATURES AND BENEFITS

FEATURE	ADVANTAGE	BENEFIT
♦ Absolute rated cartridge filters from 5 - 70 microns	♦ Absolute filtration efficiency at the specified removal rating	♦ Consistent production yields with absolute contaminant retention
♦ Rigid resin bonded structure	♦ No by-pass or unloading at high differential pressure	♦ Consistent product quality throughout the filter's life
♦ Grooved surface with true graded-density internal structure	♦ Significantly longer life	♦ Cost effective filtration with optimized yields
♦ 300°F high temperature option	♦ Choice of temperature compatible options	♦ Inventory one product for many applications
♦ No metal or plastic cores	♦ Easy disposal,suitable for incineration or shredding	♦ Disposal cost reduction
♦ Available with polypropylene or polyester end modifications	♦ Retrofit any industrial housing	♦ Usable in existing filter housings

Beta-Klean - The Clear Solution

Cuno continues an 80 year tradition of innovative cost effective solutions to challenging industrial filtration applications with Beta-Klean. Beta-Klean is a truly absolute rated, rigid (non-compressible) resin bonded filter cartridge.

Consistent quality and performance at absolute ratings from 5 to 70 m make Beta-Klean the clear choice in the confusing world of **indistinguishable "me-too" cartridge filters.**

Consistent Performance

Absolute rated rigid structure Beta-Klean provides consistent performance. Unlike many competitors, Beta-Klean does not unload or lose filtration efficiency throughout its usable life!

Significant Life Advantage

Beta-Klean's rigid graded density grooved structure provides a significant life advantage over the competition!

CUNO provides quality solutions worldwide for the most challenging filtration applications. CUNO filtration systems include clarifying filters, pre-filters, final filters, stainless steel housings and engineered skid-mounted systems designed and sized for specific applications.

What is Beta-Klean?

Beta-Klean is a rigid, graded-density filter cartridge constructed primarily of acrylic fibers, cellulose fibers, and a tough chemically resistant thermosetting resin. The proprietary manufacturing process results in more fibers towards the center core region creating a graded-density structure. The thermosetting resin "bonds" the fibers into a permanent rigid matrix. Beta-Klean cartridges are grooved to significantly increase the surface area and extend the service life. Beta-Klean is manufactured and tested to deliver quality, consistency, and absolute cost effective filtration performance. Cuno's in-process quality assurance provides the control that results in consistent cartridges with defined absolute ratings time-after-time-after-time.

Absolute Beta-Klean

Absolute Beta-Klean removal ratings are determined for the entire cartridge life using a new filter performance test developed by CUNO that complies with the general procedure outlined in ASTM 975. A copy of Cuno's Technical Report summarizing absolute rating of Beta-Klean cartridges and the test methodology is available by requesting Cuno literature number LITTDMPC2.795.

Cuno defines Absolute Rating as " the particle size (x) providing an initial Beta Ratio (β_x) = 1000." At this Beta Ratio the removal efficiency is equal to 99.9%. Beta Ratio (β_x) is defined by the following equation:

$$\beta_x = \frac{\text{Cumulative Number of Particles Larger than x in the Influent Challenge}}{\text{Cumulative Number of Particles Larger than x in the Effluent}}$$

Beta-Klean filters achieve a minimum Beta$_x$ (β_x) value of 1000 at the specified ratings seen in Table 1.

GRADE DESIGNATION	B_x = 1000 ($_x$ = ABSOLUTE MICRON RATING)
Z8 050	5
Z8 070	7
Z8 100	10
Z8 140	14
Z8 150	15
Z8 200	20
Z8 300	30
Z8 400	40
Z8 500	50
Z8 700	70

TABLE 1. - BETA-KLEAN ABSOLUTE RATINGS

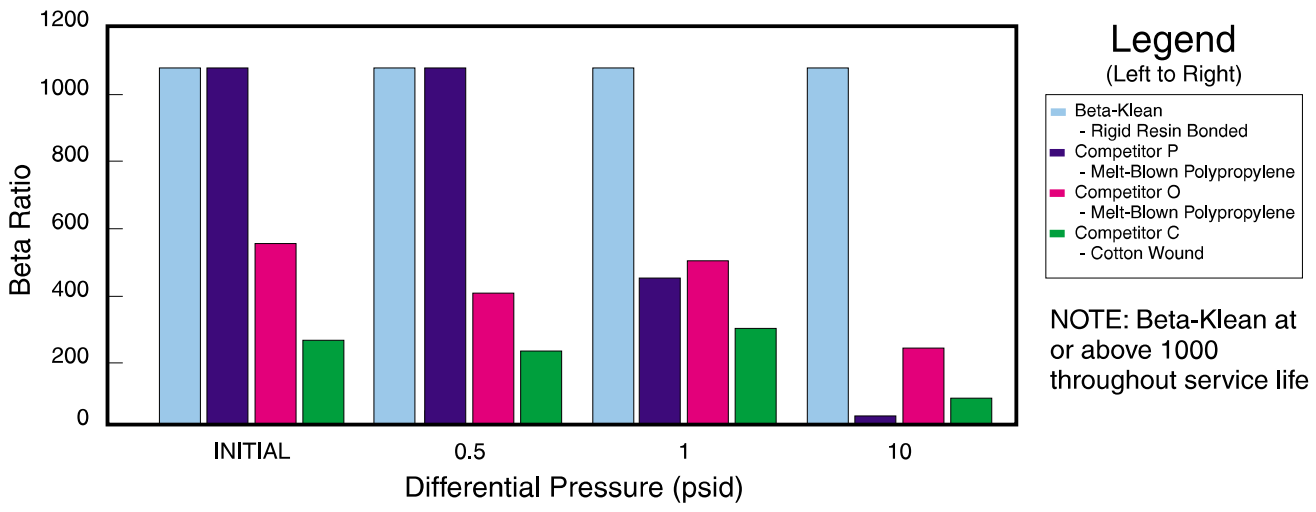
High Temperature Beta-Klean

Standard Beta-Klean provides consistent performance at temperatures to 250°F (121°C) and differential pressures to 70 psid (4.8 bar). High temperature (HT) Beta-Klean extends the temperature rating to 300°F (149°C) for those processes that require service under extreme conditions.

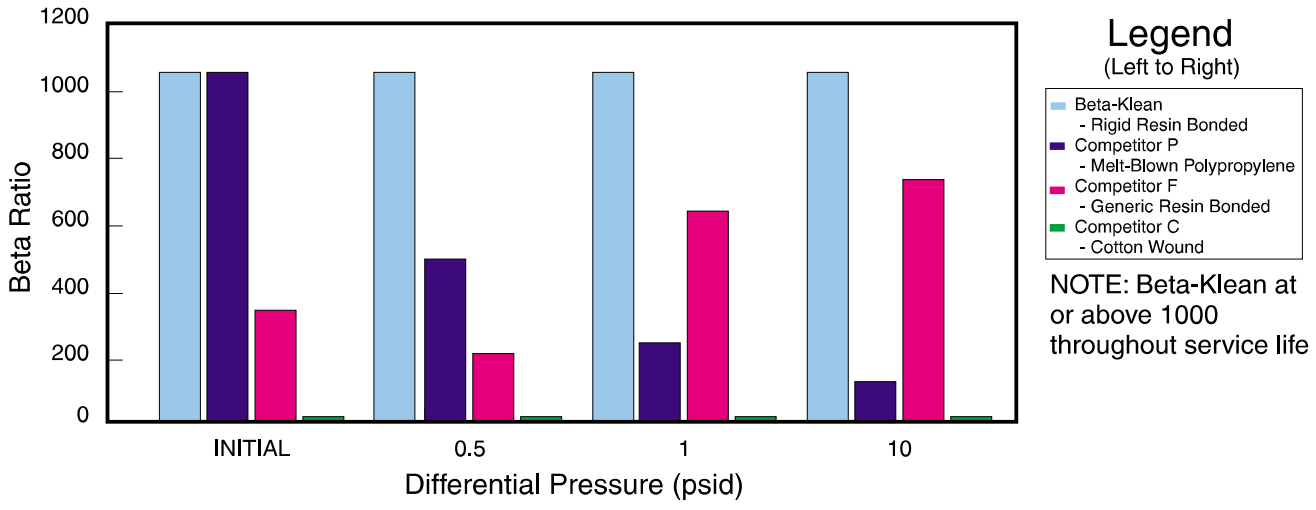
Beta-Klean - Consistent Performance

The initial Beta Ratio for all grades of Beta-Klean filter cartridges is equal to or greater than 1000, and each cartridge performs at or above this initial value throughout its usable (all the way to plugging) life! This defines Beta-Klean's absolute filtration performance. The Beta Ratio vs. Differential Pressure Graphs 1 and 2 illustrate how competitive filters do not achieve the consistent performance of Beta-Klean. Filters that show a decrease in Beta Ratio as the differential pressure increases are exhibiting either unloading of previously held contaminants or a loss of filtration efficiency. This inconsistent performance results in a reduction in finished product quality, product yield, and an increase in total filtration cost.

GRAPH 1. - BETA RATIO COMPARISON OF FILTER CARTRIDGES RATED AT 20 MICRONS



GRAPH 2. - BETA RATIO COMPARISON OF FILTER CARTRIDGES RATED AT 70 MICRONS



As illustrated in Graphs 1 and 2, the performance of melt-blown polypropylene (Competitor P) degrades rapidly after a small (0.5 psi) increase in differential pressure, indicating contaminant unloading and a loss of filtration efficiency typical of a compressible structure. In Graph 1, the generic cotton wound, Competitor C, exhibits erratic performance caused by media movement under increasing pressure, and, in Graph 2, it exhibits minimal ability to retain contaminant throughout the test. In Graph 1, melt-blown Competitor O never approaches a Beta Ratio of 1000, and it shows a decreasing Beta Ratio at high differential pressure. Resin bonded Competitor F, as shown in Graph 2, exhibits very low Beta Ratios at low differential pressures indicating poor performance. Above 1.0 psid, the contaminant builds a cake which accounts for the subsequent increase in Beta Ratio. **Beta-Klean exhibits consistent Beta Ratios at all differential pressures.**

Rigid Graded-Density Beta-Klean

Rigid Graded-Density Beta-Klean

Beta-Klean filter cartridges are manufactured using an exclusive proprietary process that achieves a true "graded-density" fiber structure with a clean and smooth inside diameter. Each fiber is locked in this arrangement by a thermosetting resin binder to create a rigid structure, eliminating the need for a metal or plastic center core. Larger particles are trapped in the outer area and finer particles towards the inner area. Figure 1 illustrates how in a graded-density structure the overall effect is to classify and retain particles by size as they progress through the cartridge.

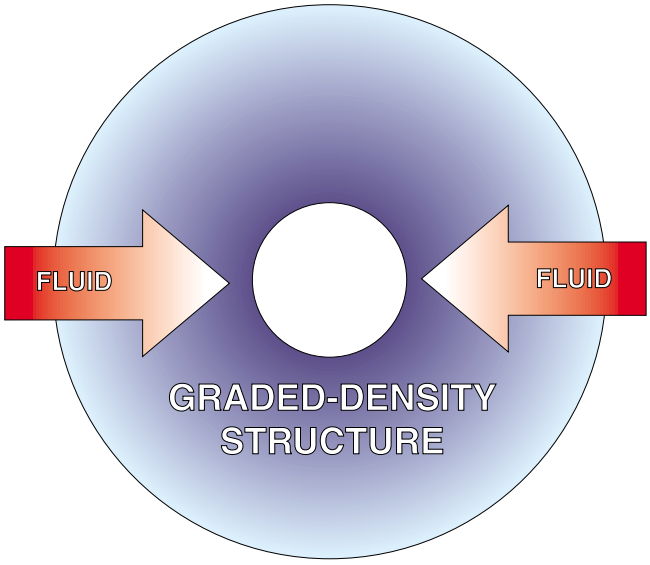


FIGURE 1. - BETA-KLEAN GRADED-DENSITY STRUCTURE

High Surface Area Beta-Klean

Beta-Klean cartridges also feature an optimized groove pattern that increases the surface area by over 65% when compared to smooth cylindrical cartridges (see Figure 2). The grooved surface prevents premature blinding of the outer surface by large particles and allows full utilization of the depth structure. Maximum surface area with a true graded-density structure means that Beta-Klean can provide **3 times or greater service life than competitive filter cartridges.**

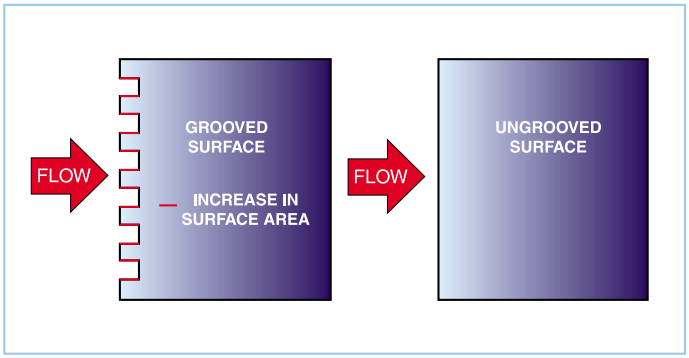


FIGURE 2. - SURFACE AREA COMPARISON

Beta-Klean Applications

Beta-Klean provides consistent reproducible filtration performance and longer life while meeting or exceeding quality specifications in a wide variety of industrial processing applications. Beta-Klean is particularly well suited for high viscosity fluids, high temperature processes, and differential pressures to 70 psid (4.8 bar).

Applications include:

- **Petroleum Products - gasoline, kerosene, lube oil, fuel oil, waxes**
- **Chemical/Petrochemical - acids, bases, organic solvents, catalysts, monomers, polymers, glycols**
- **Water - process water, produced water, boiler feed, demineralized feed, pre-reverse osmosis system, waste water**
- **General Industrial - paint, varnish, lacquer, inks, coatings, emulsions, magnetic media, resins, detergents, adhesives**
- **Brines and aqueous salt solutions**

Reproducible Cost Effective Filtration

Beta-Klean is manufactured to rigid specifications and subjected to stringent process and quality controls to ensure consistency in filtration performance and, ultimately, end-user process consistency - run after manufacturing run.

Beta-Klean Product Specifications

ABSOLUTE RATING (µm)	GRADE	FIBER	RESIN
5	Z8050	Acrylic/Glass/Cellulose	Phenolic
7	Z8070		
10	Z8100		
14	Z8140		
15	Z8150		
20	Z8200	Acrylic/Cellulose	Phenolic
30	Z8300		
40	Z8400		
50	Z8500		
70	Z8700		
Cartridge End Modifications			
Standard Temperature		Polypropylene bonding with polypropylene end modifications	
High Temperature		Thermoset epoxy bonding with polyester end modifications	
Operating Parameters			
Maximum Operating Temperature		Standard - 250°F (121°C) With **polyethylene gasket** - 200°F (93°C) With **polypropylene end modifications** - 180°F (82°C)	
		High Temperature Option - 300°F (149°C) with or without **polyester end modifications**	
Maximum Differential Pressure		70 psid (4.8 bar) @ 68°F (20°C)	
Recommended Change-out Differential Pressure		35 psid (2.4 bar)	
Dimensions			
Inside Diameter		1 1/16" (26.9 mm)	
Outside Diameter		2 19/32" (65.9 mm)	
Cartridge Length		9 3/4" through 40" (248 - 1016 mm)	

Beta-Klean - Providing Superior Performance

CARTRIDGE CROSS REFERENCE

The data in the following table was developed through extensive filter performance testing. The "Cuno Life Advantage" data is based on contaminant added values comparing filter elements of approximately equal efficiencies. The filtration efficiency/Beta Ratio performance of competitive "nominal rated" and many "absolute rated" filter cartridges vary greatly throughout their usable life (refer to Graphs 1 and 2).

Cartridge Manufacturer	Designation	Cartridge Type	Manufacturer Rating	Cuno Replacement	Cuno Absolute Rating (µm)	Cuno Life Advantage[1]
Commercial, Parker-Hannifin RBC	RBC 5	Resin bonded, coreless	5 Nominal	BKZ8300	30	1.5
	RBC 10		10 Nominal	BKZ8400	40	1.5
	RBC 25		25 Nominal	BKZ8500	50	1.5
	RBC 50		50 Nominal	BKZ8700	70	1.5
Filterite / Memtec - HiV	RPN XF	Resin bonded, coreless	1 Nominal	BKZ8200	20	1.5
	RPN 5		5 Nominal	BKZ8500	50	1.5
	RPN 10		10 Nominal	BKZ8500	50	2.0
	RPN 25		25 Nominal	BKZ8700	70	3.0
Pall Profile II	RM1F050	Melt-blown polypropylene wound on center core	5 Absolute	BKZ8050	5	1.5
	RM1F070		7 Absolute	BKZ8070	7	1.5
	RM1F100		10 Absolute	BKZ8100	10	2.0
	RM1F150		15 Absolute	BKZ8150	15	2.5
	RM1F200		20 Absolute	BKZ8200	20	2.5
	RM1F400		40 Absolute	BKZ8400	40	2.5
	RM1F700		70 Absolute	BKZ8700	70	1.5
	RM1F900		90 Absolute	BKZ8700	70	2.0
Selex / Osmonics	SXE -01	Melt-blown polypropylene, coreless	1 Not clearly defined	BKZ8050	5	3.0
	SXG-03 *		3 Not clearly defined	BKZ8070	7	2.5
	SXD -05		5 Not clearly defined	BKZ8100	10	3.0
	SXA -10 *		10 Not clearly defined	BKZ8140	14	2.5
	SXC -20		20 Not clearly defined	BKZ8300	30	3.0
	SXF-30 *		30 Not clearly defined	BKZ8400	40	2.5
Hytrex II / Osmonics	GX-01	Spun polypropylene fiber, coreless	1 Nominal	BKZ8200	20	2.0
	GX-03		3 Nominal	BKZ8300	30	3.0
	GX-05		5 Nominal	BKZ8300	30	2.5
	GX-10		10 Nominal	BKZ8400	40	2.5
	GX-20		20 Nominal	BKZ8500	50	2.5
	GX-50		50 Nominal	BKZ8700	70	3.0
Generic Wounds (Cotton)	03 µm	String wound on center core	3 Nominal	BKZ8100	10	2.0
	05 µm		5 Nominal	BKZ8150	15	2.0
	10 µm		10 Nominal	BKZ8200	20	2.0
	25 µm		25 Nominal	BKZ8300	30	2.0
	50 µm		50 Nominal	BKZ8700	70	2.5
	75 µm		75 Nominal	❑	❑	❑

[1] Life advantage is determined from laboratory performance tests at 3 gpm/EQSL

* Extrapolation from literature.

❑ Insignificant Beta Ratio for 70 µm particles.

Beta-Klean Flow Rates

Table 2 provides flow information for Beta-Klean in aqueous fluids.

GRADE	ABSOLUTE RATING (µm)	SPECIFIC PRESSURE DROP PER 10" CARTRIDGE[1]		RECOMMENDED MAXIMUM AQUEOUS FLOW RATE[2] PER 10" CARTRIDGE	
		psi/gpm	mbar/lpm	gpm	lpm
Z8 050	5	0.75	13.6	3	11.4
Z8 070	7	0.33	5.98	3	11.4
Z8 100	10	0.20	3.64	4	15.1
Z8 140	14	0.16	2.89	4	15.1
Z8 150	15	0.27	4.88	4	15.1
Z8 200	20	0.13	2.34	5	18.9
Z8 300	30	0.08	1.44	5	18.9
Z8 400	40	0.06	1.10	6	22.7
Z8 500	50	0.05	0.89	7	26.5
Z8 700	70	0.03	0.55	7	26.5

[1] Specific aqueous pressure drop at ambient temperature for a single equivalent 10" cartridge . For multiple cartridge lengths, divide total flow by the number of single length equivalents.

[2] Optimal efficiency and life is achieved at aqueous flow rates less than the maximum flow indicated.

TABLE 2. BETA-KLEAN FLOW RATES

For liquids other than water, multiply the specific pressure drop value (in column 3) by the viscosity in centipoise. The specific pressure drop values may be effectively used when three of the four variables (Viscosity, Flow, Differential Pressure, and Cartridge Grade) are set.

Examples Of Flow Or psid Calculations

Example 1: Determine the initial pressure drop for <u>water</u> flowing at 15 gpm per 30" (Z8300) 30 µm cartridge

Fluid = water (1centipoise)
Flow = 15 gpm
Flow per 10" cartridge = 15 ÷ 3 = 5 gpm (equal to rec. max. flow)
Specific pressure drop from column 3 of Table 2 = 0.08 psi/gpm
Calculate: 0.08 x 5 = 0.4 psi initial pressure drop for the 30" cartridge

Example 2: Determine the <u>oil</u> flow rate at an initial pressure drop of 2.0 psi per 10" (Z8500) 50 µm cartridge

Fluid = 100 centipoise oil
Initial differential pressure = 2.0 psi
Specific pressure drop from column 3 of Table 2 = 0.05 psi/gpm
Multiply psi/gpm x viscosity in centipoise = 0.05 x 100 = 5 psi/gpm per 10" cartridge
Calculate: 2.0 (psi) ÷ 5 (psi/gpm per 10" cartridge) = 0.4 gpm per 10" cartridge in 100 centipoise oil

Beta-Klean - Ease of Use

Waste Management

Beta-Klean filter cartridges contain no metal or plastic cores. They can be incinerated, shredded, or crushed after use to reduce overall disposal costs. For more information about Beta-Klean disposal, refer to Cuno literature GF.TD2.

Beta-Klean Chemical Compatibility

Table 3 shows Beta-Klean's wide range of chemical compatibility. Beta-Klean exhibits excellent resistance to petroleum products, organic solvents, water, acids, brines and aqueous salt solutions. Beta-Klean is not recommended for strong acids or bases at temperatures over 100°F (38°C).

FLUID		RATING
CATEGORY	EXAMPLE	
Petroleum	Gasoline	R
	Kerosene	R
	Diesel Fuel	R
	Lube Oil	R
	Fuel Oil	R
	Waxes	R
Organic Solvents	MEK	R
	Benzene	R
	Toluene	R
	Xylene	R
	Alcohols	R
	Glycols	R
	Dimethyl Formamide (DMF)	N
	Amines (DEA, MDEA, MEA) 20% - 50% up to 160°F (71°C)	L
Water	Process	R
	Produced	R
	Boiler Feed	R
	Demineralizer Feed	R
	Potable Water	N
	WFI	N
Organic Acids	Acetic (100%)	R
	Tannic 10%	R
Inorganic Acids	Hydrochloric (Muriatic) Acid 5%	R
	Sulfuric 50%	R
	Sulfurous 5-10%	R
	Nitric	R
Brines and Aqueous Salt Solutions	Sodium Chloride	R
	Sodium Sulfate	R
	Sodium Nitrate	R
Weak Alkalis	Aluminum Hydroxide	R
	Ferric Hydroxide	R
	Magnesium Hydroxide	R
Fatty Acids - Oils	Detergents	R
	Mineral Oil	R
	Industrial Vegetable Oils	R
	Silicone Oils	R
Oxidizers	Hydrogen Peroxide 90%	R
R = Generally Recommended up to 250°F (121°C) unless otherwise noted.		
N = Not Recommended		
L = Likely Compatible, test before use.		

TABLE 3. - CHEMICAL COMPATIBILITY

The data presented in Table 3 is for general guidance only. Testing under specific application conditions is recommended. For various end modifications and multi-length cartridges, consult your local distributor or Cuno. Refer to Cuno publication GF.G02.788 for additional information.

INDUSTRIAL HOUSING SELECTION GUIDE					
FILTER HOUSING MODEL	CTG. HEIGHTS	NUMBER OF CARTRIDGES *	INLET/OUTLET	MAXIMUM AQUEOUS FLOW RATE **	
				gpm	lpm
1BD1	1 x 9 3/4"	2	1/2" NPT	9 1/2	36
1BD2	2 x 9 3/4"	4			
1WTS1	1 x 9 3/4"	1			
1WTS2	1 x 19 1/2"	2			
1B1, 1M1, CT 101	1 x 9 3/4"	1	3/4" NPT	16	61
1B2, 1M2, CT 102	1 x 19 1/2"	2			
1BD1	1 x 9 3/4"	2	1" NPT	27	102
1BD2	2 x 9 3/4"	4			
CT 101, 1H	1 x 9 3/4"	1			
CT 102	1 x 19 1/2"	2			
CT 103	1 x 29 1/4"	3			
3WTS1	3 x 9 3/4"	3			
3WTS2	3 x 19 1/2"	6			
3WTS3	3 x 29 1/4"	9			
7WTS1	7 x 9 3/4"	7	1 1/4" NPT	47	178
7WTS2	7 x 19 1/2"	14			
7WTS3	7 x 29 1/4"	21			
3AL1	3 x 9 3/4"	3	1 1/2" NPT	63 1/2	240
3AL2	3 x 19 1/2"	6			
3AL3	3 x 29 1/4"	9			
4DC1	4 x 9 3/4"	4			
5DC1	5 x 9 3/4"	5			
4DC2	4 x 19 1/2"	8	2" NPT	100	397
4DC3	4 x 29 1/4"	12			
5SD1	5 x 9 3/4"	5			
5SD2, 5DC2, 5VC2	5 x 19 1/2"	10			
5SD3, 5 DC3, 5VC3	5 x 29 1/4"	15			
5SD4, 5DC4	5 x 39"	20			
6AL1	6 x 9 3/4"	6			
6AL2	6 x 19 1/2"	12			
6AL3	6 x 29 1/4"	18			
7PC1	7 x 9 3/4"	7			
7PC2	7 x 19 1/2"	14			
FL08	6 x 9 3/4"	6	2" FLANGE	100	397
	6 x 19 1/2"	12			
	6 x 29 1/4"	18			
	6 x 39"	24			
PL08	6 x 29 1/4"	18			
12DC2, 12SD2	12 x 19 1/2"	24	3" FLANGE	220	833
12SD3, 12SD3	12 x 29 1/4"	36			
12SD4	12 x 39"	48			
FL12	12 x 19 1/2"	24			
	12 x 29 1/4"	36			
	12 x 39"	48			
PL12	12 x 29 1/4"	36			
22SD3/22DC3	22 x 29 1/4"	66	4" FLANGE	380	1440
22SD4/22DC4	22 x 39"	88			
FL14	18 x 29 1/4"	54			
	18 x 39"	72			
PL14	18 x 29 1/4"	54			
FL16	24 x 29 1/4"	72	6" FLANGE	870	3290
	24 x 39"	96			
PL16	24 x 29 1/4"	72			
FL20	36 x 29 1/4"	108			
	36 x 39"	144			
PL20	36 x 29 1/4"	108			
FL24	52 x 29 1/4"	156			
	52 x 39"	208			
PL24	52 x 29 1/4"	156			
FL30	85 x 29 1/4"	255	8" FLANGE	1500	5680
	85 x 39"	340			
PL30	85 x 29 1/4"	255			
* Equivalent single length cartridges ** Based on 10 FPS housing velocity. In most cases, the filter cartridge dictates system flow and pressure drop.					

TABLE 4. - INDUSTRIAL HOUSING SELECTION GUIDE

Industrial Filter Housings

Cuno manufactures a full line (see Table 4 on opposite page) of Beta-Klean compatible standard filter housings to meet most application requirements. Models are available for both air and liquid 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.

PL Series *(LITHSPL1)*

- Available in a wide variety of standard industrial designs
- ASME Code
- Choice of carbon steel or 304 stainless steel

SD Housings *(LITHSSD1)*

- Available in a variety of sizes
- Accepts both single and double open end cartridges

CT Series *(LITHSCT3)*

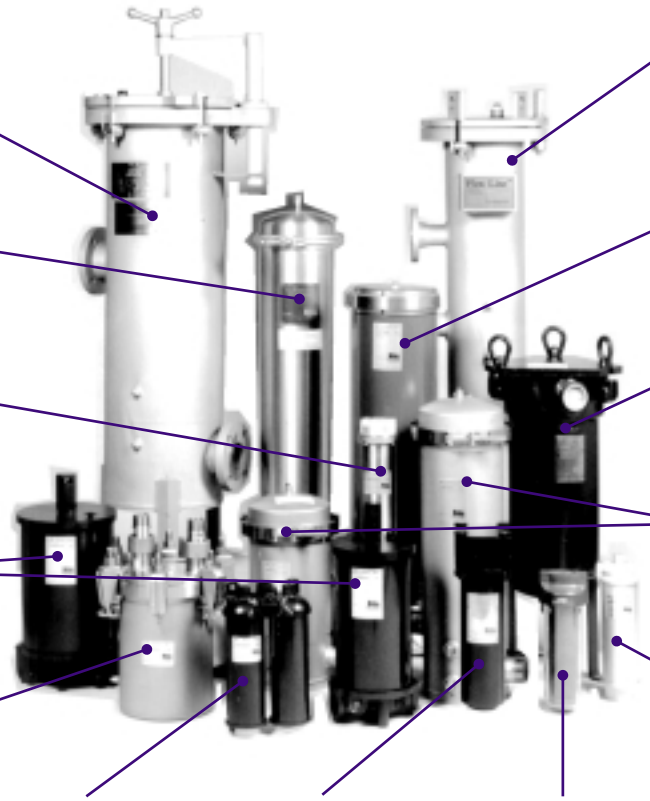
- Available in a variety of sizes and materials
- Mounting bracket available

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



Flex Line® *(LITHSFL1)*

- Maximum design flexibility for a wide variety of system requirements
- ASME Code
- Choice of carbon steel 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

EXAMPLE USING TABLES 2 AND 4 FOR FILTER SIZING

Table 2 (BETA-KLEAN FLOW RATES) and Table 4 (INDUSTRIAL HOUSING SELECTION GUIDE) can be used to determine the appropriate size housing for use with your system. After selecting the filter cartridge and calulating the number of equivalent single length (EQSL) cartridges required to achieve the desired flow and pressure drop, use Table 4 to select the housing suited to your process. Note: In most cases, the filter cartridge dictates system flow and pressure drop.

Example: Calculate Flow per EQSL and select housing

Process Parameters:

FLUID: Water
FLOW: 140 gpm
FILTRATION REQUIRED: 10 µm ABSOLUTE
PER CARTRIDGE PRESSURE DROP REQUIRED: ≤ 1.0 psi

STEP 1. From Table 2, a Z8100 (10µm) Beta-Klean gives 4 gpm/cartridge maximum recommended flow and a specific pressure drop of 0.2 psi/gpm for each 10" cartridge.

STEP 2. At 4 gpm/cartridge, the initial pressure drop will be:

4 x 0.2 = 0.8 psi

This is well within the specified limit of 1 psi. Therefore:

140 gpm 4gpm/EQSL = 35 EQSL

A total of 35 EQSL (35 x 10", 18 x 20", 12 x 30", or 9 x 40" cartridges) will meet the suggested 4 gpm/EQSL flow rate

STEP 3. From Table 4, a FL12 housing holds 12 (30") cartridges and will easily accommodate the 140 gpm system flow. (Other housings listed in Table 4 will also meet these requirements.)

Beta-Klean Ordering Guide

CTG. TYPE	LENGTH*	GRADE	SURFACE	PACKAGING **	TEMPERATURE OPTION	END MODIFICATION	GASKET/O-RING
BK - BETA-KLEAN	09 - 9 ¾" 10 - 10" 19 - 19 ½" 20 - 20" 29 - 29 ¼" 30 - 30" 39 - 39" 40 - 40"	Z8050 Z8070 Z8100 Z8140 Z8150 Z8200 Z8300 Z8400 Z8500 Z8700	G - GROOVED U - UNGROOVED	1 - STANDARD SHRINK WRAP 2 - BULK PACK	S - STANDARD H - HIGH TEMP.	C - 222 O-RING & SPEAR F - 222 O-RING & FLAT CAP K - 222 O-RING, RETAINING CLIP & FLAT CAP N - NONE P - POLYPROPYLENE CORE EXTENDER S - SS CORE EXTENDER	A - SILICONE B - FLUOROCARBON C - EPR D - NITRILE G - VOLARA GASKET*** N - NONE

* Lengths are multiples of either 9 3/4" or 10". ** All 39" and 40" cartridges poly bagged. ***Required for grades Z8050 through Z8140

Notes on End Modification Ordering

Double Open-End (DOE) Cartridges

DOE without end modification or gasket: N - N

DOE with flat gasket: N - G

Single Open-End (SOE) O-Ring Style End Modifications

C - Code 8 style end modification (222) double o-ring connector with locating spear for use with standard plug-in style housing diaphragms and positioning plates.

F - Code 3 style end modification (222) double o-ring connector with flat cap for use with standard plug-in style housing.

K - 222 style o-ring connector with one o-ring and retaining clip for use with the 7PC housing

Core Extenders - For proper alignment and cartridge centering in competitive housings

P - Polypropylene extender for applications where compatible

S - Stainless Steel extender for chemical compatibility and for high temperatures > 180°F (82°C)

Applications Support - SASS

Cuno's Scientific Applications Support Services (SASS) is staffed by scientists and engineers, with state-of-the-art laboratory facilities. The SASS staff, familiar with a wide range of filtration and separation applications, work closely with the customer to recommend the most effective and economical Cuno filtration systems.

WARRANTY

Seller warrants its equipment against defects in workmanship and material for a period of 12 months from date of shipment from the factory under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by Seller and for purposes disclosed in writing at the time of purchase, if any. Any unauthorized alteration or modification of the equipment by Buyer will void this warranty. Seller's liability under this warranty shall be limited to the replacement or repair, F.O.B. point of manufacture, of any defective equipment or part which, having been returned to the factory, transportation charges prepaid, has been inspected and determined by the Seller to be defective. THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER. Under no circumstances shall Seller be liable to Buyer or any third party for any loss of profits or other direct or indirect costs, expenses, losses or consequential damages arising out of or as a result of any defects in or failure of its products or any part or parts thereof or arising out of or as a result of parts or components incorporated in Seller's equipment but not supplied by the Seller.

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