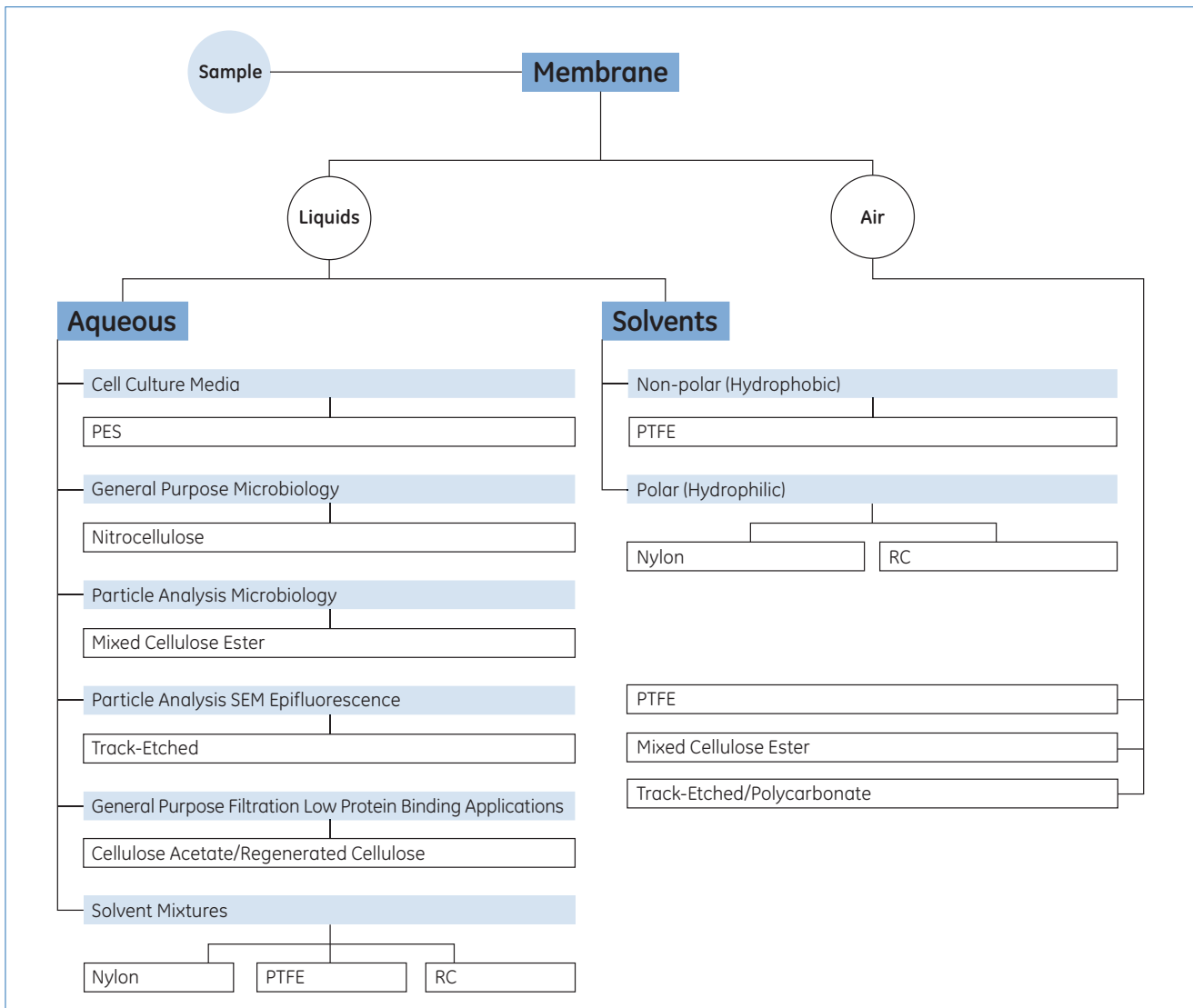


# Membrane Filters

Whatman brings to the laboratory user a range of membrane filters whose advanced technical specifications make 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 0.015 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



## Membranes

Membrane Type	Material	Pore Size* (µm)	Diameter (mm)	Rectangular	Brand Name
Track-Etched	Polyester (Polyethylene Terephthalate)	0.1, 0.2, 0.4, 1.0, 5.0	13, 25, 47	-	Cyclopore Nuclepore
-	Polycarbonate (4, 4-hydroxy-diphenyl-2, 2'-propane)	0.015, 0.03, 0.05, 0.08, 0.1, 0.2, 0.4, 0.6, 0.8, 1.0, 2.0, 3.0, 5.0, 8.0, 10.0, 12.0	13, 19, 25, 37, 47, 50, 76, 90, 142, 293	19 × 42 mm, 25 × 80 mm, 8 × 10 inches	-
Anopore	Aluminum Oxide	0.02, 0.1, 0.2	13, 25, 47	-	Anodisc
Cellulose based	Regenerated Cellulose	0.2, 0.45, 1.0	25, 47, 50, 100, 110, 142	300 × 600 mm	-
-	Cellulose Acetate	0.2, 0.45, 0.8, 1.2	13, 25, 47, 50, 85, 100, 110, 142, 293	300 × 600 mm	-
-	Cellulose Nitrate	0.025, 0.1, 0.2, 0.45, 0.65, 0.8, 1.0, 1.2, 3.0, 5.0, 8.0, 12.0	13, 25, 30, 37, 47, 50, 82, 90, 100, 110, 142, 150, 293	300 × 600 mm	-
-	Mixed Cellulose Ester (mixture of cellulose acetate and cellulose nitrate)	0.2, 0.45, 0.6, 0.8, 1.2, 3.0	25, 37, 47, 50, 90, 100, 110, 142	-	-
Polytetrafluoroethylene (PTFE)	Polytetrafluoroethylene	0.2, 0.45, 0.5, 1.0, 5.0	25, 37, 47, 50, 90, 150	-	-
Nylon (Polyamide)	Hexamethylenediamine; Nylon 66	0.2, 0.45, 0.8, 1.0	13, 25, 47, 50, 90, 142	-	-
Polyethersulfone (PES)	Polyethersulfone	0.8	47	-	-
Polypropylene	Polypropylene	0.2, 0.45	25, 47, 90	-	-
MembraClear	-	-	25, 37, 47	-	-

\* Not all pore sizes are available in all diameters

## 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.



Cyclopore track-etched membranes

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.

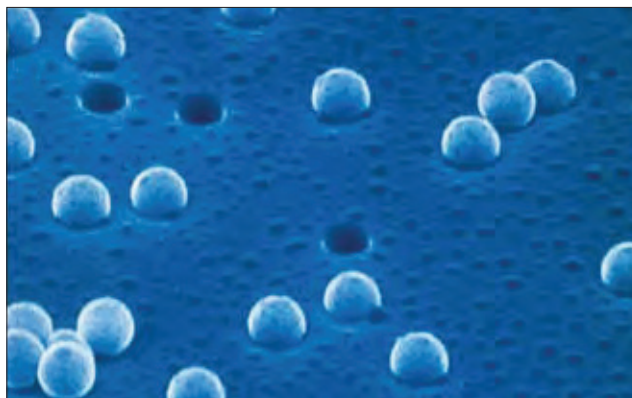
The polycarbonate membranes are hydrophilic and are available in a choice of diameters and pore sizes. The polyester membranes are resistant to most organic solvents, amides, and halogenated hydrocarbons. This broad chemical compatibility makes them suitable for the detection of particles in many corrosive 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; 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
- **General Filtration**  
Particulate and bacteria removal, cross flow filtration, HPLC sample preparation, and solution filtration



Electron micrograph of Cyclo-pore membrane with latex beads on surface

#### • 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.)

#### • 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.

*Transdermal drug delivery* – as an inert matrix for retention of therapeutics.

## Typical Data – Cyclopore Track-Etched Membranes

	Polycarbonate	Polyester
Thickness	7-20 $\mu\text{m}$	9-23 $\mu\text{m}$
Burst strength	> 10 psi	> 10 psi
Weight	0.7-2.0 $\text{mg}/\text{cm}^2$	0.9-2.3 $\text{mg}/\text{cm}^2$
Maximum service temperature	140°C	150°C
Porosity (void vol.)	4-20%	4-20%
Ash weight	0.6 $\mu\text{g}/\text{cm}^2$	2.3 $\mu\text{g}/\text{cm}^2$
Pore density	$1 \times 10^5 - 6 \times 10^8$ pores/ $\text{cm}^2$	$1 \times 10^5 - 6 \times 10^8$ pores/ $\text{cm}^2$
Opacity	Translucent*	Translucent
Autoclavable	30 minutes at 121°C	30 minutes at 121°C
Specific gravity	1.21 $\text{g}/\text{cm}^3$	1.39 $\text{g}/\text{cm}^3$
Flammability	Slow burn	Slow burn
Fiber releasing	No	No
Leachables	Negligible	Negligible
Biological compatibility	Inert	Inert

\* Transparent also available as Special Clear

## Ordering Information – Cyclopore Polycarbonate and Polyester Membrane Circles

Diameter (mm)	Pore Size ( $\mu\text{m}$ )	Catalog Number	Description	Quantity/Pack
<b>Standard Cyclopore</b>				
13	0.1	7060-1301	Polycarbonate	100
13	0.4	7060-1304	Polycarbonate	100
13	0.8	7060-1308	Polycarbonate	100
13	5.0	7061-1313	Polyester	100
25	0.1	7060-2501	Polycarbonate	100
25	0.2	7060-2502	Polycarbonate	100
25	0.2	7061-2502	Polyester	100
25	0.4	7060-2504	Polycarbonate	100
25	0.4	7061-2504	Polyester	100
25	0.6	7060-2506	Polycarbonate	100
25	0.8	7060-2508	Polycarbonate	100
25	1.0	7060-2510	Polycarbonate	100
25	1.0	7061-2510	Polyester	100
25	1.0	7091-2510	Polycarbonate, thin clear circles	100
25	2.0	7060-2511	Polycarbonate	100
25	5.0	7060-2513	Polycarbonate	100
25	5.0	7062-2513	Polycarbonate, clear circles	100
25	8.0	7060-2514	Polycarbonate	100
25	10.0	7060-2515	Polycarbonate	100
25	12.0	7060-2516	Polycarbonate	100

cont.

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>Standard Cyclopore</b>				
37	0.4	7060-3704	Polycarbonate	100
47	0.1	7060-4701	Polycarbonate	100
47	0.1	7061-4701	Polyester	100
47	0.2	7060-4702	Polycarbonate	100
47	0.2	7061-4702	Polyester	100
47	0.4	7060-4704	Polycarbonate	100
47	1.0	7060-4710	Polycarbonate*	100
47	1.0	7091-4710	Polycarbonate, thin clear circles	100
47	2.0	7060-4711	Polycarbonate	100
47	3.0	7060-4712	Polycarbonate	100
47	3.0	7062-4712	Polycarbonate, clear circles**	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
90	1.0	7060-9010	Polycarbonate	100

\* Special clear Cyclopore

\*\* Standard polycarbonate

## 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



## Ordering Information – Nuclepore Track-Etched Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>Circles</b>				
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	10.0	110415	Polycarbonate	100
13	8.0	150446	Polycarbonate PVP-free*	100
13	0.8	800195	Gold Coated PC	10
19	0.03	800307	Polycarbonate	100
19	0.05	800308	Polycarbonate	100
19	0.08	800280	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
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
25	0.4	170607	Gold Coated PC	50
25	0.8	117197	Gold Coated PC	50

\* PVP-free – hydrophobic

† AOX – suitable for AOX (Absorbable Organic Halogens) analysis

cont.

FILTER PAPERS AND MEMBRANES | TRACK-ETCHED PC AND PE MEMBRANES

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>Circles</b>				
37	0.4	110807	Polycarbonate	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
47	0.4	111130	Polycarbonate AERO**	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
76	0.1	111505	Polycarbonate	100
90	0.015	111701‡	Polycarbonate	25
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	0.4	112107	Polycarbonate	25
142	0.6	112108	Polycarbonate	25
142	1.0	112110	Polycarbonate	25
142	2.0	112111	Polycarbonate	25

\* PVP-free – hydrophobic

\*\* AERO – suitable for aerosol testing

† AOX – suitable for AOX (Absorbable Organic Halogens) analysis

‡ Product is only available in the Americas

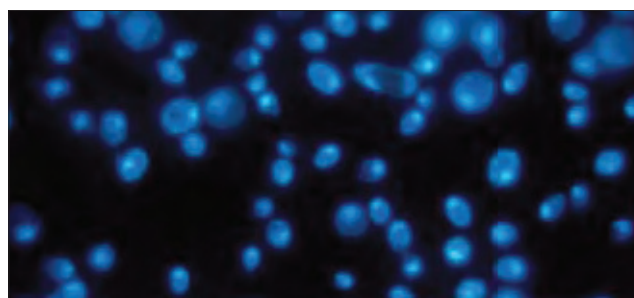
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Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>Circles</b>				
293	0.2	112806	Polycarbonate	25
293	0.4	112807	Polycarbonate	25
293	1.0	112810	Polycarbonate	25
293	2.0	112811	Polycarbonate	25
<b>Sheets</b>				
8 × 10"	0.03	113502	Polycarbonate	25
8 × 10"	0.2	113506	Polycarbonate	25
8 × 10"	5.0	113513	Polycarbonate	25
8 × 10"	12.0	113516	Polycarbonate	25
19 × 42"	5.0	113313	Polycarbonate	100
19 × 42"	8.0	113314	Polycarbonate	100
25 × 80"	8.0	155846	Polycarbonate PVP-free*	100

\* PVP-free - hydrophobic

## Black Cyclopore Membranes

Black Cyclopore 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 Cyclopore with DAPI Stain

### Typical Data – Black Cyclopore Membranes

	Black Polycarbonate
Thickness	7-20 µm
Burst strength	> 10 psi
Weight	0.7-2.0 mg/cm <sup>2</sup>
Maximum service temperature	140°C
Porosity (Void Vol.)	4-20%
Ash weight	20.6 µg/cm <sup>2</sup>
Pore density	1 × 10 <sup>5</sup> - 6 × 10 <sup>8</sup> pores/cm <sup>2</sup>
Opacity	N/A
Autoclavable	30 minutes at 121°C
Flammability	Slow burn
Fiber releasing	No
Leachables	Negligible
Biological compatibility	Inert



### Typical Properties – Black Cyclopore Membranes

Pore Size (µm)	Nominal Thickness (µm)	Mean Porosity (%)	Bubble Point in Water (bar)*	Burst Strength (bar)*
<b>Polycarbonate Microporous</b>				
0.2	20	13	4	> 1
0.4	20	15	2.2	> 1

\* 1 bar = 14.7 psi

### Ordering Information – Black Cyclopore Membranes

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
47	0.4	7063-4704	Polycarbonate	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 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.

#### Features and Benefits

- Polycarbonate track-etched membrane dyed black with Irgalan Black
- 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

### Ordering Information – Black Nuclepore 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
47	0.4	111157	Polycarbonate	100

## Hemafil Track-Etched Polycarbonate Membranes

Whatman Hemafil™ track-etched polycarbonate membranes, part of the Whatman range 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 diameter due to their ability to deform.

### Ordering Information - Hemafil Track-Etched Polycarbonate Membranes

Diameter (mm)	Catalog Number	Quantity/Pack
13	110424	100

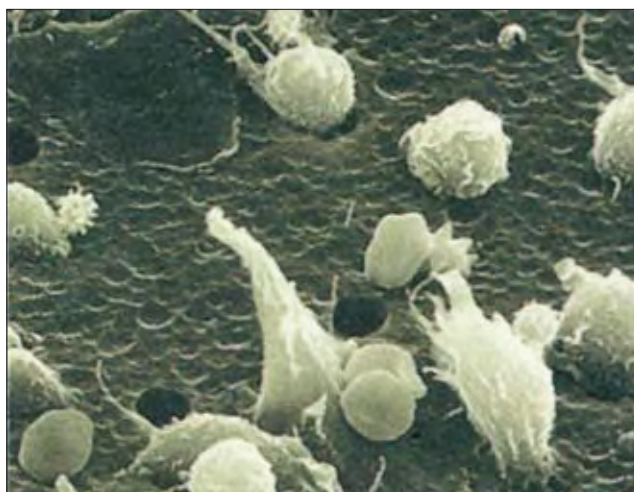
## Track-Etched Polycarbonate Membranes

### 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 Track-Etched Polycarbonate Membranes

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
25 × 80	8.0	155814	Standard	100
25 × 80	8.0	155846	PVP-free	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 crossovers 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 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.

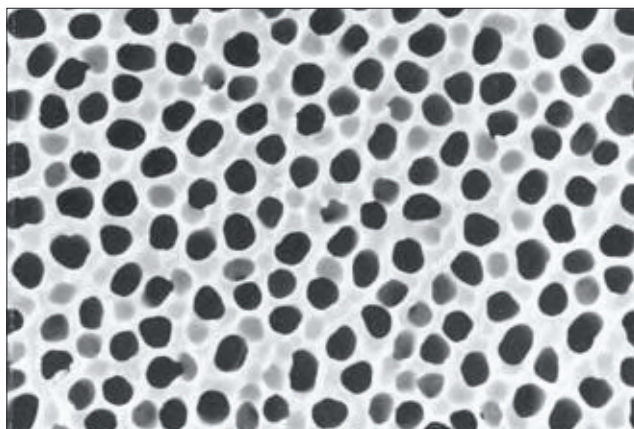
Anopore is available in three nominal pore sizes: 0.02  $\mu\text{m}$ , 0.1  $\mu\text{m}$  and 0.2  $\mu\text{m}$  and in three diameters: 13 mm, 25 mm and 47 mm.

### 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
- 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



Anodisc 47



Anodisc pore structure

### 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

## 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 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 Membranes (Anodisc)

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	6809-5502	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

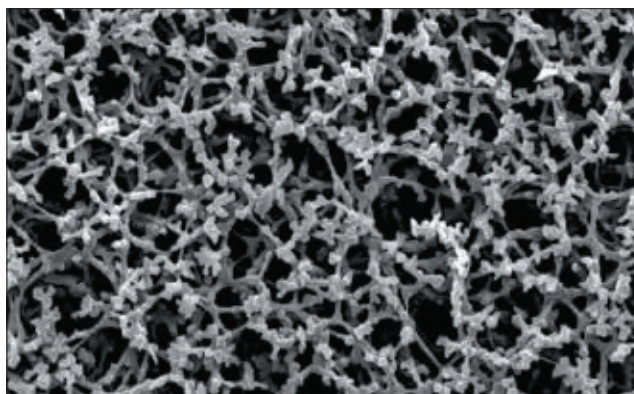
\* No support ring

## 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
- Sterilizable by all methods
- Pore sizes between 0.2 µm and 1 µm



Regenerated cellulose membrane (0.45 µm (RC 55)) electron micrograph (magnification 1000x)

## Typical Data – Regenerated Cellulose Membranes

Membrane Type	Pore Size (µm)	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (s/100 ml/12.5 cm <sup>2</sup> )	Air Flow Rate Δp = 3 mbar (s/100 ml)	Bubble Point (bar)
RC 58	0.2	75	26	–	3.7
RC 55	0.45	75	14	–	3.5
RC 60	1.0	70	15	12.5	0.8

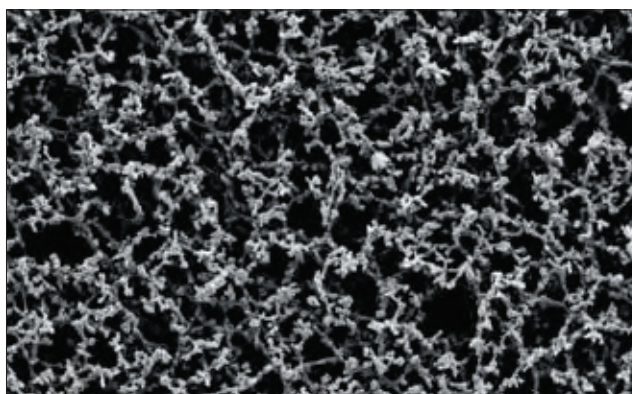
## Ordering Information – Regenerated Cellulose Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
<b>RC 55</b>			
25	0.45	10410206	100
47	0.45	10410212	100
50	0.45	10410214	100
100	0.45	10410219	25
110	0.45	10410224	25
142	0.45	10410229	25
<b>RC 58</b>			
47	0.2	10410312	100
50	0.2	10410314	100
100	0.2	10410319	25
300 × 600	0.2	10410380	5
<b>RC 60</b>			
47	1	10410012	100
50	1	10410014	100

## 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 Data – Cellulose Acetate Membranes

Membrane Type	Pore Size (µm)	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (s/100 ml/12.5 cm <sup>2</sup> )	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

## Ordering Information – Cellulose Acetate Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
<b>OE 66</b>			
25	0.2	10404106	100
47	0.2	10404112	100
47	0.2	10404170	100
50	0.2	10404114	100
110	0.2	10404126	50
142	0.2	10404131	25
293	0.2	10404139	25
300 × 600	0.2	10404180	5
<b>OE 67</b>			
13	0.45	10404001	100
25	0.45	10404006	100
47	0.45	10404012	100
50	0.45	10404014	100
85	0.45	10404044	50
100	0.45	10404021	50
110	0.45	10404026	50
142	0.45	10404031	25
<b>OE 67/A</b>			
142	0.45	10404331	25
<b>ST 68</b>			
47	0.8	10403112	100
50	0.8	10403114	100
<b>ST 69</b>			
47	1.2	10403012	100
50	1.2	10403014	100

## Cellulose Nitrate Membranes

Recommended for the majority of routine applications, this membrane is manufactured under strictly controlled conditions. The user will benefit from the performance improvements, which are now available in 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

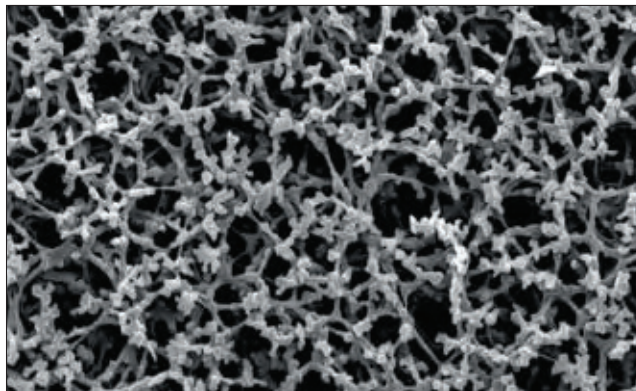
One of the major features of Whatman membrane filters is the narrow distribution of pore sizes. The rated pore size of these membranes is closely controlled due to the advanced manufacturing and control system. Additionally, the batch-to-batch variation is minimized, providing more consistent laboratory 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

### 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 Data – Cellulose Nitrate Membranes

	Cellulose Nitrate
Thickness	105-140 µm
Burst strength	> 2 psi
Weight	3.6-5.5 mg/cm <sup>2</sup>
Maximum service temperature	80°C
Porosity	66-84%
Steam autoclavable	Yes
Hydrophilic	Yes

## Typical Applications – Cellulose Nitrate Membranes

Field of Application	Pore Size (µm)
<b>General</b>	
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
<b>Water Microbiology and Analysis</b>	
Bacterial colony count	0.45 (gridded) – See Mixed Cellulose Ester Membranes
Sediment analysis	0.45
Suspended particles	5.0
<b>Air Pollution Monitoring</b>	
Asbestos Monitoring (NIOSH)	0.8
<b>Food and Beverage QC</b>	
<i>E. coli</i> and Coliforms	0.45 (gridded) – See Mixed Cellulose Ester Membranes
Total bacteria count	0.2
<b>Tissue Culture</b>	
Mycoplasma removal	0.1
Sterile filtration	0.2



### 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	0.025	10402206*	Plain (white)	100
25	0.1	7181-002	Plain (white)	100
25	0.2	7182-002	Plain (white)	100
25	0.2	10401306	Plain (white)	100
25	0.45	7184-002	Plain (white)	100
25	0.65	7186-002	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
30	0.45	10401107	Plain (white)	100
37	0.45	7184-003	Plain (white)	100
37	0.8	7188-003	Plain (white)	100
37	8.0	10400109	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	7187-114	Plain (white)	100
47	0.45	7184-004	Plain (white)	100
47	0.45	10401170	Plain (white), sterile	100
47	0.45	7153-004	Black gridded	100
47	0.45	7153-104	Black gridded, sterile	100
47	0.45	7155-004	Green gridded, sterile	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

\* Product is only available in the Americas

cont.

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
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
82	0.45	7184-008	Plain (white)	25
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	1.0	7190-009	Plain (white)	25
90	5.0	7195-009	Plain (white)	25
100	0.45	10401121	Plain (white)	50
100	8.0	10400121*	Plain (white)	50
110	0.45	10401126	Plain (white)	50
142	0.2	7182-014	Plain (white)	25
142	0.2	10401331	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
150	8.0	10400132	Plain (white)	25
293	0.45	7184-029	Plain (white)	25

\* Product is only available in the Americas

## Mixed Cellulose Ester Membranes

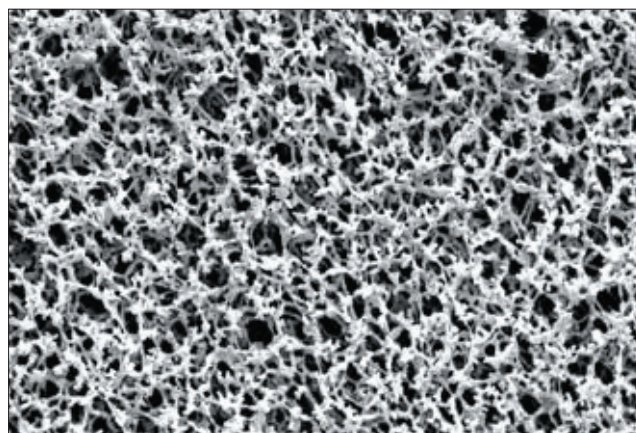
Whatman mixed cellulose ester membranes are composed of cellulose acetate and cellulose nitrate. These membranes are characterized by a smoother and more uniform surface than pure nitrocellulose filters. Also, the color contrast provided by the filter surface facilitates particle detection and minimizes 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.

### 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 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:

- 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

## Typical Data – Mixed Cellulose Ester Membranes

General	
Burst strength	> 10 psi
Weight	4.3-5.0 mg/cm <sup>2</sup>
Maximum service temperature	130°C
Porosity	74-77%
Steam autoclavable	Yes
Solvent resistancy	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 <sup>2</sup> )	Air Flow Rate Δp = 3 mbar (s/100 ml)	Bubble Point (psi)	Bubble Point (bar)
<b>WME Product Range</b>		140	-	-	-	-
<b>ME Product Range</b>						
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 Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>ME Range – ME 24, Plain</b>				
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
<b>ME Range – ME 25, Plain</b>				
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	10401662	Without interleaving paper	100
50	0.45	10401672	Plain	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
<b>ME Range – ME 26, Plain</b>				
25	0.6	10401506	Plain	100
47	0.6	10401512	Plain	100
50	0.6	10401514	Plain	100
100	0.6	10401521	Plain	100
<b>ME Range – ME 27, Plain</b>				
25	0.8	10400906	Plain	100
37	0.8	10400909	Plain	100
47	0.8	10400912	Plain	100
47	0.8	10400970	Plain	100
50	0.8	10400914	Plain	100
100	0.8	10400921	Plain	50
<b>ME Range – ME 28, Plain</b>				
25	1.2	10400806	Plain	100
47	1.2	10400812	Plain	100
50	1.2	10400814	Plain	100
100	1.2	10400821	Plain	50

\* Product is only available in the Americas

cont.

FILTER PAPERS AND MEMBRANES | TRACK-ETCHED PC AND PE MEMBRANES

Diameter (mm)	Pore Size (µm)	Catalog Number	Description	Quantity/Pack
<b>ME Range – ME 29</b>				
25	3	10400706	Plain	100
47	3	10400712	Plain	100
50	3	10400714	Plain	100
50	3	10400772	Plain, sterile	100
100	3	10400721*	Plain	50
<b>ME Range – ME 24, Gridded</b>				
47	0.2	10406970	White/black grid 3.1 mm, sterile	100
50	0.2	10406914	White/black grid 3.1 mm	100
50	0.2	10406972	White/black grid 3.1 mm, sterile	100
<b>ME Range – ME 25, Gridded</b>				
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	10406570*	White/black grid 5 mm, sterile	100
47	0.45	10409712	Black/white grid 3.1 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
47	0.45	10409471*	Green/black grid 3.1 mm, sterile	1000
50	0.45	10406814	White/black grid 3.1 mm	100
50	0.45	10406862	White/black grid 3.1 mm, without interleaving paper	100
50	0.45	10406873	White/black grid 3.1 mm, sterile	1000
50	0.45	10406514	White/black grid 5 mm	100
50	0.45	10406572	White/black grid 5 mm, sterile	100
50	0.45	10406562	White/black grid 5 mm, without interleaving paper	100
50	0.45	10409714	Black/white grid 3.1 mm	100
50	0.45	10409772	Black/white grid 3.1 mm, sterile	100
50	0.45	10409773*	Black/white grid 3.1 mm, sterile	1000
50	0.45	10409462	Green/black grid 3.1 mm, without interleaving paper, sterile	100
50	0.45	10409473	Green/black grid 3.1 mm, sterile	1000
<b>ME Range – ME 26, Gridded</b>				
50	0.6	10409814	Black/white grid 3.1 mm	100
<b>ME Range – ME 27, Gridded</b>				
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
47	0.8	10409270	Black/white grid 3.1 mm, sterile	100
50	0.8	10405672	Green/black grid 3.1 mm, sterile	100
<b>ME Range – ME 28, Gridded</b>				
50	1.2	10408372	Black/white grid 3.1 mm, sterile	100
50	1.2	10408472	Green/black grid 3.1 mm, sterile	100

\* Product is only available in the Americas

cont.

Diameter (mm)	Pore Size $\mu\text{m}$	Catalog Number	Description	Quantity/Pack
<b>WME Range, Gridded</b>				
25	0.45	7141-002	White/black grid 3.1 mm	100
25	0.8	7148-002	White/black grid 3.1 mm	100
47	0.45	7140-104	Plain, sterile	100
47	0.2	7187-114	White/black grid 3.1 mm	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, without pad	100
47	0.45	7141-124	White/black grid 3.1 mm, sterile	200
47	0.45	7141-154	White/black grid 3.1 mm, sterile, without pad	1000
47	0.45	7141-204	White/black grid 3.1 mm, autoclave pack, sterile	100
47	0.45	7153-004	Black/white grid 3.1 mm	100
47	0.45	7153-104	Black/white grid 3.1 mm, sterile	100
47	0.45	7155-004	Green/black grid 3.1 mm, sterile	100

## 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 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. The 0.5  $\mu\text{m}$  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  $\mu\text{m}$  and 0.5  $\mu\text{m}$ . Sterile venting of vacuum manifolds, fermentation vessels, and sterile filtrate tanks and containers utilize PTFE 0.2  $\mu\text{m}$  membranes.



PTFE membrane

### 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.

## Typical Data – Teflon (PTFE) Membranes

Membrane Type	Thickness (µm)	Porosity (%)	Liquid Flow Rate Δp = 0.9 bar (s/100 ml/12.5 cm <sup>2</sup> )	Liquid Flow Rate @ 10 psi Vacuum (ml/min/cm <sup>2</sup> )	Air Flow Rate Δp = 3 mbar (s/100 ml)	Air Flow Rate @ 10 psi Vacuum (l/min/cm <sup>2</sup> )	Bubble Point (psi)	Bubble Point (bar†)	Max. Temp. (°C)
<b>TE Range</b>									
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
<b>WTP Range</b>									
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

## Ordering Information – Teflon (PTFE) Membranes

Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
<b>WTP Range</b>			
25	0.2	7582-002	100
25	1.0	7590-002	100
37	1.0	7590-003	100
47	0.2	7582-004	100
47	0.5	7585-004	100
47	1.0	7590-004	100
<b>TE Range – TE 35</b>			
25	0.2	10411405	50
47	0.2	10411411	50
50	0.2	10411413	50
<b>TE Range – TE 36</b>			
25	0.45	10411305	50
47	0.45	10411311	50
50	0.45	10411313	50
<b>TE Range – TE 37</b>			
25	1.0	10411205	50
47	1.0	10411211	50
50	1.0	10411213	50

cont.

Diameter (mm)	Pore Size (µm)	Catalog Number	Quantity/Pack
<b>TE Range – TE 38</b>			
37	5.0	10411108	50
47	5.0	10411111	50
50	5.0	10411113	50
90	5.0	10411116	50
150	5.0	10411130	50

## 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 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 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.

Whatman hereby states that every manufactured 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	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/cm <sup>2</sup>	Ion	ng/cm <sup>2</sup>	Ion	ng/cm <sup>2</sup>	Ion	ng/cm <sup>2</sup>	Ion	ng/cm <sup>2</sup>	Ion	ng/cm <sup>2</sup>
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

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

# 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 135°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

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

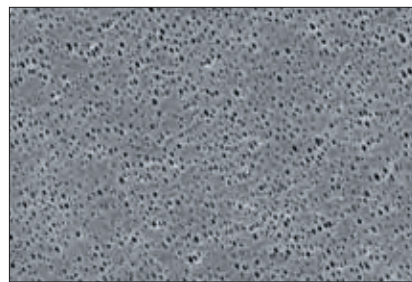
## Ordering Information - Nylon Membrane Circles

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 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 (0.45 µm, Type NL 17) electronic micrograph (magnification 1000×)

### Typical Data – Polyamide Membranes

Pore Size (µm)	Thickness (µm)	Water Flow Rate Δp = 0.9 bar (ml/min/cm <sup>2</sup> )	Air Flow Rate Δp = 3 mbar (bar) (ml/min/cm <sup>2</sup> )	Bubble Point (bar)	Maximum Temperature (°C)
0.2 (NL 16)	110	0.2	10	4.2	135
0.45 (NL 17)	110	0.45	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
142	0.45	10414131	NL 17	25

## 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. The Whatman PES membrane has a smooth surface that allows for easy enumeration of artifacts.

### Ordering Information – PES Membrane Circles

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 are available in 0.2 µm and 0.45 µm pore sizes.

## 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 prewetting or wetting with cytotoxic wetting agents that could be extracted. This makes the membranes suitable 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) Membrane Circles

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

# MembraClear Membrane

This membrane is particularly suitable for the hot block method for Asbestos fiber analysis as it becomes crystal clear and stays clear without artifacts.

## Ordering Information - MembraClear Membrane

Diameter (mm)	Catalog Number	Quantity/Pack
25	7141-025	100
37	7141-037	100
47	7141-047	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 glass microfiber filters are used as prefilters for membranes. The outstanding properties of borosilicate glass microfibers mean the filters offer 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 in the same way as the Multigrade GMF 150 simply because prefilters of a uniform density do not have the loading capacity of the multiporosity filter technology advanced by Whatman. For highly particulate loaded samples, the performance of GMF 150 filters is unsurpassed.

### Ordering Information – Glass Microfiber Prefilter Circles

Prefilter Diameter (mm)	Pore Size (µm)	Catalog Number Multigrade GMF 150	Grade GF/B (fine)	Grade GF/D (coarse)	Quantity/Pack
10	2.7		-	1823-010	100
25	1.0		1821-025	-	100
25	2.7		-	1823-025	100
35	2.7		-	1823-035	100
37	1.0		1821-037	-	100
42.5	1.0		1821-042	-	100
42.5	2.7		-	1823-042	100
47	1.0	1841-047	-		40
47	2.0	1842-047	-		40
47	1.0		1821-047	-	100
47	2.7		-	1823-047	100
90	1.0	1841-090	-		20
90	2.0	1842-090	-		20
90	1.0		1821-090	-	25
90	2.7		-	1823-090	25
125	1.0		1821-125	-	25
125	2.7		-	1823-125	25
142	2.7		-	1823-142	25
257	2.7		-	1823-257	25

## Membrane Filter Holders

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.

### 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.



Membrane filter holders

### Applications

- General laboratory microfiltration
- Quality control and sterility testing
- Removal of particulates from HPLC solvents
- Tissue culture media filtration

## Typical Data – Membrane Filter Holders

Filter Diameter (mm)	Membrane Holder Filter Systems – Glass	Reservoir Volume (ml)	Filter Surface Area (cm <sup>2</sup> )	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

*Additional types of membrane holders can be found in the Membrane Accessories section and Membrane Vacuum Filtration Equipment section.*

## Ordering Information – Membrane Filter Accessories

Diameter (mm)	Catalog Number	Description	Quantity/Pack
<b>Membrane Filter Holders</b>			
25	1960-032	Stainless steel support, 50 ml volume	1
25	1960-002	Glass support, 25 ml volume	1
25	1960-052	Stainless steel support, 25 ml volume	1
47	1960-004	Glass support, 300 ml volume	1
47	1960-054	Stainless steel support, 300 ml volume	1
47	1961-054	Glass reservoir, 300 ml volume	1
90	1960-009	Glass support, 1000 ml volume	1
<b>Drain Discs</b>			
10	230300	Polyester	100
22	230500	Polyester	100
25	230600	Polyester	100
37	230800	Polyester	100
47	231100	Polyester	100

## Glass Vacuum Filtration Devices

### Features and benefits

- Chemically resistant to most aqueous and organic solutions
- Acid and caustic solution resistant
- Autoclavable and can be sterilized in dry heat to 180°C
- Can be used up to 200°C

### Applications

- Foodstuffs (e.g., ice cream)
- Beverages (e.g., residues in beer)
- Pharmaceuticals and cosmetics
- Water and wastewater
- Residue analytics and precipitation analysis
- Contamination tests (e.g., in electroplating)
- Microbiological, biochemical, and hydrobiological detection
- Radiochemical tests
- Particle analysis in sensitive areas of electronics, aviation, and space travel



## Technical Information – Glass Vacuum Filtration Devices

Upper part, lower part	Borosilicate glass
Cap	Silicone
Flask	Borosilicate glass
Frit	Glass D2
Sieve	Stainless steel, Teflon coated
Seals	PTFE and silicone
Clamps	Aluminum and stainless steel
Hose connection	POM, thread RD14

Series	Funnel Volume (ml)	Filter Format (mm)	Filter Surface (cm <sup>2</sup> )	Prefilter (mm)	Height* × Diameter (mm)
GV 025	60	24/25	3.1	20	210/335 × 45
GV 050	250	47/50	12.5	40	225/450 × 80
GV 100	500	100	70	80	225 × 90

\* Height without/with Erlenmeyer flask, diameter without clamp and hose coupling

## Ordering Information – Glass Vacuum Filtration Devices

Code No	Description	Filter Support	Vacuum Connection	Quantity/Pack
<b>GV 025 Series</b>				
10441000	GV 025/0	Glass frit	Rubber stopper	1
10441100	GV 025/1	Sieve	Rubber stopper	1
10441200	GV 025/2	Glass frit	Hose coupling Erlenmeyer flask 250 ml (NS29)	1
<b>GV 050 Series*</b>				
10442000	GV 050/0	Glass frit	Rubber stopper	1
10442100	GV 050/1	Sieve	Rubber stopper	1
10442200	GV 050/2	Glass frit	Hose coupling Erlenmeyer flask 1000 ml (NS45)	1
10442300	GV 050/3	Sieve	Hose coupling Erlenmeyer flask 1000 ml (NS45)	1
<b>GV 100 Series</b>				
10443000	GV 100/0	Glass frit	Rubber stopper	1
10443100	GV 100/1	Sieve	Rubber stopper	1

\* Silicone cap and supplied with air inlet