SPECTRA
WATERMAKERS

LB 1800 F
LB 2800 F
Seawater Desalinator
OPERATOR'S MANUAL

Updated February 2017, from S/N 4300

Manufactured by;
Katadyn Desalination, LLC
20 Mariposa Road
San Rafael, CA 94901 USA

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Getting Started

Spectra Watermakers Land Based Desalination Systems are shipped pre-tested and pickled with propylene glycol for shipment. The system is ready for installation with the options specified with your order. Please 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. A pick list is included in the poly bags containing small parts and fittings.

We will not be held responsible for shortages that are not reported within thirty days of the ship date. Shipping damage must be reported to the carrier within 24 hours of receiving goods.

Next, please 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.

LB 1800F and LB 2800F shipping list:

- Spectra Watermaker in Powder Coated Stainless Steel Frame, Including:
  - Pre-filtration assembly**
  - Fresh Water Flush and CIP tank**
  - Inlet and Brine Discharge Service Connections**
  - Control Box with Automated Control System and Display**
  - Automated Diversion Valve with In-Process Conductivity Sensor**
  - Pressure Regulator for feed
  - Feed Valve
  - DC Power Supply

** components built into frame assembly

- **Install kit;**
  - Service hoses and filter wrench
  - Hand held TDS meter
  - User's Manual
  - Log Book
- **Optional items;**
  - Boost Pump Control Box
  - Boost Pump
  - UV Lamp

INSTALLATION

The LB 1800/2800 F desalinator should be protected from direct sun and weather. UV from the sun will degrade the hoses tubes and fittings used in the system. It is recommended that it be under a roof in a permeant enclosure. Locate the desalinator in a location with good ventilation and drainage.

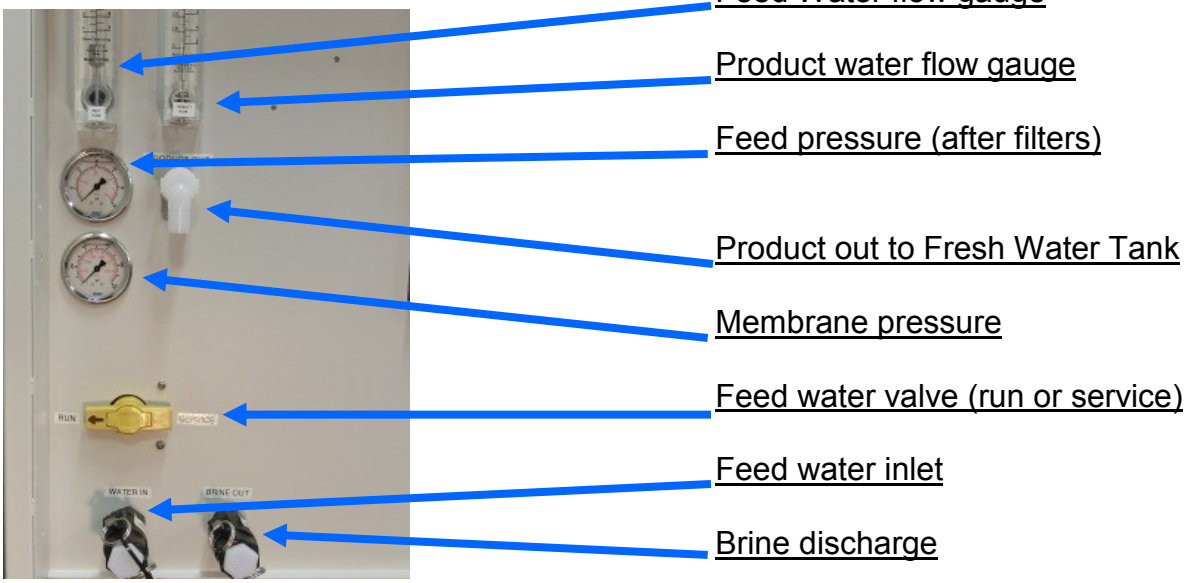
Product Water tubing

The Product Water Outlet is a 3/4" hose barb x 3/4" female pipe thread fitting. Route the product water tube from the product water outlet fitting on the front of the unit into the top of the storage tank. Ideally the product water should fall into the tank so there is no back pressure on the product line. Install a tee in the water tank fill or tap a pipe thread into an inspection port in the top of the tank. Do not feed the water into a manifold or bottom of the tank. Make sure there is no restriction in this plumbing. **The top of the water tank must be no more than 10 feet (3M) above the top of the desalinator frame.**

The limit on the system pumping product water is the back pressure created on the membrane when the system shuts down. If you need the unit to pump water over 10 ft. install a good quality check valve (with low cracking pressure) in the product line as this will eliminate back pressure on the membrane (from the product) when the system shuts down.

A product sampling tap can be installed along the tank fill hose between the outlet and the tank connection. If a sampling tap or filling manifold is to be installed on the product water line, then an "open-before-close" type 3 way valve should be used to ensure that the product water line is never accidentally pressurized.

It is not recommended to use the desalinator as a product water delivery pump. If the product water must be delivered up hill or to a tank more than 50 feet/15M away, run it to a transfer tank and use a separate pump to move water to the desired location.



INSTALLATION

Feed Water Inlet

Feed water must be supplied to the feed water inlet at a minimum pressure of 20psi (1.3bar) and a Minimum Available Flow Rate of 6.5gpm (24.5lpm). Silt density must be less than 3 SDI. If the water supply has a lot of silt in it a settling tank and or media filters are recommended.

Feed Water Inlet

Brine Discharge

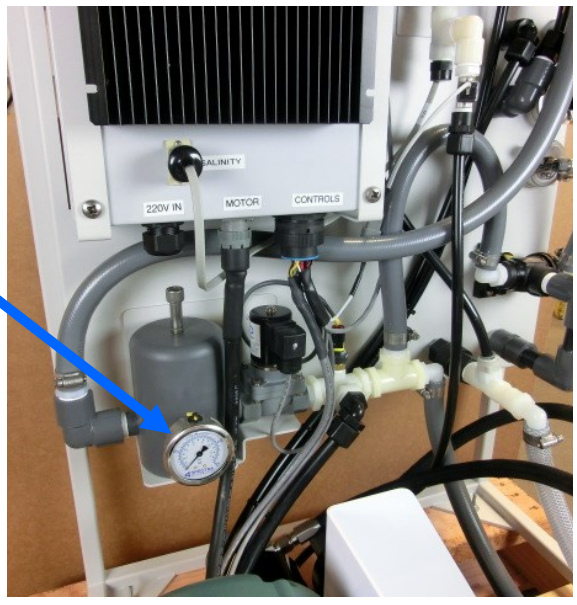
Note that the brine discharge must go to an open drain with an air gap so there is no suction possible.

Route the Brine discharge from the cam lock fitting to a second “injection well” or appropriate drain back to the feed water source, or to another ecologically acceptable location. The brine flow will be roughly 4.5gpm (17lpm) and will be saltier than the feed water.

Pressure Regulator and inlet valve

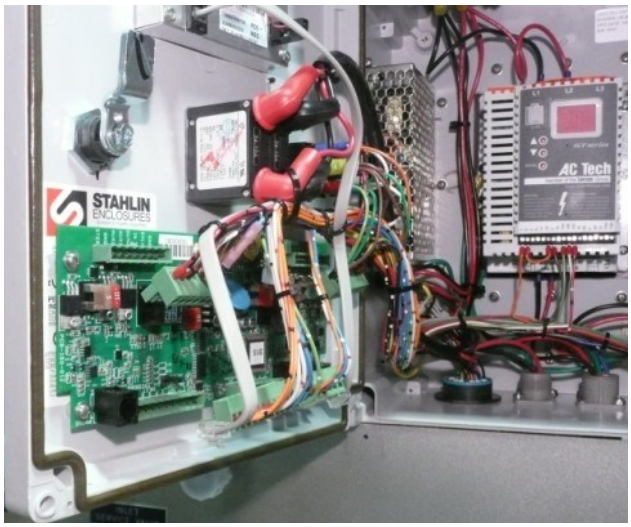
The system requires a regulated inlet pressure of 20 psi (on this gauge) and no pressure when the system is off. The picture at right shows the feed water solenoid valve and pressure regulator assembly.

Adjust the pressure regulator with a 3/8” Allan wrench so the boost pressure shown on regulator gauge is 20psi.



INSTALLATION
Control System

MPC-5000 Controls (all units)



To protect the microprocessor control during transport all the connections to the MPC board are un-plugged prior to shipping (see picture at right). Prior to installation plug all connectors into the nearest receptacle, the harness is tied together so it is easy to determine what goes where.

Electrical Cables

The mains power is connected the Watermaker using a properly sized GFI (Ground Fault Protector) between the equipment and the power source. The unit is shipped with a length of SO cable to connect to the power source. All units use 24v DC for the control circuits and a power supply is included in the box.

Optional equipment

Depending on the configuration ordered the system may have a separate control box for the boost pump contactor or speed control. All the electrical connections are done so that the system cannot be hooked up incorrectly.

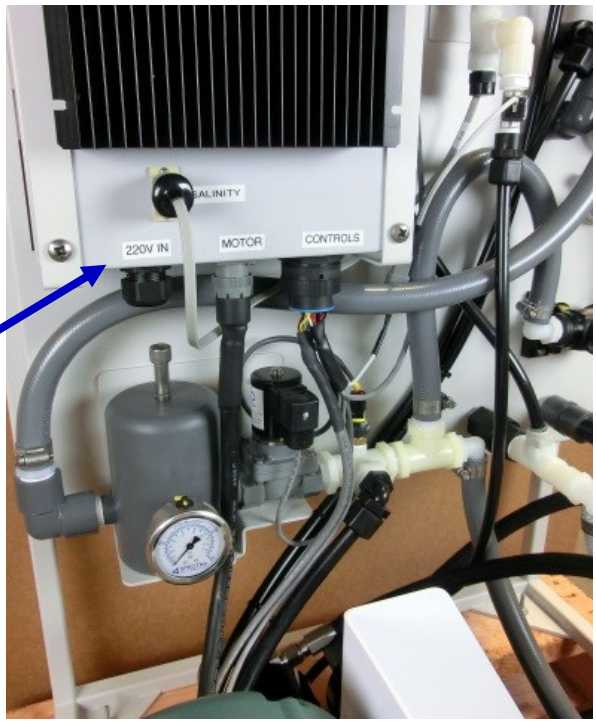
Initial power-up

Be sure the toggle switch is in the RUN AUTO position and the main breaker is off. When power is applied to the unit and the main breaker (Emergency Shut-Off) is in the on position the display light up and go through a start up sequence. The system will sound an alarm and the red light will flash, press the ALARM/DISPLAY button to silence the alarm. The display will read; OPEN PRESSURE RELIEF VALVE NOW which is part of the standard start up procedure sequence. Power the unit off and confirm all plumbing connections are complete.

INSTALLATION

Electrical Cables

All connections to the control box are clearly labeled next to the corresponding connector.



All plug connections are labeled

MPC Display

Manual Run/
Auto Run Switch

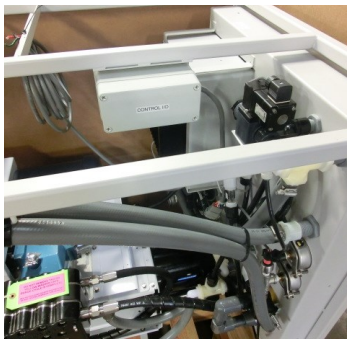
Main Breaker

Connection of Optional Accessories

Use of any external devices not approved by the factory may cause permanent damage to the controller and is not covered by the Spectra warranty. Accessory outputs are limited to 2 amps maximum load! Do not connect motors, pumps, etc. to accessory outputs, please contact Techsuport@spectrawatermakers.com if you have questions.

The external control wiring is marked with a card that shows what each wire is for.

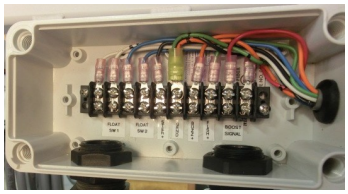
The optional control input and output terminal block (Control I/O) is located on the top cross bar of the system frame.



These circuits are 24vdc:

Float 1	Tank Full float switch
Float 2	Tank low (system start) float **switch**
Ster +	UV Sterilizer, 5 amp
Grnd	DC Ground, common
Buzz	External buzzer/alarm circuit (max 200mA)

Boost Signal is a dry contact for an external motor starter or VFD motor control for the feed pump.



Float Switches
The Spectra LB 1800F and 2800F can have optional tank float switches installed for complete automated operation. See next page for details on installation.

Ultraviolet Sterilizer
The UV sterilizer (5 amp max at 24vdc) is typically wired into the unit unless specified otherwise. The sterilizer will energize when the system is running (except during the purge or flush cycles).

External Buzzer(s)
In addition to the external buzzer(s) installed at each remote control display panel, a buzzer unit may be installed at the control box. The buzzer RED wire connects to the "BUZZ" terminal on the MPC board, and the buzzer BLACK wire connects to "GND."

Boost Signal
A dry contact is provided for control of an external motor starter or VFD motor control for the feed/boost pump. The feed pressure needs to be maintained at the system while the watermaker is in operation.

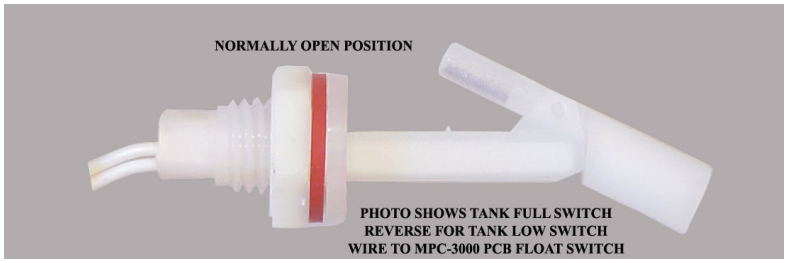
Connection of Optional Accessories

Optional Tank Switch Installation and Operation

There are control wires external to the control box with a laminated tag for connecting float switches. Any float switch can be used that makes a closed contact

For automatic fill and stop.....the unit is wired with both tank full and tank empty switches. Enter **AutoFill Mode** by pushing and holding the Auto Run button on the MPC-5000 display for 5 seconds. When the tank is full and both the tank switches have remained closed for two minutes, the watermaker will shut down and flush itself. The water maker will start automatically when the tank low switch remains open for 2 minutes, and then repeat the above. If the watermaker does not run within five days (or whatever interval you program it for) it will automatically fresh water flush. **AutoFill mode** can be ended by pushing the stop button or the Autoflush button. If the watermaker is in Autorun mode it can be put into **Autofill mode** without stopping it by holding down the Autorun button for 5 seconds.

For manual start and automatic stop.....only the tank full switch is used. Jump the low level tank switch terminal together and the high level float switch will then be used to shut the system off. You can start the watermaker by pressing the **Autorun** button or the **Stop** button (which s a **Start/Stop** button) and it will fill the tank and then shut off automatically (and do a flush. ***DO NOT press and hold the 'Auto Run' button,*** *as Auto Run is only available when both float switches are operational*.



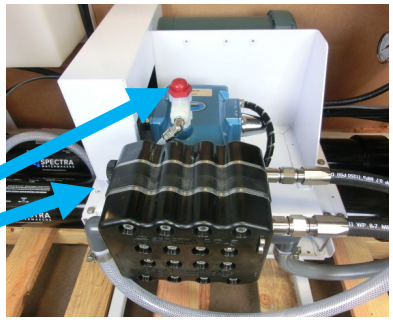
New System Start-Up and Testing

Use this procedure when the system contains Preservative or cleaning chemicals.

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

1. First Check that:

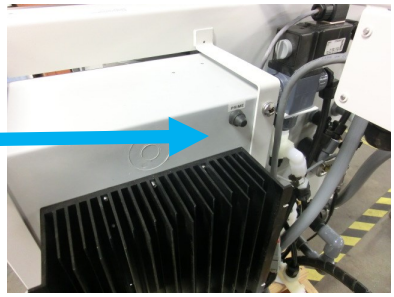
- Brine discharge is directed to a suitable location. The brine discharge will contain a small amount of propylene glycol (potable antifreeze) during the purge cycle
- **The tape is removed from the oil vent cap on the top of the crankcase**
- **Pressure Relief Valve is OPEN one full turn**



2. Confirm the toggle switch on the control box is in the **Run Auto** position and place the Master Circuit Breaker on the front of the control box in the ON position. The MPC control display with go through an initialization process and then display **"OPEN PRESSURE RELIEF VALVE NOW"**

Feed flow and filter pressure gauges
During start up the feed water solenoid will open and a few bubbles is normal but there should be no bubbles after the first minute of operation.

3. Confirm the inlet valve is in the RUN position.



4. Turn on the feed pump or if the feed pump is controlled by Boost circuit, push and hold the **PRIME button** on the back of the control box while purging the air out of the filter housings. You should see pressure on the **Filter Pressure** gauge and use the buttons on top of the filters to purge air out of the filter housings.

Note that the Filter Pressure gauge shows the feed pressure after the filters and before the pressure regulator so feed pressure will drop as the filters clog. Filters should be changed when the pressure drops 5psi from when they were new.

New System Start-Up and Testing (cont.)

5. When the filters are completely filled with feed water you can start the system.

7. Press **Auto Run Button** and the purge process will begin.

The feed pump will start (bleed the filters again if you are seeing bubbles in the feed flow gauge) and the system will go into Purge mode with the Spectra-Pearson Pump running at low speed. The system should prime within 60-90 seconds and if it alarms just start the process again. Check the brine discharge for water flow, there should be no bubbles anywhere in the intake hoses and the Spectra-Pearson Pump should sound smooth after priming. If the pump sound rough, is likely due to low feed pressure (<15psi), find the reason before continuing! Inspect the system for leaks. If the Service Pre-filters alarm is set off, check to make sure that the boost pump is primed and that water is flowing through the system. The air may need to be bled from the filter housings in order to keep the error from recurring.

Note; The system must purge for at least 20 minutes before being pressurized. If the Purge sequence is interrupted you can continue the purge process by using the RUN MANUAL switch to get the full 20 minutes or more of purging.

8. After the purge sequence the control will alarm with the message “Close pressure relief valve” - **Close the pressure relief valve** and proceed by pressing “**Auto Run.**”

9. The system is now running under pressure and making water. The display will read **“purging product water.”** This mode sends the product water to the brine discharge for ten minutes in case there are any residual chemicals in the membrane. After ten minutes the diversion valve will energize and purified fresh water will begin to fill the flush tank. When the flush tank is full water will begin to flow out of the Product Water Outlet.

10. **Carefully inspect for leaks over the entire system!** Shut down the system and repair any leaks you find.

11. Check that the system is operating within its normal parameters. Compare with the chart on the next page.

12. Stop the system by pressing the “Stop” button. If you wish to continue making water restart the system using the Normal Operation instructions on the next page. If the system is stopped with the **STOP** button it will not flush automatically, so if it is not going to run automatically push the AUTO STORE button to flush the system.

MPC Display Functions

Product Flow

LB 1800 Will produce 74 - 76 GPH (280-293LPH)
LB 2800 Will produce 115 - 117 GPH (435-443LPH)

NOTE: To toggle between US standard and Metric Units access the program mode as described in section 2 of this manual.

Salinity

Salinity reads in parts per million. System rejects water higher than 750 PPM.
Anything below 500 is excellent.

Membrane Pressure

Membrane pressure will vary depending on feed water conditions. Normal operation will see pressures between 600 and 800 psi when desalinating seawater. At no time should membrane pressure exceed 900psi.

Filter Condition

PREFILTER warns that filters are getting dirty. Clean filters as soon as convenient. If the graph reaches full scale the machine will automatically slow down to Run Low speed. If it reaches full scale again it will alarm Service Prefilters and shut off the watermaker. The number in the top right corner represents Boost Pressure from the Boost Pump. As boost pressure drops, more boxes will fill in, indicating clogged filters.

Normal Start Up Using the Auto Run Button

If the system contains preservative or cleaning chemicals follow the directions for New System Startup or Membrane damage will occur!

Normal Run

- Press Auto Run button once and the system will start and run for 1 hour. The display reads "AUTO RUN MODE—1:01" then "STARTING" with a 10 second priming countdown. Each time you tap the **"Auto Run"** button an hour of run time is added, up to a total of 12 hours. Additional hours can be added at any time during the run cycle.

- Pressing the Alarm/Display button will scroll through the system data.

- When the run timer reaches the end of its sequence the system will automatically fresh water flush. Check that the brine discharge is below 1000 ppm to confirm the freshwater flush is working correctly.

- Pressing the Stop button while the system is running stops the system, regardless of mode of operation, at any time with no flushes. Pressing the Stop button when the unit is off will start the watermaker.

- The system can be re-started from any mode by pressing the **"Auto Run"** button, and the sequence above will start all over again.
- For optimum performance, run the system for up to 23 hours per day (it should be flushed with fresh water at least once every 24 hours). **Never let the system sit with salt water in it.** Never allow air leaks in the intake, these can damage the Spectra-Pearson Pump.

Normal Shut Down

- If the system was started using the **"Auto Run"** button, the system will shut off on its own when the selected run time is over and will automatically fresh water flush.

- Pressing the Stop button at any time will shut off the system with no automated flush.

- If the *Auto Run Cycle* was stopped before the timer ran out then press the **"Auto Store"** button to initiate the fresh water flush sequence.

Note: Periodically Check all plumbing connections for leaks, including the oil pump and filter assembly.

If the gauge on the outlet of the optional charcoal filter reaches 15psi during operation, this filter has been fouled and should be replaced.

Start Up Using the 'Stop' Button

If the system contains preservative or cleaning chemicals follow the directions for New System Startup or Membrane damage will occur!

Normal Start Up

- Turn on the Power supply.

- Check the feed, brine, and product water connections.

- Start the Boost Pump* (feed water supply) if controlled separately and confirm that there is pressure at the desalinator by depressing one of the bleed buttons on the prefilters or checking the feed pressure gauge.

If the machine is equipped with the optional Boost Pump and Controller from the factory then skip this step.

- **Confirm the pressure relief valve is closed**

- Press the "Stop" button. The Stop button will start the system if it is off and stop it if it is running. The system will run indefinitely using the Stop button, you will need to shut it off and flush it.

Normal Shut Down

- Press the "Stop" button.

- *Turn off the feed water supply pump.
  **Skip this step if optional boost pump is supplied from the factory*

- Press the "Auto Store" button. The flush water pump will activate and the display will read **"FRESH WATER FLUSH"** with a countdown timer. The Spectra-Pearson Pump will start, and the system will flush for the pre-programmed time.
- For optimum performance, run the system as long as possible at one time. **Never let the system sit with salt water in it.** Never allow air leaks in the intake, these can damage the Spectra-Pearson Pump.

Log Book

Keep an accurate daily log of the operating conditions. If any of the parameters change it may indicate that chemical treatments or mechanical repairs are required.

- An increase in membrane pressure may indicate membrane fouling.
- A decrease in product water quality (higher ppm) may indicate membrane damage.
- A decrease in product water production may indicate Pearson pump damage or wear.

Monitoring the System

Pressing the Alarm/Display button will scroll through the system data readouts.

Product Flow

LB 1800 produces 74 - 76 GPH (280-293LPH)
LB 2800 produces 115 - 117 GPH (435 - 443 LPH)

NOTE: To toggle between US standard and Metric Units access the program mode as described in section 2 of this manual.

Salinity

Salinity reads in parts per million. System rejects water higher than 750 PPM. Anything below 500 is excellent.

Membrane Pressure

Membrane pressure will vary depending on feed water conditions. Sea Water operation will see pressures between 600 and 800 psi. If the membrane pressure exceeds 900psi (60bar) the high pressure pump will slow down to “Run Low Mode” If the pressure is still too high the controls will shut down the system and alarm “High Pressure”.

If necessary membrane pressure can be reduced by reducing feed pump rpm using the speed control potentiometer inside the control box. Contact the factory for detailed instructions.

Filter Condition

PREFILTER warns that filters are getting dirty. Clean filters as soon as convenient. If the graph reaches full scale the machine will automatically slow down to Run Low speed. If it reaches full scale again it will alarm Service Prefilters and shut off the desalinator. The number in the top right corner represents Boost Pressure from the Boost Pump. As boost pressure drops, more boxes will fill in, indicating clogged filters.

Manual Operation

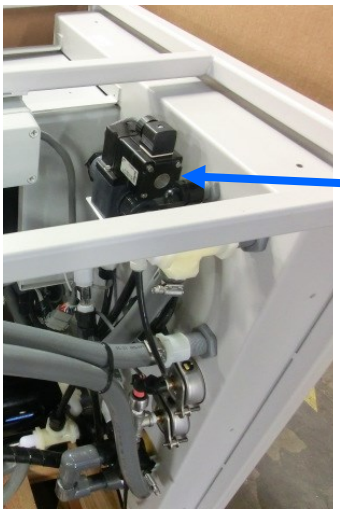
In the event of a component failure resulting in a shut down due to a false alarm, the failed component can be overridden using the Programming Function on the display. **High Pressure**, **Service Prefilter**, **System Stalled** (airlock), and **Salinity Probe Failed alarms can be defeated**. If one safety shutdown is disabled, the other safety shutdowns will still be active. The pressure sensors and salinity probe can also be calibrated from the display. Complete instructions are found in Part 2 of this manual under "Programming from the Display". **Be absolutely certain that the alarm is false before defeating the automatic controls.**

In the event of complete MPC control failure, the system may be operated manually by using the manual run switch on the Electrical Box and manually opening the diversion valve. **The automatic safety controls are disabled in manual mode.**

- For manual operation, start the Boost Pump if not controlled by the MPC. Start the Spectra-Pearson high pressure pump by setting the run manual switch to "MAN RUN ". Close the Pressure relief valve. Shut the unit down if the Spectra-Pearson Pump knocks loudly or sounds rough or if air is continuously present in the intake line.

- The diversion valve, an electrically operated three way valve which is normally energized by the MPC controls to send water to the tank, will not open automatically in manual mode. Instead, it must be opened using the mechanical override button on the valve. The button is located on the side of the valve opposite the electrical connection and above the plumbing fittings. Firmly *press the button in* as far as it will go and *rotate it 90 degrees Clockwise*. This locks the diversion valve open.

- Each time the system starts the product water will be about 2000ppm, but will quickly drop to an acceptable range in the first minute or two of operation so you will get about ½ gallon of high salinity water at the beginning of the production cycle. As long as you run the watermaker for more than 2 or 3 hours the average salinity of the water in your tank will be acceptable.



Diversion Valve
Manual Bypass
Button

Manual Run
Toggle Switch

Manual Operation Continued...

Manual Shutdown

- To shutdown the watermaker when operating manually switch the Manual/Auto/ Service switch to “Auto.”
- Turn off the feed water supply pump, if manually operated.
- Switch the Manual/Auto/Service switch to Service. The flush pump and high pressure pump will start, and the flush tank will begin to empty.
- When the flush tank is nearly empty, or the flush pump starts sucking air, return the Manual/Auto/Service switch to Auto. Both pumps will stop.
- Return the diversion valve to the “divert” position by rotating the button 90 degrees and allowing it to pop out so it is read for automatic operation.

WARNING: Do not let the pumps run dry as Permanent damage will result.

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.

System Storage for up to 6 months, "Pickling"

If the system is to be left unused for more than 2 weeks, perform the following storage procedure. The procedure introduces a chemical compound, SC-1, into the system that prevents biological growth.

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, SC-1 Storage Compound has to be mixed at a ratio of 1 Spectra container to 3 gallons (12L) of fresh water to have the proper solution. An average of 3 gallons (11L) of water is in the system. This water has to be figured in to the mixture. The system uses two SC-1 containers.

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

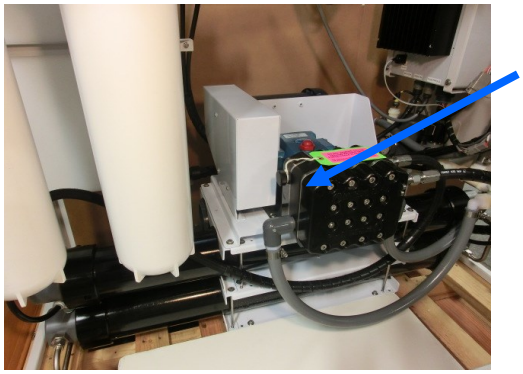
Long Term Storage Procedures

Storage Procedure: SC-1 powdered preservative (good for 6 months):

1. Fill a bucket with 3 gallons of fresh unchlorinated water. Mix 2 containers of the SC-1 storage chemical compound into the water in the bucket. Note that it will take about an hour for all the chemical to dissolve.

2. If the flush tank is full push the “Auto Flush” button on the display If the machine has already been flushed go to step 3.

3. Install the service hoses from the service kit on to the inlet and discharge connections front of the unit and turn the yellow service valve to service.



4. Confirm the pressure relief valve on the high pressure pump is open .

5. Close the flush tank valve; Handle pointing left is flush, point right is drain and halfway is off.

6. Flip the toggle switch on the control box to “Service” to turn on the feed pump and flush pump. Circulate the storage chemical in the system for approximately 20 minutes. Set the switch to “Run Auto” when finished.

Clean Up:

Remove the service hoses and replace the dust caps. Turn the valves back to the ‘Run’ position.

Discard the remaining liquid in the bucket to a suitable drain.

Turn off the power to the system.

LEAVE THE PRESSURE RELIEF VALVE OPEN

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 salt crystal formation around the Spectra-Pearson Pump blocks is normal. Wipe down any salt encrusted areas with a damp cloth.

Pre-filters

Service the pre-filters as soon as possible after the pre-filter condition graph begins to rise. If the filter condition graph gets all the way to “Replace” the machine will run at low speed until the filters are replaced. When the display reaches “Replace” a second time the alarm sounds and the system will shut down to prevent damage.

To service the filters shut off the system including the feed water supply pump. Open the housings and discard or clean the old filters. Clean out the housing bowls, reassemble the housings with new 20 and 5 micron filter elements. The 5 micron filter goes downstream from the 20 micron. Leave dry until next startup.

It may be necessary to bleed excess air out of the filter housings using the Purge buttons, located on the filter housing lids.

Use only Spectra approved filters or you may void your warranty. The filters may be cleaned a limited number of times by soaking them in water in a bucket overnight and letting them dry. Do not use a brush or water jet to clean the filters. If filters are to be re-used clean when the filter condition bar graph first begins to rise. Occasionally, lightly lube the O-rings with silicone grease.

Maintenance continued….

The Membranes

The membranes need to be cleaned only when operating pressures have risen more than 10% or the product quality degrades. The leading cause of fouling in marine use 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 bar graphs 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 issues. 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 Watermakers 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. Use hot water if possible, up to 120° F (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. Attach the brine discharge service 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.

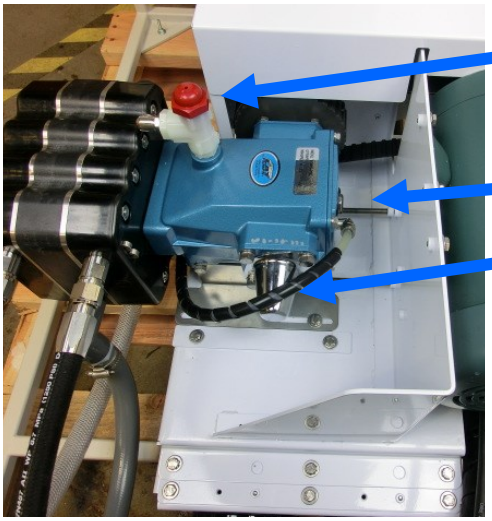
MAINTENANCE

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 5000 hours or annually, whichever comes first.

The Spectra– Pearson Pump comes mounted on a counterclockwise rotating CAT™ crankcase. **Inspect the oil level and condition often.**

The oil in the crankcase should be changed every 5,000 hours or when the oil appears milky. Note that if the oil appears milky it is time to change the seals as water is getting into the crankcase from the pump head. There is an inspection window on the back side of the crankcase that will show the oil level and condition.



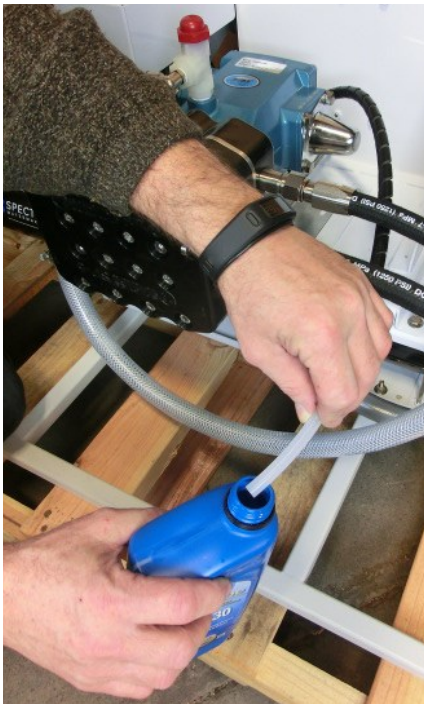
Vented Oil Cap

Inspection Window

Drain tube

Push in collar on fitting and pull out drain tube

Route drain tube so oil will drain into an appropriate container



CHANGING THE OIL

1. The oil will drain better it it is warm , after the system has been running for a few hours.

2. Disconnect the drain Tube from the (push-to-connect) fitting by pushing the collar in and pulling the tube out.

3. Replace drain tube and refill with 5W-30 Synthetic oil.

Please dispose of used oil responsibly.

Spectra Watermakers Troubleshooting Procedures

Error Messages

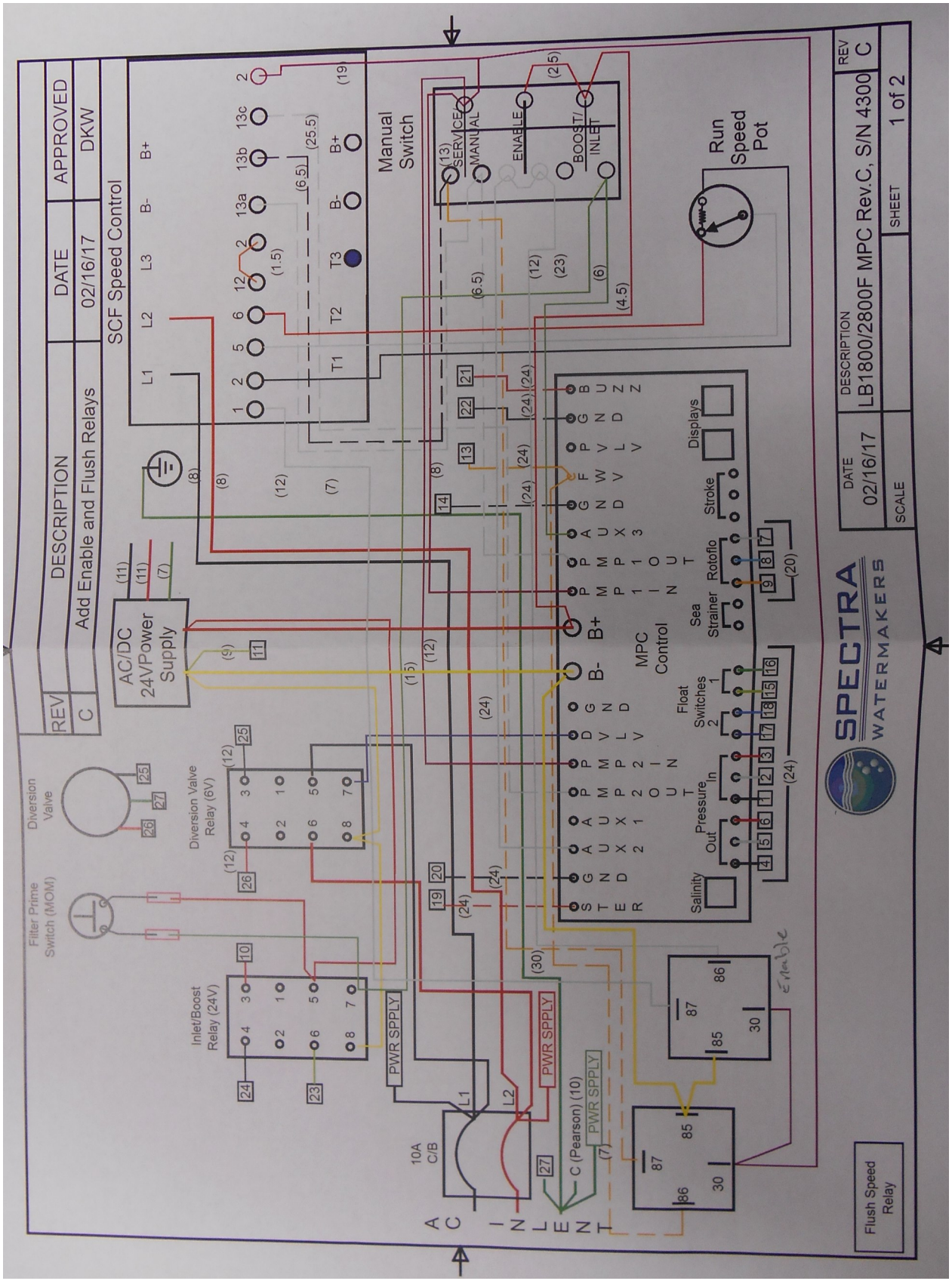
SYMPTOMS	PROBABLE CAUSE	REMEDY
Spectra-Pearson Pump runs constantly, will not turn off	Manual override switch in "MANUAL" position	Turn off manual switch on control box
Spectra-Pearson Pump knocks and bangs loudly	Air in system Boost Pressure too high	- check feed water delivery system - Replace feed pressure regulator
No lights or display, system does not operate	- No DC power to control box	- Check display cable connections at back of display and at control box - Check and reset main DC supply breaker - Check for voltage (12 or 24vDC) at control box power input studs - Try manual bypass switches; if pumps run, then control or display is defective
Display activates, but pump will not run	- loose or broken pump wire connection - speed control shutdown - AC power not turned on to system	- Check wiring at terminal block inside MPC - check speed control fault display - Check AC power
System runs, no product water delivered to water tanks, GPH display shows OK, "Good" LED activated	- diversion valve inoperative wiring fault. - disconnected or broken product tubing - diversion valve faulty	- Check wiring at diversion valve and inside control box - Check product tubing - Replace valve (contact factory)
System runs, no product water delivered to water tanks, GPH shows OK, "reject" LED activated	- high salinity of product water, causing system to reject water - salinity probe out of calibration or defective, bad cable - chlorine damage to membranes	- Check for proper boost/ membrane pressure, - Check for leaks at high pressure hoses - Test product water with hand-held tester– if over 750ppm for 1 hour, contact factory

Spectra Watermakers Troubleshooting Procedures

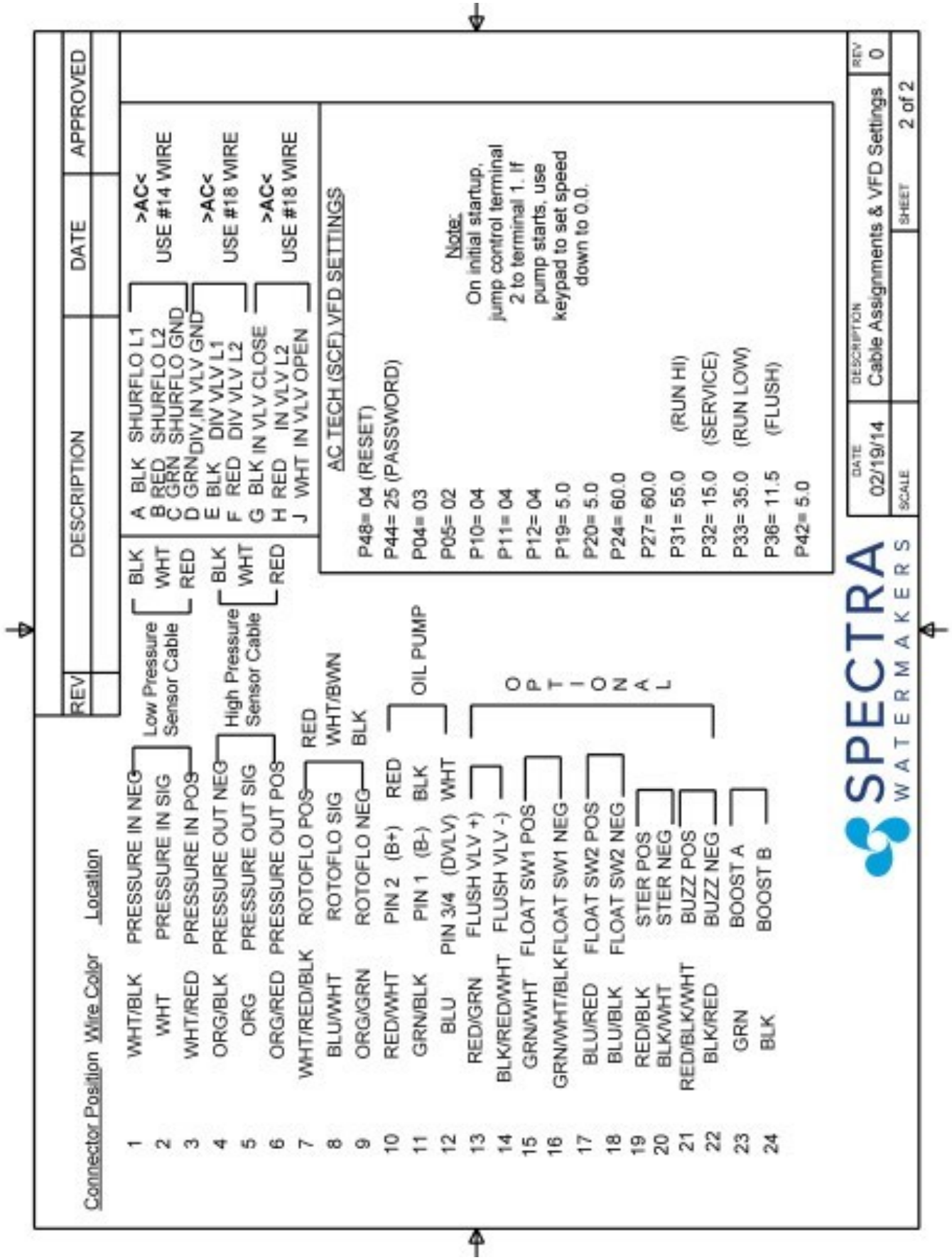
Error Messages

SYMPTOMS	PROBABLE CAUSE	REMEDY
"System stalled" ("system stalled" may alarm when using the control panel to run system for servicing with the pressure relief valve open– use manual override switch instead)	- pressure relief valve open - no signal from flow meter	- Close pressure relief valve - Check flow meter wiring at control box - Replace flow meter
"High Pressure"	- blocked brine discharge - fouled membrane - feed salinity too high	- Check brine discharge - Clean membrane - Reduce high pressure pump rpm
"Voltage Too High" "Voltage Too Low"	- battery voltage too high or low - loose wires or poor connections	- Charge batteries - Check charging voltage - Check power connections
"Re-starting"	- no signal from flow meter at startup.	- See "system stalled"
"Check Fuse" (followed by fuse number)	- blown fuse at circuit board	- Replace fuse (mini automotive type ATM) - Look for cause
"Service Prefilter"	- clogged filters - loose or defective pressure sensor wire - Incorrect setting on MPC	- Install new filters - Check sensor wiring - Check Program setting parameters
"Salinity High"	- high product water salinity - chlorine damage to membranes - defective salinity probe or cable - cable disconnected	- Check for low feed pressure - Check for leaks at high pressure hoses - Remove and clean probe contacts check calibration. - Check cable connections - Clean membrane

AC SYSTEM WIRING



AC TECH SPEED CONTROL SETTINGS & CONNECTOR PIN-OUT



Operation and Repair Bulletins

The following documents are sections of our complete service bulletin set available on our website Spectrawatermakers.com. Technical Support, - Service Bulletins.

MB-2 MEMBRANE CARE

Membrane life is affected by a large number of factors and is somewhat unpredictable. A big commercial plant running 24/7 will get 10 to 12 years out of a set of membranes. But they do all kinds of fancy chemical injections and never shut the thing off. Most cruisers are lucky to get five or six years out of one. The biggest killers of membranes are lack of use, chlorine damage, and improper storage.

Don't let membranes sit around with sea water or stale fresh water in them. Biological growth will occur in the membrane. Here at the factory we frequently get back membranes for inspection that reek of hydrogen sulfide (rotten eggs). This odor is produce by anaerobic bacteria that live in an unused membrane, feeding on whatever animal or vegetable matter is trapped in it from the plankton that gets through the system. Membranes badly fouled in this way can seldom be saved. These bacteria are always present but are inhibited by the oxygen in sea water while the unit is in frequent use. If you won't be frequently using your membrane you can prevent biological growth by Fresh Water Flushes or by Pickling your membrane. Keeping the prefilters clean is also important in preventing bio-fouling. If your prefilters are allowed to become a breeding ground for bacteria (get smelly), the contamination will spread throughout the system. When we cut open a failed membrane we also find mildew, another form of bio fouling, probably due to long term storage with no biocide or stale biocide.

After many hours of water making mineral deposits will form and must be dissolved away with an acid cleaner. Alkaline cleaners are used for bio-fouling. Cleaning chemicals, especially the alkaline, are not good for the membrane. Every time you clean the membrane it shortens its life. Clean only when necessary, and avoid cleaning as a "diagnostic tool".

Chlorine destroys a membrane in minutes. It attacks the material that the membrane is made from. Always use product water or water filtered through a charcoal filter for flushing and chemical treatments.

Oil clogs the membrane. We have brought back oil fouled membranes with Joy soap (See MB-5 Cleaning with Detergent.)

For storage we recommend using propylene glycol potable water system antifreeze if available. It can safely be left in the system for one year and will keep things from freezing in cold conditions. It is hard to find in warm climates, and takes up a lot of room on a small boat, so our SC-1 is best for tropical cruising.

MB-5 MEMBRANE CLEANING WITH DETERGENT

If the membrane has been fouled with oil it may be possible to save it by cleaning with dish soap such as Joy. Do not use anything that contains bleach. You will need a lot of chlorine free fresh water. If using shore water run it through a charcoal filter at a rate of not more than 1.5 gallons (6 liters) per minute.

Use the “Membrane Cleaning Procedure”

Fill a bucket with fresh water and mix in a couple squirts of the detergent. Run the system unpressurized (with pressure relief valve open) with the watermaker drawing water from the bucket and discharging overboard. When about half the water is gone from the bucket stop the unit and let the membrane soak for a few minutes. Restart and pump the remaining solution overboard. Repeat until the discharge appears clean.

After most of the oil is cleaned out you can put the brine discharge into the bucket and run the system with the soapy water circulating as you would for the other cleaning chemicals. Run the Fresh Water Flush cycle to clean membrane, then flush for twenty minutes using sea water. Pressurize and test.

MPC-5 PURGE MODE BYPASS

Whenever the control power (12 or 24 volt DC) has been shut off the system will prompt you through the purge mode when it is turned back on.

This is because the only time the MPC-5000 should be turned off is after the system has been pickled.

Purge Mode prompts the operator to open the pressure relief and then runs seawater through the system for 20 minutes to clear away the chemicals. Normally, during periods of disuse the MPC-5000 will remain powered up so that it can do the five day flush cycles, and no storage solution will be present. If watermaker has not been filled with storage solution, Purge Mode can be bypassed by tapping the two left hand buttons at the same time until the display reads PURGE MODE BYPASSED. Push **Auto Run** and **Stop** simultaneously.

BAD SMELLING PRODUCT WATER

The reverse osmosis membrane is permeable by many gases including hydrogen sulfide, the gas that causes rotten egg smell. If there are bad odors in the feed water they will go through the membrane and the product water will be affected. Usually the source of the odor is from the decay of plankton trapped in the sea strainer and prefilters. These tiny oxygen loving creatures soon suffocate and die inside the prefilter housings when the unit is shut down and begin to decay. Once this decay starts the only solution is to rinse the prefilter and let it dry completely (to kill the bacteria) or just replace it with a new filter. If the system is making smelly water, it will be the prefilters that are the source of the problem. In cold climates this process of decay and take weeks, but in very warm waters this can happen overnight. These bacteria can spread throughout the watermaker, and begin to grow on the membrane, causing poor water quality and high feed pressures.

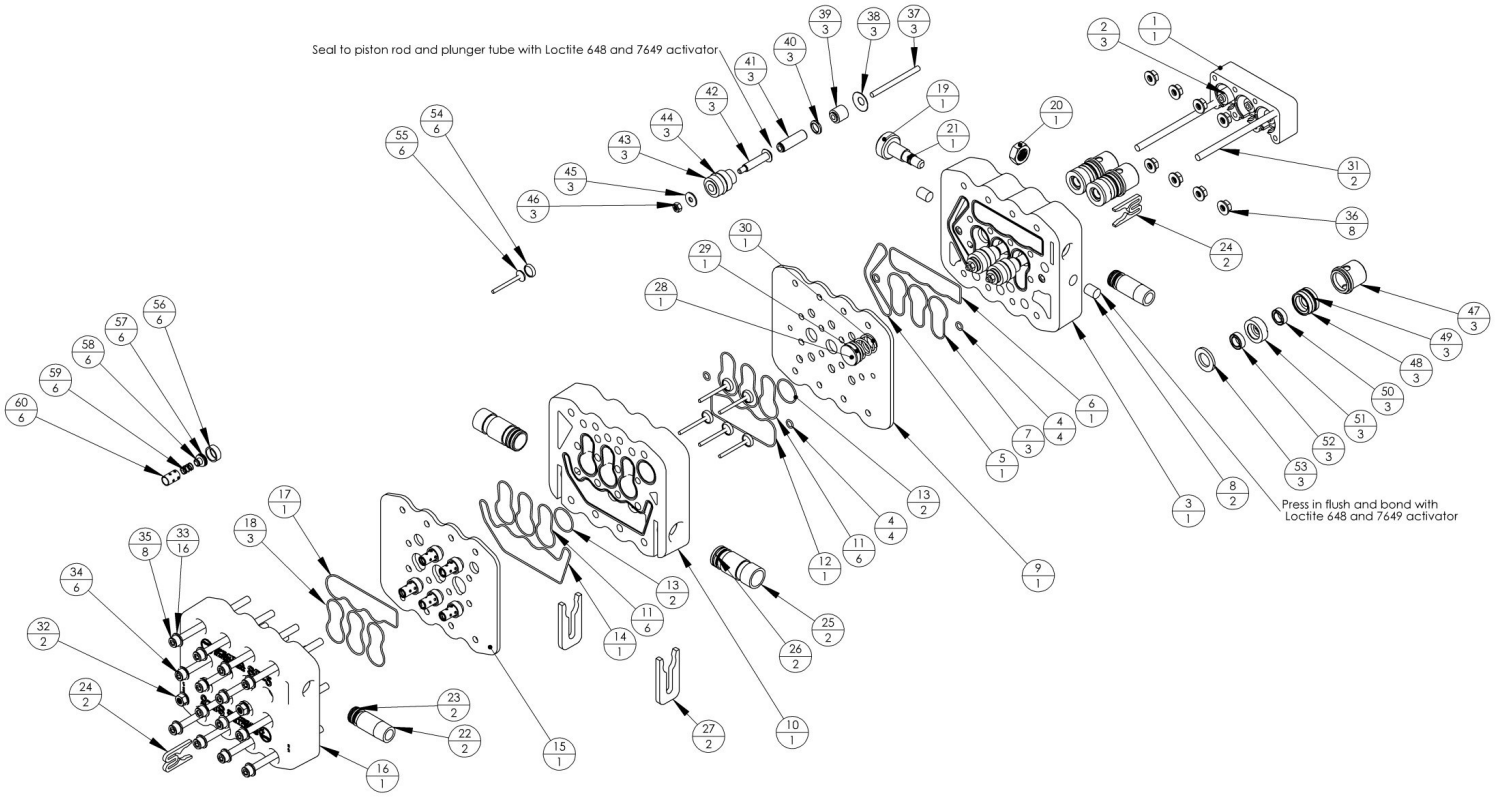
Flushing the system with fresh water after every use greatly slows this process, allowing the automated spectra units to operate with less frequent prefilter changes, but units operated for only an hour or so a day will probably need to have the filters changed due to odor before they are dirty enough to restrict water flow. After shutting down the unit remove the used prefilters and install a clean set. Leave the housings full of air until the next use. Given gentle handling, prefilters can cleaned and reused up to 3 times.

If the rotten egg smell does not go away after operating the watermaker for 6 or 8 hours it may be time to clean the membrane with SC-2. Typically the smell will go away with use, but if it persists cleaning may be indicated.

The Z-ION was created to eliminate this problem by disinfecting the system during each fresh water flush, disinfecting the filters and the membrane.

More on this subject is available on our website at www.spectrawatermakers.com.

Oct 2013



ITEM NO.	Title	QTY.	
1	5CP Mate Face 37	1	
2	Cat 5CP Crosshead Rev A	3	
3	SP5M 5CP Layer 1 Rev A	1	
4	SP5M O Ring Flush -011 NBR Shore 70A	4	
5	SP5M O ring L1 Relief -041 NBR Shore 70A	1	
6	SP5M O ring L1 Reject -043 NBR Shore 70A	1	
7	SP5M O ring L1 Cylinder -031 NBR Shore 70A	3	
8	SP5M Layer 1 Plug Rev A	2	
9	SP5M 5CP Layer 2 20-30% Rev A	1	
10	SP5M 5CP Layer 3 Rev A	1	
11	SP5M O Ring L3 Cylinder -031 NBR Shore 70A	6	
12	SP5M O Ring L3 Waste -042 NBR Shore 70A	1	
13	SP5M O Ring L3 Damper -024 NBR 70 Shore A	2	
14	SP5M O Ring L3 In -049 NBR Shore 70A	1	
15	SP5M 5CP Layer 4 Rev A	1	
16	SP5M 5CP Layer 5 Rev A	1	
17	SP5M O Ring L5 Out -043 NBR Shore 70A	1	
18	SP5M O Ring L5 Cylinder -032 NBR Shore 70A	3	
19	SP5M Relief Screw Rev B	1	
20	SP5M Relief Nut 5-8 McM 96557A140	1	

ITEM NO.	Title	QTY.	
21	SP5M O ring Relief Valve -012 NBR Shore 70A	1	
22	Fitting Tube 1-2in Rev C	2	
23	Fitting O Ring 1-2in -017 NBR Shore 70A	2	
24	Fitting Clip 1-2in HP Rev A	2	
25	Fitting Tube 3-4in LP Rev B	2	
26	Fitting O Ring 3-4in -020 NBR Shore 70A	2	
27	Fitting Clip 3-4in LP Rev A	2	
28	Damper piston	1	
29	SP5 O Ring Piston + Damper -313 NBR Shore 70A	1	
30	SP5M Damper Spring	1	
31	SP5M 5CP M8 x 150 Stud Rev A	2	
32	M8 Nut	2	
33	SP5M M8 washer	16	
34	M8x140 Skt Cap 316 Grade 70	6	
35	M8x120 Skt Cap 316 Grade 70	8	
36	M8 Flange Nut DIN 6923	8	
37	SP5M 5CP Plunger Stud Rev A	3	
38	Cat 5CP Slinger Washer Large 43328 Rev A	3	
39	SP5M 5CP Plunger Adaptor 20% Rev A	3	
40	SP5M 5CP Plunger Ring 20% Rev A	3	

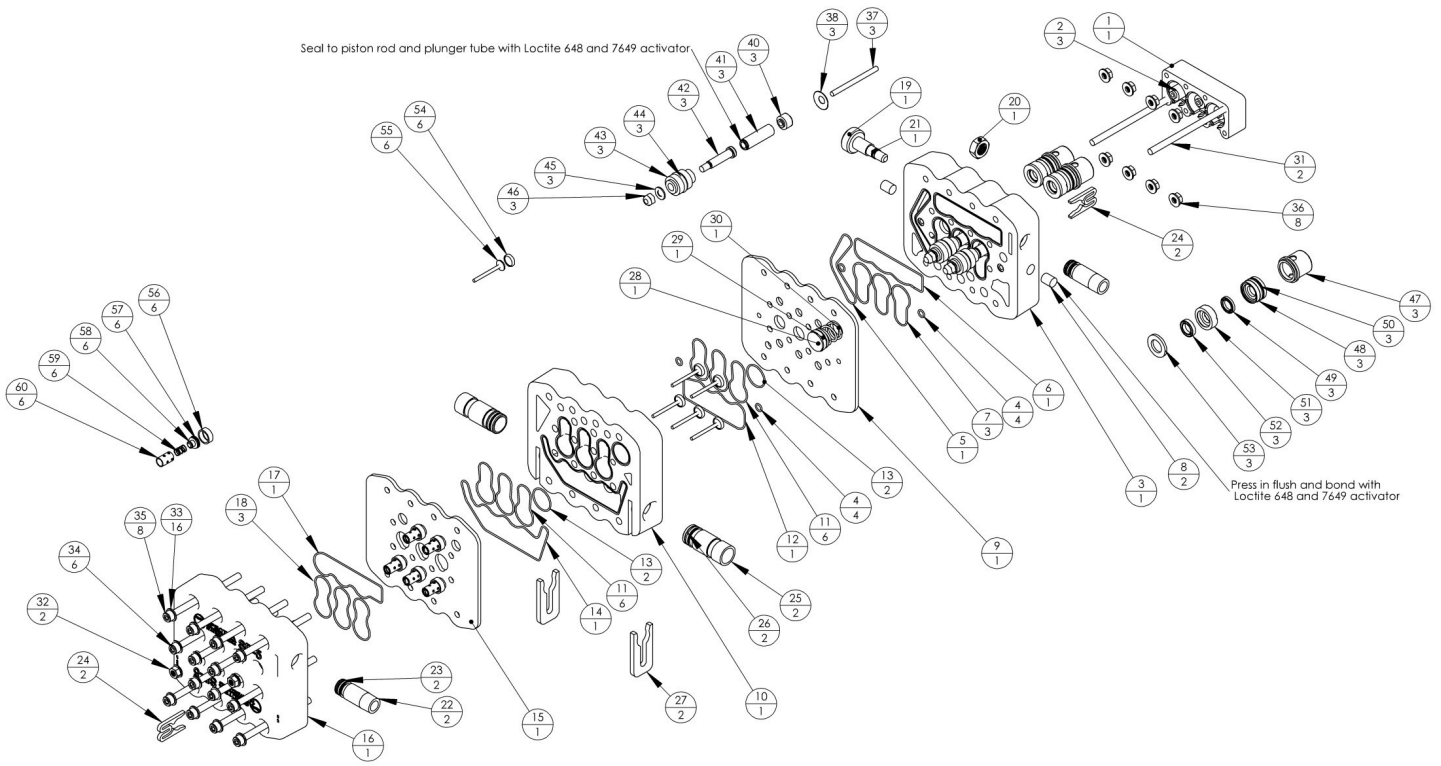
ITEM NO.	Title	QTY.	
41	Plunger Tube 12mm Rev C	3	
42	SP5M 5CP Piston Rod 20% Rev A	3	
43	SP5M 5CP Piston 20% Rev A	3	
44	SP5M O Ring Piston -313 NBR 70A Rev A	3	
45	M6 Washer DIN9021 316 McM 95211A160	3	
46	M6 Nut 316 McM 94150A345	3	
47	SP5M 5CP Seal Retainer Rev A	3	
48	SP5M 5CP LP Seal Case 20% 20x6 Rev A	3	
49	SP5M 5CP O Ring Seal Case -023 NBR Shore 70A	3	
50	SP5 LP Seal 20% 12x20x6 Rev A	3	
51	SP5M 5CP HP Seal Case 20% 20x6 Rev A	3	
52	SP5 HP Seal 20% 12x20x6 Rev A	3	
53	SP5M 5CP HP Seal Washer 20-30% Rev A	3	
54	Valve Shoe	6	
55	Valve Rev B	6	
56	Valve Sleeve - Stepped	6	
57	SP5 O Ring Valve Plug -013 NBR Shore 70A	6	
58	Valve Plug 0.506 Groove	6	
59	SP5 Valve Spring 2009	6	
60	Valve Cage	6	

Remove all burrs and sharp edges, max radius 0.010"					
Material					
Surface Finish					
Dimensions	Inches		B	110316	Layers 1, 3 & 5 use moldings from modified tool.
Tolerances			A		1st issue: SP5M Layer 1 Rev F, SP5M Machined Layer 3 Rev A, SP5M Layer 5 Rev E. Layers 1 & 5 use moldings from unmodified tool.
SCALE:1:10	Do not scale	Isometric Projection	Rev	Date	Purpose & Changes

SP5M 5CP Assembly 20% Rev B Exploded

Contact	Colin Pearson
Phone	+44 / 0 20 8340 8333
Mobile	+44 / 0 7980 093137
email	colin.pearson.spectra@gmail.com

Drg No.	Size C Sht 1 of 1



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7	SP5M O ring L1 Cylinder -031 NBR Shore 70A	3	
8	SP5M Layer 1 Plug Rev A	2	
9	SP5M 5CP Layer 2 20-30% Rev A	1	
10	SP5M 5CP Layer 3 Rev A	1	
11	SP5M O Ring L3 Cylinder -031 NBR Shore 70A	6	
12	SP5M O Ring L3 Waste -042 NBR Shore 70A	1	
13	SP5M O Ring L3 Damper -024 NBR 70 Shore A	2	
14	SP5M O Ring L3 In -049 NBR Shore 70A	1	
15	SP5M 5CP Layer 4 Rev A	1	
16	SP5M 5CP Layer 5 Rev A	1	
17	SP5M O Ring L5 Out -043 NBR Shore 70A	1	
18	SP5M O Ring L5 Cylinder -032 NBR Shore 70A	3	
19	SP5M Relief Screw Rev B	1	
20	SP5M Relief Nut 5-8 McM 96557A140	1	

ITEM NO.	Title	QTY.	
21	SP5M O ring Relief Valve -012 NBR Shore 70A	1	
22	Fitting Tube 1-2in Rev C	2	
23	Fitting O Ring 1-2in -017 NBR Shore 70A	2	
24	Fitting Clip 1-2in HP Rev A	2	
25	Fitting Tube 3-4in LP Rev B	2	
26	Fitting O Ring 3-4in -020 NBR Shore 70A	2	
27	Fitting Clip 3-4in LP Rev A	2	
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29	SP5 O Ring Piston + Damper -313 NBR Shore 70A	1	
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36	M8 Flange Nut DIN 6923	8	
37	SP5M 5CP Plunger Stud Rev A	3	
38	Cat 5CP Slinger Washer Large 43328 Rev A	3	
39	Cat 5CP Keyhole Washer 45697 Rev A	3	
40	SP5M 5CP Plunger Adaptor 30-50% Rev A	3	

ITEM NO.	Title	QTY.	
41	Plunger Tube 30% 9-16 Rev A	3	
42	SP5M 5CP Piston Rod 30% Rev A	3	
43	SP5M 5CP Piston 30% Rev A	3	
44	O Ring -313 N70	3	
45	M8 Washer 316 Stainless	3	
46	M8 Aerotight 316 Stainless	3	
47	SP5M 5CP Seal Retainer Rev A	3	
48	SP5M 5CP LP Seal Case 30% 564x854x120 Rev A	3	
49	SP5 LP Seal 30% 564x854x120 Rev A	3	Economos S06-D
50	SP5M 5CP O Ring Seal Case -023 NBR Shore 70A	3	
51	SP5M 5CP HP Seal Case 30% 564x877x181 Rev A	3	
52	SP5 HP Seal 30% 564x877x181 Rev A	3	Economos S06-D
53	SP5M 5CP HP Seal Washer 20-30% Rev A	3	
54	Valve Shoe	6	
55	Valve Rev B	6	
56	Valve Sleeve - Stepped	6	
57	SP5 O Ring Valve Plug -013 NBR Shore 70A	6	
58	Valve Plug 0.506 Groove	6	
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60	Valve Cage	6	

Remove all burrs and sharp edges, max radius 0.010"					
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Surface Finish					
Dimensions	Inches		B	110316	Layers 1, 3 & 5 use moldings from modified tool. Uses SP5 plunger tube with adaptor.
Tolerances			A		1st issue: SP5M Layer 1 Rev F, SP5M Machined Layer 3 Rev A, SP5M Layer 5 Rev E. Layers 1 & 5 use moldings from unmodified tool.
SCALE:1:10	Do not scale	Isometric Projection	Rev	Date	Purpose & Changes

SP5M 5CP Assembly 30% Rev B Exploded

Contact	Colin Pearson
Phone	+44 / 0 20 8340 8333
Mobile	+44 / 0 7980 093137
email	colin.pearson.spectra@gmail.com

Drg No.		Size C	Sht 1 of 1