



Environmental testing for water, air, and soil



Distributor
GE Healthcare

Quality matters

GE Healthcare's Life Sciences business is committed to quality. Our Whatman™ brand products are manufactured from high-purity raw materials, and our factories all operate to ISO 9001:2008 standards. Our filter selection recommendations are built on the combination of expertise in modern methods and almost 300 years of history in the paper and membrane filtration business.

Accurate and reliable analytical results are important when monitoring air, water, and soil, and GE knows that you depend on us to make sure your filtration step is efficient, reproducible, and preserves the integrity of your sample. Whether you are using one of our glass papers, syringe filters, or other Whatman products, you can count on GE to understand that quality matters.

This brochure highlights GE's filtration solutions offered for the applications shown on page 3. We also offer interactive filter selection tools so you can quickly and easily find a filtration product that will work well for you.



iPad™ and Android™ versions can be found in the Apple™ and Google™ app stores, respectively. Please search for “Whatman filters”.



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Physical analysis

Solids analysis

The level of suspended solids in a water sample is determined by pouring a carefully measured volume of water through a preweighed filter with a specified pore size, drying the filter to remove the water, and then weighing the filter again. The weight gain of the filter is a dry weight measure of the particulates present in the water sample expressed in units derived or calculated from the volume of water filtered (typically milligrams per liter).

Suspended solids measurements are typically performed using glass fiber filter circles that need additional preparation prior to use. However, GE has developed ready-to-use 934-AH RTU glass fiber filters, which are supplied in a prewashed and preweighed format and enable considerable time savings in the laboratory. 934-AH RTU filters also provide reproducible results and low background contamination.



Fig 1. Total solids analysis workflow using filtration-based methods.

▶ What are you testing for?	▶ Product	▶ Characteristics and benefits
Solids, including: <ul style="list-style-type: none"> • total suspended • total dissolved • total volatile 	GF/C™ 934-AH™ glass fiber filters Ordering information p. 5	<ul style="list-style-type: none"> • Conform to requirements of standard methodologies: GF/C for EN 872 (Fig 2); 934-AH for Standard Method 2540D • High loading capacity enabling filtration of very turbid samples • Retention of very fine particles
	934-AH RTU Ordering information p. 5	<ul style="list-style-type: none"> • Share same benefits as traditional 934-AH glass fiber filters • Ready-to-use format • Prewashed, preweighed according to 2540D • Each pretreated filter comes in an aluminium pan, with the filter weight clearly noted • Each pan has its own unique barcode

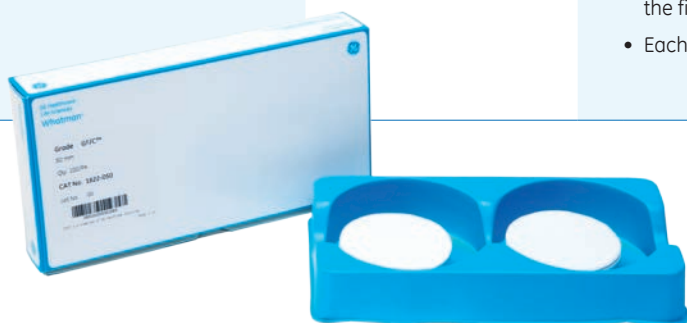


Fig 2. GF/C glass fiber filters meet the requirements of EN 872.

Ordering information Glass fiber filters for solids analysis, 100/pack

Grades	GF/C	934-AH	934-AH RTU preweighed, prewashed*
Typical particle retention (μm)**	1.2 μm	1.5 μm	1.5 μm
Diameter (mm)	Cat No.	Cat No.	Cat No.
42.5	28497-685	28496-875	97040-974
47	28497-696	28496-886	CA11008-600
55	28497-700	28496-897	97040-978
70	28497-721	28496-911	-
90	28497-743	CA28496-933	CA11025-656

* Each filter is supplied in an individual aluminum pan

** Particle retention rating at 98% efficiency

Chemical analysis

Dissolved heavy metals

Chemical analyses are commonly performed using analytic instrumentation. Filtration of water samples prior to analysis is good practice in order to remove unwanted particles from the analysis and to protect delicate instrumentation from potentially damaging compounds.

Accurate analysis of heavy metals such as lead or mercury depends on not introducing any interference into the sample from consumables used in the analytical preparation process. Water samples are often high in particulate matter, which can present filtration challenges because the particulates can

readily block membrane filters. Traditionally, a glass fiber pre-filter has been used to alleviate this problem. However, filters containing some types of glass fiber can introduce trace metals into the sample. To avoid potential sample contamination, GE offers a syringe filter that incorporates an effective pre-filter composed of polypropylene rather than glass fiber.

GD/XP syringe filters

GD/XP syringe filters can be used with samples that require inorganic ion analysis (e.g., trace metal analysis using inductively coupled plasma-mass spectrometry [ICP-MS]).

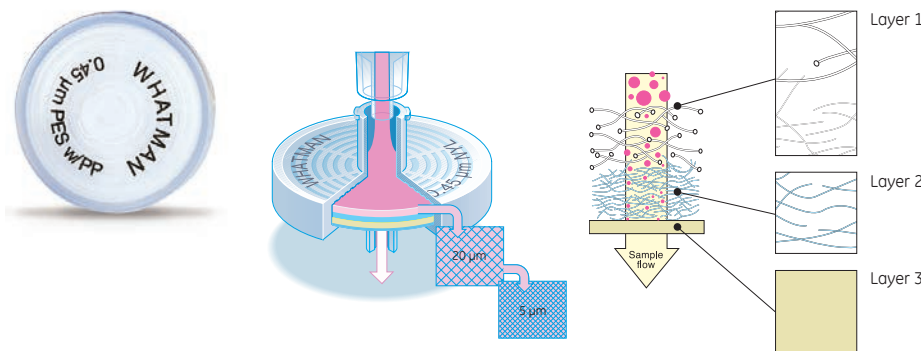


Fig 3. GD/XP syringe filters contain multiple filtration layers, which subsequently reduce blockage and increase volume throughput.

What are you testing for?	Product	Characteristics and benefits
Dissolved heavy metals	GD/XP syringe filters, 25 mm (filtration in the lab); Fig 3 Ordering information p. 7	<ul style="list-style-type: none"> Pre-filter made of polypropylene for minimization of ion extractables Integrated prefiltration with a dual-layer prefilter stack and one final 0.45 µm membrane Easy filtration of hard-to-filter samples Filtration of larger sample volumes compared to filters without pre-filters
	Polydisc GW and Polycap GW in-line filters (filtration in the field); Fig 4 Ordering information p. 7	<ul style="list-style-type: none"> Integrated prefilter Easy filtration of hard-to-filter samples Filtration of larger sample volumes compared to filters without pre-filters



Fig 4. Polycap GW (left) and Polydisc GW (right) are designed for sample preparation of ground water samples for the analysis of dissolved heavy metals.

Ordering information

GD/XP syringe filters

Membrane type	Nylon	PVDF	PP	PES	
Pore size (µm)	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
0.45	28137-976	28137-980	-	CA28137-996	150/pack
0.45	CA11013-994	CA28137-982	28137-994	CA11013-990	1500/pack


In-line filters

Quantity	1/pack	100/pack	20/pack	50/pack
Product	Cat No.	Cat No.	Cat No.	Cat No.
Polydisc GW Filter 50 mm, nylon with quartz fiber prefilter, 0.45 µm	-	-	CA11013-490	CA11012-972
Polycap GW 75, 0.45 µm, PES membrane	13503-498	CA11013-920	-	-



Dissolved ions

Filters for sample preparation prior to ion chromatography testing should feature very low levels of anion leaching.

▶ What are you testing for?	▶ Product	▶ Characteristics and benefits
Dissolved ions	<p>Anotop™ IC syringe filters</p> 	<ul style="list-style-type: none"> • Contain a proprietary alumina-based Anopore™ membrane that exhibits very low levels of anion leaching (e.g., fluoride, sulfide, nitrate, nitrite) during ion chromatography (IC) testing • Pigment-free PP housing to eliminate sample contamination • Flexibility – available in either 10 mm or 25 mm diameter • Certified and guaranteed low levels of anion leaching


Ordering information Anotop IC syringe filters

Membrane/pore size	Diameter	Quantity	Cat No.
Aluminum oxide – 0.2 µm	10 mm	100/pack	-
Aluminum oxide – 0.2 µm	10 mm	200/pack	CA11013-020
Aluminum oxide – 0.2 µm	25 mm	200/pack	CA28297-720

Dissolved organic carbons

Organic matter content is usually measured as dissolved organic carbon (DOC), which is an important component of the carbon cycle. DOC is defined as the organic matter that is able to pass through a filter, typically one with a 0.45 µm pore size.

Puradisc Aqua syringe filters are specifically designed for filtration of environmental samples prior to DOC analysis.

▶ What are you testing for?	▶ Product	▶ Characteristics and benefits
Dissolved organic carbons	<p>Puradisc Aqua 30 syringe filters</p> 	<ul style="list-style-type: none"> • Contain prewashed membranes (prior to assembly) to reduce organic carbon level and ensure low background • Designed for aqueous samples • Hydrophilic cellulose acetate membrane, 30 mm diameter

Ordering information Puradisc Aqua syringe filters

Membrane/pore size	Diameter	Quantity	Cat No.
Cellulose acetate – 0.45 µm	30 mm	50/pack	CA11013-130
Cellulose acetate – 0.45 µm	30 mm	100/pack	CA11013-156
Cellulose acetate – 0.45 µm	30 mm	500/pack	CA11013-434

HPLC, UHPLC, and other analytical techniques

What are you testing for?	Product	Characteristics and benefits
Low solids content	Puradisc Ordering information p. 10 	<ul style="list-style-type: none"> Wide range of membranes, pore sizes and diameters Pre-filter: no Diameter: 4, 13, 25, or 30 mm Available pore sizes: 0.1, 0.2, 0.45, 0.8, 1.0, 1.2, 5 µm Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE, GF
	SPARTAN™ Ordering information p. 10 	<ul style="list-style-type: none"> HPLC certified Pre-filter: no Diameter: 13 or 30 mm Available pore sizes: 0.2 or 0.45 µm Membrane materials available: Regenerated cellulose 
Hard-to-filter samples	Whatman GD/X™ Ordering information p. 10 	<ul style="list-style-type: none"> For hard-to-filter samples Pre-filter: multilayer glass filter Diameter: 13 or 25 mm Available pore sizes: 0.2, 0.45, 0.7, 1.0, 1.2, 1.5, 2.7, 5.0 µm Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE, RC 
	GD/XP Ordering information p. 10 	<ul style="list-style-type: none"> For hard-to-filter samples where analytes of interest are inorganic ions Pre-filter: Multilayer polypropylene Diameter: 25 mm Available pore sizes: 0.45 µm Membrane materials available: Nylon, PES, PVDF, PP, PTFE
HPLC/GC autosamplers	Mini-UniPrep™ Ordering information p. 11 	<ul style="list-style-type: none"> All-in-one filter and PLASTIC autosampler vial Pre-filter: no Dimensions: Once compressed equivalent to 12 mm × 32 mm vial Available pore sizes: 0.2 or 0.45 µm Membrane materials available: PTFE, RC, Nylon, PVDF, PES, PP, GMF 
	Mini-UniPrep G2 Ordering information p. 11 	<ul style="list-style-type: none"> All-in-one filter and GLASS autosampler vial Pre-filter: no Dimensions: Once compressed equivalent to 12 mm × 32 mm vial Available pore sizes: 0.2 or 0.45 µm Membrane materials available: PTFE, Nylon, PVDF, PP, GMF, RC 

RC = regenerated cellulose, PVDF = polyvinylidene difluoride, PTFE = polytetrafluoroethylene, PP = polypropylene, PES = polyethersulfone, GMF = glass microfiber filter, GF = glass fiber, CA = cellulose acetate



Regenerated cellulose membranes

Suitable for filtration of both aqueous and organic samples. We offer a range of filters for sample preparation for commonly used analytical techniques in water monitoring such as:

- HPLC or UHPLC
- Continuous flow analysis
- Gas chromatography (GC)

Ordering information – chemical analysis of water

Puradisc syringe filters

Membrane type/ diameter	Nylon 25 mm	PVDF 25 mm	PTFE 25 mm	PP 25 mm	PES 25 mm	CA 30 mm		
Pore size	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity	Cat No.	Quantity
0.2 µm	CA28205-510	89233-770	CA28137-932	28137-958	28137-942	200/pack	89233-772	100/pack
0.2 µm	CA28205-530	-	70240-162	CA28137-974	CA14233-762	1000/pack	89233-774	500/pack
0.45 µm	28205-512	70240-170	28137-934	28137-960	28137-944	200/pack	CA11008-550	100/pack
0.45 µm	28205-532	70240-174	70240-160	28137-967	28455-248	1000/pack	89233-776	500/pack

SPARTAN syringe filters

Diameter		13 mm	13 mm with mini-tip	30 mm	
Membrane	Pore size	Cat No.	Cat No.	Cat No.	Quantity
Regenerated cellulose	0.2 µm	CA52844-782	CA52844-786	CA97005-228	100/pack
Regenerated cellulose	0.2 µm	CA97005-224	CA97005-226	CA97005-230	500/pack
Regenerated cellulose	0.45 µm	CA52844-780	CA52844-784	CA97005-232	100/pack
Regenerated cellulose	0.45 µm	CA97005-220	CA97005-222	CA97005-234	500/pack

GD/X syringe filters (glass fiber prefilter), 25 mm diameter

Membrane type	Nylon	PVDF	PTFE	PP	PES	CA	RC	
Pore size	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
0.2 µm	28138-154	28138-158	28138-162	CA28138-170	28138-166	28138-174	89233-780	150/pack
0.2 µm	28138-192	CA28138-196	28138-200	-	CA89233-778	-	-	1500/pack
0.45 µm	28138-156	28138-160	28138-164	28138-172	28138-168	28138-176	89233-782	150/pack
0.45 µm	28138-194	CA28138-198	CA28138-202	14005-864	14217-554	80087-208	89233-784	1500/pack

GD/XP syringe filters (polypropylene prefilter), 25 mm diameter

Membrane type	Nylon	PVDF	PTFE	PP	PES	
Pore size	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
0.45 µm	28137-976	28137-980	28137-984	28137-988	CA28137-996	150/pack
0.45 µm	CA11013-994	CA28137-982	-	28137-994	CA11013-990	1500/pack

Mini-UniPrep with polypropylene housing

Membrane type			PTFE	PVDF	Nylon	PP	RC	PES	
Pore size	Housing	Cap	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
0.2 µm	Translucent	Standard	14224-946	14224-978	14224-976	14224-930	97015-564	14224-914	100/pack
0.45 µm	Translucent	Standard	28137-758	28137-762	28137-754	28137-766	97015-562	28137-774	100/pack
0.2 µm	Amber	Standard	84009-508	84009-504	84009-506	84009-512	-	84009-510	100/pack
0.45 µm	Amber	Standard	83009-802	84009-514	89233-786	83009-806	-	83009-804	100/pack
0.2 µm	Translucent	Slit septum	12000-528	12000-524	12000-526	12000-532	-	12000-530	100/pack
0.45 µm	Translucent	Slit septum	83009-816	83009-808	83009-814	83009-820	-	-	100/pack

Mini-UniPrep G2 with inner glass storage vial (hand or multicompressor required for use)

Membrane type			PTFE	PVDF	Nylon	PP	GMF	RC	
Pore size	Housing	Cap	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
0.2 µm	Translucent	Standard	CA89234-956	CA89234-964	CA89234-970	CA89234-974	-	CA10054-398	100 + 1 HC
0.2 µm	Translucent	Standard	CA89234-954	CA89234-962	-	CA89234-972	-	CA10054-378	100/pack
0.45 µm	Translucent	Standard	CA89234-960	CA89234-968	-	-	CA10054-400	CA10054-436	100 + 1 HC
0.45 µm	Translucent	Standard	CA89234-958	CA89234-966	-	-	CA10054-432	CA10054-434	100/pack
0.2 µm	Amber	Standard	CA89234-976	CA89234-978	-	-	-	-	100 + 1 HC
0.2 µm	Translucent	Slit septum	CA89234-980	-	-	-	-	-	100 + 1 HC
0.45 µm	Translucent	Slit septum	CA89234-982	-	-	-	CA10054-386	-	100 + 1 HC
0.45 µm	Translucent	Slit septum	-	-	-	-	CA10054-376	-	100/pack

HC = Hand compressor

Compressors for Mini-UniPrep

Compressor suitable for	Description	Cat No.	Quantity
Mini-UniPrep G2 (glass vial)	Hand compressor - 1 position	-	1/pack
	Multi Compressor - 8 positions (includes 1 tray)	CA89499-526	1/pack
Mini-UniPrep (plastic vial)	Multi Compressor - 6 positions	14227-832	1/pack



Fig 5. Mini-UniPrep G2 Multi Compressor.

Microbiological analysis

Bacterial count and/or detection

MBS I system and membranes

The MBS I filtration system is designed for laboratories that handle high numbers of samples for microbiological quality control.

Workflow



(A) Tight sealing of funnel and membrane reducing any cross contamination to a minimum by special sealing technique.



(B) Flexibility.

- Volume—either 100 ml or 350 ml
- Material—either ABS or PP
- PP version can be autoclaved up to 50 times.



(C) Easy removal of the membrane.

Membranes

We provide a wide and versatile range of filtration membranes that deliver high-quality performance consistently. The appropriate membrane filter choice will depend on the methodology being followed. ME and Microplus membranes are sterile and individually packed.

Membrane material	Cellulose mixed ester	High-flux cellulose nitrate	Nylon (polyamide)	Polycarbonate
Product name	ME	MicroPlus	NL	Nuclepore™
Color	White, black or green	White or black	White	White or black
Pore size	0.2 µm/0.45 µm/ 0.6 µm/0.8 µm	0.45 µm	0.2 µm/0.45 µm	0.2 µm/0.4 µm (and other pore sizes)
Application examples	<i>Enterococcus</i> , <i>E. coli</i> , <i>Clostridia</i> , Fecal coliforms, <i>Staphylococcus</i> , <i>Pseudomonas aeruginosa</i> , etc		<i>Legionella</i>	<i>Legionella</i>

Filtration considerations

Microorganisms in a water sample are collected using a microfiltration membrane filter. The membrane can then be transferred onto a microbiological culture medium for further identification and/or quantification of microorganisms.

Membrane filtration methods are commonly used for the detection of microorganisms such as *E. coli*, *Clostridia*, fecal coliforms, *Legionella*, *Staphylococci*, and *Pseudomonas aeruginosa*. These methods involve the use of membrane filters and filtration manifolds.

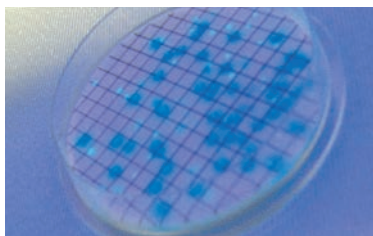


Fig 6. Gridded membrane on agar plate containing bacterial colonies.

What are you testing for?	Product	Characteristics and benefits
Bacterial count and/or detection	Membranes	<ul style="list-style-type: none"> Both sterile and nonsterile options Range of pore sizes available ME and MicroPlus membranes are sterile and individually packed. They contain a folded strip of filters for use with our membrane dispenser
	Accessories: Membrane-Butler membrane dispenser (manual version); Fig 7	<p>With each turn a membrane filter is ejected and can be removed easily with a pair of tweezers.</p> <ul style="list-style-type: none"> Cross-contamination risks are minimized Membrane is dispensed rapidly
	Other microbiological control accessories: funnel dispenser, funnels, tweezers, autoclaving bags	<ul style="list-style-type: none"> Waste reduction, because PP funnels can be autoclaved up to 20 times Time saving; no need to flame in between filtrations Easy handling Reduce cross-contamination Reproducible results Low background contamination



Ordering information

Membrane filters

Diameter					25 mm	47 mm	50 mm	
Membrane material/type	Pore size	Color	Sterile	Membrane-Butler compatible	Cat No.	Cat No.	Cat No.	Quantity
Cellulose mixed ester/ ME type	0.2 µm	white	yes	no	-	89233-756	89233-758	100/pack
	0.2 µm	white	yes	yes	-	89233-760	89233-762	400/pack
	0.45 µm	white	yes	no	-	CA11008-580	CA11013-980	100/pack
	0.45 µm	white	yes	yes	-	CA13500-170	CA28151-150	400/pack
	0.45 µm	black/white grid	yes	yes	-	CA11013-524	-	100/pack
	0.45 µm	black/white grid	yes	yes	-	CA13500-162	-	400/pack
Cellulose nitrate/ Microplus	0.45 µm	white	yes	no	-	89233-750	89233-752	100/pack
	0.45 µm	white	yes	yes	-	74330-508	74330-510	400/pack
	0.45 µm	black	yes	no	-	-	89233-754	100/pack
	0.45 µm	black	yes	yes	-	-	-	400/pack
Polycarbonate/ Nuclepore	0.2 µm	white	no	no	-	28157-927	CA11013-346	100/pack
	0.4 µm	white	no	no	-	28157-960	CA11013-328	100/pack
	0.8 µm	black	no	no	-	-	-	100/pack
Nylon (Polyamide)/NL	0.4 µm	white	no	no	-	28152-899	CA11013-046	100/pack

Accessories for microbiological control

Product	Description	Quantity/pack	Cat No.
AS 200	2-place vacuum manifold	1	74330-496
Funnel dispenser	Automatic dispenser for funnels	1	74330-498
Funnels 100 ml	PP (autoclavable)	20	74330-500
Funnels 350 ml	PP (autoclavable)	20	74330-504
Autoclaving bags	Autoclaving bags for MBS I funnels	20	89233-746
Membrane-Butler	Manual dispenser for membranes	1	CA28151-134



Fig 7. Membrane-Butler



Particulate monitoring

Manual air sampling

Two of the most significant fractions of suspended particulate matter are the respirable fraction ($< 2.5 \mu\text{m}$) and the inhalable fraction ($< 10 \mu\text{m}$). Two important tests performed in air monitoring of particulate matter, PM 2.5 and PM 10, pertain to these two fractions. Whatman glass fiber filters from GE are recommended for gravimetric determination of airborne particulates, such as PM 10, stack sampling, and absorption methods of air pollution monitoring.

In the analysis of collected particulate matter, care should be given to the choice of the filter medium used. The filter medium should give little or no background level for the elements and/or compounds being analyzed and should cause minimal interference in the determination.

Glass fiber filters and thimbles

Whatman glass microfiber filters (such as GF/A and EPM 2000) and quartz filters (such as QM-A) are particularly suitable for gravimetric determination of particulates due to the high retention efficiency of the media combined with rapid flow characteristics,

low pressure drop, high loading capacity, and low affinity for moisture. PTFE membranes are often used for specific gravimetric analyses (e.g., PM 2.5 monitoring or vehicle emissions testing) according to the employed methodology.



Stack gases are often monitored at high temperatures for which glass microfiber or quartz filters, such as QM-A or thimbles, are appropriate.

PTFE membranes

Whatman TE type and PM 2.5 are chemically resistant and possess low chemical background interference (e.g., metals), allowing the user to carry out sensitive determinations.

Whatman TE membranes are general purpose PTFE membrane filters that have multiple applications in environmental analysis.

PM 2.5 filters are used for the measurement of fine particulate matter in the atmosphere for the EPA PM 2.5 reference method (under the requirements of 40 CFR Part 50 Appendix L).

▶ What are you testing for?	▶ Product	▶ Characteristics and benefits	
Particulate manual sampling: normal environment	<ul style="list-style-type: none"> • Glass fiber filters such as GF/A and EPM 2000 • PTFE TE type • Glass fiber thimbles • PM 2.5 membranes Ordering information for all products p. 16 	<p>GF/A</p> <ul style="list-style-type: none"> • Binder free • Glass fiber • Fine particle retention • High flow rate • Good loading capacity <p>EPM 2000</p> <ul style="list-style-type: none"> • Binder free • Glass fiber • Used in high-volume PM-10 air sampling equipment • Detailed chemical analysis of trace pollutants <p>Glass fiber thimbles</p> <ul style="list-style-type: none"> • Binder and binder free • Glass fiber • Used at temperatures up to 500°C <p>GF 10</p> <ul style="list-style-type: none"> • Binder • Glass fiber • Extreme mechanical stability • Used up to 180°C 	<p>TE type PTFE membranes</p> <ul style="list-style-type: none"> • Suitable for filtration of gases and liquids • Resistant to most acids, alkalis, and solvents such as sodium hydroxide and hexane • Laminated onto a nonwoven polypropylene support material • Increased durability for aggressive testing environments • Hydrophobic characteristics prevent passage of aqueous aerosols (e.g., during venting applications) <p>PM 2.5 membranes</p> <ul style="list-style-type: none"> • Used for PM 2.5 ambient air monitoring • Conform to EPA PM 2.5 reference method under the requirements of 40 CFR Part 50 Appendix L • Do not contain glues or adhesives • Sequentially numbered for easy traceability of the filter • Chemically resistant polypropylene support ring, which eliminates curling and makes the filter robot-friendly • Retain a minimum of 99.7% of 0.3 µm size particulates
Particulate manual sampling: aggressive environment (high temperature and acidic)	<ul style="list-style-type: none"> • Quartz fiber filter such as QM-A and QM-H • Quartz fiber thimbles Ordering information for all products p. 19 	<p>QM-A quartz fiber filters</p> <ul style="list-style-type: none"> • High-purity quartz microfiber • Used for air sampling, particularly at high temperatures up to 500°C <p>QM-H quartz fiber filters</p> <ul style="list-style-type: none"> • 100% pure quartz • Can be used up to 900°C • Low heavy metal content 	<p>Quartz fiber thimbles</p> <ul style="list-style-type: none"> • Made from high-purity quartz microfiber • Able to withstand high temperatures up to 800°C • Suitable for both solvent extraction and air sampling applications
Particulate automated sampling	<ul style="list-style-type: none"> • Glass microfiber reels Ordering information p. 16	<ul style="list-style-type: none"> • Binder • Glass fiber 	<ul style="list-style-type: none"> • Extreme mechanical stability • Used up to 180°C
Radioactivity	<ul style="list-style-type: none"> • Grade 72 • SAS cards for static air sampling* • PAS cards for personal air sampling* • Glass fiber filters such as GF/A Ordering information p. 16	<p>Grade 72</p> <ul style="list-style-type: none"> • Glass fiber/cellulose • Used to absorb radioactive iodine in air pollution monitoring and in nuclear installations 	
Metal chemical analysis	<ul style="list-style-type: none"> • Mixed cellulose ester membranes Ordering information p. 16	<ul style="list-style-type: none"> • Typically used in applications for the determination of metals in airborne particulates 	

*Please contact your VWR Sales Representative for information on SAS and PAS cards

Ordering information – manual air sampling

Membrane filters

Diameter		25 mm	37 mm	46.2 mm	47 mm	50 mm	
Membrane type	Pore size	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
PM 2.5 PTFE membrane	2 µm	-		70240-148		-	50/pack
TE type PTFE membrane	0.2 µm	CA11012-914			CA89187-118	CA89187-112	50/pack
	0.45 µm	CA74330-434			CA89187-114	CA89187-116	50/pack
	1 µm	CA89187-108			CA89187-110	CA89187-112	50/pack
	5 µm	-	CA89187-098	-	CA89187-10	CA89187-102	50/pack
Mixed cellulose ester membrane	0.2 µm	CA74300-036			CA74300-038	CA74330-188	100/pack
	0.45 µm	CA74300-040	-	-	CA74300-042	CA74330-192	100/pack
	0.8 µm	CA11012-728	CA11008-538	-	CA89014-306	CA11012-898	100/pack
	3 µm	CA11012-720			CA11012-724	CA11013-902	100/pack

Glass fiber filters, circles and sheets

Dimensions	25 mm	37 mm	47 mm	50 mm	90 mm	8 × 10 inches (sheet)	
Membrane type	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
GF/A	28497-110	28497-120	28497-153	89187-080	28497-200	CA11013-028	100/pack
EPM 2000	-		28495-330			28495-420	100/pack
GF 10	-				CA11013-542	-	100/pack
GF 10	-		CA11013-464	CA11013-452		-	200/pack
Grade 72	-		89187-086			-	100/pack

Glass fiber thimbles

Dimensions*	22 × 80 mm	25 × 100 mm	26 × 100 mm	33 × 94 mm	10 × 38 mm	
Binder	Cat No.	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
Inorganic binder	CA89187-122	CA89187-124	-	CA89187-126	CA89187-128	25/pack

*internal diameter × external length

Other dimensions available for thimbles (with or without binder).

Automated air sampling

GE's microfiber filter can be customized in reel format for automated air sampling systems (Fig 9).

Glass fiber filters with binder, reels

Dimensions	70 mm × 50 m	35 mm × 30 m	40 mm × 42 m	50 mm × 100 m	
Grade	Cat No.	Cat No.	Cat No.	Cat No.	Quantity
GF 10	CA89428-196	CA89428-198	-	CA89187-082	1/pack

Other reel dimensions are available.



Fig 9. Glass fiber reel for automated samplers.

Chemical analysis

Heavy metals, organics, and inorganics

Air pollution monitoring from stacks, flues, and aerosols requires a filter that can withstand chemically harsh environments and high temperatures. High-purity quartz (SiO₂) microfiber filters are favored for these reasons and their applicability for heavy metals analysis.

Quartz fiber filters and thimbles

GE offers two types of quartz filters—QM-A and QM-H. The low level of alkaline earth metals in these filters virtually eliminates artifact products of sulfates and nitrates (from SO₂ and NO₂, respectively).

QM-H is a pure quartz fiber filter with low heavy metal content. Quartz thimbles are also available.

Mixed cellulose ester membranes

Mixed cellulose membranes from GE are designed to meet your environmental air monitoring requirements. These membranes are typically used in applications for the determination of metals in airborne particulates.

What are you testing for?	Product	Characteristics and benefits
Heavy metals	<ul style="list-style-type: none"> Quartz fiber filters such as QM-A and QM-H Ordering information p. 19 EPM 2000 glass fiber filters Ordering information p. 16 	<p>QM-A</p> <ul style="list-style-type: none"> High-purity quartz microfiber Used for air sampling, particularly at high temperatures up to 500°C <p>QM-H</p> <ul style="list-style-type: none"> 100% pure quartz Can be used up to 900°C Low heavy metal content
Other organic or inorganic chemicals (such as ozone, volatile organic carbons, SO ₂ , NO ₂ , CO, Benzotate)	<ul style="list-style-type: none"> Glass fiber filters such as GF/A Ordering information p. 16 Quartz fiber filters such as QM-A and QM-H Ordering information p. 19 Cellulose filters* PTFE membranes Ordering information p. 16 	<p>Quartz fiber thimbles</p> <ul style="list-style-type: none"> Made from high-purity quartz microfiber Able to withstand high temperatures up to 800°C Suitable for both solvent extraction and air sampling applications

* Please contact your VWR Sales Representative for information on cellulose filters

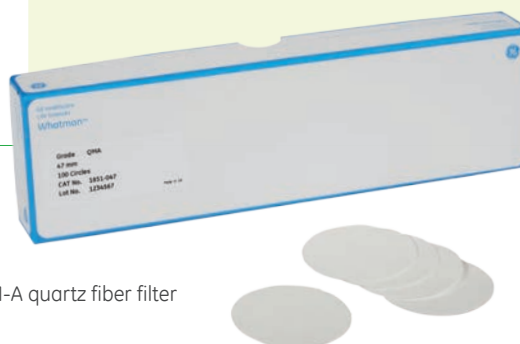


Fig 10. QM-A quartz fiber filter

Asbestos testing

Asbestos analysis is commonly undertaken by a number of microscopy techniques such as Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Phase Contrast Microscopy (PCM).

These methods usually involve sampling and/or observation, both of which involve the use of membrane filters such as polycarbonate or mixed cellulose ester membranes.

Optical analysis for asbestos sampling

GE provides Whatman membranes for the main asbestos sampling methods.

Transmission electron microscopy method

Two membrane materials are typically recommended for this method:

- Mixed ester membrane (e.g., WME membrane)
- Polycarbonate membrane (e.g., Whatman Cyclopore™ or Nuclepore™ membranes)

See the following tables for more information.

Phase-contrast microscopy method

One of the techniques used to optically determine the asbestos fiber count is the “hot block” method. Crucial to this method is the membrane filter that is used to collect fibers from a defined volume of air. During processing

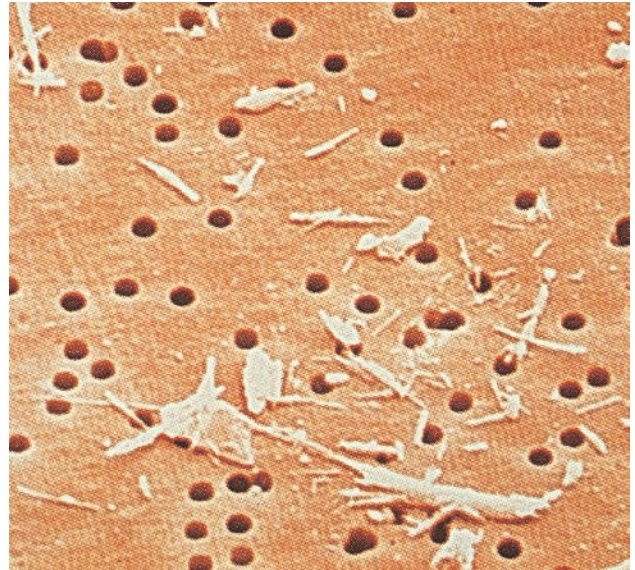


Fig 11. Asbestos fibers on a Cyclopore membrane.

the membrane is made transparent with acetone vapor. Mixed cellulose ester membrane from GE is the recommendation for this application.

Scanning electron microscopy method

GE offers a range of polycarbonate membranes, Cyclopore and Nuclepore. Nuclepore is also available in a gold-coated format.

▶ What are you testing for?	▶ Product	▶ Characteristics and benefits
Asbestos	WME mixed cellulose ester membrane Ordering information p. 19	<ul style="list-style-type: none"> • Typically used for Phase contrast microscopy (PCM) and Transmission electron microscopy (TEM) • Cellulose mixed ester membrane • Gridded, 0.8 µm pore size, 25 mm surface area with high loading capacity • High flow rates
	Nuclepore and Cyclopore Ordering information p. 19	<ul style="list-style-type: none"> • Manufactured with proprietary Whatman technology for controlled pore size distribution • Smooth, flat membrane; particles are retained on surface so are easily visible during optical analysis • Nuclepore available in two versions: gold coated or not gold coated • Typically used for electron microscopy

Ordering information

Quartz fiber filters

Product name	Dimensions	Cat No.	Quantity
QM-A quartz fiber filter	25 mm diam.	89187-090	100/pack
	37 mm diam.	28495-624	100/pack
	47 mm diam.	28495-646	100/pack
	50 mm diam.	89187-092	100/pack
	90 mm diam.	89187-094	100/pack
	8 × 10 inches (sheet)	28495-783	100/pack
QM-H (100% pure) quartz fiber filter	37 mm diam.	CA10828-402	50/pack
	47 mm diam.	CA10828-398	50/pack
	50 mm diam.	CA10828-404	50/pack
	90 mm diam.	CA10827-974	50/pack
	150 mm diam.	CA10828-400	50/pack

Glass fiber extraction thimbles , 1.5 mm thick

Dimensions*	Cat No.	Quantity
22 × 80 mm	CA89187-122	25/pack
25 × 100 mm	CA89187-124	25/pack
26 × 100 mm	-	25/pack
33 × 94 mm	CA89187-126	25/pack
10 × 38 mm	CA89187-128	25/pack

* internal diameter × external length

Quartz fiber extraction thimbles, 2 mm thick

Dimensions*	Cat No.	Quantity
25 × 90 mm	89187-130	10/pack

* internal diameter × external length

Membrane filters for asbestos sampling and analysis

Membrane	Pore size	Diameter			Quantity
		25 mm	37 mm	47 mm	
		Cat No.	Cat No.	Cat No.	
Nuclepore polycarbonate membrane	0.2 µm	28157-905	-	28157-927	100/pack
	0.4 µm	28157-949	-	28157-960	100/pack
	0.4 µm gold coated	CA89187-134	-	-	50/pack
	0.8 µm	28158-205	CA11013-334	28158-249	100/pack
Cyclopore polycarbonate membrane	0.2 µm	-	-	CA11013-184	100/pack
	0.4 µm	89187-136	-	28350-084	100/pack
	1.0 µm	-	-	28350-090	100/pack
WME cellulose mixed ester membrane	0.8 µm	CA11013-206	-	-	100/pack

Chemical analysis

Soil sample analysis requires that chemical compounds are first extracted from their matrix using pH and heat modulation and concentrated. Filters and filtration-related products play key roles throughout this process. Quality is essential to maintain the integrity of results.

▶ What are you testing for?	▶ What testing method?	▶ Product
Nitrogen	Kjeldahl analysis	Weighing boats Ordering information p. 23
Pesticide detection	Soxhlet extraction	Thimbles (cellulose) Ordering information p. 23
Trace elements	Spectrophotometry and chromatography	Syringe filters Ordering information p. 10
Phosphorus	Colorimetry	Cellulose filter papers Ordering information p. 23
pH	pH testing	Indicator papers Ordering information p. 23
Retained solids and clarified solution	Gravimetric analysis. Various quantitative and qualitative analytical techniques	Quantitative or qualitative cellulose filter papers Ordering information p. 23

Kjeldahl nitrogen analysis

Measuring soil nitrogen content can help refine nitrogen fertilizer addition before planting.

Nitrogen content analysis is typically done with Kjeldahl techniques, which involve the sampling of an exact amount of soil before transfer to a digestion tube. Low nitrogen content weighing paper makes the sample transfer easy and quick without loss of material and with minimal interference with the end result. The sample may need to be filtered through a Whatman brand qualitative filter paper prior to analysis.



Fig 12. Low nitrogen content weighing boats.

Soxhlet extraction for chemical detection

Prior to analysis by, for example, gas chromatography (GC), soils may be prepared using Soxhlet extraction or microwave digestion. Extraction thimbles are widely used for Soxhlet techniques. Qualitative filter papers or glass fiber filters can help clear extracts after microwave extraction. Samples may then be refiltered with a 0.45 μm filter to remove small particles and protect your GC instrument. Mini-UniPrep syringeless filter, which is an all-in-one filter and autosampler vial, allows you to process samples faster than traditional syringe filters and eliminates multiple consumables. See page 11 for Mini-UniPrep ordering information.



Fig 13. Extraction thimbles in Soxhlet extraction apparatus.

Spectroscopy and chromatography for trace element analysis

Trace element analysis in soil generally involves determination of essential nutrients for plant growth (e. g., potassium, magnesium, calcium) and detection of potential heavy metal contamination (e.g., lead, chromium, arsenic, zinc, copper, cadmium, mercury, and nickel).

Most trace element tests are based on extracting soil and measuring the concentration of trace elements in the soil-free liquid phase using for example inductively coupled plasma atomic emission spectrometry (ICP-AES). Extraction methods can vary between laboratories. The sample then generally needs to be filtered through a qualitative filter paper or glass fiber filter to make sure it will not clog nebulizers or interfere with injection into the analysis instrument. If digested with aqua regia, the sample may be filtered through an ashless filter paper. If syringe filters are used as an additional sample preparation step, please see “HPLC, UHPLC, and other analytical techniques” on page 9.



Fig 14. Whatman cellulose filter paper.

Colorimetry for phosphorus analysis

Through soil phosphorus testing, the amount of phosphorus fertilizer required to achieve maximum plant growth can be determined. Soils with low or medium phosphorus content will likely show higher yields if extra phosphorus is added. However, crops are not likely to respond with a yield increase in soils with high or very high phosphorus content.

To determine the soil phosphorus content, the soil is extracted with a chemical solution and the phosphorus content in the extract is measured by colorimetry. Filtration of the extract through a qualitative filter paper is generally needed before analysis. If an automated method is used for determining phosphorus concentration, acid-resistant filter paper may be needed.



Fig 15. Whatman Grade 40 ashless filter paper.

pH testing

The pH of soil is vital for how well it holds minerals. When the soil is too acidic, minerals will be leached out by rainwater before the plants have a chance to use them. Highly alkaline soils are often associated with mineral deficiencies due to the low solubility of minerals under alkaline conditions. Neutral or slightly alkaline soils are ideal for growing plants. However, some plants have very particular pH requirements.

There are many different ways of measuring soil pH. Litmus/pH paper is a quick and inexpensive method to test soil pH when a pH-meter is unavailable or when highly precise values are not necessary. When preparing your soil sample, use a weighing paper to weigh the soil before adding water. Filter papers can be used to remove unnecessary particles from the suspension.



Fig 16. Color bonded pH strips.

Clarification and solids retention

Various test methods require that liquid components of a solution be separated from suspended solids prior to analysis. GE offers a wide choice of cellulose filter papers with different levels of flow rate, loading capacity, and chemical resistance to support these applications.

Whatman quantitative filter papers are designed for gravimetric analysis and the preparation of samples for instrumental analysis. They are available in three formats: ashless, hardened low ash, and hardened ashless. Hardened low ash grade papers are acid-treated to remove trace metals, produce high wet strength, and provide chemical resistance. The tough, smooth surface of these filters makes it easy to recover precipitates, rendering them particularly suitable for Büchner filtration. Hardened ashless grade filters combine acid-hardening with extremely low ash content, making them suitable for applications requiring the filter and retained solids to be burned.

Qualitative cellulose filters are used to determine and identify the presence of materials. Two formats are available: standard filters and wet-strengthened filters. Some standard and wet-strengthened filters are available in pre-pleated forms which improves flow rate and increases loading capacity compared to equivalent flat filters. Whatman qualitative filter papers are manufactured from high-quality cotton linters, ensuring quality, reproducibility, and uniformity.

Ordering information

For what use?	Product	Quantity	Cat No.
Kjeldahl analysis	Grade 609 weighing boats	100/pack	CA11012-792
Soxhlet extraction	Thimbles (cellulose)	25/pack	27730-026
Spectrophotometry and chromatography	Various syringe filters	N/A	See page 9
Colorimetry	Grade 5, 15 cm cellulose filter paper	100/pack	28462-126
pH testing	Indicator papers	100/pack	CA11013-548
Sample clarification and solids retention	Quantitative cellulose paper grade 41, 15 cm*	100/pack	28478-080
	Qualitative cellulose paper grade 4, 40 cm*	100/pack	70240-026

*For a full list of cellulose paper grades please visit www.vwr.com

General laboratory accessories

In addition to the filtration consumable range, we provide a comprehensive range of accessories for routine work in your laboratory.



1PS phase separator



Grade 105 lens cleaning tissue



Benchkote™ protection paper



pH paper



Vacu-Guard Pump protection filter

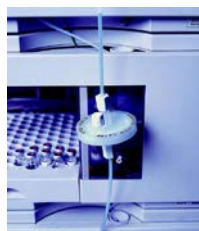
Description	Product name	Dimension	Quantity	Cat No.	
Phase separation paper <ul style="list-style-type: none"> Separatory funnel replacement: Automatic cut-off Ease of use: No special training required 	1PS Phase separator paper	Diam. 125 mm	100/pack	28491-146	
		Diam. 150 mm	100/pack	28491-168	
Optical lens cleaning tissue <ul style="list-style-type: none"> Soft tissue for removing surface moisture and grease from lenses and other optical surfaces 	Grade 105	100 × 150 mm	25 wallets of 25 sheets	CA97002-542	
		200 × 300 mm	100/pack	52846-108	
Benchkote bench protection papers <ul style="list-style-type: none"> High-quality, smooth, absorbent Whatman paper Quickly absorbs liquid spills and protect the working surface Benchkote Plus is thicker and more absorbent 	Benchkote	460 × 570 mm	50/pack	52855-001	
		460 mm × 50 m	1/pack	52856-004	
	Benchkote Plus	500 × 600 mm	50/pack	52854-994	
		600 mm × 50 m	1/pack	52857-997	
pH Indicator Paper <ul style="list-style-type: none"> Range of pH indicator and test papers for rapid results 	Color Bonded, 0.0 to 14.0 range	6 × 80 mm	100 strips, 1/pack	28297-426	
		Standard Full Range, Reel, 1.0 to 14.0 range	7 mm × 5 m	1/pack	14217-670
		Standard Narrow Range, Reel, 4.0 to 7.0 range	7 mm × 5 m	1/pack	14217-674
Pump protection filters <ul style="list-style-type: none"> Protects vacuum pump systems from aqueous aerosols. Hydrophobic PTFE membranes retain 99,99% of airborne particles > 0.1 µm 	Vacu-Guard	50 mm	10/pack	28137-858	

Filtration considerations

GE offers a broad range of membrane materials for water filtration applications. Among our supplies for mobile phase filtration are products for batch and inline filtration.



GV050/2 vacuum filtration unit.



IFD Inline Filtration Degasser 50 mm.

Description	Product name	Dimension	Quantity	Cat No.
Filtration flask for batch filtration <ul style="list-style-type: none"> Consists of a 250 ml glass filtration funnel and 1000 ml flask, funnel base, top, and clamp Good choice for use with Whatman filtration membranes 	Whatman GV050/2 vacuum filtration unit			CA14233-354
Pressure filtration apparatus <ul style="list-style-type: none"> Stainless steel Infusion vessel 2200 ml 	MD142/5/3	142 mm	1	CA11013-114
Pressure filter holder <ul style="list-style-type: none"> PTFE Infusion vessel 1500 ml 	MD142/7/3	142 mm	1	CA11013-478
In-line filtration degasser Connects directly into an HPLC line to simultaneously filter and degas the mobile phase as it is being used <ul style="list-style-type: none"> Flexibility: available with either nylon or polypropylene membranes Polypropylene housing with security ring sealing No need for preliminary mobile phase separation 	Inline Filtration Degasser (IFD)			
3-piece filter funnel <ul style="list-style-type: none"> For quick and easy filtration Choice of 3 plates 	Filter funnel	47 mm	1	80085-988
	Filter funnel	90 mm	1	28200-301
	Filter funnel	70 mm	1	CA28200-254
Membrane holder <ul style="list-style-type: none"> Produced from borosilicate glass Suitable for aqueous and organic solvent filtration 	Vacuum-type glass membrane holder	47 mm	1	28454-640
	Vacuum-type glass membrane holder	90 mm	1	CA11013-186

Chemical compatibility of membranes and housings*

Selecting the right filter depends on the solvent that you are using for your application. This table will help ensure that you get it right the first time.

Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE [‡]	PVDF	RC
Acetic acid, 5%	R	LR	R	R		R	R	R	R	R	R	R	R
Acetic acid, glacial	R	NR	NR			R	LR	R	R	R	R	R	NR
Acetone	R	NR	NR	NR	R	R	R	R	R	NR	R	NR	R
Acetonitrile	R	NR	NR			R	R	R	R	NR	R	R	R
Ammonia, 6 N	NR		NR	NR	LR	LR	R	R	R	R	R	LR	LR
Amyl acetate	LR	NR	NR	NR	R	R	R	R	R	LR	R	LR	R
Amyl alcohol	R	LR	LR			R	R	R	R	NR	R	R	R
Benzene [†]	R	R	R	NR	R	R	LR	NR	NR	R	R	R	R
Benzyl alcohol [†]	R	LR	LR	LR	R	R	LR	R	R	NR	R	R	R
Boric acid	R	R	R	R	R	R	LR	R	R		R	R	R
Butyl alcohol	R	R	R	R	R	R	R	R	R	R	R	R	R
Butyl chloride [†]						R	NR	NR	NR		R	R	
Carbon tetrachloride [†]	R	NR	R	LR	R	R	LR	NR	NR	NR	R	R	R
Chloroform [†]	R	NR	R	NR	R	R	NR	LR	LR	NR	R	R	R
Chlorobenzene [†]	R		LR	NR		R	NR	LR		NR	R	R	R
Citric acid						R	LR	R		R	R	R	R
Cresol		NR	R			R	NR	NR	NR	NR	R	NR	R
Cyclohexane	R	NR	NR	R	R	R	NR	NR	NR	NR	R	R	R
Cyclohexanone	R	NR	NR			R	NR	R	R	NR	R	R	R
Diethylacetamide		NR	NR			R	R	R	R		R	NR	R
Dimethylformamide	LR	NR	NR			R	R	R	R	NR	R	NR	LR
Dioxane	R	NR	NR	NR	R	R	R	R	R	LR	R	LR	R
DMSO	LR	NR	NR	NR	R	R	R	R	R	NR	R	LR	LR
Ethanol	R	R	NR	R	R	R	R	R	R	R	R	R	R
Ethers	R	LR	LR	R	R	R	R	NR	NR	R	R	LR	R
Ethyl acetate	R	NR	NR	NR	R	R	R	R	R	NR	R	NR	R
Ethylene glycol	R	LR	LR	R	R	R	R	R	R	R	R	R	R
Formaldehyde	LR	LR	R	R	R	R	R	LR	LR	R	R	R	LR
Freon TF	R	R	R	R	R	R	NR	NR	NR	R	R	R	
Formic acid		LR	LR			R	NR	R	R	R	R	R	LR
Hexane	R	R	R	R	R	R	R	R	R	R	R	R	R
Hydrochloric acid, conc.	NR	NR	NR	NR	NR	R	NR	LR	LR	R	R	R	NR
Hydrofluoric acid		NR	NR			NR	NR	LR	LR		R	R	NR

Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE [†]	PVDF	RC
Isobutyl alcohol	R	LR	LR	R	R	R	R	R	R		R	R	R
Isopropyl alcohol	R	R	LR			R	R	R	R		R	R	R
Methanol	R	R	NR	R	R	R	R	R	R	R	R	R	R
Methyl ethyl ketone	R	LR	NR	NR	R	R	R	R	R	NR	R	NR	R
Methylene chloride [†]	R	NR	LR			R	NR	LR	LR	NR	R	R	R
Nitric acid, conc.		NR	NR	LR	NR	R	NR	NR	NR	NR	R	R	NR
Nitric acid, 6 N		LR	LR			R	NR	LR	LR	LR	R	R	LR
Nitrobenzene [†]	LR	NR	NR	NR	R	R	LR	R	R	NR	R	R	R
Pentane	R	R	R	R	R	R	R	NR	NR	R	R	R	R
Perchloroethylene	R	R	R			R	LR	NR	NR	NR	R	R	R
Phenol 0.5%	LR	LR	R			R	NR	R	R	NR	R	R	R
Pyridine	R	NR	NR	NR	R	R	LR	R	R	NR	R	NR	R
Sodium hydroxide, 6N	NR	NR	NR	NR	NR	NR	LR	R	R	R	R	NR	NR
Sulfuric acid, conc.	NR	NR	NR	NR	NR	R	NR	NR	NR	NR	R	NR	NR
Tetrahydrofuran	R	NR	NR			R	R	LR	LR	NR	R	R	R
Toluene [†]	R	LR	R	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethane [†]	R	NR	LR	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethylene [†]	R		R			R	NR	LR	LR	NR	R	R	R
Water	R	R	R	R	R	R	R	R	R	R	R	R	R
Xylene [†]	R	R	R			R	LR	LR	LR	LR	R	R	R
Xylene [†]	R	R	R			R	LR	LR	LR	LR	R	R	R

* ANP = Anopore; CA = Cellulose acetate; CN = Cellulose nitrate; DpPP = Polypropylene depth filter; GMF = Glass microfiber; NYL = Nylon; PC = Polycarbonate; PE = Polyester; PES = Polyethersulfone; PP = Polypropylene; PTFE = Polytetrafluoroethylene; PVDF = Polyvinylidene difluoride; RC = Regenerated cellulose R = Resistant; LR = Limited Resistance; NR = Not Recommended.

[†] Short Term Resistance of Housing.

[‡] Membrane may need pre-wetting with isopropanol/methanol if filtering a polar liquid.

The above data is to be used as a guide only. Testing prior to application is recommended.



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