

Micro-Klean™ RP Series

Polypropylene Rigid Graded Porosity Cartridge Filters

Cleaner, Faster Flowing, Longer Lasting

Cleaner, faster flowing, longer lasting advancing depth filtration through technological innovation. 3M Purification Micro-Klean RP Series filters are manufactured using a rigid extrusion bonded technology. These all-polypropylene depth filter cartridges offer premium benefits compared to competitive filters. These benefits include:

- increased surface area for extended filter life,
- low initial pressure drop for enhanced flow,
- 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 Micro-Klean RP Series filters can significantly reduce total filtration cost.



Features and Benefits

Advanced graded porosity design

- Longer service life
- Fewer filter change-outs

Rigid depth filter construction

- Helps protect against unloading of particles during service life

Grooved cartridge with extended surface area

- Promotes fuller utilisation of the depth-matrix
- Longer filter life

All-polypropylene construction

- Compatibility in a wide range of applications and operating conditions
- Cleaner design with no adhesives, binders, surfactants, or lubricants

Materials of construction listed in FDA 21 CFR

- Complies with regulations for food & beverage contact

Core-less filter structure

- Ease of disposal

Continuous integral length filter element (up to 40" length)

- No bond joints to break
- Easy to install

The unique manufacturing process of Micro-Klean RP Series filters combines superior process control with the quality assurance of an ISO-certified quality system to provide consistent product performance. This exclusive manufacturing process provides a high degree of fibre-to-fibre thermal bonding, without the use of binders, to produce a rigid, coreless filter structure with the following properties:

- does not unload contaminants as differential pressure increases; a performance flaw in melt-blown 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,
- exhibits exceptionally low differential pressure for a given filter rating.

Applications

Micro-Klean RP Series filters are suitable for a wide range of particle control and equipment protection applications in the Food & Beverage and Pharmaceutical industries. 3M Purification recommends testing under actual application conditions to determine the right product and retention rating.

Food & Beverages

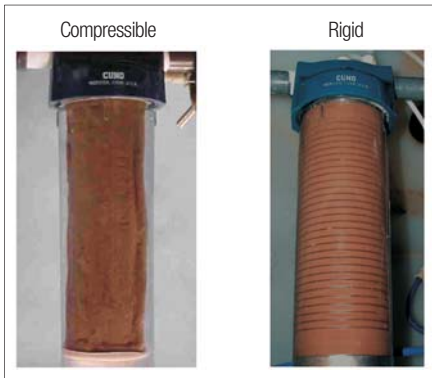
- Bottled Water
- Ready-to-Drink Beverages
- Dairy Products
- Juices
- Soft Drinks
- Process & Blending Water

Pharmaceuticals

- Pre-Reverse Osmosis
- Bulk Chemicals
- Rinse Water
- Active Pharmaceutical Ingredients



Picture 1: Compressible vs. Rigid Cartridge Structure at 2.4 bar



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 melt-blown and string-wound filters, tend to compress and change porosity with increased pressure, while rigid structures do not (see picture 1, “Compressible vs. Rigid Structure at 2.4 bar”). Media compression can result in short filter life because the pores collapse and ultimately close. Media compression can also cause the filter to release already held particles. The robust Micro-Klean RP filter captures and retains contaminant within its rigid filter matrix, even under increasing differential pressure.

In addition to enhanced filtration efficiency and contaminant retention over the service life of the Micro-Klean RP filter, the unique depth filter structure provides greater flow at a given pressure. The Micro-Klean RP filter is self-supporting, unlike soft melt-blown and wound filters that require core support 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 utilisation of the depth-matrix. The result is significantly longer life than competitive cartridges.

Figure 2: Graded Porosity

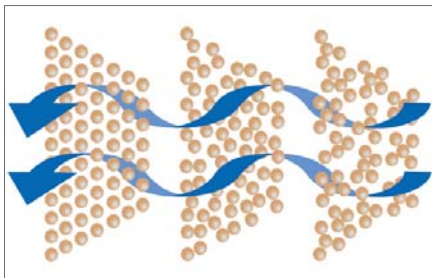
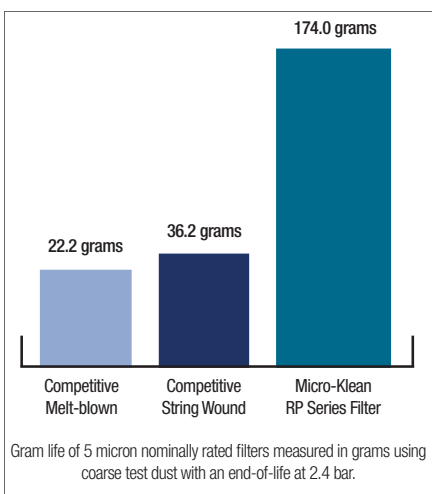


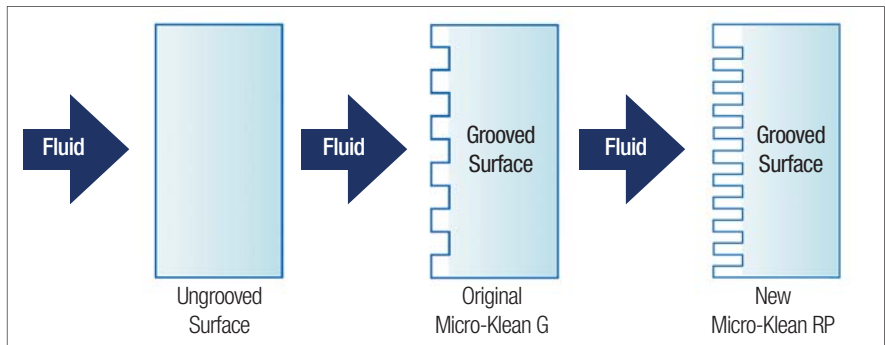
Figure 3: Cartridge Gram Life



Increased Surface Area

The Micro-Klean RP Series filter is designed with deeper and more numerous grooves compared to the standard Micro-Klean G Series filters, resulting in 34% more surface area. Compared to a conventional ungrooved filter, the surface area increase is 140%. This new design results in greater capacity and longer service life, driving down operating costs.

Figure1: Surface Area



Graded Porosity

Micro-Klean RP Series filters use a graded porosity design that effectively traps larger particles toward the outer diameter of the filter structure and progressively smaller particles toward the inner diameter of the filter. This allows for even particle loading throughout the depth of the filter and helps to maximum filter service life.

Increased Capacity

When compared to conventional polypropylene “melt-blown” and string-wound filters, Micro-Klean RP Series filters exhibit significantly greater particle capacity. In the graph at the right, the capacity of the five micron nominally rated Micro-Klean RP Series filter was tested against comparably rated melt-blown and string-wound filters. The test was conducted using standardised test dust at a common concentration and flow rate. The test was concluded when the pressure drop reached 2.4 bar and the total captured particle weight per filter type was determined. As the graph shows, the Micro-Klean RP Series offers significantly greater capacity, resulting in longer filter service life.

Greater Efficiency

When compared to conventional polypropylene pleated and string-wound filters, Micro-Klean RP Series filters exhibit significantly greater particle trapping efficiency. In the graph at the left, the efficiency of the nominally rated five micron Micro-Klean RP Series filter was tested against comparably rated pleated and string-wound filters. The test was conducted using standardised test dust with particles between 10 and 15 microns at the same concentration and flow rate. Particle counts were taken upstream and downstream of the filters and the efficiencies were calculated using the following formula:

$$\text{Efficiency \%} = \left(\frac{\text{Particles upstream} - \text{Particles downstream}}{\text{Particles upstream}} \right) \times 100$$

As the Cartridge Efficiency graph shows, the Micro-Klean RP series offers significantly better efficiency, resulting in superior particle control.

Flow Rates

The unique design and construction of the Micro-Klean RP Series filter allows for significantly lower pressure drop when compared to competitive elements. Figure 5 clearly demonstrates the Micro-Klean RP series flow advantage when compared to other five micron rated competitive melt-blown and string wound cartridge filters. For a given differential pressure, Micro-Klean RP Series filters yield flows up to ten times that of competitive filters, a significant advantage when sizing a system for a given process flow rate. Flow rate advantage translates into lower capital investment for filter housings and fewer cartridges to purchase. As shown in Table 1, a process with a water flow rate of 681 l/min and a maximum clean pressure drop of 34.5 mbar, a Micro-Klean RP Series filter system requires significantly fewer cartridges and smaller filter vessels (compared to competitive filters) for greatly reduced capital costs.

Figure 4: Cartridge Efficiency

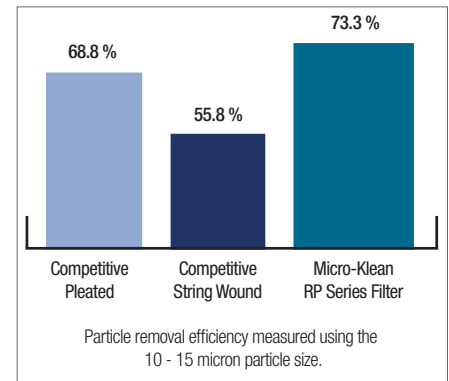
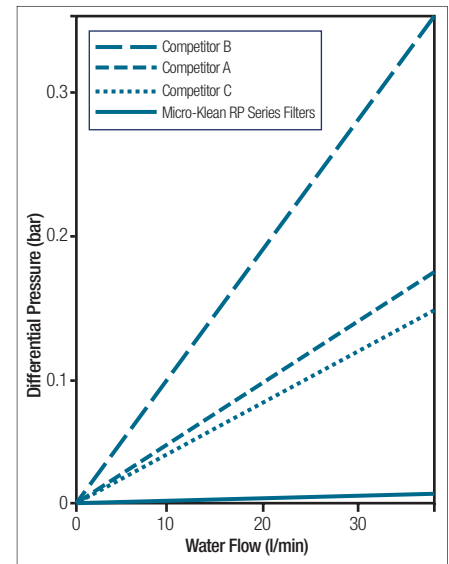


Figure 5: Flow Rates



Filter	30" Filters Required for a 681 l/min flow rate* with a clean pressure drop of 34.5 mbar	Housing Diameter (Inches) Required for 30" Double Open End Filters
Micro-Klean RP Filters	12	12
Competitor A Wound Polypropylene Filters	29	20
Competitor B Filters	60	30
Competitor C Filters	24	16

*Based on the manufacturers' literature piece specifications as of 6/09

Nominal Rating (µm)	Specific Pressure Drop per 10" filter (mbar per l/min-Cp)
5	0.637
25	0.328
50	0.182

Filter System Sizing

To size a system of Micro-Klean RP Series filters, flow vs. differential pressure data is provided in Table 2.

To calculate a filter's clean pressure drop for Newtonian fluids, use the formula on the right 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 Micro-Klean RP Series 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.

$$\text{mbar clean} = \frac{\left(\frac{\text{Total System}}{\text{in l/min}} \right) \left(\frac{\text{Viscosity}}{\text{in CP}} \right) \left(\frac{\text{SPD Value}}{\text{from Table 2}} \right)}{\text{Equivalent number of 10-inch cartridges within housing}}$$

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Table 3: Micro-Klean RP Filter Specifications	
Construction	
Filter Media	Polypropylene
Operating Conditions	
Maximum Operating Temperature	80 °C
Maximum Differential Pressure	1.0 bar at 80 °C
	1.7 bar at 60 °C
	4.1 bar at 20 °C
Recommended Change-out Differential Pressure	2.4 bar at 20 °C
Cartridge Dimensions	
Inside Diameter (nominal)	28 mm
Outside Diameter (nominal)	66 mm
Length (nominal) - see ordering guide	9.75" - 40" (248 - 1016 mm)
Regulatory	
Micro-Klean RP filters meet the requirements of USP for the Biological Test for Plastics, Class VI-70 °C. Materials used in the manufacture of Micro-Klean RP filters meet the requirements of United States FDA 21 CFR for food and beverage contact.	

Chemical Compatibility

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

Table 4: Fluid Compatibility			
Chemical	Temperature	Chemical	Temperature
Acetic Acid 20%	71 °C	Potassium Hydroxide	60 °C
Bleach 5.5%	49 °C	Sodium Carbonate	71 °C
Sulphuric Acid 70%	71 °C	Sodium Hydroxide 70%	71 °C
Hydrogen Peroxide	38 °C	Sulphuric Acid 20%	71 °C
Nitric Acid 20%	49 °C		

Micro-Klean RP Series Ordering Guide

Cartridge Type	Length	Grade	Material	Surface	Packaging	Ring Support	End Modification	Gasket/O-ring
RP (Micro-Klean RP Series)	09 = 9 ¾" 10 = 10" 19 = 19 ½" 20 = 20" 29 = 29 ¼" 30 = 30" 39 = 39" 40 = 40"	B = 5 µm F = 25 µm L = 50 µm	18 = Polypropylene	G = Grooved	2 = bulk	0 = None	N = None	N = None

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