MEMCOR®
a DuPont™ brand

MBR CLEANING PROCEDURES

1.1   Properties of membranes

Membrane cleaning is essential to their continuous operation and lifespan. Prolonged filtration without cleaning leads to fouling of membrane and loss of filtration efficiency. Membranes for filtration should have the following properties:

- Physical durability to withstand prolonged exposure to high pressure
- Chemical stability to be inert towards chemicals used during cleaning.
- Capable of filtering after cleaning without waiting for a dynamic membrane (matrix of extracellular polymeric substances present in biologically treated wastewaters) to form.

Physical cleaning methods used are relaxing the membrane. A relaxation cycle halts filtration briefly while air scouring continues to dislodge particulate matter on the membrane surface.

Chemical cleaning methods used are maintenance cleaning (MC) and a Clean-In-Place (CIP) procedure. MC is a routine cleaning to partly recover filtration permeability as well as preventing biological growth in/on the membrane and filtrate pipes. CIP is a concentrated chemical cleaning used to restore membrane permeability. A timetable of events is outlined below.

|	Operation	Duration	Frequency
Filtration	Automatic	10 – 12 minutes	-
Relaxation	Automatic	1 minute	Every 10 – 12 minutes
Maintenance clean	Automatic	60 minutes	Every 7 days
Clean-In-Place	Automatic or Operator initiated	3 – 5 hours	3 months for chlorine, 6 months for citric acid or as required.

1.2   Maintenance Clean (MC)

MCs provide interim disinfection of the membrane modules and filtrate pipework which controls biological growth and membrane fouling. MCs are performed in-situ without removing the membrane rack. Sodium hypochlorite is the chemical of choice to provide chlorine which is effective in removing biological and organic fouling agents. Citric acid is used during MCs to remove fouling from inorganic substances.

1.2.1   Features of MC

The MemCor MBR MC is fully automated and self-initiating. After a set duration of filtration and relaxation cycles, the system will enter MC where sodium hypochlorite is backwashed into the cell to remove foulants. Once the MC is complete, the chlorinated liquor is recycled back into the bioreactor where it is removed by dilution.
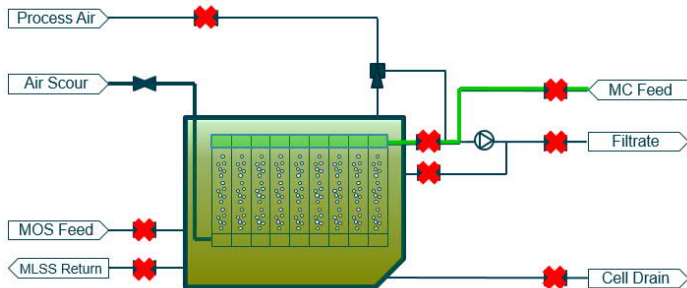
1.2.2   MC Procedure
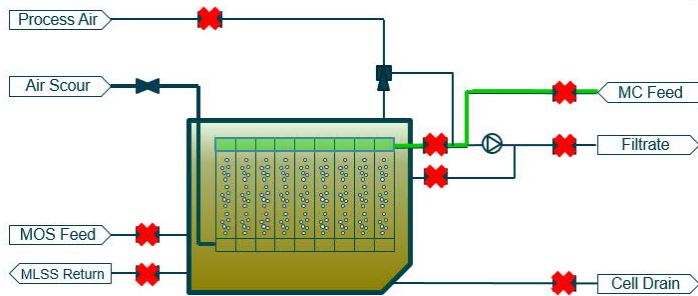
STEP 1
- Prime Line: 1 minute
- Backwash with hypochlorite: 4 minutes

Hypochlorite: 200ppm

STEP 2
- Relaxation: 15 minutes

STEP 3
- Backwash with hypochlorite: 4 minutes

STEP 4
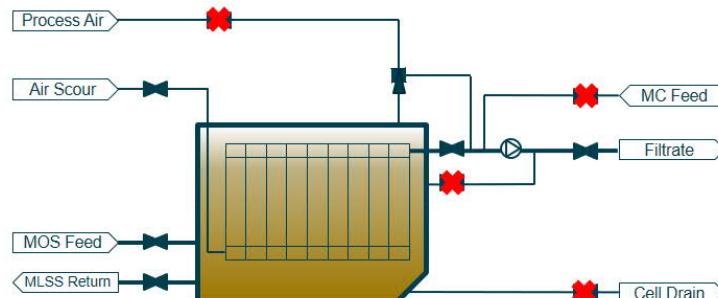- Relaxation: 15 minutes
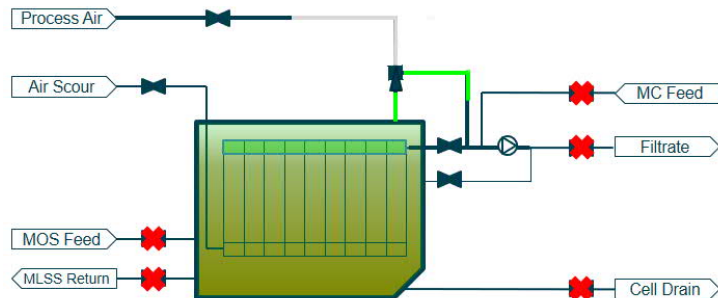
STEP 5
- Prime line using eductor

STEP 6
- Recirculate: 15 minutes
    Flux: 15 LMH

**STEP 7**
- Return to Filtration

1.3   Clean-In-Place (CIP)

CIP uses a higher concentration of cleaning chemicals, at a longer duration to restore membrane permeability. The high concentration and long duration allow irreversible fouling (formed by extracellular polymeric substance deposition) to be removed from the membrane. Sodium hypochlorite or citric acid can be used to conduct CIP. A single CIP uses only 1 type of chemical and a dual CIP runs hypochlorite and citric acid CIPs back to back.

1.3.1   CIP Features

CIP is automatically initiated after a set duration, or when the membrane flux reaches a set limit. CIP can also be manually initiated by an operator. The duration and frequency of CIP is outlined in Section 1.1.
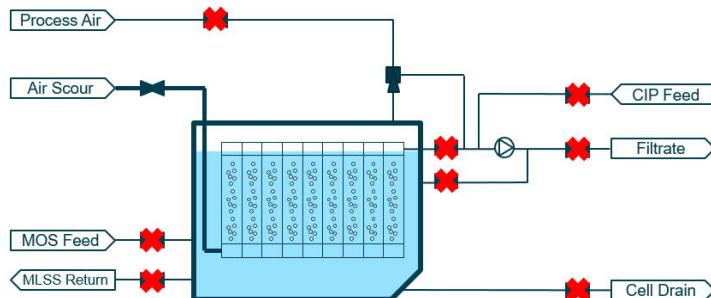
1.3.2   CIP Procedure
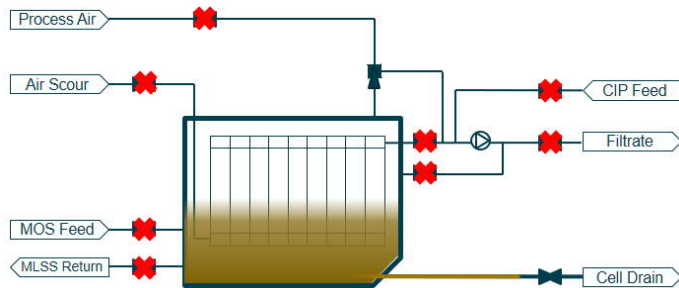
STEP 1
- Drain Tank: Low Level + 60 seconds

STEP 2
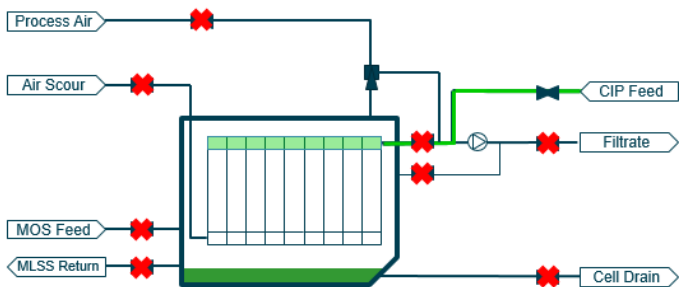- Flush Tank Floor (with ML or hose)

STEP 3
- Fill with Filtrate to CIP Level

STEP 4
- Aerate: 30 minutes

STEP 5
- Drain Tank: Low Level + 60 seconds
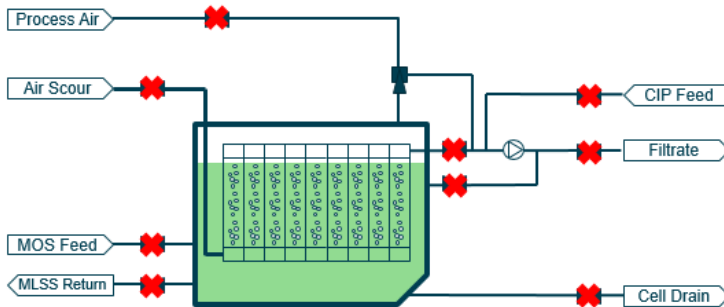

STEP 6
- Chemical Backwash: 15 seconds
  Hypochlorite: Backpulse conc. 2000ppm
  or
  Citric: Backpulse conc. 1.6%

STEP 7
- Soak: 285 seconds

STEP 8
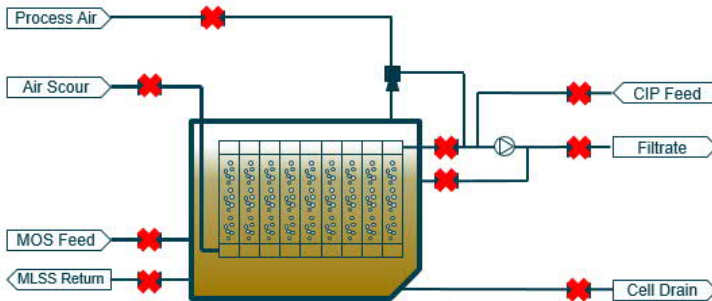- Repeat STEP 6 & 7 until Tank is $\frac{1}{8}$ full.

STEP 9
- Fill with Filtrate to CIP Level
  Dilute Hypochlorite to 500ppm
  Dilute Citric acid to 0.2%

STEP 10
- Recirculate 2700 seconds.
- Soak: 3 – 5 hours
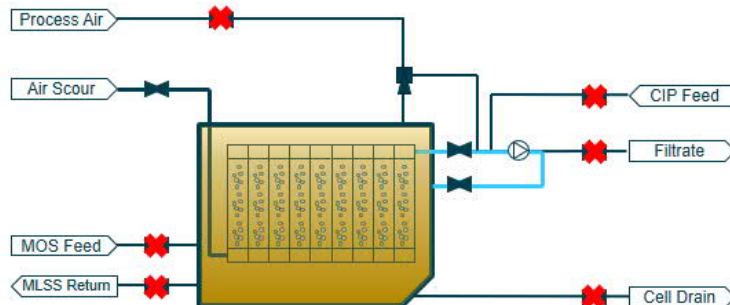- Aerate for 20 seconds every 30 minutes

STEP 11
- Drain Tank
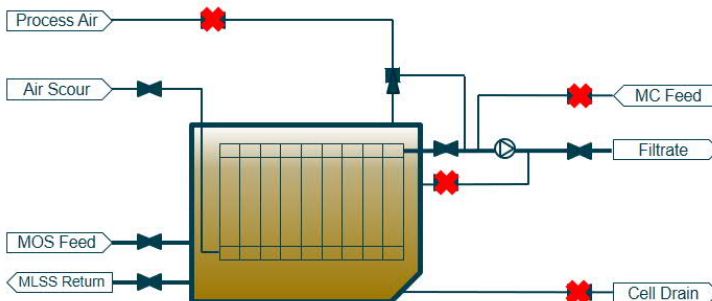- Repeat STEP 6 – 11 for double CIP

STEP 12
- Fill with ML to overflow

STEP 13
- Filtrate Recirculation: 12 minutes
  Flux: 15 LMH

STEP 14
- Return to Filtration