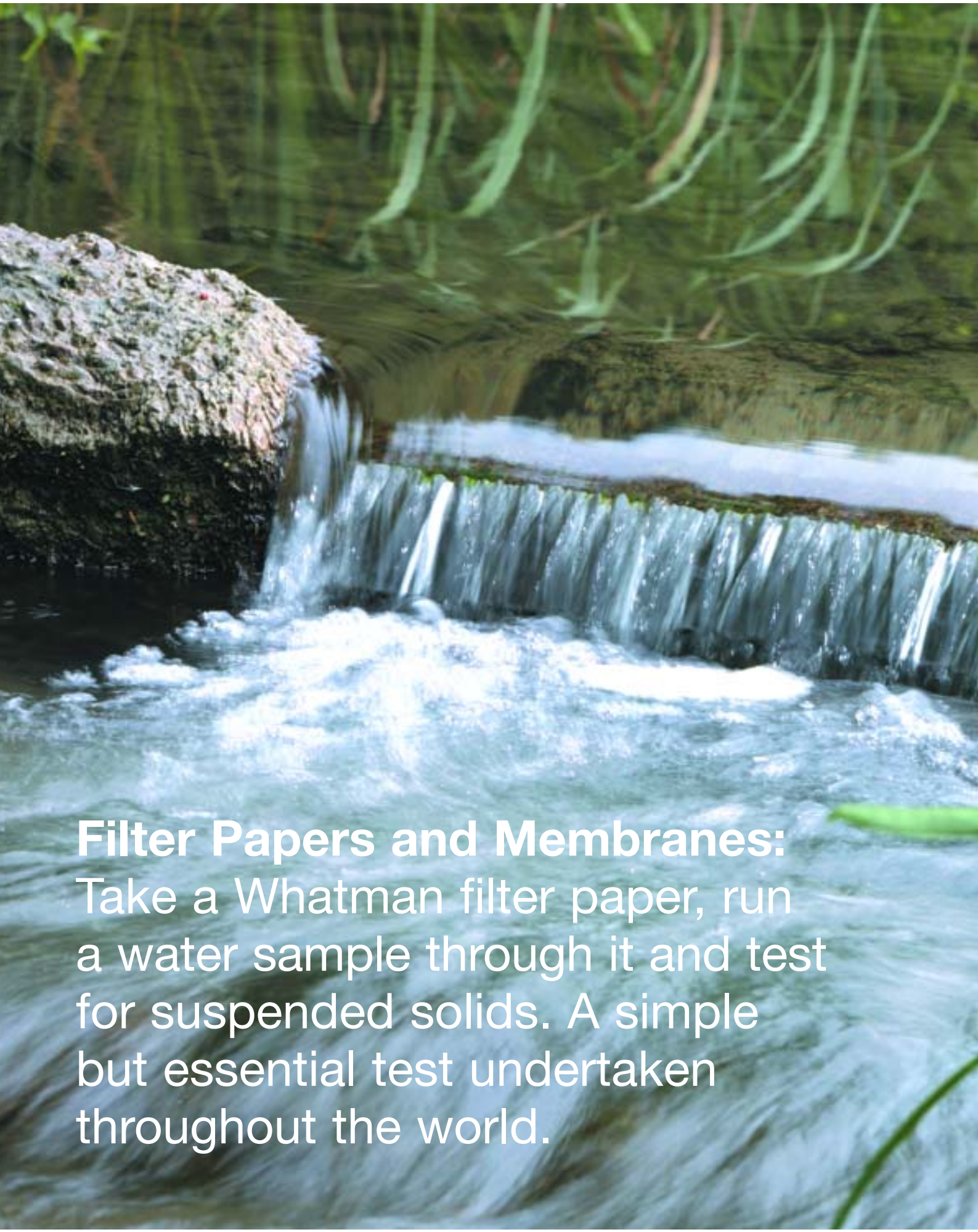
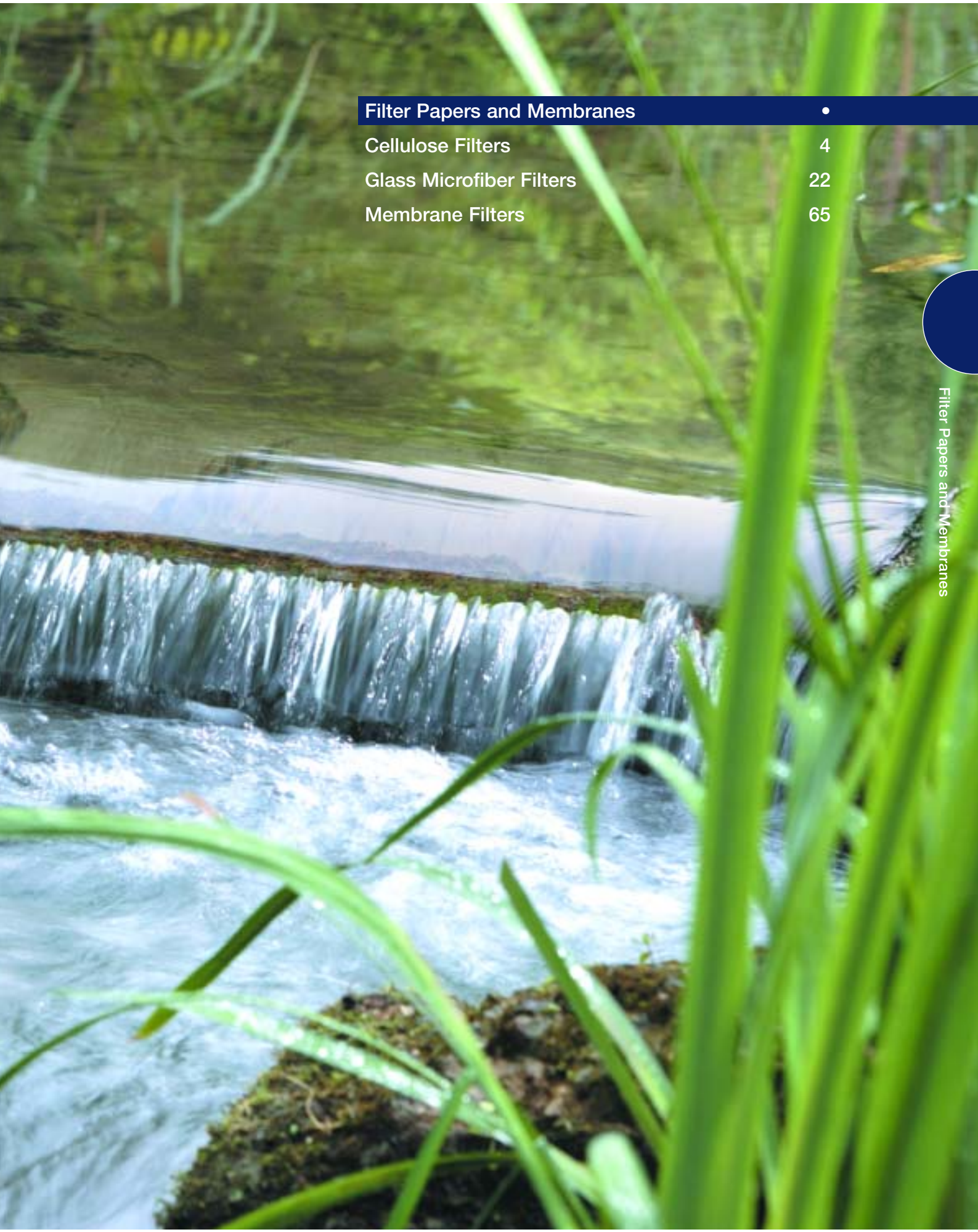


Filter Papers and Membranes: Take a Whatman filter paper, run a water sample through it and test for suspended solids. A simple but essential test undertaken throughout the world.



Filter Papers

Whatman filter papers are world-renowned as the standard for laboratory filtration and are associated with quality, reliability and customer service. The familiar Whatman Blue Box is the laboratory benchmark for filtration. Papermaking skills have been developed to the highest level, with the expertise and technology to manufacture innovative multilayer materials.

Whatman offers an extensive line of filter papers. The unique features of these filters make them the optimum choice for many filtering techniques. Whatman maintains a guaranteed quality, reproducibility and uniformity for all its filters by using only the highest quality raw materials. The filters are tested for basis weight, thickness, air flow and mechanical strength. In addition, special parameters such as pore size, wicking rate, filtration performance and surface characteristics can be measured as needed.

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. Whatman offers a wide choice of retention/flow rate combinations to match numerous laboratory applications.

The different groups of filter paper types offer increasing degrees of purity, hardness and chemical resistance.

Typical Properties - Cellulose Filters

Grade	Particle Retention* Liquid (µm)	Air Flow Rate (s/100 mL/in²)	Ash (%)	Typical Thickness (µm)	Basis Weight (g/m²)	Wet Burst (psi)	Dry Burst (psi)	Tensile M/D Dry (N/15 mm)
Qualitative								
1	11	10.5	0.06	180	88	0.3	16	39.1
2	8	21	0.06	190	103	0.7	16	44.6
3	6	26	0.06	390	187	0.5	28	72
4	20-25	3.7	0.06	205	96	0.7	10	28.4
5	2.5	94	0.06	200	98	0.4	21	55.6
6	3	35	0.2	180	105	0.3	15	39.1

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Grade	Particle Retention* Liquid (µm)	Air Flow Rate (s/100 mL/in²)	Ash (%)	Typical Thickness (µm)	Basis Weight (g/m²)	Wet Burst (psi)	Dry Burst (psi)	Tensile M/D Dry (N/15 mm)
General Purpose and Wet Strengthened Qualitative								
91	10	6.2	N/A	205	71	2	18	28
93	10	7	N/A	145	67	2.6	12	38
113	30	1.3	N/A	420	131	8	24	38.6
114	23	5.3	N/A	190	77	8.9	15	42.1
Ashless Quantitative								
40	8	19.3	0.007	210	92	0.5	16	46.7
41	20-25	3.4	0.007	215	84	0.3	10	27.2
42	2.5	107	0.007	200	100	0.7	25	55.8
43	16	8.9	0.007	220	96	0.6	12	38.2
44	3	57	0.007	176	77	0.4	44	39.4
Hardened Low Ash Quantitative								
50	2.7	96	0.015	115	97	9.1	33	84
52	7	11.4	0.015	175	101	8.3	24	71.5
54	20-25	4.2	0.015	185	92	9.4	18	57.6
Hardened Ashless Quantitative								
540	8	13.2	0.006	160	88	9	20	63
541	20-25	3.8	0.006	155	82	5.3	14	43.4
542	2.7	69	0.006	150	93	9.2	28	82.6

Ash is determined by ignition of the cellulose filter at 900° C in air

*Particle Retention Rating at 98% efficiency

Trace Elements - Typical Values

Grade	1	42	542	Grade	1	42	542
Aluminum	<0.5	2	1	Iron	5	6	3
Antimony	<0.02	<0.02	<0.02	Lead	0.3	0.2	0.1
Arsenic	<0.02	<0.02	<0.02	Magnesium	7	1.8	0.7
Barium	<1	<1	<1	Manganese	0.06	0.05	<0.05
Boron	1	1	2	Mercury	<0.005	<0.005	<0.005
Bromine	1	1	1	Nitrogen	23	12	260
Calcium	185	13	8	Potassium	3	1.5	0.6
Chlorine	130	80	55	Silicon	20	<2	<2
Chromium	0.3	0.3	0.7	Sodium	160	33	8
Copper	1.2	0.3	0.2	Sulfur	15	<5	<2
Fluorine	0.1	0.2	0.3	Zinc	2.4	0.6	0.3

Qualitative Filter Papers

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

In addition, Whatman offers a range of wet strengthened qualitative filters which contain a small quantity of a chemically stable resin to give improved high wet strength. This does not introduce any significant impurities into the filtrate. The resin, however, does contain nitrogen so these grades should not be used in Kjedldahl estimations, etc. All wet strengthened grades are available in prepleated forms. Whatman provides a wide range of qualitative filters to meet your specific needs.

Qualitative Filter Papers - Standard Grades

Grade 1: 11 µm
The most widely used filter paper for routine applications with medium retention and flow rate. Extended range of sizes includes 10 mm to 500 mm diameter circles and 460 mm x 570 mm sheets. This filter is also available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity molded from polypropylene with an integral, heat bonded filter.

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.

Grade 2: 8 µm
Slightly more retentive than Grade 1 with a corresponding increase in filtration time (i.e., slightly slower filtration speed). More absorbent than Grade 1. Also available in folded (prepleated) form as Grade 2V. 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.

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. This filter is also available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity molded from polypropylene with an integral, heat bonded filter.

Grade 4: 20-25 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.

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.

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 591 1⁄2.

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 520 a 1⁄2.

Grade 595: 4-7 µm
Very popular, thin filter paper, medium-fast with medium to fine particle retention. Used for many analytical routine applications in different industries, e.g. particle separation from food extracts for sample preparation or filtration of solid environmental samples digested, e.g. for ICP/AAS analysis. Also available prepleated as 595 1/2.

Grade 597: 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 acc. to Section 35 LMBG*) or removal of carbon dioxide and turbidity from beverages (e.g. beer analysis acc. to EBC or MEBAK). Available prepleated as 597 1⁄2.

Grade 598: 8-10 µm
A thick filter paper with high loading capacity. Combines medium retention with medium-fast to quick filtration speed. Also available prepleated as 598 1⁄2.

* German law for food and consumer products

Grade 0048
Fiber mats made of cellulose/synthetics used in milk analysis and for testing baby food (artificial milk) for textile fibers.

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 602 h 1⁄2.

Typical Properties - Qualitative Filter Papers

Grade	Properties	Classification to DIN 53 135	Thickness (mm)	Filtration time to Herzberg (s)	Filtration time to DIN 53 137 (s)	Weight (g/m²)	Retention-Range* (µm)
520 a	Very Fast, Great Wet Strength, Thin	-	0.32	35	-	90	15-18
591	Medium Fast, Thick	-	0.36	90	-	165	7-12
595	Medium Fast, Thin	1b	0.16	160	12-40	68	4-7
597	Medium Fast	-	0.19	140	11-35	85	4-7
597 L	Medium Fast, Low-fat		0.18	170	17-38	82	4-7
598	Medium Fast, Thick	-	0.32	100	-	140	8-10
602 h	Slow, Dense	1d	0.15	1500	100-200	85	< 2

* Approximate values

Ordering Information - Qualitative Standard Filter Circles

	Catalog Number						
Diameter (mm)	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Quantity/Pack
10	1001-6508	-	-	-	-	-	500
23	-	-	1003-323	-	-	-	100
25	1001-325	-	-	1004-325	1005-325	-	100
30	1001-329	-	-	-	-	-	100
32	1001-032	-	-	-	-	-	100
42.5	1001-042	1002-042	1003-042	1004-042	1005-042	1006-042	100
47	1001-047	-	-	1004-047	1005-047	-	100
55	1001-055	1002-055	1003-055	1004-055	1005-055	-	100
70	1001-070	1002-070	1003-070	1004-070	1005-070	1006-070	100
85	1001-085	-	-	-	-	-	100
90	1001-090	1002-090	1003-090	1004-090	1005-090	1006-090	100

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	Catalog Number						
Diameter (mm)	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Quantity/Pack
110	1001-110	1002-110	1003-110	1004-110	1005-110	1006-110	100 contd>
125	1001-125	1002-125	1003-125	1004-125	1005-125	1006-125	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
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	1003-500	-	-	-	100
FilterCup 70*	1600-001	-	1600-003	-	-	-	25

* FilterCup Stem with Stopper - one time purchase - **Catalog Number 1600-900**

Ordering Information - Qualitative Standard Filter Paper Circles

	Catalog Number					
Diameter (mm)	Grade 595	Grade 597	Grade 598	Grade 602 h	Grade 0048	Quantity/Pack
12.7	-	10 311 862	-	-		1000
42.5	-	10 312 040	-	-		100
45	-	10 311 804	-	-		100
55	-	10 311 807	-	-		100
70	-	10 311 808	-	-		100
90	-	10 311 809	10 312 209	10 312 609		100
110	10 311 610	10 311 810	-	-		100
125	10 311 611	10 311 811	-	10 312 611		100
150	10 311 612	10 311 812	-	10 312 612		100
185	-	10 311 814	-	10 312 614		100
240	-	10 311 820	-	10 312 620		100
320	-	10 311 822	-	-		100
32	-	-	-		10 348 903	1000
150	-	-	10 314 812			100
240	-	10 341 420**	-			100

** Grade 3612 - Black

Ordering Information - Qualitative Filter Paper Sheets

	Catalog Number					
Dimensions (mm)	Grade 595	Grade 520 a	Grade 520 bII	Grade 2411	Grade 591	Quantity/Pack
580 x 580	-	10 331 487	10 331 687	10 343 287	10 311 387	250
580 x 580	10 311 687	-	-	-		500
Dimensions (mm)	Grade 2589 a	Grade 2589 c	Grade 2589 d	Grade 0860		Quantity/Pack
580 x 580	10 343 687	-	-	10 334 597		100
25 x 75	-	10 343 876	10 343 976	-		100
Dimensions (mm)	Grade 0903	Grade 0905	Grade 0858	Grade 1574	Grade 1575	Quantity/Pack
1100 x 1100	-	-	-	-	10 314 991	100
580 x 580	10 334 887	10 334 987	10 334 387	-	-	500
580 x 580	-	-	10 334 397	-	-	100
400 x 400	-	-	-	10 314 889	10 314 984	500
450 x 450	10 334 885	10 334 985	10 334 385	-	-	500
390 x 390	-	-	10 334 383	-	-	500
300 x 309	-	-	-	-	10 314 983	500
110 x 580	-	-	10 334 365	-	-	500

Ordering Information - Qualitative Standard Filter Paper Sheets

Dimensions (mm)	Catalog Number	Quantity/Pack
Grade 1		
460 x 570	1001-917	100
460 x 570	1001-918	500
580 x 680	1001-931	100
Grade 2		
460 x 570	1002-917	100
580 x 680	1002-931	100
Grade 3		
460 x 570	1003-917	100
Grade 4		
460 x 570	1004-917	100
Grade 591		
580 x 580	10 311 387	250
Grade 597		
580 x 580	10 311 897	100
580 x 580	10 311 8 7	500
Grade 598		
580 x 580	10 312 287	250

Qualitative 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. 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 113: 30 µm
Ultra high loading capacity with a particle retention making it ideal for use with coarse or gelatinous precipitates. Fastest flow rate of the qualitative grades. Creped surface. Thickest filter paper in the Whatman range. This filter is also available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity, molded from polypropylene with an integral, heat bonded filter.

Grade 114: 25 µm
Only half the thickness of Grade 113 and suitable for coarse or gelatinous precipitates. Smooth surface for easy recovery of precipitates.

Grade 520 bII: 15-19 µm
A thick paper with high wet strength offering a very high flow rate. Also available prepleated as 520 bII 1⁄2.

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 2411: 9-11 µm
A fast filter paper with high wet strength and medium retention. Frequently used as a protective paper in filter presses.

Qualitative Filter Papers - Student Grade/Grade 93

Designed for educational use, this filter paper is intermediate in speed and retention between Grades 1 and 4. Student grade retains those flocculent and medium precipitates most often encountered in student experiments.

Available in a dispenser pack, it 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.

Ordering Information - Qualitative Wet Strengthened Filter Circles

	Catalog Number					
Diameter (mm)	Grade 91	Grade 93/ Student	Grade 113	Grade 114		Quantity/Pack
90	-	-	1113-090	1114-090		100
110	1091-110*	1093-111**	1113-110	-		100
125	1091-125*	1093-126**	1113-125	1114-125		100
150	1091-150***	-	1113-150	1114-150		100
185	1091-185***	-	1113-185	1114-185		100
190	1091-190	-	-	-		100
240	1091-240***	-	1113-240	1114-240		100
270	-	-	-	1114-270		100
320	-	-	1113-320	-		100
400	-	-	-	1114-400		100
500	-	-	1113-500	-		100
FilterCup 70****	-	-	1600-113	-		25
Diameter (mm)	Grade 520 a	Grade 2294	Grade 2589 a	Grade 1573	Grade 1575	Quantity/Pack
110	-	10 342 810	-	-	-	100
125	-	-	-	10 314 711	10 314 911	100
140	-	-	10 343 630	-	-	500
150	-	-	-	10 314 712	10 314 912	100
180 / 33 ZL[1]	-	10 342 860	-	-	-	100
185	-	-	-	10 314 714	10 314 914	100
200	-	-	-	-	10 314 916	100
210 / 60 ZL[1]	-	10 342 862	-	-	-	100
240	-	-	-	10 314 720	-	100
270	10 331 421	-	-	-	-	100
290	-	-	-	10 314 726	-	100
510	-	-	-	-	10 314 940	100

[1] Round filter with central hole

* Packed in 4000 subdivided into 100

** Packed in 50 envelopes of 25 circles each

*** Packed in 1000 subdivided into 100
**** FilterCup Stem with Stopper - one time purchase - **Catalog Number 1600-900**

Filter Papers for General Laboratory Analyses

Grade 0858: 7–12 µm
Grained, with medium fast flow rate and medium retention. A universal filter paper, e.g. used for the filtration of extracts, oils, beer, syrups etc., also applied in filter presses or for the aspiration of liquids. Available prepleated as 0858 1⁄2.

Grade 0860: 12 µm
Comparable to 0858 but with a smooth surface, slightly thinner and faster. Also available prepleated as 0860 1⁄2.

Grade 0903: 4-7 µm
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, offers a very high filtration speed.

Typical Properties - Qualitative Wet Strengthened Filter Papers

Grade	Properties	Thickness (mm)	Filtration Time to Herzberg (s)	Weight (g/m²)	Retention-Range** (µm)
2294	Fast, Wet Strength, Thick	1.5	55	550	8-15
2589 a	Medium Fast, Wet Strength	0.45	120	200	6-12
0858	Medium Fast, Wet Strength	0.21	110	75	7-12
0860	Medium Fast, Wet Strength	0.18	120	75	7-12
0903	Medium to Slow, Wet Strength	0.15	350	65	4-7
0905	Very Fast	0.24	40	65	12-25
Shark Skin	Medium to Slow, Wet Strength, Thin	0.17	155	44	8-12

** Approximate values

Ordering Information - Shark Skin Filter Circles

Diameter (mm)	Catalog Number	Quantity/Pack
110	10 347 510	100
150	10 347 513	100
290	10 347 577	100
320	10 347 530	100
812.8	10 347 576	100

Ordering Information - Shark Skin Filter Sheets

Dimensions (inches)	Catalog Number	Quantity/Pack
8 x 10	10 538 877	100
26 x 53	10 347 588	500
32 x 64	10 347 585	500
37 x 37	10 538 873	500
21 x 750 feet	10 537 138	1

Qualitative Filter Papers - Folded (Prepleated Grades)

Time-saving Whatman qualitative grades are offered in this convenient form, which have 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 because more filter area is available
- Maintained flow rate because of the reduction in filter paper contact with funnel side and, of course, 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 2V: 8 µm
Widely used for general purpose filtration. Has excellent particle retention and a good filtration speed and loading capacity.

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. Ideal for coarse particles and gelatinous precipitates.

Grade 114V: 25 µm
Strong filter with very fast flow rate. Ideal for coarse particles and gelatinous precipitates. Smooth surface.

Ordering Information - Qualitative Filter Papers - Folded (Prepleated Grades)

	Catalog Number					
Diameter (mm)	Grade 2V	Grade 113V	Grade 114V	Quantity/Pack		
125	1202-125	1213-125	1214-125	100		
150	1202-150	1213-150	1214-150	100		
185	1202-185	1213-185	1214-185	100		
240	1202-240	1213-240	1214-240	100		
270	1202-270	1213-270	-	100		
320	1202-320	1213-320	1214-320	100		
385	1202-385	-	-	100		
400	1202-400	-	-	100		
500	1202-500	1213-500	-	100		
Diameter (mm)	Grade 520 a 1/2	Grade 595 1/2	Grade 597 1/2	Grade 602 h 1/2	Grade 2555 1/2	Quantity/Pack
70	-	-	10 311 841	-	-	100
90	-	-	10 311 842	10 312 642	-	100
110	-	10 311 643	10 311 843	-	-	100
125	-	10 311 644	10 311 844	10 312 644	-	100
150	-	10 311 645	10 311 845	10 312 645	-	100
185	-	10 311 647	10 311 847	10 312 647	10 313 947	100
240	10 331 451	10 311 651	10 311 851	10 312 651	10 313 951	100
270	-	10 311 652	10 311 852	-	-	100
320	-	10 311 653	10 311 853	-	10 313 953	100
385	-	-	10 311 854	-	-	100
500	10 331 456	-	10 311 856	-	-	100
700	10 331 459	-	-	-	-	100
Diameter (mm)	Grade 591 1/2	Grade 520 b II 1/2	Grade 598 1/2	Grade 287 1/2		Quantity/Pack
125	-	-	10 312 244	10 310 244		50
150	-	-	-	10 310 245		50
185	10 311 347	-	10 312 247	10 310 247		50
240	10 311 351	-	10 312 251	10 310 251		50
320	-	10 331 653	-	10 310 253		50
500	-	-	10 312 256	-		50

Quantitative Filter Papers

Whatman quantitative filters are designed for gravimetric analysis and the preparation of samples for instrumental analysis. They are available in three formats designed to meet your specific needs.

- Ashless: 0.007% ash maximum - very pure filters ideal for a wide range of critical analytical filtration procedures
- Hardened low ash: 0.015% ash maximum - 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: 0.006% ash maximum - acid hardened to give high wet strength and chemical resistance with extreme low ash content. The tough surface makes these filters suitable for a wide range of critical filtration procedures.

Quantitative Filter Papers - Ashless Grades (Ash 0.007%)

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 spectro-photometry. Used also as a high purity filter in the collection of trace elements and radionuclides from the atmosphere.

Grade 41: 20-25 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. This filter is also available in the Whatman Disposable Filter Funnel. This is a convenient, disposable 47 mm filter funnel with a 250 mL capacity. The 47 mm Grade 41 filter can be easily removed for further analysis or culturing.

Grade 42: 2.5 µm
A world standard 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 Grade 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.

Grade 589/1: 12-25 µm
'Black Ribbon Filter' - the established standard in quantitative analysis for the filtration of coarse precipitates (class 2a acc. to DIN 53 135). 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 to Section 35 LMBG*), or for the Blaine test in the cement industry.

Grade 589/2: 4-12 µm
'White Ribbon Filter' - ashless standard filter paper for medium fine precipitates (class 2b acc. to DIN 53 135) offering medium filtration speed. Applied in a variety of routine methods in quantitative analysis, e.g. determination of the sand content in foodstuffs to Section 35 LMBG*, determination of the grade of flour or analysis of aqueous suspensions in the paper industry.

Grade 589/3: 2 µm
'Blue Ribbon Filter' - ashless standard filter paper for very fine precipitates (class 2d acc. to DIN 53 135). 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 acc. to Section 35 LBMG*.

Quantitative Filter Papers - Hardened Low Ash Grades (Ash 0.015%)

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 finest crystalline precipitates. The thinnest of all Whatman filter papers. Slow flow rate. Hardened and highly glazed surface. This finish 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. 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.

Grade 52: 7 µm
The general purpose hardened filter paper with medium retention and flow rate. Very hard surface.

* German law for food and consumer products

Grade 54: 20-25 µm
Very fast filtration for use with coarse and gelatinous precipitates. High wet strength makes this grade very suitable for vacuum assisted fast filtration of 'difficult' coarse or gelatinous precipitates.

Quantitative Filter Papers - Hardened Ashless Grades (Ash 0.006%)

These are the supreme quantitative filter papers featuring high wet strength and chemical resistance. These papers 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
The 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.

Grade 541: 20-25 µm
Fast filtration of coarse particles and gelatinous precipitates in acid/alkali solutions during gravimetric analysis. Typical applications include fiber in animal foodstuffs, gelatine in milk and cream, chloride in cement, and chloride and phosphorous 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.

Typical Properties - Quantitative Filter Papers

Grade	Properties	Classification to DIN 53 135	Thickness (mm)	Filtration Time to Herzberg (s)	Filtration Time to DIN 53 137 (s)	Weight (g/m)	Retention Range* (µm)
589/1	Fast	2a	0.19	50	6-12	80	> 12-25
589/2	Medium Fast	2b	0.19	140	11-35	85	4-12
589/3	Slow	2d	0.15	1500	100-200	85	< 2

* Approximate values

Ordering Information - Quantitative Ashless Filter Circles

	Catalog Number						
Diameter (mm)	Grade 40	Grade 41	Grade 42	Grade 43	Grade 44	Quantity/Pack	
Filter Circles							
30	1440-329	-	-	-	-	100	contd >

	Catalog Number					
Diameter (mm)	Grade 40	Grade 41	Grade 42	Grade 43	Grade 44	Quantity/Pack
42.5	1440-042	1441-042	1442-042	-	-	100
47	1440-047	1441-047	1442-047	-	-	100
55	1440-055	1441-055	1442-055	-	-	100
70	1440-070	1441-070	1442-070	-	1444-070	100
90	1440-090	1441-090	1442-090	1443-090	1444-090	100
110	1440-110	1441-110	1442-110	1443-110	1444-110	100
125	1440-125	1441-125	1442-125	1443-125	1444-125	100
150	1440-150	1441-150	1442-150	1443-150	1444-150	100
185	1440-185	1441-185	1442-185	1443-185	1444-185	100
240	1440-240	1441-240	1442-240	-	-	100
320	-	1441-320	1442-320	-	-	100
Disposable Filter Funnel						
		1920-1441				5
Filter Sheets						
8"x 10"	-	1441-866	-	-	-	100
460 mm x 570 mm	-	1441-917	-	-	-	100

Ordering Information - Quantitative Ashless Filter Circles

	Catalog Number			
Diameter (mm)	Grade 589/1	Grade 589/2	Grade 589/3	Quantity/Pack
12.7	-	10 300 102	-	1000
40.5	-	10 300 103	-	100
50	-	10 300 106	-	100
55	-	10 300 107	-	100
70	-	10 300 108	-	100
90	10 300 009	10 300 109	-	100
110	10 300 010	10 300 110	10 300 210	100
125	10 300 011	10 300 111	10 300 211	100
150	10 300 012	10 300 112	10 300 212	100
185	10 300 014	10 300 114	10 300 214	100
240	-	10 300 120	-	100

Ordering Information - Quantitative Ashless Filter Paper Folded (Prepleated) Grade

	Catalog Number	
Diameter (mm)	Grade 589/2 1/2	Quantity/Pack
110	10 300 143	100
150	10 300 145	100

Ordering Information - Quantitative Hardened Low Ash and Hardened Ashless

	Quantitative Hardened Low Ash Filter Circles Catalog Number			Quantitative Hardened Ashless Filter Circles Catalog Number			
Diameter (mm)	Grade 50	Grade 52	Grade 54	Grade 540	Grade 541	Grade 542	Quantity/Pack
21	-	-	-	1540-321	-	-	100
24	-	-	-	1540-324	-	-	100
42.5	1450-042	-	-	1540-042	1541-042	-	100
47	-	-	-	-	1541-047	-	100
55	1450-055	-	1454-055	1540-055	1541-055	1542-055	100
70	1450-070	1452-070	1454-070	1540-070	1541-070	1542-070	100
90	1450-090	1452-090	1454-090	1540-090	1541-090	1542-090	100
110	1450-110	1452-110	1454-110	1540-110	1541-110	1542-110	100
125	1450-125	1452-125	1454-125	1540-125	1541-125	1542-125	100
150	1450-150	1452-150	1454-150	1540-150	1541-150	1542-150	100
185	1450-185	-	1454-185	1540-185	1541-185	1542-185	100
240	1450-240	1452-240	1454-240	1540-240	1541-240	1542-240	100
320	1450-320	-	1454-320	-	1541-320	-	100
400	-	-	-	-	1541-400	-	100
500	-	-	1454-500	-	-	-	100
Surface Wipes							
Smear Tab	1450-993	-	-	-	-	-	100
Filter Sheets							
460 mm x 570 mm	-	-	1454-917	-	1541-917		100

Application Specific Filters

Whatman offers a line of cellulose filter papers for specific applications. The product line includes filter papers for the soil analysis and sugar industries.

Soil Analysis Filter Paper

Grade 0790 Acid-washed paper with ash content of approximately 0.01%, low-magnesium, for the determination of trace elements (Mg, Mn, Co, Cu, Mo, B).

Grade 512 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.

Sugar Industry Filter Paper
Creped or smooth filter papers have a good retentivity at a relatively high filtration speed. They are 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)

Grade 551
Black colored paper with a medium to slow flow rate. Provides contrast for the detection of very fine traces of white precipitates.

Grade 287
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. Available prepleated as 287 1⁄2.

Grade 2555
A medium fast filter paper. Used for the filtration of the mash for the determination of the extract in malt and wort acc. to the EBC and for removing carbon dioxide from beer. Available prepleated as 2555 1⁄2.

Typical Properties - Application Specific Filters

Grade	Properties	Thickness (mm)	Filtration Time to: Herzberg (s)	Weight (g/m²)
Soil Analysis Filter Papers				
0790	Low Mg and P	0.17	450	84
512	Low Phosphate	0.16	1500	76
Sugar Industry Filter Papers				
3000	Fast, Smooth	0.16	95	68
3002	Medium Fast, Smooth	0.14	150	60
Specially for the Venema Unit				
3459	Fast, Creped	0.30	110	75

Ordering Information - Application Specific Filters

Diameter (mm)	Catalog Number	Quantity/Pack
Soil Analysis Filter Papers*		
Grade 512		
110	10 310 643	100
150	10 310 645	100
185	10 310 647	100

contd>

Diameter (mm)	Catalog Number	Quantity/Pack
Grade 551		
90	10 310 809	100
Grade 790		
150	10 301 645	100
185	10 301 647	100
Sugar Industry Filter Papers		
Grade 3000		
185	10 316 114	1000
200	10 316 116	1000
Grade 3002		
200	10 316 316	1000
240	10 316 320	1000
Grade 3459		
230	10 316 619	1000

* Prepleated filter paper format

Standard Circle Filter Funnel Volumes

The maximum practical volume of the most popular disc sizes (quadrant folded) are:

Diameter (mm)	Volume (mL)
90	15
110	20
125	35
150	75
185	135
240	300

Glass Microfiber Filters

Whatman offers two types of glass microfiber filters manufactured from 100% borosilicate glass: binder-free glass microfiber that is chemically inert and binder glass microfiber.

These depth filters combine fast flow rates with high loading capacity and the retention of very fine particles, extending into the sub-microrange. Glass microfiber filters can be used at temperatures up to 500° C and are ideal 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 ideal 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.

Typical Properties - Binder-Free Glass Microfiber Filters

Grade	Particle Retention* Liquid (µm)	Air Flow Rate (s/100 mL/in²)	Basis Weight (g/m²)	Thickness (µm)	Wet Burst (psi)	Tensile MD Dry (N/15 mm)
GF/A	1.6	4.3	53	260	0.3	5.5
GF/B	1.0	12	143	675	0.5	6.4
GF/C	1.2	6.7	53	260	0.3	6.6
GF/D	2.7	2.2	121	675	0.3	6.4
GF/F	0.7	19	75	420	0.3	8.9
934-AH	1.5	3.7	64	435	0.5	4.1
QM-A	2.2	6.4	87	475	1.5	7.3
GMF 150	1.2	3.1	139	730	1.4	4.2
EPM 2000	2.0	4.7	85	450	1.8	6.3

* 98% Particle Retention Rating

Technical Specifications - Glass Microfiber Filters with Binder

Grade	Binder	Retention Rate to BS 4400 (%)	Air Resistance at 1 m/s mm Water Column	Filtration Time to: Herzberg (s)	Gurley (s)	Weight (g/m²)	Thickness (µm)
GF 8	Inorganic	99.00	700	80	8	75	350
GF 9	Inorganic	99.97	700	120	20	70	350
GF 3362	Inorganic	99.99	1000	120	25	130	500
GF 6	Inorganic	99.97	1500	200	40	80	350
GF 10	Organic	99.97	650	80	12	70	350
GF 92	Inorganic	-	-	120	20	70	350

Whatman Acid Treated Low Metal TCLP Filters

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 a binder-free borosilicate glass microfiber with a particle retention rating of 0.6 µm to 0.8 µm, as specified by the EPA Method 1311.

These acid treated low metal filters are available in 47 mm, 90 mm, 110 mm, 125 mm, 142 mm and 150 mm 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 non-volatile samples in an approved jar.

Ordering Information - Acid Treated Low Metal TCLP Filters

Catalog Number	Size (mm)	Quantity/Pack
1810-047	47	100
1810-090	90	50
1810-110	110	50
1810-125	125	50
1810-142	142	50
1810-150	150	50

Air Sampling Filters/Quartz Filters

Air Sampling Filters EPM 2000

EPM 2000 has been developed especially for use in high volume PM-10 air sampling equipment that collects atmospheric particulates and aerosols. It is manufactured from 100% pure borosilicate glass of special purity enabling detailed chemical analysis of trace pollutants to take place with the minimum of interference or background.

Whatman EPM 2000 was selected by the EPA to be the standard filter for use in the nationwide network of HiVol air samplers. Sheets are individually numbered to facilitate identification.

Quartz Filters - 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 500° C and in PM-10 testing. Because of 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.

Order Information - Air Sampling Filters

Grade - Diameter (mm)	EPM 2000
Circles (100/pack)	
47	1882-047*
Grade - Size (inches)	**EPM 2000**
Sheets (100/pack)	
8" x 10" (pre-numbered)	1882-866

Order Information - Quartz Filters

Grade - Diameter (mm)	QM-A
Circles (100/pack)	
25	1851-025
37	1851-037
47	1851-047
55	1851-055*
90	1851-090
Grade - Size (inches)	**QM-A**
Sheets (100/pack)	
8" x 10"	1851-8866* (pre-numbered)
Sheets (100/pack)	
8" x 10"	1851-865

Items marked * available on special order in Europe, South America, Africa and the Middle East

Glass Microfiber GF Series

Binder-free Glass Microfiber Filters

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, foodstuff 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.

This filter is available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity, molded from polypropylene with an integral, heat bonded filter. This filter is also available in the Whatman Disposable Filter Funnel. This is a convenient, disposable 47 mm filter funnel with a 250mL capacity. The 47 mm GF/A filter can be easily removed for further analysis or culturing.

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.

This filter is also available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity, molded from polypropylene with an integral, heat bonded filter. This filter is also available in the Whatman Disposable Filter Funnel. This is a convenient, disposable 47 mm filter funnel with a 250 mL capacity. The 47 mm GF/C filter can be easily removed for further analysis or culturing.

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. It remains today the filter of choice.

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.

This filter is also available in the Whatman FilterCup. This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity, molded from polypropylene with an integral, heat bonded filter.

Glass Microfiber Filters with Binder

Grade GF 6
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
This glass fiber filter is used in the filtration of coarse particles, 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 at the workplace, determination of the dust fraction in technical gases, testing the effectiveness of dust-collecting and filter plants and the determination of paper bleeding.

Grade GF 9
Used for air monitoring, scintillation measurements, 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 at the workplace, determination of the dust fraction in technical gases, testing the effectiveness of dust-collecting and filter plants, monitoring nuclear plants.

Grade GF 10
This filter with extreme mechanical stability and temperature resistance 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
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.

Grade GF 3362
Has inorganic binder. Thicker and slightly denser than GF 9, for the fast filtration of large amounts of particles.

Glass Microfiber Filters with Inorganic Binder

GF 6 with Inorganic Binder
Good retention for very fine particles. Used for (waste) water analysis, removing protein from difficult-to-filter beers, retention of (radioactive) aerosols, monitoring nuclear plants and scintillation measurements.

GF 8 and GF 9 with Inorganic Binder
For fast filtration of coarse particles. GF 9 is slightly slower than GF 8 but offers a higher retention rate. Frequently used in environmental analysis, e.g. for pollution measurements in industrial, urban and surburban areas, cement factories, iron and steel industry, dust measurements at the workplace, determination of the dust fraction in technical gases or testing the effectiveness of dust-collecting and filter plants.

GF 10 with Inorganic Binder
Offers high mechanical stability and temperature resistant up to 180° C. Applied in soot separation before gas analyzers, as roll filters in automatic air filtration units or as a weighing aid for infrared weighing.

GF 92 with Inorganic Binder
Membrane prefilter with inorganic binder. Frequently used in sample preparation.

Grade 934-AH: 1.5 µm - Binder-Free
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 withstands temperatures over 500° C. Specified in Standard Methods 2540D 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.

Ordering Information - 934-AH Binder-Free Glass Microfiber Filters

Diameter (mm)	Catalog Number	Quantity/ Pack
21	1827-021	100
24	1827-024	100
25	1827-025	100
32	1827-032	100
35	1827-035	100
37	1827-037	100
42.5	1827-042	100
47	1827-047	100
55	1827-055	100
70	1827-070	100

contd>

Diameter (mm)	Catalog Number	Quantity/Pack
90	1827-090	100
11	1827-110	100
125	1827-125	100
150	1827-150	100
Size (inches)	**Catalog Number**	**Quantity/Pack**
2" x 12"	1827-808	100
8" x 10"	1827-866	100
12" x 15"	1827-889	100

Ordering Information - Binder-Free Glass Microfiber Filters

	Catalog Number					
Diameter (mm)	Grade GF/A	Grade GF/B	Grade GF/C	Grade GF/D	Grade GF/F	Quantity/Pack
21	1820-021	1821-021	1822-021	1823-021	1825-021	100
24	1820-024	1821-024	1822-024	1823-024	1825-024	100
25	1820-025	1821-025	1822-025	1823-025	1825-025	100
37	1820-037	1821-037	1822-037	-	1825-037	100
42.5	1820-042	1821-042	1822-042	1823-042	1825-042	100
47	1820-047	1821-047	1822-047	1823-047	1825-047	100
55	1820-055	1821-055	1822-055	1823-055	1825-055	100
60	1820-060	-	-	-	-	100
70	1820-070	1821-070	1822-070	1823-070	1825-070	100
90	1820-090	1821-090*	1822-090	1823-090*	1825-090*	100
110	1820-110	1821-110*	1822-110	1823-110*	1825-110*	100
125	1820-125	1821-125*	1822-125	1823-125*	1825-125*	100
150	1820-150	1821-150*	1822-150	1823-150*	1825-150*	100
257	-	-	-	1823-257	1825-257	25
FilterCup 70**	1600-820	-	1600-822	-	1600-825	25
Disposable Filter Funnel 25 mm	1922-1820	-	1922-1822	-	-	50
Filter Sheets						
460 x 570	-	1821-914	1822-914	-	-	5
460 x 570	1820-915*	1821-915*	1822-915*	1823-915*	-	25

* 25 per box

** FilterCup Stem with Stopper - one time purchase - Catalog Number 1600-900

Ordering Information - Glass Microfiber Filter Circles with Binder

	Catalog Number					
Diameter (mm)	Grade GF 6	Grade GF 8	Grade GF 9	Grade GF 10	Grade GF 92	Quantity/Pack
25	10 370 018	-	-	-	-	200
42	-	-	-	-	10 421 019	200
44	-	-	-	-	10 421 022	200
47	10 370 019	10 370 119	-	10 370 319	10 421 026	200
50	10 370 002	-	10 370 202	10 370 302	10 421 030	200
55	10 370 003	-	-	-	-	100
70	10 370 004	-	-	-	-	100
90	10 370 005	10 370 105	10 370 205	10 370 305	-	100
100	10 370 020	-	-	10 370 320	10 421 043	100
110	10 370 006	-	10 370 206	-	10 421 048	100
125	10 370 007	-	-	-	-	100
130	-	-	-	-	10 421 055	100
135	-	-	-	-	10 421 057	100
142	-	-	-	-	10 421 060	100
150	10 370 008	-	10 370 208	10 370 308	-	100
185	10 370 010	-	-	-	-	100
200	10 370 011	-	-	-	-	100
240	10 370 012	-	-	-	-	100

Ordering Information - Glass Microfiber Filter Sheets with Binder

		Catalog Number		
Dimensions (mm)	Grade GF 6	Grade GF 8	Grade GF 3362	Quantity/Pack
60 x 90	-	10 370 172	-	100
610 x 620	10 370 050	-	10 372 150	100

Multigrade GMF150

The Whatman GMF150 is a unique multilayer glass microfiber filter with a coarse top layer (10 µm) and meshed with a finer layer of 1 µm or 2 µm. Manufactured from 100% borosilicate glass microfiber, the filter is binder free. It is the ideal prefilter for higher particulate loading capacity with faster flow rates.

The GMF150 allows for:

- Higher particulate loading capacity
- Faster flow rate
- Extended life of filter

Multiple Porosities, Greater Filtration Efficiency

The GMF150 represents a new dimension in separation science leading to faster and more cost-effective filtration. In application, the GMF150* 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.

* See page 65 for ordering information

Glass Microfiber 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.

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 design.

A Choice of Three Plates

For quick and easy filtration, Whatman 3-Piece Filter Funnels are available with a choice of three 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 temperatures. Suitable also 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 Funnels

Dimensions (cm)	Catalog Number	Reservoir (mL)	Effective Filtration Diameter (cm)	Effective Filtration Area (cm^2)	Filter Support Plate Diameter (cm)	Filter Funnel Height (cm)
2.5	1950-002	16	1.6	2	3	13.6
4.7	1950-004	36	3.2	8	4.7	12.1
7	1950-007	115	5	19.6	7	15.9
7*	1950-017	210	5	19.6	7	20.8
9	1950-009	200	7	38.5	9	17.9
12.5	1950-012	530	9.2	66.5	12.5	22

* Large reservoir

Ordering Information - Filter Funnels contd.

Type	Catalog Number Optional Plates		Replacement Parts	
Dimensions (cm)	PTFE Plate	Polypropylene Plate	Reservoirs	
4.7	1950-114	1950-104	-	
7	1950-117	1950-107	1950-207*	1950-217*
9	1950-119	1950-109		1950-209

* Large reservoir

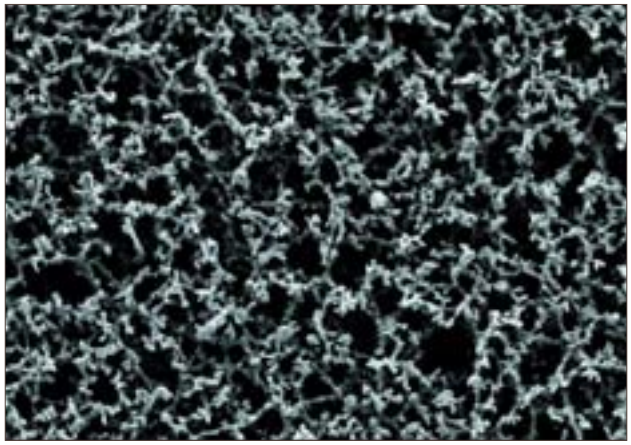
Cellulose Membranes

Whatman offers the following cellulose membranes: (a) Pure cellulose acetate. (b) Pure cellulose nitrate. (c) Mixed esters of cellulose nitrate and cellulose acetate.

Cellulose Acetate Membranes

Whatman cellulose acetate membranes are made from pure cellulose acetate making them ideal 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

Type	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (mL/min/cm²)	Air Flow Rate Δp = 3 mbar (mL/min/cm²)	Bubble Point (bar)
OE 66	115	20	-	3.7
OE 67	115	40	25	2.7
ST 68	140	170	50	1.5
ST 69	140	300	90	0.9

Ordering Information - Cellulose Acetate Membranes

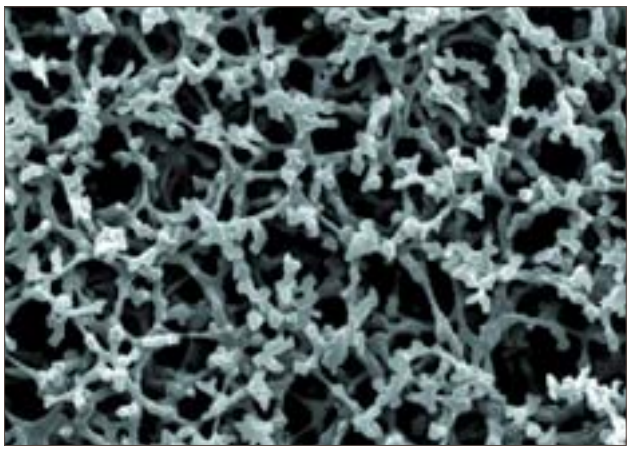
Diameter (mm)	Pore Size (µm)	Catalog Number	Sterile	Quantity/Pack
WCA				
25	0.2	7001-0004	No	100
25	0.45	7000-0002	No	100
47	0.45	7000-0004	No	100
OE 66				
25	0.2	10 404 106	No	100

contd >

Diameter (mm)	Pore Size (µm)	Catalog Number	Sterile	Quantity/Pack
47	0.2	10 404 112	No	100
47	0.2	10 404 170	Yes	100
50	0.2	10 404 114	No	100
110	0.2	10 404 126	No	50
142	0.2	10 404 131	No	25
293	0.2	10 404 139	No	25
300 x 600	0.2	10 404 180	No	5
OE 67				
13	0.45	10 404 001	No	100
25	0.45	10 404 006	No	100
47	0.45	10 404 012	No	100
50	0.45	10 404 014	No	100
85	0.45	10 404 044	No	50
100	0.45	10 404 021	No	50
110	0.45	10 404 026	No	50
142	0.45	10 404 031	No	25
OE 67/A				
142	0.45	10 404 331	No	25
ST 68				
47	0.8	10 403 112	No	100
50	0.8	10 403 114	No	100
ST 69				
47	1.2	10 403 012	No	100
50	1.2	10 403 014	No	100

Cellulose Nitrate Membranes

Recommended for the majority of routine applications, this grade is manufactured under strictly controlled clean room conditions. Usually, it can directly replace the general purpose membrane filters of other manufacturers without requiring any significant change of technique. The user will benefit from the performance improvements which are now available in Whatman membrane filters.



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, 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 controlled due to the advanced manufacturing and control system. Additionally, the batch-to-batch variation is minimized providing more consistent laboratory results.

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

Cellulose Nitrate 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 5.0 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.

Cellulose Nitrate Membranes for Nucleic Acid and Protein Analysis

In 1975 E. M. Southern developed the technique for transferring DNA from agarose gels onto a nitrocellulose membrane. The technique was named Southern Blotting after its inventor. Subsequently, techniques for protein transfer and RNA transfer were also developed. In association with the blotting technique, substantial quantities of good quality chromatography paper are required and 3MM Chr has become the leading choice throughout the world.

Typical Data - Cellulose Nitrate Membranes

	Cellulose Nitrate
Thickness	125 µm
Burst Strength	>2 psi
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
Particle Removal	5
Water Microbiology and Analysis	
Bacterial Colony Count	0.45 (grid)
Sediment Analysis	0.45
Suspended Particles	5
Air Pollution Monitoring	
Asbestos Monitoring (NIOSH)	0.8
Food and Beverage QC	
E. coli and Coliforms	0.45 (grid)
Total Bacteria Count	0.2
Tissue Culture	
Mycoplasma Removal	0.1
Sterile Filtration	0.2

Ordering Information - Cellulose Nitrate Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Type[1]	Sterile[2]	Protein Binding	Quantity/Pack
WCN						
13	0.2	7182-001	Plain	No	High	100
13	0.45	7184-001	Plain	No	High	100
25	0.2	7182-002	Plain	No	High	100
25	0.1	7181-002	Plain	No	High	100
25	0.45	7184-002	Plain	No	High	100
25	0.65	7186-002	Plain	No	High	100
25	0.8	7188-002	Plain	No	High	100
25	1.0	7190-002	Plain	No	High	100
25	3.0	7193-002	Plain	No	High	100
25	5.0	7195-002	Plain	No	High	100
37	0.45	7184-003	Plain	No	High	100
37	0.8	7188-003	Plain	No	High	100
47	0.1	7181-004	Plain	No	High	100
47	0.2	7182-004	Plain	No	High	100
47	0.45	7141-004	Gridded	No	High	100
47	0.45	7141-104	Gridded	Yes	High	100
47	0.45	7141-114*	Gridded	Yes	High	100
47	0.45	7141-204**	Gridded	Yes	Medium	100
47	0.45	7141-124	Gridded	Yes	Medium	200
47	0.45	7141-154***	Gridded	Yes	High	1000
47	0.45	7184-004	Plain	No	High	100
47	0.65	7186-004	Plain	No	High	100
47	0.8	7188-004	Plain	No	High	100
47	1.0	7190-004	Plain	No	High	100
47	3.0	7193-004	Plain	No	High	100
47	5.0	7195-004	Plain	No	High	100
82	0.45	7184-008	Plain	No	High	25
90	0.2	7182-009	Plain	No	High	25
90	0.45	7184-009	Plain	No	High	25
90	0.8	7188-009	Plain	No	High	25
90	1.0	7190-009	Plain	No	High	25
90	5.0	7195-009	Plain	No	High	25
142	0.2	7182-014	Plain	No	High	25
142	0.45	7184-014	Plain	No	High	25
293	0.45	7184-029	Plain	No	High	25
AE 98						
25	5.0	10 400 206	Plain	No	High	100
47	5.0	10 400 212	Plain	No	High	100
50	5.0	10 400 214	Plain	No	High	100

contd >

Diameter (mm)	Pore Size (µm)	Catalog Number	Type[1]	Sterile[2]	Protein Binding	Quantity/Pack
AE 99						
25	8.0	10 400 106	Plain	No	High	100
37	8.0	10 400 109	Plain	No	High	100
47	8.0	10 400 112	Plain	No	High	100
50	8.0	10 400 114	Plain	No	High	100
50	8.0	10 405 079	Plain †	No	High	100
150	8.0	10 400 132	Plain	No	High	25
AE 100						
47	12.0	10 400 012	Plain	No	High	100
50	12.0	10 400 014	Plain	No	High	100
NC 10						
47	0.1	10 402 012	Plain	No	High	100
50	0.1	10 402 014	Plain	No	High	100
NC 20						
25	0.2	10 401 306	Plain	No	High	100
47	0.2	10 401 312	Plain	No	High	100
50	0.2	10 401 314	Plain	No	High	100
142	0.2	10 401 331	Plain	No	High	25
NC 45						
24	0.45	10 401 104	Plain	No	High	100
25	0.45	10 401 106	Plain	No	High	100
47	0.45	10 401 112	Plain	No	High	100
47	0.45	10 401 170	Plain	Yes	High	100
50	0.45	10 401 114	Plain	No	High	100
90	0.45	10 401 118	Plain	No	High	50
100	0.45	10 401 121	Plain	No	High	50
110	0.45	10 401 126	Plain	No	High	50
142	0.45	10 401 131	Plain	No	High	25

[1]The ink used in the gridded filters is non-toxic and is free of bacterial growth inhibitors. Each line is spaced at 3.1 mm intervals

[2]Sterile membranes are packed individually with an absorbent pad. Sterilized using ethylene oxide gas

* Packed without pad

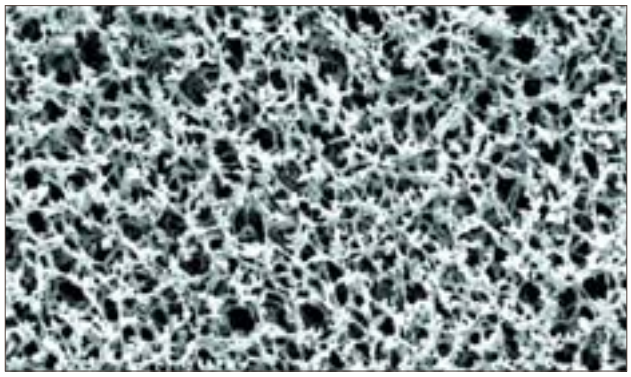
** Autoclave pack contains 10 sealed envelopes. Each envelope contains 10 filters with 10 pads

*** 1000/box without absorbent pad

† With hydrophobic rim

Membra-Fil® Mixed Ester Membranes

Whatman mixed cellulose ester membranes are composed of cellulose acetate (~20%) and cellulose nitrate (~80%). 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.



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 mm intervals. The special ink used is non-toxic 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.

Sterile Filters
For those laboratories preferring to use membranes sterilized by autoclaving for microbiological work, Whatman provides black gridded membranes 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 non-toxic and do not inhibit bacterial growth, ensuring sample integrity
- Autoclavable for repeated use
- Black plain and black gridded membranes have 80:20 ratio of cellulose nitrate to cellulose acetate
- The membrane offers a high degree of internal surface area for greater adsorption of product
- Higher dirt loading capacity
- Low protein binding characteristics
- 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:

- Clarification or sterilization of aqueous solutions
- Cytology
- Air monitoring
- HPLC samples (aqueous)
- Virus concentration
- Particulate analysis
- Biological assays
- Food microbiology including enumeration of *E. coli* in foods
- Bacteriological studies
- Particle counting from liquids and aerosols
- Yeasts and molds

Ordering Information - Membra-Fil Mixed Cellulose Ester Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
13	0.45	140418	100
13	5	140413	100
25	0.22	140628	100
25	0.45	140618	100
25	1.2	140627	100
25	5	140613	100
47	0.22	141128	100
47	0.45	141118	100
47	0.65	141119	100
47	0.8	141109	100
47	1.2	141127	100
47	3	141112	100
47	5	141113	100
90	0.45	141718	100
142	0.22	142128	25
142	0.45	142118	25
142	0.8	142109	25

Typical Data - Mixed Cellulose Ester Membranes

Burst Strength	>10 psi
Weight	4.3–5.0 mg/cm²
Maximum Service Temperature	130° C
Porosity	74–77%
Steam Autoclavable	Yes
Solvent Resistancy	Medium
Protein Binding[1]	Medium

[1] WME white gridded type: high protein binding

Product Selection - Mixed Cellulose Ester Membranes

Type	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (mL/min/cm²)	Air Flow Rate Δp = 3 mbar (mL/min/cm²)	Bubble Point (bar)
WME	140	-	-	-
ME 24	135	25	-	3.7
ME 25	135	45	25	2.5
ME 26	135	110	45	1.5
ME 27	140	170	80	1.3
ME 28	140	240	100	0.8
ME 29	150	400	140	0.7

Ordering Information - Mixed Cellulose Ester Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Type	Sterile	Quantity/Pack
WME					
47	0.45	7153-004	Black Gridded	No	100
47	0.45	7153-104	Black Gridded	Yes	100
47	0.2	7187-114	White Gridded	Yes	100
ME 24					
25	0.2	10 401 706	Plain	No	100
47	0.2	10 401 712	Plain	No	100
47	0.2	10 401 770	Plain	Yes	100
50	0.2	10 401 714	Plain	No	100
50	0.2	10 401 772	Plain	Yes	100
110	0.2	10 401 726	Plain	No	50
142	0.2	10 401 731	Plain	No	25

contd >

Diameter (mm)	Pore Size (µm)	Catalog Number	Type	Sterile	Quantity/Pack
ME 25					
25	0.45	10 401 606	Plain	No	100
47	0.45	10 401 612	Plain	No	100
47	0.45	10 401 670	Plain	Yes	100
50	0.45	10 401 614	Plain	No	100
50*	0.45	10 401 662	Plain	No	100
50	0.45	10 401 672	Plain	Yes	100
90	0.45	10 401 618	Plain	No	50
100	0.45	10 401 621	Plain	No	50
110	0.45	10 401 626	Plain	No	50
142	0.45	10 401 631	Plain	No	25
ME 26					
47	0.6	10 401 512	Plain	No	100
50	0.6	10 401 514	Plain	No	100
ME 27					
25	0.8	10 400 906	Plain	No	100
37	0.8	10 400 909	Plain	No	100
47	0.8	10 400 912	Plain	No	100
47	0.8	10 400 970	Plain	Yes	100
50	0.8	10 400 914	Plain	No	100
100	0.8	10 400 921	Plain	No	50
ME 28					
25	1.2	10 400 806	Plain	No	100
47	1.2	10 400 812	Plain	No	100
50	1.2	10 400 814	Plain	No	100
ME 29					
25	3.0	10 400 706	Plain	No	100
47	3.0	10 400 712	Plain	No	100
50	3.0	10 400 714	Plain	No	100
50	3.0	10 400 772	Plain	Yes	100

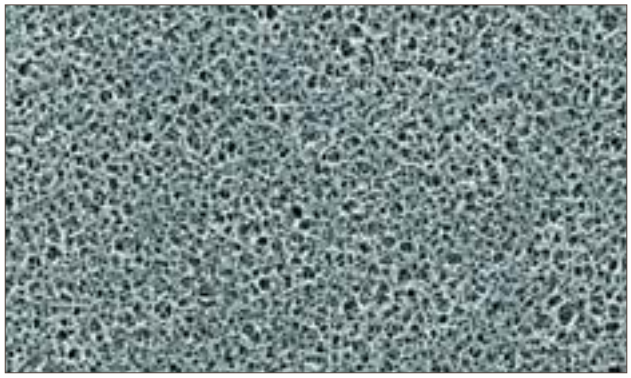
* Without interleaving papers

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
- Can be used up to 180° C
- Sterilizable by all methods
- Pore sizes between 0.2 µm and 1 µm
- Suitable for use as sterile filter to ASTM D 3862-80



Regenerated Cellulose Membrane (Type RE 55, 0.45 µm) Electron Micrograph (Magnification 1000x)

Typical Data - Regenerated Cellulose Membranes

	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (mL/min/cm²)	Air Flow Rate Δp = 3 mbar (mL/min/cm²)	Bubble Point (bar)
RC 58	75	20	-	3.7
RC 55	75	35	-	3.5
RC 60	75	240	75	0.8

Ordering Information - Regenerated Cellulose Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Sterile	Quantity/Pack
RC 58				
47	0.2	10 410 312	No	100
50	0.2	10 410 314	No	100
100	0.2	10 410 319	No	25
RC 55				
25	0.45	10 410 206	No	100
47	0.45	10 410 212	No	100
50	0.45	10 410 214	No	100
100	0.45	10 410 219	No	25
110	0.45	10 410 224	No	25
142	0.45	10 410 229	No	25
RC 60				
47	1.0	10 410 012	No	100
50	1.0	10 410 014	No	100

Nylon Membranes

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, eliminating 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 121° C.

Applications

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

Typical Data - Nylon Membranes

	0.2 µm	0.45 µm	0.8 µm
Thickness	150–187 µm	150–187 µm	137–200 µm
Fiber Releasing	No	No	No
Bubble Point	40–49 psi	34–42 psi	>13 psi
Water Flow Rate @ 5 psi	>50 mL/min	>60 mL/min	>180 mL/min
Maximum Temperature	135° C	135° C	135° C

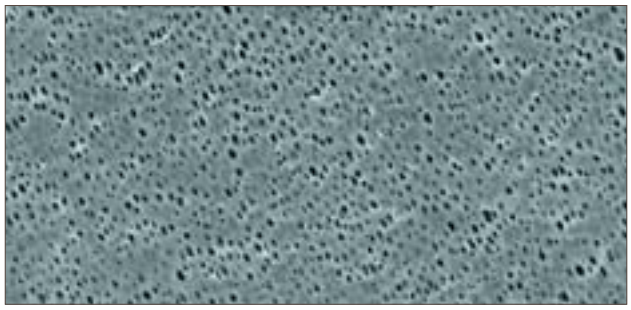
Ordering Information - Nylon Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Hydrophilic	Protein Binding	Solvent Resistance	Quantity/ Pack
13	0.2	7402-001	Yes	High	Good	100
13	0.45	7404-001	Yes	High	Good	100
25	0.2	7402-002	Yes	High	Good	100
25	0.45	7404-002	Yes	High	Good	100
47	0.2	7402-004	Yes	High	Good	100
47	0.45	7404-004	Yes	High	Good	100
47	0.8	7408-004	Yes	High	Good	100
90	0.2	7402-009	Yes	High	Good	50
90	0.45	7404-009	Yes	High	Good	50

Polyamide Membranes

Whatman polyamide membranes are made from pure polyamide making them the universal 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. The membrane filters can be used up to 135° C.



Polyamide Membrane (Type NL 17, 0.45 µm)
Electronic Micrograph (Magnification 1000x)

Typical Properties - Polyamide Membranes

Type	Nominal Pore Size (µm)	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (mL/min/cm²)	Bubble Point (bar)
NL 16	0.2	110	10	4.2
NL 17	0.45	110	20	2.8

Ordering Information - Polyamide Membranes

Pore Size (µm)	Diameter (mm)	Membrane Type	Catalog Number	Quantity/Pack
0.2 µm	25	NL 16	10 404 106	100
	47	NL 16	10 404 112	100
	50	NL 16	10 404 170	100
0.45 µm	25	NL 17	10 404 001	100
	47	NL 17	10 404 006	100
	50	NL 17	10 404 012	100
	142	NL 17	10 404 014	25

PM 2.5 Air Monitoring Membrane

A new, high-purity, thin PTFE membrane in a sequentially numbered chemically resistant polypropylene support ring has been developed for PM 2.5 Ambient Air Monitoring. Whatman PM 2.5 membranes have low tare mass for accurate gravimetric determinations. The unique thermally stable design eliminates 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 46.2 mm diameter 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) 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:

- Loose, surface particle contamination. (Drop Test - Weight Loss Stability)
- Temperature Stability. (Temperature - Weight Loss Stability)

Any filter manufacturer or vendor who sells or offers to sell filters specifically identified for use with this PM2.5 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 Air)
- Maximum Moisture Pick-up
- 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 non-uniformity or any other obvious filter defect.

Whatman hereby states that every manufacturing lot that is offered for sale, and is identified for use with the PM 2.5 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
PTFE Filter Media	n/a	n/a	PTFE	-
Filter Thickness	µm	µm	40	±10
Filter Diameter	mm	template	46.2	2.5
Filter Pore Size	ASTM F 316-94	µm	2	maximum
Support Ring Media	n/a	n/a	Polypropylene	-
Total Support Ring Thickness	mm	mm	0.38	±0.04
Support Ring width	mm	template	3.68	+0.00 – 0.51
Particle Retention (0.3 µm)	ASTM D 2986-91	%	99.7	minimum
Pressure Drop (0.3 µm) @ 16.67 L/min	ASTM D 2986-91	cm H_2O	30	maximum
Alkalinity	Section 2.12 EPA/600/R-94/038b	µeq/g of filter	<25	maximum
Temperature Wt. Loss Stability	as above	µg	<20	average
Drop Test Wt. Loss Stability	as above	µg	<20	average
Moisture Wt. Gain Stability	as above	µg	<10	average

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	Br	2	Pd	9.6	Cs	25
Si	32.8	Ti	13.8	Cu	2.8	Rb	2	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	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	Se	1.6	Rh	9.4	I	18.6	Pb	4.8

Ordering Information - PM 2.5 Air Monitoring Membranes

Diameter (mm)	Product Description	Catalog Number	Quantity/Pack
46.2	PTFE Membrane with Polypropylene Support Ring, Sequentially Numbered	7592-104	50

Polyethersulfone (PES) Membranes

Whatman polyethersulfone (PES) membranes are hydrophilic, low protein binding and stable in alkaline pH. Available in a 0.8 µm pore size, the PES membrane is recommended for aqueous applications and for biological samples. Whatman PES membranes have a smooth surface that allows for easy enumeration of artifacts.

Ordering Information - PES Membranes

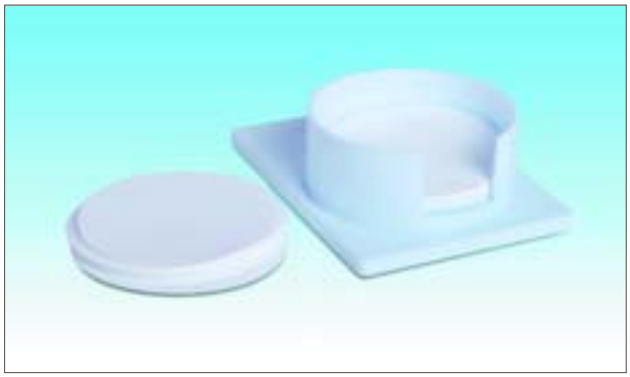
Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
47	0.8	111164	100

Polypropylene Membranes

Whatman polypropylene membrane filters are ideal for numerous applications in chromatography and biotechnology laboratories. They come in a range of diameters and pore sizes from 0.2 µm to 1.0 µm.

Easy Handling

Whatman polypropylene membrane filters are flexible, durable and virtually indestructible. The exceptionally uniform strength of the device means that the membrane will not crack, tear, break or distort when picked up by hand or forceps.



Versatility

These devices are temperature tolerant, which means they are not affected by autoclaving. This temperature resistance gives users autoclaved membranes with flow rates and throughput at least 80% higher than those of autoclaved cellulosic membranes.

Purity

There is no need for pre-wetting or wetting with cytotoxic wetting agents that could be extracted. This makes the membranes ideal as a support for cell growth, filtration of media and sterilization of tissue culture media, pharmaceuticals and other solutions used for biological work. The membranes are also compatible with organic solvents, making them highly suitable for HPLC mobile phase filtering and degassing, especially acetonitrile.

Ordering Information - Polypropylene (Type WPP) Membranes

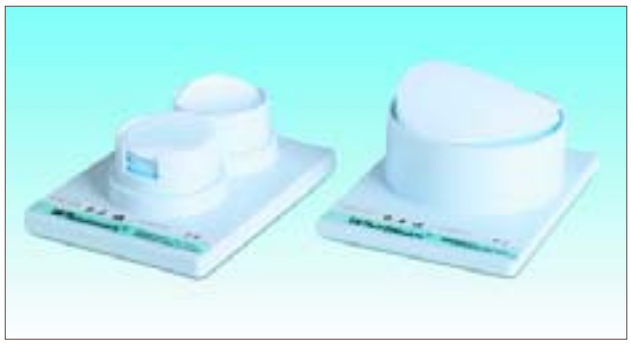
Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
25	0.45	7002-0425	100
47	0.45	7002-0447	100
90	0.2	7002-0290	50

Teflon® (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 non-woven polypropylene support web for improved strength and handling and can be used at temperatures up to 150° 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 (Type WTP) 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. The 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. Usual pore sizes are 0.2 µm and 0.5 µm. Sterile venting of vacuum manifolds, fermentation vessels and sterile filtrate tanks and containers utilize PTFE 0.2 µm membranes.

Typical Data - Teflon (PTFE) Membranes

	0.2 µm	0.5 µm	1.0 µm
Thickness	130 µm	120 µm	90 µm
Porosity	72%	74%	76%
Fiber Releasing	No	No	No
Air Flow Rate @ 10 psi Vacuum	4.5 L/min/cm^2	7.5 L/min/cm^2	17 L/min/cm^2
Bubble Point	13 psi	6 psi	3 psi
Maximum Temperature	150° C	150° C	150° C

Product Selection - Teflon (PTFE) Membranes

	Thickness (µm)	Water Flow Rate Δp 0.9 bar (mL/min/cm²)	Air Flow Rate Δp 3 m bar (mL/min/cm²)	Bubble Point (bar)
TE 35	190	20*	15	1.4
TE 36	190	40*	30	0.9
TE 37	100	90*	80	0.25
TE 38	180	220**	265	0.2

* Measured with ethanol

** Pre-wetted with isopropanol

Ordering Information - Teflon (PTFE) Membranes

Type* Diameter (mm)	Pore Size (µm)	Catalog Number	Hydrophilic	Protein Binding	Solvent Resistance	Quantity/Pack
WTP						
25	0.2	7582-002	No	Low	Very Good	100
47	0.2	7582-004	No	Low	Very Good	100
47	0.5	7585-004	No	Low	Very Good	100
47	1.0	7590-004	No	Low	Very Good	100
TE 35						
25	0.2	10 411 405	No	Low	Very Good	50
47	0.2	10 411 411	No	Low	Very Good	50
50	0.2	10 411 413	No	Low	Very Good	50
TE 36						
25	0.45	10 411 305	No	Low	Very Good	50
47	0.45	10 411 311	No	Low	Very Good	50
50	0.45	10 411 313	No	Low	Very Good	50
TE 37						
25	1.0	10 411 205	No	Low	Very Good	50
47	1.0	10 411 211	No	Low	Very Good	50
50	1.0	10 411 213	No	Low	Very Good	50
TE 38						
37	5.0	10 411 108	No	Low	Very Good	50
47	5.0	10 411 111	No	Low	Very Good	50
50	5.0	10 411 113	No	Low	Very Good	50
90	5.0	10 411 116	No	Low	Very Good	25
150	5.0	10 411 130	No	Low	Very Good	25

* WTP = Teflon membrane with polypropylene support

TE = Teflon membrane with polyester support

Track-Etched Polycarbonate and Polyester Membranes

Whatman offers a complete range of track-etched membranes manufactured using proprietary Whatman technology to produce a precision membrane filter with a closely controlled pore size distribution. These membranes include Cyclopore polycarbonate and polyester, Nuclepore polycarbonate, chemotaxis membranes, black polycarbonate and polycarbonate membranes for cell culture.

Cyclopore® Polycarbonate and Polyester 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.

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

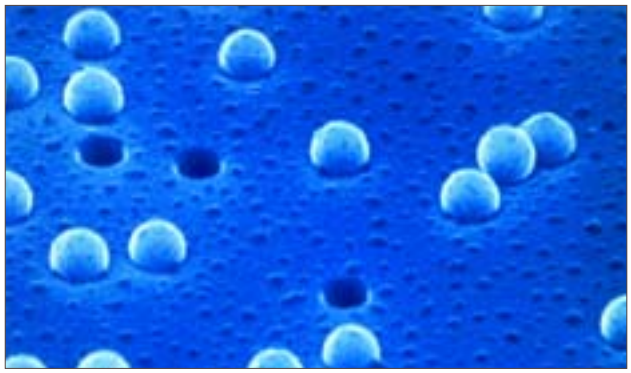
Membranes are produced from a pure polymeric film and give exceptional chemical cleanliness. They are free of contaminants, have low tare weight, minimum water adsorption and very low levels of non-specific protein binding.

The polycarbonate membranes are hydrophilic and are available in a choice of diameters and pore sizes. The polyester membranes are resistant to most organic solvents, amides and halogenated hydrocarbons. This broad chemical compatibility makes them suitable for the detection of particles in many corrosive fluids.

Cyclopore Track-Etched Membranes

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; non-hygroscopic
- Low tare weights
- No particle shedding provides ultra clean filtrate
- Biologically inert



Electron Micrograph of Cyclopore Membrane

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 plasmaphoresis, 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 new 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. (Ref: Hewes et al. 1998; Graham and Mitchell 1999; Graham 1999.)
- **Medical devices and in vitro diagnostics**
  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. Transdermal drug delivery - as an inert matrix for retention of therapeutics.

Typical Data - Cyclopore Track-Etched Membranes

	Polycarbonate	Polyester
Thickness	7–20 µm	9–23 µm
Burst Strength	>10 psi	>10 psi
Weight	0.7–2.0 mg/cm^2	0.9–2.3 mg/cm^2
Maximum Service Temperature	140° C	150° C
Porosity (Void Vol.)	4–20%	4–20%
Ash Weight	0.6 µg/cm^2	2.3 µg/cm^2
Pore Density	10^5 - 6 x 10^8 pores/cm^2	10^5 - 6 x 10^8 pores/cm^2
Opacity	Translucent or transparent	N/A
Autoclavable	30 minutes at 121° C	30 minutes at 121° C
Specific Gravity	1.21 g/cm^2	1.39 g/cm^2

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	Polycarbonate	Polyester
Flammability	Slow burn	Slow burn
Fiber Releasing	No	No
Leachables	Negligible	Negligible
Biological Compatibility	Inert	Inert

Typical Properties - Cyclopore Track-Etched Membranes

Pore Size (µm)	Nominal Thickness (µm)	Rated Pore Density (pores/cm^2)	Mean Porosity (%)	Bubble Point in Water (bar)*	Burst Strength (bar)*
Polycarbonate Microporous					
0.1	20	6×10^2	4	>6.9	>1.4
0.2	20	5×10^8	13	4	>1
0.4	20	1.5×10^8	15	2.2	>1
1.0	19	2.2×10^7	14	0.95	>3.4
5.0	15	4×10^5	6	>0.15	>3.4
8.0	12	10^5	4	>0.15	>3.4
12.0	8	10^5	5	<0.07	>3.4
Polyester Microporous					
1.0	22	2.2×10^7	14	0.95	>3.4

* 1 bar = 14.7 psi

Ordering Information - Cyclopore Track-Etched Membranes

Diameter (mm)	Pore Size (µm)	Membrane	Catalog Number	Hydrophilic	Protein Binding	Solvent Resistance	Quantity/ Pack
Standard Cyclopore							
25	0.1	Polycarbonate	7060-2501	Yes	Low	Medium	100
25	0.2	Polyester	7061-2502	Yes	Low	Medium	100
25	0.4	Polyester	7061-2504	Yes	Low	Medium	100
25	1.0	Polyester	7061-2510	Yes	Low	Medium	100
25	5.0	Polycarbonate	7060-2513	Yes	Low	Medium	100
47	0.2	Polycarbonate	7060-4702	Yes	Low	Medium	100
47	0.4	Polycarbonate	7060-4704	Yes	Low	Medium	100
47	1.0	Polycarbonate	7060-4710	Yes	Low	Medium	100
47	5.0	Polycarbonate	7060-4713	Yes	Low	Medium	100
47	12.0	Polycarbonate	7060-4716	Yes	Low	Medium	100

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Diameter (mm)	Pore Size (µm)	Membrane	Catalog Number	Hydrophilic	Protein Binding	Solvent Resistance	Quantity/ Pack
25	0.4	Polycarbonate	7060-2504	Yes	Low	Medium	100
25	0.6	Polycarbonate	7060-2506	Yes	Low	Medium	100
25	0.8	Polycarbonate	7060-2508	Yes	Low	Medium	100
25	1.0	Polycarbonate	7060-2510	Yes	Low	Medium	100
25	2.0	Polycarbonate	7060-2511	Yes	Low	Medium	100
25	8.0	Polycarbonate	7060-2514	Yes	Low	Medium	100
47	0.2	Polyester	7061-4702	Yes	Low	Medium	100
47*	1.0	Polycarbonate	7091-4710	Yes	Low	Medium	100

* Special Clear Cyclopore

Nuclepore® Track-Etched 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.

Features and Benefits

- Low protein binding and low extractables ensuring no 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
- EPA testing
- Fuel testing
- Bioassays
- Parasitology
- Air analysis
- Water microbiology

Typical Data - Nuclepore Track-Etched Membranes

	Polycarbonate
Thickness	6-11 µm
Burst Strength	>10 psi
Weight (Tare)	0.6-1 mg/cm^2
Specific Gravity Bulk Material	1.20 g/cm^3
Heat Sealing Range	230° C-275° C
Maximum Service Temperature	140° C
Flammability	Slow burn
Ash Weight	0.92 µg/cm^2
Porosity	<15%
Rated Pore Size	0.05-12.0 µm
Rated Pore Density	1 x 10^5- 6 x 10^8 pores/cm^2
Surface Texture	Flat and smooth
Optical	Translucent
Refractive Index	1.584-1.625 (birefringent)
Hydrophobic	No
Fiber Releasing	No
Autoclavable	121° C

Ordering Information - Nuclepore Track-Etched Membranes

Diameter (mm)	Membrane	Pore Size (µm)	Catalog Number	Quantity/Pack
13	Polycarbonate	0.015	110401	100
13	Polycarbonate	0.1	110405	100
13	Polycarbonate	0.2	110406	100
13	Polycarbonate	0.4	110407	100
13	Polycarbonate	0.8	110409	100
13	Polycarbonate	1	110410	100
13	Polycarbonate	3	110412	100
13	Polycarbonate	5	110413	100
13	Polycarbonate	8	110414	100
13	Polycarbonate	10	110415	100
13	Polycarbonate PVP-free	8	150446	100
13	Gold Coated PC	0.8	800195	10
25	Polycarbonate	0.015	110601	100
25	Polycarbonate	0.03	110602	100
25	Polycarbonate	0.05	110603	100
25	Polycarbonate	0.08	110604	100
25	Polycarbonate	0.1	110605	100
25	Polycarbonate	0.2	110606	100
25	Polycarbonate	0.4	110607	100
25	Polycarbonate	0.6	110608	100

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Diameter (mm)	Membrane	Pore Size (µm)	Catalog Number	Quantity/Pack
25	Polycarbonate	0.8	110609	100
25	Polycarbonate	1	110610	100
25	Polycarbonate	2	110611	100
25	Polycarbonate	3	110612	100
25	Polycarbonate	5	110613	100
25	Polycarbonate	8	110614	100
25	Polycarbonate	10	110615	100
25	Polycarbonate	12	110616	100
25	Polycarbonate AOX	0.4	110637	100
25	Gold Coated PC	0.4	170607	50
25	Gold Coated PC	0.8	117197	50
37	Polycarbonate	0.4	110807	100
37	Polycarbonate	0.8	110809	100
47	Polycarbonate	0.015	111101	100
47	Polycarbonate	0.05	111103	100
47	Polycarbonate	0.08	111104	100
47	Polycarbonate	0.1	111105	100
47	Polycarbonate	0.2	111106	100
47	Polycarbonate	0.4	111107	100
47	Polycarbonate	0.6	111108	100
47	Polycarbonate	0.8	111109	100
47	Polycarbonate	1	111110	100
47	Polycarbonate	2	111111	100
47	Polycarbonate	3	111112	100
47	Polycarbonate	5	111113	100
47	Polycarbonate	8	111114	100
47	Polycarbonate	10	111115	100
47	Polycarbonate	12	111116	100
47	Polycarbonate AOX	0.4	111137	100
47	Polycarbonate AERO	0.4	111130	100
50	Polycarbonate	0.2	111206	100
50	Polycarbonate	0.4	111207	100
50	Polycarbonate	5	111213	100
50	Polycarbonate	12	111216	100
76	Polycarbonate	0.1	111505	100
90	Polycarbonate	0.05	111703	25
90	Polycarbonate	0.1	111705	25
90	Polycarbonate	0.2	111706	25
90	Polycarbonate	0.4	111707	25
90	Polycarbonate	1	111710	25
90	Polycarbonate	2	111711	25
142	Polycarbonate	0.08	112104	25
142	Polycarbonate	0.1	112105	25

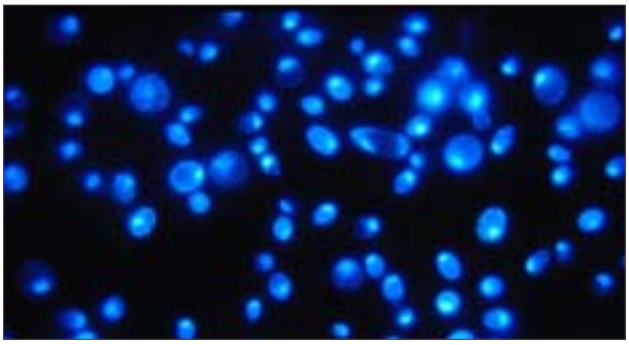
contd >

Diameter (mm)	Membrane	Pore Size (µm)	Catalog Number	Quantity/Pack
142	Polycarbonate	0.2	112106	25
142	Polycarbonate	0.4	112107	25
142	Polycarbonate	0.6	112108	25
142	Polycarbonate	1	112110	25
293	Polycarbonate	0.2	112806	25
293	Polycarbonate	0.4	112807	25
293	Polycarbonate	1	112810	25
293	Polycarbonate	2	112811	25
8 x 10	Polycarbonate	0.03	113502	25
19 x 42	Polycarbonate	5	113313	100
25 x 80	Polycarbonate PVP-free	8	155846	100

AOX – suitable for AOX (Adsorbable Organic Halogens) analysis
PVP-free – hydrophobic

Black Cyclopore® Membranes

Black Cyclopore membranes are ideal 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 Data - Black Cyclopore Membranes

	Black Polycarbonate
Thickness	7-20 µm
Burst Strength	>10 psi
Weight	0.7-2.0 mg/cm^2
Maximum Service Temperature	140° C
Porosity (Void Vol.)	4-20%
Ash Weight	20.6 µg/cm^2
Pore Density	10^5- 6 x 10^8 pores/cm^2
Opacity	N/A

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	Black Polycarbonate
Autoclavable	30 minutes at 121° C
Specific Gravity	-
Flammability	Slow burn
Fiber Releasing	No
Leachables	Negligible
Biological Compatibility	Inert

Typical Properties - Black Cyclopore Membranes

Pore Size (µm)	Nominal Thickness (µm)	Rated Pore Density (pores/cm^2)	Mean Porosity (%)	Bubble Point in Water (bar)*	Burst Strength (bar)*
Polycarbonate Microporous					
0.2	20	5 x 10^8	13	4	>1
0.4	20	1.5 x 10^8	15	2.2	>1

* 1 bar = 14.7 psi

Ordering Information - Black Cyclopore Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Hydrophilic	Protein Binding	Solvent Resistance	Quantity/Pack
25	0.2	7063-2502	Yes	Low	Medium	100
25	0.4	7063-2504	Yes	Low	Medium	100
47	0.2	7063-4702	Yes	Low	Medium	100
47	0.4	7063-4704	Yes	Low	Medium	100

Black Nuclepore® Membranes

Membranes for Use with Epifluorescence Microscopy

Nuclepore black dyed polycarbonate membranes are high-performance membranes ideally 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 non-viable 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.

Features and Benefits

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

Applications

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

Ordering Information - Black Nuclepore Polycarbonate Track-Etched Membranes

Diameter (mm)	Catalog Number	Pore Size (µm)	Quantity/Pack
25	110656	0.2	100
25	110657	0.4	100
25	110659	0.8	100
47	111156	0.2	100
47	111157	0.4	100

Hemafil™ Track-Etched Polycarbonate Membranes

Whatman Hemafil polycarbonate track-etched membranes, part of the Whatman family of Nuclepore membranes, are specially selected for measuring erythrocyte deformability to assure a uniform flow rate and pore size. Select membranes for quantitative assessment of erythrocyte (red blood cell) deformability. Healthy erythrocytes have a mean diameter of approximately 7.5 µm but pass through capillaries as small as 3.0 µm (dia) due to their ability to deform.

Ordering Information - Hemafil Track-Etched Polycarbonate Membranes

Diameter (mm)	Catalog Number	Quantity/Pack
13	110424	100

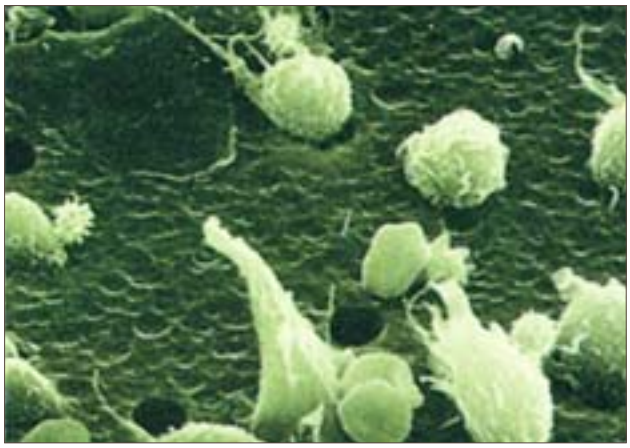
Track-Etched Polycarbonate Membranes

For Cell Culture and Chemotaxis Applications

Whatman offers 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 Membrane

Ordering Info - Track-Etched Polycarbonate Membranes for Cell Culture Applications

Diameter (mm)	Pore Size (µm)	Catalog Number	Surface	Quantity/Pack
13	3	110412	Standard	100
13	5	110413	Standard	100
13	8	110414	Standard	100
13	5	150445	PVP-free	100
13	8	150446	PVP-free	100
25	2	110611	Standard	100
25	3	110612	Standard	100
25	5	110613	Standard	100
25	8	110614	Standard	100
25 x 80	8	155814	Standard	100
25 x 80	5	155845	PVP-free	100
25 x 80	8	155846	PVP-free	100

Membrane Accessories

Membrane Prefilters

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 manufactures glass microfiber filters which are used as prefilters for membranes. The unique properties of borosilicate glass microfibers enable Whatman to manufacture filters with 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 up to the same caliper as the Multigrade GMF 150 simply because prefilters of a uniform density do not have the loading capacity of the new multiporosity filter technology advanced by Whatman.

Ordering Information - Glass Microfiber Prefilters

Prefilter Diameter (mm)	Membrane Diameter (mm)	Catalog Number - Grade GF/B (fine)	Catalog Number - Grade GF/D (coarse)	Quantity/Pack
10	13	-	1823-010	100
16	25	-	1823-016	100
25	25	1821-025	1823-025	100
35	47	-	1823-035	100
37	47	1821-037	-	100
42.5	47	1821-042	1823-042	100
47	47	1821-047	1823-047	100
90	90	1821-090	1823-090	25
125	142	1821-125	1823-125	25
142	142	-	1823-142	25
257	293	-	1823-257	25
GMF 150		10 µm/1 µm	10 µm/2 µm	
47	47	1841-047	1842-047	40
90	90	1841-090	1842-090	40

Membrane Filter Accessories

Whatman offers a choice of holders for use with membrane filters.

Membrane Filter Holders

Vacuum Type Glass Holders
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 membrane and that particulates are retained on the surface of the membrane.

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

Hardware/Replacement Parts
Whatman offers both stoppers and glass reservoirs.

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 eliminate 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.

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

Typical Data - Membrane Holders

Filter Diameter (mm)	Membrane Holder			
Membrane	Filter Systems-Glass	Reservoir Volume (mL)	Filter Surface Area (cm^2)	Prefilter Diameter (mm)
25	FG 25	25	2.1	16
25	FG 25R	50	2.1	13
25	FG 25S	25	2.1	16
47	FG 47	300	9.6	35
47	FG 47S	300	9.6	35
90	FG 90	1000	38.5	70

Ordering Information - Membrane Accessories

Diameter (mm)	Description	Catalog Number	Quantity/Pack
Membrane Filter Holders			
25	Glass Support; 50 mL-FG 25R; Sintered Glass	1960-032	1
25	Glass Support; 25 mL-FG 25; Sintered Glass	1960-002	1
25	Stainless Steel Support 25 mL		
	FG 25S; 304 Stainless Steel 100 Mesh Screen	1960-052	1
47	Glass Support; 300 mL-FG 47; Sintered Glass	1960-004	1
47	Stainless Steel Support 300 mL		
	FG 47S 304; Stainless Steel 100 Mesh Screen	1960-054	1
90	Glass Support; 1000 mL-FG 90; Sintered Glass	1960-009	1
Hardware/Replacement Parts			
	Glass Reservoir for FG47 (300 mL)	1961-054	1
Accessories			
10	Polyester Drain Disc	230300	100
22	Polyester Drain Disc	230500	100
25	Polyester Drain Disc	230600	100
37	Polyester Drain Disc	230800	100
47	Polyester Drain Disc	231100	100

Note: 25 mm holders have No. 5 stopper, fitting 125 mL flasks; 47 mm and 90 mm holders have a No. 8 stopper, fitting standard manifolds and 1 L flasks.

Syringe Type Holders S/S

Syringe Filter Type Membrane Filter Holders
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 Holder

Ordering Information - Syringe Type Holders S/S

Filter Diameter (mm)	Description	Catalog Number	Model	Prefilter Diameter (mm)	Quantity
13	S/S, Female Luer Inlet; Male Luer Nozzle Outlet	1980-001	SH13	10	1
25	S/S, Female Luer Inlet; Male Luer Nozzle Outlet	1980-002	SH25	22	1

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

Plastic Filtration Holders

Typical Data - 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 (100° F) at 50 psi (3.5 bar)		
Sterilization	121° C (250° F) for 15 minutes		
Size (cm)	2.7 OD x 2.7 H	3.5 OD x 3.7 H	6.0 OD x 6.5 H
Membrane Size (mm)	13	25	47
Prefilter Size (mm)	10	22	42
Filtration Area (cm^2)	0.8	3.9	13.8
Connection			
Cap	Male luer slip-fit	Female luer-lok	Female luer slip-fit with Male 1/4" NPT and 1/4" Tubing (multipurpose)
Base	Female luer slip-fit	Male luer slip-fit	

Ordering Information - Pop-Top and Swin-Lok Plastic Filter Holders

Diameter (mm)	Description	Catalog Number	Quantity
13	Pop-Top	420100	10
25	Swin-Lok Holder	420200	10
47	Swin-Lok Holder	420400	10

GMF 150, The Ideal Prefilter

Routine filtration performed with a membrane often results in rapid binding of the surface pores. Therefore, flow rate is quickly diminished and the volume of sample to be filtered is minimized. Tests have proven that the Whatman GMF150, 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 up to the same caliber as the Whatman GMF150 simply because prefilters of a uniform density do not have the loading capacity of the multilayer filter technology advanced by Whatman.

Ordering Information - Multigrade GMF 150 Circles

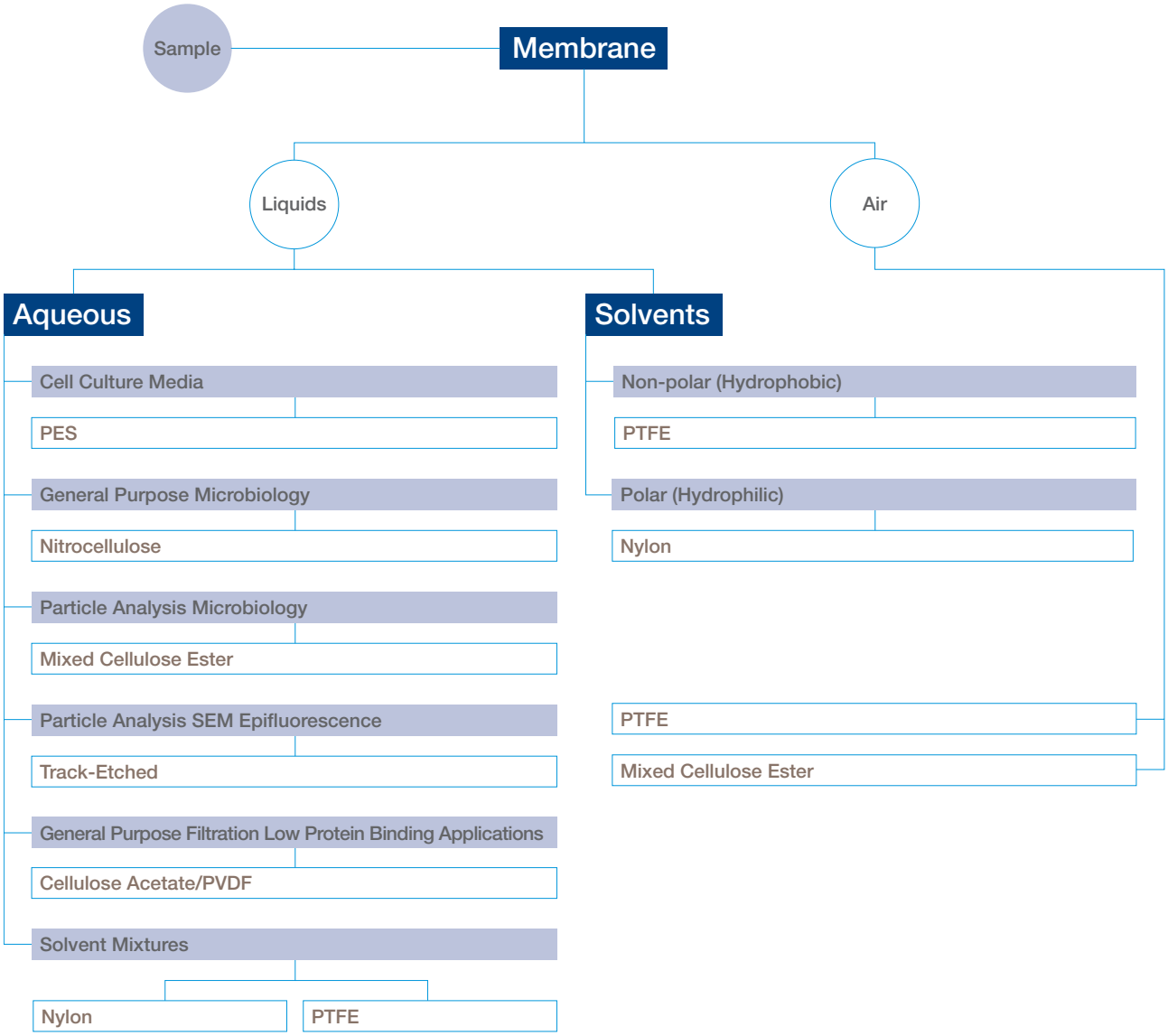
Pore Size Diameter (mm)	1 µm	2 µm	Quantity/Pack
47	1841-047	1842-04	40
90	1841-090	1842-090	20

Above items available on special order in Europe, South America, Africa and the Middle East

Membrane Filters

Whatman brings to the laboratory user a range of membrane filters whose advanced technical specifications makes them today's preferred choice for a wide range of applications. The membrane filters offer accurately controlled pore size distribution and higher strength and flexibility which ensure reproducibility and consistency. The Whatman membrane filter range includes pore sizes (from 0.02 to 12 µm) with a wide selection of membrane filters. Sterile and autoclave packs are available for specialized applications. Colored and gridded types are also available.

Quick Pick Reference Chart



Typical Properties - Membranes

Membrane Media	Material	Pore Size (µm)	Diameter (mm)	Rectangular	Brand Name
Track-Etched Membranes	Polyester - Polyethylene terephthalate	0.2, 0.4, 1.0	25	-	Cyclopore Nuclepore
	Polycarbonate - (4, 4 hydroxydiphenyl-2, 2'-propane)	0.015, 0.03, 0.05, 0.08, 0.1, 0.2, 0.4, 0.6, 0.8, 1.0, 2.0, 3.0, 5.0, 8.0, 10.0, 12.0	13, 25, 37, 47, 50, 76, 90, 142	8 x 10 mm 19 x 42 mm 25 x 80 mm 8" x 10"	
Cellulose Membranes	Cellulose Nitrate	0.45, 0.8, 1.0, 3.0, 5.0, 6.0	25, 47, 90	-	-
	Mixed Cellulose Esters - Mixed Esters (Cellulose Acetate and Nitrate)	0.22, 0.45, 0.65, 0.8, 1.2, 3.0, 5.0	13, 25, 47, 90, 142	19 x 42 mm	Membra-Fil Whatman Brand
Nylon	Polymer (Hexamethylene-diamine; Nylon 66)	0.2, 0.45, 0.8	13, 25, 47, 90	-	-
PTFE	Polytetrafluoro -ethylene	0.2, 0.5, 1.0	25, 47	-	-
Polypropylene	Polypropylene	0.2, 0.45, 1.0	25, 47, 90	-	-
Anopore	Aluminum Oxide	0.02, 0.1, 0.2	13, 21, 43	-	Anopore Anodisc
PES	Polyether Sulfone	0.8	47	-	-

Anopore® Inorganic Membranes

The Anopore inorganic membrane is ideal for a wide range of laboratory filtration applications. This unique material has a precise, non-deformable honeycomb pore structure with no lateral cross overs 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 non-toxic 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 eliminates 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.

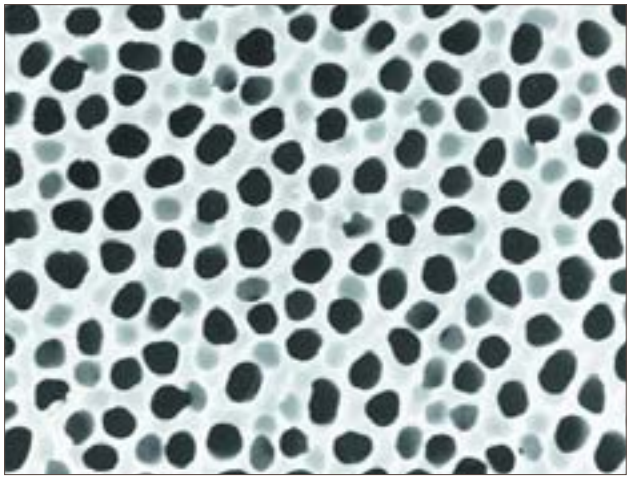
Anopore is available in 3 nominal pore sizes: 0.02 µm, 0.1 µm and 0.2 µm and in 3 diameters: 13 mm, 25 mm and 47 mm.

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
- No 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 ideal 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 Pore Structure

Typical Data - 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	None	Thermal weld	Thermal weld
Protein Adsorption	Low	Low	Low
Burst Strength	65–110 psi	65-110 psi	65-110 psi
Maximum Service Temp	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 Membranes

Diameter (mm)	Membrane	Pore Size (µm)	Catalog Number	Hydrophilic	Protein Binding	Solvent 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	6809-5002	Yes	Low	Very Good	50
47	Anodisc 47	0.1	6809-5012	Yes	Low	Very Good	50
47	Anodisc 47	0.2	6809-5022	Yes	Low	Very Good	50

* No support ring