LG QuantumFlux™ MBR/Submerged UF Membrane

Technical Service Bulletin 805

MBR & Submerged 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. LG Chem utilizes two methods 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 the skids from the filtrate side of the membranes with the air scour off. The chemical solution is then allowed to soak in and on the membrane fibers. After a set soaking time is reached, air scouring is resumed. Soaking and Air Scouring steps may be repeated up to three times. After completing the soaking and air scouring steps, filtration resumes. After maintenance cleaning, the 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 the membrane tank is drained prior to filling with chemical cleaning solution. Additionally, the RC always includes at least oxidant and acidic solutions. 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 about 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 LG Chem 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/week)	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[1]	200 ppm NaOCl	3500 ppm NaOH	1500 ppm H_2SO_4	1000 ppm NaOCl	3500 ppm NaOH	5000 ppm H_2SO_4
Sewage/Municipal Wastewater	1-2	-	-	180	-	180
Industrial Wastewater	2-4	0-1 (TIPS products only)	0-1	60	60 (TIPS products only)	60

1) Please contact LG Chem for the cleaning formulation for special contaminants.

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

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

Cleaning Process Procedures

The cleaning process for both maintenance clean and recovery clean have been outlined. On the following pages, you can find 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 30-90 days), or the TMP reaches 0.5 bar (7.5 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.

Table 2: Control Sequence Table – Maintenance Clean

				Valve Position								Pump Status								
Step Number	Step Description	Typical Step Duration (s)	Typical Cumulative Sequence Duration (s)	Feed Valve	MC Solution Supply, Value	RC Solution Supply Valve	Air Scour Supply Valve	Filtrate Discharge Valve	Membrane Tank Drain Valve	Vacuum Pump/Air Ejector Valve	Integrity Test Valve	Feed Pump	Membrane Tank Recirculation Pump	Filtrate Pump with VFD	Chemical Solution Pump	Membrane Tank Drain Down pump	Sludge Discharge Pump (or Valve)	Air Blower	NaOCl (Cleaning) Dosing Pump	Acid (Cleaning) Dosing Pump
				AV-01	AV-02	AV-03	AV-04	AV-05	AV-06	AV-07	AV-08	P-01	P-02	P-03	P-04	P-05	P-06	AB-01	DP-01	DP-02
1	Stop Filtration	0	0	O	X	X	O	O	X	X	X	R or S (on level, control)	R or S (on level, control)	R	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning, and pump and blower speed adjustment	10	10	O→X	X→O	X	O→X	O→X	X	X	X	R or S (on level, control)	R or S (on level, control)	R→S	S→R	S	S or R (on TSS meter, control)	R→S	S→R	S
2	Inject Chemical Solution		310	X	O	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R	S	S or R (on TSS meter, control)	S	R	S
	Step Transition - Valve positioning and pump speed adjustment	10	320	X	O→X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R→S	S	S or R (on TSS meter, control)	S	R→S	S
3	Chemical Soak 1		620	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	630	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
4	Chemical Air Scour 1		930	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	940	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
5	Chemical Soak 2		1240	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	1250	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
6	Chemical Air Scour 2		1550	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	1560	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
7	Chemical Soak 3		1560	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	1570	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
8	Chemical Air Scour 3		1570	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning, and pump and blower speed adjustment	10	1580	X→O	X	X	O	X→O	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
9	Resume Filtration	0	1580	O	X	X	O	O	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Sequence duration (s)		1580	Notes: O=open valve								R=run pump								
	Sequence duration (min)		26	X=closed valve								S=stop pump								

Table 3: Control Sequence Table – Recovery Clean (Sheet 1 of 2)

				Valve Position								Pump Status								
Step Number	Step Description	Typical Step Duration (s)	Typical Cumulative Sequence Duration (s)	Feed Valve	MC Solution Supply, Value	RC Solution Supply Valve	Air Scour Supply Valve	Filtrate Discharge Valve	Membrane Tank Drain Valve	Vacuum Pump/Air Ejector Valve	Integrity Test Valve	Feed Pump	Membrane Tank Recirculation Pump	Filtrate Pump with VFD	Chemical Solution Pump	Membrane Tank Drain Down pump	Sludge Discharge Pump (or Valve)	Air Blower	NaOCl (Cleaning) Dosing Pump	Acid (Cleaning) Dosing Pump
				AV-01	AV-02	AV-03	AV-04	AV-05	AV-06	AV-07	AV-08	P-01	P-02	P-03	P-04	P-05	P-06	AB-01	DP-01	DP-02
1	Stop Filtration	0	0	O	X	X	O	O	X	X	X	R or S (on level, control)	R or S (on level, control)	R	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning, and pump speed adjustment	10	10	O→X	X	X	O	O→X	X→O	X	X	R or S (on level, control)	R or S (on level, control)	R→S	S	S→R	S or R (on TSS meter, control)	R	S	S
2	Membrane tank drain	600	610	X	X	X	O	X	O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	R	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump and blower speed adjustment	10	620	X	X→O	X	O→X	X	O→X	X	X	R or S (on level, control)	R or S (on level, control)	S	S→R	R→S	S or R (on TSS meter, control)	R→S	S→R	S
3	Oxidant RC Chemical Soln Injection	600	1220	X	O	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R	S	S or R (on TSS meter, control)	S	R	S
	Step Transition - Valve positioning and pump and blower speed adjustment	10	1230	X	O→X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R→S	S	S or R (on TSS meter, control)	S	R→S	S
4	Oxidant RC chemical soak 1	3600	4830	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	4840	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
5	Oxidant RC chemical air scour 1	300	5140	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	5150	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
6	Oxidant RC chemical soak 2	2400	7550	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	7560	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
7	Oxidant RC chemical air scour 2	300	7860	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	7870	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
8	Oxidant RC chemical soak 3	300	8170	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	8180	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
9	Oxidant RC chemical air scour 3	300	8480	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	8490	X	X	X	O	X	X→O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S→R	S or R (on TSS meter, control)	R	S	S
10	Membrane tank chemical drain	600	9090	X	X	X	O	X	O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	R	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	9100	X	X→O	X	O	X	O→X	X	X	R or S (on level, control)	R or S (on level, control)	S	S→R	R→S	S or R (on TSS meter, control)	R	S	S
11	Membrane tank chemical flush	300	9400	X	O	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	9410	X	O→X	X	O	X	X→O	X	X	R or S (on level, control)	R or S (on level, control)	S	R→S	S→R	S or R (on TSS meter, control)	R	S	S
12	Membrane tank drain	600	10010	X	X	X	O	X	O	X	x	R or S (on level, control)	R or S (on level, control)	S	S	R	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump and blower speed adjustment	10	10020	X	X→O	X	O→X	X	O→X	X	X	R or S (on level, control)	R or S (on level, control)	S	S→R	R→S	S or R (on TSS meter, control)	R→S	S	S→R

Table 3: Control Sequence Table – Recovery Clean (Sheet 2 of 2)

Step Number	Step Description	Typical Step Duration (s)	Typical Cumulativ e Sequence Duration (s)	Feed Valve	MC Solution Supply, Value	RC Solution Supply Valve	Air Scour Supply Valve	Filtrate Discharge Valve	Membrane Tank Drain Valve	Vacuum Pump/Air Ejector Valve	Integrity Test Valve	Feed Pump	Membrane Tank Recirculation Pump	Filtrate Pump with VFD	Chemical Solution Pump	Membra ne Tank Drain Down pump	Sludge Discharge Pump (or Valve)	Air Blower	NaOCl (Cleanin g) Dosing Pump	Acid (Cleanin g) Dosing Pump
				AV-01	AV-02	AV-03	AV-04	AV-05	AV-06	AV-07	AV-08	P-01	P-02	P-03	P-04	P-05	P-06	AB-01	DP-01	DP-02
13	Acid RC Chemical Soln Injection	600	10620	X	O	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R	S	S or R (on TSS meter, control)	S	S	R
	Step Transition - Valve positioning and pump speed adjustment	10	10630	X	O→X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R→S	S	S or R (on TSS meter, control)	S	S	R→S
14	Acid RC chemical soak 1	2700	13330	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	13340	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
15	Acid RC chemical air scour 1	300	13640	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	13650	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
16	Acid RC chemical soak 2	1800	15450	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	15460	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
17	Acid RC chemical air scour 2	300	15760	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	15770	X	X	X	O→X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R→S	S	S
18	Acid RC chemical soak 3	1800	17570	X	X	X	X	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S	S	S
	Step Transition - Valve positioning and blower speed adjustment	10	17580	X	X	X	X→O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	S→R	S	S
19	Acid RC chemical air scour 3	300	17880	X	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	17890	X	X	X	O	X	X→O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S→R	S or R (on TSS meter, control)	R	S	S
20	Membrane tank chemical drain	600	18490	X	X	X	O	X	O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	R	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	18500	X	X→O	X	O	X	O→X	X	X	R or S (on level, control)	R or S (on level, control)	S	S→R	R→S	S or R (on TSS meter, control)	R	S	S
21	Membrane tank chemical flush	300	18800	X	O	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	R	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	18810	X	O→X	X	O	X	X→O	X	X	R or S (on level, control)	R or S (on level, control)	S	R→S	S→R	S or R (on TSS meter, control)	R	S	S
22	Membrane tank drain	600	19410	X	X	X	O	X	O	X	X	R or S (on level, control)	R or S (on level, control)	S	S	R	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	19420	X→O	X	X	O	X	O→X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	R→S	S or R (on TSS meter, control)	R	S	S
23	Membrane tank refill	600	20020	O	X	X	O	X	X	X	X	R or S (on level, control)	R or S (on level, control)	S	S	S	S or R (on TSS meter, control)	R	S	S
	Step Transition - Valve positioning and pump speed adjustment	10	20030	O	X	X	O	X→O	X	X→O	X	R or S (on level, control)	R or S (on level, control)	S→R	S	S	S or R (on TSS meter, control)	R	S	S
24	Prime and Resume Filtration	60	20090	O	X	X	O	O	X	O	X	R or S (on level, control)	R or S (on level, control)	R	S	S	S or R (on TSS meter, control)	R	S	S
	Sequence duration (s)		20090	Notes: O=open valve									R=run pump							
	Sequence duration (min)		335	X=closed valve									S=stop pump							