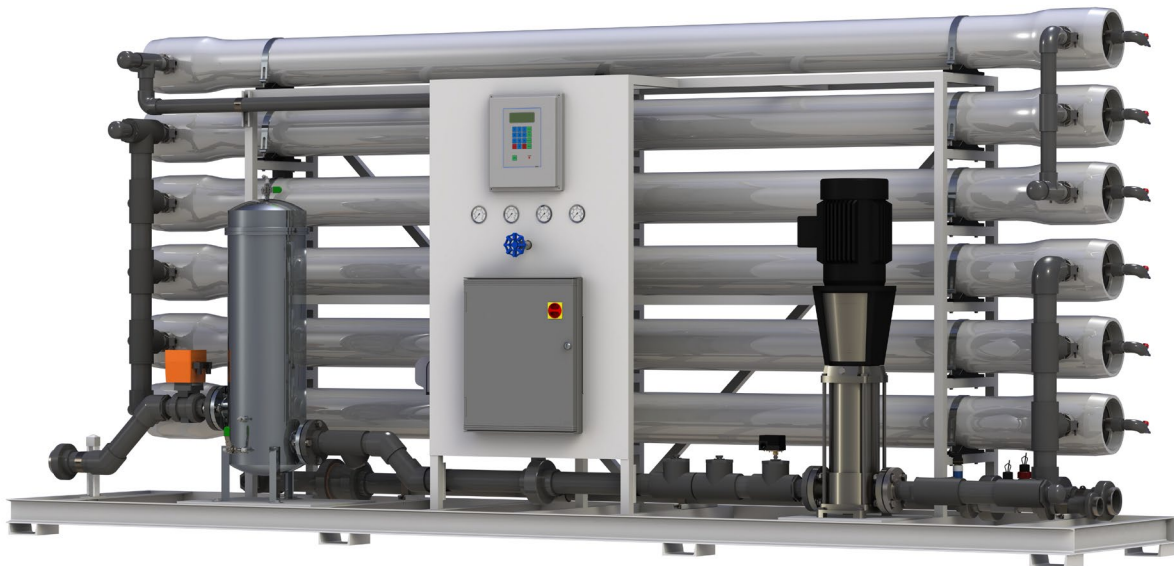


Membrane System User Manual

X1 – Series



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INTRODUCTION

The X1 – Series is a water purification unit capable of providing 32,000 to 190,000 gallons per 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 feedwater and brackish water. The construction of this unit has been engineered for durability and continuous use.

If your system is altered at the site of operation, or if the feedwater conditions change, please contact your local dealer or distributor to determine the proper recovery for your application.



NOTE: IN ORDER TO MAINTAIN THE MANUFACTURER'S WARRANTY, AN OPERATING LOG MUST BE MAINTAINED AND COPIES WILL NEED TO BE SENT TO YOUR LOCAL DEALER OR DISTRIBUTOR FOR REVIEW.



NOTE: PRIOR TO OPERATING OR SERVICING THE REVERSE OSMOSIS SYSTEM, THIS USER MANUAL MUST BE READ AND FULLY UNDERSTOOD. KEEP THIS AND OTHER ASSOCIATED INFORMATION FOR FUTURE REFERENCE AND FOR NEW OPERATORS OR QUALIFIED PERSONNEL NEAR THE SYSTEM.

SAFETY

The Safety section of this User Manual outlines the various safety headings used throughout this manual's text and are enhanced and defined below:



NOTE: INDICATES STATEMENTS THAT PROVIDE FURTHER INFORMATION AND CLARIFICATION.



CAUTION: INDICATES STATEMENTS THAT ARE USED TO IDENTIFY CONDITIONS OR PRACTICES THAT COULD RESULT IN EQUIPMENT OR OTHER PROPERTY DAMAGE.



WARNING: INDICATES STATEMENTS THAT ARE USED TO IDENTIFY CONDITIONS OR PRACTICES THAT COULD RESULT IN INJURY OR LOSS OF LIFE. FAILURE TO FOLLOW WARNINGS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH.



DO NOT, UNDER ANY CIRCUMSTANCES, REMOVE ANY CAUTION, WARNING OR OTHER DESCRIPTIVE LABELS FROM THE SYSTEM.



PLEASE READ THE ENTIRE MANUAL BEFORE PROCEEDING WITH THE INSTALLATION AND START-UP. FAILURE TO FOLLOW 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.
- PRE-TREATMENT MUST BE SUFFICIENT TO ELIMINATE CHEMICALS, ORGANICS OR INORGANICS THAT COULD ATTACK THE MEMBRANE MATERIAL.
- ALWAYS TURN OFF THE UNIT, SHUT OFF THE FEEDWATER AND DISCONNECT THE ELECTRICAL POWER BEFORE WORKING ON THE UNIT.
- NEVER ALLOW THE PUMP TO RUN DRY.
- NEVER START THE PUMP WITH THE CONCENTRATE OR GLOBE /THROTTLE VALVE CLOSED.
- NEVER ALLOW THE UNIT TO FREEZE OR OPERATE WITH A FEEDWATER TEMPERATURE ABOVE 85°F.

FEEDWATER AND OPERATION SPECIFICATIONS

Nothing has a greater effect on a reverse osmosis system than the feedwater quality.



NOTE: IT IS VERY IMPORTANT TO MEET THE MINIMUM FEEDWATER REQUIREMENTS. FAILURE TO DO SO WILL CAUSE THE MEMBRANES TO FOUL AND VOID THE MANUFACTURER'S WARRANTY.

OPERATING LIMITS*

Operating Parameters:

Feed Temperature	40 – 85°F
System Inlet Pressure	45 – 85 PSI
Maximum Operating Pressure (at 77°F)	200 PSI

Feedwater Requirements:

Maximum SDI Rating	< 3
Maximum Turbidity	1 NTU
Maximum Free Chlorine and/or Chloramines	0 PPM
PH (continuous)	2 – 11
Hardness	0 GPG

*If any of the feedwater parameters are not within the limits given, consult your local dealer or distributor for assistance.



NOTE: HIGHER TDS AND/OR LOWER TEMPERATURES WILL REDUCE THE SYSTEM'S PRODUCTION.

REJECTION, RECOVERY AND FLOW RATES

X1 – Series Reverse Osmosis Systems are designed to produce permeate water at the capacities indicated by the suffix in the system's name under the conditions listed above.

The amount of total dissolved solids (TDS) rejected by the membrane is expressed as a percentage. For example, a 99% rejection rate means that 99% of total dissolved solids do not pass through the membrane. To calculate the % rejection, use the following formula:

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

Example:

$$99\% = [(550 - 5.5) / 550] \times 100$$



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

X1 – Series Reverse Osmosis Systems are designed to reject up to 99% NaCl, unless computer projections have been provided or stated otherwise.

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

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

Example:

$$50\% = (1.02 / 2.04) \times 100$$



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

SYSTEM REQUIREMENTS AND OPERATION GUIDELINES

PLUMBING

The membranes and high pressure pumps used on the X1 – Series systems require a continuous flow of water with a minimum feed pressure of 45 psi, not to exceed 85 psi. Feed, Permeate and Concentrate ports are all labeled.

FEEDWATER CONNECTION

Attach the inlet piping to the 2” Solenoid Valve or 3” motorized 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 OR 2 PH UNITS LOWER THAN THE FEEDWATER 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 – Series reverse osmosis system is a 220 Volt, 3 Phase, 60 Hertz unit that must have an independent three phase breaker.

Ensure that the electrical circuit supplying the system is compatible with the requirements of the specific X1 model you are installing.



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.

PRE-FILTRATION

X1 – Series systems are supplied with a multi-cartridge, 5 micron sediment filter. Change these cartridges once a month or when a 10 – 15 psi differential exists between the two pre-filter gauges.



NOTE: THE SYSTEM MUST BE OPERATED WITH FILTERED WATER ONLY.

PUMP

The type of pump used on the X1 – Series system is a Vertical Multi-Stage Centrifugal Pump. Follow these guidelines to ensure proper operation of the pump:

- The pump must NEVER run dry. Operating the pump without sufficient feedwater will damage the pump.
- ALWAYS feed the pump with filtered water. The pump is susceptible to damage from sediment and debris.
- If any damage occurs to the system's pump, a re-build kit is available.

MOUNTING

The free standing system should be bolted down or securely fastened in compliance with local regulation standards.

MEMBRANE ELEMENTS

X1 – Series Reverse Osmosis Systems come pre-loaded with Low Energy BW30HRLE membranes, unless otherwise specified. General membrane element performance characteristics are listed below.

Product Specifications

Type	Diameter Inch	Membrane Area ft ² (m ²)	Salt Rejection (%)	Product Flow Rate gpd (m ³ / d)	Feed Spacer Thickness (mil)
BW30HRLE-440	8"	440 (41)	99.3%	12,650 (45.7)	28

Membrane Type		Cross Linked Fully Aromatic Polyamide Composite
Test Conditions	Feedwater Pressure Feedwater Temperature Feedwater Concentration Recovery Rate Feedwater pH	150 psi (1.03 MPa) 77°F (25°C) 2000 mg/l NaCl 15% 8
Minimum Salt Rejection		99.1%
Minimum Product Flow Rate		10,752 gpd (40.7 m3/d)

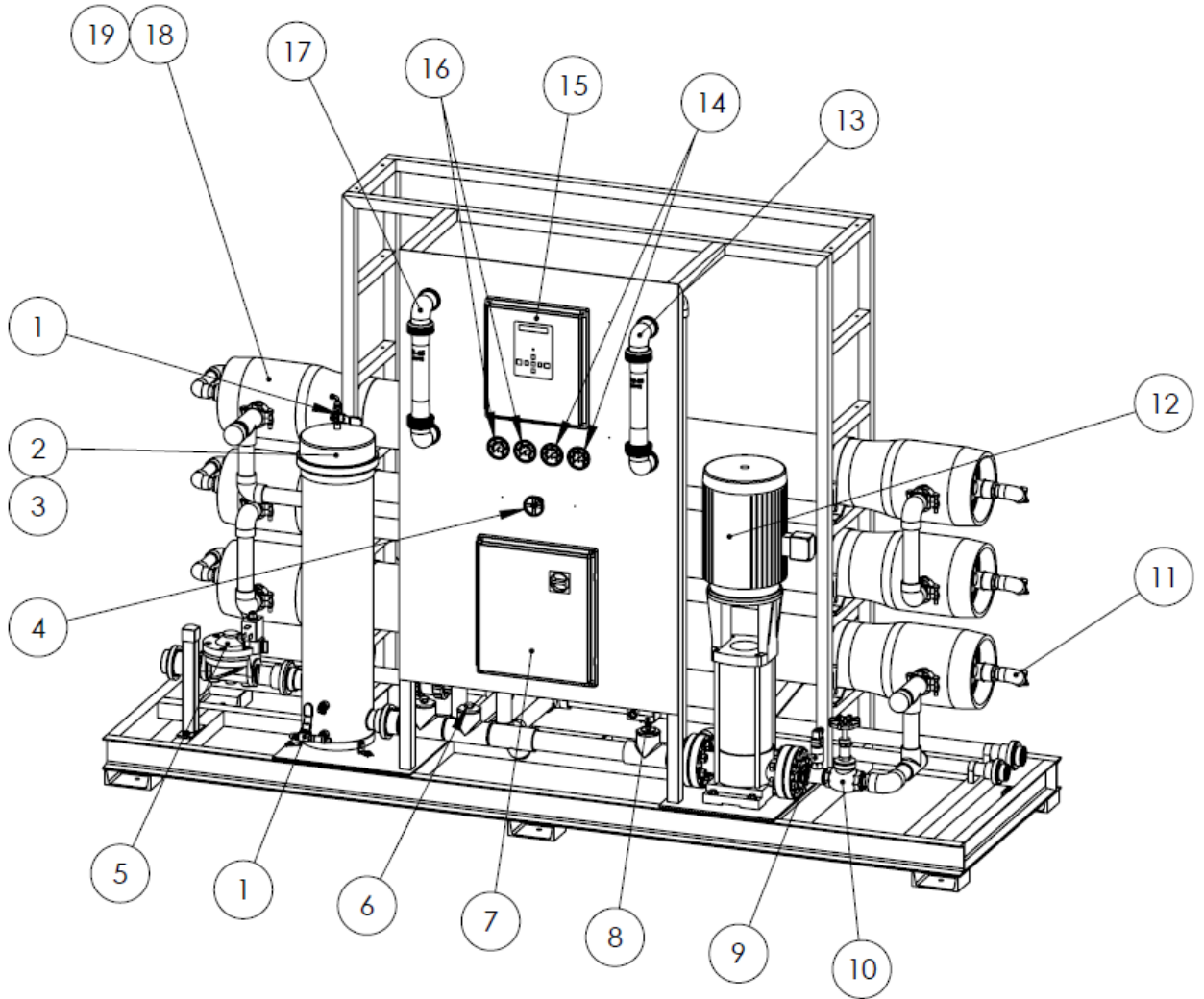
MEMBRANE OPERATING LIMITS

Membrane Type	Cross Linked Fully Aromatic Polyamide Composite
Maximum Operating Pressure	600 PSI (14 Bar)
Maximum Feed Water Temperature	113°F (45°C)
Maximum Feed Water SDI ₁₅	5
Feed Water Chlorine Concentration	Not detectable
Feed Water pH Range, Continuous Operation	2–11
Feed Water pH Range, Chemical Cleaning	1–13
Maximum Pressure Drop per Element	15 PSI (1.0 Bar)

OPERATING INFORMATION

1. All elements are wet tested, treated with a 1% by weight percent sodium bisulfite storage solution, and then vacuum packed in oxygen barrier bags, or treated with tested feedwater solution then vacuum packed in oxygen barrier bags with deoxidant inside. To prevent biological growth during short term storage, shipment or system shutdown, it is recommended that the elements be immersed in a protective solution containing 500 – 1,000 ppm of sodium bisulfite (food grade) dissolved in permeate.
2. The presence of free chlorine and other oxidizing agents under certain conditions, such as heavy metals which acts as oxidation catalyst in the feedwater will cause unexpected oxidation of the membrane. It is strongly recommended to remove these oxidizing agents contained in feedwater before operating reverse osmosis system.
3. Permeate from the first hour of operation shall be discarded.
4. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.

SYSTEM IDENTIFICATION



X1 – 3280 PICTURED

Figure 1

SYSTEM IDENTIFICATION

ITEM NUMBER	PART NUMBER	DESCRIPTION
1	202906	VALVE, BALL, 1/4" FNPT, SS
2	206851	HOUSING, FILTER, CARTRIDGE, MULTI, 304SS, 2" MNPT, 4FOS3, SHELCO
3	201932	CARTRIDGE, SEDIMENT, POLYPRO, 2.5" X 30", 5 MIC, SDF-25-3005, AXEON
4	200995	VALVE, GLOBE, SS, 1" FNPT
5	204920	VALVE, SOLENOID, N/C, 220V, 2" FNPT, 3 METER CORD, GC
6	206613	VALVE, CHECK, 1.5", PVC/VITON, GF 161.562.116
7	208860	CONTROLLER, MOTOR CONTROLS, 10HP 230V 3PH, 16X14 BOX
8	200906	SWITCH, PRESSURE, LOW, N/O 15-30, 1/4" FNPT
9	208976	SWITCH, PRESSURE, HIGH, N/C & N/O, 230PSI, 1/4" MNPT, ANFIELD
10	200996	VALVE, GLOBE, SS, 1-1/2" FNPT
11	206612	VALVE, SAMPLE, 1/4"MNPT X HOSE, PVC, EPDM, 150PSI
12	208975	PUMP, MULTI-STAGE, 10HP, 208-230/460V, 3PH, TEFC, 15SV6FC30/V12742
13	208831	METER, FLOW, PANEL MOUNT, 2-20GPM, 1" FNPT X 1" FNPT, BLUE WHITE
14	200904	GAUGE, BKM, FILL, 0-300 PSI/BAR, 2.5" DIA, 1/4" MNPT, PUROTECH
15	208859	CONTROLLER, S150, 110/220V, 14X12 BOX
16	204165	GAUGE, BKM, GLY FILL, 0-100 PSI/BAR, 2.5" DIA, 1/4" MNPT, AXEON
17	208832	METER, FLOW, PANEL MOUNT, 4-40GPM, 1" FNPT X 1" FNPT, BLUE WHITE
18	208830	VESSEL, PRESSURE, 300PSI, FRP, 8" SP, 2-ELEMENT, D-26
19	209376	MEMBRANE, BW30HRLE, 440, FILMTEC

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 each membrane into their respective pressure vessels.

REPLACING THE MEMBRANE(S):



WARNING: THE BRINE SEAL MUST BE IN THE CORRECT POSITION FOR EACH OF THE PRESSURE VESSELS. 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.

1. Remove membrane 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. Install membrane from the right side if the arrow on the pressure vessel is pointing to the left and left of the arrow if both pointing right.
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

SYSTEM PURGING



NOTE: MAKE SURE THE SYSTEM IS IN THE STANDBY POSITION BEFORE BEGINNING THIS PROCEDURE.

Carefully inspect the system before initial start-up. Check that all plumbing and electrical connections are not loose or have not come undone during shipment.

1. Fully open the concentrate valve. (#4, Figure 1, Page 12)
2. Flush the air trapped in the system with water (to avoid hammer). Open the feed valve (#5, Figure 1, Page 12) by pressing the Alarm Silence button for five seconds on a S-150 controller or by pressing the FUNCTION key, then the #2, and then the ENTER button on a S-200 controller.

INITIAL START-UP

Carefully inspect the system before initial start-up. Check that all plumbing and electrical connections are not loose or have not come undone during shipment.

Keep the permeate water line to drain for this procedure.

1. Fully open the concentrate valve located on the control panel counter-clockwise. (#4, Figure 1, Page 12). Fully close the throttle valve clockwise, then open one full turn counter-clockwise (#10, Figure 1, Page 12 and Figure 3, Page 21.)
2. Turn the system on. The unit will count down for 5 seconds before turning on the reverse osmosis pump.
3. Adjust the concentrate valve (#4, Figure 1, Page 12) and throttle valve (#10 Figure 1, Page 12 and Figure 3 Page 21) to attain proper flows. At this time, adjust the concentrate valve and recycle valve (if applicable) to obtain the designed flow and pressure. 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. During this time, make sure the permeate is directed to the drain.

After 30 minutes, shut down the system and redirect 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 feedwater.
- 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. Purge system. See Purging and Initial Start-up instructions.
2. Turn off feed supply water from system.
3. Set the system power switch to the off position. Unplug the system power cord from wall.
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.

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 instructions.

PRODUCT SPECIFICATIONS

Models	X1-2280	X1-3280	X1-4280	X1-5280	X1-3480	X1-4480	X1-5480	X1-6480
Design								
Configuration	Single Pass	Single Pass	Single Pass	Single Pass	Single Pass	Single Pass	Single Pass	Single Pass
Feedwater Source [†]	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm	TDS <2,000 ppm
Standard Recovery	60%	70%	75%	70%	75%	75%	75%	75%
Recovery with Concentrate Recycle (gpm)	80%	80%	80%	80%	80%	80%	80%	80%
Rejection and Flow Rates^{†††}								
Nominal Salt Rejection	99%	99%	99%	99%	99%	99%	99%	99%
Permeate Flow Rate (gpm)	20.00	30.00	40.00	50.00	60.00	80.00	100.00	125.00
Minimum Concentrate Flow Rate (gpm)	14	14	14	14	14	14	14	14
Connections								
Feed Connection	2" FNPT	2" FNPT	2" FNPT	2" FNPT	3" FNPT	3" FNPT	3" FNPT	3" FNPT
Permeate Connection	1 1/2" FNPT	1 1/2" FNPT	2" FNPT	2" FNPT	2 1/2" FNPT	2 1/2" FNPT	3" FNPT	3" FNPT
Concentrate Connection	1 1/4" FNPT	1 1/4" FNPT	1 1/4" FNPT	1 1/4" FNPT	1 1/2" FNPT	1 1/2" FNPT	2" FNPT	2" FNPT
Clean-In-Place Port	1 1/2" FNPT	1 1/2" FNPT	1 1/2" FNPT	1 1/2" FNPT	2" FNPT	2" FNPT	2" FNPT	2" FNPT
Chemical Feed Port	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT
Membranes								
Membrane(s) Per Vessel	2	2	2	2	4	4	4	4
Membrane Quantity	4	6	8	10	12	16	20	24
Membrane Size	8040	8040	8040	8040	8040	8040	8040	8040
Vessels								
Vessel Array	1:1	1:1:1	1:1:1:1	2:1:1:1	2:1	2:1:1	3:1:1	3:2:1
Vessel Quantity	2	3	4	5	3	4	5	6
Pumps								
Pump Type	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump	Vertical Multi-Stage Centrifugal Pump
Motor HP	10	10	10	10	15	15	20	20
System Electrical								
Standard Voltage + Amp Draw	208V-230V, 60Hz, 3PH, 28A-27A**	208V-230V, 60Hz, 3PH, 28A-27A**	208V-230V, 60Hz, 3PH, 28A-27A**	208V-230V, 60Hz, 3PH, 28A-27A**	208V-230V, 60Hz, 3PH, 40.5A-37A**	208V-230V, 60Hz, 3PH, 40.5A-37A**	208V-230V, 60Hz, 3PH, 49A**	208V-230V, 60Hz, 3PH, 49A**
Systems Dimensions								
Approximate Dimensions* L x W x H	112"x38"x86"	112"x38"x86"	112"x38"x86"	112"x38"x86"	194"x42"x87"	194"x42"x87"	194"x42"x87"	194"x42"x87"
Approximate Weight	1,285 lbs	1,435 lbs	1,585 lbs	1,735 lbs	2,005 lbs	2,275 lbs	2,645 lbs	2,910 lbs

Warranty Evaluation Test Conditions: Permeate flow rates and salt rejection based on the following test conditions – 550 ppm, filtered and dechlorinated municipal tap water, 77°F / 25°C, 15% recovery, 7.0 pH and the specified operating pressure for membrane element type. Data taken after 60 minutes of operation.

* Does not include operating space requirements.

** Varies with motor manufacturer.

Operating Limits^{††}

Design Temperature	77°F	Maximum Turbidity (NTU)	0
Maximum Feed Temperature	85°F	Maximum Free Chlorine (ppm)	0
Minimum Temperature	40°F	Maximum TDS (ppm)	2,000
Maximum Ambient Temperature	120°F	Maximum Hardness (gpg)	0
Minimum Ambient temperature	40°F	Maximum PH (continuous)	11
Maximum Feed Pressure	85	Minimum PH (continuous)	2
Minimum Feed Pressure	45	Maximum PH (cleaning 30 minutes)	12
Maximum Operating Pressure	200	Minimum PH (cleaning 30 minutes)	1
Maximum SDI Rating	<3		

† Low temperatures and feedwater quality, such as high TDS levels will significantly affect the systems production capabilities and performance. Computer projections must be run for individual applications which do not meet or exceed minimum and maximum operating limits for such conditions.

†† System pressure is variable due to water conditions. Permeate flow will increase at a higher temperature and will decrease at a lower temperature.

††† Product flow and maximum recovery rates are based on feedwater conditions as stated above. Do not exceed recommended permeate flow.

Design conditions are not identical to test conditions, please contact the manufacturer or your supplier for more information.

Proper start – up of reverse osmosis water treatment systems is essential to prepare the membranes for operating service and to prevent membrane damage due to overfeeding or hydraulic shock. Before initiating system start – up procedures, membrane pretreatment, loading of the membrane elements, instrument calibration and other system checks should be completed.

Avoid any abrupt pressure or cross–flow variations on the spiral elements during start–up, shutdown, cleaning or other sequences to prevent possible membrane damage. During start–up, a gradual change from a standstill to operating state is recommended as follows:

- Feed pressure should be increased gradually over a 30 – 60 second time frame.
- Cross – flow velocity at set operating point should be achieved gradually over 15 – 20 seconds.
- Permeate obtained from first hour of operation should be discarded.
- Maximum pressure drops across an entire pressure vessel (housing) is 30 psi / 2.1 bar.
- Avoid static permeate–side backpressure at all times.

Under certain conditions, the presence of free chlorine, chloramines and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, the manufacturer recommends removing all oxidizing agents by pretreatment prior to membrane exposure. Please contact the manufacturer or your supplier for more information.

Do not use the initial permeate for drinking water or food preparation. Keep elements moist at all times after initial wetting. To prevent biological growth during prolonged system shutdowns, it is recommended that membrane elements be immersed in a preservative solution. Rinse out the preservative before use. For membrane warranty details, contact the manufacturer or your supplier for more information.

If operating limits and guidelines given in this product specification sheet are not strictly followed, the warranty will be null and void. The customer is fully responsible for the effects of incompatible chemicals and lubricants on elements. Use of any such chemicals or lubricants will void the warranty. These membranes may be subject to drinking water application restrictions in some countries: check the application status before use and sale. The use of this product in and of itself does not guarantee the removal of cysts and pathogens from water. Effective cyst and pathogen reduction is dependent on the complete system (solution) design and the operation and maintenance of the system.

No freedom from infringement of any patent owned by the manufacturer or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for customer's use and for ensuring that customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. The claims made may not have been approved for use in all countries. The manufacturer assumes no obligation or liability for the information in this document. **NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDE.**

OPERATION AND MAINTENANCE

The reverse osmosis process causes the concentration of impurities. The impurities may precipitate (come out of solution) when their concentration reaches saturation levels.



NOTE: PRECIPITATION CAN SCALE OR FOUL MEMBRANES AND MUST BE PREVENTED.

Check your feedwater chemistry and pre-treat the water and/or reduce the system's recovery as required. If necessary, consult with your local dealer or distributor.

PRE-FILTER PRESSURE GAUGES

These gauges measure the feedwater pressure when it enters and exits the pre-filters. A pressure differential of 10 – 15 psi or more on the two pressure gauges indicates that the pre-filters require servicing. For example, if the inlet pressure is 45 psi, the filter should be changed when the outlet pressure is 30 psi or below.

PERMEATE (PRODUCT) FLOW METER AND CONCENTRATE (WASTE) FLOW METER

These flow meters indicate the flow rates of the permeate and concentrate water. The measurements, when added together, also indicate the feedwater flow rate or (total flow rate).

CONCENTRATE RECYCLE FLOW METER

The concentrate recycle flow meter indicates the amount of concentrate water being directed back to the inlet of the pump.



CAUTION: EXCESSIVE RECYCLING MAY CAUSE PREMATURE FOULING OR SCALING OF THE MEMBRANE ELEMENTS.

LOW PRESSURE SWITCH

The low pressure switch shuts off the system when the feedwater pressure drops below 15 psi, preventing damage to the pump. The system restarts automatically when there is a constant pressure of 35 psi or more.

HIGH PRESSURE SWITCH

The high pressure switch shuts off the system when pump pressure exceeds HP switch set points.



If you notice the high pressure alarm, turn the system off and inspect valves and piping for instructions.

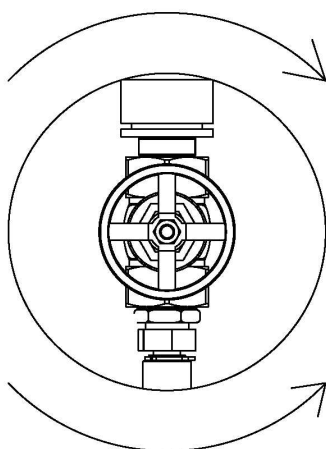
PUMP THROTTLE VALVE

The Pump Throttle Valve is installed on the discharge side of the pump as a standard feature on the X1 – 2280 and X1 – 5280 Reverse Osmosis Systems. It provides an adjustment for pump pressure. As the feedwater temperature decreases, and/or the feedwater TDS increases, the system will require a higher operating pressure to produce the specified permeate flow. The X1 – 3480 to X1 – 6470 system models utilize a VFD to increase / decrease pressure and flows. Therefore, the throttle valve has been removed.

ADJUSTING THE THROTTLE VALVE

To decrease the pressure, turn the handle clockwise. To increase the pressure, turn the handle counter clockwise. (Figure 3)

DECREASE PRESSURE



INCREASE PRESSURE

Figure 3

FLUSHING THE SYSTEM MANUALLY

The system should be flushed weekly to remove sediment from the surface of the membranes. To manually flush the system, follow these steps:

1. The system must be operating during the flush procedure.
2. Fully open the concentrate valve by turning it counter-clockwise.
(#4, Figure 1, Page 12)
3. Allow the system to run for 10 to 20 minutes.
4. After 10 to 20 minutes, close the concentrate valve to its previous setting.
Ensure the proper concentrate flow rate is going to the drain.
5. The system is now ready to operate.

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 membranes. The pressure vessels 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. Completely immerse the elements in the membrane housings using 2% M-100 solution*. 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. *For cold weather/winter storage add 20% by weight Polyglycol to the 2% M-100 solution. Add Polyglycol AFTER the 2% M-100 solution has been mixed.
2. Separate the preservation solution from the air outside by closing all valves. Any contact with oxygen will oxidize the M-100 solution.
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.

During the shut-down period, the plant must be kept frost-free, or the ambient temperature must not exceed 120°F (48.8°C) ambient.

Preparing unit for shipment:

1. Disconnect the inlet, concentrate, pre-filter, and permeate plumbing.
2. 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.
3. Disconnect the tubing from the connectors on the permeate and concentrate inlets and outlets.
4. Fully open the concentrate valve.
5. Drain the flow meters.

Allow the system to drain for a minimum of eight hours or until the opened ports quit dripping.

After draining is complete, reconnect all of the plumbing.

TROUBLESHOOTING

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
Low Inlet Pressure	Low supply pressure	Increase inlet pressure
	Cartridge filters plugged	Change filters
	Feed valve malfunction	Inspect / Replace
	Leaks	Fix any visible leaks
Low Permeate Flow	Low inlet flow	Adjust concentrate valve
	Cold feedwater	See temperature correction sheet
	Low operating pressure	See low inlet pressure
	Defective membrane brine seal	Inspect and/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 feedwater 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 ₄ , CaSO ₃ , BaSO ₄ , SiO ₂)	Increase acid addition and antiscalant dosage for CaVO ₃ and CaCO ₄ . 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 another pretreatment. Clean with high pH cleaner
	Abrasion of membrane by crystalline material	Improve pretreatment. Check all filters for media leakage

ABNORMAL PERMEATE FLOW

Permeate flow should be within 20% of the rated production, after correcting the feedwater temperatures above or below 77°F. Check the permeate flow meter to determine the permeate flow rate.



NOTE: TO DETERMINE THE TEMPERATURE CORRECTION FACTOR, LOCATE THE TEMPERATURE CORRECTION TABLE IN THIS USER MANUAL AND FOLLOW THE DIRECTIONS.

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 ₃)				

TEMPERATURE CORRECTION FACTORS FOR MEMBRANE

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.)

If a system is rated to produce 5 gpm of permeate water at 77°F, the same system will produce more water at a higher temperature. It will also produce less water at a lower temperature. Use the temperature correction table to obtain the correct flow.

Example:

5 gpm at 59°F ($5 \div 1.42 = 3.52$ gpm)

5 gpm at 77°F ($5 \div 1 = 5$ gpm)

5 gpm at 84°F ($5 \div 0.89 = 5.62$ gpm)

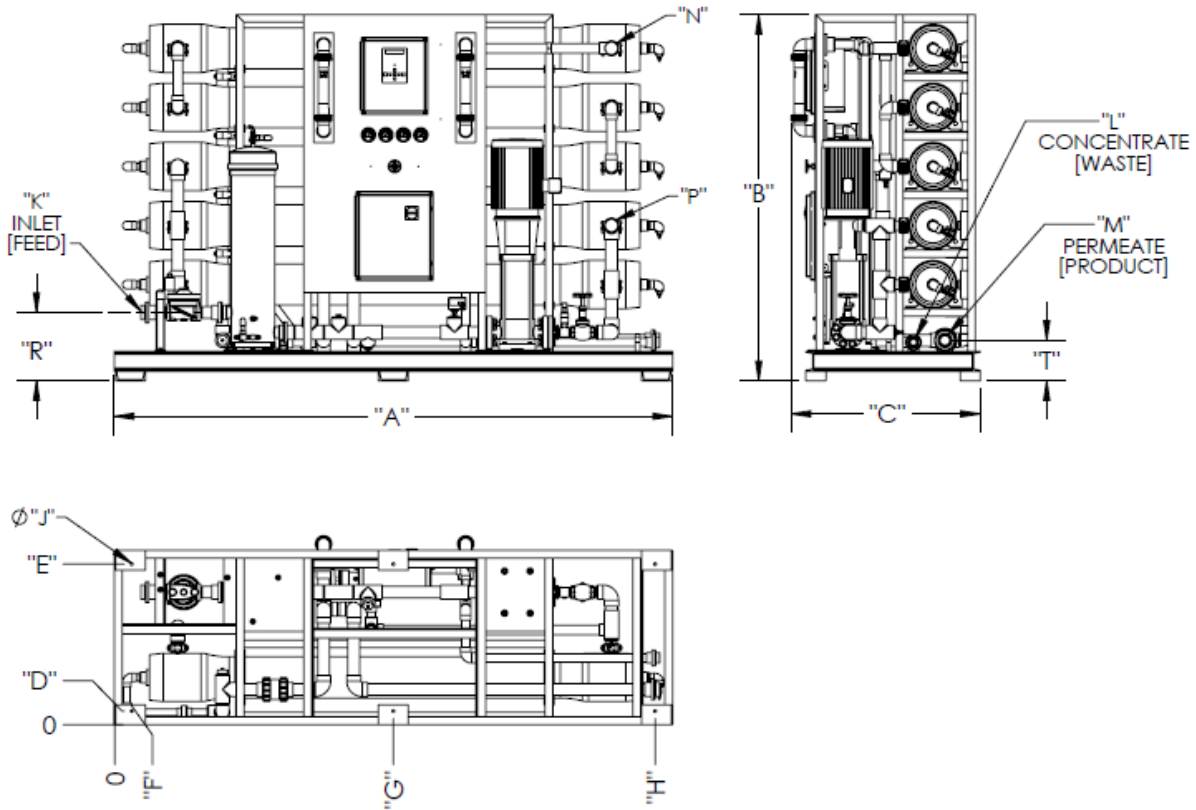
SERVICE ASSISTANCE

If service assistance is required:

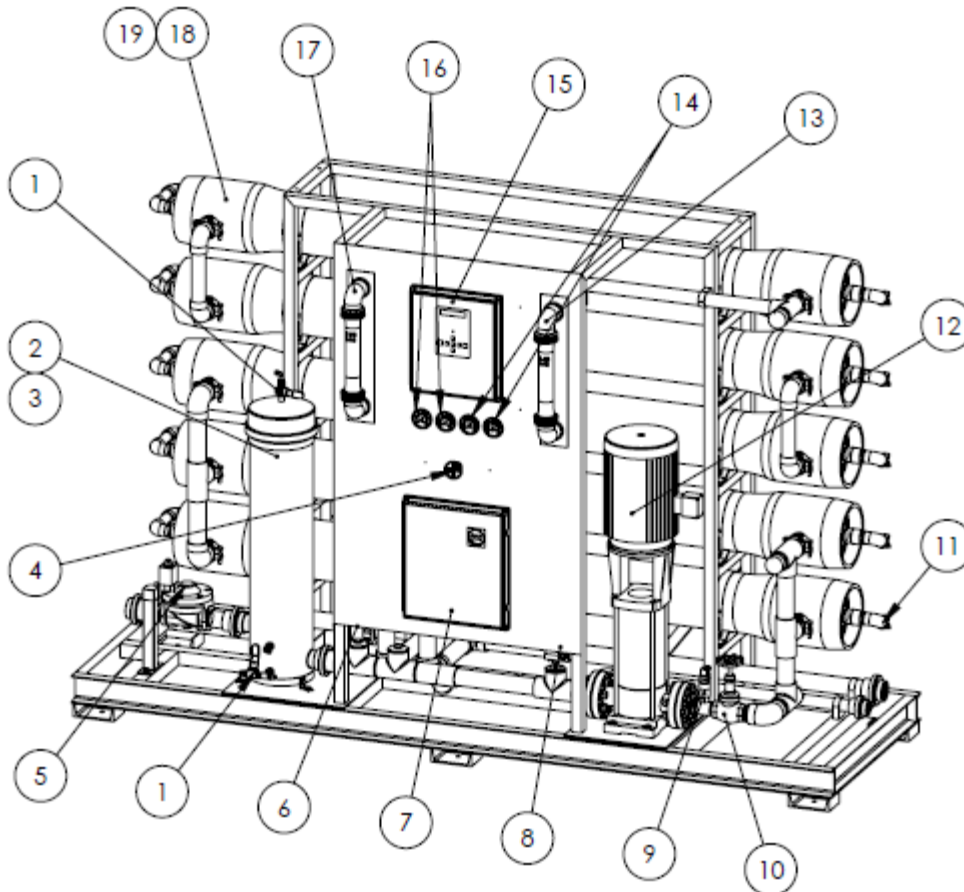
- Contact your local dealer or distributor
- Prior to making the call, have the following information available:
 - System installation date
 - Serial number
 - Daily log sheets
 - Current operating parameters (e.g., flow, operating pressures, pH, etc.)
 - Detailed description of the problem

SYSTEM DRAWINGS

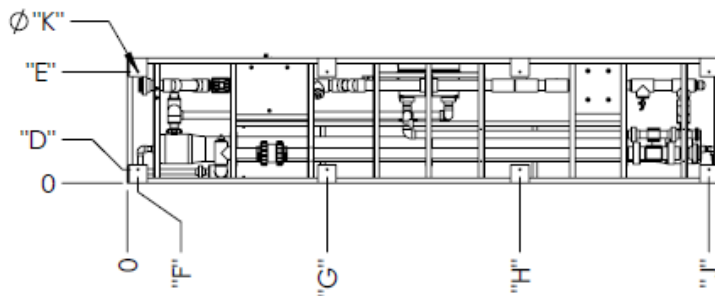
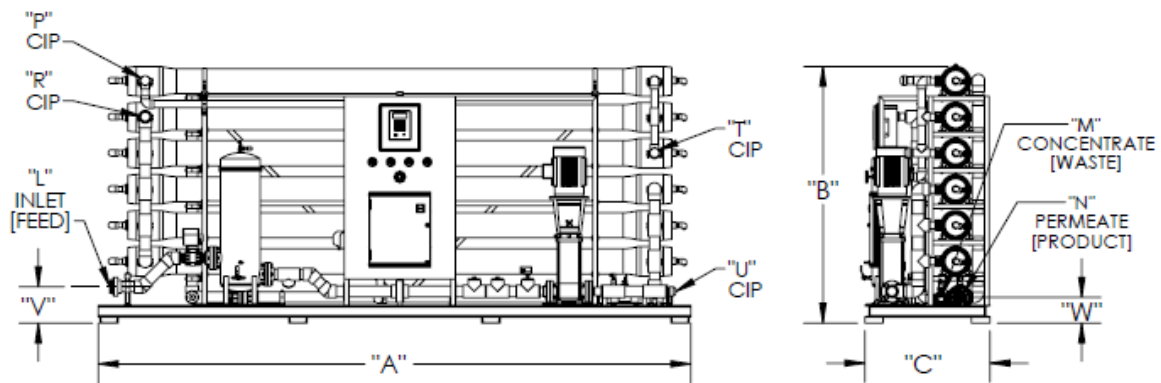
DIMENSIONS	X1-2280	X1-3280	X1-4280	X1-5280
"A" DIM	112"	112"	112"	112"
"B" DIM	73-1/2"	73-1/2"	73-1/2"	73-1/2"
"C" DIM	38"	38"	38"	38"
"D" DIM	2-3/4"	2-3/4"	2-3/4"	2-3/4"
"E" DIM	32-1/4"	32-1/4"	32-1/4"	32-1/4"
"F" DIM	3-1/2"	3-1/2"	3-1/2"	3-1/2"
"G" DIM	56"	56"	56"	56"
"H" DIM	108-1/2"	108-1/2"	108-1/2"	108-1/2"
"J" DIM	∅ 1/2"	∅ 1/2"	∅ 1/2"	∅ 1/2"
"K" CON	2" FNPT	2" FNPT	2" FNPT	2" FNPT
"L" CON	1-1/4" FNPT	1-1/4" FNPT	1-1/4" FNPT	1-1/4" FNPT
"M" CON	1-1/2" FNPT	1-1/2" FNPT	2" FNPT	2" FNPT
"N" CON	1-1/2" FNPT	1-1/2" FNPT	1-1/2" FNPT	1-1/2" FNPT
"P" CON	1-1/2" FNPT	1-1/2" FNPT	1-1/2" FNPT	1-1/2" FNPT
"R" DIM	15-1/2"	15-1/2"	15-1/2"	15-1/2"
"T" DIM	8"	8"	8"	8"



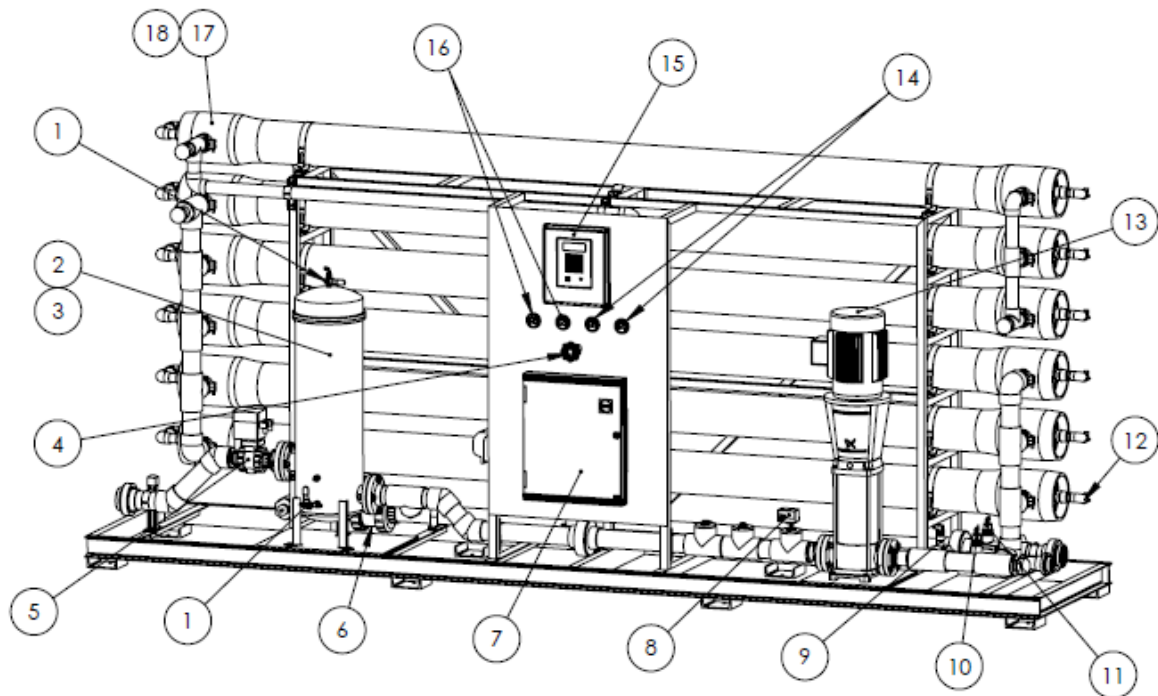
ITEM NO.	PART NUMBER	DESCRIPTION	QTY	X1 MODEL
1	202906	VALVE, BALL, 1/4" FNPT, SS	2	2280-5280
2	206851	HOUSING, FILTER, CARTRIDGE, MULTI, 304SS, 2" MNPT, 4FOS3, SHELCO	1	2280-3280
2	208982	HOUSING, FILTER, CARTRIDGE, MULTI, 304SS, 2" MNPT, 5FOS3, SHELCO	1	4280-5280
3	201932	CARTRIDGE, SEDIMENT, POLYPRO, 2.5" X 30", 5 MIC, SDF-25-3005, AXEON	4	2280-3280
3	201932	CARTRIDGE, SEDIMENT, POLYPRO, 2.5" X 30", 5 MIC, SDF-25-3005, AXEON	5	4280-5280
4	200995	VALVE, GLOBE, SS, 1" FNPT	1	2280-5280
5	204920	VALVE, SOLENOID, N/C, 220V, 2" FNPT, 3 METER CORD, GC	1	2280-5280
6	206613	VALVE, CHECK, 1.5", PVC/ITON, GF 161.562.116	1	2280-3280
6	207748	VALVE, CHECK, 2" PVC/EPDM, GF 161.562.107	1	4280-5280
7	208860	CONTROLLER, MOTOR CONTROLS, 10HP 230V 3PH, 16X14 BOX	1	2280-5280
8	200906	SWITCH, PRESSURE, LOW, N/O 15-30, 1/4" FNPT	1	2280-5280
9	208976	SWITCH, PRESSURE, HIGH, N/C & N/O, 230PSI, 1/4" MNPT, ANFIELD	1	2280-5280
10	200996	VALVE, GLOBE, SS, 1-1/2" FNPT	1	2280-5280
11	206612	VALVE, SAMPLE, 1/4"MNPT X HOSE, PVC, EPDM, 150PSI	2-5	2280-5280
12	208975	PUMP, MULTI-STAGE,10HP, 208-230/460V, 3PH, TEFC, 15SV6FC30/V12742	1	2280-5280
13	208831	METER, FLOW, PANEL MOUNT, 2-20GPM, 1" FNPT X 1" FNPT, BLUE WHITE	1	2280-3280
13	208832	METER, FLOW, PANEL MOUNT, 4-40GPM, 1" FNPT X 1" FNPT, BLUE WHITE	1	4280-5280
14	200904	GAUGE, BKM, FILL, 0-300 PSI/BAR, 2.5" DIA, 1/4" MNPT, PUROTECH	2	2280-5280
15	208859	CONTROLLER, S150, 110/220V, 14X12 BOX	1	2280-5280
16	204165	GAUGE, BKM, GLY FILL, 0-100 PSI/BAR, 2.5" DIA, 1/4" MNPT, AXEON	2	2280-5280
17	208832	METER, FLOW, PANEL MOUNT, 4-40GPM, 1" FNPT X 1" FNPT, BLUE WHITE	1	2280-3280
17	209030	METER, FLOW, PM, 7-70GPM/LPM, SS 316 FLOAT, 2" MNPT	1	4280-5280
18	208830	VESSEL, PRESSURE, 300PSI, FRP, 8" SP, 2-ELEMENT, D-26	2-5	2280-5280
19	209376	MEMBRANE, BW30HRLE, 440, FILMTEC	4-10	2280-5280



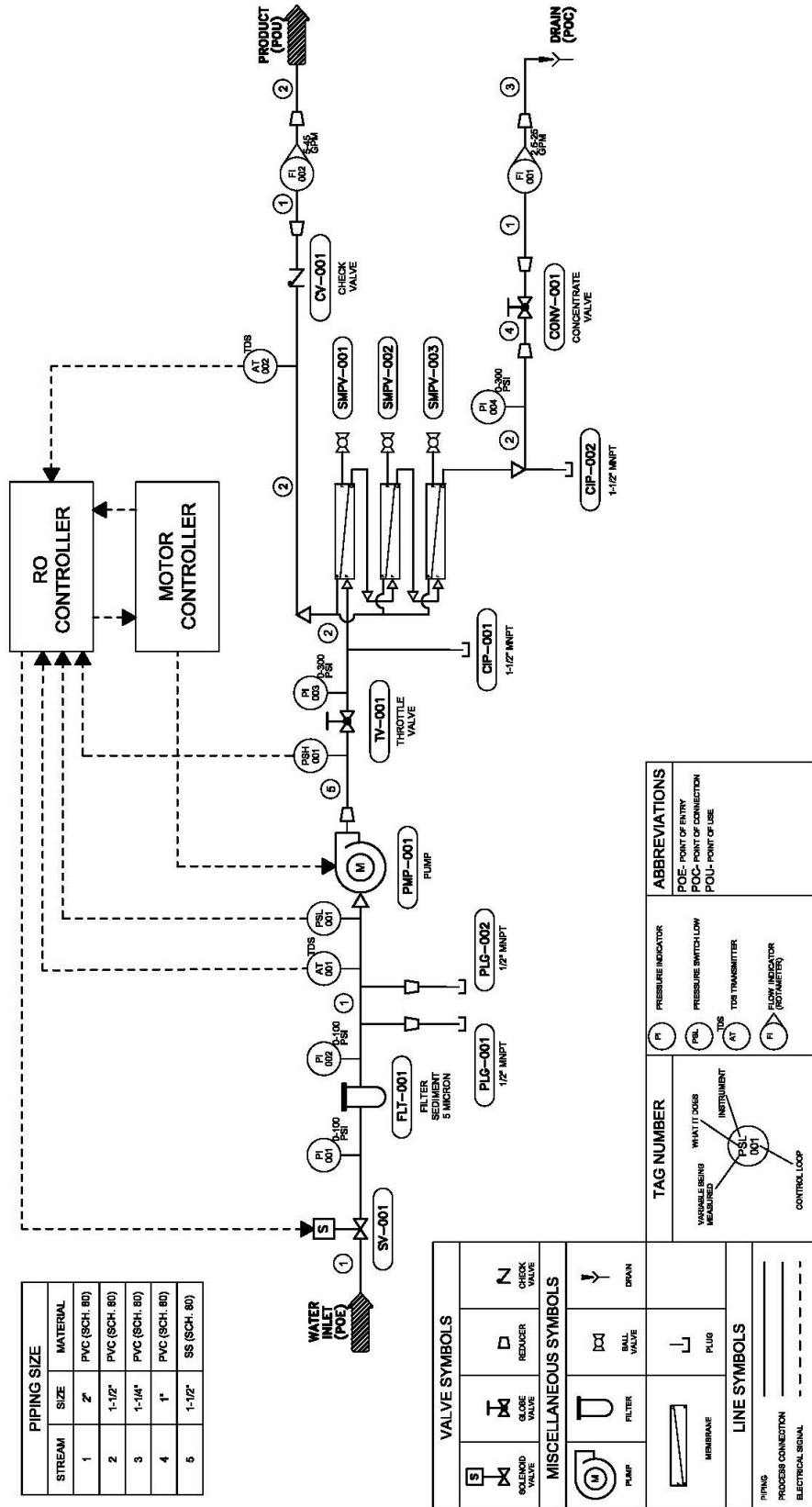
DIMENSIONS	X1-3480	X1-4480	X1-5480	X1-6480
"A" DIM	194"	194"	194"	194"
"B" DIM	74-1/2"	74-1/2"	74-1/2"	84-1/4"
"C" DIM	41"	41"	41"	41"
"D" DIM	4-1/2"	4-1/2"	4-1/2"	4-1/2"
"E" DIM	36-1/2"	36-1/2"	36-1/2"	36-1/2"
"F" DIM	3-1/2"	3-1/2"	3-1/2"	3-1/2"
"G" DIM	65-1/2"	65-1/2"	65-1/2"	65-1/2"
"H" DIM	129"	129"	129"	129"
"J" DIM	191"	191"	191"	191"
"K" DIM	Ø 1/2"	Ø 1/2"	Ø 1/2"	Ø 1/2"
"L" CON	3" FNPT	3" FNPT	3" FNPT	3" FNPT
"M" CON	1-1/2" FNPT	1-1/2" FNPT	2" FNPT	2" FNPT
"N" CON	2-1/2" FNPT	2-1/2" FNPT	3" FNPT	3" FNPT
"P" CON	2" FNPT	2" FNPT	2" FNPT	2" FNPT
"R" CON	2" FNPT	2" FNPT	2" FNPT	2" FNPT
"T" CON	2" FNPT	2" FNPT	2" FNPT	2" FNPT
"U" CON	2" FNPT	2" FNPT	2" FNPT	2" FNPT
"V" DIM	12"	12"	12"	12"
"W" DIM	8-1/2"	8-1/2"	8-1/2"	8-1/2"



ITEM NO.	PART NUMBER	DESCRIPTION	QTY	X1 MODEL
1	202908	VALVE, BALL, 1/4" FNPT, SS	2	3480-6480
2	208883	HOUSING, FILTER, CARTRIDGE, MULTI, 304SS, 3" FLANGE, 12FOS3, SHELCO	1	3480-6480
3	201932	CARTRIDGE, SEDIMENT, POLYPRO, 2.5" X 30", 5 MIC, SDF-25-3005, AXEON	12	3480-6480
4	200996	VALVE, GLOBE, SS, 1-1/2" FNPT	1	3480-6480
5	206811	VALVE, BALL, 2" MOTORIZED, PVC, 100-230V, TYPE 107, EA11	1	3480-6480
6	209619	VALVE, CHECK, 2-1/2" PVC/EPDM, GF 161.562.108	1	3480-4480
6	208977	VALVE, CHECK, 3" PVC/EPDM, GF 161.562.109	1	5480-6480
7	209006	CONTROLLER, 15HP VFD, 220V 3PH 60HZ, ENCLOSURE 24X20X12	1	3480-4480
7	209007	CONTROLLER, 20HP VFD, 220V 3PH 60HZ, ENCLOSURE 24X20X12	1	5480-6480
8	200906	SWITCH, PRESSURE, LOW, N/O 15-30, 1/4" FNPT	1	3480-6480
9	208976	SWITCH, PRESSURE, HIGH, N/C & N/O, 230PSI, 1/4" MNPT, ANFIELD	1	3480-6480
10	209133	SENSOR, FLOW, PVC W/PIPE, 1-1/2" PADDLE WHEEL, SIGNET	1	3480-4480
10	209071	SENSOR, FLOW, PVC W/PIPE, 2" PADDLE WHEEL, SIGNET	1	5480-6480
11	209616	SENSOR, FLOW, PVC W/PIPE, 2-1/2" PADDLE WHEEL, SIGNET	1	3480-4480
11	209072	SENSOR, FLOW, PVC W/PIPE, 3" PADDLE WHEEL, SIGNET	1	5480-6480
12	206812	VALVE, SAMPLE, 1/4" MNPT X HOSE, PVC, EPDM, 150PSI	4-6	4480-6480
13	208996	PUMP, 15HP, 3PH, 208-230/480V, CR120-6, GRUNDFOS	1	3480-4480
13	208997	PUMP, 20HP, 3PH, 208-230/460V, CRN32-5, GRUNDFOS	1	5480-6480
14	200904	GAUGE, BKM, FILL, 0-300 PSI/BAR, 2.5" DIA, 1/4" MNPT, PUROTECH	2	3480-6480
15	209105	CONTROLLER, COMPUTER, S200, 14X12 BOX, NO FLOW SENSORS	1	3480-6480
16	204165	GAUGE, BKM, GLY FILL, 0-100 PSI/BAR, 2.5" DIA, 1/4" MNPT, AXEON	2	3480-6480
17	208973	HOUSING, MEMBRANE, FRP-300S, 80160, 1.25" MNPT P X 2" F/C PORTS, 2E6E, PROTEC	3-6	3480-6480
18	209376	MEMBRANE, BW30HRLE, 440, FILMTEC	12-24	3480-6480



X1 - 3280



PIPING SIZE	
STREAM	MATERIAL
1	PVC (SCH. 80)
2	PVC (SCH. 80)
3	PVC (SCH. 80)
4	PVC (SCH. 80)
5	SS (SCH. 80)

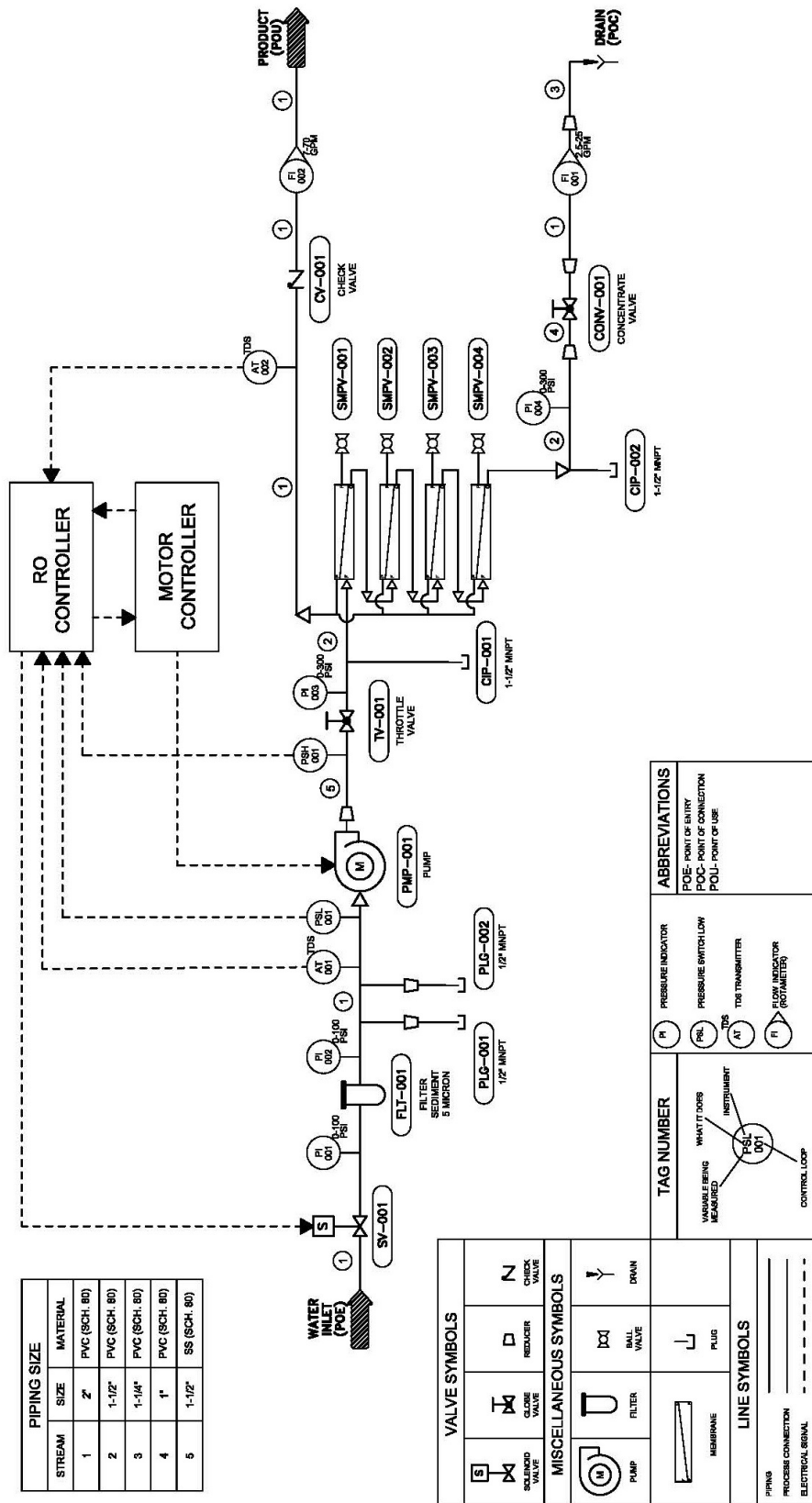
VALVE SYMBOLS	

MISCELLANEOUS SYMBOLS	

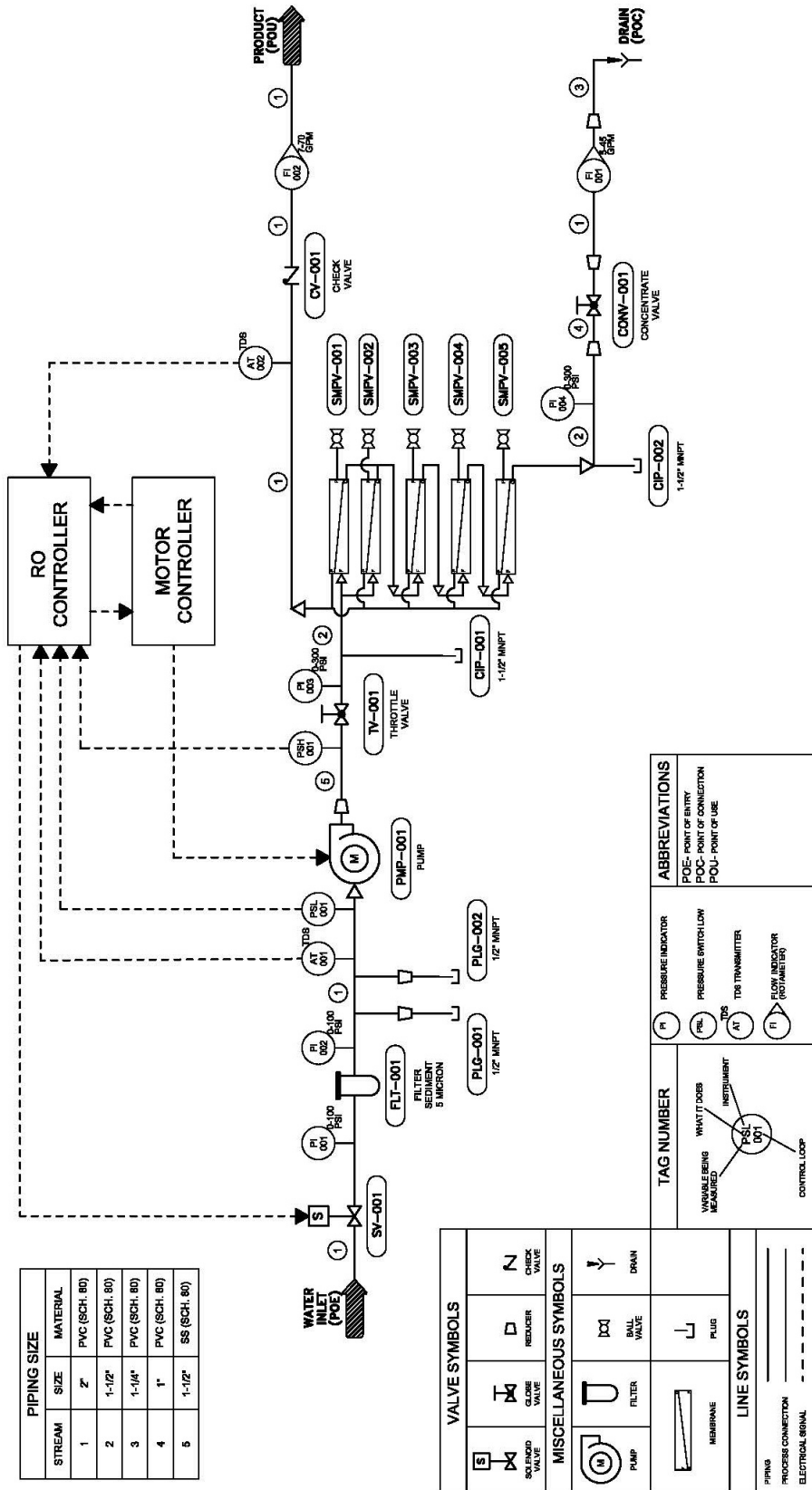
LINE SYMBOLS	

TAG NUMBER	ABBREVIATIONS
WHAT IT DOES VARIABLES BEING MEASURED	PI - PRESSURE INDICATOR PIL - PRESSURE SWITCH LOW TDS - TDS TRANSMITTER FI - FLOW INDICATOR (ROTAMETER)
INSTRUMENT CONTROL LOOP	POE - POINT OF ENTRY POC - POINT OF CONNECTION POU - POINT OF USE

X1 - 4280



X1 - 5280

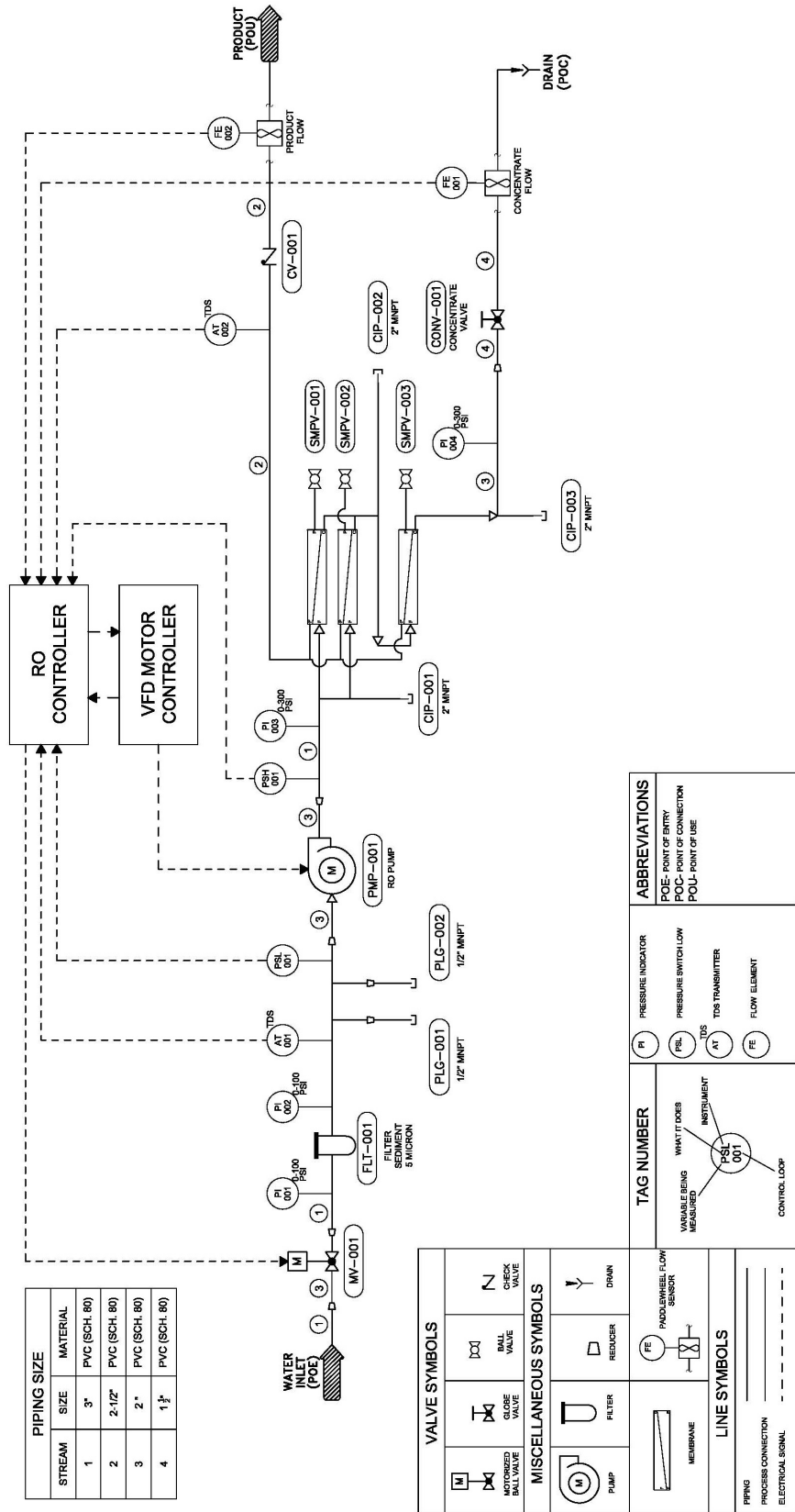


PIPING SIZE	
STREAM	MATERIAL
1	PVC (SCH. 80)
2	PVC (SCH. 80)
3	PVC (SCH. 80)
4	PVC (SCH. 80)
5	SS (SCH. 80)

VALVE SYMBOLS	MISCELLANEOUS SYMBOLS

TAG NUMBER	ABBREVIATIONS
<p>WHAT IT DOES</p> <p>INSTRUMENT</p> <p>001</p> <p>CONTROL LOOP</p>	<p>PI - PRESSURE INDICATOR</p> <p>PSPT - PRESSURE SWITCH LOW</p> <p>PIB - PRESSURE SWITCH HIGH</p> <p>AT - TDS TRANSMITTER</p> <p>FI - FLOW INDICATOR (ROTAMETER)</p>

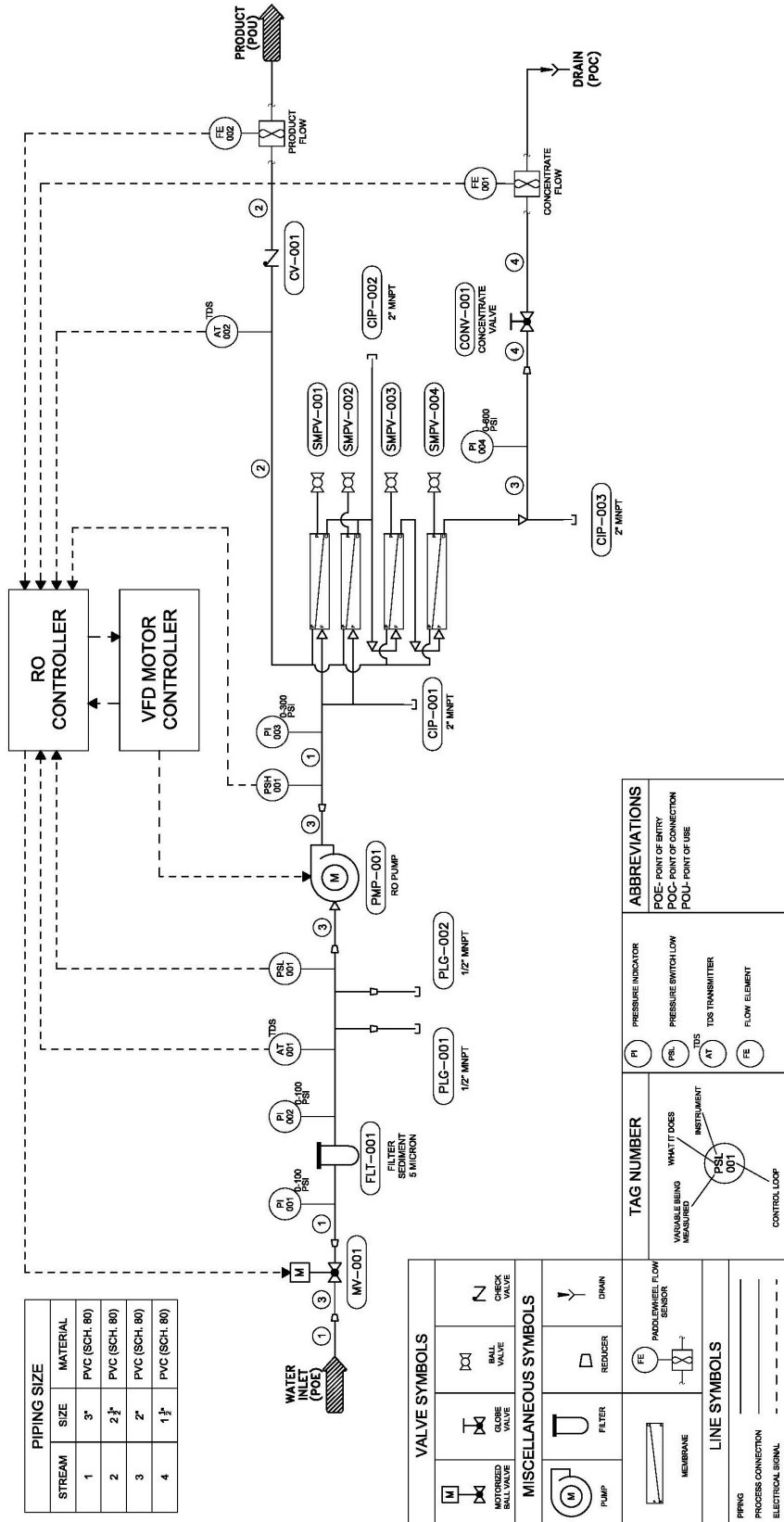
X1 - 3480



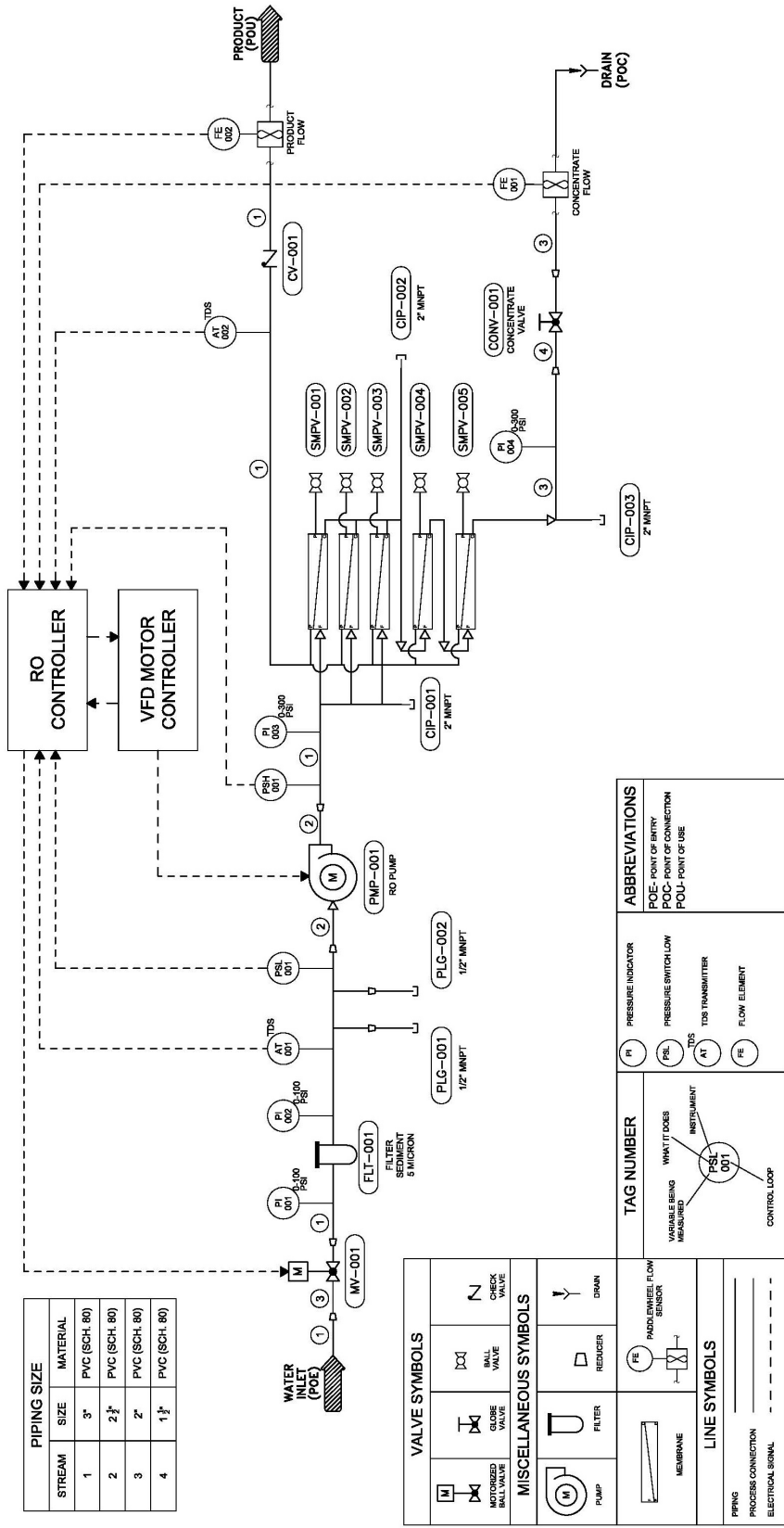
PIPING SIZE	
STREAM	MATERIAL
1	3" PVC (SCH. 80)
2	2-1/2" PVC (SCH. 80)
3	2" PVC (SCH. 80)
4	1 1/2" PVC (SCH. 80)

VALVE SYMBOLS	MISCELLANEOUS SYMBOLS	TAG NUMBER	ABBREVIATIONS
MOTORIZED BALL VALVE GLOBE VALVE BALL VALVE CHECK VALVE N	PUMP FILTER REDUCER DRAIN PRESSURE INDICATOR PRESSURE SWITCH LOW TDS TRANSMITTER FLOW ELEMENT	VARIABLE BEING MEASURED WHAT IT DOES INSTRUMENT CONTROL LOOP PSL 001	POE- POINT OF ENTRY POC- POINT OF CONNECTION POUL- POINT OF USE
LINE SYMBOLS			
MEMBRANE PIPING PROCESS CONNECTION ELECTRICAL SIGNAL			

X1 - 4480



X1 - 5480

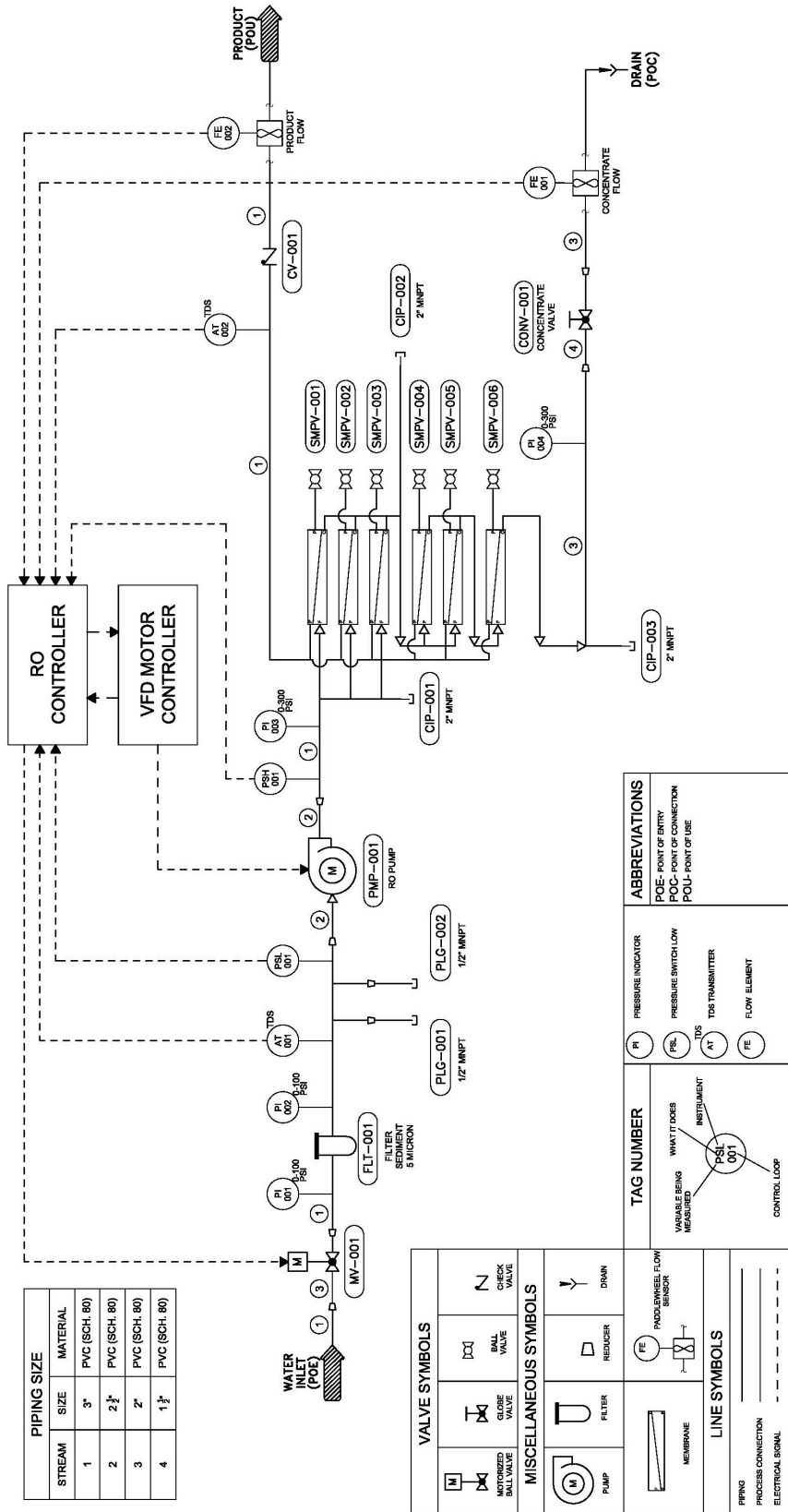


PIPING SIZE	
STREAM	MATERIAL
1	PVC (SCH. 80)
2	PVC (SCH. 80)
3	PVC (SCH. 80)
4	PVC (SCH. 80)

VALVE SYMBOLS	MISCELLANEOUS SYMBOLS
MOTORIZED BALL VALVE	CHECK VALVE
GLOBE VALVE	DRAIN
BALL VALVE	REDUCER
FILTER	PRESSURE INDICATOR
PUMP	PRESSURE SWITCH LOW
MEMBRANE	TDS TRANSMITTER
FLOW ELEMENT	FLOW ELEMENT

TAG NUMBER	ABBREVIATIONS
<p>WHAT IT DOES</p> <p>VARIABLE BEING MEASURED</p> <p>INSTRUMENT</p> <p>CONTROL LOOP</p>	<p>POE- POINT OF ENTRY</p> <p>POC- POINT OF CONNECTION</p> <p>POU- POINT OF USE</p>

X1 - 6480



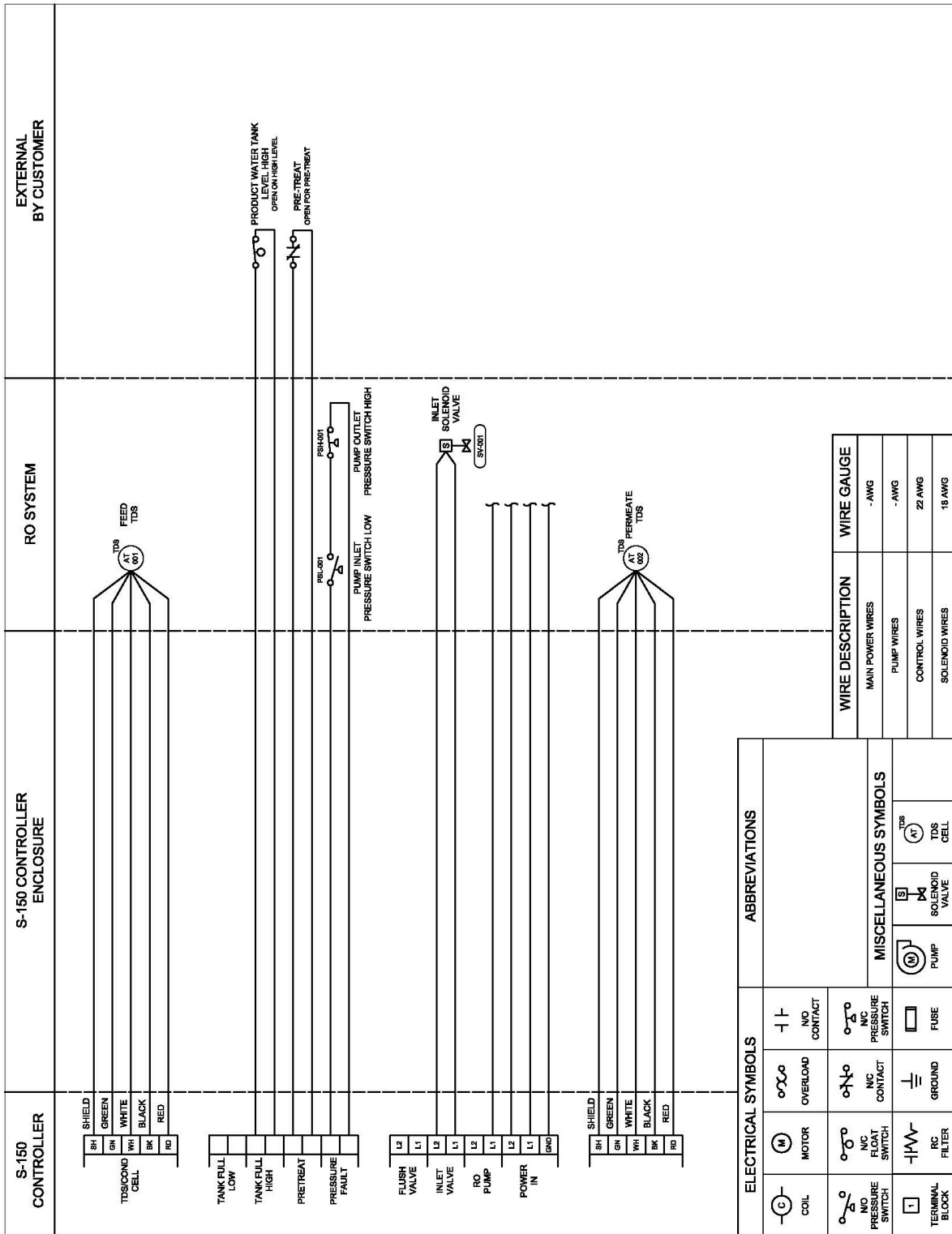
PIPING SIZE		
STREAM	SIZE	MATERIAL
1	3"	PVC (SCH. 80)
2	2½"	PVC (SCH. 80)
3	2"	PVC (SCH. 80)
4	1½"	PVC (SCH. 80)

VALVE SYMBOLS		MISCELLANEOUS SYMBOLS	

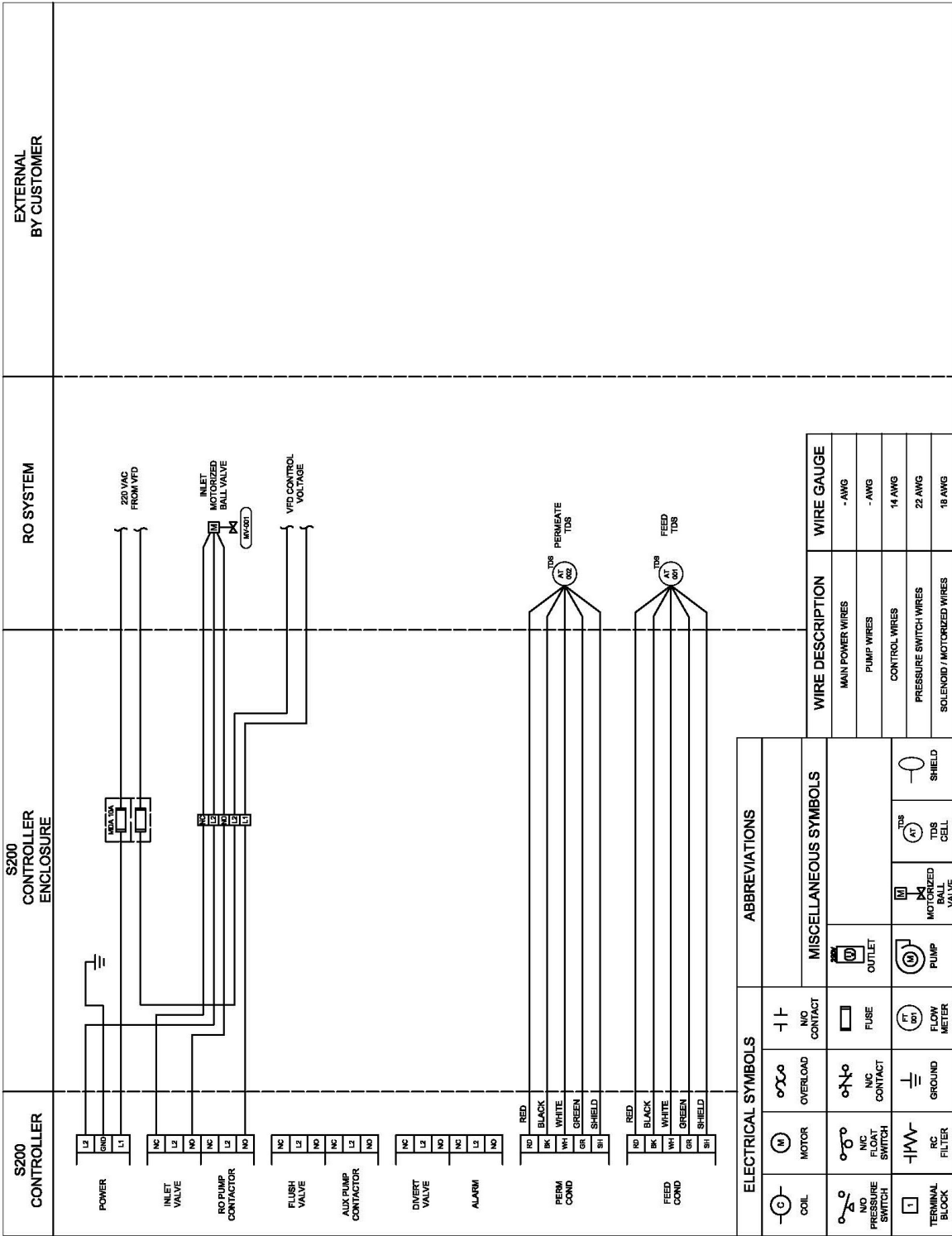
TAG NUMBER		ABBREVIATIONS	
RI	Pressure Indicator	POE	Point of Entry
PLG	Pressure Switch Low	POC	Point of Connection
TDS	TDS Transmitter	POU	Point of Use
FE	Flow Element		

ELECTRICAL SCHEMATICS

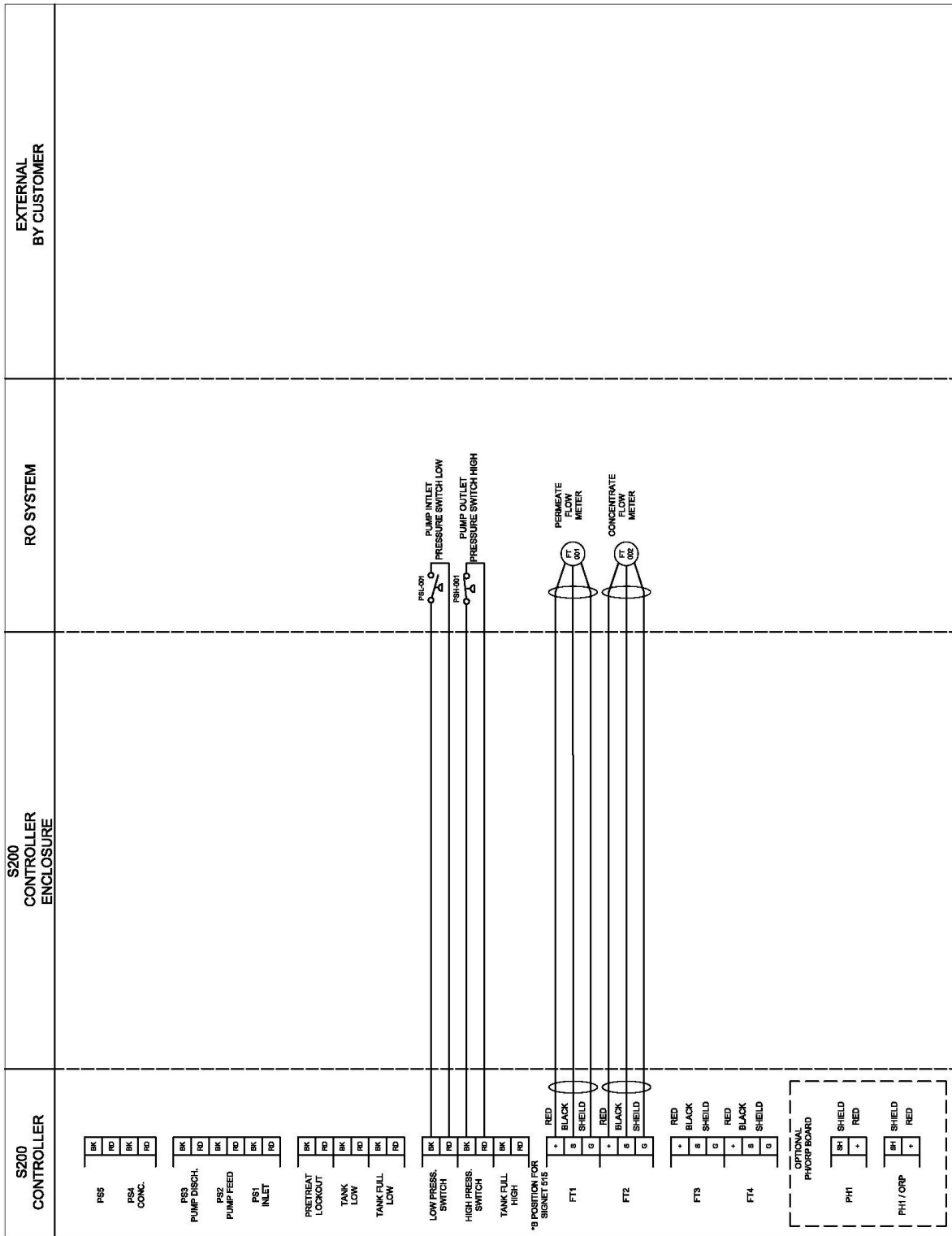
S-150 CONTROLLER



S-200 CONTROLLER



S-200 CONTROLLER (CONT'D)



SYSTEM WARRANTY

One-Year Limited Warranty

Warranty Terms

Subject to the terms and conditions set forth hereinafter, 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.

In order to maintain the Manufacturer’s Warranty, an operating log must be maintained and copies will need to be sent to your local dealer or distributor for review. 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 product by the Manufacturer but, if allowable, the 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 product by the Manufacturer 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 manufacturing 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 the 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 Manufacturer’s address, 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; (7) an operating log, which can be found in the product manual. Manufacturer shall, in 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, Manufacturer will at 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 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 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 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 Manufacturer or an authorized Manufacturer service representative; or, if any replacement parts are not authorized by 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 product by the Manufacturer 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 THE 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 THE 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 THE 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.