Laboratory Filter Papers

Qualitative Filter Papers

- **100% cotton linter cellulose**
- **pH tolerant:** 0 to 12
- **Thermostable:** up to 120°C
- **Wide selection** – seven types
- **Ash Content:** 0.1%

Applications

- Clarify and remove precipitates
- Preparation for qualitative analysis

Ordering Information

See page 28.

Qualitative filter papers

Characteristics and Applications: Conversions – Qualitative Papers

Grade	Comments	Weight (g/m^2)	Thickness (mm)	Flow Time*1 (sec)	Absorption speed*2 (cm)	Wet Strength*3 (kPa)	Nominal Rating (µm)	Collection Efficiency (%, 0.3 µm DOP)	Conversion*4	
									Whatman	ex-Schleicher & Schuell
No. 1	Retains large crystalline particles and gelatinous precipitates. Fast flow rate, smooth surface, normal hardness	90	0.20	45	9.0	7	6 (Coarse)	65	4	410 or 1450cv
No. 2	Retains medium crystalline precipitates, fast flow rate, smooth surface, normal hardness	125	0.26	80	8.0	8	5 (Medium)	80	-	604
No. 231	Retains crystalline precipitates, moderate flow rate, smooth surface, normal hardness	95	0.18	130	7.5	-	(Medium)	-	2	-
No. 232	Retains medium to medium-fine particulates, slow flow rate, smooth, normal hardness	90	0.18	250	5.0	-	(Med./ Med.-Fine)	-	6	-
No. 131	High retention efficiency for fine crystalline precipitates like barium sulfate, slow flow rate, smooth surface, normal hardness	140	0.25	240	6.0	8	3 (Med.-Fine)	90	3	597
No. 235	Highest retention efficiency, retains very fine particulates, very slow flow rate, smooth	95	0.17	1,200	4.0	-	(Very Fine)	-	5	-
No. 101	Seed germination, retains large particles	80	0.21	50	8.0	34	5 (Coarse and gelatinous)	-	91	-

*1. Flow time is the time in seconds required to filter 100 mL of distilled water at 20°C under pressure supplied by a 10 cm water column through a 10 cm^2 section of filter paper.
*2. Absorption speed is the distance in cm that water will travel in an upright strip of filter paper in ten (10) minutes at 20°C.
*3. Wet strength is the pressure measured by Mullen Burst Strength Tester after soaking in water.
*4. Conversions between manufacturers are not absolute. Use these conversions as a guideline.

Quantitative/Hardened Filter Papers

- **100% cotton linter cellulose**
- **Ash Content:** 0.01%(Except No.4A 0.025%)
- **Acid washed:** Double acid washed in hydrochloric then hydrofluoric acid (No. 3, 5A, 5B, 5C, 6, 7), then rinsed with ultrapure water to neutralize. No. 4A is further treated with nitric acid before washing

Applications

- Gravimetric analysis
- Environmental monitoring

Quantitative filter papers

Characteristics and Applications: Conversions – Quantitative Papers

Grade	Comments	Weight (g/m^2)	Thickness (mm)	Flow Time*1 (sec)	Absorption speed*2 (cm)	Wet Strength*3 (kPa)	Nominal Rating (µm)	Collection Efficiency (%, 0.3 µm DOP)	Conversion*4	
									Whatman	ex-Schleicher & Schuell
No. 3 Ashless	Medium retention (5-10 µm), fast flow rate Analysis of soils, fertilizers, cement, and minerals	113	0.23	130	7.5	12	5 (Medium)	80	43	593-A
No. 5A Ashless	Fast flow rate, retains coarse particulates and gelatinous precipitates (>10 µm). Filter hydroxides and metallic aerosols, environmental monitoring, determine silica content in steel	97	0.22	60	9.5	10	7 (Coarse and gelatinous)	75	41	589-IH
No. 5B Ashless	Retains medium particles (5-10 µm) such as $CaCO_3$, $PbSO_4$, $CaCO_4$, $MnCO_3$, $ZnCO_3$, ZnS, AgCl	108	0.21	195	7.0	12	4 (Medium)	90	40	589 / 6 Green
No. 5C Ashless	Collect fine precipitates (<5 µm) such as $SrSO_4$, $BaSO_4$, $HgCrO_4$, and colloidal dispersions; gravimetric analysis	118	0.22	570	6.0	12	1 (Fine)	93	44	589 / 3 Blue
No. 6 Ashless	Retains medium-fine particulates (2-10 µm), trace and precious metals	103	0.20	300	6.0	12	3 (Medium Fine)	90	-	589 / 2 White
No. 7 Ashless	Highest purity for retaining medium particles (5-10 µm), precise gravimetric analysis	87	0.18	200	7.0	10	4 (Medium)	85	-	-
No. 4A Hardened	High wet strength, suitable for use under high pressure, high chemical and pH resistance, retains fine crystalline precipitates (<5 µm), slow flow	96	0.12	915	4.0	52	1 (Very Fine)	90	50	-

Footnotes: See facing page

Ash content of Quantitative Papers (mg per disc)

mm	No. 3	No. 5A	No. 5B	No. 5C	No. 6	No. 7
55	0.03	0.02	0.03	0.03	0.02	0.02
70	0.04	0.04	0.04	0.05	0.04	0.03
90	0.07	0.06	0.07	0.08	0.07	0.06
110	0.11	0.09	0.10	0.11	0.10	0.08
125	0.14	0.12	0.13	0.15	0.13	0.11
150	0.20	0.17	0.19	0.21	0.18	0.15
185	0.30	0.26	0.29	0.32	0.28	0.23

Metal Content

(µg/g)	Si	Na	K	Ca	Mg	Fe	Pb	Cu	Mn	Ni	Al	Zn	Cd
Qualitative	46	62	3	140	17	<5	<1	<1	<1	<1	<2	1	<0.5
Quantitative	32	<10	<2	<10	<1	8	<1	<1	<0.5	<1	2	<1	<0.5

ORDERING INFORMATION: QUALITATIVE PAPERS

- Available in discs in the following diameters (mm): 55, 70, 90, 110, 125, 150, 185, 240, 285, 300, 330, 360, 400, 500, 600
- Additional sizes available upon request.
- Order by specifying first the grade of filter then the diameter, e.g. (NO112. 5CM), (NO2325. 5CM)
- Package of 100

ORDERING INFORMATION: QUANTITATIVE PAPERS

- Available in discs in the following diameters (mm): 55, 70, 90, 110, 125, 150, 185, 240, 285, 300, 330, 360, 400, 500
- Additional sizes available upon request.
- Order by specifying first the grade of filter then the diameter, e.g. (No.5A, 125 mm), (No.6, 55 mm)
- Package of 100

Chromatography Papers

- **High quality papers** are carefully tested for spot formation, capillary action, water flow rate and absorption speed to assure uniformity and reproducibility
- **Better resolution** with slower flow rate papers

APPLICATIONS

- Chromatography
- Electrophoresis and blotting
- Separation of heavily loaded solutes

SPECIFICATIONS AND CONVERSION GUIDE

Grade	Weight (g/m^2)	Thickness (mm)	Absorption Speed*1 (cm)	Wet Strength*2	Ash (%)	Whatman equivalent
No. 50	140	0.25	6.0	8	0.1	20 Chr
No. 51A	87	0.18	7.5	7	0.01	4 Chr
No. 51B	87	0.17	7.0	5	0.06	1 Chr
No. 514A	185	0.32	7.5	8	0.06	3MM Chr
No. 526	325	0.70	11.0	29	0.1	17 Chr
No. 590	285	0.93	18	10	0.1	17 Chr

*1. Absorption speed is the distance in cm that water will travel in an upright strip of filter paper in ten (10) minutes at 20°C.
*2. Wet Strength is the pressure measured by Mullen Burst Strength Tester after soaking in water.

ORDERING INFORMATION

All grades above are available in the following size (mm) and quantities:

Size	Qty / Pkg
20 x 400	100 / Pkg
200 x 200	50 / Pkg
600 x 600	50 / Pkg

Order by specifying first the grade of paper then the size, e.g. (NO51A20MMX400MM)

Extraction Thimbles

High purity, seamless filters with a characteristic thimble shape. Applications include analysis of fats, oils, grease, pesticides, pollutants, other organics and additives in plastics and rubber materials.

Cellulose Thimbles – No. 84

- Suitable for Soxhlet extractions of organic components
- Dust sampling
- Lipid content <0.1% by weight

Glass Fiber Thimbles – No. 86R

- Borosilicate glass
- High temperature extractions or dust monitoring (≤500°C)
- Acid resistant (except hydrofluoric)

Quartz Fiber Thimbles – No. 88R and 88RH

- Use up to 1,000°C
- No. 88RH is treated at 900°C to stabilize the weight prior to use

PTFE Fiber and PTFE/Quartz Fiber Thimbles – No. 89 and 89S

- Durable, temperature-resistant
- Non-adsorptive with respect to acid gases
- PTFE is inherently hydrophobic
- Little or no trace metal contamination

Thimbles

Specifications

Grade	Material	Nominal Rating (µm)	Thickness (mm)	Weight (g per 25 x 90 thimble)	Pressure drop (kPa at 5L/min.)	Collection Efficiency (%, 0.3 µm DOP)	Max. operating temp (°C)	Heating loss rate (%)	Conversion	
									Whatman	ex-Schleicher & Schuell
No. 84	Cellulose	8	1.5	3.6	0.25	89	120	-	2800	603
No. 86R	Glass Fiber	1	1.6	1.8	0.30	>99.9	500	0.2	2814	603G
No. 88R	Quartz Fiber	-	2.2	1.6	0.44	>99.9	1,000	-	-	-
No. 88RH	Quartz Fiber	-	2.2	1.6	0.44	>99.9	1,000	0.1	2812	-
No. 89	PTFE Fiber	-	1.8	11.0	4.5	>99.9	260	-	-	-
No. 89S	PTFE/Quartz Fiber	-	1.6	6.0	0.54	>99.9	400	0.07	-	-

Ordering Information

Internal diameter (mm) x External diameter (mm) x height (mm). 25 thimbles per package (Former internal dia. product)

Grade \ Size	19 x 22 x 90	22 x 25 x 65	22 x 25 x 80	25 x 29 x 60	25 x 29 x 80	25 x 29 x 90	25 x 29 x 100	28 x 32 x 100	30 x 34 x 80	30 x 34 x 100	33 x 37 x 80	33 x 37 x 100	43 x 47 x 123	80 x 86 x 250
No. 84	O	O	O	O	O	O	O	O	O	O	O	O	O	O
No. 86R	O (19 x 23 x 90)	-	-	-	-	O (25 x 30 x 90)	O (25 x 30 x 100)	-	O	O	O (33 x 39 x 80)	-	O	-
No. 88R	-	-	-	-	-	-	O	-	O	O	-	-	-	-

Internal diameter (mm) x External diameter (mm) x height (mm). 25 thimbles per package (Former external dia. product)

Grade \ Size	18 x 20 x 90	20 x 22 x 90	21 x 25 x 90	25 x 28 x 100	26 x 30 x 100	30 x 33 x 120	31 x 35 x 120	36 x 40 x 150	40 x 45 x 150	48 x 53 x 150	54 x 60 x 200	68 x 75 x 210
No. 84	O	O	O	O	O	O	O	O	O	O	O	O
Grade \ Size	17 x 20 x 90	19 x 22 x 90	21 x 25 x 90	24 x 28 x 100	26 x 30 x 100	29 x 33 x 120	30 x 35 x 120	34 x 40 x 150	38 x 45 x 150	45 x 53 x 150	53 x 60 x 200	68 x 75 x 210
No. 86R	O	O	O	O	O	O	O	O	O	O	O	O
Grade \ Size	17 x 20 x 90	19 x 22 x 90	22 x 25 x 90	24 x 28 x 100	25 x 30 x 100	29 x 33 x 120	30 x 35 x 120	35 x 40 x 150	39 x 45 x 150	48 x 53 x 150	55 x 60 x 200	68 x 75 x 210
No. 88R	O	O	-	O	O	O	O	O	O	O	O	O

Internal diameter (mm) x External diameter (mm) x height (mm). 10 thimbles per package (Former external dia. product)

Grade \ Size	22 x 25 x 90
No. 88RH	O
No. 89	O
No. 88R	O
No. 89S	O

Glass Fiber Filters

- **Highly resistant** to chemical attack, biologically inert
- **Autoclavable**
- **Thermostable:** Can be used up to 500°C for non-binder type.
- **Store indefinitely:** Unaffected by humidity

APPLICATIONS

- Use as a prefilter to extend membrane life
- Water/air pollution analysis
- Liquid clarification

ORDERING INFORMATION

Size	DP70	GA55	GA100	GA200	GB100R	GB140	GC50	GC90	GD120	GF75	GS25
	Quantity/package										
21–150 mm diameter discs	50	100	100	50	100	100	100	100	50	100	100
300 x 300 mm sheets	10	10	10	10	10	10	10	10	10	10	10
8 x 10 inch sheets	-	100	50	-	50	-	100	50	50	100	-

Available in discs in the following diameters (mm): 21, 24, 25, 26, 37, 45, 47, 55, 70, 90, 110, 125, 150.

Order by specifying first the grade of filter then the diameter, e.g. GC5090MM, GA5547MM.

Quartz Fiber Filters

- **Highly resistant** to chemical attack, biologically inert
- **High Purity:** Very low trace metal content, does not adsorb NOx and SOx dioxides; Grade QR100 is prefired at 1,000°C for 2 hours to reduce organic contamination
- **Easily sterilized:** Can be baked or autoclaved
- **Store indefinitely:** Unaffected by humidity

Quartz fiber filters

Applications

- Sample acidic gases at high (>500°C) temperatures
- Air pollution analysis

Ordering Information

Size	QR200	QR100
	Quantity/package	
21 – 150 mm diameter discs	50	100
8 x 10 inch sheets	S	50

S = Special order

Available in discs in the following diameters (mm): 21, 24, 26, 37, 45, 47, 55, 70, 90, 110, 125, 150.

Order by specifying first the grade of filter then the diameter, e.g. QR200125MM, QR10021MM.

Composite Filter

- **Composite Filter PG60** is specially developed for the measurement of dust concentration in the air
- **PTFE coated:** Naturally hydrophobic and unaffected by humidity

Applications

- Air pollution analysis
- Air dust analysis

Note: Cannot be used for liquid filtration

Composite filters

Ordering Information

Size	Quantity/package
21 – 70 mm diameter discs	100
90 – 150 mm diameter discs	50
300 x 300 mm sheets	10

Available in discs in the following diameters (mm): 21, 24, 25, 26, 37, 45, 47, 55, 70, 90, 110, 125, 150

Order by specifying first the grade of filter then the diameter, e.g. PG6090MM, PG60125MM.

Specifications: Glass/Quartz Fiber Filters

Grade	Applications/Characteristics	Weight (g/m^2)	Thickness (mm)	Nominal Rating (μm)	Water Flow Time*1 (sec)
GA55	Thin filter recommended for clarifying filtration Air pollution monitoring	55	0.21	0.6	23
GF75	Highest collection efficiency grade offered Collection of very fine particles	75	0.35	0.3	84
GA100	Faster filtration speed recommended for filtering viscous fluids	110	0.44	1.0	11
GA200	Thick filter with high dust holding capacity recommended for filtering viscous fluids	175	0.74	0.8	15
GB100R	High and low volume aerosols for airborne dust and metal contaminants Low trace metal contents	95	0.38	0.6	15
GB140	High dust holding capacity recommended for SS(Suspended Solid) analysis	140	0.56	0.4	58
GC50	Thin filter with high collection efficiency Prefilter for membrane filter Scintillation counting	48	0.19	0.5	28
GC90	Filter with organic binder recommended for fine particles and aerosols Prefilter for membrane filter	100	0.30	0.5	20
GD120	Medium collection efficiency grade Prefilter for membrane filter	123	0.51	0.9	14
GS25	Filter with organic binder recommended for SS(Suspended Solid) analysis Higher strength and lower released fibers compared with no-binder grades	70	0.21	0.6	15
DP70	Filter with organic binder recommended for high concentrated liquid of protein and other substances Prefilter for membrane filter	170	0.52	0.6	20
QR200	Thick quartz fiber filter with inorganic binder Low adsorption Monitor airborne particulates	200	1.0	-	-
QR100	Quartz fiber filter without binder Superior chemical resistance, does not adsorb acid gases	85	0.38	-	-

*1. Flow time is the time in seconds to filter 1,000 mL of distilled water at 20 °C under differential pressure of 39 kPa through a 9.6 cm^2 section of filter.

Collection Efficiency (%, 0.3 µm DOP)	Pressure Drop (kPa at 5 cm/sec)	Binder*	Maximum Operating Temperature (°C)	Conversion				
				Whatman	ex-Schleicher & Schuell	Pall	Millipore	Ahlstrom
99.9	0.33	None	500	GF/A (934AH)	31		APFA	111
99.999	1.67	None	500	GF/F	20		GFCP	151
96	0.20	None	500					
99.9	0.35	None	500					
99.99	0.30	None	500	EPM2000	1HV	A/E (Use for air)	AP40	
99.99	1.11	None	500	GF/B	32		APFB	121
99.99	0.52	None	500	GF/C	30/25	A/E (Use for water)	AP40/ APFC	131
99.99	0.42	Organic	120				AP15	
97	0.17	None	500	GF/D	40		APFD	141
99.9	0.32	Organic	120	-			AP20	164
-	0.52	Organic	120	-			AP25	
99.9	0.34	Inorganic	1,000					
99.99	0.45	None	1,000	QM-A		Micro Quartz		

*Binder 1. Organic – Acrylic Acid Ester Emulsion
2. Inorganic – Alumina

PTFE Filters

- **Pure PTFE fibers are sintered** to improve handling characteristics and to minimize fiber slough-off for minimal downstream contamination
- **Hydrophobic**
- **Porosity:** High air permeability with minimal pressure drop
- **Operating temperature range:** -120°C~260°C
- **Autoclavable**

PTFE filters

Applications

- Filter hot oils and strong solvents
- Venting air and gases
- Collection of airborne particulates

Specifications

Grade	Weight (g/m^2)	Thickness (mm)	Porosity (%)	Pressure Drop (kPa at 5cm/sec.)	Pressure Drop (psi)	Collection Efficiency (%, 0.3μm DOP)	Nominal Rating (μm)
PF100	500	1.00	77	0.059	0.00856	70	10
PF060	240	0.50	75	0.069	0.01001	75	6
PF050	210	0.36	73	0.26	0.0377	85	5
PF040	500	0.95	75	0.21	0.03045	95	4
PF020	500	0.54	54	1.6	0.232	99.9	2

Ordering Information: PTFE Filters

Size	PF100	PF060	PF050	PF040	PF020
	Quantity/package				
55 – 90 mm diameter discs	20	20	20	10	10
110 – 150 mm diameter discs	10	10	10	5	5
300 x 300 mm sheets	5	5	5	5	5

- Discs: Available in the following diameters (mm): 55, 70, 90, 110, 125, 150
- Sheets: Available in 300 x 300 mm sheets
- Additional sizes available upon request
- Order by specifying first the grade of filter then the size, e.g. PF04055MM.

See also Phase Separating Filters on page 37.