TROUBLESHOOTING GUIDE

SPECTRA TROUBLESHOOTING GUIDE

All Spectra Watermakers use the same basic principle of operation. Three main components are used: a FEED PUMP, a CLARK PUMP pressure intensifier, and a REVERSE OSMOSIS MEMBRANE. Many systems also are equipped with the MPC AUTOMATIC CONTROL system.

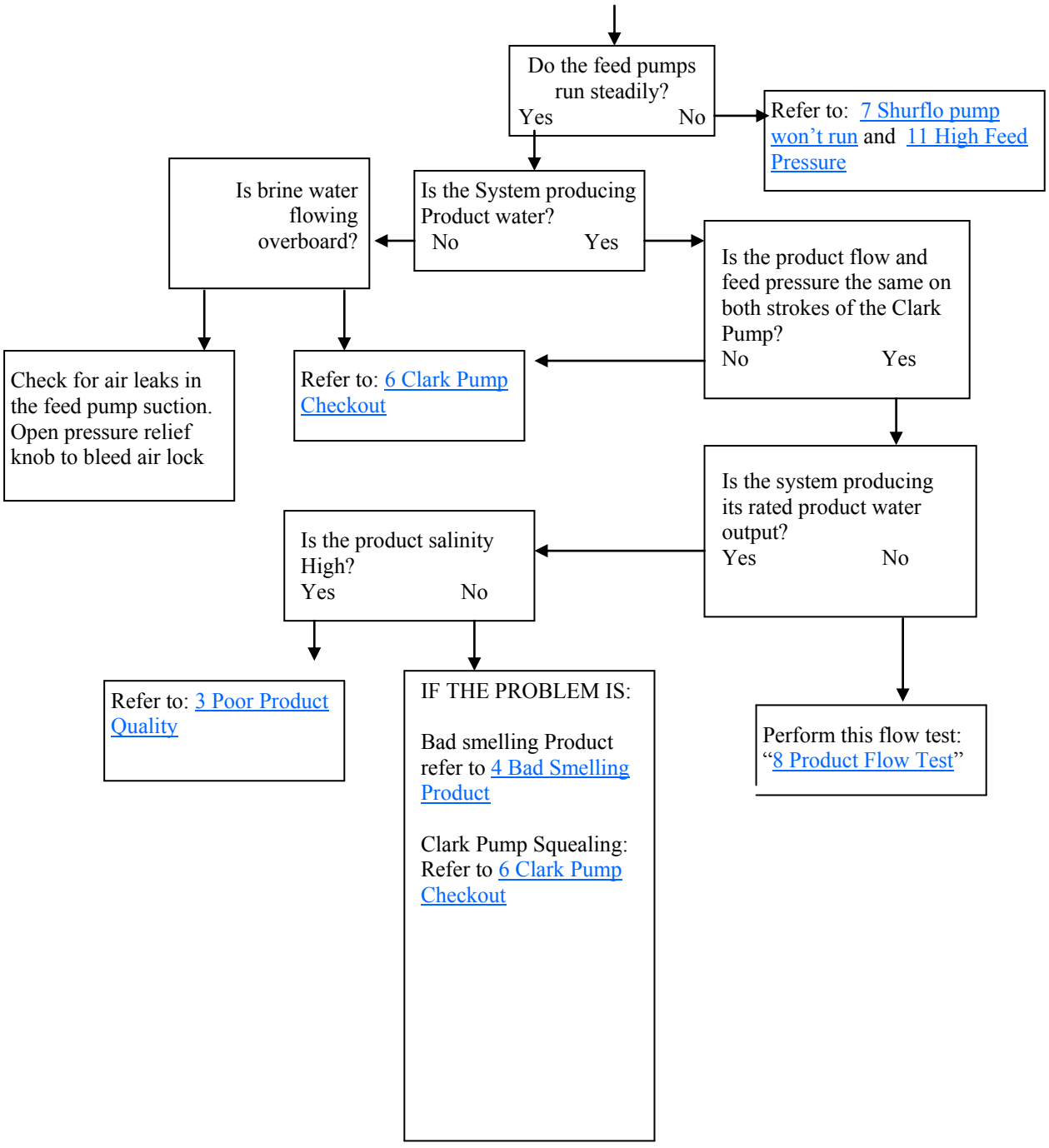
If a Spectra Watermaker is not working properly, the problem will lie with one of these three main components. On systems with the MPC control systems it may be that all three of the main components are functioning normally and it is the MPC controls that are causing the problem. This guide will assist you in determining if the problem is with the electric Feed Pump and its plumbing and power supply, the Clark Pump, the Membrane itself, or the controls. Instructions for making repairs once the problem is identified are also included.

PRINCIPLE OF OPERATION: Spectra Watermakers use a "Constant Flow" principle in which a low pressure positive displacement Feed Pump supplies pre-filtered water to the Clark Pump pressure intensifier. The Clark Pump raises the pressure of the Feed Water and supplies it to the Reverse Osmosis Membrane. The Feed Water passes over the membrane. While in contact with the Membrane, a percentage of the Feed Water is forced through the membrane to become Product Water. The remaining portion of the Feed Water, the "Brine", or "Concentrate", which is now saltier than it was before the product water was removed, is returned to the Clark Pump, where the high pressure energy is recovered. The Brine is then discarded at atmospheric pressure. Inside the Clark Pump, the cylinders discharging the Feed Water to the membrane are larger than the cylinders receiving the returning brine. This difference in cylinder size is expressed as a percentage. For example, if a 7% Clark Pump is used, 7% of the Feed Water discharged by the Clark Pump to the Membrane from the larger Feed cylinder cannot return to the smaller brine cylinder, and **must** pass through the Membrane as Product instead.

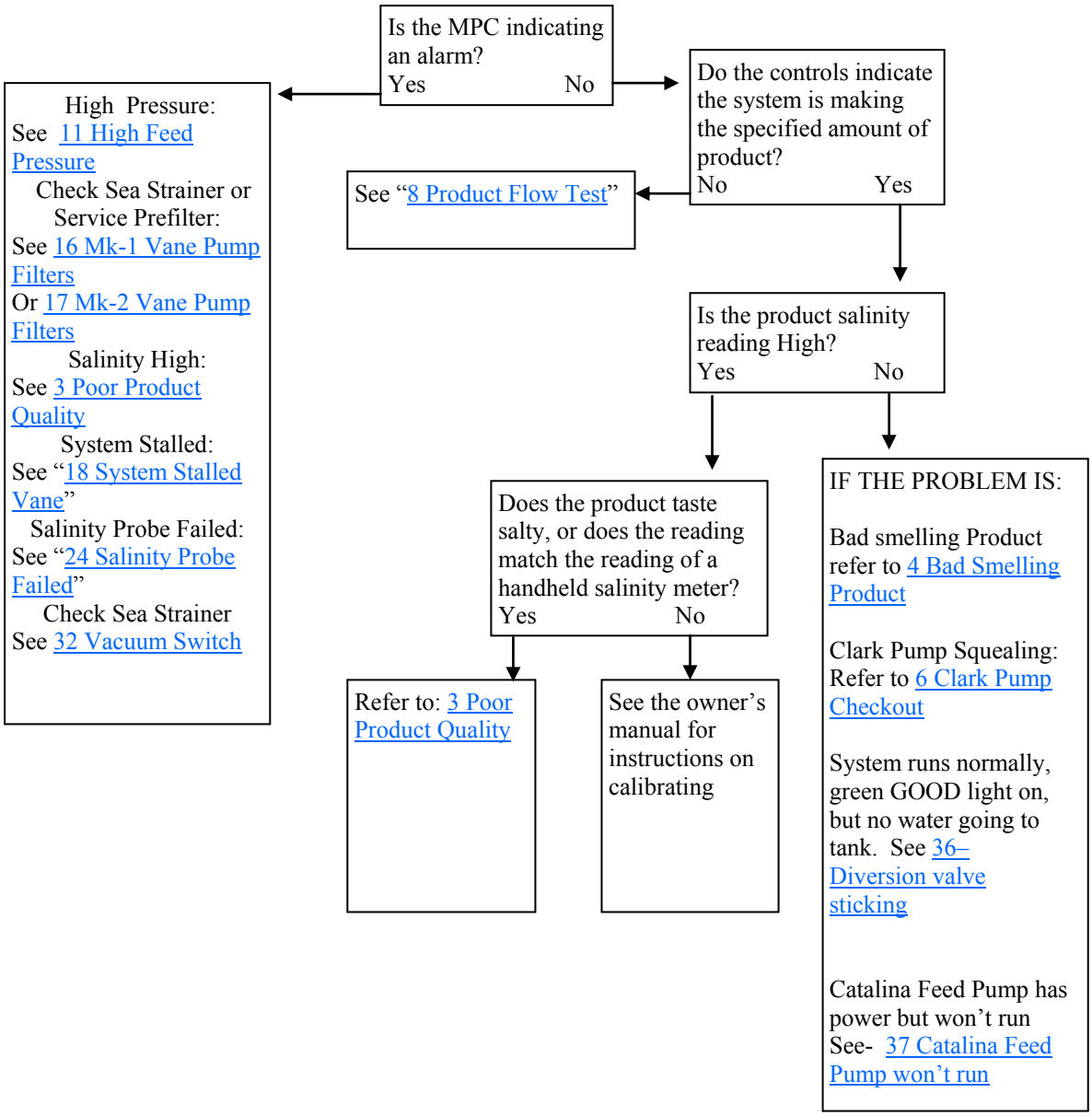
If your system uses Shurflo Pump(s), models: 180, Rowboat 150, Ventura 150, Ventura 200, 200C, 380C, Santa Cruz, Gulfstream & Cape Horn and does not have MPC controls, Refer to the "Troubleshooting Guide, Shurflo"

If your system has MPC controls go to Troubleshooting Guide, Shurflo w/ MPC, if it is one of the models above, or Troubleshooting Guide Vane Pumps if it is a Newport or Catalina.

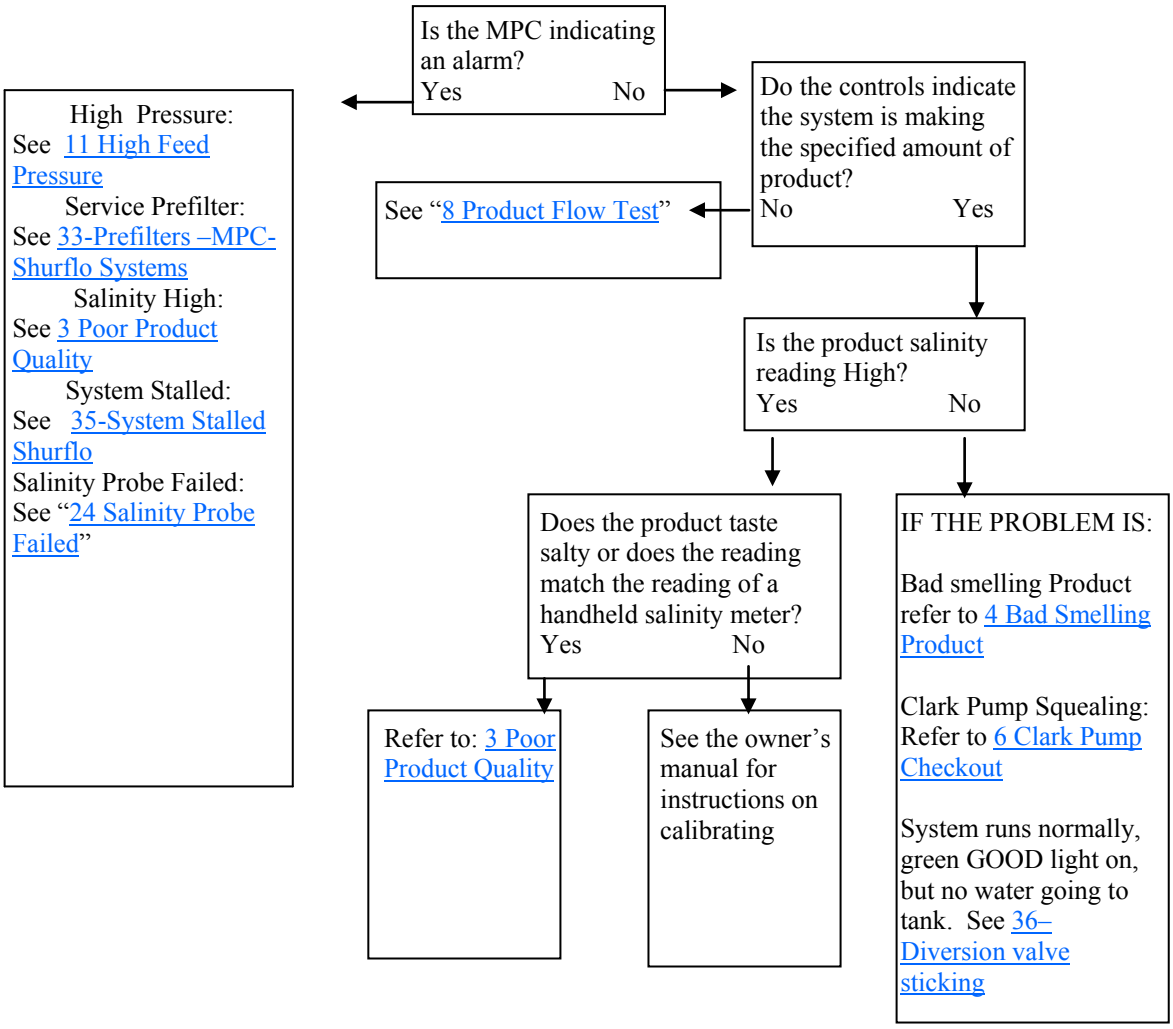
Troubleshooting Guide, Shurflo Systems



Troubleshooting Guide, Vane Pump Systems



Troubleshooting Guide Shurflo Systems with MPC Controls



(1) FLOW TEST/ SHURFLO SYSTEMS

Before the test, change all filters and clean the strainer. Make sure that there are no leaks. Check for air leaks, as air in the system will cause low production and erratic salinity. Look for air bubbles in the product flow meter, feed water hoses, and brine overboard hose.

Run the system and watch the pressures very closely. Make sure that on each shift everything is even from side to side. If the feed pressure to the Clark Pump is different (asymmetrical) on one stroke from the other, this could be part of the problem. A difference of a few PSI is acceptable, but anything over that is an issue. If the pump is asymmetrical, Clark Pump repairs should be done before continuing with these tests. Ask for "6 Clark Pump Checkout" instructions.
If no asymmetry is noted, continue with this test.

NOTE: On 150 and 200 models with only one feed pump, disregard the instructions concerning "Pump Two" and "Both"

Make sure the Shurflo overpressure cutout switches (p/n EL-FP-PS), are set correctly. If the switches are set too low one pump may cut out intermittently during two pump operation, resulting in reduced output. See "5- Adjust Shurflo Pressure Switch" bulletin.

1. Measure and log the product flow GPM (LPM) and the feed pressure with pump 1, pump 2, and both pumps running. Use a graduated container and timer to measure the flow. Log the voltage at the feed pumps at the same time. Confirm at least 12.5 volts at the pumps. You may have to run the engine or battery charger during the test.

2. Measure the total flow rate of the system. Run the system making water and divert BOTH the brine discharge AND product water into a bucket. Time how long it takes to make a given amount of water. Repeat with pump 2 and both pumps.

In order to produce the rated product output, you must have the proper amount of feed water flow. Each pump alone should pump 1.5 gallons per minute (5.7 lpm). Running on both pumps the flow should be 2.7gpm (10 lpm).

Compare the product flow to the total feed flow. Product flow should be at least 6.5% of total flow for a 150, and 9.0% of total flow for a 200 or 380 model. If product percentage is lower, you have an internal leak in the Clark Pump.

For every $^{1}/_{10}{}^{th}$ of a gpm feed water flow loss, product flow will drop about $^{1}/_{2}$ gallon per hour and the salinity will go up 100ppm.

Low feed flow combined with low system pressures (see 9: Nominal Pressures) is most frequently due to worn ShurFlo pump heads (p/n PL-PMP-SFPH).

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(2) FLOW TEST VANE PUMP

The correct feed water flow rate and product flow ratio are essential to producing rated product flow and quality. Flows should be measured as follows. You will need a large container or small drum and a watch. Before starting the test clean all the filters and check for leaks. Check for and repair air leaks in the low pressure inlet side. Air leaks cause low production and erratic salinity. Listen carefully for a buzzing sound caused by cavitation or air in the feed pump. Cavitation will be caused by a restricted feed water suction.

Set up the unit so that the brine discharge and the product can be directed into the container. On automated units the system will have to be run for a minute or two as it times through the start cycle. You may have to direct the brine and product into the bilge until the test starts. Once the unit is running normally, direct the brine and product into the bucket. Time how long it takes to fill the container with a given amount of water. For example, if it takes 60 seconds to produce 4 gallons (15.2l) your feed rate (brine + product) is 4gpm (15.2lpm.) Note: If the system is rejecting the product the product will already be in the brine stream.

Empty the container. Direct the product into the container with the brine going overboard and time the product flow rate. If the Controls are delivering the product to the water tank you will have to break into the product line at the membrane or diversion valve with a separate hose.

Compare your readings with these nominal flow rates for the various models:

Model 300: feed 2.3gpm, product 12.5gph. Model 400: feed 2.8gpm, product 16.7gph. Model 700: feed 3.8gpm, product 29 gph. Model 1000: feed 3.5gpm, product 41.7 gph. If you are working in liters divide liters by 3.8 to convert to US Gallons.

If the feed flow is low there may be something wrong with the feed pump, the unit could be sucking air, or the suction lines may be restricted. The 700 and 1000 feed pumps are equipped with an internal pressure regulator. If the regulator is set to too low water will be by-passed inside the pump and feed flow will be too low. See the "28 Adjust Relief Valve" bulletin. If the regulator is not the problem it may be a worn or damaged feed pump.

Most Newport Models have variable speed feed pumps. If the speed control is not set properly feed flow will be too high or low. See "25 AC Speed Control", "26 DC Speed Control" or 27 Spectra Speed Control for instructions on adjusting the speed controls. Contact the factory before adjusting feed pump speed.

If the feed flow is up to spec but product flow rate is low the problem is leakage in the high pressure side, probably in the Clark pump. See "6 Clark Pump Checkout".

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(3) POOR PRODUCT QUALITY

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Be sure to check the calibration of the salinity tester that you are using before proceeding.

Membranes are not an exact science, and two identical systems will have different product quality. World health standards deem water of up to 1000 PPM of total dissolved solids acceptable for drinking consumption. The United States Environmental Protection Agency sets 500 PPM as their recommended level. Factors that could affect water quality are addressed below.

LOW SYSTEM FLOW OR PRESSURE will equate to lower product quality (higher PPM). Each Spectra watermaker is designed to run at a specified feed flow and pressure. This data is available in Bulletin No. 9-Nominal Flows & Pressures.

DAMAGE TO THE MEMBRANE by chlorine contamination. Flushing the system with chlorinated water will irreparably damage the membrane. Charcoal filters are used to absorb any chlorine which might be present in flush water. They must be of proper specification to be suitable. There is no practical test for chlorine damage except the process of elimination of other causes.

DIRTY OR SCALED membranes. A dirty (foreign material), scaled (mineral deposits), or contaminated (bacterial/fungal growth) membrane can result in poor water quality and abnormal operating pressures. If operating pressures are above normal, cleaning is indicated. If the system pressures are within normal operating range, cleaning may have little result. Cleaning is no better for a membrane than it is for your clothes. Avoid cleaning as a diagnostic tool.

MECHANICAL LEAKAGE within the membrane pressure vessel. This is an unlikely but possible cause of poor water quality on the old style Codeline pressure vessels (white) that we used in the past or in Spectra pressure vessels equipped with the optional Z-brane. The standard Spectra pressure vessel has a double O-ring arrangement that includes a telltale hole between them so that any salt water leaking past an O-ring will drip into the boat and not go into the product water.

If system flow (product plus brine) is to specification, the membrane is clean, the product flows are consistent with the system flow, and the water quality is still not acceptable, then replacement of the membrane is indicated. See "1 Flow Check Shurflo" or "2 Flow Test Vane Pump" for instructions on checking flow rates and pressures.

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(4) BAD SMELLING PRODUCT WATER

The reverse osmosis membrane is permeable by many gases including hydrogen sulfide, the gas that causes rotten eggs to smell the way they do. 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 planktonic creatures 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. Once all the available oxygen is consumed, anaerobic bacteria begin to grow, causing the odor. If a unit being used frequently begins to make smelly water, it will be the prefilters that are the source of the problem. This occurs in a week or two in cold climates, but in less than one night in very warm waters like the Sea of Cortes or Red Sea. These bacteria can spread throughout the watermaker, and begin to grow on the membrane, causing poor water quality and high feed pressures. Once bacteria colonize the membrane they are difficult or impossible to eradicate.

Filling 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. Prefilters can be cleaned. If they are cleaned before they become dirty enough to cause a rise in feed pressure or the Filter condition graph, they clean up easily. If the pressure drop through the filter is allowed to rise due to serious clogging, the trapped materials will be jammed in tightly and be difficult to remove.

When operating in waters where odors are a problem, we recommend that you have three sets in service, one in the unit, one set soaking overnight in a bucket of clean fresh or salt water and one set drying for the next use. After shutting down the unit, remove the used prefilters and install the dry set. Leave the housings full of air until the next use. On non-automated systems, open the pressure relief when starting if there is a lot of air in the system until the air is cleared out through the brine overboard. The filters will get just as clean when soaked in sea water, but dry much faster if soaked in fresh. Given gentle handling, prefilters can be reused many times.

Bad smelling product water is usually caused by bad smelling feed water, but can also be caused by a fouled membrane if the membrane has been left unpickled. If the unit makes smelly but not salty water after a long idle period and the prefilters are new, the smell can be eliminated by running the unit unpressurized for an hour or so to flush the membrane.

Odors in the product water can also be eliminated by adding a charcoal filter in the product water line. Spectra offers a product water filter kit p/n KIT-FLT-CC.

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

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(5) ADJUST SHURFLO PRESSURE SWITCH

The Shurflo feed pumps are equipped with a high pressure cut out switch, p/n EL-FP-PS. This is the small black unit on the end of the wetted end of the pump head, p/n PL-PMP-SFPH, where the two red wires connect. If the pressure switch is not properly adjusted the pump may cut out each time the Clark pump cycles and the feed pressure spikes. When this happens the production will drop and an unusual noise will be heard when operating on two pumps, but the system will function normally during one pump operation on either pump. The points in the switch will fail fairly fast if set too low because of the constant arcing from cutting out each time the Clark pump shifts.

For all systems except the Gulfstream and the Ventura the feed pump pressure switches should be set as follows. On the very center of the switch is a small 5/64" allen screw. Run the system on pump one and close the brine discharge valve (1/2 way 90 deg), or kink the discharge hose, to block the flow. Watch the pressure gauge and adjust the pressure switch to shut off at 125 psi. Repeat for pump two. Turn the allen screw clockwise to increase the cut off set point.

Ventura 150 watermakers should be set to 100 psi using the procedure above.

Gulfstream models could experience seal failures in the manifold if pressurized too high. For this reason the pump should be removed from the system and the switch adjusted using a separate pressure gauge. If replacing a feed pump or pump head for a Gulfstream model arrange to preset the switch before installation.

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(6) CLARK PUMP CHECKOUT

First open the pressure relief ½ turn and start the feed pump using the manual control. Listen to see if the Clark Pump cycles. If it does not cycle, the fault may lie in the pilot valve spool pins. If these are bent or broken the pump won't cycle, and no water will flow when the pressure relief is closed. For 700 and 1000 models, see also "10 Tight Pistons". If the pump does not cycle but water flows through it, the problem is probably caused by a check valve that is stuck open. This can sometimes be solved by blocking the brine discharge and opening it suddenly to "shock" the system. Do not attempt this on systems with vane type feed pumps. If this doesn't work, see the Repair Manual for instructions on check valve service.

If the Clark Pump cycles, remove the test plug on the side of the center block just above the high pressure outlet. Close the pressure relief. If water runs, pulses, or squirts out of the test port, you have a bad piston rod seal. An occasional drip of water is not a problem. On models 200 through 1000 this can usually be repaired by replacing the seals. On Ventura 150 models, you may have to replace the center block.

If the Clark Pump is making a loud squealing noise, like someone stepped on a cat's tail during on or both entire strokes, The Piston Rod Seals are chattering. This can be helped by pushing waterproof grease down the test port with a pencil or other small rod, oe by replacing the seals.

If the pump stops cycling when the pressure relief is closed but runs OK when it is open, the problem is probably a broken reversing valve spool. See "12 Spool Valve Repair".

If the pump keeps cycling, check the feed pressure readings. On automated systems you can use the MPC-3000 display to check feed pressures even though you are running the feed pump manually. If possible, install a suitable pressure gauge in the feed pump discharge line to take pressure readings. Manual units will have a pressure gauge installed. Check with the factory for nominal pressures for your unit. The feed pressures should be within 5% of each other on each stroke, and the pressure spikes about the same.

If the pressures are far different (asymmetrical) on each stroke look for one of these problems:

1. Listen for a hissing noise on the low pressure stroke. This is an indication of a broken annular ring in the upper valve body. See 13 Reversing Valve Problems

2. If the pressures are asymmetrical without a hissing noise, the most likely cause is a bad check valve in the lower center block.

If the pressures are symmetrical but low, you may have an internal leak. Check the pressure relief valve for damage or foreign material. Inspect the check valves in the center block for dirt or damage. While the cylinders are off, check the bores for scoring. Some light scoring is normal but deep damage will cause leakage around the pistons. If the pressures are symmetrical but high the Clark Pump pistons may be binding: Refer to: 10 Tight Pistons, or the piston rod could be binding in the center block, see "14 Piston Rod Binding".

Full instructions for Clark Pump repair can be downloaded from our website at www.spectrawatermakers.com click "Repair Manual".

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(7) SHURFLO PUMP WON'T RUN

If the pump has power to it (the fan runs), but the pump won't run, the first thing to check is the pressure switch. The pressure switch, p/n EL-FP-PS, is located on the wet end of the pump and has two red wires plugged into it. Jump the two red wires together and see if the pump runs. You can safely run the system with the pressure switch jumped, just keep an eye on the pressure gauge and don't let system pressure exceed 110 psi. Replace the switch when a spare is available. The pressure switch should never open unless there is a problem with the system or it is incorrectly adjusted. If the switch has failed check the accumulator pressure, the operating feed pressure, and the switch cut-out setting bulletins: 15 Accumulator Pressure, 9 Nominal Flows & Pressures, and 5 Adjust Shurflo Pressure Switch.

If the pump will not run with the pressure switch jumped then it is most likely a problem with the brushes or overheat protection switch inside the motor. Temporary repairs can be made as follows. The motor will come completely apart by removing the two screws on the end of the motor. Remove the rear cover and paper insulator. Pull out the plastic brush holder. The thermal switch is located on one of the brush leads. With an ohmmeter, check for continuity through the switch. If it is open, you can make temporary repairs by wiring around it, being careful that your new wiring doesn't chafe on the moving parts, nor resist the springs that push the brushes on to the commutator. The overheat switch is unlikely to fail unless the motor has overheated and shut down. Consider relocating the pump or improving ventilation if the overheat protection has failed.

If any corrosion is apparent the brushes may be sticking. Once apart clean all the carbon dust from all the parts. Clean the commutator with light sand paper. Make sure to clean the small grooves on the commutator with a small sharp tool to remove the carbon in between the segments. Adjust the springs on the brush holders so the brushes slide smoothly in and out. If the bearings are rough and binding, remove the rubber dust cover and clean the best you can, grease them, and work them free by hand. Don't service the bearing unless absolutely necessary. Reassemble in reverse order. You can hold the carbon brushes back with papers clips inserted through the slots in the brush holder so they don't hang up on the bearing during assembly. Make sure the corrugated bearing shim doesn't push out, if it does, push it back into place.

This will at least keep you going until the motor can be replaced.

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(8) PRODUCT FLOW TEST

Flow should be measured as follows. You will need a Graduated container and a watch.

Disconnect the product tube that runs from the membrane(s) to the salinity probe and set it up so that the product can be directed into the container.

Direct the product into the container with the brine going overboard and time the product flow rate.
Compare your readings with these nominal flow rates for the various models:
If you are working in liters divide liters by 3.8 to convert to US Gallons.

Model 150 Product 5.8gph

Model 200 Product 8.0gph

Model 380C, Santa Cruz, Gulfstream, Product 14.5gph

If the Product flow for the above models is less than 90% of the nominal flow see "1 Shurflo flow test"

Model 300: product 12.5gph.

Model 400: product 16.7gph.

Model 700: product 29 gph.

Model 1000: product 41.7 gph.

If the product flow for these models is less than 90% of nominal see "2 Flow Test Vane Pump"

If the product flow is within specification but the MPC display GPH PRODUCT reading is inaccurate on a system with MPC-5000 controls, see the calibration instructions in the MPC controls Owner's Manual for your system .

If the GPH PRODUCT reading is incorrect on a system with MPC-3000 controls, it will be necessary to reprogram the microprocessor using a laptop computer and the Spectra 1.08 programming software. See the MPC-3000 Field repair service manual on the Spectra website for information instructions, and Software for chips A24 thru B29 to download the software.

(9) NOMINAL FLOWS & PRESSURES

Reverse osmosis water maker system pressures are temperature related. There are two fundamentally different principles of watermaker operation: Spectra Watermakers operate on a Constant Flow Principle while less energy efficient water makers use a Constant Pressure System. In colder water a watermaker will make the same amount of product at a higher pressure (Spectra Constant Flow Principle), or less product at the regulated pressure (other "Constant Pressure" systems). Product water salinity (ppm) is a function of pressure across the membrane and flow through the membrane. The higher the pressure and flow the more salt will be rejected, and the lower the salinity will be.

The Spectra Clark pump takes lower pressure from the feed pump and "intensifies" it to the higher pressures (approx 700psi) required at the membrane. Various models have different ratios of intensification. The pressures shown on the Spectra gauges and panels are the feed pressure not the membrane pressure. Because each model has a different feed pressure ratio, each model will have a different Nominal operating pressure. And, because sea temperatures vary widely and Spectra Watermaker membrane pressures vary with sea temperature, each model has a Nominal Operating Pressure Range, but System Flow should vary only slightly.

	Press Relief Closed	Press Relief Open	Feed Flow
VENTURA 150	55-70 PSI	20-30	1.5GPM
200C	70-80 PSI	20-30	1.5GPM
CATALINA 300	90-110 PSI	20-30	2.3GPM
380C	90-110 PSI	20-30	2.7GPM
NEWPORT 400	100-115 PSI	20-30	2.8GPM
NEWPORT 700	150-170 PSI	30-40	3.8GPM (15% Clark Pump)
NEWPORT 700	190-210 PSI	50-60	2.6GPM (20% Clark Pump)
NEWPORT 1000	190-210 PSI	50-60	3.5GPM

Normal pressures may fall outside of these nominal pressures in extreme arctic or tropical inland sea conditions.

If pressures are out of range, before proceeding, check product quality with a calibrated TDS meter, check product flow rate with a flow meter or timed quantity check, and check power consumption with an accurate meter.

Pressures below nominal can be due to worn Feed pumps, Low voltage, suction side flow restriction, poor membrane condition or a Clark pump problem.

Pressures above normal can be caused by discharge side filters, Clark pump resistance, (refer to "10 Tight Pistons, and "6 Clark Pump Checkout"), membrane fouling, Product flow restriction, and brine discharge system restriction, see 11 High Feed Pressure.

(10) TIGHT PISTONS

Low product flow with high feed pressure is commonly caused by clogged up membranes. However, some 700 and 1000 model watermakers may exhibit these symptoms due to "tight pistons". The pistons used in the Clark Pump cylinders on these models may swell after a time, especially in very warm waters. The piston will begin to drag inside the cylinder, slowing the Clark Pump and causing the feed pressures to rise and production to fall. In most cases the system will also be erratic, operating for a time and then shutting down on "System Stalled" or "High Pressure" and/or showing varying system pressures.

To diagnose and repair this problem, remove the cylinder end caps. Using a wooden stick or a rubber hammer handle, try to push one of the pistons farther into the cylinder. If the pistons won't move, remove the cylinders from the center block. Drive the pistons out of the cylinders using the wooden stick and a mallet. Push on the end cap side of the piston (the smooth side) to avoid damaging the piston rod socket, which is on the rod side of the piston.

Replacement pistons from Spectra Watermakers have been redesigned to prevent this from recurring. There are two different piston designs depending on the Clark Pump model. The Clark pump model can be determined from the Clark Pump serial number. If the serial number engraved on the front of the center block ends in "-15" It is a fifteen percent pump. If the serial number ends in "-20" it is a 20 percent pump. Order two p/n KIT-HP-15PAs for 15 percent pumps or two p/n KIT-HP-20PAs for each 20% model.

If you need to get the watermaker working while waiting for replacement parts, remove the white piston rings and the orange O-ring and take the pistons to a machine shop. Have the outside diameter turned down to 2.735 inches (69.50mm). Do not machine inside the piston ring grooves. In a pinch you could carefully sand or file the outside diameter down until the piston slides into the cylinder easily. Be very careful to clean off any abrasive particles from the piston as they will cause rapid cylinder wear.

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(11) HIGH FEED PRESSURE

If a High pressure alarm is valid, a magnetic drive vane type feed pump is decoupling, or the Shurflo type pump runs momentarily, then stops when its over pressure switch opens, the feed pressure is too high. See 9 Nominal flow and Pressure for the correct operating pressures for the various models.

If the Watermaker is shutting down on a High Pressure alarm, it is very important to determine whether the pressure is really high or if it is a false alarm. Check the analog pressure gauge if the system is equipped with a gauge, to determine whether the problem is actually high pressure, or the pressures are normal and the alarm is false. If it is a false alarm or there is no gauge, see 29 Pressure Sensor Test MPC-3000 , 30 Pressure Sensor Test MPC-5000 MK-1 or 31-Pressure Sensor Test MPC-5000 MK-2

High feed pressure can be caused by:

Dirty pre-filters on the downstream side of the feed pump.

A kink or other restriction in the feed or brine hoses.

Something broken or jammed in the Clark Pump. Refer to: 6 Clark Pump Checkout

Extremely cold or salty feed water. Check with the factory for what to do in this case.

A fouled membrane. If the feed pressure with the Pressure Relief Valve open falls within the range shown in 9-Nominal Flows & Pressures, and all of the above have been ruled out, refer to the owner's manual for membrane cleaning instructions.

(12) SPOOL VALVE REPAIR

A broken reversing spool (p/n KIT-HP-10VSA) can be temporarily repaired if no spare is available. The spool is pushed back and forth inside the valve block by the white pistons inside the valve block end caps. Because valve timing is very important, a repaired valve must be the same length as it was before it broke so that it will move to the right spot when pushed by the piston.

Set aside the white sealing ring and black rubber quad seal ring from the broken end of the spool. Using a ½" (13 mm) drill, countersink the threaded hole in the end of the broken off end of the spool. Drill in about $^{3}/_{8}$"(10 mm). If the threaded hole does not go all the way through the broken off end piece, drill it out with a ¼ inch (6 mm) drill. Find a sheet metal screw or machine screw about $1^{1}/_{2}$ inch (4 cm) long which will pass freely through the threaded hole and with a head diameter that will fit inside the countersink but not go all the way through. Center punch as closely as possible the exact center of the broken off end of the larger piece of the spool. Take a tap drill if using a machine screw or a suitable size drill if using a sheet metal screw, and drill as straight as possible down the center line of the spool center section about one inch (2.5 cm). Drill far enough in that the screw will not bottom out, but avoid going all the way to the white seal on the unbroken end. If using a machine screw, tap the hole. Place the black quad ring and the white seal ring on the larger piece of the spool. Holding the two pieces together in their original positions as closely as possible, insert the screw into the end of the spool and secure them together.

The spool will still work if it is not perfectly straight, and vise or wrench marks on the narrow diameter sections of the spool will not affect performance. Avoid damaging the large diameter sections or the white seals.

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(13) REVERSING VALVE PROBLEMS

If the Clark pump cycles properly when the pressure release is open ½ turn but is asymmetrical and makes a hissing noise on one stroke when pressurized, and output is very low to none, then one of the annular rings has failed. If it cycles OK when depressurized but stalls completely when the pressure release is closed, the problem may be a broken spool valve. A damaged spool valve sealing ring can cause similar problems.

See the manual or website for complete instructions on how to remove and replace the annular rings and spool. The best way to do it is to remove the complete top section of the pump by disconnecting the top high pressure line and the brine discharge hose. Remove the four allen screws that hold it down. Take care not to damage the bottom sealing surface. Remove both valve end blocks. Push out the black spool valve (P/N KIT-HP-10VSA) in the center valve body. If it is not broken, inspect it for any damage on the white seals. If the spool is broken replace it with a new one or it can be temporarily repaired (see bulletin 12 SPOOL VALVE REPAIR).

If you suspect a cracked annular ring (P/N HP-TB-AR), mark the outside of the white annular rings that the spool valve rides in with a felt tip pen. Tap the rings out from the opposite side with a wood dowel or plastic end of a screwdriver. There is probably an imperceptible crack running from one of the holes to the edge. You probably can't see the crack unless you pull on the ring to open it. If no replacement is available, the ring can be reused by turning it around and putting the crack to the outside. Reinstall the rings with the marked ends to the inside center of the valve body (crack to the outside). Reassemble and test. Note that the end blocks are left and right hand. Line up the ports to make sure you have the end blocks on the proper sides.

NOTE: You must remove the annular rings to see the crack, pull from the inside with your fingers and look for the crack.

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(14) PISTON ROD BINDING

Clark Pumps have one or two piston rods which pass through a bore in the Center Block and extend into both cylinders. When the Clark Pump is operating the entering feed water pushes against one of the piston which presses on the piston rod. The piston rod in turn transfers this force to the opposing piston in the other cylinder, causing it to move. These three parts move as one to the end of the stroke, at which point the driven piston becomes the driving piston and the pistons reverse direction and move to the other ends of the cylinders.

Both the bore in the center block through which the rod moves, and the rod itself, are machined to close tolerances. On rare occasions the rod or center block may swell over time causing the rod to bind in the bore. If the feed pressure is excessive and no other cause can be found, this may be the problem.

To determine if the rod is binding one of the cylinders must be removed by loosening the four larger Allen screws which hold the cylinder on to the Center block. The cylinder can then be pulled away for the Center Block. The rod should move easily back and forth through the Center Block.

If the rod is difficult to move pull it out of the center block, and then push it back in until it is not quite touching the lip seal in the bore. The rod should be loose, and have some play. If the rod is tight contact a Spectra Distributor or the factory to obtain replacement parts. If the rod moves easily in the bore the problem may be that the lip seals in the bore are dragging. Replacement seals should be installed if this is the case. Also check to make sure the piston moves easily in the cylinder by pushing on it with a hammer handle or similar tool. Be careful, water will squirt out at you when the piston moves. If the piston is tight see 10 Tight Pistons

Temporary repairs to oversize piston rods can be made by sanding the rod down with fine grit wet sand paper. Wrap the sand paper around the rod and slide the rod back and forth through it so that you are sanding with the long dimension. Be careful to remove any grit before putting the rod back into the bore. When the rod fits easily into the bore, clean it carefully, Grease the rod and the inside of the bore with silicon grease if possible and slid it carefully in until it is sticking out both sides.

5 May 08

(15) ACCUMULATOR PRESSURE

All Spectra Watermakers except the 700 and 1000 series are supplied with a pressure accumulator tank, p/n PL-ACC-TK, to be installed in the feed water line between the feed pump and the Clark Pump. In addition, the 300 and some 400 series also have an accumulator mounted inside the fresh water flush module or the feed pump module.

The purpose of the feed line accumulator is to reduce the spikes in the feed pressure caused by the cycling of the Clark pump.

150, 180, 200, and 380 models use Shurflo feed pumps. If the accumulator is not properly charged it can lead to problems with the Shurflo pump pressure cutout switches.

300 and 400 models having magnetically driven vane type feed pumps may experience decoupling of the magnetic drive if the accumulator is not properly charged.

All models will run more smoothly and quietly when the feed water accumulator is properly charged.

The accumulators have an air valve on top similar to those found on car tires. This allows the internal air bladder of the accumulator to be pre-charged. The accumulator should be pumped up to about 65psi (4.5bar) for best results on most systems. Ventura 150 watermakers will use about 45 to 50 psi. Add air using a tire pump or air compressor while the system is not running. You can experiment with the exact pressure that will give the best pulsation dampening on your installation.

The purpose of the fresh water flush accumulator is to allow a steady flow of 1.5 gallons per minute of flush water through the charcoal filter. Because the feed pumps on the 300 and 400 hundred series exceed this maximum allowed flow rate, the controller cycles the pump on and off, to reduce the overall flow rate. The accumulator gives the water flowing through the charcoal filter somewhere to go while the feed pump is cycled off. The flush water accumulator should be preloaded to 5 psi (.35bar).

4/26/06

(16) PREFILTERS- Mk-1 VANE PUMP SYSTEMS

Five different filters are used on these Spectra Watermakers to make sure that no damaging foreign materials enter the system. There are four filters in the system to clean the feed water of abrasive materials while the system is in operation, and a fifth filter that prevents the entrance of chlorine during fresh water flushing.

During normal operation the feed water is filtered in two stages. First it enters a fine mesh metal sea strainer then passes through a fifty micron pleated cellulose filter. These protect the vane pump from damage due to abrasion from silt and hard shelled plankton found in the feed water. If these filters cause too much restriction the system will alarm **Check Sea Strainer**. If all everything is clean and unrestricted and you still get a Check Sea Strainer alarm see 32 Vacuum Switch

After passing through the Feed Pump the feed water enters the filter housings containing 20 and 5 micron elements. These filters remove very fine particles which could damage the Clark pump and which would shorten membrane life. If the pressure drop across these filters exceeds 10psi (0.7bar) the system alarms **Service Prefilter**. If the filters are clean and you still get a Service Prefilter alarm see 29 Pressure Sensor Test MPC-3000 or 30 Pressure Sensor Test MPC-5000 MK-1

Cleaning schedules will vary widely depending on how and where the system is used. In very turbid water found in estuaries and bays the filters may plug up in only an hour or less. In some waters, such as the Florida Intracoastal the filters may look perfectly clean and still be plugged up. In crystal clear blue water conditions the filters may need to be cleaned much less frequently.

When operated only an hour or two a day in inland or near shore waters, the trapped plankton will begin to decay in the filters long before the elements plug up, and the bacteria involved in the decay will cause a “rotten egg” smell in the product water. This decay will set in overnight in tropical waters, or after a week or two in high latitudes. If handled gently and changed regularly before they get too smelly or plugged up, filters in this service can last through many of cleanings.

The charcoal filter used in the fresh water flush system will not plug up unless you have some incredibly dirty domestic water in your boat. About six months after installation the charcoal filter element will lose its effectiveness at removing any membrane damaging chlorine which may be present in domestic water. Charcoal filter elements must be replaced every six months if there is ANY chance that chorine could be introduced into the flush water. Charcoal filter elements cannot be cleaned.

To ensure that filter elements fit properly and remove chlorine effectively, they should be purchased at factory authorized dealers. Our element part number is FT-FTC-XX. The last two digits indicate the micron rating, e.g. FT-FTC-05 is for a 5 micron element. Charcoal elements are FT-FTC-CC.

05/12/06

(17) PREFILTERS- Mk-2 VANE PUMP SYSTEMS

Four different filters are used on these Spectra Watermakers to make sure that no damaging foreign materials enter the system. There are three filters in the system to clean the feed water of abrasive materials while the system is in operation, and a fourth filter that prevents the entrance of chlorine during fresh water flushing.

During normal operation the feed water is filtered in two stages. First it enters a fine mesh metal sea strainer. This protects the boost pump from damage due to larger particles found in the feed water. After passing through the Boost Pump the feed water enters the filter housings containing 20 and 5 micron elements. These filters remove very fine particles which could damage the Clark pump and which would shorten membrane life. If any of the filters get dirty causing the pressure at the outlet of the pre-filters to drop below about 10inHg vacuum the system alarms **Service Prefilter** and goes into Run Low Mode. If the filters are clean and you still get a Service Prefilter alarm See 31– Pressure Sensor test Mk-2 and 34 Mk-2 Boost Pump

Cleaning schedules will vary widely depending on how and where the system is used. In very turbid water found in estuaries and bays the filters may plug up in only an hour or less. In some waters, such as the Florida Intracoastal the filters may look perfectly clean and still be plugged up. In crystal clear blue water conditions the filters may need to be cleaned much less frequently.

When operated only an hour or two a day in inland or near shore waters, the trapped plankton will begin to decay in the filters long before the elements plug up, and the bacteria involved in the decay will cause a “rotten egg” smell in the product water. This decay will set in overnight in tropical waters, or after a week or two in high latitudes. If handled gently and changed regularly before they get too smelly or plugged up, filters in this service can last through many of cleanings.

The charcoal filter used in the fresh water flush system will not plug up unless you have some incredibly dirty domestic water in your boat. About six months after installation the charcoal filter element will lose its effectiveness at removing any membrane damaging chlorine which may be present in domestic water. Charcoal filter elements must be replaced every six months if there is ANY chance that chorine could be introduced into the flush water. Charcoal filter elements cannot be cleaned.

To ensure that filter elements fit properly and remove chlorine effectively, they should be purchased at factory authorized dealers. Our element part number is FT-FTC-XX. The last two digits indicate the micron rating, e.g. FT-FTC-05 is for a 5 micron element. Charcoal elements are FT-FTC-CC.

(18) SYSTEM STALLED, VANE PUMP

If the MPC controls do not receive a signal from the watermaker that water is flowing through it properly, the controls will stop the feed pump and attempt to "Restart." Older systems have a "Stroke Sensor" on the Clark Pump to send a signal that the Clark Pump is stroking. Because the Clark Pump is powered by water pressure from the feed pump, this can be due to a lack of feed water pressure. Failure to cycle can also be due to a malfunction inside the Clark Pump. If the Clark Pump is not cycling or a stroke sensor signal is not being received, the MPC controls it will try to start three times, displaying: RE-STARTING, and then alarm SYSTEM STALLED.

The stroke sensor, p/n EC-MPC-SC15, is on the side of the high pressure pump valve body. It is connected with a gray wire and snaps into a pocket in the side of the top section of the Clark pump. Units built after December 1, 2004 do not have a stroke sensor. These units use a "Roto Flow Meter". Check your Owner's Manual or Clark Pump to determine if you have a Roto Flow Meter. If so go to "19 Calibrate Roto Flow."

1. Confirm that the feed pump is running. **If the pump is not running** check to make sure there is power to the pump. **AC units have two power sources.** Newer Newport systems have motor speed controllers. These controllers have overheat protection. If the pump runs for a while then stops for no apparent reason the controller may have overheated: See "20 SYSTEM STALLED OVERHEAT" If a Catalina Feed pump won't run or is erratic see 37-Catalina Feed Pump won't Run

2. **If the pump is running** confirm that water is flowing through the system. Check the flow at the brine overboard. If water is flowing through the system but the Clark pump is not cycling there is a Clark Pump malfunction: perform the "6 Clark Pump Checkout" Tests. **If the motor runs but no water flows** the feed pump may have an air lock or a failed coupling/rotor shaft. To clear an air lock, do a fresh water flush by pushing and holding the AUTO STORE button for five seconds. The Clark pump should cycle during the flush. If the Clark pump cycles during the flush, but won't cycle when the feed pump is running, the feed pump drive coupling may have failed. See "21 Vane Pump Drive Failed".

3. If the Clark pump is shifting, but the MPC alarms "System Stalled" confirm that the green light on the stroke sensor is going on and off with each shift. If the light is blinking and you still get System Stalled, or the pump is cycling but the light is not blinking, perform the "22 Stroke Sensor Test."

5/09/06

(19) CALIBRATE ROTO FLOW METER

Beginning December 1, 2004, All Spectra Watermakers with MPC Controllers shipped with a "Rotor" flow meter in place of the stroke sensor previously used. Both the stroke sensor and roto flow meter are used to calculate the product flow and for the SYSTEM STALLED alarm. The Roto flow meter is a flow meter using a magnetic rotor in the product piping. The faster the water flows the faster the rotor spins, much the same as modern knot meters. It is installed in the product line between the membrane outlet and the diversion valve. The MPC will calculate the Gallons (liters) per minute product flow by counting the magnetic pulses from the rotor and applying a Mathematical Constant. If the flow rate drops below approx. 3 GPH (12LPH), or there is no signal at all, the MPC will alarm SYSTEM STALLED.

If it is suspected that the roto flow meter has failed or there is a problem in the wiring the rotor flow meter output can be checked with a voltmeter. The output of the meter is a DC pulse frequency. This will show between the "S" and "G" terminals as a voltage around 2.5 volts DC and will also register as an AC voltage. The DC reading will be lower with lower flow and higher with higher flow.
05/09/06

The Roto Flow meter can be calibrated as follows:
MPC-3000: Connect your computer to the PCB using a nine pin connector. Using the Spectra 1.08 Software in your computer, make sure that the "Rotor Flow Meter" box is checked. Click "Write". A number will appear in the "Displacement" Box. This is the Constant used to calculate the flow. The default Constant is 13578. With the watermaker making water, run the product flow into a measured container and using a timer, determine the actual flow rate. If the flow rate shown on the computer does not match the measured flow, change the constant in the "displacement" box. The up/down buttons change the number by 500 each time they are clicked. Increasing the constant increases the display reading. You have to click "write" for the changes to take effect. The display reading is heavily damped so it takes a while for the reading to change.
Always check all the parameters in the programming window before closing it to make sure nothing has been changed unintentionally.
MPC-5000: The meter can be calibrated from the display using the program mode, or with a computer as shown for the MPC-3000. To program from the display see the instructions in the owners manual or MPC-5000 field service manual.

The Roto flow meter can be retrofitted to older units in place of the Stroke Sensor if desired. The Mpc-3000 printed circuit board will remain the same but the EPROM micro chip must be Updated to the A-28 version or later. The rotor flow meter connects to the same terminals on the PCB that the stroke sensor used, labeled: STROKE SENSORS, "P" (DC+), "S"(Signal), and "G" (Ground). Red goes to "P" Brown to "S" and Black to "G". The small plastic jumper which is stored on one of the "G/M JP2" prongs must be moved to both of the "Calibrate JP1" prongs so that they are jumped together. Find this jumper by unplugging the ten pin green connector for the pressure switches.

(20) SYSTEM STALLED – OVERHEAT

All Newport series watermakers built after October 2002 are equipped with an adjustable feed pump speed controller. The speed controller is used to regulate the different flow rates in the water maker during flush, service and run modes. The speed control is mounted inside the feed pump module. AC and DC motors have different speed controls, but both types are equipped with internal overheat protection circuitry.

If the speed control temperature exceeds the limit the feed pump will stop. When the feed pump stops the system will stop producing water. The MPC control will detect this and attempt to restart the system twice. After failing to restart, the Display will alarm SYSTEM STALLED.

The ACTech AC speed controls have an LCD display that is used to adjust the controller and also displays fault messages. If the ACTech controller has shut down on overheat it will read "AF." The ACTech is set up in such a way that alarms are cleared by issuing a stop command to the control. Because the MPC issues a stop command when it alarms SYSTEM STALLED, the alarm condition will clear as soon as the control cools off.

The Winland Electronics DC control does not have a display and will not give any indication of overheat shutdown.

If the watermaker is installed in a machinery space or other hot location, and SYSTEM STALLED Alarms are occurring after the watermaker has been running normally for a considerable period of time, with no abnormal pressure or flow conditions, overheat should be suspected. This can be determined by operating the system manually using the "Run Manual" Switch. In Run Manual Mode the speed control is operated directly, and the MPC is taken completely out of the circuit. If the system runs normally for a while on "Run Manual" and then the feed pump stops, this indicates that overheating has been the problem.

Over heating problems can be resolved by moving the feed pump module to a cooler location. Spectra Watermakers must be installed in a ventilated space with maximum ambient temperatures below 120 degrees F. If this is not possible contact the factory for additional assistance.

AC powered watermakers use ACTech model SCM speed controls; part no. EL-MTR-SPCAC110 for 110 volts, and EL-MTR-SPCAC220 for 220 volt units. DC powered watermakers use a Winland Electronics control; p/n EL-MTR-SPCDC for 24 volts and EL-MTR-SPCDC12 for 12 volts.

05/09/06

(21) VANE PUMP DRIVE FAILED

If the feed pump runs but no water flows, and the system is not air bound, the pump drive may have failed. It could be one of three things.

If the pump has a magnetic drive the connection between the inner magnet inside the pump head may have failed. This will result in the magnets spinning but not transmitting the torque to the pump shaft. If this is suspected, remove the pump head from the motor by loosening the v-band clamp that holds the pump onto the motor. Inside the black bell housing of the pump head are 4 allen screws which hold the bell housing onto the pump. Remove the screws and bell housing, and pull off the stainless steel can which was inside the bell housing. Inside you will see the magnet and pump shaft. The end of the shaft has two flats on it that engage with two flats in the magnet bore. Over time the magnet bore flats will wear away and the magnet will turn without turning the shaft. If this is the case replace the magnet. Use the magnet replacement kit KIT-VP-M3RPM for Catalina and Newport 400, or KIT-VP-M5RPM for Newport 700 and 1000.

If the feed pump is Direct Drive there is a bronze tang, p/n HF142CPFFS, between the pump head and the motor. The tang fits into a slot in the motor and another slot in the pump head, transmitting the torque. The tang is simple to replace: Remove the pump module front cover and pull it to the side. Remove the stainless clamp p/n PL-PMP-VBC, that holds the pump to the motor and separate the pump from the motor. (leave the hoses in place). Inspect the tang. If it is broken contact the factory or your nearest distributor and we will ship you a new one.

If the tang has not failed then the rotor shaft may have started to slip. Vane pumps shipped before September 2003 have a two piece shaft/rotor. The shaft is pressed in, and the joint can fail and start to slip under load. It may feel ok by hand but under load it starts to slip. Usually the pump makes a loud squealing noise when this first happens. As of 8-1-03 all the pumps have a single one piece 316 SS shaft. Models 700 and 1000 take pump no. PL-PMP-240250. The model 400 takes pump no. PL-PMP-140175

If you must pickle or store the unit see "23 PICKLING WITHOUT FEED PUMP"

(22) STROKE SENSOR TEST

Watermakers with MPC controls shipped before Dec 1, 2004 are equipped with stroke sensors. The stroke sensor, p/n EL-MPC-SC15, is located on the Clark pump in a cavity on the valve body end cap, near the pressure relief valve. It has a small green light that blinks on and off with each pump cycle. The stroke sensor is used by the MPC controls to calculate the GPH (LPH) PRODUCT display, and for the SYSTEM STALLED alarm. The sensor has 5 volts supplied to it from the Printed Circuit Board. Inside the stroke sensor are two magnetically actuated switches. One switch turns the light on and off. The other switch sends the signal back to the MPC printed circuit board. There is a small magnet inside the Clark pump which moves back and forth with each cycle. When the magnet moves close to the sensor the magnetic switches are actuated, putting 5 volts on the signal wire, and turning on the light. When the magnet moves away the light goes out and the signal drops to zero volts.

If you can hear the Clark pump cycling but the green light is not blinking test the stroke sensor as follows: Remove it from the cavity for testing [use a pocket knife to pry it out]. Check for broken wires at the sensor. With DC power on to the watermaker, place a magnet next to the back of the sensor and see if the light comes on. NOTE: the magnet must be polarized properly so try both sides. If the light goes on and off the sensor may be good. In this case the problem could be with the magnet in the valve body of the Clark pump. See 6 Clark Pump Checkout.

If the light still does not come on, or if the light has been blinking but you still get the System Stalled alarm, check the wiring and the connections inside the MPC box. Open the MPC box and look at the Printed circuit board. Next to the telephone style jacks there is a green 8 pin connector marked “1STROKE SENSORS2, PRES SWITCH”. Make sure the connections are tight and the plug is firmly in place. There should be five volts steady between the “P” and “G” terminals. If not, lift the red wire from the “P” terminal and check for voltage at the terminal again. If there is till no voltage the PCB is bad. If voltage returns the stroke sensor or wiring is shorted out and should be replaced.

If you do have 5 volts between “P” and “G”, check for voltage between “S” and “G” while the Clark Pump is cycling or when you move the test magnet past the stroke sensor. The voltage should cycle between 5 volts and 0 volts with each stroke of the Clark Pump. If it stays at Zero, the stroke sensor is bad or the signal wire is broken or has a bad connection. Carefully check the wiring. If the signal voltage stays at 5 volts all the time the sensor has failed.

05/12/06

(23) PICKLING WITHOUT FEED PUMP

If your feed pump fails there are a number of ways to protect the membrane until repairs can be made.

1. If you have MPC controls, try auto flush with the pump in place and the pressure relief open and see if the pump still works well enough in combination with the domestic water pressure to auto flush the system until repairs can be made, or you can by-pass the feed pump by jumping the pump suction and discharge hoses together. If you open the pressure relief knob ½ turn the domestic water pressure should be enough to auto flush the system without the feed pump. Note: If the Clark Pump does not cycle no flush water will pass through the membrane housing.

3. If the problem is a spun vane pump shaft on a direct drive pump, you can repair it by pinning the pump shaft. Contact the factory for instructions.

4. You can temporarily put any spare water pump of the correct voltage and similar flow rate that you might have, such as a wash down pump, in place of the feed pump and pickle in the usual way described in the owner's manual.

5. You can pickle the membrane manually. To do this, disconnect the ½ inch black high pressure hose at the compression fitting on the Clark pump high pressure inlet. Disconnect the other high pressure hose at the membrane. Mix up about a third of a jar of SC-1 storage chemical in a gallon of chlorine free water and pour it into the membrane using a small funnel which will make a tight seal to the high pressure hose still connected to the membrane. The excess will run out the other end of the membrane. Then reconnect the hoses.

Be sure to open the pressure relief valve when you pickle the membrane to prevent accidentally pressurizing it while pickled the next time you start the unit.

4/26/06

(24) SALINITY PROBE FAILED

The MPC controls will alarm “Salinity Probe Failed” if the microprocessor cannot detect that a probe is plugged in to the circuit board. This can be due to a bad connection at the telephone style plugs on the main board, the sub-board is so equipped, or at the probe itself. First check to make sure that all the cables are plugged in properly. If they are properly plugged in unplug them one at a time and check each one for moisture or corrosion. Apply a small amount of watermaker grease to the plug when plugging it back in.

If the system still alarms Salinity Probe Failed the Salinity Probe and Cable should be replaced. Two styles of salinity probe have been used. Systems shipped before April 2008 have the old style probe which has a separate probe and cable. The cable has a telephone style plug on both ends and plugs in to jacks in both the main printed circuit board and the probe. We recommend that the cable and probe both be replaced if either one has failed. Ask for the replacement kit part # KIT-MPC-SP.

Systems shipped after April 2008 have the new style Salinity Probe. The new probe has the cable permanently bonded into it. This probe requires a sub-board in order to work properly. The probe cable plugs directly into the sub-board, and another cable connects the sub-board to the main board. The probe and cable assembly is available alone as part# EL-MPC-SP2 or in a kit, Part# KIT-MPC-SP2UPG, which includes the probe, sub-board and cables.

The new style probe is more accurate, reliable, and durable than the old style. Many systems which were built with the old style probe can be upgraded to the new style using the new style kit. Contact the Spectra factory technical support staff To determine if your system should be upgraded.

(25) ADJUSTING THE AC SPEED CONTROL

WARNING ELECTRICAL HAZARD: 120v OR 220v AC POWER WILL BE PRESENT ON THE TERMINAL BLOCKS WHILE ADJUSTMENTS ARE BEING MADE!

The SCM & SCL speed controls are used to set the feed pump motor speed by changing ships AC 50 or 60 HZ power to another desired frequency. This allows the pump to be operated to provide precisely the desired output pressure and flow in the three different modes. The speed control is Spectra factory preset and should only be adjusted after contacting the factory. Do not change any setting except parameter 31: run speed, parameter 32: flush speed, or parameter 33: service speed.

If you have the AC Tech Installation and Operation Manual that ships with replacement speed controllers the parameter menu section will be marked with the Spectra Watermakers factory presets for your unit. The manual is also available on the website at www.Spectrawatermakers.com . Instructions for changing the settings are found in the Programming the SCL/SCM Drive section.

To change a speed setting run the watermaker in the mode in which you want to change the speed. For example: If you want to change the speed the pump runs at while making water, have the unit actually making water.

Enter PROGRAM MODE by pushing the Mode button. This will activate the password prompt. The password is 25. Enter the password with the up and down buttons. When the display reads 25, press Mode. The display will read P01 to indicate that you have entered program mode. Using the up and down buttons select the desired Parameter (e.g. P31 for setting run speed.) Press Mode to display the current setting. The speed settings are displayed in Hertz (cycles per second AC output power frequency.) Use the up and down buttons to change the setting. Do not change the setting more than 3 Hertz at a time. Press Mode to enter the new setting. The pump speed will change, and the controller will enter parameter select mode. To continue changing the same parameter until the desired pressure or flow rate is achieved, Press the Mode button two more times. This will bring you back to Program mode in the same parameter.

If no buttons are pushed for two minutes the controller will require the password to be entered again.

6/03/04

(26) DC SPEED CONTROL NEWPORT SERIES

Most 12 and 24 Volt Newport model watermakers shipped before January 1, 2007 are equipped with a Winland speed controller that has adjustable settings for Run Speed and Flush Speed. (See Note) Watermakers shipped after January 1, 2007 use a Spectra speed control, see "27 Spectra Speed Control" if you have the Spectra speed control.

Changes in Run Speed change the feed water flow rate during "Auto Run" and "Run" modes, and when the manual switch is in the Manual Run position. Changes to the Run speed setting will affect the Product flow rate, system power consumption, and feed pressure. The Flush Speed setting regulates the flush water flow rate during "Auto Store" mode and when the manual switch is set to "Flush Manual".

Each speed setting is controlled by a "Pot," or variable resistor, which is adjusted with a screwdriver to set the desired speed. These Pots are mounted on the speed control which is attached to the back wall of the Feed Pump module above the Relay Module, or soldered directly on to the input terminals of the speed control. The MPC control pcb, as well as the manual control switches, send a control signal to the relay module for Run Speed or Flush Speed. When these relays pull in they send the control signal from the appropriate pot to the Speed Controller. The speed controller can also reverse the direction of the motor if desired, has an adjustable maximum current limit, and has an over temperature cut-out which is not adjustable.

SETTING FLUSH SPEED: Flush speed should be set to run the pump slowly enough that the vessels fresh water system can supply a sufficient flow of water through the charcoal filter, so that no sea water is drawn in during the flush cycle. The maximum flow through the Charcoal filter is 1.5 gpm (6lpm), so at flush speed the pump must discharge less than this amount. Flush speed can be checked by closing the sea cock during the flush cycle. If the system shuts down on the "Check Sea Strainer" alarm the feed pump is running too fast and drawing sea water into the system to make up the difference.

SETTING RUN SPEED: Run Speed should be adjusted so that the Watermaker produces the specified amount of product flow at the specified power consumption and nominal feed pressure. Since feed pressure and power consumption vary with sea temperature and salinity, it may be desirable to adjust the Run Speed to optimize the pressure or power consumption in very cold or high salinity waters.

MAXIMUM CURRENT LIMIT: The current limit is adjusted with a pot located near the center of the board. It should be adjusted to maximum current (fully clockwise).

NOTE: Some early Newport watermakers did not have a speed control. Instead the feed pump was pulsed to reduce flow during the flush cycle. See the MPC-3000 Service Manual for instructions on adjusting the flush water flow.

(27) SPECTRA™ SPEED CONTROL

DC powered Newport model watermakers shipped after January 1, 2007 are equipped with a Spectra™ feed pump speed controller. (See Note) The 12 and 24 Volt DC models use the same speed controller. Three preset, and one variable speed are available.

Near the center of the speed control board is a green 8 pin connector. The terminals on each end of the connector are positive and common. Next to the common terminal speed selection terminal 1. Speeds are selected by applying 12 or 24 volts to one of the speed selection terminals on the connector. The speeds have "priority" over each other. If more than one terminal has power to it the control will run at the speed having priority. 1 has priority over all other speeds, 2 has priority over 3 but not 1.

On the speed control circuit board are two magnetic switches for adjusting the pump motor rpm. The switches are narrow silver colored bars about 1/2" (1.5cm) long. The Increase Speed switch is labeled S2 and is located near the upper right corner of the board. The Decrease Speed switch is labeled S3 and is located to the right of the six cylindrical capacitors. Each time a small magnet is placed near the switch while the pump is running, a signal will be sent to the controller, changing the selected speed setting, and the pump will speed up or slow down slightly.

The speed controls have low voltage shut down protection. If the voltage drops too low the motor will stop abruptly, then start back up when the voltage recovers. This results in the feed pump motor "pulsing", stopping abruptly, then starting back up slowly.

SETTING RUN SPEED: Run Speed should be adjusted so that the Watermaker produces the specified amount of product flow at the specified power consumption and nominal feed pressure. Since feed pressure and power consumption vary with sea temperature and salinity, it may be desirable to adjust the Run Speed to optimize the pressure or power consumption in very cold or high salinity waters.

SERVICE SPEED: Limits the feed flow through the membranes during cleaning procedures and pickling to maintain feed pressure below 50psi.

SETTING FLUSH SPEED MPC-5000 MK-1 Only: Flush speed should be set to run the pump slowly enough that the vessels fresh water system can supply a sufficient flow of water through the charcoal filter, so that no sea water is drawn in during the flush cycle. The maximum flow through the Charcoal filter is 1.5 gpm (6lpm), so at flush speed the pump must discharge less than this amount. Flush speed can be checked by closing the sea cock during the flush cycle. If the system shuts down on the Check Sea Strainer alarm the feed pump is running too fast and drawing sea water into the system to make up the difference.

Instructions for setting the flush speed on MPC-5000 Mk-2 systems are found in the Owner's Manual

5/31/07

(28) VANE PUMP PRESSURE RELIEF

The Spectra vane type feed pumps used on Newport direct drive systems are equipped with an adjustable internal pressure relief valve. Magnetically driven pumps may also have a pressure relief valve on some systems. When this valve opens water is allowed to flow from the discharge side of the pump to the suction side. The valve will frequently make a "chirping" noise as it opens each time the Clark pump shifts. In cases where the feed pump is not producing its rated flow and pressure, or you here a high pitched chirp at each shift, the internal relief valve setting should be checked

On the side of the pump is an acorn nut. Remove the nut, being careful not lose the o-ring which fits into a groove in the nut. If the unit is running the pump will now suck air and make a lot of noise. Under the acorn nut is a slotted screw. Turn the screw clockwise to increase the pressure setting. Remember how many turns you give it. Replace the acorn nut. If the product flow and feed pressure readings increase then the valve was open. If there is no change the valve was closed. If the valve was closed return the screw to its original position.

If the valve was open Screw it in all the way and then back it off one turn. Replace the acorn nut.

08-28-06

5/15/06

(29) FEED PRESSURE SENSOR TEST MPC-3000

Two pressure sensors, p/n EL-SSR-XX, are on the discharge side of the feed water pump. One is located at the Inlet to the pre-filters and the other at the Outlet. The inlet side (red) sensor is used for the FEED WATER PSI reading and alarm. The inlet pressure is also compared to the outlet side (green) sensor reading to determine the pressure drop across the filters for the PREFILTER graph and alarm function. Newport 700 and 1000 systems use a 0-250 psi range sensor having a manufacturers part number "100cp2-27"printed on the sensor. All other models use a "100cp2-26" sensor. Check to make sure the correct sensors are installed. Put brand new clean 20 and 5 micron filters in the filter housings before proceeding.

If you are getting High Pressure or Service prefilter alarms check the sensors as follows. The pressure sensors connect to the MPC board at the green ten pin connector. Each has three wires. P (red) is +5V power to the sensor, G (black) is ground, and S, the middle wire, is the signal. The signal varies from .5 to 4.5 volts from 0psi to full range. With control power to the system but not running, and the pressure relief valve open. Check to make sure you have 5 volts on P and 0.5V on S. If S is higher than 0.5V the sensor is bad. If the voltages check out good on both sensors, start the system with the Manual Run Switch. The Signal voltages should come up to between one and two volts, and be nearly exactly the same.. If they do, the sensors are good. If not, replace the faulty sensor.

If the sensors are good, but you are getting false High Pressure or Service Pre-filter alarms, or the pressure reading or bar graph are not accurate, the MPC programming is wrong or the printed circuit board has a fault. To check the programming install the Spectra **Software for chips A24 thru B29** v. 1.08 software to a computer, and connect the computer to the main board using a USB to serial adapter. Consult the MPC-3000 **Field repair service manual** for instructions. When you have the computer communicating with the MPC controls, contact Tech Support at 415-526-2780 for further instructions.

If the sensors are good and you are getting a genuine High Pressure alarm see 11-High Feed Pressure.

If you are getting SERVICE PREFILTER false alarms and you cannot connect a computer to the system, you can zero out the pressure sensors with the key pad as follows. The system should be running with the pressure relief closed. Run the system manually if necessary. Simultaneously press the ALARM/DISPLAY button and the AUTO/STORE button at exactly the same time. Watch the display when you do it. When you get it right you will see some characters flash in the upper left corner of the display. Keep trying until you see the flash. Once it flashes the sensors are calibrated to zero differential.

(30) FEED PRESSURE SENSOR TEST

MPC-5000 Mk-1

Two pressure sensors, p/n EL-SSR-XX, are on the discharge side of the feed water pump. One is located at the Inlet to the pre-filters and the other at the Outlet. The inlet side (red) sensor is used for the FEED WATER PSI reading and alarm. The inlet pressure is also compared to the outlet side (green) sensor reading to determine the pressure drop across the filters for the PREFILTER graph and alarm function. Newport 700 and 1000 systems use a 0-250 psi range sensor having a part number "100cp2-27"printed on the sensor. All other models use a "100cp2 -26" sensor. Check to make sure the correct sensors are installed.

Open the Pressure Relief knob one turn. Put the controls into Program Mode and go to the "Pressure Range" window. If the selection is correct (High for –27 sensors, Low for –26) check the Inlet Pressure and Differential Pressure readings in the "Inlet Offset" and "Outlet Offset" windows. The Inlet pressure should be within a few psi of zero and the Outlet pressure should be exactly the same as the Inlet. If the Inlet Pressure reading cannot be adjusted to near zero or the outlet pressure can not be adjusted to match the inlet pressure, unplug both sensors and check the Inlet and Outlet pressures again. Both should read zero with the Offsets set to zero. If so then the sensor that didn't read properly when plugged in has failed. If the readings are not zero the cables have a short or the MPC board has a fault.

If the readings are correct both with the sensors plugged in and unplugged, put brand new clean filters in the 20 and 5 Micron filter housings. Plug in the sensors. Adjust the offsets so that both inlet and outlet pressures read zero. Start the feed pump with the Manual Run Switch. Both Inlet and Outlet pressures should be within the range of the pressures shown in 9-Nominal Flows and Pressures. If a reading stays at zero that sensor or cable is bad. If the readings are different one of the sensors is bad. If both readings exceed the nominal range something is restricting the flow. See 11-High Feed Pressure to determine what is causing the restriction.

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(31) FEED PRESSURE SENSOR TEST

MPC-5000 Mk-2

Two pressure sensors, p/n EL-SSR-XX, are used in Mark 2 systems. One (red) sensor is used for the FEED WATER PSI reading and alarm is on the discharge side of the feed water pump. Newport 700 and 1000 systems use a 0-250 psi range Feed Pressure sensor having a part number "100cp2-27" printed on the sensor. All other models use a "100cp2-26" sensor. The other (yellow) sensor is located on the feed pump suction This sensor has a 0-30 psia (absolute Pressure) range. This means that the sensor reading should be 14.7psi at atmospheric pressure. Check to make sure the correct sensors are installed.

Open the Pressure Relief knob one turn. Put the controls into Program Mode and go to the "Pressure Range" window. If the selection is correct (High for –27 sensors, Low for –26) check the Inlet Pressure and Outlet Pressure readings in the "Inlet Offset" and "Outlet Offset" windows. The Outlet pressure should read about 14.7psi. If it does the sensor is good. The Inlet pressure should be within a few psi of zero. If the Inlet Pressure reading cannot be adjusted to near zero or the outlet pressure can not be adjusted to 14.7, unplug both sensors and check the Inlet and Outlet pressures again. Both should read zero with the Offsets set to zero. If so then the sensor that didn't read properly when plugged in has failed. If the readings are not zero the cables have a short or the MPC board has a fault.

If the readings are correct both with the sensors plugged in and unplugged, put brand new clean filters in the 20 and 5 Micron filter housings. Plug in the sensors. Adjust the offsets so that the inlet reads 14.7 and the outlet pressure reads zero. With the pressure relief knob open, start the feed pump with the Manual Run Switch.

Outlet pressures should be within the range of the pressures shown in 9-Nominal Flows and Pressures. If the reading exceeds the nominal pressure given, something is restricting the flow. See 11-High Feed Pressure to determine what is causing the restriction. If the reading stays at zero the sensor or cable is bad.

Inlet Pressure should go up to about 17 psia. If it is lower than that See 34 Mark 2 Boost Pumps.

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(32) Vacuum Switch

The vacuum sensor is found inside the feed pump module in the feed pump suction piping, downstream of the sea strainer and 50 micron filter. It is used for the CHK SEA STRAINER alarm to warn of a clogged strainer or 50 micron filter. It is set for 15 inches Hg. It has three terminals: normally open, normally closed, and common.

On systems with MPC controls the switch should be wired to normally open (NO) and Common (C). When the switch closes the MPC controls shut the watermaker down and alarm CHK SEA STRAINER. If it is wired to (NC) you will get a false alarm. If you unplug the sensor the system should run normally. If you still get an alarm with the sensor unplugged there is a problem in the printed circuit board.

On Catalina Deluxe (non MPC) systems the switch is wired normally closed. If the switch opens the machine shuts off. If the switch fails the machine can be operated temporarily by jumping the leads together.

(33) PREFILTERS– MPC– SHURFLO PUMP SYSTEMS

4 different filters are used on these Spectra Watermakers to make sure that no damaging foreign materials enter the system. There are 3 filters in the system to clean the feed water of abrasive materials while the system is in operation, and a fourth filter that prevents the entrance of chlorine during fresh water flushing.

During normal operation the feed water is filtered in two stages. First it enters a fine mesh metal sea strainer That protects the feed pump from damage due to larger particles in the feed water. If the strainer causes too much restriction the feed pump will pump less water and production will drop and the product water salinity will increase.

After passing through the Feed Pump the feed water enters the filter housings containing 20 and 5 micron elements. These filters remove very fine particles which could damage the Clark pump and which would shorten membrane life. If the pressure drop across these filters exceeds 10psi (0.7bar) the system alarms **Service Prefilter**. If the filters are clean and you still get a Service Prefilter alarm see 29 Pressure Sensor Test MPC-3000 or 30 Pressure Sensor Test MPC-5000 MK-1

Cleaning schedules will vary widely depending on how and where the system is used. In very turbid water found in estuaries and bays the filters may plug up in only an hour or less. In some waters, such as the Florida Intracoastal the filters may look perfectly clean and still be plugged up. In crystal clear blue water conditions the filters may need to be cleaned much less frequently.

When operated only an hour or two a day in inland or near shore waters, the trapped plankton will begin to decay in the filters long before the elements plug up, and the bacteria involved in the decay will cause a “rotten egg” smell in the product water. This decay will set in overnight in tropical waters, or after a week or two in high latitudes. If handled gently and changed regularly before they get too smelly or plugged up, filters in this service can last through many of cleanings.

The charcoal filter used in the fresh water flush system will not plug up unless you have some incredibly dirty domestic water in your boat. About six months after installation the charcoal filter element will lose its effectiveness at removing any membrane damaging chlorine which may be present in domestic water. Charcoal filter elements must be replaced every six months if there is ANY chance that chorine could be introduced into the flush water. Charcoal filter elements cannot be cleaned.

To ensure that filter elements fit properly and remove chlorine effectively, they should be purchased at factory authorized dealers. Our element part number is FT-FTC-XX. The last two digits indicate the micron rating, e.g. FT-FTC-05 is for a 5 micron element. Charcoal elements are FT-FTC-CC.

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(34) Mark 2 Boost Pumps

All Spectra watermakers with MPC-5000 Mark 2 control systems are supplied with a Boost Pump. These Laing Pumps are small centrifugal DC pumps installed in the feed water line between the sea strainer and the pre-filters. The boost pump supplies positive pressure to the prefilter inlet. This prevents the feed pump from being damaged by cavitation due to too high a vacuum at the feed pump suction. The MPC Mk-2 control system has a pressure sensor installed at the feed pump suction. If the pressure drops to low the system will slow down to "LOW MODE". If the pressure drops even more the system will alarm Service Prefilters and shut down. This will happen if the boost pump is not operating properly even if the pre-filters are clean.

If you are getting Service pre-filter alarms even with clean pre-filters, check to make sure that the boost pump is pumping properly. First check to make sure it is getting power. If it is indeed getting power check the impellor for foreign material.

Remove the boost pump module from the bulkhead and take the pump out of the chassis. The pump can be opened by unscrewing the plastic ring that holds the pump body on to the motor. Inside the body is a magnetic impellor which will be magnetically attached to the motor. Pull the impellor out and check inside it for any foreign material. The impellor has a carbon socket that rides on a ceramic bearing. When reinstalling the impellor be put it in place gently because the carbon socket is delicate and will break if the impellor is allowed to "snap" into place.

(35) SYSTEM STALLED, SHURFLO

If the MPC controls do not receive a signal from the watermaker that water is flowing through it properly, the controls will stop the feed pump and attempt to "Restart." Older systems have a "Stroke Sensor" on the Clark Pump to send a signal that the Clark Pump is stroking. Because the Clark Pump is powered by water pressure from the feed pump, this can be due to a lack of feed water pressure. Failure to cycle can also be due to a malfunction inside the Clark Pump. If the Clark Pump is not cycling or a stroke sensor signal is not being received, the MPC controls it will try to start three times, displaying: RE-STARTING, and then alarm SYSTEM STALLED.

The stroke sensor, p/n EC-MPC-SC15, is on the side of the high pressure pump valve body. It is connected with a gray wire and snaps into a pocket in the side of the top section of the Clark pump. Units built after December 1, 2004 do not have a stroke sensor. These units use a "Roto Flow Meter". Check your Owner's Manual or Clark Pump to determine if you have a Roto Flow Meter.

1. Confirm that the feed pump is running. **If the pump is not running** check to make sure there is power to the pump. If the fan is running but the feed pump doesn't run then there is power to the pump. See 7-Shurflo Pump won't Run. If there is no power to the pump try running it from the manual switch. If the pump runs from the manual switch then there is a bad connection at the MPC board, a broken wire, or the MPC board has failed. Test the board by pressing auto run and checking for voltage at the PMP2 terminal.

2. **If the pump is running** confirm that water is flowing through the system. Check the flow at the brine overboard. If water is flowing through the system but the Clark pump is not cycling there is a Clark Pump malfunction: perform the "6 Clark Pump Checkout" Tests. **If the motor runs but no water flows** the feed pump may have an air lock. To clear an air lock, open the pressure relief knob for a few seconds while the pump is running or do a fresh water flush by pushing and holding the AUTO STORE button for five seconds, The Clark pump should cycle during the flush. If the Clark pump cycles during the flush, but won't cycle when the feed pump is running

3. Stroke Sensor Systems: If the Clark pump is shifting, but the MPC alarms "System Stalled" confirm that the green light on the stroke sensor is going on and off with each shift. If the light is blinking and you still get System Stalled, or the pump is cycling but the light is not blinking, perform the "22 Stroke Sensor Test."

4. Roto Flow Systems. Run the system on manual. Disconnect the 1/4" black product tube from the product outlet fitting on the membrane housing or where it enters the product manifold. If product water is coming out of the membrane go to "19 Calibrate Roto Flow. If no product is being made see 6-Clark Pump Checkout.

5/09/06

(36) DIVERSION VALVE STICKING

All MPC equipped systems have an electric solenoid actuated three way diversion valve in the product water line. The MPC controls monitor the salinity of the product water as it passes over the salinity probe. If the product water salinity is better than the preset upper limit, the valve will be energized and the product will go to boat's water tank. If the salinity is higher than the limit the valve will be de-energized and the product will be sent overboard in the brine.

When the system starts up and the product quality becomes good the green "GOOD" light will come on and the controls will send full "pull in" voltage (12 or 24 volts) to the valve for two seconds. After two seconds the voltage drops to 20% of full voltage for "Hold In".

If the good light is coming on but no water is going to the water tanks then either the valve is not receiving a signal or is not responding to the signal. First check to make sure the controls are sending the signal. Put you voltmeter on "GND" and "DVLV" on the printed circuit board. These are the first two terminals on the terminal strip next to the large BAT- terminal. Start the machine and watch the meter carefully. When the green light comes on the voltage should go to 12 or 24, then drop after two seconds to about 2 or 4 volts. If the voltage is good remove one of the wires from its terminal and use your ohm meter to check for continuity through the valve coil. 12 volt valves should read about 10 ohms, 24 volt valves around 38 ohms. 12 volt valves have black wires coming out of the, 24 volt valves have white wires. If the ohm reading is very high then there is a loose or broken wire or the solenoid coil has failed.

If the signal and coil are good but the valve still won't open the valve may be stuck shut and need to be cleaned. Disconnect the black product tube from the hexagonal stainless steel port on the valve and unscrew the hexagonal port from the valve. You will now be able to pull the black solenoid coil off of the valve. Under the coil is a disc with two holes in it for a spanner. Use needle nose pliers or snap ring pliers to unscrew the disc. Inside the valve you will find a plunger, a spring, and a rubber o-ring. Try not to disturb the o-ring. Remove the plunger and spring and clean them thoroughly. Clean inside the plunger housing as well. Apply a light coat of waterproof grease before to the spring and plunger when reassembling.

01-15-07

(37) CAT-300 FEED PUMP WON'T RUN

In auto run mode the Catalina 300 feed pump is powered from a relay inside the MPC printed circuit board box. On manual it is powered directly from the Bat + terminal. If the pump will run on manual but not on Auto Run, the problem will be a loose connection at the relay, a bad relay, or a fault on the PCB board not sending a signal to the relay.

If the feed pump runs poorly or won't start even on manual, check the brushes in the pump motor. They could be dirty, broken, or worn out. The rear bearing and brush holders are mounted inside the motor rear cover. Unscrew the accessible black slotted disc in the rear cover. Apply power to the motor using the manual switch and push in the top of the brush with a small non conductive rod or stick. If the motor starts, or was running badly and now speeds up, the brushes are worn out or the springs that push the brushes down are weak.

Remove the spring clip that holds the brush in its holder by pushing it in with needle nose pliers until the little hooks at the bottom disengage. Inspect the spring, if it is discolored or misshapen it has overheated and must be replaced. After removing the spring, pull the brush from the holder by pulling on the copper braid. A new brush is about almost 1 inch (2cm) long. If the old brushes are less than 1/2 inch (12mm) long they should be replaced. Replacement brushes and springs are available from Spectra Watermakers. The motor must be removed from the chassis to replace the other brush. Remove both brush covers and springs. Loosen the screw that holds down the copper braid fork connector, and pull out the brush.

Clean the end cap, brushes, brush holders, and commutator with compressed air or an electrical cleaner which will evaporate completely. Try not to get the carbon dust down inside the motor as much as possible. Check the commutator for "high mica." There should be a 1/16" (1mm) deep groove between each commutator section. If the copper commutator sections have worn down to the point that the mica insulation is flush with or higher than the copper, the brushes will not be able to touch the copper, and sparking, intermittent operation, and rapid brush wear will occur. In this case the motor should be taken to a repair shop for a rebuild. In an emergency the mica can be cut down with a hook scraper made from an old hacksaw blade or other thin metal.

5/15/06