Aquifer 4000

User Manual

Spectra Watermakers
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Updated June 2025

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Getting Started and Manual Overview

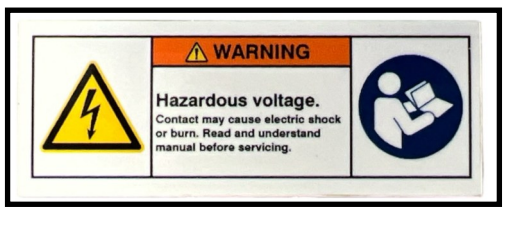
ATTENTION:

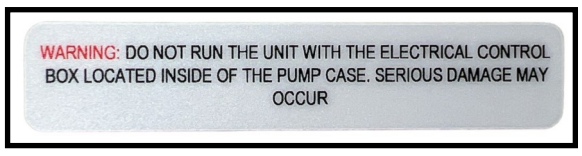
Important Information Safety Warnings

To protect the operator's safety and to avoid possible damage to the system, before carrying out any operation on the machine. It is essential to read all of the instructions and information present in the manual. Check periodically that no leaks are present. Avoid installing the plant where a leak may cause damage and/or jeopardize the safety of the vessel. Use caution with high pressure connections. Verify system is "**OFF**" and locked out prior to beginning any maintenance.

Be aware of the caution, warning, and danger signage on the system.

Important: Review and identify the stickers on the body of the system before operating.





Getting Started and Manual Overview Cont.

Scan QR code for operational instructions or visit link:
https://youtu.be/XaKR_D3WZfk

Warning! Spectra Watermakers will not be held responsible for shortages and or freight damage that are not reported within thirty days of the ship date.

Study the system layout diagrams, component photos and descriptions before beginning your set up. This will assist you in understanding the function and identification of each component.

NOTE: Refer to the Product Overview to identify the various assemblies.

Aquifer 4000 Shipping List:

- **Pump Case A Assembly:**
  - Pearson Pump Frame
  - Boost Pump Assembly
  - Control Box Assembly
  - 5-Micron Prefilter
  - (3) Laminated Quick Start Guides (2 pages)
- **Membrane Case B Assembly:**
  - (4) Membrane Housings
- **Mesh Bag Assembly:**
  - Boost Pump Power Cable
  - Dual Sensor Cable
  - Boost Pump Power Extension
  - Boost Pump Sensor Extension
  - High Pressure Hoses
  - Low Pressure Hoses
  - Strainer/Inlet Assembly
  - Optional Priming Foot Pump
  - Spares Bag
  - Filter Bowl Wrench

Introduction to the Aquifer 4000

The **Spectra Aquifer 4000 Portable Watermaker,** our newest desalination system features advanced technology and enhanced capabilities to produce high quality good tasting drinking water from a wide range of water sources.

Whether it's seawater, river water, lake water, or water from a brackish or contaminated well, this innovative watermaker excels in delivering reliable results.

The Spectra Aquifer 4000 effectively separates out salts, organic chemicals, insecticides/ pesticides, endocrine disruptors, parasites, cysts, bacteria, and viruses, ensuring that the water produced is safe for consumption. Its cutting edge process removes harmful contaminants and provide peace of mind to users.

This portable watermaker embodies the latest advancements in desalination and water purification technology. Its versatility, efficiency, and ability to deliver clean great tasting water, makes it an ideal solution for individuals and communities seeking reliable access to safe drinking water in diverse environments.

The Aquifer 4000, pumps approximately 20.5-23.0 liters (5.5-6.0 gallons) of inlet water per minute to the reverse osmosis membrane. 50% of this water passes through the membranes as purified product water and the remaining water is returned to the inlet water source as concentrated brine. The brine contains what was separated from the product water by the membrane and nothing is retained inside the machine.

Inlet water is filtered using a three stage process. First a strainer keeps out large debris using an 100 mesh screen (150 micron), and keeps the suction hose several inches below the surface. Then the inlet flow passes through a 5 micron prefilter in order to protect the Pearson Pump from silt, algae and abrasive particles. Lastly, the inlet water then is pressurized and passed through a reverse osmosis membrane where it is separated into pure freshwater and the brine discharge.

The Aquifer 4000 runs on a 220VAC (2.6 kW) power source. It is recommended to use a 3.0-3.5 kW generator or power source to account for variables on set up as well as any unforeseen surge amperages. See pg.14 for *System Specifications.*

Product Overview

Product Overview
Aquifer 4000 Components

Strainer/Inlet Assembly:

This assembly contains the hose necessary to create an inlet strainer from any appropriate water source.

Inlet Strainer: The strainer houses a 100 mesh screen (150 micron) that is designed to protect the system from larger particulate and contaminants such as gravel, general debris, and marine life.

Strainer Float: The assembly has a large float designed to support the strainer at a depth beneath the water surface.

Inlet Anchor: The assembly has a small anchor and rope designed to secure the inlet location and guarantee the strainer remains submerged. The rope length can be adjusted in order to ensure the float is not submerged along with the strainer while also securing the inlet location to avoid drift with tides and water flow.

Boost Pump Assembly:

1. **Note:** This assembly can be run inside of the case or removed from the case. This would be done in order to:

1a. Move the Boost Pump closer to the water line for priming concerns. This will be helpful for many possible points of use that are fairly high out of the water, vertically. The Boost Pump can only self prime up to 1.5 meters (5 ft) vertically.

1b. Reduce the temperature of the Boost Pump motor. When running the system in hot weather or directly exposed to sunlight.

2. The two gauges display the pressure of the inlet flow before and after the prefilter, allowing for an analog reading of the filter condition. Filter condition will also be displayed with a digital reading on the screen of the Control Box.

Product Overview
Aquifer 4000 Components Cont.

Pump Case A Assembly:

1. This assembly contains the Pearson Pump and Pump Frame as well as (1) 5 micron prefilter, and (3) laminated quick start guides (2 pages) in (1) waterproof sleeve.
2. This assembly has several Quick Connect connections which allow for rapid set up and disassembly.
3. (2) Low pressure Banjo fittings, (1) for the low pressure seawater inlet and (1) for the low pressure brine discharge.
4. (2) High pressure JIC Male fittings, (1) for the high pressure membrane inlet and (1) for the high pressure brine return.

Note: This case can also optionally house the Boost Pump assembly. It is necessary to run the Control Box outside of the Pump Case A assembly.

Case Dimensions: 1.32m W x 0.46m L x 0.47m H
(51-15/16” W x 18-1/32” L x 18-3/8” H)

Membrane Case B Assembly:

1. This case has (2) Quick Connect connections which allow for rapid setup and disassembly:
2. (2) High Pressure JIC Male fittings, (1) for the high pressure membrane inlet and (1) for the high pressure brine return. Using hand tightened Quick Connect hoses and fittings found in the Mesh Bag assembly.
3. This assembly has low pressure product water tubing which will be routed out of the Membrane Case B directly to product water storage.

Case Dimensions: 1.32m W x 0.46m L x 0.47m H
(51-15/16” W x 18-1/32” L x 18-3/8” H)

Product Overview
Aquifer 4000 Components Cont.

Control Box Assembly:

1. This assembly contains all of the electrical hardware necessary to control the system and measure pressures/safeties.
2. This Control Box has the following elements in its User Interface (UI):

2a. **LCD Screen**: This screen displays the run status of the unit (See pg.44 & 45 for *Screen State Detailing).*

2b. **Run State Selector Switch:** This selects the run state of the unit. There are 5 run states: Standby, Run Boost Pump (Automated), Run Full System (Automated), Run Boost Pump (Manual), and Run Full System (Manual). See pg.41 for *Operation-Automated Run Mode Detailing Screens*.

2c. **Speed Adjustment Knob:** This adjusts the speed set point of the Pearson Pump motor allowing the user to adjust the run condition of their unit. Adjusts from approximately 75% production capacity to 100% production capacity.

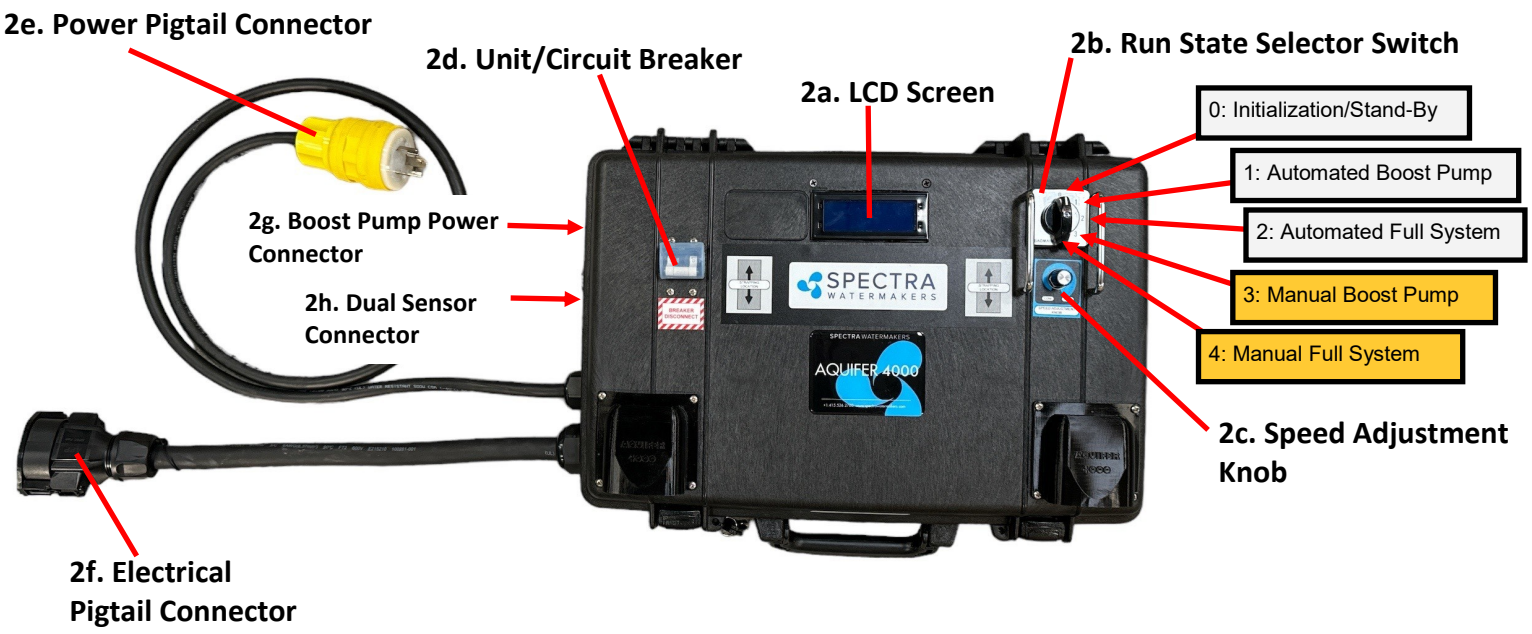
2d. **Unit/Circuit Breaker:** This can be used to shut down the unit in an emergency state or cycle power.

2e. **Power Pigtail Connector:** This L6-30P power pigtail connector ensures compatibility and seamless integration with any L6-30R receptacle, offering a versatile solution for power connections needed with your system. See pg.30 for *Set up: Electrical and Plumbing Connections* required.

2f. **Electrical Pigtail Connector:** This Quick Attach Connector is used to electrically connect the Control Box to the Pearson Pump Motor.

2g. **Boost Pump Power Connector:** This transfers electrical power from the control box to the Boost Pump, enabling the pump for operation.

2h. **Dual Sensor Connector:** This facilitates the seamless transfer of data or signals from one sensor to another within the system, enabling continuous monitoring or communication between the system.



Product Overview
Aquifer 4000 Components Cont.

System Set Up Cables:

1. This system comes with (4) bundles of wire used to make the electrical connections used for set up:

1a. **Boost Pump Power Cable:** This cable is used to attach your Boost Pump power to your Control Box. This connector contains (2) poles.

1b. **Boost Pump Power Extension:** This cable is used **only** when you want your Boost Pump set up farther than 10 ft from your Control Box. It is provided as an **optional** extension for the Boost Pump Power Cable.

1c. **Dual Sensor Cable:** This cable is used to attach all sensors throughout the system to the Control Box. The connection made to the Control Box contains (7) poles. The connection made to the Boost Pump contains (4) poles. The connection to the Pearson Pump Case contains (5) poles.

1d. **Boost Pump Sensor Extension:** This cable is used **only** when you want your Boost Pump set up farther than 10 ft from your Control Box. It is provided as an **optional** extension for the Boost Pump Sensor Cable.

1a. Boost Pump Power Cable

1b. Boost Pump Power Extension

1c. Dual Sensor Cable

1d. Boost Pump Sensor Extension

Product Overview
Aquifer 4000 Components Cont.

Mesh Bag Assembly:
1. This assembly contains all of the remaining parts required for the set up and operation of this unit. These parts include:

1a. **System Set Up Cables:** These are housed in the Mesh Bag assembly in order to allow them to properly dry during storage.

1b. **High Pressure Quick Connect Hoses:** There are (2) high pressure hoses in the Mesh Bag that have Quick Connect fittings on either end. These will be used to connect the high pressure connections between the membranes and the Pearson Pump.

1c. **Low Pressure Quick Connect Hoses:** There are (3) lengths of low pressure hose with Quick Connect fittings on either end in the located in the Mesh Bag. The hose with a **black** color coding bar will be used to connect the Strainer/Inlet assembly to the inlet of the Boost Pump assembly. The hose with the **yellow** color coding bars will be used to connect the Boost Pump assembly to the Pearson Pump assembly (this is only necessary when running the Boost Pump outside of the case). The hose with the **red** color coding bar will be used to connect the Pearson Pump assembly to the brine discharge location.

1d. **Tools Required:** The Mesh Bag will house the tools required for assembly/operation of the unit. The tools provided are as follows:

- Filter Bowl Wrench

1e. **Additional Items:**
- Spares Bag
- Strainer/ Inlet Assembly
- Optional Priming Foot Pump (pg.40)

Part Identification

Pump Case A

Boost Pump Assembly

Control Box

Laminated Quick Start Guides

5 Micron Filter

Membrane Case B

Mesh Bag

Boost Pump Power Cable

Dual Sensor Cable

Priming Foot Pump

Boost Pump Power Extension

Boost Pump Sensor Extension

Strainer/Inlet Assembly

High Pressure Quick Connect Hoses

Boost Pump Extension Hose

Brine Discharge Hose

Spares Bag

Product Water Adapter Hose

Filter Bowl Wrench

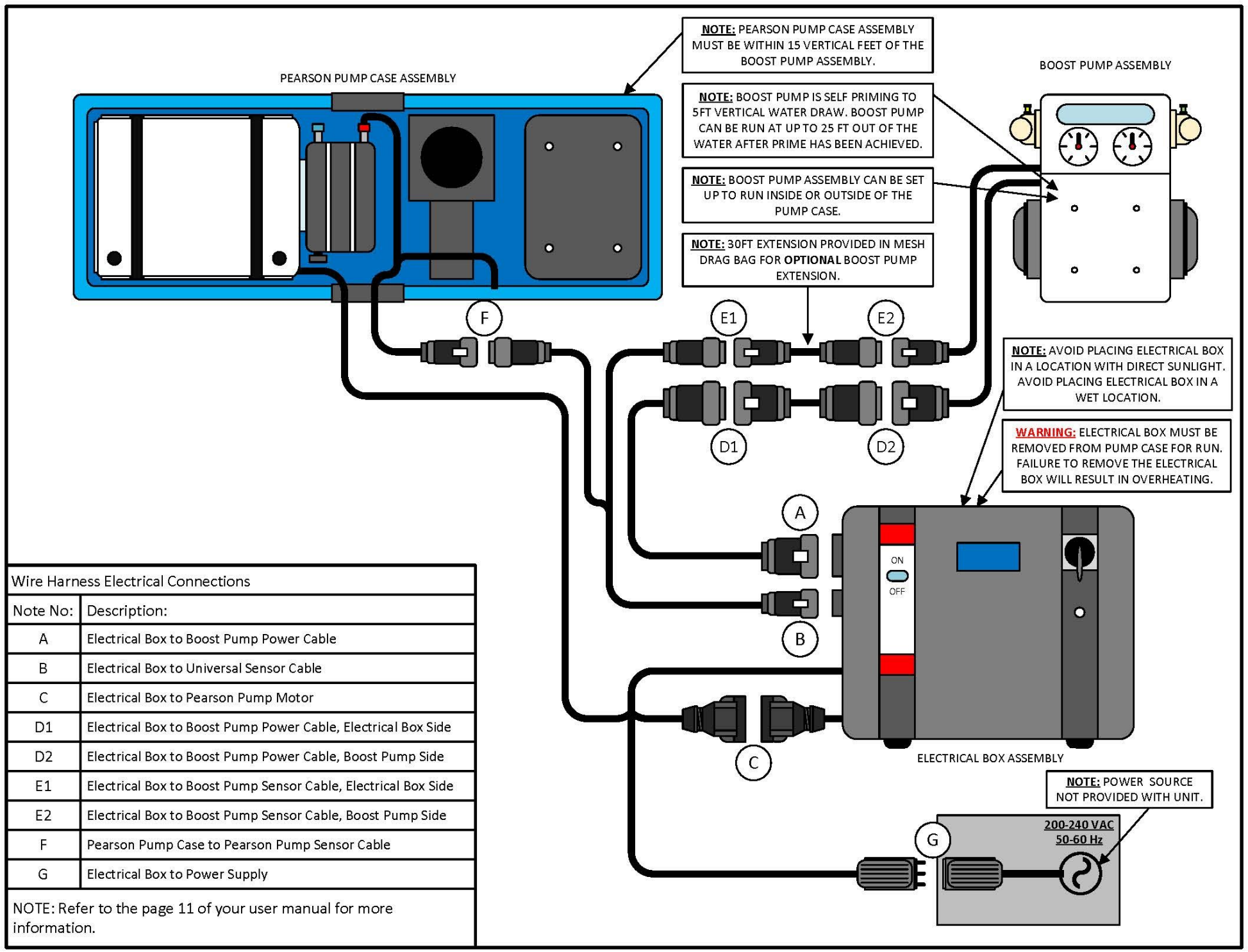
System Specifications

NAME PLATE DATA:

VOLTS	220 VAC
AMPS	10.8 (largely variable based on inlet conditions)
RPM	1050 (Pearson Pump)
LPD (inlet)	Max Speed: 32,500 LPD (8,600 GPD | 32.5 m^3/day) Min Speed: 23,450 LPD (6,200 GPD | 23.5 m^3/day)
LPD (product)	Max Speed: 16,275 LPD (4,300 GPD | 16.25 m^3/day) Min Speed: 11,725 LPD (3,100 GPD | 11.75 m^3/day)
Weight	Case A: 73 kg. (160 lbs.) Case B: 90 kg. (198.5 lbs.)
Max Operating Temp	40.5°C (105°F) | 35.0°C (95°F) unshaded
Recovery Rate	50% (mechanically fixed)

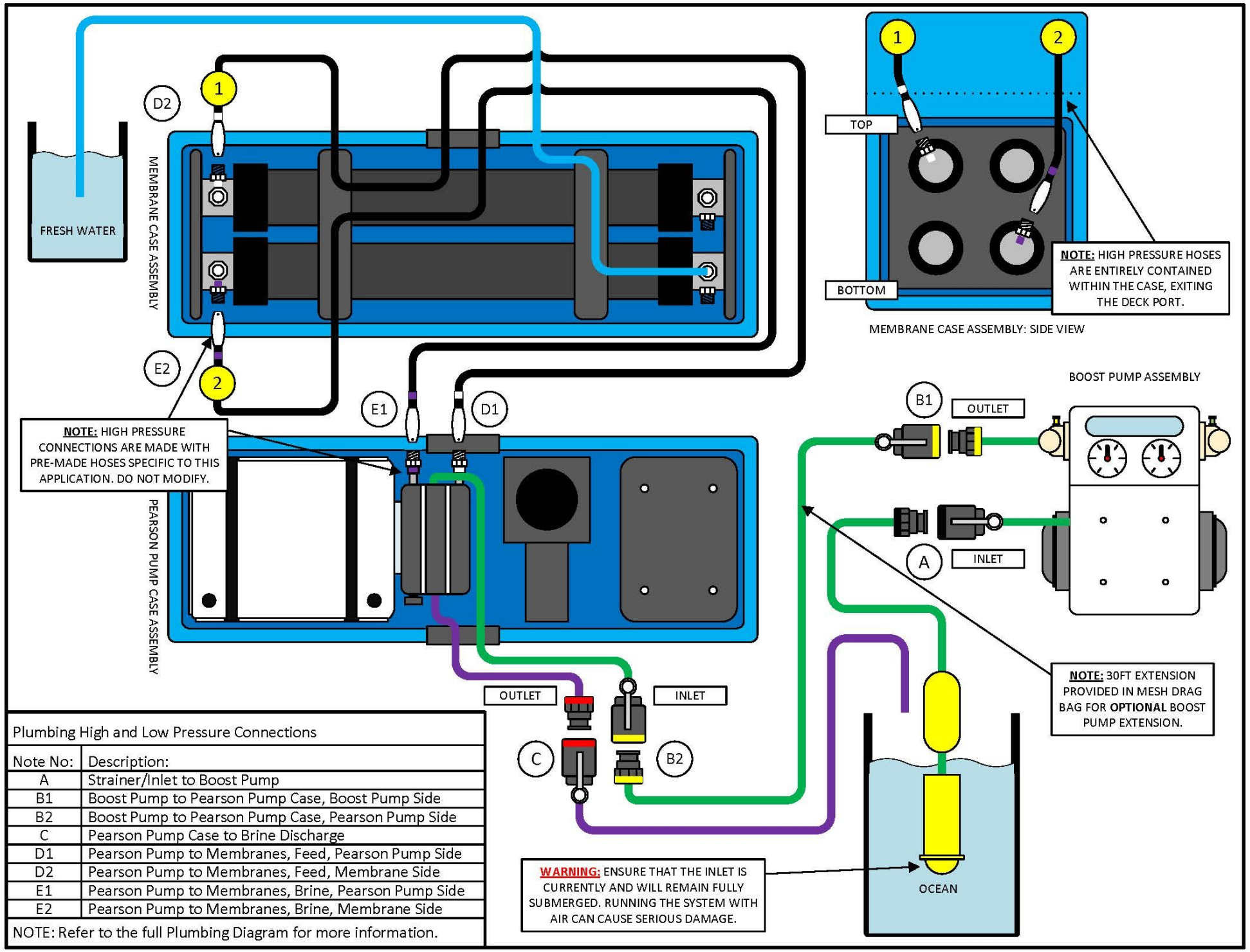
NOTE: Flow Rates, Amperages, Weights are all variable depending on the set up conditions and how much water is in the system.

Quick Start Diagrams
(Electrical + Plumbing)



Wire Harness Electrical Connections	
Note No:	Description:
A	Electrical Box to Boost Pump Power Cable
B	Electrical Box to Universal Sensor Cable
C	Electrical Box to Pearson Pump Motor
D1	Electrical Box to Boost Pump Power Cable, Electrical Box Side
D2	Electrical Box to Boost Pump Power Cable, Boost Pump Side
E1	Electrical Box to Boost Pump Sensor Cable, Electrical Box Side
E2	Electrical Box to Boost Pump Sensor Cable, Boost Pump Side
F	Pearson Pump Case to Pearson Pump Sensor Cable
G	Electrical Box to Power Supply

NOTE: Refer to the page 11 of your user manual for more information.



Plumbing High and Low Pressure Connections	
Note No:	Description:
A	Strainer/Inlet to Boost Pump
B1	Boost Pump to Pearson Pump Case, Boost Pump Side
B2	Boost Pump to Pearson Pump Case, Pearson Pump Side
C	Pearson Pump Case to Brine Discharge
D1	Pearson Pump to Membranes, Feed, Pearson Pump Side
D2	Pearson Pump to Membranes, Feed, Membrane Side
E1	Pearson Pump to Membranes, Brine, Pearson Pump Side
E2	Pearson Pump to Membranes, Brine, Membrane Side
NOTE: Refer to the full Plumbing Diagram for more information.	

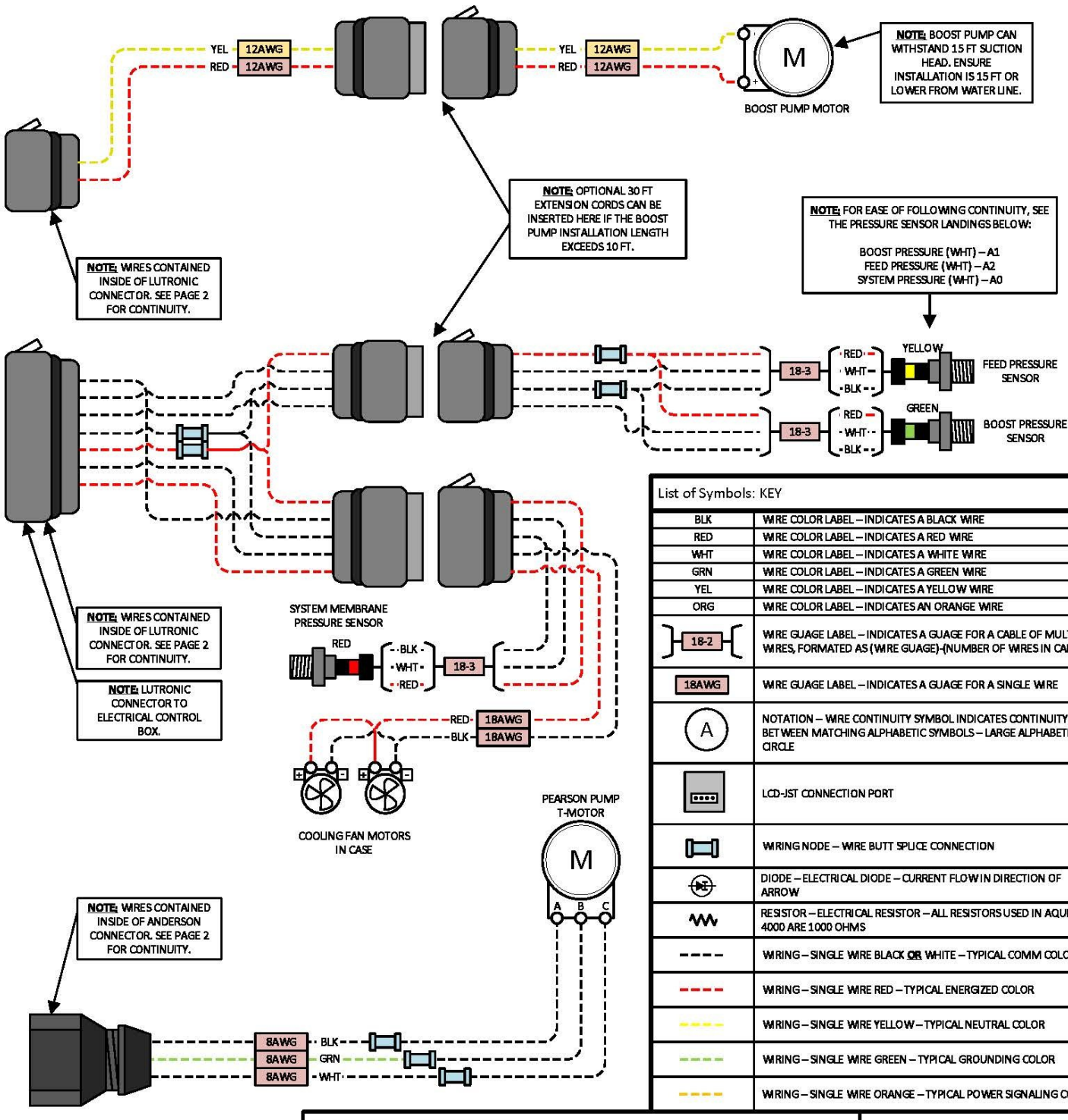
Electrical Wiring Diagram

Arduino MEGA Pin Assignments (Larger Board)

```
//Variable Assignment
//Pin Assignments:
const int BPspeedPin=11;              //  Boost Pump Relay, output pin: const int BPrelayPin=4;
const int PWMPin=10;                  //  PWM Throttle, output pin: 221118 - 11 to 8
const int PPswitchPin=A10;            //  Pearson Pump, switch pin: 230130 9 to A10
const int BPswitchPin=A6;             //  Boost Pump, switch pin: 230130 10 to A6
const int PotSpeed=A3;                //  230201: Pearson Pump Potentiometer Speed input
const int highPressurePin=A0;         //  High Pressure Signal, input pin
const int boostPressurePin=A1;        //  Boost Pressure Signal, input pin
const int feedPressurePin=A2;         //  Boost Pressure Signal, input pin: 221118 - A3 to A2
```

Arduino UNO Pin Assignments (Smaller Board)

```
//Variable Assignment
//Pin Assignments:
const int BPspeedPin=3;               //  Boost Pump Relay, output pin: const int BPrelayPin=4;
const int PWMPin=10;                  //  PWM Throttle, output pin: 221118 - 11 to 8
const int PPswitchPin=0;              //  Pearson Pump, switch pin: 230130 9 to A10
const int BPswitchPin=5;              //  Boost Pump, switch pin: 230130 10 to A6
```



List of Symbols: KEY	
BLK	WIRE COLOR LABEL – INDICATES A BLACK WIRE
RED	WIRE COLOR LABEL – INDICATES A RED WIRE
WHT	WIRE COLOR LABEL – INDICATES A WHITE WIRE
GRN	WIRE COLOR LABEL – INDICATES A GREEN WIRE
YEL	WIRE COLOR LABEL – INDICATES A YELLOW WIRE
ORG	WIRE COLOR LABEL – INDICATES AN ORANGE WIRE
18-2	WIRE GUAGE LABEL – INDICATES A GUAGE FOR A CABLE OF MULTIPLE WIRES, FORMATED AS (WIRE GUAGE)-(NUMBER OF WIRES IN CABLE)
18AWG	WIRE GUAGE LABEL – INDICATES A GUAGE FOR A SINGLE WIRE
A	NOTATION – WIRE CONTINUITY SYMBOL INDICATES CONTINUITY BETWEEN MATCHING ALPHABETIC SYMBOLS – LARGE ALPHABETIC CIRCLE
	LCD-JST CONNECTION PORT
	WIRING NODE – WIRE BUTT SPLICE CONNECTION
	DIODE – ELECTRICAL DIODE – CURRENT FLOW IN DIRECTION OF ARROW
	RESISTOR – ELECTRICAL RESISTOR – ALL RESISTORS USED IN AQUIFER 4000 ARE 1000 OHMS
	WIRING – SINGLE WIRE BLACK OR WHITE – TYPICAL COMM COLOR
	WIRING – SINGLE WIRE RED – TYPICAL ENERGIZED COLOR
	WIRING – SINGLE WIRE YELLOW – TYPICAL NEUTRAL COLOR
	WIRING – SINGLE WIRE GREEN – TYPICAL GROUNDING COLOR
	WIRING – SINGLE WIRE ORANGE – TYPICAL POWER SIGNALING COLOR

Aquifer-4000 Control System:

- 220VAC Input Voltage
- Automated & Manual System
- AF-4000-220V

Revision History: AF-4000-220V

Rev No:	Date:	Description:
A	09/21/2023	Initial Wiring Diagram for Aquifer-4000 Systems, 220V
B	11/22/2023	Deutsch Plug Replacement with Lutronic
C	02/13/2024	Minor adjustment of wire color and potentiometer power routing
D	06/18/2025	Updated "ARDUINO UNO" Wiring IAW SOP. Color Code is Now "C" Black, "D" Red.

Aquifer-4000-220V

Revision: D
Rev Date: 06/18/2025
Print Date: 06/18/2025
Drawn by: LSS

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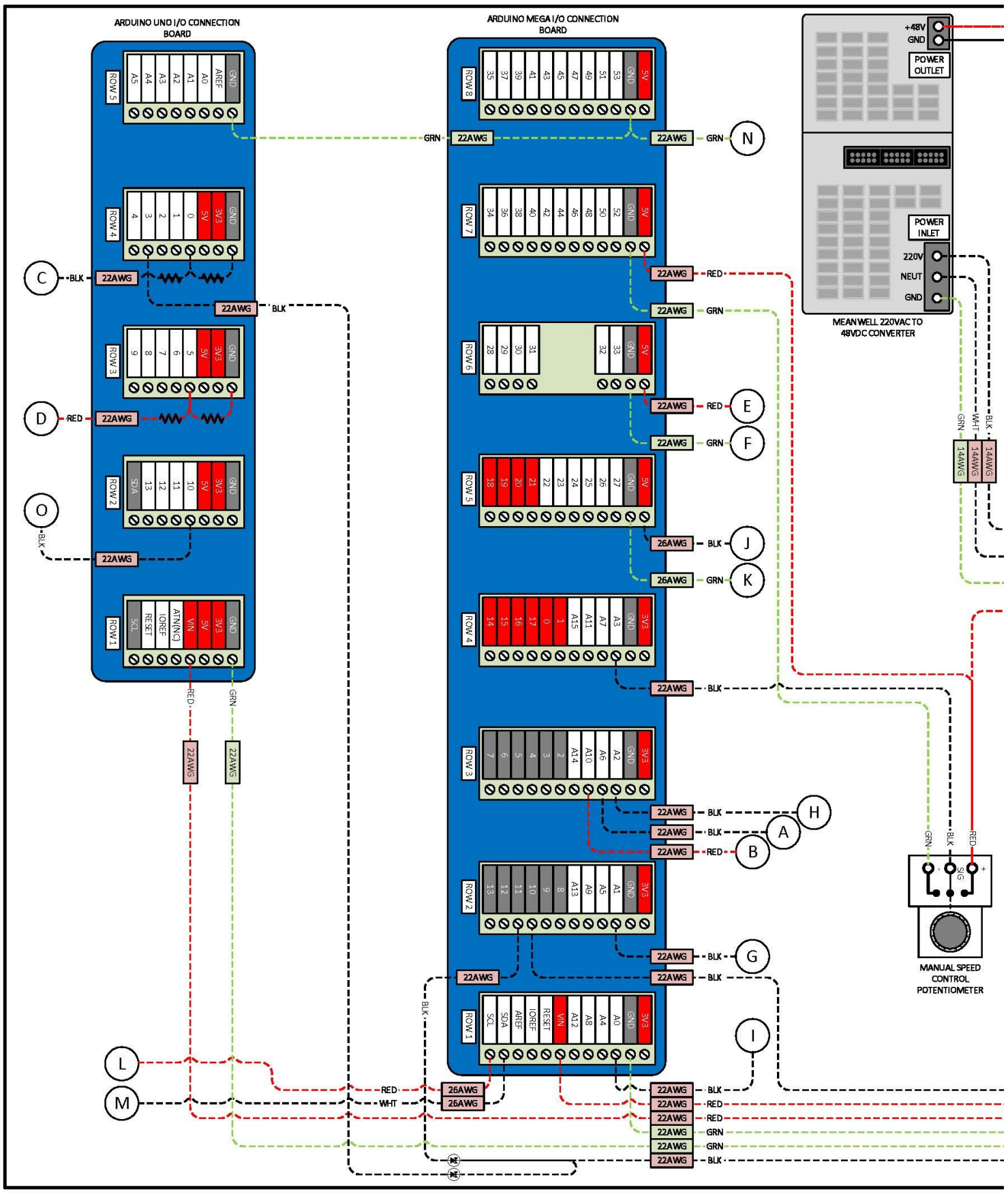
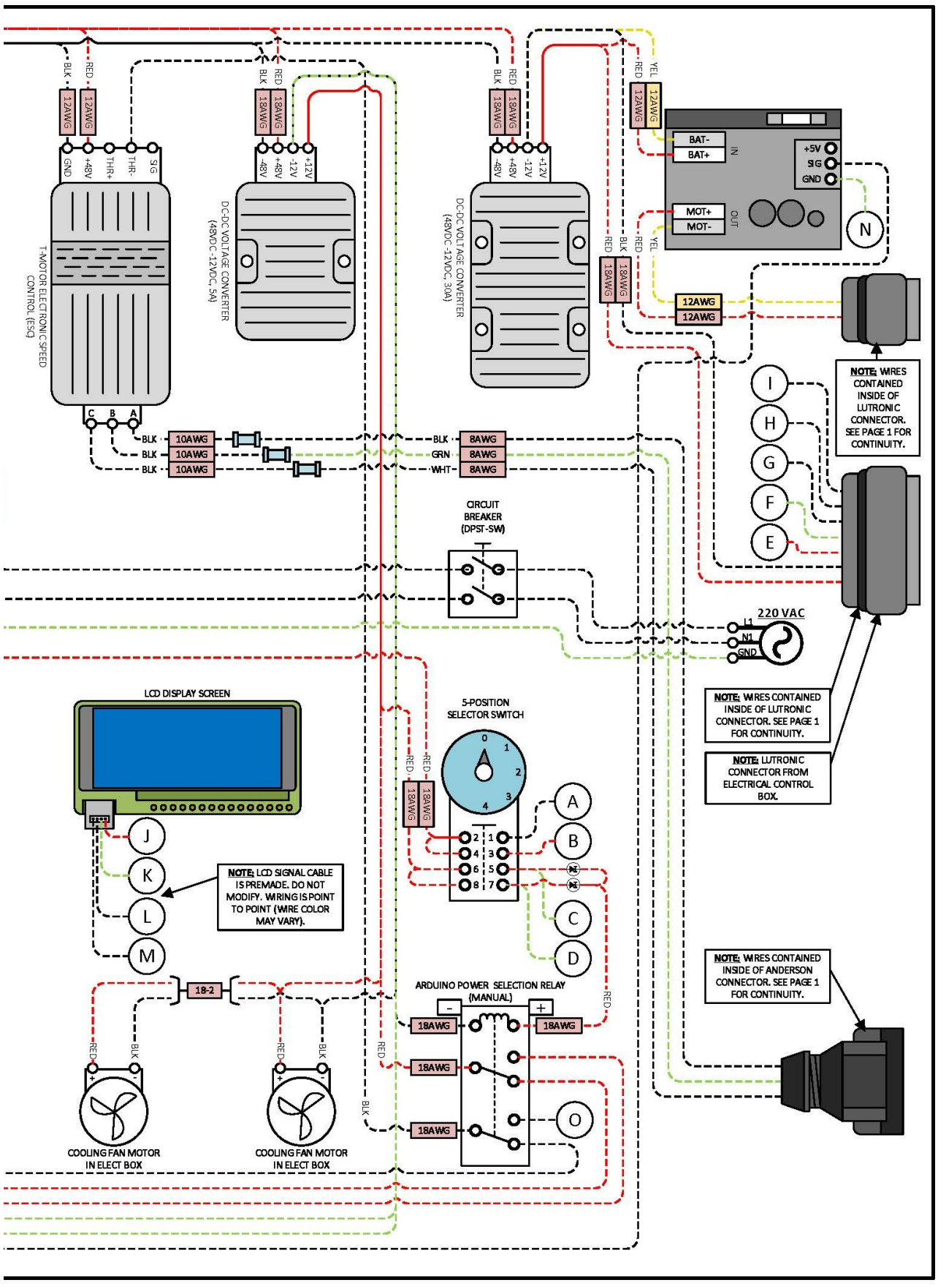
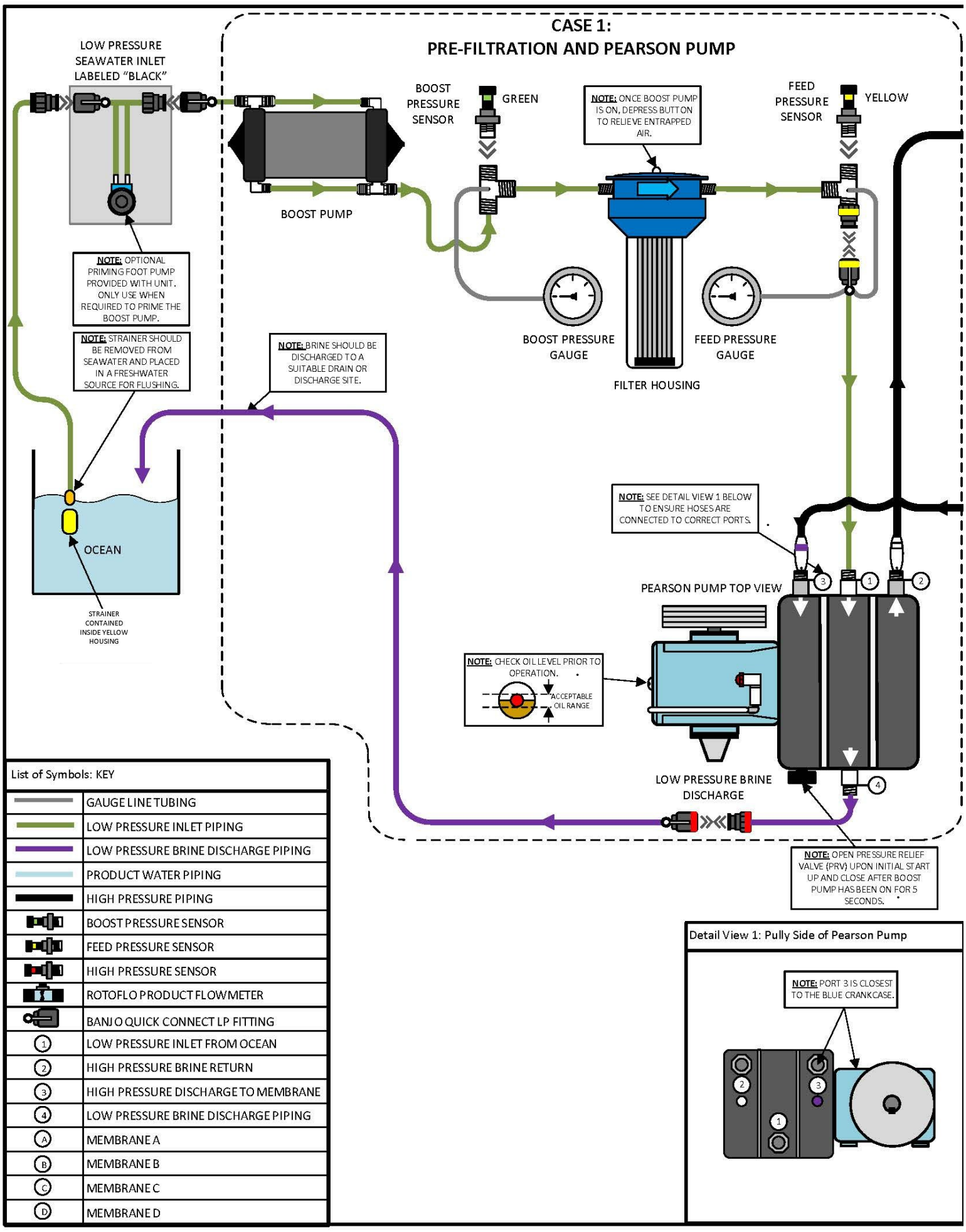
Control Box Diagram

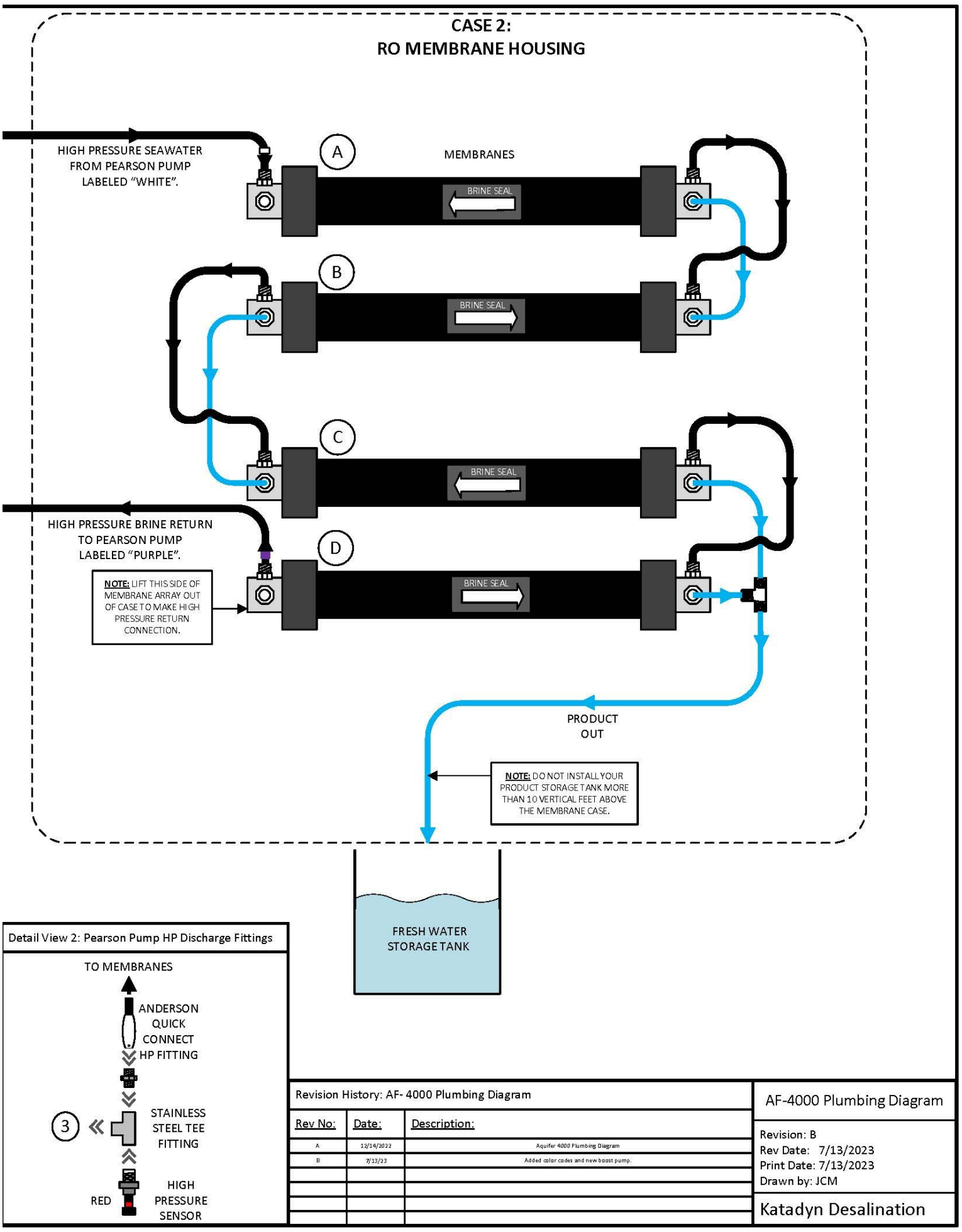


Control Box Diagram



Plumbing Diagram


CASE 1:
PRE-FILTRATION AND PEARSON PUMP
LOW PRESSURE SEAWATER INLET LABELED "BLACK"
BOOST PRESSURE SENSOR
GREEN
NOTE: ONCE BOOST PUMP IS ON, DEPRESS BUTTON TO RELIEVE ENTRAPPED AIR.
FEED PRESSURE SENSOR
YELLOW
BOOST PUMP
NOTE: OPTIONAL PRIMING FOOT PUMP PROVIDED WITH UNIT. ONLY USE WHEN REQUIRED TO PRIME THE BOOST PUMP.
NOTE: STRAINER SHOULD BE REMOVED FROM SEAWATER AND PLACED IN A FRESHWATER SOURCE FOR FLUSHING.
NOTE: BRINE SHOULD BE DISCHARGED TO A SUITABLE DRAIN OR DISCHARGE SITE.
BOOST PRESSURE GAUGE
FEED PRESSURE GAUGE
FILTER HOUSING
OCEAN
STRAINER CONTAINED INSIDE YELLOW HOUSING
NOTE: SEE DETAIL VIEW 1 BELOW TO ENSURE HOSES ARE CONNECTED TO CORRECT PORTS.
PEARSON PUMP TOP VIEW
3
1
2
4
NOTE: CHECK OIL LEVEL PRIOR TO OPERATION.
ACCEPTABLE OIL RANGE
LOW PRESSURE BRINE DISCHARGE
NOTE: OPEN PRESSURE RELIEF VALVE (PRV) UPON INITIAL START UP AND CLOSE AFTER BOOST PUMP HAS BEEN ON FOR 5 SECONDS.
List of Symbols: KEY
GAUGE LINE TUBING
LOW PRESSURE INLET PIPING
LOW PRESSURE BRINE DISCHARGE PIPING
PRODUCT WATER PIPING
HIGH PRESSURE PIPING
BOOST PRESSURE SENSOR
FEED PRESSURE SENSOR
HIGH PRESSURE SENSOR
ROTOFLO PRODUCT FLOWMETER
BANJO QUICK CONNECT LP FITTING
1 LOW PRESSURE INLET FROM OCEAN
2 HIGH PRESSURE BRINE RETURN
3 HIGH PRESSURE DISCHARGE TO MEMBRANE
4 LOW PRESSURE BRINE DISCHARGE PIPING
A MEMBRANE A
B MEMBRANE B
C MEMBRANE C
D MEMBRANE D
Detail View 1: Pully Side of Pearson Pump
NOTE: PORT 3 IS CLOSEST TO THE BLUE CRANKCASE.
2
3
1



Revision History: AF- 4000 Plumbing Diagram		
Rev No:	Date:	Description:
A	12/14/2022	Aquifer 4000 Plumbing Diagram
B	7/13/23	Added color codes and new boost pump.

AF-4000 Plumbing Diagram

Revision: B
Rev Date: 7/13/2023
Print Date: 7/13/2023
Drawn by: JCM

Katadyn Desalination

Operation/Installation

Setting Up the Aquifer

Setting Up - Choosing a Site

This is the most critical element for a successful set up. Make certain that your water source is as free as possible from suspended sand, silt, algae, for a longer prefilter life. If making water from a bay, lake, or stream; choose a location as deep as possible without pulling up silt from the water source floor. Avoid areas with surf or chop.

The Aquifer 4000 is designed to run on a wide range of water sources, ranging from 2,000 ppm to 40,000 ppm TDS. Heavy metal run-off should **never** be used as a feed water source. If significant volumes of heavy metals are expected to be present in a feed water source, find a new source of water or pretreatment will be required before running the system.

The Aquifer 4000 is designed to run in waters up to 50 NTU (at 50 NTU your prefilter life will be significantly impacted). There must be a location within 1.5 vertical meters (5 ft) of the water line for the secure placement of the Boost Pump assembly (ideally this flat is large enough for the entire unit set up). The closer to the water line the better for pump performance. If priming the Boost Pump, then relocating the Boost Pump higher out of the water always ensure that the Boost Pump is no more than 7.6 meters (25 ft) out of the water.

The most important consideration here will be the stable reduction of NTU at the inlet of the unit. Consider how the water source point will fluctuate through the use of the unit (IE: Will the tide change throughout the day or will there be changes in the NTU/salinity present through out the usage period etc.) All of these considerations can be handled with the correct usage. However, the most energy efficient and cost effective means will be to take these considerations into account before set up. Selecting a better water source is the best solution to almost all usage issues.

The Aquifer Boost Pump is capable of self priming with water up to 1.5 vertical meters (5 ft). Performance and priming time/difficulty are improved by moving the Boost Pump closer to the water line. After prime is achieved, the Boost Pump can be lifted up to 7.6 vertical meters (25 ft) out of the water. Remaining below 4.5 meters vertical (15 ft) is suggested in order to improve Boost Pump health. When setting up the watermaker, choose a spot as close to the water as possible but **do not** place the case in the water. It is much better to run a long extension cord from your power source than to run long hoses to the feed water source.

When attempting to make water in a location that is known to have high particulate load, a settling tank can be quite useful. This would generally be set up in front of the unit with a separate pump feeding it. With appropriate flow rates and tank volumes, this will allow particulate to settle out of the source water before entering the system. Spectra Watermakers does **not** provide or service settling tanks.

Setting Up the Aquifer Cont.

Setting Up - Location and Placement

The first step in setting up your unit will be placing the various cases and pieces of hardware in the correct locations **before** making any electrical or plumbing connections. Start by selecting an appropriate point of use. General criteria can be found on *Setting Up - Choosing a Site*.

Begin by moving the two large blue cases (the Pump Case A and Membrane Case B) to your point of use. These cases both require two people to lift. **Do not** attempt to move with a single person. **Only** lift cases by the handles on either side of the cases. Be very careful not to drop or impact the cases during transportation. While the unit can take minor and infrequent drops without failure, large impacts or repetitive impacts can harm the unit.

The Membrane Case B **cannot** be placed on top of the Pump Case A, the Pump Case A can be optionally placed on top of the Membrane Case B after all connections to the membranes have been made.

The Control Box can be placed on top of the Pump Case A, assuming that is has been appropriately strapped down (see face of Control Box) preventing the risk of dropping the box. The Control Box **cannot** be set up to run inside of either of the cases.

It is highly recommended to shade the unit if operating in high temperature weather. This will protect the unit from overheating and UV damage. **Do not** operate the Aquifer in temperatures above 35°C (95°F) without a sun shade.

Once all (3) Aquifer 4000 transportation assemblies (Pump Case A, Membrane Case B, and the Mesh Bag) are placed generally at the point of use, then bring and place all remaining required hardware (IE: product storage tank, settling tank, sun shade etc.) out.

NOTE: Do not install your product storage tank more than 3 vertical meters (10 ft) above the membrane case. The back pressure of pumping the product upwards can damage the membranes and hurt system performance. Ensure the vents on the Pump Case A are not blocked or exposed to dust in order to prolong the life of your unit.

Setting Up the Aquifer Cont.

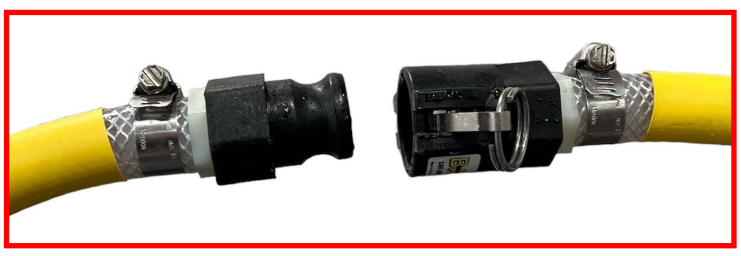
Setting Up - Electrical and Plumbing Connections

NOTE: When connecting any Quick Connect or Quick Attach fitting (plumbing or electrical) be sure to inspect them for sand or debris. Remove any sand or debris present before making the connection in order to protect the seals within the system. For electrical Quick Attach plugs, ensure the pins/sockets are dry to prevent electrical shorting which can damage the system.

First, set up the plumbing connections for the system. This consists of three (or four if using the Boost Pump extension) low pressure connections, and four high pressure connections. Refer to the *Plumbing Diagram* (pg.23) or the *Plumbing Quick Start Guide* (pg.17) for these exact attachments. All low pressure attachments follow this logic:

Male sides of Quick Connect are always outlets and female sides of Quick Connect are always inlets. This dictates the directionality of all low pressure connections to be made during set up.

Plumbing Connections
Example of a Quick Connect Fitting



Electrical Connections
Example of a Quick Attach Plug/Socket

Press silver tab to release

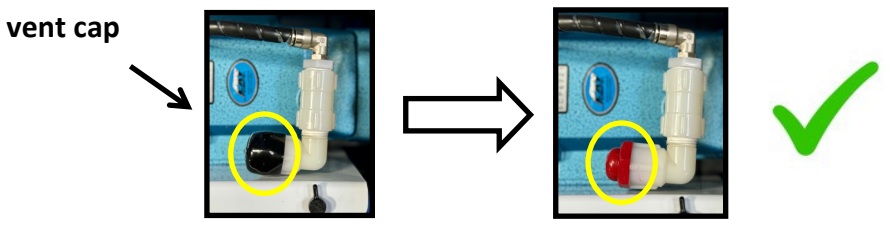
Next, set up the electrical connections for the system. This consists of seven (or nine if using the Boost Pump extension) Quick Attach multipin pigtail connections and one **L6-30** power connection. Refer to the *Electrical Wiring Diagram (*pg.18) or the *Electrical Quick Start Guide* (pg.16) for these exact attachments.

Setting Up the Aquifer Cont.

Start Up - Purging Preservatives

Warning! Your watermaker is shipped from the factory with a nontoxic potable water system preservative. **Damage may occur if this preservative is not flushed out and the membrane is pressurized with preservative in it. Be sure to follow the procedure below.**

Attention: Remove Pearson Pump gearbox vent cap prior to start up. This will allow relief to the crankcase in operation.



DO NOT OPERATE the Aquifer system if the feed water could contain oil, chlorine, or chemical treatment. If your water source is chlorinated, carbon filters may be used to protect the membrane to perform routine freshwater flushing or pickling procedures **only**. **Do not** use carbon filters as a prefilter during a production cycle or with the pressure relief valve closed.

1. **Locate a non-chlorinated water source.**
   - Place the strainer end of the feed water hose into the feed water source far enough below the surface to prevent air from being pulled in. Place the end of the brine hose at least 2 meters (6 ft) away so that the brine does not mix directly back in with the feed water.
   - Attach the product hose and place the end of it so that any product will drain on the ground (when unpressurized, the amount of product during the flush will be small).
   - **Ensure that the pressure relief valve is open 1-2 turns.**
   - Plug in the AC power source.

2. Turn on the Boost Pump (move the selector switch to Position "1") and check that it is primed by inspecting the brine discharge. About 3.75 lpm (1.0 gpm) of water should be being discharged (this will vary depending on your set up).

3. Move the selector switch into Position "2" and ensure that your pressure relief valve is **OPEN**. Move your speed adjustment knob to the **lowest** setting. Run the system without pressure for 45 minutes to purge the storage chemicals **(4-6 hours if stored for an extended period with propylene glycol)**. The system should have an open flow pressure on the feed pressure gauge of about 1.0 bar (14 psi). Water may drip from the product tube.

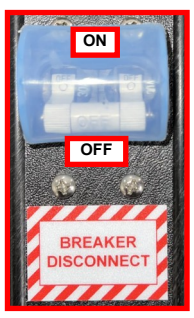
4. After the storage chemicals have been adequately purged from the system, tighten the pressure relief valve hand tight. The unit will slowly ramp up speed to the lowest speed set point and begin producing significant product flow. Typically on seawater the system pressure should reach the range of 45-52 bar (650-750 psi). This may take 1-3 minutes to build pressure after the unit has reached its speed set point. If the feed water is brackish or fresh the pressure will be significantly lower.

5. Allow the system to run for 5-10 minutes to purge the product water of preservative, and then test the product water with a handheld salinity tester. When the product water is below 750 PPM it is considered potable and may be diverted to the water container for human consumption.

Normal Operation — Large Body of Water

Confirm you have followed the steps listed in the previous sections (system has been primed, set up the correct location, and purged system from preservative chemicals).

1. Any source of feed water (oil, chlorine free, fresh water, etc.) between 2,000 - 40,000 ppm may be used. Do not use water containing large amounts of heavy metals.
2. Make certain that the Control Box elements are in the following positions:
   - The circuit breaker is in the “OFF” position.
   - The selector switch is in the “0” Position.
   - The speed adjustment knob is rotated as far counter clockwise as possible (to the “LOW” position).



Circuit Breaker Main ON/OFF

Selector Switch (Refer to pg.42-44 for **POS.** detailing)

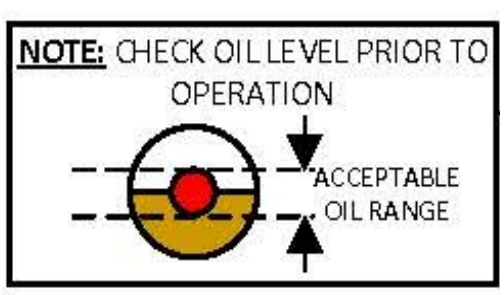
Speed Adjustment Knob

3. Ensure that your intake strainer is placed in such a way that you are drawing the lowest NTU feed water possible and such that the inlet conditions are stable. This can be done by adjusting the location of the float and the length of rope between the anchor and the strainer inlet. By adjusting these two lengths, you can precisely secure your strainer at a known depth in the water and avoid any drift of the inlet due to tides etc. If you need to adjust your inlet at this point, your prime will be lost and you will need to reprime the system.
4. Once you are certain that you have the best inlet conditions possible and all other considerations (preservative chemical purge, product water routing, operator access, etc.) have been taken care of, move the circuit breaker into the “ON” position. Wait for approximately 5 seconds until an audible “BEEP” is produced from the Pump Case A. A message stating *“Aquifer 4000 Ready”* will appear.
5. Make certain that the pressure relief valve is open approximately 1-2 turns. Move the selector switch into the “1” Position. The Boost Pump will begin moving water and providing 1.0 bar (14 psi) to the Pearson Pump. Allow the Boost Pump to run until the brine discharge and all other visible low pressure hoses contain no air. There is an air relief button on the top of the prefilter housing that is very useful for helping the Boost Pump prime as well as removing air from the system.

Normal Operation — Large Body of Water Cont.

6. Once the system has purged itself of air, tighten the pressure relief valve hand tight and move the selector switch into the “2” Position. The Pearson Pump motor will begin moving, slowly ramping up to the speed set point. Allow the system to reach the set point.
7. Once your system is running at the lowest speed set point, turn your speed adjustment knob clock wise. This will increase the speed set point of the Pearson Pump. Allow the system to reach increasingly higher set points until you have reached the highest possible stable set point (the unit will automatically lower its set point if your feed pressure is too low or if your system pressure is too high). If you notice the unit reducing its own set point then retrying to achieve the desired set point, turn down the speed adjustment knob to the highest stable set point.
8. After reaching a stable set point, check the product water with a handheld salinity tester. When it is below 750 ppm the water is good to drink and you may begin to fill containers. This will likely be ready by the time you have reached a stable set point. However, if you are still above the 750 ppm mark, wait for approximately 2-5 minutes and test again.
9. Run the system until you have filled your container or have made enough to meet your requirements and 40 liters (10 gallons) for flushing. It is suggested to make a surplus of fresh freshwater flushing water as it may take more than 40 liters (10 gallons) depending on a wide number of variables such as high inlet water ppm or NTU, low inlet water temperature, and any biofouling of the inlet water.

NOTE: Visually check the oil in the crankcase before every usage of the unit. Failure to do so may result in catastrophic unit damage.



Normal Operation — Typical Operating Parameters

Operational Parameters are all highly variable depending on inlet conditions (inlet water temperature, inlet water salinity, inlet water NTU, Outside Air Temperature - OSA, priming height, etc.). The following parameters are intended to demonstrate a typical ideal inlet rather than all possible set up conditions:

	Operational Condition	Safety Shut-Off Limit
LPD (product)	Max Speed: 16,275 lpd (4,300 gpd | 16.25 m^3/day) Min Speed: 11,725 lpd (3,100 gpd | 11.75 m^3/day)	N/A
Ocean Salinity	Approx. 32,000 ppm	N/A
Ocean Temperature	Approx. 10°C (50°F)	N/A
Feed Pressure	Max Speed: 0.13-0.26 bar (2-4 psi) Min Speed: 0.13-0.26 bar (2-4 psi) Boost Pump only: 0.89-1.04 bar (13-15 psi)	-0.71 bar (-10.3 psi)
Membrane Pressure	Max Speed: 58.6-72.4 bar (850-1,050 psi) Min Speed: 41.4-51.7 bar (600-750 psi)	86.2 bar (1,250 psi)
Max Operating Temp	40.5°C (105°F) | 35.0°C (95°F) unshaded	N/A

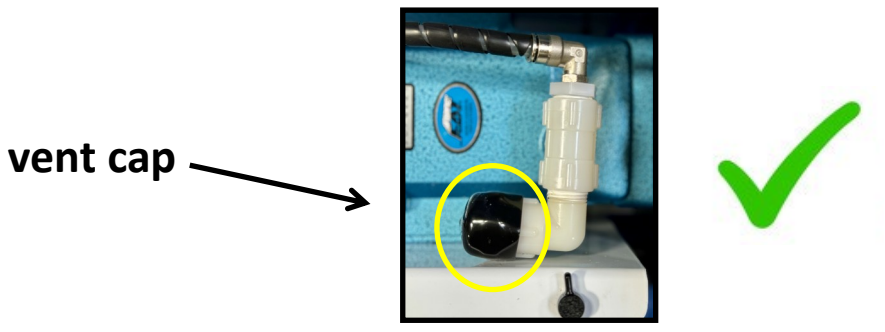
Normal Operation — Shut Down

When you are storing your unit, it is particularly important to dry the system as much as possible. There are several elements on the Aquifer 4000 that are resistant to corrosion but not entirely corrosion proof.

If the unit is stored with water inside of the case, corrosion will occur and may eventually lead to a critical part failure. If you are storing your unit in a particularly humid or wet environment, it can be very helpful to place a desiccant pouch inside of both cases to ensure the cases do not become wet. Spectra Watermakers **does not** provide or service this desiccant pouch.

Similarly, the various electrical and plumbing connections are provided with caps and plugs. When storing the system, it is important to replace these plugs so that the internals of the device can be stored containing water as well as storage chemicals and the electrical connections can be protected from water ingress during storage. When replacing these plugs and caps for the electrical system, it is particularly important to ensure that pins and sockets are completely dried prior to replacing. After the cap is attached water then does not have a path to escape via evaporation and will sit in the plug or socket, amplifying the corrosive effects. **Ensuring that the electrical connections are stored dry is critical to their long term success.**

Attention: Install Pearson Pump gearbox vent cap prior to long term storage and transportation to avoid oil spills.



Normal Operation — Shut Down (Flushing Procedure)

1. **Attention:** You will need 40 liters (10 gallons) of water in a container, which will be used to flush the watermaker. It is suggested to make an excess of this value to ensure that there will be enough water for the flush. In rare conditions it will require more that 40 liters (10 gallons) of water for a flush. **Use only non-chlorinated, low ppm (0-1,000 ppm) water for flushing. Product water (freshwater) is ideal.**

2. After you have an appropriate volume of flushing water, move the selector switch into the "0" Position. Your Pearson Pump and Boost Pump will deenergize and stop moving water almost instantly. Loosen the pressure relief valve approximately 1-2 turns and let the system depressurize. The screen will display "*Aquifer 4000 Ready*".

3. Pull the Inlet/Strainer up from your water source, pushing the strainer housing up and down to dislodge any large debris held on the surface of the strainer. Once the strainer has been adequately cleaned, place it into the freshwater container. Ensure that it is fully submerged. Temporarily removing the strainer from the inlet can be very useful for inserting the hose into the container and minimizing the amount of freshwater required.

4. Once the membranes have depressurized, move the selector switch into Position "1" and allow the Boost Pump to reprime on the freshwater. After prime has been achieved, move the selector switch into Position "2" and ensure that your pressure relief valve is **OPEN**. Ensure that your speed adjustment knob is in the **lowest** setting. The system will begin to run without building pressure. Allow this to continue until all 40 liters (10 gallons) have been fed through the system. When you have moved nearly all 40 liters (10 gallons) through the system, test the ppm of your brine discharge. If it is below 1,000 ppm you have completed your flush. If it is still significantly above 1,000 ppm, repeat the flushing procedure.

5. **Attention:** After the brine discharge is measuring below **1,000 ppm**, switch the selector switch into the "0" Position. Move the Control Box elements into the following positions:
   - The speed adjustment knob is rotated as far counter clockwise as possible (to the "LOW" position).
   - The selector switch is in the "0" Position.
   - The circuit breaker is in the "OFF" position.

Disconnect the electrical connections first to avoid water exposure. Insert the various electrical caps to protect the connections from water ingress. Then, disconnect all hoses replacing the various caps that were present on the system during shipping.

1. Tilt both the Membrane Case B and the Pump Case A toward their back edge and place something (approx. 2.5-5 cm (1-2 in) height) underneath their front edge such that they are mildly sloped toward their back edge. Open the lids to both cases and allow them sufficient time to dry and drain.

Repeat this procedure for a routine flush.

The system can now sit for up to five days without further attention. The system should be flushed after every use or every five days if not stored with long term storage chemicals. For long term storage, see section *Long Term Storage (Pickling Procedure)* on pg.37.

Normal Operation — Long Term Storage (Pickling Procedure)

Watermakers are best run frequently (every other day is ideal) as biological growth in the membrane is the leading cause of membrane fouling. A warm environment will cause faster growth than a cold environment. The freshwater flush will greatly reduce biological growth but may not stop it completely in certain conditions.

"Pickling" your system involves coating the internals of the device with either a custom made storage chemical provided by Spectra SC-1 or a specific ratio of food grade propylene glycol. Pickling your system with SC-1 will extend your storage or "down time" from 5 days to 6 months. Pickling your system with food grade propylene glycol will extend your storage or "down time" from 5 days to 1 year.

Spectra SC-1 is a special storage compound formulated to be compatible with the modern engineering plastics and composites in the Spectra pumps. **Do not** use any substitute except food grade propylene glycol. SC-1 Storage Compound must be mixed at a ratio of 1 Spectra SC-1 packet to 11.3 liters (3 gallons) of freshwater to have the proper solution. An average of 26.5 liters (7 gallons) of water is in the system. This water has to be figured in to the mixture using 3 packets of Spectra SC-1.
Caution: Avoid contact with skin, eyes, or lungs with the storage chemical.

In order to pickle your system, follow this procedure:

1. Fill a bucket with 11.3 liters (3 gallons) of fresh unchlorinated water. Mix 3 packets of SC-1 storage chemical into the bucket. **NOTE:** It will take approximately 1 hour to fully dissolve the chemical. Considering the volume of water in the system from the fresh water flush, in addition of these 11.3 liters (3 gallons) will result in a total volume of water at 37.8 liters (10 gallons). This means that 3 packets of SC-1 are required. Three packets per 37.8 liters (10 gallons) results in 12.6 liters (3.33 gallons) per packet which is an acceptable dilution ratio.
2. Ensure that the system has been flushed within the last five days and has not been run since then. If it has not then flush the system following the *Shut Down (flushing procedure)* outlined on pg.36.
3. Remove the 5 micron prefilter from the filter housing on the Boost Pump assembly. Replace the filter bowl and hand tighten bowl back onto your system.
4. Once your chemicals have dissolved, route your brine discharge and inlet hose to the bucket, ensuring both are completely submerged. Route your product water tubing to drain into the bucket if drops are produced. **Do not** submerge your product water tubing.
5. Ensure that the pressure relief valve is open at least 1 full turn.
6. Bring the unit back "ON" and run the Boost Pump by moving the selector switch to Position "1". Water will begin to cycle and the feed pressure gauge will read approximately 1 bar (14 psi).
7. Let the water and storage chemicals cycle through the system for at least 20 minutes (preferably 30 minutes to 1 hour).
8. After cycling the chemicals sufficiently, power "OFF" your unit. Detach hoses and wires, ensuring that significant volumes of water **are not** drained from the system. A small amount of spillage is fine and expected. Attach all plugs for the system.
9. Label the system stating the chemical used and the date it was pickled.
10. Your system is now ready for long term storage.

Normal Operation — Long Term Storage Cont. (Pickling Procedure)

Clean Up:

- Discard the remaining liquid in the bucket to a suitable drain.
- Drain and dry both cases, all hoses, and all elements that are going to be placed in the mesh drag bag.
- Organize system and place equipment in transportation locations. Close cases and carefully place them into your transportation vehicle.

If you are using food grade propylene glycol as your storage chemical, follow the procedure outlined on the previous page. When mixing your inlet chemical bucket, instead use this chemical mixing procedure/mixing ratio:

In order to pickle your system with food grade propylene glycol, use this mixing ratio/ procedure:

1. Fill a bucket with 11.3 liters (3 gallons) of 96% food grade propylene glycol provided by Spectra. Do not introduce water to this mixture. Ensure the percentage propylene glycol is known and preferably is sourced from Spectra Watermakers.
2. When mixed with the volume of water present in the system 26.5 liters (7 gallons) this will result in the following mixing ratio: 37.8 total liters (10 gallons) of fluid, 10.9 liters (2.88 gallons) of propylene glycol, 0.45 liters (0.12 gallons) of other preservative chemicals. This results in a mixing ratio of 28% glycol.
3. If using a different percentage source glycol, ensure that you are at a minimum of 25% glycol within your system for appropriate long term storage. You can provide a higher percentage without the possibility of damaging your system. Higher ratios will simply require extending the flush time required to purge the chemicals from the system.
4. After you have calculated your appropriate volumes and obtained the correct volumes within accessible buckets, follow the procedure outlined on the previous page.

Storage — Long Term Considerations

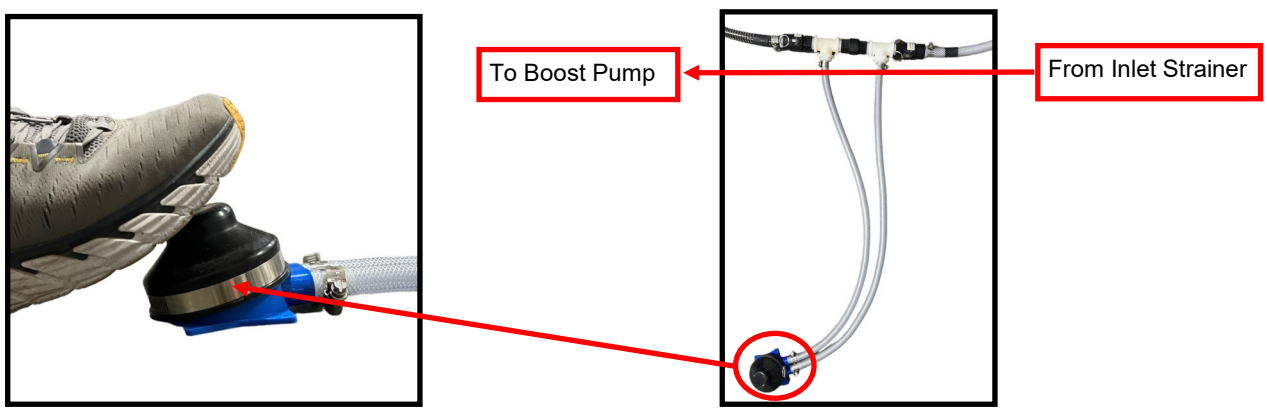
The Aquifer 4000 is easy to set up and easy to store once you are familiar with the operation of then unit. However, there are long term storage considerations which can be easily overlooked and which may cause serious potential damage. This largely consists of being aware of possible storage temperatures. At high storage temperatures, the membranes have a possibility of delaminating which destroys the membranes. This occurs at an internal water temperature of 45°C (113°F). **Do not store the Aquifer 4000 cases in an area that will reach or exceed 43.3°C (110°F).**

The most important long term storage procedure requires a log or other means of storing important data for the unit. Storage with the chemical SC-1 is only guaranteed to be effective for a maximum of six months, and storage with propylene glycol is only guaranteed to be effective for a maximum of one year. It is very important that the date and time of the storage process is recorded every time that the unit is pickled. For the *Long Term Storage (pickling procedure),* see pg.37. **It is critical that the unit be flushed and then re-pickled if the storage time will exceed the advised interval.** If your unit is stored for longer than the advised interval without a flush and re-pickle, your membranes may grow biological contaminants and become bio-fouled. If the biofouling is mild, the membranes may be able to recover using the *membrane cleaning procedure* outlined on pg.52. If the biofouling is moderate to heavy, the membranes are likely failed and are not recoverable. This failure point is easily manageable by simply re-pickling your system on a controlled schedule once every six months if using SC-1 or once a year if using propylene glycol.

Operation — Boost Pump Priming

When setting up the Aquifer 4000 each location will require priming the Boost Pump after set up. This is simply to remove air locks from the system and ready the system to pull water from the source without air. The Boost Pump provided with the system can easily self prime up to 1.5 vertical meters (5 ft) out of the water source. There are methods that can be used to prime the system if/when it is required by the set up. If you are struggling to prime the system, follow these procedures:

1. **Priming Foot Pump:** The unit is provided with a foot pump and the appropriate fittings required to set up the pump on the inlet of the system. This assembly contains a check valve and a fully manual pump which draws from the inlet of the check valve and outlets just above the check valve. This pump is a foot actuated pump that requires no electrical power. This allows the user to bring water to the unit by stepping on a foot pump several times rather than struggling against the physical limitations of the Boost Pump. While priming it is suggested that you have your Boost Pump running (position "1" on the selector switch) to aid with the priming effort. This priming method is effective up to 4.9-5.5 meters (16-18 ft) vertical water draw. **This is the most reliable method of achieving prime at over 1.5 vertical meters (5 ft) above the water source.** Refer to pg.23 for *Plumbing Diagram.*



2. **Priming without Foot Pump:** The unit's Boost Pump assembly is removable from the case and can be run with a 9 meter (30ft) extension from the system. If you are in a location which prevents the use of the foot pump (pier, cliff inlet, etc.), the Boost Pump assembly can be lowered off of the pier or cliff toward the water line. When lowering the assembly, use a secure rope to support the weight of the unit. **Do not** hang the Boost Pump by the power cord or hoses. Lower the Boost Pump toward the water line, making sure that the assembly does not fall into the water source. Run the unit in Position "1" until the Boost Pump has reached a primed condition. Then slowly lift the Boost Pump until it reaches the desired height out of water. Be certain to consider the installation limits of the Boost Pump **(maximum suction: 7.6 vertical meters (25 ft), healthy suction: 4.5 vertical meters (15 ft) or lower).**

Operation — Automated Run Mode Detailing

The Aquifer 4000 has 4 different run modes and a Stand-By State all of which are controlled through the selector switch. This 5 position switch (0, 1, 2, 3, & 4) signals to the controls which state the unit needs to be operating in. Position 0 is a Stand-By/Initialization position. Positions 1 & 2 are fully automated positions in which the control system actively monitors pressures and safeties in order to protect and optimize the unit. Positions 3 & 4 are semimanual positions with minimized electronics. In these positions there is no pressure monitoring or emergency safeties. These positions should only be used in a emergency, when there is a functional failure in the automated system and immediate water is required. **It is always safest to run the unit in Positions 1 or 2.** See below for a detailed description of each run state:

Position 0 **System Stand-By/Initialization:** While the system is in Position 0, It will hold both motors “OFF” and send initialization signals to the Pearson Pump Motor Speed Control. During the first power “ON” there will be an audible beep once the system has initialized. If returning to this mode after a run, the motor will already be initialized and the audible beep will not occur. Whenever you return to this mode after a run, let the motors stop turning and then depressurize the system before returning to a run mode.

Position 1 **Automated Boost Pump Run:** When the system is moved into Position 1, it will start the Boost Pump motor. While running the Boost Pump in Position 1, the control system will monitor the pressures through out the system and will ensure the safe operation of the Boost Pump within the system. In Position 1, the Boost Pump speed will be modulated to provide 1 bar (14 psi) through the system, allowing it to prime without moving unnecessarily large quantities of water. If this pressure set point is not being met or is being exceeded for an extended period of time (2-3 minutes), cycle the power to the system. While running in Position 1, the full suite of safeties are active and all pressures are continuously monitored by the control system. Not all safeties apply to the system with only the Boost Pump “ON”. See *Trouble Shooting — Emergency Shutdown Matrix* on pg.55 for a detailed description of the emergency safeties present in this run mode.

See next page for Position 2.

Operation — Automated Run Mode Detailing Cont.

Position 2 **<u>Automated Full System Run:</u>** When the system is moved into Position 2, it will control both the Pearson Pump motor and the Boost Pump motor. Both motors will begin moving with the Pearson Pump motor slowly approaching its speed set point. This slow ramp up allows the system to avoid knocking and allows it the appropriate time intervals to adjust the feed pressure as the system ramps up. The Boost Pump's speed will be controlled in order to provide 0.20 bar (3 psi) leaving the prefilter. This will allow the system to perform in the exact same manner independent of the prefilter condition or the Boost Pumps suction height. In this run mode, all electronic controls are applicable for tuning the system. The screen will display all pertinent control variables. While running in Position 2, the full suite of safeties are active and all pressures are continuously monitored by the control system. See *Trouble Shooting — Emergency Shutdown Matrix* on pg.55 for a detailed description of the emergency safeties present in this run mode.

See next page for Position 3 and Position 4.

Operation — Manual Run Mode Detailing

Position 3 **<u>Manual Boost Pump Run:</u>** When the system is moved into Position 3, it will deenergize the automated control system and energize the semimanual control system. This will energize the Boost Pump motor with a run “100%” signal. Typically there will be approximately 2.4-3.1 bar (35-45 psi) outlet from the prefilter in this run mode. However, there will be very large variance in this as the system does not modulate and the pressures are dependent on the set up. There is no pressure monitoring or other electronic safeties present in this run mode. **This run mode is intended as an emergency stop gap if the automated control system experiences a functional failure, temporarily preventing its use. It is not intended to be a commonly used run state. It is possible to run the system in manual however, it is highly suggested to repair the automated system as soon as possible to reinstate the safeties only present in this mode.**

Position 4 **<u>Manual Full System Run:</u>** When the system is moved into Position 4, it will deenergize the automated control system and energize the semimanual control system. This will control both the Pearson Pump motor and the Boost Pump motor. In similar fashion to Position 2, the Pearson Pump motor will slowly approach the speed set point. The set point for Position 4 is not adjustable and will always produce approximately 11,350 liters (3,000 gallons) of product water per day. There is no pressure monitoring or other electronic safeties present in this run mode. **This run mode is intended as an emergency stop gap if the automated control system experiences a functional failure, temporarily preventing its use. It is not intended to be a commonly used run state. It is possible to run the system in manual however, it is highly suggested to repair the automated system as soon as possible to reinstate the safeties only present in this mode.**

The use of the manual modes should be avoided if possible however, there are a handful of reasons to run the system in Position 3 or 4. The most common situations that may require running the system in Positions 3 and 4 are as follows:

- Your automated controller has broken: This may be caused by an electrical short, water damage, impact damage, etc. The following are identifiers of a broken automated controller: LCD Screen is not displaying anything while in either run mode, either pump motor does not energize in the associated run mode, or the LCD screen reaches a screen and stops updating.
- A pressure sensor has failed or is faulty and is not repairable: This may be caused by an electrical short, over tensioning wires or cables, water damage, impact damage, and etc. The following are identifiers of a faulty/failed pressure sensor: The system repetitively shuts down on a pressure related safety, the system generates a transducer failure shutdown, the Boost Pump will not regulate pressure (constantly providing over 2 bar (30 psi) in all states), a pressure sensor is reporting a rapidly fluctuating value, and etc.

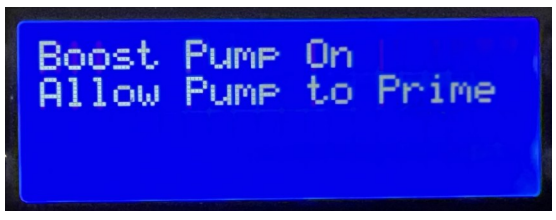
Note: If your power source has experienced a failure, neither run state will work and immediate repair is necessary before running the unit.

Operation — Screen State Detailing

The Aquifer 4000 is provided with an LCD screen which will display parameters, monitor pressures, and display all pertinent information while the system is in use. This screen will only be active in Positions 0, 1, and 2. In Positions 3 and 4, the LCD screen will be deenergized and the only information available will be through the analog gauges on the Boost Pump assembly. Each run state has a different set of information present, adapted to the particular requirements of the run states. See below for a detailed description of the screen states and what information to expect within each.

- **Position 0** **System Stand-By/Initialization:** While in Position 0, the screen will initially display "*Initializing PP Motor*", followed shortly by "*Initializing Done*". This will occur quickly as it does not take significant time to initialize the motor. After the motor has initialized, the screen will display "*Aquifer 4000 Ready*". After this message has appeared, the system is ready to move into a run state.

- **Position 1** **Automated Boost Pump Run:** While in Position 1, the system will energize the Boost Pump and ask the user to allow it to prime before continuing. Once the Boost Pump has energized, the screen will display "*Boost Pump On, Allow Boost Pump to Prime*". This will continue to display until the system is moved into the next run position.

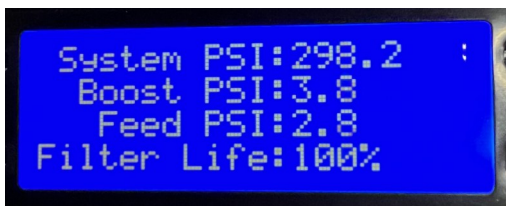


(See next page for details on **Position 2, 3** and **4)**

Operation — Screen State Detailing Cont.

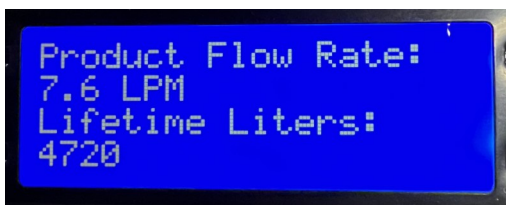
- **<u>Position 2 — Automated Full System Run:</u>** While in Position 2, the screen will display three distinct information pages. In this run state, the majority of the parameters and variables are displayed. Immediately after moving the selector switch into this position, the screen will display one of the following screen states and begin to cycle between the 3 pages with an interval of 5 seconds in between each switch in order to make all of the information available to the user. The following details the three separate screen states displayed during **Position 2:**

2a. <u>Run-Up/Pressure Screen:</u> This screen will either display the run up percentage of the Pearson Pump motor if the speed setpoint has not been achieved yet, or will display the system pressure variables if the speed setpoint has already been reached. The pressure display will appear in this format:



2b. <u>Run Time Screen:</u> After 5 seconds of displaying the first screen state, the control system will switch the LCD to display the Run Time variables. The run time display will appear in this format:

2c. <u>Flow Rate Screen:</u> After 5 seconds of displaying the second screen state, the control system will switch the LCD to display the Flow Rate variables. The Flow Rate display will appear in this format:



- **<u>Position 3 & 4 — Manual Run Modes:</u>** While in Positions 3 & 4, the screen will display nothing. In these run modes, the automated system is deenergized and the controller responsible for communicating with the LCD will be “OFF”. All information about the unit will only be present in analog gauges present in the Boost Pump Assembly.

Data Logging

To fill out the data log, please **scan** the provided QR code using a QR code scanner or the camera app on your smartphone. Scanning the code will direct you to a webpage or an application where you can enter the required information accurately and conveniently. The page will prompt you with the required data. The only tools that will be required for data logging are as follows:

- Infra Red Temperature Reading Gun
- Ocean Salinity Measurement Device
- Product Salinity Measurement Device (provided with unit)
- NTU Measurement Device
- Amperage Measurement Device

Ensure that you have a stable internet connection to complete the data logging process smoothly. If you do not have access to stable internet at your point of use, record these values and upload them when internet access is available.

https://docs.google.com/spreadsheets/d/17ert4c1YS9gNEj7KvLwekG5uY_b97uWNrT-KUTMwMVc/edit#gid=0

Service and Maintenance

Maintenance

Maintenance — General

Periodically inspect the entire system for leakage and chafe on the tubing and hoses. Repair any leaks you find as soon as possible. If there is a significant leak inside of either case, power “OFF” the unit, repair the leak, and reenergize the system following the proper procedures. Some salt crystal formation around the Spectra Pearson Pump blocks is normal. Wipe down any salt encrusted areas with a damp cloth when the unit is powered “OFF”.

Similarly, inspect all soft elements in the system (anything not made of metal or directly and rigidly mounted onto the frame) for signs of UV damage including color shifting, flaking, or increase in brittle nature of the elements. These may not need to be immediately replaced but should be replaced before part failure is a risk at all. This is a particular concern for any soft elements that are generally used outside of the case and may not be protected from UV damage from the sun.

Lastly, inspect all metal elements in the system. While it is not likely, these elements may corrode particularly when they are not maintained properly. Ensure that all metal is as dry as possible for storage and inspect its condition before each use. If early signs of corrosion occur, clean the area and apply a hydrophobic protective layer using a water repellant such as WD-40 or various other oils. Be sure to clean excess oils from the surface of the material being protected. WD-40 is flammable and should **not** be used on parts which may experience temperatures over 47°C (117°F). A non-flammable but slightly more acidic option is tung oil (typically more expensive than WD-40). Do not use any products which contain the following: heavy metals, chlorine, ammonia, or abrasive compounds. Spectra does not provide these oils.

Maintenance — Operational

You will need to do active maintenance on the system while it is producing water. This consists of monitoring and replacing the prefilter elements housed in the Boost Pump assembly as they load up with particulate from your feed water source.

While the system is running in Positions “1” or “2”, the control system will monitor pressures and filter condition etc., providing an active filter life reading (0-100%, 100% indicating a clean filter). When the prefilter has reached a pressure drop of 0.82 bar (12 psi) the control system will indicate that the prefilter needs to be serviced. The unit will continue to run, eventually shutting itself off if the prefilter has not been serviced and the pressure drop reaches 1.0 bar (15 psi). This shut off is a safety, not an indication tool. The prefilter should be serviced as soon as the “*Service Prefilter*” warning appears, not after the unit has shut down on a safety.

Maintenance Cont.

Maintenance — Operational Cont.

In order to service your prefilter, follow this procedure:

1. Move the “ON/OFF” switch into the “OFF” position. Your Pearson Pump and Boost Pump will deenergize and stop moving water almost instantly. Loosen the pressure relief valve approximately 1-2 turns and let the system depressurize.
2. Ensure that the system is depressurized and detach all plumbing and electrical connections to the Boost Pump assembly.
3. Move the Boost Pump assembly to a location where water spillage is not a concern.
4. Use the filter housing wrench to loosen and remove the filter housing bowl.
5. Remove the dirty prefilter and drain the filter housing bowl. Replace the prefilter with another 5 micron prefilter.
   NOTE: Use only Spectra approved filter or system damage may occur.
6. Tighten the filter housing bowl back onto the Boost Pump assembly using the filter housing wrench.
7. Reconnect the Boost Pump and restart the system.

The remainder of the maintenance you will need to do during operation consists of monitoring the unit. As this unit is designed to run in almost any water source and location, there is a large range of installations which may not be stable at full production volumes but are still acceptable use cases. These are a handful of situations which may interfere with the units performance:

- Feed water salinity above 35,000 ppm
- Feed water temperature below 7.2°C (45°F)
- Boost Pump significantly below Pump Case A
- Inadequate membrane cleaning (flushing) or storage (pickling)

All of these conditions may increase the membrane pressure or decrease the feed pressure. The unit will automatically limit its speed set point in order to avoid danger to the unit from either of these pressures. If the Boost Pump speed is constantly oscillating between two set points, the speed should be reduced slightly. This will be very noticeable when standing next to the unit as you will hear a high pitched whine. The oscillating speed is the pump bumping up against the pressure limit and trying to adjust. When this occurs, use the speed adjustment knob to adjust the units desired speed downward into a stable speed set point. This will ensure that the unit is operating in a healthy manner.

Similarly, in some rare installation conditions, the system will be unable to run at full speed without the Pearson Pump knocking. This will likely only occur if the installation limitations are not followed. Knocking is a very noticeable sound and is significantly louder than normal operation of the unit. The individual strokes of the Pearson Pump will sound harsh, as if a piston (or pistons) was repeatedly and rapidly impacting a wall. If knocking occurs, power down the unit as soon as possible. If the knocking was only occurring at the highest speed setting, you may attempt to bring the unit back online at the lowest speed setting. If the knocking occurs at a lowered speed range, you need to reconsider the set up of your unit, moving to a more ideal location.

Maintenance Cont.

Maintenance — General Pump (ALL)

The Boost Pump requires no routine maintenance except inspection for leaks. The oil in the Pearson Pump crankcase should be changed every 5,000 hours or if it becomes contaminated with water (milky) or any other contaminant. Any leaks should be addressed as soon as possible. If tightening a fitting does not stop the leak, unscrewing the leaking fitting, cleaning the mating surfaces, lubricating everything with silicone grease and reassembly will often solve the problem.

Maintenance — Pearson Pump

As with all high pressure pumps the seals in the Pearson Pump need to be replaced from time to time. For preventative maintenance we recommend changing the seals at 2,500 hour intervals. The pump will likely require a complete rebuild at 10,000 hours though this can be performed when indicated by leaking or a change in recovery rate. If the recovery rate drops more than 5% the valves need to be replaced (this is included in the 10,000 hour rebuild kit).

Maintenance — Membranes

The membranes need to be cleaned only when membrane pressures have risen more than 10% or the product quality degrades. For the Aquifer 4000 the easiest way to diagnose this is by having a control to measure against (IE a known operating condition, example; when used in 35000 ppm water the unit operates at X pressure and produces X ppm product water). The leading cause of fouling is from biological growth that occurs when the system is left unused without flushing or pickling. Fouling from mineral scaling can also happen during operation under certain seawater conditions, and from rust. Monitor the product salinity and system pressure for higher than normal readings for the conditions. Cold water can also cause high pressure. Low product flow is usually due to fouled membranes which is why we recommend that you keep a log of the basic operation parameters. If the system pressure is increasing and production is dropping off it is likely the membrane is becoming fouled. Catching this failure early is the only reliable way to reverse the damage.

There are two types of cleaners: acid and alkaline. The acid cleaner (SC-3) will remove mineral scaling. The alkaline cleaner (SC-2) is used to remove biological by-products such as oil, and dirt particles that get past the prefilter. If membrane performance is reduced and they have not been pickled recently, cleaning with both chemicals is recommended. The acid cleaner should be used first. If the membrane fails to respond to both cleanings, this is an indication of another problem with the system, or that it is time to replace the membrane. Contact Spectra Watermakers before removing any membrane.

Maintenance Cont.

Maintenance — Membrane Cleaning

Membrane cleaning should only be preformed when indicated by performance as Spectra systems do not scale under normal use.

Start with flushing your system prior to completing any of the membrane cleaning procedures. For normal cleaning, the SC-3 Acid Cleaning Compound is used first, then the SC-2 Alkaline Cleaning Compound. If known biofouling is present, the SC-2 may be used first. Use hot water if possible, up to 40.5°C (105°F) is recommended as it greatly enhances the ability of the cleaners to do their jobs. Do not exceed 45°C (113°F) as this can damage the membranes.

If the history of the system is unknown or has been left “unpickled” for an extended length of time and biological growth is present. It is recommended that the system is cleaned with SC-2, using an alternate source of unchlorinated freshwater before the system is run under pressure.

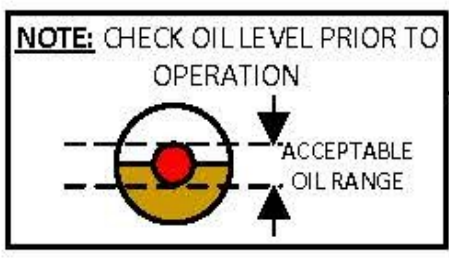
A simple test can be performed to see if biological growth has occurred. Before running the system, remove the prefilter and examine their condition. If the housings are full of smelly discolored water, the system was not properly stored. Install clean prefilter if they were bad. Next, check the membrane. Attach the brine discharge service hose and lead to a bucket. Open the pressure relief valve one turn, and manually run the system in Position “1” for 1-2 minutes. Examine the brine water: if it’s discolored and smells bad, perform an SC-2 cleaning with an alternate source of unchlorinated water before running the system pressurized. If the brine is fairly clean, the system can be purged, run normally, and checked for performance.

Maintenance Cont.

Maintenance — Oil Changes

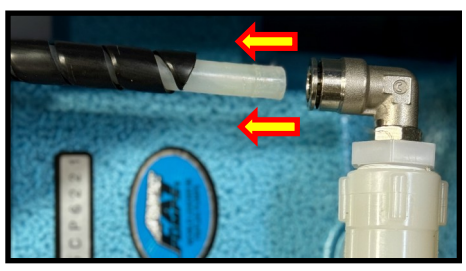
GEARCASE LUBE OIL:

Use only 5W-30 synthetic oil in Spectra Pearson Pump crankcase. Do not overfill the crankcase with oil. Check oil condition and level frequently. The oil should be changed every 5,000 hours of operation or annually, whichever comes first. When changing or checking the oil, use the oil level sight glass located on the Pearson Pump crank case (the blue crank case housed in the frame of the unit). The oil level should be in the range shown below:

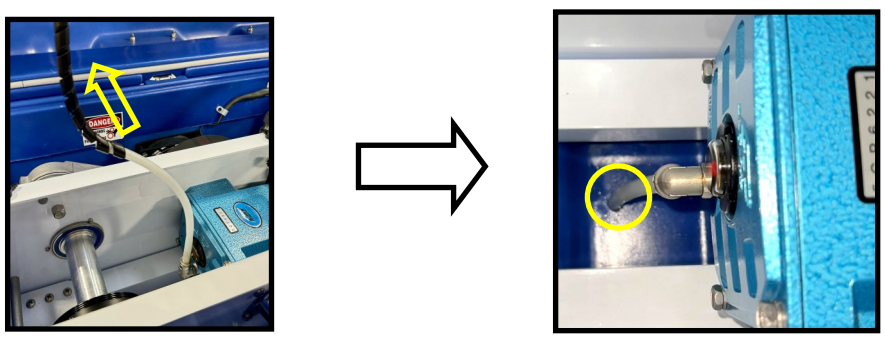


Use the following procedure for changing the oil of your Pearson Pump:

1. The oil will drain better if it is warm, after the system has been running for a few hours.
2. Disconnect the drain tube from the (push-to-connect) fitting on the top of the crank case by pushing the collar in and pulling the tube out.

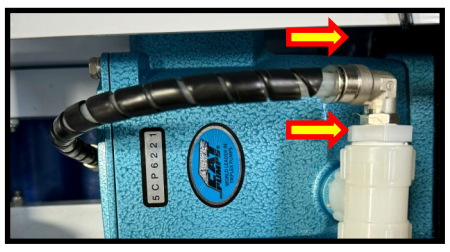


3. Remove the spiral wrap from the drainage tube. Route the oil drainage tube through the bottom of the case. There is a small drainage hole with a large enough diameter to fit the oil drainage tube through. Place an appropriate container below the oil drainage tube.



Maintenance Cont.

4. Let the crank case fully drain of oil.
5. Place the spiral wrap back on the drain tube.
6. Reroute the drain tube to its original location and undo the air vent cap on the other side of the tee on top of the crank case.



7. Using the port previously closed by the air vent, refill the crank case with 450ml (1 pt) of oil.
8. Check the sight glass to ensure the appropriate amount of oil has been added.
9. After the appropriate amount of oil has been added, reattach the air vent cap.
10. Use only 5W-30 synthetic oil.

NOTE: Please dispose of used oil responsibly. Adhere to local regulations.

Maintenance — Service Bulletin

Many service bulletins can be found at this location: **support.katadyngroup.com/945703-Technical-Bulletin-Archive**

Troubleshooting — Emergency Shutdown Matrix

Shutdown No.	Shutdown Description (LCD Text):	Cause of Shutdown:	Course of Action:
1	HP DEPRESSURIZATION Membrane Pressure: XXX PSI	The membrane pressure rapidly decreased, indicating a ruptured fitting or membrane.	-Check entire system for ruptured part or leak. -Fix it and restart. -If none is found, check sensor wiring.
2	HIGH MEMBRANE PSI Membrane Pressure: XXX PSI	The membrane pressure rose above the shutoff limit for membrane pressure. Your system was unable to adjust itself downward fast enough for a change in run conditions.	-Check all hoses for kink or blockage. -Check inlet ppm and temperature. -PPM may be too high and the temperature may be too low. -Restart.
3	LOW FEED PRESSURE PSI at Shutdown: XXX PSI	The feed pressure fell below the shutoff limit for feed pressure. Your system's boost pump could not provide adequate feed pressure.	-Check the performance of your boost pump and the inlet conditions. -Move boost pump closer to the water source. -Move your Pump Case A closer to the boost pump. -Restart.
4	HIGH FEED PRESSURE PSI at Shutdown: XXX PSI	Your feed pressure rose above the shutoff limit for feed pressure. Something caused it to surge, indicating an issue with your low pressure hoses.	-Check your system for blockages, leaks and/or clogged filter. -Restart.
5	HP SENSOR FAILURE Check Sensor	Your High Pressure sensor is reporting a value corresponding with 0V when a different response is expected. The sensor is not transmitting accurately.	-Check sensor wiring. -Restart. -If error persists, replace sensor. -If no sensor is available, run the system in manual while waiting for a new sensor.

Troubleshooting — Emergency Shutdown Matrix Cont.

Shutdown No.	Shutdown Description (LCD Text):	Cause of Shutdown:	Course of Action:
6	BP SENSOR FAILURE Check Sensor	Your Boost Pressure sensor is reporting a value corresponding with 0V when a different response is expected. The sensor is not transmitting accurately.	-Check sensor wiring. -Restart. -If error persists, replace sensor. -If no sensor is available, run the system in manual while waiting for a new sensor.
7	FP SENSOR FAILURE Check Sensor	Your Feed Pressure sensor is reporting a value corresponding with 0V when a different response is expected. The sensor is not transmitting accurately.	-Check sensor wiring. -Restart. -If error persists, replace sensor. -If no sensor is available, run the system in manual while waiting for a new sensor.
8	LP DEPRESSURIZATION Feed Pressure: XXX PSI	The feed pressure rose or dropped rapidly, indicating a ruptured prefilter or other low pressure failure.	-Check the entire low pressure line up to the Pearson Pump for leaks or blockages. -Check the prefilter for possible rupture. -Restart.
9	FILTER LIFE — 0% Replace Prefilter Restart System	The pressure drop across your prefilter has reached 1 bar (15 psi). *Service Prefilter* alarm is present after 0.82 bar (12 psi). Shutdown occurs at 1 bar (15 psi).	-Replace your prefilter. -Restart.
10	SWITCH READ ERROR Bad Switch Read: Check Switch	The selector switch reported a switch state to the control system that was not stable. Wiring may be loose.	-Power “OFF” your system and restart from Position 0. -If this error persists, check the wiring to your selector switch.
11	INVALID OPERATION Depressurize System Restart System	The system tried to run the boost pump only while the system pressure was still above 20.6 bar (300 psi).	-Open the pressure relief valve and let the system depressurize. -Restart.

Notes