

ULTRAFILTRATION (UF) SYSTEM

AN ECO-FRIENDLY WAY TO CLARIFY WATER



INNOSEP
New Generation Liquid Separation Systems

Ultrafiltration (UF)

When do you need it?

Ultrafiltration Systems are typically used as an alternative to conventional sand filter, Clarifier to produce a crystal clear water in a single step

Applications for UF Systems include:

- Turbidity Removal to produce clear water
- To remove bacteria
- As a pretreatment to RO to remove colloidal particles
- To reduce chemical consumption.

Since UF reduces use of chemicals operating and maintenance cost are much lower and maintains consistent product quality even if feed water turbidity fluctuates like in river water, surface water, effluent from wastewater streams etc.

What is it?

Ultrafiltration System is a membrane filtration process with pore size of around 0.01 micron to remove colloidal particles, bacteria etc. with a low feed pressure to produce crystal clear water for various process requirements including drinking water, industrial water production, municipal water, effluent recycle etc.

UF membranes are a kind of physical separation of particles in single step. due to pore size of UF membrane is very small it can only pass dissolved minerals while all other turbidity causing particles are removed even with fluctuation from various raw water sources.

The UF membranes are modular designed with membranes are fixed in a housing with inlet, outlet and product water connections.

How does it work?

Small pore size of membrane filter out turbidity as water pass through UF membrane surface while the removed turbidity is flushed out at certain time interval by control system.

The system is also equipped with backwash sequence that maintains system performance and continuous operation without shut down. Reject water volume is relatively less giving high output and efficiency for overall system operation.

UF membranes are usually hollow fiber where water enters from inside the fiber while product comes out on the outside with very low feed pressure.

UF membrane also have sanitization procedure that helps to increase its service life for many years with lower operation and maintenance cost.

UF Operation

Hollow fiber UF membranes can be operated in two principle ways, either cross-flow mode or dead-end mode. In dead-end, also called direct-flow mode all the water which is introduced into the membrane passes through the membrane onto the filtrate side. All the debris contained in the feed water accumulates on the membrane surface and is removed by a backwash from the filtrate side, see also Fig. 1-1

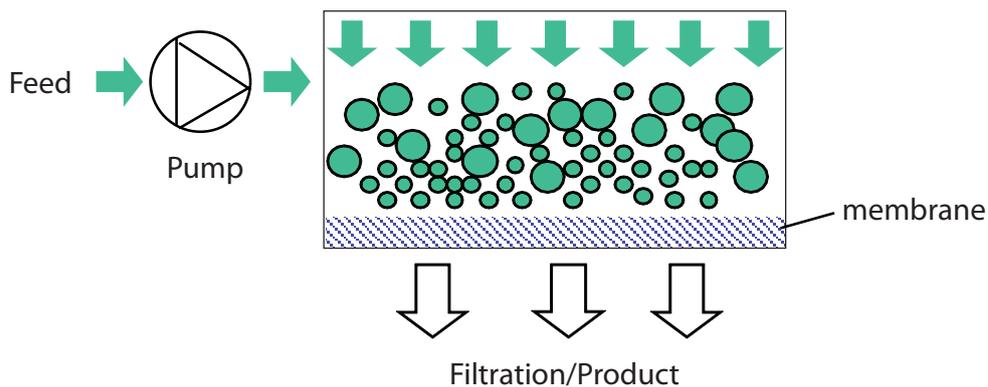


Fig. 1-1: Dead-end filtration

The dead-end mode has emerged as the membrane process of choice for all types of water treatment applications since in almost all water sources feed solid loads are very much lower than in traditional cross-flow applications such as starch or protein concentration.

In a few applications UF/MF processes utilize cross-flow to prevent the excessive build up of contaminants on the membrane surface. A schematic flow scheme is illustrated in Fig. 1-2. High cross-flow velocities create turbulent conditions in the feed channel providing a highly effective method of cleaning the surface from accumulated particulates, particularly applicable for very high solids feeds.

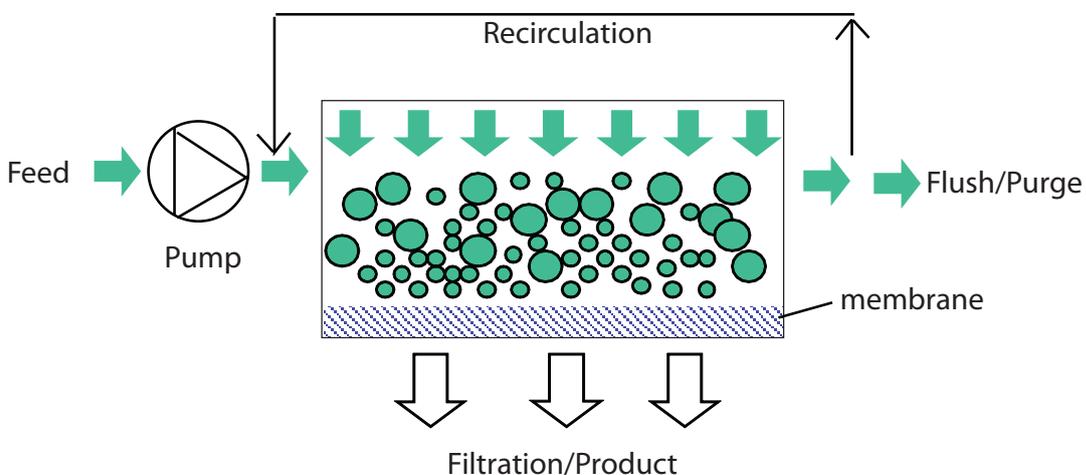
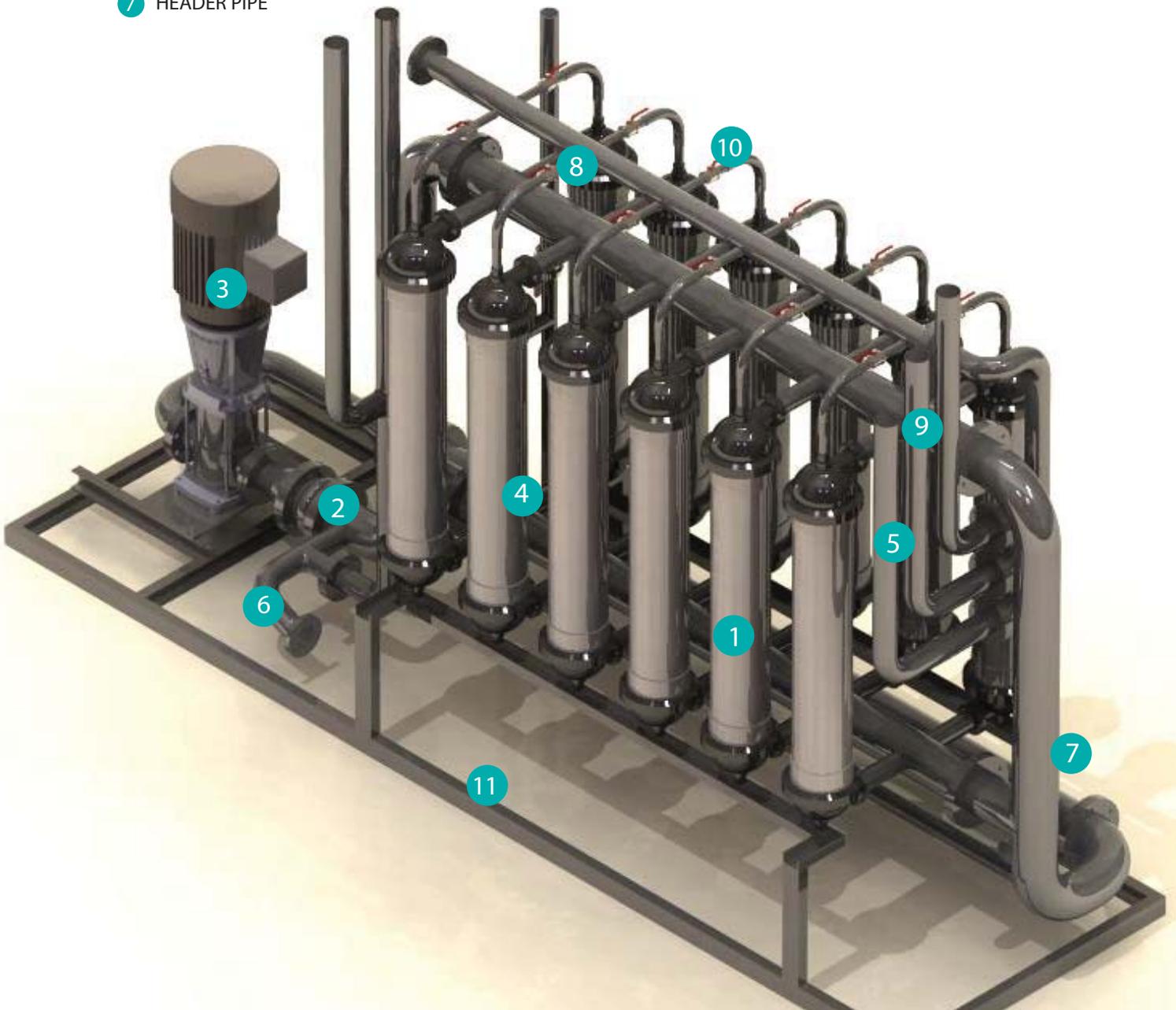


Fig. 1-2: Cross-end filtration

Key Components

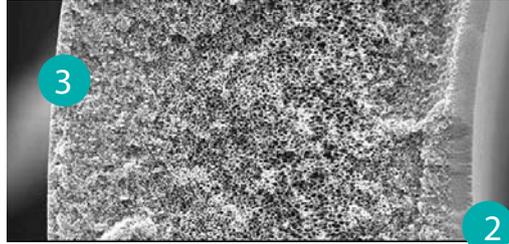
- 1 UF MEMBRANE WITH HOUSING
- 2 FEED INLET
- 3 FEED PUMP
- 4 FEED TO UF MODULE
- 5 BACKWASH LINE
- 6 FLUSH LINE
- 7 HEADER PIPE

- 8 PRODUCT/FILTRATE HEADER
- 9 PRODUCT TO TANK
- 10 PRODUCT/FILTRATE
- 11 SKID/FRAME MOUNTING

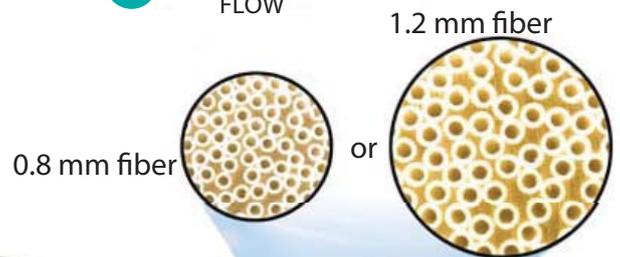


Key Components

UF MEMBRANE



- 1 UF HOLLOW FIBER
- 2 SMOOTH INNER SURFACE OF UF MEMBRANE
- 3 UNIFORM SPONGY STRUCTURE FOR SUPPORT AND LOW PRESSURE FLOW



UF MODULE DESIGN



- 4 10"x60" UF MODULE
- 5 10" x 40" UF MODULE
- 6 CLEAR TUBE TO SEE FILTRATE
- 7 4" x 40" and 4"x20" SMALL UF UNIT
- 8 AUTOMATIC TIMER FOR SMALL UF UNIT
- 9 4" x 40" UF WITH UPVC HOUSING
- 10 TYPICAL UF MEMBRANE DESIGN

Note: UF membrane are also available in various dimension 8"x60", 8" x 40". 6" x 40" with different material and pore size to suit with application

Ultrafiltration

Components	Features	Benefits
UF Membrane Housing	Standard PP or PVC construction for outer shell with NSF certification for material with bacterial and turbidity removal efficiency	Assures safety for use in water and meet compliance. High corrosion and chemical resistance for long time use and cleaning/sanitizing
	Option: Special material housing available for process	Additional safety and insurance compliance.
	Victatatic or Union or Threaded type connection.	Industry standard design.
	Option: Sanitary Tri clamp type connection.	For pharmaceuticals, food process application
Pumps	Designed to fouled condition water in the third year.	Full capability to maintain pressure during membrane warranty period.
	Centrifugal pumps.	Can be serviced by in-plant maintenance staff.
	Single-stage with variable frequency drive or soft starter control	Meets ANSI standard. minimize shock to the system
	Option: multi stage pump	For very tight UF or Spiral configuration that require higher pressure
Flush Systems	Feedwater flush, uses normal service water for flushing.	Flush out particles collecting on membrane surface and maintain flux.
	Option: Permeate Back wash/backflush.	Enhances flush effectiveness in difficult waters
	Outlet flush valve.	Allows flushing of membranes at low pressure.
	Chemical Enhanced Backwash.	to help enhance system performance for high turbid water and sanitize membrane for continuous operation
	Sampling valves available on each housing.	Operators can check individual housing performance. Speeds troubleshooting operator can pin point which housing has a problem.
Frame Painting	All carbon steel surfaces are primed with a two component primer, and epoxy-polyamide paint finish coat.	No on-site painting required. More durable.
	Option: SS Frame is also available based on requirement	Increased durability.
Piping	Low pressure(<100 psi): UPVC piping is used for most cases except for main header in large system	Strength and corrosion resistance for low pressure system
	Option: SS304, SS316L are available based on process	Location classification, high resistance
Valves	Butterfly valves for reliable, automatic on/off control. One-piece body and a one-piece shaft, with mechanical position indicators.	More durable, longer life. Compact, simple and durable construction reduces potential for failure. Visual indication of valve position.
	Option: Valve proximity or microswitch type switches.	Provides positive feedback on valve positions to control center.

Ultrafiltration

Components	Features	Benefits
Instrumentation	Flow-indicating transmitters for permeate and reject provide local readout and send signals to PLC.	Monitors appropriate product flow and recovery rate. Aids trouble shooting.
	Online Turbidity monitoring sensor in permeate provides local readout	Monitors system performance and aids trouble shooting.
	Pressure transmitter on the inlet and outlet of membrane module	To control pressure across the membrane and help in monitor pressure drop over the service period while automatically sense backwash at a certain setpoint
	Pressure gauge manifolded across the permeate and reject of each stage.	System diagnostics from a single high-accuracy pressure gauge for monitoring routine
	Option: pH analyzer in feed line	Monitors track pH to keep it within acceptable range.
	Option: Temperature indicating switch in feed line.	For cases where water temperature varies or sanitization required with hot water
	Option: Temperature indicating transmitter in feed line.	Permits automatic collection of data.
	Option: Oxidant Reduction Potential Analyzer or Chlorine analyzer.	In case of downstream RO process to control and limit chlorine to the system
Clean in Place System	Filter bags catches contaminants in the system CIP Process	Assures continuous clean supply of cleaning solution.
	UF membrane Cleaning.	Facilitates to clean membrane.
	Separate cleaning pump dedicated to cleaning system.	Pump size appropriate to specific cleaning needs.
	Optional: Cleaning solution heater	Warms cleaning solution for optimum performance.
	Internal tank piping. Return lines empty at bottom of tank	Minimizes foaming.
	Optional: Sloped tank bottom.	Provides complete drainage, and prevents sludge accumulation.
	Permeate fill valve.	Provides a connection to easily-fill cleaning system with UF Filtrate
	Flexible hose to connect cleaning skid to UF Skid	Low capital cost alternative.
Option: Solid PVC or 316L stainless steel piping	Minimizes operator activity, reduces cleaning time, improves housekeeping.	