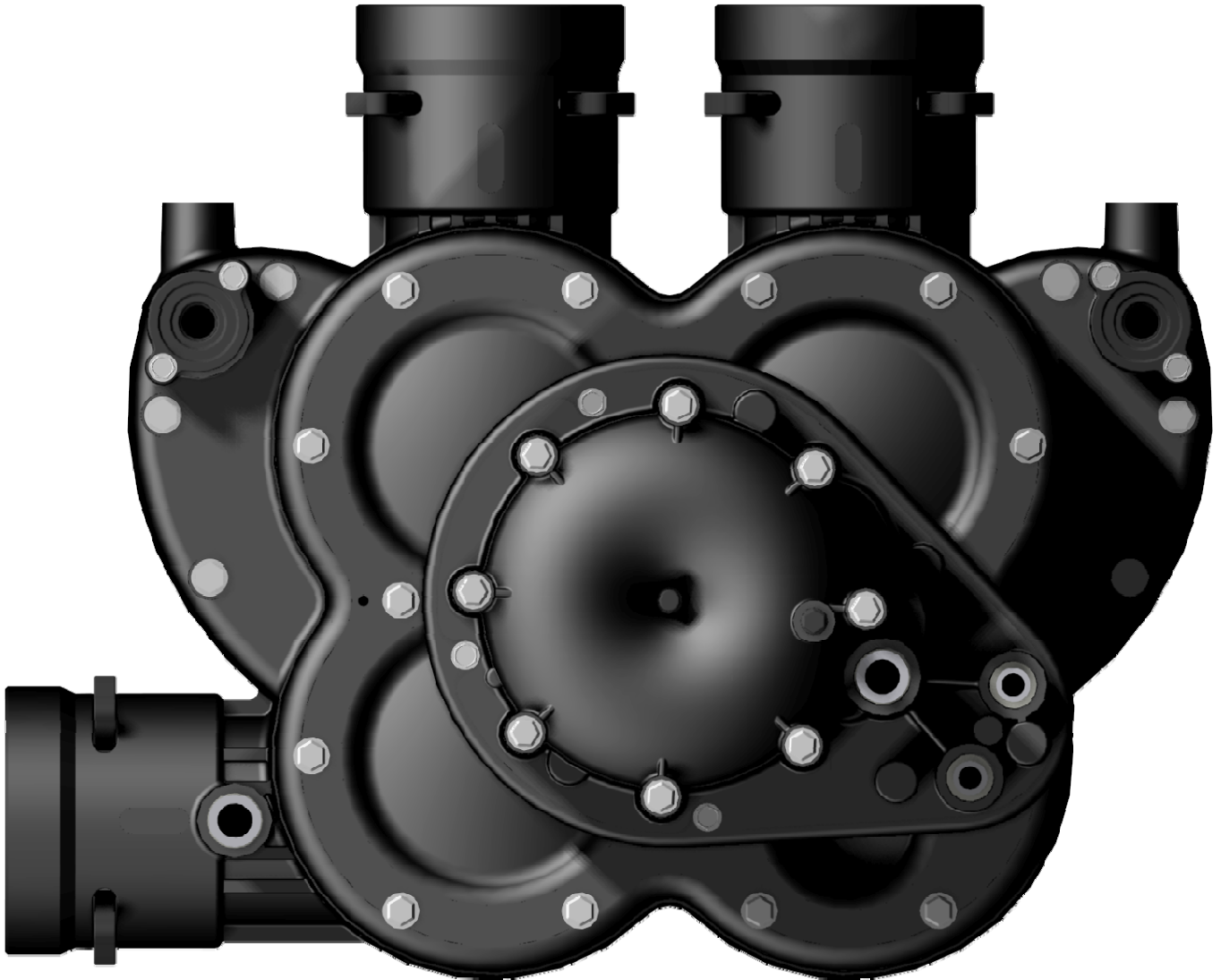




HYDRUS

Owners Manual

Hydrus Commercial Softening Systems



Models:

HS 118s
HS 121s
HS 124s
HS 130s
HS 136s
HS 142s

HS 218s OD
HS 221s OD
HS 224s OD
HS 230s OD
HS 236s OD
HS 242s OD

HS 318s OD
HS 321s OD
HS 324s OD
HS 330s OD
HS 336s OD
HS 342s OD

HS 418s OD
HS 421s OD
HS 424s OD
HS 430s OD
HS 436s OD
HS 442s OD

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The Hydrus Series Commercial Softeners

The benefits of softened water are many:

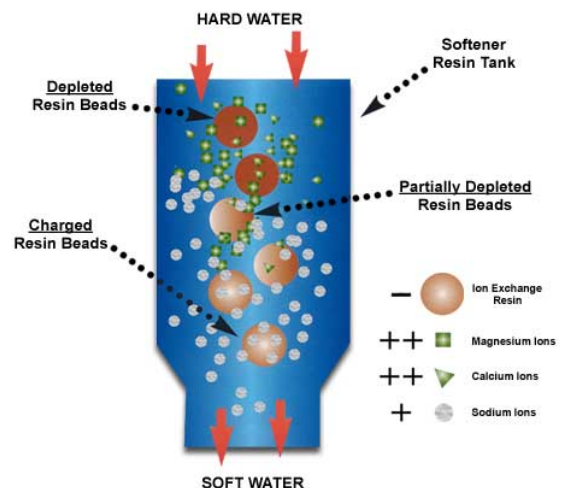
- Savings in soap products and cleaners
- Reduction or elimination of fabric softeners in laundering facilities
- Reduction of boiler chemical costs
- Reduction in rinse aids that prevent water spotting
- Elimination of scale, which inhibits heat transfer

However, the benefits gained by softening in a commercial environment far exceed chemical savings. Commercial facilities invest in high-quality equipment to carry out the daily tasks of operating that business, which is often very expensive. Dishwashers, boilers, laundering equipment and the entire plumbing system is at risk of hardness fouling that can severely limit the equipment's useful life and can be the cause of costly repairs.

How a Water Softener Works

Hard water contains calcium and magnesium ions. Kinetico softeners contain resin beads, which hold sodium ions. When hard water passes through the resin beads, the calcium and magnesium ions are exchanged for the sodium ions held by the resin. Following this ion exchange process, the water leaving is soft.

Once the resin bed is loaded with calcium and magnesium ions, it must be cleansed, or regenerated, so that it can continue to soften water. The salt in the brine tank mixes with water to provide a source of saturated brine solution for regeneration of the resin beads. The brine solution loosens the hardness minerals from the resin, which have built up. Lastly, the system fast rinses to drain, flushing the hardness minerals away. The regenerated resin beads hold sodium ions, making them ready for a new cycle of exchanging sodium ions for more calcium and magnesium ions.



Unlike other softeners, the Kinetico multiplex Hydrus systems regenerate with soft water. Just as there are differences in cleaning with soft water, there are differences in regenerating with soft water. The system uses only clean, soft water to carry out the regeneration and to make the saturated brine solution in the salt storage tank. This decreases the loading on the resin in general and preserves the virtually unloaded resin portion of the bed at the bottom of the tank. This is one of the ways countercurrent regenerating softening systems provide the softest water in the industry.

How to use soft water

Use pure soap products.

Most leading brands of laundry soaps and cleaners contain large amounts of detergents. Harsh chemicals in these detergents are necessary when using hard water. Their use can be reduced or eliminated when using soft water. Kinetico recommends the use of phosphate-free cleaners and detergents. If the use of standard detergents is to be continued, the amount used should be reduced significantly. A Kinetico dealer can provide more information and recommended detergent amounts.

Use less soap and cleaners.

Hardness minerals in water interfere with soap's cleaning ability. Once removed, soap goes farther. Even with less soap, more suds and cleaner results are obtained.

Hydrus Softener Design Features

The Kinetico Hydrus System has many design features that make the system easy to operate and adjust.

- Available in multiplex, countercurrent regeneration design
- Automatic operation
- Low leakage
- High flow
- Low maintenance requirements

Hydrus softeners are available in either a simplex or a multiplex configuration. Simplex systems are used in less critical softening applications, where the hard water by-pass aspect is not a risk. The multiplex configuration uses soft water for the entire regeneration sequence, and there is no hard water by-pass. Only softened water leaves a multiplexed Hydrus system.

Automatic Operation

Once the Hydrus Softening System has been installed and set up, operation is completely automatic. The standard, most efficient configuration is to have a flow meter in line that monitors the total amount of water that is softened. Once the set volume of water has been softened, it signals a control device called the Smart Start™ Controller. The controller in turn signals the Hydrus valve to regenerate. The Hydrus valve automatically carries out all of the regeneration operations.

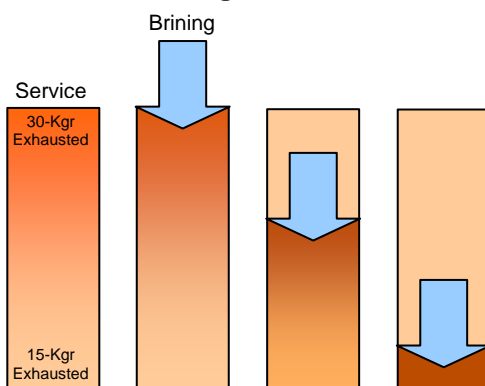
Countercurrent Regeneration

Understanding the value of countercurrent regeneration starts with an understanding of the process by which an ion exchange media is exhausted. Following the service flow through the media bed, the greatest concentration of exchanged ions is at the entry point of the media bed. As the flow path is followed through the depth of the media bed, a concentration gradient is formed.

The concentration gradient works in favor of countercurrent regeneration. By reversing the flow through the exhausted bed, regenerating from lowest to highest concentration, it allows regenerant chemicals to be introduced first to the media that is least exhausted and then, gradually, to the completely exhausted media at the service entry to the tank.

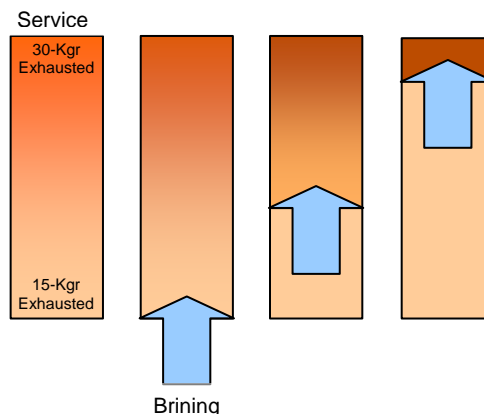
The benefits of this type of regeneration include enhanced efficiencies as well as improved product quality. The overall salt consumption of a countercurrent system can be 40-50 percent less than a similar co-current system.

Co-Current Regeneration



During **co-current** regeneration, hardness ions are pushed from the area of highest concentration through the area of least concentration, like sweeping a pile of dirt over a swept part of the floor. To achieve complete regeneration, a high dosage of salt is required, increasing costs.

Regeneration is most efficient when carried out in the **countercurrent** direction. First, the least contaminated part of the bed, followed by the most. In this way, the bottom part of the bed maintains a high quality standard, providing a polishing step just prior to the water leaving the bed. Salt is conserved, and higher quality water is the result.



Counter-Current Regeneration

Low Leakage

Leakage is a term used to describe the amount of hardness that passes through the softener and leaves as hardness in the effluent to the system. The use of countercurrent regeneration drastically reduces leakage. If required, Hydrus softeners can be configured to provide hardness less than 1.0 mg/L, as calcium carbonate.

High Flow Rates

Kinetico's Hydrus Softening Systems are designed to accommodate the high flows demanded by today's growing businesses. Despite its compact size, the system provides softened water when needed, on demand.

Flow rates through a system and pressure drops are closely related. As the flow rate increases through a softening system, the pressure drop increases. Kinetico Hydrus Softening Systems are designed specifically to minimize pressure drop while maximizing flow rate. The following features are built into every Hydrus Softening System:

- High flow distributors - provide minimal pressure loss through system
- Dual layer under-bedding, where beneficial - improves water distribution through system, increases salt and water efficiency and reduces pressure loss

High Capacity

Some manufacturers rely upon high salt dosing to maximize capacity, but this practice leads to higher salt usage and diminished efficiency. Kinetico combines the latest technologies with solid engineering practices to provide the most efficient softening system possible. With Kinetico softening systems, most applications require salt dosing of only five pounds per cubic foot of resin, compared to 15 and even 25 pounds of salt per cubic foot in competing systems.

In addition to the use of countercurrent regeneration to extend times between regenerations, high-capacity media is used. This media is a premium grade gel cation exchange resin, which meets the performance requirements of commercial water treatment.

Flow dynamics have an effect on capacity as well. The distribution system, the width versus the height of the media tank, flow rate and retention time all play a factor in the capacity of the resin. A balance is struck between all of these factors to provide the leading softening system in the industry.

Alternative brining configurations, electing capacity over efficiency, are easily set on Hydrus systems. Kinetico professionals are trained to know which is best for each installation.

Low Maintenance Requirements

There are virtually no periodic maintenance requirements of a Hydrus Softening System. The brine tanks require periodic filling. The state, local or building code may require daily inspection to check for leaks and verify system operation. Although all systems are supplied with power supplies to the Smart Start controller, the system can run on battery power alone. The batteries also serve as a backup power supply. The batteries should be replaced periodically.

On a less frequent basis, the performance of the system can be verified for hardness removal. Initially, this test should be run more often in order to optimize brine settings.

Over the system's lifetime, the resin may begin to lose capacity, and the regeneration frequency may have to be stepped up. Indication of aging resin will show up in periodic hardness testing. Under general usage, the media is expected to last five to ten years. Deterioration is due primarily to attack by chlorine. If chlorine levels are regularly above 1.0 mg/L, thought should be given to the addition of carbon pre-treatment to the Hydrus Softening System.

System Sizing

The system has been sized around the specific demands to be placed upon it in terms of peak flow rate, average flow rate and hardness. If the softener is intended for a more seasonal application, consideration is given to ensure the most efficient flow of soft water.

The peak flow rate, expressed in gallons per minute (gpm), is the maximum flow rate that is required for the operation of a facility running at a substantial percentage of its maximum effective water demand. Equipment selection, carried out by factory-trained Kinetico professionals, is made by fixture counts, data obtained from equipment manuals and incoming pipe sizes.

The average flow rate, expressed in gallons per day (gpd) or per month, can be used to measure the normalized flow demand. A monthly flow rate represents a 30-day cycle of daily flow, which tends to be a more accurate estimation of average flow. These values are obtained from water meter readings and water bills.

The remaining factor used in properly sizing a Kinetico Hydrus system is the hardness of the water to be treated. Hardness is a measure of the calcium and magnesium salts dissolved in the water. The positively-charged portions of these salts, or cations, constitute the loading on the system used to soften the water. Some contaminants, such as iron and manganese, also exchange and contribute to the “compensated” hardness of the water.

Operation

This section is provided to instruct on the operation of tanks, controls and brining systems. Kinetico's Hydrus Softening Systems are an assembly of five major sub-assemblies: media tank, remote meter, Smart Start controller, the brining system and the Hydrus valve itself. Together, they provide softened water efficiently, reliably and continuously. The Kinetico professional, if enlisted, has inspected the installation and has made all of the proper adjustments to the system to ensure proper installation, startup and operation.

Concepts

Kinetico's Hydrus Valve is designed to control commercial, industrial and municipal water treatment equipment. The valve controls all service and regeneration functions for a single tank. A separate valve is required for each tank.

Level 1-2 Assembly

The level 1-2 assembly controls the service and regeneration cycles for the entire valve.

Starting Regeneration

External water flow to the "Start Port," as shown on page 24 starts the regeneration. This water can come from opening a hand valve, a solenoid valve or some similar device. The regeneration start requires a flow of about 0.5 gpm. This flow is regulated internal to the valve, so the supply must be able to meet or exceed this flow rate. The length of time to start the cycle is dependent on the length of the overall cycle. Times can range from five to 20 minutes.

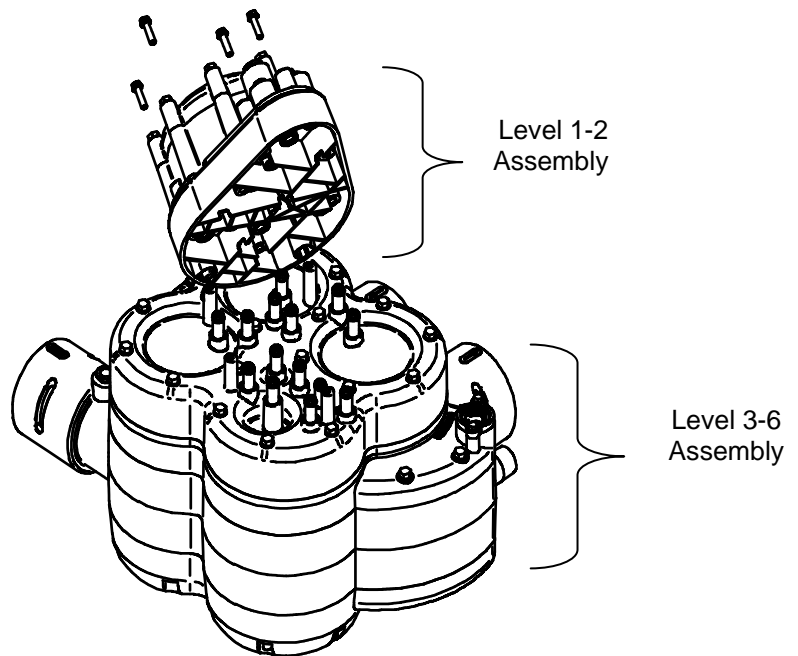
The regeneration start water enters the level 1-2 assembly by means of a ¼" tubing connection. It spins a turbine, which advances the control disc. As this disc advances, the regeneration control valve opens. This allows flow back up to the level 1-2 assembly, passing the regeneration flow control and the regeneration nozzle. Once the regeneration control valve opens, the external water flow through the ¼" tubing can stop. The nozzle directs the flow past the regeneration turbine, keeping the control disc advancing through the regeneration cycle and driving the regeneration gear stack.

Regeneration Gear Stack

The regeneration gear stack controls the length of regeneration. Depending on the gearing used, a regeneration can take between 20 minutes and 210 minutes. The regeneration gear stack drives the regeneration drive pawl, which drives the control disc.

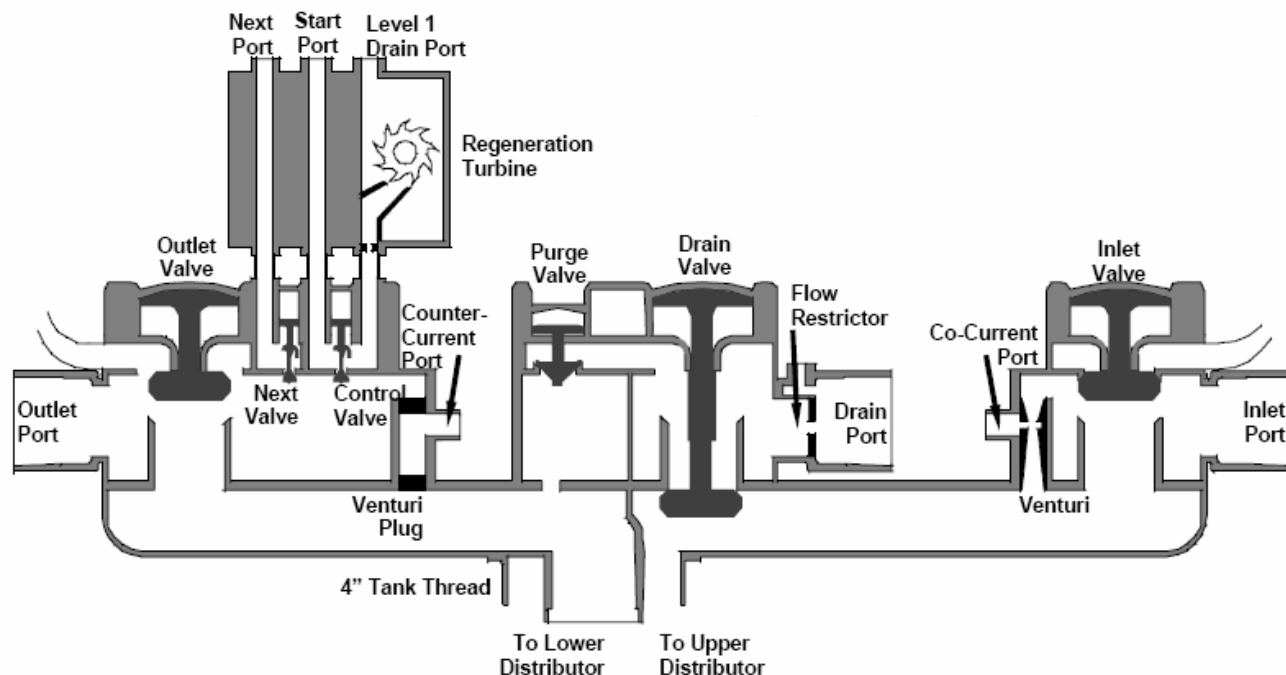
Control Disc

The control disc pressurizes or vents holes in the ceramic disc. These ceramic disc holes are connected to servo valves located in the level 3-6 assembly. Level 2 assists in routing the pressure signals from the ceramic disc holes to the proper location on the level 3-6 assembly. The control disc determines what function the module takes. There is a different control disc for each valve configuration: simplex, multiplex, softener and filter. The control disc is selected based on the tank's function.



Level 3-6 Assembly

The level 3-6 assembly holds the servo valve, valve seats, venturi and backwash flow control. Also included within this assembly is the capability of a raw water by-pass. This is located on level 5A. The raw water by-pass is used in simplex systems, allowing untreated water to be diverted to service during a regeneration. There are six valves: inlet valve, outlet valve, drain valve, purge valve, regeneration control valve and start next valve. The following graphic shows the general scheme and operation of this remarkable valve.



Simplex Systems

The Kinetico Hydrus system has two basic configurations: simplex and multiplex. The simplex configuration is straightforward in its operation. As a single tank, the regeneration occurs without affecting any other tanks or sub-systems that may be present. Raw water is by-passed around the treatment system during a regeneration. Raw, untreated water is also used for the regeneration process and to refill the brine drum.

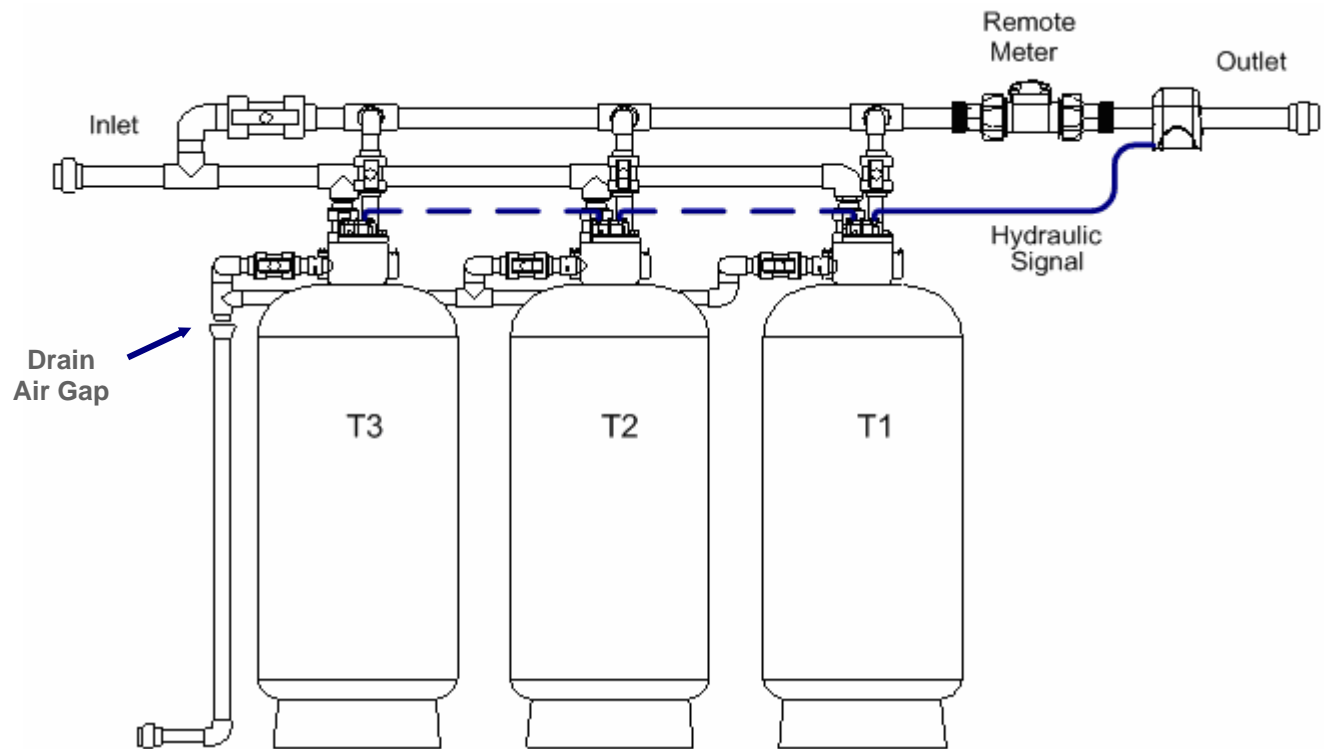
Multiplex Systems' Regeneration Sequence

The multiplex systems' configuration differs from simplex systems primarily during regeneration. Sizing of the multiplex systems carried out by Kinetico professionals consider these differences in order to meet the treatment goals. In general, multiplex systems are used for applications that are more critical, where a continuous supply of soft water is required, where high flow is required or where softened water specifications require countercurrent regeneration with soft water.

During service, all of the tanks are operating at equal flow rates in parallel. The softening media removes hardness and eventually approaches exhaustion. Taking several factors into account, a regeneration is initiated based upon time in service or the volume of processed water, depending on whether the unit is equipped with a flow meter or not.

To provide the most efficient, productive regeneration, Hydrus multiplex systems use softened water for all four stages of the regeneration and to refill the brine tank. For a better understanding, a triplex Hydrus system is used in the following example. The following steps describe the regeneration sequence of this three-tank system: T1, T2 and T3.

1. The remote meter measures the volume of water processed and produces a dry contact to activate the Smart Start controller, which produces a hydraulic signal.
2. The lead tank receives the hydraulic signal from the Smart Start Controller at the Start Port, which spins a turbine and advances the control disc to start the regeneration.



3. T1 shuts down, and a regeneration on this tank begins. The two remaining tanks continue to soften water for distribution and also supply the softened water required for the regeneration of T1. The tanks are sized so that the water system demand and the water used for regeneration can be met by the two tanks in service. The inlet valve closes, but the outlet valve remains open. This allows soft water from T2 and T3 to be used for regeneration.
4. After T1 is regenerated, the Start-Next valve opens and sends a hydraulic signal to T2. At that point, T2 shuts down and a regeneration on it begins. T1 and T3 supply water for distribution and also supply the softened water required for the regeneration of T2.
5. The process continues until all the tanks in the train have regenerated. The Start-Next port in T3 is plugged and not used.

Plumbing¹

It's important that the Hydrus system be plumbed with isolation and by-pass valves and approved materials using approved methods. It's implicit that the system is installed with proper fittings and is provided with isolation and expansion capabilities. Plumbing specification is outside the scope of this manual and subject to local code.

Media Tanks

The media tanks are made up of several components: the tank itself, upper distributor, media, underbedding, lower distributor and riser. The raw water flows into the valve and through the upper distributor at the top of the tank just beneath the valve. It flows through the media where the ion exchange process takes place. The water

¹ See installation manual for Hydrus-specific plumbing requirements, p/n 12296.

is now softened. At the bottom of the media bed, there are two different grades of underbedding. The water flows through the underbedding and into the distributors. Lastly, the water flows up the riser tube and out the valve to service.

Upper Distributor

The upper distributor prevents channeling of the inlet stream into the top of the resin bed. A plastic molded distributor is attached to the bottom of the Hydrus valve.

Media

High capacity, non-solvent resin is used in Hydrus softeners.

Underbedding

In order to ensure proper distribution, minimal pressure drop and to protect the distributors from fouling, two different grades of underbedding may be used. Only fine grade gravel is required for small tanks.

Lower Distributor

The lower distributors are of a hub and slotted lateral design. This provides excellent flow distribution through the resin bed. The high surface area of the laterals minimizes pressure loss through the system. On some laterals, there may be blocked off slots, or slots not opened fully. This design assures proper flow and even distribution of the water through the resin bed. The polypropylene construction of the distributor assembly gives it excellent durability.

Riser Tube

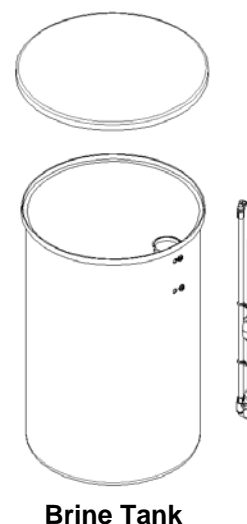
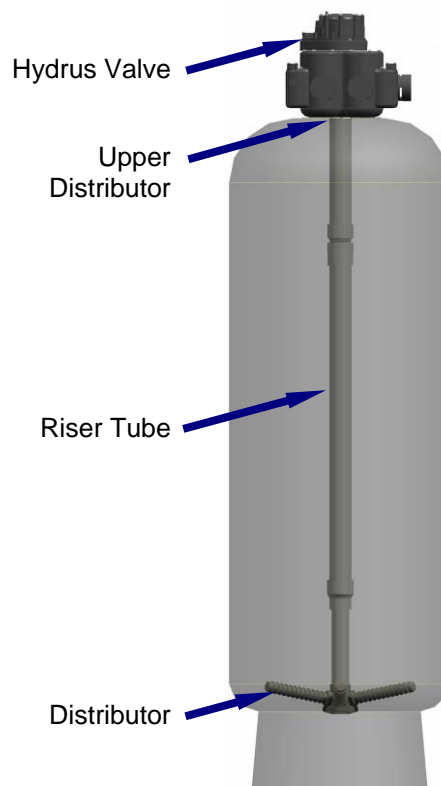
A riser tube is used to connect the lower distributor to the control valve. The riser tube is 2.0" in diameter and cut to length, depending upon the tank size.

Brining System

The brining system supplies the saturated brine required to regenerate the softening resin. It is made up of the tank, brine valve and connective plumbing. Conventional Hydrus softening systems employ a separate brine tank for each softener.

The tanks come in various sizes, typically sized based upon the volume of the media to be regenerated. Larger tanks paired with smaller softeners can extend the time between required maintenance. The tanks are designed to ease the loading of softener grade salt. They're automatically filled with water to dissolve the solid salt into a saturated liquid form. All brine tanks include an overflow connection to drain an accidental tank overflow.

Each brine tank includes a brine valve. It's used to adjust the volume of brine to be used each regeneration. Each tank, salt setting combination has its own required setting. The setting is made by Kinetico installers and should not require any operational maintenance. Should the brine tank or softener have to be moved or modified in any way, or if the hardness of the influent water changes, an adjustment may be required. A table is on page 13 of this manual that provides instruction on the adjustment of brine valves.



Brine Tank

Hydrus softeners are generally set up for two different salt dosages. They are set up for either high efficiency or for high capacity. Further, the salt dosage is based upon the configuration of the system, whether simplex or multiplex.

Multiplex systems, which all regenerate countercurrently with soft water, are the most efficient. This holds regardless of setting. Efficiencies are easily compared by considering the grains of hardness exchanged versus the number of pounds of salt used per regeneration. The values run from as low as 2,000 grains/pounds salt on a simplex unit adjusted for high capacity to as high as 4,340 grains/pounds salt for a multiplex system adjusted for high efficiency.

lb/ft ³	18x65	21x62	24x65	30x72	36x72	42x72
5.0	4,340	4,000	4,100	4,308	4,306	4,304
7.5	3,467	3,200	3,283	3,444	3,444	3,444
10	2,500	2,500	2,500	2,500	2,500	2,500
15	2,000	2,000	2,000	2,000	2,000	2,000

Efficiency, grains/pounds salt

Central Brining

Central brining, a less efficient option, is available on Hydrus systems. Election to central brine is typically based on space considerations. More brine tanks take up more space, and larger systems require more salt. A brine tank for each softener can take up a considerable amount of floor space.

With larger systems, the salt demand may be high. If a softening system treated water that had 10 grains of hardness and had an average flow rate of 100 gpm, the total amount of salt used each day would be approximately 350 pounds, even at high efficiency. This would be on a Hydrus HS 330s OD. If salt were purchased at a weight of 40 pounds per bag, then approximately nine, 40 pound bags of salt would be required by the system each day.

Central brining can be a large brine tank used to supply three small media tanks all the way up to a saturator, used to supply a large high-flow system. A good rule of thumb to use is to calculate the amount of salt used every two weeks. In the example above, that's 2 ½ tons. If the value is approaching 25 tons, then a saturator that can receive full truck loads should be considered. Buying salt in this way can save time in loading and unloading and money due to buying in bulk.

The Hydrus Valve



The Hydrus valve is at the heart of Kinetico's commercial high-flow systems. It's a multi-port valve that controls system flow through a single tank. It is designed to link to other Hydrus valves, making expansion to multi-tank configurations uncomplicated. The Hydrus valve is a revolutionary design that allows enormous flexibility in system configuration.

The Hydrus uses water pressure to move its internal pistons through service and regeneration cycles. It doesn't use electrical components; therefore, it is ideally suited for installation in the harshest environments. All regeneration sequences and timing are managed via an on-board hydraulic control disc.

The Hydrus uses a hydraulic start signal to initiate a regeneration. The Hydrus control valve controls the following functions: service, regeneration, brine tank filling and kick-next in the case of multiplex systems. If central brining is employed, the brine tank filling is done by way of a pressurized feed. Regeneration sequences differ between the countercurrent regenerating multiplex systems and co-current regenerating simplex systems. The service cycles are the same.

System Configuration

If an authorized Kinetico professional was not available to ensure a compliant installation, the following guidelines must be followed:

- The system must be complete and parameters set to factory-specified values
- The system and installation must comply with federal, state and local laws
- The system is not intended to be used for treating water that is microbiologically unsafe or of unknown quality without disinfection before or after the system
- The procedure for sanitizing the softener found on page 25 must be followed after installation or service
- The system is intended to be operated within the specified parameters given in this section, including the following:
 - The system is intended to be installed indoors, on a level surface where the temperature is controlled between 35° and 120° F and operated at an effluent pressure of at least 35 psi and an influent pressure not exceeding 125 psi.

Failure to follow the instructions in this manual, or to observe proper installation procedures may void the warranty, cause bodily harm, cause the system to operate improperly or not at all and/or cause damage to the system. Compliance must also be achieved in a modification of the original installation. Consult a Kinetico professional or the appropriate technical documentation if a modification or an alteration is planned or carried out.

Sizing

A proper salt setting is dependent upon two factors: the hardness and iron concentration in the feed water, and the desired water softness. There are two different salt settings: the high capacity setting and the high efficiency setting.

For a multi-tank system:

- The high capacity salt setting should be used if the feed water iron is higher than 1 mg/L.
- The high capacity salt setting should be used if the softened water hardness needs to be less than 4 mg/L,
- The high efficiency salt setting is used when the soft water can have 4 – 10 mg/L hardness as calcium carbonate, if the feed hardness is 15 gr/gal or less.
- The high efficiency salt setting is used when the soft water can have up to 20 mg/L as CaCO₃ when the feed water hardness is up to 40 gr/gal.

A simplex softener:

- It should not be used to provide soft water with less than 1 mg/L hardness.
- The high capacity salt setting is used to provide soft water with 2 – 9 mg/L hardness.
- The high capacity setting should be used when the feed water iron is above 1 mg/L.
- The high efficiency setting is used when the desired soft water hardness can be greater than 10 mg/L.

As discussed, resin capacity is subject to several factors: the life of the media, additional cation loading not including iron and manganese, and others. Caution can be applied by including a margin of safety to ensure a constant supply of soft water for critical applications. A table is given on page 15.

Compensated Hardness Equation:

$$\frac{\text{mg/L Hardness, as CaCO}_3}{17.1} + 3 \times \text{mg/L iron} + 5 \times \text{mg/L manganese}$$

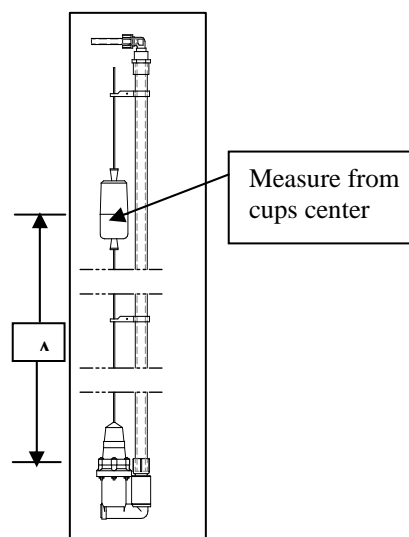
$$= \text{Compensated Hardness, gr/gallon as CaCO}_3$$

The equation above is used to determine the compensated hardness. It provides a method for converting iron and manganese into an equivalent hardness.

Brining System

Following the chart below, set the brine valve by raising or lowering the float cup:

Float Setting (A)				
Salt Dose, in Lbs	Brine Drum Size			
	24x50	30x48	39x60	50x60
25	10.1"	6.6"		
30	12.1"	8.0"		
38	15.3"	10.1"	6.0"	
40	16.1"	10.6"	6.3"	
45	18.1"	11.9"	7.1"	
50	20.1"	13.3"	7.8"	
60	24.2"	15.9"	9.4"	6.0"
75	30.2"	19.9"	11.8"	7.5"
80		21.2"	12.5"	8.0"
90		23.9"	14.1"	9.0"
120		31.8"	18.8"	12.1"
135			21.2"	13.6"
180			28.2"	18.1"
270				27.1"

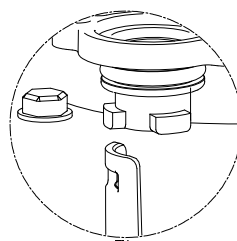


The following chart provides a guide to the required salt settings for a given tank size. Obtain the number of pounds required from the table below and then use that value to set the height of the float cup.

Salt Dose in lbs (Per Tank)					
Tank Size	ft³ of Resin	Simplex System		Multi-Tank System	
		10-pounds/ft³	15-pounds/ft³	5-pounds/ft³	7.5-pounds/ft³
18x65	5	50-pounds	75-pounds	25-pounds	38-pounds
21x62	6	60-pounds	90-pounds	30-pounds	45-pounds
24x65	8	80-pounds	120-pounds	40-pounds	60-pounds
30x72	12	120-pounds	180-pounds	60-pounds	90-pounds
36x72	18	180-pounds	270-pounds	90-pounds	135-pounds
42x72	26	260-pounds	390-pounds	130-pounds	195-pounds

Venturi Installation

1. Identify the valve body style. The valve body is either a countercurrent or a co-current style. An arrow, next to the inlet-side venturi, points to a part number. Part number 10906 is the countercurrent valve body and number 10905 is the co-current valve body.
2. Locate the proper venturi cavity for installation. The ports are marked "CO" for simplex systems and "COUNTER" for multi-tank systems.
3. Remove the two screws holding the venturi cover in place. Install the venturi into the venturi cap. Insert venturi & venturi cap into the Level 5A.



The following table identifies which venturi to use in each valve, depending upon tank size whether it's a simplex or a multiplex system:

Tank Size	Simplex, Co-Current Regeneration	Multiplex, Countercurrent Regeneration
18 x 65	Brown	Orange
21 x 62	Brown	Orange
24 x 65	Brown	Orange
30 x 72	Brown	Blue
36 x 72	Yellow	Red
42 x 72	Yellow	Gold

Central Brining

The following information is given for the conversion to central brining. So long as the brine saturator is providing a continuous, saturated supply of brine, the Hydrus valve will automatically draw the appropriate amount of brine. If a large-scale brine saturator is in place or put in place, advice and parameters for setup and configuration will come from the manufacturer of that product and may vary from manufacturer to manufacturer.

Brine Line Check Valve

In systems that are to use one brine tank to supply multiple Hydrus valves, a few provisions are required. First, the normal refill operation of the brine tank must be changed. A $\frac{3}{4}$ " diaphragm-style check valve on the brine line for each Hydrus valve is required. This will prevent other valves from feeding soft water into the brine line when one unit starts drawing brine. A high quality diaphragm check valve is recommended.

Brine Valve

Since water will not be automatically added by the Hydrus valve, central brine tanks will require an independent source of refill, which must be from a soft water source. Usually, the common softener effluent line is used and piped to a fill valve and storage tank. This modified refill should allow for the addition of water at the top of the brine tank, allowing maximum contact time with the solid salt. This will reduce the time required to make brine.

Venturi Setting

The final change to a normal Hydrus set-up is the modification of the venturi. Based on the central brining option, the venturi selection may change to help accommodate this type of brine system. The venturi installation instructions are outlined above. Based on the following tank sizes, the following venturi should be applied:

	18x65	21x62	24x65	30x72	36x72	42x72
Venturi Selection	orange	orange	orange	orange	orange	blue

Remote Meter

The remote meter monitors the soft water service flow at the control outlet with the meter impeller being the only in-stream moving part. As the turbine turns, its rotation drives a water-lubricated gear train in the dome of the meter. As the output shaft at the top of the meter rotates, the cable connection to the timer clutch assembly turns the meter program wheel on the face of the timer counterclockwise until it reaches the regeneration stop position. Regeneration may occur immediately or on a delayed basis depending upon system requirements.

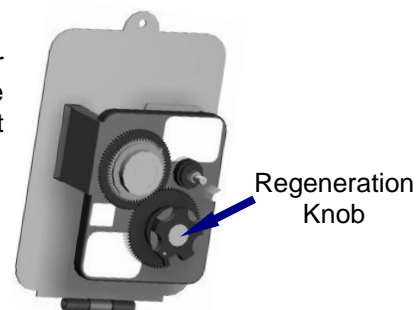
Kinetico modifies the meter from its original configuration to allow it to interface with the Smart Start controller, which directs the Hydrus valve's operation.

Manual Initiation of a Regeneration Pulse

Turn the manual regeneration knob clockwise until the Service Position Indicator dot is in the 3:00 position. This slight movement (approx. 30° advance) of the manual regeneration knob engages the program wheel and starts the reset motor. The black center knob will make one revolution in six minutes.



Important: Always disconnect the meter cable before opening the meter timer assembly.



Setting the Meter

1. Calculate the system's Gallons Set Point.
2. Set the meter by lifting the inner (clear) dial of the "Meter Program Wheel" until the 'White Dot' aligns with the desired capacity.

Gallons Set Point

The gallons set point tables represent the maximum capacity of the Hydrus softeners. The simplex table is based on typical resin capacity. The multiplex tables are based on demonstrated capacity in the softener NSF/ANSI STD 44 testing, which is to a 1.0 gpg leakage point.

For demanding application, such as desired hardness less than 3 mg/L or continuous flow, an engineering safety factor should be applied. The following table may serve as a useful guide:

Desired Hardness, mg/L CaCO ₃	Safety Factor Multiplier	
	Intermittent Service	Continuous Service
< 1	0.75	0.60
1 – 3	0.80	0.70
4 – 9	0.85	0.75
10 – 20	0.90	0.80
> 20	0.95	0.85

The following tables provide the maximum gallons set point of each system available versus the grains per gallon (gpg).

	High Efficiency Brine Dose (10 Pounds/ ft ³ Salt Setting)						High Capacity Brine Dose (15 Pounds/ft ³ Salt Setting)					
GPG	HS118s	HS121s	HS124s	HS130s	HS136s	HS142s	HS118s	HS121s	HS124s	HS130s	HS136s	HS142s
50	2.50	3.00	4.00	6.00	9.00	13.0	3.00	3.60	4.80	7.20	10.8	15.6
45	2.78	3.33	4.44	6.67	10.0	14.4	3.33	4.00	5.33	8.00	12.0	17.3
40	3.13	3.75	5.00	7.50	11.3	16.3	3.75	4.50	6.00	9.00	13.5	19.5
35	3.57	4.29	5.71	8.57	12.9	18.6	4.29	5.14	6.86	10.3	15.4	22.3
30	4.17	5.00	6.67	10.0	15.0	21.7	5.00	6.00	8.00	12.0	18.0	26.0
25	5.00	6.00	8.00	12.0	18.0	26.0	6.00	7.20	9.6	14.4	21.6	31.2
20	6.25	7.50	10.0	15.0	22.5	32.5	7.50	9.00	12.0	18.0	27.0	39.0
15	8.33	10.0	13.3	20.0	30.0	43.3	10.0	12.0	16.0	24.0	36.0	52.0
10	12.5	15.0	20.0	30.0	45.0	65.0	15.0	18.0	24.0	36.0	54.0	78.0
5	25.0	30.0	40.0	60.0	90.0	130	30.0	36.0	48.0	72.0	108	156
1	125	150	200	300	450	650	150	180	240	360	540	780

Gallons Setpoint, Simplex Systems (1,000 gallons)

	High Efficiency Brine Dose (5 Pounds/ ft ³ Salt Setting)						High Capacity Brine Dose (7.5 Pounds/ft ³ Salt Setting)					
GPG	HS218s	HS221s	HS224s	HS230s	HS236s	HS242s	HS218s	HS221s	HS224s	HS230s	HS236s	HS242s
50	3.72	4.11	5.66	8.7	13.1	19.1	4.59	5.07	6.97	10.8	16.2	23.6
45	4.20	4.65	6.39	9.9	14.8	21.6	5.17	5.71	7.85	12.2	18.3	26.6
40	4.81	5.31	7.30	11.3	17.0	24.7	5.89	6.52	8.94	13.9	20.9	30.3
35	5.58	6.17	8.47	13.1	19.8	28.7	6.82	7.54	10.4	16.1	24.2	35.1
30	6.61	7.32	10.0	15.6	23.5	34.0	8.05	8.92	12.2	19.0	28.6	41.5
25	8.05	8.92	12.2	19.0	28.6	41.5	9.79	10.8	14.9	23.2	34.8	50.4
20	10.2	11.3	15.5	24.2	36.4	52.7	12.4	13.7	18.8	29.4	44.1	63.9
15	13.8	15.3	21.0	32.8	49.3	71.3	16.7	18.5	25.4	39.7	59.6	86.3
10	21.0	23.3	31.9	50.0	75.1	109	25.4	28.1	38.5	60.4	90.6	131
5	42.7	47.4	64.8	102	153	221	51.4	57.0	77.9	122	184	265
1	216	240	327	515	772	1,116	259	288	393	618	927	1,340

Gallons Setpoint, Duplex Systems (1,000 gallons)

GPG	High Efficiency Brine Dose (5 Pounds/ft ³ Salt Setting)						High Capacity Brine Dose (7.5 Pounds/ft ³ Salt Setting)					
	HS318s	HS321s	HS324s	HS330s	HS336s	HS342s	HS318s	HS321s	HS324s	HS330s	HS336s	HS342s
50	5.58	6.17	8.49	13.1	19.7	28.7	6.88	7.61	10.5	16.2	24.3	35.4
45	6.31	6.97	9.58	14.8	22.3	32.4	7.75	8.57	11.8	18.2	27.4	39.8
40	7.21	7.97	11.0	16.9	25.5	37.0	8.83	9.77	13.4	20.8	31.3	45.4
35	8.37	9.26	12.7	19.7	29.6	43.0	10.2	11.3	15.5	24.1	36.3	52.6
30	9.91	11.0	15.1	23.4	35.2	51.0	12.1	13.4	18.3	28.6	42.9	62.2
25	12.1	13.4	18.3	28.6	42.9	62.2	14.7	16.3	22.3	34.8	52.2	75.7
20	15.3	17.0	23.3	36.3	54.5	79.0	18.6	20.6	28.2	44.1	66.2	95.8
15	20.7	23.0	31.5	49.2	73.9	107	25.1	27.8	38.0	59.6	89.4	129
10	31.6	35.0	47.9	75.1	113	163	38.1	42.2	57.7	90.6	136	197
5	64.0	71.0	97.1	153	229	331	77.0	85.5	117	184	275	398
1	324	359	491	772	1,159	1,674	389	432	590	927	1,391	2,010

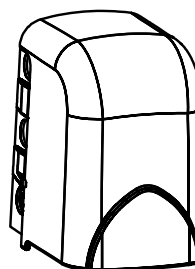
Gallons Setpoint, Triplex Systems (1,000 gallons)

NOTE: The multiplex softeners are efficiency rated according to NSF/ANSI 44 as shown in the preceding two tables, given that the salt dosages are as stated in the table heading.

Smart Start Controller

Kinetico's Smart Start Control box allows a versatile system set-up. One controller can start the sequential regeneration of multiple valves, regardless of their application. Multiple softening systems can be initiated with the same signal. For systems using multiple valves that require independent control, one Smart Start controller is required for each valve.

The Smart Start controller is designed to start a Hydrus regeneration. It has three basic operating modes.



Day Mode: Time/Day - 7-day selection. Day Mode initiates a regeneration based on the day of the week and the time of day. A time of day to regenerate can be programmed on the board. Then, the days of the week to regenerate are programmed.

Countdown Timer: 0 - 99 hours between regenerations. Countdown Timer Mode initiates a regeneration based on the time elapsed since the last regeneration.

Volume Input Mode: Starts a regeneration sequence when a signal is received from an external flow meter. This signal can start the regeneration immediately, or it can be delayed.

Additional External Inputs:

The timer board has two additional external inputs that can be used to start a regeneration sequence. These inputs must be a dry contact, for a minimum of five seconds to initiate the sequence. The inputs can be tied into either operating mode, thus extending the flexibility of any system design.

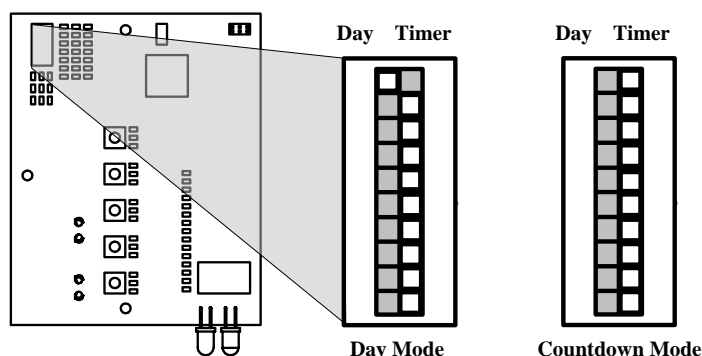
- Volume: dry contact from meter (meter not provided with Smart Start)
- Volume with Time Delay: dry contact from meter
- Quality Sensor: dry contact from sensor (sensor not provided with Smart Start)
- Differential Pressure: dry contact from pressure sensor (sensor not provided with Smart Start)

Installation Check List

The following is a summary of the steps used to set-up and install the Smart Start controller.

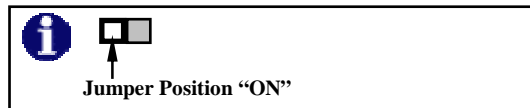
- Identify Smart Start Components
- Install External Power Hook-up
- Install Batteries
- Set Smart Start Operating Mode
- Program the Smart Start Controller
- Install Smart Start Box
- Attach External Inputs
- Attach plumbing to Hydrus Valve

Set the Smart Start Operating Mode



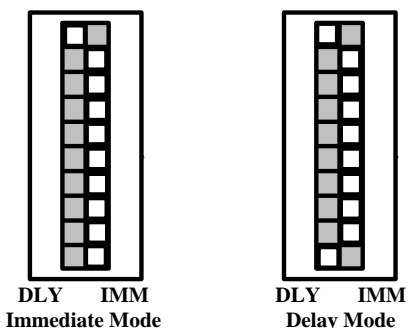
Day Mode/Volume Input Mode or Countdown Mode

The mode of operation is controlled by the top DIP switch. With the DIP switch set to the left, the unit will operate in DAY mode or volume input mode; with the switch set to the right, the unit will operate in countdown mode.



Immediate or Delay

If Volume Input Mode is to be used, selection of when the timer will signal a regeneration is required, either immediate or delayed. If the bottom DIP switch is set for IMM, the regeneration will occur immediately. If it's set for DLY, the regeneration will be delayed to a preset time of day. The Immediate or Delay DIP switch is at the bottom of the group as shown at right. An example of a volume input is a mechanical reset meter.

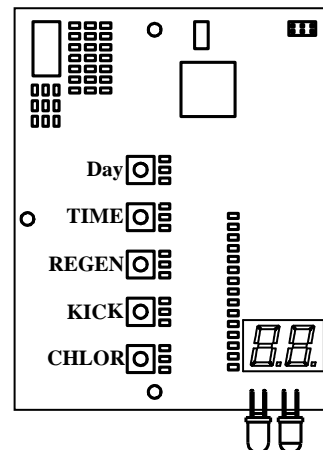


Programming the Smart Start

All programming functions for the Smart Start are controlled either through the placement of the DIP switches or by the pushbutton interface.

Programming the Smart Start through the pushbutton interface is simple. When pushing the button, the current value for each button is displayed. If the button is held for two seconds, the value will increase one digit at a time. When released, the value is recorded in the system's memory.

To set any input, simply hold the button in until the appropriate value is displayed, then release. If desired value is passed, the cycle will repeat.



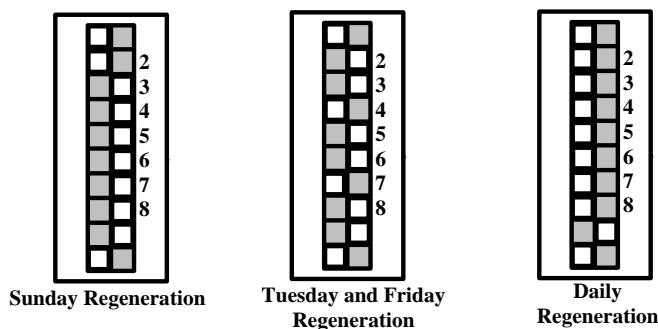
Pushbuttons

Button	Countdown Mode	Range	Day Mode	Volume Input Mode	Range
Day	Not used	NA	Current day of week (Sunday = 1)	Not used	1 - 7
Time	Hours until next regeneration, for display only – no set point	0 - 99	Current time of Day (24 hour clock)	Current time of day used in delay mode	0 - 23
Regen	Regen Frequency (in Hours)	0 - 99	Time of day to start a regeneration	Time to start a regeneration used in day mode	0 - 23
Kick	Duration to open solenoid valve in minutes (set to 10)	0 - 20	Duration to open solenoid valve in minutes (set to 10)	Duration to open solenoid valve in minutes	0 - 20
Chlor	Not Used	NA	Not Used	Not used	NA

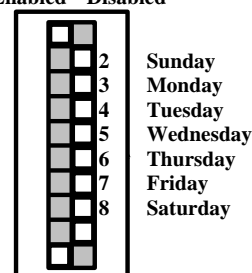
DIP Switches

In addition to setting the operating mode, the DIP switches are also used in the DAY mode to identify which days of the week the unit should regenerate. These additional switches are only used in the DAY mode. In the countdown timer mode or volume input mode, all of the day switches should be at the disabled side.

Examples:



Enabled Disabled



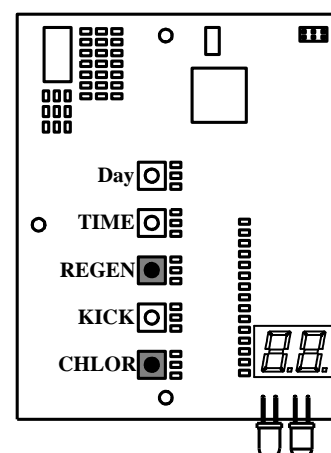
Test Mode

To verify that all the DIP switches are set properly, the unit can be placed in a test mode.

To enter the test mode, first disconnect the power. This can be done by unplugging the external power supply and disconnecting the battery pack at the circuit board via the quick connectors. If no external power supply is used, then disconnecting the battery pack will de-energize the unit.

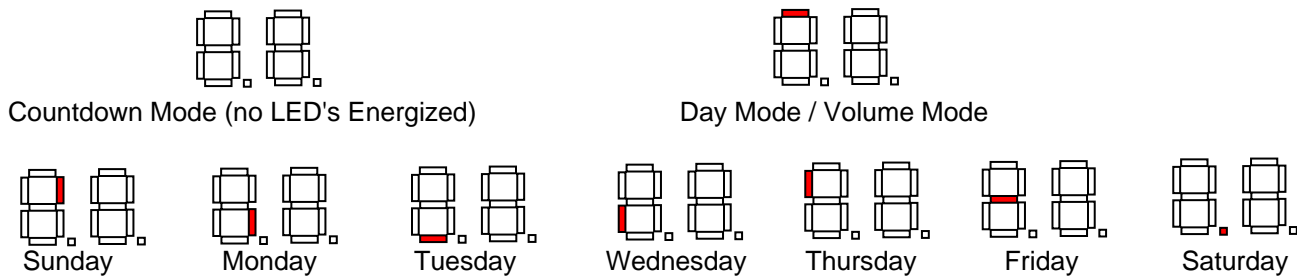
Next, reconnect power, while holding down the REGEN and CHLOR buttons. After the display illuminates, release the buttons. The unit is now in test mode, with various segments of the display LED energized, based on DIP switch settings.

To return to the regular operating mode, simply cycle the power to the board.



Test Mode Results

The following are the illuminated LED's, based on DIP switch settings:



Additional Smart Start Features

Low Battery Alarm Condition – This Smart Start board is equipped with a low battery alarm circuit. When the voltage at the solenoid, not at the battery pack, is less than 4.3 VDC, the low battery alarm turns on. The red low battery light blinks once every five seconds to denote a low battery. Change the battery at this time.

Low Battery Shutdown Condition – The Smart Start board monitors the low battery condition. When the voltage at the solenoid is less than 4.1 VDC, the system enters a shutdown mode and does not attempt to regenerate. This prevents the Smart Start board from opening the solenoid, and not being able to close it. The low battery red LED light blinks once every two and a half seconds to denote the system is in a low battery shutdown condition. Change the battery at this time.



Battery Change Out - To change the battery, press all five push buttons (one after the other) to record the current parameters to non-volatile memory. Then remove the old batteries and put in the new ones. Check your parameters to ensure the proper values are shown and have been correctly kept. A lithium ion battery is recommended for maximum battery life.

Manual Forced Regeneration

A regeneration is forced by pressing and holding the TIME and REGEN push buttons together for five seconds. "Fr" is displayed to denote the manual regeneration start. Regularly scheduled regenerations will still occur. The solenoid valve opens for the programmed KICK time. If the unit is in a lockout (minimum regeneration frequency is five hours), then the display will show "FL." This denotes that a regeneration will occur at the end of the lockout period.

Manual Close Solenoid

The solenoid is manually closed by pressing and holding the TIME and DAY push buttons together for five seconds. "CL" is displayed to denote the solenoid closed operation. One pulse is heard as the Smart Start board closes the solenoid.

Power Up

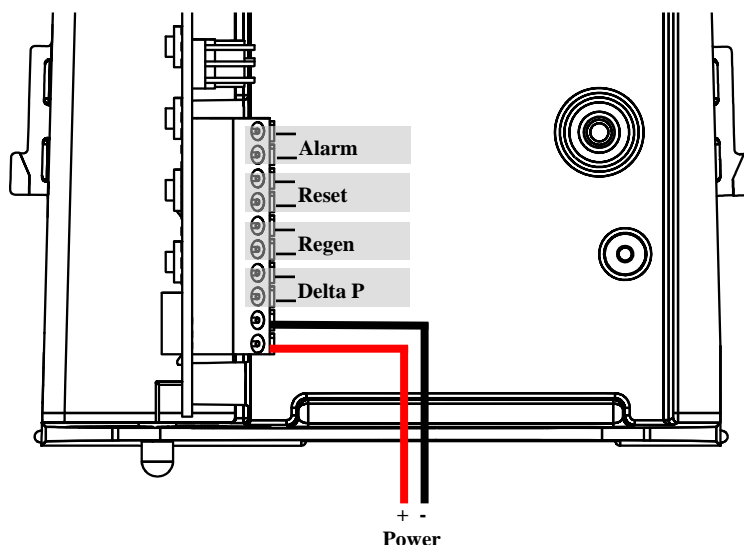
Upon application of power, all lamps are turned on. Then the display shows the program revision number. Finally, the battery voltage at the solenoid terminals is sensed and displayed.

System Lockout

The Smart Start will allow a regeneration once every five hours. When a regeneration cycle starts, a lockout time will also begin to count down from five hours. During this period, requests for regeneration will be stored and started at the end of the lockout period. Only one request will be stored to memory during the lockout period. To display the time remaining in the lockout period in hours, press the REGEN and KICK buttons.

Additional Inputs

Additional, external inputs can be used to further configure the operation of the Smart Start. For each of these signals, it is important to only use dry, non-power contacts. Applying external voltage to the Smart Start board through these inputs will damage the board.



Name	Description	Spec	Result	Time to make
Alarm	Closed contact from external salt alarm	Dry Contact	Yellow lamp blinks	10 minutes
Reset	Not Used	Dry Contact	Not used	N/A
Regen	Closed contact from external mechanical meter based on meter's set-point	Dry Contact	Starts a Regen or BW sequence	5 seconds off after 10 min.
Delta P	Closed contact from external differential pressure switch	Dry Contact	Starts a Regen or BW sequence	15 min.
12 VDC	External power connection	12 VDC + — — -	Supplies power to circuit board	N/A

System Maintenance

Kinetico has engineered the Hydrus system to provide quality water without requiring extensive maintenance. Minor, routine maintenance is recommended to keep the softener working properly.

No special tools are required for system repairs or maintenance. If the system is completely cut off from power, whether hydraulic or electrical, the system does not require resetting. It picks up where it left off. These are some of the many benefits built into all Hydrus Softening Systems to ensure trouble-free ownership.

Not only is the unit easy to maintain, it's built tough and has been extensively tested. The multiplex systems conform to NSF/ANSI¹ Standard 44 for the specific performance claims as verified and substantiated by test data. The battery of third-party testing includes:

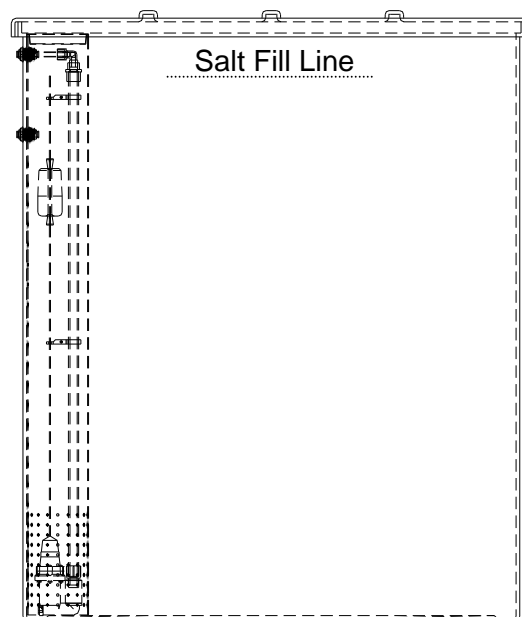
- Materials of construction – verifying they are non-leaching and able to maintain surface integrity in operation
- Structural performance – Verifying working pressure, burst testing, cycle testing, non-hazardous, electrical safety, waste segregation and verification of chemical and mechanical performance and operation
- Mandatory testing of elective claims – verifying efficiency, water use, required operating pressures and exchange capacity
- Verification of manufacturers promotional materials and the inclusion of specific information in operational and maintenance instructions

Adding Regenerant

Prior to installation of the Hydrus softener, an estimated salt usage calculation should be carried out. Based upon this calculation and other factors, the system has been set up to run at high efficiency or high capacity. These operational parameters can be fine-tuned after installation.

It's important to select the right salt for regeneration to keep the system operating optimally. Only high-quality, softener grade salt should be used. A minimum purity of 99.8 percent salt is recommended. Manufacturers of softener salt have particular formulations to ensure trouble-free softening. Some features and benefits:

- Uniquely shaped for extra hardness
- Virtually 100 percent water soluble, minimizing brine tank clean out
- Helps prevent mushing, bridging and channeling
- Designed to keep softeners clean and trouble-free



The frequency of salt replenishment is based upon usage and size brine tank in use. Simply fill the brine tank with salt until the level reaches just below the structure that houses the float assembly.

The following table shows the capacities of each available brine drum, along with other information. If a softening system is to be reconfigured, careful consideration must be given to brine drum capacities. A larger, expanded system may require additional brine storage capacity in order to operate properly.

¹ NSF/ANSI 44 – 2004, "Residential Cation Exchange Water Softeners," NSF International Standard/American National Standard

	24" x 50"	30" x 48"	39" x 60"	50" x 60"
Tank Composition	Polyethylene	Polyethylene	Polyethylene	Polyethylene
Brine Valve Material	Polypropylene	Polypropylene	Polypropylene	Polypropylene
Brine Well Size	6"	6"	6"	6"
Overflow Protection	½"	½"	½"	½"
Brine Valve Connections	½"	½"	½"	½"
Salt Capacity	850 pounds	1,350 pounds	1,500 pounds	4,500 pounds
Volume Capacity	80 gallons	147 gallons	260 gallons	425 gallons
Maximum Brine Dosing	75 pounds	136 pounds	180 pounds	270 pounds
Empty Weight	45 pounds	80 pounds.	80 pounds.	110 pounds

Maximum Brine Dosing				
5 pounds/ft ³	15 ft ³	27 ft ³	36 ft ³	54 ft ³
7.5 pounds/ft ³	10 ft ³	18 ft ³	24 ft ³	36 ft ³
10 pounds/ft ³	8 ft ³	14 ft ³	18 ft ³	27 ft ³
15 pounds/ft ³	5 ft ³	9 ft ³	12 ft ³	18 ft ³

Brine Tank Specifications

IMPORTANT: Never use rock salt in the system as it contains impurities that can interfere with performance.

Brine Drums

A combination salt storage and brine production tank, this unit is manufactured of corrosion-resistant, rigid polyethylene. The brine tank has an internal brine well chamber to house the brine valve assembly. The brine float assembly allows for adjustable salt settings and provides for a shut-off to the brine refill. The brine tank includes a safety overflow connection to be plumbed to a suitable drain.

In most cases, one brine tank is required for each media tank. This is because multiplexed systems regenerate sequentially. Once the first tank completes a regeneration, the regeneration of the second tank immediately follows. This brings two challenges to a brining system. One, the system must have sufficient capacity to provide saturated brine to each of the tanks in the sequence. Two, the brining system must retain a constant concentration of brine.

Since the previous tank in the sequence replenishes the brine tank, it changes the concentration of the brine. Although a brine tank may have sufficient capacity to brine several tanks, since the concentration of the brine solution in that tank changes, each media tank requires its own brine tank.

Due to these challenges, a change in configuration is required if brining is to be carried out centrally, and the existing Hydrus system is configured with each media tank paired to a brine tank. Likewise, a change in configuration is required if brining is to be carried out by pairing, and the existing Hydrus system is configured for central brining.

Remote Meter

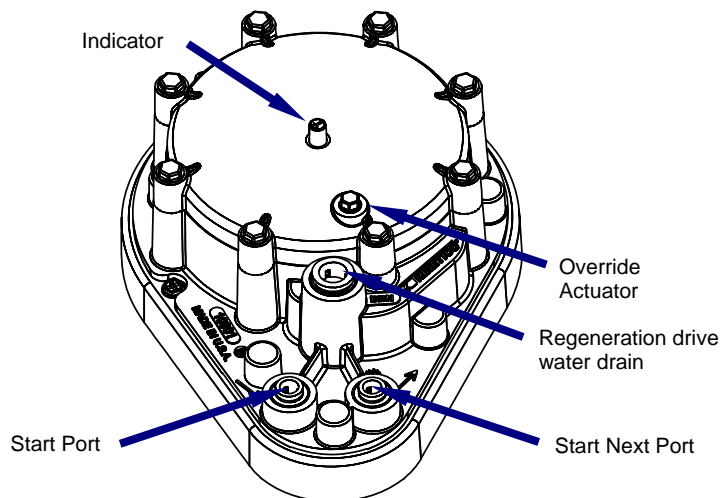
A remote meter is installed to measure the volume of processed water. Once the set volume is reached, a signal is interpreted by the Smart Start controller, which in turn sends a hydraulic signal to the lead tank to initiate a regeneration. A remote meter can be used with both simplex and multiplex systems. For multiplex systems, the meter is located on the combined system outlet.

Manual Regeneration

If the salt storage tank runs out of salt, a manual regeneration of the unit is required after adding salt. An automatic regeneration will eventually occur, but hard water will enter the water system until a regeneration occurs.

There are several ways to force the Hydrus valve to regenerate:

1. Advance the Remote Meter as described on page 17.
2. Manually advance Level 1-2 of the Hydrus valve, as shown at right and described:
 - a. To manually regenerate the system, use a $\frac{1}{4}$ " nut driver to turn the small, hex-shaped "Override Actuator." Slowly turn counter-clockwise until the actuator has advanced the "Indicator" arrow to the "BRINE" position, about 10°. At this point, the flow of water will be audible. This indicates a successful regeneration initiation has occurred. If water flow is not heard, contact a Kinetico professional.
3. A regeneration can also be forced by following the procedure described on page 22 by using the Smart Start controller. The procedure manually opens the solenoid valve, which in turn directs a flow of water to the Start Port of the Hydrus valve.



Battery Replacement

Insert the battery pack into the mid-wall section to hold the batteries. Plug the keyed battery connector into the two-terminal port on the inside of the circuit board labeled "BAT+POWER."

Battery Pack

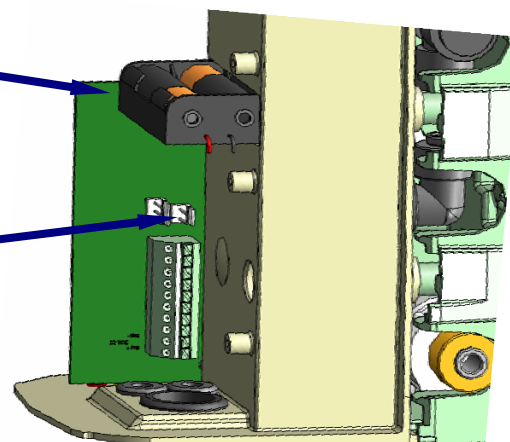
Press into mid-wall section.

Note: the fit is tight to keep the battery in place.

Battery Connection Terminal

Red positive wire is on top of connector, and the connector is keyed.

Note: Only use Kinetico battery pack.



Softener Sanitation Procedure

It's necessary to sanitize the system prior to its first use. It may also become necessary during the lifetime of the softener to disinfect the system. This procedure should be carried out when new resin is installed, any time a significant break in the system occurs and a contaminant may have entered the system, or if the water supply has been in some way temporarily contaminated.

1. Regenerate both tanks of the water conditioning unit with sodium chloride (salt). Use a clean grade of salt appropriate for use with water treatment equipment. Do NOT use rock salt.
2. Mix one fluid ounce of unscented household bleach per four gallons of clean/soft water. This should make a 100 ppm solution. A table is provided below, which gives the gallons of disinfectant required for each system.

Tank Size	18x65	21x62	24x65	30x72	36x72	42x72
Tank Volume, ft ³	8.3	11	13.4	25	35.3	46.1
Solution Required per Tank, gallons	4.5	6.0	7.3	13.6	19.2	25.1
5.25% Sodium Hypochlorite Required, ounces	1.1	1.5	1.8	3.3	4.7	6.1

3. Disconnect the brine line, and put the ½" tube into the container holding the bleach mixture from the step above.
4. Put the unit into brine draw on one tank.
5. Draw the mixture until a strong bleach odor is detected (smelled or tested) in the drain line. This procedure should produce approximately 20 ppm in the mixed solution.
6. Make sure the system is isolated from service. Advance the control disc to the service position, and allow the unit to stand for 30-60 minutes. The colder the water, the longer the stand time should be.
7. Reconnect the brine line (½" tube) to the brine tank, and backwash each tank of the softener two times.

Troubleshooting

Kinetico has identified 11 problems familiar to softening systems. This troubleshooting guide is intended to serve as a useful diagnostic tool in solving more common, easy to determine problems. If the problem is not shown below, a call to the local Kinetico professional should be helpful. Kinetico will try to assist over the phone and may send out a service professional.

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Beginning with "Frequent Regeneration," possible reasons for the complaint are given and the corresponding solutions.

Frequent Regeneration

The customer is not familiar with Hydrus unit operation

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ If customer previously owned an electric unit with timer based regeneration, they may not realize that Hydrus units can regenerate at any time of the day or night. | <ul style="list-style-type: none"> ▪ Explain to the customer how the Hydrus softener works ▪ Emphasize that regeneration is controlled by the measurement of water use rather than on an arbitrary timed basis |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

High water usage

- | | |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The customer may be using more water than he realizes | <ul style="list-style-type: none"> ▪ Obtain a water-bill (if customer is on a city water system) and determine how much water should be used |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|

Hard Water

Water meter not working

- | | |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ No water meter signal | <ul style="list-style-type: none"> ▪ Replace meter ▪ Check cable running from meter to timer |
| <ul style="list-style-type: none"> ❑ Hydraulic signal being interrupted from starter control box | <ul style="list-style-type: none"> ▪ Troubleshoot control box |
| <ul style="list-style-type: none"> ❑ Minimum flow rate for 2" meter is 3 gpm and 7 gpm for a 3" meter | <ul style="list-style-type: none"> ▪ Identify cause of low flow rate and reduce capacity set-point to compensate for non-metered low flow |
| <ul style="list-style-type: none"> ❑ Meter wiring not correct to Smart Start | <ul style="list-style-type: none"> ▪ Check wiring and continuity between meter and Smart Start control box |

The unit will not go into automatic regeneration

- | | |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Meter or timer not properly programmed | <ul style="list-style-type: none"> ▪ See set-up and troubleshooting for these devices |
| <ul style="list-style-type: none"> ❑ Start solenoid malfunctioning | <ul style="list-style-type: none"> ▪ Repair or replace solenoid |

- | | |
|------------------------------------------|--------------------------------------------------------------------------|
| ❑ Smart Start pre-filter clogged | ▪ Clean or replace pre-filter cartridge |
| ❑ Lock out time engaged | ▪ Controller requires five hours between regenerations |
| ❑ Wrong Mode of Operation on Smart Start | ▪ Check first DIP switch: Left for DAY mode and right for COUNTDOWN mode |

No vacuum in brine position

- | | |
|---------------------------------|--------------------------------------------------------------------------------------------------|
| ❑ Plugged venturi | ▪ Clean |
| ❑ Incorrect control disc | ▪ Match control disc to regeneration type:
White – Multiplex systems
Tan – Simplex systems |
| ❑ Plugged backwash flow control | ▪ Clean out backwash flow control |
| ❑ Plugged drain line | ▪ Clean out drain line |
| ❑ Broken venturi | ▪ Replace |

Short salting

- | | |
|-------------------------------------------------------|----------------------------------------------------|
| ❑ Plugged venturi – brine tank not refilling properly | ▪ Clean venturi |
| ❑ Brine valve not set properly | ▪ Refer to manual for correct brine valve settings |
| ❑ Salt mushed | ▪ Clean salt drum |

Bridged salt in the brine drum

- | | |
|-----------------------------------|--------------------------------------------------------------------------|
| ❑ Salt has solidified in the drum | ▪ Carefully move the salt around to break up the mass of solidified salt |
| | ▪ Use salt with Dextrin binder |

The by-pass is open

- ❑ An open by-pass allows water to flow around the system without any treatment at all
 - Close the by-pass
 - ❑ All simplex units incorporate an internal by-pass. While the unit is in regeneration, this by-pass is open. Do not sample for quality while a simplex unit is in regeneration.
 - Sample during service for a simplex system, not regeneration
-

The by-pass is leaking

- ❑ This can be determined by testing the water at a soft water tap. Shut off unit, disconnect the brine line, add a shut-off valve, turn unit on and test water at fitting. Water that tests soft at the brine fitting and hard at the tap indicates a by-pass is leaking.
 - Repair or replace the by-pass
-

Raw water

- ❑ Raw water statistics have changed
 - Retest raw water and reprogram meter or timer as needed
-

Distributor tube O-ring

- ❑ Distributor tube o-ring rolled or cut
 - Replace O-ring
-

Brine drum does not refill or overfills

- ❑ The brine valve is set incorrectly
 - Set the brine valve according to instructions on the brine valve installation sheet in the owner's pack or tech manual
 - ❑ The brine valve is non-conforming
 - Replace the brine valve
 - ❑ The brine drum is dirty
 - Clean out the brine drum
 - ❑ The venturi nozzle is plugged
 - Clean out the venturi
-

Fouled resin

- ❑ Obtain sample for analysis
 - Determine proper cleaning procedure
-

Wrong venturi

- ❑ Verify venturi selection
 - Replace with proper venturi
-

High Salt Consumption

Regenerates too often

- ❑ See the section entitled Frequent Regeneration
 - See the section entitled Frequent Regeneration
-

Water level in the brine drum is too high

- ❑ The brine valve is set wrong or non-conforming
 - Verify the brine valve setting. Replace non-conforming brine valve
-
- ❑ The brine valve or the brine drum is dirty
 - Clean brine valve and drum
-
- ❑ The brine valve leaks.
 - Tighten the connectors on the brine valve
-

Iron Bleed Through

Customer plumbing

- ❑ Previous iron buildup inside existing plumbing after the water softener
 - Verify that customer plumbing is the problem by testing the water quality at the brine fitting with water running
-

The salt setting is not set properly for current raw water conditions

- ❑ The composition of raw water can change with time
 - Check the hardness and iron content of raw water. Set the brine valve for current raw water conditions
-

The iron may be ferric iron

- ❑ Ferric iron is not removable by ion exchange
 - Verify by using the demo softener to determine if iron is removable by ion exchange. Add additional equipment if needed
-

The customer's plumbing may include a galvanized pressure tank

- | | |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ A galvanized pressure tank will create oxidized iron | <ul style="list-style-type: none"> ▪ Replace the galvanized pressure tank with a bladder-style pressure tank |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
-

Leaks
Water leaks from any of the assembly levels

- | | |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Valve screws are not tightened | <ul style="list-style-type: none"> ▪ Depressurize the unit and tighten the Main Valve screws. 80 inch-pounds |
| <ul style="list-style-type: none"> ❑ One of the seals between assembly levels is pinched or missing | <ul style="list-style-type: none"> ▪ Replace the non-conforming seal |
| <ul style="list-style-type: none"> ❑ One of the screw holes is stripped or cracked | <ul style="list-style-type: none"> ▪ Replace the level |
| <ul style="list-style-type: none"> ❑ There is a crack on the seal area near a screw hole | <ul style="list-style-type: none"> ▪ Replace the level |
-

Water feed pressure is too high (125 psi maximum)

- | | |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The pressure regulator is broken | <ul style="list-style-type: none"> ▪ Replace pressure regulator |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
-

Water leaks at the base

- | | |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The base is not tightened properly | <ul style="list-style-type: none"> ▪ Tighten base |
| <ul style="list-style-type: none"> ❑ The O-ring on the base is pinched or missing | <ul style="list-style-type: none"> ▪ Replace base O-ring |
-

No Water to Service
Multi-tank system with overlapping unit regeneration

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ For a duplex, overridden regeneration start signal while one tank is still in regeneration | <ul style="list-style-type: none"> ▪ Open system by-pass to allow water to outlet side of valves. Manually advance valve to service position. This will allow valves to reset. One valve can then be manually advanced to original regeneration stage, if desired |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
-

-
- | | |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Multiple regenerations prior to completion of regeneration lock-out | <ul style="list-style-type: none"> ▪ Open by-pass to allow unit to cycle |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
-
- | | |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Manual regeneration override while another unit was regenerating | <ul style="list-style-type: none"> ▪ Open by-pass to allow unit to cycle |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
-
- | | |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Stuck regeneration signal | <ul style="list-style-type: none"> ▪ Check for debris in solenoid valve |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
-

Pressure Loss

Reduced pressure entering the unit

- | | |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The pre-filter is clogged | <ul style="list-style-type: none"> ▪ Replace the clogged pre-filter |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
-

The upper and/or lower distributors are plugged

- | | |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Foreign matter from the input lines is accumulating in the distributors | <ul style="list-style-type: none"> ▪ Clean the distributors. Add a pre-filter to eliminate the foreign matter before it enters the unit |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
-

Salty Treated Water

Restricted drain line

- | | |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The drain is kinked or clogged | <ul style="list-style-type: none"> ▪ Clear any obstructions. Make sure that the drain line flows smoothly and unrestricted |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
-

Low water pressure

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ The unit should not see water pressure drop below 30 psi on the outlet at any time. During the backwash portion of the regeneration cycle, it must hold at least 30 psi or the brine may not rinse out completely | <ul style="list-style-type: none"> ▪ Test the outlet pressure with the unit in backwash and at high flow. Measure the pressure by placing a gauge on the brine fitting. Raise pressure if below 30 psi |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
-

The backwash flow control is plugged

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Without enough backwash flow to the drain, the unit cannot wash all the salt from the media tanks | <ul style="list-style-type: none"> ▪ Clean the backwash flow control ▪ Check hole size |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
-

The drain is extremely long or placed higher than 8 feet above the HydruS valve

- ❑ Such drain runs can put back-pressure on the unit and restrict the drain flow
- Locate a closer drain or use a larger diameter drain line

The upper distributors are plugged

- ❑ Foreign material that finds its way into the media tanks may be collected around the upper distributors during backwash, clogging them
- Clean upper distributors
- Install a pre-filter

Water level in the brine drum is too high

- ❑ The brine valve is set wrong or non-conforming
- Verify the brine valve setting. Replace non-conforming brine valve

Taste, Color and/or Odor

Treated water has a metallic or iron taste

- ❑ See the section entitled "Iron Bleed-Through"

Treated water has chlorine odor and/or taste

- ❑ This is due to heavily chlorinated raw city water
- Install a carbon filter

Treated water has a yellow tint

- ❑ The raw water may have traces of tannins present
- Contact Technical Support
- ❑ See the section entitled "Iron Bleed-Through"

Treated water has an odor (hot water only)

- ❑ The magnesium rod in hot water tanks can cause a reaction that gives off an odor of rotten eggs
- Remove this rod from the hot water heater. An alternative rod may be installed

Unit Sticks in Cycle

The unit sticks in regeneration or backwash cycle

<input type="checkbox"/> The regeneration flow path is plugged at the regeneration nozzle or flow control	<input type="checkbox"/> Clean the regeneration flow path
-----------------------------------------------------------------------------------------------------------	-----------------------------------------------------------

<input type="checkbox"/> The regeneration drive pawl and/or spring is weak or broken	<input type="checkbox"/> Replace the regeneration drive pawl
--------------------------------------------------------------------------------------	--------------------------------------------------------------

<input type="checkbox"/> There is a damaged tooth on the control disc	<input type="checkbox"/> Replace the control disc
-----------------------------------------------------------------------	---------------------------------------------------

<input type="checkbox"/> The eccentric pinion is worn	<input type="checkbox"/> Replace the eccentric pinion (snap fit)
-------------------------------------------------------	------------------------------------------------------------------

<input type="checkbox"/> Drain line from L-1 restricted	<input type="checkbox"/> Clean drain line
---------------------------------------------------------	-------------------------------------------

<input type="checkbox"/> Poor outlet pressure (<30 psi.)	<input type="checkbox"/> Increase pressure to system, or further reduce flow rate of system by the use of a flow control at the outlet of the system
----------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------

<input type="checkbox"/> Solenoid valve of Smart Start controller stuck in open position	<input type="checkbox"/> Clean solenoid valve or replace
------------------------------------------------------------------------------------------	----------------------------------------------------------

Water Running to Drain

Verify that the leak is in fact coming from the L-1 Level or the main drain by removing the line from the L-1 Level drain. If no leak is detected, go to "Valve not sealing – drain purge control"

The balance piston O-ring is not seated

<input type="checkbox"/> Water will leak past an improperly seated balance piston O-ring and out the drain	<input type="checkbox"/> Replace worn or non-conforming O-ring
------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------

Bad control disc

<input type="checkbox"/> A scored control disc will allow a fast drip to a pencil-sized stream to flow through the drain	<input type="checkbox"/> Replace the control disc
--------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------

Valve not sealing – drain purge control

- | | |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Foreign matter under the seals will not allow them to seat properly | <ul style="list-style-type: none"> ▪ Disassemble and remove the foreign matter from seals |
| <ul style="list-style-type: none"> ❑ Chlorine damage to seal | <ul style="list-style-type: none"> ▪ Replace seal (and valve if it is an over molded seal) |
-

Stem or piston quad rings not sealing

- | | |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Foreign matter under the seals will not allow them to seat properly | <ul style="list-style-type: none"> ▪ Disassemble and remove the foreign matter from seals |
| <ul style="list-style-type: none"> ❑ Chlorine damage to seal | <ul style="list-style-type: none"> ▪ Replace seal (and valve if it is an over molded seal) |
-

Low water pressure

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ If the water pressure is less than 30 psi at the brine fitting, the system may not operate properly | <ul style="list-style-type: none"> ▪ Increase water pressure |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
-

Plugged level 1

- | | |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <ul style="list-style-type: none"> ❑ Check level I drain is free from obstructions | <ul style="list-style-type: none"> ▪ Clean level 1 |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
-

Parts

Complete Systems, Tanks, Risers and Distribution

Complete Softener Tank Assemblies

Includes:

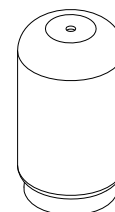
- Tank
- Distributor
- Valve
- Resin
- Underbedding
- Manual
- Diffuser

Tank Size	Simplex	Multiplex
18" x 65".....	H12239	H12245
21" x 62".....	H12240	H12246
24" x 65".....	H12241	H12247
30" x 72".....	H12242	H12248
36" x 72".....	H12243	H12249
42" x 72".....	H12244	H12250



Tanks

18" x 65".....	10999
21" x 62".....	68015
24" x 65".....	68016
30" x 72".....	71047
36" x 72".....	68021
42" x 72".....	68022



Distribution

Riser Tube Kit 12226

Includes:

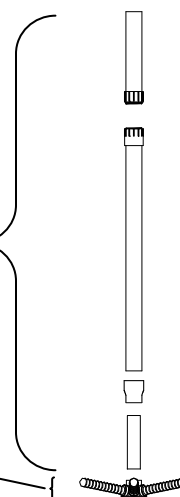
- Pipe, 1 1/2" x 15"
- Pipe, 2" x 72" (requires cutting)
- Reducer Fitting, 1 1/2" x 2"
- Adapter, 2" FNPT
- Adapter, 2" MNPT

Distributor Assembly

Includes:

- Hub, 1 1/2" x Six Lateral Sockets
- Six Laterals

18 x 65".....	10996
21 x 62".....	68363
24 x 65".....	68363
30 x 72".....	10997
36 x 72".....	68364
42 x 72".....	68364

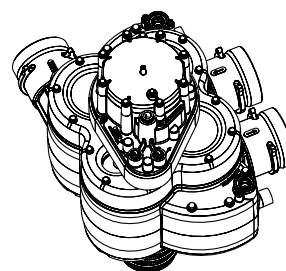


The Hydrus Valve

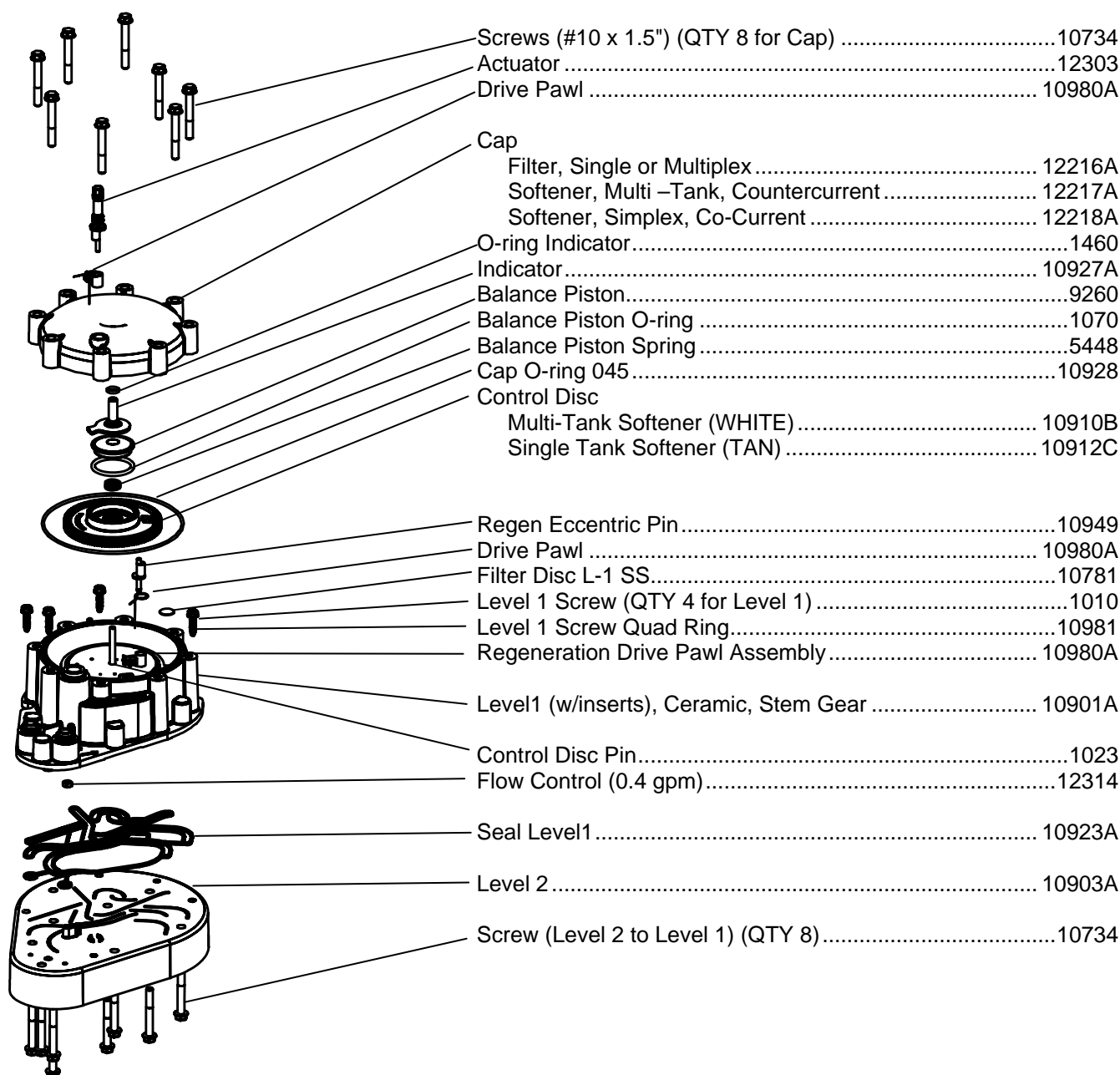
Includes valve manual

Complete Valves

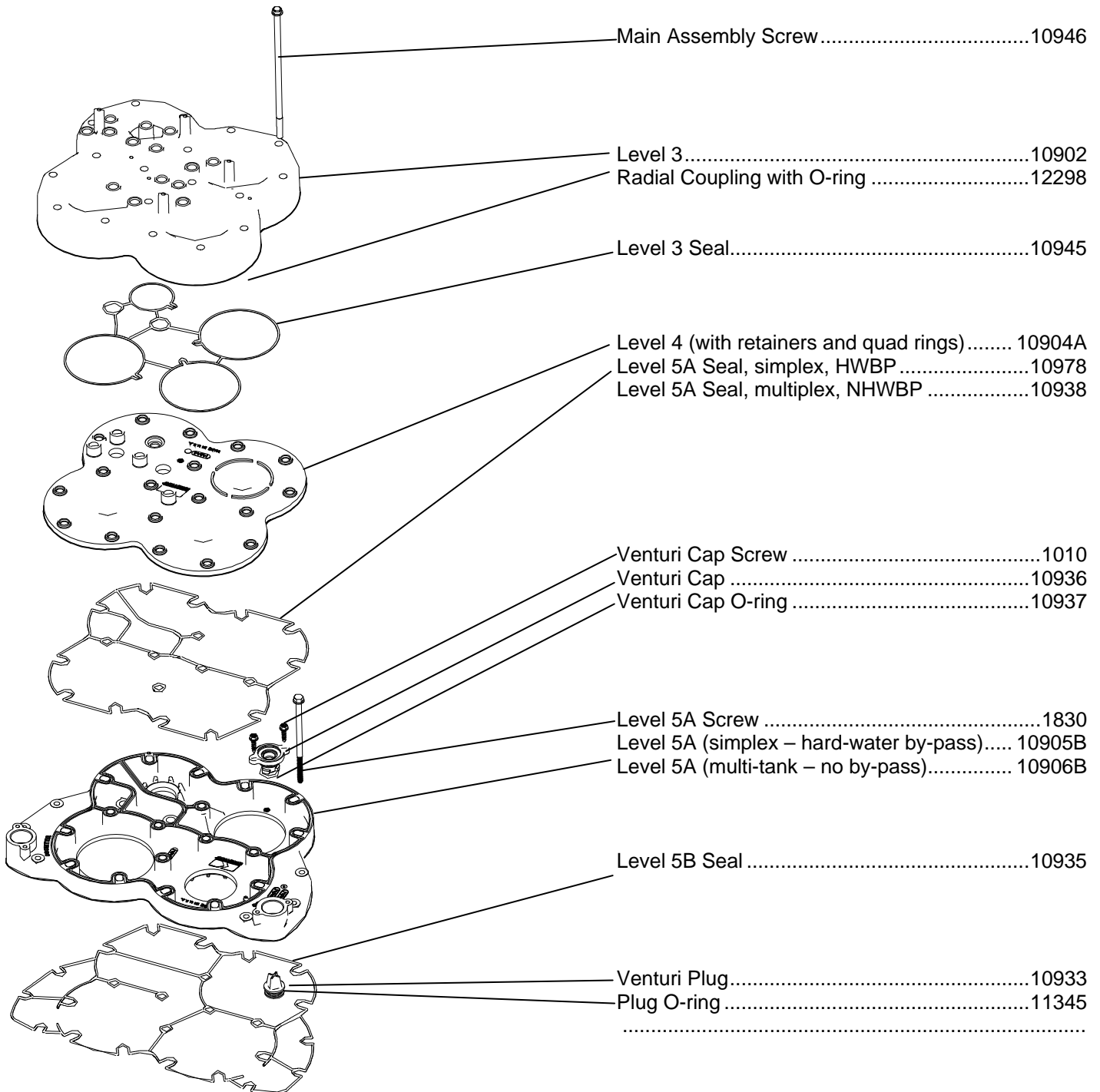
Hydrus, Soft, Multi-Tank, 18-24	H12194
Hydrus, Soft, Multi-Tank, 30-42	H12189
Hydrus, Soft, Simplex, 18-24	H12198
Hydrus, Soft, Simplex, 30-42	H12202



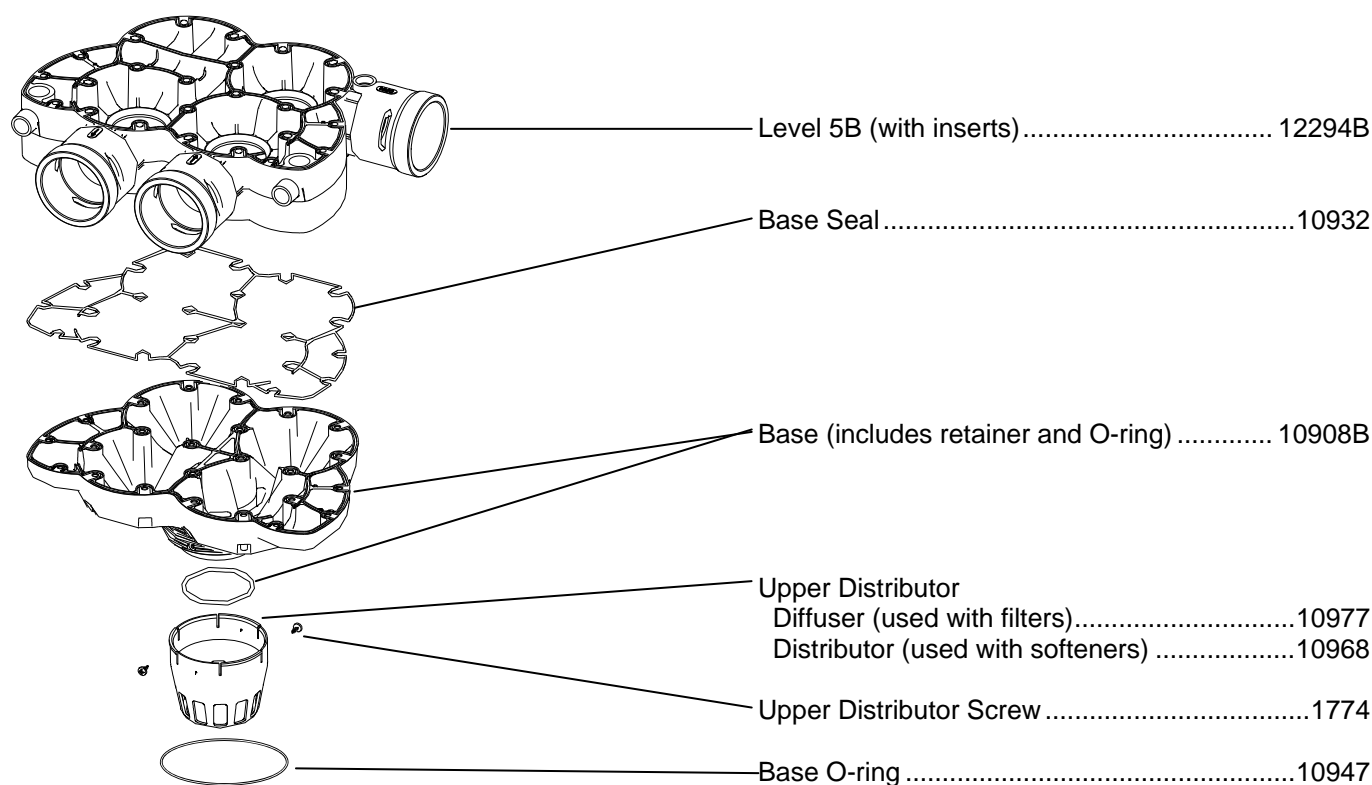
Levels 1 and 2



Levels 3 through 5



Level 5B – Base



Venturi Accessories

Venturi Plug	10933
Venturi Plug O-ring	11354



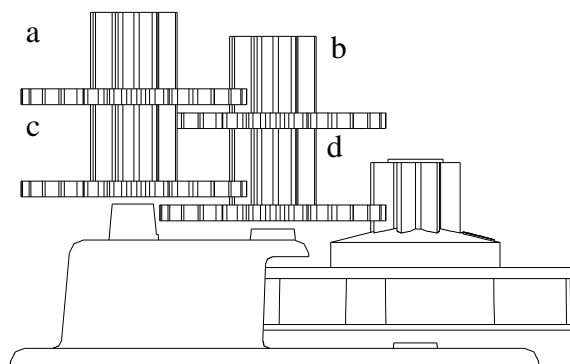
Gearing

Unit (time)	Short hand (a-b-c-d)
Standard Filter (20 min.)	2-2-2-2 #10 Jet
Special Filter (40 min.)	2-2-2-3 #8 Jet
Special Softener (90 min.)	2-1-5-4 #8 Jet
18-24 Softener (120 min.)	2-2-7-6 pp-#8
30-36 Softener (150 min.)	2-3-4-4 #8 Jet

Gearing Retainer Clip 10985

Turbines

pp-#8	9272A
#8 Jet	11011A
#10 Jet	8781F

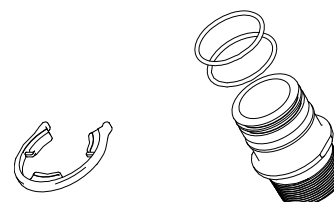


Gears

1.....	1522
2.....	1523
3.....	1524
4.....	1525
5.....	1526
6.....	1527
7.....	1528

Inlet and Outlet Adapters

2" MNPT Adapter.....	10920
1 ½ MNPT Adapter.....	12309
Adapter O-ring (2).....	10965
Adapter E-clip.....	10921

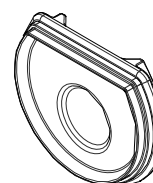


Miscellaneous

2cc Lube Packet (MED 420).....	11319
Hydrus System Service Kit.....	12316
Owners Manual.....	12223A

Drain Flow Control

Backwash Flow Control (universal)	10919
O-ring (BWFC).....	10967



Control Valve and Start Next Valve

Valve Piston (with quad ring)	7872
Seal.....	8193A



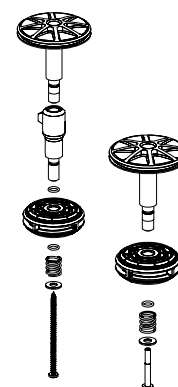
Purge Valve

Piston (with quad ring).....	2464
Seat (with glued seal)	10984A



Inlet/Outlet/Drain Valve

Piston, with quad ring and O-ring	10943
Valve Extension	12305
Seat (with over molded seal)	10942A
Piston O-ring, 011	10634
Piston Quad Ring, 231	10944
Piston Spring	10964
Piston Washer	10971
Piston Screw.....	10734
Piston Screw (long).....	12306



Smart Start Controller

Complete Smart Start Controllers

Smart Start Controller, No Box 12137

Enclosure

Back Mounting Plate Enclosure..... 12100

Midwall Enclosure..... 12101

Front Cover Enclosure..... 12102

Screws 1010

Electrical

Timer Circuit with Coating 12142

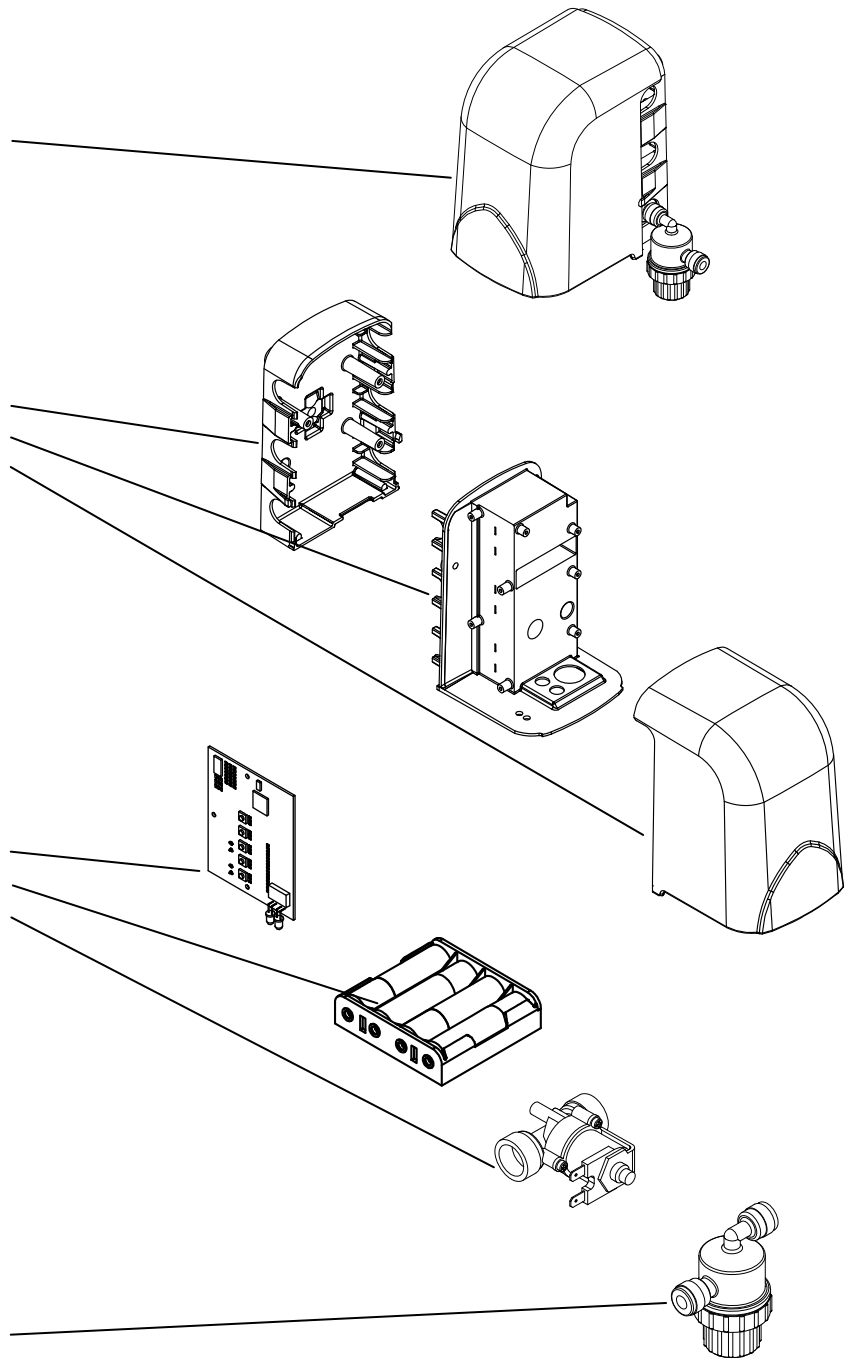
Two-Terminal Battery Pack 12106

Bi-Stable Solenoid, including fittings 12104

Miscellaneous

Inline Filter, ¼" Tube..... 12144

Power Supply, US Version 12128



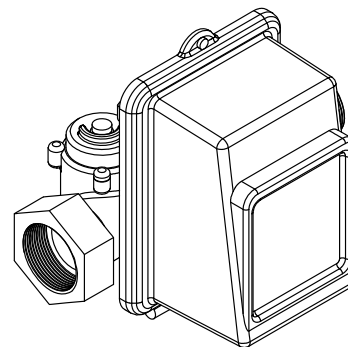
Remote Meters

Immediate Regeneration, 120 VAC

2" Brass Meter, 3 -150 gpm, 6,250-106,250 gallons	70141
2" Plastic Meter, 3 -150 gpm, 6,250-106,250 gallons	70143
3" Brass Meter, 7 - 300 gpm, 3,750-63,750 gallons	70145
3" Brass Meter, 7 - 300 gpm, 18,750-318,750 gallons	12312

50 Hz, 220 Volt Meters

2" Brass Meter, 3 -150 gpm, 6,250-106,250 gallons	72611
3" Brass Meter, 7 - 300 gpm, 18,750-318,750 gallons	12313
3" Brass Meter, 7 - 300 gpm, 3,750-63,750 gallons	72613



Brining System

Complete Brine Systems

24" x 50"	68370B
30" x 48"	68373B
39" x 60"	12295
50" x 60"	68371B

Tanks

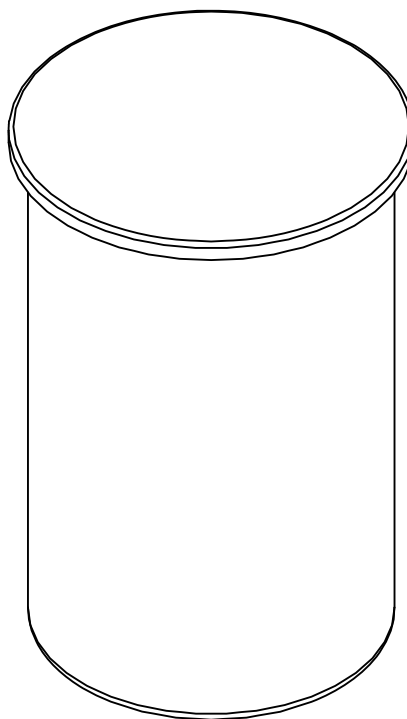
24" x 50"	4724A
39" x 60"	12299
50" x 60"	4728A

Wells¹

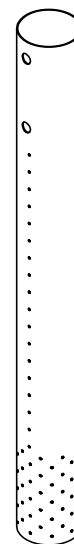
24" x 50"	12300
30" x 48"	12300
39" x 60"	12300
50" x 60"	12300

Valves²

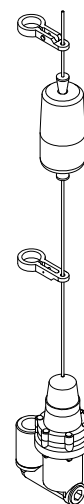
24" x 50"	74160
30" x 48"	74160
39" x 60"	74160
50" x 60"	74160



Tank



Well



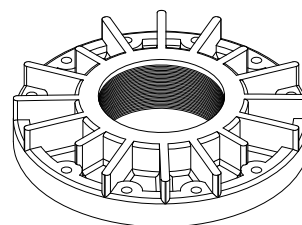
Valve

¹ Well may require cutting to size and drilling.

² Valve is not assembled.

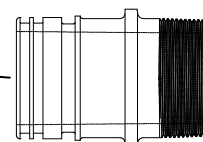
Miscellaneous Components

Adapter Flange, 6" to 4"	72868
(required on 36" and 42" tanks)	
Coarse Gravel.....	1226A
Fine Gravel	57580
Tank Closure, 4-8 UN	71336
Softener Resin	68073A



Installation Kits

Includes:	Quantity
2" MNPT Adapters	5
O-Ring, 028	1
Flow Control.....	1
E-Clips	5
O-Rings, 228.....	10
Silicone Packets, 2.00 mL	3
Distributor Screws.....	2
O-Ring, 110	1
Balance Piston O-Ring, 016	1
Venturi Kit with instruction	1



Simplex

18" x 65"	H12227
21" x 62"	H12228
24" x 65"	H12229
30" x 72"	H12230
36" x 72"	H12231
42" x 72"	H12232

Multiplex

18" x 65"	H12233
21" x 62"	H12234
24" x 65"	H12235
30" x 72"	H12236
36" x 72"	H12237
42" x 72"	H12238

Venturi Kits

Includes:
 Lubricant Packet
 Venturi
 Installation Instructions
 O-Rings

Brown.....	12204
Yellow	12205
Black	12206
Orange.....	12207
Silver	12208
Blue.....	12209
Red	12210
Gold	12211
Green.....	12212

