

Qualitative Filters

These 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. Whatman provides a wide range of Qualitative Filters to meet your specific needs.

Grade 1

11 μm —a medium retention and flow rate filter for routine applications, including soil analysis and seed testing procedures, food industry testing, air pollution monitoring and gas detection.

Grade 2

8 μm —more absorbent and slightly more retentive with a slower filtration speed than Grade 1. Available prepleated as Grade 2V. Used for monitoring specific contaminants in the atmosphere and in soil testing.

Grade 3

6 μm —a thick filter with good loading capacity, fine particle retention and increased strength. The extra thickness gives increased wet strength and makes the filter suitable for use in Büchner funnels. The high absorbency is particularly valuable when the filter is used as a sample carrier.

Grade 4

20–25 μm —offers high flow rate with good retention of larger particles and gelatinous precipitates such as ferric hydroxide and aluminum hydroxide. Also used as a rapid filter for routine cleanup of biological fluids or organic extracts and for rapid air pollution monitoring where collection of fine particles is not critical.

Grade 5

2.5 μm —the most efficient qualitative filter. Used for collecting small particles and has a slow flow rate. Suitable for chemical analysis clarifying cloudy suspensions, and for water and soil analysis.

Grade 6

3 μm —twice as fast as Grade 5 with similar particle retention. Often specified for boiler water analysis.

Wet Strengthened Filters

Wet strengthened qualitative filters contain a small quantity of a chemically stable resin to give improved wet strength. This does not introduce any significant impurities into the filtrate but because the resins contain nitrogen, these grades should not be used in Kjeldahl estimations.

Grade 91

>10 μm —a general-purpose crêped filter for less critical routine analysis. Widely used to assay sucrose in cane sugar and within pharmaceutical laboratories for routine filtration.

Student Grade/Grade 93

>10 μm —widely used in universities, colleges and schools for general laboratory filtration and coarse sample preparation. Available in a dispenser pack, which can be attached to the wall, placed on a shelf either upright or flat and used as a normal carton. Each dispenser pack contains 50 envelopes of 25 circles each.

Grade 113

30 μm —a crêped filter with high-loading capacity and the fastest flow rate of any qualitative grade. This is the thickest filter in the range and is extremely strong. Grade 113 is ideal for use with coarse or gelatinous precipitates. It is available prepleated as Grade 113V.



Grade 114

20–25 μm —half the thickness of Grade 113, this is a very strong filter with a smooth surface for easy recovery of precipitates. It is suitable for coarse or gelatinous precipitates. Also available prepleated as Grade 114V.

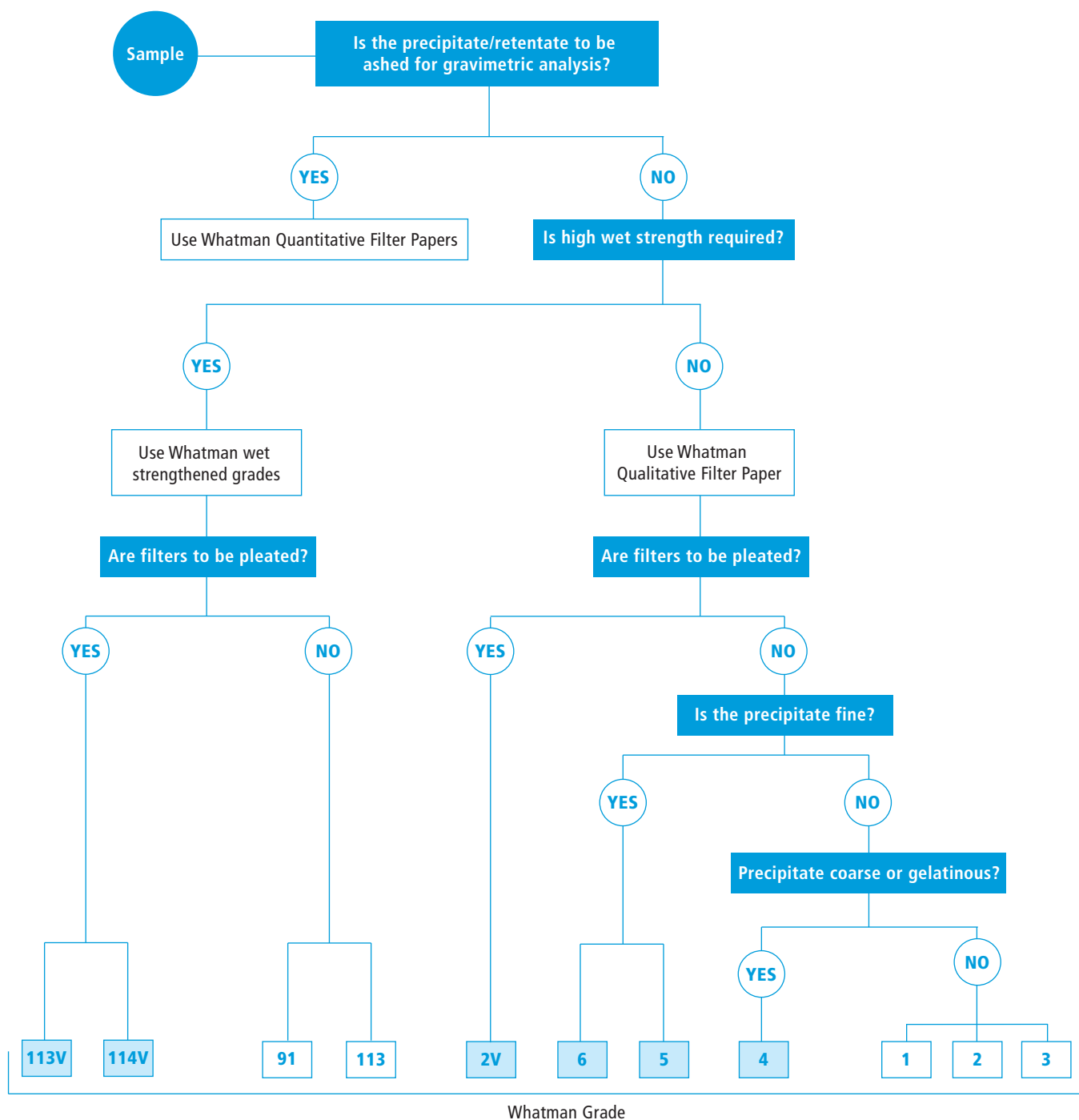
Note: For Disposable Filter Funnels, see page 54.

Cellulose filters are selected according to the required particle retention efficiency, fluid flow rate and loading capacity. Wet strength, chemical resistance, purity and ash levels are further considerations. The filter diameter selected will depend on the volume of liquid to be filtered. The maximum practical volume of the most popular disc sizes (quadrant folded) are:

Diameter (mm)	Volume (mL)
125	35
150	75
185	135
240	300

See Technical Appendices Page 177 for selection of Filter Funnels for use with filter papers.

Qualitative Filter Paper Quick Pick Reference Chart



Quantitative Filters

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 routine quantitative techniques
- Hardened low ash: 0.015% ash maximum, very high wet strength
- Hardened ashless: 0.006% ash maximum, very high wet strength

Ashless Filters

Whatman ashless filters are produced from high quality cotton linters under carefully controlled conditions. These very pure filters are ideal for a wide range of critical analytical filtration procedures.

Grade 40

8 μm —general purpose ashless filter with medium speed and particle retention. Applications include gravimetric analysis, the filtration of solutions prior to atomic absorption spectrophotometry and in air pollution monitoring.

Grade 41

20–25 μm —the fastest ashless filter is recommended for analytical procedures involving large particles or gelatinous precipitates such as iron or aluminum hydroxides. Also used in quantitative air pollution analysis for determining gaseous compounds at high flow rates.

Grade 42

2.5 μm —filter with the finest particle retention of all Whatman cellulose filters. Typical analytical precipitates include barium sulfate, metastannic acid and finely precipitated calcium carbonate.

Grade 43

16 μm —a moderately fast filter used for foodstuff analysis, soil analysis, particle collection in air pollution monitoring and inorganic analysis in the construction, mining and steel industries.

Grade 44

3.0 μm —gives the lowest ash weight for any given disc size. Slightly less efficient for collecting small particles than Grade 42 but has a higher flow rate.

Hardened Low Ash Filters

Hardened low ash filters are treated with a strong acid to 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.

Grade 50

2.7 μm —the thinnest filter with a slow flow rate and good particle retention characteristics. The hardened surface is virtually free from loose fibers. In the electronics industry, the virtual absence of fiber shedding is utilized in carriers for integrated circuits.

Grade 52

7 μm —a general purpose filter with medium retention and flow rate. Ideal for use with Büchner funnels or Whatman 3-piece filter funnels.

Grade 54

20–25 μm —very fast filtration for use with coarse and gelatinous precipitates. High wet strength is suitable for vacuum-assisted fast filtration of difficult materials.



Hardened Ashless Filters

Hardened ashless filters are 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.

Grade 540

8 μm —a general purpose filter with medium retention and flow rate. Frequently used in gravimetric analysis of metals in acid/alkali solutions.

Grade 541

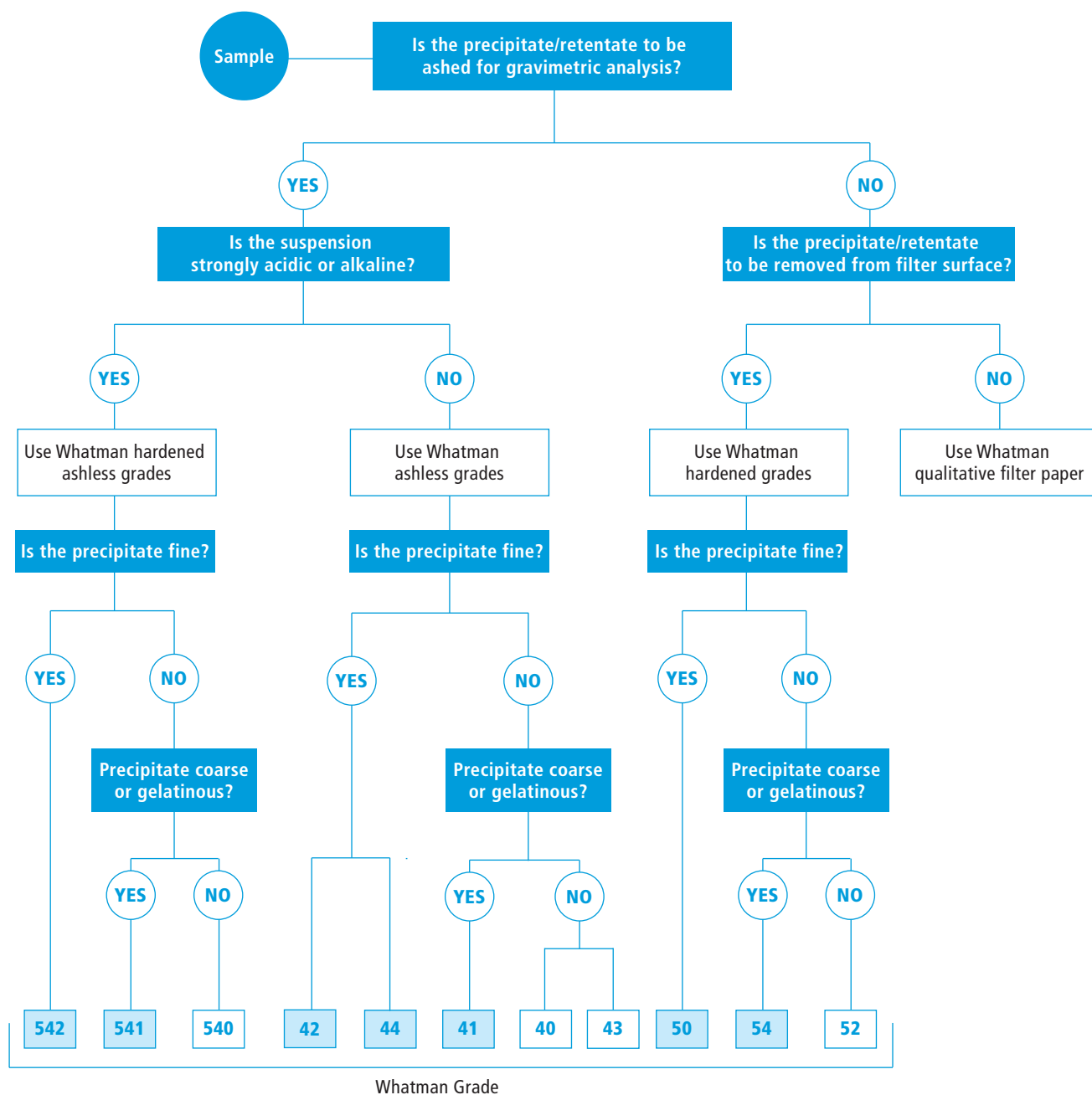
20–25 μm —offers high filtration speed for the retention of large particles and gelatinous precipitates in acid or alkaline solutions. Typical applications include protein determinations, cement analysis and the determination of fiber in animal food.

Grade 542

2.7 μm —gives efficient retention of small particles in solutions that would weaken conventional filters. Slow flow rate. Very hard and strong with excellent chemical resistance. Often used in gravimetric metal determinations.

Note: For Disposable Filter Funnels, see page 56.

Quantitative Filter Paper Quick Pick Reference Chart



Typical Properties of Cellulose Filters

Grade	Particle Retention* Liquid (µm)	Air Flow Rate (s/100 mL/in ²)	Ash (%)	Typical Thickness (µm)	Basis Weight (g/m ²)	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
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

Grade	1	42	542
Aluminum	<0.5	2	1
Antimony	<0.02	<0.02	<0.02
Arsenic	<0.02	<0.02	<0.02
Barium	<1	<1	<1
Boron	1	1	2
Bromine	1	1	1
Calcium	185	13	8
Chlorine	130	80	55
Chromium	0.3	0.3	0.7
Copper	1.2	0.3	0.2
Fluorine	0.1	0.2	0.3

Grade	1	42	542
Iron	5	6	3
Lead	0.3	0.2	0.1
Magnesium	7	1.8	0.7
Manganese	0.06	0.05	<0.05
Mercury	<0.005	<0.005	<0.005
Nitrogen	23	12	260
Potassium	3	1.5	0.6
Silicon	20	<2	<2
Sodium	160	33	8
Sulfur	15	<5	<2
Zinc	2.4	0.6	0.3

* All results expressed as µg/g.

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
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	1006-185	1006-185	100
240	1001-240	1002-240	1003-240	1004-240	1006-240	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

Ordering Information

Qualitative Wet Strengthened Filter Circles					
Catalog Number					
Diameter (mm)	Grade 91	Student Grade/Grade 93	Grade 113	Grade 114	Quantity/Pack
90	—	1093-110	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

* Packed in 4000 subdivided into 100.

** Packed in 50 envelopes of 25 circles each.

*** Packed in 1000 subdivided into 100.

Ordering Information

Qualitative Filter Circles Folded (pleated)				
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

Ordering Information

Qualitative Standard Filter Sheets		
Dimensions (mm)	Catalog Number	Quantity/Pack
Grade 1		
460 x 570	1001-917	100
460 x 570	1001-918	500
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

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
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
400	—	—	1442-400	—	—	100
Filter Sheets						
8" x 10"	—	1441-866	—	—	—	100
460 mm x 570 mm	1440-917	1441-917	—	—	—	100

Ordering Information

Quantitative Hardened Low Ash Filter Circles				Quantitative Hardened Ashless Filter Circles			
Catalog Number				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

Reeve Angel® Brand Filter Papers



Reeve Angel brand filter papers are manufactured primarily for non-critical industrial laboratory filtration applications requiring inexpensive filters of consistent performance. Some are wet strengthened by the addition of small amounts of wet strengthening resins. Such applications usually involve qualitative analysis and are characteristically routine and often repetitive. The filter papers used should, therefore, provide known and dependable performance with minimum variability.

In the applications for which they are intended, Reeve Angel brand filters offer uniformity and consistent performance at moderate cost. The student laboratory will also find Reeve Angel brand filter papers widely useful. These papers should not be used for Kjeldahl nitrogen analysis.

TCLP Glass Fiber Filters

Pure borosilicate glass fiber filter with particle retention of 0.6 μm –0.8 μm to conform to EPA method 1311, 5W-846; toxicity characteristic leaching procedure.

Grade 200

This is the most retentive of the Reeve Angel Filters with a slow flow rate and fine particle retention.

Grade 201

This is a thin retentive paper, smooth surfaced with close texture. It is excellent for general purpose use where retention of medium-fine precipitates is needed and relatively low filtration speed is unimportant; a particularly useful student grade. The paper structure is designed for retentivity and thus filtration speed and loading capacity are comparatively low.

Grade 202

Provides medium filtration speed of coarse particles. The surface is crêped, hence has a greater effective filtration area than smooth surfaced filter papers of the same diameter.

Grade 211

A retentive, relatively slow filter paper. Highly absorbent. A standard paper in cottonseed oil and other oil laboratories. Retains fine particles. Surface is smooth and white.

Grade 226

A unique Reeve Angel brand filter paper with a crêped, grey surface providing optical contrast for white or dark filtrates. Retains coarse or gelatinous precipitates. Filtration speed is high. Grade 226 is used extensively in sugar laboratories for routine and/or repetitive filtration.

Grade 230

A strong, thick crêped paper widely used in oil chemistry. American Oil Chemist's Society (AOCS) recommends Grade 230 for many oil test methods. Retains coarse particles. High speed and loading capacity.

Grade 801

Prepleated, thin, retentive, general purpose paper. Will retain medium-fine precipitates with relatively slow filtration rate and low to normal loading capacity.

Grade 802

Prepleated, crêped surface provides relatively higher filtration area than in a smooth paper of the same diameter. Retains coarse crystalline and gelatinous precipitates with fast flow rate.

Grade 830

Prepleated, strong and thick paper with crêped surface. Fast filtration speed and high loading capacity. Retains coarse particles.

Typical Grade Characteristics

Grade	Retentivity	Filtration Speed	Loading Capacity	Thickness (mm)	Basis Weight (g/m ²)	Surface	Color
200	Fine (1–5 µm)	Slow	Low-Normal	0.19	100	Smooth	White
201	Medium-Fine (7–14 µm)	Slow-Medium	Low-Normal	0.15	75	Smooth	White
202	Large crystalline coarse particles (15–19 µm)	Medium	Normal	0.29	82	Crêped	White
211	Medium (9–14 µm)	Medium	Low-Normal	0.15	68	Smooth	White
226	Coarse particles gelatinous precipitates (20–25 µm)	Fast	High-Normal	0.28	87	Crêped	Grey
230	Coarse particles (25–30 µm)	Fast	High	0.40	123	Crêped	White
801*	Medium-Fine (9–14 µm)	Slow-Medium	Low-Normal	0.15	68	Smooth	White
802*	Coarse & crystalline gelatinous precipitates (30–35 µm)	Fast	Normal	0.26	73	Crêped	White
830*	Coarse particles (25–30 µm)	Fast	High	0.40	123	Crêped	White

* The 800 grade filters are prepleated.

Ordering Information

Reeve Angel Filter Papers		
Diameter (cm)	Catalog Number	Quantity/Pack
Grade 200		
9.0	5200-090	100
Grade 201		
4.25	5201-042	100
9.0	5201-090	100
11.0	5201-110	100
12.5	5201-125	100
15.0	5201-150	100
18.5	5201-185	100
24.0	5201-240	100
32.0	5201-320	100
33.0	5201-330	100
Grade 202		
9.0	5202-090	100
11.0	5202-110	100
12.5	5202-125	100
15.0	5202-150	100
18.5	5202-185	100
20.0	5202-200	100
24.0	5202-240	100
25.0	5202-250	100
32.0	5202-320	100
33.0	5202-330	100
40.0	5202-400	100

Ordering Information continued

Reeve Angel Filter Papers		
Diameter (cm)	Catalog Number	Quantity/Pack
Grade 211		
15.0	5211-150	100
Grade 226		
12.5	5226-125	100
19.0	5226-190	100
20.0	5226-200	100
33.0	5226-330	100
8" x 8"	5226-848	1000
Grade 230		
9.0	5230-090	50
11.0	5230-110	50
12.5	5230-125	50
15.0	5230-150	50
18.5	5230-185	50
20.0	5230-200	50
24.0	5230-240	50
25.0	5230-250	50
33.0	5230-330	50
40.0	5230-400	50
50.0	5230-500	50
Grade 801		
15.0	5801-150	100
24.0	5801-240	100
32.0	5801-320	100
Grade 802		
12.5	5802-125	100
15.0	5802-150	100
18.5	5802-185	100
24.0	5802-240	100
32.0	5802-320	100
38.5	5802-385	100
Grade 830		
12.5	5830-125	50
18.5	5830-185	50
24.0	5830-240	50
RA TCLP		
4.7	5925-047	100
9.0	5925-090	100
11.0	5925-110	100
14.2	5925-142	100
15.0	5925-150	100

Ashless Powder Paper Pulp Filter Aid

Whatman ashless cellulose powder enhances filtration speed by coagulating precipitates or suspensions to form a thick retentive “prefilter” layer on top of normal filter paper.

Easily dispersible, the powder is of a purity similar to that of Whatman ashless quantitative papers. Maximum ash content is 0.015%. It is supplied with a two-ended scoop for measuring 0.50 g or 2.5 g quantities.



Ordering Information

Catalog Number	Description	Size
1700-025	Ashless Powder	250 g
1703-050	Ashless Clippings	500 g