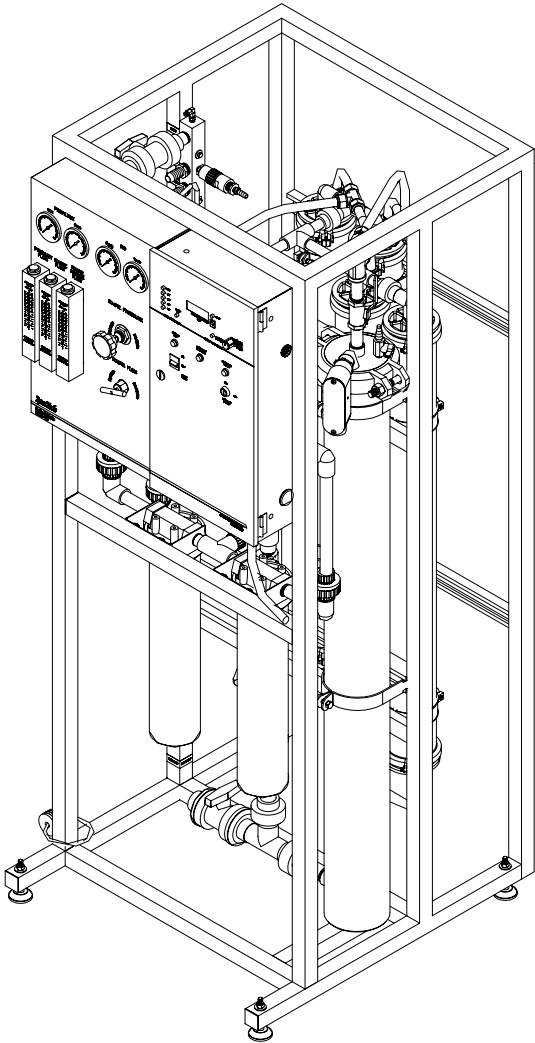


# GE OSMONICS Z SERIES REVERSE OSMOSIS SYSTEM

## Operation and Maintenance Manual



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# Z SERIES REVERSE OSMOSIS SYSTEM

## Installation, Operation and Maintenance Manual

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### TABLE OF CONTENTS

		<b>Page</b>
<b>CHAPTER ONE:</b>	<b>GENERAL INFORMATION</b>	<b>1-1</b>
<b>Section</b>	<b>1.1 The Manual</b>	<b>1-3</b>
	<b>1.2 Safety Summary</b>	<b>1-3</b>
	<b>1.3 Applications</b>	<b>1-4</b>
	<b>1.4 Contraindications</b>	<b>1-4</b>
	<b>1.5 Environmental Considerations</b>	<b>1-4</b>
	<b>1.6 Theory of Operation</b>	<b>1-6</b>
	<b>1.7 Fluid Components</b>	<b>1-6</b>
	<b>1.8 Monitors and Controls</b>	<b>1-9</b>
	<b>1.9 Optional Equipment</b>	<b>1-12</b>
	<b>1.10 Pre Treatment and Other Device RO Interlocks</b>	<b>1-14</b>
	<b>1.11 Specifications</b>	<b>1-14</b>
	<b>1.11.1 Input Water Requirements</b>	<b>1-14</b>
	<b>1.11.2 Flow Rates</b>	<b>1-15</b>
	<b>1.11.3 Electrical Requirements</b>	<b>1-15</b>
	<b>1.11.4 Dimensions &amp; Weights</b>	<b>1-16</b>
	<b>1.11.5 Membrane Performance Characteristics</b>	<b>1-16</b>
	<b>1.11.6 Environmental Requirements</b>	<b>1-16</b>
	<b>1.12 Disposal</b>	<b>1-17</b>
	<b>1.13 Electromagnetic Interference</b>	<b>1-17</b>
	<b>1.14 Service Assistance</b>	<b>1-17</b>
	<b>1.15 Return Goods Authorization (RGA)</b>	<b>1-18</b>
	<b>1.16 Symbols and Abbreviations</b>	<b>1-19</b>
<b>CHAPTER TWO:</b>	<b>INSTALLATION GUIDELINES AND INITIAL SYSTEM START UP</b>	<b>2-1</b>
<b>Section</b>	<b>2.1 Installation Considerations</b>	<b>2-3</b>
	<b>2.2 Installation Procedures</b>	<b>2-4</b>
	<b>2.3 First Time Start-Up Procedures</b>	<b>2-6</b>
	<b>2.3.1 RO Unit</b>	<b>2-6</b>
	<b>2.3.2 Rotation Verification (For 3 Phase Motors Only)</b>	<b>2-7</b>
	<b>2.3.3 Balance 3 Phase Power</b>	<b>2-7</b>
	<b>2.4 Product Water Analysis Procedure</b>	<b>2-8</b>

<b>CHAPTER THREE:</b>	<b>SYSTEM OPERATION</b>	<b>3-1</b>
<b>Section</b>	<b>3.1</b>	<b>Daily Start-Up Procedure</b>
		<b>3-3</b>
<b>CHAPTER FOUR:</b>	<b>ROUTINE MAINTENANCE</b>	<b>4-1</b>
<b>Section</b>	<b>4.1</b>	<b>Routine Maintenance of Z-Series RO System</b>
		<b>4-3</b>
	<b>4.1.1</b>	<b>Daily Maintenance</b>
		<b>4-3</b>
	<b>4.1.2</b>	<b>Monthly Maintenance</b>
		<b>4-4</b>
	<b>4.1.3</b>	<b>Quarterly Maintenance</b>
		<b>4-4</b>
	<b>4.1.4</b>	<b>Semi-Annual Maintenance</b>
		<b>4-5</b>
	<b>4.1.5</b>	<b>Annual Maintenance</b>
		<b>4-5</b>
	<b>4.2</b>	<b>Specific Maintenance Procedures and Instructions</b>
		<b>4-6</b>
	<b>4.2.1</b>	<b>Pump Lubrication Procedure</b>
		<b>4-6</b>
	<b>4.2.2</b>	<b>Product Water Divert Verification</b>
		<b>4-6</b>
	<b>4.2.3</b>	<b>Temperature Setting and Function Test</b>
		<b>4-7</b>
	<b>4.2.4</b>	<b>Pre-filter Cartridge Replacement Procedure</b>
		<b>4-8</b>
	<b>4.2.5</b>	<b>Threaded Connection Leak Repair</b>
		<b>4-8</b>
	<b>4.3</b>	<b>Z-Series Cleaning Indications</b>
		<b>4-9</b>
	<b>4.3.1</b>	<b>Cleaning Preparation</b>
		<b>4-10</b>
	<b>4.3.1.1</b>	<b>Cleaning Procedure</b>
		<b>4-11</b>
	<b>4.3.1.2</b>	<b>Post Cleaning Rinse Procedure</b>
		<b>4-12</b>
	<b>4.3.1.3</b>	<b>BIOSAN™ (Low pH Cleaner) Cleaning Procedure</b>
		<b>4-13</b>
	<b>4.4</b>	<b>Disinfection Procedure</b>
		<b>4-15</b>
	<b>4.4.1</b>	<b>Formaldehyde Disinfection Preparation</b>
		<b>4-16</b>
	<b>4.4.1.1</b>	<b>Formaldehyde Disinfection Procedure</b>
		<b>4-17</b>
	<b>4.4.1.2</b>	<b>Post Formaldehyde Disinfection Rinse Procedure</b>
		<b>4-19</b>
	<b>4.4.2</b>	<b>Peracetic Acid/Peroxide Based Compound (Renalin®) Disinfection Preparation</b>
		<b>4-20</b>
	<b>4.4.2.1</b>	<b>Renalin® Disinfection Procedure</b>
		<b>4-22</b>
	<b>4.4.2.2</b>	<b>Post Renalin® Disinfection Rinse Procedure</b>
		<b>4-24</b>
	<b>4.5</b>	<b>Product Water Culture</b>
		<b>4-25</b>
	<b>4.5.1</b>	<b>Product Water Culture Procedure</b>
		<b>4-25</b>
	<b>4.6</b>	<b>System Storage</b>
		<b>4-26</b>
	<b>4.6.1</b>	<b>Formaldehyde Storage Procedure</b>
		<b>4-26</b>
	<b>4.6.2</b>	<b>BIOSAN™ Storage Procedure</b>
		<b>4-27</b>

<b>CHAPTER FIVE:</b>	<b>TROUBLESHOOTING</b>	<b>5-1</b>
	<b>Table of Contents</b>	<b>5-3</b>
<b>Section</b>	<b>5.1 RO Fails to Run</b>	<b>5-5</b>
	<b>5.2 RO Runs Intermittently</b>	<b>5-6</b>
	<b>5.3 Motor Runs Hot</b>	<b>5-6</b>
	<b>5.4 Water Produced While RO is Off</b>	<b>5-7</b>
	<b>5.5 Low Waste Pressure</b>	<b>5-7</b>
	<b>5.6 Pressure Gauge Vibrates Erratically</b>	<b>5-7</b>
	<b>5.7 Excess Product Pressure</b>	<b>5-8</b>
	<b>5.8 Product Flow Too Low</b>	<b>5-8</b>
	<b>5.9 Product Flow Too High</b>	<b>5-9</b>
	<b>5.10 Poor Apparent Water Quality</b>	<b>5-9</b>
	<b>5.11 TDS Reading Too High</b>	<b>5-10</b>
	<b>5.12 RO Pump Leaks at Inlet End</b>	<b>5-10</b>
	<b>5.13 Leaks</b>	<b>5-10</b>
	<b>5.14 RO Fails to Draw Disinfectant</b>	<b>5-11</b>
	<b>5.15 Product Divert Controller and Valve Malfunction</b>	<b>5-11</b>
 <b>CHAPTER SIX:</b>	 <b>DRAWINGS</b>	 <b>6-1</b>
 <b>CHAPTER SEVEN:</b>	 <b>SPARE PARTS LIST</b>	 <b>7-1</b>

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# **Z Series RO System**

## **CHAPTER ONE: GENERAL INFORMATION**

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## **1.1 The Manual**

This manual has been prepared to provide the operator with information and instructions regarding the installation, use, maintenance, and troubleshooting of the GE Osmonics Z Series Reverse Osmosis System.

### **CAUTION:**

When used as a medical device, Federal law restricts this device to sale by or on the order of a physician per CFR 801.109(b)(1).

The manual has been written in narrative form supplemented with schematics and drawings for clarification. The operator can perform most procedures mentioned in this manual. Any exceptions will be clearly identified by a qualifying statement.

## **1.2 Safety Summary**

Words in **BOLD CAPITAL** letters are used to identify key safety or qualifying statements. A list of all symbols and abbreviations is located at the end of this chapter.

This safety summary does not contain all of the safety statements in the manual. Other safety statements are included within the manual text and are enhanced and defined as follows:

### **WARNING:**

Statements identifying conditions or practices that could result in personal injury or loss of life.

### **CAUTION:**

Statements identifying conditions or practices that could result in equipment or other property damage.

### **NOTE:**

Statements that provide further clarification.

### **READ THIS MANUAL:**

Prior to operating or servicing this device, this manual must be read and understood. Keep this and other associated manuals for future reference and for new operators or qualified service personnel. A note sheet is provided at the end of each chapter for operators to make notations that may be valuable to other users.

### **DO NOT REMOVE COVERS OR PANELS:**

To avoid electrical shock hazard, do not remove covers or panels when power is supplied to the device. Do not operate the device when covers or panels are removed.

### **SHOCK HAZARD:**

Connect this device to a proper ground connection in accordance with the National Electrical Code. **DO NOT** under any circumstances remove the ground wire or ground prong from any power plug. **DO NOT** use an extension cord with this equipment. Keep the surface under the RO free of water.

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**USE PROPER POWER CONNECTIONS:**

Use proper wiring and connection methods to satisfy hospital electrical codes.

**DEVICE LABELING:**

Do not under any circumstances; remove any Caution, Warning or any other descriptive labels from the devices until the conditions warranting the label are eliminated.

**DO NOT OPERATE IN A FLAMMABLE ATMOSPHERE:**

To avoid fire or explosion, do not operate this device in an explosive environment or near flammable anesthetics.

**1.3 Applications**

The Z Series Reverse Osmosis (RO) System is designed to purify water by forcing water through a semi-permeable RO membrane. Water purified by reverse osmosis has had approximately 95% of the dissolved ions and approximately 99% of most other contaminants removed. The purified water, referred to as product water or permeate, is suitable for hemodialysis applications when the quality is equal to or exceeds AAMI standards.

**1.4 Contraindications****WARNING:**

GE Osmonics RO systems are not designed, sold, or intended for use in producing water for injection.

Furthermore, GE Osmonics RO systems are not intended to be used outside of the device specifications and limitations, as outlined in this manual and other related materials.

**1.5 Environmental Considerations**

Prior to the installation of the Z-Series RO System, it will be necessary to provide utilities and create an environment suitable for the trouble free operation of the RO system and its accessories.

**POWER:**

The Z-Series unit operates on either single-phase or three-phase power with a variety of voltages being available. Histories of power failure, power surges, and low line voltages should be noted and reported to the manufacturer or their agent as they may create adverse conditions for the operation of equipment.

**DRAIN:**

A drain outlet is required by the RO system. The drain must have a minimum capacity of nine gallons per minute of continuous flow for as long as and as often as the RO is operating. A 2" pipe with a 1/8" per foot slope and a 1" minimum air gap normally satisfies the waste flow requirement.

**WATER:**

Reverse osmosis systems require a reliable water source. Additionally, it is necessary to have adequate flow rates and pressure. The Z-Series RO is equipped with safety devices to shut down the unit when the pressure falls below 10 PSI. If flow rates drop below the required level the pressure will drop as well, causing the RO to shut down.

It is important to run water at the design flow rate when testing water pressure rather than reading static pressure. The system automatically restarts when the water pressure is restored. A brief time delay has been incorporated to prevent telegraphing (short cycling) caused by the unit rapidly shutting OFF and ON while attempting to operate on marginal water pressure. During the delay period water will flow through the unit at line pressure with water being produced at a lesser rate.

**TEMPERATURE:**

The performance specifications of the RO are based on 77°F (25°C) feed temperature. Each degree Fahrenheit the feed water temperature falls, the RO product flow decreases approximately 1.5%, and each degree Celsius drop, the product flow is reduced by 3% (See Technote 113 for the “Temperature Correction Factors” chart). In climates where the winter water temperature drops significantly below 77°F it may be necessary to temper (heat) the water or increase the number of membranes in the RO unit.

**WARNING:**

The temperature of the tempered water should be monitored closely with a thermometer as high temperatures can damage the RO membranes and possibly harm the patient. Refer to the inlet water requirements (Section 1.11.1) for the maximum operating temperature for the RO.

**CAUTION:**

It is necessary to keep the RO from freezing to prevent serious damage to the RO unit.

**NOISE:**

The RO unit does not generate significant noise levels. However, it is advisable to locate the system in a mechanical room. Hard walls may reflect noise and will make the RO seem louder.

**WATER PURITY:**

Plumbing materials can significantly contribute to the contamination of the water. Metallic pipes (with the exception of ASTM 316 stainless steel) must be eliminated once the purification process has begun. Schedule 40 or 80 PVC pipes, polypropylene, PVDF, and other FDA recommended materials are suitable for most grades of purified water. Care must also be exercised in the choice of a thread sealant. Teflon tape is suitable for all threaded connections in this system.

**WARNING:**

Ordinary pipe dope must be avoided since it may leach objectionable and potentially dangerous impurities into the water.

## **1.6 Theory of Operation**

The Z-Series RO is an open-frame mounted reverse osmosis unit which is fully monitored for pressure, percent rejection and output TDS. The unit includes pre-filtration to remove gross particles capable of fouling membranes and damaging the high-pressure pump. The RO pump provides the pressure required to drive water through the membranes at economical flow rates and improves the membrane's rejection performance. The fluid controls provide a means of managing required flow rates and pressures. The following paragraphs detail the function of the components that are used within the unit.

### **NOTE:**

The Z-Series RO is available in two versions. One is a **Direct Feed** version that sends the product water directly to the patient loop. The second is an **Indirect Feed** version that feeds a storage tank. **Indirect Feed** RO units are controlled by tank level controls. The standard control is a float switch. On high level, an indicator lamp is illuminated on the front panel of the controller assembly.

## **1.7 Fluid Components**

### **Temperature Alarm Monitor Probe:**

The temperature probe is installed in the direct flow of feed water in the run of a 1" or larger piping tee after the first piece of pre-treatment equipment before the RO unit. The probe is used to measure the feed water temperature and is connected to the temperature switch inside the alarm monitor.

### **Carbon Filtration:**

Carbon Filtration is a required component of a water purification system. Two carbon filters must be used in series. The carbon tanks are used to remove chlorine / chloramine from the feed water. When chlorine / chloramine breakthrough is noted after the first carbon tank, the first tank must be removed, the second put in its place, and a new tank installed in the second position. Refer to the Carbon Tank Manual for specific operation and maintenance instructions.

### **Pre-filters:**

The fluid path flows into two Pre-filters, located in the housings on the front of the Z-Series. They are cartridge type filters with nominal ratings of 5 microns. The purpose of these elements is to collect any particles larger than 5 microns that may be detrimental to product water quality and subsequent components in the system. The pressure drop across the filters is monitored on the inlet and outlet by 0 to 100 PSI panel mounted gauges.

### **Pressure Switch:**

The low feed water Pressure Switch will shut off the RO pump and turn on an indicator lamp when the feed water supply is inadequate. The switch automatically resets once the pressure is restored.

**Inlet Water Sensor:**

The Inlet Water Sensor monitors the quality of the feed water. Input water quality is compared to the output (product) water and is displayed as "percent rejection" on the front panel.

**Disinfect Inlet Valve:**

The Disinfect Inlet Valve is a 1/4 turn ball valve which connects to the input water side of the pump. The valve is used whenever cleaners or disinfectants are introduced to the unit. The valve can also be used as a sample port for testing input water for chlorine or for hardness.

**WARNING:**

Water from this port is not RO product water and should not be used for dialysis solutions.

**NOTE:**

This port is also a good source of pretreated filtered water to fill containers for cleaner or disinfectants if the RO product water is not available.

**High Pressure Pump:**

High-Pressure Pump boosts input water pressure to the Reverse Osmosis Membrane Assembly (ROMA) by as much as 250 PSI. Two types of pumps are available on the Z-Series units. Both pump styles are multi-stage centrifugal. The standard is of submersible style; the option has an open drip proof motor. The RO pump discharge pressure is displayed as membrane supply on a 0 to 600 PSI panel mounted gauge. Submersible style multi-stage pumps are enclosed in a stainless steel housing. The **Air Bleed Valve** is used to purge air from the housing.

**Reverse Osmosis Membrane Assembly (ROMA):**

Three to six ROMA's may be included in the Z-Series. Each thin film (TFC) membrane provides up to 2000 gallons per day for **Direct Feed** units and 2400 gallons per day of product water for **Indirect Feed** units dependent upon feed water quality and temperature. The product water flow is read on a panel mounted flow meter.

**Waste Pressure:**

The Waste Pressure is displayed on a 0 to 600 PSI panel mounted gauge as Membrane Waste. The differential pressure of the supply and the waste is used to determine the need for cleaning the membranes.

**Pressure Regulator Valve:**

The Pressure Regulator Valve is an adjustable relief type valve. This valve is located off of the RO waste stream, and relieves excess waste pressure. The relieved water is then passed through the Waste Recirculation Flow Meter and fed into the feed water side of the RO pump.

**Waste Recirculation Flow Meter:**

The Waste Recirculation Flow meter displays the amount of recycled waste water returned to the inlet of the high-pressure pump. The flow is displayed in a panel mounted flow meter.

**Automatic Flush:**

The Automatic Flush feature is intended to reduce the concentrations of suspended solids at the RO membrane surface, thereby reducing the accumulation of scale. This is accomplished by forcing water at a high velocity along the membrane surface, diluting or removing existing concentrations of scale-forming contaminants.

**Total Dissolved Solids (TDS) Sensor:**

Samples the product water quality via the sensor probe, and the final quality of the product water is indicated on a digital display on the front panel as TDS in mg/L and ppm. The monitor is temperature compensated to adjust the display value to changing water temperature.

**Waste Flow Valve:**

The Waste Flow Valve is a stainless steel needle valve that controls the waste water flow to drain. The valve is used to control the ratio of waste water to permeate (% recovery) and to accelerate the rinse-out of cleaners or disinfectants from the unit. Waste flow is displayed in a panel-mounted flow meter.

**Water Quality Monitoring:**

Water Quality Monitoring is monitored in percent rejection and product output TDS. Percent rejection is a comparison of the inlet water sensor and the product water sensor and is displayed in a 5 LED array on the front panel. The product water TDS is monitored with a digital display on the front panel and is temperature compensated. The high TDS alarm level can be set by a five-position alarm set selector switch. A TDS exceeding the TDS alarm level selector switch setting will sound an audible alarm, show a visual alarm indicator on the front panel, and initiate the product divert to drain feature.

**Product Water Sensor:**

The Product Water Sensor monitors the quality of the product water. This quality is compared to the input water and is displayed as "percent rejection" on the front panel.

**Product Water Flow:**

The Product Water Flow is read on a panel mounted flow meter.

**Product Divert:**

The Product Divert Controller and Valve Assembly is intended to reduce the possibility of exposure to low quality RO water that may contain excessively high total dissolved solids (TDS). The valve assembly is located on the product water line after the RO unit and prior to the next piece of equipment.

**RO Bypass Valve:**

The RO Bypass Valve is a 1/4-turn ball valve which allows pretreated and pre-filtered water to feed an optional stand by treatment system.

**Inlet Solenoid Valve:**

The Inlet Solenoid Valve is located on the riser pipe of the Z Series RO and serves to shut off the water supply to the RO system. It is actuated open when the power switch is placed in the ON position.

**Inlet Water Valve:**

The Inlet Water Valve is located after the inlet manifold and before the pre-filter. The valve allows manual shut off of the water supply to the unit. This valve is also used to shut off the water for pre-filter changes.

**Product Return Valve:**

The Product Return Valve is a spring loaded check valve that is set to open at about 2 PSI over the inlet water pressure. If the Z-Series RO is used to supply water under pressure, all excess product water will be diverted back to the inlet water line through this valve. The valve prevents pressurized untreated inlet water from entering the product return line.

## **1.8 Monitors and Controls**

**Power Switch:**

The Power Switch is mounted on the front of the control panel. The switch is used when normal operation of the RO system is desired.

**System On Lamp:**

The System On indicator lamp is lit whenever the power switch is in the ON position.

**Low Feed Pressure Lamp:**

The Low Feed Pressure indicator lamp is lit whenever the input water pressure drops below the inlet pressure switch setting (approximately 10 PSI). The indicator will go out when the water pressure returns above the pressure switch setting.

**Pump Pressure Gauge:**

The Pump Pressure Gauge reads the pump discharge pressure from 0 to 600 PSI. It is used for monitoring during operation and when adjusting the pump pressure. It is used in conjunction with the waste pressure gauge to evaluate the need to clean the membranes.

**Waste Pressure Gauge:**

The Waste Pressure Gauge indicates the waste pressure (post membrane) from 0 to 600 PSI. It is used as a reference when adjusting the pump pressure and flow controls. It is used in conjunction with the pump pressure gauge to evaluate the need to clean the membranes.

**Pre-filter Pressure Gauges:**

Pre-filter Pressure Gauges indicate the input water pressure from 0 to 100 PSI. The input gauge indicates the raw water pressure available to the unit. The output gauge indicates the pressure available after the pre-filter. The difference (delta) is used to determine when the filter must be changed.

**Percent Rejection Display:**

The Percent Rejection Display is a 5 LED panel mounted array that indicates how the RO membranes are performing. The lights correspond to 99%, 95%, 90%, 85%, and >70% rejection. The 99% light, when illuminated, indicates a need to evaluate the RO system performance.

**CAUTION:**

RO units do not normally perform in excess of 99%; verify this reading with an independent meter and take corrective action if indicated. Some RO membranes will achieve this level of performance under optimum conditions.

**Product Water Total Dissolved Solids (TDS):**

The Product Water Total Dissolved Solids (TDS) digital display indicates product water purity in mg/L (ppm). It is temperature compensated to adjust the value of the display with changing water temperature for better accuracy.

**Less Than 0.5 mg/L Check System Lamp:**

The Less Than 0.5 mg/L Check System lamp illuminates when the TDS reading is 0.5 mg/L or less. This indicates a need to evaluate the RO system performance.

**CAUTION:**

RO units do not normally have TDS less than 0.5 mg/L. Verify this reading with an independent meter and take corrective action if required. RO membranes may achieve this level of performance under optimum conditions (good feed water).

**Tank Level Controls:**

The standard control is a float switch system. An indicator lamp is lit on the controller assembly and the RO shuts off during a high tank level condition.

**NOTE:**

Tank Level Controls are used on the **Indirect Feed** style of RO. However, the **Direct Feed** RO can be converted to operate off of a storage tank. Contact GE Osmonics Technical Service department for details.

**Override Switch:**

The override switch is used to initiate RO unit operation during a high tank level condition.

**Auto Flush Timer:**

The Auto Flush Timer is used to time the length of the automatic flush cycle. The timer can be adjusted to increase and decrease the length of each cycle.

**Alarm Set:**

The Alarm Set switch allows the operator to set the TDS levels at which an audible sounds and product water diverts to drain. The alarm should be set at twice the initial TDS reading.



**RO Interlock:**

The RO Interlock circuit, when activated, will not allow the RO unit to operate (run). An electric signal is sent from the RO unit control box (panel) to a normally open micro switch on the device. These devices are typically part of the pretreatment system. When the micro switch is closed, the signal returns to the RO unit control box activating the RO interlock circuit thus disabling RO operation. When the contact is reopened and the signal no longer is returning to the RO unit control box, the RO interlock circuit is deactivated and the RO unit will revert to its operational status prior to the lockout. The devices are connected in series so that if any of the micro switches close, it would activate the RO interlock circuit and shut down the operation of the RO.

The interlock circuit is also connected to the Temperature Alarm Monitor and will activate with an alarm condition.

**Alarm Mute:**

An Alarm Mute switch allows the operator to immediately mute the audible alarm and address an alarm condition within several minutes before re-sounding occurs. Pressing the Alarm Mute switch will not mute the audible disinfect alarm produced during disinfection with a Disinfect Alarm Monitor.

**Disinfect key switch:**

The Disinfect key switch is used to start the unit for the introduction of disinfectant/cleaner into the unit. The key switch locks out the inlet solenoid and low-pressure switch.

**CAUTION:**

Ensure the RO Unit is prepared for disinfection operations prior to engaging the Disinfect key switch.

**Temperature Alarm Monitor:**

The Temperature Alarm Monitor monitors feed water temperature and will shut down the RO unit if the reading is greater than the alarm set point. The alarm set point is factory set at 90°F and can be adjusted by the user. If high feed water temperature occurs, visual alarms will illuminate and activate the interlock circuit shutting down the RO unit. The RO unit will resume operation when the temperature alarm condition is removed.

**WARNING:**

The monitor is equipped with an override switch to bypass the alarm condition and allow the RO unit to operate. The override switch is provided for **emergency operation only**. When the monitor is alarming and has been overridden, the monitor provides the visual indication that it is in the override position and is in the alarm mode. When the temperature returns to below the 90°F limit, the RO unit will revert to its operational status prior to the alarm and RO lockout. All equipment should be checked for correct operation prior to resuming normal operation.

**Product Divert System:**

The divert valve rotates open directing water to drain during RO system start-up and/or a high TDS alarm condition. The opening of the divert valve is communicated with the illumination of an indicator on the product divert controller. The open divert valve directs product water to drain and will remain open as long as an alarm condition exists and close after an approximate two-minute start-up delay or one-minute alarm removal delay.

**1.9 Optional Equipment**

GE Osmonics offers a number of optional items to adapt the equipment to meet specific needs. Options are available to increase the volume of water produced or to increase the quality of the water produced. Options are also available to add control features not available on the standard systems. Frequently requested options are briefly described in the following paragraphs. If more information is needed, or if other options are desired, please consult the factory.

**Sanitizing System:**

A polyethylene solution tank with a flexible manifold is available for use in sanitizing/cleaning an RO system. The polyethylene solution tank will handle a wide range of chemicals and its drop tube design minimizes fumes. The flexible manifold enables quick and easy connection of the system.

**Remote Monitoring**

An RO Status Monitor is available in either an external surface mount housing or flush mount panel for junction box installation, with a variety of monitoring options that include water quality, storage tank level, distribution loop flow, and disinfect operation. Normal operation is communicated with the illumination of an In Service and Below TDS Set Point indicator. Each alarm condition is displayed with the continuous illumination of the applicable alarm indicator and sounding of an audible alarm. An Alarm Mute switch allows the operator to immediately mute the audible alarm and address the alarm condition within several minutes before re-sounding occurs.

The RO Status Monitor reduces the possibility of patient and equipment exposure to disinfectants with an optional safety feature that requires both the monitor and RO controller disinfect switches be intentionally and deliberately set for disinfect operations. An audible alarm sounds when only one of either Disinfect key switches are set to the disinfect operation and discontinues when both switches are set to disinfect or normal operation position.

**Disinfect Alarm Monitor (DAM)**

The Disinfect Alarm Monitor reduces the possibility of patient and equipment exposure to disinfectants. The monitor provides a dependence requiring that Disinfect key switches, located on the RO Controller and RO Status Monitor, are purposely engaged prior to introducing disinfectants or cleaning agents into the loop piping. The key switch dependency ensures that disinfect operations are an intentional and deliberate act.

A disinfect alarm timer controls the duration of the immutable audible disinfect alarm and prevents RO use for a preset duration (set for 10 minutes upon shipment).

**Softener**

A water softener system removes calcium, magnesium, and other scale producing contaminants from the feed water. It is an ion exchange device that substitutes sodium for larger and more highly charged cations in the feed stream. Their removal reduces the buildup of scale on the membrane surface. The control valve will initiate the regeneration of the device and will extract the hardness ions with a brine solution and rinse the ion exchange bed afterwards. The control valve is normally governed by a time clock; alternate controls are available from the factory. Scale control by chemical treatment is also available.

**Storage Tank**

A storage tank is used to collect RO product water and store it until needed. The reservoir system has internal features that, with the distribution pump running, continuously wash the sidewalls and top. Reservoir systems are available with level controls and low-level alarm monitoring.

**Distribution Pumps**

Distribution pumps are used to pressurize the RO water for delivery to the point of use. The pumps, available in both single and multi-staged centrifugals, run continuously to prevent stagnation of the system. The moving water prevents planktonic microorganisms from colonizing and results in increased efficiency of disinfection efforts.

**Earthquake/Shock Restraints**

Shock restraints are available for locations where they may be required by local codes.

**Ultraviolet Sterilizers**

UV sterilizers are used to kill planktonic (free floating) microorganisms without adding chemicals to the water. UV Bulbs produce germicidal rays that are 99% efficient at inactivating microorganisms.

## **Ultra Filters and Sub-micron Filters**

Ultra and Sub-micron filters are used to remove undesirable solids from the water. Normally these filters are used in the distribution loop to remove microorganisms and media fines. In some instances ultra filters are used in front of RO units to remove harmful colloids. In these circumstances the ultra filter is employed in a unit similar to an RO. Most frequently, filtration devices are used in the distribution plumbing. Sub-micron filters remove particles larger than 0.1 microns; ultra filters remove particles to 0.001 microns and remove endotoxins as well.

### **1.10 Pre Treatment and Other Device RO Interlocks**

1. Pre-treatment provided by a company other than GE Osmonics must come equipped with a micro switch that is closed when the device goes into regeneration or backwash. This is required to be able to connect the RO interlock circuitry to the equipment.
2. Any device provided by another company that is required to be interlocked to the RO unit so it does not operate (run) during a specific period of the devices operation must have a normally open micro switch that when activated (closed) can return a 24VAC signal to the RO unit controller.

### **1.11 Specifications:**

#### **1.11.1 Input Water Requirements**

**NOTE:**

Input water flow rate is dependant upon the size of each RO. In order to determine the minimum required flow rate of an RO measure in GPM, find the Product flow rate in the chart below, divide by % recovery, and add 5 GPM.

**NOTE:**

The maximum water temperature of 38°C (100°F) is for short-term operation only.

	<b>Minimum</b>	<b>Maximum</b>
<b>Dynamic Pressure</b>	30 PSI (Typical)	100 PSI
<b>Temperature</b>	1.7°C (35°F)	38°C (100°F)
<b>pH Levels</b>		
pH (operating)    TF Membranes	4.0	11.0
pH (cleaning)    TF Membranes	2.0	11.5
pH w/ chloramines present		
(operating)    TF Membranes	4.0	8.5

**1.11.2 Flow Rates**

- Product flow rates based on the following conditions with product flow equal to waste flow:

Operating Pressure:	200 - 250 PSI
Product Pressure:	1 PSI
pH:	6.5
Feed Water Temperature:	77°F (25°C)

<b><u>Model</u></b> <b><u>Number</u></b>	<b><u>Product Flow Rate</u></b>			
	<b><u>GPM</u></b>	<b><u>LPM</u></b>	<b><u>GPD</u></b>	<b><u>LPD</u></b>
<b><u>Indirect Units</u></b>				
Z-9600	6.67	25.24	9,600	36,340
Z-12000	8.33	31.55	12,000	45,425
Z-14400	10	37.85	14,400	54,510
<b><u>Direct Units</u></b>				
Z-6000	4.17	15.77	6,000	22,712
Z-8000	5.56	21.03	8,000	30,283
Z-10000	6.94	26.29	10,000	37,854
Z-12000	8.33	31.55	12,000	45,425

**1.11.3 Electrical Requirements**

- RO Units

<b><u>Voltage</u></b>	<b><u>Hertz</u></b>	<b><u>Amps</u></b>	<b><u>Phase</u></b>	<b><u>Hp</u></b>
230	60	24	1	5
208	60	20/27.5	3	5/7.5
230	60	16/24	3	5/7.5
460	60	8.5/12.5	3	5/7.5

- Product Divert Controller

Receptacle Type	Standard
Voltage	115 / 230~
Hertz	60 / 50
Amps	20
Phase	Single

### **1.11.4 Dimensions & Weights**

#### **Dimensions**

Height	74 inches
Depth	32.5 inches
Width	29.75 inches

#### **Operating Weight**

<u>Indirect Units</u>	<u>Lbs.</u>	<u>Direct Units</u>	<u>Lbs.</u>
Z-9600	450	Z-6000	390
Z-12000	510	Z-8000	450
Z-14400	630	Z-10000	510
		Z-12000	630

### **1.11.5 Membrane Performance Characteristics**

#### **% Salt Rejection**

95% Minimum Salt Rejection

#### **Operating Pressure**

Direct Feed	225 PSI $\pm$ 10 PSI
Indirect Feed	250 PSI $\pm$ 10 PSI

### **1.11.6 Environmental Requirement**

	<u>Minimum</u>	<u>Maximum</u>
Ambient Temperature	4°C (39°F)	32°C (90°F)
Storage Temperature	2°C (36°F)	32°C (90°F)
Altitude	N/A	10,000 feet

#### **CAUTION:**

This equipment must not be allowed to freeze. Irreparable harm to various components, including RO membranes may result.

#### **NOTE:**

The user/operator should recognize that moisture can be caused by condensation and is not necessarily an equipment leak. This equipment will function in the presence of condensation.

### **1.12 Disposal**

Disposal of this product or parts must be carried out according with local disposal codes.

### **1.13 Electromagnetic Interference**

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving device
- Increase the separation between the equipment
- Connect the equipment into an outlet on a circuit different from that to which the other device(s) is connected
- Consult the field service technician or manufacturer for help.

### **1.14 Service Assistance**

If service assistance is required, please take the following steps:

Consult the troubleshooting section of this manual (Chapter 5). If the problem cannot be identified and corrected by any of the procedures found in that section, then...

Contact your Facility Equipment Technician. If the technician is unable to help then...

Call GE Osmonics Technical Service Department at (800) 633-3080 or (253) 395-2200. Technicians are available for all calls between 7:00 a.m. and 4:30 p.m. PST, Monday through Friday. Technicians are also available at other times for **emergency calls only**. Product consultants will be on hand to discuss the problem with you and endeavor to rectify it over the phone. If the problem appears to be of a more serious nature, you will be given instructions regarding the action to be taken. Prior to making the phone call, you must be prepared to answer two questions:

1. What RO do you have, i.e. Z-9600
2. What is the serial number of your RO? (Label, found on side of controller.)

RO SERIAL NUMBER: \_\_\_\_\_

**1.15 Return Goods Authorization (RGA) Procedure**

If you wish to return goods for, warranty evaluation and/or credit please have your original sales order, invoice and device serial number available when you call GE Osmonics. Call GE Osmonics at (800)-633-3080 and request Technical Service. A representative will provide instructions and a return authorization number, which needs to be clearly written on the outside of the box used to ship your materials. All equipment must be shipped with the freight prepaid by the customer. Call our Customer Service Center with any questions or issues concerning freight claims and a representative will discuss your situation.

All materials to be returned must be rendered into a non-hazardous condition prior to shipping.



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**1.16 Symbols and Abbreviations**

<b>“RENALIN®”</b>	Refers to Peracetic Acid and Peroxide-based Compounds, such as Renalin®, Minncare™, Peracidin™ (20% peroxide, 4% Peracetic Acid)
<b>ASTM</b>	American Society for Testing and Materials
<b>AAMI</b>	Association for the Advancement of Medical Instrumentation
<b>CA</b>	Cellulose Acetate
<b>C</b>	Celsius
<b>CSA</b>	Canadian Standards Association
<b>cc</b>	Cubic Centimeters
<b>cf</b>	Cubic Foot (feet)
<b>cfu/ml.</b>	Colony Forming Units per milliliter
<b>cm</b>	Centimeters
<b>DI</b>	Deionization
<b>F</b>	Fahrenheit
<b>FDA</b>	Food and Drug Administration
<b>Ft</b>	Foot (feet)
<b>GPD</b>	Gallons Per Day
<b>GPM</b>	Gallons Per Minute
<b>GHT</b>	Garden Hose Thread
<b>gr</b>	Grains
<b>GAC</b>	Granular Activated Carbon
<b>HP</b>	Horse Power
<b>HPLC</b>	High Pressure Liquid Chromatography
<b>HZ</b>	Hertz
<b>lbs.</b>	Pounds
<b>LED</b>	Light Emitting Diode
<b>LPD</b>	Liters Per Day
<b>LPM</b>	Liters Per Minute
<b>m.</b>	Meter
<b>mg/L.</b>	Milligrams Per Liter
<b>ml.</b>	Milliliters

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<b>MNPT</b>	Male National Pipe Thread
<b>MSDS</b>	Material Safety Data Sheet
<b>Megohm/cm</b>	Million Ohms/Centimeter
<b>mw</b>	Molecular Weight
<b>NaCl</b>	Sodium Chloride
<b>N/A</b>	Not Applicable
<b>NPT</b>	National Pipe Thread
<b>NSF</b>	National Sanitation Foundation
<b>PA</b>	Polyamide
<b>P/N</b>	Part Number
<b>ppm</b>	Parts Per Million
<b>psi</b>	Pounds Per Square Inch
<b>PVC</b>	Polyvinyl Chloride
<b>QD</b>	Quick Disconnect
<b>RO</b>	Reverse Osmosis
<b>ROMA</b>	Reverse Osmosis Membrane Assembly
<b>SF</b>	Speed fit
<b>TB</b>	Terminal Barrier Strip (Main): “TB1” (Example: “TB1-9” refers to the terminal marked number 9 on the Main Terminal Barrier Strip)
<b>TF</b>	Thin Film
<b>TFC</b>	Thin Film Composite
<b>TDS</b>	Total Dissolved Solids
<b>UL</b>	Underwriters Laboratory
<b>VAC</b>	Volts Alternating Current
<b>WFI</b>	Water for Injection
<b>WT</b>	Weight
<b>~</b>	Volts Alternating Current

**NOTES:**

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# **Z Series RO System**

## **CHAPTER 2: INSTALLATION GUIDELINES AND INITIAL SYSTEM START-UP**

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**2.1 Installation Considerations**

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1. RO Unit:
  - a. Location: The Z Series RO unit is free standing and should be situated with 2 feet of clearance on all sides. Locate away from any obstructions to provide room for access to the power cord and the water connections.
  - b. Dimensions: Height – 74”; Width – 30”; Depth – 32.5”
  - c. Weight: Between 390 and 630 pounds depending on the RO unit model.
2. Product Divert Controller:
  - a. Location: Mount the Product Divert Controller on a highly visible section of the wall near an 115VAC electrical outlet and within 5 feet of the RO unit control box.
  - b. Dimensions: Height – 11.5”; Width – 9.5”; Depth – 6”
3. Product Divert Valve Assembly:
  - a. Location: Mount the Product Divert Valve Assembly on the wall between the RO unit and the storage tank or the next purification device in the treatment stream. The valve assembly should be within 5 feet of the Product Divert Controller. See the Product Divert Valve installation drawing in Chapter Six for specific details.
4. Temperature Alarm Monitor:
  - a. Location: Mount the Temperature Alarm Monitor on an accessible and a highly visible section of the wall within 5 feet of the temperature probe.
  - b. Dimensions: Height – 4.5”; Width – 7.5”; Depth – 6”.
5. Temperature Probe:
  - a. Location: The temperature probe is installed in the direct flow of feed water in the run of a 1” or larger piping tee after the first piece of pre-treatment equipment before the RO unit. See the temperature probe installation drawing in Chapter Six for specific details.

## **2.2 Installation Procedures:**

1. RO Unit:
  - a. Connect the Z Series RO to the pre-treated feed water with sufficient diameter pipe (or hose) to ensure adequate flow of water.
  - b. Connect the waste water line to the drain in accordance with the local plumbing code.
  - c. Connect the product water line to the Product Divert Valve Assembly (RO Product Water Connection).
  - d. Plug the power cord from the RO Controller into the appropriate outlet.
2. Product Divert:
  - a. Connect the product water outlet connection of the Product Divert Valve Assembly to the storage tank or the next purification device in the treatment stream. The plumbing from the Product Divert Valve Assembly to the next device in the treatment stream is to be hard plumbed.
  - b. Connect the Product Divert Valve Drain connection to the drain in accordance with the local plumbing code.
  - c. Make wiring connections from the Product Divert Controller to the RO unit controller with the wire provided as shown in the Product Divert wiring schematic in Chapter Six.
  - d. Plug the supplied power cord on the Product Divert Controller into the 115VAC outlet.
3. RO Interlock:
  - a. Connect RO Interlock wire to the terminals in the RO control box (reference the electrical wiring schematics in Chapter Six). One conductor (wire) is to connect between terminal TB3-3B in the RO unit control panel and the common terminal on the micro switch. Connect the other conductor (wire) from terminal TB3-5B in the RO unit control panel to the normally open terminal on the micro switch.

**NOTE:**

RO Interlock wire to be two-conductor wire suitable for 24VAC meeting local electrical codes.

**NOTE:**

If more than one device is to be connected to the RO unit interlock terminals, the devices must be wired in series.



4. Temperature Alarm:
  - a. Connect the Temperature Alarm Monitor wires to the terminals in the RO control box. Refer to the electrical schematic in Chapter Six for connections.
  - b. Install the Temperature Probe in the direct flow of the water in the run of a 1” or larger piping tee after the first piece of pre-treatment equipment. Refer to the installation drawing in Chapter Six for specific details.
5. Storage Tank Level Controls:
  - a. Connect the Low Tank Level Switch to terminals TB3-7B and TB3-8B.
  - b. Connect the High Tank Level Switch to terminals TB3-9B and TB3-10B.
  - c. When the low level monitoring option is chosen with the RO Status Monitor the dedicated float switch will connect to terminals TB3-4B and TB3-6B.

**NOTE:**

Operation of this unit without level switches (i.e. Direct Feed) requires a jumper to be installed (typically installed at factory) between the float switch connection terminals TB3-7B and TB3-8B.

## **2.3 First Time Start-Up Procedures:**

### **2.3.1 RO Unit**

**WARNING:**

Any pre-treatment device supplying water to the RO must be ready for use.

**CAUTION:**

Check all wire connections to ensure they are secure or torque to their proper specification. Loose connections on high amperage wires can cause a potential hazard.

1. Connect the product output (prior to the Product Divert Valve Assembly) to drain.
2. Turn on the source water supply and ensure that all the valves in the water supply line to the RO are open.
3. Turn on the RO unit power switch and the following will occur.

**NOTE:**

If your RO system is equipped with a "submersible" high-pressure pump, the pump/motor housing must be purged of all air during the start-up procedure. Turn on the RO system and open the small valve on the top end of the pump/motor housing very slowly to purge. Air should be heard escaping to the atmosphere. Close the valve when water is seen flowing from this valve.

- a. The Product Divert Valve will open.
- b. The RO will auto flush for the preset time duration.
- c. The motor will begin operation after a brief time delay.
- d. The Product Divert Valve will close after an approximate two-minute start-up delay.
4. Reference operation 2.3.2, Rotation Verification as applicable.
5. Adjust the Waste Flow Valve to achieve a waste flow equal to the product flow (50% recovery).
6. Allow the RO unit to operate in this mode until Percent Rejection and TDS stabilize at optimum values.

**WARNING:**

Verification of the absence of all sanitizers, cleaners, disinfectants and chlorine/chloramines must be performed before RO product water is used for any patient related uses. (Reference section 2.4, Product Water Analysis Procedure)

7. Set the TDS alarm limit with the Alarm Set switch. A setting of twice the normal operation levels is typical.
8. The startup delay can be changed by adjusting the motor contactor delay relay (TR-2) in the main control box.

9. Adjust system pressure to 200 to 250 PSI depending on water consumption by rotating the pressure adjustment knob and pump output throttle valve.

**CAUTION:**

**DO NOT** adjust system pressure to more than 300 PSI. **DO NOT** close throttle valve completely or severe damage will occur to the pump.

10. Turn off the RO unit and reconnect the product line to the Product Divert Valve Assembly.

**WARNING:**

The RO unit must be disinfected prior to first use. (Reference section 4.4, Disinfection Operations)

**2.3.2 Rotation Verification (FOR THREE PHASE MOTORS ONLY):**

1. Submersible Multi-Stage Pumps
  - a. Energize the unit. Let pump/motor run for no longer than ten seconds, observing the output flow and pump pressure. The flow and pressure should increase in value. If no increase is noted, the pump may be rotating backwards. Reverse two legs of the power at the fused disconnect box. Repeat rotation verification instructions until increase in flow and pressures are achieved.
2. Non-Submersible Multi-Stage Pumps
  - a. Energize the unit and check the motor rotation. If the rotation does not match the arrow on the pump/motor, turn the unit off and reverse two legs of power at the main power wires at the fused disconnect box. Repeat as necessary to get the proper rotation.

**2.3.3 Balance 3 Phase Power**

After the correct rotation of the motor has been achieved the power should be balanced. This is done with the unit operating and taking a voltage and amperage reading of all three legs. Then roll all three legs over one position and take the voltage and amperage reading. Repeat rolling all three legs and taking readings. The three different voltage and amperage readings should be compared. The wiring combination with the most similar voltage and amperage on each leg should be used.

## **2.4 Product Water Analysis Procedure:**

In order to ensure that the RO is performing at or above AAMI (Association for the Advancement of Medical Instrumentation) Standards, it is necessary to perform an AAMI Water Quality Analysis test. New RO must be operated and rinsed to drain for at least two hours before taking a product water sample. This ensures the membranes are free of preservative or other contaminants that would invalidate the test. Use a laboratory and/or facility approved water sampling kit when preparing water sample.

### **WARNING:**

There are many documented clinical risks in using less than AAMI Standard product water (refer to Technote 103 "AAMI Hemodialysis Water Quality Standards").

### **NOTE:**

Follow the procedures recommended by your water quality-testing laboratory if they vary from the following steps.

1. Ensure that all pre-RO devices are operating correctly and are performance verified by the appropriate testing.
2. Operate the RO unit with product and waste flows to drain for at least 15 minutes after the product water quality has stabilized before drawing the water sample.
3. Hold the product line over the container and run product water for approximately 1 minute.
4. Aseptically remove the lid from the sample bottle and rinse the bottle twice with RO product water.
5. Fill the bottle completely with RO product water and cap it immediately.
6. Fill out the laboratory requisition form. Ensure the requisition form has, at a minimum, information to identify the facility, the serial number or facility equipment number to ensure which RO was tested and name, phone number and address of whom to contact.
7. Place the bottle and the completed requisition in the pre-addressed mailer and mail it directly to the laboratory.

### **NOTE:**

Total chlorine must be measured on-site. Tests for Chlorine/Chloramine (total chlorine) are not typically reported on the AAMI Analysis. Chlorine and chloramine dissipate from the water sample over time and reported results will be inaccurate.

**NOTES:**

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# **Z Series RO System**

## **CHAPTER 3: SYSTEM OPERATION**

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### **3.1 Daily Start-Up Procedure**

**WARNING:**

Verification of the absence of all sanitizers, cleaners, disinfectants and chlorine/chloramines must be performed before RO product water is used for any patient related uses.

**NOTE:**

If optional remote monitoring or control equipment (i.e. RO Status Monitor, Disinfect Alarm Monitor...) is installed, refer to the appropriate manual for daily start-up conditions.

1. Ensure that all the valves in the water supply line to the RO are open.
2. Ensure that all pre-RO devices have been flushed, tested, and are operating within their specifications.
3. Ensure that the Disinfect Inlet Valve is closed and the Disinfect Start switch is in the OFF position.
4. Turn the RO power switch to the ON position.
5. Verify the Product Divert Valve opens and product water diverts to drain for an approximate two-minute start-up delay.

**NOTE:**

The TDS must be below the alarm set point for the product divert valve to close.

6. The RO will Auto-flush for the preset duration. During this cycle the pressure gauges will appear as follows:
  - a. Pre-filter pressure gauges should read between 25 and 100 PSI within 15 seconds of turning on system.
  - b. Supply and Waste pressure gauges should read approximately 100 PSI.
7. When the Auto-flush cycle is completed, the pressure gauges should indicate normal pressure readings as follows:
  - a. Pre-filter pressure gauges should read between 25 and 100 PSI within 15 seconds of turning on system.
  - b. Supply and Waste pressure gauges should read approximately 225 for Direct Feed or 250 PSI for Indirect Feed units.
8. The Percent Rejection monitor may indicate a decrease in RO performance when first started and should show normal Percent Rejection values within a few minutes.

9. The TDS monitor should stabilize within 2 to 5 minutes of start-up. The TDS during this time may be higher than the alarm set point. The audible alarm may be muted at this time by pressing the alarm mute switch. The alarm mute switch will silence the audible alarm for approximately 2 minutes.

**WARNING:**

A high TDS alarm condition requires immediate attention.

10. The absence of chlorine must be verified in the feed water after the pretreatment carbon tanks. It is imperative that thin film element equipped RO units be operated on chlorine free feed water.

**NOTE:**

Carbon filtration is a required component of a water purification system. AAMI recommends that two carbon filters be used in series. When chlorine / chloramine breakthrough is noted after the first tank, the first tank must be removed, the second put in its place, and a new tank installed in the second position. Reference the Carbon Manual for specific operation and maintenance instructions.

11. Adjust the Waste Flow Valve to achieve a waste flow equal to the product flow (50% recovery).

**NOTES:**

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# **Z Series RO System**

## **CHAPTER FOUR: ROUTINE MAINTENANCE**

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## **4.1 Routine Maintenance of Z-Series RO System**

GE Osmonics Z-Series RO systems have been designed to operate with a minimum of operator attention. The RO system will operate longer and with less trouble when maintenance is performed regularly. Operator maintenance on a GE Osmonics reverse osmosis system is limited to maintaining performance logs, cleaning and disinfection, replacement of damaged or failed parts, periodic lubrication, and cartridge filter replacement. Log sheets are available as tech notes for tracking and recording applicable operations. Reference Tech Note 140 for an equipment maintenance log.

**WARNING:**

Prior to performing any electrical maintenance disconnect the RO from power source.

**NOTE:**

The first part of this section provides the timelines and simple maintenance instructions. Specific instructions and procedures for the more complex maintenance items are provided in the second part of this section.

**NOTE:**

Reference Tech Notes 141, 142, 143, 144, and 145 for applicable record logs.

### **4.1.1 Daily Maintenance**

1. Measure the feed water hardness level and record value in the pretreatment log.

**NOTE:**

Check the softener output for hardness at the end of the operational day to confirm adequate softener capacity.

2. Observe and record salt level in the brine tank (if applicable).
3. Observe and record the Chlorine/Chloramine concentrations in the pretreatment log. Follow the instructions included with each test kit.

**WARNING:**

Take corrective action or contact your local service representative if any pretreatment device fails to provide adequate treatment of feed water before continuing with the use of the RO unit.

4. Observe and record the pre-filter inlet and outlet pressure gauges on the operation log (Reference Tech Note 142). The difference in the pressure values will help measure the condition of the filter cartridge. When the pressure differential increases 10 PSI above that of a clean filter the cartridges may need to be changed (or sooner if the pre-filter core appears soiled). Reference section 4.2.4, Pre-Filter Cartridge Replacement Procedure if a change is required.

5. Observe the supply and waste pressures and record values in the operation log. Allow water temperatures to stabilize before recording results to prevent errors due to fluctuating temperatures.
6. Observe the waste and product flow rates and record values in the operation log. Allow water temperatures to stabilize before recording results to prevent errors due to fluctuating temperatures.
7. Observe the percent rejection and TDS water quality readings and record values in the operation log.
8. Measure the feed water temperature and record value in the operation log.
9. Purge air from submersible pump housing (if applicable).
10. Verify the product water flow is diverted to drain and the Product Divert Lamp is illuminated during start up of the RO unit for the preset time.
11. Observe the normal illumination of the visual indicators on the Temperature Alarm Monitor.

#### **4.1.2 Monthly Maintenance**

1. Check the pre-filter at least monthly for core discoloration. If discoloration is observed the pre-filters will require more frequent changing or additional pre-filtration. Reference section 4.2.4, Pre-Filter Cartridge Replacement Procedure if a change is required.

#### **4.1.3 Quarterly Maintenance**

**NOTE:**

Cleaning and disinfecting should occur at least quarterly for maximum membrane life.

1. Clean the RO membranes. Reference the RO membrane cleaning procedures in sections 4.3.1 and/or 4.3.2. The RO should be disinfected after cleaning.
2. Disinfect the RO machine. Reference the membrane disinfection procedures in section 4.4.
3. Perform the Product Water Divert operation verifications as referenced in section 4.2.2.
4. Perform Temperature Alarm Monitor operation verifications as referenced in section 4.2.3.



**4.1.4 Semi-Annual Maintenance**

1. Lubricate motor and pump bearing frame if applicable (non-submersible motor only). Reference section 4.2.1, Pump Lubrication Procedure as necessary.
2. Re-torque the connection points on high amperage power and motor wires (Reference Technote 128).
3. Tighten the three screws inside the conduit elbow located on the outlet of the pump housing (submersible motor only). The three screws should be evenly tightened to provide the best possible seal.

**4.1.5 Annual Maintenance**

1. An AAMI Water Quality Analysis of the product water should be conducted at least yearly. Reference section 2.4, Product Water Analysis Procedure.
2. Check the monitoring for accuracy.
3. Check the gauges for correct functioning.
4. Check the ball valves for correct operation.
5. Check the tubing and fittings for leaks or wear.
6. Check the switches and lights for correct operation.
7. Check all pre RO devices for correct operation.

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## **4.2 Specific Maintenance Procedures and Instructions**

### **4.2.1 Pump Lubrication Procedure**

**NOTE:**

Submersible multi-stage centrifugal pumps do not require lubrication.

1. Use No. 2 Lithium grease (with molybdenum disulfide) as a lubricant (GE Osmonics P/N 50040).
2. Operate the RO for at least 15 minutes to bring the pump bearings to normal operating temperature.
3. Remove the plug from the pump bearing frame.
4. Slowly add 9 shots (12 grams) of grease through the fitting on the bearing frame with a hand operated grease gun. Remove any grease that exits through the open port. Add 6 shots (9 grams) of grease to the other grease fitting and remove any excess.

**CAUTION:**

If the bearing frame is over-lubricated, the pump shaft bearings may run excessively hot or the pressure of the grease will blow the mechanical seal out of its seat. If either of these problems occurs, the pump will leak and may be damaged beyond repair. Do not force grease into bearing frame.

5. Allow the RO to run for an additional 5 minutes or more. While the RO is running, some grease may exit the bearing frame from the open port. This is normal and should not be a concern. After the RO has been running for some time, re-install the plug into the open port. Clean the bearing frame thoroughly.

### **4.2.2 Product Water Divert Verification**

1. Disconnect the drain line at the drain connection from the Product Divert Valve.
2. Turn on the RO unit and verify the following:
  - a. Product Divert Controller indicator illuminates.
  - b. Divert valve opens and product water diverts to drain.
  - c. Divert valve closes after an approximate two-minute start-up delay and the product water stops being diverted to drain.

**NOTE:**

The TDS must be below the alarm set point for the product divert valve to close. Adjust the TDS selector switch on the RO unit as required.

3. With the RO unit operating normally, adjust the TDS alarm selector switch so that the TDS valve exceeds the TDS alarm set point and check the following;
  - a. Verify the product divert indicator illuminates and the divert valve rotates open for the duration of the alarm condition.
4. With the RO unit operating in the condition listed above, adjust the TDS alarm selector switch so that the TDS value is lower than the TDS alarm set point and check the following;
  - a. Verify the product divert indicator shuts off and the divert valve rotates closed after an approximate one-minute alarm removal delay
5. Reconnect the Product Divert Valve drain line to the drain.

### **4.2.3 Temperature Setting and Function Test**

**NOTE:**

To perform this test you will need a thermometer and a water bath that can be temperature controlled from 85°F to 95°F.

1. Remove the temperature probe from the thermal well.
2. Insert the end of the temperature probe into the 85°F water bath that without submerging beyond the threads.
3. Allow the probe to acclimatize for a minimum of 5 minutes.
4. Slowly increase the water bath temperature until the monitor indicates (red light) “RO Unit Interlock”. Check the water bath temperature with a thermometer for 90°F ± 1°F. Adjust the set point as required.

**NOTE:**

The set point is adjusted through the hole on the left side of the monitor with a screwdriver. Clockwise rotation reduces the temperature set point and counter clockwise will increase the temperature set point.

5. Check that the RO unit shuts down at the alarm set point.
6. Switch the Override Switch on the monitor from normal run to the Override position. The RO unit should start up and the Override indicator lamp will light.
7. Switch the Override Switch from the Override position to the normal run position. The RO unit should stop running if the temperature is over the set point of 90°F.
8. Slowly reduce the water bath temperature until the Monitor’s temperature switches from the alarm condition to normal operation. The RO unit should return to normal operation.
9. Log all set point and calibration data.
10. Replace the temperature probe into the thermal well.

#### **4.2.4 Pre-Filter Cartridge Replacement Procedure**

**NOTE:**

This procedure should be followed every thirty days or when the delta pressure increases by 10 PSI over a clean filter delta, whichever occurs first.

1. Close the inlet water supply valve. Pressures will drop to zero on the gauges and the RO pump will turn off automatically if the RO unit is operating.
2. Remove the pre-filter bowls by rotating to the left until it is free of the head.
3. Remove the cartridge from the bowl slowly to prevent excess spillage. Empty water from the bowl and discard spent cartridge.
4. Install new cartridge flush with the top of the bowl.
5. Ensure the filter bowl o-ring is in its groove and free of debris.
6. Align the filter cartridge hole with the receptacle head and rotate the bowl until threaded hand tight.

**NOTE:**

RO units equipped with a submersible pump must purge the air from the pump housing air vent valve after the unit has run for 5 minutes.

#### **4.2.5 Threaded Connection Leak repair**

**WARNING:**

Any piping change making contact with product water should be disinfected prior to continued use.

**CAUTION:**

Any leak from any part of the system should be corrected as soon as possible. Left unattended, leaks can cause secondary damage necessitating expensive repairs.

**NOTE:**

Use FDA/NSF approved silicone sealant when used on threaded connections.

1. Prior to performing maintenance on any threaded fitting, release the pressure in the piping/tubing system (i.e., turn off the pump, open a drain port, etc.)
2. Remove the connecting tubing.
3. Tape the pipe threads with 2 or 3 wraps of Teflon tape.
4. Re-insert the threaded fitting into the opening and hand tighten. Be careful to avoid cross threading. Tighten further using a wrench only if necessary, and only about one-half turn.
5. Connect piping, pressurize, and inspect for leaks.
6. If the leak is still present, de-pressurize system again and tighten the fitting another quarter-turn. Check again for leaks. Over tightening can crack the female fitting.
7. If the leak continues, it may be necessary to replace the male threaded fitting and/or the female threaded fitting.

### **4.3 Z-Series Cleaning Indications**

**WARNING:**

Some safety systems are disabled when the RO unit is operated with the Disinfect key switch. An operator should be present and monitoring the RO unit when operated in this manner. The following systems will not be operable:

- a. RO Interlock(s)
- b. Water Quality Monitoring Display
- c. Product Divert System
- d. Low Pressure Switch

**CAUTION:**

Water and solutions to be used must be chlorine free or damage to the RO membranes may result.

**CAUTION:**

Membranes that have not been cleaned for a long time may actually incur damage during cleaning as perforations are exposed that were masked by accumulations of foulant. Regular maintenance cleaning is the best assurance of long membrane service.

**NOTE:**

If a Disinfect Alarm Monitor is included in the RO system it's operation manual can be referenced for additional Disinfect Start key switch operations.

Foulants such as minerals, silt and organic substances may collect on the RO membrane surface and cause the RO membrane to foul and diminish in its function. Many of these foulants are prevented by proper selection of pretreatment equipment, while others are treatable only with more sophisticated designs. Regardless of the foulant, it is essential to clean the membrane promptly once the need for cleaning is indicated. The longer a foulant is allowed to remain in contact with the RO membrane, the more difficult it will be to remove. In severe cases, repeated cleanings may be required.

**NOTE:**

Some foulants CANNOT be removed with cleaning and membrane performance may not be fully restored. Observe the appearance of the cleaning solution before discarding it. If the solution is heavily soiled, repeat the cleaning procedure with fresh solution of the same type (high pH or low pH).

Routine cleaning of the RO membranes in conjunction with regular disinfection will keep bacteria counts at a minimum and the RO membrane performance at its best. Cleaning removes the silt, organic and mineral deposits that collect on the RO membrane surface, which, if left untreated, encourages bacterial growth, and will eventually impair the RO membranes' ability to perform. Disinfection kills most of the bacteria that may be present in the system, but it does not remove the deposits on the membrane.

There are a variety of indications for cleaning membranes. The most common is a reduced product flow rate. Remember that a reduction in inlet water temperature can also result in a reduced flow rate. Refer to Technote 113 "Temperature Correction Factors" to determine the reduction in flow that can be attributed to reduced water temperature. Clean the membranes whenever the temperature compensated flow rate drops by 10%. A loss in the membrane performance (percent rejection) or increase in TDS of the product water may also be an indication to clean the membranes. A good preventative maintenance practice is to clean the membranes on a quarterly basis, and more often if needed.

### **4.3.1 Cleaning Preparation**

There are two types of cleaners available, a low pH cleaner (Calcium/Iron removal) and a high pH cleaner (Silt/Organics removal). GE Osmonics provides these cleaners in liquid form. The low pH cleaner attacks mineral scale deposits such as calcium, magnesium and iron build-up, and should be used first. The high pH cleaner will remove accumulated silt and organic matter from the RO membrane.

**WARNING:**

The solution is a mild irritant to eyes and skin. It is recommended that protective gloves and eye protection be worn when handling the cleaner. Follow all applicable Material Safety Data Sheet (MSDS) precautions and OSHA Standards.

**WARNING:**

Label machine with appropriate warning signs such as "Do Not Use / Contains Cleaner" to prevent use of the RO until it is properly rinsed.

**CAUTION:**

The different cleaners must not be mixed together. Introduce the low pH cleaner first, thoroughly rinse the system, and then use the high pH cleaner.

**NOTE:**

BIOSANT™ is a low pH liquid cleaner/descaler agent intended for use in removing mineral scale and organic biofilm and is a short-term storage solution for RO water systems.

**NOTE:**

Follow the procedures recommended by cleaning solution manufacturer if they vary from the following steps.

### **Cleaning Materials**

<u>Description</u>	<u>GE Osmonics Part Number</u>
Disinfection/Cleaning Kit	12214
Low pH liquid	1228653 (1 Gallon) or 1228654 (5 Gallons)
High pH liquid	1228791 (1 Gallon) or 1228792 (5 Gallons)
Water Quality Test Strips	1232143
“DO NOT USE” Warning Labels	Not Provided by GE Osmonics
Operation Log Sheets	Reference Tech Note 142
Cleaning/Disinfect Log Sheets	Reference Tech Notes 143, 144, 145

#### **4.3.1.1 Cleaning Procedure**

1. With the RO unit operating establish a pre-cleaning % rejection, TDS, and pH record on the cleaning disinfect log sheet.

**NOTE:**

If your RO system is equipped with a "submersible" high-pressure pump, the pump/motor housing must be purged of all air during the start-up procedure. Turn on the RO system and open the small valve on the top end of the pump/motor housing very slowly to purge. Air should be heard escaping to the atmosphere. Close the valve when water is seen flowing from this valve.

2. Turn off the RO unit power switch.
3. Label machine with appropriate warning signs such as "Do Not Use / Contains Cleaner" to prevent use of the RO until it is properly rinsed.
4. Remove the RO product line from the Product Divert Valve Assembly (RO Product Water connection) and connect to one of the upper connection ports on the cleaning tank.
5. Use the RO unit to fill the cleaning tank with 10 gallons of product water and turn off the RO.
6. Prepare the cleaning solution by adding 850 mL of cleaner to the cleaning tank.
7. Connect a cleaning line hose between the Disinfect Inlet Valve on the RO and the lower connection port on the cleaning tank.
8. Remove the RO waste line from drain and connect to an upper connection port on the cleaning tank.
9. Open the Disinfect Inlet Valve and the Waste Flow Valve (counter clockwise) on the RO unit.
10. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor cleaning operations may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to circulate the solution through the RO system.

**CAUTION:**

Check that there is waste flow within 10 seconds. If not, turn off power and verify that the Disinfect Inlet Valve is open and tank connections are secure.

11. Adjust the pump pressure to 100 psi or less and circulate the cleaning solution for 10 minutes. This will allow more flow of cleaner on the reject side of the RO membrane to flush particulates away.
12. Turn off the RO unit. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect Start key switch to turn off the pump.
13. Allow the membranes to soak in the cleaning solution for a minimum of 30 minutes.

### **4.3.1.2 Post Cleaning Rinse Procedure**

1. Remove the RO waste and product lines from the cleaning tank and connect to drain.
2. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor post cleaning rinse operations may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to rinse the cleaning solution through the RO system.
3. Run cleaning solution to drain until the cleaning tank is almost empty.

**CAUTION:**

Do not allow air to be drawn into the RO system, as this will damage the pump.

4. Turn off the RO unit and pour the last amounts of cleaner into drain to protect the pump from running dry. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect Start key switch to turn off the pump.
5. Rotate the Disinfect Inlet Valve to the closed position.
6. Remove the Disinfect Inlet Valve cleaning line from cleaning tank and connect to drain.
7. Turn on the RO unit power switch and allow RO to rinse for five minutes. RO systems with the Disinfect Alarm Monitor and RO Status Monitor must have both disinfect key switches placed in the off/normal operation position to continue rinse operations.
8. Slowly open the Disinfect Inlet Valve and allow water to rinse to drain. A low pump feed pressure condition may be created if this valve is opened too far.
9. Close the valve and disconnect drain hose.
10. Adjust the waste flow to equal product flow.
11. Rinse for 20 minutes and ensure the Percent Rejection and TDS monitors display normal readings.
  - a. During this rinse period, rotate the waste flow valve open and closed to build up and release pump pressure. Perform this several times to aid in flushing the cleaner from the system.

**CAUTION:**

**DO NOT EXCEED 300 PSI DURING THIS PROCEDURE.**

12. Test product water for post cleaning pH and compare to pre-cleaning pH level. The values should be the same or very close to the pre-cleaning pH. If it is not, continue rinsing in the operate position until equalization of the values occur.



13. Turn off the RO unit when the operating parameters (% Rejection, TDS, pH) have normalized.
14. Reconnect the RO product line to the Product Divert Valve Assembly.
15. Remove the "Do Not Use/Contains Cleaner" warning label.

**CAUTION:**

The RO should be disinfected after cleaning procedures are completed.

**4.3.1.3 BIOSAN™ (Low pH Cleaner) Cleaning Procedure**

1. With the RO unit operating establish a pre-cleaning % rejection, TDS, and pH record on the cleaning disinfect log sheet.

**NOTE:**

If your RO system is equipped with a "submersible" high-pressure pump, the pump/motor housing must be purged of all air during the start-up procedure. Turn on the RO system and open the small valve on the top end of the pump/motor housing very slowly to purge. Air should be heard escaping to the atmosphere. Close the valve when water is seen flowing from this valve.

2. Turn off the RO unit power switch.
3. Label machine with appropriate warning signs such as "Do Not Use / Contains Cleaner" to prevent use of the RO until it is properly rinsed.
4. Remove the RO product line from the Product Divert Valve Assembly (RO Product Water connection) and connect to one of the upper connection ports on the cleaning tank.
5. Prepare a 10% solution of BIOSAN™ by mixing 1 part BIOSAN™ to 9 parts RO product water.
  - a. Use the RO unit to fill the cleaning tank with 9 gallons of product water and turn off the RO.
  - b. Add 1 gallon of BIOSAN™ to the cleaning tank and mix well.
6. Connect a cleaning line hose between the Disinfect Inlet Valve on the RO and the lower connection port on the cleaning tank.
7. Remove the RO waste line from drain and connect to an upper connection port on the cleaning tank.
8. Open the Disinfect Inlet Valve and the Waste Flow Valve (counter clockwise) on the RO unit.

9. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor cleaning operations may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to circulate the solution through the RO system.

**CAUTION:**

Check that there is waste flow within 10 seconds. If not, turn off power and verify that the Disinfect Inlet Valve is open and tank connections are secure.

10. Adjust the pump pressure to 100 psi or less and circulate the cleaning solution for 15 minutes. This will allow more flow of cleaner on the reject side of the RO membrane to flush particulates away.

**CAUTION:**

The BIOSAN™ will foam; this is normal. Keeping the 'return' hose under the liquid level in the tank may minimize the foam. Damage to the pump may occur if foam is drawn into the pump.

11. Turn off the RO unit. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect Start key switch to turn off the pump.
12. Allow the BIOSAN™ to dwell for one hour.
13. Rinse the RO system. Reference section 4.3.1.2, Post-Cleaning Rinse Procedure.

#### **4.4 Disinfection Procedure**

**WARNING:**

Some safety systems are disabled when the RO unit is operated with the Disinfect key switch. An operator should be present and monitoring the RO unit when operated in this manner. The following systems will not be operable:

- a. RO Interlock(s)
- b. Water Quality Monitoring Display
- c. Product Divert System
- d. Low Pressure Switch

**CAUTION:**

Glutaraldehyde and Actril™ are not recommended disinfectants.

**CAUTION:**

Water and solutions to be used must be chlorine free or damage to the RO membranes may result.

**NOTE:**

If a Disinfect Alarm Monitor is included in the RO system reference the operation manual for additional Disinfect key switch operations.

#### **DETERMINATION OF MICROBIAL CULTURING AND DISINFECTION FREQUENCY IS THE RESPONSIBILITY OF THE OPERATING FACILITY.**

The following is recommended for critical applications where bacteria and endotoxins are a major concern, such as for Hemodialysis.

Disinfect the Z-Series RO every week for one month after installation. This will ensure that bacteria levels in the fluid paths will be controlled. Sample the purified water for bacteria before each disinfection. After one month of "no growth" samples the interval between disinfecting may be increased. Disinfection should occur when any "growth" is detected. This will inhibit colonization of bacteria in the system and the distribution plumbing. See section 4.5 for the Product Water Sample procedure.

Disinfection should occur when bacterial growth is above the limits set by the facility, or when a reading over the maximum AAMI standard is detected. Routine disinfection at lower CFU counts will inhibit colonization of bacteria in the system and the distribution plumbing.

Rapid re-growth of bacteria following disinfection, or excessively high colony counts (i.e. TNTC), may indicate a need for more aggressive intervention. Strategies such as increased frequency of disinfection, longer dwell times, or alternative chemical agents may be employed.

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**4.4.1 Formaldehyde Disinfection Preparation**

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**WARNING:**

Always wear rubber gloves, apron and facemask. Use proper ventilation during disinfection and rinse-out. A face respirator with an organic cartridge to remove formaldehyde fumes may be worn. **DO NOT BREATHE FUMES OR ALLOW FORMALDEHYDE TO COME IN CONTACT WITH SKIN OR EYES.** Follow all Material Safety Data Sheet (MSDS) precautions and OSHA Standards.

**WARNING:**

Label machine with appropriate warning signs such as "Do Not Use / Contains Disinfectant" to prevent use of the RO until it is properly rinsed.

**CAUTION:**

New or replacement thin film membranes must be rinsed to drain with normal pressures for a minimum of six (6) hours before first exposure to formaldehyde, or irreversible damage may occur.

**Disinfecting Materials**

<u>Description</u>	<u>GE Osmonics Part Number</u>
Disinfection/Cleaning Kit	12214
Formaldehyde, 37% Solution	Not Provided by GE Osmonics
Formaldehyde Test Kit	Not Provided by GE Osmonics
"DO NOT USE" Warning Labels	Not Provided by GE Osmonics
Cleaning/Disinfect Log Sheets	Reference Tech Notes 143, 144, 145
Operation Log Sheet	Reference Tech Note 142
Body Protective Wear	Not Provided by GE Osmonics

#### **4.4.1.1 Formaldehyde Disinfection Procedure**

**NOTE:**

If your RO system is equipped with a "submersible" high-pressure pump, the pump/motor housing must be purged of all air during the start-up procedure. Turn on the RO system and open the small valve on the top end of the pump/motor housing very slowly to purge. Air should be heard escaping to the atmosphere. Close the valve when water is seen flowing from this valve.

1. Turn off the RO unit power switch.
2. Label machine with appropriate warning signs such as "Do Not Use / Contains Disinfectant" to prevent use of the RO until it is properly rinsed. Warning signs should be placed at each use point if the loop piping is being disinfected.
3. Remove the RO product line from the Product Divert Valve Assembly (RO Product Water connection) and connect to one of the upper connection ports on the disinfect tank.
4. Prepare a 4% solution of formaldehyde by mixing 1 gallon of 37% formaldehyde to 9 gallons of RO product water.
  - a. Use the RO unit to fill the disinfect tank with 9 gallons of product water and turn off the RO.
  - b. Add 1 gallon of 37% formaldehyde to the disinfect tank and mix well.

**NOTE:**

Ten gallons of solution is adequate for the V-Series RO; if the unit is directly feeding a distribution loop and the loop is to be disinfected at the same time, a larger volume of solution may be required.

5. Connect a disinfect line hose between the Disinfect Inlet Valve on the RO and the lower connection port on the disinfect tank.
6. Remove the RO waste line from drain and connect to an upper connection port on the disinfect tank.
7. Open the Disinfect Inlet Valve and the Waste Flow Valve (counter clockwise) on the RO unit. Direct Feed RO units will also require the loop return ball valve, mounted vertically just prior to pump housing, to be closed during disinfection.
8. Loop piping disinfection will require the product line to be removed from the disinfect tank and connected to the loop before proceeding. Direct Feed RO units having the loop disinfected will require the loop return ball valve, mounted vertically just prior to pump housing, to be open during disinfection.

9. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor disinfect operations may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to circulate the solution through the RO system.

**CAUTION:**

Check that there is waste flow within 10 seconds. If not, turn off power and verify that the Disinfect Inlet Valve is open and tank connections are secure.

10. Allow the RO to run and circulate the disinfectant solution for 10 minutes.
11. Test the product line effluent for the presence of formaldehyde. Loop piping disinfection will require each use point to draw one liter of formaldehyde solution and a positive test for the presence of formaldehyde.
12. Allow the RO to run for an additional 10 to 15 minutes after a positive formaldehyde test.
13. Turn off the RO unit. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect Start key switch to turn off the pump.
14. Remove the RO waste and product lines from the disinfect tank and connect to drain. Loop piping disinfection will require the loop output to be connected to drain. Direct Feed RO units having the loop disinfected will also require the loop return ball valve, mounted vertically just prior to pump housing, to be closed during disinfectant solution draining. Protect product line from contamination.

**WARNING:**

Formaldehyde solution may spill from this line; exercise caution.

15. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor operation may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to drain the disinfect solution.
16. Run disinfectant solution to drain until the disinfect tank is almost empty.

**CAUTION:**

Do not allow air to be drawn into the RO system, as this will damage the pump.

17. Turn off the RO unit and pour the last amounts of cleaner into drain to protect the pump from running dry. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect key switches to turn off the pump.
18. Rotate the Disinfect Inlet Valve to the closed position. Allow the disinfectant solution to remain in contact for a minimum of two hours, or preferably overnight.

**NOTE:**

Reference section 4.6, System Storage, for additional storage information.

**4.4.1.2 Post Formaldehyde Disinfection Rinse Procedure**

1. Remove the Disinfect Inlet Valve disinfection line from disinfect tank and connect to drain.
2. Ensure that the water supply to the RO unit is on. Ensure Direct Feed RO units have the loop return ball valve, mounted vertically just prior to the pump housing, is in the open position, and loop flow is being returned to the unit.
3. Turn on the RO unit power switch and allow the RO to rinse for 10 minutes. RO systems with the Disinfect Alarm Monitor and RO Status Monitor must have both disinfect key switches in the off/normal operation position to continue rinse operations.
4. Slowly open the Disinfect Inlet Valve and allow water to rinse to drain. A low pump feed pressure condition may be created if this valve is opened too far.
5. Close the valve and disconnect drain hose.
6. Turn the power switch ON and OFF in alternating one minute cycles to rinse out any trapped disinfectant in the RO unit. Repeat 3 times.
7. Continue to rinse for an additional 20-30 minutes. Open each use point in the loop if the loop piping was disinfected.
8. Check the product effluent and each use point as applicable for the absence of disinfectant. Continue rinse until absence of disinfectant is confirmed.
9. Turn off the RO unit power switch when the absence of disinfectant is confirmed.
10. Reconnect the product line to the Product Divert Valve Assembly.
11. Remove the "Do Not Use/Contains Disinfectant" warning label(s).

#### **4.4.2 Peracetic Acid/Peroxide-Based (Renalin®) Disinfection Preparation**

**WARNING:**

Always wear rubber gloves, apron and face mask. Use proper ventilation during disinfection and rinse out. A face respirator with an organic cartridge to remove fumes may be worn. **DO NOT BREATHE FUMES OR ALLOW RENALIN® / MINNCARE® TO COME IN CONTACT WITH SKIN OR EYES.** Follow all Material Safety Data Sheet (MSDS) precautions and OSHA Standards.

**WARNING:**

Label machine with appropriate warning signs such as "Do Not Use / Contains Disinfectant" to prevent use of the RO until it is properly rinsed.

**CAUTION:**

When 'RENALIN®' is to be used as a disinfectant, several preparatory steps are required by GE Osmonics as well as the membrane manufacturer. Failure to comply with these instructions, which incorporate instructions from the membrane manufacturer, will jeopardize the system performance and warranty.

- a. The system must be free of all incompatible materials.
- b. Clean the membranes with an acid such as 0.1% HCl or 0.4% phosphoric acids. Calcium and Iron Cleaner may be used as an alternate. It is essential that all iron and other transition metals be removed from the membrane surface.
- c. Any deposits on the membrane must be removed with a Silt and Organics cleaner. Removal of these deposits, which harbor microorganisms, will maximize the effectiveness of the disinfection.

**CAUTION:**

The RO system must be disconnected from the tempered water source (if present). The solution temperature must be monitored closely. At temperatures above 77°F / 25°C the 'RENALIN®' solution becomes very aggressive towards the RO membranes and will damage them in a short period of time. The disinfection procedure will raise the temperature of the solution. The operator must be prepared to add ice to the solution or discontinue the procedure when the water temperature approaches 77°F / 25°C.

**CAUTION:**

New replacement thin film membranes must be rinsed to drain with normal pressures for a minimum of three (3) hours before first exposure to disinfectants, or irreversible damage may occur.



**CAUTION:**

'RENALIN®' is corrosive to most metals other than stainless steel. Any brass components that will come into contact with the 'RENALIN®' must be replaced with suitable stainless or plastic materials prior to attempting disinfection. 'RENALIN®' type products contain oxidizing agents and are potentially damaging to thin film (polyamide) membranes. It is imperative that all the precautions and instructions are followed correctly. Failure to comply with these instructions, which incorporate instructions from the membrane manufacturer, will jeopardize the system performance and the warranty.

**Renalin®, Minncare™, Peracidin™** and others are trade names for compounds based on Peracetic Acid and Hydrogen Peroxide compounds, and are common in dialysis facilities. The products referred to in this procedure typically have 20% hydrogen peroxide and 4% peroxacetic acid before dilution. Other products are available with these same chemicals in different ratios and are not acceptable for use in the Z-Series RO. **Actril™ and other compounds with different combinations of these chemicals must not be used on polyamide (thin-film) membranes.** The name, "Renalin®" will be used in this manual to refer to acceptable products.

**Disinfecting Materials**

<u>Description</u>	<u>GE Osmonics Part Number</u>
Disinfection/Cleaning Kit	12214
Renalin®, 1 quart	Not Provided by GE Osmonics
Renalin® Test Kit	Not Provided by GE Osmonics
"DO NOT USE" Warning Labels	Not Provided by GE Osmonics
Cleaning/Disinfect Log Sheets	Reference Tech Notes 143, 144, 145
Operation Log Sheet	Reference Tech Note 142
Body Protective Wear	Not Provided by GE Osmonics

#### **4.4.2.1 Renalin<sup>®</sup> Disinfection Procedure**

**NOTE:**

If your RO system is equipped with a "submersible" high-pressure pump, the pump/motor housing must be purged of all air during the start-up procedure. Turn on the RO system and open the small valve on the top end of the pump/motor housing very slowly to purge. Air should be heard escaping to the atmosphere. Close the valve when water is seen flowing from this valve.

1. Turn off the RO unit power switch.
2. Label machine with appropriate warning signs such as "Do Not Use / Contains Disinfectant" to prevent use of the RO until it is properly rinsed. Warning signs should be placed at each use point if the loop piping is being disinfected.
3. Remove the RO product line from the Product Divert Valve Assembly (RO Product Water connection) and connect to one of the upper connection ports on the disinfect tank.
4. Prepare a 1:100 (1%) solution of Renalin<sup>®</sup> by mixing 13 ounces (400 milliliters) of disinfectant concentrate to 10 gallons (38 Liters) of RO product water.
  1. Use the RO unit to fill the disinfect tank with 10 gallons of product water and turn off the RO.
  2. Add 13 ounces (400 milliliters) of disinfectant concentrate to the disinfect tank and mix well.
5. Connect a disinfect line hose between the Disinfect Inlet Valve on the RO and the lower connection port on the disinfect tank.
6. Remove the RO waste line from drain and connect to an upper connection port on the disinfect tank.
7. Open the Disinfect Inlet Valve and the Waste Flow Valve (counter clockwise) on the RO unit. Direct Feed RO units will also require the loop return ball valve, mounted vertically just prior to pump housing, to be closed during disinfection.
8. Loop piping disinfection will require the product line to be removed from the disinfect tank and connected to the loop before proceeding. Direct Feed RO units having the loop disinfected will require the loop return ball valve, mounted vertically just prior to pump housing, to be open during disinfection.

9. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor disinfect operations may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to circulate the solution through the RO system.

**CAUTION:**

Check that there is waste flow within 10 seconds. If not, turn off power and verify that the Disinfect Inlet Valve is open and tank connections are secure.

10. Allow the disinfect solution to circulate through the system for 5 minutes. After 3 minutes of recirculation, test the product line effluent for the presence of Renalin<sup>®</sup>. If necessary, continue recirculation until a positive test is obtained. Follow specific facility procedures for loop piping point of use testing.

**CAUTION:**

Do not allow the solution temperature to climb above 25°C during this step. Failure to control temperature will result in rapid deterioration of the membrane, resulting in poor rejection.

11. Turn off the RO unit. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect Start key switch to turn off the pump.
12. Remove the RO waste and product lines from the disinfect tank and connect to drain. Loop piping disinfection will require the loop output to be connected to drain. Direct Feed RO units having the loop disinfected will require the loop return ball valve, mounted vertically just prior to pump housing, to be closed during disinfectant solution draining. Protect product line from contamination.
13. Turn on the RO unit. When the RO system is equipped with a Disinfect Alarm Monitor and RO Status Monitor operation may commence only when both disinfect key switches are activated, the RO unit power switch is turned on, and the alarm timer has expired. If the Disinfect Alarm Monitor is not included in the RO system the Disinfect Start key switch can be turned ON to drain the disinfect solution.
14. Run disinfectant solution to drain until the disinfect tank is almost empty.

**CAUTION:**

Do not allow air to be drawn into the RO system, as this will damage the pump.

15. Turn off the RO unit and pour the last amounts of cleaner into drain to protect the pump from running dry. RO systems equipped with a Disinfect Alarm Monitor will use the RO unit power switch to turn off the pump and stop circulation. RO systems without a Disinfect Alarm Monitor will use the Disinfect key switches to turn off the pump.

16. Rotate the Disinfect Inlet Valve to the closed position. Allow the disinfectant solution to remain in contact for 2-12 hours.

**CAUTION:**

Do not allow the Renalin<sup>®</sup> to dwell more than 12 hours, or the RO membranes will be permanently damaged.

**4.4.2.2 Post Renalin<sup>®</sup> Disinfection Rinse Procedure**

1. Remove the Disinfect Inlet Valve disinfection line from disinfect tank and connect to drain.
2. Ensure that the water supply to the RO unit is on. Ensure Direct Feed RO units have the loop return ball valve, mounted vertically just prior to the pump housing, is in the open position, and loop flow is being returned to the unit.
3. Turn on the RO unit power switch and allow the RO to rinse for 10 minutes. RO systems with the Disinfect Alarm Monitor and RO Status Monitor must have both disinfect key switches in the off/normal operation position to continue rinse operations.
4. Slowly open the Disinfect Inlet Valve and allow water to rinse to drain. A low pump feed pressure condition may be created if this valve is opened too far.
5. Close the Disinfect Inlet Valve and disconnect drain hose.
6. Turn the power switch ON and OFF in alternating one minute cycles to rinse out any trapped disinfectant in the RO unit. Repeat 3 times.
7. Continue to rinse for an additional 5 minutes. Open each use point in the loop if the loop piping was disinfected.
8. Check the product effluent and each use point as applicable for the absence of disinfectant. Continue rinse until absence of disinfectant is confirmed
9. Turn off the RO unit power switch when the absence of disinfectant is confirmed.
10. Reconnect the product line to the Product Divert Valve Assembly if unit was disinfected separately from loop piping.
11. Remove the "Do Not Use/Contains Disinfectant" warning label(s).

## **4.5 Product Water Culture**

**FREQUENCY:** A product water culture should be taken once a month or more often, depending upon culture results, and unit protocol. GE Osmonics recommends this be performed before and after disinfection.

**RATIONALE:** Performing a product water culture will help ensure that the microbial count of the product (RO) water falls within the AAMI Hemodialysis Water Standard. The AAMI standard maximum allowable concentration for bacteria in product water is 200 colony-forming units. A bacterial count above the maximum level may be harmful to the hemodialysis patient.

**PREPARATION:** Consult your lab to find out what type of sterile container, such as Millipore or 3M Commercial Standard Plate count sampler, to use and how much product (RO) water is required to perform the test. Make certain that your laboratory is informed of the correct procedure for performing a product water culture. A "spread plate method" NOT a "calibrated loop" technique should be used, with tryptic soy agar or equivalent agar, NOT blood or chocolate agar. If tested incorrectly, the results may be inaccurate. The sample should be assayed within 30 minutes of obtaining it, or refrigerated (5°C) immediately and assayed within a 24-hour period. Obtain the samples wearing long sleeves and a mask using a mid-stream "clean catch" type procedure to prevent contamination of samples

### **4.5.1 Product Water Culture Procedure**

**WARNING:**

This procedure must be completed at all points of use (e.g., dialysis stations, re use stations) on at least a monthly basis.

1. Read and understand all applicable instructions before initiating water culture procedure.
2. Turn on RO unit. Allow RO unit to run for 10-15 minutes.
3. Using aseptic technique, allow the RO product water to openly flow for approximately 1 minute.
4. Maintaining aseptic technique, hold the flowing product water over a sterile container (e.g. Millipore® commercial sampler, or lab recommended).
5. Fill the sterile container with the appropriate amount of RO product water. Follow the manufacturer's instructions when using commercial samplers.
6. Aseptically cap the specimen container immediately.
7. Label the specimen appropriately with:
  - Test to be performed - "culture / colony count"
  - Sample source - product water/RO, machine serial number and room location
  - Time and date sample obtained
  - Person who obtained specimen
  - Any other pertinent information or procedures your facility or lab requires
8. The samples should be assayed within 30 minutes of obtaining or refrigerated at 5° C immediately and assayed within a 24-hour period.

## **4.6 System Storage**

It is not recommended that an RO unit be dormant longer than 24 hours without disinfectant. RO units that have been left unused for more than 24 hours risk the possibility of colonizing bacteria and exceeding acceptable limits. RO units to be stored should first be disinfected with one of the procedures in this chapter.

### **CAUTION:**

'RENALIN®' products (Renalin®, Minncare™, Peracidin™, etc.) are not acceptable disinfectants for storage of systems. Exposure of more than 12 hours to RENALIN® will result in irreversible damage to the membranes.

### **4.6.1 Formaldehyde Storage Procedure**

#### **WARNING:**

Always wear rubber gloves, an apron and a facemask. If the room has ventilation, use it. If not, wear a face respirator with an organic cartridge to remove formaldehyde fumes. **DO NOT BREATHE FUMES OR ALLOW FORMALDEHYDE TO COME IN CONTACT WITH SKIN OR EYES.** Refer to the MSDS supplied by the manufacturer of the formaldehyde/formalin product.

#### **WARNING:**

Label machine with appropriate warning signs such as "Do Not Use / Contains Disinfectant" to prevent use of the RO until it is properly rinsed.

1. Follow the operations/instructions for formaldehyde disinfection (Reference Section 4.4.1) and do not rinse out after the disinfectant has been circulated in the machine.

#### **WARNING:**

After storage, the RO unit must be completely rinsed of formaldehyde, and a bacterial culture performed and interpreted before use (refer to Post Formaldehyde Rinse Procedure and Product Water Culture Procedure). Perform AAMI analysis if it has been one year or more since last done.

#### **NOTE:**

RO units can be safely stored in 4% formaldehyde for up to one year.

---

**4.6.2 BIOSAN™ Storage Procedure**

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**WARNING:**

It is recommended that protective gloves and eye protection be worn when handling the BIOSAN™. Follow all Material Safety Data Sheet (MSDS) precautions and OSHA Standards.

**WARNING:**

Label machine with appropriate warning signs such as "Do Not Use / Contains Cleaner" to prevent use of the RO until it is properly rinsed.

- a. Disinfect and rinse the RO unit with an acceptable disinfectant solution. Reference section 4.4, Disinfection Procedure.
- b. Follow the operations for BIOSAN™ cleaning and do not rinse the RO unit after the solution has been circulated in the machine. Reference section 4.3.1.3, BIOSAN™ Cleaning Procedure.

**WARNING:**

After storage, the RO unit must be completely rinsed of BIOSAN™, and a bacterial culture performed and interpreted before use (reference sections 4.3.1.2, Post Cleaning Rinse Procedure, and section 4.5, Product Water Culture Procedure). Perform AAMI analysis if it has been one year or more since last done.

**NOTE:**

The RO unit may be stored in BIOSAN™ for up to 2 weeks with systems utilizing thin film RO membranes.

**NOTES:**



# **Z Series RO System**

## **CHAPTER FIVE: TROUBLESHOOTING**

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## Table of Contents

<b>SECTION</b>		<b>PAGE</b>
5.1	RO Fails to Run	5-5
5.2	RO Runs Intermittently	5-6
5.3	Motor Runs Hot	5-6
5.4	Water Produced While RO is Off	5-7
5.5	Low Waste Pressure	5-7
5.6	Pressure Gauge Vibrates Erratically	5-7
5.7	Excess Product Pressure	5-8
5.8	Product Flow Too Low	5-8
5.9	Product Flow Too High	5-9
5.10	Poor Apparent Water Quality	5-9
5.11	TDS Reading too High	5-10
5.12	RO Pump Leaks at Inlet End	5-10
5.13	Leaks	5-10
5.14	RO Fails to Draw Disinfectant	5-11
5.15	Product Divert Controller and Valve Malfunction	5-11

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**5.1 RO Fails to Run**

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1. **Power**
  - a. Check position of power switch.
  - b. Check position of service disconnect switch.
  - c. Check outlet and circuit breaker/fuse panel for power.
  - d. Check fuses in RO and at service disconnect. Replace fuse(s) as necessary.
2. **Line Voltage**
  - a. Verify the line and equipment voltages are compatible.
3. **Electrical Connections**
  - a. Ensure the power cord is connected to the appropriate outlet.
  - b. Check all wiring connections to verify solid connection. Reference the wire connection diagrams in Chapter 6 for a visual description of wire connection locations. Restore connections as required.
4. **RO Interlock**
  - a. Check status of interlocks and correct lockout condition.
    - i. Temperature Alarm
    - ii. Pretreatment Interlock
5. **Motor Starter**
  - a. Check power to magnetic starter.
  - b. Check contactor thermal overload. Correct the condition that would have caused the thermal overload to trip. Reset overload as necessary.
  - c. Replace starter relay as necessary.
6. **Power Switch**
  - a. Replace power switch as necessary.
7. **Pressure Switch**
  - a. Verify that feed pressure is at least 30 PSI.
  - b. Adjust or replace pressure switch as necessary.
8. **Pump Motor**
  - a. Verify that voltage supply is correct and motor (non-submersible types) is wired for correct voltage
  - b. Check that power legs do not deviate by more than  $\pm 10\%$ .
  - c. Check motor starter overload switch for proper amperage setting (more than full motor amps, but less than 125% of motor full load amps).
  - d. Replace motor as necessary.

## **5.2 RO Runs Intermittently**

1. **Low Water Pressure (Static or Dynamic)**
  - a. Correct cause of low pressure by adjusting pressure regulator or installing a booster pump.
2. **Low Feed Water Flow Rate (Dynamic)**
  - a. Replace pre-filter cartridges.
  - b. Check pretreatment devices.
  - c. Check that water supply valves are open.
3. **Electrical Connection**
  - a. Ensure the power cord is connected to the appropriate outlet.
  - b. Check all wiring connections to verify solid connection. Reference the wire connection diagrams in Chapter 6 for a visual description of wire connection locations. Restore connections as required.
4. **Pressure Switch**
  - a. Adjust or replace pressure switch as necessary.
5. **Thermal Overload**
  - a. Check motor starter overload switch for proper amperage setting (more than full motor amps, but less than 125% of motor full load amps).
  - b. Verify line voltage and motor amperage draw.
  - c. Correct the condition that would have caused the thermal overload to trip. Reset overload as necessary.

## **5.3 Motor Runs Hot**

1. **Voltage too low or too high**
  - a. Check voltage against serial number label and motor label, correct condition.
2. **Current Draw**
  - a. Verify that flow rates and pressures are within RO specifications.
  - b. Check that power legs do not deviate by more than  $\pm 10\%$ .
  - c. Verify that all three power wires (legs) have proper voltage (3 phase motors only).
  - d. Check motor starter for internal short (1 phase motors only).
  - e. Check motor insulation.
  - f. Replace motor as necessary.

**NOTE:**

All of the above motor problems should blow the fuse in the user supplied main power disconnect. If not, the fuses are NOT the right size for this unit.

---

**5.4 Water Produced While RO is Off**

1. **Inlet Solenoid Valve**
  - a. Cycle valve off and on with power switch to clear obstruction.
  - b. Remove valve and clear obstruction.
  - c. Replace valve as necessary.
2. **RO By-Pass Valve (Indirect Feed Units only)**
  - a. Verify the bypass valve is not inoperative. Clean or replace valve as necessary.
3. **Product Return Check Valve (Direct Feed Units Only)**
  - b. Verify the check valve is not inoperative. Clean or replace valve as necessary.

**5.5 Low Waste Pressure**

1. **Pump Pressure**
  - a. Verify pump rotation.
  - b. Inspect motor and pump coupling for wear at shaft key (non-submersible only).
2. **Low Operating Pressure**
  - A. **Waste or Product Flow Too High**
    - a. Adjust waste flow to equal product flow rate.
    - b. Adjust system pressure.
  - B. **Incorrect Pump Rotation (3 phase motors only)**
    - a. Switch any two of three power leads to unit at service disconnect.
  - C. **Faulty Pressure Relief Valve**
    - a. Replace valve as necessary.

**5.6 Pressure Gauge Vibrates Erratically**

1. **Air In Gauge Tubing**
  - a. Loosen tube fitting at gauge to bleed air.
2. **Obstruction In Gauge Orifice**
  - a. Remove obstruction as required.
3. **Faulty Gauge**
  - a. Replace gauge as necessary.

---

**5.7 Excess Product Pressure (Product Return Port Connected)**

1. **Feed Water Pressure Too High**
  - a. Install pressure regulator if not already present and reduce pressure.
2. **Product Flow Rate Too High**
  - a. Decrease operating pressure by adjusting pump pressure regulator.
  - b. Increase waste flow by adjusting waste flow valve.
3. **Distribution Loop Creates Too Much Back Pressure**
  - a. Reduce waste pressure to reduce flow rate and resulting friction loss.
  - b. Install pressure relief valve on product line.

**5.8 Product Flow Too Low**

1. **Waste Flow Too Low**
  - a. Adjust waste pressure regulator.
2. **Low Feed Water Temperature**
  - a. Install or adjust temperature blending valve.
3. **Membrane Fouled Or Scaled**
  - a. See test report for original flow rate.
  - b. Clean membrane following procedure outlined in manual.
4. **Center Tube Of ROMA Collapsed From Operating At High Temperatures**
  - a. Correct high temperature condition.
5. **Check Pretreatment For Brackish Water**
  - a. Check inlet water for high conductivity.
  - b. Check water softener for proper function.
  - c. Regenerate softener as required.
  - d. Check supply water for hardness and conductivity.



---

**5.9 Product Flow Too High**

1. **Rejection Satisfactory**
  - A. **Waste Pressure Too High**
    - a. Adjust pressure regulator.
    - b. Waste flow too low.
  - B. **Feed Water Temperature Too High**
    - a. Adjust temperature blending valve.
    - b. Correct plumbing error that allows the cold water to be heated.
2. **Rejection Unsatisfactory**
  - A. **ROMA Internal Seals Damaged, Dirty, Or Dislodged**
    - a. Disassemble ROMA, clean and inspect “O” rings and seals.
  - B. **Membrane Hydrolyzed (Exposed To Oxidant)**
    - a. Verify condition of pretreatment equipment (GAC tank).
    - b. Replace membrane.
  - C. **Waste Flow Too Low**
    - a. Adjust flow.

**5.10 Poor Apparent Water Quality**

1. **Waste Flow Too Low**
  - a. Open waste flow control valve.
2. **Waste Pressure Too Low**
  - a. Adjust waste pressure regulator.
3. **Product Flow Too High**
  - a. See section 5.9.
4. **Membrane Scaled Or Fouled**
  - a. Verify condition of pretreatment equipment.
  - b. Reference the membrane cleaning procedure to remove scale
5. **Erroneous Meter Readout**
  - a. Verify water quality with independent meter.
  - b. Feed or product water probe wire disconnected or loose.
  - c. Replace feed and/or product water probe.
  - d. Replace monitor circuit board.
  - e. Replace product water probe.
  - f. Check or replace TDS temperature probe (10,000 Ohms @ 25°C).
6. **Membrane Failure**
  - a. Replace membrane.
7. **Change In Feed Water TDS**
  - a. Verify water quality with independent meter.

---

**5.11 TDS Reading Too High**

1. **Waste Flow Too Low**
  - a. Open waste flow control valve.
2. **Waste Pressure Too Low**
  - a. Adjust waste flow control valve.
  - b. Adjust waste pressure regulator.
3. **Product Flow Too High**
  - a. See 5.9
4. **Membrane Scaled Or Fouled**
  - a. Verify condition of pretreatment equipment.
  - b. See membrane cleaning procedure in this manual.
5. **Erroneous Meter Readout**
  - a. Verify water quality with independent meter and check conductivity probe connection.
  - b. Check all quick-disconnect connections.
  - c. Replace inlet water sensor probe.
  - d. Replace product water sensor probe (percent rejection).
  - e. Replace monitor circuit board.
6. **Membrane Failure**
  - a. Replace membrane.
7. **Change In Feed Water TDS**
  - a. Verify feed and product water quality with independent meter.
  - b. Softener problem, rinsing out high levels of salt.

**5.12 RO Pump Leaks At Inlet**

1. **Inlet Connection Leaking**
  - a. Tighten inlet fitting.
2. **Mechanical Seal Failure (Non-Submersible Only)**
  - a. Replace seals.

**5.13 Leaks**

1. Any leak from any part of the system should be corrected as soon as possible. Left unattended, leaks can cause secondary damage necessitating expensive repairs.
2. Reference the Maintenance Procedures for Leak Repair.

---

**5.14 RO Fails To Draw Disinfectant**

1. **Disinfect Inlet Valve Closed**
  - a. Open valve.
2. **Housing On Submersible Pump Contains Air**
  - a. Purge air, see cleaning or disinfect procedure.
3. **Disinfect Line Kinked Or Plugged**
  - a. Clear disinfect line.
4. **Air Leak On Disinfect Draw Line**
  - a. Tighten fittings.
  - b. Check O-ring in Disinfect Inlet Valve.
5. **Motor Fails To Turn On**
  - a. Disinfect key switch inoperative.
  - b. Remote monitor (if equipped) key switch not turned.
  - c. D.A.M. (if equipped) timer not timed out.
  - d. See 5.1.
6. **Solenoid Failure In Open Position (Fluid Level In Tank Will Increase)**
  - a. See 5.4.

**5.15 Product Divert Controller and Valve Malfunction**

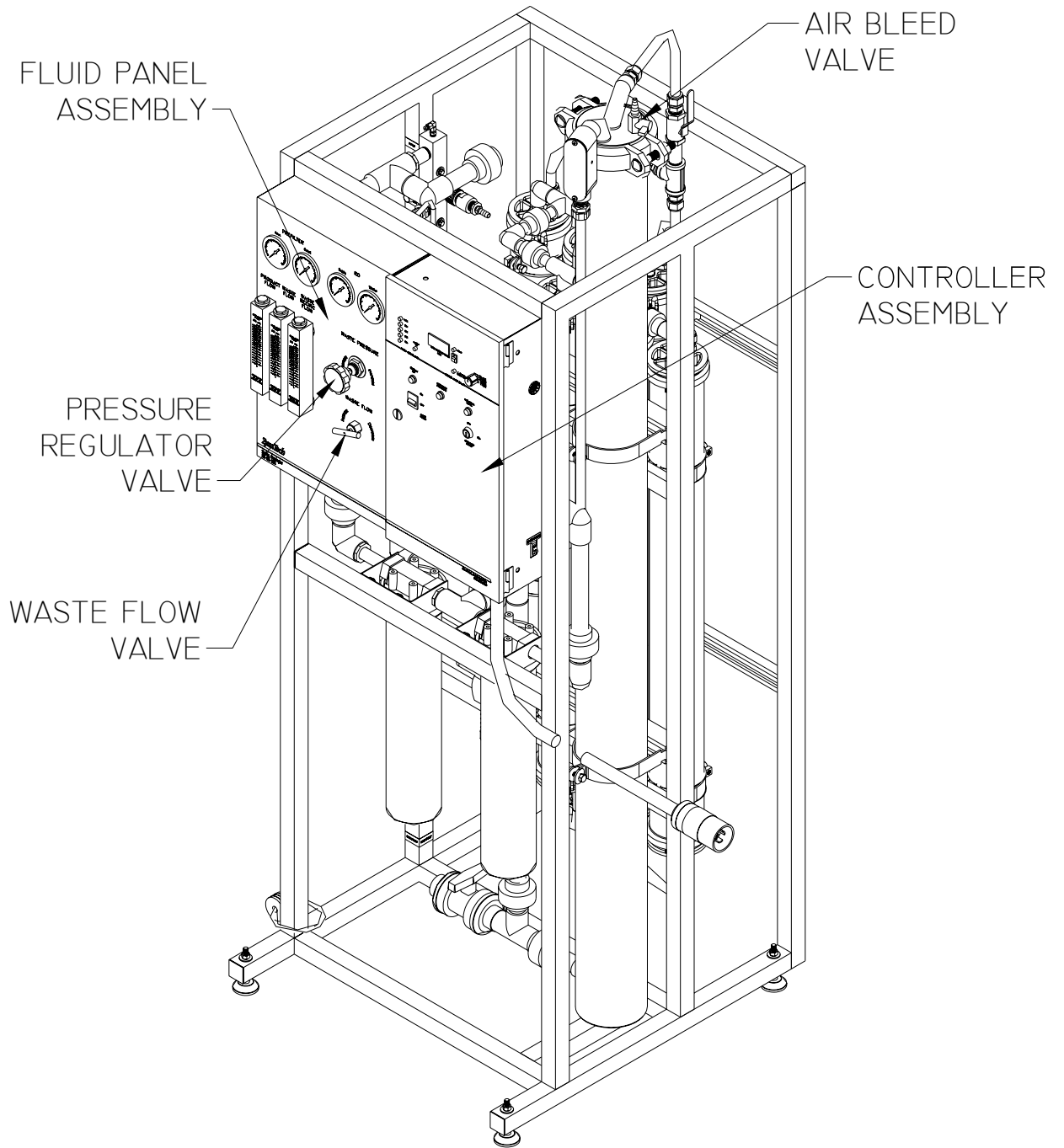
1. **Connections**
  - a. Ensure the Product Divert Controller power cord is connected to the appropriate outlet.
  - b. Check outlet and circuit breaker/fuse panel for power.
  - c. Verify the wire lead connections inside the Product Divert Controller, and to the Divert Valve and RO controller are correctly and securely attached. Reference the wire connection diagrams in Chapter 6 for a visual description of wire connection locations. Restore connections as required.
  - d. Check fuse and relay, replace as necessary.
2. **Divert Valve**
  - b. Verify correct valve movement.
  - c. Verify the divert valve is operational using separate power source. Replace valve as necessary.
3. **Indicator**
  - a. Verify the indicator lamp has not burnt out with a continuity check across the terminal connections. Replace indicator as necessary.

**NOTES:**

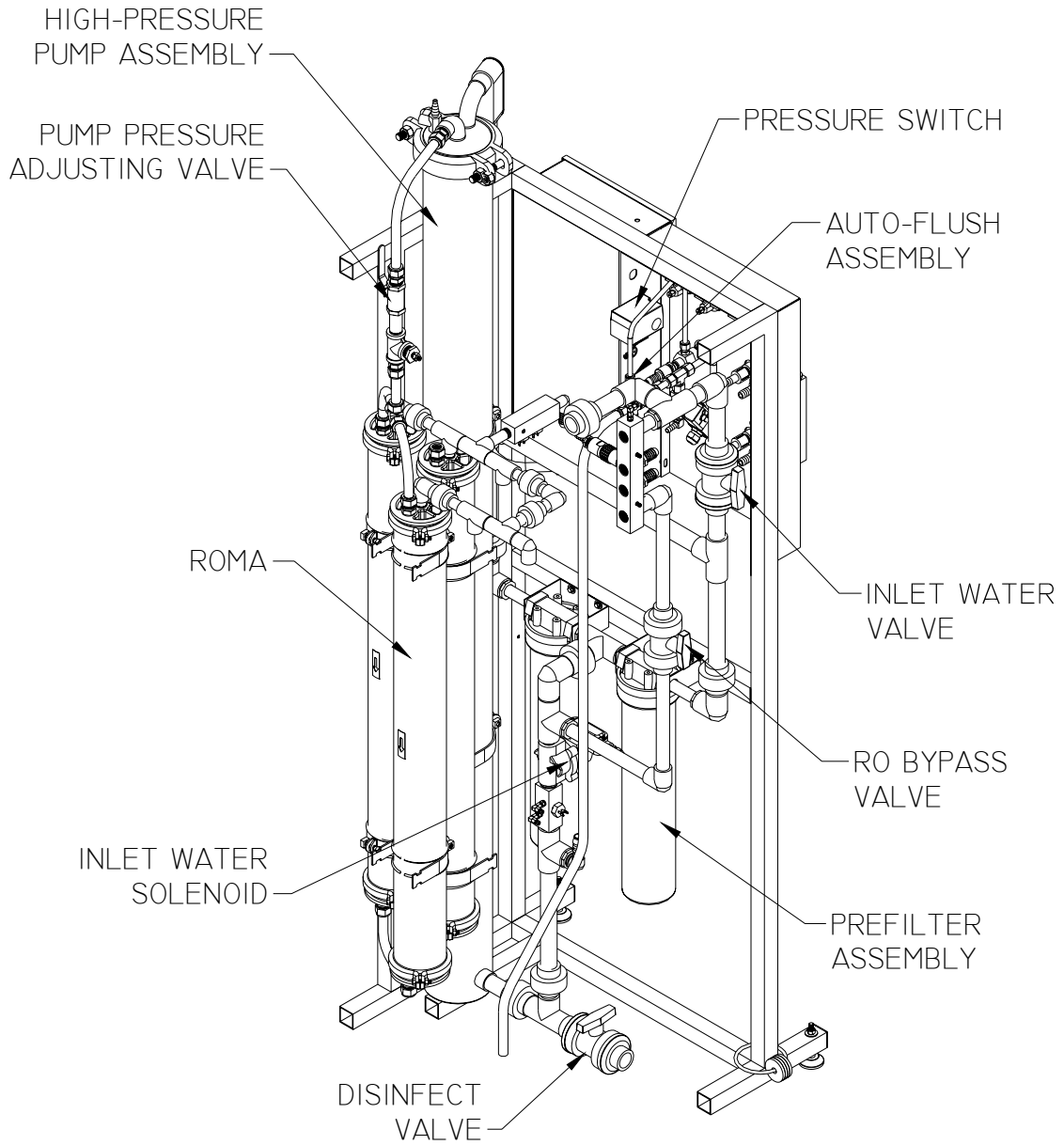
# **Z Series RO System**

## **CHAPTER SIX: DRAWINGS**

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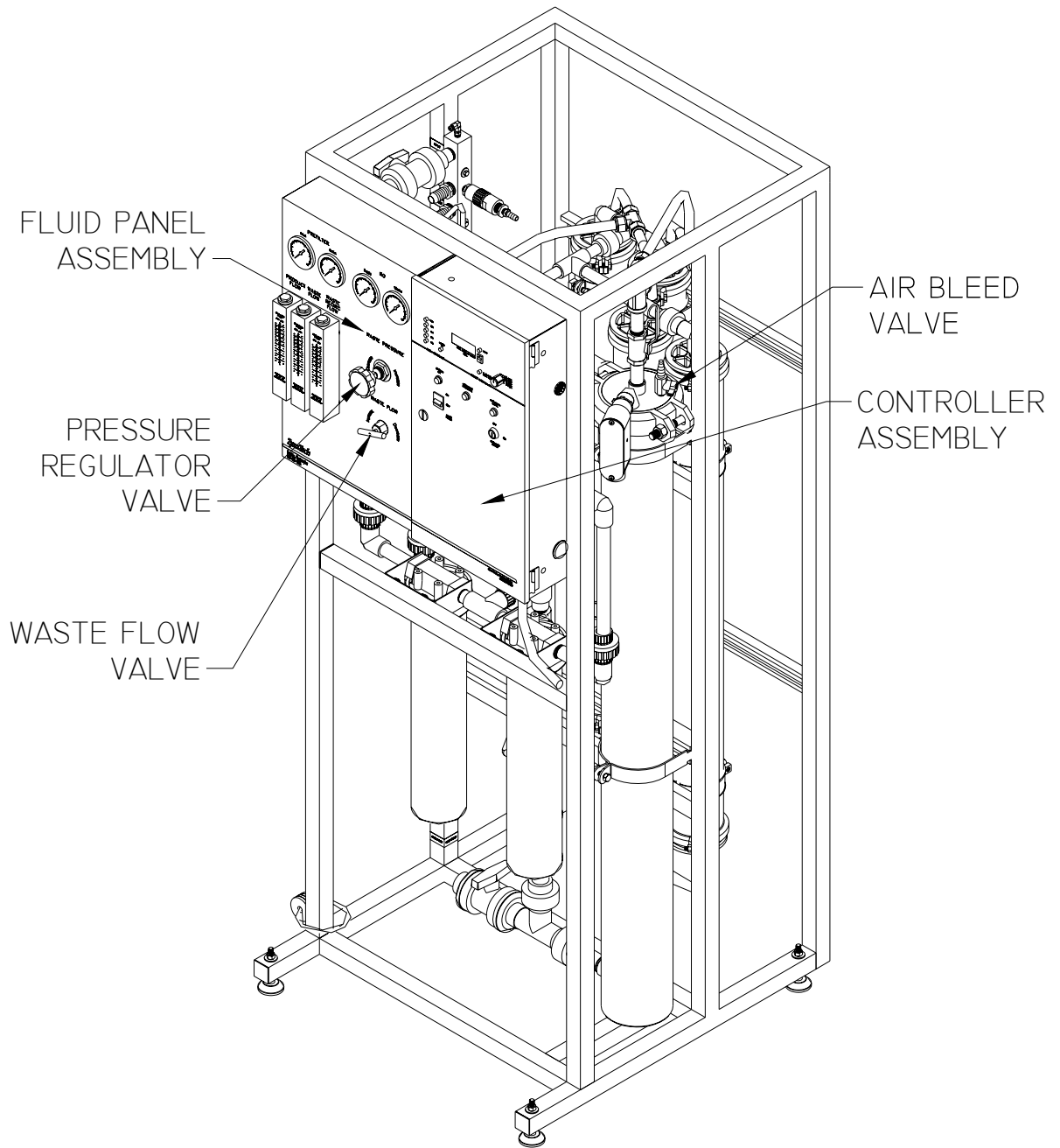
**Z Series RO (Indirect Feed)**  
(Component Layout)



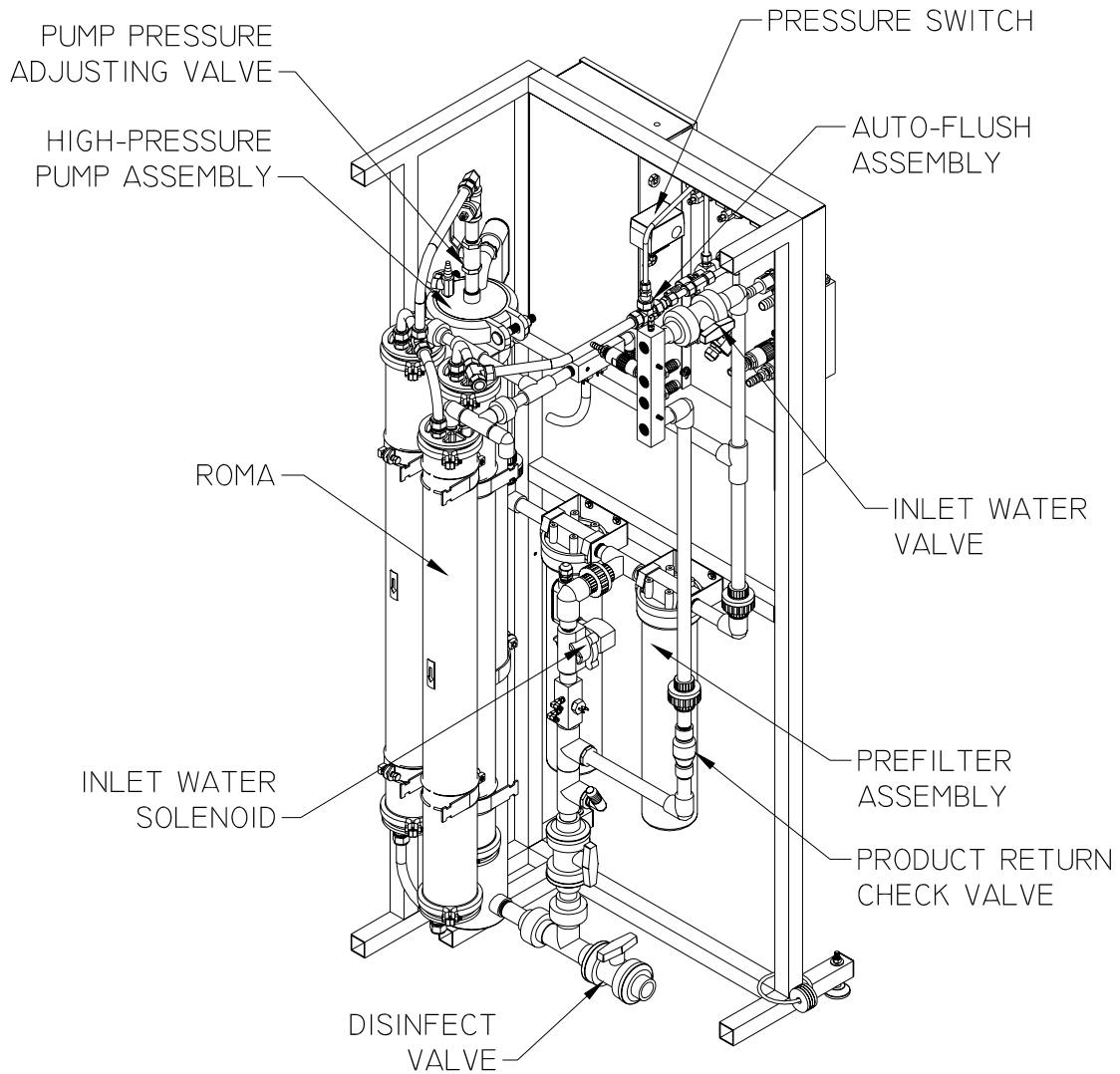
Note:  
Part of the frame has been removed to expose components.

**Z Series RO (Indirect Feed)**  
(Component Layout)



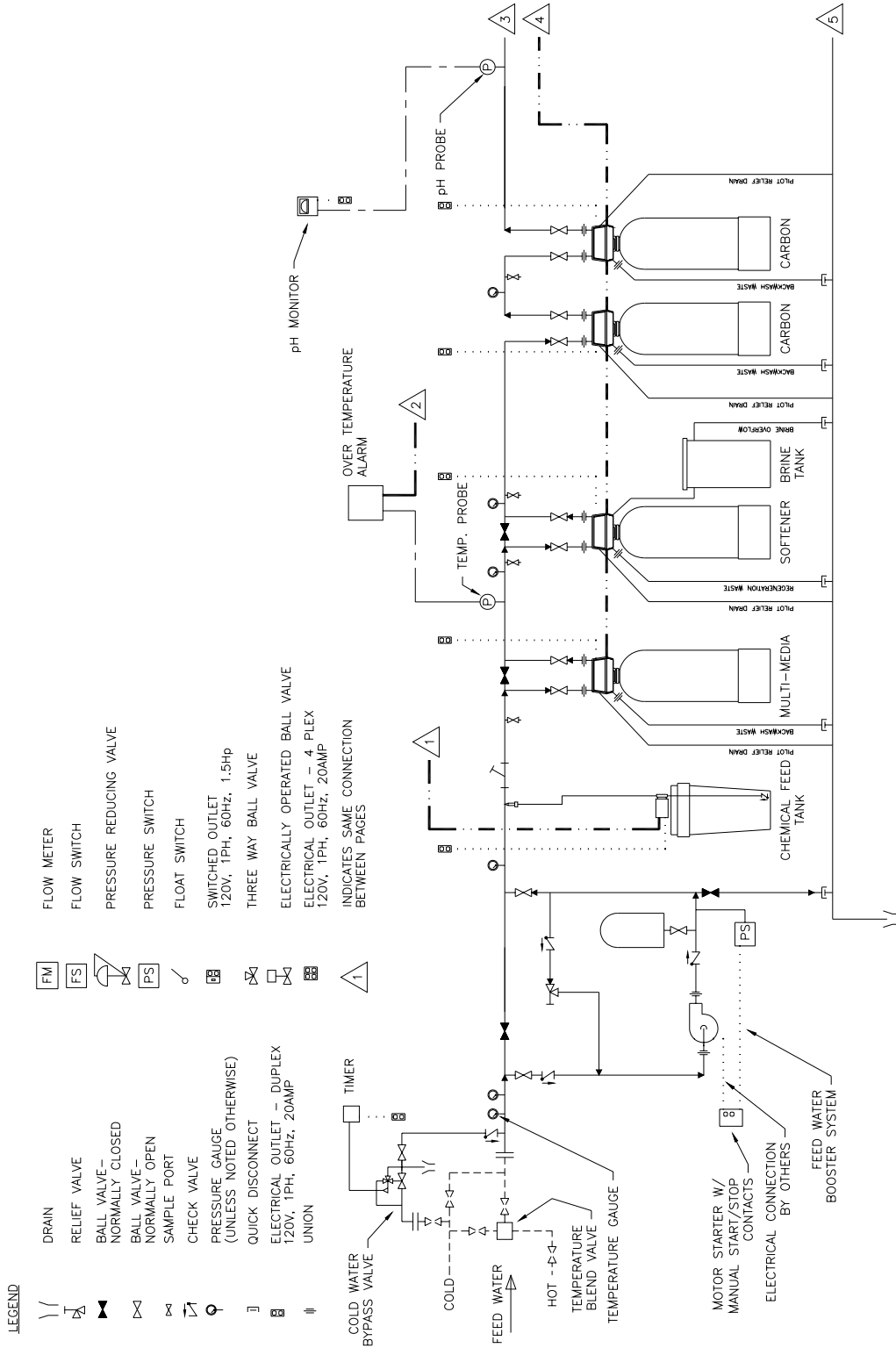


**Z Series RO (Direct Feed)**  
(Component Layout)

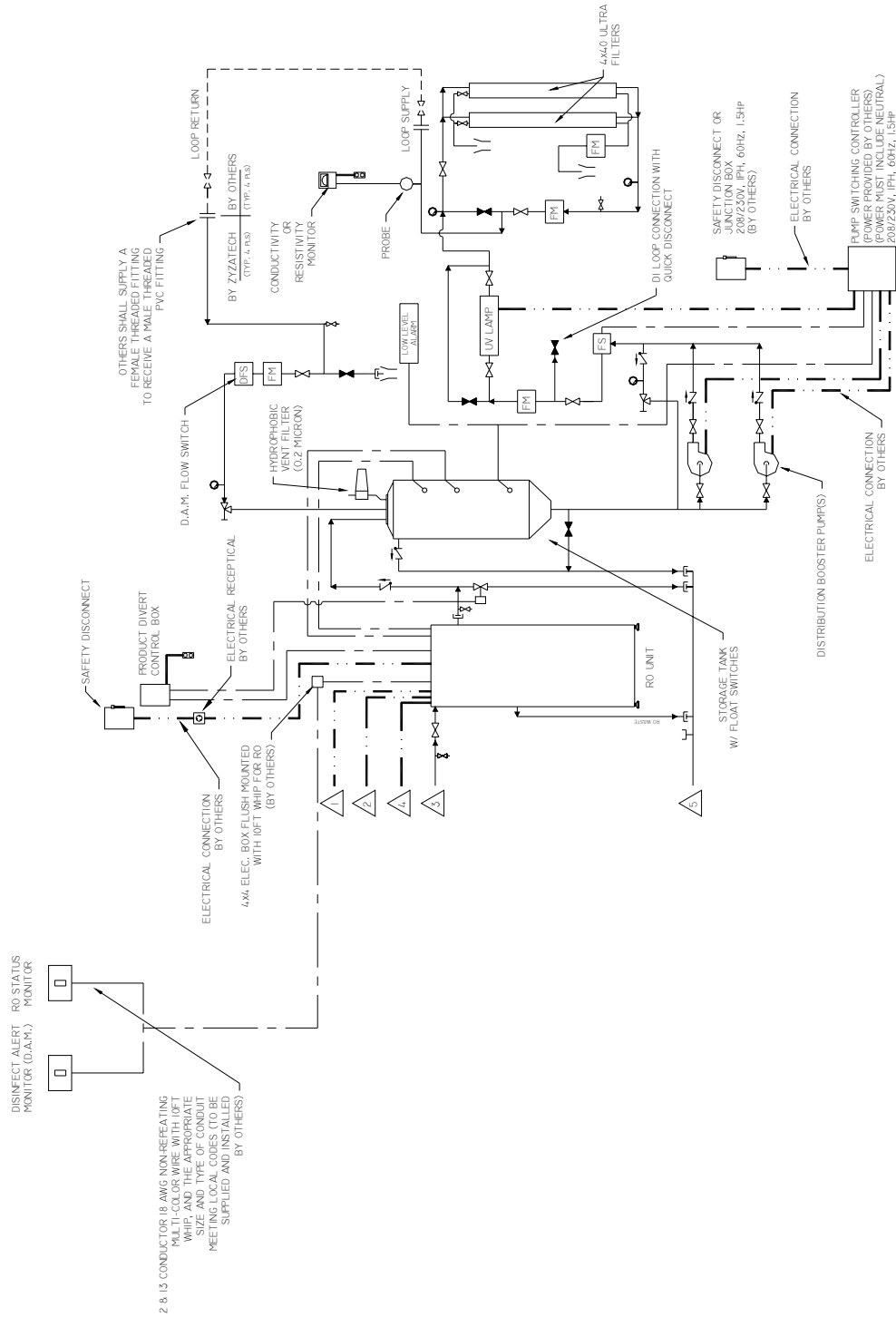


Note:  
Part of the frame has been removed to expose components.

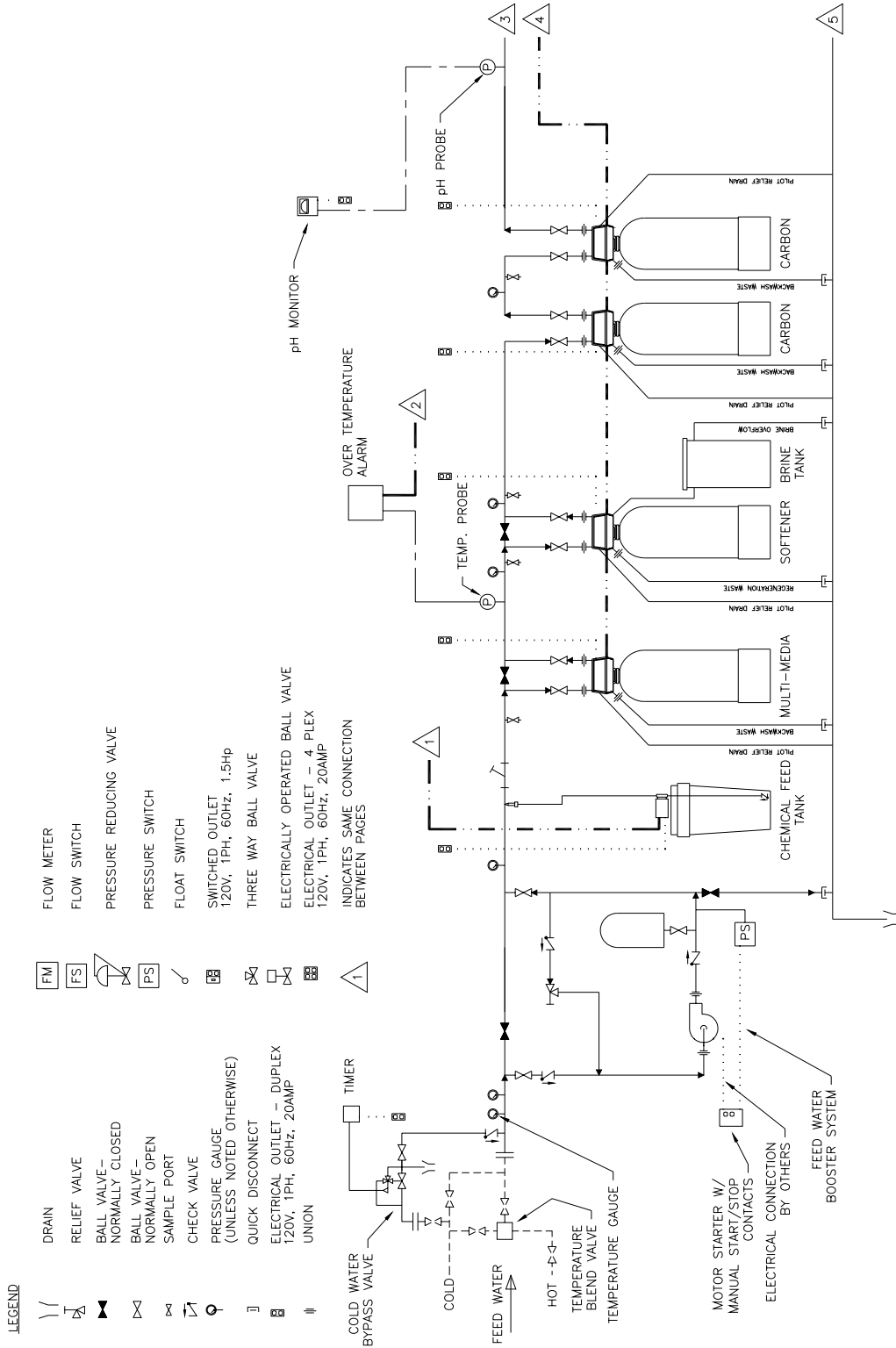
**Z Series RO (Direct Feed)**  
(Component Layout)



**Z Series RO**  
(Typical Indirect System Pretreat Diagram)

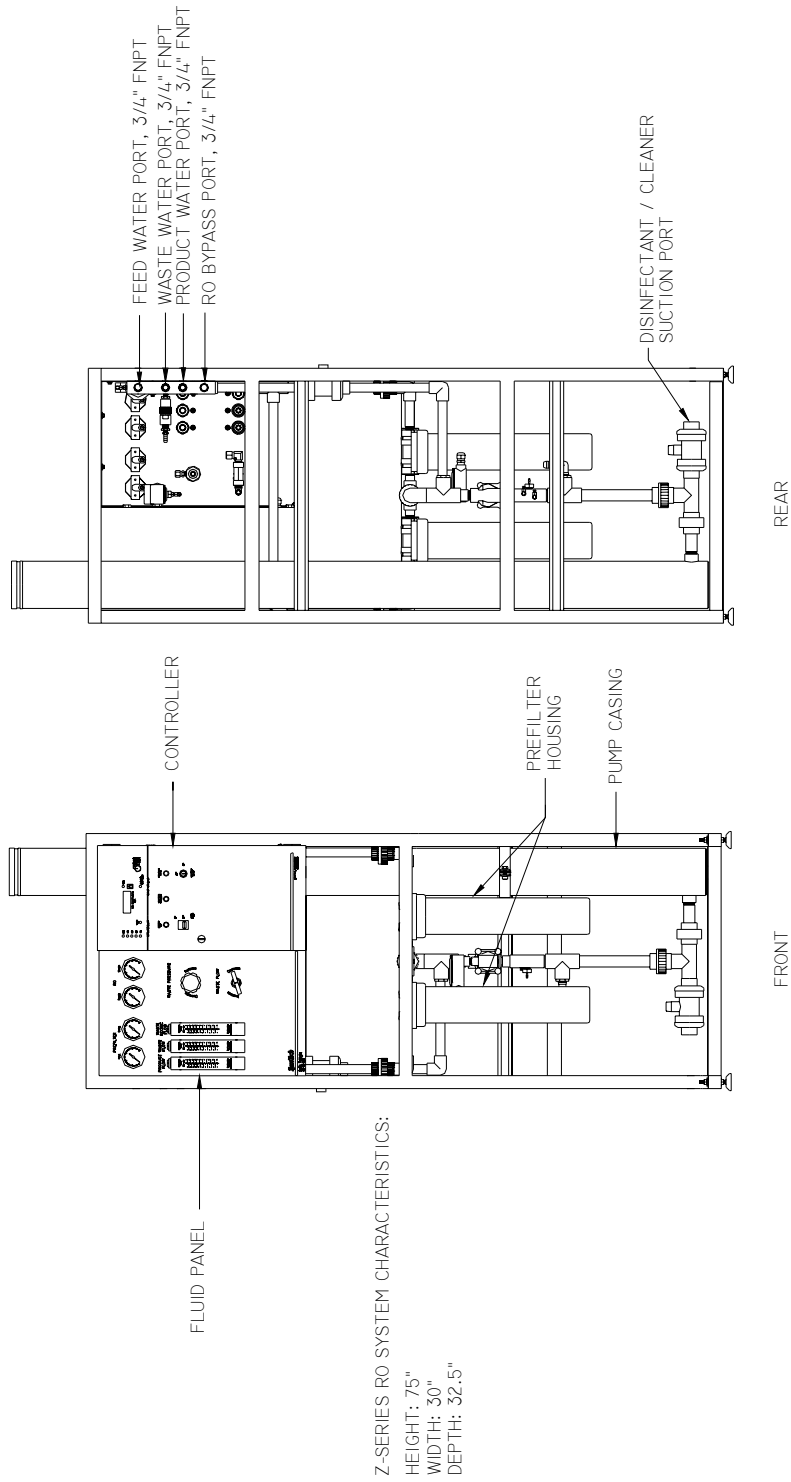


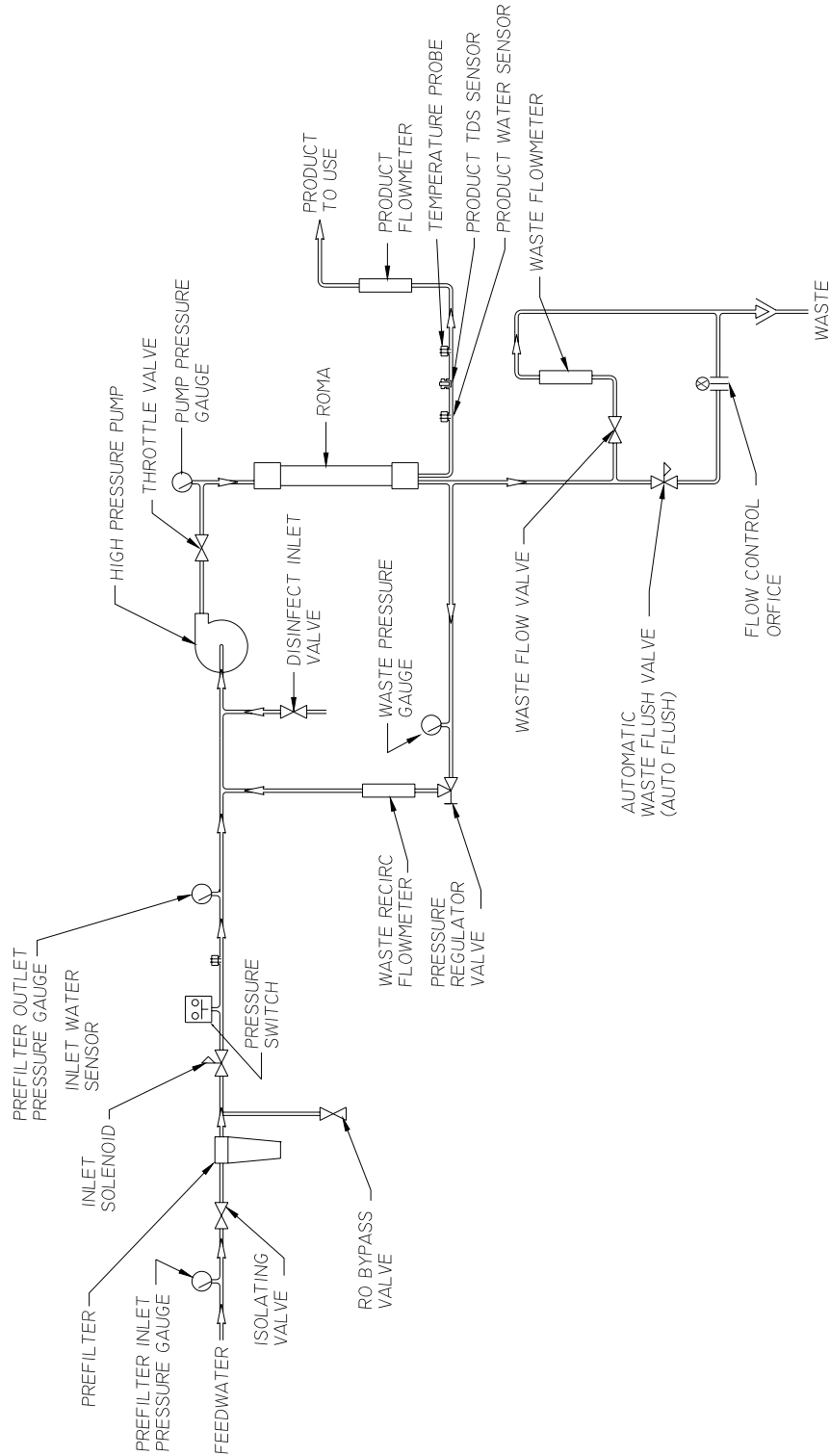
**Z Series RO**  
(Typical Indirect System RO & Loop Diagram)



**Z Series RO**  
(Typical Direct System Pretreat Diagram)

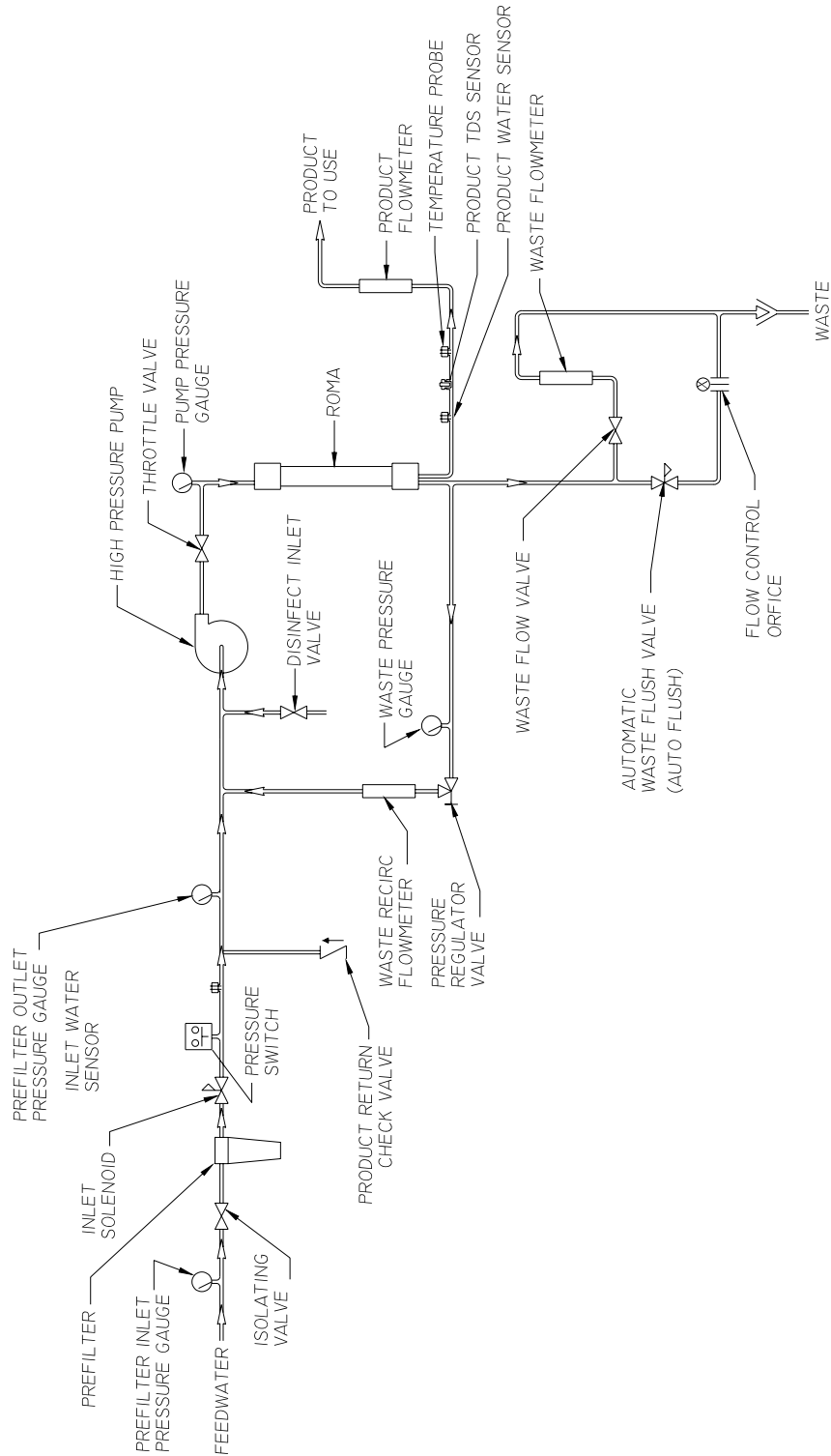






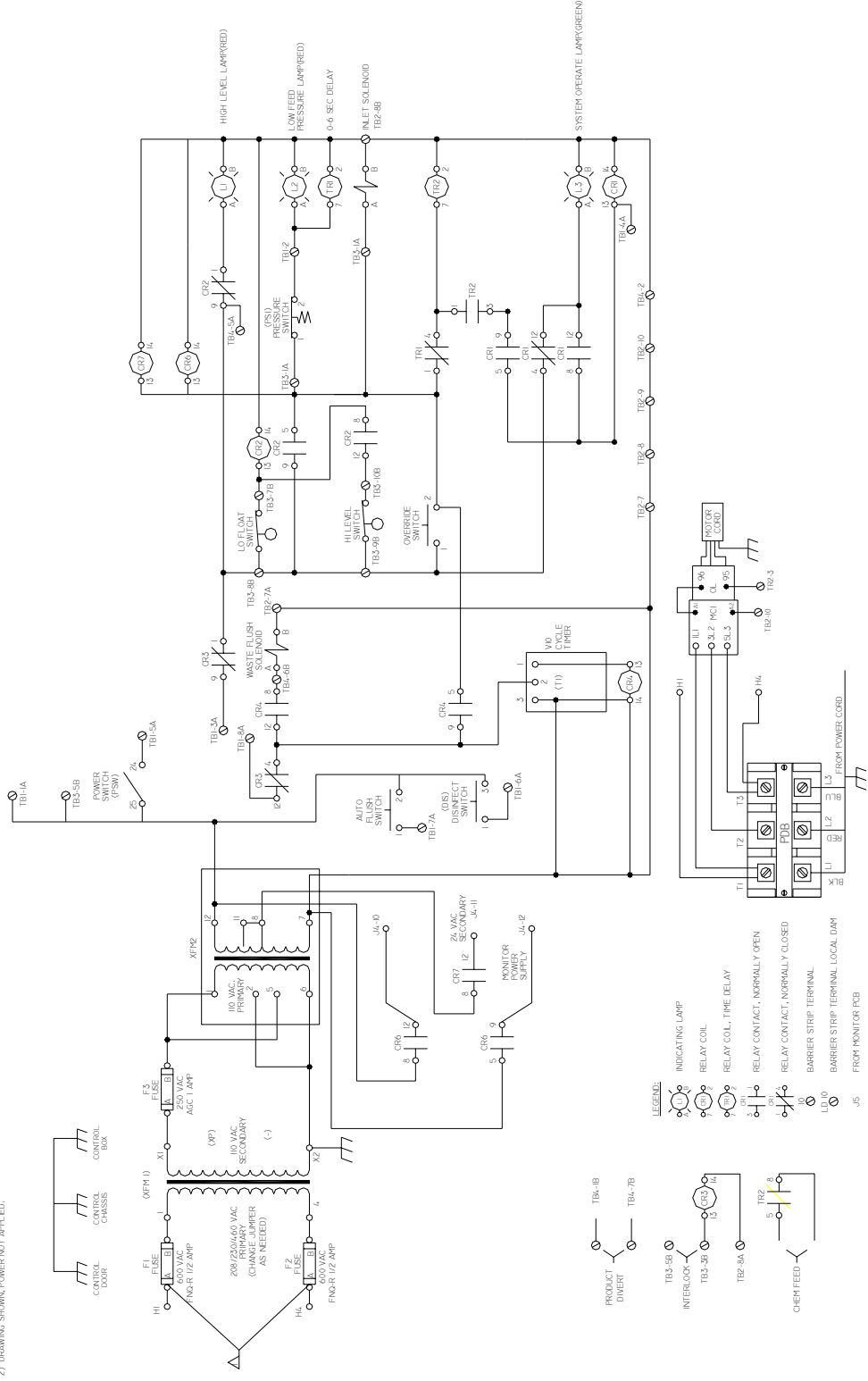
**Z Series RO (Indirect Feed)**  
(Flow Diagram)



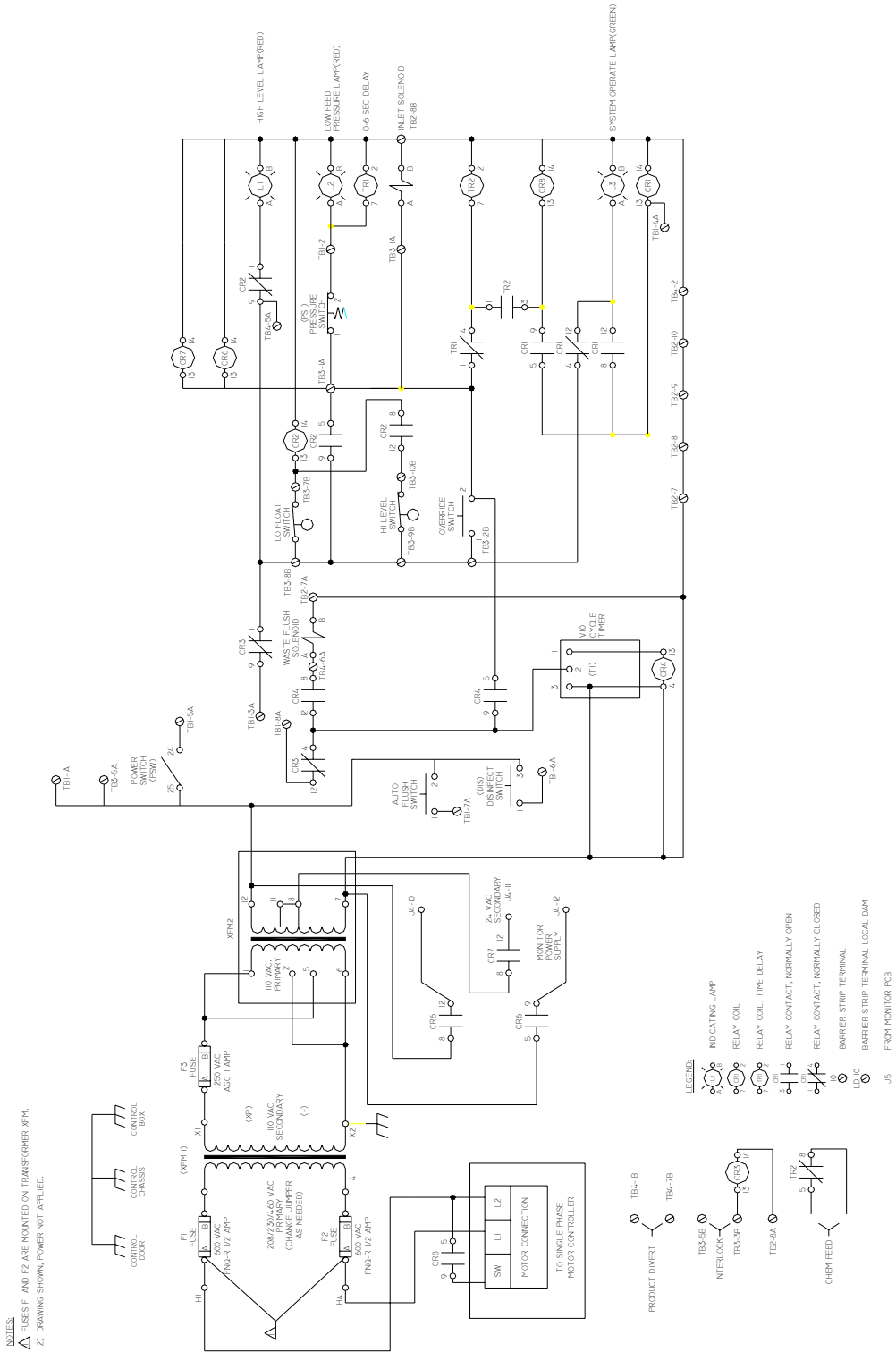


**Z Series RO (Direct Feed)**  
(Flow Diagram)

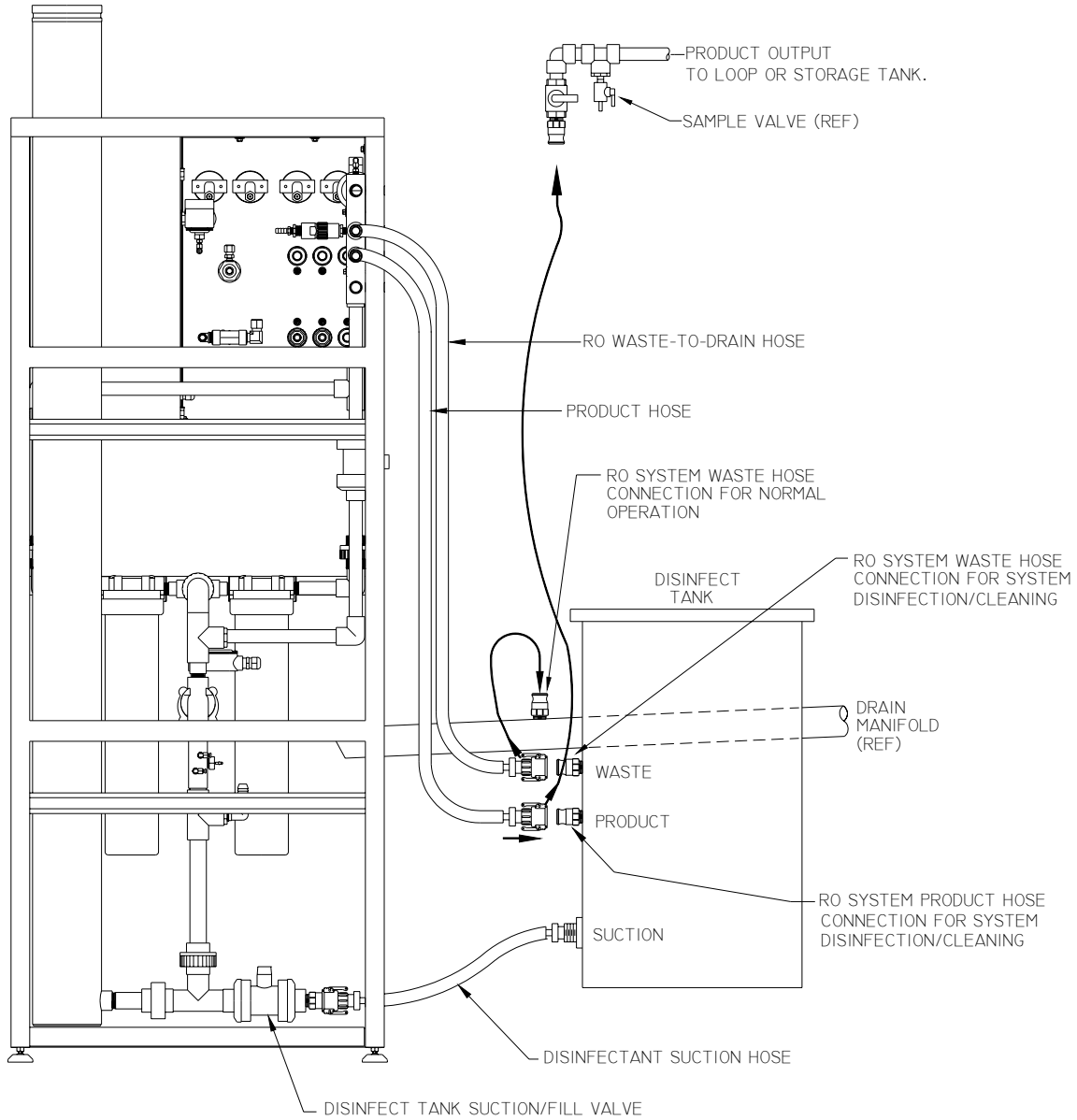
NOTES:  
 ▲ FUSES F1 AND F2 ARE MOUNTED ON TRANSFORMER XFM.  
 Z) DRAWING SHOWN, POWER NOT APPLIED.



**Z Series RO**  
 (3 Phase Electrical Schematic)

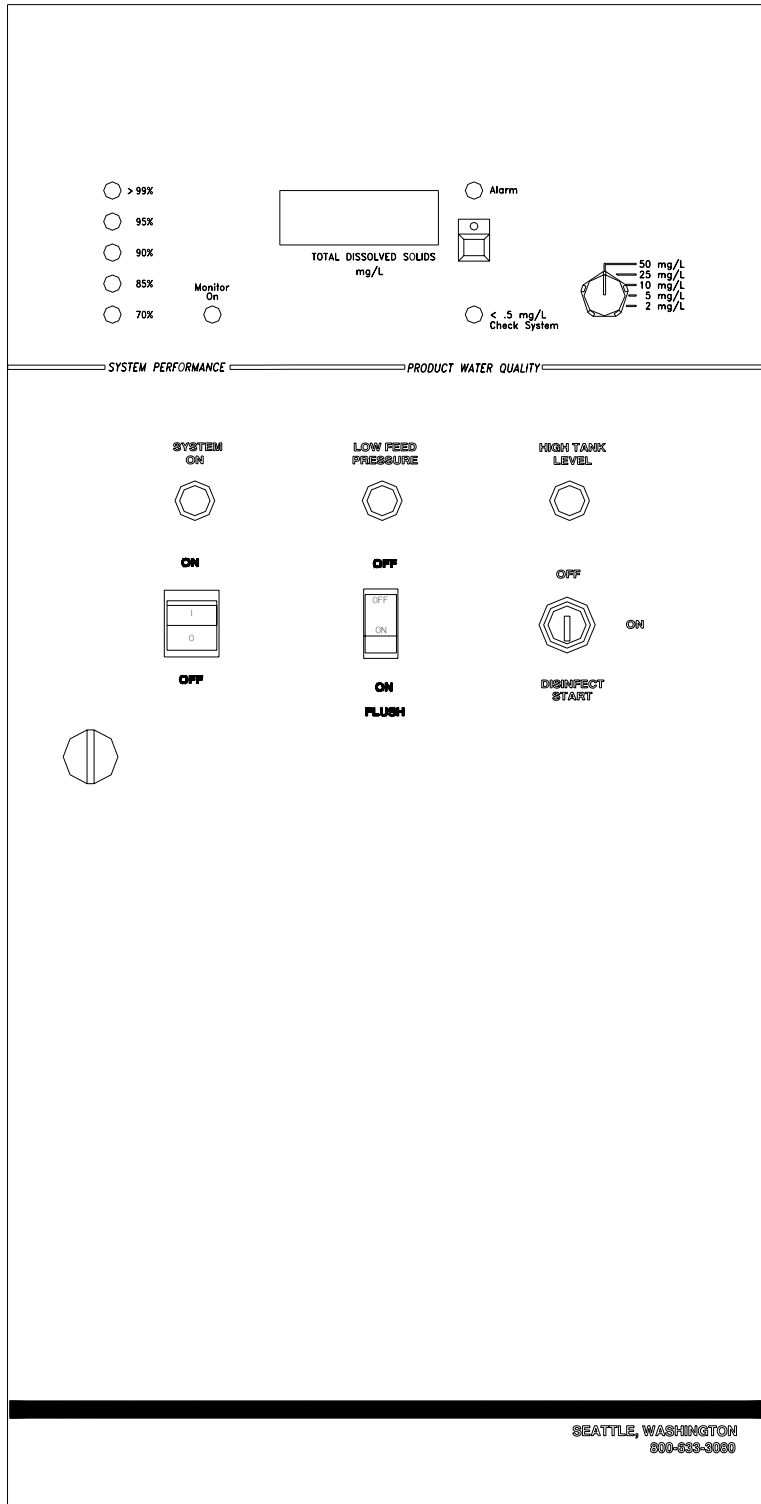


**Z Series RO**  
 (1 Phase Electrical Schematic)

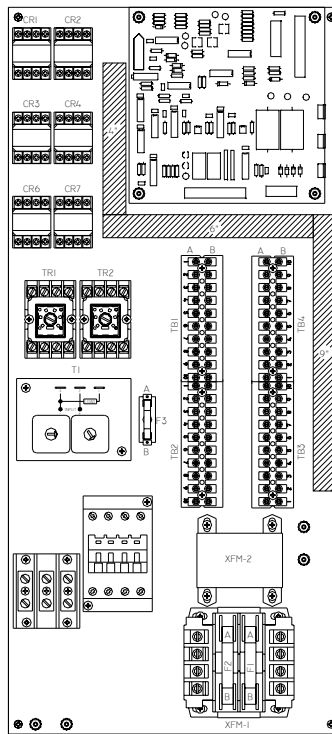


Z-SERIES RO SYSTEM  
(BACK VIEW)

**Z Series RO**  
(Typical Whisperflow Pump Connections for Disinfection)

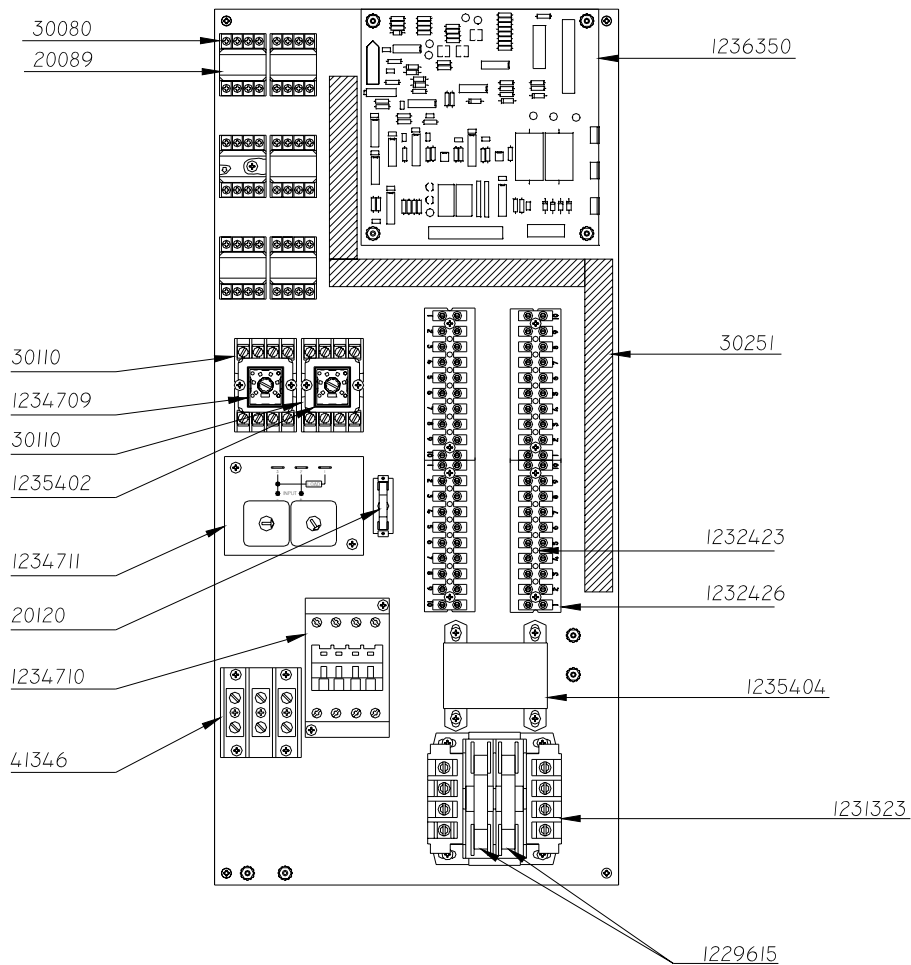


**Z Series RO**  
(Typical Controller)



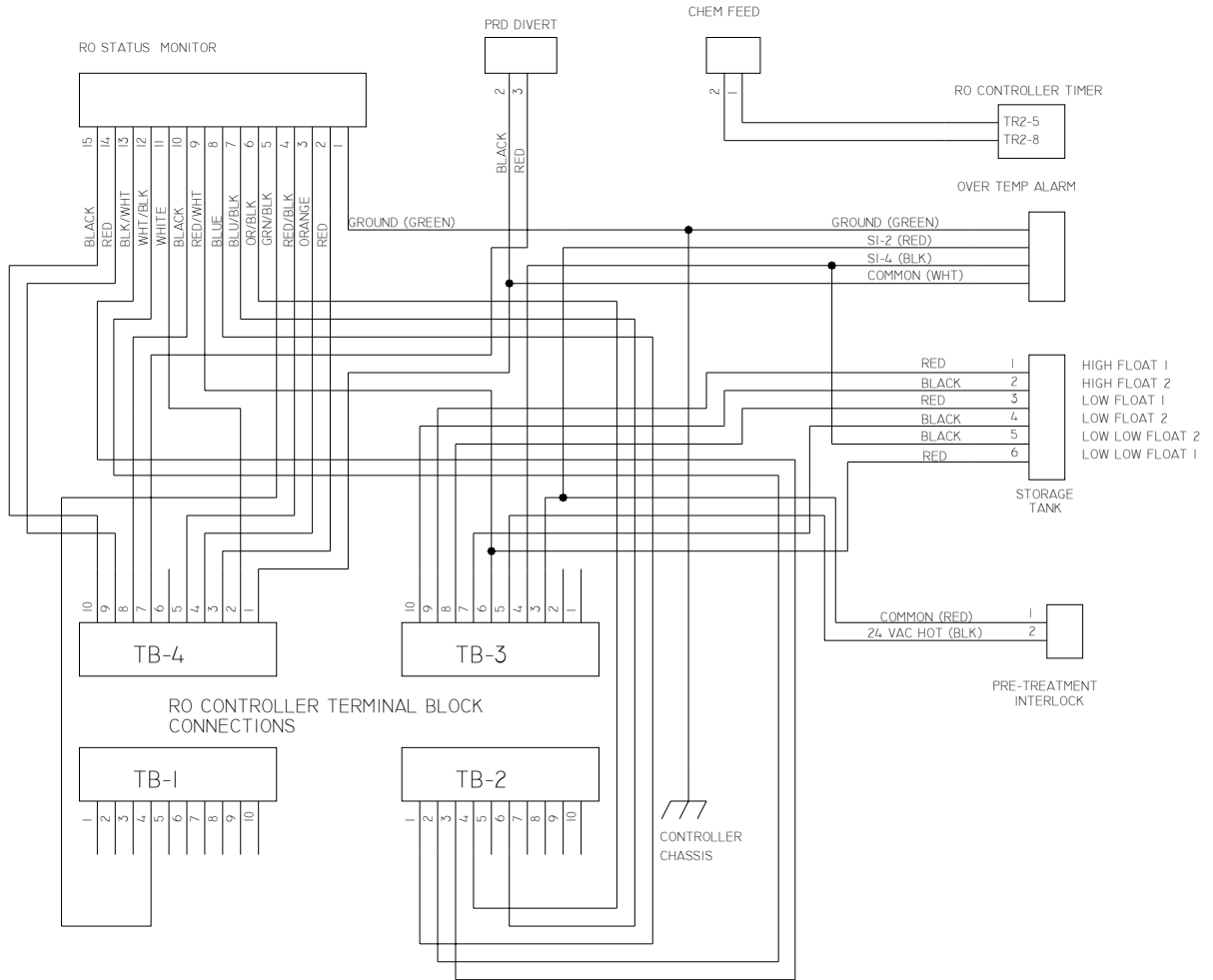
- CR1 - CONTROLLED BY DISINFECT KEY SWITCH  
CONTROLS MOTOR CONTACTOR COIL  
CONTROLS SYSTEM OPERATE LAMP  
CONTROLS CR3
- CR2 - CONTROLLED BY FLOAT SWITCH  
CONTROLS STORAGE TANK HIGH LEVEL LAMP
- CR3 - CONTROLLED BY CR1  
PROVIDES INTERLOCK FOR CONTROL OF ACCESSORIES BY RO
- CR4 - CONTROLLED BY CYCLE TIMER  
CONTROLS AUTOFLUSH SOLENOID
- CR6 - CONTROLLED BY TDS ALARM  
CONTROLS OTS MONITOR, TDS DISPLAY.
- CR7 - CONTROLLED BY TDS ALARM  
CONTROLS PRODUCT DIVERT
- T1 - CONTROLLED BY POWER SWITCH  
CONTROLS CR4
- TR1 - CONTROLLED BY PRESSURE SWITCH  
DISENGAGES MOTOR CONTACTOR IF INLET WATER PRESSURE  
FAILS TO EXCEED MINIMUM WITHIN 6 SECONDS
- TR2 - CONTROLLED BY TR1  
DELAYS MOTOR CONTACTOR FOR UP TO 1 MINUTE AFTER  
ALL INTERLOCKS HAVE BEEN SATISFIED

**Z Series RO**  
**(Relay Operation Detail)**



PART NO	DESCRIPTION
20089	RELAY,24V,DPDT
20120	FUSE,1AMP
30080	SOCKET RELAY,8 PIN,SMALL
30110	SOCKET,RELAY,8 PIN,OCTAL
30251	WIRE GUTTER,1"XI-1/2"
41346	TERMINAL BLOCK,3 POLE,50A
1229615	FUSE,0.5AMP
1231323	TRANS,100VA,240-460V,W/FUSE BLK,50/60HZ
1232423	TERMINAL STRIP,10 TRM,3A,300V,TS2.5/10WP
1232426	TERMINAL STRIP,MARKER PLATE,1-12
1234709	TIMER,24V,0-6 SEC
1234710	CONTACTOR,24V,MTR START,A26-10-81
1234711	TIMER,AUTO FLUSH RECYCLE
1235402	TIMER,24V,0-60 SEC
1235404	TRANSFORMER,24V,A43-80-10
1236350	PCB ASY,RO STATUS/CONDUCTIVITY

**Z Series RO**  
(Control Box Chassis Major Component Locations)



**NOTE:**

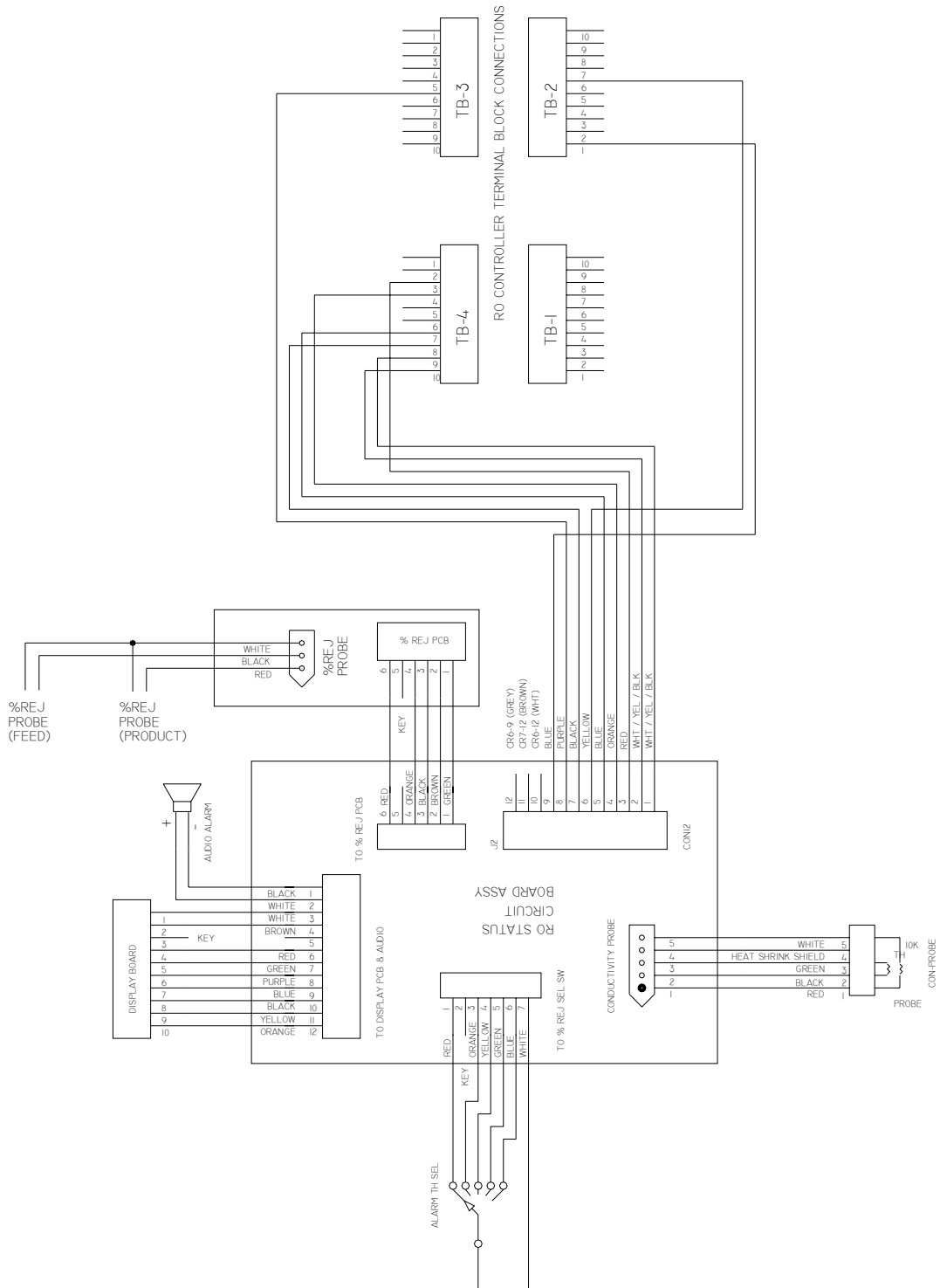
Operation of this unit without level switches (i.e. Direct Feed) requires a jumper to be installed (typically installed at factory) between the float switch connection terminals TB3-7B and TB3-8B.

**NOTE:**

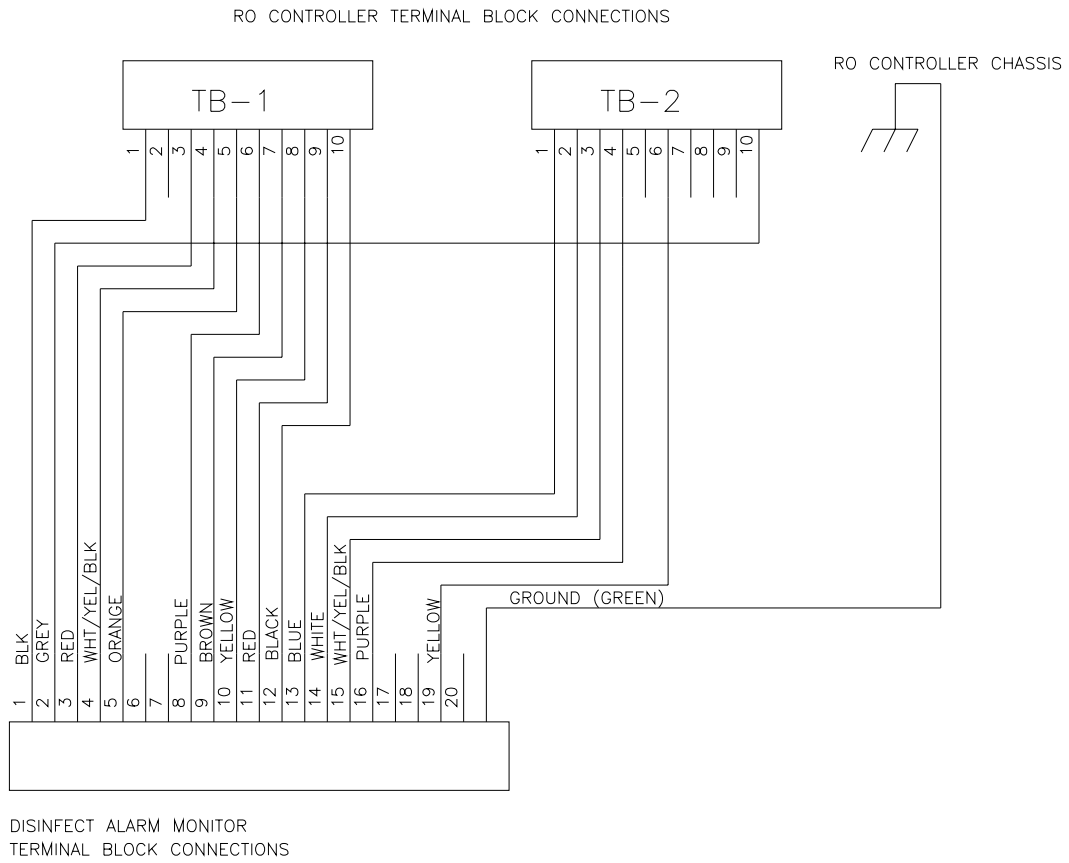
Connect the color-coded cable conductors inside the RO Controller to their associated terminal barrier strip locations.

**Z Series RO**  
(External RO Controller Wiring Connections)

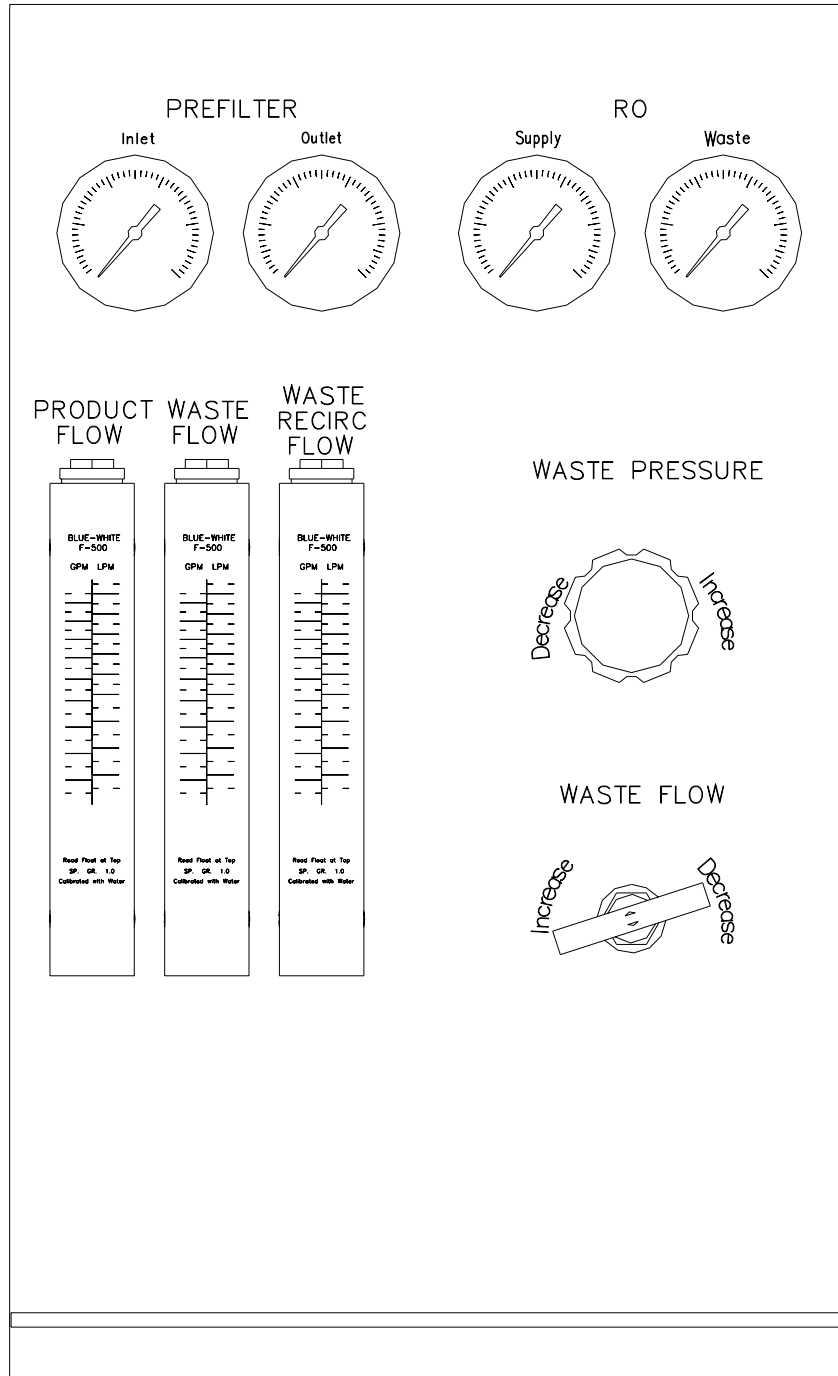




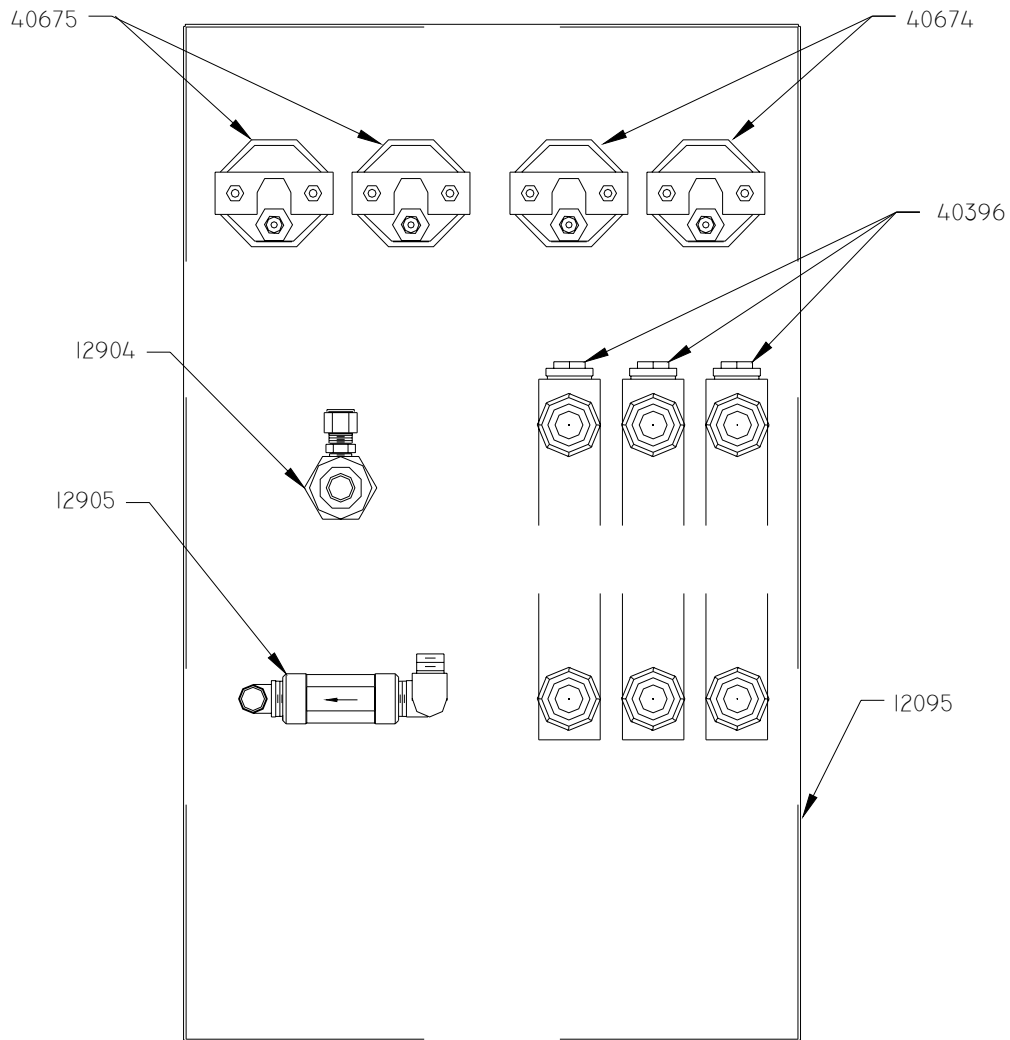
**Z Series RO**  
(Internal RO Controller Wiring Connections)



**Z Series RO**  
(Disinfect Alarm Monitor Wiring Connections)



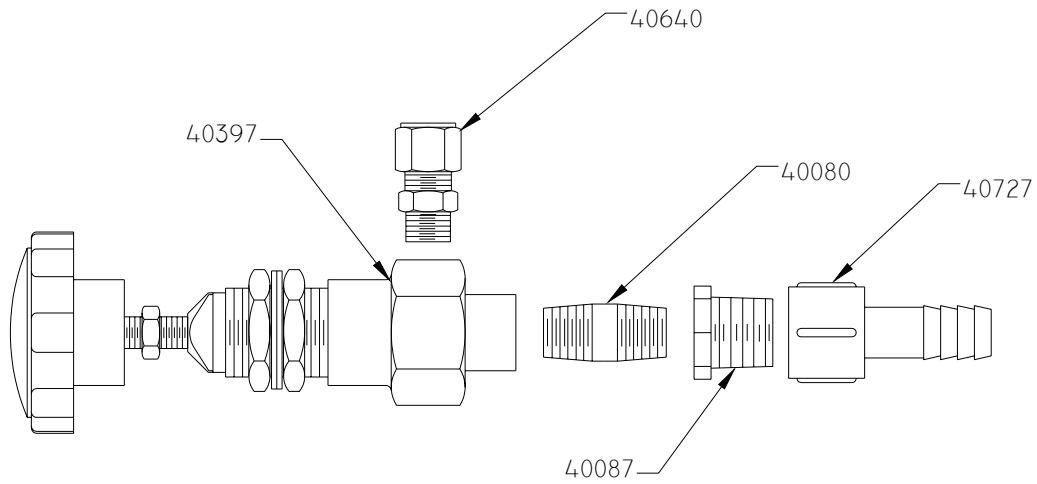
**Z Series RO**  
(Fluid Panel)



\* REFER TO ASSEMBLY DRAWING IN THIS MANUAL

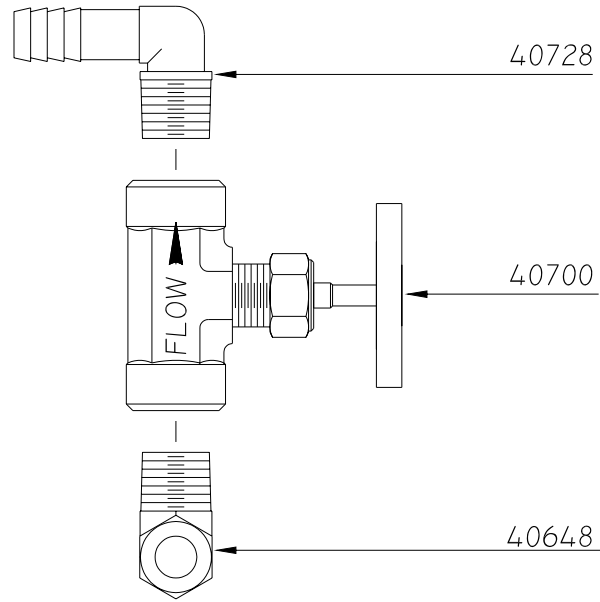
PART NO	DESCRIPTION
12095	FLUID PANEL
12904	PRESSURE REGULATOR ASSEMBLY
12905	FLOW CONTROL VALVE ASSEMBLY
40396	FLOWMETER, 2-10 GPM
40674	PRESSURE GAUGE, 0-100 PSI
40675	PRESSURE GAUGE, 0-600 PSI
40707	1/8" TUBE x 1/4" FNPT FITTING
60082	SCREW, 8-32 X 3/8

**Z Series RO**  
(Fluid Panel Assembly, Rear View)



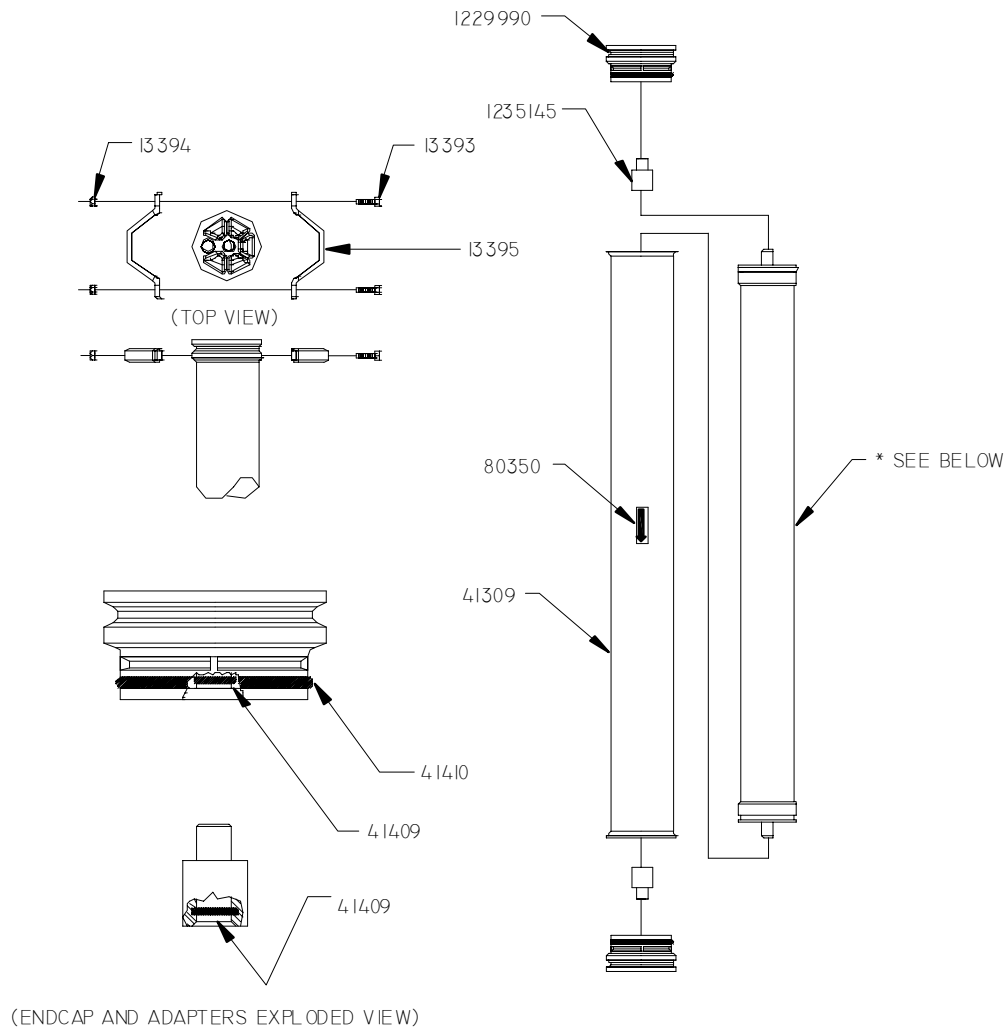
PART NO	DESCRIPTION
40080	3/8" X SHORT NIPPLE
40087	1/2" X 3/8" REDUCING BUSHING
40397	PRESSURE REGULATOR
40640	3/8" TUBE X 1/4" NPT FITTING
40727	1/2" HOSE BARB FITTING

**Z Series RO**  
(Pressure Regulator Assembly)



PART NO	DESCRIPTION
40648	1/2" TUBE x 1/2" NPT FITTING
40700	NEEDLE VALVE
40728	1/2" HOSE BARB FITTING

**Z Series RO**  
(Waste Flow Control Valve Assembly)

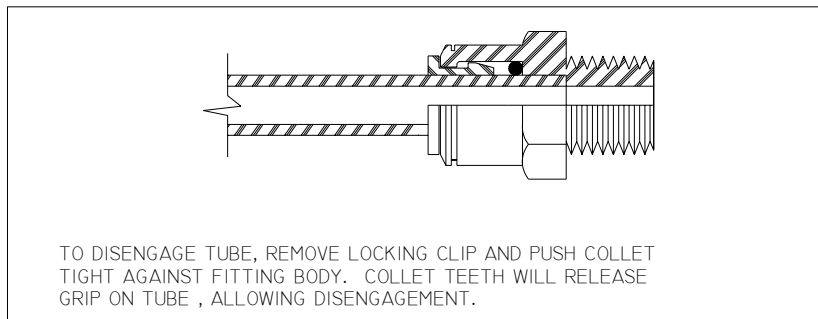
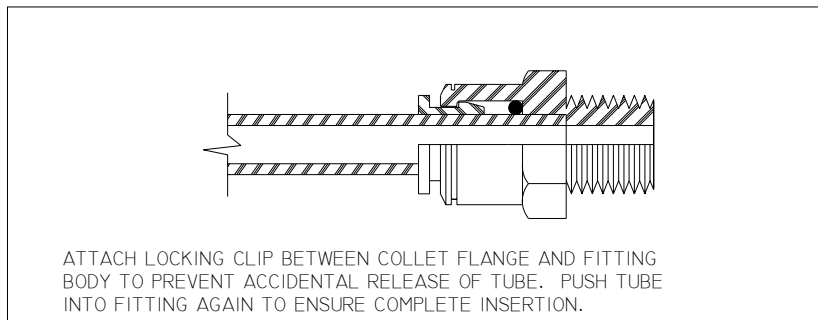
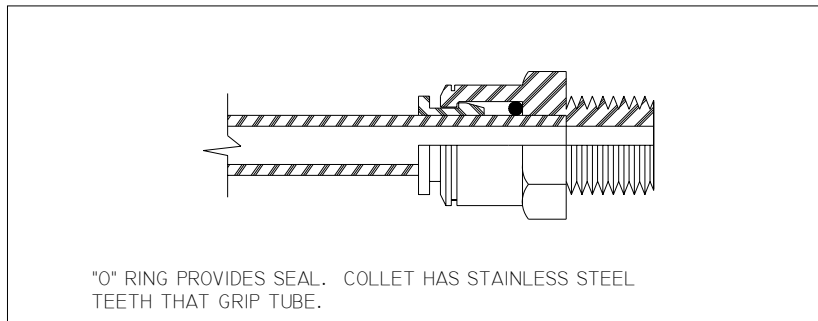
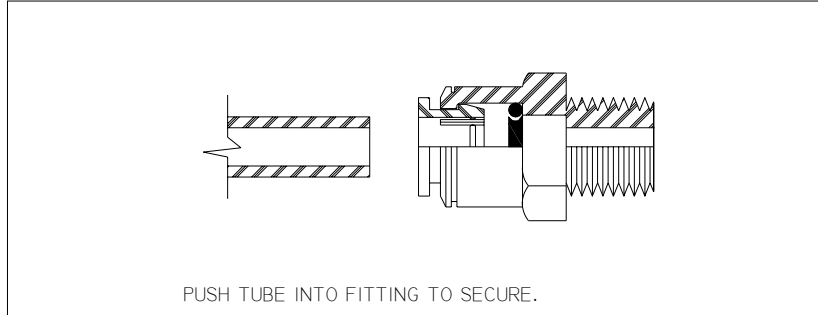


PART NO.	DESCRIPTION
1235145	MEMBRANE ADAPTER
13393	SCREW, 5/16-18 X 1-1/4"
13394	NYLOK NUT
13395	CLAMP, HALF
41309	HOUSING, SS, FLAIRED END
41408	1/2" FLUG
41409	O-RING, INTERNAL
41410	O-RING EXTERNAL
41413	HOUSING ENDCAP
42055	MEMBRANE, 4" X 40", FILMTEC
1230048	MEMBRANE, 4" X 40", FTS
80350	FLOW ARROW LABEL
1229990	END CAP 4" X 40", FLAIRED HSNQ

**Z Series RO**  
(Reverse Osmosis Membrane Assembly (ROMA) Components)

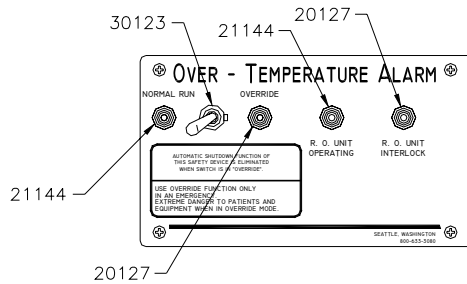
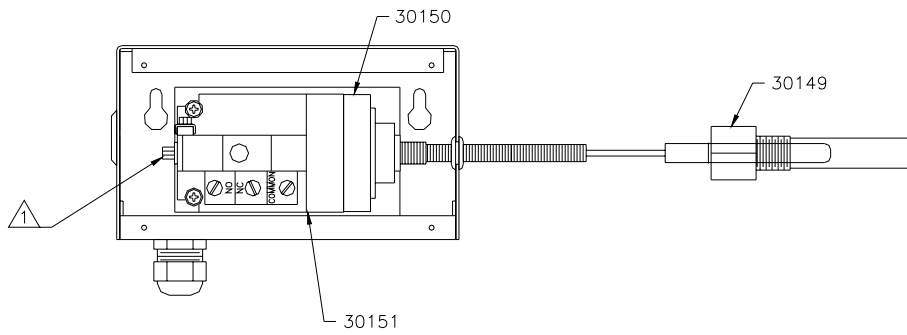
"PUSH-IN" FITTINGS

NOTE: FITTING IS NOT DESIGNED TO BE DISASSEMBLED. IF THE FITTING LEAKS, CHECK FOR IMPROPER TUBE INSERTION OR TUBE ROUTING THAT MAY CONTRIBUTE TO LEAKAGE. INTERNAL COMPONENT REPLACEMENTS ARE NOT AVAILABLE.



**"Push-In" Fitting Instructions**



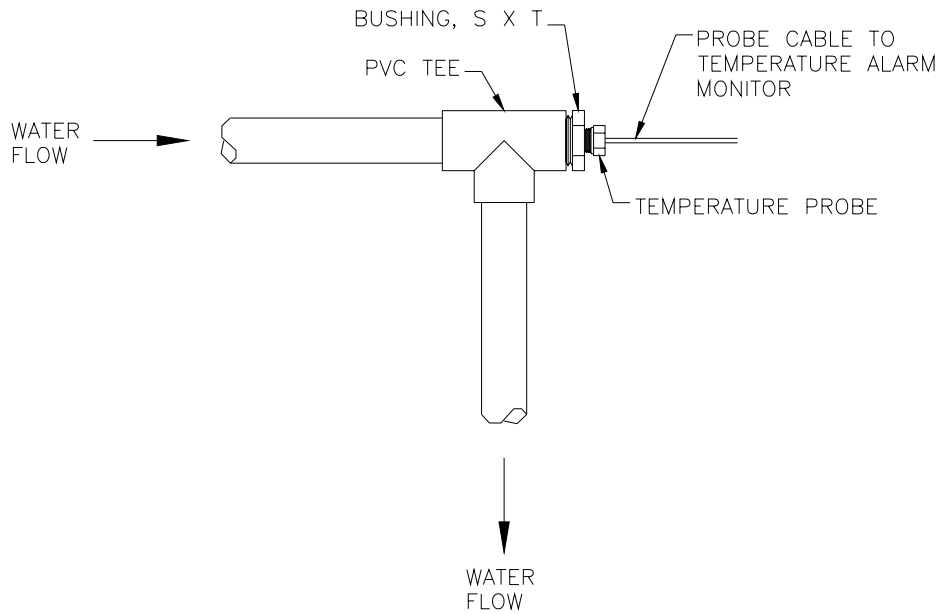


20127	INDICATOR, 1/2", 24V, RED
21144	INDICATOR, 1/2", 24V, GREEN
30123	SW, TOGGLE, DPDT
30149	THERMOWELL, SS, FOR OTA
30150	TRANSDUCER, TEMP, 6FT
30151	SW, TEMP, FOR OTA
PART #	DESCRIPTION

NOTES:

⚠ TEMPERATURE SWITCH ADJUSTING NUT IS ACCESSED BY REMOVING PLUG ON END OF BOX.

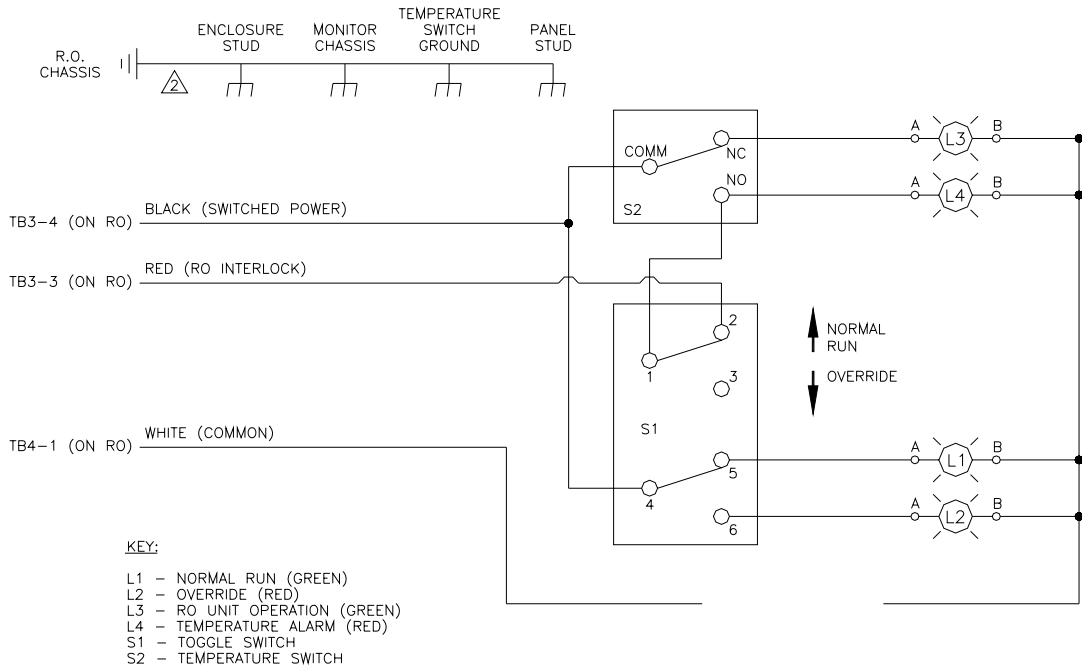
**Over Temperature Alarm**  
(General Components)




NOTES:

- 1) TEMPERATURE PROBE MUST BE INSTALLED INTO THE RUN OF A TEE AFTER THE TEMPERATURE BLEND VALVE AND COLD WATER BY-PASS AND BEFORE THE RO UNIT OR NEXT PIECE OF EQUIPMENT AFTER 1ST PRETREATMENT DEVICE.
- 2) MINIMUM PIPE SIZE 1" DIAMETER.
- 3) TEMPERATURE MONITOR TO BE INSTALLED WITHIN 5 FEET OF THE TEMPERATURE PROBE AND 10 FEET OF THE RO UNIT.
- 4) INSTALL THERMAL WELL WITH TEFLON TAPE.
- 5) INSTALL TEMPERATURE PROBE HAND TIGHT ONLY.

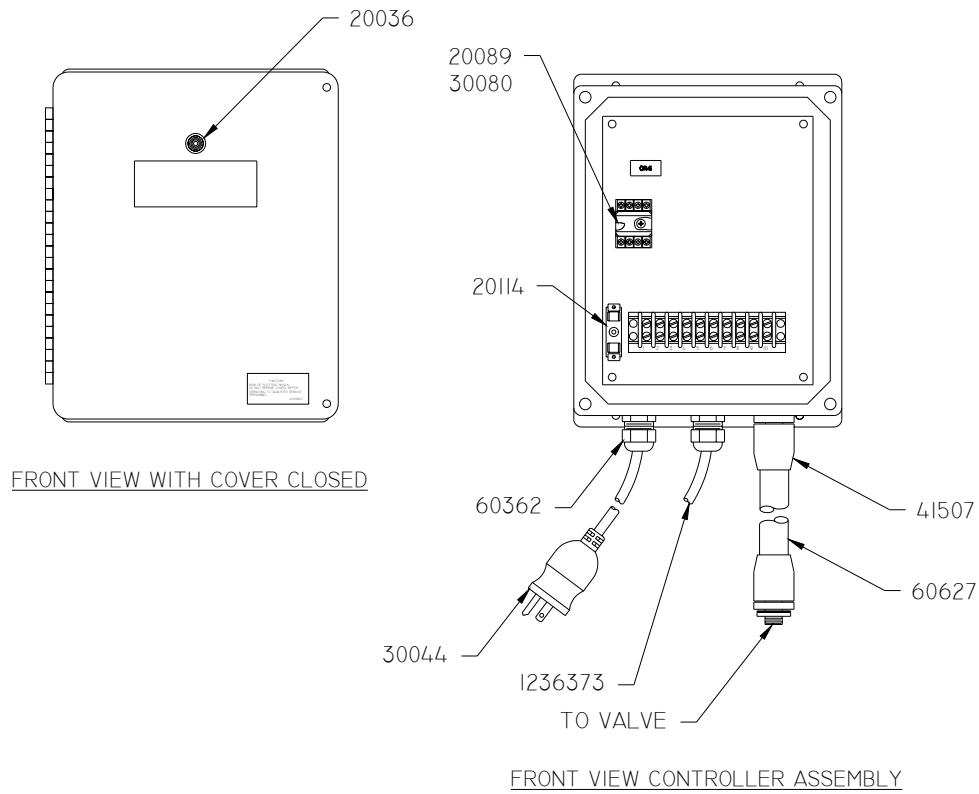
**Over Temperature Probe**  
**(Probe Installation)**



NOTES:

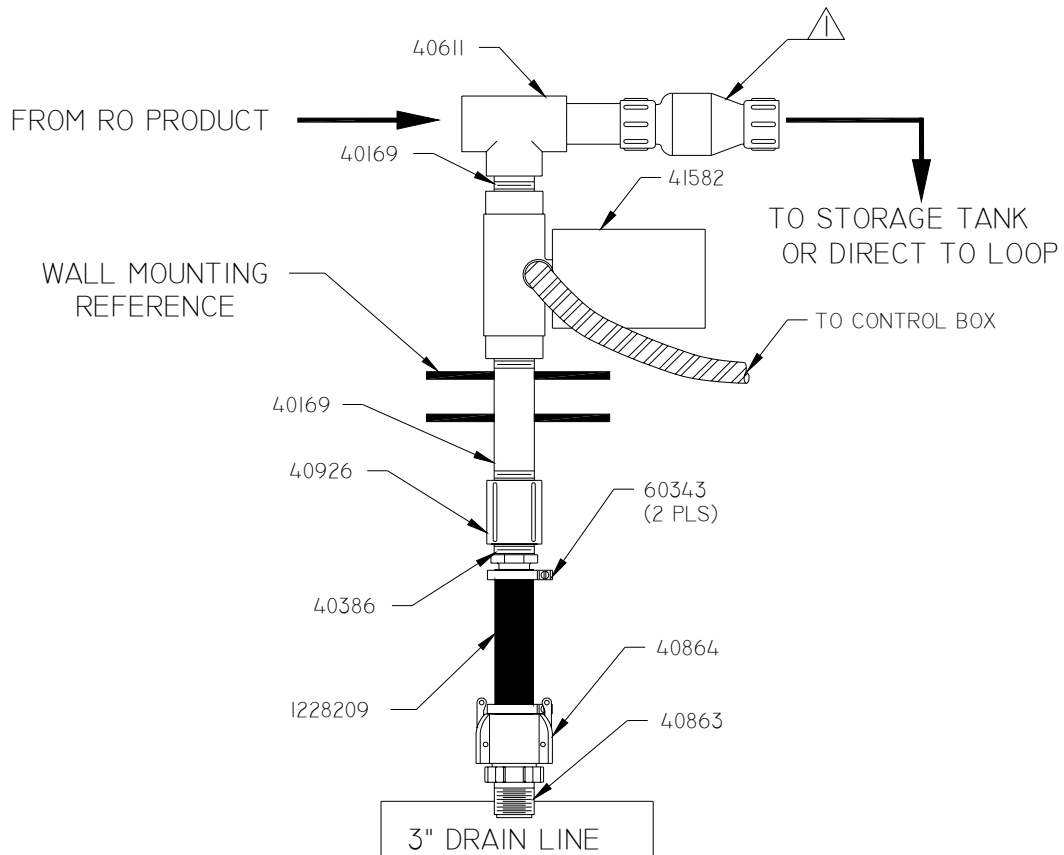
- 1) ————— DENOTES WIRING FOR FIELD INSTALLATION.
- 2)  SECURE END OF 18-4 GROUND WIRE TO ENCLOSURE STUD WITH KEPNUT. ADD GROUNDS ON TOP OF KEPNUT AND SECURE.
- 3) SCHEMATIC SHOWN IN NORMAL OPERATION (TEMPERATURE LESS THEN 90° F).

**Over Temperature Alarm**  
(Electrical Schematic, Reference Only)




60362	STRAIN CLAMP, WATER TIGHT
30080	8 PIN, SMALL
30044	POWER CORD WITH " HOSPITAL " PLUG, 8'
20114	FUSE, 3AMP, SLO-BLO
20089	RELAY, 24V, DPDT
20036	INDICATOR, 1/2". 110V, RED
1236373	CABLE, 2 COND, 18AWG
41507	FTTNG, CONDUIT, 1/2" ST
60627	CONDUIT, CRFLX, UNSHLD, 1/2"
PART NO.	DESCRIPTION

**Product Divert**  
(General Components)

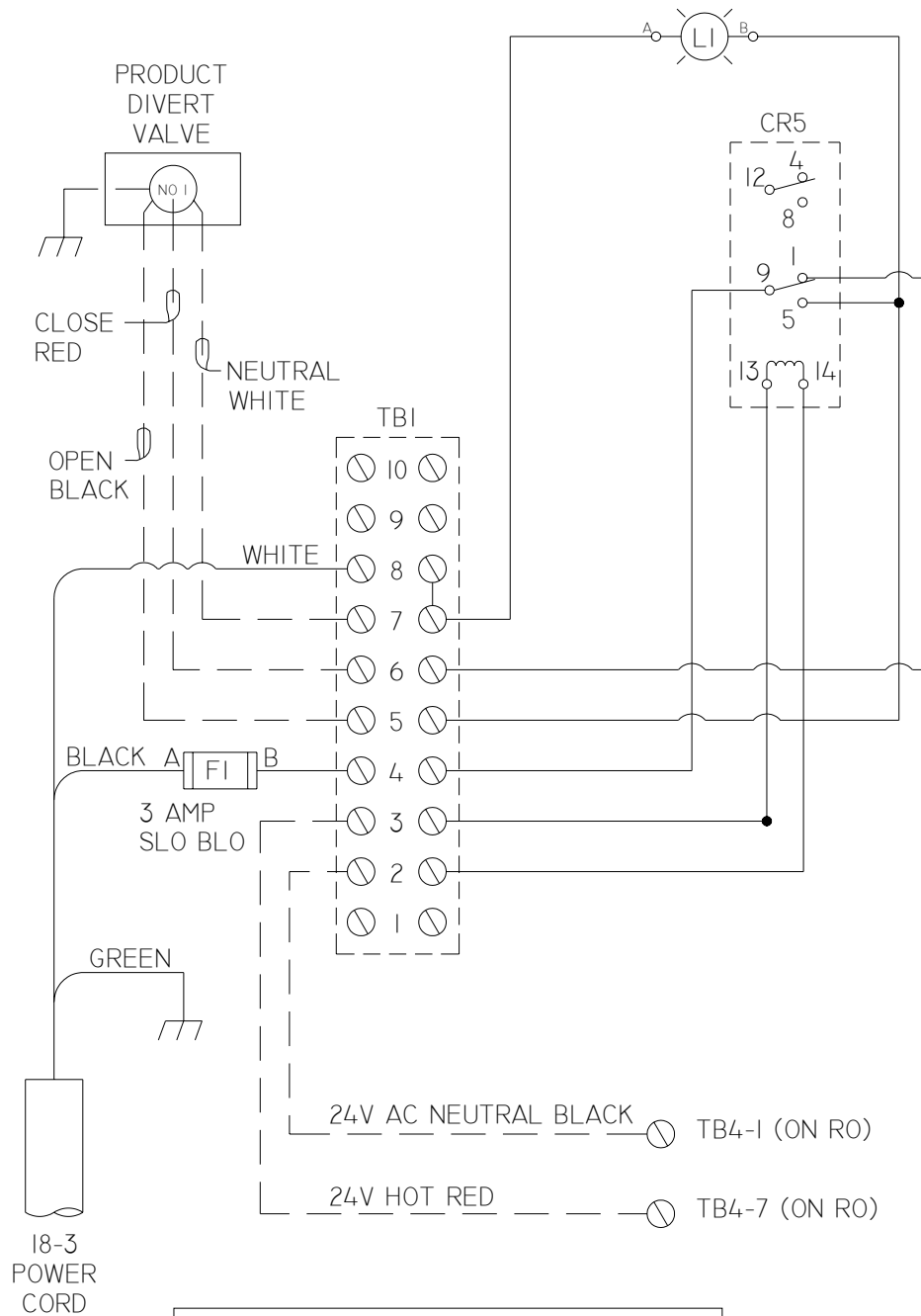


NOTES:

- 1)  A SPRING RETURN CHECK VALVE (MINIMUM 1/2 PSI) MUST BE INSTALLED DOWNSTREAM OF THE VALVE ASSEMBLY.
- 2) ALL THREADED PARTS TO BE WRAPPED WITH TEFLON TAPE.

60343	CLAMP, WORM GEAR, 1"
1228209	HOSE, 1" ID, 125 PSI, GRY
41582	1" ELECTRIC BALL VALVE
40926	1" PVC COUPLER
40864	1" QUICK-DISCONNECT, FEMALE
40863	1" QUICK-DISCONNECT, MALE
40386	1" ADAPTER, BARB X THREAD
40611	1" PVC TEE, FEMALE
40169	PVC NIPPLE, 1" X 6" THREADED
PART NO.	DESCRIPTION

**Product Divert**  
(Valve and Drain Installation)



**Product Divert**  
(Product Divert Connection to RO Controller)

**NOTES:**

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# **Z Series RO System**

## **CHAPTER SEVEN: SPARE PARTS LIST**

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**Z Series RO System****SPARE PARTS LIST**

**NOTE: Part Numbers are subject to change and should be verified when ordering spare parts.**

<u>CATALOG NUMBER</u>	<u>DESCRIPTION</u>
<b><u>PARTS</u></b>	
12131*	Sensor Probe, Total Dissolved Solids, Feed, Product
1229615*	Fuse, 0.5 Amp
1229980	ROMA, TF, Flared, 4x40 w/ 1230048 Element
1230048	Membrane only, Thin Film, 4x40, FTS
12310	Printed Circuit Board, % Rejection
12312	Printed Circuit Board, Display
1234709	Motor Contactor, 3 and 5 Hp
1234709	Relay, Pressure Switch Delay Timer
1234711	Cycle Timer (Auto Flush)
1234732	Valve, Solenoid, 1"
1235402	Motor Contactor, Delay Timer Relay
1235403	Motor contactor, 7.5 Hp
1236035	Power Switch
1236350	Printed Circuit Board, Conductivity
20007	Disinfect Switch
20089	Relay, 24 VAC
20120*	Fuse, 1 Amp
20127*	Lamp, 1/2", 24 VAC, Red
21144*	Lamp, 1/2", 24 VAC, Green
30080	Relay Socket, 8 Pin, Small
30110	Relay Socket, Adjustable Timer
30118	1/4" Float Switch
30123	Override Switch
30147	Pressure Switch
40127	Flow Meter, 2-20 GPM
40170**	Pre-filter Cartridge, 5 micron, 20"
40171	Pre-filter Assembly, 20"
40173	Disinfect Valve, 1"
40396	Flow Meter, 1-10 GPM
40674*	Gauge, 0 – 100 PSI
40675*	Gauge, 0 – 600 PSI
40700*	Pump Waste Pressure Valve

<u>CATALOG NUMBER</u>	<u>DESCRIPTION</u>
<b><u>PARTS (continued)</u></b>	
30151	Switch, Temperature
30150	Transducer, Temperature
30149	Temperature probe well, SS
41582	Valve, Ball, 1", Electric
40700	Valve, Waste Flow
40863	QD, Female x 1" Hose Barb
40864	QD, Male x 1" NPT
50040	Grease Cartridge (non-submersible pump/motor only)
40291	Valve, sample (1/4" NPT x barb)
60240	Clamp, worm gear, 3/4"
60280	Clamp, worm gear, 5/8"
60341	Tube, 1/8"
60370	Hose, 3/8"
50092	Hose, 5/8"
<b><u>CLEANERS</u></b>	
14962	Membrane Cleaner, BIOSAN™ II, 1 gal, liquid
14963	Membrane Cleaner, BIOSAN™ II, 5 gal, liquid
1228792	Membrane Cleaner, Hi pH, 5 gal
1228791	Membrane Cleaner, Hi pH, 1 gal
1228654	Membrane Cleaner, Low pH, 5 gal
1228653	Membrane Cleaner, Low pH, 1 gal
<b><u>TESTS</u></b>	
50033	Hardness Test Kit
14604	Silt Density Index (SDI) Test Kit
11656	Total Chlorine Test Kit
70001	Water Test Kit, AAMI Standards
1232143	Water Quality Test Strips
<b><u>OPTIONAL</u></b>	
14899	Kit, membrane, SS housing
14900	Kit, membrane, FG housing
14778	Kit, TDS alarm relay
12214	Disinfect kit, 30 gal.

**MOTORS/PUMPS**

30196*****	Motor only, 5HP, 1Ph, 230V~
30194*****	Motor only, 5HP, 3Ph, 208V~
30203*****	Motor only, 5HP, 3Ph, 230V~
30195*****	Motor only, 5HP, 3Ph, 460V~
30193*****	Motor only, 7.5HP, 3Ph, 208V~
30206*****	Motor only, 7.5HP, 3Ph, 230V~
30207*****	Motor only, 7.5HP, 3Ph, 460V~
14439*****	Kit, wire lead assembly, 8GA, Grundfos
14440*****	Kit, wire lead assembly, 8GA, Franklin
30400*****	Overload, Thermal, 7.5 – 11 Amp
30399*****	Overload, Thermal, 10 – 14 Amp
30398*****	Overload, Thermal, 13 – 19 Amp
30401*****	Overload, Thermal, 18 – 25 Amp
30397*****	Overload, Thermal, 24-32 Amp
10327*****	Pump only, Whisperflow, 7.5Hp, High Pressure
10261*****	Pump only, Whisperflow, 5Hp
10251*****	Pump only, Whisperflow, 7.5Hp, Low Pressure

\* Suggested Stock Items

\*\* Suggested Stock Items if applicable to unit

\*\*\* Optional

\*\*\*\* Refer to equipment for applicable part

\*\*\*\*\* Verify part number with Technical Service to ensure correct part is ordered

## NOTES



Call (253) 395-2200 for additional information, (800) 633-3080 in the U.S., or visit [www.gewater.com](http://www.gewater.com)

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