

# ElectroMaax Inc.

Marine Watermaker Series

## SolarMaax 17

12 or 24 Volt System

### INSTALLATION, OPERATION & MAINTENANCE MANUAL



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## INTRODUCTION

The team at ElectroMaax thanks you for your purchase of our *SolarMaax 17* reverse osmosis watermaker with Auto Flush, and the latest in energy recovery technology; the *Enhanced Clark Pump*.


The addition of a low energy watermaker can be a life changing upgrade for your cruising experience. Used properly, you will never have to go out your way just to get questionable and/or expensive water or have to lift jerry cans out of the dingy. The *SolarMaax 17* can easily make enough for you and your crew to have all the water necessary to live as you would at home including showers every day. In addition it can pay for itself by being able to rinse salts off your boat and gear, reducing maintenance and replacement costs.

The *SolarMaax 17* design is based on decades of real-world product testing and engineering from both Marine and Military applications ranging from supporting military operations in the mountains of Afghanistan to serious offshore yacht racing, as well as tranquil anchorages around the world.


We are confident that you will be completely satisfied with your new system and stand behind our product with an industry leading warranty and customer support.

## GENERAL WARNINGS AND NOTICES

There are several things which the installer or operator of the **SolarMaax 17** can do incorrectly, which can **seriously** damage the **SolarMaax 17** water maker, dramatically shorten the operational life span of the system, and in some cases cause personal **injury**. Knowing the things to avoid is critical to a good **SolarMaax 17** installation and operation. We will cover the following items again during the appropriate section later in the manual, however, due to their importance it is worth giving the following items extra attention.

 **WARNING:** THE SOLAR MAAX 10 IS DESIGNED TO BE USED IN TYPICAL SEA WATER. USING TASTE TO TEST THE QUALITY OF THE PRODUCT WATER ONLY WORKS WITH A SEA WATER FEED. OPERATING IN FRESH WATER WITHOUT STERILIZING THE PRODUCT COULD RESULT IN SICKNESS OR DEATH.

 **WARNING:** WHEN DISASSEMBLING THE PRESSURE VESSEL, DO NOT TOUCH THE TREADS ON THE ENDS OF THE TUBE. THERE MAY BE FIBERGLASS SPLINTERS.

 **NOTICE:** NEVER ALLOW CHLORINATED WATER TO COME IN CONTACT WITH THE RO MEMBRANES. OXIDANTS SUCH AS CHLORINE AND/OR BLEACH WATER WILL PERMANENTLY RUIN THE RO MEMBRANE.

 **NOTICE:** NEVER RUN THE *SolarMaax 17* IN OILY WATER. OIL WILL PERMANENTLY RUIN THE RO MEMBRANE.

 **NOTICE:** DO NOT INSTALL THE RO MEMBRANE MODULE IN AN AREA WHERE THE RO MEMBRANES CAN BECOME HEAT SOAKED TO TEMPERATURES ABOVE 113°F/45°C

 **NOTICE:** THE RO MEMBRANE MODULE IS SHIPPED CONTAINING A STORAGE/PRESERVATIVE SOLUTION WHICH MUST BE PURGED

 **NOTICE:** GOOD ELECTRICAL SUPPLY TO THE FEED PUMP IS MANDATORY FOR PROPER SYSTEM OPERATION.

 **NOTICE:** NEVER USE A 5 MICRON “CARBON” FILTER IN PLACE OF THE SUPPLIED 5 MICRON PREFILTER ELEMENT.

 **NOTICE:** ONLY USE THE STORAGE CHEMICAL SUPPLIED BY ELECTROMAAX. OTHER BRANDS MAY DAMAGE THE SYSTEM.

## *SOLARMAAX 17 SPECIFICATIONS*

**Production Rate:** One Feed pump, 8-10 Gallons per hour, 30- 38 liters per hour  
Two Feed pumps, 14-17 Gallons per hour, 53-64 liters per hour

The production rate is set by the displacement of the Enhanced Clark Pump energy recovery device and the feed flow rate. The **SolarMaax 17** uses two feed pumps that can be run individually or together. Water temperature and salinity affects operating pressure but has little effect on production rate. Changes in feed flow does have an effect, the more feed flow the more product. Supplying good voltage to the feed pumps gives the best production rate. Running the system while the batteries are bulk charging gives highest production rates.

### **RO Membrane:**

The **SolarMaax 17** Watermaker is equipped with one 40" or two 21" **DOW Filmtec®** RO Membrane(s)

Membrane Type: Polyamide Thin-Film Composite

Models: SW2521 or SW2540

Range of Operating Pressures: 650 to 1000 psi (45 to 69 bar)

Normal Operating Pressure: Set by feed water conditions and feed flow rate.

Salt Rejection rate: 99.4%

Maximum Operating Temperature: 113°F (45°C)

Minimum Storage/Operating Temp: 32°F (0°C)

Maximum Operating Pressure: 1,000 psi, (69 bar)

Maximum Pressure Drop: 15 psi (1 bar)

pH Range, Continuous Operation: 2-11

pH Range, short-term cleaning: 1-12

Free Chlorine Tolerance: <0.1ppm

### **Electrical Power Requirements:**

8.0 – 10.0 amps @ 12.5-14.4 VDC

4.0 – 5.0 amps @ 25.0 – 28.8 VDC

### **The Enhanced Clark Pump Hydraulic Pressure Intensifier:**

Manufactured by ElectroMaax for marine and military use. The Enhanced Clark Pump uses the Feed pump flow pressure to intensify the pressure of the flow through the RO membranes high enough for reverse osmosis to occur. There are no electrical components.

Displacement:	10 %
Feed Flow range:	1.0 gpm (3.78 lpm) to 4.0 gpm (15.14 lpm)
Maximum Inlet pressure:	up to 125 psi (8.6 bar)
Maximum Working Pressure:	1000 psi (68.9 bar)
Maximum operating temperature:	113°F (45°C)
Maximum storage temperature:	140°F (60.0°C)
Pump Dimensions:	26.38" (67cm) W, 5.75" (14.6cm) D, 8.0" (20.32cm) H
Pressure Relief Valve:	Manually open ½ turn for priming and servicing

## **Feed Pumps:**

Motor:	Permanent magnet type, fully enclosed, fan cooled, 1/8 hp
Pump Body:	Thermo plastic
Pump Type	3 chamber diaphragm
Typical Amp Draw:	8 to 10 amps, 12VDC 4 to 5 amps 24VDC
Recommended fuse size:	15 amps, 12VDC 7.5 amps, 24VDC
Flow Rate	1.5 gpm (6.8 lpm) open flow

## **Pressure Vessel:**

Filament wound fiberglass/epoxy compound with non-metallic wetted surfaces. Easily removeable end caps for membrane replacement with larger than standard internal porting and fittings for increased energy efficiency.

The most compact complete assembly available

Max pressure	1000 psi (69 Bar)
Burst pressure	3000 psi (207 Bar)

## **Prefilter and Auto Fresh Water Flush Filter housings:**

Industry standard, 10 inch, plastic, filter housings. Accepting 9.75" by 2.5" high flow carbon filter elements.

## **Enhanced Clark Pump and Pressure Vessel Assembly:**

Dimensions:	16.3" (41.3 cm) W, 24.8" (63.0 cm) L, 9.1" (23.1 cm) H
Weight:	34.2 lbs. (15.5 kg)

## **Feed Pump Assembly:**

Dimensions:	13.2" (33.5 cm) W, 8.63" (21.9 cm) D, 13.1" (33.2 cm) H
Weight:	11.2 lbs. (5.1 kg)

## **Shipping:**

Level 1 with two 21" Membrane: ships in 2 boxes

Box 1 – 18"(45.7 cm) x 18"(45.7cm) x 14"(35.6) weight: 34 lbs.

Box 2 – 29"(73.7cm) x 17"(43.2cm) x 12"(30.5cm) weight: 52 lbs.

Level 1 with 40" Membrane:

1 box 48"(122cm) x 18"(45.7cm) x 16"(40.6cm) weight: 83 lbs.

### *PARTS LIST:*

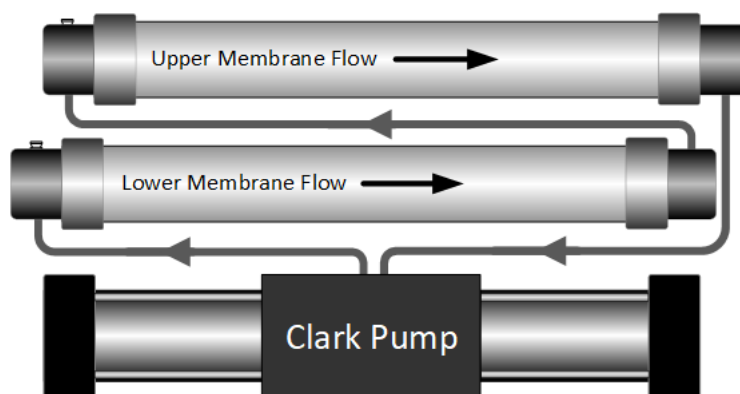
- 1) Clark Pump and Pressure Vessel Assembly
- 2) RO Membrane Elements
- 3) Feed Pump Assembly (Feed Pumps, Prefilter, Pump Control Module)
- 4) Control Panel
- 5) Carbon Filter with Solenoid Valve for Automatic Fresh Water Flush
- 6) Accumulator Tank (depressurized for shipping)
- 7) 3/4" Sea Strainer and Mount Bracket
- 8) Prefilter Status Gauge
- 9) 30' Coil 5/8" Tube, Black (Feed)
- 10) 10' Coil 5/8" tube, Clear (Flush)
- 11) 20' Coil 1/4" Tube, Black (Gauge)
- 12) 30' Coil 1/2" Tube, Red (Brine)
- 13) 30' Coil 1/4" Tube, Blue (Product)
- 14) 10" Coil Flush Valve 14/2 Power Cable

### *SMALL PARTS LIST:*

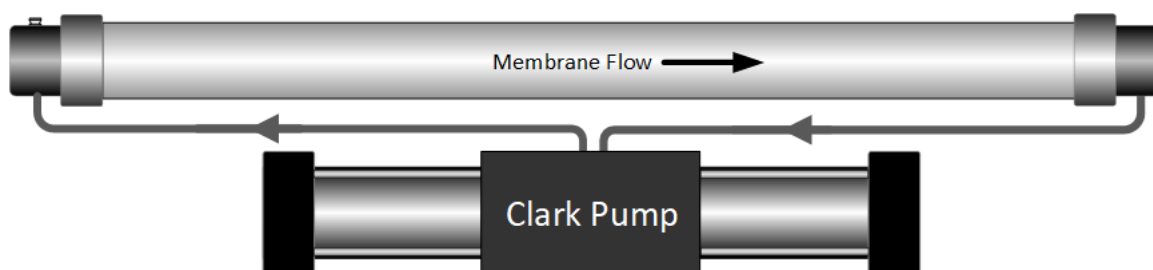
- |  |   |
|--|---|
| 15) Handheld Salinity Sensor   | 30) 2X 1/4" Tube Fittings Elbow (Filter Gauge, Attached)    |
| 16) Filter Wrench  | 31) 18X 5/8" locking rings                                  |
| 17) Tubing Cutter  | 32) 8X 1/2" locking rings                                   |
| 18) Tube Extractor Tool  | 33) 8X 1/4" locking rings                                   |
| 19) Teflon Tape  | 34) 1/2"NPT to 5/8" Tube Stem (Check Valve attached)        |
| 20) Silicone Grease Packet   | 35) 3/4" NPT to 1/2" NPT Bushing (Strainer, Attached)       |
| 21) Container Memstor  | 36) 3X 5/8" Tube Elbow Fittings (Feed line)                 |
| 22) 3/4" NPT to 3/4" Hose Barb – (Inlet Strainer)                      | 37) 2X 1/2" Tube Elbow Fittings (Brine line)                |
| 23) 3/4" Check Valve – (Attached, Flush System)                        | 38) 4X plastic U clamps (Service Valve Mounts)              |
| 24) 5/8" Tube Tee – (Flush system)                                     | 39) 3/4" NPT short nipple (Check Valve, Strainer, Attached) |
| 25) 2X 1/2" 3 way Service Valves (Service Access)                      | 40) 2X 1/2" NPT Short Nipples (Service Valves)              |
| 26) 3X 3/4" NPT to 5/8" Tube Fitting (Strainer and Check Valve)        | 41) 2X 1/8" NPT to 1/4" Tube Elbow Fittings                 |
| 27) 3X 1/2" NPT to 5/8" Tube Fittings (Intake Service Valve)           | 42) 1/2" Female Pipe to 1/2" Tube (1/2" Brine Through Hull) |
| 28) 4X 1/2" NPT to 1/2" Tube Fittings (Brine Service Valve/Clark Pump) |   |
| 29) 5/8" Tube Elbow Fitting (Clark Pump Stem Fitting)                  |   |

## CONFIGURATIONS:

The *SolarMaax 17* can be purchased with 2 different Clark Pump/Membrane configurations. All configurations are sent with the Clark Pump and the Membrane(s) mounted together on a base frame and plumbed together with High Pressure hoses. If a frame assembly cannot be reasonably mounted as a unit, the Clark Pump and Membrane can be separated for custom mounting. Usually, at least one new custom length HP hose will need to be ordered to complete the install. Membrane water flow must always be horizontal or uphill.



1. Double 21" membranes in 26.5" pressure vessels plumbed in series. One is mounted on top of the other to conserve space. Ideal for when a 40" membrane would be hard to fit.



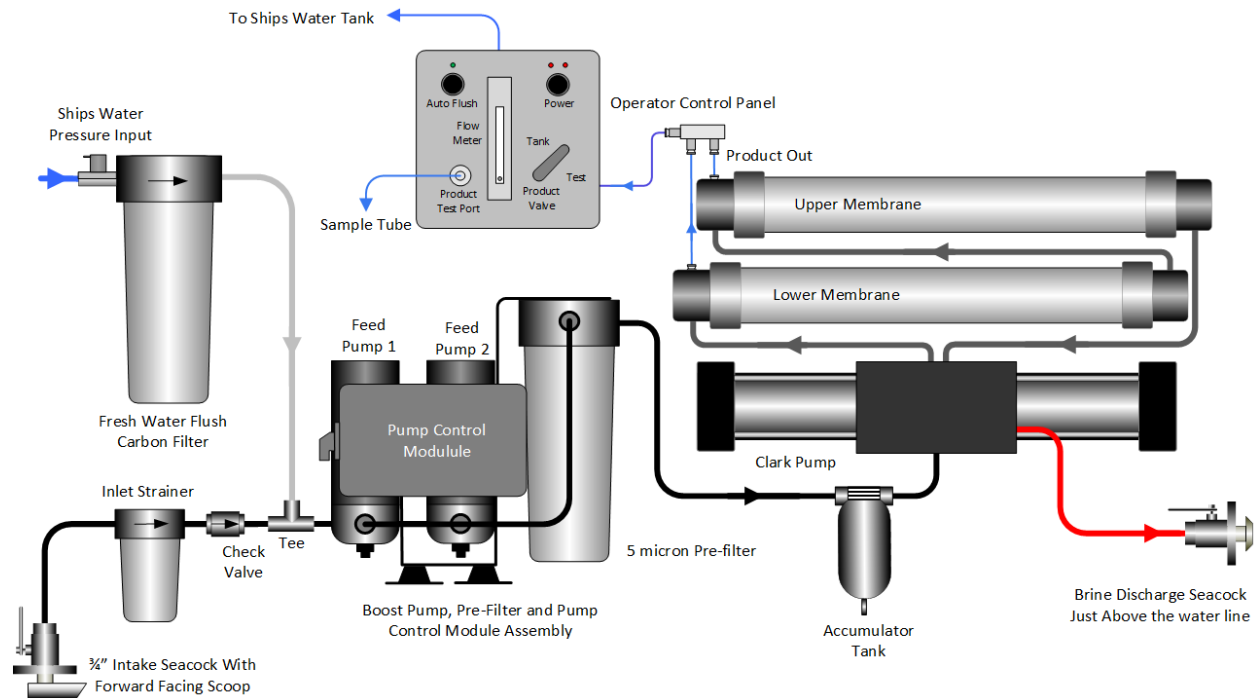
2. One 40" membrane in a 43.85 " pressure vessel is lighter and slightly more efficient.

## SYSTEM OVERVIEW:

The *SolarMaax 17* is able to operate on one or both feed pump. Use one pump when maximum electrical efficiency is needed or operating in cold water or in warm waters, use both pumps to maximize product output. The system is simple to install. When all the components are connected in the right order the system will perform as designed and give all the fresh water you need for years. Every install is going to be different in where and how the components are mounted so forethought is necessary for the ideal layout for your installation. If you are already familiar with watermakers without an energy recovery device like the Clark Pump, please try to forget what you know as much won't apply to this system and may lead you astray. Please read the instructions and don't make assumptions based on older types of systems.



The following illustration is a simplified drawing of the *SolarMaax 17* layout to familiarize yourself with how the components go together:



**Figure 1: Simplified Component and Plumbing Layout**

When installing the SolarMaax 17 in your boat; here are the top factors to consider:

- A. Make access for service, removal, and repair as easy as possible
- B. Create a space where all the service valve service tubes can reach the service pail
- C. Minimize the use of right-angle fittings to reduce water flow drag
- D. Water will be spilled when servicing filters. Do not mount over sensitive equipment
- E. Keep wire runs as short as possible and oversize the wire to minimize voltage drop
- F. Though quiet for a watermaker, consider the noise when placing the components

### INSTALLATION INSTRUCTIONS:

Prior to beginning the actual **installation** process, please **read the entire** installation procedure and take a moment to consider the following installations notes to insure the best performance, life, ease of operation, and maintenance of your *SolarMaax 17* system.

If any questions arise, please contact us via email ([support@electromaax.com](mailto:support@electromaax.com)) for the proper installation of your system. We are here to help you, so there's no need to proceed with the installation if you have any doubts or questions. We would much rather walk you through any questions you have now, than after everything mounted in place and screw holes are drilled into your boat! **In this Manual, step by step instructions are numbered, Notes are lettered.**

### Installation Notes:

- A. When selecting a mounting location, consider the parts that will require periodic **access**, such as the Pressure Relief Valve on the Clark pump, pre-filters, membrane replacement, flush filter and service valves
- B. The boost/feed pump requires a, 25AMP fuse or breaker for 12 VDC, 15 amp for 24 VDC.
- C. Both the high pressure and low-pressure water lines must be **routed** through the boat in such a way that does **not** expose them to chafing or with tight radius bends that could cause the lines to kink and inhibit flow.
- D. Use only Teflon tape or Loctite #55 sealing cord in the installation of any water line fittings and do not coat the first thread. Pastes type sealants are more likely to get into the system and cause damage to the membrane and Clark Pump
- E. The RO membrane can have its performance degraded by **exposure** to temperatures above 113°F (45°C). Select a mounting location where it will not be exposed to ambient temperatures in excess of 113°F (45C) when the *SolarMaax 17* is non-operational. If operating and being cooled by sea water, higher ambient temperatures up to 120°F (49°C) are tolerable.
- F. All of the assembly inlets and outlets are **labeled** clearly in the manual making the assembly process as “**plug and play**” as possible. Refer to the installation schematic for a detailed pictorial flow chart of the assembly.
- G. As with most projects on a boat, the key to a good installation is **planning and component layout**. We recommend that the components first be loosely (**dry fit**) in place for **verification of how the plumbing will go** before permanently mounted.
- H. Avoid sharp 90 degree fitting turns. The shortest length of tubing between two components may not be the most efficient if it has to have hard 90-degree fittings. A longer but smoother turning tube has less flow drag.
- I. **The electrical connections should be performed by a person with proper knowledge and experience in the installation of 12 and 24 vdc systems.**
- J. Voltage drop at the unit will degrade performance. Use the recommended wire size or larger.
- K. For further assistance, Email first to bring our techs up to speed with the issue at [support@electromaax.com](mailto:support@electromaax.com)

## COMPONENTS IN ORDER OF WATER FLOW:

In this section, each component's function and how it is installed is explained

### INTAKE SEACOCK:



**Figure 2: 3/4" Intake Seacock and Scoop, Owner Supplied**

Install a dedicated 3/4" seacock with a forward-facing scoop, placed as low and in the middle of the boat as possible. Avoid placing the seacock near or downstream of a head outlet or sink drain. Have a yard do the installation during a haul out. Sharing a thru-hull with another system is not recommended, but in certain cases is acceptable. Use 3/4" hose barbs that match the valve material and 3/4" ID hard walled reinforced below waterline rated hose leading to the Sea Strainer. The Seacock and Hose are not included in the *SolarMaax 17* kit

### SEA STRAINER:

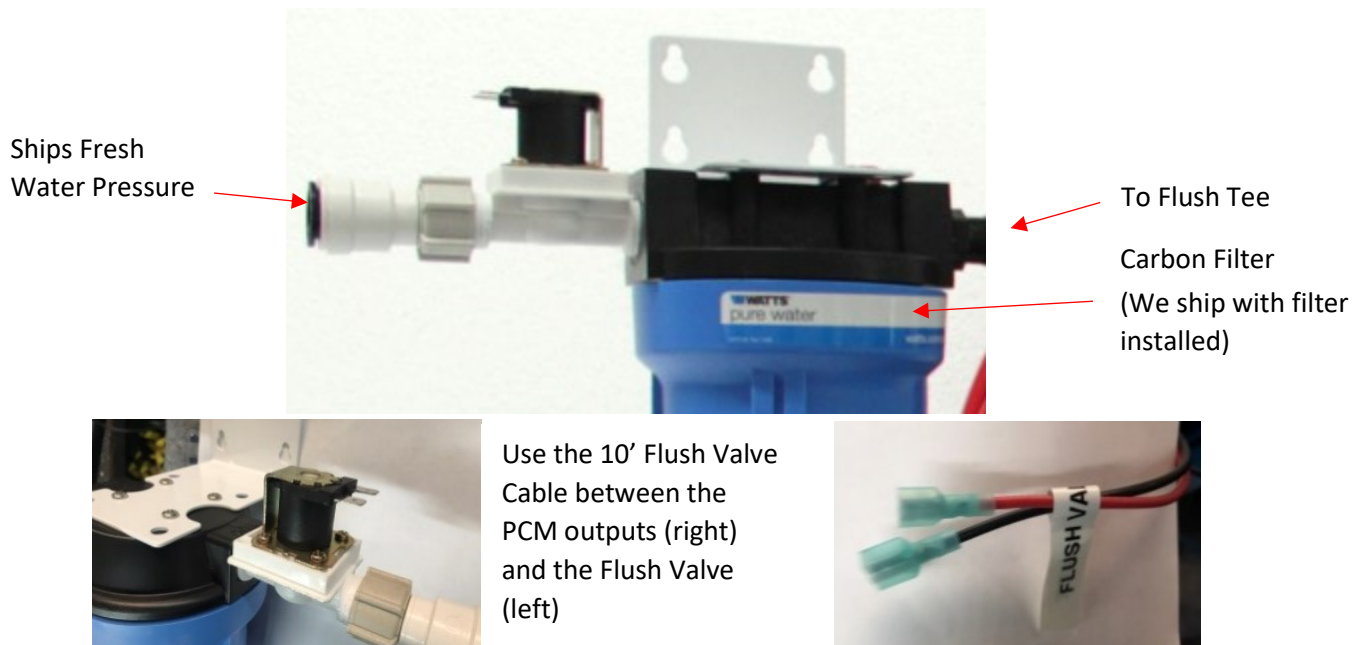


Arrow on housing shows flow direction

**Figure 3: 3/4" Sea Strainer and Mounting Bracket**

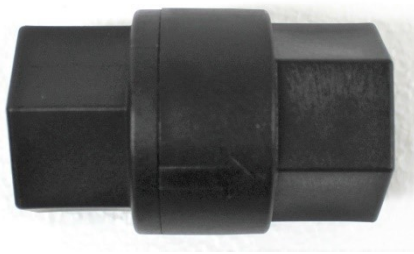
The Sea Strainer is used to protect the check valves in the Feed Pump from being jammed by debris. The Sea Strainer is placed between the Intake Thru-hull Valve and the Feed Pump. Ideal placement is just above the waterline but it can be placed above or below. Water will be spilled when servicing; avoid mounting over sensitive equipment. Use 3/4" hard wall reinforced rubber hose between the Intake Through Hull and Sea Strainer. Make sure there is enough room below the bowl for removal clearance. After selecting a location, screw down the mount bracket. Identify the flow direction by the arrow on the housing then install the hose and tube fittings through the bracket into the strainer body. The fittings hold the strainer body in the bracket. When servicing the strainer, be careful not to lose the bowl gasket. Make sure the Strainer Bowl is screwed tight, so no air is allowed to enter.

### *FRESH WATER FLUSH ASSEMBLY:*



**Figure 4: Fresh Water Flush Assembly**

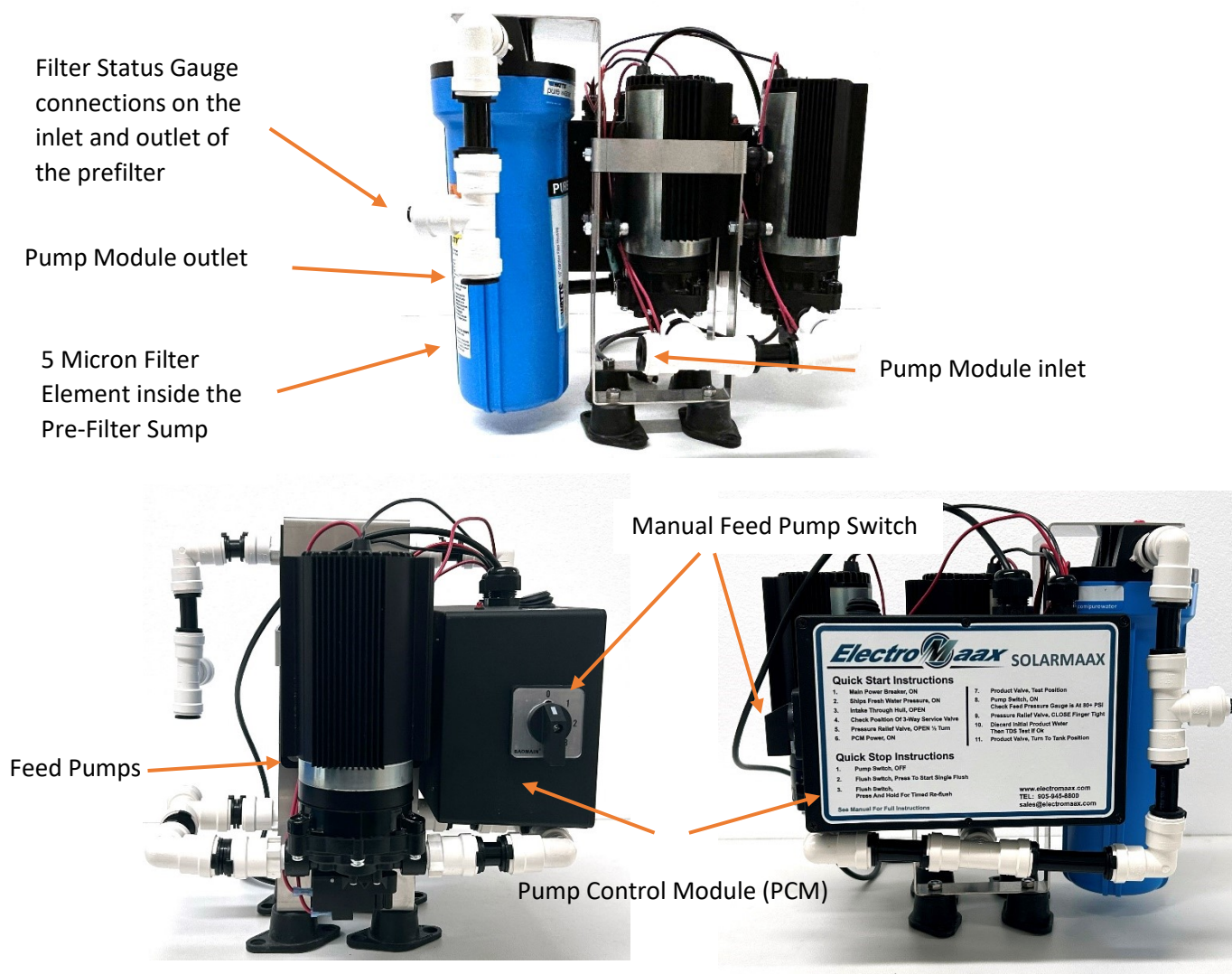
The Auto-Flush function is used to flush seawater out of the system after use. A carbon filter is used to remove any chlorine that may be in the ships water tank that will damage the membrane. Mount **vertically** using the integral mounting bracket. Be sure to leave at least 2 inches **below** the assembly to allow for opening filter housing. Fresh water will be spilled during filter replacement. The inlet is connected to the ships pressure water system with owner supplied hose/tube and Tee-fitting to match the ships plumbing. The outlet from Flush Filter is plumbed to a Tee placed in the feed line before the feed pump. Replace the Carbon Filter every 6 months of use or when the system is brought out of long-term storage. The connections to the electrical “Flush Valve” at the Flush Filter Assembly are NOT polarity sensitive. The wires can connect to either spade at the valve and the PCM.



**Figure 5: Fresh Water Flush Check Valve**

The Flush Check Valve keeps the pressurized filtered flush water from going out the intake through hull and directs it to the Feed Pump. Its ideal placement is close to the Flush Tee so there is no place for salt water to sit between the valve and the Tee. Fittings included allow for an inline placement or connected directly to the Tee using the 3/4” NPT to Stem fitting that will push into the Tee making it a single assembly.

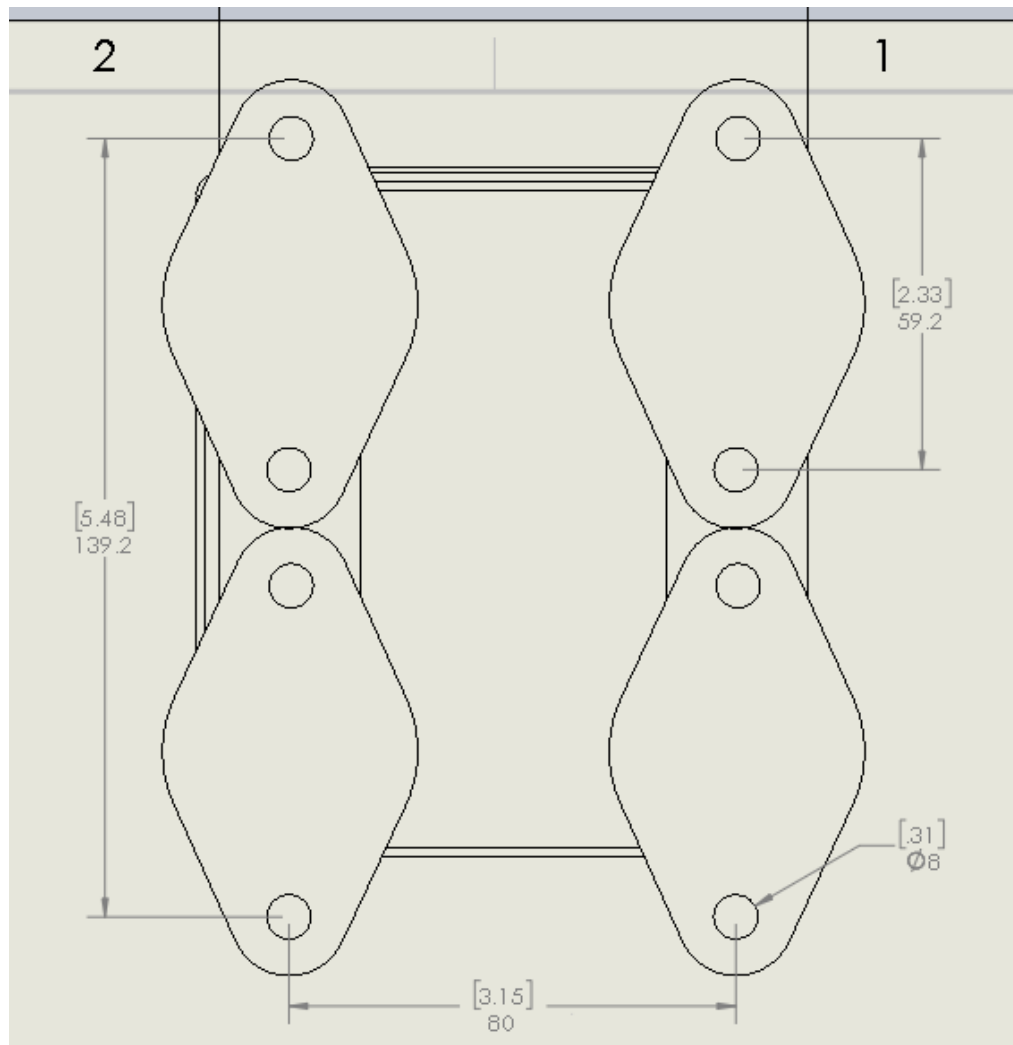
## FEED PUMP ASSEMBLY



**Figure 6: Feed Pump Assembly**

The Pump Assembly has two 3 chambered positive displacement diaphragm Feed Pumps similar to marine and RV demand pumps but generate higher pressure. They are self-priming but can't prime if the outlet is under pressure. The *Pressure Relief Valve* on the Clark Pump **must be opened 1/2 turn** and each Pump primed separately. Mount on a horizontal surface in a dry location with access to the rotary manual pump switch and room for the pre-filter wrench to loosen the sump. Have enough space around it to dissipate the heat and/or place vents below and above the pump to allow for convection currents to take away the heat. If the components have to be separated, mount the pump with the pump head down, the Prefilter with at least 2 inches of space under the Sump and the Pump Control Module in a dry area close to the Feed Pumps.

## Mounting the Feed Pump Assembly



**Figure 7: Feed Pump Assembly Foot Mount Drawing**

To mount the Feed Pump Assembly, remove the 4 rubber feet by removing the 4 5/16" nuts and use the following drawing to pre-mount the feet first then locate the pump module back onto the 4 rubber feet. See full Feed Pump Assembly measurements on page 40.



### *FILTER STATUS GAUGE:*



**Figure 8: Pre-Filter Status Gauge**

The Pre-Filter is equipped with a “Status Gauge” to indicate when replacement is required....it is connected using ¼” tubing to both the inlet and outlet of the Pre-Filter. Note flow direction through Status Gauge. Mount where it can easily be seen during operation. Double sticky foam or Alien tape works good for mounting or can be fastened to a bulkhead

### *ACCUMULATOR TANK:*

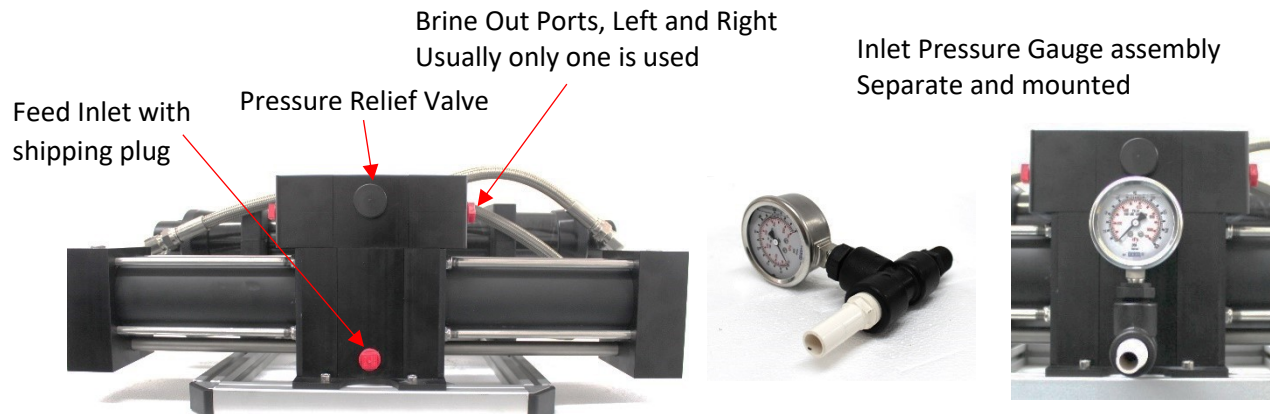
Water Flow is  
Non-directional



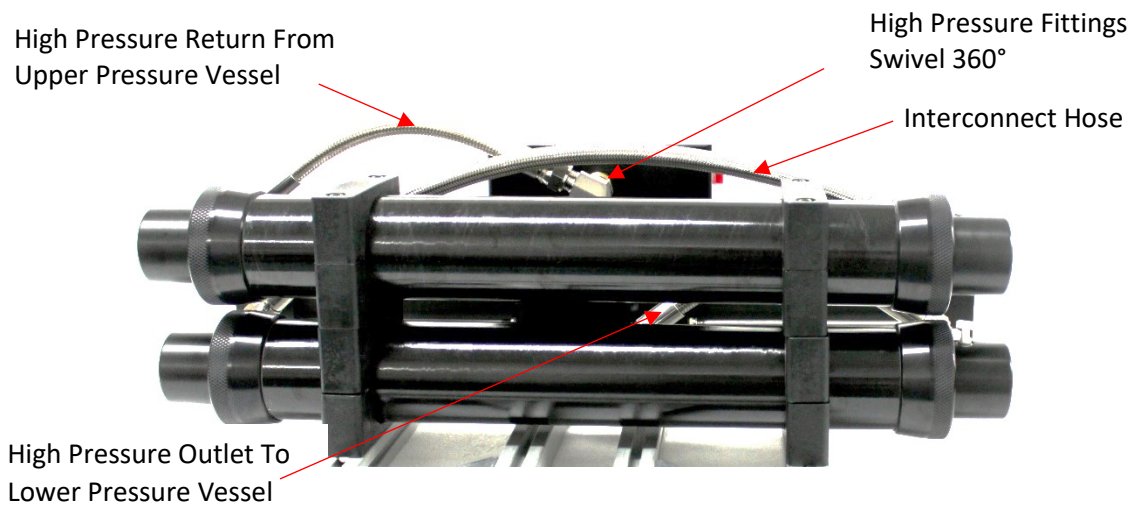
**Figure 9: Accumulator Tank**

**The Accumulator Tank must be pressurized to 60 psi before use.** It is mounted as close to the Clark Pump as possible. Mount so the Schrader Valve (bicycle tire valve) is accessible to check pressure. It is used to smooth out the feed flow to the Enhanced Clark Pump when the pump “shifts” direction internally. Without it the Feed Pump might cycle off and on during a shift with the pressure switch on the Feed Pumps reacting to the pressure spike. Due to shipping restrictions the Accumulator is not pressurized and requires being pressurized to 60 psi (4 atm). Use a bicycle pump to fill to a higher pressure, and then use an accurate tire pressure gauge to set to 60 psi. If the Clark Pump shifts are affecting the Feed Pump, check the pressure while the system is off and the Pressure Relief Valve open.

## ENHANCED CLARK PUMP



**Figure 10: Front View**

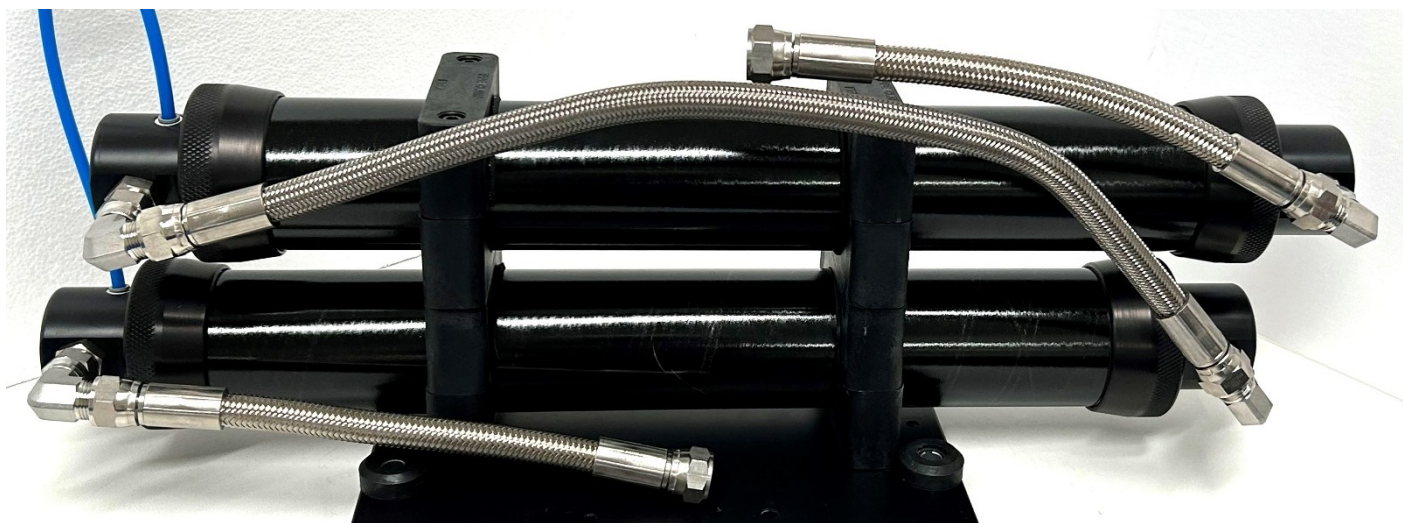


**Figure 11: Rear View**

The Feed Pressure Gauge is shipped separately. Mount the Gauge to the inlet port as shown using the Teflon Tape provided. Plastic Pipe Threads are only threaded in snug and will bottom out and leak if over tightened. Locate the Clark Pump and Membrane Assembly for easy access to the Pressure Relief Valve and access to the Pressure Vessel for Membrane replacement. The Clark Pump can be mounted in any orientation but if the Pressure Vessel is mounted vertical, the inlet of the Pressure Vessel needs to be on the bottom to purge air from the top. The Clark Pump has two brine discharge ports to choose from. Both are plugged at the factory for shipping. Remove the plug for the one that best suits the plumbing arrangement and leave the other side plugged. The Pressure Relief Valve is all plastic and is only finger tightened. **Do not over tighten.** Leave the Pressure Relief Valve open  $\frac{1}{2}$  turn for the initial commissioning. **Before first start up, have the Black Feed Tube to the Clark Pump ready but do not connect yet. The first water through the system is discarded to purge any possible debris before connecting to the Clark Pump.**



## PRESSURE VESSEL AND RO MEMBRANE ASSEMBLY:



**Figure 12: Pressure Vessel and RO Membrane Assembly**

The RO Membrane Element is shipped in the Pressure Vessel. The Clark Pump and Pressure Vessel assembly have been flushed with a storage solution, drained and the inlet and outlet of the Clark Pump and the membrane product outlet plugged to keep the membrane wet. The Membrane should never be allowed to dry out. On first start up, the residual storage solution needs to be purged before making water.

The Pressure Vessels with the RO Membranes inside, are designed to be as compact as possible for tight installations. It is specifically designed for low water flow drag for energy efficiency, minimal metal exposed to salt water and ease of membrane replacement. If mounted with one end up, place the Inlet end below the Outlet end with the flow going uphill to help purge air. The stainless steel flare fittings threaded into the plastic endcaps have straight threads and O-ring seals. They are only lightly tightened into the plastic after they bottom out. Do not over tighten! If there is a leak between the fitting and the endcap, there is a problem with the O-ring seal. *Tightening will not help.*

The Product Outlet End Cap can be positioned at either end as desired. See **Membrane Replacement** for end cap removal and reinstallation. The Product Outlet Fitting is a 1/4" Push to Fit for the product tubing. There is a 1/4" plastic plug in the product port for shipping. Remove it just before connecting the product tube during installation, see Push to Fit Instructions on page 25. Do not let a membrane element dry out.

The flow through a Pressure Vessel/Membrane is directional due to a "Brine" seal placed on one end of the membrane element to make it the inlet end. The seal directs the flow through the membrane and stops any flow around the outside. If the placement of this seal is somehow lost, remove one end of the Pressure Vessel. Grab and shake the end of the membrane. If it wobbles around easily the seal is at the other end. If it hardly moves the seal is at that end.

## CONTROL PANEL:

The **SolarMaax 17** is equipped with a basic electronic control system that includes the Pump Control Module with Auto Flush programs, a manual override switch and an Operator Control Panel. The Manual Override Switch allows for direct activation of the Feed Pumps in event of an electronic failure. The Operator Control Panel (OCP) communicates with the Pump Control Module (PCM) through a cable to control the Feed Pumps and Auto Flush Mode as required.



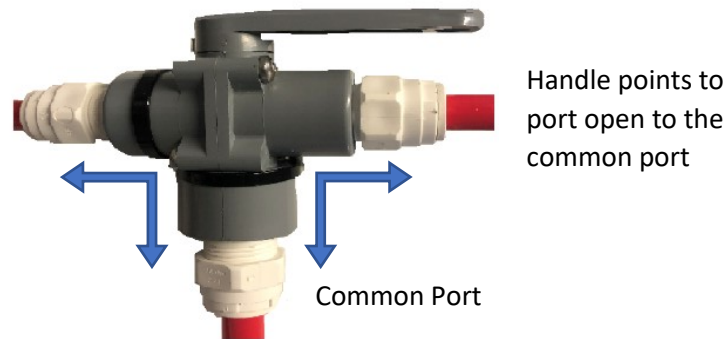
**Figure 13: Owner Control Panel (OCP)**

OCP has the following features / functions, interfacing with the Pump Control.

- 4 position Feed Pump Control Switch: OFF/Pump 1/Pump2/ Pumps 1&2
- Pump On indicator LEDs
- Manual 3-way valve to direct product flow to tank or testing port
- Analog Product Flow Meter
- Product Test Port
- Auto & Manual Flush Control with indicator LED
- 20 foot attached Electrical Connection Cable

The Control Panel is surface mounted using the supplied standoffs. Place it so it is easily accessed, and the test port tube can be led to drain somewhere safe. For ease of service, the Panel and the 3 Way Service Valves should be located close to each other so all three Service Tubes can reach the Service Pail.

### 3-WAY SERVICE VALVES:



**Figure 14: 3-way Service Valves**

Two 3-way Service Valves are provided for access to the Seawater Feed Line and Brine Discharge Line. They are used to facilitate membrane storage and cleaning procedures. They should be placed so the Service Tubes can reach a Service Pail at the same time.

- A. The Intake Service Valve can be placed anywhere between the Intake and the Feed Pump. It can be hard mounted directly to the sea strainer with the fittings supplied.
- B. The Discharge Service Valve is placed anywhere in the Brine Discharge Line including mounting directly on the Enhanced Clark Pump brine outlet port.

**Note:** The valve will always introduce a 90 degree turn in the water flow. There is no straight through position.

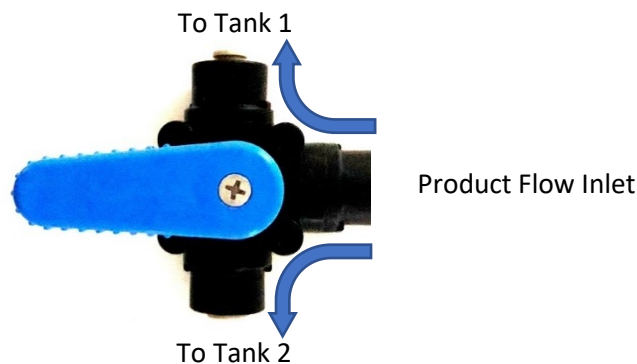
### DISCHARGE THROUGH HULL:



**Figure 15: Brine Discharge Through Hull Fittings (Owner Supplied)**

The red Brine Discharge Tube from the 3 way Brine Service Valve is led to a dedicated Owner Supplied through 1/2" hull fitting just above the waterline. It is possible to tee it into an existing drain above the waterline but there is a good chance it will cause gurgling noise and flood the boat if the drain through hull valve is closed. Sharing a discharge is highly discouraged for those reasons.

### TANK FILL SELECTOR VALVE



**Figure 16: Optional Tank fill Selector Valve**

If more than one tank needs to be filled, a Product Water 3-way Valve can be installed in the product line from the panel. A Product Water 3-way Valve is a specific type of valve that cannot block the Product flow in any valve position (non-dead heading)

**Caution: Do not use any type of selector valve that can block the flow any way, even momentarily, or damage to the system *will* happen.** The valve can be mounted in a panel or fastened to a wall by drilling out the mounting holes.

### TDS TESTER AND TESTING PRODUCT WATER QUALITY:



**Figure 17: Hand Held TDS Tester**

A good RO membrane will produce product water that is well below the upper limit of 500 parts per million (ppm) of Total Dissolved Solids (TDS) of which is mostly salt in seawater. On startup, the first flow out of a membrane that's been operating in salt water will have a high TDS reading (taste salty) because of osmosis inside the membrane while it's been depressurized. This first low-quality water will quickly be flushed out so there is a waiting period after start up to test the product. The Held Salinity/TDS Meter can accurately determine the quality of the product water and be compared to an actual "taste" test. For most people, a simple taste test is sufficient to determine if the water is drinkable. Most people can start to taste the salt when the TDS is getting close to the upper limit of 500 ppm, but some cannot taste it even if it's well above 500 ppm and would not be considered good. To "TEST" the product do the following steps on the next page.

### *HAND HELD TDS TESTER MEASUREMENT INSTRUCTIONS:*

1. Start and run the system, making, and diverting the product water, for at least a minute.
2. Remove the protective cap.
3. Turn the TDS meter on. The ON/OFF switch is located on the panel.
4. In a clean cup, **rinse 3 times** with Product Water then take a sample to about 2.5" deep.
5. Immerse the meter into the Product Water up to the max immersion level (2").
6. Lightly stir the meter to dislodge any air bubbles.
7. Wait until the display stabilizes. Once the reading stabilizes (approx. 10 seconds), press the HOLD button to view the reading out of the water.
8. If the meter displays a flashing "x10" symbol, multiply the reading by 10.
9. After usage, shake off any excess water from your meter. Replace the cap.
10. If the water reads below 500 ppm, turn the Product Diversion Valve to TANK

If the water isn't below 500 ppm or the water tastes bad, let the system run for ½ hour and test again. If the water quality continues to be poor, the membrane will need to be cleaned or replaced. See membrane cleaning and replacement sections.

If the system has been flushed with fresh water after use (recommended) the first water will not be that salty and should clear quickly. If it has been sitting with salt water even for a few minutes, the first flow will be very salty and should be diverted so it doesn't go into the tank.

**Warning:** In a Level 1 system where there is no automatic salinity sensor/diversion valve capability which always is testing the water, a manual TDS test with the Tester or a taste test should always be done on every start up just in case something has gone wrong with the membrane. If the product is drinkable at all, the membrane is rejecting all harmful pathogens.

**Warning:** If operating in fresh water, testing the Product Water with the Hand Held TDS Tester should read 10 ppm or less of TDS if the membrane is functioning well. A "Taste" test is not reliable when operating with a freshwater feed. In saltwater, if the membrane is damaged enough to let a pathogen through it will show up as very high TDS in the product water. In fresh water, a bad membrane could let pathogens through but the water still seem drinkable. A UV Product Water Sterilizer is recommended for continuous freshwater operation.

### *PURE SILICONE GREASE PACKET*

Use only pure silicone grease for lubing components when needed. A Grease Packet of the proper type of grease is provided.





### *MOUNTING THE COMPONENTS:*

- A. Dimensions for the Clark Pump Module and the Feed Pump Assembly are on page (40).
- B. Follow the flow diagram and the mounting notes in the component descriptions. Note how the 3 way valves are plumbed, **they will always introduce and 90° turn in the flow.** A set of U brackets are supplied to mount the valve to a bulkhead if desired.
- C. When mounting the components, check the thickness of the bulkhead and cabinet panels and size the fasteners appropriately. If using through bolts, use Nylock nuts and washers. Use fasteners that match the mounting holes in the components or one size under at most.
- D. The length of the feed and discharge tubes do not affect the performance, but many right-angle turns will. Long sweeping turns are better.
- E. Place the Enhanced Clark Pump/Pressure Vessel assembly for easy access to the pressure relief valve while operating the system and with consideration for how to replace the membranes which means either there is enough room off of one end of the Pressure Vessels to remove the membranes in place or the Pressure Vessels needs to be removed to allow access. Allow wrench access to the High Pressure fittings at the ends of the membrane for removal. The HP fittings require 2 wrenches for assembly or removal.
- F. The 3-way Service Valves (one is in the panel) should be located in the same area where a Service Pail can be securely placed and the Service Tubes can all reach it at the same time. This is important for ease of use and maintenance. The Service Tubes can be removed when not in use.
- G. Place the panel in an area that has easy access, and the Sample Tube can reach a place where it can drain away some product water and reach the service pail. The Sample and Service Product tube can be the same one or two different lengths if needed. The tubing is easily swapped using the push to fit fitting on the panel.
- H. The Product water must be dropped into the top of the tank without any back pressure. Do not connect it at the bottom outlet of the tank so it has to push against the weight of the water in the tank. Tee into the tank vent line or add a port into the top of the tank.
- I. Make sure the tank vent is not clogged. If the tank is overfilled, the product will flow harmlessly out the vent.
- J. The Feed Pump Assembly should be mounted to a rigid horizontal surface in a dry area.

## PLUMBING:

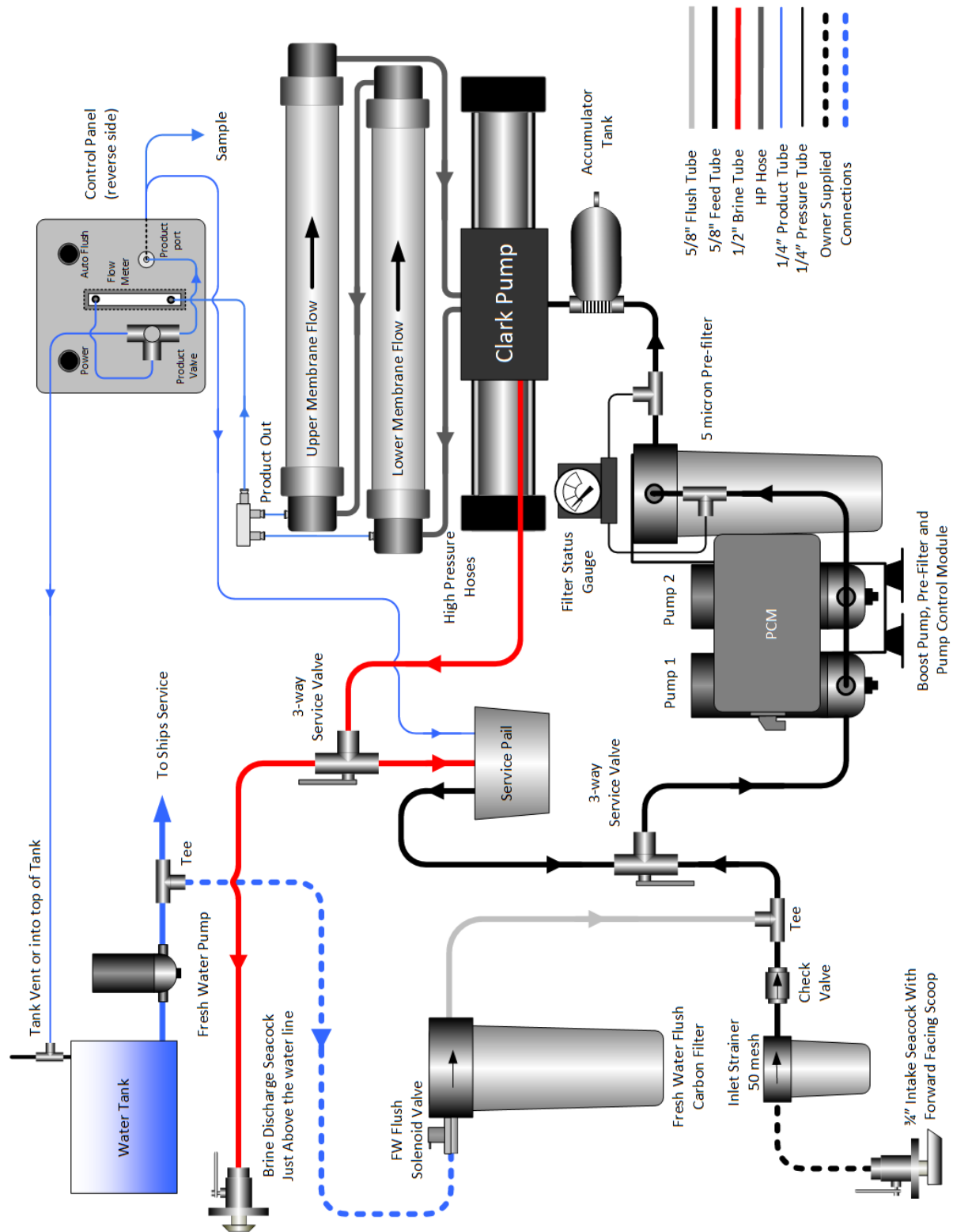


Figure 18: Complete Plumbing Diagram

## *LOW PRESSURE TUBE AND FITTINGS:*

### **Plastic Pipe Threads:**

Use 3 to 4 wraps of Teflon Tape on the threads, leaving the first thread bare. Tighten fittings until snug. Over tightening will bottom out the fittings and leak. If a pipe thread is too loose and bottoms out easily, use Loctite 55 thread cord to build up the threads.

### **Tubing Color Coding:**

The **low** pressure (pressures listed on chart pg.5) tubing has been **color coded** depending upon where it is used in the system. All plastic tubing is linear low density *polyethylene* tubing (LLDPE) approved for drinking water use.

**Black 5/8" tubing** is used for the raw water plumbing from the outlet of the ship's sea strainer to the inlet of the Clark Pump.

**Red 1/2" tubing** is used for the brine discharge from the Clark Pump to the discharge through hull.

**Blue 1/4" tubing** is used for the freshwater product discharge from the RO membrane assembly which connects to the Control Panel then to the ships water tank or Service Pail through the Product Diversion Valve on the Panel.

**Black 1/4" tubing** is used to plumb the Feed Pressure Gauges from the fittings on inlet and outlet of the Pre-filter.

**Clear 5/8" tubing** is used from the carbon filter to the 3 way valve for the freshwater flush

### **Tube Cutter:**



**Figure 19: Tube Cutter**

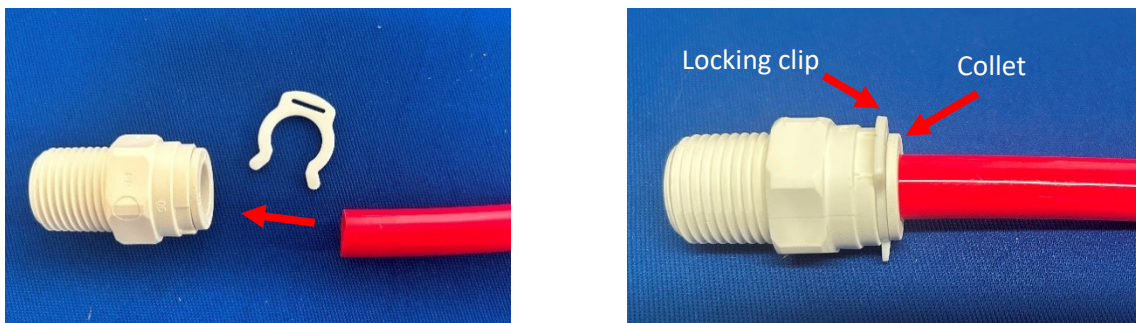
A tube cutter is supplied with every **SolarMaax 17** system. This cutter allows the tubing to be cut squarely to allow for a leak free seal on "**Push-to-Connect**" fittings. The above photo shows the correct placement of the tubing into the tubing cutter. The cutter has a **hinge** on one end and once the tubing is placed in the cradle the ends are **squeezed and rotated** together to cut the tubing



## TUBING CONNECTION:

All low-pressure fittings are “**Push-to-Connect**”, high grade, double “O” ring, NSF 58 certified, lead free, polypropylene G.A. Murdock fittings. The **SolarMaax 17** system comes with the push-to-connect fittings pre-installed on the larger components. Additional fittings are supplied to be able to customize installation as needed. The photos below show the “Push-to-Connect” fitting, locking clip, and tubing.

### Tubing Installation:

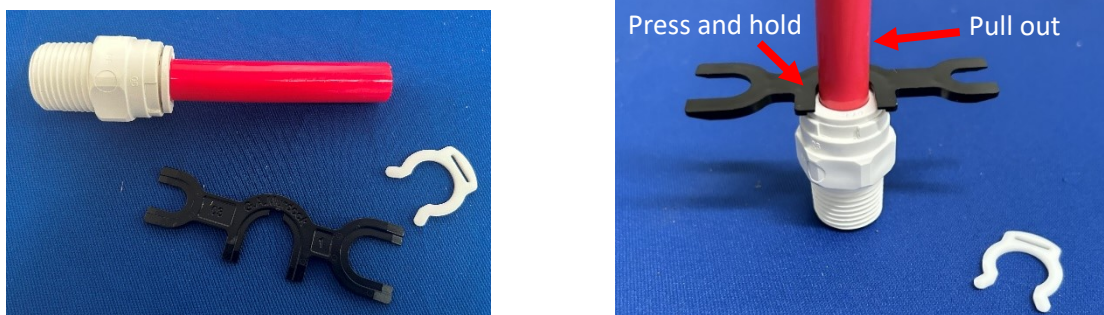


**Figure 20: Fitting, Locking Clip & Tubing Installation**

The tubing is **pushed** into the fitting until the tubing seats onto the internal stop of the fitting. The tube goes in fairly easily then push hard to get past collet and the O-ring seals. The collet keeps the tube in. The locking clip is installed between the body and the collet to prevent accidental tube separation.

It is **recommended** that tubing installations are inspected at least annually, and parts replaced as needed.

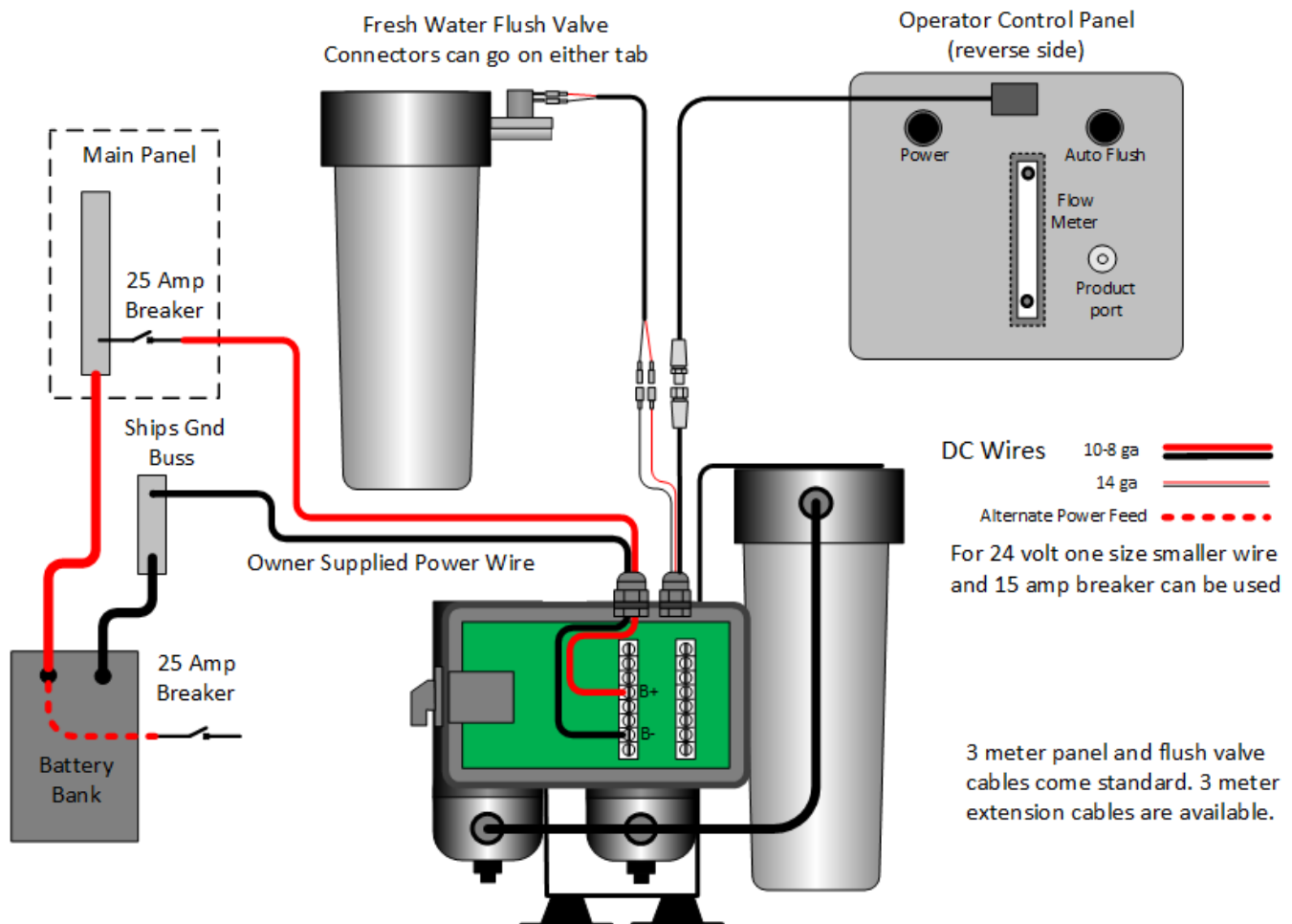
### Tubing Removal from Fittings:



**Figure 21: Tubing Removal Assist Tool**

To **remove** the tubing from the fitting the locking clip **must** be removed. Using the proper size opening on the Tubing Removal Assist Tool, **press** the notched side against the collet of the fitting and while holding the collet up against the fitting securely, **pull** on the tube to remove. Fingers can be used to push the collet down but it's easier using the tool.

## ELECTRICAL:



**Figure 22: Electrical Diagram**

To get the most out of your *SolarMaax 17*, proper wiring is important. The output of the water maker is set by how much water is pumped through the Clark Pump, more feed water in, more product out. Changes in the feed flow rate affect the product output much more than other factors like seawater temperature and salinity. The output of the Feed Pump is directly affected by the voltage it sees at the pump so keeping voltage drop from the power source to the pump is critical for maximum output. With poor wiring the output will be degraded.

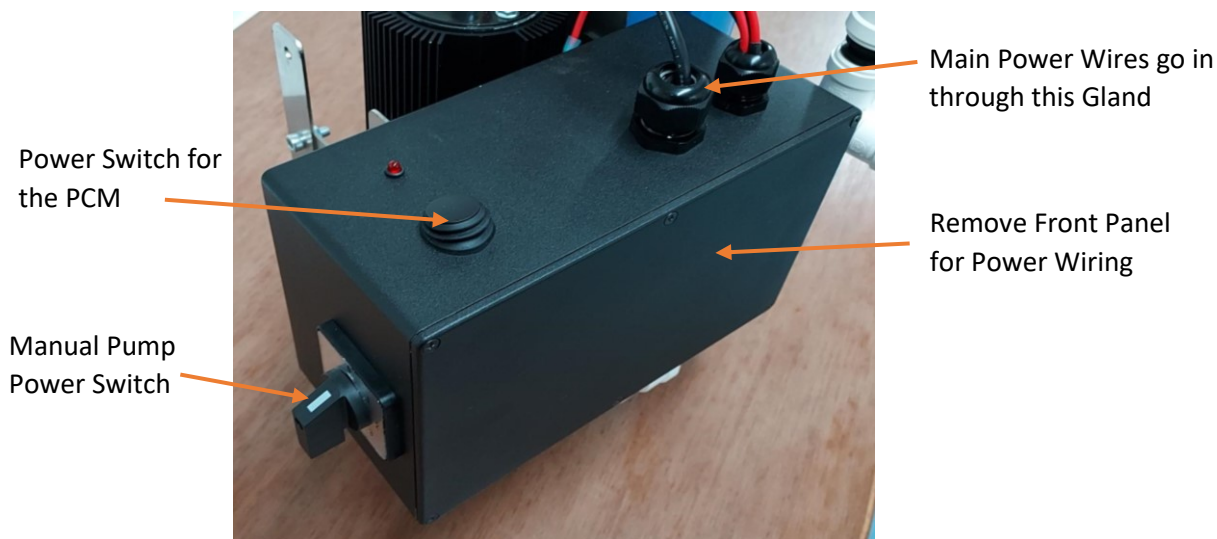
Wire gauge for distances between the power source and the SolarMaax PCM:

10 gauge for distances up to 8 feet

8 gauge up to 15 feet

6 gauge up to 25 feet

## Pump Control Module (PCM level 1)



**Figure 23: Pump Control Module (PCM)**

The PCM provides control through the Owner Control Panel of the Feed Pumps and two Auto-Flush programs. Being close to the Feed Pump and able to accept up to 8 gauge power wire enables shorter and stouter wire runs for better performance. The Main Power Wires are brought in through the large wire gland (See Electrical Drawing). Remove the 6 screws on the cover panel to access the B+ and B- terminals.

**PCM Power Switch** – This switch enables the electronics and Control Panel Buttons. The red Indicator light flashes when ON.

**Auto Flush** – When the system is stopped, a single push of the Auto-Flush will start a 5 minute Fresh Water Flush then automatically flush every 3 days. The blue indicator light will flash when in Auto-Flush mode. Starting the system or a single push of the Auto-Flush button turns off the Auto-Flush mode. **NOTE:** Auto-flush will continue to operate until disabled. **Caution: Ships water pressure must be on for Auto Flush. The PCM does NOT provide tank level sensing. Tank level must be monitored to prevent running dry during Auto Flush mode**

**Single Flush** – Press and hold the Auto Flush button for 3 seconds to start a onetime 5 minute flush. The blue indicator will come on steady while the flush is on. A single press of the Auto Flush button will stop an ongoing flush if needed.

### **Manual Feed Pump Control Switch:**

The system is provided with a manual Feed Pump control capability in the event of any electronic problems. This ensures the owner has the ability to “make water” if the electronic components are compromised. The switch is a 4-position rotary where “0” is the off position, “1” is Pump One ON, “2” is Pump Two ON, “3” is both Pumps ON.

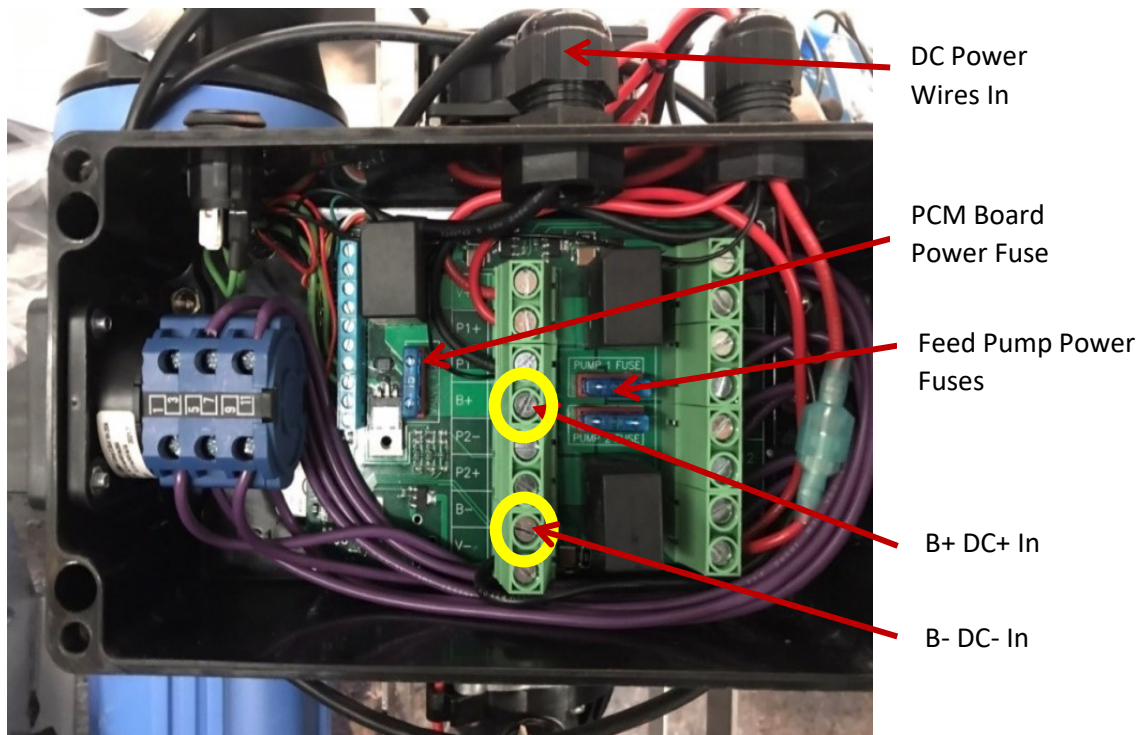
## Electrical Connections:

The primary power wires connect to the PCM as per the illustration below. The Power wires are routed through the larger gland. The internal terminal block takes up to 8 gauge wire. If 6 gauge is needed for a long power run, terminate them on a separate terminal block mounted close to the PCM, then use 10 gauge to connect to the PCM.

**B+** - Battery positive

**B-** - Battery negative

The connection between the Operator Control Panel and the Pump Control Module is via the short black cable mated with the Panel cable's corresponding 6-pin push and screw (CW) connector. The Flush Valve cable attaches to the two wires with female spade terminals coming through the small gland and connects to the Flush Valve on the Carbon filter. 10' extensions for both cables are available for purchase through ElectroMaax.



**Figure 24: Pump Control Module (PCM) Power Wire Connections**

## COMMISSIONING:

The Commissioning Procedure should be performed at a new system start up. The main function is to prime the Feed Pump, purge the system of any foreign material before it goes into the Clark Pump and purge membrane storage chemical before the system is pressurized and check for leaks.

1. Open the watermaker intake and discharge through hull valves.
2. Set the Intake and Brine Discharge 3 Way Valves to normal run. (See Plumbing Diagram Pg. 23)
3. Set the Product 3 Way Valve to "TEST". Put the Test Port Tube into a container.
4. Open the Pressure Relief Valve 1/2 turn from a finger tight closed position.
5. Place the loose end of the black Feed Tube to the Clark Pump in a container.
6. Turn on the Main Power Breaker (ship's system).
7. Turn on the Enable Switch on top of the ECM to activate the Control Panel functions
8. Press the "Pump 1" switch on the Panel. Look for water flowing through the Inlet Strainer.  
When the feed water reaches the pump, its sound will change and be uneven then smooth out as the air is purged. Water will fill the Pre-filter Assembly then finally start to fill the container by the Clark Pump. **This one time step clears any debris between the Prefilter and Clark Pump.**
9. Repeat step 8 using "Pump 2" Don't let the container over flow.
10. After priming both pumps, stop the system and connect the Feed Tube to the Clark Pump.
11. Restart the system using both Feed Pumps. Pressure will start to build in the feed pressure gauge and the Clark Pump will make its first "shift" and start to circulate water through the membrane. The shifts should start to even out as air is purged.
12. With the Feed Pumps **running**, make a visual inspection to ensure that the connections are all **leak** free. If any leaks are found, turn off the system and repair before continuing.
13. With the verification of leak free **connections**, continue to run the system unpressurized (Pressure Relief Valve open) for 20 minutes to purge the storage solution from the membrane elements. The Feed pumps should be running smoothly now. If not, there is an air leak in the Strainer system. Fix before continuing.
14. After 20 minutes and the system is running smooth with regular shifts in the Clark Pump, close the Pressure relief valve. The sound of the Feed Pumps and the Enhanced Clark Pump shifts will change as high pressure is generated in the Membrane and Product Water will start to flow through the Flow Meter then out the Test Port Tube.
15. Check for leaks at the high-pressure hose connections and around the Clark Pump, Membrane end fittings and Control Panel. Recheck the Feed system for leaks. If leaks are found, stop the unit and correct as needed.
16. Run the system with the Product Water diverted for 10 minutes to purge the Product Water side of the Membrane to clear any remaining Storage Chemical.
17. Test the Product Water with the Hand Held Salinity Sensor. If below 500 ppm, turn the Product Valve to the "TANK" position to fill the tank.
18. Note the Filter Status Gauge for the prefilter with brand new filter.



## **NORMAL START UP:**

**Note:** If there is any question about the service history of the system, perform a “Restart after Long Term Storage” (pg. 32) procedure first.

1. Turn on the Main and PCM power.
2. Check the boat’s Inlet and Brine Through Hulls are open and the sea strainer is free of debris.
3. Turn the Product Water Selector valve on the Control Panel to the “TEST” position. Place the test port tube where it can drain properly.
4. Open the Pressure Relief Valve on the Clark Pump 1/2 turn. If the system has been recently run and is well primed, the Pressure Relief Valve can remain closed.
5. Turn **ON** one or both “Power” Switches. Listen for the Feed Pump(s) to run smoothly and the Clark Pump is shifting normally.
6. Close the Pressure Relief Valve finger tight if opened. Watch for water flow in the Flow Meter, there will be bubbles at first then should clear and the reading settles down to the **rated flow rate**.
7. Wait 1 minute then test the product with the Hand Held TDS Tester. If below 500 ppm go to step 8. If not, wait another minute and re-test. If the reading again is high, wait another 10 minutes and re-test. If it fails again and the product flow rate is normal, there could be a problem with the membrane. See the Troubleshooting guide. (Pg. 42)
8. When the Product is good, turn the Product Valve to the “TANK” position to fill the water tank.
9. If the water tank overfills, the water will overflow out the vent but should not cause a problem.

## **NORMAL RUN:**

- A. Watermakers like to run. The best practice is to run until the tanks are full, shut down with a fresh water flush, then restart when the tanks are down after a few days. Flushing is important because biological growth that can happen inside the membrane in saltwater will not survive in fresh water and vis-versa.
- B. Use one Feed Pump for better efficiency or in cold water, two for max output in warmer water.
- C. Monitor the Filter Status Gauge. Filter elements clean better if they are cleaned as soon as they **start** or even better, before they start to restrict the flow.
- D. In rough sea conditions and hard sailing, watch for air getting into the system causing the feed pumps to lose their prime and the feed flow has stopped. Open the Pressure Relief Valve, prime each Feed Pump individually again then close the Valve. If this happens often, wait until better conditions to run the system. This is more likely to happen if the through-hull is not down by the keel of the boat or excessive boat speed.
- E. Oil in a membrane will ruin it. It’s usually not a problem as oil normally floats on the surface but if an oil slick is encountered at sea in rough conditions it can get into the system. Avoid running the system.
- F. The system can be run from a brackish or fresh water feed source without having to make any adjustments. A good membrane works equally well in fresh or salt water. The feed pressure will be lower operating in fresh water.

**Warning:** Testing the Product Water with the Hand Held TDS Tester while operating is fresh water should read 10 ppm or less of TDS if the membrane is good. A “Taste” test is not reliable when operating with a fresh water feed. If the membrane is damaged enough to let a pathogen through it will show up as very high TDS in the product water while operating in salt water but **not in fresh water**.

## SHUT-DOWN PROCEDURS:

### NORMAL SHUT-DOWN, NO FRESH WATER FLUSH:

1. Turn off the system with the Power button on the Panel. Main and PCM power can stay on.
2. Turn the Product Diversion Valve to the “Test” position.
3. The Pressure Relief Valve can be left closed.
4. Do not leave it unflushed for more than a day without running or flushing.
5. On restart, test the product water before turning the Product Diversion Valve to “TANK”

A watermaker is happiest running for a long time then flushed every time it’s turned off but there are times where it shouldn’t be flushed. For offshore racing, the watermaker may only be run a short time each day to make the minimum amount of water needed to save weight. Flushing every time after short runs uses up most **or more** of the water just made. Being used every day, fouling is minimal so only do a One Time Flush every 5 days or so on an offshore race.

### NORMAL SHUT-DOWN WITH AUTO FLUSH EVERY 3 DAYS:

1. Turn off the system with the Power Button. A Flush Cycle will not start with the Power Button on.
2. Turn the Product Valve to the “TEST” position.
3. Make sure the ships Fresh Water Pressure System is on with plenty of water in the tank.
4. Press the Auto-Flush Button to start the first Flush. The LED “fast” blinks to indicate flushing in Auto Flush mode. After the initial flush the LED will “slow” blink to indicate it’s in Auto Flush mode.
5. Watch for the Feed Pressure to drop and stabilize at a lower pressure as the salt water is flushed from the membrane. If the Feed Pressure remains steady, the flush is not working. Check if the fresh water pressure is functioning, Flush Valve wire connections are good and the carbon filter isn’t clogged.
6. The Pressure Relief Valve can be left closed, and the system restarted when needed.
7. On restart, test the product water before turning the Product Valve to “TANK”

**Caution:** The Ships pressure fresh water system must on with plenty of water in the tank when the *SolarMaax 17* is in Auto Flush mode. If the boat is to be left unattended it is recommended to put the system into long term storage “Pickle”.

### NORMAL SHUT-DOWN WITH A ONE TIME FLUSH:

Follow the Auto Flush instructions but push and **hold** the Auto Flush Button until the flush starts (3 seconds). The LED will be on solid while the Flush is going.

The *SolarMaax 17* can now sit idle for typically **5 days** before:

- A. The next use.
- B. An additional freshwater re-flush.
- C. Pickling for extended system storage.

The 5 day window is an average because the **rate** of biological growth **varies** with seawater composition and temperature. Use a 3 day interval in hot climates and 7 in cold climates. The freshwater flushing after running helps inhibit biological growth which could lead to Membrane Element fouling.

### *PICKLING FOR LONG-TERM STORAGE:*

1. Make 2 gallons of product water or pour 3 gallons of distilled water into the Service Pail.
2. Perform a fresh Water Flush as detailed in the Fresh Water Flush procedure.
3. Wearing gloves, thoroughly mix an 8 oz package of Memstor Storage Chemical into the water in the Service Pail. This may take some time.
4. Put the 3 service tubes (See Plumbing Diagram pg. 23) into the Service Pail. Secure the tubes if necessary to keep them in place.
5. Turn the Feed and Brine 3 way Valves to their Service positions.
6. Turn the Product Valve to the "TEST" position.
7. **Important! Open the Pressure Relief Valve.** Do not run the System under pressure while circulating the Storage Chemical.
8. Start the System to start circulating the Memstor. Let it run for 20 minutes to thoroughly saturate the membrane
9. While still running, turn the Brine Service Valve back to the Normal Run position. Almost empty the pail but try not to draw in air then turn the system off.
10. Turn the Feed 3 Way Valve back to the Normal Run position.
11. Close the Intake and Brine Through Hulls, drain, clean and dry the Intake Strainer, Pre-Filter and Flush Filter. Reinstall clean or new dry elements.
12. Turn off the Power Breaker and make a label stating when the System was Pickled.

### *WINTERIZING:*

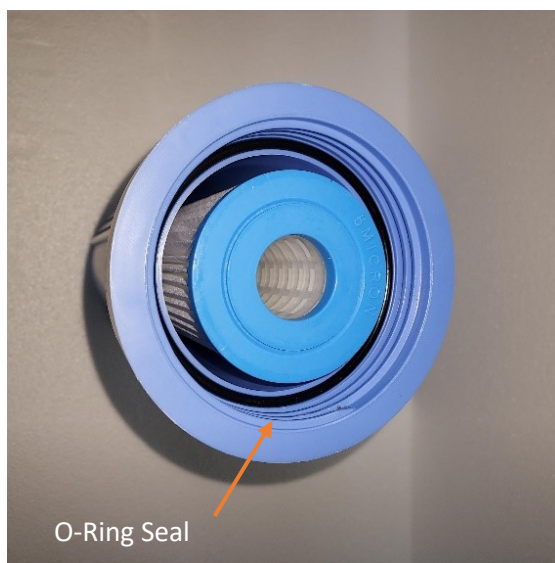
1. Instead of the Memstor, put 2 gallons of the -100° RV potable water antifreeze into the service pail then follow steps 4 through 12 for Long-Term Storage. **WARNING:** DO NOT use automotive antifreeze.

### *RESTARTING AFTER LONG-TERM STORAGE:*

1. Open the Intake and Brine Discharge Through Hulls.
2. Check the Intake strainer is clean and the sump tight
3. Open the Prefilter Sump to check for a clean 5 Micron Filter Element. If the filter is wet and smelly the system may not have been Pickled properly or at all. Install a new filter if bad.
4. Replace the Carbon Flush Filter if over 6 months old or age is unknown.
5. Open the Pressure Relief Valve on the Clark Pump 1/2 turn from finger tight.
6. Check the Intake and Brine 3 Way valves are in the Normal Run position.
7. Set the Product Valve to "TEST" and have the Product Service Tube able to drain properly.
8. Turn on the Main Power Breaker and the PCM Power switch on the Feed Pump Assembly.
9. Start the system, check for water flow and the Feed Pump running smoothly.
10. Let the system run unpressurized for 20 minutes to purge the Pickling Solution.
11. After 20 minutes, close the Pressure Relief Valve finger tight.
12. Check the Feed pressure and Product flow rate are normal.
13. Bypass the Product Water for another 10 minutes then Test the water with the Salinity Sensor.
14. If the water is good, move the Product Valve to the "TANK" position.



## PREFILTER SERVICE



**Figure 25: 5 Micron Pre-Filter**

The Clark Pump and the RO Membrane must only operate on 5 Micron or better filtered Feed Water. Not all “5 Micron” filter elements are the same. Some come with Carbon in them that let off Carbon “fines” with first use. These Fines will ruin the Clark Pump and Void the Warranty. Use only high quality 5 micron 10” by 2.5” synthetic pleated Filter Elements. The Filter Status Gauge will tell you the condition of the filter while operating. It is recommended to change the filter before it gets to the red zone. If a filter is going to be cleaned and reused, change Filters when the gauge just starts, or better yet, just before it starts to show restriction. Cleaning will be more successful if the particulates are not imbedded in hard. Never take off the filter housing and “look at” a filter without rinsing out the filter sump before putting it back on. Dirt gets loose when the filter gets lifted out to look at.

To Open the Filter Sump, Use the supplied Filter Wrench to unscrew the sump. Lower down carefully to avoid spilling. Put your hand over the Filter Element and drain the sump. Make sure the Sump O-ring seal hasn’t come loose. Clean the Sump then **unwrap** and install a new Filter Element. They go in either way. Replace the Sump with the Filter and hand tighten only. At start up, Check for a leak. If there is, stop the system and open the pressure relief valve before checking the seal. Tightening it harder with the Filter Wrench is not recommended but may be necessary in some cases.

Filters can be cleaned several times if done carefully with water pressure and a soft brush. They can be cleaned under way by running a line through the filter and tying a stopper knot to hold it on the line. Drag it behind the boat when cruising below 5 knots. If there are any signs of wear on the Filter Pleats, replace the Filter with a high quality pleated synthetic 5-Micron Filter Element.

## MEMBRANE CLEANING PROCEDURES:

Your membranes **could** require cleaning if you see a 10 psi. **rise** in the feed pressure over the base line and/or an increase in your TDS levels. The membrane cleaning procedure is a **two-step** process that first uses an alkaline solution to remove any organic fouling **followed by** an acid solution to dissolve and remove scale deposits.

**CAUTION:** The membrane cleaning process utilizes strong acid and alkaline solutions and proper personal protective equipment should be worn at all times when handling the cleaning solutions and brine and product water discharge.

**Resistant gloves and eyewear are critical for personal safety.**

- A. The cleaning solutions work better if heated to 95°F, 35°C. Maximum temperature is 107°F, 42°C.
  - B. Have plenty of water in the ships water tank for flushing.
  - C. Run the system and record the operating pressure and product flow before the cleaning.
  - D. Have clean Prefilter elements installed.
  - E. New membranes are not that expensive. Replacing the membranes may be more economical than cleaning.
- 
- 1. Follow the Long Term Storage procedures steps 1 through 7 but use the Alkali Cleaning Chemical instead of the Memstor.
  - 2. Start the system and let it recirculate the cleaner unpressurized for at least 1 to 3 hours.
  - 3. Stop the system and let it soak for at least 2 to 8 hours
  - 4. Start the system and let it recirculate the cleaner for another hour.
  - 5. While still running, switch the Brine Discharge Service Valve to the Normal Run position.
  - 6. Drain the Pail and shut down.
  - 7. Turn the Feed Service Valve to the Normal Run Position.
  - 8. Perform a "Restart from Long Term Storage Procedure" Page 32, then record the Feed Pressure and Product flow.
  - 9. Perform a Fresh Water Flush
  - 10. Rinse out the Service Pail
  - 11. Repeat the cleaning procedure steps 1 to 8 using the Acid Cleaning Chemical.
  - 12. If the performance is acceptable the system is ready for use.

After performing both cleanings, compare the 3 performance readings. This will give you an indicator of what type of fouling is affecting the membrane and how well the cleaning has worked. If there was no increase of performance on the Alkaline cleaning but did on the Acid cleaning, just try the Acid cleaning next time. If an Alkaline cleaning is performed, always follow with an Acid cleaning.

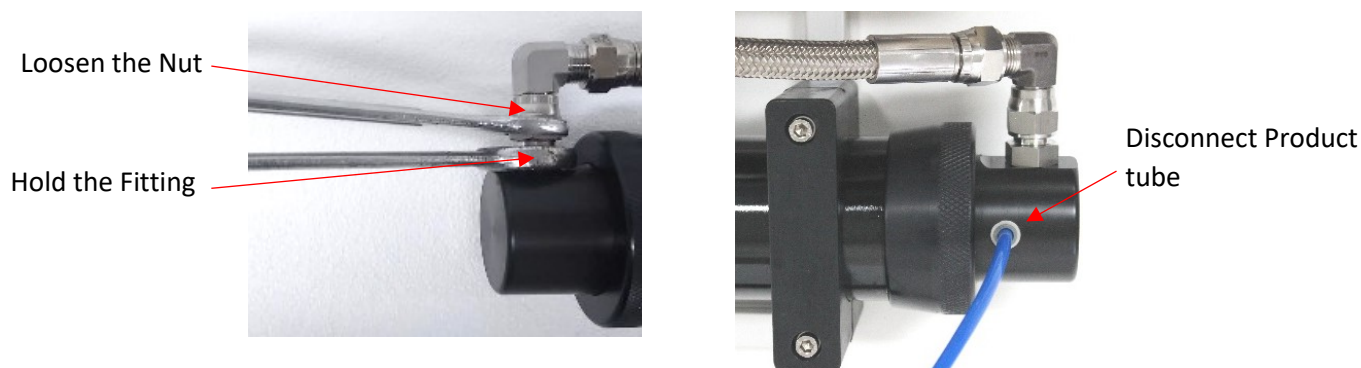
## MEMBRANE REPLACEMENT:

The easiest way to replace the membrane is to remove the Pressure Vessel from its mounts for the procedure. It can be done in place but only if there is room enough on the **outlet** end of the Pressure Vessel to pull the membrane out. When the High Pressure Hoses are disconnected from the End Caps, the hoses are free to be moved out of the way as the special HP fittings in the Enhanced Clark Pump are designed to swivel freely without leaking. The new Membrane element comes sealed in plastic. Don't break the seal until you are ready to insert it. Take a picture of the membrane assembly before starting. Use the packet of silicone grease provided to *lightly* lube the inner edge of the pressure tube before re-assembly.

**Warning:** Do not touch the threads on the ends of the Pressure Vessel Tube. It is possible to get fiberglass splinters.



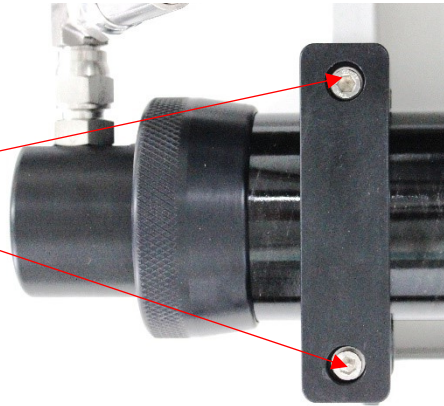
**Figure 26: Pressure Vessel Assembly**



**Figure 27: Disconnecting the HP hoses and Product Tube**

Using two wrenches, hold the fitting threaded into the End Cap and loosen the 90° flare fitting connected to the End Cap fitting. Don't let the fitting in the End Cap move. Disconnect the Product Tube. See page (25)

Remove the 4 Bolts holding the Pressure Vessel Mount Caps

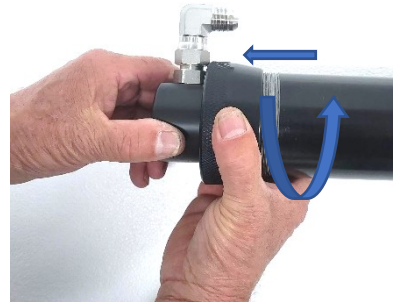


The Pressure Vessel does not have to be removed if there is room off the Outlet end for the Membrane Element to come out.

**Figure 28: Removing the Pressure Vessel**



1-Grab Metal Ring of Outlet End



2-Unscrew until the ring hits the fitting



3-Twist and pull the End Cap to free seal



4-Continue unscrewing the Ring until free

**Figure 29: Removing the Outlet Endcap**

The End Caps are held on by the metal threaded rings. They are only put on hand tight but can be hard to break loose after the Vessel has been pressurized. If they don't loosen by hand, use the Strap Wrench to loosen. Starting with the Outlet end, unscrew the ring until it meets either the SS HP fitting or the Product Tube fitting. Pull on the End Cap while twisting to start it moving out of the tube and come up against the ring. Keep unthreading the ring while alternately pulling on the end cap until the assembly is free. The Membrane Element is now exposed.

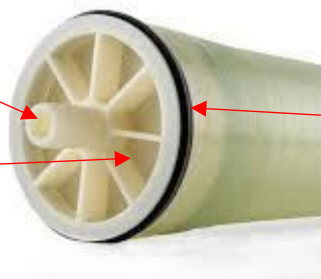


**Figure 30: Pulling the Membrane Element Out**

Using your hand, grab the white Product Collecting tube in the middle of the membrane to pull. If it doesn't want to come it's because the Brine and Product Collecting Tube seals are holding it. If the membrane element is going to be discarded, use pliers to pull it out. If it still doesn't want to come out or the element is to be reused and not damaged by the pliers remove the Inlet End Cap. The element can now be pushed from its outlet end to remove it from the Inlet end of the Pressure Vessel Tube. Don't mix up the End Caps so they can be reinstalled in the same place.

Product Collecting Tube, it must not have any scratches on the outside

Membrane Material rolled up and covered with a fiberglass wrap.



Membrane Brine lip Seal on inlet end of Membrane

**Figure 31: Parts of the Membrane**



The Membrane Element has no set Feed Flow direction until a Brine Lip Seal is placed on one end. The end with the Brine Seal is placed at the flow inlet of the Pressure Vessel. The Brine Seal directs the Feed Flow through the middle of the Membrane. The Product Water inside the Product Collection Tube is separated from the high pressure salt water by an O-ring in the End Cap. The Tube must not be scratched to make this important seal.



1-Insert Membrane into the Outlet end of the Pressure Vessel Tube



2-Place Seal into the Tube at an angle



3-Press the lip into the Tube



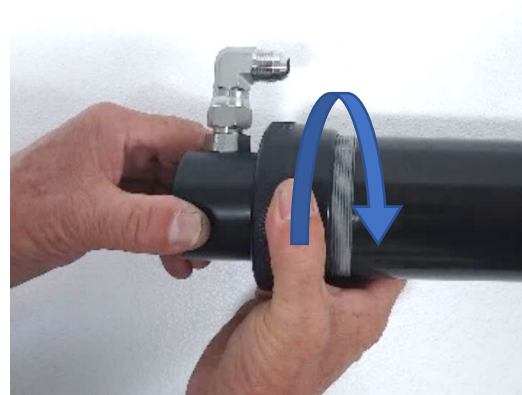
4-Align the Membrane with the Tube and push the rest of the way in

### Figure 32: Inserting the New Membrane

Reinstall the **Inlet** End Cap on the Pressure Vessel Tube if it was removed (see Reinstalling End Cap instructions). The Membrane Element is inserted Brine Seal first into the **Outlet** end of the Tube. *Lightly* lube the Brine Seal, the inner edge of the Vessel Tube, and the OD of the Product Collecting Tube with pure Silicone Grease from the Grease Packet provided. Place the Membrane in the tube at a slight angle so most of the seal is already inside. Push the last of the seal lip in as the Membrane is aligned with the tube. After the seal slips in, push the Membrane in the rest of the way until it bottoms out. You should feel the Product Tube push past the O-ring seal in the Inlet End Cap.



1-Line up the Ring and start threading on the Tube



2-Thread the Ring on until the End Cap Seal contacts the Tube



3-Twist and push the End Cap until the Seal goes in the Tube



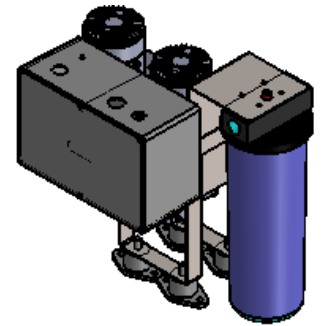
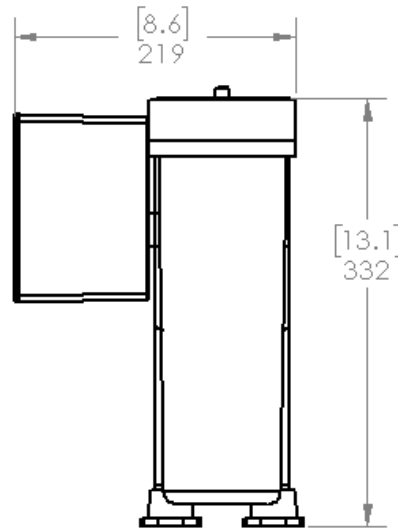
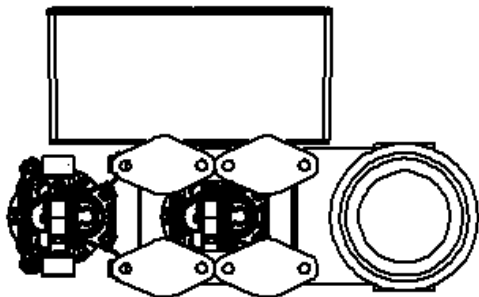
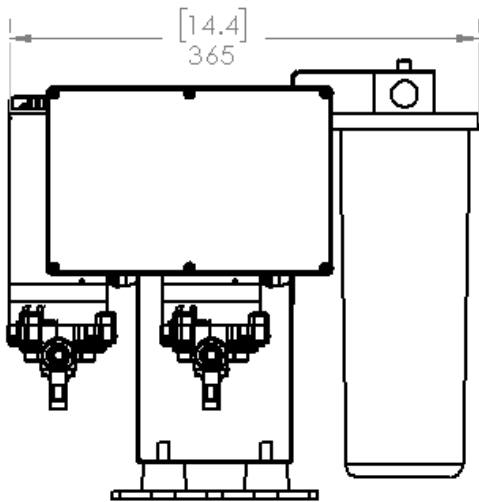
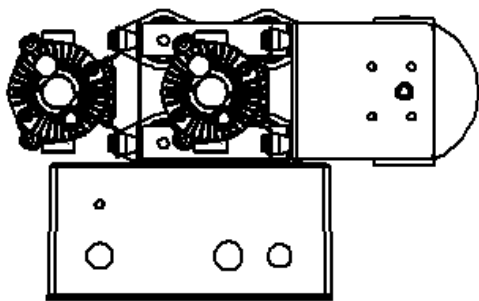
4-Finish threading the Ring on and hand tighten just snug

### Figure 33: Reinstalling the End Cap

*Lightly* lube the O-ring in the center bore of the end cap and the inner edge of the Vessel Tube with pure silicone grease from the Grease Packet provided. Carefully thread the End Cap Ring onto the Pressure vessel. Do not force the threads. When they engage properly, they are easy to turn. Thread on the Ring until End Cap meets the Vessel Tube and resistance is felt. Push and twist the End Cap until the O-ring seal engages with the Vessel Tube and the tube or hose fitting butt up against the Ring. Continue to thread on the Ring while alternately pushing in the End Cap until it bottoms out and the Ring comes tight against the End cap making it harder to twist. That is as tight as it needs to be. Rotate the End Cap until the HP fitting is at the same orientation as it was before it was removed.

Reinstall the Pressure Vessel in the reverse order it was removed making sure to use two wrenches on the HP fittings so the fitting in the End Cap isn't turned. If it does get loosened, screw it back in until it becomes snug only. Do not keep tightening it and drive it into the plastic. It is sealed by an O-ring and only needs to be snug up against the plastic.

## MODULE DIMENSIONS:



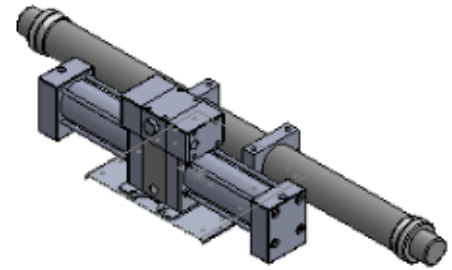
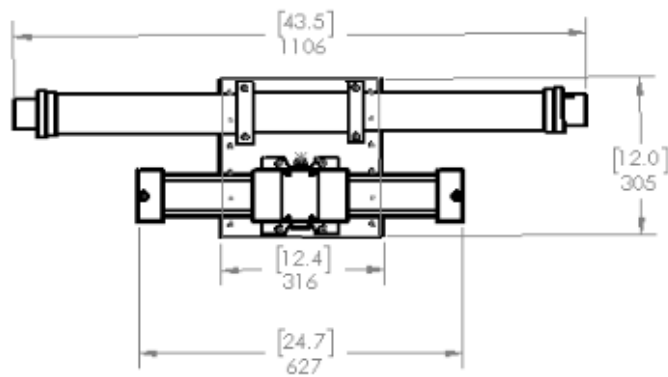
Dimensions  
[inch]  
mm

Weight  
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10.3 Kg

**ElectroMaax**

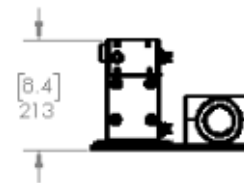
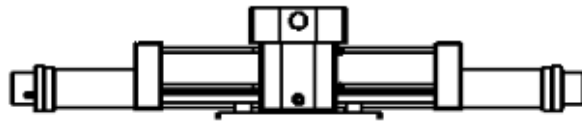
**Pump / Filter Module**





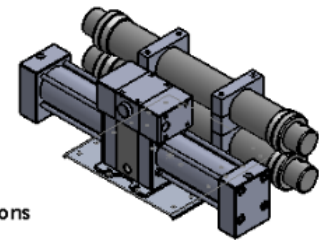
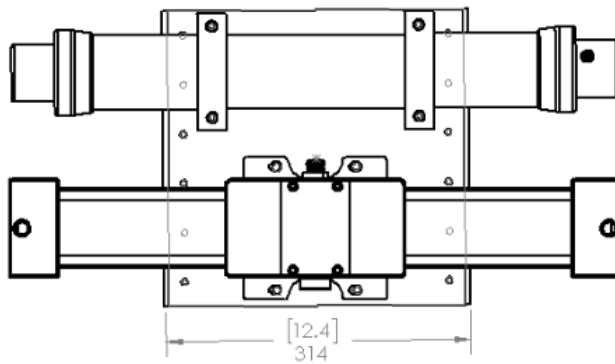
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Weight  
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15.2 Kg.



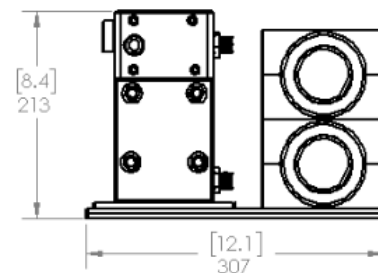
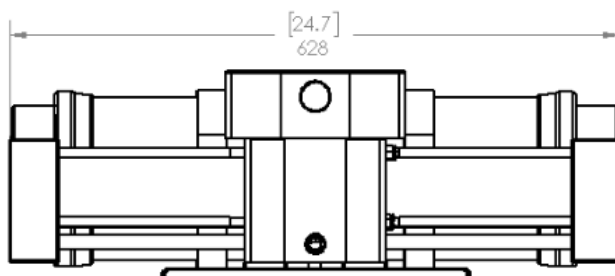
#### ElectroMaax

ER Pump & Membrane -40 Formed Base



Dimensions  
[inch]  
mm

Weight  
40 lbs.  
18.2 Kg



#### ElectroMaax

ER Pump & 2 x 21 Membrane - Formed Base

## TROUBLE SHOOTING:

Symptom	Cause	Remedy
No Product Flow	Pressure Relief Valve open  Feed Pump not primed  Feed Pump won't prime, air getting into the feed line before the Feed Pump,	Close the Pressure Relief Valve  Open the Pressure Relief Valve until the system primes then close the valve.  Check all connections and Strainer Bowl Seal in front of the Boost Pump. Draw water from the Service Pail to help isolate the leak.
Low Product Flow	Low Voltage  Incomplete prime on the Feed Pump    Pressure Relief Valve not completely closed  External HP leak  Internal Leaks in the Clark Pump	Voltage Range: 12.5 to 14.4 VDC  Turn on the Fresh Water Flush to help prime Temporarily remove the tube from the Prefilter to reduce back pressure. Mount Feed Pump vertically with the pump head down.  Close the Pressure Relief Valve finger tight  Check HP hose connections and Pressure Vessel End Caps for leaks  Rebuild the Clark Pump
Uneven Product flow between Clark Pump "Shifts"	Reversing Valve leaking in one position  Leaking Check Valve	Rebuild the Clark Pump
Feed Pump cycles ON and OFF every time the Clark Pump Shifts  Feed Pump cycles ON and OFF	Excessive Feed Pressure spikes.  Excessive feed pressure.  Excessive Prefilter inlet/outlet feed pressure differential	Set accumulator pre-charge to 60 psi (4 Bar).  Too cold and/or salty feed water. Fouled membrane, clean or replace.  Clogged Prefilter, replace.
High Product TDS Saltwater leaking into the Product	Bad or missing Membrane Product Tube O-ring seal(s).  Scratch on the Membrane Product Tube.  Poor RO salt rejection	Check the Product Tube O-ring and O-ring grooves in the End Caps.  Remove the scratch with 600 grit sandpaper.  Clean or replace the membrane