

## 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 Kjeldahl 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 (p160). This is a convenient, disposable 70 mm filter funnel with a 250 mL capacity molded from polypropylene with an integral, heat bonded filter (catalog number 1600-001).

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. 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. Also available prepleated as Grade 2V.

## Filter Papers and Membranes

### 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 (catalog number 1600-003).

### 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. Also available prepleated as Grade 5V.

### Grade 6: 3 µm

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

### Grade 591: 7-12 µm

A thick filter paper with very high loading capacity for fast filtration of medium to coarse precipitates. Offers high absorbency and increased wet strength. Also available prepleated as Grade 591 1/2.

### Grade 595: 4-7 µm

Very popular, thin filter paper, medium-fast with medium to fine particle retention. Used for many routine analytical applications in different industries, (e.g., particle separation from food extracts or filtration of solids from digested environmental samples, e.g., for ICP/AAS analysis). Also available prepleated as Grade 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). Available prepleated as Grade 597 1/2.

### Grade 598: 8-10 µm

A thick filter paper with high loading capacity. Combines medium retention with medium-fast to fast filtration speed. Also available prepleated as Grade 598 1/2.

### Grade 602 h: < 2 µm

A dense filter paper for collecting very small particles and removing fine precipitates. Used in sample preparation, e.g., in the beverage industry for residual sugar determination, acidic spectra, refractometric analysis and HPLC. Available prepleated as Grade 602 h 1/2.

\* German law for food and consumer products

## Typical Properties - Qualitative Standard Filter Grades

Grade	Description	Particle Retention Liquid (µm)	Filtration Speed (approx.) Herzberg (s)	Air Flow (s/100 mL/in <sup>2</sup> )	Typical Thickness (µm)	Basis Weight (g/m <sup>2</sup> )
1	Medium Flow	11*	150	10.5	180	88
2	Medium Flow	8*	240	21	190	103
3	Medium Flow, Thick	6*	325	26	390	187
4	Very Fast	20-25*	37	3.7	205	96
5	Slow	2.5*	1420	94	200	98
6	Medium to Slow	3*	715	35	180	105
591	Medium Fast, Thick	7-12**	45	5.9	360	165
595	Medium Fast, Thin	4-7**	80	-	160	68
597	Medium Fast	4-7**	70	-	190	85
598	Medium Fast, Thick	8-10**	50	-	320	140
602 h	Slow, Dense	< 2**	750	-	150	85

\* Particle Retention Rating at 98% efficiency

\*\* Approximate values

## Ordering Information - Qualitative Standard Filter Circles

Diameter (mm)	Catalog Number						Quantity/Pack
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
10	1001-6508	-	-	-	-	-	500
15	1001-0155	-	-	-	-	-	500
18	1001-018	-	-	-	-	-	400
20	1001-020	-	-	-	-	-	400
23	-	-	1003-323	-	-	-	100
25	1001-325	1002-325	-	1004-325	1005-325	-	100
25	1001-025	-	-	-	-	-	400
27	-	-	-	1004-027	-	-	100
30	1001-329	-	-	-	-	-	100
30	1001-030	-	-	-	-	-	400
32	1001-032	-	-	-	-	-	100
42.5	1001-042	1002-042	1003-042	1004-042	1005-042	1006-042	100
47	1001-047	1002-047	-	1004-047	1005-047	-	100
50	-	-	-	1004-050	-	-	100
55	1001-055	1002-055	1003-055	1004-055	1005-055	-	100
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
90	-	1002-094	-	-	-	-	1000
110	1001-110	1002-110	1003-110	1004-110	1005-110	1006-110	100
125	1001-125	1002-125	1003-125	1004-125	1005-125	1006-125	100
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	1003-270	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
550	-	-	-	-	1005-550	-	100

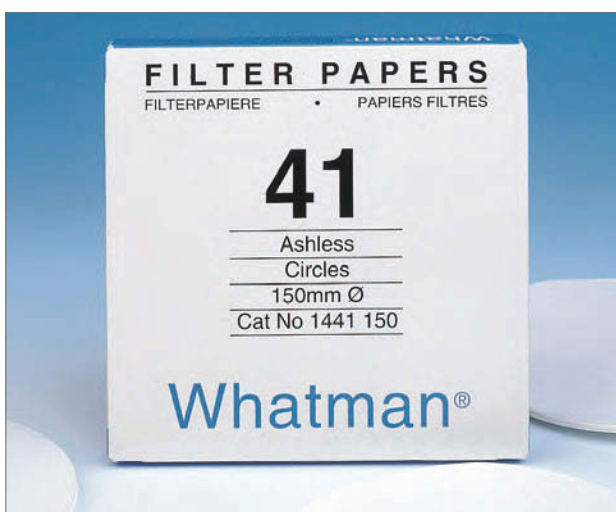
# QUANTITATIVE FILTER PAPERS



## 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 for Grades 40 to 44 and a maximum of 0.01% for the 589 Grades – 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 extremely 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 spectrometry. 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 Grades 40 and 41, and twice as fast as Grade 40. Typical applications include foodstuffs analysis; soil analysis; particle collection in air pollution monitoring for subsequent analysis by XRF techniques; and inorganic analysis in the construction, mining and steel industries.

#### Grade 44: 3 µm

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

#### 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. Also available prepleated as Grade 589/1 1/2.

#### 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. Also available prepleated as Grade 589/2 1/2.

## Filter Papers and Membranes

### 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\*. Also available prepleated as Grade 589/3 1/2.

\* German law for food and consumer products

### Typical Properties - Ashless Quantitative Papers

Grade	Description	Particle Retention Liquid (µm)	Filtration Speed Herzberg (s)	Ash Content <sup>+</sup> (%)	Typical Thickness (µm)	Basis Weight (g/m <sup>2</sup> )
40	Medium	8*	340	0.007	210	95
41	Fast	20-25*	54	0.007	220	85
42	Slow	2.5*	1870	0.007	200	100
43	Medium to Fast	16*	155	0.007	220	95
44	Slow to Medium	3*	995	0.007	180	80
589/1	Fast	12-25**	25	0.01	190	80
589/2	Medium Fast	4-12**	70	0.01	190	85
589/3	Slow	< 2**	750	0.01	150	85

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

\* Particle Retention Rating at 98% efficiency

\*\* Approximate values

### Ordering Information - Quantitative Ashless Filter Papers

Diameter (mm)	Catalog Number								Quantity/ Pack
	Grade 40	Grade 41	Grade 42	Grade 43	Grade 44	Grade 589/1	Grade 589/2	Grade 589/3	
<b>Filter Circles</b>									
12.7	-	-	-	-	-	-	10 300 102	-	1000
12.7	1440-012	-	-	-	-	-	-	-	400
25	-	1441-325	-	-	-	-	-	-	100
25	-	1441-025	-	-	-	-	-	-	400
25	-	1441-6309	-	-	-	-	-	-	10000
30	1440-329	-	-	-	-	-	-	-	100
32	1440-032	-	-	-	-	-	-	-	100
40	-	1441-040	-	-	-	-	-	-	100
40.5	-	-	-	-	-	-	10 300 103	-	100
42.5	1440-042	1441-042	1442-042	-	-	-	-	-	100
47	1440-047	1441-047	1442-047	-	-	-	-	-	100

contd >

Diameter (mm)	Catalog Number								Quantity/ Pack
	Grade 40	Grade 41	Grade 42	Grade 43	Grade 44	Grade 589/1	Grade 589/2	Grade 589/3	
50	-	1441-050	-	-	-	-	10 300 106	-	100
55	1440-055	1441-055	1442-055	-	-	-	10 300 107	-	100
60	-	1441-060	-	-	-	-	-	-	100
70	1440-070	1441-070	1442-070	-	1444-070	-	10 300 108	-	100
90	1440-090	1441-090	1442-090	1443-090	1444-090	10 300 009	10 300 109	-	100
105	-	1441-105	-	-	-	-	-	-	100
110	1440-110	1441-110	1442-110	1443-110	1444-110	10 300 010	10 300 110	10 300 210	100
125	1440-125	1441-125	1442-125	1443-125	1444-125	10 300 011	10 300 111	10 300 211	100
150	1440-150	1441-150	1442-150	1443-150	1444-150	10 300 012	10 300 112	10 300 212	100
185	1440-185	1441-185	1442-185	1443-185	1444-185	10 300 014	10 300 114	10 300 214	100
200	-	-	1442-200	-	-	-	-	-	100
240	1440-240	1441-240	1442-240	-	1444-240	-	10 300 120	-	100
320	1440-320	1441-320	1442-320	-	-	-	-	-	100
450	1440-6168	-	-	-	-	-	-	-	100
<b>Disposable Filter Funnel</b>									
-	-	1920-1441	-	-	-	-	-	-	5
<b>Filter Sheets</b>									
25.4 x 90 mm	-	-	1442-6551	-	-	-	-	-	100
8"x 10"	-	1441-866	-	-	-	-	-	-	100
460 x 570 mm	1440-917	1441-917	1442-917	-	1444-917	-	-	-	100
580 x 580 mm	-	-	1442-930	-	-	-	-	-	100

### Ordering Information - Quantitative Ashless Filter Papers-Folded (Prepleated) Grades

Diameter (mm)	Catalog Number			Quantity/Pack
	Grade 589/1 1/2	Grade 589/2 1/2	Grade 589/3 1/2	
110	-	10 300 143	-	100
150	10 300 045	10 300 145	-	100
240	-	-	10 300 251	100

## Filter Papers and Membranes

### Quantitative Filter Papers – Hardened Low Ash Grades

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

#### Grade 50: 2.7 µm

Retention of 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.

#### 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.



Hardened Low Ash Grades

### Typical Properties - Quantitative Hardened Low Ash Grades

Grade	Description	Particle Retention Liquid (µm)	Filtration Speed Herzberg (s)	Ash Content <sup>+</sup> (%)	Typical Thickness (µm)	Basis Weight (g/m <sup>2</sup> )
50	Slow	2.7	2685	0.015	115	97
52	Medium	7	235	0.015	175	101
54	Very fast	20-25	39	0.015	185	92

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

\* Particle Retention Rating at 98% efficiency



**Ordering Information - Quantitative Hardened Low Ash Filter Papers**

Diameter (mm)	Catalog Number			Quantity/Pack
	Grade 50	Grade 52	Grade 54	
<b>Filter Circles</b>				
42.5	1450-042	-	-	100
50	1450-050	-	-	100
55	1450-055	-	1454-055	100
70	1450-070	1452-070	1454-070	100
90	1450-090	1452-090	1454-090	100
110	1450-110	1452-110	1454-110	100
125	1450-125	1452-125	1454-125	100
150	1450-150	1452-150	1454-150	100
185	1450-185	-	1454-185	100
240	1450-240	1452-240	1454-240	100
320	1450-320	-	1454-320	100
400	1450-400	-	-	100
500	1450-500	-	1454-500	100
609.6	1450-561	-	-	100
Smear Tab	1450-993	-	-	100
<b>Filter Sheets</b>				
150 x 230 mm	1450-916	-	-	100
400 x 400 mm	1450-925	-	-	500
400 x 450 mm	-	1452-923	-	500
410 x 400 mm	1450-900	-	-	100
460 x 570 mm	1450-917	-	1454-917	100
10 x 10 inches	1450-880	-	-	100



Surface Wipes – Smear Tab

## Filter Papers and Membranes

### Quantitative Filter Papers – Hardened Ashless Grades

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 Hardened Ashless Grades

Grade	Description	Particle Retention Liquid (µm)	Filtration Speed Herzberg (s)	Ash Content + (%)	Typical Thickness (µm)	Basis Weight (g/m <sup>2</sup> )
540	Medium	8*	200	≤ 0.006	160	88
541	Fast	20-25*	34	≤ 0.006	155	82
542	Slow	2.7*	2510	≤ 0.006	150	93

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

\* Particle Retention Rating at 98% efficiency

### Ordering Information - Quantitative Hardened Ashless Filter Papers

Diameter (mm)	Catalog Number			Quantity/Pack
	Grade 540	Grade 541	Grade 542	
<b>Filter Circles</b>				
21	1540-321	-	-	100
24	1540-324	-	-	100
42.5	1540-042	1541-042	-	100
47	-	1541-047	-	100
55	1540-055	1541-055	1542-055	100
70	1540-070	1541-070	1542-070	100

Diameter (mm)	Catalog Number			Quantity/Pack
	Grade 540	Grade 541	Grade 542	
85	-	1541-085	-	100
90	1540-090	1541-090	1542-090	100
110	1540-110	1541-110	1542-110	100
125	1540-125	1541-125	1542-125	100
150	1540-150	1541-150	1542-150	100
185	1540-185	1541-185	1542-185	100
240	1540-240	1541-240	1542-240	100
270	1540-270	1541-270	-	100
320	1540-320	1541-320	-	100
400	-	1541-400	1542-400	100
<b>Filter Sheets</b>				
460 mm x 570 mm	-	1541-917	-	100

# GLASS MICROFIBER FILTERS



## 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-micro range. 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.



## Filter Papers and Membranes

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.

### 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  $\beta$  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.

**Grade 934-AH: 1.5 µm**

The fine particle retention of this popular grade is superior for its high retention efficiency at high flow rates and its high loading capacity. This is a smooth surface, high-retention borosilicate glass microfiber filter which withstands temperatures over 500° C. Used for determining total suspended solids in water, removal of turbidity and filtration of bacterial cultures. Grade 934-AH is used for a wide range of laboratory applications. It is recommended for water pollution monitoring, cell harvesting, liquid scintillation counting and air pollution monitoring.

**Quartz Filters – QM-A: 2.2 µm**

High-purity quartz (SiO<sub>2</sub>) 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<sub>2</sub> and NO<sub>2</sub>) are virtually eliminated. QM-A, sequentially numbered according to EPA standards, is suitable for most applications. See Air Sampling Filter/Quartz Filters section (p37) for ordering details.

**EPM 2000: 2.0 µm**

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. See Air Sampling Filter/Quartz Filters section (p37) for ordering details.

**GMF 150: 1 µm or 2 µm**

The Whatman GMF 150 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. See GMF 150 section (p34) for ordering details.

## Filter Papers and Membranes

### Typical Properties - Binder-Free Glass Microfiber Grades

Grade	Description	Particle Retention Liquid (µm)	Filtration Speed Herzberg (s)	Air Flow (s/100 mL/in <sup>2</sup> )	Typical Thickness (µm)	Basis Weight (g/m <sup>2</sup> )
GF/A	Fast, High Loading	1.6*	62	4.3	260	53
GF/B	Medium to Fast, Very High Loading	1.0*	195	12	675	143
GF/C	Medium to Fast, High Loading	1.2*	100	6.7	260	53
GF/D	Fast, Very High Loading	2.7*	41	2.2	675	121
GF/F	Medium, High Loading	0.7*	325	19	420	75
934-AH	Fast, High Loading	1.5*	47	3.7	435	64
QM-A	Quartz	2.2*	-	6.4	450	85
EPM2000	Used in PM-10 Air Monitoring	2.0*	-	4.7	450	85
GMF	Multilayer	1.2*	-	3.1	730	139
150 - 1 µm						
GMF	Multilayer	2.4*	-	1.5	750	149
150 - 2 µm						

\*Particle Retention Rating at 98% efficiency

### Ordering Information - Binder-Free Glass Microfiber Filters

Diameter (mm)	Catalog Number						Quantity/Pack
	Grade GF/A	Grade GF/B	Grade GF/C	Grade GF/D	Grade GF/F	Grade 934-AH	
7	-	-	-	1823-007	-	-	100
10	-	-	1822-9916*	-	-	-	100
13	1820-8013	-	-	-	-	-	100
13	-	-	-	-	1825-0134	-	400
14	-	-	-	1823-010	-	-	100
19	-	1821-019	-	-	-	-	100
21	1820-021	1821-021	1822-021	1823-021	1825-021	1827-021	100
24	1820-024	1821-024	1822-024	1823-024	1825-024	1827-024	100
25	1820-025	1821-025	1822-025	1823-025	1825-025	1827-025	100
25	-	-	1822-6580	-	-	-	400
27	-	-	-	-	-	1827-027	100
28	-	-	-	-	-	1827-028	100
30	1820-030	-	-	-	-	1827-030	100
32	-	-	-	-	-	1827-032	100
35	-	-	-	1823-035	-	1827-035	100
37	1820-037	1821-037	1822-037	-	1825-037	1827-037	100
42.5	1820-042	1821-042	1822-042	1823-042	1825-042	1827-042	100
47	1820-047	1821-047	1822-047	1823-047	1825-047	1827-047	100
50	1820-050	-	1822-050	-	-	-	100
55	1820-055	1821-055	1822-055	1823-055	1825-055	1827-055	100

contd >



Diameter (mm)	Catalog Number						Quantity/Pack
	Grade GF/A	Grade GF/B	Grade GF/C	Grade GF/D	Grade GF/F	Grade 934-AH	
60	1820-060	-	-	-	-	-	100
61	1820-061	-	-	-	-	-	100
70	1820-070	1821-070	1822-070	1823-070	1825-070	1827-070	100
81	1820-6537	-	-	-	-	1827-132	100
82	-	-	-	-	-	1827-082	100
85	-	-	-	-	-	1827-085	100
90	1820-090	1821-090*	1822-090	1823-090*	1825-090*	1827-090	100
100	-	-	1822-100	-	-	-	100
105	-	-	-	-	-	1827-105	100
110	1820-110	1821-110*	1822-110	1823-110*	1825-110*	1827-110	100
125	1820-125	1821-125*	1822-125	1823-125*	1825-125*	1827-125	100
142	-	-	1822-142	1823-142	1825-142	-	100
150	1820-150	1821-150*	1822-150	1823-150*	1825-150*	1827-150	100
155	-	1821-155	-	-	-	-	100
185	-	1821-185*	-	-	-	1827-185	100
240	1820-240	-	-	-	-	1827-240	100
257	-	-	-	1823-257	1825-257	-	25
262	-	-	-	-	-	1827-262	100
293	-	1821-293*	-	-	1825-293	-	100
320	-	-	-	-	-	1827-320	100
FilterCup 70**	1600-820	-	1600-822	-	1600-825	-	25
Disposable Filter Funnel 25 mm (See p158)							
	1922-1820	-	1922-1822	-	-	-	50
Filter Sheets - Size							
102 x 254 mm	-	-	1822-849	-	-	-	50
203 x 254 mm	1820-866	-	-	-	-	-	100
460 x 570 mm	-	1821-914	1822-914	-	-	-	5
460 x 570 mm	1820-915*	1821-915*	1822-915*	1823-915*	1825-915	-	25
2" x 12"	-	-	-	-	-	1827-808	100
8" x 10"	-	-	1822-866	-	-	1827-866	100
12" x 15"	-	-	-	-	-	1827-889	100
19" x 28"	-	-	-	-	-	1827-957	100

+ Individually bagged

\* 25 per box

\*\* For FilterCup use, one time purchase of Stem and Stopper required – catalog number 1600-900