

Owner's Manual

Pro, Deluxe, & Enhanced Systems

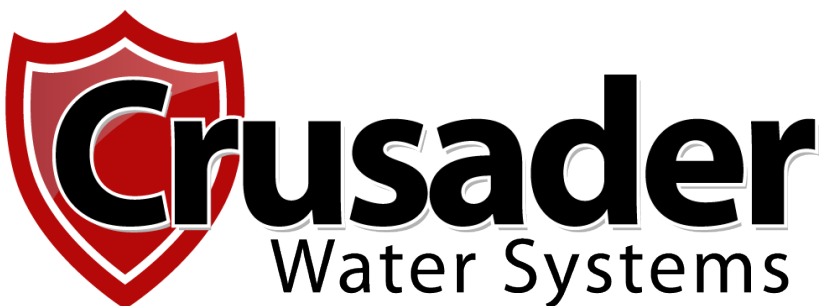
2020 Model Year



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This Product is Made with Pride in the United States of America



Each valve is tested and certified by the WQA to NSF/ANSI Standard 61 for material safety and structural integrity and lead free compliance as well as CSA B483.1.

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System Features and Benefits

Your newly purchased Crusader Water Quality Management System utilizes robust water treatment technologies which allow you to enjoy cleaner, softer, and better water.

Efficient

The Crusader System learns your lifestyle and quickly adapts itself to meet your needs to deliver exceptional water quality while also saving you salt, water, and electricity. The highly sensitive digital flow-meter installed in your system allows it to learn how much water you use and when you use it so it can adjust reserves and salt consumption to match your water usage lifestyle while minimizing bacterial growth.

Upgradeable

Designed for the future, your Crusader System is capable of being modularly upgraded as new technologies are developed to accommodate for rapidly degrading water conditions. The onboard control center can be updated with the latest software updates & upgrades as they become available.

Reliable

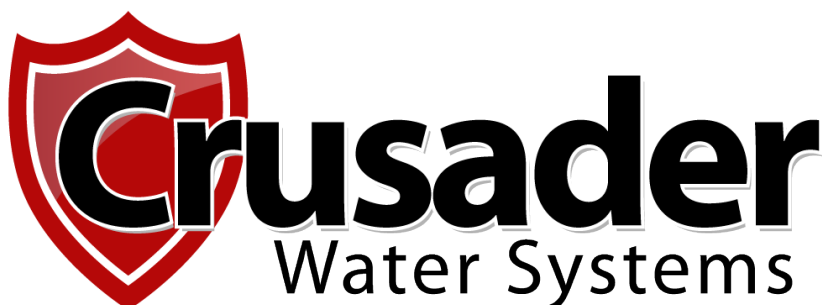
The Crusader Water Quality Management System is built around Open-platform technology that has a 40-year legacy of reliable design. It utilizes 21st century composite materials to ensure reliable and dependable performance.

Safe

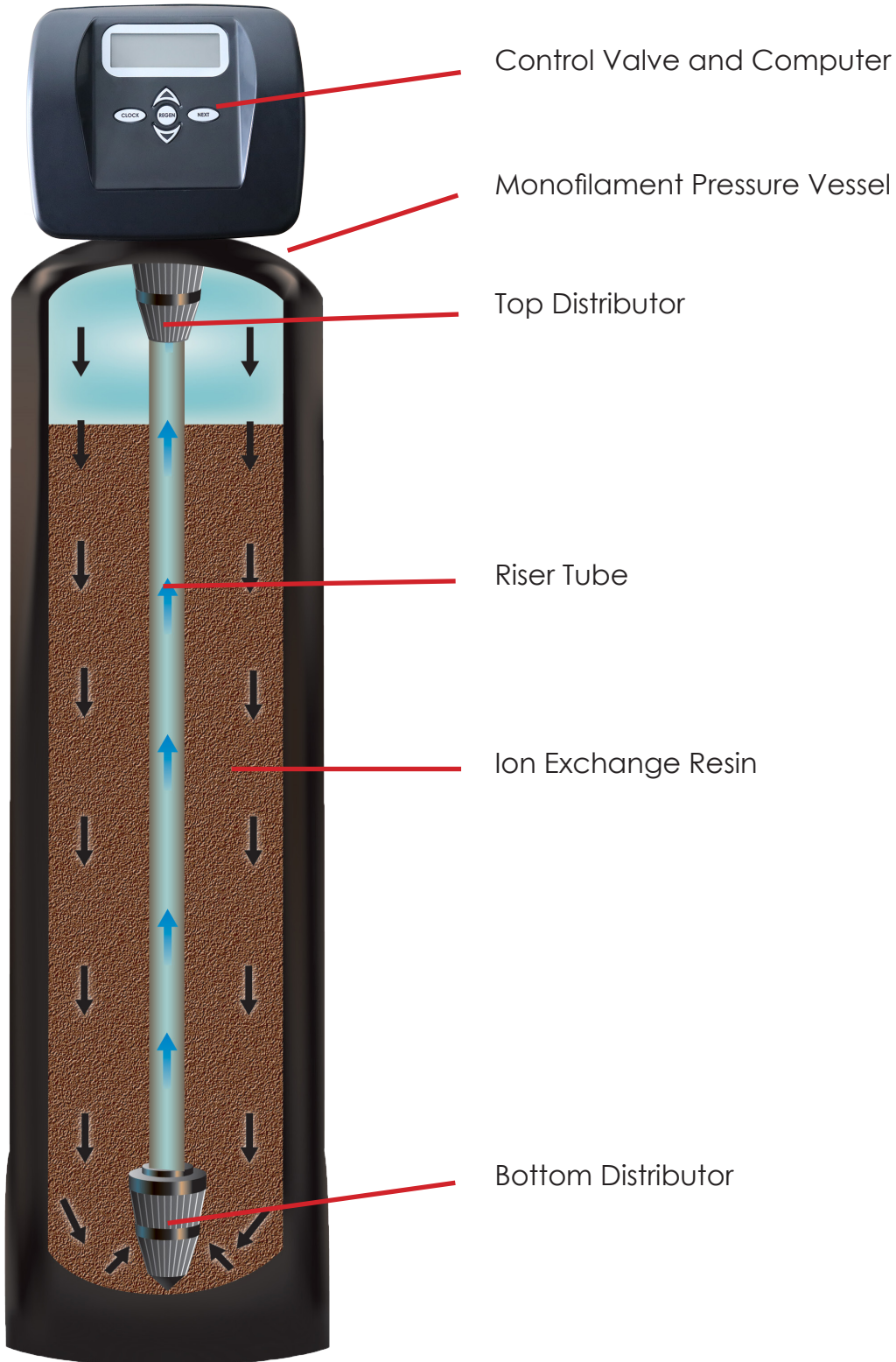
Every Crusader System is handcrafted in the USA by skilled artisans in a world-class facility to provide you with a water treatment system that exceeds industry safety, manufacturing, and quality control standards to give you peace of mind.

Simple

Advanced manufacturing methods and skillfully crafted computer hardware & software make a Crusader Water Quality Management System one of the easiest water quality improvement systems to own and operate.



System Components (Pro Model)

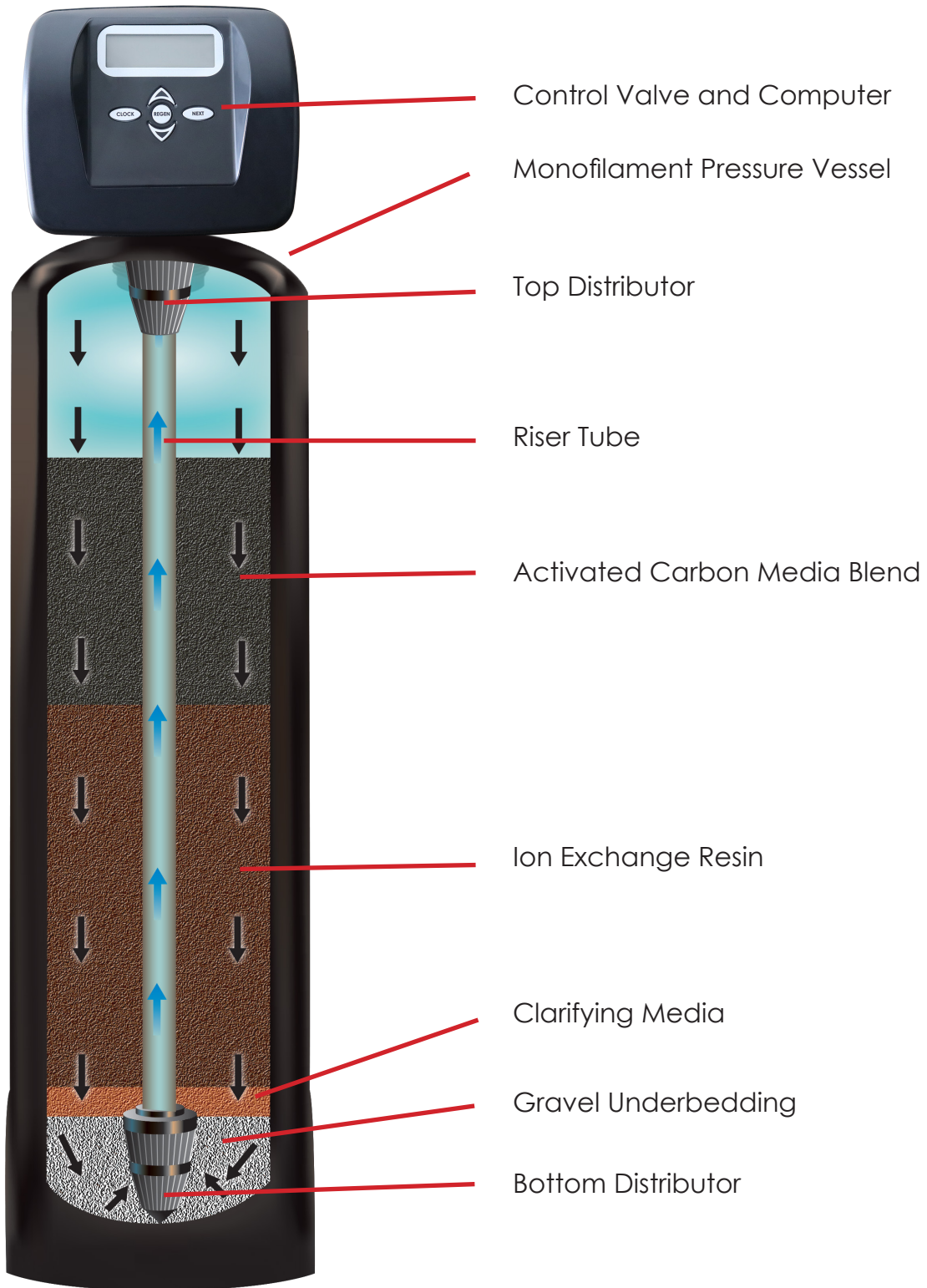


The system must be **BYPASSED, DEPRESSURIZED, and DE-ENERGIZED** before assembling or performing mechanical repairs



Disassembly, Repair, Replacement, and/or Reassembly should only be performed by properly trained service personnel

System Components (Deluxe Model)

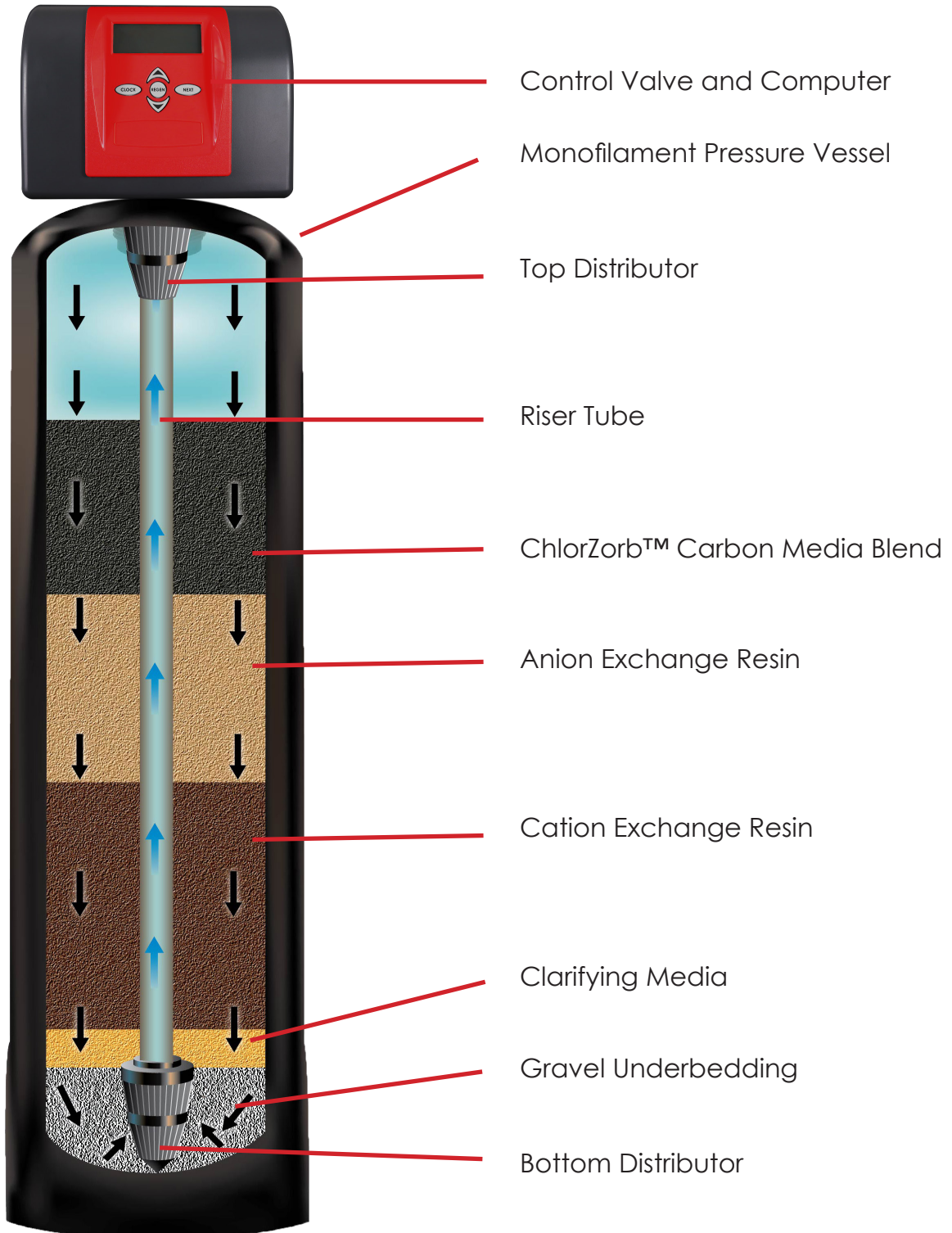


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System Components (Enhanced Model)



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Your Responsibilities as an Equipment Owner

Your Crusader Water Quality Management System is manufactured to be efficient and reliable. To ensure continued performance while keeping your system operating within manufacturer's specifications, the following operating conditions must be ensured by you, the equipment owner/operator:

Water Pressure Regulator

The influent water pressure into this water system must be regulated by a code-compliant pressure-regulating device not to exceed 75 psi.

Power Protection

Power to this system must be supplied by an unswitched 110VAC supply. Surge protection is mandatory and is to be supplied by you, the equipment owner. The use of a UPS (Uninterruptible Power Supply) is encouraged.

Salt

This water system uses either sodium or potassium salt to clean itself. The brine tank must be filled with a high quality salt to ensure proper system operation. Consult with your local water professional to decide on the best salt for your area.

ProGuard

The ProGuard reservoir should be kept full to ensure proper system operation and maximum efficiency. ProGuard works synergistically with the softening media to ensure the very best water feel and to maximize cleaning power. Check the level of your ProGuard feeder each time you fill your brine tank with salt.

Periodic Replacement of Media

While built to the highest standards, certain media in your Crusader Water Quality Management System will need to be replaced periodically. Replacement intervals vary depending on your water chemistry and water consumption habits. Consult with your local water specialist to ensure that you always enjoy the very best water quality.

ProGuard™

The ProGuard™ feeder incorporated into every Crusader System ensures that you have the best water quality all year long. This simple dispensing system is specially engineered to work in all climates to easily introduce ProGuard into your brine tank while the system is waiting to clean itself.

Your Crusader System will use varying amounts of ProGuard depending on your water consumption habits; it will always try to maximize efficiency and performance to provide you with the water quality that you deserve.

ProGuard is designed to:

- Clean ion-exchange resin without damaging structured matrix media
- Clean all moving parts & create a temporary protective coating
- Create an inhospitable environment for bacteria in the system
- Remove oils and other hydrocarbons from resin
- Clean Activated Carbon Media
- Enhance self-sanitization processes on compatible systems

Always keep your ProGuard reservoir full to ensure proper system performance, longevity, & efficiency.



Cleaning and Disinfection

Your Crusader Water Quality Management System is probably the hardest working appliance in your home. Over its service life, it will process millions of gallons of water to protect you from countless amounts of inorganic calcium, magnesium, lead, copper, zinc, iron, manganese, and other contaminants that could be in your water.

In addition to capturing inorganic contaminants, your softener also accumulates sediment, bacteria, algae, mold, and fungus that can enter the system through safe city water, salt, or even from the air. These additional contaminants slowly accumulate in your softener and can even colonize it with a biofilm of Heterotrophic Plate Count (HPC) bacteria. These bacteria are usually benign, but they can create a food base and safe refuge for potentially harmful pathogens and seriously compromise the longevity and performance of your system. While weekly antibacterial rinses and supplementation with ProGuard help minimize bacterial growth, your system should also be cleaned and disinfected on a regular schedule to ensure that it is working to the best of its ability and to protect the safety of your family.

Recommended Cleaning & Disinfection Schedule

This chart shows the recommended monthly cleaning interval.

		# PEOPLE IN HOME					
		1	2	3	4	5	6
WATER HARDNESS (grains per gallon)	1	12	12	12	12	12	12
	5	12	12	12	12	12	12
	10	12	12	12	12	12	12
	15	12	12	12	12	12	12
	20	12	12	12	12	12	6
	25	12	12	12	6	6	6
	30	12	12	6	6	6	6
	40	12	12	6	6	6	6

Your local dealer can perform the cleaning and disinfection service for you, or you can purchase a comprehensive cleaning and disinfection kit to perform this task yourself.



The system must be **BYPASSED, DEPRESSURIZED, and DE-ENERGIZED** before assembling or performing mechanical repairs



Disassembly, Repair, Replacement, and/or Reassembly should only be performed by properly trained service personnel

System Control & Operation

Your Crusader Water Quality Management system incorporates a highly sophisticated microprocessor control system, which makes it as efficient and reliable as possible. All system settings are pre-programmed at the factory and then carefully calibrated by your qualified in-staller for your specific application and area.

Your Crusader Water Quality Management System incorporates flash EEPROM memory and an innovative power backup system, which means that your system programming should never have to be reset, even in the event of an extended power outage. Your system can also be upgraded with the latest software and hardware revisions as they become available. Contact your local authorized dealer for more information.

Normal Operating Mode

In **Normal Operating Mode**, the display shows the time of day, capacity remaining, and the system status. Your system continuously monitors the flow meter and makes decisions on when and how to clean based on its programming profile and observations of your water usage habits.

Flow Meter

In **Service Mode**, the display will show the time of day and remaining capacity. The remaining capacity counts backwards in gallons as water is used. The flow display indicator can be used to determine if the flow meter is working by opening a faucet downstream of the system and observing the gallons count down as well as the flow glyph.

Power-Failure Handling

In the event of a power failure, your system's integrated Snapshot memory system will retain all programmed data indefinitely. The system will maintain the correct time of day during a period of several hours. In the case of a prolonged power failure, the time of day might not be maintained; if this happens, the time of day indicator will be flashing when the power supply is reestablished. This flashing indicator lets you know that the time of day needs to be reset. All other programming is unaffected.

Critical Software/Hardware Failure

After a critical software or hardware failure, the **Error Information** icon may illuminate with a solid or blinking light. Call your local service provider for help.

System Control & Operation

Cleaning/Regeneration Mode

Cycle times will vary depending on your water usage habits, the system operational history, pre-programmed settings, and other environmental factors. In **Regeneration Mode** the display shows the current cleaning cycle description and the remaining time for that cycle to execute. The cleaning sequence is as follows:

Tank Fill	Your system calculates the exact amount of brine solution required to properly clean itself based on pre-programmed settings, operational history, your water usage habits, and the age of the system. Your system is online and in service at this time.
Percolation	Your system remains online and in service while the water and salt slowly mix together to create a perfectly saturated sodium or potassium brine solution.
Brine Draw	Your system will extract brine water from the brine tank and apply it to the ion exchange media in the tank. This begins the ion exchange process where trapped hardness and other contaminants are forced off of the ion exchange resin beads.
Slow Rinse	Once the brine supply is exhausted, your system will begin slowly rinsing contaminants through the media bed and out of the tank to drain.
Backwash	Your system rapidly discharges water upwards through the media to the drain. This ensures that trapped sediment & broken media are flushed out of the tank to minimize pressure loss & channeling.
Rapid Rinse	A high velocity stream of water is directed downwards through the multimedia bed to compact each of the media layers, flush hard water from the tank, and prepare for returning itself to service.
Return to Service	The system slowly drives the operating piston to the home position and gracefully brings itself back online, ready to work hard for you.

Your system will periodically perform an antibacterial deep cleaning. This cleaning cycle will occur after a designated period of time (we recommend at least once a week). This cleaning cycle will inject ProGuard into your system and possibly even use salt to clean itself, depending on your water usage. If you haven't used any water during that interval, the system will not use any salt during the antibacterial cleaning cycle.

Understanding How Your System Operates

Every day, thousands of billions of tons of water evaporate from the earth's surface. As the heat of the sun evaporates the water and draws it from the earth's surface into the atmosphere, many impurities are left behind. The water vapor eventually cools to form clouds and then falls back to earth as precipitation.

On its way from the clouds to your faucet, soft rain water dissolves and absorbs a part of almost everything it touches.

Falling rain cleans the air as it falls. Unfortunately the impurities that were removed from the air have not left; they have just been relocated through the water onto the ground. These gases and other airborne contaminants can cause undesirable tastes, colors, and odors in water.

Rain falls onto the ground, collecting sediments like rust, sand, and even algae. The water eventually finds its way to a surface water supply or percolates downward and collects in an aquifer. As it percolates through the earth, the water can absorb hardness minerals, iron, heavy metals, radioactivity, organic contaminants, and many other complex elements and compounds.

Water can also collect numerous harmful man-made chemical impurities during this cycle. These synthetic chemicals are generally odorless, colorless, and tasteless; and can sometimes be life-threatening. The statement "my parents drank this water for 50 years and it never hurt them", is no longer a valid excuse to not be concerned with water quality. There has been a massive global increase in exposure to chemical waste over the last 50 years.

The scientific and medical community has not had adequate time or budget to study the long-term health effects of the more than 70,000 harmful chemicals that can be found in use today.

Approximately 1,000 new synthetic chemical compounds are entering the industrial marketplace each and every year. Precipitation falls upon commercial and municipal dump sites, toxic waste sites, industrial refuse depots, military test sites, leach fields, mining operations, farmer's fields, etc. where it dissolves minute amounts of the toxic chemicals present and carries them along into water sources.

In 1986, the United States Government estimated that close to two percent of the nation's ground water supplies were moderately polluted by sources such as hazardous waste dumps and leaking landfills.

Industrial wastewater is also a major source of water contamination. Chemicals that are considered generally acceptable in controlled amounts may react with other elements and/or chemicals to form new compounds that could be highly carcinogenic. Chlorine is one of the best-publicized examples. It reacts with organic matter in water and forms deadly trihalomethanes.

Understanding How Your System Operates

Hard water is one of the major threats facing the American home in the 21st century. Hard water can coat you, your family, your home, and your appliances with thousands of pounds of inorganic mineral rock-scale each and every year. Hard water slowly destroys everything it touches; if left untreated, hard water costs you money, ruins your lifestyle, and can even lower the value of your home.

No one needs to tell you that you're living with hard water though. Soap doesn't lather easily, glasses are cloudy after washing, a ring forms around the bathtub, faucets and shower heads are crusty, laundering results are poor, and there are many other easily recognizable signs.

There are several degrees of water hardness. Even moderately hard water can seriously damage the plumbing system in your home and, in time, cause inconvenient and expensive problems.

Hard water is a poor cleaner because it is loaded with a variety of impurities. These dissolved impurities react with certain chemicals found in soap to form a gummy, insoluble curd that clings stubbornly to everything it touches. The ring around your bathtub is curd. That same curd causes your hair to become dull and hard to manage.

Soap curd clogs skin pores and prevents your natural oils from properly moisturizing your skin. This dryness causes itching and can also aggravate skin conditions like psoriasis, eczema, and acne.

Soap curd is especially noticeable by the scummy film it forms on dishes, glassware, walls, and floors. Hardness and other dissolved solids combine to form the residue you see as spots on glasses, crockery, cutlery, and shower enclosures.

How Water Hardness is Measured

Water hardness is measured in imperial Grains per Gallon (gpg). A grain is the weight of an average dry grain of wheat, approximately 1/7000th of a pound.

Soft Water	0 - 0.5 gpg
Slightly Hard Water	0.5 - 3.5 gpg
Moderately Hard Water	3.5 - 7.0 gpg
Very Hard Water	7.1 - 10.5 gpg
Extremely Hard Water	10.5 gpg and greater

Water Softening Process

The smallest units that make up chemical compounds and still retain the properties of those compounds are called molecules. Molecules are made up of atoms or groups of atoms. Electrically charged atoms are called ions. The charge of a single ion can be either positive or negative. Ions of metals and minerals are usually positively charged, and are called cations. Ions such as chlorine, nitrate, phosphate, fluoride, and sulfates are negatively charged, and are called anions.

Certain insoluble materials are made up of large ions forming a skeletal structure containing oppositely charged ions. These ions can be exchanged with other similar ions in an ion exchange.

The first commercial application of ion exchange was water softening in 1905. Since then, ion exchange has been the most reliable and cost-effective method of softening and conditioning water in homes and industry.

The softening of water by ion exchange relies on the replacement of the calcium and magnesium ions in the water by an equivalent number of sodium ions.

The softening process may be illustrated by the following equation:

R2.Na +	Ca(HCO3)2 =	R2.Ca+	2NaHCO3
Sodium Ion Exchange Resin	Calcium Bicarbonate in Water	Calcium Ion Exchange Resin	Sodium Bicarbonate in Water

Obviously, the system can only exchange a certain amount of hardness and other contaminants before becoming exhausted. This is referred to as the capacity of the resin. The capacity of the resin is referred to as grains of calcium carbonate hardness removed per cubic foot of resin or Milliequivalents per liter. When the capacity has been exhausted, the resin needs to be regenerated with a solution of sodium chloride (brine) as follows:

R2.Ca +	2NaCl =	2 R.Na +	CaCl2
Calcium Ion Exchange Resin	Sodium Chloride Brine	Sodium Ion Exchange Resin	Calcium Chloride Water

Ion exchange resins used in your Crusader Water Quality Management System are made without harmful toxic solvents. This media is designed to be physically and chemically strong while producing water that feels good, tastes great, and works hard for you.



Your Crusader Water Quality Management System can be regenerated with Potassium Chloride salt if desired.

Warnings & System Operational Requirements

The Crusader Water Quality Management System incorporates cutting-edge technology to bring you water that is perfectly soft and free of inorganic minerals.

Your system is designed to address certain impurities in your water through the process of salt-based ion exchange.

Your system should only be installed on water that is microbiologically safe. To ensure best performance, and maintain warranty compliance, the following installation requirements should be met:

	Minimum	Maximum
Water Temperature	30 F	75 F
Water Pressure	30 psi	75 psi
Influent Water Hardness	0 gpg	100 gpg*
Influent pH	6.7	8.7
Influent TDS	10 ppm	1000 ppm*
Pathogenic Bacteria	N/A	0 CFU
Chlorine	0 ppm	3 ppm
Chloramine	0 ppm	1 ppm
Ambient Temperature	40 F	120 F

* Influent water hardness levels above 22gpg and TDS above 500ppm will negatively impact the taste of the water



Do not use with water that is unsafe or of unknown quality. Test water periodically to verify that the system is performing satisfactorily. Discard small parts remaining after installation.



Read and follow the information in this manual to minimize the risk of electric shock or personal injury.

If you are unsure about the installation of your system, contact technical support, a professional plumber, or certified water specialist.

This system must be installed in compliance with applicable state and local codes, applicable law, and regulations.

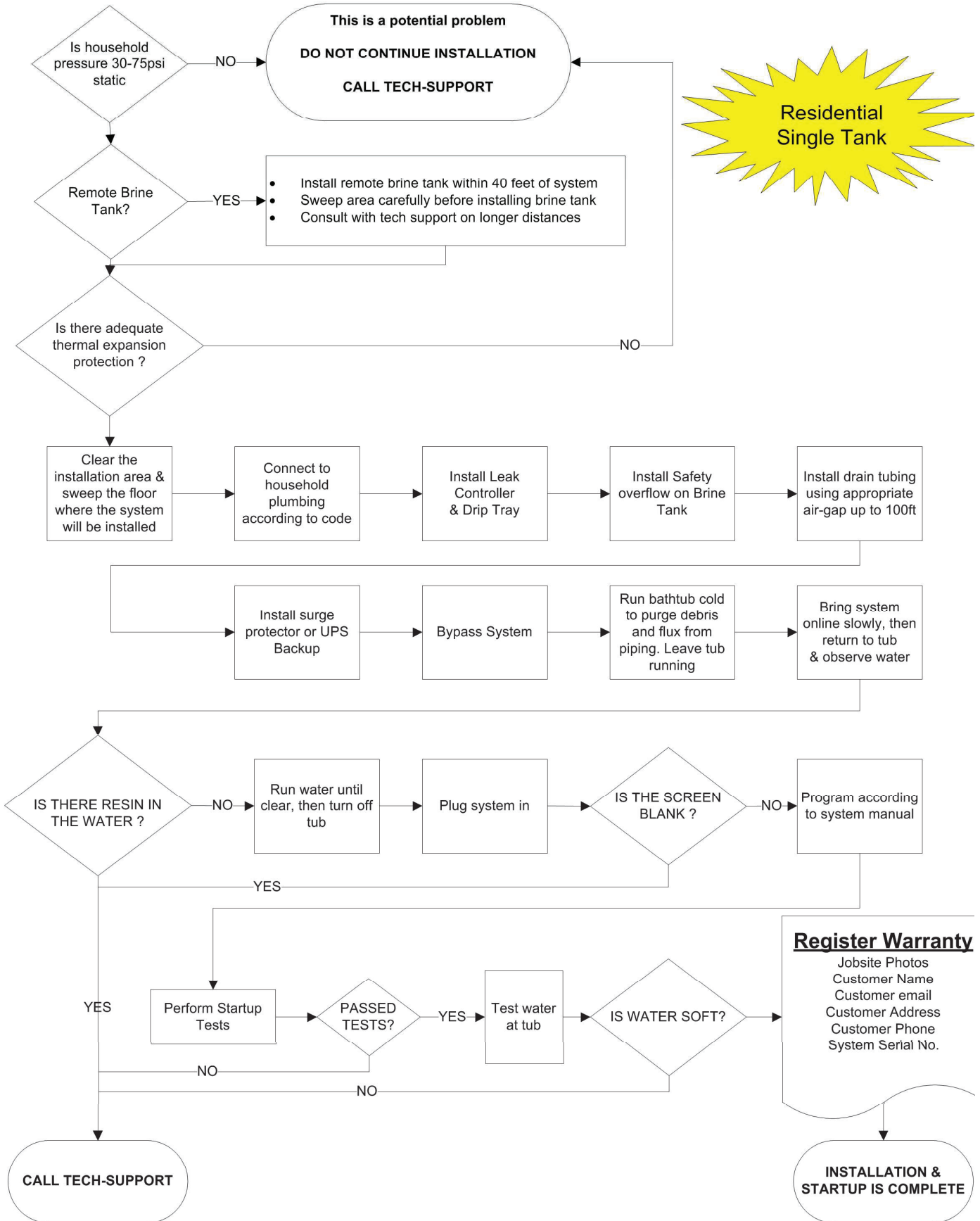


To bypass the system, turn bypass knob on both sides of the valve to bypass position. When returning to service, put the inlet into service before the outlet.

System Installation & Startup Guidelines

1. Clear the installation area and carefully sweep the floor where the system will be installed.
2. Test incoming water pressure and make sure it is 30 - 75 psi static. A code-compliant pressure regulator must be installed to protect the system on all municipal water installations.
3. Check to confirm that the water heater has adequate heat expansion protection.
4. Install the system, drain, and brine tank overflow according to the manufacturer's instructions and prevailing local code.
5. Bypass the system.
6. Run bathtub cold to purge piping of debris and chemical residue from installation. This will take approximately 5 minutes at 3 gpm.
7. Leave bathtub running and slowly open the **inlet** valve to the system.
8. Slowly open the **outlet** valve from the system.
9. Observe flow of water from the bathtub. Water will become a dark brown/black color. This color is caused by the system disinfectant/preservative as well as dust from shipping and handling. Allow water to run until clear. Observe water for particles. If resin or other softening media particles are found in the water, bypass the system and call tech-support. Leave bathtub running.
10. Enter programming mode:
 - Program the system to match the installation configuration and operating conditions.
 - Begin a cleaning cycle by pressing and holding the REGEN button for at least 5 seconds.
 - Advance the system through each cycle step by pressing the REGEN button.
 - Observe the system during each cycle and then progressively advance to the next until the regeneration terminates.
11. Once the system has been advanced to normal operating mode, observe the flow of water from the bathtub again for any sign of disinfectant or resin. Allow water to run clear. Turn bathtub off.

Installation And Startup Checklist



CONTROL VALVE OPERATING PARAMETERS

Minimum / Maximum Operating Pressures	30 psi (138 kPa) - 75 psi (862 kPa)
Minimum / Maximum Operating Temperatures	40°F (4°C) - 110°F (43°C)
Supply Voltage/ Frequency	120V AC/ 60 Hz Other Options Available
Power Consumption	9.5 W
Output Voltage	12V AC
Output Current	500 mA

GENERAL WARNINGS

The control valve, fittings and/or bypass are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC., MAY DAMAGE PRODUCTS THAT CONTAIN O-RINGS OR PLASTIC COMPONENTS. EXPOSURE TO SUCH HYDROCARBONS MAY CAUSE THE PRODUCTS TO LEAK. DO NOT USE THE PRODUCT(S) CONTAINED IN THIS DOCUMENT ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC.

THIS WATER METER SHOULD NOT BE USED AS THE PRIMARY MONITORING DEVICE FOR CRITICAL OR HEALTH EFFECT APPLICATIONS

Do not use Vaseline, oils, other hydrocarbon lubricants or spray silicone anywhere. A silicone lubricant may be used on black o-rings but is not necessary.

The nuts and caps are designed to be unscrewed or tightened by hand or with the special plastic wrench. If necessary a pliers can be used to unscrew the nut or cap. Do not use a pipe wrench to tighten or loosen nuts or caps. Do not place a screwdriver in the slots on caps and/or tap with a hammer.

Do not use pipe dope or other sealants on threads. Use Teflon tape on the threaded inlet, outlet and drain fittings. Teflon tape is not necessary on the nut connection or caps because of o-ring seals.

After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons unplug power source jack from the printed circuit board (black wire) and plug back in or press and hold NEXT and REGEN buttons for 3 seconds.

This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and then reset the valve to the service position.

All plumbing should be done in accordance with local plumbing codes. The pipe size for the drain line should be a minimum of ½". Backwash flow rates in excess of 7 gpm or length in excess of 20' require ¾" drain line.

Solder joints near the drain must be done prior to connecting the drain line flow control fitting. Leave at least 6" between the drain line control fitting and solder joints when soldering pipes that are connected on the drain line control fitting. Failure to do this could cause interior damage to the drain line flow control fitting.

When assembling the installation fitting package (inlet and outlet), connect the fitting to the plumbing system first and then attach the nut, split ring and o-ring. Heat from soldering or solvent cements may damage the nut, split ring or o-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring and o-ring. Avoid getting primer and solvent cement on any part of the o-rings, split rings, bypass valve or control valve.

Plug into an electrical outlet. Note: All electrical connections must be connected according to local codes. (Be certain the outlet is uninterrupted.)

Install grounding strap on metal pipes.

It is not recommended to change control valves from downflow to upflow brining or vice versa in the field. The valve bodies for downflow and upflow are unique to the regeneration type and should not be interchanged. A mismatch of valve body and regeneration piston will result in hard water bypass during service.

The control valve is compatible with a variety of regenerants and resin cleaners. The control valve is capable of routing the flow of water in the necessary paths to regenerate or backwash water treatment systems. The injector regulates the flow of brine or other regenerants. The control valve regulates the flow rates for backwashing, rinsing, and the replenishing of treated water into a regenerant tank, when applicable.

The control valve uses no traditional fasteners (e.g. screws); instead clips, threaded caps and nuts and snap type latches are used. Caps and nuts only need to be firmly hand tightened because radial seals are used. Tools required to service the valve include one small blade screw driver, one large blade screw driver, pliers and a pair of hands. A plastic wrench is available which eliminates the need for screwdrivers and pliers. Disassembly for servicing takes much less time than comparable products currently on the market. Control valve installation is made easy because the distributor tube can be cut ½" above to ½" below the top of tank thread. The distributor tube is held in place by an o-ring seal and the control valve also has a bayonet lock feature for upper distributor baskets.

The AC adapter comes with a 15 foot power cord and is designed for use with the control valve. The AC adapter is for dry location use only. The control valve remembers all settings until the battery power is depleted if the power goes out. After the battery power is depleted, the only item that needs to be reset is the time of day; other values are permanently stored in the nonvolatile memory. The control valve battery is not rechargeable but is replaceable.

INSTALLATION

Allow one foot of clearance to service the valve.

The valve will withstand transportation and storage temperatures of -13 °F (-25 °C) to 131 °F (55 °C) and for short periods up to 158 °F (70 °C). If valve has been exposed to freezing conditions let valve warm up to room temperature before running water through it. The valve has been packaged to prevent damage from the effects of normal humidity, vibration and shock.

Place softener in desired location close to water supply inlet, after pressure tank, and near a source for waste water, (utility sink, floor drain or sewer line). A 115/120V, 60 Hz uninterrupted outlet is required. Keep softener far enough away from walls and other obstructions to allow enough room for servicing the unit. All sillcocks and similar fixtures that will use untreated water must have their pipes connected to the hard water side of the softener. The bypass valve should be installed so that water will be available if it should be necessary to shut off the pressure in order to service the softener.

The cabinet tank or mineral tank must be reasonably level and solidly in place. Prior to beginning work to the system, make sure that water pressure is shut off at the incoming water supply and that several water spigots are open to provide sufficient venting for drainage of that system.

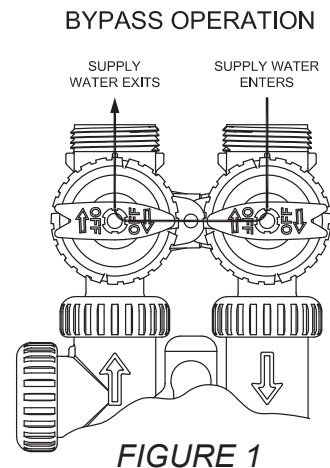
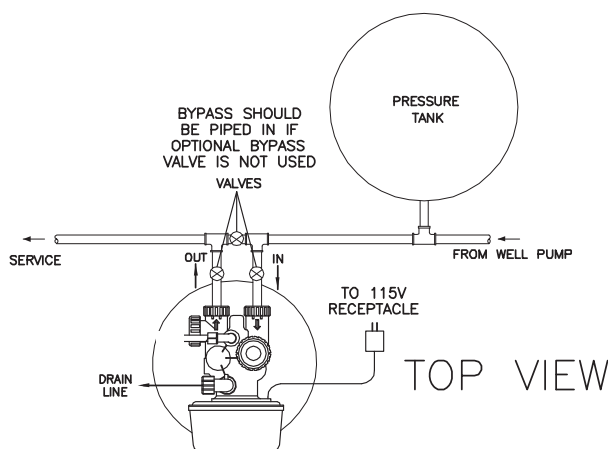
Arrows are molded into the control valve to show the direction of the flow.

BYPASS VALVE: The bypass valve easily connects to the control valve body using nuts that only require hand tightening. Install with red knobs in the upward position. Press end of bypass valve with o-rings into valve. Hand tighten nuts. Place into

BYPASS OPERATION (figure 1 page 21).

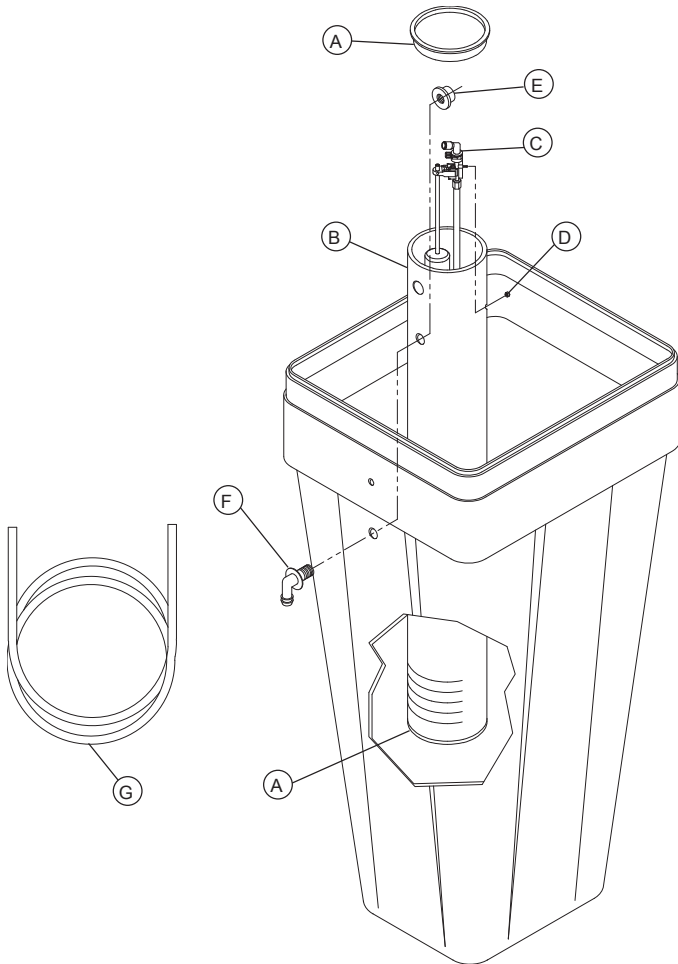
Avoid getting primer and solvent cement on any part of the o-rings or split rings, bypass valve or control valve. DO NOT use pipe dope or any other sealant on threads. Teflon tape is not necessary on the caps because of o-ring seals. Do not use Vaseline or other unacceptable lubricants on o-rings. A silicone lubricant may be used on black o-rings.

DRAIN LINE: The 3/4" drain line elbow accommodates 5/8" poly tube or 3/4" NPT drain line connections. The nut and poly tube insert for the 3/4" drain line elbow is designed for use with flexible poly tube only. The drain line elbow can be rotated so the outlet can be oriented toward the nearest drain



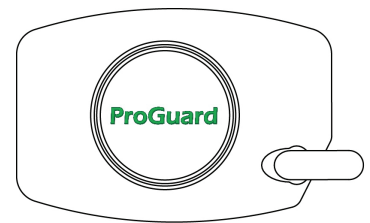
TO INSTALL 5/8" POLY TUBE DRAIN LINE: The poly tube insert is shipped attached to the drain line elbow's locking clip. Press the insert into the drain line (5/8" poly tube not included). Loosen nut of the drain line elbow. Press 5/8" poly tube with insert into the drain line elbow until it seats on the back of the fitting. Tighten nut.

It is simplest to run the drain line into a sump pump pit or washing machine drain if possible. If this is not practical, a fitting with a trap must be installed in a sewer line. Place the trap as close to the vent as possible to prevent siphoning of the trap when large amounts of waste water go through the sewer line. **DO NOT** pipe the drain line solidly into the waste line, as this is prohibited by most plumbing codes. The drain line should enter the trap from above so the water will not back up in the drain line if sewer should become plugged up and the trap overflow. The trap should have a short pipe extending from it to prevent splashing when water runs into the trap from drain line.

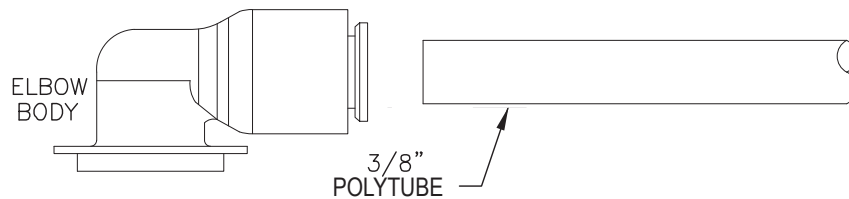


ASSEMBLE THE BRINE TANK: Install a brine well cap (Item A) on the bottom of the brine well (Item B). Remove the brine valve assembly (Item C) from the brine well by removing the nut (Item D). Attach the brine well to the brine tank with the two-piece overflow (Items E & F) using the lower holes in both pieces, as shown. Reinstall the brine valve assembly. Push brine line polytube (Item G) through the upper holes in the brine tank and brine well and press the polytube into the elbow fitting.

ProGuard



BRINE LINE CONNECTIONS: Connect the brine line polytubing found with the brine tank to the brine connection on the control valve. The control valve has a standard refill elbow to which a 3/8" flexible tube can be connected, see below. Press the polytube into the brine elbow fitting. Make sure the floor is clean beneath the brine tank and that it is level and smooth.



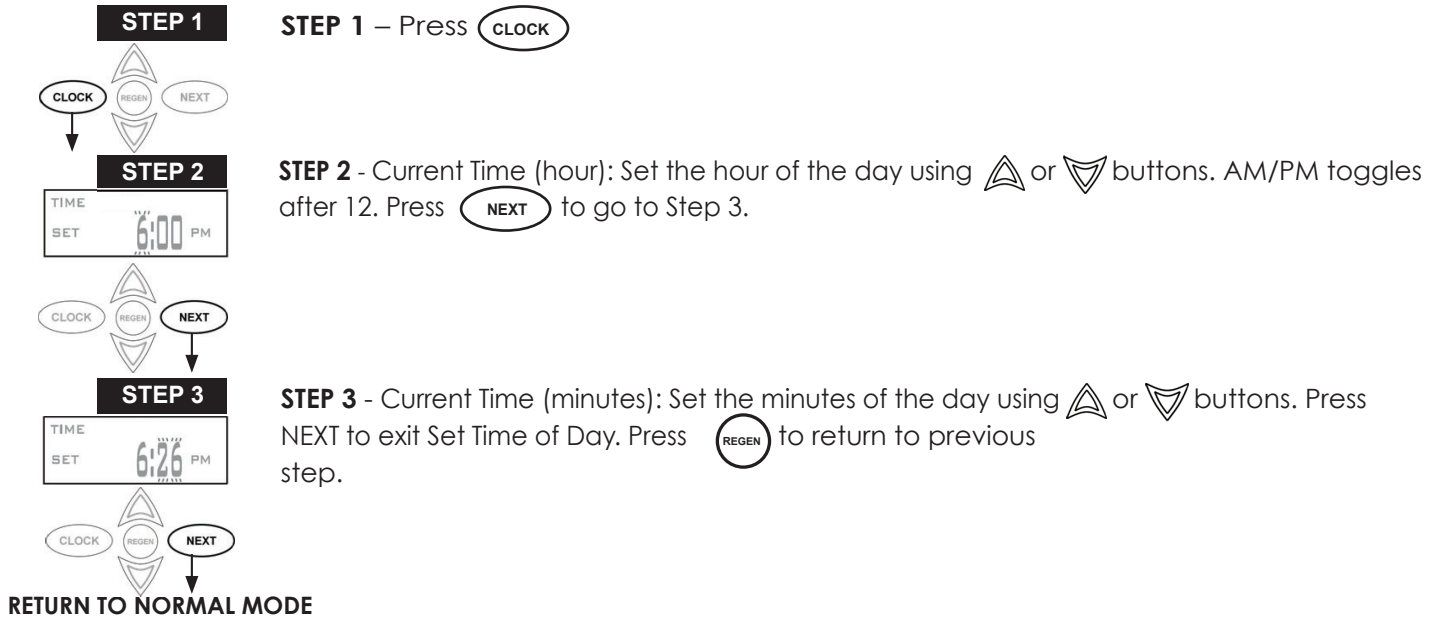
BRINE LINE FITTING CONNECTIONS

BRINE TANK OVERFLOW PRECAUTION: A 1/2" (inside diameter, not provided) gravity drain line should be connected to the overflow fitting on the side of the brine tank. This overflow is in case of a malfunction in the brine shut off. If the unit is installed where water may flow in the event of an overflow and cause water damage, connect a length of flexible tubing and run to a drain below the level of the overflow. **(Do not connect the tubing to the drain line on the control valve. Do not run tubing above overflow height at any point.)**

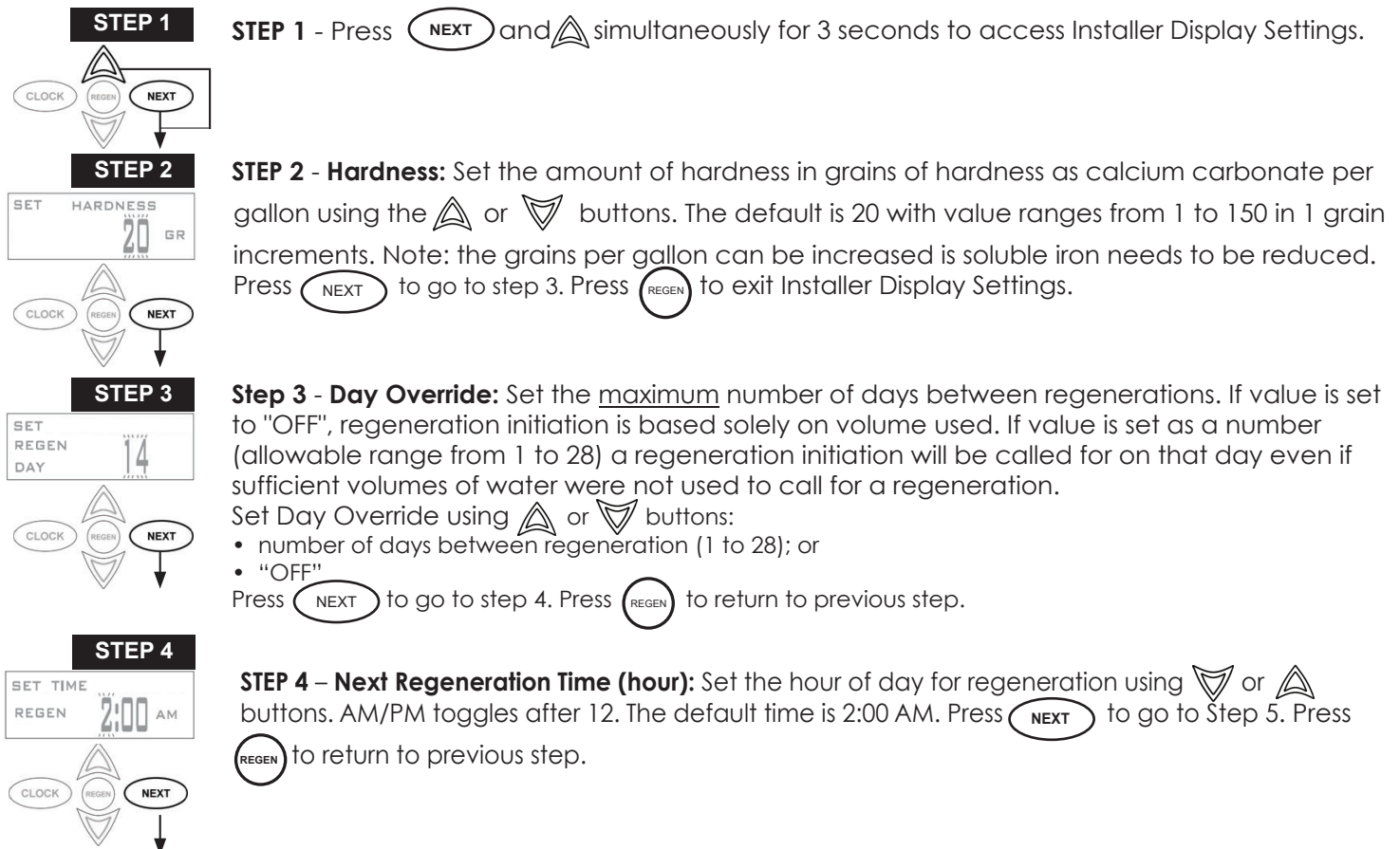
PROGRAMMING THE CONTROL VALVE: Note: A quick-reference card is stored inside the front cover of the control valve. To access this card, slightly pull tabs on side of cover outward and pull cover forward. Plug the electrical cord into a 115 Volt receptacle. **DO NOT** plug into an outlet controlled by a wall switch or pull chain that could inadvertently be turned off. Wait a couple of seconds for control valve to "home" itself. Panel should display "TIME" and the time of day will be flashing.

SET TIME OF DAY

Current time of day needs to be entered during initial installation, and adjusted when daylight saving time begins or ends. If an extended power outage occurs and depletes the on-board non-rechargeable coin cell battery, when power resumes the time of day should be reset and battery replaced.

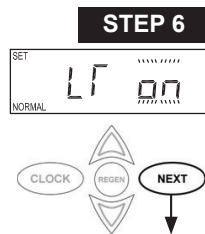


ADJUST HARDNESS, DAYS BETWEEN REGENERATIONS, OR TIME OF REGENERATION





STEP 5 – Next Regeneration Time (minutes): Set the minutes of day for regeneration using or buttons. Press to return to normal operation. Press to return to previous step.



STEP 6 – Set Backlight Operation using or : ON indicates the backlight is always on. OFF sets the backlight to go off after 5 minutes of inactivity.

RETURN TO NORMAL MODE

PLACING UNIT INTO SERVICE: Make sure inlet and outlet valves are to their closed positions. If using optional bypass, place in bypass position. Turn on main water supply. Open a cold water faucet. This will clear the lines of any debris (solder, pipe dope, etc.) that may be in the line. Let water run at tap for a couple of minutes, or until clear. Turn off faucet. Manually add 1½ gallons of water to the brine tank.

- Press and hold the **REGEN** button for approximately 5 seconds until the motor starts.
- Wait until display reads **BACKWASH** and numbers start counting down.
- Momentarily press **REGEN** again. Wait until display reads **BRINE** and numbers start counting down.
- Momentarily press **REGEN** again. Valve is now in the second **BACKWASH** position.

If using optional bypass **SLOWLY** turn bypass valve to **DIAGNOSTIC** position (**figure 2**) or slowly open inlet valve to allow water to slowly enter the softener.

When water is flowing steadily to drain without the presence of air, momentarily press **REGEN** again. Display will read **RINSE**.

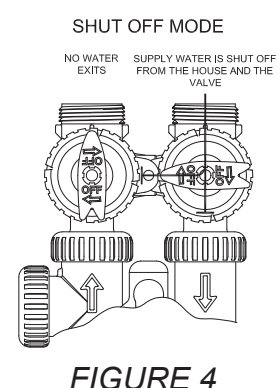
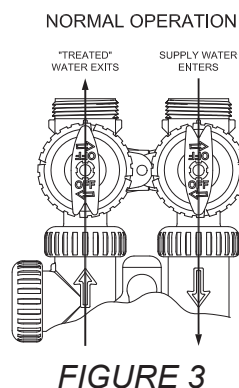
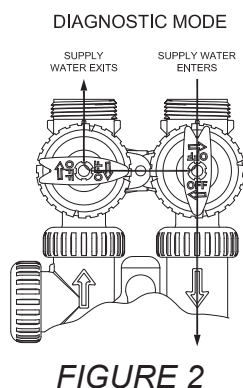
Open the outlet valve of the softener, or if using optional bypass place to **NORMAL OPERATION MODE (figure 3)**.

Allow control to finish the **RINSE** cycle. It will then advance to the **FILL** position. The brine tank will now automatically fill with the proper volume of water for the first regeneration.

Allow the control to automatically advance to the **SOFTENING** position.

Load the brine tank with salt. Solar Salt is recommended.

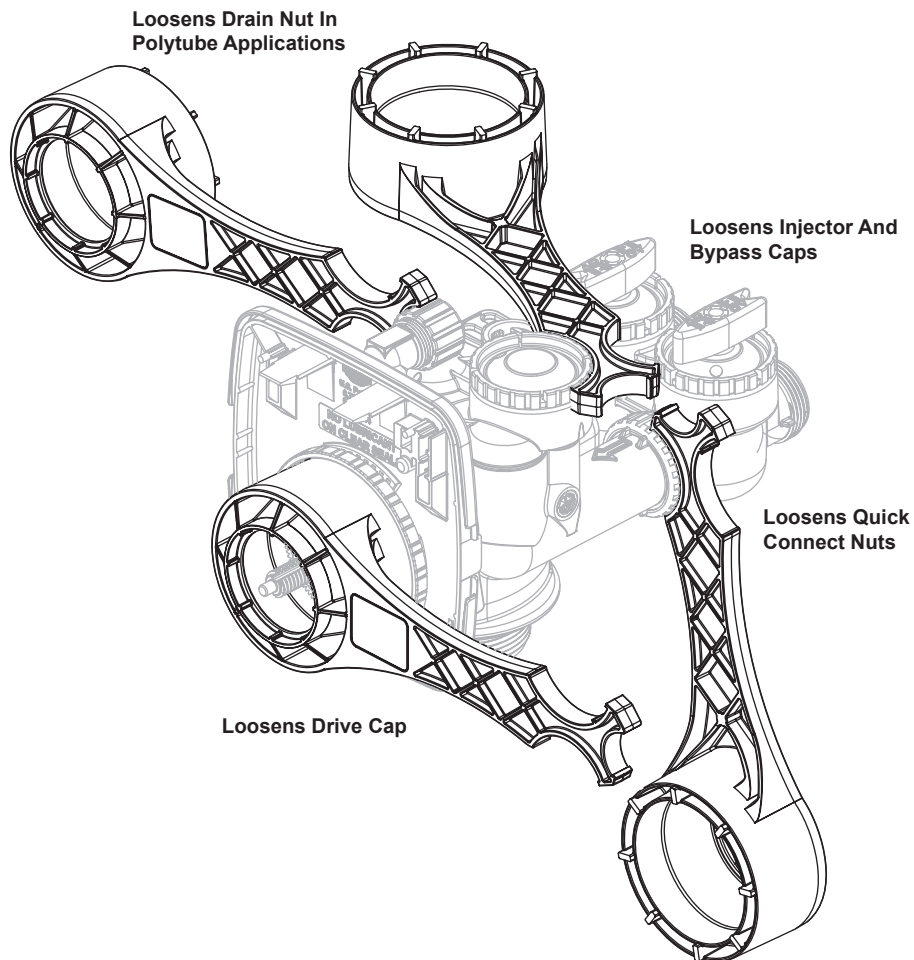
SANITIZING: Use 2 oz. of 5¼% household chlorine bleach for each cubic foot of resin. Pour bleach directly into the brine well of the softener. Press and hold the REGEN button for 5 – 6 seconds until the motor starts running. Allow system to complete the regeneration automatically. Check for other local and state codes which may also specify sanitation methods.



OPTIONAL MAINTENANCE WRENCH

Part Number V3193

Although no tools are necessary to assemble the valve, the optional maintenance wrench (shown in various positions on the valve) may be purchased to aid in assembly or disassembly.



BYPASS VALVE: The bypass valve is typically used to isolate the control valve from the plumbing system's water pressure in order to perform control valve repairs or maintenance. The WS1 bypass valve is particularly unique in the water treatment industry due to its versatility and state of the art design features. The 1" full flow bypass valve incorporates four positions, including a diagnostic position that allows service personal to work on a pressurized system while still providing untreated bypass water to the facility or residence. Its completely non-metallic, all-plastic design allows for easy access and serviceability without the need for tools.

The bypass body and rotors are glass filled Noryl³ (or equivalent) and the nuts and caps are glass filled polypropylene. All seals are self-lubricating EPDM to help prevent valve seizing after long periods of non-use. Internal o-rings can easily be replaced if service is required.

The bypass consists of two interchangeable plug valves that are operated independently by red arrow-shaped handles. The handles identify the flow direction of the water. The plug valves enable the bypass valve to operate in four positions.

- 1. Normal Operation Position:** The inlet and outlet handles point in the direction of flow indicated by the engraved arrows on the control valve. Water flows through the control valve during normal operation and this position also allows the control valve to isolate the media bed during the regeneration cycle. (See Figure 3)
- 2. Bypass Position:** The inlet and outlet handles point to the center of the bypass, the control valve is isolated from the water pressure contained in the plumbing system. Untreated water is supplied to the plumbing system. (See Figure 1)
- 3. Diagnostic Position:** The inlet handle points in the direction of flow and the outlet handle points to the center of bypass valve, system water pressure is allowed to the control valve and the plumbing system while not allowing water to exit from the control valve to the plumbing. (See Figure 2)
- 4. Shut Off Position:** The inlet handle points to the center of the bypass valve and the outlet handle points in the direction of flow, the water is shut off to the plumbing system. If water is available on the outlet side of the softener it is an indication of water bypass around the system (i.e. a plumbing connection somewhere in the building bypasses the system). (See Figure 4)

SERVICE INSTRUCTIONS

DRIVE ASSEMBLY:

The drive assembly consists of the following parts:

- Drive Bracket
- Printed Circuit (PC) Board
- Motor
- Drive Gears
- Drive Gear Cover

The drive bracket holds the PC board, the motor, the drive gears and the drive gear cover in place.

The PC board receives and retains information, displays the information, determines when to regenerate and initiates regeneration. The display shows different types of information in the initial system set up (for softeners or filters), installer display settings, diagnostics, valve history or user display settings.

The PC board powers the motor. The PC board's two-prong jack connects wires to the direct current (DC) motor. The motor is held in place on the drive bracket by a spring-loaded clip and a small bulge in the plastic, which fits in one of the slots on the motor housing. The motor turns drive gears that drive the piston to cycle positions for backwashing, regeneration, rinsing, refill or service. The motor is fully reversible (turns both ways) and changes direction of rotation to change the direction of piston motion. The motor is easily replaced if necessary.

There are three drive gears held in place by the drive gear cover. All three drive gears are the same size. A reflective coating is applied to the gears. As the center drive gear turns a light shines on the coating and a light sensing diode determines if a light pulse was returned. The PC board counts the pulses and determines when to stop driving the motor.



When servicing the valve, water may leak from the valve. Water from the valve may create a slip hazard. Clean up water spills.



Disconnect from electrical power prior to servicing the valve.

Remove the valve cover to access the drive assembly.

Disconnect the power source plug (black wire) from the PC board prior to disconnecting the motor or water meter plugs from the PC board. The power source plug connects to the four-pin jack. The motor plug connects to the two-pin jack on the left-hand side of the PC board. The water meter plug (gray wire) connects to the three-pin jack on the far right-hand side of the PC board.

The PC board can be removed separately from the drive bracket but it is not recommended. Do not attempt to remove the display panel from the PC board. Handle the board by the edges. To remove the PC board from the drive bracket, unplug the power, water meter and motor plugs from the PC board. Lift the middle latch along the top of the drive bracket while pulling outward on the top of the PC board. The drive bracket has two plastic pins that fit into the holes on the lower edge of the PC board. Once the PC board is tilted about 45° from the drive bracket it can be lifted off of these pins. To reinstall the PC board, position the lower edge of the PC board so that the holes in the PC board line up with the plastic pins. Push the top of the PC board towards the valve until it snaps under the middle latch, weave the power and water meter wires into the holders and reconnect the motor, water meter and power plugs.

The drive bracket must be removed to access the drive cap assembly and pistons or the drive gear cover. It is not necessary to remove the PC board from the drive bracket to remove the drive bracket. To remove the drive bracket start by removing the plugs for the power source and the water meter. Unweave the wires from the side holders. Two tabs on the top of the drive back plate hold the drive bracket in place. Simultaneously lift the two tabs and gently ease the top of the drive bracket forward. The lower edge of the drive bracket has two notches that rest on the drive back plate. Lift up and outward on the drive bracket to disengage the notches.

To reassemble, seat the bottom of the drive bracket so the notches are engaged at the bottom of the drive back plate. Push the top of the drive bracket toward the two latches. The drive bracket may have to be lifted slightly to let the threaded piston rod pass through the hole in the drive bracket. Maintain a slight engaging force on top of the drive bracket while deflecting the bracket slightly to the left by pressing on the side of the upper right corner. This helps the drive gears mesh with the drive cap assembly. The drive bracket is properly seated when it snaps under the latches on the drive back plate. If resistance is felt before latching, then notches are not fully engaged, the piston rod is not in hole, the wires are jammed between the drive bracket and drive back plate, or the gear is not engaging the drive cap assembly.

To inspect the drive gears, the drive gear cover needs to be removed. Before trying to remove the gear cover, the drive bracket must be removed from the drive back plate. (Refer to the instructions above regarding removing the drive bracket from the drive back plate. The drive gear cover can be removed from the drive bracket without removing the motor or the PC board.) The drive gear cover is held in place on the drive bracket by three clips. The largest of the three clips is always orientated to the bottom of the drive bracket. With the PC board facing up, push in and down on the large clip on the drive gear cover. Handle the cover and the gears carefully so that the gears do not fall off the pegs in the cover.

Replace broken or damaged drive gears. Do not lubricate any of the gears. Avoid getting any foreign matter on the reflective coating because dirt or oils may interfere with pulse counting.

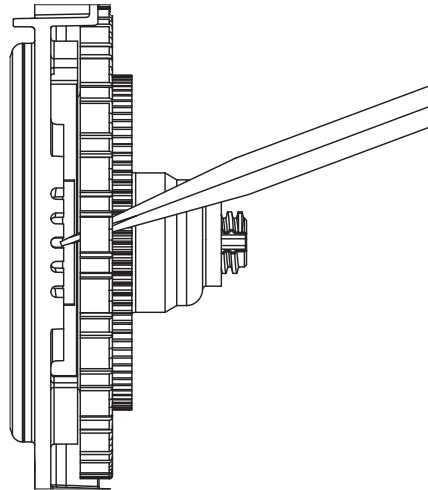
The drive gear cover only fits on one way, with the large clip orientated towards the bottom. If all three clips are outside of the gear shroud on the drive bracket the drive gear cover slips easily into place.

The drive bracket does not need to be removed from the drive plate if the motor needs to be removed. To remove the motor, disconnect the power and motor plugs from the jacks on the PC board. Move the spring clip loop to the right and hold. Rotate the motor at least a ¼ turn in either direction so the wires are vertical (up & down) before gently pulling on the wire connectors to remove the motor. Pulling directly on the wires without rotating the motor may break the wires off the motor.

DRIVE CAP ASSEMBLY, MAIN PISTON AND REGENERANT PISTON:

The drive gears turn the main gear of the drive cap assembly, which moves the piston. The screw-driven, horizontally moving piston stops at specific positions to direct the flow of water to backwash, regenerate, rinse or refill. The PC board determines the position of the piston by counting pulses produced when the piston is moved. An optical sensor looking at one of the reduction drive gears generates these pulses. Each cycle position is defined by a number of pulses. The counter is zeroed each time the valve goes to the service position. The PC board finds the service position by noting the increase in current delivered to the motor when the mechanical stop at the service position is reached. This method of controlling piston position allows for greater flexibility and requires no switches or cams (U.S. Patent 6444127).

A regenerant piston must be attached to the main piston.



SPACER STACK ASSEMBLY:

The spacer stack assembly provides the necessary flow passage for water during the different cycles. The all-plastic spacer stack assembly (U.S. Patent 6402944) is a one-piece design which allows the stack to be removed using your fingers.

The exterior of the stack is sealed against the body bore with self lubricating EPDM o-rings, while the interior surface is sealed against the piston using slippery self cleaning directional (one-way) silicone lip seals. The lip seals are clear in color and have a special slippery coating so that the piston does not need to be lubricated.

INJECTOR CAP, SCREEN, INJECTOR PLUG AND INJECTOR:

The screen, injector and/or injector plug(s) are installed under the injector cap in an easy to access location on top of the valve. The injector cap contains four slots so no water accumulates in the cap. The injector cap is designed to be hand tightened.

Under the injector cap there is an easy to clean removable screen to prevent fouling of the injector. There are two holes under the injector cap labeled "DN" and "UP". The holes will be filled with a plug or an injector.

The plug (Order # V3010-1Z) prevents water from traveling a certain pathway. The injector lets water pass through the pathway. The self-priming injector increases the velocity of the water, creating a zone of negative pressure that draws in the concentrated liquid regenerant, such as sodium chloride (brine), potassium permanganate, etc. The regenerant blends with the stream of water, which passes through the media to regenerate the bed.

The injector provides a consistent regenerant/water mixture ratio over the entire operating pressure range of the control valve. The injector provides good performance in a variety of applications, which may involve elevated drain lines and long regenerant draw lengths. Injectors are chosen by knowing the type, amount, and regenerant flow rate for a particular type of media. Guidelines can be found in the media manufacturer's literature. The color coded injectors give different regenerant draw, slow rinse and total flow rates over the pressure range.

NOTE: It is not recommended to field convert valves from upflow to downflow and vice versa. Separate areas in the valve supply water to the injector for upflow and downflow valves.

REFILL FLOW CONTROL ASSEMBLY OR REFILL PORT PLUG:

The refill flow control assembly consists of a refill flow elbow, refill flow control retainer assembly, refill flow control, polytube insert and nut assembly. The refill flow control retainer fits in the refill elbow. The refill flow control retainer houses the refill flow control which controls the flow rate when the regenerant tank is being refilled. The refill flow control is a flexible washer-like part with a small orifice and a precision molded contour that delivers a steady 0.5 gpm regenerant tank refill rate at varying inlet pressures. Refill is accomplished with treated water.

The refill flow control assembly is installed in an easy to access refill elbow located on top of the control valve. The refill flow control assembly is attached to the control valve with a locking clip. The locking clip allows the elbow to rotate 270 degrees so the outlet can be orientated towards the regenerant tank.

The control valve has a standard refill elbow to which a 3/8" flexible tube can be connected.

WATER METER:

The water meter is installed on the outlet side of the control valve. The water meter uses a turbine to measure gallons of treated water. printed circuit (PC) board. The turbine rotates with the flow of water and reports its rate of rotation through Hall effect. This rotation permits the PC board to record the total volume of treated water and the flow circuitry to the rate. The small centrally located magnet is shielded from water, which substantially reduces iron-fouling problems with the turbine.

THIS WATER METER SHOULD NOT BE USED AS THE PRIMARY MONITORING DEVICE FOR CRITICAL OR HEALTH EFFECT APPLICATIONS.

OPERATING PRESSURES: 20 PSI MINIMUM / 125 PSI MAXIMUM • OPERATING TEMPERATURES: 40°F MINIMUM / 110°F MAXIMUM

The turbine is accurate to within $\pm 5\%$ over a wide operating flow rate range (0.25 gpm (0.95 lpm) up to control valve maximums) and has a very low pressure drop. Water used for regeneration is not metered. If the control valve is set to prefill the regenerant, water used between the prefill cycle up to the start of the regeneration cycle is metered. If the control valve is in regeneration mode (e.g. a backwash cycle) and there is a water demand, that water usage is not metered.

When facing the front of the control valve, the water meter is positioned on the left-hand side of the control valve. Allow sufficient clearance to clean and repair the water meter without disconnecting the plumbing or disassembling any other parts of the control valve.

Control valves can be ordered with a meter plug (i.e. no electronics or turbine) rather than a water meter if desired. Control valves without meters should only be set up for time clock operation (i.e. no water meter, no demand-initiated regeneration). Control valves with water meters provide a wider variety of useful information.

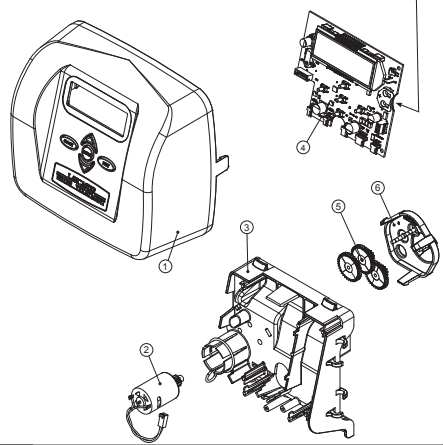
Do not lubricate the turbine shaft. The turbine shaft bearings are pre-lubricated.

Do not use Vaseline, oils or other unacceptable lubricants on the o-ring. A silicone may be used on the black o-ring. Snap the turbine on the shaft and reinsert the water meter into the side slot. Hand tighten the nut. Do not use a pipe wrench to tighten nut.

When replacing the battery, align positives and push down to fully seat.

Correct Battery Orientation

Battery replacement is 3 volt lithium coin cell type 2032.

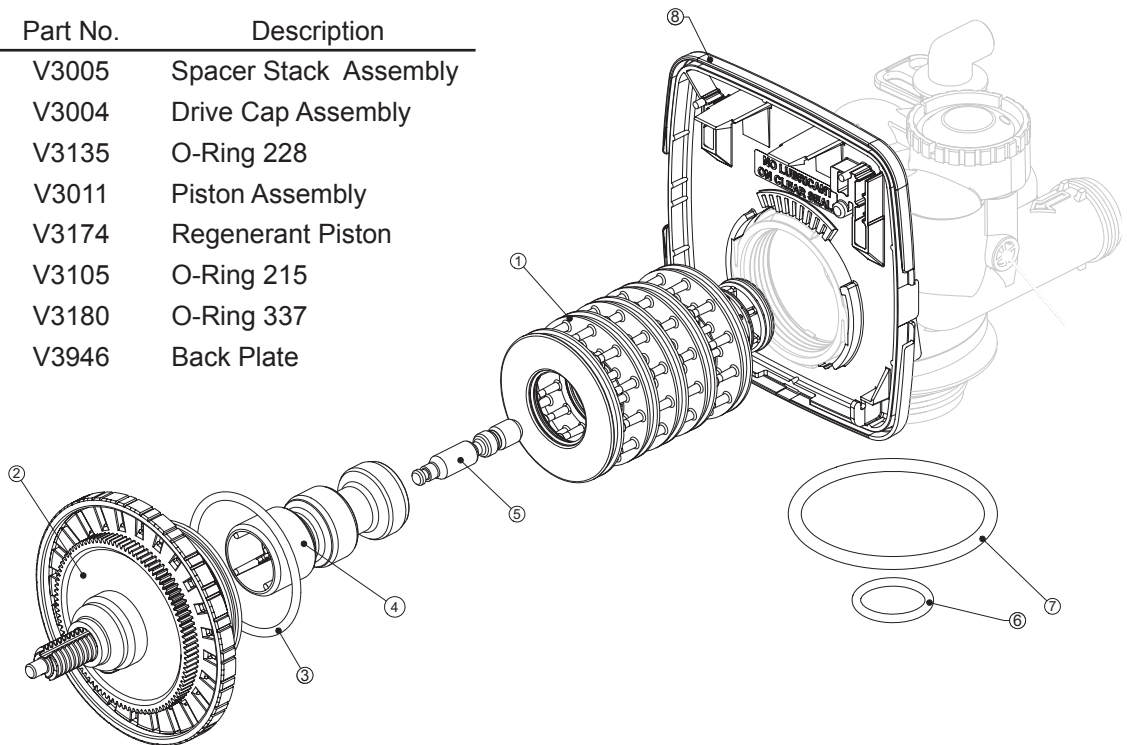


FRONT COVER AND DRIVE ASSEMBLY

Item No.	Qty.	Part No.	Description
1	1	V4161	Front Cover Assembly
2	1	V3107	Motor
3	1	V3106	Drive Bracket & Spring Clip
4	1	V4183LM-BOARD	PC Board
5	3	V3110	Drive Gear 12 x 36
6	1	V3109	Drive Gear Cover
Not Shown	1	V3186	Transformer 110V-12V

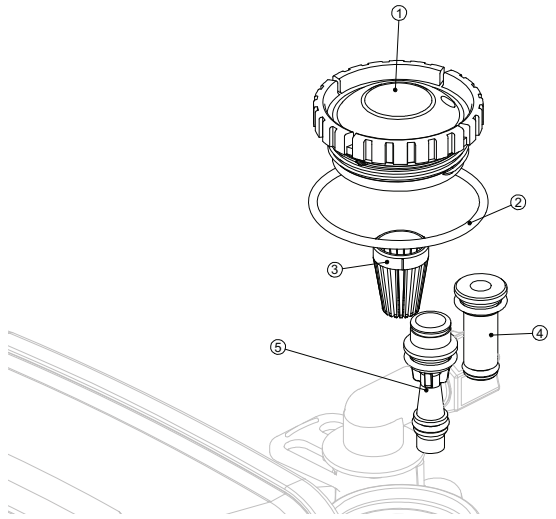
DRIVE CAP ASSEMBLY, DOWNFLOW PISTON, REGENERANT PISTON AND SPACER STACK ASSEMBLY

Item No.	Quantity	Part No.	Description
1	1	V3005	Spacer Stack Assembly
2	1	V3004	Drive Cap Assembly
3	1	V3135	O-Ring 228
4	1	V3011	Piston Assembly
5	1	V3174	Regenerant Piston
6	1	V3105	O-Ring 215
7	1	V3180	O-Ring 337
8	1	V3946	Back Plate



INJECTOR, INJECTOR CAP, SCREEN AND O-RING

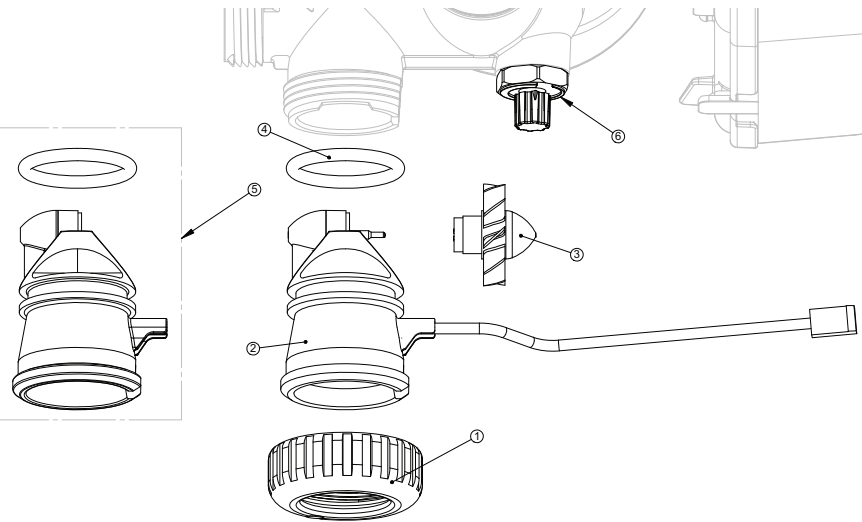
Item No.	Quantity	Part No.	Description
1	1	V3176	Injector Cap
2	1	V3152	O-Ring 135
3	1	V3177	Injector Screen
4	1	V3010-1Z	Injector Assy Z Plug
5	1	V3010-1C	Injector Assy C Violet
5	1	V3010-1E	Injector Assy E White
5	1	V3010-1F	Injector Assy F Blue
5	1	V3010-1G	Injector Assy G Yellow
Not Shown	*	V3170	O-Ring 011
Not Shown	*	V3171	O-Ring 013



WATER METER AND METER PLUG

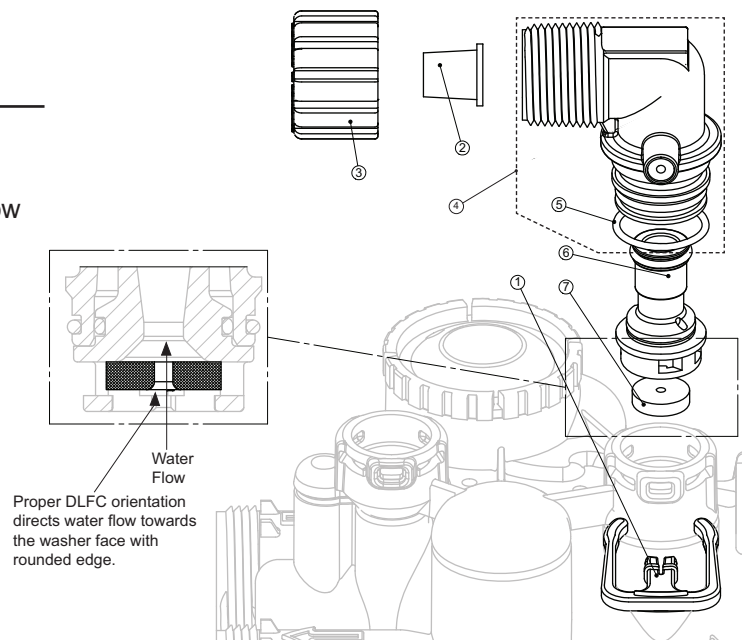
Item No.	Quantity	Part No.	Description
1	1	V3151	Nut 1" QC
2	1	V3003*	Meter Assy
3	1	V3118-01	Turbine Assy
4	1	V3105	O-Ring 215
5	1	V3003-01	Meter Plug Assy

*Part No. V3003 includes Items 2, 3 and 4

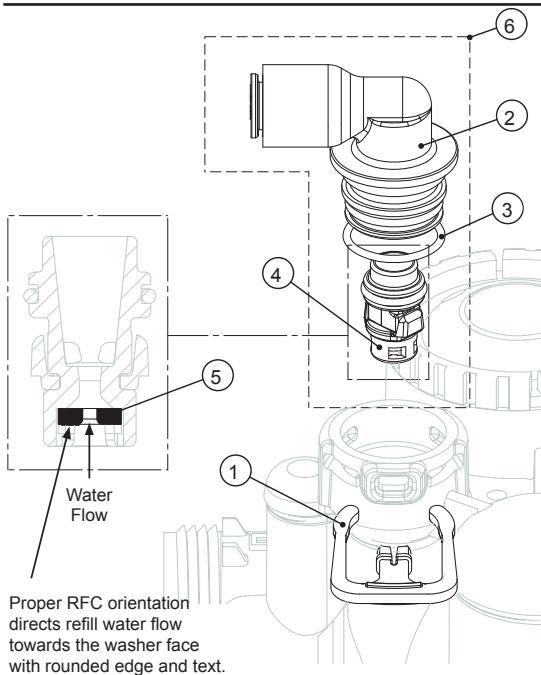


DRAIN LINE - 3/4"

Item No.	Quantity	Part No.	Description
1	1	H4615	Elbow Locking Clip
2	1	V3194	Polytube Insert 5/8
3	1	V3192	Nut for 3/4 Drain Elbow
4	1	V3158	3/4 Drain Elbow
5	1	V3163	O-Ring 019
6	1	V3159	DLFC Retainer
7	1	V3162-010	DLFC 1.0
7	1	V3162-017	DLFC 1.7
7	1	V3162-027	DLFC 2.7
7	1	V3162-032	DLFC 3.2
7	1	V3162-042	DLFC 4.2



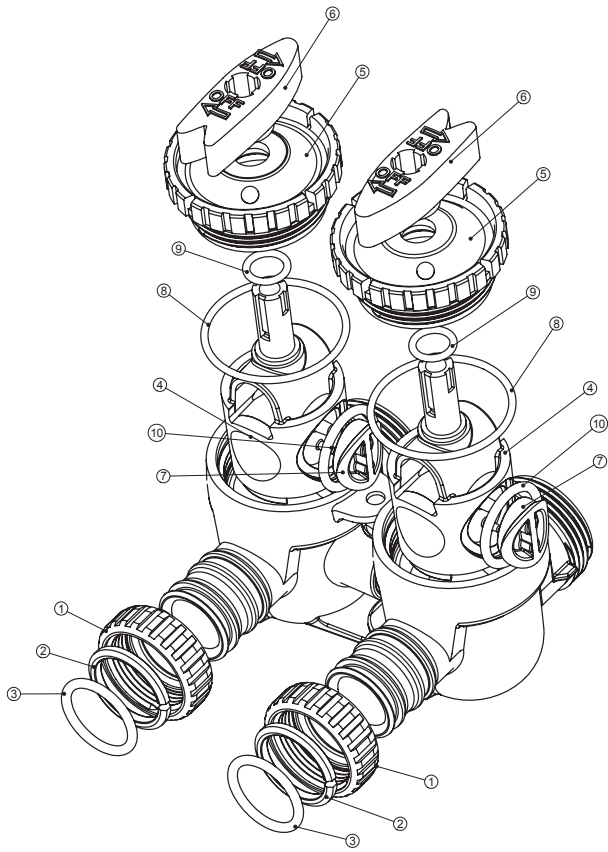
BRINE REFILL



Item No.	Qty,	Part No.	Description
1	1	H4615	Elbow Locking Clip
2	1	H4628	Elbow 3/8" Liquifit
3	1	V3163	O-ring 019
4	1	V3165-01*	RFC Retainer Assy (0.5 gpm)
5	1	V3182	RFC
6	1	V4144-01	Elbow 3/8 Liquifit Assy w/RFC

*Assembly includes V3182 RFC.

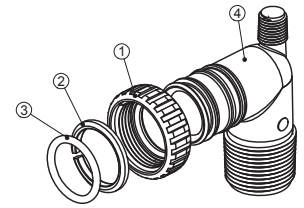
PARTS



BP2000 Bypass Valve

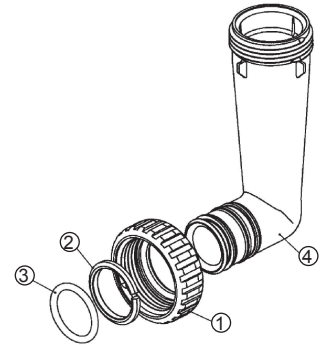
Item No.	Qty	Part No.	Description
1	2	V3151	Nut 1" Quick Connect
2	2	V3150	Split Ring
3	2	V3105	O-Ring 215
4	2	V3145	Bypass 1" Rotor
5	2	V3146	Bypass Cap
6	2	V3147	Bypass Handle
7	2	V3148	Bypass Rotor Seal Retainer
8	2	V3152	O-Ring 135
9	2	V3155	O-Ring 112
10	2	V3156	O-Ring 214

V3007 1" PVC Male NPT Elbow Assembly Standard



Item No.	Qty	Part No.	Description
1	2	V3151	Nut 1" Quick Connect
2	2	V3150	Split Ring
3	2	V3105	O-Ring 215
4	2	V3149	1" PVC Male NPT Elbow

V3191-01 Vertical Adapter Assembly Optional

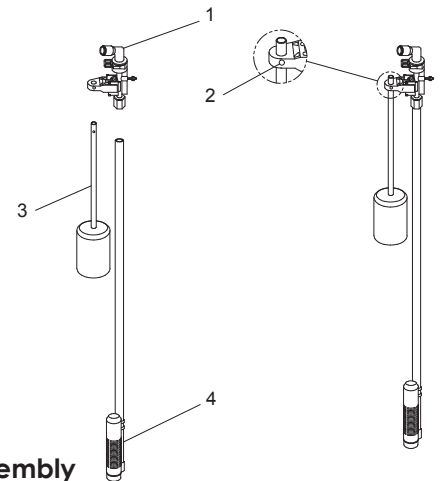


Item No.	Qty	Part No.	Description
1	2	V3151	Nut 1" Quick Connect
2	2	V3150	Split Ring
3	2	V3105	O-Ring 215
4	2	V3191	Vertical Adapter

ADDITIONAL OPTIONAL FITTINGS

Part Number	Description
V3007-01	3/4" X 1" PVC Solvent Elbow Assembly
V3007-02	1" Brass Sweat Assembly
V3007-03	3/4" Brass Sweat Assembly
V3007-04	1" Plastic Male NPT Assembly
V3007-05	1-1/4" Plastic Male NPT Assembly
V3007-07	1-1/4" & 1-1/2" PVC Solvent Elbow Assy
V3007-09	1-1/4" & 1-1/2" Brass Sweat Assembly
V3007-12	3/4" Shark Bite Assembly
V3007-13	1" Shark Bite Assembly
V3007-15	3/4" John Guest QC Elbow Assembly
V3007-17	1" John Guest Straight QC

4740 Brine Valve Assembly





Item No.	Qty	Part No.	Description
1	1	H4600	3/8" Safety Brine Valve
2	2	10151	Pin
3	1	H4640-32	Float Assembly
4	1	H4500-30.50	Air Check Assembly

ProGuard Feeder



Item #	Qty	Part #	Description
1	1	PGF01	ProGuard Feeder

	<p>The System must be BYPASSED, DEPRESSURIZED and DE-ENERGIZED before disassembling or performing mechanical repairs</p>		<p>Disassembly, Repair/Replacement/ Reassembly should only be performed by properly trained service personnel</p>
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System Troubleshooting Guidelines

These troubleshooting guidelines are not intended to be an all-inclusive or to substitute the expert diagnosis of your local Certified Water Professional.

Hard (untreated) Water to Service

Cause	Solution
Open or defective bypass	Close or verify bypass
Loss of media	Refer to problem "Loss of media"
Unit fails to regenerate	Refer to problem "System fails to clean"
Valve fails to draw brine	Refer to problem "System fails to draw brine"
Decreasing exchange capacity of resin	Clean or replace resin bed
No salt in brine tank	Add salt
Leak at riser tube	Verify that riser tube is seated correctly and is not damaged by heat or high water pressure
ProGuard supply exhausted	Refill ProGuard feeder

System Fails to Regenerate

Cause	Solution
Faulty electrical supply	Verify electrical service - Confirm unswitched power outlet
Obstructed flow meter	Clean and/or replace flow meter
Damaged PCB	Replace PCB
Damaged drive motor	Replace drive motor

System Troubleshooting Guidelines

Loss of Water Pressure

Cause	Solution
Mineral or iron build-up in resin tank	Clean resin bed and control valve; increase regeneration frequency; increase ProGuard dosage rate
Plugged lower and/or upper distributor	Verify that distributors are free of debris
Crushed lower and/or upper distributor	Replace distributor(s) - Check for adequate temperature/pressure protection
Resin damaged due to natural attrition or chlorine/chloramine oxidation	Replace resin

System Runs Continually Down the Drain

Cause	Solution
Piston stuck in brine/rinse or backwash position	Inspect drivetrain and perform remedial action
Damaged seals/spacers	Inspect seals/spacers and perform remedial action
Damaged piston	Inspect drivetrain and perform remedial action

Loss of Media Through Drain Line

Cause	Solution
Lower and/or upper distributor damaged	Replace distributor(s)
Leak between riser tube and upper distributor	Verify that riser tube is seat correctly and is not cracked
Heat and/or Pressure Damage	Inspect pressure regulating valve and hot water backup protection devices. Perform appropriate remedial action

System Troubleshooting Guidelines

System Fails to Draw Brine—Not using any Salt

Cause	Solution
Low operating pressure	Verify operating pressure; must exceed 30 psi dynamic
Plugged injector	Clean injector
Plugged injector filter	Clean injector filter
Piston stuck in incorrect position	Inspect drivetrain and perform remedial action
Restricted/obstructed drain line	Check drain line for kinks, restrictions, or obstructions
Restricted/obstructed brine line	Check brine line for kinks, restrictions, or obstructions
Leak in brine line	Verify brine line and connections for air leakage
Insufficient water in brine tank	Refer to problem "System fails to refill brine tank"

Excessive Water in Brine Tank

Cause	Solution
System fails to draw brine	Refer to problem "System fails to draw brine"
Improper brine refill time setting	Verify that brine refill time corresponds to the proper salt level and amount of ion exchange resin and other media
Missing brine refill flow control	Verify that flow control is installed and properly sized
Leak from valve to brine tank	Clean or replace brine valve
Brine valve damaged	Replace brine valve

System Troubleshooting Guidelines

System Uses too Much Salt

Cause	Solution
Excessive water in brine tank	Refer to problem "Excessive water in brine tank"
System cleaning frequently	Check household for excessive or unexpected water usage -- leaky toilet fill valves, T&P relief drainage, Reverse Osmosis processors, humidifiers, plumbing leaks, etc.

Salty Water to Service

Cause	Solution
Excessive water in brine tank	Refer to problem "Excessive water in brine tank"
Injector undersized	Verify injector selection
Injector fouled	Remove and clean injector
Improper brine/slow rinse time setting	Verify that brine/slow rinse time corresponds to the proper salt level and amount of resin
Improper fast rinse time setting	Verify that fast rinse time corresponds to the proper salt level and amount of resin

System Fails to Refill Brine Tank

Cause	Solution
Improper brine refill time setting	Verify that refill time corresponds to salt level and amount of resin
Plugged refill flow control	Clean flow control

Troubleshooting Procedures

Problem	Possible Cause	Solution
1. Timer does not display time of day.	<ul style="list-style-type: none"> a. Transformer unplugged b. No electric power at outlet c. Defective transformer d. Defective PC board 	<ul style="list-style-type: none"> a. Connect power b. Repair outlet or use working outlet c. Replace transformer d. Replace PC board
2. Timer does not display correct time of day.	<ul style="list-style-type: none"> a. Switched outlet b. Power outage c. Defective PC board 	<ul style="list-style-type: none"> a. Use uninterrupted outlet b. Reset time of day c. Replace PC board
3. No softening/filtering display when water is flowing.	<ul style="list-style-type: none"> a. Bypass valve in bypass position b. Meter connection disconnected c. Restricted/stalled meter turbine d. Defective meter e. Defective PC board 	<ul style="list-style-type: none"> a. Put bypass valve in service position b. Connect meter to PC board c. Remove meter and check for rotation or foreign material d. Replace meter e. Replace PC board
4. Control valve regenerates at wrong time of day.	<ul style="list-style-type: none"> a. Power outages b. Time of day not set correctly c. Time of regeneration incorrect d. Control valve set at "on O" (immediate regeneration) e. Control valve set at NORMAL + O 	<ul style="list-style-type: none"> a. Reset control valve to correct time of day b. Reset to correct time of day c. Reset regeneration time d. Check control valve set-up procedure regeneration time option e. Check control valve set-up procedure regeneration time option
<p>5. ERROR followed by Code number:</p> <p>Error Code 101 - Unable to recognize start of regeneration</p> <p>Error Code 102 - Unexpected stall</p> <p>Error Code 103 - Motor ran too long; timed out trying to reach next cycle position</p> <p>Error Code 104 - Motor ran too long; timed out trying to reach home position</p> <p>If other Error Codes display, contact the factory.</p>	<ul style="list-style-type: none"> a. Control valve has just been serviced b. Foreign matter is lodged in control valve c. High drive forces on piston d. Control valve piston not in home position e. Motor not inserted fully to engage pinion, motor wires broken or disconnected, motor failure f. Drive gear label dirty or damaged, missing or broken gear g. Drive bracket incorrectly aligned to back plate h. PC board is damaged or defective i. PC board incorrectly aligned to drive bracket 	<ul style="list-style-type: none"> a. Press NEXT and REGEN for 3 seconds or unplug power source jack (black wire) and plug back in to reset control valve b. Check piston and spacer stack assembly for foreign matter c. Replace piston(s) and spacer stack assembly d. Press NEXT and REGEN for 3 seconds or unplug power source jack (black wire) and plug back in to reset control valve e. Check motor and wiring. Replace motor if necessary. Replace or clean drive gear. f. Replace or clean drive gear g. Reset drive bracket properly h. Replace PC board i. Ensure PC board is correctly snapped onto drive bracket

Troubleshooting Procedures

Problem	Possible Cause	Solution
6. Control valve stalled in regeneration.	<ul style="list-style-type: none"> a. Motor not operating b. No electric power at outlet c. Defective transformer d. Defective PC board e. Broken drive gear or drive cap assembly f. Broken piston retainer g. Broken main or regenerant piston 	<ul style="list-style-type: none"> a. Replace motor b. Repair outlet or use working outlet c. Replace transformer d. Replace PC board e. Replace drive gear or drive cap assembly f. Replace drive cap assembly g. Replace main or regenerant piston
7. Control valve does not regenerate automatically when REGEN button is depressed and held.	<ul style="list-style-type: none"> a. Transformer unplugged b. No electric power at outlet c. Broken drive gear or drive cap assembly d. Defective PC board 	<ul style="list-style-type: none"> a. Connect transformer b. Repair outlet or use working outlet c. Replace drive gear or drive cap assembly d. Replace PC board
8. Control valve does not regenerate automatically but does when REGEN button is depressed.	<ul style="list-style-type: none"> a. Bypass valve in bypass position b. Meter connection disconnected c. Restricted/stalled meter turbine d. Defective meter e. Defective PC board f. Set-up error 	<ul style="list-style-type: none"> a. Put control valve in service option b. Connect meter to PC board c. Remove meter and check for rotation or foreign matter d. Replace meter e. Replace PC board f. Check control valve se-up procedure
9. Time of day flashes on and off.	<ul style="list-style-type: none"> a. Power has been out for more than two hours, the transformer was unplugged and then plugged back into wall outlet, the transformer plug was unplugged and then plugged back into the board or the NEXT and REGEN buttons were pressed to reset the valve. 	<ul style="list-style-type: none"> a. Reset the time of day

STATEMENT OF LIMITED PRODUCT WARRANTY

1st year of ownership

This residential water system is warranted as to workmanship and material for a period of one year from date of original installation at the original installation site, if properly installed by a Certified Installer. Should any component in your system prove defective in the first year, it will be repaired, rebuilt or replaced at our option, provided it is returned directly to us.

After the 1st year of ownership, and for 5 more years: should any component in your system prove defective, it will be repaired, rebuilt or replaced at our option for a maximum charge of \$50.00, provided it is returned directly to us. Labor, transportation, shipping or other charges incurred in the diagnosis, replacement or repair of defective components are not covered by this warranty. If you choose not to send a defective component back to us, repairs to your system can be conducted in your home by a factory authorized service technician if your home is within the operating radius of an Authorized Repair Center. This warranty does not cover transportation, shipping, diagnosis, replacement and repair charges resulting from your in-home repair request. We will not be held responsible for loss or damage caused by any defective component.

Conditions

This warranty must be presented at time of claim and all claims must be presented within 30 days of occurrence. This warranty is void if your water system is not installed in compliance with prevailing plumbing codes, according to our installation protocol, or if the influent water temperature is hotter than 90°F or where the static water pressure is less than 25psi, or more than 75psi. Intentional/malicious damage, misuse, neglect, unauthorized modifications or accidental damage to the system is not covered by this warranty. This warranty does not cover damage caused by pressure surges, water hammer, power surges or sags, lightning, fire, flood, freezing, earthquake, terrorism, war, or other casualty.

For this warranty to be valid, you must be the original purchaser, have purchased the water equipment from an Authorized Crusader Reseller, and provide a copy of the original purchase receipt with proof of date and purchase price.

No Liability for Consequential Damages

Unless otherwise required by applicable law, we shall not be liable for any damages whatsoever (including without limitation, lost time, inconvenience, expenses such as telephone calls, labor or material charges incurred in connection with the removal or replacement of the part(s) or product(s), special, incidental, consequential, or indirect damages for personal injury, loss of business profits, business interruption, loss of business information, or any other financial loss) arising out of the use of or inability to use the defective part(s) or product(s), even if we have been advised of the possibility of such damages. Our entire liability under any provision of this Limited Warranty shall be limited to the amount originally paid for the part(s) or product(s).

No Other Warranties

We specifically disclaim all other warranties; either express or implied, including, but not limited to implied warranties of merchantability and fitness for a particular purpose, with regard to the part(s), product(s) and/or any accompanying written materials. This limited warranty gives you specific legal rights. You may have other rights that vary from state/jurisdiction to state/jurisdiction.

Wear and Tear

Your water system is subject to normal wear and tear during its usable service life. Wear and tear is not regarded as a product defect and is not covered by this warranty.

Periodic Replacement of Media

While built to the highest standards, certain media in your Water System will need to be replaced periodically by your local authorized service agent. Replacement intervals vary depending on your water chemistry and water consumption habits. Consult with your water specialist during your annual cleaning and disinfection service to ensure that you enjoy the very best water quality. Media replacement is not covered under this warranty.

ProGuard Warranty Extension

Your system includes a ProGuard dispensing system. ProGuard is so effective at protecting water systems that we will extend your warranty by one more year for every year that you use ProGuard. Proof of Purchase history is required when filing a claim.

**This limited warranty is only valid if registered within 10 days of initial installation.
If unregistered, this warranty is only valid for 1 year from the date of original manufacture.
Consult with your Local Clean Water Crusader on availability of Extended Warranties**

Register your warranty now: www.CrusaderWater.com

What is Hard Water Costing You?

Items Affected by Hard Water	Average Family Cost		Average Family Savings		Average % Saved
	Per Year	Per Month	Per Year	Per Month	
Plumbing and Appliances Replacement and repairs of pipes, faucets, washer, dishwasher, water heater, etc. <i>Water Quality Research Council Study</i>	\$120.00	\$10.00	\$90.00	\$7.50	75%
Cooking and Coffee Tea, sugar, canning, etc. <i>National Restaurant Association</i>	\$118.56	\$9.88	\$22.44	\$1.87	25%
Personal Care Items Slips, lingerie, etc. <i>American Laundry Institute</i>	\$60.84	\$5.07	\$18.24	\$1.52	30%
Clothing and Linens Washable items such as towels and linens <i>American Laundry Institute</i>	\$600.00	\$50.00	\$175.00	\$15.00	30%
Energy Consumption Heat loss due to scale <i>University of New Mexico and WQA Studies</i>	\$320.00	\$26.67	\$64.44	\$5.37	20%
Soaps and Cleaning Aids Laundry, cleaning, dishwashing, bathing, skin-care, shaving, shampoo, etc. <i>Orange County Consumer Survey (10+ hours of cleaning per month)</i>	\$1,032.00	\$86.00	\$774.00	\$64.50	75%

What Could Soft Water Be Saving You?

TOTAL COSTS AND SAVINGS		
	HARD WATER COST	SOFT WATER SAVINGS
Total Per Day	\$6.25	\$3.19
Total Per Month	\$187.62	\$95.76
Total Per Year	\$2,251.44	\$1,149.12
Total Over 10 Years	\$22,514.40	\$11,491.20
<i>The figures above are national average figures based up on a family size of 4 persons with an average water hardness of 10 grains per gallon</i>		