

Membralox® GP-IC Ceramic Membrane Systems

Ceramic Membranes with Longitudinal Gradient Permeability

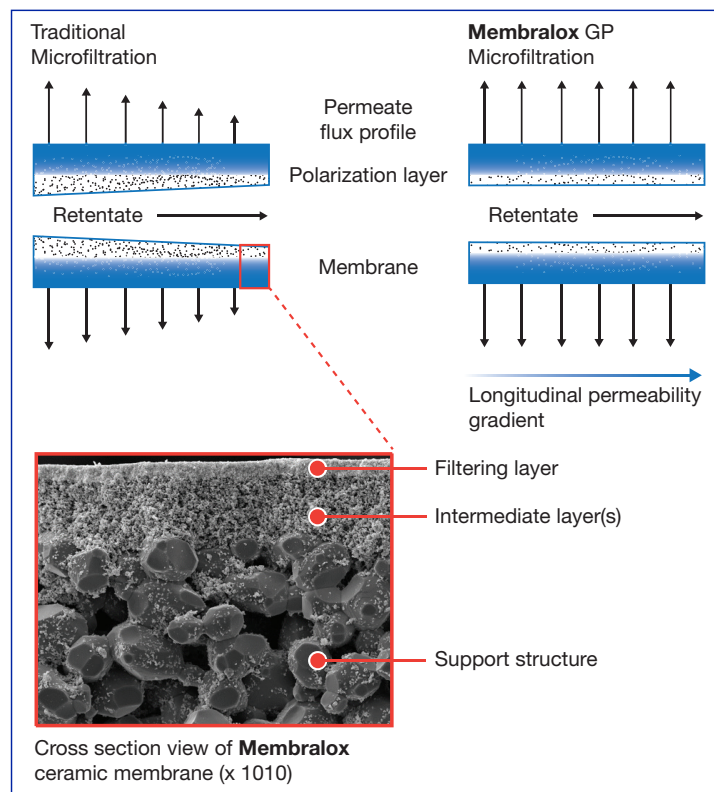
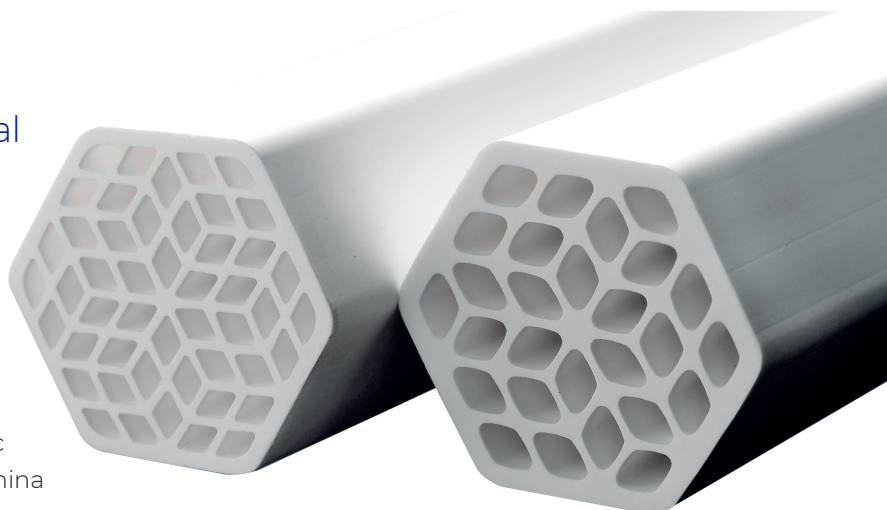
Pall Corporation is a global leader in filtration technologies with over 60 years of ceramic expertise and specialists in crossflow filtration systems.

Description

Membralox GP-IC ceramic membranes are asymmetric multi-channel membranes composed of a porous alumina support and a filtering layer (alumina or zirconia). In conventional ceramic process conditions, the natural pressure drop during extended runs creates a non-uniform transmembrane pressure (TMP) from the inlet to the outlet of the flow channel. To correct this TMP decrease, Membralox GP-IC membranes have a longitudinal Gradient Permeability (GP) built into the support structure without modification of the filtration layer. Gradient Permeability is designed for optimum transfer of macromolecules across the ceramic membrane. Hence this design ensures a stable microfiltration regime all along the membrane while providing a cost-effective separation due to its unique design.

The revolutionary design of Intermingled Channels (IC) provides a higher surface area per membrane than an equivalent membrane with round channels and is offered as a complete systems package. In addition, the increased capacity of the IC-design filtration modules, up to 45% more than standard module configurations, enables a higher surface area with optimized system loop design. This results in more compact systems with a smaller footprint and reduced hardware costs.

The smaller hold-up volume of the system loops also results in a significant reduction of the related water and chemical cleaning costs. These membranes are hydrodynamically optimized for unidirectional flow and are especially used in applications with fluids that are difficult to handle as well as premium ingredients with stringent quality and microbial testing requirements*. The exceptional structure of Membralox filtering membranes has enabled the development of the widest range of micro and ultrafiltration applications.



Comparison of Flux Profiles in Standard Crossflow Microfiltration (left), and Membralox GP-IC Crossflow (right)

Quality

- Manufactured according to ISO 9001:2015 certified Quality Management System

*Microbial removal criteria and testing must be validated by the customer.

Membralox HCB Highly Compact Modules

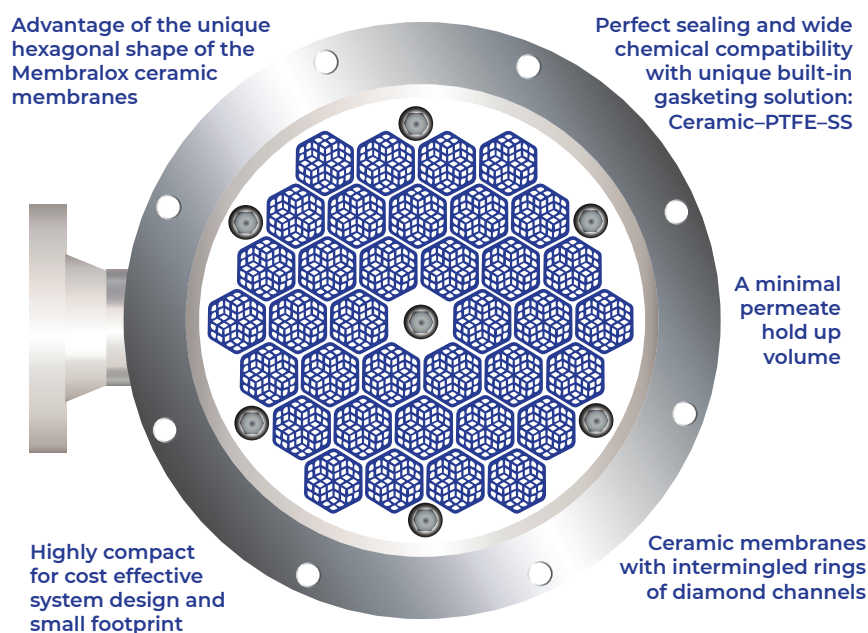
A reliable design for high value and complex industrial food applications

Membralox membranes are loaded into Stainless Steel housings (SS 316L) and sealed with gaskets to create High Capacity with Flange (HCB) or High Capacity Sanitary (HCS) modules. The module range takes advantage of the unique hexagonal shape of the membranes to obtain a high membrane packing density up to 285 m²/m³, thus significantly reducing filtration system CAPEX. These modules provide economical solutions in fluid clarification, effluent reduction, and other stream purification applications especially in fluids that are difficult to handle.

HCS modules: hexagonal ceramic membranes are sealed to housing with global Polytetrafluoroethylene (PTFE) gaskets; other housing seals are made of polymer.

HCB modules: hexagonal ceramic membranes are sealed into housing with global PTFE gaskets; other housing seals are made of PTFE.

Sanitary Design (SD) housing can be certified 3-A depending on the customer's needs. Multiple modules can be easily assembled on manifolds to create filtration loops of required membrane area. Multiple membrane loops can be connected in serial or in parallel to handle any scale of operation.



Key Features of GP-IC Systems:

- Customized design and engineering with turnkey and automatic systems for the most stringent applications
- Unique ceramic support with a 12 µm pore size that allows for high flow rate
- Precisely calibrated flux with controlled selectivity and homogeneity all along the membrane length that is tested for 100% bubble point integrity during manufacturing
- IC geometry enables Increased and optimized filtration surface area with fewer filtration modules and therefore smaller compact systems to achieve a target throughput, enabling a lower CAPEX, smaller footprint and shorter return on investment
- Ability to withstand mechanical resistance and high frequency back pulsing cycles
- Reduced permeate hold-up volume that is well suited for high fouling fluids, viscous products while still achieving high concentration factors
- Proprietary built-in gasketing solution to ensure intact sealing with PTFE global gasket
- Wide chemical and pH (0-14) compatibility with excellent thermal stability and corrosion resistance
- Long term and reliable performance and service life
- Automatic and easy cleaning in place (CIP)- sanitizable and sterilizable. Alumina end-sealing provides superior resistance to corrosion and cleaning cycles.
- Meets Food Contact Compliance (FCC) requirements to regional regulations. (Please refer to the [Pall website](#) for additional details.)

Applications

A complete range of modules allows scale-up from laboratory separations to full size industrial needs, especially in high end applications with fluids that are challenging to handle or processes that require extreme chemical and heat treatments. Typical applications of GP/IC membrane systems include:

- High value macromolecule extraction, fractionation, standardization, purification and concentration such as protein isolates and albumins from plant proteins, fermentation and upcycling sectors
- Microorganisms' removal* via clarification of fermentation broth in enzymes, amino acids and precision fermentation industries
- Degreasing bath regeneration, oily wastewater treatment, hydrocarbons/water separation and solvent recovery
- Treatment of harsh chemicals and solvent recovery

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Multichannel Membrane Characteristics of GP-IC Membrane Configuration

	EP4840	EP2760
Channel Diameter ¹	4.0 mm	5.5 mm
Number of Channels	48	27
Filtration Surface Area	0.7 m ² (7.4 ft ²)	0.5 m ² (5.38 ft ²)
Length	1020 mm (3.35 ft)	1020 mm (3.35 ft)

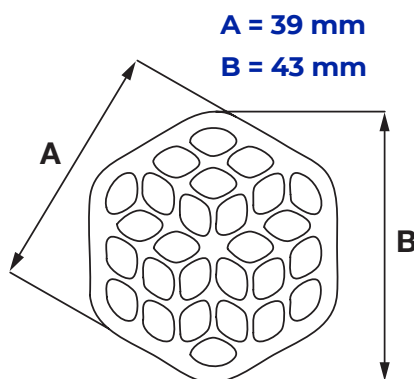
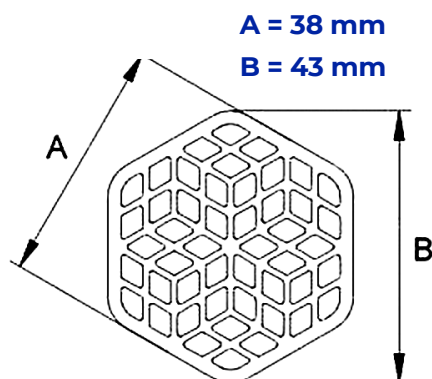
¹ Based on equivalent open cross sectional area.

Membralox GP Membranes Pore Sizes and Calibration Range

	Pore Size	Calibration
Microfiltration	1.4 µm, 0.8 µm	500 l/h.m ²
	0.1 µm, 100 nm	100 l/h.m ²

Materials of Construction

Component	Description
Membrane support	Ultrapure alpha-alumina
Filtrating layers	α-alumina and/or zirconia depending on pore size
End sealing	High purity α-alumina
Ceramic-to-housing gaskets	EPDM, FPM or PTFE depending on housing design



Drawings of 4840 and 2760 showing external dimensions of GP-IC



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