



R.O. DRINKING WATER SYSTEM  
**RayneClear**® MODEL

INSTALLATION, OPERATION & SERVICE MANUAL

**IMPORTANT NOTICES:**

This reverse osmosis system contains replaceable treatment components critical for effective performance. It is the user's responsibility to, and the manufacturer strongly recommends that the user, periodically test the product water to verify the system is performing satisfactorily.

**DO NOT USE WITH WATER THAT IS MICROBIOLOGICALLY UNSAFE OR OF UNKNOWN QUALITY, WITHOUT ADEQUATE DISINFECTION BEFORE OR AFTER THE SYSTEM.**

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## SECTION I. INTRODUCTION

Your new Reverse Osmosis (RO) Drinking Water System uses a combination of filtration technologies to reduce unwanted contaminants in a water supply. The following steps combine to give you the best in clear sparkling drinking water:

**MECHANICAL FILTRATION**—The sediment prefilter will remove the larger particles such as silt, rust and scale. Its 5 micron (equal to 0.0002 inch) nominal rating helps to give maximum life to the RO Membrane and carbon filter.

**REVERSE OSMOSIS MEMBRANE**—The RO Membrane is the heart of the filtration system. It is designed to reduce the dissolved mineral content of the water. Minerals picked up in the environment by the water are measured as Total Dissolved Solids (TDS). In the Reverse Osmosis process, dissolved minerals are separated from the incoming water (Feed Water) to produce the product water (the Permeate). The excess minerals are rinsed to drain (the Reject Water).

The membrane is a chlorine tolerant, high flux, cellulose triacetate (C.T.A.) Membrane. The spiral wound construction of the RO Membrane

provides maximum surface area for water production and is less susceptible to fouling by particulate matter, turbidity and colloidal materials.

**ACTIVATED CARBON POST FILTER**—The Activated Carbon Post Filter contains carbon particles with a vast network of pores. The tremendous surface area of these pores (typically 800–1200 square meters per gram of carbon) gives the carbon very good adsorptive sites for chlorine as well as other substances that contribute to tastes and odors. The product water from the Holding Tank passes through the Activated Carbon Post Filter on the way to the Dispensing Faucet. The Activated Carbon Post Filter reduces tastes and odors that may pass through the system. It adds a final “polish” to the water.

**AUTOMATIC SHUT-OFF VALVE**—The ASO Valve senses when the product water tank is full and closes the feed water supply to prevent excess reject water from going to drain when the unit is not producing water.

### TYPICAL RAYNECLEAR UNDER SINK INSTALLATION DIAGRAM

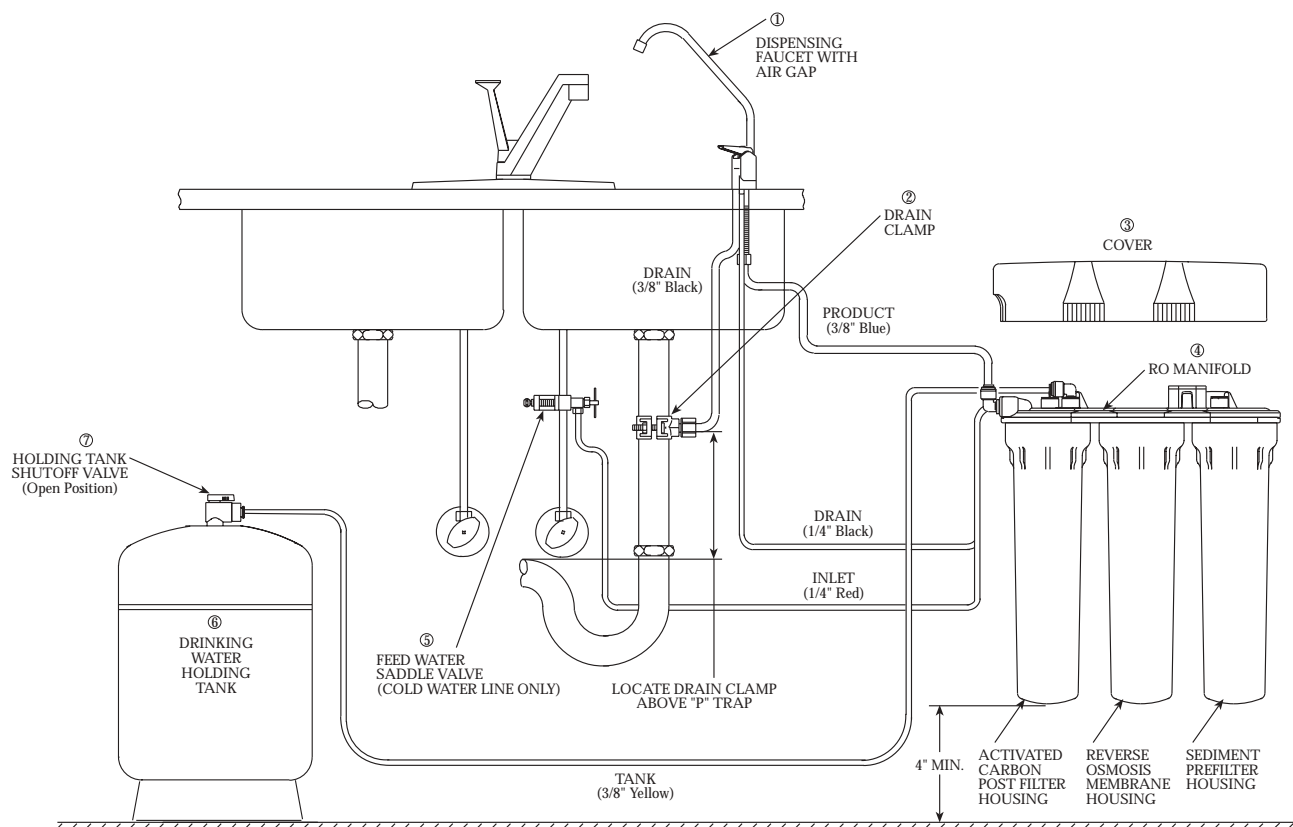
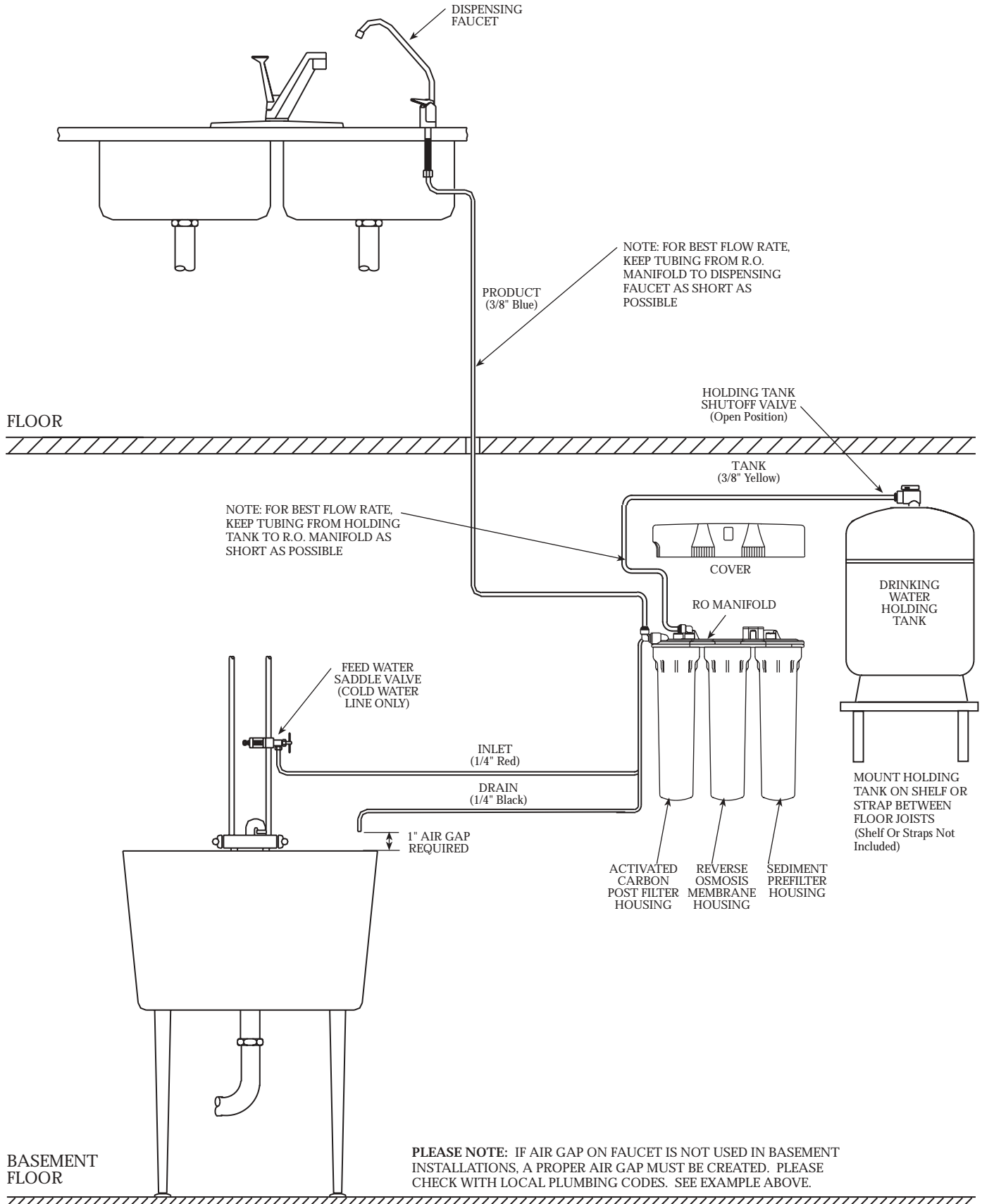


Figure 1

# OPTIONAL RAYNECLEAR BASEMENT INSTALLATION DIAGRAM



## SECTION II. SPECIFICATIONS

### TABLE A – QUALIFIED SYSTEM PERFORMANCE

Because the performance of an RO Membrane is highly dependent upon pressure, temperature, and TDS, the following should be used for comparison purposes only.

	U.S.	Metric
Membrane Production <sup>1</sup>	14 ± 2 gpd	45-60 lpd
Membrane TDS Reduction <sup>1</sup>	90% minimum	90% minimum
Warm Climate System Production <sup>2</sup>	9.5 ± 2 gpd	28-44 lpd
Warm Climate TDS Reduction <sup>2</sup>	85%+ typical	85%+ typical
Cold Climate System Production <sup>2</sup>	6 ± 1 gpd	19-26 lpd
Cold Climate TDS Reduction <sup>2</sup>	85%+ typical	85%+ typical
Drain (reject water) Flow	3-4 x product flow	3-4 x product flow
Empty Storage Tank Precharge	5-7 psig air	35-48 kPa air
Storage Tank Capacity <sup>3</sup>	1.8 gallons	6.8 liters

<sup>1</sup> Industry standards measure RO Membranes performance with no back pressure on the product water, at 65 psig (450kPa) and 77°F (25°C). Further conditions on the above are 500 ppm TDS and a 15% recovery rate. Production rate and TDS reduction figures are for a new Membrane that has been rinsed for 24 hours. The production rate of a new Membrane can decrease by 10% per year or more, depending upon the scaling and fouling tendencies of the Feed Water.

<sup>2</sup> Actual capacity measured at 55 psig, 77°F, and 750 ppm TDS.

<sup>3</sup> Measured at 50 psig inlet pressure and 7 psig tank precharge.

### TABLE B – RECOMMENDED OPERATING LIMITS FOR FEED WATER

Specifications	C.T.A. Membrane
Water Pressure	40-100 psig (280–690 kPa)
TDS	1500 ppm (also mg/l) max.
Temperature	40–85°F (4–29°C)
pH	5–8.5
Hardness	Less than 10 gpg or soften
Iron	Less than 0.1 ppm (also mg/l)
Manganese	Less than 0.05 ppm (also mg/l)
Hydrogen Sulfide	None
Chlorine	0.2–2.0 ppm (also mg/l)
Bacteria	Must be potable**

**NOTE: Bacteria can damage a C.T.A. Membrane. Chlorinated feed water is necessary for membrane protection.**

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## SECTION III. PREPARATION

### A. Major System Components

The following components comprise the RO Drinking Water System. (Refer to Fig. 1, page 1 for general system layout.)

1. An RO Manifold assembly.
2. Housings and Housing O-rings.
3. A Drinking Water Holding Tank.
4. A Dispensing Faucet.
5. A Feed Water Saddle Valve.
6. A Drain Clamp.
7. Plastic Tubing and tube connectors.
8. A Reverse Osmosis Membrane sealed in a plastic bag.
9. A 5-Micron Sediment Prefilter, shrink wrapped.
10. An Activated Carbon Post Filter, shrink wrapped.
11. Other items necessary for installation may include wood screws or machine screws and nuts for mounting the manifold, or concrete anchors for hanging on basement wall, additional tubing or tube connectors, plastic wire ties for organizing tubing.

PLEASE NOTE: A TDS Monitor may be necessary to conform to state or local codes, check with the local plumbing authority.

### B. Tools Recommended for Installation

The following tools will cover most of the installation sites encountered:

1.  $\frac{3}{8}$ " variable speed electric drill.
2. Extension work light with outlet.
3. Safety glasses.
4.  $1\frac{1}{4}$ " porcelain hole cutter kit.
5.  $1\frac{1}{4}$ " Greenlee hole punch and  $\frac{3}{32}$ " and  $\frac{1}{2}$ " metal drill bits for pilot hole.
6. Center punch and hammer.
7.  $1\frac{1}{4}$ " wood bit.
8. Concrete drill bits.
9. Assorted wood and metal drill bits including  $\frac{7}{32}$ " metal drill bit.
10. Phillips head and flat blade screw drivers.
11.  $\frac{1}{2}$ ",  $\frac{9}{16}$ " and  $\frac{5}{8}$ " open end wrenches.

12. 10" Crescent wrench with jaws taped to hold faucet.
13. Basin wrench or 10" pipe wrench.
14. Teflon tape.
15. Wide masking tape or duct tape.
16. Plastic tubing cutter.
17. Extra plastic tubing.
18. Low range air pressure gauge.
19. Bicycle hand air pump.
20. Small bottle of liquid chlorine bleach.
21. Graduated measuring cylinder.
22. Paper towels, wisk broom and assorted clean up materials.

### C. Site Selection for Major System Components

The RO System was designed to fit under a sink, however, because of space limitations or other reasons, the system's flexible design allows for other locations. When determining the location remember that access to a cold water tap line, the household drain, and ease of filter replacement are important considerations.

All components and tubing should be located in an area that does not see freezing temperatures. If winter temperatures are severe, the area should not see temperatures below the minimum temperature listed in Table B page 3 for proper performance. Do not expose unit or tubing to direct sunlight.

1. **Dispensing Faucet**—The faucet should be placed near the sink where drinking water is normally obtained. Convenience of use (filling of water pitchers and glasses), and an open area beneath the faucet under the sink for attaching product and drain tubing are considerations. A 2" diameter flat surface is required above and below the installation site. The thickness of the mounting surface should not exceed  $1\frac{1}{4}$ ". Watch for strengthening webbing on the underside of cast iron sinks.
2. **Drinking Water Holding Tank**—The Holding Tank may be placed where it is convenient within 10 feet of the faucet, under the sink or in an adjacent cabinet are best choices. If longer run of tubing is required, the tubing should be the  $\frac{3}{8}$ " diameter OD size to

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prevent a high pressure drop. Remember, these tanks can weigh up to 30 pounds when full of water; a firm, level area is required.

3. **RO Manifold Assembly**—The manifold can be installed on either the right or left side of the under-sink area or a cabinet. The right side is recommended because the tubing will be to the back of the cabinet and out of the way. Installation in the basement is also an option, one location is near the laundry/utility sink where cold potable water and drain access is handy. The mounting location should allow adequate clearance and accessibility for cartridge changes.

4. **Feed Water Connection**—The Feed Water Saddle Valve should be located as close to the manifold assembly as possible. USE A POTABLE COLD WATER SUPPLY ONLY. Softened water is preferred as it will extend the life of the RO Membrane.

5. **Drain Connection**—The waste water must go to drain through an anti-siphon air gap. The air gap is provided for in the base of the faucet. If discharging into a utility sink or standpipe, an air gap of greater than 1" above the flood rim must be provided.

Do NOT connect the system drain line to the dishwasher drain or near the garbage disposal. Backpressure from these units may cause the air gap to overflow.

**NOTE:** For proper installation the Air Gap Faucet has a critical level line "CL" marked on its body and should be mounted so that the "CL" line is at least one (1) inch (26mm) above the flood rim of the sink.

The easiest installation is to use an existing spray attachment hole. If the spray faucet hole is not available, then the sink top must be drilled. Choose a convenient location as described in Sec. III, C.1, page 4.

1. Mark the location of the center of the faucet base.

2a. Drilling a stainless steel sink:

- Center punch the hole to provide a starting point for the drill.
- Start with a smaller drill as a pilot, and then drill a ½" diameter hole to accept the bolt of a 1¼" Greenlee Hole Punch (1¼" chassis punch).
- Clean away any chips.
- Install the punch and tighten the nut to cut the hole.
- Deburr any sharp edges.

2b. Drilling a porcelain sink:

It is best to use a special 1¼" diameter cutter designed for porcelain. A carbide tipped masonry bit is a second choice.

- Place a piece of tape over the area to be drilled to help prevent chipping.
- Drill a pilot hole for the porcelain cutter. Use the pilot drill supplied with the kit or a carbide tipped drill.
- When drilling the 1¼" hole, drill slowly and carefully, the porcelain chips easily.
- After drilling, clean the area well. Iron filings, if left in place, can cause rust stains.

2c. Drilling a counter top:

**NOTE:** The counter top must be less than 1¼" thick. (See Sec. IV, A.2b, page 5.) Treat ceramic tile as porcelain until the tile is penetrated, then use the carbide tipped metal cutter.

Formica counter tops may be drilled with a good 1¼" wood bit, drilling a 3/32" pilot hole will help keep the bit going straight.

## SECTION IV. INSTALLATION STEPS

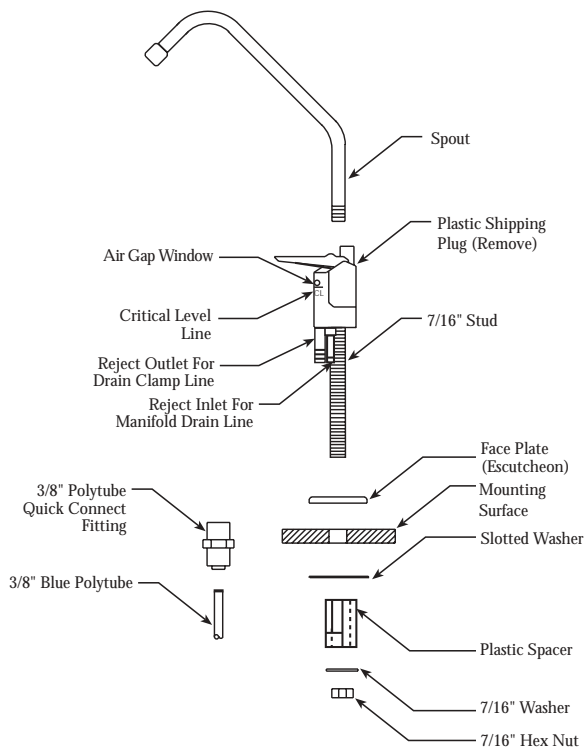
All plumbing should be done in accordance with state and local plumbing codes.

**NOTE:** Some codes may require installation by a licensed plumber; check with the local plumbing authority prior to installation.

In restricted under-sink areas, it may be easier to install the faucet first. Allow adequate tubing lengths for any final component position.

**A. Faucet Installation**—The faucet contains an anti-siphon air gap. While the system is producing water, the drain water flows from the RO, through the air gap and then to the household drain. The purpose of the air gap is to prevent water in the drain from backing up into the RO Drinking Water System.

## LONG REACH AIR GAP FAUCET WITH 3/8" CONNECTOR



**Figure 2**

### 3. Assemble and attach the Faucet. (Refer to Fig. 2 above.)

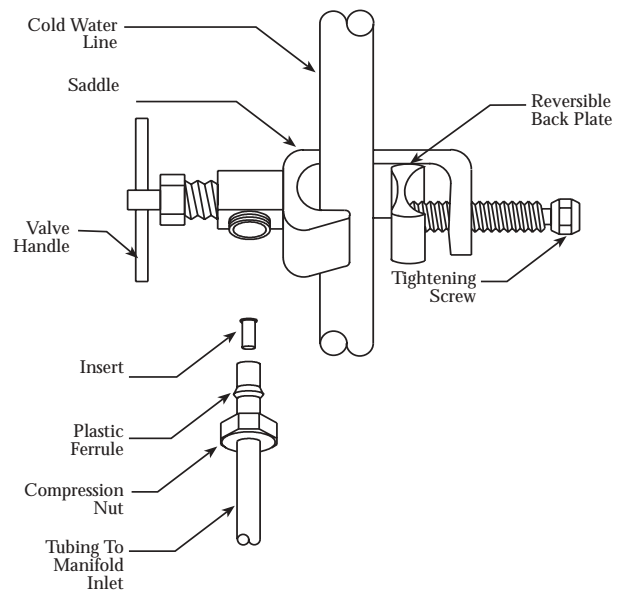
- Assemble the Body and Spout by removing the plastic shipping plug from the Body and then firmly pressing in the Spout.
- In the following order, place the Face Plate (Escutcheon) on the 7/16" stud.
- From the top of the counter place the stud through the mounting hole.
- From the bottom of the counter top in the following order assemble the steel Slotted Washer, the Plastic Spacer (with open end upwards), the 7/16" Washer and the 7/16" Hex Nut.
- To the end of the 7/16" stud screw on the 3/8" Polytube Quick Connect Fitting. Once snug by hand take a pair of pliers and tighten the fitting an additional half turn. Don't over tighten.
- Rotate the Spout and Body into position. Align the Slotted Washer and the Spacer to

allow access to the Hose Barbs, and tighten the Hex Nut while holding the faucet in alignment with a padded Crescent wrench. Do not over tighten.

### B. Feed Water Saddle Valve Installation

Decide on location. Do NOT connect to a hot water feed line. If you are not sure of the supply, run the hot water and feel the supply piping. Water over 85°F may cause permanent damage to the RO Membrane. (Refer to Fig. 3 below.)

## FEED WATER SADDLE VALVE



**Figure 3**

1. Shut off the water supply and drain the line.
- 2a. To install on (soft) Copper Tubing supply line:
  - Turn the Handle of the Feed Water Saddle Valve counter clockwise (outward) until the lance does not protrude from the gasket. It may have to be pushed in.
  - Assemble the Feed Water Saddle Valve on the tubing.
    - for 3/8" OD tubing use the back plate side with the small groove to prevent distortion of the tubing.
    - for larger tubing (up to 5/8" OD) use the large groove of the back plate.



- Assemble and tighten the brass screw.
- To pierce the tubing, turn the Valve Handle fully clockwise (inward). A small amount of water may escape from the outlet until you are fully pierced.

When you feel the Valve Handle firmly seated in the clockwise direction, the copper tube is pierced and the valve is closed.

2b. To install on (hard) Steel or Brass Tubing supply line.

- The supply line should now be drained. Use a battery powered or properly grounded drill to avoid shock hazard.
- Drill a  $\frac{3}{16}$ " hole in the supply line; (do not drill through the opposite wall).
- Turn the handle to expose the lance no more than  $\frac{3}{16}$ " beyond the rubber gasket.
- Place the body of the valve over the hole so that the lance fits into the hole.
- Assemble and tighten the brass screw.
- Turn the Valve Handle clockwise (inward) until firmly seated. The valve is closed.

3. With the Feed Water Saddle Valve closed, open the sink faucet and the water supply and allow the water to run for a few minutes to flush any debris caused by the installation.
  - Close the faucet and check the Feed Water Saddle Valve for leaks.

### C. Drain Clamp Installation

Choose the drain outlet location per Sec. III, C.5, page 5.

The following are instructions for discharging into the sink drain pipe. (Refer to Fig. 1, page 1.)

1. Position the Drain Clamp on the sink drain pipe above the drain trap. Allow room for drilling. Tighten securely.
2. Use a battery powered or properly grounded drill. Using the Clamp port as a drill guide, drill a  $\frac{7}{32}$ " hole through the wall of the drain pipe. Do NOT penetrate the opposite side of the pipe.
3. Locate the  $\frac{3}{8}$ " Black Drain Tubing which is shipped loose in the box.

### 3/8" DRAIN CLAMP ASSEMBLY

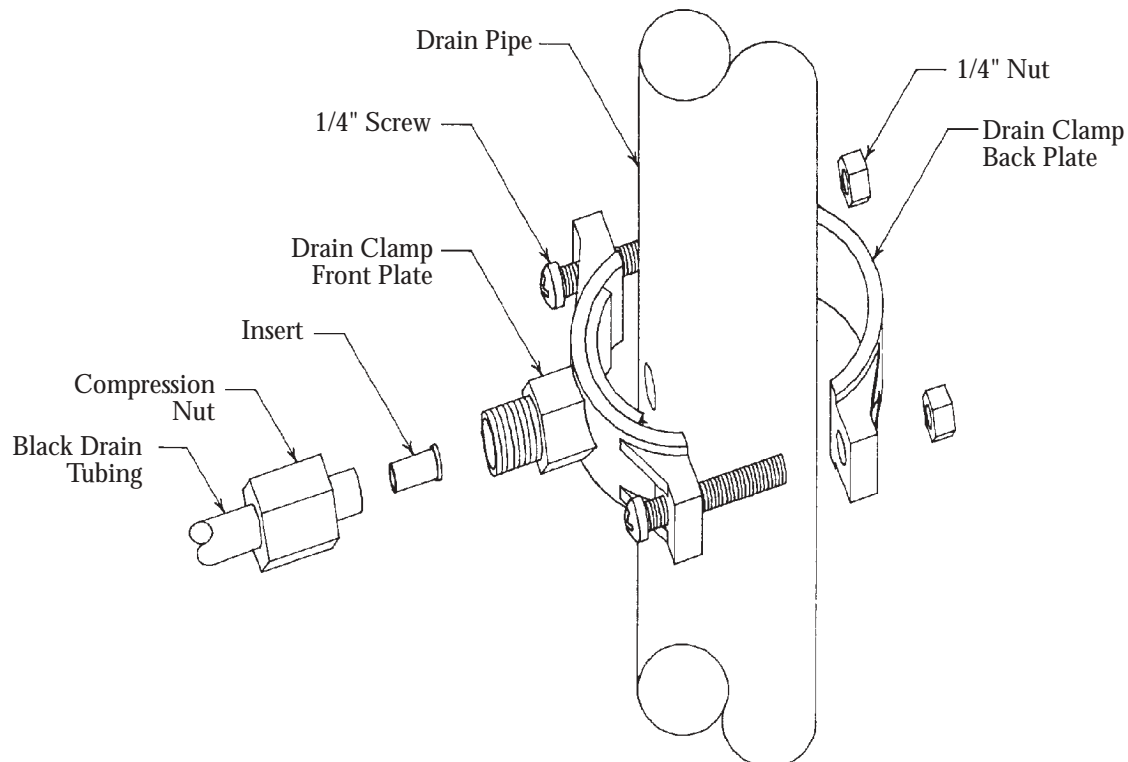


Figure 4

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**NOTE:** When cutting the polytubing make clean, square cuts, failing to do so could result in poor connections and possible leaks.

**NOTE:** The lowest point of the line should be the point of connection to the Drain Clamp. There should be no sag in the line as this may cause excessive noise as the reject water is flowing to drain.

Firmly press one end of the tubing over the  $\frac{3}{8}$ " drain outlet hose barb on the Air Gap Faucet. Allow the tubing to relax, then press firmly again to insure proper seating. No connectors are required when attaching hose to Hose Barbs. Route the tubing to the Drain Clamp and trim to length.

- Refer to Fig. 4, page 7. To connect the Drain Tubing, install the Compression Nut and the Insert.
- Insert the tubing into the Drain Clamp and tighten the Compression Nut.

#### **D. R.O. Manifold Assembly Installation**

Locate the site per Sec. III, C.3, page 5. Various installation sites will require different types of mounting fasteners; be sure the fastener selected will provide a firm, solid mounting. A support panel may be necessary on thin cabinet walls or to span between wall studs on particleboard or drywall.

Do not drill through exterior cabinet walls or leave sharp wood screw points exposed in readily accessible cabinet interiors.

The close proximity of a dishwasher or a trash compactor may require special fabrication of a mounting plate.

1. The installation bracket will accept either #10 or #12 (5mm) mounting screws spaced on 6" (15 cm) centers. Allow at least 4" (10 cm) of clearance beneath the filter housings to accommodate filter changes. Mark the two locations (the bracket can be used as a template). Install the screws and tighten them until the heads are about  $\frac{5}{8}$ " from the wall.
2. Locate the  $\frac{1}{4}$ " Red Feed Water Tubing. Remove the red plug from the fitting labelled "In" on the manifold and insert the tubing. Reference the special supplement sheet in the carton for proper connection of all tubing and removal of plugs. Run the tubing along its course to the Feed Water Saddle Valve, trim to length. (Refer to Fig. 1, page 1.)

Refer to Fig. 3, page 6. To the end of the red polytube install the Compression Nut, the Plastic Ferrule, and the Insert. Connect to the Feed Water Saddle Valve.

3. Locate the  $\frac{1}{4}$ " Black Drain Tubing. Remove the black plug from the fitting labelled "Drain" on the manifold and insert the tubing. The end of the Black Drain Tubing that should be inserted into the "Drain" port will have a red drain restrictor in it. Run the tubing along its course to the  $\frac{1}{4}$ " Hose Barb on the Dispensing Faucet, trim to length and connect by firmly pressing over the barb. Allow the tubing to relax, then press firmly again to insure proper seating.
4. Locate the  $\frac{3}{8}$ " Blue Product Water Tubing. Remove the blue plug from the elbow connected to the fitting labelled "Out" on the manifold and insert the tubing. Run the tubing along its course to the Dispensing Faucet and trim to length. Push the tubing into the faucet connector. The fitting will grab the tubing and hold and seal it in place. Make sure the tubing is pressed all the way in past the O-ring to create a pressure tight connection.  
**NOTE:** If you want to pull the tubing out for some reason, push the ring around the tubing up and pull the tubing out.
5. Locate the  $\frac{3}{8}$ " Yellow Tubing. Remove the yellow plug from the elbow connected to the fitting on top of the manifold labelled "Tank" and insert the tubing. (Refer to Fig. 1, page 1.)
6. Hang the Manifold Assembly on the mounting screws and tighten. **DO NOT OVERTIGHTEN.**

#### **E. Position the Drinking Water Holding Tank and Make the Final Hose Connections.**

1. Check the tank precharge pressure. Make sure it is between 5 to 7 psi. If not, use a bicycle hand pump or other pump to bring the pressure up to the 5 to 7 psi range.
2. Pull the cap/plug off the top of the tank where the Tank Shut-Off should go. (Refer to Fig. 1, page 1.)
3. Wrap the white teflon tape, included in the box, three times around the  $\frac{1}{4}$ " male outlet thread. Wrap in the direction of the threads (clockwise, when looking down on the holding tank). The tape will act as a thread sealant. Screw on the Holding Tank Shut-Off Valve.

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4. Locate the 3/8" Yellow Tubing which is attached to the elbow on top of the manifold and run the tubing along its course to the tank and trim to length. Insert the tubing into the Holding Tank Shut-Off Valve fitting. Make sure the tubing is pressed all the way in past the O-ring. The fitting will grab the tubing and hold and seal it in place.

## F. Start Up

At time of start up and each time the filters are changed the system should be sanitized (also see Operation and Maintenance Sec. V, B.1-4, page 10).

1. Sanitizing the system and installing the Sediment Prefilter. Use a drip pan to aid clean-up.

**NOTE:** The system should be sanitized BEFORE installing the Activated Carbon Post Filter or the RO Membrane.

- Use a good quality unscented 5¼% liquid chlorine household bleach.
- Open the Dispensing Faucet by lifting the black handle and open the Holding Tank Shut-Off Valve (the handle should be parallel with the valve body).
- Remove the plug on the underside of the manifold labelled "SEDIMENT". Remove the protective wrapping from the Sediment Prefilter. Pour one capful of bleach (this is approximately 2 tsp. or 10 ml) into one of the white Housings. Install the Sediment Prefilter Cartridge. (Install ONLY the Sediment Prefilter at this time. The O-rings should be up, toward the manifold head, on all filters.) Insert a Housing O-ring into the Housing groove, (press firmly in place). Engage and firmly tighten the Housing hand tight only.
- Remove the plugs labelled "MEMBRANE" and "ACTIVATED CARBON" from the underside of the manifold. To each of the remaining white Housings, add one capful of bleach. Insert a Housing O-ring, engage and firmly tighten the Housings hand tight only.
- Slowly open the Feed Water Saddle Valve (turning counter clockwise).
- As soon as the water begins to come out of the Dispensing Faucet, close the Faucet.

- Let stand for 15 minutes.

**NOTE:** During this time, check the system carefully for leaks.

- At the end of 15 minutes, CLOSE the Feed Water Saddle Valve and open the Dispensing Faucet.
  - Allow the Holding Tank to completely drain, then remove the Activated Carbon Filter Housing (the closest of the three to the In-Out Ports), empty, and install the Activated Carbon Post Filter. Firmly tighten the Housing hand tight only.
2. Installing the RO Membrane:
    - Remove the RO Membrane Housing, (the middle one), and empty.
    - Insert the Membrane up into the manifold. (The O-rings should be up toward the manifold.) Check the Housing O-ring for proper position in its groove, engage and firmly tighten the Housing hand tight only.
  3. Rinsing the system:
    - Slowly open the Feed Water Saddle Valve fully counter clockwise.
    - The Holding Tank Valve should be open.
    - Check the Air Gap Window on the Dispensing Faucet to be sure that the drain water is flowing. (Refer to Figure 2, page 6.) The RO System is now making water.
    - Do not open the Faucet for at least 8 hours.
    - Do not use the first three full tanks of water.

**CAUTION:** The RO Membrane is shipped with a preservative in it. This will be rinsed out with the first water produced. Allow the Holding Tank to fill (overnight) and discard the first three full tanks of production. It takes approximately 8 hours to make a full tank.

When the Faucet is first opened, expect air and carbon fines (very fine black powder) from the Activated Carbon Post Filter to be rinsed out. This is normal for the first tank of water or after the Activated Carbon Post Filter is changed.

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## SECTION V. OPERATION & MAINTENANCE

### A. Normal Operation

1. It is normal for the Total Dissolved Solids (TDS) of the water to be higher than normal during the first 5 gallons of operation, this is due to the sanitizing solution and the new Post Filter. After this water is rinsed to drain, the removal rate should stabilize at a value of greater than 75%.
2. RO systems produce drinking water at relatively slow rates, it can take up to 8 hours or more to fill the Holding Tank. Normal operation is to let the Holding Tank fill with water and then draw water as is needed. When the pressure in the Holding Tank falls to a given pressure (as the water is being used) the Automatic Shutoff Valve (ASO Valve) will start water production and the system will refill the Holding Tank. When the Holding Tank is full and no water is being used, the ASO Valve will automatically shut off the feed water to conserve water.

The more water that is used (up to the capacity of the system) the better the RO system will function. Utilize other uses for the water, such as flowers, pets and rinsing glassware.

With each use it is recommended that you turn the tap for at least 10 seconds prior to using water. This is especially important if the water tap has not been used daily. After periods of non-use, such as a week's vacation, it is better to empty the holding tank and allow the system to produce fresh water for use. If the system is not used for 3-4 weeks or longer, it is a good idea to resanitize the system and to change the Activated Carbon and Sediment Filter.

### B. Changing Filters

THIS RO SYSTEM CONTAINS FILTERS WHICH MUST BE REPLACED AT REGULAR INTERVALS TO MAINTAIN PROPER PERFORMANCE. USE ONLY FACTORY APPROVED FILTERS.

The recommended interval for changing the filters (not the RO Membrane) is every six (6) months. Typical C.T.A. Membrane life expectancy is one year. Local conditions may dictate more frequent changes.

**NOTE:** If the RO Membrane is to be replaced, see Sec. IV, F.1-3, page 9, for the proper procedure.

Use a drip pan to catch any water that may spill when the Filter Housings are removed. Refer to Fig. 1, page 1 for component location.

1. Close the Feed Water Saddle Valve by turning fully clockwise and open the Dispensing Faucet by lifting the handle. Allow the Holding Tank to empty.
2. Loosen and remove the Sediment Filter and the Activated Carbon Filter Housings. Discard the filters.
3. Wash the inside of the Housings using a mild detergent and a soft cloth. Do not use abrasive cleaners or pads. Thoroughly rinse all soap from the Housings before reassembly.
4. To sanitize the system and replace the filters:

**NOTE:** The system should be sanitized before installing the Activated Carbon Post Filter.

- Use a good quality unscented 5¼% liquid chlorine household bleach.
- Add one capful of bleach (this is 2 tsp. or 10 ml) to the Sediment Filter Housing. Remove the wrapping and install the Sediment Prefilter only. (The O-rings should be up, toward the Manifold Head, on all filters.) Check the Housing O-ring for proper position in its groove, engage and firmly tighten the Housing hand tight only.
- Add one capful of bleach to the Activated Carbon Filter Housing. Carefully fill the Housing with tap water and temporarily install the Housing, without the Activated Carbon Post Filter.
- The Dispensing Faucet should be open, slowly open the Feed Water Saddle Valve.
- As soon as water begins to drip out of the Dispensing Faucet, close the Faucet.
- Let the system stand for 15 minutes.
- At the end of 15 minutes, in the following order, close the Feed Water Saddle Valve, close the Holding Tank Valve and open the Dispensing Faucet to release the pressure.
- Remove the Activated Carbon Filter Housing and empty. Remove the wrapping and install the Activated Carbon Post Filter. Firmly tighten the Housing hand tight only.

- Disconnect the yellow product water tubing that runs from the Holding Tank to the Manifold (see Fig. 1, page 1). Put 50 drops of bleach (this is ½ tsp. or 3 ml) into the tubing and reconnect it.
- Slowly open the Feed Water Saddle Valve. When water begins dripping out of the Dispensing Faucet, in the following order, close the Faucet and then open the Holding Tank Valve.
- Do not open the Faucet for at least 8 hours.
- Discard the first three full tanks of water produced, they will contain chlorine.
- When the Faucet is first opened, expect air and carbon fines (very fine black powder), from the new Activated Carbon Post Filter to be rinsed out. This is normal for the first tank of water.

## B. Water Quantity

Water quantity is termed **Flux** or **Product Water Rate** and is measured as the amount of water produced in one day. It is reported as **Gallons per Day (gpd)** or **Liters per Day (lpd)**.

The flow of water to drain is the **Reject Water Rate** and is measured as Gallons per Day (gpd) or as **Milliliters per Minute (ml/min)**.

Milliliters per minute x 0.38 = gallons per day

EXAMPLE: The drain flow will fill a graduated cylinder to the 105 ml mark in one minute.

105 ml/min. x 0.38 = 40 gpd

If the container available measures ounces, use the following conversion:

Ounces per minute x 11.2 = gallons per day

EXAMPLE: The product flow will fill 1¾ ounces in two minutes.

1.75 oz. ÷ 2 min. = 0.875 oz./min.

0.875 oz./min. x 11.2 = 9.8 gpd

The **Reject Ratio** is the amount of water produced compared to the amount of water flowing to drain.

Reject Ratio =  $\frac{\text{Reject Rate}}{\text{Product Rate}}$

EXAMPLE: The product rate is 10 gpd and the reject rate is 40 gpd

Reject Ratio = 40 ÷ 10

Reject Ratio = 4 or 4-to-1

The **Percent Recovery** is another way to measure the amount of water produced as compared to the amount actually used.

% Recovery =  $\frac{\text{Product Rate}}{\text{Feed Rate}} \times 100\%$

NOTE: The total flow or feed water rate into the system is the sum of the product flow and the drain flow.

EXAMPLE: The product water rate is 10 gpd and the drain water rate is 40 gpd

Feed Rate = 10 gpd + 40 gpd = 50 gpd

% Recovery =  $\frac{10 \text{ gpd}}{50 \text{ gpd}} \times 100\%$

% Recovery = 0.20 x 100% or 20%

## SECTION VI. TECHNICAL DATA

### A. Water Quality

Water quality is normally measured with a special meter that measures the water's ability to conduct electricity. The more dissolved solids in the water, the higher the conductivity. The results are usually reported in **Parts per Million (ppm)** or **Milligrams per Liter (mg/l)** of **Total Dissolved Solids (TDS)**. (Although technically they are not exactly equal, in most discussions ppm = mg/l.)

R.O. Membranes are rated by the amount of dissolved solids that are rejected. This rating is a ratio of the TDS in the feed water to the TDS in the product water and is reported as **Percent Rejection**. If the feed water contained 100 ppm of TDS and the product water contained 10 ppm of TDS, 90 ppm have been rejected and the reject ratio is 90%.

Percent Rejection =  $\frac{\text{Feed TDS} - \text{Product TDS}}{\text{Feed TDS}} \times 100\%$

EXAMPLE: Feed water is 500 ppm TDS and the product water is 75 ppm TDS

Percent Rejection =  $\frac{500 - 75}{500} \times 100\%$

Percent Rejection = 0.85 x 100% or 85%

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### C. Net Pressure Differential

Most R.O. Membranes are rated at a standardized condition of 77°F (25°C) and 65 psig (450kPa) discharging to atmospheric pressure.

Product water quality and quantity greatly depend upon the **Net Pressure Differential** ( $\Delta p$ ) across the R.O. Membrane. This pressure differential is a summation of the feed water pressure at the Membrane, which tries to push the water through, the pressure in the Holding Tank, which tries to push the water backwards and the osmotic pressure, which also tries to

push the water backwards.

The **Osmotic Pressure** is in proportion to the dissolved minerals in the water and can be approximated by 1 psi for each 100 ppm of TDS.

EXAMPLE: A feed water with 1500 ppm of TDS would exert a backward pressure of about 15 psig on the membrane.

Net Pressure Differential =  
Feed Water Pressure – Holding Tank Pressure –  
Osmotic Pressure

The higher the net pressure differential, the higher the quantity and quality of water produced. Some loss of production is normal when using a pressurized Holding Tank.

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### NOTES:

## D. WATER PRODUCTION RATE CHART

Feed Water		Estimated Water Production Rate in Gallons Per Day (GPD) for Line Pressure of:					
Temp. (°F)	TDS* (ppm)	40 psi	50 psi	60 psi	70 psi	80 psi	90 psi
50	50	5.0	6.5	8.0	9.5	11.0	12.6
	500	4.3	5.8	7.3	8.8	10.4	11.9
	1000	3.5	5.0	6.6	8.1	9.6	11.1
	1500	2.7	4.3	5.8	7.3	8.8	10.4
60	50	5.8	7.6	9.4	11.2	12.9	14.7
	500	5.0	6.8	8.6	10.4	12.1	13.9
	1000	4.1	5.9	7.7	9.5	11.2	13.0
	1500	3.2	5.0	6.8	8.6	10.4	12.1
70	50	6.8	8.9	11.0	13.1	15.1	17.2
	500	5.9	7.9	10.0	12.1	14.2	16.3
	1000	4.8	6.9	9.0	11.1	13.2	15.3
	1500	3.8	5.9	7.9	10.0	12.1	14.2
80	50	8.0	10.4	12.8	15.3	17.7	20.2
	500	6.8	9.3	11.7	14.2	16.6	19.1
	1000	5.6	8.1	10.5	13.0	15.4	17.9
	1500	4.4	6.8	9.3	11.7	14.2	16.6
90	50	9.3	12.2	15.0	17.9	20.8	23.6
	500	8.0	10.9	13.7	16.6	19.5	22.3
	1000	6.6	9.5	12.3	15.2	18.0	20.9
	1500	5.2	8.0	10.9	13.7	16.6	19.5

\*Total Dissolved Solids (TDS) measured in Parts Per Million (ppm).

Please Note: This chart is based upon a start-up of a system when the storage tank is empty, (7psig precharge). As the tank fills, and backpressure from the tank increases, the GPD rating will decrease.

**SECTION VII. TROUBLE SHOOTING GUIDE**

<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
<b>Low quantity of Product Water from Holding Tank</b>	Feed Water Saddle Valve is plugged or closed.	Open Valve or unclog.
	Clogged Sediment Prefilter or Activated Carbon Post Filter.	Replace filters.
	Low water pressure.	Feed Water pressure must be above 40 psig.
	RO Membrane is fouled.	See Feed Water operating limits. Correct cause of fouling, replace Membrane.
	Air precharge pressure in Holding Tank is too high.	Empty water from Holding Tank, and with the faucet open, adjust air pressure to 5–7 psig (35–48 kPa) range.
	Air precharge is too low	
	Air bladder in the Holding Tank is ruptured.	Replace Tank.
	Holding Tank Valve is closed.	Open Valve.
	No drain flow, the Drain Restrictor is plugged.	Clear or replace Drain Restrictor.
	No drain flow, the drain orifice in the Air Gap Faucet is plugged.	Clear or replace the Air Gap Faucet.
	The Check Valve is stuck.	Free check.
	The ASO Valve is malfunctioning.	Replace ASO Valve components.
	<b>Low pressure at the Dispensing Faucet</b>	Activated Carbon Post Filter is plugged.
Air precharge in the Holding Tank is too low.		Empty water from Holding Tank and with the faucet open, adjust the air pressure to 5–7 psig (35–48 kPa) range. Check for leakage at the Air Valve Stem.
Holding Tank Valve is partially closed.		Open Valve.
The dispensing Faucet is out of adjustment or faulty.		Repair or replace Dispensing Faucet.
Heavy water use, Holding Tank is depleted.		Allow Holding Tank to refill (adding a second Holding Tank will increase storage capacity).
Low Water Production.		See Low Quantity of Product Water from Holding Tank section above.
<b>High Total Dissolved Solids (TDS) in the Product Water</b>		Clogged Sediment Prefilter.
	Low Water Pressure.	Feed Water Pressure must be above 40 psig. Check Feed Water Saddle Valve.
	RO Membrane O–ring is crimped.	Check O–ring.
	RO Membrane brine seal is not sealing up into the manifold head.	Check the brine seal.
	RO Membrane is expended.	If Membrane life is unusually short, find and correct the problem. Replace Membrane.



<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
<b>High Total Dissolved Solids (TDS) in the Product Water (continued)</b>	The Product Water and Drain Water lines are reversed.	Correct plumbing.
	No drain flow, Drain Restrictor is clogged.	Clear or replace Drain Restrictor.
	No drain flow, the drain orifice in the Air Gap Faucet is plugged.	Clear or replace Air Gap Faucet..
	The ASO Valve is not closing.	Repair or replace the ASO Valve Components.
	New Activated Carbon Post Filter not rinsed completely.	Flush with several full tanks of Product Water.
	The Feed Water TDS has increased.	An increase in Feed Water TDS will give a corresponding increase in Product Water TDS.
<b>Tastes and odors in the Product Water</b>	The Activated Carbon Post Filter is exhausted.	Replace Filter.
	There is foreign matter in the Holding Tank.	Clean, flush and sanitize the system. Replace the filters.
	The Product Water and Drain Water lines are reversed.	Correct plumbing.
	Dissolved gasses in the Feed Water.	Pretreat Feed Water to remove dissolved gasses.
	Increase in Product Water TDS.	See high TDS in the Product Water section.
<b>Drain Water overflows at the Air Gap Faucet</b>	Air Gap is blocked.	Clear Air Gap. Rinse with vinegar for removal of calcium buildup.
	Drain tubing is clogged.	Clear tubing.
	Drain Clamp hole is misaligned.	Align with hole in the drain pipe.
	Excessive drain flow rate.	Replace Drain Restrictor.
<b>Faucet leaks or drips</b>	Leaks from spout.	Adjust Faucet by turning the tee bar just below the handle to provide a small amount of free play in handle when shut off. O-rings are bad, repair or replace faucet.
	Leaks from base of the delivery tube.	O-ring is bad, replace O-ring.
	Leaks from beneath the handle.	O-rings are bad. Repair or replace the faucet.
<b>Fitting leaks in general</b>	Close the Feed Water Saddle Valve and relieve pressure before disconnecting any tubing or replacing any fitting. Before replacing a fitting, re-cut the tubing and re-insert into the fitting to see if that solves the leak. If pipe threads are leaking, remove and retape with Teflon tape.	



DRAWING NO.	PART NO.	DESCRIPTION
1 .....	S2009 .....	Self Tapping Screw
2 .....	S2005 .....	ASO Cap
3 .....	S2013 .....	ASO Cap O-Ring
4 .....	S2011 .....	ASO Diaphragm – Large
5 .....	S2007 .....	ASO Piston
6 .....	S2006 .....	ASO Piston Ring
7 .....	S2010 .....	ASO Diaphragm – Small
8 .....	S2128-03M .....	Manifold Plate
9 .....	S1276 .....	Check Valve
10 .....	S1277 .....	Check Valve Retainer
11 .....	S7011 .....	Sediment Prefilter
12 .....	S1224RS .....	C.T.A. RO Membrane 14 GPD (53 lpd)
13 .....	S3069 .....	Housing O-Ring
14 .....	S7029-09 .....	Housing
15 .....	PK-A6TEU4-MG .....	1/4" Post x 3/8" Polytube Elbow
16 .....	PK-A4TPL .....	1/4" Plug
17 .....	S2116-4 .....	Drain Restrictor 40 GPD (151 lpd) Red
18 .....	S7025 .....	Activated Carbon Post Filter
19 .....	S1405 .....	1/4"-3/8" Fitting Wrench
20 .....	S3072 .....	Wrench for Housing

**OTHER COMPONENTS AS SHOWN IN FIGURE 1, PAGE 1.**

DRAWING NO.	PART NO.	DESCRIPTION
1 .....	S1089-08 .....	Long Reach Air Gap Faucet w/ 3/8" Connector
2 .....	S1117-01 .....	3/8" Drain Clamp Assembly
3 .....	S2119-01NN .....	Cover
5 .....	S1118-01 .....	Feed Water Saddle Valve
6 .....	C2000 .....	RO-3 Holding Tank
7 .....	S1037 .....	Holding Tank Shut-Off Valve

  
**R.O. DRINKING WATER SYSTEM  
FIVE/ONE YEAR LIMITED WARRANTY**

**What Does This Warranty Cover?**

*This warranty covers any defects in materials and workmanship of the Rayne® R.O. Drinking Water System when installed and operated within recommended parameters, with the exceptions stated below.*

**How Long Does The Coverage Last?**

*Rayne® will warrant its R.O. Drinking Water System (except for the reverse osmosis membrane), for a period of five years from the date of purchase. The reverse osmosis membrane is warranted for one year from date of purchase. All implied warranties including merchantability and fitness for a particular purpose are limited to five years from the date of purchase for the R.O. Drinking Water System, except for the reverse osmosis membrane which is limited to one year from date of purchase. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.*

**What Will Rayne® Do?**

*Rayne® will repair or replace at its discretion any defective component. You must pay any labor charges. You must also pay for shipping or travel charges to return the defective part(s).*

**What Does This Warranty Not Cover?**

*This warranty does not cover the disposable sediment and carbon filters whose service life depends on feed water conditions. In addition, the membrane is only warranted if the required feed water conditions are met.*

*The above warranty will also not apply to any part of the Rayne® R.O. Drinking Water System that is damaged because of neglect, misuse, alterations, accident, misapplication, physical damage, or damage caused by fire, acts of God, freezing or hot waters or similar causes. Consequential and incidental damages are not recoverable under this warranty. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.*

*We recommend that you use only authorized Rayne® replacement parts since improper parts or incorrectly performed maintenance or repair voids this warranty.*

**How Do You Get Service?**

*In order to be eligible for service under this warranty you must (a) contact your local dealer who supplied the unit or (b) contact the factory for the dealer nearest you.*

**How Does State Law Apply?**

*This warranty gives you specific legal rights and you may also have other rights which vary from state to state.*



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