

Rev	Creation Date	Description	ECR No.	Drawn By	Reviewer
A	6/7/96	New Release	1464	R. Amato	
B	8/17/97	Update manual to properly describe all required components of a complete RO system.		S. West	

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FOR THE CUSTOMER**

ZyzaTech Water Systems, Inc. 7848 S. 202 nd Street Kent, WA 98032	Title: V SERIES REVERSE OSMOSIS SYSTEM FOR DSD		
Released By:	QA Release:	Rev: B	
Released Date:	Doc. No.: 12555	Rev. Control Cover Page	

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ZYZATECH WATER SYSTEMS, INC.
V SERIES REVERSE OSMOSIS SYSTEM

OPERATION AND MAINTENANCE MANUAL

DSD

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V-SERIES RO SYSTEM

Installation, Operation, and Maintenance Manual

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CHAPTER ONE: GENERAL INFORMATION

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CHAPTER ONE GENERAL INFORMATION

1.1 The Manual

This manual has been prepared to provide the operator with information regarding the installation, use, maintenance and troubleshooting of the V- Series RO Systems.

CAUTION: When used as a medical device, Federal law restricts this device to sale by or on the order of a physician. Per 21 CFR 801.109(b)(1).

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

1.2 Safety Summary

Words of **ENHANCED CAPITAL** letters are used to identify labels on the device and 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:

NOTE: “Notes” are statements that provide further clarification.

CAUTION: A “Caution” statement is used to identify conditions or practices that could result in equipment or other property damage.

WARNING: A “Warning” statement is used to identify conditions or practices that could result in personal injury or loss of life.

READ THIS MANUAL: Prior to operating or servicing this device, this manual must be read and understood. If anything is not clear, call for assistance before proceeding. Keep this and other associated manuals for future reference, and for new operators or qualified service personnel.

USE PROPER POWER CONNECTIONS: Use proper wiring and connection methods to satisfy hospital electrical codes.

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 properly grounded 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 extension cords without proper consideration.

DEVICE LABELING: Do not under any circumstances remove any Caution, Warning, or other descriptive labels from the device until the conditions warranting the label are eliminated.

DO NOT OPERATE IN FLAMMABLE ATMOSPHERES: To avoid fire or explosion, do not operate this device in an explosive environment.

1.3 Applications

The V-Series RO is designed to purify water by driving water through a semi-permeable membrane. Water purified by reverse osmosis has had 95% of the dissolved ions and 99% of most other contaminants removed. The quality of the purified water, referred to as product water or permeate, depends on the quality of the feed water and meets or exceeds AAMI Water Quality Standards for Dialysis. Such water is suitable for hemodialysis applications.

1.4 Contraindications

WARNING: ZyzaTech's Water Systems are not designed, sold, or intended for use in producing water for injection (WFI) or other sterile solutions.

Furthermore, ZyzaTech's Water Systems are not intended to be used outside of the device's specifications or limitations.

1.5 Environmental Considerations

Prior to the installation of your V-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 V-Series unit operates on three phase power. 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.

WATER: Reverse osmosis systems require a reliable water source. Additionally, it is necessary to have adequate flow rates and pressure. The V-Series 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.

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 two inch pipe with a 1/8" per foot slope and a 1" minimum air gap normally satisfies the waste flow requirement.

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% (Refer to the "Temperature Correction Factors" table in the Technotes section of the manual.). In climates where the winter water temperature drops significantly below 77°F it may be advisable to heat the water or increase the number of membranes in the RO unit. It is also necessary to keep the unit from freezing to prevent serious damage to the RO.

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

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

WATER PURITY: Plumbing materials can significantly contribute to the contamination of the water. Metallic pipes, other than ASTM 316 stainless steel, must be eliminated once the purification process has begun. Schedule 40 or 80 PVC, polypropylene, PVDF and other FDA recommended materials are suitable for most grades of purified water. Care must also be exercised over the choice of 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 V-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 which are used within the unit.

NOTE: Not all units will include all of the components listed.

1.7 Components

The **Temperature Alarm Monitor Probe** is located after the temperature blend valve and/or prior to the first piece of pre-treatment before the RO unit. The monitor turns off the RO unit when the water temperature becomes too warm for the system components or the applications being supplied by the system.

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 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 Manual for specific operation and maintenance instructions.

The **Inlet Water Valve** allows manual shut off of the water supply to the unit. This valve is used to shut off the water for pre-filter changes.

The fluid path flows into the **Pre-filter**, located in a blue housing on the front of the V-Series. It is a cartridge type filter with a nominal rating of 5 microns. The purpose of this element is to collect any particles larger than 5 microns which may be detrimental to product water quality and subsequent components in the system. The filter is monitored on the inlet and outlet by 0 to 100 PSI panel mounted gauges.

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

The **Inlet Solenoid** is located at the input of the V-Series RO and serves to shut off/on the water supply to the system. It is actuated open when the power switch is placed in the ON position.

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.

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.

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

The **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 V-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.

One to three **ROMA's** may be included in the V-Series. Each thin film (TFC) membrane provides up to 2400 gallons per day of product water dependent upon feed water quality and temperature. Cellulose acetate (CA) membranes are available. The product water flow is displayed by a panel mounted flow meter.

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.

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.

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.

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.

The **Waste Flow Valve** is a stainless steel needle valve which 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.

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.

The **Product TDS Sensor** monitors the quality of the product water. The product quality is displayed by a digital TDS monitor on the front panel. The **Temperature Probe** compensates the monitor reading for changing water temperatures.

The **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. High TDS value 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.

The **Product Water Flow** is displayed by a panel mounted flow meter.

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.

The **Disinfect Key Switch** is used to start the unit and introduce cleaners or disinfectant into the unit. The key switch locks out the inlet solenoid and low pressure switch.

CAUTION: The unit should not be run dry.

The V-Series can be operated by tank **level controls**. The standard control is a float switch. On high level an indicator lamp is displayed on the front panel.

1.8 Monitors and Controls

A double pole, double throw **Power Switch** is mounted on the front panel. The switch is used when normal operation of the RO system is desired.

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

The **Low Feed Pressure** indicator will light 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 approximately 10 PSI.

The **Pump Pressure Gauge** indicates the pump discharge pressure from 0 to 600 PSI. It is used as a reference when adjusting the pump. It is used in conjunction with the waste pressure gauge to evaluate the need to clean the membranes.

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 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.

The **Percent Rejection Display** is a 5 LED panel mounted array that tells how well the membranes are performing. The lights correspond to 99%, 95%, 90%, 85%, and >70% rejection. The 99% light, when energized, indicates a need to evaluate the RO system performance. 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 under optimum conditions will achieve this level of performance.

The **Product Water TDS** is a digital display on the front panel. The display has a range from 0.1 through 99.9 mg/L. The monitor is temperature compensated to adjust the display value to changing water temperature.

The **Product Divert valve** will be initiated and divert product water to drain when the unit is started up, and when the TDS alarm set point is exceeded.

The **Product Divert indicator** will light whenever the product water is being diverted to drain. The indicator will go out whenever the product water is not being diverted.

When the system is started up, the product water will be diverted to drain for a preset time duration that is user adjustable. When the TDS alarm set point is exceeded, the product water will also be diverted to drain for a preset time duration that is user adjustable. The water will remain being diverted to drain for the entire preset time duration even if the water quality improves and removes the TDS alarm condition.

The **Less Than .5 mg/L Check System** lamp indicates when the TDS is .5 mg/L or less. This indicates a need to evaluate the RO system performance. RO units do not normally have this low of a product TDS. Verify this reading with an independent meter and take corrective action if indicated. RO membranes under optimum conditions (good feed water) may achieve this level of performance.

The **Alarm Set** switch allows the operator to set the TDS level at which the alarm will sound. The alarm should be set at twice the initial TDS reading. If the set point is exceeded an audible alarm will sound.

The **Alarm Mute** switch will mute the audible alarm for 30 - 45 seconds. A red indicator lamp is displayed on the switch when the mute switch has been pressed.

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. The unit should not be run dry.

The V-Series can be operated by tank **Level Controls**. The standard control is a float switch system. On high level an indicator lamp is displayed on the front panel, and the RO is shut down.

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.

The **RO Interlock** circuit, when activated, will not allow the RO unit to operate (run). A 110V signal is sent from the RO unit control box (panel) to a normally open micro switch on the device. When the micro switch is closed, the 110V 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 **Temperature Alarm Monitor** monitors the feed water temperature and will alarm at high temperature condition limit of 90°F. If high feed water temperature occurs, the monitor provides a visual alarm and will activate the RO interlock circuit shutting down the RO unit. The monitor is equipped with an override switch that will override the alarm and allow the RO unit to operate.

The override switch is provided for emergency operation. 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.

1.9 Optional Equipment

ZyzaTech Water Systems offers a number of optional items to adapt their 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.

The **Semi-Auto Sanitizing System** is a polyethylene solution tank with flexible manifold for sanitizing/cleaning the entire RO. The polyethylene solution tank will handle a wide range of chemicals and its drop tube design will minimize the fumes. The flexible manifold enables quick and easy connection of the system.

Remote **Water System Monitoring** is available for this system. The Remote Quality Monitor will monitor the status of the RO unit. The monitor displays the water quality as above or below the set point of the TDS meter setting and the operating mode of the RO unit.

The **Softener** 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 elute 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.

The **Storage Tank** collects the RO product water and stores it until needed by the user. The Reservoir system has internal features that, with the distribution pump running, continuously wash the side-walls and top. This feature makes it possible to disinfect the system with less disinfectant. The reservoir has level controls that regulate the RO unit. Reservoir systems also can alarm when the tank water level is low.

Distribution Pumps pressurize the RO water and deliver it to the user. The pumps, both single and multi-staged centrifugals, run continuously to prevent stagnation of the system. When water is allowed to stand idle, planktonic microorganisms have the opportunity to colonize in irregularities on the pipe surface. The resulting colonies will seed the water with microorganisms and endotoxins as well as resist disinfection efforts.

Earthquake/Shock Restraints are available for locations where they may be required by local codes.

Ultraviolet 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. In some cases UV sterilizers are employed using ozone generating bulbs to reduce TOC levels.

Ultrafilters 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 ultrafilters are used in front of RO units to remove harmful colloids. In these circumstances the ultrafilter 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, ultrafilters 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 ZyzaTech must come equipment with a micro switch that is closed when the device goes into regeneration. This is required to be able to connect the RO interlock circuitry to the piece of equipment.
2. Any device provided by another company that is required to be interlocked to the RO unit, so the RO unit can not operate (run) during a period of the devices operation must have a normally open micro switch that when activated (closed) can return a 110V signal to the RO unit controller.

1.11 Specifications

1.11.1 Input Water Requirements

	<u>Minimum</u>	<u>Maximum</u>
Flow	3.25 GPM	N/A
Temperature: CA membranes	35°F (1.7°C)	80°F (26°C)
TF membranes	35°F (1.7°C)	80°F (26°C)
pH CA membranes (operating)	5.0	6.5
CA membranes (cleaning)	4.0	8.0
TF membranes (operating)	4.0	11.0
TF with chloramines present (operating)	4.0	8.5
TF membranes (cleaning)	2.0	11.5
Pressure, dynamic	30 PSI	100 PSI

1.11.2 Flow Rates

1. Product Flow, based on the following conditions:
 - Operating pressure: 250 PSI @ 77°F (25°C)
 - Product pressure: 1 PSI
 - pH: 6.5
 - Typically 50% recovery

<u>Model Number</u>	<u>Flow Rate</u>			
	<u>GPM</u>	<u>LPM</u>	<u>GPD</u>	<u>LPD</u>
V-2400	1.66	6.28	2,400	9,080
V-4800	3.33	12.16	4,800	18,160
V-7200	5.00	18.95	7,200	27,250

2. Waste Flow: To be equal to product flow
 - a. Operating Pressure: 200 - 250 PSI (TF Units)

1.11.3 Electrical Requirements

1. RO Unit:

Voltage:	<u>208</u>	<u>208</u>	<u>230</u>	<u>230</u>	<u>460</u>	<u>460</u>	<u>220</u>	<u>380</u>	<u>380</u>
Hertz:	60	60	60	60	60	60	60	50	50
Amps:	10.9	18.3	9.5	16	4.8	8	28.7	5	10
Phase:	3	3	3	3	3	3	1	3	3
HP:	3	5	3	5	3	5	5	2	5

2. Additional Electrical Requirements:

Product Divert Valve
 Four plex electrical outlet
 Voltage: 115/220
 Hertz: 60/50
 Amps: 20
 Phase: 1

1.11.4 Physical Characteristics

Height	68 inches
Depth	24 inches
Width	24 inches

Weight - Operating

<u>Model</u>	<u>Weight</u>
V-2400	260 lbs.
V-4800	300 lbs.
V-7200	325 lbs.

1.11.5 Membrane Performance Characteristics

Salt Rejection: CA 90% minimum
TF 95% minimum

Test Solution: Input water 1000 PPM NaCl
Conductivity: 2000 micro mhos
Operating Pressure: 225 PSI (CA Models 400 PSI)
Product Pressure: 1 PSI
pH: 6.5

1.11.6 Environmental Requirements

	<u>Minimum</u>	<u>Maximum</u>
Ambient Temperature	39°F (4°C)	90°F (32°C)
Storage Temperature	35°F (2°C)	90°F (32°C)
Altitude	N/A	10,000 feet

NOTE: This equipment will function in a condensing environment. The user/operator should recognize that moisture can be caused by condensation and is not necessarily an equipment leak.

1.12 Service Assistance

If service assistance is required, take the following steps:

1. Consult the "Troubleshooting" section of this manual (Chapter Five). If the problem cannot be identified and corrected by any of the procedures found in that section, then....
2. Call the ZyzaTech dealer in your area.
3. Call the ZyzaTech Technical Service Department at 800-633-3080 or (206) 395-2200. 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 unit do you have i.e.: V-Series 2400 GPD, and
 2. What is the serial number of the unit (this is found on the inside of the controller door).

1.13 Symbols and Abbreviations

C	Centigrade
cc	Cubic Centimeters
cm	Centimeters
DI	Deionization
F	Fahrenheit
ft	Foot (feet)
GAC	Granular Activated Carbon
gr	Grains
HPLC	High Pressure Liquid Chromatography
lb.	Pounds
LED	Light Emitting Diode
LPM	Liters per Minute
Megohm-cm	Million AC Ohms - Centimeter
mw	Molecular Weight
PSI	Pounds Per Square Inch
GPD	Gallons Per Day
GPM	Gallons Per Minute
GHT	Garden Hose Thread
mg/L	Milligrams Per Liter
RO	Reverse Osmosis
TF	Thin Film
CA	Cellulose Acetate
PA	Polyamide
TFC	Thin Film Composite
ROMA	Reverse Osmosis Membrane Assembly

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CHAPTER TWO: INSTALLATION / START UP

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CHAPTER TWO INSTALLATION / INITIAL SYSTEM START - UP

2.1 Location Requirements

Physical Location:

1. RO Unit:
 - a. The V-Series is free standing.
 - b. It measures: Height - 68 inches; Width - 24 inches; Depth - 24 inches.
 - c. Operating Weight: 260 to 325 pounds depending on the unit.

NOTE: Leave a minimum 2 feet of clearance between the right side and the back of the unit and any obstruction to allow room for the power cord and the water connections.
2. Product divert controller:
 - a. Mount the product divert controller on a highly visible section of the wall, near the 120 volt electrical outlet. Within 5 feet of the RO Unit control box and 5 feet of the product divert valve assembly.
 - b. It measures: Height - 11.5 inches; Width - 9.25 inches; Depth - 6 inches.
3. Product divert valve assembly:
 - a. Mount the product divert valve assembly on the wall between the RO unit and the storage reservoir or the next purification device in the treatment stream.
4. Temperature Alarm Monitor:
 - a. Mount the Temperature alarm monitor on a highly visible section of the wall within 5 feet of the temperature probe and 10 feet of the RO unit control box.
 - b. It measures: Height - 4.25 inches; Width - 7.25 inches; Depth - 6 inches.
5. Temperature Probe:
 - a. The temperature probe should be located after the temperature blend valve and/or prior to the first piece of pre-treatment equipment before the RO unit. See the temperature probe installation drawing for specific details.

Installation Connections:

1. Connect the V-Series RO to the pretreated feed water with sufficient diameter pipe (or tubing) to ensure adequate flow of water.
2. Connect the waste water line to the drain in accordance with the local plumbing code.
3. Connect the product water line to the product divert valve assembly (RO product water connection).
4. Connect the product water outlet connection of the product divert valve assembly to the storage reservoir or the next purification device in the treatment stream. The plumbing from the product divert valve assembly to the next purification device in the treatment stream is to be hard plumbed.
5. Connect the product divert valve drain connection to the drain in accordance with the local plumbing code.

6. 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.
7. Plug in the supplied power cord on the product divert controller into the 120 volt outlet.
8. Connect RO Interlock wire to the terminals in the RO control box (see electrical schematic in the Drawings section).

NOTE: RO Interlock wire to be two conductor wire suitable for 110 volt 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.

One conductor (wire) is to connect between terminal 1 in the RO unit control panel and the common terminal on the micro switch. Connect the other conductor (wire) from terminal 3 on the RO unit control panel to the normally open terminal on the micro switch.

9. Connect the Over Temperature Alarm Monitor wires to the terminals in the RO control box. See electrical schematics of the RO unit and Over Temperature Alarm Monitor in the manual for connection points.
10. The V-Series RO operation can be controlled by one or two tank level sensor/switch system. The level switch is ZyzaTech P/N 11712. Operation of this unit without level switches requires a jumper installed between the float switch connection terminals number 16, 17 and 18. Refer to the electrical drawing for hook-up.

2.2 First Time Start-Up Procedures

Any water pretreatment device supplying water to the RO must be ready for use.

Connect the product output (prior to the product divert valve assembly) to drain.

Turn on the source water supply.

Turn the unit on.

1. Water will start to fill the RO unit.
2. The product divert valve will open. (No water should flow through the product divert valve since the RO product water has been connected to drain before the valve assembly).
3. If the Auto-flush option was installed, the RO will auto-flush for the preset time duration.

4. The motor will begin operation after a short time delay.

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. Purging is accomplished by turning the RO system on and opening the small valve on the top end of the pump/motor housing very slowly (the pressure inside the pump/motor housing is feed water pressure). Air should be heard escaping to the atmosphere. When water is seen flowing from this valve, close the valve.

5. The product divert valve will close after a preset duration.

NOTE: The product divert valve may open and close during this operation based on product water quality.

Rotation Verification (FOR THREE PHASE MOTORS ONLY).

- a. Units equipped with submersible multi-stage centrifugal pumps: 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 is achieved.
- b. Units equipped with multi-staged centrifugal pumps. 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 of the main power wires at the fused disconnect box (as in step "a" above). Repeat as necessary to get the proper rotation.

Balancing the three 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 closest voltage and amperage on each leg should be used.

Operator Adjustments

The start up delay can be changed by adjusting the contactor delay relay (P/N 12407) in the main control box.

The start-up product divert cycle time can be changed by adjusting the Product Flush Start Timer in the product divert controller. See section 4.5, Specific Instructions, for instructions on timer adjustments.

The TDS alarm product divert cycle time can be changed by adjusting the Product Flush Alarm Timer in the product divert controller. See section 4.5, Specific Instructions, for instructions on timer adjustments.

Adjust system pressure to 250 PSI by rotating the pressure adjustment knob and pump output throttle valve. DO NOT adjust system pressure to more than 300 PSI. DO NOT close throttle valve completely or severe damage will occur to the pump.

Adjust waste flow to equal product flow.

Allow the unit to operate in this mode until percent rejection and TDS stabilize at optimum values.

WARNING: If the unit is to be used for dialysis, the product water MUST be checked for the absence of cleaners, disinfectants or storage solution and a satisfactory AAMI Water Quality Analysis must be obtained before proceeding any further. The system must also be tested for microbial contamination. (see section 2.3).

Turn the unit OFF and reconnect the product line to the product divert valve assembly.

The unit is now ready for normal use.

2.3 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 do an AAMI Water Quality Analysis test.

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.

Materials Required:

Product water sampling kit
Sterile gauze
Tape
Container (such as a bucket).

1. Operate the RO for at least 15 minutes before drawing the water sample.
2. Hold product line over a container, open the product valve and run product water for 30 - 60 seconds.
3. Aseptically remove the lid from the sample bottle and rinse the bottle twice with RO product water.
4. Fill the bottle completely with RO product water and cap immediately.
5. Place the bottle and completed requisition back 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 may be inaccurate.

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CHAPTER THREE: SYSTEM OPERATION

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CHAPTER THREE SYSTEM OPERATION

3.1 Daily Start - up

WARNING: Verification of an absence of sanitizers, disinfectants and chlorine / chloramines must be performed before water is used for any patient related uses.

1. Ensure that all appropriate valves in the water supply line to the unit are opened.
2. Ensure that DISINFECT valve is closed and the disinfect start key switch on the electrical panel is in the OFF position.
3. Move the power switch to "ON".
4. The product divert valve will open diverting product water to drain for the preset duration.
5. If the Auto-flush option was installed, the RO will auto-flush for the preset duration. During this cycle the pressure gauges will be as follows:
 - a. Pre-filter gauges should read between 25 and 100 PSI within 15 seconds of turning on system.
 - b. Pump and waste pressure gauges should read approximately 100 PSI.

NOTE: If the water quality falls below the alarm set point the product water will be diverted to drain for a preset duration. Once the set time has elapsed and the water quality is still below the alarm set point the product water will again be diverted to drain for a preset duration. This cycle will repeat itself until the alarm condition is satisfied.

6. When the Auto-flush cycle is completed, or if no Auto-flush is installed, the pressure gauges should indicate normal pressure readings:
 - a. Pre-filter gauges should read between 25 and 100 PSI within 15 seconds of turning on system.
 - b. Pump and waste pressure gauges should read approximately 250 PSI after motor has started.
7. The "Percent Rejection" monitor should indicate a decrease in RO performance when first started, and should show normal percent rejection values within a few minutes.

8. 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. The alarm mute switch will silence the audible alarm for 30 to 45 seconds each time the switch is used.

WARNING: High TDS (above twice the initial TDS value after system stabilization) requires immediate attention. Assure that the automatic product water divert-to-drain has initiated. If not, place the dialysis machines in bypass and do not use ancillary points of use. Consult with the medical director as to whether dialysis should continue. Refer to the trouble shooting guidelines for high TDS in the Trouble Shooting section of this manual.

9. The absence of chlorine must be verified in the feed water after the carbon tank. It is imperative that thin-film units be operated on chlorine free feed water.

NOTE: Carbon filtration is a required component of a water purification system. Two carbon filters must 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. Refer to the Carbon Manual for specific operation and maintenance instructions.

10. Adjust the waste flow valve to achieve a waste flow equal to the product flow (50% recovery).

WARNING: When RO system is used for dialysis service, a test for formaldehyde or sanitizer residual and chloramines at the dialyzer connection line MUST be performed to verify absence of residual chemical.

CHAPTER FOUR: ROUTINE MAINTENANCE

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CHAPTER FOUR

ROUTINE MAINTENANCE OF V-SERIES

ZyzaTech V-Series RO systems have been designed to operate with a minimum of operator attention. Like all mechanical systems they will operate longer with less trouble when operator maintenance is performed regularly. Operator maintenance on a ZyzaTech reverse osmosis system is limited to maintaining performance logs, cleaning and disinfection, periodic lubrication, and cartridge filter replacement. The maintenance procedures have been categorized by their frequency of action and are as follows (specific instructions follow the maintenance schedule):

4.1 Daily Requirements

1. Observe and record hardness level in the Pretreatment Log (for systems with softener pretreatment).

NOTE: Periodically, 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 brine tank (for systems with softener pretreatment).
3. Observe and record Chlorine/Chloramine concentrations in the Pretreatment Log. Follow instructions included in each test kit.

WARNING: Take corrective action or contact the dealer/factory if any pretreatment device fails to provide adequate treatment of feed water.

4. Observe and record the pre-filter inlet and outlet pressure gauges on the Operation Log. The difference in the pressure values will measure the condition of the filter cartridge. When the pressure differential (delta P) increases ten PSI above the clean delta P, or the usual inspection shows any change of color, the cartridges need to be changed.
5. Observe and record the pump and waste pressures on the Operation Log.
6. Observe and record the waste and product flow rates on the Operation Log. Allow water temperatures to stabilize before attempting to record results, to prevent errors due to fluctuating temperatures.
7. Observe and record the % rejection and TDS quality on the Operation Log.
8. Measure and record the feed water temperature on the Operation Log. A hand held thermometer may be used. The water temperature has a significant effect on the flow rate of the RO membrane and on the evaluation of the membrane's need to be cleaned.
9. Purge air from submersible pump housing (if applicable), or after pre-filter cartridge change.
10. Observe that 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 visual indicators on the Temperature Alarm Monitor.

4.2 Quarterly Requirements

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

1. Clean membranes. Refer to membrane cleaning procedure located in section 4.7.
2. Disinfect unit. Membranes should be disinfected after cleaning. Refer to membrane disinfection procedure located in section 4.8.
3. Check time settings of the flush cycle timers in the product divert controller.
4. Check to see there is flow from the product divert valve to drain when the RO unit is started.
5. Check to see there is flow from the product divert valve to drain when the RO unit is running and the TDS exceeds the set point.
6. Check to see that there is no flow from the product divert valve to drain when the RO unit is running and the TDS does not exceed the set point.
7. Check calibration setting of the temperature switch.
8. Ensure RO lockout (turns off the RO unit) occurs at water temperatures above 90°F.
9. Ensure temperature alarm monitor override switch energizes the RO unit when it is in the over temperature condition.

4.3 Semi-annual Requirements

1. Lubricate motor if applicable (non-submersible motor only).
2. Lubricate pump bearing frame if applicable (non-submersible pump only).
3. Re-torque connection on high amperage power and motor wires (refer to Technote 128).

4.4 Annual Requirements

1. Complete an AAMI Water Quality Analysis of the product water. (refer to section 2.3).

4.5 Specific Instructions

1. Check the pre-filter at least monthly. When changing the white pre-filter cartridge the user should inspect the inside core for color. If the inside is discolored then the filter has been used too long and should be changed more often. If pre-filters require frequent changing, additional pre-filtration is recommended.

2. Flush Setting and Function Check.

- a. Open the product divert control box and check the timer settings:
 - i. Product Flush Start Timer (TR-3) can be set from 2 - 5 minutes.
 - ii. Product Flush Alarm Timer (TR-4) can be set from 1 - 5 minutes.
- b. Close the product control box.
- c. Disconnect the drain line at the drain connection from the product divert valve.
- d. Check to ensure that there is no flow to the drain when the RO unit is not in the product divert mode.
- e. Start the RO unit with the on/off power switch.
 - i. Product divert indicator light is illuminated.
 - ii. Divert valve rotates open and the product water is diverted to drain.
 - iii. Divert valve rotates closed and the product water is no longer diverted to drain after the Product Flush Start Timer has timed out.

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.

- f. 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:
 - i. Product divert indicator is illuminated.
 - ii. The product divert valve rotates open and diverts the product water to drain.
- g. With the RO unit operating in the condition listed above, adjust the TDS alarm selector switch so that the TDS valve is lower than the TDS alarm set point and check the following:
 - i. Divert valve rotates closed and the product water is no longer diverted to drain after the Product Flush Start Timer has timed out.
 - ii. The product divert indicator should no longer be illuminated.
- h. Reconnect the product divert valve drain line to the drain.

3. Temperature Setting and Function Check.

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.

- a. Remove the temperature probe from the thermal well.
- b. Insert the end of the temperature probe into three inches of water bath that is 85°F.

- c. Slowly increase the water bath temperature until the monitor indicates (red light) "Temperature Alarm above 90°F". 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 screw driver. Clockwise rotation reduces the temperature set point and counter clockwise will increase the temperature set point.

- d. Check that the RO unit shuts down at the alarm set point.
- e. Switch override switch from normal run to the override position. The RO unit should start up and the override indicator lamp will light.
- f. 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.
- g. Slowly reduce the water bath temperature until the monitors temperature switches from the alarm condition to normal operation. The RO unit should return to normal operation.
- h. Log all set point and calibration data.
- i. Replace the temperature probe into the thermal well.

4.5.1 Replacement of Pre-filter Cartridge

To replace pre-filter cartridge.

NOTE: This procedure should be followed every thirty days or when delta pressure increases by 10 PSI, whichever occurs first.

- a. Turn the inlet water valve OFF. The pressures will drop to zero on the gauges and the RO pump will turn off automatically.
- b. Remove the pre-filter bowl by rotating it to the left until it is free of the head.
- c. Remove the cartridge from the bowl slowly, to prevent excess spillage, and discard. Empty water from the bowl.
- d. Install new cartridge into bowl. Cartridge should be flush with the top of the bowl.
- e. Ensure o-ring in the filter bowl is in groove and free of debris.
- f. Align hole in cartridge with receptacle in head. Rotate the bowl until threaded hand tight.
- g. Turn the system ON.

NOTE: 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.

4.6 Pump Lubrication

NOTE: Submersible multi-stage centrifugal pumps (Whisperflow) need no lubrication.

Lubrication of Non Submersible multi-staged centrifugal pumps only:

1. Use No. 2 lithium grease (with molybdenum disulfide) as a lubricant. Catalog No. 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 one grease 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 occur, 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.

4.7 Cleaning Procedure for Reverse Osmosis Systems

Foulants such as minerals, silt and organics collect on the RO membrane surface and cause the RO membrane to plug 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 pretreatment designs. Regardless of the foulant, it is essential to promptly clean the membrane once 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 cleaning may be required.

NOTE: Some foulants CANNOT be removed with cleaning, 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, encourage bacterial growth and 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 input 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, or more often if needed.

4.7.1 Powder Cleaner Cleaning Procedure

The following cleaning procedure is for the ZyzaTech brand powdered cleaners, and has been established for thin film (TF) RO membranes. There are two types of cleaners available, a high pH cleaner and a low pH cleaner. The high pH cleaner will remove accumulated silt and organic matter from the RO membrane. The low pH cleaner attacks mineral scale deposits such as calcium, magnesium and iron build-up. **The Different cleaners are not to be mixed. Introduce the low pH cleaner first (P/N 11271), thoroughly rinse the system, and then use the high pH cleaner (P/N 12032).**

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. Neither respiratory protection nor special ventilation are required.

Materials Required

V-Series Disinfection/Cleaning Kit (P/N 12214)

Two pounds of Calcium and Iron (Low pH) cleaner (P/N 11271, 1 lb. bag).

(The cleaner can also be supplied in 5 lb. bags P/N 11351.)

Two pounds of Silt and Organics (High pH) cleaner (P/N 12032, 1 lb. bag).

(The cleaner can also be supplied in 5 lb. bags P/N 10902.)

Cleaning Procedure:

NOTE: If your RO system is equipped with a "submersible" high pressure pump, the pump/motor housing must be purged of all air prior to cleaning or disinfection of the machine. This is required because the pump is not self-priming. The pump/motor housing will partially fill with air during normal operation of the RO from air in the water supply. This air will prevent the pump from drawing solution from the cleaning/disinfect tank. Purging is accomplished by turning the RO system on and opening the small valve on the top end of the pump/motor housing very slowly (the pressure inside the pump/motor housing is feed water pressure). Air should be heard escaping to the atmosphere. Once water is seen flowing from this valve, close the valve and turn off the RO in preparation for cleaning or disinfection.

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 water divert
- d. Low pressure switch

WARNING: Label machine with appropriate warning signs such as "**Do Not Use /Contains cleaner**" to prevent use of RO until properly rinsed.

CAUTION: **Do not mix the cleaners together.** The cleaners are intended to be used separately. ZyzaTech recommends the complete procedure including "rinse out" be done using the Calcium and Iron (Low pH) cleaner first. The complete procedure using the Silt and Organics (High pH) cleaner should be done second.

1. Turn on the RO unit. Establish a pre-cleaning % rejection and TDS and record on the Cleaning/Disinfection Log sheet. Test a sample of product water for pre cleaning pH. Record for later comparison.
2. Turn the power switch off.
3. Prepare cleaning solution by adding three pounds of cleaner to fifteen gallons of water. RO or pretreated water is desirable.

CAUTION: Water to be used must be chlorine/chloramine free.

WARNING: This water is not suitable to mix dialysate or other fluids used for dialysis purposes.

CAUTION: Make sure that the cleaner is well dissolved, otherwise the solution will not be at full strength, and the undissolved particles may be sucked into the pump resulting in irreversible damage.

4. Connect the disinfect line to the disinfect port of the unit. Put the other end of the disinfect line into the disinfect tank.
5. Remove RO waste line from drain and connect to the disinfect tank.
6. Remove the RO product line from product divert valve assembly (RO product water connection) and place in the disinfect tank.
7. Turn disinfect inlet valve to the open position.
8. Open (counter-clockwise) waste flow valve all the way open.

9. Place the disinfect start key switch into the disinfect position. The motor will start.

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.

CAUTION: Do not allow air to be drawn into the RO System as this will damage the pump.

10. After 20 minutes, shut off recirculation of cleaning solution by placing the disinfect start key switch in the off position.
11. Allow the membranes to soak in the cleaning solution for 1/2 hour.
12. Remove the drain line from the disinfect tank and connect to the drain. Remove the RO Product line and connect to drain. Ensure that the liquid level is below the disconnect fitting before disconnecting the line.

4.7.1.1 Post Powder Cleaning Rinse Procedure

1. Using the disinfection key switch, turn unit on and run cleaning solution to drain until the container is empty. Using the disinfect key switch, turn the unit OFF. Alternatively, the solution may be poured in drain.

CAUTION: DO NOT ALLOW PUMP TO RUN DRY.

2. Rotate disinfect inlet valve to the closed position.
3. Disconnect the disinfect line from the disinfect inlet valve and attach hose from disinfect inlet valve to drain.
4. Ensure that the water supply to the RO unit is on.
5. Turn on power switch to start unit. Let unit operate for five minutes.
6. During this five minute operation, slowly open the disinfect inlet valve to allow water to rinse to drain for one minute. Close valve and disconnect hose to drain.
7. Rotate the waste flow valve (clockwise) to normal waste flow (equal to product).
8. Rinse for 20 minutes until % rejection and TDS monitor displays normalize (e.g. 'normal' % rejection and 'normal' TDS reading). Refer to Operation Log for 'normal' readings and compare to pre-cleaning values.
 - a. During this rinse period, rotate the waste flow valve open and closed three times to build-up and release pump pressure (aids in flushing cleaner from system). DO NOT EXCEED 300 PSI DURING THIS PROCEDURE.
9. 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.

10. When all parameters (% Rejection, TDS, pH) have normalized, turn unit off.

NOTE: If only one cleaner has been used, repeat the procedure with the next cleaner. If both cleaners have been used go to step 11.

11. Reconnect the product line to its original connection.

12. Remove the "**Do Not Use/Contains cleaner**" warning label.

CAUTION: The RO should be disinfected after cleaning procedures are completed.

4.7.2 BIOSAN™ Cleaning Procedure

BIOSAN™ is a liquid cleaner/descaler agent intended for use in removing mineral scale and organic biofilms from RO water systems.

WARNING: BIOSAN™ is not intended for use in hemodialysis machines.

WARNING: The solution is a mild irritant to eyes and skin. It is recommended that protective gloves and eye protection be worn when handling BIOSAN™. Neither respiratory protection nor special ventilation are required.

Materials Required

V-Series Disinfection/Cleaning Kit (P/N 12214)

BIOSAN™ 1 gallon (P/N 10230). BIOSAN™ is also supplied in 5 gallons (P/N 10231).

pH test strips

Current log sheets for water quality comparison.

Cleaning Procedure

NOTE: If your RO system is equipped with a "submersible" high pressure pump, the pump/motor housing must be purged of all air prior to cleaning or disinfection of the machine. This is required because the pump is not self-priming. The pump/motor housing will partially fill with air during normal operation of the RO from air in the water supply. This air will prevent the pump from drawing solution from the cleaning/disinfect tank. Purging is accomplished by turning the RO system on and opening the small valve on the top end of the pump/motor housing very slowly (the pressure inside the pump/motor housing is feed water pressure). Air should be heard escaping to the atmosphere. Once water is seen flowing from this valve, close the valve and turn off the RO in preparation for cleaning or disinfection.

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 water divert
- d. Low pressure switch

Read and understand all BIOSAN™ cleaning instructions before beginning procedure.

WARNING: Label machine with appropriate warning signs such as "**Do Not Use / Contains BIOSAN™**" to prevent use of RO until properly rinsed.

1. Turn on the RO unit. Establish a pre-cleaning % rejection and TDS and record on the Cleaning/Disinfect Log Sheet. Test a sample of product water for pre cleaning pH. Record for later comparison.
2. Prepare a 10% solution of BIOSAN™ by mixing 1 part BIOSAN™ to 9 parts product (RO) water.
 - a. Fill the cleaning solution container with 9 gallons product water.
 - b. Add 1 gallon BIOSAN™ to the 9 gallons product water in the solution container and mix well.
3. Connect the disinfect line to the disinfect port of the unit. Put the other end of the disinfect line into the disinfect tank.
4. Turn the power switch off.
5. Remove waste line from drain and connect to disinfect tank.
6. Remove the product line from the product divert valve assembly (RO product water connection) and place in disinfect tank. Rotate disinfect valve to open position.
7. Turn the disinfect key switch for ten minutes. This will operate the RO pump. Check that there is waste flow within 10 seconds. If not, turn off the disinfect key switch and verify that the disinfect line is connected properly and that disinfect valve is open.
8. Increase the waste flow until the pump pressure is less than 75 PSI. Operate for five minutes and turn unit off. The Flush mode will allow the flow of BIOSAN™ cleaner only on the reject side of the RO membrane to flush particulates away. Very little or no product water will be made.

CAUTION: The BIOSAN™ will foam; this is normal. The foam may be minimized by keeping the 'return' hose under the liquid level in the tank. Damage to the pump may occur if foam is drawn into the pump.

9. Allow the BIOSAN™ to dwell a minimum of one hour.

NOTE: **Thin-film RO membranes:** The RO unit may be stored in BIOSAN™ for up to **two weeks** with systems utilizing thin-film RO membranes.

Cellulose acetate membranes: A maximum dwell time of **four hours** is advised with cellulose acetate RO membranes.

10. Remove the product and waste lines from the solution tank and place in the drain.

4.7.2.1 Post BIOSAN™ Cleaning Rinse Procedure

1. Using the disinfection key switch, turn unit on and run cleaning solution to drain until the container is empty. Alternatively, the solution may be poured in drain.

CAUTION: DO NOT ALLOW PUMP TO RUN DRY.

2. Rotate disinfect inlet valve to the closed position.
3. Disconnect the disinfect line from the disinfect inlet valve and attach hose from disinfect inlet valve to drain.
4. Ensure that the water supply to the RO unit is on.
5. Turn on power switch to start unit. Let unit operate for five minutes.
6. During this five minute operation, slowly open the disinfect inlet valve to allow water to rinse to drain for one minute. Close valve and disconnect hose to drain.
7. Rotate the waste flow valve to normal waste flow (equal to product).
8. Rinse for 20 minutes until % rejection and TDS monitor displays normalize (e.g. 'normal' % rejection and 'normal' TDS reading). Refer to Operation Log for 'normal' readings and compare to pre-cleaning values.
 - a. During this rinse period, rotate the waste flow valve open and closed three times to build-up and release pump pressure (aids in flushing cleaner from system). DO NOT EXCEED 300 PSI DURING THIS PROCEDURE.
9. Test product water for post cleaning pH and compare to pre-cleaning pH level.

WARNING: 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.

10. When all parameters (% Rejection, TDS, pH) have normalized, turn unit off.
11. Reconnect the product line to its original connection.
12. Remove the “**Do Not Use/Contains BIOSAN™**” warning label. The V-Series RO System is now ready for use.

4.8 Membrane Disinfection for Reverse Osmosis

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:

Disinfect the V-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 4.9 for sample procedure.

4.8.1 Disinfection with Formaldehyde

Materials Required

V-Series Disinfection Kit (P/N 12214)

Formaldehyde, 37% 1 gallon

Formaldehyde test kit.

WARNING: Follow all Material Safety Data Sheet (MSDS) precautions and OSHA Standards when handling formaldehyde. 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 FORMALDEHYDE TO COME IN CONTACT WITH SKIN OR EYES.**

CAUTION: RO units with thin film (TF) membranes must be rinsed to drain with normal pressures for a minimum of eight (8) hours before first exposure to disinfectants, or irreversible damage may occur. No sanitizing agent containing chlorine should be used to sanitize this system. Use of chlorine will damage the RO membranes.

Procedure

NOTE: If your RO system is equipped with a "submersible" high pressure pump, the pump/motor housing must be purged of all air prior to cleaning or disinfection of the machine. This is required because the pump is not self-priming. The pump/motor housing will partially fill with air during normal operation of the RO from air in the water supply. This air will prevent the pump from drawing solution from the cleaning/disinfect tank. Purging is accomplished by turning the RO system on and opening the small valve on the top end of the pump/motor housing very slowly (the pressure inside the pump/motor housing is feed water pressure). Air should be heard escaping to the atmosphere. When water is seen flowing from this valve, close the valve and turn off the RO in preparation for cleaning or disinfection.

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 water divert
- d. Low pressure switch

WARNING: Place **DANGER, POISON, or “Do Not Use/Contains FORMALDEHYDE”** signs on all use points in the system.

1. Turn the power switch off.
2. Prepare a 4% solution of formaldehyde, one gallon of 37% formaldehyde to nine gallons of pre-treated water. If the system contains a ZyzaTech disinfect tank, transfer one gallon of formaldehyde to the mix tank, and fill to the ten gallon mark. 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.
3. Connect the disinfect line to the disinfect port of the unit. Put the other end of the disinfect line into the disinfect tank.
4. Remove waste line from drain and connect to the disinfect tank. If the loop piping is not being disinfected at this time, remove the product divert valve assembly (RO product water connection) and place in disinfect tank. Rotate disinfect valve to the open position.
5. Turn disinfect inlet valve to the open position.
6. Place the disinfect start key switch into the on position. The motor will start.

CAUTION: Check that there is waste flow within 10 seconds. If not, turn off power and verify that the disinfect inlet valve is open.

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

7. After 10 minutes, open each use point to draw one liter of formaldehyde solution and test for the presence of formaldehyde (in a distribution loop system). Test product line effluent if unit is disinfected separately from loop.
8. After all use points have had solution drawn and tested positive, run for 10 to 15 minutes longer, then turn off Disinfect key switch.
9. Remove the drain line from disinfect tank and connect to the drain. Ensure that liquid level is below disconnect fitting before disconnecting line. Run product of unit to drain to lower solution level if needed. If unit is being disinfected separately, place product line in drain for rinsing out unit. Protect product line from contamination.

WARNING: Formaldehyde solution may spill from this line; exercise caution.

10. Turn on disinfect key switch and drain tank. Turn off when tank is empty.

CAUTION: Do not run V-Series RO dry.

11. Allow the disinfectant solution to remain in contact for a minimum of two hours, or preferably overnight.

NOTE: Unit may be stored for up to one year at this time. Refer to section 4.10, System Storage.

4.8.1.1 Post Formaldehyde Disinfection Rinse Procedure

1. Rotate disinfect inlet valve to the closed position.
2. Disconnect the disinfect line from the disinfect inlet valve and attach hose from disinfect inlet valve to drain.
3. Ensure that the water supply to the RO unit is on.
4. Turn on system power and run unit for 10 minutes.
5. During this ten minute operation, slowly open the disinfect inlet valve to allow water to rinse to drain for one minute. Close valve and disconnect hose to drain.
6. Turn off system power for 1 minute. Turn on system power for 2-3 minutes. Repeat this step three times. This will help to rinse out any trapped formaldehyde in the V-Series RO.
7. With system power on, continue to rinse for 20-30 minutes. During this time, open each use point in the loop, if any.
8. Check each use point for disinfectant. If the test is positive, continue to rinse until a negative test is reached at each use point. Remove "DO NOT USE" signs from use points only after negative test at each use point in the distribution plumbing. Reconnect product line to loop piping if unit was disinfected separately.

4.8.2 Disinfection with Renalin® / Minncare®

CAUTION: RO units with thin film (TF) membranes must be rinsed to drain with normal pressures for a minimum of eight (8) hours before first exposure to disinfectants, or irreversible damage may occur.

WARNING: Follow all MSDS precautions and OSHA Standards when handling Renalin® / Minncare®.

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

CAUTION: When Renalin® / Minncare® is to be used as a disinfectant, ZyzaTech and the membrane manufacturer require that several preparatory steps be performed by the system operator:

1. The system must be free of all incompatible materials.
2. 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.
3. Clean the membranes with an acid such as 0.1% HCl or 0.4% phosphoric acid. Calcium and iron cleaner or BIOSAN™ may be used as an alternative. It is essential that all iron and other transition metals be removed from the membrane surface. Renalin® / Minncare® reacts with certain metals such as iron, on the membrane surface, causing irreparable damage.
4. The RO system must be disconnected from the tempered water source (if present). If the solution make-up water supply is warm (near 77°F / 25°C), the solution temperature must be monitored closely. 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: At temperatures above 77°F (25°C) the Renalin® / Minncare® solution becomes very aggressive towards the RO membranes and will damage them in a short period of time.

Materials Required

V-Series Disinfection Kit (P/N 12214)

Renalin® / Minncare®, 1 quart

Renalin® / Minncare® test kit.

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.

Procedure

NOTE: If your RO system is equipped with a "submersible" high pressure pump, the pump/motor housing must be purged of all air prior to cleaning or disinfection of the machine. This is required because the pump is not self-priming. The pump/motor housing will partially fill with air during normal operation of the RO from air in the water supply. This air will prevent the pump from drawing solution from the cleaning/disinfect tank. Purging is accomplished by turning the RO system on and opening the small valve on the top end of the pump/motor housing very slowly (the pressure inside the pump/motor housing is feed water pressure). Air should be heard escaping to the atmosphere. When water is seen flowing from this valve, close the valve and turn off the RO in preparation for cleaning or disinfection.

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 water divert
- d. Low pressure switch

WARNING: Place **DANGER, POISON, or "Do Not Use/Contains Renalin® / Minncare®"** signs on all use points in the system.

1. Ensure the cleaning/disinfection reservoir is clean. Add ten gallons (36 liters) of RO permeate to reservoir.
2. Add 13 ounces (400 milliliters) of Renalin® / Minncare® concentrate to the reservoir and mix to prepare a 1:100 dilution of Renalin® / Minncare®.

CAUTION: A dilution of Renalin® / Minncare® higher than 1% must NOT be used, or damage to the membranes will result.

3. Connect the disinfect line to the disinfect port of the unit. Put the other end of the disinfect line into the disinfect tank.
4. Remove the RO product line from the product divert valve assembly (RO product water connection) and place in the disinfect tank. Rotate disinfect valve to the open position.
5. Disconnect the waste line from the drain connection and connect to Renalin® / Minncare® solution reservoir.
6. Place end of the product line in the Renalin® / Minncare® solution reservoir. Rotate disinfect inlet valve to the open position.

7. Turn disinfect key switch and circulate the Renalin® / Minncare® solution through the system for five minutes. After three minutes of recirculation, test the product line for Renalin® / Minncare®. If necessary, continue recirculation until a positive test is obtained.

CAUTION: Do not allow the solution temperature to climb above 77°F (25°C) during this step. Failure to control temperature will result in rapid deterioration of the membrane, resulting in high salt passage.

8. Place the product and waste lines into the drain. Protect the product tube from contamination. Turn on the disinfect key switch until the reservoir empties. Turn off the RO; do not operate the RO dry.
9. Rotate the disinfect valve to the closed position. Allow the elements to soak in the disinfecting solution for 2-12 hrs.

CAUTION: Do not allow the Renalin® / Minncare® to swell more than 12 hours, or the RO membranes will be permanently damaged.

10. Place warning signs on unit.

4.8.2.1 Post Renalin® / Minncare® Disinfection Rinse Procedure

1. Ensure product and waste lines are routed to drain.
2. Rotate the waste flow valve counter clock wise to full open to increase the waste flow and speed rinsing.
3. Disconnect disinfect line from disinfect inlet valve and attach hose from disinfect inlet valve to drain.
4. Turn on RO pump power switch and run unit for 10 minutes.
5. During this ten minute operation, slowly open disinfect inlet valve to allow water to rinse to drain for one minute. Close valve and disconnect hose to drain.
6. Rotate waste flow valve clock wise to equal waste flow to product flow.
7. Turn off power switch for 1 minute. Turn on power switch. This will rinse out any trapped disinfectant in the V-Series RO. Repeat 3 times.
8. Continue to rinse for an additional 5 minutes.
9. Check product line for residual disinfectant with test kit. If the test is positive, continue to rinse until a negative test is obtained. Remove warning signs from unit only after negative test is confirmed.
10. The V-Series is now ready for use.

4.9 Product Water Culture Procedure

FREQUENCY: Once a month (or more often, depending upon culture results and facility policy).

MATERIALS NEEDED: Sterile specimen container, Commercial Standard Plate count sampler, or whatever container your lab may require, long sleeves, gloves and large container (such as a bucket).

RATIONALE: To ensure that the microbial count of the product (RO) water complies with the AAMI Hemodialysis Water Standard. The AAMI standard maximum allowable concentration for bacteria in product water is 200 cfu/ml. (colony forming units). A bacteria count above the acceptable level of bacterial concentration may be harmful to the hemodialysis patient.

NOTE: Consult your lab to find out what type of sterile container 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” nor a pour plate technique should be used, with trypticase soy agar or equivalent agar, NOT blood agar. If tested incorrectly the results may be inaccurate. The sample should be assayed within 30 minutes of collection or refrigerated (5°C) immediately and assayed within a 24 hour period.

PROCEDURE:

NOTE: 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 instructions before initiating water culture procedure.
2. Turn on RO unit. Allow RO unit to run for 10-15 minutes.
3. Using aseptic technique, hold product line over a container and allow approximately 3 liters of product (RO) water to drain (or allow product water to flow for 30 seconds).
4. Maintaining aseptic technique, hold the product line over a sterile container (e.g., Millipore® commercial sampler, or lab recommended container) with the product water flowing.
5. Fill the sterile container with the appropriate amount of product (RO) water. (If using commercial samplers, follow the manufacturer’s instructions.)
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 and machine number.
 - Time and date sample obtained.
 - Person who obtained specimen.
 - Any other pertinent information or procedures your facility or lab requires.
8. The sample must be assayed within 30 minutes of collection, or refrigerated (5°C) immediately and assayed within a 24 hour period.
9. Make certain that your laboratory is informed of the correct procedure for performing a product water culture. If tested incorrectly, the results may be inaccurate.

4.10 System Storage

This storage procedure has been established to store both cellulose acetate (CA) and thin film composite (TFC) RO units. It is not recommended that a unit be dormant longer than 24 hours without disinfectant. Units that have been left dormant 24 hours risk the possibility of exceeding the acceptable bacterial colony count. Units to be stored should first be disinfected with one of the acceptable procedures in this chapter.

WARNING: Renalin® / Minncare® is NOT an acceptable disinfectant for storage of systems. Storage of systems with Renalin® / Minncare® will result in irreversible damage.

4.10.1 Formaldehyde Storage Procedure

WARNING: Always wear rubber gloves, apron and face mask. 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 EYE.**

1. If formaldehyde is chosen to disinfect the unit, follow the instructions for formaldehyde disinfection, in this chapter.
2. Do not rinse out the formaldehyde after it has been introduced to the RO unit.

NOTE: All units can be safely stored in 4% formaldehyde for up to one year.

WARNING: After storage, the RO 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).

4.10.2 BIOSAN™ Storage Procedure

1. Disinfect and rinse the RO unit with an acceptable disinfectant. Follow one of the disinfection and rinse procedures previously in this chapter.
2. Follow the BIOSAN™ cleaning procedure in this chapter.
3. Do not rinse out the BIOSAN™ after it has been introduced to the RO unit.

CAUTION: **Thin-Film** membranes should not be stored for more than two weeks in BIOSAN™.

Cellulose Acetate membranes should not be stored in BIOSAN™.

WARNING: After storage, the RO must be completely rinsed of BIOSAN™, and a bacterial culture performed and interpreted before use (refer to Post BIOSAN™ Rinse procedure and Product Water Culture Procedure).

CHAPTER FIVE: TROUBLE SHOOTING GUIDE

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CHAPTER FIVE TROUBLE SHOOTING GUIDE

5.1 Unit Fails to Run

1. Power off.
 - a. Check position of switches.
 - b. Check position of service disconnect switch.
 - c. Check power with voltmeter.
 - d. Check fuses at service disconnect and on transformer in high voltage portion of controller.

2. Improper line voltage.
 - a. Verify that line and equipment voltages are compatible.

3. Loose electrical connections.
 - a. Check all wiring connections to verify solid connection.

4. RO Interlock activated.
 - a. Check status of interlocks and correct lockout condition.
 - i. Pressure switch is closed.
 - ii. Optional disinfect relay is closed.
 - iii. Temperature Alarm Monitor is in alarm mode.

5. Motor starter inoperative.
 - a. Check power to magnetic starter.
 - b. Check contactor thermal overload, reset if tripped. (Correct condition that would cause thermal overload to trip.)
 - c. If power OK replace starter relay.

6. Power switch inoperative.
 - a. Replace power switch.

7. Pressure switch inoperative.
 - a. Verify that feed pressure is at least 30 PSI, and if not, verify that inlet water valve is open.
 - b. Replace pressure switch.

8. Pump motor burned out.
 - a. Verify that voltage supply is correct and motor 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.

5.2 Unit Runs Intermittently

1. Low water pressure (static or dynamic)
 - a. Correct cause of low pressure (adjust pressure regulator or install booster pump).
2. Low feed water flow rate (dynamic)
 - a. Replace pre-filter cartridge.
 - b. Check pretreatment devices.
 - c. Check that water supply valves are open.
3. Loose electrical connection.
 - a. Verify that all wiring connections are secure.
4. Oversensitive pressure switch.
 - a. Adjust or replace pressure switch.
5. Thermal overload trips.
 - a. Verify line voltage and motor amperage draw.
 - b. Verify overload amperage setting.

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. Excessive current draw.
 - a. Verify that flow rates and pressure are within unit specifications.
 - b. Confirm amperage draw with meter. (All legs should be within 10% of each other.)
 - 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).
 - e. Motor insulation shorted, replace motor.

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 Unit is Off

1. (Optional) by-pass valve open, check valve missing or inoperative.
 - a. Clean or replace valve.
2. Faulty solenoid valve.
 - a. Cycle valve off and on with power switch to clear obstruction.
 - b. Disassemble valve, clean and inspect diaphragm and seat.
 - c. Replace valve.

5.5 Low Waste Pressure

1. No pressure develops above level of feed pressure.
 - a. Verify pump rotation.
 - b. Inspect motor and pump coupling for wear at shaft key. (Non Submersible only)
2. Pressure develops but does not achieve normal operating pressure.
 - a. Waste or product flow too high.
 - i. Adjust waste flow to equal product flow rate
 - ii. Adjust system pressure.
 - b. Incorrect pump rotation (3 phase motors only).
 - i. Switch any two of three power leads to unit at service disconnect.
 - c. Faulty pressure relief valve.
 - i. Replace valve.

5.6 Pressure Gauges Vibrate Erratically

1. Obstruction in pressure gauge orifice.
 - a. Remove obstruction.
2. Air in pressure gauge line.
 - a. Loosen tubing connection on pressure gauge to bleed air.
3. Faulty gauge.
 - a. Replace gauge.

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 pressure 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 outline in manual.
- 4. Center tube of ROMA collapsed from operating at high temperatures.
 - a. Correct high temperature condition.
 - b. Replace membranes.
- 5. Check pretreatment for brackish water.
 - a. Check input water conductivity.

5.9 Product Flow too High

- 1. Rejection Satisfactory.
 - a. Waste pressure too high.
 - i. Adjust pressure regulator.
 - ii. Waste flow too low.
 - b. Temperature too high.
 - i. Adjust temperature blending valve.
 - ii. Correct plumbing error that allows the cold water to be heated.
- 2. Rejection Unsatisfactory.
 - a. ROMA internal seals damaged, dirty, or dislodged.
 - i. Disassemble ROMA, clean and inspect "O" ring and seals.
 - b. Membrane hydrolyzed. Damaged due to exposure to oxidant.
 - i. Verify condition of pretreatment equipment. (GAC tank)
 - ii. Replace membrane.
 - c. Waste flow too low.
 - i. 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. See membrane cleaning procedure in this manual.

5. Erroneous meter readout.
 - a. Verify water quality with independent meter.
 - b. Feed water probe wire disconnected or loose.
 - c. Replace feed 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 section 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. See 5.10, number 5 above.
6. Membrane failure.
 - a. Replace membrane.
7. Change in feed water TDS.
 - a. Verify water quality with independent meter.

5.12 RO Fails to Draw Disinfectant

1. Disinfect inlet valve closed.
 - a. Open disinfect inlet 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. See section 5.1.
- 6. Solenoid failure in open position. (Fluid level in tank will increase)
 - a. See section 5.4.

5.13 RO Pump Leaks at Inlet End

- 1. Inlet connection leaking.
 - a. Tighten inlet fitting.
- 2. Mechanical seal failure. (Non Submersible only)
 - a. Replace seals.

5.14 Product Divert Controller and Valve Malfunction

- 1. Product Divert indicator not illuminating during TDS alarm.
 - a. Check wire connections to light.
 - b. Check light bulb.
- 2. Flow to drain from valve.
 - a. Product water TDS above alarm set point.
 - i. Correct high TDS conditions, refer to section 5.10.
 - b. Electrical valve not closed.
 - i. Ensure power cord is plugged in.
 - ii. Check movement of the valve.
 - iii. Check electrical connections.
 - iv. Replace valve.
- 3. Flow to drain from valve
 - a. Product water TDS low
 - i. Normal operation
 - b. Product water TDS above set point, product divert indicator lamp illuminated.
 - i. Ensure power cord is plugged in.
 - ii. Check movement of the valve, see.
 - iii. Check electrical connections.
 - iv. Replace valve.

- c. Product water TDS above set point, product divert indicator lamp not illuminated.
 - i. See section 1.
 - ii. Ensure power cord is plugged in.
 - iii. Check movement of the valve.
 - iv. Check electrical connections.
 - v. Replace valve.

- 4. Timer setting.
 - a. Setting too high.
 - i. Adjust knob on timer counter clock wise to decrease the divert cycle duration.

 - b. Setting too low.
 - i. Adjust knob on timer clock wise to increase the divert cycle duration.

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V-Series Spare Parts List

NOTE: Motors and non-submersible pumps/motors are voltage specific, and are not listed here. Please call ZyzaTech Technical Service for assistance.

Description	Catalog Number
Cycle Timer (Auto Flush)	20192
Disinfect switch	20007
Disinfect valve 3/4"	40352
Flow meter, 0.5 - 5.0 GPM	40337
Flow meter, 1.0 - 10 GPM	40396 ***
Fuse, 1 amp	20120 *
Gauge, 0-100 PSI	40674 *
Gauge, 0-600 PSI	40675 *
Lamp, 1/4", 120 VAC, green	20173
Lamp, 1/4", 120 VAC, red	20174
Lamp, 1/2", 120 VAC, green	20037 *
Lamp, 1/2", 120 VAC, red	20036 *
Membrane cleaner, BIOSAN™, 5 gallon	10231
Membrane cleaner, silt and organic, 5 lb.	10902 *
Membrane cleaner, calcium and iron, 5 lb.	11351 *
Membrane only, cellulose acetate 4X40	40100
Membrane only, Thin Film 4x40 CAGE	40182A
Motor contactor delay timer relay	12407
Motor contactor, 3 PH	30182
Override switch	30123
PCB assembly, conductivity	12311
PCB assembly, display	12312
PCB assembly, percent rejection	12310
PCB assembly, power supply	12315
Plug-in relay	20100
Power switch	20053 *
Pre-filter assembly, 20"	40171
Pre-filter cartridge, 5 micron 20" 4 pack	40170/4 **
Pressure switch	30147
Pressure switch delay timer relay	12406
Pump only, Whisperflow 3 hp	10240 ****
Pump only, Whisperflow 5 hp	10261 ****
Pump waste pressure valve	40086 *

- * Suggested Stock Items
- ** Suggested Stock Items if applicable to unit
- *** Optional
- **** Refer to equipment for applicable part

V-Series Spare Parts List, Continued

NOTE: Motors and non-submersible pumps/motors are voltage specific, and are not listed here. Please call ZyzaTech Technical Service for assistance.

Description	Catalog Number
QD, Female x 1" hose barb	40863
QD, Male x 1" NPT	40864
Relay, 12 volt DC	20099
Relay, 110 volt AC	20100
Relay, Adjustable timer	20189
ROMA assembly, TF 4x40 (complete)	14403
Sensor probes	12131 *
Solenoid valve (3/4")	41172
Temperature switch	30151
Temperature transducer	30150
Thermal overload 7.5-11 amp	30185 ****
Thermal overload 10-14 amp	30033 ****
Thermal overload 13-19 amp	30187 ****
Thermal overload 18-25 amp	30186 ****
Thermowell, SS	30149
Valve, ball, 1", electrical	41582
Waste flow valve	40700

- * Suggested Stock Items
- ** Suggested Stock Items if applicable to unit
- *** Optional
- **** Refer to equipment for applicable part

CHAPTER SIX: DRAWINGS

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CHAPTER SEVEN: TECHNOTES

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CHAPTER EIGHT: LOG SHEETS

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CHAPTER NINE: WARRANTY

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