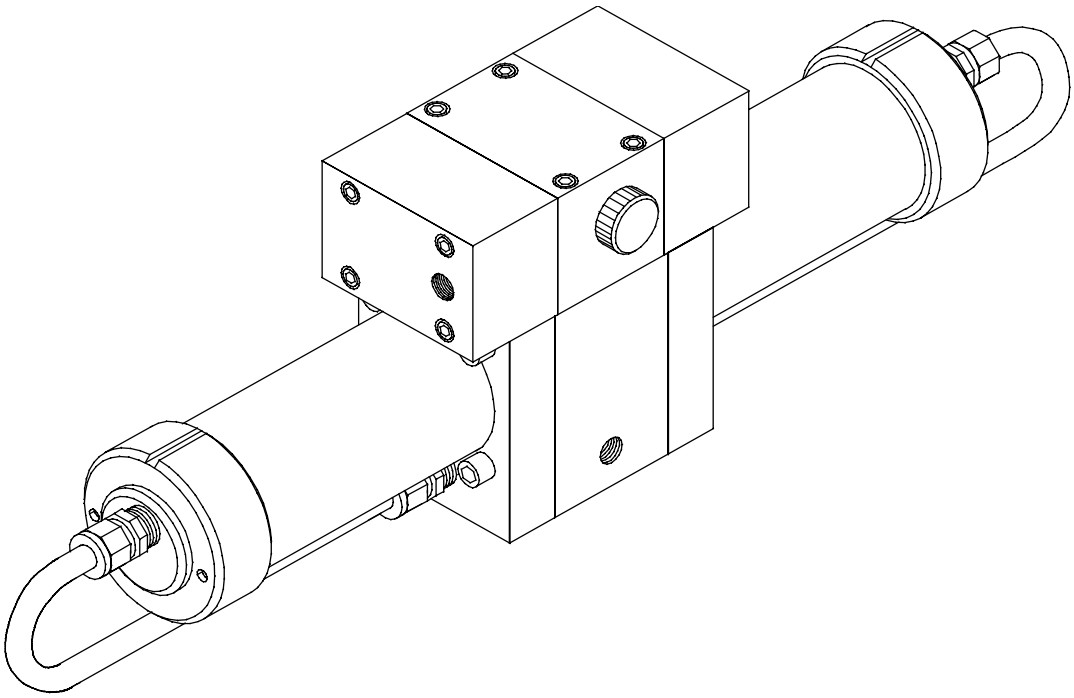
SPECTRA Watermakers



MODEL 200c & MODEL 380c
OPERATION AND INSTALLATION MANUAL

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Introduction

Thank you for choosing a Spectra Watermaker! It is our wish for you to be completely satisfied with our product. We have inspected and tested all of the components before shipping, and feel we have produced one of the finest products available.

Your long term satisfaction with this system will depend greatly on how the **Spectra** system is installed. The unique performance is obtained not only by our new pressurization process, but by careful attention to reducing flow restriction, mechanical friction and electrical resistance. All of this is affected by the final installation, and that is ultimately up to you. By reading, understanding and following this manual, even if you are not doing the installation yourself, we are confident you will be happy with your new **Spectra** system.

With years of experience installing and repairing many different kinds of watermakers, we have seen nearly everything that should or should not be done. This manual includes the summation of that knowledge, tailored for **Spectra Watermakers**.

It is very important that you follow the instructions in this manual. They are designed to help you "customize" the installation to your boat, while maintaining performance. If any questions arise, please call us for help immediately. This is a unique product so be careful of "experts," as they most likely will not have gone through the same learning curve as we have during the development of the **Spectra** systems.

If someone else is installing the watermaker for you, review all aspects of the system with them before the drilling and cutting begins. This will help avoid making mistakes. From experience, there is a very good chance that a “Professional” installer will not have completely read the instructions. If you have any doubts, please call us. We will be happy to help tailor the system to your particular needs. As with any sophisticated device, there may be “bugs” or minor problems. Please call us for consultation or advice before attempting to repair a new system. It is very important that the system is completely run tested before accepting the installation! See “New system start up” in this manual.

"Use it or lose it" really *does* apply to watermakers, but we prefer "use it or pickle it". All watermakers will suffer damage if they are run and left without storage treatment or "pickling". We have found that if the pickling and cleaning processes are made easy, there is a higher probability of it happening. This is why we have included the 3 way service valves in the Installation Kit. Even though the system can work without them, they are necessary for the proper servicing of your system.

In conclusion, having an adequate and reliable watermaker can improve the quality of life on board more than almost any other piece of equipment. It is our sincere desire that you will be able to take full advantage of your new **Spectra Watermaker**, confirming that you have indeed made the best choice! And don’t forget to tell all your friends!

Thank you from all of us at **Spectra Watermakers.**

Table of Contents

System and Start-Up Log

System Information

Model Number _____

Serial Number _____

Date Purchased _____

Purchased From _____
_____
_____

Installation Date _____

Start-Up Performance Readings

Measure during operation after 3 and 24 hours of pressurized run time in similar conditions.

	3 hrs	24 hrs
Feed Water Temperature	_____	_____
Voltage at Feed Pump(s)	_____	_____
Amperage Draw	_____	_____
Feed Pressure (psi)	_____	_____
Product Water Flow (gph)	_____	_____

Shipping List

(1) Operation and Installation Manual
(1) Clark Pump and mounting hardware
(1) Feed Pump and heat sink (model 200c)
(2) Pumps, heat sinks, cooling fan kits, and fittings (Spectra 380c)
(1) Accumulator Tank
(1) Membrane and Housing Assembly with mounts
(10') High Pressure Tube
(1) Sea Water Strainer
(1) Pre-filter and Bracket
(1) Monitor Panel
(1) Hand Held Salinity Monitor
(1) Installation Kit
(1) SC-1 Storage/Cleaning Chemical & (1) SC-2 Cleaning Chemical

Options

Automatic Salinity Control,

Includes power control module, remote panel, salinity sensor, and reject valve

Automatic Fresh Water Flush System (Adds on to auto salinity control)

Includes a timer in the power control module, a switch in the remote control panel, a charcoal filter, solenoid valve, check valve, and fittings

Manual Fresh Water Flush System

Includes charcoal filter, flush service valve, and fittings

Service Valve Mounting Bracket

Anodized aluminum bracket for service and manual flush valves

Clark Pump Bulkhead Mounting Bracket

Anodized aluminum pre-drilled bracket

20 micron Pre-filter Kit

Includes filter housing and bracket, 6 filter elements, and fittings

Basic Cruise Kit

Includes six 5-micron filters and 2 SC-1 storage chemical containers

Offshore Kit

Includes Clark pump seals, pump shaft, tools, 2 SC-2 cleaning chemical containers, instructions

Spare Feed Pump

Cooling Fan for 200c Feed Pump

Shopping List

In addition to the optional installation kit.
Refer to manual for wire size and type of fasteners

Fasteners/Hardware for mounting components to desired surfaces
Marine grade duplex wire, connectors, heat shrink, wire ties and mounts
One 5 gallon plastic container. 2 gallon with an optional flush system
One 15 amp fuse or circuit breaker switch for the Spectra 200c or
Two 15 amp fuses or circuit breakers for the Spectra 380c
One 25 amp fuse or circuit breaker for optional salinity control system

Recommended Tools

Wrench set to 7/8”
Adjustable wrench
3/8” drill, drill index and a hole saw set
Jig saw or coping saw
Screwdrivers
5/16” nut driver for hose clamps
Wire cutter
Wire stripper
Electrical crimping tool for insulated connectors
Heat gun
Soldering iron

Features

The new **Spectra Watermaker** systems are designed to meet the needs of a wide range of cruising yachts. The **Spectra 200c** is ideal for the small yacht with limited power, but will easily handle the water needs of medium size yachts. The **Spectra 380c** is ideal for the larger sail and motor yachts.

Using the patented Clark Pump and paying careful attention to system efficiency, the **Spectra 200c** operates on a fresh water-to-power ratio that surpasses everything in the marine industry. The system makes an average of 8.3 gallons per hour on 8 amps @ 12.5 vdc, less than *13 watt hours* per gallon! That means that making one gallon of fresh water is like running only a small cabin light for one hour!

The **Spectra 380c** with two fan cooled feed pumps produces 16 gallons per hour using less than 20 amps. Most other components are the same as the 200c.

The system's modular components allow for easy custom installations. Component layout can be optimized for efficiency, ease of operation and maintenance. The system's feed pump is self priming and can be mounted up to ***4 feet above the water line*****!** The rest of the system can go even higher.

The production of fresh water is stable through the system's normal operating sea water temperature and salinity range. Only the working pressures change with the water conditions. A typical leading brand "200 gallon per day" unit running in 61 degree F water will only make 144 gallons per day. The **Spectra 200c** will still be producing 200 gallons per day or more on a fraction of the power.

Total water flow through the system has been minimized in order to extend the life of the pre-filter and for energy efficiency, but is within membrane manufacture's operating limits.

Pressures are self-regulating, eliminating the need for adjustments, even when operating in brackish waters. The feed pressure is limited to 125 psi maximum for the both models The self priming multi-diaphragm feed pump is all that drives the system. No additional boost pump is needed, or even helpful. The **Spectra 380c**'s duplex pump system allows the choice of using one pump for the same efficiency as the **Spectra 200c** or both pumps for maximum production. Each pump includes a small low watt cooling fan.

A 5-micron pre-filter is provided for maximum system life, no extra boost pump is needed to use this filter.

The system's noise level is exceptionally low and unobtrusive, especially compared to other systems of similar capacity. The feed pump has a smooth, steady sound and almost no vibration, and can be placed almost anywhere on board.

Spectra 200c Performance Specifications

Sea water temperature @ 50º F (10º C):

Voltage	Feed flow	Feed pressure	High pressure	Amperage	Product
12.5v	1.5 gpm (5.7 lpm)	76 psi (5.2 bar)	650 psi (44.2 bar)	9.0	8.0 gph (30.0 lph)
13.8v	1.6 gpm (6.0 lpm)	82 psi (5.6 bar)	685 psi (46.6 bar)	9.6	9.5 gph (35.2 lph)
14.4v	1.7 gpm (6.4 lpm)	84 psi (5.7 bar)	700 psi (47.6 bar)	10.0	10.0 gph (37.8 lph)

Sea water temperature @ 77º F (25º C):

Voltage	**Feed flow**	**Feed pressure**	**High pressure**	**Amperage**	**Product**
12.5v	1.5 gpm (5.7 lpm)	64 psi (4.3 bar)	550 psi (37.4 bar)	8.0	8.3 gph (31.4 lph)
13.8v	1.6 gpm (6.0 lpm)	68 psi (4.6 bar)	570 psi (38.8 bar)	8.5	9.3 gph (36.0 lph)
14.4v	1.7 gpm (6.4 lpm)	70 psi (4.8 bar)	580 psi (39.4 bar)	8.8	10.0 gph (37.8 lph)

Sea water temperature @ 90º F (32º C):

Voltage	Feed flow	Feed pressure	High pressure	Amperage	Product
12.5v	1.5 gpm (5.7 lpm)	64 psi (4.3 bar)	530 psi (36.0 bar)	7.9	8.5 gph (32.2 lph)
13.8v	1.6 gpm (6.0 lpm)	68 psi (4.6 bar)	550 psi (37.4 bar)	8.4	9.5 gph (35.9 lph)
14.4v	1.7 gpm (6.4 lpm)	70 psi (4.7 bar)	560 psi (38.0 bar)	8.9	10.3 gph (39.0 lph)

Sea water salinity @ 35,000 parts per million TDS
Salt rejection: 99.0% ~99.4% Typical purity test: < 400 mhos, 200 ppm, 99.4% pure
Performance Tolerance +/- 10%
Maximum Operating Temperature 113º F (45 degrees C)

System Specifications

Weights and Dimensions:

Clark Pump	18.0 lbs.	(8.18 kg)	27.25" (69.2 cm) L	8.25" (21.6 cm) H	6.5" (16.5 cm) D
Membrane	13.0 lbs.	(5.91 kg)	43.5" (110.5 cm) L	3.5" (8.9 cm) Dia.	
Feed Pump	6.5 lbs.	(2.95 kg)	9.25" (23.5 cm) L	4" (10.2 cm) H	4" (10.2 cm) W
Panel	1.0 lbs.	(0.45 kg)	5" (12.7 cm) W	5.5" (14.0 cm) H	3" (7.6 cm) D
Strainer	5 lbs.	(0.23 kg)	3.5" (8.9 cm) W	5" (12.7 cm) H	2.75" (7.3 cm) D
Pre-filter	2.5 lbs.	(1.14 kg)	4.5" (11.4 cm) W	12" (30.4 cm) H	4.875" (12.4 cm) D
Hose & Fittings	3.5 lbs.	(1.60 kg)			
Total weight	45.0 lbs.	(20.46 kg)			

Salinity Control System	4.0 lbs. (1.8 kg)		
Power Control Module	9.5” (24.1 cm) L	4.75” (12.0 cm) W	4.75” (12.0 cm) D

See component dimension drawing on page 35 & 36

Spectra 380c Performance Specifications

Sea water temperature @ 50º (10º C):

Voltage	Feed flow	Feed pressure	High pressure	Amperage	Product
12.5v	2.1 gpm (7.9 lpm)	104 psi (7.0 bar)	845 psi (57.5 bar)	20.0	14.0 gph (53.0 lph)
13.8v	2.3 gpm (8.7 lpm)	110 psi (7.5 bar)	880 psi (59.8 bar)	21.2	15.0 gph (56.8 lph)
14.4v	2.4 gpm (9.1 lpm)	112 psi (7.6 bar)	900 psi (61.2 bar)	21.5	15.5 gph (57.8 lph)

Sea water temperature @ 77º (25º C):

Voltage	**Feed flow**	**Feed pressure**	**High pressure**	**Amperage**	**Product**
12.5v	2.4 gpm (9.0 lpm)	92 psi (6.2 bar)	670 psi (45.6 bar)	18.5	15.0 gph (56.8 lph)
13.8v	2.6 gpm (9.8 lpm)	98 psi (6.6 bar)	700 psi (47.6 bar)	19.6	16.5 gph (62.4 lph)
14.4v	2.7 gpm (10.2 lpm)	102 psi (6.9 bar)	710 psi (48.3 bar)	20.0	17.0 gph (64.3 lph)

Sea water temperature @ 90º (32º C):

Voltage	Feed flow	Feed pressure	High pressure	Amperage	Product
12.5v	2.4 gpm (9.0 lpm)	92 psi (6.2 bar)	645 psi (43.9 bar)	18.2	15.3 gph (57.9 lph)
13.8v	2.6 gpm (9.8 lpm)	98 psi (6.6 bar)	665 psi (45.2 bar)	19.1	17.0 gph (64.3 lph)
14.4v	2.7 gpm (10.2 lpm)	100 psi (6.8 bar)	675 psi (45.9 bar)	19.5	17.5 gph (66.2 lph)

Sea water salinity @ 35,000 parts per million TDS
Salt rejection: 99.0% ~99.4% Typical purity test: < 400 mhos, 200 ppm, 99.4% pure
Performance Tolerance +/- 10%
Maximum Operating Temperature 113 degrees F (45 degrees C)

System Specifications

Weights and Dimensions:

Clark Pump	18.0 lbs.	(8.18 kg)	27.25" (69.2 cm) L	8.25" (21.6 cm) H	6.5" (16.5 cm)D
Membrane	13.0 lbs.	(5.91 kg)	43.5" (112.4 cm) L	3.5" (8.9 cm) Dia.	
Feed Pumps	14.5 lbs.	(6.60 kg)	10.0" (25.4 cm) L	4" (10.2 cm) H	4" (10.2 cm) W ea.
Panel	1.0 lbs.	(0.45 kg)	5" (12.7 cm) W	5.5" (14.0 cm) H	3" (7.6 cm) D
Strainer	5 lbs.	(0.23 kg)	3.5" (8.9 cm) W	5" (12.7 cm) H	2.75" (7.3 cm) D
Pre-filter	2.5 lbs.	(1.14 kg)	4.5" (11.4 cm) W	12" (30.4 cm) H	4.875" (12.4 cm) D
Hose & Fittings	3.5 lbs.	(1.60 kg)			
Total weight	53.0 lbs.	(24.11 kg)			

Salinity Control System	4.0 lbs. (1.8 kg)			
Power Control Module		9.5” (24.1 cm) L	4.75” (12.0 cm) W	4.75” (12.0 cm) D

See component dimension drawings on pages 35 & 36

Component Description

The Clark Pump

This is the heart of the system. The Clark Pump uses two opposing cylinders and pistons that share a single rod through a center block. A reversing valve, controlled by a pilot valve that is actuated by the pistons, allows the cylinders to alternate between driving and pressurizing. Pressurization is achieved by the rod being driven into the other cylinder. As the rod enters the cylinder, it pushes the piston which circulates the water out through the membrane and back to the reversing valve. The valve directs the water back into the same cylinder behind the piston, creating a *closed loop.* The rod displaces water as it enters the cylinder, raising the pressure enough for reverse osmosis to occur in the membrane, thus fresh water equal to the volume of the rod is produced on every stroke. The driving cylinder has feed pressure pushing on the top of the piston which has ten times the surface area than the end of the rod under it. The water under the piston (brine) is discharged overboard. This gives the piston a 10-to-1 advantage over the rod, allowing it to drive the rod into the pressurizing cylinder. When the piston bottoms out on the center block, it actuates the pilot valve and the process is instantly reversed. High efficiency is achieved because there is no "back stroke," allowing one cylinder to always be under pressure.

The speed of this process is determined by the water flow from the feed pump. The pump has a nearly constant flow rate at a given voltage so the production of fresh water is nearly constant, only the pressures change with changes in sea water temperature and salinity. (see "Membrane" section)

A pressure relief valve and a reset button are incorporated in the Clark Pump to depressurize the system for priming and service and resetting the reversing valve if the Clark Pump is stopped with the control valves at dead center. ***Refer to the Clark Pump diagram on page 34.***

Spectra 200c Feed Pump

The feed pump is the sole driving force in the system. It is a self priming, continuos duty, multi-diaphragm water pump similar to the pumps used for domestic pressure water systems. The pump has a flow rate of 1.6 gpm. Feed pressure averages 65 psi, drawing 8 amps @ 12.5 vdc. The feed pressure cut out switch is factory set at 125 psi.

Spectra 380c Dual Feed Pump System

The system is simply two identical self priming, multi-diaphragm, ***fan cooled***, feed pumps with that are plumbed in parallel. They are individually wired to separate circuits to allow single or duplex operation. In dual pump mode, the feed flow rate is 2.6 gpm. Feed pressure averages 95 psi, drawing less than 20 amps per hour @ 12.5 vdc. In single pump mode, the performance is the same as the **Spectra 200c**. It is very important that the cooling fans be operational when both pumps are running. Each pump is drawing almost 10 amps which will generate too much heat for the cooling fins to dissipate adequately. The feed pressure cut out switches are are factory set at 125 psi.

The Reverse Osmosis Membrane

The “R.O.” membrane is where the magic happens. A semi-permeable membrane, deposited over a capillary layer, is attached and wrapped with a separating layer around a center catch tube, then encased in fiberglass. The ends of the windings are open, allowing the salt water to freely pass from end to end. This "membrane element" is enclosed in a high pressure housing that directs the pressurized salt water to flow through the membrane and lets the product (fresh) water escape from the center catch tube. Threaded ports are provided for hose connections in the end caps of the pressure housing.

In the **Spectra 200c**, approximately 85 gph of high pressure salt water flows across the membrane as 8.5 gph of fresh water is forced through the membrane and lead by a capillary layer to the catch tube. The excess salt water flowing out of the membrane is approximately 1/10th saltier and is called “brine.” No salts are collected in the membrane. Membrane function is affected by sea water temperature and salinity. The warmer or less salty the water, the easier it is for the fresh water to pass through the membrane. This means that since the water production of the **Spectra** systems are nearly constant, warmer water lowers the operating pressures. The membrane is carefully sized to handle typical sea water temperatures and salinity, keeping the pressures within limits.

The R.O. membrane theoretically will not let microbes or viruses through with the product water. This cannot be guaranteed, however, because of the possibility of microscopic flaws in the membrane or the brine seals in the pressure housing that could let these contaminates pass through. This is the reason that it is recommended that water made in a possibly contaminated environment should not be directed into the tank. An optional ultra violet sterilizer is available for additional protection.

The Sea Water Strainer

The strainer filters the salt water to the feed pump for its protection. It has a cleanable, fine mesh, stainless steel element. The filter mesh is sized to stop debris that could jam in the pump’s check valves. ***A coarse strainer should not be substituted.***

The 5 Micron Pre-filter

The pre-filter does the essential job of cleaning the sea water before it gets to the Clark Pump and R.O. membrane. A replaceable 5 micron pleated fiber filter is used. Filter maintenance is crucial to the efficiency and life of the system. Operation with 5 micron filtered sea water is very important. A reverse osmosis system running on 5 micron filtered water will last much longer than one running on 20 or 30 micron filtered water.

Accumulator Tank

The accumulator tank is an air chamber divided by a rubber diaphragm. The top chamber is pressurized with air to 10 psi below the expected feed pressure. For example, if the feed pressure is 70 psi, the tank should be pressurized to 60 psi when the system is off. When running, feed water will enter the lower chamber until the pressures equalize. It’s function

resembles a cushion to smooth out the feed pressure spikes when the Clark Pump "shifts." This will extend the life of the feed pump and quiet the shift between strokes.
Component Description, cont.

Standard Monitor Panel

The monitor panel gives information on the system's status. The round gauge shows feed pressure. This gauge is fluid filled and the air bubble is normal. The vertical flow meter indicates product water flow in gallons per minute. The flow is read at the widest part of the indicator ball.

Feed pressure is taken before the pre-filter so a rise in feed pressure can indicate a clogged pre-filter.

Hand-held salinity monitor

The hand-held salinity monitor is used to test the product water. Readout is in "parts per million" (ppm). The monitor must be calibrated periodically. Calibration solution is supplied.

Installation Kit

The installation kit includes 50 feet of 5/8"reinforced non-toxic feed and discharge hoses, 10 feet of 1/2" high pressure tubing, 25 feet of 1/4" plastic product water tubing, special 3-way service valves for service procedures, and all of the required tube fittings, hose fittings, hose clamps, and standard mounting brackets.

The 3 Way Service Valves *(note: The common port is opposite the handle shaft)*

The service valves are installed on the feed, brine discharge, and product lines to provide easy access for proper maintenance. The service hoses should be able to lead to the five gallon cleaning container. ***IMPORTANT:*** **The intake and discharge service valves will close off all the ports if the lever is moved to the middle position, i.e. half way between the run and service positions.** The smaller product service valve cannot close the ports when the lever is moved half way. This precludes the possibility of blocking the product flow and causing an over pressure condition that could burst the tube.

Remote Control Panel (optional)

The Spectra remote control panel is integrated with the Spectra power control module, salinity control system, and the optional automatic flush system. The panel has switches for one or two feed pumps, a switch to start a flush cycle, and lights that indicate when a feed pump is on, the flush cycle is in progress, product water is being rejected, and when good product water and going to the tanks. The remote panel is wired to the power control module.

Power Control Module (optional)

The Spectra power control module is a plastic enclosure that has all of the power relays and electronics for the feed pumps and the salinity control system. It also can incorporate the timer for the automatic flush system. The module is connected to the ships power from a single breaker that is rated for all the system loads. The feed pumps or pumps, salinity and flush solenoid valves, salinity probe and the remote paned are all wired to the power control module.

Salinity Control System (optional)

The salinity control is integrated with the remote control system. The system includes the Spectra power control module, a salinity probe that is mounted in a plastic pipe tee, an electric three way solenoid valve, fittings, and the Spectra remote control panel. The probe and diversion valve are plumbed into the product line, The salinity control continuously samples the purity of the product water. If the probe detects non-potable product, the diversion valve rejects the product overboard. The reject product water is combined with the brine discharge after the brine service valve to avoid the possibility of excessive back pressure.

Manual Fresh Water Flush Kit (optional)

An easy way to flush the salt water out of the system for longer intervals between run times. The manual system uses a 3 way service valve to switch from the sea water inlet to charcoal filtered fresh water from the ship's pressure water system, or direct from the tank. The kit includes a charcoal filter and housing, service valve, and fittings for a typical installation.

Automatic Fresh Water Flush Systems (optional)

An automatic fresh water flush system allows the operator to start a timed flush cycle from the remote control panel. The automatic system incorporates an electric solenoid valve, controlled by an adjustable timer, a power relay to run one feed pump, and a check valve. When the timer is initialized the valve opens to let pressurized charcoal filtered fresh water into the feed system and one feed pump starts. The check valve prevents the fresh water from going out the intake thru-hull. The system will run until the salt water is flushed then automatically shuts down. The timer is adjusted at installation.

Purging the system with nonchlorinated fresh water is advisable every time the system is shut down, especially in hot climates.

The pressure relief valve does not have to be opened during the flush because the **Spectra's** unique high pressure system will not generate membrane damaging excessive product flow when brackish or fresh water is introduced into a pressurized system. The length of time to flush the system depends on the installation. Longer hose runs and extra pre-filters will lengthen the flush time. The feed pump is run during the flush. The flush time is determined by recording the time it takes for the feed pressure to drop and then stabilize as the salt water leaves the membrane, and then adding at least 1 more minute.

Bulkhead Mounting Bracket (optional)

A black anodized pre-drilled aluminum "L" bracket for easy bulkhead mounting of the Clark Pump.

Service Valve Mounting Bracket (optional)

A black anodized pre-drilled aluminum "L" bracket for mounting the three service valves and the manual fresh water flush valve in various configurations. Labels are included.

Second 20-micron Pre-filter Kit (optional)

Add a second 20-micron pre-filter assembly before the 5-micron pre-filter for longer intervals between filter service. Recommended for systems that will run for long periods of time and may be operated in turbid sea water conditions. Six 20-micron filters and plumbing fittings are included.

Ultraviolet Sterilization Filter (optional)

The "UV filter" is placed in the product line between the watermaker and the tank for double protection of the product water purity.

Basic Cruise Kit (optional)

The kit includes six 5-micron filters and the SC-1 storage and scale cleaning compound (pickling) for 4-6 storage procedures.

Offshore Kit (optional)

The kit includes all the seals, valve sleeves, tools, and rebuild instructions for the Clark Pump and the SC-2 alkaline membrane cleaning chemical compound.

Cooling Fan Kit (optional)

The kit includes a low watt DC muffin fan mounted on a plastic shroud that slips over the cooling fins of the feed pump and instructions.

Spares, Accessories and Supplies

Spare feed pump
Cooling clip for feed pump
SC-1 membrane cleaning and storage compound
SC-2 alkaline membrane cleaning compound
5-micron pre-filters
20-micron pre-filters
Charcoal flush filters
UV light bulbs

Operating Procedures

New System Start-Up

Caution: **Avoid running the system if the vessel is in contaminated water, as in a harbor or canal, membrane damage and pre-filter clogging may result. Move the vessel to cleaner water. If the boat cannot be moved and a manual fresh water flush system is installed, run the system with the flush valve on "flush"and the pressure relief valve open for 30 minutes. Close the pressure relief valve and continue flushing for another 30 minutes with the product water diverted. With an auto flush, flush the system 10 times with the pressure relief valve open and 10 times with the pressure relief valve closed. This will flush the storage solution from the membrane using fresh water from the tank. Add water to the ships tank if necessary. The system can now be run using a clean source of sea water in the cleaning container or divert flush water to the container and mix with aquarium salt. Use the intake, brine, and product service hoses to recirculate the salt water to and from the container. Salt water must be used to fully test the system.**

1. Check battery voltage. A nominal 12.8 vdc to 14.4 vdc should be indicated.

2. Check that the accumulator tank is pre-charged to 60 psi

3. Confirm that the intake thru-hull is open and the strainer is clear.

4. Have the intake and brine discharge service valves in the normal position and the product service valve in the service position. Direct the product alternate tube to a container or into the bilge.

5. **Open the pressure relief valve 1/2 turn** and start the system. On standard systems, the pump is started using the owner supplied breaker or switch. For systems with the power control module the pumps are started from the remote control panel. Listen for the feed pump to prime itself and the Clark Pump start to "shift." Check the brine discharge for water flow. **The Spectra 380c's two feed pumps must be primed separately.** Start one pump and run until there is good water flow. Shut down the first pump and start the second pump. After the second pump is primed, the first pump can be restarted. Check the feed pressure, about 18 psi should be indicated with one pump running (for both the 200c & 380c systems), and about 35 psi with two pumps running (the 380c system) between "shifts" of the Clark Pump.

6. Check the feed pump high pressure cut out switch set point. For the **Spectra 380c** do one pump at a time. With the system primed and running unpressurized, block the brine flow by moving the brine discharge service valve lever to the center position, half way between the run and service positions. This will stop the water flow and cause the feed pump to shut off. Check the feed pressure gauge, it should be holding steady at about 120 to 125 psi. The pressure can be adjusted by tightening (higher pressure) or loosening (lower pressure) the Allen head set screw on the pump switch (at the very bottom of the pump head) using a 5/64" Allen wrench. Repeat for the second pump on the **Spectra 380c**. Now is a good time to check for leaks in the feed and brine connections as they are now pressurized to maximum. The membrane housing end caps have a vent that will show if there is a possible leak between the salt and product water.

7. **Run the system unpressurized for 30 minutes after start-up to purge the pickling solution in a new membrane.** Make sure that the product water is diverted then close the pressure relief valve to pressurize the system. Re-check the whole system for leaks, especially the high pressure hose connections. If any are found, turn off the system and repair them before continuing. Run the system under pressure for at least one hour while rejecting the product water. Compare the voltage, feed pressure, water temperature and amp draw to the specification table. The feed pressure should not spike more than 5 to 10 lbs. over normal when the Clark Pump shifts and should stay under 85 psi at all times for the **Spectra 200c** and under 100 psi for the **Spectra 380c**. The feed pump(s) should never be allowed to cycle their high pressure cut out switch on and off during the shift. The pump sound should remain almost steady. If the pressure
spikes are high and/or the pump stops momentarily during the shift, re-check the accumulator pre-charge and/or check the high pressure cut out set point. If the feed water is around 55 deg. or colder and/or is extra salty, the 380c's feed pressure might go high enough to cycle one pump on and off even when all else is normal. In those conditions only run one feed pump.

8. After one hour, use the hand held salinity meter to check the product water. The salinity meter reads in parts per million (ppm) of total dissolved solids (TDS). Readings should be below 500 ppm. Typical readings are 200 ppm - 300 ppm. If the water is good, the product service valve can now be switched to the run position to direct the flow to the water tank. If an optional automatic salinity control is installed, watch the "reject" and "good" product water indicator lights on the remote panel after the product water service valve is turned to the run position. The green light should go on and the diversion solenoid valve directing the product water to the tank. Break open the product line to the tank to see if the water is flowing. If not recheck the solenoid valve plumbing and electrical connections. Check voltage at the feed pump while the system is running. There should be less than 1/2 volt drop at the feed pump.

9. At 3 & 24 hours of pressurized run time, re-check for leaks. Take note of the system feed pressure, product flow, feed pump voltage , amp draw, and enter them into the start up log.

Normal Start-Up

1. For normal start-up (meaning the unit has been run within the last 2 days, or has been flushed with fresh water only), reject the product water by switching the product service valve to the service position and start the system. It is not necessary to open the pressure relief valve. The first two pints of product water may be brackish. Wait a few minutes then test the water. If it is OK, switch the service valve to the run position. If the system has the automatic salinity control system there is no need to switch the service valve. Any brackish product water will automatically be diverted to the brine discharge. When the salinity probe detects potable water, the diversion valve sends it to the tank. Periodically check the product water with the hand-held salinity probe to test the the automatic system.

2. If air is in the system and the feed pump has lost it's prime, open the pressure relief valve to allow the air to purge from the system. ***The feed pump cannot prime if it's output is under pressure. Remember to prime the Spectra 380c's pumps separately.***

3. After starting and pressurizing the unit, check for leaks and wait for it to stabilize, then check for proper readings **(see Specifications pages 8 & 9)**. Air in the system will cause erratic shifts and readings until it is purged out of the system. This may take up to 10 minutes.

Pickled System Start-Up (*CAUTION! Open the pressure relief valve before starting)*

If the system has biocide in it (also known as "pickling" or storage solution), open the pressure relief valve 1/2 turn and run the system unpressurized for 30 minutes to purge the biocide. Direct the product line to a bucket or into the bilge by switching the product service valve to the service position. Close the pressure relief valve to pressurize the system. Manually reject the product water. Do not rely on the salinity control system at this point. Run for another 30 minutes, then test the water by using the hand held salinity probe even if the automatic salinity control system is installed. If the water is OK, switch the service valve back to the run position. ***Pressurizing the system with biocide in it will clog the membrane!*** The system will have to be cleaned with SC-2 to restore the membrane.

Unknown Condition Start-Up (*CAUTION! Do not start the system yet!)*

If the system has been left unpickled for an extended length of time or the history is unknown, perform this simple test:

Before starting the system, open the pre-filter(s) and inspect its condition. If the filter is black and smells bad it's an indicator that the system is fouled. Install a new or cleaned pre-filter then open the pressure relief valve and direct the ***brine*** discharge into a bucket. Start the system and watch the brine that first comes out. If the water is discolored and smells bad, perform an alkaline cleaning on the system before pressurizing (see cleaning instructions). Pressurizing a system with a fouled membrane will compact the biological growth into the membrane and make it harder to clean. If the water is only slightly discolored and smells OK, perform a ***Pickled System Start Up.*** Compare the system readings to the performance specifications and start up log to see if the system is performing properly.

Normal Operation

For best performance and longevity, especially in tropical climates, run the system until the tanks are full then fresh water flush the system before shut down. In moderate climates, running the system for an hour twice a day without flushing is acceptable. Always divert the product water at startup and test the quality after a few minutes. Running the unit during charging cycles will produce more water because of the higher voltage (see Performance Specifications). Run both of the **380c's** feed pumps (high output mode) during a charge cycle and use one pump (efficiency mode) when running direct from the batteries. System readings should be periodically checked and compared to the start-up log readings and performance specifications. Look for asymmetrical readings and listen for any change in the sound of the system that may indicate potential problems.

If the system has the automatic salinity control, manually diverting the product water at start up is unnecessary, but periodically test the water manually to see if the automatic system is working properly.

If too much air is introduced into the system when the system is running and pressurized, the feed pump will cavitate and water flow will stop. This will not damage the system. Open the pressure relief valve to allow the feed pump to re-prime. Remember to re-prime the **Spectra 380c**'s feed pumps separately.

All reverse osmosis watermakers are affected by water temperature and salinity. The **Spectra** operating pressures will rise with colder temperatures and/or higher salinity, and fall with warmer temperatures and/or lower salinity, but the product flow is effected very little.

Shutdown Procedures

Biological growth in the membrane when it's not in use, is the leading cause of membrane fouling. A warm environment will cause faster growth than a cold environment. The following procedures assume a warm environment, such as in the tropics. In colder conditions, the day count could be safely doubled.

Normal Shutdown

Ideal operation is to run system to fill the tanks then fresh water flush. Leaving the system with salt water in it is acceptable if the system is run again within one day in moderate temperatures or half a day in hot temperatures. Leaving salt water in the system can invite biological membrane fouling.

For standard systems, make 5 gallons of water allowing it to flow into the service container using the product service valve. ***Do not use tap water or chlorinated water!*** If making its own water is not an option, using the ships tank water is OK if there is only product water in it. Distilled or charcoal filtered chlorinated tank water is also acceptable . Open the pressure relief valve one half turn. Draw the fresh water through the system using the intake service valve. Service the pre-filter(s) and strainer, leave them empty and dry if possible.

If a manual fresh water flush system is installed, switch the flush service valve to the service position while the system is running and pressurized. Watch for the feed pressure to fall and stabilize, wait 1 minute more and then shut down the system. Return the flush service valve to the run position. Service the pre-filter(s) and strainer.

If an automatic flush system is installed, stop the system, make sure that the ships pressure water system is on, and then start the flush cycle. When the system turns itself off, service the pre-filter(s) and strainer if necessary.

Extended Shutdown, *two days - one week*

If the system has been properly flushed, it can be left without further treatment up to three days in warm temperatures and up to one week in moderate temperatures. If there is any uncertainty that the system may be left for a longer period, do a storage treatment.

Storage Shutdown or "Pickling," *one week to one year*

The Spectra SC-1 Storage Compound is specially formulated to be used as a system preservative. Sodium bisulfite or metabisulfite should not be used as a preservative in the Spectra systems. Sodium bisulfite will attack materials used in the Spectra systems.

The SC-1 Storage Compound has to be mixed at 1 Spectra container to 3 gallons of fresh water to have the proper solution. An average of two gallons of water is in the Spectra system. This water has to be figured in the mixture. For short term storage of less than one month, 1/3 of a container can be used.

Note that the compound may not dissolve completely.

1. For standard systems, make 5 gallons of water into a clean container using the product service valve. ***Do not use tap water or chlorinated water!*** Distilled or charcoal filtered water is acceptable if making its own water is not an option. With manual or auto flush see § 2b or c.

Shutdown Procedures, cont.

2. a. ***Open the pressure relief valve one half turn to depressurize the system***. Flush the first 4 gallons through the system using the intake service valve. **Leave 1 gallon in the container.** Now mix 1/3-1/2 container of SC-1 into the 1 gallon that is left. **Do not let skin, eyes, or lungs have any contact with the storage chemical.**

b. If a manual flush system is installed, a 2 gallon container may be used. Perform a normal flush, then divert the brine discharge into the container using the discharge service valve to get the 1 gallon of filtered fresh water needed. ***Open the pressure relief valve*** and mix in 1/3-1/2 container of Spectra SC-1.

c. If the automatic flush is installed, a 2 gallon container may be used. Start the flush cycle. When the system stops, divert the brine discharge into the container and restart the flush cycle to get the 1 gallon needed. Stop the system by the main power breaker or return the brine discharge service valve to the run position and let it stop automatically. ***Open the pressure relief valve*** and mix in 1/3-1/2 container of Spectra SC-1.

3. Direct the brine discharge into the container with the discharged service valve. Run the system, recirculating the solution for 10 minutes to completely mix the chemical and saturate the membrane. (Check the prime on both feed pumps on a 380c). Light discoloration of the solution is acceptable. After 10 minutes return the discharge service valve to the run position and empty the container.

4. Close the intake thru-hull and switch the intake service valve back to the run position. If the system shares an intake thru-hull, move the intake service valve lever midway between run and service positions. This will close off both ports and isolate the watermaker.

5. Remove and clean the sea water strainer screen and pre-filter. Reassemble dry.

6. When returning the system to service after pickling, check the intake thru-hull and service valves, then run ***unpressurized*** for at least 30 minutes to purge the system. Discard the product water for another 30 minutes after pressurizing.

7. To ***winterize***, Flush 5 gallons of **potable water system antifreeze** straight through the system instead of using the normal SC-1 storage procedures. The antifreeze will prevent biological growth as well as freeze protection.

Maintenance

The Seawater Strainer

The sea water strainer's stainless steel element should be inspected, removed and cleaned as needed. Be careful to ensure that the thru-hull is closed before disassembly and the seal and element are in place on reassemble. When the system is put into storage, remove, rinse and reassemble dry to impede corrosion. Check frequently during operation.

The Micron Pre-filter(s) **Caution! The final pre-filter must be 5-micron. Do not use any kind of charcoal elements as pre-filters**

The pleated pre-filter(s) will need the most attention. Clogged filters will cause higher than normal feed pressure readings. A very clogged filter will cause the feed pump(s) to cycle off and on. The easiest way to service the filter is to first shut off the thru-hull, open the housing, discard the old filter, **remove the O-ring to prevent loss,** and clean the housing. Reinstall the O-ring and reassemble the pre-filter with a new 5-micron filter element in a single filter system and 20 and 5-micron elements in a duel filter system. Leave dry until the next start-up.

Used pleated elements can be carefully cleaned if they are not too compacted. Do not use full pressure from a garden hose or scrub with a hard brush on the pleats. Gently spray the outside with water and then plug one end with your hand, filling from the other end to flush from the inside. Be careful to not distort the pleats. Another way is to tow them behind the boat until clean, 4 knots maximum. Slip a line through the filter and tie a stopper knot. Elements that show *any* signs of deterioration should be replaced. Check for leaks on the first run after a filter service. 20-micron filters can be cleaned more often than the 5-micron as they are not as critical.

The Membrane

The membrane needs to be cleaned only when it has lost up to 10% of its capacity due to fouling. This can be observed through a 10% rise in power consumption in normal conditions. Excessive discoloration of the storage solution indicates a need for cleaning. The leading cause of fouling is from biological growth that occurs when the system is left unused without flushing or pickling. Fouling from mineral scaling can happen under certain sea water conditions, and from rust. Higher than normal pressures and amp draw for the sea water temperature and salinity conditions are the main indicators of membrane fouling. Other conditions can cause high pressure (such as in very cold water). Low product flow is usually due to low voltage or a clogged pre-filter. Look for all other causes before cleaning the membrane.

There are two types of cleaners: acid and alkaline. The acid cleaner (SC-1) will remove mineral scaling and kill live microbes and is also used for storage. The alkaline (SC-2) cleaner is used to remove biological byproducts, oil and dirt particles that get past the pre-filters. If membrane performance is reduced and has not been pickled recently, cleaning with both chemicals is recommended. The acid cleaner should be used first. The acid cleaner is also used as the storage solution so scale is automatically reduced when the system is "pickled". If biological growth is suspected the alkaline cleaner can be used on the next start up after the unit has been "pickled"

If the membrane fails to respond to both cleanings, this is an indication of another problem with the system, or that it is time to replace the membrane. Call **Spectra Watermakers** before removing a membrane.

Maintenance cont.

Hand-held Salinity Monitor

Periodically recalibrate the hand-held salinity monitor. Make sure the batteries are good and use the calibrating solution and instructions supplied.

Automatic Salinity Control

Check the calibration of the automatic salinity control monitor every 6 months. Compare it against the hand held monitor that has good batteries and been recently calibrated. Recalibrate if there is a difference of more than 100 ppm. See the calibration procedure section of this manual. If the system will not calibrate properly, remove and clean the salinity sensor.

Ultraviolet Sterilization Filter

Periodically check the indicator light on the power supply while the UV filter is on. If no light is visible, check the power to the unit. If power supply is OK, replace the bulb. The quartz sleeve needs to be periodically cleaned and the bulb replaced once a year. Follow the instructions that come with the UV filter option.

Product Flow Meter

The product flow meter may become dirty over time, especially if the system is left with salt water in it regularly. To clean, remove the meter from the panel, slide off the small clear cover on the top of the meter to expose a clear plastic plug. Use a 1/4" Allen wrench to remove the plug, being careful to not loose the indicator ball. Remove the ball and clean the chamber with a pipe cleaner or equivalent and rinse thoroughly. Clean the indicator ball and reassemble the meter. Do not over tighten the plug. An O-ring makes the seal so just screw it in snug.

Clark Pump

Some dry salts may appear around the seams of the pump and are normal. Any wetness indicates a leak that should be fixed. Rinse the Clark pump with fresh water periodically to remove any salts, especially on the SS return tubes and fittings. The only parts affected by salt water in the Clark pump are the return tubes and fittings. Fresh water flushing and external rinsing will increase the tubes service life.

Feed pump(s)

Periodically check for leaks, cutout switch setting, and tighten all 6 screws that hold the pump head together.

Electrical

The main reason for poor system performance is excessive voltage drop in the wiring to the feed pump(s). Periodically check all the connections and check the voltage at the feed pump with the system running under pressure with a good digital volt meter. There should be less than 1/2 volt difference between the power source and the feed pump.

Membrane Cleaning Procedures

We do not recommend cleaning unless you are sure that it is indicated. With a Spectra System cleaning is required when higher than normal pressures are encountered and the water

production has fallen. Always check the prefilters first.
For normal cleaning, the SC-3 Acid Cleaning Compound is used first, then the SC-2 Alkaline Cleaning Compound. If known bio-fouling is present, the SC-2 may be used first.Using hot water if possible, 120º, is highly recommended as it greatly enhances the ability of the cleaners to do their jobs.

If the history of the system is unknown or has been left "unpickled" for an extended length of time and biological growth is present, it is recommended that the system is cleaned with the SC-2, using an alternate source of unchlorinated fresh water before the system is run under pressure. A simple test can be performed to see if biological growth has occurred: Before running the system, remove the pre-filters and examine their condition. If the housings are full of discolored smelly water, the system was not properly stored. Install clean pre-filters if they were bad. Next check the membrane. Attach the brine discharge service hose and lead to a container. Open the pressure relief valve 1 turn and turn the brine discharge service valve to the "Service" position. Manually run the system for 30 seconds. Examine the brine water; if it's discolored and smells bad, perform a SC-2 cleaning with an alternate source of unchlorinated water before running the system pressurized. If the brine is fairly clean, the system can be purged, run normally, and checked for performance. Clean the membranes only if performance is reduced.

Heating the water is preferable. One way to do this is find a camp stove and use a large SS pot to heat the solution in. The cleaning solution throughout the system will heat as it circulates in and out of the pot. An alternative is to heat the one or two gallons of initial water in the cleaning container to 120° F on the main stove before mixing in the cleaner and circulating it into the system. Periodically stop and reheat the solution.

Perform the cleaning procedures while the ship is in acceptable sea water for purging and testing.

Cleaning Procedures

Note: procedures are the same for the SC-3 and SC-2 cleaners

A Spectra Cleaning Compound (SC-2 or SC-3) must be mixed with fresh water at a ratio of 1 Spectra container to 3 gallons to have the proper solution. An average of two gallons of water is in the system. This water has to be figured in the mixture. SC-3 and SC-2 are never mixed together. Do not use them for storage.

Warning! The pressure relief valve on the Clark pump must be open for this procedure or membrane damage may result. Maximum pressure 50 psi.

Note: Triple the run/soak times if the solution is not heated

Membrane cleaning, cont.

- Attach the service hoses to the three way valves and direct them to the cleaning container.

Make sure the domestic water pressure system is on then start the automatic flush system. When the flush cycle stops, move only the brine discharge to the "Service" position and restart the flush cycle. Allow one gallon of flush water to flow into the container, then stop the system with the Start/Stop button. ***Do not use tap water or chlorinated water!*** Distilled or charcoal filtered water is acceptable if using the flush water is not an option. Start heating the water.

- With the system flushed and unchlorinated fresh water in the container, thoroughly mix the proper amount (see above) of the chosen cleaning chemical into the mixing container. **Warning! Re-check that the pressure relief valve is open or membrane damage may result.** Turn all the "Service" valves to the service position. Start the main feed pump manually using the manual switch on the MPC control box. Do not use the remote control panel.

- Run the system unpressurized for one hour while maintaining the solution at warm if possible then turn off for one hour to let the membrane soak. Don't forget to turn off the stove. Run the system again for 1 hour while heating the solution, then turn off for one hour. Do not let the water get above 120º F! Triple the run soak times if the water is not heated.

- Turn the brine discharge service valve to the "Run" position. Restart the system, the solution will now drain from the container.

- Place the intake service valve to the "Run" position. Run the system unpressurized on sea water for at least 30 minutes to purge the cleaning solution.

- After purging, close the pressure relief valve to pressurize the system. Manually divert the product water with the product service valve into the cleaning container. After 30 minutes, check the feed pressure, product flow, and quality, to determine if the membrane is functioning normally. If the cleaning solution became very discolored during the cleaning process, it is recommended to repeat the process. If the first cleaning did not affect the membrane enough, repeat the cleaning process using the other cleaner. Always manually reject the product water for 30 minutes after cleaning.

Membrane Element Replacement

Do not remove the membrane from the housing unless absolutely necessary. Troubleshoot for all other causes of poor performance and try the recommend procedures first. **Caution: membranes must be kept wet to prevent permanent damage. Do not open the new membrane packaging until ready to install.**

Disassembly:

Flush the system. Disconnect the high pressure tubes, cut the housing mount bands, and move the membrane housing to a work area that can handle water spillage. Clean off any deposits on the ends with a stiff brush and fresh water. Note which end goes where so it can be reinstalled the same way later. Inlet and outlet are marked on the housing. The housing end caps are plastic and are held on by anodized aluminum retainer rings threaded to the pressure vessel.

Loosen the retainer rings by tapping with a hard plastic or wood punch and a mallet on the slot provided. As the retainer rings unscrew, twist and pull the black plastic end caps, to follow the rings out. This way they can be removed with the factory plumbing fittings in place as a ring/end cap assembly. Inspect the end caps and O-rings for damage, replace if necessary. There are three O-rings per end cap, two are in the center bore of the end cap with a *tiny* vent hole to the outside between them. Both of these O-rings must be in place and the vent clear.

Push the membrane element out of the housing by first pushing on the outlet end. If it resists, try pushing on the other end. If the membrane is going to be kept for any reason, seal it in plastic before it dries out.

Assembly:

Install the ***inlet*** end cap first. Lubricate all the O-rings and the housing with soapy water or with a very thin layer of a pure silicone lubricant and start threading on the ring/end cap assembly. As the end caps large O-ring comes into contact with the housing, twist and push on the end cap to properly insert the O-ring, then continue tightening the retainer ring. If the tube fittings were removed from the end cap, lubricate and insert the end cap, then install the retainer ring, and then the plumbing fittings. See “Installation Basics”.

Check that the new element has a black rubber lip seal (brine seal) in a groove on one end *only*. Check that the small product catch tubes that stick out from both ends of the membrane are smooth and free of scratches and nicks. If there are scratches, dress them with 400 grit sandpaper if they are not too deep. The product tube surface condition is important because the O-ring seal on the tubes separate the high pressure salt water from the product water.

Lubricate the element brine seal and wet the whole inside of the housing. Insert the brine seal end of the element into the ***outlet*** end of the housing. A gentle push with a slight rocking motion and help with fingers should compress the brine seal lip so it slips inside. Push the element into the housing, the brine seal will give some resistance, until it completely engages the inlet end plug. The element’s product catch tube engaging and passing through the small O-rings in the end cap center bore can be felt. The element brine seal should now be next to the ***inlet*** plug.

Install the outlet end plug the same way as the inlet. It will go in harder because of the center bore O-rings engaging the element’s product catch tube.

A new membrane has a pickling solution in it and should be thoroughly flushed before use. Follow the “New System Start-Up” procedures.

Installation Basics

The **Spectra Watermakers** are designed for energy efficiency. All aspects of the system have been optimized for this goal, therefore any changes in the basic layout or components will most likely reduce this efficiency. Electrical power to the feed pump is one of the most critical aspects of the installation. Wiring must be done to minimize voltage drop to the pump. If there is any doubt, go oversize on the wire size. Larger wine will only help, marginal wiring will reduce performance significantly.

The overall length of the feed, discharge and high pressure hoses have little effect on performance but that every sharp turn absorbs power. Avoid adding 90 degree fittings. Use gentle hose bends where possible. Careful consideration of the direction of water flow through the pre-filters and boost pump in relation to how they mount will minimize hose lengths and turns.

Thru-hulls

It is recommended that a designated 3/4" intake thru-hull and seacock be installed for the system as far below the water line as possible . Sharing a thru-hull with another system is acceptable, but can introduce unforeseen problems such as intermittent flow restriction, air bubbles and contaminates. If the system is sharing an intake thru-hull, the intake service valve can be used to shut off water to the system.

Do not install the intake close to or down stream of a head discharge. Install as far below the water line and as close to center line as possible to avoid contamination and air induction.

We recommend that a reputable boatyard install any underwater thru-hulls.

The discharge thru-hull should be mounted above the waterline, in or just above the boot stripe to minimize water lift. Having the discharge feed into a cockpit or sink drain will work, but can make an unpleasant gurgle sound.

Double clamp all hose connections below the water line if possible.

Fittings

Metal pipe fittings that are to thread into ***plastic*** should be coated with 3-4 wraps of Teflon tape. To avoid cracking the plastic, tighten until only 1/2 of the threads are buried. This may not seem tight, but they will not, and should not, bottom out like a metal to metal connection.

Metal to metal pipe connections should have 1-1/2 to 2 Teflon wraps only.

Plastic to plastic pipe connections should have 3-4 wraps of Teflon tape and be threaded almost all the way in.

Be very careful to avoid getting any tape over the end of the fitting that might get into the system. To insure this does not happen, leave the very first thread uncoated.

General Plumbing

Follow the Plumbing Diagrams on pages 37 or 38 for hose and tube connections. All feed and discharge hoses are made of 5/8" reinforced nylon. The high pressure tubing is 1/2" OD connected with 1/2" tube to pipe 316 SS compression fittings. The 90 degree high pressure SS tube fittings mounted in the high pressure in and out on the Clark Pump can be ***rotated*** up to 1/2 turn for better tube runs. Straight SS tube fittings can also be used. The product water lines are 1/4" black plastic tubing with plastic connectors. Feed water operating pressure up to 125 psi requires ***vigorous*** hose clamp tightening. It is recommended to lubricate the clamp screw and use a nut driver for the final tightening. ***Re-tighten*** all hose clamps and check for leaks after the first few hours of running.

Where hose runs are through areas that could get hotter than normal cabin temperatures, use hose that is rated for the temperature expected.

If you use feed hose or product tubing that is not supplied by **Spectra Watermakers**, it is mandatory to use products with a ***minimum burst pressure of 250 psi.*** If other types of pre-filter housings are used, they must be rated to at least 125 psi maximum working pressure.

Feed and Discharge Hoses

Route the 5/8" hose smoothly between the components. Use straight hose fittings and gentle turns in the hose where possible. ***Minimum hose bend radius is 6"***. Tightly secure hoses with tie wraps to avoid chafe.

High Pressure Tubes

Be sure to follow the Clark Pump and Plumbing Diagrams for proper connection between the Clark pump and the membrane housing. Membrane water flow direction is marked on the housing. ***Rotate*** the 90 deg. high pressure tube fittings on the Clark Pump for ideal tube runs. The high pressure tubes are usually made in place. Loosely route the tubes between the Clark pump and the membrane and cut long. Minimum tube bend radius is 6". ***Follow the tube connection instructions on page 40.*** Connect the tubes to one of the components, secure the tube runs, and then trim and connect to the other component. A 90 degree bend in a hose is better than a 90 degree fitting. A tube, when mounted, should have at least ***one gentle bend*** to allow for expansion. Do not connect a tube straight between hard mounted fittings.

If other than the Spectra supplied tube and fittings are used, they need to be at least 1/2" ID if hose, 1/2" OD if tube, with non-ferrous 1/2" high pressure fitting,s and have a working pressure of at least 2000 psi.

When connecting the tubes to the components, be sure to hold fitting body during the final tightening. ***See the High Pressure Tube Fitting Instructions on page 43.***

General Plumbing, cont.

Product Water Tubing

The product water lines are 1/4" plastic tubing. Minimum tube bend radius is 3." Connection can be made to either end of the membrane housing. ***Refer to the tube fitting assembly diagram on page 41. IMPORTANT: The product water flow should not be restricted in any way*. If the line gets blocked, the pressure will build until the line fails. Restricting the flow will reduce efficiency and may cause damage to the membrane. Adding manifolds to the product line that could inadvertently stop the flow is prohibited and will void the warranty. If more that one tank has to be filled, use more of the Spectra *product* service valves. Do not substitute.**

Connect to the water tank at or near the top. The ideal spots are to tee into the tank fill hose or tap into the tank top or upper side. Do not feed into the bottom of the tank or a tank feed manifold no matter how much you might want to. Air can be pulled through the membrane and affect the domestic water system and pushing against head pressure will affect system performance.

Service Valves

Carefully study the function of the service valves before committing to a plumbing plan. It is easy to design a clean looking layout only to find out that it doesn't work. The stem of the tee shape is the common port so the valve will always introduce a 90 degree turn in the line. Try to mount the valves so that the run positions of the handles are the same, such as all vertical or all to the right. The service port 5/8" hoses can be attached to the service valves using hose barbs or brass garden hose couplings for easy removal and storage. The product service tube can be easily removed by unscrewing the plastic gland nut.

Fittings

Metal pipe fittings that are to thread into ***plastic*** should be coated with 3-4 wraps of Teflon tape. To avoid cracking the plastic, tighten until only 1/2 of the threads are buried. This may not seem tight, but they will not, and should not, bottom out like a metal to metal connection. If it leaks, take another turn. If it still leaks, remove and re-wrap, adding an extra wrap.

Metal to metal pipe connections should have 1-1/2 to 2 Teflon wraps only.

Plastic to plastic pipe connection should have 3-4 wraps of Teflon tape and be threaded almost all the way in.

Be very careful to avoid getting any tape over the end of the fitting that might get into the system. To insure this does not happen, leave the very first thread uncoated.

Component Placement

Refer to the Plumbing Diagrams on pages 37 and 38

Sea Water Strainer

Mount the sea water strainer between the intake thru-hull valve and the intake service valve in a protected, accessible and visible spot that is not above water sensitive equipment. Secure the upper section with the black plastic mount and tie provided. Allow a minimum of 1-1/2" space below for the strainer bowl removal. Mounting the strainer before the service valve will give better protection, for normal operation mounting it after the service valve will allow it to be flushed and pickled with the rest of the system. Note the direction of flow on the housing and mount to minimize hose lengths and bends.

Intake Service Valve (*Note: The intake(common) port is opposite the handle shaft)*

Install the 1/2" intake service valve between the strainer and the feed pump. Use the "U" clamps provided. It is ideal to have the intake, discharge and product service valves accessible from a single position. The extra hose runs that may be needed are worth it. The hose attached to the service port should reach a cleaning container that is positioned in a stable area that can handle water spillage. The lever will move 180°. Moving the lever to the center position half way between the run and service positions will close all the ports. The lever can be removed and repositioned if necessary as long as it will still have its 180° throw.

Feed Pump (*Note: Cooling fins can snap or slide off the motor for mounting access)*

Pull or slide off the cooling fins and mount the feed pump in a vertical position, pump head down, in a dry area and as far below the water line as practical to provide positive feed pressure. Snap the cooling fins back on after fastening. Do not mount over water sensitive equipment. The pump is self priming and can be mounted up to 4 feet above the water line, but keep it as low as possible. Note the direction of flow through the pump and mount to minimize hose lengths and bends. ***Use the feed pump mounting hole template taped into place, see page 47,*** to mark and drill for the fasteners. Avoid mounting the pump on large unsupported panels to help reduce noise. For quieter operation, do not mount the pump with the rubber feet, instead hang the pump by the hoses and secure the motor with large wire ties with a piece of foam underneath ***Do not mount the pump horizontally, priming problems can occur***. If the pump has to be mounted in a hot area, installing the optional cooling fan is recommended. To install the optional fan, slip the split plastic shroud over the cooling fins, with the split on the mount side, till the fan touches the end of the motor. Make sure the pump wiring is clear. Leave a minimum of 1"clearance above the cooling fan.

Dual Feed Pump System *(Spectra 380c)*

Mount the two fan cooled pumps in the same manner as specified in the last paragraph. Mounting the pumps close to each other allows for easier plumbing but is not necessary. The pumps are plumbed in parallel using the 5/8" tees supplied. Orient the tees so that if the feed to a pump is straight through the top if a tee, that the discharge goes into the stem of the tee and turning a right angle. The other pump will be opposite. This helps balance the flow through the pumps. ***Follow the Plumbing Diagram on page 38 for proper tee connections.***

Component Placement, cont.

Pre-filter

Refer to pre-filter plumbing on page 41. Use the bracket as a template for the mounting fasteners. The bracket can be mounted with the angle down by first mounting the bracket, then attaching the filter it to with the screws provided. Mount the pre-filter in an accessible location that can be reached with both hands, as the bowl can get tight. Wrenches designed for filter removal are available. 6" of clearance around the pre-filter are needed for the filter tool. Salt water will be spilled during servicing so do not mount the pre-filter above any sensitive equipment. Note the flow direction and mount to minimize hose lengths and bends, allowing room for the hose fittings and gentle hose bends. Allow 1-1/2" of space below the filter for housing removal. The feed pressure gauge tubing is attached to a tee before the pre-filter. The tee is usually hard plumbed directly to the pre-filter inlet but can be installed anywhere between the feed pump and the pre-filter.

Clark Pump

Refer to the the Clark Pump Mounting Diagram on page 42 to install the mounting brackets and shock mounts. Bolt the mounting brackets to the base of the center block with the short 5/16" SS bolts and washers, sandwiching the plastic washers in between the center block and the brackets. The brackets will over hang from the front and back of the center block. Moisten the rubber shock mounts and slip them into the bracket holes, then install the plastic inserts into the rubber mounts

The Clark Pump can be mounted on any horizontal surface that will support it's weight and is not subjected to excessive vibration. Height above or below the water line is unrestricted. Allow for easy access to the pressure relief valve for system servicing. Mounting on a vertical surface can be expedited by using the optional "L" bracket. For hanging from overhead, the rubber mounts can be used upside down. If necessary the Clark pump can be hard mounted, using the bolt pattern in the base, to mount in any position. Avoid mounting in the middle of a large unsupported flat surface that could amplify the sound of the pump "shift".

Allow room in the front and back for access to the high pressure tube and hose connections. If mounting up against a bulkhead, attach the high pressure tubes before mounting. The 90 degree fittings supplied are acceptable for the feed and high pressure tube connections to the unit and can be rotated for easy tube runs. Straight fittings can also be used. The brine discharge hose connection to the reversing valve body should be straight if possible, and can be connected to either end of the reversing valve. Plug the unused port.

Make sure that the area around and under the pump does not have any water sensitive equipment. Water will be spilled during any repairs or if a leak occurs.

Use the Clark Pump mounting hole template, see page 47, to mark and drill for the fasteners. 1/4" bolts and Nylock nuts are preferred, but lag bolts are acceptable if they penetrate at least 1" into solid material. Drill pilot holes for lags bolts.

Caution: Tighten the fasteners until there is light pressure on the plastic inserts. The plastic inserts will collapse if over tightened. The 1/4" fender washer must be on top to prevent the mounting brackets from slipping out of the rubber mounts under adverse conditions.

Do not mount the Clark Pump in an area that is subject to sustained temperatures over 120 deg. F.

Component Placement, cont.

Membrane and Housing Assembly

Mount the membrane and housing assembly as close to the Clark Pump as possible, using the black plastic brackets and heavy duty black tie wraps provided. The plastic tie wraps allow the membrane housing to expand and contract with pressure changes without damage. The membrane housing is marked for water flow direction and can be mounted at an angle or vertical, but the ***brine outlet end should be up to help purge air***. If the Inlet and Outlet labels are lost, refer to the membrane housing assembly instructions to remove the membrane element and check for the brine lip-seal on one end of the membrane. The high pressure inlet and membrane brine seal go on the same end.

Route the high pressure tubing to and from the membrane housing as smoothly as possible. Avoid clamping the tubes tightly to any surfaces for sound dampening. "Hanging" the tubes away from a surface with wire ties so that they are neither tight nor completely loose is best.

The product water tube can be connected to either end of the membrane. Plug the unused 1/8" pipe product port.

Do not mount the membrane in an area that is subject to sustained temperatures over 120 deg. F.

Brine Discharge Service Valve

Mount the brine discharge service valve between the Clark Pump and discharge thru-hull, within reach of the other service valves if possible. Use the "U" clamps provided. The service hose should easily reach the cleaning container. The lever will move 180°. Moving the lever to the center position half way between the run and service positions will close all the ports. The lever can be removed and repositioned if necessary as long as it will still have its 180° throw.

Spectra Monitor Panel

Mount the panel vertically in an easily visible area that can be reached by the feed pressure and product water tubing. ***Use the Spectra Panel cut-out template, page 48,*** taped into position, to mark and drill for the fasteners and cut-out. Since keeping tabs on the system is vital for longevity, mount the panel where you will see it often. Make sure there is room behind the panel for the tube connections. If the mounting area is finished wood, tape the outside perimeter of the cutout and use a reverse tooth saw blade to prevent splintering.

Refer to the drawings on pages 37 and 45. The product water tube from the membrane is connected to the bottom of the flow meter. The top port is connected to the product service valve, and finally to a tee in the tank fill or a fitting tapped into the tank top or top side. The feed pressure gauge is connected to a tee in the line between the Clark Pump and the pre-filter. Use the 1/4" black tubing and fittings. If access to the back of the panel is limited, leave enough extra tubing to allow the connections to be made before the panel is secured. Route the tubes so they won't kink when the panel is pushed into place. Fasten with # 4 screws.

Component Placement, cont.

Product Water Service Valve

The 1/4" product water service valve can be placed anywhere between the Spectra Panel and the tank. The ideal location is within reach of the other service valves. Use the "U" clamps provided. The service line should be long enough to reach the cleaning container for servicing. The lever can move only 90°. Moving the product service valve lever to the center cannot close the ports. This feature is important! ***Do not substitute other valves for use in the product line.*** The lever can be removed and repositioned if necessary as long as it will still have its 90° throw.

Accumulator Tank

Refer to the plumbing diagram on page 34. The accumulator tank connects to a tee placed in the hose between the pre-filter and the Clark Pump. Mount in any position that allows access to the air valve. Do not place the tee before the pre-filter. Connect one port to the tee using the fittings supplied and the 5/8" feed hose. The other port is plugged.

Manual Fresh Water Flush System (optional)

The optional manual fresh water flush system uses a charcoal filter that is in the same type of housing as the micron pre-filter and the same type of service valve as the intake and brine service valves. They mount the same way. The flush service valve can be placed anywhere between the intake strainer and the feed pump but is usually mounted between the intake service valve and the feed pump. Mount is a convenient spot at it will be accessed often. ***See the Manual Fresh Water Flush Diagram on page 46.*** The fresh water is normally drawn from the tank in the same manner as the domestic water pressure pump. Water from the pressure side of the domestic system can be used but there is a higher chance of leaks.

Power Control Module (optional)

(For automatic salinity control with remote panel and optional automatic fresh water flush)

The power control module ideally should be mounted between the ships power panel and the feed pump(s). Mount in a dry area preferably on a vertical surface with the wires down. It can also be mounted horizontally. ***Refer to the wiring diagram on page 48*** for proper breaker and wire sizing. Do not scrimp on the wire size. Run all the wires through the hole in the bottom side leaving enough extra to make the connections to the electrical boards.

Remote Control Panel (optional)

The remote control panel is designed to fit just above or below the monitor panel but can be mounted anywhere that's dry and convenient. ***Use the cut-out template on page 48*** . The dotted lines show where the sides of the panel will be. If the mounting area is finished wood, tape the outside perimeter of the cutout and use a reverse tooth saw blade to prevent splintering. Run the multi-conductor cable through the panel cut out to the power control module. Connect the wires to the terminal strips on the power control module, matching colors. The cable may be shortened if desired. If access to the back of the panel is limited, leave a loop cable behind the panel for service access. Fold the extra cable back through the cut-out and secure the panel with # 4 screws.

Component Placement, cont.

Automatic Salinity Control Sensor and Diversion Valve (optional)

Follow the Salinity Control Plumbing diagram page 36. The sensors assembly and the diversion valve are usually mounted together as illustrated. They can be mounted separately but the sensor must be up stream of the diversion valve. The sensor assembly must be mounted with the sensor on the bottom so any trapped air will not affect the system. Mount the sensor and valve between the product service valve and the water tank. Plumb the reject port on the diversion valve to the small check valve and then to a tee in the brine discharge line between the brine discharge service valve and the brine thru-hull. **Do not have a shut off valve in the brine discharge line down stream of where the diverted product tees into that line. The diverted product water flow must not be blocked in any way.** The tee can be hard plumbed to the brine service valve or the thru-hull if desired. Do not mount the tee up stream of the brine discharge service valve or damage to the membrane and diversion valve ***will*** result. Orientation of the diversion valve is not critical and the ports are labeled. Follow the Installation Basics section and 1/4" tube connection instructions in this manual for proper pipe and tube connections. **Caution: Do not over tighten the pipe fittings to the solenoid valve or cracking may result!**

Follow the 380c with Salinity Control and flush Options Wiring Diagram on page 52 for proper wire connections. For 200c models, pump 2 and the fans are omitted.

Automatic Fresh Water Flush System (an option for the salinity control)

Follow the automatic flush plumbing diagram on page 40. The check valve must be mounted vertical with flow upwards to prevent the possibility of it sticking open and the solenoid valve must be plumbed down stream of the charcoal filter to prevent salt water contamination of the filter element. The components can be mounted separately if desired. The system is usually teed into the intake hose between the intake service valve and the feed pump. Use tie mounts and wire ties to fasten to a vertical surface. ***Follow the 380c with salinity control and flush options wiring diagram on page 42 for proper wiring***. The flush time is factory set. After installation check if the timing is correct. Run the system normally then shut down. Make sure the ships pressure water system is on then activate the flush system and watch the feed pressure at the monitor panel. The feed pressure will drop and stabilize. The system should continue run for 30 to 90 seconds after the feed pressure stabilizes then turn itself off. To adjust, open the power control module and adjust the flush trim pot that is wired to the timer. Turn clockwise to increase flush duration, counter-clockwise to decrease.

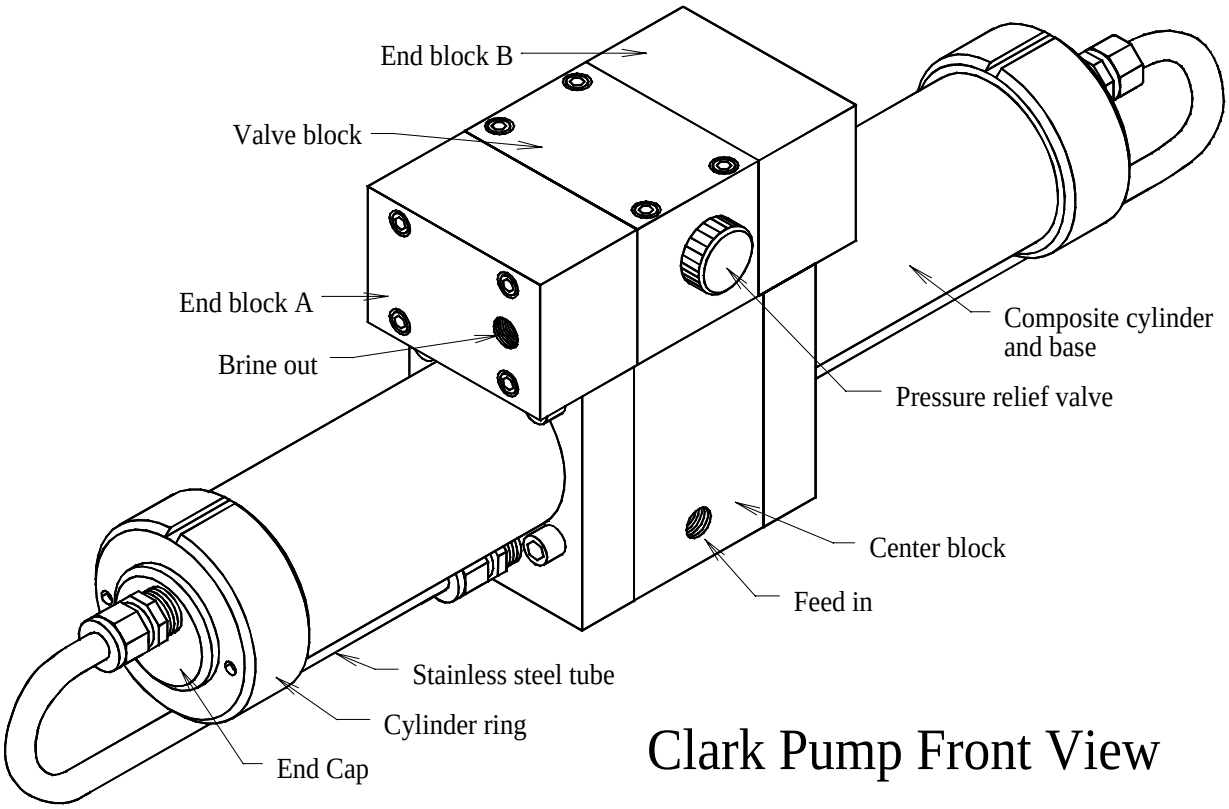
Service Valve Panel

Mount the service valves in the panel as shown in the directions that come with the panel. The panel is designed to mount hanging from the overhead, along a wall, or sticking up from a horizontal surface. After placement, label the valves with the stick-on labels provided. Use this option to place the service valves and the manual flush valve in a convenient location. Any extra hose runs are worth the effort to have the service valves easily accessible.

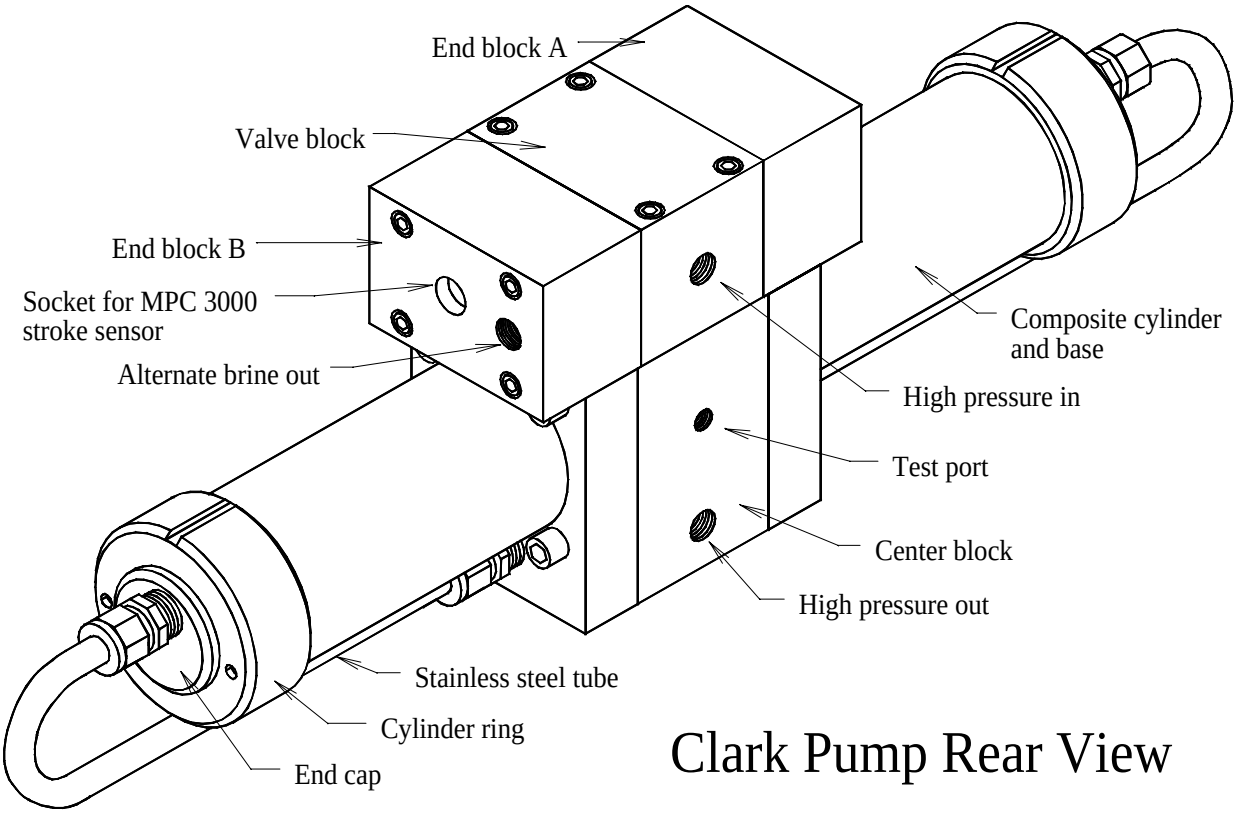
Component Placement cont.

Ultraviolet Sterilization Filter

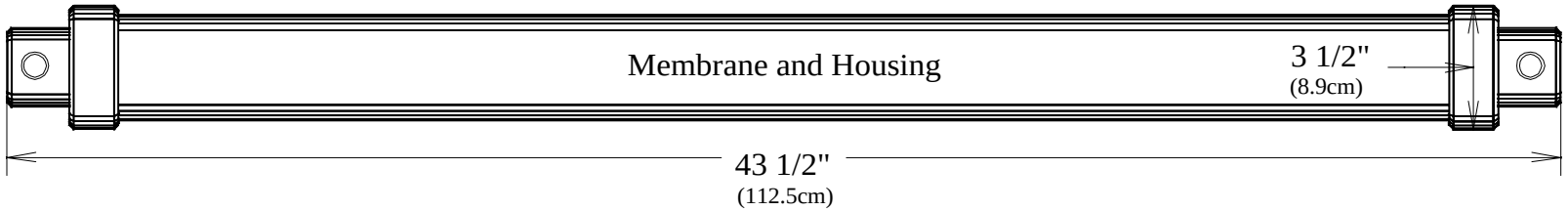
The “UV filter” is plumbed in the product tube going to the water tank, typically after the service and diversion valves but can go anywhere between the membrane and the water tank. The unit is designed for the Spectra’s product flow only. Do not place it in the vessel’s domestic water system. Do not install a valve in the product system that could cause the product flow to be inadvertently blocked. High pressure damage could result to the UV filter and the product tubing. Follow the mounting and service instructions that are supplied with the unit.



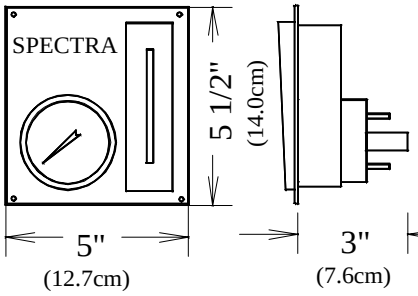
Clark Pump Front View



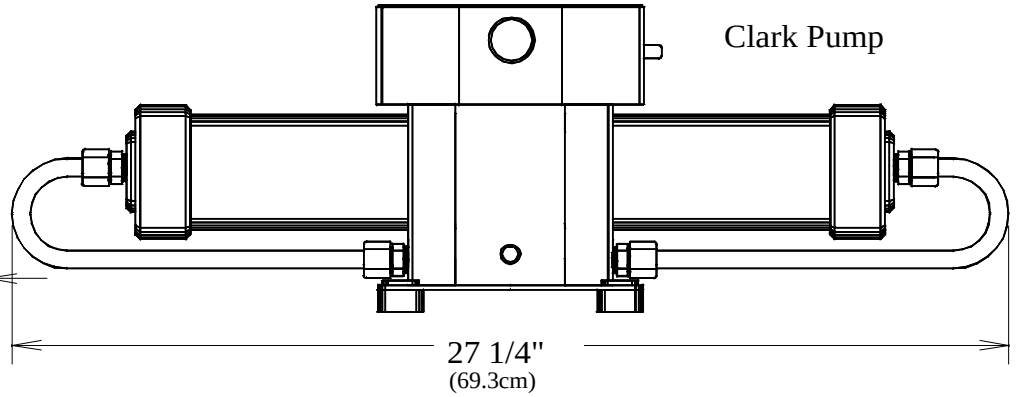
Clark Pump Rear View

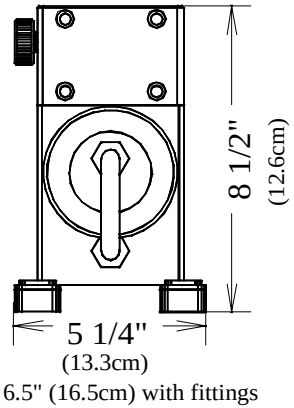


Remote panel

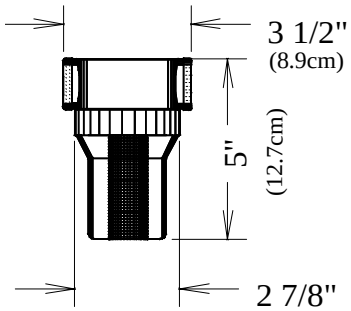


Clark Pump



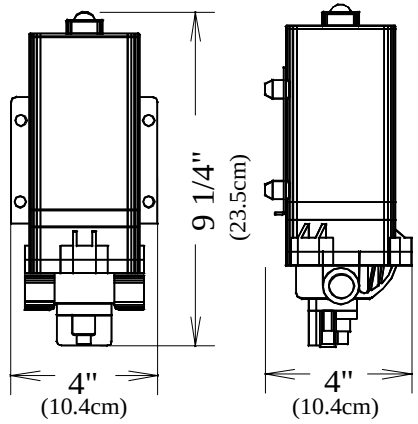


Sea strainer

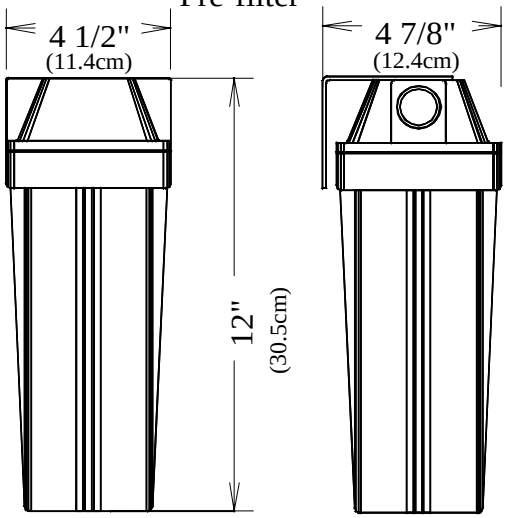


Feed pump

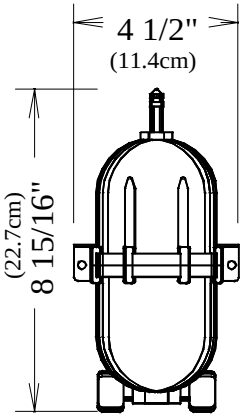
Add 1" (2.54cm) in length for cooling fan



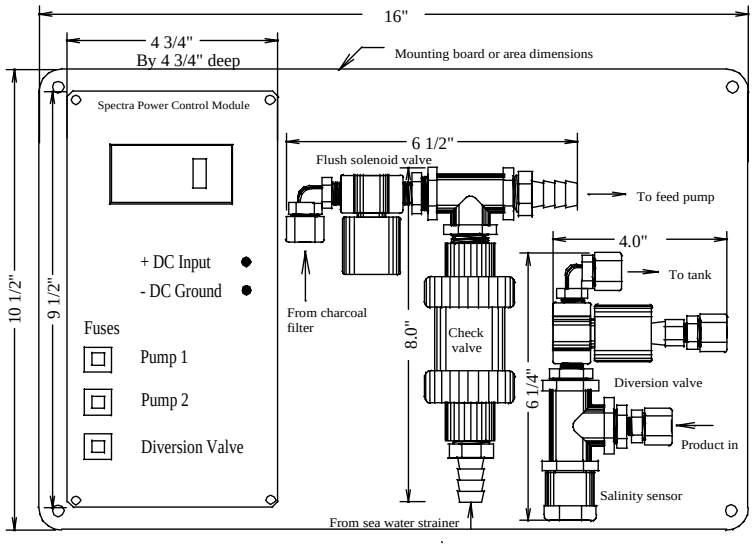
Pre-filter



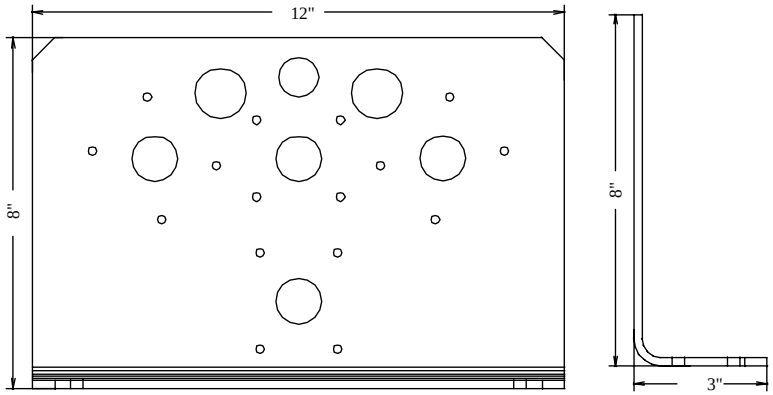
Accumulator tank



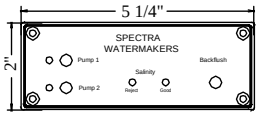
Spectra Components Dimensions



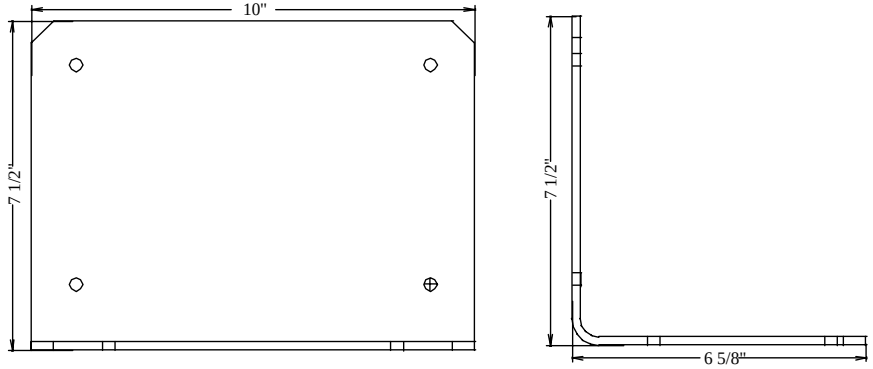
Power Control Module, Fresh Water Flush, and Salinity Control Diversion Valve with Sensor in a compact layout configuration



Valve Mounting Bracket

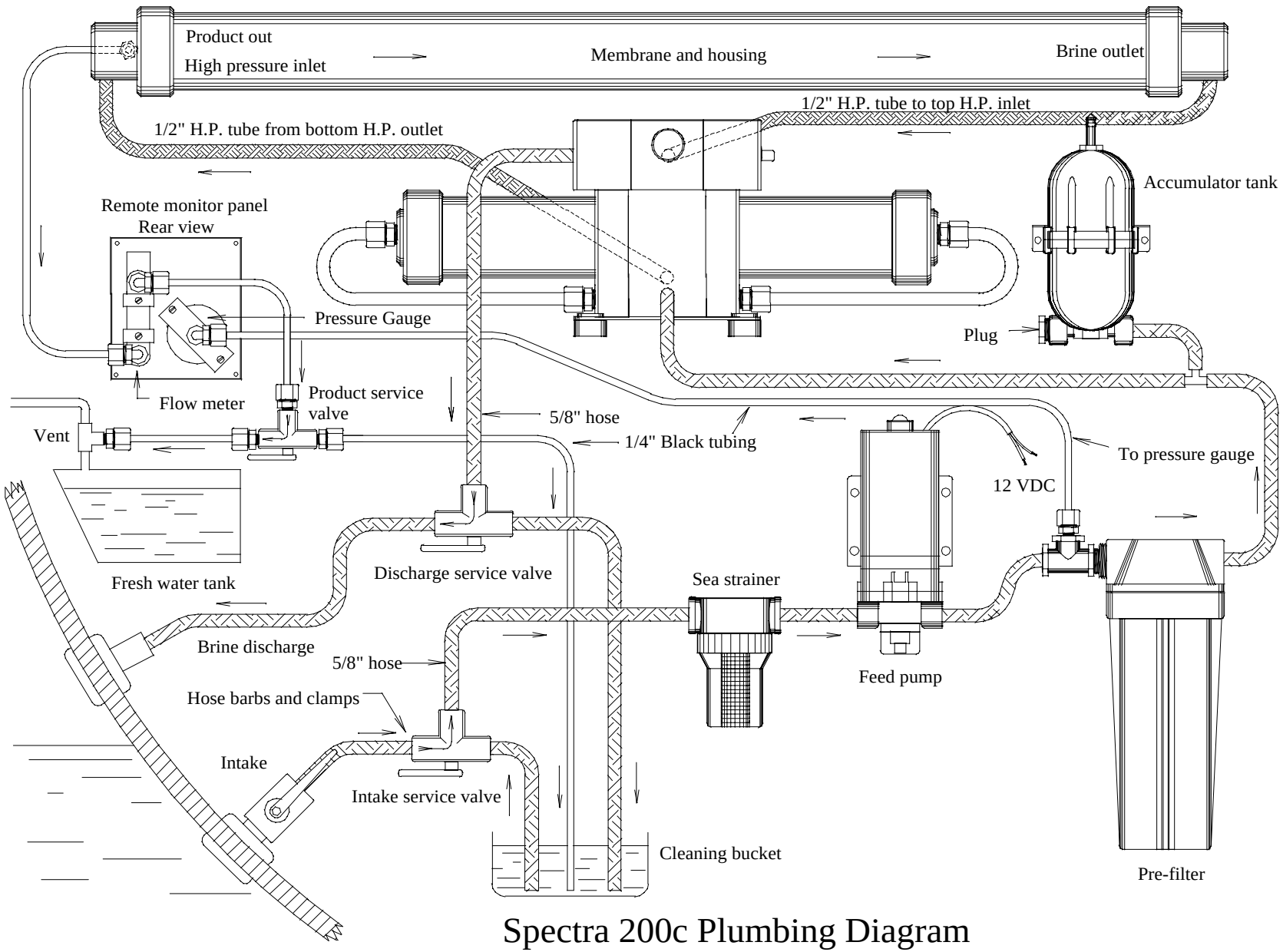


Remote Control Panel

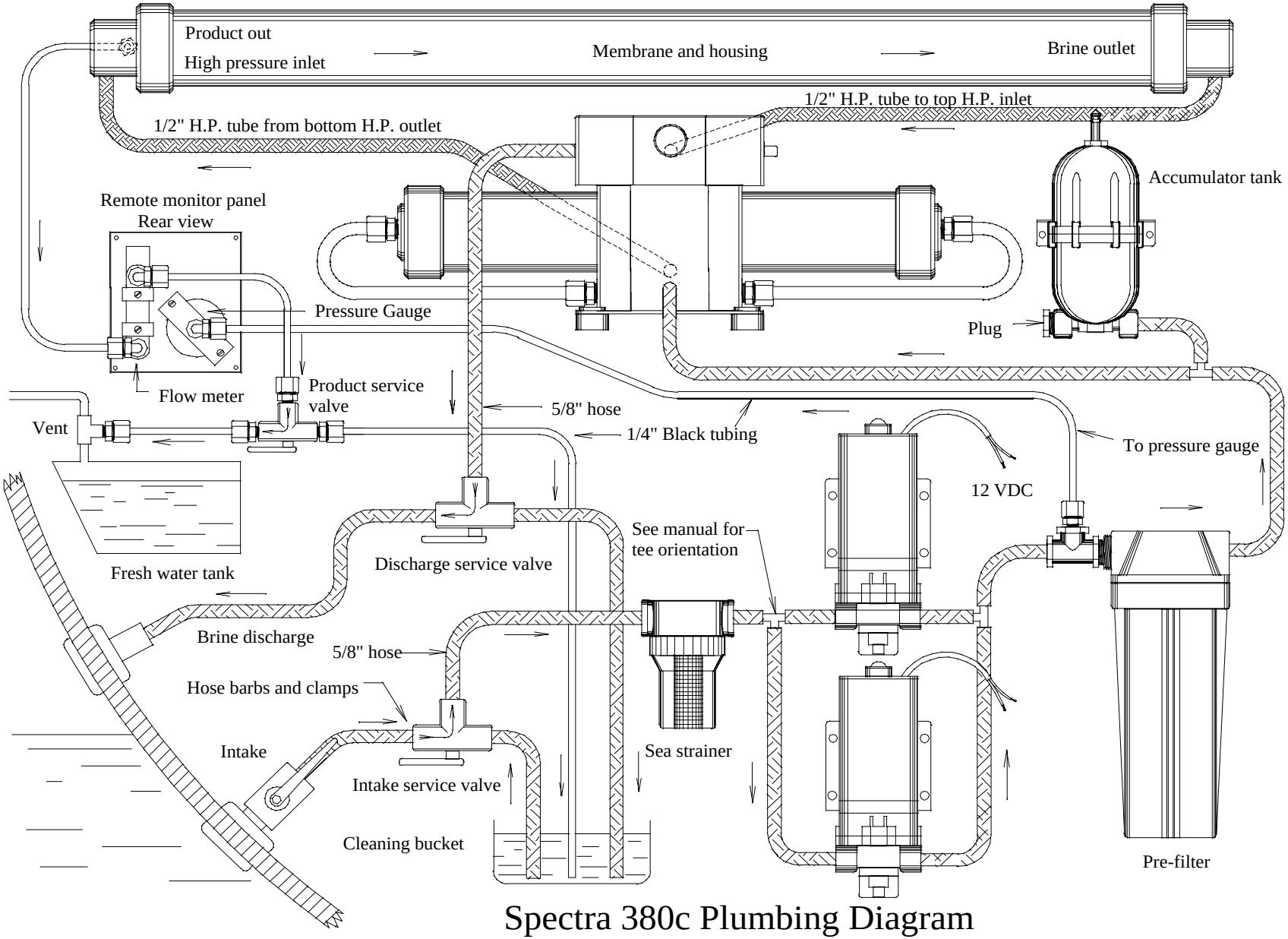


Clark Pump Bulkhead Mounting Bracket

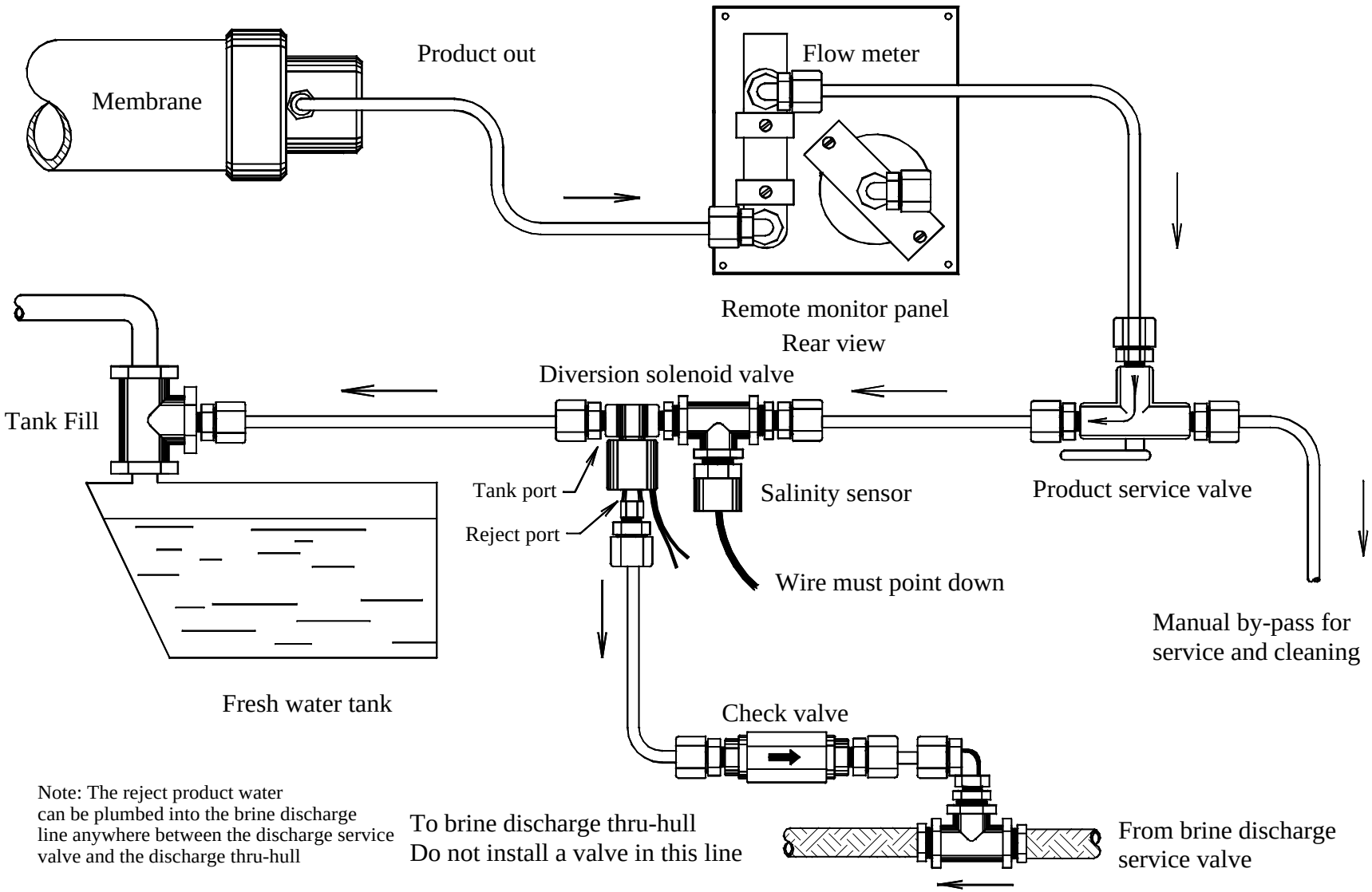
Optional Component Layout and Dimensions



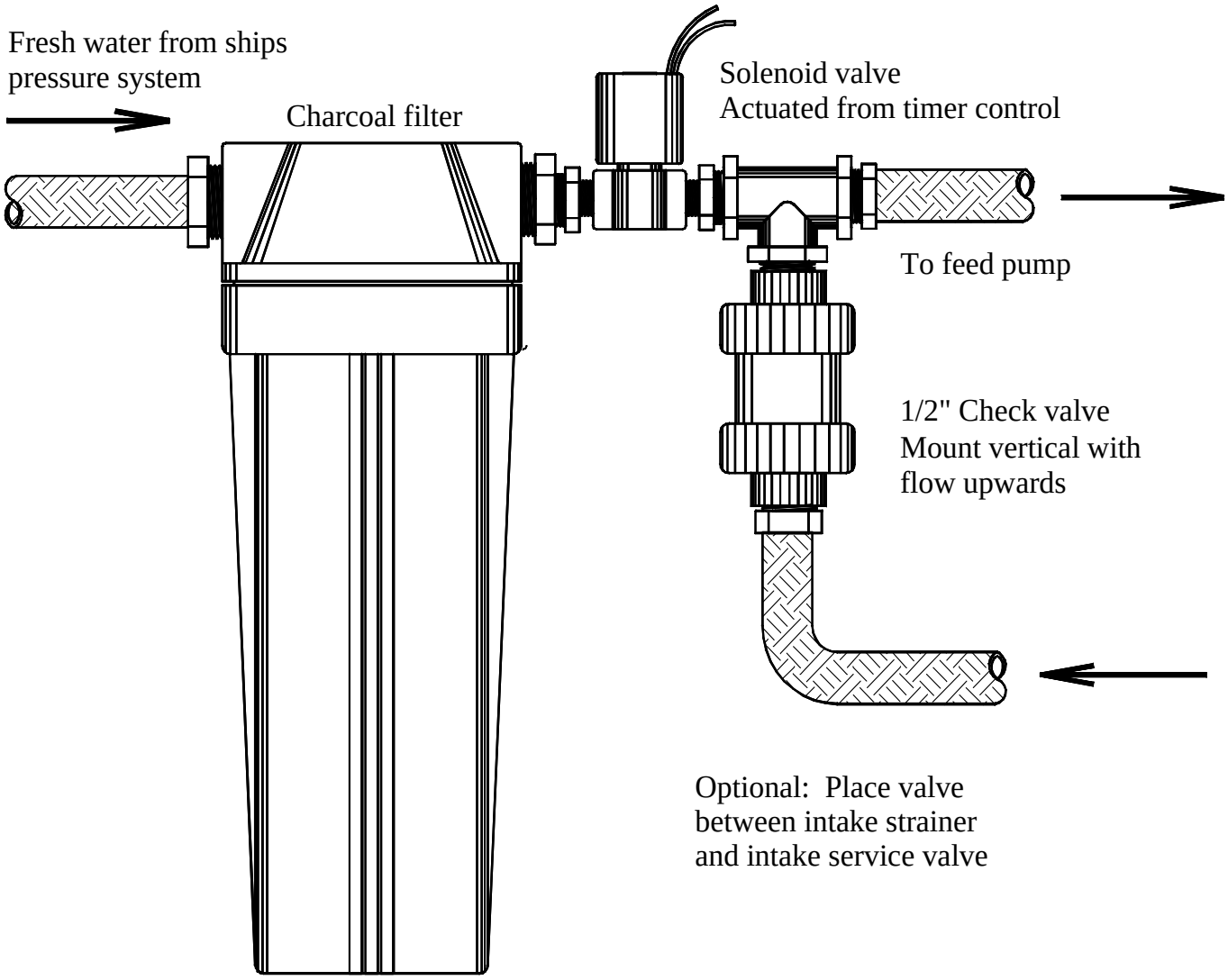
Spectra 200c Plumbing Diagram



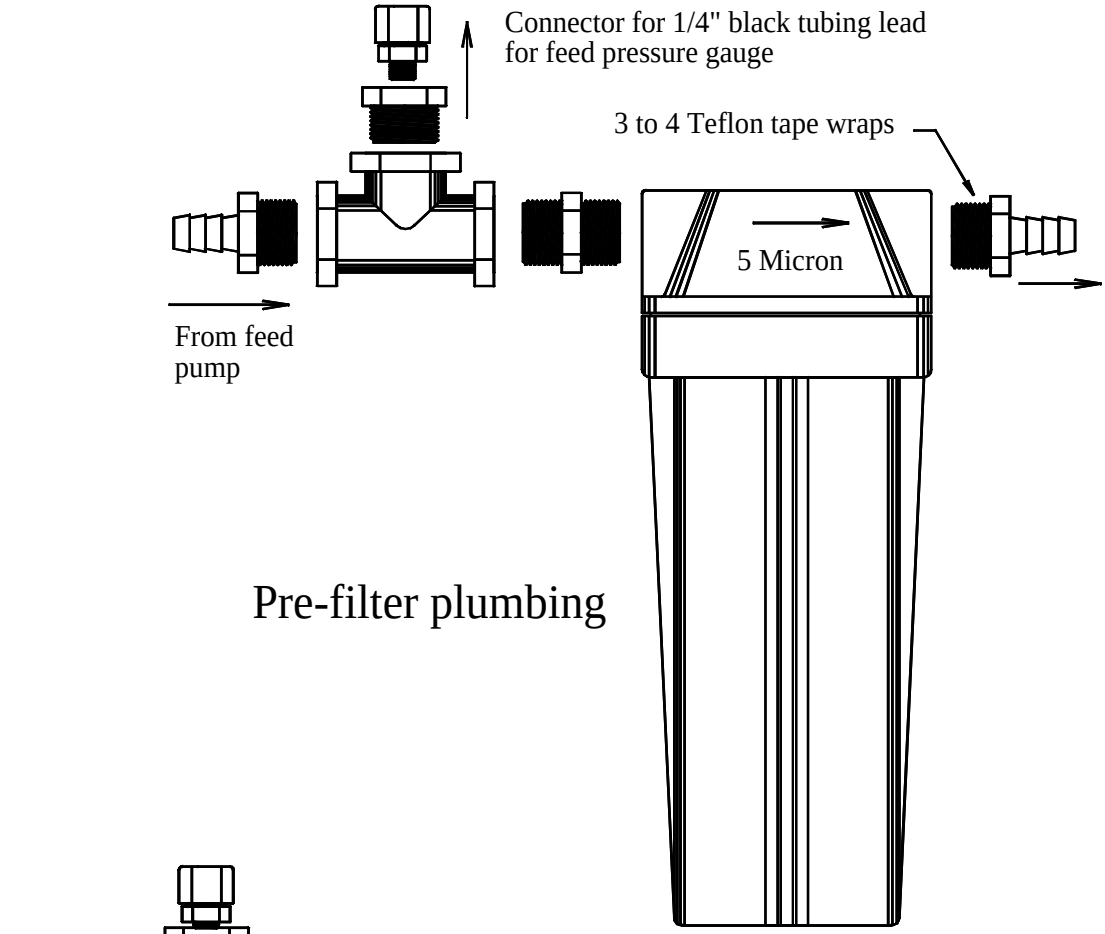
Spectra 380c Plumbing Diagram



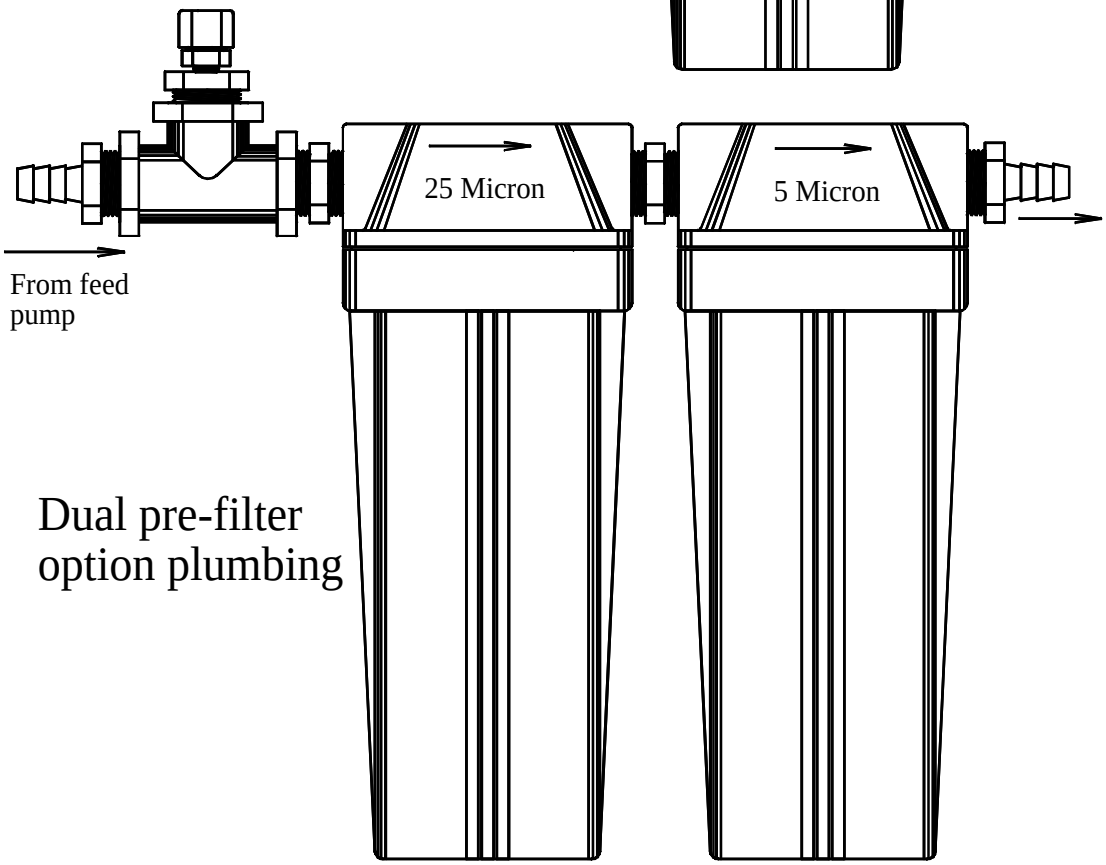
Spectra Salinity Sensor and Diversion Valve Plumbing



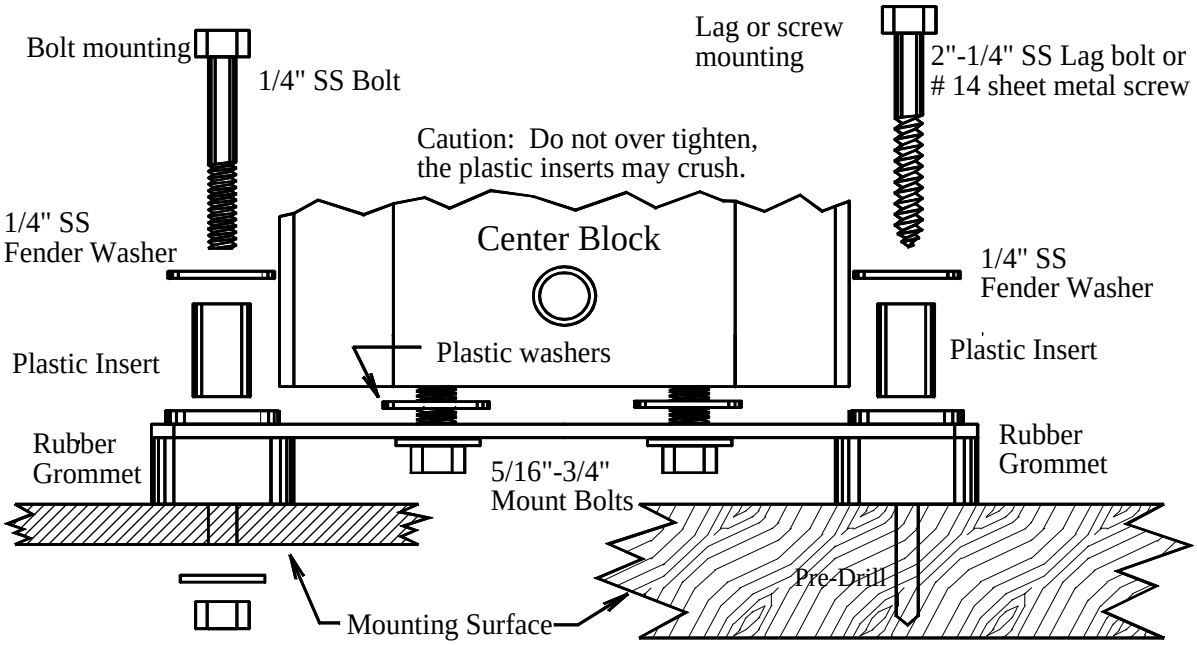
Spectra Automatic Fresh Water Flush Plumbing

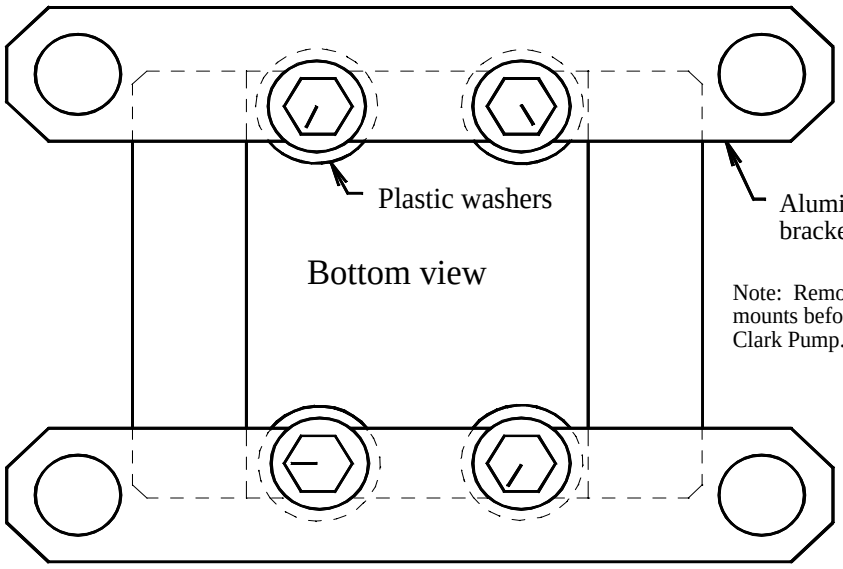


Pre-filter plumbing



Dual pre-filter
option plumbing





Clark Pump Mounting

Spectra High Pressure Tube Fitting Assembly

Carefully fit and measure the tubing before cutting with a sharp razor knife or hose cutter and remove any burrs. Minimum tubing bend radius is 6". Route tubing away from excessive heat sources and secure from vibration and chafe. Have at least one shallow bend in a tube assembly after it is installed.

Refer to figure 1. If a fitting has been dissembled, reassemble as illustrated. The notch on the ferrule must engage the inside of the nut properly for the nut to seat down fully. Once the tube is inserted, the ferrule and nut will naturally align.

Refer to figure 2. Insert tube fully into the fitting, it should go in 0.9". Tighten the nut finger tight while moving the tube around to prevent binding. One thread should be showing under the nut. Secure the tube so it won't back out when tightening.

Refer to figure 3. Use 13/16" wrench to hold a straight body fitting or a 3/4" wrench for a 90º body, and a 7/8" wrench for the nut. Hold the body, recheck the tube insertion, then tighten the nut 1-2/3 turns (10 flats) after a good finger tight. Use the index mark on the nut as a guide. The threads should be completely covered by the nut.

The tube connectors can be disconnected and re-tighten several times. To reconnect, insert the tube and ferrule into the body then hand tighten the nut. Hold the body and tighten the nut with a wrench a little past where resistance is encountered. When correct, the nut should be tightened a little past where it was before disassembly. Always check for leaks.

Figure 1.

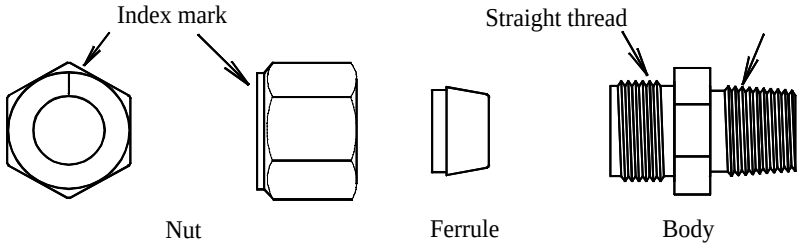


Figure 2.

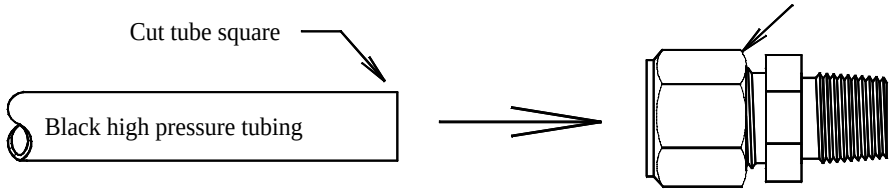
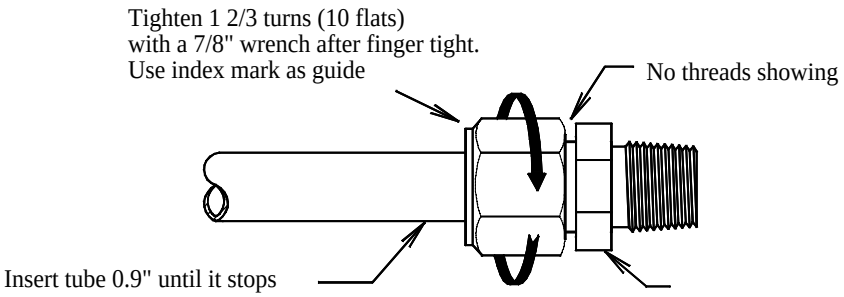
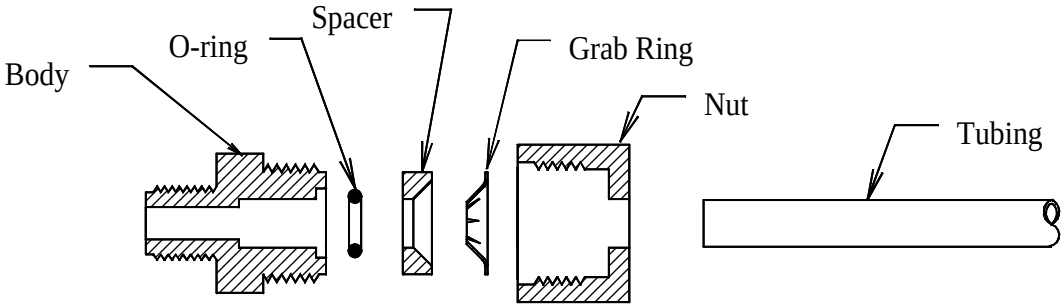
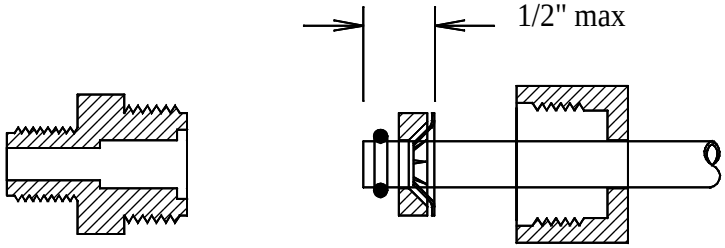


Figure 3.

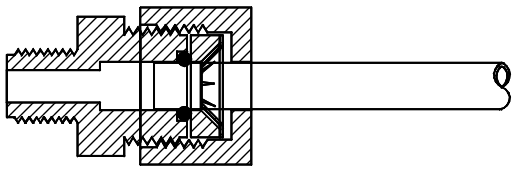




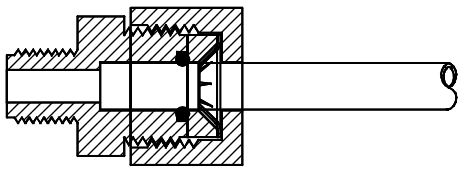
Step 1: Dissemble fitting components



Step 2: Install the Nut first then use the bevelled side of the Spacer to push the Grab Ring onto the tube no more than 1/2". Slip the O-ring over the tube to hold the Spacer in place. If the Grab Ring is pushed too far, trim back the tube so about 1/4" of tube extends past the O-ring.



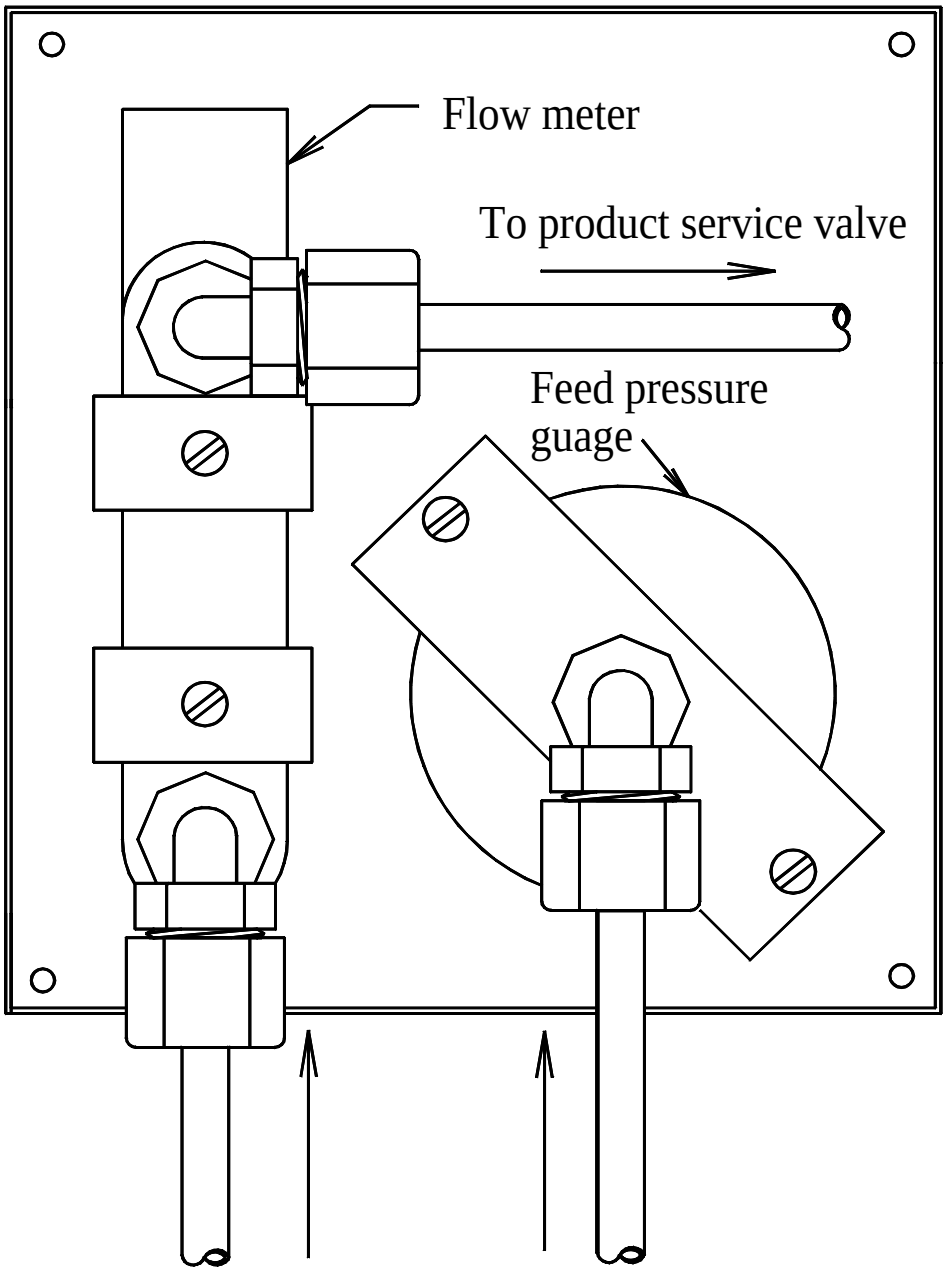
Step 3: Gently fit the tube into the body and loosely thread on the nut.



Step 4: Push the tube into the body until it bottoms out then hand tighten the nut. DO NOT OVER TIGHTEN!

1/4" Tube Fitting Assembly

Rear view

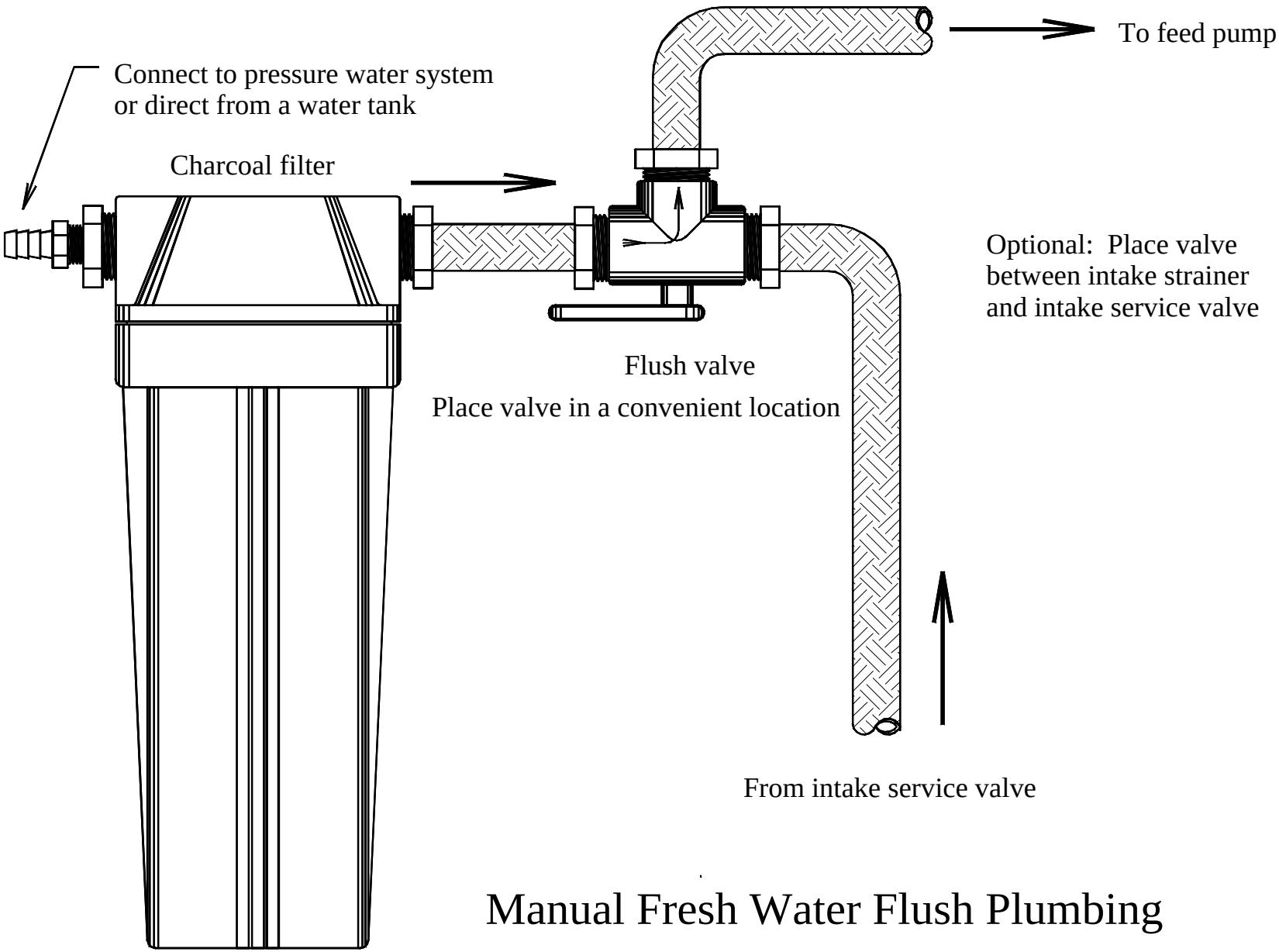


From membrane

From tee upstream
of all pre-filters

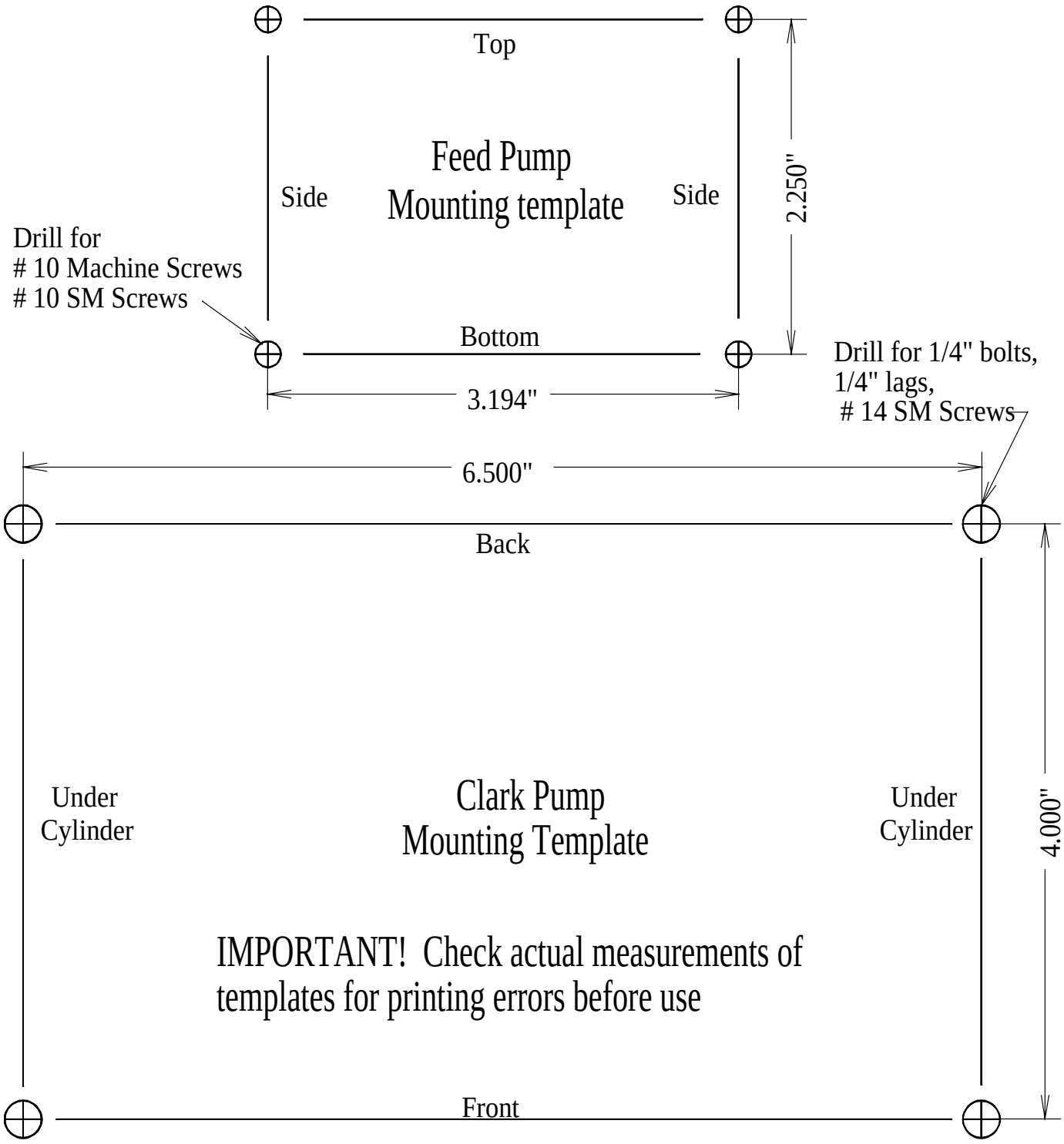
Use 1/4" black tubing and straight
or 90 deg. tube fittings

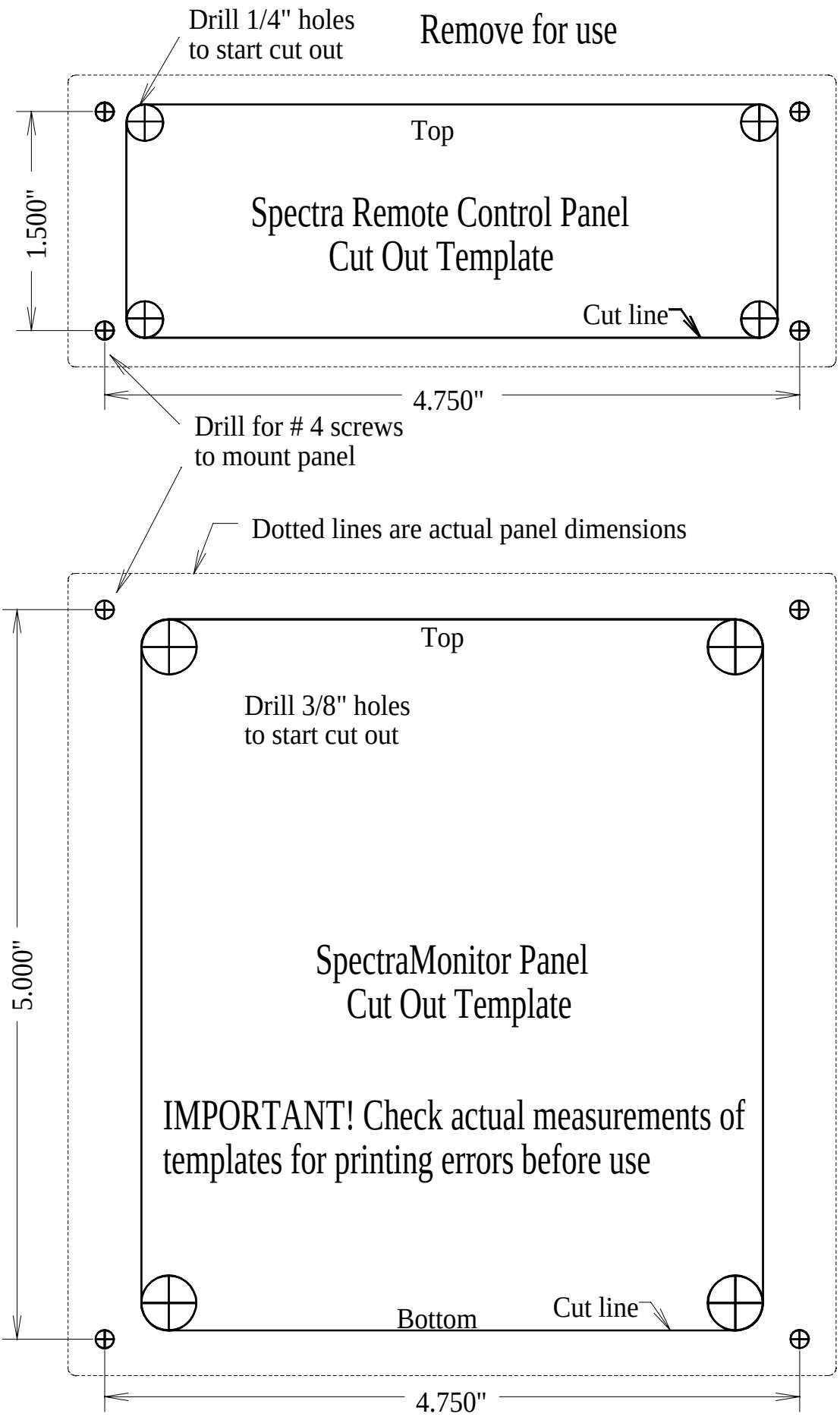
Monitor Panel Plumbing



Manual Fresh Water Flush Plumbing

REMOVE FOR USE




Drill 1/4" holes
to start cut out
Remove for use
Top
Spectra Remote Control Panel
Cut Out Template
Cut line
1.500"
4.750"
Drill for # 4 screws
to mount panel
Dotted lines are actual panel dimensions
Top
Drill 3/8" holes
to start cut out
SpectraMonitor Panel
Cut Out Template
IMPORTANT! Check actual measurements of
templates for printing errors before use
Bottom
Cut line
5.000"
4.750"

ELECTRICAL

See the wiring diagrams on the following pages.

A robust electrical connection is crucial to the proper operation of the system. Examine your electrical system carefully to determine the proper place from which to draw power. If power will be drawn from a breaker(s) on the main distribution panel, make sure the panel has at least #8 gauge wire for panel positive feed *and* ground. Check all connections for tightness, including the ground buss. ***Refer to the wiring diagrams on pages 50, 51, & 52 .***

If the panel is inadequate or too far away, a direct connection to a battery is advisable. An in-line fuse (15 amp-slow blow) next to the battery and a switch (15 amp minimum rating) will be necessary for each pump on standard 200c and 380c models. If the system has the Power Control Module-Remote Control Panel option, a 25 amp fuse is required. For 24 VDC systems use 7 amp breakers for the feed pump wiring and a 15 amp breaker for the Power Control Module.

For standard 12 VDC systems with individual pump wiring, use a 15 amp breaker and #10 gauge up to 10 feet, and #8 gauge up to 25 feet. A terminal strip mounted next to the feed pump can help connect the large wire to the #14 gauge wire from the pump. For 24 VDC systems use a 7 amp breaker and use #12 gauge to 10 feet and #10 gauge to 25 feet.

For systems with a Power Control Module, use a 25 amp breaker and #8 gauge to 10 feet, and #6 gauge to 25 feet from the power source to the module and follow the individual pump wiring directions in the last paragraph for the feed pump wiring from the Power Control Module. For 24 VDC systems use a 15 amp breaker and use #10 gauge up to 10 feet and #8 up to 25 feet.

Use marine grade insulated double-crimp connectors that match the wire gauge. Size ring terminals to the size of the fasteners. Crimp the connectors with a crimper designed for insulated connectors using *both* hands as hard as you can for the main crimp, and a little easier for the insulation crimp. Pull on the connector to test the strength of the crimp, you should not be able to pull it off. If butt connectors are used to connect #10 gauge wire to #14 gauge wire, strip twice the amount of insulation from the small wire, then fold the bare wire back on itself before inserting into the connector. Solder and heat shrink all connections where possible. Remember to slip the heat shrink onto the wires before connecting.

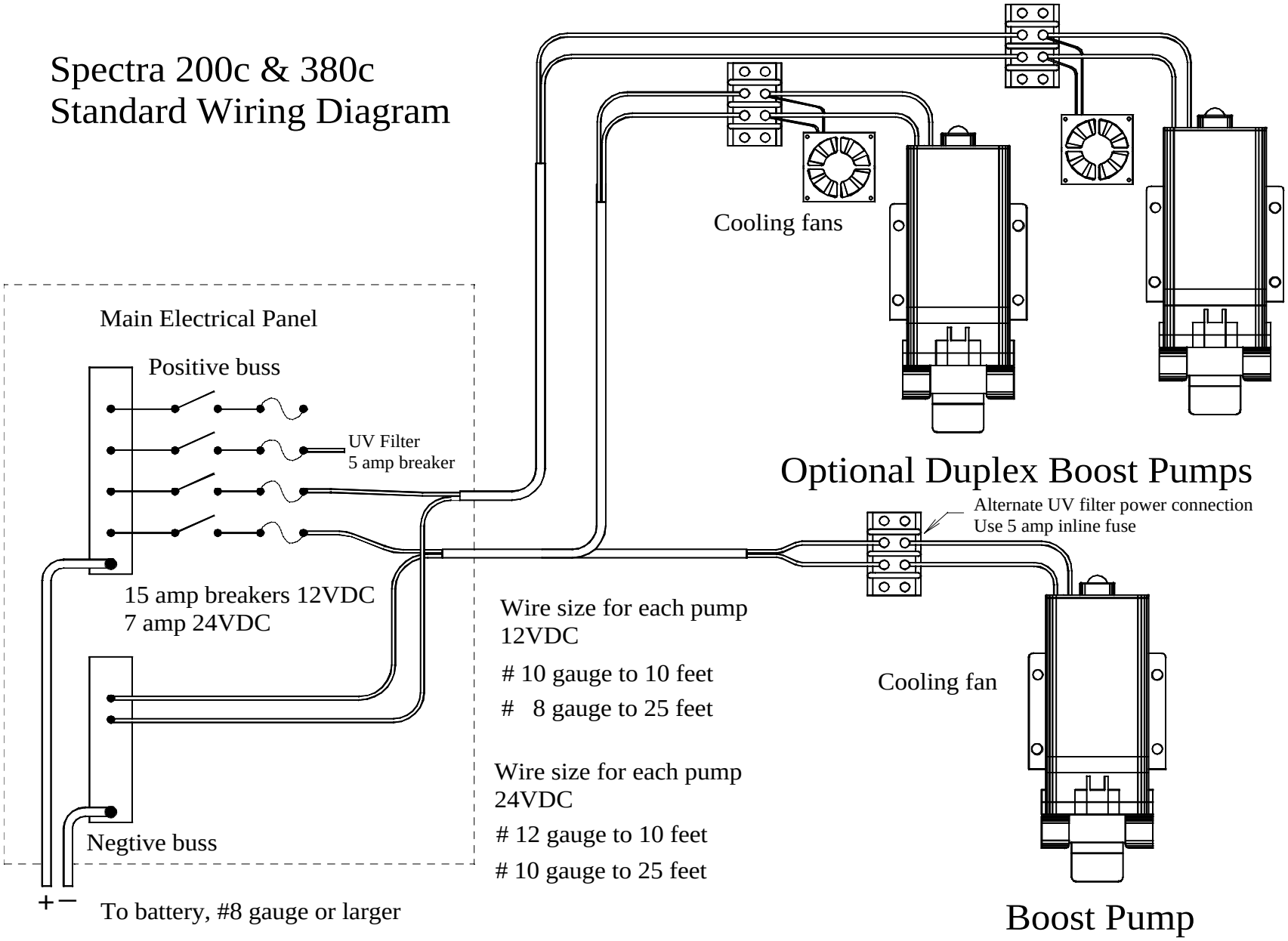
If the optional cooling fan is used, or in the Spectra 380c, insert the fan wires in the connectors along with the pump wires, positive with positive, negative with negative.

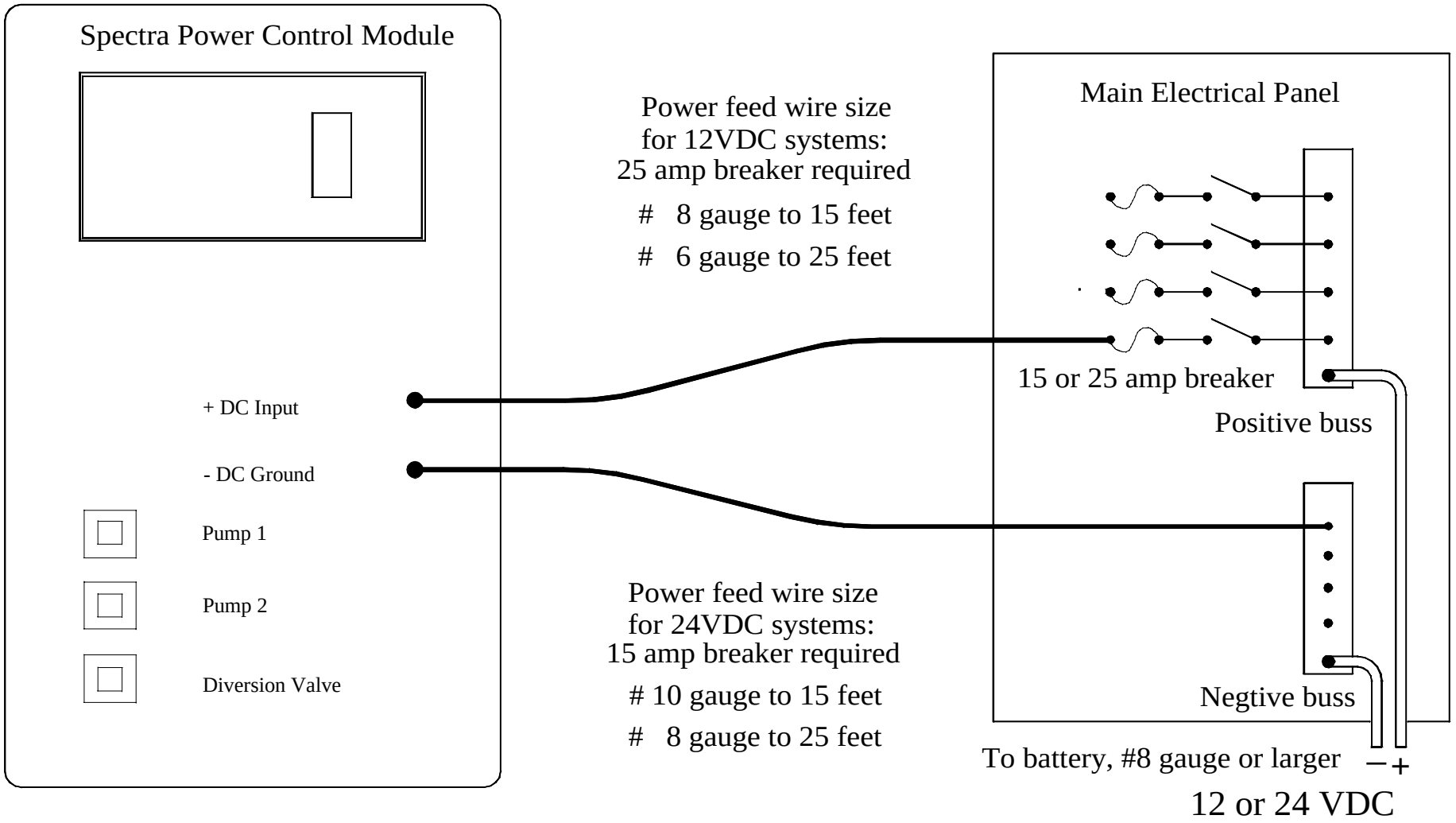
An optional UV filter is typically powered by it’s own switched 5 amp circuit so it can be used only when desired but can be wired directly with one of the feed pumps. If wired direct to a feed pump, it will only be operational when that pump is running. Use #16 gauge wire.

Follow the pattern of the original factory wiring when adding a new circuit. When adding a new wire to an existing wire bundle, remove all the old tie wraps where possible, run the new wire, then tie at even intervals. This will result in a clean and "original" look.

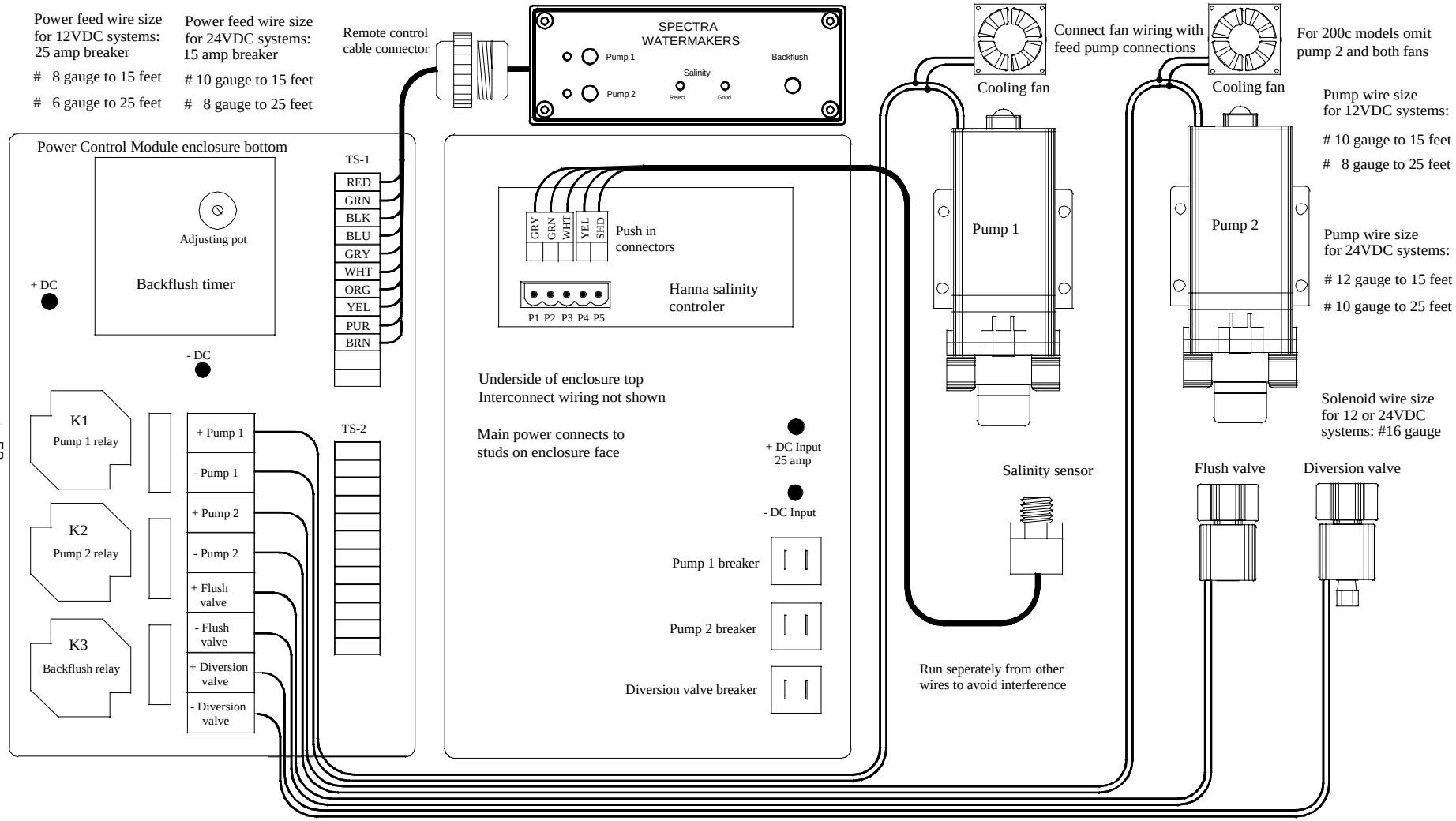
LIMITED WARRANTY

Spectra 200c & 380c
Standard Wiring Diagram





Power Control Module Wiring Diagram



Automatic Salinity Control and Auto Fresh Water Flush Wiring Diagram

Troubleshooting Guide-Basic System

Symptom:	Cause:	Remedy:
Feed pump start but shuts down on high pressure. (over 100 psi)	A. Pre-filters excessively clogged B. Brine service valve in mid (off) position C. Clark pump stalled	A. Service pre-filters B. Open brine service valve C. Press reset button
Pump(s) do not run and no feed pressure	A. Tripped breaker, blown fuse, or bad connection B. Bad pump motor	A. Check voltage at motor then search back B. Replace
Feed pump runs but no fresh water flow	A. Thru-hull closed B. Pressure relief valve open C. Pump air-locked	A. Check system, then open thru-hull B. Close relief valve C. Open relief valve to purge air, then close
Lower water production, high amp draw, high feed pressure, pump cycles	A. Pre-filter clogged B. Very cold water	A. Service pre-filters B. Use one pump (380c)
Low water production, low amp draw, low feed pressure	A. Low voltage at feed pump(s) under load B. Relief valve partially open C. Leak in high pressure hoses or fittings D. Debris in feed pump check valves E. Internal leakage in the Clark Pump	A. Check battery and wiring B. Tighten hand tight only C. Tighten or replace fitting and/or hose D. Disassemble pump head and clean E. See Clark Pump Repair Manual
Water production normal, feed pressure high, high amp draw	A. Cold sea water temperature B. Membrane starting to foul C. Pre-filters starting to clog	A. Normal operation B. Clean membrane C. Service pre-filters
Water production normal, feed pressure low, amp draw low	A. Warm sea water temperature B. Brackish water	A. Normal operation B. Normal operation
Water production high, poor water quality	A. Seal failure inside membrane housing B. Membrane failure	A. Disassemble and check for bad seals B. Replace membrane
Asymmetrical pressure and flow readings between shifts or no pressure and flow generated	A. Reversing valve seal leaking B. Shaft seal leaking C. Pin seal leaking D. Check valve leaking	A. See Clark Pump Repair Manual

Troubleshooting Guide - Auto Salinity Control System W/ Remote Panel: REV 7/00

Symptom:	Cause:	Remedy:
No pump action, no LED's activate.	A. No power to control box.	A. Check supply circuit breaker / fuse / wiring.
	B. Disconnected remote control Wiring harness.	B. Check 10-pin remote panel plug for damage or corrosion. Also check remote panel connections at 10-pin terminal strip inside control box, and at rear of control panel.
Pump 1 / 2 LED's activate, but no pumping action.	A. Tripped breaker on control box, or defective K1 / K2 relay.	A. Reset breaker, or try switching K3 relay into K1 / K2 position. If pumps then operate, replace defective relay[s].
	B. Loose / broken wire between control box and pumps.	B. Check for voltage at each feed pump. Should be within 1/2 volt of the input voltage at control box.
Reject LED stays on, diversion valve stays in reject mode.	A. Tripped breaker on control box, or defective K3 relay.	A. Replace fuse, or try switching K1 relay into K3 position. If diversion valve then operates, replace defective relay.
	B. Salinity sensor control out of calibration	B. Run system in normal mode for at least 15 min, check product water salinity with a recently calibrated hand held tester. If PPM on hand held tester is over 800 PPM, then control is OK; call for assistance with testing the rest of the system. **See below to calibrate control.**
'Good' & 'Reject' LED's do not light, diversion valve stays in reject mode.	A. Blown mini glass fuse on circuit board for salinity sensor control.	A. Replace with 1 amp mini glass fuse or equivalent.

Troubleshooting Guide – Continued:

Symptom:	Cause:	Remedy:
Pump 1 / Pump 2 LED's stay on, One or both pumps cycle on / off, Erratic operation of 'good' & 'reject' LED's	A. One or both pumps pressure switches out of adjustment, causing pumps to short cycle B. System fault	A. Refer to "New system startup" section of operation and installation manual for proper pump switch adjustment procedure. B. See Troubleshoot Basic System
No flush operation *'pump 1' & 'good' LED come on.*	A. No fresh water available	A. Turn on ships' fresh water pump, verify that water pressure is available.
	B. Clogged flush charcoal Filter element.	B. Replace charcoal filter element.
	C. Defective flush solenoid	C. Disconnect hose from solenoid valve, and activate flush switch, if no water flows, then replace solenoid valve.
	D. Loose / broken wire between control box and solenoid.	D. Check wiring connections between control box and solenoid valve. Check for voltage at solenoid during flush cycle.
	E. Low voltage to control box.	E. Control box must have at least 12.5 [24.9] volts in order to open valve under pressure.
No flush operation *'pump 1' or 'good' LED do not come on.*	A. No power to control box	A. Check supply circuit breaker / fuse / wiring.
	B. Blown F4 on relay board	B. Unsolder & replace F4 with 3 amp, slow blow Fuse. [any similar fuse may be substituted]
More [or less] flush cycle time desired	A. Adjust timer [orange cube].	A. Adjust small screw on blue potentiometer CW for more time, or CCW for less time.

***NOTE: On Gulfstream 400 models, step #C above will not apply, consult factory for flush testing procedure.**

NOTES:

1. When ordering replacement parts, or calling for assistance with the salinity control system, we need to know the **system voltage** and the **serial number** on the bottom of the control box.
2. Be sure to carefully test all components before ordering replacement items, electrical parts are NOT returnable.

The automatic salinity control system must be periodically recalibrated to ensure proper operation. At a minimum, the salinity probe pins must be periodically cleaned as described below to remove mineral deposits, scale, etc.

Calibrating salinity control: [Serial numbers 2000 – 5541] with internal adjustment knob]

1. The salinity sensor is the only device with just ONE wire connected. All other solenoids, etc, have TWO wires. Unplug the sensor wire from the control box and carefully remove the salinity sensor from the diversion tee [or manifold on Gulfstream 400 models] Be careful not to twist the sensor wire!
2. Trim away the plastic 'fins' around the probe pins, and clean the pins with fine sandpaper or a stainless steel wire brush. The pins must be bright and shiny clean for proper calibration.
3. Reconnect the sensor wire to the control box, turn on one feed pump, and insert the sensor into the package of 800 PPM calibration solution.
4 Turn the black shaft at the top of the salinity circuit board until the diversion valve & 'reject' LED just activate. Try this adjustment several times to be sure.
5. Reassemble the diversion tee [or manifold on Gulfstream 400 models] and sensor, and retest the system.

Calibrating salinity control system: [serial numbers 6000 – 6999] with digital readout on front of control box.

1. The salinity sensor is the only device with just ONE wire connected. All other solenoids, etc, have TWO wires. Unplug the sensor wire from the control box and carefully remove the salinity sensor from the diversion tee [or manifold on Gulfstream 400 models] Be careful not to twist the sensor wire!
2. Trim away the plastic 'fins' around the probe pins, and clean the pins with fine sandpaper or a stainless steel wire brush. The pins must be bright and shiny clean for proper calibration.
3. Reconnect the sensor to the control box, turn on the system, and insert the sensor into the package of 800 PPM calibration solution. Push the "meas" button to display the actual PPM at the sensor.
4. Use a thermometer to determine the approximate temperature of the sensor and calibrating solution. Refer to the temperature compensation chart on the package of the calibration solution, to determine the actual salinity value of the solution. For example, if the thermometer reads 80 degrees F, then the solution value is 832 PPM. If no thermometer is available, use the baseline value of 800 PPM.
5. Use a small screwdriver to turn the "cal" adjusting screw until the display reads the calibrating value determined in step #3.
6. Remove the sensor from the solution, display should read '000'.
7. Verify the reject set point by pressing the "set" button on the display readout. Value should be 500 PPM.
8. Reassemble the diversion tee [or manifold on Gulfstream 400 models] and sensor, and retest the system.

Spectra Watermakers warrants to the original purchaser that all components, except for the Clark Pump, are free from any defects in material and/or workmanship for a period of one year from the date of purchase.

Spectra Watermakers warrants to the original purchaser that the **Clark Pump** is free from any defects in material and/or workmanship with a limited life time warranty from the date of purchase.

If any such defect is discovered and reported within the warranty period, **Spectra Watermakers** will repair or replace the affected component free of charge, subject to verification of the defect or malfunction upon inspection at **Spectra Watermakers.** The customer is responsible for all costs incurred for removal, shipping to and from our facility, and reinstallation.

This warranty *does not* apply to malfunctions or physical damage resulting from abuse, neglect, accident, alteration, modification, feed pump substitution, submersion, shipping damage, hoses and fittings not supplied by **Spectra Watermakers**, improper membrane maintenance, oil and chlorine damage, use of sodium bisulfite or sodium metabisulfite, or improper installation**.** Consumables such as pre-filter elements are not covered.

Spectra Watermakers, under no circumstances, shall be liable for any consequential damages arising out of, or in any way connected with, the failure of the product to perform as set forth herein. This limited warranty is in lieu of any and all other expressed or implied warranties.

Spectra Watermakers reserves the right to make changes or improvements on its products without incurring the obligation to retrofit such changes or improvements on previously manufactured units.

If a possible warranty problem is detected, please contact one of our service representatives *before any disassembly* for assistance, and to receive a Return Authorization number if a component is to be returned for a warranty repair.

Proof of purchase, return address, and a Return Authorization number are required for all warranty repairs.

Ship to:

Spectra Watermakers

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E-mail: spectra@spectrawatermakers.com