Technical Cleanliness

Filters, Balances and Accessories for Your Particle Analysis

Simplifying Progress

SARTORIUS

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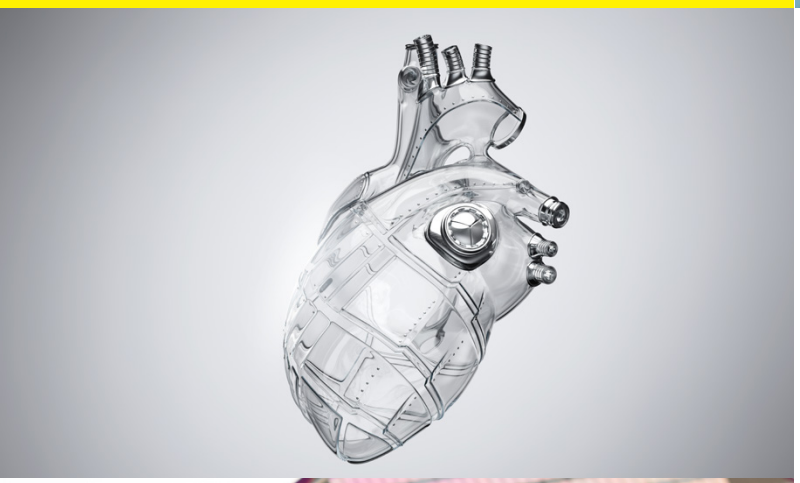
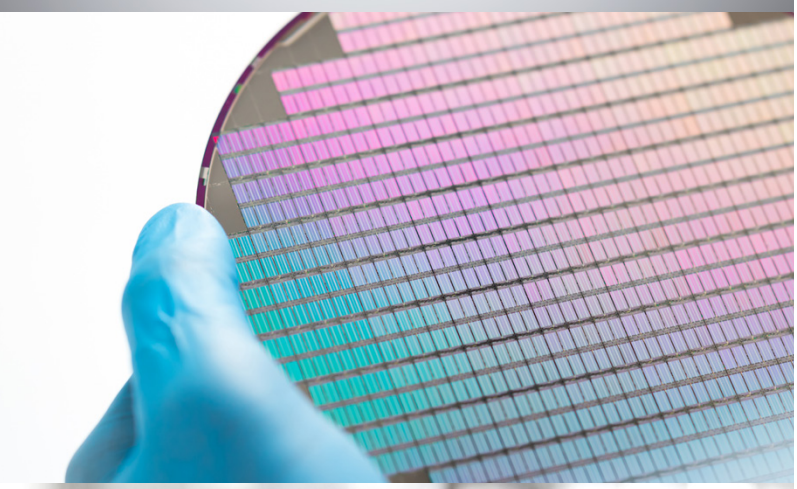
Technical Cleanliness

In many cases, the absence of critical particles is decisive for the reliable performance and durability of a technical system. This is why analysis of the cleanliness of components is of crucial importance.

Sartorius, as a leading supplier of laboratory equipment, offers filtration and weighing products that meet even the most demanding requirements of cleanliness analysis.

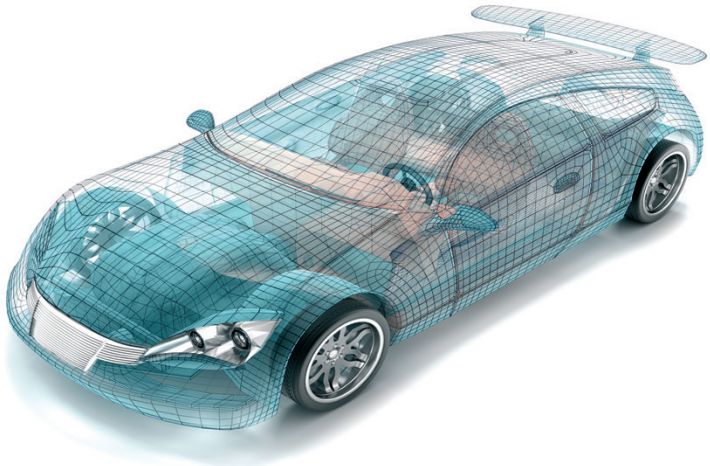




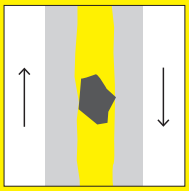
Cleaning Testing

Cleanliness testing is a crucial quality assurance process employed across diverse industries to ensure the absence of contaminants or particulate matters in critical applications.

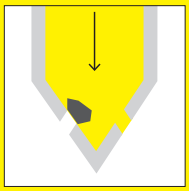
The gravimetric determination by filtration is a widely used analytical method for determining cleanliness in various industries, including pharmaceuticals, medical devices, and electronics. This method involves collecting a sample from a liquid or gas stream using a filter, and then weighing the filter before and after it is cleaned. The differential weight between the two measurements represents the amount of residue or contaminants that were present in the liquid or gas stream. This method allows further analytical identification or microscopical characterization.



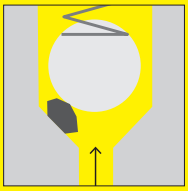
Examples of Damage on Applied Industry Components



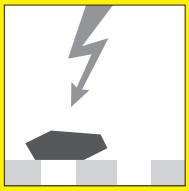
Blocked bearings or hydrodynamic surfaces
- Turbochargers
- Crankshaft bearings
- Dispensing pumps
- Cylinder linings



Plugged nozzles or filters
- Injectors
- Fuel feed components



Blocked valves
- Anti-lock brakes
- Brake boosters
- Lubrication components and hydraulic parts



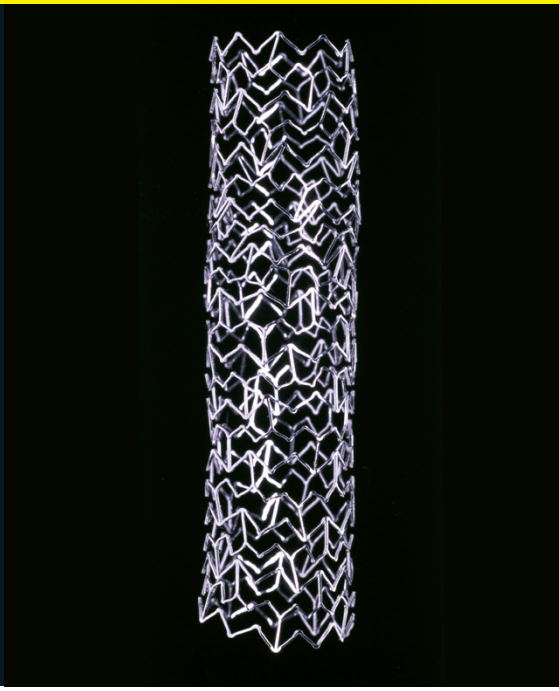
Short-circuited electrical contacts
- Control electronics

Component ■ Particle □ Liquid, such as fuel or oil

Risks in Medical Device Industry

If particles remain in an implantable medical device, it can lead to a range of complications and adverse effects. These particles can cause inflammation, tissue damage, and immune reactions, which can lead to pain, swelling, and infection. In some cases, the particles can also interfere with the proper functioning of the device, leading to device failure or malfunction.

In addition, particles in implantable medical devices can also increase the risk of blood clots, which can cause serious complications such as stroke or heart attack. This is particularly true for implantable devices that come into contact with blood, such as pacemakers or artificial heart valves. To prevent these complications, it is important to ensure that implantable medical devices are thoroughly cleaned and free from particles before they are implanted in the body. This requires careful environmental monitoring of manufacturing processes and quality control measures to ensure that the devices meet strict cleanliness standards.



Typical Standards and Guidance

Industry	Examples of standards or guidance	Risk
Medical Devices	ISO 19227 – ISO 14644-9 VDI 2083 Blatt 21 - USP <788>	Patient safety
Automotive, fuel, petroleum	ISO 16232 | ASTM D8194 – ASTM D2276	Engine performance
Aerospace	ASTM F312 | ISO 12584 – ISO 11218	Integrity of components in critical environments
Pharmaceutical	USP <788> | USP <789>	Patient safety
Semiconductor	SEMI F73 | SEMI F75	Microcracks, defects
Food and beverage	HACCP	Consumer safety
Electronics	VDA 19	Short circuits
Hydraulic Power Systems	ISO 18413	Increase in ware rates and catastrophic failures

Schematic Workflow of Cleanliness Analysis

Inspection of components for cleanliness can be subdivided into the steps of extraction, filtration and analysis. In the process, all critical particles need to be detected as just a few individual particles are all it takes to cause a malfunction in a technical system.

Extraction of Particles
To obtain a sample, a test liquid is used to rinse particles off of a test component and to transfer such contaminants into this liquid to perform extraction

Filtration
- Fitration of the sample: Prior to filtration, a blank is determined, which represents the degree of contamination of the test system
- Rinsing to ensure that not a single particle goes undetected
- Filtration of a fixing agent (optional)

Gravimetric Analysis
- Drying of the filters (desiccation)
- Cooling and equilibration for stable weighing
- Weighing of the filters with the sample and the blank; the filters are also weighed before filtration to determine the difference in weight

Photo-Optical Analysis
Determination of the number of particles, particle size, metallic particle reflection and shape of fibers

Further Analysis
Additional methods, such as IR, Raman spectroscopy, LIBS or REM | EDS, can be used to identify the properties of a particulate substance

Filtration

In cleanliness analysis, filtration of a sample is an essential step. Filters are used in this process to separate particles from the extraction liquid, and as sample carriers for gravimetric and photo-optical analysis.

Sartorius offers a wide variety of filter materials and pore sizes to cover many different requirements.

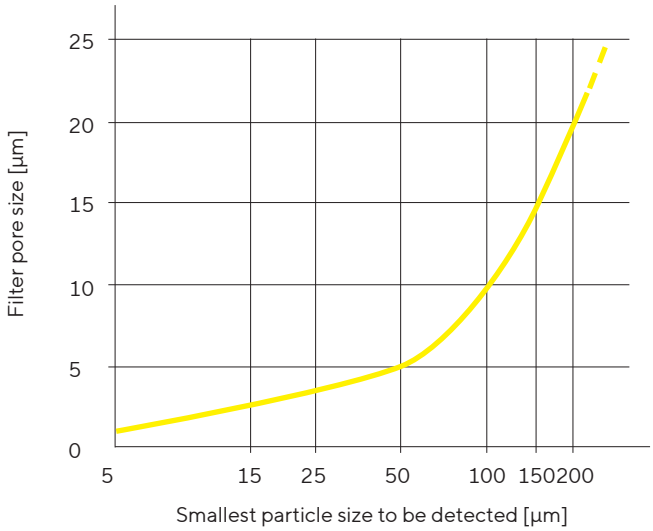
Selection of a Suitable Analytical Filter

Chemical Compatibility

Cellulose nitrate filters are the No. 1 choice for many applications. If this filter material is not compatible or has limited compatibility with the test, rinsing or fixing solution, alternative filter materials can be considered, such as cellulose acetate or PTFE having different compatibility properties.

Pore Size

The pore size of an analytical filter depends on the rated retentive capability of the particle sizes to be determined. As a rule, these pore sizes are specified in the requirements defined for the cleanliness of a specific component. For example, in VDA 19, Part 1, the pore sizes for retaining the smallest critical particles are suggested (see diagram) as a rule of thumb.



Particle size > 50 µm
Pore size (max.) = 1/10 to 1/5 of the particle size

Particle size < 50 µm
Pore size (max.) = 1/5 of the particle size

Guidance Table for Filter Selection

	Filter Material				
	Cellulose Nitrate (Mixed Cellulose Esters)	Cellulose Acetate	Polyamide	Polycarbonate Track-Etched	PTFE
Test or Rinsing Liquids					
Neutral cleaning agent, water-based	■	■	■	■	■
Isopropanol	□	■	■	■	■
Ethanol	□	■	■	■	■
Aliphatic hydrocarbons (e.g. cold cleaner)	■	■	■	■	■
Ketone (e.g., acetone)	–	–	■	■	■

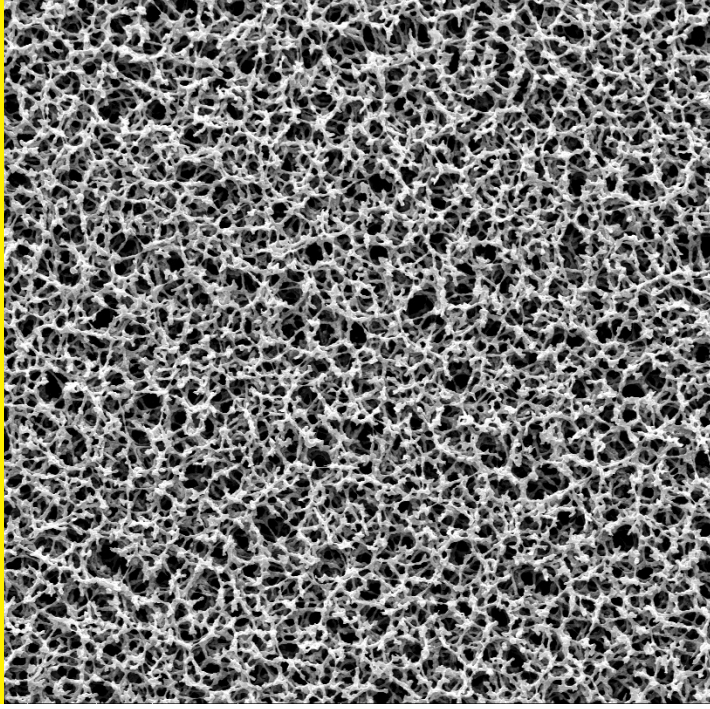
■ Compatible – Not compatible □ Limited compatibility

Pore Size					
0.1 µm	–	–	–	■	–
0.2 µm	■	■	■	■	■
0.45 µm | 0.4 µm	■	■	■	■	■
0.65 µm	■	■	–	–	–
0.8 µm	■	■	–	■	–
1.2 µm	■	■	–	–	■
3 µm	■	–	–	–	–
5 µm	■	■	–	–	■
8 µm	■	–	–	–	–

■ Available – Not available

Cellulose Nitrate (Mixed Cellulose Esters)

Cellulose nitrate membrane filters are hydrophilic, have high flow rates thanks to their symmetrical structure and are compatible with aqueous solutions (pH 4 – 8), hydrocarbons and several other organic solvents. These cellulose nitrate membranes are available in different pore sizes from 0.2 µm to 8 µm.



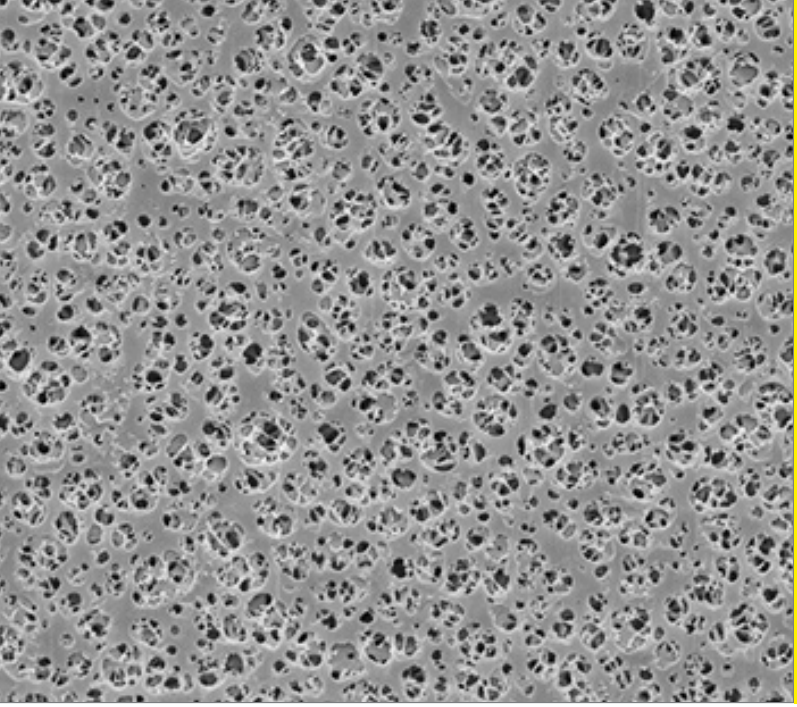
Typical Performance Characteristics

Pore Size (µm)	Type	Thickness (µm)	Water Flow Rate (mL/min/cm²/bar)	Thermal Resistance max. (°C)	Bubble Point (bar)
0.2	11327	130	25	130	≥ 4.4
0.45	11306	120	68	130	≥ 2.4
0.65	11305	120	102	130	≥ 2.0
0.8	11304	130	5*	130	≥ 1.5
1.2	11303	130	7*	130	≥ 1.0
3	11302	140	16*	130	≥ 0.6
5	11342	140	25*	130	≥ 0.5
8	11301	140	37*	130	≥ 0.3

Ordering Information

Ø (mm)	0.2 µm	0.45 µm	0.65 µm	0.8 µm	1.2 µm	3 µm	5 µm	8 µm
13	11327--13------N	11306--13------N	11305--13------N			11302--13------N	11342--13------N	11301--13------N
25	11327--25------N	11306--25------N	11305--25------N	11304--25------N	11303--25------N	11302--25------N	11342--25------N	11301--25------N
47	11327--47------N	11306--47------N	11305--47------N	11304--47------N	11303--47------N	11302--47------N	11342--47------N	11301--47------N
50		11306--50------N	11305--50------N	11304--50------N	11303--50------N	11302--50------N	11342--50------N	11301--50------N
90		11306--90------N 11306--90------G		11304--90------G	11303--90------G	11302--90------G		
100		11306-100------N 11306-100------G	11305-100------N	11304-100------G	11303-100------G	11302-100------G		11301-100------N 11301-100------G
142	11327-142------N	11306-142------N		11304-142------G 11304-142------N	11303-142------G 11303-142------N	11302-142------G	11342-142------G 11342-142------N	11301-142------G
150								11301-150------G
293		11306-293------G 11306-293------N		11304-293------G 11304-293------N	11303-293------G	11302-293------G	11342-293------G	11301-293------G

G = 25 filters, N = 100 filters | Other dimensions and quantities per package are available on request



Cellulose Acetate

Cellulose acetate membranes combine thermal stability with exceptionally low adsorption characteristics. They are hydrophilic, have high flow rates thanks to their symmetrical structure and are compatible with aqueous solutions (pH 4 – 8), oils, alcohols and other organic solvents. These cellulose acetate membranes are available in different pore sizes from 0.2 to 5 µm.

Typical Performance Characteristics

Pore Size (µm)	Type	Thickness (µm)	Water Flow Rate (mL | min | cm2 | bar)	Thermal Resistance max. (°C)	Bubble Point (bar)
0.2	11107	120	24	180	≥ 2.9**
0.45	11106	120	65	180	≥ 2.0
0.65	11105	120	116	180	≥ 1.3
0.8	11104	120	6*	180	≥ 0.8
1.2	12303	140	10*	180	≥ 0.6
5	12342	140	23*	180	≥ 0.3

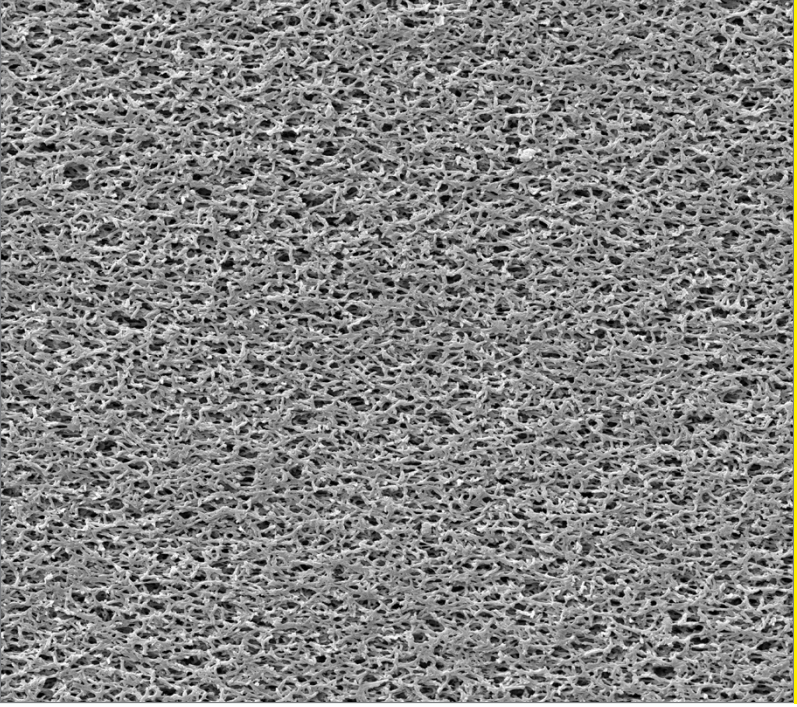
*Flow rate for air [L | (m^2s)]

**with Sartocheck®

Ordering Information

Ø (mm)	0.2 µm	0.45 µm	0.65 µm	0.8 µm	1.2 µm	5 µm
13	11107--13------N	11106--13------N				
25	11107--25------N	11106--25------N	11105--25------N	11104--25------N	12303--25------N	12342--25------N
47	11107--47------N	11106--47------N	11105--47------N	11104--47------N	12303--47------N	12342--47------N
50	11107--50------N	11106--50------N	11105--50------N	11104--50------N	12303--50------N	
90	11107--90------G	11106--90------G	11105--90------G	11104--90------N		
100	11107-100------N 11107-100------G	11106-100------N			12303-100------G	11106-100------G
142	11107-142------G 11107-142------N	11106-142------G 11106-142------N		11104-142------G 11104-142------N	12303-142------G 12303-142------N	11105-142------G 11105-142------N
293	11107-293------G 11107-293------N	11106-293------G 11106-293------N		11104-293------G 11104-293------N		11105-293------G

G = 25 filters, N = 100 filters | Other dimensions and quantities per package are available on request



Polyamide

Polyamide membrane filters are hydrophilic and chemically resistant to alkaline solutions and organic solvents.

Typical Performance Characteristics

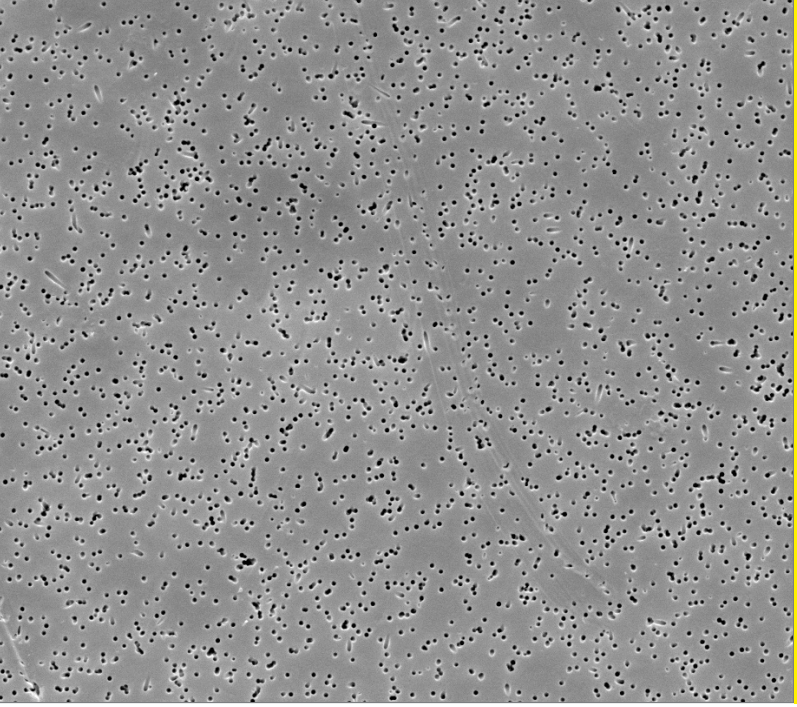
Pore Size (µm)	Type	Thickness (µm)	Water Flow Rate (mL/min/cm²/bar)	Thermal Resistance max. (°C)	Bubble Point (bar)
0.2	25007	110	24	100	≥ 3.3
0.45	25006	110	46	100	≥ 2.3

*Max. continuous operating temperature in water

Ordering Information

Ø (mm)	0.2 µm	0.45 µm
13	25007--13------N	25006--13------N
25	25007--25------N	25006--25------N
47	25007--47------N	25006--47------N
50	25007--50------N	25006--50------N
90	25007--90------G	25006--90------G
142	25007-142------N	25006-142------N
293	25007-293------N 25007-293------G	25006-293------G

G = 25 filters, N = 100 units | Other dimensions and quantities per package are available on request



Polycarbonate Track-Etched

White and hydrophilic polycarbonate track-etched membranes are manufactured from high-grade polycarbonate film using track-etch technology. Their capillary pore structure is uniform and precise, with a narrow pore size distribution.

Typical Performance Characteristics

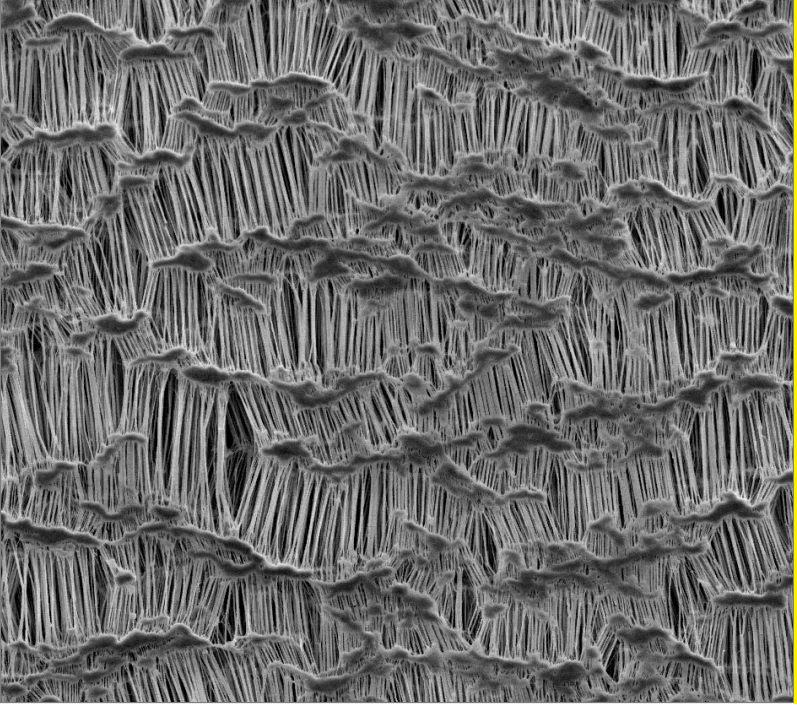
Pore Size (µm)	Type	Thickness (µm)	Water Flow Rate (mL/min/cm²/bar)	Thermal Resistance max. (°C)	Bubble Point (bar)
0.1	23058	25	0.5	140	≥7
0.2	23007	25	≤ 10	140	≥ 3.5
0.4	23006	25	≤ 30	140	≥ 2.0
0.8	23004	25	≤ 40	140	≥ 0.6

*Flow rate for air [L | (m²s)]

Ordering Information

Ø (mm)	0.1 µm	0.2 µm	0.4 µm	0.8 µm
25	23058--25------N	23007--25------N	23006--25------N	23004--25------N
47	23058--47------N	23007--47------N	23006--47------N	
50		23007--50------N		

G = 25 pieces, K=50 pieces, N = 100 pieces | Other dimensions and quantities per package are available on request



Hydrophobic PTFE

PTFE filters are permanently hydrophobic. These membrane filters feature excellent chemical compatibility (pH 1 to 14) so they are also used for filtration of solvents and acids that cannot be filtered using other filter types due to a lack of or limited compatibility.

Typical Performance Characteristics

Pore Size (µm)	Type	Thickness (µm)	Isopropanol Flow Rate (mL/min/cm²/bar)	Thermal Resistance max. (°C)	Bubble Point (bar)
0.2	11807	60	9	200	≥ 1.2
0.45	11806	80	20	200	≥ 0.9
1.2	11803	100	86	200	N/A
5	11842	100	250	200	N/A

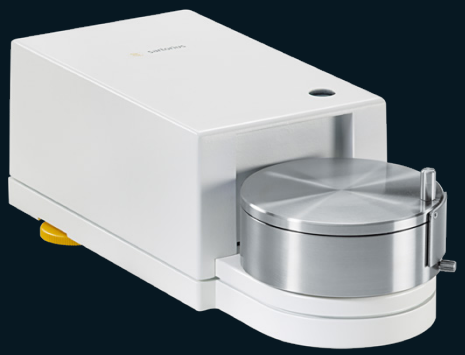
Ordering Information

Ø (mm)	0.2 µm	0.45 µm	0.8 µm	1.2 µm	5 µm
13	11807--13------N	11806--13------N		11803--13------N	
25	11807--25------N	11806--25------N	11842--25------N	11806--25------N	
47	11807--47------N	11806--47------N	11842--47------N	11803--47------N	
50	11807--50------N	11806--50------N	11842--50------N	11803--50------N	
90	11807--90------G	11806--90------G		11803--90------G	
100	11807-100------G	11806-100------G	11842-100------N	11803-100------G	11842-100------G
142	11807-142------G	11806-142------G		11803-142------G	11842-142------G
293	11807-293------G	11806-293------G		11803-142------G	11842-293------G

G = 25 filters, N = 100 filters | Other dimensions and quantities per package are available on request

Gravimetric Analysis

The gravimetric method is used as a standard procedure for determining technical cleanliness as it provides information on the total particle burden of a component. Our Cubis® II balances meet the highest requirements on accuracy and ease of operation for particle load determination.



Cubis® II Premium Laboratory Balances

Cubis® II enables you to combine your choice of display, weighing module, draft shield, software packages and much more. Your can choose from thousands of options to configure your balance to suit your individual needs and obtain the optimal solution for integration into your process.

Cubis® QApp Residual Dirt Analysis

The Cubis® II balance series brings weighing workflows as small software applications (QApps) directly on the balance, without the need for additional PC-based software. For the gravimetric determination of residual dirt according to VDA19, we offer a QApp guiding the user step by step through the workflow an and automatically calculating and documenting the results. This guarantees trustworthy results and increases efficiency in the laboratory.

Cubis® QApp Filter Particulate Matter

Filter particulte matter is used for the differential weighing of filters with individual sample ID. During the process the initial and back weighing of filters is performed and difference between the initial and back weight of each filter is determined. The acquired weights are corrected by the air buoyancy and the difference between unloaded and loaded filter in mg and % (particle load value) is calculated. Furthermore the application creates a statistics for a batch of filters by calculating the average, standard deviation, minimum and maximum particle load

Cubis II Titanium Weighing Pans for Uncompromized Accuracy

We offer various sizes of filter holders from 50 mm - up to 150 mm diameter for ulta-micro and micro filter balances, and semi-micro balances. Made of titanium, not only the highest material quality is guaranteed, but notably the repeatibility is not compromized because of the non-magnetic properties.

Selection of an Optimal Balance

Two criteria are important for selecting a balance in line with the recommendations of VDA 19 or ISO 16232:

- Maximum allowable particle load on a component
- Maximum allowable blank value (10% of the maximum allowable particle load)

The blank is determined at the beginning before extraction of particles flushed from a component and indicates the basic particulate contamination of the test setup and the liquids used.

Your Needs		Our Solutions	
Max. Allowable Particle Load	Max. Allowable Blank Value	Min. Resolution of the Balance	Recommended Type of Balance
10 mg	1 mg	0.1 mg	Analytical balance or better
1 mg	0.1 mg	0.01 mg	Semi-micro balance or better
0.1 mg	0.01 mg	0.001 mg	Micro balance or better
0.01 mg	0.001 mg	0.0001 mg	Ultra-micro balance

Specifications

Note: This table only contains selected modules. Other weighing modules are available on request.

	Ultra-Micro Balance 0.0001 mg	Micro Balance 0.001 mg	Micro Balance 0.001 mg	Semi-Micro Balance 0.01 mg	Analytical Balance 0.1 mg
Weighing module	MCA 2.7S	MCA 66S	MCA 36S	MCA 225S	MCA 224S
Draft shield	F	D	D	I	I
Scale interval (d)	0.0001	0.001	0.001	0.01	0.1
Maximum capacity (Max)	2.1	61	32	220	220
Standard weighing pan (W × D) [mm]	Ø 20	Ø 50	Ø 50	85 × 85	85 × 85
Filter weighing pan (50 mm)	incl.	-	-	–	–
Typical stabilization time [<s]	7	3.5	3.5	2	1
Typical measurement time	10	10	10	6	3
Repeatability near max. [<±mg], standard deviation of the load values, tolerance	0.00025	0.004	0.0025	0.025	0.07
Linearity deviation [<±mg], tolerance	0.0009	0.0s	0.005	0.1	0.2
Off-center load [mg]*, tolerance	0.0007	0.02	0.006	0.15	0.2

* Position according to OIML R76

Accessories

Description	Availability for High-Capacity Micro Balances	Availability for Semi-Micro Balances and Analytical Balances	Order Number
Cubis® II MCA QApp Package Advanced	■	■	QP2
Cubis® II MCA Residual Dirt Analysis QApp	■	■	QAPP208
Filter weighing pan made of titanium, diameter 90 mm, for ultra-micro balance or micro balance models	■	–	VF2562
Filter weighing pan made of titanium, diameter 52 mm, for ultra-micro and micro balances			YSH34
Filter weighing pan made of titanium, diameter 90 mm, for ultra-micro balance or micro balance models only together with F draft shield			YSH36
Filter weighing pan made of titanium, diameter 75 mm, for ultra-micro balance or micro balance models	■	–	YSH35-3
Filter weighing pan made of titanium, diameter 150 mm, for high-capacity micro balances YSH30-3	■	■	YSH30-3
Stat-Pen ionizing probe for neutralizing static electricity on samples or filters	■	■	YSTP01
Balance table made of cast stone; for weighing with vibration damping	■	■	YWT03
Motion sensor for triggering a maximum of 4 functions via gesture control, selection via menu	–	■	YHS02MS
Thermal transfer | thermal printer for GMP | GLP printouts on continuous paper and labels	■	■	YDP30
Laboratory thermal transfer printer YDP30 with USB and ethernet connection	■	■	YDP30-NET
Wireless Nano USB Adapter	■	■	YWLAN01MS
WIFI Nano Router	■	■	YWLAN02MS
SartoriusWedge software for data communication between the balance and a PC	■	■	YSW02
Tower incl. climate module YCM20MC; can be ported to all Cubis® II weighing modules with user interface MCA	■	■	YCM20MC-TOWER
Calibration of a climate module YCM20MC with DAkkS calibration certificate	■	■	YCM20DAkkS

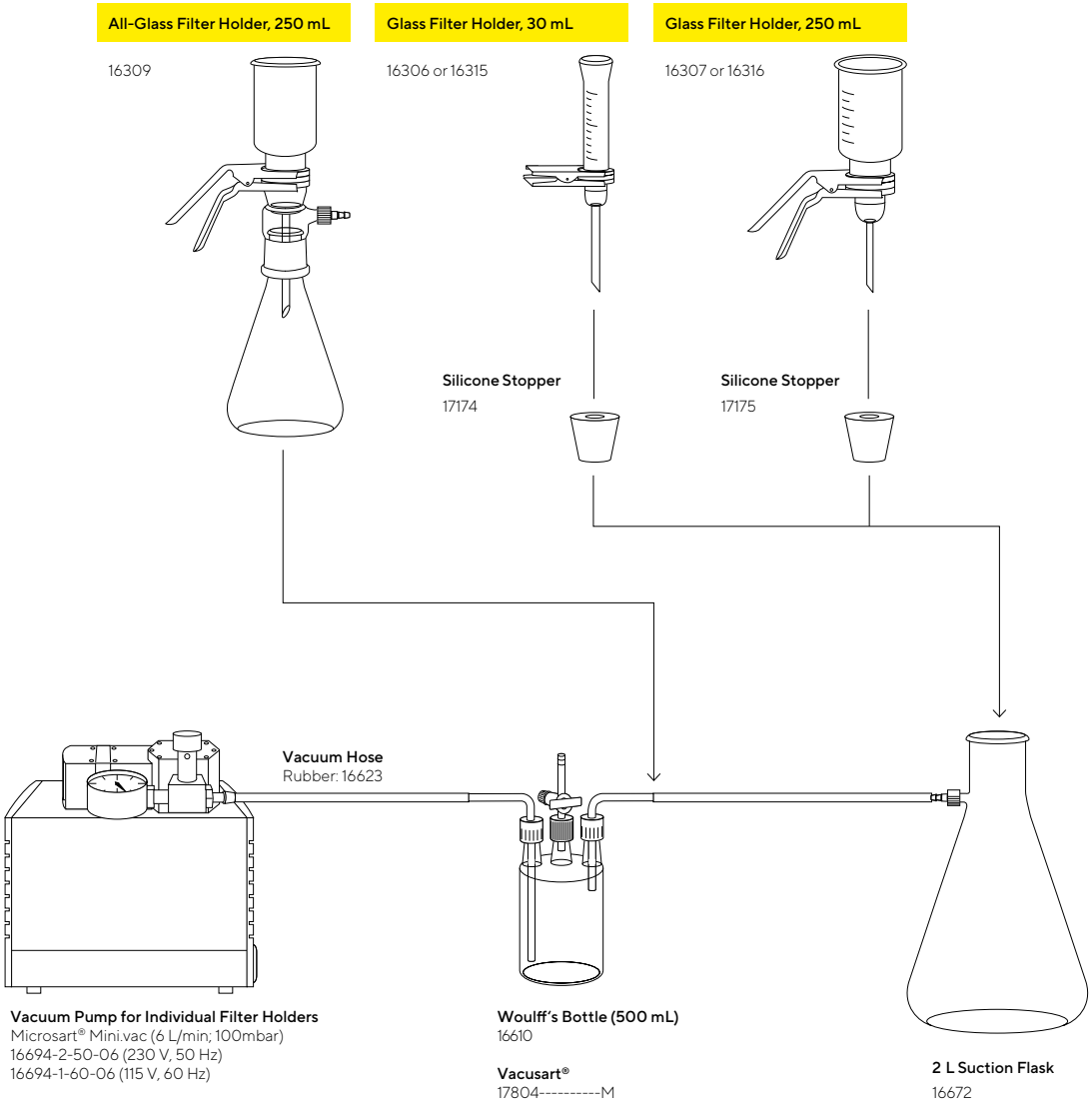
■ Available – Not available

Accessories

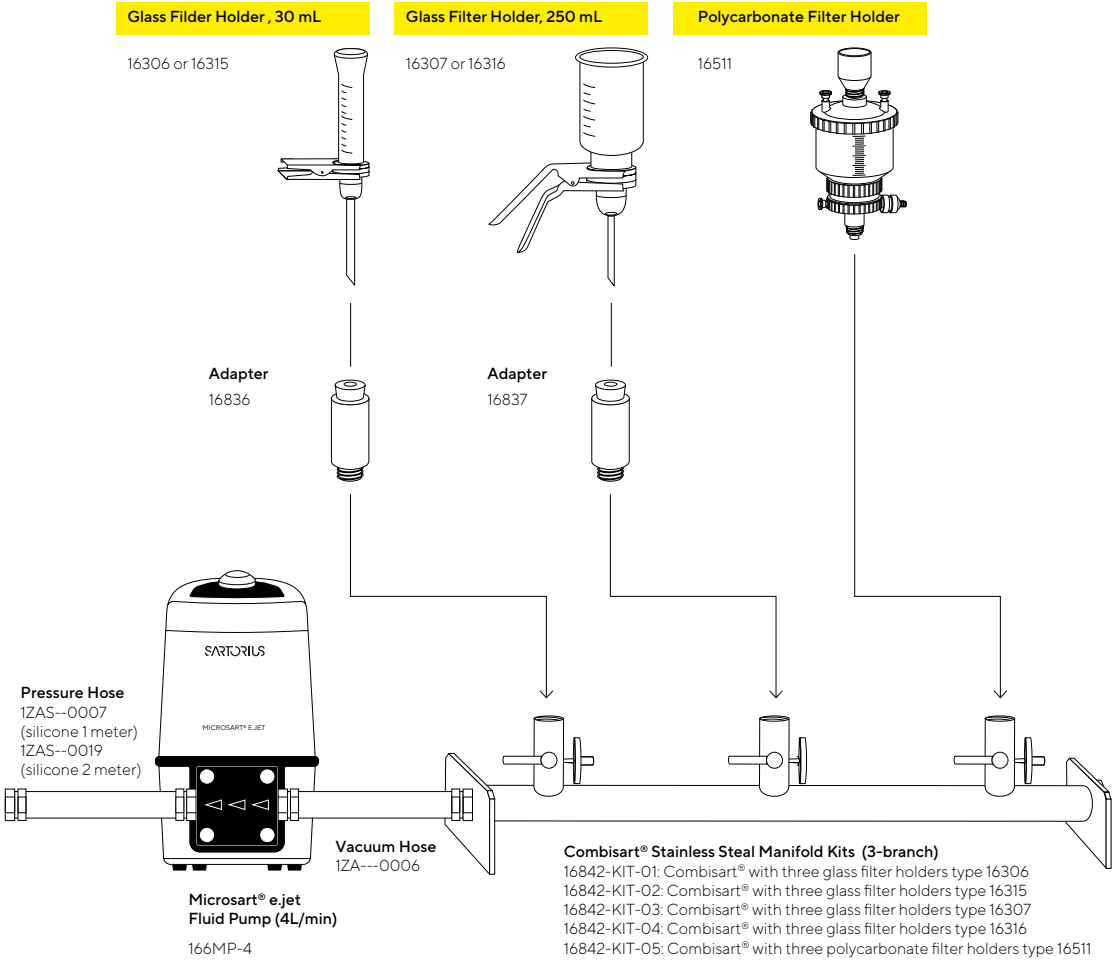
Rugged and efficient filtration accessories are required to ensure reliable removal of particles in every filtration run. Sartorius facilitiates your filtration procedures by offering a large selection of filter holders and vacuum systems.

Selection of Filtration Accessories

Individual Filter Holders

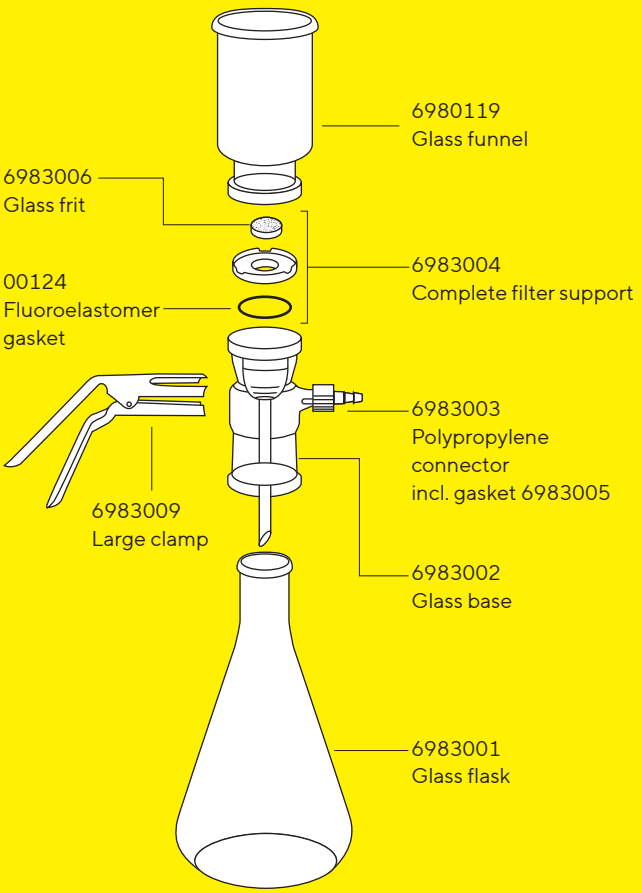


3-Branch Manifold



All-Glass Vacuum Filter Holder

All areas where liquid and device can come into direct contact are made of glass or PTFE. Several features ensure convenient handling. A 6-mm-wide, non-ground rim above the ground glass neck of the suction flask prevents the filtrate from coming in contact with grease on the ground glass surface, thus preventing it from contamination while being poured out of the flask.



Specifications

Parts and materials	Borosilicate glass funnel, base and flask; sintered glass frit in a PTFE ring and fluoroelastomer O-ring (45 × 3 mm) underneath; anodized aluminium clamp
Chemical compatibility	As for glass and PTFE
Funnel capacity	250 mL
Capacity of the filtrate flask	1 liter
Filtration area	12.5 cm²
Max. operating pressure	Only for vacuum
Suitable membrane filter diameter	47 mm | 50 mm
Sterilization (without connector)	By autoclaving (max. 134°C) or by dry heat (max. 180°C)

Ordering Information

Description	Order No.
All-glass vacuum filter holder for 50 mm (or 47 mm) membrane filter, with vacuum-resistant flask, capacity 1 liter	16309

Replacement parts are shown in the diagram.

Glass Vacuum Filter Holders

25 mm Glass Vacuum Filter Holder

This filter holder is available in two versions that differ from each other only in the type of the filter support. The filter holder with a glass frit ensures uniform distribution of retained particles and is therefore recommended if the residue on the filter surface is of interest. Because it is easy to clean, the filter holder with the PTFE-coated screen support is preferable if the filtrate is required or if liquids difficult to remove from the glass frit need to be examined.

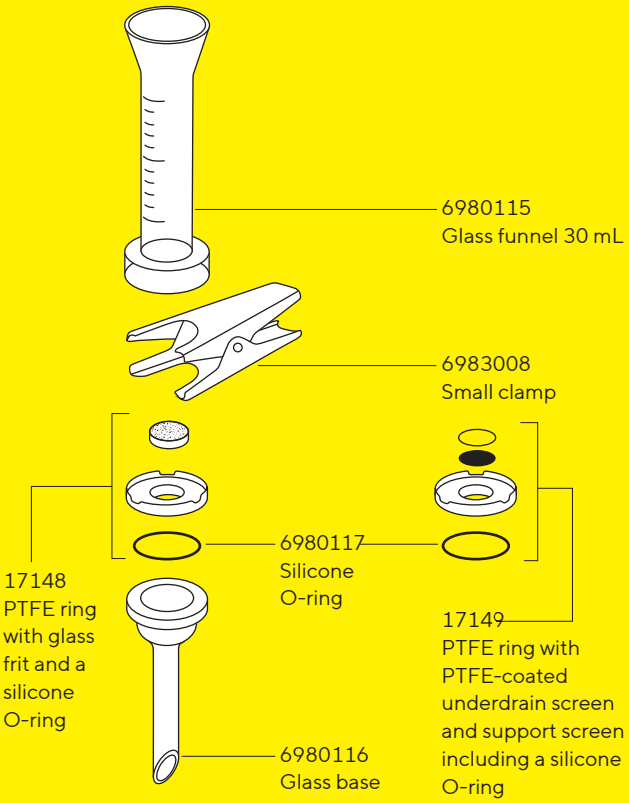
Specifications

Base outlet	12 mm diameter
Parts and materials	Borosilicate glass funnel and base; PTFE | glass filter support (type 16306) or PTFE | stainless steel filter support, coated with PTFE (type 16315) Silicone O-ring 25 × 3 mm Anodized aluminum clamp
Chemical compatibility	As for glass, PTFE and silicone. The silicone O-ring can be replaced by a fluoroelastomer O-ring (order no. 00118)
Funnel capacity	30 mL
Filtration area	3 cm²
Max. operating pressure	Only for vacuum
Suitable membrane filter diameter	25 mm
Sterilization	By autoclaving (max. 134°C) or by dry heat (max. 180°C)

Ordering Information

Description	Order No.
Glass vacuum filtration holder for 25 mm membrane filter, with glass frit filter support	16306
Glass vacuum filtration holder for 25 mm membrane filter, with PTFE-coated screen filter support	16315

Replacement parts are shown in the diagram.



Note: PTFE rings in sets 17148 and 17149 have different dimensions and are not interchangeable.

Glass Vacuum Filter Holders

50 mm Glass Vacuum Filter Holder

This filter holder is available in two versions that differ from each other only in the type of filter support. The filter holder with a glass frit ensures uniform distribution of retained particles and is therefore recommended if the residue on the filter surface is of interest. Because it is easy to clean, the filter holder with a PTFE-coated screen support is preferable if the filtrate is required or if a liquid difficult to remove from the glass frit needs to be examined.

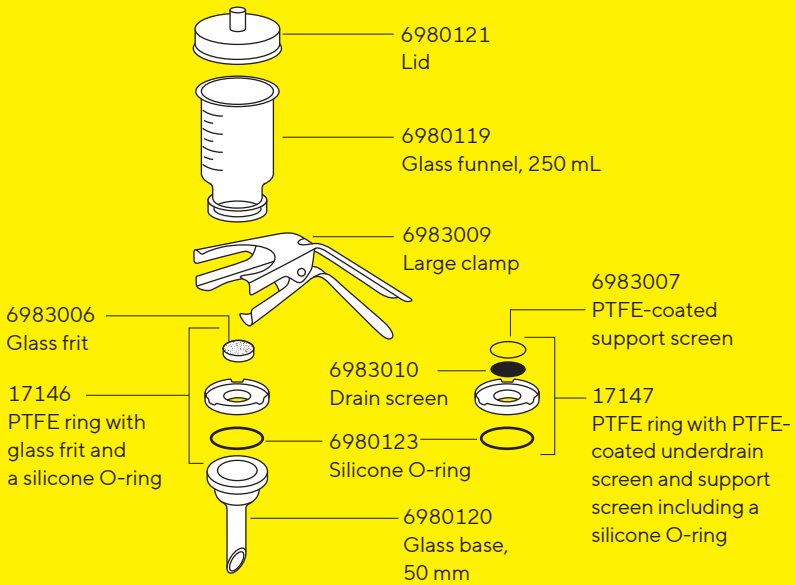
Specifications

Base outlet	15 mm diameter
Parts and materials	Borosilicate glass funnel and base Silicone rubber lid PTFE | glass filter support (type 16307) or PTFE | stainless steel filter support, coated with PTFE (type 16316) Silicone O-ring 45 × 3 mm Anodized aluminum clamp
Chemical compatibility	As for glass, PTFE and silicone The silicone O-ring can be replaced by a fluoroelastomer O-ring (order no. 00124).
Funnel capacity	250 mL
Filtration area	12.5 cm²
Max. operating pressure	Only for vacuum
Suitable membrane filter diameter	47 mm | 50 mm
Sterilization	By autoclaving (max. 134°C) or by dry heat (max. 180°C)

Ordering Information

Description	Order No.
Glass vacuum filtration holder for 50 mm (or 47 mm) membrane filter, with glass frit filter support	16307
Glass vacuum filtration holder for 50 mm (or 47 mm) membrane filter, with PTFE-coated screen filter support	16316

Replacement parts are shown in the diagram.



Note: PTFE rings in sets 17146 and 17147 have different dimensions and are not interchangeable.

Additional Accessories

Ordering Information

Suction Flasks

Description	Order No.
Suction flask, 2 liters acc. to DIN 12476, without stopper	16672
Suction flask, 5 liters acc. to DIN 12476, incl. stopper 75 D and glass tube	16672-----1

Silicone Stoppers and Connectors

Description	Flask Type	Order No.
Perforated stopper for individual stainless steel filter holders6201 | 16219 | 16220 and for tube connector (17204)	2 liters (16672)	17173
Tube connector for connecting a rubber hose 16623 or a silicone hose (1ZAS--0029)	2 liters (16672)	17204
Perforated stopper for 30 mL glass funnels 16306 | 16315	2 liters (16672)	17174
Perforated stopper for 250 mL glass funnel 16307 | 16316	2 liters (16672)	17175
Perforated stopper 75 D for glass tube (1EAQ--0017)	5liters(16672-----1)	1EAS--0019
Glass tube for silicone stopper 75 D (1EAS--0019)	5liters(16672-----1)	1EAQ--0017

Replacement Parts

Hose barb, complete, polypropylene	2 liters (16672)	6983003
Glass tube for silicone stopper 75 D (1EAS--0019)	5 liters (16672-----1)	1EAQ--0017
Assembly kit for hose barb	5 liters (16672-----1)	1EA---0018

Woulff's Bottle

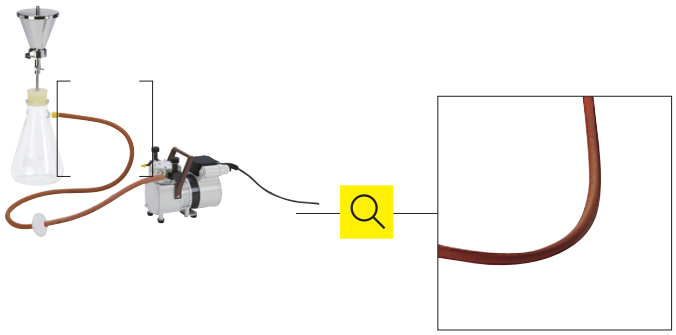
Used between a suction flask and a vacuum source for simple control of vacuum in glass units without a separate tap and also prevents the filtrate from overflowing from the suction flask.

Description	Order No.
Woulff's Bottle, 500 mL	16610

Vacuum Hoses

Thick-walled hoses for connecting system components, e. g. suction flasks, vacuum pumps, etc. When ordering, please state the length you require in meters.

Description	Order No.
Rubber vacuum hose (1 meter), ID: 7mm	16623
Silicone vacuum hose (1 meter), ID: 7 mm	1ZAS--0029



Vacusart®

Description	Order No.
Vacusart® water trap, package of 3	17804----------M

Stainless Steel Tweezers

Membrane filters need to be handled using suitable tweezers. Sartorius tweezers have blunt-edged tips for a careful, firm hold of the membrane filter. The stainless steel tweezers can be flamed and are autoclavable.

Description	Order No.
Stainless steel tweezers	16625

Stainless Steel Prefilter Attachment

The stainless steel prefilter holder allows gradual retention ("cascade filtration") of particles by size. The device is clipped between the funnel and the base of stainless steel vacuum filter holders. It can be sterilized by autoclaving or flaming.

Description	Order No.
Stainless steel prefilter attachment	16807
Replacement part: support plate; sterilizable by autoclaving or flaming	6981139

Vacuum Pumps

Microsart® mini.vac | Microsart® maxi.vac

These Sartorius neoprene membrane pumps have a low noise level and are reliable oil- and maintenance-free sources of vacuum. The two vacuum pump series feature state-of-the-art technology for daily use. Vacuum produced by the pumps is controlled and can be easily adjusted to your specifications.

Specifications

	Microsart® maxi.vac	Microsart® mini.vac
Delivery	22 L/min	6 L/min
Final vacuum	100 mbar	100 mbar
Noise level [100 mbar]	57.5–59.0 dBA	53.5 dBA
Operating pressure	1 bar (14.5 psi)	2.5 bar (~36 psi)
Materials (contact with filtrate possible)	Aluminum, CR (neoprene), NBR (Perbunan®)	PPS, EPDM, FPM (fluoroelastomer)
Connectors for tube (mm)	ID 9	ID 4
Ambient temperature	5 °C to 40 °C	5 °C to 40 °C
Power requirements (mains)	16694-2-50-22: 230 V | 50 Hz 16694-1-60-22: 115 V | 60 Hz	16694-2-50-06: 230 V | 50 Hz 16694-1-60-06: 115 V | 60 Hz
Motor protection rating	IP 44	IP 20
Power P1	130 W	65 W
Operating current	0.9 A	0.63 A
Weight	7.1 kg	1.9 kg
Dimensions W | H | D (mm)	261 | 204 | 110	164 | 141 | 90
Recommended application	All multi-branch manifolds	Individual filtration run using up to 3-branch manifolds

Ordering Information

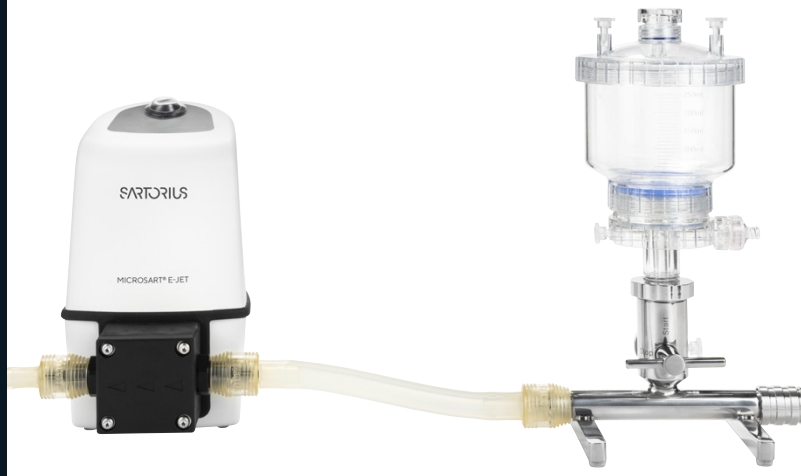
Description	Order No.
Microsart® maxi.vac for multiple filtration runs, 230 V, 50 Hz	16694-2-50-22
Microsart® maxi.vac for multiple filtration runs, 115 V, 60 Hz	16694-1-60-22
Microsart® mini.vac up to 3 filter stations in parallel, 230 V, 50 Hz	16694-2-50-06
Microsart® mini.vac up to 3 filter stations in parallel, 115 V, 60 Hz	16694-1-60-06

Replacement Parts

Description	Order No.
Replacement kit for 16694-2-50-22 and -1-60-22; set of one membrane, two valve springs and two head seals	1ED---0055
Replacement kit for 16694-2-50-06 and -1-60-06; set of one membrane, two valve springs and two head seals	1ED---0054
Sound absorber for 16694-2-50-22 and -1-60-22	1EH---0002
Sound absorber for 16694-2-50-06 and -1-60-06	1EH---0001
Fine adjustment head for 16694-2-50-22 and -1-60-22	1EV---0002
Fine adjustment head for 16694-2-50-06 and -1-60-06	1EV---0001
Fine adjustment head for 16694-2-50-06 and -1-60-06, for pressure filtration	1EV---0003

Microsart® e.jet Pump

The Microsart® e.jet simplifies liquid filtration by combining vacuum creation and waste transfer in one pump. It ensures consistent flow and optimal vacuum for reliable results. Traditional membrane filtration setups involve many components like connectors, tubes, and vacuum pumps, taking up space and requiring time to operate and maintain. With the Microsart® e.jet, the cumbersome process of breaking vacuum to empty containers is eliminated, streamlining lab work and reducing the need for extensive equipment.



Specifications

Flow Rate	Upto 4 l/min
Max. Vacuum	700 mbar (acc. ISO 8199)
Max. Pressure	1.0 bar
Materials (contact with filtrate)	PTFE, ETFE, Polypropylene, EPDM, POM, PSU
Mains	100–240 V | 47–63 Hz
Weight Pump Power supply	1,425.3 g 242.6 g
Dimensions (W x L x H)	12 × 17 × 19 cm
Max. ambient temperature	+5...+40 °C
Max. temp, of liquid	+5...+80 °C
Max. viscosity	< 150 cSt
Protection type	IP 64
Protection class	III
Inlet | Outlet	Quick Connection on hose nipples for DN 10 tubings

Ordering Information

Order Number	Description
166MP-4	Microsart® e.jet Transfer Pump

Spare Parts

Order Number	Description
1EP---0003	Pump head complete for 166MP-4
1EE---0012	Power supply complete for 166MP-4
1EAS--0027	2 Quick Connection Couplings (PSU) and 2 Nipples (POM)

Chemical Compatibility

Filter Materials

	Cellulose Acetate	Cellulose Nitrate	Reg. Cellulose	PTFE	Polyamide	Glass Fiber	Polycar-bonate	Polyether-sulfone
Solvents	**111**	**113**	**184**	**118**	**250**	**134**	**230**	**154**
Acetone	–	–	■	■	–	■	□	–
Acetonitrile	?	?	■	■	–	?	?	■
Benzene	■	■	■	■	■	■	?	■
Benzyl alcohol	□	□	■	■	■	■	?	–
n-Butyl acetate	□	–	■	■	■	■	■	■
n-Butanol	■	■	■	■	■	■	■	■
Carbon tetrachloride	□	■	■	■	■	■	?	■
Cellosolve	■	–	■	■	?	■	–	■
Chloroform	–	■	■	■	■	■	–	–
Cyclohexane	□	□	■	■	?	■	■	–
Cyclohexanone	–	–	■	■	■	■	?	?
Diethylacetamide	–	–	■	■	■	■	?	?
Diethyl ether	■	–	■	■	■	■	■	?
Dimethyl formamide	–	–	□	■	□	■	–	?
Dimethylsulfoxide	–	–	■	■	■	■	–	–
Dioxane	–	–	■	■	■	■	–	■
Ethanol, 98%	■	□	■	■	■	■	■	■
Ethyl acetate	–	–	■	■	■	■	?	–
Ethylene glycol	■	□	■	■	?	■	■	■
Formamide	?	?	?	■	?	■	–	?
Gasoline	■	■	■	■	■	■	■	■
Glycerine	■	■	■	■	■	■	■	■
n-Heptane	■	■	■	■	?	■	?	?
n-Hexane	■	■	■	■	■	■	■	?
Isobutanol	□	□	■	■	■	■	■	?
Isopropanol	■	□	■	■	■	■	■	■
Isopropyl acetate	□	–	■	■	?	■	?	■
Methanol, 98%	■	–	■	■	?	■	■	■
Methyl acetate	–	–	■	■	■	■	?	–
Methylene chloride	–	■	■	■	■	■	–	–
Methyl ethyl ketone	–	–	■	■	■	■	?	–
Methyl isobutyl ketone	■	–	■	■	■	■	?	?
Monochlorobenzene	■	■	■	■	■	■	–	?
Nitrobenzene	■	□	■	■	■	■	–	?
n-Pentane	■	■	■	■	■	■	■	?
Perchloroethylene	■	■	■	■	■	■	■	?
Pyridine	–	–	■	■	■	■	–	–
Tetrahydrofuran	–	–	■	■	■	■	–	–

	Cellulose Acetate	Cellulose Nitrate	Reg. Cellulose	PTFE	Polyamide	Glass Fiber	Polycar-bonate	Polyether-sulfone
Solvents	111	113	184	118	250	134	230	154
Toluene	■	■	■	■	■	■	?	■
Trichloroethane	□	■	■	■	?	■	?	?
Trichloroethylene	■	■	■	■	■	■	–	■
Xylene	■	■	■	■	■	■	■	■
Acids								
Acetic acid, 25%	■	■	■	■	□	?	□	■
Acetic acid, 96%	–	–	■	■	–	?	?	■
Hydrochloric acid, 25%	–	□	–	■	–	?	■	■
Hydrochloric acid, 37%	–	–	–	■	–	?	■	■
Hydrofluoric acid, 25%	■	□	□	■	–	?	■	?
Hydrofluoric acid, 50%	■	□	–	■	–	?	■	?
Perchloric acid, 25%	–	□	□	■	–	?	?	?
Phosphoric acid, 25%	■	□	□	■	–	?	?	?
Phosphoric acid, 85%	■	□	□	■	–	?	–	?
Nitric acid, 25%	–	□	–	■	–	?	■	■
Nitric acid, 65%	–	–	–	■	–	?	■	■
Sulfuric acid, 25%	–	□	□	■	–	■	?	■
Sulfuric acid, 98%	–	–	–	■	–	?	–	?
Trichloroacetic acid, 25%	–	□	■	■	–	?	?	?
Bases								
Ammonium, 1N	■	■	□	■	■	■	–	■
Ammonium hydroxide, 25%	–	□	–	□	■	□	–	■
Potassium hydroxide, 32%	–	–	□	■	□	□	–	■
Sodium hydroxide, 32%	–	–	□	■	□	□	–	■
Sodium hydroxide, 1N	□	–	□	■	■	■	–	■
Aqueous Solutions								
Formaline, 30%	□	■	□	■	□	■	■	■
Hydrogen peroxide, 35%	■	■	□	■	□	?	?	?
Sodium hypochlorite, 5%	■	□	■	■	□	■	?	?

Key to Symbols
■ = Compatible □ = Limited compatibility
– = Not compatible ? = Not tested
E = Compatible after replacing the silicone O-ring with an EPDM O-ring
V = Compatible after replacing the silicone O-ring with a fluoroelastomer O-ring

Contact time: 24 hours at 20°C
Chemical compatibilities can be influenced by various factors. Therefore, we recommend that you confirm compatibility with the liquid you wish to filter by performing a trial filtration run before you begin with actual filtration.

Filter Holder | O-Ring Materials

	Glass	Poly-carbonate	Poly-propylene	PTFE	Stain-less-Steel	EPDM O-Ring	PTFE O-Ring	Silicone O-Ring	Fluoro-elastomer O-Ring
Solvents									
Acetone	■	□	■	■	■	■	■	–	–
Acetonitrile	■	?	■	■	■	□	■	–	■
Benzene	■	–	–	■	■	–	■	–	■
Benzyl alcohol	■	–	■	■	■	□	■	■	■
n-Butyl acetate	■	–	□	■	■	■	■	–	–
n-Butanol	■	■	■	■	■	■	■	■	■
Carbon tetrachloride	■	–	□	■	■	–	■	–	■
Cellosolve	■	–	–	■	■	□	■	–	–
Chloroform	■	–	–	■	■	–	■	–	■
Cyclohexane	■	□	■	■	■	–	■	–	■
Cyclohexanone	■	–	■	■	■	–	■	–	–
Diethylacetamide	■	–	?	■	■	?	■	■	–
Diethyl ether	■	–	□	■	■	–	■	–	–
Dimethyl formamide	■	–	■	■	■	■	■	□	–
Dimethylsulfoxide	■	?	?	■	■	?	■	□	–
Dioxane	■	–	□	■	■	■	■	–	–
Ethanol, 98%	■	■	■	■	■	■	■	■	■
Ethyl acetate	■	–	■	■	■	■	■	–	–
Ethylene glycol	■	■	■	■	■	■	■	■	■
Formamide	■	–	■	■	■	■	■	–	□
Gasoline	■	□	■	■	■	–	■	–	■
Glycerine	■	□	■	■	■	■	■	■	■
n-Heptane	■	■	■	■	■	–	■	■	■
n-Hexane	■	■	■	■	■	–	■	–	■
Isobutanol	■	■	■	■	■	■	■	■	■
Isopropanol	■	□	■	■	■	■	■	■	■
Isopropyl acetate	■	■	■	■	■	■	■	–	–
Methanol, 98%	■	–	■	■	■	■	■	■	■
Methyl acetate	■	?	■	■	■	■	■	–	–
Methylene chloride	■	–	–	■	■	–	■	–	□
Methyl ethyl ketone	■	–	■	■	■	■	■	–	–
Methyl isobutyl ketone	■	–	?	■	■	–	■	–	–
Monochlorobenzene	■	–	■	■	■	–	■	–	■
Nitrobenzene	■	–	□	■	■	–	■	–	–
n-Pentane	■	■	■	■	■	–	■	–	■
Perchloroethylene	■	–	□	■	■	–	■	–	■
Pyridine	■	–	□	■	■	–	■	–	–

	Glass	Poly-carbonate	Poly-propylene	PTFE	Stain-less-Steel	EPDM O-Ring	PTFE O-Ring	Silicone O-Ring	Fluoro-elastomer O-Ring
Solvents									
Tetrahydrofuran	■	–	□	■	■	–	■	–	–
Toluene	■	–	■	■	■	–	■	–	□
Trichloroethane	■	–	?	■	■	–	■	–	■
Trichloroethylene	■	–	–	■	■	–	■	–	■
Xylene	■	–	□	■	■	–	■	–	□
Acids									
Acetic acid, 25%	■	■	■	■	■	■	■	■	–
Acetic acid, 96%	■	–	■	■	■	■	■	?	–
Hydrochloric acid, 25%	■	□	■	■	–	□	■	–	■
Hydrochloric acid, 37%	■	–	■	■	–	■	■	–	■
Hydrofluoric acid, 25%	–	–	■	■	–	□	■	–	□
Hydrofluoric acid, 50%	–	–	■	■	–	□	■	–	□
Perchloric acid, 25%	■	□	■	■	–	■	■	–	■
Phosphoric acid, 25%	■	□	■	■	□	■	■	–	■
Phosphoric acid, 85%	■	□	■	■	□	■	■	–	■
Nitric acid, 25%	■	–	■	■	–	□	■	–	■
Nitric acid, 65%	■	–	–	■	–	–	■	–	■
Sulfuric acid, 25%	■	■	■	■	□	■	■	–	■
Sulfuric acid, 98%	■	–	–	■	–	–	■	–	■
Trichloroacetic acid, 25%	■	□	■	■	–	■	■	–	–
Bases									
Ammonium, 1N	■	–	■	■	■	■	■	–	–
Ammonium hydroxide, 25%	■	–	■	■	■	■	■	■	–
Potassium hydroxide, 32%	■	–	■	■	■	■	■	□	□
Sodium hydroxide, 32%	■	–	■	■	■	■	■	□	■
Sodium hydroxide, 1N	■	–	■	■	■	■	■	■	■
Aqueous Solutions									
Formaline, 30%	■	■	■	■	■	■	■	□	■
Hydrogen peroxide, 35%	■	■	■	■	■	■	■	■	■
Sodium hypochlorite, 5%	■	■	■	■	■	■	■	■	■

Key to Symbols
■ = Compatible □ = Limited compatibility
– = Not compatible ? = Not tested

Contact time: 24 hours at 20°C
Chemical compatibilities can be influenced by various factors. Therefore, we recommend that you confirm compatibility with the liquid you wish to filter by performing a trial filtration run before you begin with actual filtration.

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