

3M Purification Inc.

Micro-Klean™ RT Series

All-Polypropylene Rigid Thermal Bonded Filters



Innovative
Filtration
Solutions

Quality. Consistency. Performance.



Micro-Klean™ RT Series Filter Cartridges

Advancing Depth Filtration Through Technological Innovation

Micro-Klean™ RT series filters, manufactured using 3M Purification Inc.'s rigid extrusion bonded technology, are all-polypropylene depth filter cartridges offering premium features including:

- consistent particle reduction efficiencies throughout the filter's life,
- increased surface area for extended filter life,
- low initial pressure drop for enhanced flow, and
- high particle reduction 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 RT series filters can significantly reduce total filtration costs.

Micro-Klean™ RT Series Filter Construction

The unique Micro-Klean RT series 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. 3M Purification 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.

Media compression can also cause the filter to release already held particles. The robust Micro-Klean RT series filter captures and retains contaminant within its rigid filter matrix, even under increasing differential pressure. In addition, the unique depth filter structure of the Micro-Klean RT series 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 Micro-Klean RT series 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.

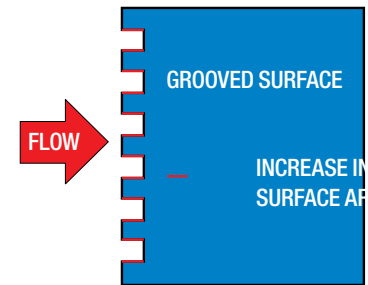


Photo 1. – Compressible vs Rigid Structures @ 35 psid

Compressible

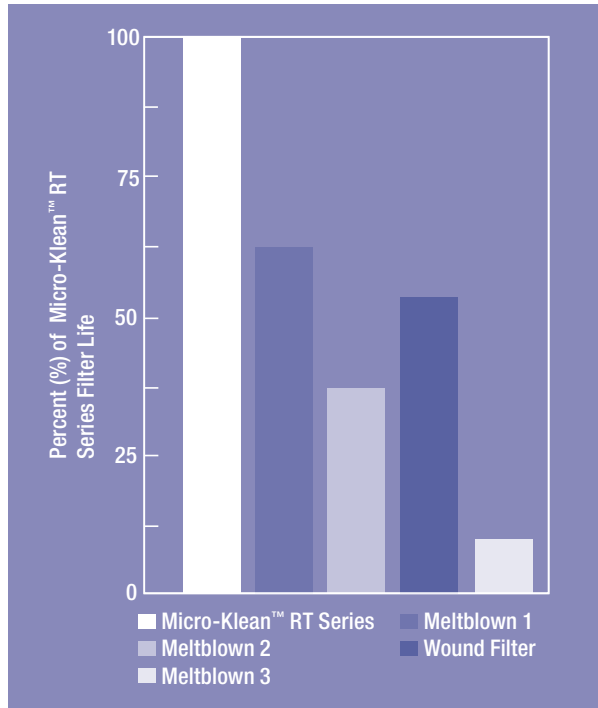
Rigid



Micro-Klean™ RT Series Filter Performance

Micro-Klean™ RT series filters exhibit superior filtration characteristics. The rigid construction allows for enhanced performance compared to other filter structures with equivalent reduction ratings.

Graph 1 . – Life Comparison of Filters Exhibiting Similar Efficiency



Features & Benefits

Rigid depth filter construction

- Reduces unloading at high differential pressure
- Efficient reduction of deformable materials
- Consistently superior particle reduction 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

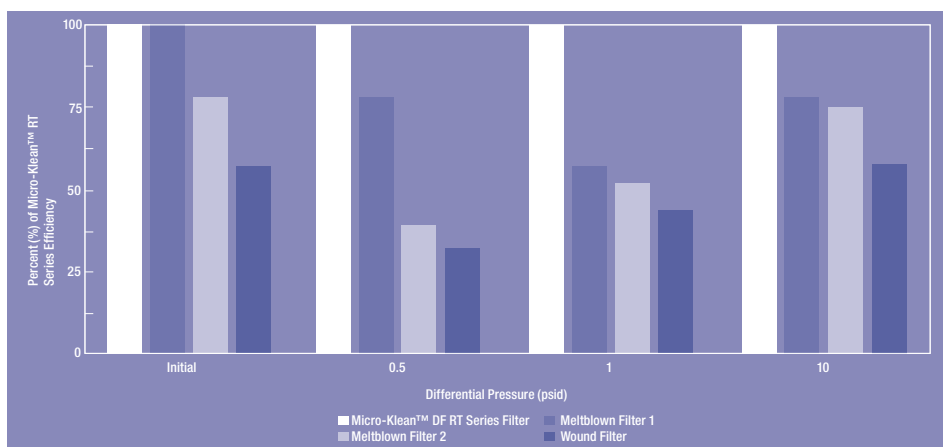
Continuous integral length filter element (up to 40")

- No bond joints to break
- Easy to install

Superior Service Life

Extensive testing of Micro-Klean RT series filters has demonstrated an appreciable advantage in service life. Graph 1 compares rigid Micro-Klean RT series 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, Micro-Klean RT series filters typically provide nearly twice the life of its closest competitor, and up to 10 times or more the life of some competitive filters.

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



Consistent Reduction Efficiency

The rigid Micro-Klean™ RT series structure resists deformation, filter by-pass, compression, and particle unloading. This allows Micro-Klean RT series 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 reduction efficiency at much lower differential pressures (10 psid).

To demonstrate the Micro-Klean RT series filter’s reduction consistency, efficiency at four sampling points (initial, 0.5 psid, 1 psid, and 10 psid) was measured on Micro-Klean RT series 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, Micro-Klean RT series filters display a stable, consistently higher contaminant reduction throughout the duration of the test. Note that the other melt blown and string wound structures yield erratic reduction and as such can not provide predictable performance even under controlled conditions of uniform contaminant loading and pressure.

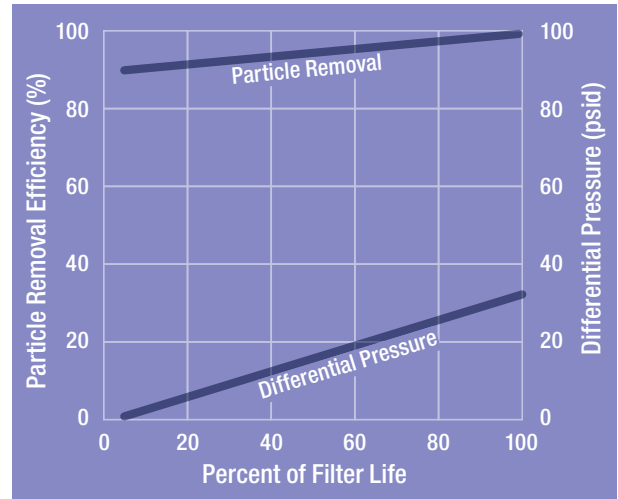
Micro-Klean RT series filters are also capable of delivering consistent particle reduction efficiencies at high fluid flux (flow rate per surface area). This capability is demonstrated in Graph 3 which shows both reduction efficiency and differential pressure results from tests conducted with 25u Micro-Klean RT series 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, Micro-Klean RT series cartridges are able to maintain high particle reduction efficiencies throughout the life of the filter at this high flux.

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

Lower Initial Differential Pressure

The unique design and construction of the Micro-Klean RT series element allows for significantly lower pressure drop when compared to competitive elements. Graph 4 clearly demonstrates the Micro-Klean RT series flow advantage when compared to other 5 m rated competitive meltblown and wound cartridges. For a given differential pressure, Micro-Klean RT series 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

Graph 3. – Particle Reduction Efficiency at Increased Flux



Graph 4. – Flow vs. Differential Pressure (see note * in Table 1)

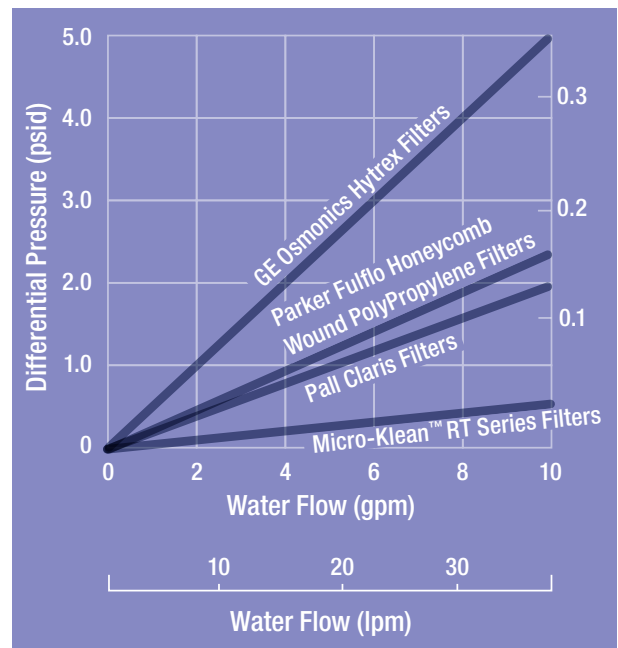


Table 1. – Comparison of 5 Micron Filters in a Water System

Filter	30" Filters Required for a 180 gpm Flow Rate*	Housing Diameter (inches) Required for 30" Double Open End Filters
Micro-Klean™ RT Series 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 specification

Micro-Klean™ RT Series

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and a maximum clean pressure drop of 0.5 psid, a Micro-Klean™ RT series filter system requires significantly fewer cartridges and smaller filter vessels (compared to competitive filters) for greatly reduced capital costs.

Micro-Klean™ RT Series Filter System Sizing

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

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 Micro-Klean RT 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.

Table 2. – Micro-Klean™ RT Series Filter Specific Pressure Drop (SPD)

Nominal Rating (µm)	Specific Pressure Drop per 10" Filter (psid/gmp-Cp)	Specific Pressure Drop per 10" Filter (mbar/lmp-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

$$\frac{\text{psid [mbar]}}{\text{clean}} = \frac{\left(\text{total system gpm [lpm]} \right) \left(\text{viscosity in Cp} \right) \left(\text{SPD value from Table 2} \right)}{\left(\text{Equivalent number of 10 inch Cartridges in housing} \right)}$$

Applications

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



Micro-Klean™ RT Series Filter Cartridge Specifications

Table 3. – Micro-Klean™ RT Series 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	85 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	
Micro-Klean RT series filters meet the requirements of USP for the Biological Test for Plastics, Class VI-70 °C.	
Materials used in the manufacture of Micro-Klean RT series filters meet the requirements of USFDA 21 CFR for food and beverage contact Micro-Klean RT series 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. Micro-Klean RT series 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)
Beach 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 3M Purification 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 3M Purification Incorporated, the SASS staff can also perform on site-testing at customer's facilities. Contact your 3M Purification Distributor for more information.



Service Worldwide

3M Purification 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.

3M™ Filter Housings

3M Purification 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 3M™ filter housings, consult your local 3M Purification distributor and ask for the literature listed below.

3M™ SD Filter Housings (LITHSSD1)

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

3M™ CT Series Filter Housings (LITHSCT3)

Available in a variety of sizes and materials
Mounting bracket available

3M™ AL Series Filter Housings (LITHSAL1)

Rugged economical design in cast iron and steel
Easy assembly

CUNO™ CTG-Klean (LITHSCK1)

Enclosed System
Uses disposable filter pack
Easy to use — housing clean-up reduced

3M™ 18D Series Filter Housings (LITHSBD1)

Available in cast iron and steel, or 304 stainless steel
Built-in valve for duplex or single operation

3M™ 1H Series Filter Housings (LITHS1H1)

Ideal for high pressure applications
Durable steel construction

3M™ 1M Series Filter Housings (LITHS1M1)

Lightweight plastic construction
Choice of 1 or 2 high cartridge models

3M™ ES Series Filter Housings (LITHSES1)

Maximum design flexibility for a wide variety of system requirements
ASME Code
Choice of carbon steel, 304L or 316L stainless steel

3M™ VC Series Filter Housings (LITHSVC1)

Polyvinylchloride construction
Available for 2 or 3 high cartridges

3M™ PC Series Filter Housings (LITHSPC1)

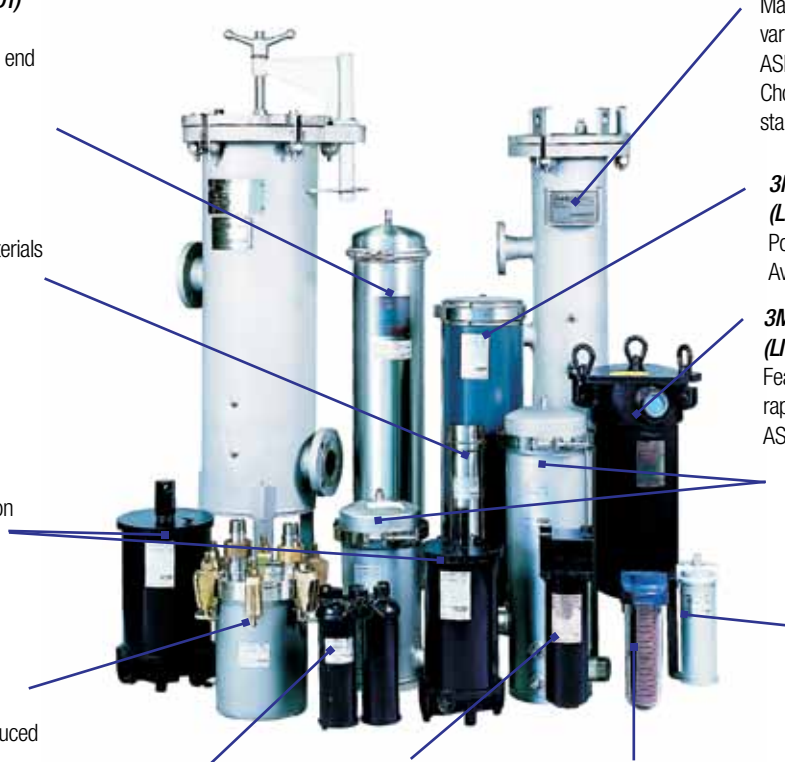
Features a removable cartridge pack for rapid change-out and easy cleaning
ASME Code

3M™ Series Filter Housings (LITHSDC1)

Available in a wide variety of sizes
304 stainless steel construction

3M™ 1B Series Filter Housings (LITHS1B1)

Available in cast iron and steel, or 304 stainless steel
Choice of 1 or 2 high cartridge models



3M™ ES Series Filter Housing – the 3M 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 3M ES filter housing can accommodate a wide range of flow requirements. For more information, ask your local 3M Purification Distributor for brochure LITCHSES1

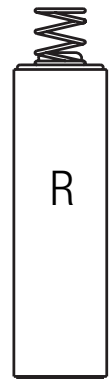
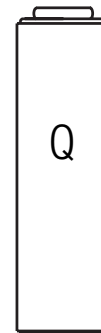
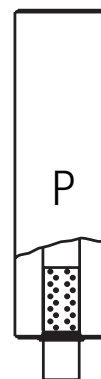
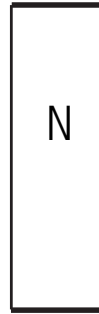
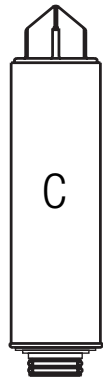
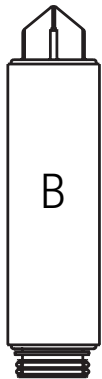
3M™ AL and 3M™ CT Series Filter Housings – 3M AL series and 3M CT series filter housings offer a wide range of sizes from one cartridge to eighteen cartridges. For more information, ask your local 3M Purification Distributor for brochure LITHSAL1 and LITHSCT3.

3M™ DC and 3M™ SD Series Filter Housings – 3M DC and 3M SD series filter housings offer a low cost alternative for low volume filtration. Constructed from reliable 304L stainless steel (Model 3M DC) or 316L stainless steel (Model 3M SD), these housings are available for a wide range of flow rates and applications. For more information, ask your local 3M Purification Distributor for brochure LITHSDC1 and LITHSSD1.

Micro-Klean™ RT series filters are available for use in a CUNO™ 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 3M Purification distributor for brochure LITCCK001.

Micro-Klean™ RT Series Filter Cartridge Ordering Guide

Cartridge Type	Length	Grade	Material	Surface	Packaging	Ring Support	End Modification	Gasket/O-ring
RT – Micro Klean™ RT Series	09 – 9 ¾ ^{**} 10 – 10" 19 – 19 ½ ^{**} 20 – 20" 29 – 29 ¼ ^{**} 30 – 30" 39 – 39" 40 – 40"	Y – 1 µm B – 5 µm C – 10 µm F – 10 µm L – 50 µm Q – 75 µm	16 – Polypropylene	G – Grooved	2 – Bulk	0 – None	B – 226 O-ring & Spear C – 222 O-ring & Spear F – 222 O-ring & Flat Cap N – None P – Polypropylene Core Extender Q – Cap without Spring R – Cap with Spring	A – Silicone B – Fluorocarbon C – EPR D – Nitrile G – Polyethylene** H – Clear Silicone N – None**
			* Available with N or P end modifications only					
			** Available with N, P, Q, or R end modifications only					



This Micro-Klean RT series filter is tested and certified by NSF International against NSF/ANSI Standard 42 For Material Requirements Only*



This Micro-Klean RT series filter is tested and certified by WQA against NSF/ANSI Standard 61 For Material Requirements Only*

* For End Treatment "P" and O-ring "H" consult factory.

Important Notice

The information described in this literature is accurate to the best of our knowledge. A variety of factors, however, can affect the performance of the Product(s) in a particular application, some of which are uniquely within your knowledge and control. **INFORMATION IS SUPPLIED UPON THE CONDITION THAT THE PERSONS RECEIVING THE SAME WILL MAKE THEIR OWN DETERMINATION AS TO ITS SUITABILITY FOR THEIR USE. IN NO EVENT WILL 3M PURIFICATION INC. BE RESPONSIBLE FOR DAMAGES OF ANY NATURE WHATSOEVER RESULTING FROM THE USE OF OR RELIANCE UPON INFORMATION.**

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