

NANO H₂O QuantumFlux™ Pressurized UF Membrane

Technical Service Bulletin 605

UF Membrane Cleaning

Air scouring will remove most fouling from the membranes, but not all. Over time, fouling will accumulate. Chemical cleanings are used to remove fouling that is not removed by air scouring. Chemicals should be selected based on the type of foulants present. The chemicals used should not damage the membrane module or create secondary pollution. NANO H₂O utilizes two types of chemical cleaning to recover membrane performance.

⚠ DANGER

If sodium hypochlorite and acid are mixed, poisonous chlorine gas will be formed. The skids should be thoroughly rinsed between chemical cleanings so that the chemicals do not mix.

⚠ CAUTION

Maintain cleaning solutions within allowable pH ranges and only use approved chemicals.

Maintenance Clean (MC)

The maintenance clean is a shorter clean designed to maintain the membrane permeability. In general, a chemical solution is pumped into a drained skid from the feed or filtrate side of the membranes, usually the filtrate side. After a set soaking time is reached, low pressure air is used to scour the membrane. After air scouring, the skid is drained and rinsed, before resuming filtration. After maintenance cleaning, the Transmembrane Pressure (TMP) should be at least partially recovered.

Recovery Clean (RC)

The recovery clean is similar to the maintenance clean but uses a higher concentration of the chemical and longer soak times. The recovery clean is designed to recover the membrane permeability to the original value. The steps of the RC are very similar to the MC, but with an extra soaking step. A recovery clean may be triggered by time (every 30-90 days), or when MC fails to restore membrane permeability and the TMP continues to rise a certain amount above the initial value. For example, more than 50KPa (7.3 psi) above the initial value.

Chemical Cleaning Regime Design

The chemical cleaning regime (chemicals, frequencies, durations, and concentrations) should be uniquely selected for each site-specific condition. Contact NANO H₂O for assistance selecting the cleaning regime for your system. The following table is an indicative guide for various water types with typical quality. Variation from this table due to site-specific water quality is common.

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Table 1: Chemical Cleaning Parameters

	Oxidant MC Frequency (# per skid/day)	Basic MC Frequency (# per skid/day)	Acid MC Frequency (# per skid/day)	Oxidant RC Frequency (Days between clean)	Basic RC Frequency (Days between clean)	Acid RC Frequency (Days between clean)
Chemical & Concentration	200 ppm NaOCl	3500 ppm NaOH	1500 ppm H2SO4	500 ppm NaOCl	3500 ppm NaOH	2000 ppm Citric Acid + 1500 ppm H2SO4
Ground Water	0.5	-	0.14	90	-	90
Seawater	1	-	0.14	60	-	60
Surface Water	1	0.33 ²⁾	0.25	60	60 ²⁾	60
Municipal WW – Clarifier Effluent	1	1 ²⁾	0.14	45	45 ²⁾	45
Industrial WW – Treated Effluent	2	1 ²⁾	0.25	30	30 ²⁾	30

¹⁾ Please contact us for the cleaning formulation for special contaminants.

²⁾ Only for TIPS products. pH would exceed limits of NIPS products.

Method to Verify the Effectiveness of the Cleaning

Please record the following parameters before and after the cleaning:

1. Feed and filtrate flow rate
2. Feed, concentrate, and filtrate pressure
3. Water temperature

After the cleaning compare the data. If the filtrate flow rate, or TMP could not be recovered it means the cleaning is not effective, please contact our engineer to find a solution for this issue.

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Cleaning Process Procedures

The cleaning process for both maintenance clean and recovery clean have been outlined. On the following pages, you can find step-by-step diagrams and detailed sequence tables.

The maintenance clean and recovery clean procedures should be programmed into the control system. Maintenance cleans should occur automatically based on time or number of completed filtration cycles. Recovery Cleans should be manually initiated when an established number of days have passed (commonly, 30 days), or the TMP reaches 1.5 bar (22 psi). The procedure should be repeated for each chemical. Ensure rinsing is complete before introducing a new chemical. Typically, sodium hypochlorite is first, followed by sodium hydroxide. Finally, citric, hydrochloric, or sulfuric acid is used.

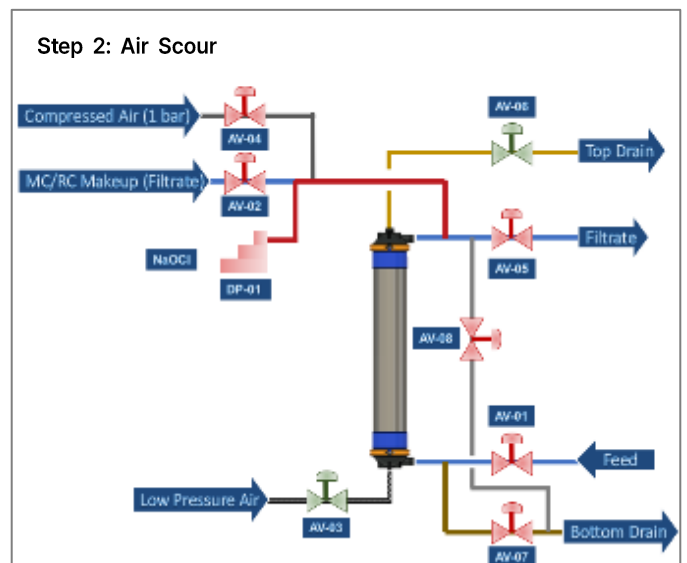
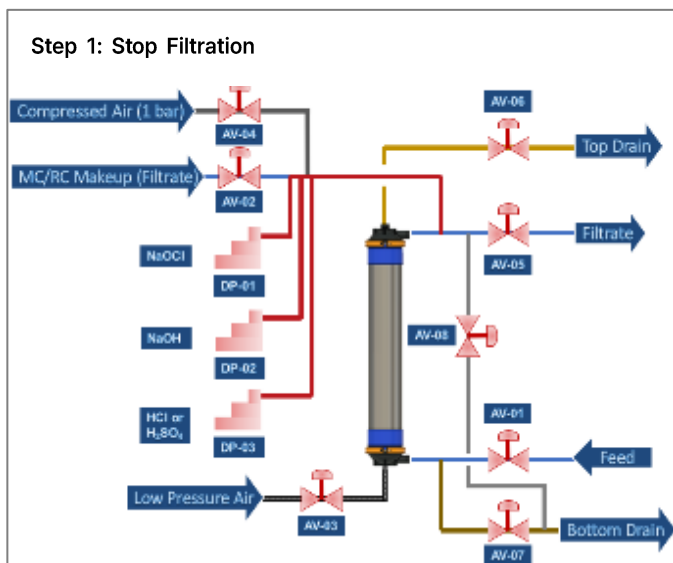
CAUTION

Ensure top drain valve is open during chemical soak step.

CAUTION

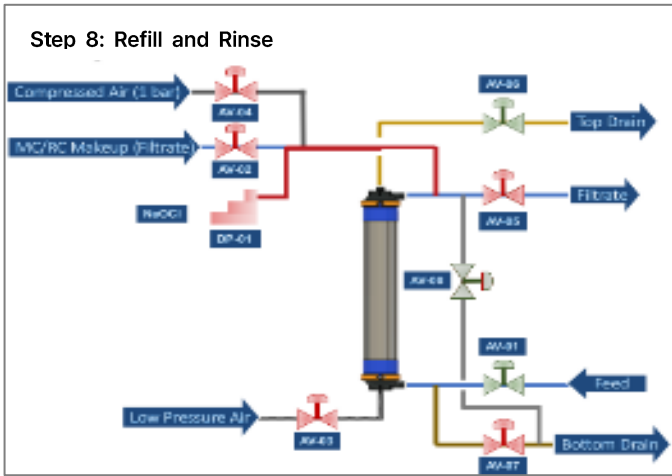
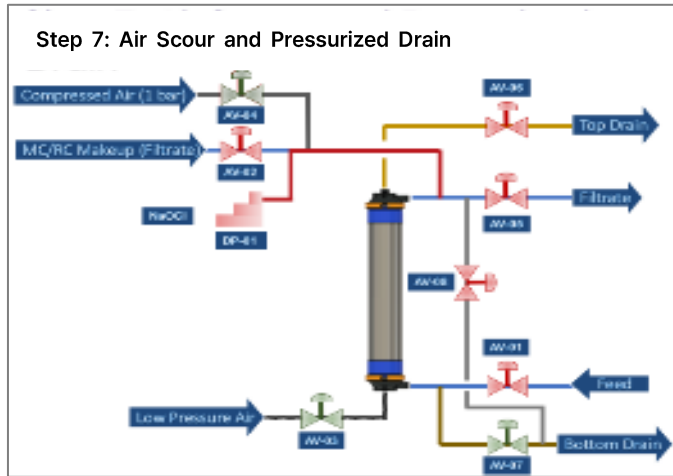
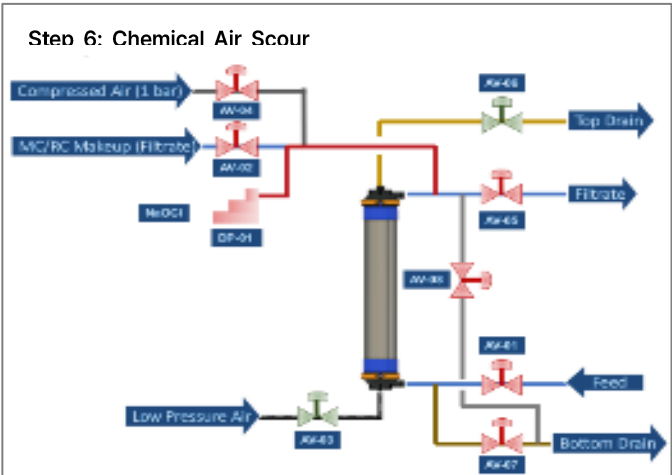
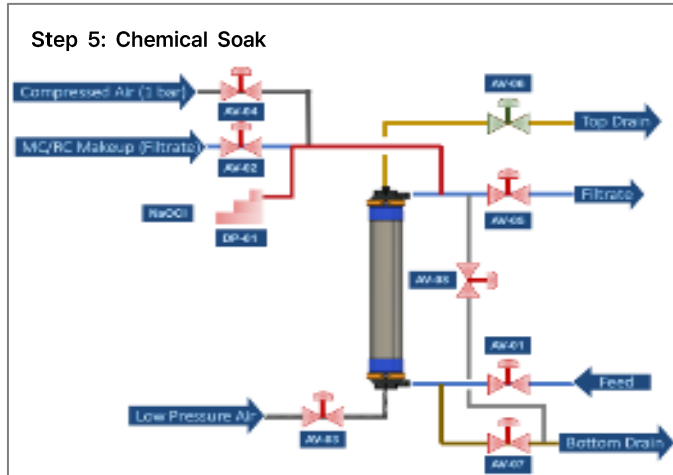
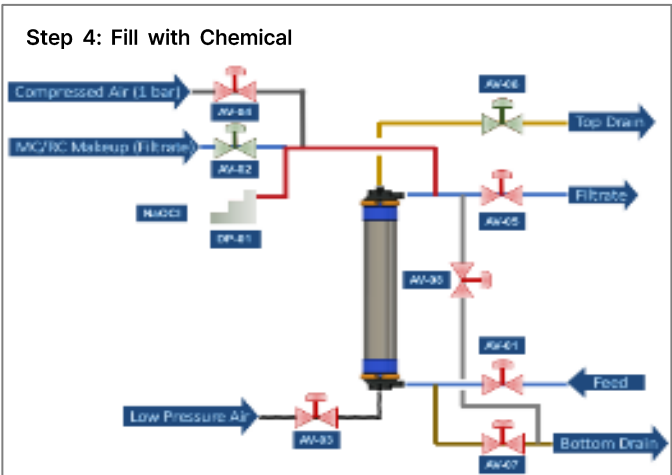
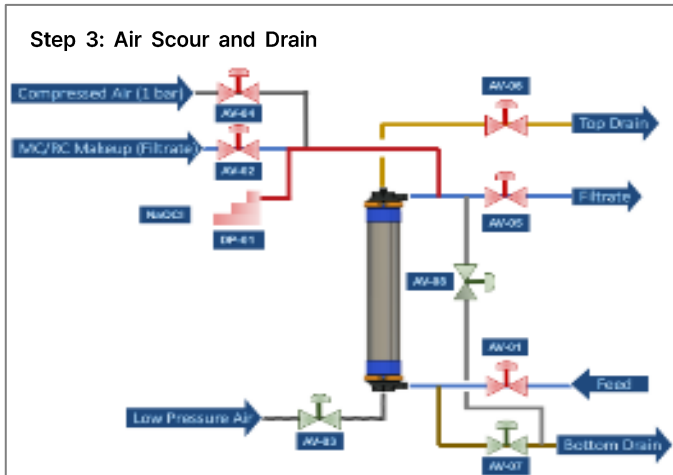
Check for potential exothermic reactions between cleaning solutions and foulants.

Maintenance Cleaning Process Steps



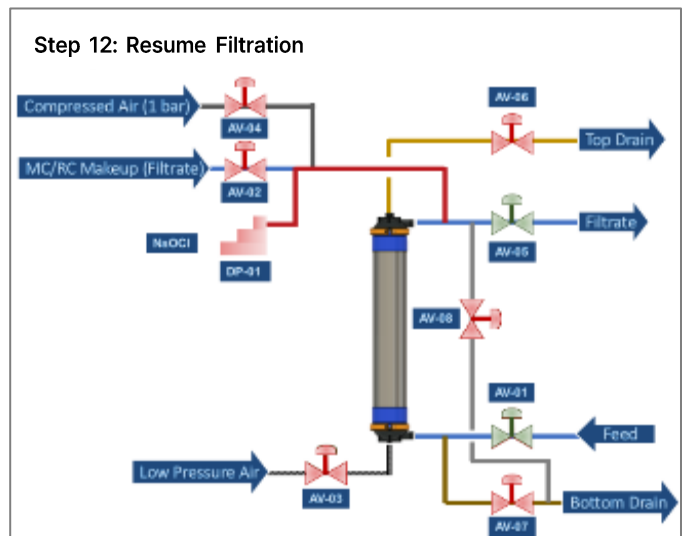
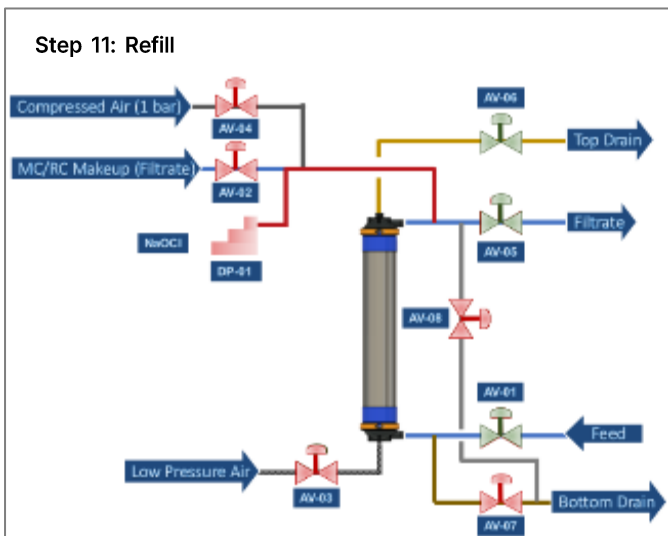
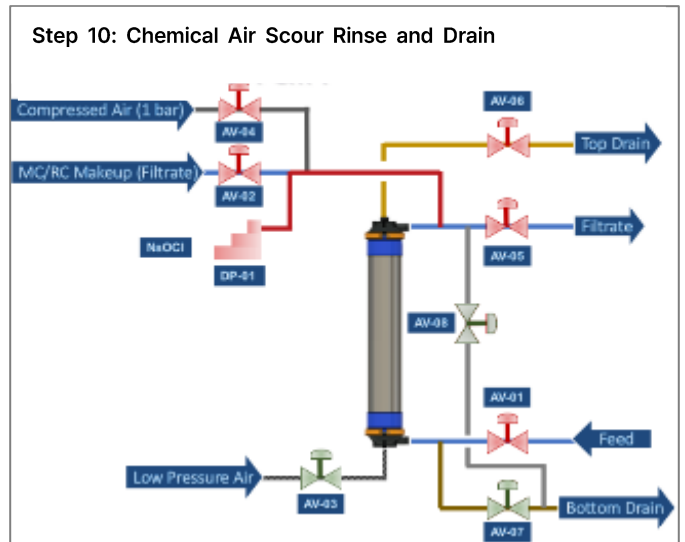
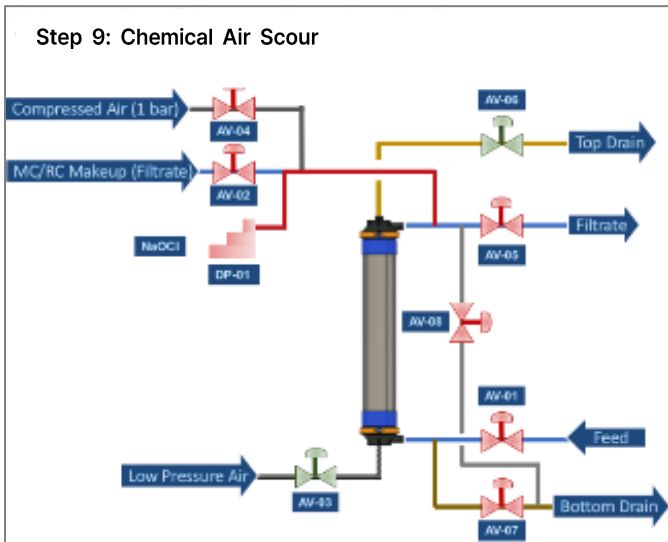
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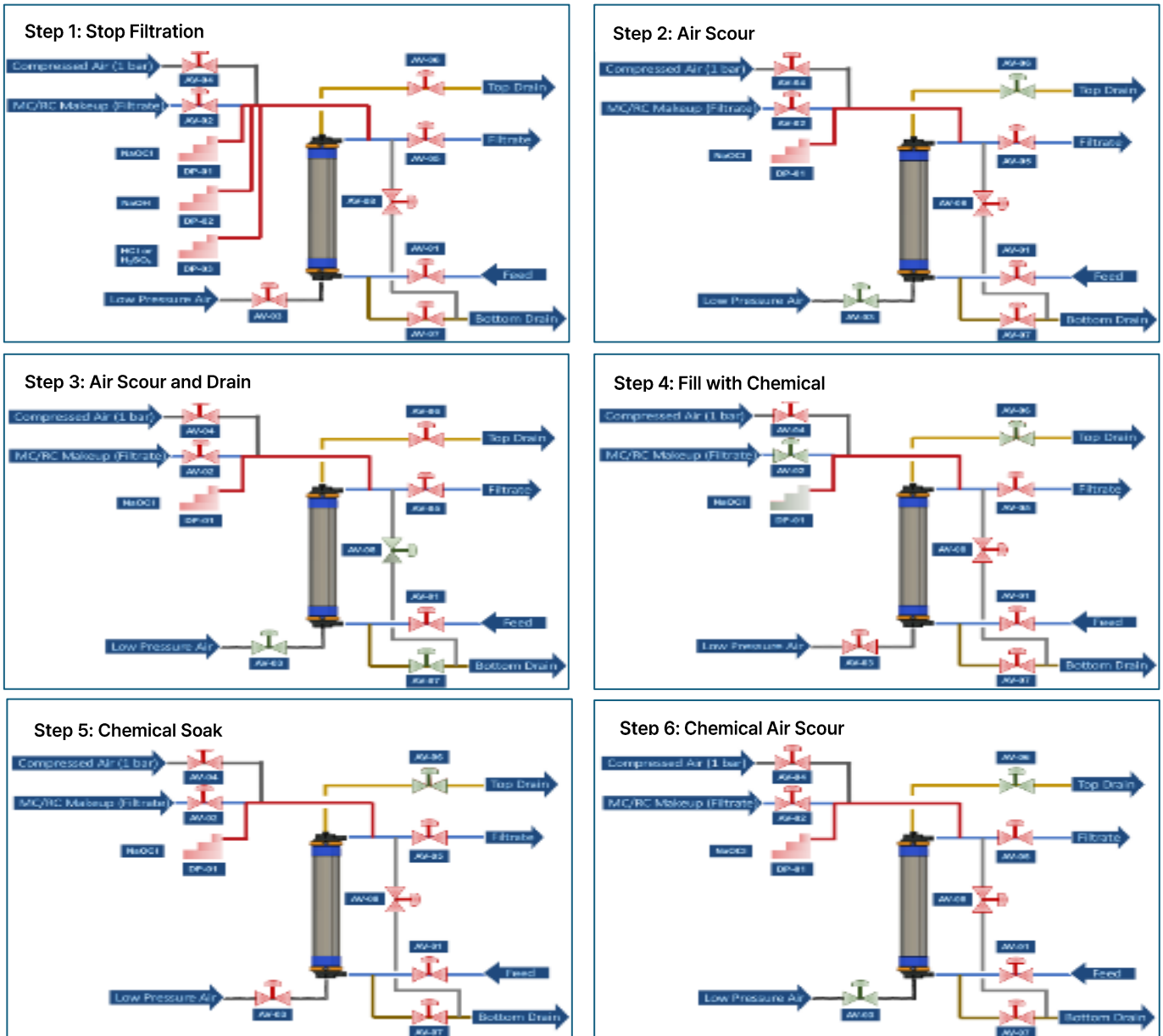
Table 2: Control Sequence Table – Maintenance Clean

Step Number	Step Description	Typical Step Duration (s)	Typical Cumulative Sequence Duration (s)	Valve Position									Pump Status			
				Feed (AV-01)	Filtrate (AV-05)	Top Drain (AV-06)	Drain (AV-07)	Air Scour (AV-03)	Filtrate to Drain (AV-08)	Air for MIT (AV-04)	MC/RC Feed (AV-02)	Chemical Injection	Feed Pump (P-1)	MC/RC Pump (P-2)	Air Blower (B-1)	Chemical Dosing Pump (DP-1/2/3)
1	Stop Filtration	0		O	O	X	X	X	X	X	X	X	R	S	S	S
	Step Transition - Feed pump speed adjustment	10	10	O	O	X	X	X	X	X	X	X	R → S	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	5	15	O → X	O → X	X → O	X	X → O	X	X	X	X	S	S	S → R	S
2	Air Scour	60	75	X	X	O	X	O	X	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	80	X	X	O → X	X → O	O	X → O	X	X	X	S	S	R	S
3	Air Scour and Drain	60	140	X	X	X	O	O	O	X	X	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	145	X	X	X → O	O → X	O → X	O → X	X	X → O	O → X	S	S	R → S	S
	Step Transition - RC pump and chemical pump speed adjustment	10	155	X	X	O	X	X	X	X	O	O	S	S → R	S	S → R
4	Fill with cleaning solution	60	215	X	X	O	X	X	X	X	O	O	S	R	S	R
	Step Transition - RC pump and chemical pump speed adjustment	10	225	X	X	O	X	X	X	X	O	O	S	R → S	S	R → S
	Step Transition - Valve positioning	5	230	X	X	O	X	X	X	X	O → X	O → X	S	S	S	S
5	Chemical soak	600	830	X	X	O	X	X	X	X	X	X	S	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	5	835	X	X	O	X	X → O	X	X	X	X	S	S	S → R	S
6	Chemical Air Scour	300	1135	X	X	O	X	O	X	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	1140	X	X	O → X	X → O	O	X	X → O	X	X	S	S	R	S
7	Air Scour and Pressurized Chemical Drain	10	1150	X	X	X	O	O	X	O	X	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	1155	X → O	X	X → O	O → X	O → X	X → O	O → X	X	X	S	S	R → S	S
	Step Transition - Feed pump speed adjustment and valve positioning	10	1165	O	X	O	X	X	O	X	X	X	S → R	S	S	S
8	Refill	30	1195	O	X	O	X	X	O	X	X	X	R	S	S	S
	Step Transition - Valve positioning	5	1200	O	X	O → X	X	X	O	X	X	X	R	S	S → R	S
9	Chem Rinse Air Scour	60	1260	X	X	O	X	O	X	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	1265	X	X	O → X	X → O	O	X → O	X	X	X	S	S	R	S
10	Chemical Rinse Air Scour and Drain	60	1325	X	X	X	O	O	O	X	X	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	1330	X → O	O	X → O	O → X	O → X	O → X	X	X	X → O	S	S	R → S	S
11	Refill	30	1230	O	X	X	X	X	O	X	X	X	R	S	S	S
	Step Transition - Valve positioning	5	1235	O	X → O	X	X	X	O → X	X	X	X	R	S	S	S
	Step Transition - Feed pump speed adjustment	10	1245	O	O	X	X	X	X	X	X	X	R	S	S	S
12	Resume Filtration	0	1245	O	O	X	X	X	X	X	X	X	R	S	S	S
	Sequence duration (s)		1245	Notes: O = Open valve									R = Run pump			
	Sequence duration (min)		21	X = Closed valve									S = Stop pump			

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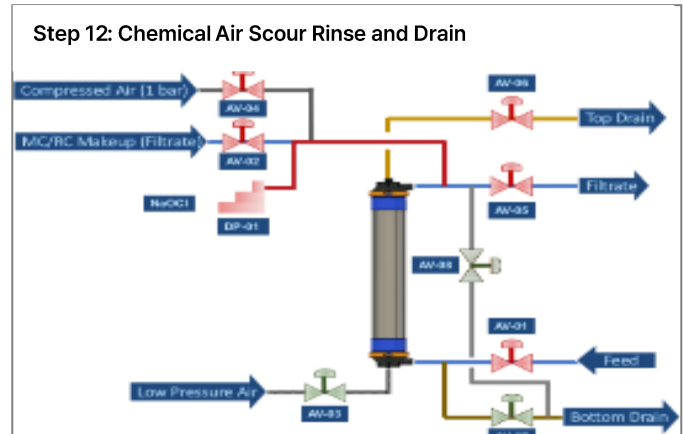
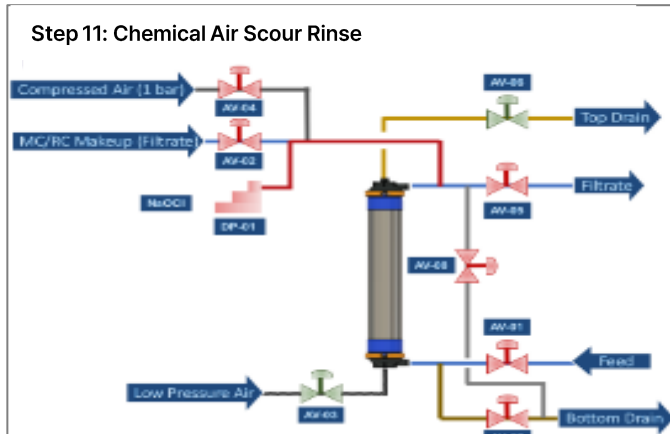
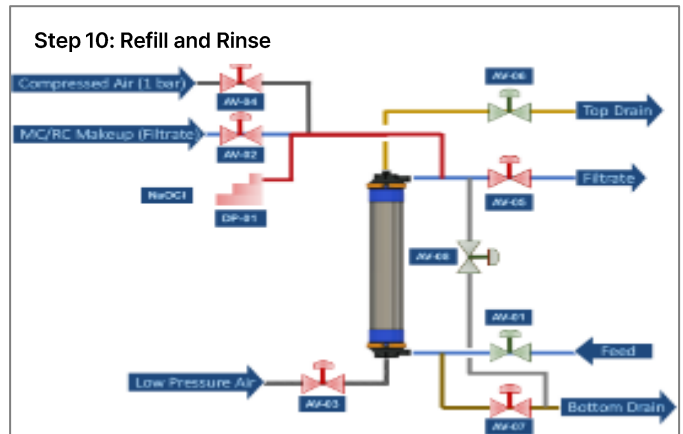
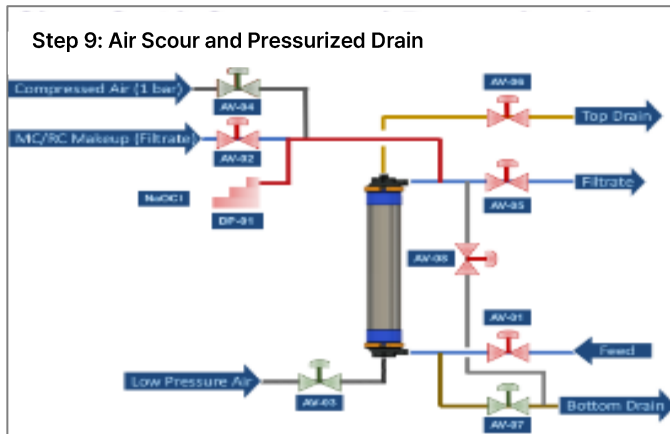
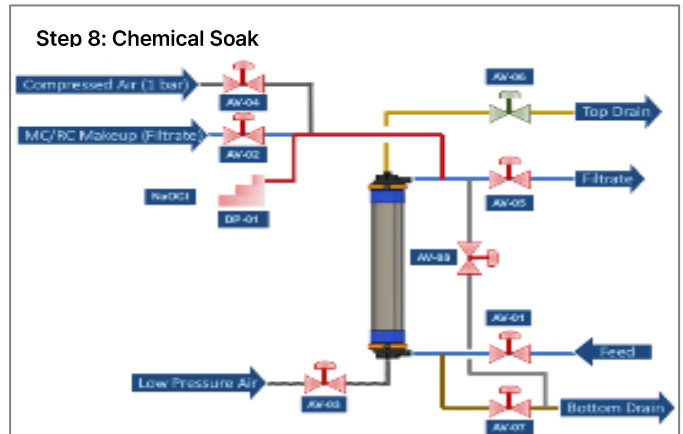
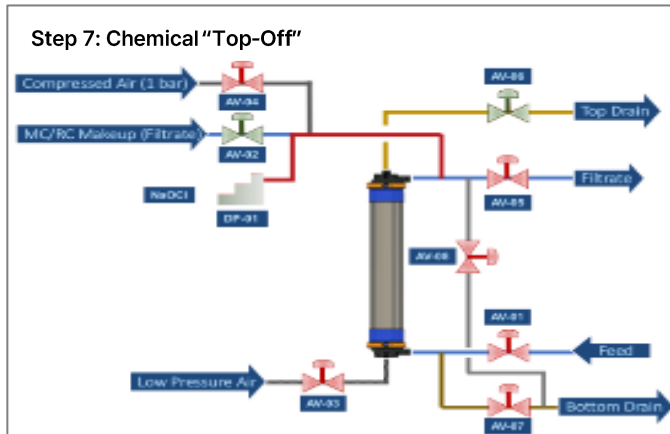
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Recovery Cleaning Process



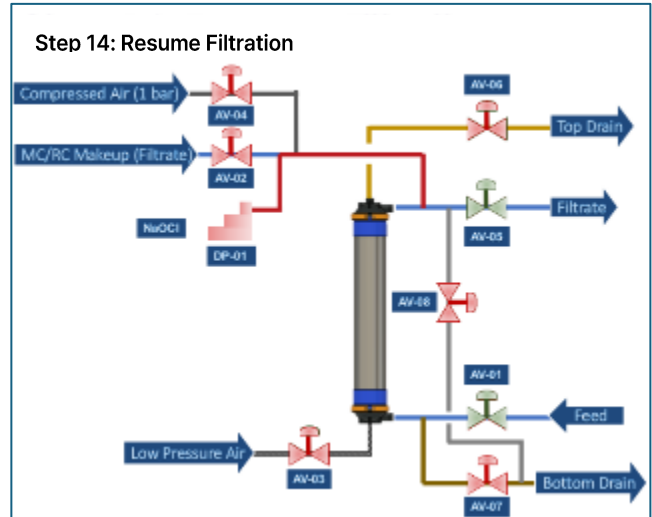
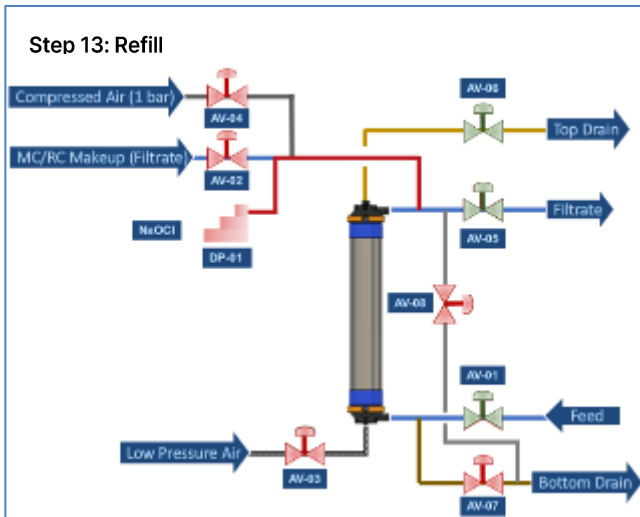
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Table 3: Control Sequence Table – Recovery Clean

Step Number	Step Description	Typical Step Duration (s)	Typical Cumulative Sequence Duration (s)	Valve Position								Pump Status			
				Feed (AV-01)	Filtrate (AV-05)	Top Drain (AV-06)	Drain (AV-07)	Air Scour (AV-03)	Filtrate to Drain (AV-08)	Air for MIT (AV-04)	MC/RC Feed (AV-02)	Feed Pump (P-1)	MC/RC Pump (P-2)	Air Blower (B-1)	Chemical Dosing Pump (DP-1/2/3)
1	Stop Filtration	0		O	O	X	X	X	X	X	X	R	S	S	S
	Step Transition - Feed pump speed adjustment	10	10	O	O	X	X	X	X	X	X	R → S	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	5	15	O → X	O → X	X → O	X	X → O	X	X	X	S	S	S → R	S
2	Air Scour	60	75	X	X	O	X	O	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	80	X	X	O → X	X → O	O	X → O	X	X	S	S	R	S
3	Air Scour and Drain	60	140	X	X	X	O	O	O	X	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	145	X	X	X → O	O → X	O → X	O → X	X	X → O	S	S	R → S	S
	Step Transition - RC pump and chemical pump speed adjustmen	10	155	X	X	O	X	X	X	X	O	S	S → R	S	S → R
4	Fill with cleaning solution	600	755	X	X	O	X	X	X	X	O	S	R	S	R
	Step Transition - RC pump and chemical pump speed adjustmen	10	765	X	X	O	X	X	X	X	O	S	R → S	S	R → S
	Step Transition - Valve positioning	5	770	X	X	O	X	X	X	X	O → X	S	S	S	S
5	Chemical soak	2700	3470	X	X	O	X	X	X	X	X	S	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	5	3475	X	X	O	X	X → O	X	X	X	S	S	S → R	S
6	Chemical Air Scour	300	3775	X	X	O	X	O	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	3780	X	X	O	X	O	X	X	X → O	S	S → R	R → S	S → R
7	Skid Topoff	10	3790	X	X	O	X	X	X	X	O	S	R	S	R
	Step Transition - Valve positioning	5	3795	X	X	O	X	X	X	X	O → X	S	R → S	S → R	R → S
8	Chemical soak	2700	6480	X	X	O	X	X	X	X	X	S	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	5	6485	X	X	O → X	X → O	X → O	X	X → O	X	S	S	S → R	S
9	Air Scour and Pressurized Chemical Drain	10	6495	X	X	X	O	O	X	O	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	6500	X → O	X	X → O	O → X	O → X	X → O	O → X	X	S	S	R → S	S
	Step Transition - Feed pump speed adjustment and valve positioning	10	6510	O	X	O	X	X	O	X	X	S → R	S	S	S
10	Refill	30	6540	O	X	O	X	X	O	X	X	R	S	S	S
	Step Transition - Valve positioning	5	6545	O	X	O → X	X	X	O	X	X	R	S	S → R	S
11	Chem Rinse Air Scour	60	6605	X	X	O	X	O	X	X	X	S	S	R	S
	Step Transition - Valve positioning	5	6610	X	X	O → X	X → O	O	X → O	X	X	S	S	R	S
12	Chemical Rinse Air Scour and Drain	60	6670	X	X	X	O	O	O	X	X	S	S	R	S
	Step Transition - Valve positioning and blower speed adjustment	5	6675	X → O	O	X → O	O → X	O → X	O → X	X	X	S	S	R → S	S
13	Refill	30	6575	O	X	X	X	X	O	X	X	R	S	S	S
	Step Transition - Valve positioning	5	6580	O	X → O	X	X	X	O → X	X	X	R	S	S	S
	Step Transition - Feed pump speed adjustment	10	6590	O	O	X	X	X	X	X	X	R	S	S	S
14	Resume Filtration	0	6590	O	O	X	X	X	X	X	X	R	S	S	S
	Sequence duration (s)		6590	Notes: O = Open valve X = Closed valve								R = Run pump S = Stop pump			
	Sequence duration (min)		110												