Microporous PES Membranes
High Efficiency Membranes for
Filtration and Venting Applications
Sartorius Stedim Biotech
Strong Commitment to the Industry

Sartorius Stedim Biotech is a leading provider of cutting-edge membrane technologies for the industry around the world. Sartorius Stedim Biotech focuses on technologies to meet the rapidly changing requirements of the industry it serves. Strongly rooted in the scientific community and closely allied with customers and technology partners, the company is dedicated to its philosophy of “Turning science into solutions”.

Headquartered in Aubagne, France, Sartorius Stedim Biotech is listed on the Eurolist of Euronext Paris. With its own manufacturing and R&D sites in Europe, North America and Asia and a global network of sales companies, Sartorius Stedim Biotech enjoys a worldwide presence. Its key membrane manufacturing and R&D site are located in Germany.

Sartorius Stedim Biotech enjoys a dedicated sales structure for OEM membranes to meet the customer needs. Whether located in Europe, America or Asia our sales representative can meet with you. Our experienced sales organization can help you to develop OEM solutions to your request and to define product specifications to your needs.
Microporous polyethersulfone (PES) membranes are available with a multitude of different pore sizes and performance characteristics making them ideally suited for a wide variety of applications including:

- Sterilizing Grade Filtration
- Mycoplasma Retentive Filtration
- Bioburden Reduction
- Prefiltration
- Clarification
- Venting & Gas Filtration

Sartorius Stedim Biotech produces a wide variety of microporous membranes that are especially designed, developed and manufactured to meet differing needs of biotechnology and medical device industries. Backed up by many decades of experience in membrane manufacturing and by utilizing the most state-of-the-art production equipment on the market, we guarantee excellent performance, consistent quality and a reliable supply of our membrane products.

Microporous polyethersulfone (PES) membranes are manufactured in our premier production facilities in Göttingen, Germany. With our advanced casting technologies and strict environmental controls in place we ensure a stable and clean manufacturing process as well as a strong security of supply. Consistent process performance is secured by stringent qualification of all components and assemblies, manufacturing processes and personnel. Visits to our manufacturing facilities may be arranged on request.

Sartorius Stedim Biotech’s quality philosophy ensures that our customers receive products and services that meet the strictest quality requirements. The entire range of our membrane products is supplied with Certificates of Analysis.
Removal of Particles and Microorganisms from Liquids and Gases

Membrane processes are one of the most effective separation processes and they are steadily under development leading to new prospects of their applications. Sartorius Stedim Biotech polyethersulfone (PES) membranes are available in a wide variety of different pore sizes and structures as well as surface properties to serve nearly unlimited selectivity of separation. Their superior intra and inter lot consistency guarantees for reliable results. Further outstanding features like their excellent gamma compatibility and high mechanical and thermal resistance make Sartorius Stedim Biotech PES membranes the first choice for all major liquid and gas filtration applications, including medical devices.

Hydrophilic PES Membranes

**Clarification | Sterile Filtration**
Hydrophilic PES membranes are ideal for clarification and sterilization of aqueous liquids laden with particles, e.g. for preparation of pharmaceuticals or infusion solutions. All microorganisms and particles are reliably removed, without any effects on the ingredients, due to adsorption or decomposition. For optimal results, our hydrophilic PES membranes provide high flow rates and lowest adsorption characteristics. Different structures from symmetric to highly asymmetric allow you to select the membrane with the best combination of selectivity, flux and total throughput for your individual OEM device.

Hydrophobic and Oleophobic PES Membranes

**Sterile Venting | Medical Use**
These hydrophobic and oleophobic PES membranes have been developed to combine exceptionally high air flow rates with reliable liquid repelling properties. The membrane serves as a barrier against contamination from particles, aerosols, microorganisms, and other undesirable substances. In addition, venting membranes efficiently equalize pressure fluctuations that can occur during manufacturing processes or within a product during normal use, thus leading to increased process and product security. These high efficiency membranes are ideally suited for fast air filtration or sterile venting while preventing any liquid passage or condensate blockage.
Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Hydrophilic PES membranes</th>
<th>Hydrophobic and oleophobic PES membranes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Filtration Devices</td>
<td>IV therapy</td>
<td>Infusion Sets</td>
</tr>
<tr>
<td></td>
<td>Ophthalmic</td>
<td>IV filter</td>
</tr>
<tr>
<td></td>
<td>Drug preparation</td>
<td>Transducer protectors</td>
</tr>
<tr>
<td></td>
<td>Clinical reagents</td>
<td>Catheters</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>Buffer, media and sera filtration</td>
<td>Tubing systems</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Biotechnology</td>
<td>Industry</td>
</tr>
<tr>
<td>Cell separation</td>
<td>Vent caps</td>
<td>Sterile vents for containers, bioreactors, fermenters</td>
</tr>
<tr>
<td>Water treatment</td>
<td>Liquid stopper devices</td>
<td></td>
</tr>
<tr>
<td>Sterile filtration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food &amp; Beverage Industry</td>
<td>Clarification</td>
<td>Liquid bottling</td>
</tr>
<tr>
<td></td>
<td>Concentration</td>
<td>Food packaging</td>
</tr>
<tr>
<td></td>
<td>Sterile filtration</td>
<td></td>
</tr>
<tr>
<td>Electronics Industry</td>
<td>Sensors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric motors</td>
<td></td>
</tr>
</tbody>
</table>

Do You Need Assistance to Choose the Best Suitable Membrane?

Please do not hesitate to contact us at unisart@sartorius-stedim.com. Our team of experts and scientists will assist you with the choice of the right membrane for your OEM application.

Custom Made Membranes and Dimensions

OEM membranes often need custom dimensions in order to suit individual customer application requirements. From the master rolls, stored immediately after production, smaller slit rolls, sheets or disks of different format can be generated. Based on technical feasibility and quantity, a customized membrane development is possible. Please contact us at unisart@sartorius-stedim.com to get more information.
Hydrophilic PES Membranes for Liquid Filtration

Hydrophilic PES membranes have a high internal porosity. They perform well at high flux with an excellent throughput of aqueous solutions over the entire pH range of 1–14. Their low level of extractables makes them suitable for environmental analysis. Thanks to their low non-specific protein binding the PES membranes are recommended for filtering biological and pharmaceutical solutions.

Hydrophilic PES membranes are available in different membrane structures. The symmetric membrane structure allows for high physical stress levels in the final product manufacturing, still ensuring the integrity of the membrane. The asymmetric membrane structure features higher flow rates in combination with relatively high physical stress levels in final device manufacturing. If total throughput is most important for the application, a highly asymmetric membrane is the membrane of choice.

Regardless of the membrane structure, 0.1–0.22 µm rated PES membranes provide sterile filtration making the membranes well suited for biological sample preparation or sterile filtration of culture media and buffers.
### Typical Performance Characteristics

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Nominal Pore Size [µm]</th>
<th>Structure*</th>
<th>Water Flow Rate [ml/(cm² min bar)]</th>
<th>Bubble Point Sartocheck [bar]</th>
<th>Burst Pressure [bar]</th>
<th>Thickness [µm]</th>
<th>Retention (10^7$/cm² Filter Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15442</td>
<td>5</td>
<td>AS</td>
<td>&gt; 40**</td>
<td>0.3****</td>
<td>≥ 0.2</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15402</td>
<td>3</td>
<td>AS</td>
<td>&gt; 25**</td>
<td>0.5****</td>
<td>≥ 0.2</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15413</td>
<td>1.2</td>
<td>AS</td>
<td>&gt; 12**</td>
<td>0.8</td>
<td>≥ 0.3</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15405</td>
<td>0.65</td>
<td>AS</td>
<td>&gt; 80</td>
<td>1.5</td>
<td>≥ 0.4</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15445</td>
<td>0.5</td>
<td>AS</td>
<td>90</td>
<td>2.3</td>
<td>≥ 0.4</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15456</td>
<td>0.45</td>
<td>AS</td>
<td>&gt; 40</td>
<td>2.4</td>
<td>≥ 0.5</td>
<td>160</td>
<td>N/A</td>
</tr>
<tr>
<td>15406</td>
<td>0.45</td>
<td>S</td>
<td>45</td>
<td>2.6</td>
<td>≥ 0.4</td>
<td>150</td>
<td>100% Serratia marcescens</td>
</tr>
<tr>
<td>15467</td>
<td>0.3</td>
<td>AS</td>
<td>&gt; 23</td>
<td>&gt; 2.9</td>
<td>≥ 0.4</td>
<td>150</td>
<td>N/A</td>
</tr>
<tr>
<td>15407</td>
<td>0.2</td>
<td>S</td>
<td>25</td>
<td>&gt; 3.5</td>
<td>≥ 0.4</td>
<td>150</td>
<td>100% Brevundimonas diminuta</td>
</tr>
<tr>
<td>15407MI</td>
<td>0.2</td>
<td>AS</td>
<td>&gt; 30</td>
<td>&gt; 3.2</td>
<td>≥ 0.4</td>
<td>140</td>
<td>100% Brevundimonas diminuta</td>
</tr>
<tr>
<td>15427EP</td>
<td>0.22</td>
<td>HAS</td>
<td>&gt; 34</td>
<td>&gt; 3.55</td>
<td>≥ 0.4</td>
<td>160</td>
<td>100% Brevundimonas diminuta</td>
</tr>
<tr>
<td>15458</td>
<td>0.1</td>
<td>S</td>
<td>9</td>
<td>&gt; 2.5****</td>
<td>≥ 0.5</td>
<td>150</td>
<td>100% Brevundimonas diminuta; LRV ≥ 7 Acholeplasma laidlawii</td>
</tr>
</tbody>
</table>

* S = symmetric, AS = asymmetric, HAS = highly asymmetric  
** air flow rate [l/(m² s) at 200 Pa]  
*** with isopropyl alcohol | water 60 vol% | 40 vol%  
**** visual

**Structure**
- Symmetric, asymmetric, highly asymmetric

**Adsorption, Non-specific**
- ~ 10 µg/cm² for Γ-globulin  
- < 8 µg/cm² for BSA

**pH Stability**
- Resistant to aqueous solutions pH 1–14

**Thermal Resistance**
- 200 °C max.

**Biocompatibility According to USP Standard**
- Passes USP Biological Tests Plastic Class VI for biocompatibility and cytotoxicity  
- Tests are partially performed on final devices
Hydrophobic and Oleophobic PES Membranes for Venting & Gas Filtration

These PES membranes are treated to make their hydrophobic or oleophobic surfaces perfectly liquid repelling. Even under high humidity or high moisture, outstanding air permeability is guaranteed to assure rapid venting at low differential pressure. Due to their high mechanical stability, the membranes can easily be welded and integrated into a wide variety of devices. An additional specific feature of these membranes is their excellent gamma compatibility. In contrast to other common polymeric matrices for venting and gas filtration, such as PTFE, Sartorius Stedim Biotech PES membranes can be sterilized by gamma irradiation making them also best suited for the most demanding applications like medical devices.

Water Intrusion Pressure

Air Flow Rate
## Typical Performance Characteristics

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Surface Property</th>
<th>Nominal Pore Size* [µm]</th>
<th>Thickness [µm]</th>
<th>Air Flow Rate [l/(m² sec) at 200 Pa]</th>
<th>Water Intrusion Pressure [bar]</th>
<th>IPA** Wettability</th>
</tr>
</thead>
<tbody>
<tr>
<td>15C77</td>
<td>hydrophobic</td>
<td>0.2</td>
<td>135</td>
<td>1.4</td>
<td>2.8</td>
<td>+</td>
</tr>
<tr>
<td>15D07MI</td>
<td>oleophobic</td>
<td>0.2</td>
<td>135</td>
<td>1.4</td>
<td>2.8</td>
<td>–</td>
</tr>
<tr>
<td>15D13</td>
<td>oleophobic</td>
<td>1.2</td>
<td>160</td>
<td>14</td>
<td>0.5</td>
<td>–</td>
</tr>
<tr>
<td>15D02</td>
<td>oleophobic</td>
<td>3.0</td>
<td>160</td>
<td>25</td>
<td>0.4</td>
<td>–</td>
</tr>
<tr>
<td>15D42</td>
<td>oleophobic</td>
<td>5.0</td>
<td>160</td>
<td>50</td>
<td>0.3</td>
<td>–</td>
</tr>
</tbody>
</table>

* Additional pore sizes are available, please contact us at unisart@sartorius-stedim.com

** isopropyl alcohol

### Thermal Resistance
- 200 °C max.

### Biocompatibility According to USP Standard
- Passes USP Biological Tests Plastic Class VI for biocompatibility and cytotoxicity
Technical Information

Sterilization Methods

All Sartorius Stedim Biotech PES membrane products show excellent gamma compatibility and high thermal resistance giving you the freedom to choose the sterilization method that best meets the requirements of your device:

- Gamma irradiation (≤ 50 kGy)
- Autoclaving at 121 °C or 134 °C
- EtO sterilization

Membrane Sealing Methods

Due to their good tensile strength and high thermal resistance, all PES membrane products can easily be sealed onto plastic support or housing using most common welding methods like heat, radio frequency, ultrasonic and adhesives.
Storage and Handling

By respecting the following recommendations you will ensure that your membrane products will always be at their optimum condition before use.

- The membranes are stored in their original package until use.
- Do not expose the membrane to direct sunlight or chemical vapors and keep it away from sources of heat.
- Constant temperatures between 15 – 25 °C and a relative humidity of max. 70% are best for storage and handling of the membrane. Very dry or humid storage conditions might alter the wettability and handling properties of the membrane. This change is only temporarily and can be overcome by conditioning the membrane at relative humidity between 40 – 70% for approximately 12 hours before processing the membrane.
- After unpacking the membrane, please avoid any direct contact of the membrane to materials that have the potential to release chemicals or additives. Adsorption or absorption of such substances could affect essential membrane properties like wettability. For the same reason, any direct contact with the membrane should be avoided.

Would You Like to Use Membranes with Other Polymeric Matrices?

Microporous membranes can be composed of various polymers that differ from one another in their chemical and physical properties. Together with the characteristics of the filter pores these polymer properties govern the results in many filtration applications. The table below provides an overview which other polymeric matrices are available at Sartorius Stedim Biotech in addition to our PES portfolio.

<table>
<thead>
<tr>
<th>Polymer</th>
<th>Features</th>
<th>Typical Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose acetate (CA)</td>
<td>high flow rates</td>
<td>protein filtration,</td>
</tr>
<tr>
<td></td>
<td>thermal stability</td>
<td>biological and clinical analysis,</td>
</tr>
<tr>
<td></td>
<td>very low non-specific adsorption</td>
<td>sterility tests</td>
</tr>
<tr>
<td>Surfactant free</td>
<td>excellent wettability</td>
<td>removal of particles and microorganisms from aqueous</td>
</tr>
<tr>
<td>cellulose acetate (SFCA)</td>
<td>very low non-specific adsorption low content of</td>
<td>solutions, sterile filtration</td>
</tr>
<tr>
<td>Cellulose nitrate (CN)</td>
<td>very high protein and DNA binding</td>
<td>cell retention, buffer filtration, microbiological testing</td>
</tr>
<tr>
<td>Regenerated cellulose (RC)</td>
<td>strong chemical resistance low protein binding</td>
<td>particle removal from organic and aqueous media,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ultracleaning of solutions for HPLC</td>
</tr>
<tr>
<td>Polyamide (PA)</td>
<td>chemically resistant to alkaline solutions and</td>
<td>particle removal in solutions for HPLC, filtration of</td>
</tr>
<tr>
<td></td>
<td>organic solvents</td>
<td>protein-free culture media</td>
</tr>
</tbody>
</table>

Please contact us at unisart@sartorius-stedim.com for a complete listing of our membrane products.
Europe

Germany
Sartorius Stedim Biotech GmbH
August-Spindler-Strasse 11
37079 Gottingen
Phone +49.551.308.0

Sartorius Stedim Systems GmbH
Robert-Bosch-Strasse 5 – 7
34302 Guxhagen
Phone +49.5566.407.0

France
Sartorius Stedim FMT S.A.S.
ZI des Paluds
Avenue de Jouques – CS 91051
13781 Aubagne Cedex
Phone +33.442.845600

Sartorius Stedim France SAS
ZI des Paluds
Avenue de Jouques – CS 71058
13781 Aubagne Cedex
Phone +33.442.845600

Austria
Sartorius Stedim Austria GmbH
Modecenterstrasse 22
1030 Vienna
Phone +43.1.7965763.18

Belgium
Sartorius Stedim Belgium N.V.
Rue Colonel Bourg 105
1030 Bruxelles
Phone +32.2.756.06.80

Hungary
Sartorius Stedim Hungária Kft.
Kaigyő u. 5
2092 Budakeszi
Phone +36.23.457.227

Italy
Sartorius Stedim Italy S.r.l.
Via dell’Antella, 76/A
50012 Antella-Bagno a Ripoli (FI)
Phone +39.055.63.40.41

Netherlands
Sartorius Stedim Netherlands B.V.
Phone +31.30.60.25.080
filtratie.nederland@sartorius-stedim.com

Poland
Sartorius Stedim Poland Sp. z o.o.
ul. Wreszinska 70
62-025 Koszyn
Phone +48.61.647.38.40

Russia
Sartorius Stedim Russia
Vasilyevsky Island
5th line 70, Lit. A
199178 St. Petersburg
Phone +7.812.327.53.27

Spain
Sartorius Stedim Spain, S.A.U.
Avda. de la Industria, 32
15076 – San Isidro, Lima
Phone +51.1.441.0158

Switzerland
Sartorius Stedim Switzerland AG
Ringstrasse 24 a
8317 Tagelswangen
Phone +41.52.354.36.36

U.K.
Sartorius Stedim UK Ltd.
Longmead Business Centre
Blenheim Road, Epsom
Surrey KT19 9 QQ
Phone +44.1372.737159

Ukraine
LLC “Sartorius Stedim RUS”
Post Box 440 “B”
01001 Kiev, Ukraine
Phone +380.44.411.4918

Americas

USA
Sartorius Stedim North America Inc.
5 Orville Drive, Suite 200
Bohemia, NY 11716
Toll-Free +1.800.368.7178

Argentina
Sartorius Argentina S.A.
Int. A. Ávalos 4251
B1605ECS Munro
Buenos Aires
Phone +54.11.4721.0505

Brazil
Sartorius do Brasil Ltda
Avenida Senador Vergueiro 2962
São Bernardo do Campo
CEP 09600-000 - SP - Brasil
Phone +55.11.4362.8900

Mexico
Sartorius de México, S.A. de C.V.
Libramiento Norte de Tepozotlan s/n,
Colonia Barrio Tlacateco,
Municipio de Tepozotlan,
Estado de México,
C.P. 54605
Phone +52.55.5562.1102
leadsmex@sartorius.com

Peru
Sartorius Peru S.A.C.
Avenue Alberto del Campo 411
Floor 12 – The Office
562 123 Bangalore, India
Phone +91.80.4350.5250

Japan
Sartorius Stedim Japan K.K.
4th Fl., Daiwa Shinagawa North Bldg.
8-11, Kita-Shinagawa 1-chome
Shinagawa-ku, Tokyo, 140-0001 Japan
Phone +81.3.4331.4300

Malaysia
Sartorius Stedim Malaysia Sdn. Bhd.
Lot L3-E-3B, Enterprise 4
Technology Park Malaysia
Bukit Jalil
57000 Kuala Lumpur, Malaysia
Phone +60.3.8996.0622

South Korea
Sartorius Korea Biotech Co., Ltd.
8th Floor, Solid Space B/D,
ParnGyoYeok-Ro 220, BunDang-Gu
SeongNam-Si, GyeongGi-Do, 463-400
Phone +82.31.622.5700

Asia | Pacific

Australia
Sartorius Stedim Australia Pty. Ltd.
Unit 5, 7-11 Rodeo Drive
Dandenong South Vic 3175
Phone +61.3.8762.1800

China
Sartorius Stedim Biotech (Beijing) Co. Ltd.
No. 33 Yu’an Road
Airport Industrial Park Zone B
Shunyi District, Beijing 101300
Phone +86.10.80426516

Sartorius Stedim Biotech (Shanghai)
Trading Co., Ltd.
3rd Floor, North Wing, Tower 1
No. 4560 Jinke Road
Zhangjiang Hi-Tech Park
Pudong District
Shanghai 201210, P.R. China
Phone +86.21.6878.2300

India
Sartorius Stedim India Pvt. Ltd.
#692-693, NH 48, Jakkasandra
Nelamangala Tq
 Bangalore 562 123 Bangalore, India
Phone +91.80.4350.5250

Singapore
Sartorius Stedim Singapore Pte. Ltd.
10 Science Park Rd
The Alpha #02-13/14
Singapore Science Park II
Singapore 117684
Phone +65.6872.3966