

# Membrane System User's Manual

Model

X1-3280-30



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**PLEASE READ THE ENTIRE MANUAL BEFORE PROCEEDING WITH THE INSTALLATION AND STARTUP. YOUR FAILURE TO FOLLOW ANY ATTACHED INSTRUCTIONS OR OPERATING PARAMETERS MAY LEAD TO THE PRODUCT'S FAILURE, WHICH CAN CAUSE PROPERTY DAMAGE AND/OR PERSONAL INJURY.**

- DO NOT USE WHERE THE WATER IS MICROBIOLOGICALLY UNSAFE OR OF UNKNOWN QUALITY WITHOUT ADEQUATE DISINFECTION BEFORE OR AFTER THE SYSTEM.
- PRETREATMENT MUST BE SUFFICIENT TO ELIMINATE THE POSSIBILITY OF PREMATURE FOULING.
- ALWAYS TURN OFF THE UNIT, SHUT OFF THE FEED WATER, AND DISCONNECT THE ELECTRICAL POWER WHEN WORKING ON THE UNIT.
- NEVER ALLOW THE PUMP TO RUN DRY.
- NEVER START THE PUMP WITH THE CONCENTRATE VALVE CLOSED.
- NEVER ALLOW THE UNIT TO FREEZE OR OPERATE WITH A FEED WATER TEMPERATURE ABOVE 85°F

**INTRODUCTION**

The X1-3280-30 is a water purification unit capable of providing 43,200 gallon a day of potable water. This unit has been designed to reduce contaminants and impurities in the water utilizing Reverse Osmosis technology. Such water sources are fresh water, chlorinated feed water, and brackish water. The construction of this unit has been engineered for durability and continuous use.

**DESIGN PARAMETERS**

<b><u>Operation Conditions</u></b>	<b><u>Design</u></b>	<b><u>Notes</u></b>
Feed Flow	40	
X1-3280 Permeate Flow, GPM	30	Note 1
Concentrate Flow, GPM	10	
Permeate to Feed Flow Ratio (Recovery)	75%	
Inlet Pressure PSI	30-60	
X1-3280 System Pressure PSI	170	Note 2
X1-3280 Concentrate Pressure, PSI	137	
Design Temperature, DEG F	50	Note 3

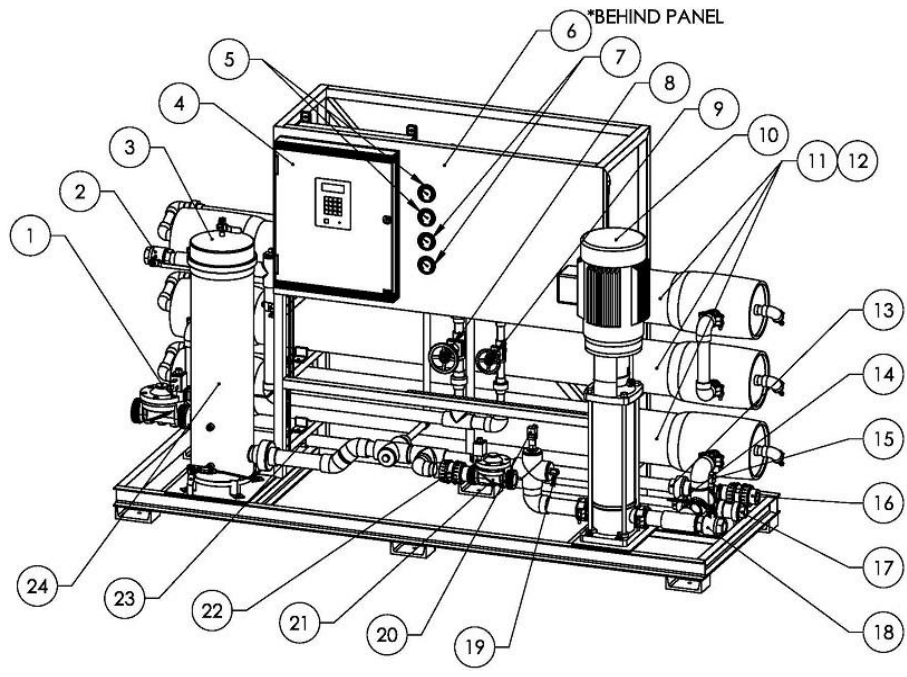
**Note 1:** Do not exceed recommended permeate flow.

**Note 2:** System pressure is variable due to water conditions. Adjust pressure to obtain the correct permeate and concentrate flows.

**Note 3:** Permeate flow will increase at a higher temperature.

**SYSTEM INFORMATION**

<b><u>System Specifications</u></b>	<b><u>X1-3280-30</u></b>
Gallons Per Day (GPD)	43,200
Element Model	NF90-400
Number of Elements	6
RO Motor HP	10 HP
System Voltage	220v 3ph
Hertz	60
Feed Line Size	2"
Permeate Line Size	1.5"
Concentrate Line Size	1"
Recycle Line Size	0.75"



**SYSTEM IDENTIFICATION**

ITEM NO.	AXEON PART NO.	AXEON DESCRIPTION	QTY
1	204920	VALVE, SOLENOID, N/C, UL, 220V, 2" FNPT, 3 METER CORD	1
2	206615	VALVE, BALL, FULL PORT, 1.5"FNPT,316SS	1
3	207398	HOUSING, MULTI-CART, SS 316L, 7 RND 30", 150 PSI, 2" MNPT SHELCO	1
4	208013	CONTROLLER, COMPUTER, S200, 220V 3PH, 60HZ, 10 HP, 24 X 20 ENCLOSURE	1
5	205099	GAUGE, BKM, GLY FILL, 0-100 PSI/BAR, 2.5" DIA, SS, 1/4" MNPT	2
6	206633	SENSOR, FLOW, PVC, 3/4" W/HALL EFFECT, 10FT CABLE	1
7	205100	GAUGE, BKM, GLY FILL, 0-600 PSI/BAR, 2.5" DIA, SS, 1/4" MNPT	2
8	200995	VALVE, GLOBE, 316SS, 1" FNPT	1
9	200994	VALVE, GLOBE, SS, 3/4" FNPT	1
10	207400	PUMP, 10SV12P14F20	1
11	207399	PRO-8-300-SP-2	3
12	200474	MEMBRANE, NF-90, 400, FILMTEC	6
13	206635	SENSOR, FLOW, PVC, 1-1/2" W/HALL EFFECT, 10FT CABLE	1
14	206634	SENSOR, FLOW, PVC, 1" W/HALL EFFECT, 10FT CABLE	1
15	207084	SWITCH, PRESSURE, HIGH, N/C, 950PSI, 1/4" MNPT, RIGHT ANGLE, SW. SOL.	1
16	206539	VALVE, CHECK, BALL, PVC, 1-1/2X1-1/2" SLIP/FNPT, HAYWARD	1
17	206545	VALVE, CHECK, BALL, PVC, 1X1 SLIP/FNPT, HAYWARD	1
18	206615	VALVE, BALL, FULL PORT, 1.5"FNPT,316SS	1
19	200861	PROBE, DUAL, ROTROL S-150, TDS/COND, 3/4" NPT, 10' CABLE	1
20	207083	SWITCH, PRESSURE, LOW, N/C, 5PSI, 1/4" MNPT, RIGHT ANGLE, SW. SOL.	1
21	204918	VALVE, SOLENOID, N/C, 220V, 1.5" FNPT, 3 METER CORD	1
22	206539	VALVE, CHECK, BALL, PVC, 1-1/2" X 1-1/2" SLIP/FNPT, HAYWARD	1
23	200861	PROBE, DUAL, ROTROL S-150, TDS/COND, 3/4" NPT, 10' CABLE	1
24	201932	CARTRIDGE, SEDIMENT, POLYPRO, 2.5" X 30", 5 MIC	7

## **COMPONENT DESCRIPTIONS**

1. **Solenoid Valve** - The valve opens when the system is in operation. The RO pump will start a few second after the solenoid valve opens. The valve will close when the system is not in operation.
2. **Cleaning Ports** - Used for membrane cleaning procedure.
3. **Housing Filter** – Multi-Cartridge.
4. **Controller** - Controls the operation of the RO unit with integrated VFD to control pump flow.
5. **Filter Pressure Gauges** - Measures the line pressure of feed water before and after the filter.
6. **Flow Meter Digital, Recycle** - Measures the amount of recycled concentrate water returning to the RO pump.

7. **Membrane Pressure Gauges** - Measures the pressure at the inlet and outlet of the pressure vessels.
8. **Control Valve** - Controls the flow of the concentrate water to the drain. This valve should never be completely closed when the system is in operation.
9. **Recycle Valve** - Controls the flow of concentrate being recycled to the inlet of the RO Pump.
10. **RO Pump** - Pressurizes the incoming water to the design pressure.
11. **Membrane Pressure Vessels** - Membrane elements housed in fiberglass vessels.
12. **Membrane Pressure Vessels** - Membrane elements housed in fiberglass vessels.
13. **Flow Meter Digital, Permeate** - Measures the flow rate of permeate water.
14. **Flow Meter Digital, Concentrate** - Measures the flow rate of concentrate water.
15. **High Pressure Switch** - Turns the pump off when the discharge pressure is higher than 300 PSI.
16. **Check Valve, Permeate** - Prevents back flow in the permeate line.
17. **Check Valve, Concentrate** - Prevents back flow in the concentrate line.
18. **Cleaning Ports** - Used for membrane cleaning procedure.
19. **TDS Sensors** - Measures the quality of feed and permeate.
20. **Low Pressure Switch** - Turns the pump off when the inlet pressure is lower than 15 PSI.
21. **Permeate Flush Solenoid** - Helps prolong the life of the membranes.
22. **Check Valve** – prevents backflow.
23. **TDS Sensors** - Measures the quality of feed and permeate.
24. **Cartridge Filter** - 5 micron sediment filter.



## **INSTALLATION GUIDELINES**

### **PLUMBING**

The membranes and high pressure pumps used on X1-Series systems require a continuous flow of water with a minimum feed pressure of 40 psi. Feed, Permeate and Concentrate ports are all labeled.

### **FEED WATER INLET**

1. Locate the 2" inlet connection located to the left of the filter housing.
2. Attach the inlet piping to the 2" Solenoid Valve.

### **PERMEATE (PRODUCT WATER) CONNECTION**

Locate the 1.5" connection labeled permeate and attach to the holding tank. Ensure that the permeate water can flow freely with no backpressure. Backpressure can cause irreversible damage to the membrane elements.

The 1.5" permeate line can be run to the holding tank with PVC fittings, or other FDA approved materials. This is so the material being used does not dissolve into the permeate water.

**CAUTION:** *THE PH OF THE REVERSE OSMOSIS PERMEATE WATER WILL TYPICALLY BE 1-2 POINTS LOWER THAN THE FEED WATER PH. A LOW PH CAN BE VERY AGGRESSIVE TO SOME PLUMBING MATERIALS SUCH AS COPPER PIPING.*

### **CONCENTRATE (WASTE WATER) CONNECTION**

Locate the 1" connection labeled concentrate and attach to a drain. Run the concentrate line to an open drain in a free and unrestricted manner (no backpressure).

**CAUTION:** *ANY RESTRICTIONS OR BLOCKAGE IN THE DRAIN LINE CAN CAUSE BACKPRESSURE, WHICH WILL INCREASE THE SYSTEM'S OPERATING PRESSURE. THIS CAN RESULT IN DAMAGE TO THE SYSTEM'S MEMBRANES AND COMPONENTS.*

### **ELECTRICAL**

The X1-3280-30 Reverse Osmosis system is a 220 Volt, 3 Phase, 60 Hertz unit with a Variable Frequency Drive that powers the motor. Must have an independent 30 AMP three phase breaker.

Ensure that the electrical circuit supplying the system is compatible with the requirements of the specific X1 model you are installing. Must use a 10 or below gauge rated wire.

**NOTE:** *IT'S RECOMMENDED THAT A LICENSED ELECTRICIAN WIRE YOUR SYSTEM IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES (NEC).*

**WARNING:** *TO REDUCE THE RISK OF ELECTRICAL SHOCK, THE INCOMING POWER SUPPLY MUST INCLUDE A PROTECTIVE EARTH GROUND.*

## **PURGING AND INITIAL STARTUP**

Direct the permeate water line to drain.

1. Fully open the concentrate valve #8 (counter clockwise) located on the control panel.
2. Fully close the recycle valve #9 (clockwise) located on the control panel if applicable.
3. Press the POWER key #4 to power up the system.
4. Press "Function" Key > "2" key > "Enter" key to initiate manual flush

The unit will flush with feed water for 10 minutes (Adjustable). Once the time expires the display screen will say STANDBY.

## **INITIAL STARTUP**

1. Fully open the concentrate valve #8 (counter clockwise) located on the control panel.
2. Fully close the recycle valve #9 (clockwise) located on the control panel if applicable.
3. Press the POWER key #4 to power up the system.
4. Adjust VFD #4, Concentrate #8 and Recycle #9 valve to attain proper flows.

The unit will count down for 5 second before turning on the RO Pump. At this time adjust the concentrate valve, recycle valve to obtain the designed flow and pressure. If needed, adjust the hertz in the VFD to increase or decrease the feed flow. Inspect the unit for any possible leaks due to shipment.

Once the correct flow is achieved, allow the unit to run for 30 minutes to flush any preservative solution from the unit.

After 30 minutes, shut down the system and re-direct the permeate line back to the holding tank. Record the readings daily for a week and after a week record the readings once a week.

## **OPERATING DO's AND DON'Ts**

### **DO:**

- Change the cartridge filters regularly
- Monitor the system and keep a daily log
- Run the system, as much as possible, on a continuous basis.
- Adjust the system recovery to the recommended value
- Always feed the pump with filtered water.

### **DON'T:**

- Permit chlorine to enter or be present in the feed water.
- Shut down the system for extended periods.
- Close the throttle valve completely.
- Operate the system with insufficient feed flow.
- Operate the pump dry.

## **RO SHUT-DOWN PROCEDURE**

1. Press the POWER key. Allow the unit to go through the flush cycle before proceeding to the next step.
2. Flip the switch to the **OFF** position on the main branch circuit protection enclosure. (We recommend every unit should have circuit protection)
3. If the Reverse Osmosis unit is to be shut down for an extended period of time, a membrane preservative should be used to preserve the membranes. See Preparing Unit for Storage or Shipment.
4. When the unit is ready to restart please follow the initial start up procedures. The permeate line should be diverted to drain for 30 minutes.

# OPERATING LOG

\_\_\_\_\_  
- Company Name

\_\_\_\_\_  
- Day of Start Up

\_\_\_\_\_  
- Location

\_\_\_\_\_  
- Date of Last Cleaning

\_\_\_\_\_  
- Week Of

\_\_\_\_\_  
- System Serial No.

Date					
Time					
Hour of Operation					
Filter Inlet Pressure (PSI)					
Filter Outlet Pressure (PSI)					
Concentrate Pressure (PSI)					
Pump Discharge Pressure (PSI)					
Feed Flow (GPM)					
Permeate Flow (GPM)					
Concentrate Flow (GPM)					
Recycle Flow (GPM)					
Recovery %					
Feed Temperature					
Feed TDS (PPM)					
Permeate TDS (PPM)					
Rejection %					
Feed pH					
Permeate pH					
Scale Inhibitor Feed (PPM)					
Iron (mg/L)					
Free Chlorine (mg/L)					
Hardness (GPG CaCO <sub>3</sub> )					

## **TEMPERATURE CORRECTION SHEET**

Find the temperature correction factor (TCF) from the table below. Divide the rated permeate flow at 77°F by the temperature correction factor. The result is the permeate flow at the desired temperature. See example on the next page.

Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor
50.0 (10.0)	1.711	57.2 (14.0)	1.475	64.4 (18.0)	1.276	71.6 (22.0)	1.109	78.8 (26.0)	0.971
50.2 (10.1)	1.705	57.4 (14.1)	1.469	64.6 (18.1)	1.272	71.8 (22.1)	1.105	79.0 (26.1)	0.968
50.4 (10.2)	1.698	57.6 (14.2)	1.464	64.8 (18.2)	1.267	72.0 (22.2)	1.101	79.2 (26.2)	0.965
50.5 (10.3)	1.692	57.7 (14.3)	1.459	64.9 (18.3)	1.262	72.1 (22.3)	1.097	79.3 (26.3)	0.962
50.7 (10.4)	1.686	57.9 (14.4)	1.453	65.1 (18.4)	1.258	72.3 (22.4)	1.093	79.5 (26.4)	0.959
50.9 (10.5)	1.679	58.1 (14.5)	1.448	65.3 (18.5)	1.254	72.5 (22.5)	1.090	79.7 (26.5)	0.957
51.1 (10.6)	1.673	58.3 (14.6)	1.443	65.5 (18.6)	1.249	72.7 (22.6)	1.086	79.9 (26.6)	0.954
51.3 (10.7)	1.667	58.5 (14.7)	1.437	65.7 (18.7)	1.245	72.9 (22.7)	1.082	80.1 (26.7)	0.951
51.4 (10.8)	1.660	58.6 (14.8)	1.432	65.8 (18.8)	1.240	73.0 (22.8)	1.078	80.2 (26.8)	0.948
51.6 (10.9)	1.654	58.8 (14.9)	1.427	66.0 (18.9)	1.236	73.2 (22.9)	1.075	80.4 (26.9)	0.945
51.8 (11.0)	1.648	59.0 (15.0)	1.422	66.2 (19.0)	1.232	73.4 (23.0)	1.071	80.6 (27.0)	0.943
52.0 (11.1)	1.642	59.2 (15.1)	1.417	66.4 (19.1)	1.227	73.6 (23.1)	1.067	80.8 (27.1)	0.940
52.2 (11.2)	1.636	59.4 (15.2)	1.411	66.6 (19.2)	1.223	73.8 (23.2)	1.064	81.0 (27.2)	0.937
52.3 (11.3)	1.630	59.5 (15.3)	1.406	66.7 (19.3)	1.219	73.9 (23.3)	1.060	81.1 (27.3)	0.934
52.5 (11.4)	1.624	59.7 (15.4)	1.401	66.9 (19.4)	1.214	74.1 (23.4)	1.056	81.3 (27.4)	0.932
52.7 (11.5)	1.618	59.9 (15.5)	1.396	67.1 (19.5)	1.210	74.3 (23.5)	1.053	81.5 (27.5)	0.929
52.9 (11.6)	1.611	60.1 (15.6)	1.391	67.3 (19.6)	1.206	74.5 (23.6)	1.049	81.7 (27.6)	0.926
53.1 (11.7)	1.605	60.3 (15.7)	1.386	67.5 (19.7)	1.201	74.7 (23.7)	1.045	81.9 (27.7)	0.924
53.2 (11.8)	1.600	60.4 (15.8)	1.381	67.6 (19.8)	1.197	74.8 (23.8)	1.042	82.0 (27.8)	0.921
53.4 (11.9)	1.594	60.6 (15.9)	1.376	67.8 (19.9)	1.193	75.0 (23.9)	1.038	82.2 (27.9)	0.918
53.6 (12.0)	1.588	60.8 (16.0)	1.371	68.0 (20.0)	1.189	75.2 (24.0)	1.035	82.4 (28.0)	0.915
53.8 (12.1)	1.582	61.0 (16.1)	1.366	68.2 (20.1)	1.185	75.4 (24.1)	1.031	82.6 (28.1)	0.913
54.0 (12.2)	1.576	61.2 (16.2)	1.361	68.4 (20.2)	1.180	75.6 (24.2)	1.028	82.8 (28.2)	0.910
54.1 (12.3)	1.570	61.3 (16.3)	1.356	68.5 (20.3)	1.176	75.7 (24.3)	1.024	82.9 (28.3)	0.908
54.3 (12.4)	1.564	61.5 (16.4)	1.351	68.7 (20.4)	1.172	75.9 (24.4)	1.021	83.1 (28.4)	0.905
54.5 (12.5)	1.558	61.7 (16.5)	1.347	68.9 (20.5)	1.168	76.1 (24.5)	1.017	83.3 (28.5)	0.902
54.7 (12.6)	1.553	61.9 (16.6)	1.342	69.1 (20.6)	1.164	76.3 (24.6)	1.014	83.5 (28.6)	0.900
54.9 (12.7)	1.547	62.1 (16.7)	1.337	69.3 (20.7)	1.160	76.5 (24.7)	1.010	83.7 (28.7)	0.897
55.0 (12.8)	1.541	62.2 (16.8)	1.332	69.4 (20.8)	1.156	76.6 (24.8)	1.007	83.8 (28.8)	0.894
55.2 (12.9)	1.536	62.4 (16.9)	1.327	69.6 (20.9)	1.152	76.8 (24.9)	1.003	84.0 (28.9)	0.892
55.4 (13.0)	1.530	62.6 (17.0)	1.323	69.8 (21.0)	1.148	77.0 (25.0)	1.000	84.2 (29.0)	0.889
55.6 (13.1)	1.524	62.8 (17.1)	1.318	70.0 (21.1)	1.144	77.2 (25.1)	0.997	84.4 (29.1)	0.887
55.8 (13.2)	1.519	63.0 (17.2)	1.313	70.2 (21.2)	1.140	77.4 (25.2)	0.994	84.6 (29.2)	0.884
55.9 (13.3)	1.513	63.1 (17.3)	1.308	70.3 (21.3)	1.136	77.5 (25.3)	0.991	84.7 (29.3)	0.882
56.1 (13.4)	1.508	63.3 (17.4)	1.304	70.5 (21.4)	1.132	77.7 (25.4)	0.988	84.9 (29.4)	0.879
56.3 (13.5)	1.502	63.5 (17.5)	1.299	70.7 (21.5)	1.128	77.9 (25.5)	0.985	85.1 (29.5)	0.877
56.5 (13.6)	1.496	63.7 (17.6)	1.294	70.9 (21.6)	1.124	78.1 (25.6)	0.982	85.3 (29.6)	0.874
56.7 (13.7)	1.491	63.9 (17.7)	1.290	71.1 (21.7)	1.120	78.3 (25.7)	0.979	85.5 (29.7)	0.871
56.8 (13.8)	1.486	64.0 (17.8)	1.285	71.2 (21.8)	1.116	78.4 (25.8)	0.977	85.6 (29.8)	0.869
57.0 (13.9)	1.480	64.2 (17.9)	1.281	71.4 (21.9)	1.112	78.6 (25.9)	0.974	85.8 (29.9)	0.866

\*F = (°C x 9/5) + 32

Corrected Flow Rate = (Measured Flow Rate) \* (TCF @ Feed Water Temp.)

## TEMPERATURE CORRECTION FORMULA

25 gpm @ 59° F (25÷1.42=17.60 gpm)

25 gpm @ 77° F (25÷1=25 gpm)

25 gpm @ 84° F (25÷0.89=28.08 gpm)

## REJECTION FORMULA

The amount of total dissolved solids (TDS) rejected by the membrane is expressed as a percentage. For example, a 99.5% rejection rate means that 99.5% of total dissolved solids do not pass through the membrane. To calculate the % rejection, use the following formula:

$$\% \text{ Rejection} = [(\text{Feed TDS} - \text{Product TDS}) / \text{Feed TDS}] \times 100$$

$$99.5\% = [(10000 - 8.25) / 10000] \times 100$$

**NOTE:** ALL TDS FIGURES MUST BE EXPRESSED IN THE SAME UNITS, TYPICALLY PARTS PER MILLION (PPM) OR MILLIGRAMS PER LITER (MG/L).

## RECOVERY FORMULA

The amount of permeate water recovered for use is expressed as a percentage. To calculate % recovery, use the following formula:

$$\% \text{ Recovery} = (\text{Product Water Flow Rate} / \text{Feed Water Flow Rate}) \times 100$$

$$75\% = (60/80) \times 100$$

**NOTE:** ALL FLOW RATES MUST BE EXPRESSED IN THE SAME UNITS, TYPICALLY GALLONS PER MINUTE (GPM).

## MAINTENANCE

The performance of a Reverse Osmosis Unit is influenced by the feed water composition, feed pressure, temperature and recovery. For example, a feed temperature drop of 4°C will cause a permeate flow decrease of about 10%. This, however, is a normal phenomenon.

In order to distinguish between such normal phenomena and performance changes due to fouling or problems, the measured permeate flow and salt passage have to be normalized. Normalization is a comparison of the actual performance to a given reference performance while the influences of operating parameters are taken into account. The reference performance may be the designed performance or the measured initial performance.

Normalization with reference to the designed (or warranted) system performance is useful to verify that the plant gives the specified (or warranted) performance. Normalization with reference to the initial system performance is useful to show up any performance changes between day one and the actual date.

Plant performance normalization is strongly recommended, because it allows an early identification of potential problems (e.g. scaling or fouling) when the normalized data are recorded daily. Corrective measures are much more effective when taken early.

### **REPLACING FILTER CARTRIDGES**

The Reverse Osmosis unit uses 5 micron sediment filter cartridges that need to be replaced frequently. Change the sediment cartridges when the pressure gauges on the inlet and outlet of the filter housing indicates a pressure differential of 15 psi.

1. Turn off Reverse Osmosis unit.
2. Open the sample valve on the outlet side of the filter housing to release any pressure.
3. Loosen the V-and clamp and remove carefully.
4. Remove the top of the filter housing.
5. Loosen the two knobs holding the plate in place.
6. Remove the round plate and the spring seals.
7. Remove and discard the old filter cartridges.
8. Install new filter cartridges.
9. Re-assemble the filter housing.
10. Turn on the RO unit and inspect filter housing for leaks.

### **MEMBRANE INSTALLATION, REMOVAL AND REPLACEMENT**

Installation and replacing membranes in the pressure vessels is an easy process if you have the proper information and tools at hand. Please refer to the following instructions when removing and replacing membrane elements:



**WARNING: ALL PRESSURE GAUGES MUST READ ZERO BEFORE PROCEEDING. BEFORE ATTEMPTING, DISCONNECT THE POWER FROM THE SYSTEM AND BLEED ALL WATER PRESSURE FROM THE SYSTEM.**

1. Turn off the Reverse Osmosis unit.
2. Open the sample valve on each vessel to release any pressure and drain excess water.
3. Remove all necessary PVC piping on the permeate manifold.
4. Remove the retaining ring with the finger pull.
5. Remove the end plugs by pulling carefully from the center of the cap.
6. Remove the end adapter and the old membrane.
7. Use lubricant (Dow 111) to lubricate the brine seal before inserting the membrane.
8. Install the new membrane making sure the brine seal is oriented towards the feed side of the vessel.
9. Re-assemble the end plug and retaining ring.
10. Reconnect all PVC piping that was removed previously.

**NOTE: WEAR GLOVES FOR THE FOLLOWING STEPS IN ORDER NOT TO CONTAMINATE THE MEMBRANE.**

1. Cut the bag open as close as possible to the seal at one end of the bag, so the bag may be re-used if necessary.

2. Make sure that all parts are clean and free from dirt. Examine the brine seal, and permeate tube for nicks or cuts. Replace the O-rings or brine seal if damaged.
3. Flow directions should be observed for installation of the membrane element into the pressure vessels.

#### **REPLACING THE MEMBRANE ELEMENT:**



**WARNING: THE BRINE SEAL MUST BE IN THE SAME POSITION AS IT WAS FOR FACTORY PRE-INSTALLED MEMBRANE ELEMENT. THE BRINE SEAL IS A RUBBER SEAL THAT PROTRUDES ON ONE SIDE OF THE MEMBRANE AND IS ALWAYS ON THE FEED SIDE OF THE MEMBRANE ELEMENT.**

1. Remove membrane elements from the left side if the arrow on the pressure vessels is pointing to the left and right if arrow is pointing to the right.
2. Lubricate the brine seal and o-rings with a non-petroleum based lubricant, such as Dow Corning® 111. Do not use a petroleum-based lubricant.
3. Carefully install membrane through the membrane housing with brine seal entering last.
4. Re-install the end plug while pushing it onto the housing. Ensure that you do not pinch or fatigue any o-rings while re-installing the end plug. Push the end plug on until the outer diameter of the plug is flush with the retaining ring groove.
5. Insert the retaining ring until they are fully seated.
6. Reconnect any fittings that may have been disconnected when the membrane pressure vessels were disassembled.
7. To Start-Up the system, please refer to the Initial Start-Up section of this manual.



**CAUTION: WET MEMBRANES ARE SHIPPED IN A PRESERVATIVE SOLUTION. THE MEMBRANES MUST BE FLUSHED FOR AT LEAST 30 MINUTES TO REMOVE THE PRESERVATIVE FROM THE MEMBRANE. DISCARD ALL OF THE PERMEATE, WHICH IS PRODUCED DURING THE FLUSH PERIOD.**

#### **MEMBRANE CLEANING**

The surface of a reverse osmosis (RO) membrane is subject to fouling by foreign materials that may be present in the feed water, such as hydrates of metal oxides, calcium precipitates, organics and biological matter. The term “fouling” includes the build-up of all kinds of layers on the membrane surface, including scaling.

Pretreatment of the feed water prior to the RO process is basically designed to reduce contamination of the membrane surfaces as much as possible. This is accomplished by installing an adequate pretreatment system and selecting optimum operating conditions, such as permeate flow rate, pressure and permeate water recovery ratio.



Occasionally, fouling of the membrane surfaces is caused by:

- Inadequate pretreatment system
- Pretreatment upset conditions
- Improper materials selection (pumps, piping, etc.)
- Failure of chemical dosing systems
- Inadequate flushing following shutdown
- Improper operational control
- Slow build-up of precipitates over extended periods (barium, silica)
- Change in feed water composition
- Biological contamination of feed water

The fouling of membrane surfaces manifests itself in performance decline; lower permeate flow rate and/or higher solute passage. Increased pressure drop between the feed and concentrate side can be a side effect of fouling.

Cleaning can be accomplished very effectively because of the combination of pH stability and temperature resistance of the membrane and the element components. However, if cleaning is delayed too long, it could be difficult to remove the foulants completely from the membrane surface. Cleaning will be more effective the better it is tailored to the specific fouling problem. Sometimes a wrong choice of cleaning chemicals can make a situation worse. Therefore, the type of foulants on the membrane surface should be determined prior to cleaning.

Fresh cleaning solution needs to be prepared when the cleaning solution becomes turbid and/or discolored. High-flow recirculation, however, should be carried out separately for each stage, so the flow rate is not too low in the first stage or too high in the last. This can be accomplished either by using one cleaning pump and operating one stage at a time.

The fouling or scaling of elements typically consists of a combination of foulants and scalants, for instance a mixture of organic fouling, colloidal fouling and biofouling. Therefore, it is very critical that the first cleaning step is wisely chosen. We strongly recommend alkaline cleaning as the first cleaning step. Acid cleaning should only be applied as the first cleaning step if it is known that only calcium carbonate or iron oxide/hydroxide is present on the membrane elements. Acid cleaners typically react with silica, organics (for instance humic acids) and biofilm present on the membrane surface which may cause a further decline of the membrane performance. Sometimes, an alkaline cleaning may restore this decline that was caused by the acid cleaner. The acid cleaning may be performed when the alkaline cleaning has effectively removed the organic fouling, colloidal fouling and biofouling.

Always measure the pH during cleaning. If the pH increases more than 0.5 pH units during acid cleaning, more acid needs to be added. If the pH decreases more than 0.5 pH units during alkaline cleaning, more caustic needs to be added.

Long soak times. It is possible for the solution to be fully saturated and the foulants can precipitate back onto the membrane surface. In addition, the temperature will drop during this period, therefore the soaking becomes less effective. It is recommended to circulate the solution regularly in order to maintain the temperature (temperature should not drop more than 5°C) and add chemicals if the pH needs to be adjusted.

Turbid or strong colored cleaning solutions should be replaced. The cleaning is repeated with a fresh cleaning solution.

If the system has to be shut down for more than 24 hours, the elements should be stored in 2% w/w M-100 solution.

### **PREPARING UNIT FOR STORAGE OR SHIPMENT**

Prior to shipping or storing your system, the system should be cleaned with an appropriate cleaner, flushed with water, and protected from biological attack with an appropriate solution for membrane elements. The membrane housing(s) and plumbing lines of the system must be completely drained. Any water remaining in the plumbing of a system may freeze, causing serious damage.

Preparing system for storage:

1. Totally immerse the elements in the membrane housing in a solution of 2 % M-100, venting the air outside of the pressure vessels. Use the overflow technique: circulate the M-100 solution in such a way that the remaining air in the system is minimized after the recirculation is completed. After the pressure vessel is filled, the M-100 solution should be allowed to overflow through an opening located higher than the upper end of the highest pressure vessel being filled.
2. Separate the preservation solution from the air outside by closing all valves. Any contact with oxygen will oxidize the M-100.
3. Check the pH once a week. When the pH becomes 3 or lower, change the preservation solution.
4. Repeat this process at least once a month.
5. During the shutdown period, the plant must be kept frost-free, or the temperature must not exceed 113°F (45°C).
6. Preparing unit for shipment:
7. Disconnect the inlet, concentrate, pre-filter, and permeate plumbing.
8. Drain all water from the pre-filter cartridge housings by unscrewing the housings, removing the pre-filter cartridges, and drain the water from the housings.
9. Disconnect the tubing from the connectors on the permeate and concentrate inlets and outlets.
10. Fully open the concentrate valve.
11. Drain the flow meters (If applicable)
12. Allow the system to drain for a minimum of eight hours or until the opened ports quit dripping.
13. After draining is complete, reconnect all of the plumbing.

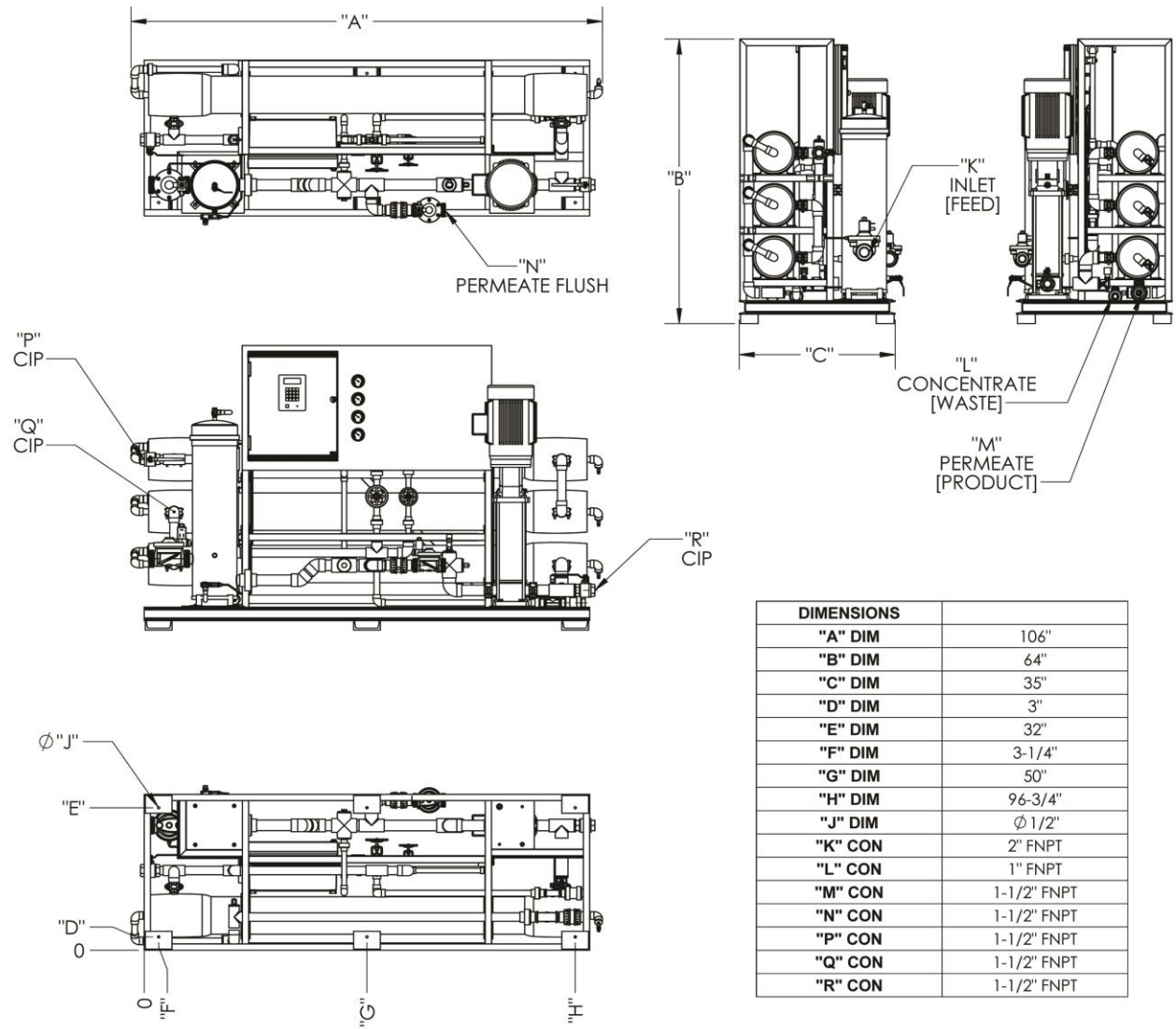


## **TROUBLESHOOTING**

<b>SYMPTOMS</b>	<b>POSSIBLE CAUSES</b>	<b>CORRECTIVE ACTION</b>
Low Inlet Pressure	Low supply pressure	Increase Inlet Pressure
	Cartridge filters plugged	Change Filters
	Solenoid valve malfunction	Replace Sol. Valve and/or Coil
	Motor may not be drawing correct current	Use clamp-on amp meter to check the motor amp draw.
	Concentrate valve might be damage	Replace Needle Valve
	Leaks	Fix any visible leaks
Low Permeate Flow	Low inlet flow	Adjust concentrate valve
	Cold feed water	See temperature correction sheet
	Low operating pressure	See low inlet pressure
	Defective membrane brine seal	Inspect & or replace brine seal
	Fouled or Scaled membrane	Clean membranes
High permeate flow	Damaged product tube o-rings	Inspect and/or replace
	Damaged or oxidized membrane	Replace membrane
	Exceeding maximum feed water temperature	See temperature correction sheet
Poor permeate quality	Low operating pressure	See low inlet pressure
	Damage product tube o-rings	Inspect and/or replace
	Damaged or oxidized membrane	Replace membrane
Membrane fouling	Metal Oxide Fouling	Improve pretreatment to remove metals. Clean with Acid Cleaners.
	Colloidal Fouling	Optimize pretreatment for colloid removal. Clean with high pH anionic cleaners.
	Scaling (CaSO <sub>4</sub> , CaSO <sub>3</sub> , BaSO <sub>4</sub> , SiO <sub>2</sub> )	Increase acid addition and antiscalant dosage for CaVO <sub>3</sub> and CaCO <sub>4</sub> . Reduce recovery. Clean with Acid Cleaners
	Biological Fouling	Shock dosage of Sodium Bi-Sulfate. Continuous feed of Sodium Bi-Sulfate at reduced pH. Chlorination and de-chlorination. Replace cartridge filters.
	Organic Fouling	Activated Carbon or other pretreatment. Clean with high pH cleaner.
	Chlorine Oxidation	Check Chlorine feed equipment and de-chlorination system.
	Abrasion of membrane by Crystalline Material	Improve pretreatment. Check all filters for media leakage.

**MANUFACTURER'S**  
**LITERATURE & DRAWINGS**

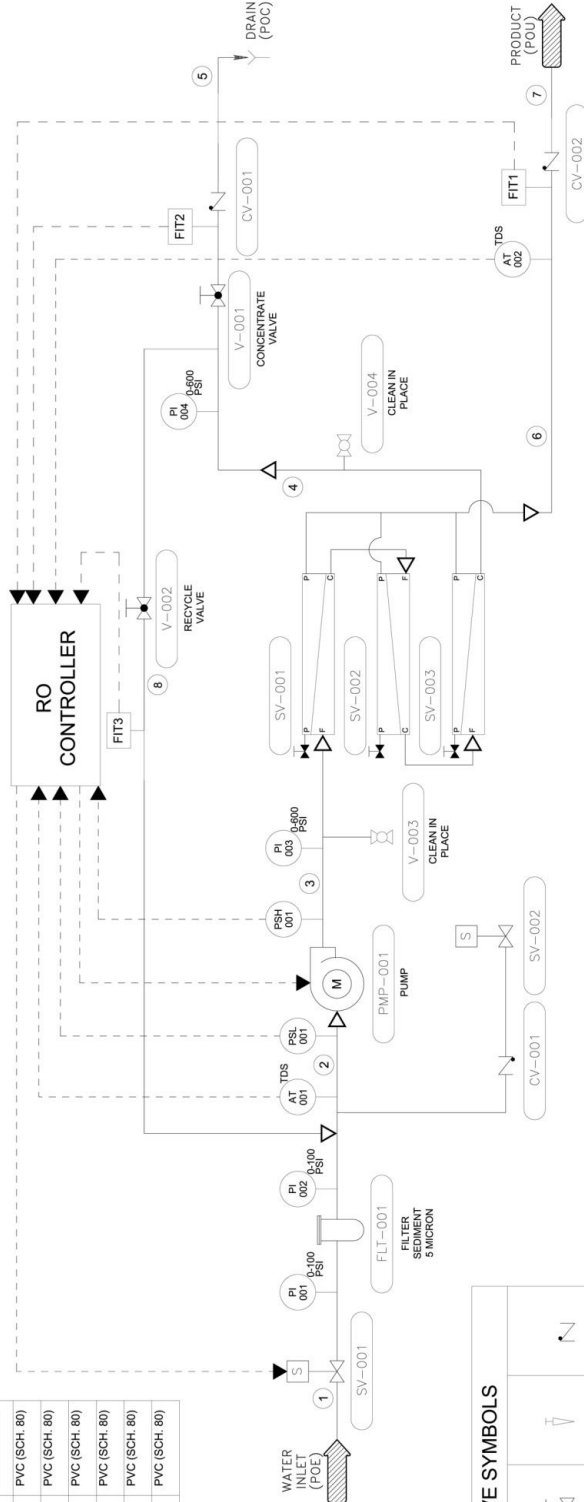
**SYSTEM DRAWING**



DIMENSIONS	
"A" DIM	106"
"B" DIM	64"
"C" DIM	35"
"D" DIM	3"
"E" DIM	32"
"F" DIM	3-1/4"
"G" DIM	50"
"H" DIM	96-3/4"
"J" DIM	Ø 1/2"
"K" CON	2" FNPT
"L" CON	1" FNPT
"M" CON	1-1/2" FNPT
"N" CON	1-1/2" FNPT
"P" CON	1-1/2" FNPT
"Q" CON	1-1/2" FNPT
"R" CON	1-1/2" FNPT

NO.	REVISION	DATE	BY	APPROVED
1				

PIPING SIZE	
STREAM	MATERIAL
1	PVC (SCH. 80)
2	PVC (SCH. 80)
3	PVC (SCH. 80)
4	PVC (SCH. 80)
5	PVC (SCH. 80)
6	PVC (SCH. 80)
7	PVC (SCH. 80)
8	PVC (SCH. 80)



VALVE SYMBOLS	MISCELLANEOUS SYMBOLS

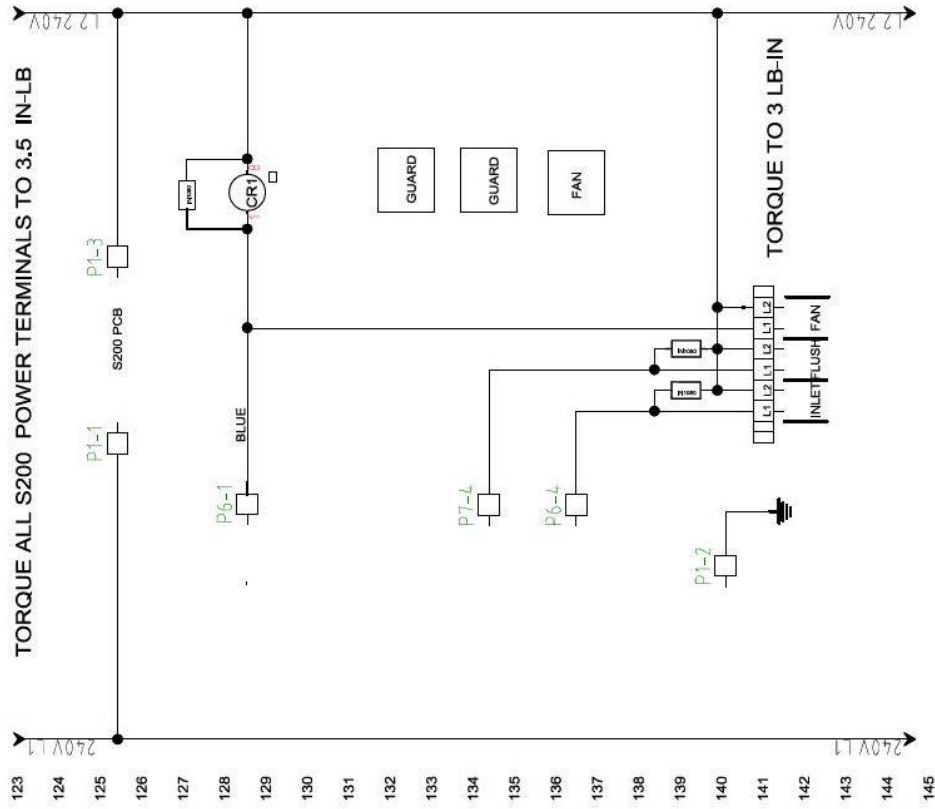
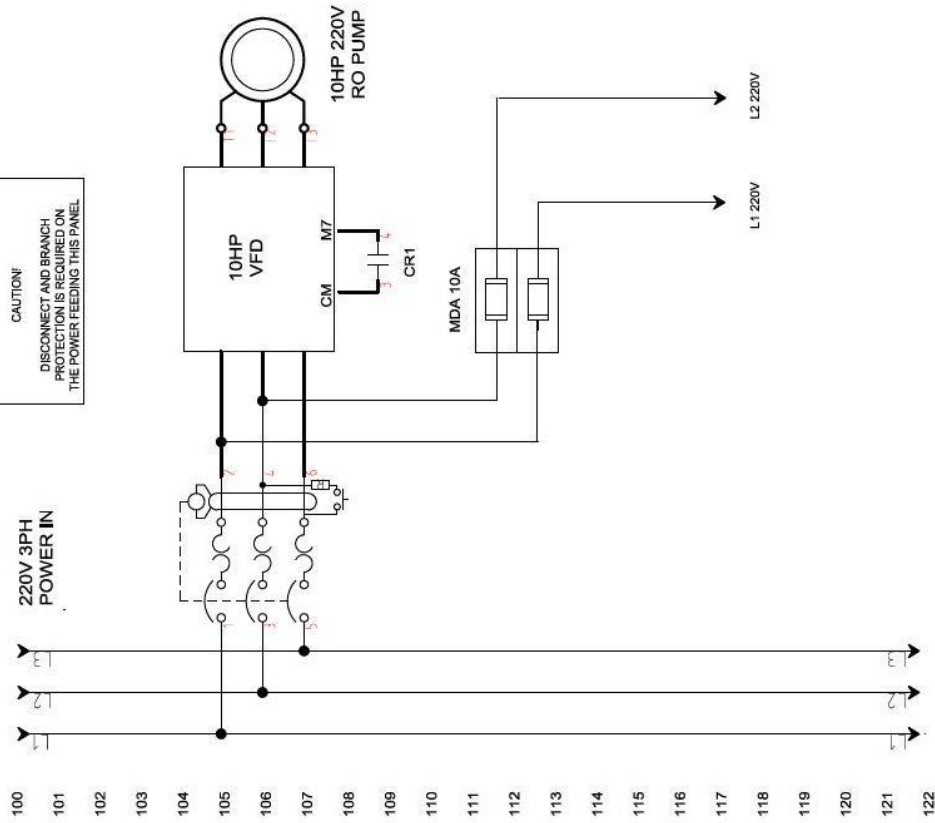
TAG NUMBER	ABBREVIATIONS
	PI - PRESSURE INDICATOR
	PSL - PRESSURE SWITCH LOW
	AT - TDS TRANSMITTER
	FI - FLOW INDICATOR (ROTAMETER)

LINE SYMBOLS

**ELECTRICAL**





## **SYSTEM WARRANTY**

### **One-Year Limited Warranty**

#### **Warranty Terms**

Subject to the terms and conditions set forth hereinafter, the Manufacturer (hereafter "Manufacturer") warrants to the original purchaser (hereafter the "Customer") that the systems and products manufactured by the Manufacturer are free from defects in material and in workmanship for twelve (12) months from the Warranty Commencement Date (as defined below) only when used strictly in accordance with the applicable operating instructions and within the range of the operating conditions specified by the Manufacturer for each such product.

This Warranty does not extend to systems, equipment, or components manufactured by others, nor to systems, equipment, or components manufactured by others and distributed by the Manufacturer. This Warranty does not extend to equipment or components manufactured by others which have been incorporated into a Manufacturer product but, if allowable, Manufacturer hereby assigns, without warranty, to the Customer its interest, if any, under any warranty made by the manufacturer of such equipment or component. This Warranty does not cover disposable items such as fuses, o-rings, regeneration materials/chemicals, or other such disposable items, which must be replaced periodically under the normal and foreseeable operating conditions of the goods warranted hereby.

#### **Warranty Commencement Date**

The Warranty Commencement Date for each Manufacturer product shall be the later of the date of: (1) receipt by the Customer, or (2) the date of installation at the Customer's premises provided that such installation must occur within three (3) months of shipment from the Manufacturer's facility. In no event shall the Warranty Commencement Date exceed three (3) months from the shipment from Manufacturer's facility. The Customer shall provide proof of purchase in order to exercise rights granted under this Warranty. If requested by the Manufacturer, the Customer must also provide proof of the installation date. Proof of installation shall be returned by Customer to the Manufacturer within thirty (30) days after installation by virtue of supplying a Warranty Validation Card supplied with each Manufacturer product fully completed and signed in ink by Customer and the authorized installer of the product.

#### **Warranty Service**

MANUFACTURER'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT (AT MANUFACTURER'S SOLE DISCRETION) OF ANY PRODUCT, OR COMPONENT THEREOF, PROVED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP WITHIN THE COVERED WARRANTY PERIOD.

The Customer, at the Customer's risk and expense, shall be responsible for returning such product or component, only after obtaining a Return Goods Authorization (RGA) number from the Manufacturer, arranging for freight prepaid, and in conformance with any special packaging and shipping instructions set forth on the operation documentation or RGA instructions, or as otherwise reasonably required, to the Manufacturer's address set forth below, together with (1) RGA number issued by the Manufacturer at Customer's request; (2) proof of purchase and, if necessary, proof of installation date; (3) a Return Goods Authorization Form; (4) a description of the suspected defects; (5) the serial number of the Manufacturer product alleged to be defective; and (6) a description of the type of water and pretreatment equipment which has been utilized in connection with the product, if any. The Manufacturer shall, in the Manufacturer's reasonable discretion, be the sole judge of whether a returned product or component is defective in material or workmanship. Required or replaced products or components shall be returned surface freight. In genuine emergency situations, the Manufacturer will (at the Manufacturer's sole discretion) forward replacement parts to Customer without waiting for authorized return of the questionable part(s). In such cases, Customer will issue a purchase order or other payment guarantee prior to shipment. If the returned part is found to have been misused or abused, or the defective part is not received by the Manufacturer within thirty (30) days; the Customer will be invoiced for the replacement part(s) provided. This Warranty does not cover or include labor and/or travel to the Customer's premise or

location or any other location. Charges of \$1000 per day plus associated travel expenses will be incurred by the Customer in providing the Warranty Service at any location other than the Manufacturer's main headquarters; that is if the Manufacturer deems that the product is not covered by said Warranty. The Manufacturer reserves the right to precondition such travel to Customer's premises upon prepayment of the Manufacturer's anticipated costs of attending such premises.

### **Voidability of Warranty**

This Warranty shall be void and unenforceable as to any Manufacturer product which has been damaged by accident, mishandling, abuse or has been repaired, modified, altered, disassembled or otherwise tampered with by anyone other than the Manufacturer or an authorized Manufacturer service representative; or, if any replacement parts are not authorized by the Manufacturer have been used, or, the product has not been installed, operated and maintained in strict accordance and adherence with the operating documentation and manuals for such product. Any expressed warranty, or similar representation of performance set forth in the operation documentation for media or resin incorporated into a Manufacturer product shall be void and unenforceable unless the feed water requirements set forth in the operating documentation for such product are unequivocally and strictly adhered to.

### **Limitations and Exclusions**

THIS WARRANTY AND REMEDIES DESCRIBED HEREIN AND HEREINABOVE ARE EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER WARRANTY OR REMEDIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MANUFACTURER BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL OR OTHER SIMILAR TYPES OF DAMAGES, FOR DAMAGES FOR THE LOSS OF PRODUCTION OR PROFITS, OR INJURY TO PERSON OR PROPERTY. NO PERSON HAS ANY AUTHORITY TO BIND MANUFACTURER TO OTHER THAN WHAT IS SET FORTH ABOVE.

THIS WARRANTY GIVES THE CUSTOMER SPECIFIC LEGAL RIGHTS AND THE CUSTOMER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. THE PARTIES RECOGNIZE AND AGREE, THAT IN ALL RESPECTS THE LAWS OF THE STATE OF CALIFORNIA SHALL APPLY TO AND SHALL GOVERN ANY INTERPRETATION OR LEGAL SIGNIFICANCE OF THIS DOCUMENT.

NO WARRANTY OR OTHER LIABILITY OF MANUFACTURER TO CUSTOMER UNDER THIS AGREEMENT OR OTHERWISE WILL IN ANY EVENT EXCEED THE COST OF REPLACEMENT OF THE APPLICABLE MANUFACTURER PRODUCT, PART, OR ACCESSORY THAT IS SUBJECT TO ANY BREACH OF MANUFACTURER'S WARRANTY. MANUFACTURER WILL NOT BE LIABLE FOR ANY DAMAGE TO ANY PROPERTY OF CUSTOMER OR TO CUSTOMER'S CUSTOMERS FOR ANY CONSEQUENTIAL, INCIDENTAL, OR ECONOMIC LOSS OR COMMERCIAL DAMAGE WHATSOEVER. REMEDIES HEREIN PROVIDED ARE EXPRESSLY MADE THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY OR OTHER OBLIGATION HEREUNDER EXPRESS OR IMPLIED OR FROM THE OPERATION OF LAW.