Laboratory filtration

Product guide

Because innovation matters.
Because quality matters.
Because your science matters.

gelifesciences.com

Application finder

Basic lab

Education, commercial labs

Basic laboratory filtration for educational purposes, quality control, analysis, and R&D

Filter papers....9
Membrane filters....47
Filtration devices....89
Thimbles....160
Specialty products....157
Benchkote....165
pH papers....169

Environmental monitoring

Air

Analysis of air for biological and particulate contaminants

Particulate detection—asbestos, flue/gas stacks

Glass microfiber filters....34
QM-A (quartz)....43
Cyclopore track-etched membranes....49
PTFE membranes....66
PM 2.5 air monitoring membrane....68

Aerosols

Membrane filters....47
Cyclopore track-etched membranes....49
PTFE membranes....66
HEPA-VENT....140
VACU-GUARD....142

Microorganisms

Glass microfiber filters....34
Cellulosic membranes....58
PTFE membranes....66

Non-medical respiratory

Glass microfiber filters....34
Cellulosic membranes....58

Water

Analysis of drinking and waste water for biological and particulate contaminants

Bacterial detection

Cyclopore track-etched membranes....49
Black Cyclopore track-etched membranes....54
Cellulose nitrate membranes....60
Nylon membranes....70
Membrane filters....47
Membrane filtration accessories....81

Particulates/suspended solids

Glass microfiber filters....34
934-AH....37
Cellulosic membranes....58
Cellulose nitrate membranes....60
934-AH RTU-VSS....44

Ground water

Capsule filters....126

Trace organics

Thimbles....160

Others

Analysis of non-water/air (eg. fuel, soils, nuclear)

Turbine/diesel fuel

Cyclopore track-etched membranes....47
Black Cyclopore track-etched membranes....52

Particulates/suspended solids

Glass microfiber filters....34
Cellulosic membranes....58
Cellulose nitrate membranes....60

Hazardous contaminants

Glass microfiber filters....34
Thimbles....160

Soil analysis

Filter papers....9
Glass microfiber filters....34
Cellulose nitrate membranes....60
Thimbles....160

Cement filtration

Quantitative standard papers....14
Quantitative ashless papers....17
Quantitative hardened ashless papers....20

Mining filtration

Quantitative ashless papers....17
Binder-free glass microfiber filters....35
Glass and quartz thimbles....163

Nuclear radiation monitoring

Glass microfiber filters....34

Airport explosives detection

Cellulose filters....10

Food and beverage

QA/QC

Microbial and contaminant detection in food and beverage products

Analysis and detection of microorganisms

Black Cyclopore track-etched membranes....54
Membrane filters....47
Membrane filtration accessories....81

Physical properties testing

Filter papers....9

Wine filtration analysis

Filter papers....9
Membrane filters....47
Chromatography paper....158

HPLC sample preparation

Filter vials....90
Syringe filters....99
MBS I....84
Weighing papers....167

Operations

In process filtration in the production of food and beverage products

Clarification

Glass microfiber filters....34
Cellulosic membranes....58
Capsule filters....126

Final filtration

Capsule filters....126

Sterilizing filters

Syringe filters....99
Capsule filters....126

Solvents, acids, bases

PTFE membranes....66
Syringe filters....99
Capsule filters....126

Sterilizing filtration of air and gases

Syringe filters....99
Capsule filters....126

Liposome extrusion

Cyclopore track-etched membranes....49
Anodisc inorganic membranes....56

Non-life sciences

Microelectronics
Products in process and for analysis in semiconductor production

Cyclopore track-etched membranes 49
Nuclepore track-etched membranes 52
Polydisc 50 mm disc filters 120
Capsule filters 126

Chemical process industries
The analysis of chemicals, polymers, and petrochemicals

Filter papers 9

Pharmaceutical, biotechnology, medical research, specialty chemicals, life science research

R&D
The discovery of new pharmaceutical, therapeutic, and biotech products for human and animal uses

Basic lab

Filter papers 9
Membrane filters 47

Prefiltration

Cellulose filters 10
Glass microfiber filters 35

Sterilizing filters

Membrane filters 47
Syringe filters 99
Capsule filters 126

Blotting

Cellulose filters 10

Specialized procedures

Cyclopore track-etched membranes 49

Analysis and detection

Filtration devices 89

HPLC sample preparation

Filter vials 90
Syringe filters 99

Manufacturing operations
Full scale production of pharmaceuticals and other products

Prefiltration

Capsule filters 126

Sterilizing filters

Cyclopore track-etched membranes 49
Nuclepore track-etched membranes 52

Liposome extrusion

Cyclopore track-etched membranes 49
Anodisc inorganic membranes 56

Analysis and detection

Membrane filters 47
Membrane filtration accessories 152

Product development
Scale up of new products from R&D to clinical trials

Prefiltration

Cellulose filters 10
Glass microfiber filters 35
Syringe filters 99
Capsule filters 126

Pharmacogenomics

Filter papers and membranes

Cellulose filters 10
Glass microfiber filters 35
Membrane filters 47

Filtration devices

Filter vials 90
Syringe filters (including syringe filters for automation) 99
Inline filters 120
Capsule filters 126
Venting filters 137
Vacuum protection filters 141

Microbiology products

Membrane filters 47
Membrane filtration accessories 152

Specialty products

Extraction thimbles 160
Benchkote and Benchkote Plus 165
Weighing papers 167
Seed testing papers 167
pH indicators and test papers 169
Papers for healthcare 171
Phase separator paper 172
Lens cleaning tissue 173

Chromatography products

Chromatography paper 158

Contents

Filter papers 9

Membrane filters 47

Filtration hardware and accessories 73

Filtration devices 89

Microbiology products 145

Specialty products 157

Diagnostic components 175

Appendices 193

Filter papers

Whatman filter papers are the associated with quality, reliability, and customer service. Quality, reproducibility, and uniformity is maintained by using only the highest quality raw materials.

The filters are tested for grammage, thickness, air flow, and mechanical strength. Special parameters such as particle retention, wicking rate, filtration performance, and surface characteristics can be measured as needed.

Cellulose filters 10

Qualitative filter papers 11
Quantitative filter papers 15
Wet strengthened/general purpose filter papers 21
Folded (prepleated) filter papers 25
Application specific filter papers 31
Seed germination testing papers 33

Glass microfiber filters 35

Binder-free glass microfiber filter papers 36
Multigrade GMF filter papers 39
Glass microfiber filter papers with binder 40
Acid treated low metal TCLP filter papers 42
Quartz fiber filter papers 43
Ready-to-use (RTU) filter papers 44

Cellulose filters

Whatman cellulose filters are manufactured from high-quality cotton linters, which have been treated to achieve a minimum alpha cellulose content of 98%. These cellulose filter papers are used for general filtration and exhibit particle retention levels down to 2.5 µm. A wide choice of retention/flow rate combinations is offered to suit numerous laboratory applications.

The different groups of cellulose filters offer increasing degrees of purity, hardness, and chemical resistance.

Grade 5 Qualitative Filter Papers

Grade 3 Qualitative Filter Papers

Cellulose filters: trace element composition—typical values (µg/g paper)

Grade	1	42	542
Aluminum	3.6	2.5	3.4
Antimony	< 0.5	< 0.5	< 0.5
Arsenic	< 0.5	< 0.5	< 0.5
Barium	< 0.5	< 0.5	< 0.5
Boron	< 1.0	< 1.0	< 1.0
Calcium	27.5	8.3	14.7
Chromium	1.0	1.5	1.1
Copper	0.9	2.0	8.2
Iron	13.7	12.0	16.3
Lead	< 0.5	< 0.5	< 0.5
Magnesium	21.0	4.0	3.3
Manganese	< 0.5	< 0.5	< 0.5
Mercury	< 0.5	< 0.5	< 0.5
Potassium	6.2	2.3	3.7
Silicon	8.8	6.2	< 6.0
Sodium	32.3	16.8	17.0
Zinc	58.3	64.5	87.8

Typical values for additional grades can be found in Appendix A.

Qualitative filter papers

These cellulose filters are used in qualitative analytical techniques to determine and identify materials. Prepleated qualitative filters are available, which give improved flow rate and increased loading capacity compared to equivalent flat filters.

Grade 1: 11 µm*

The most widely used filter paper for routine applications with medium retention and flow rate. This grade covers a wide range of laboratory applications and is frequently used for clarifying liquids. Traditionally, the grade is used in qualitative analytical separations for precipitates such as lead sulfate, calcium oxalate (hot), and calcium carbonate.

In agriculture, it is used for soil analysis and seed testing procedures. In the food industry, Grade 1 is used for numerous routine techniques to separate solid foodstuffs from associated liquid, or extracting liquid and is widely used in education for teaching simple qualitative analytical separations.

In air pollution monitoring, using circles or rolls, atmospheric dust is collected from airflow and the stain intensity measured photometrically. For gas detection, the paper is impregnated with a chromogenic reagent and color formation quantified by optical reflectance. Available prepleated as Grade 1V.

Grade 1 Quantitative Filter Papers

Grade 2: 8 µm*

Slightly more retentive and absorbent than Grade 1 with a corresponding increase in filtration time (i.e. slightly slower filtration speed). In addition to general filtration in the 8 µm particle size range, the extra absorbency is utilized, for example, to hold soil nutrient in plant growth trials. Also used for monitoring specific contaminants in the atmosphere and in soil testing. Available prepleated as Grade 2V.

Grade 4 Qualitative Filter Papers

Grade 3: 6 µm*

Double the thickness of Grade 1 with still finer particle retention and excellent loading capacity; more precipitate can be held without clogging. The extra thickness gives increased wet strength and makes this grade highly suitable for use in Büchner funnels. The high absorbency is particularly valuable when the paper is used as a sample carrier.

Grade 4: 25 µm*

Extremely fast filtering with excellent retention of coarse particles and gelatinous precipitates such as ferric hydroxide and aluminum hydroxide. Very useful as a rapid filter for routine clean-up of biological fluids or organic extracts during analysis. Used when high flow rates in air pollution monitoring are required and the collection of fine particles is not critical. Available prepleated as Grade 4V.

Grade 5: 2.5 µm*

The maximum degree of fine particle filtration in the qualitative range. Capable of retaining the fine precipitates encountered in chemical analysis. Slow flow rate. Excellent clarifying filter for cloudy suspensions and for water and soil analysis. Also available prepleated as Grade 5V.

* *Particle retention rating at 98% efficiency.*

Grade 6: 3 µm*

Twice as fast as Grade 5 with similar fine particle retention. Often specified for boiler water analysis applications.

Grade 591: 7–12 µm*

A thick filter paper with very high loading capacity for fast filtration of medium to coarse precipitates. Offers high absorbency and increased wet strength. Also available prepleated as Grade 591 ½.

Grade 595: 4–7 µm*

Very popular, thin filter paper, medium-fast with medium to fine particle retention. Used for many routine analytical applications in different industries (e.g. particle separation from food extracts or filtration of solids from digested environmental samples for ICP/AAS analysis). Also available prepleated as Grade 595 ½.

Grade 597: 4–7 µm*

A medium fast filter paper with medium to fine particle retention. Used for a wide variety of routine analytical applications in different industries like food testing (e.g. determination of fat content) or removal of carbon dioxide and turbidity from beverages (as in beer analysis). Available prepleated as Grade 597 ½.

Grade 597L: 7 µm*

A qualitative filter paper with low fat content. Suitable for nitrate determination in foodstuffs to §35 LMBG* (* LMBG = German law for food and consumer products).

Grade 598: 8–10 µm*

A thick filter paper with high loading capacity. Combines medium retention with medium-fast to fast filtration speed. Also available prepleated as Grade 598 ½.

Grade 602 h: < 2 µm*

A dense filter paper for collecting very small particles and removing fine precipitates. Used in sample preparation (e.g. in the beverage industry for residual sugar determination, acidic spectra, refractometric analysis, and HPLC). Available prepleated as Grade 602 h ½.

Grade 602 eh: 2 µm*

These cellulose filters are used in qualitative analytical techniques to determine and identify materials. A standard grade filter paper for very fine precipitates. Used for recovery of microfine ultrapure crystalline components (< 1 µm) in alkaline tests in waste analysis (e.g. soils, filter dust, ash, ore/slag waste). Available prepleated as Grade 602 eh ½.

For qualitative wet strengthened papers see *Wet Strengthened/General Purpose Filter Papers* section.

Filter Paper Circles

* *Particle retention rating at 98% efficiency.*

Typical properties—qualitative filter papers—standard grades

Grade	Description	Typical particle retention in liquid (µm)[1]	Filtration speed (approx) herzberg (s)	Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]	Nominal ash content (%)[3]
1	–	11	–	13	180	87	57	0.06
2	–	8	–	20	190	97	38	0.06
3	Thick	6	–	26	390	185	28	0.06
4	–	25	37	4	210	92	247	0.06
5	–	2.5	1420	96	200	100	5	0.06
6	–	3	–	32	180	100	22	0.15
591	Medium fast, thick	7-12	45	5.9	350	161	–	–
595	Medium fast, thin	4-7	80	–	150	68	–	–
597	Medium fast	4-7	140	–	180	85	–	–
597L	Medium fast, low fat	7	170	_	180	82	–	–
598	Medium fast, thick	8-10	50	–	320	140	–	–
602 h	Slow, dense	< 2	375	–	160	84	–	–
602 eh	Very slow, very dense	2	3000	–	150	85	–	–

[1] *Particle retention rating at 98% efficiency*
[2] *For 9 cm diameter*
[3] *Ash is determined by ignition of the cellulose filter at 900°C in air*

Ordering information—qualitative filter circles—standard grades

Diameter (mm)	Catalog number						Quantity/pack
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
10	1001-6508	–	–	–	–	–	500
15	1001-0155	–	–	–	–	–	500
20	1001-020	–	–	–	–	–	400
23	–	–	1003-323	–	–	–	100
25	1001-325	–	–	–	1005-325	–	100
25	1001-025	–	–	–	–	–	400
27	–	–	–	1004-027	–	–	400
30	1001-329	–	–	–	–	–	100
30	1001-030	–	–	–	–	–	400
32	1001-032	–	–	–	–	–	100
41	–	–	–	1004-041	–	–	100
42.5	1001-042	1002-042	–	1004-042	1005-042	1006-042	100
47	1001-047	1002-047	–	1004-047	1005-047	–	100
50	–	–	–	1004-050	–	–	100
55	1001-055	1002-055	1003-055	1004-055	1005-055	–	100
60	–	–	–	–	1005-060	–	100
70	1001-070	1002-070	1003-070	1004-070	1005-070	1006-070	100
82	1001-082	–	–	–	–	–	100
85	1001-085	–	–	–	–	–	100
90	1001-090	1002-090	1003-090	1004-090	1005-090	1006-090	100
110	1001-110	1002-110	1003-110	1004-110	1005-110	1006-110	100
125	1001-125	1002-125	1003-125	1004-125	1005-125	1006-125	100
145	1001-045	–	–	–	–	–	100
150		1002-147	–	–	–	–	100
150	1001-150	1002-150	1003-150	1004-150	1005-150	1006-150	100
185	1001-185	1002-185	1003-185	1004-185	1005-185	1006-185	100

Ordering information—qualitative filter circles—standard grades (*continuation*)

	Catalog number						
Diameter (mm)	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Quantity/pack**
240	1001-240	1002-240	1003-240	1004-240	1005-240	1006-240	100
270	1001-270	1002-270	–	1004-270	–	–	100
320	1001-320	1002-320	1003-320	1004-320	1005-320	–	100
385	1001-385	1002-385	–	–	–	–	100
400	1001-400	–	–	1004-400	–	–	100
500	1001-500	1002-500	–	–	–	–	100

Ordering information—qualitative filter circles—standard grades

	Catalog number				
Diameter (mm)	**Grade 595**	**Grade 597**	**Grade 598**	**Grade 602 h**	**Quantity/pack**
12.7	–	10311862	–	–	1000
45	–	10311804	–	–	100
55	–	10311807	–	–	100
70	–	10311808	–	–	100
90	–	10311809	10312209	–	100
110	10311610	10311810	–	–	100
125	10311611	10311811	–	10312611	100
150	10311612	10311812	-	10312612	100
185	10316114	10311814	–	10312614	100
240	–	10311820	–	10312620	100
320	–	10311822	–	–	100

Ordering information—qualitative filter sheets—standard grades

Dimensions (mm)	**Catalog number**	**Quantity/pack**
Grade 1		
26 × 31	1001-813	1000
75 × 100	1001-824	500
460 × 570	1001-917	100
460 × 570	1001-918	500
580 × 680	1001-931	100
580 × 680	1001-932	500
600 × 600	1001-929	100
Grade 2		
460 × 570	1002-917	100
580 × 680	1002-931	100
600 × 600	1002-929	100
Grade 3		
460 × 570	1003-917	100

Dimensions (mm)	**Catalog number**	**Quantity/pack**
Grade 4		
460 × 570	1004-917	100
580 × 580	1004-930	100
6 × 6 in	1004-492	100
Grade 591		
580 × 580	10311387	250
Grade 595		
580 × 580	10311687	500
Grade 597		
580 × 580	10311887	500
580 × 580	10311897	100
Grade 598		
580 × 580	10312287	250

Ordering information—qualitative filter reels—standard grades

	Catalog number			
Dimensions	**Grade 4**	**Grade 597L**	**Grade 602 eh**	**Quantity/pack**
10 mm × 50 m	–	–	10312500	20
38 mm × 30 m[#]	1004-648	–	–	1
40 mm × 100 m	–	10312070	–	10

[#] *Approximate dimensions*

Quantitative filter papers

Whatman quantitative filters are designed for gravimetric analysis and the preparation of samples for instrument analysis. They are available in three formats designed for specific requirements.

- **Ashless:** 0.007% ash nominal for Grades 40 to 44 and a typical of 0.01% for the 589 Grades—very pure filters suitable for a wide range of critical analytical filtration procedures.
- **Hardened low ash:** 0.015% ash nominal—treated with a strong acid to remove trace metals and produce high wet strength and chemical resistance. These filters are particularly suitable for Büchner filtration where the tough, smooth surface of the filter makes it easy to recover precipitates.
- **Hardened ashless:** 0.005% ash nominal—acid hardened to give high wet strength and chemical resistance with extremely low ash content. The tough surface makes these filters suitable for a wide range of critical filtration procedures.

Quantitative filter papers—ashless grades

Grade 40: 8 µm*

The classic general purpose ashless filter paper with medium speed and retention. Typical applications include gravimetric analysis for numerous components in cements, clays, iron, and steel products; as a primary filter for separating solid matter from aqueous extracts in general soil analysis; quantitative determination of sediments in milk, and as a pure analytical grade clean-up filter for solutions prior to AA spectrometry. Also used as a high-purity filter in the collection of trace elements and radionuclides from the atmosphere.

Quantitative Filter Papers, Ashless

Grade 41: 20 µm*

The fastest ashless filter paper, recommended for analytical procedures involving coarse particles or gelatinous precipitates (e.g. iron or aluminum hydroxides). Also used in quantitative air pollution analysis as a paper tape for impregnation when determining gaseous compounds at high flow rates.

Grade 42: 2.5 µm*

Used for critical gravimetric analysis with the finest particle retention of all Whatman cellulose filter papers. Typical analytical precipitates include barium sulfate, metastannic acid, and finely precipitated calcium carbonate.

Grade 43: 16 µm*

Intermediate in retention between Grades 40 and 41, and twice as fast as Grade 40. Typical applications include foodstuffs analysis, soil analysis, particle collection in air pollution monitoring for subsequent analysis by XRF techniques, and inorganic analysis in the construction, mining, and steel industries.

Grade 44: 3 µm*

Thin version of Grade 42 retaining very fine particles but with lower ash weight per sample and almost twice the flow rate of Grade 42.

* *Particle retention rating at 98% efficiency.*

Grade 589/1: 12-25 µm*

Black Ribbon Filter— ashless filter paper with very high flow rate. Used for many quantitative standard methods, especially for gravimetric applications (e.g. determination of the ash content in foodstuffs or for the Blaine test in the cement industry). Also available prepleated as Grade 589/1 ½.

Grade 589/2: 4-12 µm*

White Ribbon Filter—ashless standard filter paper for medium fine precipitates offering medium filtration speed. Applied in a variety of routine methods in quantitative analysis, (e.g. determination of the sand content in foodstuffs, determination of the grade of flour or analysis of aqueous suspensions in the paper industry). Also available prepleated as Grade 589/2 ½.

Grade 589/3: 2 µm*

Blue Ribbon Filter—ashless standard filter paper for very fine precipitates. Slow filter paper with highest efficiency for collecting very small particles. Also used for many analytical routine methods in different industries (e.g. determination of the amount of insoluble contaminants in animal and vegetable fats and oils).

Grade 589 Filter Paper Family

Typical properties—quantitative filter papers—ashless grades

Grade	Typical particle retention in liquid (µm)[1]	Filtration speed (approx) herzberg (s)	Nominal ash content (%)[3]	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]	Nominal air flow rate (s/100 mL/in²)
40	8	–	0.007	210	95	25	21
41	20	–	0.007	215	85	254	4
42	2.5	–	0.007	200	100	5	96
43	16	–	0.007	220	95	62	11
44	3	–	0.007	176	80	11	56
589/1	12-25	25	0.01	190	80	–	–
589/2	4-12	70	0.01	180	85	–	–
589/3	2	375	0.01	160	84	–	–

1 *Particle retention rating at 98% efficiency*
2 *For 9 cm diameter*
3 *Ash is determined by ignition of the cellulose filter at 900°C in air*

Whatman Filter Paper Circles

* *Particle retention rating at 98% efficiency.*

Ordering information—quantitative filter papers—ashless grades

Dimensions (mm)	Catalog number								Quantity/ pack
	Grade 40	Grade 41	Grade 42	Grade 43	Grade 44	Grade 589/1	Grade 589/2	Grade 589/3	
Filter circles									
12.7	1440-012	–	–	–	–	–	–	–	400
12.7	–	–	–	–	–	–	10300102	10300263	1000
25	1441-6309	1441- 6309	–	–	–	–	–	–	10000
30	1440-329	–	–	–	–	–	–	–	100
32	1440-032	–	–	–	–	–	–	–	100
40.5	–	–	–	–	–	–	10300103	–	100
42.5	1440-042	1441-042	1442-042	–	–	–	–	–	100
47	1440-047	1441-047	1442-047	–	–	–	–	–	100
50	–	1441-050	–	–	–	–	10300106	–	100
55	1440-055	1441-055	1442-055	–	–	–	10300107	–	100
60	–	1441-060	–	–	–	–	–	–	100
70	1440-070	1441-070	1442-070	–	1444-070	–	10300108	–	100
79	–	–	1442-10055	–	–	–	–	–	100
90	1440-090	1441-090	1442-090	1443-090	1444-090	10300009	10300109	–	100
110	1440-110	1441-110	1442-110	1443-110	1444-110	10300010	10300110	10300210	100
125	1440-125	1441-125	1442-125	1443-125	1444-125	10300011	10300111	10300211	100
150	1440-150	1441-150	1442-150	1443-150	1444-150	10300012	10300112	10300212	100
185	1440-185	1441-185	1442-185	1443-185	1444-185	10300014	10300114	10300214	100
240	1440-240	1441-240	1442-240	–	1444-240	–	10300120	–	100
320	1440-320	1441-320	1442-320	–	–	–	–		100
450	1440-6168	–	–	–	–	–	–	–	100
500	–	–	–	–	–	–	–	–	100
700	–	–	–	–	–	–	–	–	100
Filter sheets									
25.4 × 90	–	–	1442-6551	–	–	–	–	–	100
203 × 254	–	1441-866	–	–	–	–	–	–	100
460 × 570	1440-917	1441-917	1442-917	–	–	–	–	–	100
Flag shape	–	–	1442-971	–	–	–	–	–	100

Quantitative filter papers—hardened low ash grades

The maximum ash content of these grades is intermediate between ashless and qualitative grades. They are particularly suitable for Büchner filtrations where it is desirable to recover the precipitate from the filter surface after filtration. Other characteristics include high wet strength and chemical resistance, which are similar to the acid hardened ashless filter papers.

Grade 50: 2.7 µm*

Retention of very fine crystalline precipitates. The thinnest of all Whatman filter papers with a slow flow rate, these filters have a hardened and highly glazed surface, which also keeps the paper free from loose surface fibers. Highly suitable for qualitative or quantitative filtrations requiring vacuum assistance on Büchner or 3-piece filter funnels. Very strong when wet and will withstand wet handling and precipitate removal by scraping. In the electronics industry, the virtual absence of fiber shedding is utilized in carriers for integrated circuits.

This grade is also available in Smear Tab format for wipe testing (e.g. testing of surfaces for radionuclide contamination).

Quantitative Filter Papers, Ashless

Grade 52: 7 µm*

The general purpose hardened filter paper with medium retention and flow rate. Very hard surface.

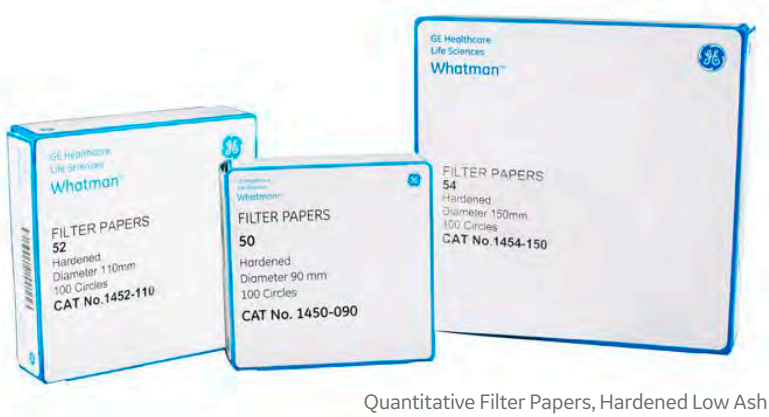
Grade 54: 22 µm*

Very fast filtration and high wet strength makes this grade very suitable for vacuum assisted fast filtration of difficult coarse or gelatinous precipitates.

Typical properties—quantitative filter papers—hardened low ash grades

Grade	Typical particle retention in liquid (µm)[1]	Nominal ash content (%)[3]	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]	Nominal air flow rate (s/100 mL/in²)
50	2.7	0.015	115	96	10	144
52	7	0.015	175	96	66	15
54	22	0.015	185	90	453	3

[1] *Particle retention rating at 98% efficiency*
[2] *For 9 cm diameter*
[3] *Ash is determined by ignition of the cellulose filter at 900°C in air*



Quantitative Filter Papers, Hardened Low Ash

* *Particle retention rating at 98% efficiency.*

Ordering information—quantitative filter papers—hardened low ash grades

	Catalog number			
Dimensions (mm)	**Grade 50**	**Grade 52**	**Grade 54**	**Quantity/pack**
Filter circles				
42.5	1450-042	–	–	100
55	1450-055	–	1454-055	100
70	1450-070	–	1454-070	100
90	1450-090	1452-090	1454-090	100
110	1450-110	1452-110	1454-110	100
125	1450-125	1452-125	1454-125	100
150	1450-150	1452-150	1454-150	100
185	1450-185	–	1454-185	100
240	1450-240	1452-240	1454-240	100
320	1450-320	–	1454-320	100
500	1450-500	–	1454-500	100
Smear Tab	1450-993	–	–	100
Filter sheets				
150 × 230	1450-916	–	–	100
460 × 570	1450-917	–	1454-917	100

Quantitative filter papers—hardened ashless grades

Hardened ashless filter papers are suited for a variety of precipitate sizes. Along with general filtration Grade 540, the range includes Grade 542 for retention of fine precipitates and Grade 541 for fast filtration. All three grades are designed for use in gravimetric analysis.

These filter papers exhibit high wet strength and chemical resistance and are acid hardened, which reduces ash to an extremely low level. Their tough surfaces make them suitable for a wide range of critical analytical filtration operations. Each grade offers a convenient combination of filtration speed and particle retention.

Grade 540: 8 µm*

A general purpose hardened ashless filter paper with medium retention and flow rate. Extremely pure and strong with a hard surface. High chemical resistance to strong acid and alkali. Frequently used in the gravimetric analysis of metals in acid/alkali solutions and in collecting hydroxides after precipitation by strong alkalis.

Quantitative Filter Papers, Hardened Ashless, Grade 540

Grade 541: 22 µm*

Fast filtration of coarse particles and gelatinous precipitates in acid/alkali solutions during gravimetric analysis. Typical applications include fiber in animal foodstuffs, gelatin in milk and cream, chloride in cement, and chloride and phosphorus in coal and coke.

Grade 542: 2.7 µm*

High retention of fine particles under demanding conditions. Slow flow rate. Very hard and strong with excellent chemical resistance. Often used in gravimetric metal determinations.

* *Particle retention rating at 98% efficiency.*

Typical properties—quantitative filter papers—hardened ashless grades

Grade	Typical particle retention in liquid (µm)[1]	Nominal ash content (%)[3]	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]	Nominal air flow rate (s/100 mL/in²)
540	8	0.005	160	85	97	13
541	22	0.005	155	78	359	3
542	2.7	0.005	150	96	13	64

[1] *Particle retention rating at 98% efficiency*
[2] *For 9 cm diameter*
[3] *Ash is determined by ignition of the cellulose filter at 900°C in air*

Ordering information—quantitative filter papers—hardened ashless grades

	Catalog number			
Dimensions (mm)	**Grade 540**	**Grade 541**	**Grade 542**	**Quantity/pack**
Filter circles				
21	1540-321	–	–	100
24	1540-324	–	–	100
42.5	1540-042	1541-042	–	100
47	–	1541-047	–	100
55	1540-055	1541-055	1542-055	100
70	–	1541-070	1542-070	100
90	1540-090	1541-090	1542-090	100
110	1540-110	1541-110	1542-110	100
125	1540-125	1541-125	1542-125	100
150	1540-150	1541-150	1542-150	100
185	1540-185	1541-185	1542-185	100
240	1540-240	1541-240	1542-240	100
270	–	1541-270	–	100
320	1540-320	1541-320	–	100
400	–	1541-400	1542-400	100
Filter sheets				
460 × 570	–	1541-917	–	100

Quantitative Filter Papers, Hardened Ashless

Wet strengthened/general purpose filter papers

Wet strengthened grades

These extremely strong filter papers have a high wet strength due to the addition of a small quantity of chemically stable resin. Their use in normal qualitative applications will not introduce any significant impurities into the filtrate. The resins do, however, contain nitrogen so these grades should not be used in Kjeldahl estimations, etc. Some wet strengthened grades are available in folded (prepleated) forms.

Grade 91: 10 µm*

A general purpose creped filter for less critical routine analysis. Widely used to assay sucrose in cane sugar and within pharmaceutical laboratories for routine filtration.

Grade 91 Qualitative Filter Papers

Grade 93: 10 µm*

This filter paper is intermediate in speed and retention between Grades 1 and 4. Available in a dispenser pack, which can be attached to the wall or bench, placed on a shelf either upright or flat, and used as a normal carton or as a convenient dispenser. The envelopes are released individually for easy one-at-a-time removal. Package and envelopes are clearly marked for size and content.

Grade 113: 30 µm*

A fast, open filter paper with creped surface and high loading capacity — making it highly suited for use with coarse or gelatinous precipitates. Fastest flow rate of the qualitative grades. Also available as Grade 113V.

Grade 114: 25 µm*

Half the thickness of Grade 113 and suitable for coarse or gelatinous precipitates. Smooth surface for easy recovery of precipitates. Also available prepleated as Grade 114V.

Grade 1573: 12-25 µm*

A fast filter paper with high wet strength. It has a very smooth surface, making it easy to scrape or wash off precipitate. Resistant against: sulfuric and nitric acid solutions (up to 40% at 50°C), hydrochloric (up to 10% at 100°C, 20% at 60°C, 25% at 20°C) and alkalis (up to 10% at 20°C). Also available prepleated as Grade 1573 ½.

Grade 1574: 7–12 µm*

A medium fast filter paper with high wet strength. This paper has the same chemical resistance characteristics as Grade 1573 (see above). Available prepleated as Grade 1574 ½.

Grade 1575: < 2 µm*

Slow filter paper with high wet strength. This paper has the same chemical resistance characteristics as Grade 1573 (see above).

* *Particle retention rating at 98% efficiency.*

Typical properties—wet strengthened grades

Grade	Description	Typical particle retention in liquid (µm)[1]	Filtration speed (approx) herzberg (s)	Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]
91	Creped	10	–	6	205	65	274
93	Medium	10	–	7	145	65	194
113	Creped	30	–	2	420	125	774
114	–	25	–	4	190	75	333
1573	Fast, smooth	12-25	25	–	170	88	–
1574	Medium fast, very low fiber release	7-12	85	–	160	90	–
1575	Slow	< 2	700	–	140	92	–

[1] *Particle retention rating at 98% efficiency*
[2] *For 9 cm diameter*

Ordering information—wet strengthened grades

	Catalog number							
Dimensions (mm)	**Grade 91**	**Grade 93**	**Grade 113**	**Grade 114**	**Grade 1573**	**Grade 1574**	**Grade 1575**	**Quantity/pack**
Filter circles								
90	–	–	1113-090	1114-090	–	–	–	100
110	1091-110	–	–	–	–	–	–	4000†
110	–	1093-110	1113-110	–	–	–	–	100
110	–	1093-111*	–	–	–	–	–	1250
125	1091-125	–	–	–	–	–	–	4000†
125	–	1093-125	1113-125	1114-125	–	–	–	100
125	–	1093-126*	–	–	–	–	–	1250
150	1091-150	1093-6215**	–	–	–	–	–	1000†
150	–	–	1113-150	1114-150	10314712	–	–	100
165	1091-165	–	–	–	–	–	–	1000†
185	1091-185	–	–	–	–	–	–	1000†
185	–	–	1113-185	1114-185	10314714	–	–	100
190	1091-190	–	–	–	–	–	–	1000†
200	–	–	-	-	-	–	10314916	100
240	1091-240	–	–	–	–	–	–	1000†
240	–	–	1113-240	1114-240	10314720	–	–	100
290	–	–	-	-	10314726	–	-	100
320	–	–	1113-320	–	–	–	–	100
400	–	–	–	1114-400	–	–	–	100
500	–	–	1113-500	–	–	–	–	100
685	–	–	–	–	–	10314828	–	100
Filter sheets								
580 mm × 580 mm	1091-930	1093-930	–	–	–		–	500
610 mm × 610 mm	1091-935	1093-935	–	–	–		–	500
460 mm × 570 mm	–	–	1113-917	–	–		–	100
Rolls								
22.5 m × 210 mm	–	–	–	–	10314766	–	–	1

* *Packed 50 envelopes of 25 circles*
** *Packed 10 bags of 100 circles*
† *Subdivided into 100*

General purpose filter papers

These filter papers are made from super-refined cellulose and have been specifically designed to have particular properties for each application, ranging from the filtration of beverages to the purification of electroplating baths.

Grade 520 a: 15-18 µm*

A thin paper with great wet strength and a very high flow rate. Frequently used in technical applications such as the filtration of viscous liquids and emulsions (e.g. sweetened juices, spirits and syrups, resin solutions, oils, or plant extracts). Available prepleated as Grade 520 a ½.

Grade 520 bII : 15-19 µm*

A thick paper with high wet strength offering a very high flow rate.

Grade 0858: 7-12 µm*

Medium retention and flow rate with a grained surface. Used for the filtration of extracts, oils, beer, syrups, etc. Also suitable for use in filter presses or for the aspiration of liquids. Available prepleated as Grade 0858 ½.

Grade 0903: 7 µm*

A thin filter paper with smooth surface. Offers medium to slow flow rate and good retention for small particles.

Grade 0905: 12-25 µm*

A creped paper for coarse particles, offering a very high filtration speed.

Grade 2294: 8-15 µm*

A very thick filter card with high wet strength. Offers very high flow rate and retains medium to coarse particles.

Grade 2589 a: 6-12 µm*

A fast to medium fast filter with high wet strength offering medium retention.

Grade 2589 c: 4-8 µm*

Thick filter with medium to slow filtration speed, high wet strength, and good retention for smaller particles.

Grade 2589 d: 2-6 µm*

A very thick filter with high wet strength. Offers medium to slow flow rate and retains very fine precipitates.

Grade Shark Skin: 8-12 µm*

Creped, medium to slow filter paper. Resistant to weak acids and bases. Often used as a protective paper for filter press cloths, as well as in processing of cocoa butter and edible oils.

Grade 2294 Filter Papers for Technical Use

* *Particle retention rating at 98% efficiency.*

Typical properties—general purpose filter papers

Grade	Description	Typical particle retention in liquid (µm)	Filtration speed (approx) herzberg (s)	Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)
520 a	Very fast, creped, high wet strength	15-18	17.5	–	300	90
520 b II	Very fast, creped, wet strength, thick	15-19	15	–	500	135
0858	Medium fast, grained	7-12	55	4.9	170	75
0903	Medium to slow, smooth	7	175	–	140	65
0905	Very fast, creped	12-25	20	–	270	75
2294	Fast, wet strength, thick	8-15	27.5	4.4	1500	556
2589 a	Medium fast, wet strength	6-12	60	–	430	200
2589 c	Medium to slow, wet strength	4-8	160	–	750	400
2589 d	Medium to slow, wet strength, thick	2-6	235	–	1000	500
Shark Skin™	Medium to slow, wet strength, thin, creped	8-12	77.5	–	170	44

Ordering information—general purpose filter papers

	Catalog number						
Dimensions (mm)	**Grade 0858**	**Grade 0903**	**Grade 0905**	**Grade 520 a**	**Grade 520 bII**	**Shark Skin**	**Quantity/pack**
Filter sheets							
110 × 580	10334365	–	–	–	–	–	500
390 × 390	10334383	–	–	–	–	–	500
450 × 450	10334385	10334885	–	–	–	–	500
580 × 580	–	–	10334987	–	–	–	500
580 × 580	–	–	–	10331487	10331687	–	250
300 × 250	–	–	–	–	–	10538877	100
Filter reels							
21" × 750'	–	–	–	–	–	10537138	1
	Grade 2589 a	**Grade 2589 c**	**Grade 2589 d**				**Quantity/pack**
25 × 75	–	10343876	10343976				100
580 × 580	10343687	–	–				100
Filter circles							
	Grade 2294	**Grade 2589 a**	**Shark Skin**				**Quantity/pack**
90	–	–	10347509				100
110	10342810	–	10347510				100
125	–	–	10347511				100
140	–	10343630	–				500
150	–	–	10347513				100
180	10342860[1]	–	–				100
185	–	–	10347512				100
210	10342862[2]	–	–				100
240	–	–	10347519				100
270	–	–	10347521				100
290	–	–	10347577				100
320	–	–	10347530				100
340	–	–	10347522				100
385	–	–	10347523				100
500	–	–	10347525				100

[1] *180 mm with central hole 33 mm*
[2] *210 mm with central hole 60 mm*

Folded (prepleated) filter papers

Whatman qualitative and quantitative grades are offered in this convenient format which has major advantages over flat circles.

- Savings in time required to quadrant-fold circles to fit conical filter funnels in repetitive or multiple analyses
- Decreased overall filtration time because of the extra surface area exposed; the normal slow down of filtration speed due to the loading of particulate is postponed
- Increased total loading capacity as more filter area is available
- Maintained flow rate due to the reduction in filter paper contact with funnel side and the self-supporting shape of the filter itself
- The prepleating does not significantly affect any of the technical data and the same figures may be used for the flat circles

Grade 1V: 11 µm*

A folded filter paper for routine applications with medium retention and flow rate. Covers a wide range of laboratory applications and is frequently used for clarifying liquids. Available in flat stock form as Grade 1.

Grade 2V: 8 µm*

Widely used for general purpose filtration. Has excellent particle retention and a good filtration speed and loading capacity. Available in flat stock form as Grade 2.

Qualitative Filter Papers, Fluted

Grade 4V: 25 µm*

Extremely fast filtering with excellent retention of coarse particles and gelatinous precipitates such as ferric hydroxide and aluminum hydroxide. Available in flat stock form as Grade 4

Grade 5V: 2.5 µm*

The maximum degree of fine particle filtration in the qualitative range. Capable of retaining the fine precipitates encountered in chemical analysis. Slow flow rate. Excellent clarifying filter for cloudy suspensions and for water and soil analysis. Also available in flat stock form as Grade 5.

Grade 113V: 30 µm*

Very thick and strong filter with creped surface for extremely high loading capacity, particularly in folded form. Fastest flow rate of any qualitative grade. Excellent for coarse particles and gelatinous precipitates. Supplied in flat stock form as Grade 113.

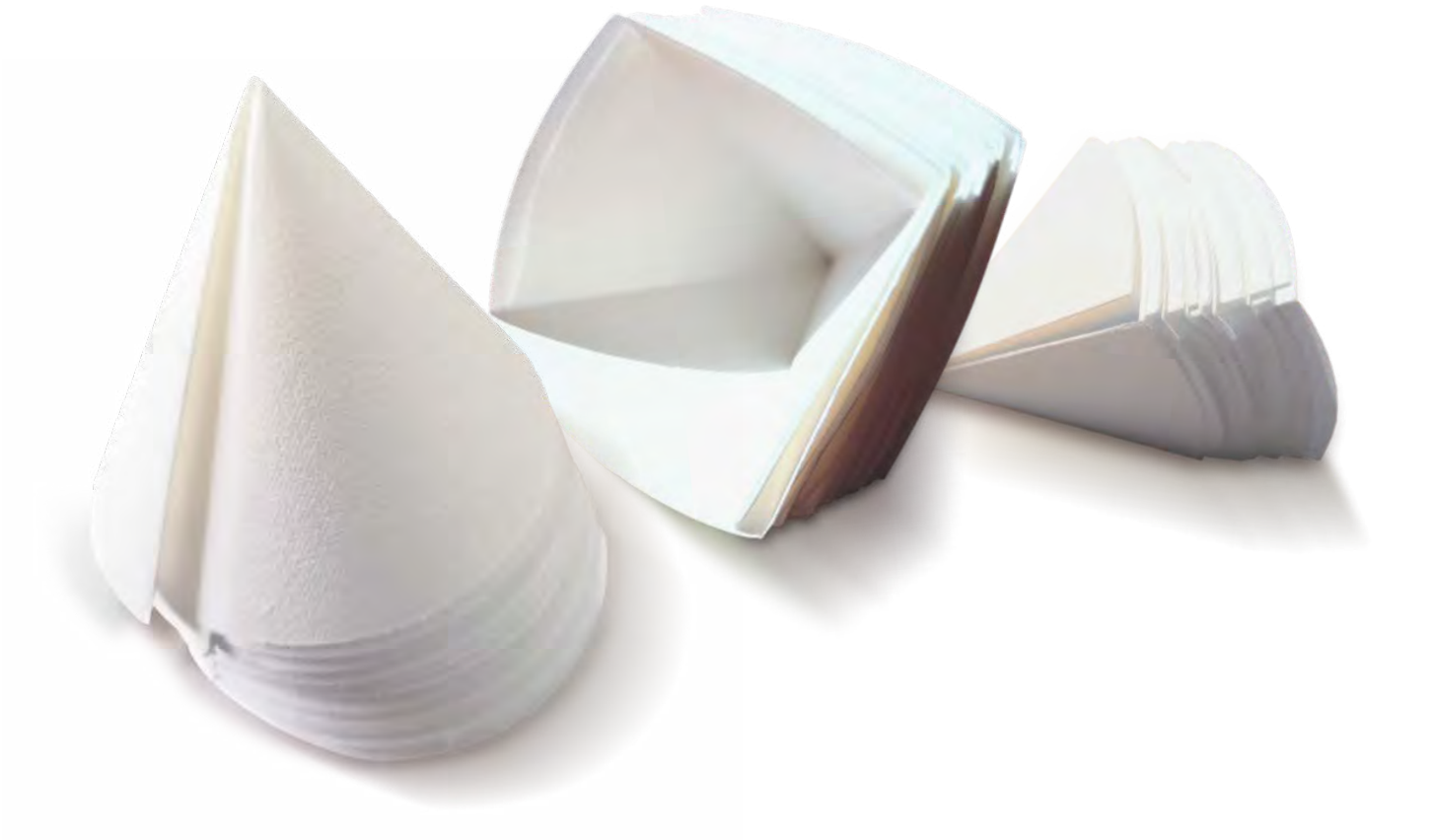
Grade 114V: 25 µm*

Strong filter with very fast flow rate. Excellent for coarse particles and gelatinous precipitates. Smooth surface. Flat stock form as Grade 114.

Grade 287 ½

Kieselguhr paper with a medium to slow flow rate. Additional adsorption effect (e.g. for the separation of very fine semi-colloidal turbidity, for clarifying milk serum, starch solutions, soil suspensions, or sugar-containing solutions prior to polarimetry or refractometry).

* *Particle retention rating at 98% efficiency.*



New custom Whatman folded filter papers

Ready-to-use paper solutions

Whatman ready-to-use folded filter papers from GE Healthcare Life Sciences support your application needs, save valuable time and provide ease of use when undertaking repetitive or multiple analyses.

Customized formats

Qualitative and quantitative grades are now available in NEW convenient formats. The pre-folded paper filters are available in cone, pyramid, and flat quadrant formats, in diameters and grades to support your applications. Convenient stacking and packaging options are available.

Product name	Fold shape	Pack size	Product code
Grade 6 12.5 cm	Pyramid	1000	9891-128
Grade 40 12.5 cm	Pyramid	1000	9892-128

The above table is an example of products set-up; please contact us at scientific.support@ge.com for a full listing of available products.

New cone and pyramid folded filter papers

Grade 520 a ½: 15–18 µm*

A thin paper with great wet strength and a very high flow rate. Frequently used in technical applications such as the filtration of viscous liquids and emulsions (e.g. sweetened juices, spirits and syrups, resin solutions, oils or plant extracts). Also available in flat stock form as Grade 520 a.

Grade 520 b FF

A filter paper with high wet strength offering a very high flow rate.

Grade 593 ½: 5 µm*

A standard grade filter paper for fine precipitates.

Grade 594 ½: 4 µm*

A standard grade filter paper for fine precipitates.

Grade 595 ½: 4–7 µm*

A thin filter paper, medium-fast with medium to fine particle retention. Used for many routine analytical applications in different industries (e.g. particle separation from food extracts or filtration of solids from digested environmental samples for ICP/AAS analysis). Also available in flat stock form as Grade 595.

Grade 597 ½: 4–7 µm*

A medium fast filter paper with medium to fine particle retention. Used for a wide variety of analytical routine applications in different industries like food testing (e.g. determination of fat content) or removal of carbon dioxide and turbidity from beverages (e.g. beer analysis). Also available in flat stock form as Grade 597.

Grade 598 ½: 8–10 µm*

A thick filter paper with high loading capacity. Combines medium retention with medium-fast to quick filtration speed. Also available in flat stock form as Grade 598.

Grade 602 h ½: < 2 µm*

A dense filter paper for collecting very small particles and removing fine precipitates. Used in sample preparation (e.g. in the beverage industry for residual sugar determination, acidic spectra, refractometric analysis, and HPLC). Also available in flat stock form as Grade 602 h.

Grade 602 eh ½: 2 µm*

A qualitative filter paper for very fine precipitates. Available in flat stock form as Grade 602 eh.

Grade 604 ½: 25 µm*

Grade 604½ qualitative filter paper for coarse precipitates.

Grade 802

A prepleated filter for use with a conical filter funnel, offering fast filtration and high loading capacity for analysis involving coarse particles or gelatinous precipitates.

The filter is wet-strengthened and for normal qualitative application it will not introduce any significant impurities into the filtrate. However, it is not recommended for Kjeldahl nitrogen analysis.

Grade 0858 ½: 7–12 µm*

Medium retention and flow rate with a grained surface. A universal filter paper used for the filtration of extracts, oils, beer, syrups, etc., also suitable for use in filter presses or for the aspiration of liquids. Available in flat stock form as Grade 0858.

Grade 0860 ½: 12 µm*

Comparable to Grade 0858 but with a smooth surface, slightly thinner and faster.

* *Particle retention rating at 98% efficiency.*

Grade 1573 ½: 12–25 µm*

A fast filter paper with high wet strength. It has a very smooth surface, making it easy to scrape or wash off precipitate. Resistant against: sulfuric and nitric acid solutions (up to 40% at 50°C), hydrochloric (up to 10% at 100°C, 20% at 60°C, 25% at 20°C), alkalis (up to 10% at 20°C). Also available in flat stock form as Grade 1573.

Grade 1574 ½: 7–12 µm*

A medium fast filter paper with high wet strength. This paper has the same chemical resistance characteristics as Grade 1573 ½ (see above). Available in flat stock form as Grade 1574.

Grade 2555 ½: 12 µm*

A medium fast filter paper. Used for the filtration of the mash for the determination of the extract in malt and wort and for removing carbon dioxide from beer.

Grade 0790 ½

Acid-washed paper with ash content of approximately 0.01%, low magnesium, and phosphorus for the determination of trace elements (Mg, Mn, Co, Cu, Mo, B).

Grade 512 ½

Low phosphate papers approximately 1.5 ppm phosphate, for the filtration of calcium lactate extracts from soil samples for the determination of K and P according to Egnér, Riehm and Lederle.

Typical properties—folded (prepleated) grades

Grade	Description	Typical particle retention in liquid (µm)[1]	Filtration speed (approx) herzberg (s)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Typical water flow rate (mL/min)[2]	Nominal ash content (%)[3]
1V	Medium flow	11	–	180	87	57	0.06
2V	–	8	–	190	97	38	–
4V	Very fast	25	–	210	92	247	0.06
5V	Slow	2.5	–	200	92	5	–
113V	Creped	30	–	420	125	774	–
114V	–	25	–	190	75	333	–
287 ½	Kieselguhr	–	330	360	154	–	–
520 a ½	Very fast, creped, high wet strength	15-18	17.5	300	90	–	–
520 b FF	Very fast, wet strength, extra thick	20	30	500	155	–	–
593 ½	Medium to slow	5	450	170	85	–	–
594 ½	Slow	4	800	150	75	–	–
595 ½	Medium fast, thin	4-7	80	150	68	–	–
597 ½	Medium fast	4-7	70	180	85	–	–
598 ½	Medium fast, thick	8-10	50	320	140	–	–
602 h ½	Slow, dense	< 2	375	160	84	–	–
602 eh ½	Very slow, very dense	2	3000	150	85	–	–
604 ½	Fast	25	50	190	80	–	–
802	Fast	–	–	–	73	–	–
0858 ½	Medium fast, grained	7-12	55	170	75	–	–
0860 ½	Medium fast, smooth	12	60	170	75	–	–
1573 ½	Fast, smooth	12-25	25	170	88	–	–
1574 ½	Medium fast, very low fiber release	7-12	85	160	90	–	–
2555 ½	Medium fast	12	55	170	75	–	–

1 *Particle retention rating at 98% efficiency*
2 *For 9 cm diameter*
3 *Ash is determined by ignition of the cellulose filter at 900°C in air*

Ordering information—filter papers—folded (prepleated) grades

Diameter (mm)	Catalog number								Quantity/ pack
	Grade 1V	Grade 2V	Grade 4V	Grade 5V	Grade 113V	Grade 114V	Grade 287 ½	Grade 520 a ½	
125	1201-125	1202-125	1204-125	–	1213-125	1214-125	–	–	100
125	–	–	–	–	–	–	10310244	–	50
150	–	–	–	–	–	–	10310245	–	50
150	1201-150	1202-150	1204-150	–	1213-150	1214-150		–	100
185	–	–	–	–	–	–	10310247	–	50
185	1201-185	1202-185	1204-0185	1205-185	1213-185	1214-185		–	100
240	1201-240	1202-240	1204-240	–	1213-240	1214-240	–	10331451	100
270	1201-270	1202-270	1204-270	–	1213-270	–	–	–	100
320	1201-320	1202-320	1204-320	–	1213-320	1214-320		–	100
385	–	1202-385	–	–	–	–	–	–	100
400	–	1202-400	–	–	–	–	–	–	100
500	–	1202-500	–	–	1213-500	–	–	10331456	100

Ordering information—filter papers—folded (prepleated) grades

Diameter (mm)	Catalog number							Quantity/ pack
	Grade 520 b FF	Grade 593 ½	Grade 594 ½	Grade 595 ½	Grade 597 ½	Grade 598 ½	Grade 602 h ½	
70	–	–	–	10311641	10311841	–	–	100
90	–	–	–	10311642	10311842	–	10312642	100
110	–	–	–	10311643	10311843	–	–	100
125	–	–	–	–	–	10312244	–	50
125	–	–	–	10311644	10311844	–	10312644	100
150	–	–	–	10311645	10311845	–	10312645	100
185	–	–	–	–	–	10312247	–	50
185	–	10311447	10311547	10311647	10311847		10312647	100
210	–	–	–	10311649	–	–	–	100
240	10331551	–	–	–	–	10312251	–	50
240	–	10311451	–	10311651	10311851	–	10312651	100
270	–	–	–	10311652	10311852	–	–	100
320	10331553	–	–	–	–	–	–	50
320	–	–	–	10311653	10311853	–	–	100
385	10331554	–	–	–	–	–	–	50
385	–	–	–	10311654	10311854	–	–	100
500	10331556	–	–	–	–	10312256	–	50
500	–	–	–	10311656	10311856	–	–	100
600	10331558	–	–	–	–	–	–	50

Diameter (mm)	Catalog number							Quantity/ pack
	Grade 602 eh ½	Grade 604 ½	Grade 0858 ½	Grade 0860 ½	Grade 1573 ½	Grade 1574 ½	Grade 2555 ½	
110	–	–	–	–	–	10314843	–	100
125	10312544	10312744	–	–	10314744	10314844	–	100
150	10312545	10312745	10334345	–	10314745	–	–	100
185	–	10312747	10334347	10334547	10314747	–	10313947	100
240	–	10312751	10334351	10334551	10314751	–	10313951	100
270	–	–	10334352	–	10314752	–	–	100
320	–	10312753	10334353	10334553	10314753	–	10313953	100
Sheets								
570 mm × 870 mm	–	–	10334346	–	–	–	–	100
670 mm × 770mm	–	–	10334435	–	–	–	–	100

Ordering information—quantitative filter papers—ashless folded (prepleated) grades

Diameter (mm)	Catalog number		Quantity/pack
	Grade 589/1 ½	Grade 589/2 ½	
110	–	10300143	100
150	10300045	10300145	100

For further information on these grades see Quantitative Filter Papers section.

Quantitative Filter Papers, Ashless

Ordering information—filter papers—wet strengthened folded (prepleated) grade

Diameter (mm)	Description	Catalog number	Quantity/pack
125	Grade 802	5802-125	100
150	Grade 802	5802-150	100
185	Grade 802	5802-185	100
240	Grade 802	5802-240	100
240	Grade 802	5802-6698	1000
320	Grade 802	5802-320	100
385	Grade 802	5802-385	100

Quadrant folded filter papers

Whatman cellulose filter paper grades are now available in a flat, quadrant folded format to fit conical filter funnels. This saves the user valuable time and provides ease of use when undertaking repetitive or multiple analyses.

Typical properties—filter papers quadrant folded

Grade	Nominal thickness (µm)	Nominal basis weight (g/m²)	Nominal ash content (%)[1]
1	180	87	0.06
40	210	95	0.007
41	215	85	0.007
0858	170	75	–

[1] *Ash is determined by ignition of the cellulose filter at 900°C in air*

Ordering information—filter papers quadrant folded

Diameter (mm)	Description	Format	Catalog number	Quantity/pack
110	Grade 1 FF Quadrant	Quadrant fold	10380404	500
125	Grade 1 FF Quadrant	Quadrant fold	10380405	500
150	Grade 1 FF Quadrant	Quadrant fold	10380406	500
110	Grade 40 FF Quadrant	Quadrant fold	10380004	500
125	Grade 40 FF Quadrant	Quadrant fold	10380005	500
150	Grade 40 FF Quadrant	Quadrant fold	10380006	500
110	Grade 41 FF Quadrant	Quadrant fold	10380204	500
125	Grade 41 FF Quadrant	Quadrant fold	10380205	500
150	Grade 41 FF Quadrant	Quadrant fold	10380206	500
185	Grade 0858 FF Quadrant	Quadrant fold	10334348	100

Application specific filter papers

GE offers Whatman cellulose filter papers for specific applications. The product range includes filter papers for use in soil analysis and for the sugar industry.

Grade 0048

Filter mat made from a mixture of cellulose and polyester. This mat is used for optically testing baby food (artificial milk) for textile fibers.

Grade 72

Composite cellulose/glass filter loaded with activated carbon. Used to absorb radioactive iodine in air pollution monitoring and in nuclear installations.

Grade 71

Similar to Grade 72 but has a higher level of activated carbon.

Whatman application filter papers

Grade 8 ruled filter paper

A white filter paper with printed green lines for optical assessment (5 mm intervals). For routine investigations of foreign substances in a variety of sample types.

Grade 1450CV

Filter paper for the identification of undissolved dyes in the textile industry.

Grade 0965

A coarse filter mat with high wet strength.

Grade 287 ½

Kieselguhr paper with a medium to slow flow rate. Additional adsorption effect (e.g. for the separation of very fine semicolloidal turbidity, for clarifying milk serum, starch solutions, soil suspensions, or sugar-containing solutions prior to polarimetry or refractometry). Prepleated.

Grade 2555 ½

A medium fast filter paper. Used for the filtration of the mash for the determination of the extract in malt and wort and for removing carbon dioxide from beer. Prepleated.

Soil analysis filter papers

Grade 0790 ½

Acid-washed paper with ash content of approximately 0.01%, low magnesium, and phosphorus for the determination of trace elements (Mg, Mn, Co, Cu, Mo, B). Prepleated.

Grade 512 ½

Low phosphate papers approximately 1.5 ppm phosphate, for the filtration of calcium lactate extracts from soil samples for the determination of K and P according to Egnér, Riehm and Lederle. Prepleated.

Sugar/food industry filter papers

Grade 3459

A creped filter paper, Grade 3459 has good retentivity at a relatively high filtration speed. Used for the clarifying filtration of:

- Dried beet pulp extracts
- Beet juice after the addition of lead acetate for subsequent polarimetric sugar determination
- Grade 3459 is specifically designed for the Venema unit (lead acetate method)

Typical properties—application specific filters

Grade	Properties	Filtration speed (approx) herzberg (s)	Nominal thickness (µm)	Nominal basis weight (g/m²)
Soil analysis filter papers				
0790 ½	Low Mg and P	225	–	84
512 ½	Low phosphate	375	–	84
Specially for the venema unit				
3459	Fast, creped	55	–	75
Malt and beer filter				
2555 ½	Medium fast	55	–	75
Food industry mat (cellulose/polyester)				
0048	–	–	0.86	130
Activated carbon loaded paper				
72	–	–	–	195
71	–	–	702-898	160-230
Kieselguhr paper				
287 ½	Kieselguhr	330	360	154
Filter mat				
0965	–	–	250	30
Identification of undissolved dyes				
1450CV	–	30	–	120
Routine investigations				
8	–	–	–	65

Ordering information—application specific filters

Diameter (mm)	Catalog number							Quantity/ pack
	Grade 0048	Grade 72	Grade 71	Grade 0965	Grade 1450CV	Grade 8	Grade 3459	
Filter circles								
32	10348903	–	–	–	–	–	–	1000
45	–	–	–	–	–	10347004	–	100
47	–	1872-047	–	–	–	–	–	100
50	–	1872-050	–	–	–	–	–	100
55	–	1872-055	–	–	–	–	–	100
60	–	1872-060	–	–	–	–	–	100
70	–	–	–	–	–	10347008	–	100
75	–	–	–	–	–	10347033	–	100
90	–	–	–	–	10313209	–	–	50
90	–	–	–	–	–	10347009	–	100
110	–	–	–	10340810	–	–	–	100
230	–	–	–	–	–	–	10316619	1000

Ordering information—application specific filters *(continuation)*

	Catalog number				
Diameter (mm)	**Grade 287 ½**	**Grade 512 ½**	**Grade 0790 ½**	**Grade 2555 ½**	**Quantity/pack**
Folded filters					
110	–	10310643	–	–	100
125	10310244	–	–	–	50
150	10310245	–	–	–	50
150	–	10310645	10301645	–	100
185	10310247	10301647	–	–	50
185	–	10310647	10301647	10313947	100
240	–	–	–	10313951	100
320	–	–	–	10313953	100
Sheets					
1060 mm × 560 mm	–	–	10390046	–	100

Seed germination testing papers

Seed testing papers are made from pure cellulose without any additives and do not contain any substances which could influence the growth of the seeds. The constant water absorption of the papers ensures the continuous provision of the required amount of water.

The contrast of the color seed testing papers makes evaluation easier, particularly for seeds with fine white rootlets or under artificial light. This makes work easier, improves the results, and saves time. The dyes used have been thoroughly investigated and have no influence on the growth of the seeds.

Product selection—seed germination testing papers

Grade	**Description**	**Nominal thickness (µm)**	**Nominal weight (g/m²)**
PP method			
3014	Pleated strips, white*	0.22	113
3236	Pleated strips, white*	0.22	110
TP method			
597	For Petri dishes or Jacobsen/Copenhagen tanks, white	0.18	85
598	For Petri dishes or Jacobsen/Copenhagen tanks, white	0.32	140
3621	Blotter, light blue	1.44	710
3633	Blotter, light blue	0.65	300
3644	Blotter, blue	1.4	720
3645	Yellow	0.35	165

* *50 double pleats*

Applications—seed germination testing papers

Grade	**Description**
597, 598	Small seeds (e.g. grasses, flowers)
3014, 3236	Medium-large and coated seeds (e.g. sugar beet, fodder beet, grain, sunflower, rapeseed, mustard)
3014	Particularly sensitive seeds
3645	Seeds with small white rootlets

Ordering information—seed germination testing papers

Dimensions (mm)	Grade	Catalog number	Color	Description	Quantity/pack
Circles					
70	597	10311808	–	Circles	100
85	3645	10342555	Yellow	Circles	100
90	597	10311809	–	Circles	100
90	598	10312209	–	Circles	100
90	181	2181-090	White	Circles	100
Sheets					
100 × 100	3645	10342500	–	Sheets	1000
105 × 190	3645	10342596	Yellow	Sheets	1000
110 × 170	3645	10342583	Yellow	Sheets	100
110 × 170	3645	10342594	–	Sheets	1000
140 × 200	3644	10342580	Blue	Sheets	1000
140 × 200	3621	10342579	White	Sheets	1000
280 × 340	3644	10342582	–	Sheets	100
420 × 594	3644	10342581	–	Sheets	50
450 × 690	3645	10342570	Yellow	Sheets	100
Pleated strips					
110 × 20	3014	10344672	White	Double pleated strips, without wrap strips	1000
110 × 20	3014	10344676	White	Double pleated strips, with wrap strips	1000
110 × 20	3236	10345572	Grey	Double pleated strips, without wrap strips	1000
110 × 20	3236	10345576	Grey	Double pleated strips, with wrap strips	1000
110 × 20	3236	10345573	Grey	Double pleated strips	500
110 × 580	0858	10334365	White	Wrap for pleated strips	500

Grade 597 Qualitative Filter Papers

Glass microfiber filters

Whatman glass microfiber filters are manufactured from 100% borosilicate glass and are available with or without binder. These depth filters combine fast flow rates with high loading capacity and the retention of very fine particles, extending into the sub-micron range. Glass microfiber filters can be used at temperatures up to 550°C and are excellent for use in applications involving air filtration and for gravimetric analysis of volatile materials where ignition is involved.

Whatman glass microfiber filters have a fine capillary structure and can absorb significantly larger quantities of water than an equivalent cellulose filter, making them suitable for spot tests and liquid scintillation counting methods. The filters can also be made completely transparent for subsequent microscopic examination.

The particle loading capacity of a filtration system can be greatly increased by using a prefilter. Whatman glass microfiber filters such as GF/B or GF/D are recommended because of the low resistance to fluid flow and high particle loading capacity. Whatman Multigrade GMF 150 is particularly valuable for the prefiltration of larger volumes and solutions that are normally difficult to filter.

Whatman Glass Microfiber Filters

Grade EPM 2000 Air Sampling Filter

Glass microfiber and quartz filters: trace element composition—typical values (µg/g paper)

	QM-A*	EPM 2000	934-AH	GF/A and GF/C
Arsenic (As)	< 1	< 1	24	5
Beryllium (Be)	< 1	< 1	< 1	< 1
Cobalt (Co)	< 1	1	< 1	< 1
Cadmium (Cd)	< 1	< 1	< 1	< 1
Copper (Cu)	< 1	5	3	< 1
Lead (Pb)	< 1	3	9	5
Manganese (Mn)	2	20	18	6
Mercury (Hg)	< 1	< 1	< 1	< 1
Nickel (Ni)	1	1	3	1
Selenium (Se)	< 3	< 3	< 3	< 3
Silver (Ag)	< 1	< 1	< 1	< 1
Thallium (TI)	< 1	< 1	< 1	< 1

Typical composition based on ICP-MS analysis

* *Trace element report can be downloaded from the GELS website for each lot of QM-A*

Glass microfiber GF series

Binder-free glass microfiber filter papers

Whatman glass microfiber filter papers

Grade GF/A: 1.6 µm*

Offers fine particle retention and high flow rate, as well as good loading capacity. Used for high-efficiency general purpose laboratory filtration, including water pollution monitoring of effluents, for filtration of water, algae and bacteria cultures, food stuff analyses, protein filtration, and radioimmunoassay of weak ß emitters. Recommended for gravimetric determination of airborne particulates, stack sampling, and absorption methods of air pollution monitoring.

Whatman Grade GF/A card-mounted filters are used in static sample and personal air sampler applications. These aerosol sampling and particulate monitoring filters provide high flow rates and minimal sample interference.

Grade GF/B: 1.0 µm*

Three times thicker than GF/A with higher wet strength and significantly increased loading capacity. Combines fine particle retention with good flow rate. Particularly useful where liquid clarification or solids quantification is required for heavily-loaded, fine particulate suspensions. Can be used as a finely retentive membrane prefilter. Used in LSC techniques where high loading capacity is required.

Grade GF/C: 1.2 µm*

Combines fine particle retention with good flow rate. The standard filter in many parts of the world for the collection of suspended solids in potable water and natural and industrial wastes. Fast and efficient clarification of aqueous liquids containing low to medium levels of fine particulates. Widely used for cell harvesting, liquid scintillation counting, and binding assays where more loading capacity is required.

Ready-to-use (RTU) formats available for Total Suspended Solids (TSS) and Total Dissolved Solids (TDS).

Grade GF/D: 2.7 µm*

Considerably faster in flow rate and overall filtration speed than cellulose filter papers of similar particle retention. The filter is thick and consequently exhibits a high loading capacity. Designed as a membrane prefilter and available in sizes to fit most holders. GF/D will provide good protection for finely retentive membranes. Can be used in combination with GF/B to provide very efficient graded prefilter protection for membranes.

Grade GF/F: 0.7 µm*

This high-efficiency filter will retain fine particles down to 0.7 µm. Unlike membrane filters with a comparable retention value, it has a very rapid flow rate and an extremely high loading capacity.

Because of the tight specification of 0.6 µm—0.8 µm particle retention and pure borosilicate glass structure, GF/F is the material upon which the EPA Method TCLP 1311 for Toxicity Characteristic Leaching Procedure was developed.

Recommended for DNA binding and purification. Very effective in filtering finely precipitated proteins, GF/F can be used in conjunction with GF/D as a prefilter for the successful clarification of extremely difficult biochemical solutions and fluids, and nucleic acids.

Grade GF/F glass microfiber filters, binder free

* *Particle retention rating at 98% efficiency.*

Grade 934-AH: 1.5 µm*

The fine particle retention of this popular grade is superior for its high retention efficiency at high flow rates and its high loading capacity. This is a smooth surface, high retention borosilicate glass microfiber filter, which has been pre-fired and withstands temperatures over 550°C. Used for determining total suspended solids in water, removal of turbidity, and filtration of bacterial cultures. Grade 934-AH is used for a wide range of laboratory applications. It is recommended for water pollution monitoring, cell harvesting, liquid scintillation counting, and air pollution monitoring.

Ready-to-use (RTU) formats available for Total Suspended Solid (TSS), Total Dissolved Solids (TDS) and Total Suspended Volatiles (VSS).

Grade 934-AH

Grade EPM 2000

EPM 2000 has been developed and selected by the U.S. Environmental Protection Agency (EPA) for use in high volume air sampling equipment that collects atmospheric particulates and aerosols. It is manufactured from 100% pure borosilicate glass of special purity, has been pre-fired, and is enabled for detailed chemical analysis of trace pollutants to take place with the minimum of interference or background.


Grade EPM 2000 air sampling filter

Grade GMF 150: 1 µm or 2 µm*

Whatman GMF 150 is a multilayer glass microfiber filter with a coarse top layer (10 µm) meshed with a finer layer of 1 µm or 2 µm. Manufactured from 100% borosilicate glass microfiber, the filter is binder free. It is an excellent prefilter for higher particulate loading capacity with faster flow rates. See GMF 150 section for ordering information.

Typical properties—binder-free glass microfiber grades

Grade	Minimum retention efficiency in air (% @ 0.3 µm)	Typical retention efficiency in air (% @ 0.3 µm)	Typical particle retention in liquid (µm)[1]	Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Maximum recommended temperature (°C)	Typical water flow rate (mL/min)[2]
GF/A	≥ 99.85	≥ 99.99	1.6	4.3	260	53	550	143
GF/B	–	–	1.0	12	675	143	550	81
GF/C	–	–	1.2	6.7	260	53	550	105
GF/D	–	–	2.7	2.6	675	121	550	681
GF/F	–	–	0.7	19	420	75	550	41
934-AH	–	–	1.5	3.7	435	64	550	341
EPM 2000	≥ 99.85	≥ 99.99	–	5.6	450	85	550	–

[1] *Particle retention rating at 98% efficiency*
[2] *Normalized for 9 cm diameter. Measured under gravity for comparative purposes*

* *Particle retention rating at 98% efficiency.*

Ordering information—binder-free glass microfiber grades

Dimensions (mm)	Catalog number							Quantity/ pack
	Grade GF/A	Grade GF/B	Grade GF/C	Grade GF/D	Grade GF/F	Grade 934-AH	EPM 2000	
Filter circles								
7	–	–	–	1823-007	–	–	–	100
10	–	–	–	1823-010	–	–	–	100
13	1820-8013	–	–	–	–	–	–	100
15	–	–	–	–	1825-015	–	–	100
21	1820-021	1821-021	1822-021	1823-021	1825-021	1827-021	–	100
24	1820-024	1821-024	1822-024	1823-024	1825-024	1827-024	–	100
25	1820-025	1821-025	1822-025	1823-025	1825-025	1827-025	–	100
25	–	–	1822-6580	–	–	–	–	400
28	–	–	–	–	–	1827-028	–	100
30	–	–	–	–	–	1827-030	–	100
32	18208296[4]	–	1822-320	–	–	1827-032	–	100
34	1820900086[4]	–	–	–	–	–	–	80
34	1820-10026[4]	–	–	–	–	–	–	100
35	–	–	–	1823-035	–	1827-035	–	100
37	1820-037	1821-037	1822-037	–	1825-037	1827-037	–	100
42.5	1820-042	1821-042	1822-042	1823-042	1825-042	1827-042	–	100
47	1820-047	1821-047	1822-047	1823-047	1825-047	1827-047	1882-047	100
50	1820-050	–	1822-050	–	–	–	–	100
55	1820-055	1821-055	1822-055	1823-055	1825-055	1827-055	–	100
60	1820-061[4]	–	–	–	–	–	–	50
60	1820-060	1821-060	–	–	–	–	–	100
70	1820-070	1821-070	1822-070	1823-070	1825-070	1827-070	–	100
81	1820-6537	–	–	–	–	–	–	100
82	–	–	–	–	–	1827-082	–	100
85	–		–	–		1827-085	–	100
90	1820-090	1821-090*	1822-090	1823-090*	1825-090*	1827-090	–	100
100	–	–	1822-100	–	–	–	–	100
100	–	–	1822-9916[2]	–	–	–	–	100
105	–	–	–	–	–	1827-105	–	100
110	1820-110	1821-110*	1822-110	1823-110[1]	1825-110[1]	1827-110	–	100
125	1820-125	1821-125*	1822-125	1823-125[1]	1825-125[1]	1827-125	–	100
142	–	–	–	1823-142[1]	1825-142[1]	–	–	100
150	1820-150	1821-150*	1822-150	1823-150[1]	1825-150[1]	1827-150	–	100
185	–	1821-185*	1822-185	–	–	1827-185	–	100
240	1820-240	–	–	–	–	1827-240	–	100
257	–	–	–	1823-257	1825-257	–	–	25
293	–	–	–	–	1825-293	–	–	25
320	–	–	–	–	–	1827-320	–	100
Filter sheets								
102 × 254	–	–	1822-849	–	–	–	–	50
203 × 254	–	–	–	–	–	–	–	100
460 × 570	–	1821-914	–	–	–	–	–	5
460 × 570	1820-915	1821-915	1822-915	1823-915	1825-915	–	–	25
2” × 12”	–	–	–	–	–	1827-808	–	100
2.25” × 12.25”	–	1821-271	–	–	–	–	–	100
8” × 10”	1820-866	–	1822-866	–	–	1827-866	–	100
8” × 10” (prenumbered)	–	–	–	–	–	–	1882-866	100
12” × 15”	–	–	–	–	–	1827-889	–	100
19” × 28”	–	–	–	–	–	1827-957	–	100
50 mm × 87 mm card holder (perforated)	1820-10026	–	–	–	–	–	–	100
50 mm × 87 mm card holder	1820900086	–	–	–	–	–	–	80

* *Particle retention rating at 98% efficiency*

[1] *25 per box*

[2] *Individually bagged*

[3] With reinforced rim

[4] *Filter in holder for personal air samplers*

Multigrade GMF 150

Whatman GMF 150 is a multilayer glass microfiber filter with a coarse top layer meshed with a finer layer. Manufactured from 100% borosilicate glass microfiber, the filter is binder free. It is an excellent prefilter for higher particulate loading capacity with faster flow rates, extending the life of the filter.

Multilayer, greater filtration efficiency

GMF 150 represents a new dimension in separation science leading to faster and more cost-effective filtration. In application, the GMF 150 traps larger particles in the pores or on the surface of the coarse layer while the medium sized particles are caught in the interface meshing. The smaller particles are netted in the interstices of the fine layer.

Typical properties—multigrade GMF 150 grades

Grade	Description	Typical particle retention in liquid (µm)[1]	Nominal air flow (s/100 mL/in)	Nominal thickness (µm)	Nominal basis weight (g/m)	Typical water flow rate (mL/min)[2]	Maximum recommended temperature (°C)
GMF 150 1 µm	Multilayer	> 1	4	730	145	222	550
GMF 150 2 µm	Multilayer	> 2	1.6	750	145	887	550

[1] *Particle retention rating at 98% efficiency*
[2] *Normalized for 9 cm diameter. Measured under gravity for comparative purposes*

Ordering information—multigrade GMF 150 grades

	Catalog number		
Diameter (mm)	1 µm	2 µm	Quantity/pack
47	1841-047	1842-047	40
90	–	1842-090	40
90	1841-090	–	20

Glass microfiber filter papers with binder

Grade GF 6—inorganic binder

Good retention for very fine particles. This filter is used in water pollution applications, for removing protein from difficult-to-filter beers, for determination of chlorophyll and phytoplankton residues, for the determination of filterable substances and the residue on ignition (dry weight), for the analysis of aggressive media (e.g. acidic gases), for scintillation measurements, and for determination of the elemental iron content in the presence of iron oxides.

Grade GF 8—inorganic binder

This glass fiber filter is used in the filtration of coarse particles. Frequently used in environmental analysis, in the determination of PCB, DDE , DDT, furans and dioxins in the air; pollution measurements in industrial, urban and populated areas, cement factories, iron and steel industry, dust measurements in the workplace, determination of the dust fraction in technical gases, and testing the effectiveness of dust collecting.

Grade GF 8 flass microfiber filters with binder

Grade GF 9—inorganic binder

Used in similar applications to GF 8.

Grade GF 10—organic binder

This filter with extreme mechanical stability and temperature resistant up to 180°C is used as a weighing aid for infrared weighing and as a roll filter in automatic air filtration units.

Grade GF 92—inorganic binder

This filter is used as a membrane prefilter in applications such as the determination of crop protection agent residues by GC or HPLC, in cold sludge determination of beer, in soot separation before gas analyzers, and as roll filters in automatic air filtration units.

HGF61 glass fiber tape

Grade F319-04—organic binder

Cambridge filter pad F319-04 meets the requirements of Standard ISO3308:2000.

Grade HGF61—organic binder

This glass fiber paper has excellent mechanical strength and it can retain <99% air particulate matter which make it very suitable as a filter tape in continual air monitor. The grade is also used as venting filter due to its water-repellent feature.

Grade HGF65—organic binder and inorganic binder

This glass is very similar to HGF61 and it is mainly used as filter tape in continual air sampling and as venting filter in industrial applications.

Glass fiber filter with binder

~ 3 µm retention capability < 1 µm

GF8	GF9	GF10	GF6
Fast	Medium		Slow

filtration speed

Typical properties—glass microfiber filter papers with binder

Grade	Nominal air flow (s/100 mL/in²)	Nominal air flow (s/100 mL/1.56 cm²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Filtration speed	Operating temperature (°C)
GF 6	40	–	350	80	Slow	< 500
GF 8	–	12	350	80	Fast	< 500
GF 9	–	27	350	70	Medium	< 500
GF 10	–	12	350	70	Medium	< 180
GF 92	–	27	350	70	Medium	< 500
HGF61	–	–	285	54	–	–
HGF65	–	–	280	54	–	–
F319-04	–	–	1300	215	–	–

Ordering information—glass microfiber filter papers with binder

Dimensions (mm)	Catalog number								Quantity/ pack
	GF 6	GF 8	GF 9	GF 10	GF 92	HGF61	HGF65	F319-04	
Filter circles									
25	10370018	–	–	–	–	–	–	–	200
42	–	–	–	–	10421019	–	–	–	200
44	–	–	–	–	–	–	–	–	200
44	–	–	–	–	–	–	–	97039654	960
47	10370019	10370119	–	10370319	10421026	–	–	–	200
50	10370002	–	10370202	10370302	10421030	–	–	–	200
55	10370003	–	–	–	–	–	–	9703900241	100
70	10370004	–	–	–	–	–	–	–	100
90	10370005	10370105	10370205	10370305	–	–	–	–	100
92						–	–	97039944	100
100	10370020	–	–	10370320	10421043	–	–	–	100
110	10370006	–	10370206	–	–	–	–	–	100
125	10370007	–	–	–	–	–	–	–	100
135	–	–	–	–	10421057	–	–	–	100
142	–	–	–	–	10421060	–	–	–	100
150	10370008	–	–	10370308	–	–	–	–	100
185	10370010	–	–	–	–	–	–	–	100
200	10370011	10370111	–	–	–	–	–	–	100
240	10370012	–	–	–	–	–	–	–	100
Filter sheets									
60 × 90	–	10370172	–	–	–	–	–	–	100
610 × 620	10370050	–	–	–	–	–	–	–	100
Filter reels									
30 mm × 13 m	–	–	–	–	–	–	95039860	–	1
30 mm × 20 m	–	–	–	–	–	1830-6236	–	–	1
30 mm × 100 m	–	–	–	–	–	1830-640	–	–	1
40 mm × 42 m	–	–	–	10370393*	–	–	–	–	1
60 mm × 42 m				10370391*					1
600 mm × 228 m				10370434					1

* *Core 28 mm*

Whatman acid treated low metal TCLP filter papers

Toxicity Characteristic Leaching Procedure (TCLP) is an analytical test designed to determine the leaching potential in a landfill for hazardous organic and inorganic contaminants that could potentially migrate into groundwater, threatening drinking water sources.

Used for EPA Method 1311

The Whatman TCLP Filter is manufactured using a binder free borosilicate glass microfiber with a particle retention rating of 0.6 to 0.8 µm.

These acid treated, low metal filters are available in a variety of diameters. The 90 mm filter is required for volatile samples and use with a Zero Headspace Extractor.

The 142 mm filter is typically used with nonvolatile samples in an approved jar.

TCLP Testing Filters

Typical properties—acid treated low metal TCLP filters

Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Maximum recommended temperature (°C)	Typical particle retention in liquid (µm)	Typical water flow rate (mL/min)
19	420	75	550	0.7	60

Ordering information—acid treated low metal TCLP filters

Diameter (mm)	Catalog number	Quantity/pack
47	1810-047	100
90	1810-090	50
90	5925-090	100
110	1810-110	50
125	1810-125	50
142	1810-142	50
142	5925-142	100
150	1810-150	50

TCLP Testing Filters

Quartz fiber filter papers

Grade QM-A

High-purity quartz (SiO_2) microfiber filters are used for air sampling in acidic gases, stacks, flues, and aerosols, particularly at high temperatures up to 800°C and in PM2.5/PM10 and trace element analysis. Due to the low level of alkaline earth metals, artifact products of sulfates and nitrates (from SO_2 and NO_2) are virtually eliminated. QM-A, sequentially numbered according to EPA standards, is suitable for most applications, Grade QM-A filter papers are pre-fired.

Grade QM-A

Grade QM-H

This is a pure quartz fiber filter with low heavy metal content, which can be used at temperatures over 900°C.

Grade QM-B

QM-B is a thicker quartz fiber filter than QM-A. It has higher loading capacity and is suitable for air sampling.

Typical properties—quartz fiber filter grades

Grade	Minimum retention efficiency in air (% @ 0.3 µm)	Typical retention efficiency in air (% @ 0.3 µm)	Nominal air flow (s/100 mL/in²)	Nominal thickness (µm)	Nominal basis weight (g/m²)	Maximum recommended temperature (°C)
QM-A	≥ 99.85	≥ 99.99	6.3	475	85	800
QM-B	≥ 99.85	≥ 99.99	12	950	170	800
QM-H	–	≥ 99.97	–	430	85	900

Ordering information—quartz fiber filter grades

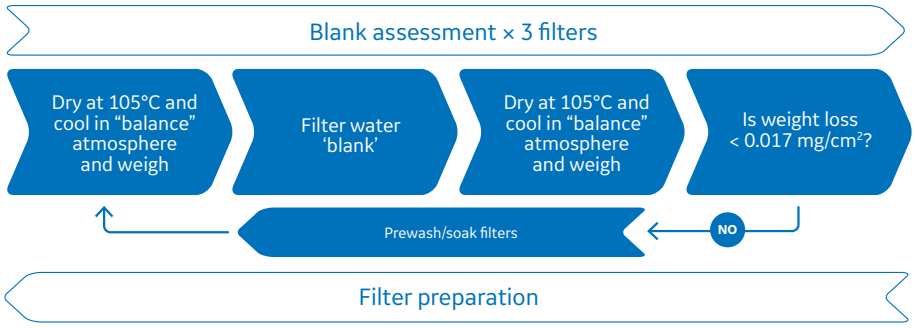
	Catalog number			
Dimensions (mm)	QM-A	QM-H	QM-B	Quantity/pack
Filter circles				
25	1851-025	–	–	100
32	1851-032	–	–	100
37	–	1853-037-50	–	50
37	1851-037	–	–	100
40	–	–	1852-040	50
42	–	–	1852-042	50
47	–	1853-047-50	–	50
47	1851-047	–	–	100
50	–	1853-050-50	–	50
50	1851-050	–	–	100
55	1851-055		–	100
82	1851-082	–	–	100
85	1851-085	–	–	100
90	–	1853-090-50	–	50
90	1851-090	–	–	100
101.6	1851-101	–	–	100
110	1851-110	–	–	100
118	1851-118	–	–	100
150	–	1853-150-50	–	50
150	1851-150	–	–	100
Filter sheets				
8” × 10”	1851-8866 (prenumbered)	–	–	100
8” × 10”	1851-865	–	–	25

Ready-to-use filter for suspended solid and volatile solid testing

Maintaining accuracy under the time pressure of a busy lab can be a challenge. The Whatman Ready-to-use (RTU) filter range is certified to have been pre-treated in line with key requirements for sample preparation, helping you to support an accurate analysis while reducing time spent on sample preparation. GE also offers economy RTU products, which have been washed and dried but have not been weighed.

Filter preparation workflows

EN872



Standard method 2540

Instruction for pan identification

Reading the barcode with a scanner, the weight of filter and the Pan ID can be automatically loaded into a lab management system.

Input Box ID "xxxxxxxx" on gelifesciences.com/documents/RTU, filter weights of a whole box can be downloaded in a excel file.

Example of filter weights of a whole box

	Pad ID	Box ID	Weight	Unit
1	B0535335	B2002404	0.4310	G
2	B0535336	B2002404	0.4353	G
3	B0535337	B2002404	0.4311	G
4	B0535338	B2002404	0.4311	G
5	B0535339	B2002404	0.4350	G
6	B0535340	B2002404	0.4295	G
7	B0535341	B2002404	0.4277	G
8	B0535342	B2002404	0.4350	G
9	B0535343	B2002404	0.4365	G
10	B0535344	B2002404	0.4321	G
11	B0535345	B2002404	0.4302	G
12	B0535346	B2002404	0.4381	G

Instruction of use 934-AH ready-to-use filter for total suspended solids analysis

1 Each pre-treated 934-AH RTU filter comes in an aluminum pan, with the filter weight clearly noted. Open a box and take a 934-AH RTU filter out from the box

2. Place the 934-AH RTU filter on a Whatman 3-piece funnel or a funnel of the vacuum filtration apparatus or and seal the filter to the funnel by wetting with a small amount of water. Then, filter your sample* and finally, wash the filter with three aliquots of 10 ml reagent grade water.

3. Remove the filter, return it to the aluminum weigh pan and dry it to constant weight at 103°C to 105°C. To obtain the weight of total suspended solids, subtract the weight of the filter indicated on the pan label from the final weight. For volatile solids analysis, please filter sample with Whatman 934-AH RTU VSS filter. After the measurement of total suspended solids, ignite the filter at 550°C for 15 min in a muffle furnace. The weight loss is the weight of total suspended volatile solids.

	GF/C RTU	934-AH RTU for suspended and dissolved solids	934-AH RTU for volatiles	934-AH RTU double weigh
Pre-washed, dried, cooled, and weighed	•	•	•	•
Barcoded aluminum pans to download filter weight	•	•	•	•
Box barcoded to download weights of all filters contained	•	•	•	•
Pre-fired at 550°C			•	
Certified filter mass loss the lesser of 0.5 mg or 4% after Standard Method 2540 parts C, D and E preparatory workflow		•	•	•
Certified mass loss of less than 0.017 mg/cm^2 after EN 872 preparatory workflow	•			
Economy option available (washed and dried without weighing or barcoding)	•	•	•	
Drying and weighing steps repeated and documented twice to conform to process in US EPA Lab Standard Method 2540 parts C and D				•

Ordering information—Ready-to-use (RTU) filters

	Catalog number							
Diameter (mm)	934-AH RTU	934-AH RTU VSS*	934-AH RTU VSS economy**	GF/C RTU*	GF/C RTU economy***	934-AH RTU double weigh	934-AH RTU economy***	Quantity/ pack
35	–	3827-035	4827-035	–	–	–	–	100
42.5	9907-042	3827-042	4827-042	–	–	–	–	100
47	9907-047	3827-047	4827-047	3822-047	2822-047	9927-047#	2827-047**	100
47	9907-9436†	–	–	–	–	–	–	100
55	9907-055	–	–	–	–	–	–	100
70	9907-070	3827-070	4827-070	3822-070	2822-070	9927-070#	–	100
90	9907-090	3827-090	4827-090	3822-090	2822-090	9927-090#		100

* *Pre-weighed*
** *Pre-rinsed and ignited*
*** *Pre-rinsed and dried*
\# *Double weigh*
† *Weigh to 5 digit places*

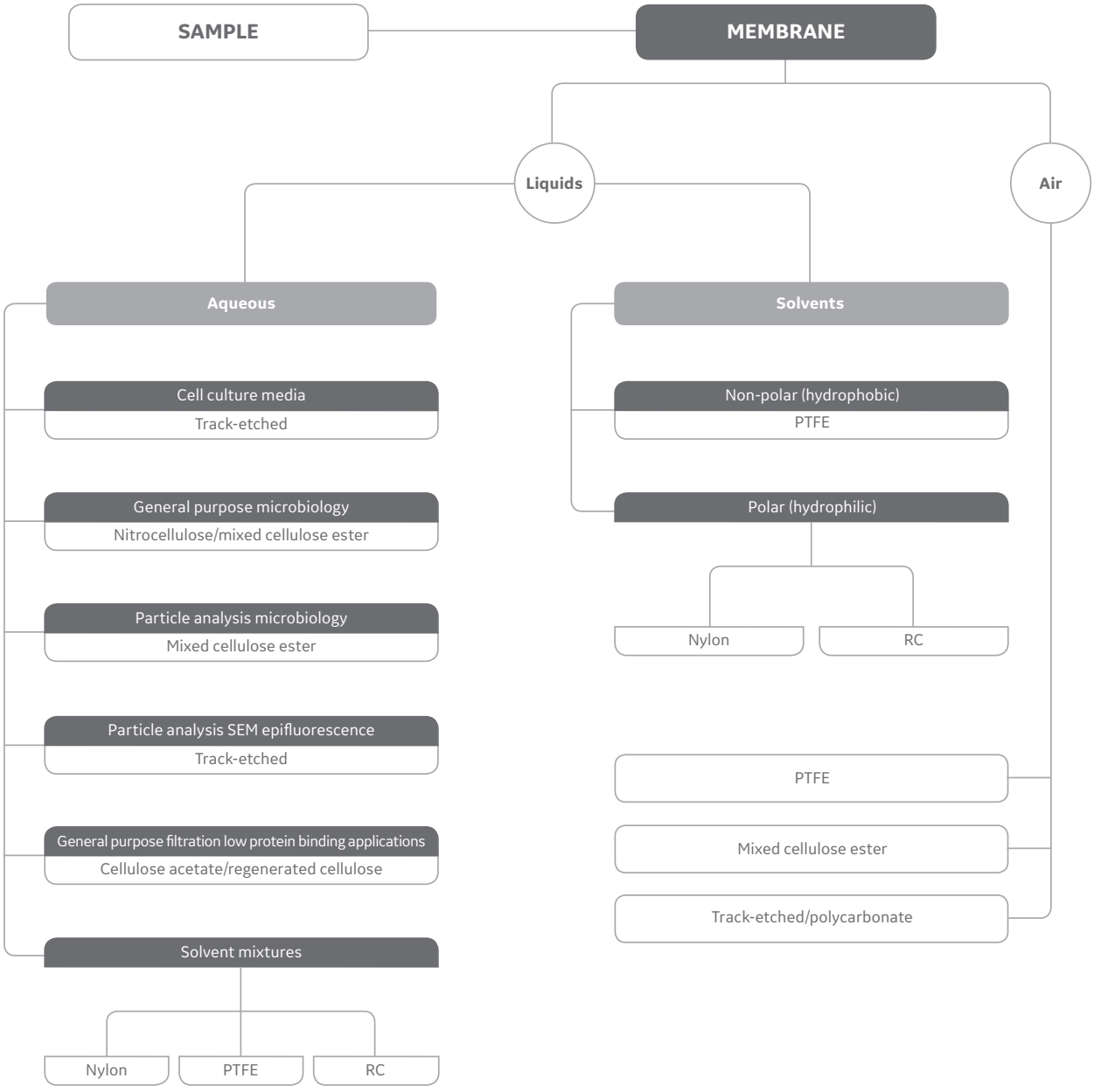
Membrane filters

Whatman membrane filters offer accurately controlled pore size distribution and higher strength and flexibility, ensuring reproducibility and consistency. Available in a range of pore sizes and formats including sterile and autoclave packs and colored and gridded forms for specialized applications.

Capillary (true) pore membranes 48
- Cyclopore track-etched membranes 49
- Nuclepore track-etched membranes 52
- Black track-etched membranes 54
- Anopore inorganic membranes 56

Tortuous path (pore) membranes 58
- Regenerated cellulose membranes 58
- Cellulose acetate membranes 59
- Cellulose nitrate membranes 60
- Mixed cellulose ester membranes 63
- PTFE membranes 66
- PM2.5 air monitoring membranes 68
- Nylon membranes 70
- Polyamide membranes 71

Quick pick reference chart



Track-etched polycarbonate membranes

Whatman track-etched membranes are manufactured using proprietary technology to produce a precision membrane filter with a closely controlled pore size distribution.

These membranes include Cyclopore™ polycarbonate, Nuclepore™ polycarbonate, chemotaxis membranes, black polycarbonate, and polycarbonate membranes for cell culture.

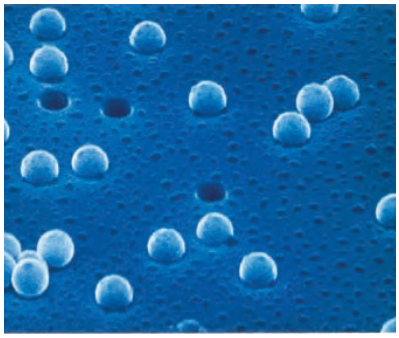
Cyclopore polycarbonate membranes

Whatman Cyclopore membranes are true pore size microporous membranes featuring sharp cut-off and reproducible microfiltration performance characteristics of track-etched membranes. The smooth flat membrane ensures particles are retained on the surface so that they are easily visible under a microscope.

Membranes are produced from a pure polymeric film and give exceptional chemical cleanliness. They are free of contaminants, have low tare weight, minimum water adsorption, and very low levels of nonspecific protein binding.

The polycarbonate membranes are hydrophilic and are available in a choice of diameters and pore sizes.

Cyclopore PC Polycarbonate Membrane Filters



Microscope image of the surface area of Cyclopore PC Polycarbonate Membrane Filters

Features and benefits

- Low affinity for stains providing higher optical contrast and making visibility under a microscope easy
- True surface capture provides easy examination of samples and short analysis times
- Totally transparent membranes available
- Negligible absorption and adsorption of filtrate; nonhygroscopic
- Low tare weights
- No particle shedding provides ultra clean filtrate
- Biologically inert

Typical applications

- **Air monitoring**
  Trace elements (chemicals, radioactivity) and particulate analysis (dust, pollens, and airborne particles)
- **Analytical methods**
  Gravimetric analysis, densitometry, emission spectroscopy, X-ray fluorescence, and infrared analysis
- **Water analysis**
  Absorbable organic halides (AOX), direct count of microorganisms, marine biology and dissolved phosphates, nitrates, and ammonia analysis
- **Blood filtration and cell analysis**
  RBC deformability, leukocyte removal, RBC filtration and plasmapheresis, chemotaxis, cytology, and cell culture

- **General filtration**
  Particulate and bacteria removal, cross flow filtration, HPLC sample preparation, and solution filtration
- **Microscopy**
  Electron microscopy, epifluorescence microscopy, and direct optical microscopy
- **Microorganism analysis**
  Direct total microbial count, harvesting, concentration, fractionation, yeast, molds, *Giardia*, *Legionella*, coliform, and canine microfilaria
- **Nucleic acid studies**
  Alkaline elution and DNA fragment fractionation
- **Oceanographic studies**
  Transparent polycarbonate membrane filters provide a tool for studying planktonic organisms. These ultra thin transparent membranes are strong yet flexible, allowing for planktonic samples to be filtered and the membranes to be mounted directly onto microscope slides.
- **Healthcare**
  Biosensors—as a barrier offering controlled diffusion for biological reagents and electrochemical detectors

  Diagnostic assays—for flow control, sample preparation, blood separation, and capture of latex microparticles

  Cell biology—for cell culture, chemotaxis, and cytological analyses (e.g. direct staining, isotopic, and fluorescence based assays)

Typical properties—Cyclopore polycarbonate membranes

Thickness	7–20 µm
Weight	0.7–2.0 mg/cm^2
Maximum service temperature	140°C
Porosity (void volume)	4–20%
Ash weight	0.6 µg/cm^2
Pore density	1 × 10^5—6 × 10^8 pores/cm^2
Opacity	Translucent*
Autoclavable	30 minutes at 121°C
Specific gravity	1.21 g/cm^2
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert

* *Transparent also available as Special Clear*

Ordering information—Cyclopore polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
13	0.4	7060-1304	Polycarbonate	100
25	0.1	7060-2501	Polycarbonate	100
25	0.2	7060-2502	Polycarbonate	100
25	0.4	7060-2504	Polycarbonate	100
25	2.0	7060-2511	Polycarbonate	100
25	5.0	7060-2513	Polycarbonate	100
25	5.0	7062-2513	Polycarbonate, clear	100
25	8.0	7060-2514	Polycarbonate	100
25	12.0	7060-2516	Polycarbonate	100
47	0.1	7060-4701	Polycarbonate	100
47	0.2	7060-4702	Polycarbonate	100
47	0.4	7060-4704	Polycarbonate	100
47	1.0	7060-4710	Polycarbonate*	100
47	1.0	7091-4710	Polycarbonate, thin clear	100
47	3.0	7060-4712	Polycarbonate	100
47	5.0	7060-4713	Polycarbonate	100
47	8.0	7060-4714	Polycarbonate	100
47	10.0	7060-4715	Polycarbonate	100
47	12.0	7060-4716	Polycarbonate	100

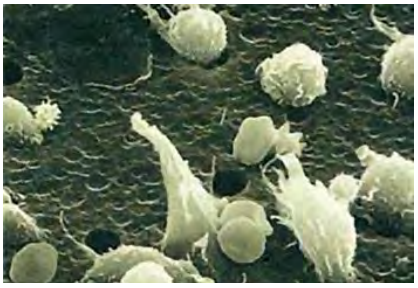
* *Transparent also available as Special Clear*

Cell culture and chemotaxis applications

Whatman track-etched polycarbonate membranes for cell culture applications.

Features and benefits

- For the analysis of cell migration toward a chemical stimulus
- Thin and uniform; cylindrical pores facilitate rapid cell migration
- Reduces incubation time and the need to sterilize
- Offered without the standard wetting agent (PVP-free membranes) for increased cellular adhesion (e.g. neutrophil chemotaxis)



Chemotaxis membranes

Ordering information—cell culture polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Surface	Quantity/pack
13	3.0	110412	Standard	100
13	5.0	110413	Standard	100
13	5.0	150445	PVP-free	100
13	8.0	110414	Standard	100
13	8.0	150446	PVP-free	100
25	2.0	110611	Standard	100
25	3.0	110612	Standard	100
25	5.0	110613	Standard	100
25	8.0	110614	Standard	100
25 × 80	5.0	155845	PVP-free	100

Nuclepore polycarbonate membranes

Nuclepore track-etched polycarbonate membranes are manufactured from high-quality polycarbonate film and have sharply defined pore sizes, high flow rates, and excellent chemical and thermal resistance. The membranes have a smooth flat surface and exhibit very low levels of extractables.

Nuclepore Polycarbonate Membranes

Features and benefits

- Low protein binding and low extractables, minimizing sample contamination
- High chemical resistance and good thermal stability for a wide range of samples
- Low, consistent ash and tare weights
- Smooth flat surface for good visibility of particles

Applications

- Epifluorescence microscopy
- Environmental analysis
- Cell biology
- eDNA
- EPA testing
- Fuel testing
- Bioassays
- Parasitology
- Air analysis
- Water microbiology

Typical properties—Nuclepore polycarbonate membranes

Thickness	7-22 µm
Rated pore size	0.015 µm–15 µm
Rated pore density	1×10^5–6×10^5 pores/cm
Surface texture	Flat and smooth
Opacity	Translucent
Hydrophobic/hydrophilic	Both
Fiber releasing	No

Ordering information—Nuclepore polycarbonate membrane circles

Dimensions (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
Filter circles				
13	0.015	110401	Polycarbonate	100
13	0.1	110405	Polycarbonate	100
13	0.2	110406	Polycarbonate	100
13	0.4	110407	Polycarbonate	100
13	0.8	110409	Polycarbonate	100
13	1.0	110410	Polycarbonate	100
13	3.0	110412	Polycarbonate	100
13	5.0	110413	Polycarbonate	100
13	8.0	110414	Polycarbonate	100
13	8.0	150446	Polycarbonate PVP-free*	100
13	10.0	110415	Polycarbonate	100
13	12.0	110416	Polycarbonate	100
19	0.03	800307	Polycarbonate	100
19	0.05	800308	Polycarbonate	100
19	0.1	800309	Polycarbonate	100
19	0.2	800281	Polycarbonate	100
19	0.4	800282	Polycarbonate	100
19	0.8	800284	Polycarbonate	100
19	1.0	800319	Polycarbonate	100
25	0.015	110601	Polycarbonate	100
25	0.03	110602	Polycarbonate	100
25	0.05	110603	Polycarbonate	100

* *PVP-free—hydrophobic*

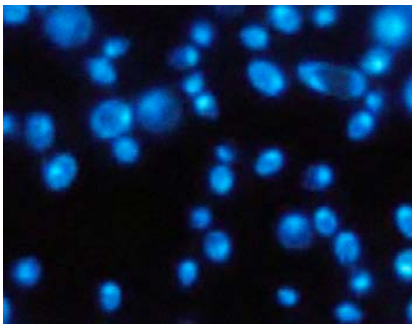
Ordering information—Nuclepore polycarbonate membrane circles (*continuation*)

Dimensions (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
Filter circles				
25	0.08	110604	Polycarbonate	100
25	0.1	110605	Polycarbonate	100
25	0.2	110606	Polycarbonate	100
25	0.4	110607	Polycarbonate	100
25	0.6	110608	Polycarbonate	100
25	0.8	110609	Polycarbonate	100
25	1.0	110610	Polycarbonate	100
25	2.0	110611	Polycarbonate	100
25	3.0	110612	Polycarbonate	100
25	5.0	110613	Polycarbonate	100
25	8.0	110614	Polycarbonate	100
25	10.0	110615	Polycarbonate	100
25	12.0	110616	Polycarbonate	100
25	0.4	110637	Polycarbonate AOX†	100
37	0.8	110809	Polycarbonate	100
47	0.015	111101	Polycarbonate	100
47	0.05	111103	Polycarbonate	100
47	0.08	111104	Polycarbonate	100
47	0.1	111105	Polycarbonate	100
47	0.2	111106	Polycarbonate	100
47	0.4	111107	Polycarbonate	100
47	0.6	111108	Polycarbonate	100
47	0.8	111109	Polycarbonate	100
47	1.0	111110	Polycarbonate	100
47	2.0	111111	Polycarbonate	100
47	3.0	111112	Polycarbonate	100
47	5.0	111113	Polycarbonate	100
47	8.0	111114	Polycarbonate	100
47	10.0	111115	Polycarbonate	100
47	12.0	111116	Polycarbonate	100
47	0.4	111137	Polycarbonate AOX†	100
50	0.2	111206	Polycarbonate	100
50	0.4	111207	Polycarbonate	100
50	5.0	111213	Polycarbonate	100
50	12.0	111216	Polycarbonate	100
76	0.05	111503	Polycarbonate	100
90	0.05	111703	Polycarbonate	25
90	0.1	111705	Polycarbonate	25
90	0.2	111706	Polycarbonate	25
90	0.4	111707	Polycarbonate	25
90	1.0	111710	Polycarbonate	25
90	2.0	111711	Polycarbonate	25
90	3.0	111712	Polycarbonate	25
142	0.08	112104	Polycarbonate	25
142	0.1	112105	Polycarbonate	25
142	0.2	112106	Polycarbonate	25
142	1.0	112110	Polycarbonate	25
293	1.0	112810	Polycarbonate	25
Filter sheets				
8 × 10”	0.03	113502	Polycarbonate	25
8 × 10”	0.2	113506	Polycarbonate	25
19 × 42 mm	5.0	113313	Polycarbonate	100

† *AOX—suitable for AOX (Absorbable Organic Halogens) analysis*

Cyclopore black polycarbonate membranes

Black Cyclopore membranes are excellent for epifluorescence and other microscopy applications requiring a contrasting background. The polycarbonate membrane is used to filter the sample and is then used directly for analysis. The dark membrane gives lower background fluorescence and improves the sensitivity of the test.



Yeast cells on Black Cyclopore with DAPI Stain

Typical properties—Cyclopore black polycarbonate membranes

Thickness	7-20 µm
Weight	0.7-2.0 mg/cm^2
Maximum service temperature	140°C
Porosity (void volume)	13%
Ash weight	20.6 µg/cm^2
Pore density	1 × 10^5—6 × 10^8 pores/cm^2
Autoclavable	30 minutes at 121°C
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert

Cyclopore PC Polycarbonate Black Membrane Filters

Ordering information—Cyclopore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	7063-2502	Polycarbonate	100
25	0.4	7063-2504	Polycarbonate	100
47	0.2	7063-4702	Polycarbonate	100

Nuclepore black polycarbonate membranes

Membranes for use with epifluorescence microscopy

Nuclepore black dyed polycarbonate membranes are high performance membranes suited for applications using epifluorescence microscopy. Black membranes greatly reduce background fluorescence, which results in improved microorganism and particulate visibility.

Using these membranes in combination with epifluorescence techniques, rapid enumeration of viable and nonviable microorganisms and particulate matter can be conducted in 30 minutes or less. Conventional culturing methods require incubation times of more than 24 hours. Use black track-etched membranes with epifluorescence techniques to achieve rapid, direct enumeration of microorganisms.

Nuclepore Polycarbonate Membranes—Black

Features and benefits

- Polycarbonate track-etched membrane dyed black with Irgalan
- Flat, smooth surface assures surface capture of microorganisms and particles
- Extremely low nonspecific absorption

Applications

- Potable water
- Ultra pure water
- Food and dairy
- Wine and beverages
- Clinical
- Electronics

Typical properties—Nuclepore black polycarbonate membrane circles

Thickness	7-22 µm
Rated pore size	0.015 µm—15 µm
Rated pore density	1×10^5–6×10^5 pores/cm
Surface texture	Flat and smooth
Opacity	Translucent
Hydrophobic/hydrophilic	Both
Fiber releasing	No

Ordering information—Nuclepore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	110656	Polycarbonate	100
25	0.4	110657	Polycarbonate	100
25	0.8	110659	Polycarbonate	100
47	0.2	111156	Polycarbonate	100

Anopore™ inorganic membranes

The Anopore inorganic membrane (Anodisc™) is excellent for a wide range of laboratory filtration applications. This material has a precise, nondeformable honeycomb pore structure, with no lateral crossover between individual pores, that filters at precisely the stated cut-off, allowing no larger sized particles to pass through the membrane. The Anopore inorganic membrane is composed of a high-purity alumina matrix that is manufactured electrochemically. The membrane also exhibits low protein binding, has minimal autofluorescence, is nontoxic, and supports cellular growth.

The precise pore structure and narrow pore size distribution of the Anopore membrane ensure a high level of particle removal efficiency. Microorganisms and particulate material are captured on the surface of the membrane for subsequent analysis by light or electron microscopy. When wet, the membrane is virtually transparent, which means that retained particles do not need to be transferred to another surface before microscopic examination.

The membrane is hydrophilic and is compatible with most solvents and aqueous material. No monomers, plasticizers, adhesives, surfactants or wetting agents are used in the manufacturing process, which removes sample contamination and ensures low protein binding and minimal loss of sample.

The Anopore membrane is supplied in the form of Anodisc membrane filters. The membrane is peripherally bonded to an annular polypropylene ring (except the 13 mm diameter disc) for ease of handling and is suitable for both vacuum and pressure filtration.

Anopore is available in three nominal pore sizes: 0.02 µm, 0.1 µm and 0.2 µm and in three diameters: 13 mm, 25 mm and 47 mm.

Features and benefits

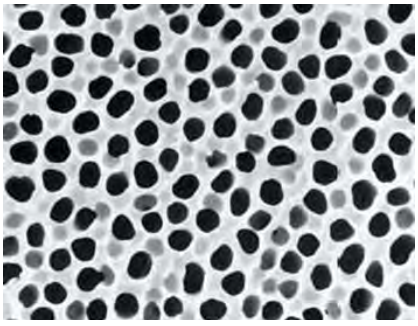
- High pore density and narrow pore size distribution make it an extremely precise membrane
- Wide solvent compatibility reduces the need to stock a variety of membranes in the laboratory
- Minimizes additives used in the manufacturing process ensures minimal extractables and no sample contamination
- Extremely low protein binding minimizes sample loss
- Virtually transparent when wet, making it suitable for microscopy studies

Applications

- HPLC mobile phase filtration and degassing
- Ultra cleaning of solvents
- Gravimetric analysis
- Liposome extrusion
- Scanning electron microscopy studies
- Bacterial analysis by epifluorescence light microscopy
- Micrometer and nanometer filtration
- Metal nanorods formation

Anodisc Circle with Support Ring

Anopore Inorganic Membranes Without Support Ring



Anodisc pore structure

Typical properties—Anopore inorganic membranes

	Anodisc 13	Anodisc 25	Anodisc 47
Average membrane thickness	60 µm	60 µm	60 µm
Membrane diameter	13 mm	21 mm	43 mm
Membrane type	Anopore aluminum oxide	Anopore aluminum oxide	Anopore aluminum oxide
Support ring material	None	Polypropylene	Polypropylene
Construction process	N/A	Thermal weld	Thermal weld
Protein adsorption	Low	Low	Low
Burst strength	65-110 psi	–	–
Maximum service temperature	400°C	40°C	40°C
Porosity	25–50%	25–50%	25–50%
Autoclavable	Yes	No	No
Refractive index	1.6	1.6	1.6

Ordering information—Anopore inorganic membrane circles (Anodisc)

Diameter (mm)	Membrane	Pore size (µm)	Catalog number	Hydrophilic	Protein binding	Ssolvent resistance	Quantity/ pack
13	Anodisc 13*	0.02	6809-7003	Yes	Low	Very good	100
13	Anodisc 13*	0.1	6809-7013	Yes	Low	Very good	100
13	Anodisc 13*	0.2	6809-7023	Yes	Low	Very good	100
25	Anodisc 25	0.02	6809-6002	Yes	Low	Very good	50
25	Anodisc 25	0.1	6809-6012	Yes	Low	Very good	50
25	Anodisc 25	0.2	6809-6022	Yes	Low	Very good	50
47	Anodisc 47*	0.02	6809-5502	Yes	Low	Very good	50
47	Anodisc 47	0.02	6809-5002	Yes	Low	Very good	50
47	Anodisc 47	0.1	6809-5012	Yes	Low	Very good	50
47	Anodisc 47*	0.2	6809-5522	Yes	Low	Very good	50
47	Anodisc 47	0.2	6809-5022	Yes	Low	Very good	50

* *Without support ring*

Anopore Inorganic Membranes Without Support Ring

Cellulosic membranes

Regenerated cellulose membranes

Whatman regenerated cellulose membranes are made of pure cellulose, without any wetting agents.

Features and benefits

- Spontaneously wetting, very good wet strength
- Extremely chemically resistant; suitable for aqueous and organic media
- Hydrophilic
- Mechanically stable with low protein binding
- Sterilizable by all common methods
- Low extractable levels to minimize sample contamination

Regenerated Cellulose Membrane Filter Circles

Typical properties—regenerated cellulose membranes

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Air flow rate Δp = 3 mbar (s/100 mL)	Bubble point (bar)
RC 58	0.2	75	14	–	3.7
RC 55	0.45	75	26	–	3.5
RC 60	1.0	70	3	12.5	0.8

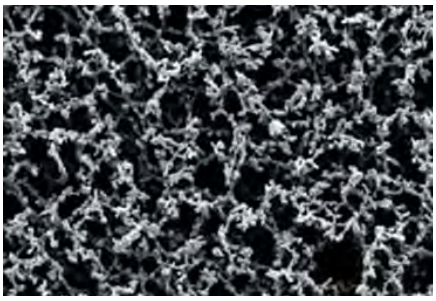
Ordering information—regenerated cellulose membrane circles

Dimensions (mm)	Membrane type	Pore size (µm)	Catalog number	Quantity/pack
Filter circles				
25	RC 55	0.45	10410206	100
47	RC 55	0.45	10410212	100
50	RC 55	0.45	10410214	100
100	RC 55	0.45	10410219	25
110	RC 55	0.45	10410224	25
142	RC 55	0.45	10410229	25
47	RC 58	0.2	10410312	100
50	RC 58	0.2	10410314	100
100	RC 58	0.2	10410319	25
47	RC 60	1	10410012	100
50	RC 60	1	10410014	100
Filter sheets				
300 × 600	RC 58	0.2	10410380	5

Cellulose acetate membranes

Whatman cellulose acetate membranes are made from pure cellulose acetate, making them suitable for biological and clinical analysis, sterility tests, and scintillation measurements.

Cellulose acetate membrane filters exhibit very low protein binding capacity. They are hydrophilic, making them suitable for aqueous and alcoholic media. The cellulose acetate membranes have improved solvent resistance, particularly to low molecular weight alcohols and increased heat resistance. With high physical strength, the membrane filters can be used up to 180°C, are suitable for hot gases, and can be sterilized by all methods without sacrificing the integrity of the membrane.



Cellulose acetate membrane (Type ST 68, 0.8 µm)

Typical properties—cellulose acetate membranes

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Bubble point (psi)	Bubble point (bar)
OE 66	0.2	115	26	58	4
OE 67	0.45	115	12	44.95	3.1
ST 68	0.8	140	16	21.75	1.5
ST 69	1.2	140	12	13.05	0.9
WCA	0.2	–	12	–	–

Ordering information—cellulose acetate membranes

Dimensions (mm)	Membrane type	Pore size (µm)	Catalog number	Quantity/pack
Filter circles				
25	OE 66	0.2	10404106	100
47	OE 66	0.2	10404112	100
47	OE 66	0.2	10404170*	100
50	OE 66	0.2	10404114	100
110	OE 66	0.2	10404126	50
142	OE 66	0.2	10404131	25
293	OE 66	0.2	10404139	25
13	OE 67	0.45	10404001	100
25	OE 67	0.45	10404006	100
47	OE 67	0.45	10404012	100
50	OE 67	0.45	10404014	100
85	OE 67	0.45	10404044	50
110	OE 67	0.45	10404026	50
142	OE 67	0.45	10404031	25
47	ST 68	0.8	10403112	100
47	ST 69	1.2	10403012	100
25	WCA	0.45	7000-0002	100
Filter sheets				
300 × 600	OE 66	0.2	10404180	5

* *Sterile*

Cellulose nitrate membranes

Recommended for the majority of routine applications, this membrane is manufactured under strictly controlled conditions. The user will benefit from recent performance improvements to Whatman membrane filters, including very narrow pore size distribution and low levels of extractables.

Higher strength and flexibility

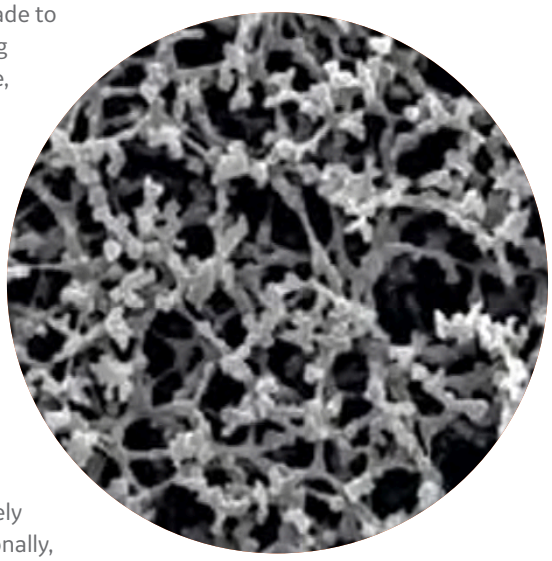
Most membranes are inherently brittle and difficult to handle; it is not uncommon for filters to be damaged during loading into holders or while in use. Whatman cellulose nitrate membrane filters have a noticeably improved flexibility and are made to tolerate abuse during handling, loading and autoclaving without sacrificing integrity. These membranes are among the strongest of their type available, as measured and compared by burst pressure tests.

Low extractable levels

The level of extractables in membrane filters has become more important with advances in filtration or adsorption techniques. In particular, pharmaceutical, immunological and biomedical tissue culture and trace analysis applications can be adversely affected by high extractable levels. Whatman cellulose nitrate membrane filters have a low level of extractables, generally below that of other membranes of a similar type.

Narrow pore size distribution

One of the major features of Whatman membrane filters is the narrow distribution of pore sizes. The rated pore size of these membranes is closely managed due to the advanced manufacturing and control system. Additionally, the batch-to-batch variation is minimized, providing more consistent laboratory results.



Cellulose acetate membrane (Type ST 68, 0.8 µm)

Increased temperature stability

Membrane filters are normally autoclaved at 121°C without loss of integrity. Cellulose nitrate membranes are supplied as circles, sheets, or reels.

Reduced shrinkage

Excessive shrinkage can cause problems during autoclaving and is often the cause of membranes tearing in their holders after autoclaving. It may also cause a reduction in flow rate and total throughput. Whatman membranes exhibit a low shrinkage during autoclaving.

Features and benefits

- Narrow pore size distribution for improved surface capture and analysis
- Low levels of extractables to ensure sample integrity

Applications

- Sample preparation
- Microbiological studies
- Filtration of aqueous solutions

Filter types

White plain filters

This is the standard membrane filter for the majority of laboratory applications involving particles and cells in the range of 0.1 µm to 12.0 µm. The residue after filtration is found to be almost completely on the surface of the membrane and allows physical recovery of deposits and microscopic examination.

Gridded filters

Gridded filters make it easier to count particles, microorganisms and colonies. If a gridded membrane is required, please see mixed cellulose ester membranes.

Typical properties—cellulose nitrate membranes

Thickness	105–140 µm
Weight	3.6–5.5 mg/cm^2
Maximum service temperature	80°C
Porosity	66–84%
Steam autoclavable	Yes
Hydrophilic	Yes

Typical applications—cellulose nitrate membranes

Field of application	**Pore size (µm)**
General	
Microfiltration	0.1
Ultracleaning	0.1
Sterilizing	0.2
Bulk bacterial removal	0.45
Analytical precipitates	0.65
Clarifying filtration	1.0
Particle removal	5.0
Water microbiology and analysis	
Bacterial colony count	0.45 (gridded)—see mixed cellulose ester membranes
Sediment analysis	0.45
Suspended particles	5.0
Air pollution monitoring	
Asbestos monitoring (NiOsH)	0.8
Food and beverage QC	
E. coli and coliforms	0.45 (gridded)—see mixed cellulose ester membranes
Total bacteria count	0.2
Tissue culture	
Mycoplasma removal	0.1
Sterile[#] filtration	0.2

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Ordering information—cellulose nitrate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
13	0.2	7182-001	Plain (white)	100
13	0.45	7184-001	Plain (white)	100
25	0.1	7181-002	Plain (white)	100
25	0.2	7182-002	Plain (white)	100
25	0.45	10401106	Plain (white)	100
25	0.45	7184-002	Plain (white)	100
25	0.8	7188-002	Plain (white)	100
25	1.0	7190-002	Plain (white)	100
25	3.0	7193-002	Plain (white)	100
25	5.0	7195-002	Plain (white)	100
25	5.0	10400206	Plain (white)	100
25	8.0	10400106	Plain (white)	100
37	0.8	7188-003	Plain (white)	100
47	0.1	7181-004	Plain (white)	100
47	0.1	10402012	Plain (white)	100
47	0.2	7182-004	Plain (white)	100
47	0.2	10401312	Plain (white)	100
47	0.2	10401320	Plain (white)	50
47	0.45	7184-004	Plain (white)	100
47	0.45	10401170	Plain (white), sterile	100
47	0.45	10401112	Plain (white)	100
47	0.65	7186-004	Plain (white)	100
47	0.8	7188-004	Plain (white)	100
47	1.0	7190-004	Plain (white)	100
47	3.0	7193-004	Plain (white)	100
47	5.0	7195-004	Plain (white)	100
47	5.0	10400212	Plain (white)	100
47	8.0	10400112	Plain (white)	100
47	12.0	10400012	Plain (white)	100
50	0.1	10402014	Plain (white)	100
50	0.2	10401314	Plain (white)	100
50	0.45	10401114	Plain (white)	100
50	0.45	7184-005	Plain (white)	100
50	1.2	7191-005	Plain (white)	100
50	5.0	10400214	Plain (white)	100
50	8.0	10400114	Plain (white)	100
50	8.0	10405079	Plain (white), with hydrophobic rim	100
50	12.0	10400014	Plain (white)	100
85	0.45	10401122	Plain (white)	50
90	0.2	7182-009	Plain (white)	25
90	0.45	10401118	Plain (white)	50
90	0.45	7184-009	Plain (white)	25
90	0.8	7188-009	Plain (white)	25
90	5.0	7195-009	Plain (white)	25
100	0.45	10401121	Plain (white)	50
110	0.45	10401126	Plain (white)	50
142	0.2	7182-014	Plain (white)	25
142	0.45	7184-014	Plain (white)	25
142	0.45	10401131	Plain (white)	25
142	1.2	7191-014	Plain (white)	25

Mixed cellulose ester membranes

Whatman mixed cellulose ester membranes are composed of cellulose acetate and cellulose nitrate. These membranes are characterized by a smoother and more uniform surface than pure nitrocellulose filters. Also, the color contrast provided by the filter surface facilitates particle detection and minimizes eye fatigue. The ME range has a lower cellulose acetate content compared to the WME range of membranes.

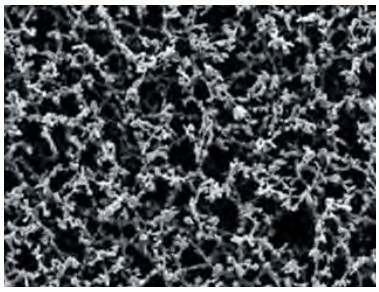
Eased counting process

In microbiological colony counting procedures, the color contrast between the surface and the colonies facilitates the counting process.

Plain or gridded

Many microbiological techniques include colony counting after incubation as the standard method of quantification. Whatman gridded filters have clearly defined grid lines spaced at 3.1 or 5 mm intervals. The special ink used is nontoxic and completely free from bacterial growth inhibitors.

Whatman black mixed cellulose esters are available plain for automatic colony counting applications, as well as gridded to assist in manual counting procedures. Black membranes provide contrast between residue or cell colors and the filter without having to counter-stain the membrane.



Mixed cellulose ester membrane

Sterile filters

For those laboratories preferring to use membranes sterilized by autoclaving for microbiological work, Whatman black gridded membranes are available in packs with pads ready for laboratory autoclaving.

Features and benefits

- Sterile options available for critical applications
- Excellent contrast for easier particle detection
- Grids are nontoxic and do not inhibit bacterial growth, ensuring sample integrity
- Black plain and black gridded membranes have a mix of cellulose nitrate and cellulose acetate
- The membrane offers a high degree of internal surface area for greater adsorption of product
- Higher dirt loading capacity
- Biologically inert with good thermal stability
- No surfactants to contaminate samples
- Uniform microporous structure of membrane gives high flow rates
- Thermally stable

Applications

The membrane is particularly effective in applications requiring higher flow rates and larger volume filtration, including clarification or sterilization[#] of aqueous solutions, particulate analysis and removal, air monitoring and microbial analysis. Other applications include:

- Cytology
- HPLC samples (aqueous)
- Biological assays
- Food microbiology, including enumeration of E. coli in foods
- Bacteriological studies
- Particle counting from liquids and aerosols
- Yeasts and molds

MembraClear

The MembraClear PCM filter is designed for asbestos sampling using the membrane filter method for phase contrast microscopy. Asbestos sampling isolates these fibers from circulating air to determine concentrations.

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Typical properties—mixed cellulose ester membranes

Burst strength	> 10 psi
Weight	4.3–5.0 mg/cm^2
Maximum service temperature	130°C
Porosity	74–77%
Steam autoclavable	Yes
Solvent resistance	Medium
Protein binding	Medium

Product selection—mixed cellulose ester membranes

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm^2)	Air flow rate Δp = 3 mbar (s/100 mL)	Bubble point (psi)	Bubble point (bar)
WME product range		140	–	–	–	–
ME product range						
ME 24	0.2	135	20	–	53.65	3.7
ME 25	0.45	145	12.5	–	40.6	2.8
ME 26	0.6	135	48	21	27.55	1.9
ME 27	0.8	140	2.8	11.6	18.85	1.3
ME 28	1.2	140	2	9.3	11.6	0.8
ME 29	3	150	1.2	6.7	10.15	0.7

Note: Autoclave pack contains 10 sealed envelopes. Each envelope contains 10 filters with 10 pads.

Ordering information—mixed cellulose ester membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
ME range—ME 24, plain				
25	0.2	10401706	Plain	100
47	0.2	10401712	Plain	100
47	0.2	10401770	Plain	100
50	0.2	10401714	Plain	100
50	0.2	10401772	Plain, sterile	100
100	0.2	10401721	Plain	50
110	0.2	10401726	Plain	50
142	0.2	10401731	Plain	25
ME range—ME 25, plain				
25	0.45	10401606	Plain	100
47	0.45	10401612	Plain	100
47	0.45	10401670	Plain	100
50	0.45	10401614	Plain	100
50	0.45	10401672	Plain	100
50	0.45	10401662	Plain, without interleaving paper	100
50	0.45	10401664	Plain, low C	100
90	0.45	10401618	Plain	50
100	0.45	10401621	Plain	50
110	0.45	10401626	Plain	50
142	0.45	10401631	Plain	25
ME range—ME 26, plain				
25	0.6	10401506	Plain	100
47	0.6	10401512	Plain	100
50	0.6	10401514	Plain	100
ME range—ME 27, plain				
25	0.8	10400906	Plain	100
37	0.8	10400909	Plain	100
47	0.8	10400912	Plain	100
50	0.8	10400914	Plain	100
100	0.8	10400921	Plain	50

Ordering information—mixed cellulose ester membrane circles *(continuation)*

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
ME range—ME 28, plain				
25	1.2	10400806	Plain	100
47	1.2	10400812	Plain	100
50	1.2	10400814	Plain	100
100	1.2	10400821	Plain	50
ME range—ME 29, plain				
25	3	10400706	Plain	100
47	3	10400712	Plain	100
50	3	10400714	Plain	100
50	3	10400772	Plain, sterile	100
ME range—ME 24, gridded				
47	0.2	10406970	White/black grid 3.1 mm, sterile	100
47	0.2	10408712	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
50	0.2	10406972	White/black grid 3.1 mm, sterile	100
50	0.2	10408714	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
ME range—ME 25, gridded				
47	0.45	10406812	White/black grid 3.1 mm	100
47	0.45	10407970	White/black grid 3.1 mm, sterile	100
47	0.45	10406871	White/black grid 3.1 mm, sterile	1000
47	0.45	10406512	White/black grid 5 mm	100
47	0.45	10409770	Black/white grid 3.1 mm, sterile	100
47	0.45	10409771	Black/white grid 3.1 mm, sterile	1000
47	0.45	10409414	Green/black grid 3.1 mm	1000
50	0.45	10406814	White/black grid 3.1 mm	100
50	0.45	10406572	White/black grid 5 mm, sterile	100
50	0.45	10409714	Black/white grid 3.1 mm	100
50	0.45	10409772	Black/white grid 3.1 mm, sterile	100
ME range—ME 25 Select, gridded				
47	0.45	10406800	White/black grid 3.1 mm, sterile, single packed	100
47	0.45	10406803	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
50	0.45	10406801	White/black grid 3.1 mm, sterile, single packed	100
50	0.45	10406802	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
ME range—ME 26, gridded				
50	0.6	10409814	Black/white grid 3.1 mm	100
ME range—ME 27, gridded				
47	0.8	10408970	White/black grid 3.1 mm, sterile	100
47	0.8	10409970	White/black grid 3.1 mm with pad, sterile	100
50	0.8	10405672	Green/black grid 3.1 mm, sterile	100
ME range—ME 28, gridded				
50	1.2	10408472	Green/black grid 3.1 mm, sterile	100
WME range, gridded				
25	0.8	7148-002	White/black grid 3.1 mm	100
47	0.45	7140-104	Plain, sterile, individually packed, with pad	100
47	0.2	7187-114	White/black grid 3.1 mm, sterile, individually packed, without pad	100
47	0.45	7141-004	White/black grid 3.1 mm	100
47	0.45	7141-104	White/black grid 3.1 mm, sterile	100
47	0.45	7141-114	White/black grid 3.1 mm, sterile, individually packed, without pad	100
47	0.45	7141-124	White/black grid 3.1 mm, sterile, individually packed, without pad	200
47	0.45	7141-154	White/black grid 3.1 mm, sterile, individually packed, without pad	1000
47	0.45	7141-204	White/black grid 3.1 mm, autoclave pack	100
47	0.45	7153-104	Black/white grid 3.1 mm, sterile, individually packed, with pad	100
MembraClear				
25	–	7141-025	Plain	100
47	–	7141-047	Plain	100

PTFE membranes

Whatman PTFE membranes are chemically stable and inert. They are suitable for applications involving aggressive organic solvents, strong acids and alkalis. PTFE membranes are particularly suitable for preparing samples for HPLC analysis. The hydrophobic nature of the membrane also has applications for air and gas sterilization[#]. The membrane is laminated onto a nonwoven polypropylene support web for improved strength and handling, and can be used at temperatures up to 120°C.

Chemically stable and inert

PTFE is the membrane of choice for use with aggressive solvents, liquids, and gases that can attack other membranes. It is resistant to most acids, alkalis, and solvents.

Applications

One of the major applications for the PTFE membrane is the clarification of corrosives, solvents, and aggressive fluids. This includes the important requirement in HPLC analysis for sample filtration where any solid particles can cause permanent damage to the column, where a 0.5 µm pore size is normally used. Air and gas sterilization[#] make use of the hydrophobic characteristics of PTFE membranes and their ability to stop aqueous aerosols and pore sizes of 0.2 µm and 0.5 µm are generally used. Sterile[#] venting of vacuum manifolds, fermentation vessels, and sterile filtrate tanks and containers utilize PTFE 0.2 µm membranes.

WTP and TE membrane ranges

WTP membranes use a polypropylene grid as the support material whereas the TE range uses a randomly arranged polypropylene support material.

PFTE Membrane Filters—TE Range

Typical properties—PTFE membranes

Membrane type	Nominal thickness (µm)	Porosity (%)	Liquid flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Liquid flow rate @ 10 psi vacuum (mL/min/cm²)	Air flow rate Δp = 3 mbar (s/100 mL)	Air flow rate @ 10 psi vacuum (L/min/cm²)	Bubble point (psi)	Bubble point (bar †)	Max. temp. (°C)
TE range									
0.2 µm (TE 35)	240	–	24*	–	70	–	1.29	18.8	100
0.45 µm (TE 36)	220	–	12*	–	60	–	0.89	13	100
1.0 µm (TE 37)	275	–	5.4*	–	24	–	0.24	3.5	100
5.0 µm (TE 38)	265	–	2.2*	–	3.5	–	0.19	2.9	100
WTP range									
0.2 µm	130	72	–	61.4**	–	4.5	0.89	13	120
0.5 µm	120	74	–	110**	–	7.5	0.41	6	120
1.0 µm	90	76	–	445**	–	17	0.21	3	120

* *Measured with ethanol*
** *Measured with acetone*
† *Measured using 2-propanol*

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Ordering information—PTFE membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Quantity/pack
WTP range			
25	0.2	7582-002	100
25	1.0	7590-002	100
47	0.2	7582-004	100
47	0.5	7585-004	100
47	1.0	7590-004	100
TE range—TE 35			
25	0.2	10411405	50
47	0.2	10411411	50
50	0.2	10411413	50
TE range—TE 36			
25	0.45	10411305	50
47	0.45	10411311	50
50	0.45	10411313	50
TE range—TE 37			
25	1.0	10411205	50
47	1.0	10411211	50
50	1.0	10411213	50
TE range—TE 38			
37	5.0	10411108	50
47	5.0	10411111	50
50	5.0	10411113	50
90	5.0	10411116	25
150	5.0	10411130	25

PM 2.5 air monitoring membrane

A high-purity, thin PTFE membrane in a sequentially numbered, chemically resistant polypropylene support ring for PM 2.5 ambient air monitoring. Whatman PM 2.5 membranes have low tare mass for accurate gravimetric determinations. The thermally stable design prevents curling, keeps the membrane flat, and makes the filter robot-friendly.

The PM 2.5 PTFE membranes are manufactured under clean room conditions. These chemically resistant, low chemical background filters permit sensitive, interference-free determinations. No glues or adhesives are used in making these products.

Statement of conformance

PTFE Filters for EPA PM 2.5 Reference Method. Under the requirements of 40 CFR Part 50, Appendix L, shown below, the manufacturer must perform the following tests as listed.

Any filter manufacturer or vendor who sells or offers to sell filters specifically identified for use with this PM 2.5 reference method shall certify that the required number of filters from each lot (0.1% or 10, whichever is greater) offered for sale have been tested as specified and meet 90% of each of the design and performance specifications:

- Loose, surface particle contamination (drop test—weight loss stability)
- Temperature stability (temperature—weight loss stability)

PM2.5 Air Monitoring Membrane Filters

Any filter manufacturer or vendor who sells or offers to sell filters specifically identified for use with this PM 2.5 reference method shall certify that a minimum number of 50 filters from each lot of filters offered for sale have been tested as specified for the following tests and meet 90% of each of the design and performance specifications:

- Filter type
- Filter diameter
- Filter thickness
- Filter pore size
- Support ring width
- Support ring thickness (total)
- Maximum pressure drop (clean filter)
- Maximum moisture pickup
- Collection efficiency
- Alkalinity
- Special requirements

These include trace metal analysis by XRF and visual inspection for defects such as pinholes, support ring separation, chaff or flashing, loose material, discoloration, filter nonuniformity or any other obvious filter defect.

Every manufactured lot that is offered for sale, and is identified for use with the PM2.5 reference method, conforms to EPA acceptance criteria.

Technical specifications—PTFE filters for use in US EPA PM 2.5 ambient air monitoring

Property	Test method	Unit of measure	Value	Range
Filter media	N/A	N/A	PTFE	–
Filter thickness	–	µm	40	± 10
Filter diameter	Template	mm	46.2	± 0.25
Filter pore size	ASTM f 316-94	µm	2.0	Maximum
Support ring media	N/A	N/A	Polypropylene	–
Total support ring thickness	–	mm	0.38	± 0.04
Support ring width	Template	mm	3.68	± 0.00—0.51
Particle retention (0.3 µm)	ASTM D 2986-95a	%	99.7	Minimum
Pressure drop (0.3 µm) @ 16.67 L/min	ASTM D 2986-95a	cm water	30	Maximum
Alkalinity	Section 2.12 EPA/600/R-94/038b	µeq/g of filter	< 25	Maximum
Temperature weight loss stability	As above	µg	< 20	Maximum
Drop test weight loss stability	As above	µg	< 20	Maximum
Moisture weight gain stability	As above	µg	< 10	Maximum

Maximum trace element concentration by X-ray fluorescence

Ion	ng/cm²	Ion	ng/cm²	ion	ng/cm²	Ion	ng/cm²	Ion	ng/cm²	Ion	ng/cm²
Al	94.4	Sc	7.2	Ni	3.0	Br	2.0	Pd	9.6	Cs	25
Si	32.8	ti	13.8	Cu	2.8	Rb	2.0	Ag	9.6	Ba	32.2
P	22.6	V	4.8	Zn	2.2	Sr	2.2	Cd	10.8	La	87.6
S	13.4	Cr	2.2	Ga	1.8	Y	14.6	Sn	15.2	W	5
Cl	9.4	Mn	2.2	Ge	3.0	Zr	13.2	Sb	14.4	Au	4.4
K	5.6	Fe	5.8	As	2.8	Mo	11.6	Te	16.2	Hg	4.4
Ca	8.2	Co	4.0	Se	1.6	Rh	9.4	I	18.6	Pb	4.8

Ordering information—PM 2.5 air monitoring membrane circles

Diameter (mm)	Catalog number	Description	Quantity/pack
46.2	7592-104	With support ring, sequentially numbered	50

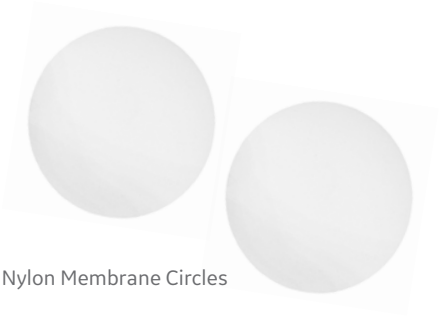
Nylon nembranes

High-quality nylon membranes are suitable for filtering aqueous solutions and most organic solvents. The membranes are suitable for use with a wide range of biological preparations and can be used where other membranes are unsuitable or difficult to use.

Nylon membranes are hydrophilic, removing the need for wetting agents that could be extracted when filtering aqueous solutions. The membranes are flexible, durable and tear resistant, and can be autoclaved at 135°C.

Applications

- Filtration of aqueous and organic mobile phases
- Vacuum degassing
- Filtration of tissue culture media, microbiological media, buffers, and solutions



Nylon Membrane Circles

Typical properties—nylon membranes

Pore size (µm)	Thickness (µm)	Fiber releasing	Water flow rate @ 5 psi	Bubble point (psi)	Maximum temperature (°C)
0.2	150-187	No	> 50 mL/min	40-49	135
0.45	150-187	No	> 60 mL/min	34-42	135
0.8	137-200	No	> 180 mL/min	> 13	135
1.0	–	–	–	–	135

Ordering information—nylon membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Quantity/pack
13	0.2	7402-001	100
13	0.45	7404-001	100
25	0.2	7402-002	100
25	0.45	7404-002	100
47	0.2	7402-004	100
47	0.45	7404-004	100
47	0.8	7408-004	100
47	1.0	7410-004	100
90	0.2	7402-009	50
90	0.45	7404-009	50

Polyamide membranes

Whatman polyamide membranes are made from pure polyamide, making them the recommended filter for clarification and sterile[#] filtration.

Polyamide membrane filters are mechanically very strong and exhibit excellent wet strength and dry strength. They are hydrophilic, making them suitable for aqueous and organic solutions, and can be used up to 135°C.

Applications

- Filtration of aqueous and organic mobile phases
- Vacuum degassing
- Filtration of tissue culture media, microbiological media, buffers, and solutions

Polyamide Membrane Circles

Typical properties—polyamide membranes

Pore size (µm)	Nominal thickness (µm)	Water flow rate Δp = 0.9 bar (mL/min/cm²)	Air flow rate Δp = 3 mbar (bar) (mL/min/cm²)	Bubble point (bar)	Maximum temperature (°C)
0.2 (NL 16)	110	10	10	4.2	135
0.45 (NL 17)	110	20	20	2.8	135

Ordering information—polyamide membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Membrane type	Quantity/pack
25	0.2	10414006	NL 16	100
25	0.45	10414106	NL 17	100
47	0.2	10414012	NL 16	100
47	0.45	10414112	NL 17	100
50	0.2	10414014	NL 16	100
50	0.45	10414114	NL 17	100

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Filtration hardware and accessories

Whatman filter holders and accessories are designed for convenience and precision in use. The vacuum funnels are well suited for filtration in a range of applications. The funnels and bases have precision ground faces to ensure secure clamping and integral sealing, and graduated funnels have clearly printed scales. All glassware is 100% borosilicate glass and can be rapidly disassembled for cleaning, loading, and autoclaving.

A choice of filter supports is available depending on the intended application. The stainless steel screen is advised for proteinaceous solutions and glass frit types are recommended for general filtration and for biological analyses.

Syringe type holders are suited for filtering or clearing small amounts of liquid where a replaceable or removable filter is desired. Filter holders for pressure filtration are available in a variety of formats and sizes to accommodate a range of filter diameters.

Glass microfiber filter accessories 74
Glass vacuum filtration devices 75
Vacuum filtration equipment 77
Single vacuum filtration apparatus 77
Multiple vacuum filtration apparatus 78
Syringe type holders 79
Membrane filtration accessories 81
Pressure filtration devices 81
Membrane prefilters and separators 82
Microbiology accessories 84
MBS I 84
Accessories and vacuum filtration apparatus 86

Glass microfiber filter accessories

3-piece filter funnel

The increased use of high-efficiency glass microfiber filters in modern laboratories has created a demand for simple and effective filter-holding systems. Whatman 3-Piece Filter Funnels have been designed to complement the range of Whatman fine particle retention, rapid flow rate glass microfiber filters.

3- piece filter funnel

Functional design

Three-piece construction. The funnel is quickly dismantled, ready for the insertion of a new filter. The glass sealing flanges of the funnel and reservoir are ground flat to ensure a good filter seal.

Positive filter clamping

All retained solids are deposited within the filter circle. Edge clamping prevents peripheral loss and possible passage of solution around, rather than through, the filter circle.

Simple to clean

The parts can be quickly and efficiently cleaned because of the simplicity of the design.

A choice of plates

For quick and easy filtration, Whatman 3-piece filter funnels are available with a choice of plates. They also come in several sizes to match your needs.

- **Acrylic plate:** Supplied as standard. Suitable for filtration of most aqueous solutions. Maximum working temperature 65°C.
- **Polypropylene plate:** Optional extra. Recommended for most acids (except concentrated nitric acid and fuming sulfuric acid) at room temperature. Suitable for most alcohols, glycols, ethers, and ketones. Maximum working temperature 100°C.
- **PTFE plate:** Optional extra. For virtually all common acids, alkalis and solvents at temperatures up to 100°C. Maximum working temperature 200°C.

Ordering information—3-piece filter funnel

Filter dimensions (mm)	Catalog number	Reservoir volume (mL)	Effective filtration diameter (mm)	Effective filtration area (cm^2)	Filter support plate diameter (mm)	Filter funnel height (cm)
25	1950-002	16	16	2	30	13.6
47	1950-004	36	32	8	47	12.1
70	1950-007	115	50	19.6	70	15.9
70	1950-017	210	50	19.6	70	20.8
70	1950-027	400	50	19.6	70	–
90	1950-009	200	70	38.5	90	17.9
125	1950-012	530	92	66.5	125	22

Ordering information—3-piece filter funnel accessories

	Catalog number			
Dimensions (mm)	Polypropylene plates	PTFE plates	Replacement reservoirs	
47	–	1950-114	–	–
70	–	1950-117	1950-207*	1950-217***
90	1950-109	–	1950-209**	–

* *115 mL*
** *200 mL*
*** *210 mL*

Glass vacuum filtration devices

Produced from borosilicate glass and available with a choice of support screen. Suitable for aqueous and organic solvent filtration. The funnel seal ensures that the sample does not bypass the filter and that particulates are retained on the surface of the filter.

The sintered glass support is recommended for filtration and biological analysis. The 304 stainless steel support screen is suitable for use with proteinaceous solutions.

Glass Vacuum filtration devices

Features and benefits

- Chemically resistant to most aqueous and organic solutions
- Acid and caustic solution resistant

Applications

- Foodstuffs (e.g. ice cream)
- Beverages (e.g. residues in beer)
- Pharmaceuticals and cosmetics
- Water and wastewater
- Residue analytics and precipitation analysis
- Contamination tests (e.g. in electroplating)
- Microbiological, biochemical, and hydrobiological detection
- Radiochemical tests
- Particle analysis in sensitive areas of electronics, aviation, and space travel

Technical information—glass vacuum filtration devices

Upper part, lower part	Borosilicate glass
Cap	Silicone
Flask	Borosilicate glass
Frit	Glass D2
Sieve	Stainless steel, PTFE coated
Seals	PTFE and silicone
Clamps	Aluminum and stainless steel
Hose connection	POM, thread RD14

Typical properties—glass vacuum filtration devices

Series	Filter diameter (mm)	Funnel volume (mL)	Filter format (mm)	Filter surface area (cm^2)	Prefilter diameter (mm)	Height* × diameter (mm)
GV 025	25	60	24/25	3.1	20	210/335 × 45
GV 050	50	250	47/50	12.5	40	225/450 × 80
GV 100	100	500	100	70	80	225 × 90
FG 25	25	25	–	2.1	16	–
FG 25R	25	50	–	2.1	13	–
FG 25S	25	25	–	2.1	16	–
FG 47	47	300	–	9.6	35	–
FG 47S	47	300	–	9.6	35	–
FG 90	90	1000	–	38.5	70	–

* *Height without/with Erlenmeyer flask, diameter without clamp and hose coupling*

Ordering information—glass vacuum filtration devices

Diameter (mm)	Catalog number	Filter system	Filter support	Vacuum connection	Quantity/pack
Membrane filter holders					
25	1960-032	FG 25R	Stainless steel	Rubber stopper	1
25	1960-002	FG 25	Glass	Rubber stopper	1
25	1960-052	FG 25S	Stainless steel	Rubber stopper	1
47	1960-004	FG 47	Glass	Rubber stopper	1
47	1960-054	FG 47S	Stainless steel	Rubber stopper	1
47	1961-054	–	Glass	–	1
90	1960-009	FG 90	Glass	Rubber stopper	1
GV 025 series					
–	10441000	GV 025/0	Glass frit	Rubber stopper	1
–	10441200	GV 025/2	Glass frit	Hose coupling Erlenmeyer flask 250 mL (NS29)	1
GV 050 series*					
–	10442000	GV 050/0	Glass frit	Rubber stopper	1
–	10442100	GV 050/1	Sieve	Rubber stopper	1
–	10442200	GV 050/2	Glass frit	Hose coupling Erlenmeyer flask 1000 mL (NS45)	1
–	10442300	GV 050/3	Sieve	Hose coupling Erlenmeyer flask 1000 mL (NS45)	1
GV 100 series					
–	10443000	GV 100/0	Glass frit	Rubber stopper	1
–	10443100	GV 100/1	Sieve	Rubber stopper	1

* *Silicone cap and supplied with air inlet*

SF 100 Suction Flask

SF 100 Suction Flask, 1000ml with tubing nozzle, vacuum filtration apparatus accessories

SF 100 Suction Flask

Technical data—vacuum filtration—SF 100 Suction Flask

Apparatus selection	
Parameter	SF 100 Suction Flask
Capacity	1000 mL
Pack size	1 piece

Ordering information—SF 100 Suction Flask

Catalog number	Description	Quantity/pack
10477600	SF 100 Suction Flask	1

Vacuum filtration equipment

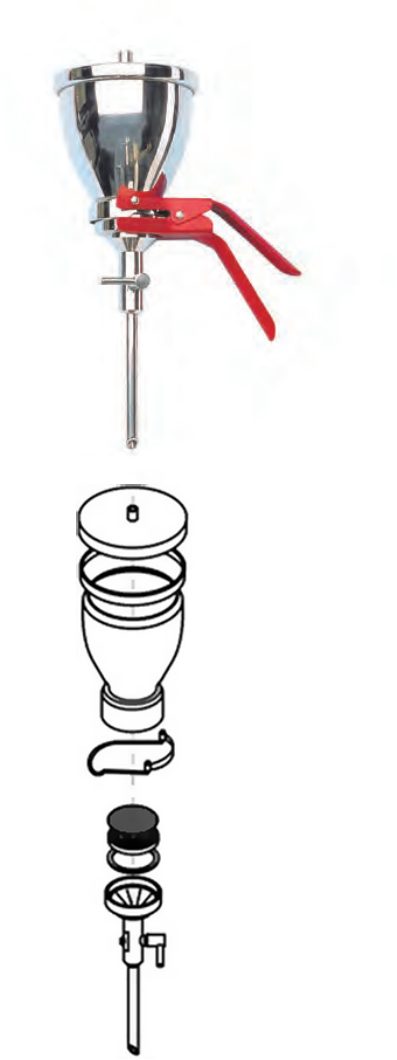
MV 050 series

All MV series vacuum filtration devices are made of stainless steel, which is especially suitable for microbiological applications.

The system can be used up to 200°C, is autoclavable and can be sterilized by dry heat up to 180°C.

Applications

- Microbiology (e.g. *Escherichia coli* detection), biochemistry, hydrobiology
- Drinks (e.g. cold sludge in beer), foodstuffs (e.g. ice cream), pharmaceuticals, cosmetics, water, wastewater
- Residue analysis, precipitate analysis, contamination tests.



MV 050/0

Technical data—vacuum filtration—MV 050 series

Apparatus selection	
Filter size	47/50 mm
Filter volume	100 or 500 mL
Filter area	12.5 cm^2
Prefilter	40 mm diameter
Vacuum connection	Rubber stopper
Filter support	Sieve (frit as accessory)

Materials selection	
Upper and lower parts	Stainless steel 1.4301
Cover	Stainless steel 1.4301
Frit	Stainless steel 1.4571
Sieve	Stainless steel 1.4301
Seals	PTFE and silicone
Clamps	Aluminum

Ordering information—MV 050 series

Catalog number	Description	Quantity/pack
10440000	MV050/0 vacuum filtration apparatus, stainless steel, 500 mL, 47/50 mm	1
10440020	MV050A/0 vacuum filtration apparatus with rapid closure clamp, stainless steel, 500 mL, 47/50 mm	1

Multiple vacuum filtration apparatus

AS 300 and 600 series

The stainless steel manifold for three or six filtration units is fitted with stainless steel units. The apparatus can be autoclaved and sterilized by dry heat at up to 180°C. Suitable only for vacuum operation. If flushing tubes are used, do not exceed 1.3 bar (300 mbar over-pressure).

Applications

- Microbiological quality control
- Residue analyses
- Serial filtration carried out rapidly and easily with a common drainage outlet

AS 300/3

AS 610/3

Technical data

AS 300 and 600 series—multiple vacuum filtration apparatus

Apparatus Selection	
Filter size	47/50 mm
Filter volume	100 or 500 mL
Manifold	3 or 6 stopcocks and lower parts for individual choice of filter units
Filter support	Sieve (frit as accessory)
Vacuum connection	Tubing nozzle 9 mm (inside diameter)

Multiple filtration apparatus complete and ready for use. Filters and prefilters sold separately.

Ordering information—multiple vacuum filtration apparatus

Catalog number	Description	Quantity/pack
Three-place filtration		
10445850	AS300/5 vacuum filtration system, stainless steel 100 mL, 47/50 mm, support screen	1
10445830	AS300/3 vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10445835*	AS310/3 vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10498761**	Stainless steel filter funnel 3-place manifold	1
Six-place filtration		
10444850	AS600/5 vacuum filtration system, stainless steel 100 mL, 47/50 mm, support screen	1
10444830	AS600/3 vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10444835*	AS610/3 vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10498762**	Stainless steel filter funnel 6-place manifold	1

* *With rapid closure clamp*
** *Recommended for Microbiology Monitors and Analytical Funnels*

Syringe type filter holders

Syringe type holders S/S

Available in stainless steel and polypropylene with luer fittings for use with a standard syringe. The holders are designed for the quick and easy clarification, sterilization[#], and removal of particulates from small volume samples, typically for HPLC applications. The holders contain PTFE gaskets and O-rings, and allow the membrane to be autoclaved in place without the filter sticking to the holder.

Luer lock fittings connect to a standard syringe and offer convenience and ease of use for clarification, sterilization[#], and removal of particulates from small volumes of liquid (e.g. HPLC samples and solvents).

Syringe Type Holders

Ordering information—syringe type holders S/S

Diameter (mm)	Catalog number	Description	Quantity/pack
Membrane holders			
13	1980-001	Stainless steel	1
25	1980-002	Stainless steel	1
25	10460100	FM025/0 stainless steel	1
50	10464100	ML050/0 stainless steel	1

Ordering information—polysulfone filter holders

Filter diameter (mm)	Catalog number	Description	Quantity/pack
25	10461000	FP025/1 PSU	10
50	10461100	FP050/0 PSU	1
50	10461200	FP050/0 PSU	5
50	10461300	FP050/1 PSU	1
50	10461400	FP050/1 PSU	5

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Pop-Top™ and Swin-Lok™ plastic filter holders

Pop-Top and Swin-Lok plastic filter holders

Features and benefits

- Designed for microfiltration and ultra cleaning of small volumes of liquids using positive pressure
- All three holders will accommodate Nuclepore track-etched and cast membranes
- Syringe compatible

Typical properties—Pop-Top and Swin-Lok plastic filter holders

Materials	**13 mm Pop-Top**	**25 mm Swin-Lok**	**47 mm Swin-Lok**
Holder	Polycarbonate	Polypropylene	Polycarbonate
Maximum operating temperature and pressure	–	38°C at 3.5 bar (50 psi)	38°C at 3.5 bar (50 psi)
Sterilization	–	121°C (250°F) for 15 minutes	121°C (250°F) for 15 minutes
Size (cm)	2.7 OD × 2.7 H	3.5 OD × 3.7 H	6.0 OD × 6.5 H
Membrane size (mm)	13	25	47
Prefilter size (mm)	10	22	42
Filter surface area (cm^2)	0.8	3.9	13.8
Connection			
Cap	Male luer slip-fit	Female luer-lok	Female luer slip-fit
Base	Female luer slip-fit	Male luer slip-fit	Male 1/4” NPT and 1/4” tubing (multipurpose)

Ordering information—Pop-Top and Swin-Lok plastic filter holders

Diameter (mm)	**Catalog number**	**Description**	**Quantity/pack**
13	420100	Pop-Top holder	10
25	420200	Swin-Lok holder	10
47	420400	Swin-Lok holder	8

Membrane filtration accessories

Whatman offers a line of analytical funnels and vacuum filtration equipment for use in microbiological testing processes.

Pressure filtration devices

Pressure filtration devices

Pressure filtration devices with a sample loading cylinder are suitable for batch filtration of samples from 20 mL, while devices without infusion cylinders are connected inline and are suitable for larger volumes of several liters. Filtration of liquids and gases is possible, including sterile[#] filtration of serums or the clear filtration of media that are difficult to filter, especially those that are highly viscous.

Membranes, paper or glass fiber filter discs can be used. Cleaning and changing of filters is completed in a few steps. All units are equipped with pressure resistant filter supports. High-quality silicone or PTFE O-rings seal the systems. Please ensure you only use intact seals for safety reasons. PTFE versions are available, in addition to stainless steel devices, for use with corrosive media.

Pressure filtration connection

Applications

- Clear filtration of liquids that are difficult to filter and sterile[#] filtration of liquids and gases. For small volumes: MD 050
- Inline filtration of corrosive liquids which must not come into contact with metals: MD 142/7 or with infusion cylinder MD 142/7/3

Typical properties—pressure filtration devices

Series	Material	Seals	Max pressure* (bar)	Max temperature resistance (°C)	Filter diameter (mm)	Prefilter diameter (mm)
MD 050	Stainless steel	Silicone/PTFE	10/4	200	50	43
MD 142/5	Stainless steel	Silicone/PTFE	10/4	200	142	134
MD 142/7	PTFE	PTFE	3.5	200	142	134

* *With silicone O-ring/PTFE O-ring*

Ordering information—pressure filtration devices

Catalog number	Description	Quantity/pack
Stainless steel		
10450450	MD 050/4, 200 mL, 230 × 70 mm with rapid seal	1
10451610	MD 142/5/3, 2200 mL, 545 × 200 mm	1
PTFE		
10451710	MD 142/7/3, 1500 mL, 470 × 200 mm	1
Accessories—inlet/outlet connections for stainless steel pressure filtration devices of the MD 050 and MD 142/5 series*		
10453001	MD 050/0/12, connection: rapid seal coupling, for SV 003 c	1
10453007	MD 050/0/18, connection: olive external diameter 9–11 mm, for pressure hoses	1
Pressure hose		
10471101	Pressure hose, SV 003 c, loadable bar 10, connector SVK/R 3/8", inner diameter 6 mm, length 1.5 m	1

* *All connections are supplied with PTFE seal*

SVK—rapid seal coupling

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Membrane prefilters and separators

The life of a membrane filter can be extended many times by placing a prefilter adjacent to or upstream of the membrane. The total particulate load challenging the membrane is considerably reduced thus allowing the membrane to operate efficiently.

Whatman glass microfiber filters are used as prefilters for membranes. The outstanding properties of borosilicate glass microfibers mean the filters offer high loading capacity and retention of very fine particulates.

The Whatman Multigrade GMF 150, used as a prefilter, nearly doubles the volume of sample filtered compared to a single density prefilter. Compared to an unprotected membrane, the volume of sample filtered is three to seven times greater. Conventional prefilters cannot perform in the same way as the Multigrade GMF 150 simply because prefilters of a uniform density do not have the same loading capacity. For highly particulate loaded samples, the performance of GMF 150 filters is outstanding.

Glass Microfiber Filters, Binder Free

Ordering information—glass microfiber prefilter circles

		Catalog number			
Prefilter diameter (mm)	**Pore size (µm)**	**Multigrade GMF 150**	**Grade GF/B (fine)**	**Grade GF/D (coarse)**	**Quantity/pack**
10	2.7	–	–	1823-010	100
25	1.0	–	1821-025	–	100
25	2.7	–	–	1823-025	100
35	2.7	–	–	1823-035	100
37	1.0	–	1821-037	–	100
42.5	1.0	–	1821-042	–	100
42.5	2.7	–	–	1823-042	100
47	1.0		–	–	40
47	2.0	1842-047	–	–	40
47	1.0	–	1821-047	–	100
47	2.7	–	–	1823-047	100
90	1.0	1841-090	–	–	20
90	2.0	1842-090	–	–	20
90	1.0	–	1821-090	–	25
90	2.7	–	–	1823-090	25
125	1.0	–	1821-125	–	25
125	2.7	–	–	1823-125	25
142	2.7	–	–	1823-142	25
257	2.7	–	–	1823-257	25

For further information on these grades please refer to the Filter Papers section

Polyester drain discs

For use with membrane hardware where extra support is needed for improved flow rate and throughput. The polyester drain disc is binder free and has a thickness of 100 µm. It provides a flat surface to prevent filter tearing or rupturing. It is also used as a separator between membrane layers in serial stack filtration applications. This chemically inert support disc is available in a variety of diameters for use in a range of devices.

Polyester Drain Disc

Applications

- General laboratory microfiltration
- Quality control and sterility testing
- Removal of particulates from HPLC solvents
- Tissue culture media filtration

Ordering information—polyester drain discs

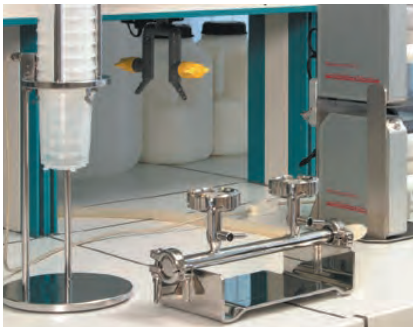
Diameter (mm)	Catalog number	Filter support	Quantity/pack
10	230300	Polyester	100
22	230500	Polyester	100
25	230600	Polyester	100
37	230800	Polyester	100
47	231100	Polyester	100
90	231200	Polyester	100
90	232100	Polyester	100
293	232300	Polyester	100

Microbiology accessories

MBS I microbiological filtration system

MBS I is an excellent system for optimal microbiological control using membranes. The overall procedure time is reduced to a minimum. The design of the system, which consists of an electrical membrane dispenser, a funnel dispenser, and a vacuum manifold, leads to more reproducible results.

The special sealing technique ensures easy handling and a good integrity of the funnel and membrane during filtration. This reduces any cross contamination to a minimum.



MBS I system in a quality control laboratory

Features and benefits

- Simple to use
- Safe sealing mechanism
- Shorter preparation time
- High reproducibility
- Funnels can be autoclaved up to 50 times
- Large funnel capacity for foaming liquids
- Easier to validate
- Risk of cross contamination is minimized

A combination of comfort and progress

When a funnel is taken from the dispenser, the butler automatically dispenses a membrane from the sterile pack, which is ready to use.

Find the right funnel

The new funnels are provided sterile in a magazine and save time especially when a large number of samples need to be processed by one apparatus.

The funnels (350 mL) are of high grade polypropylene and can be autoclaved up to 50 times. For applications in which funnels are only used once, the system offers another solution: a 100 mL funnel which is presterilized and supplied ready for immediate use. A special closure mechanism at the extraction edge ensures that the funnel seals tightly with the membrane.

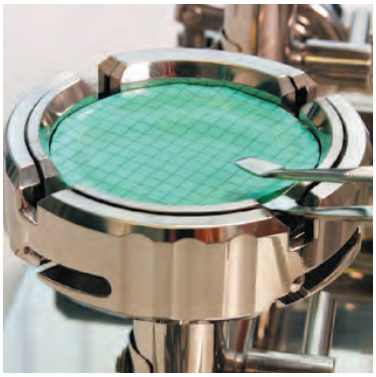
MBS I, Steel Frit with Ring for AS220

MBS I workflow

1. When taking a new presterilized funnel, the membrane is dispensed automatically

2. Membrane is placed onto the filter base and the funnel installed

3. Liquid is poured into the funnel and a vacuum is applied



4. Membrane is easily removed after filtration

Ordering information—MBS I

Catalog number	Product	Description	Quantity/pack
10445890	AS220	2-place vacuum filtration manifold for MBS I	1
10445863	Frit	Steel frit with ring for AS220	1
10445870	Dispenser for funnels	Dispenser for 100 mL and 350 mL funnels for MBS I	1
10445861	Funnel—100 mL	Plastic funnel of PP, autoclavable	20
10445866	Funnel—350 mL	Plastic funnel of PP, autoclavable	20
10445868	Autoclaving bags	For MBS I plastic funnels	20
10477602	PZ 001	Tweezers, stainless steel	1

Accessories and vacuum filtration apparatus

Vacuum and pressure pump*

Vacuum pumps are required especially in the fields of microbiological quality control, analyses, medicine, and production technology. The pumps are used for pumping gases, taking samples (even liquids in a vacuum), and evacuating vessels.

** 220 Volts. This product is only available in Europe*

Features and benefits

- AC model
- Contamination-free pumping of air, gases, and vapors
- High performance and minimum size
- Extremely quiet and smooth running
- Equipped with thermo switch and standard fuse
- Simple to use
- Maintenance free
- Oil-free membrane pump

Vacuum Pump VP003

Witt's bottle WT 100

For filtrate collection in an inserted container. The bottle is made of borosilicate glass. It has a replaceable round lid and side-mounted tubing nozzle for vacuum tubing 8 mm (inside diameter).

Forceps PZ 001

The stainless steel forceps with smooth angled jaws (104 mm long) are excellent for handling membrane filters. They are autoclavable and can be flame sterilized with ethanol.

Witt's Bottle WT 100 and Forceps PZ 001

Typical properties—vacuum and pressure pump

	Delivery (L/min) m^3/h	Vacuum (mbar absolute)	Pressure (bar)	Weight (kg)
VP003	3.6	< 100	4	11

Technical data—Witt's bottle WT 100

Apparatus selection	
Size	100 mm diameter
Height	160 mm
Capacity	1000 mL
Vacuum connection	Tubing nozzle 8 mm (inside diameter)

Ordering information—vacuum filtration apparatus accessories

Catalog number	Description	Quantity/pack
10470300	VP 003 electrical vacuum and pressure pump	1
10477601	WT 100 Witt's flask, 1000 mL with tubing nozzle	1
10477600	SF 100 suction flask, 1000 mL with tubing nozzle	1
10471700	SV 006 vacuum tubing, 1 m length	1
10477602	PZ 001 tweezers, stainless steel	1

Filtration devices

Whatman disposable filtration devices are designed to enable filtration of many types of samples. They are available in a wide variety of filter choices with a polypropylene or polycarbonate housing and utilize the most advanced construction methods and design features. This level of engineering provides for the finest disposable filtration devices possible.

Integrated syringeless filters and filter vials 90
- Mini-UniPrep 90
- Glass Mini-UniPrep G2 91
- UniPrep 95
- Autovial 97

Syringe filters (including syringe filters for automation) 99
- Whatman GD/X syringe filters 101
- Whatman GD/XP syringe filters 104
- Puradisc syringe filters 105
- SPARTAN syringe filters 110
- ReZist syringe filters 111
- Anotop syringe filters 112
- Uniflo syringe filters 116
- Roby syringe filters 118
- Protein Prep syringe filter for ÄKTA systems 119

Inline filters 120
- Polydisc filters 120
- Aqueous IFD/Solvent IFD 125

Capsule filters 126

Venting filters 137
- PolyVENT 137
- HEPA-VENT and HEPA-CAP 139

Vacuum protection filters 141

Integrated syringeless filters and filter vials

Whatman integrated syringeless filters and filter vials are preassembled, convenient filtration devices for removing particulates from samples. They replace syringe-coupled filtration devices with single disposable units, making sample preparation easier, faster, and more efficient.

Mini-UniPrep™ integrated syringeless filters and filter vials

Mini-UniPrep is a preassembled filtration device consisting of a 0.4 mL capacity chamber and a plunger. The plunger contains a filtration membrane at one end and a preattached cap/septum at the other. The plunger is pressed through the sample in the outer chamber and positive pressure forces the filtrate into the reservoir of the plunger. Air escapes through the vent hole until the locking ring is engaged, providing an air-tight seal. Within seconds, the Mini-UniPrep can be placed into any autosampler able to contain 2 mL vials for injection into your instrument.

The device can be used either manually or with a compressor unit. The multicompressor can process up to six samples at one time, further improving sample processing time and reducing the risk of hand stress. The Mini-UniPrep device is designed to fit into any autosampler accommodating 12 × 32 mm vials. Alternatively the septum can be pierced with a needle and the sample drawn off for manual injection into an analyzer.

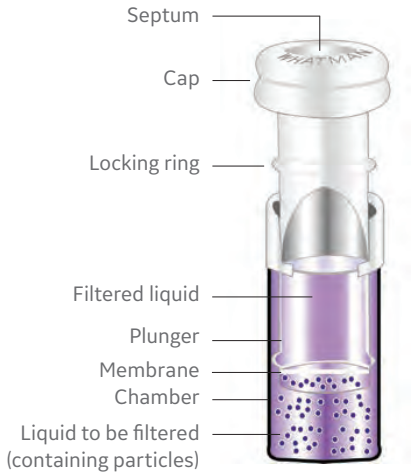
Mini-UniPrep Syringeless Filters

Features and benefits

- All-in-one filtration process allows you to process sample loads in one-third the time
- Wide range of membrane choices from 0.2 and 0.45 µm pore sizes to meet specific sample application requirements
- Compatible with most major autosamplers
- Fewer consumables required. Reduce costs by up to 40%

Applications

- Routine HPLC/UHPLC analysis
- Composite assays
- Content uniformity
- Protein precipitation
- Solubility testing
- Dissolution testing
- Sample filtration



A variety of Mini-UniPrep filters to meet your needs

For customers who need to filter light-sensitive samples, there is Amber Mini-UniPrep. Slit septa Mini-UniPrep is available for customers using robotics to maximize throughput.

Amber Mini-UniPrep filter vial

Protects samples from UV damage.

Features and benefits

- Amber colorant prevents photodegradation of light sensitive samples
- Same colorant used in pharmaceutical containers designed to meet United States Pharmacopeia specifications for light resistance
- Translucent amber chamber and plunger enable easy visual inspection

Applications

- Use with any compound that requires protection from light, such as catecholamines or vitamins

Slit septa Mini-UniPrep filter vial

For high-throughput automation.

Features and benefits

- Slit septum cap enables Mini-UniPrep use with current robotics on HPLC instruments for high throughput automation
- Durable yet flexible slit septum cap has been specially designed for instruments with sensitive sampling needs. Sample evaporation is minimal
- Pre-slit septa for easier needle penetration

Applications

- Use with standard robotics on HPLC instruments with sensitive needles, allowing for higher throughput

New Whatman Mini-UniPrep multi-compressor

Mini-UniPrep G2 Multi-compressor tray

Mini-UniPrep in an HPLC autosampler

Amber Mini-UniPrep filter vial

Selection—Mini-UniPrep filtering media

Sample type	Suitable Mini-UniPrep media
High particulate laden liquids	Glass Microfiber (GMF)
Aqueous/organic samples in 3 to 10 pH range	Nylon (NYL)
General filtration media/solvent based samples	Polypropylene (PP)
Chemically aggressive solutions	Polytetrafluoroethylene (PTFE)
Biological samples requiring low protein binding media	Regenerated Cellulose (RC) or Polyethersulfone (PES)
Aqueous/organic solvents—low nonspecific protein binding media	Polyvinylidene Difluoride (PVDF) or Regenerated Cellulose (RC)
Aqueous/organic solvents—high flow and loading capacity	Polypropylene Depth Filter non woven PP fibers

Typical properties—Mini-UniPrep integrated syringeless filters and filter vials

Dimensions	Equivalent in size to 12 × 32 mm vials
Materials of construction	
Housing and cap	Polypropylene
Filter media	As specified
Septa	PTFE coated silicone rubber
Filtering capacity	0.4 mL
Nominal force needed to compress	Approximately 18 lbs/8.2 kg
Maximum operating temperature	120°F (50°C)

Ordering information—Mini-UniPrep integrated syringeless filters and filter vials

Pore size (µm)	Catalog number	Media	Quantity/pack
Standard cap—translucent housing			
0.2	UN203NPENYL	Nylon	100
0.2	UN503NPENYL	Nylon	1000
0.45	UN203NPUNYL	Nylon	100
0.45	UN503NPUNYL	Nylon	1000
0.2	UN203NPEPES	PES	100
0.45	UN203NPUPES	PES	100
0.45	UN503NPUPES	PES	1000
0.2	UN203NPEAQU	PVDF	100
0.2	UN503NPEAQU	PVDF	1000
0.45	UN203NPUAQU	PVDF	100
0.45	UN503NPUAQU	PVDF	1000
0.2	UN203NPERC	RC	100
0.2	UN503NPERC	RC	1000
0.45	UN203NPURC	RC	100
0.45	UN503NPURC	RC	1000
0.2	UN203NPEORG	PTFE	100
0.2	UN503NPEORG	PTFE	1000
0.45	UN203NPUORG	PTFE	100
0.45	UN503NPUORG	PTFE	1000
0.2	UN203NPEPP	PP	100
0.2	UN503NPEPP	PP	1000
0.45	UN203NPUPP	PP	100
0.45	UN503NPUPP	PP	1000
0.45	UN203NPUDPP	DpPP	100
0.45	UN503NPUDPP	DpPP	1000
0.45	UN203NPUGMF	GMF	100
0.45	UN503NPUGMF	GMF	1000

PES—Polyethersulfone
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
RC—Regenerated Cellulose
DpPP—Polypropylene Depth Filter
GMF—Glass Microfiber
PP—Polypropylene

Ordering information—Mini-UniPrep integrated syringeless filters and filter vials (*continuation*)

Pore size (µm)	Catalog number	Media	Quantity/pack
Slit septum cap—translucent housing			
0.2	US203NPENYL	Nylon	100
0.2	US503NPENYL	Nylon	1000
0.45	US203NPUNYL	Nylon	100
0.2	US203NPEPES	PES	100
0.2	US503NPEPES	PES	1000
0.45	US203NPUPES	PES	100
0.2	US203NPEAQU	PVDF	100
0.2	US503NPEAQU	PVDF	1000
0.45	US203NPUAQU	PVDF	100
0.45	US503NPUAQU	PVDF	1000
0.2	US203NPEORG	PTFE	100
0.2	US503NPEORG	PTFE	1000
0.45	US203NPUORG	PTFE	100
0.45	US503NPUORG	PTFE	1000
0.2	US203NPEPP	PP	100
0.2	US503NPEPP	PP	1000
0.45	US203NPUPP	PP	100
0.45	US503NPUPP	PP	1000
0.45	US203NPUDPP	DpPP	100
0.45	US503NPUDPP	DpPP	1000
0.45	US203NPUGMF	GMF	100
0.45	US503NPUGMF	GMF	1000
Amber housing (for light sensitive samples)—standard cap			
0.2	UN203APENYL	Nylon	100
0.45	UN203APUNYL	Nylon	100
0.2	UN203APEPES	PES	100
0.45	UN203APUPES	PES	100
0.2	UN203APEAQU	PVDF	100
0.45	UN203APUAQU	PVDF	100
0.2	UN203APEORG	PTFE	100
0.45	UN203APUORG	PTFE	100
0.2	UN203APEPP	PP	100
0.45	UN203APUPP	PP	100
0.45	UN203APUDPP	DpPP	100
0.45	UN203APUGMF	GMF	100
Amber housing (for light sensitive samples)—slit septum cap			
0.45	US203APUNYL	Nylon	100
Accessories—multi-compressor			
–	MUPMCPBC8	Mini-UniPrep multi-compressor 1/pack comes with one tray	
–	MUPMCBT8	Mini-UniPrep multi-compressor tray 1/pack	

PES—Polyethersulfone
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
RC—Regenerated Cellulose
DpPP—Polypropylene Depth Filter
GMF—Glass Microfiber
PP—Polypropylene

Whatman Mini-UniPrep G2 integrated syringeless filters and glass vials

The Mini-UniPrep G2 includes an integral borosilicate glass vial housed within the plunger and a borosilicate glass chamber for holding the unfiltered liquid. It offers the same great Mini-UniPrep performance while minimizing the risk of extractable compounds from a plastic housing that might otherwise leach into your sample.

Technical specifications—Mini-UniPrep G2 integrated syringeless filters and glass vials

Dimensions	Once compressed, equivalent in size to 12 mm × 32 mm vial
Materials of construction	Chamber: Borosilicate glass Plunger outer housing: Polypropylene Plunger inner storage vial: Borosilicate glass Filter medium: As specified Septa: Silicone with PTFE liner Cap: Polypropylene
Maximum operating temp.	50°C (122°F)
Filtering capacity	Chamber (unfiltered sample): 500 µL Inner storage vial (filtered sample): 330 µL Recommended minimum filtering volume: 220 µL placed in the chamber to obtain 50 µL in inner storage vial
Nominal force needed to compress	Approx. 11.3 kg (25 lbs)
Autosampler compatibility	Any autosampler that accommodates standard 12 mm × 32 mm profile vials
Autosampler needle height adjustment	5 mm from bottom of Mini-UniPrep G2

Liquid storage capacity

Volume (µL)	Height of liquid in inner glass reservoir (mm)
50	4.3
100	7.0
150	10.3
200	12.4
250	15.4
300	18.4
350	21.4
410 (max.)	25.0

Mini-UniPrep G2 Multicompressor

Ordering information—Mini-UniPrep G2 integrated syringeless filters and glass vials

Membrane	Pore size (µm)	Housing	Cap	Catalog number*	Catalog number**	Catalog number***
PTFE	0.2	Translucent	Normal	GN203NPEORG	GN503NPEORG	GN203NPEORGSP
PTFE	0.2	Translucent	Slit septum	GS203NPEORG	GS503NPEORG	GS203NPEORGSP
PTFE	0.2	Amber	Normal	GN203APEORG	–	GN203APEORGSP
PTFE	0.45	Translucent	Normal	GN203NPUORG	GN503NPUORG	GN203NPUORGSP
PTFE	0.45	Translucent	Slit septum	GS203NPUORG	GS503NPUORG	GS203NPUORGSP
PVDF	0.2	Translucent	Normal	GN203NPEAQU	GN503NPEAQU	GN203NPEAQUSP
PVDF	0.2	Translucent	Slit septum	GS203NPEAQU	GS503NPEAQU	GS203NPEAQUSP
PVDF	0.2	Amber	Normal	GN203APEAQU	–	GN203APEAQUSP
PVDF	0.45	Translucent	Normal	GN203NPUAQU	GN503NPUAQU	GN203NPUAQUSP
PVDF	0.45	Translucent	Slit septum	GS203NPUAQU	GS503NPUAQU	GS203NPUAQUSP
RC	0.2	Translucent	Normal	GN203NPERC	GN503NPERC	GN203NPERCSP
RC	0.45	Translucent	Normal	GN203NPURC	GN503NPURC	GN203NPURCSP
Nylon	0.2	Translucent	Normal	GN203NPENYL	GN503NPENYL	GN203NPENYLSP
Nylon	0.2	Translucent	Slit septum	GS203NPENYL	GS503NPENYL	GS203NPENYLSP
PP	0.2	Translucent	Normal	GN203NPEPP	GN503NPEPP	GN203NPEPPSP
PP	0.2	Translucent	Slit septum	GS203NPEPP	–	GS203NPEPPSP
Glass fiber	0.45	Translucent	Normal	GN203NPUGMF	GN503NPUGMF	GN203NPUGMFSP
Glass fiber	0.45	Translucent	Slit septum	GS203NPUGMF	–	GS203NPUGMFSP
Hand compressor						
Mini-UniPrep G2 hand compressor 1/pack						MUPG2HCPWC1
Multi-compressor						
Mini-UniPrep G2 multi-compressor 1/pack, comes with one tray						MUPG2MCPWC8
Mini-UniPrep G2 multi-compressor tray 1/pack						MUPG2MCWT8

* *100 pack*
** *1000 pack*
*** *100 pack—starter pack with hand compressor*

PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene difluoride
RC—Regenerated Cellulose
PP—Polypropylene

UniPrep™ filter vials

UniPrep filter vials are preassembled filtration devices for the filtration and storage of laboratory samples. These devices are quick and easy to use and feature a plunger, filter, and vial in one unit. They replace syringe-coupled filtration devices with single, disposable units.

UniPrep devices consist of two parts: a test tube and a filter-plunger. The design incorporates a prefilter and a membrane into the tip of the plunger. When the filter-plunger is pressed through the liquid placed in the test tube, positive pressure forces the filtrate up into the reservoir of the filter-plunger.

UniPrep devices function in a similar way to the Mini-UniPrep. However, UniPrep does not contain a septum in the cap and can be used to filter larger volumes (1 to 5 mL).

UniPrep Syringeless Filters

Features and benefits

- Integral storage vial saves time and minimizes laboratory waste
- Built-in glass fiber prefilter means even difficult samples are quick and easy to prepare
- Choice of membranes for wide sample compatibility

Applications

- Sample preparation (e.g. prior to preparative HPLC)
- Difficult-to-filter samples
- Quick filtration of samples

The UniPrep filter vial is selected based on compatibility with the sample in use. In manual operation, the filter-plunger, after the tip comes in contact with the liquid, is slowly pushed into the test tube until it stops at the bottom. The UniPrep is emptied either by decanting into a sample or autosampler vial or by drawing the filtered sample into a syringe for manual injection into an instrument.

UniPrep membranes for various applications

- **GMF:** Layered glass microfiber depth filter for use with samples containing aqueous or organic solvents (indicated pore size is the particle retention rating)
- **NYL:** Naturally hydrophilic membrane for filtration of samples containing aqueous or organic solvents with a pH range of 3-10
- **PTFE:** Chemically inert PTFE membrane for filtration of samples containing > 50% organic solvent
- **PVDF:** Low protein binding membrane for filtration of samples with aqueous or aqueous/organic solvent composition

Typical properties—UniPrep filter vials

Housing	Polypropylene
Filtration area	0.3 cm^2
Capacity	1-5 mL
Volume hold-up	50 µL
Prefilter	Glass fiber
Sterilization	Autoclave: 121°C at 15 psi (1 bar) for 20 min.

Ordering information—UniPrep filter vials

Pore size (µm)	Catalog number	Media	Quantity/pack
0.2	UN113ENYL	Nylon	50
0.45	UN113UNYL	Nylon	50
0.2	UN113EAQU	PVDF	50
0.45	UN113UAQU	PVDF	50
0.45	UN513UAQU	PVDF	1000
0.2	UN113EORG	PTFE	50
0.45	UN113UORG	PTFE	50
0.45	UN513UORG	PTFE	1000
0.45*	UN113UGMF	GMF	50

** Particle retention rating*

GMF—Glass Microfiber
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Autovial™ filter vials

Autovial filter vials are preassembled filtration devices for removing particulates from samples. They replace syringe-coupled filtration devices with single, disposable units.

Autovial devices are comprised of two parts: a graduated filter barrel and a plunger. The proven design features an integral filter, built-in air purge and a support stand that protects the recessed slip-luer tip. They are available in a 5 mL and 12 mL volume capacity.

The Autovial filter is selected according to membrane compatibility with the sample. In practice, the sample is poured into the 5 mL or 12 mL capacity filter barrel. A plunger is inserted into the barrel until the bottom is securely in place; there is a gap of air between the sample and plunger. Then, the tip of the Autovial is placed into the mouth of an autosampler vial or container and the plunger compressed. Filtration begins immediately and, as the plunger is compressed until it reaches the bottom, the membrane is purged with air for maximum sample recovery. For direct instrument injection, a needle is placed on the Autovial slip-luer outlet.

Features and benefits

- Single unit convenience—pre-assembled and easy to load
- Choice of filter media. Compatible with a wide range of sample types
- Excellent for hazardous samples. Self-contained device removes the risk of filter pop-off
- Built-in air purge maximizes sample recovery
- Sterile option available to maintain sample integrity
- Glass fiber or polypropylene prefilter in selected 12 mL vials—for difficult-to-filter samples

Autovial membranes for various applications

- **CA:** Low nonspecific protein binding and high loading capacity membrane for biological solutions
- **GMF:** Glass microfiber depth filter for samples in aqueous or organic solutions
- **NYL:** Nylon membrane for aqueous and organic samples within a pH range of 3 to 10
- **PES:** Low nonspecific protein binding membrane for samples in aqueous solutions
- **PP:** Hydrophobic membrane, resistant to a wide range of organic solvents
- **PTFE:** For samples with > 50% organic solvent
- **PVDF:** Low nonspecific protein binding membrane for samples in aqueous solutions and/or organic solvents

Autovial Syringeless Filters

Typical properties—Autovial filter vials

	Autovial 5	**Autovial 12**
Housing	Polypropylene	Polypropylene
Filtration area	1.7 cm^2	3.0 cm^2
Capacity	5 mL	12 mL
Volume hold-up	30 µL	140 µL
Outlet connection	Male slip luer	Male slip luer
Sterilization	Autoclave at 121°C for 20 min	Autoclave at 121°C for 20 min

Ordering information—Autovial filter vials

Pore size (µm)	**Catalog number**	**Media**	**Sterile**	**Quantity/pack**
Autovial 5—no prefilter				
0.45	AV115NPUNYL**	Nylon	No	50
0.45	AV115NPUAQU**	PVDF	No	50
0.2	AV115NPEORG**	PTFE	No	50
0.45	AV115NPUORG**	PTFE	No	50
0.45*	AV115UGMF**	GMF	No	50
Autovial 12—with glass prefilter				
0.45	AV125UCA	CA	No	50
0.2	AV125SNAO	Nylon	Yes	40
0.2	AV125ENAO	Nylon	No	50
0.45	AV125UNAO	Nylon	No	50
0.45	AV525UNAO	Nylon	No	1000
0.45	AV125NPUPSU**	PES	No	50
0.2	AV125SAQU	PVDF	Yes	40
0.2	AV125EAQU	PVDF	No	50
0.45	AV125UAQU	PVDF	No	50
0.45	AV525UAQU	PVDF	No	1000
0.45	AV125NPUAQU**	PVDF	No	50
0.2	AV125EORG	PTFE	No	50
0.45	AV125UORG	PTFE	No	50
0.45	AV525UORG	PTFE	No	1000
0.45*	AV125UGMF	GMF	No	50
Autovial 12—with polypropylene prefilter				
0.2	AV125EPP	PP	No	50
0.45	AV125UPP	PP	No	50

* *Particle retention rating*
** *No prefilters*

CA—Cellulose Acetate
GMF—Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Guide to laboratory filtration

Filtration devices for small volume sample preparation

Select the optimal Whatman filter for your application

Step 1: Choose application
Step 2: Choose appropriate filter

Start here

Applications

1. Air venting
2. Automated filtration of samples/ Tablet dissolution testing
3. Biological sample preparation
4. Capillary electrophoresis
5. Difficult to filter samples (high solid content samples)
6. Filtration of colloidal material
7. HPLC/UHPLC sample preparation
8. Ion-chromatography
9. Filtration of protein containing samples
10. Filtration of nano particles
11. Sterile filtration (use sterile filter and membrane with pore size 0.2 µm)
12. COD/TOC/DOC
13. Trace metal analysis (ICP/AAS/ICP-MS)
14. UV/VIS analysis

COD = Chemical oxygen demand;
TOC = Total organic carbon;
DOC = Dissolved organic carbon
Note: For guidance. Only a selection of applications shown above

Puradisc FP
3* 4 9*
11 14
*Notes:
3 and 9: CA

Puradisc Aqua 30
12 13

ReZist™
1 4 7 14

Protein Prep for ÄKTA™
9

Puradisc
3* 4 7 9*
11 12* 13* 14
*Notes:
3 & 9: CA, PES, PVDF
12 & 13: PES

Anotop™
3 4 6 7 8
9 10* 11 14
*Notes: 0.02 µm

Mini-UniPrep™ G2
2 7

Anotop Plus
4 5 7 10*
*Notes: 0.02 µm

Mini-UniPrep
2 7

Roby
2

GD/XP
4 5 7 8
12 13 14

Uniflo™
3 4 7 11
12 13 14

SPARTAN™
4 7 9 14

Whatman GD/X™
4 5
7 11 14

Syringe filters

Whatman disposable syringe filter devices are designed to provide fast and efficient filtration of aqueous and organic solutions. They are made with a wide variety of membrane filters with a polypropylene or polycarbonate housing using the most advanced methods and design features available today. These syringe filters are suitable for numerous applications in pharmaceutical, environmental, biotechnology, food/beverage, and agricultural testing laboratories.

Whatman syringe filters are composed of either pure polypropylene or polycarbonate housing, and heat sealed without the use of glues or sealants.

Safety—applicable to ALL syringe filters

Syringe use can result in high pressure. The smaller the syringe, the higher the pressure that can be generated. As a general guide, the following pressures can be obtained by hand with the syringes indicated:

- 20 mL—30 psi (2 bar)
- 10 mL—50 psi (3.4 bar)
- 5 mL—75 psi (5.2 bar)
- 3 mL—100 psi (6.9 bar)
- 1 mL—150 psi (10.3 bar)

Individual users should determine the pressure they generate by hand with a specific size syringe and take appropriate safety precautions not to exceed the recommended rating for the device used. If the limitations are exceeded, the device may burst.

See appendix section for summary of typical properties, product availability and application guidance.

Product overview—syringe filters

Diameter (mm)	Filters	Features	Media
10, 25	Anotop	• Use with most organic solvents and aqueous materials	Anopore
10, 25	Anotop Plus	• Suitable for ion chromatography • Low levels of anion leaching	Anopore
13, 25	GD/X	• Contains proprietary prefiltration stack of Whatman GMF 150 and Grade GF/F • 3x flow rates compared to unprotected membrane	CA, PTFE, Nylon, PP, PES, PVDF, GMF, RC
25	GD/XP	• Contains proprietary polypropylene prefiltration stack • Suitable for inorganic ion analysis	Nylon, PVDF, PP, PES, PTFE, Depth Polypropylene
4, 13, 25	Puradisc	• Designed for manual operation	PTFE, Nylon, PP, PES, CA PVDF, GMF, DpPP
13, 30	Puradisc FP	• Polycarbonate housing	CA, CN, RC
30	Puradisc Aqua	• Filtration of environmental samples prior to COD and DOC	CA
25	Roby 25	• Designed to be compatible with the major dissolution test systems	CA, Nylon, RC, GMF
13, 30	ReZist	• PTFE for HPLC sample prep	PTFE, GF
13, 30	SPARTAN	• Optimized for HPLC sample prep, HPLC certified, batch certificate can be downloaded. Compatible with organic and aqueous solvents	RC
13, 25	Uniflo	• Overmolded syringe filter • Disposable filter units designed to provide clean filtrate up to 100 mL	PTFE, Nylon, PES, PVDF

CA—Cellulose Acetate
CN—Cellulose Nitrate
GMF—Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
RC—Regenerated Cellulose
DpPP—Polypropylene Depth Filter

Whatman GD/X™ syringe filters

The Whatman GD/X range is specifically designed for high particulate loaded samples. Constructed of a pigment-free polypropylene housing with a prefiltration stack of Whatman GMF 150 (graded density) and GF/F glass microfiber media, these filters remove sample contamination and allow you to filter even the most difficult samples with less hand pressure. GD/X syringe filters can process three to seven times more sample volume than standard syringe filters.

GMF 150 and GF/F are produced from 100% borosilicate glass microfiber. Graded density GMF 150 medium has a coarse top layer meshed with a fine bottom layer that retains particles to 1.0 µm. A GF/F filter then retains particles down to 0.7 µm. The prefilter stack ends with a final membrane.

The filter construction facilitates exceptional loading capacity with fast flow rates. This prevents the build up of back pressure typically caused by the blocking of an unprotected membrane.

Whatman GD/X Syringe filter

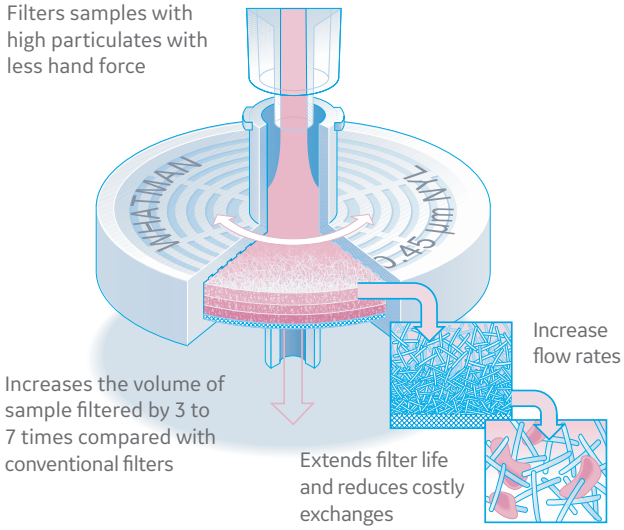
Features and benefits

- 13 mm devices for samples up to 10 mL and 25 mm devices for samples greater than 10 mL (however, the volume of sample that can be filtered through each filter depends on the characteristics of the sample)
- Sterile options
- Pigment-free polypropylene housing
- Prefiltration stack of Whatman GMF 150 (graded density) and GF/F glass microfiber media
- Minimizes sample contamination
- Requires less hand pressure, even with the most difficult samples
- Processes three to seven times more sample volume

Applications

Whatman GD/X syringe filters are excellent for heavily particulate-laden samples found in:

- Dissolution testing
- Content uniformity
- Concentration analysis
- Routine sample preparation
- Food analysis
- Environmental samples
- Composite assay



Typical properties—Whatman GD/X syringe filters

	GD/X 13 mm	GD/X 25 mm
Housing	Polypropylene (pigment free)	Polypropylene (pigment free)
Filtration area	1.3 cm^2	4.6 cm^2
Maximum pressure	100 psi (6.9 bar)	75 psi (5.2 bar)
Volume hold-up*—full housing —with air purge	0.5 mL 50 µL (approx)	1.4 mL 250 µL (approx)
Dimensions*	20.8 × 30.0 mm	20.8 × 30.0 mm
Weight	3 g (approx)	3 g (approx)
Flow direction	Flow should enter from the inlet	Flow should enter from the inlet
Inlet connection	Female luer lock	Female luer lock
Outlet connection	Male luer	Male luer
Sterlization	Autoclave at 121°C (131°C max) at 15 psi (1 bar) for 20 min	Autoclave at 121°C (131°C max) at 15 psi (1 bar) for 20 min
Glass microfiber prefiltration media	100% borosilicate glass fiber GMF 150 10 µm: 1 µm GF/F 0.7 µm	100% borosilicate glass fiber GMF 150 10 µm: 1 µm GF/F 0.7 µm

* *Housings are the same size but the filtration size is smaller*

Ordering information—Whatman GD/X syringe filters

Pore size (µm)	Catalog number	Media	Quantity/pack
GD/X 13 mm—nonsterile			
0.2	6880-1302	CA	150
0.45	6880-1304	CA	150
0.2	6870-1302	Nylon	150
0.2	6871-1302	Nylon	1500
0.45	6870-1304	Nylon	150
0.45	6871-1304	Nylon	1500
0.2	6876-1302	PES	150
0.45	6876-1304	PES	150
0.2	6872-1302	PVDF	150
0.45	6872-1304	PVDF	150
0.45	6873-1304	PVDF	1500
0.2	6878-1302	PP***	150
0.45	6878-1304	PP***	150
0.2	6874-1302	PTFE	150
0.2	6875-1302	PTFE	1500
0.45	6874-1304	PTFE	150
0.45	6875-1304	PTFE	1500
1.6*	6882-1316	GF/A**	150
1.0*	6884-1310	GF/B**	150
1.2*	6886-1312	GF/C**	150
2.7*	6888-1327	GF/D**	150
0.7*	6890-1307	GF/F**	150
0.45*	6894-1304	GMF	150

* *Glass microfiber particle retention rating*
** *Contains GMF 150 without the GF/F prefilter*
*** *Mildly hydrophobic*

CA—Cellulose Acetate
GF—Glass Fiber
GMF - Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Ordering information—Whatman GD/X syringe filters *(continuation)*

Pore size (µm)	Catalog number	Media	Quantity/pack
GD/X 25 mm—nonsterile			
0.2	6887-2502	RC	150
0.45	6882-2504	RC	150
0.2	6888-2502	RC	1500
0.45	6883-2504	RC	1500
0.2	6880-2502	CA	150
0.45	6880-2504	CA	150
0.45	6881-2504	CA	1500
0.2	6869-2502	Nylon high charge (positive)	150
0.45	6869-2504	Nylon high charge (positive)	150
0.2	6870-2502	Nylon	150
0.2	6871-2502	Nylon	1500
0.45	6870-2504	Nylon	150
0.45	6871-2504	Nylon	1500
5.0	6870-2550	Nylon	150
5.0	6871-2550	Nylon	1500
0.2	6876-2502	PES	150
0.2	6905-2502	PES	1500
0.45	6876-2504	PES	150
0.45	6905-2504	PES	1500
0.2	6872-2502	PVDF	150
0.2	6873-2502	PVDF	1500
0.45	6872-2504	PVDF	150
0.45	6873-2504	PVDF	1500
0.2	6878-2502	PP	150
0.45	6878-2504	PP	150
0.45	6879-2504	PP	1500
0.2	6874-2502	PTFE	150
0.2	6875-2502	PTFE	1500
0.45	6874-2504	PTFE	150
0.45	6875-2504	PTFE	1500
1.6*	6882-2516	GF/A**	150
1.6*	6883-2516	GF/A**	1500
1.0*	6884-2510	GF/B**	150
1.2*	6886-2512	GF/C**	150
2.7*	6888-2527	GF/D**	150
0.7*	6890-2507	GF/F**	150
0.7*	6891-2507	GF/F**	1500
0.45*	6894-2504	GMF**	150
0.45*	6895-2504	GMF**	1500
1.5*	6892-2515	934-AH**	150
GD/X 25 mm—sterile			
0.2	6896-2502	PES	50
0.45	6896-2504	PES	50
0.2	6897-2502	PES	500
0.45	6897-2504	PES	500
0.2	6900-2502	PVDF	50
0.45	6900-2504	PVDF	50
0.45*	6902-2504	GMF**	50
0.2	6901-2502	CA	50
0.45	6901-2504	CA	50

* *Glass microfiber particle retention rating*
** *Contains GMF 150 without the GF/F prefilter*

CA—Cellulose Acetate
GF—Glass Fiber
GMF—Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
RC—Regenerated Cellulose

GD/XP syringe filters

Whatman GD/XP disposable syringe filters are designed for use with samples that require inorganic ion analysis, as levels of ion extractables are minimized. They are also an alternative choice for users requiring a filter that exhibits extremely low protein binding characteristics.

GD/XP syringe filters contain a two layer prefilter stack comprised of 20 µm and 5 µm polypropylene filters. The last stage of filtration is a choice of membrane, which is positioned below the prefilter stack.

Applications

- HPLC sample preparation
- Trace metal analysis
- Sample preparation prior to determination of dissolved heavy metals

GD/XP Syringe Filters—Prefilter

Typical properties—GD/XP syringe filters

	GD/XP 25 mm
Housing	Polypropylene (pigment free)
Filtration area	4.6 cm^2
Maximum pressure	75 psi (5.2 bar)
Volume hold-up full housing with air purge	1.4 mL 250 µL (approx)
Dimensions	20.8 × 30.0 mm
Weight	3 g (approx)
Flow direction	Flow should enter from the inlet
Inlet connection	Female luer lock
Outlet connection	Male luer
Sterlization	Autoclave at 121°C (131°C max) at 15 psi (1 bar) for 20 min
Prefiltration media	PP 20 µm: 5 µm

Ordering information—GD/XP syringe filters

Diameter (mm)	Pore size (µm)	Catalog number	Media	Hydrophilic	Quantity/pack
25	0.45	6970-2504	Nylon	Yes	150
25	0.45	6971-2504	Nylon	Yes	1500
25	0.45	6994-2504	PES	Yes	150
25	0.45	6995-2504	PES	Yes	1500
25	0.45	6972-2504	PVDF	Yes	150
25	0.45	6973-2504	PVDF	Yes	1500
25	0.45	6978-2504	PP	No	150
25	0.45	6992-2504	DpPP	No	150
25	0.45	6974-2504	PTFE	No	150
25	0.45	6993-2504	DpPP	No	1500

DpPP—Polypropylene Depth Filter
PES—Polyethersulfone
PP—Polypropylene
PVDF—Polyvinylidene Difluoride
PTFE—Polytetrafluoroethylene

Puradisc syringe filters

Puradisc syringe filters combine premium quality and economy. They are used for the quick, efficient filtration of samples up to 100 mL volume.

Puradisc filters are produced from pigment-free polypropylene or polycarbonate with standard inlet (female luer lock) and outlet (male luer) connections (unless otherwise stated). Options include a sterile, medical-grade blister pack for critical applications and a special tube tip outlet that allows the sample to be accurately dispensed into a micro-vial, removing air lock.

Features and benefits

- Pigment-free polypropylene (polycarbonate for Puradisc FP 30 and Aqua 30)
- Standard inlet and outlet luer connectors
- Optional sterile, medical-grade blister pack
- Tube-tip format (optional) for accurate dispensing into a micro-vial
- Choice of membrane or glass microfiber filter media
- Choice of filter sizes (4, 13, 25 or 30 mm) to minimize sample loss
- Sterile option for critical applications
- Wide range of membranes

Puradisc 4

Features

- 4 mm diameter syringe filter
- Sample volume up to 2 mL
- Low hold-up volume < 10 µL ensures maximum sample recovery
- Tube-tip format (optional)

Applications

- HPLC samples containing low solid content—filtration will improve column life
- CE (Capillary Electrophoresis) samples—filtration will remove spurious peaks
- Sterile[#] filtration of low volume samples
- UV/Vis samples—filter directly into cuvette using tube tip
- Refractometry—filter samples to prevent damage to instrument optics and improve accuracy of results
- Minimizing nonspecific binding to membrane (due to small membrane size)

Puradisc 13

Features

- 13 mm diameter syringe filter
- Sample volume up to 10 mL
- Low hold-up volume < 25 µL ensures maximum sample recovery
- Glass microfiber option available
- Tube-tip format (optional)

Applications

- Biological sample preparation
- HPLC sample preparation

Puradisc 13 syringe filters with tube tip

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Puradisc 25

Features

- 25 mm diameter syringe filter
- Sample volume up to 100 mL
- Low hold-up volumes for maximum sample recovery
- Glass microfiber option available

Applications

- HPLC aqueous sample preparation
- Biological sample preparation
- Buffer solutions
- Salt solutions
- Tissue culture media
- Irrigation solutions
- Sterile# isolation

Puradisc 25 syringe filters

Puradisc FP 30

Features

- 30 mm diameter
- Larger filtration area (44% greater in comparison with 25 mm)
- Designed for aqueous samples

Puradisc FP 30 syringe filter

Puradisc Aqua 30

Specifically designed for filtration of environmental samples prior to COD and DOC analysis. The membranes used in these devices are prewashed prior to assembly of the filters so as to reduce the organic carbon level.

Typical properties—Puradisc syringe filters

	Puradisc 4	Puradisc 13	Puradisc 25	Puradisc 30/Aqua 30
Housing	Polypropylene	Polypropylene	Polypropylene	Polycarbonate
Filtration area	0.2 cm^2	1.3 cm^2	4.2 cm^2	5.7 cm^2
Maximum pressure	75 psi (5.2 bar)	75 psi (5.2 bar)	75 psi (5.2 bar)	100 psi (6.9 bar)
Volume hold-up full housing with air purge	< 10 µL	< 25 µL	< 100 µL	< 50 µL
Dimensions	10.1 × 23.5 mm	16.3 × 19.8 mm	22.9 × 28.4 mm	26 × 34 mm
Weight	0.55 g	0.95 g	2.7 g	4.7 g
Volume throughput	Up to 2 mL	Up to 10 mL	Up to 100 mL	Up to 100 mL
Inlet connection	Female luer lock	Female luer lock	Female luer lock	Female luer lock
Outlet connection	Male luer	Male luer	Male luer	Male luer
Sterlization	Autoclave at 121°C (131°C max)	Autoclave at 121°C (131°C max)	Autoclave at 121°C (131°C max)	Autoclave at 121°C (131°C max)

Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).

Ordering information—Puradisc 4 mm syringe filters

	Catalog number			
Pore size (µm)	**Nylon**	**PVDF**	**PTFE**	**Quantity/pack**
Nonsterile with tube tip				
0.2	–	6777-0402	–	50
0.45	–	6777-0404	–	50
Sterile without tube tip				
0.2	6786-0402	6791-0402	–	50
Nonsterile without tube tip				
0.2	6789-0402	6779-0402	6784-0402	100
0.2	6790-0402	6792-0402	6783-0402	500
0.45	6789-0404	6779-0404	6784-0404	100
0.45	6790-0404	6792-0404	6783-0404	500

PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Ordering information—Puradisc 13 mm syringe filters (nonsterile)

	Catalog Number							Quantity/ pack
Pore size (µm)	**CA**	**Nylon**	**PES**	**PVDF**	**PP**	**PTFE**	**GMF**	
With tube tip								
0.2	–	–	–	6777-1302	–	6775-1302	–	50
0.2	–	–	–	6778-1302	–	–	–	50
0.45	–	–	–	6777-1304	–	6775-1304	–	50
Without tube tip								
0.1	–	6789-1301	–	–	–	6784-1301	–	100
0.2	–	6789-1302	6782-1302	6779-1302	6788-1302	6784-1302	–	100
0.2	–	6790-1302	–	6792-1302	6785-1302	6783-1302	–	500
0.2	–	6768-1302	–	6765-1302	–	6766-1302	–	2000
0.45	6771-1304	6789-1304	6782-1304	6779-1304	6788-1304	6784-1304	–	100
0.45	–	6790-1304	6781-1304	6792-1304	6785-1304	6783-1304	6818-1304	500
0.45	–	6768-1304	–	6765-1304	–	6766-1304	–	2000
1.0	–	–	–	–	–	6784-1310	–	100
5.0	–	–	–	–	–	6784-1350		100
GF/F 0.7*	–	–	–	–	–	–	6825-1307	100
GF/B 1.0*	–	–	–	–	–	–	6821-1310	100
GF/C 1.2*	–	–	–	–	–	–	6822-1312	100
GF/A 1.6*	–	–	–	–	–	–	6820-1316	100
GF/A 1.6	–	–	–		–	–	6806-1316	500
GF/D 2.7*	–	–	–	–	–	–	6823-1327	100
934-AH 1.5*	–	–	–	–	–	–	6827-1315	100

** Particle retention rating*

CA—Cellulose Acetate
GMF—Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Ordering information—Puradisc 13 mm syringe filters (sterile)

	Catalog number		
Pore size (µm)	**PVDF**	**PES**	**Quantity/pack**
Without tube tip			
0.2	6791-1302	6780-1302	50
0.45	6791-1304	6780-1304	50

PES—Polyethersulfone
PVDF—Polyvinylidene Difluoride

Ordering information—Puradisc FP 13 syringe filters (sterile)

Pore size (µm)	**Media**	**Catalog number**	**Quantity/pack**
With mini tip			
0.2	Regenerated Cellulose	10462940	50
Without mini tip			
0.2	Regenerated Cellulose	10462945	50

Ordering information—Puradisc 25 mm syringe filters

	Catalog number							
Pore size (µm)	**Nylon**	**PES**	**PVDF**	**PP**	**PTFE**	**GMF**	**DpPP**	**Quantity/pack**
Sterile								
0.2	–	6780-2502	–	–	–	–	–	50
0.2	–	6794-2512	–	–	–	–	–	1000
0.45	–	6780-2504	–	–	–	–	–	50
0.45	–	6794-2514	–	–	–	–	–	1000
1.0	–	6780-2510	–	–	–	–	–	50
Nonsterile								
0.1	–	–	–	–	6784-2501	–	–	50
0.1	–	–	–	–	6798-2501	–	–	1000
0.2	6750-2502	–	6746-2502	6786-2502	6784-2502	–	–	50
0.2	6751-2502	6781-2502	6747-2502	6788-2502	6785-2502	–	–	200
0.2	6753-2502	6794-2502	–	6790-2502	6798-2502	–	–	1000
0.45	6750-2504	–	6746-2504	–	6784-2504	–	6786-2504	50
0.45	6751-2504	6781-2504	6747-2504	–	6785-2504	–	6788-2504	200
0.45	6752-2504	–	–	–	–	–	–	500
0.45	6753-2504	6794-2504	6749-2504	–	6798-2504	–	6790-2504	1000
0.7 GF/F*	–	–	–	–	–	6825-2517	–	50
0.7 GF/F*	–	–	–	–	–	6825-2527	–	200
0.7 GF/F*	–	–	–	–	–	6787-2520	–	1000
1.0	6750-2510	–	–	–	6784-2510	–	–	50
1.0	6751-2510	6781-2510	–	–	–	–	–	200
1.0	6753-2510	6794-2510	–	–	6798-2510	–	–	1000
1.0 GD 1*	–	–	–	–	–	6783-2510	–	100
1.0 GD 1*	–	–	–	–	–	6792-2510	–	1000
2.0 GD 2*	–	–	–	–	–	6783-2520	–	100

* *Particle retention rating*

DpPP—Polypropylene Depth Filter
GD—Graded Density
GMF—Glass Microfiber
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride

Ordering information—Puradisc FP 30 mm syringe filters

Pore size (µm)	Catalog number	Description	Media housing	Connection in/out	Color code	Quantity/pack
0.2	10462200*	FP 30 CA-S	CA/PC	FLL/ML	Red	50
0.2	10462701	FP 30 CA	CA/PC	FLL/ML	Red	50
0.2	10462710	FP 30 CA	CA/PC	FLL/ML	Red	100
0.2	10462700	FP 30 CA	CA/PC	FLL/ML	Red	500
0.45	10462100*	FP 30 CA-S**	CA/PC	FLL/ML	White	50
0.45	10462601	FP 30 CA	CA/PC	FLL/ML	White	50
0.45	10462610	FP 30 CA	CA/PC	FLL/ML	White	100
0.45	10462600	FP 30 CA	CA/PC	FLL/ML	White	500
0.8	10462241	FP 30 CA	CA/PC	FLL/ML	Green	50
0.8	10462240*	FP 30 CA-S**	CA/PC	FLL/ML	Green	50
0.8	10462243	FP 30 CA	CA/PC	FLL/ML	Green	500
1.2	10462260*	FP 30 CA-S	CA/PC	FLL/ML	Orange	50
1.2	10462261	FP 30 CA	CA/PC	FLL/ML	Orange	50
1.2	10462263	FP 30 CA	CA/PC	FLL/ML	Orange	500
5.0	10462000*	FP 30 CN-S	CN/PC	FLL/ML	Black	50
5.0	10462520	FP 30 CN	CN/PC	FLL/ML	Black	50
5.0	10462510	FP 30 CN	CN/PC	FLL/ML	Black	100
5.0	10462500	FP 30 CN	CN/PC	FLL/ML	Black	500
Luer-lock outlet						
0.2	10462205*	FP 30 CA-S**	CA/PC	FLL/MLL	Red	50
0.2	10462206	FP 30 CA	CA/PC	FLL/MLL	Red	500
0.2	10462300*	FP 30	PTFE/PC	FLL/ML	Blue	50

* *Sterile*
** *Edotoxin-free according to LAL test (USPXXII), sensitivity: 0.25 EU/mL*

CA—Cellulose Acetate
CN—Cellulose Nitrate
FLL—Female Luer Lock
ML—Male Luer
MLL—Male Luer Lock
PC—Polycarbonate

Ordering information—Puradisc Aqua 30 mm syringe filters

Pore size (µm)	Catalog number	Description	Media housing	Connection in/out	Color code	Quantity/pack
0.45	10462656	Aqua 30 CA	CA/PC	FLL/ML	White	50
0.45	10462655	Aqua 30 CA	CA/PC	FLL/ML	White	100
0.45	10462650	Aqua 30 CA	CA/PC	FLL/ML	White	500

CA—Cellulose Acetate
PC—Polycarbonate
FLL—Female Luer Lock
ML—Male Luer

Puradisc Syringe Filters

SPARTAN™ HPLC certified syringe filters

SPARTAN syringe filters ensure reproducible results from the filtration of organic or aqueous solutions for HPLC. For batch-to-batch consistency, the SPARTAN range of filters is tested and certified for the absence of UV-absorbing substances at wavelengths of 210 and 254 nm with water, methanol, and acetonitrile.

Features and benefits

- Ready-to-use filter unit with a hydrophilic, low protein-binding membrane made of regenerated cellulose
- Excellent chemical resistance against the standard aqueous and organic HPLC solvents
- 13 mm diameter with extremely low dead volume < 10 µL
- Use for any application requiring a chemically resistant, hydrophilic, low protein-binding membrane
- Documented batch-to-batch quality and consistency ensure reproducible results
- 13 mm diameter with Mini-Tip outlet is excellent for filtration into very small sample bottles

Applications

- Filtration of organic and aqueous solutions in HPLC with reproducible results
- Purification of aqueous and organic solutions
- Filtration of protein solutions

Technical tip

Download your SPARTAN 13 and 30 batch certificate from the Internet to document the unequalled purity of each batch.

To download, visit the gelifesciences.com/support/quality/certificates. Enter the lot number, and you will receive the lot-specific chromatogram and test conditions.

SPARTAN 30 mm syringe filter

Ordering information—SPARTAN HPLC certified syringe filters

Diameter (mm)	Pore size (µm)	Catalog number	Media/housing	Connection (in/out)	Color code	Quantity/pack
13	0.2	10463040	RC/PP	FLL/Mini-tip	Dark brown	100
13	0.2	10463042	RC/PP	FLL/Mini-tip	Dark brown	500
13	0.2	10463100	RC/PP	FLL/ML	Dark brown	100
13	0.2	10463102	RC/PP	FLL/ML	Dark brown	500
13	0.45	10463030	RC/PP	FLL/Mini-tip	Light brown	100
13	0.45	10463032	RC/PP	FLL/Mini-tip	Light brown	500
13	0.45	10463110	RC/PP	FLL/ML	Light brown	100
13	0.45	10463112	RC/PP	FLL/ML	Light brown	500
30	0.2	10462960*	RC/PP	FLL/ML	Dark brown	50
30	0.2	10463060	RC/PP	FLL/ML	Dark brown	100
30	0.2	10463062	RC/PP	FLL/ML	Dark brown	500
30	0.45	10462950*	RC/PP	FLL/ML	Light brown	50
30	0.45	10463053	RC/PP	FLL/ML	Light brown	50
30	0.45	10463050	RC/PP	FLL/ML	Light brown	100
30	0.45	10463052	RC/PP	FLL/ML	Light brown	500

* *Sterile filters*

FLL—Female Luer Lock
ML—Male Luer
PP—Polypropylene
RC—Regenerated Cellulose

ReZist™ syringe filters

The Whatman ReZist range of syringe filters has been specifically designed to be resistant to organic solvents. These filters are suitable for the clarification of aggressive organic solvents. ReZist 30 mm filters can also be used as a venting filter for small vessels.

ReZist for HPLC sample preparation

Features and benefits

- Hydrophobic PTFE membrane is laminated with polypropylene
- 13 mm diameter with extremely low dead volume < 10 µL
- Excellent chemical resistance against standard organic HPLC solvents
- 13 mm diameter with Mini-Tip outlet permits filtration into very small sample bottles
- Permits optimal utilization of small sample volumes

ReZist for air venting

Features and benefits

- Integral, permanently hydrophobic PTFE membranes
- Polypropylene support
- Extremely high chemical resistance

ReZist Syringe Filters

Typical applications—ReZist syringe filters

Filtration of organic solutions in HPLC	ReZist 13 and 30
Filtration of aggressive solutions	ReZist 13 and 30
Moisture barrier when venting	ReZist 30
Aerosol separation for protecting vacuum pumps	ReZist 30
Sterile[#] venting of small volumes	ReZist 30
Prefiltration of difficult-to-filter aqueous or organic solutions containing particles	ReZist 30/GF92

Ordering information—ReZist syringe filters

Diameter (mm)	Pore size (µm)	Catalog number	Media/housing	Connection (in/out)	Color code	Quantity/pack
13	0.2	10463703	PTFE/PP	FLL/Mini-Tip	White	100
13	0.45	10463713	PTFE/PP	FLL/Mini-Tip	Green	100
30	0.2	10463500*	PTFE/PP	FLL/ML	White	50
30	0.2	10463503	PTFE/PP	FLL/ML	White	100
30	0.2	10463505	PTFE/PP	FLL/ML	White	500
30	0.45	10463513	PTFE/PP	FLL/ML	Green	100
30	0.45	10463515	PTFE/PP	FLL/ML	Green	500
30	> 1.0	10463545	GF92/PP	FLL/ML	Natural	500
30	> 1.0	10463543	GF92/PP	FLL/ML	Natural	100
30	1.0	10463523	PTFE/PP	FLL/ML	Yellow	100
30	1.0	10463525	PTFE/PP	FLL/ML	Yellow	500
30	5.0	10463533	PTFE/PP	FLL/ML	Grey	100
30	5.0	10463535	PTFE/PP	FLL/ML	Grey	500

** Sterile*

FLL—Female Luer Lock
GF—Glass Fiber
ML—Male Luer
PP—Polypropylene
PTFE—Polytetrafluoroethylene

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Anotop™ syringe filters

Anotop filters contain the proprietary alumina-based Anopore membrane and are supplied in three pore sizes. Glass microfiber prefilter versions are available for difficult-to-filter samples. Anotop filters can be used with most organic solvents and aqueous materials.

Anotop 10

Features and benefits

- 10 mm diameter syringe filter
- Inorganic membrane
- Capillary pore structure
- Low protein binding
- Filters sample volume up to 10 mL
- Low hold-up volume < 20 µL ensures maximum sample recovery
- Sterile formats are available for critical applications

Anotop 10 Syringe Filters—Sterile

Anotop 25

Features

- 25 mm diameter syringe filter
- Filters sample volume up to 100 mL

Applications

- Cold sterilization[#] of growth media
- Phage and virus filtration
- Removal of high molecular weight proteins or polymers
- Liposome extrusion
- Filtration of solvents for spectroanalysis and analytical sample preparation

Anotop 10 Syringe Filters—Sterile

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Anotop 10 and Anotop 25 Plus

The Anotop Plus syringe filter offers the added benefit of an integral glass microfiber prefilter. This unit is designed to enable difficult and hard-to-filter solutions to be filtered without adversely affecting the filtration efficiency of the final membrane. This can remove the need for sample clean-up or expensive and time-consuming sequential filtration.

Anotop 25 Plus Syringe Filters—Prefilter, Non-Sterile

Applications

- Filtration of tissue culture media
- Clean-up of difficult samples
- Filtration of colloidal material
- Removal of mycoplasma
- HPLC sample preparation
- Biological sample preparation

Anotop IC

Whatman Anotop IC syringe filters are specifically designed for the preparation of samples for subsequent ion chromatography and HPLC analysis. These devices ensure very low levels of anion leaching for ion chromatography testing.

Features and benefits

- 10 mm and 25 mm diameter syringe filters
- Each batch certified for IC
- Enhanced consistency of analytical results
- Extended column life
- Certified and guaranteed low levels of anion leaching for improved results

Applications

- Ion chromatography sample preparation
- HPLC sample preparation

Anotop LC

Whatman Anotop LC syringe filters have been specially designed for simple and effective preparation of your samples prior to HPLC. They preserve the life of your column by efficiently removing particulates from your analytical samples. Because the Anotop LC syringe filter is made from pigment-free polypropylene and uses the Anopore inorganic membrane, you can be sure that after filtration the level of extractable UV absorbing compounds is minimal.

Features

- Better consistency of analytical results and longer column life
- Extremely low levels of UV absorbing compounds mean better HPLC results
- Easy to use with all sample types

Typical properties—Anotop syringe filters

	Anotop 10	**Anotop 10 Plus**	**Anotop 25**	**Anotop 25 Plus**
Housing	Polypropylene	Polypropylene	Polypropylene	Polypropylene
Filtration area	0.78 cm^2	0.78 cm^2	4.78 cm^2	4.78 cm^2
Maximum pressure	100 psi (6.9 bar)	100 psi (6.9 bar)	100 psi (6.9 bar)	100 psi (6.9 bar)
Volume hold-up	< 20 µL	< 30 µL	< 150 µL	< 200 µL
Prefilter type	N/A	Glass microfiber (binderless)	N/A	Glass microfiber (binderless)
Membrane diameter	10 mm	10 mm	25 mm	25 mm
Membrane type	Anopore	Anopore	Anopore	Anopore
Average membrane thickness	60 µm	60 µm	60 µm	60 µm
Device width	15.4 mm	15.4 mm	36.8 mm	36.8 mm
Device length	18.5 mm	18.5 mm	26.3 mm	26.3 mm
Device shape	Hexagonal	Hexagonal	Hexagonal	Hexagonal
Construction process	Thermal weld	Thermal weld	Thermal weld	Thermal weld
Inlet connection	Female luer lock	Female luer lock	Female luer lock	Female luer lock
Outlet connection	Male luer	Male luer	Male luer	Male luer
Protein adsorption	Low	Medium/High	Low	Medium/High
Extractable materials	Low	Low	Low	Low
Cytotoxicity	Non-cytotoxic	Non-cytotoxic	Non-cytotoxic	Non-cytotoxic

Typical properties—Anotop syringe filters

	Anotop 10 IC	**Anotop 10 LC**	**Anotop 25 IC**	**Anotop 25 LC**
Housing	Polypropylene	Polypropylene (pigment free)	Polypropylene	Polypropylene (pigment free)
Filtration area	0.78 cm^2	0.78 cm^2	4.78 cm^2	4.78 cm^2
Maximum pressure	100 psi (6.9 bar)	100 psi (6.9 bar)	100 psi (6.9 bar)	100 psi (6.9 bar)
Volume hold-up with air purge	< 20 µL	< 20 µL	< 150 µL	< 150 µL
Membrane diameter	10 mm	10 mm	25 mm	25 mm
Construction process	Thermal weld	Thermal weld	Thermal weld	Thermal weld
Extractable materials	Negligible	Negligible	Negligible	Negligible
Average membrane thickness	60 µm	60 µm	60 µm	60 µm
Device width	15.4 mm	15.4 mm	36.8 mm	36.8 mm
Device length	18.5 mm	18.5 mm	26.3 mm	26.3 mm
Inlet connection	Female luer lock	Female luer lock	Female luer lock	Female luer lock
Outlet connection	Male luer	Male luer	Male luer	Male luer
Membrane type	Anopore	Anopore	Anopore	Anopore

Typical properties—Anotop IC syringe filters

Anion	**Level (ppb)**	**Anion**	**Level (ppb)**
Fluoride	< 10	Phosphate	< 75
Chloride	< 15	Nitrite	< 30
Bromide	< 20	Nitrate	< 30
Sulfate	< 30	–	–

Typical average anion leaching levels in 18 MΩ × cm (MegaOhm × cm) water at 20°C

Ordering information—Anotop syringe filters

Pore size (µm)	Media	Catalog number	Quantity/pack
Anotop 10			
0.02	Anopore	6809-1002	50
0.1	Anopore	6809-1012	50
0.2	Anopore	6809-1022	50
0.02	Anopore, sterile	6809-1102	50
0.1	Anopore, sterile	6809-1112	50
0.2	Anopore, sterile	6809-1122	50
Anotop 10 Plus			
0.02	Anopore with prefilter	6809-3002	50
0.1	Anopore with prefilter	6809-3012	50
0.2	Anopore with prefilter	6809-3022	50
0.02	Anopore with prefilter, sterile	6809-3102	50
0.1	Anopore with prefilter, sterile	6809-3112	50
0.2	Anopore with prefilter, sterile	6809-3122	50
Anotop 25			
0.02	Anopore	6809-2002	50
0.1	Anopore	6809-2012	50
0.2	Anopore	6809-2022	50
0.2	Anopore	6809-2024	200
0.02	Anopore, sterile	6809-2102	50
0.1	Anopore, sterile	6809-2112	50
0.2	Anopore, sterile	6809-2122	50
Anotop 25 Plus			
0.02	Anopore with prefilter	6809-4002	50
0.1	Anopore with prefilter	6809-4012	50
0.2	Anopore with prefilter	6809-4022	50
0.02	Anopore with prefilter, sterile	6809-4102	50
0.1	Anopore with prefilter, sterile	6809-4112	50
0.2	Anopore with prefilter, sterile	6809-4122	50
0.2	Anopore with prefilter	6809-4024	200
Anotop 10 IC			
0.2	Anopore	6809-9233	100
0.2	Anopore	6809-9234	200
Anotop 25 IC			
0.2	Anopore	6809-9244	200
Anotop 10 IC blister			
0.2	Anopore	6809-9232	50
0.2	Anopore	6809-9235	250
Anotop 10 LC			
0.2	Anopore	2001-0100	100
0.2	Anopore	2001-0200	200
Anotop 25 LC			
0.2	Anopore	2002-5100	100
0.2	Anopore	2002-5200	200

Whatman Uniflo™ syringe filters

Disposable filter units designed to provide clean filtrate from small volumes up to 100 mL. Available in a variety of membrane choices and a polypropylene overmold housing. Whatman Uniflo syringe filters are available in 13 mm and 25 mm diameters and 0.2 µm and 0.45 µm pore sizes.

Whatman Uniflo 13 mm syringe filters

Uniflo 13 mm Syringe Filters are designed to enable maximum filtrate throughput from typical sample volumes of 10 mL or less.

Whatman Uniflo 25 mm syringe filters

Uniflo 25 mm Syringe Filters are designed to enable maximum filtrate throughput from typical sample volumes of 100 mL or less.

Filter media	Typical application
Nylon	Aqueous and/or organic samples; hydrophilic
PES	Aqueous samples
PTFE	Organic based samples Hydrophobic membrane
PVDF	Aqueous and/or organic based samples; low protein binding membrane

Uniflo Syringe Filters

Integrity test data

Description	Pore size (µm)	Minimum bubble point (psi)
Nylon	0.22	29.0
Nylon	0.45	20.0
Polyethersulfone	0.22	40.0
Polyethersulfone	0.45	33.0
Polytetrafluoroethylene*	0.22	10.0
Polytetrafluoroethylene*	0.45	6.0
Polyvinylidene Difluoride	0.22	39.0
Polyvinylidene Difluoride	0.45	17.5

* *Bubble point determined with 95% Ethanol (v/v), all others determined with water*

Uniflo Syringe Filters

Typical properties—Whatman Uniflo syringe filters

	Uniflo 13 mm	**Uniflo 25 mm**
Dimensions	19.6 mm × 16.9 mm	24.5 mm × 29.2 mm
Filtration area	0.88 cm^2	3.45 cm^2
Operating pressure	65.2 psi	65.2 psi
Housing	Polypropylene	Polypropylene
Volume hold up	≤ 50 µL after air purge	≤ 100 µL after air purge
Flow direction	Flow should enter from inlet	Flow should enter from inlet
Inlet Connectors	Female Luer Lock	Female Luer Lock
Outlet Connectors	Male Slip Luer	Male Slip Luer
Sterilization	Autoclave at 121°C at 15 psi for 20 minutes	Autoclave at 121°C at 15 psi for 20 minutes
Biosafe	Polymer grade and membrane types meet the USP test requirements (for Class VI Plastics)	Polymer grade and membrane types meet the USP test requirements (for Class VI Plastics)

Ordering information—Whatman Uniflo syringe filters

Diameter (mm)	**Sterility**	**Pore size (µm)**	**Membrane**	**Catalog number**	**Quantity/pack**
13	Nonsterile	0.22	PVDF	9909-1302	500
13	Nonsterile	0.45	PVDF	9909-1304	500
13	Nonsterile	0.22	Nylon	9910-1302	500
13	Nonsterile	0.45	Nylon	9910-1304	500
13	Nonsterile	0.22	PTFE	9911-1302	500
13	Nonsterile	0.45	PTFE	9911-1304	500
13	Nonsterile	0.22	PES	9912-1302	500
13	Nonsterile	0.45	PES	9912-1304	500
25	Nonsterile	0.22	PVDF	9909-2502	500
25	Nonsterile	0.45	PVDF	9909-2504	500
25	Nonsterile	0.22	Nylon	9910-2502	500
25	Nonsterile	0.45	Nylon	9910-2504	500
25	Nonsterile	0.22	PTFE	9911-2502	500
25	Nonsterile	0.45	PTFE	9911-2504	500
25	Nonsterile	0.22	PES	9912-2502	500
25	Nonsterile	0.45	PES	9912-2504	500
13	Sterile	0.22	PES	9916-1302	100
13	Sterile	0.45	PES	9916-1304	100
25	Sterile	0.22	PVDF	9913-2502	45
25	Sterile	0.45	PVDF	9913-2504	45
25	Sterile	0.22	PES	9914-2502	45
25	Sterile	0.45	PES	9914-2504	45
25	Sterile	0.22	PES	9915-2502	200
25	Sterile	0.45	PES	9915-2504	200

PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
PES—Polyethersulfone

Roby 25 for robotic systems

Roby 25 syringe filters for robotic systems were developed specifically for automated sample filtration and are available with various membranes. For difficult-to-filter samples, Roby syringe filters are also available with membranes plus an integral glass fiber prefilter.

The filter housing is made from mechanically stable polypropylene. The external geometry of the filter housing ensures simple and smooth filter transport from the storage turntable to the filtration site and easy filter changing.

Features and benefits

- Optimized for automatic dissolution test systems
- Mechanically stable polypropylene
- Easy filter changing
- Ensures simple and smooth filter transport

Applications

- Fine filtration of samples in the automatic tablet dissolution test
- Method development with the Roby 25 Filter Validation Kit

Roby Automated Filter Validation Kit

Roby 25 filter validation kit

The Roby 25 Filter Validation Kit includes step-by-step instructions for essential selection tests. Instructions include all important properties in an at-a-glance format.

Features

- Six types of filters: six tubes each with 25 filters
- Filter validation protocol with filter selection aid

Ordering information—Roby 25 syringe filters for automation

Diameter (mm)	Pore size (µm)	Description	Catalog number	Media/ housing	Connection in/out	Color code	Quantity/ pack
25	0.45	Roby 25 CA-GF92	10463813	CA-GF/PP	FLL/ML	Green	200*
25	0.45	Roby 25 NL	10463803	NYL/PP	FLL/ML	Translucent yellow	200*
25	0.45	Roby 25 NL	10463802	NYL/PP	–	–	1000
25	0.45	Roby 25 NL-GF92	10463805	NYL-GF/PP	FLL/ML	Yellow	200*
25	0.45	Roby 25 NL-GF92	10463804	NYL-GF/PP	FLL/ML	Yellow	1000
25	0.45	Roby 25 RC	10463806	RC/PP	–	–	1000
25	0.45	Roby 25 RC-GF92	10463809	RC-GF/PP	FLL/ML	Brown	200*
25	0.45	Roby 25 RC-GF92	10463808	RC-GF/PP	–	–	1000
25	0.7	Roby 25/GF55	10463814	GF/PP	FLL/ML	Natural	200*
25	0.7	Roby 25/GF55	10463815	GF/PP	FLL/ML	Natural	1000
25	1.0	Roby 25/GF92	10463801	GF/PP	FLL/ML	Natural	200*
25	1.0	Roby 25/GF92	10463800	GF/PP	FLL/ML	Natural	1000
25	–	Filter validation kit**	10463898	–	FLL/ML	–	1

* *8 tubes with 25 pieces each*

** *Filter Validation Kit includes: Roby 25 NL; Roby 25 NL-GF92; Roby 25/RC; Roby 25/RC-GF92; Roby 25/GF55; Roby 25/GF92*

CA—Cellulose Acetate
GF—Glass Fiber
ML—Male Luer
FLL—Female Luer Lock
NYL—Nylon
PP—Polypropylene
RC—Regenerated Cellulose

Sample preparation with the Protein Prep syringe filter for ÄKTA systems

Sample
(from cell lysis and centrifugation)

Filtration with syringe filter
To remove particles and microorganisms

The sample can be injected into the system

ÄKTA start system

Protein Prep syringe filter for ÄKTA systems

- 13 mm or 30 mm diameter
- 0.2 µm or 0.45 µm pore size

Tips for choosing the right filter

- Use 13 mm diameter filter for sample volumes < 10 mL
- Use 0.2 µm pore size filter if the particle size of the chromatography resin is < 30 µm

Ordering information—Protein Prep syringe filter for ÄKTA systems

Description	Diameter (mm)	Pore size (µm)	Quantity per pack	Catalog number
Protein Prep filter for ÄKTA systems	13	0.2	150	10463103
Protein Prep filter for ÄKTA systems	13	0.45	150	10463113
Protein Prep filter for ÄKTA systems	30	0.2	150	10463043
Protein Prep filter for ÄKTA systems	30	0.45	150	10463033

Inline filters

Whatman inline filters feature a high-purity polypropylene housing to maintain sample purity and are available with a choice of filtration media to suit a range of aqueous and organic samples.

Polydisc filters

Whatman Polydisc 50 mm inline disc filters are designed for larger volume sample filtration in the laboratory, at a pilot plant, or in manufacturing. Sample volumes up to 1 liter can be filtered with one device. Polydisc devices can be used in conjunction with a syringe or connected inline via stepped hose barbs.

Polydisc filters feature a high-purity polypropylene housing to maintain sample purity and are available with a choice of filtration media to suit a range of aqueous and organic samples. The devices are autoclavable and sterile options are available.

Whatman Inline Filter/Degassers (IFD) connect directly into an HPLC line to simultaneously filter and degas the mobile phase as it is being used.

Polydisc AS

The Polydisc AS (Aqueous Solution) family of 50 mm filter devices features a high throughput polyethersulfone membrane, which has low protein binding and no surfactants, developed for use in the pharmaceutical industry. A glass microfiber prefilter extends the life of the membrane and effectively filters heavily contaminated samples. Each Polydisc AS device has a sterility cap on the outlet and is sealed in its own medical-grade clear blister pack, radiation sterilized, and secured in a protective shelf pack.

Features and benefits

- Radiation sterilized. No EtO residuals
- Barbed hose connections fit multiple tubing sizes
- Integrity-testable (bubble point method)
- Lightweight (11.5 g); avoids the collapsing of tubing, which can be caused by heavy filter devices

Applications

- Tissue culture media
- Reagent preparation
- Particle counting solutions

Typical properties—Polydisc AS

Pore size (µm)*	Inline connection	Filling volume (µL)	Prefilter/media	Filtration area (cm^2)	Water flow rate mL/min at 0.7 bar (10 psi)
0.2	6–10 mm ID hose	540	GMF/PES	20.4	150
0.45	6–10 mm ID hose	540	GMF/PES	20.4	225

* *Liquid rating. Retention efficiency in gas streams is significantly higher*

GMF—Glass Microfiber
PES—Polyethersulfone

Ordering information—Polydisc AS

Pore size (µm)	Catalog number	Prefilter/media	Quantity/pack
Sterile			
0.2	6724-5002	GMF/PES	10
0.45	6724-5045	GMF/PES	10
Nonsterile			
0.45	6724-5145	GMF/PES	50

Polydisc TF and ReZist

This device features a PTFE membrane, which is suitable for chemically aggressive solutions, reagents, and organic solvents. This lightweight unit is particularly suitable for protective vents and for inline filtration and isolation applications. The 1 µm device features a polypropylene prefilter for use with heavily contaminated samples.

Polydisc In-line Filters, TF

Features and benefits

- Solvent-resistant membrane
- Chemical-resistant housing
- Hydrophobic PTFE membrane
- Autoclavable (multiple times)
- Integrity-testable (bubble point or water breakthrough pressure “in situ” methods)
- Biosafe
- Lightweight (11.5 g for Polydisc and 17.9 g for ReZist); avoids the collapsing of tubing, which can be caused by heavy filter devices

Applications

- Pharmaceutical: vents and inline applications
- Biotech: sterile vents and exhausts for growth environments, inline sterilization# of gases
- Laboratory: filtration of solvents and reagents, drying gases
- Electronics: photoresists, solvents, gases for research

Typical properties—Polydisc TF

Pore size (µm)	Integrity test data* IPA bubble point		Water breakthrough		Flow rates* methanol mL/min at 0.7 bar (10 psi)	Air SLPM at 0.2 bar (3 psi)
	(bar)	(psi)	(bar)	(psi)		
0.1	1.7	25	3.4	50	200	8
0.2	0.9	13	2.1	38	400	16
0.45	0.5	7	1.1	16	700	24
1.0	0.2	3	0.3	13	900	30

* *Typical values*

\# *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Ordering information—Polydisc TF and ReZist

Pore size (µm)	Media	Catalog number	Sterile	Quantity/pack
Polydisc TF				
0.1	PTFE	6720-5001	No	10
0.2	PTFE	6720-5002	No	10
0.45	PTFE	6720-5045	No	10
1.0	PTFE*	6721-5010	No	10
ReZist filter 50 mm, sterile				
0.2	PTFE	10463607	Yes	10
0.2	PTFE	10463608	No	10
0.2	PTFE	10463609	No	50

* *With PP prefilter*

Inline connection 6-10 mm ID hose
PTFE—Polytetrafluoroethylene

Polydisc HD

Excellent flow rate characteristics for filtering large volumes to 1 liter of aqueous and solvent samples. Polydisc HD (Heavy Duty) is available in 5 and 10 µm retention ratings.

Features and benefits

- All polypropylene unit for aqueous and solvent samples
- Broad solvent compatibility

Applications

- Large volume sample preparation

Typical properties—Polydisc HD

Pore size (µm)*	Filling volume (µL)	Air flow rate SLPM at 1.0 bar (14.5 psi)	Filtration area (cm^2)	Water flow rate mL/min at 1.0 bar (14.5 psi)
5.0	540	110	20.4	1500
10.0	540	140	20.4	2200

* *Liquid rating. Retention efficiency in gas streams is significantly higher*

Ordering information—Polydisc HD

Pore size (µm)	Catalog number	Media	Quantity/pack
5.0	6728-5050	Polypropylene	10
10.0	6728-5100	Polypropylene	10
5.0	2227	Polypropylene	50
10.0	2228	Polypropylene	50

Polydisc GW

Polydisc GW (Ground Water) is specifically designed for sample preparation of ground water samples for the analysis of dissolved heavy metals. It is an aqueous filter with low background values for the determination of trace elements (each pack contains a certificate).

It has everything that makes the preparation of aqueous solutions for the analysis of dissolved heavy metals easy: a large filter surface, quartz fiber prefilter, a membrane filter in sandwich arrangement and a high dirt loading capacity.

Polydisc In-Line Filters, Ground Water

Typical properties—Polydisc GW

Housing	Polypropylene
Membrane type	Nylon
Prefilter	100% quartz fiber
Filtration diameter	52 mm
Filtration area	20.4 cm^2
Dead volume	220 µL
Filling volume	540 µL
Maximum pressure	4.5 bar (65 psi)
Connections	Tubing nozzle 6-14 mm i.d. hose
Maximum operating temperature	80°C

Ordering information—Polydisc GW 50 mm

Pore size (µm)	Catalog number	Prefilter/media	Quantity/pack
0.45	10463400	Quartz fiber/nylon	20
0.45	10463401	Quartz fiber/nylon	50

Inline connection—Polydisc GW accepts 6-14 mm i.d. hose

Polydisc SPF

Filtering serum requires removing proteins, lipids, salts, and other cell debris. This range of particulate matter is effectively handled with multilayer prefilters to facilitate downstream work and to avoid clogging later serum filters.

Polydisc SPF stacks a high-flow, hydrophilic PES membrane with a high particle-loading GMF filter to clean out particulates from serum and reduce stress on the final-stage serum filters.

Features and benefits

- High-throughput, inline prefilters for use upstream of serum filters
- GMF prefilter captures large particles and cell debris while PES stack removes remaining particles and bacteria larger than 1 µm
- Designed to extend the life of downstream serum filters
- Effective for microbiology and tissue culture, immunoassays, virology, and diagnostic controls
- 6 to 10 mm i.d. hose connection

Typical properties—Polydisc SPF

Prefilter material	Glass Microfiber (GMF)
Diameter	50 mm
Housing	Polypropylene (PP)
Connections	Tubing nozzle 6-10 mm i.d. hose
Filtration area	20.4 cm²
Filling volume	540 µL

Ordering information—Polydisc SPF

Pore size (µm)	Catalog number	Prefilter/media	Membrane	Quantity/pack
1.0	6724-5000	Glass Microfiber (GMF)	1.0 µm PES	10

PES—Polyethersulfone

Inline filter degasser

Whatman Inline Filter/Degassers (IFD) connect directly into an HPLC line to simultaneously filter and degas the mobile phase as it is being used. The Aqueous IFD provides pure filtration of aqueous based HPLC mobile phases while the Solvent IFD is used with organically based HPLC mobile phases. Aqueous IFD is designed to work with mobile phases containing at least 20% of the aqueous component.

The Aqueous IFD has a 0.2 µm hydrophilic nylon membrane for use with aqueous-based mobile phases. Solvent IFD has a 0.2 µm high-flow polypropylene membrane for mobile phases containing organic solvents. Both devices have a polypropylene housing, the circumference of which is sealed by a security ring, fittings to accommodate 1⁄16”–1⁄8” tubing and an air vent on the inlet with luer lock cap to enable priming.

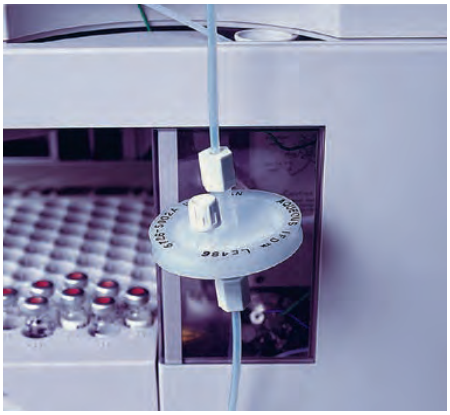
The inline filters work on the principle of “bubble point”—the point of pressure at which gases will pass through a wet membrane. If pressure is maintained below the bubble point, the gas will not pass through the membrane and is trapped by the particular filter device.

Features and benefits

- Faster than traditional methods of mobile phase preparation, saving time in the laboratory
- Enhanced laboratory safety
- No need to purchase expensive degassing equipment
- Rugged, chemically resistant polypropylene construction
- Air vent on inlet with luer lock cap
- Integrity-testable (bubble point method)

Applications

- HPLC analysis
- Pharmaceutical research
- Analytical chemistry



Inline Filter/ Degassers (IFD)

Typical properties—Aqueous IFD and Solvent IFD

	Aqueous IFD	Solvent IFD
*Bubble point**		
bar	2.9 (a)	0.76 (b)
psi	42 (a)	11.0 (b)
Maximum flow rate**	2.5 mL/min	2.5 mL/min
Filtration area	16 cm^2	16 cm^2

* *Typical values determined with (a) water and (b) isopropanol*
** *For effective gas bubble removal in HPLC*

Ordering information—Aqueous IFD and Solvent IFD

Diameter	Pore size (µm)	Catalog number	Description	Media	Quantity/pack
50	0.2	6726-5002	Aqueous IFD*	Nylon	10
50	0.2	6726-5002A	Aqueous IFD**	Nylon	10
50	0.2	6725-5002	Solvent IFD*	PP	10
50	0.2	6725-5002A	Solvent IFD**	PP	10

* *Standard catalog numbers include O-rings: 1/32-5/32; accepts different diameter tubing 0.8-4 mm*
** *Catalog numbers with suffix A are non-o-ring style and accept 1/8 tubing only*

PP—Polypropylene

Capsule filters

Whether you are conducting research, pilot manufacturing or filtering large volumes or hard-to-filter samples, GE has a capsule to fit your needs.

Polycap AS

Polycap AS (Aqueous Solution) is recommended for filtering aqueous solutions. It combines a Glass Microfiber (GMF) prefilter and a nylon membrane, prolonging the life of the filter and allowing larger volumes and difficult samples to be filtered easily.

Features and benefits

- First layer (GMF) acts as a prefilter to ensure longer membrane (0.2, 0.45, and 1.0 µm) life and higher filtration efficiency
- Nylon membrane layer is inherently hydrophilic, has low extractables, is biosafe, and has excellent flow rates
- Ultra-clean, containing no surfactant or mold release agents
- Housing is thermally fused (no glues, adhesives or extraneous materials)
- Integrity-testable by bubble point, pressure decay, or forward flow methods
- Provides highly effective filtration area in a small size
- Autoclavable; some presterilized with gamma irradiation
- Manufactured in clean room facilities under ISO Quality Systems

Label the image Polycap AS

Applications

- Admixtures
- Biologicals
- Buffers
- Cleaning/rinsing solutions
- Enzymes
- Immunologicals
- Irrigation solutions
- Nutrients
- Pharmaceutical preparations
- Reagent preparation
- Salt solutions
- Tissue culture media
- Viral suspensions

Typical properties—Polycap AS

Housing	Polypropylene
Vent	On inlet
Prefilter	Glass microfiber double laminated with polyolefin monofilament nonwoven
Membrane	Nylon
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)
Endotoxin level	LAL tested, ≤ 0.5 EU/mL
Biosafety	Materials pass USP Class VI
Sterilization	Certain filter devices have been sterilized*. Capsules may be autoclaved at 121°C for 20 min (maximum 132°C). However, an integrity test should be performed after autoclaving. Filling bell is not autoclavable but is detachable.
Nominal filtration area	36 mm capsule: ~ 400 cm^2 (62 in^2) 75 mm capsule: ~ 820 cm^2 (127 in^2)
IPA bubble point	0.2 µm membrane: > 1.1 bar (16 psi) 0.45 µm membrane: > 0.70 bar (10 psi) 1.0 µm membrane: > 0.21 bar (3 psi)

* *Sterile and nonsterile options offered*

Ordering information—Polycap AS

				Connections			
Pore size (µm)	**Catalog number**	**Media**	**Prefilter**	**Inlet**	**Outlet**	**Sterile**	**Quantity/pack**
Polycap AS 36							
0.2	6708-3602	Nylon	GMF	1/2 SB	1/2 SB	Yes	1
0.2	6705-3602	Nylon	GMF	SB	SB	Yes	1
0.2	6709-3602	Nylon	GMF	MNPT	SB	Yes	1
0.2	2606T	Nylon	GMF	FNPT	FNPT	No	5
0.45	6705-3604	Nylon	GMF	SB	SB	Yes	1
1.0	2608NS	Nylon	GMF	SB	SB	No	5
Polycap AS 36 plus filling bell							
0.2	6706-3602	Nylon	GMF	SB	SB	Yes	1
Polycap AS 75							
0.2	2706T	Nylon	GMF	FNPT	FNPT	No	5
0.45	2707NS	Nylon	GMF	SB	SB	No	5

FNPT—Female National Pipe Thread
GMF—Glass Microfiber Filter
MNPT—Male National Pipe Thread
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Polycap HD

Polycap HD provides an advantage in process applications as its performance characteristics fit between gross filters and microporous membrane filters used for final filtration.

Features and benefits

- 100% polypropylene filter media, support system, and housing allows usage with a broad range of solutions, pH and temperature
- High flow and high retention capacity
- Materials of construction are FDA approved for food contact
- Able to be sterilized by autoclaving with steam at 121°C for 20 min
- Manual vent with luer lock to bleed air from upstream or serve as an injection or sample port
- Available with a retention rating of 0.2, 0.45, 1.0, 5.0 or 10 µm and a variety of end-fitting configurations
- Manufactured in a Class 10,000 clean room in an ISO certified manufacturing plant

Polycap HD

Applications

- Buffers
- Clean air and gas equipment
- Cosmetics and personal care products
- Food and beverage
- General fine filtration
- Inks and pigments
- Pharmaceutical solutions
- Photographic emulsions and make-up water
- Prefiltration for RO/UF/MF membranes
- Reagents
- Sample preparations
- Semiconductor and magnetic media
- Solvents

Typical properties—Polycap HD

Housing	Polypropylene
Vent	On inlet
Filter media	Polypropylene
Support system	Polypropylene
Biosafety	Materials pass USP Class VI
Nominal filtration area	36 mm capsule: ~ 400 cm^2 (62 in^2) 75 mm capsule: ~ 820 cm^2 (127 in^2) 150 mm capsule: ~ 1650 cm^2 (256 in^2)
Sterilization	Capsules autoclavable at 121°C for 20 min (maximum temperature is 132°C)
Maximum pressure	4.1 bar (60 psi)

Ordering information—Polycap HD (nonsterile)

				Connections		
Pore size (µm)	**Catalog number**	**Media**	**Prefilter**	**Inlet**	**Outlet**	**Quantity/pack**
Polycap HD 36						
0.2	2610T	PP	No	FNPT	FNPT	5
1.0	6703-3610	PP	No	SB	SB	1
1.0	2611	PP	No	SB	SB	5
1.0	2611T	PP	No	FNPT	FNPT	5
5.0	6703-3650	PP	No	SB	SB	1
5.0	2612T	PP	No	FNPT	FNPT	5
10.0	6703-3611	PP	No	SB	SB	1
10.0	2613T	PP	No	FNPT	FNPT	5
20.0	6703-3621	PP	No	SB	SB	1
20.0	2614T	PP	No	FNPT	FNPT	5
Polycap HD 75						
0.45	2710	PP	No	1/2 HB	1/2 HB	5
1.0	6703-7510	PP	No	1/2 SB	1/2 SB	1
1.0	2711T	PP	No	FNPT	FNPT	5
5.0	6703-7550	PP	No	1/2 SB	1/2 SB	1
5.0	2712M	PP	No	MNPT	MNPT	5
5.0	2712T	PP	No	FNPT	FNPT	5
10.0	6703-7511	PP	No	1/2 SB	1/2 SB	1
10.0	2713T	PP	No	FNPT	FNPT	5
10.0	2713	PP	No	HB	SB	5
20.0	6703-7521	PP	No	1/2 SB	1/2 SB	1
20	2714	PP	No	1/2 HB	1/2 HB	5
20.0	2714T	PP	No	FNPT	FNPT	5
Polycap HD 150						
0.45	2810	PP	No	1/2 HB	1/2 HB	5
0.45	2810T	PP	No	FNPT	FNPT	5
5.0	2812T	PP	No	FNPT	FNPT	5
10.0	2813T	PP	No	FNPT	FNPT	5
10.0	2813	PP	No	1/2 HB	1/2 HB	5
20.0	2814T	PP	No	FNPT	FNPT	5

FNPT—Female National Pipe Thread
HB—1/2 Hose Barb
MNPT—Male National Pipe Thread
PP—Polypropylene
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Polycap SPF

Serum is difficult to filter because it contains a high degree of loading of complex particulates, lipids, triglycerides, and lipoproteins that clog filters. When filtering serum without proper prefiltration, membrane filters clog rapidly.

Features and benefits

- Three layers of special media: fine and ultrafine Glass Microfiber (GMF) and polyethersulfone membrane
- Excellent for hard-to-filter solutions such as serums and protein solutions
- Able to be sterilized by autoclaving with steam
- Manufactured under ISO manufacturing system
- Suitable for filtering serums, viral suspensions, nutrients, biologicals, immunologicals, enzymes, and buffers
- Prefilters help extend the life of the final filter

Polycap SPF

Applications

- Biologicals
- Buffers
- Diagnostic standards
- Enzymes
- Immunologicals
- Nutrients
- Serum prefiltration
- Tissue culture media
- Viral suspensions

Typical properties—Polycap SPF

Housing	Polypropylene
Vent	On inlet
Prefilter	Two layers of glass microfiber
Membrane	Polyethersulfone (PES)
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)
Sterilization	Autoclave at 121°C for 20 min (132°C max)
Nominal filtration area	36 mm capsule: ~ 260 cm^2 (40 in^2) 75 mm capsule: ~ 535 cm^2 (83 in^2)

Ordering information—Polycap SPF (nonsterile)

				Connections		
Pore size (µm)	**Catalog number**	**Media**	**Prefilter**	**Inlet**	**Outlet**	**Quantity/pack**
Polycap SPF 36						
1.0	6705-3600	PES	GMF	SB	SB	1
Polycap SPF 75						
1.0	6705-7500	PES	GMF	SB	SB	1

GMF—Glass Microfiber Filter
PES—Polyethersulfone
SB—Stepped Barb for 6-10 mm (1/4-3/8) tubing

Polycap TC

Polycap TC (PES) is available with and without a filling bell. They are disposable, dual layer Polyethersulfone (PES) membrane filtration capsules that provide efficient filtration for critical aqueous solutions.

The PES membrane is inherently hydrophilic, has low extractables, is biosafe, has excellent flow rates, and exhibits low protein binding.

Features and benefits

- Polycap TC/PES 0.2/0.1, 0.2/0.2, and 0.8/0.2 µm capsules pass the HIMA Challenge Test for Sterilizing Grade Filters
- 100% integrity-tested during manufacturing; results are correlated to microbial retention
- Housing thermally fused (no surfactants or mold releasing agents)
- Integrity-testable by bubble point, pressure decay or forward flow methods
- Available in sterile and nonsterile versions with a filling bell option
- Manufactured in clean room facilities under ISO Quality Systems
- PES membrane protein adsorption characteristics:
  - HSA 0.4 µg/cm^2
  - Insulin 2.0 µg/cm^2
  - Gammaglobulin 1.5 µg/cm^2

Applications

- Aqueous solutions
- Biologicals
- Buffers
- Cleaning/rinsing solutions
- Enzymes
- High-quality water
- Particle counting solutions
- Pharmaceutical preparations
- Reagent preparation
- Salt solutions
- Tissue culture media
- Virus suspensions

Polycap TC

Typical properties—Polycap TC

Housing	Polypropylene
Vent	On inlet
Membrane	Polyethersulfone (PES)
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)
Flow direction	If there is a prefilter, it is located on the inlet side and flow should follow arrows
Endotoxin level	LAL tested, ≤ 0.5 EU/mL
Biosafety	Materials pass USP class VI
Sterilization	Certain filter devices have been sterilized*. Capsule may be autoclaved at 121°C for 20 min (maximum 132°C). However, an integrity test should be performed after autoclaving.
Nominal filtration area	36 mm capsule: ~ 440 cm^2 (72 in^2) 75 mm capsule: ~ 930 cm^2 (144 in^2) 150 mm capsule: ~ 1900 cm^2 (302 in^2)
Water bubble point (final membrane)	0.1 µm > 3.2 bar (46 psi) 0.2 µm > 2.7 bar (40 psi) 0.45 µm > 2.1 bar (30 psi) 1.0 µm > 1.1 bar (16 psi)

** Sterile and nonsterile options offered*

Ordering information—Polycap TC

				Connections		
Pore size (µm)	**Catalog number**	**Media**	**Inlet**	**Outlet**	**Sterile**	**Quantity/pack**
Polycap TC 36						
0.2/0.1	6714-3601	PES	SB	SB	Yes	1
0.2/0.2	6714-3602	PES	SB	SB	Yes	1
0.65/0.45	6714-3604	PES	SB	SB	Yes	1
Polycap TC 36 plus filling bell						
0.2/0.1	6715-3601	PES	SB	SB	Yes	1
0.2/0.2	6715-3602	PES	SB	SB	Yes	1
0.2/0.2	6716-3602	PES	MNPT	SB	Yes	1
0.65/0.45	6715-3604	PES	SB	SB	Yes	1
0.8/0.2	6715-3682	PES	SB	SB	Yes	1
Polycap TC 75						
0.2/0.1	6714-7501	PES	SB	SB	Yes	1
0.2/0.2	6714-7502	PES	SB	SB	Yes	1
0.65/0.45	6717-7504	PES	1/2 SB	1/2 SB	Yes	1
1.0/1.0	6717-7510	PES	1/2 SB	1/2 SB	Yes	1
Polycap TC 75 plus filling bell						
0.2/0.2	6715-7502	PES	SB	SB	Yes	1
0.8/0.2	6715-7582	PES	SB	SB	Yes	1
Polycap TC 150						
0.2/0.1	6717-9501	PES	1/2 SB	1/2 SB	Yes	1
0.2/0.2	6717-9502	PES	1/2 SB	1/2 SB	Yes	1
0.2/0.2	6704-9502	PES	1 1/2" Sanitary	1 1/2" Sanitary	No	1
0.65/0.45	6717-9504	PES	1/2 SB	1/2 SB	Yes	1
Polycap TC 150 plus filling bell						
0.2/0.2	6718-9502	PES	1/2 SB	1/2 SB	Yes	1
0.8/0.2	6718-9582	PES	1/2 SB	1/2 SB	Yes	1

MNPT—Male National Pipe Thread
PES—Polyethersulfone
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Polycap TF

Polycap TF filter capsules are made with durable, hydrophobic Polytetrafluoroethylene (PTFE) membranes in a polypropylene housing and are designed for use with organic solvents and chemically aggressive solutions.

Features and benefits

- Resistant to most solvents, autoclavable, and integrity-testable
- Available in 0.1, 0.2, 0.45, and 1.0 µm pore sizes
- 1.0 µm used for extended life and filtration of highly contaminated solutions
- Able to be sterilized by autoclaving with steam or EtO
- Manufactured under very clean conditions in a Class 10 000 clean room and under ISO Quality Systems

Applications

- Venting
- Inline filtration
- Isolation
- Electronics
- Pharmaceutical
- Biotech
- Laboratory
- Other uses

Polycap TF

Typical properties—Polycap TF

Housing	Polypropylene
Membrane	PTFE
Vent	On inlet
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)
Flow direction	Supported bi-directionally. certain applications may require orientation, i.e. vents. Reverse flow only for low-pressure applications.
Biosafety	Materials pass USP Class VI
Sterilization	May be autoclaved at 121°C for 20 min (maximum 132°C). Multiple autoclave cycles are possible. However, the responsibility for reuse is with the operator. The device should be protected from cross contamination. An integrity test should be performed after autoclaving.
Nominal filtration area	36 mm capsule: ~ 500 cm^2 (77 in^2) 75 mm capsule: ~ 1000 cm^2 (155 in^2) 150 mm capsule: ~ 2000 cm^2 (310 in^2)
IPA bubble point	0.1 µm membrane: > 1.5 bar (23 psi) 0.2 µm membrane: > 0.9 bar (13 psi) 0.45 µm membrane: > 0.5 bar (7 psi) 1.0 µm membrane: > 0.2 bar (3 psi)

Ordering information—Polycap TF (nonsterile)

			Connections		
Pore size (µm)	**Catalog number**	**Media**	**Inlet**	**Outlet**	**Quantity/pack**
Polycap TF 36					
0.1	6711-3601	PTFE	MNPT	3/8 SB	1
0.2	6711-3602	PTFE	MNPT	3/8 SB	1
0.2	6710-3602	PTFE	1/2 SB	1/2 SB	1
0.2	6700-3602	PTFE	3/8 SB	3/8 SB	1
0.2	2601	PTFE	–	–	5
0.2	2601T	PTFE	FNPT	FNPT	5
0.45	6711-3604	PTFE	MNPT	3/8 SB	1
0.45	2602S	PTFE	1 1/2" Sanitary	1 1/2" Sanitary	5
1.0	6700-3610	PTFE	3/8 SB	3/8 SB	1
1.0	2603	PTFE	–	–	5
1.0	2603T	PTFE	FNPT	FNPT	5
Polycap TF 75					
0.1	6700-7501	PTFE	3/8 SB	3/8 SB	1
0.1	2700T	PTFE	FNPT	FNPT	5
0.2	6711-7502	PTFE	MNPT	3/8 SB	1
0.2	6710-7502	PTFE	1/2 SB	1/2 SB	1
0.2	6700-7502	PTFE	3/8 SB	3/8 SB	1
0.2	2702M	PTFE	MNPT	MNPT	5
0.2	2702T	PTFE	FNPT	FNPT	5
0.45	6700-7504	PTFE	3/8 SB	3/8 SB	1
0.45	2703T	PTFE	FNPT	FNPT	5
1.0	6701-7510	PTFE	1/2 SB	1/2 SB	1
Polycap TF 150					
0.1	2800T	PTFE	FNPT	FNPT	5
0.2	2802T	PTFE	FNPT	FNPT	5
0.2	2801	PTFE	1 1/2" Sanitary	1 1/2" Sanitary	5
0.45	2803T	PTFE	FNPT	FNPT	5
1.0	2804T	PTFE	FNPT	FNPT	5

FNPT—Female National Pipe Thread
MNPT—Male National Pipe Thread
PTFE—Polytetrafluoroethylene
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Polycap GW

The US Environmental Protection Agency (EPA) and local Departments for Environmental Protection protocols specify filtering ground water samples with a 0.45 µm filter when analyzing dissolved or suspended metals (EPA Method 3005). Specifically designed with field sampling in mind, the Whatman Polycap Ground Water sampling capsule can be used as a convenient inline filter unit.

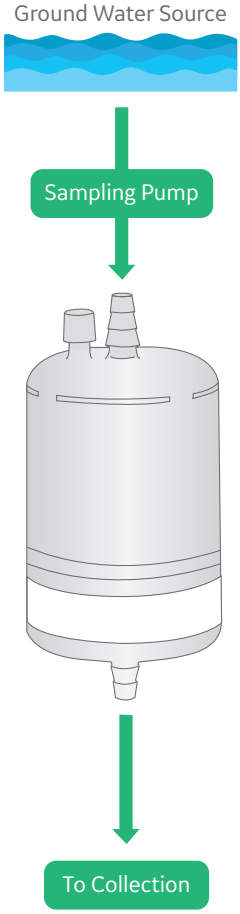
Features and benefits

- Connects directly to outlet of a sampling pump
- Easy to use
- Filtration membrane is encapsulated in durable polypropylene housing
- Large surface area optimized to provide at least 600 cm^2 of effective filtration area to ensure rapid sample collection
- Housing components thermally fused (no glues, adhesives, metals, epoxies, or extraneous materials)
- Suitable for filtration procedure outlined in EPA Method 3005 for ground water analysis
- Stepped hose barb fittings allow for connection with various size tubings
- Lot number printed on each unit for traceability

Polycap GW

Applications

- Filter ground water samples before dissolved metal analysis



Typical properties—Polycap GW

Housing	Polypropylene
Filter media	0.45 µm: PES filter
Inlet/outlet	1⁄4 to 3⁄8 in (6-9 mm) Stepped Barb (SB)
Support system	Polypropylene
Vent	On inlet
Nominal filtration area	600 cm^2 (93 in^2)
Wetting characteristics	Hydrophilic
Maximum pressure	60 psi (4.1 bar)
Water flow rate at 1.0 bar (14.5 psi)	60 L/min
Flow direction	Flow should follow arrows

Ordering information—Polycap GW

Pore size (µm)	Catalog number	Media	Connections		Quantity/ pack
			Inlet	Outlet	
Polycap GW 75					
0.45	6714-6004	PES	SB	SB	1
0.45	6724-6004	PES	SB	SB	100

PES—Polyethersulfone
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Carbon Cap

This filter capsule is suitable for adsorption of organics from air and removal of color, organics, and chlorine from water.

Carbon Cap is filled with high-purity, high-efficiency, acidwashed, granular-activated carbon and a pleated HEPA filter. It is made specially to meet the requirements for continuous column percolation purification processes.

Features and benefits

- Carbon acts as an adsorption media
- Pleated glass microfiber filter structure
- Retains 99.97% of particles greater than 0.3 µm
- Large surface area of activated carbon for effective operation
- Two sizes of capsules available to suit your specific application

Applications

- Water, chemical, and reagent purification
- Removes noxious odors, oil mists, and contaminants
- Compressed air lines and vacuum pumps
- Instrument outlet exhausts
- Removes a potential health hazard from the workplace

Carbon Cap

Typical properties—Carbon Cap

Housing	Polypropylene
Filter media	Activated carbon with a pleated HEPA cartridge
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)
Surface area (activated carbon)	Carbon Cap 75 capsule: 26,000 m^2 Carbon Cap 150 capsule: 82,000 m^2

Ordering information—Carbon Cap

Description	Catalog number	Quantity/pack
Carbon Cap 75	6704-7500	1
Carbon Cap 150	6704-1500	1

Venting filters

Whatman Venting Filters are disposable devices designed and manufactured with a high-purity polypropylene housing to maintain sample purity. Products are available with a choice of filtration media to suit a range of venting applications. No glue, adhesive, metal, epoxy, or other extraneous materials are used in construction. All seals are fused.

Whatman PolyVENT integral vent filters

Whatman PolyVENT filters are integral venting filters that work bidirectionally to prevent contaminants from entering vessels like fermentation tanks during draining or filling.

Feature and benefits

- 0.2 µm hydrophobic PTFE air filters are excellent industrial air filter media
- Testable by water break through (WBT) test or bubble point testing
- Passes USP Class VI biosafety tests for plastics
- Manufactured in clean room facilities
- Range of filtration areas from 4–2000 cm² to support filtration volumes as small as one liter and as large as a large tank vessel

Draining or filling of incubators, fermentation tanks, and other vessels requires a venting filter capable of preventing bacterial contamination. With an integral PTFE filter membrane, Whatman PolyVENT acts as an industrial air filter media for sterilization# of gases entering bioreactors such as fermentation tanks.

PolyVENT Integral Vent Filters

Typical properties—PolyVENT venting filters

Housing	Polypropylene
Filter media	PTFE (polytetrafluoroethylene)
Pore size	0.2 µm
Vent	On inlet
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	29 psi (2 bar)—forward direction
Water breakthrough test	29 psi (2 bar)/15 seconds
Flow direction	Bidirectional
Biosafety	Materials pass USP Class VI
Sterilization	Can be autoclaved at 121°C for 20 min (maximum 132°C). Multiple autoclave cycles are possible. However, the responsibility for reuse is with the operator. The device should be protected from cross contamination. An integrity test should be performed after autoclaving.
Nominal filtration area	36 mm capsule: ~ 500 cm^2 75 mm capsule: ~ 1000 cm^2 150 mm capsule: ~ 2000 cm^2 50 mm disc: 16 cm^2 25 mm disc: 4 cm^2

Ordering information—PolyVENT venting filters

			Connections*			
Pore size (µm)	**Catalog number**	**Housing type**	**Inlet**	**Outlet**	**Media**	**Quantity/pack**
PolyVENT 36						
0.2	6713-5036	Capsule	SB	SB	PTFE	1
0.2	2103	Capsule	1/2 SB	1/2 SB	PTFE	1
PolyVENT 75						
0.2	6713-1075	Capsule	1/2 SB	1/2 SB	PTFE	1
PolyVENT 150						
0.2	2107	Capsule	1/2 SB	1/2 SB	PTFE	1
0.2	2108	Capsule	1 1/2" Sanitary	1 1/2" Sanitary	PTFE	1
PolyVENT discs						
0.2	6713-0425	25 mm	FLL	ML	PTFE	50
0.2	6713-1650	50 mm	SB	SB	PTFE	10
0.2	6713-1651	50 mm	SB	SB	PTFE	100

FLL—Female Luer Lock
ML—Male Luer Lock
PTFE—Polytetrafluoroethylene
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Refers to sterilization by filtration for small sample use, which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).

HEPA-VENT and HEPA-CAP

HEPA filter media are used throughout the scientific, research, and industrial environments in a variety of air and gas filtration applications where high retention, dirt-holding capacity, and flow rates are required.

Features and benefits

- Glass filter media strengthened by dual lamination with a tough polyester monofilament
- Retains 99.97% of all particles ≥ 0.3 µm in air
- Durable polypropylene housing
- High flow rates with low pressure drops across filter media, ensuring clean air passing in and out of vessels
- Suitable for particulate removal from air and gases, prefilter for suction or to serve gas inline filter
- Able to be sterilized by autoclaving with steam
- Available in a variety of end-fitting configurations
- Manufactured in clean room facilities under ISO Quality Systems
- Repeatedly autoclavable at 121°C for 20 min (132°C max) for assured sterility
- Allows bidirectional flow
- Depth filter design allows for high loading capacity
- Preventing bacterial, algal, or fungal contamination in fermentors or incubators
- Tissue culture applications

HEPA- VENT and HEPA—CAP Filters

Applications

- Gas line filter
- Particulate removal from gases
- Prefilters for suction

Typical properties—HEPA venting filters

Housing	Polypropylene
Filter media	Laminated hydrophobically treated glass microfiber
Support system	Polypropylene
Sealing	Heat-fused
Maximum pressure	60 psi (4.1 bar)—capsule
Flow direction	Bidirectional
Biosafety	Materials pass USP Class VI
Sterilization	Autoclavable
Nominal filtration area	36 mm capsule: ~ 625 cm^2 (97 in^2) 75 mm capsule: ~ 1300 cm^2 (201 in^2) 150 mm capsule: ~ 2590 cm^2 (402 in^2) 50 mm disc: 16 cm^2

Ordering information—HEPA-VENT and HEPA-CAP filters

		Connections		
Catalog number	**Housing type**	**Inlet**	**Outlet**	**Quantity/pack**
HEPA-CAP 36				
6702-3600	Capsule	1/4-3/8 SB	1/4-3/8 SB	1
2609T	Capsule	3/8 in. FNPT	3/8 in. FNPT	5
HEPA-CAP 75				
6702-7500	Capsule	3/8-1/2 in. SB	3/8-1/2 in. SB	1
2709T	Capsule	3/8 in. FNPT	3/8 in. FNPT	5
HEPA-CAP 150				
6702-9500	Capsule	3/8 in. FNPT	3/8 in. FNPT	1
2809T	Capsule	3/8 in. FNPT	3/8 in. FNPT	5
HEPA-VENT disc filter				
6723-5000	50 mm disc	1/4-3/8 SB	1/4-3/8 SB	10

FNPT—Female National Pipe Thread
1/2 SB—Stepped Barb for 10-12 mm (3/8"-1/2") tubing
SB—Stepped Barb for 6-10 mm (1/4"-3/8") tubing

Vacuum protection filters

VACU-GUARD vacuum protection filters

VACU-GUARD help protect your equipment from potentially damaging contaminants.

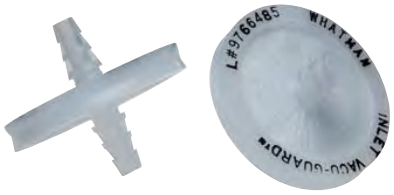
VACU-GUARD

Features and benefits

- Prevents fluid and aerosol contamination of vacuum pumps or aspiration suction systems while removing hazardous exhaust
- Flexible: designed for use with 6–10 or 10–12 mm i.d. tubing
- Biosafe: all materials pass USP Class VI Test for Plastics

Applications

- Protects vacuum pumps and systems from aerosols and particulate contamination



In-line disc filters protect vacuum systems from aqueous aerosols

VACU-GUARD 150

Features and benefits

- Choice of media: VACU-GUARD 150 capsule filters include all the features and benefits of standard VACU-GUARD disc filters, plus a range of media for specific applications
- Added back-up protection: use as a backup between a cold trap and pump to protect against moisture and organic vapors if cold trap fails

Applications

- Activated carbon removes organic vapors from air
- Molecular sieve for removal of water and small organic and alkaline molecules from air streams
- Desiccant for use with high velocity acidic air

In-line capsule filters trap chemicals in addition to aqueous aerosols

Typical properties—VACU-GUARD inline disc filter — 50 and 60 mm

	50 mm	**60 mm**
Filtration area	16 cm^2	25 cm^2
Maximum operating pressure	1 bar (15 psi)	1 bar (15 psi)
Biosafety	All materials pass USP Class VI test for plastics	
Rated retention in air	99.99% particle retention for particles ≥ 0.1 µm	
Pore size (in liquid)	0.45 µm	0.45 µm
Housing	Polypropylene	Polypropylene
Filtration media	PTFE membrane	PTFE membrane
Connectors	1/4–3/8" (6–10 mm) SB (stepped barb) inlet and outlet	3/8–1/2" (10–12 mm) SB inlet and outlet
Flow rates (SLPM):		
2 psi (0.14 bar)*	15	27
4 psi (0.28 bar)*	27	57
6 psi (0.41 bar)*	38	83
10 psi (0.69 bar)*	53	139
Flow direction	Inlet to outlet	Inlet to outlet

* *Differential pressure*

Typical properties—VACU-GUARD 150 inline capsule filter

	Activated carbon	**Desiccant**	**Molecular sieve**
Chemical trap media	Activated carbon	Anhydrous calcium sulphate	Silico aluminate zeolite
Filter media	PTFE	PTFE	PTFE
Surface area or weight (nominal)	82 000 m^2 (carbon)	318 g (desiccant)	363 g (zeolite)
Flow rates (SLPM) (nominal):			
0.1 bar (1.45 psi)*	210	280	250
0.5 bar (7.25 psi)*	450	600	570
Maximum operating pressure:			
Dry gas	4 bar (60 psi)	4 bar (60 psi)	4 bar (60 psi)
Wet gas	1 bar (14 psi)	1 bar (14 psi)	1 bar (14 psi)
Connectors:			
Inlet	Hose barb for 1/2" (12.7 mm) tube		
Outlet	3/8–1/2" (10–12 mm) step barb		

* *Differential pressure*

Note: as with any chemical reaction, care should be used to determine the safety and usefulness of VACU-GUARD 150 products prior to routine use. For example, the molecular sieve rapidly heats up when exposed to water.

Ordering information—VACU-GUARD

Product	**Catalog number**	**Quantity/pack**
VACU-GUARD, 50 mm disc	6722-5000	10
VACU-GUARD, 60 mm disc	6722-5001	10
VACU-GUARD 150 capsule, activated carbon	6722-1001	1
VACU-GUARD 150 capsule, desiccant	6722-1002	1
VACU-GUARD 150 capsule, molecular sieve	6722-1003	1

Microbiology products

We provide a broad range of high-quality products for microbiology quality control in food and beverage testing, environmental analysis, pharmaceutical quality control and a range of other industries. Our products help you ensure that every person who eats or drinks your products is getting the highest quality and safest ingredients.

Membrane filtration **146**
- MicroPlus and ME membranes 146
- Black polycarbonate membranes 148
- MBS I microbiological filtration system 150
- Membrane-Butler filter dispenser 151

Membrane filtration accessories **152**
- Pressure filtration devices 152
- Vacuum filtration equipment 153

Membrane filtration

MicroPlus membranes

MicroPlus membranes are high-flux membranes, with 0.45 µm characteristics for: Bacteria challenge test with Serratia marcescens ATCC 14756 (DSM 1636) with 1×10^3 germs/100 mL with reference to the Standard Methods for the Examination of Water and Waste Water Part 9020 (intra-laboratory Quality Control Guidelines) for microbiological quality control in the beverage industry.

Sterile Cellulose MicroPlus Membrane Filters

Features and benefits

- Economical
- Specifically for aqueous solutions
- Hydrophilic
- For use up to 125°C
- Sterile, individually packed
- All membrane filters have a high-contrast grid
- Type STL in dispenser boxes with 100 numbered membrane filters for easy removal and safe handling with the Membrane-Butler (supplied in four boxes each with 100 membrane filters)

For a wider choice of membranes, please refer to the Membrane Filters section.

Ordering information—MicroPlus and ME membrane filters

Diameter (mm)	Catalog number	Description	Pore size (µm)	Color	Grid/color	Quantity/pack
MicroPlus (cellulose nitrate)						
47	10407112	MicroPlus-21 STL	0.45	White	3.1 mm/black	100 × 4
50	10407114	MicroPlus-21 STL	0.45	White	3.1 mm/black	100 × 4
47	10407713	MicroPlus-21 ST	0.45	White	3.1 mm/black	100
50	10407714	MicroPlus-21 ST	0.45	White	3.1 mm/black	100
47	10407132	MicroPlus-31 STL	0.45	Black	3.1 mm/white	100 × 4
50	10407134	MicroPlus-31 STL	0.45	Black	3.1 mm/white	100 × 4
50	10407734	MicroPlus-31 ST	0.45	Black	3.1 mm/white	100
47	10407170	MicroPlus-41 STL	0.45	Green	3.1 mm/black	100 × 4
50	10407172	MicroPlus-41 STL	0.45	Green	3.1 mm/black	100 × 4
ME (mixed cellulose ester)						
47	10407312	ME25/21 STL	0.45	White	3.1 mm/black	400
50	10407314	ME25/21 STL	0.45	White	3.1 mm/black	400
47	10406870	ME25/21 ST	0.45	White	3.1 mm/black	100
47	10406871	ME25/21 ST	0.45	White	3.1 mm/black	1000
47	10407332	ME25/31 STL	0.45	Black	3.1 mm/white	400
50	10406872	ME25/21 ST	0.45	White	3.1 mm/black	100
50	10407334	ME25/31 STL	0.45	Black	3.1 mm/white	400
47	10407370	ME25/41 STL	0.45	Green	3.1 mm/black	400
50	10407372	ME25/41 STL	0.45	Green	3.1 mm/black	400
47	10409470	ME25/41 ST	0.45	Green	3.1 mm/black	100
50	10409472	ME25/41 ST	0.45	Green	3.1 mm/black	100
47	10408712	ME24/21 STL	0.2	White	3.1 mm/black	400
50	10408714	ME24/21 STL	0.2	White	3.1 mm/black	400
50	10407324	ME25/20 STL	0.45	White	5.0 mm/black	400

Ordering information—MicroPlus and ME membrane filters *(continuation)*

Diameter (mm)	Catalog number	Description	Pore size (µm)	Color	Grid/color	Quantity/pack
ME (mixed cellulose ester) *(continuation)*						
50	10408915	ME27/21 STL	0.8	White	3.1 mm/black	400
47	10407342	ME27/31 STL	0.8	Black	3.1 mm/white	400
50	10407615	ME27/41 STL	0.8	Green	3.1 mm/black	400
50	10409834	ME26/31 STL	0.6	Black	3.1 mm/white	400
ME 24						
47	10406970	ME24/21 ST	0.2	White	3.1 mm/black	100
47	10408712	ME24/21 STL	0.2	White	3.1 mm/black	400
50	10406972	ME24/21 ST	0.2	White	3.1 mm/black	100
50	10408714	ME24/21 STL	0.2	White	3.1 mm/black	400
ME 25						
47	10407970	ME25/51 ST**	0.45	White	3.1 mm/black	100
47	10406871	ME25/21 ST	0.45	White	3.1 mm/black	1000
47	10409770	ME25/31 ST	0.45	Black	3.1 mm/white	100
47	10409771	ME25/31 ST	0.45	Black	3.1 mm/white	1000
50	10406572	ME25/20 ST	0.45	White	5.0 mm/black	100
50	10409772	ME25/31 ST	0.45	Black	3.1 mm/white	100
ME 27						
47	10408970	ME27/21 ST	0.8	White	3.1 mm/black	100
47	10409970	ME27/61 ST with pad	0.8	White	3.1 mm/black	100
50	10405672	ME27/41 ST	0.8	Green	3.1 mm/black	100
ME 28						
50	10408472	ME28/41 ST	1.2	Green	3.1 mm/black	100
WME						
47	7187-114	WME ST without pad*	0.2	White	3.1 mm/black	100
47	7141-104	WME ST with pad	0.45	White	3.1 mm/black	100
47	7141-114	WME ST without pad*	0.45	White	3.1 mm/black	100
47	7141-124	WME ST without pad*	0.45	White	3.1 mm/black	200
47	7141-154	WME ST without pad*	0.45	White	3.1 mm/black	1000
47	7141-204	WME autoclave pack	0.45	White	3.1 mm/black	100
47	7153-104	WME ST with pad*	0.45	Black	3.1 mm/white	100

* *Individually packed*
** *With hydrophobic rim*

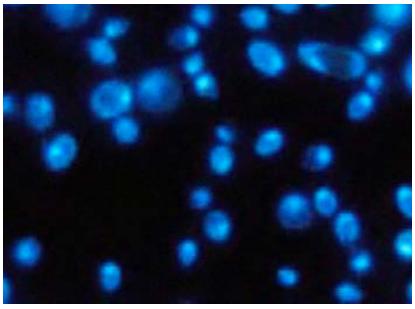
ST—Single sterile packed
STL—Sterile, for use with Whatman Membrane-Butler

Black polycarbonate membranes

Cyclopore black polycarbonate membranes

Black Cyclopore membranes are excellent for epifluorescence and other microscopy applications requiring a contrasting background. The polycarbonate membrane is used to filter the sample and is then used directly for analysis. The dark membrane gives lower background fluorescence and improves the sensitivity of the test.

Cyclopore PC Polycarbonate Black Membrane Filters



Yeast cells on Black Cyclopore with DAPI Stain

Typical properties—Cyclopore black polycarbonate membranes

Thickness	7-20 µm
Weight	0.7-2.0 mg/cm^2
Maximum service temperature	140°C
Porosity (void volume)	13%
Ash weight	20.6 µg/cm^2
Pore density	1 × 10^5—6 × 10^8 pores/cm^2
Autoclavable	30 minutes at 121°C
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert

Ordering information—Cyclopore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	7063-2502	Polycarbonate	100
25	0.4	7063-2504	Polycarbonate	100
47	0.2	7063-4702	Polycarbonate	100

Nuclepore black polycarbonate membranes

Nuclepore black dyed polycarbonate membranes are high performance membranes suited for applications using epifluorescence microscopy. Black membranes greatly reduce background fluorescence, which results in improved microorganism and particulate visibility.

Using these membranes in combination with epifluorescence techniques, rapid enumeration of viable and nonviable microorganisms and particulate matter can be conducted in 30 minutes or less. Conventional culturing methods require incubation times of more than 24 hours. Use black track-etched membranes with epifluorescence techniques to achieve rapid, direct enumeration of microorganisms.

Cyclopore PC Polycarbonate Black Membrane Filters

Features and benefits

- Polycarbonate track-etched membrane dyed black with Irgalan Black
- Flat, smooth surface assures surface capture of microorganisms and particles
- Extremely low nonspecific absorption

Applications

- Potable water
- Ultra pure water
- Food and dairy
- Wine and beverages
- Clinical
- Electronics

Ordering information—Nuclepore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	110656	Polycarbonate	100
25	0.4	110657	Polycarbonate	100
25	0.8	110659	Polycarbonate	100
47	0.2	111156	Polycarbonate	100

MBS I microbiological filtration system

MBS I is an excellent system for optimal microbiological control using membranes. The overall procedure time is reduced to a minimum. The design of the system, which consists of an electrical membrane dispenser, a funnel dispenser, and a vacuum manifold, leads to more reproducible results.

The special sealing technique ensures easy handling and a good integrity of the funnel and membrane during filtration. This reduces any cross contamination to a minimum.

MBS I, Steel Frit with Ring for AS220

Features and benefits

- Simple to use
- Safe sealing mechanism
- Shorter preparation time
- High reproducibility
- Funnels can be autoclaved up to 50 times
- Large funnel capacity for foaming liquids
- Easier to validate
- Risk of cross contamination is minimized

A combination of comfort and progress

When a funnel is taken from the dispenser, the butler automatically dispenses a membrane from the sterile pack, which is ready to use.

Find the right funnel

The new funnels are provided sterile in a magazine and save time especially when a large number of samples need to be processed by one apparatus.

The funnels (350 mL) are of high grade polypropylene and can be autoclaved up to 50 times. For applications in which funnels are only used once, the system offers another solution: a 100 mL funnel which is presterilized and supplied ready for immediate use. A special closure mechanism at the extraction edge ensures that the funnel seals tightly with the membrane.

MBS I workflow

1. When taking a new presterilized funnel, the membrane is dispensed automatically

2. Membrane is placed onto the filter base and the funnel installed

3. Liquid is poured into the funnel and a vacuum is applied

4. Membrane is easily removed after filtration

Ordering information—MBS I

Catalog number	Product	Description	Quantity/pack
10445890	AS220	2-place vacuum filtration manifold for MBS I	1
10445863	Frit	Steel frit with ring for AS220	1
10445870	Dispenser for funnels	Dispenser for 100 mL and 350 mL funnels for MBS I	1
10445861	Funnel—100 mL	Plastic funnel of PP, autoclavable	20
10445866	Funnel—350 mL	Plastic funnel of PP, autoclavable	20
10445868	Autoclaving bags	For MBS I plastic funnels	20
10477602	PZ 001	Tweezers, stainless steel	1

Membrane-Butler

Membrane filter dispenser for microbiological control

Membrane filters for microbiological checks must be handled carefully to ensure that they remain sterile and that quantitative results are being obtained.

The Membrane-Butler offers optimal handling for all MicroPlus and ME membrane filters with the type name “STL.” The dispenser box is placed in the Membrane-Butler, the sterile packaging is inserted into the roller system and the system is ready. With each turn (manual Butler) or by pressing the push button (eButler), a membrane filter is ejected from its sterile packing and can be removed easily with forceps.

Features and benefits

- High reliability
- Simple handling (applies only to eButler)
- Cross contamination risks are minimized
- Membrane dispensed rapidly
- Suited for use on sterile benches
- Compact dimensions for portable use

eButler

Ordering information—Membrane-Butler

Catalog Number	Description	Use	Quantity/Pack
10477100	Membrane-Butler	Manual Butler for dispensing filtration membranes	1
10477103	eButler	Electric Butler for dispensing filtration membranes	1

Membrane filtration accessories

Whatman offers a line of analytical funnels and vacuum filtration equipment for use in microbiological testing processes.

Pressure filtration devices

Pressure filtration devices with a sample loading cylinder are suitable for batch filtration of samples from 20 mL, while devices without infusion cylinders are connected inline and are suitable for larger volumes of several liters. Filtration of liquids and gases is possible, including sterile[#] filtration of serums or the clear filtration of media that are difficult to filter, especially those that are highly viscous.

Membranes, paper, or glass fiber filter discs can be used. Cleaning and changing of filters is completed in a few steps. All units are equipped with pressure resistant filter supports. High-quality silicone or PTFE O-rings seal the systems. Please ensure you only use intact seals for safety reasons. PTFE versions are available, in addition to stainless steel devices, for use with corrosive media.

Pressure Filtration Devices

Applications

- Clear filtration of liquids that are difficult to filter and sterile filtration of liquids and gases. For small volumes: MD 050
- Inline filtration of corrosive liquids which must not come into contact with metals: MD 142/7 or with infusion cylinder MD 142/7/3

Typical properties—pressure filtration devices

Series	Material	Seals	Max pressure* (bar)	Max temperature resistance (°C)	Filter diameter (mm)	Prefilter diameter (mm)
MD 050	Stainless steel	Silicone/PTFE	10/4	200	50	43
MD 142/5	Stainless steel	Silicone/PTFE	10/4	200	142	134
MD 142/7	PTFE	PTFE	3.5	200	142	134

* *With silicone O-ring/PTFE O-ring*

Ordering information—pressure filtration devices

Catalog number	Description	Quantity/pack
Stainless steel		
10450450	MD 050/4, 200 mL, 230 × 70 mm with rapid seal	1
10451610	MD 142/5/3, 2200 mL, 545 × 200 mm	1
PTFE		
10451710	MD 142/7/3, 1500 mL, 470 × 200 mm	1
Accessories—inlet/outlet connections for stainless steel pressure filtration devices of the MD 050 and MD 142/5 series*		
10453001	MD 050/0/12, connection: rapid seal coupling, for SV 003 c	1
10453007	MD 050/0/18, connection: olive external diameter 9–11 mm, for pressure hoses	1
Pressure hose		
10471101	Pressure hose, SV 003 c, loadable bar 10, connector SVK/R 3/8", inner diameter 6 mm, length 1.5 m	1

* *All connections are supplied with PTFE seal*

SVK—rapid seal coupling

[#] *Refers to sterilization by filtration for small sample use, which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Vacuum filtration equipment

MV 050 series

All MV series vacuum filtration devices are made of stainless steel, which is especially suitable for microbiological applications.

The system can be used up to 200°C, is autoclavable and can be sterilized by dry heat up to 180°C.

Applications

- Microbiology (e.g. Escherichia coli detection), biochemistry, hydrobiology
- Drinks (e.g. cold sludge in beer), foodstuffs (e.g. ice cream), pharmaceuticals, cosmetics, water, wastewater
- Residue analysis, precipitate analysis, contamination tests.

MV 050/0

Technical data—vacuum filtration—MV 050 series

Apparatus selection	
Filter size	47/50 mm
Filter volume	100 or 500 mL
Filter area	12.5 cm^2
Prefilter	40 mm diameter
Vacuum connection	Rubber stopper
Filter support	Sieve (frit as accessory)

Materials selection	
Upper and lower parts	Stainless steel 1.4301
Cover	Stainless steel 1.4301
Frit	Stainless steel 1.4571
Sieve	Stainless steel 1.4301
Seals	PTFE and silicone
Clamps	Aluminum

Ordering information—MV 050 series

Catalog number	Description	Quantity/pack
10440000	MV050/0 vacuum filtration apparatus, stainless steel, 500 mL, 47/50 mm	1
10440020	MV050A/0 vacuum filtration apparatus with rapid closure clamp, stainless steel, 500 mL, 47/50 mm	1

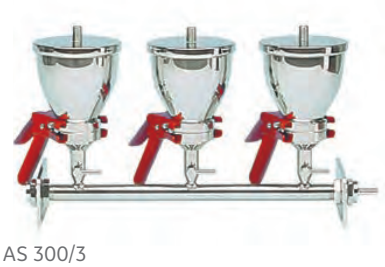
Multiple vacuum filtration apparatus

AS 300 and 600 series

The stainless steel manifold for three or six filtration units is fitted with stainless steel units. The apparatus can be autoclaved and sterilized by dry heat at up to 180°C. Suitable only for vacuum operation. If flushing tubes are used, do not exceed 1.3 bar (300 mbar over-pressure).

Applications

- Microbiological quality control
- Residue analyses
- Serial filtration carried out rapidly and easily with a common drainage outlet



AS 300/3

AS 610/3

Technical data

AS 300 and 600 series—multiple vacuum filtration apparatus

Apparatus selection	
Filter size	47/50 mm
Filter volume	100 or 500 mL
Manifold	3 or 6 stopcocks and lower parts for individual choice of filter units
Filter support	Sieve (frit as accessory)
Vacuum connection	Tubing nozzle 9 mm (inside diameter)

Multiple filtration apparatus complete and ready for use. Filters and prefilters sold separately.

Filter Funnel Manifolds

Ordering information—multiple vacuum filtration apparatus

Catalog number	Description	Quantity/pack
Three-place filtration		
10445850	AS300/5 Vacuum filtration system, stainless steel 100 mL, 47/50 mm, support screen	1
10445830	AS300/3 Vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10445835*	AS310/3 Vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10498761**	Stainless steel filter funnel 3-place manifold	1
Six-place filtration		
10444850	AS600/5 Vacuum filtration system, stainless steel 100 mL, 47/50 mm, support screen	1
10444830	AS600/3 Vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10444835*	AS610/3 Vacuum filtration system, stainless steel 500 mL, 47/50 mm, support screen	1
10498762**	Stainless steel filter funnel 6-place manifold	1

* *With rapid closure clamp*
** *Recommended for Microbiology Monitors and Analytical Funnels*

Accessories and vacuum filtration apparatus

Vacuum and pressure pump*

Vacuum pumps are required especially in the fields of microbiological quality control, analyses, medicine, and production technology. The pumps are used for pumping gases, taking samples (even liquids in a vacuum), and evacuating vessels.

** 220 Volts. This product is only available in Europe*

Vacuum Pump VP003

Features and benefits

- AC model
- Contamination-free pumping of air, gases, and vapors
- High performance and minimum size
- Extremely quiet and smooth running
- Equipped with thermo switch and standard fuse
- Simple to use
- Maintenance free
- Oil-free membrane pump

Witt's bottle WT 100

For filtrate collection in an inserted container. The bottle is made of borosilicate glass. It has a replaceable round lid and side-mounted tubing nozzle for vacuum tubing 8 mm (inside diameter).

Forceps PZ 001

The stainless steel forceps with smooth angled jaws (104 mm long) are excellent for handling membrane filters. They are autoclavable and can be flame sterilized with ethanol.

Witt's Bottle WT 100 and Forceps PZ 001

Typical properties—vacuum and pressure pump

	Delivery (L/min) m^3/h	Vacuum (mbar absolute)	Pressure (bar)	Weight (kg)
VP003	3.6	< 100	4	11

Technical data—Witt's bottle WT 100

Apparatus selection	
Size	100 mm diameter
Height	160 mm
Capacity	1000 mL
Vacuum connection	Tubing nozzle 8 mm (inside diameter)

Ordering information—vacuum filtration apparatus accessories

Catalog number	Description	Quantity/pack
10470300	VP 003 Electrical vacuum and pressure pump	1
10477601	WT 100 Witt's flask, 1000 mL with tubing nozzle	1
10477600	SF 100 Suction flask, 1000 mL with tubing nozzle	1
10471700	SV 006 Vacuum tubing, 1 m length	1
10477602	PZ 001 Tweezers, stainless steel	1

Specialty products

Separate the organic from the inorganic. Protect lab surfaces. Test the pH levels in swimming pools. A range of products for a variety of tasks. GE offers a range of specialty products to meet your specific testing requirements.

Chromatography papers 158
Extraction thimbles 160
Benchkote and Benchkote Plus 165
Weighing papers 167
Paper for ignition strength (IS) measurement 168
pH indicators and test papers 169
Papers for healthcare 171
Phase separator paper 172
Lens cleaning tissue 173
Moisture testing papers 173

Chromatography papers

Whatman chromatography paper media are made from specially selected cotton cellulose. They are rigorously quality controlled for characteristics important to the chromatographer and to ensure uniformity within the grade.

Features and benefits

- Pure cellulose produced entirely from the highest quality cotton linters with no additives of any kind
- Manufactured and tested specifically for chromatographic techniques—this ensures the wicking capability and uniformity of capillary action that are important in chemical separations
- Also widely used in protein and nucleic acid blotting

Cellulose chromatography papers

Cellulose chromatography papers

Grade 1 Chr

A smooth surface, 0.18 mm thick with a linear flow rate (water) of 130 mm/30 min. Good resolution for general analytical separations.

Grade 2 Chr

Thickness 0.18 mm. Flow rate 115 mm/30 min. Slower than 1 Chr for higher resolution applications. Smooth surface. Particularly recommended for optical or radiometric scanning.

Grade 3 Chr

A medium thickness paper (0.36 mm) with a flow rate of 130 mm/30 min. For general applications with medium/heavy solute loadings. Frequently used for separation of inorganic compounds and for electrophoresis.

Grade 4 Chr

Thickness 0.21 mm. Flow rate 180 mm/30 min. Fastest of the thin papers. Recommended for routine and/or repetitive chromatography when loadings are relatively low. Smooth surface. Very suitable where speed is important and very high resolution is not required.

Grade 17 Chr

A thick (0.92 mm) and highly absorbent paper with a very high flow rate of 190 mm/30 min. Suitable for the heaviest loadings and for preparative paper chromatography and electrophoresis.

Grade 20 Chr

Thickness 0.17 mm. Flow rate 85 mm/30 min. For maximum resolution, this grade is supreme, giving the greatest possible separation of closely related compounds. Smooth surface. Recommended for separation of samples of unknown composition, with outstanding resolution at low loadings.

Grade 31ET Chr

Thickness 0.50 mm. Flow rate 225 mm/30 min. Extremely fast. Flow rate is the highest of all chromatography papers in the Whatman range. Thick paper with fairly soft surface. Principal application is in electrophoresis of large molecules.

Grade 54 SFC

Thin (0.18 mm) hardened paper with high speed (180 mm/30 min) and fair to good resolution. Recommended for routine chromatography. High wet strength.

Grade 2668 Chr

Thickness 0.9 mm. Flow rate 155 mm/10 min. For separation of relatively large molecules by electrophoresis.

Grade 2727 Chr

Thickness 1.40 mm. Flow rate 180 mm/30 min. For separation of very large amounts of substance.

Ordering information—cellulose chromatography paper

	Catalog number										
Dimensions	**Grade 1 Chr**	**Grade 2 Chr**	**Grade 3 Chr**	**Grade 4 Chr**	**Grade 17 Chr**	**Grade 20 Chr**	**Grade 31ET Chr**	**Grade 54 SFC**	**Grade 2668 Chr**	**Grade 2727 Chr**	**Quantity/ pack**
Circles											
185 mm	–	–	–	–	–	–	–	–	–	10382514	100
Sheets											
2 × 5 cm	–	–	–	–	–	–	3031-901	–	–	–	1000
2.5 × 22 cm	–	–	–	–	3017-8793	–	–	–	–	–	100
7 × 9 cm	–	–	–	–	3017-820	–	–	–	–	–	100
10 × 30 cm	3001-845	–	–	–	–	–	–	–	–	–	100
19 × 19 cm	–	–	–	–	–	–	–	–	–	10382581	100
20 × 20 cm	3001-861	–	–	–	–	–	–	–	–	–	100
25 × 25 cm	3001-878	–	–	–	–	–	–	–	–	–	100
46 × 57 cm	–	–	–	–	3017-915	–	3031-915	–	–	–	25
46 × 57 cm	3001-917	3002-917	3003-917	3004-917	3017-917	3020-917	–	–	–	–	100
58 × 60 cm	–	–	–	–	–	–	–	–	–	10382562	50
58 × 60 cm	–	3002-911	–	–	–	–	–	–	10382461	–	100
58 × 68 cm	3001-931	–	–	–	–	–	–	–	–	–	100
Reels											
1.0 cm × 100 m	3001-604	–	–	–	–	–	–	–	–	–	1
2.0 cm × 100 m	3001-614	–	–	3004-614	–	–	–	–	–	–	1
2.5 cm × 30 m	–	–	–	–	3017-621	–	–	–	–	–	1
3.0 cm × 100 m	3001-640	–	–	–	–	–	–	–	–	–	1
4.0 cm × 100 m	3001-652	–	–	–	–	–	–	–	–	–	1
5.0 cm × 100 m	3001-653	–	–	–	–	–	–	–	–	–	1
10.0 cm × 100 m	3001-672	–	–	–	–	–	–	–	–	–	1
15.0 cm × 100 m	3001-681	–	–	–	–	–	3031-681	–	–	–	1
1.5" × 300'	3001-651	–	–	–	–	–	–	3454-651	–	–	1
Strips											
11 × 21.3 cm with 12 strips of 1.5 cm*	3001-964	–	–	–	–	–	–	–	–	–	100

* *1 Chr sheet divided into 15 mm lanes for running up to 12 samples in parallel*

For details on 3MM Chr products please visit the GE website: gelifesciences.com

Extraction thimbles

The thimbles are widely used in Soxhlet extraction units, providing a safe, convenient, and efficient method of solvent extraction of solids and semi-solids. Soxhlet extraction is a widely used technique for the analysis of fats or pesticides in foods and soil materials as well as in many other procedures that involve a solid-liquid extraction.

Cellulose thimbles

High-performance cellulose thimbles

Cellulose extraction thimbles are produced from high-quality alpha cellulose cotton linter and have excellent mechanical strength and retention.

Standard single thickness thimbles have a wall thickness of approximately 1 mm (10.0 µm nominal particle retention).

Double thickness thimbles have a wall thickness of approximately 2 mm (6.0 µm nominal particle retention) for applications where higher retention and increased wet or dry strength, or rigidity are required.

The high purity of the materials ensures reliable and reproducible analytical results.

High Performance Cellulose Extraction Thimbles

Standard cellulose thimbles

Thimbles of type 603 are made from high-quality cellulose and 603 g thimbles are made from borosilicate glass fibers with an inorganic binder. For all automated extraction apparatus in common use, we offer thimbles whose dimensions are matched exactly to those of the thimble holders to ensure optimal fit.

Thimble size selection guide

Thimble sizes should be selected carefully to fit extractors correctly. The different sizes represent the established practice of showing the internal diameter and overall length of the thimble in millimeters. Therefore, an extra allowance for wall thickness should be made when calculating external diameters. The thimble should pass through the narrower end of the upper extractor socket, allowing 1-2 mm clearance, and be 5-10 mm above the level of the top of the siphon tube.

Typical properties—standard thimbles

Grade	Material	Maximum temperature °C
603	Cellulose	130
603 g	Borosilicate glass fibers*	500

* *With inorganic binder*

Ordering information—high-performance cellulose thimbles

Dimensions (mm)* †	Catalog number	Quantity/pack
Single thickness (nominal wall thickness = 1 mm)		
10 × 50	2800-105	25
18 × 55	2800-185	25
19 × 90	2800-199	25
22 × 65	2800-226	25
22 × 80	2800-228	25
25 × 80	2800-258	25
25 × 90	2800-259	25
25 × 100	2800-250	25
26 × 60	2800-266**	25
26 × 100	2800-260	25
28 × 80	2800-288	25
28 × 100	2800-280	25
28 × 120	2800-282	25
30 × 80	2800-308	25
30 × 100	2800-300	25
33 × 80	2800-338	25
33 × 94	2800-339	25
33 × 100	2800-330	25
33 × 118	2800-331	25
37 × 130	2800-373	25
41 × 123	2800-412	25
43 × 123	2800-432	25
60 × 180	2800-608#	25
Double thickness (nominal wall thickness = 2 mm)		
16 × 60	2810-166	25
22 × 80	2810-228	25
25 × 80	2810-258	25
26 × 60	2810-266	25
33 × 80	2810-338	25
33 × 94	2810-339	25
43 × 123	2810-432	25
90 × 200	2810-902	25

* *Internal diameter and external length*
** *Fits Soxtec™ extractor*
† *See Thimble Size Selection Guide on p. 156*
# *Nominal wall thickness 1.5 mm*

Ordering information—standard cellulose thimbles

Dimensions (mm)*†	Grade	Wall thickness (mm)	Catalog number	Quantity/pack
22 × 60	603	2.0	10350306	25
22 × 80	603	1.5	10350211	25
25 × 60	603	1.5	10350215	25
25 × 80	603	1.5	10350217	25
25 × 100	603	1.5	10350219	25
26 × 60	603	1.5	10350220	25
27 × 25 × 60	603T	1.0	10350416	25
27 × 80	603	1.5	10350223	25
28 × 60	603	1.5	10350225	25
28 × 80	603	1.5	10350226	25
28 × 100	603	1.5	10350227	25
30 × 80	603	1.5	10350234	25
30 × 100	603	1.5	10350236	25
33 × 60	603	1.5	10350238	25
33 × 80	603	1.5	10350240	25
33 × 31 × 80	603T	1.0	10350437	25
33 × 90	603	1.5	10350241	25
33 × 94	603	1.5	10350242	25
33 × 100	603	1.5	10350243	25
33 × 118	603	1.5	10350245	25
33 × 130	603	1.5	10350247	25
33 × 205	603	1.5	10350250	25
34 × 130	603	1.5	10350252	25
35 × 150	603	1.5	10350255	25
40 × 85	603	2.0	10350261	25
41 × 123	603	2.0	10350265	25
44 × 230	603	2.0	10350275	25
48 × 145	603	2.0	10350273	25
48 × 200	603	2.0	10350274	25
75 × 250	603	2.5	10350287	25
80 × 250	603	3.0	10350324	25

* *Internal diameter and external length*
† *See Thimble Size Selection Guide on p. 156*

Ordering information—standard cellulose thimbles for DIONEX™ ASE

Extraction volume (mL)	Extraction system	Nominal wall thickness (mm)	Catalog number	Quantity/pack
11	200	1.0	10350106	25
22	200	1.0	10350108	25

Glass and quartz thimbles

High-purity glass microfiber thimbles

High-purity glass microfiber thimbles manufactured from 100% pure borosilicate glass are available for specialized applications. The thimbles are completely free of binders or additives and can be used at temperatures up to 500°C or when using solvents that are incompatible with cellulose thimbles. These thimbles are also used in pollution monitoring techniques (0.8 µm nominal particle retention). Typical thickness 1.7 mm.

High-purity glass microfiber thimbles

Features and benefits

- Available in a range of sizes and wall thicknesses to suit your application
- Designed to fit most commercially available Soxhlet extractors
- No binders are added

Applications

- Smoke stack gas monitoring
- Soxhlet extraction
- Analyzing pesticide residues
- Determining oil/fat content of foods (e.g. french fries)
- Analysis of oil and grease in solid wastes

Quartz microfiber thimbles

Made from high-purity quartz microfiber, this thimble is able to withstand high temperatures (up to 1000°C). Suitable for solvent extraction, dioxin detection and smoke stack gas sampling.

Standard glass fiber thimbles

Thimbles of type 603 g are made from borosilicate glass fibers with inorganic binder. There is also a selection of borosilicate glass thimbles without binder.

Ordering information—high-purity glass and quartz microfiber thimbles

Dimensions (mm)*	Catalog number	Quantity/pack
Glass microfiber thimbles—Grade HP-GF		
19 × 90	2814-199	25
25 × 90, tapered	2814-259	25
30 × 100	2814-300	25
43 × 123	2814-432	25
33 × 135	2814-533	25
Quartz microfiber thimbles		
25 × 90, tapered	2812-259	10
28 × 70, tapered	2812-287	10

* *See Thimble Size Selection Guide on p. 156*

Ordering information—standard glass microfiber thimbles

Dimensions (mm)*	Wall thickness (mm)	Catalog number	Quantity/pack
Grade 603 g (glass fiber with inorganic binder)			
10 × 38	1.0	10371103	25
16 × 50	1.0	10371005	25
19 × 90	1.0	10371007	25
22 × 80	1.5	10371011	25
23.8 × 68	1.5	10371114	25
25 × 100	1.5	10371019	25
28 × 60	1.5	10371025	25
30 × 100	1.5	10371036	25
33 × 94	1.5	10371042	25
33 × 100	1.5	10371043	25
33 × 118	1.5	10371045	25
35 × 150	1.5	10371055	25
44 × 230	1.5	10371075	25
Glass microfiber (without binder)			
30 × 80	–	2811-308	25

* *Internal diameter and external length*

Benchkote, Benchkote Plus and Benchkote for ÄKTA surface protector

Benchkote

Benchkote is an absorbent, impermeable material designed to protect laboratory surfaces against hazardous spills. The material features a high-quality, smooth, absorbent Whatman paper, which quickly absorbs liquid spills, and a laminated polyethylene layer that prevents flow through to the working surface. After use, the sheet is incinerated or disposed of according to local regulations.

Benchkote Plus

Benchkote Plus is a thicker, more absorbent material for more demanding applications and can absorb in excess of 0.75 liters of water per square meter.

Features and benefits

- Material is very strong, making it tear resistant, wet or dry
- Smooth white surface can be written on with ink or pencil and lies flat
- Suitable for saturation with disinfectant to protect benches where pathogens and other bacteria are present
- Use polyethylene side up to collect deposits without absorption
- Paper side quickly absorbs liquid spills, preventing liquids from going through to the work surface
- Spillages are trapped in the absorbent paper
- Benchkote can be incinerated after use; the polyethylene layer does not melt or drip but is rapidly consumed in the flames

Applications

- Containing radiochemical spillage and avoiding contamination
- Recovering spillage of expensive materials
- Protecting hard surfaces to lessen impact
- Water or solvent wick for humidity chambers
- Lining of chemical cabinets, laboratory bench drawers, and laboratory hoods

Benchkote Surface Protector

Ordering information—Benchkote surface protector

Dimensions (mm)	Catalog number	Description	Quantity/pack
Benchkote surface protector			
460 × 570	2300-594	Pad (NA)	1 (50 sheets)
460 × 570	2300-599	Pad (EU)	1 (50 sheets)
460 × 570	2300-916	Sheets	50
460 × 570	2300-917	Sheets	100
–	2300-004	A4 sheets	1000
460 mm × 50 m	2300-731	Reel	1
920 mm × 50 m	2300-772	Reel	1
Benchkote Plus surface protector			
460 × 570	2301-916	Sheets	50
500 × 600	2301-6150	Sheets	50
600 mm × 50 m	2301-6160	Reel	1
Benchkote sheet for ÄKTA			
420 × 300	2300-10060	Benchkote sheet for ÄKTA pure	10
420 × 300	2300-10061	Benchkote sheet for ÄKTA pure	25
420 × 300	2300-10062	Benchkote sheet for ÄKTA pure	50
310 × 210	2300-10063	Benchkote sheet for ÄKTA start	10
310 × 210	2300-10064	Benchkote sheet for ÄKTA start	25
310 × 210	2300-10065	Benchkote sheet for ÄKTA start	50
520 × 500	2300-10072	Benchkote sheet for ÄKTA avant	10
520 × 500	2300-10073	Benchkote sheet for ÄKTA avant	25
520 × 500	2300-10074	Benchkote sheet for ÄKTA avant	50

Weighing papers

Kjeldahl weighing boats

Kjeldahl Analysis Weighing Boat

Features and benefits

- Excellent for weighing and transferring Kjeldahl samples safely and reliably
- Dissolves residue-free in the digestion solution without influencing the analytical results in any way
- Made from very low nitrogen parchment paper without any glue or additives

Transfer your samples completely loss-free by simply dropping the entire weighing boat containing the sample into the acid solution in the Kjeldahl flask/digestion tube.

Parchment paper

Features and benefits

- Transparent and smooth
- Simplifies sample transfer
- Quantitative transfer from paper

Typical properties—weighing papers

Product	Grade	Nominal thickness (µm)	Nominal weight (g/m²)
Weighing boat, ≤ 0.07% N	609	0.07	80
Pergamyne paper	2122	0.03	40
Parchment paper, ≤ 0.05% N	B-2	0.04	43

Ordering information—weighing papers

Dimensions (mm)	Grade	Catalog number	Description	Quantity/pack
55 × 10 × 10	609	10313032	Kjeldahl Weighing Boat	100
100 × 100	2122	10347893	Sheets	500
150 × 150	2122	10347890	Sheets	500
3” × 3”	B-2	10347671	Sheets	500
4” × 4”	B-2	10347672	Sheets	500
6” × 6”	B-2	10347673	Sheets	500
12” × 12”	B-2	10347670	Sheets	500

Paper for ignition strength (IS) measurement

This certified Grade 2 is tested according to the procedure detailed in ASTM E 2187-09, Sections 9.3.1 and 9.3.2. The paper meets both the conditioned (26.1 ± 0.5 g, SD < 0.3 g) and dried (24.7 ± 0.5 g, SD < 0.3 g) weight requirements.

The lot specific certificate can be downloaded from www.gelifesciences.com/certificates

Features and benefits

- Each lot is guaranteed to meet the ASTM E 2187-09 specifications
- Simplifies testing process by removing lot suitability testing
- Just condition and use

Ordering information—paper for ignition strength (IS) measurement

Diameter (mm)	Catalog number	Grade	Quantity/pack
150	1002-147	Grade 2 (for IS testing)	100

pH Indicator and test papers

Whatman pH indicator and test papers are designed to meet your specific needs, and combine ease of use with unsurpassed accuracy and consistency.

The convenience of using indicator papers for the rapid determination of pH values has led to many applications in laboratories and industry.

pH indicators

Features and benefits

- Instant pH readings
- Accurate for a wide range of routine pH testing
- Inexpensive
- Convenient and portable for field use

pH indicators

Strips type CF (color bonded dye system)

Individual plastic support strips carry four different segments of dye-impregnated indicator papers. The resulting combination of color differences gives an extremely clear and accurate visual pH value. All the dyes are chemically bonded to the paper and cannot be leached into solution; problems associated with contamination of the sample and resultant anomalous readings are avoided.

Strips type CS (integral comparison chart)

Each test strip has a central segment of indicator dye and, printed alongside, eight or more different color segments marked with corresponding pH values for matching purposes. The pH test value can be read off by direct comparison of the test strip color and the color bars. Excellent for colored solutions, when any changes in color of the paper stock are automatically cancelled out.

Dispensers type TC (triple color band)

The strip has three separate indicator dye color bands. The individual combination of color change resulting from each test is compared with the color-coded comparison chart printed on the dispenser, giving improved speed and accuracy in reading.

Dispensers type SR (standard range)

A full range and some narrow ranges in this popular pH indicator dispenser.

Indicator books

The book format is particularly suitable for educational and industrial use. In schools they are economical because the amount of paper per student can be carefully controlled.

Acid-alkali test papers

Litmus blue and litmus red

These easy-to-use test papers facilitate a general test for acid or alkaline reaction. The change occurs around pH 5-8. They are particularly recommended for educational use.

Congo red

This test paper changes color from blue to red in the range pH 3-5 for the determination of neutralization point in strong acid/weak alkali reactions.

Phenolpthalein

This white paper changes to pink at pH 8.3 and becomes red at pH 10. It is useful for the determination of the neutralization point in weak acid/strong alkali reactions.

Specialized test papers

Lead acetate test paper

Used for detecting hydrogen sulfide, this rapid qualitative test paper, when wetted with distilled water, can detect as little as 5 ppm of H_2S in the atmosphere or in a gas stream. Hydrogen peroxide can be detected with this paper by preblackening the paper in H_2S. Concentrations as low as 4 ppm can be detected.

Potassium iodide test paper

Used for detecting chlorine and other oxidizing agents. In acid solution, oxidizing agents react with the iodide in the test paper to liberate iodine. The paper will turn blue in the presence of an oxidizing agent (e.g. CI_2, Br_2, H_2O_2, HNO_2 etc.).

Universal indicator papers

Universal indicator papers have been impregnated with a mixture of several indicators. On contact with the sample solution they assume a particular color. A check against the color comparison table supplied allows the pH to be determined.

Ordering information—pH indicators and test papers

Dimensions (mm)	pH range	Catalog number	Description	Packaging	Quantity/pack
Strips					
6 × 80	0.0 to 14.0	2613-991	Color bonded	100 strips	1
6 × 80	4.5 to 10.0	2614-991	Color bonded	100 strips	1
6 × 85	0.0 to 14.0	10362000	Panpeha Plus, non bleeding	Strip, 4 sections	100
6 × 85	2.0 to 9.0	10362010	Panpeha Plus, non bleeding	Strip, 3 sections	100
9 × 85	0.0 to 14.0	10360005	Panpeha 112	–	200
11 × 100	1.0 to 12.0	2612-990	Integral comparison strip	200 strips	1
11 × 100	1.8 to 3.8	2626-990	Integral comparison strip	200 strips	1
11 × 100	3.8 to 5.5	2627-990	Integral comparison strip	200 strips	1
11 × 100	5.2 to 6.8	2628-990	Integral comparison strip	200 strips	1
11 × 100	6.0 to 8.1	2629-990	Integral comparison strip	200 strips	1
11 × 100	8.0 to 9.7	2630-990	Integral comparison strip	200 strips	1
11 × 100	9.5 to 12.0	2631-990	Integral comparison strip	200 strips	1
Dispensers (reel)					
10 mm × 5 m	1.0 to 11.0	2611-628	Three colors	–	1
7 mm × 5 m	1.0 to 14.0	2600-100A	Standard full range	–	1
7 mm × 5 m	0.5 to 5.5	2600-101A	Standard narrow range	–	1
7 mm × 5 m	4.0 to 7.0	2600-102A	Standard narrow range	–	1
7 mm × 5 m	6.4 to 8.0	2600-103A	Standard narrow range	–	1
7 mm × 5 m	8.0 to 10.0	2600-104A	Standard narrow range	–	1
7 mm × 5 m	1.0 to 11.0	10362030	Panpeha	–	1
Books					
–	1.0 to 11.0	2600-500	–	10 books of 20 strips	1 carton*

* *1 carton contains 10 packs of 10 books—product is 20 strips per book*

Ordering information—acid-alkali test papers

Dimensions	pH range	Catalog number	Description	Packaging	Quantity/pack
Dispensers (reel)					
7 mm × 5 m	–	2600-201A	Litmus blue	–	1
7 mm × 5 m	–	2600-202A	Litmus red	–	1
7 mm × 5 m	–	2600-204A	Phenophthalein	–	1
Books					
10 mm × 75 mm	0.0 to 12.0	10360300	Litmus blue	–	100
–	–	2600-601	Litmus blue	10 books of 20 strips	1 carton*
–	–	2600-602	Litmus red	10 books of 20 strips	1 carton*
Specialized test paper dispensers (reel)					
7 mm × 5 m	–	2602-501A	Ind lead acetate	–	1
7 mm × 5 m	–	2602-500A	Potassium iodide	–	1
Specialized test paper dispensers (book)					
–	–	2651-500	Starch iodide	10 books of 20 strips	10*

* *1 carton contains 10 packs of 10 books—product is 20 strips per book*

Papers for healthcare

Antibiotic assay discs

For determining the type of causal agent of infectious diseases and for checking their sensitivity to antibiotics and chemotherapeutic agents in vitro by means of the inhibition zone determination method. The antibiogram allows rational and selective chemotherapy.

The test discs can be coated with chemotherapeutic agents, placed on the innoculated nutrient agar and incubated. The size of the inhibition zone is a measure for the effectiveness of the substances.

Ordering information—antibiotic assay (AA) paper

Diameter (mm)	Catalog number	Quantity/pack
6	2017-006	1000
9	2017-009	1000
13	2017-013	1000

Grade 470

Soft surface. For gelatinous samples. Used for the absorption of culture media, as a blotting paper, for electrophoresis, and amino acid chromatography.

Ordering information—papers for healthcare applications

Dimensions (mm)	Grade	Catalog number	Format	Quantity/pack
460 × 570	470	10318493	Sheets	100
1.5” × 450’	470	10539028	Reel	1
12.7	740E	10328170	Circles	1000
1.5” × 550’	740E	10539167	Reel	1

Phase separator paper

Whatman 1PS Phase Separator is a high-grade filter paper impregnated with a stabilized silicone that renders it hydrophobic, retaining the aqueous phase and passing the solvent phase through.

Features and benefits

- Ease of use—no special training required
- Any number of separations can be processed together
- Staff involvement in routine separations is at a minimum

Automatic cut-off, separatory funnel replacement

After being shaken, the mixed phases are simply poured directly into the 1PS circle, which is quadrant-folded in a funnel. The separation is extremely rapid so it is unnecessary to wait until the two phases have settled into separate layers. Droplets are automatically separated after only a few moments, giving a solvent phase completely free of the aqueous phase.

In many applications, 1PS can replace the use of separatory funnels. The solvent phase flows through the paper quickly and cleanly. It then stops automatically, leaving the aqueous phase completely in the paper. This feature is particularly important when carrying out a large number of routine solvent extractions at the same time. Samples can be shaken with solvent in stoppered conical flasks or test tubes and transferred directly to funnels containing 1PS.

Unsupervised separation

A key benefit of the 1PS method is that cut-off is automatic and complete as soon as the solvent phase has passed through*. The result is no skilled operators are required.

* *Water may break through upon prolonged standing.*

1PS Phase Separator Papers

Ordering information—1PS phase separators

Diameter (mm)	Catalog number	Quantity/pack
70	2200-070	100
90	2200-090	100
110	2200-110	100
125	2200-125	100
150	2200-150	100
185	2200-185	100
240	2200-240	100
270	2200-270	100

Lens cleaning tissue

Lenses and other optical surfaces made from glass, quartz or plastic can be easily scratched if you do not clean them with a very soft surface. High-quality Whatman lens cleaning tissue provides the solution. The tissue is chemically pure and free from silicones and other additives. Most importantly, it can be relied on to safely remove surface moisture and grease.

Lens cleaning tissue

Features and benefits

- Soft texture will not damage lenses or optical surfaces
- Chemically pure tissue is free from silicones and other additives
- High absorbency ensures the safe removal of surface moisture and grease
- Thickness 0.035 to 0.040 mm
- Very strong and leaves no fibers

Ordering information—lens cleaning tissues

Dimensions (mm)	Catalog number	Packaging	Quantity/pack
Grade 105 (sheets)			
100 × 150	2105-841	25 wallets of 25 sheets	25
200 × 300	2105-862	–	100
460 × 570	2105-918	–	500

Moisture testing papers

Moisture test paper for use when drying samples during moisture assessment.

Ordering information—moisture testing papers

Dimensions (mm)	Material	Catalog number	Quantity/pack
90	Borosilicate glass	5401-090E	100

Helping you build a smarter diagnostic assay

GE Healthcare Life Sciences offers a wide selection of high performance, customizable components and solutions for immunoassay and molecular diagnostic applications. You also benefit from our extensive experience and expertise, not only when unexpected issues emerge, but from design stage through launch. Our experts will help you optimize components, identify the best-suited technologies, and offer invaluable assistance to help expand your customer base and get you to market earlier.

Point-of-care immunoassays 176
Membrane selection for Lateral Flow 177
Lateral-flow immunoassays 178
Sample pads 179
Blood separators 180
Conjugate release pads 181
Membranes 182
Absorbent pads 186
Flow-through immunoassays 187
Nitrocellulose membranes 187
Absorbents 187
Dipstick colorimetric assays 189
Track-etched membranes for diagnostic applications 190

Point-of-care immunoassays

Rapid point-of-care tests are among the most widely used analytical technologies in diagnostics. Due to their high performance, ease of use and cost effectiveness, diagnostic rapid tests can deliver semiquantitative or quantitative results.

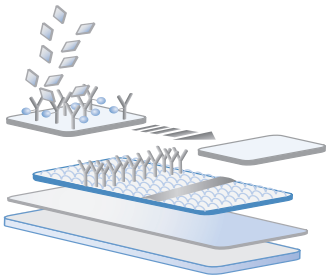
GE Healthcare Life Sciences is an established technology component provider for point-of-care immunodiagnostic assays, specifically:

- Lateral-flow immunoassays
- Flow-through immunoassays
- Dipstick colorimetric assays

We produce a comprehensive range of cellulose and glass fiber substrates and nitrocellulose membranes to an assured quality, ensuring accurate and reproducible results.

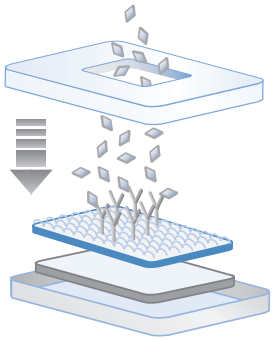
Lateral-flow immunoassays

Sample pads.....179
Blood separators 180
Conjugate release pads.....181
Membranes 182
Absorption pads 186



Flow-through immunoassays

Nitrocellulose membranes 187
Absorbents 189



Dipstick colorimetric assays

Cellulose pads 189

Membrane selection for lateral flow

We understand that a Nitrocellulose membrane is a key part of any lateral flow immunoassay and something that is vial to the sensitivity and specificity of your assay. As such, we've put together the below guide to help explain the benefits, constraints and differences of each product family we offer to help simplify your selection process.

The Whatman Faster Flow, Higher Performance Membrane (FFHP)

Description of Grade	A thinner membrane (200 uM thick including backing) with reduced surfactant content.
When to Use Grade	Quantificative assays or where you can reduce reagent dispensing to save cost on reagents. Designed for lateral flow assays.
Variants of Grade	FF80HP—60-100 second flow FF120HP—90-150 second flow FF170HP—140-200 second flow

The Whatman Post-Treatment Membrane (Immunopore™)

Description of Grade	Structurally different membrane as treated with surfactant post-drying. 200 uM thick membrane.
When to Use Grade	When looking for more consistent membrane performance than wet-treated surfactant products.
Variants of Grade	Immunopore RP—90-150 second flow Immunopore FP—110-150 second flow Immunopore SP—160-220 second flow

The Whatman Higher Surfactant Membrane (FFHP Plus)

Description of Grade	Higher surfactant membrane to overcome hydrophobic issues. 200 uM thick membrane incl. backing.
When to Use Grade	When using viscous samples and you wish to reduce reagent dispensing rates to save cost.
Variants of Grade	FF80HP PLUS—60-100 second flow FF120HP PLUS—90-150 second flow FF170HP PLUS—140-200 second flow

The Whatman High-Surfactant Membrane (Prima)

Description of Grade	High concentration surfactant nitrocellulose membrane. Note: Product may contain some surface dust, due to manufacturing process.
When to Use Grade	When you need a very quick flow membrane. Works very well with dairy.
Variants of Grade	Prima40—40 second flow Prima80—80 second flow Prima120—120 second flow

The Whatman Thicker Membrane (FFHP Plus Thick)

Description of Grade	Thicker membrane (235 uM thick including backing) and higher surfactant content
When to Use Grade	Optimised for when looking for easy swap-out of competitor grades.
Variants of Grade	FF80HP PLUS THICK—60-100 second flow; FF120HP PLUS THICK—90-150 second flow; FF170HP PLUS THICK—140-200 second flow;

The Whatman Unbacked Membrane (AE)

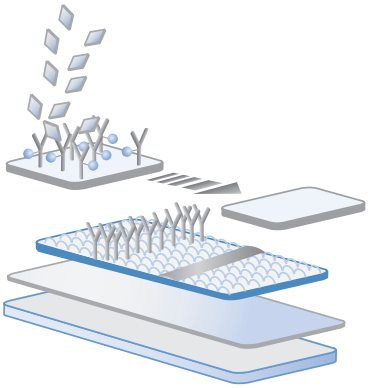
Description of Grade	Unbacked nitrocellulose, 120 uM thick
When to Use Grade	For experienced users as trickier to handle, typically available at lower cost.
Variants of Grade	AE100—90-120 second flow AE99—120-160 second flow AE98—160-210 second flow

Note: Flow time is measured by timing how long water takes to flow cross-web to completely fill 4 centimetres of membrane. This is an indication of how a sample will flow in your assay, but times with serum/other liquids will differ.

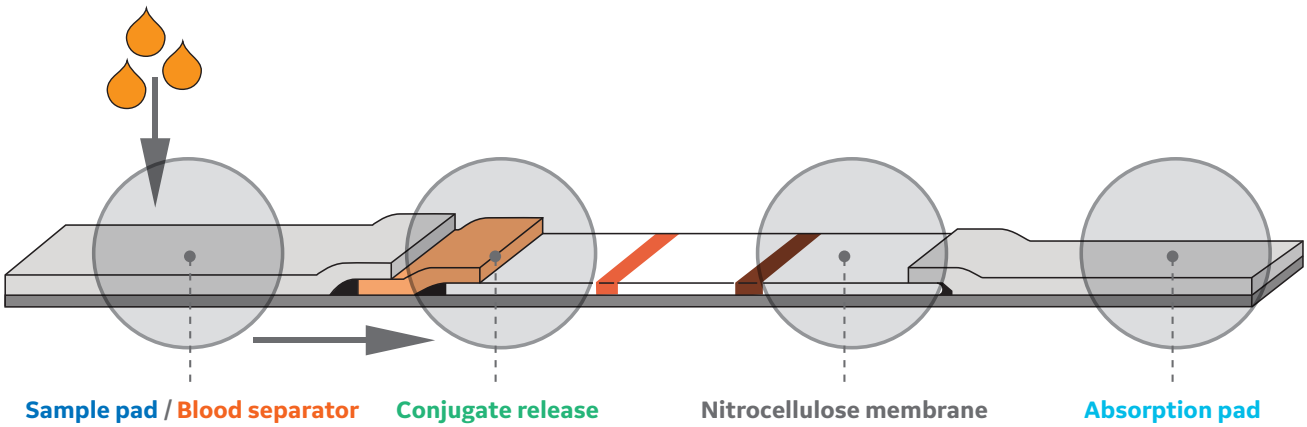
Lateral-flow immunoassays

With a diverse array of products, GE Healthcare is one of the leading suppliers in lateral-flow technology. Our offering includes our wide range of blood separation products, conjugate release pads, nitrocellulose membranes, and absorbents.

Developments in lateral-flow immunoassay systems allow for single step assays that require only the addition of a sample. The sample flows through the device and comes in contact with dried reagents, usually a tagged secondary antibody. The antibody and analyte migrate to a capture zone of membrane-immobilized antibody. Any unreacted tagged antibody flows past the capture zone.



Lateral flow assay



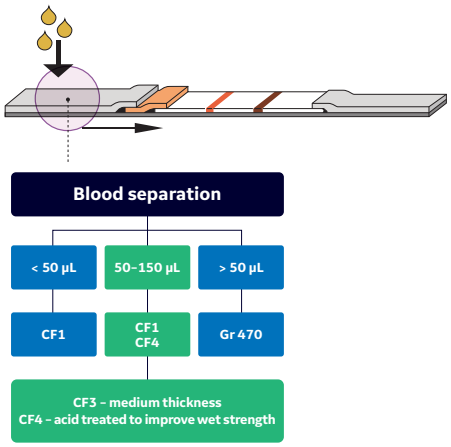
Drawing of a lateral flow immunoassay, showing its different components

Sample pads for lateral-flow immunoassays

Sample pads begin the assay by transporting samples from the point of application to the test components.

Features and benefits

- **Consistent absorbency and wicking rates:** Ensures test-to-test reproducibility
- **Product manufactured in controlled environments from highest-quality materials:** No false results due to sample contamination
- **Low protein binding:** Minimal loss of analyte, so test sensitivity is maintained
- **Naturally hydrophilic:** Rapid rewetting after prolonged storage
- **Wide range of thickness, absorbency and wicking rate**
- **Compatible with most styles of housings**
- **Minimal leakage along the strip:** No contamination of test results



Sample pads selection tree

Typical properties—sample pads for lateral-flow immunoassays

Product	Material	Properties	Thickness (µm @ 53kPA)	Wicking rate (s/4 cm)	Water absorption (mg/cm²)
CF1	100% cotton linter	Light, thin grade suitable for small volume	176	207.3	18.7
CF3	100% cotton linter	Medium weight	322	174.3	34.6
CF4	100% cotton linter	Medium weight	482	67.3	49.9
Grade 470	100% cotton linter	Medium weight	840	77	78
Standard 14	Bound glass fiber	Faster flow than cotton, with lower sample retention	355	23.1	50.9
Standard 17	Bound glass fiber	Faster flow than cotton, with lower sample retention	370	34.5	44.9
GF/DVA	Bound glass fiber	Works with saliva samples and as a blood separator	785	28.2	93
LF1	Bound glass fiber	Works with whole blood or serum samples and as a blood separator	247	35.6	25.3
MF1	Bound glass fiber	Works with whole blood or serum samples and as a blood separator	367	29.7	39.4
VF2	Bound glass fiber	Works with whole blood or serum samples and as a blood separator	785	23.8	86.2

Ordering information—sample pads for lateral-flow immunoassays

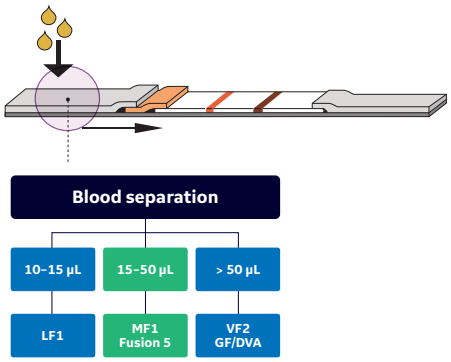
Grade	Description	Catalog number	Quantity/pack
CF1	22 mm × 50 m	8111-2250	1
CF3	22 mm × 50 m	8113-2250	1
CF4	22 mm × 50 m	8114-2250	1
STD 14	22 mm × 50 m	8133-2250	1
STD 17	22 mm × 50 m	8134-2250	1
LF1	17 mm × 50 m	8121-1750	1
MF1	22 mm × 50 m	8122-2250	1
VF2	17 mm × 50 m	8124-1750	1
Grade 470	22 mm × 50 m	10539995	1

Blood separators for lateral-flow immunoassays

Because of the increasing demand for whole-blood assays, GE Healthcare Life Sciences offers a family of blood separators to meet the strict requirements of the rapid diagnostic market. These products enable whole blood analysis, with no red cell hemolysis.

Features and benefits

- **Separation in 30-120 seconds:** Rapid assays save time
- **No appreciable red cell hemolysis:** Improved reproducibility
- **Consistency of materials:** Reliability
- **Materials suitable for use in a range of tests:** Flexibility in test optimization
- **Choice of separation times:** Allows for test optimization
- **Separators appropriate for a range of blood volumes:** Enhances the separation rate according to the volume of blood available



Blood separator selection tree

Typical properties—blood separators for lateral-flow immunoassays

Product	Properties	Thickness (µm @ 53kPA)	Wicking rate (s/4 cm)	Water absorption (mg/cm²)
GF/DVA	Bound glass fiber	785	28.2	93
LF1	May be used for lateral flow assays. Works well with one drop of whole blood	247	35.6	25.3
MF1	Used for lateral- or vertical-flow assays. Typically used for whole-blood volumes around 100 µL	367	29.7	39.4
VF2	Vertical separator used as single or multiple layers for separation of a wide range of blood volumes	785	23.8	86.2
Fusion 5	Can be used as a lateral flow blood separator with two drops of whole blood	370	43.9	42.3

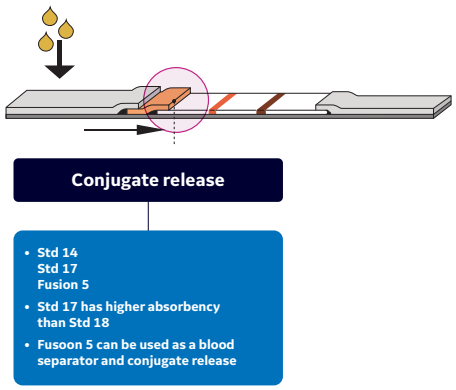
Ordering information—blood separators for lateral-flow immunoassays

Grade	Description	Catalog number	Quantity/pack
LF1	17 mm × 50 m	8121-1750	1
MF1	22 mm × 50 m	8122-2250	1
VF2	17 mm × 50 m	8124-1750	1
Fusion 5	22 mm × 50 m	8151-9915	1
GF/DVA	22 mm × 50 m	8145-2250	1

Conjugate release pads for lateral-flow immunoassays

Conjugate release pads are critical to lateral-flow immunoassays. To ensure consistent performance, the conjugate must dry without damage or aggregation and release rapidly when the sample comes into contact with it.

Whatman conjugate release pads do not require treatment prior to conjugate application, as they are inherently hydrophilic. The open structure of the material allows rapid penetration by both conjugate and sample.



Conjugate release selection tree

Features and benefits

- **Higher level of conjugate release:** Less waste means reduced reagent costs
- **Higher capture line intensity, as more conjugate gets to the capture line:** Improved sensitivity
- **Pad rewets naturally and rapidly every time:** Improved consistency

Typical properties—conjugate release pads for lateral-flow immunoassays

Grade	Thickness (µm @ 53kPA)	Wicking rate (s/4 cm)	Water absorption (mg/cm²)	Percent release of gold conjugate (after 90 s)
Standard 14	355	23.1	50.9	75
Standard 17	370	34.5	44.9	75
Fusion 5	370	43.9	42.3	> 94

Ordering information—conjugate release pads for lateral-flow immunoassays

Grade	Description	Catalog number	Quantity/pack
Standard 14	22 mm × 50 m	8133-2250	1
Standard 17	22 mm × 50 m	8134-2250	1
Fusion 5	22 mm × 50 m	8151-9915	1

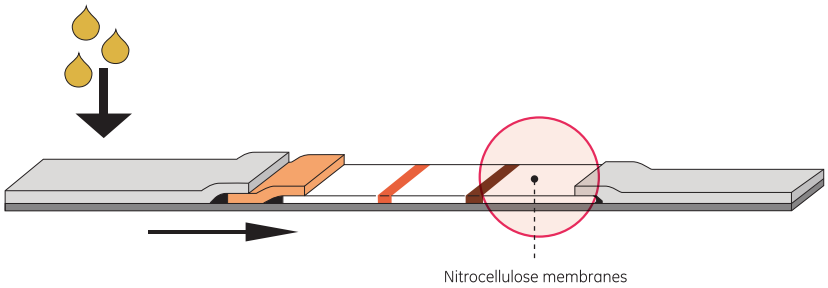
Other slit widths are available—please contact your GE Healthcare Life Sciences representative for more information.

Membranes for lateral-flow immunoassays

Nitrocellulose membranes are a key functional part of lateral-flow immunoassays. The membrane must provide sufficient protein binding to produce a sharp and intense capture line, but at the same time the level of nonspecific background must be low enough for easy interpretation of the results.

Nitrocellulose membranes are available in a range of wicking rates and formulations. The wicking rate of a membrane has a significant impact on test sensitivity.

FF120HP Membranes



Nitrocellulose membranes

Features and benefits

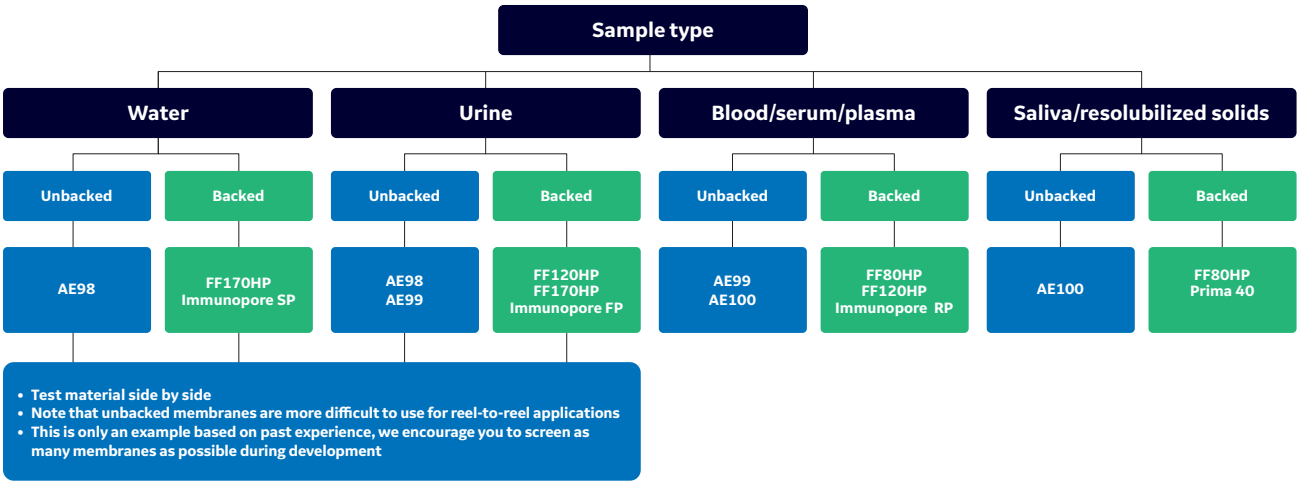
Backed membrane

- Increased mechanical strength of the membranes, simplifying use in reel-to-reel machines
- Direct contact is prevented between the nitrocellulose material and the adhesive from the lamination card where the test elements are mounted

Unbacked membrane

- Enables assay suitability tests of both air and belt side of the membrane

Membrane selector according to sample type



Unbacked membranes

AE nitrocellulose membranes

Constructed of 100% nitrocellulose, the AE membrane offers a higher level of purity and performance than that seen in post-treated materials. AE membranes have been used extensively since the development of the original lateral flow tests and have become a standard for manufacturers worldwide. There is a long history of success and experience for assay optimization using these products.

AE membranes are unbacked, which means either belt or air side of the membrane can be used.

Typical properties—AE nitrocellulose membranes

Grade	Capillary rise (s/4 cm)	Total caliper (µm)	Properties
AE98	160—210	120	An unsupported membrane that gives good line intensity for use with low-viscosity samples
AE99	120—160	120	A general-purpose membrane for use with most sample types giving a good combination of sensitivity with fast wicking
AE100	90—120	120	A very fast wicking membrane for use with highly viscous samples (e.g. undiluted serum)

Ordering information—AE nitrocellulose membranes

Grade	Dimensions	Catalog number	Quantity/pack
AE99	25 mm × 50 m	10548081	1
AE98	25 mm × 50 m	10549916	1
AE100	25 mm × 50 m	10549867	1

Backed membranes

Immunopore nitrocellulose membranes

Immunopore is a plastic-backed nitrocellulose membrane. A proprietary polymer is included in the membrane matrix to ensure rapid rewetting and low background signal, removing protein-binding interference commonly experienced with surfactants.

Typical properties—Immunopore nitrocellulose membranes

Grade	Capillary rise (s/4 cm)	Total caliper (µm)	Properties
Immunopore RP	90—150	200	Fast-flowing membrane, yielding shorter test times while still retaining excellent capture line intensity and reproducibility
Immunopore FP	140—200	200	Excellent general membrane that offers high capture line intensity coupled with fast flow/wicking rate
Immunopore SP	190—280	200	Highly suitable for use with low-viscosity samples when maximum capture line intensity is required

Ordering information—Immunopore nitrocellulose membranes

Grade	Dimensions	Catalog Number	Quantity/pack
Immunopore RP	25 mm × 50 m	78356403	1
Immunopore FP	25 mm × 50 m	78336403	1
Immunopore SP	25 mm × 50 m	78316404	1

FF high performance nitrocellulose membranes

FF High Performance (HP) membranes are part of the AE family that are directly cast onto a plastic film. The FF HP membranes are a result of improved membrane casting procedures, which result in membranes with high reproducibility, enhanced intra- and inter- lot consistency and sharper lines. The surface is uniform without any unincorporated nitrocellulose powder and the fine structure fiber distribution provides large internal surfaces for binding proteins.

Features and benefits

- Improved assay consistency
- More consistent limit of detection
- Reduced optimization costs

Typical properties—FF high performance nitrocellulose membranes

Description	Capillary rise (s/4 cm)	Total caliper (µm)	Properties
FF80HP	60—100	200	A very fast wicking membrane for use with highly viscous samples (e.g. undiluted serum)
FF120HP	90—150	200	A general-purpose membrane for use with most sample types
FF170HP	140—200	200	A membrane for use with low viscosity samples

Ordering information—FF high performance nitrocellulose membranes

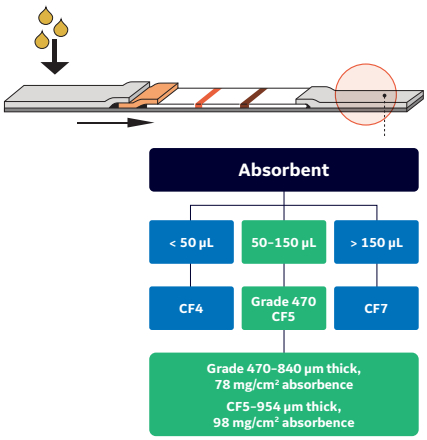
Grade	Dimensions	Catalog number	Quantity/pack
FF80HP	25 mm × 50 m	10547003	1
FF80HP	20 mm × 50 m	10547002	1
FF120HP	25 mm × 50 m	10547001	1
FF120HP	20 mm × 50 m	10547006	1
FF170HP	25 mm × 50 m	10547005	1
FF170HP	20 mm × 50 m	10547004	1
FF80HP Lam 60	60 (25) mm × 300 mm	10547020	100
FF120HP Lam 60	60 (25) mm × 300 mm	10547021	100
FF170HP Lam 60	60 (25) mm × 300 mm	10547023	100
FF170HP Din A4	210 mm × 297 mm	13549204	10
FF120HP Din A4	210 mm × 297 mm	13549205	10
FF80HP Din A4	210 mm × 297 mm	13549206	10

Absorption pads

Absorption pads at the downstream end of tests control sample flow along the strip. GE Healthcare Life Sciences has also developed pads with excellent wicking characteristics that give rise to greater consistencies. Choosing an absorbent with sufficient capacity is an important consideration when designing an immunoassay.

Features and benefits

- **Consistent absorbency:** Ensures test-to-test reproducibility
- **Product manufactured in controlled environments from highest-quality materials:** No false results due to contamination
- **Naturally hydrophilic:** Minimal loss of analyte, so test sensitivity is maintained
- **Wide range of thickness, absorbency and wicking rate:** Rapid rewetting after prolonged storage
- **Minimal leakage along the strip:** No contamination of test results



Absorption pads selection tree

Typical properties—absorption pads

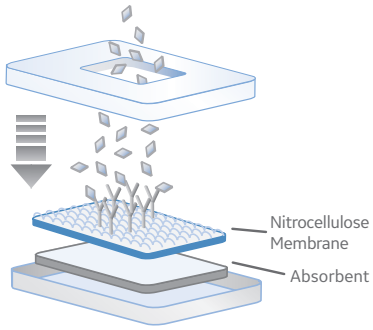
Product	Material	Properties	Thickness (µm @ 53kPA)	Wicking rate (s/4 cm)	Water absorption (mg/cm²)
CF3	100% cotton linter	Medium weight	322	174.3	34.6
CF4	100% cotton linter	Medium weight	482	67.3	49.9
CF5	100% cotton linter	Medium weight	954	63.3	99.2
CF7	100% cotton linter	Thick material suitable for high sample volume	1873	35	252.3

Ordering information—absorption pads

Grade	Dimensions	Catalog number	Quantity/pack
CF3	22 mm × 50 m	8113-2250	1
CF4	22 mm × 50 m	8114-2250	1
CF5	22 mm × 50 m	8115-2250	1
CF7	22 mm × 50 m	8117-2250	1

Flow-through immunoassays

In a flow-through immunoassay the sample is applied directly to the membrane surface and is allowed to wick through the membrane into an absorbent paper below.



Flow-through assay

Nitrocellulose membranes

Small-pore unsupported membranes such as BA83 and BA85 can be used; they are highly sensitive small-pore membranes with large surface area and high protein binding capacity. However, they have to be carefully encapsulated, ensuring good contact between the membrane and the absorbent, to give good flow.

Features and benefits

- **Manufactured for vertical-flow assays:** Removes problems caused by capillary rise
- **Small pore structure**: Accurate results; low nonspecific binding; greater sensitivity
- **One hundred percent pure nitrocellulose:** Provides high binding capacity

Absorbents

The absorbents used for flow-through assays must wick quickly and be highly water absorbent. The volumes of liquids used in flow-through assays can be much higher than those in lateral flow. Thicker cellulose materials with fast wicking are therefore the material of choice.

Typical properties—nitrocellulose membranes and absorbent pads

Grade	Description	Pore size (µm)	Thickness (µm @ 53kPA)	Wicking rate (s/4 cm)	Water absorption (mg/cm²)
BA 79	Membrane	0.10	120	–	–
BA 83	Membrane	0.20	120	–	–
BA 85	Membrane	0.45	120	–	–
CF4	Absorbent	–	482	67.3	49.9
CF5	Absorbent	–	954	63.3	99.2
CF6	Absorbent	–	1450	65	136.3
CF7	Absorbent	–	1873	35	252.3

Ordering information—nitrocellulose membranes and absorbent pads

Grade	Dimensions	Description	Catalog number
BA79	–	BA Nitrocellulose Membrane	Please inquire
BA83	300 mm × 600 mm	BA Nitrocellulose Membrane	10401380
BA85	300 mm × 600 mm	BA Nitrocellulose Membrane	10401180
CF4	22 mm × 50 m	Absorbent	8114-2250
CF5	22 mm × 50 m	Absorbent	8115-2250
CF6	22 mm × 50 m	Absorbent	8116-2250
CF7	22 mm × 50 m	Absorbent	8117-2250

Other slit widths are available—please contact your GE Healthcare Life Sciences representative for more information.

Dipstick colorimetric assays

Dipstick colorimetric assays, in which a cellulose pad is impregnated with a color reagent, are widely used in everything from urine testing to environmental assays. The base cellulose is a key part of the system, and the correct choice of absorbency, wicking rate, and wet strength are critical to producing a working assay. The GE Healthcare Life Sciences range of cellulose materials for dipstick colorimetric assays offers highly consistent and inert substrates for absorption of the active chemicals required for development of dipstick tests.

The purity of the cellulose base material coupled with our quality manufacturing practices make these papers an exceptional choice for large-scale manufacturing. The range also includes a wet strengthened grade.

Dipstick colorimetric assays

Typical properties—dipstick colorimetric assays

Grade	Thickness (µm @ 53kPA)	Water absorption (mg/cm²)
CF1	176	18.7
CF2	172	16.1
CF3	322	34.6
CF4	782	49.9
CF7	1873	252.3

Ordering information—dipstick colorimetric assays

Grade	Dimensions	Catalog number	Quantity/pack
CF1	22 mm × 50 m	8111-2250	1
CF2	22 mm × 50 m	8112-2250	1
CF3	22 mm × 50 m	8113-2250	1
CF4	22 mm × 50 m	8114-2250	1
CF7	22 mm × 50 m	8117-2250	1

Track-etched membranes for diagnostic applications

GE Healthcare Life Sciences provides a range of Whatman track-etched membranes (TEMs) whose advanced technical specifications make them an outstanding choice for a wide range of diagnostic applications.

TEMs have very tightly controlled pore size distribution. This allows for quantification of cells or microorganisms, which are captured on the membrane surface. TEMs are usually transparent at larger pore sizes, which allows complete transmission of light, ensuring excellent signal-to-noise ratio.

Choose Cyclopore or Nuclepore track-etched membranes for applications including:

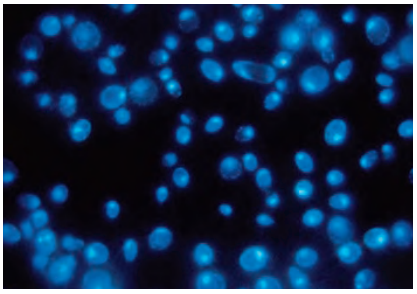
- Cell capture
- Particle-capture assays
- Biosensors

Features	Benefits
Biologically inert	Whole cell assays can be performed
Low protein binding and low extractables	There is no interference with assay results because of membrane
Choice of surface properties (hydrophilic and hydrophobic version available)	Assays can be designed with the appropriate flow or retention characteristics
Does not bind stains or labels	Gives lower background signal than traditional materials
True surface capture on a flat, smooth surface	Cells or particles are highly visible or available for sample recovery by backflushing
Low hold-up volume	Practically all the applied sample is available for analysis
Controllable optical properties (transparent, translucent, and/or dyed)	The optical properties can be chosen to ensure excellent signal-to-noise ratio. Clear materials allow complete transmission of light, whereas dyed varieties block signal from behind the membrane
PC or PET material	Allows easy attachment to a range of housings for design of components

Application examples

Cell capture

Since TEMs have tightly controlled filtration characteristics, they can be used in cell capture applications. This application allows for easier identification of marked cells in a number of formats. The retention of cells upon the membrane surface allows cells to be stained and observed in a very clear environment. The improved resolution and accuracy have applications in any area of clinical chemistry in which cells are observed. The reduced likelihood of a false diagnosis also has a significant impact, especially in large-scale screening procedures.



Yeast cells on Black Cyclopore with DAPI Stain

Particle-capture assays

Using membranes for particle-capture tests is a relatively well-known technique. The usefulness of these assays can be enhanced by using dyed or fluorescent latex particles as a label. Such labels can produce a more sensitive or stable assay. Using a TEM for particle capture allows for a more specific capture reaction, and capturing the particles on the membrane surface rather than in the depth of the membrane matrix enhances sensitivity.

Biosensors

TEMs provide accurate flow control of diffusion properties in biosensor applications in which the membrane acts as a barrier to biological cells and controls their flow to the sensor. The membrane also serves as a barrier to many potential contaminants, improving the assay's specificity. In applications involving the presence of biochemical reagents to measure the reaction, the pores can be filled with the desired materials (e.g. antigen or enzymes). The complete biosensor can therefore be dried onto the membrane.

We offer a complete range of track-etched membranes manufactured using proprietary technology to produce a precision membrane filter with a closely controlled pore size distribution.

Please contact your GE Healthcare Life Sciences representative for more information on track-etched membranes.

Electron micrograph of Cyclopore membrane with latex beads on surface

Appendices

Appendix A: filtration simplified

Basic filtration concepts and terms 194
Filter types and filter holders 196
Trace element composition cellulose and glass microfiber filters 199
Filter media information 200
Chemical compatibility of membranes and housings 201
Glossary of terms 202

Appendix B: product selection

Syringe filters product summary 205
Syringe filters application guide 207

Appendix C: alphabetical and numeric indices

Index by catalog product number 208
Alphabetical index 217

Filtration simplified

Basic filtration concepts and terms

Selecting a filter with the appropriate properties can help you achieve accurate results and reach discovery faster. But with so many types of filters to choose from, how can you be sure you're making the right choice? GE Healthcare Life Sciences, maker of Whatman brand filtration products, has assembled this compilation of basic filtration concepts and terms to clarify the various options available to you to speed up your selection process.

Ash content

Determined by ignition of the cellulose filter at 900°C in air. Minimizing ash content is essential in gravimetric applications and also a useful measure of the level of general purity.

Chemical compatibility

It is very important to ensure that the structure of the filter media will not be impaired by exposure to certain chemicals. In addition, exposure to these chemicals should not cause the filter to shed fibers or particles, or add extractables. Length of exposure time, temperature, concentration, and applied pressure can all affect compatibility. Chemical compatibility charts are provided to aid your filter selection.

Depth filters

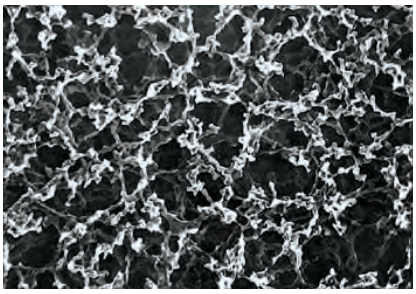
Depth filters are usually characterized as filters that retain particles on the surface and within the filter matrix. All conventional fibrous filters (whether manufactured from cellulose, borosilicate glass microfiber or other fibrous material) are depth filters and are normally characterized by good loading capacity.

Hydrophilic

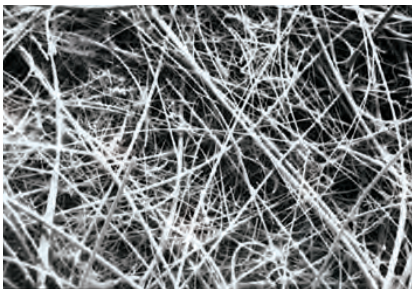
Because hydrophilic filters possess an affinity for water and can be wetted with virtually any liquid, they are typically used for aqueous solutions and compatible organic solvents.

Hydrophobic

These filters repel water, and are thus best suited for filtering organic solvents as well as for venting and gas filtration applications.



Membrane filters allow the efficient retention of submicron particulates and organisms.



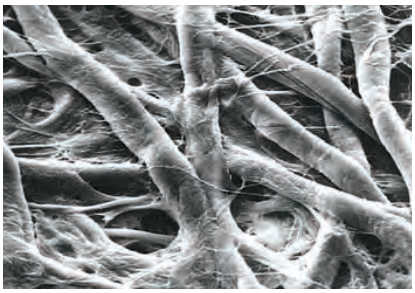
Glass microfiber filters are manufactured from 100% borosilicate glass.

Liquid flow rate (including herzberg method)

Under practical filtration conditions, the liquid flow rate will depend on a number of factors, many of which will be specific to the solid/liquid being filtered. In order to compare filter performances, a standardized set of conditions is required which will characterize liquid flow rate for a given filter without the complicating secondary effects derived from the presence of particulates.

Liquid flow rate can be quantified by a variety of methods. For example, the Herzberg flow rate test where prefiltered, deaerated water is applied to the test filter (effective area 10 cm^2) at a constant hydrostatic head (10 cm). The rate of the flow is measured in seconds per 100 mL.

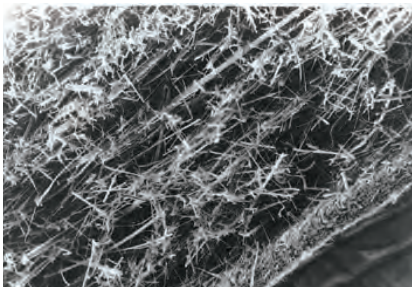
Flow rate can also be measured by the modified ASTM method which uses a quadrant folded filter held in a wire loop.



Whatman cellulose filter papers exhibit particle retention levels down to 2.5 µm.

Loading capacity

This relates to the ability of a filter to load particulates into the fibrous matrix while maintaining a practical filtration speed and a workable pressure differential across the filter. In general, glass microfiber filters have a high loading capacity when compared with cellulose filters of the same retention rating and thickness. Membranes have inherently low loading capacity.



Multigrade GMF 150 combines two filters in one for fast, effective, multilayered filtration.

Particle retention (air/gas)

Retention mechanisms for removing particulates from air or gas enable much higher efficiencies to be realized than those applicable to liquids. Efficiencies for air filtration are normally expressed as percent penetration or retention for a stated airborne particle size. The dioctyl phthalate (DOP) test is commonly used, wherein the filter is tested with an aerosol containing 0.3 µm particles.

Particle retention (liquid)

In a filtration process, the particle retention efficiency of a depth-type filter is often expressed in terms of the particle size (in µm) at which a set level of the total number of particles initially testing the filter is obtained. It is customary to quote the retention levels at 98% efficiency to allow for secondary filtration effects.

Pore size (membranes)

The pore size, usually stated in micrometers (µm), of Whatman membranes is based upon bubble point. Pore size ratings are nominal for all membranes apart from those for track-etched and Anopore membranes. For track-etched and Anopore membranes the pore sizes are absolute, as these membranes have true pores (i.e. a top-to-bottom hole through the membrane).

Prefilters

The life of a membrane filter can be extended many times by placing a prefilter upstream of the membrane. The total particulate load challenging the membrane is considerably reduced thus allowing the membrane to operate efficiently.

Screen or surface filters

Membrane filters are generally described as screen filters because particles are almost entirely trapped on the filter surface. The narrow effective pore size distribution of Whatman membrane filters is one of their major features.

Filter types and filter holders

Filter papers

Whatman brand qualitative and quantitative filter papers are, with few exceptions, manufactured from high-quality cotton linters that have been treated to achieve a minimum alpha cellulose content of 98%. These cellulose filter papers are used for general filtration and exhibit particle retention levels down to 2.5 µm. There is a wide choice of retention/flow rate combinations to meet the needs of numerous laboratory applications. The different groups of filter paper types offer increasing degrees of purity, hardness and chemical resistance. Whatman quantitative filter papers have extremely high purity to allow for analytical and gravimetric work.

Glass microfiber filters (GMF)

The properties of borosilicate glass microfibers enable GE Healthcare Life Sciences to manufacture filters with retention levels extended into the submicron range. These depth filters combine fast flow rate with high loading capacity and retention of very fine particulates. Due to the high void volume exhibited by glass microfiber filters, the loading capacity is considerably higher than for a cellulose filter of similar retention. Glass microfiber filters must be used flat and should not be folded. Whatman glass microfiber filters are manufactured from 100% borosilicate glass and most are completely binder-free. Binder-free glass microfiber filters will withstand temperatures up to 550° C and can therefore be used in gravimetric analysis where ignition is involved.

Membrane filters

Unlike cellulose and glass microfiber depth filters, membrane filters are conventionally classified as surface filters because the filter matrix acts as a screen and retains particulates almost entirely on the smooth membrane surface. The retention levels for these filters extend down to 0.02 µm and allow the efficient retention of sub-micron particulates and organisms. Water microbiology and air pollution monitoring are major applications for membranes.

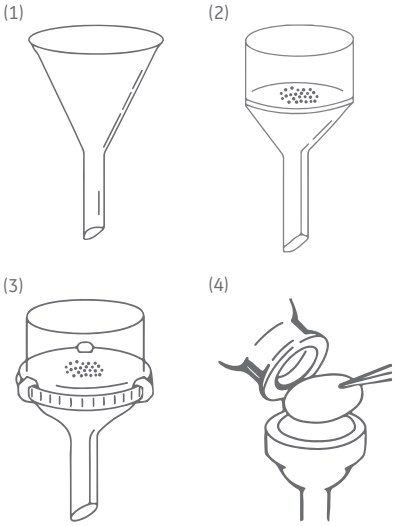
Standard circle funnel volumes

The maximum practical volume of the most popular circle sizes (quadrant folded) is given in the following chart. Membrane and glass microfiber filters are used flat.

Diameter (cm)	Volume (mL)
9	15
11	20
12.5	35
15	75
18.5	135
24	300

Types of filter holders

A filter matrix requires a suitable support structure to enable it to be used for the filtration of liquids or gases. One of the simplest forms of holder is the conical glass filter funnel into which a quadrant folded or fluted filter paper is placed (1). Some applications require additional motivating force for the solid particulate/ liquid separation to occur (i.e. vacuum assisted filtration). This type of filtration can be carried out in a one-piece Büchner style funnel (2) where the filter is used flat on a perforated base sealed into the funnel. Due to the difficulties encountered in cleaning this type of funnel, the demountable 3-piece funnel was developed (3). The Whatman 3-Piece Filter Funnel can be fully disassembled and enables the filter paper to be securely clamped between the support plate and filter reservoir flange. Membrane holders (4) incorporate either sealed-in sintered glass or removable stainless steel mesh supports for the membrane. Syringe and in-line filters are also available. Large diameter membranes are typically used in pressure holders.



Examples of Filter Holders

Selecting the right filter

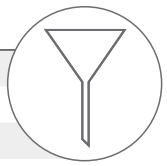
The selection of a laboratory filter depends on the conditions and objectives of the experiment or analytical procedure. The three most important characteristics of any laboratory filter are:

- Particle retention efficiency
- Fluid flow rate through the filter
- Loading capacity

In addition, according to the particular application, other important characteristics may require examination. For instance, wet strength, chemical resistance, purity and ash level may assume equal importance under certain circumstances.

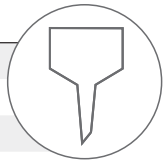
The vacuum level placed across a filter will influence the flow rate, however it is not a linear relationship. For example, for depth filters, it has been found that when the vacuum increases over about 5 cm Hg, no significant increase in flow rate occurs. Generally, the optimum vacuum level is between 2-5 cm Hg. The type of support under the filter can also play a significant role in the level of vacuum that can be applied to a fibrous material.

Standard 58° or 60° funnels



Glass/polyethylene funnel diameter (mm)	Filter paper size (cm)
35	5.5
45	7.0
55	9.0
65	11.0
75	12.5
90	15.0
100	18.5
160	24.0
180	32.0
220	40.0
260	50.0

Büchner funnel filter selection



Diameter (mm)	Perforated area (mm)	Filter paper size (mm)
43	32	42.5
63	42	55
83	60	75
100	77	90
114	95	110
126	105	125
151	135	150
186	160	185
253	213	240

Typical particle sizes

		µm
Gelatinous precipitates	Metal hydroxides	25–40
	Precipitated silica	25–40
Crystalline precipitates	Ammonium phosphomolybdate	20
	Calcium oxatate	15
	Lead sulfate	10
	Barium sulfate (hot ppt.)	8
	Barium sulfate (cold ppt.)	3
Blood cells	Platelets	2–3
	Erythrocytes (average)	7
	Polymorphs	8–12
	Small lymphocytes	7–10
	Large lymphocytes	12–15
	Monocytes	16–22
Bacteria*	Cocci	0.5
	Bacilli	1.0 × (2.0–6.0)
	Serratia marcescens	0.5 × (0.5–1.0)
	Pneumococcus	1.0
	Bacillus tuberculosis	0.3 × (2.5–3.5)
	Amoeba	12–30
	Escherichia Coli	0.5 × (1.0–3.0)
	Smallest bacteria	0.22
Other microorganisms, etc.	Yeast cells	2.0–8.0
	Colloids	0.06–0.30
	Rye grass pollen	34
	Ragweed pollen	20
	Puffball spores	3.3

* *Where bacteria are rod-shaped, range of lengths is given in parentheses*

Trace element composition cellulose and glass microfiber filters

Cellulose filters: trace element composition—typical values (µg/g paper)

Grade	1	2	3	4	5	6	40	41	42	43	44	540	541	542
Aluminum	3.6	3.6	3.6	3.6	2.5	–	2.5	2.5	2.5	2.5	2.5	3.4	3.4	3.4
Antimony	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Arsenic	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Barium	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Boron	< 1	< 1	< 1	< 1	< 1	–	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Calcium	27.5	27.5	27.5	27.5	8.3	–	8.3	8.3	8.3	8.3	8.3	14.7	14.7	14.7
Chromium	1	1	1	1	1.5	–	1.5	1.5	1.5	1.5	1.5	1.1	1.1	1.1
Copper	0.9	0.9	0.9	0.9	2	–	2	2	2	2	2	8.2	8.2	8.2
Iron	13.7	13.7	13.7	13.7	12	–	12	12	12	12	12	16.3	16.3	16.3
Lead	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Magnesium	21	21	21	21	4	–	4	4	4	4	4	3.3	3.3	3.3
Manganese	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Mercury	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	–	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Potassium	6.2	6.2	6.2	6.2	2.3	–	2.3	2.3	2.3	2.3	2.3	3.7	3.7	3.7
Silicon	8.8	8.8	8.8	8.8	6.2	–	6.2	6.2	6.2	6.2	6.2	< 6	< 6	< 6
Sodium	32.3	32.3	32.3	32.3	16.8	–	16.8	16.8	16.8	16.8	16.8	17	17	17
Zinc	58.3	58.3	58.3	58.3	64.5	–	64.5	64.5	64.5	64.5	64.5	87.8	87.8	87.8

Glass microfiber and quartz filters: trace element composition—typical values (µg/g paper)

	QM-A*	EPM 2000	934-AH	GF/A and GF/C
Arsenic (As)	< 1	< 1	24	5
Beryllium (Be)	< 1	< 1	< 1	< 1
Cobalt (Co)	< 1	1	< 1	< 1
Cadmium (Cd)	< 1	< 1	< 1	< 1
Copper (Cu)	< 1	5	3	< 1
Lead (Pb)	< 1	3	9	5
Manganese (Mn)	2	20	18	6
Mercury (Hg)	< 1	< 1	< 1	< 1
Nickel (Ni)	1	1	3	1
Selenium (Se)	< 3	< 3	< 3	< 3
Silver (Ag)	< 1	< 1	< 1	< 1
Thallium (Tl)	< 1	< 1	< 1	< 1

Typical composition based on ICP-MS analysis

* *Trace element report can be downloaded from the GELS website for each lot of QM-A*

Filter media information

Polytetrafluoroethylene (PTFE)

Hydrophobic membrane. Resistant to organic solvents as well as strong acids and bases. Low protein binding. Low in extractables. Main applications are the filtration of non-aqueous samples. Prior to filtering of aqueous samples the membrane must be pre-wetted with a water-miscible organic solvent.

Polyvinylidene difluoride (PVDF)

Hydrophilic membrane. Resistant to a broad range of organic solvents. Low protein binding.

Polypropylene (PP)

Slightly hydrophobic membrane. Resistant to a wide range of organic solvents.

Polyethersulfone (PES)

Hydrophilic membrane. Broad solvent compatibility. Suitable for filtration of aqueous and compatible organic solvents. Higher liquid flow than either PTFE or PVDF. Low in extractables. Low protein binding.

Nylon/polyamide (NYL)

Hydrophilic membrane. Resistant to a range of organic solvents. Suitable for use with high pH samples. Binds proteins, which makes it unsuitable for protein recovery applications.

Cellulose acetate (CA)

Hydrophilic membrane. Limited solvent resistance. Very low protein binding capacity, which makes it an excellent choice for protein recovery applications.

Cellulose nitrate (CN)

Hydrophilic membrane. Limited resistance to organic solvents. High liquid flow rate. High protein binding capacity, which makes it unsuitable for protein recovery applications.

Regenerated cellulose (RC)

Hydrophilic membrane. Resistant to a very wide range of solvents. Suitable for use with either aqueous solutions or organic solvents. Compatible with HPLC solvents. Very low protein binding capacity, which makes it an excellent choice for protein recovery applications.

Anopore (ANP) (membrane used in Anotop filters)

Anopore is a hydrophilic membrane with excellent organic solvent compatibility. Suitable for use with both aqueous and organic samples. The membrane has very tight pore-size distribution. Not suitable for use with very acidic or very basic samples.

Glass microfiber/glass fiber (GMF/GF)

Hydrophilic material. Excellent compatibility with organic solvents and strong acids (apart from hydrofluoric acid) and bases. Either used as a prefilter or as a final filter.

Chemical compatibility of membranes and housings

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, 6N	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
Cyclohexanone	R	NR	NR			R	NR	R	R	NR	R	R	R
Cyclohexane*	R	NR	NR	R	R	R	NR	NR	NR	NR	R	R	R
Diethyl acetamide		NR	NR			R	R	R	R		R	NR	R
Dimethyl formamide	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
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, 6N*		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
Perchloro ethylene*	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

R = Resistant; LR = Limited Resistance;
NR = Not Recommended
** Short-term resistance of housing*
The above data is to be used as a guide only.
Testing prior to application is recommended.
*** Membrane may need pre-wetting with isopropanol/methanol if filtering a polar liquid*

Material abbreviations:
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

Glossary of terms

A	
Absolute filter rating	Particles larger than the specified size rating of the filter media will not pass through that filter media (e.g. particles larger than 0.2 µm will not pass through a filter with an absolute rating of 0.2 µm). This rating refers to the size of particles retained by the filter at 100% efficiency.
Activated carbon	Porous carbon with a large surface area that can adsorb certain organic chemicals.
Absorption	The amount of material taken up by the structure of the filter media. Usually expressed as volume or mass per unit area of filter.
Adsorption	Retention of substances by loosely attaching to the surface of the filter media.
Aerosol	A dispersion (suspension) of particles or droplets of liquid in air or gas.
Air filter	A filter that removes contamination (particles) from air or a gas. If the filter media is hydrophobic it will also remove water based liquid from air streams.
Air lock	Liquid flow is prevented by the high pressure required to expel air trapped in the pore structure of a wet membrane.
Air venting filter	A filter that removes air from liquid or allows air to pass in or out of a closed container.
Ambient	The term used to present a generalized description of an environment. Usually room temperature (20-25°C) and standard atmospheric pressure.
Anisotropic membrane	A membrane in which the pore openings are larger on one side than the other. The membrane must be oriented correctly to obtain the best filtration characteristics.
Aseptic conditions	A test or operation performed in a sterile environment designed to prevent the introduction of bacteria.
Ash content	The amount of material remaining after a known mass of filter paper is completely combusted. Expressed as a %.
B	
Back pressure	A pressure downstream (outlet side) of the filter that creates resistance to flow of liquid or gas. This can result from closing a valve or entrapped air in a liquid system. This can also result from gradual blocking of the filter during use or to the resistance to flow caused by the filter itself. The amount of force required to move a sample through a filter increases as back pressure increases.
Bacterial retention	The number of microorganisms that a membrane filter will retain upstream with no passage through the membrane. Usually expressed as a log reduction in the number of organisms (CFU—colony forming units), from a defined starting concentration.
Basis weight	Weight of a sheet, usually expressed as g/m^2 (at a predfined level of moisture content or conditions of measurement).
Bubble point	The pressure at which air will pass through a wetted membrane filter. This pressure is correlated to the pore size of the membrane and thus this test can be used to confirm the pore size and integrity of a membrane or filter device.
Burst pressure	The pressure at which a membrane or filter device will rupture.
C	
Cold sterilization	Removal of bacteria by filtration, generally using a 0.2 µm filter to a pre-defined level (general definition is a log 10exp^7 reduction in CFU/mL).
D	
Depth filter	A filter that does not have a defined pore size or structure. Particles are entrapped or adsorbed both within and on the filter due to a random matrix or structure that creates a tortuous path through the filter.
Downstream (of the filter)	Any process occurring after the sample has passed through the filter positioned in the system.
Dry burst	The pressure required to burst a dry, unsupported area of filter paper (uses compressed air).
E	
EFA (effective filtration area)	The total area of the filter media exposed to the flow of liquid or air, that is usable for filtration. This is usually designated in square centimeters (cm^2), square inches (in^2) or square feet (ft^2).
EtO sterilization	Chemical method of treating a material to render microorganisms non viable.
Extractables	Chemicals which may leach from a material such as a filter or filter device under certain conditions. Care should be taken to ensure that extractables do not interfere with the analysis.

F	
Filter medium	Permeable material that removes particles from a fluid when one of those substances is passed through the material.
Filtrate	The liquid, air, or gas which has passed out of the filter.
Filtration	The process by which particles are removed from a fluid by passing it through a permeable material.
Flow rate	The volume of liquid or gas which flows through a filter or device at a specified pressure in a specified amount of time (e.g. 20 mL/min @ 30 psi).
G	
Grammage	Weight of a 1 m^2 sheet (at a predfined level of moisture content or conditions of measurement).
Gurley porosity	Expression of air flow rate. Expressed as the time taken for a certain volume of air to pass through a specific filter area under a certain pressure.
H	
Hardened	Process of treating a cellulose paper to increase its strength.
HEPA filter	A High Efficiency Particulate Air filter that removes particles from an air stream to a defined level of efficiency.
Herzberg	The time taken to filter a defined volume of water through a filter area of 10 cm^2 at a constant, defined head of pressure.
Hold-up volume	The volume of liquid retained in a filter or housing (can be expressed with or without air purge).
Hydrophilic (water loving)	Having an affinity for water. A membrane which will wet with aqueous (water) solutions. Hydrophilic membranes are generally chosen for use with aqueous solutions.
Hydrophobic (water hating)	A membrane which will not readily wet with aqueous (water) solutions. It acts as a barrier to aqueous solutions but allows air to pass freely through it.
K	
Klemm	The time taken for a liquid flow front to travel a defined distance in the lateral plane of a defined width strip of test material whilst the sample is maintained either horizontally or vertically (e.g. Vertical Klemm of 40 seconds for 7.5 cm).
L	
Loading capacity	A characteristic of a filter that indicates the relationship between reduction in flow rate and volume throughput.
LRV (log reduction value)	A way of expressing the bacterial retention of a filter.
Luer fitting	A fitting made to connect components of systems together in the medical and scientific industries. These fittings have specific dimensions that allow them to withstand relatively high pressure.
M	
Micron	A measure of length equal to one millionth of a meter.
N	
Nominal filter retention (efficiency)	The particle size which is retained at a given % efficiency (often expressed at 98%). This is usually how depth filters are specified.
P	
Particle	A single piece of solid material which is small in relation to its environment. Normally characterized by its size and shape.
Pinched pleat	A pleat that is closed off by excessive pressure or crowding, thus reducing the effective filtration area.
Pleating	The folding process which provides a large surface area within a given volume of filter.
Pore	A hole or cavity.
Pore size (absolute)	The pore size at which a particle of defined size will be retained with an efficiency of 100% under specified conditions.
Pore size (nominal)	The pore size at which a particle of defined size will be retained with an efficiency below 100% (typically 90-98%).
Pore size rating	The diameter of a particle which normally will be retained by the filter. This applies whether the pore size rating is nominal or absolute.
Porosity	A measure of how porous a filter material is. Normally expressed as a percentage, it is the volume of the filter that is composed of pores compared to the total volume.
Prefilter	A filter for removing gross contamination before the substance being filtered passes through the final filter. This is used to extend the life of a small pore size filter.

R	
Radiation sterilised	Rendering microorganisms inactive by subjecting the object to be sterilized to a beam or field of concentrated energy.
Retention	The ability of a filter medium to hold back particles of a given size.
S	
Sterile	Free from living microorganisms to a defined level.
Sterilising filter	A filter that removes bacteria to a specified level when used according to a specific method.
T	
Tensile strength	A measure of how much a material stretches and then breaks under tension. Can be performed in different directions across the paper. Can be performed wet or dry.
Thickness	Thickness of a sheet measured under defined compression force.
Throughput	The amount of fluid that will pass through a filter before the filter blocks or the flow rate is reduced to a point that is unacceptable.
U	
Upstream	Before the filter positioned in the system.
W	
Water absorption	The amount of water absorbed by a sheet per square area.
Water breakthrough pressure	The pressure required to force water through the pores of a hydrophobic membrane.
Water flow rate	The rate of passage of clean (prefiltered) water through a filter of defined area under defined conditions of pressure or vaccum. The flow rate may be expressed as volume/time or as time for a defined volume to pass through the filter.
Wet burst	The pressure required to burst a wet, unsupported area of filter paper (uses water).
Wet strength	An indication of the strength of a sheet of material when wet. Tested by applying water pressure to an unsupported area of filter material.
Wicking rate	The rate of movement of a liquid, usually water, laterally through a sheet of filter material. The rate can be expressed as the time taken for liquid to move a certain distance or the distance moved in a certain time. The orientation of the material must be specified and can be either vertical or horizontal.

Whatman syringe filter summary

General features

Product	Uniflo 1	Uniflo 2	Puradisc	Puradisc FP 30	Puradisc Aqua 30	SPARTAN	ReZist	Anotop	Anotop LC	Anotop IC	Roby	Anotop Plus	GD/X	GD/XP
Prefilters	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	Some	All	All	All
Housing (Pigment-Free)	PP	PP	PP	PC	PC	PP	PP	PP	PP	PP	PP	PP	PP	PP
Sterile Option (Blister-Packed)	✖	✖	✔	✔	✖	✖	✔	✔	✖	✖	✖	✔	✔	✖
Blister Pack Option	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖	✖
Automation-Compatible	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖
Inlet														
FLL	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Outlet														
ML	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
MLL	✖	✖	✖	✔	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖
Tube Tip	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
Mini Tip	✖	✖	✖	✔	✖	✔	✔	✖	✖	✖	✖	✖	✖	✖

FLL—Female Luer Lock
ML—Male Luer
MLL—Male Luer Lock

Filter diameter and recommended volume

Product/Diameter	Uniflo 1	Uniflo 2	Puradisc	Puradisc FP 30	Puradisc Aqua 30	SPARTAN	ReZist	Anotop	Anotop LC	Anotop IC	Roby	Anotop Plus	GD/X	GD/XP
4 mm for sample volume < 2 mL	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
10 mm for sample volume 2 to 10 mL	✖	✖	✖	✖	✖	✖	✖	✔	✔	✔	✖	✔	✖	✖
13 mm for sample volume 2 to 10 mL	✔	✔	✔	✖	✖	✔	✔	✖	✖	✖	✖	✖	✔	✖
25 mm for sample volume 10 to ~ 100 mL	✔	✔	✔	✖	✖	✖	✖	✔	✔	✖	✔	✔	✔	✔
30 mm for sample volume 10 to ~ 100 mL	✖	✖	✖	✔	✔	✔	✔	✖	✖	✖	✖	✖	✖	✖

Syringe filter pore size/retention options

Product	Uniflo 1	Uniflo 2	Puradisc	Puradisc FP 30	Puradisc Aqua 30	SPARTAN	ReZist	Anotop	Anotop LC	Anotop IC	Roby	Anotop Plus	GD/X	GD/XP
Pore Sizes/Retention														
0.02 µm	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖	✔	✖	✖
0.1 µm	✖	✖	✔	✖	✖	✖	✖	✔	✖	✖	✖	✔	✖	✖
0.2 µm	✖	✔	✔	✔	✖	✔	✔	✔	✔	✔	✖	✔	✔	✖
0.22 µm	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
0.45 µm	✔	✔	✔	✔	✖	✔	✔	✖	✖	✖	✔	✖	✔	✔
0.7 µm	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✔	✖	✔	✖
0.8 µm	✖	✖	✔	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
1 µm	✖	✖	✔	✖	✖	✖	✔	✖	✖	✖	✔	✖	✔	✖
1.2 µm	✖	✖	✔	✔	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖
1.5 µm	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖
1.6 µm	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖
2 µm	✖	✖	✔	✖	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖
2.7 µm	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖
5 µm	✖	✖	✔	✔	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖

Syringe filter media options

Product	Uniflo 1	Uniflo 2	Puradisc	Puradisc FP 30	Puradisc Aqua 30	SPARTAN	ReZist	Anotop	Anotop LC	Anotop IC	Roby	Anotop Plus	GD/X	GD/XP
Membranes														
Anopore	✖	✖	✖	✖	✖	✖	✖	✔	✔	✔	✖	✔	✖	✖
CA	✖	✖	✔	✔	✔	✖	✖	✖	✖	✖	✔	✖	✔	✖
CN	✖	✖	✔	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
DpPP	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
NYL	✔	✔	✔	✖	✖	✖	✖	✖	✖	✖	✔	✖	✔	✔
Nylon high charge (positive)	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖
PES	✔	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✔
PP	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✔
PTFE	✔	✔	✔	✔	✖	✖	✔	✖	✖	✖	✖	✖	✔	✔
PVDF	✔	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✔
RC	✖	✔	✖	✔	✖	✔	✖	✖	✖	✖	✔	✖	✔	✖

CA—Cellulose Acetate
CN—Cellulose Nitrate
DpPP—Depth Polypropylene
NYL—Nylon
PES—Polyethersulfone
PP—Polypropylene
PTFE—Polytetrafluoroethylene
PVDF—Polyvinylidene Difluoride
RC—Regenerated Cellulose

Typical applications

Product	Uniflo 1	Uniflo 2	Puradisc	Puradisc FP 30	Puradisc Aqua 30	SPARTAN	ReZist	Anotop	Anotop LC	Anotop IC	Roby	Anotop Plus	GD/X	GD/XP
Removal of mycoplasma/virus	✖	✖	✖	✖	✖	✖	✖	0.02 µm (Sterile)	✖	✖	✖	0.02 µm (Sterile)	✖	✖
Aggressive solvents	✖	✖	PTFE	✖	✖	✖	✔	✔	✖	✖	✖	✔	PTFE, GMF, GF/A, GF/B, GF/C, GF/D, GF/F	✖
Air venting	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖
Automated filtration/ Tablet dissolution testing	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖
Biological sample prep	✖	✖	CA, PES, PVDF	CA	✖	✖	✖	✔	✖	✖	✖	✖	✖	✖
Capillary electrophoresis	✖	✖	✔	✔	✖	✔	✔	✔	✖	✖	✖	✔	✔	✔
Colloidal material	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖	✖	✖	✖
High solid content samples	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✔	✔
HPLC sample prep	✖	✖	✔	✖	✖	✔	✔	✖	✔	✖	✖	✔	✔	✔
Ion-chromatography	✖	✖	✖	✖	✖	✖	✖	✖	✖	✔	✖	✖	✖	✔
Polarimetry	✖	✖	✔	✔	✖	✖	✖	✔	✖	✖	✖	✔	✔	✔
Protein analysis	✖	✖	CA, PES, PVDF	CA	✖	✔	✖	✔	✖	✖	✖	✖	✖	✖
Refractometry	✖	✖	✔	✔	✖	✔	✖	✔	✖	✖	✖	✔	✔	✔
Nano particle filtration	✖	✖	✖	✖	✖	✖	✖	0.02 µm	✖	✖	✖	0.02 µm	✖	✖
Sterile filtration	✖	✖	0.2 µm (Sterile)	0.2 µm (Sterile)	✖	✖	✖	0.2 µm (Sterile)	✖	✖	✖	✖	0.2 µm (Sterile)	✖
COD/TOC/DOC	✖	✖	PES	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✔
Trace metal analysis (ICP/AAS/ICP-MS)	✖	✖	PES	✖	✔	✖	✖	✖	✖	✖	✖	✖	✖	✔
UV/VIS analysis	✖	✖	✔	✔	✖	✔	✔	✔	✔	✖	✖	✖	✔	✔

Numerical index

Catalog number	Page
1001-020	13
1001-025	13
1001-030	13
1001-032	13
1001-042	13
1001-045	13
1001-047	13
1001-055	13
1001-070	13
1001-082	13
1001-085	13
1001-090	13
1001-110	13
1001-125	13
1001-150	13
1001-0155	13
1001-185	13
1001-240	14
1001-270	14
1001-320	14
1001-325	13
1001-329	13
1001-385	14
1001-400	14
1001-500	14
1001-813	14
1001-824	14
1001-917	14
1001-918	14
1001-929	14
1001-931	14
1001-932	14
1001-6508	13
1002-042	13
1002-047	13
1002-055	13
1002-070	13
1002-090	13
1002-110	13
1002-125	13
1002-147	13, 168
1002-150	13
1002-185	13
1002-240	14
1002-270	14
1002-320	14
1002-385	14
1002-500	14
1002-917	14
1002-929	14
1002-931	14
1003-055	13
1003-070	13
1003-090	13
1003-110	13
1003-125	13
1003-150	13
1003-185	13
1003-240	14
1003-320	14
1003-323	13
1003-917	14
1004-027	13
1004-041	13
1004-042	13
1004-047	13
1004-050	13
1004-055	13
1004-070	13
1004-090	13
1004-110	13
1004-125	13
1004-150	13
1004-185	13
1004-240	14
1004-270	14
1004-320	14
1004-400	14
1004-492	14
1004-648	14
1004-917	14
1004-930	14
1005-042	13
1005-047	13
1005-055	13
1005-060	13
1005-070	13
1005-090	13
1005-110	13
1005-125	13
1005-150	13
1005-185	13
1005-240	14
1005-320	14
1005-325	13
1006-042	13
1006-070	13
1006-090	13
1006-110	13
1006-125	13
1006-150	13
1006-185	13
1006-240	14
1091-110	22
1091-125	22
1091-150	22
1091-165	22
1091-185	22
1091-190	22
1091-240	22
1091-930	22
1091-935	22
1093-110	22
1093-111	22
1093-125	22
1093-126	22
1093-930	22
1093-935	22
1093-6215	22
1113-090	22
1113-110	22
1113-125	22
1113-150	22
1113-185	22
1113-240	22
1113-320	22
1113-500	22
1113-917	22
1114-090	22
1114-125	22
1114-150	22
1114-185	22
1114-240	22
1114-400	22
1201-125	29
1201-150	29
1201-185	29
1201-240	29
1201-270	29
1201-320	29
1202-125	29
1202-150	29
1202-185	29
1202-240	29
1202-270	29
1202-320	29
1202-385	29
1202-400	29
1202-500	29
1204-125	29
1204-150	29
1204-0185	29
1204-240	29
1204-270	29
1204-320	29
1205-185	29
1213-125	29
1213-150	29
1213-185	29
1213-240	29
1213-270	29
1213-320	29
1213-500	29
1214-125	29
1214-150	29
1214-185	29
1214-240	29
1214-320	29
1440-012	17
1440-032	17
1440-042	17
1440-047	17
1440-055	17
1440-070	17
1440-090	17
1440-110	17
1440-125	17
1440-150	17
1440-185	17
1440-240	17
1440-320	17
1440-329	17
1440-917	17
1440-6168	17
1441-042	17
1441-047	17
1441-050	17
1441-055	17
1441-060	17
1441-070	17
1441-090	17
1441-110	17
1441-125	17
1441-150	17
1441-185	17
1441-240	17
1441-320	17
1441-866	17
1441-917	17
1441- 6309	17
1441-6309	17
1442-042	17
1442-047	17
1442-055	17
1442-070	17
1442-090	17
1442-110	17
1442-125	17
1442-150	17
1442-185	17
1442-240	17
1442-320	17
1442-917	17
1442-971	17
1442-6551	17
1442-10055	17
1443-090	17
1443-110	17
1443-125	17
1443-150	17

Catalog number	Page
1443-185	17
1444-070	17
1444-090	17
1444-110	17
1444-125	17
1444-150	17
1444-185	17
1444-240	17
1450-042	19
1450-055	19
1450-070	19
1450-090	19
1450-110	19
1450-125	19
1450-150	19
1450-185	19
1450-240	19
1450-320	19
1450-500	19
1450-916	19
1450-917	19
1450-993	19
1452-090	19
1452-110	19
1452-125	19
1452-150	19
1452-240	19
1454-055	19
1454-070	19
1454-090	19
1454-110	19
1454-125	19
1454-150	19
1454-185	19
1454-240	19
1454-320	19
1454-500	19
1454-917	19
1540-042	20
1540-055	20
1540-090	20
1540-110	20
1540-125	20
1540-150	20
1540-185	20
1540-240	20
1540-320	20
1540-321	20
1540-324	20
1541-042	20
1541-047	20
1541-055	20
1541-070	20
1541-090	20
1541-110	20
1541-125	20
1541-150	20
1541-185	20
1541-240	20
1541-270	20
1541-320	20
1541-400	20
1541-917	20
1542-055	20
1542-070	20
1542-090	20
1542-110	20
1542-125	20
1542-150	20
1542-185	20
1542-240	20
1542-400	20
1810-047	42
1810-090	42
1810-110	42
1810-125	42
1810-142	42
1810-150	42
1820-021	38
1820-024	38
1820-025	38
1820-037	38
1820-042	38
1820-047	38
1820-050	38
1820-055	38
1820-060	38
1820-070	38
1820-090	38
1820-110	38
1820-125	38
1820-150	38
1820-240	38
1820-061	38
1820-866	38
1820-915	38
1820-6537	38
1820-8013	38
1820-10026	38
1821-021	38
1821-024	38
1821-025	38, 82
1821-037	38, 82
1821-042	38, 82
1821-047	38, 82
1821-055	38
1821-060	38
1821-070	38
1821-090	38, 82
1821-110	38
1821-125	38, 82
1821-150	38
1821-185	38
1821-271	38
1821-914	38
1821-915	38
1822-021	38
1822-024	38
1822-025	38
1822-037	38
1822-042	38
1822-047	38
1822-050	38
1822-055	38
1822-070	38
1822-090	38
1822-100	38
1822-110	38
1822-125	38
1822-150	38
1822-185	38
1822-320	38
1822-849	38
1822-866	38
1822-915	38
1822-6580	38
1822-9916	38
1823-007	38
1823-010	38
1823-010	82
1823-021	38
1823-024	38
1823-025	38, 82
1823-035	38, 82
1823-042	38, 82
1823-047	38, 82
1823-055	38
1823-070	38
1823-090	38, 82
1823-125	82
1823-142	82
1823-257	38, 82
1823-915	38
1823-110	38
1823-125	38
1823-142	38
1823-150	38
1825-015	38
1825-021	38
1825-024	38
1825-025	38
1825-037	38
1825-042	38
1825-047	38
1825-055	38
1825-070	38
1825-090	38
1825-257	38
1825-293	38
1825-915	38
1825-110[1]	38
1825-125	38
1825-142	38
1825-150	38
1827-021	38
1827-024	38
1827-025	38
1827-028	38
1827-030	38
1827-032	38
1827-035	38
1827-037	38
1827-042	38
1827-047	38
1827-055	38
1827-070	38
1827-082	38
1827-085	38
1827-090	38
1827-105	38
1827-110	38
1827-125	38
1827-150	38
1827-185	38
1827-240	38
1827-320	38
1827-808	38
1827-866	38
1827-889	38
1827-957	38
1830-640	41
1830-6236	41
1841-047	39
1841-090	39, 82
1842-047	39, 82
1842-090	39, 82
1851-025	43
1851-032	43
1851-037	43
1851-047	43
1851-050	43
1851-055	43
1851-082	43
1851-085	43
1851-090	43
1851-101	43
1851-110	43
1851-118	43
1851-150	43
1851-865	43

Catalog number	Page
1851-8866	43
1852-040	43
1852-042	43
1853-037-50	43
1853-047-50	43
1853-050-50	43
1853-090-50	43
1853-150-50	43
1872-047	32
1872-050	32
1872-055	32
1872-060	32
1882-047	38
1882-866	38
1950-002	74
1950-004	74
1950-007	74
1950-009	74
1950-012	74
1950-017	74
1950-027	74
1950-109	74
1950-114	74
1950-117	74
1950-207	74
1950-209	74
1950-217	74
1960-002	76
1960-004	76
1960-009	76
1960-032	76
1960-052	76
1960-054	76
1961-054	76
1980-001	79
1980-002	79
2001-0100	115
2001-0200	115
2002-5100	115
2002-5200	115
2017-006	171
2017-009	171
2017-013	171
2103	138
2105-841	173
2105-862	173
2105-918	173
2107	138
2108	138
2181-090	34
2200-070	172
2200-090	172
2200-110	172
2200-125	172
2200-150	172
2200-185	172
2200-240	172
2200-270	172
2227	122
2228	122
2300-004	166
2300-594	166
2300-599	166
2300-731	166
2300-772	166
2300-916	166
2300-917	166
2300-10060	166
2300-10061	166
2300-10062	166
2300-10063	166
2300-10064	166
2300-10065	166
2300-10072	166
2300-10073	166
2300-10074	166
2301-916	166
2301-6150	166
2301-6160	166
2600-100A	170
2600-101A	170
2600-102A	170
2600-103A	170
2600-104A	170
2600-201A	171
2600-202A	171
2600-204A	171
2600-500	170
2600-601	171
2600-602	171
2601	134
2601T	134
2602-500A	171
2602-501A	171
2602S	134
2603	134
2603T	134
2606T	127
2608NS	127
2609T	140
2610T	129
2611	129
2611-628	170
2611T	129
2612-990	170
2612T	129
2613-991	170
2613T	129
2614-991	170
2614T	129
2626-990	170
2627-990	170
2628-990	170
2629-990	170
2630-990	170
2631-990	170
2651-500	171
2700T	134
2702M	134
2702T	134
2703T	134
2706T	127
2707NS	127
2709T	140
2710	129
2711T	129
2712M	129
2712T	129
2713	129
2713T	129
2714	129
2714T	129
2800-105	161
2800-185	161
2800-199	161
2800-226	161
2800-228	161
2800-250	161
2800-258	161
2800-259	161
2800-260	161
2800-266	161
2800-280	161
2800-282	161
2800-288	161
2800-300	161
2800-308	161
2800-330	161
2800-331	161
2800-338	161
2800-339	161
2800-373	161
2800-412	161
2800-432	161
2800-608	161
2800T	134
2801	134
2802T	134
2803T	134
2804T	134
2809T	140
2810	129
2810-166	161
2810-228	161
2810-258	161
2810-266	161
2810-338	161
2810-339	161
2810-432	161
2810-902	161
2810T	129
2811-308	164
2812-259	163
2812-287	163
2812T	129
2813	129
2813T	129
2814-199	163
2814-259	163
2814-300	163
2814-432	163
2814-533	163
2814T	129
2822-047	45
2822-070	45
2822-090	45
2827-047	45
3001-604	159
3001-614	159
3001-640	159
3001-651	159
3001-652	159
3001-653	159
3001-672	159
3001-681	159
3001-845	159
3001-861	159
3001-878	159
3001-917	159
3001-931	159
3001-964	159
3002-911	159
3002-917	159
3003-917	159
3004-614	159
3004-917	159
3017-621	159
3017-820	159
3017-915	159
3017-917	159
3017-8793	159
3020-917	159
3031-681	159
3031-901	159
3031-915	159
3454-651	159
3822-047	45
3822-070	45
3822-090	45
3827-035	45

Catalog number	Page
3827-042	45
3827-047	45
3827-070	45
3827-090	45
4827-035	45
4827-042	45
4827-047	45
4827-070	45
4827-090	45
5401-090E	173
5802-125	30
5802-150	30
5802-185	30
5802-240	30
5802-320	30
5802-385	30
5802-6698	30
5925-090	42
5925-142	42
6700-3602	134
6700-3610	134
6700-7501	134
6700-7502	134
6700-7504	134
6701-7510	134
6702-3600	140
6702-7500	140
6702-9500	140
6703-3610	129
6703-3611	129
6703-3621	129
6703-3650	129
6703-7510	129
6703-7511	129
6703-7521	129
6703-7550	129
6704-1500	136
6704-7500	136
6704-9502	132
6705-3600	130
6705-3602	127
6705-3604	127
6705-7500	130
6706-3602	127
6708-3602	127
6709-3602	127
6710-3602	134
6710-7502	134
6711-3601	134
6711-3602	134
6711-3604	134
6711-7502	134
6713-0425	138
6713-1075	138
6713-1650	138
6713-1651	138
6713-5036	138
6714-3601	132
6714-3602	132
6714-3604	132
6714-6004	135
6714-7501	132
6714-7502	132
6715-3601	132
6715-3602	132
6715-3604	132
6715-3682	132
6715-7502	132
6715-7582	132
6716-3602	132
6717-7504	132
6717-7510	132
6717-9501	132
6717-9502	132
6717-9504	132
6718-9502	132
6718-9582	132
6720-5001	122
6720-5002	122
6720-5045	122
6721-5010	122
6722-1001	142
6722-1002	142
6722-1003	142
6722-5000	142
6722-5001	142
6723-5000	140
6724-5000	124
6724-5002	121
6724-5045	121
6724-5145	121
6724-6004	135
6725-5002	125
6725-5002A	125
6726-5002	125
6726-5002A	125
6728-5050	122
6728-5100	122
6746-2502	108
6746-2504	108
6747-2502	108
6747-2504	108
6749-2504	108
6750-2502	108
6750-2504	108
6750-2510	108
6751-2502	108
6751-2504	108
6751-2510	108
6752-2504	108
6753-2502	108
6753-2504	108
6753-2510	108
6765-1302	107
6765-1304	107
6766-1302	107
6766-1304	107
6768-1302	107
6768-1304	107
6771-1304	107
6775-1302	107
6775-1304	107
6777-0402	107
6777-0404	107
6777-1302	107
6777-1304	107
6778-1302	107
6779-0402	107
6779-0404	107
6779-1302	107
6779-1304	107
6780-1302	108
6780-1304	108
6780-2502	108
6780-2504	108
6780-2510	108
6781-1304	107
6781-2502	108
6781-2504	108
6781-2510	108
6782-1302	107
6782-1304	107
6783-0402	107
6783-0404	107
6783-1302	107
6783-1304	107
6783-2510	108
6783-2520	108
6784-0402	107
6784-0404	107
6784-1301	107
6784-1302	107
6784-1304	107
6784-1310	107
6784-1350	107
6784-2501	108
6784-2502	108
6784-2504	108
6784-2510	108
6785-1302	107
6785-1304	107
6785-2502	108
6785-2504	108
6786-0402	107
6786-2502	108
6786-2504	108
6787-2520	108
6788-1302	107
6788-1304	107
6788-2502	108
6788-2504	108
6789-0402	107
6789-0404	107
6789-1301	107
6789-1302	107
6789-1304	107
6790-0402	107
6790-0404	107
6790-1302	107
6790-1304	107
6790-2502	108
6790-2504	108
6791-1302	108
6791-1304	108
6792-0402	107
6792-0404	107
6792-1302	107
6792-1304	107
6792-2510	108
6794-2502	108
6794-2504	108
6794-2510	108
6794-2512	108
6794-2514	108
6798-2501	108
6798-2502	108
6798-2504	108
6798-2510	108
6806-1316	107
6809-1002	115
6809-1012	115
6809-1022	115
6809-1102	115
6809-1112	115
6809-1122	115
6809-2002	115
6809-2012	115
6809-2022	115
6809-2024	115
6809-2102	115
6809-2112	115
6809-2122	115
6809-3002	115
6809-3012	115
6809-3022	115
6809-3102	115
6809-3112	115
6809-3122	115
6809-4002	115
6809-4012	115

Catalog number	Page
6809-4022	115
6809-4024	115
6809-4102	115
6809-4112	115
6809-4122	115
6809-5002	57
6809-5012	57
6809-5022	57
6809-5502	57
6809-5522	57
6809-6002	57
6809-6012	57
6809-6022	57
6809-7003	57
6809-7013	57
6809-7023	57
6809-9232	115
6809-9233	115
6809-9234	115
6809-9235	115
6809-9244	115
6818-1304	107
6820-1316	107
6821-1310	107
6822-1312	107
6823-1327	107
6825-1307	107
6825-2517	108
6825-2527	108
6827-1315	107
6869-2502	103
6869-2504	103
6870-1302	102
6870-1304	102
6870-2502	103
6870-2504	103
6870-2550	103
6871-1302	102
6871-1304	102
6871-2502	103
6871-2504	103
6871-2550	103
6872-1302	102
6872-1304	102
6872-2502	103
6872-2504	103
6873-1304	102
6873-2502	103
6873-2504	103
6874-1302	102
6874-1304	102
6874-2502	103
6874-2504	103
6875-1302	102
6875-1304	102
6875-2502	103
6875-2504	103
6876-1302	102
6876-1304	102
6876-2502	103
6876-2504	103
6878-1302	102
6878-1304	102
6878-2502	103
6878-2504	103
6879-2504	103
6880-1302	102
6880-1304	102
6880-2502	103
6880-2504	103
6881-2504	103
6882-1316	102
6882-2504	103
6882-2516	103
6883-2504	103
6883-2516	103
6884-1310	102
6884-2510	103
6886-1312	102
6886-2512	103
6887-2502	103
6888-1327	102
6888-2502	103
6888-2527	103
6890-1307	102
6890-2507	103
6891-2507	103
6892-2515	103
6894-1304	102
6894-2504	103
6895-2504	103
6896-2502	103
6896-2504	103
6897-2502	103
6897-2504	103
6900-2502	103
6900-2504	103
6901-2502	103
6901-2504	103
6902-2504	103
6905-2502	103
6905-2504	103
6970-2504	104
6971-2504	104
6972-2504	104
6973-2504	104
6974-2504	104
6978-2504	104
6992-2504	104
6993-2504	104
6994-2504	104
6995-2504	104
7000-0002	59
7060-1304	51
7060-2501	51
7060-2502	51
7060-2504	51
7060-2511	51
7060-2513	51
7060-2514	51
7060-2516	51
7060-4701	51
7060-4702	51
7060-4704	51
7060-4710	51
7060-4712	51
7060-4713	51
7060-4714	51
7060-4715	51
7060-4716	51
7062-2513	51
7063-2502	54, 148
7063-2504	54, 148
7063-4702	54, 148
7091-4710	51
7140-104	65
7141-004	65
7141-025	65
7141-047	65
7141-104	65, 147
7141-114	65, 147
7141-124	65, 147
7141-154	65, 147
7141-204	65, 147
7148-002	65
7153-104	65, 147
7181-002	62
7181-004	62
7182-001	62
7182-002	62
7182-004	62
7182-009	62
7182-014	62
7184-001	62
7184-002	62
7184-004	62
7184-005	62
7184-009	62
7184-014	62
7186-004	62
7187-114	65, 147
7188-002	62
7188-003	62
7188-004	62
7188-009	62
7190-002	62
7190-004	62
7191-005	62
7191-014	62
7193-002	62
7193-004	62
7195-002	62
7195-004	62
7195-009	62
7402-001	70
7402-002	70
7402-004	70
7402-009	70
7404-001	70
7404-002	70
7404-004	70
7404-009	70
7408-004	70
7410-004	70
7582-002	67
7582-004	67
7585-004	67
7590-002	67
7590-004	67
7592-104	69
8111-2250	179, 189
8112-2250	189
8113-2250	179
8113-2250	186, 189
8114-2250	179, 186, 188, 189, 186, 188
8116-2250	188
8117-2250	186
8117-2250	188, 189
8121-1750	179, 180
8122-2250	179
8122-2250	180
8124-1750	179, 180
8133-2250	179, 181
8134-2250	179, 181
8145-2250	180
8151-9915	180, 181
9907-042	45
9907-047	45
9907-055	45
9907-070	45
9907-090	45
9907-9436	*45*
9909-1302	117
9909-1304	117
9909-2502	117
9909-2504	117
9910-1302	117
9910-1304	117

Catalog number	Page
9910-2502	117
9910-2504	117
9911-1302	117
9911-1304	117
9911-2502	117
9911-2504	117
9912-1302	117
9912-1304	117
9912-2502	117
9912-2504	117
9913-2502	117
9913-2504	117
9914-2502	117
9914-2504	117
9915-2502	117
9915-2504	117
9916-1302	117
9916-1304	117
9927-047	45
9927-070	45
9927-090	45
110401	52
110405	52
110406	52
110407	52
110409	52
110410	52
110412	51, 52
110413	51, 52
110414	51, 52
110415	52
110416	52
110601	52
110602	52
110603	52
110604	53
110605	53
110606	53
110607	53
110608	53
110609	53
110610	53
110611	51, 53
110612	51, 53
110613	51, 53
110614	51, 53
110615	53
110616	53
110637	53
110656	55
110656	149
110657	55
110657	149
110659	55
110659	149

Catalog number	Page
110809	53
111101	53
111103	53
111104	53
111105	53
111106	53
111107	53
111108	53
111109	53
111110	53
111111	53
111112	53
111113	53
111114	53
111115	53
111116	53
111137	53
111156	55, 149
111206	53
111207	53
111213	53
111216	53
111503	53
111703	53
111705	53
111706	53
111707	53
111710	53
111711	53
111712	53
112104	53
112105	53
112106	53
112110	53
112810	53
113313	53
113502	53
113506	53
150445	51
150446	51, 52
155845	51
230300	83
230500	83
230600	83
230800	83
231100	83
231200	83
232100	83
232300	83
420100	80
420200	80
420400	80
800281	52
800282	52
800284	52

Catalog number	Page
800307	52
800308	52
800309	52
800319	52
10300009	17
10300010	17
10300011	17
10300012	17
10300014	17
10300045	30
10300102	17
10300103	17
10300106	17
10300107	17
10300108	17
10300109	17
10300110	17
10300111	17
10300112	17
10300114	17
10300120	17
10300143	30
10300145	30
10300210	17
10300211	17
10300212	17
10300214	17
10300263	17
10301645	33
10301647	33, 33
10310244	29, 33
10310245	29
10310245	33
10310247	29, 33
10310643	33
10310645	33
10310647	33
10311387	14
10311447	29
10311451	29
10311547	29
10311610	14
10311611	14
10311612	14
10311641	29
10311642	29
10311643	29
10311644	29
10311645	29
10311647	29
10311649	29
10311651	29
10311652	29
10311653	29
10311654	29

Catalog number	Page
10311656	29
10311687	14
10311804	14
10311807	14
10311808	14, 34
10311809	14, 34
10311810	14
10311811	14
10311812	14
10311814	14
10311820	14
10311822	14
10311841	29
10311842	29
10311843	29
10311844	29
10311845	29
10311847	29
10311851	29
10311852	29
10311853	29
10311854	29
10311856	29
10311862	14
10311887	14
10311897	14
10312070	14
10312209	14, 34
10312244	29
10312247	29
10312251	29
10312256	29
10312287	14
10312500	14
10312544	29
10312545	29
10312611	14
10312612	14
10312614	14
10312620	14
10312642	29
10312644	29
10312645	29
10312647	29
10312651	29
10312744	29
10312745	29
10312747	29
10312751	29
10312753	29
10313032	167
10313209	32
10313947	29, 33
10313951	29, 33
10313953	29, 33

Catalog number	Page
10314712	22
10314714	22
10314720	22
10314726	22
10314744	29
10314745	29
10314747	29
10314751	29
10314752	29
10314753	29
10314828	22
10314843	29
10314844	29
10314916	22
10316114	14
10316619	32
10318493	171
10328170	171
10331451	29
10331456	29
10331487	24
10331551	29
10331553	29
10331554	29
10331556	29
10331558	29
10331687	24
10334345	29
10334346	29
10334347	29
10334348	30
10334351	29
10334352	29
10334353	29
10334365	24, 34
10334383	24
10334385	24
10334435	29
10334547	29
10334551	29
10334553	29
10334885	24
10334987	24
10340810	32
10342500	34
10342555	34
10342570	34
10342579	34
10342580	34
10342581	34
10342582	34
10342583	34
10342594	34
10342596	34
10342810	24

Catalog number	Page
10343630	24
10343687	24
10343876	24
10344672	34
10344676	34
10345572	34
10345573	34
10345576	34
10347004	32
10347008	32
10347009	32
10347033	32
10347509	24
10347510	24
10347511	24
10347512	24
10347513	24
10347519	24
10347521	24
10347522	24
10347523	24
10347525	24
10347530	24
10347577	24
10347670	167
10347671	167
10347672	167
10347673	167
10347890	167
10347893	167
10348903	32
10350106	162
10350108	162
10350211	162
10350215	162
10350217	162
10350219	162
10350220	162
10350223	162
10350225	162
10350226	162
10350227	162
10350234	162
10350236	162
10350238	162
10350240	162
10350241	162
10350242	162
10350243	162
10350245	162
10350247	162
10350250	162
10350252	162
10350255	162
10350261	162

Catalog number	Page
10350265	162
10350273	162
10350274	162
10350275	162
10350287	162
10350306	162
10350324	162
10350416	162
10350437	162
10360005	170
10360300	171
10362000	170
10362010	170
10362030	170
10370002	41
10370003	41
10370004	41
10370005	41
10370006	41
10370007	41
10370008	41
10370010	41
10370011	41
10370012	41
10370018	41
10370019	41
10370020	41
10370050	41
10370105	41
10370111	41
10370119	41
10370172	41
10370202	41
10370205	41
10370206	41
10370302	41
10370305	41
10370308	41
10370319	41
10370320	41
10370391*	41
10370393*	41
10370434	41
10371005	164
10371007	164
10371011	164
10371019	164
10371025	164
10371036	164
10371042	164
10371043	164
10371045	164
10371055	164
10371075	164
10371103	164

Catalog number	Page
10371114	164
10380004	30
10380005	30
10380006	30
10380204	30
10380205	30
10380206	30
10380404	30
10380405	30
10380406	30
10382461	159
10382514	159
10382562	159
10382581	159
10390046	33
10400012	62
10400014	62
10400106	62
10400112	62
10400114	62
10400206	62
10400212	62
10400214	62
10400706	65
10400712	65
10400714	65
10400772	65
10400806	65
10400812	65
10400814	65
10400821	65
10400906	64
10400909	64
10400912	64
10400914	64
10400921	64
10401106	62
10401114	62
10401118	62
10401121	62
10401122	62
10401126	62
10401170	62
10401180	188
10401312	62
10401314	62
10401380	188
10401506	64
10401512	64
10401514	64
10401606	64
10401612	64
10401614	64
10401618	64
10401621	64

Catalog number	Page
10401626	64
10401631	64
10401662	64
10401664	64
10401670	64
10401672	64
10401706	64
10401712	64
10401714	64
10401721	64
10401726	64
10401731	64
10401770	64
10401772	64
10402012	62
10402014	62
10403012	59
10403112	59
10404001	59
10404006	59
10404012	59
10404014	59
10404026	59
10404031	59
10404044	59
10404106	59
10404112	59
10404114	59
10404126	59
10404131	59
10404139	59
10404170	59
10404180	59
10405079	62
10405672	65, 147
10406512	65
10406572	65, 147
10406800	65
10406801	65
10406802	65
10406803	65
10406812	65
10406814	65
10406870	146
10406871	65, 146, 147
10406872	146
10406970	65
10406970	147
10406972	65, 147
10407112	146
10407114	146
10407132	146
10407134	146
10407170	146
10407172	146
10407312	146
10407314	146
10407324	146
10407332	146
10407334	146
10407342	147
10407370	146
10407372	146
10407615	147
10407713	146
10407714	146
10407734	146
10407970	65
10407970	147
10408472	65, 147
10408712	65, 146, 147
10408714	65
10408714	146
10408714	147
10408915	147
10408970	65, 147
10409414	65
10409470	146
10409472	146
10409714	65
10409770	65
10409770	147
10409771	65, 147
10409772	65, 147
10409814	65
10409834	147
10409970	65, 147
10410012	58
10410014	58
10410206	58
10410212	58
10410214	58
10410219	58
10410224	58
10410229	58
10410312	58
10410314	58
10410319	58
10410380	58
10411108	67
10411111	67
10411113	67
10411116	67
10411130	67
10411205	67
10411211	67
10411213	67
10411305	67
10411311	67
10411313	67
10411405	67
10411411	67
10411413	67
10414006	71
10414012	71
10414014	71
10414106	71
10414112	71
10414114	71
10421019	41
10421026	41
10421030	41
10421043	41
10421057	41
10421060	41
10440000	77, 153
10440020	77, 153
10441000	76
10441200	76
10442000	76
10442100	76
10442200	76
10442300	76
10443000	76
10443100	76
10444830	78, 154
10444835	78, 154
10444850	78, 154
10445830	78, 154
10445835	78, 154
10445850	78, 154
10445861	85, 151
10445863	85, 151
10445866	85, 151
10445868	85, 151
10445870	85, 151
10445890	85, 151
10450450	81, 152
10451610	81, 152
10451710	81, 152
10453001	81, 152
10453007	81, 152
10460100	79
10461000	79
10461100	79
10461200	79
10461300	79
10461400	79
10462000	109
10462100	109
10462200	109
10462205	109
10462206	109
10462240	109
10462241	109
10462243	109
10462260	109
10462261	109
10462263	109
10462300	109
10462500	109
10462510	109
10462520	109
10462600	109
10462601	109
10462610	109
10462650	109
10462655	109
10462656	109
10462700	109
10462701	109
10462710	109
10462940	108
10462945	108
10462950	110
10462960	110
10463030	110
10463032	110
10463040	110
10463042	110
10463050	110
10463052	110
10463053	110
10463060	110
10463062	110
10463100	110
10463102	110
10463110	110
10463112	110
10463400	123
10463401	123
10463500	111
10463503	111
10463505	111
10463513	111
10463515	111
10463523	111
10463533	111
10463535	111
10463543	111
10463545	111
10463607	122
10463608	122
10463609	122
10463703	111
10463713	111
10463800	118
10463801	118

Catalog number	Page
10463802	118
10463803	118
10463804	118
10463805	118
10463806	118
10463808	118
10463809	118
10463813	118
10463814	118
10463815	118
10463898	118
10464100	79
10470300	86
10470300	155
10471101	81, 152
10471700	86, 155
10477100	151
10477103	151
10477600	76, 86
10477600	155
10477601	86, 155
10477602	85, 86
10477602	151, 155
10498761	78, 154
10498762	78, 154
10537138	24
10538877	24
10539028	171
10539167	171
10539995	179
10547001	185
10547002	185
10547003	185
10547004	185
10547005	185
10547006	185
10547020	185
10547021	185
10547023	185
10548081	183
13549204	185
13549205	185
13549206	185
78336403	184
78356403	184
95039860	41
97039654	41
97039944	41
10342860[1]	24
10342862[2]	24
18208296[4]	38
1820900086	38
9703900241	41
1820900086	38
AV115NPEORG	98
AV115NPUAQU	98
AV115NPUNYL	98
AV115NPUORG	98
AV115UGMF	98
AV125EAQU	98
AV125ENAO	98
AV125EORG	98
AV125EPP	98
AV125NPUAQU	98
AV125NPUPSU	98
AV125SAQU	98
AV125SNAO	98
AV125UAQU	98
AV125UCA	98
AV125UGMF	98
AV125UNAO	98
AV125UORG	98
AV125UPP	98
AV525UAQU	98
AV525UNAO	98
AV525UORG	98
GN203APEAQU	95
GN203APEAQUSP	95
GN203APEORG	95
GN203APEORGSP	95
GN203NPEAQU	95
GN203NPEAQUSP	95
GN203NPENYL	95
GN203NPENYLSP	95
GN203NPEORG	95
GN203NPEORGSP	95
GN203NPEPP	95
GN203NPEPPSP	95
GN203NPERC	95
GN203NPERCSP	95
GN203NPUAQU	95
GN203NPUGMF	95
GN203NPUORG	95
GN203NPURC	95
GN203NPURCSP	95
GN503NPEAQU	95
GN503NPENYL	95
GN503NPEORG	95
GN503NPEPP	95
GN503NPERC	95
GN503NPUAQU	95
GN503NPUGMF	95
GN503NPUORG	95
GN503NPURC	95
GS203NPEAQU	95
GS203NPEAQUSP	95
GS203NPENYL	95
GS203NPENYLSP	95
GS203NPEORG	95
GS203NPEORGSP	95
GS203NPEPP	95
GS203NPEPPSP	95
GS203NPUAQU	95
GS203NPUAQUSP	95
GS203NPUGMF	95
GS203NPUGMFSP	95
GS203NPUORG	95
GS203NPUORGSP	95
GS503NPEAQU	95
GS503NPENYL	95
GS503NPEORG	95
GS503NPUAQU	95
GS503NPUORG	95
MUPG2HCPWC1	95
MUPG2MCPWC8	95
MUPG2MCWT8	95
MUPMCBT8	93
MUPMCPBC8	93
UN113EAQU	96
UN113ENYL	96
UN113EORG	96
UN113UAQU	96
UN113UGMF	96
UN113UNYL	96
UN113UORG	96
UN203APEAQU	93
UN203APENYL	93
UN203APEORG	93
UN203APEPES	93
UN203APEPP	93
UN203APUAQU	93
UN203APUDPP	93
UN203APUGMF	93
UN203APUNYL	93
UN203APUORG	93
UN203APUPES	93
UN203APUPP	93
UN203NPEAQU	92
UN203NPENYL	92
UN203NPEORG	92
UN203NPEPES	92
UN203NPEPP	92
UN203NPERC	92
UN203NPUAQU	92
UN203NPUDPP	92
UN203NPUGMF	92
UN203NPUNYL	92
UN203NPUORG	92
UN203NPUPES	92
UN203NPUPP	92
UN203NPURC	92
UN503NPEAQU	92
UN503NPENYL	92
UN503NPEORG	92
UN503NPEPP	92
UN503NPERC	92
UN503NPUAQU	92
UN503NPUDPP	92
UN503NPUGMF	92
UN503NPUNYL	92
UN503NPUORG	92
UN503NPUPES	92
UN503NPUPP	92
UN503NPURC	92
UN513UAQU	96
UN513UORG	96
US203APUNYL	93
US203NPEAQU	93
US203NPENYL	93
US203NPEORG	93
US203NPEPES	93
US203NPEPP	93
US203NPUAQU	93
US203NPUDPP	93
US203NPUGMF	93
US203NPUNYL	93
US203NPUORG	93
US203NPUPES	93
US203NPUPP	93
US503NPEAQU	93
US503NPENYL	93
US503NPEORG	93
US503NPEPES	93
US503NPEPP	93
US503NPUAQU	93
US503NPUDPP	93
US503NPUGMF	93
US503NPUORG	93
US503NPUPP	93

Alphabetical index

	Page
3-piece filter funnel	74
934-AH RTU double weigh	45
934-AH RTU for suspended and dissolved solids	45
934-AH RTU for volatiles	45
A	
Absorption pads	186
Acid-alkali test papers	169
Acid treated low metal TCLP filters	42
Air monitoring membrane, PM 2.5	68
Air sampling filters	43
Amber Mini-UniPrep filter vial	91
Analytical funnels	152
Anodisc membrane filter	56
Anopore inorganic membranes	56
Anotop syringe filters	112
Antibiotic assay paper and discs	171
Application specific filter papers	31
Aqueous IFD and Solvent IFD	125
AS 300 and 600 multiple vacuum filtration apparatus	154
Ashless quantitative filter paper	15
Autovial filter vial	97
B	
Benchkote and Benchkote Plus surface protector	165
Binder-free glass microfiber filters	36
Black Cyclopore membranes	54
Black Nuclepore membranes	55
Blood separators for lateral-flow immunoassays	180
C	
Capsule filters	126
Carbon cap	136
Cell culture and chemotaxis membranes	51
Cellulose acetate membranes	59
Cellulose filters	10
Cellulosic membranes	58
Cellulose nitrate membranes	60
Chromatography paper	158
Conjugate release pads for lateral-flow immunoassays	180
Cyclopore track-etched polycarbonate membranes	49
D	
DIONEX ASE 100/300 extraction thimble	162
Dispensers Type SR pH indicator	169
Dispensers Type TC pH indicator	169
E	
eButler	151
EPM 2000 air sampling filters	37
Extraction thimbles	160
Extraction thimbles for standard soxhlet apparatus	160

	Page
F	
FF high performance nitrocellulose membranes	185
Filter funnel, glass	74
Filter funnel manifold for vacuum filtration	78
Filter papers	9
Filtration devices	89
Folded (prepleated) filter papers	25
Forceps PZ 001	86
G	
GD/XP syringe filters	104
GD/X syringe filters	101
GF/C RTU filter grades	45
General purpose filter papers	21
Glass microfiber filters	35
Glass microfiber filter without binder	36
Glass microfiber filter with binder	40
Glass microfiber filter with inorganic binder	40
Glass microfiber filter with organic binder	40
Glass microfiber accessories	74
Glass microfiber GF series	36
Glass microfiber thimbles	163
GMF 150 multigrade membrane prefilter	37
H	
Hardened ashless quantitative filter paper	19
Hardened low ash filter paper	18
HEPA-VENT and HEPA-CAP	139
High-performance cellulose extraction thimbles	160
HPLC certified syringe filters	110
I	
Immunopore membranes	184
Indicator books	169
Indicator papers	169
Inline filters	120
K	
Kjeldahl weighing boats	167
L	
Lens cleaning tissue	173
M	
MBS I microbiological filtration system	84
MBS I accessories	84
Membraclear membrane	63
Membrane accessories	81
Membrane-Butler	151
Membrane filters	47
Membrane filtration accessories	81
Membranes for lateral-flow immunoassays	182
Membrane prefilters and separators	82

	Page
Microbiology	145
MicroPlus and ME membranes	146
Mini-UniPrep filter vials	90
Mini-UniPrep G2 Glass filter vials	94
Mixed cellulose ester membranes	63
Moisture test paper	173
N	
Nitrocellulose membranes	187
Nuclepore polycarbonate track-etched membranes	52
Nylon membranes	70
P	
Papers for healthcare	171
Parchment weighing paper	167
Phase separator paper	172
pH indicator and test papers	169
Polyamide membranes	71
Polycap capsule filters	126
Polycarbonate track-etched membranes	49
Polydisc inline filters	120
Polyester drain discs	83
PolyVENT venting filters	137
Pop-Top and Swin-Lok plastic filter holders	80
Pressure filtration devices	81
PTFE membranes	66
Puradisc syringe filters	105
Q	
Quadrant folded filter papers	30
Qualitative filter papers	11
Qualitative filter papers—folded (prepleated) grades	25
Quantitative filter papers	15
Quantitative filter papers—hardened low ash grades	18
Quantitative filter papers—hardened ashless grades	19
Quantitative filter papers—ashless grades	15
Quantitative filter papers—ashless folded grades	29
Quartz fiber filter papers	43
R	
Ready-to-use filter grades	44
Regenerated cellulose membranes	58
ReZist syringe filters	111
Roby 25 automation filters	118
Roby 25 filter validation kit	118
S	
Sample pads for lateral-flow immunoassays	178
Seed testing papers	33
Shark Skin	23
Six-position compressor accessory—Mini-UniPrep	93
Slit septa Mini-UniPrep filter vial	91
Soil analysis filter papers	31
SPARTAN—HPLC certified syringe filters	110
Specialized test papers	170
Specialty products	159
Standard cellulose extraction thimbles	160
Standard glass fiber extraction thimbles	163
Strips Type CF pH indicator	169
Strips Type CS pH indicator	169
Suction Flask	78
Sugar/food industry filter papers	32
Surface wipes, smear tab	19
Syringe filters	100
Syringe type holders S/S	79
T	
Test papers	169
Track-etched polycarbonate membranes	49
Track-etched membranes for diagnostic applications	189
U	
UniFlo syringe filters	116
UniPrep filter vials	95
Universal indicator papers	170
V	
VACU-GUARD	141
VACU-GUARD 150	141
Vacuum filtration equipment	77
Vacuum manifolds	78
Vacuum and pressure pumps	86
Vacuum protection filters	141
Vacuum type glass holders	75
Venting filters	137
W	
Weighing papers	167
Wet strengthened qualitative filter papers	21
Whatman GD/X syringe filters	101
Whatman GD/XP syringe filters	104
Witt's bottle WT 100	86