Culligan®

INSTALLATION, OPERATION, and SERVICE INSTRUCTIONS with Parts Lists

Top Mount (CTM) Water Softeners

Models from 2020

CAT# 01029401 Rev F
DCO# 200293 10/21/20

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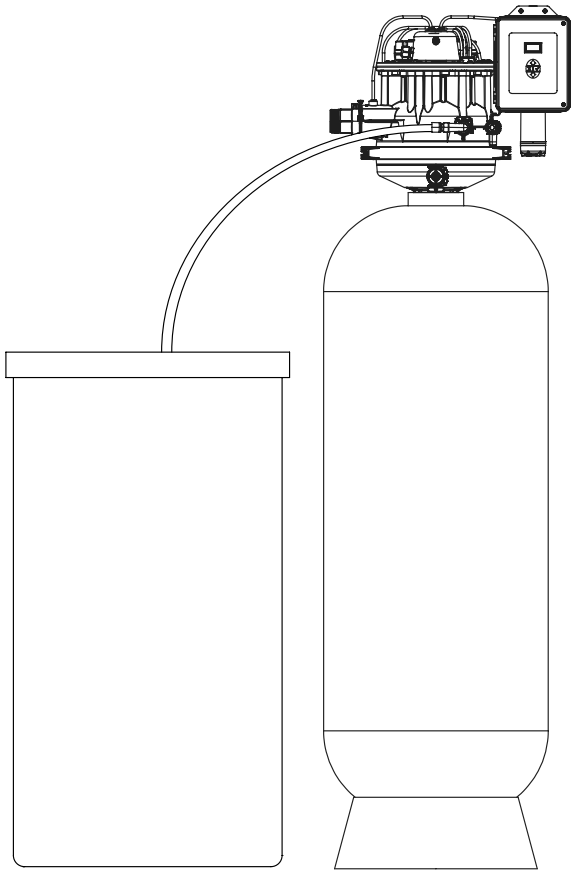

Contents

Cat. No. 01029401

Read this Manual First

Before you operate the Culligan® Top Mount (CTM) Water Softeners, read this manual to become familiar with the device and its capabilities.

The Culligan CTM Water Softeners are tested and certified by WQA against NSF/ANSI/CAN 61 and NSF/ANSI 372. Not certified for Structural Integrity (except for CSA models) or Contaminant Reduction by WQA.

The Culligan CTM 60K, 90K and 120K Water Softeners are also tested and certified by WQA against CSA B483.1. Not certified for Contaminant Reduction by WQA.

Models listed by WQA are:
CTM Downflow HWB Capacity Softener (60K, 90K, 120K, 150K, 210K, 300K, 450K, 600K)
CTM Downflow NHWB Capacity Softener (120K, 150K, 210K, 300K, 450K)
CTM Downflow Multi-Tank Capacity Softener (60K, 90K, 120K, 150K, 210K, 300K, 450K, 600K).

The Culligan CTM Water Softeners have been certified by IAPMO R&T against NSF/ANSI Standard 372, CSA B483.1 and NSF/ANSI/CAN Standard 61 for Material Safety and Structural Integrity Requirements. Not certified for Contaminant Reductions by IAPMO R&T.

The skid mounted systems have not been tested or certified by IAPMO R&T and WQA.

The Culligan® Top Mount (CTM) Water Softeners are designed to meet the needs of applications for high quality water. This manual contains important information about the unit, including information needed for installation, operating, and maintenance procedures. A troubleshooting section provides a guide for quick and accurate problem solving.

In order for the water treatment system to continue to provide high quality water, you must develop a thorough understanding of the system and its operation. Review this manual before making any attempt to install, operate, or service the system. Installation or maintenance done on this system by an untrained service person can cause major damage to equipment or property damage.

Licensed plumbers know that standard industry procedures include only to hand tighten or use strap wrenches on plastic parts. Plastic piping systems must be installed, operated and maintained in accordance with accepted standards and procedures. Not adhering to the recommended service/maintenance can cause damage to equipment or property damage.

This manual is based on information available at the time it was finalized, approved, and published. Continuing design refinement could cause changes that may not be included in this publication.

Your local independently operated Culligan dealer employs trained service and maintenance personnel who are experienced in the installation, function and repair of Culligan equipment. This publication is written specifically for these individuals and is intended for their use.

We encourage Culligan users to learn about Culligan products, but we believe that product knowledge is best obtained by consulting with your Culligan dealer. Untrained individuals who use this manual assume the risk of any resulting property damage or personal injury.

NOTE! This manual can be obtained from your local dealer, on CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Safety Instructions and Safety Definitions

Throughout this manual there are paragraphs set off by special headings.

Note

Note is used to emphasize installation, operation or maintenance information which is important, but does not present any hazard. For example,

NOTE! The clamp and valve will be able to rotate on the tank until pressure is applied.

Caution

Caution is used when failure to follow directions could result in damage to equipment or property. For example,

CAUTION!
Disassembly while under water pressure can result in flooding.

Warning

Warning is used to indicate a hazard which could cause injury or death if ignored. For example,

WARNING!
Electrical shock hazard!
Unplug the unit before removing the timer mechanism or cover plates!

The CAUTION and WARNING paragraphs are not meant to cover all possible conditions and situations that may occur. It must be understood that common sense, caution, and careful attention are conditions which cannot be built into the equipment. These MUST be supplied by the personnel installing, operating, or maintaining the system.

Be sure to check and follow the applicable plumbing codes and ordinances when installing this equipment. Local codes may prohibit the discharge of sanitizing or descaling solutions to drain.

Use protective clothing and proper face or eye protection equipment when handling chemicals or power tools.

Attention Service Technician:

This publication is written specifically for, and is intended to be used by, trained service and maintenance personnel who are experienced in the installation, function and repair of Culligan equipment. Untrained individuals who use this manual assume the risk of any resulting property damage and/or personal injury.

NOTE! Please send any suggestions for improving this manual to productmanuals@culligan.com

WARNING!
Electrical shock hazard! Prior to servicing equipment, disconnect power supply to prevent electrical shock.

WARNING!
If incorrectly installed, operated, or maintained, this product can cause severe injury. Those who install, operate, or maintain this product should be trained in its proper use, warned of its dangers, and should read the entire manual before attempting to install, operate, or maintain this product. Failure to comply with any warning or caution that results in any damage will void the warranty.

CAUTION!
This product is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, unless they have been given supervision or instruction.

CAUTION!
Children should be instructed not to play with this appliance.

CAUTION!
If the power cord from the power supply to the unit looks or becomes damaged, the cord and power supply should be replaced by a Culligan Service Agent or similarly qualified person in order to avoid a hazard.

CAUTION!
To reduce the risk of fire, use only No. 26 AWG or larger telecommunications line cord.

NOTE! This system is not intended for use with water that is microbiologically unsafe or of unknown quality without adequate disinfection either before or after the system.

NOTE! Check with your public works department for applicable local plumbing and sanitation codes. Follow local codes if they differ from the standards used in this manual. To ensure proper and efficient operation of this Culligan product to your full satisfaction, carefully follow the instructions in this manual.

Culligan International Company

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Rosemont, Illinois 60018

1-847-430-2800
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Specifications for CTM Water Softeners

Culligan commercial water softeners are designed to remove hardness minerals from water. In order to function properly, some operational parameters must be followed. They include:

An operating water pressure between 50 dynamic psi and 125 psi (345–862 kPa). If water pressure is greater than 80 psi, Culligan recommends following the IAPMO Uniform Plumbing code section 806.2 by installing a Pressure Regulating Valve before the system. Operating on high pressure for extended periods of time can increase the service frequency of replacement parts. If water pressure can drop below the minimum water pressure, add a booster pump or operate the pilot valve using compressed air to maintain a 50 dynamic psi (241 kPa) minimum operating pressure.

NOTE! If an air compressor is used, it must be "oil free" and set at 10 psi greater than the maximum static water pressure.

1. Operating temperature between 40° and 120°F or 4.4°–49°C.
2. Clear (non-turbid) water supplies (Less than 5 NTU).
3. Voltage of 120V, 50/60 Hz.

Table 1. CTM Flow Specifications.

Softener Model		60K	90K	120K	150K	210K	300K	450K	600K
Service	Continuous Minimum (gpm)	1.6	2.1	2.8	5	5	6	10	14
	Continuous Maximum (gpm)[1]	20	30	40	45	55	65	76	82
	Continuous @ 15 psi max. pressure loss	51	57	55	59	65	70	76	82
	Peak @ 25 psi max. pressure loss	69	75	73	76	85	95	104	109
Suggested Progressive Flow Trip Point (gpm)[2]		20	30	40	45	55	65	76	82
Drain	Backwash/ Fast Rinse (gpm)	3.5	5	6	8	10	12	20	30
	Brine Draw (gpm)	0.53	0.53	1.08	1.08	1.13	1.65	2.07	2.07
	Slow Rinse (gpm)	0.93	0.93	1.60	1.60	2.00	2.66	5.34	5.34
	Refill (gpm), Standard [Fast Refill][3]	0.8	0.8	1.25	1.25	1.48 [1.62]	1.78 [2.0]	2.0 [2.75]	2.0 [2.75]

[1]Maximum softening performance (minimized hardness leakage) can be achieved using this service flow rate.

[2]The Suggested Progressive Flow Trip Point is simply a suggested flow rate at which point an additional tank will be brought on line if facility flow demand meets this rate. The Culligan GBE Controller will not remove a tank brought on line by attaining the Trip Point unless the flow is under the Trip Point amount for a 30-second period. In the event additional units are not brought on line or off line when desired, simply adjust the programmed Trip Point. Refer to the revised GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for more information about the Progressive Flow mode of operation.

[3]Refill flow rates based on 60 psi inlet/influent pressure and eductor combinations specified per Table 5 on page 20 and brine refill flow control inserts specified on page 21. The use of the standard or fast refill brine refill flow control insert options will change the brine refill times (see Table 8 on page 46).

CTM Dimensions

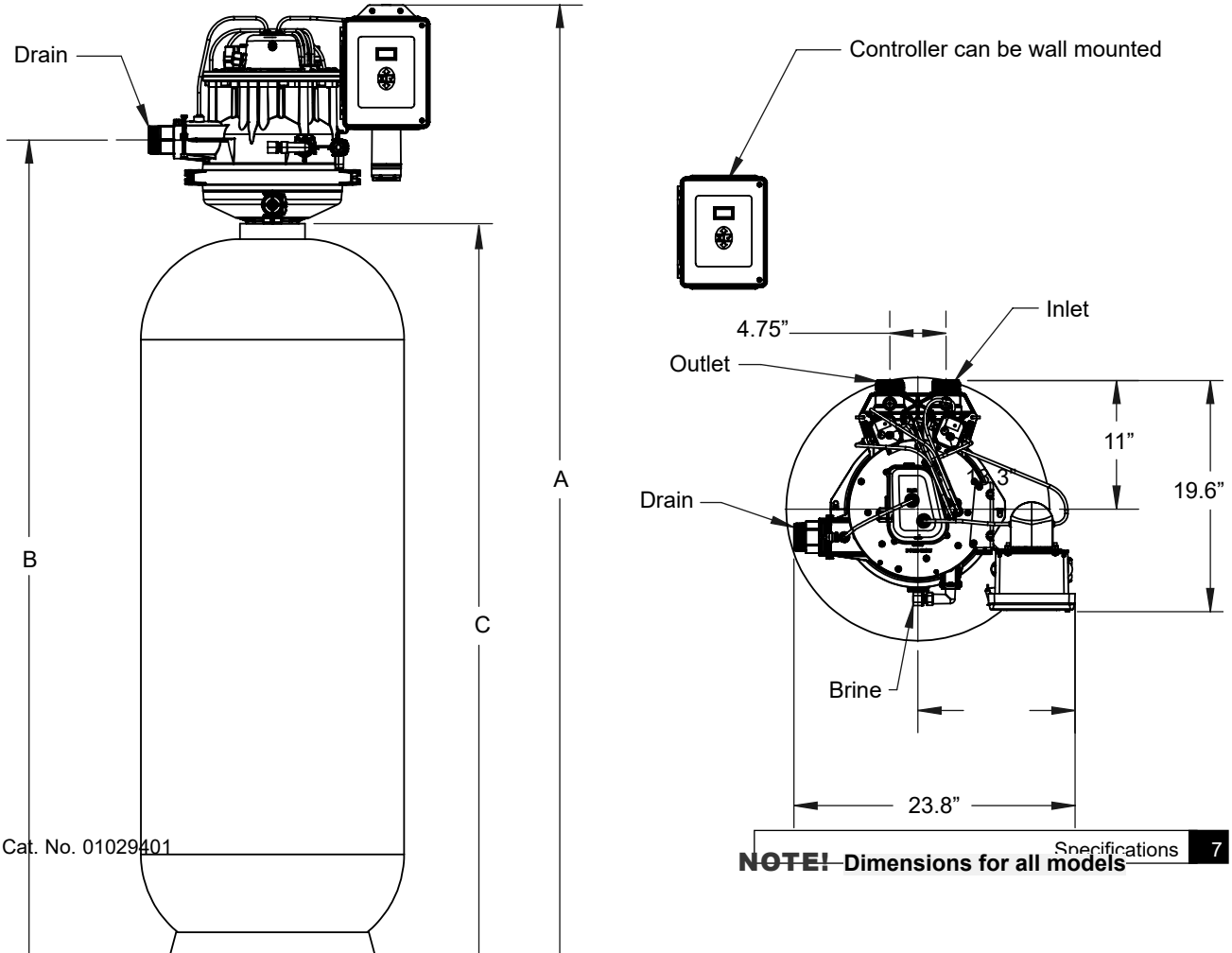
Table 2. CTM Dimensions (inches)

Model	60K	90K	120K	150K	210K	300K	450K	600K
Overall Depth	19.6	24	24	24	24	24	30	39
Overall Width	43	50	50	52	55	58	69	83
Overall Height (A)	65.5	73.5	84.7	85.4	85.5	94	95.7	102
Plumbing Height (B)	54.1	62.1	73.3	74	74.1	82.6	84.3	90.6
Tank Height (C)	47	55	66.2	67	67	75.5	77.2	83.6

NOTE! Overall dimensions assume systems include an optional, standard size brine tank.

NOTE! Allow a minimum of 12" above the overall system height for access into the top of tank(s).

Figure 1. Overview



NOTE! Dimensions for all models

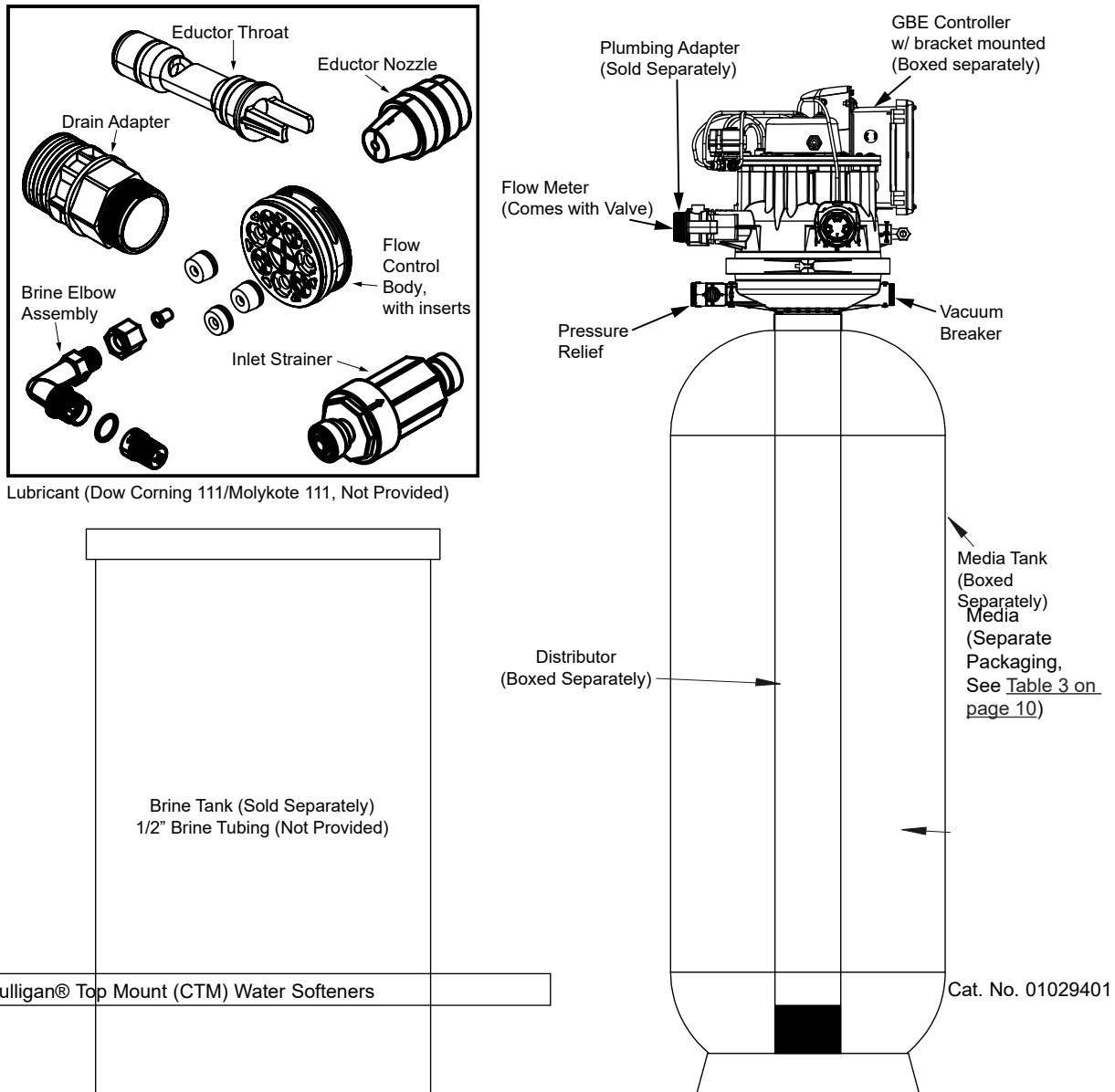
Installation

Materials

With the exception of media containers, open the remaining containers, remove all the components, and inspect them before starting installation.

The following are necessary components for installing a CTM Softener.

Figure 2. Materials



Locate Softener

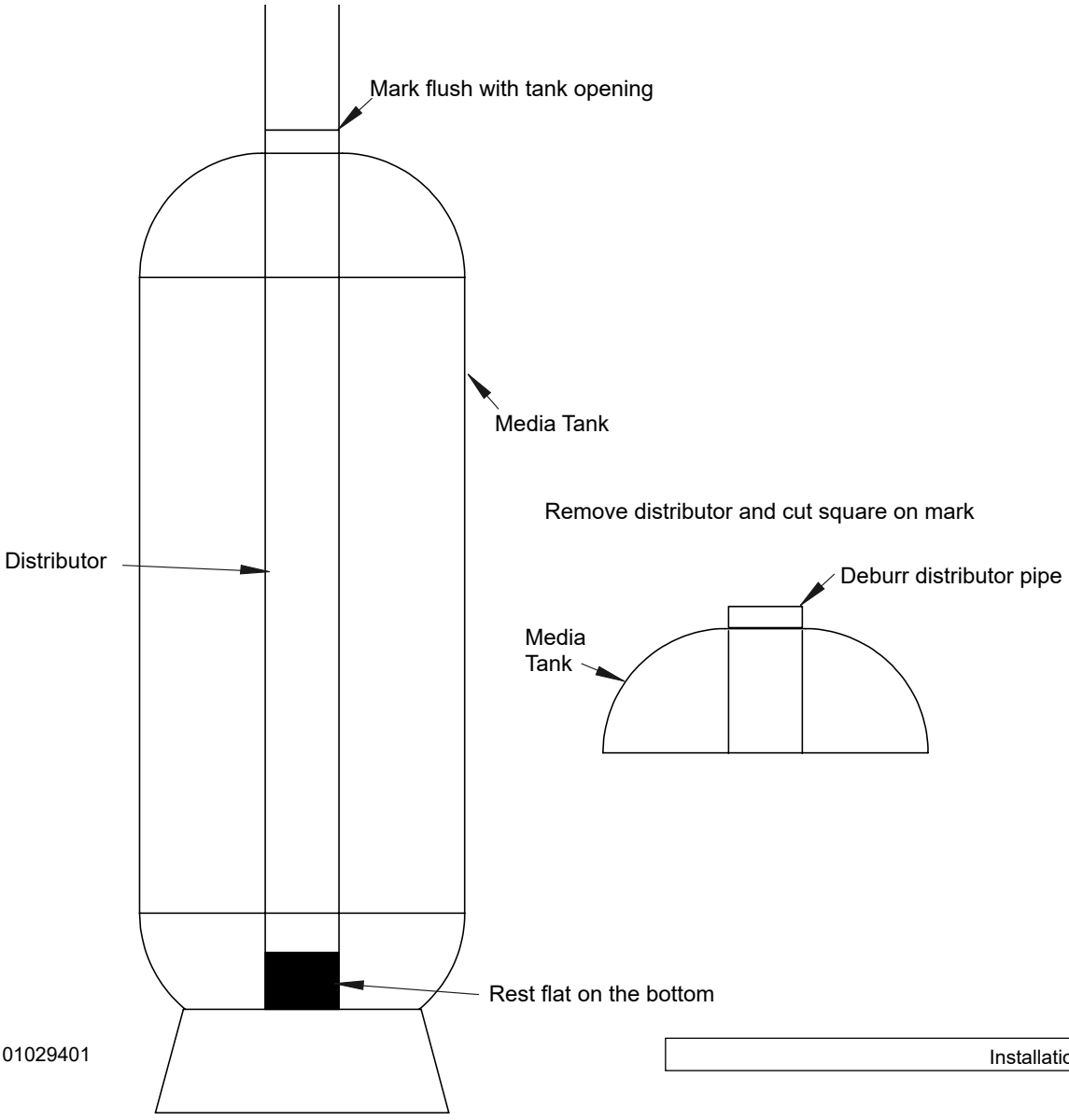
1. Select a space that is level and allows a sufficient amount of room above and behind the softener tank(s) for service access and plumbing supply and drain lines.
2. Floor surface—Choose an area with a smooth, solid and level floor capable of supporting the operating weight of the softening system
3. Drain facilities—A nearby drain must be capable of handling the water softener discharge flow rates during the backwash cycle of the regeneration process in addition to the maximum flow rates of other equipment feeding into the same drain. Refer to page 6 for information concerning the backwash flow rate.

Install Distribution System

CAUTION!

Do not attempt to use any distribution part that is damaged. Doing so may create operational problems and/or create a substantial risk of consequential damage not covered by the product warranty.

Figure 3. Install Distribution System



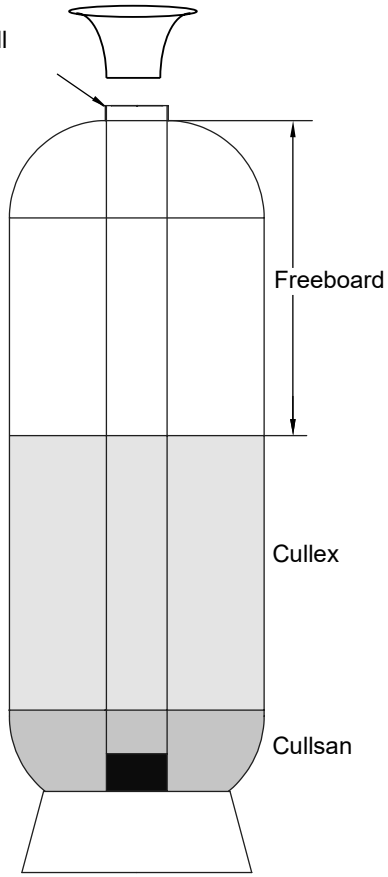
Loading The Media

Table 3. Loading Quantities.

Model	60K	90K	120K	150K	210K	300K	450K	600K
Cullex (Ft^3)	2	3	4	5	7	10	15	20
Cullsan (lbs)	30	40	50	70	100	130	300	400
Freeboard (inches)	19	22	22	23	22	22	19	22

NOTE! **Do NOT attempt to load the media without having the tank in its final position. Moving the tank once the media has been loaded will be difficult at best.**

Figure 4.



1. Cover the top of the distributor pipe with tape that will prevent media from entering the distributor.
2. Use a funnel (P/N 01029516) in the opening to add 6” of water to protect the distributor. Pour Cullsan per Table 3, level before adding resin.
3. Pour bags of Cullex per Table 3.
4. Clean tank threads, remove tape and check for any foreign materials

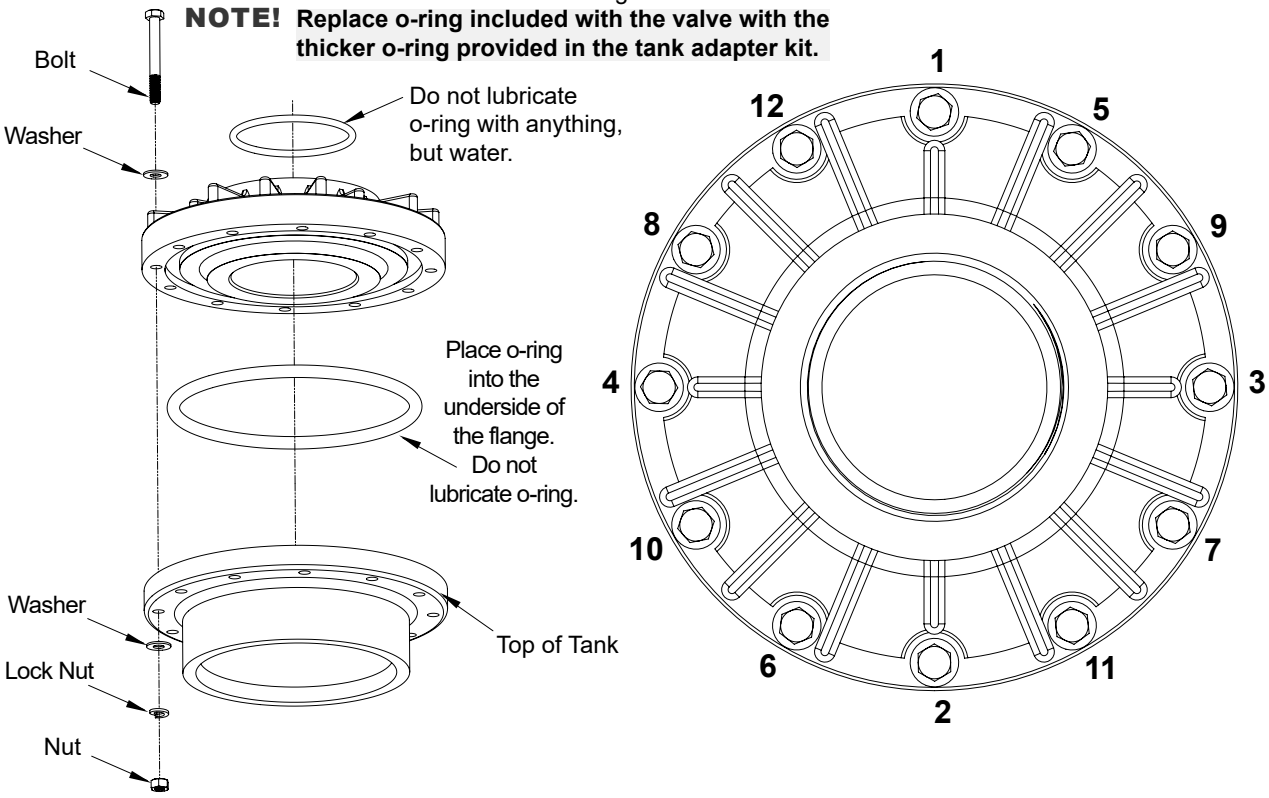
NOTE! **Minimize the amount of water added until final positioning of the tank with the control valve mounted**

Attach Tank Adapter (30” and 36” Tanks Only)

Aqua-Sensor Ported Tanks

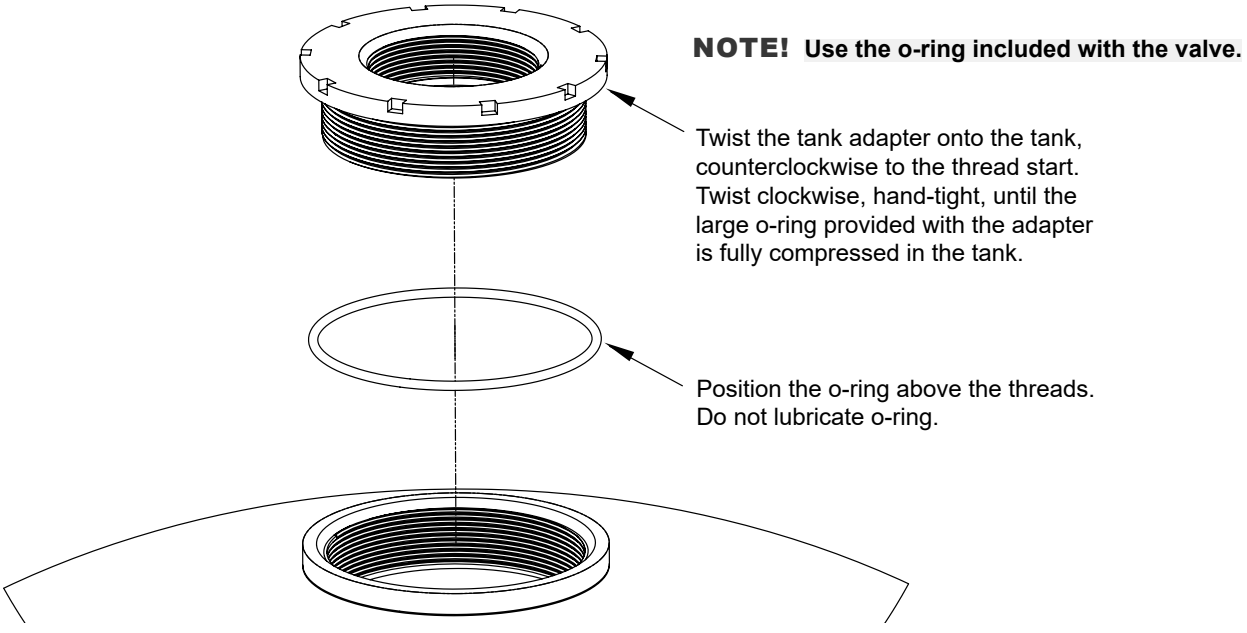
Fasten the 12 bolts in the sequence indicated below.
Once all of the bolts have been tightened, complete a second pass to ensure all of the bolts are secure.

Figure 5.



Non-Ported Tanks

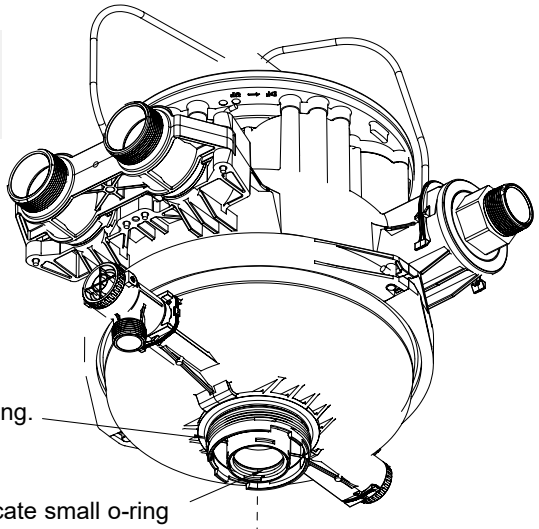
Figure 6.



Mount the Valve

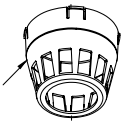
Figure 7.

NOTE! **For 24” Aqua-Sensor ported tanks, replace o-ring included with the valve with the thicker o-ring provided with the tank.**



1. Position large o-ring above threads. Do not lubricate o-ring.

2. Lubricate small o-ring

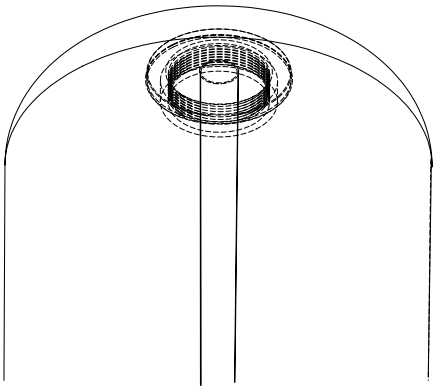


3. Attach upper disperser by snapping into the slots in the tank adapter. Making sure, that it is secured.

4. Twist the valve onto the tank, counterclockwise to the thread start. Twist clockwise, handtight, until the large o-ring is fully compressed in the tank.

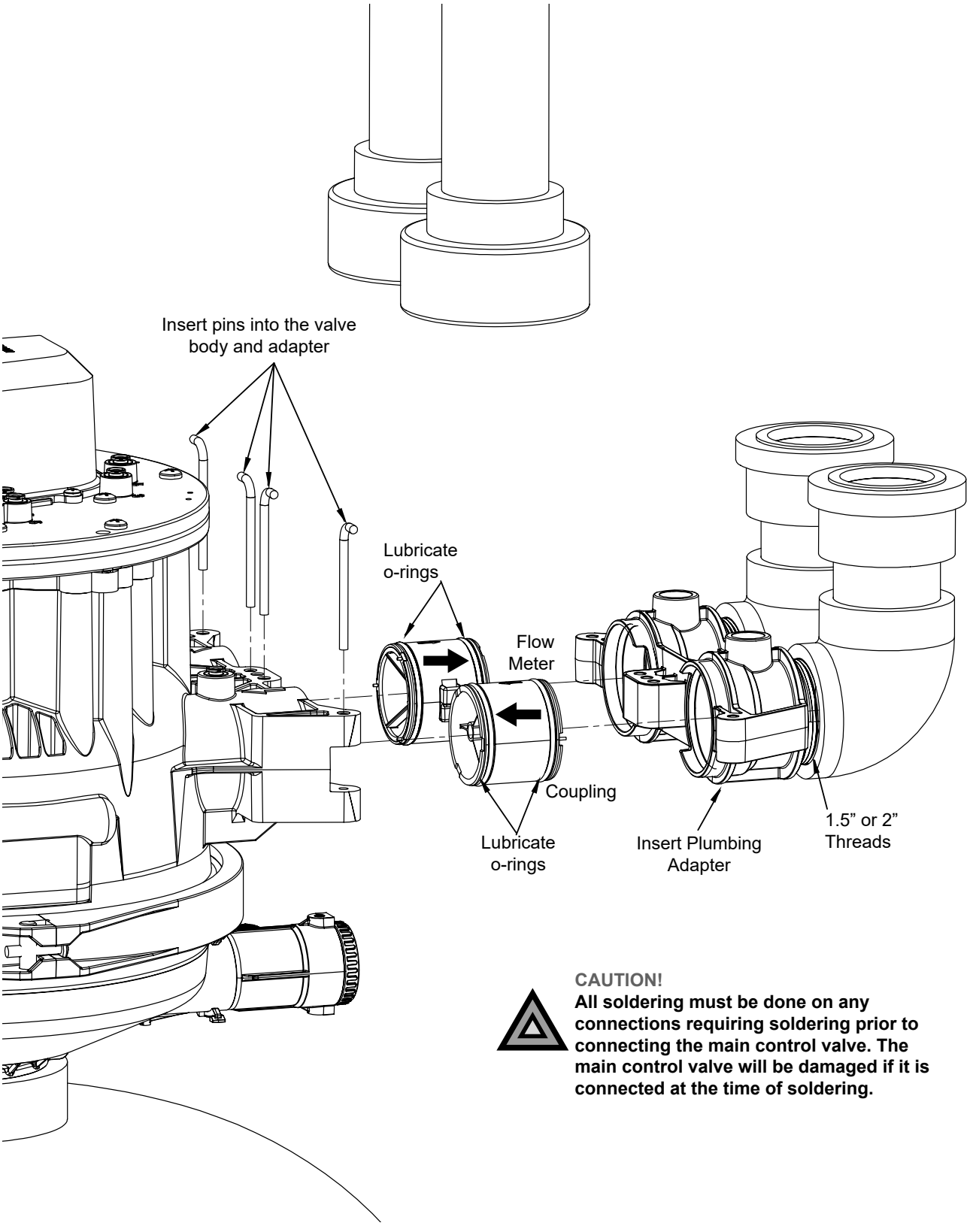
CAUTION!
Do not overtighten.

NOTE! **Tank may need to be rotated for preferred positioning.**



Plumbing Adapter

Figure 8.



CAUTION!

All soldering must be done on any connections requiring soldering prior to connecting the main control valve. The main control valve will be damaged if it is connected at the time of soldering.

Install Piping

1. Depending on the type of softener system (such as single, duplex, or triplex) and the installation parameters, required pipe lengths and piping accessories will vary. See "Specifications" on page 6 to aid the installation. If the layout drawings are not sufficient for your application, consult the Culligan dealer for specific installation guidelines.

NOTE! The use of unions and inlet and outlet isolation valves is REQUIRED to facilitate the servicing of the system. It is also recommended a full flow by-pass line be provided.

2. Follow good plumbing practices for installation. These include:
   a. Check threads and make certain that they are clean and free of foreign matter.
   b. Fittings must be free of cracks or chips.
   c. Prepare threads with either a pipe dope sealant or Teflon tape.
   d. Make certain that the fittings are not cross threaded during the assembly process.
   e. Do not over-tighten fitting or threaded pipe being inserted into a cast or forged part.

CAUTION!
The media tank must never be subjected to an internal vacuum or it might be damaged. Drain line suction can be prevented by installing siphon break. Refer to Figure 11 on page 17.

Use of Bypass Valve

Depending on where the particular installation was made, the outside sill cocks may or may not be served by conditioned water. Ideally, all lines not requiring softened water should be taken off upstream of the softener. This is not always possible, however, due to the difficulty or expense of rearranging the piping.

Bypass the softener if:

1. The outside lines do not bypass the water softener and the water is to be used for lawn sprinkling or other outside uses.
2. Water is not used for several days.
3. You wish to inspect or work on the valve or brine system.
4. A water leak from the valve is evident.

Three-Valve Bypass

To bypass, close the inlet and outlet valves, and open the bypass valve. Reverse the process to get softened water once again. Be sure to close the bypass valve completely to avoid mixing hard water with softened water. (See Figure 9)

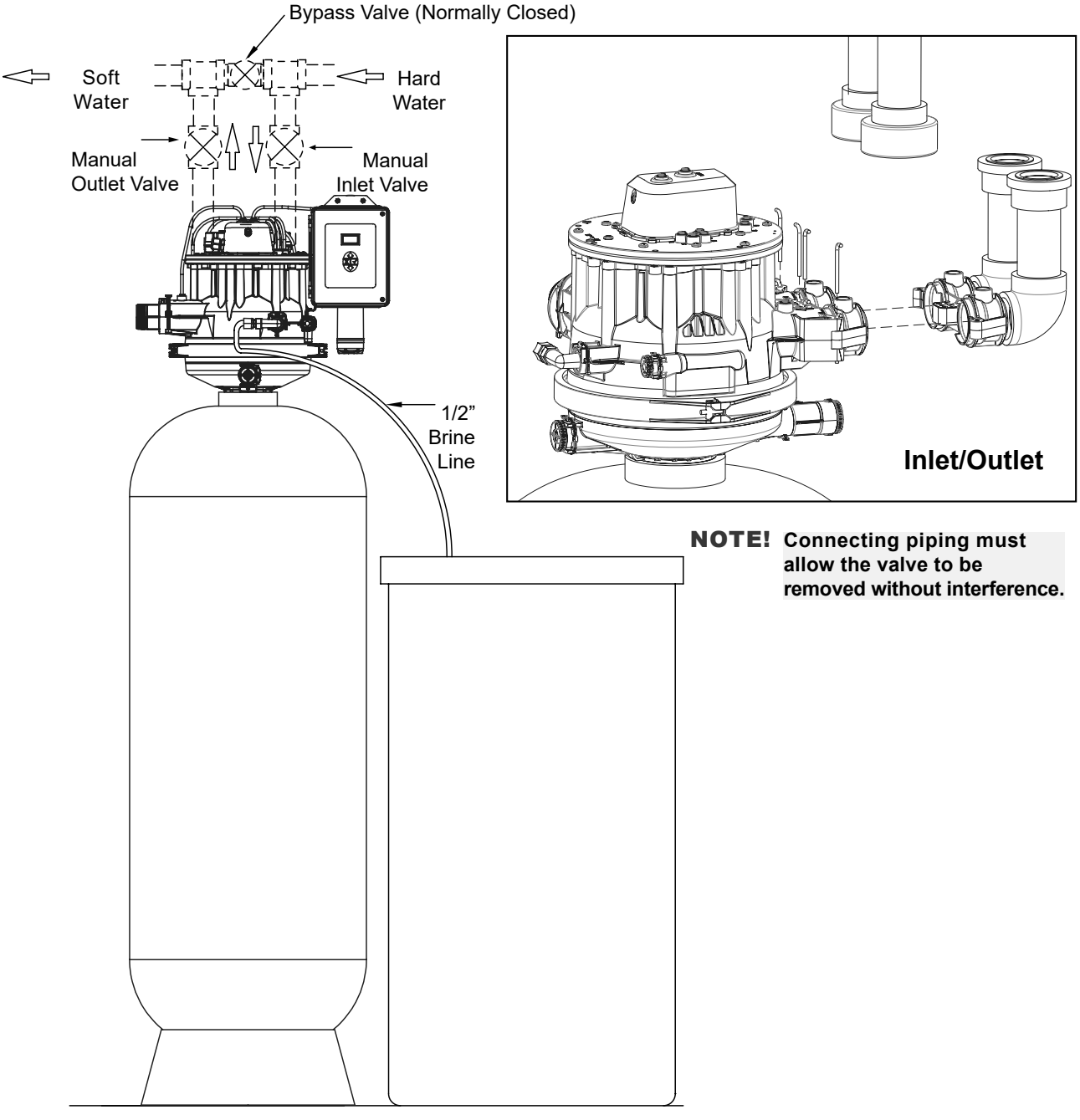
CAUTION!
If the media tank is to remain attached to the control valve, close only the inlet valve, then open the bypass valve. This will prevent pressure from increasing in the media tank due to warming.

Suggested Piping Installation

CAUTION!

Make sure that the plumbing connections to the inlet and outlet are all securely fastened using items, such as pipe hangers, clamp, etc, to prevent damage to the valve. The plumbing connections should also allow for 1/4" of movement.

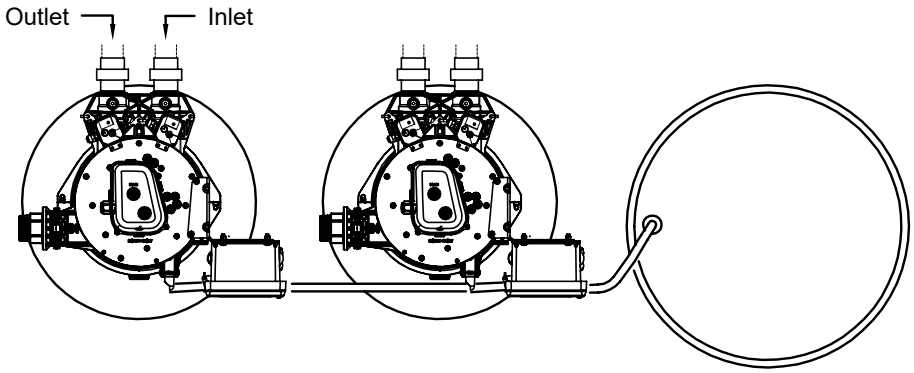
Figure 9. Three-Valve Bypass CTM Single Tank Piping



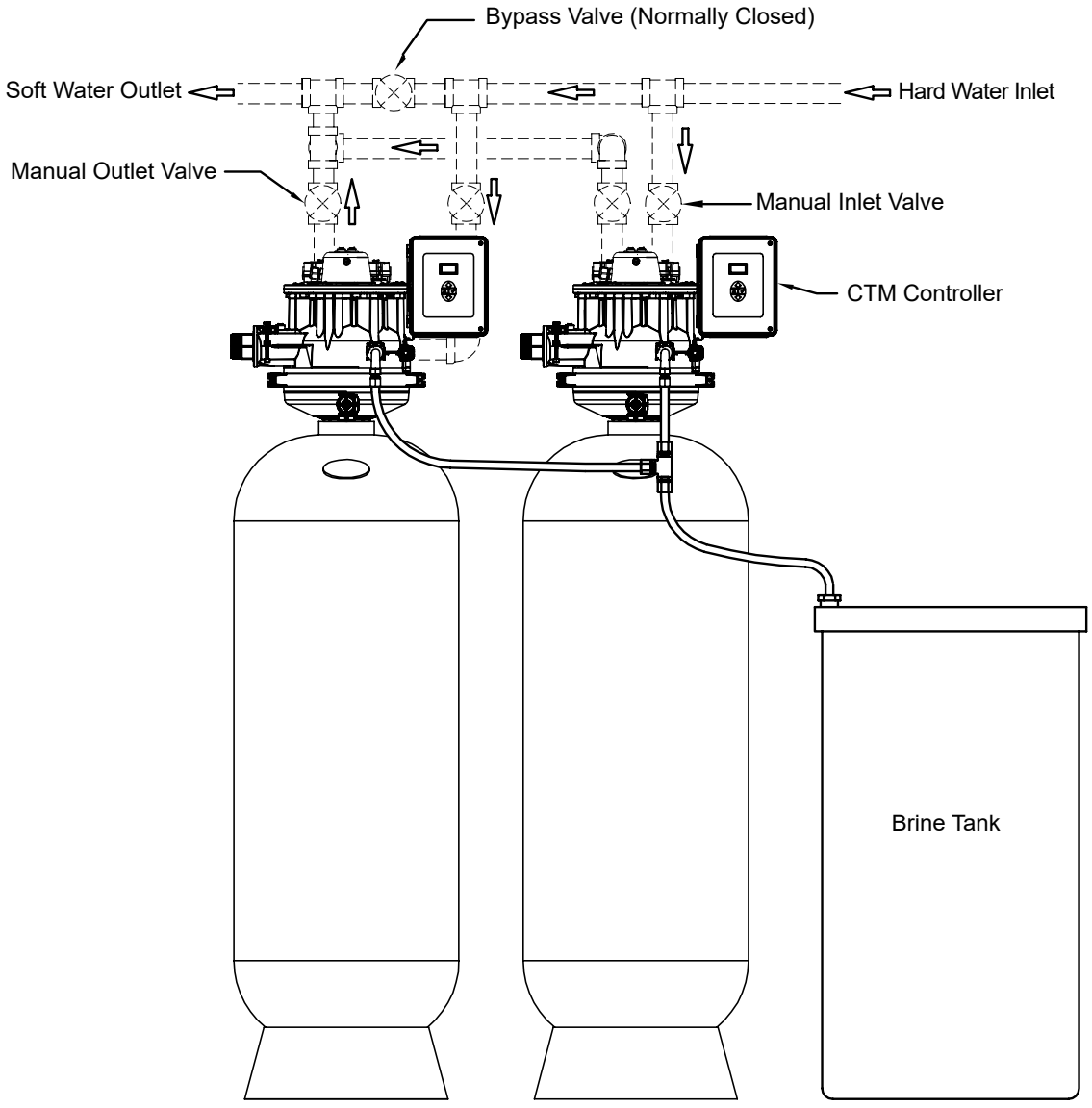
NOTE! Connecting piping must allow the valve to be removed without interference.

NOTE! Interconnecting pipe and fittings, bypass valves and isolation valves are not supplied.

Figure 10. CTM Duplex Piping



Top View

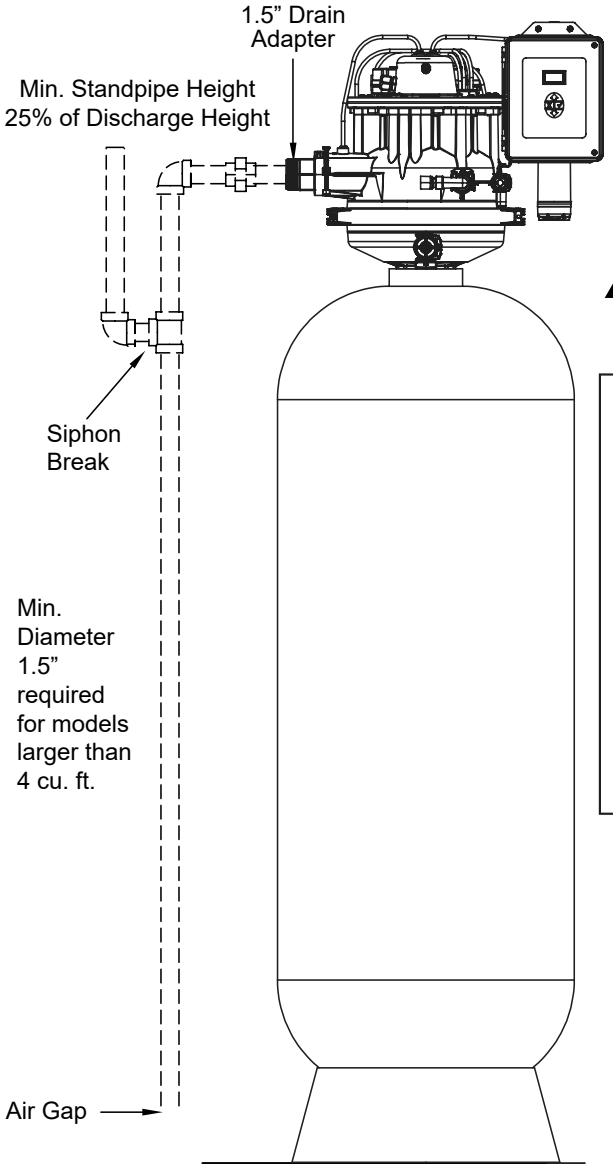


Drain Line

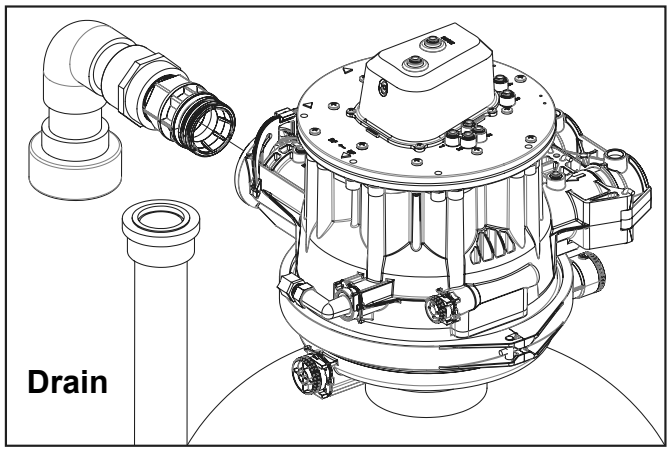
Proper discharge height and distance of the drain line will be dependent on the pressure supplied to the valve. Discharge to a nearby floor drain will cause no backpressure, if the drain line needs to run overhead, the maximum height is 10’ at the minimum supply pressure without decreasing vacuum on the brine line.

Make sure unit is properly located to the drain, refer to “Locate Softener” on page 9.

Figure 11.



CAUTION!
Securely fasten and support drain piping to prevent damage to the valve and allow for 1/4” of movement during regeneration.



NOTE! **Hard piped drains should include a union for ease of service.**

WARNING!
Build an anti-siphon or drain line using an air vent.

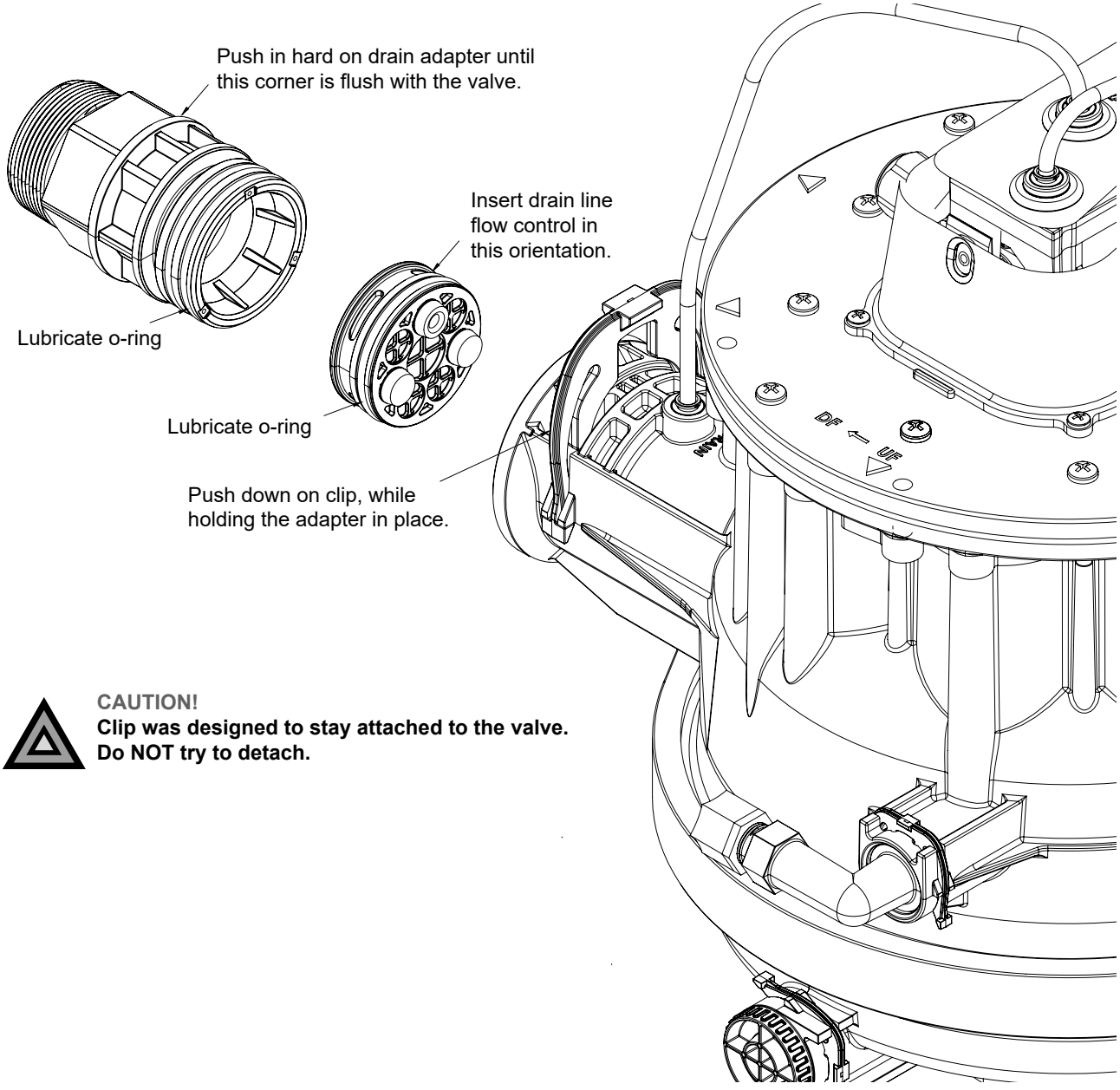
WARNING!
Do not make a direct connection to the drain. Provide an air gap, that conforms to state and local sanitation codes and to permit the observation of drain flow

Drain Line Flow Control (DLFC) and 1.5” Drain Adapter

Table 4. Drain Line Flow Control

Model	60K	90K	120K	150K	210K	300K	450K	600K
Body/Flow Rate	3.5 gpm	5 gpm*	6 gpm*	8 gpm*	10 gpm*	12 gpm*	20 gpm*	30 gpm*
Inserts	0.4 gpm Black, 0.4 gpm Black, 2.5 gpm Black	Plug, Plug, Blue	Plug, Plug, Red	Plug, Plug, Green	Plug, Blue, Blue	Plug, Red, Red	Blue, Blue, Orange	Orange, Orange, Orange
* Please make sure to use the specific Sizing Kit for the correct tank size so all internal components are correct.								

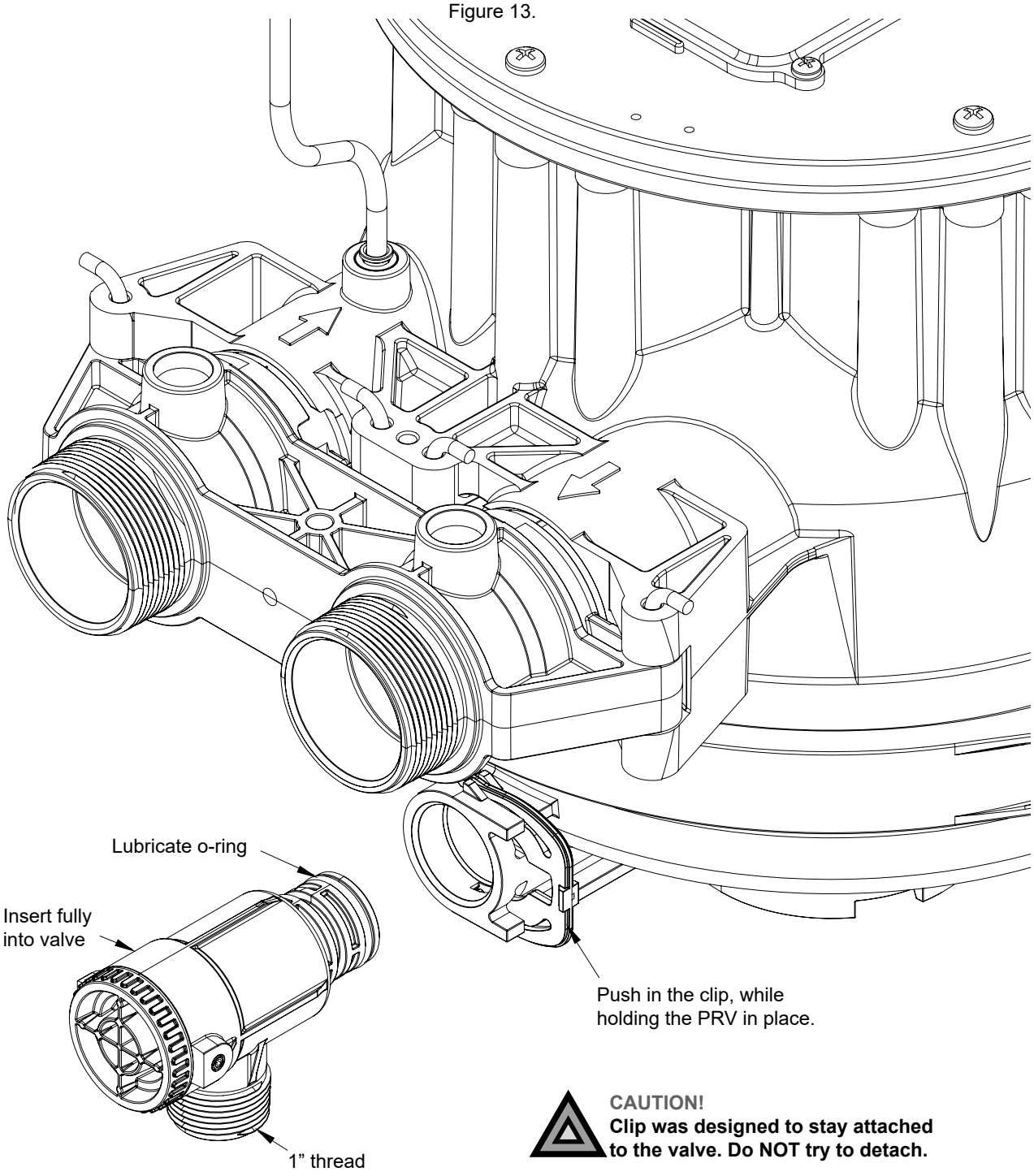
Figure 12.



CAUTION!
Clip was designed to stay attached to the valve.
Do NOT try to detach.

Pressure Relief Valve (PRV)

Figure 13.



CAUTION!
Clip was designed to stay attached to the valve. Do NOT try to detach.

NOTE! **The PRV is set to release at 137 psi.**

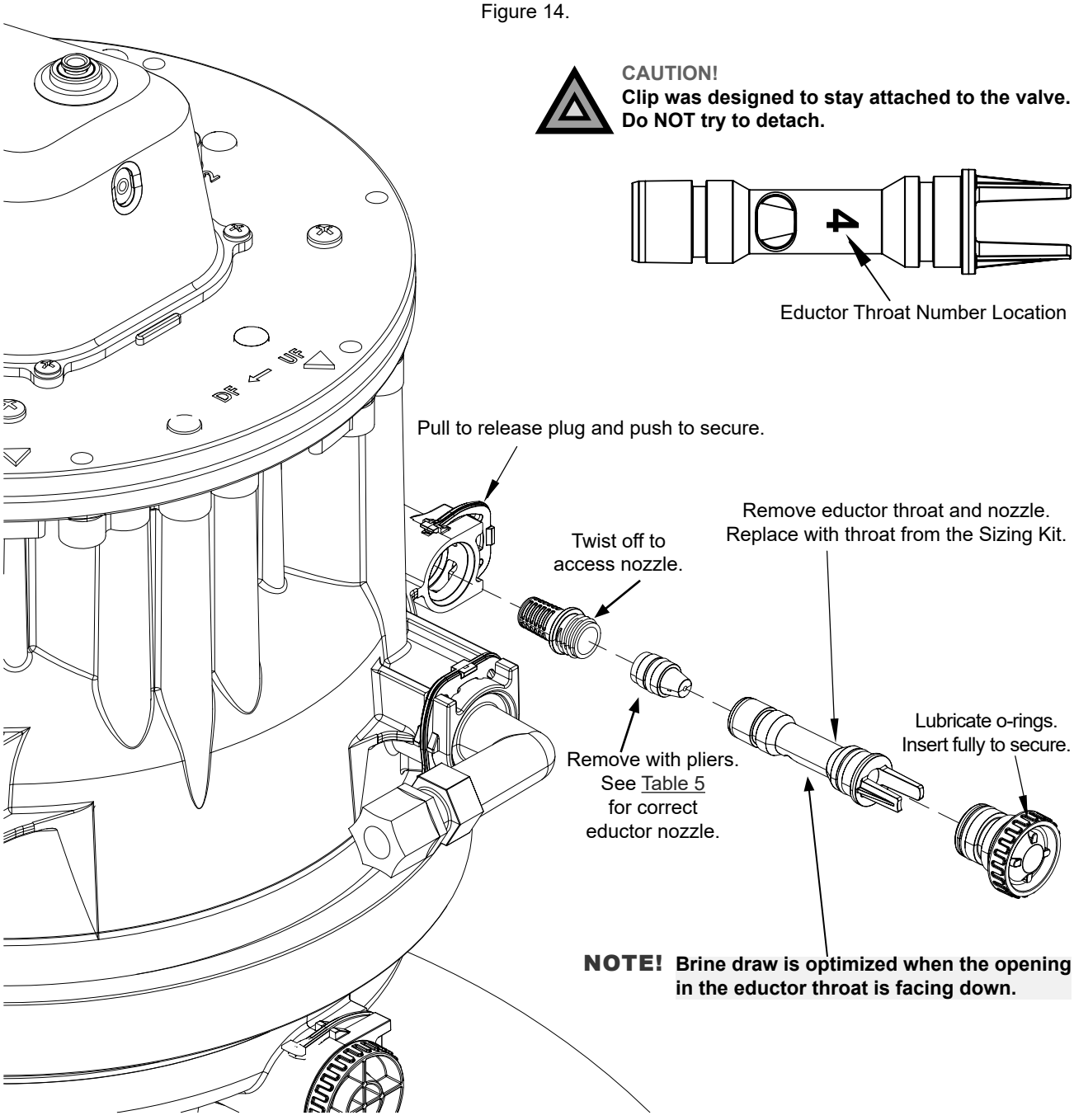
WARNING!
PRV should be plumbed to a suitable floor drain independent of the drain line for emergency relief.

Eductor Nozzle and Throat Replacement

Table 5. Eductors

Model	60K	90K	120K	150K	210K	300K	450K	600K
Throat	Blue #3	Blue #3	Blue #4*	Blue #4*	Blue #4*	Blue #5	Blue #8	Blue #8
Nozzle	Black	Black	Violet*	Violet*	Red	White	Blue	Beige
*Shipped assembled inside the control standard from factory								

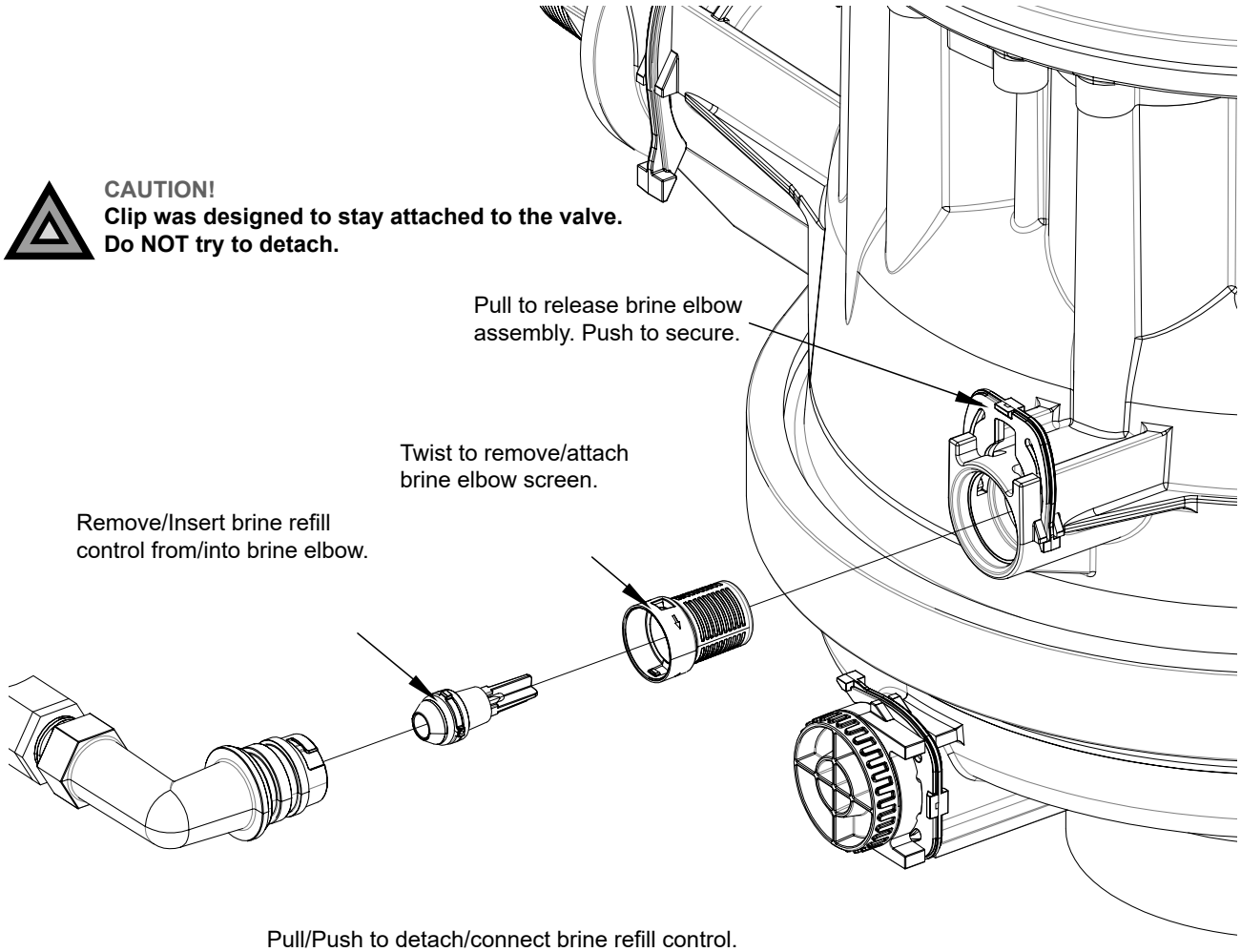
Figure 14.



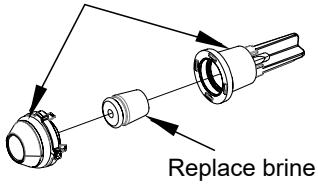
Brine Refill Elbow Assembly

Brine Refill Elbow Assembly is found in the Sizing Kit. Standard brine refill flow control is 2 gpm (molded identifier is 180) and refill rates list in Table 8 on page 49 are based on 60 psi incoming pressure. When using 18X38 or 24X40 brine systems with 60K or 90K units, the 0.80 flow control should be removed from the brine valve.

Figure 15.



Pull/Push to detach/connect brine refill control. Brine Refill Elbow Assembly is found in the Sizing Kit. Standard brine refill flow control is 2 gpm.



Brine System Installation

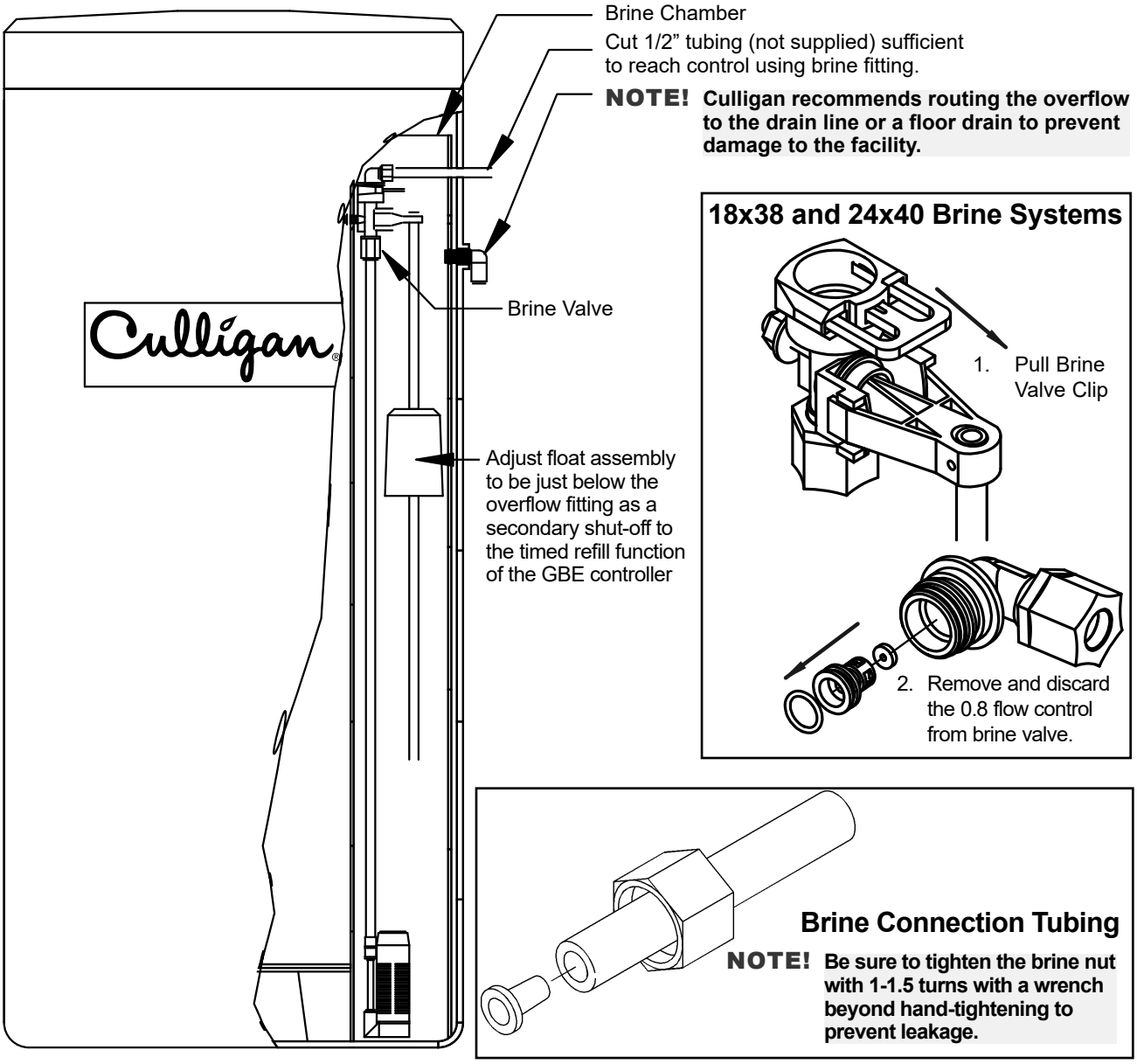
NOTE! The brine system is purchased as an optional item to allow the use of various brine tank sizes to better suit the needs of the user.

The softener system is normally regenerated using a timed brine refill, dry or wet salt storage brine system. To properly install the brine system, set the brine tank assembly in a convenient location for ease of service and refill of salt into the brine tank.

Brine Piping

The softeners can be used with a variety of brine systems. Please refer to Table 6 on page 44 for sizing parameters. Position the salt storage tank in a convenient location on a smooth surface. The brine valve should be at the rear to simplify removal of the tank cover.

Figure 16. 1/2” Brine System.



If connecting multiple softeners to the same brine tank, use the tee provided in a Duplex Kit 01040950 or Triplex Kit 01040951.

Tubing Pilot Valve

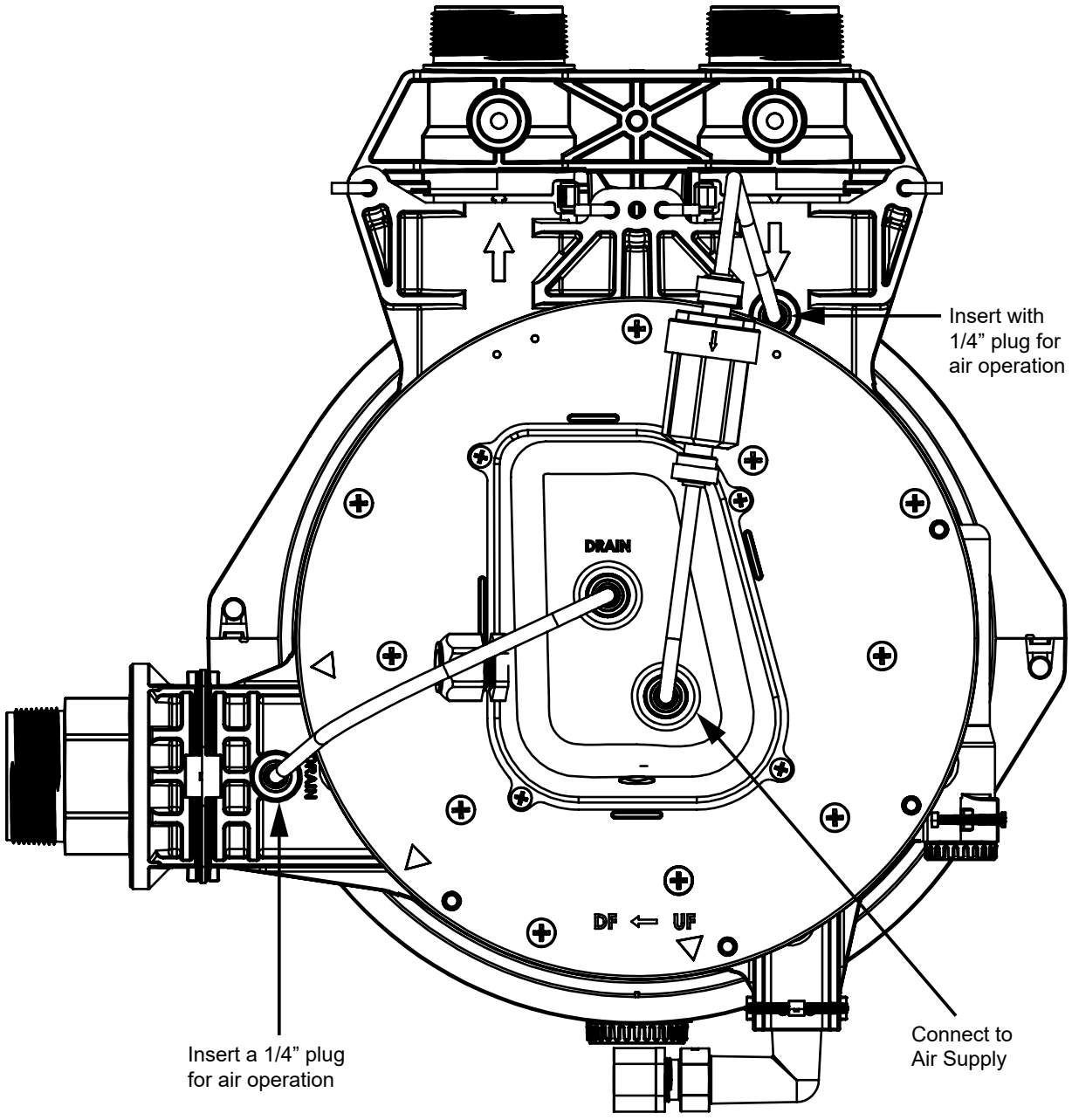
For Pilot Valves operating on water, install tubing and strainer as detailed by the image. Water Operating Pressure must be 50 dynamic PSI - 125 PSI.

For Pilot Valves operating on air, install plugs and connect as detailed by the arrows. Air Supply must be at least 10 PSI GREATER than the Highest Water Pressure.

Refer to page 30 for multi-tank tubing instructions.

NOTE! At least 50 psi dynamic pressure must be maintained for the pilot valve to hold the proper piston position. If the unit falls below this amount, even during the regeneration cycle of another unit, the system will not operate as expected.

Figure 17. Inlet/Outlet Tubing

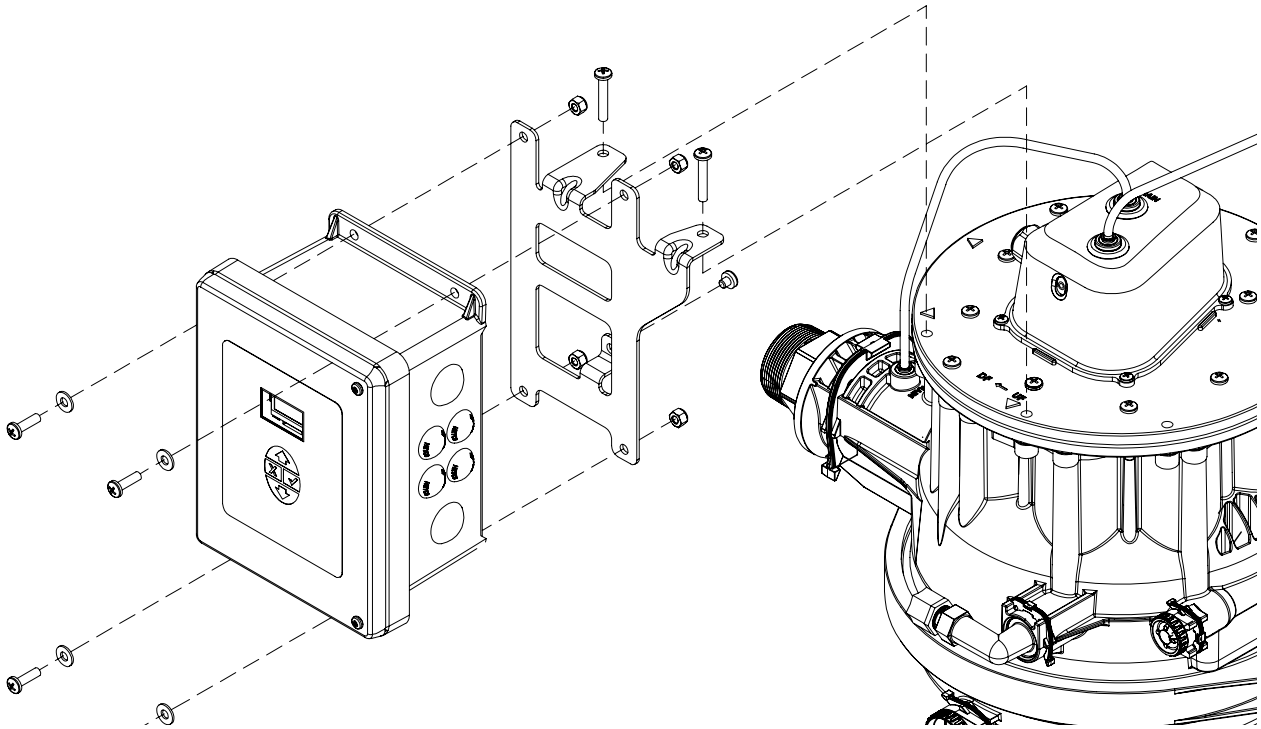


Electrical Controller Circuit Board Layout

Mounting the Controller

Valve Front Mount (already attached to controller)

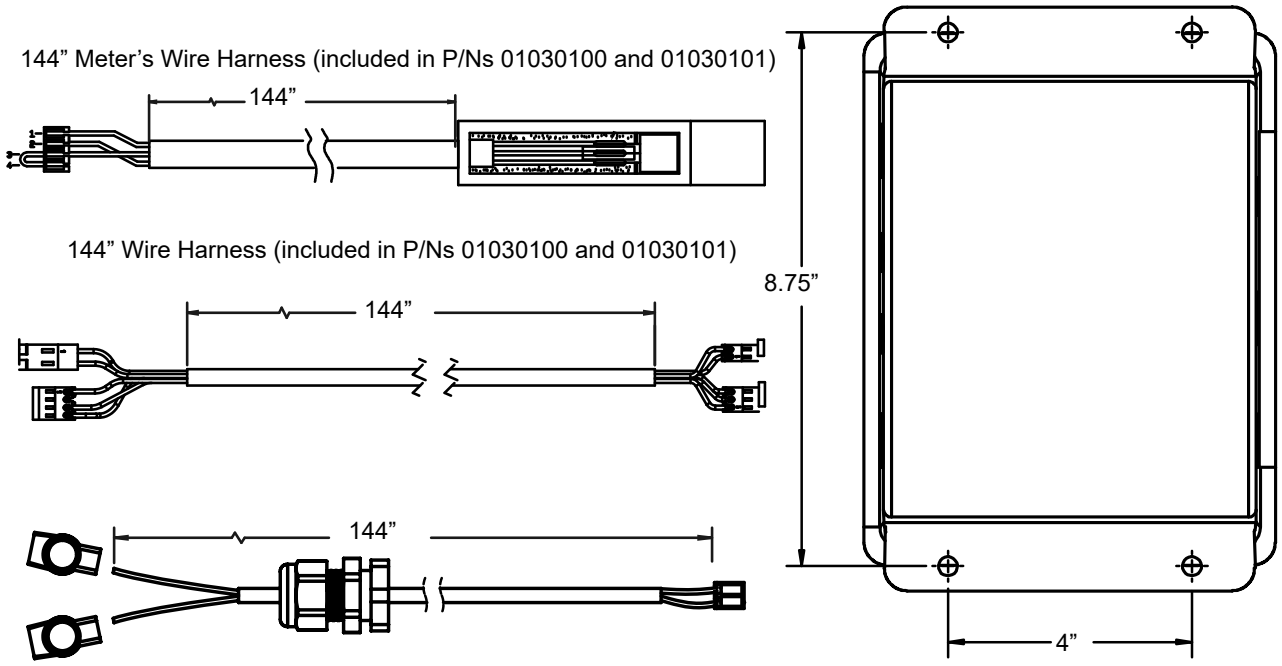
Figure 18. Controller Valve Front Mounted



Wall Mount (Single Unit - P/N 01030100, Multi-Unit - P/N 01030101)

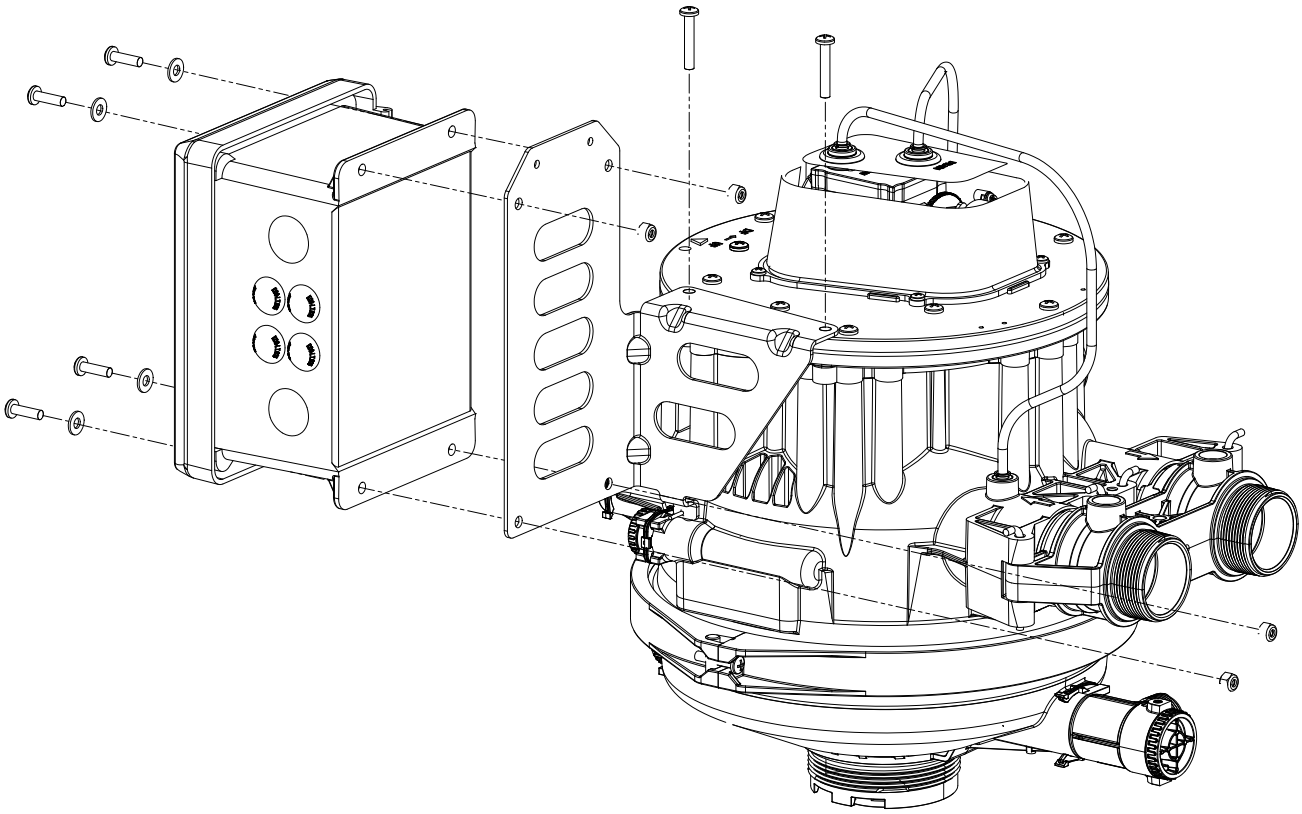
Front mount bracket will need to be removed for wall mounting.

Figure 19. Controller Wall Mounted (Not Actual Size)



Valve Side Mount (Optional, P/N 01029171)

Figure 20. Controller Valve Side Mounted



Wiring Procedures and Diagrams

Preparation

1. Loosen the screws securing the controller access cover (see Figure 21) on each controller provided.

Cable Routing

All input and output connections to the circuit board are 24 Volt or less.

Although the cables do not have to be run in conduit, it is necessary that long runs of cable be supported or protected by strapping them to the equipment piping. If conduit will be used to route the shielded cables, three factors must be considered:

1. DO NOT share the same conduit or raceway with 120 Volt or higher circuits.
2. Keep cables at least six (6) inches away from 120 Volt or higher electrical circuits.
3. GROUND the conduit (if metallic) to a known “earth ground” location.

A series of openings are located on the sides of the Smart Controller enclosure (see Figure 22). Strain relief fittings are provided with the controller enclosure for interconnecting wiring. Install the plastic fittings as needed. Remove the compression nut and rubber sleeve from each fitting. Prior to connection of the cable wires to the circuit board, slide the compression nut and sleeve over the cable for the wiring connections. When wiring is completed, apply a small amount of silicone to the rubber sleeve and reassemble. This will assure all wiring is secure and assist in making the tightening of the fitting easier. Insert the plugs provided to block any holes not used for wiring or other accessories.

Figure 21.

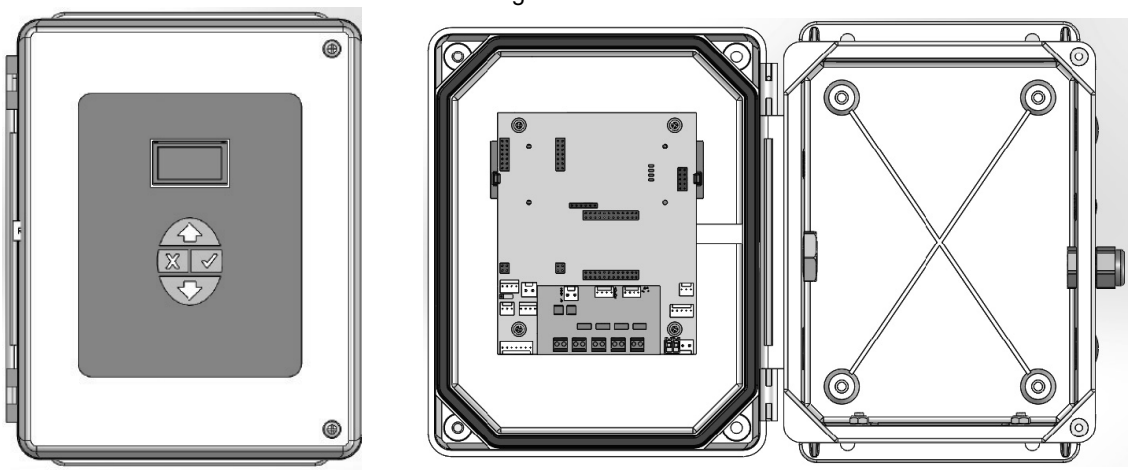


Figure 22.

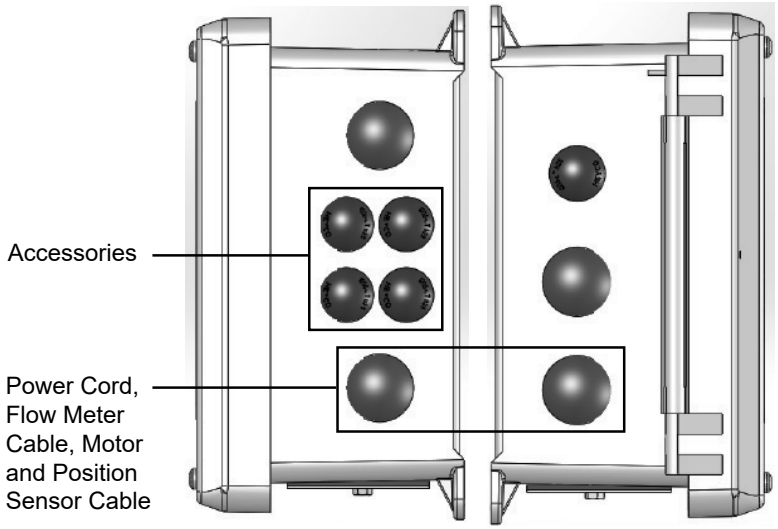


Figure 23. 01021015
Cord Grip for 24V Power Cord

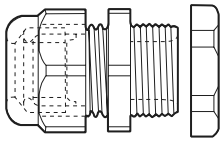
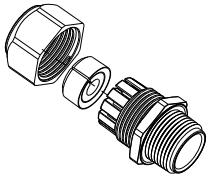


Figure 24.
01028132 Cord Grip for Flow Meter, Position Sensor and Motor Cables



Wiring the Smart Controller Power Cord and 24V Transformer

CAUTION!
DO NOT PLUG THE TRANSFORMER INTO THE WALL UNTIL ALL WIRING IS COMPLETED.

The Smart Controller is powered by a 24 VAC and 2.1 Amps (50 VA) transformer (P/N 01014897, 60 Hz). If there are multiple controls in the system being installed, **each controller will require its own transformer**. It is recommended that each transformer be plugged into a dedicated 120V circuit.

CAUTION!
Connecting 24 V to the 2.5 V connection on the circuit board will damage the circuit board.

NOTE! The 2.5 V cord is only necessary when using an Aqua-Sensor.

CAUTION!
To eliminate the possibility of polarity issues, carefully follow the wiring details shown in Figure 26.

Figure 25. 24 V Power Connection

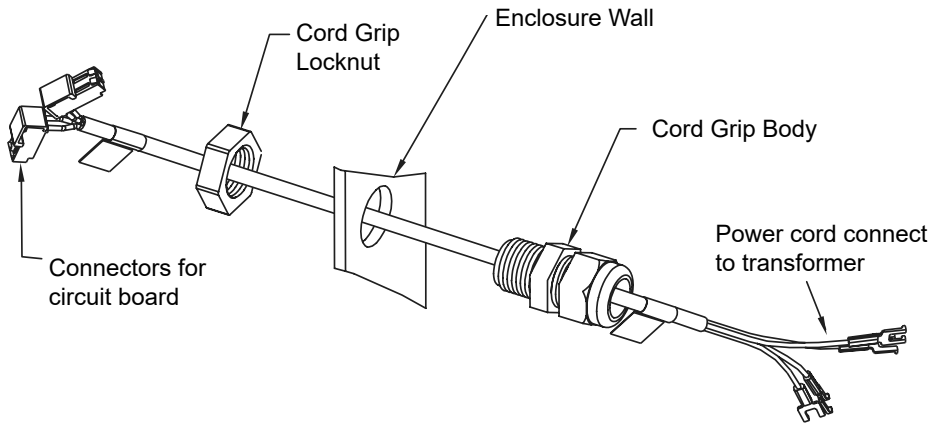
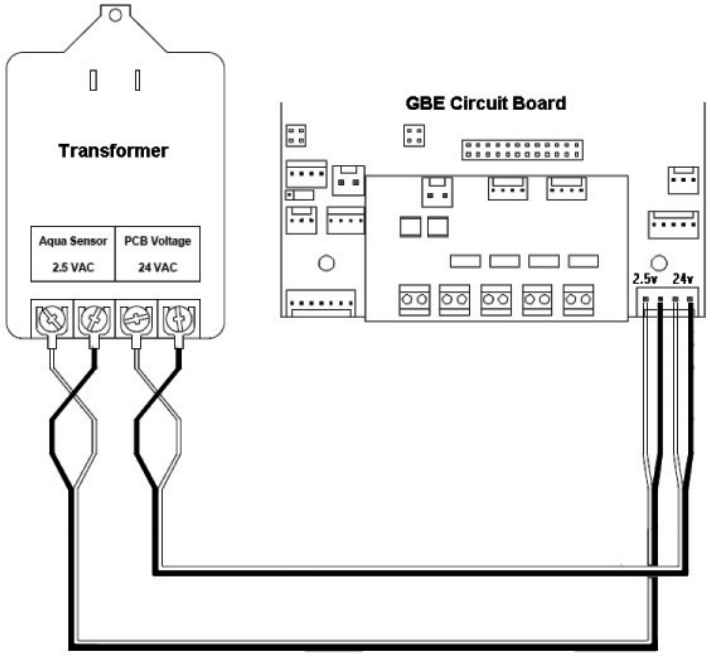
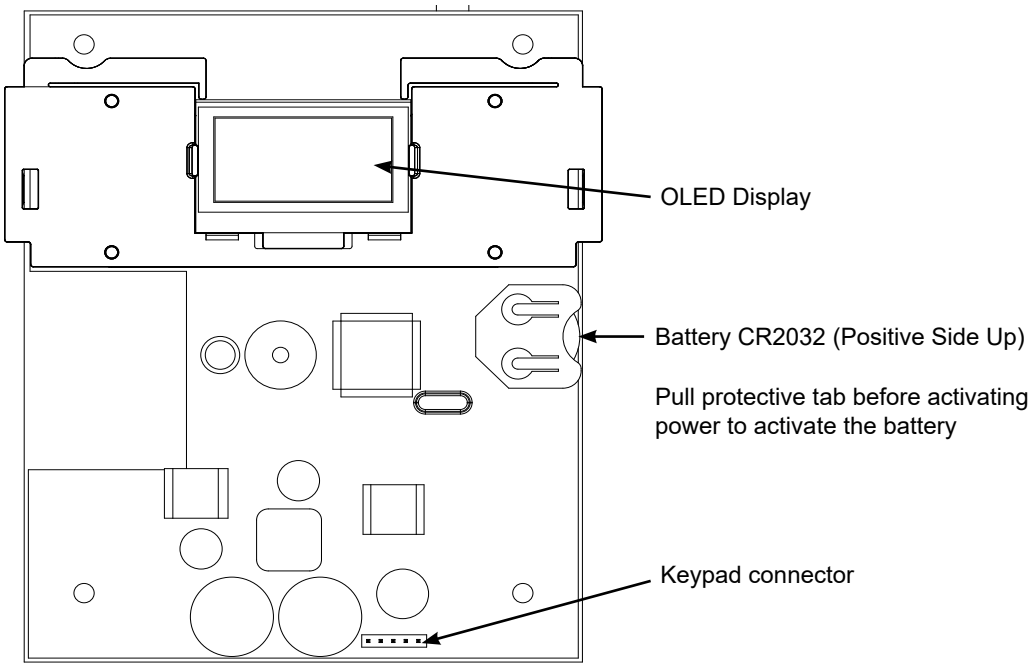


Figure 26. Transformer and Smart Controller circuit board.



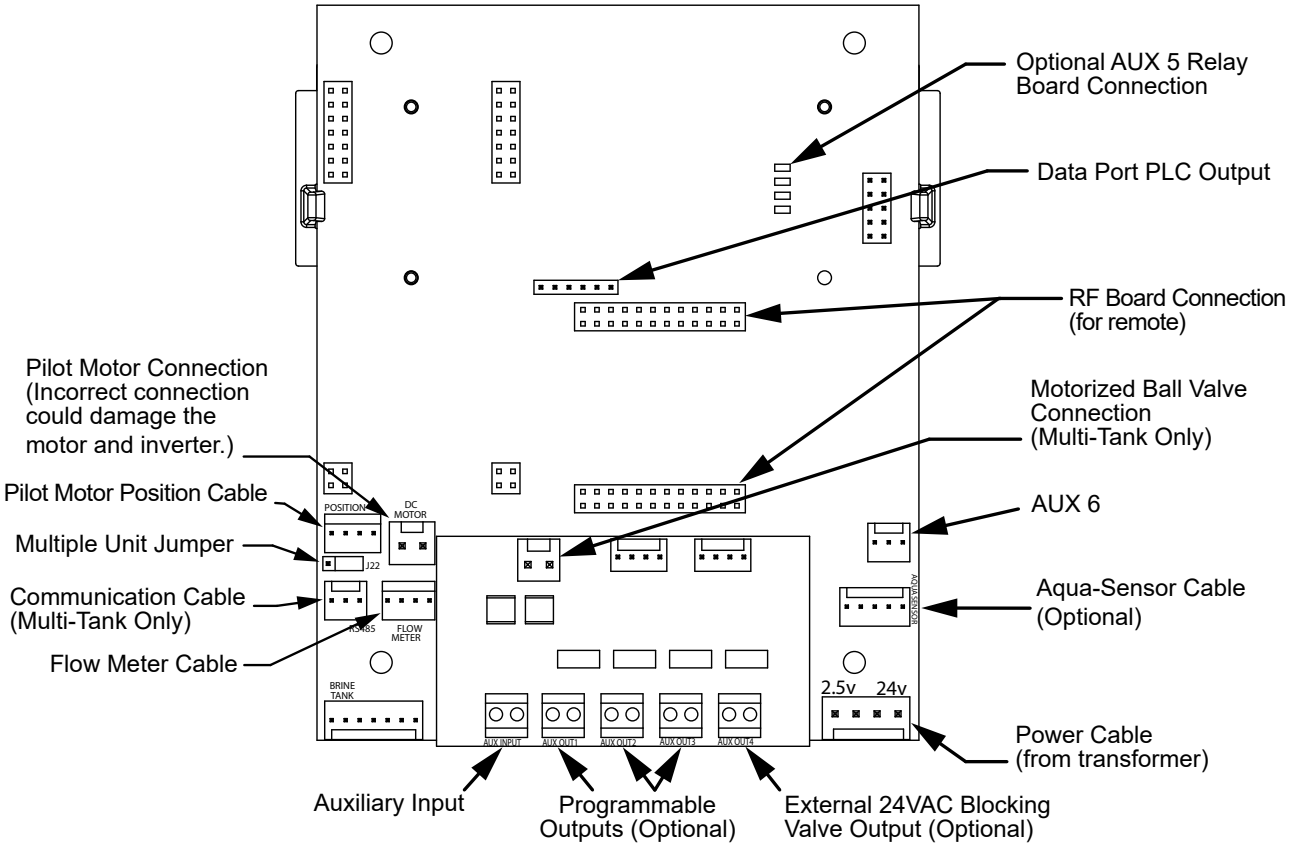
Smart Controller Circuit Board Layout—Front

Figure 27. Smart Controller circuit board layout, front view.



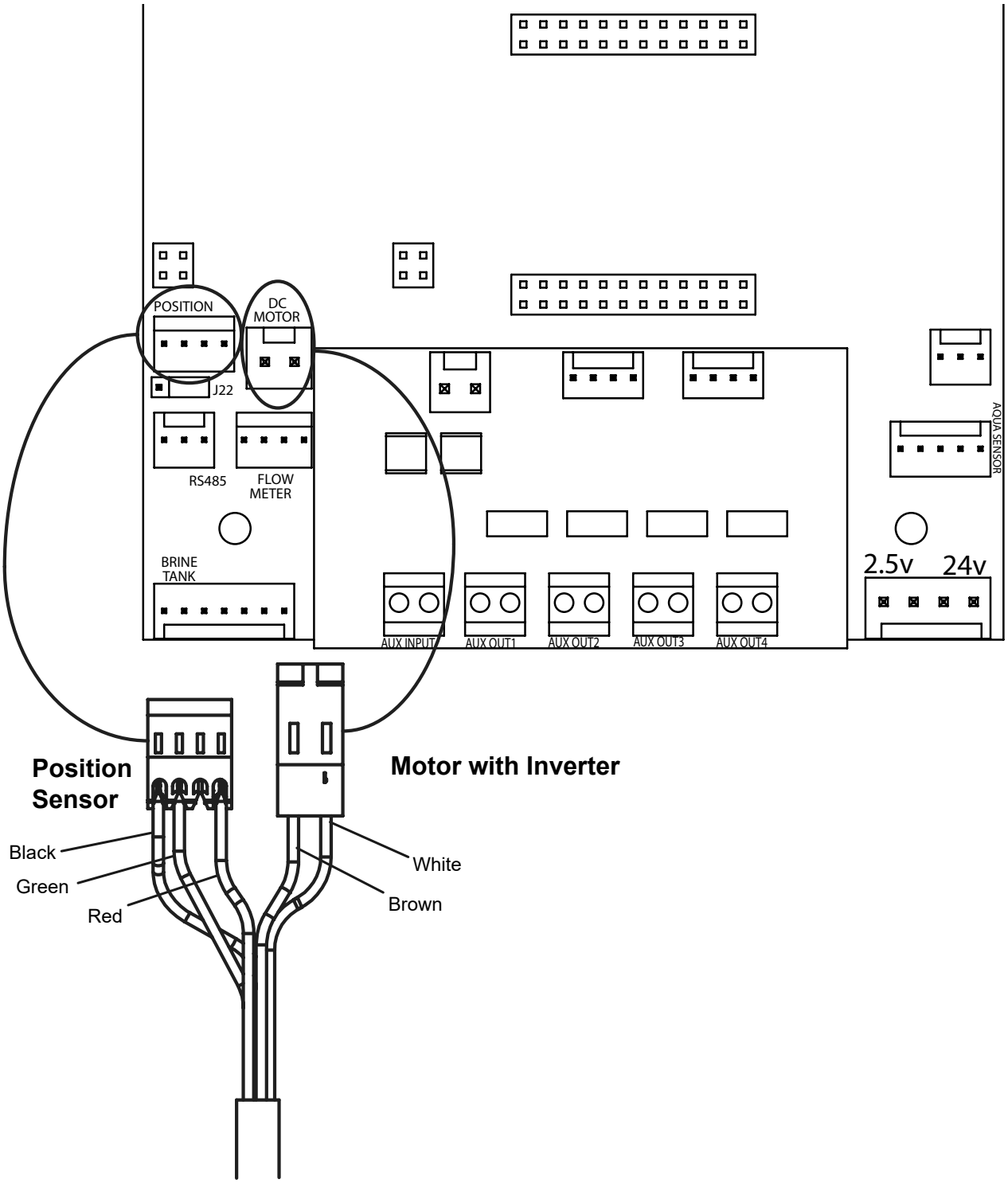
Smart Controller Circuit Board Layout—Back

Figure 28. Smart Controller circuit board layout, rear view.



Circuit Board - Motor and Position Sensor

Figure 29.



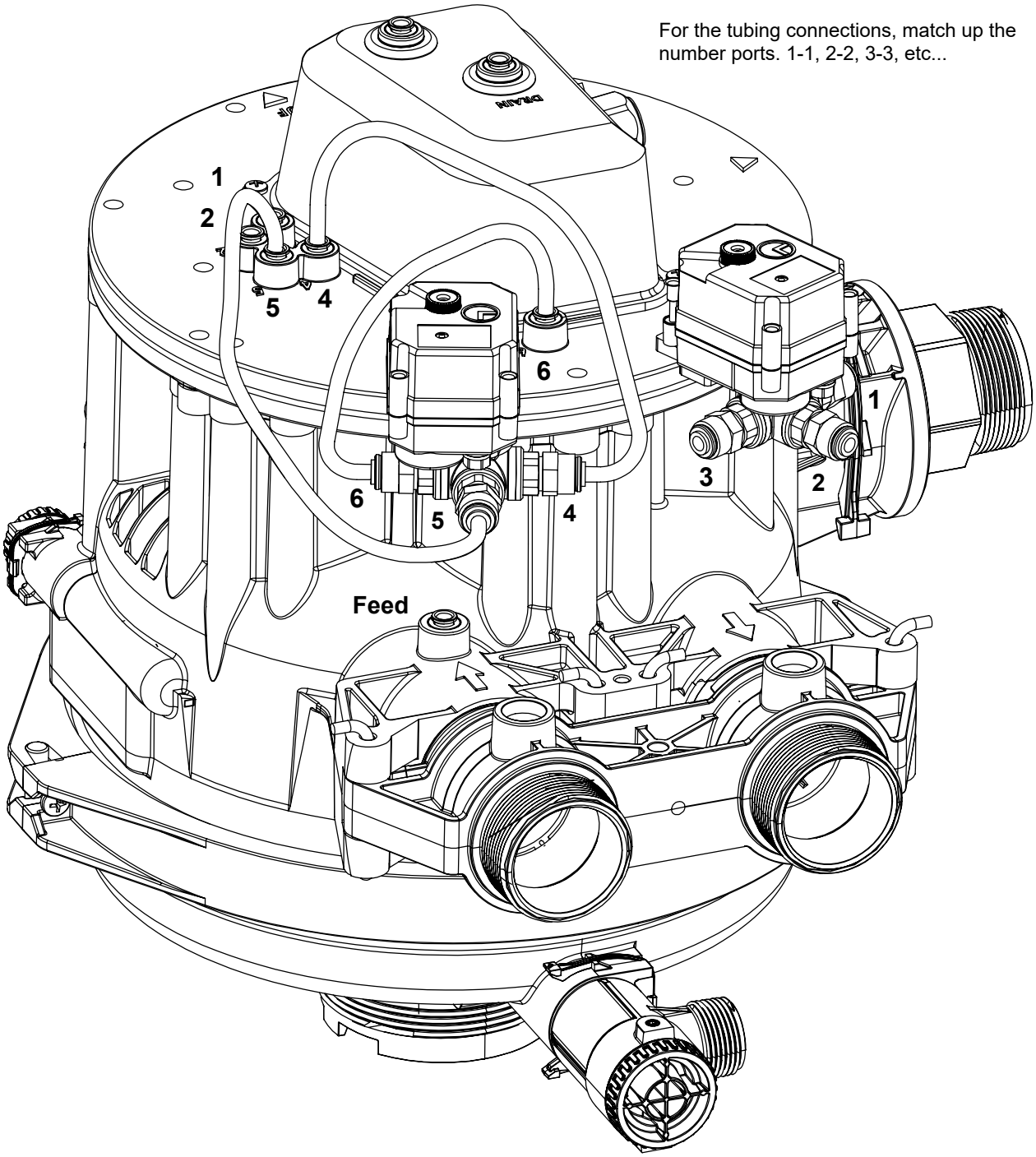
Multi-Tank Systems

Tubing Ball Valves for Multi-Tank Systems

For multiple units, motorized ball valves are installed and tubing connected to the Progressive Flow Top Manifold to alternate the valves from Service to Standby. (See page 76 for more details.)

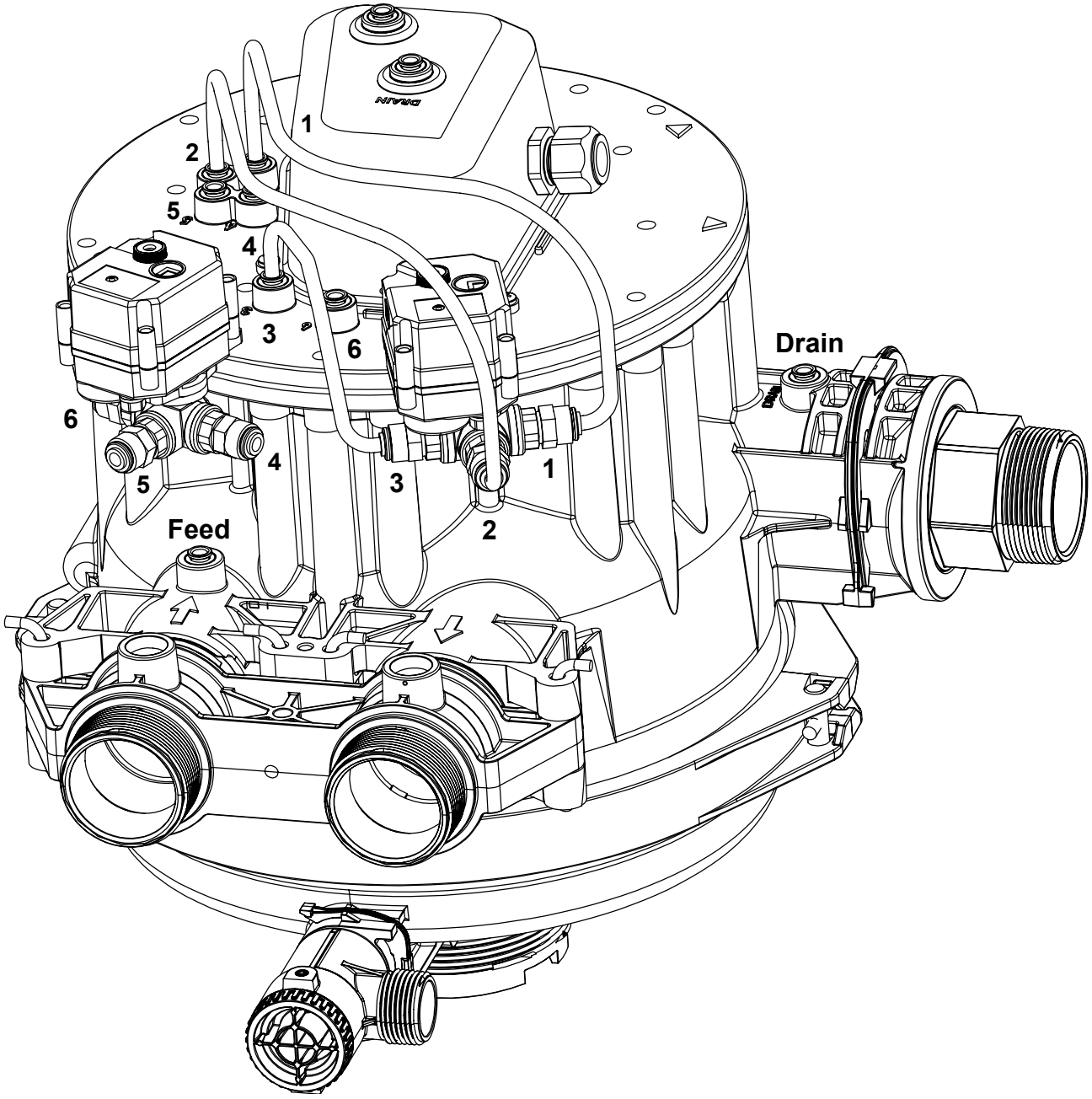
See page 23 for tubing the pilot valve.

Figure 30. Tubing to Ball Valve #1 (Ports 4, 5, 6) (Multi-Tank Softeners Only)



For the tubing connections, match up the number ports. 1-1, 2-2, 3-3, etc...

Figure 31. Tubing to Ball Valve #2 (Ports 1, 2, 3) (Multi-Tank Softeners Only)

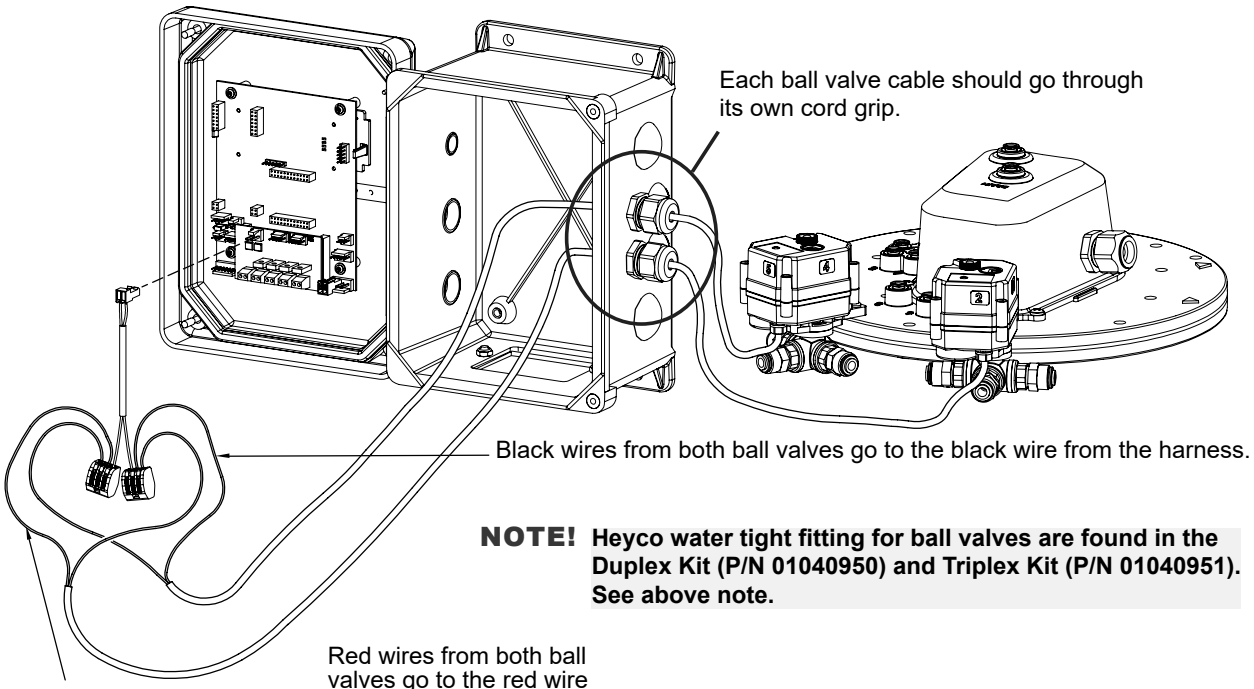


NOTE! **At least 50 psi dynamic pressure must be maintained for the pilot valve to hold the proper piston position. If the unit falls below this amount, even during the regeneration cycle of another unit, the system will not operate as expected.**

Wiring for Multi-Tank Systems

Motorized Ball Valves, Valve Mounted Controller

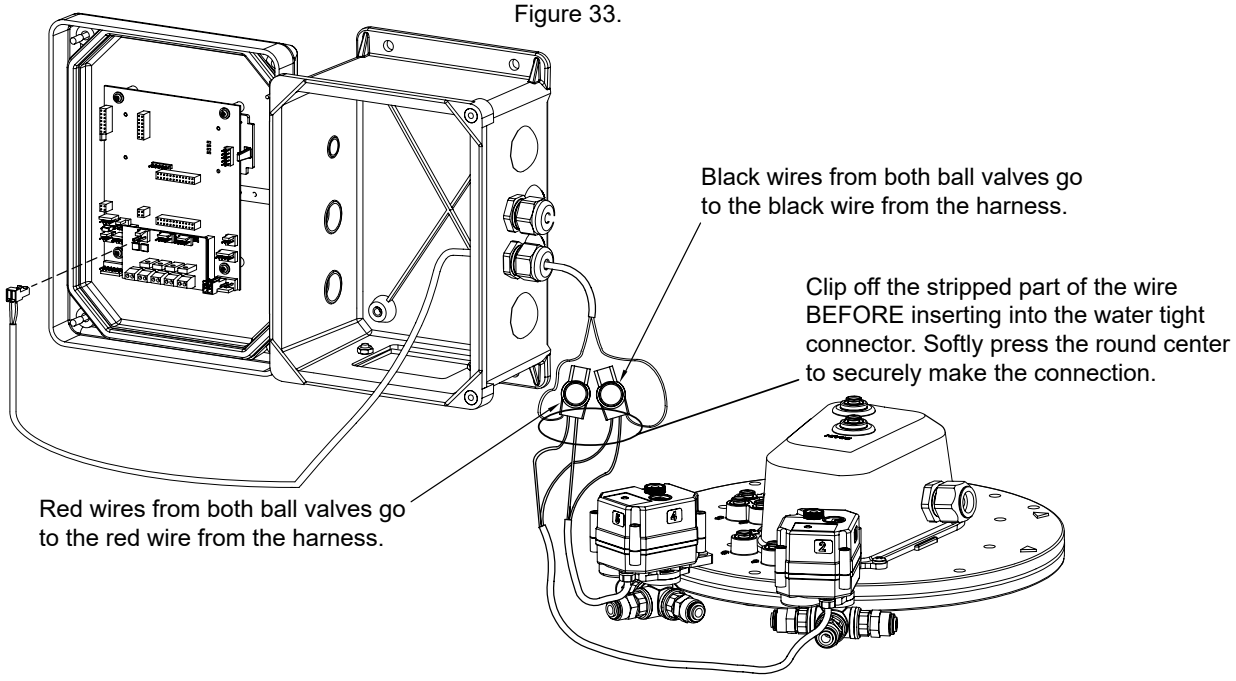
Figure 32. Ball Valve Wire Harness, Valve Mounted Controller



NOTE! **Heyco water tight fitting for ball valves are found in the Duplex Kit (P/N 01040950) and Triplex Kit (P/N 01040951). See above note.**

Motorized ~~Ball Valves, Wall~~ Mounted Controller (Optional, Two are included in 01030101)

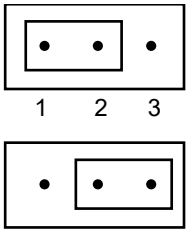
Figure 33.



IMPORTANT—Setting the Jumpers for GBE to GBE RS485 Communication

For GBE controls to communicate via RS485 properly, the first and last units must have the jumpers set to pins 1 and 2 on terminal J22 (see Figure 34 at right). All middle units should have the jumpers on pins 2 and 3 (see Figure 34).

Figure 34.



Jumper location for first and last units (end units).

Jumper location for middle units.

Progressive Flow or Parallel Flow

Figure 35 shows duplex connections.
Repeat the connections on any additional systems.

Figure 36 shows communication cable connections.

Figure 35. Duplex connections.

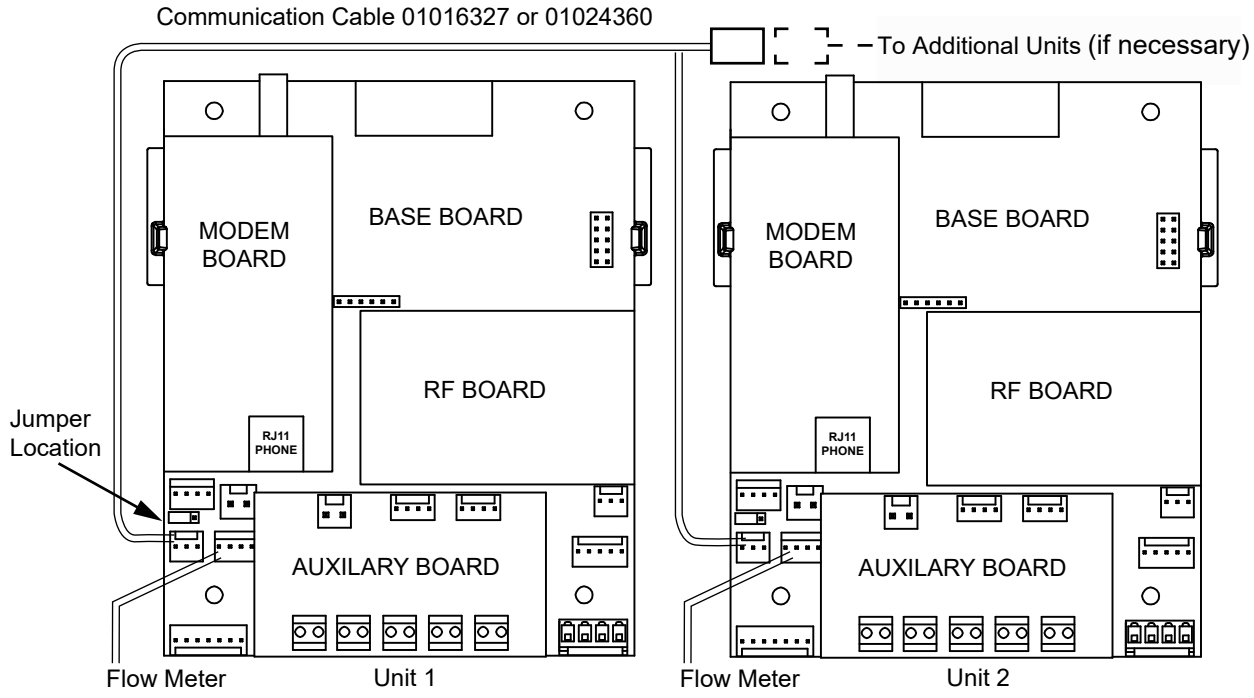


Figure 36. Water-tight communication cable (01024360).

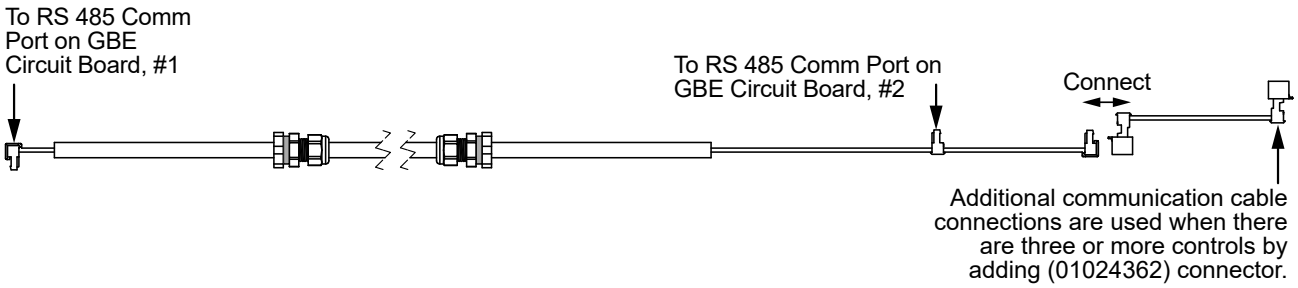
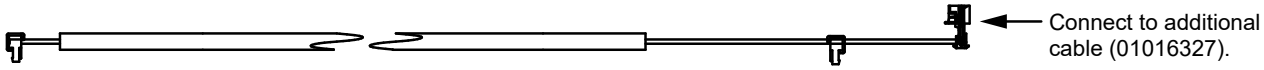


Figure 37. Non water-tight cable (01016327).



Connecting Multiple Circuit Boards to 24VAC Power Supplies

In progressive flow systems, each GBE circuit board requires electrical power. Because the GBE circuit boards are electrically connected to each other via the communication cable, it is very important to use care in properly wiring these systems to electrical power. Failure to do so can result in, at a minimum, damaging the GBE circuit boards.

Culligan STRONGLY RECOMMENDS that every GBE circuit board be provided with its own individual power transformer as shown in Figure 38.

When using individual power supplies, the GBE boards can be connected to each other using communication cables without paying attention to the polarity of the wiring used on the power supplies. DO NOT connect the Aux-Outputs of multiple GBE boards to the same electrical load (for example, a “load” can be the coils of a relay or a solenoid valve). If you need the Aux Outputs of multiple GBE boards to run the same load; it is required that you use isolation relays as shown in Figure 39.

Figure 38. Correct connections for multiple GBE boards to individual 24VAC power supplies.

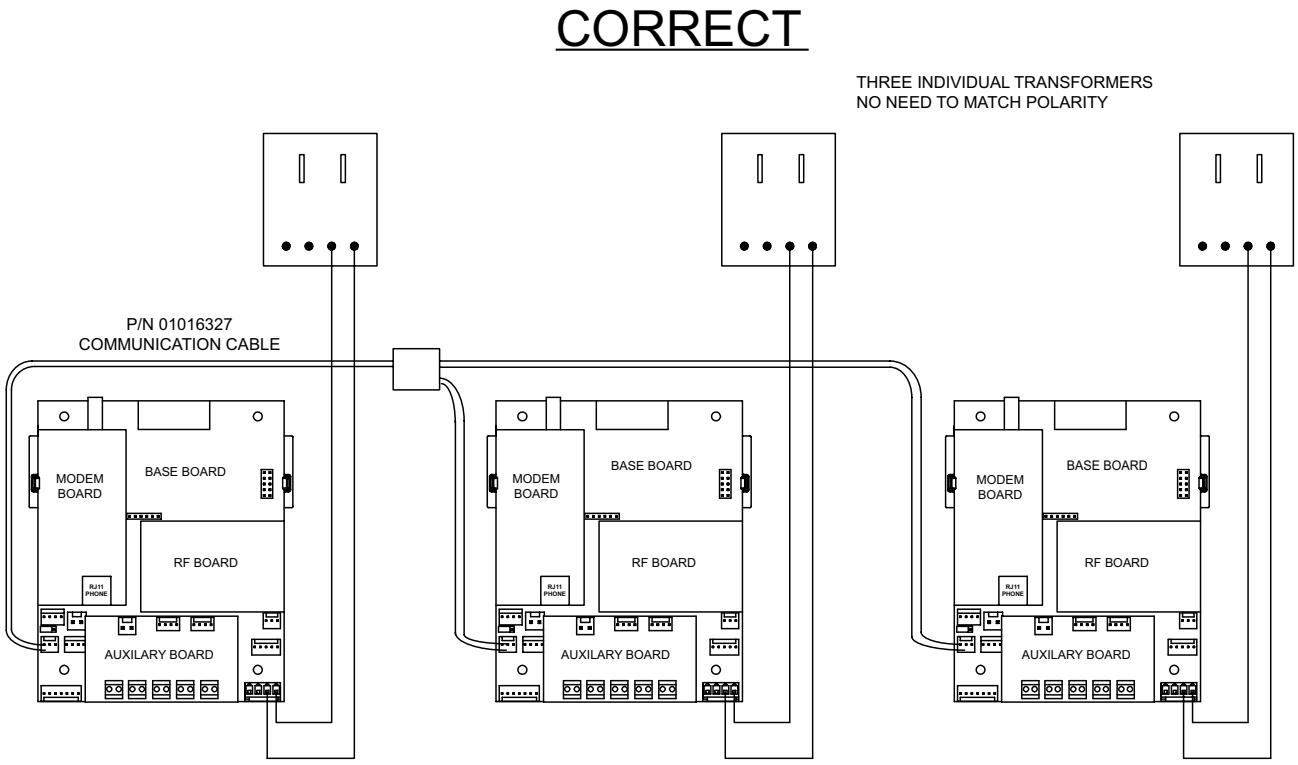


Figure 39. Use of isolation relays to allow multiple GBE boards to control a shared solenoid valve.

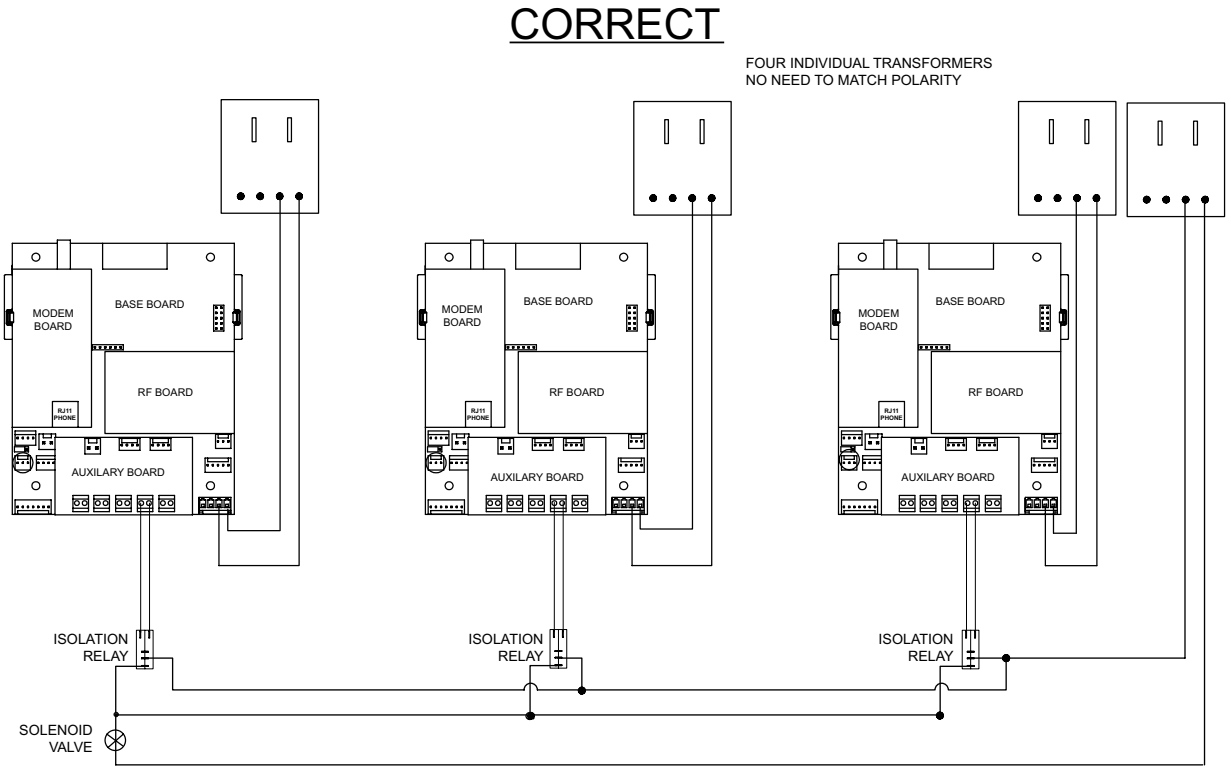
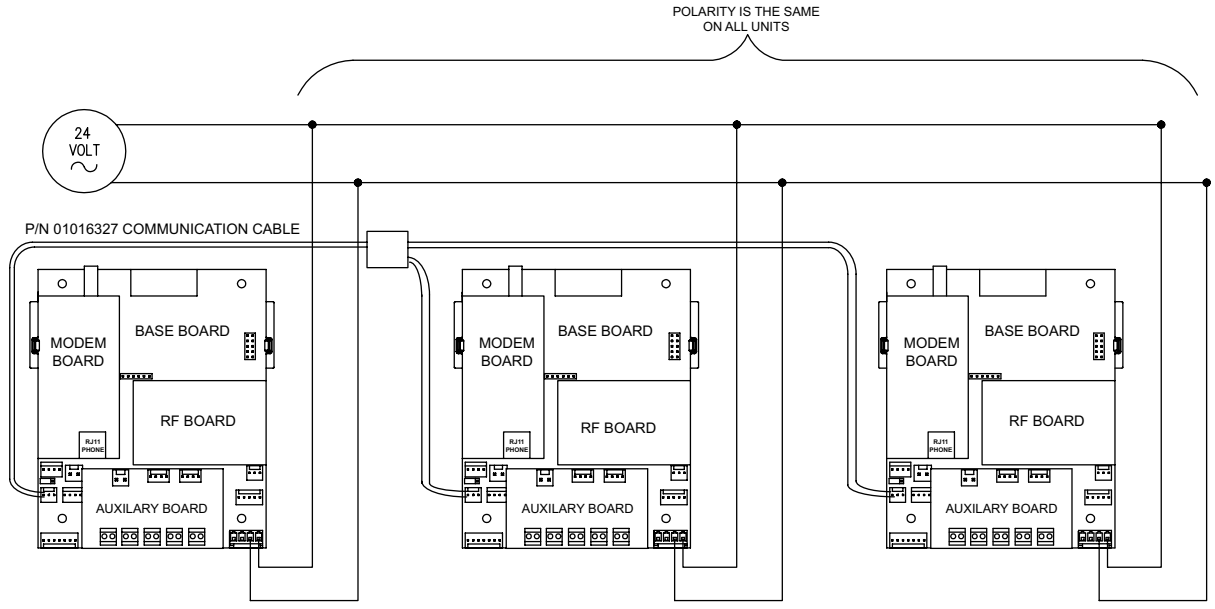


Figure 40. Not recommended connections for multiple GBE boards to shared 24VAC.



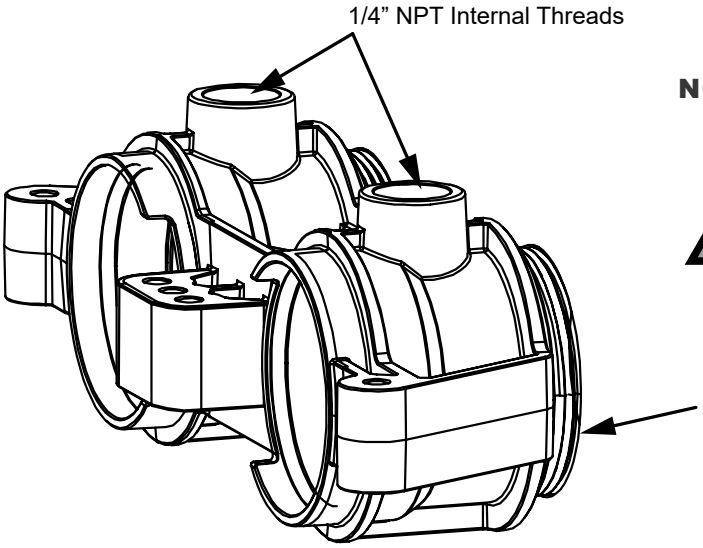
NOTE! **This configuration, while correct, should be avoided, since any single polarity change will cause immediate failure of GBE boards and/or transformers.**

Accessories

Ported Plumbing Adapter

The ported plumbing adapter is installed onto the valve the same way as the standard plumbing adapter.
See page 13 for instructions.

Figure 41. .



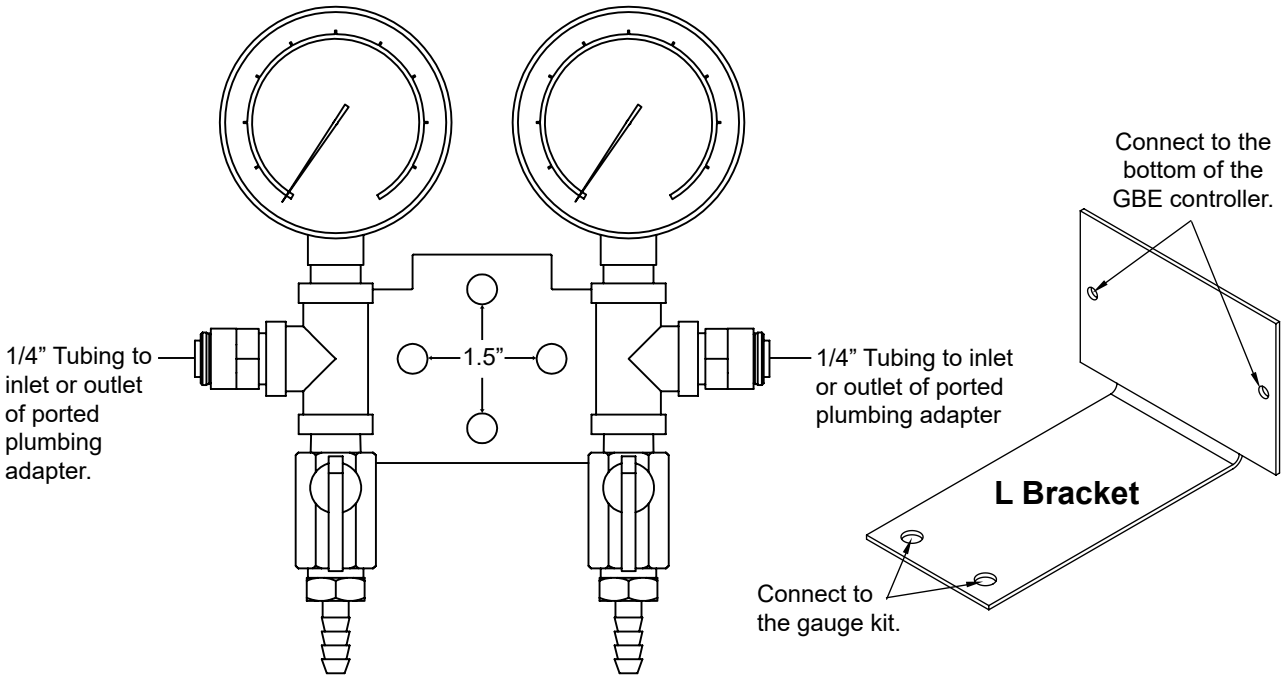
NOTE! **Ports can be positioned upwards for gauges or downwards for sample valves.**

CAUTION!
Do not over tighten fittings in the port adapter. Over tightening can damage the ports causing them to leak.

Gauge and Sample Valve Kit (P/N 01029507)

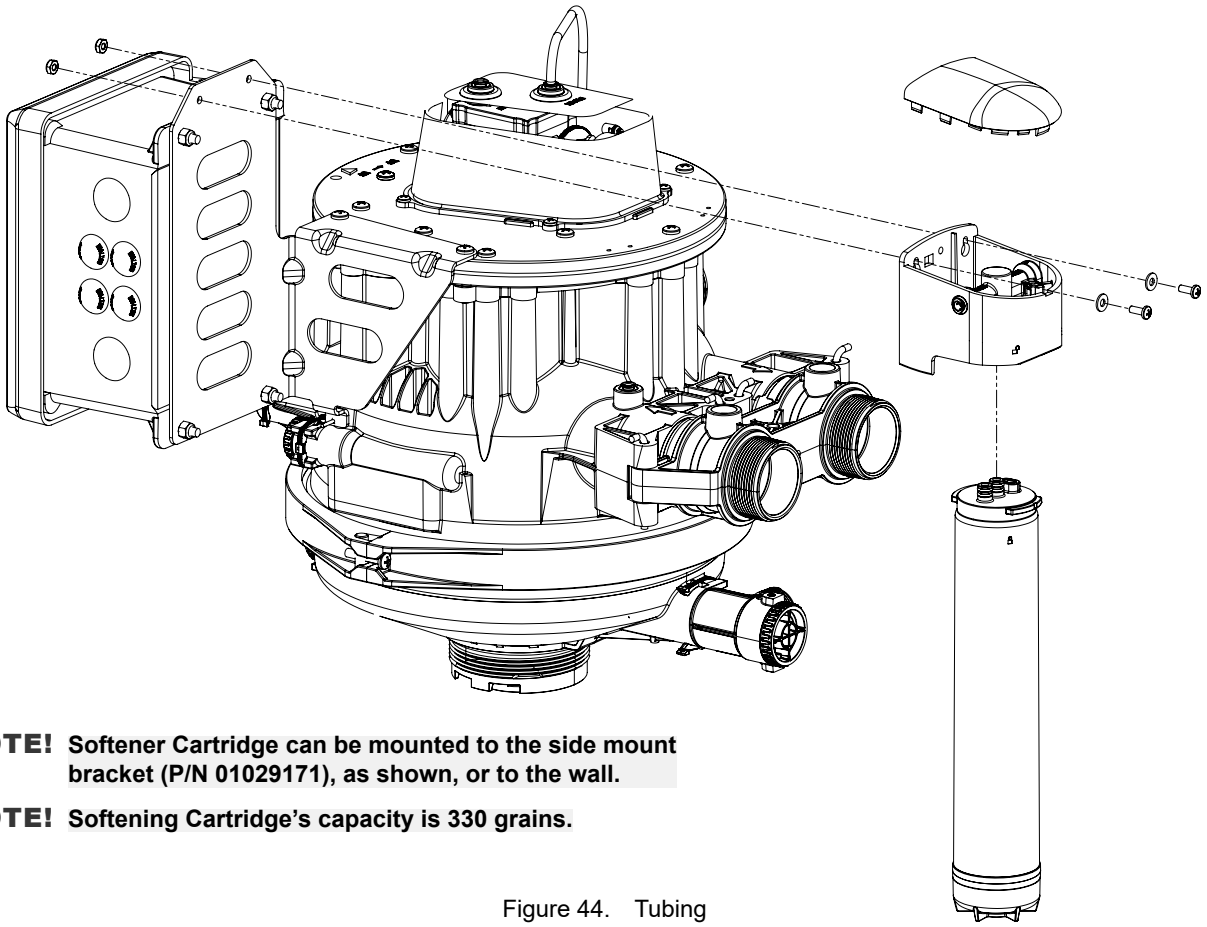
This kit requires the use of a ported plumbing adapter (see above), 1/4” tubing (P/N 00303177 (1’ blue) or 00402184 (1’ black) and two 1/4” PI x 1/4” NPTE adapters (not provided). The gauge kit can be mounted on the wall, on the piping or using the L-bracket it can be mounted under the GBE controller. (hardware is not included)

Figure 42.



Softening Cartridge with Cartridge Adapter (P/N 01029504)

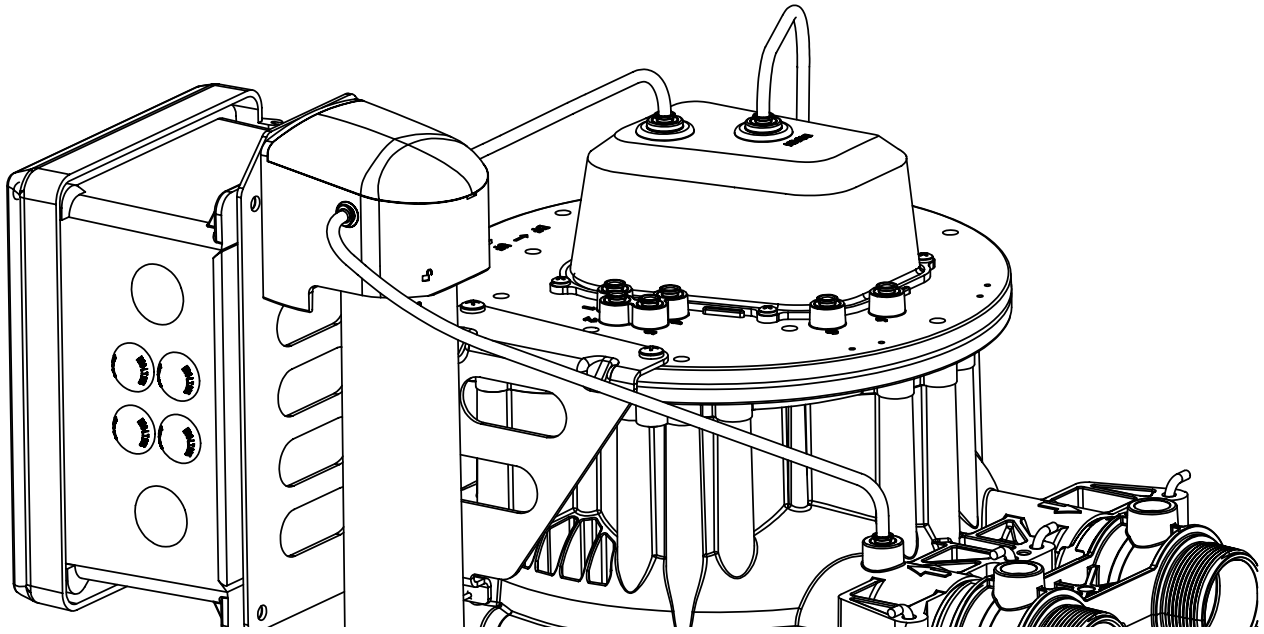
Figure 43. Mounting to bracket



NOTE! Softener Cartridge can be mounted to the side mount bracket (P/N 01029171), as shown, or to the wall.

NOTE! Softening Cartridge's capacity is 330 grains.

Figure 44. Tubing



Aqua-Sensor® (P/N 01025279)

Aqua-Sensor® probe detects and initializes a regeneration based on exhaustion of the resin bed, which is monitored by electrical conductivity. The conductivity is also monitored in the resin during regeneration to determine the brining process has been complete and to optimize the slow rinse times, potentially saving water.

WARNING!
For best results, do not subject the Aqua-Sensor® to conditions outside the operating parameters of the water softening system. See page 6.

Adjust the cable to the proper length for the CTM tank size. The small center plug can be loosened to allow cable movement and then re-tightened with pliers to prevent leaks. Remove the Fillport plug by turning it a 1/4 turn and lifting up on the plug. Lube the o-ring of the Aqua-Sensor probe plug before inserting it into the port.

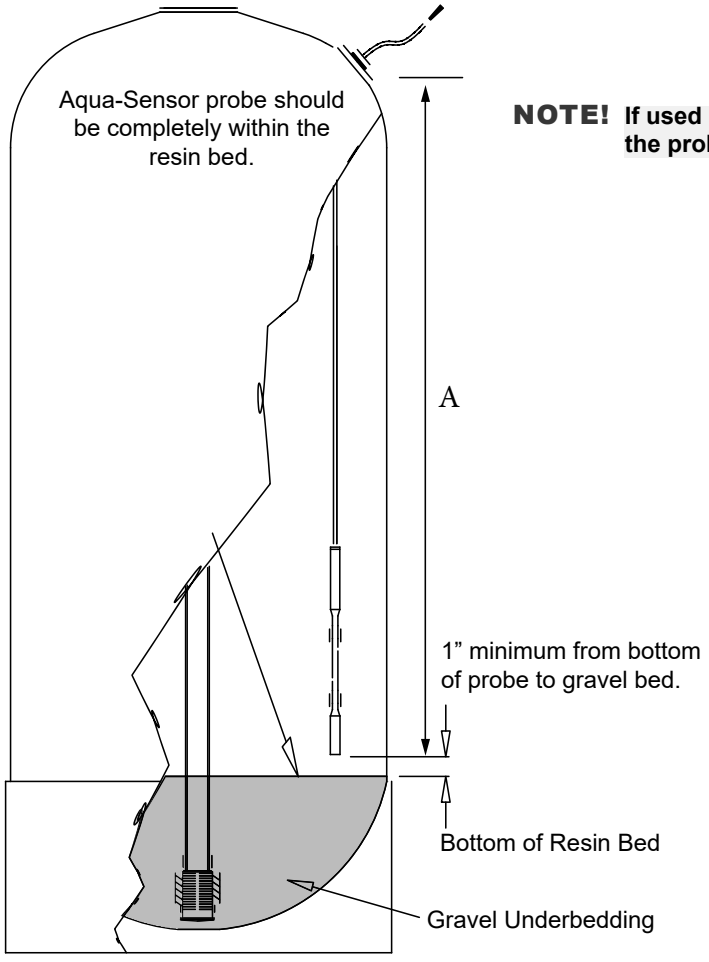
NOTE! After installation of the Aqua-Sensor probe, a complete regeneration is required to set the probe at its proper depth, and record the conductivity in the tank. Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

NOTE! Aqua-Sensor probe requires the connection of the 2.5V power cord to the transformer and circuit board. See page 26 for details.

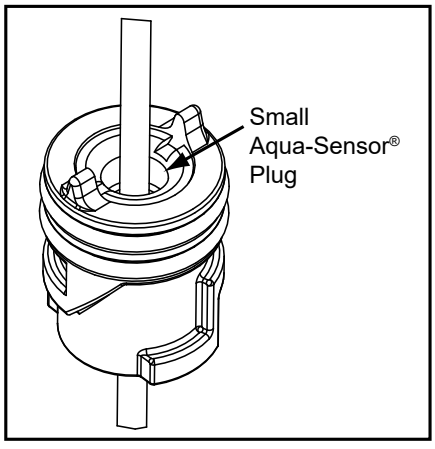
Softener Model	60K	90K	120K	150K	210K	300K	450K	600K
Recommended "A"	37.5"	42.6"	54.4"	52.5"	52.5"	62.1"	55.0"	54.8"

NOTE! Measurement to the bottom of the probe allows for a 30% reserve capacity.

Figure 45. Aqua-Sensor® probe positioning.



NOTE! If used in a multiple tank configuration, lower the probes to be just above the underbedding.



Auxiliary Outputs (P/N 01020748)

The auxiliary board (Figure 46) comes installed in all CTM softeners and filters. It has four 24 VAC outputs for driving 24VAC control valve motors, energizing 24VAC relay coils, or 24VAC solenoids directly. Each solid state triac output is capable of handling up to 4 Amps maximum; HOWEVER, the 24VAC transformer determines how much total current is available. Max supply current of the 01014897 transformer is only 2.1 Amps, so the sum of all loads on the triac outputs should never exceed the maximum that the transformer can supply. The Auxiliary Outputs (see Figure 47) can be programmed to be “normally off” (output stays OFF until the designated time, it is needed to be ON) or “normally on” (output stays ON until the designated time, it is needed to be turned OFF).

Figure 46. Auxiliary outputs

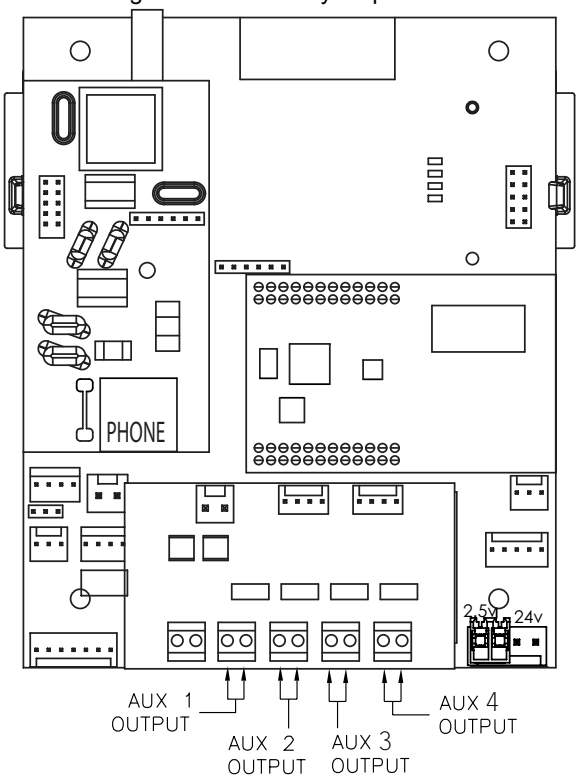
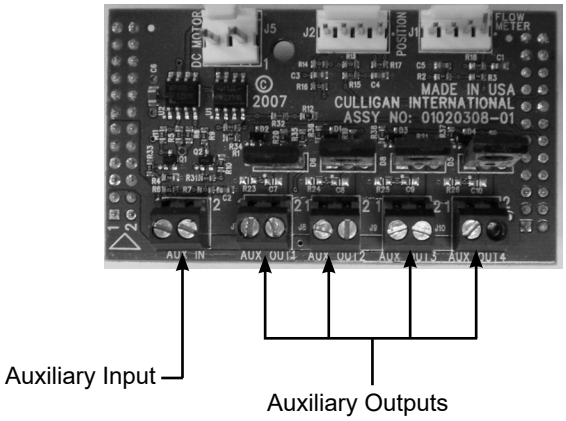


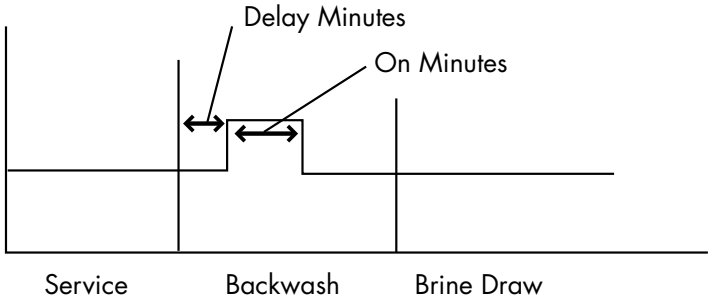
Figure 47. Auxiliary board input and outputs



Aux Output 1 is used to power the 24 VAC drive motor found on all valves. When Aux Output 1 is used for this, then Aux Output 4 is automatically configured to operate a solenoid which can be used for a standby or blocking. Aux Output 4 is powered during all cycles except service, and unpowered during service.

For example, Figure 48 shows how the timing would work if an auxiliary output is set to NORMALLY OFF. The cycle position is set to BACKWASH, the delay minutes setting is greater than zero, and ON minutes is greater than zero.

Figure 48. Auxiliary board activation timing.



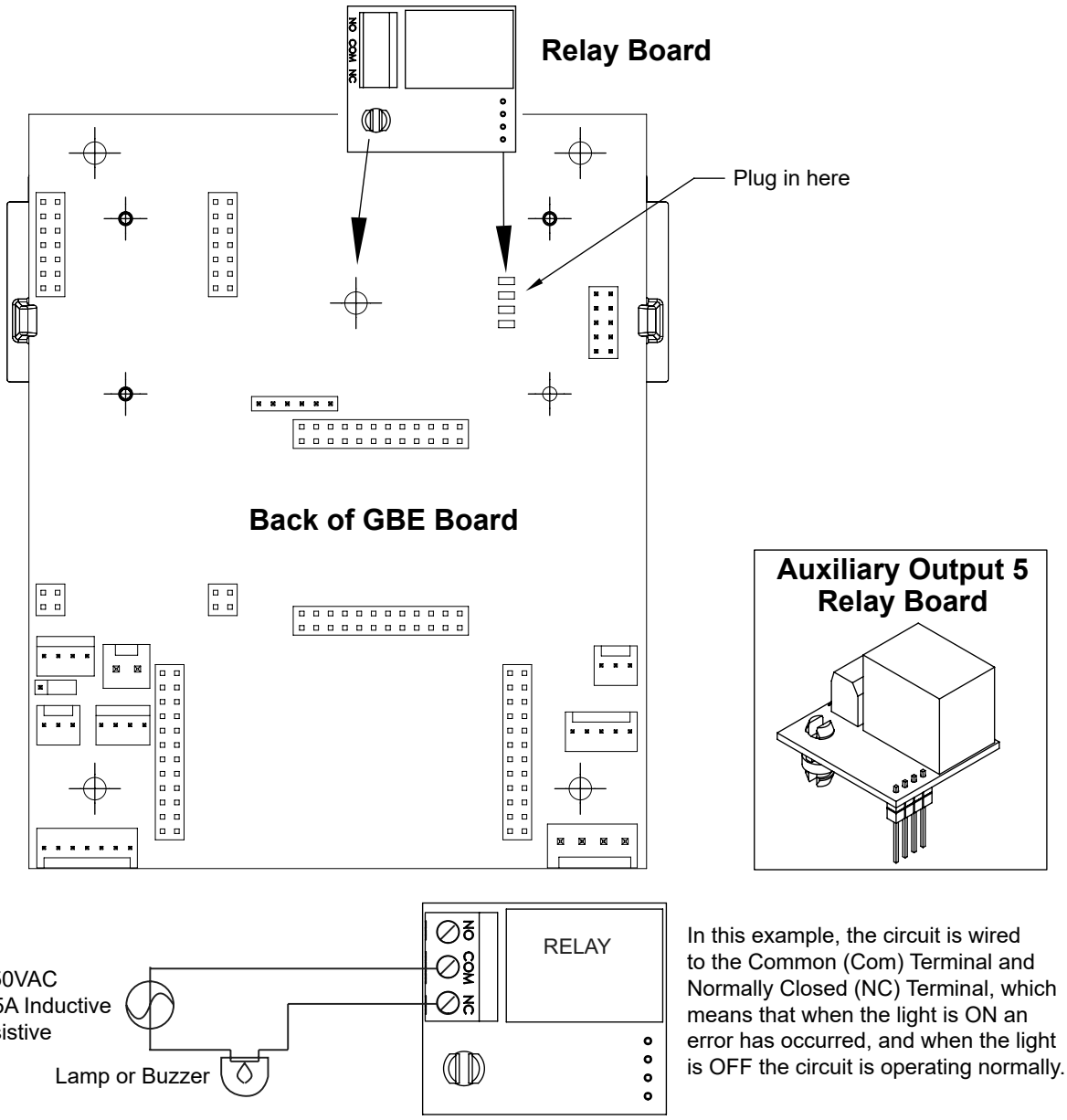
Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Auxiliary Output 5 Relay Board (P/N 01022238)

The GBE board offers support for the Auxiliary Output 5 Relay board (P/N 01022238).
To use the relay board, install it onto the back of the GBE board.

Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Figure 49. Example of customer wiring to the GBE Alarm Signal Output.



In this example, the circuit is wired to the Common (Com) Terminal and Normally Closed (NC) Terminal, which means that when the light is ON an error has occurred, and when the light is OFF the circuit is operating normally.

This mode of operation occurs when the relay board is plugged into the GBE board chlorinator socket. When Error Status is selected on the display, this relay is energized holding the normally closed contact open, and when the GBE board has power AND there are no errors present the relay is energized. (“Problem Found” is not showing on the Home screen). The relay is in the de-energized state when the GBE is either powered OFF or when there is an error present on the GBE board.

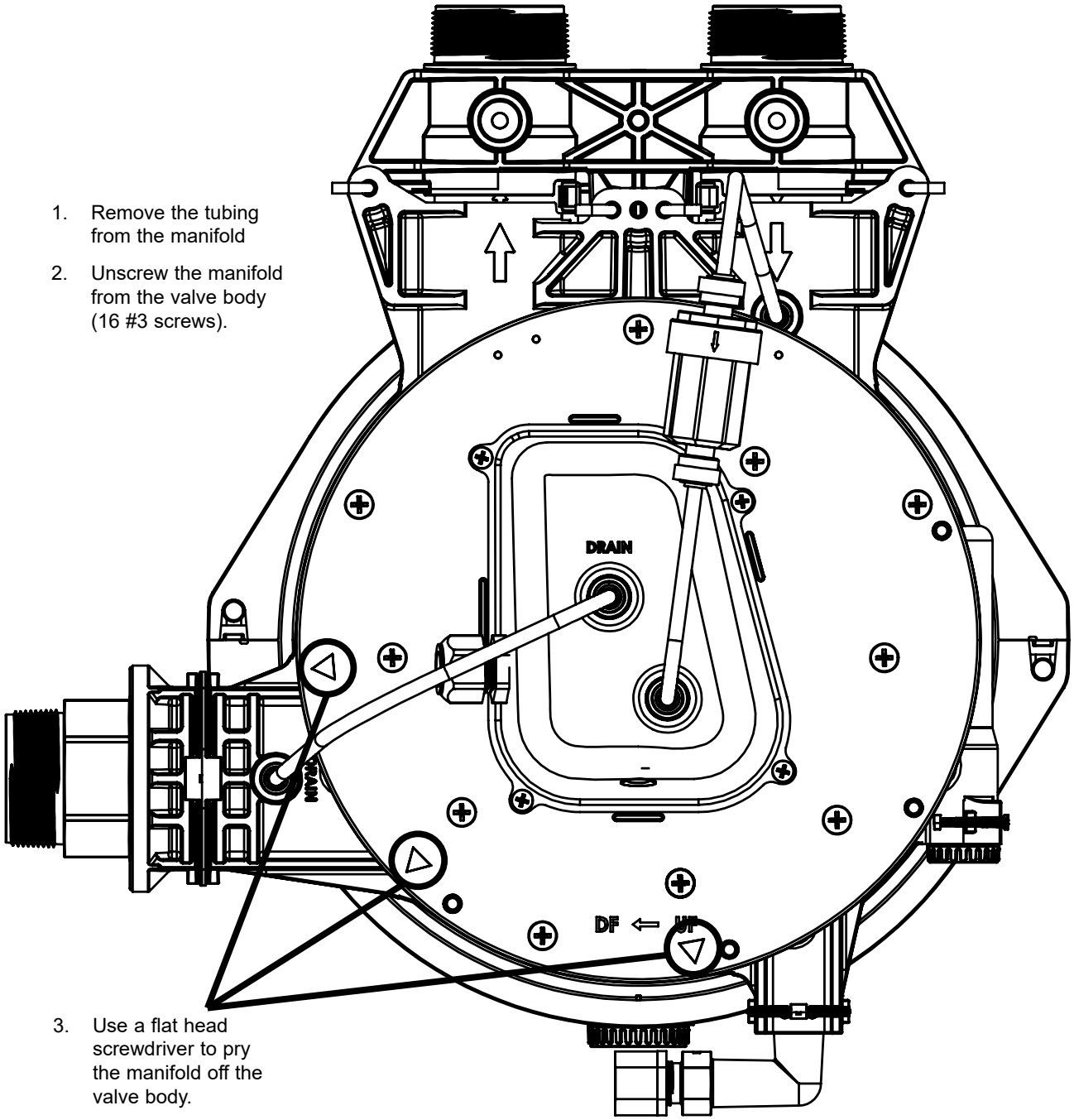
On a multiple-tank softener system, such as a twin-alternating, or progressive flow network, the Alarm Signal Output Relay board must be installed on each Smart Controller that the user wants monitored for errors.

Non-Hardwater Bypass Conversion

NOTE! The Non-Hardwater Bypass is installed at the factory for the Multi-Tank valves and systems.

Figure 50.

1. Remove the tubing from the manifold
2. Unscrew the manifold from the valve body (16 #3 screws).



3. Use a flat head screwdriver to pry the manifold off the valve body.

Figure 51.

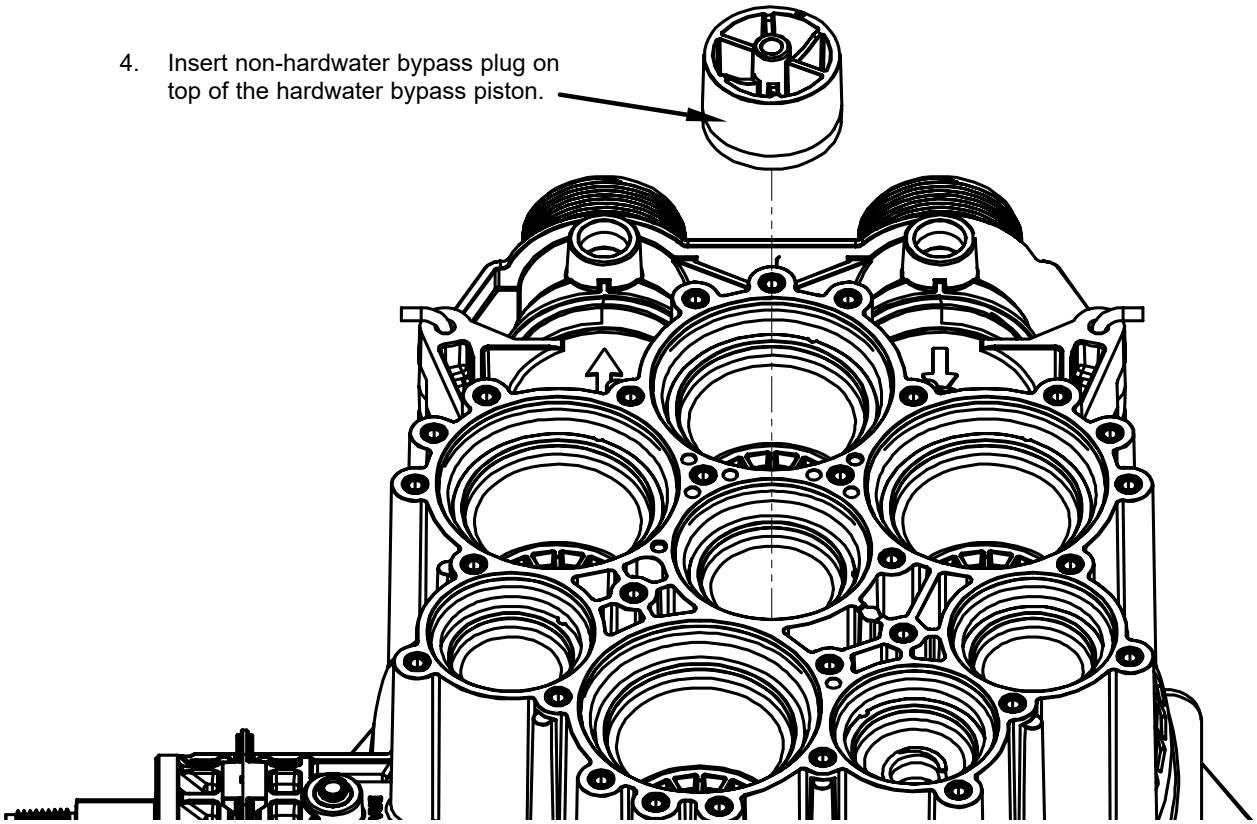
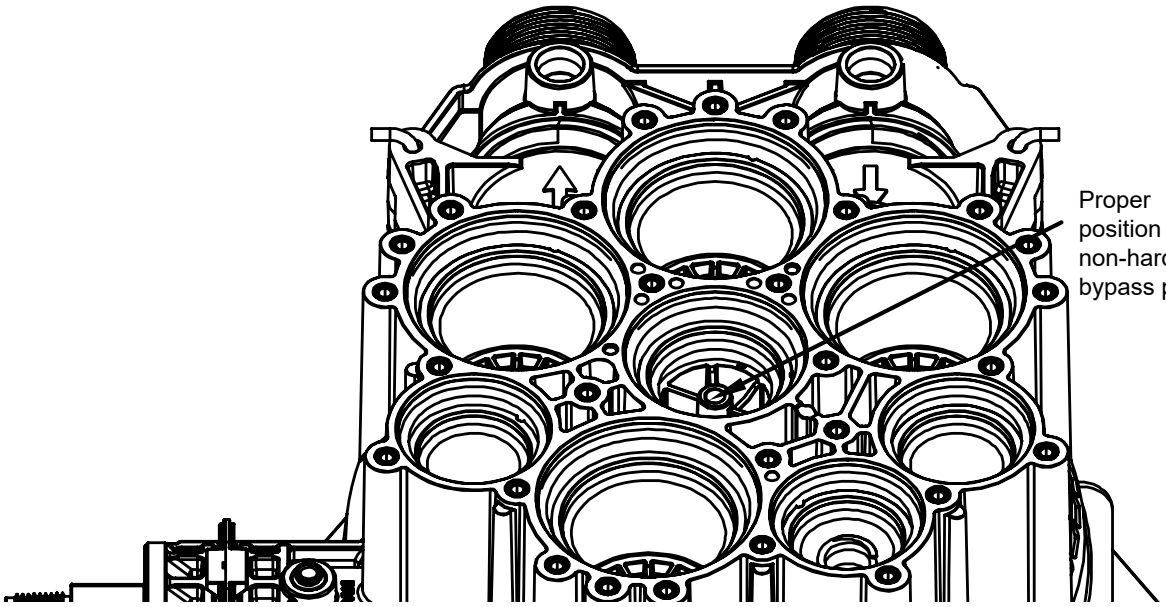


Figure 52.



5. Make sure all the coupling o-rings are fully inserted into the manifold.
6. Screw manifold back onto the valve body. Be careful not to pinch any of the o-rings
7. Screw the cover onto the manifold. (16 screws)
8. Reconnect the tubing (see page 23).

Breakout Cycling

The rubber seals in the CTM control valve need to be cycled before installation startup to eliminate what is known as “breakout friction”, where the O-ring settles into the porous surface of the valve body. This cycling can easily be done while the valve is still in the box, or after the valve is on the tank ready for water pressure at start-up.

1. If you are cycling the valve before installation the best method is using an air compressor with minimum 50 psi able to connect to ¼” tubing. If only water pressure is available, you don’t want to have the whole system pressurized, only the pilot and pistons should have pressure during the cycling.
2. Using a Phillips screwdriver, remove the four screws and the enclosure, then loosen the two screws on the Pilot Drive Motor and set it aside.
3. Connect the ¼” tubing to the inlet fitting of the pilot valve and open the air supply with it regulated to min. of 50 dynamic psi.
4. Advance the position indicator wheel by hand turning it clockwise for at least three complete revolutions.
5. Some popping noises are likely as you advance the indicator wheel as the pistons break loose and then air exhausts from the drain port.
6. Disconnect the tubing, reassemble components, re-tighten the screws, and make preparations to fully pressurize the system.

Pressurize the Media Tank

1. Remove the fillport plug, if equipped on the tank, by a 1/4 turn and lifting up. Open the inlet isolation valve about 1/3 to allow water to fill the media tank. Some flow to the drain is to be expected until the system is fully pressurized.
2. The pilot valve located on top of the CTM valve body should be in home position (position 1) indicated by the 1 in the window facing the front of the control. If it is not in home position, follow the instructions on manual cycling in the GBE Programming for Commercial Softeners and Filters (except HFxN) Manual (01027295).
3. When the water has reached the fillport, replace the plug and allow the system to pressurize. After filling the tank, cycle the pilot valve several times to start purging the air on both sides of the pistons. Once the air has all been purged, only water, and not air will be discharged to the drain.
4. Check the system and piping for leaks. If leaks occur, close the inlet valve to depressurize the system and make the needed repairs before going onto the next step.
5. With the system fully pressurized without leaks the GBE controller can be fully programmed following the instructions provided in the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295). This manual can be obtained from your local dealer, Cport (www.cport.culligan.com) under the Technical Service Tab or the Service Tech App.

To use Table 6 locate the resin volume of the softener model along the left side of the table. Select a 6, 10 or 15 pound/cubic foot of resin salt dosage amount. Continue reading the table to the right until you find a brine system that provides the salt storage characteristics desired. Refer to the key at the bottom of the chart for information concerning the shaded areas of this table.

NOTE! These charts are based on the use coarse Solar Salt which weighs approximately 70 #'s/ CuFt. (most commonly used today)

Table 6. CTM Brinemaker Data - 3/4" Brine Valve Chart

Mineral Tank	Brine Tank Diameter	24		30		39		42	
	Gals/In. W/Out Salt	2		3.1		5.2		6	
	Max Load LBS.	700		1100		2000		2300	
Cubic Ft.	LBS./CuFt	Max Load	# Regens	Max Load	# Regens	Max Load	# Regens	Max Load	# Regens
2	6	Use Only Smaller Brine Tank Sizes							
	10								
	15								
3	6								
	10								
	15	700	15.5	1100	24.4				
4	6								
	10								
	15	700	11.7	1100	18.23				
5	6	700	23.3			2000	66.7	2300	76.7
	10	700	14	1100	22	2000	40	2300	46
	15	700	9.3	1100	14.6	2000	26.7	2300	30.7
7	6	700	16.6			2000	47.6	2300	61.9
	10	700	10	1100	15.7	2000	28.6	2300	32.8
	15	286	2.72	1100	10.5	2000	19	2300	21.9
10	6	700	11.6	1100	18.3	2000	33.3	2300	38.3
	10	312	3.1	1100	11	2000	20	2300	23
	15			520	5	2000	13.3	2300	15.3
15	6	364	4	1100	12.2	2000	22.2	2300	25.5
	10			520	3.4	2000	13.3	2300	15.3
	15					1027	4.5	1378	6.1
20	6	208	2.31	1100	9.1	2000	16.6	2300	19.1
	10			260	1.3	1157	5.7	1508	7.5
	15					637	2.1	988	3.3
25	6			520	3.4	2000	13.3	2300	15.3
	10					897	3.5	1248	4.9
	15							598	1.6
30	6			364	2	1261	7	2300	12.7
	10					637	2.1	988	3.3
	15								

Key for 3/4" Brine Valve Chart and 1" Brine Valve Chart	
Dry Storage	
Wet Storage	
Do Not Use This Size	

Table 7. CTM Brinemaker Data - 1” Brine Valve Chart

Mineral Tank	Brine Tank Diameter	24		30		39		42	
	Gals/In. W/Out Salt	2		3.1		5.2		6	
	Max Load LBS.	700		1100		2000		2300	
Cubic Ft.	LBS./CuFt	Max Load	# Regens	Max Load	# Regens	Max Load	# Regens	Max Load	# Regens
2	6	Use Only Smaller Brine Tank Sizes							
	10								
	15								
3	6								
	10								
	15	700	15.5						
4	6								
	10								
	15	700	10.9						
5	6					2000	66.7		
	10	700	14			2000	40	2300	46
	15	700	9.3	1100	14.6	2000	26.6	2300	30.7
7	6	700	16.7			2000	47.6	2300	54.7
	10	700	10	1100	15.7	2000	28.5	2300	32.8
	15	185	1.7	1100	10.4	2000	19	2300	21.9
10	6	700	11.6			2000	33.3	2300	38.3
	10	211	2.1	1100	11	2000	20	2300	23
	15			361	2.4	2000	13.3	2300	15.3
15	6	263	2.9	1100	12.2	2000	22.2	2300	25.5
	10			361	2.4	2000	13.3	2300	15.3
	15					757	3.3	1065	4.7
20	6			517	4.3	2000	16.7	2300	19.1
	10					887	4.4	1195	5.9
	15					367	1.2	675	2.2
25	6			361	2.4	2000	13.3	2300	15.3
	10					627	2.5	935	3.74
	15								
30	6			205	1.1	991	5.5	2300	12.7
	10					367	1.2	675	2.25
	15								

Key for 3/4” Brine Valve Chart and 1” Brine Valve Chart	
Dry Storage	
Wet Storage	
Do Not Use This Size	

Key for Table 8 on the Next Two Pages

Column Name	Description
lbs/ft³	= Salt Usage
Dos.	= Salt Dosage
Cap.	= Capacity
XXX	= Wet storage (for more information regarding wet storage, see page 48)

Table 8. CTM Refill Minutes/Salt Dosage/Capacity

Resin Volume (ft³)	2.0			3.0			4.0			5.0			7.0		
Refill Insert Size (GPM) [Molded Identifier]	2.0 [180]			2.0 [180]			2.0 [180]			2.0 [180]			2.0 [180]		
Refill (GPM), Standard [Fast Refill]	0.8			0.8			1.25			1.25			1.48		
Resin Tank Diameter (in.)	12.0			14.0			16.0			18.0			21.0		
Refill Minutes	lbs/ ft³	Dos.	Cap.	lbs/ ft³	Dos.	Cap.	lbs/ ft³	Dos.	Cap.	lbs/ ft³	Dos.	Cap.	lbs/ ft³	Dos.	Cap.
5	5.7	11		3.8	11		4.5	18		3.6	18		3.1	22	
6	6.9	14	40,000	4.6	14		5.4	21		4.4	22		3.7	26	
7	8.0	16		5.3	16		6.3	25	80,000	5.1	25		4.3	30	
8	9.2	18		6.1	18	60,000	7.2	29		5.8	29		4.9	34	
9	10.3	21	50,000	6.9	21		8.1	32		6.5	33	100,000	5.5	39	
10	11.5	23		7.6	23		9.0	36		7.3	36		6.1	43	140,000
11	12.6	25		8.4	25		9.9	39	100,000	8.0	40		6.8	47	
12	13.8	28		9.2	28		10.7	43		8.7	44		7.4	52	
13	14.9	30	60,000	9.9	30	75,000	11.6	47		9.4	47		8.0	56	
14				10.7	32		12.5	50		10.2	51		8.6	60	
15				11.5	34		13.4	54		10.9	54	125,000	9.2	65	
16				12.2	37		14.3	57		11.6	58		9.8	69	
17				13.0	39		15.2	61	120,000	12.4	62		10.4	73	175,000
18				13.8	41					13.1	65		11.1	77	
19				14.5	44					13.8	69		11.7	82	
20				15.3	46	90,000				14.5	73		12.3	86	
21										15.3	76	150,000	12.9	90	
22													13.5	95	
23													14.1	99	
24													14.7	103	
25													15.4	108	210,000

Resin Volume (ft3)	10.0			15.0			20.0		
Refill Insert Size (GPM) [Molded Identifier]	2.0 [180]			2.0 [180]			2.0 [180]		
Refill (GPM), Standard [Fast Refill]	1.78			2.00			2.00		
Resin Tank Diameter (in.)	24.0			30.0			36.0		
Refill Minutes	lbs/ft3	Dos.	Cap.	lbs/ft3	Dos.	Cap.	lbs/ft3	Dos.	Cap.
5	2.6	26	-	1.9	29	-	1.5	29	-
6	3.1	31	-	2.3	35	-	1.7	35	-
7	3.6	36	-	2.7	41	-	2.0	41	-
8	4.1	41	-	3.1	46	-	2.3	46	-
9	4.7	47	-	3.5	52	-	2.6	52	-
10	5.2	52	-	3.9	58	-	2.9	58	-
11	5.7	57	-	4.3	64	-	3.2	64	-
12	6.2	62	200,000	4.6	70	-	3.5	70	-
13	6.7	67	-	5.0	76	-	3.8	76	-
14	7.2	72	-	5.4	81	-	9.3	187	-
15	7.8	78	-	5.8	87	-	4.4	87	-
16	8.3	83	-	6.2	93	300,000	4.6	93	-
17	8.8	88	-	6.6	99	-	4.9	99	-
18	9.3	93	-	7.0	105	-	5.2	105	-
19	9.8	98	-	7.4	110	-	5.5	110	-
20	10.3	103	250,000	7.7	116	-	5.8	116	-
21	10.9	109	-	8.1	122	-	6.1	122	400,000
22	11.4	114	-	8.5	128	-	6.4	128	-
23	11.9	119	-	8.9	134	-	6.7	134	-
24	12.4	124	-	9.3	139	-	7.0	139	-
25	12.9	129	-	9.7	145	-	7.3	145	-
26	13.4	134	-	10.1	151	375,000	7.6	151	-
27	14.0	140	-	10.5	157	-	7.8	157	-
28	14.5	145	-	10.8	163	-	8.1	163	-
29	15.0	150	-	11.2	169	-	8.4	169	-
30	15.5	155	300,000	11.6	174	-	8.7	174	-
32	-	-	-	12.4	186	-	9.3	186	-
34	-	-	-	13.2	198	-	9.9	198	500,000
35	-	-	-	13.6	203	-	10.2	203	-
36	-	-	-	13.9	209	-	10.5	209	-
37	-	-	-	14.3	215	-	10.8	215	-
38	-	-	-	14.7	221	-	11.0	221	-
39	-	-	-	15.1	227	450,000	11.3	227	-
40	-	-	-	-	-	-	11.6	232	-
44	-	-	-	-	-	-	12.8	256	-
48	-	-	-	-	-	-	13.9	279	-
52	-	-	-	-	-	-	15.1	302	600,000

Initial Backwash of the System

1. In order to properly purge excessive air in the system. The pilot valve will need to be manually cycled following the instructions in the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295). The inlet isolation valve should not be fully opened until this step is complete and all air from the system has been purged.
2. Remain in the backwash position (position 2) for at least 5 minutes or until the water to the drain runs clear.

NOTE! This step is especially important to follow if you have installed the Aqua-Sensor probe, because it allows the probe to settle to its proper depth in the resin bed.

3. Cycle the pilot valve through all the valve cycles 3-4 times to insure that all the air is evacuated from the control and pilot spool. The outlet isolation valve must remain closed and the bypass valve must remain open until the pilot valve is back in the home position (position 1).

Installation Wrap Up

Table 1 on page 6, provides the expected flow rates to the drain during the various steps of the regeneration process.

Creating Brine

Once salt has been added to the brine tank the control valve must be manually cycled to the brine refill cycle to create the required amount of brine for the unit's first regeneration. Allow the valve to refill for the cycle #4 programmed time.

Fill the Salt Storage Container

Before filling the brine tank with salt, add water until it is visible at the salt plate level. Afterwards, refer to Table 8 on page 46 to find the regeneration capacity based on the chosen salt dosage.

The following terms will be helpful to know:

- Max. Salt Fill, lbs - This value is the maximum number of pounds of salt that can be put into the brine tank. This may be less than the total capacity depending on whether there is wet or dry storage (see definitions below).
- No. of Regens - This is the number of softener systems regenerations that can be obtained from the maximum salt fill.
- Wet or Dry - This column will note whether wet or dry storage is required
- Dry Storage - When the salt storage container is filled to capacity and the proper amount of water is returned to the salt storage container during brine refill without shutting off the brine safety float valve. (See Figure 53).
- Wet Storage - When the salt level has to remain lower than the water level after refill to allow for the volume of water required for the appropriate salt dosage. (See Figure 54).

Figure 53. Dry storage.

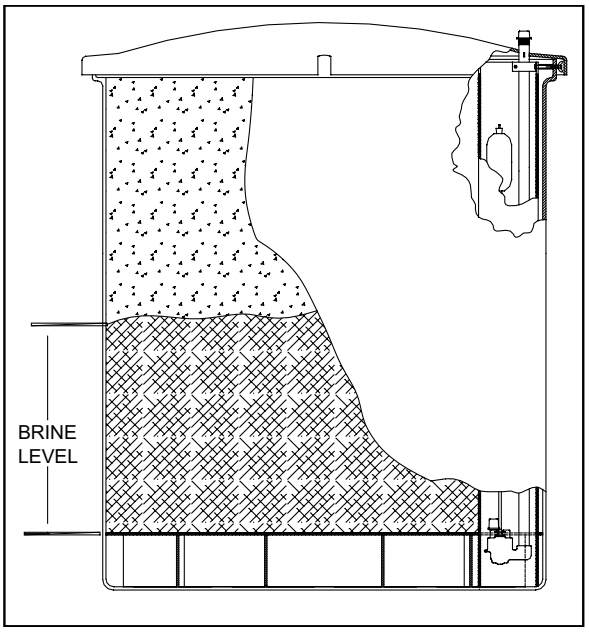
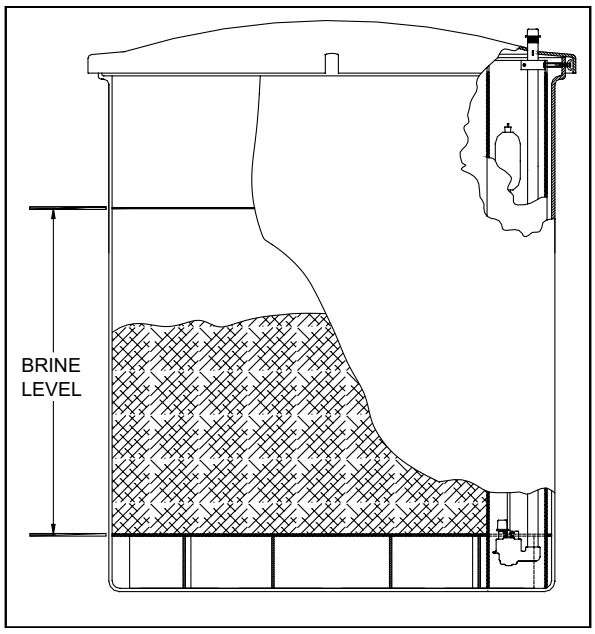


Figure 54. Wet storage.



Sanitize the System

A water softener in daily use on a potable water supply generally requires no special attention other than keeping the salt tank filled. Occasionally, however, a unit may require sanitization under one of the following conditions:

- At start-up time.
- After standing idle for a week or more.
- On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria).

NOTE! If the water supply contains iron, regenerate the softener before sanitizing to remove iron from the resin.

CAUTION!
Hazard from toxic fumes! Chlorine bleach and common iron control chemicals may generate toxic fumes when mixed. Do not use this procedure if the softener salt contains iron control additives.

1. Remove the brine tank cover.
2. Pour directly into the brine chamber 2/3 of cup to one-cup of common household bleach (5.25% sodium hypochlorite) for each cubic foot of resin in the tank.
3. Manually start a regeneration following the instructions provided in the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295). This manual can be obtained from your local dealer, Cport (www.cport.culligan.com) under the Technical Service Tab or the Service Tech App.

NOTE! If tastes and odors return frequently, even after sanitization, a continuous chlorination system may be needed. Send a water sample to a qualified laboratory for bacterial analysis.

Before Leaving the Installation Site

Once you have completed the installation the system is ready to be placed in service.
Prior to placing the system in service review the following checklist to be sure the system is properly installed.

Check List

√ The media tank(s) has been properly loaded with gravel and media.
√ The drain line has been properly installed.
√ All option kits have been properly installed.
√ The system has been properly piped and tubed.
√ Each media tank has been backwashed manually.
√ The GBE controller(s) have been correctly and completely wired, including differential pressure switches if equipped.
√ All GBE controllers have been properly programmed and are active (power on).
√ All manual isolation valves are open and system by-pass valves are closed.
√ Clean up the unit and the installation site, removing any soldering or pipe threading residues from the equipment with a damp towel.
√ Explain the operation of the system to the customer.
√ Advise the customer to check and replenish the salt supply regularly.

Care and Cleaning

Protect the operation and appearance of the water conditioner by following these precautions:

1. Do not place heavy objects on top of the conditioner cover.
2. Use only mild soap and warm water to clean the exterior of the unit. Never use harsh abrasive cleaners or compounds which contain acid or bleach. Culligan recommends Simple Green or an equivalent cleaner.
3. Protect the conditioner and drain line from freezing temperatures.

Preventative Maintenance

Suggested Preventive Maintenance Inspection Schedule

The Culligan CTM commercial water softener has been designed to provide a good, consistent service life. Routinely inspecting the system may help avoid potentially costly breakdowns related to circumstances outside of the control of the dealer and/or user.

Table 9.

Component	Suggested Inspection Frequency	Reason for Maintenance
Entire System	At Startup, after infrequent use (idle for one week or more) or every 3–6 months if on a private water supply.	On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria) may indicate a need for the system to be sanitized.
Drain Line Flow Control	Every 12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Control Valve	Every 6–12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Softening Media	Every 2–3 years	Chlorinated water supplies can break-down/destroy resin material. Resin material may also perform poorly if subjected to other materials (sediment, iron, alum, etc) found in some water supplies (but not necessarily all).
Pilot Strainer	Every 6-12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Softening Cartridge, if equipped	Every 6-12 months or every time service is performed on the system.	Exhausted cartridge. Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.

Serial Numbers

The unit has a serial number label located on the side of the pilot enclosure which is on the top of the valve. Do not remove or destroy these serial number labels. The information contained in the serial number is used for completing information on the IQR Form.

This manual is based on information available at the time it was finalized, approved, and published.
Continuing design refinement could cause changes that may not be included in this publication.

NOTE! Do not remove or destroy the serial number; it is referenced on request for warranty repair or replacement.

Familiarize yourself with the replacement procedures and component parts thoroughly before attempting any repair.

Analyze the System

Analyzing the problem involves three basic steps:

1. Check the system in all cycle positions.
2. Compare the data to normal operating data.
3. Determine which component may cause the problem (troubleshooting).
4. If steps 1-3 did not reveal the problem, initiate a regeneration cycle and manually cycle the valve to backwash (#2 position). Allow the unit to complete the backwash cycle and observe how the system reacts.

Although it may be possible to solve a specific problem simply by changing a component, analyzing the entire system can reveal additional problems which would otherwise require extra service calls. Changing parts is not the same as service.

Check the System

The following tools are needed to collect data:

- Hardness, iron and chlorine test kits
- Thermometer
- Pressure gauge, 0-120 psi
- Vacuum gauge, 0-30” Hg
- 5-gallon bucket and watch
- Calculator

The customer can provide most data. By collecting data prior to a service call, a first guess about the cause of the problem can be made and the need for any special parts can be determined. If the problem is as simple as lack of salt in the brine tank, a service call may not be needed at all. Data can assist the troubleshooting process; see the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) on how to access the mini data report.

NOTE! Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Procedure for Depressurizing the CTM System for Service

Complete shut down procedure is as follows:

1. Make certain that the lines you shut off are for the system you are performing service on.
   a. Open by-pass valve if one is available.
   b. Close the inlet isolation valve.
   c. Close the outlet isolation valve.
   d. Close the separate source isolation valve if one is available.
   e. Any external source of pressure to the pilot valve.
2. Manually cycle the pilot valve to backwash position #2 (Main Menu > DIAGNOSTICS > MANUAL CYCLING). See the GBE Programming for Commercial Softeners and Filters (except HFxN) Manual (01027295) for more information.
3. Allow water to flow to the drain until this system is no longer under pressure.
4. Disconnect electrical connection to the controller.
5. Proceed with servicing the CTM System.

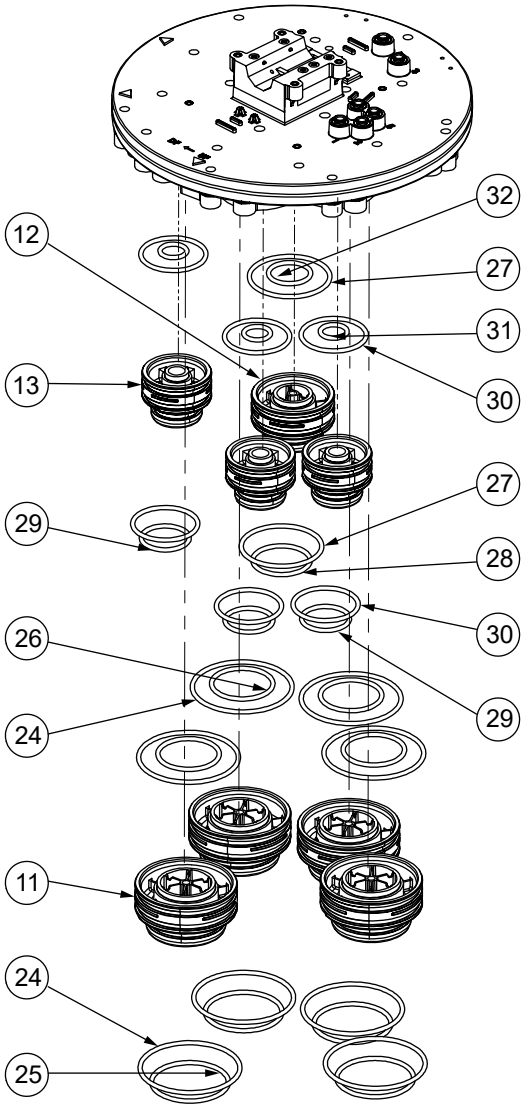
We suggest the use of “a mild cleaning solvent”. We suggest the following brands or their equivalents:

- ☐ Cleaning Solvent: Simple Green --- water soluble for removing corrosion and dirt.
- ☐ Dow Corning #111, silicone grease, must be used in order to maintain the unit’s NSF certifications.

CTM Valve O-Ring Kit Description

The Valve O-Ring Kit 01029578 contains all the sealing o-rings needed for rebuilding a valve. The different o-ring sizes and quantities are divided into separate bags within the kit to help with proper placement in the valve. Use Figure 55 and Figure 56 to identify the o-rings by part number and placement. These o-rings are not sold separately from the kit.

Figure 55.



#11: 3 ⅜” Coupler (Qty. 4)

#12: 2 ¾” Coupler (Qty. 1)

#13: 2¼” Coupler (Qty. 3)

#24: 01014031 (Qty. 8)

#25: 01028130 (Qty. 4)

#26: 01028129 (Qty. 4)

#27: 01028131 (Qty. 2)

#28: 01028128 (Qty. 1)

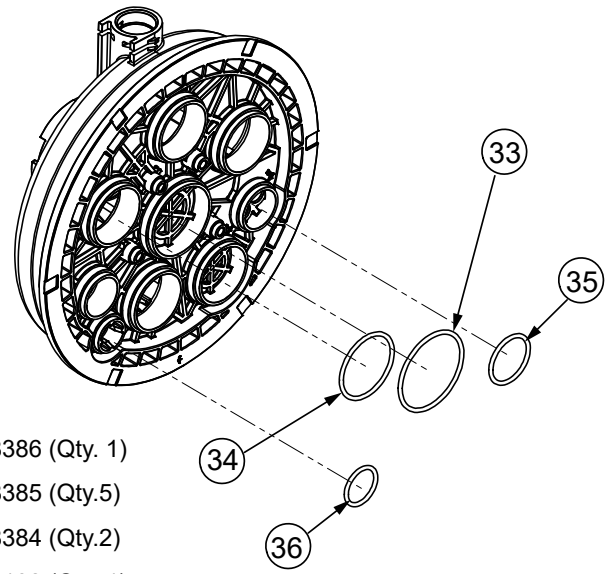
#29: 01027288 (Qty. 3)

#30: 01023560 (Qty. 6)

#31: 01028127 (Qty. 3)

#32: 01028182 (Qty.1)

Figure 56.



#33: 01028386 (Qty. 1)

#34: 01028385 (Qty.5)

#35: 01028384 (Qty.2)

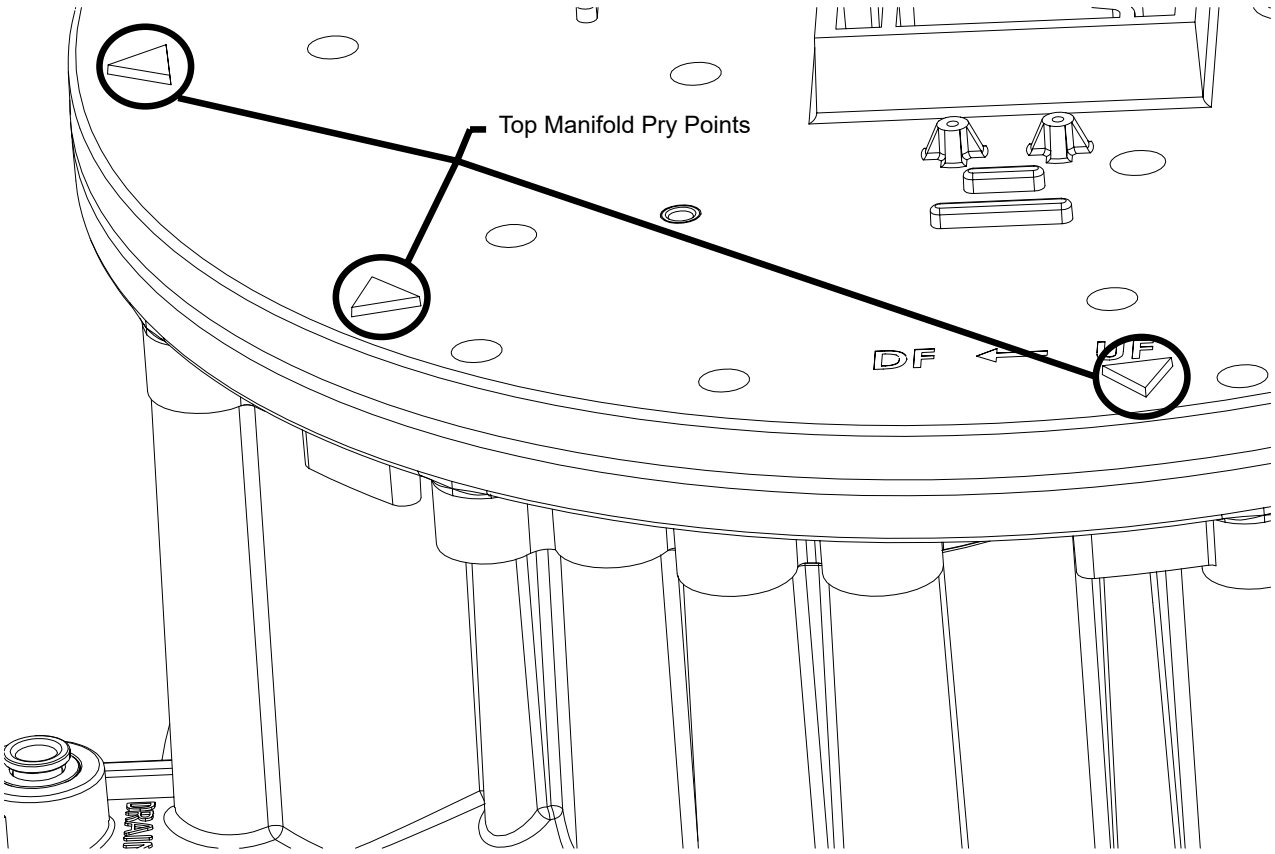
#36: 01028182 (Qty. 1)

CTM Piston Rebuild (Refer to page 84 for Kit Options)

Valve Removal and Disassembly

1. Having bypassed and depressurized (page 51) the system, disconnect from the valve; the pressure relief valve (PRV), vacuum breaker, drain adapter and plumbing adapter.
2. Separate the plumbing at the unions, if necessary to remove the plumbing adapter from the valve.
3. Disconnect the tubing from the pilot valve at the inlet and drain ports on the valve.
4. Disconnect the wiring and remove the GBE controller by removing the two mounting screws, if using a front or side mount bracket.
5. Remove the tank adapter clamp by loosening the bolts on both sides and lift the valve body from the tank using the pry points (see Figure 71 on page 61)
6. Remove 16 #3 screws from the top manifold, including the two under the enclosure, then remove the top manifold by prying at the pry points. (see Figure 57)

Figure 57.



Upper Manifold Disassembly

Figure 58.

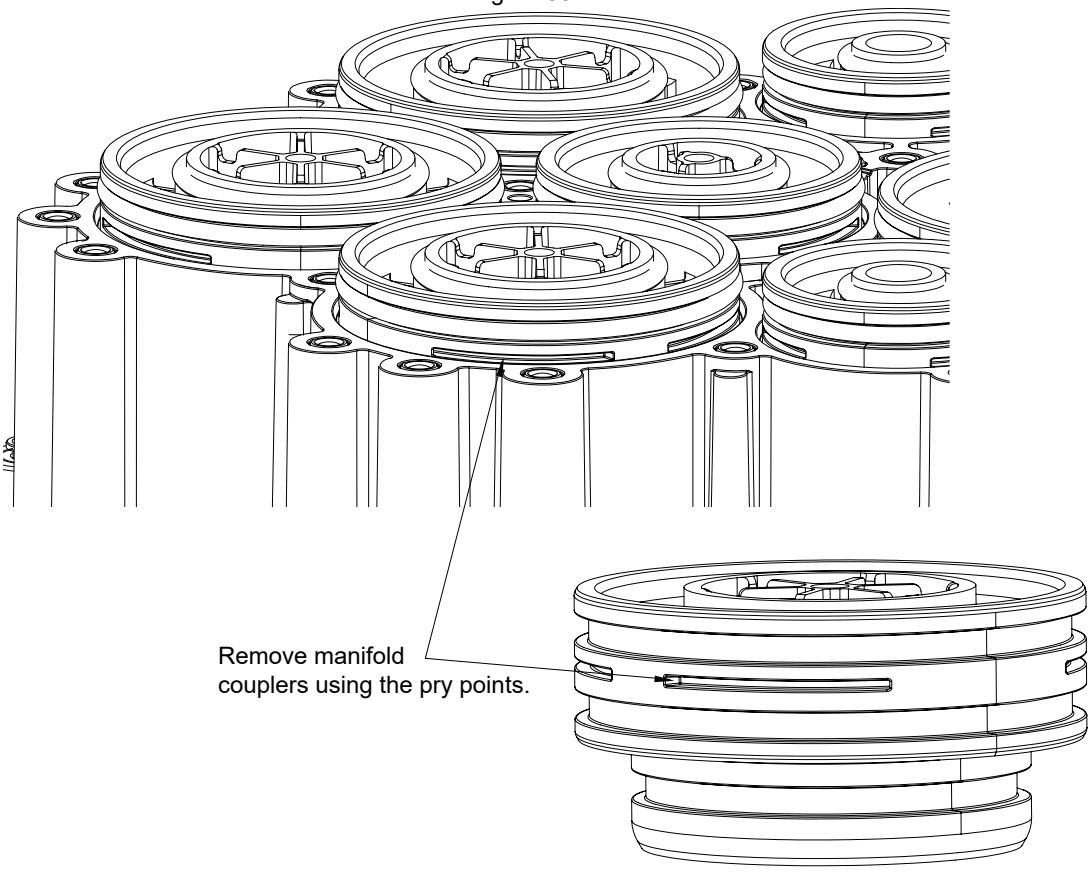
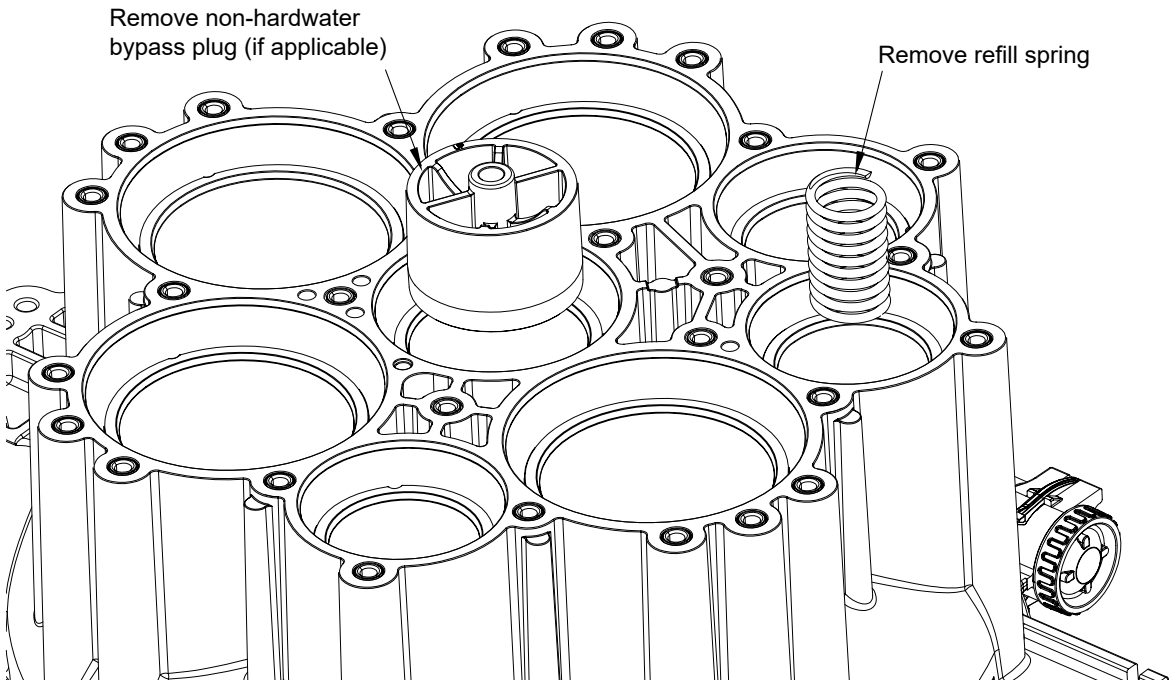


Figure 59.



Removing the Pistons

Push all the pistons into the fully seated position.

Figure 60.

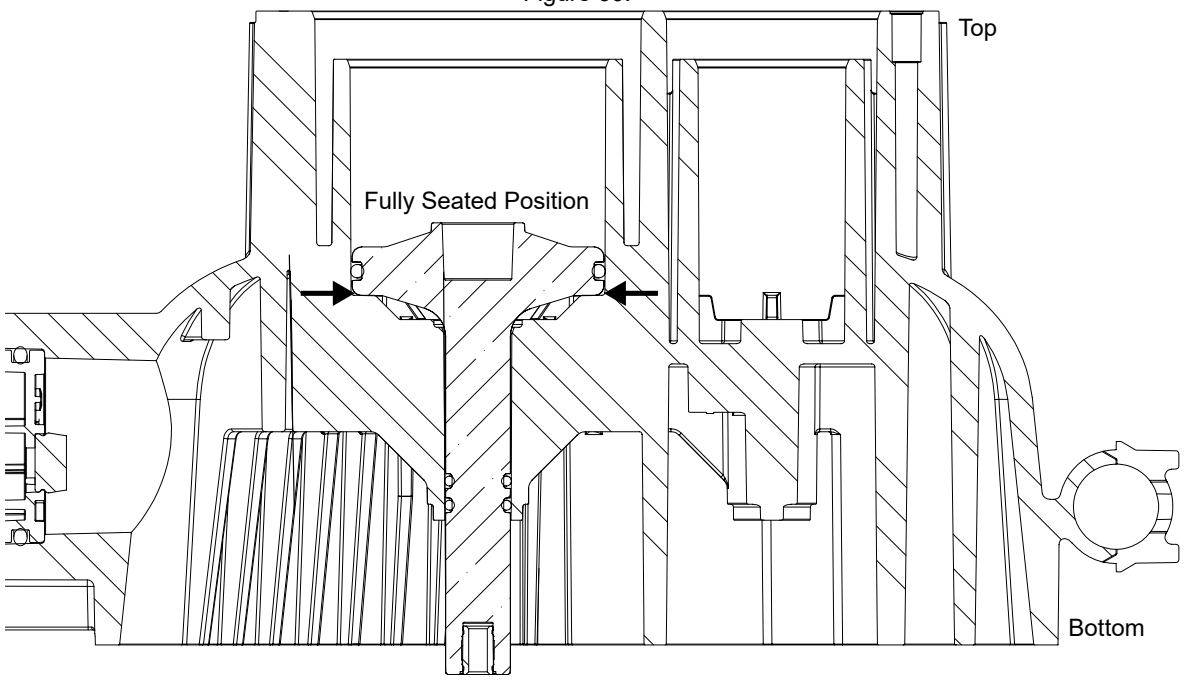


Figure 61.

Lay the valve body on its side with the drain port facing up to remove the pistons.

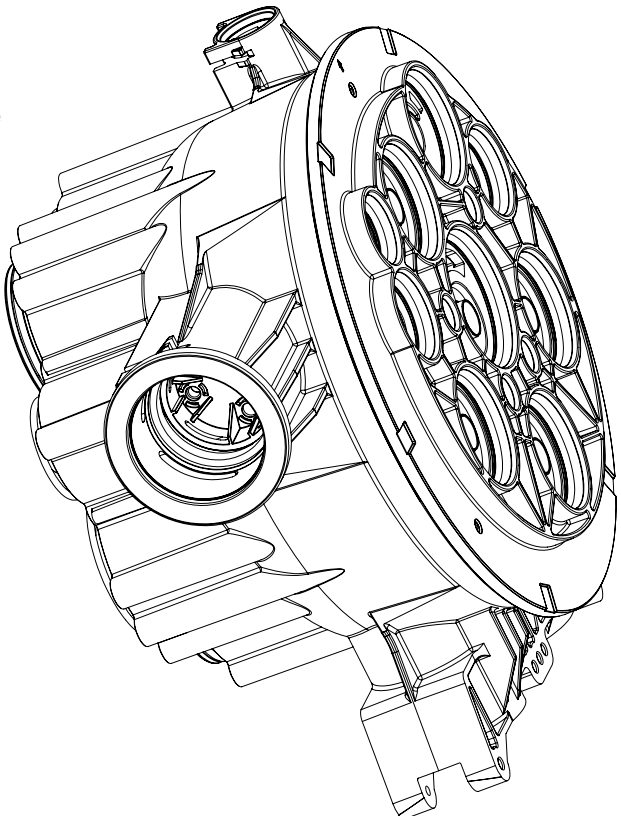
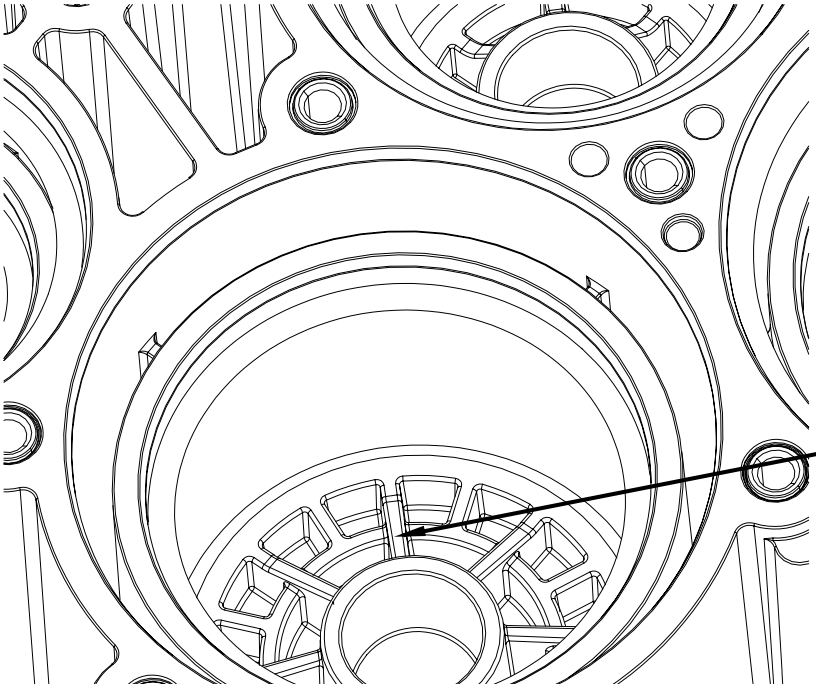


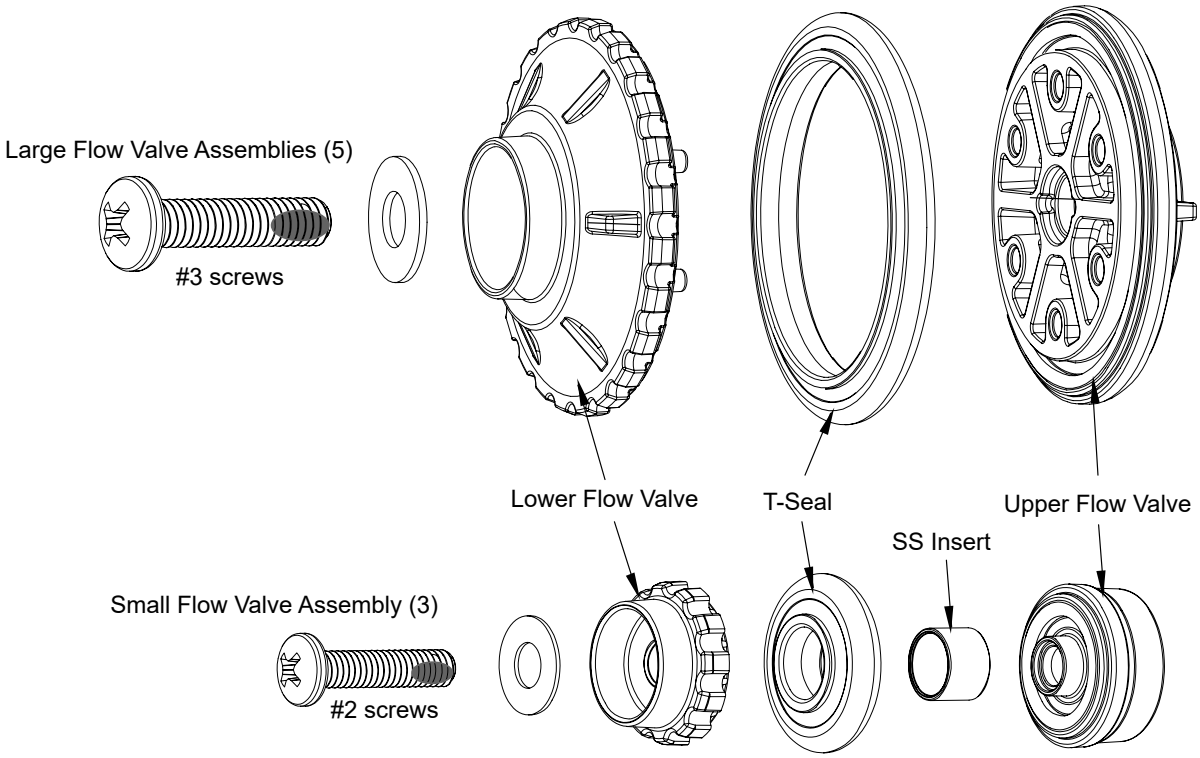
Figure 62.



Top View

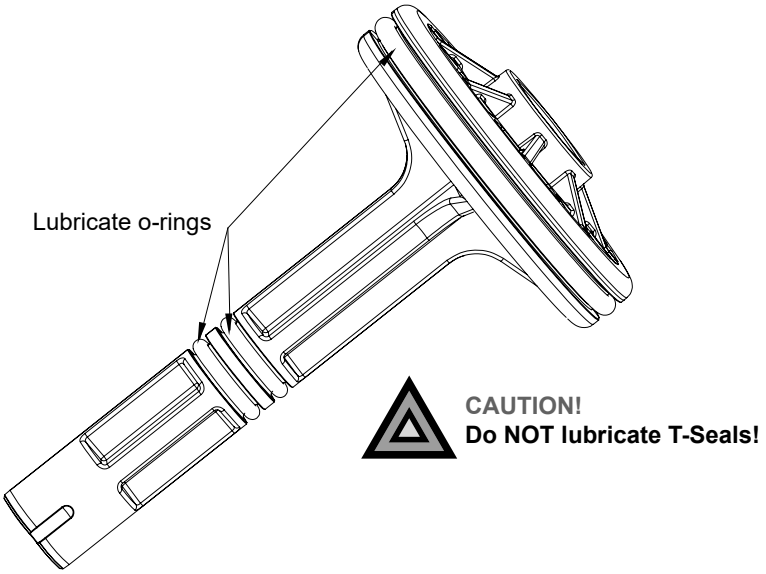
Using pliers grab the rib on the top of the piston, while removing the screws from the bottom of the piston and removing the flow valve assemblies

Figure 63.



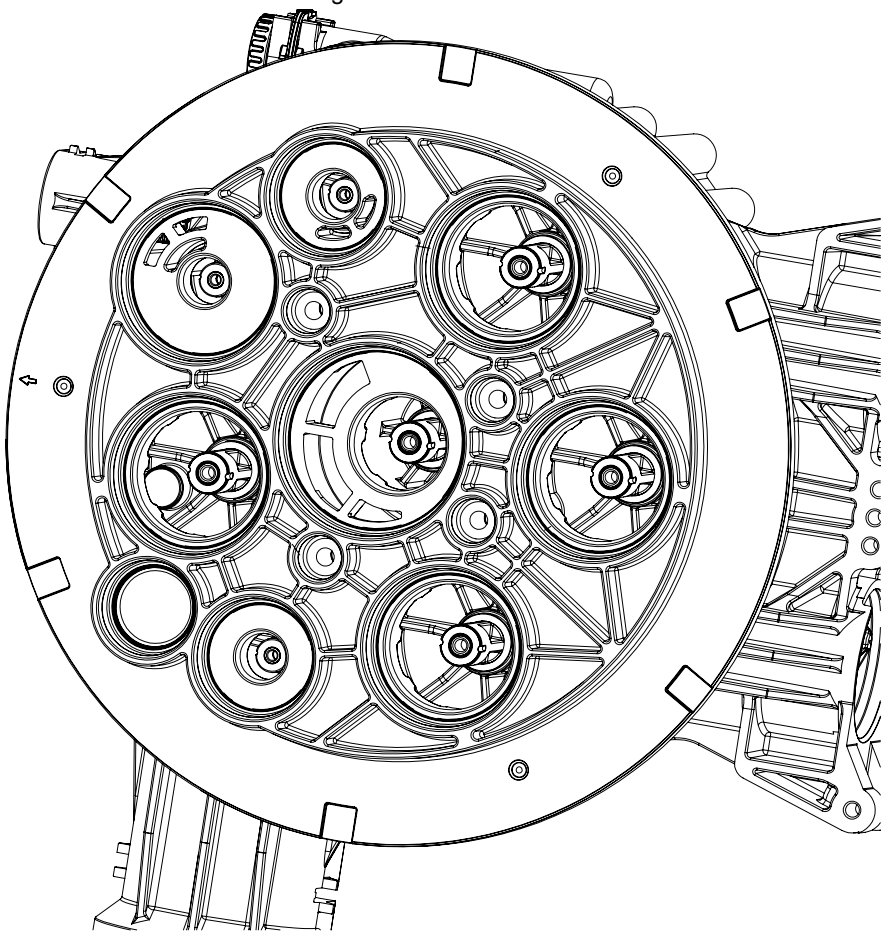
Push all the pistons from the bottom and remove from the top side of the valve body.

Figure 64.



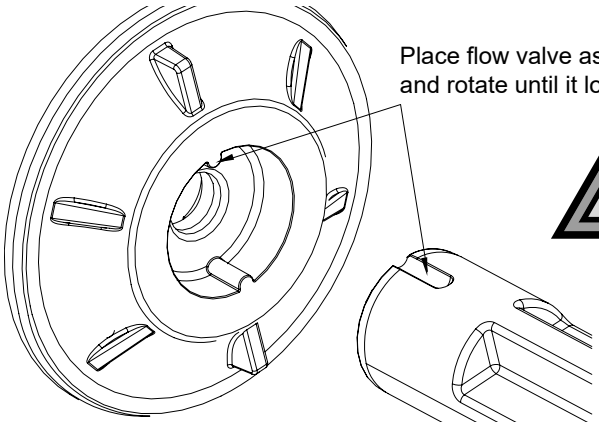
Load all pistons (8) in from the top and push to lower into the fully seated position. Flip the valve body onto its top (flow valves up)

Figure 65.



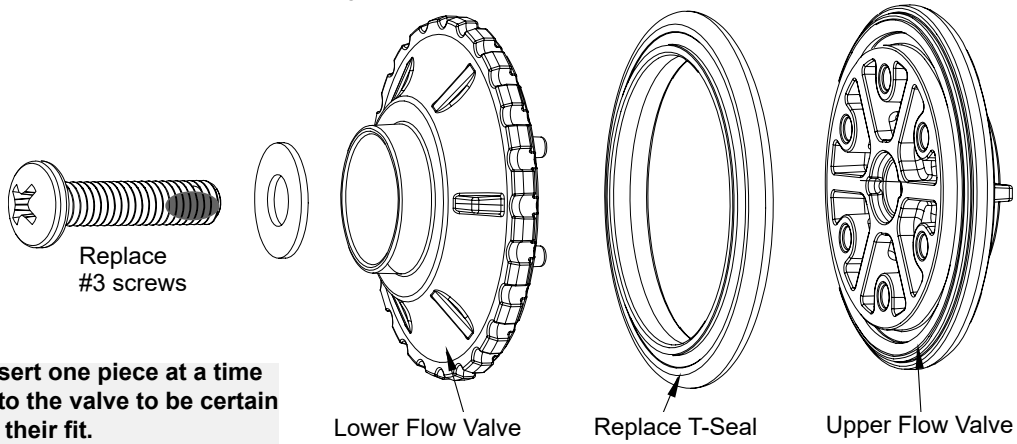
T-Seal Replacement and Assembly

Figure 66. For All 5 Large Pistons



CAUTION!
Do NOT lubricate T-Seals! Instead, lightly lubricate the t-seal valve bore.

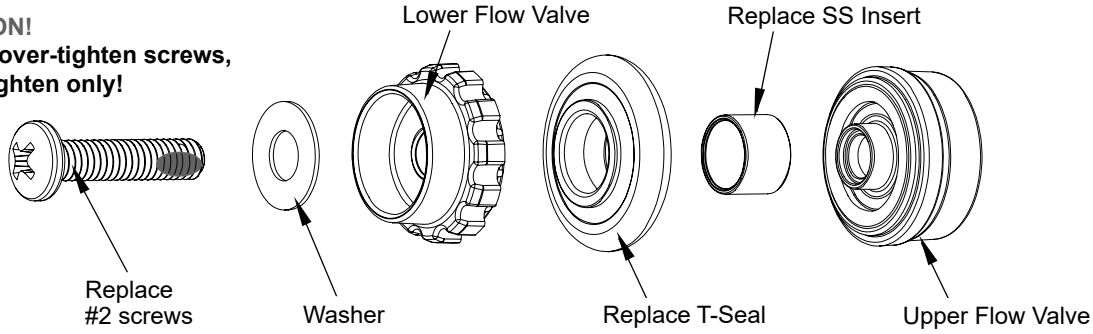
Figure 67. For All 3 Small Pistons



NOTE! **Insert one piece at a time into the valve to be certain of their fit.**

Figure 68. For All 8 Pistons

CAUTION!
Do not over-tighten screws, hand tighten only!



1. Push all the valves down into the fully seated position. Use the screws provided in the replacement kit. Do not reuse old screws. Start each screw then flip the core onto it's side, hold back pressure on the top of the valve. "Hand tighten" the screws.
2. Move all valves into the upper position.

Reassemble Manifold

Ensure all couplers are inserted in the top manifold

CAUTION!
Make sure, this o-ring is in place and not on the top manifold for all couplers (8).

Figure 69.

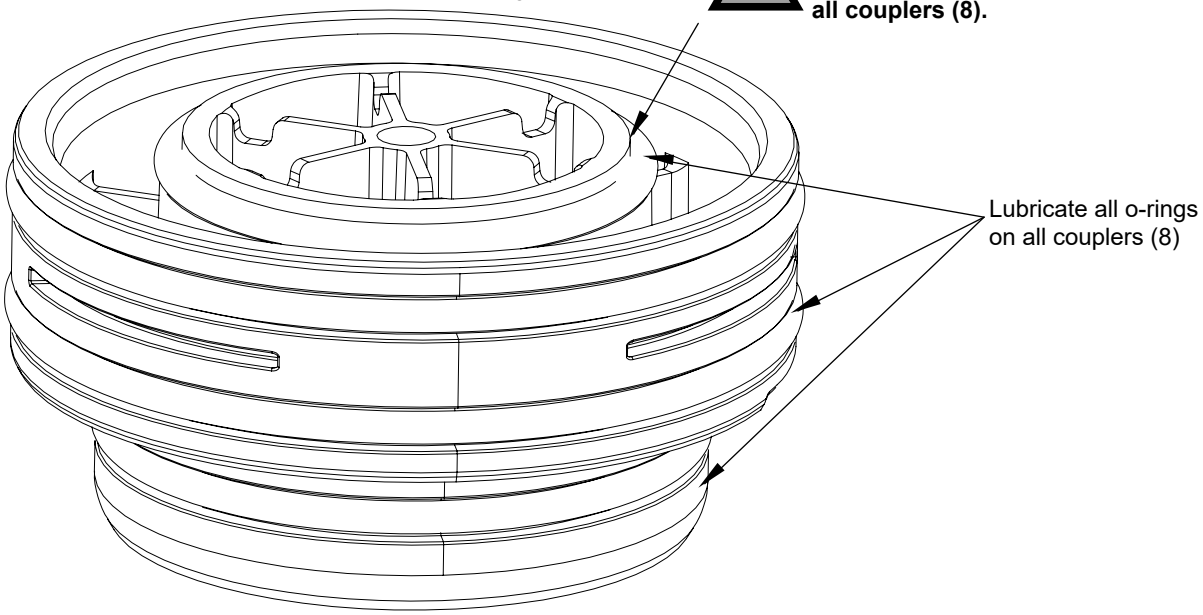
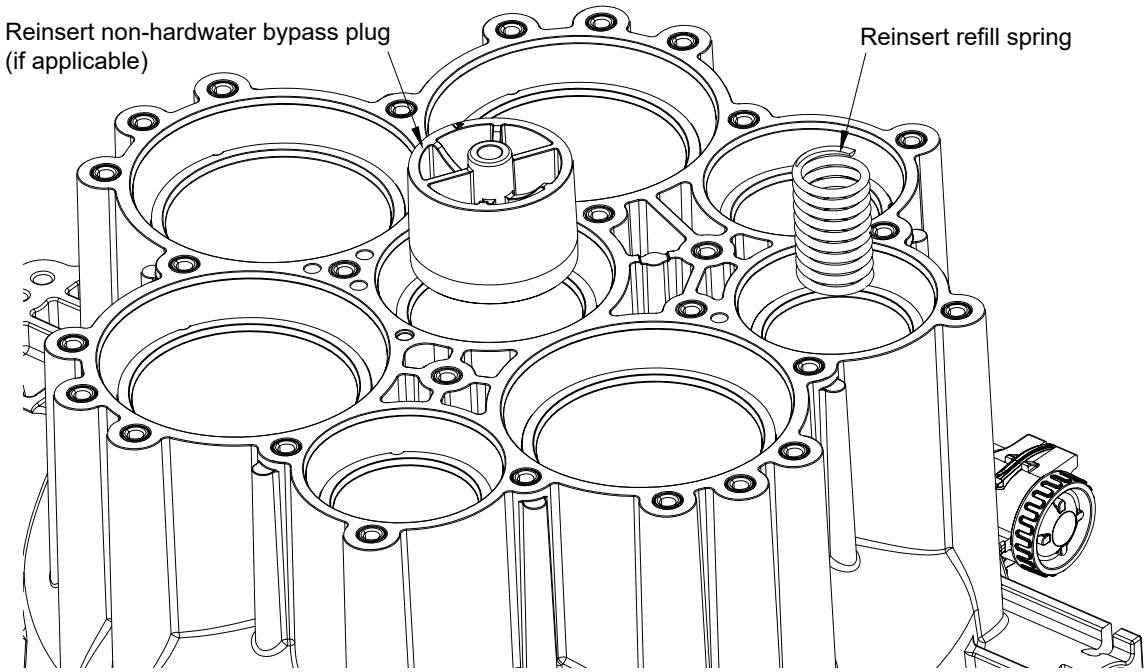


Figure 70.



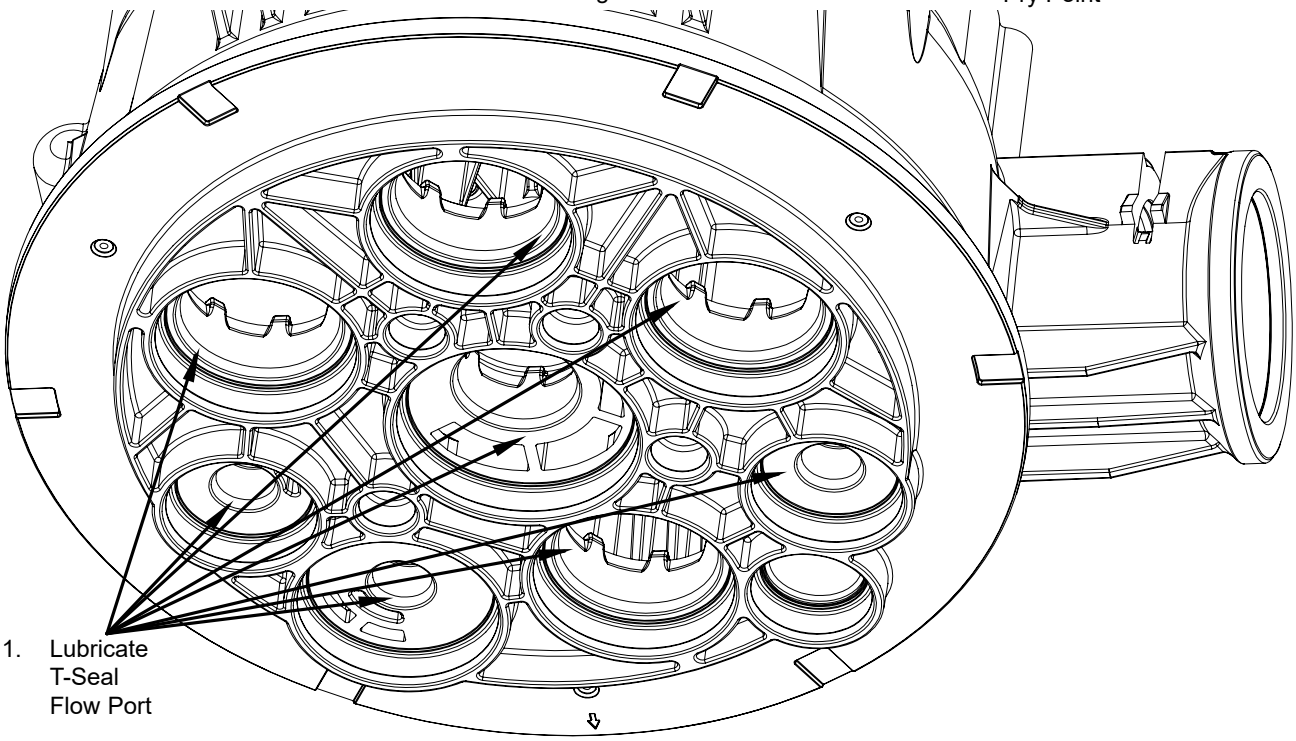
Secure top manifold assembly to valve body with 16 #3 screws

NOTE! Screws will need to compress the top manifold to valve body with resistance from refill spring.

CAUTION!
Do not overtighten the screws. It will not prevent a leak, but it could likely loosen the embedded insert.

Reassemble Valve

Figure 71.



1. Lubricate T-Seal Flow Port

CAUTION!

Do not rock the valve core onto the tank adapter, just place it straight down. Rocking may cause damage to the o-rings.

Figure 72.

NOTE! Remove excess water from the tank adapter to prevent o-ring(s) from floating during attachment with the valve body.

2. Be certain o-rings are all in place on the tank adapter before mating with the valve body.

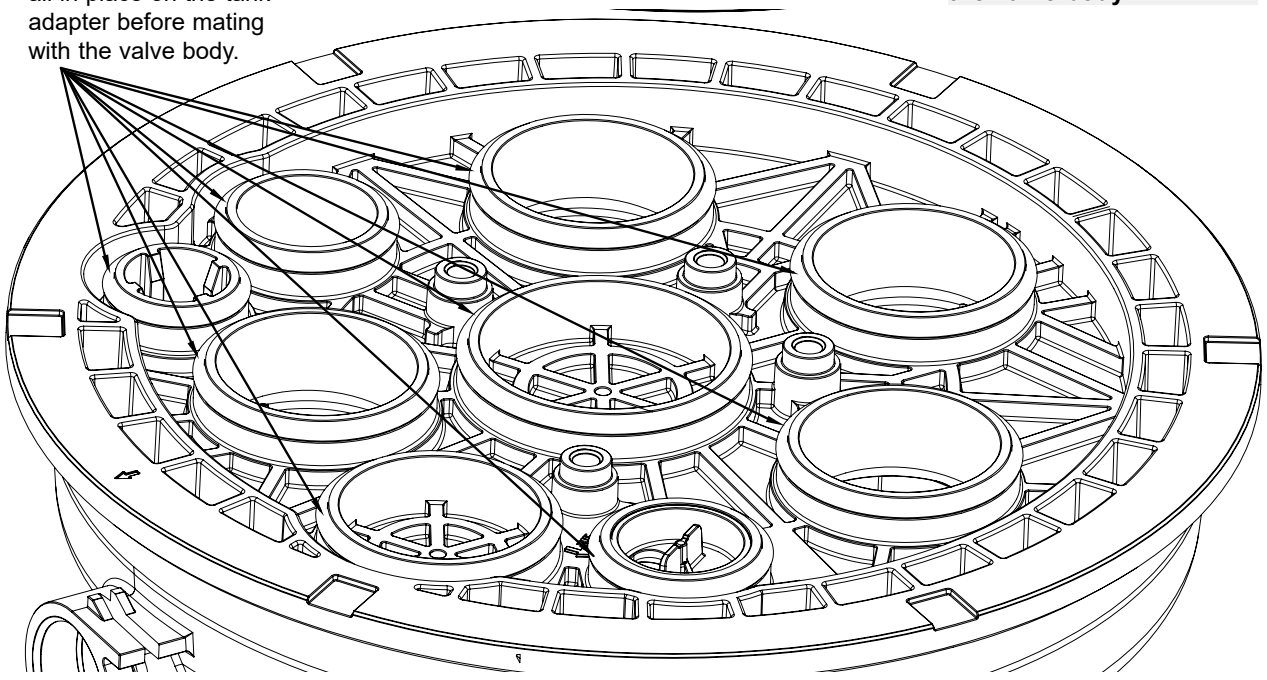
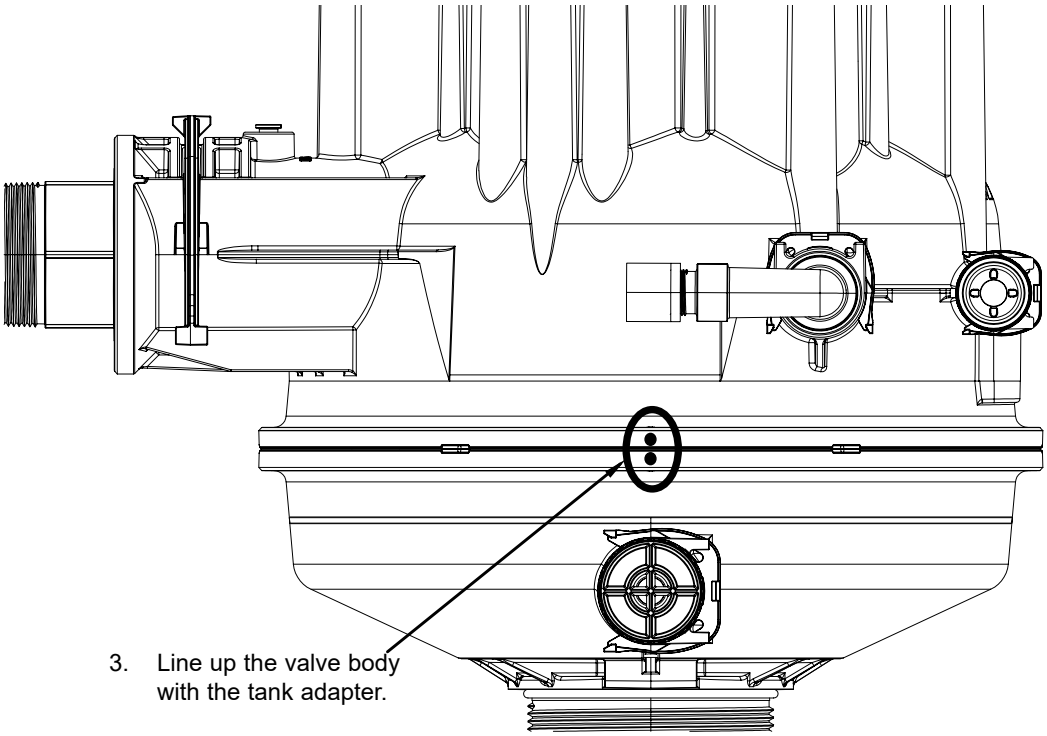


Figure 73.



3. Line up the valve body with the tank adapter.

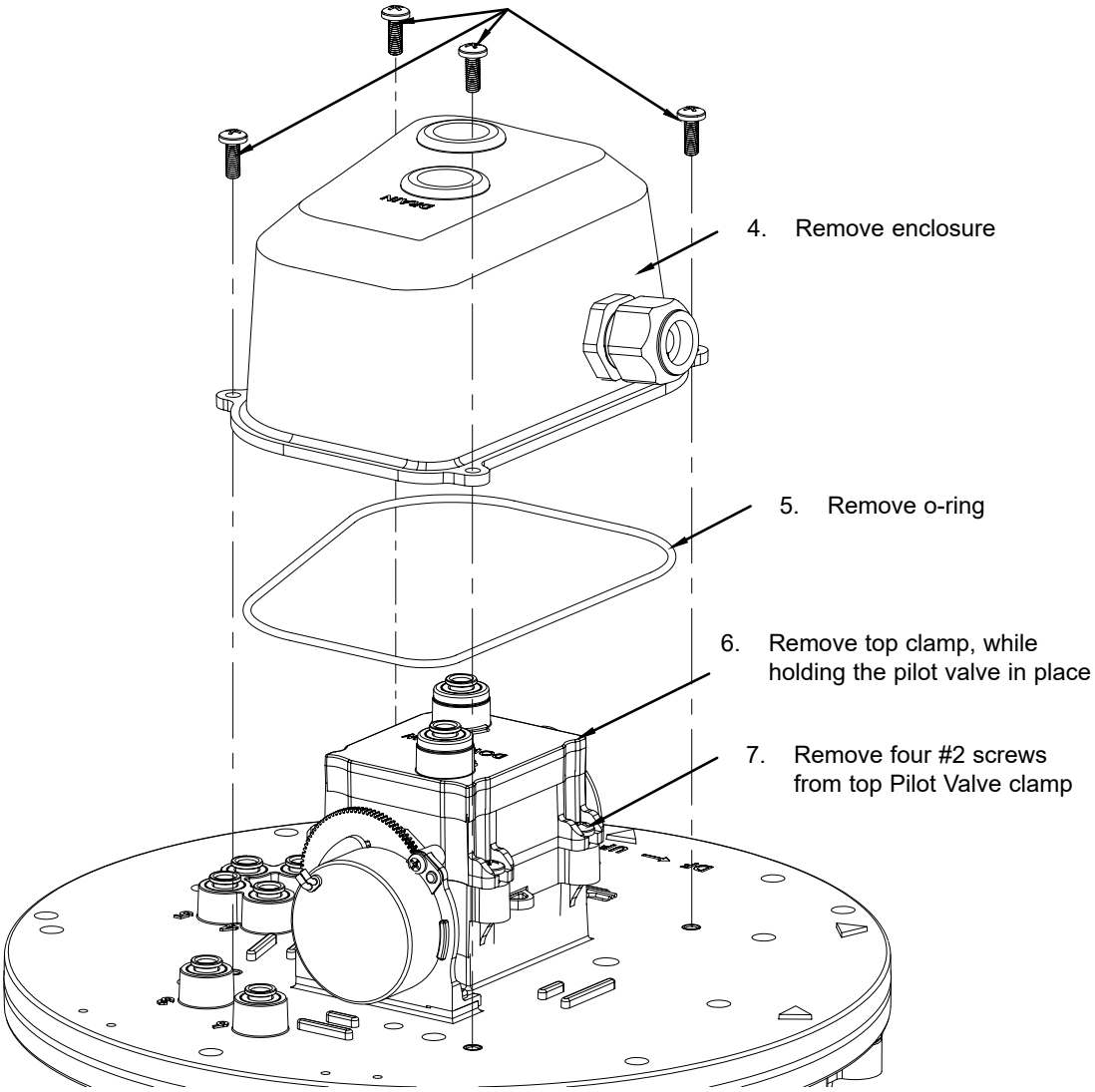
4. Replace Clamp.
5. Connect tubing (see page 23).
6. Reconnect to the valve; the pressure relief valve (PRV), vacuum breaker, drain adapter and plumbing adapter.
7. Reattach the plumbing at the unions, if applicable.
8. Attach plumbing adapter and drain adapter and unions, if applicable.
9. Re-pressurize unit (page 43). Check for leaks around the Top Manifold, Clamp and to the drain.
10. Reassemble the GBE Controller and wiring after checking the valve body for leaks. Pilot Valve Rebuild (Kit P/N 01029583)

Pilot Valve Rebuild (Kit P/N 01029583)

Pilot Valve Disassembly

1. Bypass and depressurize unit (page 43)
2. Disconnect electrical connections and tubing

Figure 74.



8. Remove pilot valve

Motor Replacement (P/N 01029558, if only replacing the motor assembly)

Figure 75.

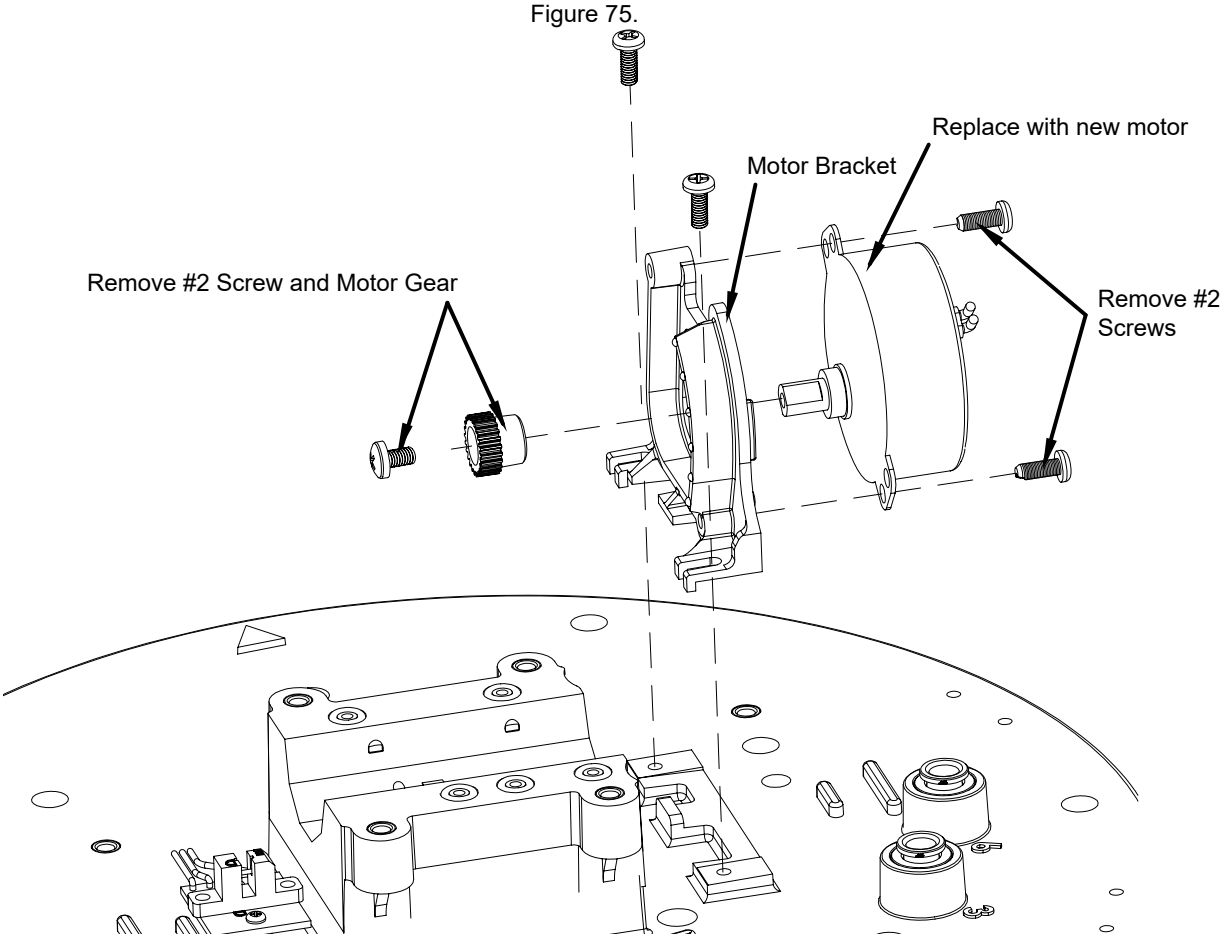
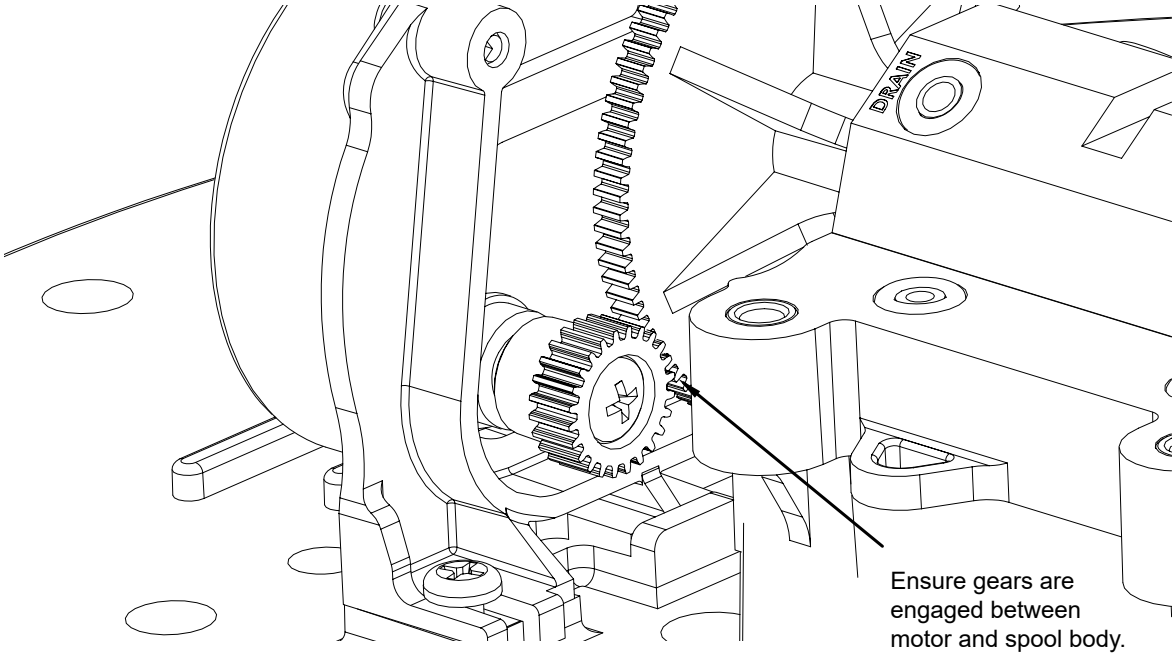


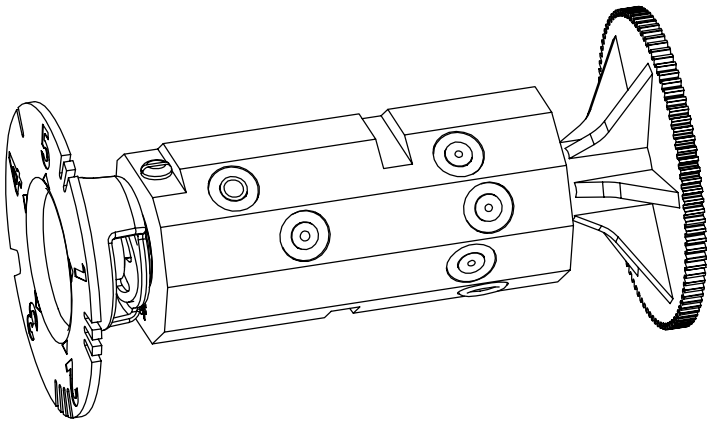
Figure 76.



Pilot Spool Replacement

Figure 77.

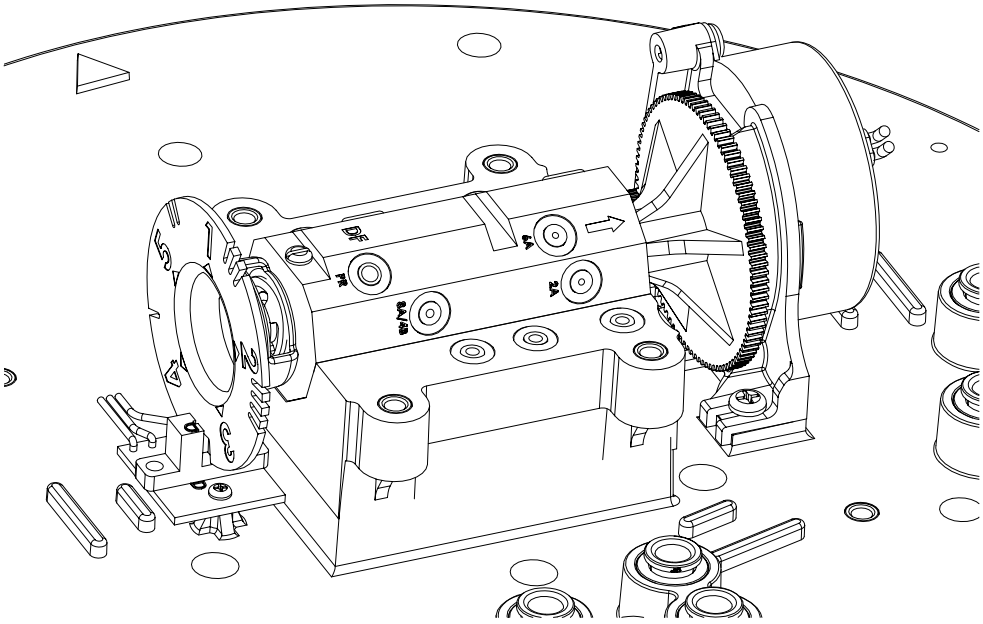
1. Replace pilot valve spool (P/N 01029555).



2. Check o-rings to make sure they stay in place (or replace all 13 o-rings)

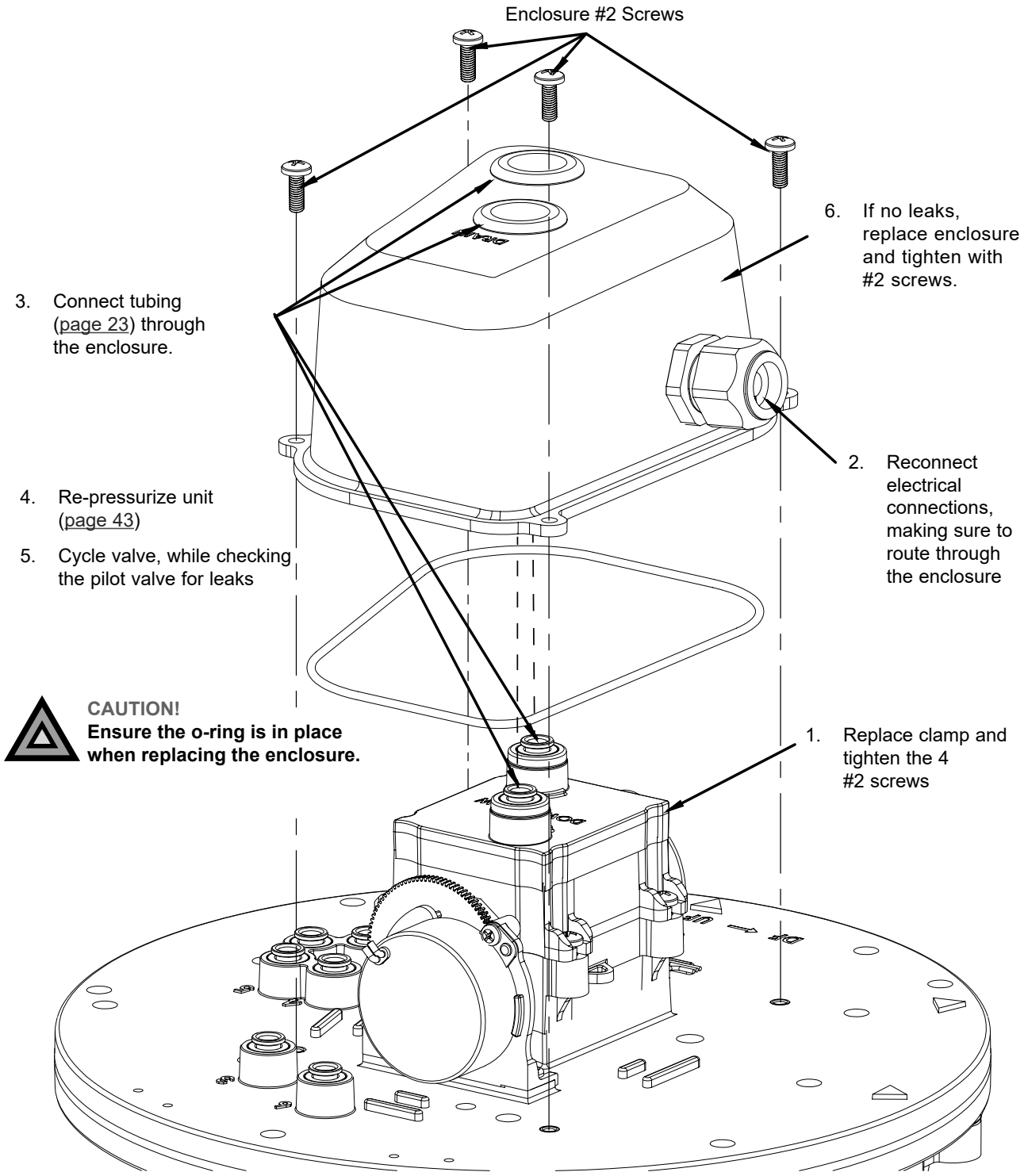
NOTE! Make sure to that the position indicator dial is centered between the position sensor.

Figure 78.



Pilot Valve Reassembly

Figure 79.



Drain Line Flow Control—Service

Located on the drain connection of the valve, the purpose of the drain line flow controller is to regulate the up flow backwash required to expand and agitate the resin in the softener. The softener will allow maximum expansion of the resin, while preventing any loss to the drain.

The flow control principle is simple and trouble free. The specified rate of flow will be constant regardless of inlet pressure variations.

Occasionally, the Drain Line Flow Controller may become plugged with scale, rust, or other foreign material. If this occurs, cleaning is required. This can be done while the softener is in SERVICE and under pressure.

Brine System Analysis

If the brine system is functioning properly, there will be water in the brine tank, but the level should be below the safety valve float and the fiberglass rod should travel freely. If these conditions do not exist, one of the following conditions will indicate the nature of the problem:

1. NO WATER IN BRINE TANK—ROD TRAVELS FREELY. The flow control is plugged. Remove refill flow control. Clean or replace.
2. NO WATER IN BRINE TANK—ROD IS RIGID. Air or water slammed the safety valve closed before water could enter the tank. Clean parts at the base of the brine safety valve and also make sure that the seat of the check valve in the brine line is clean. Check for possible air leaks in the brining system.
3. WATER IN BRINE TANK UP TO SAFETY VALVE FLOAT—ROD IS RIGID. There are possible causes:
   a. Brine piston is not in service position when control is in service or brine piston seals are defective. Remove brine line while in service. There should be no flow to brine tank.
   b. Refill flow rate is too high or refill time length is too long. Check refill flow rate and compare to specification in “Specifications” on page 6.
   c. Brine tank is smaller than the recommended size. Refer to Table 6 on page 44.

CTM Complete Brine Draw/Slow Rinse Times

Table 10. CTM Brine Times

lbs/ft³	4	5	6	7	8	9	10	11	12	13	14	15
Model	**min**	**min**	**min**	**min**	**min**	**min**	**min**	**min**	**min**	**min**	**min**	**min**
60K	21	23	25	26	28	30	31	33	34	36	38	39
90K	36	39	41	43	46	48	51	53	56	58	60	63
120K	25	27	28	30	31	33	35	36	38	39	41	42
150K	34	36	38	40	42	44	46	48	50	52	54	56
210K	28	29	31	33	35	37	39	40	42	44	46	48
300K	42	45	48	50	53	55	58	61	63	66	68	71
450K	36	39	42	45	48	51	55	58	61	64	67	70
600K	50	55	59	63	67	71	75	80	84	88	92	96

General Troubleshooting

NOTE! Error Codes can be found in the GBE Programming for Commercial Softeners and Filters manual (01027295)

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Slight Leak to Drain.	Disconnect pilot valve tubing at drain port on the valve.	Flow from tubing indicates leaky seal in pilot valve spool.
	If pilot valve is not leaking, use a test kit and check for hard water at the drain. Multi-tank units - Check Ball valves. Follow checkout procedure on page 76.	Possible missing or damage piston/cap O-Rings or T-Seal. If water tests soft then fast rinse drain piston is open. If the water tests hard then backwash drain piston is open. Bad seal in ball valves.
Leak at the Pilot Valve.	Check to see if the leak is at the top clamp, valve manifold and/or outer spool body.	Pilot spool body o-rings are missing or damaged.
	Check to see if the leak is at the drain port on the valve manifold.	Pilot spool o-rings damaged.
	Check to see if the leak is at the pilot spool shaft and/or inner pilot spool body.	Pilot spool shaft o-rings damaged.
Leak around the Outside of the Valve Core.	Check drain holes. (See Figure 55 on page 53)	See the Check Procedures and Causes for “Leak at the Pilot Valve”.
	Check the o-rings on the couplers of the valve manifold.	O-rings are missing or damaged.
	Check Piston #7 vent port. (See Figure 10 on page 16)	No damage to valve. Expulsion of water built up from factory testing.
High Flow to Drain During Service.	Check position dial pilot.	If not in Position #1, manually cycle the pilot drive assembly to Position #1. If the flow stops, check the pilot drive assembly.
	Use a test kit and check the hardness of the water at the drain.	Use a test kit and check the hardness of the water at the drain. If soft then fast rinse drain piston #5 is open. If the water tests hard then backwash drain piston #4 is open.
	Check the feed water pressure.	Water pressure is less than 50 dynamic psi.
Piston Does Not Close or Open. **CAUTION!** **Make certain that the water pressure is relieved from the system before removing the spool manifold.**	Turn off the water pressure, remove spool manifold, then remove piston from control valve. Check Pilot Spool. Turn off the water pressure, remove the clamp, remove external plumbing connections. Turn the valve on its side, hook the valve to compressed air (above 50 psi) and cycle through observing each piston position for proper positioning.	• If there is no flow from the tubing, the pilot strainer may be plugged. • T-Seal may be dirty, worn or loose. • Seat may be eroded. • Upper piston o-ring may be torn. • Replace Pilot Spool if necessary • T-Seal may be worn. • O-rings on Piston may be worn. • Pilot Assembly may need replacing

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Piston Does Not Open	Turn off the water pressure, remove clamp, remove external plumbing connections then remove valve body from tank adapter. Visually inspect T-Seal.	T-Seal may be fouled or swollen. Pilot Assembly may need replacement.
Hard Water Leakage Into the Service Lines. **CAUTION!** **Make certain that the water pressure is relieved from the system before disassembling the control valve.**	Inspect the bypass piston.	If no flow from the tubing the pilot strainer is probably plugged. • T-Seal may be dirty, worn or loose. • Seat may be eroded. • Upper piston o-ring may be torn. Build-up on the inside of the valve cavity may be preventing the piston assembly from seating. Check Bypass Valve(s)
Restricted or No Service Flow.	Either Service Inlet piston or Service Outlet piston are not opening fully. To determine which one, turn the pilot to position #2. Observe the flow to the drain. Cycle the pilot to position #4 and compare the flow of water in position #4 to the flow in position #2. Return the pilot to position #1.	Flow should be the same for both positions but if not: Service Outlet piston is not opening properly. If backwash (position #2) is higher, then Service Inlet piston is not responding properly.
	Potentially clogged distributors or compacted media bed.	Failed distributors. Contamination of resin bed.
	Check feed water pressure. Multi-tank units - Check Ball valves. Follow checkout procedure on page 76.	Water pressure is less than 50 dynamic psi. Replace Ball Valve if necessary.

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Failure to Draw Brine/Restricted Brine Draw.	Check that the brine line is unrestricted.	Restrictions will not allow the system to draw brine.
	Check water level in brine tank.	Failure to Refill properly. Check “Check Procedures and Cause for Failure to Refill”.
	Check the feed water pressure.	Water pressure must be a minimum of 50 dynamic psi during regeneration.
	Verify the pilot is in the #3 (brine draw) position.	If the pilot is not in the proper position for the brine draw/slow rinse cycle, the system will not draw brine. Check the pilot drive assembly.
	Verify there is a vacuum on the brine line.	If there is a vacuum, the brine valve should have 20 - 27 in. Hg. No vacuum indicates: • Drain line is too small or discharging at a level too high above the floor. • The pilot strainer is plugged. • Pistons are not in the correct position. Refer to flow table. Possibly broken piston. • Plugged or incorrect backwash flow control. • Dirty resin bed.
	Place pressure gauge downstream of drain flow control.	The back pressure of drain line downstream of the flow control is greater than 5 psi.
	Visually inspect eductor for blockages.	Plugged eductor, eductor filter, or eductor nozzle.
	Inspect eductor o-rings.	Missing or damaged eductor o-ring.
	Inspect brine refill elbow assembly.	Plugged brine refill elbow assembly Check piston stuck or plugged Plugged brine refill elbow filter.
	Check correct function of brine valve inside the brine tank.	Not working properly.
	Inspect eductor and refer to Table 5 on page 20.	Incorrectly sized eductor.
	Check feed water pressure is always above 50 dynamic psi.	Low feed water pressure to the pilot valve will prevent proper setting of the pistons.

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Continuous refill to the brine tank.	Backpressure on piston #7. (See Figure 85 on page 78) #7 piston stuck open.	Confirm correct brine refill control is being used, see on page 21. For 18x38 and 24x40 brine systems, confirm 0.8 gpm brine refill control was removed from brine valve, see "Brine System Installation" on page 22. Check T-Seal for damage and adjust the torque. When screwing the T-Seal in place, snug the screw up and back off 1/8 turn. Replace with heavier spring (P/N P1039618 77# Spring, 10 PK)
Restricted or No Drain Flow During Backwash.	Turn the pilot to position #2 and then to position #4, comparing the rate of flow to the drain. Return the pilot to position #1.	Flow should be the same. If not: If the flow in position #4 is low, see Restricted or No Service Flow Check Procedures and causes. Inlet water pressure may be low. Backwash flow control may be plugged. If flow rate in position #4 is greater than position #2 then Backwash Inlet piston and Backwash Drain piston are not functioning properly. Check Drain Line Flow Control.
Media to Service.	Check tank distribution system.	Broken lateral. Bad distributor.
	Trace and examine the plumbing.	Unit is plumbed backwards.
Media to Drain.	High flow of water to drain.	Check/replace backwash flow control washer(s).
	Air in system.	Brine valve did not air check, allowing air into media tank. Air from source other than water softener. Eliminate source or install air vent in top of tank.

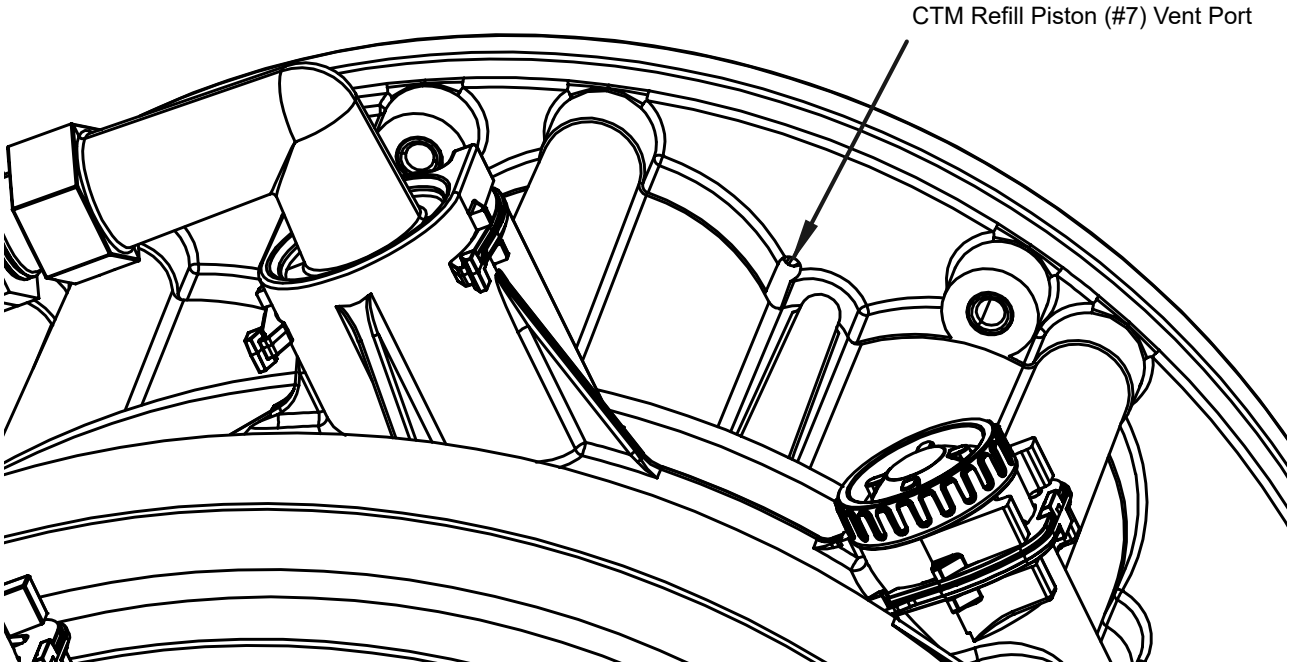
PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Fails to Refill Properly.	Feed water pressure must be above 50 dynamic psi. T-Seal on Piston 7 needs replacement. Eductor Nozzle Plugged.	Low pilot valve pressure will prevent the #7 piston from opening properly. Replace T-Seal. Clean Eductor Nozzle.
Pilot Does Not Pressurize or Vent Valve Ports Properly.	Check Screen on Pilot Strainer.	Clogged Screen prevents control pressure from reaching pilot valve (and solenoid valves if applicable).
	1. Using the GBE, manually cycle the pilot as required until the piston(s) in question should be closed. (Refer to Table 13 on page 78). Remove the tubing from the inlet to the pilot valve strainer and check for water from the tube. 2. Manually cycle the pilot to position #1.	If water flows out of the tubing, check the fitting in the valve inlet port and pilot valve strainer for an obstruction. If water does not flow out of the control tubing, check the tubing and fittings for an obstruction.
	1. Remove the external plumbing connections and clamp. Remove valve body from tank adapter. Lay the valve body on its side. Attach an external air supply, hand vacuum/pressure pump with gauge or water supply to the spool body pressure port. 2. While in position #1 and not in stand by (multiple units with blocking solenoids). Confirm the correct piston function using Table 13 on page 78. 3. Using the GBE, manually cycle the pilot to position #2. Confirm the correct piston function using Table 13. 4. Using the GBE, manually cycle the pilot to position #3. Confirm the correct piston function using Table 13. 5. Using the GBE, manually cycle the pilot to position #4. Confirm the correct piston function using Table 13. 6. Using the GBE, manually cycle the pilot to position #5. Confirm the correct piston function using Table 13. 7. Using the GBE, manually cycle the pilot to position #1.	2 - 4. If piston function does match Table 13: • Coupling O-Ring(s) missing or damaged. • Piston O-Ring(s) missing or damaged. 5 & 6. If piston function does match Table 13: • Coupling O-Ring(s) missing or damaged. • Piston O-Ring(s) missing or damaged. • Refill Piston Spring missing or damaged.

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Overfilled Brine Tank.	Remove the valve manifold and check refill piston spring.	Missing or damaged refill piston spring. Change to heavier spring if pressure is above 50 psi.
	Incorrectly sized drain line flow control.	Replace with the correct drain line flow control. See Table 4 on page 18.
	Incorrect programming. Brine valve not functioning.	Correct programming. See the GBE Programming for Commercial Softeners and Filters, except for HFxN Manual (P/N 01027295). Check brine valve.
Softener Tank Does Not Remain in Stand By Mode or Will Not Provide Water Through the Outlet of the Control Valve When in Service (Only systems using blocking valves).	Verify operation of the motorized ball valves of the control valve. Communication cable problem.	Motorized ball valve may not be properly wired or water hardness scale build-up inside motorized ball valve is causing malfunction. (See page 24). Check communication cable. Also refer to page 76 Ball Valve Troubleshooting.

NOTE! **If there are any problems not described in the Troubleshooting Table above, please contact your RTA for additional information.**

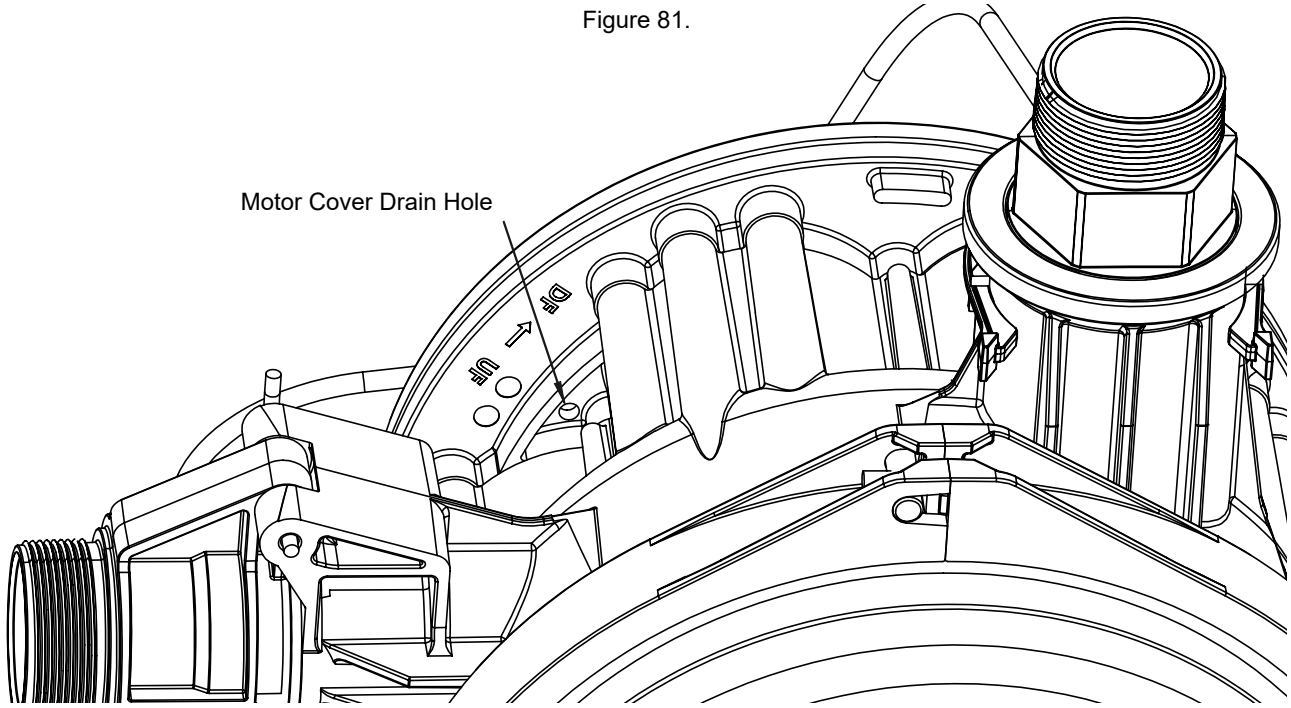
CTM Refill Piston (#7) Vent Port Location

Figure 80.



CTM Motor Cover Drain Hole Location

Figure 81.



Aqua-Sensor® Troubleshooting

The following procedure will help you diagnose problems in units equipped with Aqua-Sensor® sensing device. Because many sensor problems are actually regeneration problems, it contains a combination of sensor diagnostics and routine control valve and brine system checks. Refer to the GBE Programming for Commercial Softeners and Filters, except for HFxN Manual (P/N 01027295) . This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Recording Important Information

Record the following information from the GBE diagnostic menu screens to use in analyzing the Aqua-Sensor's performance.
Select: Main Menu > Diagnostics > Advanced Stats > Regen Stats

Last Regen Trigger: _____

If it shows Aqua-Sensor, the probe and circuits are working correctly to detect resin exhaust. If you see Manual, Flow Meter, Manual, etc., the Aqua-Sensor may not be reading correctly or programming could be favoring another trigger to regenerate. Gallons or Reserve could be higher than needed for the probe to signal exhaustion. Be sure your reserve is less than 5% in the Regen Setup.

Last Brine Draw Slow Rinse: _____

If it shows a number of minutes less than the programmed Slow Rinse Time, found in Advanced Setup > Cycle Times > Slow Rinse, then the patented rinse-out feature of the Aqua-Sensor is operating based on the probe sensing the removal of brine and hardness during regeneration. If the number is the same as the Slow Rinse Time, the setting could be too short for the salt dosage and eduction rate or the probe may not be sensing the rinse-out. Lengthening the cycle time greater than 75 minutes can often insure it isn't the first possibility. In general, the time you read should be 8-15 minutes less than the cycle time.

Select: Main Menu > Diagnostics > Check Sensors

AquaSensor Supply Voltage 2.5VAC: _____

This should always read PASS. If you see FAIL, check the voltage at the wall transformer for 2.5VAC.
If the transformer checks out it might be the power cord, the pin connector at the board or damage to the circuit board.

Pass SIM Test: Ignore this unless you have the Simulator Box (P/N 01017705 plugged into the board instead of the Aqua-Sensor Probe at the time of the reading. Reading PASS is only necessary when using the Sim Box.

With water flowing through the tank record Z-ratio: _____

This is a reading from the sensing probe while you have water flowing passed it. Unless the tank has just finished a full regeneration, this reading should be increasing slightly or at least be a number higher than the Z-minimum recording. The exact number is not important as you might see something near 1078 or higher. What is critical is the number is increasing, since it determines the need to regenerate.

Z-minimum: _____

If this number remains at 0000 the tank has not yet regenerated successfully sending brine through the resin bed or there is no 2.5VAC power to operate the probe; preventing it form recording a number; or the probe is not installed correctly inside the tank and into the circuit board; which would also affect the Z-ratio reading. Z-minimum should always be a number lower than Z-ratio, since it is the starting point for monitoring conductivity in the resin. Also it might change slightly after each successful regeneration.

Z-increase %: _____

This number represents a difference, an increase in Z-ratio over the Z-minimum. As this percentage reaches 7.5% for longer than 6 minutes, the circuit board will get ready to regenerate. The percentage can be seen higher than 7.5%, but it has no bearing on the need to regenerate.

By understanding each of these indicators in the programming, technicians should be able to see if the Aqua-Sensor is functioning properly. Remember that it is only a trigger to regenerate based on reading the hardness level in the resin bed. If the softener does not fully operate mechanically through a proper regeneration, the sensor cannot perform its functions correctly either.

If the power supply, programmed settings and regeneration are all correct, and the unit fails to trigger a regeneration from the sensor, replace the Aqua-Sensor probe.

If all of these factors are correct and the unit seems to be continually regenerating, consider the quality of the resin and a proper regeneration before deciding to replace the Aqua-Sensor probe.

Motorized Ball Valve Operation

When ball valves are in the “Service” position, Pilot Valve controls the flow path. When the ball valves are in the “Standby” position, the Ball Valves with Piston #1 control the flow path.

Table 11.Ball Valve to Pilot Valve Flow Paths

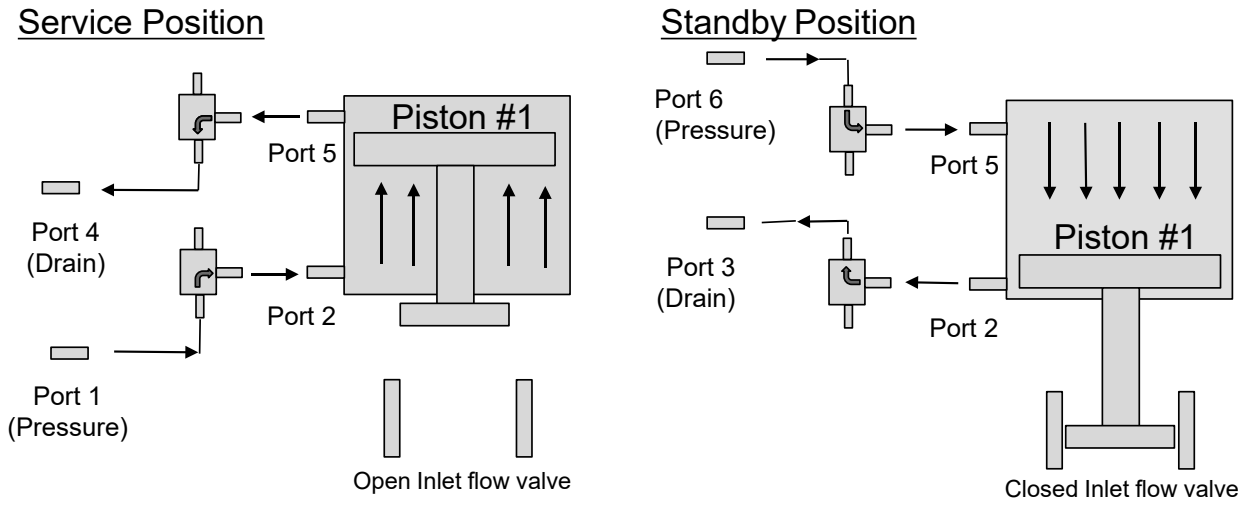
Port		Flow Path to/from the Ball Valve During	
Ball Valve	**Pilot**	**Service**	**Standby**
1	1	Pressure from the Pilot Valve	
2	2	Flow to the Bottom of Piston #1	Flow from the Bottom of Piston #1
3	3	Exhaust to Drain	
4	4	Exhaust through the Pilot Valve	
5	5	Flow from the Top of Piston #1	Flow to the Top of Piston #1
6	6	Pressure to Ball Valve	

Table 12. CTM Ball Valve and Port Testing

Cycle	Indicator Position[1]	Ball Valve 1			Ball Valve 2		
		Port 1	**Port 2**	**Port 3**	**Port 4**	**Port 5**	**Port 6**
Ball Valves in Service		PTV[2] ◄►	PFV[3]	NP[4]	NP[4] ◄►	NP[4]	PTV[2]
Ball Valves in Standby		PTV[2]	NP[4] ◄►	NP[4]	NP[4]	PFV[3] ◄►	PTV[2]

[1] View from front of control.
[2] PTV = Pressure TO Ball Valve.
[3] PFV = Pressure FROM Ball Valve.
[4] NP = No CONSTANT Pressure.
◄► = Ball Valve PORT TO PORT Communication.

Figure 82. Ball Valve Operational Positions



Manual Valve Override

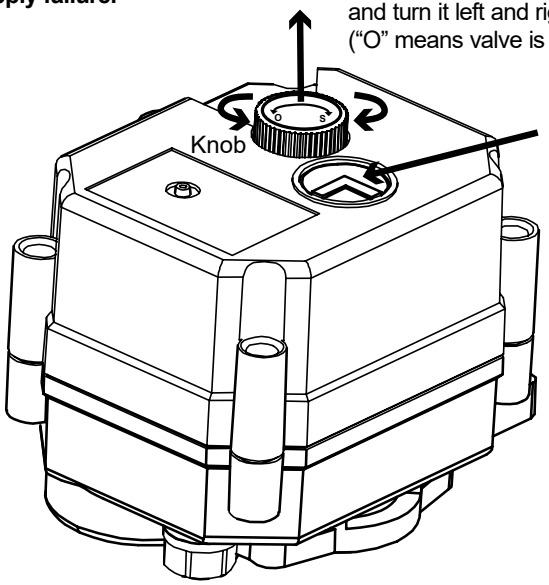
Figure 83.

1. Power MUST be in the OFF position when starting manual override.

CAUTION!
The manual function can only be used in the case of electrical supply failure.

CAUTION!
It is possible to operate the actuator manually.

2. Gently pull up the knob approximately 1/8" and turn it left and right to control the valve ("O" means valve is OPEN, "S" means valve is SHUT).



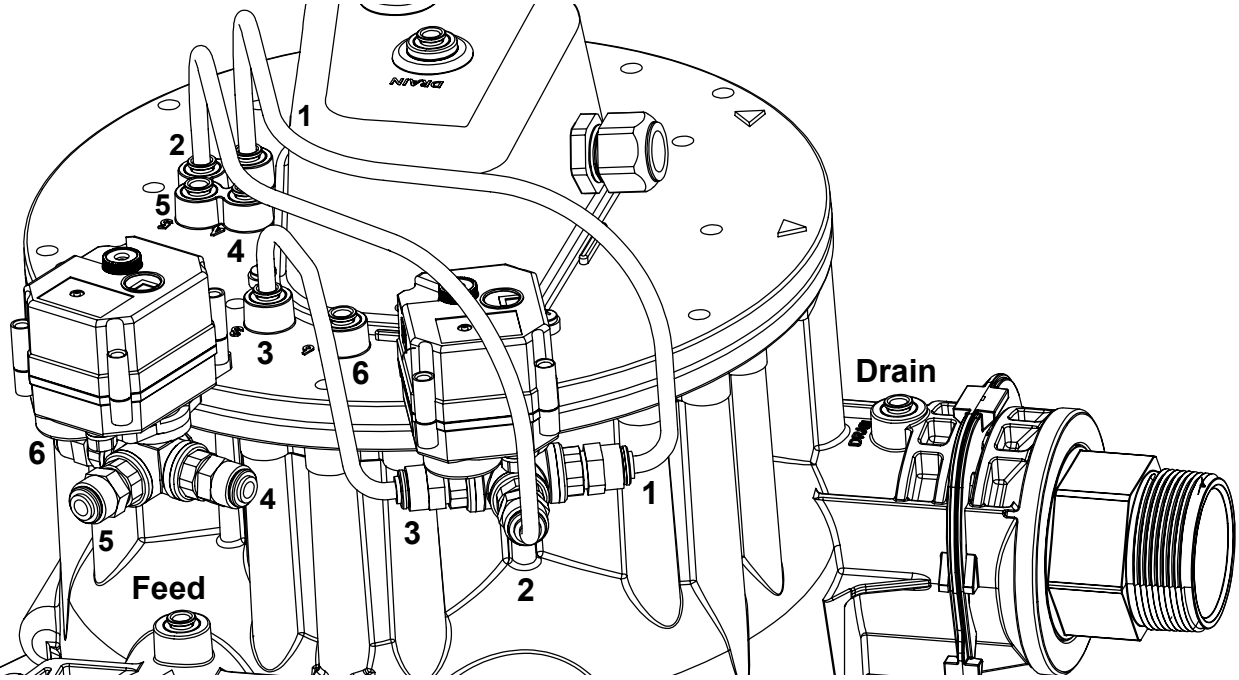
3. In the indicator window, when the red needle points to "S", the valve is closed/shut.

   When the red needle points to "O", the valve is open.

4. When manual override operation is complete, press the knob down for normal electrical operation.

Ball Valve Ports (Multi-Tank Softeners Only)

Figure 84.

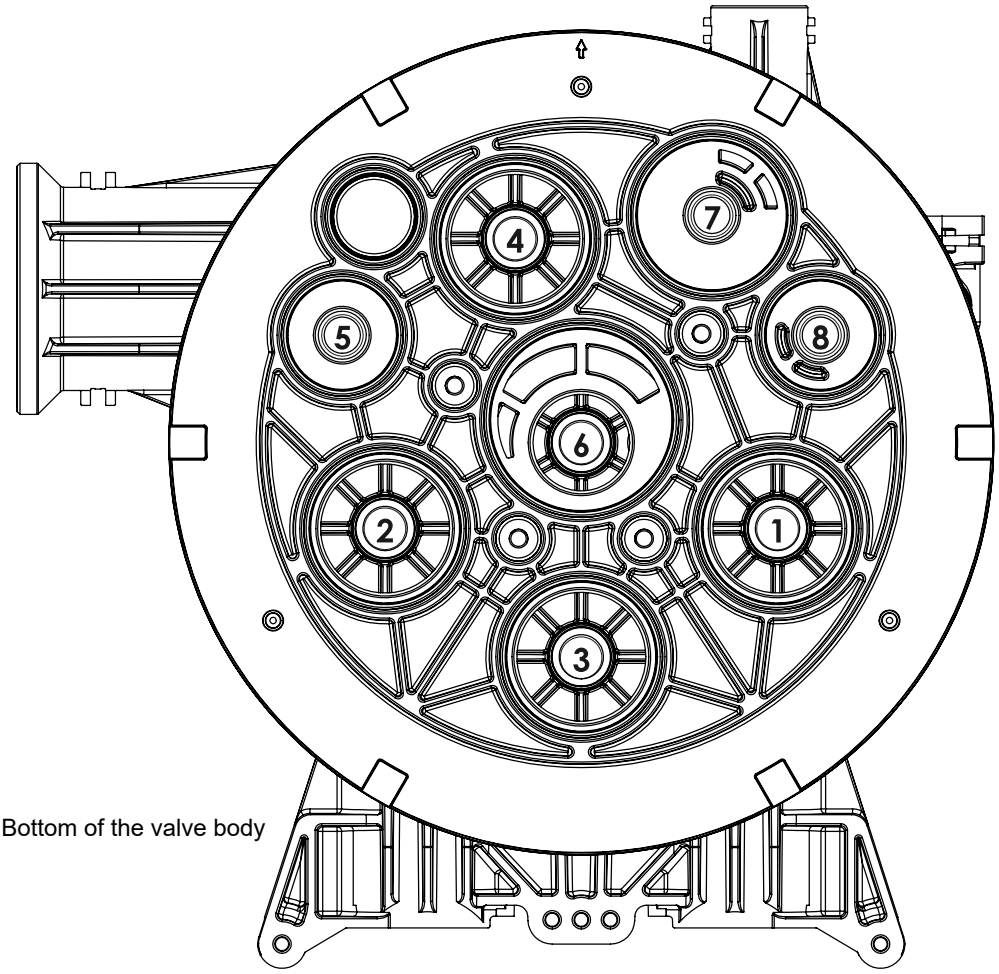


NOTE! **When testing ball valve operation using the Aux Out Test menu in Diagnostics, leave the ball valve energized for at least 30 seconds before pressing the check mark to cancel and move it back to the "home" position. This amount of time is needed to charge the capacitor that operates the DC motor.**

Flow Diagrams

CTM Flow Valve Piston Locations

Figure 85. Piston Locations



View: Bottom of the valve body

Table 13. Piston Cycle Positions

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Service

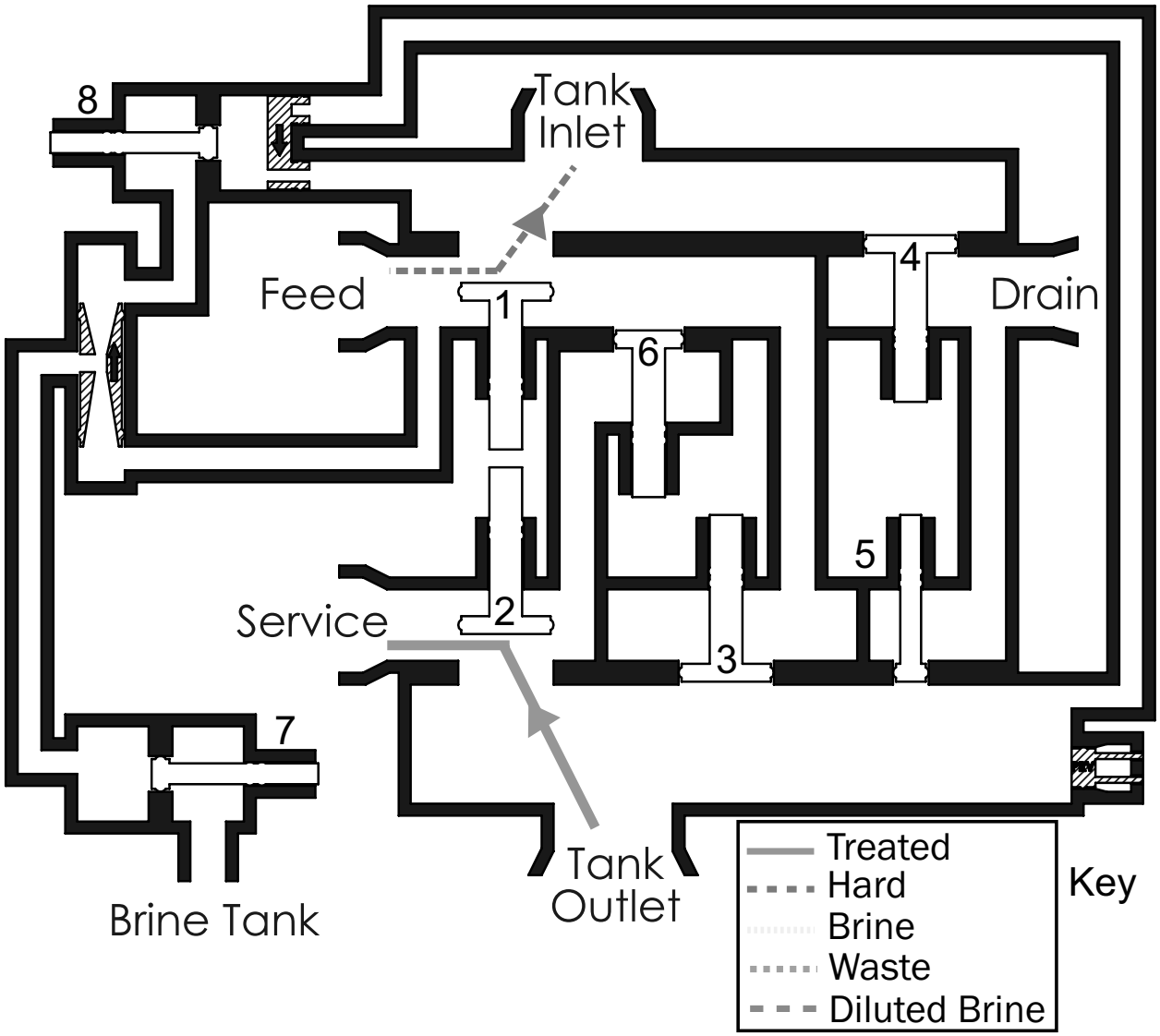


Table 14. Piston Cycle Positions, Service

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Backwash

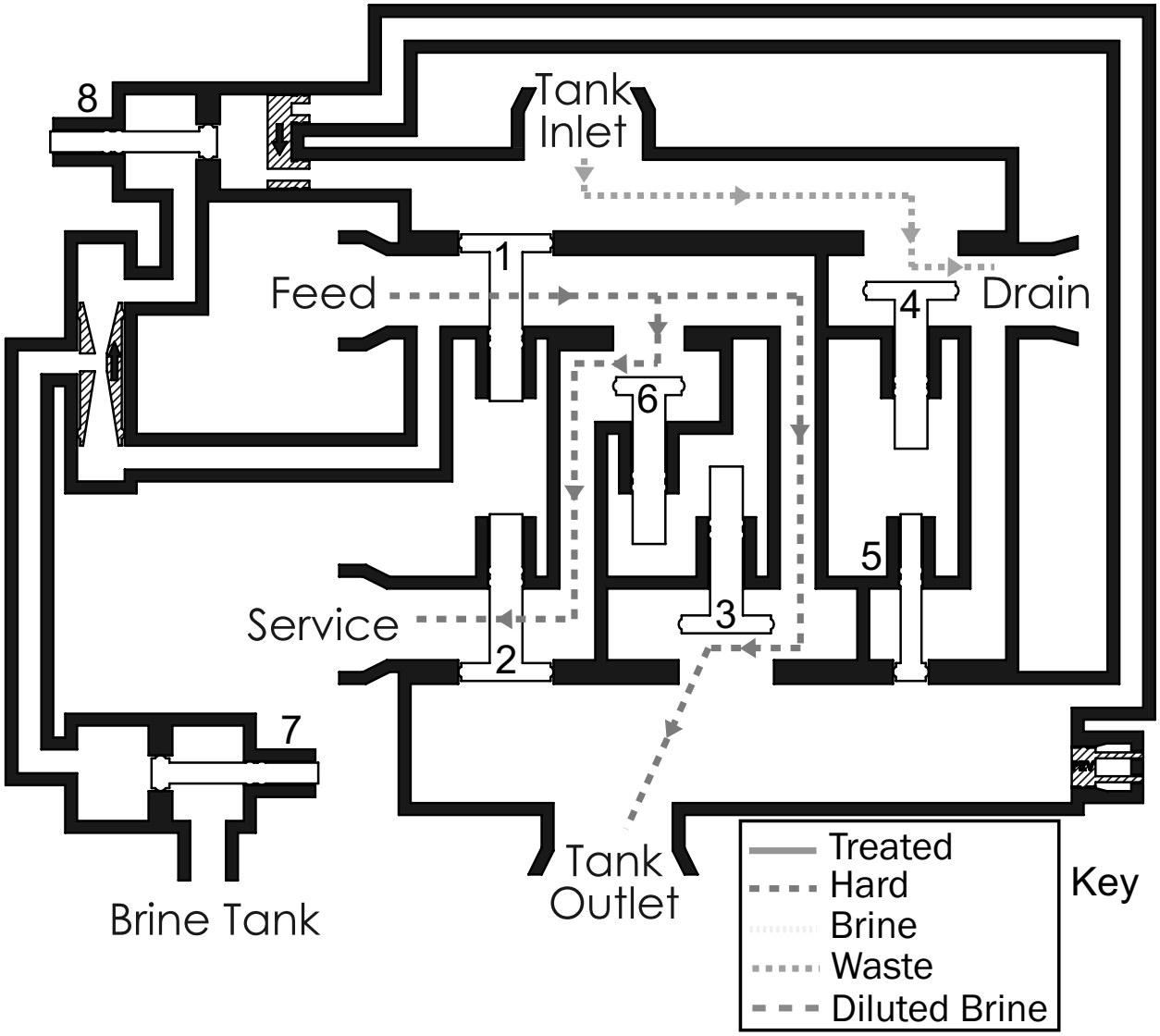


Table 15. Piston Cycle Positions, Backwash

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Brine Draw/Slow Rinse

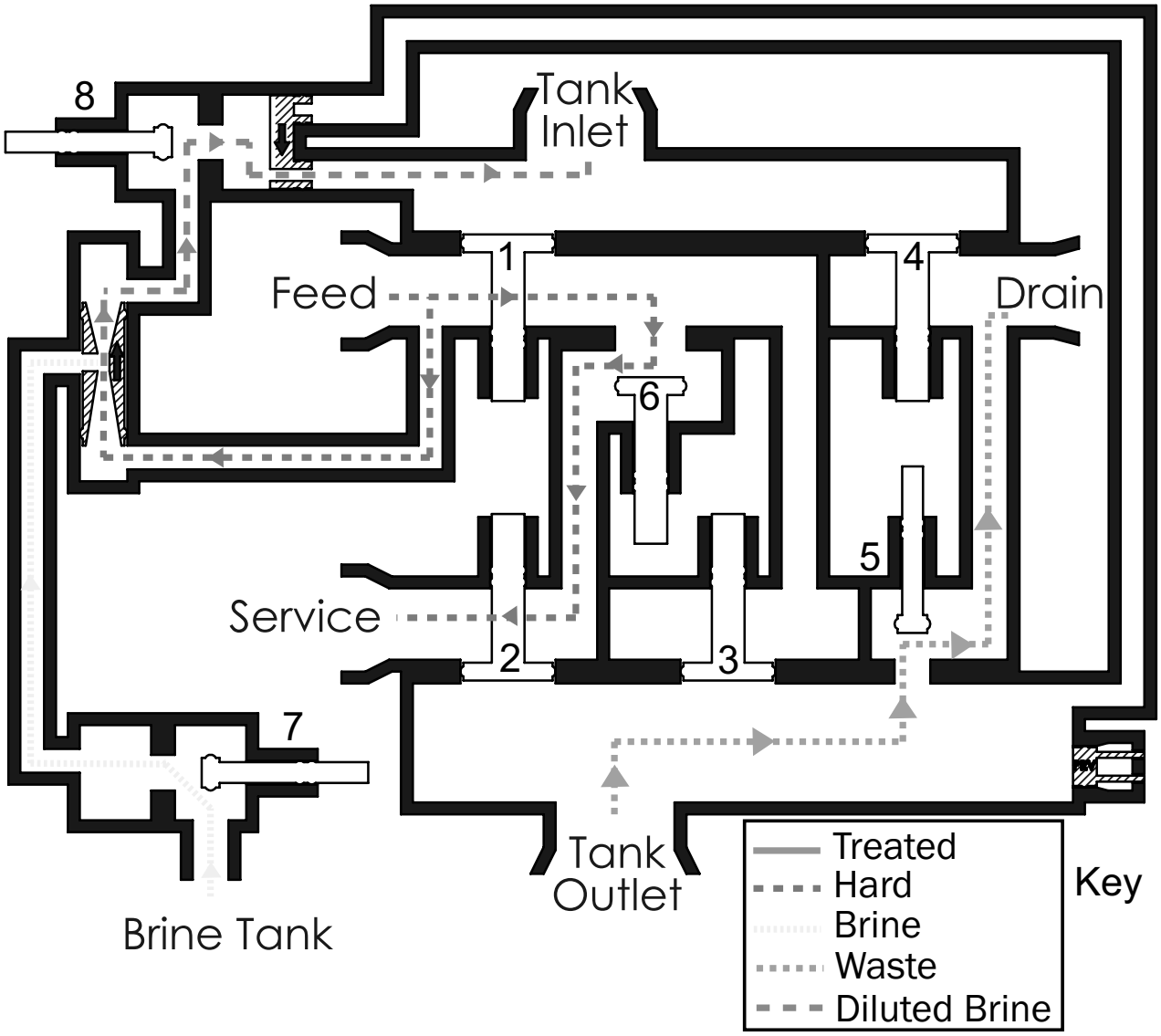


Table 16. Piston Cycle Positions, Brine Draw/Slow Rinse

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Fast Rinse

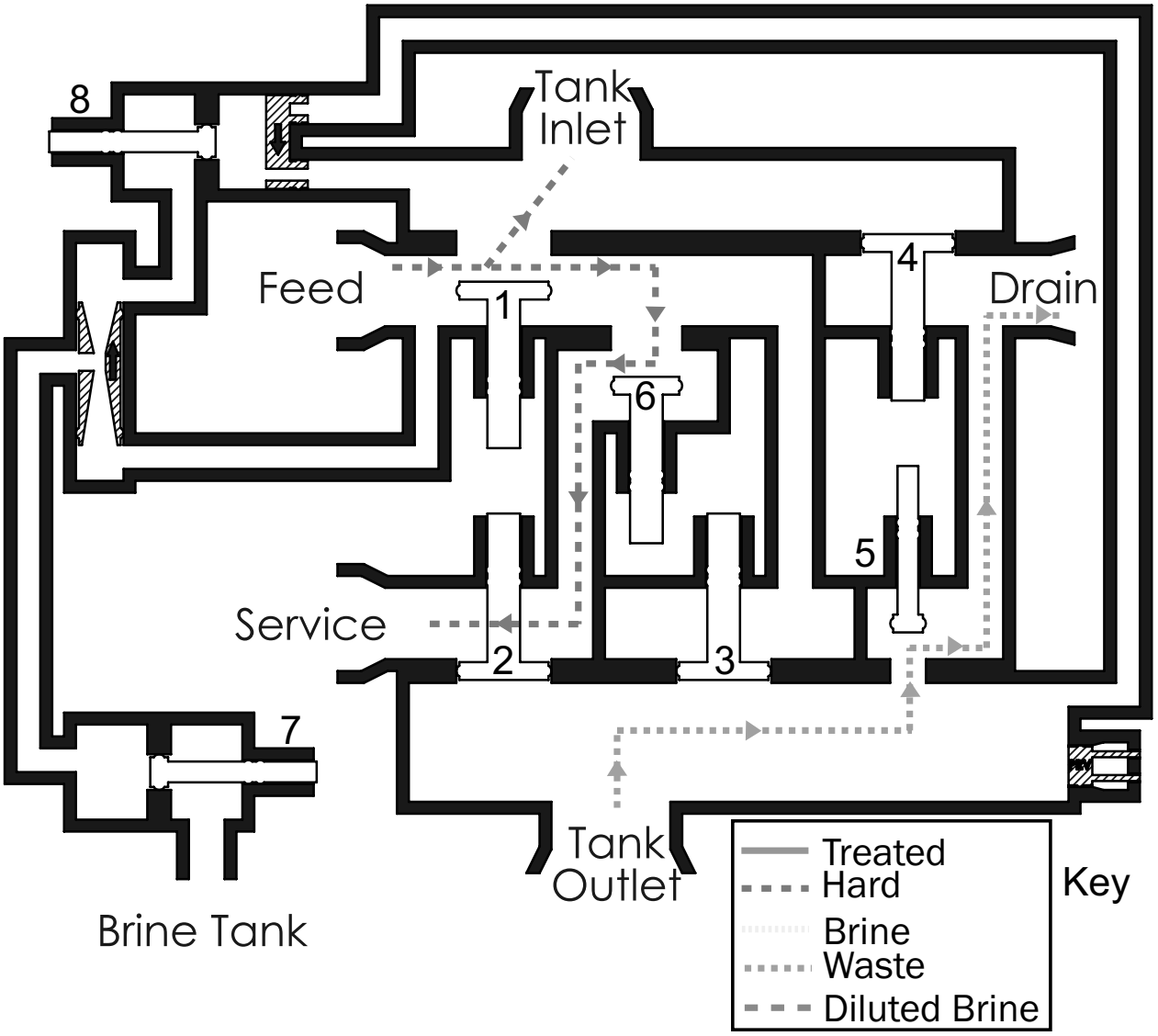


Table 17. Piston Cycle Positions, Fast Rinse

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Refill

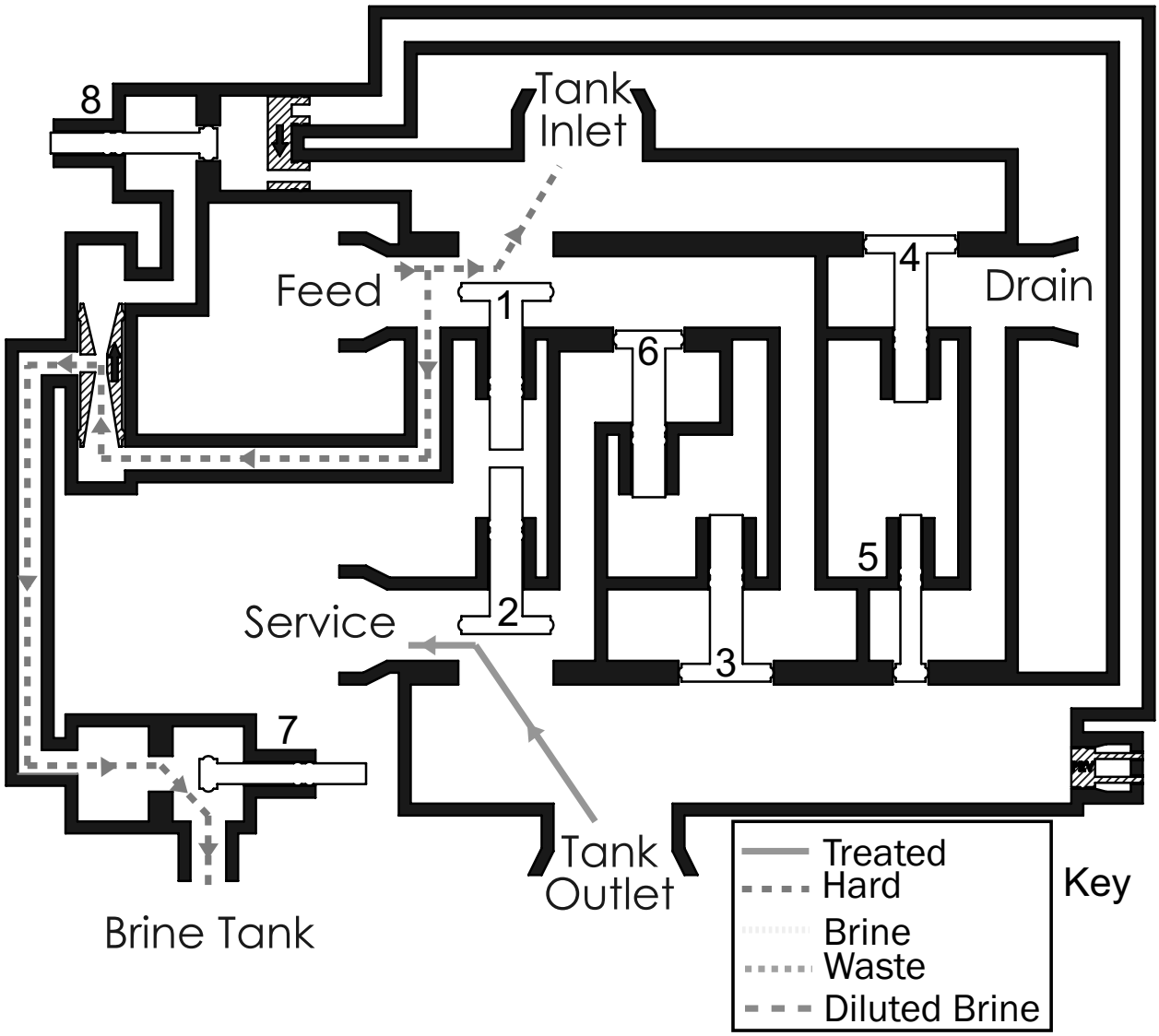


Table 18. Piston Cycle Positions, Fill

Piston Number	Piston	Position 1	Position 2	Position 3	Position 4	Position 5
		Service	Backwash	Brine Draw/ Slow Rinse	Fast Rinse	Fill
1	Valve Inlet	Up	Down	Down	Up	Up
2	Valve Outlet	Up	Down	Down	Down	Up
3	Backwash	Down	Up	Down	Down	Down
4	Drain - Backwash	Down	Up	Down	Down	Down
5	Drain - Fast Rinse	Down	Down	Up	Up	Down
6	Hard Water Bypass	Down	Up	Up	Up	Down
7	Refill	Down	Down	Up	Down	Up
8	Brine Draw	Down	Down	Up	Down	Down

Parts List

Replacement Softener Tanks and Media

Model	Model Type	Size	Part No.	A/S Port[1]	Distributor Part No.	Underbedding Required		Cullex® Resin Required Bags[2]	Media Loading Funnel
						Part No. (Bags)	Total, lbs.		
60K	Meter	14” x 47”	01019578	Y	01011985	00160707 (1)	30	2	01029516
90K	Meter	16” x 53”	01019577	Y		00160702 (2)	20	3	
120K	Meter	16” x 65”	01019579	Y		00160710 (1)	50	4	
150K	Meter	18” x 65”	01025244	Y	01019618	00160702 (1) & 00160710 (1)	70	5	
210K	Meter	21” x 62”	01025245	Y				7	
300K	Meter	24” x 72”	01030825	Y		00160707 (1) & 00160710 (2)	130	10	
450K	Meter	30” x 72”	01030826[1]	Y		00160710 (6)	300	15	
600K	Meter	36” x 72”	01030827[1]	Y	01029377	00160710 (8)	400	20	

[1]The flanged tank adapter kit (P/N 01030828) required to mount the valve to these tanks is sold separately.

[2]Each Cullex (P/N 00156001) bag is 1 cubic foot.

Sizing Kits

Figure 86. Softener Sizing Kit

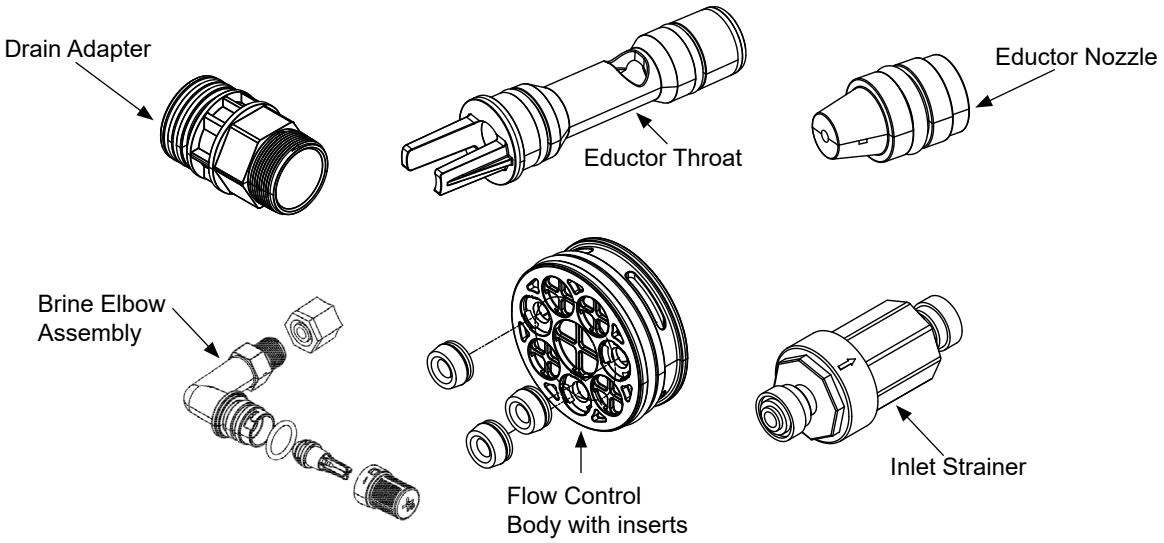


Table 19. Softener Sizing Kits

Kit Component	60K 01040940	90K 01040941	120K 01037836	150K 01037838	210K 01037840	300K 01040942	450K 01040943	600K 01037844
01038537 Black Inlet Strainer, 1/4",100 Mesh	Included in all Kits							
01029565 Brine Elbow Assy & Refill Poppet								
01028257 1 1/2" Drain Adapter								
Flow Control Body , 3-5 GPM	1							
Flow Control Body, 5-30 GPM		1	1	1	1	1	1	1
#3 Eductor Throat	1	1						
#4 Eductor Throat			in valve	in valve	in valve			
#5 Eductor Throat						1		
#8 Eductor Throat							1	1
Black Eductor Nozzle w/O-Ring	1	1						
Violet Eductor Nozzle w/O-Ring			in valve	in valve				
Red Eductor Nozzle w/O-Ring					1			
White Eductor Nozzle w/O-Ring						1		
Blue Eductor Nozzle w/O-Ring							1	
Beige Eductor Nozzle w/O-Ring								1
Black 0.4 GPM Flow Control	2							
Black 2.5 GPM Flow Control	1							
Blue 5.0 GPM Flow Control		1			2		2	
Red 6.0 GPM Flow Control			1			2		
Green 8.0 GPM Flow Control				1				
Orange 10.0 GPM Flow Control							1	3
Black 0 GPM Plug		2	2	2	1	1		

Control Valve

Figure 87. Valve Body and Adapter

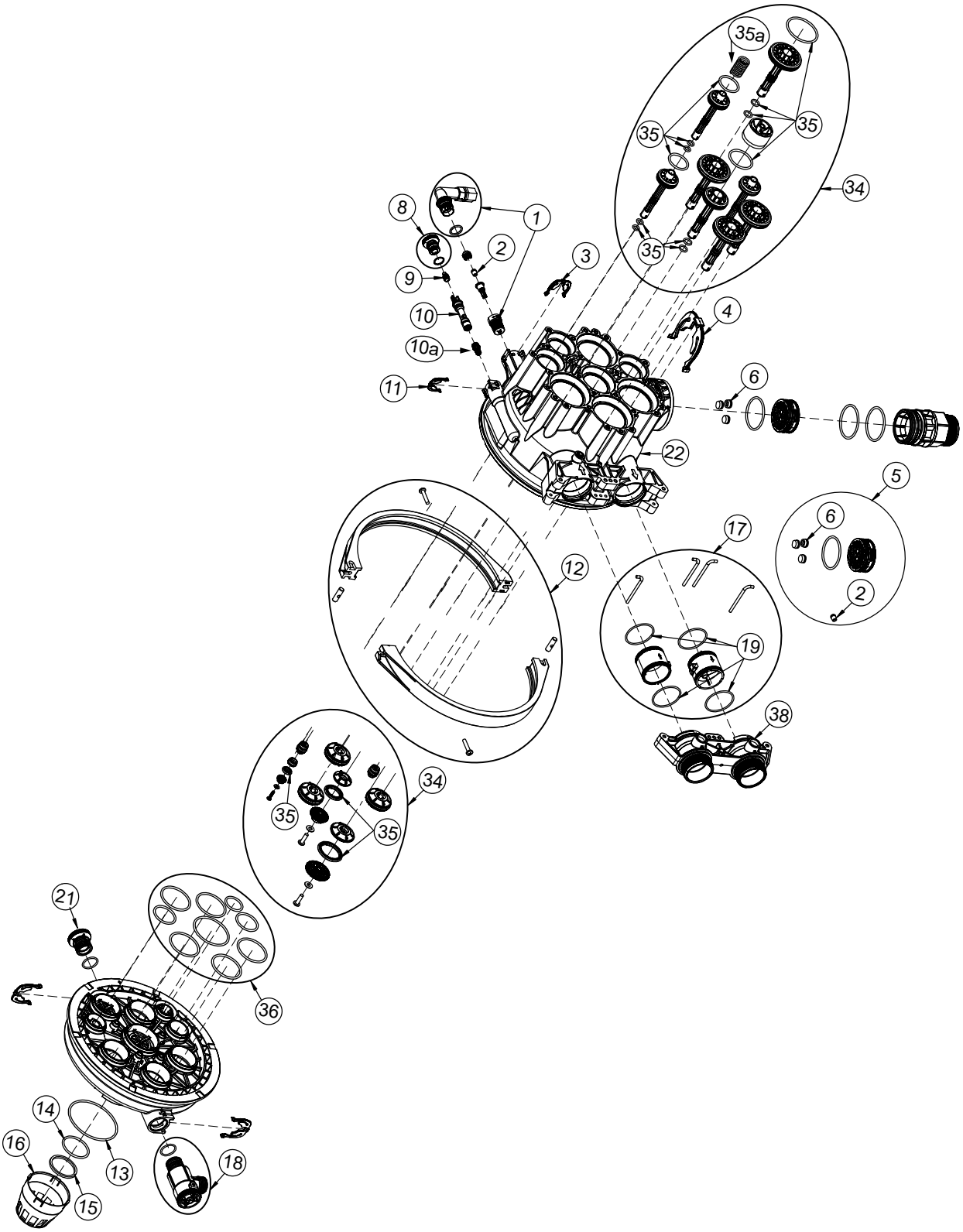
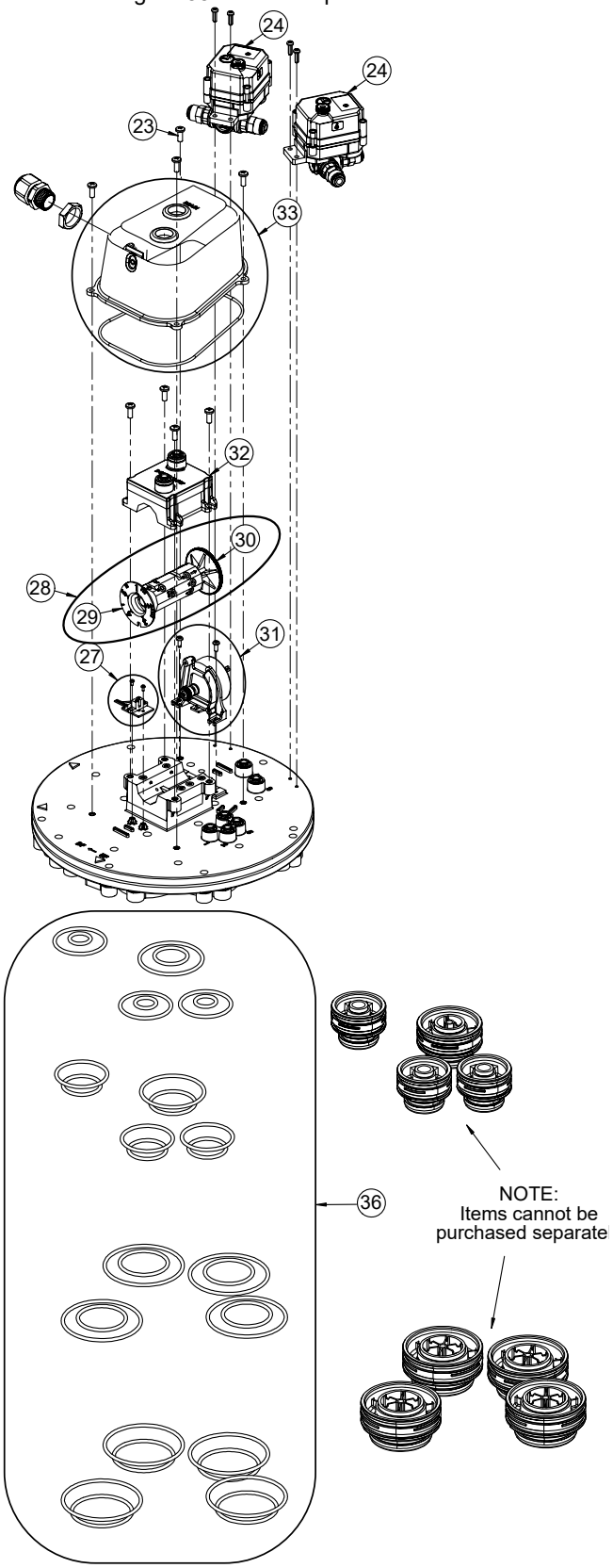


Figure 88. Valve Top Manifold



Item	Part No.	Description
—	01028301	Control Valve, Single Tank, Downflow, Hard Water Bypass
—	01028304	Control Valve, Single Tank, Downflow, No Hard Water Bypass
—	01028300	Control Valve, Multi Tank, Downflow, No Hard Water Bypass[1]
1	01029565	Kit, Brine Elbow Assembly
2	01000602	Insert, Refill Flow Control, 2.0 gpm
	01000603	Insert, Refill Flow Control, 3.0 gpm
3	—	Clip, Brine Adapter[3]
4	P1028012	Clip, Drain Line Flow Adapter, 10 PK[3]
5	01029469	Kit, Drain and Brine Line Flow Control, 60K Units (Contains Items 2 and 6)
	01029460	Kit, Drain and Brine Line Flow Control, 90K-600K Units (Contains Items 2 and 6)
6	P1028331	Inserts, Drain Line Flow Control, 0 GPM, Black, 10 PK
	P1028332	Inserts, Drain Line Flow Control, 5 GPM, Blue, 10 PK
	P1030741	Inserts, Drain Line Flow Control, 6 GPM, Red, 10 PK
	P1028333	Inserts, Drain Line Flow Control, 8 GPM, Green, 10 PK
	P1028334	Inserts, Drain Line Flow Control, 10 GPM, Orange, 10 PK
7	01029581	No Hard Water Bypass Plug (for conversion)
8	01029564	Eductor Port Cap
9	P1028311	Eductor Nozzle, Black, w/O-Ring, 0.28 gpm, 10 PK
	P1028313	Eductor Nozzle, Violet, w/O-Ring, 0.58 gpm, 10 PK
	P1028314	Eductor Nozzle, Red, w/O-Ring, 0.72 gpm, 10 PK
	P1028315	Eductor Nozzle, White, w/O-Ring, 1.01 gpm, 10 PK
	P1028316	Eductor Nozzle, Blue, w/O-Ring, 1.44 gpm, 10 PK
	P1028317	Eductor Nozzle, Beige, w/O-Ring, 2.16 gpm, 10 PK
10	P1028318	Eductor Throat, Blue #4, w/O-Rings, 2.4 gpm, 10 PK
	P1028319	Eductor Throat, Blue #5, w/O-Rings, 10 PK
	P1028320	Eductor Throat, Blue #3, w/O-Rings, 10 PK
	P1028321	Eductor Throat, Blue #8, w/O-Rings, 10 PK
10a	P1028087	Eductor Screen, 10 PK
11	—	Clip, Eductor Plug Cap[3]
12	01029567	Kit, Valve Clamp
13	P1023559	O-Ring, ARP #240, 10 PK
	00401858	O-Ring (24”, 30” & 36” Ported Tanks Only)
14	P1023560	O-Ring, ARP #226 EPDM, 10 PK
15	P1023558	Retainer Ring, 10 PK
16	01019742	Upper Disperser
17	01028328	Kit, Flow Meter Assembly

Item	Part No.	Description
18	01029566	Kit, PRV Assembly
19	P1028381	Coupling/Flow Meter O-Ring, 10 PK
20	—	Clip, Vacuum Breaker/PRV[3]
21	01029511	Vacuum Breaker
22	01029580	Kit, Core Control Valve Replacement
23	01029584	Screws, Top Manifold[5] and Pilot Enclosure
26	01029583	Pilot Valve Rebuild Kit
27	01029554	Kit, Position Sensor (also part of kit #26)
28	—	Kit, Pilot Body and O-Rings[3]
29	—	Kit, Position Indicator Wheel[3]
30	—	Gear, Pilot Drive Spool, CTM[3]
31	01029558	Kit, Motor Assy, CTM
32	01029560	Housing, Top, Pilot Body, Downflow
33	01029561	Kit, Enclosure, Pilot Drive
34	01029576	Kit, Piston Actuator w/O-Rings, Flow Valves and T-Seals
35	01029577	Kit, Piston O-Rings and T-Seals
35a	P1028329	33# Spring, 10 PK
	P1039618	77# Spring, 10 PK
36	01029578	Kit, Seals for upper, lower and external valve body
38	01029500	1.5” NPT Inlet/Outlet Plumbing Adapter
	01029502	1.5” NPT Inlet/Outlet Plumbing Adapter w/ Ports
	01029512	Inlet/Outlet Plumbing Adapter
	01029514	Inlet/Outlet Plumbing Adapter w/Ports
	01029501	2” NPT Inlet/Outlet Plumbing Adapter
	01029503	2” NPT Inlet/Outlet Plumbing Adapter w/ Ports
	01029513	Inlet/Outlet Plumbing Adapter
	01029515	Inlet/Outlet Plumbing Adapter w/Ports
	00303177	Tubing, 1/4”, PE Black, 1 ft. (for Pilot Valve)
	01030179	Cable Harness, Ball Valves, Valve Mount[1]
	01030177	Cable Harness, Ball Valves, Remote Mount[1]
	01028019	Kit, Clips (Contains Item 3, 4, 11, and 20)
	01029550	Kit, Single to Multi Tank Manifold Conversion[5]
	01040950	Duplex Kit
	01040951	Triplex Kit

[1]Multi-Tank Only
[3]A part of a Kit
[5]Not Shown

Valve Service Rebuild Kits

More than one option exists for rebuilding the CTM valve.
Select the kit that best suits the customer's rebuilding plans and costs.

CTM Valve O-Ring Kit

The CTM Valve O-ring Kit contains all the sealing o-rings needed in the valve.
Use with the Piston Rebuild Kit, Piston Replacement Kit or the Valve Core Replacement Kit.
(NOTE: For Item numbers listed below see Figure 55 and Figure 56.

Item	Part No.	Description	Qty
—	01029578	Seals for upper, lower and external valve body Kit	—
24	—	O-Ring, ARP#235, EPDM	8
25	—	O-Ring, ARP#229, EPDM	4
26	—	O-Ring, ARP#225, EPDM	4
27	—	O-Ring, ARP#230, EPDM	2
28	—	O-Ring, ARP#224, EPDM	1
29	—	O-Ring, ARP#221, EPDM	3
30	—	O-Ring, ARP#226, EPDM	6
31	—	O-Ring, ARP#210, EPDM	3
32/36	—	O-Ring, ARP#218, EPDM	2
33	—	O-Ring, ARP#232, EPDM	1
34	—	O-Ring, ARP#228, EPDM	5
35	—	O-Ring, ARP#223, EPDM	2
	—	O-Ring, ARP#137, EPDM (Flow Meter)	4
	—	O-Ring, ARP# 229, EPDM (Drain Adapter)	2
	—	O-Ring, ARP#121, EPDM (PRV and Vacuum Breaker)	2

CTM Piston Rebuild Kit

Contains all the o-rings and T-seals needed to rebuild the 8 piston assemblies only. A Valve O-Ring Kit is also needed.

Part No.	Description	Qty
01029577	Piston O-Rings and T-Seals Kit	—
—	T-Seal (2.00")	4
—	T-Seal (1.50")	1
—	T-Seal (0.75")	3
—	O-Ring, ARP#110, EPDM	6
—	O-Ring, ARP#112, EPDM	10
—	O-Ring, ARP#221, EPDM	3
—	O-Ring, ARP#224, EPDM	1
—	O-Ring, ARP#229, EPDM	4

CTM Piston Replacement Kit

Contains each of the 8 piston with the o-rings,T-seals and Flow Valves complete. Use this kit if you don't want to change all the individual o-rings on each piston. A Valve O-Ring Kit is also needed.

Part No.	Description	Qty
01029576	Piston Actuator w/O-Rings, Flow Valves and T-Seals Kit	—
—	Piston Actuator w/O-rings (2.63")	4
—	Piston Actuator w/O-rings (2.00")	1
—	Piston Actuator w/O-rings (1.50")	2
—	Piston Actuator Refill w/O-rings & Spring (1.50)	1
—	Piston Flow Valve Kit w/T-seal (2.00 valve)	4
—	Piston Flow Valve Kit w/T-seal (1.50 valve)	1
—	Piston Flow Valve Kit w/T-seal (0.75 valve)	3

CTM Valve Core Replacement

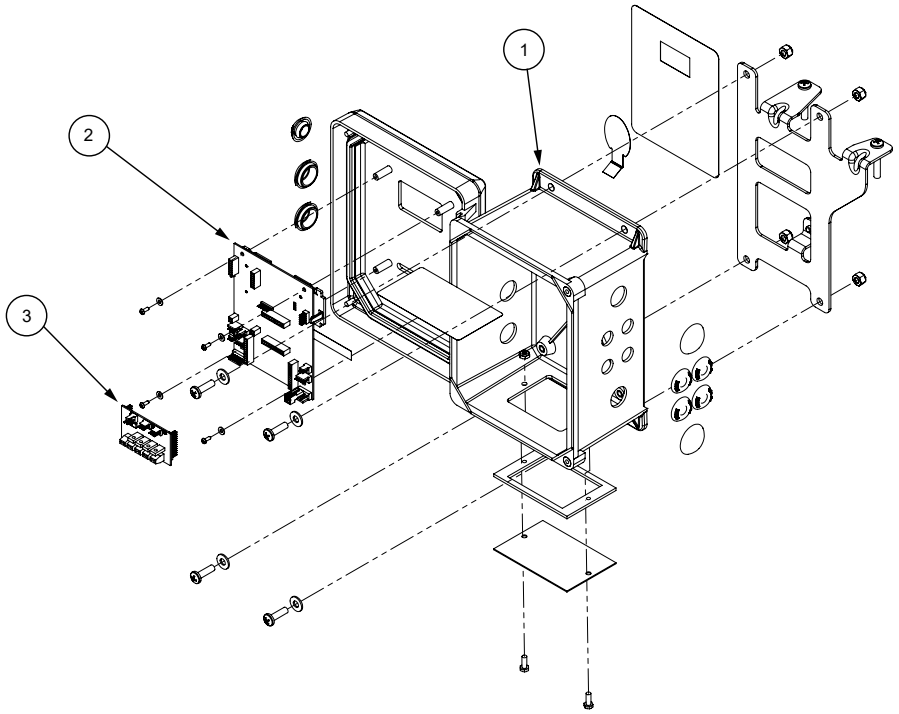
Contains the center core with the pistons fully installed. Transfer the manifold, couplers, tank adapter, eductor assembly, drain fitting, brine fitting, PRV, vacuum breaker and etc. A Valve O-Ring Kit is also needed

Part No.	Description	Qty
01029580	Valve Core Replacement Kit	—
—	Core Valve Body	1
—	Piston Actuator w/O-rings (2.63")	4
—	Piston Actuator w/O-rings (2.00")	1
—	Piston Actuator w/O-rings (1.50")	2
—	Piston Actuator Refill w/O-rings & Spring (1.50)	1
—	Piston Flow Valve Kit w/T-seal (2.00 valve)	4
—	Piston Flow Valve Kit w/T-seal (1.50 valve)	1
—	Piston Flow Valve Kit w/T-seal (0.75 valve)	3

Pilot Valve Rebuild Kits

Part No.	Description
01029583	Pilot Valve Rebuild Kit
—	Kit, Position Sensor
—	Kit, Pilot Body and O-Rings
—	Kit, Position Indicator Wheel
—	Gear, Pilot Drive Spool, CTM

Culligan GBE Controller for CTM

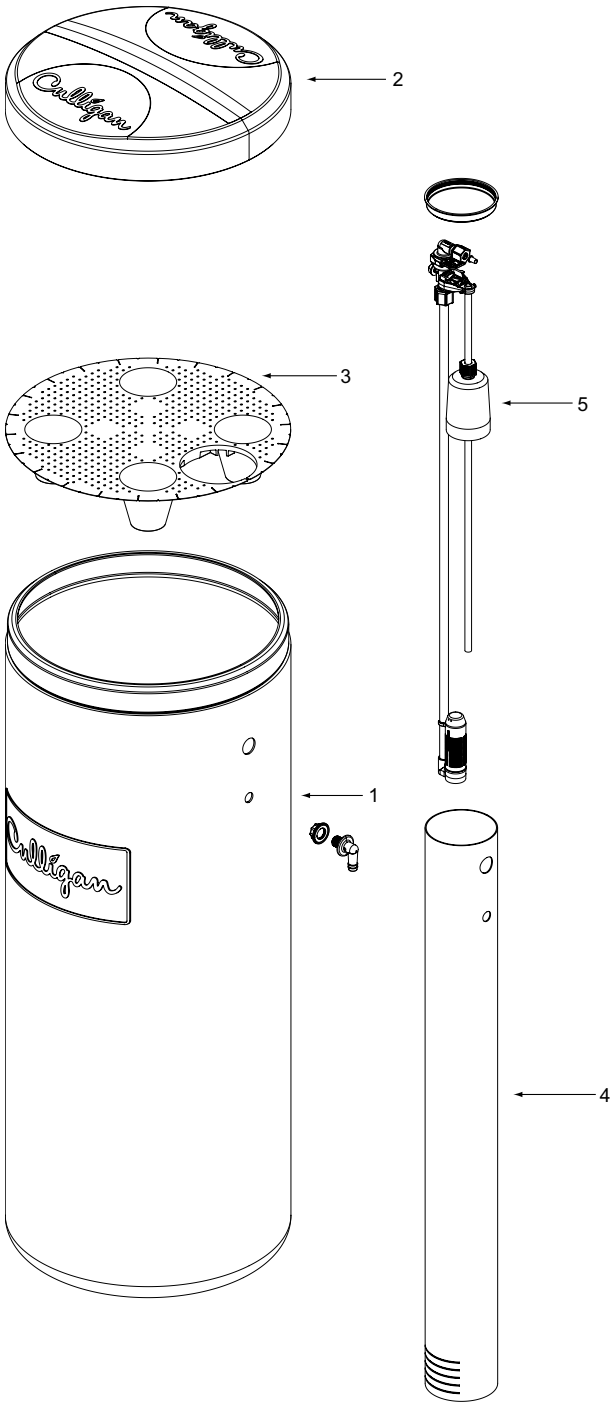


Item	Part No.	Description
A	01028037	CTM GBE Controller - Complete with front mounting bracket
B	01030100	Wall Mount Kit for Single Unit GBEs
C	01030101	Wall Mount Kit for Multi-Unit GBEs
1	01024325, A	GBE Enclosure
2	01020745, A	GBE Circuit Board
3	01020748, A	GBE Auxiliary Board
*	A	Wire Harness, 6ft, 5 conductor (Valve Mount)
	B, C	Kit, 12 ft. Wire Harness, CTM (Wall Mount)
*	01029554	Kit, Position Sensor, CTM
*	01014739	Wire Harness, Meter, 48” (Valve Mount)
	01017176, B, C	Wire Harness, Meter, 144” (Wall Mount)
*	01030179	Wire Harness, Ball Valve (Valve Mount) - Multi-Unit GBEs Only
	01030177, Qty 2 in C	Wire Harness, Ball Valve, 144” (Wall Mount) - Multi-Unit GBEs Only
*	01014897	24 VAC/60 Hz Transformer
*	01018844	Power Cord, 4 conductor
*	01030153	Kit, Front Mount GBE Bracket
*	01029171	Kit, Side Mount GBE Bracket
*	01029504	Kit, Softener Cartridge, Head Adapter and Single Cartridge
	P1028833	Softener Cartridge, 12 PK
*	01029507	Kit, Bracket and Gauges

*Not Shown.

18”x38” and 24”x40” Brine Systems

Figure 89. 18"x38" and 24"x40" brine systems.



Item No.	Qty.	Part No.	Description
—		01019525	18” x 38” Brine System Complete
—		01018720	24” x 40” Brine System Complete
1	1	01018716	Tank Repl 18” x 38”
1	1	01018718	Tank Repl 24” x 48”
2	1	01018717	Cover Repl 18”
2	1	01018719	Cover Repl 24”
3	1	01018713	Salt Plate Repl 18”
3	1	01018714	Salt Plate Repl 24”
4	1	01018708	Brine Well with Cap
5	1	01019526	Brine Valve Repl 18" - 24” (1/2")

NOTE! **18x38 and 24x40 brine systems may be used with 60k and 90k units; the 0.80 flow control must be removed from the brine valve for proper operation. 120k and larger should use 3/4” or larger brine valve.**

24”, 30”, 39” and 42” Brine Systems

Figure 90. 24” and 30” brine systems.

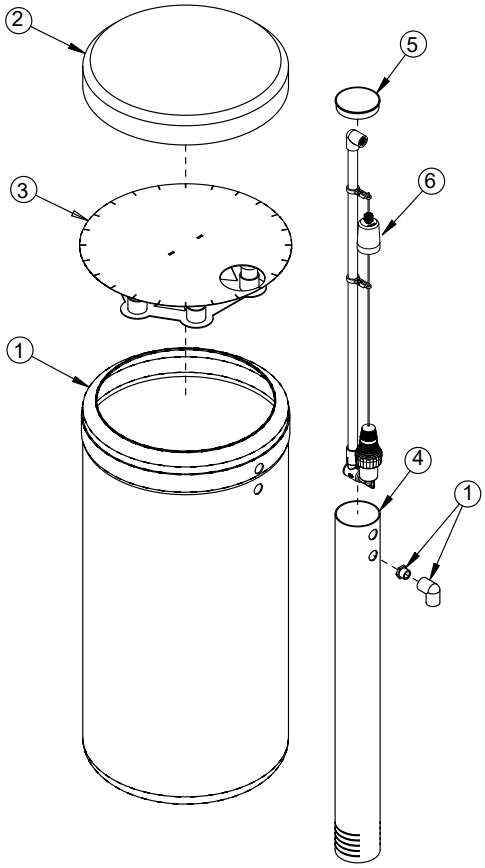
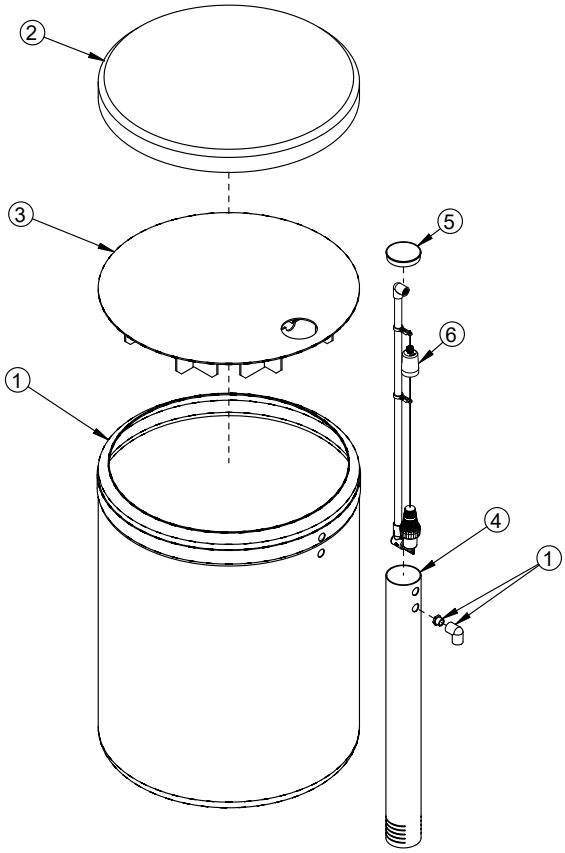


Figure 91. 39” and 42” brine systems.

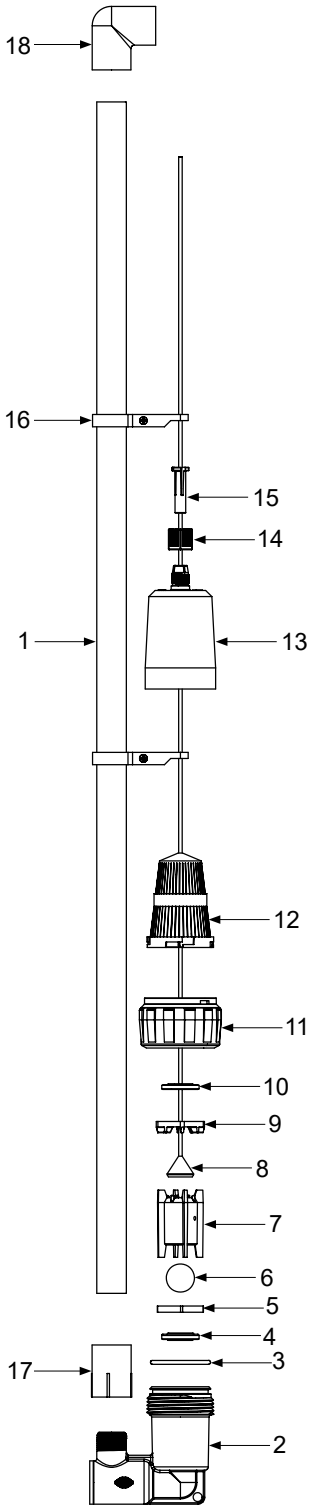


Item No.	Part No.	Description	Qty Req.
	01024800	24" x 50" Brine System Complete	
	01024801	30" x 50" Brine System Complete	
	01024802	39" x 48" Brine System Complete	
	01024803	42" x 48" Brine System Complete	
1		Tank	1
2		Cover	1
3	01019623	Salt Plate Repl 24"	1
	01019624	Salt Plate Repl 30"	1
	01019625	Salt Plate, Screen & Supports 39"	1
	01019626	Salt Plate, Screen & Supports 42"	1
4	01019621	Brine Well	1
5	01019622	Brine Well Cap	1
6	01029094	Brine Valve (3/4”), Replacement	1
—	01029095	Brine Valve Rebuild	
—	01019620	Upper Clamp Kit for Valve[1]	

[1]Clamp kit includes clamp, spacer, nuts, screws and washer.

3/4” Brine Valve Subassembly (484)

Figure 92. 3/4” Brine Valve Subassembly (484)

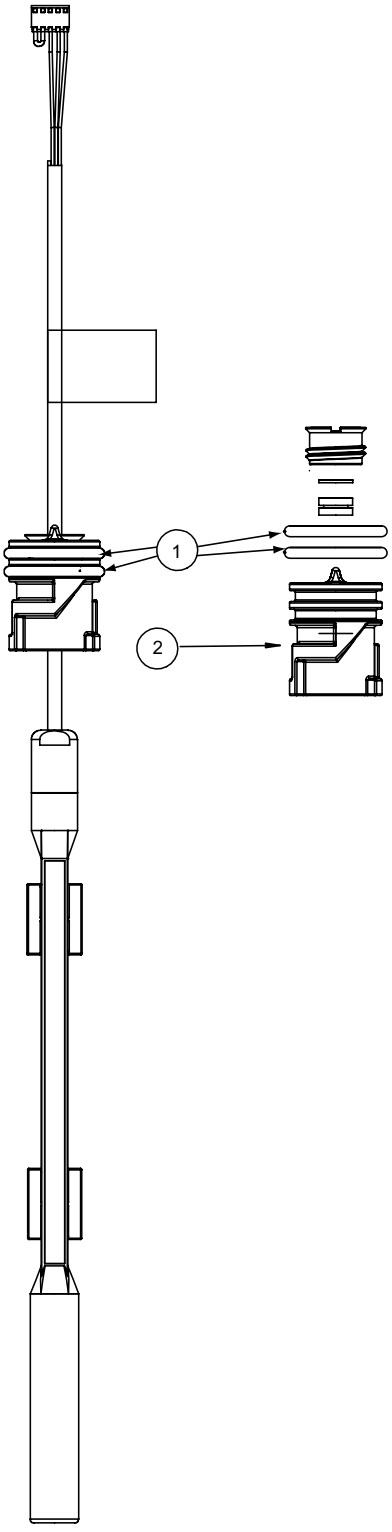


Item	Qty.	P/N	Description
A	—	01033059	Brine Valve (3/4”), Replacement
B	—	01033062	Brine Valve Rebuild Kit
1	1	A	3/4” PVC Riser Pipe
2	1	A	Body, Threaded
3	1	A, B	O-Ring
4	1	A, B	Seat Washer Bottom (Clear)
5	1	A, B	Lower Retainer
6	1	A	High Flow Air Check Ball
7	1	A	484 Cage, Long
8	1	A	Brine Valve Cone
9	1	A, B	Upper Seal Retainer
10	1	A, B	Seat Washer Top (Orange)
11	1	A	Cap, Threaded
12	1	A	Basket Diffuser
13	1	A	Bell Float with Locking Nipple
14	1	A	3/8” Compression Nut
15	1	A	Float Collet
16	2	A	Float Rod Guide
17	1	A	Coupling, Socket x FIPT Schedule 80 3/4”
18	1	A	3/4” NPT PVC Elbow

* Please note orientation of seals when disassembling and reassembling.

Aqua-Sensor Plug and Probe

Figure 93. Aqua-Sensor Probe.



Item No.	Part No.	Description	Qty
—	01025279	Aqua-Sensor Probe	
—	01029510	Aqua Sensor Extension Cable	
1	P1017434	O-Ring, Plug and Sensor, 10ea/Kit	2
2	01015122	Aqua-Sensor Plug	1

Limited Warranty

You have just purchased one of the finest water conditioners made. As an expression of our confidence in Culligan International Company products, this product is warranted to the original end-user, when installed in accordance with Culligan specifications, against defects in material and workmanship from the date of original installation, as follows:

For a period of THREE YEARS	**The entire metered model conditioner, including internal parts. The control valve internal parts. The brine valve and its component parts. Culligan-designed accessories limited to the flow meter, vacuum braker, pressure relief valve, plumbing adapter, GBE board, pilot valve and Aqua-Sensor Probe.**
For a period of FIVE YEARS	**The control valve body, excluding internal parts. The salt storage container internal components. The fiberglass wound container(s), if so equipped*. The salt storage container(s), if so equipped.**

*The tank must be protected by a vacuum breaker device as described in the unit's operating manual. Damage to the tank caused by vacuum is not covered by this warranty. The unit must be used in operating conditions that conform to Culligan's recommended design guidelines. This warranty will not apply if the unit has been modified, repaired or altered by someone not authorized by Culligan.

If a part described above is found defective within the specified period, you should notify your independently operated Culligan dealer and arrange a time during normal business hours for the dealer to inspect the water conditioner on your premises. Any part found defective within the terms of this warranty will be repaired or replaced by the dealer. You pay only freight from our factory and local dealer charges.

We are not responsible for damage caused by accident, fire, flood, freezing, Act of God, misuse, misapplication, neglect, oxidizing agents (such as chlorine, ozone, chloramines and other related components), alteration, installation or operation contrary to our printed instructions, or by the use of accessories or components which do not meet Culligan specifications. Refer to the specifications section in the Installation and Operating manual for application parameters.

Our product performance specifications are furnished with each water conditioning unit. TO THE EXTENT PERMITTED BY LAW, CULLIGAN DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE; TO THE EXTENT REQUIRED BY LAW, ANY SUCH IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE ONE-YEAR PERIOD SPECIFIED ABOVE FOR THE ENTIRE CONDITIONER. As a manufacturer, we do not know the characteristics of your water supply or the purpose for which you are purchasing this product. The quality of water supplies may vary seasonally or over a period of time, and your water usage rate may vary as well. Water characteristics can also differ considerably if this product is moved to a new location. For these reasons, we assume no liability for the determination of the proper equipment necessary to meet your requirements, and we do not authorize others to assume such obligations for us. Further, we assume no liability and extend no warranties, express or implied, for the use of this product with a nontaxable water source or a water source which does not meet the conditions for use described in the installation and operation manual(s) that accompany the equipment. OUR OBLIGATIONS UNDER THIS WARRANTY ARE LIMITED TO THE REPAIR OR REPLACEMENT OF THE FAILED PARTS OF THE WATER CONDITIONER, AND WE ASSUME NO LIABILITY WHATSOEVER FOR DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL, GENERAL, OR OTHER DAMAGES.

Some states do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Similarly, some states do not allow the exclusion of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. Consult your telephone directory for your local independently operated Culligan dealer, or write Culligan International Company for warranty and service information.

Culligan International Company
9399 West Higgins Road, Suite 1100
Rosemont, Illinois 60018

Appendix A - Basic Principles

What Is Hard Water?

Water is said to be hard when it carries too high a concentration of calcium and magnesium. Acceptable water hardness levels will vary depending on the application.

Why Should Hardness Be Removed?

Hard water causes scaling and etching which greatly impairs the life and efficiency of boilers, air-conditioning systems, cooling towers, water heaters, refrigeration plants and other equipment using water.

How Does It Work?

The components of dissolved minerals are called ions. They carry either a positive or negative charge. Hardness ions of minerals dissolved in water carry a positive charge. These positively charged ions (cations) are attracted to a synthetic softening material called ion exchange resin.

The heart of the softening system, therefore, is a deep bed of resin which draws calcium and magnesium ions, as well as ferrous iron, from the water as it passes through the resin bed.

Can The Resin Draw Out Hardness Ions Indefinitely?

No. During normal operation, the resin becomes saturated with positive ions and functions less efficiently. When hardness leakage occurs, the resin should be regenerated to restore its efficiency.

How Do You Regenerate Resin?

You regenerate a resin bed by removing the mineral ions through a process called ion exchange. This regeneration process occurs in four steps and takes approximately 80 to 90 minutes.

Backwash

During the backwash step, raw water flows rapidly upward (in reverse direction to the service flow) through the resin bed to expand the bed and flush out accumulated dirt, sediment and other sources of turbidity.

Brine Draw

The brine solution consisting of water and salt is drawn from a brine storage tank and allowed to flow slowly down through the resin bed. The brine solution removes the calcium and magnesium ions from the resin. This cycle can also be split into three “sub-cycles” which allow for the cost saving feature of brine reclaim.

Slow Rinse

Brine draw is then followed by a raw water slow rinse. This rinse step will slowly remove most of the remaining brine, exchanged calcium and magnesium ions from the resin. This cycle can also be split into three “sub-titles” which allow for the cost saving feature of brine reclaim.

Fast Rinse

Slow rinse is followed by a raw water flush, a very rapid down flow of raw water which removes the last traces of brine, and settles the resin bed.

How Often Must You Regenerate?

Frequency must be determined for each installation based on the amount of water usage, its degree of hardness and the amount of resin through which it flows. In some cases it is necessary to utilize a resin cleaner when the raw water contains iron. Contact your local Culligan dealer for more information.

How Do You Control The Regeneration Process?

The regeneration process for your commercial water softener is controlled automatically either on a predetermined time, volume, or external signal basis through the use of the Culligan Smart Controller with optional flow sensor. See the Installation chapter for further information. The regeneration process can also be initiated manually by the operator as required.

Appendix B - Hi-Flo 3/3e to CTM Conversion

1. Order the appropriate retrofit kit and plumbing adapter, see table:

Original Hi-Flo 3/3e Model	Single Meter HWB Downflow	Multi-Tank Meter Downflow
	Retrofit Kits*/Plumbing Adapters	
HC-60-1.5T	01029521 Kit	01029517 Kit
	01029500 (without ports) or 01029502 (with ports)	
HC-90-1.5T HC-120-1.5T HC-150-1.5T	01029522 Kit	01029518 Kit
	01029500 (without ports) or 01029502 (with ports)	
HC-120-2T HCE-120-2 HC-150-2T HCE-150-2 HC-210-2T HCE-210-2	01029522 Kit	01029518 Kit
	01029501 (without ports) or 01029503 (with ports)	
HC-300-2T, HCE-300-2	01029523 Kit	01029519 Kit
	01029501 (without ports) or 01029503 (with ports)	
HC-450-2T, HCE-450-2	01029524 Kit	01029520 Kit
	01029501 (without ports) or 01029503 (with ports)	

*Retrofit Kits include the CTM control valve, GBE controller and sizing kit.

2. When you remove the Hi-Flo 3/3e control valve, it is critical to keep the manifold from coming up with the control valve.
3. Mount the CTM control valve (See page 12).
4. Make sure, that the control valve has the correct eductor throat and nozzle (Table 5), brine refill control insert (page 21) and drain line flow control (page 22). Replace parts using the sizing kits, if necessary.
5. Insert the PRV (page 19) and vacuum breaker for metered control valves.
6. If possible, move the tank so that either the inlet or outlet pipe is lined up with the control valve. This can decrease the amount of plumbing needed in making the conversion. Reconnect the plumbing, drain line and brine line. Connect the PRV to a suitable floor drain independent of the drain line for emergency relief.
7. Install accessories, if applicable (page 36).
8. Attach tubing (page 23) and electrical connections (page 39 - page 40 and page 30 (for multi-tank systems).
9. Initiate Startup (page 43).

Appendix C - Aqua-Sensor Guidelines

Aqua-Sensor Application Guidelines

Table 20. Aqua-Sensor Application Guidelines

Parameter	Value
Hardness (gpg as $CaCO_3$)	7 - 99 (See Notes 1 & 2)
Soluble iron (ppm as Fe)	< 2 (See Note 3)
Manganese (ppm as Mn)	< 0.5 (See Note 4)
Hardness versus Salt Dosage	See Table 21 and Note 2
TDS to Hardness Index	TDS hardness (as $CaCO_3$) <10 (i.e., hardness must be at least 10% of TDS; see Note 5)
Temperature, °F	Any within equipment's operating range
Alum and phosphate	Anecdotal evidence indicates potential foulant; effect has not been confirmed experimentally
Commercial cell: distance between sensing and reference cell pairs	6 inches (See Note 2)

Hardness vs. Salt Dosage

Table 21. Hardness vs. Salt Dosage

Hardness (gpg as $CaCO_3$)	Recommended Salt Dosage (lbs/ft³)
7-10	5-6
10-15	6-8
15-25	8-9
25-50	9-11
50-75	11-12
75-99	12-16

Resin Bed Depth and Estimated Capacity per Inch at Various Salt Dosages (Downflow)

Table 22. Resin Bed Depth and Estimated Capacity per Inch at Various Salt Dosages (Downflow)*

Model	Resin Qty	Depth of Resin (in.)	Grains Capacity per inch (15 lb/ft³ salt dosage)	Grains Capacity per inch (6 lb/ft³ salt dosage)	Grains Reserve Capacity@15 lb/ft³ salt dosage	Grains Reserve Capacity@ 6 lb/ft³ salt dosage
60K	2	22.5	2667	1778	16002	10668
90K	3	25.8	3488	2326	20928	13956
120K	4	34.4	3488	2326	20928	13956
150K	5	34.0	4412	2941	26472	17646
210K	7	35.0	6000	4000	36000	24000

* 300K, 450K and 600K models were not designed to be used with an Aqua-Sensor.

NOTE! Although the Aqua-Sensor device has been used successfully on water with hardness as low as 3 gpg, there is an increased risk of missed signal (no regeneration) when the hardness is less than 6 gpg.

NOTE! For each tank diameter, there is a specific volume of resin in the space between the cell pairs. The capacity of that resin is influenced by hardness and salt dosage. Any combination of flow rate and hardness that causes the hardness front to pass through that volume of resin in less than 6 minutes will result in the sensor failing to detect the need to regenerate. In general, the volume of resin between the cell pairs on commercial units will permit a proper signal at or below the continuous flow rating when raw water hardness is less than 50 gpg. At higher hardness levels, it may be necessary to reduce the flow rate to assure adequate sensor signal duration.

NOTE! If precipitated or bound iron is present it must be removed before the softener.

NOTE! Manganese can deposit on the sensor electrodes, particularly on the upper pair, causing missed signals (no regeneration). Periodic cleaning may be needed to maintain satisfactory performance.

NOTE! Adequate signal strength has been demonstrated at ratios as high as 14, but signal strength diminishes with decreasing TDS to hardness index.

NOTE! Amount shown is based on the distance between the referencing cell pairs. Reserve capacity at salt dosages less than 15 lbs per cubic foot are shown for reference purposes only and may not provide adequate representation of actual capacity per inch of bed depth for operational purposes.

Appendix D - Operation Log

Use the log provided to maintain a record of the system operation.
This can be very helpful in identifying any operation problems or maintenance requirements.
Most of this information can be found by going to Diagnostics > Advanced Stats on the GBE Controller.

Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for more information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the Service Tech App.

Date	Soft Water Test Results	Unit ID (If Multiple)	Totalized Flow	Current Flow rate	Total Regens	Date of Last Regen	Regen Trigger

Index

Notes