GRAFiL
Intelligent Flow

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GRAFiL UF MEMBRANE RESTORATION PROCEDURE

As Contaminants deposit on the surface of UF membrane we expect deterioration in performance due to fouling with time. To restore the membrane performance without dismantling the unit, we shall adopt the Clean In Place (CIP). This document focuses on membrane performance restoration to make it as good as new.

Want to Resolve Fouling Problem ?

During UF Operation the Foulants start depositing on the surface of the membrane and it starts fouling. If the Feed pressure is constant, it will results drop in productivity (Flux). To restore productivity the operator shall increase the feed pressure to compensate for the resistance due to fouled membrane. Since the permeate is open to atmospheric pressure, this method will increase the Trans membrane pressure differential (TMP). But the good thing is production will restore.

How to know rate of Fouling & CIP Frequency ?

We are monitoring membrane performance in new term called Permeability (Can be calculated by Flux÷TMP). When Fouling occurs Permeability decreases. To restore the membrane performance one must perform CIP. Be aware the TMP can not be higher than the maximum recommended TMP in Process Engineering Datasheet.

What to do before CIP ?

Permeate Tank	Make sure that permeate tank is enough filled with the permeate water or fresh water to perform CIP.
Chemicals	Prepare the CIP solution as per guidelines given in this document.
pH	Check the pH of the CIP solution. (2 To 11 pH)
Valve	Close all the Valves of the Uf System.
Temperature	With Prior approval from Technorbital, CIP solution (NaOH) can be heated upto 40˚C to increase its effectiveness.

Chemical Preparation Guideline

Sr. No.	Names	IS. NO.	Concentration	Application	Cleaning Time	Attention !
1	Citric Acid	IS 13186 :1991	2.00%	Inorganic $CaCO_3$	1-3 Hours	If pH increases by 0.5 while recycling the solution then, restore the pH using HCl.
2	Oxalic Acid	IS 501: 1976	2.00%	Inorganic Metal Ion + $CaCO_3$	1-3 Hours	
3	Sodium Carbonate	IS 251:1998	0.20%	Organic, Oil	1-3 Hours	If pH decreases by 0.5 while recycling the solution, then restore the pH using NaOH.
4	Sodium Hypochlorite	IS 11673:1992	0.20%	Biological	1-3 Hours	
5	Sodium Hydroxide	IS 252:1991	0.10%	Organic, Oil	1-3 Hours	Before use take Prior approval by Technorbital Advanced Materials Pvt. Ltd.
6	Sodium Dodecyl Sulfate	IS 4956: 2002	0.10%	Organic, Oil	1-3 Hours	
7	Sodium Benzoate	IS 4447:1994	0.10%	Only Membrane Preservation	NA	This chemical to be used only during Prolong storage membranes. Follow Procedure

Attention !

1) Prepare Citric acid solution 12 hrs. before performing the CIP.
2) Volume of chemical solution shall be equal to System Volume + 50% Extra.

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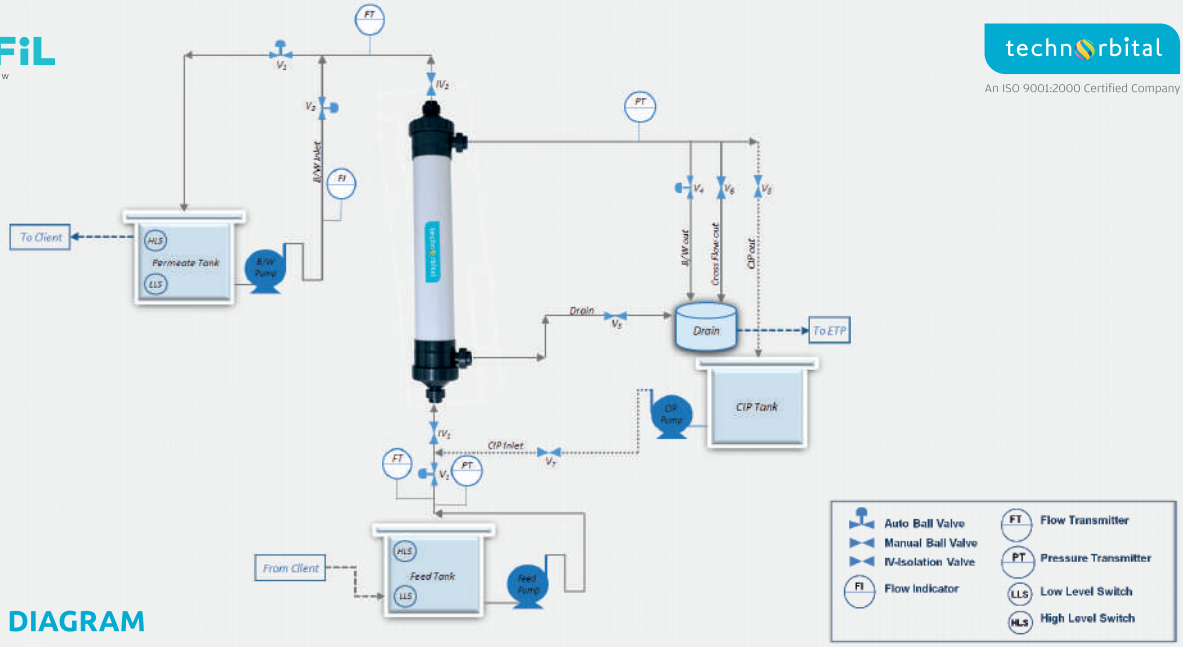

GRAFiL UF SEQUENCE DIAGRAM

UF System Operation Logic

Step Description / UF System Start Mode	Sr. No.	Time	Flow Rate	UF Feed Pump (P1)	UF Backwash Pump (P2)	CIP Pump (P3)	Feed in Valve (V1)	Permeate Out Valve (V2)	Backwash In Valve (V3)	Backwash Out Valve (V4)	Drain Valve (V5)	Cross Flow Out Valve (V6)	CIP in Valve (V7)	CIP Out Valve (V8)	Feed Isolation Valve (IV1)	Permeate Isolation Valve (IV2)
Filtration Cycle																
Filtration Service	1	29 min	---	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
Backwash	2	1 min	---	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON	ON
Draining	3	NA	---	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Attention !	If TMP after backwash is still higher than the limit of 1.5 kg/cm2, perform the backwash cycle 2 times - 5 times subject to avaibility of permeate in permeate tank.															
Membrane Performance Restoration																
Draining	1	NA	---	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Clean In Place	2	30 min	---	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Soaking	3	60 min	NA	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
Draining	4	NA	---	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Backwash	5	1 min	---	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON	ON
Flushing	6	1 min	---	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	ON	ON
Filtration Service	7	29 min	---	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
Attention !	1) The BW out valve V4 shall be manually activated to open during flushing. 2) Soaking time will varry and can be extent to 24 hrs. depending on the degree of fouling. Consult Technorbital for longer soak. 3) The CIP steps described above are for a single alkali or acid chemical solution. 4) If an acid and alkali cleaning are required, the CIP steps would be repeated for each chemical solution															
Membrane Storage Procedure																
Draining	1	NA	---	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Clean In Place	2	30 Min	---	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Soaking	3	60 Min	NA	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
Draining	4	NA	---	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Backwash	5	1 Min	---	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON	ON
Flushing	6	1 Min	---	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	ON	ON
Preservative Injection	7	2 Min	---	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Preservation	8	60 Min	NA	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

For more information and for any queries please contact us at : grafil@technorbital.com