Nitto
Innovation for Customers

HYDRANAUTICS

HYDRAcap™ MAX Ultrafiltration

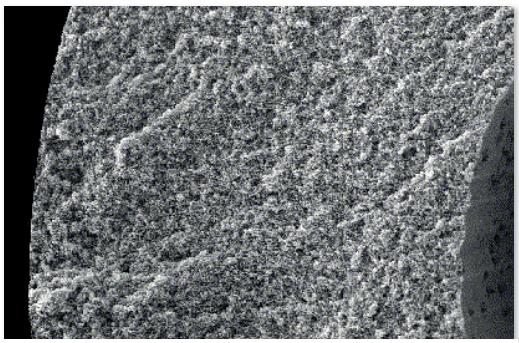
Maximum Performance, Optimal Solution

HYDRAcap™ MAX is used to treat a wide range of highly variable waters as either primary treatment or as pretreatment to reverse osmosis (RO) and nanofiltration (NF). Compared to conventional pretreatment and other UF membrane pre-treatment, HYDRAcap™ MAX offers the combined benefits of high recovery and low footprint requirement due to its optimized membrane area and novel cleaning regimes. High strength TIPS PVDF membrane minimizes fiber breakage rate and ensures consistently superior filtrate quality, which enables RO and NF systems to be operated at higher fluxes, while maintaining longer intervals between cleanings.

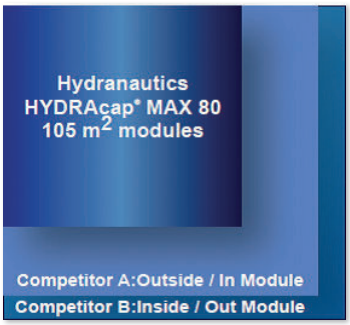


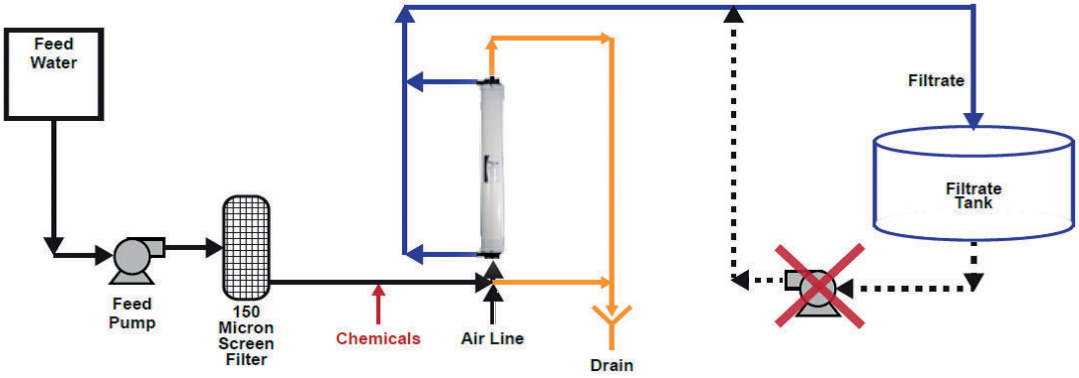
Capillary Technology vs. Conventional Pretreatment

- Consistent filtrate quality with turbidity below 0.1 NTU
- Smaller footprint
- Reduced chemical consumption, especially of coagulants
- Wastewater disposal is less problematic due to lower volume and decreased chemical consumption
- Increased efficiency of RO membrane system design and operation, contributing to reduced capital and operational costs
- Maximizes RO performance by allowing elements to operate longer with less cleaning



Cross-sectional view of TIPS PVDF fiber





Footprint Comparison

Basis: 20,000 m^3/day production with one rack

- Hydranautics: 120 HYDRAcap™ MAX 80 modules
- Competitor A: Outside-in flow configuration
- Competitor B: Inside-out flow configuration

HYDRAcap™ MAX Advantages

Backwash-free Operation

- Air scour replaces traditional backwash as physical cleaning mode
- Leads to maximized recovery >98%.
- No backwash pump nor ancillary equipment required

High Membrane Area

(up to 105 m^2 per module)

- Reduced footprint
- Lower skid cost
- Fewer seals / connections

TIPS Fiber Technology

- Increased tensile and fatigue strength which minimizes integrity issues
- Increased chemical resistance which allows for more effective cleans at extreme pH
- Increased tolerance to chlorine, peroxide, ozone and other oxidants

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HYDRAcap™ MAX Reference Plants

Potable Water UF Plant, Croatia



A small-town municipality drinking water plant, using sand filtration to treat surface water, had high levels of effluent bacteria and turbidity and the plant was unable to meet regulatory requirements as a result. Chlorine dosing concentrations had to be increased for disinfection, which subsequently increased formation of disinfection byproducts. In order to improve plant effluent quality, 2.06 MGD (8.0 MLD) UF system was installed in parallel to the sand filters. This system, fed by surface water, was commissioned in Sep. 2014 and is installed with 2 racks of 34 HYDRAcap™ MAX 60 modules (68 in total). HYDRAcap™ MAX membrane technology helps in complete removal of bacteria and provides consistent water quality.

Ground Water UF – RO Plant, China



Two systems were supplied to the same customer at this location in Hebei. 19.2 MLD (4.95 MGD) first UF system, fed by ground water, commissioned in Sep. 2013 utilized 4 racks of 38 HYDRAcap™ MAX 60 modules (152 in total) followed by 696 Hydranautics RO membranes. Permeate is used as boiler feed water. 2.25 MGD (8.7 MLD) second UF system, fed by wastewater, commissioned in Aug. 2014 utilized 2 racks of 42 HYDRAcap™ MAX 60 modules (84 in total) followed by 324 Hydranautics RO membranes. Permeate is used for cooling tower.

Wastewater Reuse UF – RO Plant, UAE



This 6.9 MGD (26.8 MLD) UF system built with 8 racks of 33 HYDRAcap™ MAX 80 modules (264 in total) treats tertiary sewage to produce water most suitable to be fed to downstream RO system. UF system is typically fed with 2-3 NTU turbidity and consistently produces permeate with ≤ 0.1 NTU turbidity. Such consistent performance of UF membrane modules has led to optimum performance of Hydranautics low energy RO membranes (1176 in total) which then produces permeate used in district cooling. This largest HYDRAcap™ MAX installations commissioned until 2017, worldwide, is located near one of the tallest buildings in the World – Burj Khalifa!

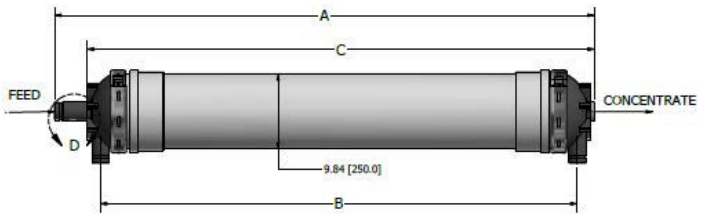
Specifications

Configuration	Capillary (outside-in)
Membrane Polymer	TIPS PVDF
Pore size	0.08 µm
Capillary inner diameter, *inches (mm)*	0.024 (0.6)
Capillary outer diameter, *inches (mm)*	0.047 (1.2)
Nominal membrane area	*ft² (m²)*
HYDRAcap™ MAX 40	560 (52)
HYDRAcap™ MAX 60	840 (78)
HYDRAcap™ MAX 80	1130 (105)

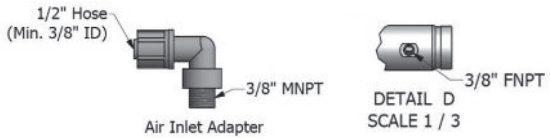
Application Data

Typical Filtrate Flux Range, *gfd (l/m²/h)*	20 – 65 (34 – 110)
Flow Rate Range	*gpm (m³/h)*
HYDRAcap™ MAX 40	7.5 – 24.4 (1.7 – 5.5)
HYDRAcap™ MAX 60	11.7 – 37.9 (2.7 – 8.6)
HYDRAcap™ MAX 80	15.7 – 51.0 (3.6 – 11.6)
Operating pH range	2.0 – 11.0
Cleaning pH range	1.0 – 13.0
Instantaneous Chlorine Tolerance, *ppm*	5,000*
Maximum Chlorine Tolerance, *ppm-hr*	1,000,000
Operating Mode	Cross-flow or dead-end
Maximum Feed Pressure, *psig (bar), at ≤20°C*	73 (5.0)
Transmembrane Pressure (TMP) Range, *psig (bar)*	30 (2.0)
Maximum Instantaneous Turbidity *(NTU)*	300**

**For 60 minutes or less*
***Higher values can be treated. Consult Hydranautics' technical staff.*



	HYDRAcap™ MAX 40	HYDRAcap™ MAX 60	HYDRAcap™ MAX 80
A, *inches (mm)*	53.74 (1364.9)	72.15 (1832.6)	92.15 (2340.6)
B, *inches (mm)*	44.70 (1135.5)	63.11 (1602.9)	83.11 (2110.9)
C, *inches (mm)*	49.50 (1257.3)	67.90 (1724.7)	87.90 (2232.7)
Dry Weight, *lbs. (kgs.)*	90 (41)	115 (52)	135 (62)
Wet Weight, *lbs. (kgs.)*	161 (73)	220 (100)	260 (118)
2" Victaulic Pipe Connections in all HYDRAcap™ MAX models			



Typical Process Conditions

Air Scour Rate, *acfm (m³/h)*	7.3 – 9.1 (12.3 – 15.4)
Air Scour Duration	120 – 240 secs.
Air Scour Frequency	Once every 20 – 60 mins.
Maintenance Cleaning Freq.	1 – 3 times per day
Maintenance Cleaning Duration	20 – 30 mins.
Recovery Cleaning Freq.	Once every 1 – 3 months
Recovery Cleaning Duration	2 hours
Disinfection Chemicals	NaOCl, ClO_2 or NH_2Cl
Cleaning Chemicals	NaOH, HCl, H_2SO_4 or citric acid

Certification

NSF 61, NSF419. Acceptable for drinking water use under LT2ESWTR

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