Better Water LLC

4” x 40” Spiral Wound Ultra Filter System

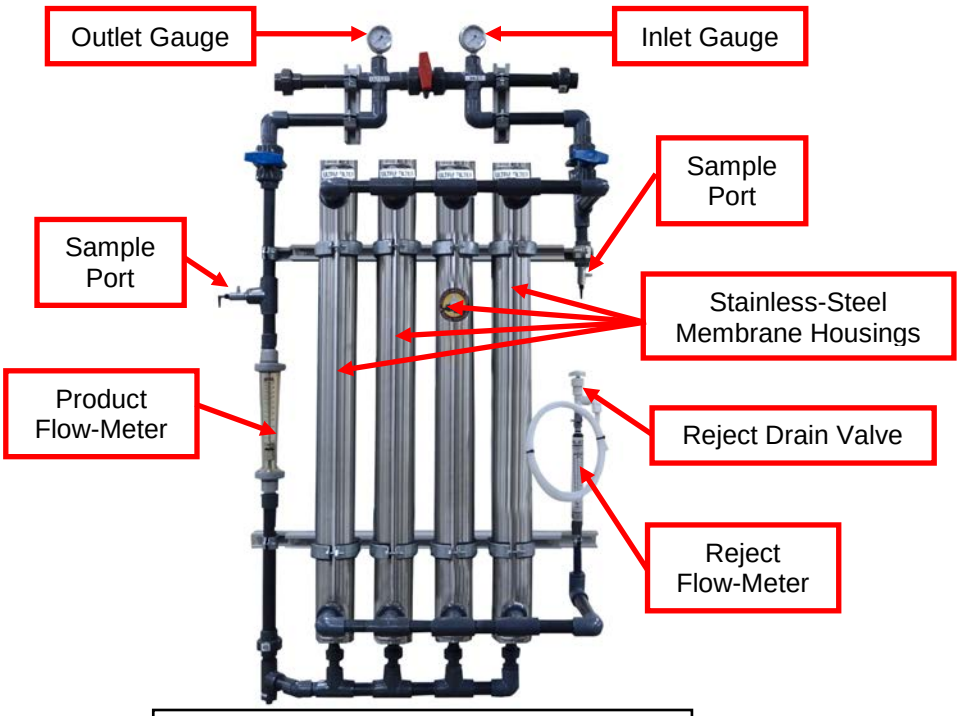
Operator Manual

rev. Apr 2015

Better Water LLC

4” x 40” Ultra Filter System

Models and Specifications					
Models	**UF17000**	**UF25500**	**UF34000**	**UF42500**	**UF51000**
Capacity GPM	10	15	20	25	30
Number of Ultra Filters	2	3	4	5	6
Operating Weight	95 lbs	141 lbs	175 lbs	222 lbs	269 lbs
Ultra Filters	4" x 40" sanitary sleeve design				
% Recovery	90% - 95%				
MWCO	10,000 daltons				
Overall Dimensions	12" depth x 50" width x 72" height; wall mounted				
Incoming Water Requirements	RO or DI water				
Gauges	stainless steel, accurate to within 1%				
Flow meters	reject and product flow meters				
Disinfecting	compatible with 1% peracetic acid (*Minncare*) and iron-free bleach				



4 Membrane, Right-to-Left Model Shown

Visit our website to see our complete product line of water purification products!

www.betterwater.com

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Better Water LLC; 698 Swan Dr; Smyrna, TN 37167; www.betterwater.com

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Our Company

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

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

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

Contact Us

Better Water LLC
698 Swan Dr
Smyrna, TN 37167

Phone (615) 355-6063
Fax (615) 355-6065

Technical Support:
Phone (615) 355-6063, press "1"
Email support@betterwater.com

Customer Service:
Phone (615) 355-6063, press "3"
Email customerservice@betterwater.com

Technical Phone Support

Support is available regarding all Better Water LLC systems,
24 hours a day,7 days a week.

- Normal business hours are Monday through Friday from 8:00 am until 3:30 pm, Central Standard Time (*excluding holidays*)

Call (615) 355-6063, press "1" for Technical Support

Emergency assistance is available after normal business hours *(including holidays)* by calling **(615) 708-8627.**

BEFORE calling for emergency assistance:

- Check the Troubleshooting guide in this manual
- Check the electrical-power connections, fuses/circuit breakers *(if applicable)*
- Check all valves to ensure each is in the correct position *(if applicable)*

Technical Support Info Online

Our website, **www.betterwater.com**, which is updated frequently, contains a wealth of technical support information on the **SUPPORT** tab and includes:

- Operator and Service Manuals
- Interactive Frequently Asked Questions for Troubleshooting
- Consumables and Accessories Lists
- Technical Service Bulletins

For your convenience there are also online forms for placing **Orders** and requesting **Returned Goods Authorization**. These are Adobe forms that can be downloaded and either faxed or emailed to us.

Specific Contacts

Technical Support	Phone	(615) 355-6063, option “1”
	Email	support@betterwater.com
To Place an Order (*purchase orders*)	Fax	(615) 355-6065
	Email	orders@betterwater.com
	Phone	(615) 355-6063
Customer Service (*returns*)	Phone	(615) 355-6063, option “2”
	Fax	(615) 355-6065
	Email	customerservice@betterwater.com

Website **www.betterwater.com**

Helpful information and forms that can be found on our website:

- Operator & Service Manuals
- Technical Service Bulletins
- Consumables and Replacement Parts List
- Brochures
- Order Form
- Return Goods Authorization Request Form

Introduction

The Better Water LLC 4” x 40” Ultra Filter System is manufactured to the utmost quality. With proper operation, maintenance, and care, this device should give you years of reliable service.

Before starting you should first read and have a thorough understanding of this entire Operator Manual. It describes in detail the steps and procedures for safe usage of Ultra Filter System.

This device was designed and built with consideration for the information that has been provided to use on the current product water requirements at your site of operation.

This device was designed and built to filter RO/DI product water, and is not intended for any other application.

Once the device has been delivered to you, "it is the **responsibility** of the **Medical Director** to ensure that the [device] is operated, monitored, and maintained in such a manner so as to satisfy all applicable standards for which the water may be used". (*Quoted from HHS Publication FDA 89-4234*).

WARNINGS

1. It is unsafe to operate or service this device without first reading and understanding the **entire** Operator's 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.

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 this device could result in a low or no-flow alarm on the dialysis machines.

3. Misuse or improper operation of this device will void any warranty.

4. Where water is mentioned, unless otherwise noted, it must be AAMI standard quality water.

5. Plumbing connections must adhere to local statutes and any facility codes.

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.

8. Do not use this device to store, mix or transfer flammable liquids. 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^{o} F or above 90^{o} F.

10. This device should not be used for purposes outside the device’s stated applications, specifications or limitations.

GENERAL REQUIREMENTS & SPECIFICATIONS

1. Water requirements:
a. A properly pretreated water supply consisting of RO/DI product water.
- Better Water recommends 1.2 megohms as the minimum for DI water (AAMI standard is 1 megohm), but these minimums are set by the Medical Director.
b. Pressure: 30-100 psi

2. Electrical requirements: None

3. Drain requirements: Must facilitate 3-5 gpm.

4. Floor space: This unit is normally assembled at Better Water LLC and mounted to the wall surface. Requirements: Approx. 12” (*depth-from wall*) x 50” (*width-along the wall*) x 72” (*height-up the wall*).

MODELS

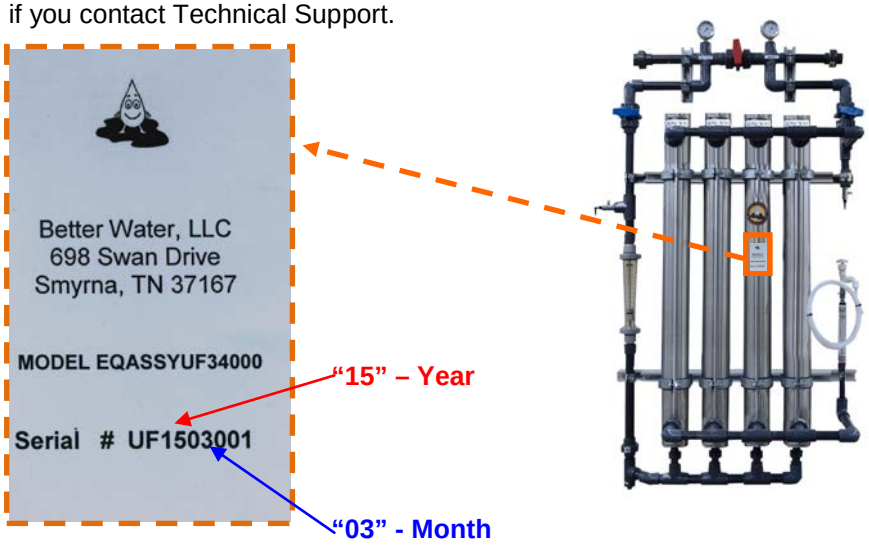
There are three models of the 4” x 40” Ultra Filter System, each with of which can be built with the water flow moving either left-to-right or right-to left. The primary difference is the number of ultra filters each can accommodate with these standard models being built with either two, three, four five, or six ultra filters. The operation and service for these models are basically the same, with very little physical differences between them.

Model	Specifications
EQASSYUF17000	2 Ultra filters, 10 gpm capacity
EQASSYUF25500	3 Ultra filters, 15 gpm capacity
EQASSYUF34000	4 Ultra filters, 20 gpm capacity
EQASSYUF42500	5 Ultra filters, 25 gpm capacity
EQASSYUF51000	6 Ultra filters, 30 gpm capacity

Four Ultra Filter, Right-to-Left Model Shown

IMPORTANT INFORMATION FOR SUPPORT

Adhered to one of the center membrane housings of each Ultra Filter is a label containing important information relating to the specific unit, and details both the **Model** and **Serial Number**. Both of these pieces of information are very important in obtaining support, determining warranty, and properly servicing the Ultra Filter unit. Please have this information available if you contact Technical Support.



The first four numbers in the serial number denote the year and month the device was manufactured. *In the example above the unit, was produced in **2015**, in the month of **March**.*

PRODUCT DESCRIPTION

The Ultra Filter System uses 4” x40” spiral wound polysulfone elements that are enclosed in special vessels to process RO/DI water at a required minimum and provides an extremely high recovery rate.

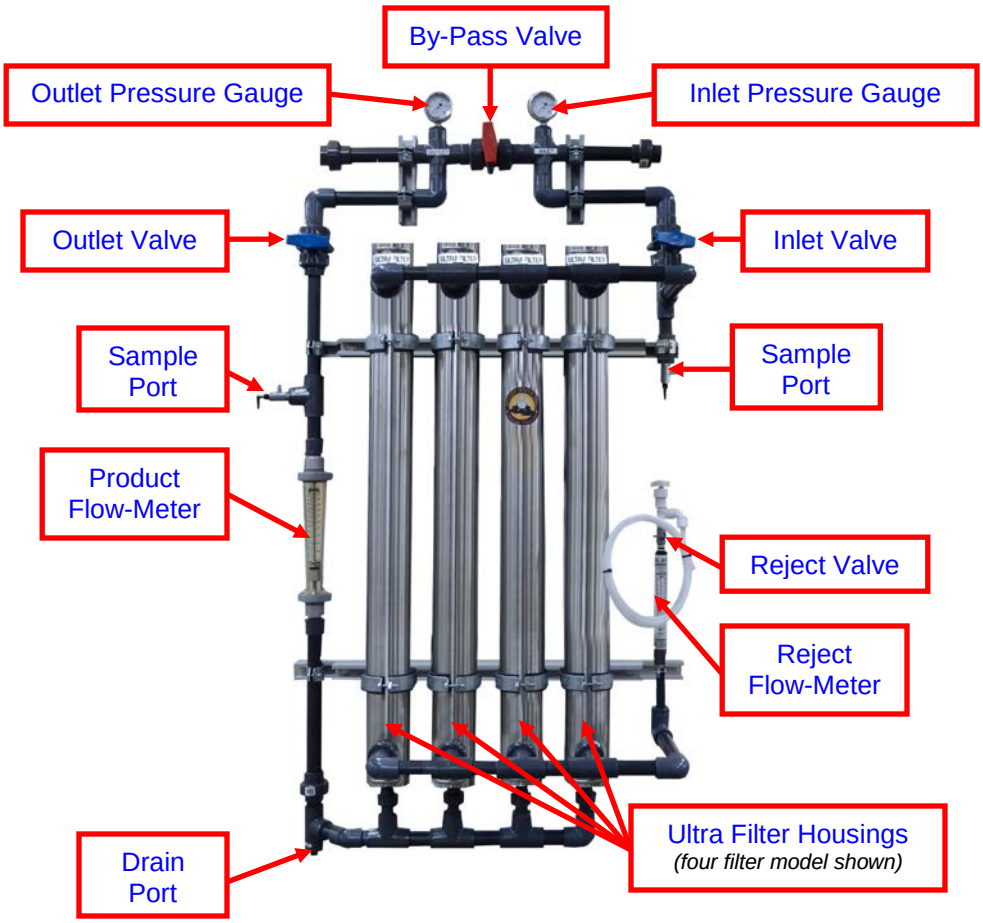
This device is not intended for any other application. The filtration process is similar to a Reverse Osmosis machine, however this device has no pump attached and is equipped with a 3 valve by-pass.

This device works from system water pressure, with a small amount of waste or reject water going to drain. The output (*product*) water from the filtration system is affected by other components in the water treatment system which affect, pressure, temperature and flow-rate.

Ultra filter membranes are a consumable product. The life of the membrane is directly related to the monitoring and routine care programs that you maintain in your facility. With proper care, monitoring, and disinfection, the life of the spiral wound membranes can be prolonged for several years.

An Ultra Filter system, in conjunction with good disinfecting programs, is a very effective means of controlling bacteria and endotoxins in the post treatment and distribution segments of a water purification system.

DETAILED VIEW of a 4” x40” ULTRA FILTER



GENERAL OPERATION

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. With proper operation, maintenance, and care, this device should give you years of reliable service.

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

Incoming tap water contaminants, temperature, pH, pressure, and flow-rates have a direct impact on the quality and quantity of the RO 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.*"

INITIAL START-UP

1. On initial start-up or membrane replacement, divert the product water flow to drain (*not to reservoir or distribution loop*) for a minimum of 2 hours to rinse preservative from the membranes.

DAILY START-UP

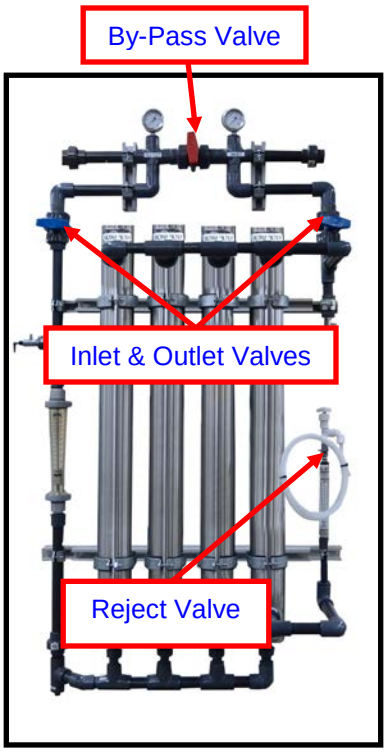
1. Ensure the **RO machine** has been placed into the **OPERATE** mode.

2. Ensure **Storage Tank** is at least half full (*not applicable For direct feed systems*).

3. The **INLET and OUTLET VALVES** (*blue handles*) are normally open, and the **BY-PASS VALVE** (*red handle*) is in the closed position.
**** Location of these two valves is based on the left-to-right or right-to-left orientation of the system flow.***

4. Open the **REJECT VALVE**.

5. Verify that the reject flow is 5% to 10% of product flow.



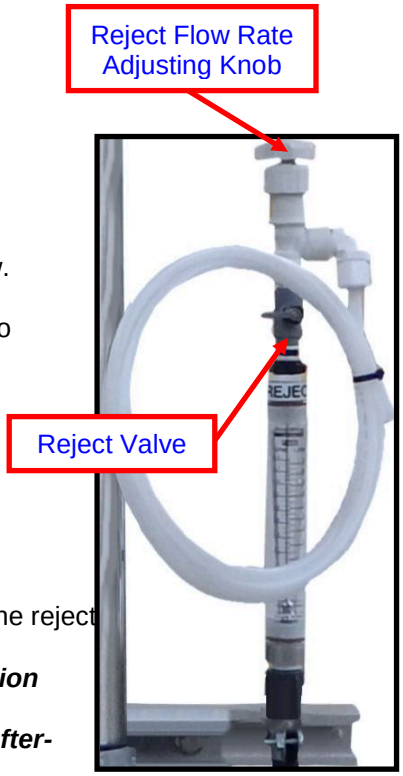
MONITORING PROCEDURES

1. The Ultra Filter System **must be monitored** on a **daily** schedule by a **qualified technician** using a **Quality Assurance Checklist**. An example checklist is provided in the **Appendix A** of this manual and may be reproduced for use.

2. The filter gauges should be checked with water flowing when there is **NO** demand for purified water.

3. Monitoring Requirements: (*record on the Quality Assurance Checklist*)
a. Filter system inlet pressure
b. Filter system outlet pressure
c. By-pass valve normally closed (*if By-Pass valve is open, do not dialyze patients*)
d. Product flow
e. Reject flow (*this should be 5-10% of Product Flow*)
f. Bacteria/endotoxins (*check at least monthly; more often if necessary*) must meet established standards

ADJUSTING PROCEDURES



1. The only adjustment to an Ultra Filter system is the reject flow.
a. Locate the **REJECT FLOW RATE ADJUSTING KNOB** on the filter system.
b. Slowly turn the knob clockwise or counterclockwise as required to increase or decrease the reject flow rate to 5-10% of product flow.

2. Any other adjustments are to the re-pressurization pump and/or to the pressure by-pass on the loop return at the reservoir.

DAILY SHUTDOWN

1. Ensure there are no requirements for purified water.

2. Close the **REJECT VALVE (labcock)** until the flow ceases and the reject meter indicates zero flow rate.
* ***Do not over tighten the reject needle valve in the closed position as this can damage the needle valve.***
**** This is done to prevent draining the storage tank dry during after-hours recirculation.***

VALVES LEGEND and OPERATION

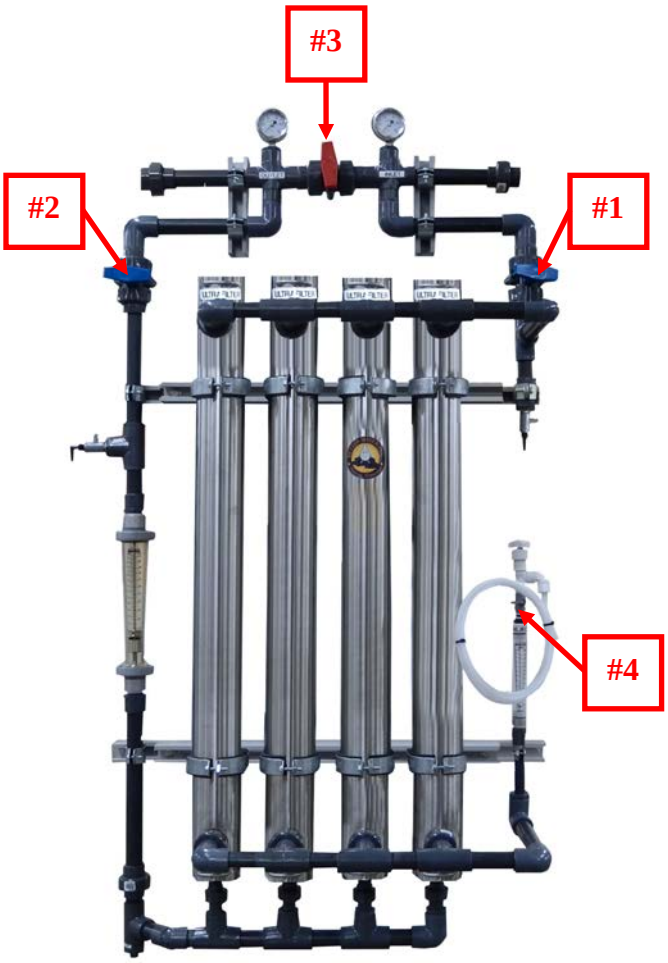
Placement of Inlet and Outlet Valves will be opposite between and Right-to-Left Model (*shown*) and a Left-to-Right Model.

1. Inlet Valve
Open or close for inlet water source.
* OPEN during normal operation

2. Outlet Valve
Open or close to allow water to exit.
* OPEN during normal operation

3. By-Pass Valve
Prevents water from being filtered
* CLOSED during normal operation

4. Reject Valve
Allows reject water to flow to drain.
* OPEN during normal operation, but CLOSED during recirculation.



DISINFECTING OVERVIEW

The 4x40 Spiral Wound Ultra Filter System is disinfected as a component of the Post-Treatment and/or Distribution Segment of the water treatment system. The disinfecting schedule is determined by the Medical Director and the results of bacteria and endotoxins test, but Better Water LLC recommends disinfecting monthly.

The use of typical household bleach (5.25%) is common for use in disinfecting water treatment systems for hemodialysis. Bleach is a cost effective disinfectant and generally produces satisfactory results. Varying concentrations of Sodium Hypochlorite (bleach) are used among dialysis facilities for disinfection.

a. 5.25% household bleach is 50,000 ppm Sodium Hypochlorite
b. 6% household bleach is 60,000 ppm Sodium Hypochlorite

Better Water LLC recommends using IRON FREE bleach. Care should be taken to select iron free bleach because many discount or generic brands will have high iron content. Iron will be harmful to the equipment and shorten its lifespan.

**** WARNING: DO NOT USE "SPLASH-LESS" BLEACH. The content of "splash-less" bleach may damage the equipment, and will create foam.***
**** WARNING: Ozone should not be used as a disinfectant on the 4 x 40 Spiral Wound Ultra Filter System, because the membranes will be damaged.***

BLEACH SOLUTION FOR TANK FEED SYSTEMS

- NOTE: Bleach will only be used on Tank Feed Systems

a. 500 ppm solution of sodium hypochlorite (*bleach*)
This is 1 gallon (128 ounces) of bleach per 100 gallons of water or a **1:100 dilution**
5.25% = 500 ppm dilution Water Gallons x 1.28 = ounces of bleach 5.25%
6% = 600 ppm dilution Water Gallons x 0.96 = ounces of bleach 6%
*** Total water gallons should include gallons in the tank as well as the loop.**
b. Recommended dwell time is **30-60 minutes**
**** See Appendix A for other bleach dilution ratios and pipe volume calculations, and 3 feet per second flow velocity rates if needed.***

RENALIN / MINNCARE SOLUTION FOR DIRECT FEED or TANK FEED SYSTEMS

- NOTE: Renalin / Minncare can be used on Direct Feed or Tank Feed Systems

a. 1% Renalin / Minncare solution at a 1:25 dilution
This is 750 ml (25.36 ounces) of Renalin / Minncare per 25 gallons of water or **1:25 dilution**
*** Total water gallons should include gallons in the tank as well as the loop.**
b. Recommended dwell time is **2-4 hours**

DISINFECTING PROCEDURE

1. The 4 x 40 Spiral Wound Ultra Filter System is disinfected as a component of the Post-Treatment and/or Distribution Segment of the water treatment system. Better Water LLC recommends that this filter assembly be disinfected monthly (every 30 days) or more often if necessary.

2. Slowly open and close the bypass valve a few times during the disinfect process to allow the bypass ball valve and associated piping to be disinfected.

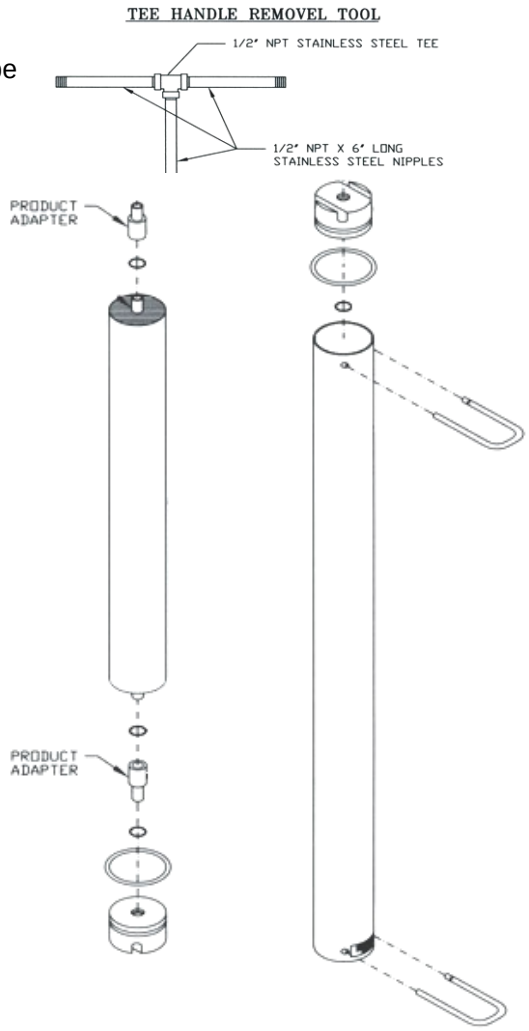
3. Slowly open and close the sample ports a few times during the disinfect process to allow these ports to be disinfected.

4. Slowly open and close the bypass valve a few times during the disinfect rinse process to allow the bypass ball valve and associated piping to be rinsed.

5. Slowly open and close the sample ports a few times during the disinfect rinse process to allow these ports to be rinsed.

SYSTEM MAINTENANCE: Changing the Membranes

Better Water LLC recommends that the membranes be changed **every 3 years**, unless otherwise dictated by, bacteria/endotoxin testing, and/or higher Delta-P pressure across the system.



Before starting you will need the following:

a. tee-handle removal tool
b. medical grade glycerin (*water soluble*)
c. Teflon enriched tape thread sealant
d. Teflon tape
e. sterile gloves

1. Start with all valves, sample ports, and drain ports closed.

2. Open either the reject valve or sanitary sample port to relieve the pressure.

3. Remove the u-pin from the top end-cap.

4. Using a tee-handle removal tool remove the top end-cap from the housing by screwing the tool into the end-cap until snug and then pull up.

5. Remove membrane and adapters.

6. Remove u-pin from the lower part of the housing.

7. Loosen all unions on the product header.

8. Remove each product union assembly from each end-cap.

9. Using the tee-handle removal tool to remove the bottom bottom end-cap.

10. Replace inner end-cap o-rings for both end-caps and lubricate with medical grade glycerin.

11. Wearing sterile gloves, remove the new membrane from the box.

12. Prepare the adapters by ensuring that the o-rings are in place and lubricated, and place onto membrane ends.

13. Reinstall bottom end-cap and reinsert u-pin.

14. Place membrane with adapters into housing and reinstall top end-cap and u-pin.

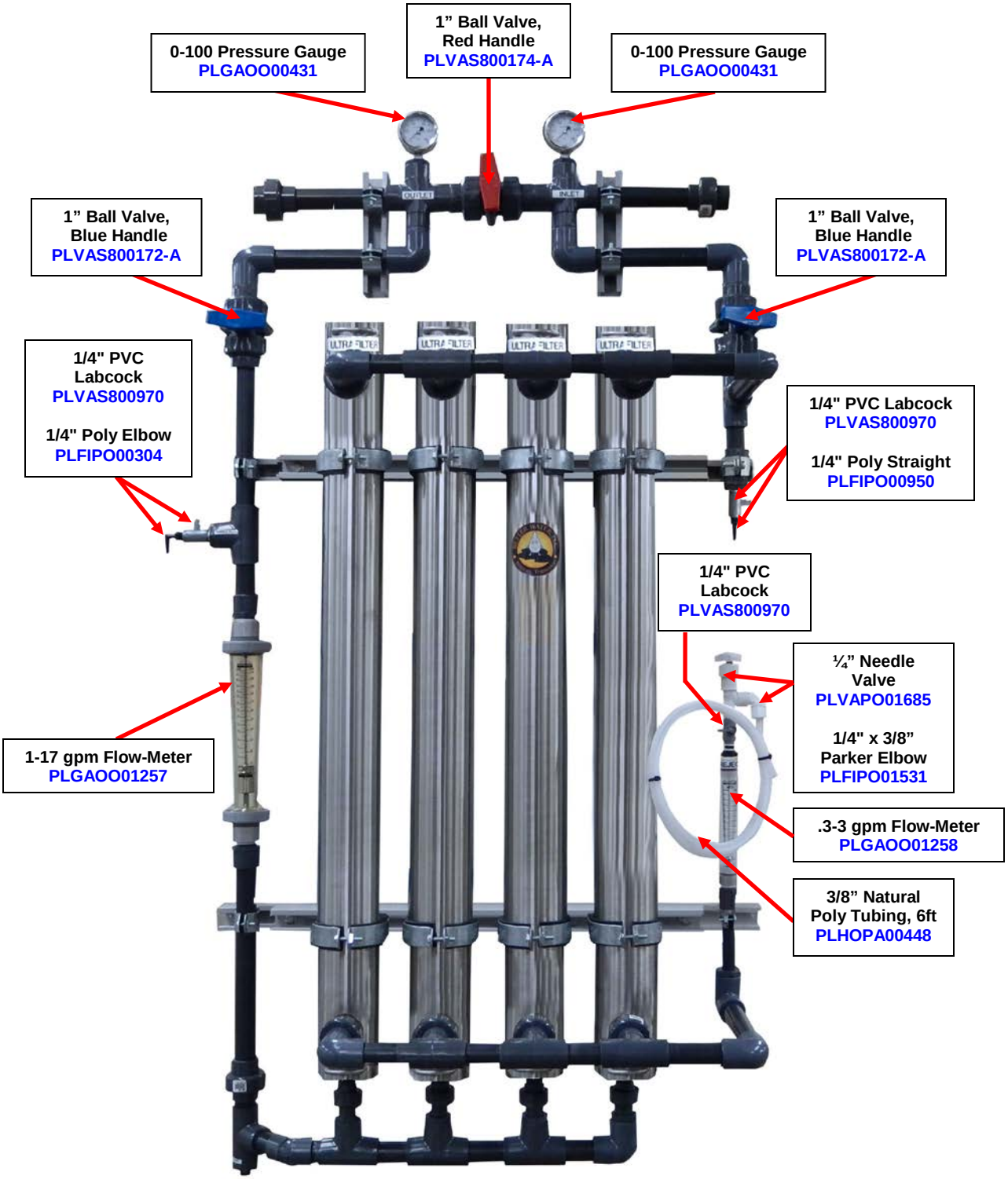
15. Re-tape each product union assembly with about 6 wraps of Teflon tape and then apply Teflon enriched tape thread sealant and re-install.

16. Open inlet and outlet water valves, and run product water to drain (***not to reservoir***) for two hours, and check for leaks.

17. Perform a disinfect.

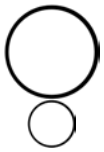
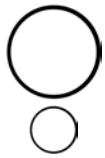
18. Membranes are now on-line and ready for use.

SERVICE HELP: Ultra Filter System



Current models are equipped with Stainless Steel Membrane Housings, whereas older models have Fiberglass Membrane Housings. See NEXT PAGE for parts list specific to the type of housing utilized.

SERVICE HELP: Ultra Filter System

DESCRIPTION	PART#	PICTURE
Current Model using Stainless Steel Membrane Housings		
4” x 40” Stainless Steel Membrane Housing	EQFHOO02005	< No Picture >
Top End-Cap for Stainless Steel Housing, no port	EQFHOO01585	
Bottom End-Cap for Stainless Steel Housing, with port	EQFHOO01586	
Outer O-ring for Stainless Steel Housing (*2 per housing*)	EQFHOO01587	
Inner O-ring for Stainless Steel Housing (*2 per housing*)	EQFHOO01588	
Product Adapter for Stainless Steel Housing	EQFHOO02007	
Membrane and Adapter Subassembly *- includes 4”x40” Sanitary/Full-Fit Membrane and adapters*	EQSUBUF001	
Older Model using Fiberglass Membrane Housings		
4” x 40” Fiberglass Membrane Housing	< No Longer Available – no picture >	
Top/Bottom End-Cap for Fiberglass Housing	EQFHOO01004	
Outer O-ring for Fiberglass Housing (*2 per housing*)	EQFHOO01587	
Inner O-ring for Fiberglass Housing (*2 per housing*)	EQFHOO01581	
Product Adapter for Fiberglass Housing	EQFHOO02009	
Membrane and Adapter Subassembly *- includes 4”x40” Sanitary/Full-Fit Membrane and adapters*	EQSUBUF002	

Pictures do not reflect the size of the item in relation to the other pictures

SERVICE HELP: Consumable Items

DESCRIPTION	PART#	PICTURE
Minncare, Disinfectant	SUMCOO00575	
Minncare Disinfect Residual Test Strips, 100 pk	SUMCOO00576	
Minncare 1% Test Strips, 100 pk	SUMCOO00577	
4” x 40” Ultra Filter Membrane * For Membrane + Adapters Kit for Stainless Steel Housing use part number **EQSUBUF001** * For Membrane + Adapters Kit for Fiberglass Housing use part number **EQSUBUF002**	SUUF01346	

Pictures do not reflect the size of the item in relation to the other pictures

TROUBLE-SHOOTING GUIDE

The information in this document is intended to serve as a guide only for qualified operators. It is not all inclusive of the 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.

Problem	Possible Causes	Possible Solutions
The recovery rate is less than 90%	**1. Reject shut-off valve needs adjusting**	**1.** Adjust the reject shut-off valve to establish a recovery rate of 90-95%.
The product (*permeate*) flow has decreased by 10% or greater	**1. Membranes are fouled** **2. Membranes exceed recommended change out time**	**1.** Check the inlet pressure to the filter system. If the inlet pressure has decreased below the design specification, then adjust the pressure regulator at the loop return at the reservoir (*typically 20-30 psi, for tank-feed systems with no demand*). **2.** Perform a disinfect
If the Delta P is lower than the initial qualification	**1. Loop return pressure regulator could be out of adjustment** **2. Membrane ruptured** **3. Missing or damaged o-rings** **4. Oxidized membrane**	**1.** Adjust the pressure regulator at the loop return at the reservoir (*typically 20-30 psi, for tank-feed systems with no demand*). **2.** If the above step does not correct the problem, replace the membranes and/or o-rings.
The product (*permeate*) water is contaminated with microbiological contaminants (*bacteria and/or endotoxins*)	**1. Membranes are fouled** **2. Improper disinfection** **3. Membranes exceed recommended change out time**	**1.** Perform a disinfect **2.** If disinfection does not correct the problem, the membranes must be replaced
The pressure drop is greater than 15 psi Delta P at the initial qualification with zero demand	**1. Loop return pressure regulator could be out of adjustment** **2. Membranes are fouled** **3. Membranes exceed recommended change out time**	**1.** Adjust the pressure regulator at the loop return at the reservoir (*typically 20-30 psi, for tank-feed systems with no demand*). **2.** Perform a disinfect

LIMITED WARRANTY TERMS and CONDITIONS

a. This limited warranty is given only to the original buyer and covers the equipment delivered with this limited warranty.
b. The buyer shall be barred from any recovery on this limited warranty or otherwise for damages due in whole or in part to…

… unreasonable use
… improper operation
… use beyond normal fashion
… failure to follow instructions
… failure to maintain the product in good condition and repair
… or the like.

c. If the buyer discovers or should have discovered a defect in which it is reasonable to conclude that damage, either personal, property, or economic, may result, the buyer's continued use of the product shall constitute any assumption of risk by the buyer and a bar to any recovery for breach of this limited warranty or otherwise.
d. No oral or written representation, information, or advice given by Better Water LLC or any of its representatives shall create a warranty or in any way increase the scope of this express limited warranty and shall not form a part of the basis for bargain.

WHAT IS WARRANTED AND FOR HOW LONG?

a. All equipment, excluding ion exchange and filtration media and cartridges, are warranted to be free from factory defects in materials, and workmanship under normal use for a period of one (1) year from the date of shipment.
b. It is a condition precedent to recovery on this limited warranty that the buyer strictly comply with all operating and maintenance guidelines established by Better Water LLC and that the serial number (*if applicable*) is intact and legible on the equipment.
c. It is a condition precedent to recovery on this limited warranty for damage to the external finish of the equipment that the buyer notifies Better Water LLC at the time of the installation that the finish is damaged.

WHAT IS REMEDY FOR BREACH OF THIS LIMITED WARRANTY or NEGLIGENCE BY BETTER WATER LLC

a. Buyer's sole and exclusive remedy for any breach of this limited warranty or negligence by Better Water LLC shall be repair or replacement of the defective part, at the option of Better Water LLC, provided such defective part is returned to Better Water LLC for inspection.
b. Better Water LLC shall not be obligated to supply an exact replacement of the defective part and reserves the right to substitute new and improved parts.
c. Better Water LLC shall provide at no cost to buyer, labor to remove and/or replace defective parts covered by this limited warranty for a period of ninety (90) days from the date of installation by Better Water LLC of the equipment.
d. After such ninety (90) day period, buyer shall be responsible for any labor or service charge for the removal and/or replacement of any defective parts.
e. Buyer shall be responsible for all travel expenses and freight charges at all times.
f. Better Water LLC shall have no obligation to repair or replace any defective part if buyer fails to follow the procedure set forth in “HOW TO OBTAIN A REPLACEMENT PART UNDER LIMITED WARRANTY”.

IN NO EVENT SHALL THIS LIMITED WARRANTY BE CONSTRUED TO COVER, NOR SHALL BETTER WATER LLC BE LIABLE TO BUYER AS ANY OTHER PERSON FOR, ANY CONSEQUENTIAL, INCEDENTAL, ECONOMIC, DIRECT, INDIRECT, GENERAL OR SPECIAL DAMAGES, WHICH ARE HEREBY EXPRESSLY DISCLAIMED.

HOW TO OBTAIN A REPLACEMENT PART UNDER LIMITED WARRANTY

a. Buyer should contact the Customer Service or Technical Support Departments and request a Return Goods Authorization.

b. Described part(s) will be sent with a purchase order.
c. The returned part(s) will be returned to the factory for limited warranty consideration. If part(s) are not covered under the limited warranty, part(s) will be considered billable against the purchase order supplied.

WHAT IS NOT COVERED BY THIS LIMITED WARRANTY:

By way of example and not limitation, this limited warranty does not cover:

- Damage to or replacement of any ion exchange resin of filter media
- Labor or service charges for the removal and/or replacement of any defective parts after the ninety (90) day period from the date of installation or sale by Better Water LLC
- Freight charges and travel expenses
- Damage from inadequate or defective wiring, improper voltage, improper connections or electrical service, inadequate or defective plumbing, water supply, or water pressure, or in violation of applicable building, plumbing or electrical codes, laws, ordinances or regulations.
- Damage from improper installation or operation, including but not limited to, abuse, accident, neglect, improper maintenance, freezing and fires, or abnormal use.
- Damage caused by contaminants in Buyer’s water supply, including hardness, chlorine, chloramines, sulfur, bacterial iron, tannin, algae, oil, organic matter or other unusual substances, if special equipment has not been installed by Better Water LLC to remove such contaminants
- Damage to or caused by filters/membranes or other replacement parts not purchased from Better Water LLC or damage caused by modification, alteration, repair or service of the equipment or any of its parts by anyone other than Better Water LLC or its expressly authorized representatives.

APPENDIX A: Sample Quality Assurance Checklist

WATER TREATMENT SYSTEM QUALITY ASSURANCE CHECKLIST (example)							
ITEMS TO BE CHECKED	**MON**	**TUE**	**WED**	**THU**	**FRI**	**SAT**	**SUN**
DATE							
Storage Tank							
Water Level Above 2nd Float							
.2 Vent Filter							
Last Changed							
Next Change Due							
PSI Post-Repress. Pump							
DI Tanks							
PSI Pre-DI							
PSI Post-DI							
DI Tank(s) ΔP (<15)							
Post-DI 5 Micron							
PSI Pre-5 micron Filter (if used)							
PSI Post-5 micron Filter (if used)							
Post-DI 5 micron ΔP (<15)							
UV Light (if used)							
PSI Pre-UV							
PSI Post-UV							
UV Light On?							
Cartridge Based Pyrogen Filter (if used)							
PSI Pre-Filter (if used)							
PSI Post-Filter (if used)							
.03 micron Absolute Filter ΔP (<15)							
4x40 Spiral Wound Ultra Filter (Post-Treat)							
PSI Pre-4 x 40 (if used)							
PSI Post-4 x 40 (if used)							
Product Flow in GPM							
Reject Flow in GPM							
Loop Return Flow in GPM (if used)							
Loop Return Pressure (at Pressure Bypass)							
4x40 Spiral Wound Ultra Filter (Reuse)							
PSI Pre-4 x 40 (if used)							
PSI Post-4 x 40 (if used)							
Product Flow in GPM							
Reject Flow in GPM							
Loop Return Flow in GPM (if used)							
Loop Return Pressure (at Pressure Bypass)							
Technician's Initials							

APPENDIX B: CALCULATIONS & CONVERSIONS

BLEACH DISINFECTING DILUTIONS

a. 5.25% household bleach is 50,000 ppm Sodium Hypochlorite
b. 6% household bleach is 60,000 ppm Sodium Hypochlorite

1:50 Dilution

5.25% = 1000 ppm	Tank Gallons x 2.56 = ounces of bleach 5.25%
6% = 1200 ppm	Tank Gallons x 1.92 = ounces of bleach 6%

1:100 Dilution

5.25% = 500 ppm	Tank Gallons x 1.28 = ounces of bleach 5.25%
6% = 600 ppm	Tank Gallons x 0.96 = ounces of bleach 6%

1:500 Dilution

5.25% = 100 ppm	Tank Gallons x 0.64 = ounces of bleach 5.25%
6% = 120 ppm	Tank Gallons x 0.48 = ounces of bleach 6%

1:1000 Dilution

5.25% = 50 ppm	Tank Gallons x 0.128 = ounces of bleach 5.25%
6% = 60 ppm	Tank Gallons x 0.096 = ounces of bleach 6%

CONVERSION FORMULAS

OUNCES to MILLILITERS
Formula: **Fluid Ounces x 29.6 = Milliliters**
Example: 128 oz x 29.6 = 3790 milliliters

MILLILITERS to OUNCES
Formula: **Milliliters / 29.6 = Ounces**
Example: 750 ml / 29.6 = 25.34 ounces

GALLONS to OUNCES
Formula: **Gallon * 128 = Ounces**
*Example: 1 gal * 128 = 128 ounces*

OUNCES to GALLONS
Formula: **Ounces / 128 = Gallons**
Example: 128 ounces / 128 = 1 Gallon

CALCULATION for AREA of PIPE VOLUME

To calculate the cross sectional area of pipe, use the following formula: Area = pi x r^2

- pi =3.14
- r = radius (*which is ½ the diameter*)

The following calculation uses a 1" diameter pipe as an example:

Calculate the cross sectional area of the pipe using the formula above:

1. divide the diameter by 2 to get the radius in inches	1" diameter / 2 = **0.5 inches**
2. divide the radius by 12 to convert from inches to feet	0.5 / 12 = **0.0417 feet**
3. square the radius	0.0417^2 = **.00174 sq ft**
4. Multiply by pi	0.00174 x 3.14 = **.00546 sq ft**

Answer: the area of a 1” diameter pipe is 0.00546 ft^2

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3 FEET per SECOND FLOW VELOCITY RATES

Nominal Loop Pipe Inner Diameter

3/4" Teflon id	=	0.60in.
3/4" schedule 80 pvc id	=	0.74in
1" Teflon id	=	0.88in
1" schedule 80 id	=	0.96in
1 1/2" schedule 80 id	=	1.48 in
3/4" (25mm) polypropylene id	=	0.80in
1" (32mm) polypropylene id	=	1.03in
1 1/2" (50mm) polypropylene id	=	1.61 in

Nominal Flow Rates at 3 Feet per Second

3/4" Teflon	=	2.64 gpm @ 3ft/sec (Nominal)
3/4" schedule 80 pvc	=	4.02 gpm @ 3ft/sec (Nominal)
1" Teflon	=	5.69 gpm @ 3ft/sec (Nominal)
1" schedule 80	=	6.77 gpm @ 3ft/sec (Nominal)
1 1/2" schedule 80	=	16.1 gpm @ 3ft/sec (Nominal)
3/4" (25mm) polypropylene	=	4.70 gpm @ 3ft/sec (Nominal)
1" (32mm) polypropylene	=	7.79 gpm @ 3ft/sec (Nominal)
1 1/2" (50mm) polypropylene	=	19.0 gpm @ 3ft/sec (Nominal)

a. All 3ft/sec flow rates at the loop return flow meter are calculated for the loop inner diameter only.
b. The above flow rates should be set with all dialysis machines running.
c. If bicarb or acid makeup water is required, both should have the proper flow controls to maintain flow velocity.


BETTER WATER LLC
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