



**PURE YOUR LIFE**

**OPERATION AND INSTRUCTION MANUAL  
SPECIALIST SERIES AERATION FILTER SYSTEM**



**For Residential Filter Systems with Clack WS1EE (4 Button) AIO Control Valve**

## Introduction

Blake Water Solutions' Specialist Series™ point-of-entry (POE) Aerating Iron Oxidizer (AIO) filter systems function as a regenerable water treatment unit utilizing oxygen instead of potentially harmful chemicals to rejuvenate and enhance the performance of the selective filtration media. The filtration media provided is specific to the water contaminant or contaminants that your water treatment specialist has identified.

The AIO system utilizes the Clack WS1EE control valve equipped with air injection capability to remove ferrous (or clear water) iron, manganese, and sulfur from the water by both oxidation and filtration. During the regeneration cycle, an air bubble is established in the head space of the filter tank above the media. Then, during service, as untreated water enters the tank, it mixes with the air. Oxygen present in the air oxidizes some of the iron and manganese that are present in the water, causing them to precipitate into particles which become trapped in the filter media. The remaining dissolved iron and manganese precipitate out in the filter bed as they are oxidized by the catalytic reactions occurring on the media surface.

Unlike other iron filter alternatives, the Clack WS1EE AIO technology is designed for use in a single tank / valve system configuration, reducing both installation and maintenance costs, yet delivering years of trouble-free service. No chemical additives or air compressors are required for operation or regeneration with the Clack WS1EE AIO's unique and advanced design.

**Do not install this system if methane is present in the water - DANGEROUS DEADLY GAS CAN ACCUMULATE**

**This system is not intended to be used for treating water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.**

## Installation Requirements

**WATER PRESSURE:** A least 30 psi of water pressure (2.7bar) is required for the injector to draw air and operate effectively.

**CAUTION:** Water pressure must not exceed 80psi (5.5 bars), water temperature is not to exceed 110°F (43°C), and the unit cannot be subjected to freezing conditions.

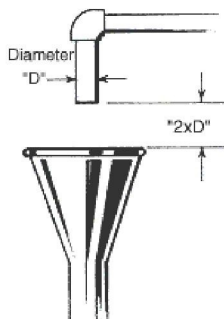
**NOTE:** Due to the air pocket, exceeding 80PSI will adversely impact performance.

**ELECTRICAL FACILITIES:** An uninterrupted 120 VAC supply is required. The valve is supplied with a 12 VAC transformer. Please make sure your voltage supply is compatible with your unit before installation.

**EXISTING PLUMBING:** Condition of existing plumbing should be free from scale and iron buildup. Piping that is built up heavily with scale and/or iron should be replaced.

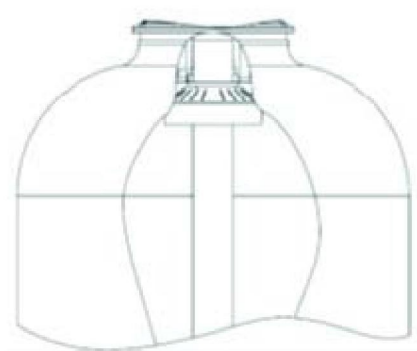
**LOCATION OF FILTER AND DRAIN:** The filter should be located close to a drain to prevent air breaks and back flow.

**DRAIN AIR GAP:** Always provide the proper air gap distance of two drain pipe diameters.



## Installation & Commissioning

1. Note this system is supplied without media installed for ease of transportation and simplifying site location. Refer to the section of this manual for Media Filtration Installation Guide/Commissioning.
2. Place the tank where you want to install the unit making sure the unit is level and on a firm base.
3. During cold weather, the installer should warm the valve to room temperature before operating.
4. All plumbing must be done in accordance with local plumbing codes. The pipe size for residential drain line should be a minimum of 1/2" (13 mm). Backwash flow rates in excess of 7 gpm or length in excess of 20' require 3/4" drain line. Commercial drain lines should be the same size as the drain line flow control. **Due to the release of the air during regeneration, the drain line must be secured at the end, and anchored throughout the run.**
5. Ensure that the check valve supplied with the AIO control valve is securely installed inside the control valve inlet. This is required to prevent the pressurized air bubble inside the oxidizer tank from venting backwards up the feed water plumbing.
6. If not factory installed assemble the deflector to the distributor tube:  
Put a thin layer of silicone lube around inside diameter of the deflector. Slowly slide the deflector over the distributor tube down about 1". When threading the AIO valve to the tank, the bottom of the threads will slide the deflector down. As shown below.



7. Lubricate the distributor O-ring and tank O-ring. Place the main control valve on tank. **Note: Only use silicone lubricant.**
8. Solder joints near the inlet / outlet / drain must be done prior to making those connections. Leave at least 6" (15 cm) between the inlet / outlet / drain fittings and solder joints when soldering pipes that are connected. Failure to do this could cause interior damage to the fitting.
9. Teflon® tape is the only sealant to be used on the drain fitting. Do not use pipe dope or other compounds as they contain petrochemical elements and will attack the drain housing and cause failure.
10. Place the bypass valve in the by-pass position (see page 6). Turn on the main water supply. Open a cold filtered water tap nearby and let run a few minutes or until the system is free from foreign material (usually solder) that may have resulted from the installation. Once clean, close the water tap.
11. Refer to Filtration Media Loading on page 12.
12. Plug unit transformer into an electrical outlet. Note: All electrical connections must be connected according to local codes. Be certain the outlet is continually powered (unswitched/uninterrupted).
13. Connect Raw Water Inlet / Treated Water Outlet to control valve as indicated by the embossed direction arrows.
14. Set the current time on the UF Controller. Refer to Setting Time of Day on page 10.



## **Filtration Media Loading**

Media filtration systems supplied by Blake Water Solutions are shipped without the media preloaded.

Aeration/Oxidation filtration media selected for Iron, Manganese, Hydrogen Sulfide removal or (other conditions your equipment supplier has identified) are dependent on many factors and are carefully selected and applied based on reported water conditions at the time of testing. Variables such as pH changes, changes in mineral concentration, unreported water contaminants as well as increased flow and usage rates may affect the performance of this system.

1. With the bypass valve in the bypass position disconnect the control valve from the bypass valve and remove the control valve from the mineral tank. Care should be exercised to avoid damage to the distribution tube and screen while loading the selected media for the application.
2. Plug the open end of the riser tube to ensure that no filtration media or gravel falls down into the riser tube. The riser tube should be firmly seated and centered in the tank and should be flush with the top of the tank opening (or tank top bushing if required). Underbed support gravel if required should be pre-rinsed to remove fines and grit which could clog the screens and then carefully loaded covering the distributor basket. Adding a sufficient amount of water (approximately 6" above the distributor) to the vessel prior to adding the gravel will minimize the potential for damage and help to level the support bed.
3. Next load the required amount of media selected for the application. Again, adding additional water to the vessel will assist in loading by minimizing dust and optimize leveling.
4. Unplug the riser tube, carefully position the valve over it and turn the valve into the threads in the fiberglass tank, tightening securely into tank and secure to the existing piping bypass.

**Note: Ensure that the internal O-ring in the valve fits securely over the riser tube.**

***Silicone lubricant should be applied to the O-ring to ease installation of the riser tube.***

DO NOT use petroleum based lubricants as they will cause swelling of O-ring seals.

The bypass valve supplied with the equipment should still be in the bypass position and the filter tank can now be completely filled with water by depressing REGEN on the control valve to initiate backwash and slowly opening the bypass to fill the tank with water and purge any air. Once filled and purged of air the bypass should be returned to the bypass position. The valve controller can now be cycled back to the service position. This step will allow the media to absorb water and will reduce the chance of backwashing media out of the tank during the initial backwash on final start-up. Once the media is sufficiently hydrated the system regeneration cycle should be initiated and the bypass valve slowly opened as the valve cycles into backwash. The backwash cycle should continue until the water runs clear. The valve can now be cycled to service and the bypass valve opened allowing treated water to enter the household piping.

**Caution: most Medias including, but not limited to, Carbon, Filter Ag, and Chemsorb require hydration prior to being put into service as they are shipped dry. A minimum of 4 hours presoak, but preferably overnight saturation is recommended to condition any newly installed media for service.**



## **Backwash / Regeneration Cycle**

The AIO filter is factory preset to backwash / regenerate every third day at 12:30 am. Only untreated water is available during backwash / regeneration. A complete backwash / regeneration cycle lasts approximately 50 minutes, after which filtered water service is restored. Homeowners with waters that contain very heavy iron / manganese loading may experience loss of pressure and/or flow if too much water is filtered between backwash cycles. In this case, the backwash frequency may be reduced to every other day (or every day in extreme cases). It is not recommend to operate more than 3 days between backwash cycles.

### **1. Backwash (10 minutes):**

The valve piston will drive to the backwash position. Only unfiltered water is available during backwash.

Initially, what remains of the air bubble will be released to drain (the sound of air being released can be heard). Unfiltered raw water will flow into the control valve through the inlet, down the riser tube, out the distribution basket, and up through the media. This will fluidize and expand the media bed allowing oxidized iron and manganese and any other particles that were trapped during service to be dislodged from the media and flushed to drain. The media is also de-compacted and readied for the the air injection step. After the 10 minutes of flow to drain, the valve piston will drive to the draw position.

The Backwash step can be lengthened, if necessary, but it should never be shortened.

### **2. Air Recharge (40 minutes):**

During this cycle, water flows to drain, creating a suction which allows air to be drawn into the filter. The air forces most of the water out of the tank allowing the catalytic surface of the media to be recharged with oxygen from the air. The sound of air being recharged will be heard. Air bubbles should go down to the drain before proceeding to the next step.

After the 40 minutes of air draw, the valve piston will drive back to the service position. As water begins to refill the tank, it will compress the air and reestablish the air bubble in the top of the tank. Filtered water is available once again. The first draw of treated water after regeneration may have a milky or cloudy appearance but this will dissipate quickly. It is just a bit of excess air in the water.

The Air Recharge step can be lengthened, if necessary, but it should never be shortened.

### **3. Second Backwash (OFF)**

### **4. Rinse (OFF)**

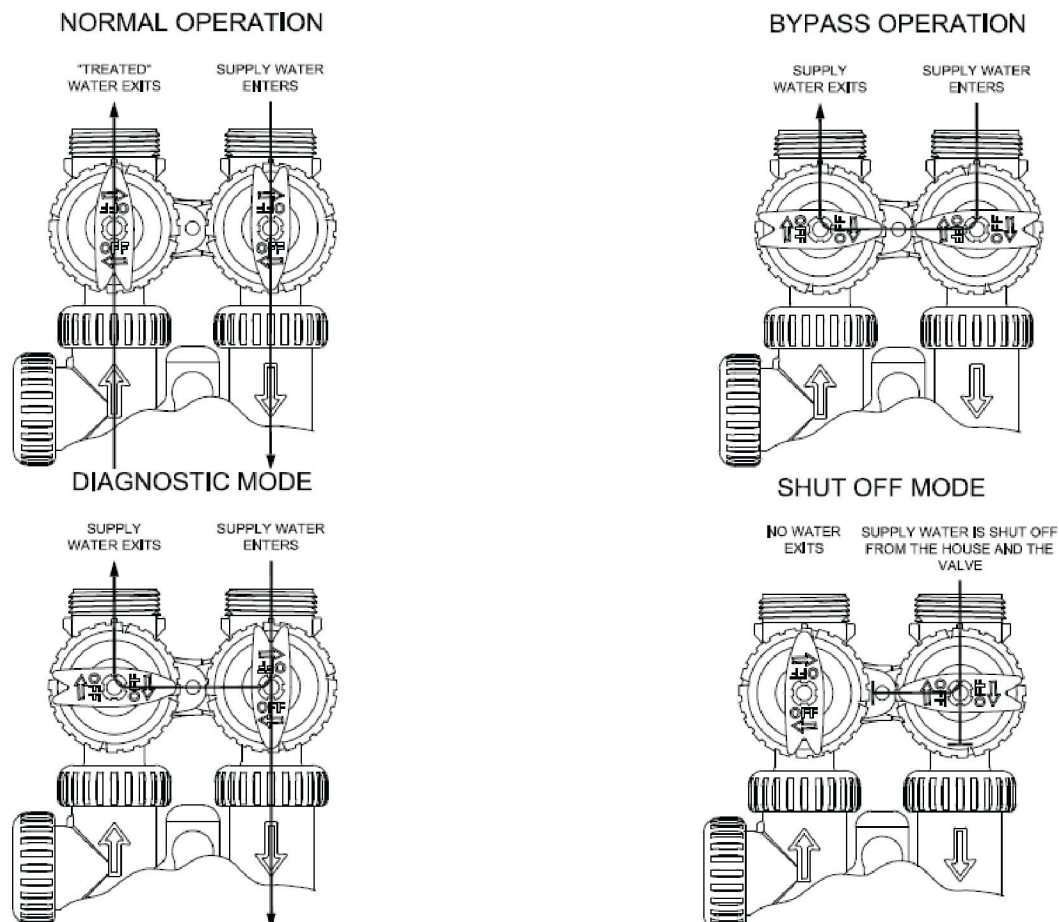
Default is Off, but can be set to 1 or 2 minutes. Keep in mind that the longer the rinse cycle, the smaller the air bubble will be.

### **5. Fill (OFF)**

## Bypass Valve

The bypass valve can isolate the control valve from the plumbing system in order to perform repairs or maintenance. The bypass consists of two interchangeable plug valves that are operated independently by red arrow-shaped handles. The handles identify the flow direction of the water. The plug valves enable the bypass valve to operate in four positions.

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



## Controller

### Control Operation During Service

One of five displays is shown. Pressing NEXT alternates between displays.

**User 1** - Displays gallons until backwash (not shown if set for time-clock operation).

**User 2** - Displays number of days until next backwash.

**User 3** - Displays present flow rate in gallons per minute (always reads 0 because no meter is installed).

**User 4** - Displays total volume in gallons since last reset (always reads 0 because no meter is installed).

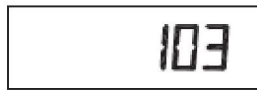
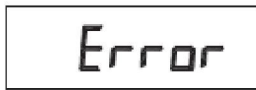
**User 5** - Shows current time.

### Regeneration and Error Screens



#### Regen Screen

Displays the time remaining in the current cycle. Pressing REGEN advances to the next cycle.

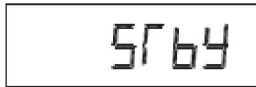


#### Error Screen

Alternated flashing Err and error code every 3 seconds. Clear by disconnecting the power supply at the PC board and reconnecting, or press NEXT and REGEN simultaneously for 3 seconds.



In Alternator Systems when a unit is waiting to initiate the first cycle step of regeneration, "REGEN Pndg" is displayed.



"STBY" is displayed in Alternator Systems when a valve is in Standby state.



"REGEN Pndg RINSE FILL" is displayed whenever a zero-capacity tank has transferred to an off-line state and is currently waiting to initiate the second portion of a regeneration cycle. Viewed only when Delayed Rinse and Fill is set to ON.

### Button Operation and Function



Scrolls to the next display.

Pressing once and releasing will schedule a regeneration at the preset delayed regeneration time.



Pressing again and releasing will cancel the regeneration.

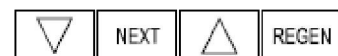
Pressing and holding for 3 seconds will initiate an immediate regeneration

Pressing while in regeneration will advance to the next cycle.

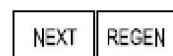
Pressing in the program levels will go backwards to the previous screen



Changes variable being displayed.

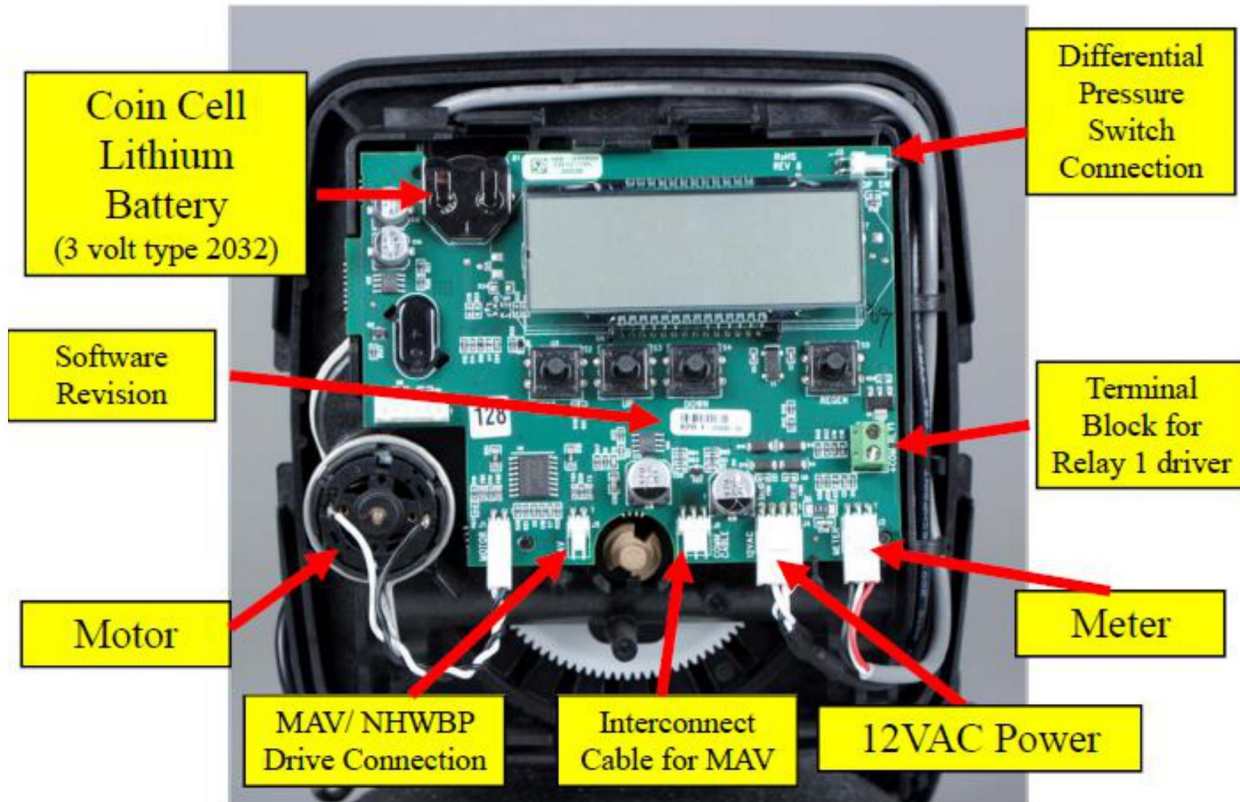


Key sequence to lock and unlock program settings.



Holding for 3 seconds initiates a control reset. The software version is displayed and the piston returns to the home/service position, resynchronizing the valve.





### **Control Operation during Backwash / Regeneration**

During regeneration, the control displays the time remaining in the step that the valve is either advancing to, or has reached. The step time flashes until the valve completes driving to that step. Once all steps are complete the valve returns to service / normal operation. Pressing the **REGEN** button during regeneration advances the valve to the next step.

### **Control Operation during Programming**

The control can only enter the Programming Mode with the valve in service. While in the Programming Mode, the control continues to monitor water usage and time. Control programming settings are permanently stored in nonvolatile memory.

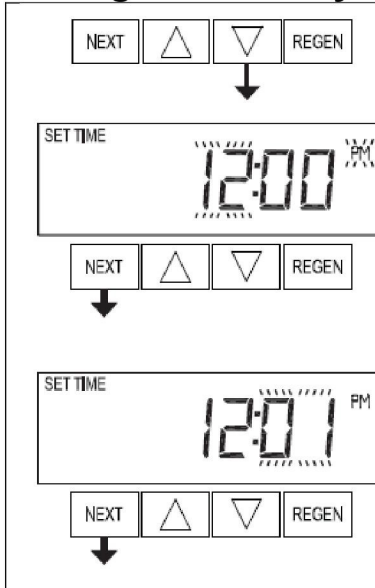
### **Control Operation during a Power Failure**

The control valve includes a coin cell backup battery. In the event of power failure, the control shifts into power-saving mode and stops monitoring water usage. The display and motor shut down, but the control continues to keep track of the time for approximately 8 hours. System configuration settings are stored indefinitely in non-volatile memory. The Time of Day flashes after a power failure. Press any button to stop the flashing. Reset time if necessary.

If power fails while the unit is in regeneration, the control will save the current valve position. When power is restored, the control will resume the regen cycle from the point where power failed. The installation should include all required safety components to prevent overflows resulting from a power failure during regeneration. The control will not start regeneration cycle without power.

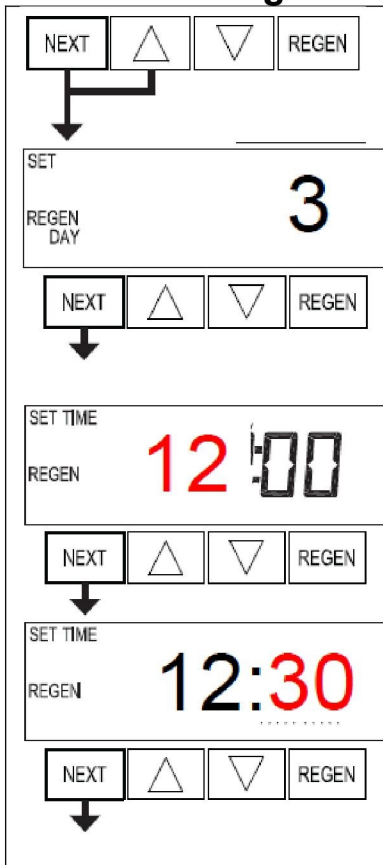
## Programming Screens

### Setting Time of Day



Push NEXT until time of day screen is displayed. Press and hold ▼ until SET TIME is displayed and the hour flashes. Press ▲ or ▼ until the correct hour is displayed. Then press NEXT. The minutes will flash. Press ▲ or ▼ until the correct minute is displayed. Press NEXT to return to the User Displays. In the event of a power outage that is less than 8 hours, the control valve will remember all settings and time of day. After 8 hours, the only item that needs to be reset is the time of day (indicated by the time of day flashing). All other settings are permanently stored in the control valve's nonvolatile memory. If a power loss occurs that is less than 8 hours and the time of day flashes, this indicates that the battery is depleted. The time of day should be reset and the non-rechargeable battery should be replaced. The battery is a 3 Volt Lithium Coin Cell type 2032. Time of day should be reset when Daylight Savings Time starts / ends.

### Installer Settings




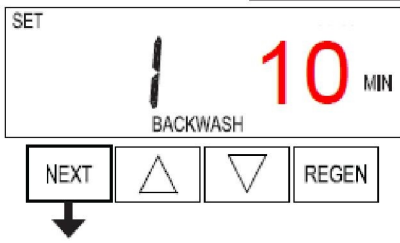
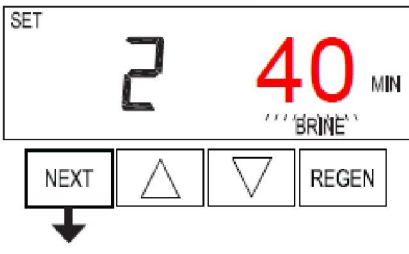


To enter Installer Display press NEXT and ▲ simultaneously for about 5 seconds and release.

Day Override: sets the number of days between regenerations. Set Day Override using ▲ or ▼ (1 to 28). Default is 3 Days Press NEXT to go to step 3I. Press REGEN to return to previous step.

Regeneration Time (hour): Set the hour of day for regeneration using ▲ or ▼. The default time is 12:30 am. Press NEXT to go to step 4I. Press REGEN to return to previous step.

Regeneration Time (minutes): Set the minutes of day for regeneration using ▲ or ▼. The default time is 12:30 am. Press NEXT to exit Installer Display Settings. Press REGEN to return to previous step.

## System Setup (for reference only – completed during assembly)

<p><b>Step 1S</b></p> 	<p><b>Step 1S</b> - Press NEXT and ▼ simultaneously for 5 seconds and release.</p> <p><b>Step 2S – Leave as default setting = “SOFTENING”.</b> Press NEXT to go to Step 3S. Press REGEN to exit OEM Softener System Setup.</p>
<p><b>Step 5S</b></p> 	<p><b>Step 3S – Leave as default Brining Direction = “dn”.</b> Press NEXT to go to Step 4S. Press REGEN to return to previous step.</p> <p><b>Step 4S – Leave as default Fill = “Post”.</b> Press NEXT to go to Step 4S. Press REGEN to return to previous step.</p> <p><b>Step 5S – Select the time for the first cycle (Backwash) using ▲ or ▼.</b> Default = 10 minutes. <b>INCREASE AS NECESSARY BUT DO NOT DECREASE.</b> Press NEXT to go to Step 6S. Press REGEN to return to previous step.</p>
<p><b>Step 6S</b></p> 	<p><b>Step 6S – Select the time for the second cycle (Air Recharge) using ▲ or ▼.</b> Default = 40 minutes. <b>INCREASE AS NECESSARY BUT DO NOT DECREASE.</b> The display will flash between cycle number &amp; time, &amp; brine direction (UP or dn). Press NEXT to go to Step 7S. Press REGEN to return to previous step.</p> <p><b>Step 7S – Select the time for the third cycle using ▲ or ▼.</b> Default = “oFF”. <b>DO NOT CHANGE.</b> Press NEXT to go to Step 8S. Press REGEN to return to previous step.</p>
<p><b>Step 8S</b></p> 	<p><b>Step 8S – Select the time for the fourth cycle using ▲ or ▼.</b> Default = “oFF”. <b>DO NOT EXCEED 1 MINUTE.</b> Press NEXT to go to Step 9S. Press REGEN to return to previous step.</p> <p><b>Step 9S – Select the pounds for the fifth cycle using ▲ or ▼.</b> Default = “oFF”. <b>DO NOT CHANGE.</b> Press NEXT to go to Step 10S. Press REGEN to return to previous step.</p>
<p><b>Step 10S</b></p> 	<p><b>Step 10S – Set System Capacity – Leave at Default.</b> Press NEXT to go to Step 11S. Press REGEN to return to previous step.</p> <p><b>Step 11S – Set Volume Capacity – Leave at “oFF”</b> Regeneration will be triggered by the day override setting, or can be set to regenerate on specific days of the week. Press NEXT to go to Step 12S. Press REGEN to return to previous step.</p> <p><b>Step 12S – Set Regeneration Trigger using ▲ or ▼.</b> If Step 11S is set to OFF, Regeneration Trigger can be set to 28 day or 7 day. Press NEXT to go to Step 13S. Press REGEN to return to previous</p> <p><b>Step 13S – Not Shown</b></p> <p><b>Step 14S – Set Relay Operation – “oFF”.</b> If set to “oFF”, 15S &amp; 16S are not shown. Press NEXT to go to Step 15S. Press REGEN to return to previous step.</p>



**REPLACEMENT PARTS**

<b>Part #</b>	<b>Desc.</b>	<b>Photo (not to scale)</b>
KT7704AIO	WS1EE AIO Valve	
K74V3005	STACK	
K74V3011	PISTON	
K74V3174	REGENERANT PISTON	
OV32	INLET CHECK VALVE	
OV15HT	AIR DRAW CHECK VALVE	
H6061	AIR DRAW SCREEN	
KTSCREEN	SCREEN W/ TUBE	
K74V4144AIO	AIR DRAW ASSY COMPLETE	
AIOGROM	GROMMET	
D7147	UPPER DEFLECTOR	
K74V30101F*	INJECTOR F (BLUE)	
RKWS1AIO	AERATION MAINTANANCE KIT	Includes Blue Injector, Pistons, Stack Assy, Stack Puller Tool, and Service Wrench
VARIES	DRAIN LINE FLOW CONTROL	~

\*Injector may vary on larger tanks

### FILTRATION MEDIA OVERVIEW

Media	Physical Characteristics	Description
Birm®	Color: black Density: 40 – 45 lbs. per CF Mesh size: 10 x 50	Birm® is a granular, silica based, manganese dioxide coated, filter media commonly used for the reduction of iron and/or manganese from water supplies. It acts as an insoluble catalyst to enhance the oxidation reaction between dissolved oxygen in the water and the iron and manganese compounds. The oxidized minerals are precipitated out of solution and removed by filtration in the bed. Birm offers long material life with relatively low attrition loss, a wide temperature performance range and extremely high removal efficiency. Regeneration is not required. Certified to NSF/ANSI Standard 61.
BWS™ Aeration Mix	Color: black / brown / whitish Density: 45 lbs. per CF	BWS Aeration Mix is a custom media blend for use with Aeration Iron Oxidizing (AIO) filters for the reduction of iron and/or manganese from water supplies. It consists of a proprietary mixture of Birm®, Calcite®, Corosex® and Filter Ag® medias for pH correction, oxidation acceleration, and particle filtration in a single media tank. Due to the sacrificial nature of both Calcite and Corosex, periodic replenishment will be required. Birm and Filter Ag are durable minerals with a life expectancy of 8-10 years.
Calcite Georgia Marble	Color: whitish Density: 100 lbs. per CF Mesh size: 16 x 40 CaCO <sub>3</sub> : 95% min MgCO <sub>3</sub> : 3.0% max	Calcite is a naturally occurring, crushed and screened white marble media which is used to neutralize acidic or low pH waters to a neutral, less corrosive state. Upon contact with Calcite, acidic waters slowly dissolve the calcium carbonate to raise the pH which reduces the potential leaching of copper, lead and other metals found in typical plumbing systems. Calcite corrects pH only enough to reach a non-corrosive equilibrium. It does not overcorrect under normal conditions. Periodic backwashing will prevent packing, reclassify the bed and maintain high service rates. The media will have to be periodically replenished as the Calcite is depleted. As the Calcite's calcium carbonate neutralizes the water, it will increase hardness and a softener may become necessary after the neutralizing filter. Certified to NSF/ANSI Standard 61.
CENTAUR® Catalytic Activated Carbon	Color: black Density: 34 lbs. per CF Mesh size: 12 x 40	CENTAUR is engineered carbon with enhanced catalytic properties to accelerate and promote oxidation, reduction, decomposition, substitution reactions for the elimination of chloramines, hydrogen sulfide and iron from drinking water. Advantages include low water-soluble ash content, wide pH operating range, and it is not impregnated with metals or alkali, eliminating safety concerns. Certified to NSF/ANSI Standard 42.
Chemsorb®	Color: light green Density: 55 lbs. per CF Mesh size: 14 x 40	Chemsorb is a natural Zeolite mineral with a highly porous granular surface area that provides superior filtration down to 5 micron at high flows up to 12-18 gpm/ft <sup>2</sup> . Advantages include the removal of a wide range of colloidal and soluble inorganic contaminants by surface sorption, chemical-binding, charge-neutralization, coagulation reactions, and/or ion-exchange phenomena. Certified to NSF/ANSI Standard 61.
Corosex®	Color: brownish white Density: 75 lbs. per CF Mesh size: 6 x 16	Corosex® is a specially processed hard, bead-like magnesium oxide media, adapted for use in filters to neutralize acidity by increasing the pH value. Corosex neutralizes free carbon dioxide in water correcting acidic conditions and rendering it less corrosive. Corosex is a highly reactive magnesium oxide and is most effective where pH correction is substantial or high flows are required. Under certain low flow conditions, Corosex may over correct and create a highly basic (high pH) condition. As Corosex's neutralizes the water, it will increase hardness and a softener may become necessary after the neutralizing filter. Certified to NSF/ANSI Standard 61.
Filter-AG®	Color: light gray to whitish Density: 24 - 26 lbs. per CF Mesh size: 10 x 34	Filter-AG is a granular pumicite media with a fractured and highly irregular surface area. This unique structure creates a complex flow path allowing for maximum removal of suspended matter throughout the filter bed. It typically removes suspended solids down to 20 – 40 microns. Filter-AG's larger particle size creates less pressure loss and high dirt removal capacity resulting in longer filter runs. Due to this and its lighter weight, it works very well in dual bed or multi-media filtration systems (in addition to single beds). Certified to NSF/ANSI Standard 61.
Katalox Light®	Color: black Density: 66 lbs. per CF Mesh size: 14 x 30	Katalox-Light® is an engineered catalytic ZEOSORB media coated with manganese dioxide. It is used for high level filtration, color and odor removal, Iron, Manganese, Hydrogen sulfide removal, and pH correction. Under certain conditions, an oxidizer such as H <sub>2</sub> O <sub>2</sub> may be used to accelerate the catalytic oxidation on the surface of the media. Certified to NSF/ANSI Standard 61.
Greensand Plus™	Color: black Density: 85 lbs. per CF Mesh size: 18 x 60	GreensandPlus™ is a granular, silica based, manganese dioxide coated, filter media commonly used for the removal of soluble iron, manganese and hydrogen sulfide from well water. The manganese dioxide coating acts as a catalyst in the oxidation reaction of iron and manganese. Chemical regeneration is necessary. Depending on the application, regeneration may be continuous (CR) or intermittent (IR). Certified to NSF/ANSI Standard 61.
MTM®	Color: dark brown Density: 45 - 50 lbs. per CF Mesh size: 12 x 50	MTM is a granular manganese dioxide filtering media used for reducing iron, manganese and hydrogen sulfide from water. Its active surface coating oxidizes and precipitates soluble iron and manganese. Hydrogen sulfide is oxidized to sulfur. The precipitates are then filtered out in the granular bed and removed by backwashing. Chemical regeneration is necessary. Depending on application, regeneration may be continuous or intermittent. Certified to NSF/ANSI Standard 61.