



LB 400

Installation and Operating Manual



Spectra Watermakers

Katadyn Desalination LLC.

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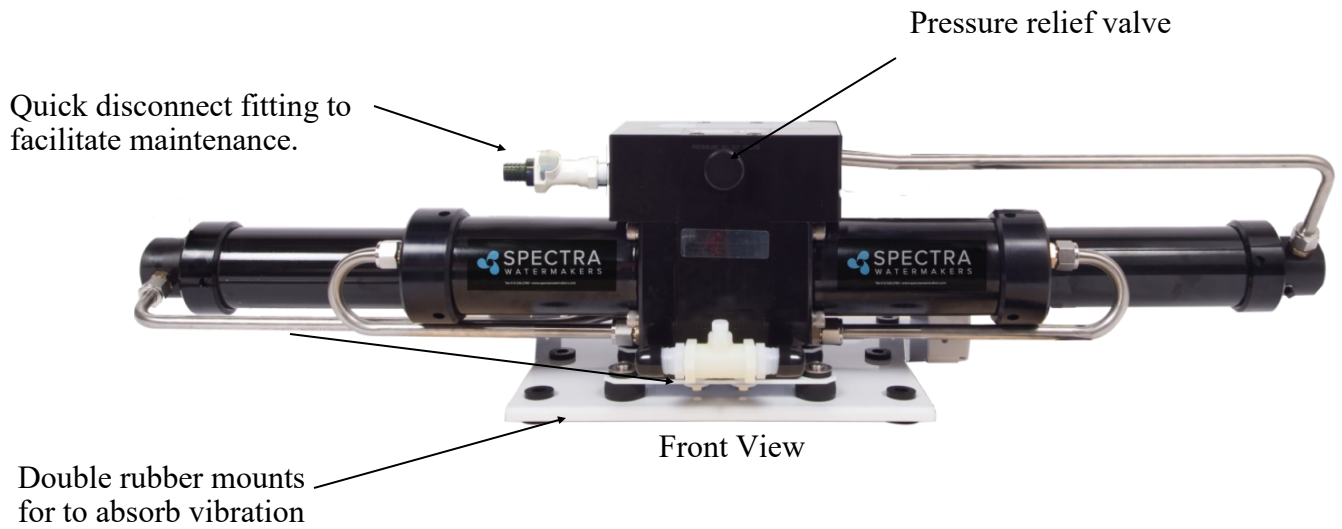
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Updated March 2025

Introduction to the LB 400

The Spectra Clark Pump is a hydraulic intensifier and energy recovery device that was introduced in 1997 and has been utilized in over 12,000 watermakers to date. It is built with epoxy composites, engineered plastics and is designed to survive in a seawater environment.



Filter Module



Optional Flush & Service module



Pressure Gauge and Product Flow Meter

Getting Started

Unpack the system and inspect it to make sure that it has not been damaged in shipment.

Refer to the shipping list for your system to make sure you have received all of the components listed. Do not discard any packaging until you have found and identified all of the parts. The small installation parts are listed on the kit list.

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

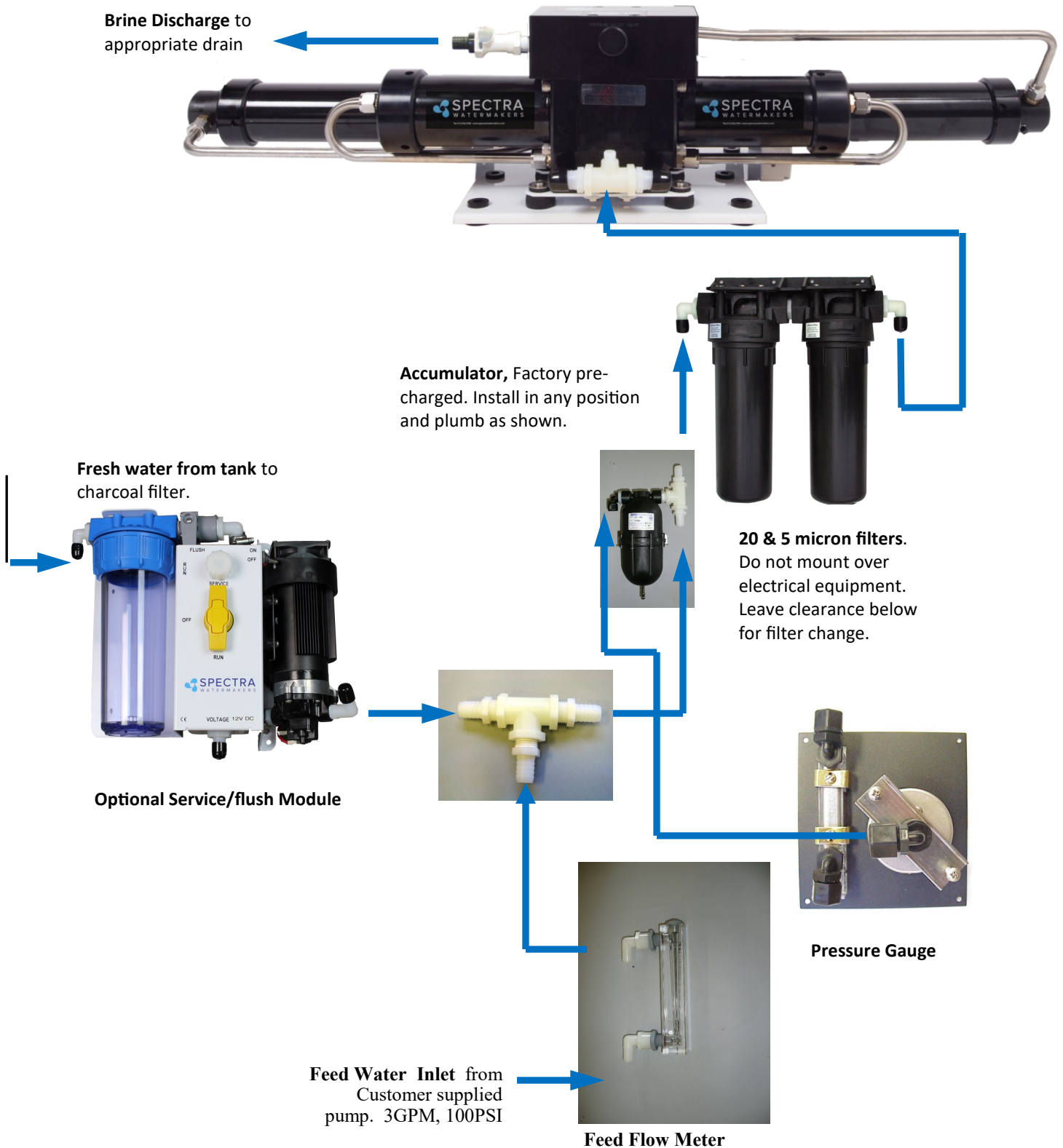
Study the system layout diagram, component photos and descriptions before beginning your installation. This will assist you in understanding the function of each component.

Layout the system. Before starting the installation identify the location where each module and component will be placed. Insure that there is proper clearance around the components for removal of filters and system service. Also check to make sure you have adequate tubing and hose before starting so additional parts may be ordered.

Shipping List

- High Pressure Clark Pump and a 40" Reverse Osmosis Membrane Module.
- Accumulator Tank
- Monitor Gauge panel
- Installation Fittings Kit
- Hand held Salinity monitor
- 5/8" (14.75mm) Hose 25 Feet
- 1/4 product tubing (50')
- Feed Water flow meter
- 20 and 5 micron prefilter assembly
- Product sampling 3-way valve
- Brine Service Hose
- Optional Flush/Service Module

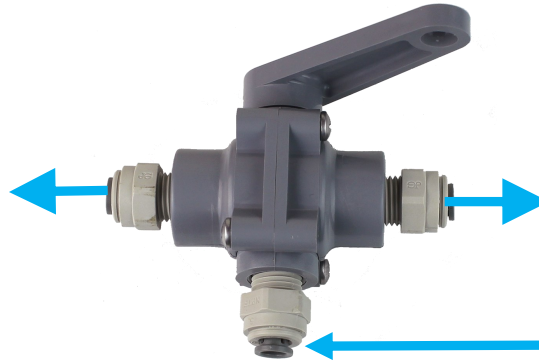
Plumbing Layout



Product Water and Pressure Gauge Tube Installation

Product water should fall into the storage tank through an air gap or have a low cracking pressure (<3psi) check valve installed to prevent back flow.

To Sampling Tap for testing the product water or for service procedures. Put enough tube on this port to reach your service (pickling) container.



Product to tank, route the product water from the valve into the top of the tank.

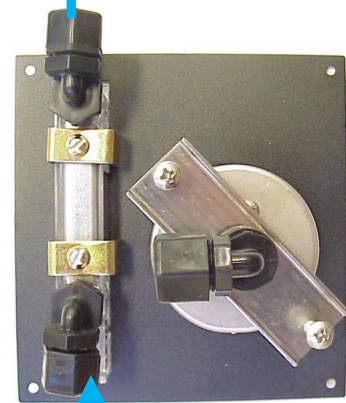
Product sampling valve. Mount using the supplied plastic straps as shown.

Note: the handle points in the direction of the flow.

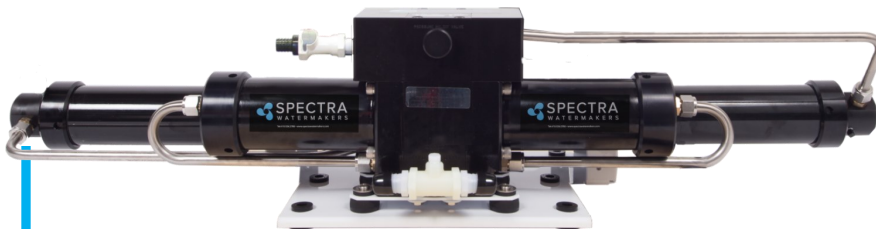
Plastic fittings should have 3-4 wraps of Teflon tape and will thread almost all the way in. Leave the first pipe thread uncoated to avoid cross threading. Avoid getting dirt or debris in the system during assembly. Secure piping away from moving objects and protect from chafe.

Product Flow meter

Pressure Gauge



Back view of instrument panel.



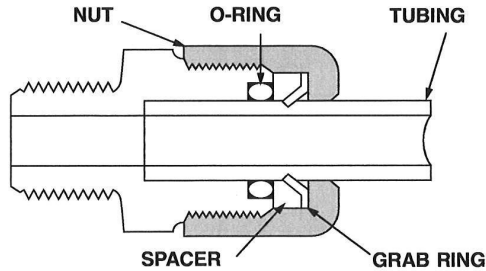
Each of the four 1/8" ports in the membrane endcaps are common to the product manifold so product can come from any of these ports



Parker Tube Fitting Assembly Procedure

Fast & Tite® Thermoplastic Fittings

Fast & Tite® fittings are the most complete line of plastic fittings for thermoplastic tubing in the industry.



Fast & Tite® thermoplastic tube fittings from Parker will prove to be the answer to your tubing connector needs. Patented Fast & Tite® fittings install in seconds without tools and provide a tight, sure, leak proof seal without clamps or adjustments. A unique 302 stainless steel grab ring for tube retention, coupled with a Nitrile O-Ring for positive seal, assures good tube connection with only hand tight assembly. A plastic grab ring is also available upon special request. Vibration or tube movement will not break the seal and cause leakage. Preassembled in either highly inert polypropylene, or strong, durable nylon, Fast & Tite® fittings are the answer to full flow thermoplastic tubing system requirements.

When necessary, Fast & Tite® fittings can be disassembled by hand for fast system drainage. Fittings are completely reusable.

Parts are easily replaced. O-Rings are standard size and universally available. (For applications requiring other than Nitrile O-Rings, consult your Fast & Tite® distributor.)

Use Fast & Tite® fittings with Parker Parflex tubing or other plastic, glass or metal tubing for low pressure or vacuum lines up to the pressure limits shown below.

Fast & Tite® fittings meet FDA and NSF-51 requirements for food contact.

Working Pressures for Fast & Tite® Fittings

Tube O. D., in.	Air-Oil-Water Pressure in PSI		
	Up to 75°F	76° to 125°F	126° to 175°F
1/4	300	300	300
5/16	300	300	300
3/8	250	250	150
1/2	200	200	150
5/8	150	100	50

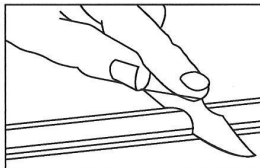
Ratings are based on use with copper tubing, and in all cases represent the maximum recommended working pressure of the fitting only. Working pressures (vs. temperatures) of other types of tubing may limit the tube and fitting assembly to pressures lower than shown above. Consult factory for recommendations on applications other than shown above.

Temperature Range:

Black/White Polypropylene: 0°F (-18°C) to +212°F (+100°C)
White Nylon: -40°F (-40°C) to +200°F (+93°C)

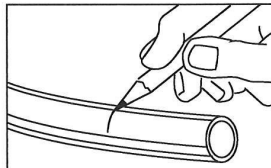
Fast Assembly

Step 1.



Cut the tube square and remove any burrs.

Step 2.



Mark from end of tube the length of insertion.
(See table below)

Tube O.D. (in.)	Insertion Length with Tube Support (in.)	Insertion Length without Tube Support (in.)
1/4	5/8	9/16
5/16	5/8	9/16
3/8	13/16	3/4
1/2	7/8	13/16
5/8	1	15/16

Step 3.

Loosen nut on fitting until three threads are visible. Fittings for glass tubes must be disassembled and the grab ring removed.

Step 4.

Moisten end of the tube with water. Push the tube **Straight** into fitting until it bottoms on the fitting's shoulder. Tighten nut by hand. Additional tightening should not be necessary, but 1/4 additional turn may be added if desired. **Do not overtighten** nut as the threads will strip and the fitting will not function properly. A proper assembly will not show the insertion mark extending beyond the nut. If the insertion mark is visible, then steps 1 thru 4 must be repeated.

Step 5.

When using clear vinyl tubing or urethane tubing, it is necessary to use a **TS** tube support. Disassemble the fitting and place the nut, grab ring, spacer and tube support, in that order on the tube. Locate the grab ring at the insertion mark as shown. Seat the O-ring in the body, then proceed with Step 4.

Note: Provide adequate fail-safe mechanisms such as leakage detection sensors, automatic shut-off controls or other industry and code appropriate fail-safe devices in the design of your water-handling appliance to protect against personal injury and property damage.

Plastic fittings containing an o-ring that are used in water applications should be replaced at least every five years or more frequently depending on the environment and severity of the application.

New System Start-Up and Testing

Warning! Damage may occur if the purge sequence is bypassed and the membrane is pressurized with storage chemical in it.

1. First Check That:

- The feed water pump is ready and primed
- All of your hose connections are tight.
- The pressure relief valve is open 1/2 turn.
- The sampling valve is set to the sample position.

Remove Tag and Washer



Open 1/2 Turn



2. Disconnect the feed water hose at the prefilters or Clark Pump Inlet. Start the feed pump and regulate the feed flow to 3GPM (11LPH). Reconnect the hoses.

3. Start the feed pump and run the system without pressure for 20 minutes to purge the storage chemicals. The system should have an open flow pressure on the gauge of about 30 PSI (2 Bar)

4. Close the pressure relief valve. The pressure should rise to 100 PSI (7 Bar) and after several minutes start making water. If the feed water is brackish or fresh the pressure will be lower. Regulate the feed flow to 2.8 GPM.

5. Allow the system to run for 5-10 minutes and then test the product with your hand held salinity tester. If the product is below 750 PPM it is considered potable and may be diverted to the tank.

6. If the system is equipped with a customer supplied fresh water flush Charcoal filter and valve, the **flush water flow rate must be regulated to 1.5GPM or less**. Ensure that this is the case by timing the flow rate of brine out of the system. Close the service valve, open the flush valve, and collect the brine in a graduated container to time the flow.

System Operation

Normal operation

If the system has been pickled or stored use the New system startup procedure.

1. Check to see that the feed water regulator valve is open to its correct position.
2. Turn the product valve to the "Sample" position.
3. Start the feed pump and check for flow. After five minutes check the product water with your hand held salinity tester. If it is good you may divert it into your tank.
4. Run the system until you have filled your tank or have made enough to meet your requirements for several days.
5. Stop the feed pump.
6. Open the fresh water flush valve and start the flush pump.
7. Flush for 2 1/2 minutes or until fresh water begins to appear at the brine discharge.
8. Return flush valve to its run position.

You may now leave the system unattended for up to five days without further attention. We recommend operating the system for longer periods and effecting a FW flush than running the machine every day and not flushing the system.

NOTE: Flush water must be chlorine free! Use only product water or water filtered through an activated charcoal filter at the manufacturer's specified flow rate.

Long Term Storage Procedures

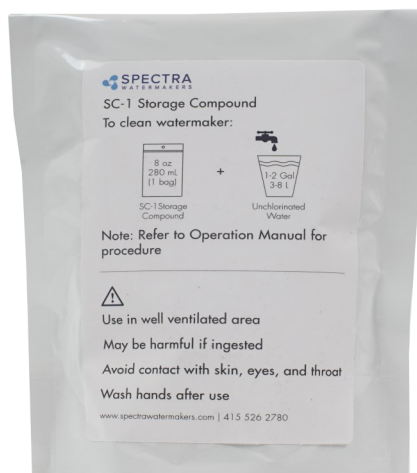
Watermakers are best run continuously. When not in use, biological growth in the membrane is the leading cause of membrane fouling. A warm environment will cause more growth than a cold environment. The fresh water flush system will greatly reduce biological growth but may not stop it completely in certain conditions. If an optional “Zeta Guard” or Z-Brane water treatment system is installed in the system, then three to five day flushing intervals will maintain the system as long as fresh water is provided and the charcoal filter maintained.

System Storage or “Pickling”

If the system is to be left unused for more than five days, perform the following storage procedure. The procedure introduces a chemical compound into the system that prevents biological growth. This procedure requires de-chlorinated water which can be made with the Spectra’s charcoal filter. **Charcoal filters last a maximum of 6 months once wetted.**

Spectra SC-1 is a special storage compound used by the US Navy. It is formulated to be compatible with the modern engineering plastics and composites in the Spectra pumps. Do not use any substitute except propylene Glycol, and SC-1 Storage Compound. SC-1 has to be mixed at a ratio of one Spectra SC-1 container to 3 gallons (12L) of fresh water to have the proper solution. Approximately 2 gallons of water is already in the system which has to be figured in the mixture ratio. Then add 1 gallon of fresh unchlorinated water to the inlet, totaling 3 gallons of water volume. One packet of SC-1 to the 3 gallons of water is considered a proper ratio of SC-1 to water.

Caution! Avoid contact with skin, eyes, or lungs with the storage chemical.



Storage Procedure

1. Perform a fresh water flush as described in the normal operation section.
2. Connect the Intake Service Hose to the Service connection on the Service/Flush Module and set the valve to "Service". Place the Hose in a clean bucket containing 1 gallon of chlorine free water.
3. Disconnect the brine discharge hose and connect the brine service hose to the Clark Pump Brine discharge fitting. Run the hose to the bucket.
4. Mix 1 container of SC-1 storage compound with the water in the bucket. Note that it will take about an hour for all the chemical to dissolve.

5. Make sure the pressure relief valve on the Clark pump is Open 1/2 turn counterclockwise to un-pressurize the system.



Note; If the system is pressurized while chemicals are present, permanent membrane damage may occur.

6. Turn on the service/flush pump. Circulate the storage chemical in the system for approximately 10 minutes.

Clean Up:

Remove the quick disconnect from the Clark pump brine discharge, and replace the original hose. Remove the prefilters, drain the filter housings, and replace the prefilters with clean dry ones.

Turn the service valve 180° back to its original position, restore the system to its operating configuration.

If the system is not equipped with a Service/Flush Module use a portable pump rated at 3GPM or less and at least 40 psi. Use Chlorine free water. Disconnect the feed hose at the flow meter and connect the portable pump discharge hose to the meter.

Winterizing

Storage Procedure

1. Perform a fresh water flush as described in the normal operation section.

Connect the Intake Service Hose to the Service connection on the Service/Flush Module and set the valve to “Service”. Place the Hose in a clean bucket containing 1 gallon of chlorine free water.

3. Disconnect the brine discharge hose and connect the brine service hose to the Clark Pump Brine discharge fitting. Run the hose to the bucket.

4. Pour 2 gallons of Propylene Glycol Potable water antifreeze into the bucket.

5. Make sure the pressure relief valve on the Clark pump is Open 1/2 turn counterclockwise to un-pressurize the system.

If the system is pressurized while chemicals are present, permanent membrane damage may occur.



6. Turn on the service/flush pump. Circulate the antifreeze in the system for approximately 10 minutes.

Clean Up:

Remove the quick disconnect from the Clark pump brine discharge, and replace the original hose. Remove the prefilters, drain the filter housings, and replace the prefilters with clean dry ones.

Turn the service valve 180° back to its original position, restore the system to its operating configuration.

The product water system will not be protected and should be drained or blown out with compressed air.

Note: If the system is not equipped with a Service/Flush Module use a portable pump rated at 3GPM or less and at least 40 psi. Use Chlorine free water. Disconnect the feed hose at the flow meter and connect the portable pump discharge hose to the meter.

Maintenance

General

Periodically inspect the entire system for leakage and chafe on the tubing and hoses. Repair any leaks you find as soon as practical. Some crystal formation around the Clark pump blocks is normal. Wipe down any salt encrusted areas with a damp cloth. Do not tolerate leaks or corrosion, as they will damage the watermaker.

The Prefilter

- Service the prefilter on a regular basis. The pressure will rise on the remote gauge when the filter becomes dirty. Extremely dirty filters will harm system performance and may cause the feed pump to cycle on the high pressure switch.
- To service the filters shut off the service valve open the housing, discard the old filter, Clean out the housing bowl, reassemble the housing with new 5 micron filter element. Leave dry until next startup.
- Use only Spectra approved filters or you may void your warranty. The filters may be cleaned several times with a soft brush and water in a bucket. Occasionally, lightly lube the filter housing O-ring with silicone grease.

The Charcoal Fresh Water Flush Filter

- Replace the charcoal filter element at least every 6 months! This filter protects the membrane by removing chlorine from the fresh flush water. Use only a Spectra replacement!

The Clark Pump

Clark pump requires no routine maintenance except inspection for leaks. Tighten any hose clamps or fittings that show signs of leakage. The High Pressure fittings threaded into the Clark pump are o-ring seals with a straight thread. These should never leak and should never be over tightened. If one of the tube nuts starts to leak it can be un-threaded, sealed with a bit of silicone grease or silicone seal and with two wrenches, tightened very tight!

The Membranes

The membranes need to be cleaned only when they have lost up to 15% of their capacity due to fouling or the product quality degrades. The leading cause of fouling is from biological growth that occurs when the system is left unused without flushing or pickling. Fouling from mineral scaling can happen during operation under certain sea water conditions, and from rust. Monitor the product salinity and feed pressure for higher than normal readings for the conditions. Other conditions can cause high pressure such as cold feed water or clogged filters. Low product flow is usually due to low voltage, damaged feed pump or Clark pump. Look for all other causes before cleaning the membrane. Membrane life can be shortened by excessive cleaning.

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, oil, and dirt particles that get past the prefilters. 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 Water-makers before removing a membrane.

Membrane Cleaning

For normal cleaning, the SC-3 Acid Cleaning Compound is used first, then the SC-2 Alkaline Cleaning Compound. If known bio-fouling is present, the SC-2 may be used first. Using hot water if possible, up to 120° (45C) is recommended as it greatly enhances the ability of the cleaners to do their jobs.

If the history of the system is unknown or has been left “unpickled” for an extended length of time and biological growth is present, it is recommended that the system is cleaned with SC-2, using an alternate source of unchlorinated fresh water before the system is run under pressure. A simple test can be performed to see if biological growth has occurred. Before running the system, remove the prefilters and examine their condition. If the housings are full of smelly discolored water, the system was not properly stored. Install clean prefilters if they were bad. Next check the membrane. Detach the brine discharge hose and lead to a bucket. Open the pressure relief valve one turn, and manually run the system for 30 seconds. 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. Clean the membranes only if performance is reduced.

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

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

Membrane Cleaning Cont.

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

A Spectra Cleaning Compound (SC-2 or SC-3) must be mixed with fresh water at a ratio of 1 container of compound to 3 gallons (12L) of unchlorinated water to have the proper solution. An average of two gallons (8L) of water is already present inside a 150 system . This water has to be figured into the mixture. A 150 system will use 1 container of compound,

Note: If the system is not equipped with a Service/Flush Module use a portable pump rated at 3GPM or less and at least 40 psi. Use Chlorine free water. Disconnect the feed hose at the flow meter and connect the portable pump discharge hose to the meter.

1. Perform a fresh water flush as described in the normal operation section.
2. Connect the Intake Service Hose to the Service connection on the Service/Flush Module and set the valve to "Service". Place the Hose in a clean bucket containing 1 gallon of chlorine free water.
3. Disconnect the brine discharge hose and connect the brine service hose to the Clark Pump Brine discharge fitting. Run the hose to the bucket.
4. Mix 1 container of SC-2 or SC-3 cleaning compound with the water in the bucket.
5. **Make sure the pressure relief valve on the Clark pump is Open 1/2 turn counterclockwise to un-pressurize the system.**

Note; If the system is pressurized while chemicals are present, permanent membrane damage may occur.

6. Turn on the flush module pump. Circulate the cleaning chemical in the system for approximately 20 minutes. Allow the chemical to stand in the system for about 2 hours, circulating it occasionally. The solutions act more rapidly if kept warm.

Clean Up:

Remove the quick disconnect from the Clark pump brine discharge, and replace the original hose. Remove the prefilters, drain the filter housings, and replace the prefilters with clean dry ones.

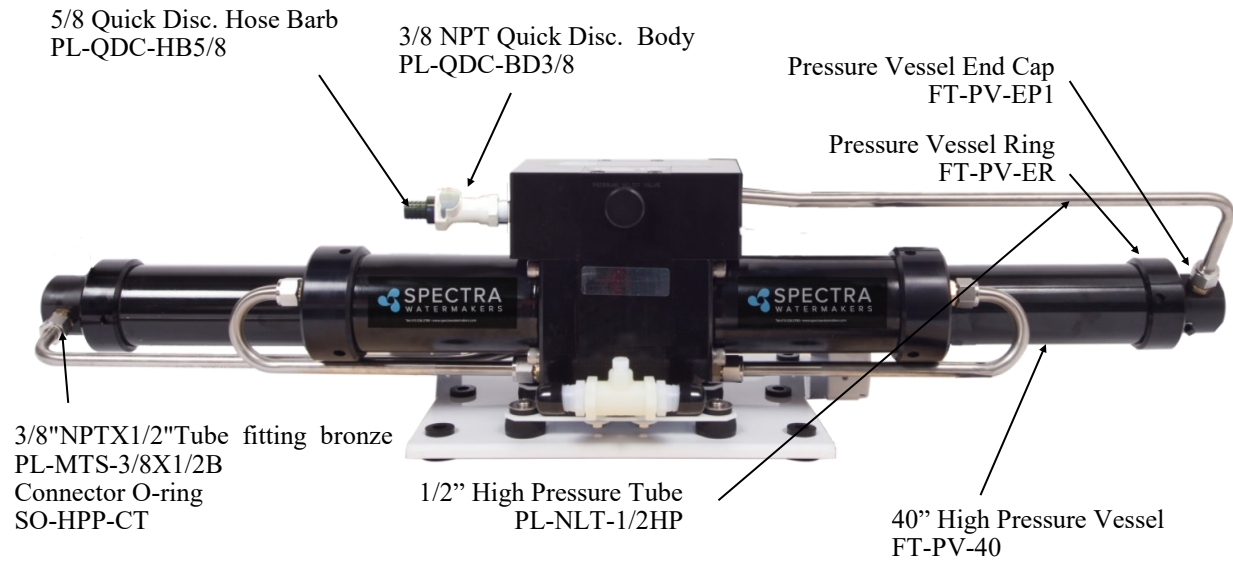
Turn the service valve 180° back to its original position, restore the system to its operating configuration.

Follow the New System Startup Procedures to purge the chemicals from the system.

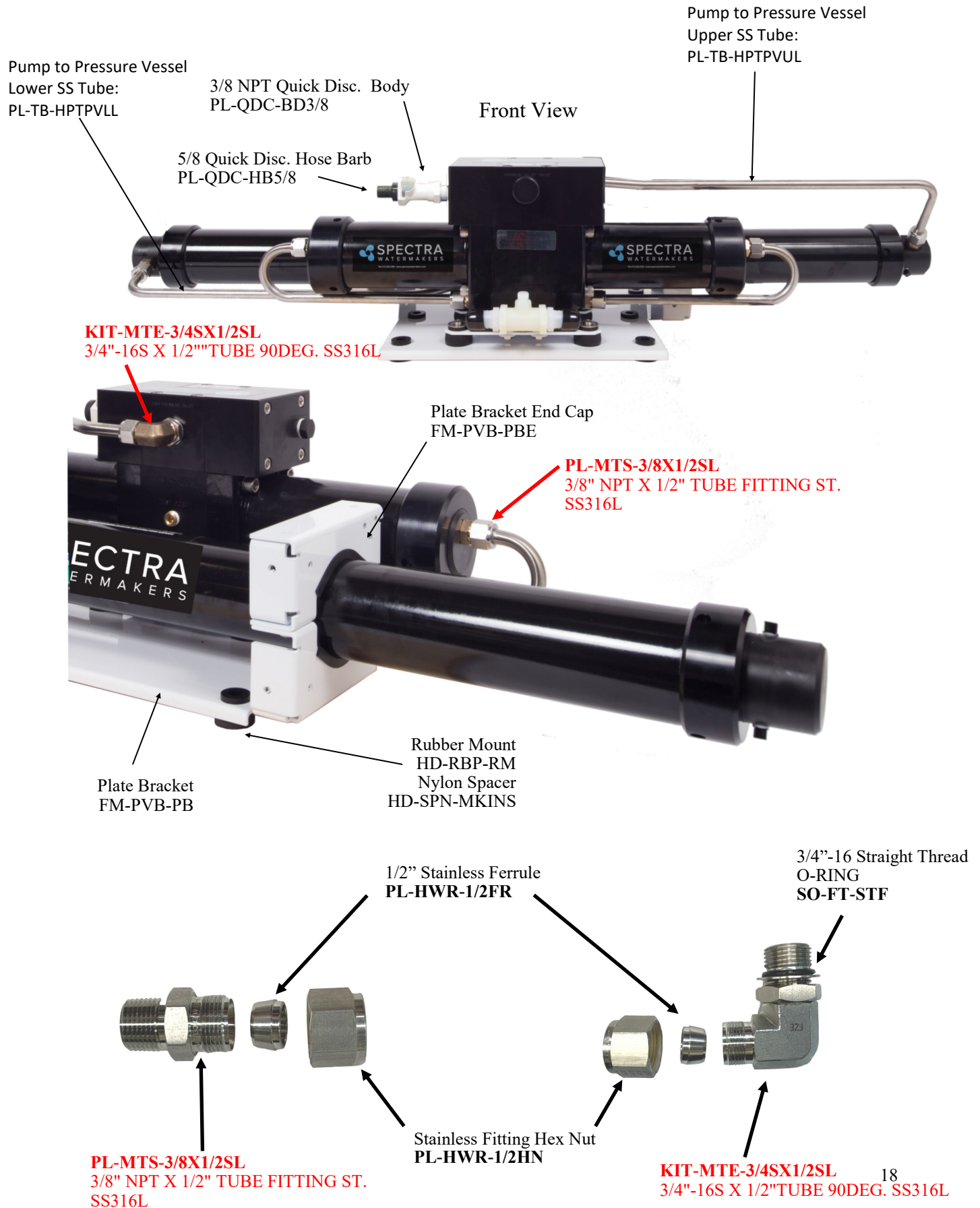
Suggested Spares

Spectra Watermakers parts list:	Part Number:
SC-1 STORAGE CHEMICAL.....	KIT-CHEM-SC1
SC-2 CLEANER.....	KIT-CHEM-SC2
SC-3 CLEANER.....	KIT-CHEM-SC3
BASIC CRUISE A	KIT-BCK-B
5 MIC FILTER.....	FT-FTC-5
CHARCOAL FILTER.....	FT-FTC-CC
20 MICRON FILTER.....	FT-FTC-20
FILTER HOUSING O-RING.....	SO-FHS-10H
OFF SHORE KIT.....	KIT-OFFSH

Part Numbers



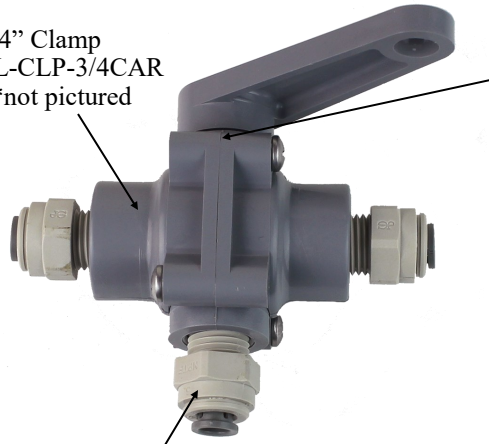
Part Numbers



Part Numbers

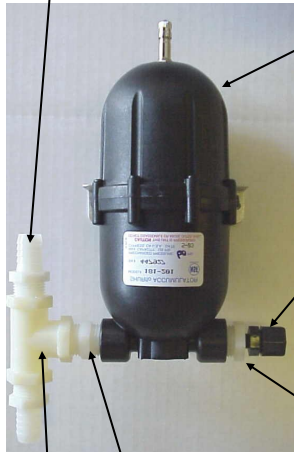
3/4" Clamp
PL-CLP-3/4CAR
**not pictured

1/4" 3-Way Valve
PL-VLV-3W1/4



1/2NPTX5/8 Hose Barb
PL-HBS-1/2X5/8

1/4"NPTX1/4" Tube Fitting El.
PL-MTE-1/4X1/4P



Accumulator Tank
PL-ACC-TK

Spectra Panel
FM-KIT-MP

Product Flow Meter
PL-FMT-20

1/4"NPTX1/4"Tube Fitting
PL-MTS-1/4X1/4J

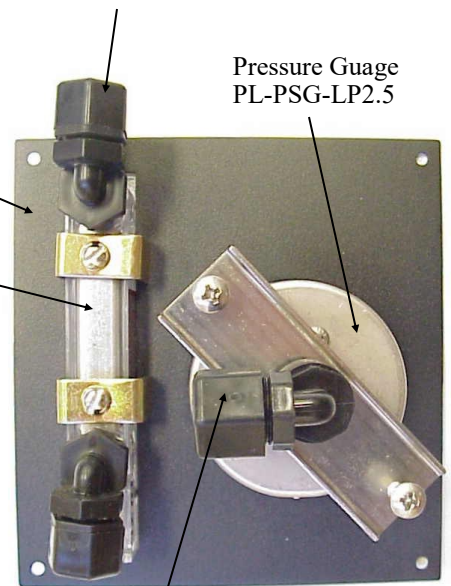
1/2NPT X 1/4FPT Bushing Reducer
PL-BSH-1/2X1/4N

1/2" NPT Nipple
PL-NP-1/2N

1/2" Female Tee
PL-TEE-1/2FN

1/8"NPTX1/4"Tube Fitting El
PL-MTE-1/8X1/4P

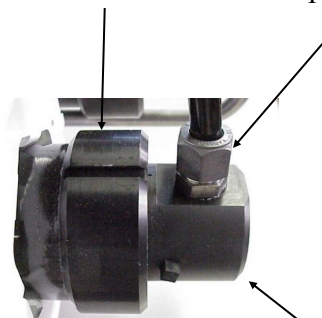
Pressure Gauge
PL-PSG-LP2.5



1/4"FPTX1/4" Tube Fitting El
PL-FTE-1/4X1/4P

Pressure Vessel Ring
FT-PV-ER

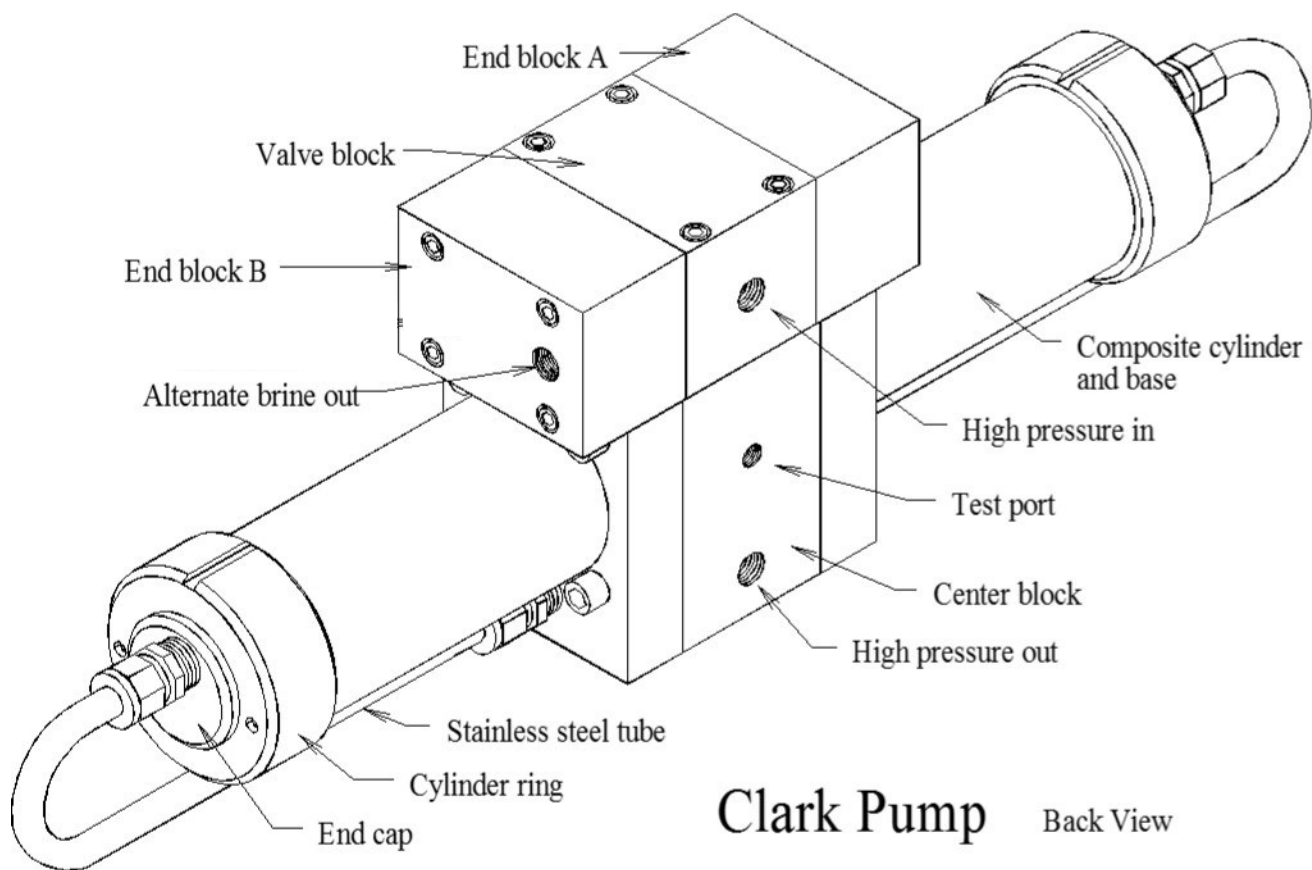
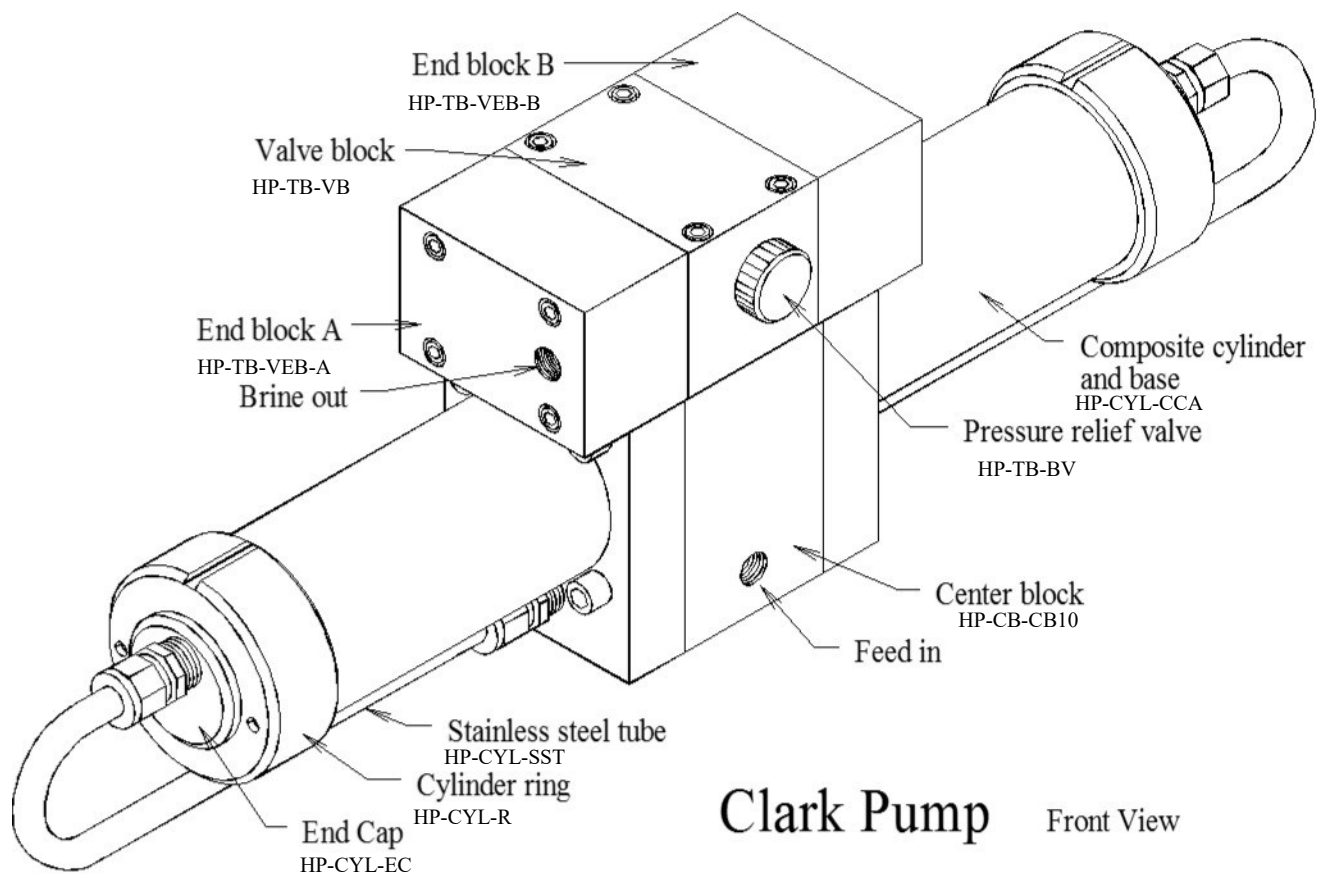
3/8"NPTX1/2"Tube Fitting SS.
PL-MTS-3/8X1/2B



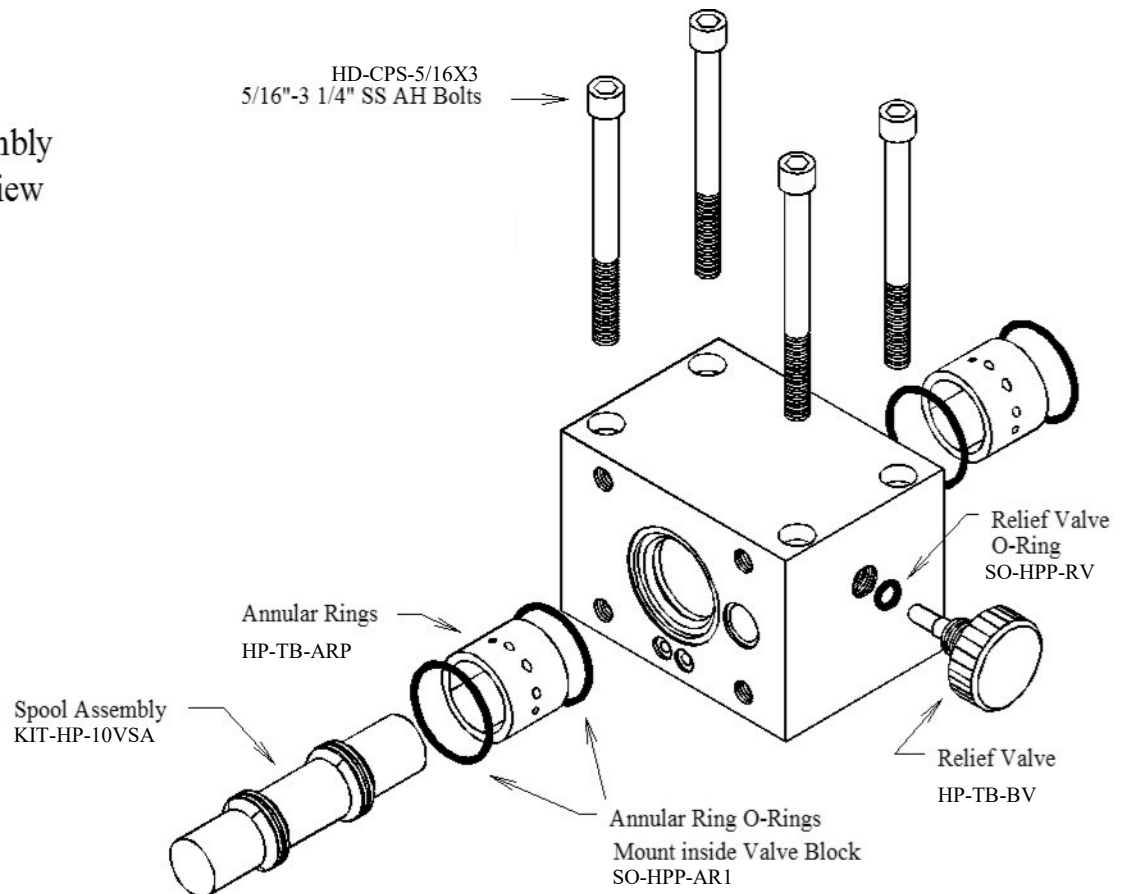
Pressure Vessel End Cap
KIT-PV-25EP1

1/8"FPTX1/4"Tube
Fitting
PL-SWF-1/8X1/4J

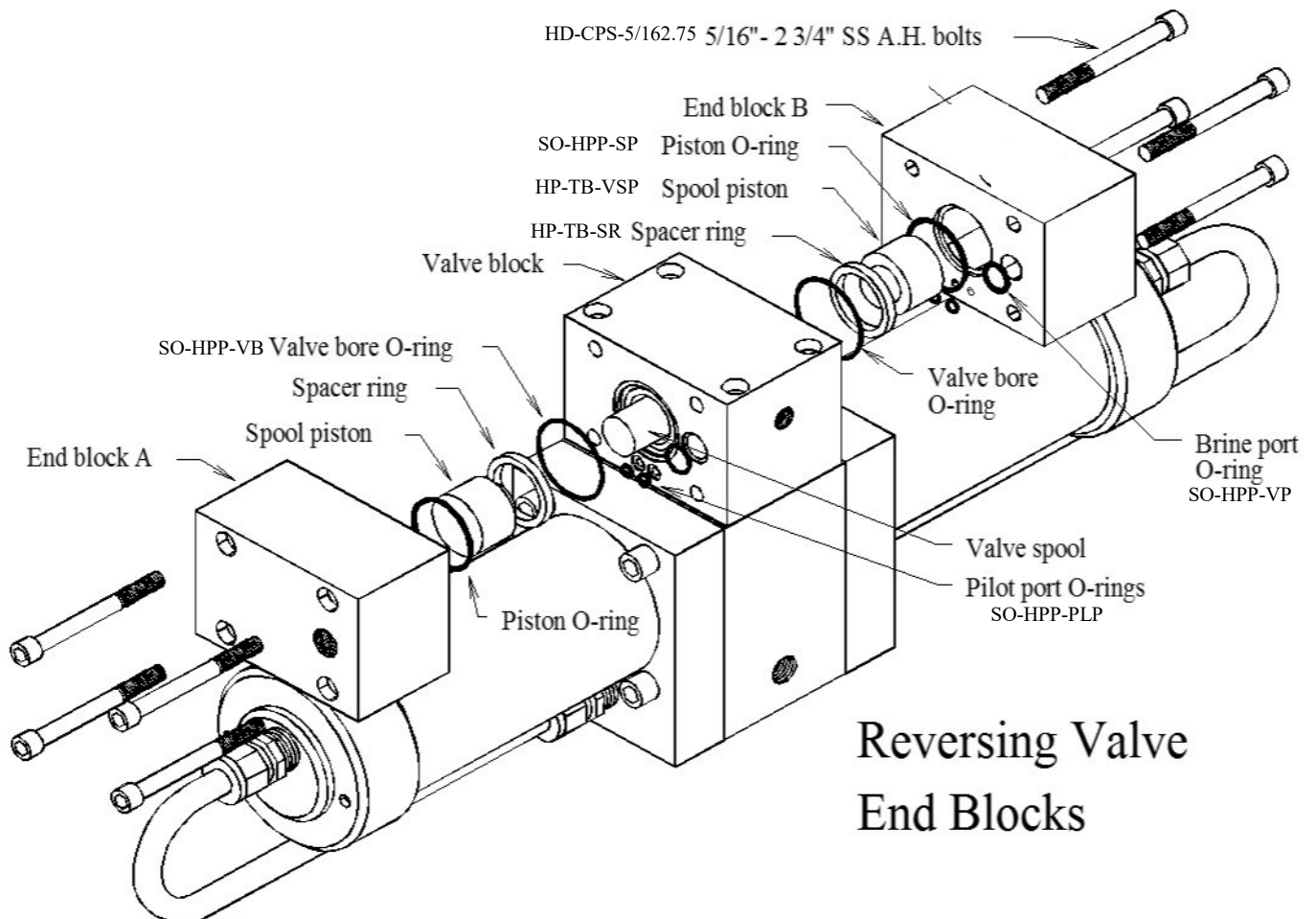




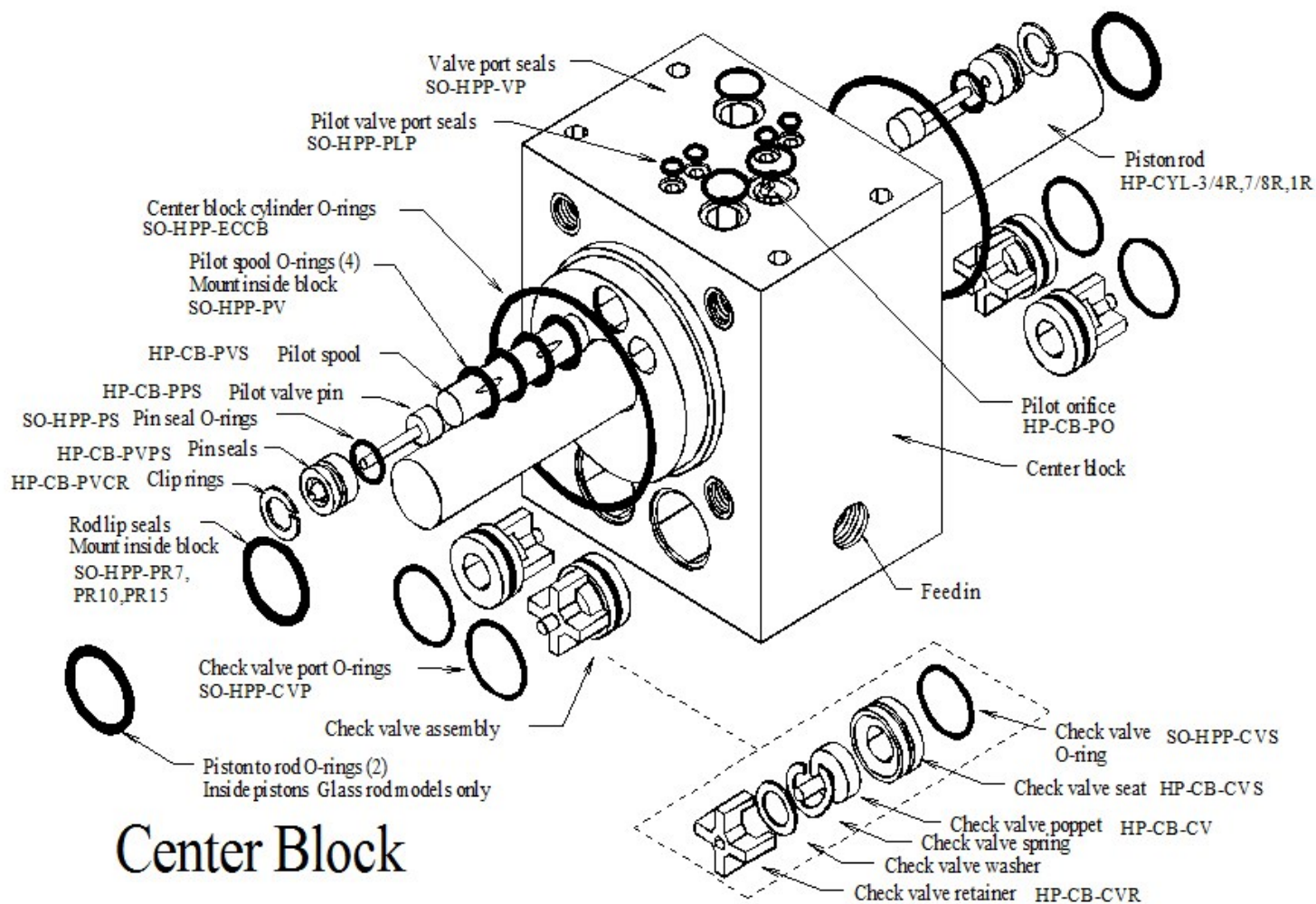
Spool Assembly Exploded View



Valve Block



Reversing Valve End Blocks



Parts

