OPERATION AND MAINTENANCE MANUAL
FOR
ULTRA FILTRATION MEMBRANE

MEMBRANE HITEC
Division of Titanium Equipment and Anode Manufacturing Company Ltd
# OPERATION AND MAINTENANCE MANUAL

FOR

ULTRA FILTRATION MEMBRANE

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UF PLANT START UP PROCEDURE
PRE COMMISSIONING

The following procedures should be followed for the start–up of Membrane Hitec UF membrane system.

**PRE START VERIFICATIONS:**

1. Check the piping system is as per the P&ID
2. Verify that the PLC program is loaded and functioning properly.
3. Verify the (on/off) functioning of the valves available in the system.
4. Verify the electrical system for proper earthling.
5. Verify the feed pump, back wash pump for alignment, lubrication and correct side rotation.
6. Verify the calibration certificates of the instruments (Flow meter, Pressure gauges) connected and ensure for zero error.
7. Verify the operation of the dosing pumps for satisfactory functioning.
8. Flush the piping system/headers before loading the modules, by switching on the feed pump, to remove any foreign particles present in the headers.
9. Similarly repeat the operation with backwash pump.
10. All pipe lines are to be thoroughly cleaned and disinfected by caustic /hypo solution if the system is designed for pure water application.
COMMISSIONING
START UP PROCEDURE:

1. Check the water supply pressure. The minimum pressure shall be 1.5 bars.
2. Manually start the system during initial operation.
3. Close all the valves test the unit with a pressure of 1.5 bars to check for any leakage on the piping.
4. Start feed pump and set feed flow to 25% of the designed product flow and open all the valves manually and run the system for 5 minutes to remove air locks. Ensure air locks are removed.
5. Check the system for any leakage and tighten the fasteners if required to stop leakage.
6. Then keep Valves V1 and V4 in open and all other valves in closed condition and run the system for 10 minutes to forward flush the UF membrane to remove the preservative.
7. Next, keep Valve-1 & Valve 2 fully open and Valve -5 & Valve -6 partially open to let out permeate to flow. Valve 3, 4 to be kept closed. Operate the system in this mode for 15 minutes.
8. Stop the system. Drain the product tank completely and clean to collect fresh product water.
9. Restart the system in the same mode and collect fresh product water for 5 minutes in the product storage tank and then switch off feed pump.
10. Switch on the back wash pump and open Valve 3 and Valve 4 for backwash mode and close Valve 1, Valve 2. Operate in this mode for 2 - 5 minutes. Note: Ensure availability of product water for back wash.
11. Back Wash flux for UF membranes to be maintained at 170 LMH.
12. Switch off backwash Pump.
13. Switch on the feed pump and open valve V1 and V4 for forward flush for 2 minutes. Switch off feed pump.
14. Now, put the system in auto-mode operation after setting the PLC as given below:

- Filtration cycle - 30 minutes
- Forward flush - A - 15 - 60 seconds
- Backwash - 30 – 60 seconds
- Forward flush – B - 15 - 60 seconds

**NOTE:** 1) Discard the product water for 10-15 minutes into drain.
### OPERATING SEQUENCE

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration</td>
<td>UF Feed Pump on</td>
<td>30 – 60 min</td>
<td>V1, V2</td>
<td>V3, V4, V5</td>
</tr>
<tr>
<td>UF Forward Flush A</td>
<td>UF Feed Pump on</td>
<td>15 – 30 Sec</td>
<td>V1, V4</td>
<td>V2, V3, V5</td>
</tr>
<tr>
<td>UF Backwash (Top)</td>
<td>UF B/w Pump on</td>
<td>20 – 30 Sec</td>
<td>V3, V4</td>
<td>V1, V2, V5</td>
</tr>
<tr>
<td>UF Backwash (Bottom)</td>
<td>UF B/w Pump on</td>
<td>20 – 30 Sec</td>
<td>V3, V5</td>
<td>V1, V2, V4</td>
</tr>
<tr>
<td>UF Forward Flush B</td>
<td>UF Feed Pump on</td>
<td>15 – 30 Sec</td>
<td>V1, V4</td>
<td>V2, V3, V5</td>
</tr>
</tbody>
</table>

* Valve Open /Close Timing depends upon the valve make

* V6 (Ball valve) – to control the cross flow rate – always in partially open condition
NORMALIZATION OF UF SYSTEM:
After 8 hours from start up, the permeate flow can be adjusted to 50% of design flow. Adjust dosing requirement according to the TMP rise, Feed Pressure rise and fouling nature of the feed water.

- After 24 hrs from start up, the permeate flow can be adjusted to 75% of design conditions flow.
- After 48 hrs from the start up, the permeate flow can be adjusted at the maximum design flow.
- Disinfection of the membranes, Backwashing, Dosing, and Chemical cleaning duration and concentration to be decided according to the fouling nature of the feed water.

GENERAL INFORMATION ON UF SYSTEM OPERATION.
1. Typically, the process is run with a constant permeate flow; consequently the Trans Membrane Pressure (TMP) will increase during filtration. A periodical back flush using permeate is required to control the increase of TMP. From time to time (depending on the feed stream) dosing of disinfection chemicals like hypo-chloride should be used to control bacterial growth.

2. UF Backwash should be done with UF Permeate water. Backwash pumps should be made on non-corrosive materials (PP/PVDF or stainless steel). For high hardness water, we recommend using RO or Soft water.

3. To avoid mechanical damage, do not subject the UF element to sudden temperature changes. Do not exceed process temperature more than 45°C.

4. The UF membrane needs to be stored in wet condition at all times once taken for service.

5. To avoid biological growth during shutdowns or storage, wet membranes should be treated with a compatible biocide (non oxidizing type only).

6. For short term shutdowns, a daily flush (forward flush) with RO permeate water maintaining FRC up to 2.0 ppm for 30 to 60 minutes may be adequate for bacteria control.

7. For long term storage, a 1% sodium meta-bi-sulphite solution can be used. In either situation, modules should be stored hydraulically filled.

8. The UF membrane is resistant to a wide range of chemicals. However do not expose the membranes to chlorinated, brominated & any Halogenic solvents, concentrated acids or polar organic solvents.
UF OPERATION PHILOSOPHY
ULTRA FILTRATION - OPERATION PHILOSOPHY

The UF Plant operation consists of following operating steps:

- Filtration
- Forward Flush A
- Backwash
- Forward Flush B

Normally membranes are subjected to chemical cleaning (in terms CEB) using alkali like Sodium Hydroxide & Hydrochloric Acid once in a day for duration of 5-10 minutes. (Depends upon feed water quality)

❖ FILTRATION

The UF feed pump will pump the feed water at velocity of approximately 2 meters / second from the fibre side to the shell side of the membrane. It is operated in the Cross Flow Mode when all turbid particles of suspended solids, colloids and bacteria are trapped across the membrane. Pure water termed permeate comes out of the centre hollow pipe. The process is normally run at a constant pressure across the membrane (Between feed & permeate sides) called Trans Membrane Pressure.

TMP will increase with the operation of the plant with repeated Filtration Cycles. The duration of each cycle is about 20 to 40 Minutes.
Filtration

- Valve Open / Close Timing depends upon the valve make
- V6 (Ball valve) – to control the cross flow rate – always in partially open condition

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration</td>
<td>UF Feed Pump on</td>
<td>20 – 40 min</td>
<td>V1, V2</td>
<td>V3, V4, V5</td>
</tr>
</tbody>
</table>

UF Permeate

UF Backwash Inlet

UF Forward Flush / Backwash Drain

UF Feed

V1

V3

V2

V5

V6

V4
It is essential to remove all accumulated particles both on the inside walls of the hollow fibre and also those clogging the pores in the walls of the membrane tubes. This is done as follows:

- **FORWARD FLUSH A:**

The feed water is flushed through the inside of hollow fibre at the end of the Filtration Operation. This will remove all loose particles adhering to the membrane surface. The duration of forward flush is dependent on the feed water quality. Normally, this duration is about 15 to 60 seconds.

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Flush A</td>
<td>UF Feed Pump</td>
<td>15 – 60 Sec</td>
<td>V1, V4</td>
<td>V2, V3, V5</td>
</tr>
</tbody>
</table>

- Valve Open /Close Timing depends upon the valve make
- V6 (Ball valve) – to control the cross flow rate – always in partially open condition
BACKWASH:

Permeate water is used for backwash. The backwash pumps the water at a velocity of 2.5 to 3.0 meters / second. The flow rate will vary between 2.0 to 2.5 times the feed flow rates. The operation has duration of about 30 to 60 seconds.

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backwash</td>
<td>Backwash Pump on</td>
<td>30 – 60 Sec</td>
<td>V3, V4</td>
<td>V1, V2, V5</td>
</tr>
</tbody>
</table>

Valve Open /Close Timing depends upon the valve make

V6 (Ball valve) – to control the cross flow rate – always in partially open condition
**BACK WASH – BOTTOM DRAIN**

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backwash Cycle</td>
<td>UF B/W Pump</td>
<td>20 - 30 Sec</td>
<td>V3, V5</td>
<td>V1, V2, V4</td>
</tr>
</tbody>
</table>

- Valve Open /Close Timing depends upon the valve make
- V6 (Ball valve) – to control the cross flow rate – always in partially open condition
FORWARD FLUSH B:

Backwash is followed once again by forward flush. Particles driven across the membrane wall during backwash and sticking to the inner walls will be removed during this operation. The duration varies between 15 to 60 seconds.

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Pump</th>
<th>Time Duration</th>
<th>Valve Open</th>
<th>Valve Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Flush B</td>
<td>UF Feed Pump on</td>
<td>15 – 60 Sec</td>
<td>V1, V4</td>
<td>V2, V3, V5</td>
</tr>
</tbody>
</table>

- Valve Open /Close Timing depends upon the valve make
- V6 (Ball valve) – to control the cross flow rate – always in partially open condition
CHEMICAL CLEANING OPERATION:

Chemical cleaning is required, when the differential pressure across the membrane system increases beyond 1.0 Kg / Cm². UF Permeate or RO permeate is used for the chemical cleaning. The chemical cleaning operation consists of the following stages:

- Backwash.
- Soaking
- Backwash
- Forward flush

Depending on the outlet PH value at the end of the above cycle, it may become necessary to carry out one more cycle of operations. Then the operation is switched back to the filtration mode.

GENERAL:

- The duration of the various steps in the UF operation is controlled by the PLC. The timing of each step is preset in the Timing set screen. The timings of the steps of chemical cleaning are also set in this screen. The duration of various steps can be changed from the PLC.
- The elapsed time of the ongoing operational step can also seen on the screen.

PLC SPECIFICATIONS:

- The Ultra filtration Plant is to be operated from a Programmable Logic Controller located on the Local Panel mounted within the UF skid. The operating sequences as well as the duration of each step of the operation can be set and monitored from the operator Interface located on the panel. Various alarms and trips will be provided to monitor the plant operation. These alarms & trips are automatically initiated when there is deviation from the set process conditions.

- The operational control of the plant & its monitoring is carried out through a number of graphic screens provided on the operator station. The screens include time settings, Elapsed time of each step of operation, shut down valve status etc.
CEB & CIP PROCEDURES
UF MEMBRANE CLEANING CHEMICALS & APPLICATIONS

CHEMICAL ENHANCED BACKWASH:

- CEB is an out to in operation.
- CEB frequency depends upon the feed water quality.
- The CEB is performed using UF permeate with base combined with an oxidant added to more effectively clean contaminants from the membrane surface area.
- The CEB process occurs manually by PLC, the frequency can be adjusted after gaining operating experience.
- The actual chemical consumption depends upon the feed water quality.
- The selection of chemicals for CEB is based on the operating & feed quality.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Chemical</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hypo Chlorite (NaOCl) @ 7 – 10%</td>
<td>Hypochlorite is dosed for removing the biological fouling and for preventing the bio growth inside the membranes. The Hypo is dosed in two modes to accomplish the function of disinfection and removing the bio growth. The two modes are</td>
</tr>
<tr>
<td></td>
<td>Concentration</td>
<td>1. Chemically Enhanced Cleaning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Chemical cleaning in Place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The above two modes can be dosed with the any required level of Hypo as demanded by the membrane fouling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using of more than 25 ppm of NaOCl while cleaning would affect the membrane fibre. Hence we recommend you not to dose more than 25 ppm.</td>
</tr>
<tr>
<td>2</td>
<td>Hydro Chloric Acid (HCl) @ 33%</td>
<td>Hydrochloric acid is used for cleaning the membrane to remove the metallic oxides such as iron oxide etc.</td>
</tr>
<tr>
<td></td>
<td>Concentration</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sodium Hydroxide (NaOH) @ 45%</td>
<td>NaOH cleaning is used for the removal of organic fouling and to de-scale silica fouling</td>
</tr>
<tr>
<td></td>
<td>(Lye) Concentration.</td>
<td></td>
</tr>
</tbody>
</table>
CHEMICAL ENHANCED BACKWASH

UF Backwash Inlet

Caustic /Hypo pump & Tank

HCL pump & Tank

UF Inlet

UF Feed

V1

V2

V3

V4

V5

UF Permeate

UF Forward Flush / Backwash Drain
CHEMICAL ENHANCED BACK WASH PROCEDURE

i) CAUSTIC CLEANING (For fouling conditions – Regular basis)

Make up water : UF - Permeate (or) RO - Permeate
Dosing Chemical : Sodium Hydroxide (NaOH) + Hypo
Dosage rate : NaOH – 500ppm + 100 PPM Hypo
Concentration of NaOH : 45 % (Lye) or 100% (Flakes)
Hypo Concentration : 7-10%
Chemical Dosing Time : 5 minutes
pH : Between 12 – 13
Soaking Time : 10-20 minutes
Flushing Time : 2 minutes.
Backwash time : 3 minutes.

*Frequency : Once in a day normally. Under high fouling condition, additional CEB would be required.

* Actual depends on the feed water quality
ii) **Hydrochloric Acid Cleaning: (For fouling conditions – Regular basis)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make up water</td>
<td>UF - Permeate (or) RO - Permeate</td>
</tr>
<tr>
<td>Dosing Chemicals</td>
<td>Hydro Chloric Acid (HCl)</td>
</tr>
<tr>
<td>Dosage rate</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Concentration of HCl</td>
<td>33 %</td>
</tr>
<tr>
<td>Chemical Dosing Time</td>
<td>5 minutes</td>
</tr>
<tr>
<td>pH</td>
<td>Between 2 – 3 (Acid)</td>
</tr>
<tr>
<td>Soaking Time</td>
<td>10-20 minutes</td>
</tr>
<tr>
<td>Flushing Time</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Backwash time</td>
<td>3 minutes. System on-line</td>
</tr>
<tr>
<td>*Frequency</td>
<td>Once in a day normally. Under high fouling condition, additional CEB would be required.</td>
</tr>
</tbody>
</table>

* Actual depends on the feed water quality
CHEMICAL IN PLACE

- CIP is an IN to IN operation
- A Clean in place (CIP) operation includes forward flush and chemical recycle to clean the inner side of the fibre.
- The CIP is an on demand operation.
- The frequency of a CIP is depends upon the feed water quality.
- The CIP step includes chemical dosing, circulation, soaking & draining.
- The CIP chemicals circulated inside the fibre to remove contaminants or foulants. The period of circulation ranges would be around 20 minutes.
- After CIP start the flushing mode to remove residual chemicals held in the fibre.

CIP CLEANING
# CLEAN IN PLACE PROCEDURE - CAUSTIC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make up water</td>
<td>UF - Permeate (or) RO - Permeate</td>
</tr>
<tr>
<td>Dosing Chemicals</td>
<td>Sodium Hydroxide (NaOH)</td>
</tr>
<tr>
<td>Dosage rate</td>
<td>NaOH - 500ppm* + 100 PPM Hypo</td>
</tr>
<tr>
<td>Concentration of NaOH</td>
<td>45 % (Lye) or 100% (Flakes)</td>
</tr>
<tr>
<td>Concentration of Hypo</td>
<td>7-10%</td>
</tr>
<tr>
<td>Circulation</td>
<td>20 minutes*</td>
</tr>
<tr>
<td>Soaking Time</td>
<td>10-20 minutes§</td>
</tr>
<tr>
<td>Backwash time</td>
<td>3 minutes</td>
</tr>
<tr>
<td>Flushing time</td>
<td>2 minutes. System on-line</td>
</tr>
<tr>
<td>Frequency</td>
<td>Once in a week* or whenever feed pressure rises by 20%, whichever is earlier.</td>
</tr>
<tr>
<td>CIP Tank Capacity</td>
<td>Depends upon the number of modules to be cleaned.</td>
</tr>
</tbody>
</table>

* Actual depends on the contaminants or foulants.

* Chemical solution to be prepared based on the above concentration suitably

§ If required 2 - 3 hrs, for very hard scales, over night soaking.

**Note:**

1. Check the concentration of the cleaning chemicals, and add according to the requirement.

2. Cleaning Chemicals selection according to the scale deposition on the membrane and chemical resistance to UF membrane.
## CLEAN IN PLACE PROCEDURE - ACIDIC

<table>
<thead>
<tr>
<th>Make up water</th>
<th>UF - Permeate (or) RO - Permeate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosing Chemicals</td>
<td>Hydrochloric Acid / Citric Acid</td>
</tr>
<tr>
<td>Dosage rate</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Concentration of HCl</td>
<td>33%</td>
</tr>
<tr>
<td>Concentration of Citric Acid</td>
<td>99%</td>
</tr>
<tr>
<td>pH of circulation water</td>
<td>2-3</td>
</tr>
<tr>
<td>Circulation</td>
<td>20 minutes*</td>
</tr>
<tr>
<td>Soaking Time</td>
<td>10-20 minutes$^+$</td>
</tr>
<tr>
<td>Backwash time</td>
<td>3 minutes</td>
</tr>
<tr>
<td>Flushing time</td>
<td>2 minutes.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Twice in a Month* or when ever feed pressure rises by 20%, whichever is earlier.</td>
</tr>
<tr>
<td>CIP Tank Capacity</td>
<td>Depends upon the number of modules to be cleaned.</td>
</tr>
</tbody>
</table>

**Note:**

* Actual depends on the contaminants or foulants.
* Chemical solution to be prepared based on the above concentration suitably
* We recommend you to dose HCl and Citric acid on rotational basis (Every 15 days). This is recommended as HCl works well for removal of Inorganic scales and Citric acid for Organic fouling.
* We recommend soaking for 2-3 hrs for any hard scales deposits on UF membrane.
* Check the concentration of the cleaning chemicals, and add according to the requirement.
* Cleaning Chemicals selection according to the scale deposition on the membrane and chemical resistance to UF membrane.
* Cleaning Chemicals quality to be checked once in a month and ensure it doesn’t have any contaminants. Any contaminants present would foul the UF membrane. Kindly insist for QC certificate from Acid, Caustic and Hypo supplier.
UF MEMBRANE MAINTENANCE INSTRUCTION
UF - MAINTENANCE INSTRUCTION

1. Typically, the process is run with a constant permeate flow consequently; the Trans Membrane Pressure (TMP) will increase during filtration. A periodical back flush using permeate is required to control the increase of TMP. TMP not to exceed 1.2. From time to time (depending on the feed stream) dosing of disinfection chemicals like peroxide or hypo chloride should be used to control bacterial growth.

2. Permeate is generally recommended for this purpose. Backwash water should be of UF quality Permeate. However for high hardness water, we recommend RO or Soft water. Backwash pumps should be made on non-corroding materials (plastic or stainless steel).

3. To avoid mechanical damage, do not subject the UF element to sudden temperature changes. Do not exceed 45 °C process temperatures.

4. The UF membrane needs to be stored wet at all times.

5. To avoid biological growth during shutdowns or storage, wet membranes should be treated with a compatible biocide. The membrane is compatible with many common disinfecting agents or biocides preservatives.

6. For long-term storage, 1% sodium metabisulfite solution can be used. In either situation, modules should be stored hydraulically filled.

7. The UF membrane is resistant to a wide range of chemicals. However do not expose the membranes to chlorinated, brominated and any Halogenic solvents, concentrated acids or polar organic solvents.

8. CEB and CIP to be done regularly as per recommendations.

9. For certain type of scales, we recommend cleaning at temperature around 35-40 Deg C. However the same to be checked with Membrane Hitec prior to taking up enhanced temperature cleaning.

9. UF system data and water analysis date to be shared once in month or 15 days for suggestions from Membrane Hitec.
**UF – Recommended Feed Water Quality**

Ensure feed water quality as given below for optimum performance of UF membrane:

<table>
<thead>
<tr>
<th>Feed Water Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
</tr>
<tr>
<td><strong>TSS</strong></td>
</tr>
<tr>
<td><strong>Turbidity</strong></td>
</tr>
<tr>
<td><strong>COD</strong></td>
</tr>
<tr>
<td><strong>BOD</strong></td>
</tr>
<tr>
<td><strong>Total Iron</strong></td>
</tr>
<tr>
<td><strong>Oil &amp; Grease</strong></td>
</tr>
<tr>
<td><strong>FRC</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Permeate Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SDI</strong></td>
</tr>
<tr>
<td><strong>Turbidity, NTU</strong></td>
</tr>
<tr>
<td><strong>TSS, ppm</strong></td>
</tr>
<tr>
<td><strong>FRC, ppm</strong></td>
</tr>
</tbody>
</table>
## UF Membrane Troubleshooting

<table>
<thead>
<tr>
<th>S. No</th>
<th>Symptoms</th>
<th>Possible Causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>High TMP</td>
<td>Membranes are Clogged or fouled</td>
<td>To steady the feed water quality</td>
</tr>
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</table>
| 2.    | High Feed Pressure  | a) Metal Oxide fouling  
                b) Bio fouling  
                c) Membrane plugged by dust particles           | a) Acid cleaning to be given.  
                b) Hypo / caustic cleaning to be given.  
                c) Pre Filter to be provided                |
| 3.    | Very less feed pressure | a) Fibre may be broken  
                b) Feed pump may be tripped  
                c) Feed pump section line may be plugged.  
                d) Feed tank empty                  | a) Membranes to do integrity test/replaced.  
                b) Feed pump to be serviced  
                c) Feed pump suction line to be cleaned  
                d) Feed tank to be filled.            |
| 4.    | Less flow rate of feed | a) Metal Oxide fouling  
                b) Bio fouling  
                c) Membrane plugged by dust particles.  
                d) Feed pump suction line may be plugged.  
                e) Feed tank empty                   | a) Acid cleaning to be given.  
                b) Hypo / caustic cleaning to be given.  
                c) End cap removed and clean  
                d) Pump suction line to be cleaned  
                e) Feed tank to be filled.            |
| 5.    | Low Quality of permeate | a) Feed water parameters are higher than limited parameter  
                b) Slightly slipped the O ring from their position.  
                c) Fibre may be broken.                | a) Pre-treatment to be improved.  
                b) The O ring to be changed with new one.  
                e) Membranes to do integrity test/replaced. |
UF MEMBRANE

RESISTANCE TO CHEMICALS

UF- MEMBRANE - RESISTANCE TO CHEMICALS
- **Chlorine Tolerance**: Max 2,00,000 ppm hrs

- **Other Oxidizing Chemicals Tolerance**
  - Alcohol - Ethanol: 50 %

- **Acid**
  - Hydro Chloric Acid: 5%
  - Nitric Acid: 1%
  - Formic Acid: 1%
  - Acidic Acid: 1%

- **Base**
  - Caustic: 2%

- **Others**
  - Formaldehyde: 1%
  - Sodium Meta bi sulfite: 1%

**Aprotic solvents**: (Disintegrates, i.e. Dissolves membrane disclaimer)
- Di- methyl formamide
- Di-methyl-sulfoxide
- Di-methyl-acetamide
- N-methyl-pyrrolidone

**Ketone**: (Disintegrates, i.e. Dissolves membrane disclaimer)
- Acetone
- Alcohol: (50 %) (Membrane properties slightly change)
- Methanol
- Ethanol
- Iso-propanol

**Aromatic hydrocarbons**: (Disintegrates, i.e., dissolves membrane disclaimer)
- Benzene
- Toluene
- Ethyl-benzene
- Xylenes

**Aliphatic Hydrocarbons**: (Membrane properties slightly change)

**Others**: (Change in membrane properties)
- Poly ethylene glycol
- Glycerin
- Glycols
UF MEMBRANE

STORAGE & PRESERVATION DETAILS
UF MEMBRANE STORAGE AND PRESERVATION DETAILS

1. The UF Membrane needs to be stored wet at all times.

2. The Membranes should not be subjected to any freezing temperature

3. The Membranes should be kept in the area where the temperature should be around 20 to 30 deg. C

4. For short term shutdowns, a daily flush with permeate quality water containing up to 2.0 ppm free chlorine for 30 to 60 minutes may be adequate for bacteria control.

5. For long-term storage, 1% sodium Meta bi-sulfite solution can be used. In either situation modules should be stores hydraulically filled. Circulation of water for 5-10 minutes per day is recommended.

6. 1% sodium meta bi sulfite preparation:
   Mix 10 Gms. of sodium Meta bi-sulfite in one liter of good quality water.