



Better Water Incorporated

Revision 8-31-2006

Reverse Osmosis Operator's Manual

For BWI Series 2020,2436 and 3046

Better Water, Inc.

Specialists in Water Purification Systems

Hemodialysis • Medical • Pharmaceutical • Commercial • Industrial



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Better Water Incorporated

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Introduction

Our Company

Better Water, Inc. is a leading integrated manufacturer of water treatment machines, components and equipment for the industrial, commercial and institutional markets.



Located in Smyrna, Tennessee, Better Water Incorporated continues its history of manufacturing and worldwide distribution of equipment specifically designed for the renal dialysis market.

Founded in 1971, Better Water has built a reputation for solving our customers' toughest problems with high-quality products and unmatched service.

User Assistance Information

Support is available regarding your system 24 hours a day.

Normal business hours are Monday through Friday (excluding holidays)
8:00 am to 3:30 pm Central Time call :

615-355-6063

Emergency Assistance is available after normal business hours (including holidays)

BEFORE calling for emergency assistance:

- Check the Operator's Trouble-shooting guide
- Check the electrical power connections, fuses and/or circuit breakers
- Check all valves to ensure each is in the correct position.

If this fails to correct the problem and a hemodialysis treatment emergency situation exists, call:

615-355-6063

Your call will be automatically forwarded to the on-call cell phone directory. Please copy all the numbers and select the most appropriate number for your emergency.

Contact Us

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Warnings

Important Operator Warnings

1. It is unsafe to operate or service this device without first reading and understanding the **entire** Operator's Instruction Manual. Keep this manual and other associated documentation for future reference.
2. Misuse, improper operation, and/or improper monitoring of this system could result in serious injury, death, or other serious reactions to patients undergoing hemodialysis treatment.
3. Misuse, improper use or handling of disinfectants and chemical cleaning solutions could result in serious injury or even death. You must comply with the information contained in the Material Safety Data Sheet (MSDS) for the chemical being used.
4. To avoid electrical shock hazard, do not operate this device when the covers or panels are removed.

Electromagnetic Interference

This device can create and radiate radio frequency energy and may cause harmful interference if not installed according to the manufacturer's instructions.

NOTICE

All graphics or pictures used in this manual are representative examples and used for clarification only. The object(s) depicted may differ from the actual unit.

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User Cautions

User Cautions

1. When used as a medical device, federal law restricts this device to sale by or on the authority of a physician. Per CFR 801.109 (b)(1).
2. Improper operation of any of these devices could result in a low or no-flow alarm on the dialysis machines.
3. Misuse or improper operation of these devices will void any warranty.
4. Where water is mentioned, unless otherwise noted, it must be AAMI standard quality water.
5. Electrical and plumbing connections must adhere to local statutes and any facility codes. Connect this device to a proper ground connection in accordance with the National Electrical Code. Do not remove the ground wire or ground plug. Do not use an extension cord with this equipment.
6. Do not remove any Caution, Warning or any other descriptive labels from the device.
7. Do not operate this device in an explosive environment or in the presence of flammable materials. Do not use this device to store, mix or transfer flammable liquids.
8. Movement or vibrations during shipment may cause connections to loosen.
9. Do not operate this unit in an environment where temperatures may be below 50° F or above 90° F.

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System Requirements

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System Prerequisites

Space

The system should be level and located as close as possible to the point of use.

Minimum space required 60" Deep x 40" to 102" Wide (depending upon model and configuration) x 72" Tall.

The floor must be capable of support up to 500 pounds.

Space considerations should include adequate Operator access.

Water Supply

The system requires a 1 inch female NPT threaded water connection with an adjacent shut off valve.

Drain

The system requires a sanitary drain capable of discharging 20 gallons per minute (GPM) or better.

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Feed Water Requirements

Pressure

The importance of monitoring and controlling the municipal tap water can not be underestimated. The RO feed water must meet the following parameters:

40 psi (**Minimum**) to 90 psi (Maximum). The minimum pressure must be maintained with water flowing at the maximum required flow-rate.

Flow Rate

The Requirement for Feed Water will be determined by the size and model of the specific RO.

Refer to the unit's Specification Sheet for specific flow values.

Chlorine / Chloramines

Chlorine is commonly used as a disinfecting agent in municipal systems. Disinfection byproducts can form when disinfectants, such as chlorine, react with naturally present compounds in the water.

Chlorine/Chloramines in the RO unit feed water must be less than 0.1 ppm.

Silt Density Index

Silt Density Index (SDI) is a test to measure of the level of suspended solids in feed water. High SDI values can lead to membrane fouling.

A SDI of less than 3 is considered acceptable for the RO system.

Turbidity

Turbidity is the amount of small particles of solid matter suspended in water as measured by the amount of scattering and absorption of light rays caused by the particles.

Feed water turbidity must be less than 1 nephelometric turbidity units (NTU).

Hardness

Hardness is a characteristic of feed water due to the presence of dissolved calcium and magnesium; water hardness is responsible for most scale formation and can form insoluble residue in pipes and other water contact surfaces. Hardness is usually expressed in grains per gallon or parts per million, all as calcium carbonate equivalent.

Hardness level of feed water for the RO system must be less than 2 gpg (grains-per-gallon) or 34.2 ppm (parts-per-million).

Temperature

Feed water temperature must be between 70 and 92°F. (Optimum: 77°F; at 93°F, RO will shut-down in a high feed temp. alarm).

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RO System Components

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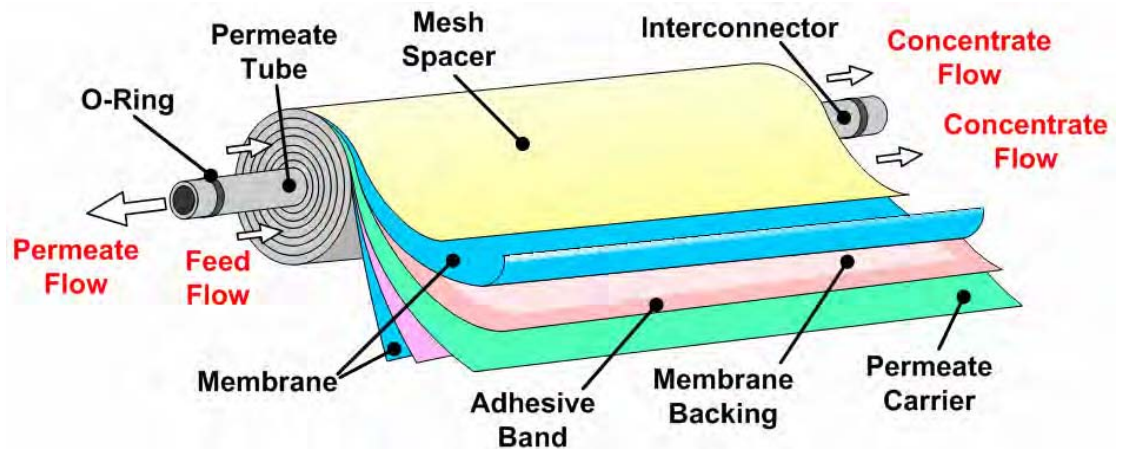
Fluid Contact Materials

Membranes

Component Description

The RO system fluid contact components are constructed entirely of polyethylene, 300 series stainless steel or other AAMI recognized materials. These components include:

The Reverse Osmosis process uses a semi-permeable membrane to separate the dissolved solids, organics, pyrogens, submicron colloidal matter from the water. The process is called "reverse" osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind. Reverse Osmosis is capable of removing 95%-99% of the total dissolved solids (TDS) thus providing safe, pure water.



Example of a Reverse Osmosis Membrane

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RO Single Membrane Specification* (Equivalent or Better)

	4.0 x 40
Membrane Type	Polyamide
Configuration	Spiral wound full fit
Active Membrane Area	85 - 90 sq. ft
Recommended Applied Pressure	100 - 200 psi
Max. Applied Pressure	400 psi
Max. Operating Temperature	122 F
Feed Water PH Operating Range	4.0 - 11.0
Optimum PH Range for Optimum % Rejection	5.0 - 8.5
Chlorine Tolerance	< .1 ppm
Max. Feed Flow GPM	20
Minimum Brine Flow / Permeate Flow Ratio	5:1
Max. SDI (15 minuets)	3
Max. Turbidity NTU	< 1
Permeate Flow GPD	2487.5 (+/- 25%)
Minimum Rejection Rate	98% based on test conditions

*Test Conditions = 2000 ppm NaCl @ 225 psi, 77° F, 15% recovery, pH 8.0

Nominal Rejection Characteristics of Reverse Osmosis Membranes
(Equivalent or Better)

Ion	% Rejection*	Ion	% Rejection*	Ion	% Rejection*
Sodium	90-95	Lead	94-96	Cadmium	95-97
Calcium	92-95	Chloride	90-95	Silver	90-95
Magnesium	94-97	Bicarbonate	85-95	Mercury	94-96
Potassium	85-95	Nitrate	50-70	Barium	94-96
Iron	92-96	Fluoride	85-90	Chromium	94-96
Manganese	92-96	Silicate	80-90	Bromide	85-90
Aluminum	95-98	Phosphate	95-97	Borate	25-50
Ammonium	85-90	Chromate	80-90	Sulfate	96-98
Copper	96-98	Cyanide	80-90	Arsenic	90-95
Nickel	96-98	Sulfite	94-96	Selenium	90-95
Zinc	96-98	Thiosulfate	94-97	Ferrocyanide	96-98
Strontium	95-97				

*The above percent rejection is for reference only. Actual rejection will depend on the exact chemistry, temperature, pressure, and TDS content of the feed water.

Source: Applied Membranes, Inc.

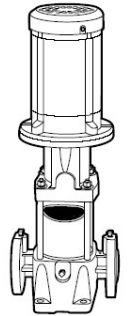
RO Pump - Air Cooled

Description

A stainless steel, multi-stage, air-cooled centrifugal pump designed for continuous duty service. The pump is powered by a 2 hp, 3 hp or 5 hp motor that operates continuously. When a no-water situation occurs, the pump will automatically shut-down to prevent damage from running dry.

The features and specifications of this device include, but are not limited to :

- 304 Stainless Steel construction
- Heavy-duty cast motor bracket
- 304 SS and 316 SS impellers, diffusers and 316 SS shaft for superior corrosion resistance
- Aluminum-oxide ceramic chamber bearings with tungsten-carbide bearing rings for extra durability
- Self-aligning Teflon® impeller wear rings.



**Example of
Air-Cooled
Pump**

When May Be Omitted

The pump is an integral component of the RO unit and can not be omitted.

Daily Startup

There are no daily startup requirements.

Monitoring Requirements

The performance is monitored daily by the user to ensure design pressure is being maintained.

Consequences of Failure

If this device should fail, AAMI quality water will not be produced by the RO and could cause harm to the patients undergoing hemodialysis treatments.

Maintenance

Other than routine cleaning of the exterior surfaces, there is no required cleaning or maintenance schedule or procedure.

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Variable Frequency Drive

Description

Variable-frequency drives are reliable, easy to operate, increase the degree of flow control, and reduce pump noise. A variable-frequency drive is an electronic controller that adjusts the speed of an electric (RO Pump) motor by modulating the power being delivered. Variable frequency drives provide continuous control matching motor speed to the specific demands of the work being performed.



Example of Variable Frequency Drive Controller

The features and specifications of this device include, but are not limited to:

- Speed regulation of 0.1% over a 60:1 speed range
- Master/follower configurable bipolar trimming with adjustable bandwidth
- Volts/Hz - constant torque, variable torque, automatic torque boost, sensorless vector, automatic energy savings, and permanent-magnet motor control
- Extreme continuous operating voltage 230V class: 200VAC -10%, 240VAC +10%, 480V class: 380VAC -10%, 500VAC +10%

Energy savings from variable-frequency drives can be significant. Even a small reduction in motor speed will highly leverage energy savings. Variable-frequency drives can reduce a pump's energy use by as much as 70%. A variable frequency drive controlling a pump motor that usually runs less than full speed can substantially reduce energy consumption over a motor running at constant speed for the same period.

When May Be Omitted

The variable frequency drive is a device used in conjunction with the RO Pump and cannot be omitted.

Daily Startup

There are no startup requirements for this device.

Monitoring Requirements

The performance is monitored daily by the user to ensure design pressure is being maintained.

Consequences of Failure

The probability of failure is remote; however should the variable frequency drive fail, the RO pump will not operate properly.

Maintenance

Other than routine cleaning of the exterior surfaces, there is no required cleaning or maintenance schedule or procedure.

Pressure Transmitter

Description

The measurement of water pressure during the operation of the system will be accomplished using a Digital Pressure Transmitter.

The pressure sensor uses either piezo-resistive or metallic thin film to convert input mechanical pressure into an output electrical signal.

The features and specifications of this device include, but are not limited to :

- Materials (Wetted Parts) - 300 Series Stainless Steel
- Materials (Case) - 300 Series Stainless Steel
- Pressure Rating -0-300 psi (RO Pump Pressure)
- Power Supply - 24 VDC
- Max Load - 20 mA, 2 wire



Example of Pressure Transmitter

When May Be Omitted

The pressure transmitter is required for the Variable Frequency Drive controlling the RO pump, and therefore cannot be omitted.

Daily Startup

This device is automatic and requires no operator start-up procedures.

Monitoring Requirements

The performance is monitored daily by the user to ensure design pressure is being maintained.

Consequences of Failure

If the Pressure Transmitter fails, the RO Pump will operate continuously at maximum pressure.

Maintenance

Other than routine cleaning of the exterior surfaces, there is no required cleaning or maintenance schedule or procedure.

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Water Quality Monitor

Description

The Poor Water Quality Monitoring Box is a molded plastic box, usually located on the patient floor, in a position where it can be easily seen by clinic personnel during normal work duties. The box is equipped with remote audio and visual alarms that monitor the Resistivity and/or Conductivity Meters (usually located in the water treatment room. Under normal conditions, a green "GOOD QUALITY" light will be illuminated. In the case of water quality changes, (monitored by the Resistivity or Conductivity meter) the red "POOR QUALITY" light will illuminate, an audible alarm will sound, and the "GOOD QUALITY" light will turn off. The Poor Water Quality Monitoring Box requires no external power supply, but receives 24vac power and signals from the meters from which they are monitoring. If both Conductivity and Resistivity Meters are used, a Poor Water Quality Monitoring Box is required for each.

When May Be Omitted

The Poor Water Quality Monitoring Box is an option offered to the customer for convenience and is not required.

Daily Startup

This device is automatic and requires no daily startup procedures.

Monitoring Requirements

This is a monitoring device; therefore it will be monitored constantly, as to the state of the water, determined by the Resistivity and / or Conductivity meters.

Consequences of Failure

The probability of failure is remote; however, should the Poor Water Quality Monitoring Box fail, the clinic personnel may not be aware of the changes in water quality.

Maintenance

See the Section – Maintenance.

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Miscellaneous

Feed Water Low Pressure Switch

The Pressure Switch is located on the suction side of the pump. The switch, via the main controller board, acts to shut down the RO in the event of insufficient pressure to the RO.

Keyed Switch

A keyed switch is an additional safety feature and prevents unauthorized activation of the disinfect cycle. A key must be inserted to place the unit into the disinfect mode.

Alarm Lights

An Alarm light will be turned on when any alarm conditions occur. The light will remain on until the alarms conditions are cleared and the alarms are reset by the RESET button on the Control Panel.

NOTICE

If the alarm condition is caused by poor water quality in the first 3 minutes, the alarm light will be on, the audio alarm will not sound, and the alarm condition will not be sent to the nurse's station. The light will go out when the water quality meets the requirement(s). After 3 minutes, if the water quality alarm condition persists, both the light and audio alarm will be on. The alarm condition will be sent to the nurse's station.

Flush Timer

The Flush Timer is an important component of the Reverse Osmosis Machine. The flush timer is a 24-hour adjustable 24 volt mechanism that controls the frequency and duration of the Flush Cycle.

There are 96 Switch Actuators that give switching intervals of 15 minutes each. Depending on your operation, you will be using only 1 to 4 of these. The Switch Actuators are easily set by using a small blade screwdriver.

The dial contains the Switch Actuators and a Black Ring that is clearly visible and located directly under the Switch Actuators. The disc serves two purposes: It is used to set the time of day, and the Black Ring will indicate the Switch Actuators "ON" position for Switch Actuator(s) that have been selected.

Power failures and any time the Reverse Osmosis Machine has been either physically disconnected from its power source or electrically disconnected by turning the circuit breaker off will cause an incorrect time of day setting. It must be checked DAILY for correct time of day setting.

The Flush Timer was preset at the factory and re-set by the system installers on the day of the installation. Once the Frequency and the Length of the Flush Cycle have been set, that setting will remain until manually changed.

For details regarding the Flush Timer, see the section Maintenance – Flush Timer Adjustment.

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RO Operation

Revision 8-31-2006

Reverse Osmosis Operator's Manual

System Operation

Your Better Water Reverse Osmosis (RO) Machine is computer-aided designed, custom built, and of the utmost quality. With proper operation, maintenance and care, this device should give you years of reliable service.

Before you start using this device, Operators must read and understand this manual in its entirety. This manual of Operator's Instructions describes in considerable detail all of the steps and procedures required to **safely** operate this device.

It is **unsafe** to operate this device without a basic understanding of water treatment and a thorough understanding of the contents of this manual.

The RO was designed and built to your facility's specifications and information regarding the current tap water conditions at your site.

There is not a Reverse Osmosis Machine on the market that is a panacea for all water treatment requirements. The RO cannot do the job alone. It is imperative to monitor the tap water and feed water conditions.

Incoming tap water **contaminants, temperature, pH, pressure and flow-rates** have a **direct impact** on the **quality** and **quantity** of the Reverse Osmosis Machine **output**.

The Operator must be aware of changing tap water conditions. This can be easily accomplished with good, two-way communications with the local municipal water supplier and with routine testing of the tap water.

To emphasize the importance of water treatment and proper use of water treatment equipment used for hemodialysis, the following is quoted from Health and Human Services Publication FDA 89-4234,

"Numerous reports have documented that use of inadequately treated water for hemodialysis poses a severe threat to the health and safety of the hemodialysis patient. Despite this, water treatment and water quality are often neglected areas of hemodialysis. A major reason for this neglect is that water treatment is a technically complex subject which is not generally a part of the education and training of clinical staff in hemodialysis facilities."

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Reverse Osmosis (RO) Machine

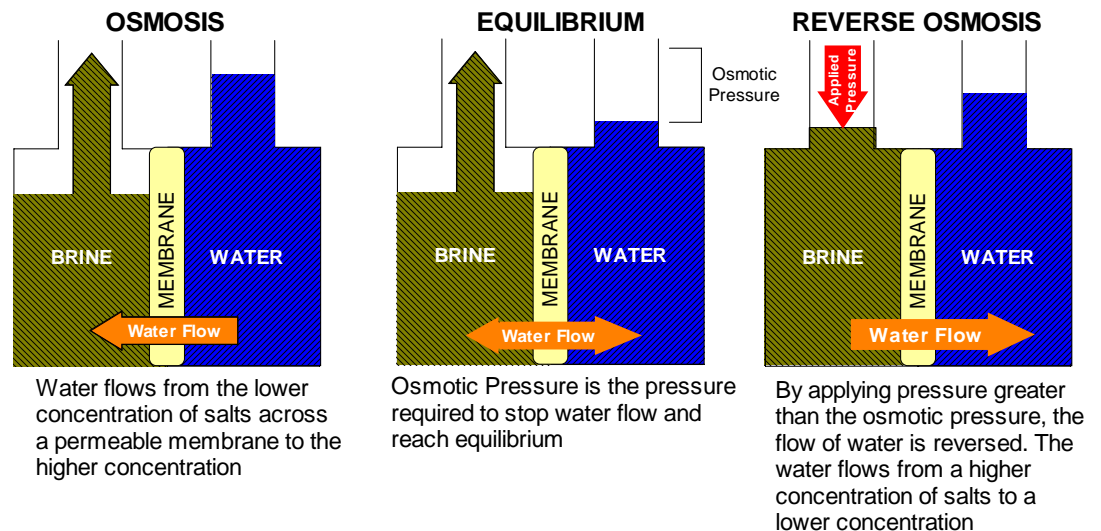
Description

The Reverse Osmosis (RO) Machine is computer aided designed, multiple-membrane, multiple-array device that is pressurized by a stainless steel pump and motor.

The Reverse Osmosis process uses a semi-permeable membrane to separate and remove dissolved solids, organics, pyrogens, submicron colloidal matter from the water. The process is called "reverse" osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind. Reverse Osmosis is capable of removing 95%-99% of the total dissolved solids (TDS) thus providing safe, pure water.

Based upon your facility's specifications and information about tap water data, the RO was custom designed and built to exacting standards and Good Manufacturing Practices as outlined by the FDA.

The RO is a device that uses a membrane separation process for removing solvent (contaminants) from solution (tap water).



The RO is the most important and costly component in the water treatment system. With appropriate pretreatment of the tap water, proper cleaning and disinfection, the RO life can be prolonged for several years.

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Reverse Osmosis (RO) Machine

Startup Pre-Checks

Unit Startup

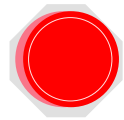
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Check the RO CONTROL PANEL:

- a) All alarm lights should be **OFF** and **NO** audible alarm should be sounding. If any one or more of the alarm lights are **ON** and/or an audible alarm is sounding, **PRESS** the Alarm **RESET** button. All alarm lights should go out and audible alarms should stop sounding.

ALARM RESET

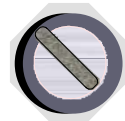


WARNING

Disinfectants can cause serious injury or death to patients undergoing hemodialysis treatment.

- b) The keyed, **OPERATE-DISINFECT** switch should be in the **OPERATE** position. **If this switch is in the DISINFECT position, you MUST verify that the RO does NOT contain any disinfecting solution BEFORE proceeding to the next step.**

OPER. DISINFECT



- c) The **OPERATE-DISINFECT-OFF** switch should be in the **OPERATE** position. If the switch is in the **DISINFECT** or **OFF** position, see step b and the warning above.

OPER. DISINFECT OFF



- d) If you must reset the switches listed above, the alarm lights will illuminate and the audible alarm will sound, Press the **ALARM RESET** button to return the alarms to normal.

To start the RO: Simply move the **OPERATE-FLUSH** switch from **FLUSH** to the **OPERATE** position. The rest is automatic.

- a) The Quality Purge cycle will commence. An air purge cycle will run for approximately 10 seconds. Then the Product Purge Valve will open and run to drain until the water quality is above the set point.

OPER. FLUSH



NOTICE:

After approximately 30 seconds the RO pump will start, and at the same time, the Water Quality Alarm light will illuminate. This is a normal function to advise you that the first water produced by the RO is being routed to drain until the water quality equals the set-point on the Water Quality Monitor. This purge cycles will take approximately two minutes.

Reverse Osmosis (RO) Machine

Initial Operational Values

After the Purge Cycles have completed, the R.O. should be operating within the parameters as listed below:

- i) Membrane pressure should read: **85-175** psi.
- ii) There is no standard for Reject Pressure.
- iii) Product Pressure should read: **less than 20 psi** on tank feed systems and **less than 65** psi on direct feed systems.
- iv) The water quality should be above the set-point (90%).

NOTICE:
Refer to the Product Data Sheet for detailed information regarding product flow meter, reject flow meter and recirculation flow meter readings specific for this RO machine.

If the RO is not within the design specifications listed above, go to the section titled: **Adjustment Procedures**.

Perform a thorough quality assurance check of your entire water treatment system including pretreatment, primary treatment, post treatment, and distribution.

After the hemodialysis day is over, the RO may be shut-down by changing the setting on only one switch.

NOTICE:
The RO is not completely turned-off. It is placed into an idle or standby mode that is called the FLUSH Mode.

Unit Shutdown - Flush Startup

To shut-down the Reverse Osmosis Machine (RO):

1. Ensure there are no further requirements for water for hemodialysis or other systems used in your facility.
2. Move the **OPERATE-FLUSH** switch from the **OPERATE** to the **FLUSH** position, and the RO will enter into an automatic and scheduled Flush program. The amber, Flush light will come on when the R.O. actually starts-up and goes into flush at the pre-determined time, or when manually cycled into the flush mode by the 24 hr. timer.

OPER. FLUSH



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Reverse Osmosis (RO) Machine

Unit Adjustments

Adjusting Product Flow

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On occasion, the RO may require adjustments that can be performed by qualified operators. There are many factors that can affect the performance of the RO. If minor adjustments to the RO do not produce the desired results, you must investigate changes in the tap water feeding the RO. Tap water pH, temperature, pressure, TDS, and flow changes may cause a drastic reduction in the RO performance. In worst case situations, changes to the tap water can create conditions the RO cannot handle without supplemental processing.

CAUTION:

Only qualified RO operators should make adjustments to the RO.

PREPARATION: Before making any adjustments, read this entire section and pay close attention to cautions, notes, and items marked important.

CAUTION:

While making adjustments, the RO must be running with no alarm conditions indicated.

1. On the front panel of the RO, locate the "T-Handle" on the Reject/Product Regulating Valve.
2. Slowly, turn the "T-Handle" on the Reject/Product Regulating Valve clockwise or counterclockwise, as required, to set (as close as possible) the Reject and the Product Flows. (i.e. [50%recovery: 5 gpm product and 5 gpm reject flow]).



3. After the Reject and Product Flows have been balanced, perform a Quality Assurance Check on the RO to insure all pressures and flows are within design specifications.

CAUTION:

The inlet water temperature must be 70°F - 92°F with 77°F being optimum. The temperature must be measured while the RO is running. The RO inlet water pressure must be >39 psi while flowing at a minimum rate appropriate for the size of the RO. See Product Data Sheet for specific details about this unit.

RO Adjustments

Reject Flow

The Reject Flow Adjustment is achieved with the Product Flow Adjustment. See Product Flow Adjustment

Recirculation Flow

There is no recirculation flow adjustment on this R.O. machine. This is controlled by the built-in factory-set flow controller

Membrane Pressure

There are no user adjustments to the Membrane Pressure. The Membrane Pressure is adjusted automatically via the Variable Frequency Drive on the RO pump.

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RO Adjustments

Product Pressure Adjustment (Tank Feed)

There are no requirements to adjust the Product Pressure on a Tank Feed system. The Product Pressure Gauge is for measuring any possible system changes in the future.

Product Pressure Adjustment (Direct-Feed)

On Direct Feed Systems, the product pressure should be adjusted only when there are no requirements for R.O. water. Locate the pressure T-handle on the pressure regulating valve at the end of the distribution loop (return to RO).

To increase product pressure, turn T-handle clockwise. Maximum product pressure is 70 psi.

To decrease product pressure, turn the T-handle counter-clockwise. The minimum pressure is 20 psi.

NOTICE:

Product pressure must be 10 psi greater than feed water/5 micron filter out pressure to the R.O. Adjustments on feed water pressure may be required before attempting to adjust product pressure.

If you are unsure of any adjusting procedure, please call the Assistance Phone Number for consultation.

Flush Timer

Normally, the Reverse Osmosis Machine Membranes should be flushed only once per day and for only 15 minutes. If your operation is considered less than normal (less than 6 days a week operation), the FREQUENCY of the FLUSH CYCLE should be set to occur more often. In this case, we recommend that the FREQUENCY of the FLUSH CYCLE should be set to occur once every six hours for 15 minutes.

If you should elect to operate the clinic (water treatment system) on an unscheduled basis, there would be no problem, because the OPERATE-FLUSH switch controls the Flush Timer. In other words, the Flush Timer would be inactivated when the OPERATE-FLUSH switch is in the OPERATE position, and when the OPERATE-FLUSH switch is returned to the FLUSH position, the FLUSH TIMER would be reactivated. In either position of the OPERATE-FLUSH switch, the FLUSH TIMER CLOCK would continue to keep the correct time of the day; however, the position of the OPERATE-FLUSH switch would determine if a flush of the membranes would occur or not.

CAUTION

The time that a FLUSH CYCLE would occur should not coincide with the backwash or regeneration of a pre-treatment component.

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RO Remote Alarm Box

Description

The RO Remote Alarm Box is a molded plastic box, usually located on the patient floor, in a position where it can be easily seen by clinic personnel during normal work duties. The box is equipped with audible and visual alarms that monitor the RO and Reservoir water level. The Remote Alarm Monitoring Box requires no external power supply, but receives 24vac power and signals from the RO which it is monitoring. This box has 2 RED lights that will illuminate when the RO goes into an alarm condition or when the water level in the reservoir falls below the bottom float, and 1 AMBER light that will illuminate and flash when the RO is in Disinfect Mode.

When May Be Omitted

AAMI standards require that the RO alarms be audible in the patient area. If the RO is located close enough to be heard in the patient area, the remote alarm may be omitted

Daily Startup

This device is automatic and requires no daily startup procedures.

Monitoring Requirements

This is a monitoring device; therefore it will monitor the RO constantly, as to the state of the water.

Consequences of Failure

The probability of failure is remote; however, should the Poor Water Quality Monitoring Box fail, the clinic personnel may not be aware of the changes in water quality.

Maintenance

See the Section – Maintenance.

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Typical RO Remote Alarm Monitoring Box

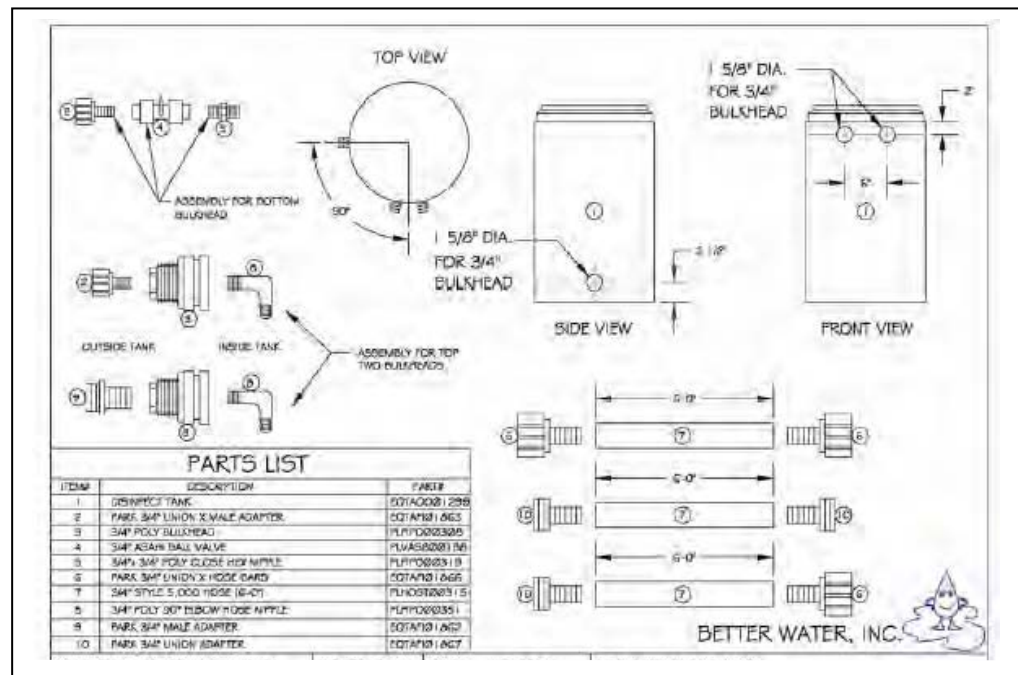
Disinfect Tank

Description

The Disinfect Tank is made of a non corrosive, molded plastic with a lid. The tank is equipped with 2 ports on the top (side) and a single port on the bottom (side), and all the necessary hoses, valves and fittings. (Some assembly required) The hoses supplied with the Disinfect Tank will connect to the top (side) ports on the Disinfect Tank and the other ends will connect to the RO Product and Drain. The third hose will connect the bottom (side) port to the Clean/Disinfect Valve on the RO. (See Disinfect Procedures)



Each RO is supplied with a Disinfect Tank to speed the process of disinfection when multiple RO's are used.



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System Maintenance

Revision 8-31-2006

Reverse Osmosis Operator's Manual

SYSTEM MAINTENANCE

Maintenance Schedule

Maintenance Task	Frequency (More Often If Needed)	Notes
Check the System For Leaks	Daily	Visual Inspection
Monitor the System For Unusual Sounds	Daily	Visual/Auditory
Clean External Surfaces	Weekly	Use Soft Damp Towel or Sponge. (DO NOT USE BLEACH)
Record Operational Values (i.e. Flows, Pressures, Temperature, etc.)	Daily or more often as required by facility	Record on Daily (Shift) Checklist
Change 5-micron Pre-Filter	Every 30 Days or when ΔP reaches or exceeds 15 psi	
Disinfect The System (membranes)	Every 30 Days	See Operator's Manual Disinfection and Cleaning
Perform Chemical, Microbial and Endotoxin Testing On Feed and Product Water As Per AAMI Requirements	Every 12 Months (Chemical)- 30 Days (Microbial) or more often as required.	Submit Samples To A Qualified Testing Laboratory

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SYSTEM MAINTENANCE

Flush Timer Adjustment

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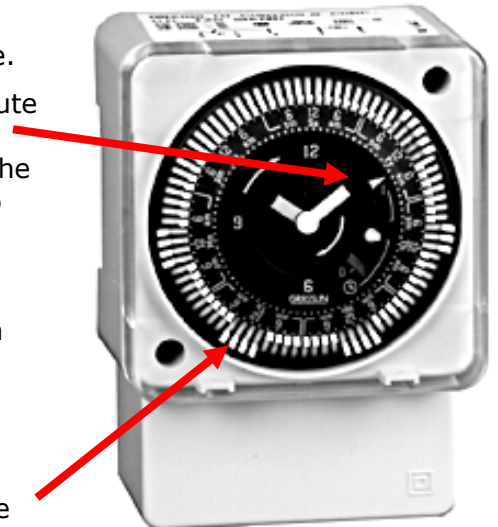
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WARNING
Electrical Hazard
The RO Control Box has 24 VAC

1. To Set The Correct Time Of Day
 - a) Open the Reverse Osmosis Machine Control Box door. See warning above.
 - b) Turn the dial (which will turn the minute hand) clockwise until the time of day on the outer dial is aligned with the triangle marker on the inner dial (two o'clock position).

2. To Set The FREQUENCY (the time a Flush Cycle will begin)
 - a) The time switch is set by pushing the captive actuators to the outer ring position for the entire period that the RO is to be in Flush Mode. Each white actuator represents 15 minutes. When the actuator is pushed to the inside, the switch is in the off position.

- b) If you want additional Flush Cycles, you may set as many as you wish; however, we recommend no more than four flush cycles in any 24-hour period.
- c) If you have any problems or questions about this procedure, call Better Water.



Example of Flush Timer

SYSTEM MAINTENANCE

Cleaning And Disinfecting Agents For RO Membranes

Minnicare

BWI Acid Cleaner 1000

BWI Alkaline Cleaner 2000

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WARNING:

All Cleaning And Disinfecting Agents Used With RO Units May Be Hazardous If Handled Improperly. Proper Protective Equipment Must Be Used

MINNCARE: DISINFECTING AGENT (Replaces Renalin or Actril)

CAUTION:

Can not be used on R.O. with brass fittings;
R.O. Unit must have stainless steel fittings.

- **Application:** R.O. and system disinfectant. **MUST use Acid Cleaner 1000 BEFORE using Minncare.** For routine maintenance, there should be a dwell time of 2-4 hours. If a highly contaminated condition exists, dwell time can be increased to 12 hours.
- **Dilution:** 750 cc's to 20 gallons of R.O. water.
- **Minncare Part Number :** SUMCOO00575
- **1% Test Strips Part Number :** SUMCOO00577



BWI ACID CLEANER 1000: (Replaces Minnclean AC & Citric Acid)

- Cleaner may be used with brass fittings.
- **Application:** For removing mineral scale in membrane applications. **MUST** first use Acid Cleaner 1000 **BEFORE** using: Minncare, Alkaline Cleaner 2000.
- **Dilution:** 1 pound of Acid Cleaner 1000 to 15 gallons of R.O. water.
- **Acid Cleaner Part Number :** SUMCOO00571



BWI ALKALINE CLEANER 2000: (Replaces Minnclean TF & Organoclean)

- Cleaner may be used with brass fittings.
- **Application:** For removing oil, grease, biological matter and grime on Thin Film Composite membranes. **MUST** first use Acid Cleaner 1000 **BEFORE** using Alkaline Cleaner 2000.
- **Dilution:** 1 pound of Alkaline Cleaner 2000 to 15 gallons of R.O. water.
- **Alkaline Cleaner Part Number:** SUMCOO00572



NOTE: The label on all Minncare and BWI products will have mixing directions.

Residual Test Strips used to confirm rinsing – Part Number : SUMCOO00576

MAINTENANCE Cleaning RO Membranes

Cleaning The RO Membranes

Membrane Fouling

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On occasion, your RO Membranes will require cleaning with chemical cleaners to regain maximum performance. The membrane cleaning procedure is almost identical to the RO disinfecting procedure with the exception: there is no stand or dwell time for the chemical cleaning solution.

Membrane fouling is **indicated** when:

- The Product Flow **decreases** and the Reject Flow **increases**, and the two cannot be adjusted to design specifications.
- The Pump Pressure **increases**, the Membrane Pressure **increases**, and the Reject Pressure **decreases**.
- The Quality Monitor indicates a continuous **decline** in water quality.

NOTICE:

Other factors, such as changes in the tap water pH, TDS, temperature, and/or pressure can cause drastic changes in the overall performance of the RO.

WARNING:

Chemical cleaners can cause serious injury or death.

This procedure covers the mechanical steps required to clean the Reverse Osmosis Machine Membranes.

The preparation of the chemical cleaning solution must be in accordance with the specifications established for the selected cleaning chemical.

The cleaning chemical must be handled in accordance with its **Material Safety Data Sheet (MSDS)**.

CAUTION:

This procedure should be performed by trained and qualified people

MAINTENANCE Cleaning RO Membranes

Preparation For Cleaning The RO Membranes

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1. Rinse the inside of the Disinfect Tank with RO Product water and drain thoroughly.

CAUTION:

The line between the Disinfect Tank and the RO must be primed before proceeding. Failure to do so may result in damage to the RO Pump.

2. Add the predetermined quantity of RO Product water to the Disinfect Tank. **DO NOT ADD THE CLEANING CHEMICAL AT THIS TIME.**
3. Place the RO into the DISINFECT mode.
4. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
5. Turn the keyed, **OPERATE-DISINFECT** switch to the **DISINFECT** position. **REMOVE AND PROTECT THE KEY.**
6. Turn the **OPERATE-FLUSH** switch to the **OPERATE** position.
7. Connect the Disinfect Tank to the RO.
8. Properly identify and connect the Disinfectant Line (bottom line on the Disinfect Tank) to the RO **DISINFECT/CLEAN** Valve (Yellow Handle Valve, located at the bottom left side of the RO and labeled **DISINFECT/CLEAN** Valve).
9. On the Disinfect Tank, properly identify and **OPEN** the **DISINFECT FEED** Valve (located on the bottom, front of the Disinfect Tank).
10. **OPEN** the RO Disinfect/Clean Valve (Yellow Handle Valve located at the bottom left side of the RO and labeled **DISINFECT/CLEAN** Valve).
11. Disconnect the RO Drain Line from the drain, and connect it to the corresponding port on the top (side) of the Disinfect Tank.
12. Disconnect the RO Product (permeate) line from its normal operate position, and connect it to the remaining port located at the top of the Disinfect Tank.

CAUTION:

If the lines are not connected properly and the valves are not open, the RO pump may be damaged.

13. Double-check your work. **DO NOT ADD THE CHEMICAL CLEANER.**
14. Check the cleaning system for leaks. For **safety** reasons, this step is performed without the cleaning chemical.

MAINTENANCE Cleaning RO Membranes

Checking For Leaks

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-
15. Turn the **OPERATE-DISINFECT-OFF** switch to the **DISINFECT** position and PRESS the **ALARM RESET** to reset the alarms.
 16. **IMPORTANT:** Check for an **immediate** flow into the top of the Disinfect/Tank. If there is no flow, **immediately** turn the **OPERATEDISINFECT OFF** switch to the **OFF** position and check the RO **DISINFECT/ CLEAN** Valve and the **DISINFECT** Valve on the Disinfect Tank. **BOTH** valves must be **OPEN**.

CAUTION:

Upon pump start, there must be an immediate flow into the top of the Disinfect/Cleaning Tank

17. Allow the water to flow for one to two minutes and check for leaks.
18. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.

WARNING:

Before proceeding, don appropriate protective clothing and face protection.

19. **IF NO LEAKS ARE FOUND**, add the predetermined quantity of chemical cleaner to the water in the Disinfect Tank. Do **NOT** close the lid to the Disinfect Tank.

MAINTENANCE Cleaning RO Membranes

Cleaning The RO Membranes

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1. Turn the **OPERATE-DISINFECT-OFF** switch to the **DISINFECT** position. Press the **ALARM RESET** to reset the alarms. The RO pump will start, and cleaning solution will circulate throughout the RO and immediately return to the Disinfect Tank.

CAUTION:

There must be an immediate flow return to the Disinfect Tank. If NOT, immediately, turn the OPERATE- DISINFECT- OFF switch to the OFF position AND RECHECK the steps in Section – Checking For Leaks.

2. Close the lid on the Disinfect Tank.
3. **IMPORTANT:** Allow the RO to run in the **DISINFECT** mode for 10-15 minutes. A longer period of time can cause the pump to **overheat**.
4. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position. The RO pump will shut down, and all power will be disconnected from the control panel.
5. While wearing protective face shields and protective clothing, carefully perform the following steps to remove the Disinfect Tank and lines from the RO.
6. On the RO, **close** the RO Disinfect/Clean Valve.
7. On the Disinfect Tank, **close** the **DISINFECT FEED** Valve.

WARNING:

All lines from the Disinfect Tank to the RO contain cleaning solution. When each line is disconnected, the solution will drain from the line; therefore, you must use a disposable container to catch the solution, or you must hold the end of the line in an elevated position to cause the solution to flow to the Disinfect

8. Disconnect the RO Drain line from the Disinfect Tank and return it to **DRAIN**.
9. Disconnect the RO Product (permeate) line from the Disinfect Tank and connect it to **DRAIN**.
10. Disconnect the Disinfect Line from the RO **DISINFECT/CLEAN** Valve.
11. In accordance with approved methods and procedures, dispose of the remaining cleaning solution.
12. Allow proper amount of dwell time for the disinfectant you are using.

MAINTENANCE Cleaning RO Membranes

Rinsing Cleaning Agent

Rinse Time

Residual Testing

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1. Ensure the RO Product (permeate) line is connected to a drain. Secure the line.
2. Ensure the RO Reject (drain) line is connected to drain.
3. Ensure the RO **DISINFECT/CLEAN** Valve is **closed**.
4. Ensure the **OPERATE-FLUSH** switch is in the **OPERATE** position.
5. Insert the key into the **OPERATE-DISINFECT** switch and turn it to the **OPERATE** position.
6. Turn the **OPERATE-DISINFECT-OFF** switch to the **OPERATE** position and **PRESS** the alarm **RESET** to reset the alarms.
 - a). The Purge cycles will begin.
 - b). After approximately 30 seconds, the RO pump will start.
 - c). The product water will be routed to drain.
 - d). The Water Quality Alarm will sound until the water quality reaches acceptable parameters.
7. Allow the RO to operate in this configuration for a **minimum of two hours**.
8. After the two-hour rinse period, check for residual cleaning chemicals by performing a pH test of the tap water feeding the RO and the RO Product water. The Product pH should be within one point of the tap water pH. If residual cleaning chemicals are detected, continue the rinse program for an additional 30 minutes and retest. Continue the rinse-test procedure until no cleaning chemicals are detected.
9. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
10. Allow the RO to stand idle for **30 minutes**.
11. After the 30 minute, idle period, turn the **OPERATE-DISINFECT-OFF** switch to the **OPERATE** position. Press the **ALARM RESET** to reset the alarms.
12. Allow the RO to run for another **10 minutes (minimum)**.
13. Perform the pH test for residual cleaning chemicals. This test is for a phenomenon known as "rebound". If cleaning chemicals are detected, continue the run-test procedure until no residual cleaning chemicals are detectable.

NOTICE:

**Residual Test Strips used to confirm rinsing – Part Number :
SUMCOO00576**

MAINTENANCE Cleaning RO Membranes

Rinsing Cleaning
Agent
continued

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-
14. When no residual cleaning chemicals are detectable:
 - a. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
 - b. Reconnect the RO Product (permeate) line to its normal operate position.
 - c. Advise the Nursing Supervisor that the RO Membranes have been cleaned, and the cleaning chemicals have been rinsed from the RO.
 15. **Before the next hemodialysis treatment**, have a second, knowledgeable person verify the absence of residual cleaning chemicals.
 16. Perform a Quality Assurance Check on the RO and begin normal operations.
 17. Document the cleaning activity on the Maintenance Log.

MAINTENANCE

Disinfecting RO Membranes

Disinfecting RO Membranes

Warnings

Preparation

Disinfect Mode

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The RO is equipped with new, proprietary Thin Film Material membranes that should not be disinfected for a period of six-weeks after initial installation. After the initial break-in period of six-weeks, it is recommended that the unit be routinely disinfect the membranes every 30 days with an approved disinfectant that will not degrade the membranes or the components of the RO.

Based on the specifications for Minncare disinfectant, the RO was built with components that will tolerate peracetic acid type disinfectants.

WARNING:

The membranes will not tolerate sodium hypochlorite (bleach).

WARNING:

Disinfectant agents can cause serious injury or death and should be handled by trained and qualified personnel wearing protective clothing and face protection.

This procedure covers the mechanical steps required to disinfect the Reverse Osmosis Machine. The preparation of the disinfecting solution must be in accordance with specification established for the selected disinfectant. The disinfectant must be handled in accordance with its Material Safety Data Sheet (MSDS).

1. Rinse the inside of the Disinfect Tank with RO Product water and drain thoroughly.
2. Add the predetermined quantity of RO Product water (approx. 20 gallons) to the Disinfect Tank. **DO NOT ADD THE DISINFECTANT AT THIS TIME.**
3. Place the RO into the **DISINFECT** mode:
 - a. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
 - b. Turn the keyed, **OPERATE-DISINFECT** switch to the **DISINFECT** position. **REMOVE AND PROTECT THE KEY.**
 - c. Turn the **OPERATE-FLUSH** switch to the **OPERATE** position.

MAINTENANCE Disinfecting RO Membranes

Connecting Disinfect Tank

Direct Feed Systems

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4. Connect the Disinfect Tank to the RO:
 - a. Properly identify and connect the **Disinfectant Feed Line** (bottom line on the Disinfect Tank) to the **RO Disinfect/Clean Valve** (Yellow Handle Valve, located at the bottom left side of the RO and labeled **DISINFECT/CLEAN Valve**).
 - b. On the Disinfect Tank, properly identify and **OPEN** the **Disinfect Feed Valve** (located on the bottom, front of the Disinfect Tank).
 - c. **OPEN** the **RO Disinfect/Clean Valve** (Yellow Handle Valve located at the bottom left side of the RO and labeled **DISINFECT/ CLEAN Valve**).
 - d. Disconnect the **RO Drain Line** from the drain, and connect it to the corresponding port on the top (side) of the Disinfect Tank.
 - e. Disconnect the **RO Product (permeate) line** from the Storage Tank, and connect it to the remaining **port located at the top of the Disinfect Tank**.

NOTICE:

On a Direct Feed system, before proceeding, ensure that the disinfectant of choice is compatible with water contact materials, as well as the Dialysis Machine. Also ensure that all post R.O. filters are removed and D.I. tanks are by-passed. The product/permeate line should remain connected to the loop. Disconnect the loop return line from the R.O. and connect it to either of the disinfect tank top ports.

MAINTENANCE Disinfecting RO Membranes

Disinfecting RO
Membranes
continued

Checking For Leaks

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Double-check your work. **DO NOT ADD THE DISINFECTANT.**

Using the following procedure, check the disinfecting system for leaks. **For safety reasons, this step is performed without the disinfecting chemical.**

CAUTION

Upon pump start, there must be an immediate flow into the top of the disinfect tank.

CAUTION:

The line between the Disinfect Tank and the RO must be primed before proceeding. Failure to do so may result in damage to the RO Pump.

- a. Turn the **OPERATE-DISINFECT-OFF** switch to the **DISINFECT** position.
- b. **IMPORTANT:** Check for an **immediate** flow into the top of the Disinfect Tank. If there is no flow, **immediately** turn the **OPERATEDISINFECT OFF** switch to the **OFF** position and check the RO **DISINFECT/CLEAN VALVE** and the **DISINFECT FEED VALVE** on the Disinfect tank. **BOTH** valves must be **OPEN**.
- c. Allow the water to flow for one to two minutes and check for leaks.
- d. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
- e. Investigate and repair any leaks that are discovered before proceeding with the disinfect process.

WARNING:

Before proceeding, don appropriate protective clothing and face protection.

Add the predetermined quantity of chemical disinfectant to the water in the Disinfect Tank.

Do NOT close the lid to the Disinfect Tank.

MAINTENANCE Disinfecting RO Membranes

Disinfecting The RO Membranes

Removing Disinfect Tank And Lines

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To disinfect the RO:

1. Turn the **OPERATE-DISINFECT-OFF** switch to the **DISINFECT** position. The RO pump will start, and disinfecting solution will circulate throughout the RO and immediately return to the Disinfect Tank.

CAUTION:

There must be an immediate flow return to the Disinfect Tank. IF NOT, immediately, turn the OPERATE-DISINFECT-OFF switch to the OFF position and repeat Section – Checking For Leaks.

2. Close the lid on the Disinfect Tank.
3. **IMPORTANT:** Allow the RO to run in the **DISINFECT** mode for 10-15 minutes. **A longer period of time can cause the pump to overheat.**
4. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position. The RO pump will shut-down, and all power will be disconnected from the control panel.
5. Place a WARNING placard on the RO Control Panel stating the, "RO contains disinfectant DO NOT OPERATE".

-
1. On the RO, close the RO **DISINFECT/CLEAN** Valve.
 2. On the Disinfect Tank, close the **DISINFECT FEED** Valve.

WARNING:

All lines from the Disinfect Tank to the RO contain disinfecting solution, and when each one is disconnected from the RO, the solution will drain from the line; therefore, you must use a disposable container to catch the solution or hold the line in a position to cause the solution to flow to the Disinfect Tank.

3. Disconnect the RO Drain line and return it to drain.
4. Disconnect the RO Product (permeate) line and connect it to a drain.

NOTICE:

On Direct Feed systems, the R.O. product line will remain connected to the distribution loop.

MAINTENANCE Disinfecting RO Membranes

Removing Disinfect Tank And Lines continued

Rinsing Disinfect Agent

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5. Disconnect the Disinfect Feed Line from the RO **DISINFECT/CLEAN** Valve.

NOTICE:

On Direct Feed systems, connect the loop return line to drain.

6. In accordance with approved methods and procedures, dispose of the remaining disinfecting solution.
7. Allow the disinfecting solution to stand or dwell in the RO for the specified period of time for the disinfectant used.
8. Alert the nursing supervisor; the RO contains a disinfectant.

1. Verify the disinfectant has been allowed to stand or dwell for the specified time.
2. Connect the RO Product (permeate) to the **drain**. Secure the line.

NOTICE:

On Direct Feed systems, the product line should remain connected to the distribution loop.

3. Connect the RO Reject (drain) line is to **drain**.

NOTICE:

On Direct Feed systems, ensure that the loop return line is connected to the drain.

4. Close the RO **DISINFECT/CLEAN** Valve.
5. Turn the **OPERATE-FLUSH** switch to the **OPERATE** position.
6. Insert the key into the **OPERATE-DISINFECT** switch and turn it to the **OPERATE** position.
7. Turn the **OPERATE-DISINFECT-OFF** switch to the **OPERATE** position and **PRESS** the **ALARM RESET** to reset the alarms.
8. The Purge cycles will begin.
 - a. After approximately 30 seconds, the RO pump will start.
 - b. The product water will be routed to drain.
 - c. The Water Quality Alarm will sound.

MAINTENANCE Disinfecting RO Membranes

Rinsing Disinfect Agent continued

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9. Allow the RO to operate in this configuration for a **minimum of two hours**, or until the disinfectant is rinsed clear.
10. After the two-hour time period and by using an approved reagent, check for residual disinfectant. If residual disinfectant is detected, allow the RO to run and retest every 30 minutes until no residual disinfectant is detectable.
11. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
12. Allow the RO to stand idle for **30 minutes**.
13. After the 30 minute, idle period, turn the **OPERATE-DISINFECT-OFF** switch to the **OPERATE** position and **PRESS** the alarm **RESET** to reset the alarms.
14. Allow the RO to run for another 10 minutes (**minimum**).
15. Check the RO product water for residual disinfectant. This test is for a phenomenon known as "**disinfectant rebound**". If disinfectant is detected, continue the run-test procedure until no residual disinfectant is detectable.

NOTICE:

**Residual Test Strips used to confirm rinsing – Part Number :
SUMCOO00576**

16. When no residual disinfectant is detectable:
 - a. Turn the **OPERATE-DISINFECT-OFF** switch to the **OFF** position.
 - b. Reconnect the RO Product (permeate) line to its normal operate position.

NOTICE:

On Direct Feed systems, reconnect the loop return line to the R.O.

- c. Remove the **WARNING** placard from the RO.
17. Advise the Nursing Supervisor that the disinfectant has been removed from the RO and no residual disinfectant is detectable.
18. Before the next hemodialysis treatment, have a second, knowledgeable person verify the absence of residual disinfectant.
19. Perform a Quality Assurance Check on the RO. Begin normal operation.
20. Document the disinfect activity on the Maintenance Log.

SYSTEM MAINTENANCE

Sample Collection

Required Materials

Bacteria Culture & Endotoxin Samples

1. Identify sample locations and tests required.
2. Obtain the correct sample tube for the test required:
 - a) Bacteria Culture (CUL) – 10 ML Red Top Vacutainer Tube
 - b) Endotoxin (Endo) – Plastic Pyrogen Free Tube
 - c) Chemistry – Red Top Vacutainer Tube (Dialysate Only)
 - d) Water Profile AAMI – 50 ML Screw Cap Tube
 - e) Testing Laboratory Submission Document or Form

1. Identify sample by writing description on sample tube label. Description MUST match documentation.
2. Wear rubber gloves and mask to prevent contaminating the sample.
3. Swab sample port area with alcohol and allow to stand for 1 minute. DO NOT touch or allow anything to come in contact with port area until AFTER sample has been collected.
4. Open sample port and allow water to flow for 1-2 minutes prior to collecting sample.
5. DO NOT touch the inside of the tube, cap or sample with fingers or foreign objects as this will contaminate the sample.
6. Rinse sample tube with water to be collected 1-2 times.
7. Collect the sample(s) mid-stream, fill sample tubes only ½ full.
8. DO NOT add any preservatives.
9. Culture samples must be kept refrigerated, **NOT FROZEN**, up to the time they are received by the testing laboratory, NOT to exceed 24 hours from the time the samples were taken.

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SYSTEM MAINTENANCE

Sample Collection continued

Chemistry & AAMI Water Profile Samples

Total Organic Carbon (TOC) Samples

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-
1. Identify sample by writing description on sample tube label. Description MUST match documentation.
 2. Wear rubber gloves and mask to prevent contaminating the sample.
 3. Open sample port and allow water to flow for a minimum of 30 seconds prior to collecting sample.
 4. DO NOT touch the inside of the tube, cap or sample with fingers or foreign objects as this will contaminate the sample.
 5. Rinse sample tube(s) with water to be collected 1-2 times.
 6. Collect the sample(s) mid-stream, filling the sample tube(s).
 7. DO NOT add any preservatives.
 8. Water profile samples are NOT required to be refrigerated, but should be delivered to the testing laboratory as soon as possible.

-
1. Identify sample by writing description on sample tube label.
 2. Wear rubber gloves to prevent contaminating the sample.
 3. Open sample port and allow water to flow for a minimum of 30 seconds prior to collecting sample.
 4. DO NOT touch the inside of the bottle, cap or sample with fingers or foreign objects as this will contaminate the sample.
 5. Pour contents from small vial into the 250ml amber sample bottle. (Both supplied in kit)

CAUTION:

**Small Vial Contains Acid With A pH less than 2.
Contents Will Cause Burns. Handle With Extreme Care!**

6. Collect the sample mid-stream, filling the sample bottle to the top.
7. TOC samples must be kept refrigerated, **NOT FROZEN**, up to the time they are received by the testing laboratory, NOT to exceed 24 hours from the time the samples were taken.

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Troubleshooting

Revision 8-31-2006

Reverse Osmosis Operator's Manual

SYSTEM TROUBLE SHOOTING

No Power To The RO

The information presented in this document is intended to serve as a guide only for qualified operators. It is not all inclusive of problems that may be encountered. This guide should aid operators with reminders and routine trouble-shooting tasks.

For any problem outside the confines of this guide, call for technical assistance.

Possible Causes	Possible Solutions
Main Breaker Tripped (In Building Electrical Panel)	Reset Breaker
RO Not Plugged Into Electrical Receptacle.	Plug RO Power Cord Into Receptacle. (The RO Is Equipped With A Hospital-Grade Twist-And-Lock Plug. Make Sure That The Plug Is Seated And Locked Into The Receptacle.)

Power To RO But RO Will Not Start

Possible Causes	Possible Solutions
Motor Starter Protector Tripped.	Reset Motor Starter Protector In RO Junction Box.
Interlock Circuit Interrupted	Verify If Any Pre-Treatment Equipment (i.e. Carbon, Softener) are in Backwash Or Regeneration.
Reservoir Water Level Is Above Middle Float Switch	This Is Normal. The RO Will Start When The Water Level In The Reservoir Falls Below The Middle Float.

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SYSTEM TROUBLE SHOOTING

Power To RO But RO Will Not Start Continued

Possible Causes	Possible Solutions
RO Is In An Alarm Condition	<ul style="list-style-type: none"> a. Identify The Specific Alarm By Observing The Illuminated Alarm Light On The Front Of The RO Control Panel. b. Press The Red Reset Button On The RO Control Panel. c. Reference Alarm Conditions Listed Below.
Switches Are In Incorrect Positions	<p>For Normal Operation, Verify As Follows:</p> <ul style="list-style-type: none"> a. OPERATE-FLUSH Switch In The OPERATE Position b. OPERATE-DISINFECT Keyed Switch In The OPERATE Position c. OPERATE-DISINFECT-OFF Switch In The OPERATE Position d. TANK-OFF-DIRECT Switch (Inside The RO Control Box) In Either TANK Or DIRECT Position.

RO Runs Intermittently

Possible Causes	Possible Solutions
Faulty Interlock Circuit Connections	Check All Interlock Wiring And Connections.

Incoming RO Feed Water Characteristics Out Of Design Specifications

Possible Causes	Possible Solutions
Pre-Treatment Equipment Not Operating To Design Specifications.	Check All Pre-Treatment Equipment To Verify Proper Operation.
Source Water Has Changed From Initial Design Water Analysis.	<p>Have Source Water Analyzed By Qualified Laboratory And Compare Results To The Initial Design Water Analysis.</p> <p>If Source Water Characteristics Have Changed Significantly, Changes May Be Required To Pre-Treatment Equipment.</p> <p>Contact Technical Assistance.</p>

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SYSTEM TROUBLE SHOOTING

Alarm Conditions

Possible Causes	Possible Solutions
Low Pressure Alarm	Verify The City Booster Pump Is Operating Properly And Providing Sufficient Pressure For RO Operation.
High Feed Temperature Alarm	Verify The Blending Valve Is Set To 77° F At The RO. Adjust As Needed.
High Membrane Pressure Alarm	Press The Red ALARM RESET On The Control Panel. If the alarm condition does not clear, call Better Water for assistance.
High Product Alarm	On Tank Feed Systems – Check The Product Hose For Kinks Or Obstructions. Clear As Needed. On Direct Feed Systems – Check The Pressure Regulating Valve At The End Of The Loop (RO Return). Adjust As Needed.
Poor Water Quality Alarm	The Water Quality Has Fallen Below 90% Rejection (Pre-Set At Factory) When The Water Quality Reaches 95% Or More, The Alarm Will Silence.

RO Shuts Down In Alarm Condition (With Alarm Lights)

Possible Causes	Possible Solutions
An Alarm Condition Has Occurred.	Note The Alarm Indicated On The Panel. Perform The Corrective Action For The Specific Cause Of The Alarm Condition Listed Above. Press The Red ALARM RESET On The Control Panel. If the alarm condition does not clear, call Better Water for assistance.

SYSTEM TROUBLE SHOOTING

RO Shuts Down Without Alarming

Possible Causes	Possible Solutions
Loss Of Power	See Sections Related To Power Above
Motor Starter Protector Has Tripped	Reset Motor Starter Protector In RO Junction Box.
Reservoir Is Full	This Is Normal. The RO Will Start When The Water Level In The Reservoir Falls Below The Middle Float.
Interlock Circuit Interrupted	Verify If Any Pre-Treatment Equipment (i.e. Carbon, Softener) are in Backwash Or Regeneration.

RO Audible Alarm Is Sounding But No Lights Illuminated

Possible Causes	Possible Solutions
Alarm Lamp Is Burned Out	Replace Bulb.

Low Level Alarm Does Not Sound When Water Level Falls Below Bottom Float Switch

Possible Causes	Possible Solutions
ALARM-MUTE Switch On The Level Control Box Is In MUTE Position	Place ALARM-MUTE Switch In The ALARM Position.

Remote Alarm Lights Do Not Illuminate In Alarm Condition

Possible Causes	Possible Solutions
Alarm Lamp Is Burned Out	Replace Bulb.
Loose Connection In Remote Alarm Wiring	Inspect All Wiring.

RO Does Not Shut Off After Reservoir Full

Possible Causes	Possible Solutions
Tank-Off-Direct Switch	It should be in the TANK position.
High Level Switch Malfunction	<ul style="list-style-type: none"> a. Gently tap the solenoid. This may clear any obstruction. b. Defective Switch – Replace

SYSTEM TROUBLE SHOOTING

Product water is continuously flowing to drain

% Rejection Will Not Rise Above 90%

Δ Pressure Across RO Pre-Filter Is Greater Than 15 PSI

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Possible Causes	Possible Solutions
Water Quality Monitor Not Within Set-Points Of Water Quality Monitor.	Check the Water Quality Monitor Set-Points. If this does not correct the problem, contact technical support.
Faulty Water Quality Monitor Or Water Quality Monitor Control Board	Contact Technical Support.
Product Purge Valve May Be In The Open Position	If the Water Quality is good, the valve is stuck open; replace the valve. If this does not correct the problem, contact technical support.

Possible Causes	Possible Solutions
Pre-Treatment Equipment Is Not Operating Properly	Check All Pre-Treatment Equipment To Verify Proper Operation.
RO Requires Cleaning / Disinfection	Reference Section – Cleaning And Disinfection
Membranes Need To Be Replaced	Call Technical Assistance To Verify

Possible Causes	Possible Solutions
Filter Fouled	Replace Filter Every 30 Days Or When Δ Pressure Is Equal Or Greater Than 15 PSI.
Filter Inlet Hose Is Kinked Or Obstructed.	Check Hose. Remove Kinks Or Obstructions.
Faulty Gauge	Verify The Accuracy Of The Gauge. Replace As Needed.

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System Forms - Daily Checklists

Revision 8-31-2006

Reverse Osmosis Operator's Manual

The Daily Checklists are examples of what can be used when evaluating a system and troubleshooting. They are standard and generic and contain all of the equipment that is standard in a most complete water treatment system. The Sheets are divided into: Pre- Treatment, RO, & Post-Treatment.

These sheets are also included in the water system manual that is supplied with each system for the customer. While many customers will use this checklist as it is designed, some customers will choose to design their own checklist, specific to the individual clinic.

The Daily Checklists listed in this manual are:

1. Quality Assurance Checklist

<p style="text-align: center;">QUALITY ASSURANCE CHECKLIST</p> <p style="text-align: center;">Items to be checked</p>	DATE	NOTES
<p>R.O. SWITCH POSITIONS:</p> <p>Check Normal Operation TANK</p> <p>Check Normal Operation DIRECT</p> <p>R.O. FLUSHES Correctly</p> <p>R.O. Goes into DISINFECT</p>		
<p>R.O. LIGHTS & ALARMS:</p> <p>Operate Light (ON)</p> <p>High Feed Temp. (OFF)</p> <p>Low Pressure shuts off at what psi?</p> <p>High Product Pressure shuts off at what psi?</p> <p>Poor Water Quality Monitor functions properly?</p>		
<p>FLOWMETERS:</p> <p>Product Flow in GPM</p> <p>Reject Flow in GPM</p> <p>Recirculation Flow in GPM</p>		
<p>WATER QUALITY METER:</p> <p>Feed Water TDS (ppm)</p> <p>Product Water TDS (ppm)</p> <p>Rejection Rate (>90%)</p> <p>Poor Water Quality Set-Point</p>		
<p>R.O. PRESSURE GAUGES:</p> <p>Pre-Filter Pressure</p> <p>Membrane Pressure</p> <p>Reject Pressure</p> <p>Product Pressure</p>		
<p>FLUSH TIMER:</p> <p>Time R.O. is set to Flush</p> <p>How Long is the R.O. set to Flush?</p> <p>Set to Correct time of day?</p>		
<p>INCOMING POWER</p> <p>Adjusted to correct voltage?</p> <p>L1 - L2</p> <p>L1 - L3</p> <p>L2 - L3</p> <p>L1 - GROUND</p> <p>L2 - GROUND</p> <p>L3 - GROUND</p> <p>L1 AMP Draw</p> <p>L2 AMP Draw</p> <p>L3 AMP Draw</p> <p>Thermal Overload Setting</p> <p>Interlock Circuit Tested?</p>		