

ULTRA  PURE

**OPERATING  
MANUAL**

**ML-2 to ML-20**

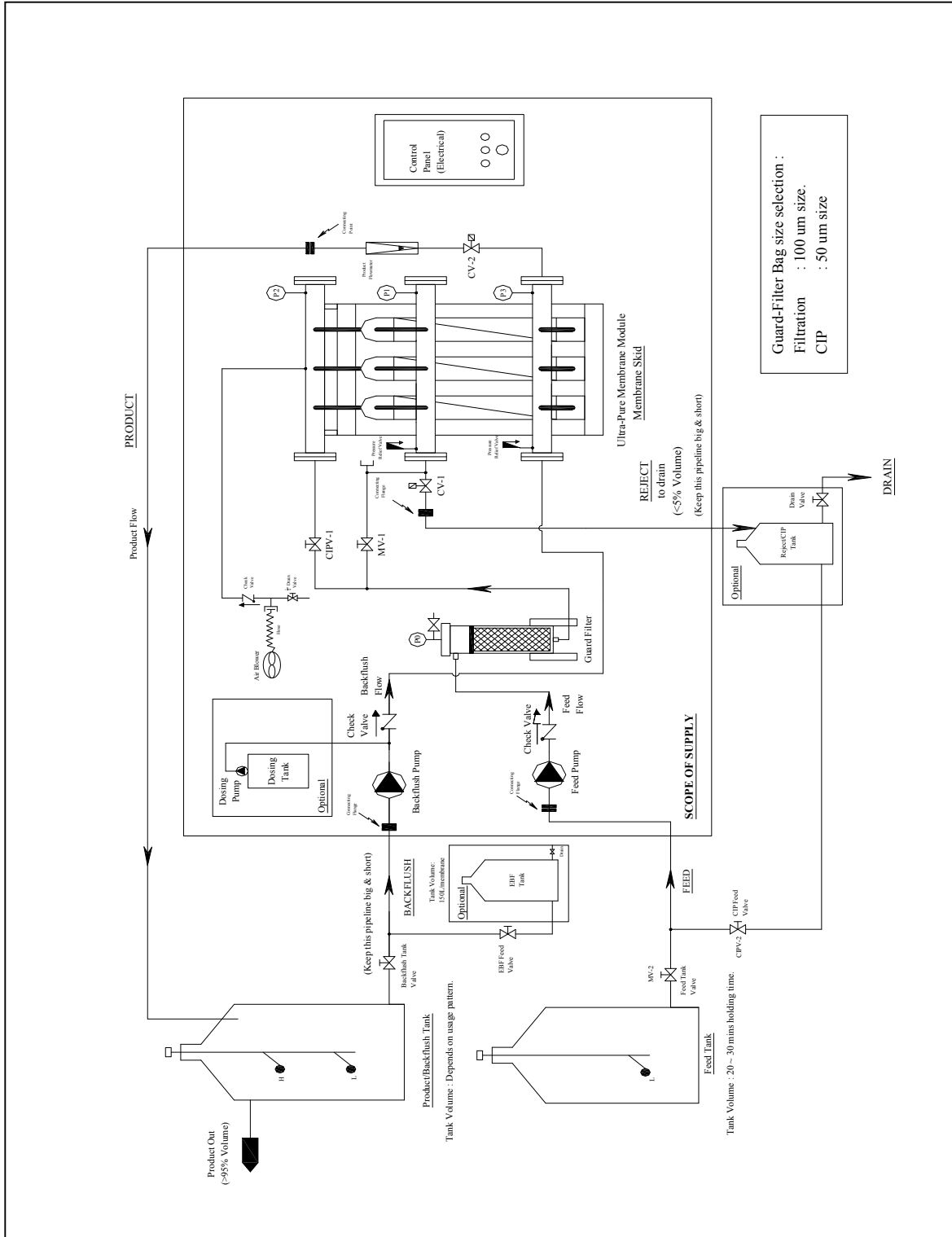
*Ultra-Pure Membrane Module*



## CONTENT

		<u>Pages</u>
1	Brochures and information Ultra-Pure U860 membrane cartridge Ultra-Pure ML-02 system	2
2	Process and Plant setup diagram	3
3	Process description Filtration, air scouring, air scouring + backflush	4 ~ 8
4	Membrane regeneration Functional EBF (FEBF) Enhanced Backflush (EBF) Clean In Place (CIP)	9 ~ 14
5	System / Electrical control and schematics	15 ~ 23
6	Storage and usage	24
7	Trouble shooting	25
8	System parameter record chart	26

## 2. Process and Plant Setup Diagram



### **3. Process Description: (2-Valve Control)**

**Start process in ‘Auto’.** Select SS-1 to “Auto”, depress PB-1 “System On/Off” once to start. The system will go through the following sequence.

**P1 – Feed Pressure**

**P2 – Air Scouring Pressure**

**P3 – Backflush Pressure**

#### **1. Filtration cycle ( T1 ) (Refer to Filtration Flow Diagram Page7)**

**Aim : Produce filtered water**

**CV-1 Close, CV-2 Open, Feed Pump On, Backflush pump Off, Blower Off**

**Outside to inside flow, on a dead-end configuration.**

Filtration cycle will pump feed water through the Guard-strainer to the membrane cartridges. Filtered product water will flow through the flow-meter to the Product / Backflush Tank.

Filtration Pressure (P1 – P3 = **TMP1**), maximum at **8 psi** (*Default setting at 3 psi*)

Filtration Pressure / product flow rate can be increase or decrease by adjusting from the frequency controller (refer to inverter operating manual).

**(Start filtration at low pressure first, example at 1 psi for a few cycles and records down the parameters before increasing to higher pressure/flow.)**

Time duration is set in the PLC, ‘Filtration’ (**T1**). (Default is at 5 minutes)

Timer duration can be set longer according to the feed water condition.

#### **2. Air Scouring cycle ( T2 ) (Refer to Air Scouring Diagram Page 8)**

**Aim : Dislodge Suspended Solids from membrane**

**CV-1 Open, CV-2 Close, Feed Pump Off, Backflush pump Off, Blower On**

**Air scouring** is a process of releasing air bubbles into the membrane cartridge via the Blower.

When the Blower is activated, air scouring **pressure gauge (P2) should read 1.5 ~ 2.0 psi** above the gauge reading.

This will dislodge Suspended Solids from the membrane surface. Time duration is set in the PLC, ‘Air-Scouring’ (**T2**). (Default is at 30 seconds)

Timer duration is set according to the feed water condition.

**3. Air Scouring + Backflush cycle ( T3 ) (Refer to Air Scouring + Backflush Flow Diagram Page 9)**

**Aim : Membrane regeneration**  
**CV-1 Open, CV-2 Close, Feed Pump Off, Backflush pump On, Blower On**

**Inside to outside flow, on a dead-end configuration.**

Backflush cycle will pump product water through the membrane cartridges through Reject valve CV-1 for disposal.

Backflush Pressure ( $P3 - P1 = \text{TMP2}$ ) maximum of **14 psi** (*When Blower is Activated*)

Backflush pressure or flow rate can be either increase or decrease by adjusting from the frequency controller (refer to the inverter operating manual) .

Time duration is set in the PLC, ‘Backflush’ (T3). (Default is at 30 seconds)

Timer duration is set according to the feed water condition.

Backflushing flow rate during this cycle is much higher relative to the filtration cycle, 6~7m<sup>3</sup>/h per membrane (26-30 GPM). **Important to keep the following pipelines big in diameter and short in length:**

- suction pipe line from tank to backflush pump.
- reject pipe line after CV-1, to open drain.

**Important Instructions:**

**Flushing Instructions:**

Membrane contains preservatives such as sodium meta-bisulphite or glycerine. Flush the membrane with clean water (normally city water) for about 10mins before operating the system.

**Bag Filter:-**

It is a routine operational procedure to monitor and to ensure that the bag filter is not clogged. If the flowrate decreases or if the differential pressure between the bag filter and Feed pressure (P0-P1) exceeds 10psi, changing or cleaning the filter bag must be done immediately.

**System startup procedure:**

Start operating this system with clean water (normal city water supply) in the feed tank. Operate the system for 30 minutes with this feed water. Record the operating parameters and keep this as the reference for this plant.

**Long term usage:**

During long term usage, it will be useful to add a shock level of Biocide into the feed water on a once a day basis. Chlorine can be applied at a dosage below 20 ppm. Other forms of non-oxidizing Biocide can be applied at higher levels.

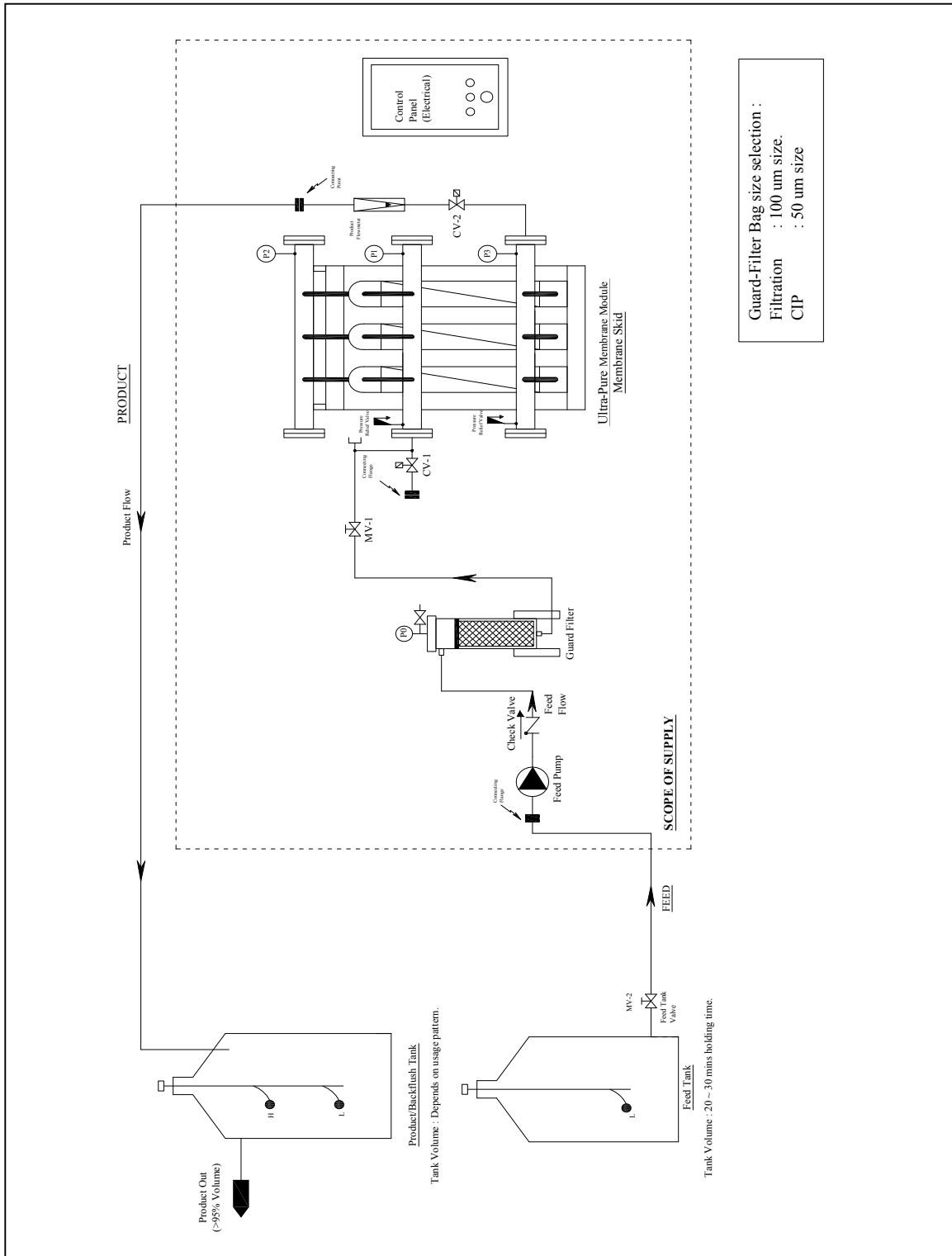
**Testing of Free Chlorine:**

Free Chlorine concentration in the water can easily be measured by using a simple comparison of a colour scale with a test strip.

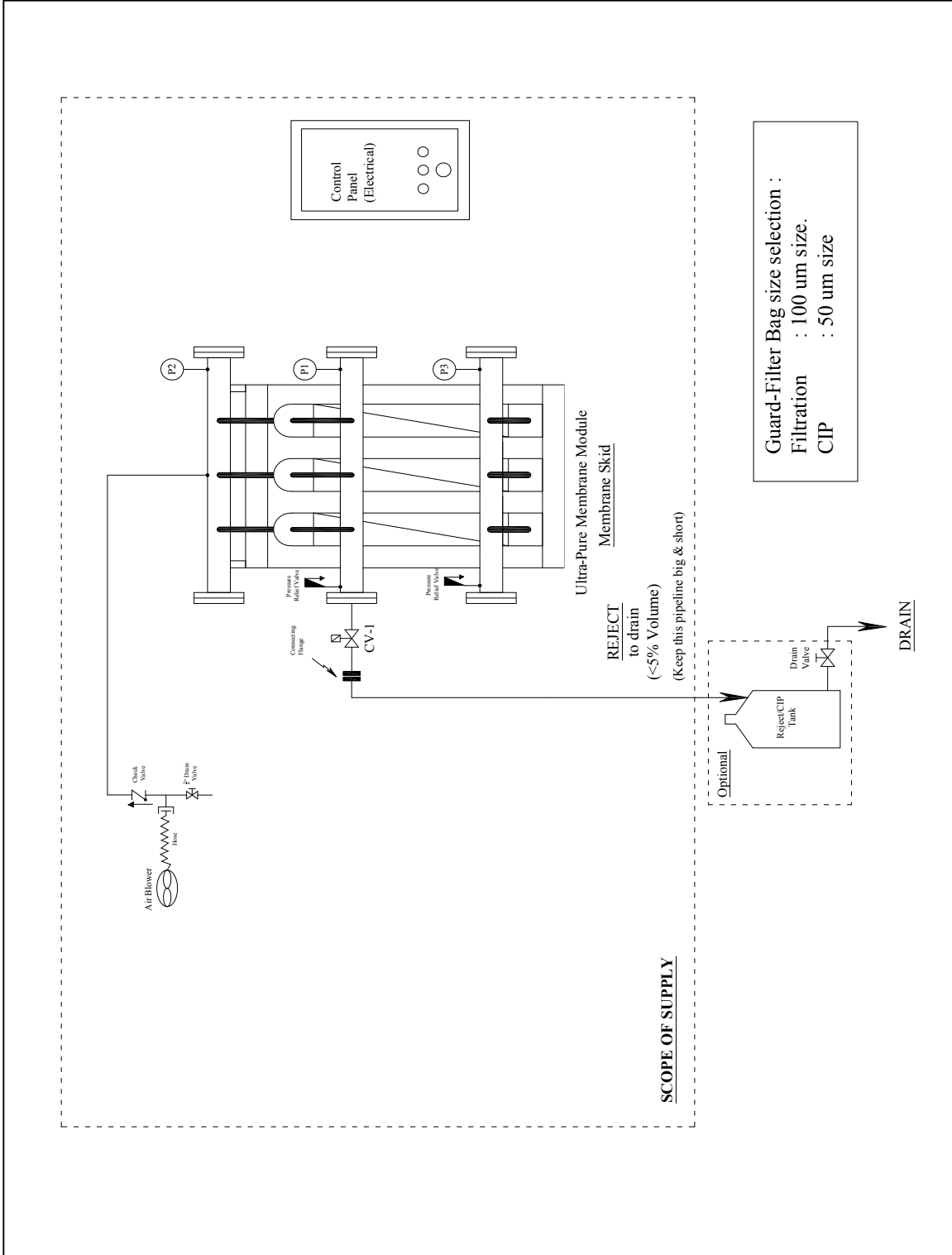
Recommended chlorine test strips – Merckoquant Chlorine Test

Cat No.	Measuring Range – mg/l/Cl <sub>2</sub>
1.17924.0001	25 ~ 500
1.17925.0001	0.5 ~ 20

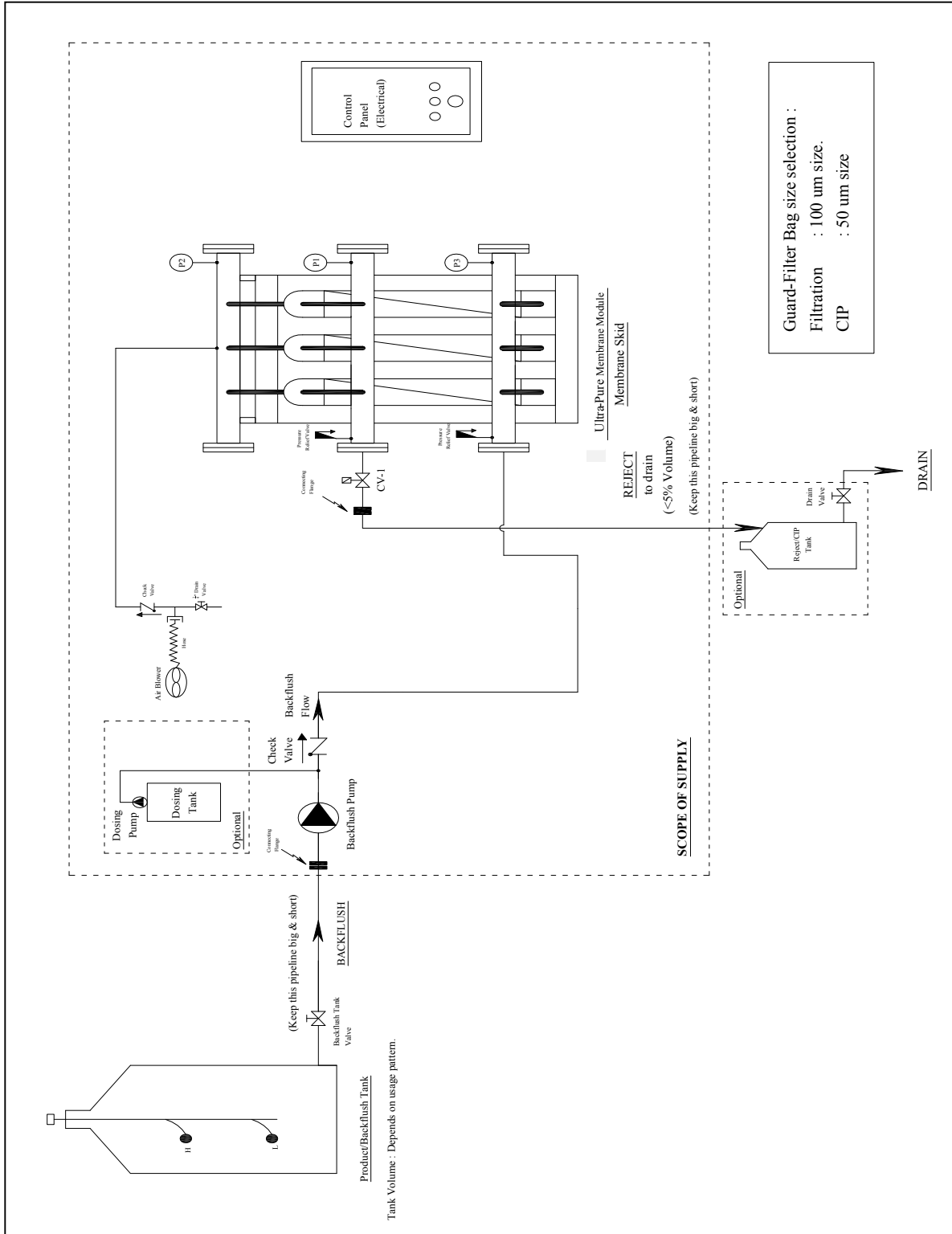
# Filtration Flow Diagram



## Air Scouring Diagram



## Air Scouring + Backflush Flow Diagram





## **4. Membrane Regeneration**

After some time of usage, and depending on the feed water conditions. The membrane cartridges may experience fouling. This will result in a drop in product flow rate and/or an increase in filtration pressure. A regeneration procedure can be performed to reverse this situation.

### **4.1 \*Optional : Functional EBF (T4)** **(Default frequency of Functional EBF is set at every 24hrs)** **(Refer to Page 11)**

**Aim : Membrane Regeneration**  
**(Enhance Backflushing at periodic time to prevent further fouling)**

A shock level of free chlorine at 20ppm is added into the backflushing stream during the backflushing cycle. This is done automatically by having an optional dosing system (Pump and Chemical Tank) to pump in the required amount of chlorine.

According to the feed water condition, the frequency of dosing can be determined in PLC 'FEBF' (Timer T4). The default frequency is once every 24hrs. To activate or deactivate the dosing simply by connecting or disconnecting the power plug provided.

## 4. Membrane Regeneration

### 4.2 Enhanced Backflush “EBF” (Refer to EBF Flow Diagram Page 14)

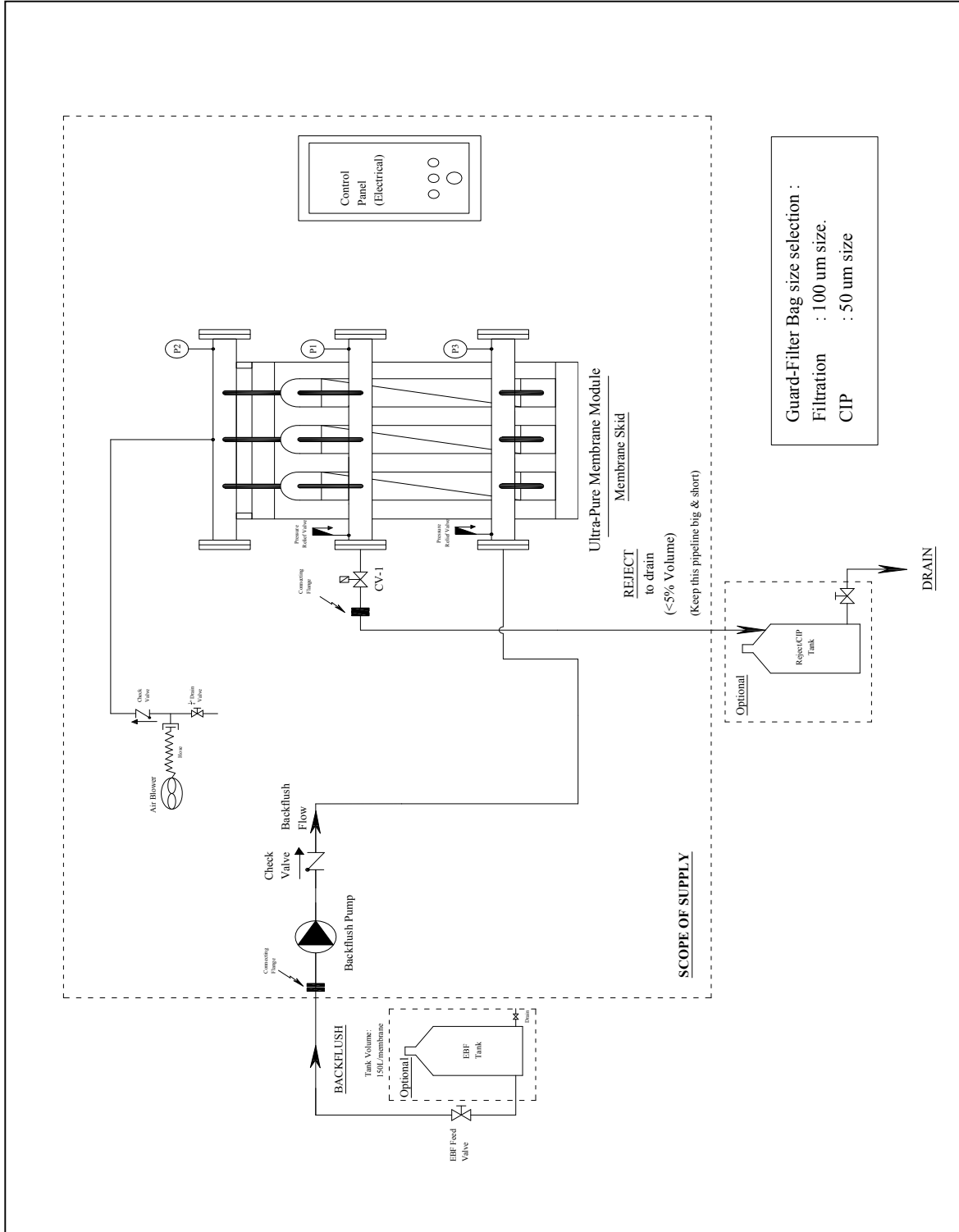
**EBF** is a process of backflushing the membrane cartridges with a preferred Chemical for cleaning purpose. This regeneration process will reverse the fouling issue.

It should be implemented as a routine during the usage of this system. Depending on the feed water conditions and system performance, it can be performed on a daily, every 2 or 3 days, or even weekly basis.

Before starting the EBF. Step 1 and 2 will put the system through a normal **Air Scouring + Backflush** cycle to reduce some loading before chemical usage.

- 1 **Air Scouring + Backflush** the system once, depress PB-2 ‘Backflush’ button.
- 2 **Stop** the system, depress PB-1 ‘System on/off’ button.
- 3 **Fill-up the ‘Backflush Tank’** with reference amount of clean water (prefer from its own product water or directly from the utility water).  
**Add chemical to EBF tank** (selection depends on fouling conditions)  
Select to **Backflush from EBF tank** by setting manual valve.
  - 20~100 ppm of chlorine, Cl<sub>2</sub> ( Organics and Biological ), **Or**
  - pH 2 for acid cleaning ( Inorganic and scaling ), **Or**
  - pH 11 for alkaline cleaning (Organics and Biological )
- 4 To commence **EBF**. Select SS-1 to “EBF” depress PB-1 “System On/Off” once to start the EBF process. The system will go through one cycle of **Air Scouring + Backflush**. Depress PB-1 “System On/Off” again to stop the system.
- 5 **Soak the membrane** cartridges for about 10~20 mins.
- 6 Repeat Step 4 & 5 if necessary.
- 7 Select **Backflush** from **Product / backflush tank**, by setting manual valve.
- 8 Select SS-1 to ‘Auto’ start **filtration** by depress PB-1 “System On/Off” once. **Air Scouring + Backflush** the system once, depress PB-2 ‘Backflush’ button. This will help to neutralize the residual chemical in the system
- 9 **End of EBF**

## 4.2 Membrane Regeneration (EBF) Flow Diagram



#### **4.3 Clean In Place “CIP” (Refer to page 14 & 15)**

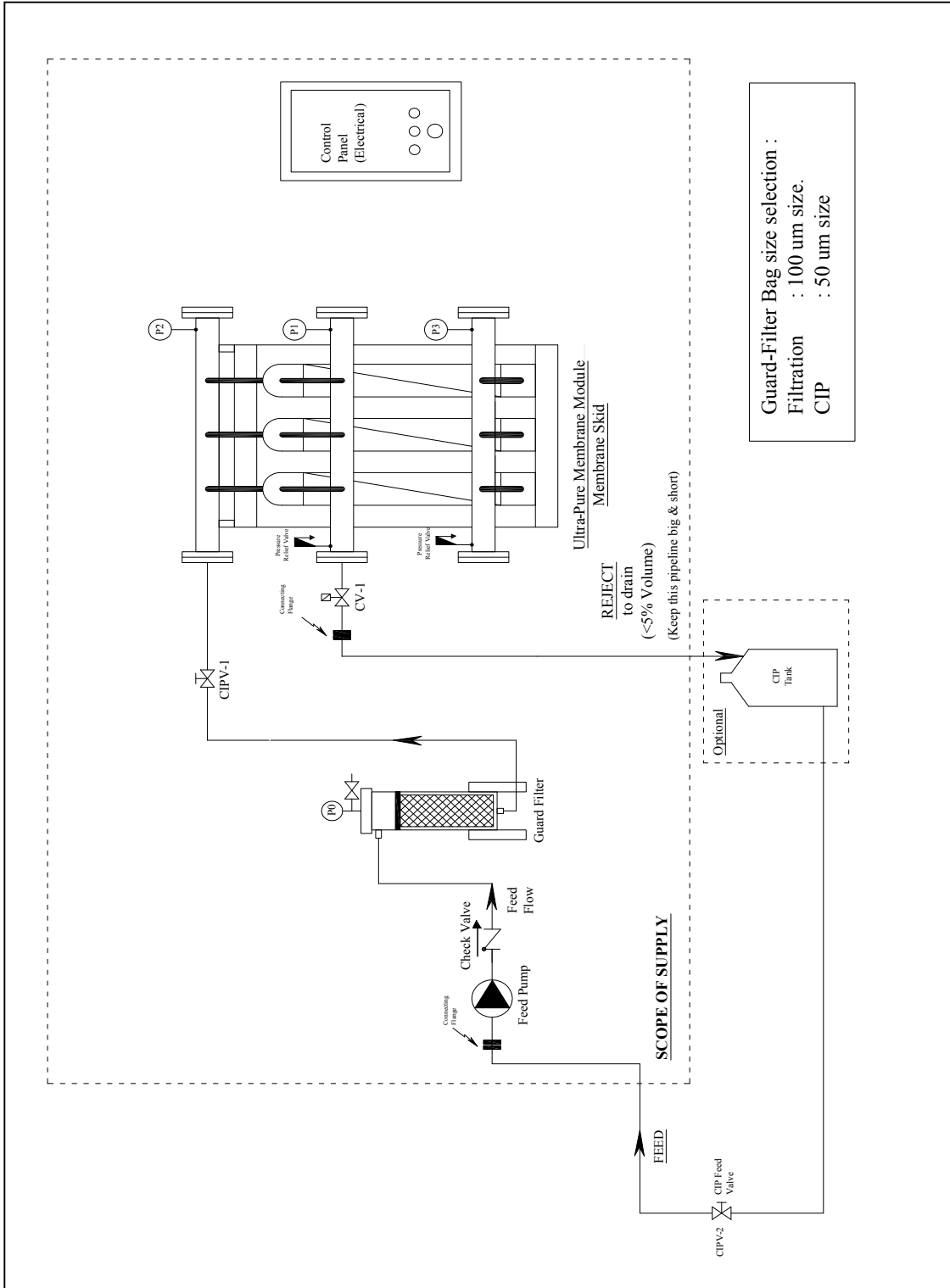
**CIP** is a process of cross flowing the membrane cartridges with the preferred Chemicals for cleaning purpose. This regeneration process will reverse the fouling issue.

It should be implemented as a routine during the usage of this system. Depending on the feed water conditions and system performance, it should be performed on a routine basis.

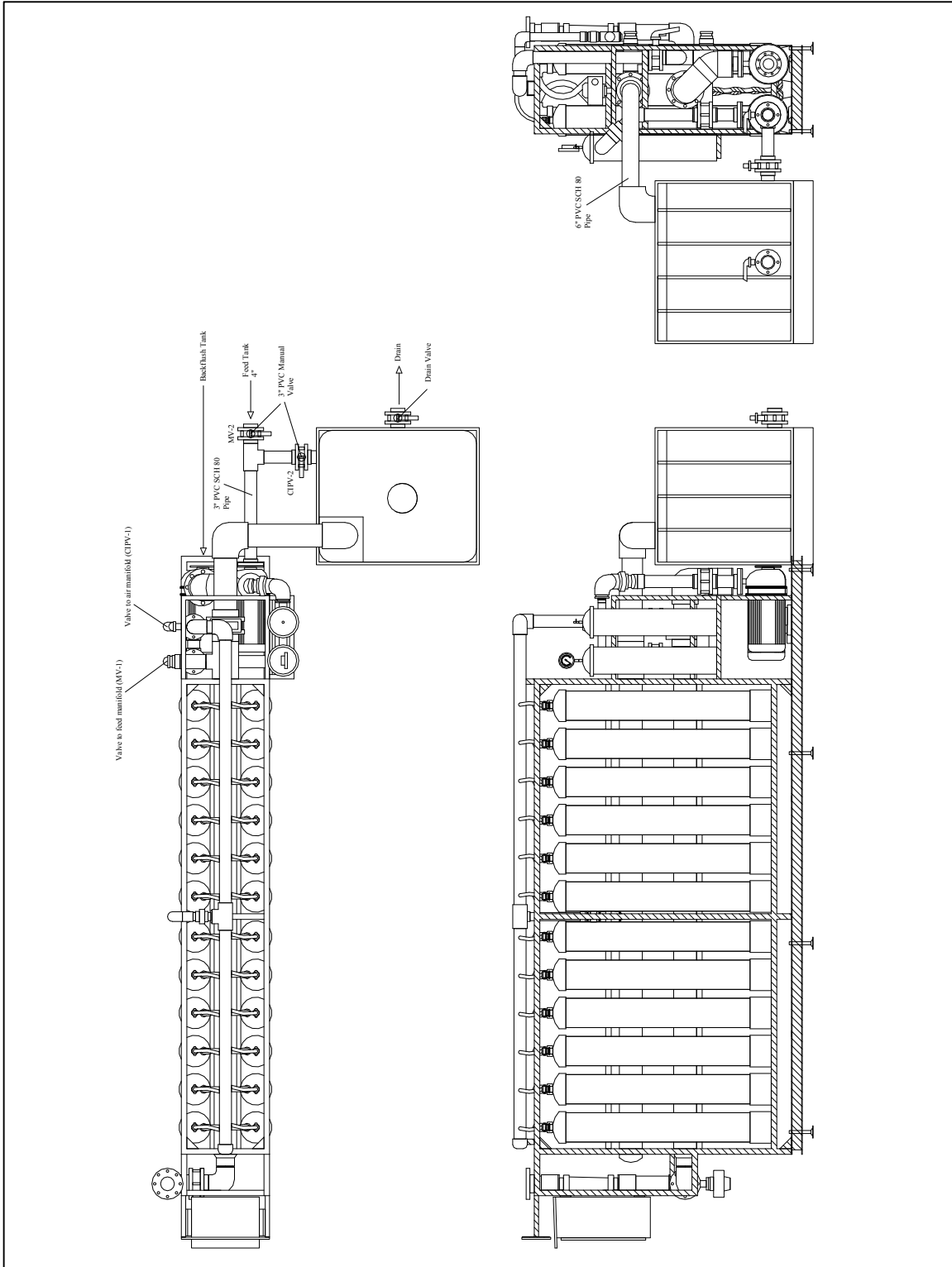
Before starting the CIP. Step 1 will put the system through a normal **Air Scouring + Backflush** cycle to reduce some dirt loading before chemical usage.

- 1 **Air Scouring + Backflush** the system once, depress PB-2 ‘Backflush’ button.
- 2 **Stop** the system, depress PB-1 ‘System on/off’ button.
- 3 Close the drain valve to convert the Reject tank as CIP tank.
- 4 **Fill-up the CIP Tank** with reference amount of clean water (prefer its own product water or directly from utility water supply). **Add chemical to CIP tank** (selection depends on fouling conditions)
  - 50~100 ppm of chlorine, Cl<sub>2</sub> ( Organics and Biological ),**Or**
  - pH 2 for acid cleaning ( Inorganic and scaling ), **Or**
  - pH 11 for alkaline cleaning (Organics and Biological )
- 5 Close manual valve from feed tank (MV-2) and open manual valve to CIP tank (CIPV-2). Open manual valve to air manifold (CIPV-1), close manual valve to feed manifold (MV-1). Change filter bag to 50/100µm.
- 6 To commence **CIP**. Select SS-1 to “**CIP**”, then depress PB-1 “System On/Off” once to start the CIP process. Adjust the feed pump frequency to 45Hz in order to achieve a good circulation flowrate.
- 7 In CIP mode, the system will go through an alternate process of cross flow and air scouring for 5mins (TT6A) and 20secs (TT6B) respectively. There will be 5 cycles, at the end of 5th cycle, the cartridges will be soaked for 10mins. At the end of 10mins of soaking, the above 5 cycles will be repeated. After which the system will automatically off. **End of CIP**.
- 8 Reverse the actions in above step 3 to 5.
- 9 Reset the feed pump frequency back to normal. Start **filtration**. Select SS-1 to “**Auto**”, depress PB-1 “System On/Off” once. **Air Scouring + Backflush** the system once, depress PB-2 ‘Backflush’ button. This will help to neutralize the residual chemical in the system.
- 10 Process in ‘**Auto**’.

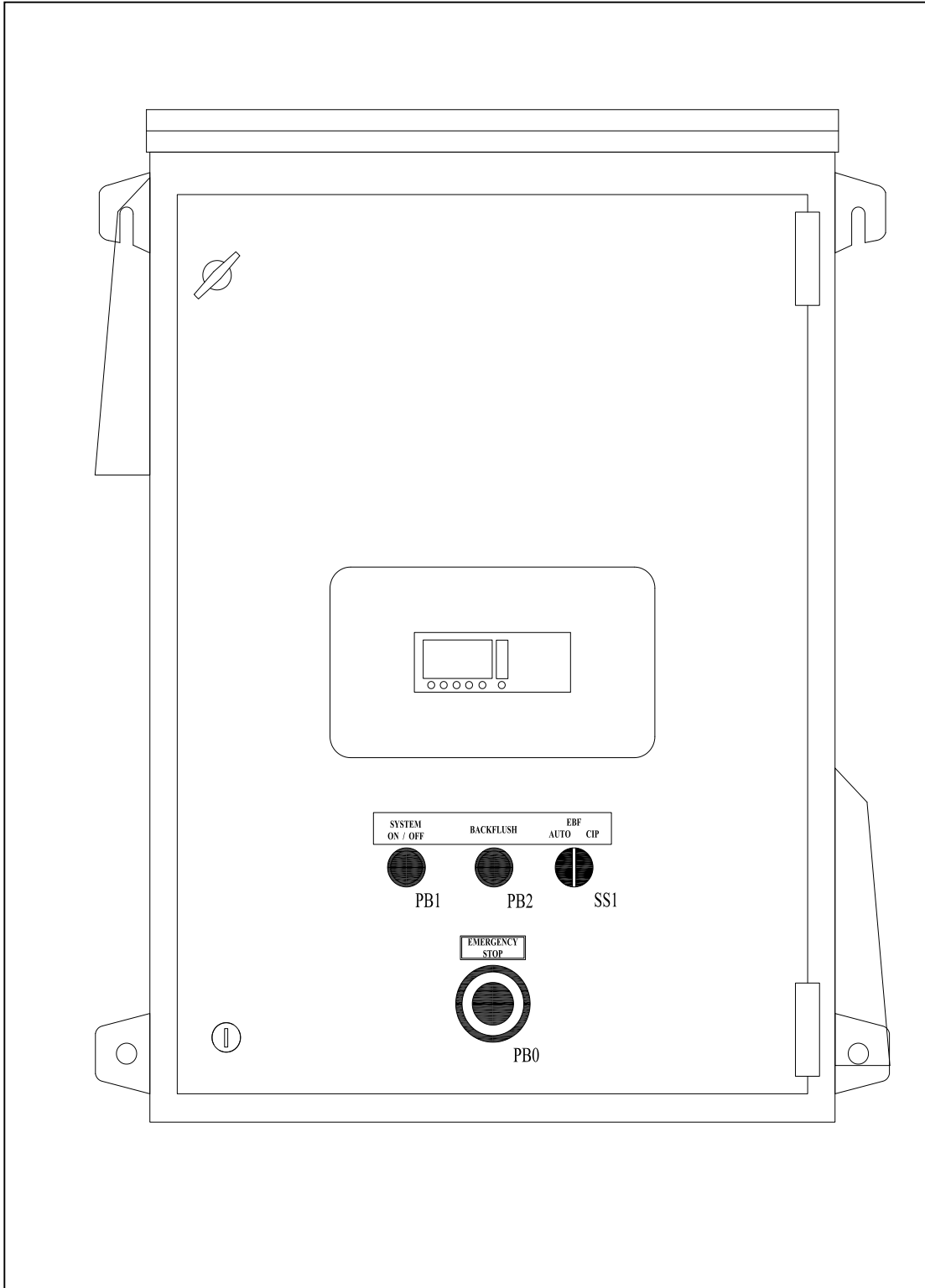
### 4.3 Membrane Regeneration (CIP) Flow Diagram



**Reject/CIP Tank Connection Drawing**



## 5. System / Electrical Control & Schematics



### Basic controls on Starting and Stopping the System

1	Release “ <b>Emergency Stop</b> ” Switch (PB-0) (turn red knob clockwise)	Connect power supply to PLC, Control Valves, Flow-switches, etc.
2	Select Selector switch SS1 to ‘ <b>AUTO</b> ’	
3	Press “ <b>System On/Off</b> ” button ONCE (PB-1)  (Start process)	Step 1 : Filtration  Step 2 : Air Scouring only  Step 3 : Air Scouring & Backflush  Return to Step 1
4	Press “ <b>Backflush</b> ” button ONCE (PB-2)  (enabled only during Filtration cycle)	Jump to  Step 2 : Air Scouring only  Step 3 : Air Scouring & Backflush  Return to Step 1
5	Press “ <b>System On/Off</b> ” button ONCE (PB-1)  (Stop process)	System Stop  (Filtration time stopped at last count)

### Level switches controls on the System

1	Feed Tank Low Level Switch (TB-20, 21)	Contact close (level above switch): System run Contact open (level below switch): System stop
2	Product / Backflush Tank High Level Switch (TB-22, 23)	Contact close (level above switch): System run Contact open (level below switch): System stop
3	Product / Backflush Tank Low Level Switch (TB-24, 25)	Contact close (level above switch): System run Contact open (level below switch): System will skip ONE backflush cycle, system will stop on SECOND backflush cycle



**PLC settings, changing timer on Filtration, Air scouring, Air scouring + Backflush, FEBF, Air Scouring frequency during CIP & Air Scouring duration during CIP.**

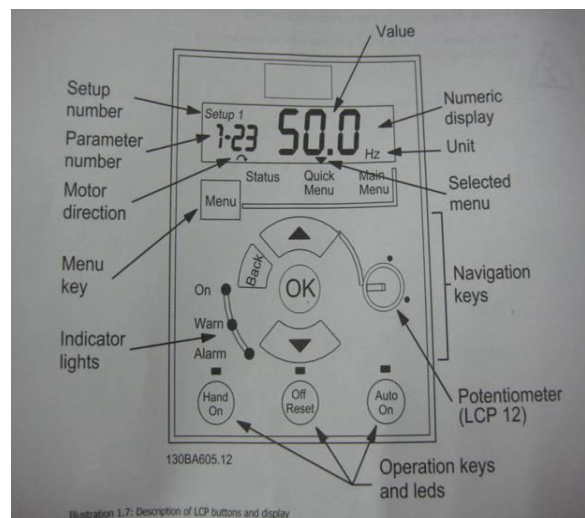
**Warning : Do not change other parameters or settings, except TT1, TT2 ,TT3, TT4, TT5A & TT5B**

1	Press <b>MENU/OK</b> once to enter Mode page	
2	Press <b>▲ / ▼</b> to select 'PARAMETER'	
3	Press <b>MENU/OK</b> once to enter parameter setting	
4	Press <b>▲ / ▼</b> to TT1(Filtration), TT2 (Air scouring), TT3 (Air Scouring + Backflush), TT4 (FEBF Frequency), TT5A (Air Scouring OFF during CIP), TT5B (Air Scouring ON during CIP)	
5	Press <b>MENU/OK</b> once then <b>▶</b> to change set time	Time setting will "blink"
6	Press <b>▲</b> to increase or <b>▼</b> to decrease timing	
7	Press <b>MENU/OK</b> and then select <b>Yes</b> to save new setting	
8	Press <b>MENU/OK</b> to return to Run screen	

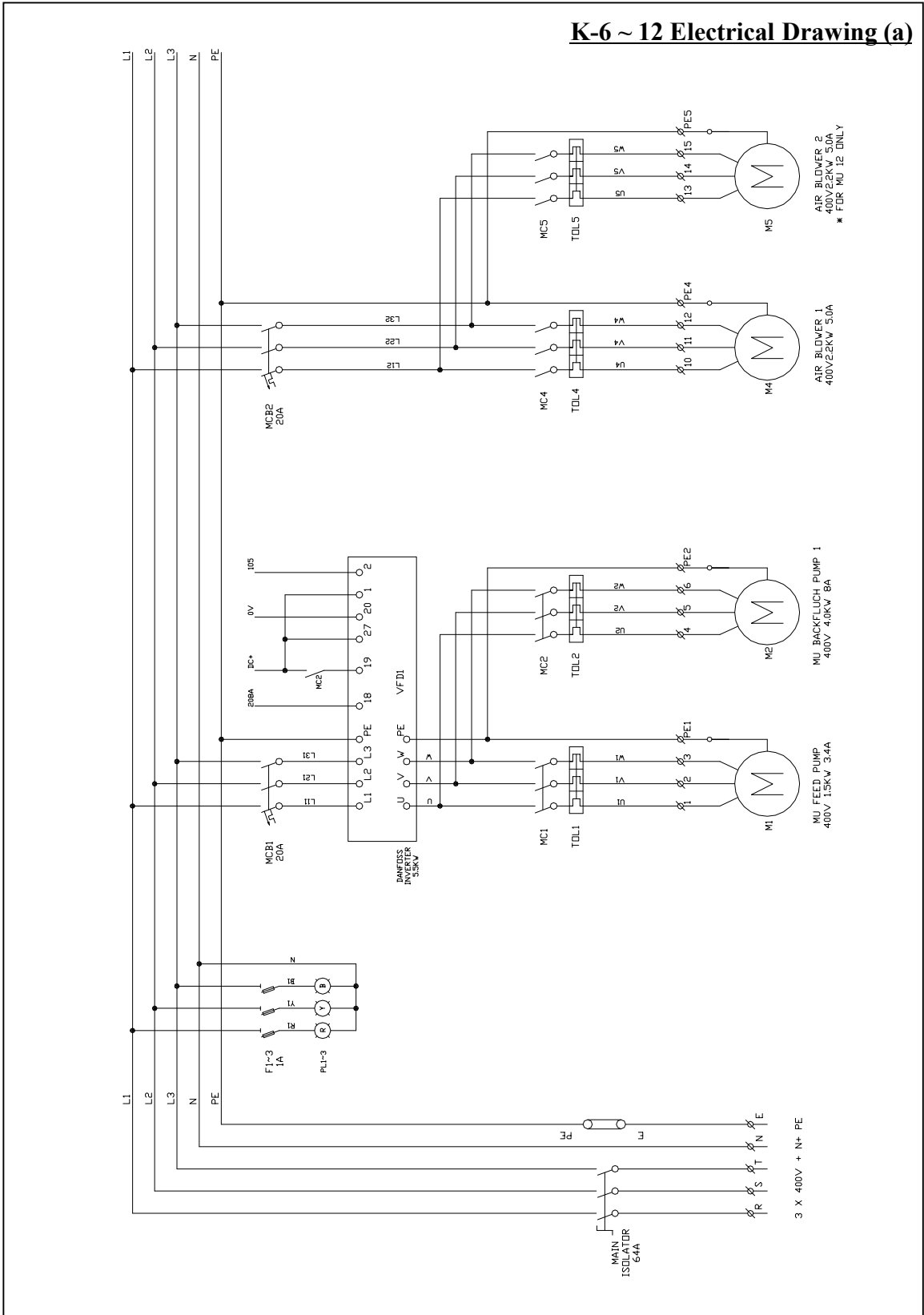
**Inverter settings, changing Filtration & Backflushing pump frequency setting**

**Warning : Do not change other parameters or settings, except for 3-10-0 & 3-10-1**

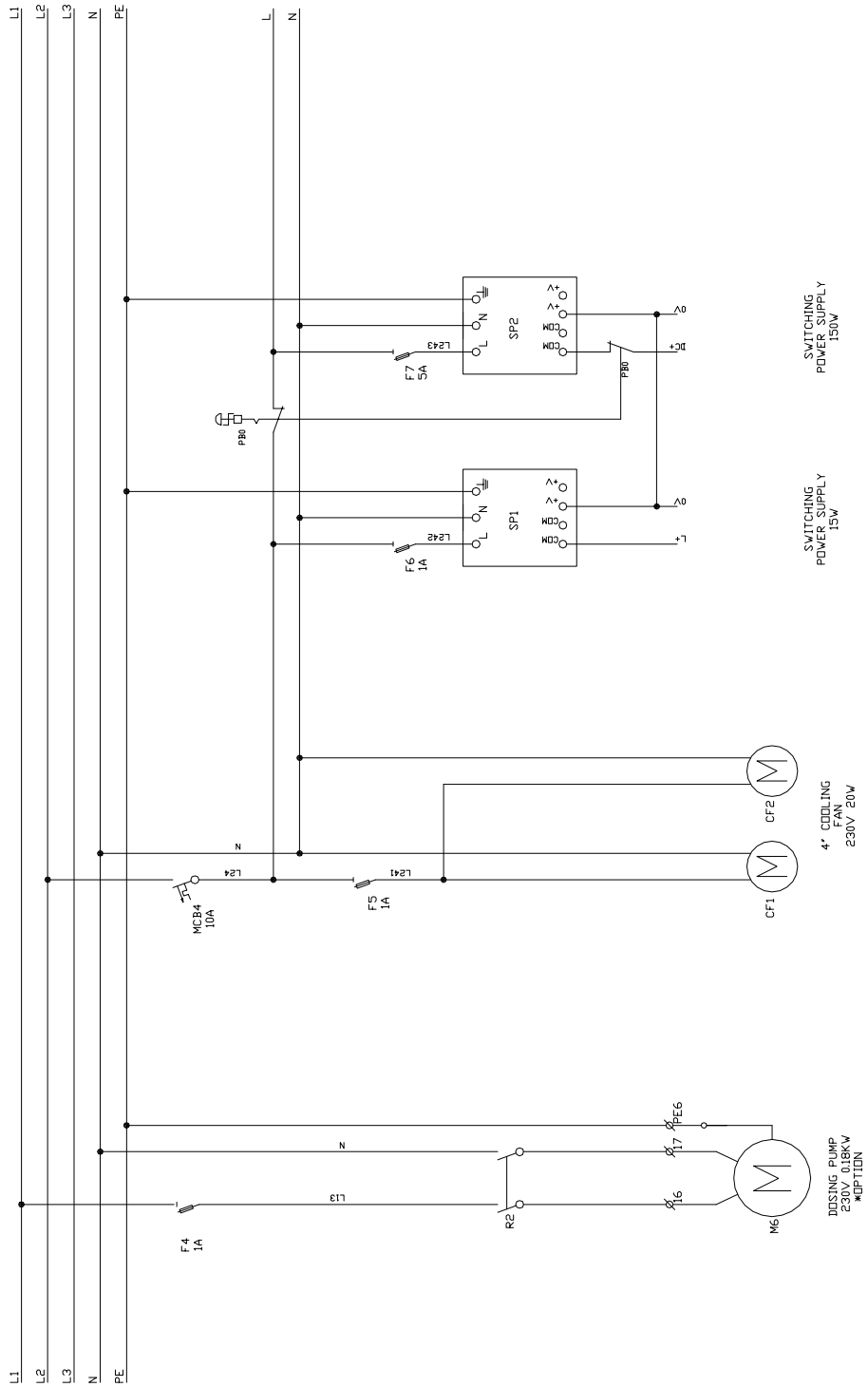
- To enter the Main Menu, press [MENU] key until indicator in display is placed above Main Menu.
- Use **▲ / ▼** to browse through the parameter Groups 3-10-0 & 3-10-1.
- Press [OK] to select a parameter group.
- Use **▲ / ▼** to browse through the parameters in the specific group.
- Press [OK] to select the parameter.
- Use **▲ / ▼** to set/change the parameter value.
- Press [OK] to accept the value.
- To exit, press either [BACK] twice to enter Quick Menu, or press [MENU] once to enter Status.



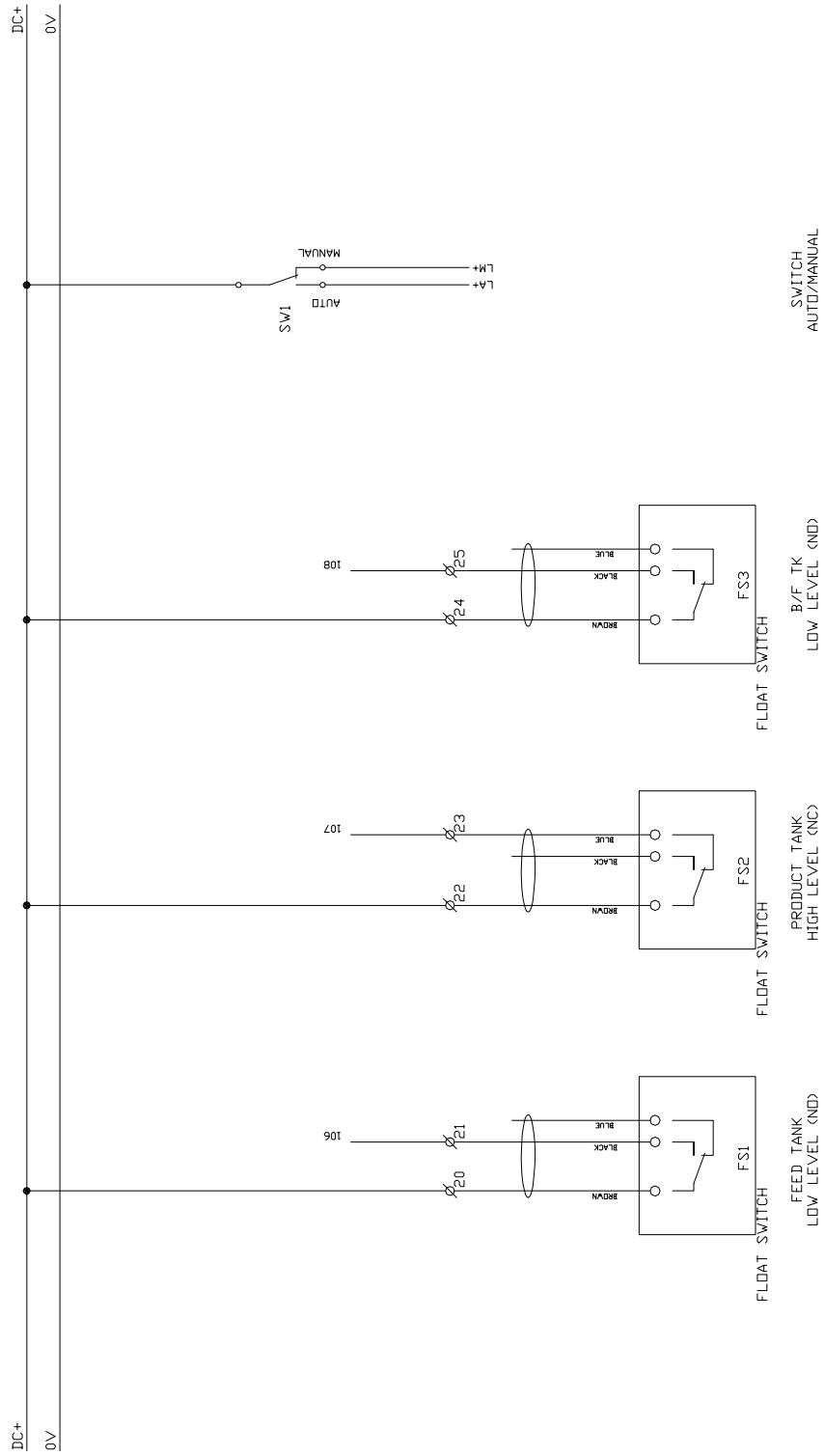
**K-6 ~ 12 Electrical Drawing (a)**



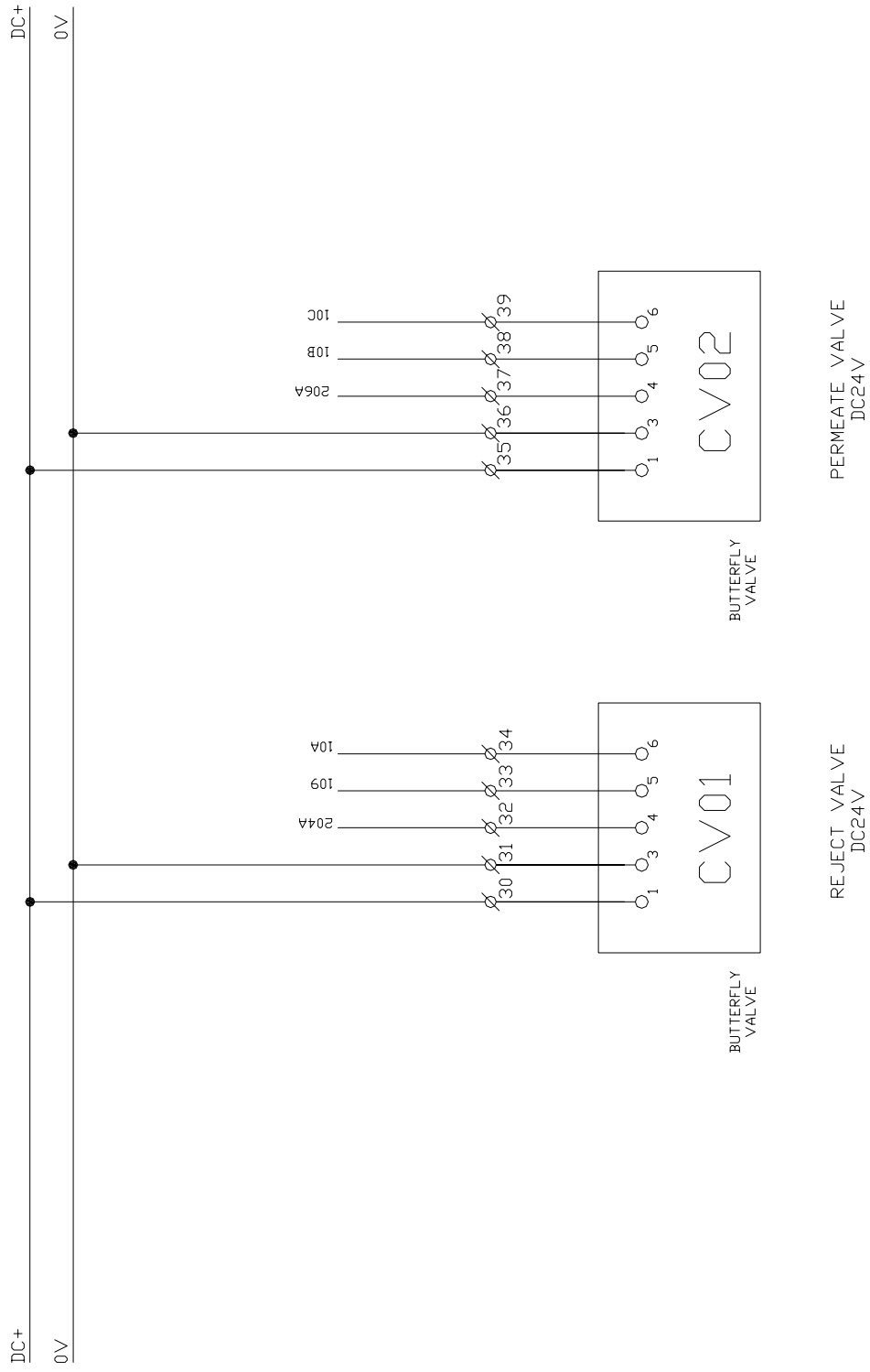
**K-6 ~ 12 Electrical Drawing (b)**



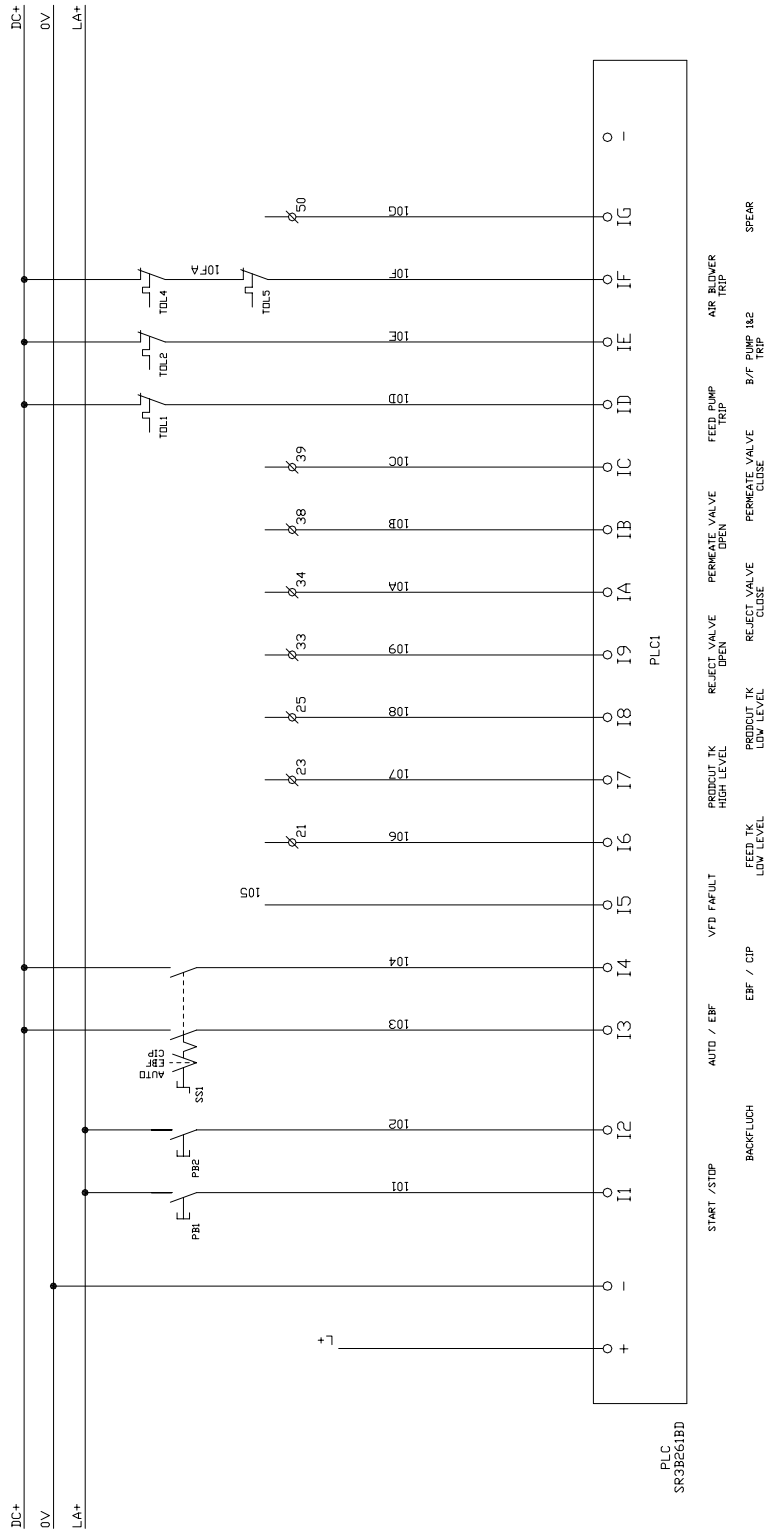
**K-6 ~ 12 Electrical Drawing (c)**



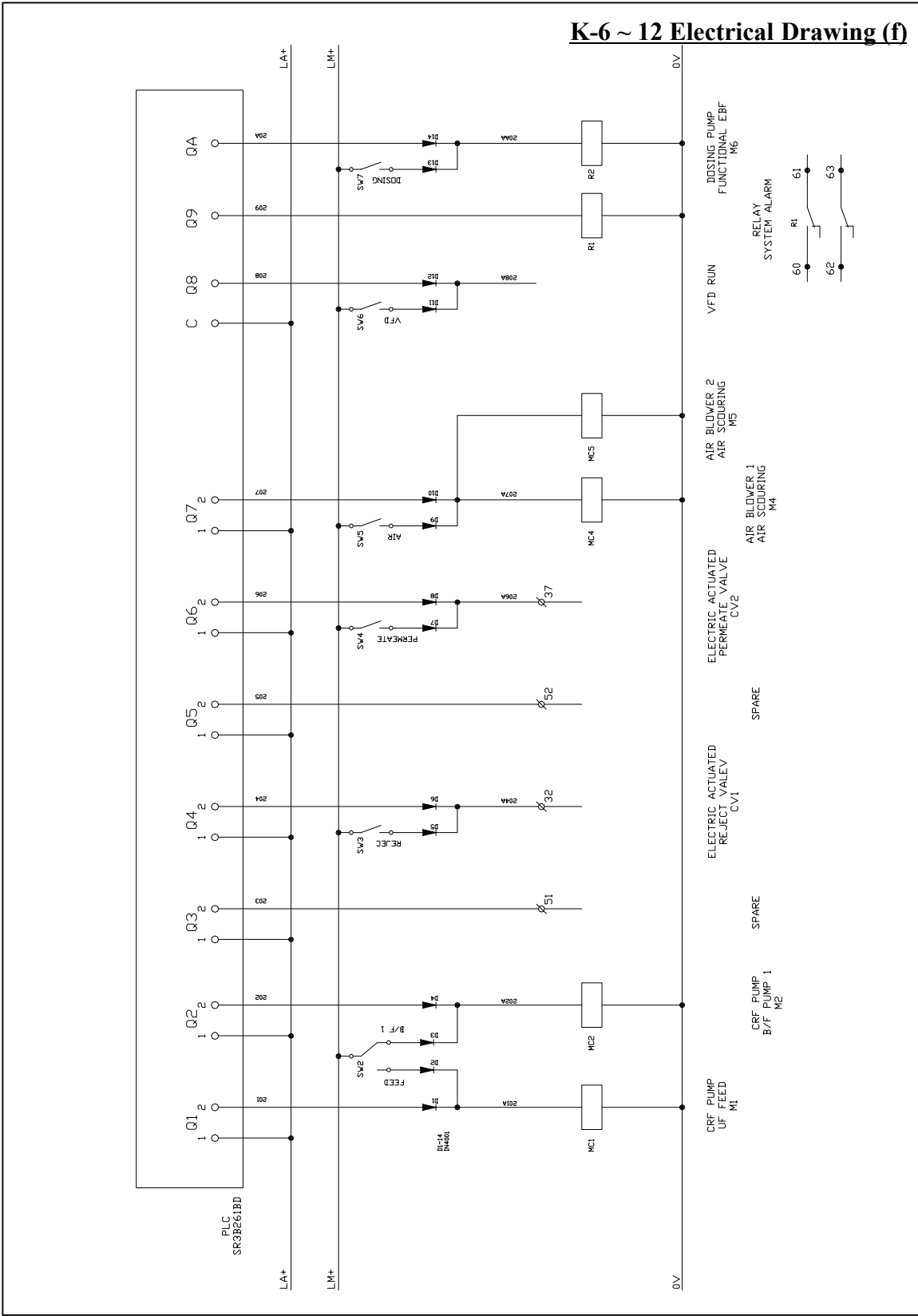
**K-6 ~ 12 Electrical Drawing (d)**



**K-6 ~ 12 Electrical Drawing (e)**



K-6 ~ 12 Electrical Drawing (f)



## 6. Storage and Usage

### Storage

- Long term storage, the membrane element should be filled (10% v/v) and locked up with a 0.5 % Sodium Meta Bi-Sulphite solution.

### Usage

Avoid the following situation in order to prevent membrane damage:

- Do not allow the membrane to **Dry out** under all circumstances.
- Do not allow the membrane to operate beyond stipulated Trans-Membrane Pressure (TMP).

### Warning!!!

This membrane product contains preservative (Sodium Meta Bi-Sulphite) in liquid form. Ensure thorough flushing before usage.

This membrane product (fibers in the membrane cartridge) should be kept moist at all times. That is; during storage, installation, usage or any form of stoppage during any point of usage.



## Error Message and Troubleshooting

This chart only covers on the functions on the system's components except the Danfoss inverter and the membrane. For the error message & troubleshooting on the inverter, please refer to the inverter instruction manual.

S/N	Fault Contents	Error Causes	Action to Be Taken
1	LCD no display	Could due to no power supply to the PLC.	<ul style="list-style-type: none"> <li>• Check the source voltage and wiring.</li> <li>• Check the power capacity and breaker/fuse system.</li> <li>• Check that the E-stop on the front panel is activate.</li> <li>• Check that the 24Vdc power supply is working.</li> </ul>
2	Inverter fault display	Fault contact point activated at the inverter.	<ul style="list-style-type: none"> <li>• Refer to the inverter instruction manual and reset the inverter fault contact.</li> </ul>
3	System cannot run after initiate the On button. (LCD display : Low/High tank level)	No return signal to feedback to the PLC from the level switch.	<ul style="list-style-type: none"> <li>• Check water level in the respective tank.</li> <li>• Check the contact point of the level switch.</li> </ul>
4	Timing display did not start.	No return signal to feedback to the PLC from the control motorize valve.	<ul style="list-style-type: none"> <li>• Check that the valves are in the correct position and that its limit-switch is sending the correct signal back to the PLC. (refer to the wiring drawing)</li> </ul>
5	Pump running but no flow & pressure.	Could due to air-lock in the pump.	<ul style="list-style-type: none"> <li>• Check that the air are bleed from the pump and all valves are in the right position.</li> </ul>
6	No or low pressure indication on the pressure gauge.	Could due to blockage or with air in the tubing.	<ul style="list-style-type: none"> <li>• Bleed the tubing to clear the dirt or air and reconnect it back to the gauge.</li> </ul>
7	Siren "On" , read message on PLC	<ol style="list-style-type: none"> <li>1. Inverter trip</li> <li>2. Product tank low level</li> <li>3. System over pressure</li> </ol>	<ul style="list-style-type: none"> <li>• Check Inverter</li> <li>• Check tank and system pipeline</li> <li>• Perform maintenance; membrane regeneration (section 4)</li> </ul>

## 8. System parameter record chart

### Filtration cycle (T1)

		Requirement
Filtration pressure (P1-P3)	_____ psi	< 8
Time duration (T1)	_____ minutes	depend on water
Inverter frequency	_____ hertz	

### Air scouring cycle (T2)

Air-scouring pressure (P2) (take this reading when blower is activated)	_____ psi	1.5 ~ 2
Time duration (T2)	__30_ seconds	depend on water

### Air scouring + backflush cycle (T3)

Backflush pressure (P3-P1) (take this reading when blower is activated)	_____ psi	< 14
Time duration (T3)	__30_ seconds	depend on water
Inverter frequency	_____ hertz	

