



Filter Papers and Membranes •

Cellulose Filters 4

Glass Microfiber Filters 22

Membrane Filters 65

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.

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

* Large reservoir

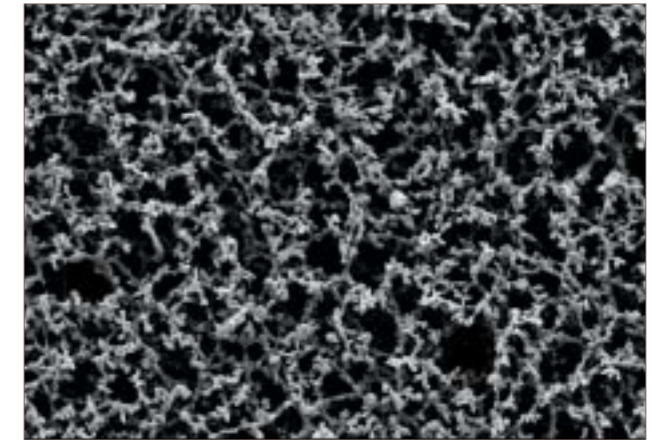
Cellulose Membranes

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/cm ²)	Air Flow Rate Δp = 3 mbar (mL/min/cm ²)	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

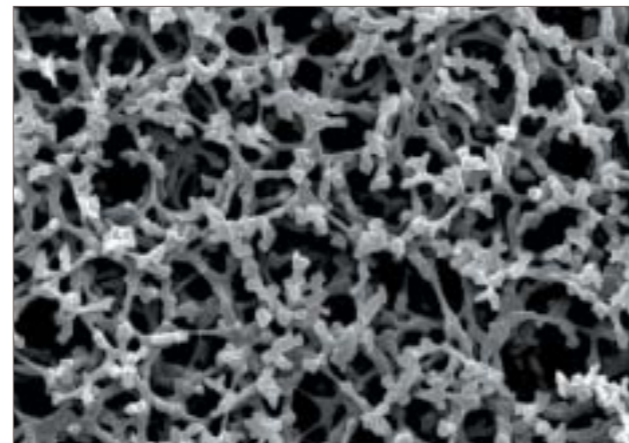
Ordering Information - Cellulose Acetate Membranes

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	
<i>E. coli</i> 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

¹The 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

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

* Packed without pad

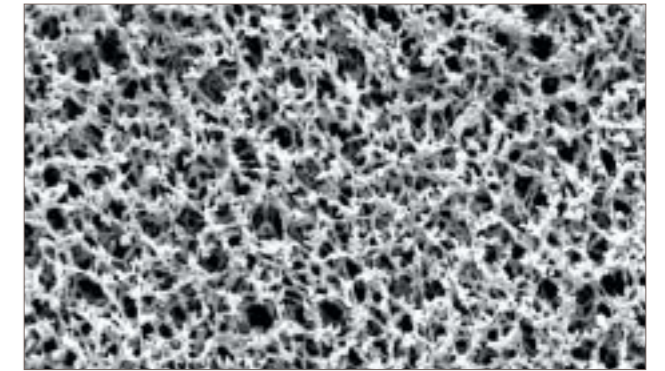
** Autoclave pack contains 10 sealed envelopes. Each envelope contains 10 filters with 10 pads

*** 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/cm ²
Maximum Service Temperature	130° C
Porosity	74–77%
Steam Autoclavable	Yes
Solvent Resistancy	Medium
Protein Binding ¹	Medium

¹WME white gridded type: high protein binding

Product Selection - Mixed Cellulose Ester Membranes

Type	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (mL/min/cm ²)	Air Flow Rate Δp = 3 mbar (mL/min/cm ²)	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

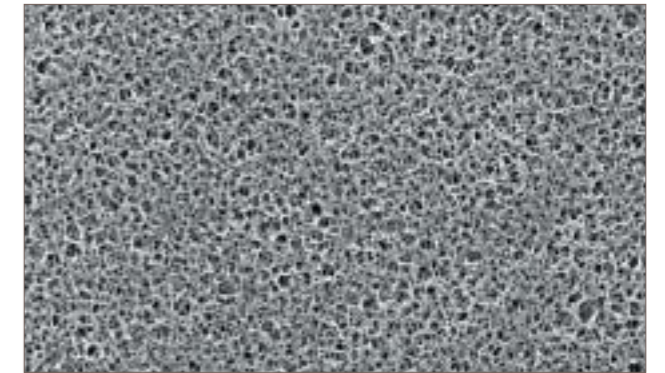
* Without interleaving papers

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/cm ²)	Air Flow Rate Δp = 3 mbar (mL/min/cm ²)	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

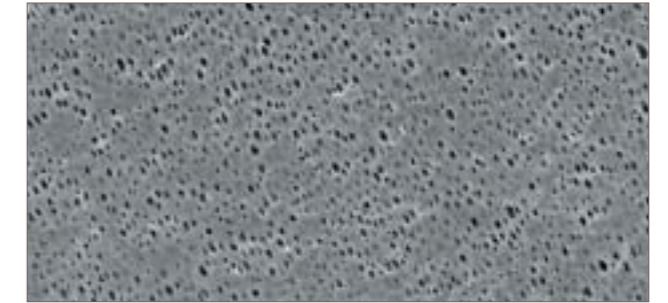
Ordering Information - Nylon Membranes

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 ₂ O	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/cm ²	Ion	ng/cm ²	Ion	ng/cm ²	Ion	ng/cm ²	Ion	ng/cm ²	Ion	ng/cm ²
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/cm ²)	Air Flow Rate Δp 3 m bar (mL/min/cm ²)	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.

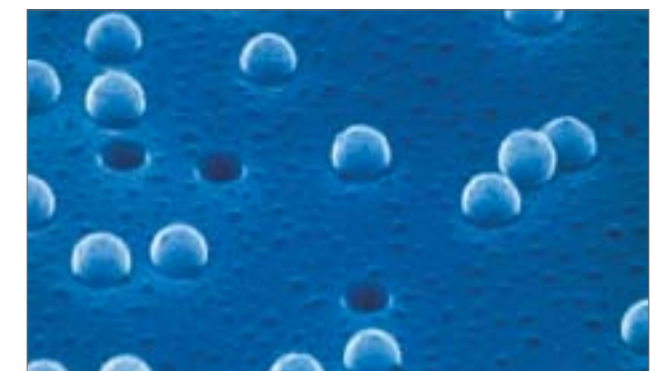
The polycarbonate membranes are hydrophilic and are available in a choice of diameters and pore sizes. The polyester membranes are resistant to most organic solvents, amides and halogenated hydrocarbons. This broad chemical compatibility makes them suitable for the detection of particles in many corrosive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

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



Cyclopore Track-Etched Membranes



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 ³	1.39 g/cm ³

contd >

	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 x 10 ²	4	>6.9	>1.4
0.2	20	5 x 10 ⁸	13	4	>1
0.4	20	1.5 x 10 ⁸	15	2.2	>1
1.0	19	2.2 x 10 ⁷	14	0.95	>3.4
5.0	15	4 x 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 x 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

contd >

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 ⁶ 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

contd >

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

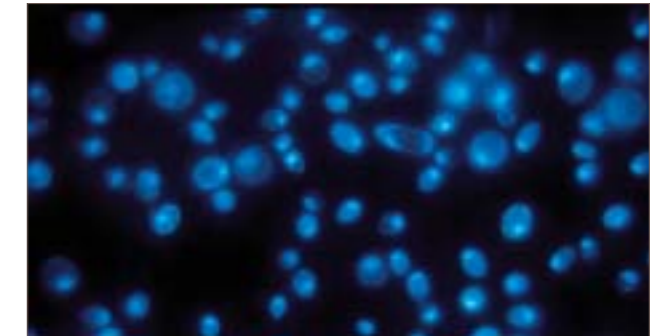
contd >

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 Cyclopure® Membranes

Black Cyclopure 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 Cyclopure with DAPI Stain

Typical Data - Black Cyclopure 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

contd >

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 ⁹	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 caliber 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.

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.



Membrane Filter Holders

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 (cm²)	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

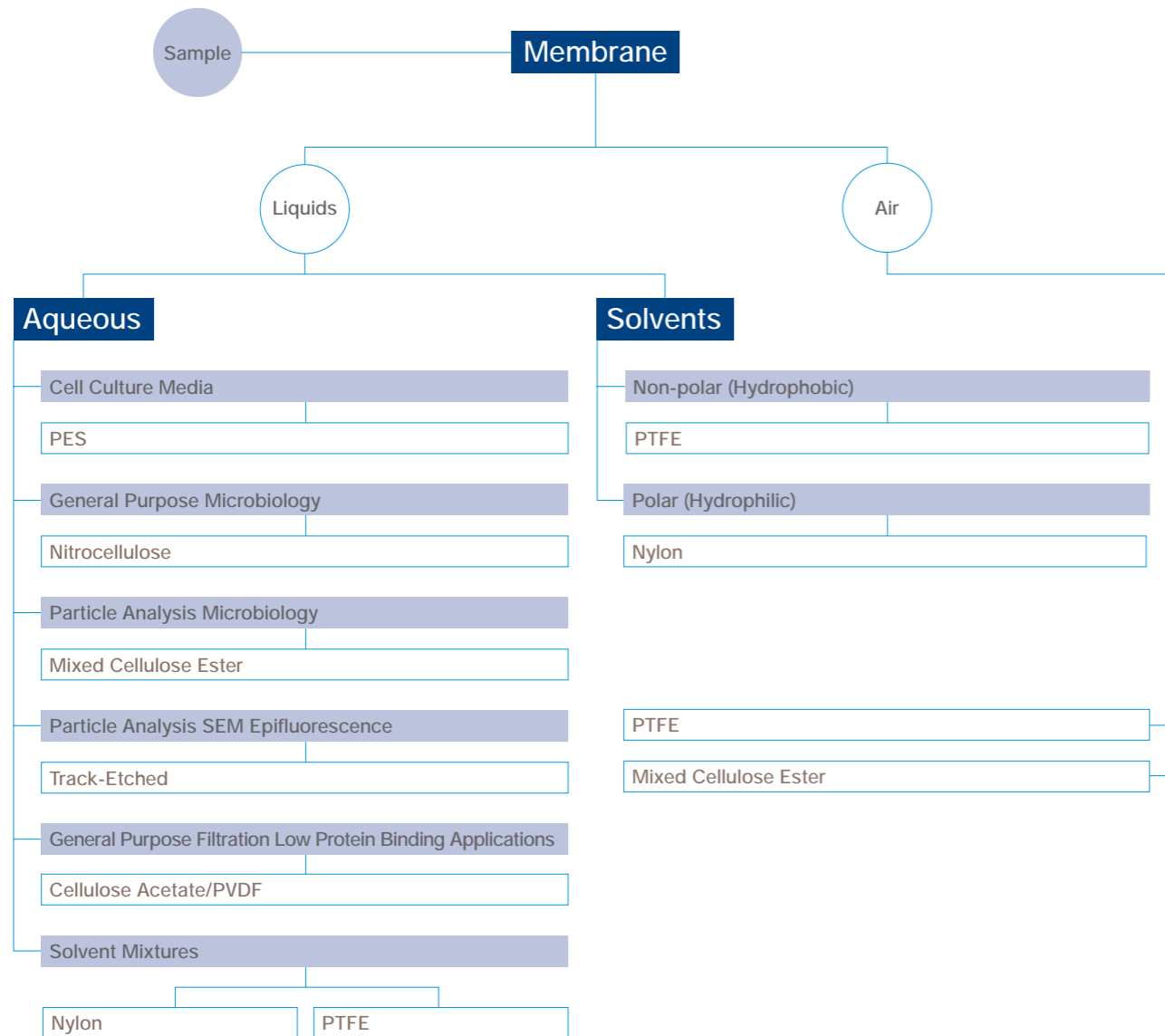
Above items available on special order in Europe, South America, Africa and the Middle East

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 -	0.2, 0.4, 1.0	25	-	Cyclopore
	Polyethylene terephthalate				Nuclepore
Cellulose Membranes	Polycarbonate - (4, 4 hydroxydiphenyl-2, 2'-propane)	0.015, 0.03, 0.05, 0.08,	13, 25, 37,	8 x 10 mm	
		0.1, 0.2, 0.4, 0.6, 0.8,	47, 50, 76,	19 x 42 mm	
	1.0, 2.0, 3.0, 5.0, 8.0, 10.0, 12.0	90, 142	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.

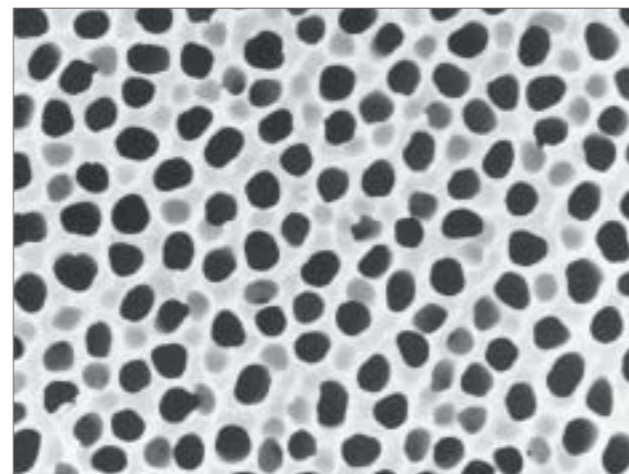
Anopore is available in 3 nominal pore sizes: 0.02 µm, 0.1 µm and 0.2 µm and in 3 diameters: 13 mm, 25 mm and 47 mm.

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