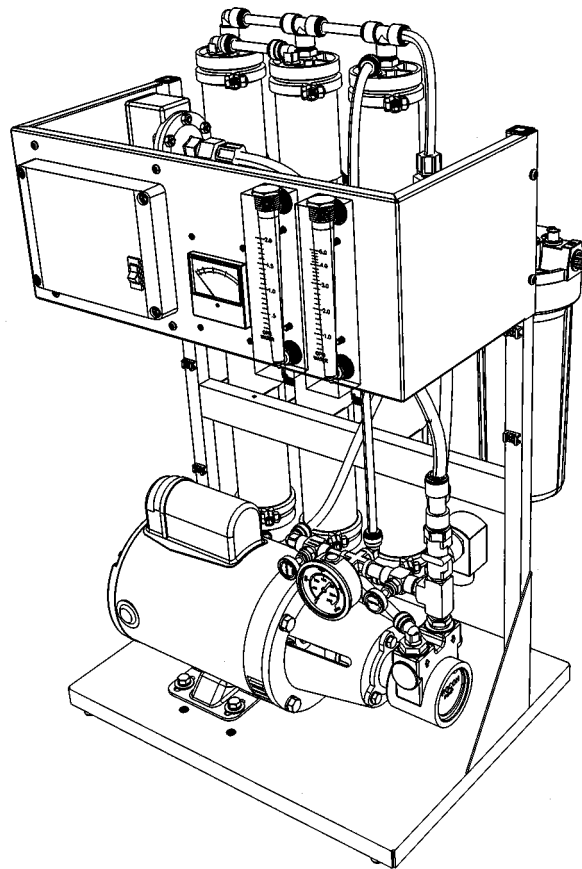


OSMONICS E2/EZ2 SERIES™

WATER PURIFICATION MACHINES



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

GE Infrastructure
Water & Process Technologies



Distributor Information

Distributor: _____

Contact: _____

Phone: _____

Fax: _____

Email: _____

Machine Information

Installation Date: _____

Model Number: _____

Serial Number: _____

Service Assistance

Consult the Troubleshooting Section of this manual (Section 2.19). If the problem cannot be identified and corrected, contact your distributor. Prior to making the call, have the following information available:

Model Number	Daily Log Sheets
Serial Number	Operating Parameters
Installation Date	Description of Problem

Spare Parts

Contact your distributor to order spare parts. Refer to the Spare Parts List (Technote 109).

**INSTALLATION, OPERATION,
AND MAINTENANCE MANUAL**

**E2/EZ2-SERIES
WATER PURIFICATION MACHINES**

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NOTE: This manual, along with all GE Infrastructure manuals, is available at www.ge.water.com.

2.0 INSTALLATION

2.1 Mounting the Unit

When installing your new GE Osmonics reverse osmosis (RO) machine, allow at least 45-inches (114.3 cm) above the machine for membrane element removal and loading. If space is not available, the entire membrane element housing can be removed for membrane element change-outs. If the membrane element housings are to be removed to change-out the membrane elements, at least 25-inches (65.3 cm) is required at one end of each membrane element housing and 6-inches (15.2 cm) behind the machine.

2.2 Plumbing

The feed water source must be able to provide water quantity and pressures to maintain an operating feed water pressure of 30 - 60 psi (2.1 - 4.1 bar). If the feed water pressure with the machine is in excess of 60 psi (4.1 bar) or fluctuates by more than 5 psi (0.34 bar) a pressure regulator should be installed upstream of the machine inlet. If proper water pressure cannot be maintained to the RO, a booster pump may need to be installed in front of the pretreatment to provide the proper water quantity and pressure for the operation of the machine.

2.3 Plumbing Connections

Connect proper size drain line to the concentrate outlet (Table 2.1, E2/EZ2-Series Machine Piping Connections) and run to an open drain. The drain capacity needs to be large enough to properly drain the feed water flow of the RO.

Table 2.1
E2/EZ2- Series Machine
Piping Connections

C O N N E C T I O N S	
Inlet inch (cm)	0.38 (0.96)
Permeate inch (cm)	0.38 (0.96)
Concentrate inch (cm)	0.38 (0.96)

2.4 Feed Water Requirements

The following feed water requirements must be met before installing your E2/EZ2-Series machine to ensure quality permeate and extended membrane element life. Refer to Table 2.2 (E2/EZ2-Series Feed Water Requirements) for feed water information.

Table 2.2
E2/EZ2-Series Feed
Water Requirements

Temperature	Typical: 50° - 85°F (10° - 29°C) Limits: 33° - 104°F (0.60° - 40°C)
Inlet Pressure	Minimum: 30 psig (2.1 barg) Maximum: 60 psig (4.1 barg)
Chlorine (continuous feed)	0 parts per million (ppm)
Operating pH	5.5 - 8.5
Silt Density Index (SDI)	Less than or equal to 5 to minimize membrane element fouling and extend cleaning intervals. Refer to ASTM* Standard D4189.

* American Standard for Testing Materials

2.5 Transporting Pure Water (Permeate) to Point-of-Use

Pure water, or permeate, is in an aggressive state and should only be transported from the machine to the point-of-use in food grade flexible nylon, stainless steel (SS) tubing, or polyvinyl chloride (PVC) material for the inlet, permeate, and concentrate piping sizes.

Refer to Connections (Table 2.1, E2/EZ2-Series Machine Plumbing Connections) for inlet, permeate, and concentrate piping sizes.

WARNING: MACHINE DAMAGE MAY OCCUR IF PERMEATE BACK PRESSURE EXCEEDS 60 PSI (4.1 BAR) DURING OPERATION.

2.6 Machine Control

2.6.1 Economy Model

To remotely control the Economy Model (ECN) with float switches and/or pretreatment lockout, remove the jumper between terminals 4 and 5 and wire in the float switches or pretreatment components in series. After all field wiring is complete and complies with local and national electrical codes, move onto Section 2.7 (Single-Phase Electrical).

NOTE: External control contacts are normally closed, dry contacts.

2.6.2 Deluxe Model

To remotely control the Deluxe Model (DLX), with float switches and/or pretreatment lockout, remove the jumper between terminals 2 and 3 and wire in the float switches and pretreatment in series. After all field wiring is complete and complies with local and national electrical codes, move onto Section 2.10 (Pretreatment for Water Purification).

NOTE: External control contacts are normally closed, dry contacts.

2.7 Single-Phase Electrical

Always check voltage tag on the machine to ensure the correct voltage and amperage is available.

The E2/EZ2-Series machines are shipped as either 120 Volt 60 Hertz or 220 Volt 50 Hertz from the factory. Machines should always be connected to a 15 Amp single-phase dedicated circuit. The circuit provided should be a separately fused disconnect with the proper protection for the Hp and Amp draws of the machine. Reverse osmosis (RO) machines with 115 Volt circuit include an 8-foot (2.4 m) electrical cord which plugs into a single-phase outlet. All machines shipped with a 220 VAC single-phase power requirement are shipped with an 8-foot (2.4 m) electrical cord, but customers must provide electrical plug. All field wiring must comply with applicable local and national electrical codes.

2.8 Machine Start-Up Preparations

2.8.1 Pretreatment for Water Purification

A water analysis of your feed water should have been performed, as part of the planning and engineering that went into developing your RO system.

The water analysis will provide information on what type of pretreatment may be required and what recovery the machine can be run at on the feed water provided. If the machine is moved to a different water source, a new water analysis should be taken before operating the machine.

Your RO is designed to operate on softened tap feed water with an SDI of 5 or less. The pH should be in a range of 5.5 - 8.5. Exposure to any levels of chlorine may cause irreversible damage to the Thin-layer composite (TLC) polyamide (PA) membrane elements in your machine. Daily water checks are recommended to ensure the integrity of your pretreatment and RO system. Refer to Table 2.2 (E2/EZ2-Series Feed Water Requirements).

2.8.2 Machine Start-Up Preparation

Check the function and integrity of your pretreatment equipment. Ensure that your water softener and activated carbon filters have been leaked checked and properly flushed, before starting up your RO machine.

WARNING: IMPROPERLY FLUSHED PRETREATMENT MAY CAUSE SERIOUS RO MACHINES PROBLEMS AT START-UP.

WARNING: NEVER OPERATE THE MACHINE WITH THE CONCENTRATE OR PERMEATE LINES BLOCKED. SEVERE DAMAGE TO THE UNIT MAY RESULT.

2.9 Machine Start-Up

STEPS

1. Turn the feed water supply to the machine ON, while checking for leaks in the pretreatment and inlet feed water lines.
2. Check to ensure power to the motor is de-energized and the ON/OFF button, on the machine, is in the ON position.
3. Plug in the factory-supplied power cord.

NOTE: Fifty (50) Hertz models require customer supplied plug compatible with existing outlet.

4. For initial start-up, redirect the permeate and concentrate lines to the drain for start-up flush.
5. Open the concentrate and recycle flow control valves two (2) complete turns. These valves are positioned on the flow control plumbing (Figure 2.1, Flow Control Center).

WARNING: ONCE MACHINE IS OPERATING, FLUSH CONCENTRATE AND PERMEATE TO THE DRAIN FOR 20 - 30 MINUTES. FLUSHING ENSURES ALL BIOCIDES AND CONTAMINATES ARE REMOVED FROM THE MEMBRANE ELEMENTS.

6. Turn the ON/OFF button on the machine ON.
7. As the pump starts to build pressure, begin to adjust the valves in the following manner: start by slowly closing the concentrate valves while slowly opening the recycle valve (Figure 2.1, Flow Control Center).

CAUTION: Monitor machine to ensure inlet pressure of 30 - 60 psi (2.1 - 4.1 bar) is maintained during operation.

8. After 20 - 30 minutes of flushing permeate to the drain, ensure all chemical residue has been removed before hooking up to point of use.

While operating, the pressure range should never operate outside of the pressure ranges displayed in Table 2.3 (E2/EZ2-Series Primary Pressure Range).

Table 2.3
E2/EZ2-Series
Primary Pressure Range*

E2/EZ2-Series	
Operating Pressure	220 psi (15.2 bar)
Operating Range	165 - 250 psi (114. - 17.2 bar)

* Primary pressure temperature for normal operation is 77°F (25°C).

CAUTION: The E2/EZ2-Series must not operate outside the ranges listed above.

NOTE: Optimum recovery will vary according to feed water quality.

The concentrate valve is drilled, and when completely closed the machine is running at the correct concentrate flow for a 75% recovery (Table 2.4, Flow Specifications for E2/EZ2-Series Machines).

If the temperature of the inlet feed water is not 77°F (25°C) use the Temperature Correction Factor Table (Technote 113). The proper adjustment of the recycle and concentrate valves are critical to the correct operation of the machine.

9. Complete the Start-Up Data Sheet (Technote 101). The Start-Up Data Sheet and the Daily Log Sheet (Technote 106) are invaluable in diagnosing the performance of the equipment, and must be kept for reference. If you have questions concerning the operation of your machine or the method of data recording, contact your distributor or the manufacturer.

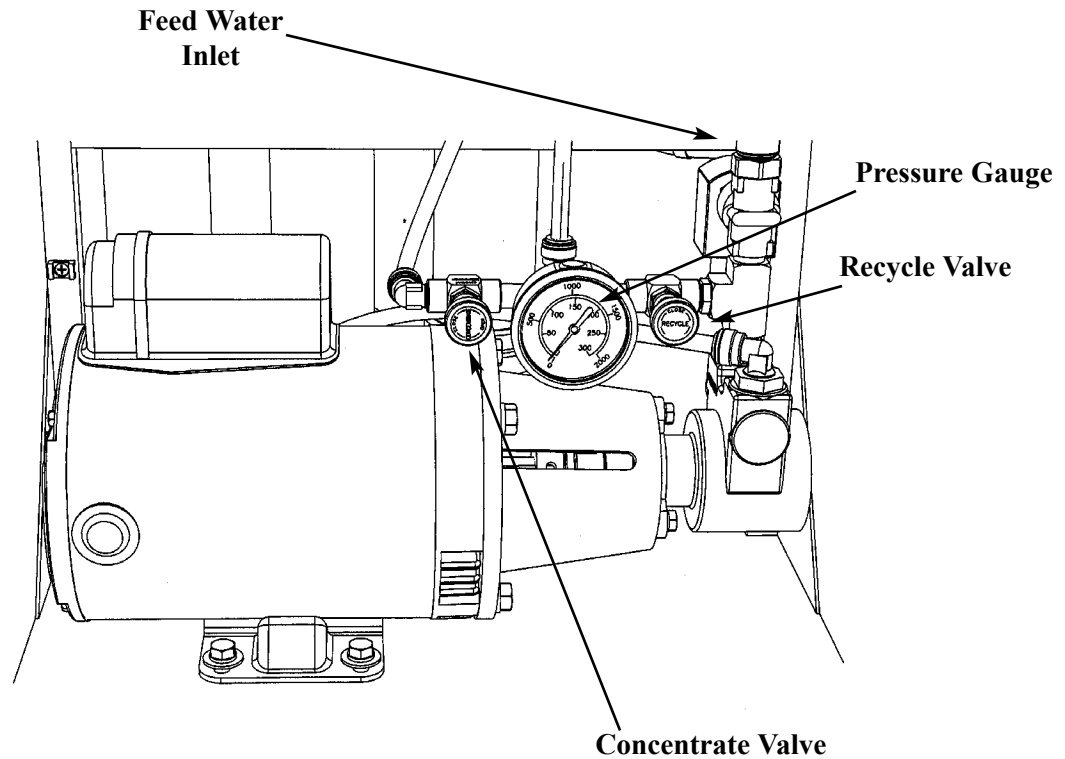


Figure 2.1
Flow Control Center

CAUTION: Once the machine is running, with orifices, adjust pressures and flows to the correct measure, flush machine to drain for 30 - 45 minutes.

CAUTION: The E2/EZ2-Series machines are designed to run at 50% recovery. To confirm flows are correct, check Table 2.4 (Flow Specifications for E2/EZ2-Series Machines). To correct any temperature variations, check Table 2.4. If your E2/EZ2-Series machine is operating under permeate back pressure to point of use, refer to Table 2.5 (E2/EZ2-Series Permeate Back Pressure Correction Factors).

CAUTION: Machine performance is based on a feed water temperature of 77°F (25°C). If feed water temperature is other than 77°F (25°C), reference Table 2.4 (Temperature Correction Factors) to confirm machine's performance

2.10 Recovery

The machine flow specifications listed below are based on 77°F (25°C).

Table 2.4
E2/EZ2 - Series
Flow Specifications for
Machines

E2/EZ2-Series Units	0375	620/ 750	1125	1400/ 1690	2100/ 2535
Recovery Range	33 - 50%	33 - 50%	33 - 50%	33 - 50%	33 - 50%
Rejection Rate	95 - 98%	95 - 98%	95 - 98%	95 - 98%	95 - 98%
Permeate Rate gpm (m³/h)	0.3 (0.07)	0.5 (0.11)	0.9 (0.20)	1.2 (0.27)	1.8 (0.40)
Concentrate Rate gpm (m³/h)	0.3 - 0.2 (0.07 - 0.14)	0.5 - 0.3 (0.11 - 0.07)	0.9 - 0.6 (0.20 - 0.13)	1.2 - 0.8 (0.27 - 0.54)	1.8 - 1.2 (0.41 - 0.82)

2.11 Permeate Back Pressure Correction Factors

It is often necessary to operate RO machines with permeate back pressure. Permeate back pressure will decrease permeate production. See Table 2.5 (Permeate Back Pressure Correction Factors) to calculate loss of permeate.

Table 2.5
E2/EZ2-Series
Permeate Back
Pressure Correction
Factors

BACK PRESSURE	% LOSS OF PERMEATE FLOW	PRESSURE CORRECTION FACTOR (PCF)
10 psig (0.7 barg)	5%	0.95
20 psig (1.4 barg)	10%	0.90
30 psig (2.0 barg)	15%	0.80
40 psig (2.7 barg)	20%	0.70
50 psig (3.4 barg)	25%	0.60
60 psig (4.1 barg)	30%	0.50

WARNING: IF PERMEATE BACK PRESSURE EXCEEDS 60 PSI (4.1 BAR) MACHINE DAMAGE MAY OCCUR.

WARNING: INSTALLING A CHECK VALVE WILL PREVENT REVERSE FLOW THROUGH THE MEMBRANE ELEMENT WHEN THE MACHINE IS NOT IN OPERATION. REVERSE FLOW, WHEN THE MACHINE IS NOT IN OPERATION, CAN SEVERELY DAMAGE THE MEMBRANE ELEMENTS.

2.12 Operation and Maintenance

The operation and maintenance of an E2/EZ2-Series RO machine requires regular data recording and routine preventative maintenance. It cannot be emphasized enough the importance of filling out the Daily Log Sheet (Technote 106) during each operating shift. A Start-Up Data Sheet (Technote 101) should have been completed at start-up. The Start-Up Data Sheet contains pertinent facts on the operation of your machine. These two records are invaluable in diagnosing the performance of the equipment, and must be kept for reference. If you have questions concerning the operation of your machine or the method of data recording, contact the manufacturer.

Three preventative maintenance procedures, which must be done on a regular basis, are as follows:

1. Change the pre-filter cartridges as needed.
2. The machine needs to run and flush for at least 10 minutes every 72 hours, clock time.
3. Clean the RO membrane elements with approved cleaners at least quarterly, depending on feed water quality.

2.13 Pre-filter Cartridge

A 1 micron pre-filter cartridge is factory installed to protect the membrane elements and valves from particles, which may be in the feed water. To order replacements, see the Spare Parts List (Technote 109).

A pressure drop across the filter of 8 psi (0.55 bar) or more during operation indicates that the pre-filter cartridge(s) need changeing. Use only GE approved filters rated at 2 microns or less. Refer to Technote 109 (Spare Parts List) for pre-filter cartridge replacements. Do not attempt to clean used pre-filter cartridges.

NOTE: Failure to perform normal preventative maintenance procedures will void machine warranty.

2.14 Daily Flushing

A manually flush of the E2/EZ2-Series must be done machine daily.

To flush the machine:

NOTE: During flushing procedure, the machine must be running.

STEPS

1. With the machine running, open the concentrate valve 1/2 -3/4 of a turn (Figure 2.1, Flow Control Center).

2. Allow the machine to operate with the concentrate valve open 1/2 - 3/4- of a turn (Step 1) for 10 - 15 minutes.
3. After 10 - 15 minutes, return the concentrate valve to its previous setting, and return to normal operation.

CAUTION: When opening the concentrate valve, never allow the machine's primary pressure to drop more than 10% below normal operating pressure (Table 2.3, E2/EZ2-Series Primary Pressure Range).

2.15 Membrane Element Cleaning

Periodic cleaning of the machine with appropriate membrane element cleaners will prolong the life of the membrane elements. Local conditions will determine the frequency of cleaning. Cleaning may be required when:

1. The permeate quality begins to decline.
2. The reading on the final pressure gauge begins to change noticeably.

GE recommends that you clean your E2/EZ2-Series RO machine every quarter. You may have to clean the RO machine more frequently, depending on the quality of your feed water. Cleaning of the membrane elements is vital because contaminants can build-up on the membrane element surfaces, reducing the permeate flow rate and affecting the quality of the permeate.

To clean the membrane elements:

NOTE: It is always best to start with the acid or inorganic cleaner.

STEPS

1. Remove and replace the pre-filter cartridge (Section 2.14, Pre-filter Cartridge).

NOTE: For best results, GE recommend pre-filters be replaced before and after cleaning.

2. In a clean container, collect approximately five (5) gallons (19 Liters) of RO permeate water.
3. Turn machine and water supply OFF.

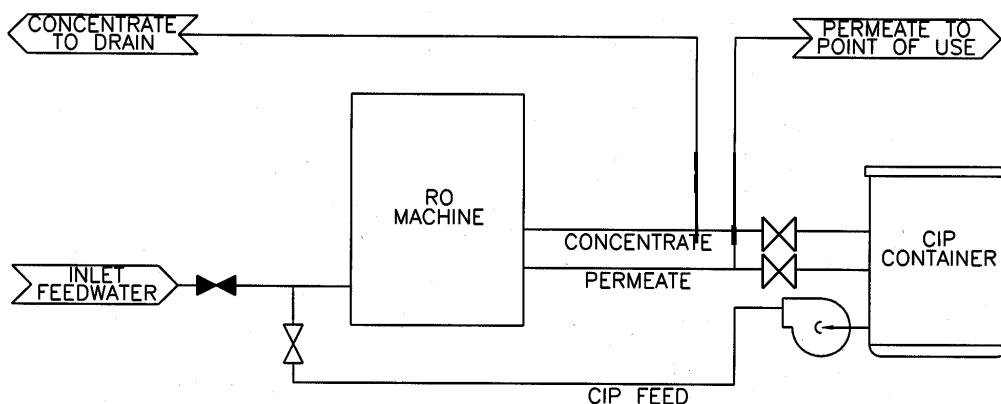


Figure 2.2
E2/EZ2-Series
Closed Loop Membrane
Element Cleaning

NOTE: This clean container will be referred to as the Clean-In-Place (CIP) container.

4. Disconnect and route the inlet, permeate, concentrate lines from their service locations to the CIP container (Figure 2.2 E2/EZ2-Series Closed Loop Membrane Element Cleaning).
5. Connect the CIP feed line to the E2/EZ2-Series machine inlet feed water port (Figure 2.2, E2/EZ2-Series Closed Loop Membrane Element Cleaning).
6. Mix the appropriate cleaning compound in the 5 gallons of permeate water, in the CIP container, according to the cleaning label instructions.
7. Turn machine ON and allow machine to recirculate the cleaning solution for 10 - 15 minutes.

NOTE: The incoming feed pressure should be 30 psi (2.1 bar).

As machine starts up it will achieve prime and begin to draw solution into the machine and circulate the solution back into the CIP container.

If the machine makes noise or primary pressure does not climb to normal operating pressure (Table 2.3, E2/EZ2-Series Primary Pressure Range) turn machine OFF. Refer to Troubleshooting (Section 1.18). Once pressure range is corrected, continue start-up procedure.

As the machine runs normally check CIP tank to ensure that the CIP inlet line to the machine is submerged in the cleaning solution, so the pump prime will not be lost.

8. After circulating the machine for 10 - 15 minutes or solution has reached 95°F (35°C), shut machine OFF.
9. Dump solution. Repeat Steps 6 - 8.
10. With machine OFF (Step 8), let cleaning solution dwell in machine for 15 - 30 minutes.
11. After 15 - 30 minutes, reconnect feed to RO unit and connect concentrate and permeate to drain. Turn machine ON and flush permeate water to the drain for 10 - 15 minutes.

This ensures that all cleaning agents have been removed for the machine.

12. If cleaning with an organic cleaner, return to Step 1 and repeat Steps 1 -11.
13. After completing cleaning (normal and organic) and flushing to the drain reconnect permeate to the point of use, concentrate to the drain, and reconnect feed to the RO unit.

WARNING: LOSS OF PRIME DURING SUCTION CLEANING MAY RESULT IN SERIOUS DAMAGE TO THE PUMP.

NOTE: As previously mentioned, the manufacturer recommends use of a CIP or booster pump to circulate the cleaning solution during membrane element cleaning.

2.16 Membrane Element Replacement

CAUTION: Replacement membrane elements are shipped from the factory in a plastic bag with a small amount of bactericide solution to prevent biological growth. When installing the membrane elements, always provide adequate ventilation and wear gloves while handling the membrane elements as recommended. The membrane elements must be kept moist at all times to prevent possible damage to the membrane element material.

STEPS

1. Remove the top end caps and clamps from the membrane element housings (Figure 2.4, Membrane Element Installation). Lubricate all O-rings and brine seals, and the polyvinyl chloride (PVC) membrane element stems (stingers) with a non-petroleum based lubricate (i.e., glycerin or poly water).
2. Load the down flow membrane elements first, by inserting the membrane element into the membrane element housing with the brine seal end of the membrane element up. Slowly turn the membrane element as you lower it into the membrane

element housing. As you reach the bottom of the housing slowly guide the PVC stem or stinger on the end of the membrane element into the head of the end cap. As the membrane element slides into the housing the brine seal will be on the top (Figure 2.4, Direction of Membrane Element Installation).

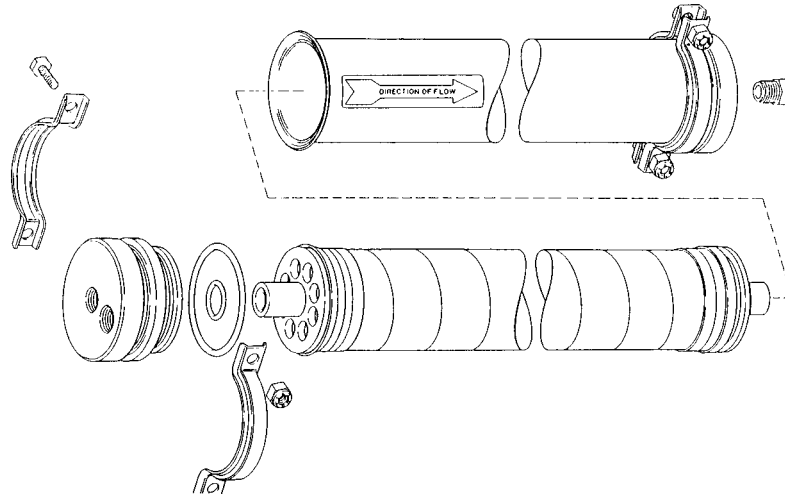
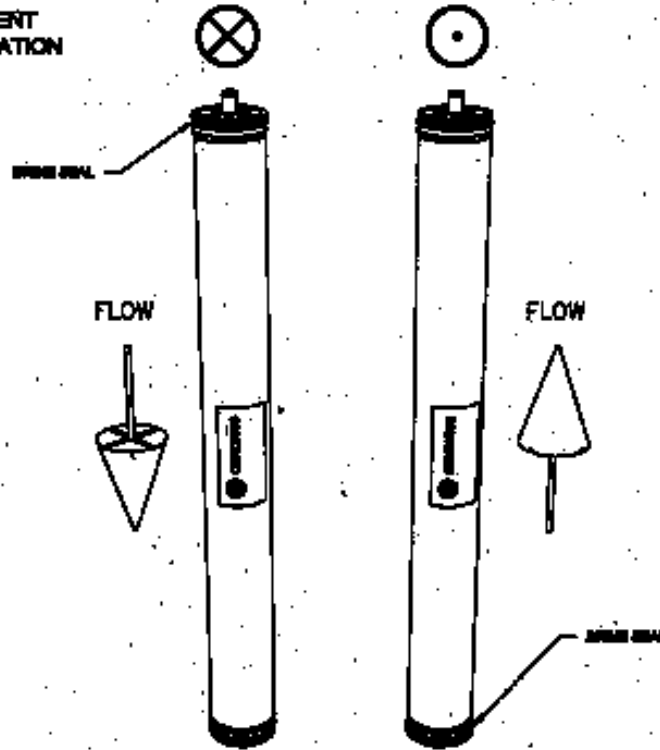


Figure 2.3
Membrane Element
Installation

3. Next, load the up flow membrane elements, by lubricating all brine seals, O-rings, and the membrane element stingers. With the up flow membrane element and the brine seal will be on the bottom of the membrane element. Turn the membrane element slowly as you lower it down into the housing. As with the down flow membrane element, one must slowly guide the PVC stinger on the end of the membrane element into the end cap.
4. Reinstall the end caps by using non-petroleum based lubricant to lubricate the O-ring inside the end cap. Reinstall the end cap on the membrane element by first, aligning the stinger into the hole in the end cap and then turn the end cap slowly clockwise, as you push it down into the membrane element housing.
5. Reattach the housing clamp and tighten.
6. Reattach the feed line and flush permeate and concentrate lines to the drain for 25 - 30 minutes.
7. Take appropriate tests to insure biocide has been flushed from the machine.
8. Reconnect permeate line to point-of-use.
9. The machine is now ready for operation.

**ELEMENT
INSTALLATION**



**Figure 2.4
Membrane Element
Direction for
Installation**

2.17 Troubleshooting

This troubleshooting guide can assist you in identifying common operating problems you may experience with your machine. The operator can easily correct many of these problems, however, for those that persist or are not understood you should contact the GE Customer Support Center. Have the following information available when calling the Customer Support Center:

1. Machine installation date
2. Model number
3. Serial number
4. Detailed description of problem.

TROUBLESHOOTING GUIDE		
PROBLEM	POSSIBLE CAUSES	REMEDIES
Low operating pressure	Insufficient feed water pressure or flow	Open feed water valve. Check feed water valve for restrictions in feed plumbing.
	Clogged pre-filter cartridge	Replace pre-filter cartridge.
	Dirty or fouled membrane elements	Flush and/or clean machine.
	Inlet solenoid valve not opening	Verify valve receiving power when machine is ON. Clean or replace solenoid valve.
	Insufficient electrical power	Verify proper voltage is present. Check fuses and circuit breakers.
	Pump or motor not operating correctly	Contact your distributor for replacement or repair of pump or motor.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	REMEDIES
Low operating pressure (continued)	Concentrate or recycle valve too far open	Refer to Section 2.9 for properly setting concentrate and recycle valves
Low permeate production	Low operating pressure	See above.
	Machine operating on cold water	Check the water temperature. If needed, install a hot/cold tempering valve. Permeate production rate is dependent on 77°F (25°C). Refer to Section 2.5 (Temperature Correction Factor).
	Membrane elements installed incorrectly	Refer to Section 2.18 for correct membrane element installation procedure. Membrane elements with damaged brine seals may be returned for repair. For low permeate production, it is wise to test the permeate production of each membrane element.
	Brine seal has “rolled” or been damaged	Refer to Section 2.18 for correct membrane element installation.
	Dirty or fouled membrane elements	Flush and/or clean the machine.
	Backpressure on the permeate line	Reduce permeate line backpressure. Check for restrictions in permeate plumbing.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	REMEDIES
Low permeate production (continued)	Useful life of membrane element(s) expired	Install new membrane element(s). See Spare Parts List (Section 2.20).
	Inaccurate permeate flow meter (DLX only)	Check the flow rate manually with a stop watch and a calibrated container.
Low concentrate flow with normal or high operating pressure	Dirty or fouled membrane element (s)	Flush and/or clean machine.
Declining rejection (high permeate conductivity)	O-rings on membrane element(s) unseated or damaged parts	Replace the O-rings, check the sealing surfaces on the O-ring groove and end caps. Replace damaged parts.
	Useful life of membrane element(s) expired	Replace with new membrane elements. See Spare Parts List (Section 2.20).
	Change in incoming water quality	Calibrate the meter with a DS standard solution or check the readings with another conductivity meter. Replace or clean the probe. Check the connections between the probe and monitor. Refer to Section 2.16.2 (Deluxe Model).
ON/OFF switch ON: machine not running	No power to machine	Ensure machine is plugged in.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	REMEDIES
ON/OFF switch ON: machine not running (continued)	Pressurized storage switch or storage tank float switch cut power to machine	The storage tank may be full. The switch control may require adjustment.
	Thermal overload of motor	Allow the machine to cool. Check the Amp draw to the machine.
	Pump motor failure	Check the fuses or circuit breakers; measure the voltage. Contact your distributor for service.
Pressure does not drop when concentrate valve opened	Dirty concentrate valve	Disconnect and clean the concentrate valve.
Excessive pressure drop across membrane element(s) [over 50 psi (3.5 bar)]	Restricted flow after pump outlet	Check for blockage of the concentrate flow at the inlets and outlets of membrane element housings.
	Telescoped membrane element covering membrane element housing	Ensure that the anti-telescoping device (ATD) is intact.
	Fouled or dirty membrane elements	Flush and/or clean the machine.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	REMEDIES
Flow through machine while power is OFF	Inlet solenoid valve not fully closed	Ensure valve is not getting any power when machine is OFF.
		Replace inlet solenoid valve.

For more information call 952-933-2277 or 800-848-1750 in the U.S., or visit www.gewater.com.

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