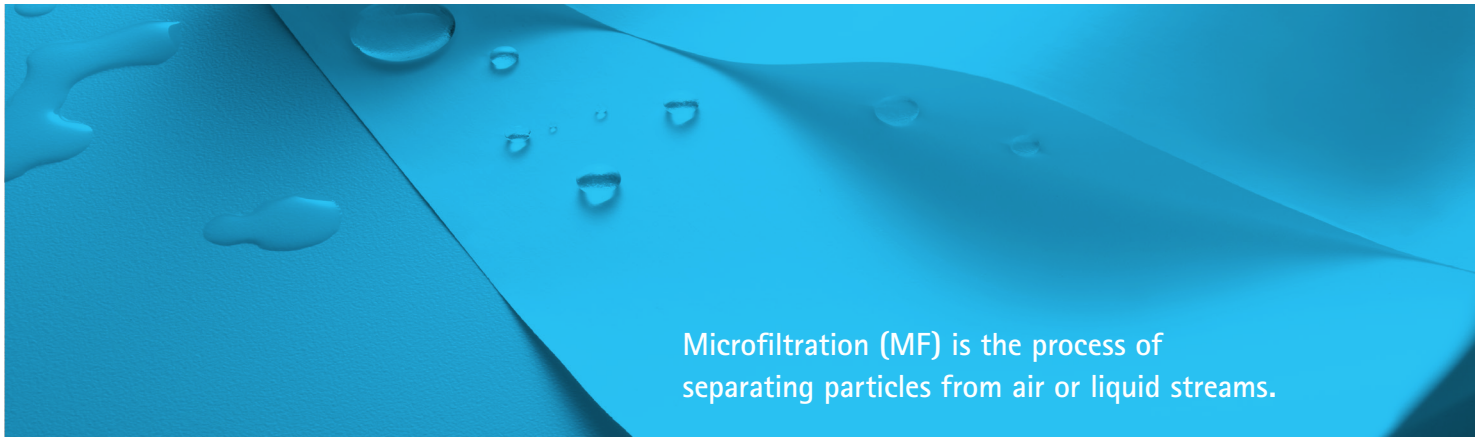
Microfiltration Membranes

Microfiltration Membranes for Filtration and Venting Applications

Merck Millipore is a division of MERCK

Microfiltration Membranes for Filtration and Venting

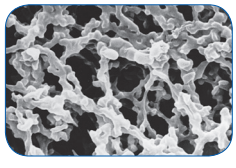


This guide provides an introduction to the Merck Millipore membranes which are typically used in venting and filtration applications, including medical devices. Merck Millipore offers a wide variety of hydrophobic and hydrophilic membranes, in a variety of formats to suit your product or application needs.

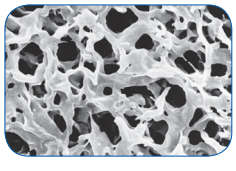
Also, included in this guide is a performance characteristic table which details the most pertinent product attributes and outlines the performance (e.g. flow rate, biocompatibility and average bubble point) of each of Merck Millipore's microfiltration membranes. Selecting a membrane with the desired characteristics will support high levels of performance and retention; however optimization through experimentation should always be conducted to find a suitable balance between retention and flow rate levels.

All Merck Millipore membranes are manufactured in our world class facility located in Cork, Ireland. Visits to our manufacturing facilities may be arranged upon request.

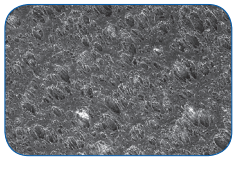
Hydrophilic Membranes



MF-Millipore™ Membranes

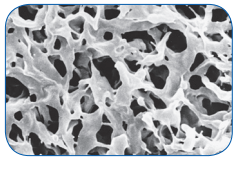


PVDF Membranes



Millipore Express® PES Membranes

Superhydrophobic Membranes



SureVent® PVDF Membranes

Hydrophilic Membranes

Typical medical filtration applications for hydrophilic membranes include:

- IV therapy
- Ophthalmic
- Drug preparation
- Blood, plasma
- Irrigation
- Clinical reagents

MF-Millipore Membrane

- Mixed esters of cellulose (MCE)
- Allows for high flow rate and effective retention of microorganisms.

PVDF Membrane

- Polyvinylidene fluoride (PVDF)
- Merck Millipore's unique manufacturing process makes it the lowest protein binding membrane filter available.
- Available in hydrophilic, hydrophobic and cationic forms.

Millipore Express PES Membrane

- Surface-modified polyethersulfone (PES)
- Unique pore structures allow fast flow and less membrane clogging.
- Has higher flow rates and throughput than comparable membranes rated at the same pore size.

Superhydrophobic Membranes

Typical medical device applications for hydrophobic membranes include:

- Bag and tubing vents
- Vial, pump and IV vents
- Transducer protection
- Vent caps
- Insufflation filters
- Anesthesia gas monitoring

SureVent PVDF Membrane

- Superhydrophobic polyvinylidene fluoride (PVDF)
- Membrane is treated with a validated process that makes it one of the most hydrophobic materials available.

For a complete listing of our membrane products, please visit www.millipore.com/diagnostics.

Performance Characteristics

Mixed Cellulose Ester (MCE) Membranes (Hydrophilic)

Membrane Name	MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore
Pore Size	0.025 µm	0.05 µm	0.1 µm	0.22 µm	0.3 µm
Membrane Material	MCE	MCE	MCE	MCE	MCE
Support Material	None	None	None	None	None
Average Bubble Point	306 psi	255 psi	204 psi	55 psi	40 psi
Average Thickness	105 µm	105 µm	105 µm	150 µm	150 µm
Flow Rate (at 13.5 psi)	0.15 mL/min/cm^2	0.74 mL/min/cm^2	1.5 mL/min/cm^2	18 mL/min/cm^2	32 mL/min/cm^2
Membrane Code	VSWP	VMWP	VCWP	GSWP	PHWP

PVDF, PES Membranes (Hydrophilic)

Membrane Name	Hydrophilic PVDF	Hydrophilic PVDF	Hydrophilic PVDF	Hydrophilic PVDF	Hydrophilic PVDF	Hydrophilic PVDF
Pore Size	0.1 µm	0.22 µm	0.45 µm	0.65 µm	0.8 µm	0.8 µm
Membrane Material	Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF
Support Material	None	None	None	None	None	None
Bacterial Retention	*B. diminuta* challenge with 10^7 org/cm^2	*B. diminuta* challenged with 10^7 org/cm^2	N/A	N/A	N/A	N/A
Average Bubble Point	73 psi	57 psi	25 psi	18 psi	11.5 psi	10.5 psi
Biocompatibility	Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI	N/A	N/A	N/A	N/A
Average Thickness	103 µm	125 µm	115 µm	115 µm	115 µm	115 µm
Flow Rate (at 13.5 psi)	≤ 2.5 mL/min/cm^2	7.2 mL/min/cm^2	29 mL/min/cm^2	69 mL/min/cm^2	91 mL/min/cm^2	87 mL/min/cm^2
Membrane Code	VVPP	GVPP	HVPP	DVPP	CVPP	BVPP

PVDF Membranes (Hydrophobic and Superhydrophobic)

Membrane Name	Hydrophobic PVDF	Hydrophobic PVDF	Hydrophobic PVDF	Hydrophobic PVDF
Pore Size	0.1 µm	0.22 µm	0.45 µm	0.65 µm
Membrane Material	PVDF	PVDF	PVDF	PVDF
Support Material	None	None	None	None
Average Bubble Point	28 psi (methanol)	21.5 psi (methanol)	10.5 psi (methanol)	6.2 psi (methanol)
Average Thickness	107 µm	125 µm	115 µm	115 µm
Water Intrusion Pressure	≥ 50 psi	≥ 30 psi	≥ 15 psi	≥ 8 psi
Flow Rate	≤ 3.5 mL/min/cm^2 at 13.5 psi (water flow)	≤ 6.4 mL/min/cm^2 at 13.5 psi (water flow)	15.1 mL/min/cm^2 at 13.5 psi (water flow)	68 mL/min/cm^2 at 13.5 psi (water flow)
Phobicity	Hydrophobic	Hydrophobic	Hydrophobic	Hydrophobic
Membrane Code	VVHP	GVHP	HVHP	DVHP

MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore	MF-Millipore
0.45 µm	0.65 µm	0.8 µm	1.2 µm	3 µm	5 µm	8 µm
MCE	MCE	MCE	MCE	MCE	MCE	MCE
None	None	None	None	None	None	None
31 psi	20 psi	16 psi	12 psi	11 psi	8 psi	8 psi
148 µm	148 µm	150 µm	150 µm	153 µm	135 µm	135 µm
60 mL/min/cm^2	140 mL/min/cm^2	190 mL/min/cm^2	270 mL/min/cm^2	320 mL/min/cm^2	580 mL/min/cm^2	620 mL/min/cm^2
HAWP	DAWP	AAWP	RAWP	SSWP	SMWP	SCWP

Hydrophilic PVDF	Millipore Express PLUS	Millipore Express PLUS	Millipore Express PLUS	Millipore Express PLUS	Millipore Express PLUS
5 µm	0.1 µm	0.2 µm	0.2 µm	0.45 µm	0.5 µm
Modified PVDF	Modified PES	Modified PES	Modified PES	Modified PES	Modified PES
Polyester web	None	None	None	None	None
N/A	quantitative retention of 10^7 cfu/cm^2 *(B. diminuta)*	quantitative retention of 10^7 cfu/cm^2 *(B. diminuta)*	quantitative retention of 10^7 cfu/cm^2 *(B. diminuta)*	N/A	N/A
4.5 psi	44 psi	23.7 psi	>20 psi	16.1 psi	16.1 psi
Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI	Passes the USP Biological test for plastics, Class VI
120 µm	110 µm	138 µm	150 µm	143 µm	143 µm
193 mL/min/cm^2	5.6 mL/min/cm^2	25 to 57 mL/min/cm^2	15 mL/min/cm^2	24 mL/min/cm^2	43 mL/min/cm^2
SVPP	VEPP	GEPP	EIMF	HEMF	HEPP

SureVent PVDF	SureVent PVDF	SureVent PVDF	SureVent PVDF	SureVent PVDF	SureVent PVDF
0.1 µm	0.22 µm	0.45 µm	0.65 µm	1.0 µm	5.0 µm
Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF	Modified PVDF
None	None	None	None	None	Polyester Nonwoven
N/A	N/A	N/A	N/A	N/A	N/A
115 µm	125 µm	115 µm	115 µm	115 µm	115 µm
≥73 psi	≥45 psi	≥25 psi	≥15 psi	≥7 psi	>2 psi
≥0.3 slpm at 5 psi (air flow)	>0.4 slpm at 1 psi (air flow)	≥1.1 slpm at 1 psi (air flow)	≥2.2 slpm/cm^2 at 1 psi (air flow)	≥5.0 slpm at 1 psi (air flow)	≥1.3 slpm/cm^2 at 1 psi (air flow)
Superhydrophobic/ oleophobic	Superhydrophobic/ oleophobic	Superhydrophobic/ oleophobic	Superhydrophobic/ oleophobic	Superhydrophobic/ oleophobic	Superhydrophobic/ oleophobic
VVSP	GVSP	HVSP	DVSP	BVSP	SVSP

Membrane Sealing Methods

This section provides an overview of membrane sealing methods and key considerations when designing a sealing process.

Heat Sealing

Heat is transferred through a die that is applied directly onto the materials being sealed. As the heat melts the substrate plastic, the pressure forces the softened plastic into the pore structure of the membrane and forms a bond between the materials. The sealing parameters of temperature, pressure and dwell time must be optimized for each process and material combination.

- Apply a low surface-energy coating to the heater head to minimize plastic build-up
- A transparent seal area generally indicates a complete seal
- Simple seal geometries, such as a circle, yield better results
- Seal membranes to substrate materials with similar or lower melting points
- A minimum seal width of 0.05 in. (1.25 mm) is recommended
- Seal integrity can be tested using low air or water pressure in the reverse flow direction

Membrane Sealing Properties*

PVDF Membrane

HEAT SEALING

Housing Material	Temperature Range	Pressure	Dwell Time
Acrylic	390 °F – 440 °F	35 psi	4 sec
Co-polyester	390 °F – 450 °F	35 psi	4 sec
Polyethylene	420 °F – 435 °F	35 psi	3 sec
Polypropylene	420 °F – 440 °F	35 psi	3 sec
PVC	375 °F – 475 °F	35 psi	3 sec

ULTRASONIC WELDING

Can be sealed to a variety of plastics, including co-polyester, PVC, polyethylene and polypropylene. Ultrasonic welding to acrylic is not recommended.

* The parameters presented are guidelines only.

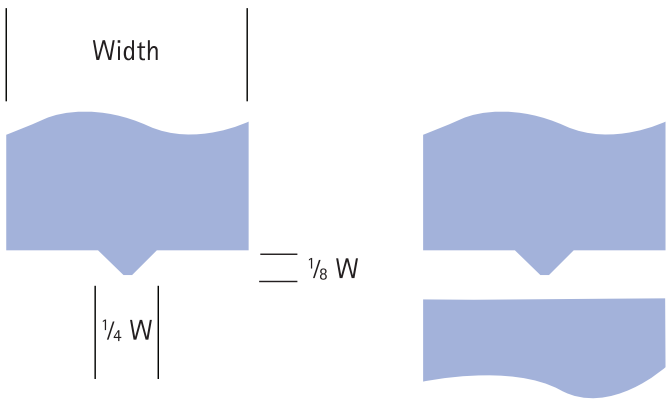
Ultrasonic Welding

Ultrasonic welding is the joining of thermoplastics through the use of heat generated from high frequency mechanical motion or vibrations. The vibrations are created in a vertical direction; the heat is generated from the repeated collision of the materials.

- Use a welder with high frequency and low amplitude (40 KHz) to reduce damage to delicate materials such as membranes
- Avoid excess vibration
- Proper horn, nest, and part design are crucial to achieve a good seal
- Use energy directors to reduce the required weld energy
- Cutting and sealing can occur with one pass of the welder

Assembly and Joining

Ultrasonic Bonding

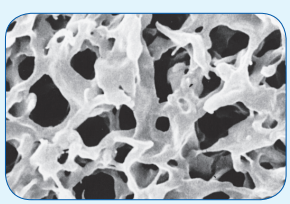


Recommended proportional ratios for energy director design.

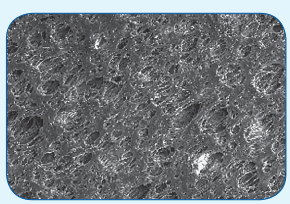
Sterilization Compatibility

	Autoclave	Ethylene Oxide	Gamma Irradiation
PVDF	●	●	●
PES	●	●	●

● = Recommended ○ = Not Recommended



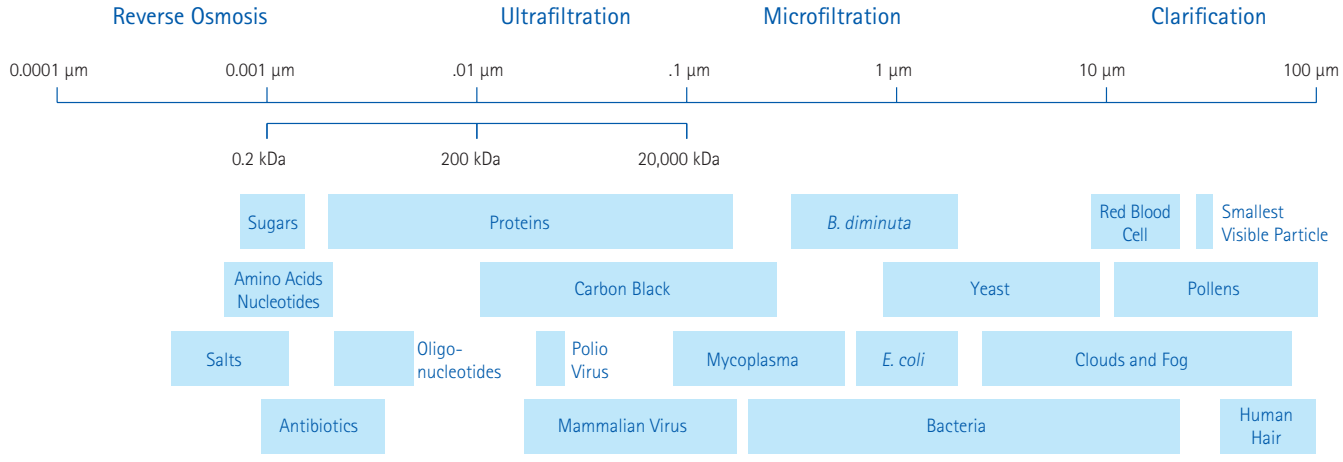
PVDF



PES

Comparison of Microfiltration with Other Commonly Used Membrane Separation Techniques

This table is an overview of common molecules and particles with the recommended filtration/separation technology based on the size and/or type of molecule or particle. Merck Millipore offers a wide array of membrane products to support both your microfiltration and ultrafiltration needs.



To Place an Order or Receive Technical Assistance

Europe

Aziz Elbalboul
Business Development Manager
Tel: +33 67 838 5629
Email: aziz.elbalboul@merckgroup.com

Japan

Kazuhisa Kameyama
Sales Manager Japan
Tel: +81 90 7424 1147
Email: kazuhisa.kameyama@merckgroup.com

Daigo Kanai
Business Development Manager
Tel: +81 80 1260 4412
Email: daigo.kanai@merckgroup.com

China

Wei Zhu
Business Development Manager
Tel: +86-13788954409
Email: wei.zhu@merckgroup.com

Rest of World

Peter McGregor
Business Development Manager
Tel: +44 7775 79 44 23
Email: peter.mcgregor@merckgroup.com

Email: Diagnostic.Technical.Group@merckgroup.com

MERCK MILLIPORE

www.merckmillipore.com/offices

Lit No. PF1176EN00MM Rev. E DI-12-06269 4/2012 Printed in the USA.