



Product Selection Guide

# Ultrafiltration Membranes

## Ultrafiltration Membranes for Macromolecule Processing



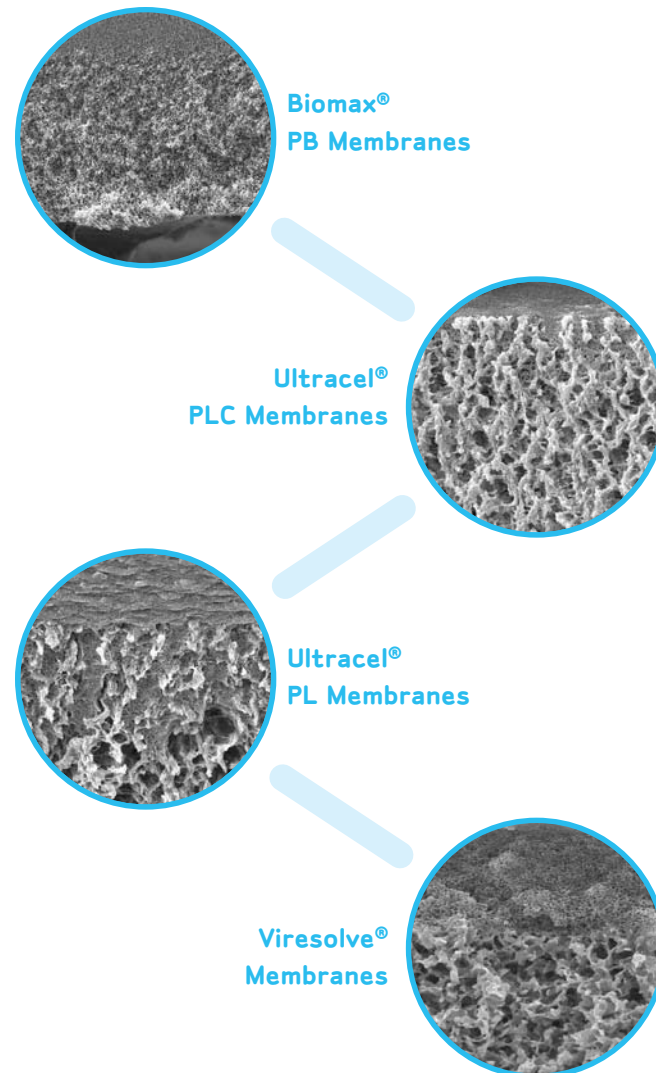
# Ultrafiltration Membranes for Macromolecule Processing

Ultrafiltration (UF) is the process of separating extremely small particles and dissolved molecules from fluids. The primary basis for separation is molecular size – particles ranging from 1,000 to 1,000,000 molecular weight are retained by ultrafiltration membranes.



Millipore's UF membranes are manufactured in our world class facility in Jaffrey, New Hampshire. This state-of-the-art facility is dedicated to the reliable production of our high quality UF membranes, deploying GMP practices and ISO compliant measures. The 44,000 sq ft facility is a Commissioned Class 100K controlled environment; containing the most innovative manufacturing equipment and processes in the industry.

This guide provides an introduction to Millipore's family of Ultrafiltration Membranes and an overview of the key criteria and product characteristics to consider when selecting an UF membrane for your application or medical device. Using this guide will help ensure high levels of retention; however optimization through experimentation should always be conducted to find a suitable balance between retention and flow rate levels.



## BIOMAX PB MEMBRANES

Biomax PB membranes are well suited for applications requiring high flux, low to moderate protein binding, and harsh chemical cleaning and/ or sanitization. Made of polyethersulfone (PES), these void-free membranes are caustic and chlorine resistant, and are modified to reduce non-specific protein binding and fouling. The high flux and high retention of Biomax membranes result in faster processing speeds with higher yields. This allows shorter processing time and more compact processing systems.

### Product Features

- Composite PES membrane provides a stable hydraulic environment for excellent mechanical strength and integrity.
- Void-free structure results in higher flux, excellent retention, and higher yields.
- Low to moderate protein binding – for use with protein solutions containing more than 0.1 mg/mL of protein.
- Available in a broad range of molecular weight cut-offs to suit a variety of applications.

## ULTRACEL PLC MEMBRANES

Ultracel PLC membranes are the membranes of choice for high-recovery purification. These void-free membranes combine ultra-low protein binding and low fouling with solvent resistance and superb mechanical strength. Casting the regenerated cellulose membrane onto a microporous polyethylene substrate creates a uniform, robust structure, with high integrity and greater resistance to back pressure.

### Product Features

- Void-free structure results in excellent retention and improved integrity.
- Ultra-low protein binding – for use with protein solutions (less than 0.1 mg/mL).
- Composite structure gives the membrane improved back pressure resistance.
- Available in a broad range of molecular weight cut-offs to suit a variety of applications.

## ULTRACEL PL MEMBRANES

Ultracel PL membranes are ideal for the concentration and desalination of solutes especially when only small volumes or low concentrations are available. The membrane's permeability is optimized for improved performance with high solute retention and higher flux levels. In addition, the regular non-voided support layer is also more resistant to damage due to handling, manufacture or process condition variations.

### Product Features

- Available in a broad range of molecular weight cut-offs.
- Polypropylene backing material provides support without impeding flow.
- Low to moderate protein binding.

## VIRESOLVE MEMBRANES

Virus contamination poses a threat to the safety of clinical compounds derived from recombinant or human plasma sources. Patented, composite Viresolve membranes provide reliable and consistent viral clearance. Viresolve membranes are available in varieties suitable for normal-flow and tangential-flow filtration.

### Product Features

- Low-binding polyvinylidene fluoride structure yields high protein recovery (greater than 90%).
- Greater than 3 log removal of viruses for quantifiable virus load reduction.
- Suitable for normal-flow and tangential-flow filtration applications.

For a complete listing of our membrane products, please visit [www.millipore.com/oemproducts](http://www.millipore.com/oemproducts).

## Biomax PB Membranes

HIGH FLUX

Membrane Name	Biomax 5	Biomax 8	Biomax 10	Biomax 30	Biomax 50	Biomax 100	Biomax 300	Biomax 500	Biomax 1000	PBSEQ
NMWL Cutoff	5 kiloDalton	8 kiloDalton	10 kiloDalton	30 kiloDalton	50 kiloDalton	100 kiloDalton	300 kiloDalton	500 kiloDalton	1000 kiloDalton	8 kiloDalton
Membrane Material	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone	Polyethersulfone
Support Material	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven	Polyolefin Nonwoven
Dextran Retention	90% at 10 kD	90% at 18 kD	90% at 15 kD	90% at 70 kD	90% at 95 kD	90% at 160 kD	BP ≥ 80 psi	BP ≥ 45 psi to ≤ 90 psi	BP ≥ 30 psi to ≤ 55 psi	90% at 18 kD
Thickness	280 microns	280 microns	280 microns	280 microns	280 microns	280 microns	280 microns	280 microns	280 microns	280 microns
Air Permeability	0 at 30 psi	0 at 30 psi	0 at 30 psi	0 at 30 psi	0 at 30 psi	0 at 30 psi	0 at 30 psi	0 at 30 psi	1 ml/min at 10 psi	0 at 30 psi
Water Flux	3.5 l/h/psi	10 l/h/psi	27 l/h/psi	37.5 l/h/psi	47.5 l/h/psi	95 l/h/psi	230 l/h/psi	390 l/h/psi	750 l/h/psi	15 l/h/psi
Membrane Code	PBCC	PBFC	PBGC	PBTK	PBQK	PBHK	PBMK	PBVK	PBXK	PBSEQ
pH range	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14
Max Operating Temp	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C
Max Support Width	30 inches*	15 inches**	30 inches*	30 inches*	30 inches*	30 inches*	15 inches**	15 inches**	30 inches*	15 inches**
Standard Length	400 feet	400 feet	400 feet	400 feet	400 feet	400 feet	400 feet	400 feet	400 feet	400 feet

## Ultracel PLC Membranes

MAXIMUM RETENTION/LOWEST BINDING

Membrane Name	Ultracel 5 kD	Ultracel 8 kD	Ultracel 10 kD	Ultracel 20 kD	Ultracel 30 kD	Ultracel 100 kD	Ultracel 300 kD	Ultracel 1000 kD
NMWL Cutoff	5 kiloDalton	8 kiloDalton	10 kiloDalton	20 kiloDalton	30 kiloDalton	100 kiloDalton	300 kiloDalton	1000 kiloDalton
Membrane Material	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose
Support Material	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene	UHMW Polyethylene
Dextran Retention	90% at 5 kD	90% at 8 kD	90% at 5 kD	90% at 10 kD	90% at 30 kD	90% at 100 kD	90% at 300 kD	90% at 840 kD
Average Thickness	130 microns	200 microns	130 microns	130 microns	130 microns	130 microns	130 microns	130 microns
Air Permeability	0 at 70 psi	0 at 70 psi	0 at 70 psi	0 at 70 psi	0 at 30 psi	0 at 30 psi	≤ 2.5 cc/min at 30 psi	≤ 2.5 cc/min at 30 psi
Ave Water Flux	1 l/h/psi	3.5 l/h/psi	4.2 l/h/psi	9 l/h/psi	21.5 l/h/psi	94.5 l/h/psi	272 l/h/psi	300 l/h/psi
Membrane Code	PLCCC	PLGCD	PLC010	PLCGC	PLCTK	PLCHK	PLCMK	PLCCK
pH range	2–13	2–13	2–13	2–13	2–13	2–13	2–13	2–13
Max Operating Temp	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C
Max Width	13 inches	13 inches	13 inches	13 inches	13 inches	13 inches	13 inches	13 inches
Standard Length	350 feet	350 feet	350 feet	350 feet	350 feet	350 feet	350 feet	350 feet

## Ultracel PL Membranes

MAXIMUM RETENTION/LOWEST BINDING

Membrane Code	PLAC	PLBC	PLCC	PLGC	PLTK	PLHK
NMWL Cutoff	1 kiloDalton	3 kiloDalton	5 kiloDalton	10 kiloDalton	30 kiloDalton	100 kiloDalton
Membrane Material	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose	Regenerated Cellulose
Support Material	Polypropylene Nonwoven	Polypropylene Nonwoven	Polypropylene Nonwoven	Polypropylene Nonwoven	Polypropylene Nonwoven	Polypropylene Nonwoven
Dextran Retention	90% at 1 kD	90% at 3 kD	90% at 5 kD	90% at 10 kD	90% at 30 kD	90% at 100kD
Thickness	230 microns	230 microns	230 microns	230 microns	230 microns	230 microns
Air Permeability	< 5 mL/min at 30 psi	< 5 mL/min at 30 psi	< 5 mL/min at 30 psi	< 5 mL/min at 30 psi	< 5 mL/min at 30 psi	< 5 mL/min at 30 psi
Water Flux	0.5 l/h/psi	1.0 l/h/psi	1.5 l/h/psi	7.5 l/h/psi	25 l/h/psi	30 l/h / PSI
Membrane Code	PLAC	PLBC	PLCC	PLGC	PLTK	PLHK
pH Range	2 – 10	2 – 10	2 – 10	2 – 10	2 – 10	2 – 10
Max Operating Temp	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C
Max Width	27 inches	27 inches	27 inches	27 inches	27 inches	27 inches
Standard Length	200 feet	200 feet	200 feet	200 feet	200 feet	200 feet

Coated UF Width: \* 27.5 inches, \*\* 13.25 inches

## Viresolve Membranes

VIRUS CLEARANCE

Membrane Name	Viresolve 180	Viresolve 180 (Normal Flow Filtration)	Retrovirus Membrane
NMWL Cutoff	180 kiloDalton	180 kiloDalton	NA
Membrane Material	PVDF	PVDF	PES (asymmetric)
Support Material	None	None	None
Thickness	150 μm	150 μ m	140 μm
Water Permeability	63 l/h/psi	63 l/h/psi	110 l/h/psi
Membrane Code	PPVG	PPVGNF	RVRM
Endotoxins	< 0.5 Eu/mL	< 0.5 Eu/mL	< 0.5 Eu/mL
Extractables	≤ 0.3 %	≤ 0.3 %	< 10 μg C/cm2
Virus Retention	LRV > 1.5	LRV > 1.5	LRV > 6
pH range	4–8	4–8	4–8
Max Operating Temp	37 °C	37 °C	80 °C
Max Width	12 inches	12 inches	11 inches
Standard Length	500 feet	500 feet	1,000 feet

## SELECTING THE NOMINAL MOLECULAR WEIGHT LIMIT (NMWL) RATING FOR CONCENTRATING, DESALTING, AND BUFFER EXCHANGE OF MACROMOLECULES

This rating reflects the molecular weight of solutes retained by the membrane. Reference the chart to select an appropriate Millipore ultrafiltration membrane based on NMWL cutoff. The chart is accurate for applications requiring the membrane to pass only water, salts, and other low molecular weight molecules.

### For Macromolecules:

- 1 Determine the molecular weight (in kiloDaltons) of the macromolecule the membrane should retain. Locate the molecular weight on the x-axis of the chart.
- 2 Move vertically from the molecular weight until you intersect one of the diagonal lines. If your macromolecule

is globular or is a protein, stop at the light blue line; if your macromolecule is linear or is a polysaccharide, stop at the dark blue line. This point corresponds on the y-axis to the Stokes radius (in nm) of that macromolecule in aqueous solutions.

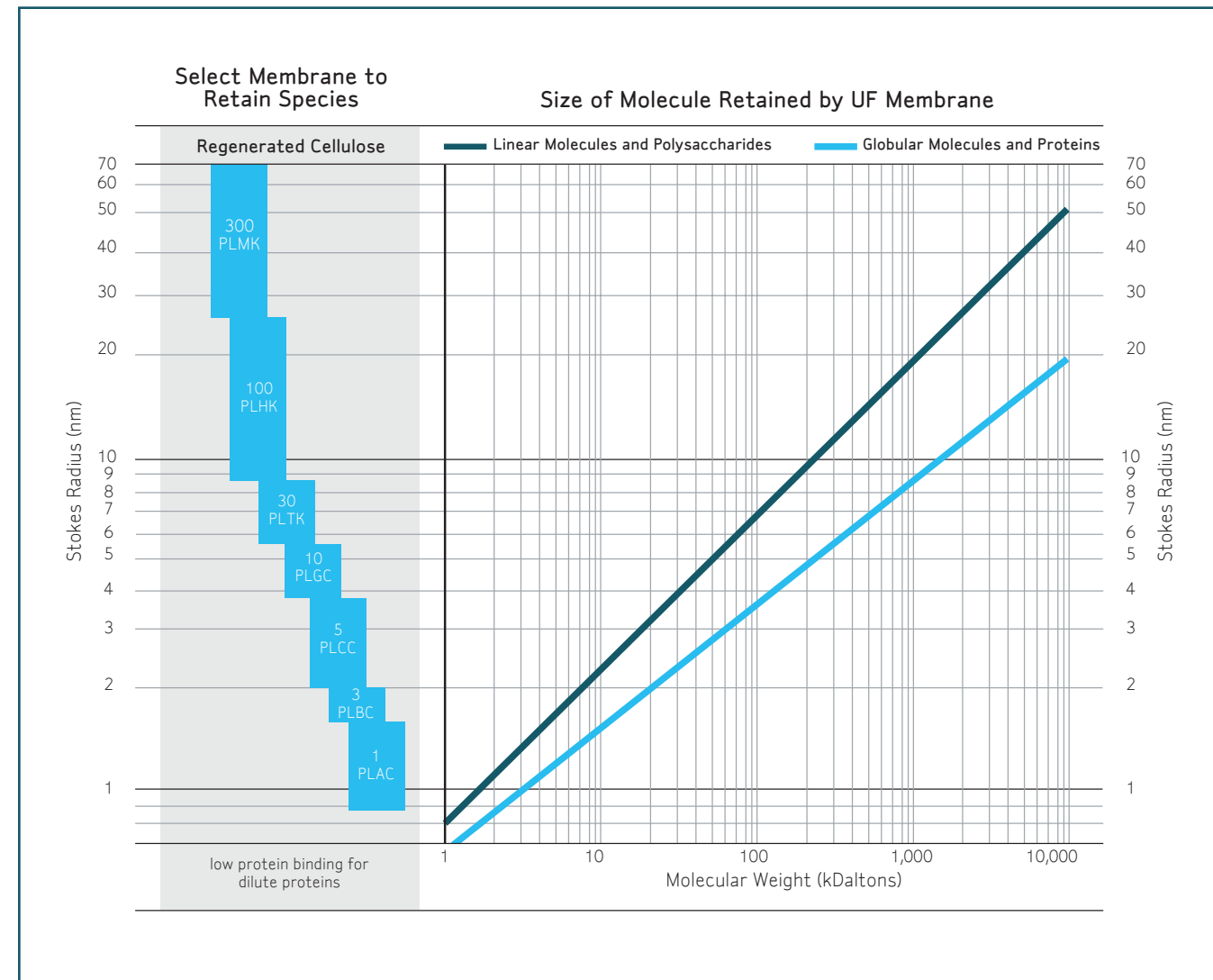
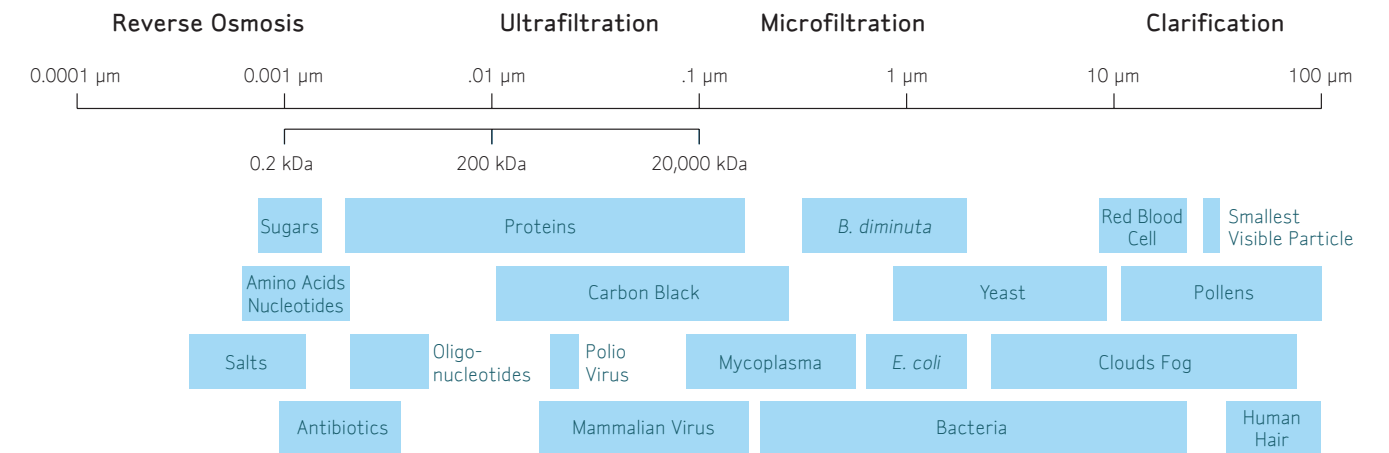
- 3 To determine the radius move horizontally to the left to determine the recommended Millipore ultrafiltration membrane for your application.

### For Viruses and Colloids:

- 1 Determine the radius of the smallest virus or colloid particles in nanometers.
- 2 Locate that radius on the left hand side y-axis of the chart.
- 3 From the radius move horizontally to the right to determine the recommended Millipore ultrafiltration membrane for your application.

## COMPARISON OF ULTRAFILTRATION WITH OTHER COMMONLY USED MEMBRANE SEPARATION TECHNIQUES

This table is an overview of common filtrates and particles with the recommended filtration/separation technology based on the size and/or type of filtrate or particle.



## FOR MORE INFORMATION

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