

# Membrane Maintenance Information

## Membrane Cleaning Guidelines

### When To Clean Membranes

In normal operation, the membrane in reverse osmosis elements can become fouled by suspended solids, microorganisms, and mineral scale. These deposits build up during operation and cause loss in water output or salt rejection, or both.

Elements should be cleaned whenever the normalized permeate water output rate drops by 10% from its initial flow rate (the flow rate established during the first 24 to 48 hours of operation), when salt passage in the product water increases over 5-10%, or when normalized pressure drop across the membrane increases by 10-15%.

It should be noted that the water output rate will drop if feed water temperature decreases (see Temperature Correction, page 11-2). This is normal and does not indicate membrane fouling.

### Common Foulants and Their Associated Symptoms

Foulant	Symptoms	Solution per Membrane Type
Biological Growth	Element may have strong odor, possible mold growth on scroll end. Element will likely exhibit low permeate flow, but salt rejection will usually be as good if not better than original test.	TF: AM-22 CA: AM-33
Carbonate Scale	Usually on tap water or brackish water elements only. The element may be noticeably heavier than normal. Element will exhibit low permeate flow and poor salt rejection.	TF: AM-11 CA: AM-44
Iron Fouling	Rust coloring seen on end of scroll. Possibly some large rust flakes from iron plumbing. Element will exhibit low permeate flow and poor salt rejection. Rust colored reject water may be seen on start of baseline test	TF: AM-11 CA: AM-44
Silt or Carbon Fines	Brown or black material on scroll end. Low Flow, good rejection in early stages. High flow and very poor rejection in later stages due to the abrasive effects of the material on the membrane.	AM-55

### Cleaning Sequence

Whether the system needs acid or alkaline cleaning will depend on the type of foulant suspected. If  $\text{CaCO}_3$  is the known scalant, acid cleaning alone may be sufficient. Otherwise both kinds of cleaning are needed and it is recommended to start with the alkaline cleaning then follow with the acid cleaning after the system has been flushed.

1. ALKALINE CLEANING (if required)
2. FLUSH
3. ACID CLEANING
4. FLUSH

Note: Acid cleaning may be performed alone, but alkaline cleanings should always be followed by an acid cleaning after the system has been flushed.

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**APPLIED MEMBRANES INC.**



(760) 727-3711 • FX: (760) 727-4427  
sales@appliedmembranes.com

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## Membrane Cleaning Procedure

Use RO permeate water if possible, preferred. Whether the system needs acid (AM-11) or alkaline (AM-22) cleaning will depend on the type of foulant suspected. If both kinds of cleaning are desired, we recommend starting with the alkaline cleaning, then cleaning with the acid.

Note: If CaCO<sub>3</sub> is the known scalant, acid cleaning alone may be sufficient.

### Cleaning System

Connect cleaning tank and pump system to the membrane system. It may be necessary to clean one tube at a time (see flow requirements, page 11-8). Pump pressure must not exceed 60 psi. Permeate and concentrate lines must return to the cleaning tank. Include a 10 micron filter in the feed line to the membrane.

### Cleaning Procedure

#### Preparation of Solution

Add the cleaner slowly (for the proper amounts, check the detailed procedure for that cleaner) to cleaning tank water, and mix well.

**CAUTION:** *Mix with care and wear protective clothing.*

#### Cleaning Procedure

**CAUTION:** *Do not allow the cleaning solution temperature to exceed 120 degrees F. Do not allow the flows to exceed 4 gpm for 2½" elements, 12 gpm for 4" elements, or 40 gpm for 8" elements. Recirculate solution.*

- Operate system at 50 psi for 10 minutes. During this first 10 minutes of the cleaning cycle, the flow rate should be maintained at less than 1 gpm for 2½" elements, and less than 3 gpm for 4" elements, and less than 12 gpm for 8" elements to allow the foulants to loosen. The flow rate should then be increased to 3 gpm for 2½" elements, 9 gpm for 4" elements, and 35 gpm for 8" elements for 20 minutes to clear foulants from the system.
- Do not let the tank run dry. Add more water and cleaner if necessary.
- Discard cleaning solution to drain, diluting with copious amounts of water, then rinse tank well.
- Fill tank with clean water and flush system to drain for 10 to 15 minutes. Add clean water as necessary. Rinse the system until the concentrate pH is almost the same as the clean water pH.

**CAUTION:** *Flush thoroughly before cleaning with other cleaners. Cleaning chemicals may react with one another or with foulants to produce additional fouling on the membrane.*

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### Cleaning Flow Rates for Spiral Wound Membranes

Type	Volume (Gallons)	Medium Flow (GPM)	High Flow (GPM)
4" x 40"	2.5	4	10
4" Magnum	3.5	4	10
6" x 40"	4.0	12	20
8" x 40"	6.0	25	35
8" Magnum	8.5	25	35

### Estimate of Cleaning Solution Volume

$$V = EI \times Vol \times 5$$

EI = Number of Elements

Vol = Volume of one element from Flow Tables

### Estimate of Total Flow Required

$$HTF = NV \times HF$$

$$MTF = NV \times MF$$

HTF = High Total Flow

MTF = Medium Total Flow

NV= Number of Vessels in Parallel

HF = High Flow from Flow Table

MF = Medium Flow from Flow Table

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