





# TABLE OF CONTENTS

<b>SECTION 1, GENERAL INFORMATION</b> .....	<b>1</b>
1.1 INTRODUCTION.....	1
1.2 RESTRICTION ON USE.....	1
1.3 ELECTRICAL LEAKAGE STANDARDS.....	2
1.4 CAUTIONARY SYMBOLS.....	3
<b>SECTION 2, TECHNICAL INFORMATION</b> .....	<b>4</b>
2.1 SPECIFICATIONS.....	4
2.2 RO+ OUTPUT WATER QUALITY.....	5
2.3 TEMPERATURE CORRECTED RO+ PRODUCTION RATES.....	6
2.4 MRO2 DIRECT FEED TO DIALYSIS MACHINE(S).....	7
<b>SECTION 3, COMPONENTS AND SCHEMATICS</b> .....	<b>8</b>
3.1 EXTERNAL FRONT VIEW.....	8
3.2 INTERNAL REAR VIEW.....	10
3.3 MRO2 TUBING DIAGRAM.....	12
3.5 ELECTRICAL DIAGRAM, MRO2.....	13
<b>SECTION 4, RO+ STARTUP &amp; OPERATION</b> .....	<b>14</b>
4.1 CAUTION.....	14
4.2 SAFETY FEATURES.....	16
4.3 INITIAL STARTUP.....	17
4.4 SYSTEM SHUTDOWN.....	19
4.5 STARTUP AND OPERATION LOG.....	20
<b>SECTION 5, DISINFECTING THE SYSTEM</b> .....	<b>21</b>
5.1 DISINFECTING THE SYSTEM.....	21
5.2 A WORD ABOUT HYDROGEN PEROXIDE/PEROXYACETIC ACID.....	27
5.3 RO PRESERVATIVE PROCEDURE.....	28
5.4 MEMBRANE FLUSH FEATURE (AUTO FLUSH).....	28
<b>SECTION 6, RO+ CONTROLLER</b> .....	<b>30</b>
6.1 FRONT PANEL CONTROLS AND INDICATORS.....	30
6.2 CONTROLLER OPERATION.....	31
6.3 CONTROLLER ADJUSTMENTS.....	34
6.4 STANDARD SETPOINTS.....	37
6.5 TO DISPLAY OR CHANGE SETPOINTS.....	39
<b>SECTION 7, EXTERNAL WIRE INSTALLATION</b> .....	<b>40</b>
<b>SECTION 8, MAINTENANCE</b> .....	<b>41</b>
8.1 MAINTAINING THE SYSTEM.....	41
8.2 PT401 PRIMING PROCEDURE.....	42
8.3 REFILLING PT401.....	43
8.4 MEMBRANE MAINTENANCE INSTRUCTIONS.....	43
8.5 AMERI WATER CLEAN IN PLACE (CIP).....	43
8.6 EXCHANGE PREPERATION.....	43
<b>SECTION 9, TROUBLESHOOTING AND REPAIR</b> .....	<b>46</b>

9.1 TROUBLESHOOTING CHART .....46  
9.2 CONTROLLER TROUBLESHOOTING .....49  
9.3 PUMP REMOVAL .....51  
9.4 INSTALLING AN RO+ REPLACEMENT PUMP ASSEMBLY .....52  
9.5 SOLENOID TEST PROCEDURE .....52  
9.6 SOLENOID VALVE REPLACEMENT.....53

**SECTION 10, WARRANTY .....55**

**SECTION 11 - MRO2 SPARE PARTS LIST .....56**

**ATTACHMENT 1: MRO1 & 2 SUMMARY DISINFECT PROCEDURE**

**ATTACHMENT 2: MRO1 & 2 OPERATION SUMMARY**

# SECTION 1, GENERAL INFORMATION

## 1.1 INTRODUCTION

Congratulations on your decision to use the RO+ system! It is designed to pretreat and purify water resulting in product water that meets or exceeds ANSI/AAMI RD62 requirements for use in making dialysate for hemodialysis. The MRO2 has the capacity to supply two to five dialysis machines. This device provides quiet operation and is intended for use in hospitals, clinics and dialysis centers.

All models of the MRO2 are shipped completely assembled with required and optional water treatment components. The model that you purchased was selected for the volume of water needed and the analysis of your input water. This Operation Manual was written specifically for the MRO2 models.

Your RO+ system was thoroughly tested and in excellent condition when it was shipped to you. However, because damage during shipment is possible, please unpack and carefully inspect the RO+ as soon as you receive it. Please notify AmeriWater® if any problems are encountered.

The initials "PAA" are used occasionally throughout this manual to generically represent the hydrogen peroxide/ peroxyacetic acid solution that is to be used for disinfection. Peracidin® is an example of this solution. The caution on the front panel of the RO+ that states "Use only PAA/Use no substitutes" means that any of these products are acceptable. Do not attempt to use anything other than hydrogen peroxide/ peroxyacetic acid disinfecting solution.

**Please read the Operations Manual before using the system.** Contact AmeriWater Customer Service with any questions at 1-800-535-5585 Monday through Friday 8:00 a.m. to 5:00 p.m. eastern standard time. For afterhours emergencies call 1-800-535-5585 and follow the instructions on the recorded message. Our on-call technician will return your call as soon as possible.

**NOTE:** This entire Operations Manual should be read before operating or servicing the system. This Operations Manual should then be kept near the system and used as a reference and troubleshooting guide.

**WARNING:** This Reverse Osmosis System (RO) contains a preservative solution to prevent microbiological growth and freezing. Discard all product water for at least two hours of operation before placing the RO in service.

**CAUTION:** No person should attempt to operate or service the AmeriWater RO+ without prior authorization, instruction, and training from AmeriWater and/or your medical facility director.

## 1.2 RESTRICTION ON USE

Federal law restricts this device for sale by or on the order of a physician (medical director) for use as a water treatment device for hemodialysis.

### **1.3 ELECTRICAL LEAKAGE STANDARDS**

The AmeriWater RO+ water treatment system complies with the National Electrical Standards for Product Safety and Construction.

According to the categories of ANSI/AAME Standards, the RO+ is considered a Nonpatient Contact Medical Device.

During the design process the individual components were tested and the initial test results for the electrical components (pump, solenoid valves, and controller) were all less than 0.1 microampere leakage.

Completed product testing with the RO+ functioning resulted in the following RO+ standards being set.

<b>TEST PERFORMED</b>	<b>RO+ ELECTRICAL LEAKAGE STANDARD</b>	<b>ANSI / AAMI SAFE LIMITS STANDARDS</b>
Normal Polarity	<10 microamperes	100 microamperes
Neutral Open (single fault)	<100 microamperes	500 microamperes
Ground Open (single fault)	<100 microamperes	500 microamperes
Ground & Neutral Open *	<200 microamperes	Not Required

\* Although this test is not required by ANSI/AAMI, it is still performed as an additional safety measure.

The cabinet of the RO+ is PVC for additional operator safety.

The RO+ is compliant with ANSI/AAMI ESI-1993, Safe Current Limits for Electro medical Apparatus. All major components of the RO+ (controller, pump, solenoid valve, antiscalant pump) as well as other components are UL listed.

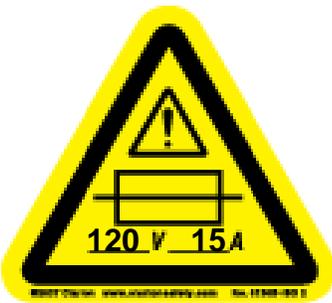
## 1.4 CAUTIONARY SYMBOLS



Caution, risk of electrical shock!  
**Attention, risque de choc électrique!**

Open by qualified service personnel only!  
**Ouverture par le personnel qualifié seulement!**

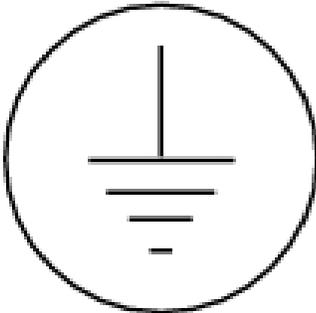
Refer to this Operation and Maintenance Manual for instructions and safety considerations. **Référez-vous au manuel des Opérations et Entretien pour instructions et mesures de sécurité.**



Caution, risk of danger!  
**Attention, danger potentiel!**

For service by qualified service personnel only!  
**Entretien par le personnel qualifié seulement!**

Replace with 120Vac, 15amp, time-delay fuse only.  
**Remplacer avec 120Vac, 15 amp, fusible à retardement seulement.**



Earth Ground terminal  
**Borne de mise à la terre**

# SECTION 2, TECHNICAL INFORMATION

## 2.1 SPECIFICATIONS

Ideal, minimum, and maximum incoming water temperature	Min = 41° F (5° C)                      Max = 90° F (33° C) Ideal Temperature = 77° F (25° C)
Prefilter gauge pressure (when the RO+ is running) Minimum Maximum	20 PSI 90 PSI ( <b>P</b> ounds per <b>S</b> quare <b>I</b> nch)
Pump pressure – Minimum Maximum	120 PSI 240 PSI
Water pressure to dialysis machine	≤ 70 PSI
Maximum output of product water @ 77°F (25°C), TDS<1000 ppm of NaCl, & pump pressure of 150 psi.	2800 GPD (10598 LPD) ( <b>G</b> allons <b>P</b> er <b>D</b> ay / <b>L</b> iters <b>P</b> er <b>D</b> ay)

Connections	Feed = 3/4" Female GHT Product = 3/4" Male GHT Drain = 1/2" hose with check valve ( <b>G</b> arden <b>H</b> ose <b>T</b> hread)
Electrical Requirements	115V/60Hz/20A GFI ( <b>G</b> round <b>F</b> ault <b>I</b> nterrupter)
Dimensions Packaged	58" H x 42" W x 38" D
Dimensions not Packaged	52"H x 18 1/2"W x 24"D
Shipping Weight	195 - 205 lbs.

### Materials that Contact Product Water:

ABS	Polyethylene
Acrylic	Polypropylene
Carbon	Stainless Steel
Nylon	Thin Film Composite Membrane (polyimide)
PVC	Tygon
Polyester	

All of the above listed materials meet FDA and/or NSF standards.

## **2.2 RO+ Output Water Quality**

The physician in charge of dialysis has the ultimate responsibility for selecting the maximum allowable levels of chemical contaminants in the water and also is responsible for monitoring the water. The AmeriWater RO+ System is designed to produce water that meets or exceeds ANSI/AAMI RD62 requirements.

### **Thin Film Composite Membrane**

<b>Contaminants</b>	<b>Percentage Removal</b>
Calcium	99.5
Magnesium	99.5
Sodium	98.0
Potassium	97.0
Fluoride	87.0 - 93.0
Nitrate (NO <sub>3</sub> )	60.0 - 75.0
Sulfate	99.5
Copper	98.0 - 99.0
Barium	96.0 - 98.0
Zinc	98.0 - 99.0
Aluminum	98.0 - 99.0
Arsenic	94.0 - 96.0
Lead	96.0 - 98.0
Silver	93.0 - 96.0
Cadmium	96.0 - 98.0
Chromium	96.0 - 98.0
Selenium	94.0 - 96.0
Mercury	96.0 - 98.0
Antimony	96.0 - 98.0
Beryllium	96.0 - 98.0
Thallium	96.0 - 98.0

### **PT401 Antiscalant/Scale Inhibitor**

<b>Contaminants</b>	<b>Chemical Feed System</b>
Membrane Scale Control	Not to exceed 40 ppm

## **2.3 TEMPERATURE CORRECTED RO+ PRODUCTION RATES**

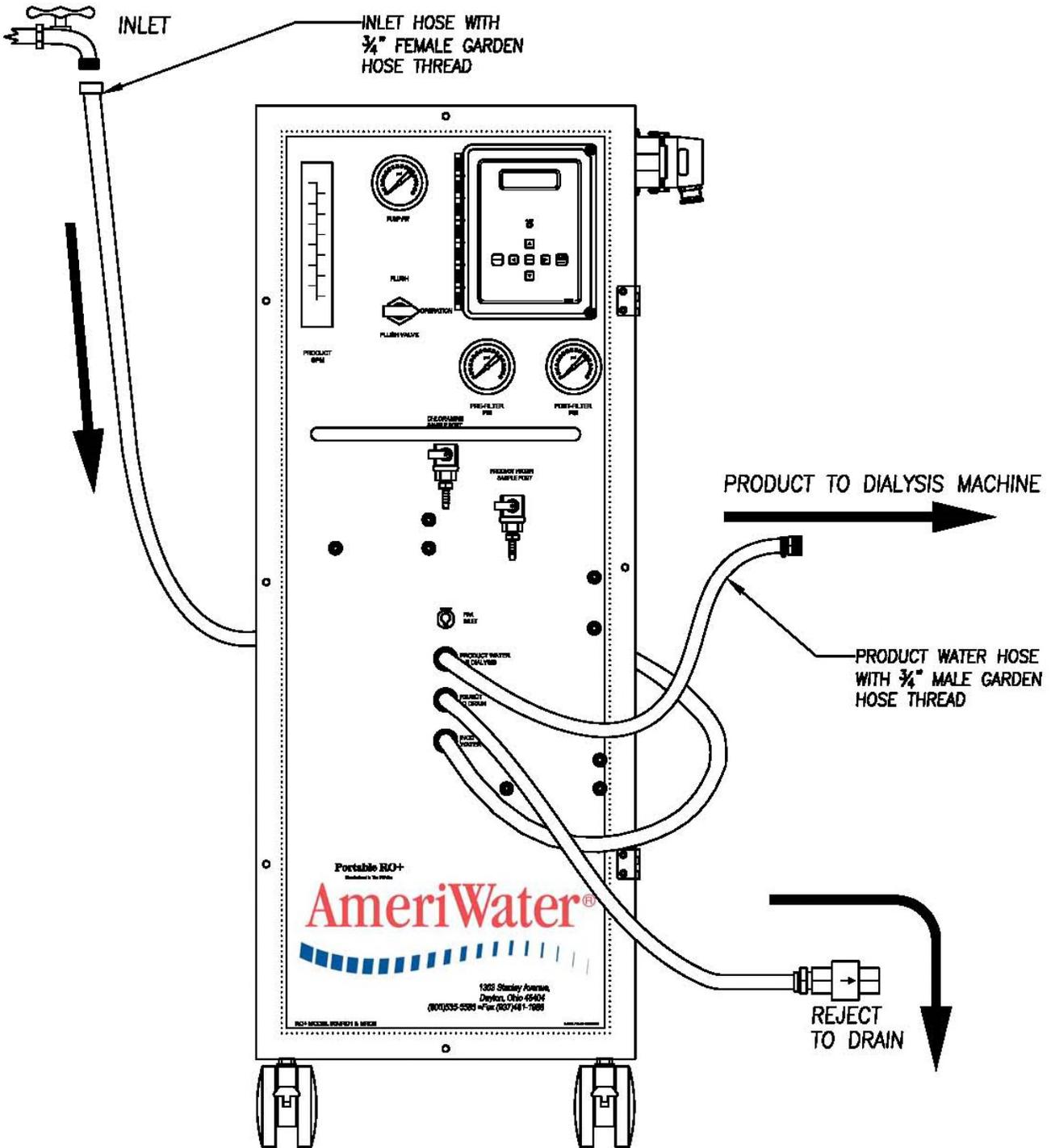
RO+ membrane performance is affected by water temperature. The Product Water Flow Rate and Output decreases as the temperature of the Incoming Tap Water decreases. The chart below provides both Total Product Output (in **Gallons Per Day**) and Product Flow Rate (in **Gallons Per Minute**).

- Measure your Incoming Tap Water temperature by reading the temperature on the controller LCD display.
- Follow the chart across to find your Temperature Corrected Product Water Total Output and Flow Rates.

**MRO2 Temperature Corrected Production Rates**

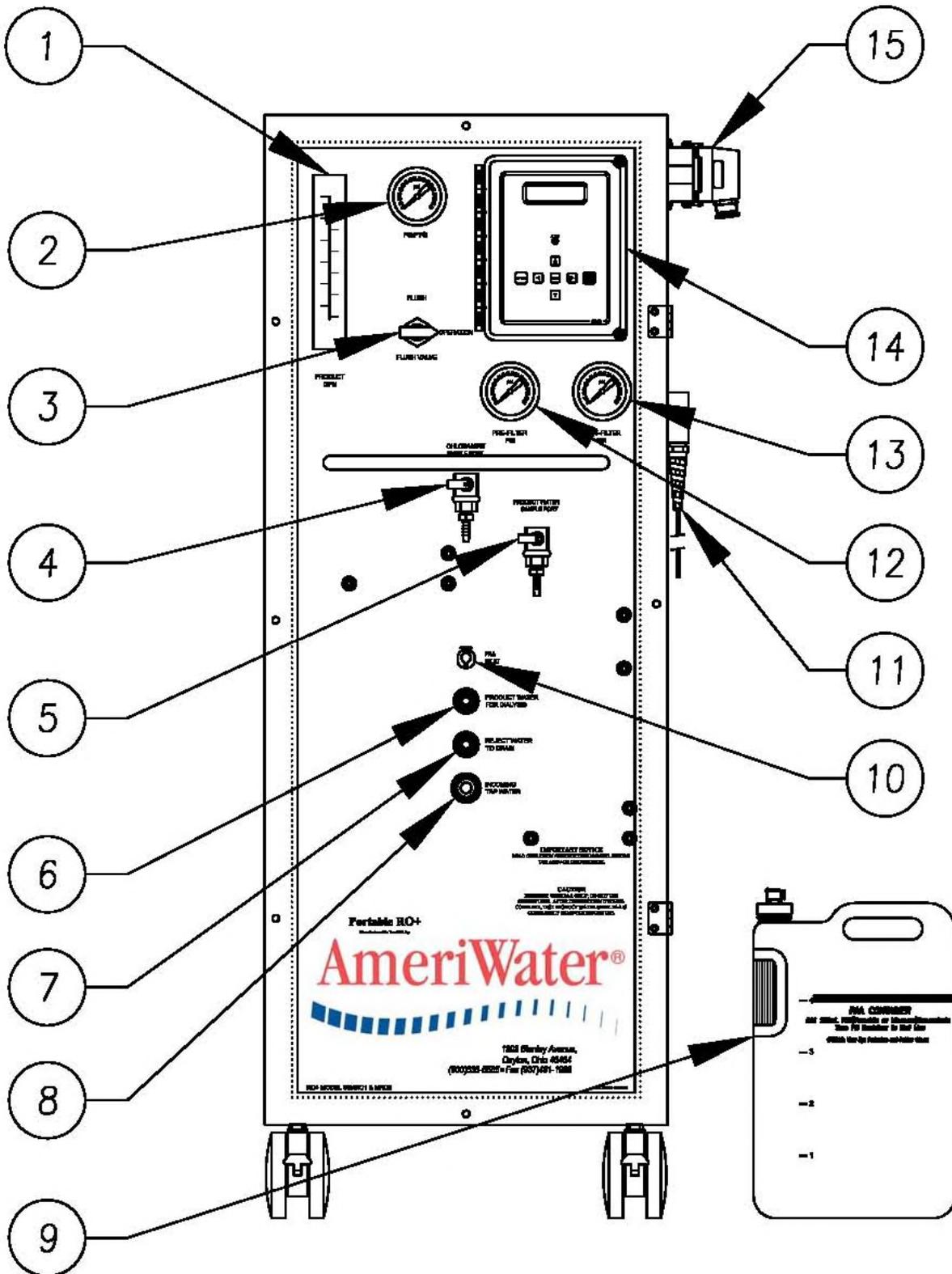
Temperature F	Temperature C	Total Output GPD	Flow Rate GPM
40	4.45	1428	0.99
45	7.23	1599	1.11
50	10.01	1764	1.22
55	12.79	1932	1.34
60	15.57	2100	1.45
65	18.35	2268	1.57
70	21.13	2486	1.72
75	23.91	2727	1.88

## 2.4 MRO2 DIRECT FEED TO DIALYSIS MACHINE(S)



# SECTION 3, COMPONENTS AND SCHEMATICS

## 3.1 EXTERNAL FRONT VIEW

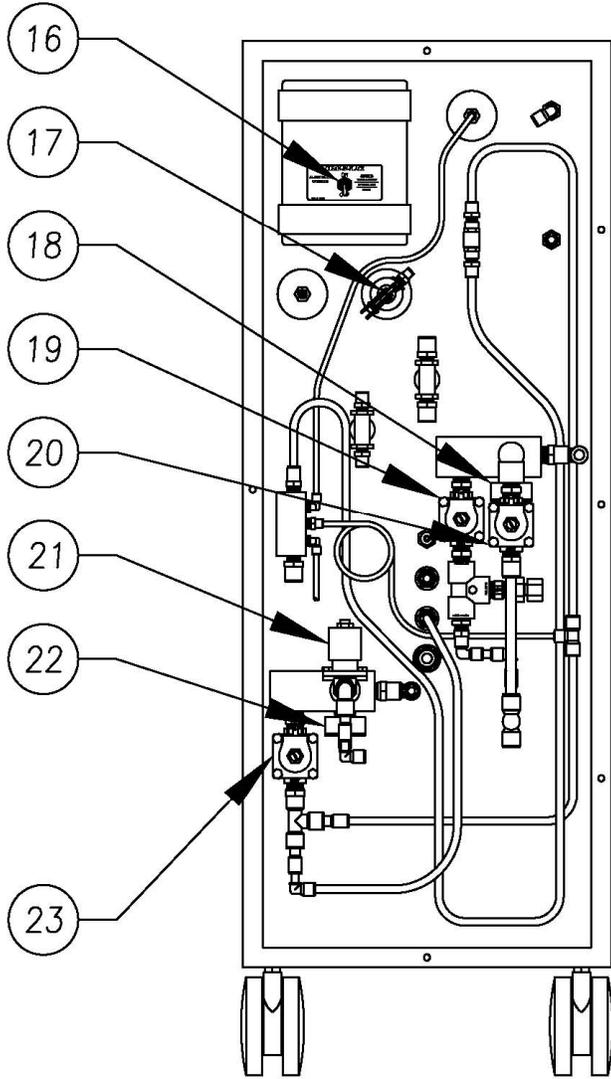


## **IDENTIFICATION OF COMPONENTS (EXTERNAL VIEW)**

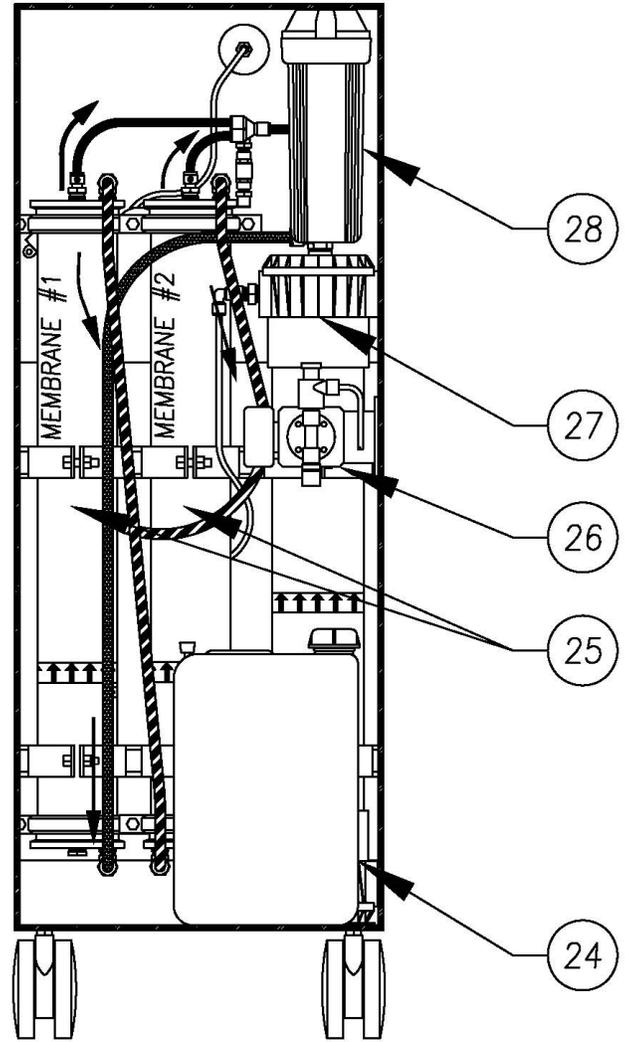
1. **PRODUCT GPM**– Flowmeter that measures the flow of the product water for dialysis in gallons per minute (GPM) and liters per minute (LPM).
2. **PUMP PRESSURE** – Gauge that measures the primary feed pressure in pounds per square inch (PSI) from the pump to the RO+ membrane.
3. **TEMPORARY FLUSH VALVE** – When the unit is in operation (feeding a dialysis machine), the valve must be in the “IN SERVICE” position. **Do not place the TEMPORARY FLUSH VALVE in the FLUSH position when the RO+ is feeding a dialysis machine. Serious injury to the patient may occur!**
4. **CHLORAMINES SAMPLE PORT** – Valve with nozzle to let small amounts of water out to test for the presence of chloramines before the RO+ membrane.
5. **PRODUCT WATER SAMPLE PORT** – Valve with nozzle to let small amounts of water out to test the quality of the product water for dialysis.
6. **PRODUCT WATER FOR DIALYSIS** – Hose transmitting purified water from the RO+ system to the dialysis machine.
7. **REJECT WATER TO DRAIN** – Hose transmitting wastewater to the drain.
8. **INCOMING TAP WATER** – Hose feeding tap water into the RO+ system.
9. **PAA CONTAINER** – The PAA container is used to mix the solution used for disinfection, and attaches to the RO+ (for disinfection) via quick connect fittings.
10. **PAA QUICK CONNECT FITTING (RO+)** – Quick connect fitting that the PAA container is connected to on the RO+ for sanitization.
11. **HOSPITAL GRADE POWER CORD:** must be connected to a single phase, 3-conductor type, hospital grade receptacle with a ground fault interrupter (GFI) at 115V, 20amp, and 60Hz.
12. **PREFILTER INLET GAUGE** – Gauge that measures the pressure in pounds per square inch (PSI) of the incoming tap water as it enters the micron prefilter.
13. **PREFILTER OUTLET GAUGE** – Gauge that measures the pressure in pounds per square inch (PSI) of the water after going through the micron prefilter. Change the micron prefilter when the outlet gauge reads 10 PSI less than the prefilter inlet gauge.
14. **CONTROLLER** – Control mechanism for the RO+ (Section 6, RO+ Controller).
15. **SIDE ENTRY HOOD** (from external view): External wire installation for float level switches, pretreat lockout and RO alarm relay connectors; (See Section 7).

### 3.2 INTERNAL REAR VIEW

#### FRONT PANEL



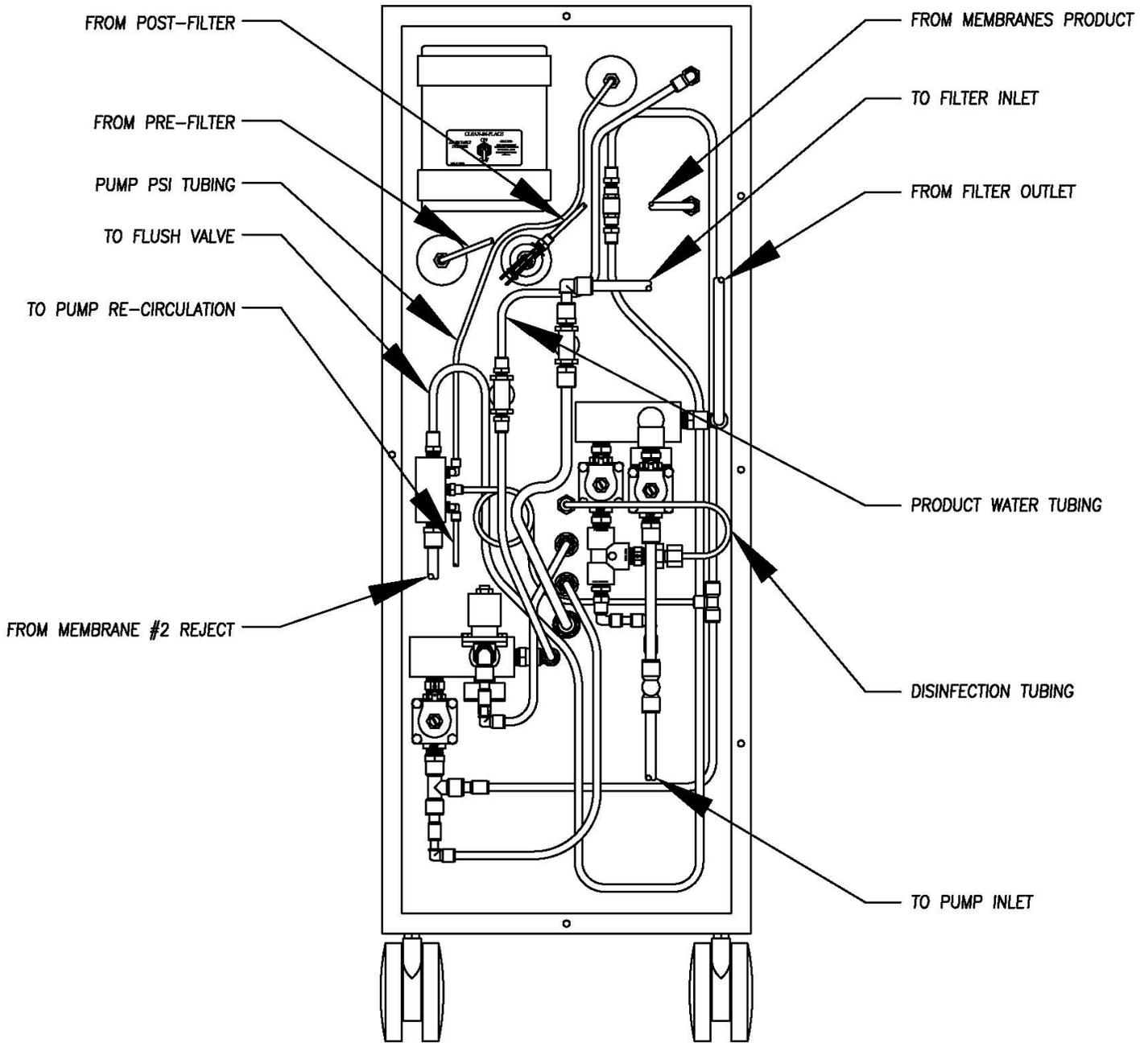
#### REAR PANEL OPEN



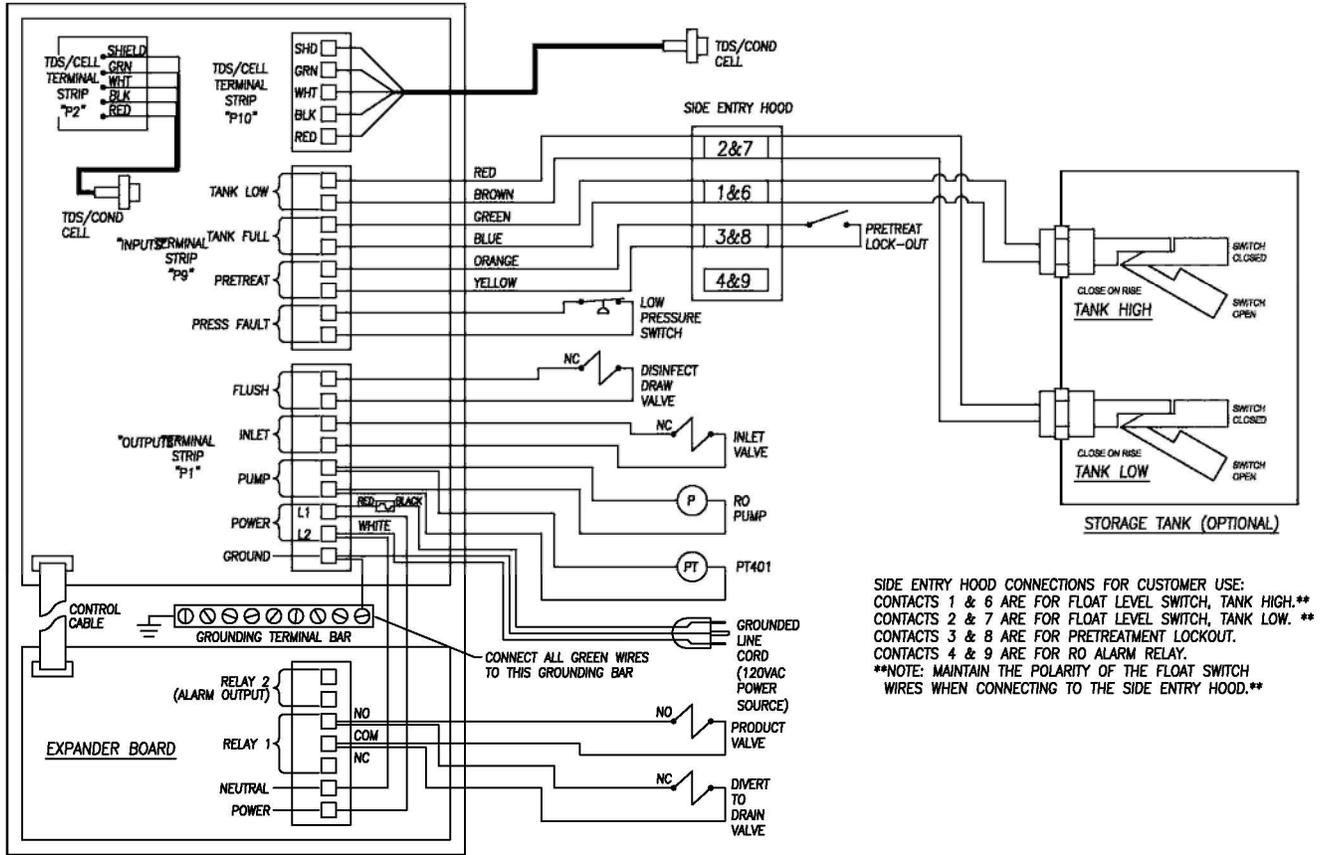
## **IDENTIFICATION OF COMPONENTS (INTERNAL VIEW)**

16. **CLEAN IN PLACE (CIP) SWITCH** – When the CIP Switch is placed in the ON position, all RO+ fail-safe modes are disabled for low pressure membrane cleaning with the optional AmeriWater Clean In Place System (P/N 00CIP1).
17. **PRESSURE SWITCH** – Protects the pump from running when there is insufficient source water.
18. **INLET CONDUCTIVITY SENSOR** – Measures the conductivity of the incoming water in microsiemens.
19. **DISINFECT SOLENOID** – Solenoid valve that is normally closed and opens during the disinfection process for the MRO.
20. **INLET SOLENOID** – Solenoid valve that is normally closed and opens when the controller is in operation.
21. **PRODUCT SOLENOID** – Solenoid valve that is normally open when product water conductivity is within specification. This will power on when the product water is out of specification preventing flow through the product water hose.
22. **PRODUCT CONDUCTIVITY SENSOR** – Measures the conductivity of the product water in microsiemens.
23. **REJECT SOLENOID**– Solenoid valve that is closed when the conductivity of the product water is within specification. This valve opens when the conductivity of the product water is below the set-point.
24. **PT401 ANTISCALANT / SCALE INHIBITOR** – Plastic container filled with 2 ½ gallons of PT401 solution to prevent the RO+ membrane from scaling. The plastic container should be refilled with PT401 solution when it reaches the half-full level.
25. **MEMBRANES** – Spiral-wound, thin film, composite membranes for reverse osmosis.
26. **PT401 FEED PUMP** – Injects PT401 Antiscalant/Scale inhibitor solution at a predetermined dosage based on a water analysis. The PT401 pump runs when the main pump runs.
27. **PUMP** – Provides the pressure for the RO+ system. The RO+ ON/OFF switch controls the pump motor.
28. **PREFILTER** –A 1 micron sediment filter is provided.

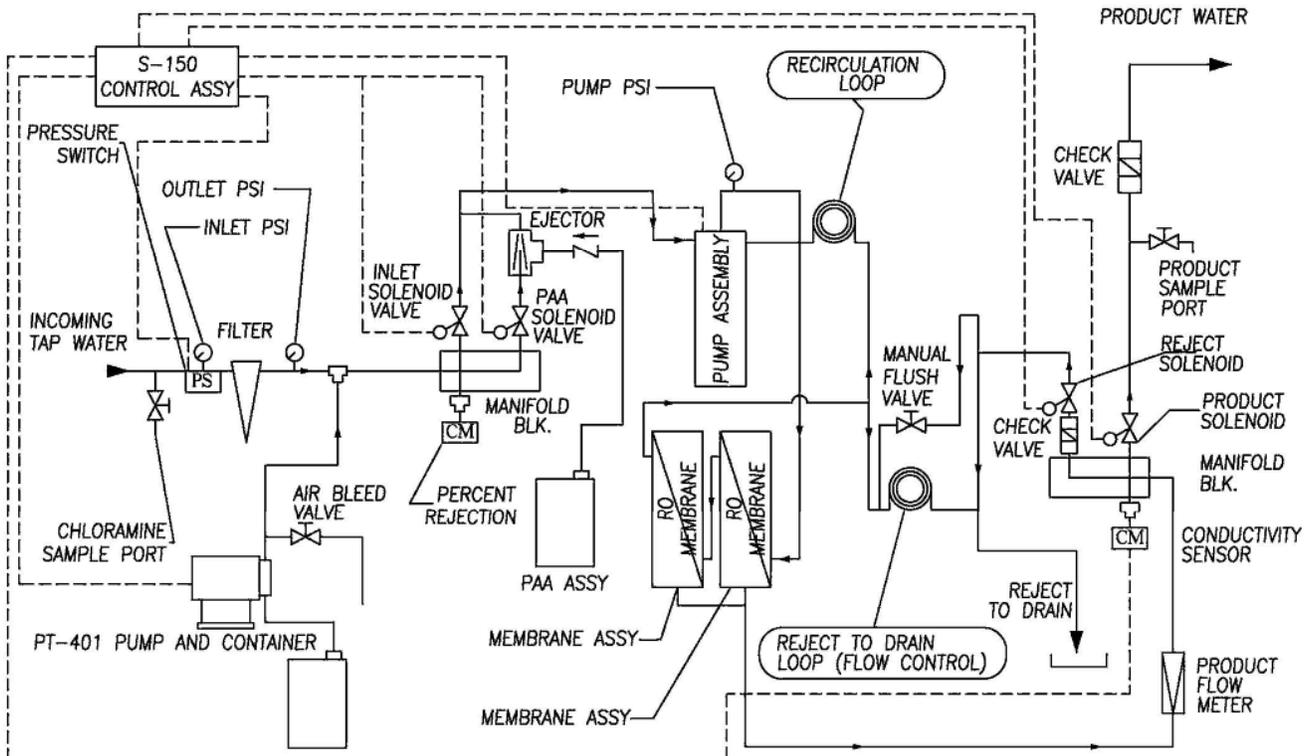
### 3.3 MRO2 TUBING DIAGRAM



### 3.5 ELECTRICAL DIAGRAM, MRO2



### 3.6 FLUID DIAGRAM, MRO2



# SECTION 4, RO+ STARTUP & OPERATION

## 4.1 CAUTION

**NOTE:** This entire Operations Manual should be read before operating or servicing the RO+ system. The Operations Manual should then be kept near the system and used as a reference and troubleshooting guide.

**WARNING:** This Reverse Osmosis System (RO) contains a preservative solution to prevent microbiological growth and freezing. Discard all product water for at least two hours of operation before placing the RO in service.

**CAUTION:** No person should attempt to operate or service the RO+ without prior authorization or instruction from your medical facility director.

The following operating or water supply conditions could cause an accident or the RO+ system to fail:

1. The electrical source must be single phase, 3-conductor type provided with a hospital grade receptacle and a ground fault interrupter (GFI) at 115V, 20amp, and 60Hz. The proper polarity and ground integrity must be initially checked and thereafter maintained. Failure to do so may result in electrical shock to the operator or patient. It is suggested that the RO+ be placed on an electric supply with emergency backup.
2. The RO+ must only be plugged directly into a GFI receptacle. It must not be plugged into an extension cord or power strip that could cause low amperage.
3. All local plumbing and electrical requirements should be met.



To avoid electric shock, always unplug the RO+ system before opening the face of the electrical controller.

4. Incoming water should be between 41° F and 90° F (5° C and 33° C). It is not recommended to use water at temperatures below 41° F (5° C) because it will reduce membrane performance significantly. Use only the cold water supply unless using an automatic blending valve to get 77° F (25° C) water. Never use water warmer than 90° F (33° C).
5. Water with silt density index (SDI) above 5 SDI will foul the membrane.
6. The RO+ system may be equipped with a pretreatment system to remove chlorine and chloramines. It is important to test for chlorine and chloramines at the CHLORAMINES SAMPLE PORT before each use of the system. Chlorine will deteriorate the membrane and cause system failure. It is recommended to use a Total Chlorine test kit, such as Water Check 2 Low Level Chlorine/Chloramines Test Strips (P/N 97CM20201).
7. Incoming tap water pH should be within EPA National Secondary Drinking Water Regulations of 6.5 - 8.5. Incoming tap water with pH higher or lower than the regulation will cause higher conductivity in the product water. If the water changes drastically, the

membrane will be harder to clean. Periodically check the pH of the incoming tap water to verify that it is within the specified range (pH Water/Bicarbonate/Dialysate Test Strips P/N 97PH20901). Contact AmeriWater if the pH is above 8.5.

**CAUTION:** Mixing chlorine and hydrogen peroxide/peroxyacetic acid causes a toxic chemical reaction. Never allow them to mix!

**CAUTION:** Do not use chlorine to disinfect the system!

8. Use only the exact amount of hydrogen peroxide/peroxyacetic acid disinfectant solution and in proper dilution during disinfection of the system.
9. It is important to test for PAA in the Product Water For Dialysis after rinsing during disinfection of the system. Do not use the system until the PAA is below 3 PPM in the PRODUCT WATER hose.

**CAUTION:** Never operate the RO+ with a dialysis machine if the water conductivity exceeds the set point, indicating Poor Quality!

10. Always maintain water flow and pressure to avoid damage to the pump.
11. Minimum feed pressure is 20 PSI (while the RO+ is in operation, with flow). Maximum feed pressure is 90 PSI.
12. The micron prefilter must be replaced every time that the membranes and/or carbon tanks are changed, or when the differential pressure on the prefilter gauges is 10 PSI or greater than initially recorded.

**CAUTION:** If the prefilter is not replaced, damage may occur to the pump and/or membrane.

13. If the system is operated without a micron prefilter, the membrane will foul.

**WARNING:** The Clean In Place Switch, located inside the cabinet on the back of the controller, must be in the OFF position during normal operation. If the Clean In Place Switch is left in the ON position during normal operation, all RO+ fail-safe modes will be disabled and damage to the RO+ or injury to the patient may occur.

14. Minimize the opportunities for bacterial growth between uses!

**CAUTION:** To minimize bacterial growth, operate the MRO for 5 minutes in “FLUSH” and then 5 minutes with the FLUSH VALVE in “OPERATION” before connecting to a dialysis machine and using for dialysis.

Whenever the MRO is not used for a period of several hours, the “Membrane Flush Feature” of the MRO should be programmed to be active when in the STANDBY mode (See section 5.4 for activating this feature).

Before determining a bacteria count, the MRO should be PLACED in FLUSH for 5 minutes, and then placed in OPERATE for 5 – 10 more minutes after a period of non-use, but before taking a sample of the PRODUCT WATER. Bacteria is known to increase in population when water is not moving.

## **4.2 SAFETY FEATURES**

The RO+ is equipped with several safety features for the benefit of both the user and the patient. They consist of the following:

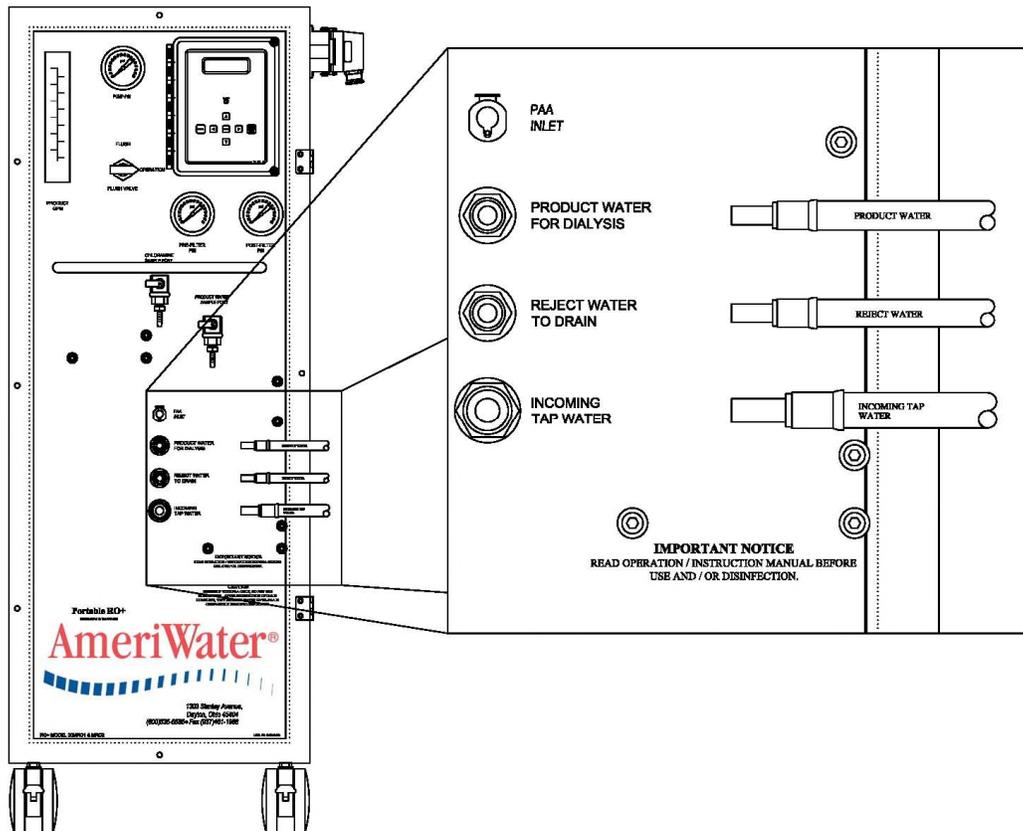
1. Disinfection using hydrogen peroxide/peroxyacetic acid disinfecting solution instead of formaldehyde to increase safety and avoid health risks associated with formaldehyde. Hydrogen peroxide/peroxyacetic acid produces no harmful by-products or side effects, thus it is safer for patients. Using hydrogen peroxide/peroxyacetic acid does not require additional ventilation, and disposal is safe and easy. Important information regarding the usage and handling of hydrogen peroxide/peroxyacetic acid is listed in Section 5.2, A WORD ABOUT HYDROGEN PEROXIDE/PEROXYACETIC ACID, and in the hydrogen peroxide/peroxyacetic acid Materials Safety Data Sheet. Please read them carefully.
2. Color-coded inlets and outlets are on the membrane assembly to avoid mix-ups.
3. INCOMING TAP WATER, PRODUCT WATER, and REJECT WATER TO DRAIN hoses are labeled to prevent incorrect connections.
4. An audible alarm sounds whenever water quality drops to an unacceptable level.
5. Low pressure shutdown to protect the pump whenever the feed pressure is too low.

**WARNING:** The AmeriWater model MRO2 is a device that can be used by being a direct feed to dialysis machines or used in a loop system. For this reason, there is a divert to drain on this model. **TERMINATE TREATMENT IMMEDIATELY IF WATER QUALITY FALLS OUT OF SPECIFICATION WHEN NO STORAGE TANK IS BEING USED.**

### 4.3 INITIAL STARTUP

**WARNING:** This Reverse Osmosis System (RO) contains a preservative solution to prevent microbiological growth and freezing. Discard all product water for at least two hours of operation before placing the RO in service.

1. Lock the two front casters so that the RO+ will remain stationary during startup.
2. Remove the plugs from the PRODUCT WATER, REJECT WATER TO DRAIN, and INCOMING TAP WATER fittings on the front of the RO+.
3. Connect the INCOMING TAP WATER, PRODUCT WATER and REJECT WATER TO DRAIN hoses to the appropriate fittings (see Figure 4.1).



**FIGURE 4.1**

- Insert the hose assembly tube extension into the appropriate bulkhead fitting in the front of the cabinet. The hose assemblies come in the installation kit for the MRO.
- Gripping the tube insert, firmly press this into the fitting until you reach the positive stop. The Inlet hose will go in approximately 1" and the Product and Reject hoses will go in about  $\frac{3}{4}$ ".

**NOTE:** To remove the hoses, depress the gray "collet" inward while gently pulling the hose out.

**CAUTION:** To insure proper assembly, tubing extension **MUST** be fully inserted into the fitting body to the tube stop.

4. Connect the RO+ INCOMING TAP WATER hose to the potable cold water supply using the Incoming Tap Water hose and fittings supplied. If blending both warm and cold water to improve product flow rate, do not exceed 90° F (33° C).
5. The REJECT WATER TO DRAIN hose coming out of the RO+ system is for reject water. The water from this hose will go down the sink. Leave at least a 2" air gap between the hose and the drain to prevent contamination or siphoning.
6. The PRODUCT WATER hose should also be secured to the sink until the disinfection cycle is completed and the water quality is in the good range (below the conductivity setpoint and not in alarm).
7. Open the access panel.
8. If your RO+ was ordered with the optional PT401 antiscalant system, remove the gray packing foam between the PT401 CONTAINER and the cabinet wall.
9. Plug the power cord into a 115-volt, 20-amp GFI receptacle.
10. Turn on the potable cold water supply to the RO+.
11. Ensure that the CIP switch is set to off.
12. Turn on the RO+ and place the FLUSH VALVE in the FLUSH position. Allow the RO+ to run in FLUSH for 5 minutes.

**NOTE: The RO+ conductivity alarm may sound, which is normal when the RO+ is in FLUSH. Press the ALARM SILENCE key on the RO+ controller to silence the alarm. The alarm will restart after a 3 minute delay.**

13. After flushing for 5 minutes, turn the FLUSH VALVE to OPERATION position and run for 2 hours to rinse the preservative out of the system.
  14. Disinfect the system prior to use **(See Disinfecting the System, Section 5)**.
  15. When all disinfection procedures have been completed, turn on the feed water supply.
  16. Press the POWER key (the display will show OPERATING after a 10 second delay).
- NOTE:** The conductivity may alarm for a few seconds before dropping into the desired range.
17. Turn the FLUSH VALVE to the OPERATION position. The PRODUCT GPM FLOWMETER should indicate at least 1.0 GPM (3.79 LPM).
  18. Refer to the Start-Up Log in Section 4.5. Complete the entire RO+ Performance section making sure that the system is operating within all the required ranges.

**WARNING:** Do not use the RO+ to feed a dialysis machine until all specifications are met.

19. When the log shows that all start-up conditions are met, the system is now ready for use. Press the POWER key (the display will show STANDBY). Connect the PRODUCT WATER hose to the dialysis machine (**Note: See the Operations Manual for your dialysis machine for instructions, and perform the procedure aseptically.**)

**CAUTION:** Although the water treatment system may produce water of sufficient quality to meet the requirements of AAMI standards, distribution of the water may degrade its quality to the point where it no longer meets the requirements of this standard. AmeriWater offers information about ultra pure water piping to prevent the degradation of product water in a water loop.

#### **4.4 SYSTEM SHUTDOWN**

1. Before turning off the POWER key, it is recommended to turn the FLUSH VALVE to the FLUSH position and allow the RO+ to flush for 5 minutes. This will flush the concentrate out of the system.
2. Press the POWER key (the display will show STANDBY).
3. Turn off the potable tap water supply to the system.
4. Disconnect the PRODUCT WATER hose from the dialysis machine and the INCOMING TAP WATER hose from the potable tap water supply. The hoses may be connected together to prevent dirt from entering the hoses.
5. Remove the REJECT WATER TO DRAIN hose from the sink. The hoses and power cord may be secured by the hose strap on the side of the RO+ for storage or transport of the RO+.
6. Store the system until next use. If the system will be stored for more than 24 hours, it is recommended that the system be stored with a suitable RO preservative or allowed to run in OPERATION at least every 8 hours to discourage microbiological growth during storage. Refer to section 5.3 for detail on the recommended preservation method, or enable the MEMBRANE FLUSH FEATURE (Section 5.4).
7. See Initial Startup in Section 4.3 for instructions before the next use. **The system will need to be preserved or disinfected before the next use if it sits unused for 1 or more days, or in accordance to the guidelines of your medical facility director.**
8. When transporting the RO+, push or pull the system by the handle only.

**WARNING:** **DO NOT attempt to push or pull the RO+ from the side! This will cause the RO+ to tip over and may result in injury and/or damage to the system. Use only the handle at the front of the cabinet to move the MRO.**

## 4.5 STARTUP AND OPERATION LOG

1) DATE									
<b>RO PERFORMANCE (DURING WATER FLOW)</b>									
2) Temperature (41°F - 90°F)									
3) Product flow (MRO2 minimum 1.0 GPM)									
4) Pump PSI (120 - 240 PSI)									
5) Pre-filter Gauge (Feed) (20 - 90 PSI)									
6) Filter Pressure Drop (maximum 10 PSI)									
7) Hour Meter Reading									
8) Chloramines Test (maximum 0.1 PPM)									
9) Product Water Quality Reading									
9a.) Percent Rejection									
<b>DISINFECTION CYCLE</b>									
10) Complete PAA Draw									
11) Record PAA in Reject Water ( $\geq 1\%$ )									
12) Record PAA Test Product Water ( $\geq 0.5\%$ )									
13) 60 Minute Soak Start Time									
14) 60 Minute Soak Stop Time									
15) Rinse Start Time									
16) Rinse Stop Time									
17) PAA Test to Less than 3 PPM at Product & Reject Hoses and Product Test Port.									
<b>STORAGE WITH MEMBRANE PRESERVATIVE</b>									
18) Product Water Pre-Storage pH									
19) Complete Draw									
20) Rinse Start Time									
21) Rinse Stop Time									
22) Product Water Post - Storage pH ( $\pm 1$ of Pre-Storage pH)									
<b>EXCHANGE</b>									
23) Micron Prefilter (monthly)									
24) Clean or Replace the Membrane									
25) Add PT401 Antiscalant (as consumed)									
<b>INITIALS</b>									

**NOTE:** Be sure to operate the RO+ with the TEMPORARY FLUSH VALVE in the FLUSH position for 5 minutes prior to and following each treatment. When a value is indicated on the form, ensure that a value is recorded on the form.

# SECTION 5, DISINFECTING THE SYSTEM

## 5.1 DISINFECTING THE SYSTEM

The RO+ system should be disinfected according to specifications of your medical facility director. As a general guideline, AmeriWater recommends that the system should be disinfected at least monthly. Additionally, the system should be disinfected if it has not been: used for 24 hours; flushed at least every 8 hours; or “preserved”

**Be sure to refer to the Start-Up Operation Log in Section 4.5. This will help you verify and document that all steps are performed to disinfect the system properly.**

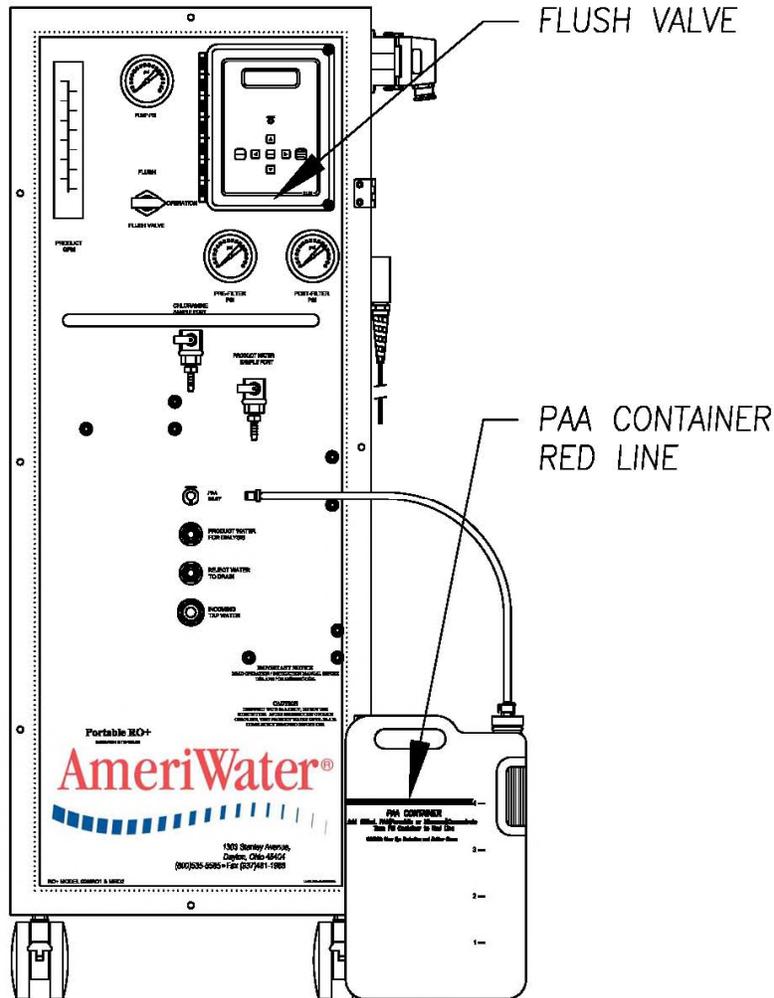


FIGURE 5.1

1. Switch off the RO+ by pressing the POWER key (the display will show STANDBY).
2. Verify that the feed water supply to the RO+ is ON.
3. Disconnect the RO+ from the water loop before starting the disinfection procedure. Disinfectant for the RO+ or loop may be allowed to enter a dialysis machine. Check your dialysis machine manufacturers recommendations.

**WARNING:** The disinfection mode will allow PAA to flow through the PRODUCT WATER hose. This is to allow disinfection of the hoses and the connected direct-feed water loop. If the direct-feed water loop is to be disinfected with the MRO+, fill and draw the PAA solution container at least twice to allow sufficient volume into the loop for complete disinfection. It is recommended to use the optional loop disinfection kit.

- 4a. To disinfect only the MRO2, (direct connected to dialysis machines and not connected to a loop) put the PRODUCT WATER hose along with the REJECT WATER TO DRAIN hose in a sink.
- 4b. To disinfect the MRO2 AND direct-feed water loop allow the PRODUCT WATER hose to remain connected to the loop during the disinfection procedure, **but be sure all dialysis machines are disconnected during the disinfection procedure.**
5. Unscrew the cap assembly of the PAA container.
6. Put on rubber gloves, apron, and goggles.

**CAUTION:** Exposure to PAA concentrate or solution may cause severe chemical burns to the skin or eyes. Additional information regarding the safe handling of PAA is found in this section, on the Peracidin container, and in the material safety data sheet. Please read carefully before using.

7. Add 150 ml of 100% PAA disinfecting solution to the PAA Container (plastic gallon container) and fill with water to the red line (tap water or treated water may be used).
8. Screw the cap assembly securely back onto the PAA container.
9. Agitate the container in a circular motion for approximately 10 seconds.
10. Connect the PAA tubing male fitting into the PAA Container's quick disconnect fitting that is mounted in the cap assembly (Figure 5.1).
11. Turn the FLUSH VALVE to the FLUSH position (Figure 5.1).
12. Turn on the feed water supply to the RO+.
13. Press and hold the LEFT ARROW key and then, press the RIGHT ARROW key. This will access the DISINFECT MODE. The controller display will show DISINFECT ENABLED and the keys can be released.
14. When in DISINFECT MODE, the signal from the conductivity cell is disabled. The Product Water for Dialysis will pass through and out the Product Water hose laden with PAA disinfectant. If connected to a water loop, PAA disinfectant solution will, also, pass through the loop.
15. Pressing and holding the ENTER key will activate the disinfect function, will draw PAA from the container, and will pump PAA solution through the MRO.

- 16a. If disinfecting only the MRO without a direct-feed loop:  
When the PAA empties (or a level approximately 2" from the bottom) on the PAA Container, turn the FLUSH VALVE to the OPERATION position. Continue holding the ENTER key until the container is empty.
- 16b. If disinfecting the MRO while connected to a direct-feed loop, pushing the disinfectant through to the end of the loop is more difficult than with the MRO alone:

Draw a complete PAA container into the MRO2

**While drawing PAA, "throttle" the FLUSH VALVE from the full FLUSH position counterclockwise to achieve pump pressure on the membrane to "push" the disinfectant through the loop, but throttled to the point that it doesn't take more than 2.5 minutes to draw all the PAA from the container.**

Release the ENTER key, then refill the PAA container, reconnect the PAA container to the MRO, press & hold the ENTER key, and draw the 2<sup>nd</sup> PAA container into the MRO in the same manner with the "throttled" Flush Valve. When the 2<sup>nd</sup> PAA container is emptied immediately release the ENTER key to avoid sucking air into the system and diluting the PAA by additional running. Test for the presence of PAA at the return from the loop.

**NOTE: The ENTER key must be held until all the PAA is drawn into the RO+.**

- a. **Avoid stopping and starting the disinfect function which may cause a thermal overload of the RO+ pump.**
- b. **Releasing the ENTER key may cause the system to lose its prime preventing all of the disinfectant from being drawn into the MRO.**
- c. **Approximately ¼" of the solution will remain in the bottom of the PAA container. This is normal and may be emptied down the drain after the entire process is complete.**

17. Record on the Start-Up Log that this step was performed.
- 18a. The MRO (if not connected to a loop) should be filled with hydrogen peroxide/peroxyacetic acid disinfecting solution. To ensure that PAA solution has been pumped through the MRO, use Peracid test strips (P/N 97hp20401):
- a. Using a test strip, test the water at the REJECT WATER TO DRAIN hose, the result must be at least 1% (500 ppm).
  - b. Use another test strip at the PRODUCT WATER hose, the result must be at least 0.5% (250 ppm).
- 18b. If the MRO is connected to a direct-feed loop during disinfection, then the entire loop must test positive for PAA throughout the loop. Using a fresh test strip at each dialysis machine water outlet, test the water. The result must be at least 0.5% (250 ppm).

- 18c. If the direct-feed loop uses a Product Recovery, the presence of PAA must test positive at the Chloramine Test Port at the front of the MRO in addition to each dialysis machine water outlet. The result must be at least 0.5% (250 ppm).

**NOTE:**

Water loop systems will vary in size and in volume for each installation. If the loop is to be disinfected along with the MRO, then PAA must be drawn into the MRO using only the disinfection function, pumped into the loop through the MRO, and out through the PRODUCT WATER hose connection. After each container of PAA solution is drawn into the MRO, then the MRO must be stopped without delay, and each water outlet must be tested for PAA at the minimum amount. Continuing to run the MRO after all the PAA solution is drawn out of the PAA container will only result with diluting the strength of the PAA, which reduces the disinfecting capability.

If the PAA at each water outlet has not been found to be positive at the minimum required amount, another container must be drawn into the loop through the MRO until the minimum strength is tested and verified using a PAA test strip.

**UNTIL THE PAA IS FOUND TO BE POSITIVE AT EACH WATER OUTLET TEST POINT AT 0.5% MINIMUM, THE LOOP SYSTEM CANNOT BE RELIABLY DISINFECTED.**

19. Record on the Startup Log that this step was performed.
20. To assure that the MRO will not be used for dialysis, leave the MRO in the DISINFECT ENABLED mode, label the RO+ with appropriate WARNING signs (Example: "DO NOT USE / CONTAINS PAA"). Allow the mixture to soak in the system for 60 minutes.

**WARNING: Soaking longer than 12 hours may cause damage to the membrane.**

21. The FLUSH VALVE should remain in the OPERATION position during soaking.
22. Record the Start and Stop times on the Log to have a record of how long the system soaked in hydrogen peroxide/peroxyacetic acid disinfecting solution.
23. After the soaking time has elapsed, turn on the RO+ by pressing the POWER key with the FLUSH VALVE in the OPERATION position.
24. Flush the residual PAA from the disinfectant draw plumbing.
- Fill the PAA Container to the red line with dechlorinated water from the Chloramines Sample Port and connect the PAA tubing to the PAA connection on the front of the RO+.
  - Switch off the RO+ by pressing the POWER key (the display will show STANDBY).
  - Turn the FLUSH VALVE to the FLUSH position.

- d. Press and hold the LEFT ARROW key, and then, press the RIGHT ARROW key to access the DISINFECT MODE. The controller display will show DISINFECT ENABLED, and then the keys can be released.
  - e. Press and hold the ENTER key to turn on the Disinfect Draw function and THE DISPLAY WILL READ **DISINFECT ENABLED DRAW**. Continue to hold the ENTER key, until all of the water is drawn in and you begin to see air bubbles in the draw tube. This will flush out any residual PAA left in the injection plumbing.
  - f. Disconnect the PAA Container PAA tubing from the PAA connection on the front of the RO+.
25. Place the FLUSH VALVE in the OPERATION position.
  26. Turn on the RO+ by pressing the ALARM/SILENCE RESET to restart the RO+ in the operating mode. Record the Start time on the Log. Allow the machine to run at its current setting for at least 15 minutes.

**WARNING:** Do not connect to any dialysis machine at this time. The water quality may register good, but it is possible that some residual PAA solution is still in the system. All of the disinfecting solution MUST be completely flushed out before the system is reconnected to any dialysis machine.

27. After rinsing with the FLUSH VALVE in OPERATION position for at least 15 minutes, turn the FLUSH VALVE to “FLUSH” and allow the MRO to run in “FLUSH” for 15 more minutes.
28. After the MRO has run for a minimum of 15 minutes with the FLUSH VALVE in OPERATION and 15 more minutes minimum in FLUSH, return the flush valve to OPERATION and allow to run for an additional 15 minutes. Begin to test for the presence of PAA with residual test strips (**Renal Check PX Test Strips (P/N 97PX20501)**) at all water outlet points (if connected to a loop).
- 29a. If the MRO is not connected to a loop, periodically test for the presence of residual PAA at the ends of the REJECT HOSE, PRODUCT WATER hose and the Product Water Sample port as the water exits the hoses into the sink until less than 3 PPM of PAA is detected by the residual test strips.
- 29b. If the MRO is connected to a closed end loop dumping through a relief valve to drain, periodically test for the presence of residual PAA at each water use outlet until less than 3 PPM of PAA is detected by the residual test strips.
- 29c. If the MRO is connected to a loop that is being recirculated through a Product Recovery valve and then back into the MRO, periodically test for the presence of residual PAA at each water use outlet AND at the CHLORAMINE SAMPLE PORT at the front of the MRO until less than 3 PPM of PAA is detected by the residual test strips.

**WARNING:** Continue rinsing and testing with test strips until all test strips show a negative result (no color change) to ensure that there less than 3 PPM of PAA disinfecting solution remaining in the system. AmeriWater recommends using Renal Check PX Test Strips (P/N 97PX20501)

30. Record the Stop time on the Log to have a record of how long it takes for the disinfecting solution to completely rinse out. Place a checkmark on the log to verify that residual PAA tested negative.
31. Disinfection is complete. Push the POWER key to turn off the RO+. The display will show STANDBY.

**WARNING:** The PAA Container PAA tubing must remain disconnected from the PAA connection on the front of the RO+ during patient treatment!

## **5.2 A WORD ABOUT HYDROGEN PEROXIDE/PEROXYACETIC ACID**

Do not use hydrogen peroxide/ peroxyacetic acid concentrate (PAA) after the expiration date. Using outdated PAA may cause incomplete disinfection.

PAA loses effectiveness if not kept out of direct sunlight and/or the cap is not tightly sealed. Using ineffective disinfecting solution will cause incomplete disinfection.

Using less than the required volume of PAA will result in incomplete disinfection.

### **Disposal of Outdated Hydrogen Peroxide/Peroxyacetic Acid:**

Supplies Needed

- a sink with a supply of tap water
- rubber gloves, lab apron, and goggles
- a supply of paper towels

1. Put on rubber gloves, apron and goggles.

**CAUTION:** Exposure to hydrogen peroxide/ peroxyacetic acid concentrate or solution may cause severe chemical burns to skin or eyes.

2. Start a flow of cold tap water to dilute the PAA as it flows down the sink drain.
3. Slowly and carefully pour the disinfecting solution down the drain, taking care to avoid spills, splashes, or breathing the vapors.

**CAUTION:** Splashing PAA concentrate may cause severe chemical burns.

4. Rinse the emptied PAA container with tap water to remove all traces of the chemical. **Rinsing emptied containers is needed to protect waste handlers from accidental exposure to the chemical.**
5. Rinse the sink with tap water to remove residual disinfecting solution from the surfaces and flush the chemical from the sink traps.
6. Discard the emptied and rinsed container in a waste receptacle or set aside for recycling.
7. Inspect the area for spilled or dripped disinfecting solution. Wipe up small spills with a damp paper towel. Larger spills should be either flushed to drain with water or removed with a water bucket and floor mop.

**WARNING:** Verify that there is no chlorine (bleach) in the water bucket or floor mop. Chlorine (bleach) will cause a severe chemical reaction when it comes in contact with hydrogen peroxide/ peroxyacetic acid concentrate!

8. Rinse rubber gloves with tap water to remove any residues due to handling.
9. Return rubber gloves, apron, and goggles to their storage area.

### **5.3 RO PRESERVATIVE PROCEDURE**

AmeriWater has developed a method to discourage bacteria growth in the RO+ during long or short term storage (up to 6 months). Contact your AmeriWater representative to purchase a BIOTROL+ kit for portable cabinet ROs (part number 000-095-0001). This kit contains all of the required components to preserve the system for up to 6 months.

AmeriWater recommends that the RO+ be “Auto-Flushed” at least every 8 hours, or “preserved” in BIOTROL+ for storage if the RO+ is not used for a period of 24 hours or longer.

### **5.4 MEMBRANE FLUSH FEATURE (AUTO FLUSH)**

The MEMBRANE FLUSH FEATURE is an alternative to storing the MRO filled with BIOTROL+ when not in use. You can set up the machine to flush periodically when not in use to discourage microbiological growth.

The Membrane Flush feature is disabled as a default from the factory. To enable this feature, set the following setpoints on the RO+ controller accordingly (See Section 6):

<u>SETPOINT</u>	<u>SETTING</u>
Flush Type	6
Flush Time	15 to 45 (minutes)
Flush Interval	4 to 12 (hours)
Flush Mode	3 or 4

<b>FLUSH MODE</b>	<b>RO PUMP</b>	<b>INLET VALVE</b>	<b>DIVERT VALVE</b>
3 For storage tank applications	ON	OPEN	ENABLED
4 For loop applications	ON	OPEN	DISABLED

These settings will allow a flush to occur each time an MRO that is not connected to a direct-feed loop which has been placed in “STANDBY” for the number of hours programmed in the Flush Interval Setpoint. The Flush Time and Flush Interval settings are recommended settings, but may be adjusted to fit your specific needs. Contact your AmeriWater representative for guidance.

For an MRO that is connected to a direct-feed loop, the Product Water during the programmed “MEMBRANE FLUSH” will direct the Product Water through the loop during “STANDBY” to keep the water in the loop “fresh”.

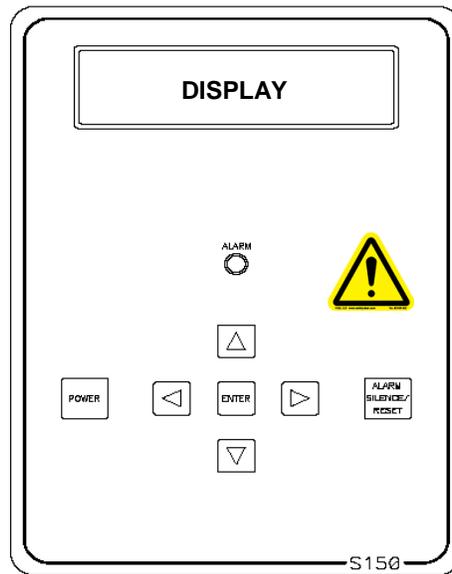
The RO+ must be connected to the electric power source, incoming water supply, and drain while not in use (in “STANDBY”) for this feature to be operable. The FLUSH VALVE must be

in the OPERATION position. The MEMBRANE FLUSH FEATURE cycles the RO+ and directs water to both the PRODUCT WATER and REJECT WATER hoses.

Before determining a bacteria count, the MRO should be PLACED in FLUSH for 5 minutes, and then placed in OPERATE for 5 – 10 more minutes after a period of non-use, but before taking a sample of the PRODUCT WATER. The sample to be taken from the PRODUCT SAMPLE PORT should be allowed to flow briskly into a container for 1 minute, minimum after flushing the MRO and placing it back into operation before taking the aseptic sample for bacteria count. Bacteria is known to increase in population when water is not moving.

# SECTION 6, RO+ CONTROLLER

## 6.1 FRONT PANEL CONTROLS AND INDICATORS



**FIGURE 6.1**

- |                          |   |
|--------------------------|---|
| DISPLAY                  | - Shows status of system.   |
| ALARM LAMP               | - Flashes when fault causes an RO system shut down. On steady when a Setpoint is exceeded that does not cause an RO system shut down. |
| POWER KEY                | - Places controller in operating or standby mode.   |
| LEFT ARROW KEY           | - Scrolls through Setpoints starting with first Setpoint.   |
| RIGHT ARROW KEY          | - Scrolls through Setpoints starting with last Setpoint.  |
| UP ARROW KEY             | - Increases value of Setpoint.  |
| DOWN ARROW KEY           | - Decreases value of Setpoint   |
| ENTER KEY                | - Confirms entry of new Setpoint value  |
| ALARM SILENCE/RESET KEY  | - Push once for alarm silence and twice to reset system after a shut down has occurred.   |
| ACCESSING DISINFECT MODE | - Push and hold the left arrow key, and then push the right arrow key.  |

**(NOTE: The J2 jumper must already be installed to make this an active mode. Ref. Fig. 6.2).**

- |           |  |
|-----------|--|
| DISINFECT | - Push the ENTER key and hold until all of the solution is drawn into the MRO. |
|-----------|--|

## 6.2 CONTROLLER OPERATION

### GENERAL OPERATION

The unit has 2 modes of operation, a standby mode and an operating mode that are controlled by the POWER key. In the standby mode, the unit is effectively off. All outputs are turned off and the display shows STANDBY. In the operating mode, the unit operates automatically. All inputs are monitored and the outputs are controlled accordingly. Pressing the POWER key will toggle the unit from STANDBY to OPERATE or from OPERATE to STANDBY. If power is removed from the unit, when power is reapplied, the unit will restart in the mode it was in when power was removed.

### OPERATING STATUS MESSAGES

The operating status of the unit is shown on the top line of the display. The following list describes the items shown for the operating status.

STANDBY - The unit is in the STANDBY mode.

DELAY 99 - The unit is in the RO start delay. The number is the seconds remaining before the RO pump starts.

OPERATING - The RO unit is operating.

TANK FULL - The unit is shut down due to a tank full condition.

TANK FULL 99 - The unit is shut down due to a tank full condition. If the number is blinking, the tank full high switch has cleared, but the tank full low switch is still active. If the number is on steady, both tank level switches have cleared and the delay is counting down.

PRETREAT - The unit is shut down due to a pretreat lockout condition.

PRESS FAULT - The unit is shut down due to a pressure fault condition.

MEMB FLUSH 99 – Membrane Flush is active. The number is the minutes remaining in the flush cycle.

### CONDUCTIVITY

The Conductivity is shown on the top line after the unit operating status. When the unit is in STANDBY, because of a shut down condition, the reading is replaced with '----'. If the reading is over range, the reading is shown as '^^^' when in the OPERATE mode.

### OPERATING HOURS

The current operating hours are shown on the bottom line.

## TEMPERATURE

The current water temperature is shown on the bottom line to the right of operating hours. When the unit is in STANDBY due to a shut down condition, the reading is replaced with '---'.

## WARNING MESSAGES

Warning messages are also shown on the second line. If any warnings are active, the active warnings will alternate with the normal displays for the bottom line. The following lists the warning messages.

HI COND - The Conductivity reading has exceeded the programmed limit.

## TANK FULL OPERATION

The unit can be operated with 1 or 2 level switches. With 1 level switch, the switch is connected to the contacts 1 & 6 on the side entry hood. When this switch has been active for 5 seconds, the unit will shut down on tank full. TANK FULL will show on the display. When the tank full condition clears, the display will show TANK FULL 99. The number is the tank full restart time and the unit will restart when this delay times out.

For 2 level switch operation, the upper switch is connected to contacts 1 & 6 while the lower switch is connected to contacts 2 & 7 on the side entry hood. When both switches are "open", the MRO unit will start. The MRO unit will continue to run when the water level rises, and while the lower switch becomes active (closed). When the upper switch becomes active (closes), after the 5 second delay, the MRO unit will shut down. TANK FULL will show on the display. When the tank level drops and the upper level switch clears, the display will show TANK FULL 99 and the MRO unit will remain off. The number is the tank full restart time and the number will blink until the lower level switch clears (opens). When the lower level switch clears (opens), the number will remain steady and the MRO will restart when the delay times out. Ensure that the polarity for each switch is maintained.

## TANK FULL RESTART

The tank full restart is the delay before the MRO unit starts when a tank full condition clears. This delay can be in minutes or in seconds. The TF Restart Setpoint selects seconds or minutes.

## TANK FULL OVERRIDE

A timed tank full override can be initiated when the RO unit is shut down due to a tank full condition. Pressing the Alarm Silence/Reset key for 3 seconds during a tank full condition will enable the tank full override. The RO will start and TF OVERRIDE 9 will show on the display. The number is the minutes remaining in the override timer. When the override times out, the unit will return to the tank full shut down condition. The TANK FULL OVERRIDE will divert all water to the drain, whether the water quality is good or bad coming into the RO.

## PRESSURE FAULT

If the pressure fault input becomes active (closes) and stays active for the delay programmed in the PF Delay Setpoint, the unit will shut down for a pressure fault. The display will show PRESS FAULT, the alarm lamp will flash and the audible alarm will sound. The pressure fault can be cleared by pressing the Alarm Silence/Reset key twice.

## AUTO RESET

If a pressure fault shut down occurs and the Auto Reset Setpoint is programmed to 0, the unit will remain shut down until manually reset. If the Auto Reset Setpoint is programmed to a value greater than 0, the unit will automatically clear the pressure fault and attempt to restart after this delay times out.

## ALARM SILENCE

When a shut down occurs that causes the audible alarm to sound, the alarm can be silenced by pressing the Alarm Silence/Reset key once. The alarm will remain silenced for 3 minutes [180 seconds (AAMI RD62 standard)] when the Alarm Silence Setpoint is programmed to the factory default 3. If the Alarm Silence Setpoint is programmed to a value other than 3, the alarm will resound after this delay times out. Pressing the Alarm Silence/Reset key will silence the alarm and reset this delay.

## PRETREAT

If the pretreat input becomes active (closes) and stays active for 2 seconds, the unit will shut down in a pretreat lockout condition. PRETREAT will show on the display and the unit will remain shut down as long as the pretreat input is active.

## HIGH CONDUCTIVITY

If the Conductivity reading exceeds the limit programmed the Cond Limit Setpoint for the delay programmed in the Cond Delay Setpoint, the alarm lamp will light and the HI COND warning message will show on the display. This warning will clear when the Conductivity drops below the Setpoint.

When the High Conductivity warning message is active, the MRO will divert the Product water to drain (through the Reject hose), until the Product water goes back into the acceptable range.

## ALARM OUTPUT

The Expansion I/O relay 2 has been programmed to operate as an alarm relay. The relay will energize whenever a warning or alarm condition occurs. The relay will remain energized as long as the warning/alarm condition is active.

## **6.3 CONTROLLER ADJUSTMENTS**

Your controller has been calibrated prior to shipment and the conductivity set point has been preset based on an analysis of your water provided at the time of sale. It may be necessary to periodically calibrate the Conductivity. If the controller should require calibration, follow the instructions below. Please contact AmeriWater at 800/535-5585 or 937/461-8833 if you have any questions regarding the procedure.

### **CONDUCTIVITY CALIBRATION**

Refer to Figure 6.2 for adjustment location (SPAN). To calibrate the Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample from the PRODUCT TEST PORT and testing it with a known, calibrated meter. Adjust the span control until the reading matches the meter.

To calibrate the 2<sup>nd</sup> TDS / Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample of the water from the Chloramine Sample Port and testing it with a known, good meter. Adjust the span control until the reading matches the meter.

### **DISPLAY ADJUSTMENT**

The display contrast can be adjusted for best viewing by adjusting control R3. This control is located toward the upper right corner of the board, just to the left of the cell connector and below the percent rejection expander board.

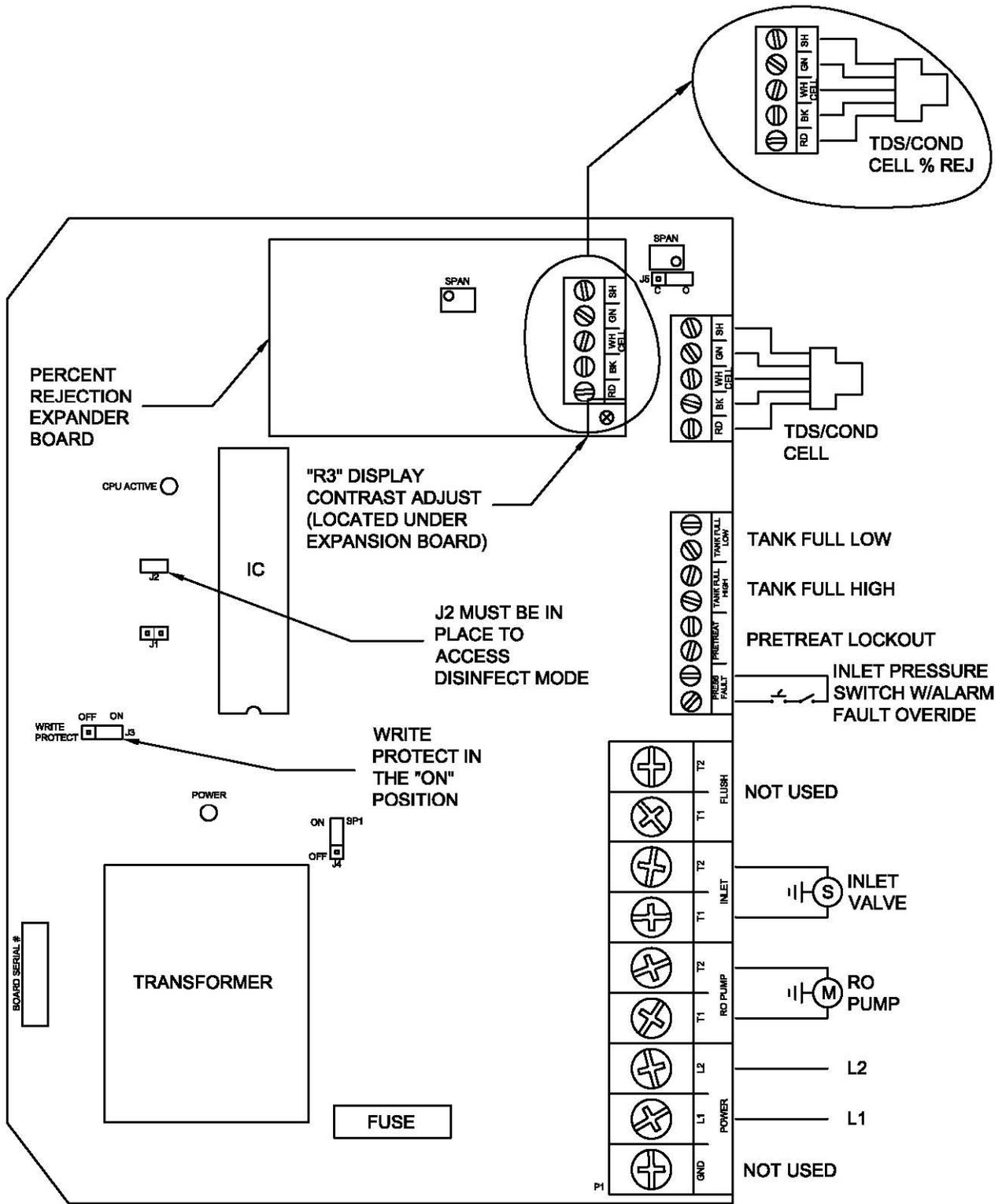


FIGURE 6.2

RIBBON CABLE  
FROM MAIN BOARD  
CONNECTION

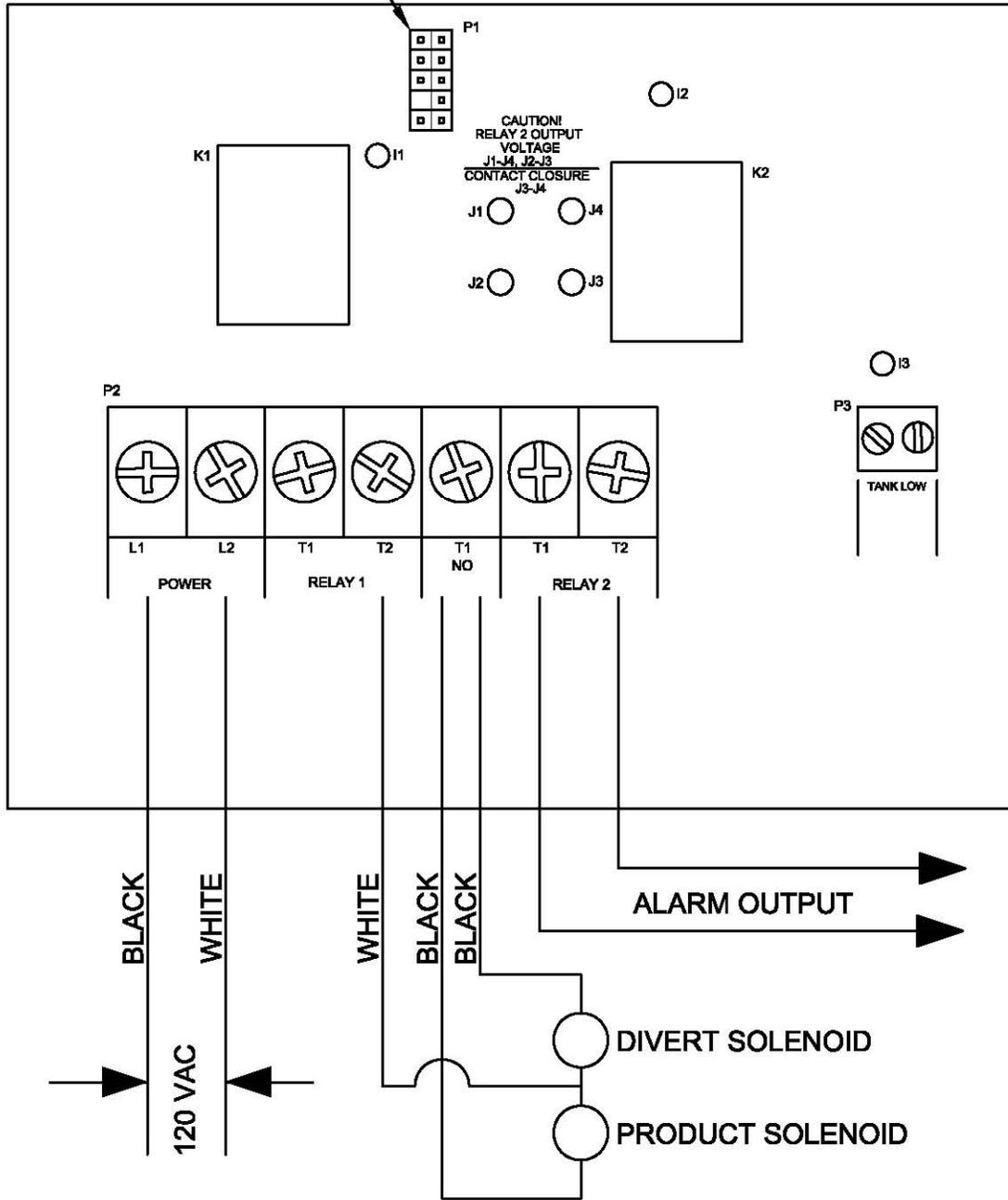


FIGURE 6.3

## **6.4 STANDARD SETPOINTS**

<b>SETPOINT</b>	<b>DESCRIPTION</b>	<b>RANGE</b>	<b>FACTORY SETTING</b>
TDS/Cond Limit	When this value is met or exceeded, the alarm lamp will light and high TDS/Cond will show on the display. To disable, set to 0.	0-999 μS or PPM*	Based on water analysis.
TDS/Cond Delay	When the limit Setpoint is exceeded, no alarm will be given until this time has expired.	0-999 seconds	10
RO Start Delay	The amount of time between the inlet valve opening and the RO pump start.	0-99 Seconds	10
Press Fault Delay	The time a pressure fault must be active before a pressure fault shut down occurs.	0-99 Seconds	10
Auto Reset	When a pressure fault shut down is active, the system will attempt to restart after this delay. If set to 0, system must be manually reset.	0-99 minutes	0
Alarm Silence	If the audible alarm is silenced, after this delay, the alarm will resound. If set to 0, the alarm will remain silenced.	0-99 minutes	3
TF Restart Delay	When a tank full condition clears, the system will restart after this delay.	0-99 sec/min	5
TF Restart	Selects whether the tank full restart delay is in seconds or minutes. 0=seconds, 1=minutes.	0-1	0
TFO Time	The amount of time that a tank full override lasts.	0-15 Minutes	3
Flush Type	Selects the type of flush. Set to 0 to disable.	0-8	0
Flush Time	The length of time a membrane flush cycle will last when flush is active.	0-99	0
Flush Interval	The interval between flush cycles. Only valid with operation hour, elapsed time or off flush types.	0-99 minutes	0

\* μS = microsiemens; PPM = Parts Per Million

SETPOINT	DESCRIPTION	RANGE	DEFAULT
Flush Mode	Selects if the inlet and RO pump relays operate during flush.	1-4	0
Maximum Hours	If the current operating hours exceed this limit, the operating hours warning will occur. To disable, set to 0.	0-65000 hours	0
Current Hours	Current number of hours of RO system operation.	0-65000 hours	0
Temp Offset	Allows adjustment of temperature reading by +-5 degrees.	± 5	0
Temp UOM	Selects display of temperature in °F or °C	0-1	0
Switch Select	Selects if switch inputs are normally open or normally closed.	0-32	0
TDS/Cond UOM	Selects display of water quality in uS or PPM <b>NOTE: If this Setpoint is changed, the unit must be recalibrated.</b>	0-1	0
TDS/Cond Range	Selects range of TDS/Conductivity monitor 0-50, 1-100, 2-250, 3-500, 4-1000, 5-2500 6-5000 <b>NOTE: If this Setpoint is changed, the unit must be recalibrated.</b>	0-6	1
C2 Range	Selects range of TDS/Conductivity monitor 0-50, 1-100, 2-250, 3-500, 4-1000, 5-2500 6-5000 <b>NOTE: If this Setpoint is changed, the unit must be recalibrated and range components may need to be changed.</b>	0-6	4
C2 Limit	When this value is met or exceeded, the alarm lamp will light and high TDS/Cond will show on the display. To disable, set to 0.	0-999 uS or PPM	0
%Rej	The 2 <sup>nd</sup> TDS/Conductivity is used to monitor feed water, programming this setpoint to 1 allows the % rejection to be displayed.	0-1	1

## **6.5 TO DISPLAY OR CHANGE SETPOINTS**

**NOTE: Please contact your AmeriWater representative prior to changing set points.**

1. Refer to Figure 6.1 for the location of the keys used to display or change the Setpoints and Figure 6.2 for the location of the write protect jumper, J3. For the unit to be able to accept a change in a Setpoint, the shorting jumper must be in the WRITE PROTECT OFF position (center and left pins).

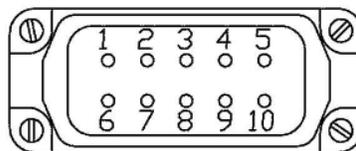
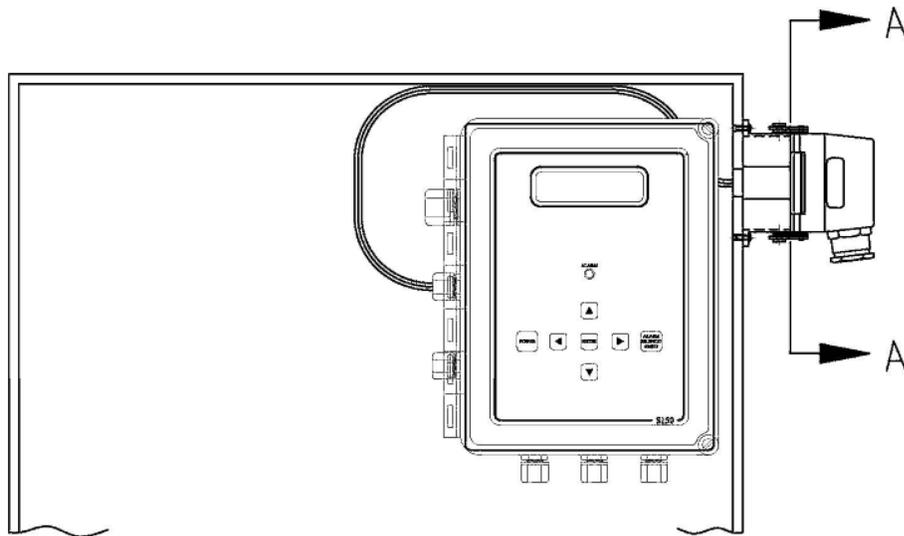
**NOTE: Setpoints cannot be changed if the write protect jumper is in the ON position.**

2. Use the LEFT and RIGHT ARROW keys to display the Setpoints. Each press of an arrow key will advance the display to the next Setpoint. The Left arrow key starts with the beginning Setpoint and the Right arrow key starts with the last Setpoint.
3. The Up and Down arrow keys are used to increase or decrease the Setpoint value. The value will change by 1 count each time a key is pressed. If the key is pressed and held for >1 second, the Setpoint value will change at a fast rate. When the key is released, the fast rate will be reset. Pressing both the UP and DOWN ARROW keys together will reset the set point value to 0.
4. Pressing the ALARM SILENCE/RESET key at any time will cancel the operation and return the display to the main screen.
5. To accept the new set point value, press the ENTER key.
6. The unit will beep twice if the change is accepted. If the write protect jumper is on, the unit will show WRITE PROTECTED on the display and one long beep will sound.
7. When finished changing Setpoints, the write protect jumper should be placed in the ON position (center and right pins).

# SECTION 7, EXTERNAL WIRE INSTALLATION

FOR FLOAT LEVEL SWITCHES, PRETREAT LOCKOUT & RO ALARM RELAY CONNECTORS

1. Remove the side entry hood by disengaging the lock and pulling down.
2. Loosen 4 retaining screws from outer shroud and remove inner terminals.
3. Loosen the nut and run the float switch wires through the outer housing.
4. Connect the High Tank float wires to contacts 1 & 6, Low Tank wires to contacts 2 & 7, Pretreatment Lockout wires to contacts 3 & 8 and RO Alarm Relay wires to contacts 4 & 9. Maintain the polarity on the float switches.
5. Replace the inner terminals into the outer shroud.
6. Tighten the nut, replace the retaining screws and re-install the side entry and engage the lock.



SECTION A-A

4 X SIZE

CONTACTS 1 & 6 ARE FOR FLOAT LEVEL SWITCH, TANK HIGH.

CONTACTS 2 & 7 ARE FOR FLOAT LEVEL SWITCH, TANK LOW.

CONTACTS 3 & 8 ARE FOR PRETREATMENT LOCKOUT.

CONTACTS 4 & 9 ARE FOR RO ALARM RELAY.

## SECTION 8, MAINTENANCE

**WARNING:** If any component of the water treatment system is changed or replaced, the user should conduct appropriate tests to ensure that the revised system meets all standards to which it was initially tested.

**NOTE:** All major components for the Portable RO+ are stocked for emergency shipment (See section 11).

### **8.1 MAINTAINING THE SYSTEM**

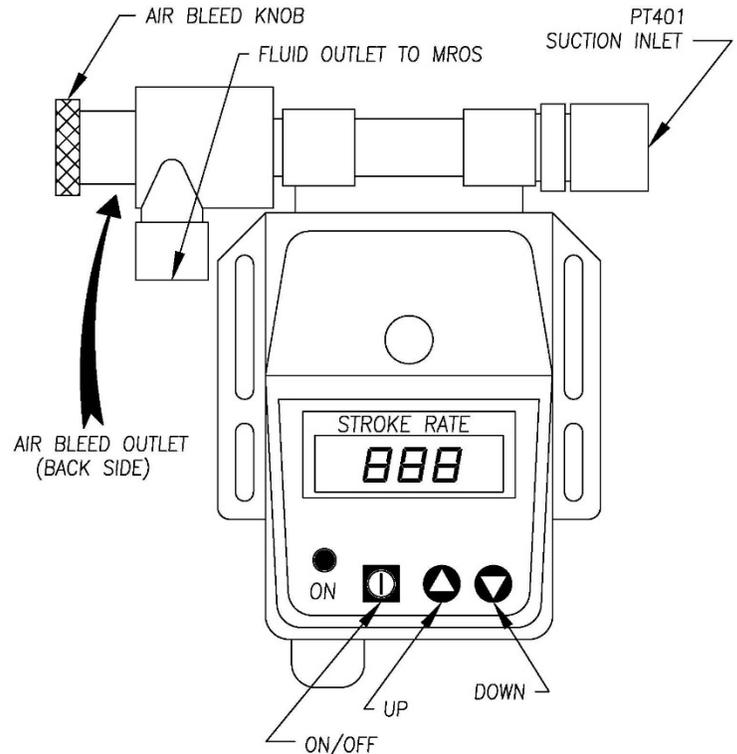
1. AmeriWater has provided a Startup Log for the RO+ system. This must be filled out completely each time the system is used. The recorded information may be useful in troubleshooting problems encountered with the RO+. Please see the Startup Log in Section 4.
2. The prefilter and membrane are non-durable components and will need to be exchanged periodically. The prefilter is recommended to be exchanged at no greater than 3 month intervals.
3. The RO+ system will need to be disinfected regularly. The frequency is determined by the usage of the system. If the RO+ system is being used every day, it should be disinfected monthly. If the system is being used on an "as needed" basis, with 1 or more days between uses, then it should be "preserved" or disinfected before each use.
4. Bacteria and L.A.L. (Limulus Amebocyte Lysate) testing is required monthly and AAMI testing is required annually. AAMI recommends samples be pulled prior to disinfection.
5. RO+ System product water quality is dependent on input water quality. Actual product water quality may vary substantially from the value for specified input water. The expected results for the user's water can only be verified on the basis of analysis of the user's water. If there are variations in the input water or changes detected in the output water, contact AmeriWater immediately.
6. Monitoring of the water bacteriology of the system following installation is the responsibility of the user. Total viable microbial counts shall not exceed the AAMI standard for bacterial colony forming units per milliliter (CFU/ML) and endotoxins measured in endotoxin units (EU). See instructions for proper disinfection of the system in Section 5.
7. The accuracy of the Conductivity display should be verified with a calibrated, hand-held meter at least annually. If the conductivity display is not within 5% of the hand-held meter readings, the controller should be calibrated in accordance to the procedures in Section 6.3. Conductivity may also be verified each time an AAMI analysis is done by noting the conductivity readings when the AAMI sample is drawn and verifying the reading with the AAMI results.

## 8.2 PT401 PRIMING PROCEDURE

AmeriWater RO+ products featuring the PT401 antiscalant system are equipped with a priming valve. The following procedure should be followed during the initial start up of the RO+ system, and whenever the PT401 pump loses its prime:

**WARNING:** DO NOT use PT401 with softened water. Turn off the pump and empty the PT401 container.

1. Verify that the RO+ is on and running.
2. Be sure the injection pump's suction line is immersed in solution in the PT401 container.
3. Press the ON key to turn on the PT401 injection pump.
4. Press the "DOWN" key to change the STROKE RATE to 360.
5. Remove the cap from the PT401 container and verify that a stream of PT401 without air bubbles flows out of the air bleed tube.
6. Close the adjustment knob completely by turning clockwise until the knob stops, making sure there is no liquid flow out of the air bleed tubing.
7. If the pump does not prime, repeat the foregoing steps.
8. Once the pump has been primed, and is pumping the chemical through the head into the water stream, adjust the stroke rate to "20".



At the stroke rate of 20, the PT401 injection pump will put about 150 milliliters (approximately 5 liquid ounces) per hour into the MRO2 incoming water stream.

Repeat these steps as necessary when the system is started after sitting for extended periods of time or the PT401 Bottle is empty and air has drawn into the pump. The priming may not take as long as the initial time.

If you have very hard water and/or iron water condition, AmeriWater will work with you to set the pump injection rate for your particular water hardness condition. The recommended pump rate is for "average" water hardness. Higher injection rates may be necessary to control hardness and prevent damage to the MRO membrane.

If a reduction of PRODUCT flow or an increase in conductivity is observed over a few months, the PT-401 pump may not be adjusted high enough to control the hardness at your particular hardness condition.

### **8.3 REFILLING PT401**

The amount of PT401 in the container should be checked weekly. When it is less than half full, you should add more PT401.

1. Remove the cap from the PT401 Container. It is not necessary to remove the rubber stopper with the hose; this will break the prime of the PT401 pump.
2. Refill the bottle with new PT401 purchased from AmeriWater (P/N 95810125, sold in (4) 1 gallon containers). Close the bottle with the cap.
3. Follow the priming procedures (Section 8.2) to ensure the PT401 pump remained primed.

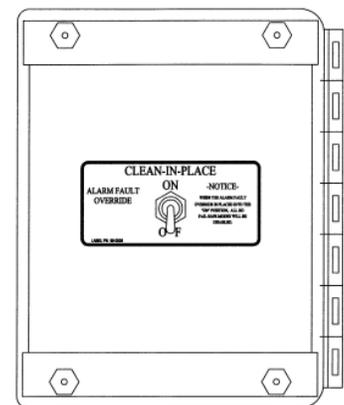
### **8.4 MEMBRANE MAINTENANCE INSTRUCTIONS**

There are two options available for membrane maintenance on the AmeriWater Portable RO+ System:

- Purchase the AmeriWater Clean In Place System (P/N 00CIP1) and clean the membrane yourself.
- Use the membrane to failure and replace.

### **8.5 AmeriWater Clean In Place (CIP)**

1. Move the CLEAN IN PLACE SWITCH (inside the RO+ on the back of the controller) to the ON position.
2. Follow the CIP instructions for connecting the drum to the RO+ and disinfecting the system.



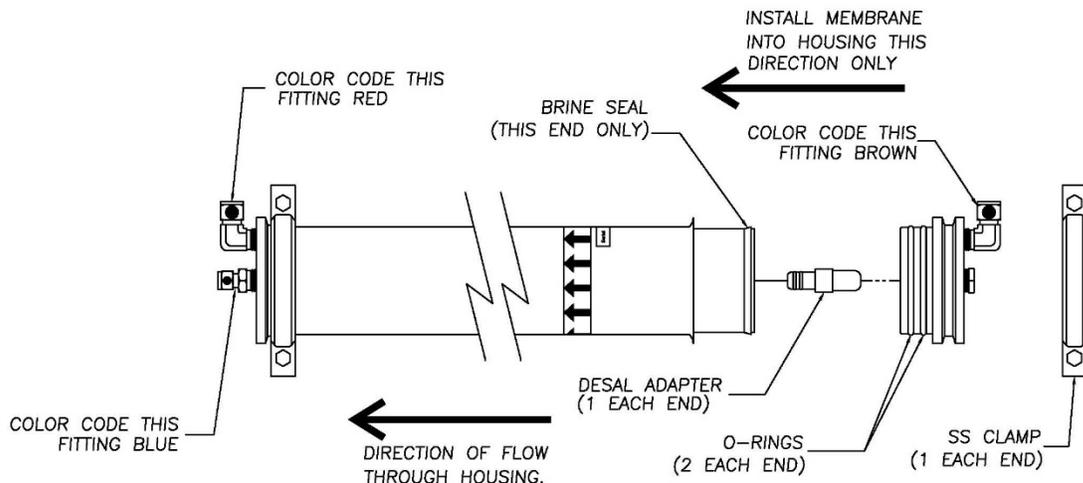
### **8.6 EXCHANGE PREPERATION**

1. Turn off the RO+.
2. Turn off the incoming tap water supply.
3. Put a container under the CHLORAMINE TEST PORT. Slowly open the sample port to relieve the pressure and let the water drain.
4. Unplug the RO+ from the electrical outlet.
5. Open the access panel.

## **8.7 MEMBRANE REPLACEMENT PROCEDURE:**

Turn off the incoming tap water supply to the RO+ and unplug the RO+ from the GFI receptacle.

1. Follow exchange preparation instructions in section 8.6.
2. Note the location of the nuts on each of the tubing fittings with a witness line.
3. Disconnect the tubing from the color-coded fittings on the membrane assembly. You may get wet. The nuts will remain with the tubing.
4. Remove the clamp securing the membrane assembly to the unistrut in the RO+ cabinet and remove the membrane assembly from the cabinet.
5. Remove the bottom (inlet) end cap from the housing by loosening the nuts on the end clamp.
6. Remove the old membrane.
7. Insert the new membrane. Be sure that the brine seal is in the inlet end of the housing per the drawing.
8. Verify that the O-ring is clean and replace the end cap and snap ring.
9. Replace the end cap and secure with the clamp. Install the membrane assembly in the cabinet by securing the membrane assembly to the unistrut in the cabinet with the clamp.
10. Replace the nuts on the appropriate fittings and run down by hand until the secure. Using a wrench, rotate until the witness lines line up. It may be necessary to go slightly beyond the original witness line to get a leak free seal. Turning beyond this will result in the tubing "necking" down and eventually breaking.
11. Replace the 2<sup>nd</sup> membrane by repeating steps 2 through 10.



## Rinse Out Cycle

**WARNING:** This Reverse Osmosis (RO) membrane contains a preservative solution to prevent microbiological growth and freezing. Discard all product water for at least two hours of operation before placing the RO back into service.

After the exchange is complete, it is important to put the RO+ through a rinse out cycle to flush the preservative out of the new membrane.

1. Put the PRODUCT WATER hose at a sink.
2. Turn the FLUSH VALVE to the FLUSH position. The Pump pressure will be lower than normal during this rinse out cycle.
3. Turn on the RO+ and allow water to run through the system for a minimum of 2 hours. This will rinse the preservative out of the new membrane.
4. Turn the FLUSH VALVE to the OPERATION position and allow the RO+ to run until the conductivity is below the setpoint and no longer alarming. Turn off the RO+.
5. Disinfect the system per the instructions in section 5.1.
6. Pull an AAMI analysis. The RO+ can be used after disinfection when it begins producing water to the specifications.
7. Reconnect the PRODUCT WATER hose to the dialysis machine.
8. Turn on the RO+. The rinse out cycle is now complete.

**WARNING:** If the product water conductivity does not come out of alarm, do not use the system! Continue rinsing, or call AmeriWater for guidance.

### 8.8 To exchange the prefilter:

1. Use the filter wrench to unscrew the white filter housing and discard the used filter.
2. Partially unwrap the plastic from a brand new filter. Holding the end covered with plastic, place the new filter in the housing. Discard the plastic after installation.
3. Screw the filter housing back on making sure the o-ring is in the groove and not pinched. Hand-tighten, only.

# SECTION 9, TROUBLESHOOTING AND REPAIR

## 9.1 TROUBLESHOOTING CHART

**WARNING:** Only those persons who have read the complete operations manual or who have received authorization from the medical facility director should attempt to troubleshoot and/or repair the RO+ system.

To assist you in quickly restoring your system into service, AmeriWater will send your replacement part out immediately and check your bad part when it comes in to verify if it is covered under your equipment warranty.

<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE ACTION</u>
RO+ will not start	RO+ not plugged in	Plug into electrical outlet.
	Circuit breaker blown	Reset the breaker.
	RO+ in a FAULT condition	Check RO+ controller display for FAULT condition and correct the FAULT.
System has power but no water flow	Feed source not open	Open Incoming Tap Water valve.
	Feed pressure < 20 PSI	Increase pressure to $\geq$ 20 PSI.
	Incoming hose kinked	Straighten kinks from the INCOMING TAP WATER hose.
	Prefilter clogged	Check the prefilter gauges for pressure drop; replace the prefilter if the pressure drop is 10 PSI greater than initially recorded.
	Circuit board relay is not operating	Replace the controller circuit board (Section 9)
	Feed solenoid is not operating	Test the solenoid (Section 9). Replace the valve if it is defective.

**PROBLEM**

Disinfect cycle will not operate when holding the ENTER key

**POSSIBLE CAUSE**

DISINFECT MODE has not been accessed correctly.

Circuit board relay not operating in DISINFECT MODE.

Disinfect Solenoid Valve not operating

Low pressure or flow rate feeding the RO+

Feed solenoid is not operating

Pump motor or impeller failing

Pump Loose in cabinet

High Bacteria Count

Too long since the last disinfection or the procedure was not performed correctly

Poor quality product water

RO+ not rinsed thoroughly

Fouled membrane

**CORRECTIVE ACTION**

Access DISINFECT MODE (see Section 5).

Replace the controller circuit board (see Section 9).

Test solenoid valve (Section 9). Replace the valve if it fails.

Check the prefilter outlet gauge PSI (must be  $\geq 20$  PSI), and verify that the product flow  $> 0.4$  GPM.

Test the solenoid (Section 9). Replace the valve if it is defective.

Check PUMP PSI GAUGE to verify that it is within operating parameters. Replace the pump if needed (see Section 9).

Isolate pump from cabinet.

Disinfect the RO+ following the procedures in Section 5.

Rinse membrane (see Section 8.7, Rinse Out Cycle).

- a. Clean or replace membranes (section 8).
- b. Check and correct the antiscalant system.

**PROBLEM**

Poor quality product water  
Cont'd

**POSSIBLE CAUSE**

FLUSH VALVE in the  
FLUSH position

Conductivity Cell out of  
calibration

High pH

Low product flow rate

Low pressure feeding  
membrane

Low pump PSI

Reject GPM flow rate too  
high

Excessive PRODUCT line  
backpressure

Low temperature incoming  
tap water

Prefilter clogged

Membrane needs replaced

**CORRECTIVE ACTION**

Put the FLUSH VALVE in the  
SERVICE position.

Verify the conductivity cell  
accuracy with a known good  
meter. Follow the calibration  
procedures in Section 6.4 or  
replace cell if necessary.

Call AmeriWater

Verify that the incoming tap  
water supply is fully open.  
The pressure on the prefilter  
gauges should be  $\geq 20$  PSI  
when the RO+ is operating.

Pump should be operating at  
115 – 235 PSI.

Turn FLUSH VALVE to the  
SERVICE position.

Check for restrictions in the  
PRODUCT WATER hose.  
Check the feed pressure  
gauge on the dialysis  
machine. If the dialysis  
machine does not have a  
pressure gauge, install one  
inline.

Consult the Temperature  
Correction Chart in Section  
2.3 to determine if the flow  
rate is normal in relation to  
the feed water temperature.

Check the prefilter gauges  
for pressure drop. Replace  
the prefilter cartridge if the  
pressure drop is  $\geq 10$  PSI.

Replace the membrane.

## 9.2 CONTROLLER TROUBLESHOOTING

**CAUTION:** Hazardous voltages are present when power is applied to the unit. Care should be taken when troubleshooting any of the input power or output circuits. When disconnecting or connecting any board or accessory, be sure power is unplugged.

Before contacting AmeriWater for technical help, verify the programming of all Setpoints, check the display and check the status of all lights and indicators. The more information available when you contact us, the easier it will be to determine the source of the problem. Standard setpoints and drawings of the controller and pc boards can be found in Section 6, RO+ Controller.

<u>PROBLEM</u>	<u>INVESTIGATION</u>	<u>CORRECTIVE ACTION</u>
System Inoperative	Is the yellow CPU active LED blinking?	If power is applied to the power terminals and the other checks are OK, the pc board is defective and should be replaced.
	If no, is the green power LED, DS1 Lit?	
	If no, is the fuse OK?	If no power is applied to the board, check the power wiring to the system.
	If no, replace the fuse.	
Display Blank	If yes, with a voltmeter, verify power is applied to the power terminals L1 and L2.	If no, refer to the system inoperative section.
	Is the green power LED, DS1 lit?	
	If yes, is the CPU active LED, DS9 blinking?	If no, replace the board.
Inlet Valve Will Not Operate	If yes, adjust the display contrast adjustment, R3. Is the display still blank?	If yes, replace the board.
	Is the system in standby?	If no, replace the board.
	If no, are any shut down conditions active?	
	If no, is the inlet LED, DS8 lit?	If no, replace the board.
If yes, with a voltmeter, verify if there is power on the inlet terminals. Is there power?	If yes, check the valve and wiring.	

**PROBLEM**

**INVESTIGATION**

**CORRECTIVE ACTION**

RO Pump Will Not Operate  
(Cont.)

Is the system in standby?

If no, are any shut down conditions active?

If no, is the RO LED, DS6 lit?

If yes, with a voltmeter, verify if there is power on the RO pump terminals. Is there power?

If no, replace the board.

If no, replace the board.

If yes, check the pump and wiring.

No or incorrect conductivity reading

Is sensor wired correctly?

If yes, is sensor installed inline as shown in the tubing diagram?

If yes, verify correct Conductivity range. Range correct?

Does unit calibrate OK?

If no, disconnect green and white wires of sensor. Does reading show 0?

If yes, reconnect wires and remove sensor from piping and dry. Does reading show 0?

If yes, short terminals of cell together. Does reading show '^^^' ?

If no, correct wiring.

If no, install correctly.

If no, correct range.

If yes, calibrate unit.

If no, replace board.

If no, replace cell.

If no, replace board.

### 9.3 PUMP REMOVAL

Before replacing the pump, be sure the pump's thermal overload has not tripped. Allow the pump to sit at least 5 minutes to reset, then, try to re-start the pump.

1. Turn off the water supply and the RO+. Unplug the power cord from the electrical outlet.
2. Remove the access panel. Disconnect the pump from the control box by disconnecting the wires from the terminals located in the control box (See controller drawings in Section 6).
3. Remove the PT401 container (if applicable).
4. Disconnect the feed hose on the pump inlet by depressing the gray collett on the fitting and pulling the tubing straight out. Water will drain from the pump.
5. Place a witness mark on the pump discharge nut. Loosen the nut on this fitting and remove from the pump. The volume of the water draining from the pump will increase.
6. Depress the gray collett on the recirculation fitting back to the pump and remove the tubing from the pump by pulling straight out.
7. Remove the clamp securing the pump assembly and remove the assembly from the cabinet.
8. Allow the pump assembly to fully drain before shipping (warranty replacement only).

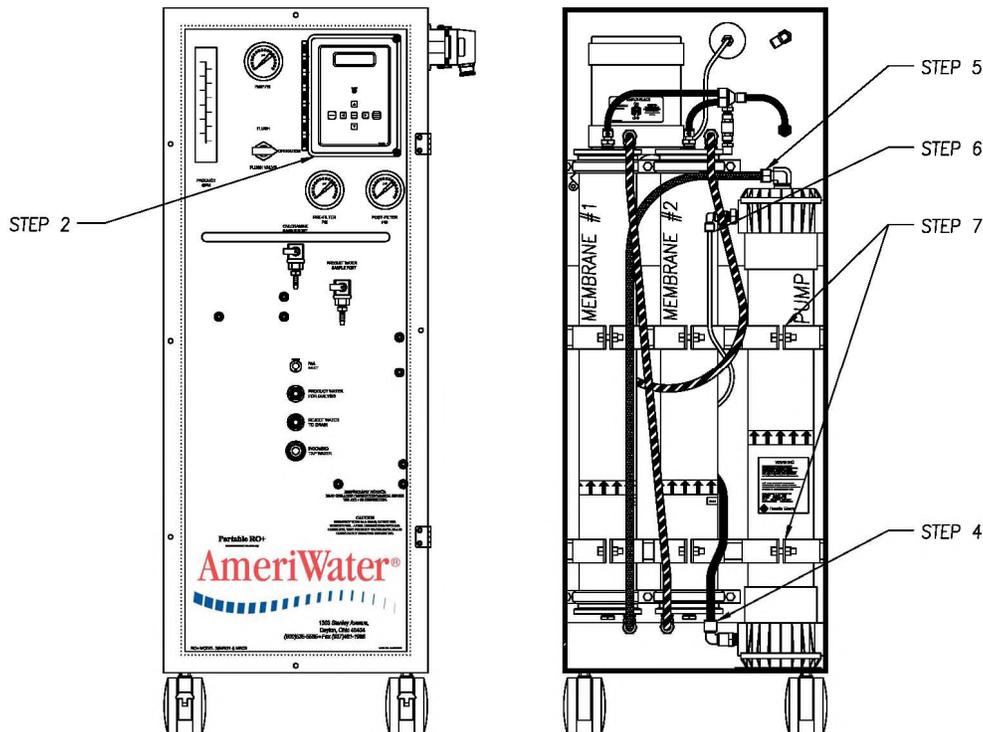


FIGURE 9.1

## **9.4 INSTALLING AN RO+ REPLACEMENT PUMP ASSEMBLY**

The following procedures are instructions to install the replacement pump assembly:

1. Position the pump housing against the unistrut and place a piece of the rubber vibration isolator between the clamps on the upper support frame, and secure in place.
2. Place the second set of unistrut clamps in the lower channel and secure as noted in step #1.
3. Connect the membrane feed tube to the pump housing outlet port (at the top), and hand tighten the nut. Use a wrench to tighten this nut to the witness line. It may be necessary to go slightly beyond this to ensure a water tight seal. Do not turn this in excess as this will cause a “necking” of the tubing, and may lead to leaks.
4. Connect the pump feed tube to the inlet of the pump by inserting into the fitting until it reaches the positive stop. About 1” of the tubing will need to be inserted.
5. Install the recirculation tubing into the fitting. About ½” of the tubing will need to be inserted to reach the positive stop.
6. Connect the pump wires to the control box by inserting the wires through the Sealcon fitting on the bottom of the controller and connecting them to the terminal block as shown in Figure 6.2. Connect the green (ground) wire to the threaded lug in the control box.
7. Re-install the PT-401 container assembly (if necessary).

## **9.5 SOLENOID TEST PROCEDURE**

### **Feed Solenoid**

1. With the RO+ Off, turn the Incoming Tap Water supply on. **If there is water flowing to the drain, the solenoid has failed open.**
2. Turn on the RO+, with the Incoming Tap Water supply still on. **If there is no flow to the drain, the solenoid has failed closed.**
3. Use a voltmeter to verify that power is not being supplied to the INLET SOLENOID VALVE terminal when the RO+ is off, and that power is being supplied to the terminal when the RO+ is on. If the power supply is normal, the solenoid valve is bad. If the power supply is not correct, see Section 9, Controller Troubleshooting.

### **Disinfect Solenoid**

1. Turn off the RO+.
2. Turn the FLUSH VALVE in the FLUSH position.

3. Press and hold the LEFT ARROW KEY and press the RIGHT ARROW KEY to access the DISINFECT MODE.
4. Hold in the ENTER KEY until water flows to the drain. **If there is no water flow to the drain, the solenoid has failed closed.**

### Product Solenoid

1. Turn on the RO+, with the Incoming Tap Water supply on. **If the product conductivity registers as “good” and there is no flow to the product hose, the solenoid has failed closed.**
2. Move the write protect jumper (Figure 6.2) to “off” to allow changes to the set-points.
3. Note the current set-point for “TDS/Cond Limit”. Change the value to “1”.
4. Once the RO goes into alarm, **if there is water flowing through the product hose, the solenoid has failed open.**
5. Upon completion, return the value for “TDS/Cond Limit” to the value initially recorded.

### Reject Solenoid

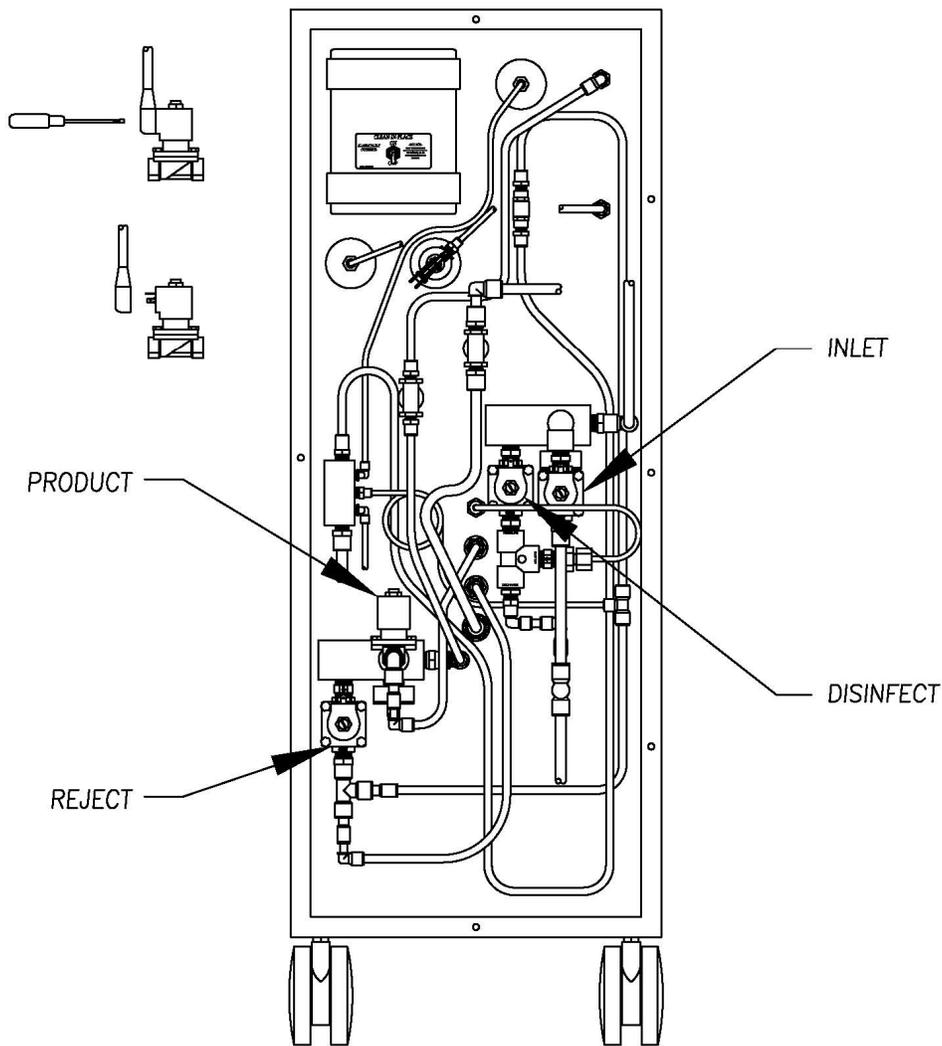
1. Turn on the RO+, with the Incoming Tap Water supply on. **If the product conductivity registers as “bad” and the flow to the drain is not increased, the solenoid has failed closed.**
2. Allow the RO+ to come into quality. **If the product conductivity registers as “good” and the flow to the drain is not decreased, the solenoid has failed open.**

## 9.6 SOLENOID VALVE REPLACEMENT

### For any of the Solenoid Valves

1. Turn off the RO+ by pressing the POWER key (the display will show STANDBY) and unplug the power cord from the electrical outlet.
2. Turn off the incoming tap water supply to the RO+. Open the chloramine sample port to relieve the pressure from the system.
3. Remove the access screws from the front panel of the cabinet.
4. Disconnect the solenoid wiring harness plug from the solenoid valve that is to be replaced. (Figure 9.2).
5. Remove the 3 screws that secure the manifold block in place.
6. Note the position of the fittings and orientation of the valve to the manifold block. Disconnect the fittings from the solenoid valve.

7. Clean the threads on the fittings to be re-used and prepare them for installation by applying Teflon tape to the threads.
8. Install the prepared fittings in the same location on the replacement valve.
9. Make sure that the flow direction arrow located on the side of the valve is pointing in the correct direction.
10. Bolt the manifold block back onto the RO+ cabinet.
11. Reattach the tubing to the corresponding fittings on the valve.
12. Reconnect the wire harness to the valve.
13. To verify that the solenoid valve is installed correctly, follow the Solenoid Test Procedures in Section 9.5.



**FIGURE 9.2**

## SECTION 10, WARRANTY

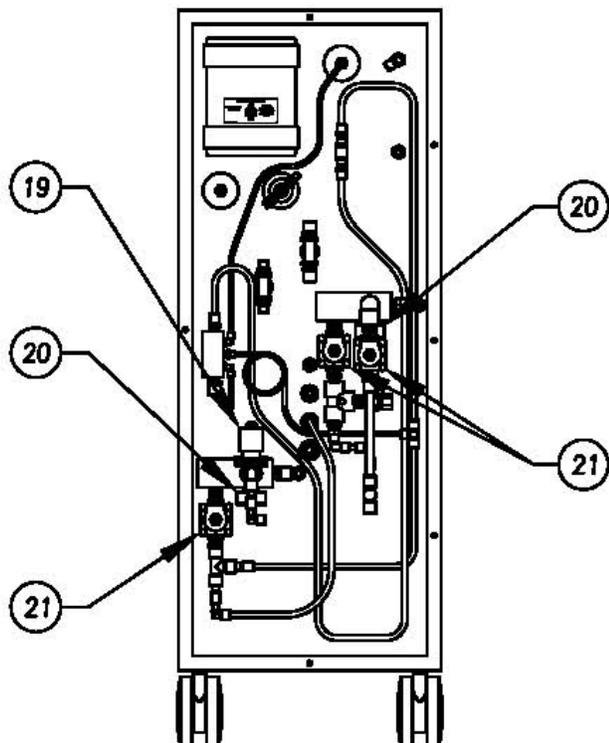
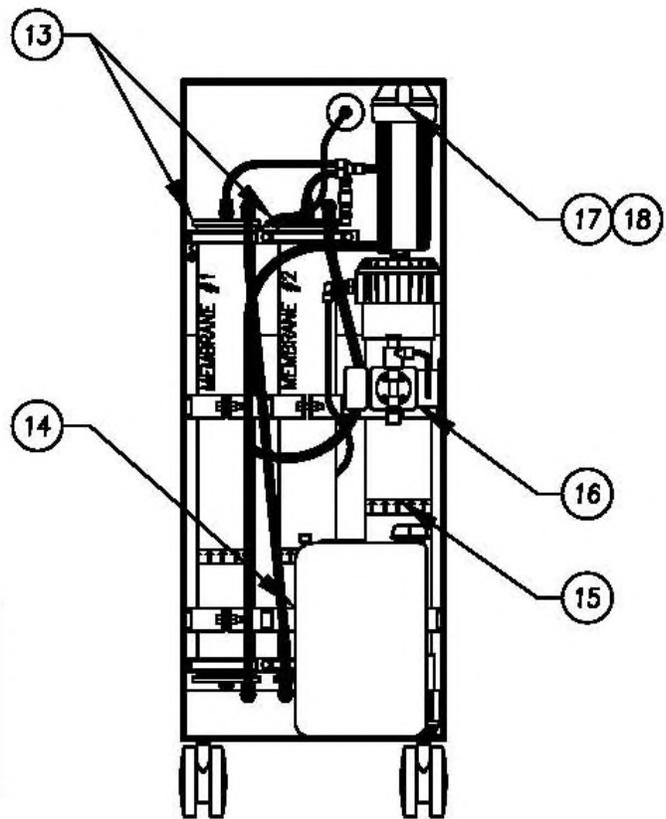
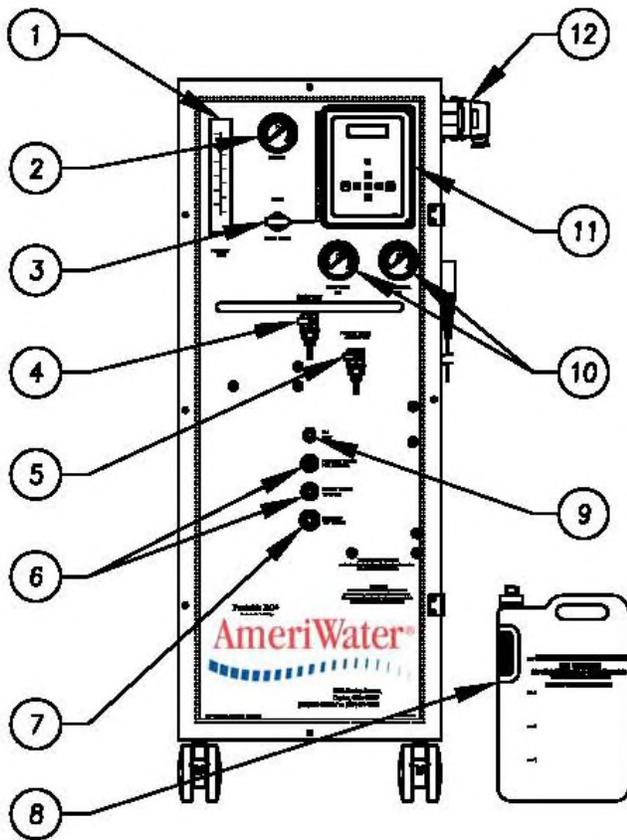
The buyer has a one year warranty on all equipment and parts, excluding non-durable components (e.g., RO membrane, carbon, PT401, and micron prefilter); provided that the system is not subject to abuse, misuse, alteration, neglect, freezing, accident or negligence; and provided further that the system is not damaged as the result of any unusual force of nature such as, but not limited to, flood, hurricane, tornado, or earthquake. The warranty covers the replacement of equipment and/or parts only. The warranty does not cover labor charges or travel expenses resulting from the service of equipment. The manufacturer is excused if failure to perform its warranty obligations is the result of strikes, government regulation, materials shortages, or other circumstances beyond its control.

To obtain warranty service, notice must be given to the manufacturer within 30 days of the discovery of the defect.

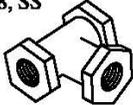
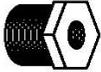
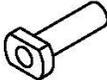
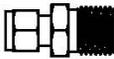
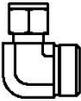
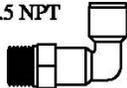
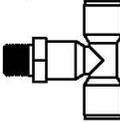
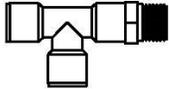
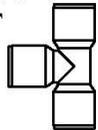
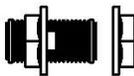
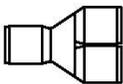
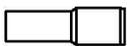
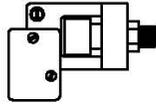
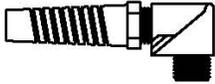
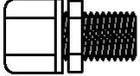
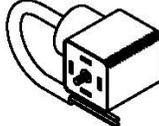
There are no warranties on the RO+ system beyond those specifically described above. All implied warranties, including any implied warranty of merchantability or of fitness for a particular purpose are disclaimed to the extent they might extend beyond the above periods. The sole obligation of the manufacturer under these warranties is to replace or repair the component or part which proves to be defective within the specified time period, and the manufacturer is not liable for consequential or incidental damages. No dealer, agent, representative, or other person is authorized to extend or expand the warranties expressly described above.

Some states do not allow limitations on how long an implied warranty lasts or exclusions or limitations of incidental or consequential damage, so the limitations and exclusions in the warranty may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

# SECTION 11 - MRO2 SPARE PARTS LIST



NO	DESCRIPTION	PART #
1	FLOW METER	41530606
2	PUMP PRESSURE GAUGE	43530714
3	FLUSH VALVE	04-5001
4	CHLORAMINE TEST PORT	041003
5	PRODUCT TEST PORT	041004
6	3/8 INCH BULKHEAD	10-L277
7	1/2 INCH BULKHEAD	10-L278
8	PAA BOTTLE ASSEMBLY	0185-0020
9	PAA CONNECTOR	16-0042
10	PREFILTER GAUGES	43-0012
11	CONTROLLER ASSEMBLY	R69446010
12	SIDE ENTRY HOOD	0167-0014
13	MEMBRANE ASSEMBLY	R124-0047
13	MEMBRANE ONLY	R22-4026
14	PT401 (4 GALLONS/CASE)	95810125
15	RO PUMP ASSEMBLY	R80-0055
16	PT401 PUMP (OPTIONAL)	R84-0002
17	FILTER HOUSING (10")	21-0033
18	O-RING, FILTER (10")	21530234
19	SOLENOID VALVE NO	R59-0006
20	CONDUCTIVITY SENSOR	69446017
21	SOLENOID VALVE NC	R59-0002

<p><b>HOSES</b> INLET P/N: 0112-0030 PRODUCT P/N: 0112-0031 REJECT P/N: 0112-0032</p> 	<p><b>GARDEN HOSE FEMALE ADAPTER KIT: NUT, WASHER, .5" BARB, P/N: 0112-0046</b></p> 	<p><b>NIPPLE</b> P/N: 046531105, 0.5 X CL, PP P/N: 044531107, 0.5 X 1.5, SS</p> 	<p><b>TEE, THREAD, NPT</b> P/N: 044730135, .25, SS P/N: 044531506, .38, SS</p> 
<p><b>BUSHING</b> P/N: 046531845 .75 MPT x .5 FPT P/N: 046531849 .75 MPT X .38 FPT P/N: 046530201 .5 MPT X .25 FPT</p> 	<p><b>PLUG</b> P/N:10520898 3/8 STEM P/N:10521106 1/2 STEM</p> 	<p><b>BARB CONNECTORS</b> .38 STEM x .38 BARB P/N: 10521026 .5 STEM X .5 BARB P/N: 10521011</p> 	<p><b>CHECK VALVE, .5MPT</b> P/N:10720102</p> 
<p><b>SS TUBE INSERT</b> 3/8" P/N: 10-0018 1/2" P/N: 10-0019</p> 	<p><b>CON, MALE, T X NPT, SS</b> P/N: 10-0021 .38 T X .5 NPT</p> 	<p><b>ELBOW, MALE, T X NPT, SS</b> P/N: 10-0023 .5 T X .5 NPT</p> 	<p><b>ELBOW, FEMALE, T X NPT, SS</b> P/N: 10-0025 .5 T X .5 NPT</p> 
<p><b>REPLACEMENT NUTS, SS</b> 10-0027 .38" NUT 10-0028 .5" NUT</p> 	<p><b>REPLACEMENT FERRULES, SS</b> 10-0030 .38" FERRULE SET 10-0031 .5" FERRULE SET FITTING SIDE  NUT SIDE </p> <p><b>SOLD IN SETS OF 10 ONLY</b></p>	<p><b>MALE QUICK CONNECTORS</b> P/N: 10-L002 .25 T X .25 NPT P/N: 10-L003 .38 T X .25 NPT P/N: 10-L005 .5 T X .38 NPT P/N: 10-L006 .5 T X .5 NPT</p> 	<p><b>FEMALE QUICK CONNECTOR</b> P/N: 10-L026 .25 T X .25 NPT P/N: 10-L027 .38 T X .38 NPT</p> 
<p><b>FIXED EL, TUBE X MALE NPT</b> P/N: 10-L051 .25 T X .25 NPT</p> 	<p><b>SWIVEL EL, TUBE X NPT</b> P/N: 10-L102 .25 T X .25 NPT P/N: 10-L105 .38 T X .38 NPT P/N: 10-L107 .5 T X .5 NPT</p> 	<p><b>SWIVEL BR TEE, TUBE X NPT</b> P/N: 10-L132 .5 T X .5 NPT</p> 	<p><b>SWIVEL RUN TEE, TUBE X NPT</b> P/N: 10-L157 .5 T X .5 NPT</p> 
<p><b>UNION TEE</b> P/N: 10-L253 .38 T X .25 T P/N: 10-L254 .5 T X .5 T</p> 	<p><b>QUICK CONNECT BULKHEAD</b> P/N: 10-L277 3/8" P/N: 10-L278 1/2"</p> 	<p><b>2-WAY DIVIDER</b> P/N: 10-L302 3/8"</p> 	<p><b>REDUCER</b> P/N: 10-L352 3/8" X 1/4" P/N: 10-L353 1/2" X 3/8"</p> 
<p><b>PLUG-IN EL, STEM x TUBE</b> P/N: 10-L377 3/8" P/N: 10-L378 1/2"</p> 	<p><b>FILTER WRENCH</b> P/N: 21675184</p> 	<p><b>CHECK VALVE 3/8" TUBE X TUBE</b> P/N: 55-0011</p> 	<p><b>INLET PRESSURE SWITCH</b> P/N: R65511105 SET AT 3 PSI</p> 
<p><b>STRAIN RELIEF</b> P/N:66510619</p> 	<p><b>STRAIN RELIEF FITTING P/N:66510621</b> 3 HOLE BUSHING PN- 66-0041</p> 	<p><b>SOLENOID WIRE HARNESS</b> P/N: 66932109</p> 	<p><b>CASTER 100MM</b> P/N: 94-0013 W/BRAKE P/N: 94-0014 W/O BRAKE</p> 

**ROUTINE REPLACEMENT ITEMS (NON-DURABLE COMPONENTS)**

<b>PART #</b>	<b>DESCRIPTION</b>
20-1011	1 Micron Particulate Filter
95810125	PT401 Antiscalant, (4) 1 Gallon Containers
95810126	PT401 Antiscalant for High pH WATER, (4) 1 Gallon Containers
R22-4026	RO+ Membrane
95-0006	Peracidin (2) quart containers
95-0007	Peracidin (4) quart containers
000-095-0001	Kit,Biotrol+,5 Gal Container+Powder,Portable MRO
97HP20401	Test Strips Peracid Test (6 Bottles of 100 Strips each) For Measuring High Range Paracetic Acid
97PX20501	Test Strips Renal Check (6 Bottles of 100 Strips each) For Measuring Residual Peroxide
97PH20901	Test Strips pH (6 Bottles of 100 Strips each) For Measuring pH/Water/Acid,Base/Bicarbonate/Dialysate
97RC22101	WaterCheck RC (6 Bottles of 100 Strips each) For Measuring Residual Chlorine
97CM20201	WaterCheck 2 (6 Bottles of 100 Strips each) For Measuring Low Level Chlorine/Chloramine
LAL	LAL Endotoxin Testing, Exact results in just a few days
AAMI	AAMI Chemical Analysis, Results within one week

\*Call AmeriWater or your AmeriWater distributor for pricing.

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 **WARNING**

This product can expose you to chemicals such as vinyl chloride (used in the production of PVC) or Nickel (used in the production of stainless steel), that are known to the State of California to cause cancer. For more information go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

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Dear Valued Customer,

California Proposition 65 (Prop 65) is the Safe Water and Toxic Enforcement Act of 1986. The State of California began enforcing amendments to California Prop 65 at the end of August 2018. Prop 65 requires manufacturers to provide a clear and reasonable warning to residents of California about chemicals used in products that they purchase that are included on the Prop 65 Chemical List. The chemicals included on the list are chemicals that are known to the State of California to cause cancer, birth defects, or other reproductive harm. One such chemical is Vinyl Chloride, a compound used to produce Polyvinyl Chloride (PVC). The AmeriWater system you have purchased may contain PVC or stainless steel parts.

While warnings are only required in the State of California, AmeriWater has initiated the use of Prop 65 labeling for all products to ensure compliance with California regulations. Please note that the above warning does not necessarily mean that the product that you have purchased is unsafe. Products that have been cleared for market by FDA have been determined to be safe and effective by the United States Food and Drug Administration. The warning is simply a requirement by the State of California. If you wish to obtain additional information, please visit: [p65warnings.ca.gov](http://p65warnings.ca.gov). You may also contact your AmeriWater representative if you have any questions.

Thank you for your understanding and we look forward to continuing to serve you.