



Horizontal Direct-Drive User Manual and Installation Guide



Congratulations on joining an elite group of like-minded boat and yacht owners, who value their investment and have chosen the industry's most reliable and advanced marine reverse osmosis system available. A great deal of time and effort has been put into the design and manufacture of your new FCI Watermakers desalination system. Please take time to read this entire manual and familiarize yourself with its operation. It will benefit you by insuring long trouble-free operation.

Thank you for purchasing FCI Watermakers Reverse Osmosis System. Your choice of FCI Watermakers proves that quality, craftsmanship and performance do matter. The system you have chosen is of the highest quality, and it is the most advanced watermaker available today. Over 30 years of experience of engineering and extensive lab testing has gone into the design of your watermaker. In fact many industry standards are a result of innovations made by FCI Watermakers, including one-touch commands, multiple station operation, remote system control, touchscreen displays, and automated pressure control. Each component was chosen for its ability to withstand the marine environment and to provide a lifetime of trouble-free operation. Design considerations included noise, size, ease of use and simple maintenance. Its open-frame construction allows quick, easy inspections, and it aids in shipboard or land-based maintenance without having to move the system from its location.

The intent of this manual is to allow the operator to become familiar with each component of the reverse osmosis system. By understanding the function, importance, and normal operation of each watermaker module, the operator can readily diagnose minor problems. When such problems first arise, they usually require minor maintenance and the issue is easily corrected. However, if left unattended, a problem in one component may eventually affect the rest of the system and it could lead to further repairs.

FCI Watermakers systems use non-proprietary membranes that are readily available worldwide, and the systems are designed to be more tolerant of water conditions. Your vessel travels around the world and encounters water that varies in both salinity and particulate. FCI utilizes low RPM components that allow full-function operation in these conditions.

FCI has the most comprehensive warranty on the market. The Neptune⁺ system is covered for one year on all non-consumable parts. A copy of our warranty is included in this manual. Please read and familiarize yourself with it.

PREFACE

We are committed to customer service that exceeds your expectations. If at any time you have questions about what's covered in this manual, our hands-on technical support will never leave you adrift. This manual contains technical information and instructions for the installation, operation, maintenance, and troubleshooting of FCI Watermakers Desalination Systems. Anyone responsible for the installation, operation, and maintenance of a FCI Watermakers Desalination System must read and understand the contents of this manual, and comply with these instructions, guidelines and safety requirements at all times.

The term *system* will be used throughout this manual, and it generally refers to the FCI Watermakers System. Reading this manual in its entirety will familiarize you with the system and the operation of its components. By understanding the system in its entirety, one can readily operate and diagnose problems.

All references within this manual refers to other sections unless specifically defined. Graphics and illustrations are used for reference only and may not represent the actual part or arrangement of parts in a customized system.

ABOUT SAFETY NOTES

Safety issues requiring users attention are highlighted throughout this manual as follows:

WARNING:

Provides critical information in order to prevent the possibility of injuries and/or death.

CAUTION:

Provides important information to prevent the possibility of damaging the device or equipment.

NOTE:

Provides additional information to safely and properly operate the equipment.

NEW SYSTEM PERFORMANCE

Although each system has been fully tested prior to shipping, there will be a break-in period. During this period, approximately 48 hours, the pumps and membrane performance will change or settle. Small adjustments will need to be made to the high-pressure valve and the water quality and quantity will vary. For installations without APC, the high-pressure valve will need to be increased (turned clockwise) and the water quality produced will improve over this break-in period. For systems with APC, this adjustment will be automatic.

GLOSSARY OF TERMS

Following terms are helpful in becoming familiar with a FCI Watermakers Reverse Osmosis System.

BOUNDARY LAYER / CONCENTRATION POLARIZATION

When water permeates through the membrane, nearly all the salt is left behind in the brine channel. In any dynamic hydraulic system, the fluid adjacent to the wall of the vessel is moving relatively slow. Even though the main body of the stream is turbulent, a thin film adjacent to the wall (membrane) is laminar. This thin film is called the boundary layer.

If the feed water flow is insufficient, the salts are saturated at the boundary layer and can readily adhere to and pack into the R.O. membrane element surface. For this reason, it is important to maintain sufficient feed water flow through the R.O. membrane element and prevent concentration polarization.

BRINE VELOCITY

The brine velocity, or flow, over the membrane surface is very important to both product water quality and quantity. At low flows, concentration polarization occurs, causing the water quality to decline.

In addition to inferior product water quality, low brine flows can increase the precipitation of sparingly soluble salts. The salts will foul the R.O. membrane element surface (concentration polarization). If this occurs, the product water flux (production) will decline.

The feed pump integrated design provides a relatively smooth and continual flow of feed water across and through the R.O. membrane element.

COMPACTION

Some densification of the membrane structure may take place while operating at elevated pressures, above 1000 PSI. The change is known as compaction and is accompanied by a reduction in the water permeation rate.

When the R.O. membrane element is subjected to elevated pressures beyond 1000 PSI, the product water channel becomes squeezed, resulting in restriction and product water recovery reduction.

OSMOTIC PRESSURE

The transfer of the water from one side of the membrane to the other will continue until the head (pressure) is great enough to prevent any net transfer of the solvent (water) to the more concentrated (feed water) solution.

At equilibrium, the quantity of water passing in either direction is equal, and the head pressure is then defined as the "osmotic pressure" of the solution having that particular concentration of dissolved solids.

PRESSURE

The operating pressure has a direct effect on product water quality and quantity. Both factors will increase as the system pressure increases (within design limits).

The system must be operated at the lowest pressure required to achieve the designed product water flow rate. This parameter also minimizes compaction, which occurs faster at higher pressures and temperatures.

At low temperatures or high salinity feed water, the system will have to operate at higher than normal pressure to maintain the specified amount of product water flow. This is normal and is due to the design characteristics of the system.

SPIRAL-WOUND MEMBRANE

The spiral-wound membrane consists of multiple membrane envelopes, each formed by enclosing a channelized product-water carrying material between two large flat membrane sheets. The membrane envelope is sealed on three edges with a special adhesive and attached with the adhesive to a small diameter pipe.

A polypropylene screen is used to form the feed water channel between the membrane envelopes. A wrap is applied to the membrane element to maintain the cylindrical configuration. The center tube is also the permeate (product water) collecting channel. Several elements may be connected in series within single pressure vessel or multiple pressure vessels.

WATER TEMPERATURE EFFECT

The product water flow through the membrane is significantly affected by the water temperature. At any given pressure, this flow increases with increasing water temperature and is reduced at lower temperatures. The system pressure will need to be adjusted to maintain a precise amount of product water flow.

LIMITED WARRANTY

This policy will define, in detail, what is and is not covered under warranty. It will also define how to obtain warranty service and approval.

I. Filtration Concepts Incorporated, dba FCI Watermakers (“FCI”), warrants to the original purchaser (“Purchaser”) that new Water Purification Products, Pumps, and Related Accessories (“Product(s)”), if used in accordance with FCI’s published specifications and operating manuals and all applicable laws and regulations, will not fail due to defects in material or workmanship during the period of the earlier of (i) one year from Startup (defined below), or (ii) 18 months from shipment (“Warranty Period”). At FCI’s option, it will repair, replace, or refund the original purchase price for the defective Product. Any parts repaired or replaced under this Product warranty shall not extend the original Warranty Period for the Product and will not be warranted any longer than the original Warranty Period. Labor costs to repair or replace are not included in this warranty.

Replacement parts (outside the original sale of the Product) shall carry a separate warranty as set forth in Article VI below.

Products built to Purchaser’s own specifications (“Custom products”). Custom Product Warranty: All Custom products manufactured by FCI pursuant to the design and specifications provide by Purchaser are warranted for one year from the date of manufacture. FCI warrants only that the Custom product will be manufactured in accordance with the Purchaser’s specifications.

II. To commence the warranty process, the Purchaser must call FCI’s Customer Service Department (see IV.2. below) for a recommendation as to the closest Authorized Servicing Dealer (see IV.2. below). If the Purchaser has a prior relationship with an Authorized Servicing Dealer, the Purchaser may contact same directly. If the Purchaser contacts FCI’s Customer Service Department for an Authorized Servicing Dealer and FCI has no one located in that particular area on the list, FCI will authorize the use of a local service company and work with that local company to assist in any way possible.

III. Exclusions to the above warranty:

1. Product failures resulting from improper installation or use contrary to operating manuals and other Product instructions;
2. Product failures resulting from abuse, misuse, accident, fire, or submergence;
3. Products manufactured by a third party that are not included in the original Product;
4. Products which fail as a result of improper application or improper installation, including but not limited to hose clamps, fittings, flare nuts, quick disconnects;
5. Products damaged during loading or shipment;
6. Cosmetic damages that do not affect the use and function of the Products;
7. Pumps that have been run dry, are water damaged or have been allowed to freeze;
8. Pumps with cracked heads;

LIMITED WARRANTY (continued)

9. Pump seals and UV light bulbs;
10. Sea strainer elements and cartridge filter elements;
11. Damage due to sand and/or gravel in a multi-media filter;
12. Pump packing assemblies;
13. Pump valve assemblies;
14. Pump crankcase oil;
15. Gauge instrument calibration;
16. Fuses;
17. Valve seals and packings;
18. Exterior corrosion;
19. Membrane elements;
20. Water damage to logic boards;
21. Logic boards with blown MOV's (Power Surge) or mis-programmed displays;
22. Water damage to displays or remotes;
23. Failures due to improper winterization;
24. All other consumable parts not covered herein;
25. Product damage resulting from improper return packaging by Purchaser; or
26. Force Majeure as more specifically defined in Section 9 of the General Terms and Conditions.

IV. Additional Exclusions/Restrictions:

1. For issues regarding installation, assembly or Start-up of the Product, the installer maintains all liability for its work, and FCI disclaims all liability therefor. Purchaser shall defend, indemnify and release FCI from and against any claims arising from the installer's work. "Start-up" is when the OEM or Authorized Servicing Dealer ("installer") has put the Product into service as shown on the Warranty Card (as defined in Article V. #3 below).
2. The installer must be an OEM or "Authorized Servicing Dealer". A list of Authorized Servicing Dealers can be found at <https://fciwatermakers.com/dealer-map/> or by calling FCI's Customer Service Department Monday-Friday from 8:00 a.m. until 5:00 p.m. (MT) at (801) 906-8840. If Purchaser wishes to use an installer that is not found on the list, please call the telephone number above for prior authorization. FCI is not liable for work performed by an installer and Purchaser shall defend, indemnify and release FCI from and against any claims arising from such third-party work.
3. Warranty repairs shall be subject to the same restriction as found in IV. #2 above. If an OEM or Authorized Servicing Dealer is not used for warranty repairs and/or installation, the warranty shall be voided.

LIMITED WARRANTY (continued)

4. Except as provided in IV. #5 below, labor costs and expenses for warranty repairs are excluded.
 5. If Purchaser, at its own cost and liability, packages and ships the defective Product to FCI for repair, FCI will repair the Product (or component) in its facility at its own expense (including labor) if found to be defective.
 6. If the Product is replaced under this warranty, all costs of uninstallation of the warranted Product and reinstallation of the new Product are excluded.
 7. In the case of a refund, the Purchaser must package and ship the Product back to FCI at its own cost and liability. If found to be defective, a refund will be issued.
 8. If the Product is uninstalled and reinstalled by Purchaser or its agent to another location, the warranty shall be voided.
 9. Purchaser (or its agents) shall be responsible for the cost to make the Product accessible for warranty repair.
 10. Products are not intended for use in connection with any nuclear facility or activity and FCI disclaims all liability for nuclear damage, injury, or contamination. Purchaser shall indemnify, defend, and hold FCI, its officers, directors, agents, employees, successors, assigns harmless from and against any and all damages or expenses of whatever nature (including attorney's fees and costs) which may be incurred arising from such use.
 11. If Purchaser or an installer purchases replacement parts to perform warranty repairs, unless FCI finds the returned part to be defective, FCI will not credit such purchase of a new part. Instead, FCI encourages Buyer to send the part in question to FCI's facility for evaluation of the alleged defect prior to purchasing a new part.
- V. Additional required conditions to warranty effectiveness:
1. FCI WARRANTIES ARE EFFECTIVE UPON PAYMENT IN FULL, AND FCI IS NOT OBLIGATED TO HONOR ANY WARRANTY OR PROVIDE ANY SERVICE UNTIL FCI RECEIVES PAYMENT IN FULL.
 2. Proof of purchase or proof of installation date may be required to verify warranty coverage.
 3. Purchaser must submit the "Warranty Card" at the time of Start-up through the portal found at <https://fciwatermakers.com/register-your-product/>. If Buyer fails to submit the Warranty Card upon Start-up, the Warranty Period for the purchased Product shall be limited to one year from shipment. All other terms and conditions herein shall apply.
 4. All products manufactured by FCI are based on a set criterion for performance based on feed water conditions. These parameters can be found on the product data sheet(s) ("PDS") for each product. Please refer to the applicable PDS for additional warranties, exclusions and terms and conditions. Variations from these parameters will affect system performance and in some cases damage system components. FCI is not responsible for feed water quality or changes in the feed water over time or the resulting system performance due to feed water being unbalanced or containing contaminants or biological elements. In these circumstances, the warranty will be void.

LIMITED WARRANTY (continued)

In cases when FCI's Application Questionnaire is completed by Purchaser, FCI assumes no liability for the accuracy of the data submitted by Purchaser or subsequent recommendations based on the submittal. If Purchaser's responses are inaccurate or incomplete, the warranty shall be void. If the feed water conditions change, the warranty will be void. If Purchaser does not return the Application Questionnaire and the product fails due to improper feed water conditions for the model purchased, the warranty will be void.

VI. Parts' Warranty: All parts ("Parts") sold outside the original Product sale (excluding replacement parts covered by the Product warranty above in Article I) that are sold by FCI shall be warranted for 90 days from the date of sale. FCI does not warrant parts manufactured by third parties and the Parts buyer should contact the original manufacturer for any applicable warranty rights.

VII. Additional limitations to the Product, Custom product and Parts warranties:

THE REMEDIES SET FORTH HEREIN ARE THE ONLY REMEDIES AVAILABLE TO ANY PERSON OR ENTITY FOR BREACH OF WARRANTY OR FOR BREACH OF ANY OTHER COVENANT OR OBLIGATION ON THE PART OF FCI AS SET FORTH HEREIN. FCI SHALL HAVE NO LIABILITY OR OBLIGATION TO ANY PERSON OR ENTITY FOR BREACH OF ANY OTHER COVENANT OR OBLIGATION UNDER THIS WARRANTY EXCEPT AS EXPRESSLY SET FORTH HEREIN.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY DOES NOT FAIL OF ITS ESSENTIAL PURPOSE.

IN NO EVENT SHALL FCI BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL OR PUNITIVE DAMAGES OF ANY NATURE WHATSOEVER, WHETHER ANY SUCH CLAIM OR DAMAGES BE BASED UPON WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, OR OTHERWISE.

IN NO EVENT SHALL FCI'S TOTAL LIABILITY HEREUNDER EXCEED THE ORIGINAL PURCHASE PRICE OF THE PRODUCT OR PART, AS APPLICABLE.

THIS LIMITED WARRANTY CONSTITUTES FCI'S EXCLUSIVE PRODUCT, CUSTOM PRODUCT AND PARTS WARRANTIES. ANY SERVICE, ADVICE, OR CONSULTATION FURNISHED TO PURCHASER OR BUYER BY FCI OR ITS REPRESENTATIVES AS WELL AS ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

VIII. FCI's General Terms and Conditions of Sale and applicable PDS are included in and applicable to this Limited Warranty. FCI's Customer Service Department can provide Purchaser with a copy of the General Terms and Conditions of Sale upon request.

Effective Date: 4/29/2022

WARRANTY REGISTRATION

INSTRUCTIONS: At the time of purchase of the FCI Watermakers system, please complete the warranty information listed below. After completing this form, please make a copy and submit the copy using one of the options at the bottom of the page— Keep this copy in your manual for future reference.

SYSTEM INFORMATION:

Model # _____

Serial # _____

Operating Voltage: _____

Date Purchased: _____

Date Commissioned: _____

DEALER INFORMATION:

Dealer Name: _____

Address: _____

City: _____ State: _____

Country: _____ Postal Code: _____

Dealer Invoice #: _____

CUSTOMER INFORMATION:

Customer Name: _____

Address: _____

City: _____

State: _____ Postal Code: _____

Country: _____

Phone: _____ Fax: _____

E-mail: _____

VESSEL INFORMATION:

Boat Manufacturer: _____

Boat Model: _____

Boat Name: _____

Boat Length: _____

LAND BASED INFORMATION:

Installation site: _____

Site Name: (resort, company etc) _____

Application: _____

Operator Contact Information:
(person in charge of system maintenance and operation)

Name: _____

E-mail: _____

Phone: _____

COMMERCIAL APPLICATION:

Rig Name: _____

Rig Location: _____

Operator Name: _____

Operator E-mail: _____

Mail a copy to:

FCI WATERMAKERS, INC
ATTENTION: WARRANTY REGISTRATION
3782 W 2340 S, STE E
WEST VALLEY CITY, UT 84120-7291 USA

EMAIL: info@fciwatermakers.com

Subject: Warranty Registration

FAX: +1-801-883-9985

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FCI CONTACT INFORMATION

If you have questions regarding your FCI Watermakers system or the contents of this manual, or if you need replacement parts, please do not hesitate to contact us immediately. Our hands-on technical support is always at your service.

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GENERAL INFORMATION

FCI watermakers are the most advanced desalinating systems available, which produce potable water from seawater or brackish water. For over a thirty years, FCI Watermakers, Inc. has pioneered technology and innovated features that have become standards for today's desalinators: one-touch commands, multiple station operation and remote system control and monitoring. As both engineers and craftsmen, we specialize in high-performance, value-driven watermakers and are proud of the thousands of continuously operating units that have been cruising the globe for decades.

At FCI Watermakers, our commitment and attention to detail transcends beyond materials and construction. Things that are seemingly trivial are never overlooked. For instance, your system's specifications formulate the Model Number. It is comprised of the Series, GPD, Voltage, Hertz, Voltage Phase, and Options of the unit:

A B C D E F G
NH100263+APC

A	B	C	D	E	F	G
Series	GPD	Voltage	Hertz	Phase	Plus	Options:
NH: Neptune	34: 3,400	2: 240VAC	6: 60Hz	3: 3-Phase	+: V4	BLANK: Standard
Horizontal	46: 4,600	3: 380VAC	5: 50Hz		Control	APC: Automatic
System	58: 5,800	4: 480VAC			System	Pressure
	80: 8,000					Control
	100: 10,000					

Your FCI Reverse Osmosis Desalination System is designed to provide lasting performance using high-grade materials and uncompromising engineering. FCI systems utilize high-grade alloys in critical components, where competing brands often use inferior material that compromise system operation and jeopardize the vessel.

NEW SYSTEM PERFORMANCE

Although each system has been fully tested prior to shipping, there will be a break-in period. During this period, approximately 48 hours, the pumps and membrane performance will change or settle. Small adjustments will need to be made to the high-pressure valve. The water quality and quantity will vary. For a typical installation, the high-pressure valve will need to be increased (turned clockwise) and the water quality produced will improve over this break-in period. For systems with APC, this adjustment will be automatic.

THEORY OF OPERATION

The process of reverse osmosis (R.O.) represents the finest level of liquid filtration available today. Though the term sounds mysterious, reverse osmosis isn't really that complicated.

Reverse osmosis is a process in which a semipermeable membrane is used to separate fluids of various qualities into a highly-saturated concentrate (brine) and a high-quality permeated fluid low in dissolved solids. The separation is accomplished by passing the fluid across the membrane at a specified pressure and velocity (*Figure 1*). The membranes contain pores which approximate two hundred molecular weight in diameter. This allows the fluid and approximately one to two percent of the solids to pass through and be collected for storage. The concentrated solution (brine) unable to pass through the membrane is then processed out of the system. Unlike standard filtration where contaminants continually build up on the filter surface area and gradually decrease the filtering capabilities of the system, reverse osmosis filtration systems provide a self cleaning system by allowing the unfiltered fluid to continuously pass across the membrane surface, removing the contaminants as a concentrated solution, and preventing surface fouling.

Typical applications for reverse osmosis are the purification of seawater, waste water, brackish well water, and city water. However, as the industry grows many more applications are being implemented and researched, many of which have nothing to do with water purification. Presently this technology is being expanded to include gas separation in the oil industry, protein concentration, brew, wine and food processing, maple syrup production, dairy processing, removal of cholesterol from butter, undesirable bacteria removal, undesirable pyrogen removal from I.V.'s, etc. As the market expands the industries future prospects are excellent and should continue to expand well into the next century.

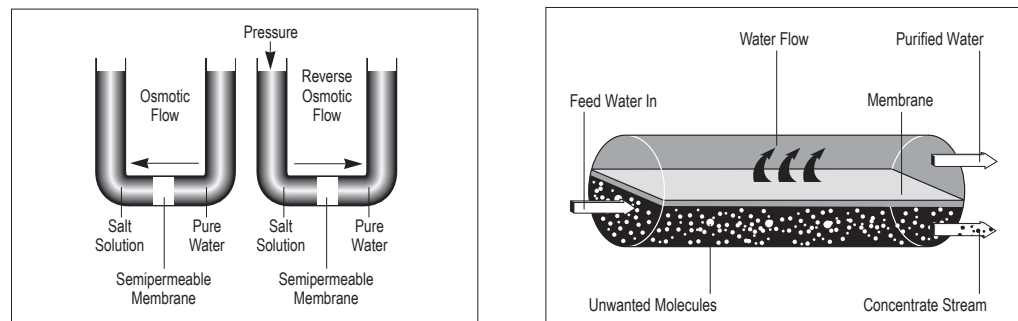


Figure 1: R.O. Process

SEMIPERMEABLE MEMBRANES

Reverse Osmosis Membranes are a spiral wound filtration system using alternating semipermeable and permeable materials to process and separate the product fluid from the concentrate solution. Their filtration capabilities and application are dependent on several factors: chemical composition of the fluid to be filtered, properties of the semipermeable material required due to this composition, fluid temperature, operating pressure, total dissolved solids to be removed, as well as several other small factors to be taken into account. The filter size or permeate flow rates are determined as a function of the square foot of semipermeable material used in the membrane, as well as the factors described above. The typical rejection rate of reverse osmosis filters is 90 to 99.9 percent of Sodium Chloride, as well as many other impurities. This constitutes an excellent utilization of available water resources for large scale water purification requirements. Filter sizes for both commercial and residential applications generally range from 2" X 12" to 8" X 40". These sizes will meet almost all applications in today's water purification industry.

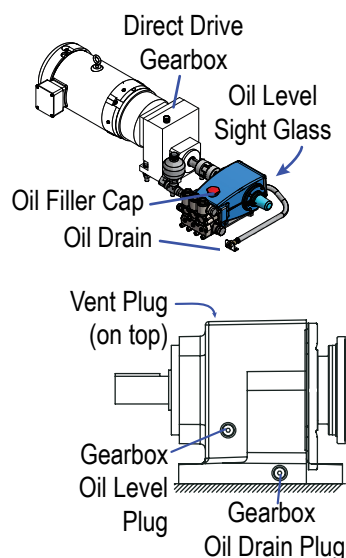
TYPICAL MEMBRANE ELEMENT

The typical membrane element has the following properties:

- Semipermeable Materials
- Thin Film Composite (TFC)
- Chlorine sensitive, chlorine must be removed up stream of the membrane
- Bacteria resistant
- pH range is 3.0 to 11.0
- Highest water production rate of all reverse osmosis membranes

2/ PRE-INSTALLATION

This section provides key information for a successful install, leading to long-term enjoyment of your FCI desalination system. It includes warnings, cautions and notes associated with the preparatory work necessary to properly install and maintain your watermaking system.



The FCI Watermakers System is supplied with an installation kit which includes an assortment of hoses needed to install the system. Because of the various options with regard to location, voltage and optional accessories, wire is not provided with the system and some installations will require additional hose. Please contact your local dealer for these supplies. Be sure to follow all local codes when installing your new FCI watermaking system.

Always use genuine FCI approved parts to ensure proper operation of your watermaker.

The high-pressure pump and gearbox ship with oil and are ready to run. Should you need to add oil, be sure NOT to over fill the pump. With the oil fill plug removed, oil will not be visible through the opening—this is normal. The correct level is the middle of the sight glass.

PRE-INSTALLATION PRECAUTIONS

STORAGE PRIOR TO REMOVAL FROM CRATE

Adhere to crate markings:

- DO NOT store in direct sunlight;
- DO NOT store above 120°F (50°C);
- DO NOT freeze;
- DO NOT store longer than 4 months without flushing with storage chemical;
- STORE ONLY on base with ARROWS UP.
- KEEP THE R.O. MEMBRANE ELEMENT WET AT ALL TIMES.

REVERSE OSMOSIS MEMBRANE ELEMENT IS SUSCEPTIBILITY TO CHEMICAL ATTACK

CAUTION: Do Not expose the FCI Watermakers system to intake Feed Water from any chemical not approved in writing by FCI Watermakers, or any of the following chemicals:

- | | |
|---------------------|-------------------------|
| • Hydrogen peroxide | • Chloramines-T |
| • Chlorine dioxide | • Chlorine |
| • Bromine phenolic | • Disinfectants |
| • Chloramines | • N-chloroisocyanurates |
| • Hypochlorite | • Iodine |
| • Bromide | • Petroleum products |

USE OF NON-AUTHORIZED OR MISUSE OF AUTHORIZED CHEMICALS VOIDS SYSTEM WARRANTY

Do not connect any water line to the system that may contain any of the aforementioned chemicals. Example: Do not connect the inlet of the system to the ship's potable water system if the ship's system contains chlorinated or brominated water. These chemicals destroy the copolymer components within the R.O. system. These oxidants and others also damage the R.O. membrane element. The fresh water flush system removes chlorine and bromine from the ship's potable water system.

DO NOT PERFORM INSTALLATION UNLESS:

- 1 The system feed water sea cock valve is closed.
- 2 The system main electrical disconnect switch is switched **OFF, LOCKED, and TAGGED.**
- 3 A volt/ohm meter will be necessary.

WARNING: ELECTRICAL SHOCK HAZARD. The installation procedures expose the installer to **HIGH VOLTAGE** and electrical shock hazard. Only attempt installation if you are a qualified electrician and only if surrounding conditions are safe.

QUALIFICATIONS

Technicians must have technical knowledge and ability in the following fields:

- a) Electrical, Electronic, Electric Motors and Circuits
- b) Electromechanical and Mechanical Systems
- c) Hydraulic and Liquid Pressure and Flow Systems
- d) Piping and Plumbing Systems
- e) Water Suction and Pressure Lines
- f) Thru-Hull Fitting below and above water level

WARNING: Do not attempt installation, commissioning, troubleshooting, or repair if you are not proficient in the above fields of expertise.

SPECIAL CONSIDERATIONS INSTALLATION CAUTIONS

Do not over tighten PVC fittings. If threaded pipe fittings leak after installation, remove the fitting, clean the mating threads, apply 3 to 4 wraps of Teflon tape to the male threads, apply liquid Teflon pipe sealer sparingly, and thread the parts back together. PVC fittings should only be hand tightened without the use of a wrench. The sea cock valve, in-line pressure gauge, sea strainer, rinse-clean inlet valve, and booster pump should be installed below water level. This will aid the booster pump in priming.

Always allow hoses and tubes to enter and exit straight from the connection for a minimum of one inch prior to a bend. If stress is placed on the fitting due to a tight bend, the fitting will leak and may break.

Avoid skin and eye contact with the membrane packaging solution. In case of skin contact, rinse the skin thoroughly with water. In case of eye contact, flush repeatedly with water and notify a physician immediately. R.O. membrane elements are stored in “sodium bisulfite.”

NEVER mount liquid holding component above any electrical or electronic device. Extensive damage to the electronic device will result if liquid enters device during maintenance and or component failure.

CONNECTION LINE CAUTIONS— All connection lines should be as short and straight as possible using minimum fittings. The connection lines must not be “kinked.”

ACCESSIBILITY CAUTIONS— This is a simple rule: Install the system and its supporting components in an accessible manner. The electrical control display or panel must be accessible for operation and monitoring of the system.

ELECTRICAL POWER REQUIREMENTS— Ensure that the power source is sufficiently sized to provide the correct voltage and cycles during start up and operation. If unsure, please consult with your local installation specialist or qualified electrician.

R.O. MEMBRANE ELEMENT NOTES

CAUTION: Some systems are shipped **WITHOUT** the reverse osmosis membrane element. This is to accommodate boat builders that will install the system well in advance of commissioning the boat and the system.

DOES THIS SYSTEM HAVE R.O. MEMBRANE(S) INSTALLED OR NOT?

If not, is it your intention to install the R.O. membrane(s) at this time, or do you wish to install them at a later date when the boat is commissioned?

If the R.O. membrane element has been installed, there will be a R.O. membrane element serial number tag attached to the high pressure vessel(s). Find this serial number tag to ensure that the R.O. membrane element(s) have been installed. If the R.O. membrane element serial number tag is missing or does not contain a serial number, then the R.O. membranes are not installed. If the R.O. membrane elements are not installed and you wish to install them at this time, contact FCI Watermakers, Inc. and supply us with your original purchase order number, FCI's invoice number, and this system's serial number.

WARNING: If the reverse osmosis membrane element is not to be installed at this time, ensure that you leave a visible note at the system controller and at the front of the control panel informing the end user that:

The reverse osmosis membrane elements are not installed;
to contact the factory for the R.O. membrane elements; and
DO NOT operate the system without the R.O. membrane
elements installed. Extensive damage will occur if the system is
operated without the R.O. membrane elements installed.

Damage to the system caused by the operation of the system without R.O. membrane elements installed:

- Is **NOT** covered by the FCI Watermakers, Inc. warranty
- Is the liability of the installer if the installer did not notify the end user.
- Is the liability of the end user if the installer notified the end user that the R.O. membranes were not installed and to not operate the system without the R.O. membrane elements installed.

SYSTEM COMPONENTS IDENTIFICATION

Figure 2 introduces the basic components required for the install. Each component plays an important part in the install and is reference throughout this manual.

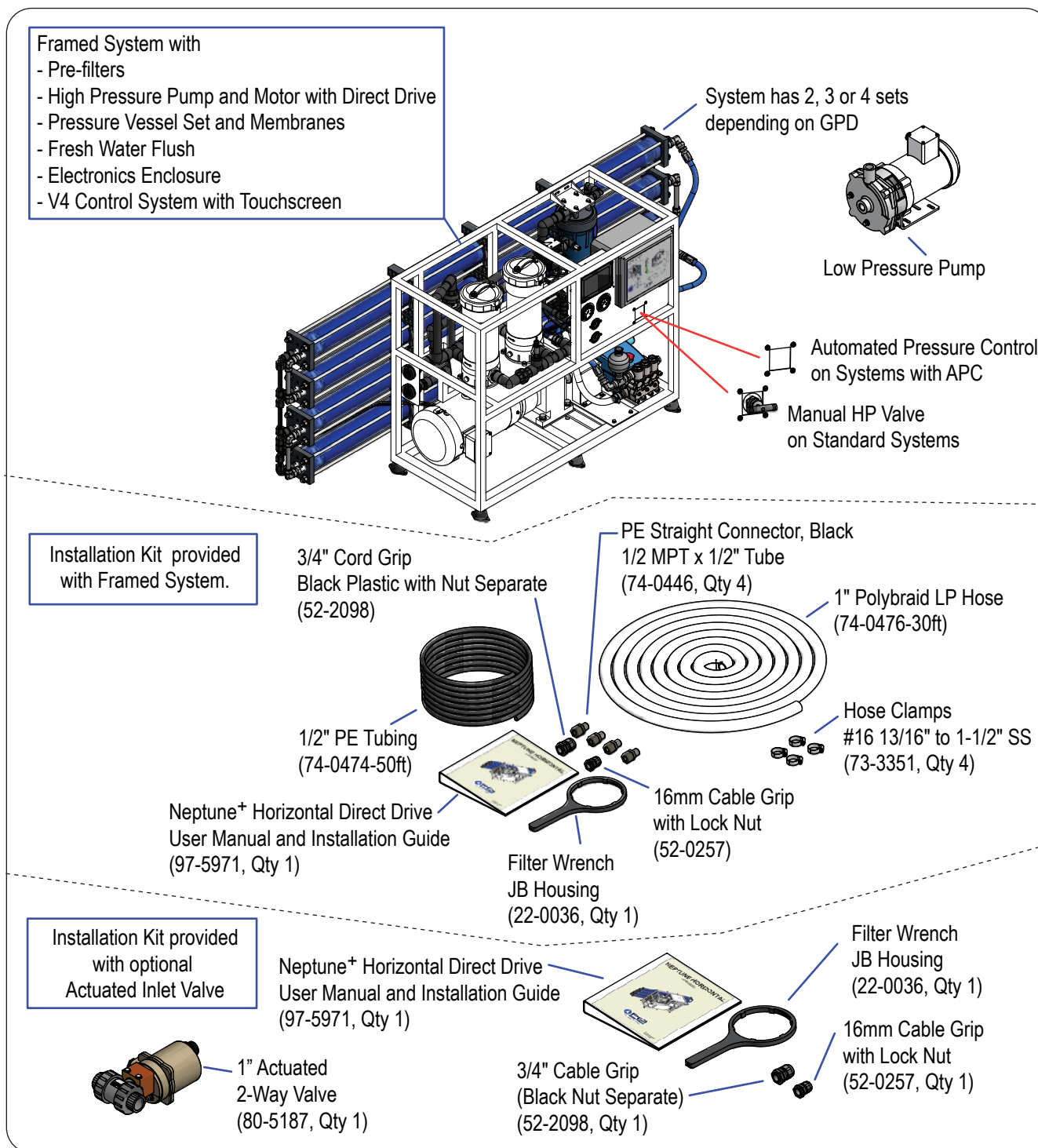


Figure 2: System Components Identification

PIPING & INTERCONNECT DIAGRAM

Figure 3 shows the piping and interconnect of the components, including standard and optional accessory configurations. Determine the pre-filtration and post-filtration components that were supplied with your system, and identify how each component interconnects.

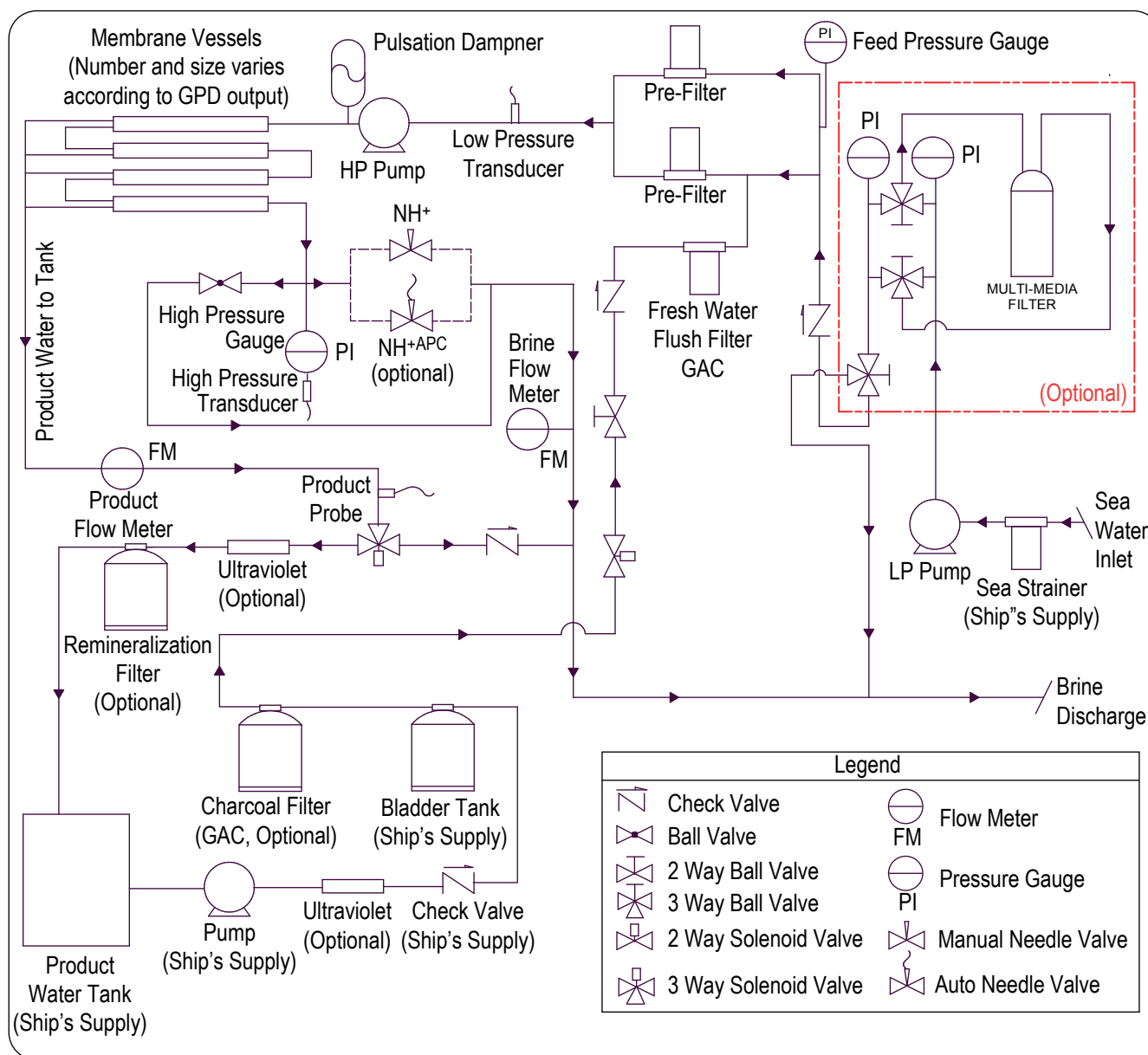
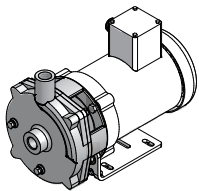


Figure 3: Piping & Interconnect Diagram

COMPONENT DESCRIPTIONS

The standard and optional components are described in this section, and items required for or desired by the installer are listed. The location, operation, and purpose of each major component of your FCI Watermakers system is briefly explained.

Use of third party, Non-FCI (or unauthorized) components may lead to premature failure, added operating and maintenance costs, and increased labor. Using 3rd party, Non-FCI components may void any and all FCI Watermakers Warranty. We only wish to help you enjoy the luxury of owning a FCI Desalinating System. Treat it properly by using only FCI supplied parts, recommended consumables, and authorized accessories.



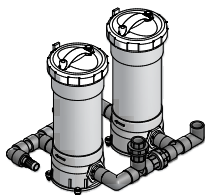
LOW PRESSURE PUMP

The low-pressure pump is a one horsepower. Inlet and discharge connections are 1" hose. The pump should be mounted at or below the waterline to allow the pump to be flooded. Wiring diagrams are provided on the capacitor cover and in the installation section of this manual. Wire was not provided with the pump because of unknown distances, and can be provided by the installer or authorized FCI dealer.

NOTE: Follow all local codes when wiring the motor.

Connection points for the low-pressure pump to the main control can be found in the electrical schematic section.

PRE-FILTER



The system comes with a two pre-filters (frame mounted), each with a 5-micron 40-sq. ft. filter. The oversize pre-filter cartridge has longer filter life. This greatly extends the time interval between required maintenance, reducing maintenance labor and filter replacement costs.

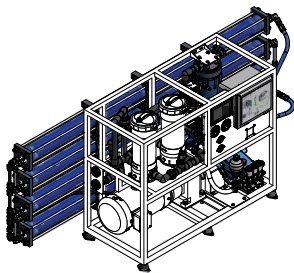
The system will notify the user when filters should be cleaned or replaced. The filters can be cleaned once or twice before replacing. When cleaning the filter, do not scrub the pleats to the point that the material begins to fray. If fraying occurs, replace element.

NOTE: The prefilter is your first line of defense protecting the high-pressure pump and membrane. Keeping the filter in good condition will help insure trouble-free operation.

WARNING: PREFILTER ELEMENT Do not use third party prefilter elements, use only FCI prefilter elements. Third party prefilter elements do not properly fit and the seams fall apart. They also allow by-pass resulting in extensive and very costly damage to the high pressure pump as well as premature fouling of the R.O. membrane element(s).

CAUTION: PREFILTER ELEMENT Do not use "string wound" or "fiber" prefilter elements. String wound and fiber filter elements are designed for the photographic film developing industry. When used in seawater, they will plug up rapidly in 1/10th or less the time of a FCI supplied prefilter cartridge element. This will cause frequent shut downs of the system, and the very frequent changing will result in very high cost of maintenance, and user frustration.

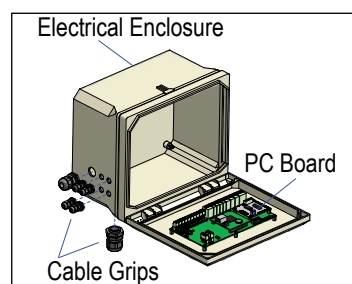
COMPONENT DESCRIPTIONS *(continued)*



DESPITE BEING FRAMED, THESE SYSTEMS ARE DESIGNED FOR VERSATILITY AND ARE OPTIMIZED TO MEET CUSTOM DEMANDS. For instance, the system shown to the left is a 4-vessel Neptune⁺APC Horizontal System (the systems can be equipped with 2, 3 or 4 vessels). The frame was design to provide as much versatility for installation as possible. If the depth is too great, the membranes can be removed and remotely mounted on a bulkhead or overhead. (Special fittings required, please consult your dealer or FCI Watermakers directly.)

USEFUL AMENITIES

Cable and cord grips are provided for the various wires that will need to be run to the electrical box. You will also find a service valve on the fresh-water-flush assembly to allow you to change the filter without having to shutdown the onboard pressure system.



SYSTEM CONTROLS

The Neptune⁺ Horizontal System is designed with advanced system controls for versatile operation (*Figure 4*). These include the V4 Control System with touchscreen display, manual high pressure valve (standard systems), automated pressure control (systems with optional APC), flowmeters, and pressure gauges. Important system information is conveniently posted right on the system control panel so that everything you need for operation is right at hand.

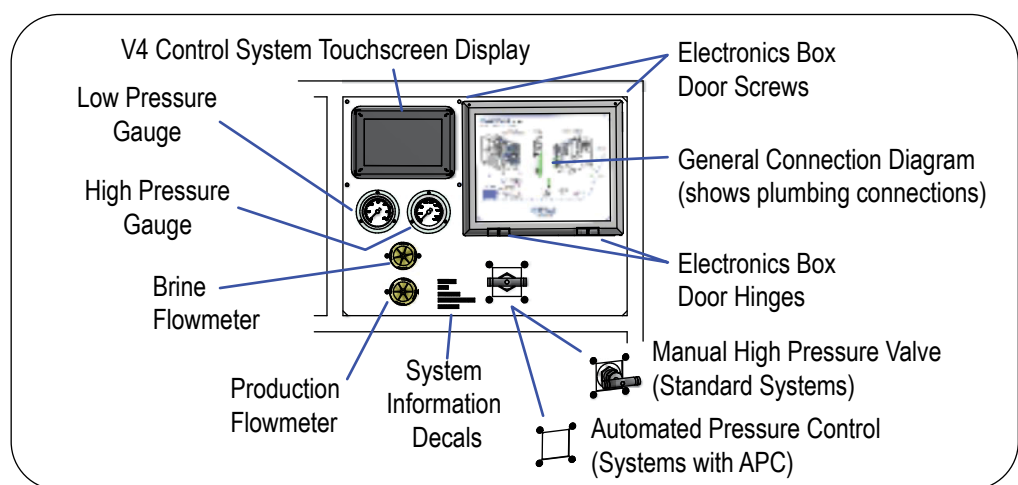
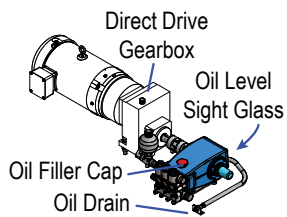


Figure 4: System Controls

COMPONENT DESCRIPTIONS (continued)



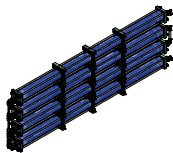
HIGH PRESSURE PUMP ASSEMBLY

The pump and motor assembly is mounted inside the frame. This is direct-driven assembly through a gearbox, eliminating the need to monitor and adjust belts. Oil changes are necessary the first 50 hours and every 250 hours thereafter. The V4 control system will alert you when an oil change is needed. There will be a break-in oil change after approximately 50 hours.



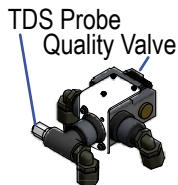
FRESH WATER FLUSH ASSEMBLY

The fresh-water-flush feature allows the system to be flushed with fresh water after each use or on a programmed schedule. Seawater, if left un-flushed, can be more corrosive, can promote biological growth, and can naturally decay materials. The carbon filter removes particulate and chlorine (bleach) from the fresh water holding tank. These elements can be harmful to the membrane. The shut-off service valve allows the filter cartridge to be replaced without having to depressurize the on-board pressure system.



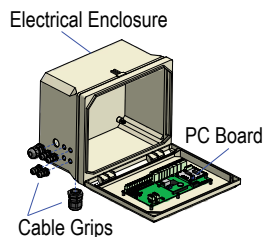
PRESSURE VESSEL ASSEMBLY

The vessels house the membranes, which are the heart of the system. A system can be equipped with 2, 3 or 4 assemblies depending on its rated output. Each vessel houses one or two membranes.



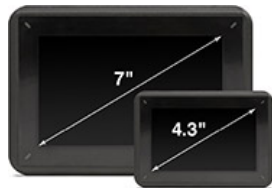
PRODUCT TDS PROBE AND QUALITY VALVE

The product TDS probe samples the total dissolved solids in the product flow. When water quality is acceptable, the quality valve diverts the product water to the product water storage tank.



ELECTRICAL ENCLOSURE

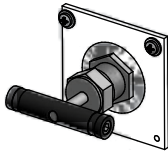
The door to the electrical enclosure has the General Connection Diagram. All wires and cables are routed into the electrical enclosure. The system incoming power and the outgoing power (to low-pressure pump or optional actuated inlet valve) connect to the connector blocks inside the enclosure. If you are installing an optional remote display, its cable connects to the PC Board on the door of the enclosure.



TOUCHSCREEN DISPLAY AND OPTIONAL REMOTE

The 7" display provides touchscreen convenience and at-a-glance monitoring. The display allows you to interface with the V4 Control System, the intelligence that runs the watermaker. The parameters the V4 Control System uses to make decisions are called setpoints. These are pre-set at the factory to get you up and going quicker. As you familiarize yourself with your watermaking needs, the setpoints can be changed, providing a fully programmable system. Also an optional 7" or 4.3" display may be installed for remote operation.

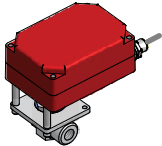
COMPONENT DESCRIPTIONS (continued)



HP VALVE

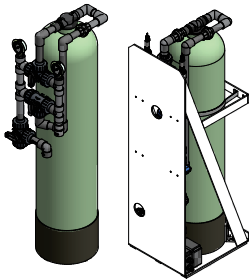
On standard systems, pressure is regulated manually by the HP valve. When running the system, the HP valve is turned counterclockwise to lower production and clockwise to raise production until the production matches the system's rated output. The system's rated output can be found on the information section of the display.

It's important to match the system's rated output for optimum water quality and long membrane lifetime.



AUTOMATED PRESSURE CONTROL (optional)

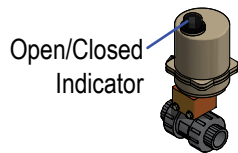
On systems with Automated Pressure Control (APC), the pressure is regulated automatically.



MEDIA FILTER (optional)

For operation with iron or heavy particulate in the feed water, the optional media filter will help remove the contaminants before they can potentially damage the high pressure pump or foul the membranes.

The media filter consists of a tank, valve assembly, and pressure gauges. The media is loaded in the tank. The valve assembly is used to set the media filter to in-service or backwash. For manual media filters, the valves are set by hand as prompted by the V4 Control System. For automated media filters, the valves are actuated and set by the V4 Control System.



INLET ACTUATED VALVE (optional)

The inlet actuated valve is comprised of a 2-way union ball valve with an actuated motor drive on top. The valve is equipped with a post on the top that indicates the valve position (open / closed). The actuated valve is used in place of the low pressure pump for installations where the inlet feed is already pressurized.

3/ INSTALLATION

Refer to the outline below for an overview of the installation process and the structure of this chapter.

Each system has its unique environment. To allow for this, the instructions are presented in part by discussion rather than by procedure. Start by reading through this chapter completely, matching the tasks to your environment.

COMPONENTS SUPPLIED BY INSTALLER

The first section lists the items not included with the system that you may need to supply for the installation.

DIAGRAMS SHOWING THE COMPONENTS AND LAYOUT

This section contains diagrams of the system components with their dimensions, weight, and footprints. Possible system layouts are shown in plumbing diagrams. The diagrams are used to become familiar with how the parts fit together.

SYSTEM INSTALLATION / MOUNTING

Following the diagrams are instructions on mounting the components. The footprint and layout diagrams of the previous section are available for reference when mounting the system components.

SYSTEM INSTALLATION / PLUMBING

After the mounting instructions, the installation focuses on plumbing. The plumbing connections are listed, referring to the tubes and hoses by letter. The plumbing diagrams presented earlier illustrate the tubes and hoses and call out their letters. A chart within the plumbing diagrams describe the connections, tubes, and hoses. The plumbing diagrams are available for reference when connecting the plumbing.

SYSTEM INSTALLATION / ELECTRICAL CONNECTIONS

The next task is connecting the electrical wiring. This includes wiring power from the main source to the frame's electrical enclosure contactor blocks, and wiring power from the frame's contactor blocks to the low pressure pump. If installing the optional actuated inlet valve, power is also routed from the contactor blocks. If installing the remote control panel, wiring is routed from the remote to the PC board located on the door of the enclosure.

WIRING SCHEMATICS

Schematics are available for reference when connecting the wiring.

FINAL INSTALLATION CHECKLIST

After completing the installation, a checklist is provided to help you check your work.

COMPONENTS SUPPLIED BY INSTALLER

Most of what you will need to install your system is included in your package. As each system installation varies, not all installation fittings, hose and tubing can be provided. There are a few items that you will need to consider for your individual system.

Select a suitable location for the components and evaluate where you plan to place them. Obtain a good working estimate as to the footage of hose that will be needed and contact your dealer or FCI for the supplies. *Table 1* summarizes the specifications for components supplied by installer.

Table 1: Specifications for Components Supplied by Installer

Connection	Specification
Inlet Thru Hull	1" minimum
Sea Strainer	1" minimum
Connection at Sea Strainer	1" hose barb or hard pipe
Brine Discharge Thru Hull (If installing optional media filter, the backwash line can tee into the brine discharge line. Add a check valve on the brine discharge line to prevent back flow to the system.)	1" minimum at or above water level
Connection at Brine Discharge Thru Hull	1" hose barb or hard pipe
Connection at Ship's Unpressurized Potable Water Storage Tank	1/2" tubing compression fitting x 1/2" NPT, barb or hard pipe
Connection at Ship's Pressurized Water Supply	1/2" tubing compression fitting x 1/2" NPT, barb or hard pipe
Incoming Power	240VAC, 380-415VAC or 480VAC, 50/60 Hz as listed on system's serial number plate
Incoming Wire Size	Per local electrical specifications
Current Draw (Actual current draw will vary with incoming power conditions)	28.2 A (240 VAC 3PH)
	16.1 A (380 VAC 3 PH)
	13.6 A (480 VAC 3 PH)

COMPONENTS SUPPLIED BY INSTALLER (continued)

COMPONENTS SUPPLIED BY INSTALLER

CAUTION: All fittings, valves, and piping installed prior to, within, and after the system must not contain iron. If the resulting failure of the R.O. membrane element is attributed to improper installation, it is the liability of the installer.

- 1 *Inlet Thru Hull Fitting with Forward Facing Scoop and Shut-off Valve:*
The inlet thru hull fitting must be minimum 1" and dedicated to only the FCI system. It is important that the installer utilizes a forward-facing scoop so that the system receives a positive flow of water as the boat is under way. The fitting must be installed on the boats hull in a position that provides continual feed water flow without air to the system.

CAUTION:

- A flush inlet thru-hull fitting will cause a vacuum as the boat is under way, and this will cause loss of feed water flow and cavitation of the booster and high pressure pump, resulting in continual system shut down.
- The FCI Watermakers System must receive an uninterrupted supply of feed water without air.
- The FCI Watermakers System must not be tied into another existing auxiliary water line already supplying another accessory on the boat.
- If the FCI Watermakers System is connected to a sea chest or stand pipe, **DO NOT** plumb the FCI Watermakers System feed line to the "top" of the sea chest or stand pipe. Plumb the FCI Watermakers System to the "bottom" of such feed water arrangements to ensure a continual air free supply of feed water to the system.

- 2 *1" Sea Strainer and Connection at the Sea Strainer:*
The low pressure pump inlet is to be connected to the sea strainer. Barbs (supplied by installer), hose, and hose clamps can be used. If desired, the connection can be hard piped.
- 3 *Brine Discharge Connection and Brine Discharge Thru Hull:*
The Brine Discharge Connection is intended mate to a 1" MNPT connection and be plumbed to the ship's brine discharge thru hull. Barbs (supplied by installer), hose, and hose clamps can be used. If desired, the connection can be hard piped.
- 4 *Connection at the Ships Unpressurized Potable Water Storage Tank:*
The Product Water Connection is intended to be plumbed to a 1/2" FNPT connection on the ship's unpressurized potable water storage tank. In order to avoid problems such as reverse flow (osmosis) from the tank to the system and chlorination attack of the R.O. membrane element, the fitting must terminate above the maximum water level. The connection can be made with two 1/2" MNPT x 1/2" Tube PE Black Straight Connectors and the 1/2" PE tubing included in installation kit. Installer-supplied barbs may be used instead of the connectors. If desired, the connection can be hard piped.

WARNING: No valves should be installed in this line. A blockage or closed valve in the product water line will cause extensive damage to the system and R.O. membrane element.

COMPONENTS SUPPLIED BY INSTALLER (continued)

- 5 *Connection at the Ship's Pressurized Water Supply:*
The Fresh Water Flush Connection is intended to be plumbed to a 1/2" FNPT connection at the ship's pressurized water supply. The connection can be made with two 1/2" MNPT x 1/2" Tube PE Black Straight Connectors and the 1/2" PE tubing included in installation kit. Or the connection can be hard piped.
- 6 *Circuit Breaker* with appropriate Amperage Rating.
- 7 Properly sized *Power Cables*. Consult local regulations for proper sizing.
- 8 *Electrical Power Source* capable of delivering the required constant voltage and cycles during start up and operation of the system.

INSTALLATION KITS

Match the components included with the installation kit to the items listed in *Figure 5*. If you are installing the optional actuated inlet valve, also match the components to *Figure 6*.

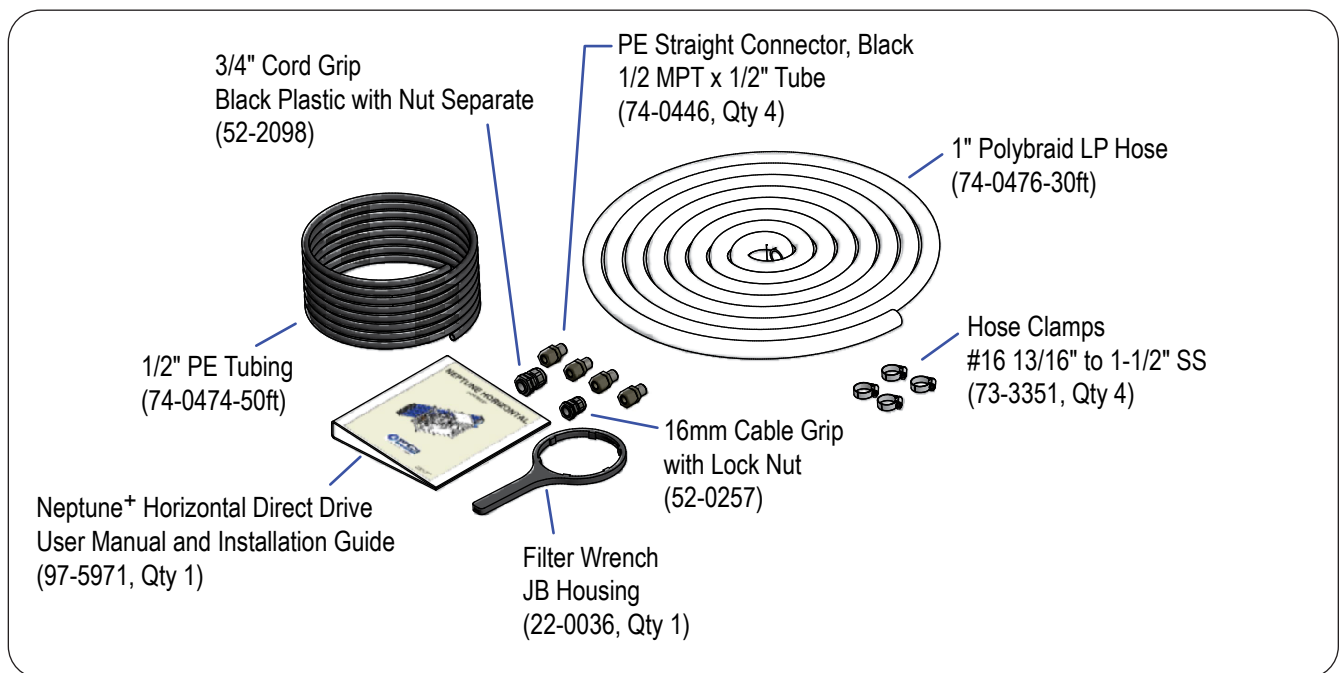


Figure 5: Installation Kit Provided with Framed System

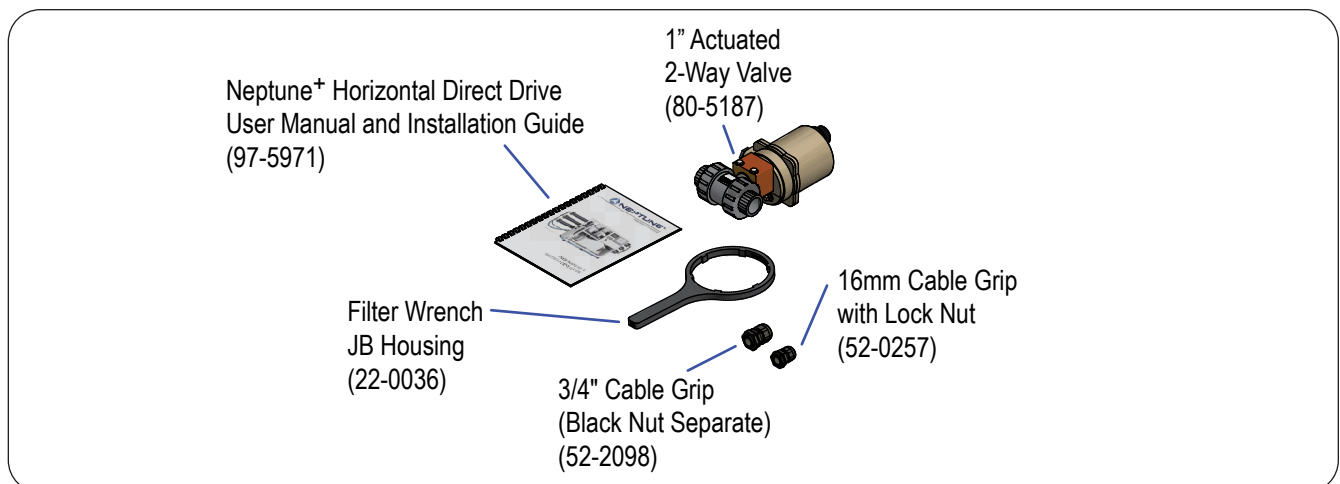
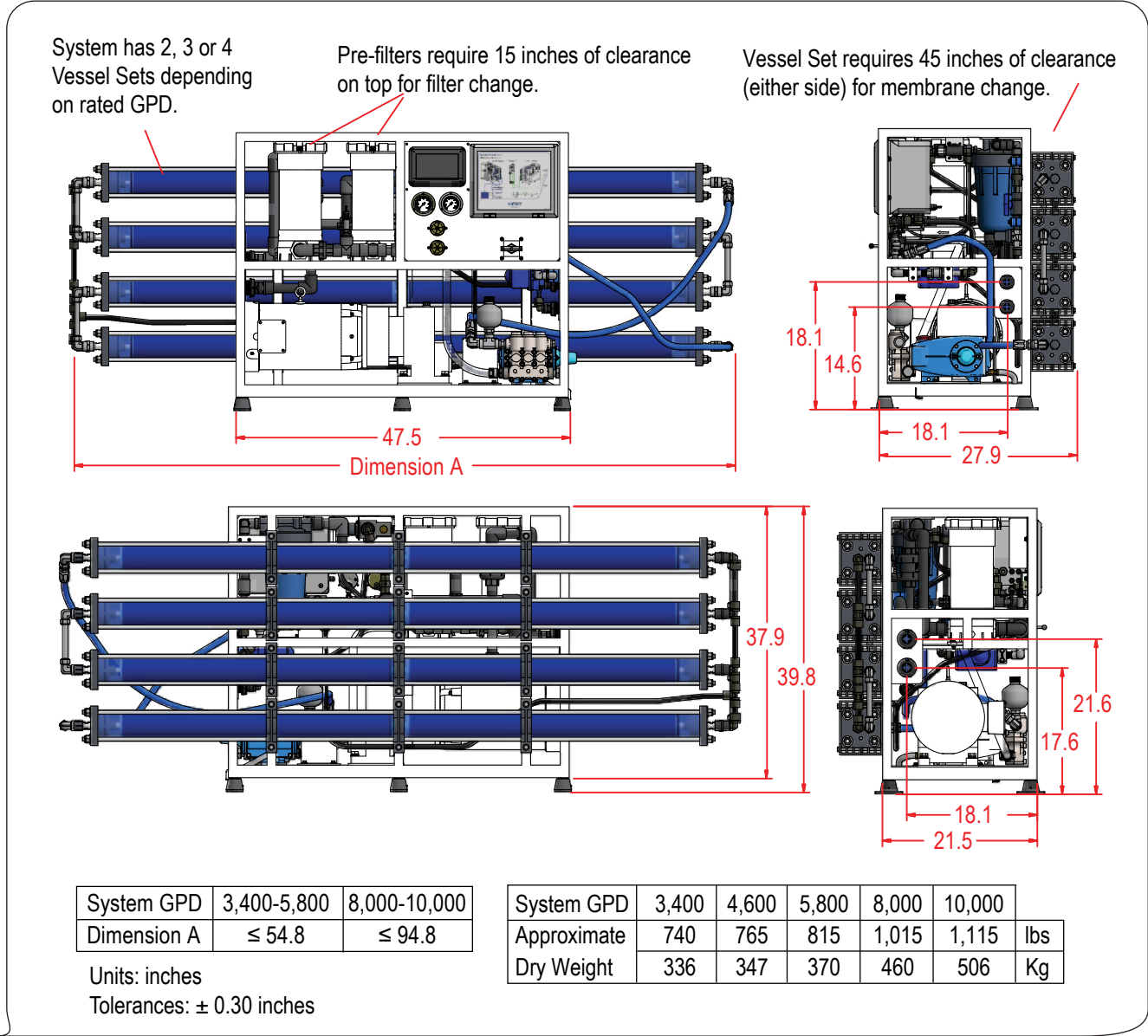


Figure 6: Installation Kit Provided with Actuated Inlet Valve (optional)

DIMENSIONS, WEIGHT & FOOTPRINT

Weight, dimensions, and footprints of the systems components are shown in *Figure 7* to *Figure 14*. Refer to the figures appropriate to your system components when planning where to mount the components. Planning considerations are discussed in "SYSTEM INSTALLATION / MOUNTING" on page 42.



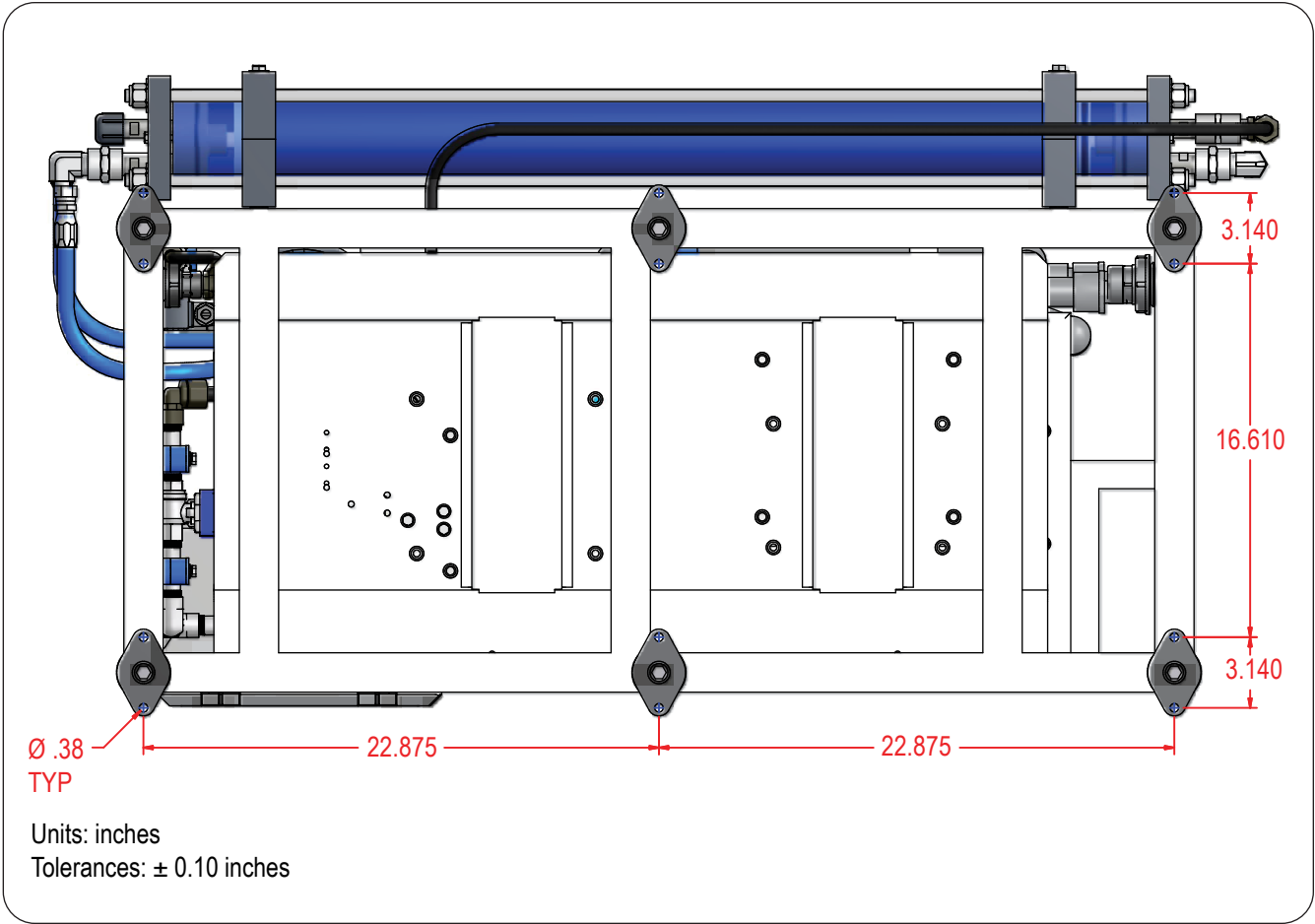
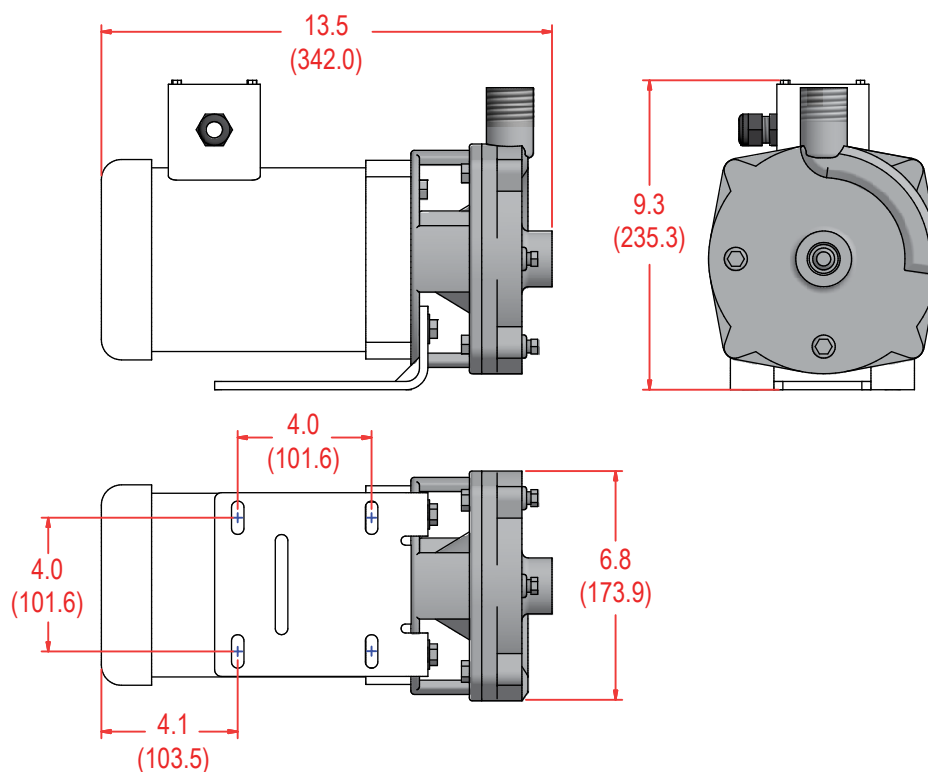


Figure 8: Footprint for Framed System

DIMENSIONS, WEIGHT & FOOTPRINT (continued)

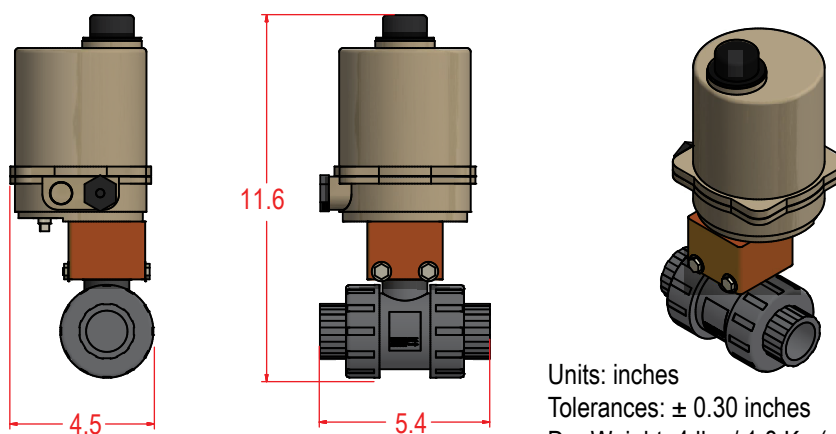


Units: inches (mm)

Tolerances: ± 0.30 inches (7.6 mm)

Dry Weight: 18 lbs / 8 Kg (approximately)

Figure 9: Dimensions, Weight & Footprint for Low Pressure Pump



Units: inches

Tolerances: ± 0.30 inches

Dry Weight: 4 lbs / 1.8 Kg (approximately)

Figure 10: Dimensions & Weight for Actuated Inlet Valve (optional)

DIMENSIONS, WEIGHT & FOOTPRINT (continued)

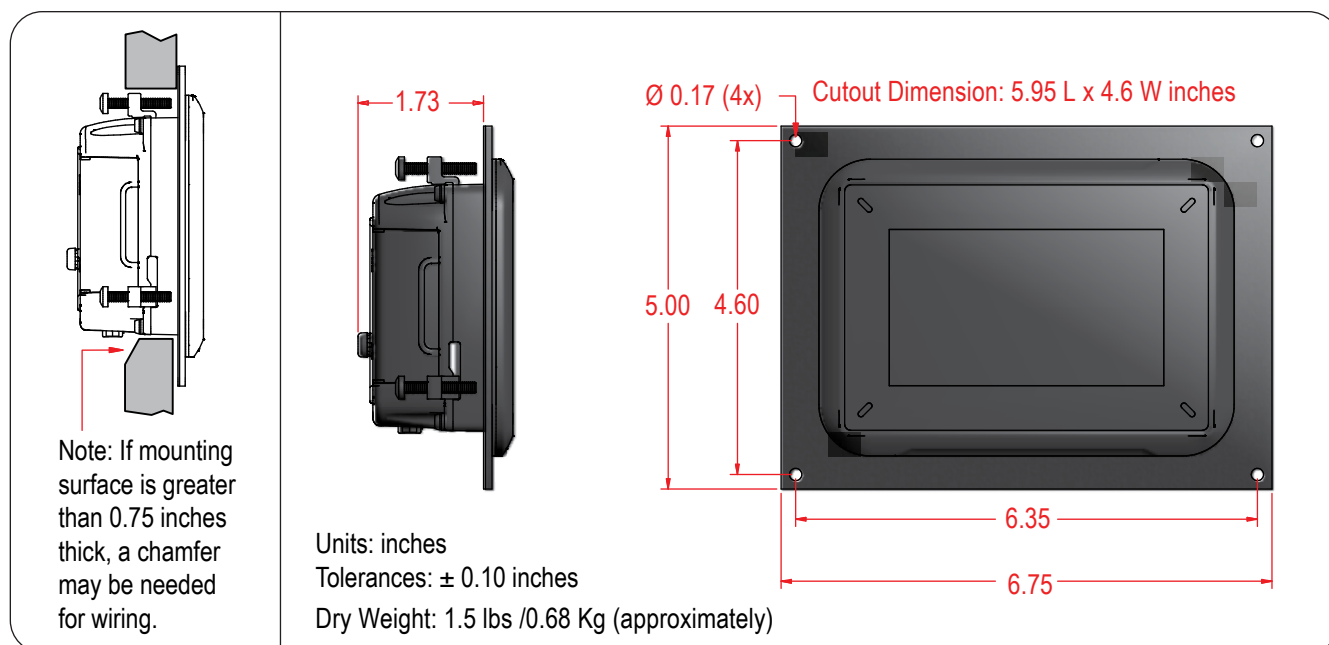


Figure 11: Dimensions, Weight & Footprint for 4.3" Remote (optional)

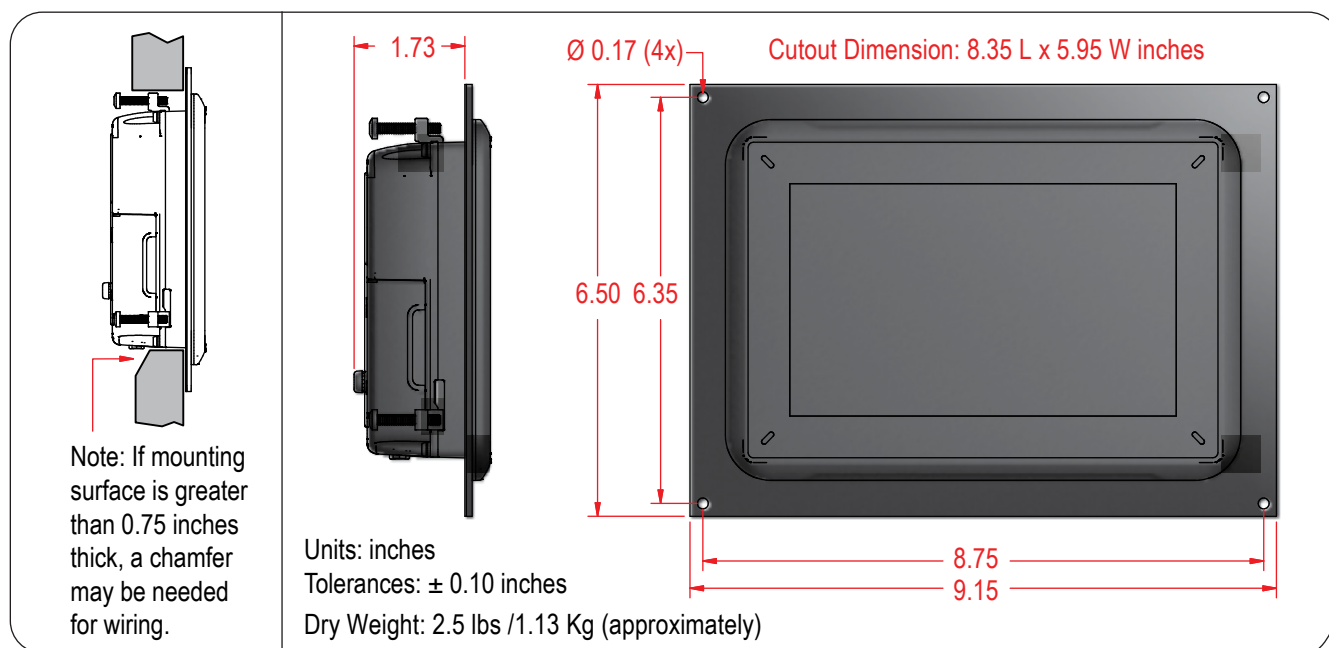
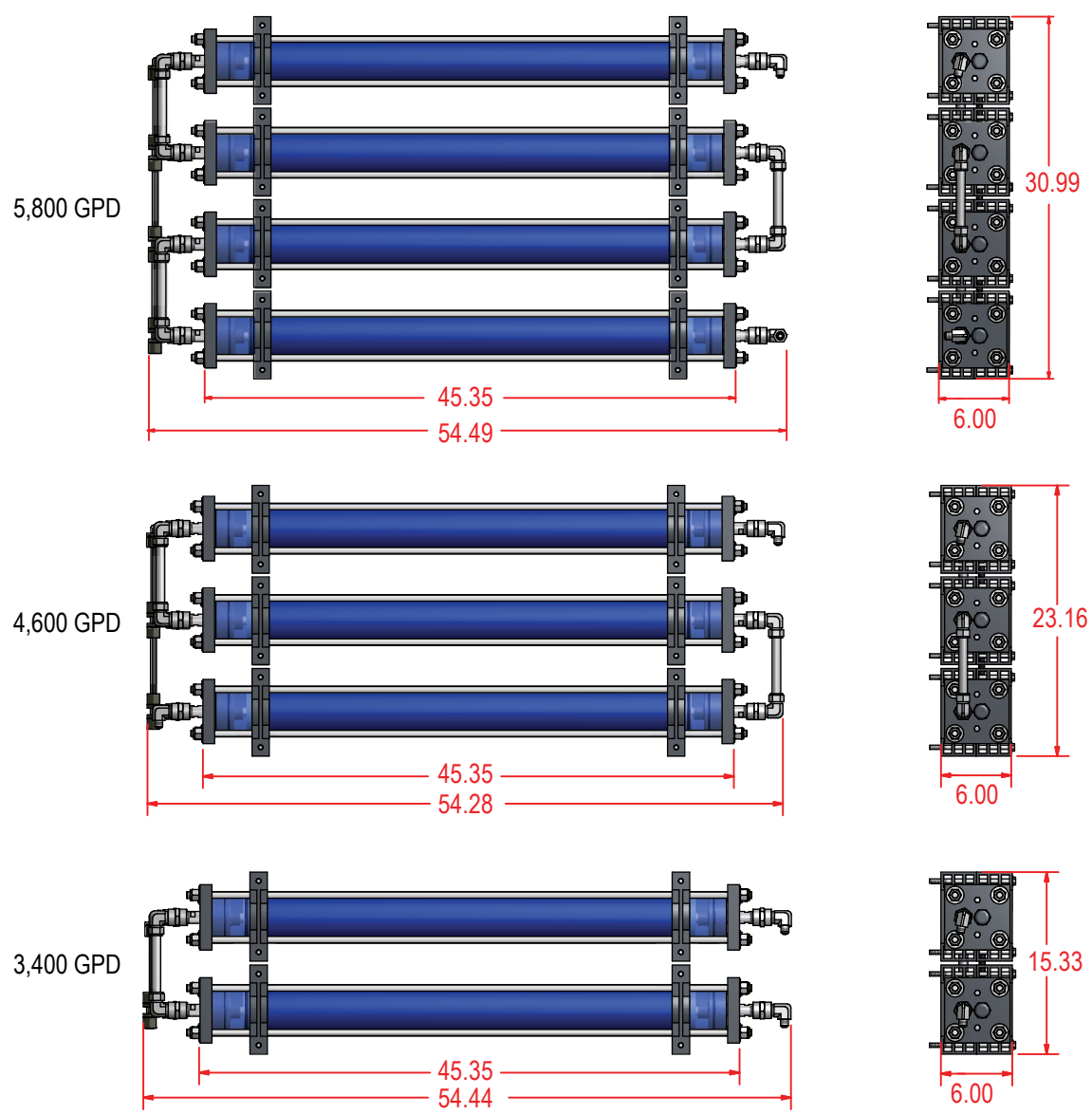


Figure 12: Dimensions, Weight & Footprint for 7" Remote (optional)

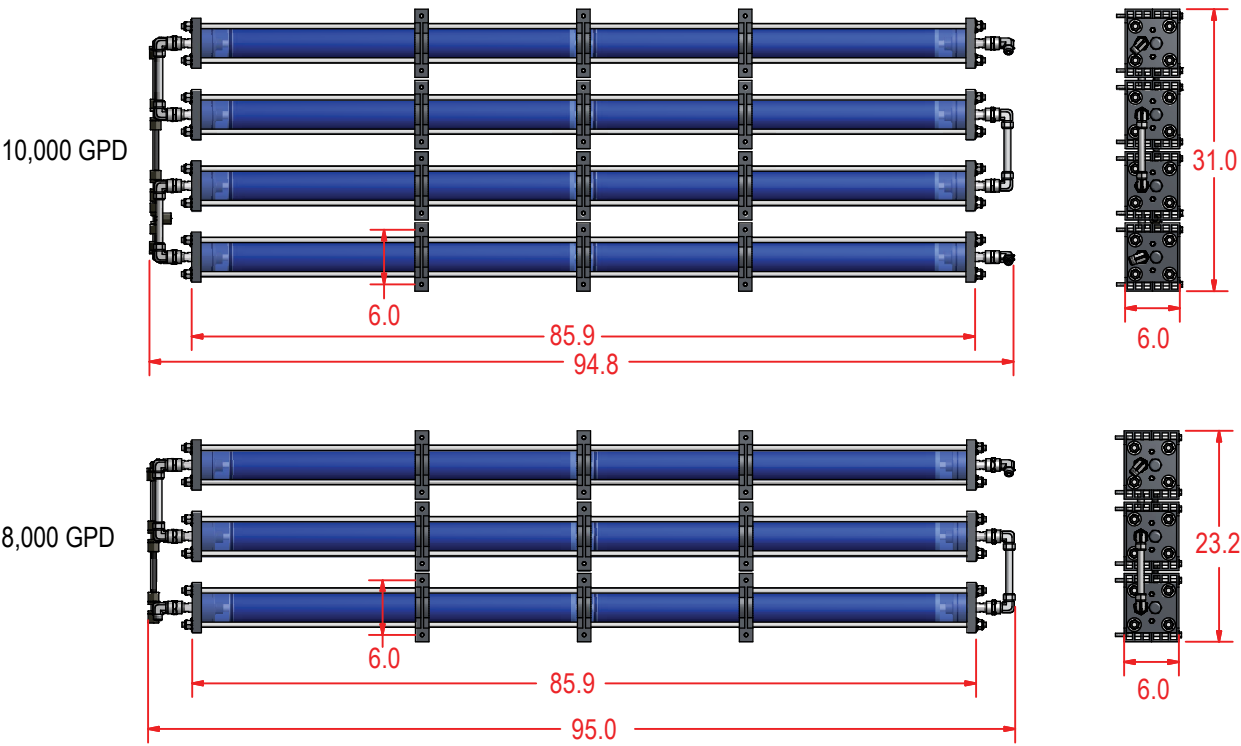
DIMENSIONS, WEIGHT & FOOTPRINT (continued)



Units: inches
Tolerances: ± 0.10 inches
Note: Vessel Set requires 45 inches of clearance (either side) for membrane change.

Figure 13: Dimensions PVs 3,400-5,800 GPD (if mounting off frame)

DIMENSIONS, WEIGHT & FOOTPRINT (continued)



Units: inches
Tolerances: ± 0.10 inches Note: Vessel Set requires 45 inches of clearance (either side) for membrane change.

Figure 14: Dimensions PVs 8,000-10,000 GPD (if mounting off frame)

PLUMBING DIAGRAM

Possible system plumbing layout is shown in *Figure 15*. The plumbing installation is discussed in "SYSTEM INSTALLATION / PLUMBING" on page 43.

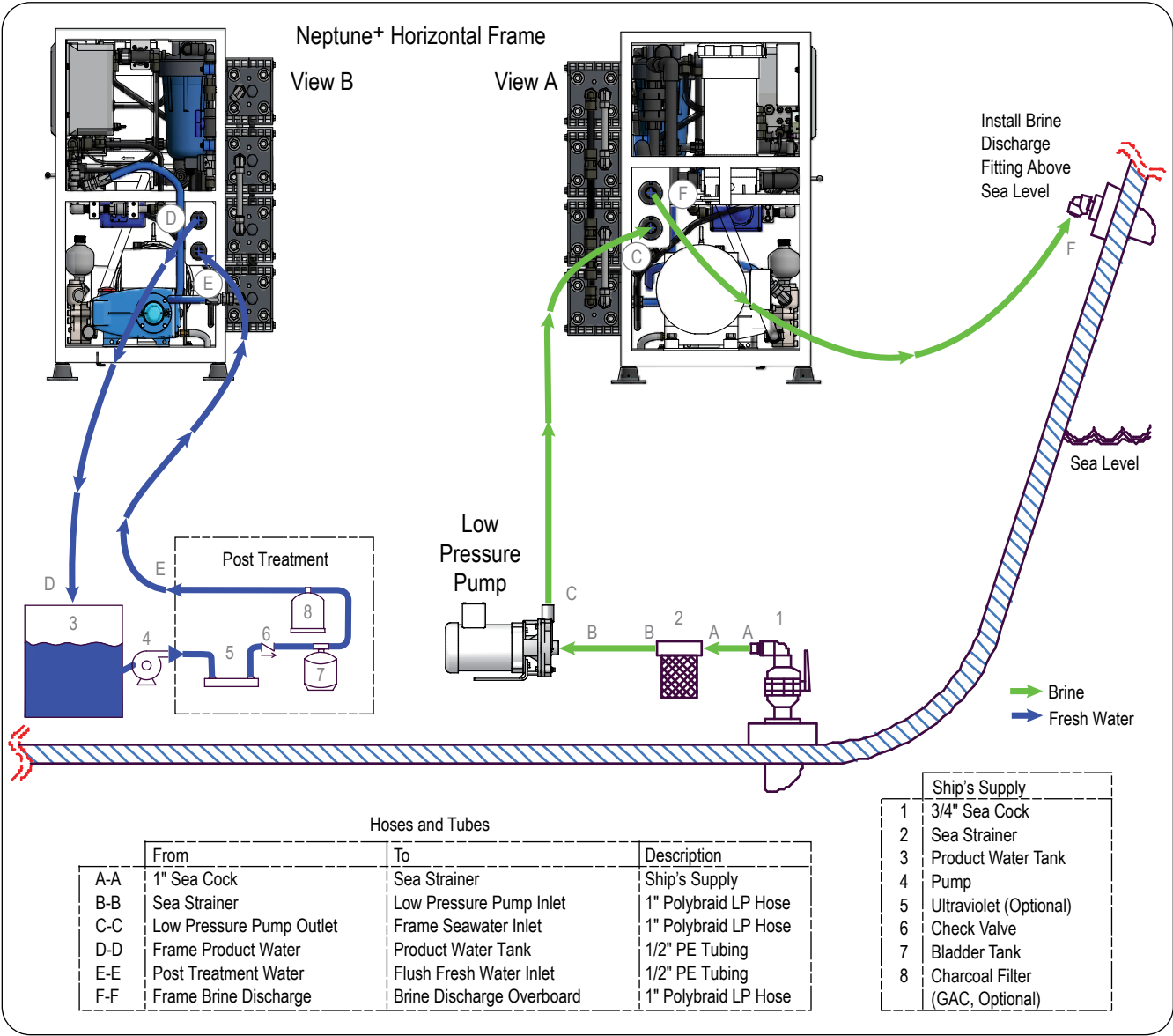


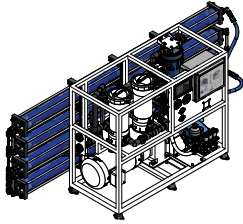
Figure 15: Plumbing Diagram

SYSTEM INSTALLATION / MOUNTING

Please refer to the appropriate footprint and layout diagrams from "DIMENSIONS, WEIGHT & FOOTPRINT" starting on page 35.

FRAME MOUNTING

Locate an area to mount the frame. Considerations should be: access to the fresh water flush cartridge, access to the oil drain and if possible, an additional 45" on one side of the pressure vessels for membrane replacement without dismounting vessels. Allow 15" clearance on top for changing the pre-filters. Allow at least two (2) feet of clearance in front of the machine to allow an operator to adjust the high-pressure valve and operate the control panel.

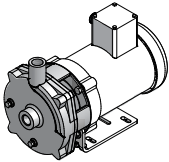


Place the entire system on predetermined location. Trace around the six shock mounts, or inside the mounting holes on the shock mounts. Remove the frame from the location. Following the traced mount outline or the hole location marks, install 1/4" lag bolts or through bolts with backing nuts. Be sure to use all mounting holes. Replace the frame. Because the mounts are rubber you will be able to bend them out of the way enough to allow you to position the frame in place.

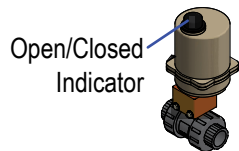
The pressure vessels can be removed and mounted remotely if space is an issue. The mounting brackets are designed to accommodate a remote installation, and additional tubing and high-pressure hose will be required.

LOW PRESSURE PUMP MOUNTING

The low-pressure pump should be mounted below the waterline. If the low pressure pump must be mounted above the waterline, install a check valve to insure the pump keeps its prime. Allow plenty of room around the pump motor to provide proper ventilation. The suction line should be fitted to allow at least one foot straight section of pipe on the inlet and discharge lines.



Position the pump in the desired location and trace around the mounting holes on the base. Remove the base from the pump by loosening the securing bolts. Mount the base using 5/16" lag bolts or through bolts with back nuts. If desired, a neoprene or rubber pad may be installed under the base to further insulate the pump from the hull or foundation. Replace pump and motor on base and tighten the bolts.



INLET ACTUATED VALVE MOUNTING (optional)

Mounting considerations are unique to each installation. FCI Watermakers recommends you consult an installer for installation of the optional inlet actuated valve.

SYSTEM INSTALLATION / PLUMBING

Before proceeding, review *Figure 16* and the notes below to ensure proper tube fittings and hose connections.

PROPER INSTALLATION OF HOSE ENDS AND FITTINGS

Follow these best practices when installing fittings and clamps:

- Cut the tube or hose end square and clean. You may use a vise and fine-tooth saw to facilitate a square and clean cut. Remove any burrs.
- For tubes, fittings are supplied. There are two types of fittings. Fittings with release button (called push-in fittings) require you to only insert tube until it bottoms. Fittings with nut require you to loosen nut three turns, insert tube until it bottoms, then tighten nut.
- For PVC helix wire suction hose, feed hose through a two clamps, push hose on over the barb until it bottoms against the barb, and tighten clamps. Do not use lubricant on the tube end; it may leave a residue that compromises the connection. You may, however, soak the hose end in hot water for a few minutes before pushing the hose on the barb.

CAUTION: Always allow slack in all tube and hose lines. Never cause the tube or hose to immediately bend from the fitting. Allow the line to enter or leave from the fitting in a straight manner for several inches to ensure proper connection, to relieve stress to the fitting and tube or hose, and to allow ease of detachment and reattachment during maintenance or repair.

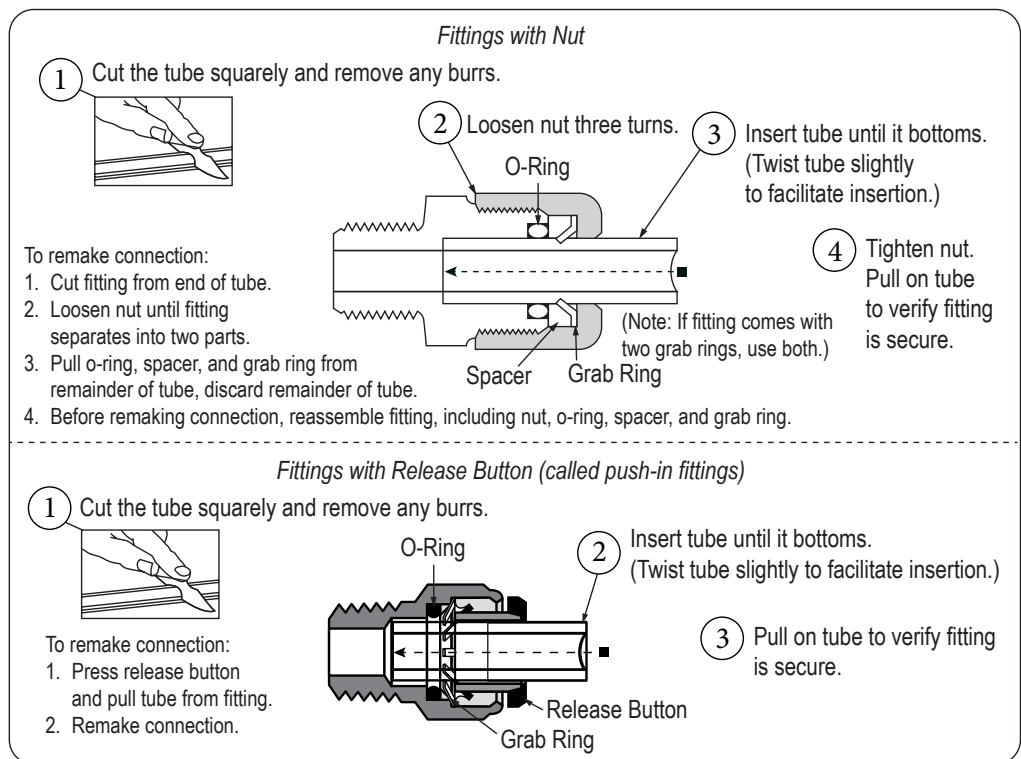


Figure 16: Proper Tube Fitting and Hose Connections

The "COMPONENTS SUPPLIED BY INSTALLER" on page 31 should be ready before plumbing the system.

Refer to "Figure 15: Plumbing Diagram" on page 41. Connect the plumbing as described.

LOW PRESSURE PUMP OR OPTIONAL ACTUATED INLET VALVE

Connect 1" non-ferrous pipe or non-collapsing suction hose from the sea strainer to the inlet connection of the low pressure pump or optional actuated inlet valve. Installer-supplied barbs may be used with the one-inch polybraided LP hose and hose clamps included in the installation kit.

FEED WATER INLET CONNECTION

Connect 1" non-ferrous pipe or non-collapsing suction hose from the low-pressure pump discharge connection (or the optional actuated inlet valve discharge connection) to the designated feed connection (Seawater Inlet) on the frame. Installer-supplied barbs may be used with the one-inch polybraided LP hose and hose clamps included in the installation kit. See *Hose C-C* in the plumbing diagram.

BRINE DISCHARGE CONNECTION

Using 1" pipe or hose, connect the port marked "Brine Outlet" to your overboard thru-hull fitting. Installer-supplied barbs may be used with the one-inch polybraided LP hose and hose clamps included in the installation kit. This line should not be combined with flow from other equipment without installing check valves to prevent backflow. This line should not have back pressure in excess of 20 PSI. See *Hose F-F* in the plumbing diagram.

PRODUCT WATER CONNECTION

Using 1/2" pipe or food grade hose connect the 1/2" NPT fitting on the right of the system to your fresh water storage tank. Make the run as straight as possible. Always make the connection on the top of the tank. Do not connect to a pressurized line as this will cause the system production to be reduced. Two 1/2" MNPT x 1/2" Tube PE Black Straight Connectors and 1/2" PE tubing are included in installation kit to assist in the connection. Installer-supplied barbs and hose clamps may be used instead of the connectors. If desired, the connection can be hard piped. See *Tubing D-D* in the plumbing diagram.

FRESH WATER FLUSH CONNECTION

Using the 1/2" NPT connection marked "fresh water flush", connect a 1/2" line from your pressurized fresh water source to the connection on the frame. Two 1/2" MNPT x 1/2" Tube PE Black Straight Connectors and 1/2" PE tubing are included in installation kit to assist in the connection. Installer-supplied barbs and hose clamps may be used instead of the connectors. If desired, the connection can be hard piped. A maximum of 50 PSI can be applied to this port. If your pressure is in excess of this an additional pressure regulator may be needed. Contact FCI Watermakers for details. See *Tubing E-E* in the plumbing diagram.

SYSTEM INSTALLATION / ELECTRICAL CONNECTIONS

Please refer to the wiring schematic for your unit, immediately following these electrical connections instructions.

CAUTION: DO NOT PERFORM INSTALLATION UNLESS:

1. The system feed water sea cock valve is closed.
2. The system main electrical disconnect switch is switched **OFF, LOCKED, and TAGGED.**

WARNING: ELECTRICAL SHOCK HAZARD. A volt/ohm meter will be necessary. The following installation procedures expose the installer to **HIGH VOLTAGE** and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.

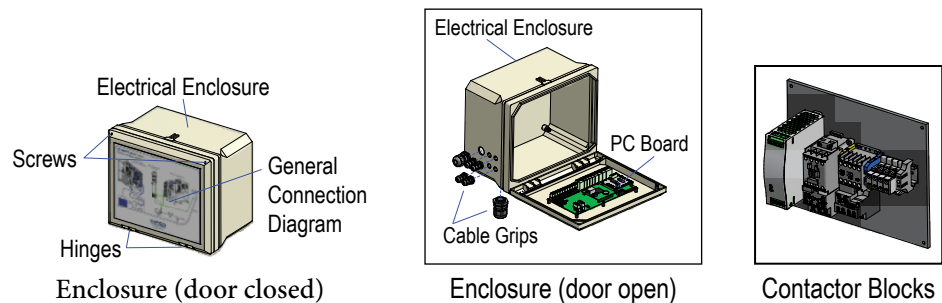
CAUTION: Always allow slack in electrical cables. Allow the cable to enter or leave from the strain relief in a straight manner for several inches to ensure proper connection, to relieve stress to the cable and fitting, and to allow ease of detachment and reattachment for maintenance or replacement. If electrical cables are pulled tight causing them to bend at the strain relief, they will pull out of the strain relief causing a dangerous electrical shock condition.

NOTE:

- Always follow all local and Coast Guard codes when installing this system.
- Grounding and circuit protection should be done in accordance with National Electrical Code.
- Never attempt to hook-up or service this system without disconnecting all power.
- Always check to make sure system voltage matches incoming voltage.
- If system is 3-phase, be sure to check for correct rotation on all pumps before running system.

ELECTRICAL ENCLOSURE

Locate the door of the electrical enclosure by looking for the General Connection Diagram on the system's front panel. To open the enclosure, loosen the two screws on the top corners of the control panel. The control panel is hinged on the bottom and swings open. The PC board is attached to the door of the control panel) and the contactor blocks are inside the enclosure. Cable and cord grips are provided in the installation kits to assist in routing the main power, the low pressure pump power, optional remote wires and optional actuated inlet valve wires into the enclosure.



WIRING THE LOW PRESSURE PUMP

Consult local codes to determine the correct gauge wire and follow standard color coding to attach wire the low pressure pump. Refer to wiring diagram on capacitor cover of pump (*Figure 17*).

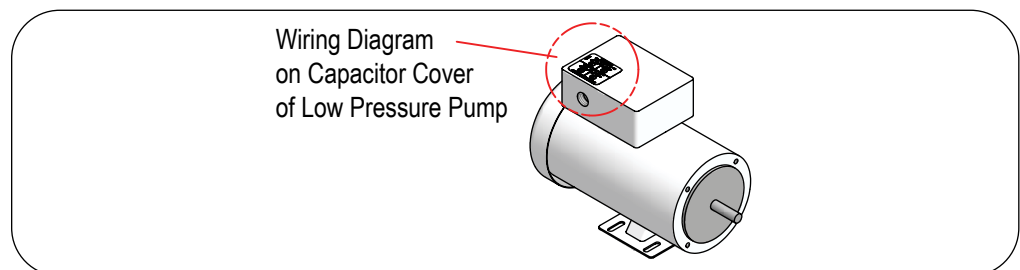


Figure 17: Location of Wire Diagram for Low Pressure Pump

Next, feed the wires through a cable or cord grip and into the electrical enclosure.

For three phase power, (50 or 60 Hz), attach the wires to terminals #2T1, #4T2, and #6T3 of the LPP contactor, and #G to the green isolated ground block. See *Figure 18* on page 47.

CAUTION: Centrifugal pumps must receive an initial prime in ALL cases. **DO NOT START PUMP BEFORE PRIMING**, except to check for proper rotation for 3-phase applications. Running with reverse rotation may cause impeller to spin off. Merely jog switch to check rotation. **DO NOT** run pump with liquid in reverse. Completely fill the pump volute and suction line. Remove air from volute by removing top pipe plug of volute while filling. After filling, check by turning pump shaft a few times. Add more water if required. If pump does not build up pressure as motor develops speed, shut down and re-prime. **DO NOT** attempt to prime pump or add liquid while pump is in operation.

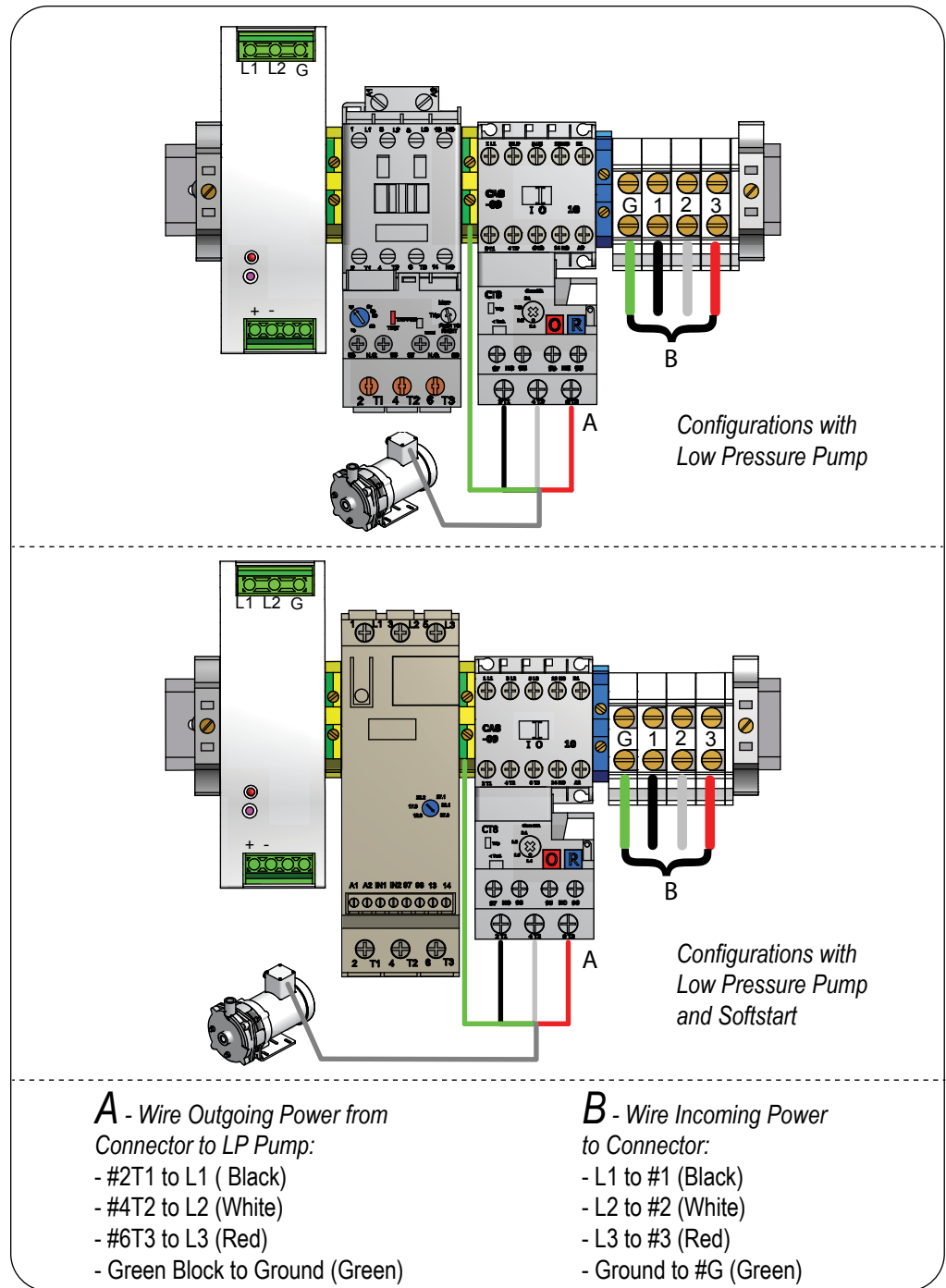


Figure 18: Wiring at the Contactor Block

WIRING THE INCOMING POWER AND GROUND

Using the proper gauge wire (consult with your local electrical codes), route the wires into the electrical enclosure via a cable or cord grip. Attach the wires to the contactor block's terminals marked:

- #1, #2, #3, and #G for three phase power (Figure 18 shown above)

WIRING THE ACTUATED VALVE (optional)

If you are installing the optional actuated valve in place of a low pressure pump, refer to *Figure 19* and wire the actuated valve to the connector block.

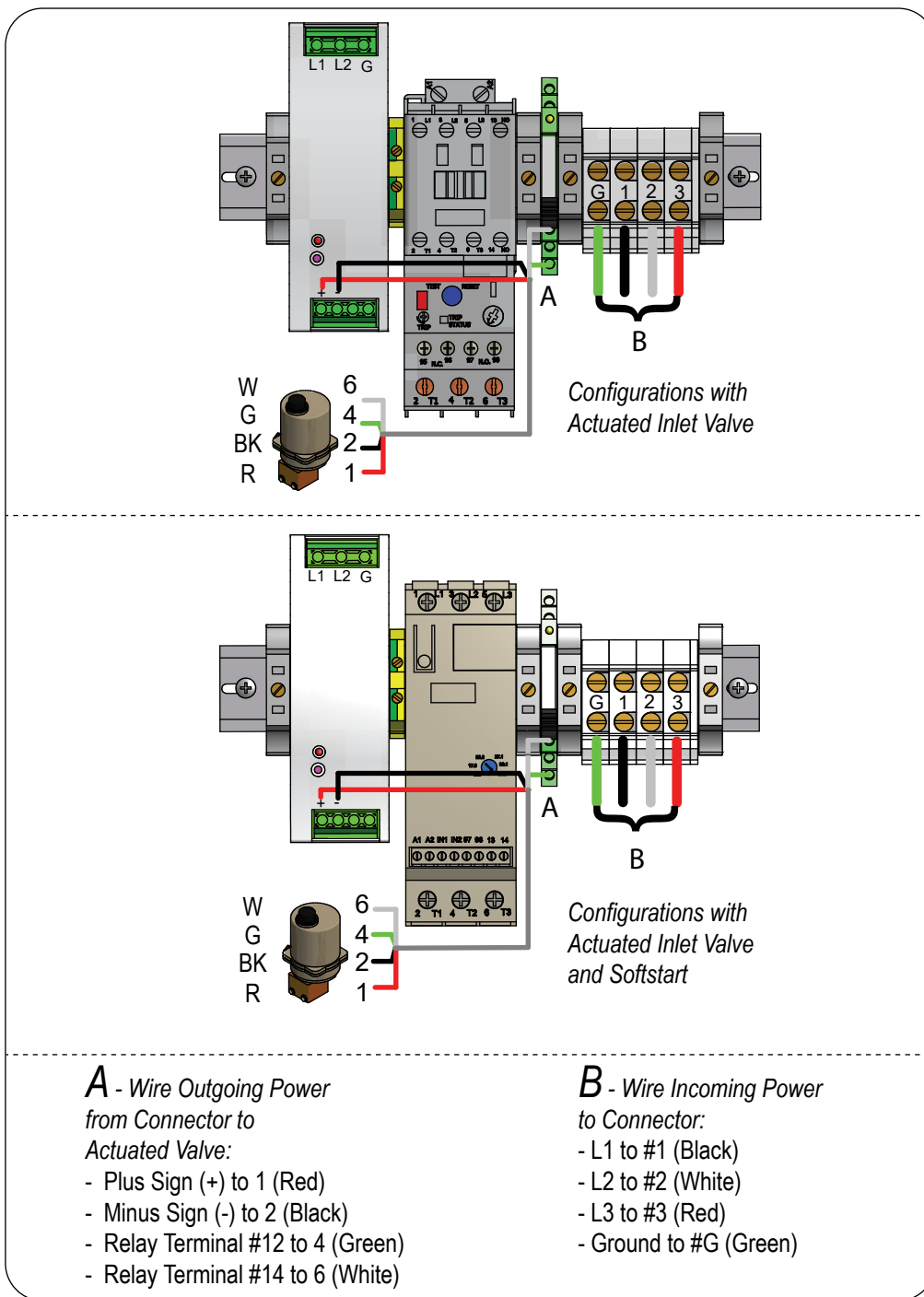


Figure 19: Wiring the Actuated Inlet Valve (optional)

REMOTE WIRING DIAGRAM

WIRING THE REMOTE (optional)

Mount the remote control panel using four #8 screws of choice (not supplied). See page 38 for dimensions and footprint. Refer to *Figure 20* and connect the remote control display to the PC board. The wiring uses a DB9 connector; soldering tool is needed to make the connections.

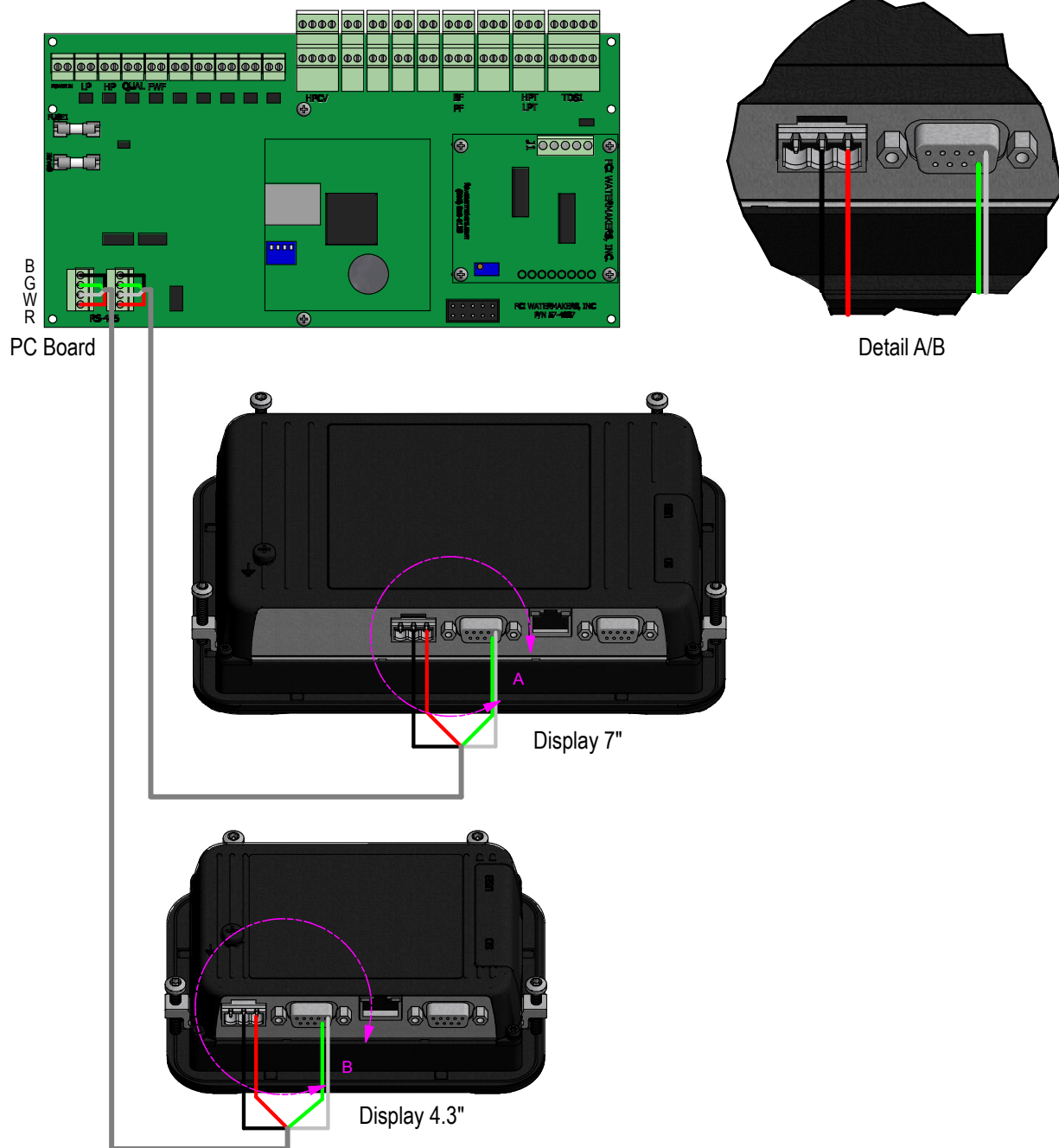
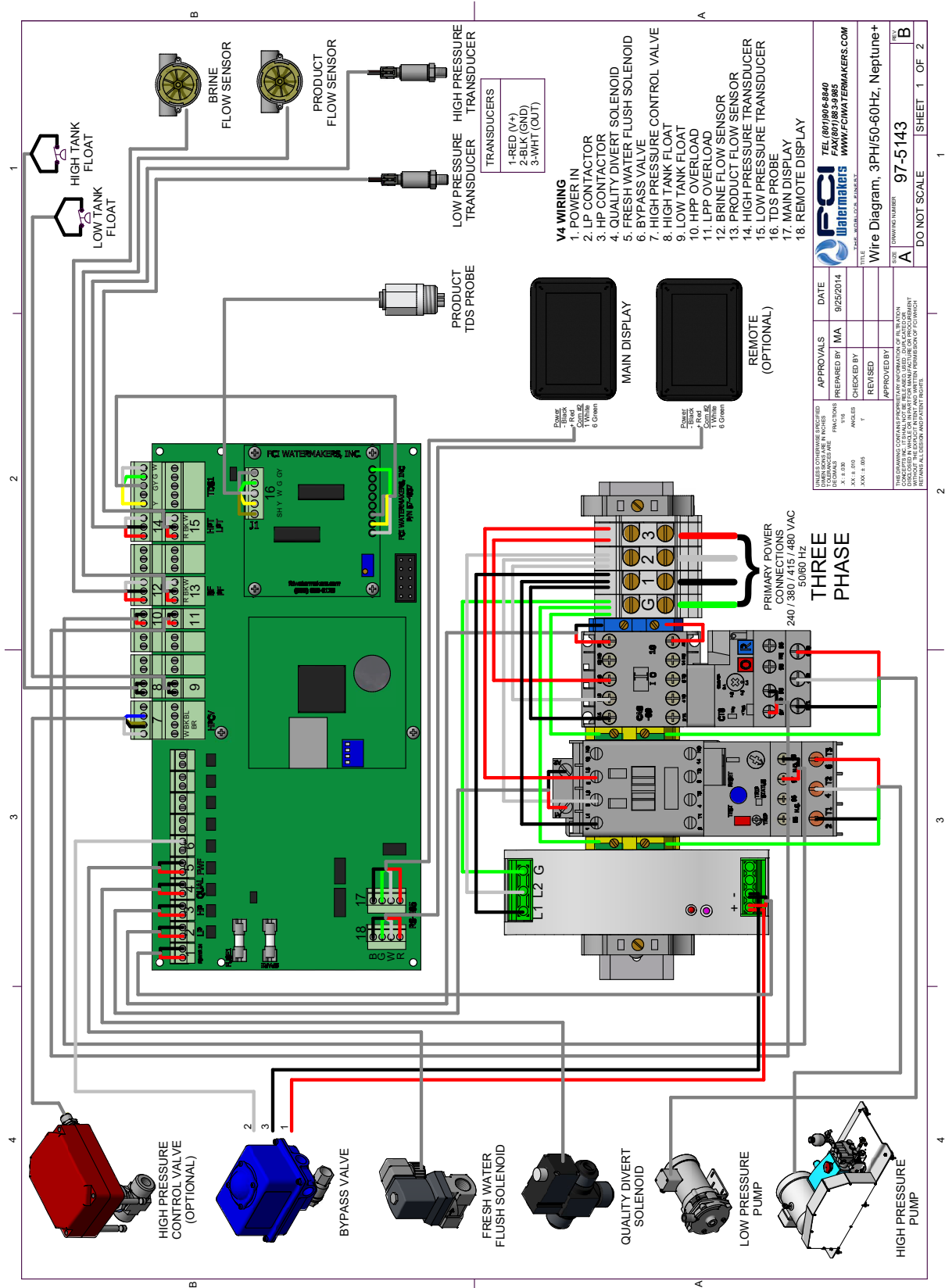
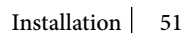


Figure 20: Wiring the Remote (optional)

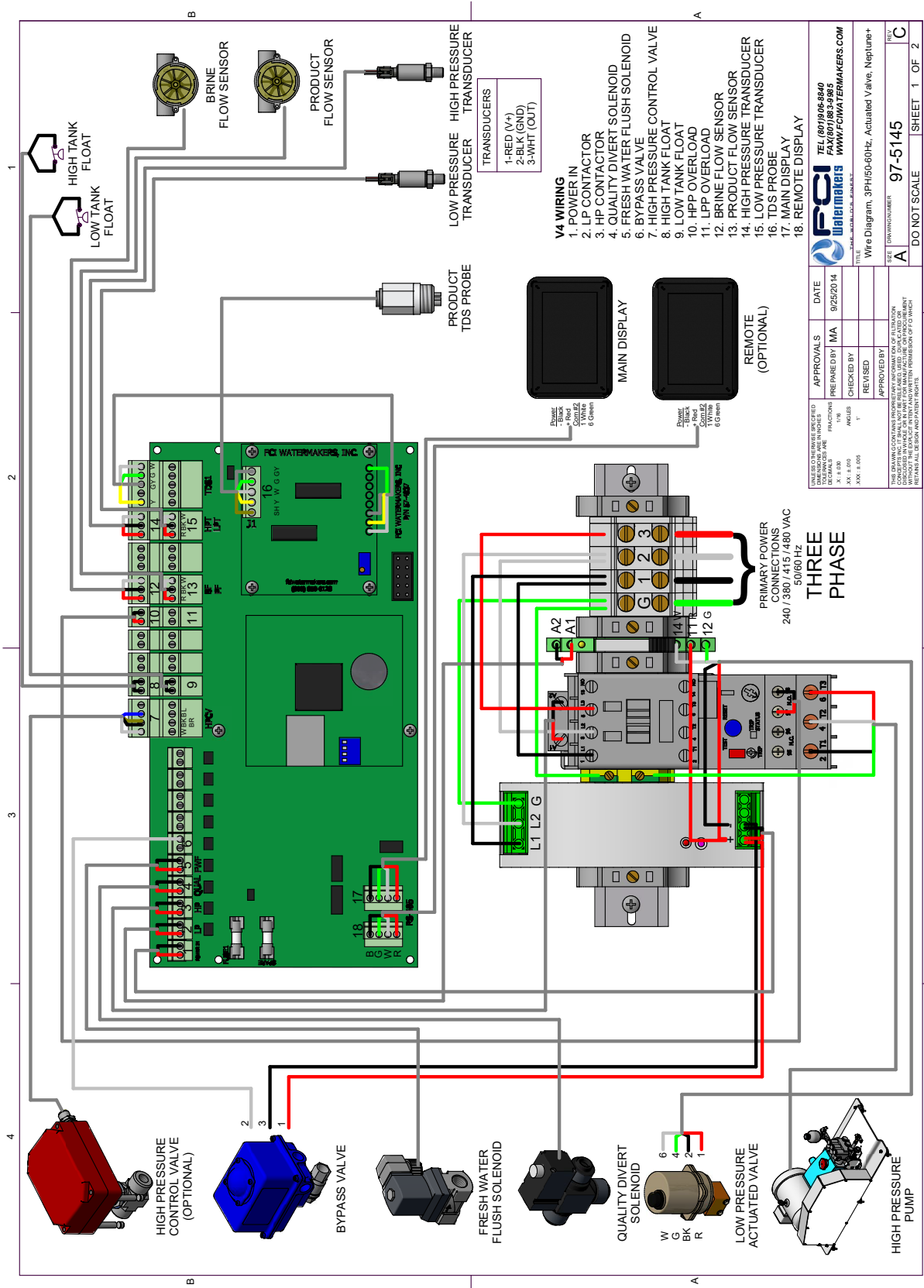
WIRING SCHEMATICS



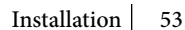
FCI WATERMAKERS, INC.



WIRING SCHEMATICS (actuator)



FCI WATERMAKERS, INC.



FINAL INSTALLATION CHECKLIST

The following list will help ensure a successful installation:

- Ample access around system/components
- All connections are tight
- Supply and discharge valves open
- Electrical connections are secure
- Storage tank is cleaned
- Pump rotations have been checked
- Pump crankcase is filled with oil
- All Coast Guard/local codes have been met
- No iron or ferrous fittings have been used
- Electrical connections are correct
- Plumbing connections do not leak
- Thru hull is open
- Filter housings are tight
- Hose clamps are tight

4/ OPERATIONAL INSTRUCTIONS

Prior to Start-Up, it is important to take note of the following:

FEED WATER — Be aware of the condition of the water the system is processing. Is it muddy, silty, or oily? Does it show signs of other man-made contaminants? If this is the case, DO NOT run the system. If these feed water conditions are unavoidable, additional filtration will be necessary. Consult the factory or your local dealer for further details and assistance with specific water conditions.

SALINITY EFFECT — Like water temperature, the salinity of the seawater has a direct effect on the output of the system and the quality of water produced. Your new watermaker is equipped with protection for overproduction and low quality water produced. When operating in low saline water, like rivers, deltas, or lakes, the “high-pressure” required will be less. For systems without APC, reduce the pressure to the point where you are making the rated output of your system. If this pressure adjustment is not monitored the system may detect a fault condition, protect itself, and shutdown.

PRESSURE EFFECT — The pressure within a system is regulated by the size of the orifice through which the brine stream flows; thus, creating back pressure in the pressure vessel. This pressure squeezes the fresh water out of the seawater stream. The amount of pressure applied through the system directly affects the quantity and quality of water produced. More pressure is needed in cold water than in warm waters. The reason being, membranes contract in cold water, not allowing the fresh water through as easily. When operating systems without APC, always try to maintain the pressure necessary for the system to operate at its rated output. As a safety feature, the system will shutdown when the pressure is too high or too low.

TEMPERATURE & PRESSURE EFFECTS CHART

TEMPERATURE EFFECT — Water temperature has a great effect on the output of the system. Increased water temperatures increases output at a given pressure. For systems without APC, it is very critical to adjust the pressure of the machine to maintain proper fresh-water production rate. It is more important to produce the rated output than it is to achieve a certain pressure. It is perfectly normal and acceptable for your system to produce good quality water while operating at its rated output at a pressure of 600 PSI. This reduced pressure is most likely caused by an increase in the seawater temperature, or a reduction in seawater salinity. Refer to *Figure 21*.

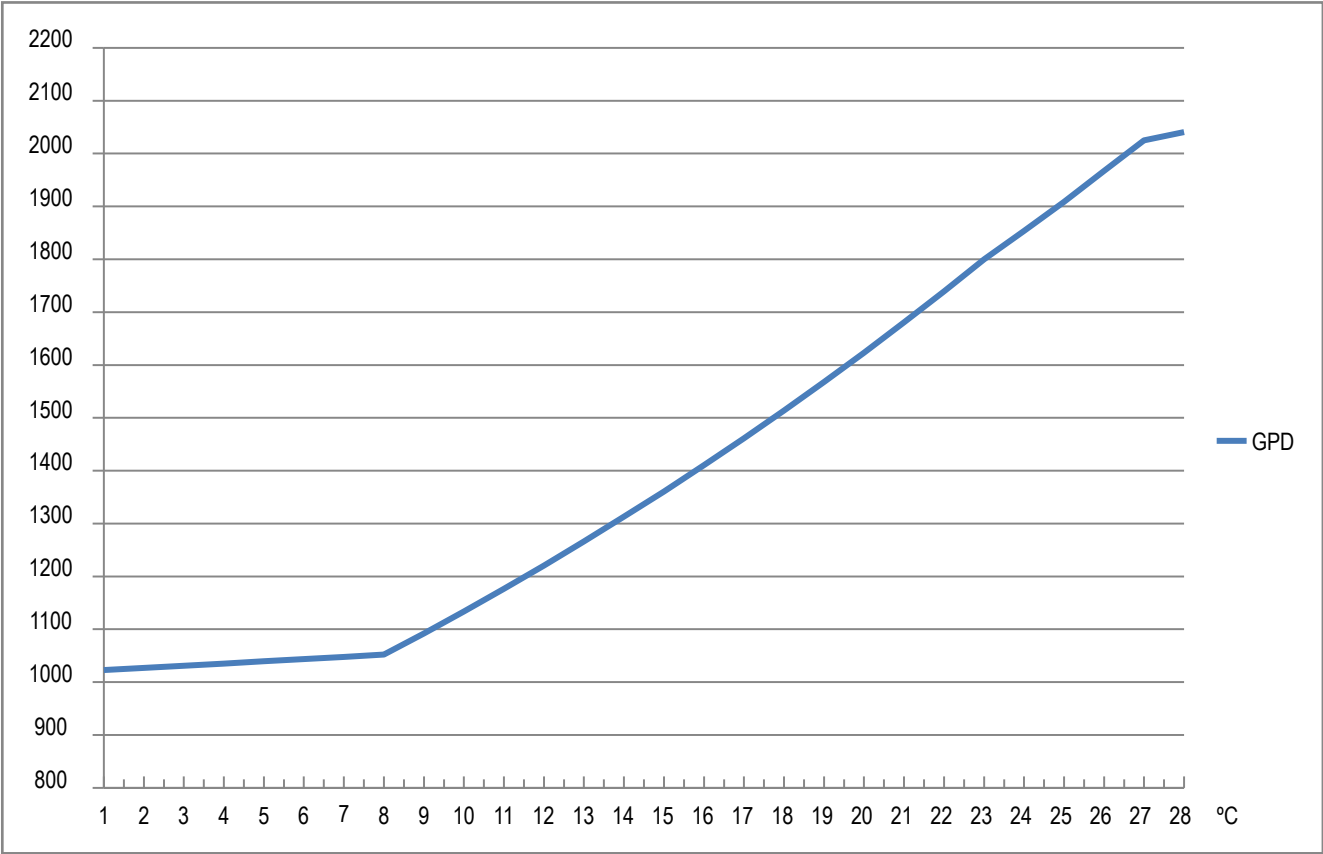
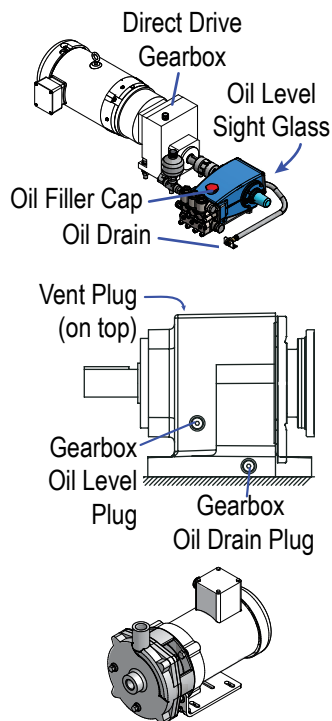


Figure 21: Water Temperature vs.. Output (constant pressure)

INITIAL START AND STOP

Follow the instruction below for a summary of the initial startup and shutdown. The pages that follow this summary describe the operation of the system in detail.



CHECK OIL LEVEL IN HIGH PRESSURE PUMP AND GEARBOX

The high-pressure pump and gearbox ship with oil and are ready to run. Should you need to add oil, be sure NOT to over fill the pump. With the oil fill plug removed, oil will not be visible through the opening—this is normal. The correct level is the middle of the sight glass.

CHECK THE ROTATION OF LP AND HP PUMPS

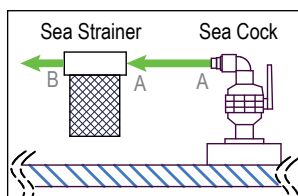
Centrifugal pumps must receive an initial prime in ALL cases. DO NOT START PUMP BEFORE PRIMING, except to check for proper rotation for 3-phase applications. Running with reverse rotation may cause impeller to spin off. Merely jog switch to check rotation. DO NOT run pump with liquid in reverse.

MAKE SURE LP AND HP PUMPS ARE PRIMED

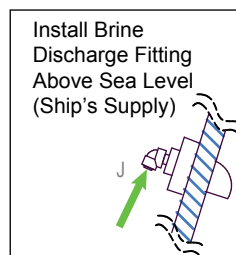
Centrifugal pumps must receive an initial prime in ALL cases. DO NOT START PUMP BEFORE PRIMING. Completely fill the pump volute and suction line. Remove air from volute by removing top pipe plug of volute while filling. After filling, check by turning pump shaft a few times. Add more water if required. If pump does not build up pressure as motor develops speed, shut down and re-prime. DO NOT attempt to prime pump or add liquid while pump is in operation.

INITIAL STARTUP AND SHUTDOWN

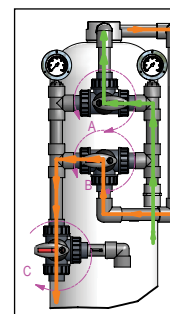
- 1 Make sure the sea cock is open, the sea strainer is clear and operational, and the brine discharge is unblocked. If your installation includes the optional media filter, make sure the valves are set to "in-service."



Sea Cock and Strainer



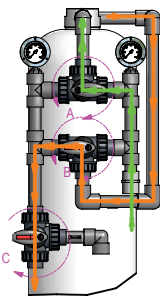
Brine Discharge



Media Filter

INITIAL START AND STOP (continued)

- 2 Apply power to the system. Wait until the LED indicator in the upper left of the display turns a solid blue. This indicates the system is powered up and in standby.
- 3 The display should show the power up screen. Touch the large watermaker logo to display the home screen.
- 4 If this is the initial startup and your installation includes the optional media filter, backwash the system for 20 minutes:
 - A. Press the setup icon.
 - B. The setup screen appears. Press the Media Tank icon.
 - C. The backwash screen appears.



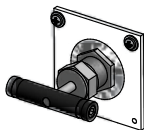
- If equipped with the manual media filter, press the manual circle and follow on-screen instructions.

You will be instructed to set the media filter valves to the “backwash” position, touch and confirm when done.

Pressing the valves icon will display the valves chart, showing the “backwash” position in which to set the valves before proceeding.

After backwashing is complete, follow on-screen instructions to set the valves to “in-service.” Touch and confirm when done.

- If equipped with an automated media filter, press the auto circle and follow on-screen instructions. Set the time and press start. The V4 control system will take care of the rest.



- 5 Press the start icon to start up the system. After priming and initializing, the system will display the run screen. For standard systems, turn the high pressure control valve clockwise until production is equal to the system's rated output. For systems with APC, the pressure will automatically adjust.
- 6 Production starts when water quality is acceptable.
- 7 To shutdown, press the stop icon. The system will shutdown and then flush with fresh water for a pre-set time. For standard systems, turn the high pressure valve all the way counterclockwise. For systems with APC, the valve will reset automatically.

V4 CONTROL SYSTEM OVERVIEW

The V4 Control System was specially designed by FCI Watermakers for our reverse osmosis systems. The system is designed to be run either locally via the display, or remotely via remote display or remote IP access.

The V4 Control System continuously monitors all inputs and controls all outputs for proper machine operation,

The Control System is designed to make machine operation as simple as possible for the operator. Once the operator places the machine into production with the appropriate setpoints, the Control System automatically sequences all controlled devices in order to ensure the proper amount of fresh water is delivered. In addition, water quality, flow rates, filter life, pressures, and pump status are all monitored to ensure safe and reliable operation.

All operation, machine setup, and calibration is performed via the display, with factory default settings stored permanently in the system in addition to a user savable settings.

SAFETY

The V4 Control System has four different processes to ensure the safety of the personnel operating the unit and also the unit itself. The process the V4 Control System uses depends on the severity of the issue.

- Notification
- Warning
- Alarm
- Shutdown

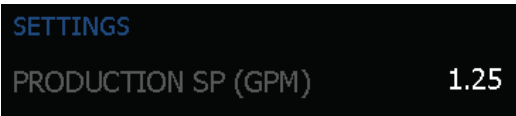
DISPLAY OPERATIONAL OVERVIEW

The FCI display was specifically selected due to its extreme durability in the marine environment. It is designed to not interfere with marine electronics, features a NEMA 4X design, and can be fully dimmable for night time operation. The display utilizes a resistive touch screen, and unlike most touch screens, the display relies on the press action of your finger in order to make contact with the screen. This allows the user to be able to activate the screen even with gloves on.

The following is a list of basic operational graphics, and a brief description how they function.

NUMERIC INPUT

Numeric Inputs show the value of a setpoint that can be adjusted, for example, a Timer Setpoint or a TDS Setting. These can be found in the setup section of the display. To change a setting, touch the number in white.



Upon pressing a Numeric Input, the Numeric Keypad will open up.



DISPLAY OPERATIONAL OVERVIEW (continued)

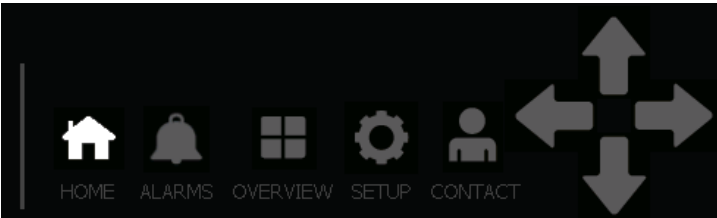
NUMERIC DISPLAY

Numeric Displays show the value of an device, such as a pressure transducer or flow meter. These values cannot be adjusted and are for reading machine status.

LOW PRESSURE	35.0	PSI
BRINE FLOW	2.96	GPM

NAVIGATION BAR

The Navigation Bar is positioned at the bottom of each screen for quick and easy navigation between the various screens.



Home – Displays the Home Screen, or the Run Screen when the unit is in operation.

Alarms – Displays the Alarm Screen.

Overview – Displays the Overview Screen which shows a graphical representation of the overall system status.

Setup – Displays the Setup Screen which allows the user to change settings.

Contact – Displays the Contact Screen.

Direction Arrows – Allow the user to navigate through various screens. The arrows will be white when they can be pressed to show additional screens.

DISPLAY OPERATIONAL OVERVIEW (continued)

STATUS INDICATOR

The Status Indicator shows a quick overview of what is active in the system and if there is any alarm conditions present.



LPP – This shows the status of the Low Pressure Pump/Low Pressure Actuator:

- Green = Pump On
- Grey = Pump Off

HPP – This shows the status of the High Pressure Pump:

- Green = Pump On
- Grey = Pump Off

TDS – This shows the status of the product quality (Total Dissolved Solids):

- Green = Quality Valve Open/Water Quality Below Setpoint
- Flashing Green = Quality Valve Closed/Checking Water Quality
- Red = Quality Valve Closed/Water Quality Above Setpoint

FWF – This shows the status of the Fresh Water Flush Valve:

- Green = Valve Open
- Grey = Valve Closed

ALM – This shows the status of any system alarms:

- Red = System Alarm
- Grey = No Alarm

STATUS BAR

The Status Bar shows a quick overview of what is active in the system and if there is any fault alarm conditions present.



Grey – System is not active and in standby mode.

Flashing Green – System is active, and is either priming or initializing.

Green – System is active and running.

Red – System is shutting down.

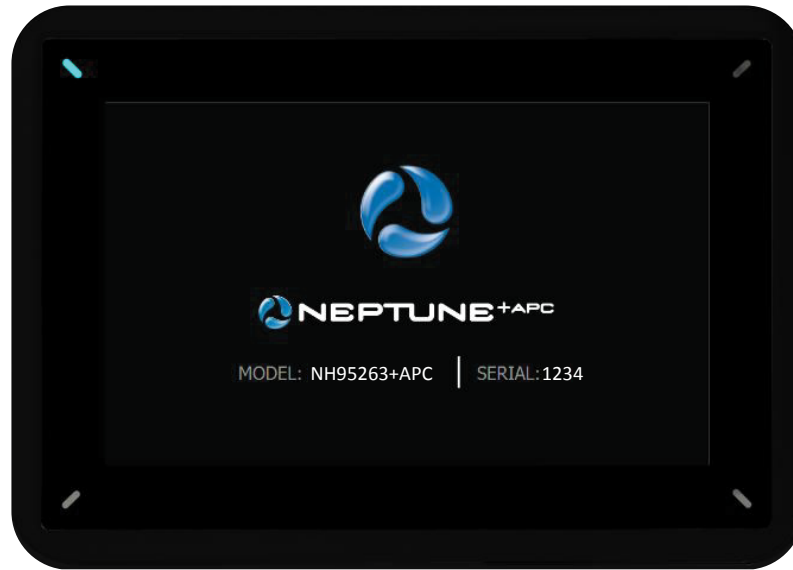
Flashing Blue – Fresh water flush delay is active and will start soon.

Blue – Fresh water flush is active.

DISPLAY OPERATIONAL OVERVIEW (continued)

DISPLAY INDICATOR

Located in the upper left hand corner of the screen is a LED light. This is used to quickly show the user the status of the system.



Blue – System is not running and in standby mode.

Slow Flashing Blue – System is running.

Slow Flashing Red – System is running, but a warning or alarm condition is present.

Red – System has stopped due to a shutdown.

Fast Flashing Blue – System is not ready to start due to Service Mode or Backwash mode being selected.

DISPLAY SCREENS

STARTUP SCREEN

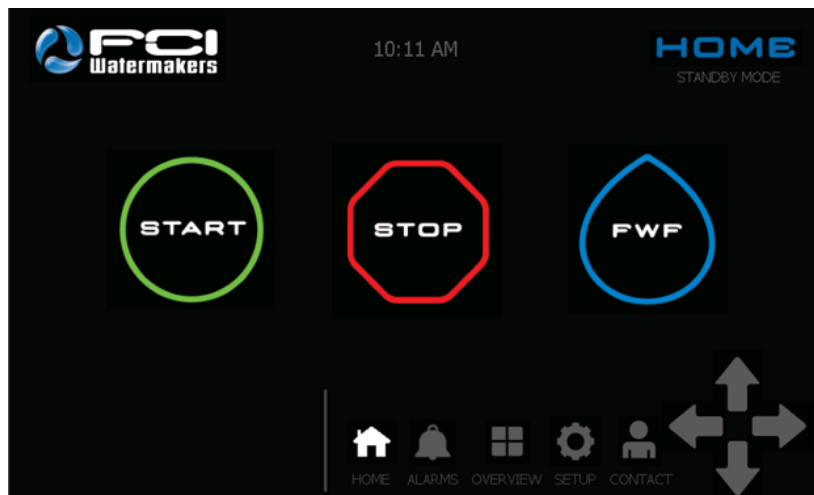
Upon powering your unit on, the screen will go through its boot process. Once complete, it will show the Startup Screen.



The startup screen displays Model # and Serial # for you reference. Touch the large watermaker logo to proceed to the Home Screen.

HOME SCREEN

The Home Screen is your main navigation portal.

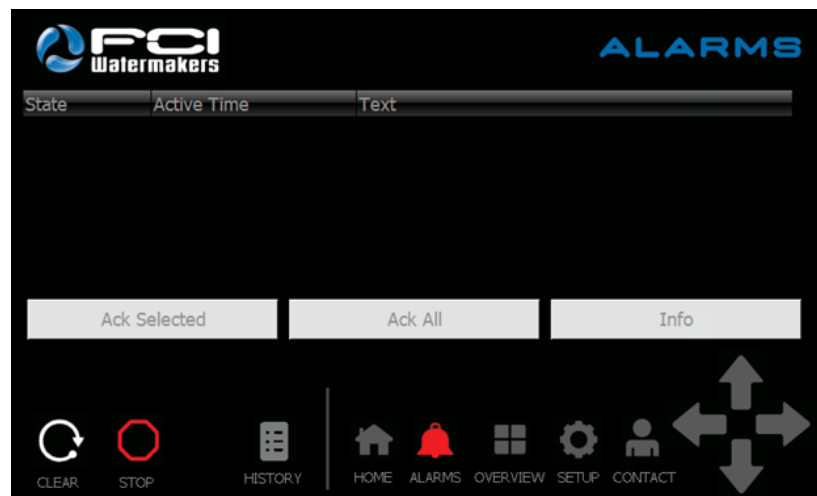


You will be able to access all screens from here by using the Navigation Bar located on the bottom right. In addition you can Start / Stop / FWF your unit from this screen. If any run options are selected they will be displayed in the lower left hand corner of the screen.

DISPLAY SCREENS (continued)

ALARMS SCREEN

The Alarms Screen is where you can view and clear any current alarms.



State – Describes the current condition of the alarm, “Active” or “Inactive.”

Active Time – This will show the time in which the alarm became active.

Text – This will tell the user what the alarm is.

Ack Selected – This is a button that allows you to acknowledge the alarm. Once the alarm has been acknowledge, you will need to hit the clear button on the lower left to clear the system prior to starting the unit up again.

Ack All – This allows the user to acknowledge all the active alarms.

Info – You can select an alarm by touching it on the screen. Once selected, press the info button. This will give you detailed information about the alarm and helpful troubleshooting tips.

History – This button will take you to the alarm history screen. Once an active or inactive alarm has been cleared, it will move to the alarm history page.

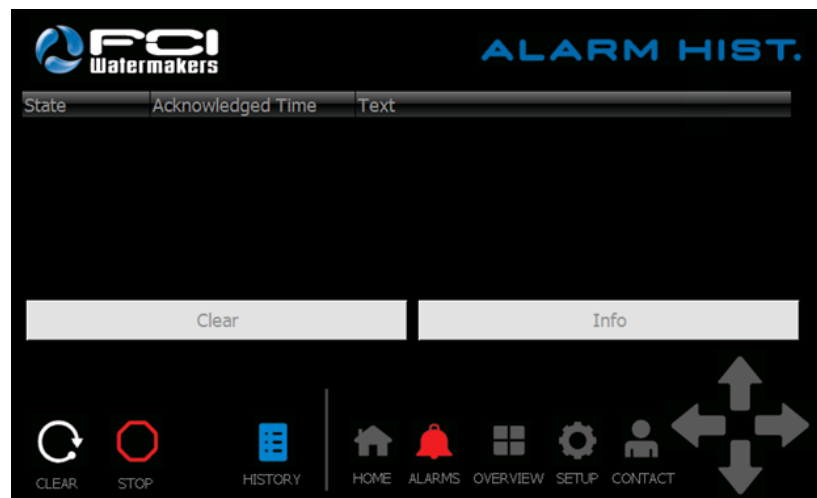
Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

ALARM HISTORY SCREEN

The Alarm History Screen is where you can view already-acknowledged alarms.



State – Describes the current condition of the alarm.

Acknowledged Time – This will show the time in which the alarm was acknowledged by the user.

Text – This will tell the user what the alarm is.

Clear – This button will clear the alarm history.

Info – You can select on alarm by touching it on the screen. Once selected, press the info button. This will give you detailed information about the alarm and helpful troubleshooting tips.

History – This button will take you back to the alarm screen.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

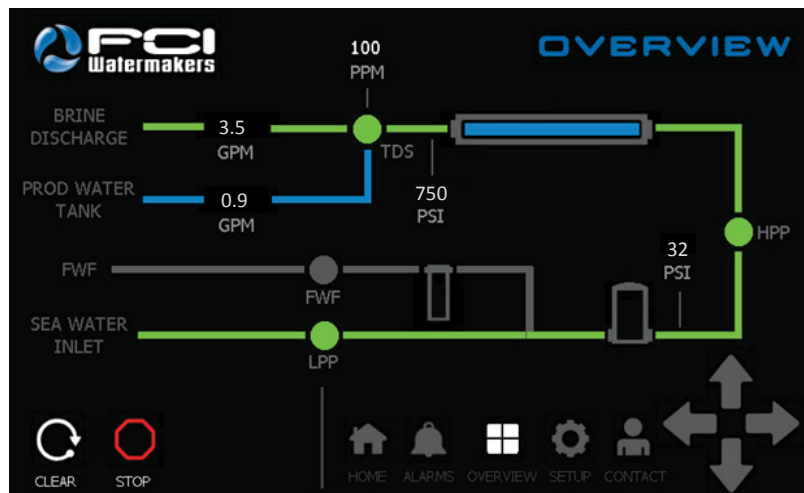
Navigation Bar – This allows the user to easily navigate between main screens.

DISPLAY SCREENS (continued)

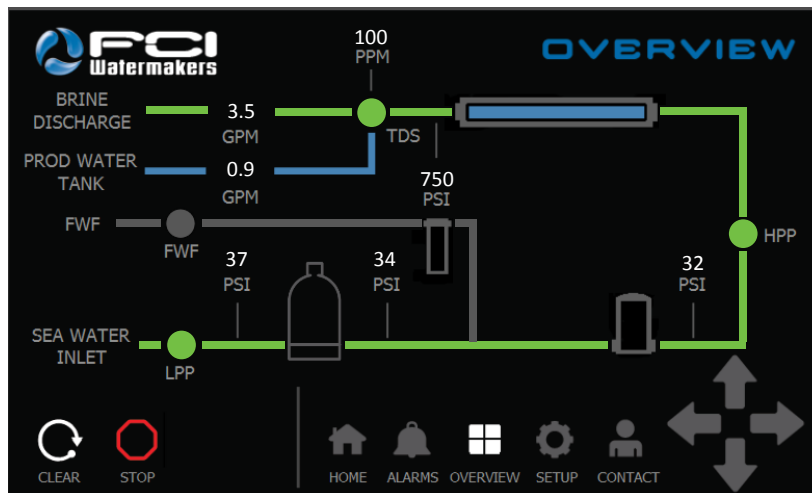
OVERVIEW SCREEN

The Overview Screen is a quick reference of the status of the system.

The Overview Screen for systems without media filter or with manual media filter is as follows:



The Overview Screen for systems with automated media filter is as follows:



It will display the pressures and flows in your system and show what outputs are active. For example, if you look at LPP, it shows a green circle, meaning the LPP is currently running. You are able to follow the flow of the water, where the green lines indicate sea water and the blue lines indicated fresh water.

Clear – Press this button to clear the system once a shutdown has taken place.

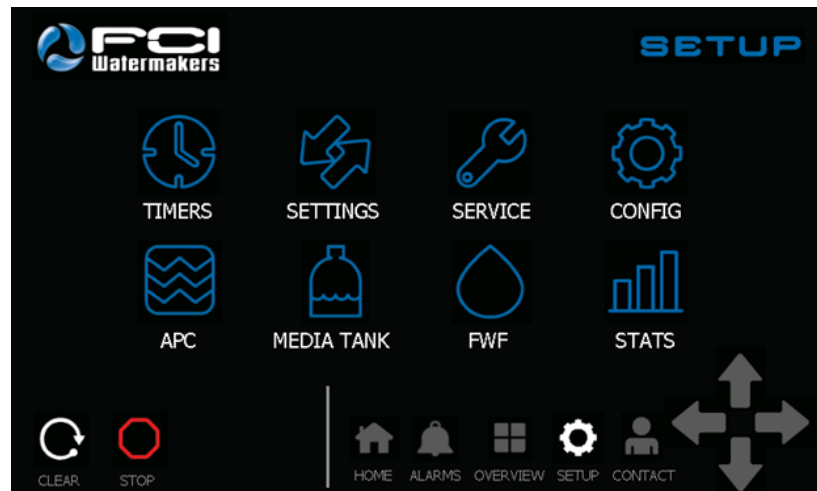
Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

DISPLAY SCREENS (continued)

SETUP SCREEN

The Setup Screen will show you all the areas in which you can adjust settings or see statistics of your system.



Timers – Press the image to take you to the system timers.

Settings – Press the image to take you to the system settings.

Service – Press the image to take you to the system service mode.

Config – Press the image to take you to the system configurations.

APC – Press the image to take you to the system Automatic Pressure Control.

Media Tank – Press the image to take you to the media tank mode.

FWF – Press the image to take you to the Fresh Water Flush Interval settings.

Stats – Press the image to take you to the system statistics.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

DISPLAY SCREENS (continued)

TIMERS SCREEN

The Timers Screen will allow you to adjust timer setpoints for the system.



To adjust a timer, press the white number of the timer you would like to adjust. Once pressed, a numeric keypad will come up.

Prime – The Prime Timer is the amount of time in minutes the Prime Sequence will be active.

Initialization – The Initialization Timer is the amount of time in minutes the Initialization Sequence will be active.

Flush – The Flush Timer is the amount of time the Fresh Water Flush Sequence will be active.

High TDS Shutdown – The High TDS Shutdown Timer is the amount of time the system will allow for a high TDS prior to shutting down the system.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

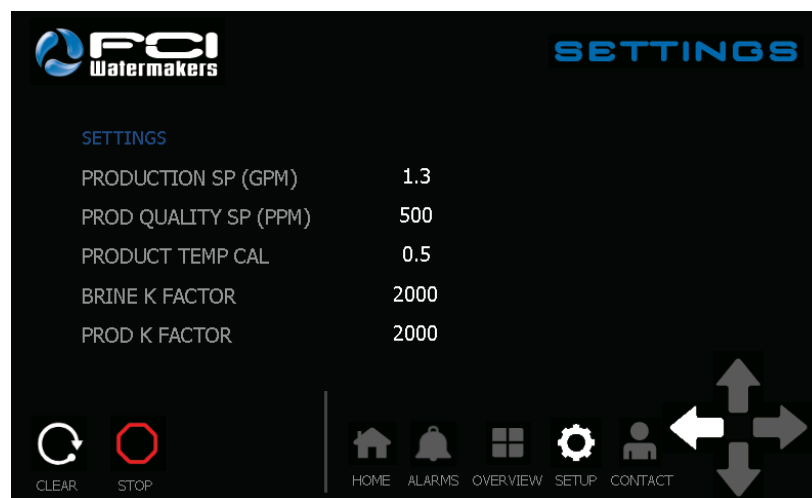
Navigation Bar – This allows the user to easily navigate between main screens.

Left Arrow – Goes back to the main setup screen.

DISPLAY SCREENS (continued)

SETTINGS SCREEN #1

The Settings Screen #1 will allow you to adjust system settings.



To adjust a setting, press the white number of the setting you would like to adjust. Once pressed, a numeric keypad will come up.

Production SP (GPM) – If equipped with APC, this setting is the amount of water your system will produce. It is recommended to keep the setting as is to maintain efficiency and life of your system. If not equipped with APC, this is what you should dial your high pressure control valve to for maximum efficiency and life of your system.

Prod Quality SP (PPM) – This setting is the Product Quality Setpoint. Once the system reaches a number below the setpoint, the system will allow the water to go to your product tank. If the system is above the setpoint, the water will not be allowed to go to the product tank.

Prod Temp Cal – This is your Product Temperature Calibration. This is set by the factory and can be adjusted if needed.

Brine K Factor – This is your Brine Flow Meter Calibration. This is set by the factory and it is not recommended to change this setting.

Prod K Factor – This is your Product Flow Meter Calibration. This is set by the factory and it is not recommended to change this setting.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Left Arrow – Goes back to the main setup screen.

Down Arrow – Displays Settings Screen #2 (only available with an automated media tank installed).

DISPLAY SCREENS (continued)

SETTINGS SCREEN #2

Settings Screen #2 will allow you to adjust system settings for the automated media tank, if installed



To adjust the settings, press the white number of the setting you would like to adjust. Once pressed, a numeric keypad will come up.

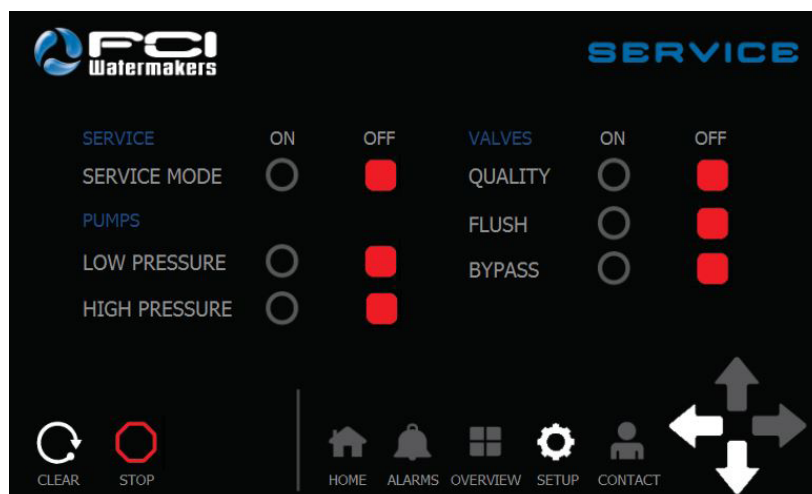
Media Tank Diff SP (PSI) – This setting is the high differential setpoint in which the media tank will alarm and proceed to backwash if no action is taking.

Filter Diff SP (PSI) – This setting is the high differential setpoint in which the pre-filter will alarm and allow the user to select to continue to run, or to stop the unit and replace the pre-filter.

DISPLAY SCREENS (continued)

SERVICE SCREEN #1

The Service Screen allows the user to test and run the system in a manual mode.



To turn on a setting, touch the grey circle. The circle will then turn to a green circle, indicating the item is on. To turn off an item, touch the grey square. The square will turn red once the item is off.

Service Mode – Allows the user to turn service mode on/off. When service mode is on, the user can manually activate the pumps and valves. Once complete, turn off service mode in order to run the machine normally. Service mode can only be activated when the machine is not running.

LP Pump – Manually turn on the low pressure pump.

HP Pump – Manually turn on the high pressure pump.

Quality – Manually open or close the quality valve.

Flush – Manually open or close the fresh water flush valve.

Bypass – Manually open or close bypass valve.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

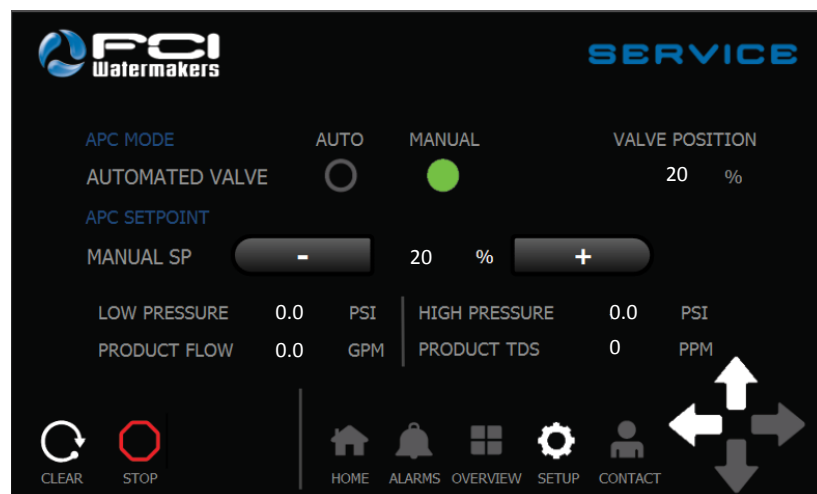
Left Arrow – Goes back to the main setup screen.

Down Arrow – Goes to page #2 of Service.

DISPLAY SCREENS (continued)

SERVICE SCREEN #2

The Service Screen allows the user to test and run the system in a manual mode.



Service Screen #2 gives key pressures and flows to allow the user to run in a manual mode.

Automated Valve – Controls the APC. Auto mode allows the control system to adjust the valve for maximum efficiency. Manual mode allows the user to adjust the valve via Manual SP.

Valve Position – Informs the user the position of the valve in percentage closed.

Manual SP (%) - When the unit is in manual mode, the user can adjust the valve position by touching (-) or (+). This will open or close the valve from 0% (open) to 100% (closed).

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

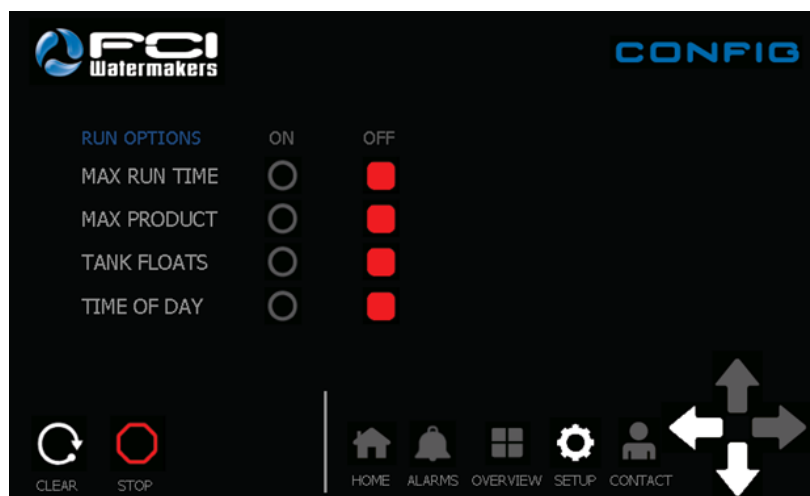
Left Arrow – Goes back to the main setup screen.

Up Arrow – Goes to page #1 of Service.

DISPLAY SCREENS (continued)

CONFIG SCREEN #1

The Config Screen allows the user to select different run options for their unit.



Max Run Time – This allows the user to setup the maximum amount of time the unit will run. Once this option is turned on, you will be able to set the number of hours you want the system to run for prior to shutting down and fresh-water flushing itself.

Max Product – This allows the user to setup the maximum number of gallons the system will produce. Once the option is turned on, you will be able to set the number of gallons you want the system to produce prior to shutting down and fresh-water flushing itself.

Tank Floats – This allows the user to install tank floats on their product water tank and wire the floats to the controller (see instruction in wiring schematic). Once the option is turned on, the controller will wait till both floats are dry and turn on the unit. Once both floats are wet the unit will shutdown and fresh-water flush itself.

Time of Day – This allows the user to set times to start and stop the system. Once pressed, a start hour and minute will appear, and a stop hour and minute will appear. Set your time (24 hour based) and the system will automatically start and stop. Once stopped, the system will shutdown and fresh-water flush itself.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

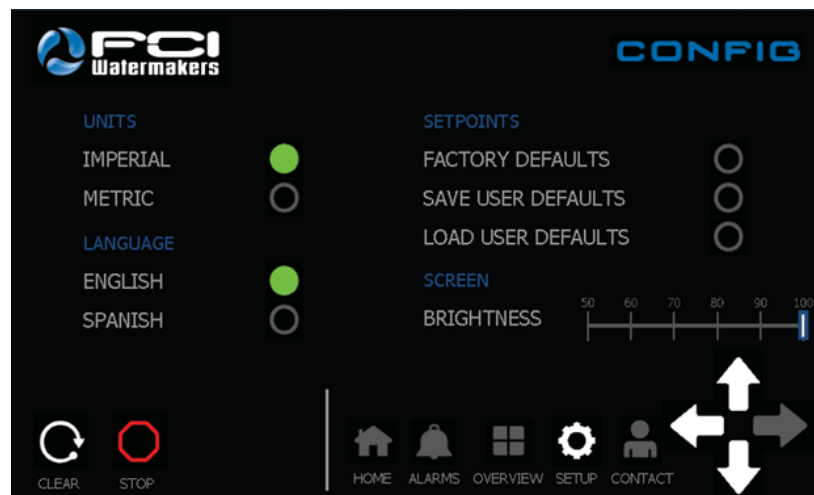
Navigation Bar – This allows the user to easily navigate between main screens.

Left Arrow – Goes back to the main setup screen.

Down Arrow – Goes to page #2 of Config.

CONFIG SCREEN #2

The Config Screen allows the user to adjust units, language, setpoints and screen brightness

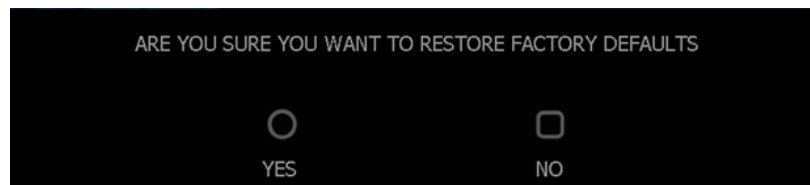


Units – Either Imperial or Metric units can be selected

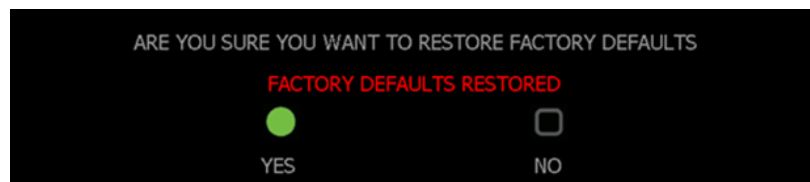
Language – Either English or Spanish can be selected

Setpoints –

- **Factory Defaults.** This restores the defaults set in place by the factory. Press and hold the grey circle to restore factory defaults, a popup will appear confirming you want to Restore Factory Defaults.



Press and hold Yes until a red **FACTORY DEFAULTS RESTORED** appears.



- **Save User Defaults.** This allows the user to save their own defaults specific for their system. Press and hold the grey circle to save user defaults, a popup will appear confirming you want to Save User Defaults. Press and hold Yes until a red **USER DEFAULTS SAVED** appears.
- **Load User Defaults,** this allows the user to load their saved defaults for their system. Press and hold the grey circle to load user defaults, a popup will appear confirming you want to Load User Defaults. Press and hold Yes until a red **USER DEFAULTS LOADED** appears.

DISPLAY SCREENS (continued)

Screen – Brightness – This allows the user to dim their screen for night time operation.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

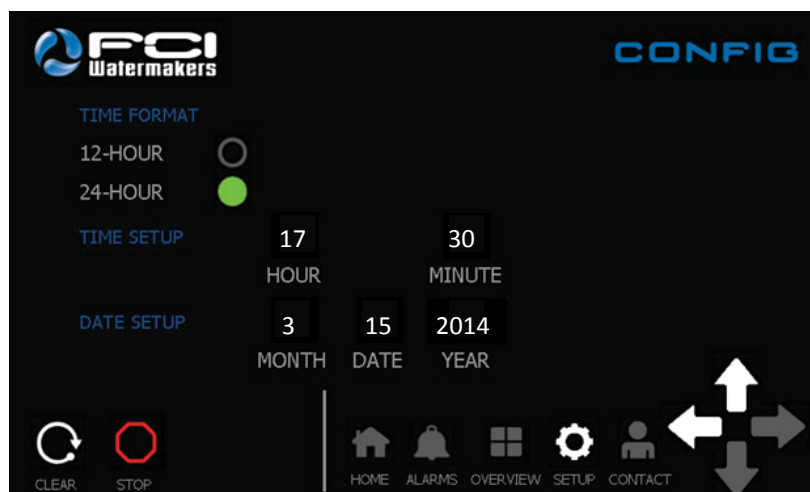
Left Arrow – Goes back to the main setup screen.

Up Arrow – Goes to page #1 of Config.

Down Arrow – Goes to page #3 of Config.

CONFIG SCREEN #3

The Config Screen allows the user to adjust the time format, time, and date.



Time Format – User is able to adjust the way the time is displayed, 12-hour based time vs. 24-hour based time.

Time Setup – Set the hour and minute (24-hour based).

Date Setup – Set the Month, Date, and Year.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Left Arrow – Goes back to the main setup screen.

Up Arrow – Goes to page #2 of Config.

DISPLAY SCREENS (continued)

APC SCREEN

If your system is equipped with APC, the screen will graph the controller in action as it is matching your requested product water production. This will assist in troubleshooting if there are any issues. If APC is not equipped, the graph will not show.



PV – Process Variable shows your Product Water Flow Meter Reading.

SV – Set Variable shows your Production Setpoint.

Output – Indicates the output going to the valve.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

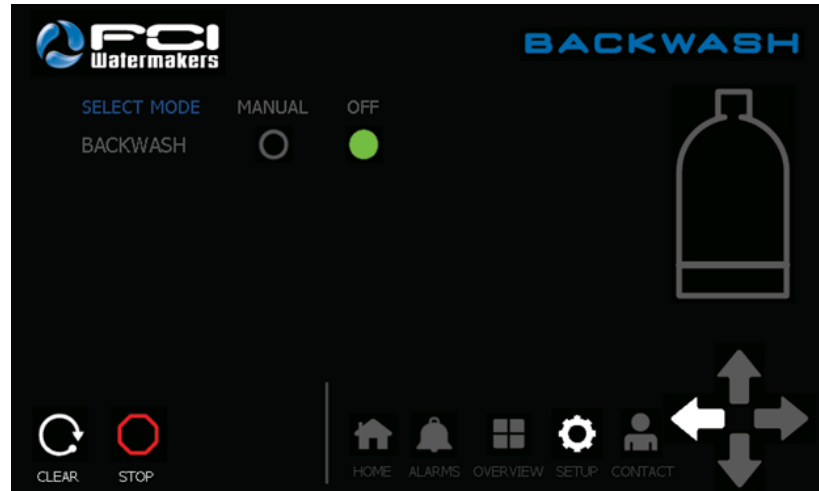
Left Arrow – Goes back to the main setup screen.

DISPLAY SCREENS (continued)

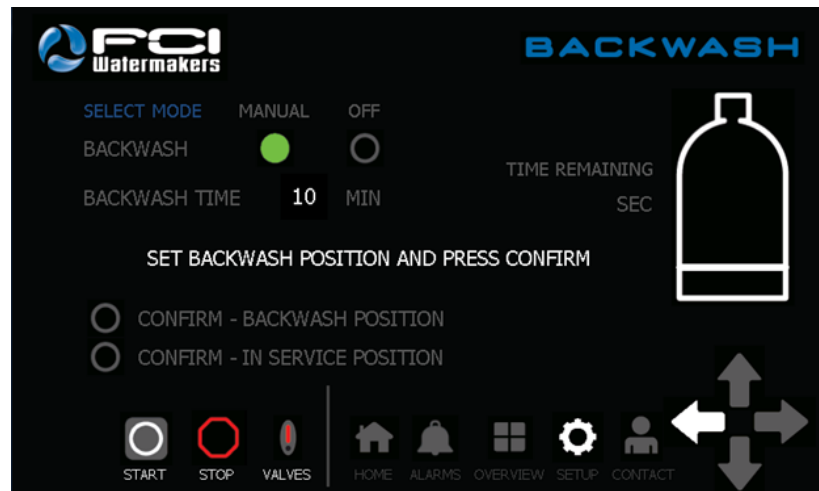
BACKWASH SCREENS (Manual Media Filter)

If your system is equipped with a Media Tank, these screens will guide you how to backwash your tank.

1. Select backwash mode by touching the grey circle marked, “MANUAL.”

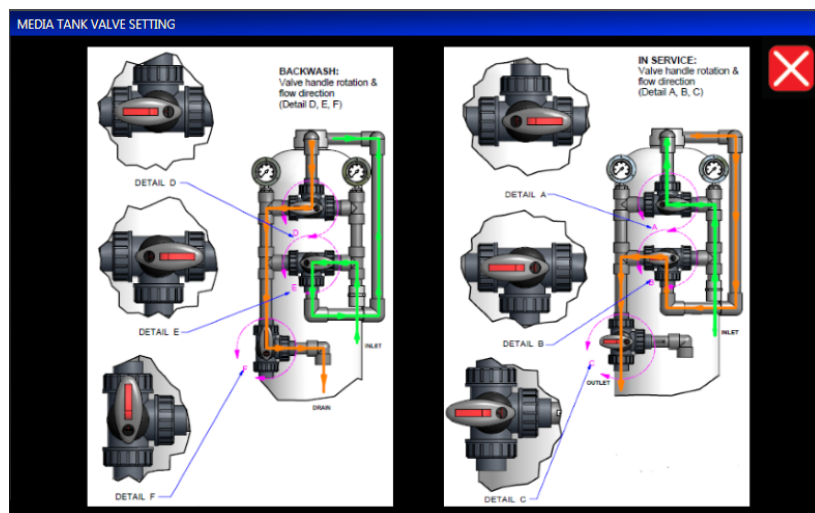


2. Once selected, use the on screen directions to complete a backwash. You will be instructed to set the media filter valves to the backwash position, and touch confirm when done.

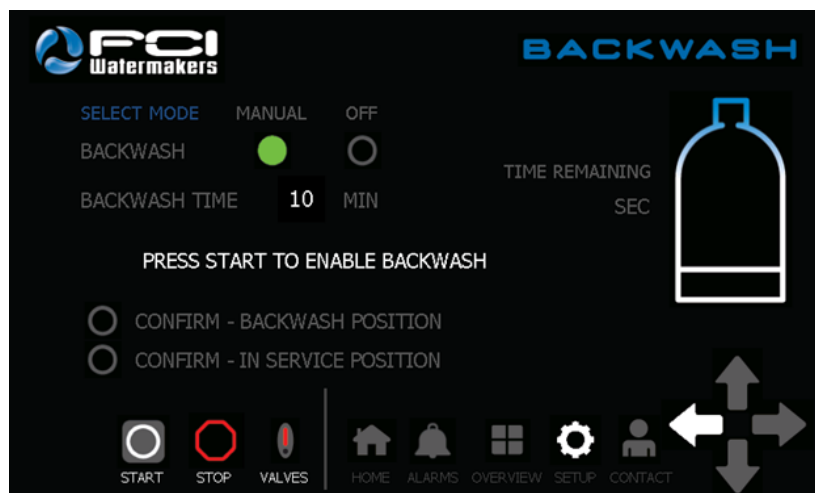


DISPLAY SCREENS (continued)

3. You can select the valves icon towards the bottom center of the screen for help in the setup the media tank valves.

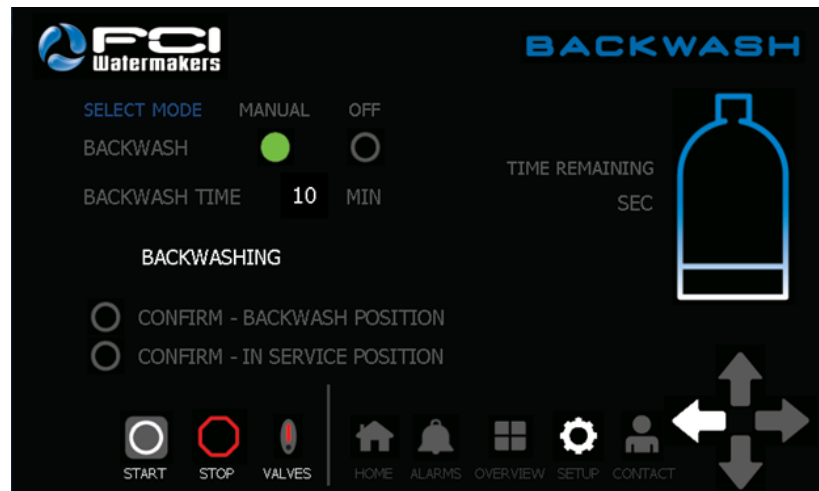


4. Once backwash position is set and the confirm button is pressed, you will be prompted to start the backwash process.

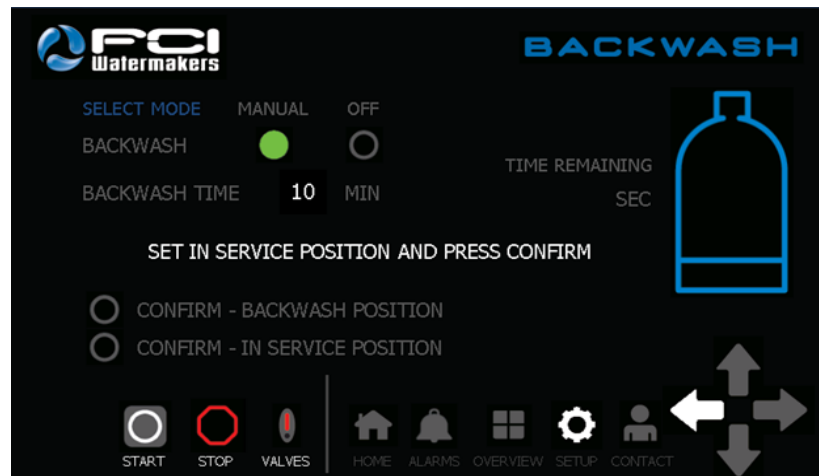


DISPLAY SCREENS (continued)

- During the backwash process, the display will indicate backwashing by flashing the word, “BACKWASHING.” Also, the timer will indicate how many seconds are left in the backwash till completed.



- Once completed, set the media tank valves back into service position and confirm. Backwashing has now been completed.

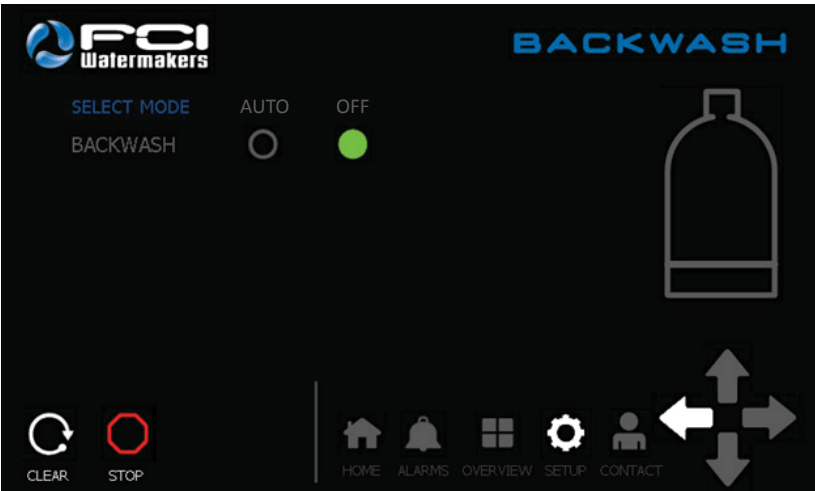


DISPLAY SCREENS (continued)

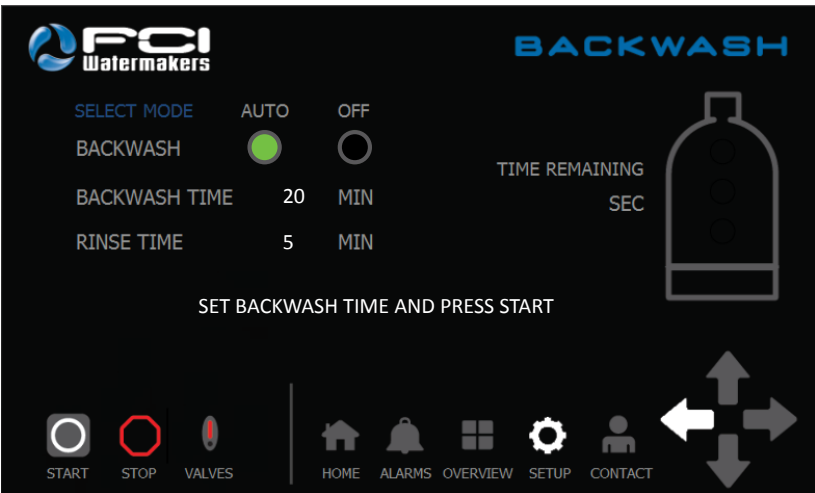
BACKWASH SCREENS (Automated Media Tank)

If you system is equipped with a Automated Media Tank, these screens will guide you how to backwash your tank.

1. Select backwash mode by touching the grey circle marked, “AUTO.”

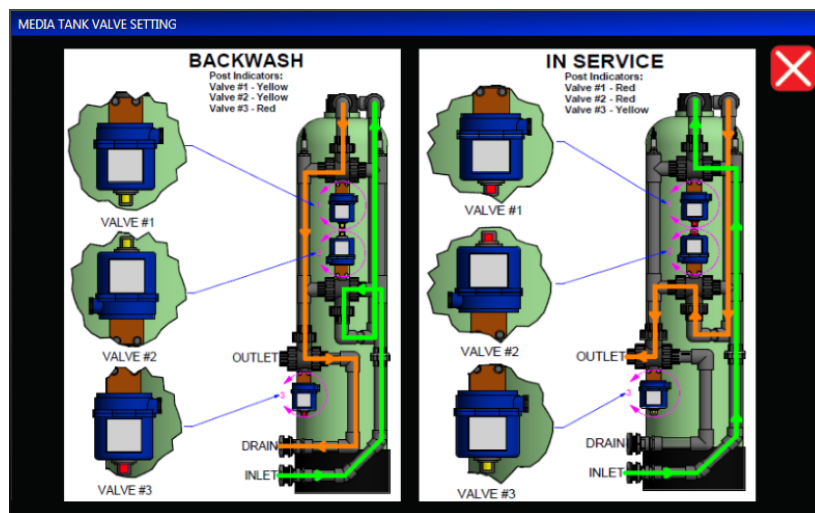


2. Once selected, use the on screen directions to complete a backwash.

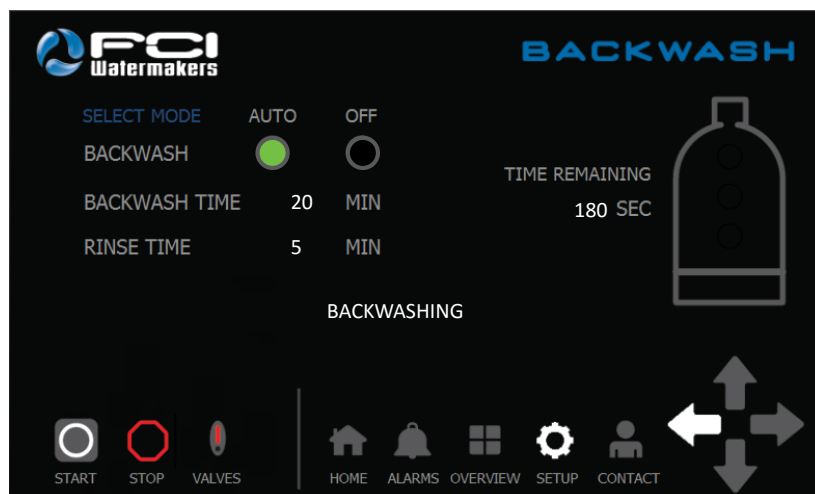


DISPLAY SCREENS (continued)

3. You can select the valves icon towards the bottom center of the screen for help to see where the valves should be positioned.



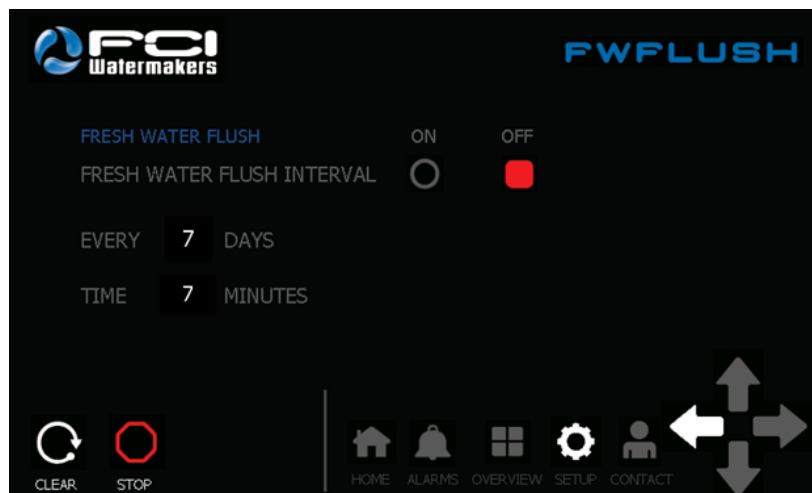
4. During the backwash process, the display will indicate backwashing by flashing the word, "BACKWASHING." Also, the timer will indicate how many seconds are left in the backwash till completed.



DISPLAY SCREENS (continued)

FWFLUSH SCREEN

Fresh Water Flush Interval allows you to set how often you would like to fresh water flush your system.



Fresh Water Flush – Select on/off to enable/disable the interval setting.

To set the Fresh Water Flush Interval, proceed as follows:

1. Set how often you would like the system to flush, by setting the number of days.
2. Select the time of how long you would like your system to flush.
3. Once completed and with the Fresh Water Flush Interval in the “On” position, the system will automatically flush.

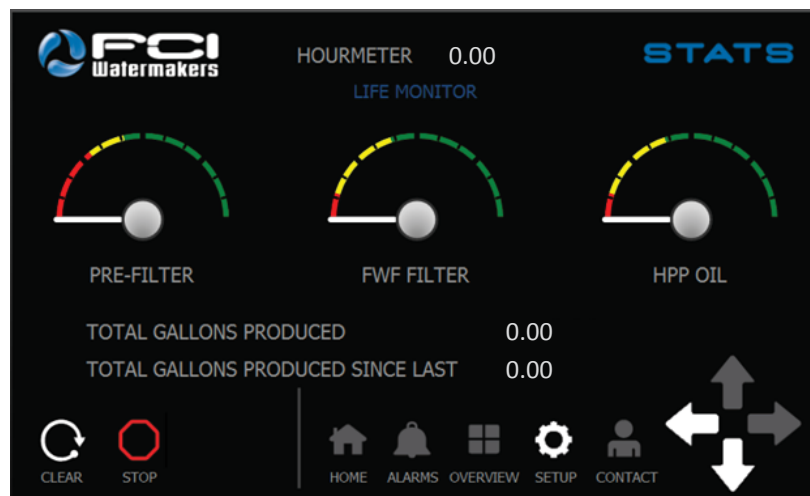
In the example shown in the screen capture above, this system will flush every seven days for seven minutes.

The Fresh Water Flush Interval can be left active even when you run your machine as normal. The control system will calculate and ensure there is a Fresh Water Flush completed on your system based on the number of days set by the user.

DISPLAY SCREENS (continued)

STATS SCREEN #1

The Stats Screen #1 gives the user feedback on a number of different items.



Hour Meter – Indicates the number of run hours on the unit.

Life Monitor –

- **Pre-Filter.** Indicates the current life of the pre-filter while the unit is running.
- **FWF Filter.** Indicates the life of the FWF Filter. The system will warn you when the filter needs to be changed, once changed you will reset the filter on this screen. To reset the filter, hold down on the life monitor gauge for 5 seconds.
- **HPP Oil.** Indicates the life of the High Pressure Pump Oil. The system will warn you when the oil needs to be changed. Once changed you will reset the oil on this screen. To reset the oil, hold down on the life monitor gauge for 5 seconds.

When you take delivery of your unit the oil life monitor will be in the yellow area. This is because you will need to change the oil after approximately fifty run hours. In addition to the Life Monitor display, the control system will warn you when this is needed to be completed.

Total Gallons Produced – This shows the total number of gallons the unit has produced.

Total Gallons Produced Since Last – This shows the total number of gallons the unit has produced since the last time the unit was started.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Left Arrow – Goes back to the main setup screen.

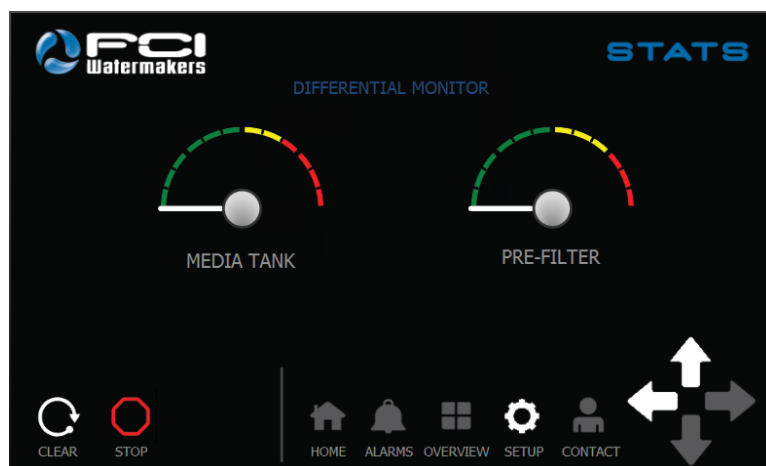
Down Arrow – Goes back to the main setup screen.

Down Arrow – Displays Stats Screen #2 (only available with an automated media tank installed).

DISPLAY SCREENS (continued)

STATS SCREEN #2

The Stats Screen is available if the system is equipped with automated media filter.

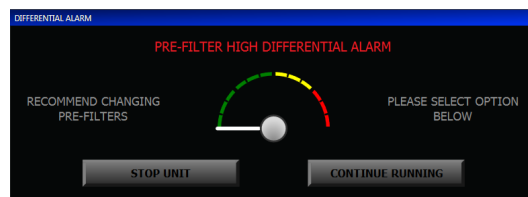


Differential Monitor –

- **Media Tank.** Indicates the differential pressure of the media tank. The system will warn you when the media tank is needed to be backwashed. If the system is running, a High Differential Alarm will pop up, and inform you the Media Tank will automatically backwash unless this is aborted. Once the media tank completes its backwash the system will restart.



- **Pre-Filter.** Indicates the differential pressure of the pre-filter. The system will warn you when the pre-filter needs to be changed. If the system is running, a High Differential Alarm will pop up, and inform you the pre-filter needs to be changed. You will have two options, to continue to run, or stop and change filters.



Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Up Arrow – Goes back to Stats Screen #1.

Left Arrow – Goes back to the main setup screen.

DISPLAY SCREENS (continued)

CONTACT SCREEN

The Contact Screen shows information of how the company can be contacted if you have any questions.



Clear – Press this button to clear the system once a shutdown has taken place.

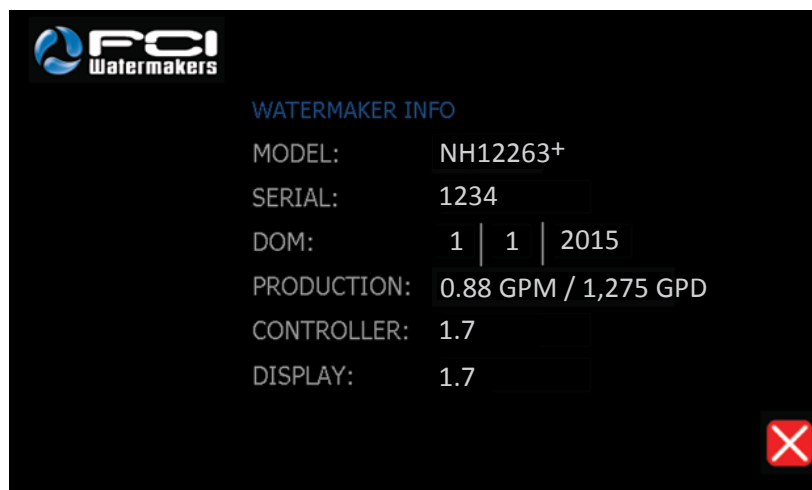
Stop – Press this button to stop the system.

Info – Press this button to get system information. This will be needed for troubleshooting purposes.

Navigation Bar – This allows the user to easily navigate between main screens.

INFO SCREEN

The information screen provides vital data of your system.



SYSTEM FUNCTIONALITY

STANDBY MODE

When the machine is at rest, the unit will be in standby mode. This is the only time the system can be started. A quick indicator of the system in standby mode is the Display LED located at the top left. It should be solid blue in color.

When the system is in Standby Mode:

LPP – off

HPP – off

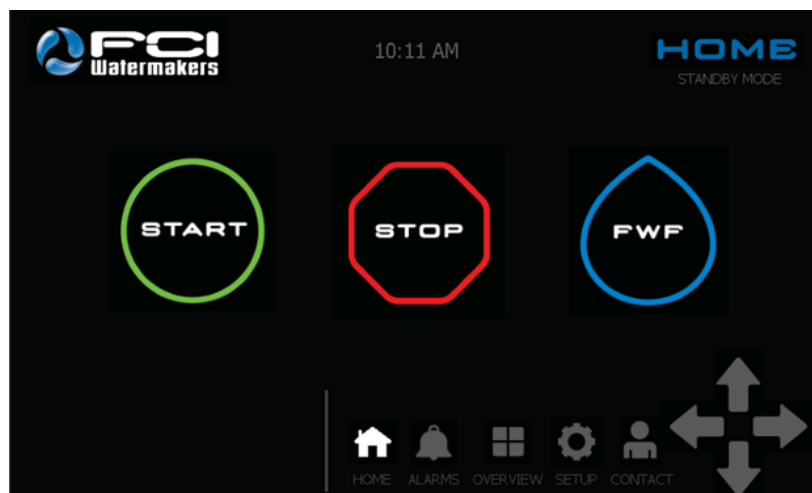
FWF Valve – closed position

Quality Valve – directed overboard

Bypass Valve – open position

APC (if equipped) – open position

The system can be started at any point during Standby Mode by pressing the Start Button on the Home Screen. Once started, the system will proceed to the Prime Screen. If any Run Options are selected, they will be shown on the Home Screen in the lower left hand area. Certain Run Options will allow the system to start automatically. A manual Fresh Water Flush can also be selected when in Standby Mode from the Home screen.



SYSTEM FUNCTIONALITY (continued)

PRIME SEQUENCE

During the Prime Sequence, the LPP turns on. The pump status is then verified by the Low Pressure Transducer. It must be greater than 3 PSI and less than 50 PSI or the system will shutdown.

When the system is in Prime Sequence:

LPP – on

HPP – off

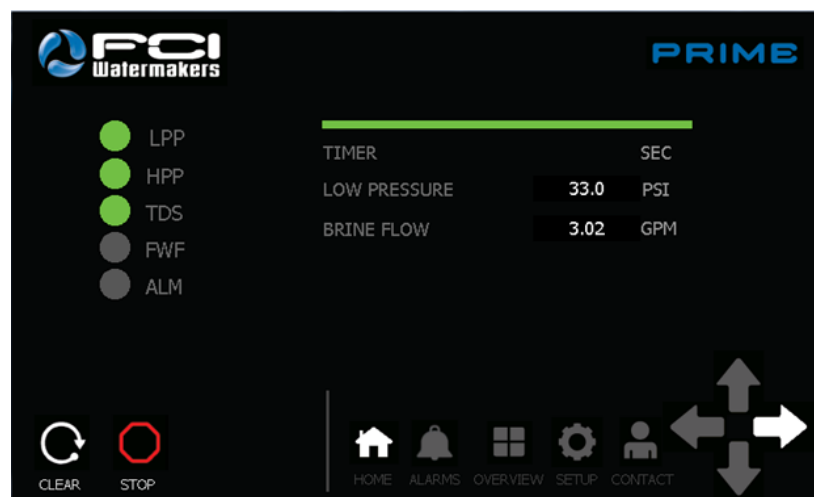
FWF Valve – closed position

Quality Valve – directed overboard

Bypass Valve – open position

APC (if equipped) – open position

The Prime Timer counts down from its setpoint (Prime Timer Setpoint) which is entered by the operator. Once the timer reaches zero, the timer has expired and the system then moves to Initialize Sequence.



Timer – Indicates time left in seconds for the Prime Sequence.

Low Pressure – Shows the Low Pressure Transducer reading.

Brine Flow – Shows the Brine Flow Meter reading.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Right Arrow – When pressed, system will proceed to the Initialize Sequence.

SYSTEM FUNCTIONALITY (continued)

INITIALIZE SEQUENCE

During the Initialize Sequence, the HPP turns on. The pump status is verified by the Low Pressure Transducer. It must be greater than 7 PSI or the system will shut down. During this time if the unit is equipped with APC, the High Pressure Control Valve will start to slowly close until the desired production rate is achieved. If your system is not equipped with APC, you will start to turn your High Pressure Valve clockwise until you reach your production rate.

When the system is in Initialize Sequence:

LPP – on

HPP – on

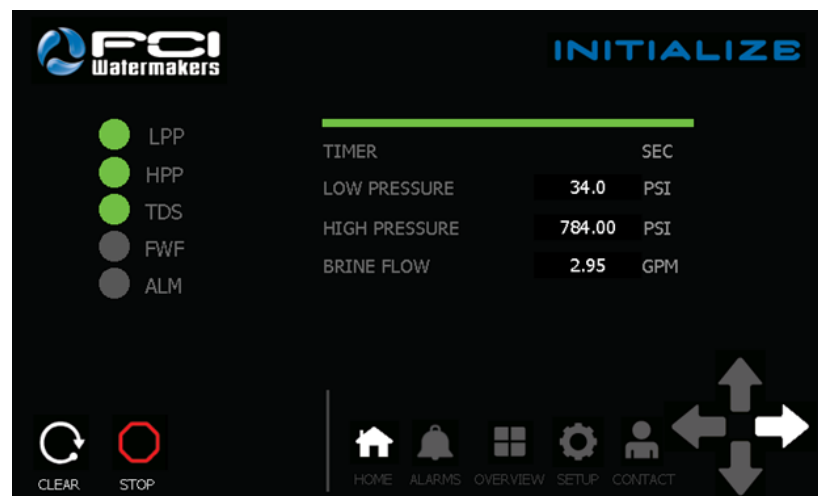
FWF Valve – closed position

Quality Valve – directed overboard

Bypass Valve – will start to close

APC (if equipped) – will start to close

The Initialize Timer counts down from its setpoint (Initialize Timer Setpoint) which is entered by the operator. Once the timer reaches zero, the timer has expired and the system then moves to Running Sequence.



Timer – Indicates time left in seconds for the Initialize Sequence.

Low Pressure – Shows the Low Pressure Transducer reading.

High Pressure – Shows the High Pressure Transducer reading.

Brine Flow – Shows the Brine Flow Meter reading.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

Right Arrow – When pressed, system will proceed to the Running Sequence.

SYSTEM FUNCTIONALITY (continued)

RUN SEQUENCE

During the Run Sequence, if equipped with APC, the High Pressure Control Valve will stabilize once the desired production rate is achieved. If not equipped with APC, the High Pressure Valve should be set to where you are making your production rate. The unit's production rate can be found in the info section under the contact screen. The system will wait for a given time period to allow the TDS sensor to verify the PPM reading.

When the system is in Run Sequence and stabilizing:

LPP – on

HPP – on

FWF Valve – closed position

Quality Valve – directed overboard

Bypass Valve – closed position

APC (if equipped) – stabilizing

When the time period has expired, the system will verify the PPM reading. If the PPM reading is below the Product Quality Setpoint for ten seconds, the Quality Valve will divert to the product water tank. If the PPM reading is above the setpoint for more than sixty seconds, you will get a High TDS Alarm. If the PPM reading continues to stay above the setpoint for the set High TDS Shutdown Time (amount of time set by the operator), the system will shut down with a High TDS Shutdown. If at any point during the production the water quality goes above the setpoint, the Quality Valve will immediately divert back to overboard until the Product TDS sensor is able to get a reading below the setpoint for ten seconds. At this point the system will divert back to the product tank.

When the system is in Run Sequence and stabilized:

LPP – on

HPP – on

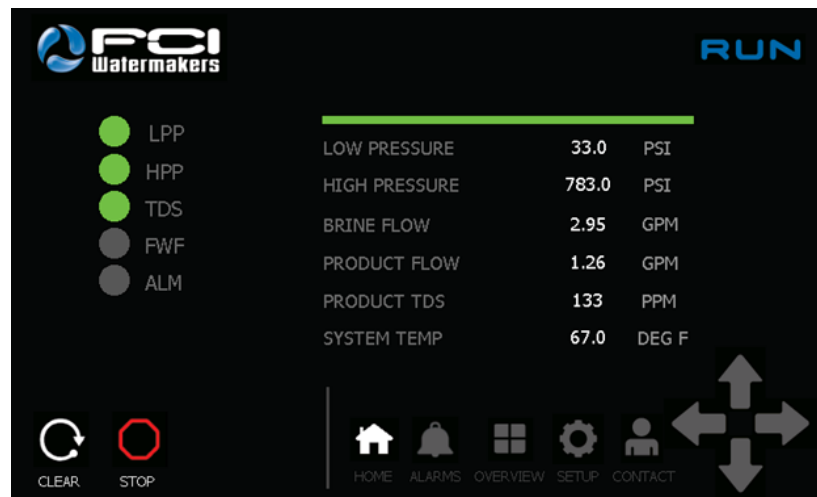
FWF Valve – closed position

Quality Valve – directed to product tank

Bypass Valve – closed position

APC (if equipped) – stabilized

SYSTEM FUNCTIONALITY (continued)



Low Pressure – Shows the Low Pressure Transducer reading.

High Pressure – Shows the High Pressure Transducer reading.

Brine Flow – Shows the Brine Flow Meter reading.

Product Flow – Shows the Product Flow Meter reading.

Product TDS – Shows the Product TDS meter reading.

System Temp – Shows the temperature of the product water.

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

FLUSH SEQUENCE

At any point when the system is running, the stop button can be pressed. When pressed, the Quality Valve will divert overboard, the Bypass valve will go to its open position. If equipped with APC, the High Pressure Control Valve will go to its open position. The HPP will turn off, the LPP will turn off, and there will be a 10 second delay prior to starting the flush.

When the system is in Flush Sequence and the Delay Timer is counting down:

LPP – off

HPP – off

FWF Valve – closed position

Quality Valve – directed overboard

Bypass Valve – open position

APC (if equipped) – open position

Once the delay timer has expired, the Flush Sequence will start. The Fresh Water Flush valve will open and will remain open until the Fresh Water Flush Timer expires. Once completed the system will return to the Home Screen and be in Standby Mode.

When the system is in Flush Sequence and Fresh Water Flush Timer is counting down;

LPP – off

HPP – off

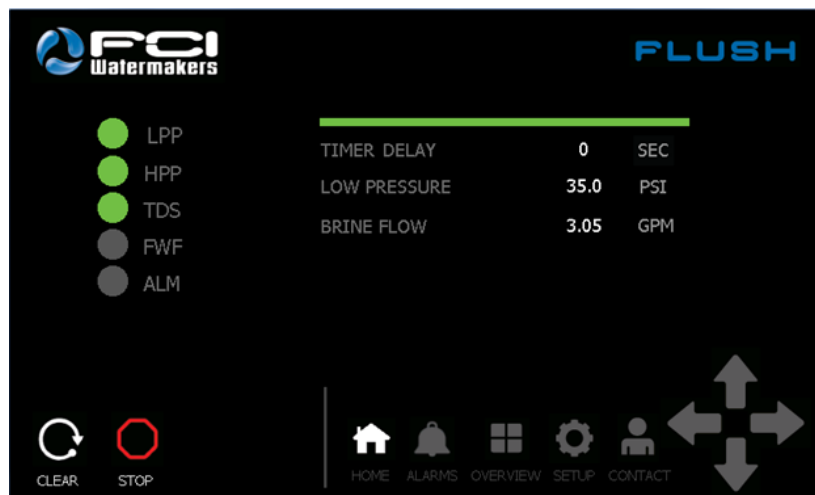
FWF Valve – open position

Quality Valve – directed overboard

Bypass Valve – open position

APC (if equipped) – open position

SYSTEM FUNCTIONALITY (continued)



Timer Delay – Amount of time in seconds prior to the fresh water flush starting.

Timer – Amount of time in seconds left in the fresh water flush sequence.

Low Pressure – Low pressure transducer reading (can be used to confirm FWF pressure).

Brine Flow – Brine flow meter reading (can be used to confirm FWF flow).

Clear – Press this button to clear the system once a shutdown has taken place.

Stop – Press this button to stop the system.

Navigation Bar – This allows the user to easily navigate between main screens.

SYSTEM ALARMS

The V4 Control System Alarms are divided into four categories:

Notification – This is used to alert the user of a situation happening that does not affect the safety of the machine.

Warning – This is used to alert the user that an item needs to be addressed in the near future. An example would be the High Pressure Pump Oil change is due soon.

Alarm – This is used to alert the user that an item needs to be addressed immediately otherwise the system will shutdown. An example would be if the Product TDS is higher than the setpoint. If left alone, the system will safely shut itself down to avoid damage.

Shutdown – This is used to protect both the user and machine. If a condition arises that is considered unsafe, the unit will immediately shutdown. An example would be the High Pressure Shutdown. If the system reaches its high pressure limit the unit will immediately shutdown.

NOTIFICATIONS

The following is a list of notifications and their causes.

1. *High Pressure APC Notification (If equipped with APC):*

Cause: Notification is triggered when the unit is running and the high pressure reaches 950 PSI. The APC system stops running and holds the High Pressure Control Valve at its current setpoint to prevent High Pressure Shutdown. System can be run but production output may be reduced. System will resume APC when pressure is reduced due to water conditions.

Clear: Watermaker is being run in a very high salinity environment or cold water.

WARNINGS

The following is a list of warnings and their causes, and how to clear the warning condition.

1. *FWF Filter Change Warning:*

Cause: Warning is triggered when the Life Monitor indicates the Fresh Water Filter needs to be changed.

Clear: Once you have changed the Fresh Water Flush Filter, navigate to the Setup / Stats. To reset, press and hold the Fresh Water Flush Life Monitor gauge for 5 seconds..

2. *Oil Change Warning:*

Cause: Warning is triggered when the Life Monitor indicates the HPP Oil needs to be changed.

Clear: Once you have changed the HPP Oil, navigate to the Setup / Stats. To reset, press and hold the HPP oil life monitor gauge for 5 seconds.

SYSTEM ALARMS (continued)

ALARMS

The following is a list of alarms and their causes, and how to clear the alarm condition.

1. *Over Production Alarm:*

Cause: Alarm is triggered when the Product Flow is 15% greater than the rated output.

Clear: If equipped with APC, check to see if the HPCV is in manual mode, or possible Product Flow Sensor Failure. If not equipped with APC, reduce HPCV by turning the valve counter clockwise until you reach your rated output.

2. *High TDS Alarm:*

Cause: When the Product TDS is greater than the setpoint for more than 60 seconds.

Clear: Increase product quality by reducing the PPM reading. Check for possible bad membranes.

3. *Media Tank High Differential Alarm (if equipped with an Automated Media Tank):*

Cause: When the Media Tank differential pressure is greater than the setpoint for more than 20 seconds.

Clear: Perform a backwash, or allow the system to automatically backwash the media tank.

4. *Pre-Filter High Differential Alarm (if equipped with an Automated Media Tank):*

Cause: When the Pre-Filter differential pressure is greater than the setpoint for more than 20 seconds.

Clear: Replace the pre-filters.

SHUTDOWNS

The following is a list of shutdowns and their causes, and how to clear the shutdown condition.

1. *Inlet Low Pressure Shutdown:*

Cause: Triggered when the low pressure reading is below 3 psi for 30 seconds.

Clear: Select the alarm, press the Ack Selected button, then clear the system by pressing icon in the lower left hand corner.

2. *Inlet High Pressure Shutdown:*

Cause: Triggered when the low pressure reading is greater than 50 psi for 30 seconds.

Clear: Select the alarm, press the Ack Selected button, then clear the system by pressing icon in the lower left hand corner.

3. *HPP Feed Pressure Low Shutdown:*

Cause: Triggered when HPP is running and the low pressure reading is below 7 psi.

Clear: Select the alarm, Press the Ack Selected button, and clear the system in the lower left hand corner.

SYSTEM ALARMS (continued)

4. HPP Interlock Shutdown:

Cause: Triggered when the HPP is running but the LPP pump is not meeting the minimum flow rate.

Clear: Select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

5. Over Production Shutdown:

Cause: Triggered when the Over Production Alarm has been active for 60 seconds, or when the Product Flow is 20% greater than the rated output.

Clear: Select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

6. High Pressure Shutdown:

Cause: Triggered when the system's pressure reaches 1000 psi.

Clear: Select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

7. High TDS Shutdown:

Cause: Triggered when the High TDS Alarm has been active for set High TDS Shutdown Timer duration.

Clear: Select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

8. HPP Overload Shutdown

Cause: Triggered when the HPP overload trips on high amp load.

Clear: Find the HPP overload and reset, select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

9. LPP Overload Shutdown

Cause: Triggered when the LPP overload trips on high amp load.

Clear: Find the LPP overload and reset, select the alarm, press the Ack Selected button, and clear the system by pressing icon in the lower left hand corner.

5/ MAINTENANCE & REPAIR

Troubleshooting and subsequent correction or repair of your watermaker will require understanding of:

- Electrical circuits
- Hydraulic systems
- Mechanical knowledge
- Electronic circuits
- Liquid pressures and flows

DO NOT attempt troubleshooting or repair if you are not familiar with or are not proficient in the above fields of expertise.

USE CAUTION WHEN TROUBLESHOOTING.

DO NOT perform maintenance unless:

- 1 The feed water sea cock valve is closed
- 2 The system main electrical disconnect switch is **OFF, LOCKED, and TAGGED.**

CAUTION: ELECTRICAL SHOCK HAZARD. A volt/ohm meter will be necessary. The following procedures expose the technician to high voltage and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.

CAUTION: AVOID CHEMICAL ATTACK TO THE SYSTEM:

Do not use for storage and do not expose the watermaker to:

- Hydrogen Peroxide
- Chlorine Dioxide
- Bromine
- Chloramines
- Hypochlorite
- Bromide
- Chlorine
- Phenolic Disinfectants
- N-chloroisocyanurates
- Iodine
- Petroleum Products

Or any other specific chemical not approved in writing by FCI Watermakers Inc. Use of non- authorized or misuse of authorized chemicals voids warranty. Never use third party “cleaners” or “storage” chemicals. Third party chemicals will dissolve copolymer components within the watermaker and will destroy the membrane element. Use of and subsequent damage caused by non FCI Watermaker chemicals are the liability and responsibility of the operator and are not covered by the FCI Watermakers warranty.

DO NOT connect any water line to the watermaker system that may contain any of the above listed chemicals.

WEEKLY QUICK CHECK

The following steps ensure that potential problems are resolved, preventing major repairs:

- 1 Inspect all fasteners for tightness, including brackets, screws, nuts, and bolts. Pay special attention to the high pressure pump and electric motor since they are subject to increased vibration.
- 2 Clean any salt water or salt deposits from the system with a wet rag.
- 3 Check for water leaks throughout the system and supporting water lines.
- 4 Check all tubing and high-pressure hoses for wear and abrasion against rough surfaces. The hoses must not contact heated or abrasive surfaces.
- 5 Perform weekly coupling inspection, refer to "COUPLING / WEEKLY VISUAL INSPECTION" on page 110.

COMPONENT MAINTENANCE INTERVALS

The frequency of required maintenance is dependent on the regularity of usage, the condition of the intake water (the location of use), the length of time the system is exposed to water, the total running time, and the manner in which the system is installed or operated. Because of these factors, it is virtually impossible to comprise an exact timetable for required maintenance. The following maintenance timetable (Table 2) is an estimate of the time intervals at which maintenance may be required on the various system components. This is based upon factual data compiled from FCI Watermakers installations around the world. However, this schedule must be adjusted to each individual system depending upon the variables listed.

Table 2: Component Maintenance Intervals

Component	Maintenance Required	Time Interval Continuous	Time Interval Intermittent Duty
SEA STRAINER	Inspect & Clean Screen & Housing	Weekly	100 Hours
MULTI-MEDIA FILTER (if equipped)	Back wash & Rinse	When pressure drop across filter is > 20 PSI (manual filter)	
		V4 Control System will advise when needed (automated filter)	
PRE-FILTER	Replace element(s)	V4 Control System will advise when needed	
COUPLINGS	Inspect for excessive wear	Weekly	500 hours
LOW PRESSURE PUMP	Seals	6 weeks	1,000 hours
HIGH PRESSURE PUMP	Seals	6 weeks	1,000 hours
	Valves	8 weeks	1,500 hours
	Oil	V4 Control System will advise when needed (First oil change at 50 hours, then at every 250 hours)	
GEARBOX	Oil	Every 10,000 hours	3 years
PULSATION DAMPENERS	Check Pre-charge	Every 4,000 hours	Annually
MEMBRANE	Clean element	When production or salt rejection decreases by 10%	
SALINITY PROBE	Clean probe	Annually	Annually
FRESH WATER FLUSH FILTER	Replace Element	V4 Control System will advise when needed	
PH NEUTRALIZING CARTRIDGE (if equipped)	Replace Element	When Granules are depleted	
U.V. STERILIZER (if equipped)	Replace lamp	Annually	7,000 hours
	Replace quartz sleeve	As needed	As needed
CARBON DOCK FILL TANK (if equipped)	Replace Carbon	25,000 gallons of flow	Annually
ELECTRICAL BOX	Inspect and tighten all connections	6 months	6 months

COMPONENT MAINTENANCE INTERVALS (continued)

WARNING: Components, spares, and consumables utilized within the FCI Watermakers System can be specific to FCI Watermakers specifications and are not commercially available from other sources. Many of these special components can appear to be similar to FCI Watermakers components. Extensive and expensive damage to the FCI Watermakers System WILL result if incompatible components are used in the FCI Watermakers System. Damage caused to the FCI Watermakers System as a result of third party components is the liability and responsibility of both the marine dealer that sold the component for use in the FCI Watermakers System as well as the owner/operator that purchased and installed the third party component in the FCI Watermakers System and is not covered by the FCI Watermakers Warranty.

ALWAYS INSIST ON ONLY FCI WATERMAKERS SUPPLIED COMPONENTS, SPARES, AND CONSUMABLES.

COMPONENT MAINTENANCE & REPAIR OVERVIEW

Performing routine maintenance and following proper procedures will ensure worry-free operation for the long haul.

AFTER 50 HOURS / BREAK-IN PERIOD

- Change oil in high-pressure pump
- Check low pressure pump for leaks
- Check inlet hosing and all connections for leaks

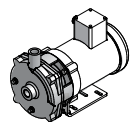
PERIODIC MAINTENANCE

Do a 10-minute visual inspection of the entire system every 500 hours. Start the system and trace the lines from the feed thru-hull to the discharge thru-hull, as well as the fresh water line to tank. Be sure to inspect the coupling, see page 110. This type of preventative check can save time and money in the future.



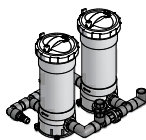
INLET THRU HULL FITTING

Keep the inlet thru hull fitting free and clear of debris and marine growth.



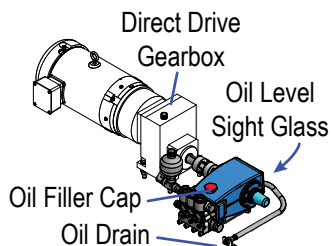
LOW-PRESSURE PUMP

Replace the seal every 1,000 hours or when a leak develops.



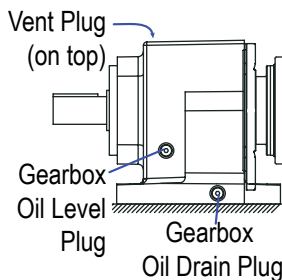
PREFILTER

The prefilter is changed when the V4 Control System issues a notification. Since it is fresh water flushed when the unit is stopped, it will not foul or clog due to biological growth and you will get longer life. The cartridge can be cleaned once, using a soft brush or a nozzle on the end of a hose. Gently separate the pleats and remove as much debris as possible. Be careful not to fray the filter material. If the filter shows signs of fraying or does not come clean, replace the cartridge. The cost of a cartridge is not worth the risk of damaging a membrane or high-pressure pump seal.



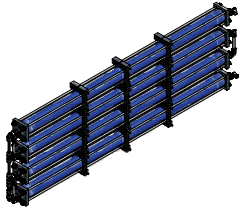
HIGH-PRESSURE PUMP

Replace the seals every 1,000 hours and the valves every 1,500 hours. Replace the pump's oil the first 50 hours and every 250 hours thereafter. The V4 Control System will advise when an oil change is needed.



GEARBOX

The gearbox does not require an oil change after break-in. The initial oil fill is good for up to 10,000 hours or 3 years, depending on operating conditions.



MEMBRANE

The membranes are rated for 3 years of operation. This includes operation time and down time. However, with proper care and the fresh-water-flush system, you can achieve significantly longer life. When the PPM reading on the display starts to climb or the product output is reduced, it may be time to replace them. It is best to contact your local FCI representative or the factory for guidance. Your system uses a special high-output membrane. This is how we are able to achieve the great quality and quantity of fresh water you have become accustomed to. Since our membranes are non-proprietary (or readily available), be sure your technician uses the same type of membrane when they are replaced. Use of membrane brands such as Hydranautics or AquaPro are not recommended, and their use may affect the quality and quantity of water produced.

CLEANING AND STORAGE

Short term storage is a shutdown for less than 6 months. Long term storage is a shutdown for 6 months or longer. If the system is subjected to freezing temperatures, or will be stored, or needs cleaning, follow the procedures in "CLEANING AND STORAGE PROCEDURES" on page 127.

INLET THRU HULL / MAINTENANCE & REPAIR

The components are shown on the plumbing and interconnect diagrams located in Installation chapter of this manual.

INLET THRU HULL FITTING

Non FCI Watermakers component. Keep the inlet thru hull fitting free and clear of debris and marine growth. If the inlet thru hull fitting is clogged, this results in a low feed pressure condition, which causes the system to shut off.



Blockage at the inlet thru hull fitting causes the system to shut off due to lack of feed water flow. Unfortunately, since it is under water, operators are reluctant to thoroughly inspect the inlet thru hull fitting for problems. This can cause time-consuming frustrations in attempting to gain feed water flow by troubleshooting other components in the system.

The inlet thru hull fitting must be free and clear allowing the system to draw 16.0 U.S. Gallons Per Minute / 60.6 Liters Per Minute with minimal resistance. Any blockage at the inlet thru hull fitting will cause low pressure and low flow problems at the system. This inlet thru hull fitting must be a forward facing scoop so that the system receives a positive flow of water as the boat is under way. It must be minimum 1" inside diameter. It must be installed in a position on the bottom of the hull so as to allow free flowing feed water without air.

CAUTION: A flat profile, flush mount, inlet thru-hull fitting will cause a vacuum as the boat is under way, and this will cause loss of feed water flow and cavitation of the booster pump and high pressure pump resulting in continual system shut down due to low feed water flow and pressure. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the FCI Watermakers warranty.

CAUTION: If the thru-hull fitting has been placed in a position on the underside of the hull that allows air to continually enter the thru-hull fitting, this will cause the system to continually shut down due to loss of feed water. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the FCI Watermakers warranty.

CAUTION: The FCI Watermakers System must not be tied into another existing auxiliary water line already supplying another accessory on the boat. Using one thru hull fitting for other equipment will cause the FCI Watermakers System to draw air, or cavitate, leading to continual system shut down. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the FCI Watermakers warranty.

CAUTION: If the FCI Watermakers System is connected to a sea chest or stand pipe, do not plumb the FCI Watermakers System feed line to the “top” of the sea chest or stand pipe. If plumbed into the top of these feed water arrangements, the FCI Watermakers System will experience continual shut down due to air inducement into the system. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the FCI Watermakers warranty. Plumb the FCI Watermakers System to the “bottom” of such feed water arrangements to ensure a continual air free supply of feed water to the system.



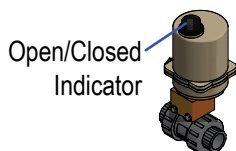
SEA COCK VALVE

This is a non-FCI Watermakers component. The packing and connections of the inlet sea cock valve must be tight and must properly seal. Clean the valve cavity of debris or replace the seal and seat or the entire valve, as required. This section is under a vacuum condition while operating the system. Loose fittings or a worn seal will allow air to enter the system causing continual shut down due to subsequent low feed water pressure.



SEA STRAINER

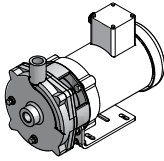
Keep the mesh screen free and clear of debris. When the mesh screen is clogged, it results in a low-pressure condition causing system shut off. This section is under a vacuum condition while operating the system. If the sea strainer's bowl is loose or if the O-ring seal is worn or not properly seated, air will enter the system causing continual shut down due to subsequent low feed water pressure.



INLET ACTUATED VALVE (if equipped)

The actuated valve is comprised of a 2-way union ball valve with an actuated motor drive on top. The valve is equipped with a post on the top that indicates the valve position (open / closed). If the valve does not open, turn power off to the system and loosen the union nuts. If the union nuts are too tight, it will inhibit the ball from being able to turn freely. If power is applied and the valve will still not actuate, check all wiring connections.

LOW PRESSURE PUMP / MAINTENANCE & REPAIR



LOW PRESSURE PUMP/FEED PUMP (if equipped)

Pump is centrifugal, with a counter clockwise rotation as viewed from volute end (front) of pump.

Troubleshoot electric motor failure to ensure that any abnormality from the power, wiring, wiring connections, contactor, or control circuit are not at fault or at cause. If the electric motor has failed, it will require repair. However, depending upon failure, replacement may be more cost effective than repair. If failure of the motor is due to external source, not the motor itself, then correct the cause or else the replaced or repaired motor will fail again.

FAILURES OF THE ELECTRIC MOTOR MAY BE:

- A Bearing failure: Bearings are field replaceable.
- B Winding failure: Generally caused by low or high power, below or above the specified voltage requirements of the system. This is NOT economically repairable.
- C Internal centrifugal switch: Generally caused by mechanical failure of the switch. Field replaceable.
- D Capacitor failure: Generally caused by low power feeding the motor or low cycles from the power source. Also caused by rapidly repeating starting and stopping of the motor. Field replaceable.

THE ELECTRIC MOTOR IS:

- 1 horse power
- Totally enclosed fan cooled
- 2 pole, dual cycle
- Dual voltage.

WARNING: The feed pump **MUST** rotate in the **COUNTER CLOCKWISE DIRECTION ONLY** Rotating the feed pump in the clockwise direction will cause extensive damage to it. Never operate the feed pump in the clockwise direction.

WARNING: When switching from three phase generator power to three phase shore power **ALWAYS** check phases prior to operating the system else reverse rotation along with extensive damage to the feed pump will occur should the power be out of phase.

PROBLEMS & SYMPTOMS APPEARING TO BE CAUSED BY ELECTRIC MOTOR:

- 1 The three phase (230 // 380 // 415 // 480 VAC) electric motor “hums,” pulls starting current (locked rotor) amperage, does not rotate, and trips the supply power circuit breaker when attempting to operate the system.

The three phase electric motor requires all three power lines (all three phases) to be operative else it will “single phase” causing extensive damage to the motor’s internal windings.

Low voltage will also cause the same symptom. Low voltage is caused by an

undersized power supply or generator, undersized power lead wires to the system or motor, loose power wire, or connection at the motor or within the power supply line, and “burnt” contacts on the motor starter relay (contactor).

SOLUTIONS: Check wiring size and connections to, from, and in between the Power Supply and the electric motor. Correct wire size or any loose wires. Measure voltage at the motor during attempt to start it. If voltage drops more than 10% locate and correct the reason. Cross check voltage across all 3 power leads. Check the motor starter relay (contactor) for “burnt” contacts.

- 2 The Electric Motor makes an unusual “grinding” sound when operated.

SOLUTIONS: Check and replace as necessary the front and rear bearings. Check to see if the fan is rubbing against the fan guard.

REPLACE THE CERAMIC SEAL (P/N 43-2235):

- Approximately every 1,000 hours, or
- At the sign of leakage

When replacing the seals, refer to "Figure 22: LPP Parts Diagram and List" on page 107.

DISASSEMBLY

Before you begin, please be sure to disconnect the electrical power to the system. Remove the four 3/8-16 Bolts holding the volute to the motor bracket. To remove the impeller, remove the bearing cap on the motor to expose the screwdriver slot on the motor shaft. Hold the motor shaft with a large screwdriver and remove the impeller by grasping it with your hand and turning the impeller counter clockwise. Remove the seal. Two screwdrivers wedged into the seal at 180 degrees apart serve as tools to wedge the seal out. The ceramic seat is removed by removing the end bell gasket.

REASSEMBLY

Clean the motor shaft and the bracket of any corrosion or salt deposits. Replace the end bell gasket and the tap seat portion into the bracket cavity. Use a new gasket. Place the ceramic seat into the cavity over the shaft. Make sure that the polished side is toward the end of the shaft. Tap into place evenly using a hollow piece of wood or plastic tool. If a metal tool is used to tap it into place, protect the seat with cardboard or a clean cloth. Lubricate the shaft with water, water and soap, or a light oil, and slip the rotating portion of the seal over the shaft with the carbon element toward the ceramic. Slide it down onto the shaft as far as possible. Apply blue Loctite® to the motor shaft threads. Hold the motor shaft and reinstall the impeller. Tighten the impeller by turning it clockwise until it is snug. Reinstall the volute. Tighten the bolts evenly. Thoroughly prime the pump.

LUBRICATING BEARINGS: Some electric motors supplied by FCI Watermakers have permanently sealed and lubricated bearings. Others require lubrication from time to time. If your electric motor has grease jerks at each end of the motor, over the front and rear bearings, the bearings require lubrication every 6 months. Give three pumps of high temperature motor bearing lubricant into each grease jerk. Use a Polyurea Base Grease such as Chevron SRI (Polyurea Base) or Shell Dolium R (Polyurea Base). DO NOT USE LITHIUM OR SILICONE BASE GREASE.

LOW PRESSURE PUMP / PARTS DIAGRAM & LIST

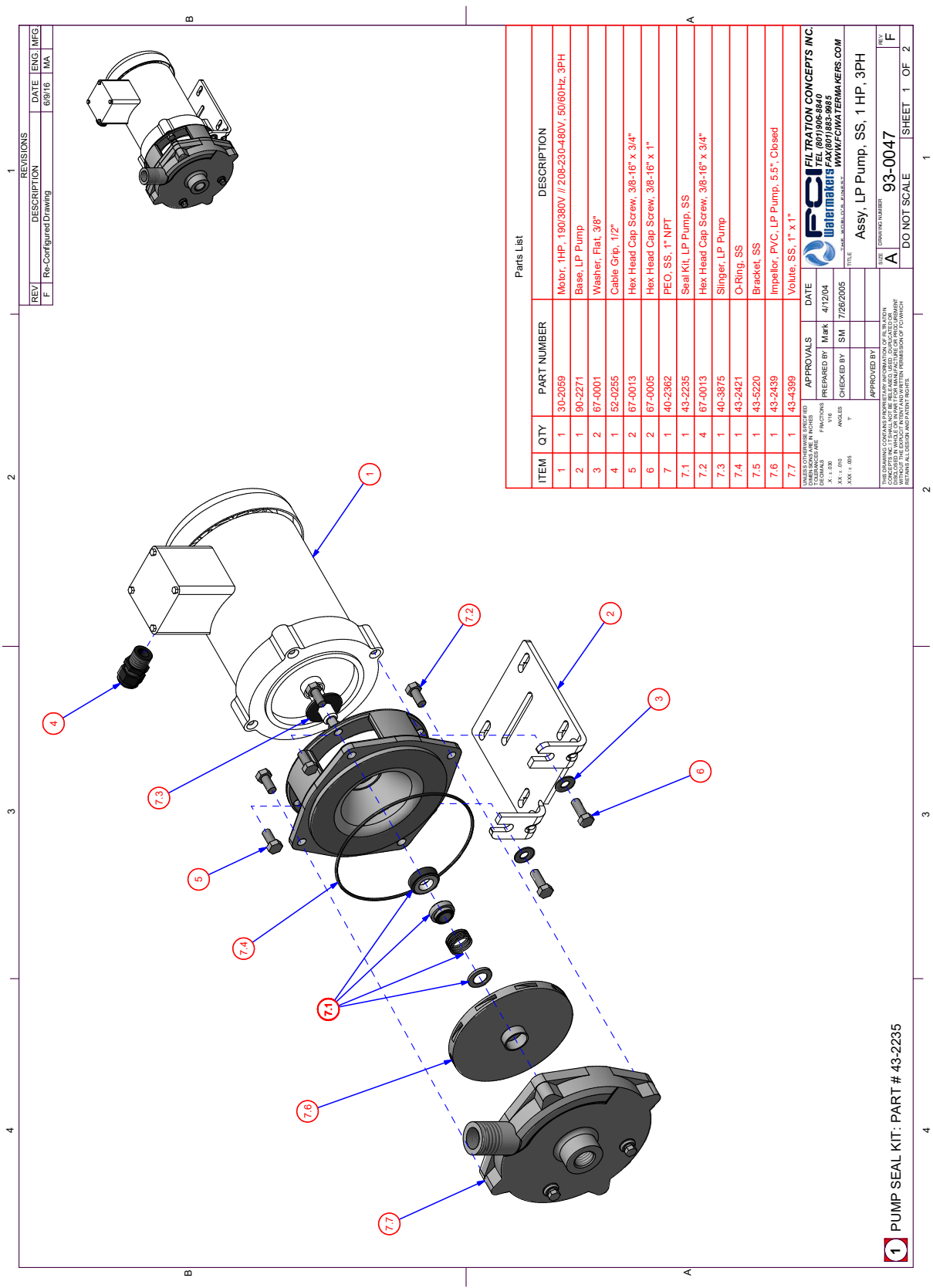
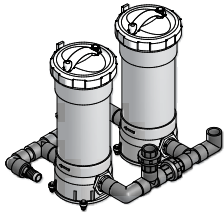


Figure 22: LPP Parts Diagram and List

PREFILTER ELEMENT REPLACEMENT



PREFILTER ELEMENT REPLACEMENT

The pre-filter pleated cartridge element may be cleaned with water spray once or twice. After cleaning the expected life will be reduced in half. Attempts to clean the element more than twice will result in a very short life and will damage the element, rendering it useless. Change the element after the first or second cleaning. Clean or replace the element when plugged. At slightly below 5 PSI the system will turn off and display a fault screen indicating low pressure.

CAUTION: Do not use third party pre-filter elements; use only FCI Watermakers pre-filter elements. Third party pre-filter elements on the market do not properly fit, the seams fall apart, they will allow by-pass.

WARNING: By-pass of debris through the third party element will prematurely foul the R.O. membrane element. Use of third party prefilter elements will void any and all FCI Watermakers warranty to the R.O. membrane element.

IMPORTANT: Do not use “string wound” or “fiber” pre-filter elements. These type of elements are designed for the photographic film developing industry. When used in sea water, they will plug up rapidly in 1/10th or less the time causing frequent shut down of the system and very frequent changing which will also lead to very high cost of maintenance. Use of string wound or fiber type elements will only lead to user frustration and very high maintenance costs. Use of third party prefilter elements will void any and all FCI Watermakers warranty to the R.O. membrane element.

DO NOT ACCEPT THIRD PARTY PREFILTER ELEMENTS FROM ANY MARINE DEALER. USE ONLY FCI WATERMAKERS SUPPLIED PREFILTER ELEMENTS.

The resulting failure of the system to remain in operation, and or damage to the FCI Watermakers System caused by third party pre-filter elements is attributed to improper maintenance and operation, is the liability of the operator and owner, and is not covered by the FCI Watermakers warranty.

PREFILTER ELEMENT REPLACEMENT (continued)

TO REPLACE PRE-FILTER ELEMENT

Refer to *Figure 23* and proceed as follows:

- 1 With system off and thru-hull closed, unscrew the bleed valve to relieve any pressure.
- 2 Remove locking ring collar counter-clockwise.
- 3 Firmly grasp lid and twist and lift to remove.
- 4 Remove cartridge, drain and clean debris from inside housing.

NOTE: Be sure not to discard the O-rings when emptying bowl.

- 5 Thoroughly clean the inside of the bowl.
- 6 Install a new FCI cartridge Part #20-2261.
- 7 Replace lid and screw collar on hand tight.
- 8 After a cartridge change, the watermaker will need to be primed and the housing bled of air.

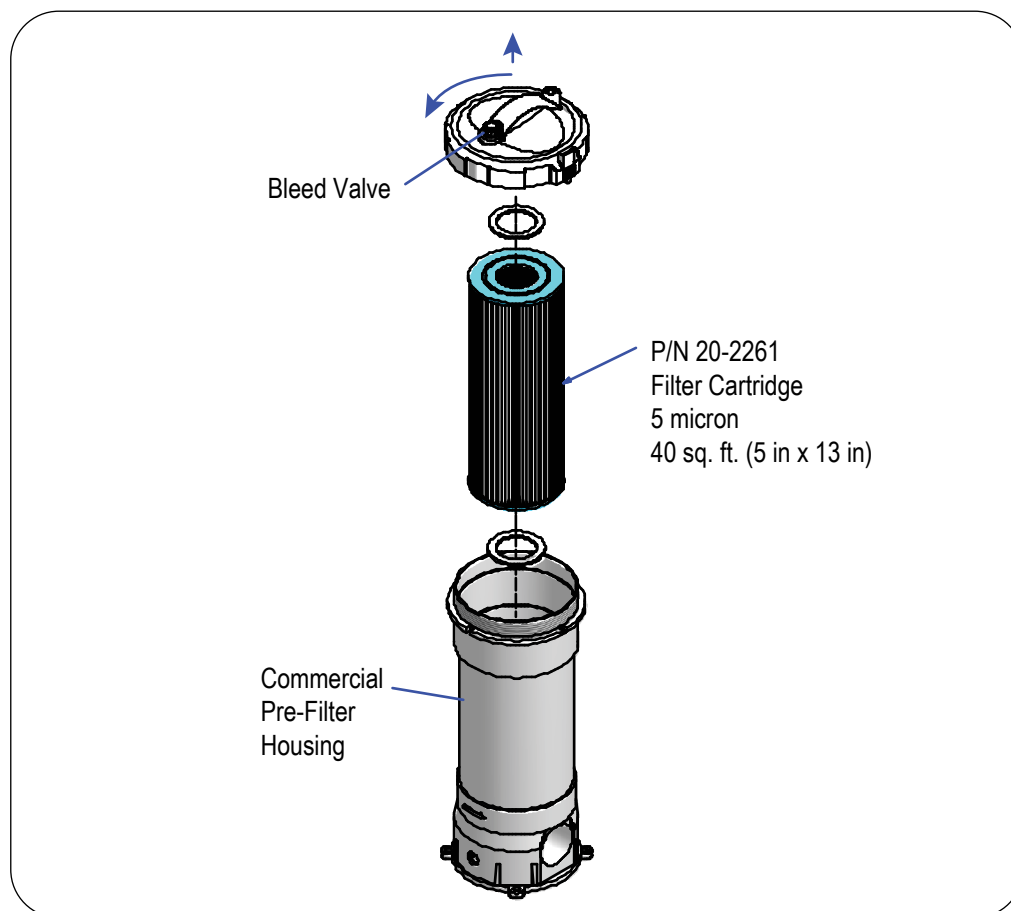


Figure 23: Replacing the Pre-filter Element

COUPLING / WEEKLY VISUAL INSPECTION

COUPLING WEEKLY VISUAL INSPECTION

The high-pressure pump assembly has two coupling assemblies, motor-to-gearbox, and gearbox-to-pump (*Figure 24*).

Visually inspect both coupling assemblies weekly for signs of excessive wear, fatigue, misalignment, and looseness in keys or set screws, if equipped. Abnormal noise (such as screeching, squealing, or chattering), and vibration or wobble may indicate wear and misalignment.

If inspection finds excessive wear or misalignment, replace coupling.

If coupling has lubrication, inspect lubrication for hardening. Clean out old lubrication and re-lubricate if needed. Pay attention to avoid improper solvent removal or introduction of particulate when removing old lubrication.

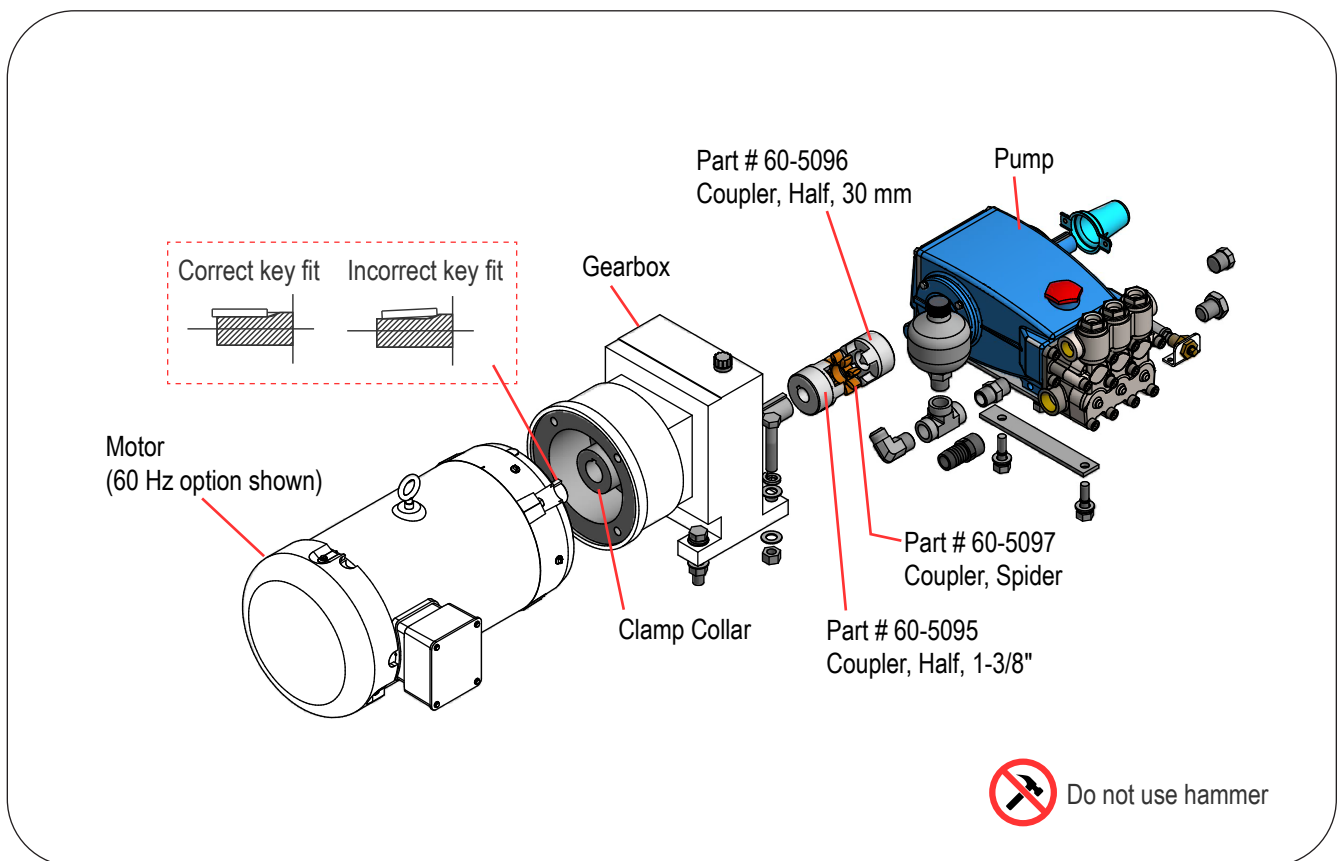


Figure 24: Couplings, Inspect Weekly

HIGH PRESSURE PUMP / MAINTENANCE & REPAIR

HIGH PRESSURE PUMP - ELECTRIC MOTOR

Troubleshoot electric motor failure to ensure that any abnormality from the power, wiring, wiring connections, contactor or control circuit are not at fault or at cause. If the electric motor has failed, it will require repair. However, depending upon failure, replacement may be more cost effective than repair. If failure of the motor is due to external source, not the motor itself, then correct the cause or else the replaced or repaired motor will fail again.

FAILURES OF THE ELECTRIC MOTOR MAY BE:

- A Bearing failure: Bearings are field replaceable.
- B Winding failure: Generally caused by low or high power, below or above the specified voltage requirements of the system. This is NOT economically repairable.
- C Internal centrifugal switch: Generally caused by mechanical failure of the switch. Field replaceable.
- D Capacitor failure: Generally caused by low power feeding the motor or low cycles from the power source. Also caused by rapidly repeating starting and stopping of the motor. Field replaceable.

THE ELECTRIC MOTOR IS:

- 15 horsepower
- Totally enclosed fan cooled

WARNING: The high pressure pump **MUST** rotate in the **COUNTER CLOCKWISE DIRECTION ONLY**. Never operate the high pressure pump in the clockwise direction.

WARNING: When switching from three phase generator power to three phase shore power **ALWAYS** check phases prior to operating the watermaker. Reverse Rotation will occur should the power be out of phase.

HIGH PRESSURE PUMP MAINTENANCE & REPAIR (continued)

PROBLEMS & SYMPTOMS APPEARING TO BE CAUSED BY ELECTRIC MOTOR:

- 1 The three phase (230 // 380-415 // 480 VAC) electric motor “hums,” pulls starting current (locked rotor) amperage, does not rotate, and trips the supply power circuit breaker when attempting to operate the system.

The three phase electric motor requires all three power lines (all three phases) to be operative else it will “single phase” causing extensive damage to the motor’s internal windings.

Low voltage will also cause the same symptom. Low voltage is caused by an undersized power supply or generator, undersized power lead wires to the system or motor, loose power wire, or connection at the motor or within the power supply line, and “burnt” contacts on the motor starter relay (contactor).

SOLUTIONS: Check wiring size and connections to, from, and in between the Power Supply and the electric motor. Correct wire size or any loose wires. Measure voltage at the motor during attempt to start it. If voltage drops more than 10% locate and correct the reason. Cross check voltage across all 3 power leads. Check the motor starter relay (contactor) for “burnt” contacts.

- 2 The Electric Motor makes an unusual “grinding” sound when operated.

SOLUTIONS: Check and replace as necessary the front and rear bearings. Check to see if the fan is rubbing against the fan guard.

HPP SPECIFICATIONS

Refer to *Table 3* for specifications on the high pressure pump.

Table 3: High Pressure Pump Specifications

Item	U.S. Measure (Metric Measure)
Pressure Range	100 to 1,200 psi (7 to 85 bar)
Inlet Pressure Range	Flooded to 70 psi (Flooded to 4.9 bar)
Crankcase Capacity	42 oz. (1.26 l)
Maximum Liquid Temperature	140°F (60°C)
Inlet Ports (2)	1" NPTF (1" NPTF)
Discharge Ports (2)	3/4" NPTF (3/4" NPTF)
Weight	42.6 lbs. (21 kg)
Dimensions	14.57 x 13.0 x 7.20" (370 x 330 x 183 mm)

HIGH PRESSURE PUMP / PARTS DIAGRAM & LIST

HIGH PRESSURE PUMP PARTS DIAGRAM & LIST

When servicing the high pressure pump, refer to *Figure 25* below and *Table 4* on page 114.

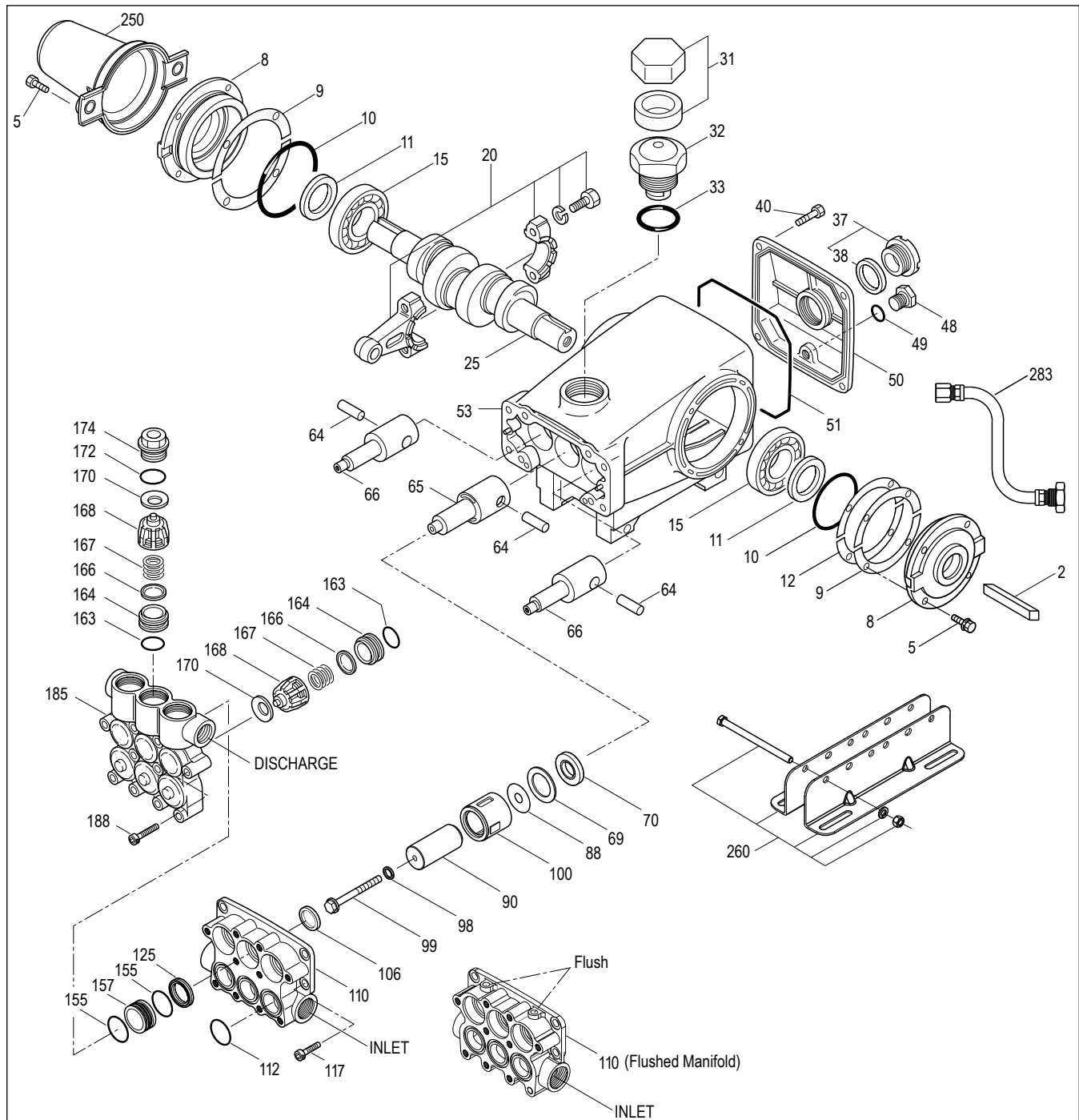


Figure 25: High Pressure Pump Parts Diagram

HIGH PRESSURE PUMP / PARTS DIAGRAM & LIST (continued)

Table 4: High Pressure Pump Parts List

Item	Material	Description	Qty
2	STL	Key (M8x7x40) Use w/"H" Hub and "B" Hub	1
	STL	Key (M8x7.5x25) Use w/"H" Hub	1
5	S	Screw, HHC Sems (M6x16)	8
8	AL	Cover, Bearing	2
9	FBR	Shim, Split 2-Pc	3
10	NBR	O-Ring, Bearing Cover - 70D	2
11	NBR	Seal, Oil, Crankshaft - 70D	2
12	S	Shim, Split, 2-Pc	2
15	STL	Bearing, Roller	2
20	TNM	Rod, Connecting Assembly	3
25	FCM	Crankshaft, Dual-End (M30)	1
31	PE	Protector, Oil Cap w/Foam Gasket	1
32	ABS	Cap, Oil Filler	1
33	NBR	O-Ring, Filler Cap - 70D	1
37	—	Gauge, Oil, Bubble w/Gasket - 80D	1
38	NBR	Gasket, Flat, Oil Gauge - 80D	1
40	S	Screw, HHC Sems (M6x20)	4
48	STCP	Plug, Drain (1/4"x19BSP)	1
49	NBR	O-Ring, Drain Plug - 70D	1
50	AL	Cover, Rear	1
51	NBR	O-Ring, Rear Cover - 70D	1
53	ALE	Crankcase (Includes Guide pin)	1
64	CM	Pin, Crosshead	3
65	SS	Rod, Plunger (Center)	1
66	SS	Rod, Plunger (Outside)	2
69	STCP R	Washer, Oil Seal	3
70	NBR	Seal, Oil Crankcase - 80D	3
88	S	Washer, Flat	3
90	CC	Plunger, Ceramic (M30x65)	3
98	NBR	Washer, Seal - 90D	3
	FPM	Washer, Seal - 90D	3
99	SS	Retainer, Plunger*	3
100	PVDF	Retainer, Seal	3
106	SNG	Seal, LPS w/SS-Spg	3
110	SS	Manifold, Inlet	1
112	NBR	O-Ring, Inlet Manifold - 90D	3
	FPM	O-Ring, Inlet Manifold - 80D	3
117	S	Screw, HSH (M10x25)	4

HIGH PRESSURE PUMP / PARTS DIAGRAM & LIST (continued)

Continued: High Pressure Pump Parts List

Item	Material	Description	Qty
125	STG	Seal, HPS w/SS	3
155	NBR	O-Ring, Spacer - 90D	6
	FPM	O-Ring, Inlet Manifold - 80D	6
157	SS	Spacer, HPS	3
163	NBR	O-Ring, Seat - 80D	6
	FPM	O-Ring, Seat - 70D	6
164	SS	Seat	6
166	SS	Valve	6
167	SS	Spring, Valve	6
168	PVDF	Retainer, Spring	6
170	SS	Washer, Spring Retainer	6
172	NBR	O-Ring, Valve Plug - 80D	3
	FPM	O-Ring, Valve Plug	3
174	SS	Plug, Valve	3
185	SS	Manifold, Discharge	1
188	S	Screw, HSH (M10x55)	10
250	NY	Protector, Shaft w/2 Screws	1
260	STZP	Mounting, Angle Rail	1
269	F	Pulley (10")	1
270	STL	Hub, "H", M30 (Keyway M8)	1
	STL	Hub, "B", M30 (Keyway M8)	1
283	—	Kit, Oil Drain (3/8" x 24")	1
299	SS	Head, Complete	1
300	NBR	Kit, Seal (Incls: 98,106,112,125,155)	1
	FPM	Kit, Seal (Incls: 98,106,112,125,155) (.0110)	1
310	NBR	Kit, Valve (Incls: 163,164,166,167,168,170,172)	2
	FPM	Kit, Valve (Incls: 163,164,166,167,168,170,172) (.0110)	2
—	—	Oil, Bottle (21 oz. Bottles) ISO-68 Hydraulic	2
—	—	Lubricant, Antiseize (1 oz.)	1

*Production parts are different than replacement parts.

R Components comply with RoHS Directive.

MATERIAL CODES: ABS=ABS Plastic; ALE=Aluminum Epoxy; BB=Brass;
 CC=Ceramic; CM=Chrome-moly; F=Cast Iron; FBB=Forged Brass; FCM=Forged
 Chrome-moly; NBR=Medium Nitrile (Buna-N); NY=Nylon; PE=Polyethylene;
 PVDF=Polyvinylidene Fluoride; S=304SS; SHS=304SS/High Strength; SS=316SS;
 SNG=Special Blend (Buna); STG=Special Blend PTFE White; ST4=Special PTFE 4;
 STCP=Steel/Chrome Plated STL=Steel; STZP=Steel/Zinc Plated;
 TNM=Special High Strength

HIGH PRESSURE PUMP / SERVICING THE VALVES

HPP SERVICE GUIDELINES

CAUTION: Before commencing with service, shut off drive (electric motor) and turn off water supply to pump. Relieve all discharge line pressure by opening valve in discharge line. After servicing is completed, turn on water supply to pump, start drive, reset pressure regulating device and secondary valve, read system pressure on the gauge at the pump head. Check for any leaks, vibration or pressure fluctuations and resume operation.

NOTE: Loctite and 242 are registered trademarks of the Henkel Corporation.

SERVICING THE VALVES



Complete Inlet/Discharge Valve Assembly

Disassembly

- 1 Remove the hex valve plugs with o-ring.
- 2 Remove washer from the top of the spring retainer.
- 3 Using a pliers to grasp the spring retainer by the tab at the top and remove from valve chamber. Normally the valve assembly will remain together. If the assembly separates during removal, use a reverse pliers and lift the seats from the chamber.
- 4 To separate valve assemblies, insert screwdriver into spring retainer and press the backside of valve until seat separates from the spring retainer. Each assembly consists of a spring retainer, spring, valve, seat, o-ring and back-up-ring. The discharge manifold must be removed in order to remove the inlet valve assemblies. Follow disassembly procedure for "REMOVING THE DISCHARGE MANIFOLD" on page 118.

Reassembly

NOTE: For certain applications apply liquid gasket to the o-ring crevices and seal surfaces.

NOTE: EPDM elastomers require silicone-base lubricant.

- 1 Examine spring retainers for internal wear or breaks in the structure and replace as needed.
- 2 Examine springs and coil springs for fatigue or breaks and replace as needed.
- 3 Examine valves and seats for grooves, pitting or wear and replace as needed.
- 4 Examine seat o-rings and back-up-rings for cuts or wear and replace as needed.
- 5 Install o-ring onto seat.
- 6 Place the valve onto the seat with dish side down.
- 7 Place spring on valve and snap the spring retainer onto seat.
- 8 Place the valve onto the seat with dish side down.
- 9 Place spring on valve and snap longer spring retainer with large opening onto seat.
- 10 Install o-ring, then back-up-ring onto discharge seat. Snap discharge seat onto inlet spring retainer.
- 11 Place valve onto seat with dish side down.
- 12 Place spring on valve and snap smaller spring retainer onto discharge seat.
- 13 Lubricate outer o-ring and back-up-ring surface and walls of valve chamber and press valve assembly squarely into valve chamber until completely seated.
- 14 Place washer on top of the spring retainer.
- 15 Place washer into valve chamber on back side of manifold. Lubricate outer o-ring and press valve assembly into valve chamber, retainer first, until completely seated.
- 16 Examine the o-ring on the valve plug and replace if cut or worn. Lubricate new o-ring before installing on valve plug to avoid damaging as they are worked over the plug threads.

NOTE: It is highly recommended that antiseize lubricant be applied to the threads on all stainless steel components to prevent galling.
- 17 Slowly thread the valve plug into chamber. Exercise caution to avoid extruding or cutting the o-ring. Torque to specifications in "TORQUE CHART" on page 121.
- 18 Install new o-rings at bottom inlet ports of inlet manifold. Support the discharge manifold from the underside and press discharge manifold into inlet manifold. Thread HSH screws in hand tight. Torque in sequence to specifications in "TORQUE CHART" on page 121.

HIGH PRESSURE PUMP / REMOVING THE MANIFOLDS

REMOVING THE DISCHARGE MANIFOLD

- 1 Remove the HSH screws.
- 2 Support the manifold from the underside and tap the backside of the discharge manifold with a soft mallet to gradually work manifold from pump.
- 3 Remove the o-rings from lower chambers of the face of the inlet manifold.

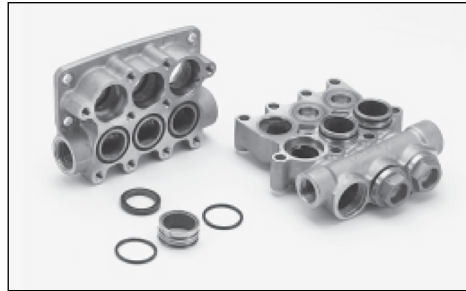
REMOVING THE INLET MANIFOLD

- 1 Remove the HSH Screws. Rotate the crankshaft to begin the separation of the inlet manifold from the crankcase.
- 2 Support the manifold from the underside and tap the rear of the inlet manifold with a soft mallet to gradually work from pump.

NOTE: Two screwdrivers on opposite sides of the manifold may be used to assist separation.

HIGH PRESSURE PUMP / SERVICING THE SEALS

SERVICING THE SEALS



Hi-Pressure Seal Arrangement



Lo-Pressure Seal

Disassembly

- 1 To service the seals and packings, it is necessary to remove both the discharge and inlet manifolds. Follow disassembly procedures for "REMOVING THE DISCHARGE MANIFOLD" and "REMOVING THE INLET MANIFOLD" on page 118.

NOTE: The HPS spacer will generally stay in the inlet manifold.

- 2 Remove the exposed o-ring. Insert two screwdrivers into the grooves on opposite sides of the spacer and pry from the chamber.

CAUTION: Exercise caution as the screwdrivers may score o-ring sealing surface.

- 3 Remove Hi-Pressure seal (HPS) from each seal chamber.
- 4 Place the inlet manifold on the work surface with crankcase side up.
- 5 Use a screwdriver to remove Lo-Pressure seal (LPS) from backside of manifold.

CAUTION: Exercise caution as the screwdriver may score o-ring sealing surface.

Reassembly

NOTE: For certain applications apply liquid gasket to the o-ring crevices and seal surfaces.

NOTE: EPDM elastomers require silicone-base lubricant.

NOTE: For standard applications, apply a small amount of oil to the outside edge of the LPS, HPS, VP, MA, FA and o-rings for ease of installation and to avoid damage.

- 1 Examine Lo-Pressure seals for wear to the internal ridges, outer surfaces or for broken springs and replace as needed.
- 2 Press Lo-Pressure seal into each seal chamber of the Inlet Manifold with the garter spring down.

NOTE: When using alternate materials, the fit of the special materials may be snug and require gently driving the LPS into position with a cylinder of the same diameter to assure a square seating and no damage to the LPS.

- 3 Examine the HPS spacer for scale build-up or wear and replace as needed. Examine the front and rear o-rings for cuts or deterioration and replace as needed.
- 4 Examine Hi-Pressure seals for frayed edges or uneven wear and replace as needed.
- 5 Place the inlet manifold on work surface with crankcase side down.
- 6 Lubricate outer surfaces of Hi-Pressure seals and position into seal chamber with metal back down, grooved side up. Lubricate the outer o-rings on the HPS spacer and press into IM seal chamber.

HIGH PRESSURE PUMP / SERVICING THE SEALS (continued)

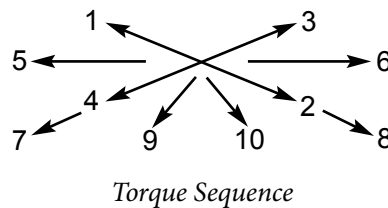
- 7 Support the inlet manifold from the underside and slide over plungers. Apply Loctite® 242® to HSH screw threads and thread in hand tight. Torque in sequence to specifications in torque chart. (See "TORQUE SEQUENCE" and "TORQUE CHART" below.)

NOTE: Loctite and 242 are registered trademarks of the Henkel Corporation.

- 8 Install new o-rings at bottom inlet ports of inlet manifold.
- 9 Support the discharge manifold from the underside and press discharge manifold into inlet manifold. Thread HSH screws in hand tight. Torque in sequence to specifications in torque chart. (See "TORQUE SEQUENCE" and "TORQUE CHART" below.)

NOTE: It is highly recommended that antiseize lubricant be applied to the threads on all stainless steel components to prevent galling.

TORQUE SEQUENCE

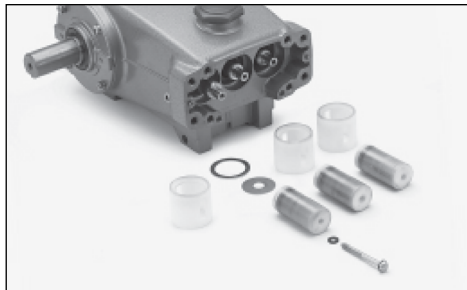


TORQUE CHART

System with HPP	Thread	Tool Size	in. lbs.	ft. lbs.	Nm
Plunger Retainer	M6	M12 Hex	55	4.6	6.2
Inlet Manifold Screws	M10	M8 Allen	222	18.5	25
Discharge Manifold Screws	M10	M8 Allen	250	21.0	28
Valve Plug/Valve Cover Screws	M36	M32 Hex	1,060	88	119
Rear Cover/Bearing Cover Screws	M6	M10 Hex	50	4.0	5.4
Connecting Rod Screws	M8	M13 Hex	216	18	24
Bubble Oil Gauge	M28	Oil Gauge Tool	45	3.8	5

HIGH PRESSURE PUMP / SERVICING THE PLUNGERS

SERVICING THE PLUNGERS



Plunger Arrangement

Disassembly

- 1 To service the plungers, it is necessary to remove the discharge and inlet manifolds. Follow disassembly procedures for "REMOVING THE DISCHARGE MANIFOLD" and "REMOVING THE INLET MANIFOLD" on page 118.
- 2 Remove the one-piece seal retainer from each plunger rod.
- 3 Using a wrench, loosen the plunger retainers about three to four turns.
- 4 Push the ceramic plungers back towards the crankcase to separate from the plunger retainers and proceed with unthreading the plunger retainers by hand.
- 5 Remove plunger retainers, o-rings, back-up-rings and gaskets.
- 6 Remove ceramic plungers and barrier slingers.

Reassembly

- 1 Visually inspect crankcase oil seals for deterioration or leaks.
- 2 Examine plunger retainers, studs, barrier slingers and keyhole washers for wear and replace as needed.
- 3 Slide barrier slingers over plunger rods with concave side away from crankcase.
- 4 Examine ceramic plungers for scoring, scale build-up, chips or cracks and replace as needed. Generally the ceramic plungers do not need to be replaced.
- 5 Slide ceramic plungers over plunger rods.

NOTE: Ceramic plunger can only be installed in one direction. Do not force onto plunger rod.

NOTE: Do not lubricate wicks at initial start-up. Operate for 10 to 15 minutes to allow grease from LPS to penetrate the plunger surface, then lubricate as needed.

- 6 Examine gaskets, o-rings and back-up-rings for cuts or wear and replace as needed.
- 7 Install gasket onto plunger retainers.

NOTE: Lubricate o-rings and back-up-rings for ease in installation and to reduce possible damage.

HIGH PRESSURE PUMP / SERVICING THE CRANKCASE

- 8 Apply Loctite® 242® to exposed threads on the plunger retainer and torque per chart on page 121.

NOTE: Loctite and 242 are registered trademarks of the Henkel Corporation.

- 9 Rotate the crankshaft so the two outside plungers are extended the same distance.
- 10 The seal retainer openings should be at top and bottom. Press completely into crankcase.

- 11 Lightly lubricate ceramic plungers to assist in installing into the manifold.

- 12 Support the inlet manifold from the underside and slide over plungers. Press completely into crankcase. Apply Loctite® 242® to HSH screw threads and thread in hand tight. Torque in sequence to specifications in torque chart. (See "TORQUE SEQUENCE" and "TORQUE CHART" on page 121.)

NOTE: Loctite and 242 are registered trademarks of the Henkel Corporation.

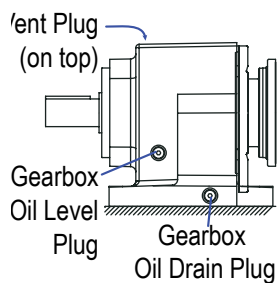
- 13 Install new o-rings at bottom inlet ports of inlet manifold.
- 14 Support the discharge manifold from the underside and align with inlet manifold. Thread in hand tight. Torque in sequence to specifications in torque chart. (See "TORQUE SEQUENCE" and "TORQUE CHART" on page 121.)

NOTE: It is highly recommended that antiseize lubricant be applied to the threads on all stainless steel components to prevent galling.

SERVICING THE CRANKCASE SECTION

- 1 While manifolds, plungers and seal retainers are removed examine crankcase oil seals for leaking and wear.
- 2 Check for any signs of leaking at rear cover, drain plug, and bubble gauge.
- 3 Check oil level and check for evidence of water in oil. Change crankcase oil on a regular schedule.
- 4 Rotate crankshaft by hand to feel for smooth bearing movement.
- 5 Examine crankshaft oil seals externally for drying, cracking or leaking.
- 6 Contact your local distributor if crankcase service is required.

HIGH PRESSURE PUMP / SERVICING THE GEARBOX



GEARBOX OIL

The gearbox is factory filled with lubricant. The factory fill lubricant is suitable for use at all output speeds and in ambient temperatures from +10°F to +105°F (-12°C to +41°C). No initial oil change after break in is needed. The initial factory oil fill is good for up to 10000 hours or 3 years of service, whichever comes first, in normal industrial environments. Normal operating conditions are defined as steady loads not exceeding normal ratings and running conditions. Oil quantity and levels should be checked at frequent intervals, depending on usage. Oil changes are required after 10,000 operating hours, or three years whichever comes first. The period can be extended to 20,000 operating hours, or six years, if a synthetic lubricant is used. The lubricant should be changed more frequently if the unit is operating in a hostile environment.

NOTE: Do not mix oils from different manufacturers. If a change to another type or brand of oil is made, the existing lubricant should be drained and the gearcase flushed with a small quantity of the new lubricant before refilling with the new lubricant. This is necessary to avoid possible incompatibility problems between the two lubricants.

BEARING LUBRICATION

In those mountings that require grease lubrication for specific bearings, re-lubricate the affected bearings every year, or every 2,000 operating hours whichever comes first. Use a grease with a lithium complex thickener and ISO 220 viscosity mineral oil base lubricant. Use 15 pumps of grease for the first re-greasing and 5 pumps of grease for subsequent re-greasing.

GEARBOX LONG TERM STORAGE

If the drive is not installed immediately, it should be stored in a clean, dry, protected area. During periods of long term storage (six months or longer) special procedures must be followed. The unit should be filled to the highest oil level hole with an approved lubricant blended with 2%, by volume, of "Daubert Chemical Co. Nox-Rust VCI-105" oil. Apply a thick coating of rust preventative on all unpainted surfaces including threads, bores, keyways, and shafts. Apply a thick coating of chassis-type grease to all exposed shaft seals. If the unit is to be stored outdoors or in a damp, unheated area indoors, cover the entire exterior with a rust preventative. Seal the unit in a moisture proof container or wrapping with a desiccant inside. Shade the enclosure from direct sunlight. Rotate the input shaft at least 60 revolutions once a month to redistribute the lubricant and prevent brinelling of bearings and drying of seals.

Upon removal from storage, remove all protective coatings applied for protection during storage. Check all hardware for proper tightness. Drain and refill the gear reducer with a recommended lubricant. If the gear reducer has been stored for more than three years or in an area with high ambient temperatures, replace the oil seals.

MEMBRANE REPLACEMENT

MEMBRANE REPLACEMENT PROCEDURE

As your Watermaker ages, your membrane will start to deteriorate and produce lower grade water. When this happens you may try to chemically clean the membrane(s) to recover the performance. If this fails you will need to replace the membrane. Refer to *Figure 26 on page 126* and proceed as follows:

- 1 Shut the thru-hull, and disconnect the high-pressure (and low-pressure if needed) hose connections from the end of the vessel in question.
- 2 Using a 9/16 open-end wrench and a slotted screwdriver, remove the four (4) nuts on the end of the pressure vessel.
- 3 With the nuts off, push the rods back clear of the black anodized plate.
- 4 Holding the black anodized plate in both hands, twist and pull the plate clear of the vessel. The end plug assembly will be removed with the plate, and the membrane will now be visible inside the pressure vessel.
- 5 Using a pair of needle-nose pliers, grab the exposed white tube. With a firm grip, pull the membrane out of the vessel. If you are taking the membrane(s) out to be returned to FCI for evaluation, do not damage or mar the white tube—doing so will make it impossible for us to evaluate the membrane.
- 6 Notice the position of the Brine-Seal when the membrane was pulled from the vessel. There is only one brine seal per membrane. The cup portion of the seal must face the incoming flow from the high-pressure pump.
- 7 Take the new membrane out of the bag. Take care NOT to get the membrane dirty.
- 8 If the old membrane is being returned to FCI, rinse well with fresh water and place into the bag. Seal the end with tape and return immediately.
- 9 With the new membrane in hand, lubricate the brine seal and slide into the vessel in the same position as the original came out. Be sure the brine seal has not become UN-seated.
- 10 Inspect the o-rings on the end plug, replace if needed, lubricate the o-ring and slide into the vessel.
- 11 Slide rods forward through the mounting holes and re-assemble nuts. Tighten until the washer does not spin freely. DO NOT OVERTIGHTEN.
- 12 Reconnect the hoses.

MEMBRANE REPLACEMENT (continued)

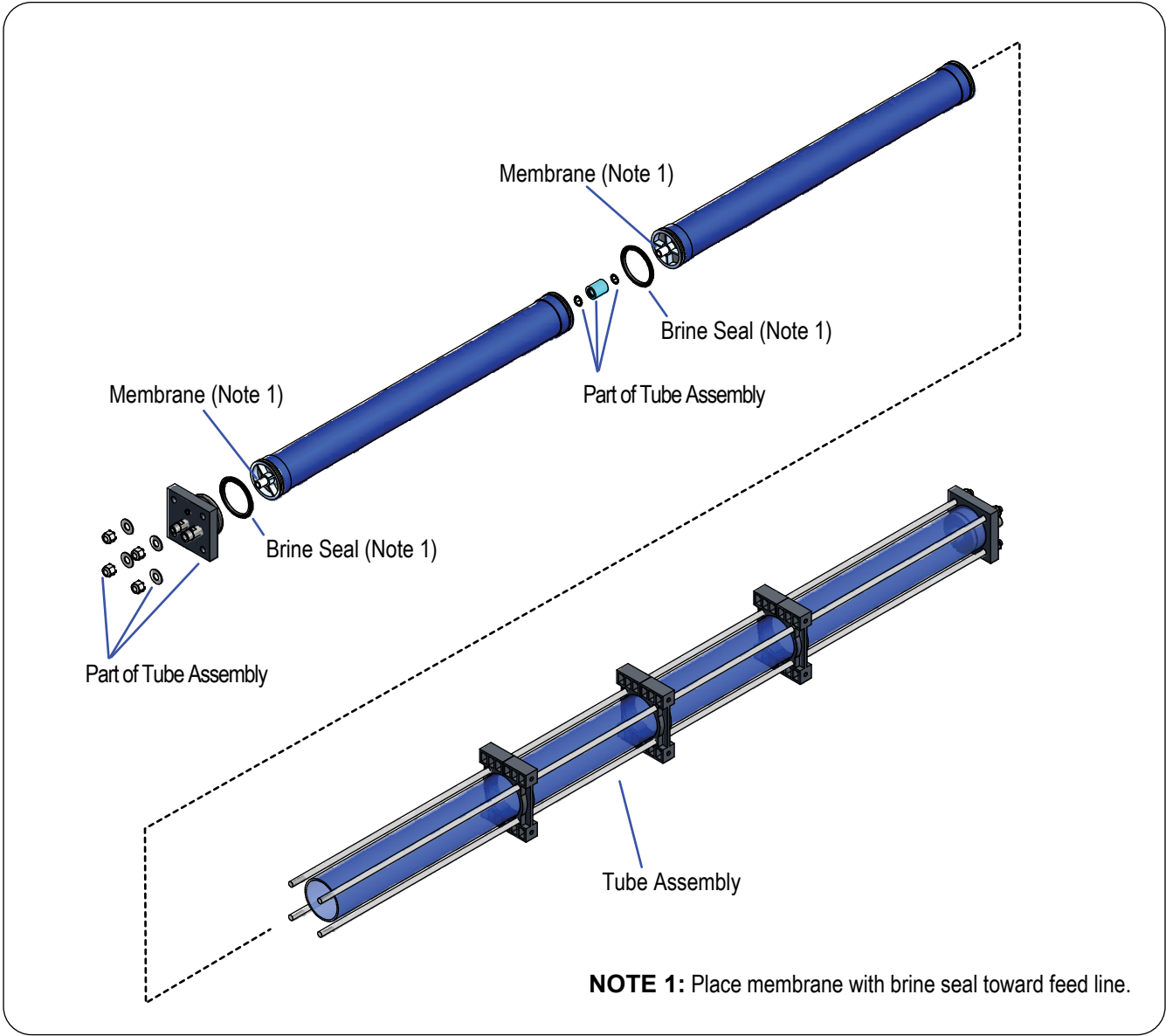


Figure 26: Replacing the Membrane

CLEANING AND STORAGE PROCEDURES

Invariably there will be times when the watermaker will not be used. During this time, it is recommended that the system be shut down and certain precautions are taken. By following these simple instructions, your FCI System will continue to provide you with fresh water for years to come.

SHORT TERM SHUTDOWN (UP TO 6 MONTHS)

Fresh water flushes are recommended. FCI Watermakers systems come standard with a fresh water flush installed. Your system is set to automatically cycle, and no additional procedures are necessary. For systems without the automatic flush installed, it is recommended to manually run fresh water through the system at “0” high pressure, until the majority of the seawater has been displaced by fresh water.

LONG TERM SHUTDOWN (6 MONTHS OR LONGER)

For long term shutdown there are two options. The first is to allow the control system to automatically flush the system every week. The other option is to “pickle”, or preserve the system, which will last up to six months. Please refer to "STORAGE PROCEDURE".

WARNING: FRESH WATER FLUSH

There must be sufficient fresh water in the potable water storage tank: In order to provide the required flow of water to the system during the fresh water flush cycle, the boat or home's fresh water pressure system must deliver minimum 1 U.S. Gallons (3.8 Liters) Per Minute at minimum 25 PSI (172 kPa) and maximum 60 PSI (414 kPa).

WARNING: FREEZING TEMPERATURE

The system must be protected from freezing if it will be exposed to temperatures below 32° Fahrenheit (0° Celsius). Freezing temperatures (below 32° F / 0° C) will cause extensive damage to the system as the water expands within the system during the freezing process. Resulting damage to the System caused by freezing temperatures is the liability of the operator. DO NOT subject the system to temperatures below 32° Fahrenheit (0° Celsius) unless the system has been rinsed with a solution of product water with twenty percent (20%) food-grade glycerin (propylene glycol).

NOTE: USE OF CHEMICALS

Although chemicals are necessary in some instances, FCI recommends using them only as needed. The chemicals can attack the membrane polymers and weaken the integrity of the membrane.

CLEANING AND STORAGE PROCEDURES (continued)

WINTERIZING PROCEDURE

If the system will be exposed to freezing temperatures the system must be drained of all product water, and rinsed with a solution of product water with 20% food-grade glycerin (propylene glycol).

After rinsing with glycerin, switch the power to the system OFF. Lock and tag the power breaker to ensure that no one will accidentally operate the system and displace the winterizing mixture with feed or fresh water.

After placing system to OFF, LOCKED, and TAGGED statem, perform the following:

- Charcoal Filter (if equipped)
 1. Remove the charcoal filter bowl.
 2. Remove the water from the bowl.
 3. Replace the charcoal filter element with a new charcoal filter element.
 4. Replace the bowl back onto the lid.
- pH Neutralizing Filter (if equipped)
 1. Remove the pH neutralizing bowl.
 2. Remove the water from the bowl.
 3. Replace the bowl and pH element back onto the lid.
- UV Sterilizer (if equipped)

Disconnect the product water line from the UV sterilizer filter and drain product water from it.

When returning the system to operation, discard the storage chemical in an environmentally safe manner.

CLEANING AND STORAGE PROCEDURES (continued)

CLEANING PROCEDURE

HIGH PH CLEANER (Green Cap — Part# 14-0013)

- 1 Disconnect system feed line, turn system on and let drain for 30 seconds.
- 2 Place feed line and discharge line in a container filled with clean de-chlorinated fresh water.
- 3 Mix one pound of chemical for every 15 gallons of water.
- 4 With regulator valves completely open, and a maximum of 50 PSI on the system, circulate the solution through the system for 30 minutes. If solution discolors, dump solution after 15 minutes and start at *Step 2* again.
- 5 Remove suction line from container and let system drain for 30 seconds.
- 6 Rinse the system with fresh water, to drain, for 15 minutes.
- 7 When R.O. unit is first restarted, product water should be diverted to drain for the first 15 minutes.

LOW PH CLEANER (Red Cap — Part# 14-0014)

- 1 Disconnect system feed line, turn system on and let drain for 30 seconds.
- 2 Place feed line and discharge line in a clean container filled with de-chlorinated fresh water.
- 3 Mix one pound of chemical for every 15 gallons of water.
- 4 With regulator valves complete open, and a maximum of 50 PSI on the system, circulate the solution through the system for 30 minutes. If solution discolors, dump solution after 15 minutes and start *Step 2* again.
- 5 Remove suction line from container and let system drain for 30 seconds.
- 6 Rinse system with fresh water, to drain, for 15 minutes.
- 7 When R.O. unit is first restarted, product water should be diverted to drain for the first 15 minutes.

CLEANING AND STORAGE PROCEDURES (continued)

STORAGE PROCEDURE

MEMBRANE STORAGE AGENT (Blue Cap — Part# 14-0015)

- 1 Membranes should be cleaned prior to storage.
- 2 Disconnect system feed line, turn system on and let drain for 30 seconds.
- 3 Place feed line and discharge line in a container filled with clean de-chlorinated fresh water.
- 4 Mix one pound of chemical for every 10 gallons of water.
For 2 1/2" membranes use 15 gallons of water.
- 5 With regulator valves completely open, and a maximum of 50 PSI on the system, circulate the solution through the system for 10 minutes.
- 6 After circulation, shut system down and close valves.
Make sure solution does not drain out.
- 7 Upon start up, after storage, open valves for operation. Start the system up and run for 15 minutes, with no applied pressure.
- 8 When R.O. unit is first restarted, product water should be diverted for 15 minutes.

6/ TROUBLESHOOTING

If you experience drastic changes in performance, take note of the following...

During performance comparisons, feed water temperature, feed water salinity, and system operating pressure must be taken into consideration and be compensated for. After compensations, a 15% decline in productivity (GPH Flow) and/or a 15% increase in salt passage indicate that the R.O. membrane element may require cleaning.

If production rate has dropped dramatically since the last time the system was used, this may be due to drying out of the R.O. membrane element and/or fouling during storage. If the system has not been used for several months and the production rate has dropped dramatically since the last time used, try operating the system for 48 or more continuous hours to saturate the product water channel within the R.O. membrane element.

If production rate drops dramatically from one day to another, this may be due to chemical attack, which is not cleanable. Sewage chemicals or petroleum products cause irreparable damage to the R.O. membrane element. Suspended solids fouling resulting from silt, coral dust, iron (rust), river or inland waterway debris, or other small solid matter may not be cleanable.

For "System Troubleshooting Guide", refer to *Table 5*.

SYSTEM TROUBLESHOOTING GUIDE

Table 5: System Troubleshooting Guide

Problem	Probable Cause	Solution
LP FAULT • Low Pressure Feed Pressure Too Low	Pre-filter clogged	Clean (up to 2X) or replace
	Sea strainer clogged	Clean
	Thru-hull obstructed	Clear obstruction
	Kink in feed hose	Correct hose run or replace hose
	LP pump lost prime	Prime Low-pressure pump
	Thru-hull valve closed	Open Thru-hull valve
	Pump Rotation incorrect	Reverse rotation
	Media filter needs back washing (if equipped)	Backwash or change media
	Low-pressure switch	Replace switch
		Tighten wire connections
		Replace cable
	Air in feed line	Install forward facing scoop
		Move thru-hull position
		Use dedicated thru-hull
LP FAULT • LP pump won't run	Fuse blown on Controller	Replace fuse – see electrical diagram
	Capacitor blown on motor	Replace
	Thermal overload tripped on motor	Will automatically reset when cools down
	Thermal overload on contactor tripped (if equipped)	Press reset button on thermal overload (inside electrical box)
	Loose wire in junction box	Check and secure
	Loose wire on control board	Check and secure
	Contactor faulty	Replace
	Loose wire on contactor coil A1, A2	Check and secure
PRE-FILTER LEAKS	O-ring needs replacing	Replace
HP FAULT • System Pressure Too High	Pressure beyond high pressure trip point	Reduce pressure
		Adjust trip point
	Switch has failed or wire connections to switch are loose	Replace switch
		Check wire connection
		Replace wire
	Restriction downstream of brine discharge	Remove restriction

SYSTEM TROUBLESHOOTING GUIDE (continued)

Continued: System Troubleshooting Guide

Problem	Probable Cause	Solution
High-pressure Pump Won't Run	Fuse blown on controller	Replace fuse – see electrical diagram
	Capacitors blown (run or start)	Replace
	Motor bearings failed	Replace bearing
	Thermal Overload tripped (if equipped)	Press reset button
	Loose wire in junction box	Check and secure
	Loose wire on control board	Check and secure
	Contactor faulty	Replace
	Loose wire on contactor coil , A1, A2	Check and secure
	High pressure pump has seized	Check and take necessary action
TDS FAULT	Membrane Fouling	Clean or replace membrane
	Loss of feed flow from HP Pump	Check pump RPM, Adjust Belt tension, Service pump seals
	Pressure too low	Increase pressure to rated output
	Product Probe Needs Cleaning	Wipe down probe pins
	Pressure not being applied to system soon enough to allow for water to be made prior to the 3 minute shutdown	Apply pressure when screen advances to the "init" screen to allow for the system to make water sooner
PERM FAULT (Permeate)	System making water beyond rated capacity	Reduce pressure to bring product flow rate within design specifications
System has power, but display is blank	Possible short on flow sensors or switches resulting in power supply shutting down	Kill power to unit. Unplug the flow sensors and transducers. Reapply power. If display comes on, plug each component in one by one and see which one brings the screen down. Replace identified item
	Power supply down on main control board	Check output on power supply. If not 24 VDC return to factory for repair
System has power, but pumps will not turn on	Main fuse on control board has blown. Usually caused by one of the coils in the solenoids or contactors	Replace fuse. Monitor system and determine at what stage the fuse blows. (Ex. When HP pump starts, when fresh water flush solenoid engages etc.) Check connections to that component, secure wires or replace component

SYSTEM TROUBLESHOOTING GUIDE (continued)

Continued: System Troubleshooting Guide

Problem	Probable Cause	Solution
System turns off by itself, no fault condition showing	Loss of power	No action
	Program set up to run for a certain amount of time	Adjust as needed (see control section)
	Program set to make a specified amount of water	Adjust as needed (see control section)
	Program set to turn on or off at specified times	Adjust as needed (see control section)
Low-pressure pump will not shut off	Isolation relay on main control board is faulty	Send to factory for repair
High-pressure pump will not shut off	Isolation relay on main control board is faulty	Send to factory for repair
Brine flow paddle wheel does not stop spinning after shutdown	System is in a fresh water flush mode	Wait for fresh water flush to time out
	Fresh water flush solenoid valve is faulty	Replace or repair valve
	Fresh water flush relay on control board has failed	Send to factory for repair
System is making good water but not diverting to fresh water tank	Quality solenoid has failed	Check wiring / Replace valve (use over ride button on valve to divert water until repaired)
	Quality solenoid relay on control board has failed	Return control board to factory for repair
Brine flow is too low	High pressure pump seals worn	Replace seals
Product flow is low	System pressure too low	Increase pressure
	Feed TDS high	Adjust pressure up to 1000 PSI to compensate for high TDS
	Water temperature low	Adjust pressure up to 1000 PSI to compensate for low temperature
	Membranes are fouled	Clean or replace membranes
System does not turn on when power button is pressed	Fuses blown on main control	Replace fuses
	Power not on	Apply power
System draws high amperes	Low or incorrect voltage applied	Adjust voltage to system specifications
High pressure not increasing when HP Valve is turned counter clockwise	HP pump seals need service	Repair high pressure pump
	Valve stem worn	Replace high pressure valve
High quality light does not come on	Pressure too low on system	Increase pressure to rated output
	Membrane is fouled	Clean or replace membrane
	Probe needs to be cleaned	Clean or replace probe

HIGH PRESSURE PUMP TROUBLESHOOTING GUIDE

One of the most important steps in a high pressure system is to establish a regular maintenance program. This will vary slightly with each system and is determined by various elements such as the duty cycle, the liquid being pumped, the actual specifications vs. rated specifications of the pump, the ambient conditions, the inlet conditions and the accessories in the system. A careful review of the necessary inlet conditions and protection devices required before the system is installed will eliminate many potential problems.

These pumps are very easy pumps to service and require far less frequent service than most pumps. Typically, only common tools are required, making in-field service convenient, however, there are a few custom tools special to certain models that do simplify the process. This section of this manual is designed to assist you with the disassembly and reassembly of your pump. *Table 6* will assist in determining the cause and remedy to various operating conditions.

Table 6: High Pressure Pump Troubleshooting Guide

Problem	Probable Cause	Solution
LOW PRESSURE	Air leak in inlet plumbing.	Tighten fittings and hoses. Use PTFE liquid or tape.
	Pressure gauge inoperative or not registering accurately.	Check with new gauge. Replace worn or damaged gauge.
	Inlet suction strainer (filter) clogged or improperly sized.	Clean/adjust relief valve. Replace worn seats/valves and o-rings.
	Abrasives in pumped liquid.	Clean filter. Use adequate size filter. Check more frequently. Install proper filter.
	Leaky discharge hose.	Replace discharge hose with proper rating for system.
	Inadequate liquid supply.	Pressurize inlet.
	Severe cavitation.	Check inlet conditions.
	Worn seals.	Install new seal kit. Increase frequency of service
	Worn or dirty inlet/discharge valves.	Clean inlet/discharge valves or install new valve kit.
PULSATION	Foreign material trapped in inlet/discharge valves.	Clean inlet/discharge valves or install new valve kit..
WATER LEAK • Under the manifold • Into the crankcase	Worn V-Packings or Lo-Pressure Seals.	Install new seal kit. Increase frequency of service.
	Worn adapter o-rings.	Install new o-rings.
	Humid air condensing into water inside the crankcase.	Install oil cap protector. Change oil every 3 months or 250 hours.
	Excessive wear to seals and V-Packings.	Install new seal kit. Increase frequency of service.
KNOCKING NOISE • Inlet supply • Bearing • Pulley	Inadequate inlet liquid supply.	Check liquid supply. Increase line size, pressurize.
	Broken or worn bearing.	Replace bearing.
	Loose pulley on crankshaft	Check key and tighten set screw.

HIGH PRESSURE PUMP TROUBLESHOOTING GUIDE (continued)

Continued: High Pressure Pump Troubleshooting Guide

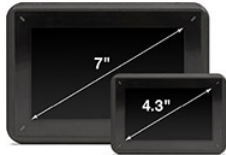
Problem	Probable Cause	Solution
OIL LEAK • Crankcase oil seals. • Crankshaft oil seals and o-rings. • Drain plug • Bubble gauge • Rear Cover • Filler cap	Worn crankcase oil seals.	Replace crankcase oil seals.
	Worn crankshaft oil seals or o-rings on bearing cover.	Remove bearing cover and replace o-rings and/or oil seals.
	Loose drain plug or worn drain plug o-ring.	Tighten drain plug or replace o-ring.
	Loose bubble gauge or worn bubble gauge gasket.	Tighten bubble gauge or replace gasket.
	Loose rear cover or worn rear cover o-ring.	Tighten rear cover or replace o-ring.
	Loose filler cap or excessive oil in crankcase.	Tighten filler cap. Fill crankcase to specified capacity.
PUMP RUNS EXTREMELY ROUGH • Inlet conditions • Pump valves • Pump seals	Restricted inlet or air entering the inlet plumbing.	Correct inlet size plumbing. Check for air tight seal.
	Stuck inlet/discharge valves.	Clean out foreign material or install new valve kit.
	Leaking V-Packings or Lo-Pressure seals.	Install new seal kit. Increase frequency of service.
PREMATURE SEAL FAILURE	Scored plungers.	Replace plungers.
	Over pressure to inlet manifold.	Reduce inlet pressure per specifications.
	Abrasive material in the liquid being pumped.	Install proper filtration at pump inlet and clean regularly.
	Excessive pressure and/or temperature of pumped liquid.	Check pressure and inlet liquid temperature. DO NOT RUN PUMP WITHOUT LIQUID.
	Running pump dry.	Increase hose one size larger than inlet port size. Pressurize.
	Starving pump of adequate liquid.	Increase hose one size larger than inlet port size. Pressurize.
	Eroded manifold.	Replace manifold. Check liquid compatibility.

7/ ACCESSORIES & OPTIONAL EQUIPMENT

Contact your authorized FCI dealer for the following items:

- REPLACEMENT PARTS
- ACCESSORIES & OPTIONAL EQUIPMENT

For more information, please call 1-801-906-8840,
or visit us online at fcewatermakers.com.



ADDITIONAL DISPLAYS

Monitor, program and access the system from one or more remote locations. Install one on the bridge, in the salon and/or engineering room. In the case of an island installation place one anywhere remote control and monitoring is desired.



MEDIA FILTERS

Multi-media and iron removal filters remove particulate or iron from the feed water stream. Filter includes valve tree assembly and stainless steel differential gauges.



ULTRA-VIOLET STERILIZERS

Stainless steel, ultra-violet sterilizers provide 99.8% sterilization of bacteria and micro-organisms in water. Available in a variety of flow rates.

Recommended installation is after the holding tank, not immediately after the watermaker, as specified by other manufacturers and/or installers. The reason for this is that in addition to receiving clean water from the on-board watermaker, holding tanks are vented (inviting potential for contaminants) and are also fed by dockside fillings from shore—there is no control of water quality in the holding tank itself. If a UV sterilizer is used, it should be sized to accommodate the requirements of the boat's fresh water pump.



POST GRANULAR ACTIVATED CARBON FILTERS

Granular-activated charcoal filters are great for post-tank filtration, and remove particulate, chlorine and other contaminants found in your fresh water holding tank.



REPLACEMENT PARTS

FCI carries a complete line of replacement parts including filters, membranes, hoses, fittings, spanners, o-rings and more.

Refer to the General Assembly Diagrams included in this chapter for information about parts used in the system.

The General Assembly Diagrams in this chapter are organized in the following order:

- Systems
- Frame
- Pre-filter
- HP Pump
- Vessels
- FWF Assembly
- Control Valves
- Flowmeters
- Pressure Gauge
- Quality Valve
- Plumbing
- Hoses
- Electrical

GENERAL ASSEMBLY DIAGRAMS / SYSTEMS

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Part List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	50-4909	Display, 7" HMI
2	1	74-2460-89.3	Tubing, PE 5/8"
3	1	91-4919	Panel, Front, NH+
4	1	91-4937	Plate, HMI Back Cover, Neptune+
5	1	93-0047	Asy, LP Pump, SS, 1 HP, 3PH
6	1	93-3537	Neptune+ Horizontal Install Kit
7	1	93-4920	Asy, Feed/Discharge Plumbing, NH+
8	1	93-4925	Asy, FWF, 24 VDC, NH+
9	1	93-4939	Asy, Pre-Filler, NH+
10	1	93-4952	Asy, Enclosure, 12x10, V4, NH+
11	1	93-4966	Asy, Control Valve, NH+
12	1	93-4967	Asy, 1/2" Product Flow Meter, NH+
13	1	93-4968	Asy, Quality Valve, 24 VDC, NH+
14	1	93-5028	Asy, 1/2" Brine Flow Meter, NH+
15	1	93-5029	Asy, LP Gauge, NH+
16	1	93-5815	Asy, Frame, Direct Drive, NH+
17	1	93-5817	Asy, Pump/Motor, 10HP, 60HZ/3PH, Direct Drive
18	1	93-5949	Asy, HPP Feed Hose, NH+
19	1	93-5951	Asy, Vessel, 3400GPD, Neptune+ DD
20	1	93-5954	Asy, HP Feed Hose, NH+ 3400-5800GPD
21	1	93-5955	Asy, HP Discharge Hose, NH+ 3400GPD
22	1	93-5985	Asy, Contactor, 240-415VAC/3PH, 24VDC, 12x10, Neptune+ DD

APPROVALS

DATE

8/8/2017

REPREPARED BY

Mark

CHECKED BY

SM

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DATE

8/8/2017

SCALE

AS SHOWN

PROJECT

NEPTUNE+ DD

REV

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FCI FILTRATION CONCEPTS, INC.

10000 WILLOW CREEK DRIVE

NEW CANEY, OH 44663

TEL: 800-906-8840

FAX: 800-906-8840

WWW.FCIWATERMAKERS.COM

NEPTUNE+ DD Horizontal 3400 GPD

DO NOT SCALE

SHEET 1 OF 2

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REV		DESCRIPTION		DATE		ENG MFG	
A	Production Release			6/6/17	MA		

ITEM	QTY	PART NUMBER	DESCRIPTION
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2	1	74-2460-89.3	Tubing, PE 5/8"
3	1	91-4919	Panel, Front, NH+
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7	1	93-4920	Assy, Feed/Discharge Plumbing, NH+
8	1	93-4925	Assy, FWF, 24 VDC, NH+
9	1	93-4939	Assy, Pre-Filler, NH+
10	1	93-4952	Assy, Enclosure, 12x10, V4, NH+
11	1	93-4967	Assy, 1/2" Product Flow Meter, NH+
12	1	93-4968	Assy, Quality Valve, 24 VDC, NH+
13	1	93-4969	Assy, Auto Control Valve, NH+
14	1	93-5028	Assy, 1/2" Brine Flow Meter, NH+
15	1	93-5029	Assy, LP Gauge, NH+
16	1	93-5815	Assy, Frame, Direct Drive, NH+
17	1	93-5817	Assy, Pump/Motor, 10HP, 60HZ/3PH, Direct Drive
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DATE: 6/6/2017

SCALE: 1/8" = 1'-0"

AXIS: 1/8" = 1'-0"

AXIS: 1/8" = 1'-0"

FCI FILTRATION CONCEPTS INC.

10000 W. 100th Ave.

Northglenn, CO 80061

TEL: 303.440.4444 FAX: 303.440.4444

WWW.FCIWATERMAKERS.COM

Neptune+ APC DD Horizontal 3400 GPD

DO NOT SCALE

SHEET 1 OF 2

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Exploded view diagram of a water filtration system. The diagram shows the main unit with various components labeled with numbers 1 through 22. The components include a display, pump, valves, hoses, and other internal parts. The diagram is oriented with a vertical axis labeled 1, 2, 3, 4 and a horizontal axis labeled A, B.

REV		DESCRIPTION		DATE		ENG MFG	
A		Production Release		6/6/17		MA	

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SIZE

DRAWING NUMBER

NEPTUNE+ DD Horizontal 4600 GPD

DO NOT SCALE

SHEET 1 OF 2

FCI FILTRATION CONCEPTS INC.

10000 WILLOW CREEK DRIVE

NEW CANE, OH 44663

TEL 800.906.8840

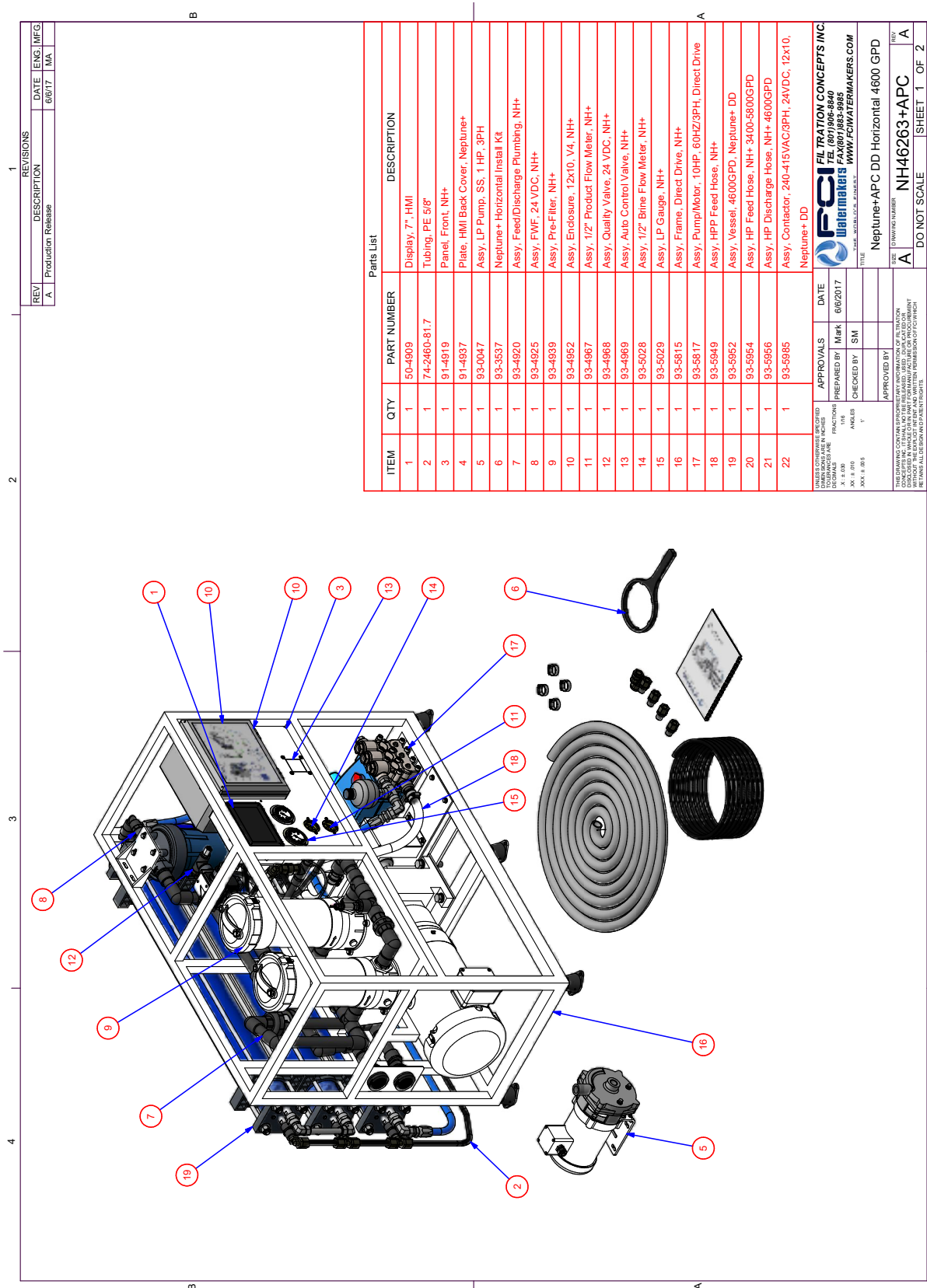
FAX 800.906.8840

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TITLE

NEPTUNE+ DD Horizontal 4600 GPD

GENERAL ASSEMBLY DIAGRAMS / SYSTEMS (continued)



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A	Production Release			6/6/17	MA		

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12	1	93-4967	Asy, 1/2" Product Flow Meter, NH+
13	1	93-4968	Asy, Quality Valve, 24 VDC, NH+
14	1	93-5028	Asy, 1/2" Brine Flow Meter, NH+
15	1	93-5029	Asy, LP Gauge, NH+
16	1	93-5815	Asy, Frame, Direct Drive, NH+
17	1	93-5817	Asy, Pump/Motor, 10HP, 60HZ/3PH, Direct Drive
18	1	93-5949	Asy, HPP Feed Hose, NH+
19	1	93-5953	Asy, Vessel, 5800GPD, Neptune+ DD
20	1	93-5954	Asy, HP Feed Hose, NH+ 3400-5800GPD
21	1	93-5957	Asy, HP Discharge Hose, NH+ 5800GPD
22	1	93-5985	Asy, Contactor, 240-415VAC/3PH, 24VDC, 12x10, Neptune+ DD

APPROVALS

DATE

8/6/2017

REPREPARED BY

Mark

CHECKED BY

SM

APPROVED BY

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TEL (801)906-3840

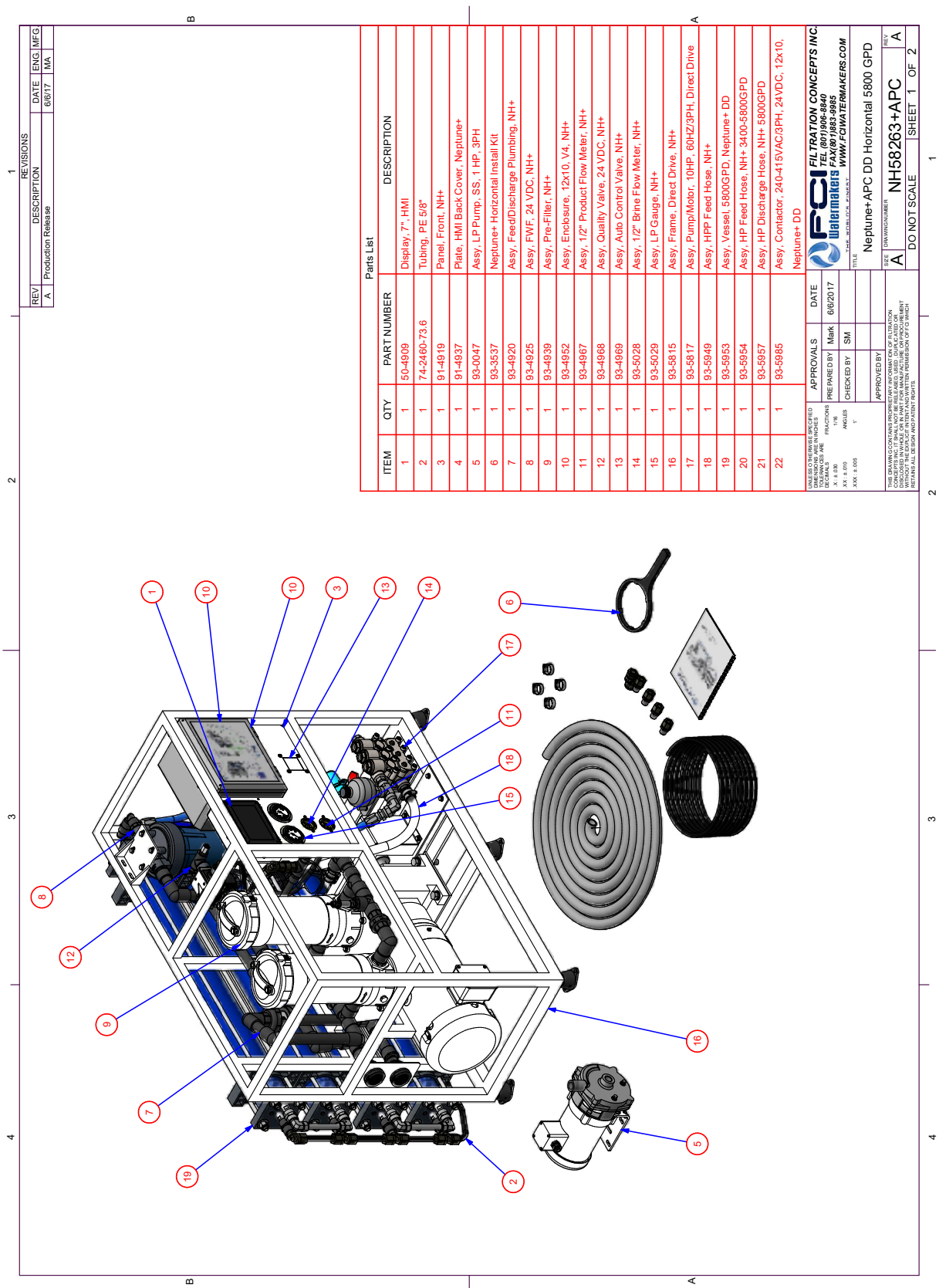
FAX (801)983-3985

WWW.FCIWATERMAKERS.COM

Neptune+ DD Horizontal 5800 GPD

DO NOT SCALE

SHEET 1 OF 2



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REVISIONS		DATE	ENG	MFG
REV	DESCRIPTION			
A	Production Release	6/6/17	MA	

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	50-4909	Display, 7" HMI
2	1	74-2460-88.3	Tubing, PE 5/8"
3	1	91-4919	Panel, Front, NH+
4	1	91-4937	Plate, HMI Back Cover, Neptune+
5	1	93-0047	Assy, LP Pump, SS, 1 HP, 3PH
6	1	93-3537	Neptune+ Horizontal Install Kit
7	1	93-4920	Assy, Feed/Discharge Plumbing, NH+
8	1	93-4925	Assy, FWF, 24 VDC, NH+
9	1	93-4939	Assy, Pre-Filler, NH+
10	1	93-4952	Assy, Enclosure, 12x10, V4, NH+
11	1	93-4966	Assy, Control Valve, NH+
12	1	93-4967	Assy, 1/2" Product Flow Meter, NH+
13	1	93-4968	Assy, Quality Valve, 24 VDC, NH+
14	1	93-5028	Assy, 1/2" Brine Flow Meter, NH+
15	1	93-5029	Assy, LP Gauge, NH+
16	1	93-5815	Assy, Frame, Direct Drive, NH+
17	1	93-5817	Assy, Pump/Motor, 10HP, 60HZ/3PH, Direct Drive
18	1	93-5949	Assy, HPP Feed Hose, NH+
19	1	93-5950	Assy, HP Feed Hose, NH+ 8000-10000GPD
20	1	93-5981	Assy, Vessel, 8000GPD, NH+ DD
21	1	93-5983	Assy, HP Discharge Hose, NH+ 8000GPD
22	1	93-5985	Assy, Contactor, 240-415VAC/3PH, 24VDC, 12x10, Neptune+ DD

APPROVALS

DATE

6/6/2017

PREPARED BY

Mark

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DATE: 6/6/2017

SCALE: 1/8" = 1'-0"

AX: 1/8" = 1'-0"

AY: 1/8" = 1'-0"

AXX: 1/8" = 1'-0"

AXY: 1/8" = 1'-0"

SIZE

DRAWING NUMBER

Neptune+ DD Horizontal 8000 GPD

REV

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DO NOT SCALE

SHEET 1 OF 2

FCI FILTRATION CONCEPTS INC.

10000 W. 100th Ave.

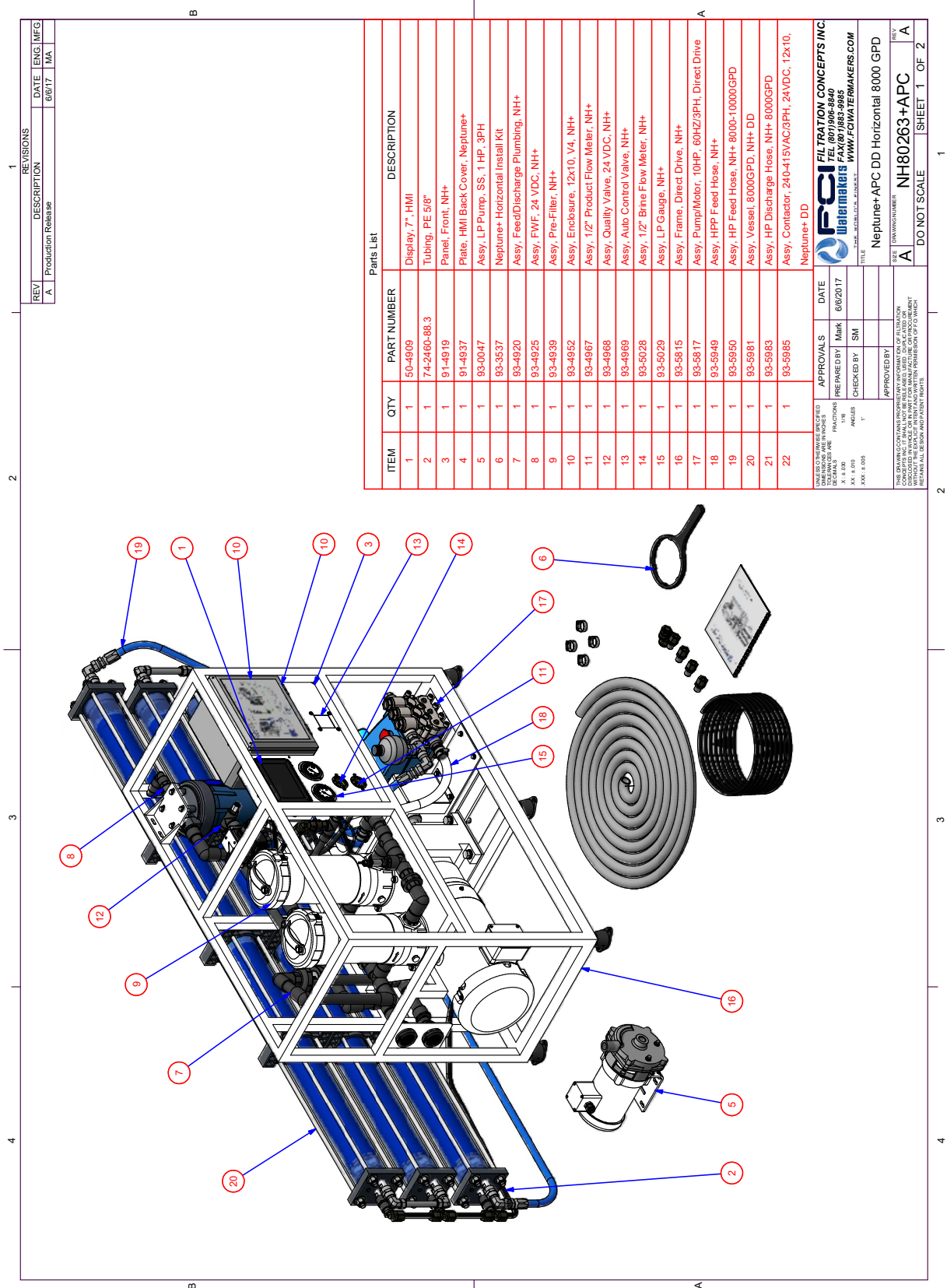
Denver, CO 80231

TEL: (801) 906-3840

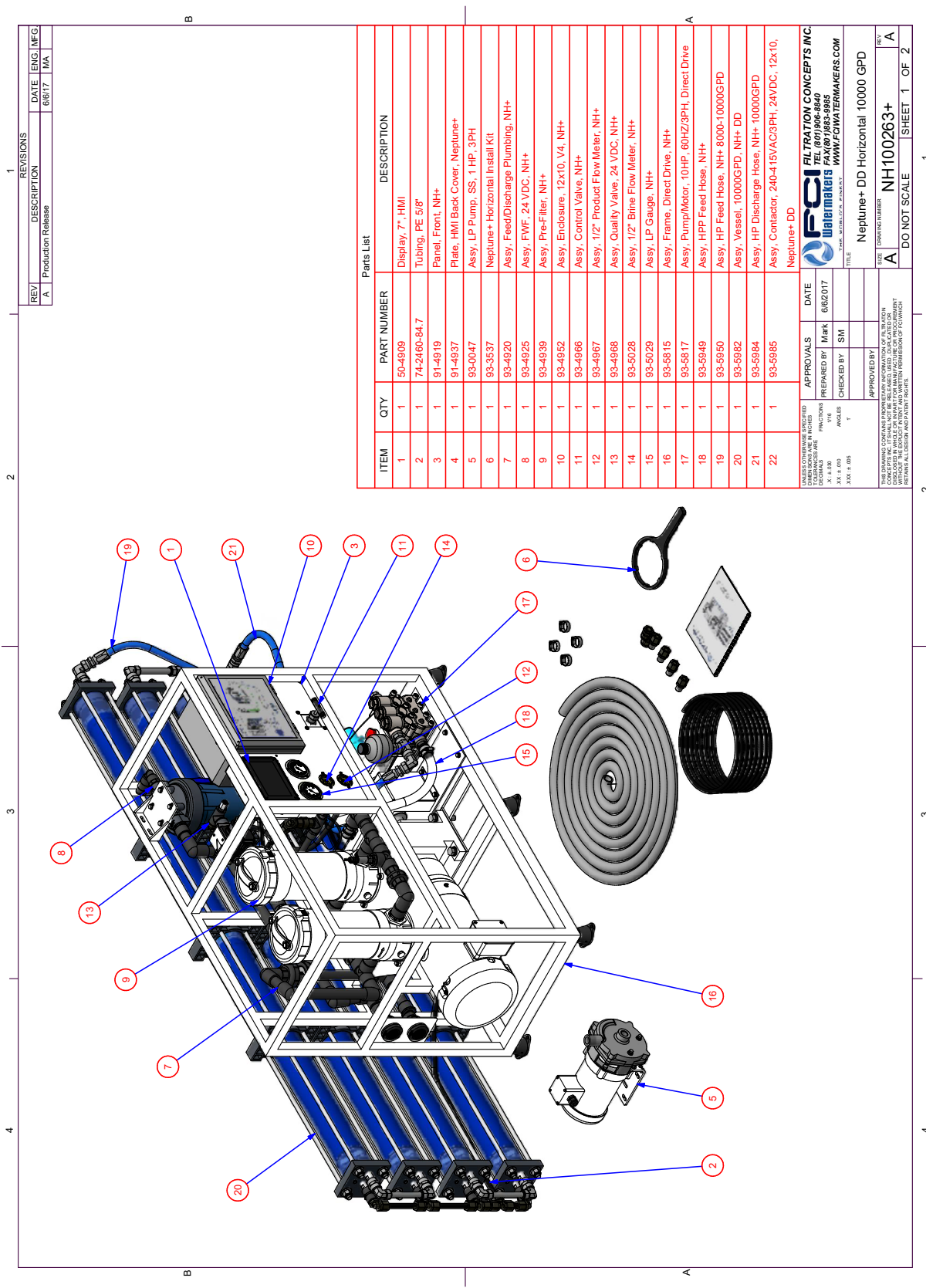
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FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / SYSTEMS (continued)



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Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	50-4909	Display, 7" HMI
2	1	74-2460-84.7	Tubing, PE 5/8"
3	1	91-4919	Panel, Front, NH+
4	1	91-4937	Plate, HMI Back Cover, Neptune+
5	1	93-0047	Asy, LP Pump, SS, 1 HP, 3PH
6	1	93-3537	Neptune+ Horizontal Install Kit
7	1	93-4920	Asy, Feed/Discharge Plumbing, NH+
8	1	93-4925	Asy, FWF, 24 VDC, NH+
9	1	93-4939	Asy, Pre-Filler, NH+
10	1	93-4952	Asy, Enclosure, 12x10, V4, NH+
11	1	93-4967	Asy, 1/2" Product Flow Meter, NH+
12	1	93-4968	Asy, Quality Valve, 24 VDC, NH+
13	1	93-4969	Asy, Auto Control Valve, NH+
14	1	93-5028	Asy, 1/2" Brine Flow Meter, NH+
15	1	93-5029	Asy, LP Gauge, NH+
16	1	93-5815	Asy, Frame, Direct Drive, NH+
17	1	93-5817	Asy, Pump/Motor, 10HP, 60HZ/3PH, Direct Drive
18	1	93-5949	Asy, HPP Feed Hose, NH+
19	1	93-5950	Asy, HP Feed Hose, NH+ 8000-10000GPD
20	1	93-5982	Asy, Vessel, 10000GPD, NH+ DD
21	1	93-5984	Asy, HP Discharge Hose, NH+ 10000GPD
22	1	93-5985	Asy, Contactor, 240-415VAC/3PH, 24VDC, 12x10, Neptune+ DD

APPROVALS

DATE

8/6/2017

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FCI FILTRATION CONCEPTS, INC.

10000 GPD

TEL: (801) 906-3840

FAX: (801) 983-3988

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TEL: 201-346-6344, EXT. 1001

Neptune+APC DD Horizontal 10000 GPD

SIZE

10000 GPD

REV

A

DO NOT SCALE

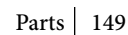
SHEET

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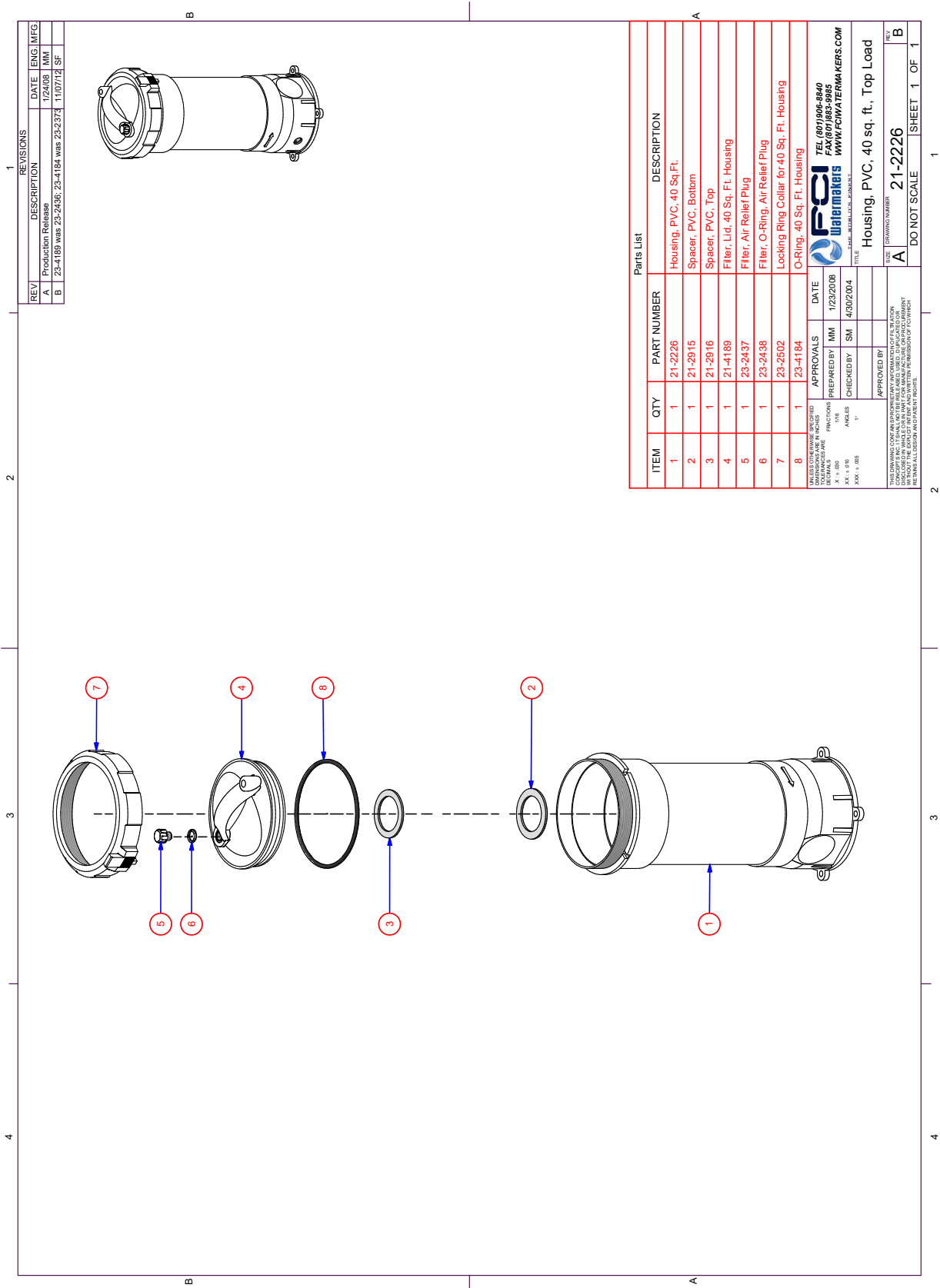
OF

2

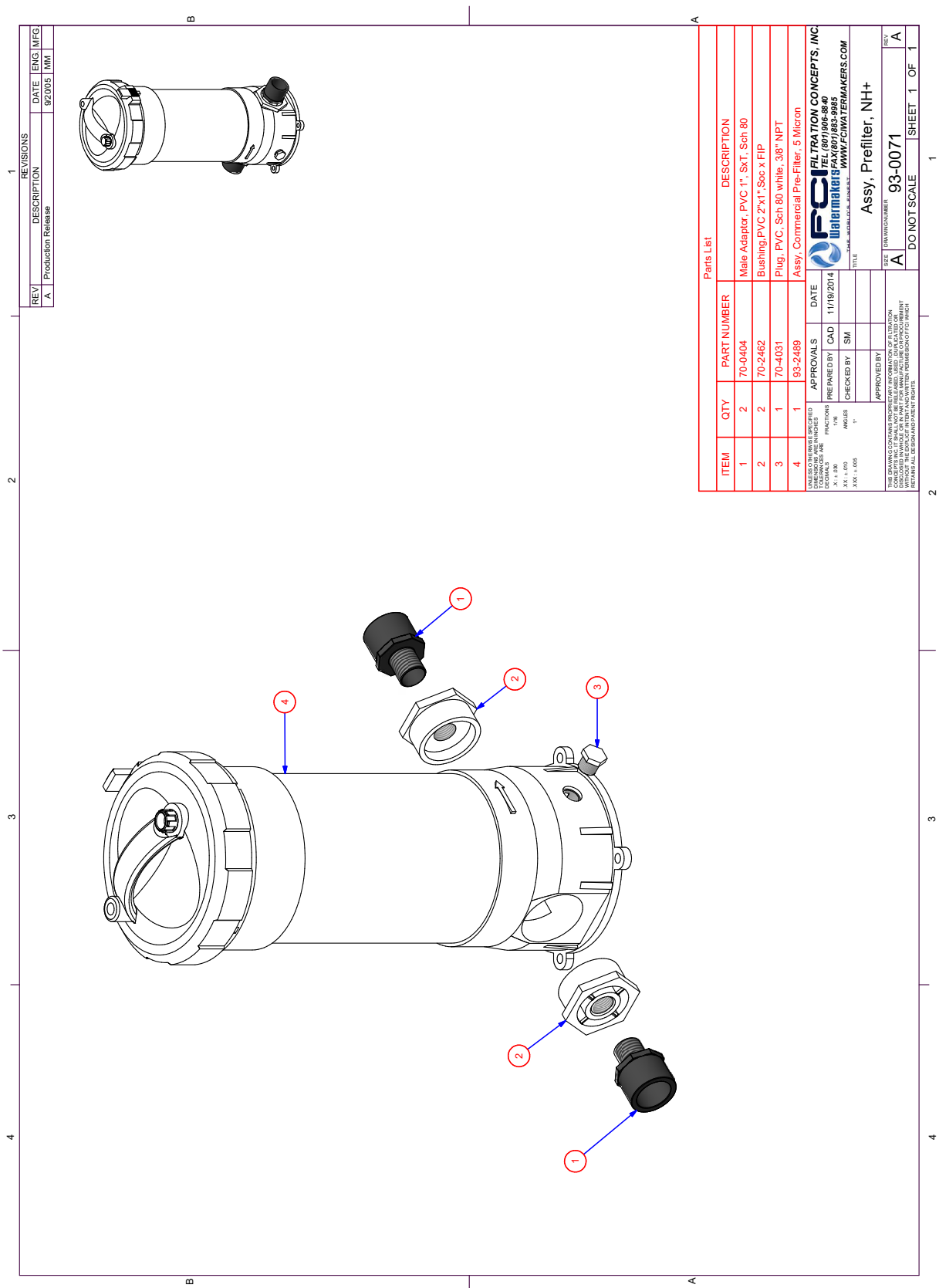
FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / PRE-FILTER



GENERAL ASSEMBLY DIAGRAMS / PRE-FILTER (continued)



REVISIONS			
REV	DESCRIPTION	DATE	ENG. MFG.
A	Production Release	9/2/05	MM

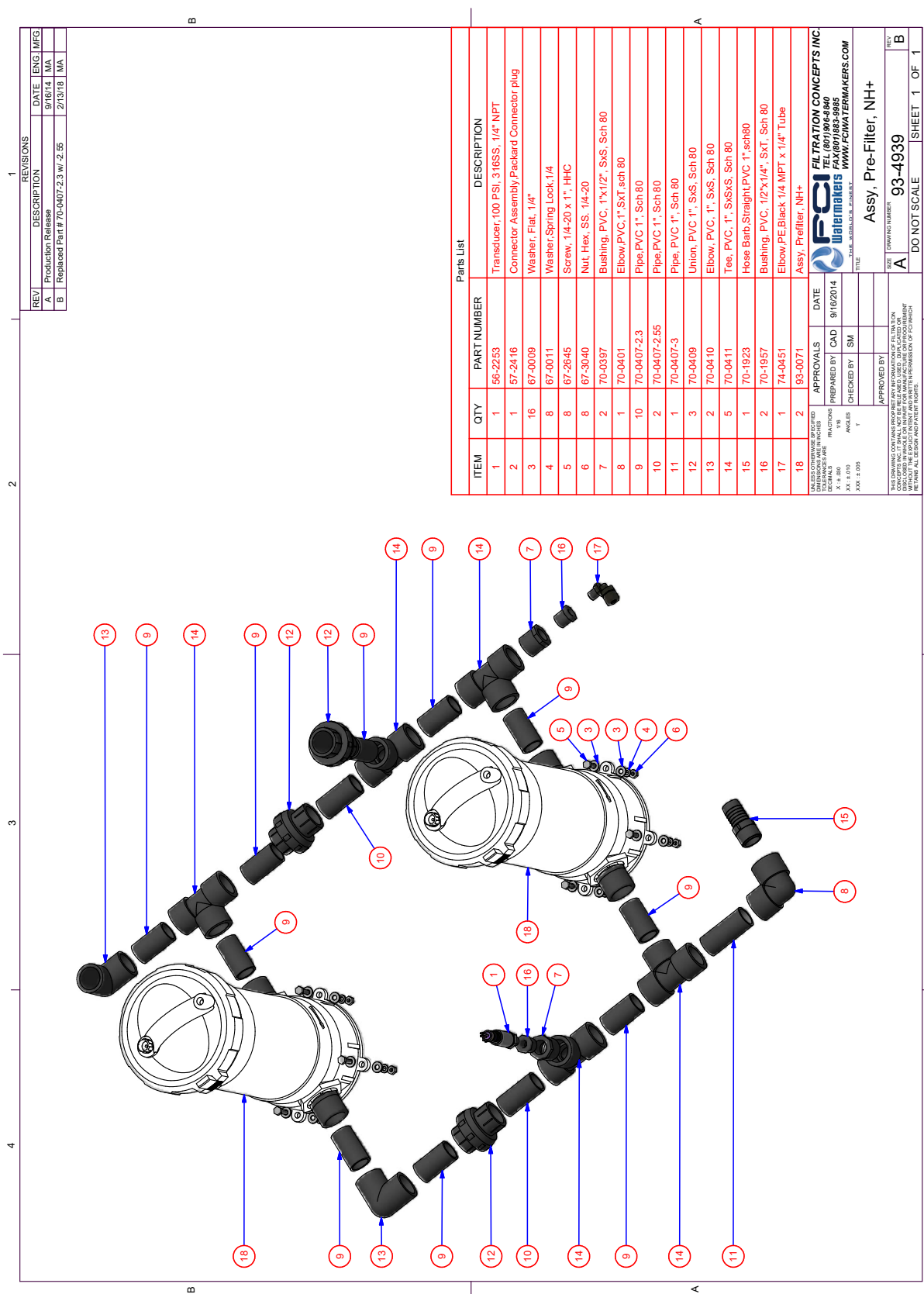
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	70-0404	Male Adaptor, PVC 1", SxT, Sch 80
2	2	70-2462	Bushing, PVC 2"x1" Soc x FIP
3	1	70-4031	Plug, PVC, Sch 80 white, 3/8" NPT
4	1	93-2489	Assy, Commercial Pre-Filter, 5 Micron

APPROVALS		DATE
PREPARED BY	CAD	11/19/2014
CHECKED BY	SM	
APPROVED BY		

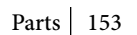
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FAX: (801) 906-8840	
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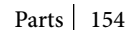
TITLE	Assy, Prefilter, NH+
SIZE	DO NOT SCALE
DRAWING NUMBER	93-0071
REV	A
SHEET	1 OF 1



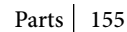
FCI WATERMAKERS, INC.

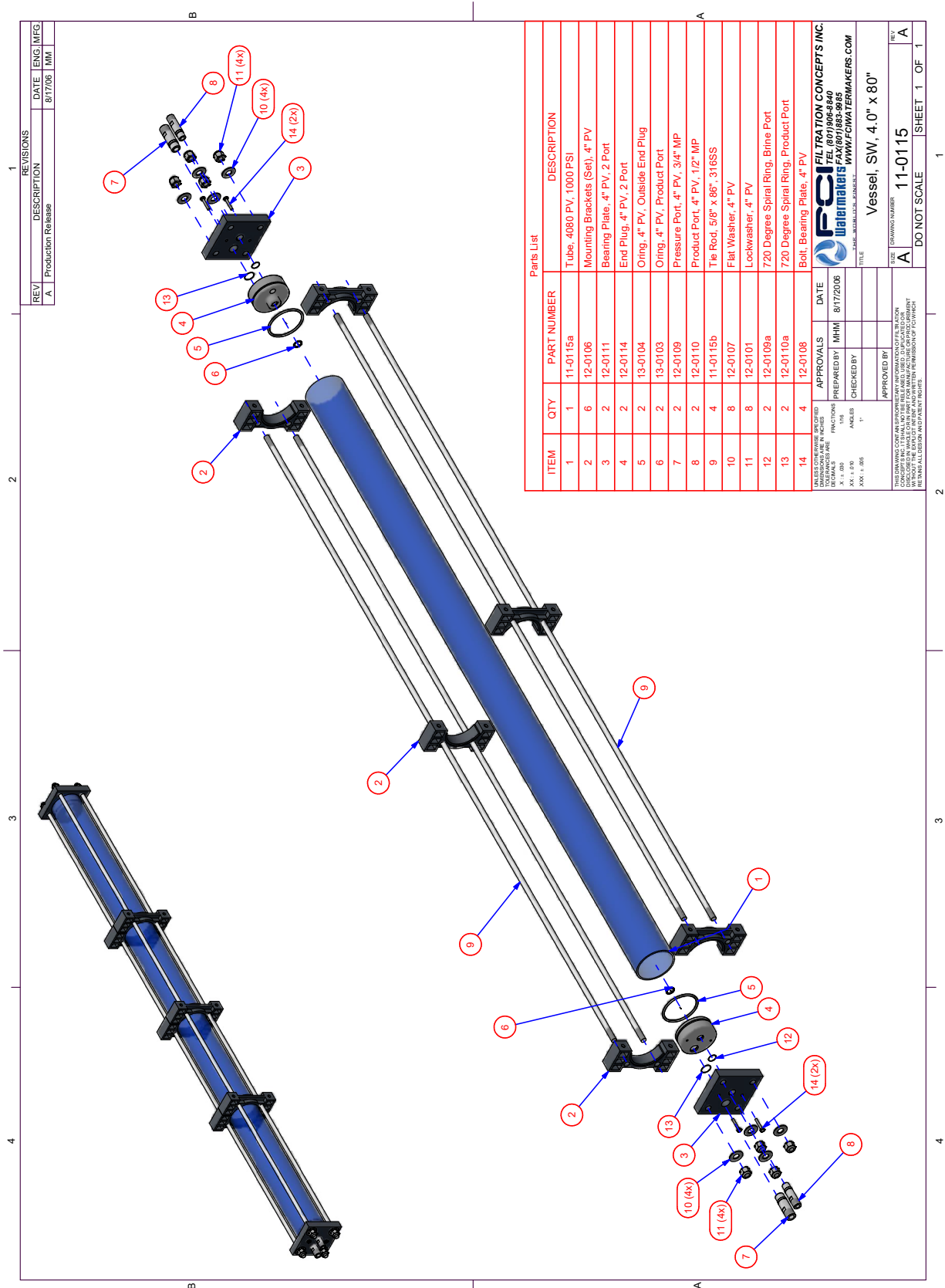


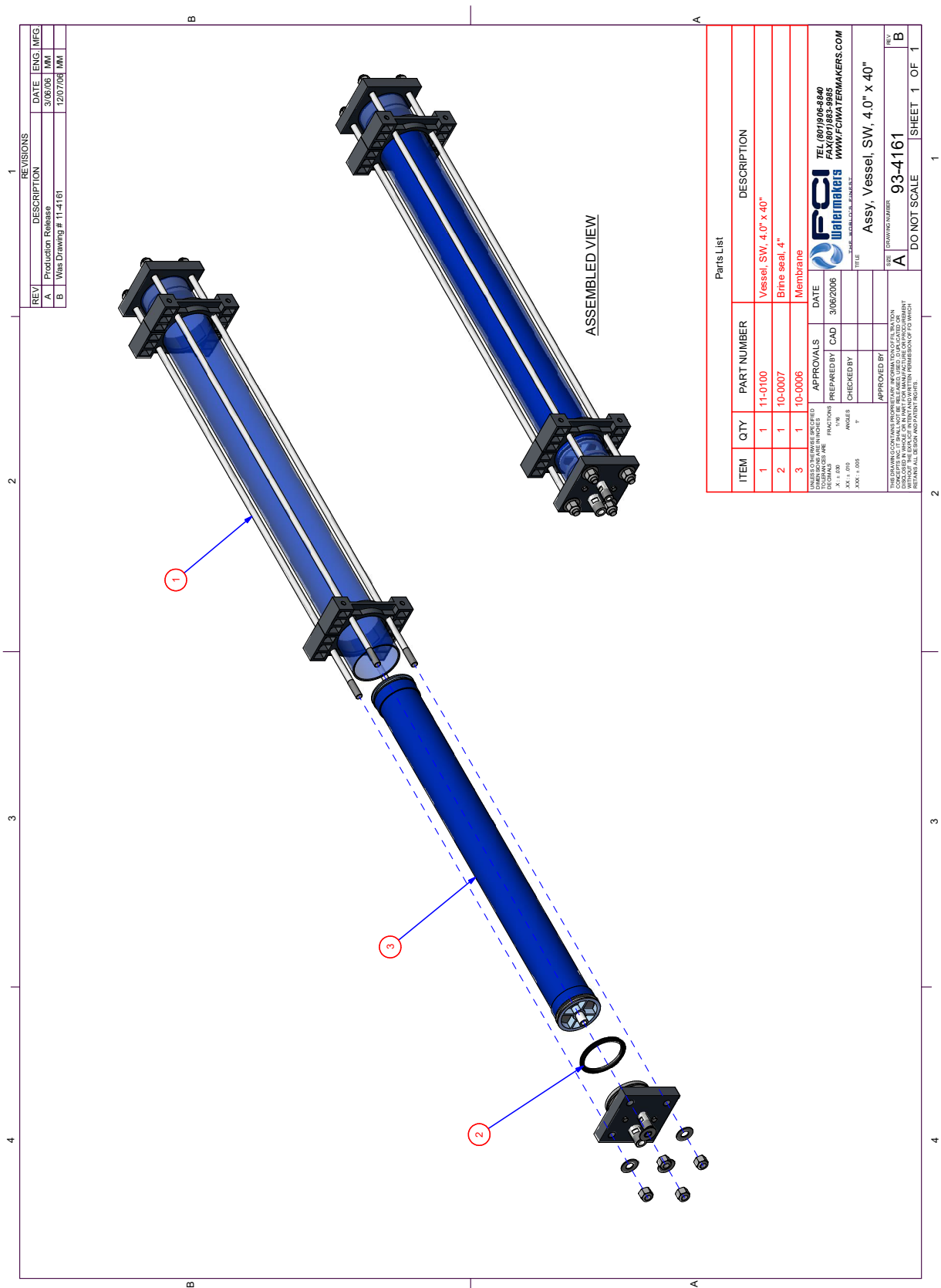
FCI WATERMAKERS, INC.

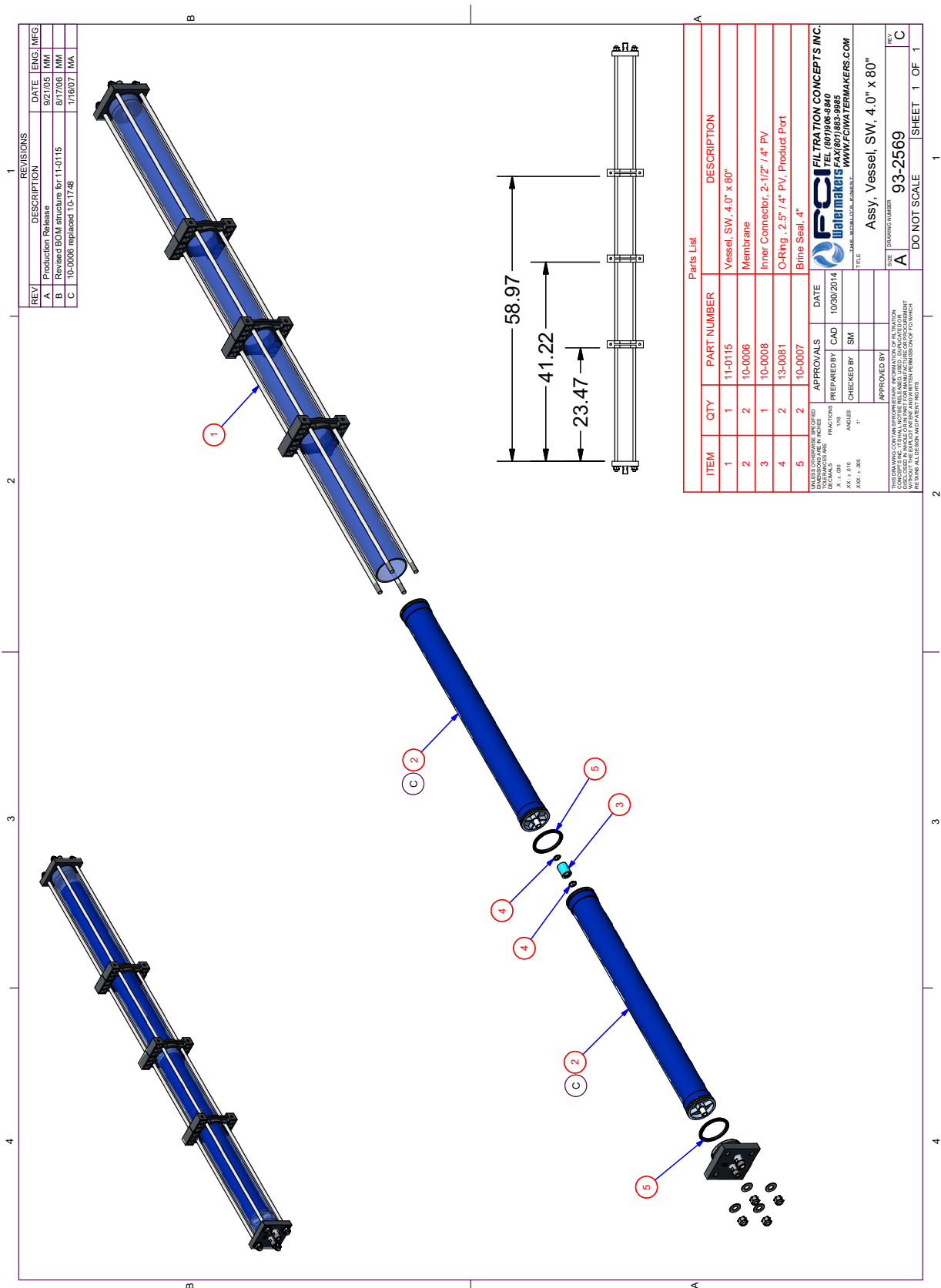


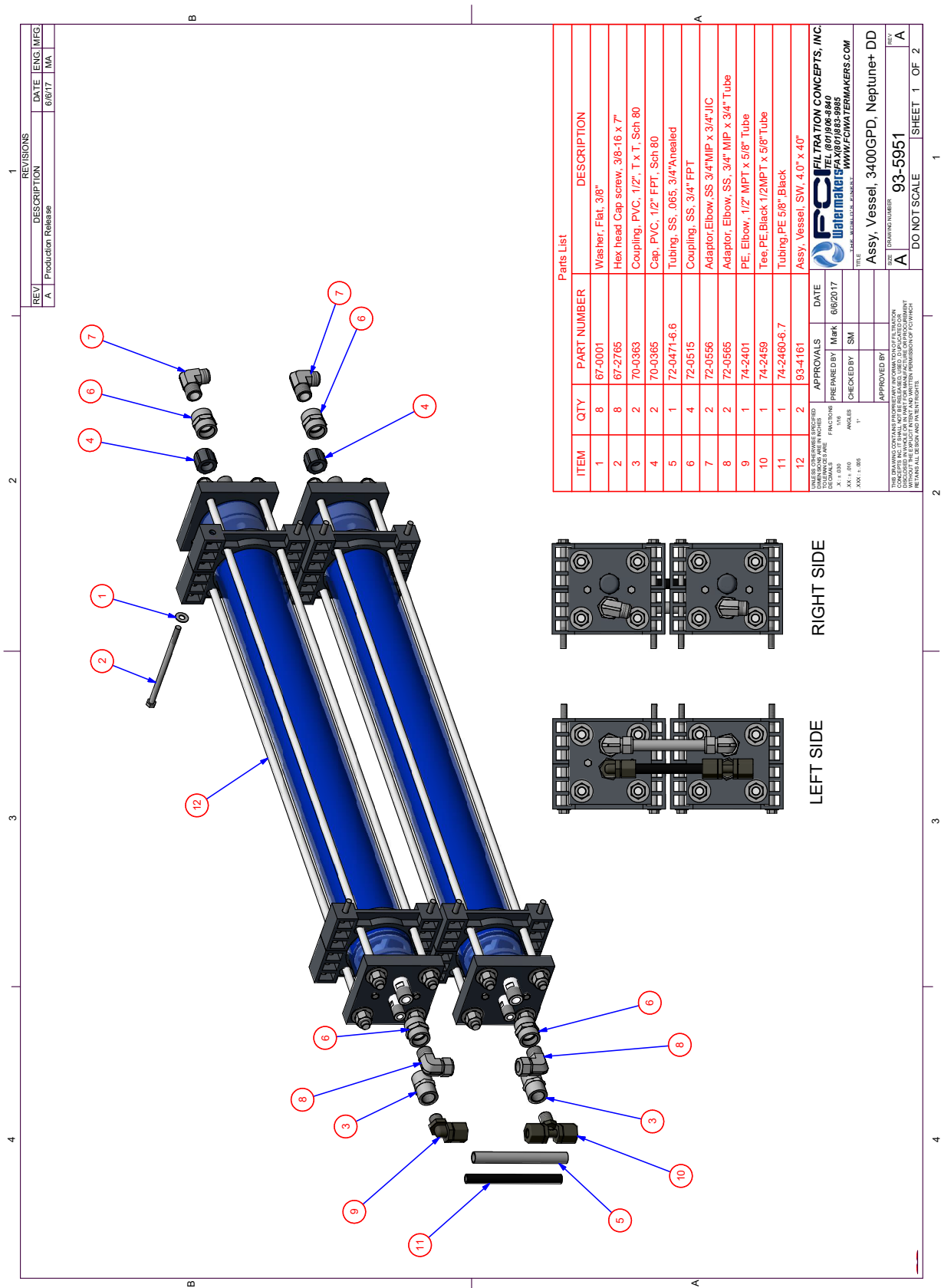
FCI WATERMAKERS, INC.

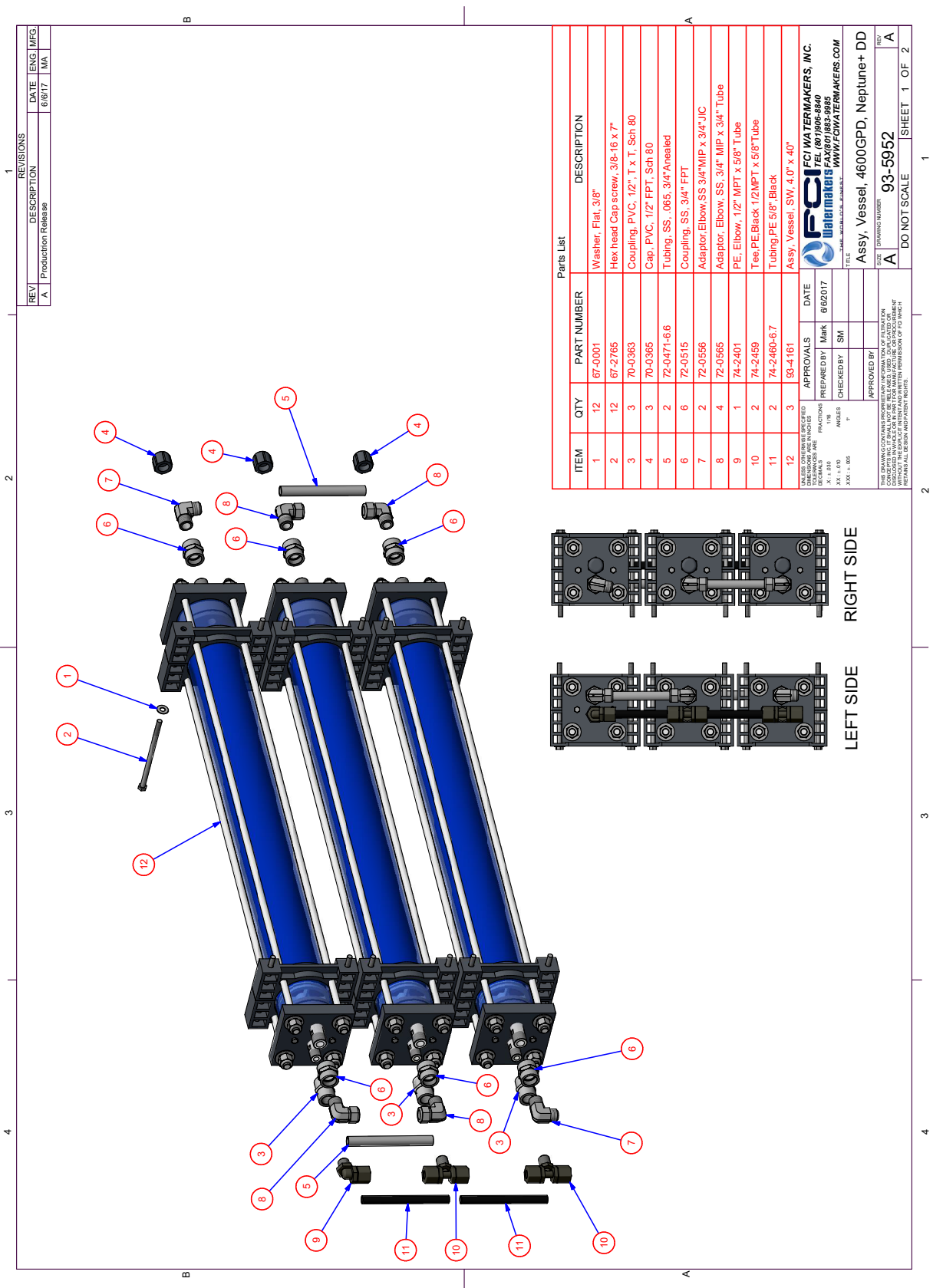










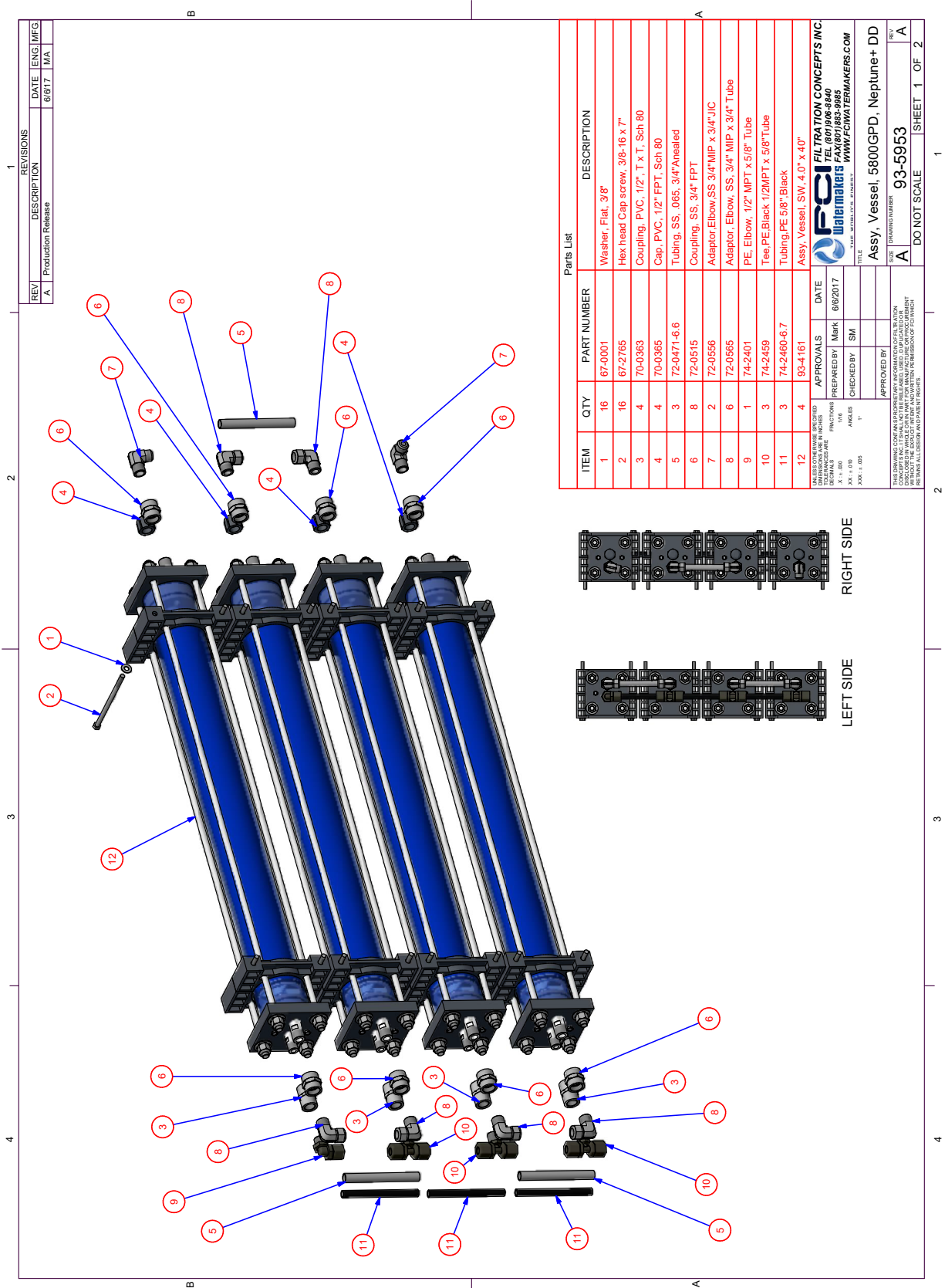


REVISIONS		
REV	DESCRIPTION	DATE
A	Production Release	06/17/17

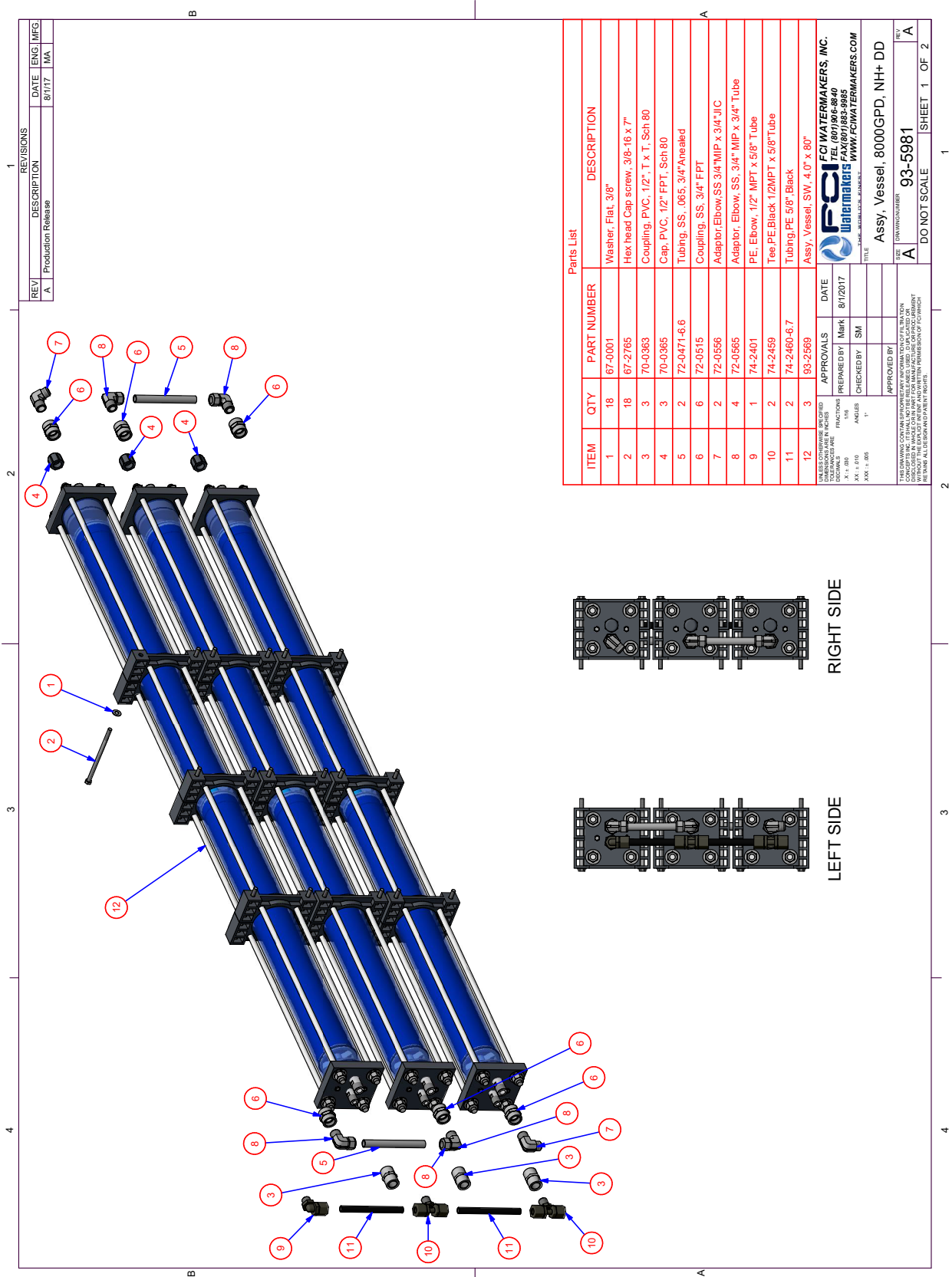
ITEM		QTY	PART NUMBER	DESCRIPTION
1	12	67-0001	Washer, Flat, 3/8"	
2	12	67-2785	Hex head Cap screw, 3/8-16 x 7"	
3	3	70-0363	Coupling, PVC, 1/2" T x T, Sch 80	
4	3	70-0365	Cap, PVC, 1/2" FPT, Sch 80	
5	2	72-0471-6.6	Tubing, SS, .065, 3/4" Annealed	
6	6	72-0515	Coupling, SS, 3/4" FPT	
7	2	72-0556	Adaptor, Elbow, SS, 3/4" MIP x 3/4" JIC	
8	4	72-0565	Adaptor, Elbow, SS, 3/4" MIP x 3/4" Tube	
9	1	74-2401	PE, Elbow, 1/2" MPT x 5/8" Tube	
10	2	74-2459	Tee, PE Black, 1/2 MPT x 5/8" Tube	
11	2	74-2460-6.7	Tubing, PE 5/8" Black	
12	3	93-4161	Assy, Vessel, SW, 4.0" x 40"	

APPROVALS	DATE	PREPARED BY	CHK	6/6/2017
CHECKED BY	SM			
APPROVED BY				
FCI WATERMAKERS, INC. 18181 E. 10th Ave., Suite 100 Denver, CO 80231 TEL: (303) 751-8800 FAX: (303) 751-8805 WWW.FCIWATERMAKERS.COM				
Assy, Vessel, 4600GPD, Neptune+ DD				
DO NOT SCALE				
SHEET 1 OF 2				

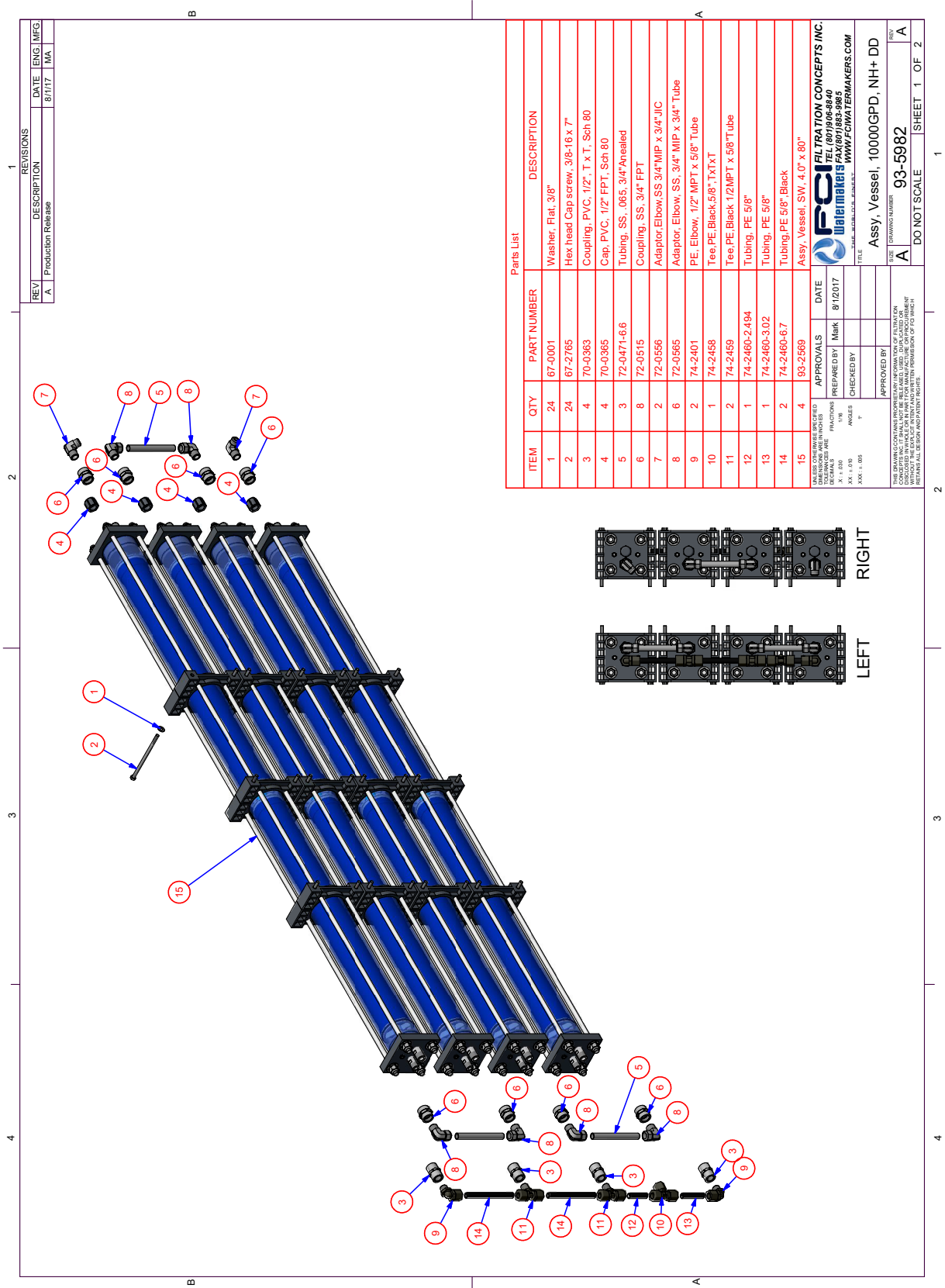
GENERAL ASSEMBLY DIAGRAMS / VESSELS (continued)



GENERAL ASSEMBLY DIAGRAMS / VESSELS (continued)



GENERAL ASSEMBLY DIAGRAMS / VESSELS (continued)



FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / CONTROL VALVES

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REV	DESCRIPTION	DATE	ENG. MFG.
A	Production Release	9/16/14	MA
B	Re-Designed	3/29/16	MA

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	56-2255	Transducer, 1000PSI 3/16SS, 1/4" NPT, DIN
2	1	57-2416	Connector Assembly, Packard Connector plug
3	4	67-0017	Washer, Flat, #10
4	4	67-2620	Screw, 316 SS, #10-32 x 1/2", Philips Pan
5	3	67-2788	632" X 3/8" Phil Filler
6	1	72-0469-18.5	Tubing, SS, .035, 1/4" Annealed
7	2	72-0521	Nipple, Hex, 316 SS, 1/2" MPT
8	1	72-0529	Tee, SS, 1/4" MPT
9	1	72-0536	Bushing, 316 SS, 1/2" MPT x 1/4" FPT
10	2	72-0541	Adaptor, Elbow, 316 SS, 1/4" MPT x 1/4" Tube
11	1	72-0555	Adaptor, Elbow, 316 SS, 1/2" MPT x 3/4" JIC
12	1	72-0568	Cross, 316 SS, 1/2"
13	1	72-4927	Elbow, 90°, adaptor, 316SS 1/2" FNPT x 1/2" FNPT
14	2	72-4928	Nipple, 316 SS, 1/2" x 3-1/2", Sch 80
15	1	72-5487	Street, Elbow, 316 SS, 1/2" MPT x 1/2" FPT
16	1	74-2401	PE, Elbow, 1/2" MPT x 5/8" Tube
17	1	74-2457	PE, Elbow, 1/2" FPT x 5/8" Tube
18	1	74-2460-1.75	Tubing, PE, 5/8", Black
19	1	74-2460-19.7	Tubing, PE, 5/8"
20	1	78-0334	Gauge, HP, Lower Back Mount, 1500 PSI
21	1	83-0570	Valve, Needle, HP, SS, 1/2" FNPT
22	1	83-4771	Valve, 316 SS, 1000 WOG, 24VDC
23	1	91-4931	Plate, Manual Valve, Neptune+ (Large)

FCI

FILTRATION CONCEPTS INC.

Watermakers

TEL: (801) 804-8840

FAX: (801) 883-9885

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APPROVED BY

PREPARED BY

CHECKED BY

DATE

9/16/2014

SM

SIZE

93-4966

DO NOT SCALE

REV

1

OF 1

FCI WATERMAKERS, INC.

Parts | 165

GENERAL ASSEMBLY DIAGRAMS / CONTROL VALVES (continued)

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Exploded view diagram of an auto control valve assembly. The diagram shows various components including a pressure transducer, connector assembly, washers, screws, tubing, elbows, tees, bushings, adapters, crosses, nipples, street elbows, PE elbows, tubing, a gauge, a valve, and an HPCV. Each part is numbered from 1 to 23, corresponding to the parts list.

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Isometric view of the assembled auto control valve. The assembly includes a blue valve body, a red pressure transducer, and various connecting pipes and fittings. The assembly is shown in a compact, functional form.

REV	DESCRIPTION	DATE	ENG	INFG
A	Production Release	9/16/14	MA	
B	Re-Designed	3/25/16	MA	

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	56-2255	Transducer, 1000PSI 3/16SS, 1/4" NPT DIN
2	1	57-2416	Connector Assembly, Packard Connector plug
3	4	67-0017	Washer, Flat, #10
4	4	67-2620	Screw, 3/16 SS, #10-32 x 1/2", Phillips Pan
5	3	67-2788	632" X 3/8" Phil Filler
6	1	72-0469-20.8	Tubing, SS, 035, 1/4" Annealed
7	1	72-0521	Nipple, Hex, 3/16 SS, 1/2" MPT
8	1	72-0529	Tee, SS, 1/4" MPT
9	1	72-0536	Bushing, 3/16 SS, 1/2" MPT x 1/4" FPT
10	2	72-0541	Adaptor, Elbow, 3/16 SS, 1/4" MPT x 1/4" Tube
11	1	72-0555	Adaptor, Elbow, 3/16 SS, 1/2" MPT x 3/4" JIC
12	1	72-0568	Cross, 3/16 SS, 1/2"
13	2	72-0928	Nipple, 3/16 SS, 1/2" x 3/4", Sch 80
14	2	72-0487	Street, Elbow, 3/16 SS, 1/2" MPT x 1/2" FPT
15	1	74-2401	PE, Elbow, 1/2" MPT x 5/8" Tube
16	1	74-2457	PE, Elbow, 1/2" FPT x 5/8" Tube
17	1	74-2460-19.7	Tubing, PE 5/8"
18	1	74-2460-3.0	Tubing, PE, 5/8", Black
19	1	78-0334	Gauge, HP, Lower Back Mount, 1500 PSI
20	1	83-0570	Valve, Needle, HP, SS, 1/2" FNPT
21	1	83-4771	Valve, 3/16 SS, 1000 WOG, 24VDC
22	1	85-4768	HPCV, 1/2"
23	1	91-4930	Plate, APC, Neptune +

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND DECIMALS THEREOF. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.

XX: 1:100

XX: 1:100

XX: 1:100

APPROVED BY

DATE

9/16/2014

PREPARED BY

MARK

9/16/2014

CHECKED BY

SM

APPROVED BY

DATE

FILE

SIZE

93-4969

DO NOT SCALE

SHEET 1 OF 1

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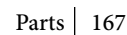
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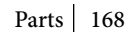
FCI WATERMAKERS, INC.

Parts | 166

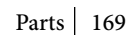
FCI WATERMAKERS, INC.



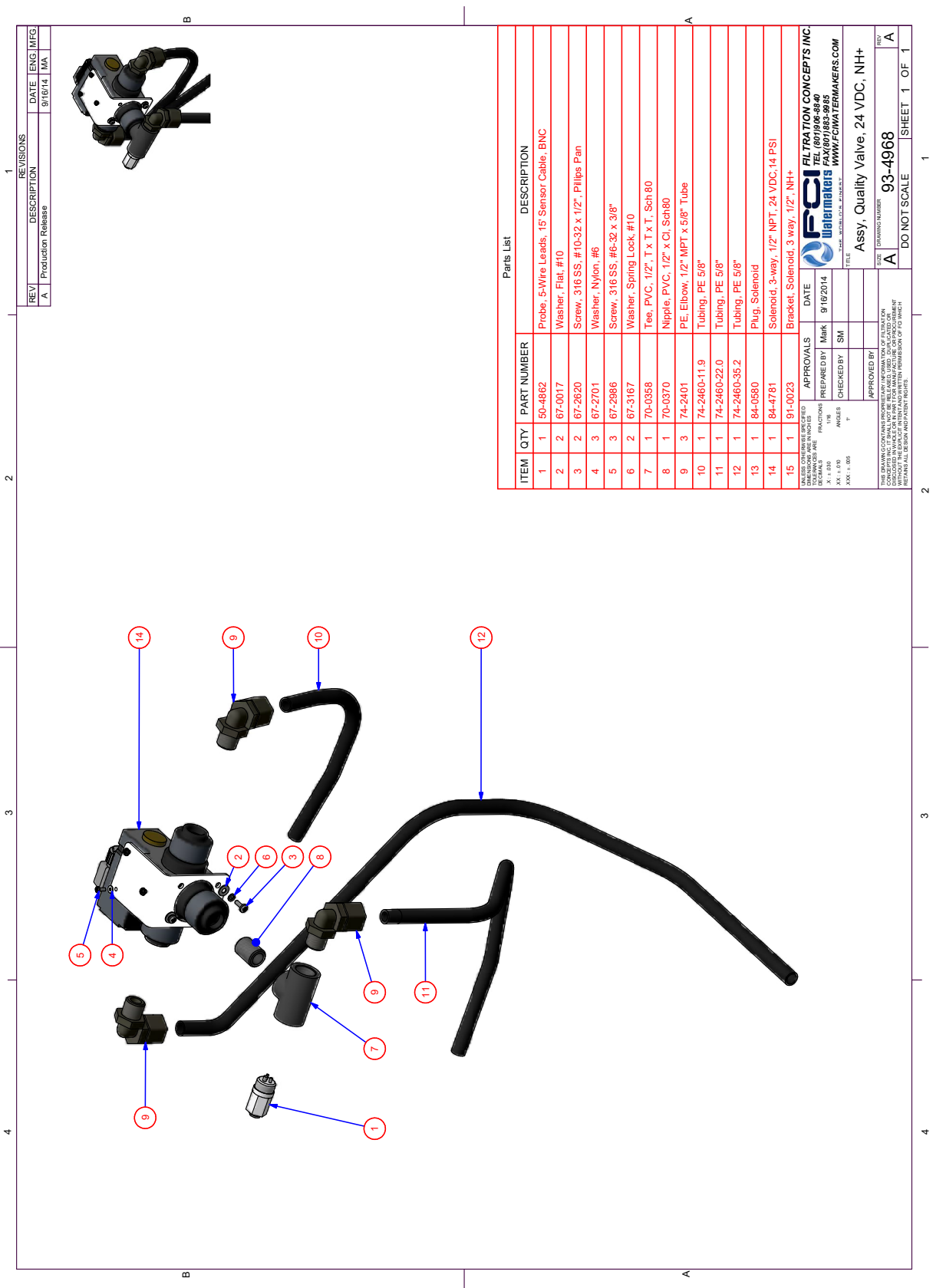
FCI WATERMAKERS, INC.



FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / QUALITY VALVE

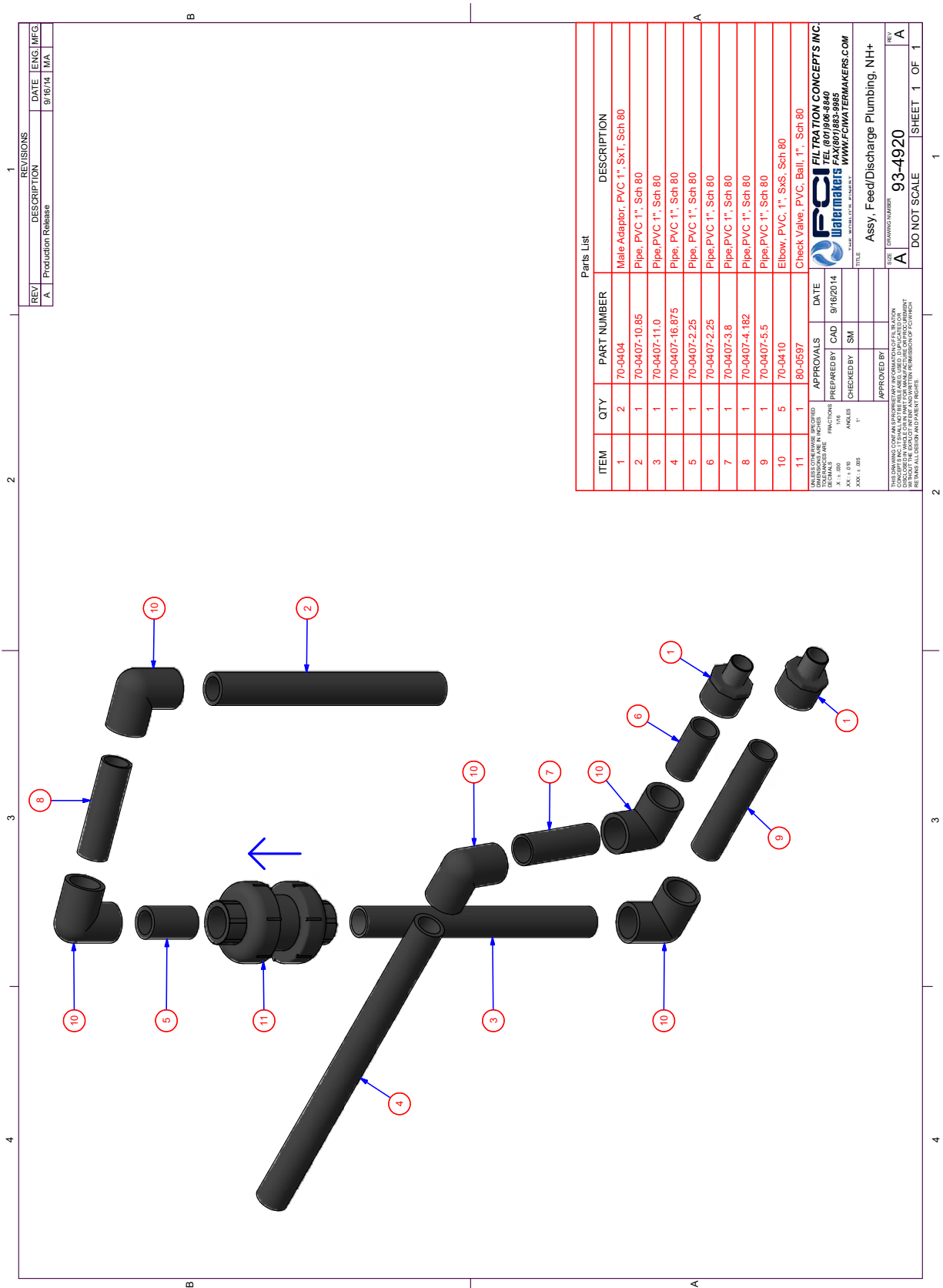


REVISIONS		DATE	ENG	MFG
REV	DESCRIPTION			
A	Production Release	9/10/14	MA	

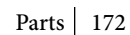
Parts List			DESCRIPTION
ITEM	QTY	PART NUMBER	
1	1	50-4862	Probe, 5-Wire Leads, 15' Sensor Cable, BNC
2	2	67-0017	Washer, Flat, #10
3	2	67-2620	Screw, 316 SS, #10-32 x 1/2", Phillips Pan
4	3	67-2701	Washer, Nylon, #6
5	3	67-2986	Screw, 316 SS, #6-32 x 3/8"
6	2	67-3167	Washer, Spring Lock, #10
7	1	70-0358	TEE, PVC, 1/2", T x T x T, Sch 80
8	1	70-0370	Nipple, PVC, 1/2" x CI, Sch 80
9	3	74-2401	PE Elbow, 1/2" MPT x 5/8" Tube
10	1	74-2460-11.9	Tubing, PE 5/8"
11	1	74-2460-22.0	Tubing, PE 5/8"
12	1	74-2460-35.2	Tubing, PE 5/8"
13	1	84-0580	Plug, Solenoid
14	1	84-4781	Solenoid, 3-way, 1/2" NPT, 24 VDC, 14 PSI
15	1	91-0023	Bracket, Solenoid, 3 way, 1/2", NH+

APPROVALS	DATE	9/16/2014
PREPARED BY	Mark	
CHECKED BY	SM	
APPROVED BY		
FCI WATERMAKERS CONCEPTS INC. 10000 W. 10th Ave., Suite 100 Denver, CO 80231 TEL: (800) 883-9885 WWW.FCIWATERMAKERS.COM		
Assy, Quality Valve, 24 VDC, NH+		
93-4968		
DO NOT SCALE		
SHEET 1 OF 1		

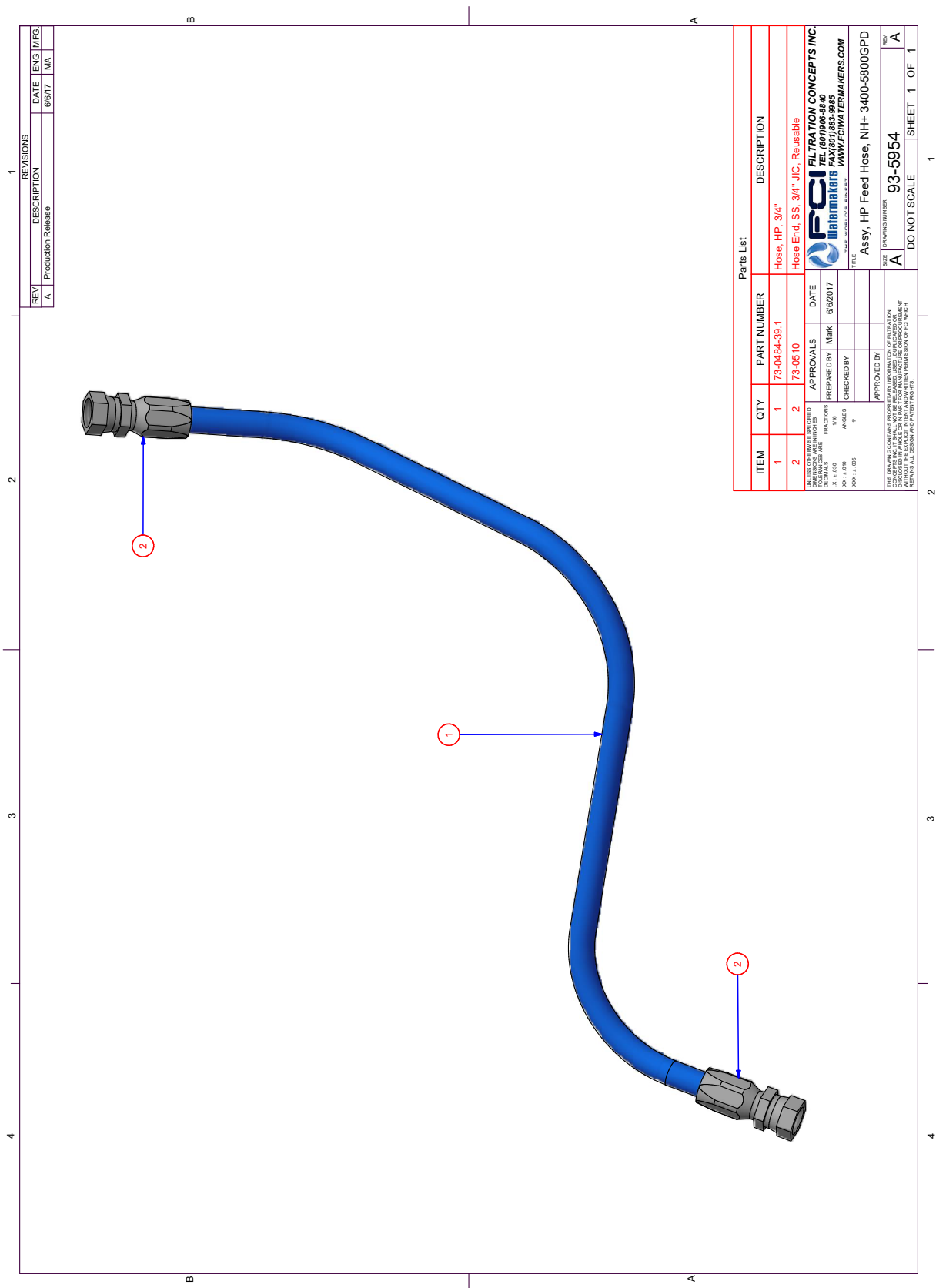
GENERAL ASSEMBLY DIAGRAMS / PLUMBING



FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / HOSES (continued)



REVISIONS		DATE	ENG	MFG
REV	DESCRIPTION			
A	Production Release	06/17	MA	

Parts List		DESCRIPTION	
ITEM	QTY	PART NUMBER	
1	1	73-0484-39.1	Hose, HP, 3/4"
2	2	73-0510	Hose End, SS, 3/4" JIC, Reusable
VALUES OF DIMENSIONS SPECIFIED UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES FRACTIONS XX = 1/32 ANGLES XXX = .005			
APPROVALS		DATE	
PREPARED BY Mark		06/2017	
CHECKED BY			
APPROVED BY			
THE INFORMATION CONTAINED HEREIN IS THE PROPERTY OF FCI WATERMAKERS, INC. AND IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED. NO PART OF THIS DOCUMENT IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, WITHOUT THE EXPRESS WRITTEN PERMISSION OF FCI WATERMAKERS, INC.			
DRAWING NUMBER		93-5954	
DO NOT SCALE		SHEET 1 OF 1	

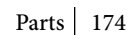
FCI FILTRATION CONCEPTS INC.
WATERMAKERS
TEL (801) 906-8840
FAX (801) 983-9885
WWW.FCIWATERMAKERS.COM

Assy, HP Feed Hose, NH+ 3400-5800GPD

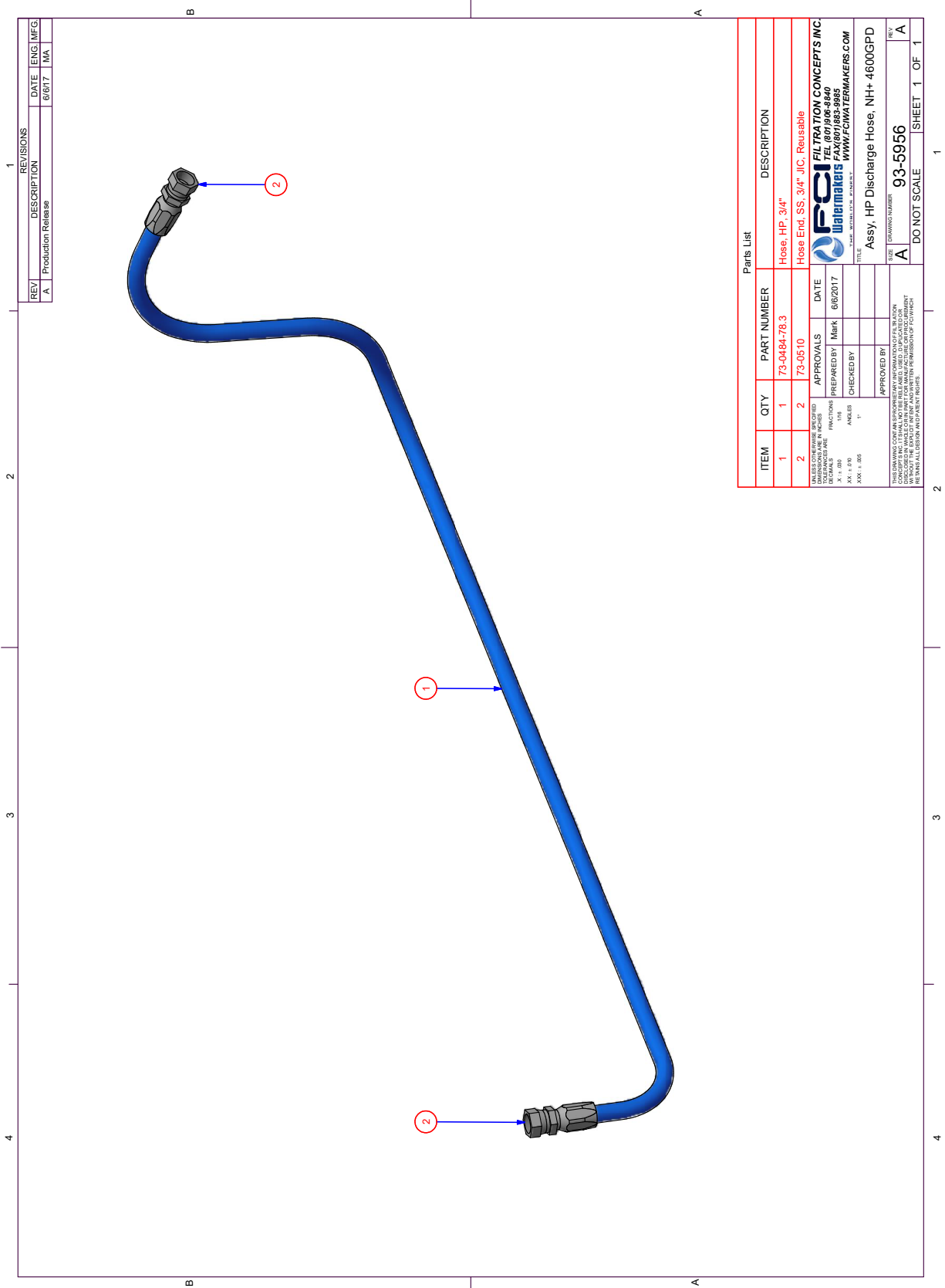
93-5954

SHEET 1 OF 1

FCI WATERMAKERS, INC.



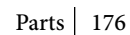
GENERAL ASSEMBLY DIAGRAMS / HOSES (continued)



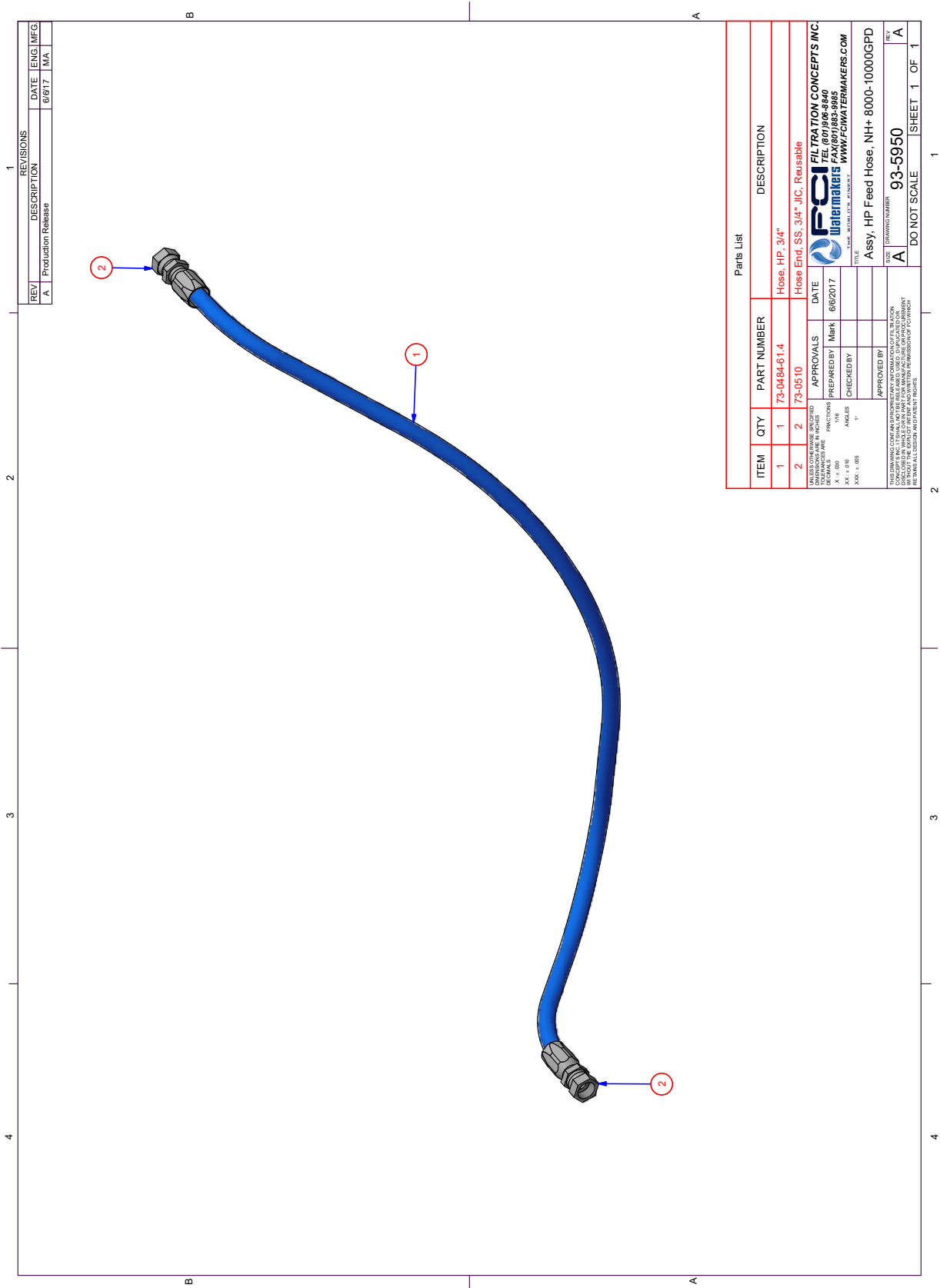
REVISIONS			
REV	DESCRIPTION	DATE	ENG. MFG.
A	Production Release	6/6/17	MA

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	73-0484-78.3	Hose, HP, 3/4"
2	2	73-0510	Hose End, SS, 3/4" JIC, Reusable
VALUES CONTAINED ON DRAWING ARE FOR INFORMATION ONLY. FCI WATERMAKERS, INC. SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS. THE USER SHALL BE RESPONSIBLE FOR VERIFYING THE ACCURACY OF THE INFORMATION CONTAINED HEREON. FCI WATERMAKERS, INC. SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS. THE USER SHALL BE RESPONSIBLE FOR VERIFYING THE ACCURACY OF THE INFORMATION CONTAINED HEREON.			
APPROVALS		DATE	
PREPARED BY Mark		6/6/2017	
CHECKED BY			
APPROVED BY			
FCI WATERMAKERS, INC. 10000 W. 10TH AVENUE, SUITE 100, DENVER, CO 80231 TEL: (800) 898-8840 FAX: (800) 898-8840 WWW.FCIWATERMAKERS.COM			
Assy, HP Discharge Hose, NH+ 4600GPD			REV
A 93-5956			A
DO NOT SCALE			SHEET 1 OF 1

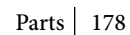
FCI WATERMAKERS, INC.



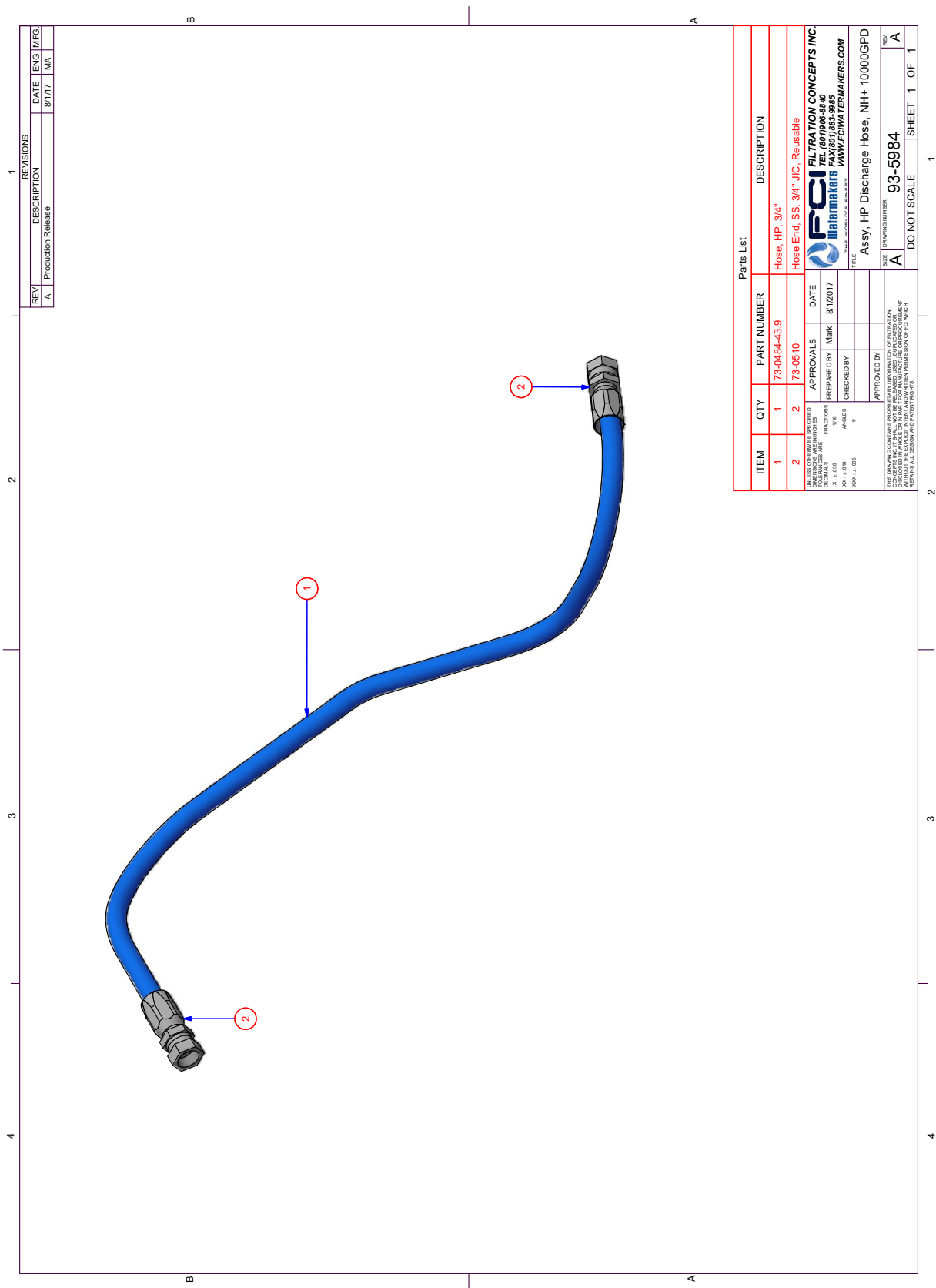
GENERAL ASSEMBLY DIAGRAMS / HOSES (continued)



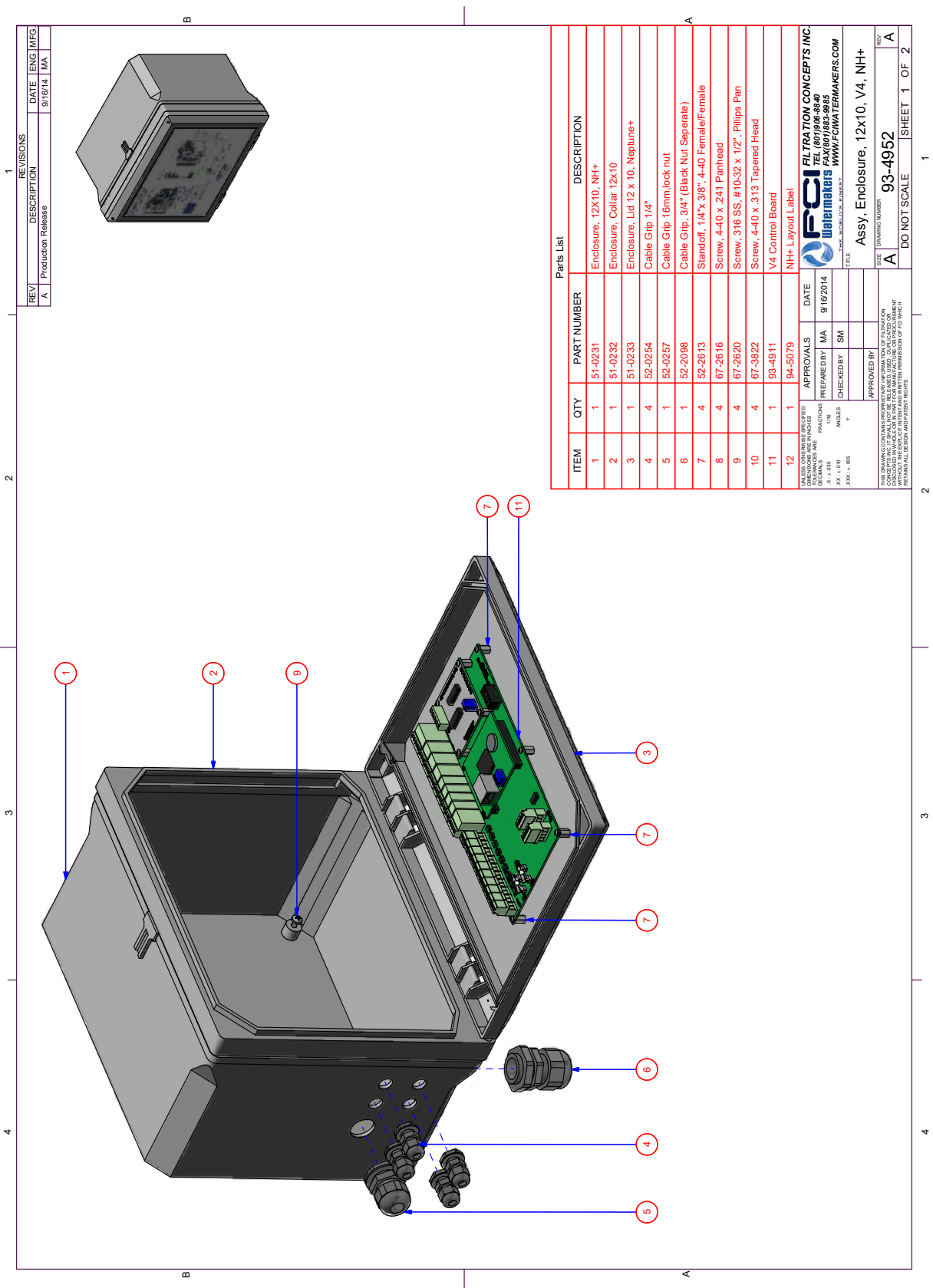
FCI WATERMAKERS, INC.



GENERAL ASSEMBLY DIAGRAMS / HOSES (continued)



GENERAL ASSEMBLY DIAGRAMS / ELECTRICAL

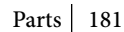


REVISIONS		
REV	DESCRIPTION	DATE
A	Production Release	9/10/14

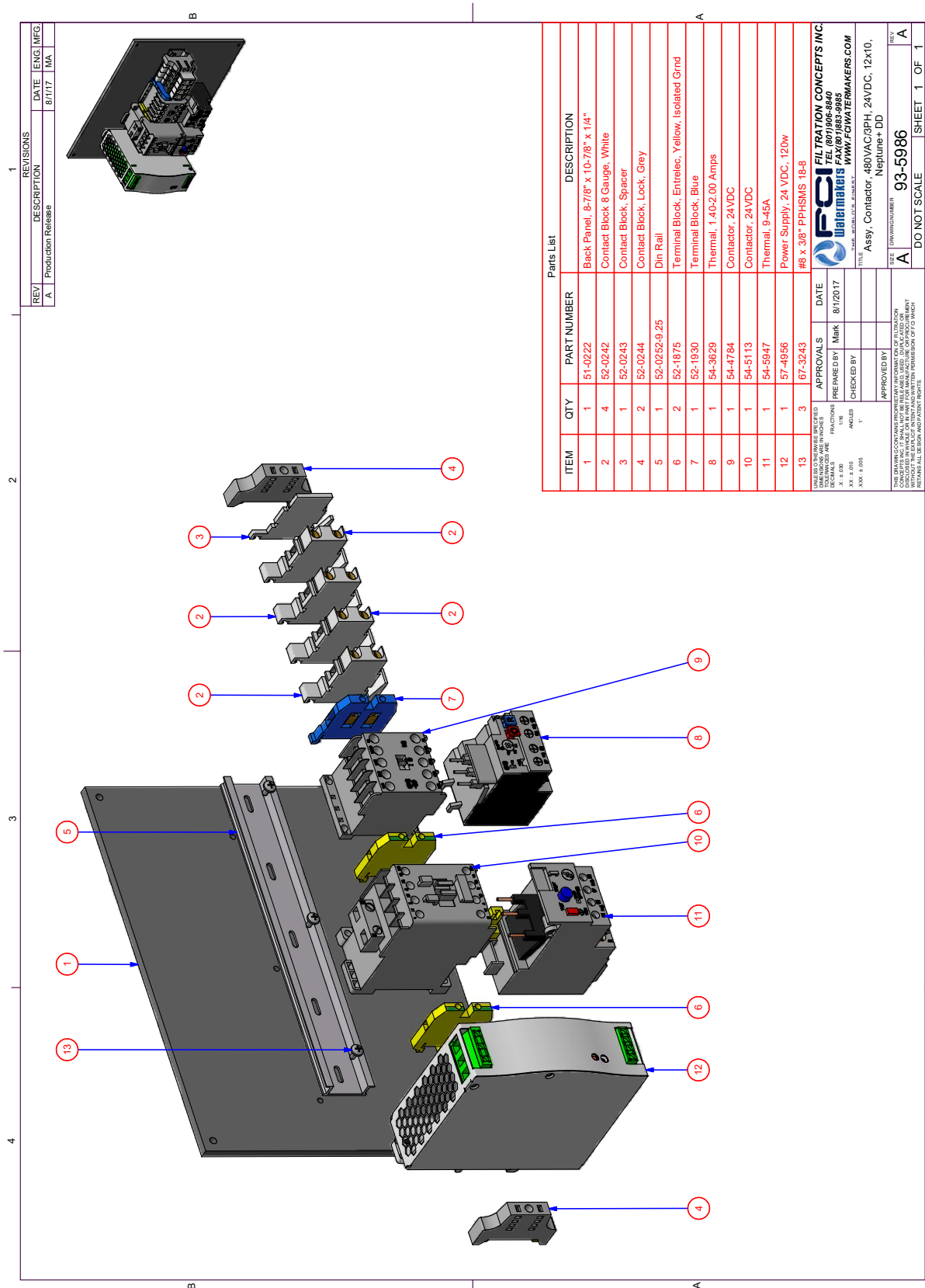
Parts List		
ITEM	QTY	PART NUMBER
1	1	51-0231
2	1	51-0232
3	1	51-0233
4	4	52-0254
5	1	52-0257
6	1	52-2098
7	4	52-2613
8	4	67-2616
9	4	67-2620
10	4	67-3822
11	1	93-4911
12	1	94-5079

APPROVALS		DATE
PREPARED BY	MA	9/16/2014
CHECKED BY	SM	
APPROVED BY		
TITLE		
DRAWING NUMBER		
DO NOT SCALE		
SHEET 1 OF 2		

FCI WATERMAKERS, INC.

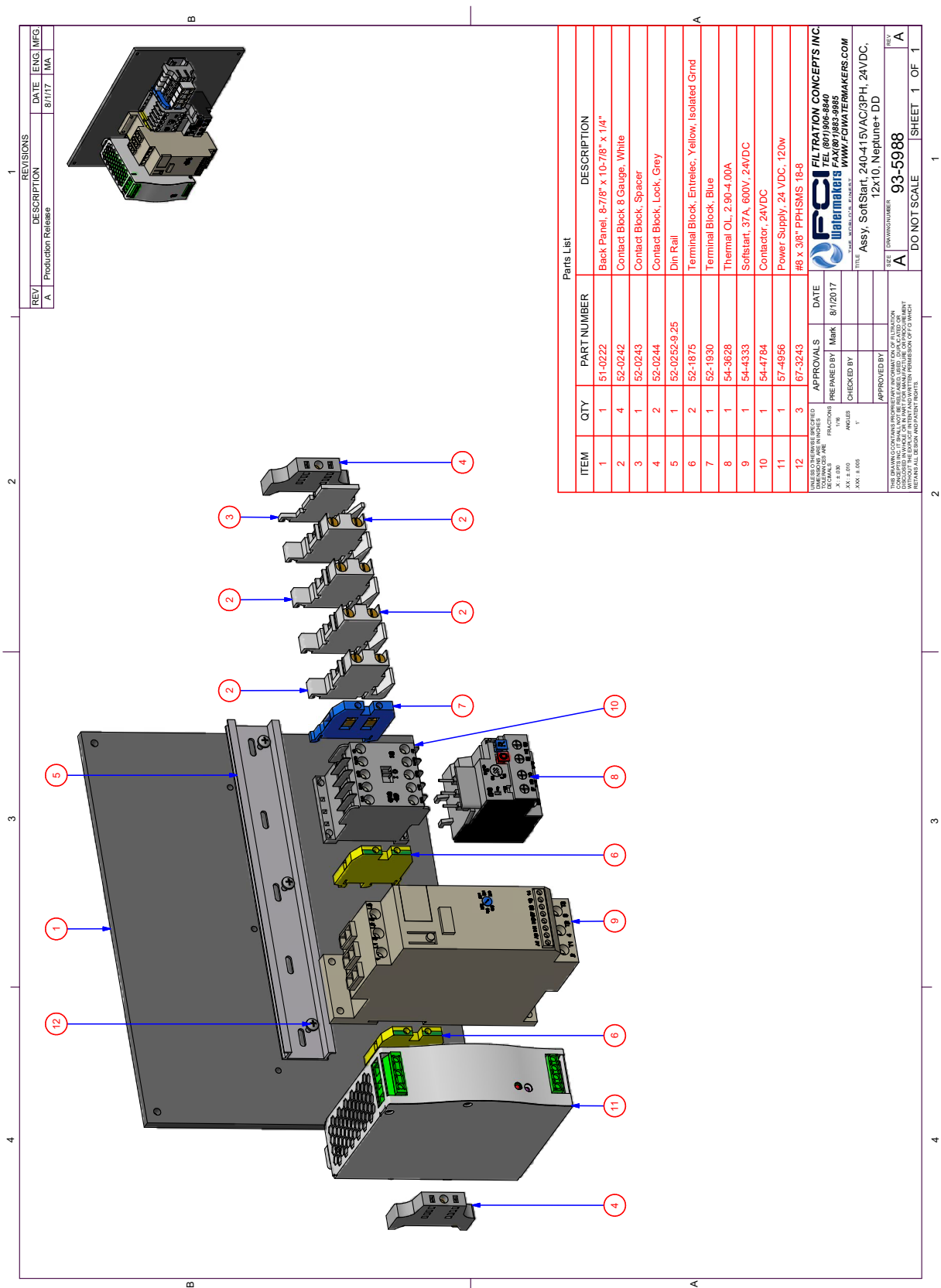


GENERAL ASSEMBLY DIAGRAMS / ELECTRICAL (continued)

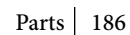


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9/ REVISION HISTORY

REVISION HISTORY

Revision	Date	Description
A	08/10/2017	Initial release.
B	05/31/2020	Coupling Inspection added.
C	06/04/2023	Warranty updated.

NOTES



Document Part Number: 97-5971 Revision C