

BEFORE INSTALLING THE RO SYSTEM

- Best performance of the system will be achieved when the incoming water has been pre-treated (softener or other pre-treatment equipment).
- The water coming into the system must be within certain limits for sediments, pressure, etc. Refer to the specifications to determine if your installation is within the limits.
- A water quality analysis can be performed to determine if incoming water requires any treatment. Contact your dealer/installer.
- The filters and membrane elements in the RO system need to be replaced on a regular basis. Follow the instructions for replacement that are in this manual. Follow the guidelines for filter and membrane replacement found in the user manual supplement.

NOTE: For optimal system performance, use the system for at least 2 minutes continuously each day.

WARNING: The RO system is designed to work without the aid of a pressurized storage tank. Installation of a pressurized storage tank will negatively affect system performance. An open, atmospheric, storage tank or reservoir is the best option to collect water.

LOCATION OF SYSTEM

NOTE: Keep the lengths of tubing short. Longer lengths of tubing will decrease system performance.

NOTE: All plumbing should be done in accordance with state and local plumbing codes. Some codes may require installation by a licensed plumber. Check with the local plumbing authority prior to installation.

WARNING: All components and tubing should be located in an area which is not exposed to freezing temperatures. Do not expose unit or tubing to direct sunlight or high intensity lights.

Water Supply: To provide supply water to the RO system inlet, a garden hose adapter is include. Should you wish to connect the system to you household plumbing your dealer has a selection of options. The feed water 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 element.

Drain Point: A suitable drain point is needed for reject water from the RO system. A floor

WARRANTY

Commercial vs. Residential Warranty

The Merlin is designed as a home RO system. The continuous flow nature of the Merlin system makes it a prime candidate for many light commercial applications. Most light commercial applications cause more wear-and-tear on the Merlin system. Because of this, we offer a commercial warranty to cover light commercial applications, as well as a residential warranty.

We consider any application that uses more than 20 gallons

(7.57 liters) per day of permeate water to be a commercial application.

Residential applications—36-month warranty Commercial applications—
12-month warranty

System Warranty

GE Infrastructure Water & Process Technologies will replace any plastic component on the system that has failed because of a manufacturing or design defect. Failures caused by misapplication, or incorrect system installation by the installing dealer cannot be honored. GE Infrastructure Water & Process Technologies may require proof of correct application/installation before warranting the product.

Membrane Element Warranty

The Merlin membrane element is warranted for manufacturing or design defects for a 12-month period from the date of manufacture, when installation inlet water conditions are within the published limits.

Elements that fail prematurely due to fouling from iron, hardness, manganese or chlorine cannot be warranted.

Pre/post Filter Warranty

The Merlin pre/post carbon filters are not warranted due to the very high variability in inlet water conditions that may cause significant life deviation from the published carbon filter life.

INSTALLATION

STEP 1: Install cold water supply valve

STEP 2: Install optional faucet

STEP 3: Make tubing connections (NOTE: steps 3 and 4 are reversed on the quick start guide.)

STEP 4: Assemble RO components

STEP 5: Put system into operation

NOTE: Consult a licensed plumber if you are not familiar with plumbing procedures.

STEP 1: INSTALL COLD WATER SUPPLY VALVE

If not using the included garden hose adapter for the feed water, you will need a feed valve, available from your dealer. Cold water pipes vary in size and style. You must determine the type of valve that will be used. Install a valve on the cold water supply pipe to adapt 1/2-inch OD tubing. If threaded fittings are used, use pipe joint compound or Teflon tape on outside threads. There are a large variety of feed valve options available through your dealer. To view these please visit www.hydrologicsystems.com

Turn the valve off.

STEP 2: INSTALL OPTIONAL FAUCET (General Instructions)

A. Prepare Mounting Hole

1. Select a location for the faucet. Be sure it will fit flat against the sink or counter and that there is space underneath for tubing.
2. If drilling is needed, make a 1-1/2 inch diameter hole. If the air gap module is not being used, a smaller diameter hole is acceptable.

WARNING: To avoid damaging a sink, consult a qualified plumber or installer for the proper method of drilling holes in porcelain or stainless steel.

SALT DIFFUSION

Like all reverse osmosis systems, the Merlin uses semi-permeable membrane elements to filter contaminants. When pressurized, this membrane element allows water with low salt concentrations to pass through, leaving higher concentrations of salt on the opposite side of the element. Unpressurized, naturally occurring diffusion takes place between the low salt permeate water and higher salt concentrate water. This process, which happens in all RO systems when not in operation, begins to equalize salt concentrations on each side of the element. After approximately two hours of inactivity, measured TDS rejection of the permeate water held within the RO membrane elements and manifold will have dropped below steady-state rejection levels.

Salt Diffusion in Traditional RO Systems

In a typical home RO system, the salt-diffused permeate water created through periods of inactivity is mixed into the storage tank. Over time, the salt concentration within the storage tank slightly increases. The end users are eventually forced to use salt-diffused water. This is one reason why most RO manufacturers recommend flushing holding tanks on a weekly basis — it minimizes, but does not eliminate, salt diffusion effects.

Salt Diffusion in the Merlin

After extended periods of inactivity in the Merlin system, any salt-diffused water will be exhausted through the faucet when the system is operated. After this water is flushed from the system, the RO continues producing water at typical steady-state high rejection levels. The Merlin, therefore, allows users to eliminate the effects of salt diffusion by simply running their system for 1 to 3 minutes after extended periods of inactivity. For most end users, the salt diffusion will be undetectable. For those users who monitor rejection levels, a spike of water with higher conductivity may be seen when testing is conducted immediately after an extended period of inactivity. Because of salt diffusion, rejection levels should be tested when the system has reached steady-state operation.

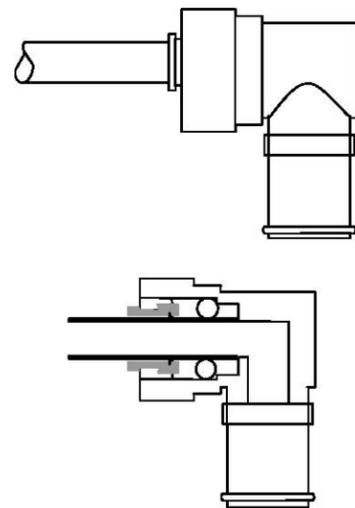
Merlin Flush System

For highly demanding applications that require an alternate method to lessen the effects of salt diffusion, a Merlin flush kit is available. This kit includes a small tank that connects to the 1/4-inch light blue elbow on the Merlin. The kit forces permeate water to flush the high salt concentrate water from the membrane elements. By doing this, the system rests with low salt concentrations on both sides of the elements. Because low salt concentrations remain on each side of the membrane, salt diffusion is greatly reduced. The kit uses approximately 0.7 gallons (2.5 liters) of permeate water to flush the membrane elements each time it operates. Figure 14 through Figure 18 illustrate the flush kit operation.

8. The horseshoe clip is positioned around the threaded pipe under the sink and above the standoff. This clip should engage the tubing connected to the air gap, if used.
9. Tighten the nut against the clip to hold the faucet in position.

STEP 3: MAKE TUBING CONNECTIONS

- Feed connection—clear tubing from feed valve to white elbow connector
- Permeate connection—blue tubing from faucet to blue elbow connection
- To the flush tank (if used)
- Attach the fittings to the manifold



NOTE: Make sure the tubing is pushed past the O-rings for a secure fit. Also, when replacing any tubing, cut tubing back ~1/4 inch prior to re-inserting to prevent leaks.

Figure 3: Side View and Cutaway of Tubing Fitting

NOTE: For optimal system performance, we recommend using tubing lengths that are as short as possible.

The Merlin Advantage

Since the Merlin requires no storage tank, its membrane element performs at the optimal recovery rate at all times. This makes the Merlin's efficiency the same as the Merlin's recovery. Because of this, the Merlin sends significantly less waste water to the drain than traditional home RO systems with a tank.

This is a huge advantage in areas where water conservation is critical.

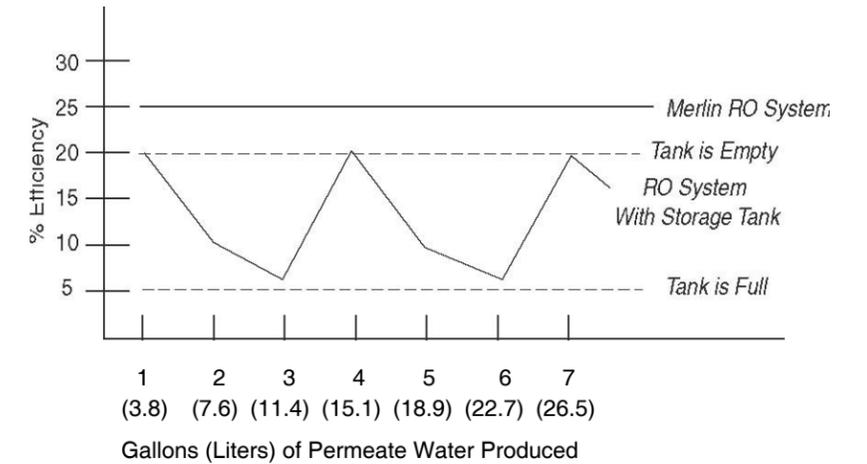


Figure 12 Merlin vs. RO Efficiency with Three Gallon Tank

The Proof Is In the Numbers

Below is a waste water calculation to show the amount of waste water produced to make 3 gallons of permeate water.

Table 3	Standard Home RO	Merlin RO
Gallon 1	1 gallon of permeate water @ 20% efficiency = 4 gallons of water to drain	1 gallon permeate @ 25% efficiency = 3 gallons to drain
Gallon 2	1 gallon of permeate water at 10% efficiency = 9 gallons of water to drain	1 gallon permeate @ 25% efficiency = 3 gallons to drain
Gallon 3	1 gallon of permeate water @ 5% efficiency = 19 gallons of water to drain	1 gallon permeate @ 25% efficiency = 3 gallons to drain
Results	32 total gallons of water to drain	9 total gallons to drain

Which system is better for the environment?

Consider that the average consumer is using only 8-12 oz. of water at a time. An RO system with a storage tank generally is operating under 10% efficiency!

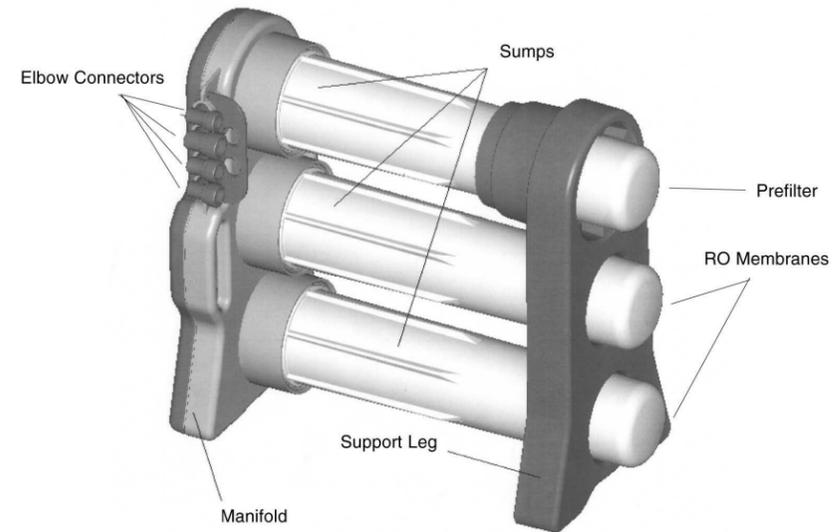


Figure 4: RO Assembly

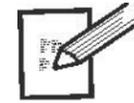
WARNING: Do not attempt to mount/hang the main body. Do not try to drill mounting holes anywhere on the system. If putting above ground/cabinet level, a sturdy, permanent shelf is recommended.

The table below shows the coding system for the fitting connections. Each fitting has a unique “keyed” socket on the manifold. Each fitting also has a graphic symbol molded into the elbow with a corresponding symbol on the manifold.

Connector Symbol	Connection	Tubing Color
O	Flushing (optional)	Blue
←	Feed-Inlet	Natural
△	Concentrate	Black
□	Product (RO)	Blue

WARNING: Lubricate the O-rings on the fitting elbows with silicone lubricant, prior to inserting into manifold.

WARNING: Do not turn the incoming water valve on until the locking bar is in place.



EXAMPLE:

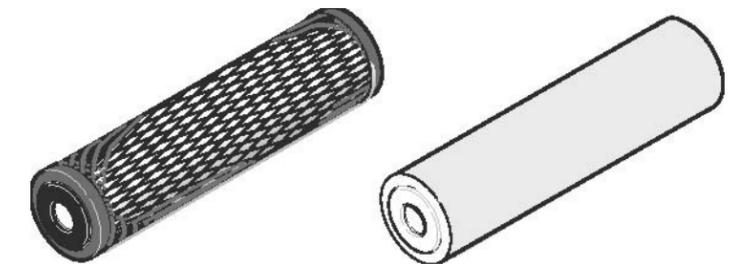
Q: A light commercial application uses 200 gals (757 liters) permeate water per day. Estimate the pre-filter life.

A:
$$\frac{\text{Pre-filter life } 5000}{(\text{days}) 4 \times 200 \text{ gals}} = = 6.25 \text{ days}$$

For these higher water use commercial applications, we recommend using a high capacity carbon cartridge or backwash carbon filter as pretreatment to the Merlin. Remove the standard Merlin carbon block filter from the system.

An alternate 10-micron nominal high capacity sediment pre-filter is available for Merlin. This filter can be used for commercial or well water applications where no chlorine is present in the Merlin inlet water.

This sediment filter is interchangeable with the standard Merlin carbon pre-filter for applications without chlorine.



Standard Merlin Pre-filter 5-micron nominal 3 NTU max turbidity 5000 gal capacity 1 ppm chlorine max at inlet

Alternate Merlin Filter for Commercial or Well Applications 10-micron nominal TBD NTU max turbidity TBD gal capacity 0 ppm chlorine max at inlet

Figure 11



NOTE: Some applications may have water turbidity or iron levels that negatively affect pre-filter life. If a pre-filter clogs very quickly, consider additional pretreatment before the system.

MERLIN-GARDEN PRO™ BOOSTER PUMP

The RO system is now ready for use.

TO CARE FOR THE RO SYSTEM

The components of the RO system are designed to function with minimal maintenance. However, the membrane elements and filters will need to be replaced on a regular schedule.

NOTE: Run the system for at least five minutes each day for optimal performance.

REPLACEMENT OF PREFILTER AND POSTFILTER

The included carbon/sediment pre-filter reduces sediment and certain chemicals, such as chlorine, from the water. Depending on water use and the amount of impurities, this filter should be replaced every six months for residential applications and more often for commercial applications. Roughly at every **1500 gallons** of RO product water the carbon-pre-filters should be changed. Running the carbon pre-filter past its useful life will result in damage to your RO membranes.

If using non-chlorinated well or spring water, the replacement sediment pre-filter should be used for all future pre-filter changes. Replace as needed.

Installations using more than 20 gallons product water per day average, should install external pre-filters (not supplied) to reduce chlorine and sediments larger than 10 microns. Light commercial applications should have a water softener and extra high capacity carbon filtration (see below).

# Gallons Per Week Average	Recommended System
140 gallon or less	Merlin-Garden Pro™
140-300 gallons	Tall Blue™ w/ Merlin-Garden Pro™
300+ gallons	Big Boy XL™ and Softener w/ Merlin-Garden Pro™

The Tall Blue™ High Capacity and the Big Boy™ and Big Boy XL™ Extra High Capacity Pre-Filters all offer substantial pre-treatment for the inlet water. These options are available from your dealer.

REPLACEMENT OF RO MEMBRANE ELEMENTS

The functional life of the RO membrane elements will vary based on feed water quality. Product water should be tested periodically to verify the membrane elements are performing properly. For most residential applications, using about 20 gallons per day average, the RO membrane elements should be replaced every two to four years.

For lower pressure and/or low temperature applications, a pressure activated booster pump for Merlin is available. Refer to Figure 2 for help determining when applications may require a booster pump to improve system performance.

To install, connect the pump to the 1/2-inch inlet tubing, and plug in the motor. The pump will automatically turn on and off whenever the Merlin is producing water.

The Merlin booster pump is a variable speed pump designed to produce water pressure at 62 to 68 psi (4.27 to 4.69 bar) regardless of the inlet pressure. As with all pumps, make sure the water flow rate is at least 2 gpm (7.6 Lpm).

Pump Specifications

- Inlet water pre-pump pressure range -20 to 60 psi (1.38 to 4.14 bar)
- Pump outlet pressure - 60 to 68 psi (4.14 to 4.69 bar)
- Necessary water flow for proper pump operation -2 to 4 gpm (7.6 to 15.1 Lpm)
- Pump electrical ratings -110 to 120 VAC, 60 Hz, 500 watt
- Pump duty cycle -intermittent operation -1 hour

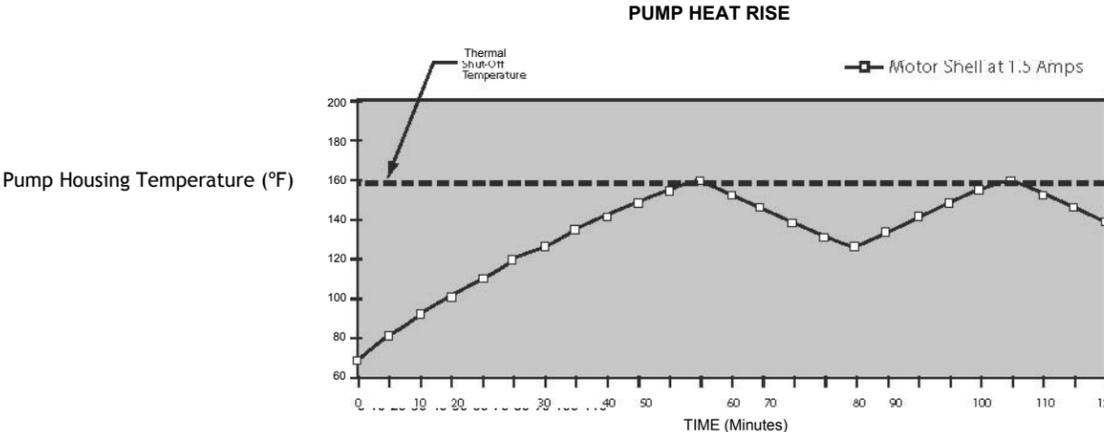


Figure 10

We recommend using only the Merlin provided booster pump. Other pumps may result in reduced membrane element or system life.



NOTE: The Merlin booster pump is a great way to increase flow for low pressure applications. The pump will also help increase TDS rejection and system efficiency.

7. If changing membrane elements:
 - A. Remove membrane sumps. Remove and discard used elements.
 - B. Remove new elements from packaging.

WARNING: Elements contain a food grade preservative. The use of sterile/ latex gloves is highly recommended.

- C. Lubricate element O-rings, brine seals, and housing O-rings with silicone lubricant.
- D. Securely insert O-ring end of elements into manifold. See Figure 7.
- E. Replace housings and tighten until it bottoms out.

NOTE: The system should be sanitized whenever a membrane element or filter is replaced.

8. Sanitize the system.
 - A. The manifold should be positioned flat with the housing connections facing up.

Prefilter Center Opening Membrane Element Locations

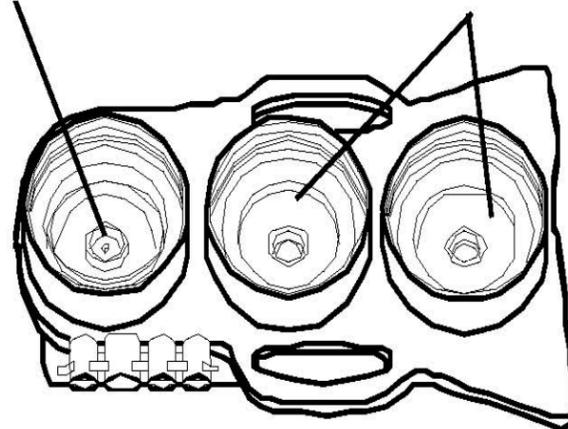


Figure 7

- B. Pour a tablespoon (15 milliliters) of chlorine bleach into the center opening of the pre-filter housing connection. See Figure 7.
9. Install pre-filter.
 - A. Remove new pre-filter from packaging. Ensure gaskets are secure. Insert pre-filter into proper opening on manifold.
 - B. Lubricate housing O-ring with silicone lubricant.
 - C. With the pre-filter element in place, screw the housing into the connection. Tighten until it bottoms out.

Table 1 -Merlin-Garden Pro™ System Flow Rates (gpm), Based on 750 ppm NaCl, sodium chloride, Inlet Water^a

Temperature °F [°C]	Net Driving Pressure, psi [bar]								
	75 [5.2]	70 [4.8]	65 [4.5]	60 [4.1]	55 [3.8]	50 [3.4]	45 [3.1]	40 [2.8]	35 [2.4]
80 [27]	1.03	0.95	0.88	0.81	0.74	0.67	0.60	0.53	0.46
70 [21]	0.89	0.83	0.77	0.71	0.65	0.58	0.52	0.46	0.40
60 [16]	0.77	0.72	0.66	0.61	0.55	0.50	0.44	0.39	0.33
50 [10]	0.63	0.59	0.54	0.49	0.45	0.40	0.36	0.31	0.26

- To adjust data to actual conditions, multiply measured TDS by -0.0002 and add 0.15. Add answer to Table data to achieve actual flow rate. Estimated flow change from 750 ppm NaCl = -.0002 X measured TDS + 0.15
- Net Driving Pressure = Flowing Inlet Pressure - System Pressure Drop



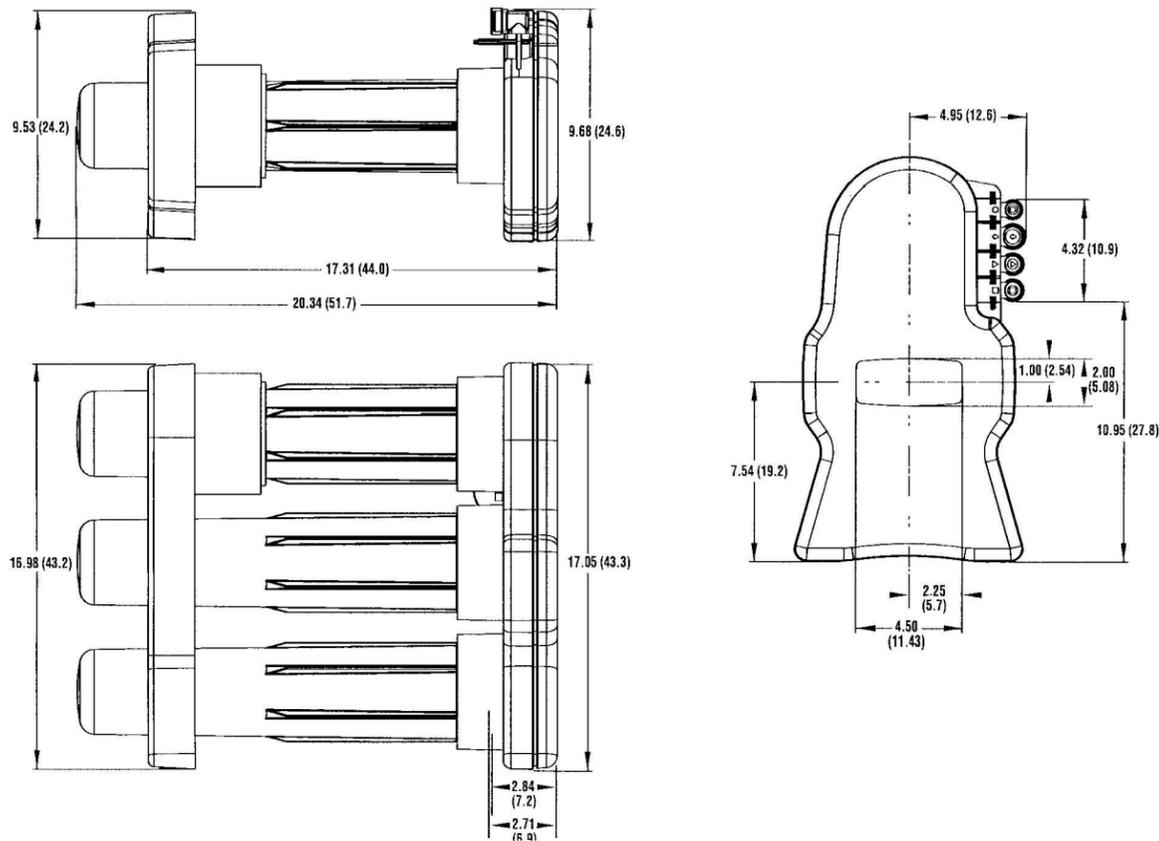
NOTE: Pressure drop throughout the system is caused by such things as frictional tubing losses, vertical tubing runs, post filter, faucet, and obstructions. See section on system pressure drop for more detailed information.



NOTE: Actual system performance may vary due to manufacturing tolerances and installation factors.

Use the flow rate worksheet located at the end of this document to estimate flow from the Merlin-Garden Pro™.

DIMENSIONS



SYSTEM PERFORMANCE: THE MERLIN-GARDEN PRO™ SWEET SPOT

The Merlin-Garden Pro™ uses a new, patented membrane element technology that provides flow rates up to five times greater than standard home RO membranes. The membrane element is designed to work from 40-80 psi (2.7-5.5 bar) inlet water pressure and 40-100°F (4.4-37.8°C) water temperature. The Merlin-Garden Pro™ performs better as pressure and temperature increase. Ideally, pressures will be higher than 50 psi (3.4 bar) and temperatures will be higher than 50°F (10°C). Figure 2 represents the application conditions recommended for the Merlin-Garden Pro™ system.

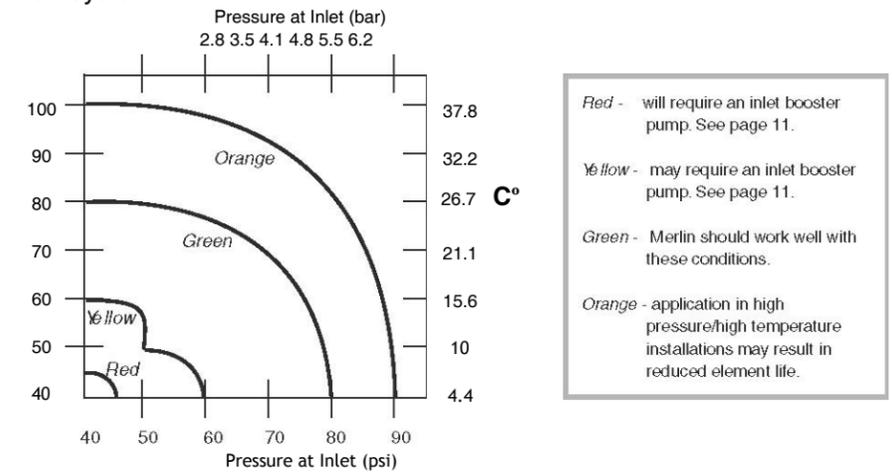


Figure 2

Flow Rates

Performance Specifications^{1, 2}

Average Permeate Flow Rate 0.50 gals/min (1.89 Lpm)
 Average TDS Rejection (NaCl)³ 90%

Minimum and Maximum Operating Conditions

Condition	Minimum	Maximum
Inlet Pressure	40 psi (2.76 bar)	80 psi (5.52 bar)
Inlet Temperature	40° F (4.4° C)	100° F (37.8° C)
Inlet TDS	50 mg/L	2,000 mg/L
Inlet Hardness	0 mg/L (0 grain)	171 mg/L (10 grain)
Inlet Chlorine	0 mg/L	1.0 mg/L
Inlet Iron	0 mg/L	0.1 mg/L
Inlet Manganese	0 mg/L	0.05 mg/L
Inlet pH	4	10
Inlet Turbidity	0	1 NTU

¹ Based on 50 psi (3.44 bar), 77° F (25° C), 750 mg/L NaCl, 23.7% Recovery

² System is designed for use on potable water systems only.

Factors that directly affect flow performance from the Merlin-Garden Pro™ include: Net driving pressure (NDP) Inlet water temperature Inlet water conductivity (TDS) Installation factors

An understanding of these factors and how they affect flow is critical for maximizing the Merlin's performance. To estimate Merlin's performance, follow these steps:

1. Determine inlet TDS.
2. Determine inlet water temperature.
3. Determine net driving pressure.
4. Consult Table 1 for estimated flow.

