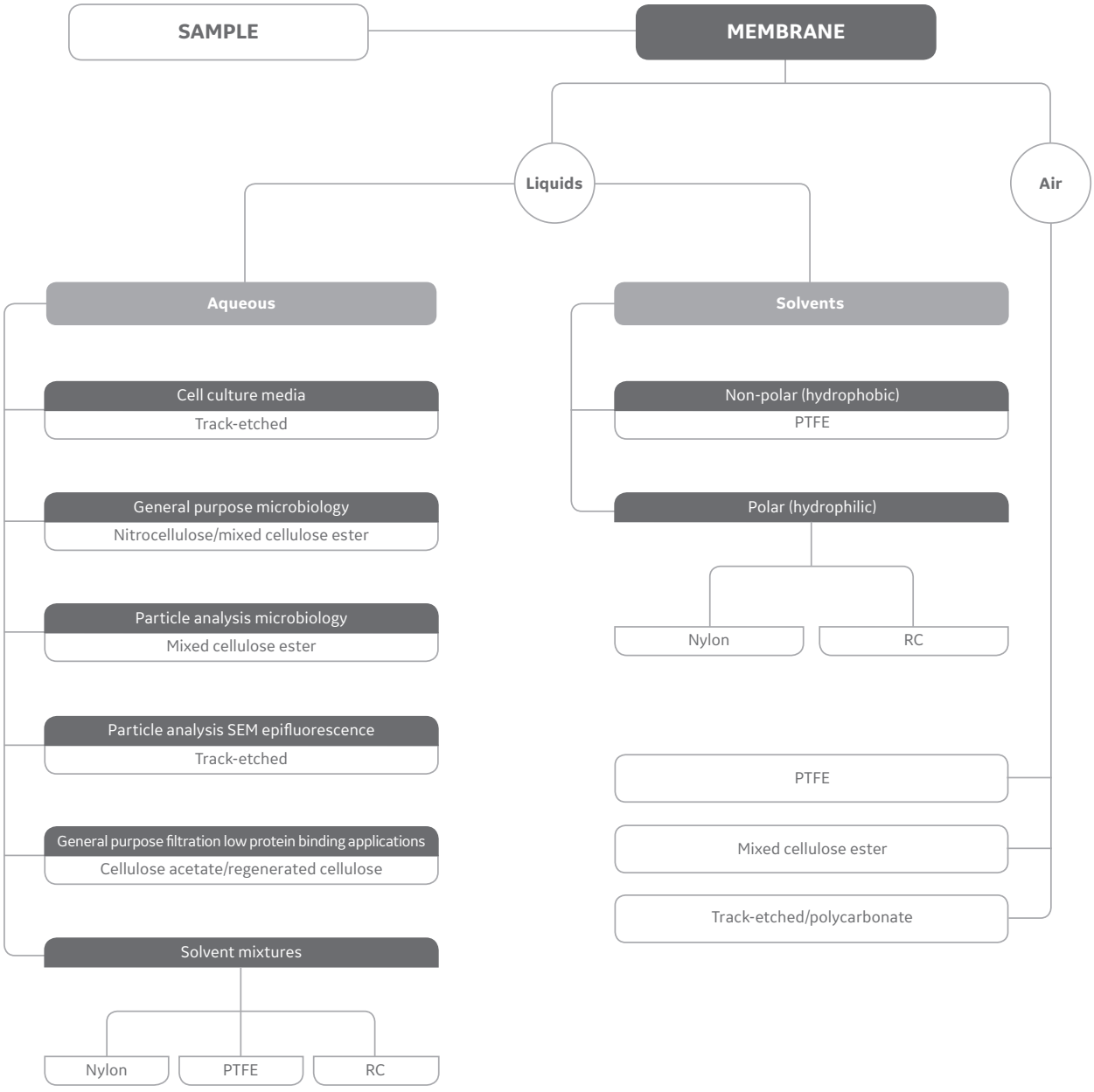
Membrane filters

Whatman membrane filters offer accurately controlled pore size distribution and higher strength and flexibility, ensuring reproducibility and consistency. Available in a range of pore sizes and formats including sterile and autoclave packs and colored and gridded forms for specialized applications.

Quick pick reference chart



Track-etched polycarbonate membranes

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

These membranes include Cyclopore™ polycarbonate, Nuclepore™ polycarbonate, chemotaxis membranes, black polycarbonate, and polycarbonate membranes for cell culture.

Cyclopore polycarbonate 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.

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 nonspecific protein binding.

The polycarbonate membranes are hydrophilic and are available in a choice of diameters and pore sizes.

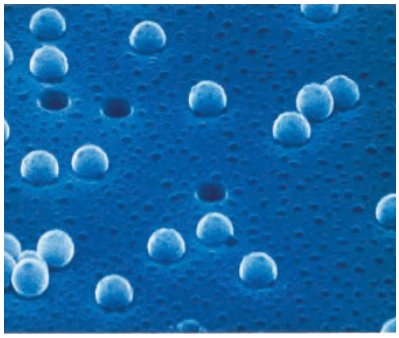
Features and benefits

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

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 plasmapheresis, chemotaxis, cytology, and cell culture

Cyclopore PC Polycarbonate Membrane Filters



Microscope image of the surface area of Cyclopore PC Polycarbonate Membrane Filters

- **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 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.
- **Healthcare**
  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)

Typical properties—Cyclopore polycarbonate membranes

Thickness	7–20 µm
Weight	0.7–2.0 mg/cm^2
Maximum service temperature	140°C
Porosity (void volume)	4–20%
Ash weight	0.6 µg/cm^2
Pore density	1 × 10^5—6 × 10^8 pores/cm^2
Opacity	Translucent*
Autoclavable	30 minutes at 121°C
Specific gravity	1.21 g/cm^2
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert

* *Transparent also available as Special Clear*

Ordering information—Cyclopore polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
13	0.4	7060-1304	Polycarbonate	100
25	0.1	7060-2501	Polycarbonate	100
25	0.2	7060-2502	Polycarbonate	100
25	0.4	7060-2504	Polycarbonate	100
25	2.0	7060-2511	Polycarbonate	100
25	5.0	7060-2513	Polycarbonate	100
25	5.0	7062-2513	Polycarbonate, clear	100
25	8.0	7060-2514	Polycarbonate	100
25	12.0	7060-2516	Polycarbonate	100
47	0.1	7060-4701	Polycarbonate	100
47	0.2	7060-4702	Polycarbonate	100
47	0.4	7060-4704	Polycarbonate	100
47	1.0	7060-4710	Polycarbonate*	100
47	1.0	7091-4710	Polycarbonate, thin clear	100
47	3.0	7060-4712	Polycarbonate	100
47	5.0	7060-4713	Polycarbonate	100
47	8.0	7060-4714	Polycarbonate	100
47	10.0	7060-4715	Polycarbonate	100
47	12.0	7060-4716	Polycarbonate	100

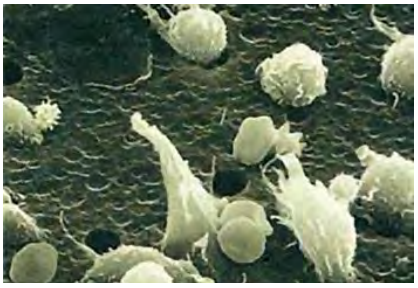
* *Transparent also available as Special Clear*

Cell culture and chemotaxis applications

Whatman 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 membranes

Ordering information—cell culture polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Surface	Quantity/pack
13	3.0	110412	Standard	100
13	5.0	110413	Standard	100
13	5.0	150445	PVP-free	100
13	8.0	110414	Standard	100
13	8.0	150446	PVP-free	100
25	2.0	110611	Standard	100
25	3.0	110612	Standard	100
25	5.0	110613	Standard	100
25	8.0	110614	Standard	100
25 × 80	5.0	155845	PVP-free	100

Nuclepore polycarbonate 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, minimizing 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
- eDNA
- EPA testing
- Fuel testing
- Bioassays
- Parasitology
- Air analysis
- Water microbiology

Nuclepore Polycarbonate Membranes

Typical properties—Nuclepore polycarbonate membranes

Thickness	7-22 µm
Rated pore size	0.015 µm–15 µm
Rated pore density	1×10^5–6×10^5 pores/cm
Surface texture	Flat and smooth
Opacity	Translucent
Hydrophobic/hydrophilic	Both
Fiber releasing	No

Ordering information—Nuclepore polycarbonate membrane circles

Dimensions (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
Filter circles				
13	0.015	110401	Polycarbonate	100
13	0.1	110405	Polycarbonate	100
13	0.2	110406	Polycarbonate	100
13	0.4	110407	Polycarbonate	100
13	0.8	110409	Polycarbonate	100
13	1.0	110410	Polycarbonate	100
13	3.0	110412	Polycarbonate	100
13	5.0	110413	Polycarbonate	100
13	8.0	110414	Polycarbonate	100
13	8.0	150446	Polycarbonate PVP-free*	100
13	10.0	110415	Polycarbonate	100
13	12.0	110416	Polycarbonate	100
19	0.03	800307	Polycarbonate	100
19	0.05	800308	Polycarbonate	100
19	0.1	800309	Polycarbonate	100
19	0.2	800281	Polycarbonate	100
19	0.4	800282	Polycarbonate	100
19	0.8	800284	Polycarbonate	100
19	1.0	800319	Polycarbonate	100
25	0.015	110601	Polycarbonate	100
25	0.03	110602	Polycarbonate	100
25	0.05	110603	Polycarbonate	100

* *PVP-free—hydrophobic*

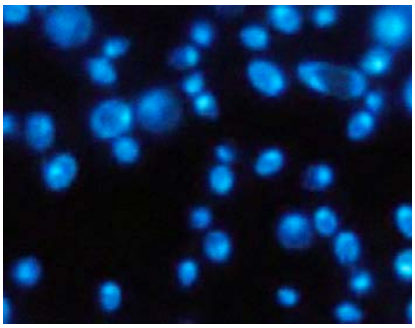
Ordering information—Nuclepore polycarbonate membrane circles (*continuation*)

Dimensions (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
Filter circles				
25	0.08	110604	Polycarbonate	100
25	0.1	110605	Polycarbonate	100
25	0.2	110606	Polycarbonate	100
25	0.4	110607	Polycarbonate	100
25	0.6	110608	Polycarbonate	100
25	0.8	110609	Polycarbonate	100
25	1.0	110610	Polycarbonate	100
25	2.0	110611	Polycarbonate	100
25	3.0	110612	Polycarbonate	100
25	5.0	110613	Polycarbonate	100
25	8.0	110614	Polycarbonate	100
25	10.0	110615	Polycarbonate	100
25	12.0	110616	Polycarbonate	100
25	0.4	110637	Polycarbonate AOX†	100
37	0.8	110809	Polycarbonate	100
47	0.015	111101	Polycarbonate	100
47	0.05	111103	Polycarbonate	100
47	0.08	111104	Polycarbonate	100
47	0.1	111105	Polycarbonate	100
47	0.2	111106	Polycarbonate	100
47	0.4	111107	Polycarbonate	100
47	0.6	111108	Polycarbonate	100
47	0.8	111109	Polycarbonate	100
47	1.0	111110	Polycarbonate	100
47	2.0	111111	Polycarbonate	100
47	3.0	111112	Polycarbonate	100
47	5.0	111113	Polycarbonate	100
47	8.0	111114	Polycarbonate	100
47	10.0	111115	Polycarbonate	100
47	12.0	111116	Polycarbonate	100
47	0.4	111137	Polycarbonate AOX†	100
50	0.2	111206	Polycarbonate	100
50	0.4	111207	Polycarbonate	100
50	5.0	111213	Polycarbonate	100
50	12.0	111216	Polycarbonate	100
76	0.05	111503	Polycarbonate	100
90	0.05	111703	Polycarbonate	25
90	0.1	111705	Polycarbonate	25
90	0.2	111706	Polycarbonate	25
90	0.4	111707	Polycarbonate	25
90	1.0	111710	Polycarbonate	25
90	2.0	111711	Polycarbonate	25
90	3.0	111712	Polycarbonate	25
142	0.08	112104	Polycarbonate	25
142	0.1	112105	Polycarbonate	25
142	0.2	112106	Polycarbonate	25
142	1.0	112110	Polycarbonate	25
293	1.0	112810	Polycarbonate	25
Filter sheets				
8 × 10”	0.03	113502	Polycarbonate	25
8 × 10”	0.2	113506	Polycarbonate	25
19 × 42 mm	5.0	113313	Polycarbonate	100

† *AOX—suitable for AOX (Absorbable Organic Halogens) analysis*

Cyclopore black polycarbonate membranes

Black Cyclopore membranes are excellent for epifluorescence and other microscopy applications requiring a contrasting background. The polycarbonate membrane is used to filter the sample and is then used directly for analysis. The dark membrane gives lower background fluorescence and improves the sensitivity of the test.



Yeast cells on Black Cyclopore with DAPI Stain

Typical properties—Cyclopore black polycarbonate membranes

Thickness	7-20 µm
Weight	0.7-2.0 mg/cm^2
Maximum service temperature	140°C
Porosity (void volume)	13%
Ash weight	20.6 µg/cm^2
Pore density	1 × 10^5—6 × 10^8 pores/cm^2
Autoclavable	30 minutes at 121°C
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert

Cyclopore PC Polycarbonate Black Membrane Filters

Ordering information—Cyclopore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	7063-2502	Polycarbonate	100
25	0.4	7063-2504	Polycarbonate	100
47	0.2	7063-4702	Polycarbonate	100

Nuclepore black polycarbonate membranes

Membranes for use with epifluorescence microscopy

Nuclepore black dyed polycarbonate membranes are high performance membranes 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 nonviable 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.

Nuclepore Polycarbonate Membranes—Black

Features and benefits

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

Applications

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

Typical properties—Nuclepore black polycarbonate membrane circles

Thickness	7-22 µm
Rated pore size	0.015 µm—15 µm
Rated pore density	1×10^5–6×10^5 pores/cm
Surface texture	Flat and smooth
Opacity	Translucent
Hydrophobic/hydrophilic	Both
Fiber releasing	No

Ordering information—Nuclepore black polycarbonate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
25	0.2	110656	Polycarbonate	100
25	0.4	110657	Polycarbonate	100
25	0.8	110659	Polycarbonate	100
47	0.2	111156	Polycarbonate	100

Anopore™ inorganic membranes

The Anopore inorganic membrane (Anodisc™) is excellent for a wide range of laboratory filtration applications. This material has a precise, nondeformable honeycomb pore structure, with no lateral crossover 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 nontoxic, 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 removes 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 three nominal pore sizes: 0.02 µm, 0.1 µm and 0.2 µm and in three diameters: 13 mm, 25 mm and 47 mm.

Features and benefits

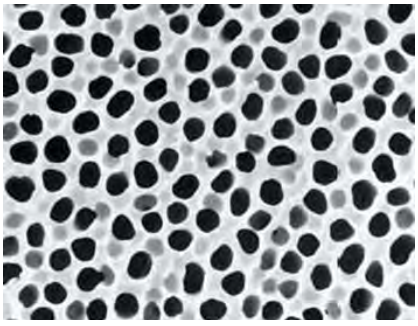
- High pore density and narrow pore size distribution make it an extremely precise membrane
- Wide solvent compatibility reduces the need to stock a variety of membranes in the laboratory
- Minimizes additives used in the manufacturing process ensures minimal extractables and no sample contamination
- Extremely low protein binding minimizes sample loss
- Virtually transparent when wet, making it suitable 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 Circle with Support Ring

Anopore Inorganic Membranes Without Support Ring



Anodisc pore structure

Typical properties—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	N/A	Thermal weld	Thermal weld
Protein adsorption	Low	Low	Low
Burst strength	65-110 psi	–	–
Maximum service temperature	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 membrane circles (Anodisc)

Diameter (mm)	Membrane	Pore size (µm)	Catalog number	Hydrophilic	Protein binding	Ssolvent 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	6809-5502	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	6809-5522	Yes	Low	Very good	50
47	Anodisc 47	0.2	6809-5022	Yes	Low	Very good	50

* *Without support ring*

Anopore Inorganic Membranes Without Support Ring

Cellulosic membranes

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 with low protein binding
- Sterilizable by all common methods
- Low extractable levels to minimize sample contamination

Regenerated Cellulose Membrane Filter Circles

Typical properties—regenerated cellulose membranes

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Air flow rate Δp = 3 mbar (s/100 mL)	Bubble point (bar)
RC 58	0.2	75	14	–	3.7
RC 55	0.45	75	26	–	3.5
RC 60	1.0	70	3	12.5	0.8

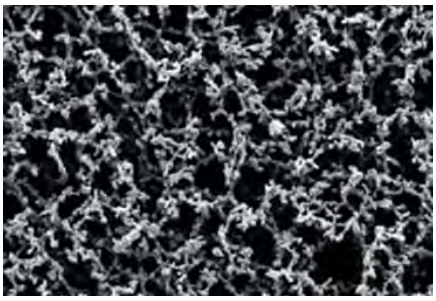
Ordering information—regenerated cellulose membrane circles

Dimensions (mm)	Membrane type	Pore size (µm)	Catalog number	Quantity/pack
Filter circles				
25	RC 55	0.45	10410206	100
47	RC 55	0.45	10410212	100
50	RC 55	0.45	10410214	100
100	RC 55	0.45	10410219	25
110	RC 55	0.45	10410224	25
142	RC 55	0.45	10410229	25
47	RC 58	0.2	10410312	100
50	RC 58	0.2	10410314	100
100	RC 58	0.2	10410319	25
47	RC 60	1	10410012	100
50	RC 60	1	10410014	100
Filter sheets				
300 × 600	RC 58	0.2	10410380	5

Cellulose acetate membranes

Whatman cellulose acetate membranes are made from pure cellulose acetate, making them suitable 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

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Bubble point (psi)	Bubble point (bar)
OE 66	0.2	115	26	58	4
OE 67	0.45	115	12	44.95	3.1
ST 68	0.8	140	16	21.75	1.5
ST 69	1.2	140	12	13.05	0.9
WCA	0.2	–	12	–	–

Ordering information—cellulose acetate membranes

Dimensions (mm)	Membrane type	Pore size (µm)	Catalog number	Quantity/pack
Filter circles				
25	OE 66	0.2	10404106	100
47	OE 66	0.2	10404112	100
47	OE 66	0.2	10404170*	100
50	OE 66	0.2	10404114	100
110	OE 66	0.2	10404126	50
142	OE 66	0.2	10404131	25
293	OE 66	0.2	10404139	25
13	OE 67	0.45	10404001	100
25	OE 67	0.45	10404006	100
47	OE 67	0.45	10404012	100
50	OE 67	0.45	10404014	100
85	OE 67	0.45	10404044	50
110	OE 67	0.45	10404026	50
142	OE 67	0.45	10404031	25
47	ST 68	0.8	10403112	100
47	ST 69	1.2	10403012	100
25	WCA	0.45	7000-0002	100
Filter sheets				
300 × 600	OE 66	0.2	10404180	5

* *Sterile*

Cellulose nitrate membranes

Recommended for the majority of routine applications, this membrane is manufactured under strictly controlled conditions. The user will benefit from recent performance improvements to Whatman membrane filters, including very narrow pore size distribution and low levels of extractables.

Higher strength and flexibility

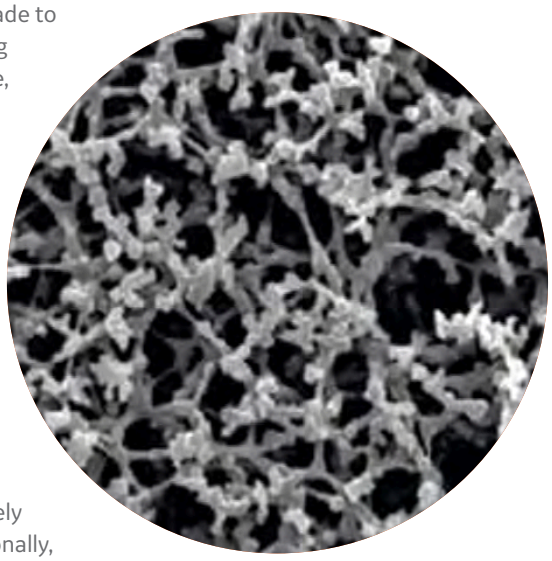
Most membranes are inherently brittle and difficult to handle; it is not uncommon for filters to be damaged during loading into holders or while in use. Whatman cellulose nitrate membrane filters have a noticeably improved flexibility and are made to tolerate abuse during handling, loading and autoclaving 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 and 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 managed due to the advanced manufacturing and control system. Additionally, the batch-to-batch variation is minimized, providing more consistent laboratory results.



Cellulose acetate membrane (Type ST 68, 0.8 µm)

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

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 12.0 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.

Gridded filters

Gridded filters make it easier to count particles, microorganisms and colonies. If a gridded membrane is required, please see mixed cellulose ester membranes.

Typical properties—cellulose nitrate membranes

Thickness	105–140 µm
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	1.0
Particle removal	5.0
Water microbiology and analysis	
Bacterial colony count	0.45 (gridded)—see mixed cellulose ester membranes
Sediment analysis	0.45
Suspended particles	5.0
Air pollution monitoring	
Asbestos monitoring (NiOsH)	0.8
Food and beverage QC	
E. coli and coliforms	0.45 (gridded)—see mixed cellulose ester membranes
Total bacteria count	0.2
Tissue culture	
Mycoplasma removal	0.1
Sterile[#] filtration	0.2

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Ordering information—cellulose nitrate membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
13	0.2	7182-001	Plain (white)	100
13	0.45	7184-001	Plain (white)	100
25	0.1	7181-002	Plain (white)	100
25	0.2	7182-002	Plain (white)	100
25	0.45	10401106	Plain (white)	100
25	0.45	7184-002	Plain (white)	100
25	0.8	7188-002	Plain (white)	100
25	1.0	7190-002	Plain (white)	100
25	3.0	7193-002	Plain (white)	100
25	5.0	7195-002	Plain (white)	100
25	5.0	10400206	Plain (white)	100
25	8.0	10400106	Plain (white)	100
37	0.8	7188-003	Plain (white)	100
47	0.1	7181-004	Plain (white)	100
47	0.1	10402012	Plain (white)	100
47	0.2	7182-004	Plain (white)	100
47	0.2	10401312	Plain (white)	100
47	0.2	10401320	Plain (white)	50
47	0.45	7184-004	Plain (white)	100
47	0.45	10401170	Plain (white), sterile	100
47	0.45	10401112	Plain (white)	100
47	0.65	7186-004	Plain (white)	100
47	0.8	7188-004	Plain (white)	100
47	1.0	7190-004	Plain (white)	100
47	3.0	7193-004	Plain (white)	100
47	5.0	7195-004	Plain (white)	100
47	5.0	10400212	Plain (white)	100
47	8.0	10400112	Plain (white)	100
47	12.0	10400012	Plain (white)	100
50	0.1	10402014	Plain (white)	100
50	0.2	10401314	Plain (white)	100
50	0.45	10401114	Plain (white)	100
50	0.45	7184-005	Plain (white)	100
50	1.2	7191-005	Plain (white)	100
50	5.0	10400214	Plain (white)	100
50	8.0	10400114	Plain (white)	100
50	8.0	10405079	Plain (white), with hydrophobic rim	100
50	12.0	10400014	Plain (white)	100
85	0.45	10401122	Plain (white)	50
90	0.2	7182-009	Plain (white)	25
90	0.45	10401118	Plain (white)	50
90	0.45	7184-009	Plain (white)	25
90	0.8	7188-009	Plain (white)	25
90	5.0	7195-009	Plain (white)	25
100	0.45	10401121	Plain (white)	50
110	0.45	10401126	Plain (white)	50
142	0.2	7182-014	Plain (white)	25
142	0.45	7184-014	Plain (white)	25
142	0.45	10401131	Plain (white)	25
142	1.2	7191-014	Plain (white)	25

Mixed cellulose ester membranes

Whatman mixed cellulose ester membranes are composed of cellulose acetate and cellulose nitrate. 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. The ME range has a lower cellulose acetate content compared to the WME range of membranes.

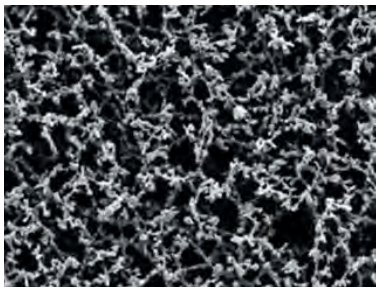
Eased counting process

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 or 5 mm intervals. The special ink used is nontoxic 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.



Mixed cellulose ester membrane

Sterile filters

For those laboratories preferring to use membranes sterilized by autoclaving for microbiological work, Whatman black gridded membranes are available 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 nontoxic and do not inhibit bacterial growth, ensuring sample integrity
- Black plain and black gridded membranes have a mix of cellulose nitrate and cellulose acetate
- The membrane offers a high degree of internal surface area for greater adsorption of product
- Higher dirt loading capacity
- 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:

- Cytology
- HPLC samples (aqueous)
- Biological assays
- Food microbiology, including enumeration of E. coli in foods
- Bacteriological studies
- Particle counting from liquids and aerosols
- Yeasts and molds

MembraClear

The MembraClear PCM filter is designed for asbestos sampling using the membrane filter method for phase contrast microscopy. Asbestos sampling isolates these fibers from circulating air to determine concentrations.

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Typical properties—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 resistance	Medium
Protein binding	Medium

Product selection—mixed cellulose ester membranes

Membrane type	Pore size (µm)	Thickness (µm)	Water flow rate Δp = 0.9 bar (s/100 mL/12.5 cm^2)	Air flow rate Δp = 3 mbar (s/100 mL)	Bubble point (psi)	Bubble point (bar)
WME product range		140	–	–	–	–
ME product range						
ME 24	0.2	135	20	–	53.65	3.7
ME 25	0.45	145	12.5	–	40.6	2.8
ME 26	0.6	135	48	21	27.55	1.9
ME 27	0.8	140	2.8	11.6	18.85	1.3
ME 28	1.2	140	2	9.3	11.6	0.8
ME 29	3	150	1.2	6.7	10.15	0.7

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

Ordering information—mixed cellulose ester membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
ME range—ME 24, plain				
25	0.2	10401706	Plain	100
47	0.2	10401712	Plain	100
47	0.2	10401770	Plain	100
50	0.2	10401714	Plain	100
50	0.2	10401772	Plain, sterile	100
100	0.2	10401721	Plain	50
110	0.2	10401726	Plain	50
142	0.2	10401731	Plain	25
ME range—ME 25, plain				
25	0.45	10401606	Plain	100
47	0.45	10401612	Plain	100
47	0.45	10401670	Plain	100
50	0.45	10401614	Plain	100
50	0.45	10401672	Plain	100
50	0.45	10401662	Plain, without interleaving paper	100
50	0.45	10401664	Plain, low C	100
90	0.45	10401618	Plain	50
100	0.45	10401621	Plain	50
110	0.45	10401626	Plain	50
142	0.45	10401631	Plain	25
ME range—ME 26, plain				
25	0.6	10401506	Plain	100
47	0.6	10401512	Plain	100
50	0.6	10401514	Plain	100
ME range—ME 27, plain				
25	0.8	10400906	Plain	100
37	0.8	10400909	Plain	100
47	0.8	10400912	Plain	100
50	0.8	10400914	Plain	100
100	0.8	10400921	Plain	50

Ordering information—mixed cellulose ester membrane circles *(continuation)*

Diameter (mm)	Pore size (µm)	Catalog number	Description	Quantity/pack
ME range—ME 28, plain				
25	1.2	10400806	Plain	100
47	1.2	10400812	Plain	100
50	1.2	10400814	Plain	100
100	1.2	10400821	Plain	50
ME range—ME 29, plain				
25	3	10400706	Plain	100
47	3	10400712	Plain	100
50	3	10400714	Plain	100
50	3	10400772	Plain, sterile	100
ME range—ME 24, gridded				
47	0.2	10406970	White/black grid 3.1 mm, sterile	100
47	0.2	10408712	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
50	0.2	10406972	White/black grid 3.1 mm, sterile	100
50	0.2	10408714	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
ME range—ME 25, gridded				
47	0.45	10406812	White/black grid 3.1 mm	100
47	0.45	10407970	White/black grid 3.1 mm, sterile	100
47	0.45	10406871	White/black grid 3.1 mm, sterile	1000
47	0.45	10406512	White/black grid 5 mm	100
47	0.45	10409770	Black/white grid 3.1 mm, sterile	100
47	0.45	10409771	Black/white grid 3.1 mm, sterile	1000
47	0.45	10409414	Green/black grid 3.1 mm	1000
50	0.45	10406814	White/black grid 3.1 mm	100
50	0.45	10406572	White/black grid 5 mm, sterile	100
50	0.45	10409714	Black/white grid 3.1 mm	100
50	0.45	10409772	Black/white grid 3.1 mm, sterile	100
ME range—ME 25 Select, gridded				
47	0.45	10406800	White/black grid 3.1 mm, sterile, single packed	100
47	0.45	10406803	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
50	0.45	10406801	White/black grid 3.1 mm, sterile, single packed	100
50	0.45	10406802	White/black grid 3.1 mm, sterile, for Membrane-Butler	400
ME range—ME 26, gridded				
50	0.6	10409814	Black/white grid 3.1 mm	100
ME range—ME 27, gridded				
47	0.8	10408970	White/black grid 3.1 mm, sterile	100
47	0.8	10409970	White/black grid 3.1 mm with pad, sterile	100
50	0.8	10405672	Green/black grid 3.1 mm, sterile	100
ME range—ME 28, gridded				
50	1.2	10408472	Green/black grid 3.1 mm, sterile	100
WME range, gridded				
25	0.8	7148-002	White/black grid 3.1 mm	100
47	0.45	7140-104	Plain, sterile, individually packed, with pad	100
47	0.2	7187-114	White/black grid 3.1 mm, sterile, individually packed, without pad	100
47	0.45	7141-004	White/black grid 3.1 mm	100
47	0.45	7141-104	White/black grid 3.1 mm, sterile	100
47	0.45	7141-114	White/black grid 3.1 mm, sterile, individually packed, without pad	100
47	0.45	7141-124	White/black grid 3.1 mm, sterile, individually packed, without pad	200
47	0.45	7141-154	White/black grid 3.1 mm, sterile, individually packed, without pad	1000
47	0.45	7141-204	White/black grid 3.1 mm, autoclave pack	100
47	0.45	7153-104	Black/white grid 3.1 mm, sterile, individually packed, with pad	100
MembraClear				
25	–	7141-025	Plain	100
47	–	7141-047	Plain	100

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 nonwoven polypropylene support web for improved strength and handling, and can be used at temperatures up to 120°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 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, where a 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 and pore sizes of 0.2 µm and 0.5 µm are generally used. Sterile[#] venting of vacuum manifolds, fermentation vessels, and sterile filtrate tanks and containers utilize PTFE 0.2 µm membranes.

WTP and TE membrane ranges

WTP membranes use a polypropylene grid as the support material whereas the TE range uses a randomly arranged polypropylene support material.

PFTE Membrane Filters—TE Range

Typical properties—PTFE membranes

Membrane type	Nominal thickness (µm)	Porosity (%)	Liquid flow rate Δp = 0.9 bar (s/100 mL/12.5 cm²)	Liquid flow rate @ 10 psi vacuum (mL/min/cm²)	Air flow rate Δp = 3 mbar (s/100 mL)	Air flow rate @ 10 psi vacuum (L/min/cm²)	Bubble point (psi)	Bubble point (bar †)	Max. temp. (°C)
TE range									
0.2 µm (TE 35)	240	–	24*	–	70	–	1.29	18.8	100
0.45 µm (TE 36)	220	–	12*	–	60	–	0.89	13	100
1.0 µm (TE 37)	275	–	5.4*	–	24	–	0.24	3.5	100
5.0 µm (TE 38)	265	–	2.2*	–	3.5	–	0.19	2.9	100
WTP range									
0.2 µm	130	72	–	61.4**	–	4.5	0.89	13	120
0.5 µm	120	74	–	110**	–	7.5	0.41	6	120
1.0 µm	90	76	–	445**	–	17	0.21	3	120

* *Measured with ethanol*
** *Measured with acetone*
† *Measured using 2-propanol*

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*

Ordering information—PTFE membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Quantity/pack
WTP range			
25	0.2	7582-002	100
25	1.0	7590-002	100
47	0.2	7582-004	100
47	0.5	7585-004	100
47	1.0	7590-004	100
TE range—TE 35			
25	0.2	10411405	50
47	0.2	10411411	50
50	0.2	10411413	50
TE range—TE 36			
25	0.45	10411305	50
47	0.45	10411311	50
50	0.45	10411313	50
TE range—TE 37			
25	1.0	10411205	50
47	1.0	10411211	50
50	1.0	10411213	50
TE range—TE 38			
37	5.0	10411108	50
47	5.0	10411111	50
50	5.0	10411113	50
90	5.0	10411116	25
150	5.0	10411130	25

PM 2.5 air monitoring membrane

A high-purity, thin PTFE membrane in a sequentially numbered, chemically resistant polypropylene support ring for PM 2.5 ambient air monitoring. Whatman PM 2.5 membranes have low tare mass for accurate gravimetric determinations. The thermally stable design prevents 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 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) offered for sale have been tested as specified 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)

PM2.5 Air Monitoring Membrane Filters

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 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 filter)
- Maximum moisture pickup
- 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 nonuniformity or any other obvious filter defect.

Every manufactured lot that is offered for sale, and is identified for use with the PM2.5 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
Filter media	N/A	N/A	PTFE	–
Filter thickness	–	µm	40	± 10
Filter diameter	Template	mm	46.2	± 0.25
Filter pore size	ASTM f 316-94	µm	2.0	Maximum
Support ring media	N/A	N/A	Polypropylene	–
Total support ring thickness	–	mm	0.38	± 0.04
Support ring width	Template	mm	3.68	± 0.00—0.51
Particle retention (0.3 µm)	ASTM D 2986-95a	%	99.7	Minimum
Pressure drop (0.3 µm) @ 16.67 L/min	ASTM D 2986-95a	cm water	30	Maximum
Alkalinity	Section 2.12 EPA/600/R-94/038b	µeq/g of filter	< 25	Maximum
Temperature weight loss stability	As above	µg	< 20	Maximum
Drop test weight loss stability	As above	µg	< 20	Maximum
Moisture weight gain stability	As above	µg	< 10	Maximum

Maximum trace element concentration by X-ray fluorescence

Ion	ng/cm²	Ion	ng/cm²	ion	ng/cm²	Ion	ng/cm²	Ion	ng/cm²	Ion	ng/cm²
Al	94.4	Sc	7.2	Ni	3.0	Br	2.0	Pd	9.6	Cs	25
Si	32.8	ti	13.8	Cu	2.8	Rb	2.0	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	3.0	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	4.0	Se	1.6	Rh	9.4	I	18.6	Pb	4.8

Ordering information—PM 2.5 air monitoring membrane circles

Diameter (mm)	Catalog number	Description	Quantity/pack
46.2	7592-104	With support ring, sequentially numbered	50

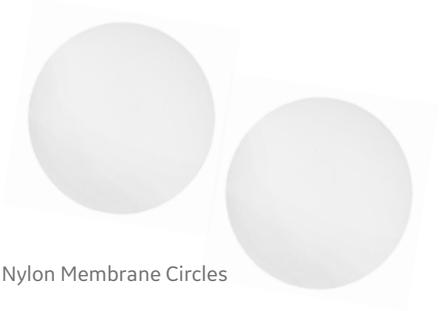
Nylon nembranes

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, removing 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 135°C.

Applications

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



Nylon Membrane Circles

Typical properties—nylon membranes

Pore size (µm)	Thickness (µm)	Fiber releasing	Water flow rate @ 5 psi	Bubble point (psi)	Maximum temperature (°C)
0.2	150-187	No	> 50 mL/min	40-49	135
0.45	150-187	No	> 60 mL/min	34-42	135
0.8	137-200	No	> 180 mL/min	> 13	135
1.0	–	–	–	–	135

Ordering information—nylon membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Quantity/pack
13	0.2	7402-001	100
13	0.45	7404-001	100
25	0.2	7402-002	100
25	0.45	7404-002	100
47	0.2	7402-004	100
47	0.45	7404-004	100
47	0.8	7408-004	100
47	1.0	7410-004	100
90	0.2	7402-009	50
90	0.45	7404-009	50

Polyamide membranes

Whatman polyamide membranes are made from pure polyamide, making them the recommended 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, and can be used up to 135°C.

Applications

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

Polyamide Membrane Circles

Typical properties—polyamide membranes

Pore size (µm)	Nominal thickness (µm)	Water flow rate Δp = 0.9 bar (mL/min/cm²)	Air flow rate Δp = 3 mbar (bar) (mL/min/cm²)	Bubble point (bar)	Maximum temperature (°C)
0.2 (NL 16)	110	10	10	4.2	135
0.45 (NL 17)	110	20	20	2.8	135

Ordering information—polyamide membrane circles

Diameter (mm)	Pore size (µm)	Catalog number	Membrane type	Quantity/pack
25	0.2	10414006	NL 16	100
25	0.45	10414106	NL 17	100
47	0.2	10414012	NL 16	100
47	0.45	10414112	NL 17	100
50	0.2	10414014	NL 16	100
50	0.45	10414114	NL 17	100

[#] *Refers to sterilization by filtration for small sample use which is an industry term for filters of pore size 0.2 µm or smaller as referenced in guidance such as EPA Guidance for Industry Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice Section IX, Part B (September 2004).*