

 **Dometic** ***SPOT ZERO***

***Spot Zero Mobile Wash Down
System***

01/12/2015



SZ MWD SZ MWD WH 110v
SZ MWDZ SZ MWDZ WH 220v

2000 N Andrews Ext.
Pompano Beach, FL 33069
Phone 954-973-2477
Fax 954-979-4414
Email: info@spotzerowater.com
Website: spotzerowater.com

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Introduction

Your Spot Zero™ Reverse Osmosis System is a durable piece of equipment which, with proper care, will last for many years. This User's Manual outlines installation, operation, maintenance and troubleshooting details vital to the sustained performance of your system.

Your system is designed to operate at a pressure of 80-150 psi, unless otherwise stated. The recovery set for your system is between 50%-75%.

NOTE: Prior to operating or servicing the Spot Zero™ Reverse Osmosis System, this User's Manual must be read and fully understood. Keep it and other associated information for future reference and for new operators or qualified personnel near the system.

System Requirements & Operation Guidelines

Plumbing

The membranes and high pressure pumps used on Spot Zero™ systems require a continuous and non-turbulent flow of water to the system with a minimum feed pressure of 20 psi during operation, which does not exceed 105°F.

The tubing or piping used for the inlet of the feed water is 1/2" NPT. The tubing or piping used for the discharge of the concentrate is 3/8" OD and should be run to an open over board in a free and unrestricted manner.

The tubing or piping used for the product is 3/8" OD and can be transported to the holding tank or directly through a high quality nylon tubing or PVC pipe or other FDA accepted materials.

Material must not precipitate in the system. Be certain that all of the components of the feed water are soluble at the concentrations attained in the system

CAUTION: Any restrictions or blockage in the overboard discharge line can cause back pressure, which will increase the system's operating pressure. This can result in damage to the system's components and possible leaks of components or tubing.

Electrical

The motors used on Spot Zero™ systems are pump and motor combinations. They are available in single-phase 115 volt or 230 volt AC.

Please ensure that the electrical circuit supplying the system is compatible with the requirements of the specific Spot Zero™ model.

Pre-Filtration

Spot Zero™ systems are supplied with a 1 micron sediment pre-filter (part # SZ-MS1) that filters out most particles over 1 microns, a GAC/KDF (part # SZ-MS2) Cartridge that removes chlorine, chloramine, VOCs and heavy metals. **CAUTION: a traditional carbon block filter must not be used as it will not remove chloramines and will cause permanent membrane damage.** Pre Filters should be changed every 100 hours and/or whenever there is a pressure difference of 15 psi or more between the pressure readings before and after the filter. The pump must NEVER be run dry. Operating the pump without sufficient feed water will damage the pump. ALWAYS feed the pump with filtered water. The pump is susceptible to damage from sediment and debris.

NOTE: THE SZ-CARTRIDGE MUST BE FLUSHED OUTSIDE OF SYSTEM BEFORE OPERATING TO REMOVE CARBON DUST. [Youtube Demo Link](#) The system must be operated on filtered water only. Do not attempt to clean used filter cartridges. The SZ-cartridge is rated to absorb chlorine, chloramine, heavy metals, etc., up to 18,000 gallons of feed water which is the equivalent to approximately 100 hours of run time. **CAUTION:** If the pre-filter becomes clogged and the water flow to the pump is reduced or interrupted, cavitation will occur. This will damage the pump.

There is a membrane cleaning chemical in the new filters to help preserve the membranes. Upon changing the filters bleed air out of system by flushing water through the flush valve for 1 minute. Turn water off and let membranes soak for 30 minutes. Turn water back on and flush for 10 minutes. Then return to normal use.

Operating Instructions

1. Attach feed water to the water supply fitting with a non-collapsible garden hose.



2. Attach garden hose to the spot zero water fitting. Use a heavy duty garden hose to avoid collapsing or bursting.



3. Open the red flush valve to allow air to purge from the system



4. Plug in AC Power, from a GFCI protected outlet, to the system.



5. Close the red flush valve.



6. Wash down vessel with system.

7. Open red flush valve and allow water to flush system for 1 minute for every hour of use.



8. Close red flush valve for storage.



***NOTE: A GFCI protected outlet should be used to supply power to this system.

***NOTE: To prevent system damage filter should be replaced every 25,000 gallons of use.

***NOTE: Use a heavy duty garden hose to avoid collapsing or bursting.

Membrane Performance Check Instructions:

1. With a handheld TDS meter, record a reading of the dock water feed PPM of TDS.



2. Membrane Rejection =
$$\frac{\text{Feed Water Parts Per Million (PPM) of Total Dissolved Solids (TDS)} - \text{Product Water PPM}}{\text{Feed Water PPM of TDS}}$$

Example: (117 ppm of Feed Water - 4 ppm of Product Water) = 113 ppm / 117 ppm of Feed TDS

$$113\text{ppm}/117\text{ppm} = 96.58 \% \text{ Rejection}$$

Note: Rejection Rates above 94% @ 77 Deg. F indicates acceptable membrane performance.

Note: To get best results from the system, change membranes every 100,000 gallons

Filter, Membrane Removal & Replacement

Changing membranes in pressure vessels is an easy process if you have the proper information and tools at hand. Please refer to the following instructions when removing and replacing membrane elements:

1. Locate the inlet end of the pressure vessel, that is opposite the flow direction.



2. Remove the screw from the yellow snap ring lock at the end of the pressure vessel.



3. Remove the white Nylon snap ring from the end cap.



4. Remove the end cap from the pressure vessel, using the filter removal tool.



For Membranes skip to Step 12

5. Remove both filters and discard.
6. Install the Stage #2 SZMS2 Filter first, push all the way in.



7. Install the Stage #1 SZMS1 filter second.



8. Put End Cap and Snap Ring in place.

NOTE: The new filters have a membrane treatment chemical in them be sure to discard any product water until done with the following steps!

9. Bleed air out of the system through the flush valve for 1 minute, turn water off and let soak for 30 minutes.
 10. Turn water back on and flush for 10 minutes to remove chemical.
 11. Return to normal use.
- (Continue to number 12 for membrane replacement only!)
12. Slowly remove the membrane element from the pressure vessel being careful not to grasp it by the permeate tube. Needle nose pliers may be necessary to pull the old membrane element out of the pressure vessel.



13. Remove new membrane element from container and inspect. Make sure that all parts are clean and free from dirt. Examine the brine seal, and permeate tube for nicks or cuts. Replace the O-rings or brine seal if damaged.
14. Lubricate the brine seal with a food grade lubricant.
15. Install the membrane element so the brine seal will be located and the opposite end of the flow direction.



16. At a slight angle insert membrane while slightly rotating element being careful not to tear or flip the brine seal. Re-lube the brine seal if necessary.
17. With a smooth and constant motion, push the membrane element into the housing so that the brine seal enters the housing without coming out of the brine seal groove. A slow twisting motion should be used to insert the membrane element, to ensure that the brine seal stays in place.
18. Reinstall the end caps by gently twisting the end cap while pushing it onto the housing. Ensure that you do not pinch or fatigue any O-rings while pushing the end plug on. Push the end plug on until the outer diameter of the plug is flush with the outer diameter of the membrane housing.
19. Re-install the white nylon snap ring and the yellow snap ring lock
20. These directions should be observed for installation of each element in each housing.

Note: As time progresses, the efficiency of the membrane will be reduced. The permeate flow rate will begin to decline slightly after one year of operation, but can be extended with diligent flushing and cleaning of the system. A high pH and/or precipitation of hardness can cause premature loss in rejection of membrane elements in the system.

Operation Do's and Do Not's

Do

1. Do change filter cartridges (SZ-MS1 & SZ-MS2) every 25,000 gallons to prevent membrane damage
2. Do run the system often
3. Do perform weekly system flush
4. Replace membranes every 100,000 gallons.

Do Not

1. Do Not re-use filter cartridges
2. Do Not produce more product than system is rated for
3. Do Not run machine without water supply
4. Do Not use unapproved pre-filter cartridges, membrane damage may occur
5. Do Not leave system unused for long periods of time
6. Do Not expose system to temperatures below 32 degrees F (0 Degrees C)

Example Membrane Temperature Correction Factor



Membrane Temperature Correction Factor

Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor
50.0 (10.0)	1.711	57.2 (14.0)	1.475	64.4 (18.0)	1.276	71.6 (22.0)	1.109	78.8 (26.0)	0.971
50.2 (10.1)	1.705	57.4 (14.1)	1.469	64.6 (18.1)	1.272	71.8 (22.1)	1.105	79.0 (26.1)	0.968
50.4 (10.2)	1.698	57.6 (14.2)	1.464	64.8 (18.2)	1.267	72.0 (22.2)	1.101	79.2 (26.2)	0.965
50.5 (10.3)	1.692	57.7 (14.3)	1.459	64.9 (18.3)	1.262	72.1 (22.3)	1.097	79.3 (26.3)	0.962
50.7 (10.4)	1.686	57.9 (14.4)	1.453	65.1 (18.4)	1.258	72.3 (22.4)	1.093	79.5 (26.4)	0.959
50.9 (10.5)	1.679	58.1 (14.5)	1.448	65.3 (18.5)	1.254	72.5 (22.5)	1.090	79.7 (26.5)	0.957
51.1 (10.6)	1.673	58.3 (14.6)	1.443	65.5 (18.6)	1.249	72.7 (22.6)	1.086	79.9 (26.6)	0.954
51.3 (10.7)	1.667	58.5 (14.7)	1.437	65.7 (18.7)	1.245	72.9 (22.7)	1.082	80.1 (26.7)	0.951
51.4 (10.8)	1.660	58.6 (14.8)	1.432	65.8 (18.8)	1.240	73.0 (22.8)	1.078	80.2 (26.8)	0.948
51.6 (10.9)	1.654	58.8 (14.9)	1.427	66.0 (18.9)	1.236	73.2 (22.9)	1.075	80.4 (26.9)	0.945
51.8 (11.0)	1.648	59.0 (15.0)	1.422	66.2 (19.0)	1.232	73.4 (23.0)	1.071	80.6 (27.0)	0.943
52.0 (11.1)	1.642	59.2 (15.1)	1.417	66.4 (19.1)	1.227	73.6 (23.1)	1.067	80.8 (27.1)	0.940
52.1 (11.2)	1.636	59.4 (15.2)	1.411	66.6 (19.2)	1.223	73.8 (23.2)	1.064	81.0 (27.2)	0.937
52.3 (11.3)	1.630	59.5 (15.3)	1.406	66.7 (19.3)	1.219	73.9 (23.3)	1.060	81.1 (27.3)	0.934
52.5 (11.4)	1.624	59.7 (15.4)	1.401	66.9 (19.4)	1.214	74.1 (23.4)	1.056	81.3 (27.4)	0.932
52.7 (11.5)	1.618	59.9 (15.5)	1.396	67.1 (19.5)	1.210	74.3 (23.5)	1.053	81.5 (27.5)	0.929
52.9 (11.6)	1.611	60.1 (15.6)	1.391	67.3 (19.6)	1.206	74.5 (23.6)	1.049	81.7 (27.6)	0.926
53.1 (11.7)	1.605	60.3 (15.7)	1.386	67.5 (19.7)	1.201	74.7 (23.7)	1.045	81.9 (27.7)	0.924
53.2 (11.8)	1.600	60.4 (15.8)	1.381	67.6 (19.8)	1.197	74.8 (23.8)	1.042	82.0 (27.8)	0.921
53.4 (11.9)	1.594	60.6 (15.9)	1.376	67.8 (19.9)	1.193	75.0 (23.9)	1.038	82.2 (27.9)	0.918
53.6 (12.0)	1.588	60.8 (16.0)	1.371	68.0 (20.0)	1.189	75.2 (24.0)	1.035	82.4 (28.0)	0.915
53.8 (12.1)	1.582	61.0 (16.1)	1.366	68.2 (20.1)	1.185	75.4 (24.1)	1.031	82.6 (28.1)	0.913
54.0 (12.2)	1.576	61.2 (16.2)	1.361	68.4 (20.2)	1.180	75.6 (24.2)	1.028	82.8 (28.2)	0.910
54.1 (12.3)	1.570	61.3 (16.3)	1.356	68.5 (20.3)	1.176	75.7 (24.3)	1.024	82.9 (28.3)	0.908
54.3 (12.4)	1.564	61.5 (16.4)	1.351	68.7 (20.4)	1.172	75.9 (24.4)	1.021	83.1 (28.4)	0.905
54.5 (12.5)	1.558	61.7 (16.5)	1.347	68.9 (20.5)	1.168	76.1 (24.5)	1.017	83.3 (28.5)	0.902
54.7 (12.6)	1.553	61.9 (16.6)	1.342	69.1 (20.6)	1.164	76.3 (24.6)	1.014	83.5 (28.6)	0.900
54.9 (12.7)	1.547	62.1 (16.7)	1.337	69.3 (20.7)	1.160	76.5 (24.7)	1.010	83.7 (28.7)	0.897
55.0 (12.8)	1.541	62.2 (16.8)	1.332	69.4 (20.8)	1.156	76.6 (24.8)	1.007	83.8 (28.8)	0.894
55.2 (12.9)	1.536	62.4 (16.9)	1.327	69.6 (20.9)	1.152	76.8 (24.9)	1.003	84.0 (28.9)	0.892
55.4 (13.0)	1.530	62.6 (17.0)	1.323	69.8 (21.0)	1.148	77.0 (25.0)	1.000	84.2 (29.0)	0.889
55.6 (13.1)	1.524	62.8 (17.1)	1.318	70.0 (21.1)	1.144	77.2 (25.1)	0.997	84.4 (29.1)	0.887
55.8 (13.2)	1.519	63.0 (17.2)	1.313	70.2 (21.2)	1.140	77.4 (25.2)	0.994	84.6 (29.2)	0.884
55.9 (13.3)	1.513	63.1 (17.3)	1.308	70.3 (21.3)	1.136	77.5 (25.3)	0.991	84.7 (29.3)	0.882
56.1 (13.4)	1.508	63.3 (17.4)	1.304	70.5 (21.4)	1.132	77.7 (25.4)	0.988	84.9 (29.4)	0.879
56.3 (13.5)	1.502	63.5 (17.5)	1.299	70.7 (21.5)	1.128	77.9 (25.5)	0.985	85.1 (29.5)	0.877
56.5 (13.6)	1.496	63.7 (17.6)	1.294	70.9 (21.6)	1.124	78.1 (25.6)	0.982	85.3 (29.6)	0.874
56.7 (13.7)	1.491	63.9 (17.7)	1.290	71.1 (21.7)	1.120	78.3 (25.7)	0.979	85.5 (29.7)	0.871
56.8 (13.8)	1.486	64.0 (17.8)	1.285	71.2 (21.8)	1.116	78.4 (25.8)	0.977	85.6 (29.8)	0.869
57.0 (13.9)	1.480	64.2 (17.9)	1.281	71.4 (21.9)	1.112	78.6 (25.9)	0.974	85.8 (29.9)	0.866

T = (°C x 9/5) + 32

Corrected Flow Rate = (Measured Flow Rate) x TCF @ Feed Water Temp.



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Corrected Flow Rate = (measured flow rate) x TCF (temperature correction factor @ feed water temperature)

Example # 1 - A Spot Zero 2000 (SZ 2000) is producing 1 GPM of product @ 60 Degrees F

1 GPM x 1.371 TCF = 1.371 GPM of Corrected Flow Rate. (system operating properly, SZ 2000 rated to produce 1.38 GPM)

Example # 2 - Spot Zero 3000 (SZ 3000) is producing 1.25 GPM @ 50 Degrees F

1.2 GPM x 1.7 TCF = 2.04 GPM of Corrected Flow Rate. (system operating properly, SZ 3000 rated to produce 2.0 GPM)

Example # 3 - Spot Zero 2000 (SZ 2000) is producing 0.9 GPM @ 77 Degrees F

0.9GPM x 1.0 TCF = 0.9 GPM of Corrected Flow Rate (system is not producing water properly, increase pump pressure or cleaning of membrane/s may be required)



Membrane Temperature Correction Factor

Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor	Temperature °F (°C)	Temperature Correction Factor
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50.2 (10.1)	1.705	57.4 (14.1)	1.469	64.6 (18.1)	1.272	71.8 (22.1)	1.105	79.0 (26.1)	0.968
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56.5 (13.6)	1.496	63.7 (17.6)	1.294	70.9 (21.6)	1.124	78.1 (25.6)	0.982	85.3 (29.6)	0.874
56.7 (13.7)	1.491	63.9 (17.7)	1.290	71.1 (21.7)	1.120	78.3 (25.7)	0.979	85.5 (29.7)	0.871
56.8 (13.8)	1.486	64.0 (17.8)	1.285	71.2 (21.8)	1.116	78.4 (25.8)	0.977	85.6 (29.8)	0.869
57.0 (13.9)	1.480	64.2 (17.9)	1.281	71.4 (21.9)	1.112	78.6 (25.9)	0.974	85.8 (29.9)	0.866

*F = (°C x 9/5) + 32

Corrected Flow Rate = (Measured Flow Rate) * (TCF @ Feed Water Temp.)



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 p:954.533.5640 • f:877.765.7650
 e:info@spotzerowater.com • w:spotzerowater.com

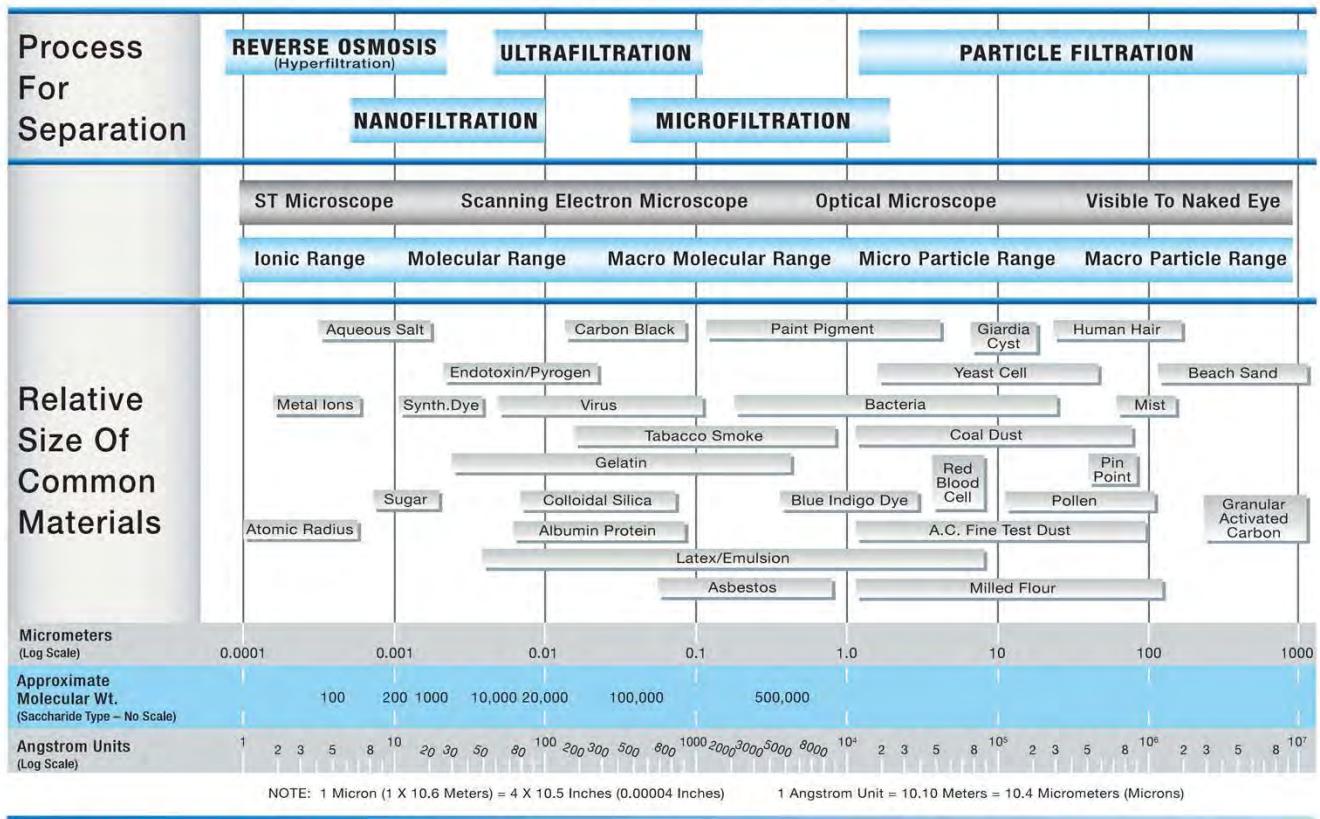
Reverse Osmosis Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
LP FAULT	Low dock supply pressure	Increase Inlet Pressure. A minimum of 25psi is recommended for pre-filter outlet pressure during operation
	Cartridge filters plugged	Change Filters
	Solenoid valve malfunction	Replace Sol. Valve and/or Coil
	Leaks	Fix any visible leaks
LOW PERMEATE FLOW	Cold feed water	See temperature correction sheet
	Low operating pressure	Adjust throttle and concentrate valve
	Defective membrane brine seal/ Membrane installed backwards	Replace brine seal and / or Reposition membranes
	Fouled or Scaled membrane	Clean membranes
	Damaged product tube o-rings	Inspect and/or replace
HIGH PERMEATE FLOW	Damaged or oxidized membrane	Replace membrane
	Exceeding maximum feed water temperature	See temperature correction sheet
	Low operating pressure	Adjust concentrate valve
POOR PERMEATE QUALITY	Damage product tube o-rings	Inspect and/or replace
	Damaged or oxidized membrane from Chlorine or Chloramine in feed water	Replace membrane and be sure that SZ-MS2 is changed every 25,000 Gallons.
MEMBRANE FOULING	Scaling (CaSO ₄ , CaSO ₃ , BaSO ₄ , SiO ₂)	Clean with Cleaning Cartridge. Check for over production, conduct weekly maintenance flush.
	Trapped sediment media	Replace Membrane, check pre-filtration
	Chlorine Oxidation	Check Chlorine feed equipment and de-chlorination system. Be sure that SZ-MS2 is replaced every 25,000 Gallons.
HIGH PUMP PRESSURE (<150 PSI)	Cold feed water	See temperature correction sheet.
	Membrane Fouling	See: Membrane Fouling

Water Filtration Range & Sizing Table



Water Filtration Range & Sizing Table



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Membrane Element Ion Rejection Rates



Membrane Element Ion Rejection Rates

TFC Membranes

* Nominal Rejection

CHARACTERISTICS OF THIN FILM COMPOSITE POLYAMIDE MEMBRANE

Ion	Symbol	% Rejection
Aluminum	Al ⁺³	97 – 98
Ammonium	NH ₄ ⁺	85 – 95
Borate	B ₄ O ₇ ⁻²	30 – 50
Boron	B	60 – 70
Bromide	Br ⁻	93 – 96
Cadmium	Cd ⁺²	93 – 97
Calcium	Ca ⁺²	95 – 98
Chloride	Cl ⁻	92 – 98
Chromate	CrO ₄ ⁻²	85 – 95
Copper	Cu ⁺²	96 – 98
Fluoride	F ⁻	93 – 95
Iron	Fe ⁺²	96 – 98
Lead	Pb ⁺²	95 – 98
Manganese	Mn ⁺²	97 – 98
Magnesium	Mg ⁺²	95 – 98
Mercury	Hg ⁺²	95 – 97
Nickel	Ni ⁺²	97 – 98
Nitrate	NO ₃ ⁻	90 – 95
Phosphate	PO ₄ ⁻³	95 – 98
Polyphosphate		96 – 98
Potassium	K ⁺	92 – 96
Silica	Si	85 – 90
Silicate	SiO ₂ ⁻²	92 – 95
Silver	Ag ⁺	95 – 97
Sodium	Na ⁺	92 – 98
Sulfate	SO ₄ ⁻²	96 – 98
Thiosulfate	S ₂ O ₃ ⁻²	97 – 98
Zinc	Zn ⁺²	97 – 99

CTA Membranes

* Nominal Rejection

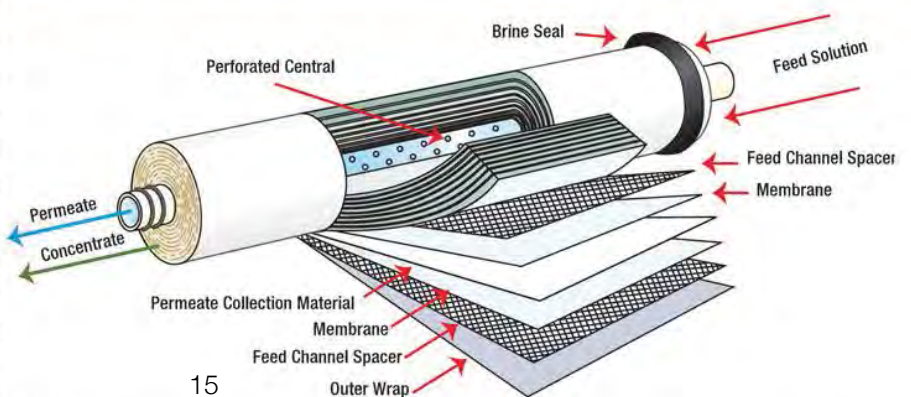
CHARACTERISTICS OF CELLULOSE ACETATE MEMBRANE

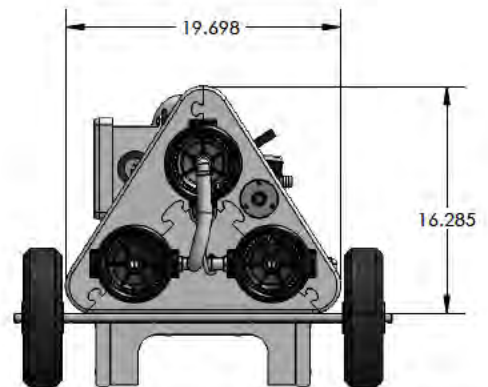
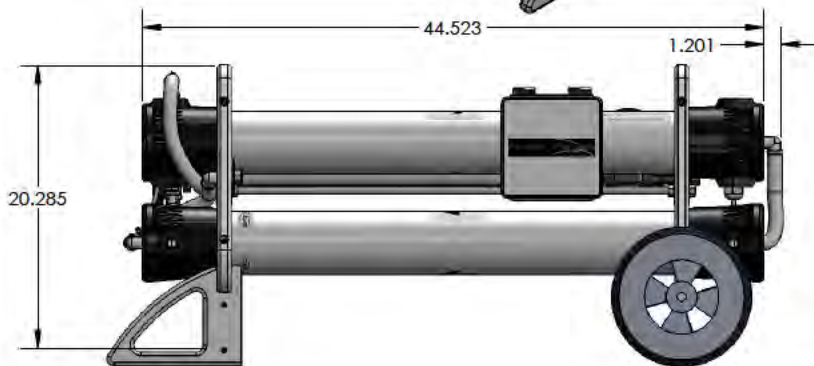
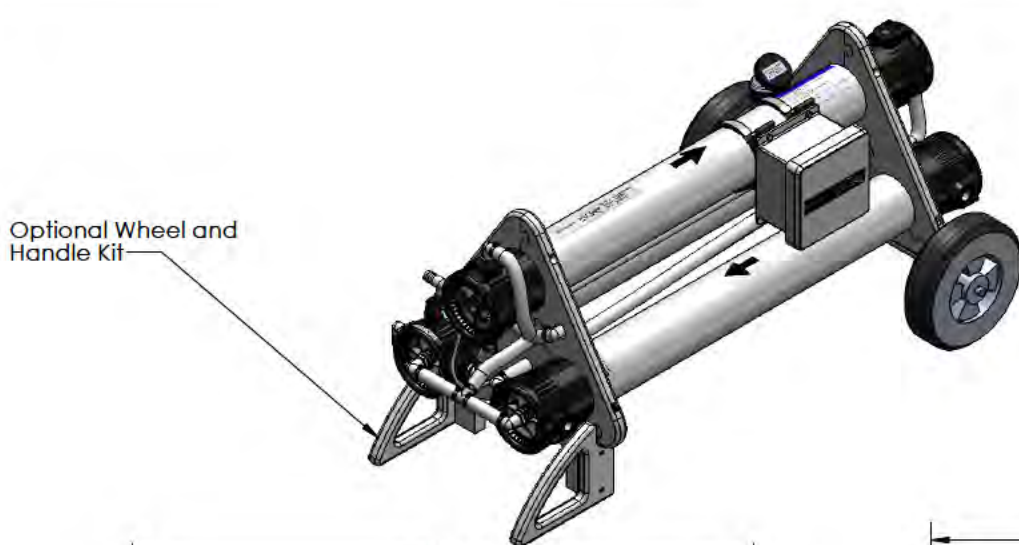
Ion	Symbol	% Rejection
Aluminum	Al ⁺³	96 – 99
Ammonium	NH ₄ ⁺	85 – 95
Barium	Ba ⁺²	94 – 96
Bicarbonate	HCO ₃	90 – 95
Borate	B ₄ O ₇ ⁻²	25 – 50
Bromide	Br ⁻	87 – 93
Cadmium	Cd ⁺²	96 – 98
Calcium	Ca ⁺²	92 – 95
Chloride	Cl ⁻	90 – 95
Chromate	CrO ₄ ⁻²	80 – 90
Chromium	Cr ⁺³	96 – 98
Copper	Cu ⁺²	98 – 99
Fluoride	F ⁻	87 – 93
Iron	Fe ⁺²	95 – 98
Lead	Pb ⁺²	96 – 98
Manganese	Mn ⁺²	92 – 96
Magnesium	Mg ⁺²	96 – 98
Mercury	Hg ⁺²	96 – 98
Nickel	Ni ⁺²	96 – 98
Nitrate	NO ₃ ⁻	50 – 70
Phosphate	PO ₄ ⁻³	96 – 99
Potassium	K ⁺	85 – 95
Silicate	SiO ₂ ⁻²	80 – 90
Silver	Ag ⁺	90 – 95
Sodium	Na ⁺	87 – 93
Sulfate	SO ₄ ⁻²	98 – 99
Thiosulfate	S ₂ O ₃ ⁻²	96 – 99
Zinc	Zn ⁺²	98 – 99

* The above percent of rejection is for reference only and not to be construed as chemistry, temperature, and TDS are not constant in each water supply.

Reverse Osmosis – How Does it Work

Reverse osmosis (RO) is a separation process that uses pressure to force a solvent through a membrane that retains the solute on one side and allows the pure solvent to pass to the other side. More formally, it is the process of forcing a solvent from a region of high solute concentration through a membrane to a region of low solute concentration by applying a pressure in excess of the osmotic pressure. This is the reverse of the normal osmosis process, which is the natural movement of solvent from an area of low solute concentration, through a membrane, to an area of high solute concentration when no external pressure is applied. The membrane here is semipermeable, meaning it allows the passage of solvent but not of solute.





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	NAME	DATE						
DRAWN	JIL	4-16-14				Spot Zero Portable RO System		
UNLESS OTHERWISE SPECIFIED:	CHECKED		SCALE: 1:16	DWG. #: SZ0016	SHEET 1 OF 1			
DIMENSIONS ARE IN INCHES	ENG APPR							
TOLERANCES ±.015	MFG APPR							
FRACTIONAL ±1/32	G A							
ANGULAR MATCH ±1/2 BEND ±1								
TWO PLACE DECIMAL ±.010								
THREE PLACE DECIMAL ±.005								