



# INFORMATIONAL AND TROUBLESHOOTING GUIDE

## REVERSE OSMOSIS AND DE-IONIZATION SYSTEMS



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## **WHAT DOES EACH FILTER REMOVE AND HOW DO I KNOW WHEN TO REPLACE IT**

RO systems usually consists of several individual filters placed in series. Each filter is considered a "stage". The individual filter may differ according to the manufacturer but the flow remains the same.

### **- SEDIMENT PRE-FILTER: (1ST STAGE)**

Sediment filters have specific ratings. They range from 10, 5, 1, 0.5, and 0.2 Microns. Water that comes from rivers can have high levels of particulate matter, so the micron rating of Sediment and Carbon Pre-Filters will affect the unit's performance, and also determines how often you need to replace each Pre-Filter. The Sediment Filter is a fibrous type filter. This filter removes particulate matter that could plug up the Carbon Pre-Filter and RO Membrane.

A Sediment Filter will usually last approx. 4-6 months, depending on micron rating and quality of water. **The best way to determine when your Sediment Pre-Filter needs replacement is to use a Pressure Gauge.**

- When you have a drop in pressure between 15-20% from where your normal house pressure is, replace filter. To check this, run water through the system without the filter in its housing. If the pressure returns to your normal house pressure without the filter, you know the filter you just took out was plugged up.

### **- CARBON BLOCK PRE-FILTER: (SECOND STAGE)**

A Carbon Filter also has specific ratings that range from 5, 1 and 0.5. Each rating determines how much chlorine is removed in gallons of water. The 5 micron can remove chlorine for up to 6,000 gal, the 1 micron for up to 9,000 and the 0.5 micron 20,000. This filter is in the 2nd stage. It removes chlorine, organics, heavy metals, trihalomethanes, pesticides and many other chemical pollutants. It will also break-up chloramines, which is chlorine bonded with ammonia (removes the chlorine and leaves the ammonia).

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A Carbon Filter will usually last approx. 4-6 months ,depending on micron rating for the filters, usage and the quality of your tap water. **The best way to determine when your Carbon Block Pre-Filter needs replacement is to use a chlorine test kit to monitor the waste line.**

- Any chlorine level above 0.1 ppm will cause damage to the membrane and indicates that the carbon block filter must be changed. The Carbon Block Filter can also be plugged up with material that the sediment did not remove. You should also check this filter by doing the pressure test. (Same test done on the Sediment)

## **- REVERSE OSMOSIS MEMBRANE: (THIRD STAGE)**

A Reverse Osmosis membrane reduces Total Dissolved Solids (TDS) that are present in the water. It will also remove arsenic and fluoride. It is capable of rejecting salts, proteins, bacteria, sugars, particles, dyes, and other constituents that have a molecular weight larger than 150-250 daltons. Separation of ions with RO is aided by charged particles (dissolved ions that carry a charge), like salts that are more likely rejected by the membrane than those that are not charged. The larger the charge and particle size, the more likely it will be rejected.

To process the water, the membrane must be under pressure which is provided by your municipal water company or a well pump (i.e. your tap line pressure). If your pressure is below 40 psi, we recommend using a Booster Pump. A membrane should last approx. 2 or more years, depending on the quality of your tap water. (Membrane life is a factor that is determined by the tap water chemistry and total gallons produced per sq. in. of membrane material). **The best way to determine when your RO Membrane needs replacement is to use a TDS meter. Please follow calculation for membrane rejection. (page 9)**

## **- THE FLOW RESTRICTOR: ( Capillary Tube inside the yellow line)**

An RO membrane naturally produces concentrated brine (waste) water. As some of the fluid passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane, in a concentrated brine water. The process is known as "cross flow" which allows the membrane to continually clean itself.

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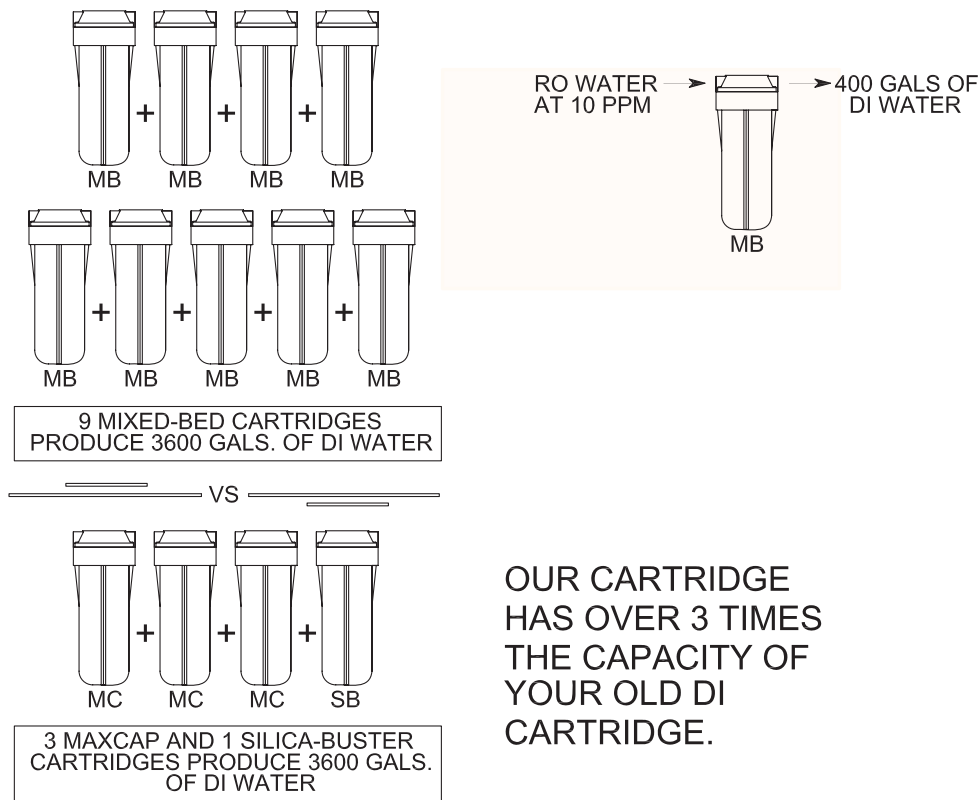
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The ratio that you need of waste vs. product water is 4/1. The ratio is achieved by adjusting a capillary tube called the Flow Restrictor. (Check out this procedure in the installation manual.)

## - DE-IONIZATION (DI) CARTRIDGE: (FOURTH AND/OR FIFTH STAGES)

A DI Cartridge takes the remaining ionic load not removed by the RO Membrane and reduces it down to nearly "pure", which can be measured as 18 meg-ohms or 0.05 micro-siemens. This water is High-Purity grade water used in applications such as Laboratory & Aquarium use. Usually, systems that have 2 DI stages use a back-up method. When the first DI exhausts, the second DI takes over. (This prevents the leaching effect when a single cartridge is exhausted.) Systems like our MaxCap RO/DI does not use the back-up method. This system has two types of DI cartridges that work together to have 3x more life than that of standard DI systems. The best way to determine when your DI Cartridge(s) needs replacement is to use a TDS/Conductivity meter.



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## **- WHY DOESN'T MY DI CARTRIDGE FILL UP ALL THE WAY:**

It is natural that the DI housing will not fill up like the others do. This will not affect the purity of the water.

- If the line is sloping below the system , the water will gravity drain out of the housing, never allowing it to fill.
- The flow rate that the water leaves the membrane is slow enough that when the water enters the housing it is forced through the center of the cartridge. At this rate, the housing will never fill up all the way.

## **- WHY DOES MY DI CARTRIDGE SMELL:**

Type 1 Strong based Anion resins release very low levels of amines (trimethylamine). A very low threshold of 5 PPB or greater will cause a fishy odor to be noticeable. The odor is most noticeable when the resins are new and when they are at or near the point of exhaustion.

NOTE: Trimethylamine is also released by decomposing fish which also results in the same type of odor.

## **- COLOR CODED WATER LINES.**

There are three types of water line on the system:

- Black Line: The black line is the tap water input to the system.
- Blue Line: The blue line is your product water for both the RO water and DI water output
- Yellow Line: The yellow line is your waste (concentrate) water. The waste water is 25-33% more concentrated in hardness than the tap water. This water should be directed down the drain.

## **- OPTIONS FOR INSTALLATION.**

SpectraPure systems come standard with a garden hose adapter. We provide additional accessories for installation. Each option is dependent on the customers application.

- Garden Hose Adapter: The garden hose adapter connects the tap water line (black) to a standard garden hose. If not needed, it can be removed easily by the push fitting that connects the black line to the adapter.

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- Feed Valves: A Feed Valve allows the customer to connect a cold water line, like under a sink, to the black line of the system. There are two types of feed valve; Piercing Valves and Feed Water Adapters.
  - Piercing Valves: This valve taps a hole into a cold water line and has an adapter that connects to the black line.
  - Feed Water Adapter: This valve is a non-piercing valve. Under a sink, you will find a braided tubing that connects the cold water line to the sink faucet. This fitting acts as a tee and will tee off the cold line which then adapts the black line to the fitting connection. (Use a feed water adapter for systems that produce high volumes of water, like a 90 or 180 gallon per day system).

If customer is installing the system under a sink, they will also need a few more additional components:

- Drain Saddle: A drain saddle connects the waste water line (yellow) to a drain pipe under the sink. The Customer will have to pierce the drain pipe for installation.
- Automatic Shut-Off Valve (ASO): An ASO valve will completely shut down the system, including the waste water, when the product water is shut off. This valve requires the use of a 1 lb Check Valve to operate.
- 1 lb Check Valve: Assists the ASO valve to shut down the system.
- 2 Way Ball Valve: Installs on the product line (blue) for easy shut-down for system, when installed under a sink.

If the customer does not want to install the system under a sink, they can use a Quick Connect Faucet Coupler.

- Quick Connect Faucet Coupler with Aerator: This device connects to a standard sink faucet, which will then connect to the black line.

Standard RO and RO/DI systems do not come with the accessories listed above. For automation control, please refer to our website on Drinking water kits and Liquid Level Controllers.

\*Drinking Water systems do provide full automation and installation products.

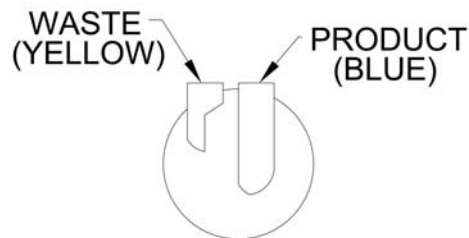
## TOOLS NEEDED FOR TESTING

- 1- OPERATING MANUAL FOR SYSTEM
- 1- MEASURING CUP or GRADUATED CYLINDER (IN MILLILITERS)
- 1- THERMOMETER
- 1- PRESSURE GAUGE KIT (IF THE SYSTEM DOES NOT HAVE A GAUGE)
- 1- CHLORINE TEST KIT

## CHECK THE FOLLOWING...

### 1. CHECK THE LOCATION OF THE PRODUCT AND WASTE LINE.

- Make sure that the Flow Restrictor is inside the Waste Line (Yellow)



*END VIEW OF MEMBRANE HOUSING*

### 2. CHECK ALL LINES FOR KINKS.

- If the tubing is pinched in any way, it will affect the system's performance. Replace pinched tubing.

### 3. INSPECT THE FLOW RESTRICTOR.

*STEP 1:* Remove the Flow Restrictor from the yellow tubing. One end of the capillary tube is bonded to a plastic insert. Inspect the bonding material for voids between the capillary tube and the plastic insert. If the bonding material has developed a void or the capillary tubing is missing, you have found the problem.

*STEP 2:* Inspect the internal diameter of the capillary tube. The ends of the tubing should have clean cuts without burrs at either end. The internal diameter should be open throughout the length of the tubing and you should be able to blow a slight amount of air through the tubing. If the tubing is deformed, if either end has burrs, if a particle

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or a foreign substance is blocking the internal diameter of the tubing, or if the tubing was crimped, you have found a problem that may have permanently damaged the membrane. **Note: Inform the customer that the membrane can be easily damaged if any of these conditions existed for even a very short period of time.**

**Solution # 1:** If the tubing has burrs or is crimped near the end: Cut off the damaged end of the tubing with a sharp razor blade or Exacto blade at a 45 to 60 degree angle, then re-install the Flow Restrictor into the yellow tubing and insert the yellow tubing into the waste water port on the RO membrane housing.

**Solution # 2:** If the capillary tubing is damaged beyond repair, replace the Flow Restrictor.

## **TEST THE FOLLOWING...**

You are now ready to start testing the system for the proper flow rates from the product and waste lines. You will also determine the condition of the sediment, carbon pre-filters and the RO membrane.

### **1 - PREPARE SYSTEM FOR TESTING**

*STEP 1:* Insert the "tee" of the Pressure Gauge Kit between the "OUT" of the carbon filter and the "IN" of the RO membrane housing. (If an Auto Shut-Off Valve has been installed on the unit, insert the pressure gauge kit between the "OUT " of the ASO and the "IN" of the RO membrane). USE THEIR GAUGE IF THEY HAVE ONE.

*STEP 2:* Attach the input line of the system to a water source. Slowly turn on the water until the water supply valve is on full (< 80PSI). Allow the air to bleed from the system for a few minutes.

### **2 - RECORD..**

Water temperature. (\_\_\_\_\_)

Pressure reading on the pressure gauge. (\_\_\_\_\_) (Pbefore)

This would also be a good time to test for chlorine leakage through the carbon pre-filter.

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## 3 - TEST SYSTEM FOR CHLORINE BREAK-THROUGH

*STEP 1:* Use the Chlorine Test Kit, which is accurate to < 0.2 PPM. If “any” level of chlorine is present in the wastewater stream, the RO membrane could have been damaged. The carbon pre-filter will need to be replaced after testing is complete and possibly the RO membrane. *(This test assumes that you have a chlorinated water source).*

*STEP 2:* Turn off the water. Allow the pressure to bleed off. Unscrew the sediment and carbon pre-filter housings and remove both filters. Re-install the empty housings.

Note: The remaining test will be performed without the pre-filters installed!!

## 4 - TESTING THE CONDITION OF THE PRE-FILTERS

*STEP 1:* Slowly turn-on the water until the water supply valve is on full (< 80PSI). Allow the air to bleed from the system for a few moments.

*STEP 2:* Record the water pressure reading on the pressure gauge. (\_\_\_\_)(Pafter)

*STEP 3:* Compare the water pressure before and after removal of the prefilters. Divide the pressure reading after the filters were removed by the pressure reading before they were removed. Subtract 1 from the result then multiply by 100. [ ( Pafter / Pbefore ) - 1 ] X 100 ]

*Example: [(60 / 54) - 1] x 100] = 10%*

This is the percentage of pressure drop across the pre-filters. If the pressure reduction is greater than 15%, both of the pre-filters should be replaced, after all testing is completed.

*This would be a good opportunity to educate the customer on the benefits of having the Pressure Gauge Kit ( PGK-4) permanently installed on their RO system. If it is suspected that the customer has low pressure, a Booster Pump (# BPHF-MO-115) should be recommended.*

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## **5 - TEST THE MEMBRANE FLOW RATE**

We are now ready to check the product and waste water flow rate from the RO membrane. After completing the pre-filter and the tap water tests place the pre-filters back in and turn “on” the system.

If you are confident that the existing Flow Restrictor is in good condition and has passed your prior inspection and testing, you may continue to the next test. If the condition of the Flow Restrictor is suspect, we would recommend removing the customer’s Flow Restrictor and installing a new one. If you install a new flow restrictor the customer will have to follow the procedure for adjustment. (shown in manual)

*STEP 1:* With the water on full (< 80 PSI), measure the water volume from both the waste and product lines individually for one minute each.

- Record the Milliliters per Minute from the Product line. (\_\_\_\_\_)
- Record the Milliliters per Minute from the Wastewater line. (\_\_\_\_\_)

For the purposes of this test, we would expect that most systems will be used under average conditions at approximately 50 PSI @ 60 F.

If the Wastewater volume is less than 4 times the Product water volume (using the customer’s original Flow Restrictor), the membrane may have been damaged due to insufficient Waste water flushing effect caused by improper or no adjustment of the Flow Restrictor.

Inform the customer that operating the system at less than a 4 to 1 ratio will cause premature fouling of the membrane and a loss of water production. This condition will also void any warranty on the RO membrane. (Before recommending a membrane replacement, complete the test procedure).

## **6 - PROCEED TO MEMBRANE OUTPUT CALCULATION**

The result of your calculations will show the “Expected” GPD production rate from the system after taking into account the water temperature and water pressure variations. Unfortunately, most customers will not be aware of the effects that water pressure and temperature have on RO membranes. It may be necessary to explain the calculations to the customer at this time.

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Ratings for each membrane is based on our water conditions. **All our systems are tested with 60 PSI and 77 Degree water.** Actual performance of the system depends on the conditions the customer has on their water source.

Use this equation to calculate what their system will do with their water conditions:

## PRESSURE COMPENSATION FACTOR

STEP 1  $\frac{\text{_____ PSI}}{\text{SHOWN ON PRESSURE GAUGE}}$  **DIVIDED BY 60** = \_\_\_\_\_

STEP 2  $\frac{\text{_____ MEM GPD}}{\text{MEMBRANE SIZE FOR SYSTEM}}$  **MULTIPLY BY**  $\frac{\text{_____}}{\text{FROM STEP 1}}$  = \_\_\_\_\_ **P.C.F**

## TEMPERATURE COMPENSATION FACTOR

STEP 3 \_\_\_\_\_ = T.C.F (Look up water temperature on chart p.13)

STEP 4 \_\_\_\_\_ P.C.F **MULTIPLY BY** \_\_\_\_\_ T.C.F =  $\frac{\text{_____}}{\text{ACTUAL GPD RATE}}$

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**Temperature Correction Factor Table (TCF)**

°F / °C	TCF	°F \ °C	TCF	°F \ °C	TCF
41.0 / 5	0.521	59.0 / 15	0.730	77.0 / 25	1.000
42.8 / 6	0.540	60.8 / 16	0.754	78.8 / 26	1.031
44.6 / 7	0.560	62.6 / 17	0.779	80.6 / 27	1.063
46.4 / 8	0.578	64.4 / 18	0.804	82.4 / 28	1.094
48.2 / 9	0.598	66.2 / 19	0.830	84.2 / 29	1.127
50.0 / 10	0.620	68.0 / 20	0.857	86.0 / 30	1.161
51.8 / 11	0.640	69.8 / 21	0.884	87.8 / 31	1.196
53.6 / 12	0.661	71.6 / 22	0.912	89.6 / 32	1.232
55.4 / 13	0.684	73.4 / 23	0.941	91.4 / 33	1.267
57.2 / 14	0.707	75.2 / 24	0.970	93.2 / 34	1.304

**EXAMPLE:**

If your customer has **45 PSI, 71 Degree** water temperature and a **90 Gallon Per Day (GPD)** membrane:

STEP 1      **45PSI / 60 = 0.75**

STEP 2      **90 GPD X 0.75 = 67.5 (P.C.F)**

STEP 3      **0.912 = T.C.F** (Look up water temperature on chart)

STEP 4      **67.5 (P.C.F) X 0.912 (T.C.F) = 61.5 GPD**

This customer would expect to produce 61.5 Gallons Per day with their 90 GPD membrane.

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## **7 - MEMBRANE NOT PRODUCING WATER**

If your membrane is not producing water, and you just installed it, you may have not pushed it in all the way. There are two o-rings that need to be seated in order to have a good seal to produce water.

or

You have not allowed enough water to soak the membrane. Let the system run for about 15-20 minutes to allow the material to soak with water.

## **8 - INADEQUATE WATER PRESSURE**

If the tap water line pressure is below 40 psi, recommend a booster pump. RO systems perform best with pressures from 40-80 PSI.

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## WATER PURITY

Before proceeding with the following test procedure please follow all of the previous test procedures and verify that the water pressure is adequate. Also confirm that the monitor is calibrated correctly and is in good working order. (See the owner's manual for the tester.)

### 1 - TOOLS REQUIRED FOR TESTING

TDS or Conductivity Monitor

*STEP 1:* Allow the system to operate for 10 to 20 minutes without interruption and verify that the pressure is greater than 40 PSI. Direct the product and waste water streams to a drain.

Most TDS testers include a reservoir cap for retaining the water that is to be tested, if not get a clean, sterile glass.

*STEP 2:* Be sure the reservoir is clean by rinsing it thoroughly at least three times with the product water as it drips directly from the product water line, before attempting to take the reading.

*STEP 3:* After filling and discarding the water three times record the reading. (\_\_\_\_\_)

*STEP 4:* Turn on a tap water faucet and let it run for a minimum of 30 seconds. Follow the step above and record reading. (\_\_\_\_\_)

### 2 - CALCULATION FOR % REJECTION

Use the two readings from STEP 3 & STEP 4 to calculate your rejection rate of the membrane:

STEP 1:  $[(X - Y) / X] \times 100$

TAP TDS = X
RO TDS = Y

*EXAMPLE:*  $[(100 - 10 = 90) / 100 = 0.90] \times 100 = \mathbf{90\%}$

We recommend to replace your membrane when you have a rejection rate below 95%.

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## 3 - WATER READING TO EXPECT FROM THE RO MEMBRANE

*SPECTRASELECT "TESTED" MEMBRANES:* Have a **98% rejection** "guaranteed". These membranes produce rated **GPD ± 10%** at 60 psi and 77°F.

*STANDARD FILMTEC MEMBRANES:* Have a **96% rejection**. These membranes produce the rated **GPD ± 20%** at 60 psi and 77°F.

## 4 - WATER READING TO EXPECT FROM THE DI CARTRIDGE

Using a standard TDS meter, you can determine when to replace your DI cartridge. Any reading above 0 is an indication that your DI is exhausted. An exhausted DI cartridge will leach back the impurities at a higher amount than it took out. Therefore it is best to replace it right away.

## FEED WATER REQUIREMENTS

In order for the system to work properly, the customers incoming feed water needs to fall under these requirements:

### Reverse Osmosis Membrane Feed Water Requirements

Tap Water Pressure*	40 – 80 psi (2.75 – 5.5 bar)
pH Range	3 – 11
Maximum Temperature	100° F (38° C)
Maximum Turbidity	1.0 NTU
Maximum Silt Density Index	5.0 (based on 15 min. test time)
Maximum Chlorine	less than 0.1 ppm
Maximum TDS	2000 ppm
Maximum Hardness	10 grains (170 ppm as CaCO <sub>3</sub> )
Maximum Iron	less than 0.1 ppm
Maximum Manganese	less than 0.1 ppm
Maximum Hydrogen Sulfide	0 ppm
Langlier Saturation Index	LSI must be negative

Many of these requirements should be listed in the city's water report.

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## **WHAT IF MY WATER DOES NOT FALL UNDER THE SYSTEM REQUIREMENTS?**

**LOW PRESSURE:** The rated GPD for our systems is based on 60PSI and 70° F. So, if you have half the pressure, you will get half the production.

- *If your customer has less than 40 PSI, recommend a Booster Pump.*
- *If it is greater than 80, get a pressure reducing valve.*

**pH RANGE:** If the water exceeds the pH range there will be too much alkaline and it will foul the membrane. *Warranty will be void.*

**MAXIMUM TEMPERATURE:** If the water temperature exceeds 100° F (38° C) it will damage the membrane. *Warranty will be void.*

**MAXIMUM CHLORINE:** If your customer allows chlorine to get to the membrane, it will oxidize the membrane material and allow tap water to leak through.

- *Customer needs to monitor Carbon filter with a chlorine test kit to know when it needs replacement.*

**MAXIMUM TDS:** If the water exceeds the maximum level of TDS the membrane will plug up prematurely. *Warranty will be void.*

**HIGH HARDNESS CONTENT:** If your customer exceeds the maximum hardness, recommend a Water Softener. (The harder their water is, the less life the membrane has and will *void its warranty.*)

**MAXIMUM IRON & MANGANESE:** If your customer exceeds the maximum amount of iron and manganese, it will prematurely plug up the membrane. *Warranty will be void for the membrane.*

- *If the levels are greater than 0.1 ppm, recommend a water softener.*
- *If the levels are over 4 ppm the customer will need an iron removal system.*

**HYDROGEN SULFIDE:** If your customer has any hydrogen sulfide it will degrade the membrane material and *void its warranty.*

## **ACCESSORY PROBLEMS**

### **1 - ASO NOT SHUTTING OFF WASTE WATER:**

*Problem 1:* Water keeps coming out of the waste water line (yellow) even though the output line (blue) has been closed off.

- Solution: 1) Insufficient pressure on the feed to the filter will not produce enough back pressure to activate the automatic shutoff valve. Low water pressure may be corrected by two methods: (a) by consulting a qualified plumber to adjust water pressure entering your home, or (b) purchasing a booster pump to increase water pressure.
- Solution: 2) If there is an air pocket in the system the ASO will not shut down. Position the system so that the blue and yellow lines are on top of the system ( rotating the system clockwise). Let the system run like this for approx 15-20 min.

*Problem 2:* Pressure seems to go up and down on the pressure gauge.

- Solution: 1) If you have connected a pressurized storage tank to your system, the water may run from the waste water line (yellow) for a while after you have closed the output line (blue). This is an effect of the filtration system topping off the storage tank. When the storage tank is full the waste water line (yellow) will stop running.

### **2 - WHY IS THERE A NOISE COMING FROM THE AIR-GAP FAUCET?**

The noise is caused by the location of the drain saddle with an Air-Gap Faucet.

- Solution: 1) The Air-Gap Faucet inherently makes a noise that is amplified when the water running from the drain saddle splashes into the water in the sink trap. The noise is most commonly heard on start-up or after filter changes by air being purged from the system. Once the air is expelled, usually after 5 min, the noise should subside. To purge air, rotate the system so the product and waste ports of the membrane are pointing up. Let the system run like this for 10-15 min.
- Solution: 2) The noise can also be reduced if you relocate the drain saddle to a greater height and make sure that the waste line is as straight as possible.

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## **2 - BOOSTER PUMP NOT INCREASING PRESSURE ON SYSTEM.**

- Solution: 1) No flow restrictor. Check waste (yellow) line for flow restrictor.
- Solution: 2) Customer did not adjust allen screw on pump head. Pressure for pump can be adjusted by screwing in or out the allen screw on the pump's head.

### **NOTES:**

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## **CHECK LIST**

*.BEFORE SENDING SYSTEM IN, TRY TESTING THE FOLLOWING:*

- Check to see if pre-filter are plugged.
- Check membrane performance
- Was the Flow Restrictor Adjusted?
- Is the Flow Restrictor in the waste line?
- Check Product (Blue) and Waste (Yellow) line connections.
- Do you have enough pressure for system operation?