
The Ultra filtration membrane module consists of multiple fine fibers with 0.2 mm internal diameter. The membrane fibers are made of PVDF. The filtration cycle is from out to in, the feed water passes from outside of the fibers to the inside during filtration. Typical operation cycle for the UF will be



- Filtration – produces useful water.
- Air scouring.
- Flush / Rinse.
- Maintenance cleans at prefix intervals.

Air scouring and maintenance clean

Dedicated backwash pumps connected to a backwash water source will be provided as part of the equipment. Modules will be filled with the filtrate before scouring with them air. A suitable acidic/alkaline cleaner dosing and chlorine dosing system will be provided to dose chemicals as required during air scouring of the Ultra-filtration membranes. The dosing sequence will be controlled by the PLC and will be done by means of metering pumps to ensure accurate and optimum dosing.

The wash water from the UF and the filters will be led back to the EQ tank.

UF Automation

The Ultra filtration operation will be automatic controlled by means of a PLC. The PLC will perform a programmed set of operations consisting of service, air scouring and rinse at a preset sequence. It will also initiate the addition of chemicals during the chemically enhanced backwash to enhance the cleaning efficiency. The operation sequence and changeover will be achieved by means of pneumatically actuated butterfly valves.

The Ultra filtration unit will be provided with all safety features and critical fault, or abnormal condition will be indicated by an audiovisual alarm in the control panel.

Process Monitoring

UF plant will be provided with following instrumentation for safe & easy operation.

- Differential pressure switch across the UF unit
 - Flow indicator for the UF Back wash
 - Pressure transmitter and gauges at the UF feed inlet, filtrate and concentrate outlets.
 - Electromagnetic flow meter for the UF filtrate.
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RO FEED CONDITIONING

pH Correction

Feed pH correction is done to ensure all sparingly soluble salts are kept within their solubility levels at the reject end of the RO. Acid is dosed to adjust pH and ensure the reject water saturation index is maintained below 2.0. Hydrochloric acid / Sulfuric acid are the commonly used acids for pH correction.

Feed pH correction can be automated based on the feed water pH online monitoring to ensure the feed pH remains within the desired range.

Antiscalant

To achieve higher recovery from the RO membranes it is necessary to hold the sparingly soluble salts in the water at super saturation levels, this is achieved by adding chelating agents that prevent precipitation of the sparingly soluble ions like Ca, Mg and silica. The nature and quantity of antiscalant used is based on the feed water chemistry. At the design stage software simulations are generated, this however will have to be established during the plant commissioning.



Antioxidant

Polyamide based membranes are very sensitive to oxidants and chlorine in the feed water, trace amounts of such oxidants can cause irreversible damage to the membranes. In general, a positive ORP is maintained in the RO feed by dosing a catalyzed antioxidant. The antioxidant instantaneously reacts and neutralizes any harmful oxidizing compounds in the feed water.

High Pressure Booster pumps

An online high-pressure booster pump is used to pressurize the RO feed to the desired pressure to achieve the desired recovery. Multistage centrifugal booster pumps are offered for this service. The pumps offered with Duplex SS wetted parts.



Reverse Osmosis Block

The RO block contains the membranes housed in the FRP housings. The housing is fitted in a compact skid frame with the feed, permeate and reject piping. The housings are arranged in such a manner that the hydraulic flows across all the housing are uniform and the off take of permeate from each membrane is uniform.

Each stage is designed for a uniform of take of permeate to maintain the required cross flow and the reject flows. This will ensure that fouling and scaling do not take place on the membrane surface. The membranes used are the latest generation spiral wound thin film composite membranes. For specific applications fouling resistant membranes will be used, however this will be decided based on the nature of the feed water.



First – High TDS RO

This will be the first RO system. The RO system is offered with the latest generation, high TDS compatible and antifouling and neutral charge **ProLF series** membranes.

The RO is offered with Two stage configuration, inter-pass booster pumps are provided to ensure uniform flux in all stages.

The RO plant will have booster pumps after the first stage and the second stage.

Second – Ultra High TDS RO

This will be the second RO system. The RO system is offered with the latest generation, very high TDS compatible and advanced antifouling properties **ProLFE / Pro XP** series membranes.

The RO is offered with a Two stage configuration, interpass booster pumps are provided to ensure uniform flux in all stages.

Auto Flushing

Since the RO systems are working with highly concentrated saline water, any stagnation with the RO can trigger corrosion/ scaling/ fouling. To eliminate this the RO system will be provided with an auto flushing system, the RO block will be flushed using permeate water after preset hours of continuous operation, or before shutdown. This is to ensure that the water present on both side of the membranes have almost the same level of TDS when the plant is idle.

The auto flushing will be done from the high-pressure booster pump suction, this will ensure that high TDS water does not stagnate within the pumps and the piping during idle time of the Reverse Osmosis units.

PLANT AUTOMATION

The RO plant is offered with safety interlocks for the following,

- ✓ Low suction pressure
- ✓ High RO feed pressure
- ✓ High Delta P across stages.
- ✓ High permeate Conductivity
- ✓ High / low feed pH (If acid dosing is done).
- ✓ Chemical levels in the dosing tanks.

A PLC based real time control system to control the following,

- ✓ Timer based auto flushing
 - ✓ Auto start up.
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PLANT CAPACITY

Pre-treatment System (Silica reduction)

S. No	Description	Unit	Value
1.	Input effluent design flow	m ³ / hr	82.6
2.	Input Effluent quantity	m ³ /day	1982.4
3.	Plant backwash / rinse water recycled	m ³ /day	285
4.	Total plant feed flow	m ³ /day	2267.4

Ultra-Filtration system

S. No	Description	Unit	Value
1.	Feed	m ³ /Day	2147.4
2.	Filtrate Flow rate	m ³ /Day	1952.4
3.	Recovery	%	90.1

High TDS Reverse Osmosis System

S. No	Description	Unit	Value
1.	Feed flow rate	m ³ /Day	1952.4
2.	Permeate Flow rate	m ³ /Day	1464.3
3.	Reject	m ³ /Day	488.16
4.	Recovery	%	75

Ultra-High TDS Reverse Osmosis System

S. No	Description	Unit	Value
1.	Feed flow rate	m ³ /Day	488.16
2.	Permeate Flow rate	m ³ /Day	292.8
3.	Reject	m ³ /Day	195.3
4.	Recovery	%	60
