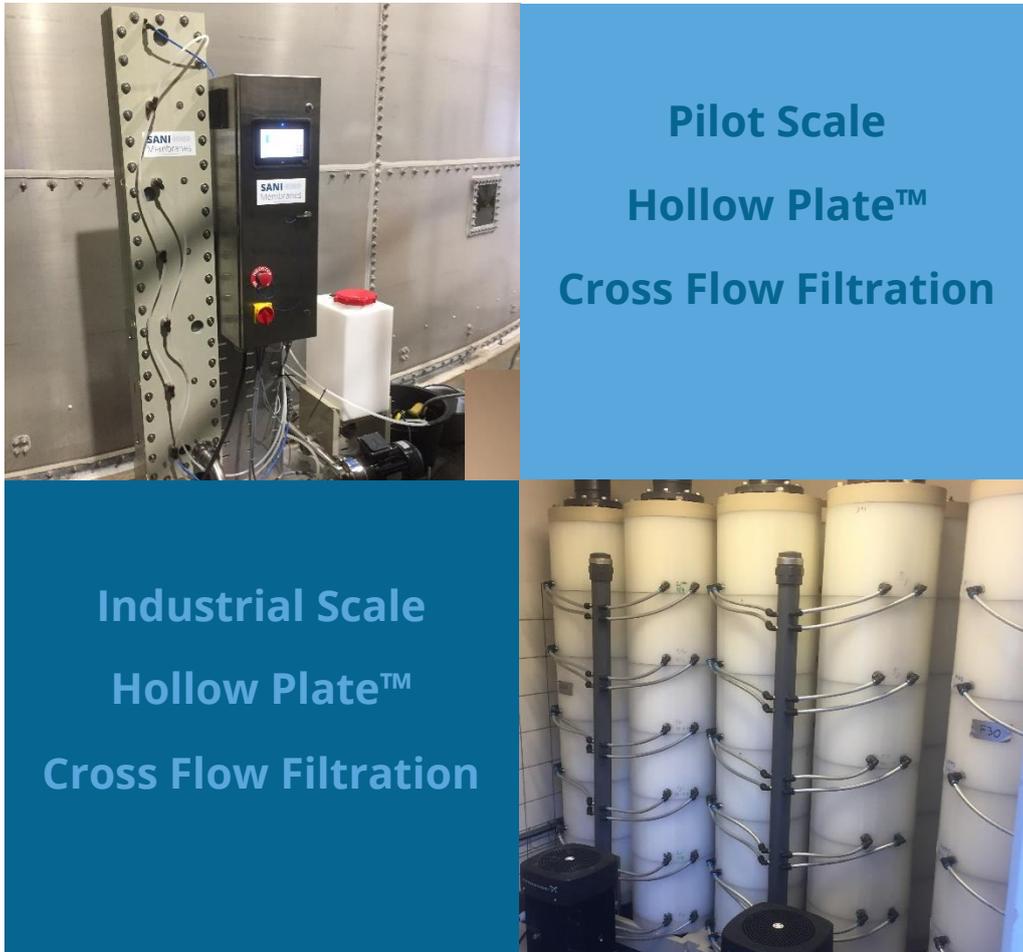


Hollow Plate™ Cross Flow Filtration

The Hollow Plate™ technology is the perfect MF and UF filtration solution for industrial membrane filtration and process development for any application where low energy consumption, sanitary function, high flux and low capital investment are key words. Hollow Plate™ technology systems deliver low fouling continuous filtration where the filter is kept clean by cross flow shear.



Hollow Plate™ technology is conceived with excellent sanitary function and low energy consumption as the main focus. The result is a very open design with no flow dead areas and an extremely low pressure loss in cross flow settings. The design is fully drainable of both retentate and permeate and very easy and fast to clean.

The patented Hollow Plate™ technology is built around a hollow polymer plate where the membrane is welded onto. The Hollow Plates™ are then welded together to form a rigid membrane element. Filtration takes place from the outside of the plate through the membrane to the inner hollow part of the plate.

SANI 
Membranes

MORE FILTRATION, LESS ENERGY

The Hollow Plate™ Technology

The open design with parallel membranes fused onto the Hollow Plates™ gives a membrane to membrane distance of 1,7 mm, creating rectangular flow channels for the feed between the Hollow Plates™. As no spacers is necessary the feed experience true free flow, and turbulence at the membrane surface is created by fast re-circulation of the feed in a loop. The flow speed needed to create the necessary turbulence is low in the Hollow Plate™ configuration as the channel shape ensures high turbulence at low pressure loss.

The open design of the modules results in a very low pressure loss over the modules. The low pressure loss makes the Hollow Plate™ configuration very energy efficient as the energy needed to drive the circulation pump is dramatically reduced compared to any other cross flow systems.

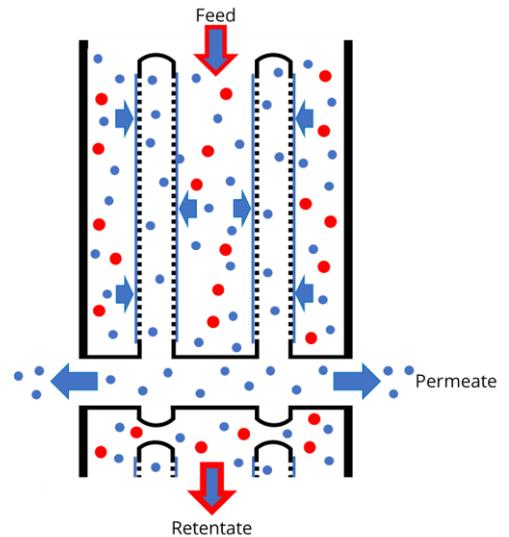
The open design with no flow dead areas also makes the Hollow Plate™ modules very sanitary in operation. As no spacers are needed, no flow dead areas are present. As a result, severe fouling has no natural initiation points to build up from. The lack of flow dead areas also makes the fouling much easier to remove in cleaning cycles, where the fouled flow dead areas often is the main challenge. Thus, Hollow Plate™ modules are very easy and quick to wash with normal CIP chemicals.

The modules are fully drainable of both retentate and permeate, which gives you shorter cleaning cycles and no loss of valuable products as everything can be drained prior to cleaning cycles.

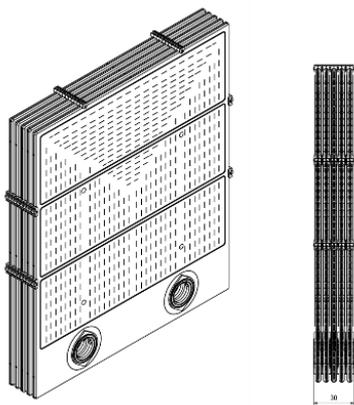
Because of the low pressure loss over the modules, the Hollow Plate™ systems can operate with unprecedented uniform trans membrane pressures (TMP). The uniform TMP's results in sharper membrane cut-offs, which again leads to better filtration.

The open design also makes it possible to work with very demanding feeds with high viscosity, high solid loads and even high particulates. Often pre-filtration is no longer needed when switching to the Hollow Plate™ technology.

Most commercial MF membranes, UF membranes and fine are used in the Hollow Plate™ Elements and modules.



The open design of the Hollow Plate™ Cross Flow



0,35 m² Hollow Plate™ Pilot Element (HPP)



2,5 m² Hollow Plate Module (HP1)

Typical applications

Sanitary:	Biotech and pharma, cell harvesting, broth filtration, enzyme and protein concentration etc.
Food & Beverages:	Dairy milk fractionation and concentration, wine, beer, juice filtration and concentration etc.
Water:	Sterile water, drinking water, pre-filtration, industrial and municipal waste water etc.
Industrial:	Fuel oil, lubrication media, gear box oils, hydraulic oils etc.

Industrial Scale Hollow Plate™ Cross Flow Filtration

Hollow Plate™ cross flow filtration is an industrial MF and UF solution for applications where low energy consumption, sanitary function, high flux and low capital investment are key words.

Hollow Plates™ plants utilizes the 2,5 m² Hollow Plate™ module (HP1) and delivers continuous low fouling filtration where the filter is kept clean by cross flow shear.

The open design of the modules results in a very low pressure loss over the modules. The low pressure loss makes the Hollow Plate™ cross flow plants very energy efficient, as the energy needed to drive the circulation pump is dramatically reduced compared to other cross flow systems e.g. plate and frame and spiral wound systems.

The low pressure loss over the modules also reduces the energy needed to cool the circulating retentate in many applications.

The open module design with no flow dead areas makes the Hollow Plate™ cross flow plants very sanitary in operation. As no spacers are needed, no flow dead areas are present. Thus, severe fouling and cake build-up has no natural initiation points.

The elimination of flow dead areas also makes the fouling easier to remove in cleaning cycles, where the fouled flow dead areas often is the main challenge. Thus, Hollow Plate™ modules are very easy and quick to wash with normal CIP chemicals.

The Hollow Plate™ cross flow plants are fully drainable of both retentate and permeate, which gives shorter cleaning cycles and no loss of valuable products as the plant can be drained completely prior to cleaning.

Due to the open sanitary design of the Hollow Plate™ Module (HP1), the Hollow Plates™ cross flow plants can handle very difficult samples with high viscosity, high mass loadings and even high particulates. Often pre-filtration is no longer needed when switching to Hollow Plate™ technology.

Because of the low pressure loss over the modules the Hollow Plate™ plants can operate with unprecedented uniform TMP. The uniform TMP's results in sharper membrane cut-offs which again leads to better filtration.

New and improved products with e.g. higher viscosity and sharper cut-offs are made possible by the Hollow Plate™ technology.

Benchmarking a Hollow Plate™ cross flow plant with a conventional spiral wound plant typically results in a 40% reduction in energy consumption at the same flux.

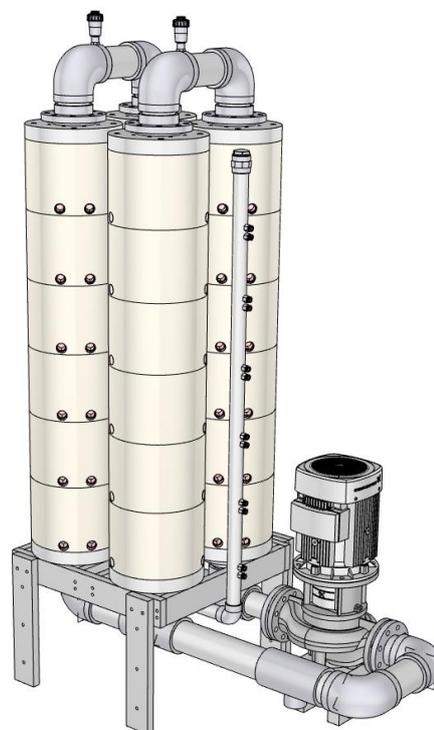
Benchmarking a Hollow Plate cross flow plant with a conventional plate-and-frame plant typically results in an 80% reduction in energy consumption at the same flux.

The footprint of a Hollow Plate™ cross flow plant is smaller than a plate and frame system and comparable to a spiral wound system with the same membrane area.

All media contacting parts are in durable polymeric materials or stainless steel. Hollow Plate™ plants can conform to FDA materials and sanitary standards if required.



A 20 m² Hollow Plate™ cross flow plant



A 60 m² Hollow Plate cross flow loop.

Hollow Plate™ Cross Flow Pilot Plants

The perfect MF and UF cross flow filtration pilot plant solution. Low fouling continues filtration where the filter is kept clean by cross flow shear.

The Hollow Plate™ pilot plants are exceptional for gaining insight into filtration processes, for selecting the right membranes and for filtering or separating almost any media in a development or even a small production set-up. The ability to work with small samples makes it the perfect tool for process development in biotech, pharma, food etc.

The pilot plants have a 2 or 4 m² membrane module utilizing 6 or 12 Hollow Plate™ Pilot elements (HPP) respectively. Due to the open design of the 0,35 m² HPP, the pilot plants can handle very demanding feeds with high viscosity, high mass loadings and even high particulates.

Individual permeate outlets from each HPP element makes it possible to use several different membranes in the same experiment series. Thus, membrane selection for a given application is made straight forward.

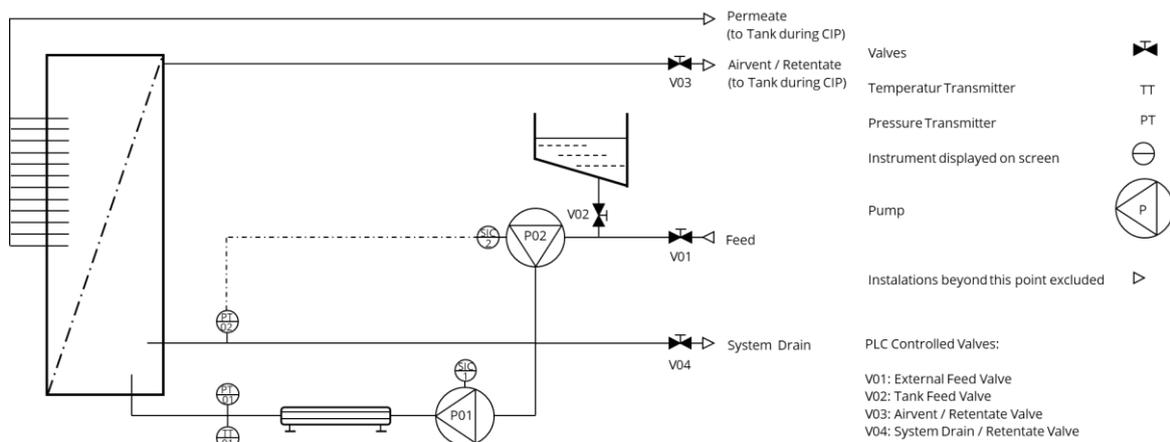
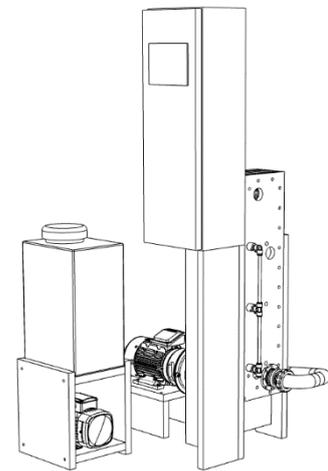
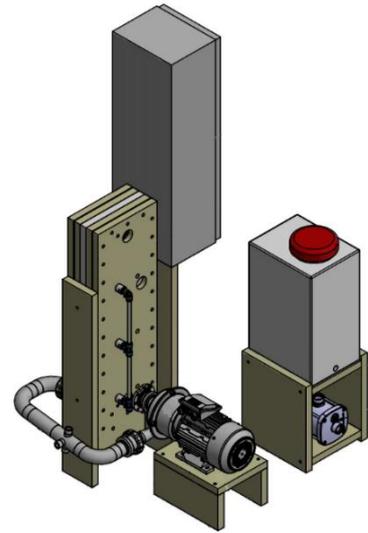
The pilot plants have clear polymer windows giving excellent visibility of the membrane during operation and cleaning. A groundbreaking feature that makes it possible to visually follow fouling build-up and membrane cleaning processes.

The standard pilot plants are easy to use with manual valves, PLC controlled centrifugal pumps, limited instrumentation and an optional heat exchanger. The standard pilot plants can however be customized with additional instrumentation and automation if required.

All temperatures, pressures and pump speeds are logged automatically for later analysis.

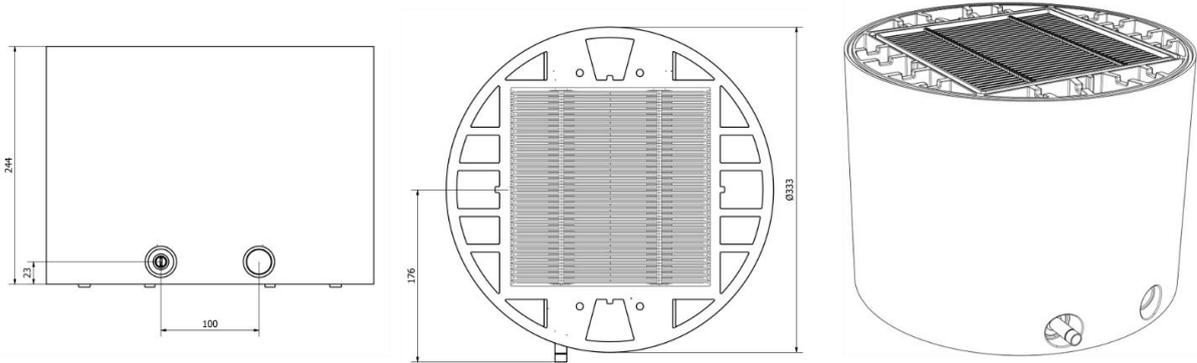
All media contacting parts are in durable polymeric materials or stainless steel. The Hollow Plate™ pilot plants can conform to FDA materials and sanitary standards if required.

SANI Membranes can also design and produce a custom pilot plant from scratch - tailored for your specific application and special needs. Pilots utilizing the industrial 2,5 m² HP1 module are also possible.



PI diagram of a standard Hollow Plate™ pilot plant with heat exchanger

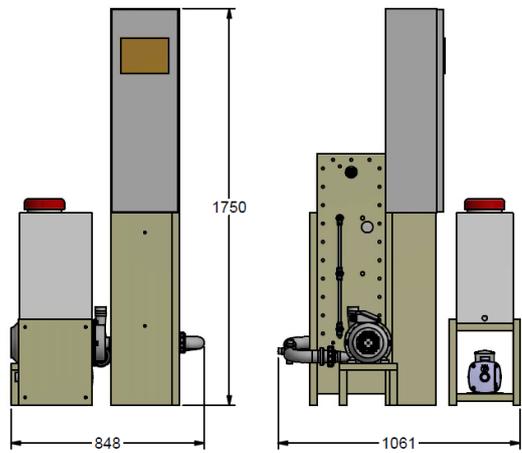
Technical Data Hollow Plate™ Systems and Modules



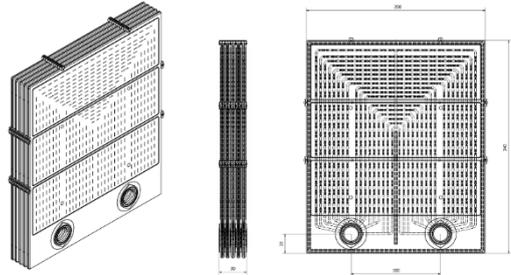
Hollow Plate™ Module (HP1) Data	
Generic Design	Hollow Plate™. Fused Polypropylenes
Membrane Type	Most organic membranes (MF, UF, and other filter types)
Membrane Area	2,5 m ²
Dimensions (D x H)	333 mm x 245 mm
Viscosity Range, Apparent	1-1000 cP (e.g. Cream Cheese+)
Temperature Range	5-85°C
pH Range	1-14
Operating Pressure	0-4 bar
Free Chlorine	Membrane dependent

Hollow Plate™ Pilot Plant Data	
Membrane Type	Hollow Plate Pilot Elements - HPP
Membrane Area	2,1 m ² (6 x 0,35 m ²) or 4,2 m ² (12 x 0,35 m ²)
Dimensions (L x W x H)	1061 mm x 848 cm x 1750 cm
Pressure Pump	0,43 kW 400 V AC 2900 RPM Centrifugal Pump
Circulation Pump	2,2 kW 400V AC 2900 RPM Centrifugal Pump
Feed/CIP Tank	40 L
Dead Volume	6 L for 2,1 m ² version and 9 L for 4,2 m ² version
Instruments*	2 PLC Controlled Frequency Converters 2 Electronic Pressure Transducers (0-6 bar) 1 Temperature Transducer (0-100°C)
Viscosity Range, Apparent	1-1000 cP (e.g. Cream Cheese+)
Temperature Range	5-85°C
Flow	Feed inlet 0-4 m ³ /h, circulation flow 0-15 m ³ /h
Operating Pressure	0-10 bar

*Standard Pilot Plant, additional instruments and heat exchanger can be fitted



Hollow Plate™ Pilot Element (HPP) Data	
Generic Design	Hollow Plate™. Fused Polypropylenes
Membrane Type	Most organic membranes (MF, UF, and other filter types)
Membrane Area	0,35 m ²
Dimensions (L x W x H)	242 mm x 30 mm x 202 mm
Viscosity Range, Apparent	1-1000 cP (e.g. Cream Cheese+)
Temperature Range	5-85°C
pH Range	1-14
Operating Pressure	0-10 bar
Free Chlorine	Membrane dependent



The HP1 and HPP can be equipped with your membrane of choice. SANI Membranes have a line of standard MF and UF membranes from Synder, Microdyn-Nadir and others on stock. Most commercial available membranes can however also be used with the HP1. Please, do not hesitate to contact us with your membrane wishes.

Hollow Plate™ Cross Flow Filtration

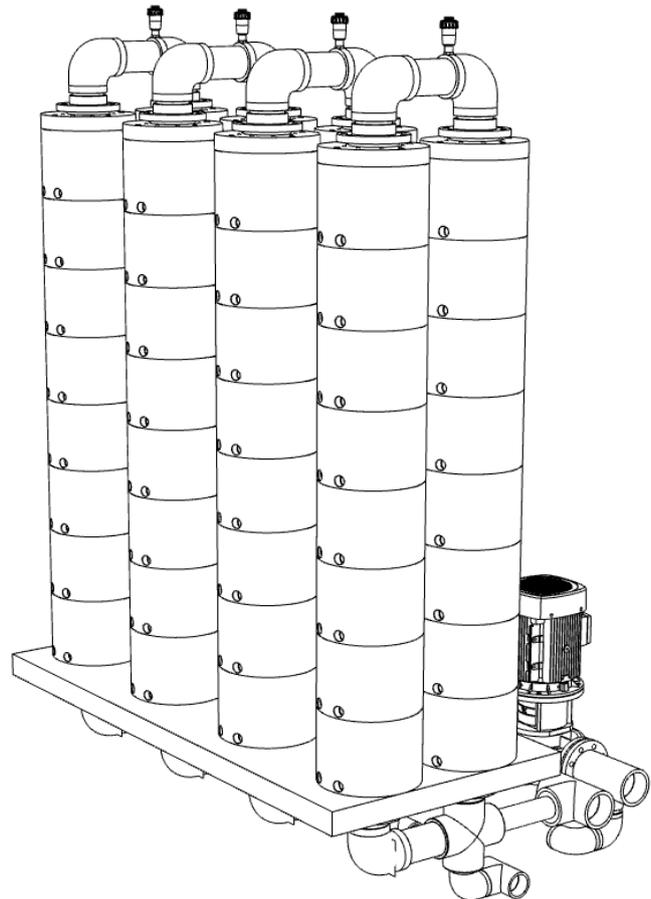
Sanitary - The simple and open design makes the module very sanitary – fully drainable, easy to wash and with no flow dead areas

Energy Efficient - The simple and open design makes the pressure loss in crossflow operation very minute. This means highly energy efficient.

New processes - Low pressure loss means very uniform TMP which leads to very sharp cut-offs. New and improved products are possible



2,1 m² Hollow Plate™ Pilot Plant



160 m² Industrial Hollow Plate™ Plant

For more information see sanimembranes.com

SANI 
Membranes

MORE FILTRATION, LESS ENERGY

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