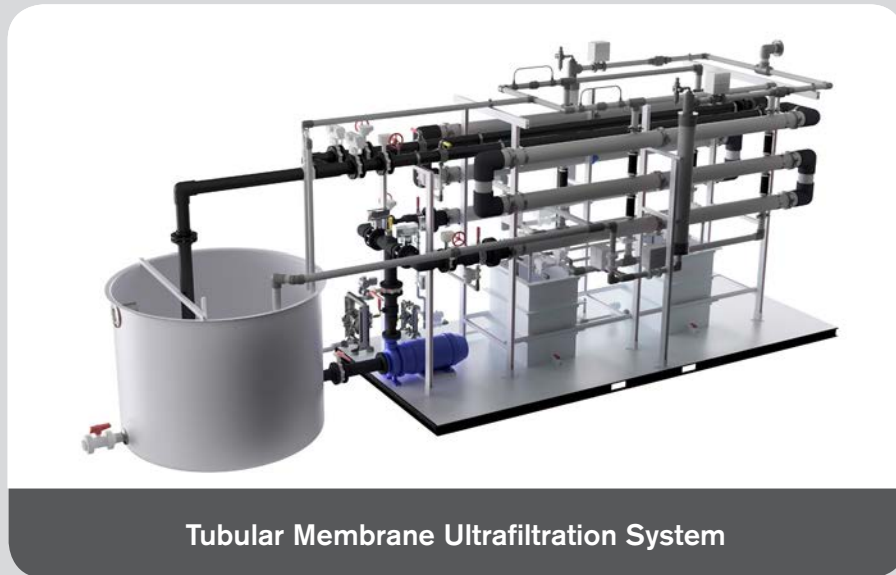


PRAB TUBULAR MEMBRANE FILTRATION TECHNOLOGIES

PROVEN TO REDUCE HAUL-AWAY COSTS UP TO 90%

Best Available Technology for Tertiary Filtration of Industrial Wastewater

Wastewater produced by industrial processes contaminated with solids, heavy metals, or oil and greases often require treatment prior to discharge or reuse. A treatment system using tubular membrane modules can significantly reduce solids and emulsified oil and greases, and in combination with chemical precipitation, provides excellent reduction of heavy metals (nickel, zinc, copper, lead, chromium, and more). Treated water (permeate or filtrate) is then ready for either disposal into existing municipal waste systems or further treatment for plant reuse/recycle. Tubular ultrafiltration is the best available technology for pretreatment before reverse osmosis systems, increasing recoveries for either process/wastewater recycling or pure water applications.



Tubular Membrane Ultrafiltration System

Features & Benefits:

- Best available technology for tertiary filtration and pretreatment for brackish water desalination
- System operates automatically, including cleaning sequence
- Modular package design minimizes site installation costs and allows for future capacity additions
- Separated control and high voltage circuits with single power disconnect
- Allen Bradley PLC & HMI
- 4-20 mA instruments on touch screen
- VFD motor starter
- Bank-by-bank cleaning manifolds and valves
- UF permeate flush on shutdown
- Automated air back-pulse allows high average membrane flux

Backed by the **PRAB Difference**

PRAB TUBULAR MEMBRANE FILTRATION TECHNOLOGIES

REDUCE ENERGY USAGE AN AVERAGE OF 20%

Typical Permeate Quality

Contaminant	Influent (mg/L)	Membrane Permeate (mg/L)
Oils Removal		
Oils & Grease	5,000 - 50,000	< 30
COD/BOD ¹	15,000 - 100,000	< 1500
Metals Removal²		
Cadmium - Cd	10 - 30	< 0.05
Chrome - Cr	10 - 50	< 0.1
Copper - Cu	20 - 130	< 0.1
Iron - Fe	5 - 100	< 0.1
Lead - Pb	1 - 15	< 0.1
Nickel - Ni	5 - 75	< 0.1
Zinc - Zn	5 - 130	< 0.1
Fluoride - F ⁻	10-500	<5.0
Solids - TSS	10 - 500	< 1.0

¹ Dependent on influent water quality and source of COD/BOD

² Pretreatment required

Tubular Membrane Filtration (TMF) System Operation

Inside a TMF Module

TMF modules utilize cross-flow filtration. They are composed of 1- or 1/2-inch polyethylene (PE) or polyvinylidene difluoride (PVDF) support tubes that have been coated on the inside with a PVDF material to form a filtration membrane. Next, several of the membrane-coated tubes are bundled into a larger housing to form a single TMF module.

About the TMF System

The TMF system is an excellent treatment system for many uses involving both waste and process water. Combined with proper chemical pretreatment, TMF systems will provide many years of efficient, trouble-free operation. High solids loading allowed by the rugged TMF modules results in a treatment system that surpasses many other types of membrane filtration systems.

TMF System Operation

A typical TMF system operates as follows:

1. Influent water flows by gravity from a chemical reaction system into the concentration tank of a TMF system.
2. This water is then pumped from the concentration tank through the TMF membrane modules for solids separation via cross-flow filtration, forming a slurry within the center of the membrane tubes.
3. The slurry is pumped at a high velocity through the center of the membrane tubes and returned back to the concentration tank.

Contact us for questions about your specific application

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DECREASE WATER COSTS OF UP TO 99%

Tubular Membrane Filtration System Operation (Continued)

4. The clear water, or permeate, passes through the membrane tubes and onto reuse or final processing.
5. The membranes are back-pulsed with air and clean (treated) water. Back pulse is used to force obstructions in the pores or on the membrane surface back into the slurry stream, resulting in greater average membrane flux rates.

TMF Process Concentration Tank

The purpose of the TMF concentration tank is to ensure that a consistent concentration of solids (between 2-5% slurry) is being pumped to and from the microfiltration or ultrafiltration membranes. The concentration tank is equipped with a level sensor that allows the ultrafilter feed pump to cycle on and off as the tank level varies.

TMF Solids Management

The solids are removed from the concentration tank by a pump. An air-operated positive displacement pump is used. Material is pumped from the concentration tank to a sludge settling tank. The sludge can then be removed from the solids settling tank to a filter press or other solids-handling method. The liquid from the sludge settling tank can be returned to the concentration tank. Occasionally, the operator will need to draw a sample from the concentration tank and do a simple settling test to determine if the sludge pump controls require field adjustment. Online TSS monitoring of the concentration tank is also available.

TMF Permeate Flow

TMF permeate is the water that has passed through the pores of the TMF membrane. It is continually monitored during system operation. If permeate flow drops below a predetermined rate, the TMF system will alert the operator that all or a portion of the modules (depending on module configuration) require chemical cleaning. Permeate from the modules flow under small pressure to the next stage in the treatment system, or to reuse or discharge.

TMF Modules and Chemical Cleaning

The TMF clean-in-place system contains a recirculation pump along with both a chemical cleaning tank and a fresh water tank. The chemical cleaning cycle may take several hours to complete. Cleaning chemicals are mixed in the chemical cleaning tank and are pumped into the membrane modules. The chemicals can be circulated in the modules or allowed to sit in the modules without circulation. Acid solutions are used to remove inorganic scale, while bleach or caustic solutions are used to remove organic materials. Once chemical cleaning has been completed, the TMF modules are flushed with fresh water prior to being placed back in service.

In the past 2 years PRAB has provided equipment saving customers nearly \$2.6 million annually by re-purposing their wastewater for reuse or sending to sewer.

Backed by a PRAB **100% Performance Guarantee**

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REDUCE OILY WATER VOLUMES BY AS MUCH AS 98%

Tubular Ultrafiltration System Models:

6" Module - Tubular UF System Models					
	PWUF-10/12-1	PWUF-10/24-2	PWUF-10/36-3	PWUF-10/48-4	
Avg Permeate Flow Rate [gpm] @ Design Flux	25	50	75	100	
MEMBRANES					
Design Flux [gal/ft ² /day]	200				
Membrane Type	Tubular, PVDF Membrane, Cross-flow Ultrafiltration				
Diameter of membrane [in.]	1	1	1	1	
Membranes / Module	10	10	10	10	
Membrane Surface Area [ft ²] / Module	15.2	15.2	15.2	15.2	
# of Modules	12	24	36	48	
# of Trains	1	2	3	4	
Membrane Mfg	Porex Filtration				
PROCESS EQUIPMENT					
Centrifugal Process Pump	Qty	1	1	1	2
	Power [hp]	25	40	60	40
	Recirculation Flow Rate [gpm]	300	600	900	1200
	Mfg	Gusher			
Process Tank	Qty	1	1	1	1
	Volume [gal]	1000	1200	1800	2500
	Material	XLPE			
Slurry AODD Pump	Flowrate	115 gpm at 80 psi			
	Mfg	Warren Rupp			
CIP EQUIPMENT					
CIP AODD Pump	Flowrate	40 gpm at 80 psi			
	Mfg	Warren Rupp			
Tanks	Qty	2	2	2	2
	Volume [gal]	250	400	500	600
	Material	PVC			
ELECTRICAL					
PLC	Allen Bradley or Siemens				
Power	480/600 VAC, 3-phase, 60 Hz				
Control Circuit	120 VAC, Single phase 24 VDC				
INSTALLATION & UTILITY REQUIREMENTS					
Skid L x W x H [ft.]	25 x 6 x 10	25 x 8 x 10	35 x 8 x 11.5	38 x 10 x 11.5	
Permeate Flange [in.]	3	3	4	4	
Concentrate Flange [in.]	1.5	1.5	2	2	
Power Drain Flange [in.]	1	1	1	1	
Air Supply Connection NPT [in.]	3/4	3/4	3/4	3/4	
Utility Water Inlet [in.]	2	2	2	2	

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Tubular Ultrafiltration System Models (Continued):

6" Module - Tubular UF System Models					
	PWUF-13/8-1	PWUF-13/16-2	PWUF-13/24-3	PWUF-13/32-4	
Avg Permeate Flow Rate [gpm] @ Design Flux	22	44	66	88	
MEMBRANES					
Design Flux [gal/ft ² /day]	200				
Membrane Type	Tubular, PVDF Membrane, Cross-flow Ultrafiltration				
Diameter of membrane [in.]	1	1	1	1	
Membranes / Module	13	13	13	13	
Membrane Surface Area [ft ²] / Module	19.8	19.8	19.8	19.8	
# of Modules	8	16	24	32	
# of Trains	1	2	3	4	
Membrane Mfg	Porex Filtration				
PROCESS EQUIPMENT					
Centrifugal Process Pump	Qty	1	1	2	2
	Power [hp]	30	60	50	60
	Recirculation Flow Rate [gpm]	375	750	1125	1500
	Mfg	Gusher			
Process Tank	Qty	1	1	1	1
	Volume [gal]	960	1200	2650	3050
	Material	XLPE			
Slurry AODD Pump	Flowrate	115 gpm at 80 psi			
	Mfg	Warren Rupp			
CIP EQUIPMENT					
CIP AODD Pump	Flowrate	40 gpm at 80 psi			
	Mfg	Warren Rupp			
Tanks	Qty	2	2	2	2
	Volume [gal]	250	400	500	600
	Material	PVC			
ELECTRICAL					
PLC	Allen Bradley or Siemens				
Power	480/600 VAC, 3-phase, 60 Hz				
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INSTALLATION & UTILITY REQUIREMENTS					
Skid L x W x H [ft.]	25 x 6 x 10	25 x 8 x 10	30 x 8 x 11.5	38 x 10 x 11.5	
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Power Drain Flange [in.]	1	1	1	1	
Air Supply Connection NPT [in.]	3/4	3/4	3/4	3/4	
Utility Water Inlet [in.]	2	2	2	2	

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Available Options:

- Pre-treatment (coagulation, oxidation, pH adjustment)
- Clean-in-place chemicals
- Feed and/or permeate turbidity monitoring
- CIP neutralization
- Permeate storage tank
- Ethernet communication
- Allen Bradley or Siemens PLC

Lifecycle Services with Lifetime Support:

- Scheduled preventative maintenance services
- Operator training and resources
- Available remote monitoring
- Instrumentation calibration
- 24/7 technical support
- Upgrades to help you keep up with new technology

Construction Materials:

- PipingPVC Sch 80
- FrameEpoxy coated carbon steel
- Enclosure.....Nema 4
- Clamps/Fittings.....Zinc-plated



A true performance guarantee ensuring your PRAB equipment achieves the specific results it was designed and manufactured to deliver. And if you need technical support, call us. We are available 24/7.

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