



# **MATD 9500 XT**

1-½" Systems

## **AUTOMATIC WATER DEALKALIZER**

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**INSTALLATION, OPERATION, AND  
MAINTENANCE MANUAL**

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**Appendix:**

8 Series 150 Chemical Feed Pump Manual



## **PRODUCT WARRANTY**

Marlo, Inc. warrants all water treatment products manufactured and/or distributed by it to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. The fiberglass mineral tank(s) alone have a warranty for a period of five (5) year from the date of shipment. If within that period any products shall be proven to Marlo, Inc.'s satisfaction to be defective, those products will be replaced, or the price refunded at Marlo Inc.'s option.

Marlo Inc.'s obligations or nonperformance, defective, or any damage caused by its products or their use, and buyer's exclusive remedy therefore, shall be limited to product replacement or refund and shall be conditioned upon Marlo Inc.'s receiving written notice together with a demand for such replacement or refund:

The foregoing warranty is exclusive and in lieu of all other expressed implied warranty (except of title) including but not limited to implied warranty of merchantability and fitness for particular purpose.

Marlo Inc. will not be subject to and disclaims the following:

1. Any other obligations or liabilities arising out of breach of contract or out of warranty.
2. Any obligations whatsoever arising from tort claims (including negligence and strict liability) or arising under other theories of law with respect to products sold or services rendered by Marlo Inc. or any undertakings, acts, or omissions relating thereto.
3. All consequential, incidental, and contingent damages.

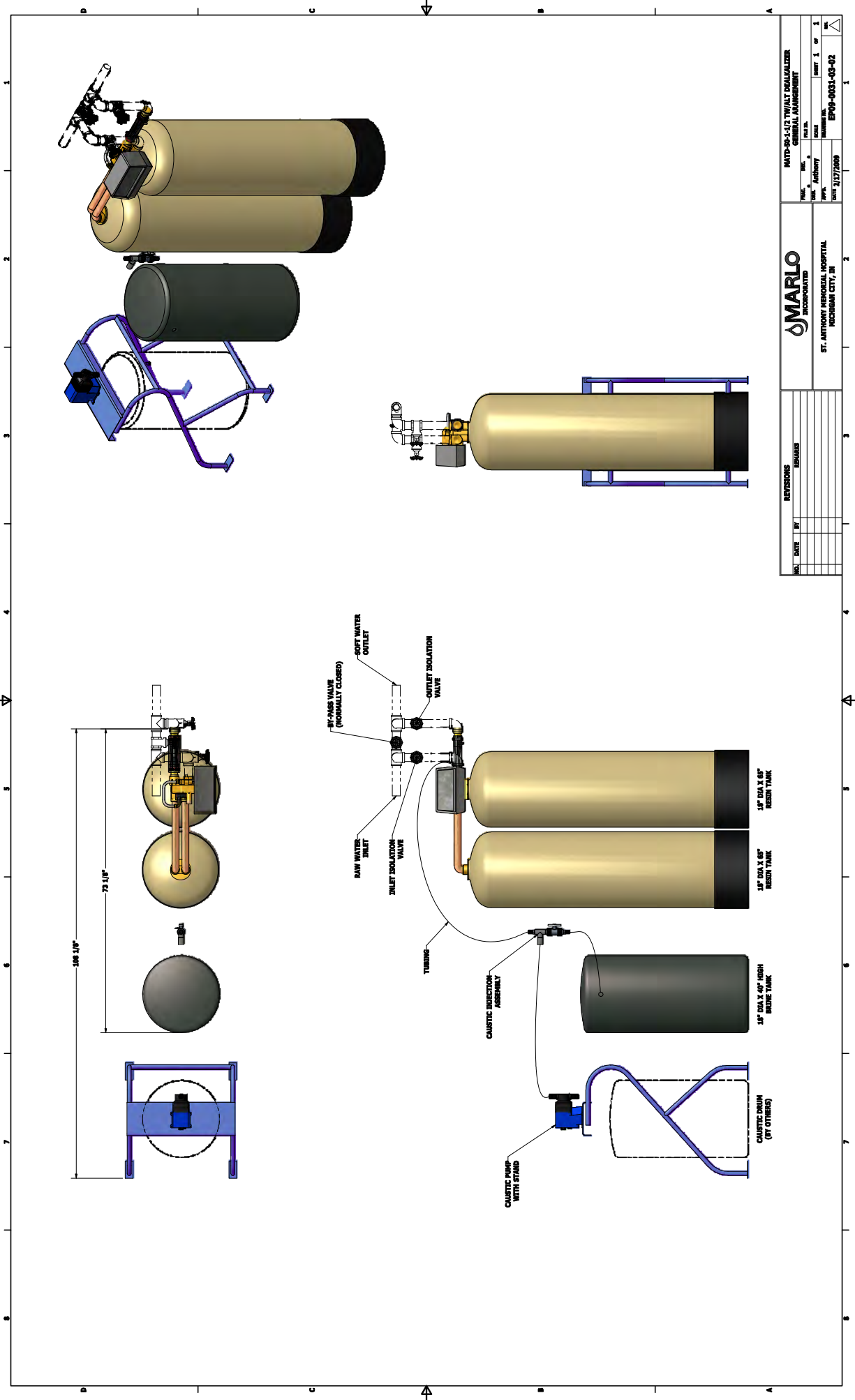
Labor charges, change backs or handling charges are excluded from Marlo Inc.'s warranty provisions.

## **WATER CONDITIONER GUARANTEE**

Under normal operating conditions:

1. The loss of resin through attrition during the first three (3) years shall not exceed 3% per year.
2. The resin shall not be washed out of the system during backwash.
3. The color and turbidity of the softener effluent shall not be greater than the incoming water.

Any mechanical equipment proving defective in workmanship or material within one year after installation or (18) months after shipment, whichever comes first, shall be replaced FOB factory.



REV.	DATE	BY	REVISIONS

**MARLO**  
 INCORPORATED  
 ST. ANTHONY MEMORIAL HOSPITAL  
 MICIGRAM CITY, IN

MATD-95-517 TWTAL DIALYZER  
 WATER MANAGEMENT  
 VAC. INC.      J. JACOBI  
 ST. ANTHONY      ST. ANTHONY  
 APP.      APP.  
 NUMBER IN.      NUMBER IN.  
 UNIT 217/2509      UNIT 1 OF 1

## SPECIFICATION TABLE

**MODEL** MATD-60-1-1/2

### SPECIFICATIONS

Design Temperature 35-100°F  
Design Pressure 30-100 psig  
Power Requirements 120 VAC 60 Hz  
Resin Capacity 60,000 grains @ 5 lbs. Salt Dosage and 0.3 lbs Caustic

### SYSTEM FLOW RATES

Continuous Service 14.0 gpm  
Backwash Rate 6.0 gpm  
Brine Draw Rate 0.6 gpm  
Brine Rinse Rate 1.75 gpm  
Fast Rinse Rate 6.0 gpm  
Caustic Injection Rate 1.6 gph

### MINERAL TANK

Mineral Tank Size 21 inch diameter / 62 inch side shell  
Gravel Quantity 80 lbs. / tank  
Resin Quantity 6 ft<sup>3</sup>

### CONNECTIONS

Inlet / Outlet 1.5" inch inlet / outlet  
Drain Size 1 inches  
Brine Connection 1/2 inch

### BRINE MEASURING TANK

Brine Measuring Tank Size 18 inch diameter / 40 inch height  
Refill Water Volume Requirement 12 gallons of water required @ 5 lbs. Salt dosage  
Brine Volume Requirement 15 gallons of brine required @ 5 lbs. Salt dosage  
Brine Draw Dimension 13 inches Refill Height  
Salt Requirements 5 lbs. salt (Dry Total) dosage per cubic foot of resin

### CAUSTIC PUMP

Pump Model Chemtech X068 Series 150 (X068-XA-AAAAXXX)  
Pump Setup 3.33 lbs. caustic (Dry) Dosage per Cuft of Resin  
Caustic Volume Requirement 0.31 Gallons @ 50% Sodium Hydroxide  
Caustic Injection Rate 0.94 gph  
Duration 20 min  
Caustic Volume Requirement 50% Sodium Hydroxide (RAYON GRADE)

## SPECIFICATIONS

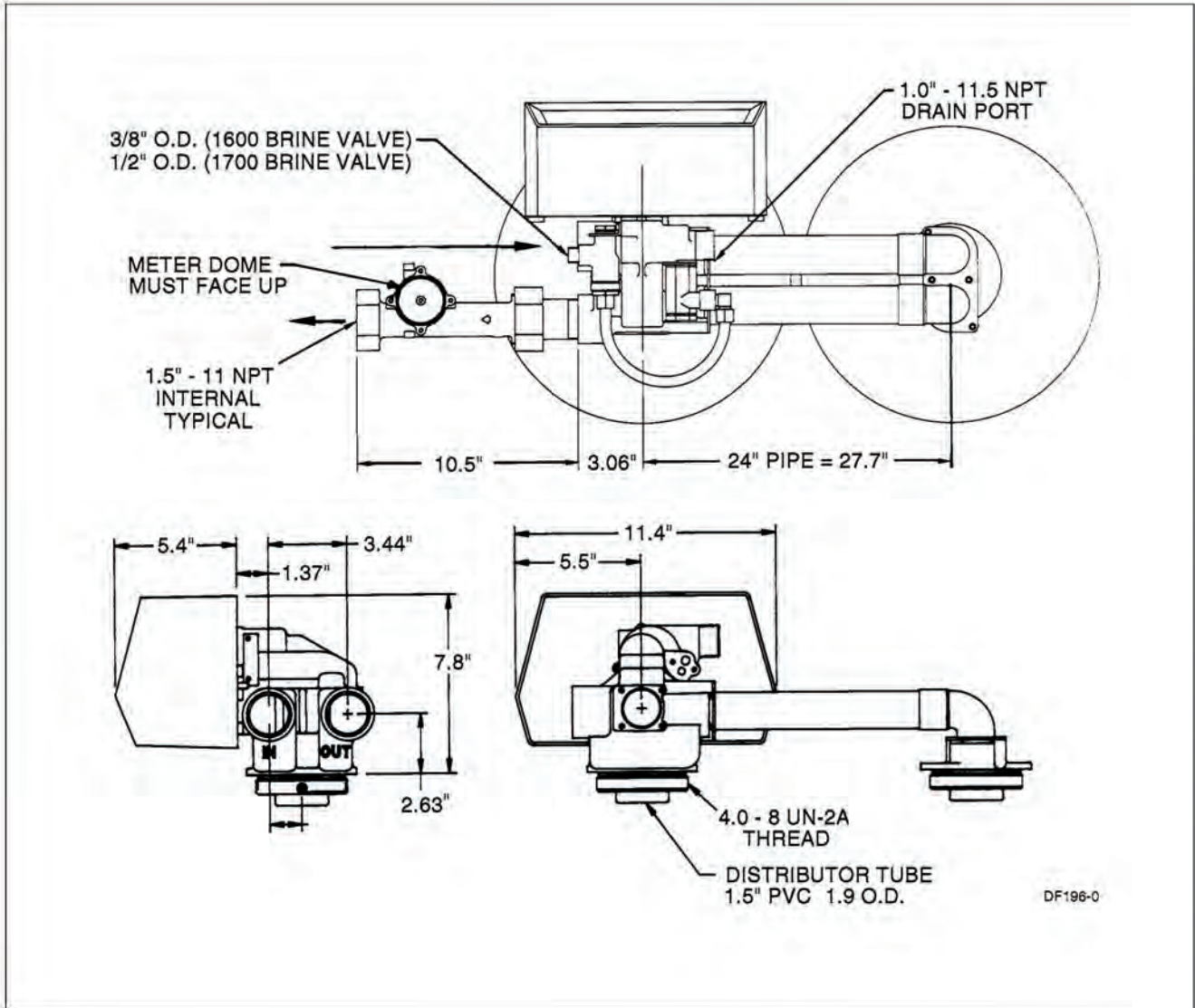
MODEL		MATD	50	60	80	100
Valve Size		Inches	1-1/2	1-1/2	1-1/2	1-1/2
Capacity (Kilograins)			50	60	80	100
FLOWRATE (GPM)	Service	Continuous	12.5	15	20	25
		Peak	25	30	40	50
	Backwash & Fast Flush		5	6	8	12
	Brine Draw & Rinse		1.5	1.5	3.2	3.2
	Brine Tank Refill		2	2	2	2
TIMER SETTINGS	Backwash	Minutes	10	10	10	10
	Brine Draw & Rinse	Minutes	60	60	60	60
	Fast Flush	Minutes	10	10	10	10
	Brine Tank Refill	Minutes	4	5	7	8
SOFTENER TANK	Size	Dia x Height Inches	18 x 65	21 x 62	24 x 72	30 x 72
	Gravel Subfill	Pounds	40	80	120	225
	Resin	Cubic Feet	5	6	8	10
	Freeboard	Inches	24	23	30	22
BRINE SYSTEM	Tank Size	Dia x Height Inches	18 x 40	18 x 40	24 x 40	24 x 40
	Injector	Code	3C	4C	5C	5C
		Color	YEL	GRN	WHT	WHT
	Maximum Salt Storage	Pounds	325	325	550	550
	Salt Dosage ❶		25	30	40	50
	Caustic Dosage ❷		0.23	0.28	0.37	0.55
	Refill Time	Minutes	4	5	7	8
	Caustic Pump Setting ❸		1	1.2	1.5	2.2
Regeneration per Salt Refill		13	10	13	11	
Regeneration Waste Volume		Gallons	200	250	490	520

NOTE ❶: Salt is pellet salt which is 99% Sodium Hydroxide

NOTE ❷: Caustic dosage is 50% Sodium Hydroxide Rayon Grade or better

NOTE ❸: Set Caustic Pump

**9500 Control Dimensions**



# INSTALLATION INSTRUCTIONS

## WATER DEALKALIZER

### GENERAL INFORMATION

1. Minimum operating pressure is 25 psi.

If pressures less than 25 psi are encountered, a pump must be installed.

**Note:** The control valve will not operate correctly if feeding into an atmospheric tank. A pressure control device must be added to the outlet to maintain the minimum pressure.

2. Maximum operating pressure is 120 psi.

If pressures greater than 120 psi are encountered, a pressure regulator must be installed.

3. Power requirements are shown on inside cover of the control valve.

4. Standard units are designed to condition unheated water not to exceed 100° F.

Special valve assemblies are available to handle heated water supplies exceeding 100°F. Consult factory if applicable.

5. Each dealkalizer tank is shipped with distributor manifold and control valve preassembled. Take care when uncrating and erecting so that no items are damaged.

6. The distributor assembly has been shipped inside the fiberglass mineral tank.

Check to make sure that there is no damage to the riser pipe, baskets, laterals, or hub.

8. Freeboard is the distance between the surface of the resin and the top of the tank.

9. Regeneration waste volume is the total gallons of water that is discharged per regeneration.

10. The water meter has a flow range of 1.5 to 75 gpm with accuracy  $\pm 5\%$ .

11. On continuous flow rates pressure loss does not exceed 15 psig.

On peak flow rates pressure does not exceed 25 psig.



## DEALKALIZATION

Alkalinity is a measure of a water's ability to neutralize an acid. There are three components to alkalinity including, bicarbonate ( $\text{HCO}_3$ ), carbonate ( $\text{CO}_3$ ) and hydroxide ( $\text{OH}$ ). The existence of these ions is pH dependent.  $\text{HCO}_3$  will be the predominant constituent of alkalinity at a pH of 4.3 to 8.3. The  $\text{CO}_3$  ion will begin to form at a pH greater than 8.3. At a pH of approximately 10 the  $\text{OH}$  ion will start to exist.

The relationship between the components of alkalinity and pH allows for the accuracy of the water analysis to be verified. If water has a pH of 9.0 and only the bicarbonate alkalinity was reported on the analysis, the analytical results are deficient. Carbonate alkalinity should have also been reported on the analysis. In order to eliminate the potential for error in the water analysis a total alkalinity test can be performed. Total alkalinity is run by testing for P and M alkalinity. P alkalinity or phenolphthalein endpoint is a measure of the amount of acid required to neutralize the alkalinity down to a pH of approximately 8.3. M alkalinity or methyl orange endpoint is a measure of the amount of acid required to neutralize the alkalinity down to pH of approximately 4.3. The actual concentrations of  $\text{HCO}_3$ ,  $\text{CO}_3$ , and  $\text{OH}$  are derived from calculations using the P and M alkalinity; see Standard Methods Edition 17 Method 2320 B.

The most common question asked is why when caustic ( $\text{NaOH}$ ) is added to acidic water and the pH is elevated to 8 that no  $\text{OH}$  alkalinity exists? The answer goes back to pH. No  $\text{OH}$  alkalinity can exist at this pH. The  $\text{OH}$  will react with  $\text{CO}_2$  to form bicarbonate, at this pH.

If water's alkalinity concentration becomes too high, it can have a bitter taste. Anion ion exchange resin can be used to remove alkalinity, thereby reducing the pH and bitter taste associated with high concentrations of alkalinity. If the alkalinity concentration in the influent water is high, the replacement of alkalinity with chloride may result in a salty taste. The salty taste may be noticed at levels of 600 to 800 ppm TDS. An R/O system should be used to eliminate the salty taste.

Alkalinity is also a problem with boiler feed water. The bicarbonate and/or carbonate ions can be broken down to form  $\text{OH}$  and  $\text{CO}_2$  when water is converted to steam in the boiler. The  $\text{OH}$  ion remains in the water while the steam contains  $\text{CO}_2$ . When this steam condenses the  $\text{CO}_2$  forms carbonic acid ( $\text{H}_2\text{CO}_3$ ), which will attack most metals, it will shorten the life of the condensate return system. For this reason dealkalization of water used in boilers may be required, depending on the conditions of operation. Consult your local water doctor.

A type II anion resin is generally used to dealkalize water. There are two types of regeneration. The first utilizes only salt, the second uses a combination of salt and caustic ( $\text{NaOH}$ ). If salt is used, the hardness in the influent water should be less than 10 grains / gallon to prevent the precipitation of  $\text{CaCO}_3$ . In most cases, where dealkalization is necessary, the hardness will have to be removed, since scaling may occur. If salt and caustic are used, the water that is fed into the dealkalizer, as well as the water used to regenerate it, should be soft. The biggest difference between the two regeneration processes is that the salt and caustic will achieve higher capacities than salt alone.

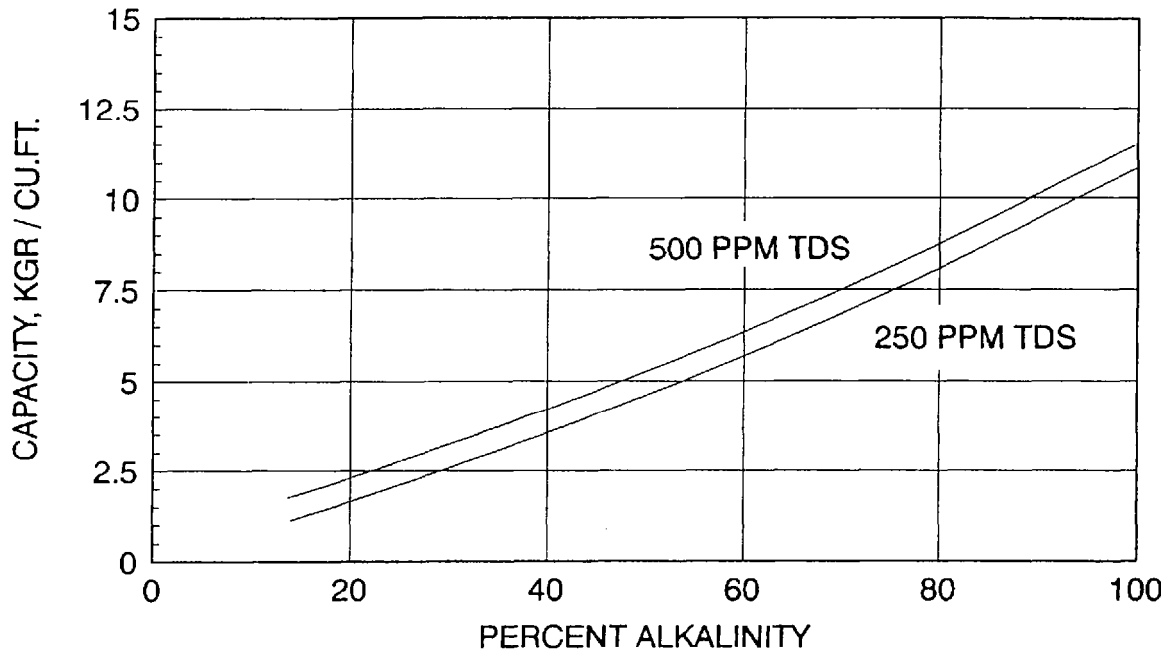
## DEALKALIZATION continued

When sizing a dealkalizer, the water analysis must as a minimum include the following parameters; total alkalinity, chloride (Cl), sulfate ( $\text{SO}_4$ ), total hardness and TDS. The Cl and  $\text{SO}_4$  must then be converted to their  $\text{CaCO}_3$  equivalents. Remember, the total alkalinity is already expressed as  $\text{CaCO}_3$ . The next step is to calculate the percentage of alkalinity as a function of the total anions. From the capacity curve using the percent alkalinity the operating capacity (kgr/cu.ft.) can be obtained. When using only salt, a dosage of 5 lbs/cu.ft. is used to regenerate the resin. Higher concentrations can be utilized; however, capacity will not be significantly increased. When caustic is utilized, 0.25 lbs of 100% NaOH are used in conjunction with 5 lbs of salt. The amount of caustic employed in the regeneration can be adjusted, so that the effluent OH concentration will be at a desired level. In boiler treatment some OH alkalinity is desirable to assure the corrosion potential is reduced to a minimum. Leakage will be approximately 10% of the influent alkalinity. This is applicable to either type of regeneration. When caustic is used in conjunction with salt as the regenerant, leakage must be calculated. The 10% leakage is carbonate alkalinity. Hydroxide alkalinity will exchange off the resin bed and exist in the effluent along with the carbonate alkalinity resulting in a high pH effluent. Caustic soda is normally used when the dealkalizer is supplying water for boiler make-up. Caustic soda should not be used as a regenerant when dealkalizing potable water.

Figure 12.

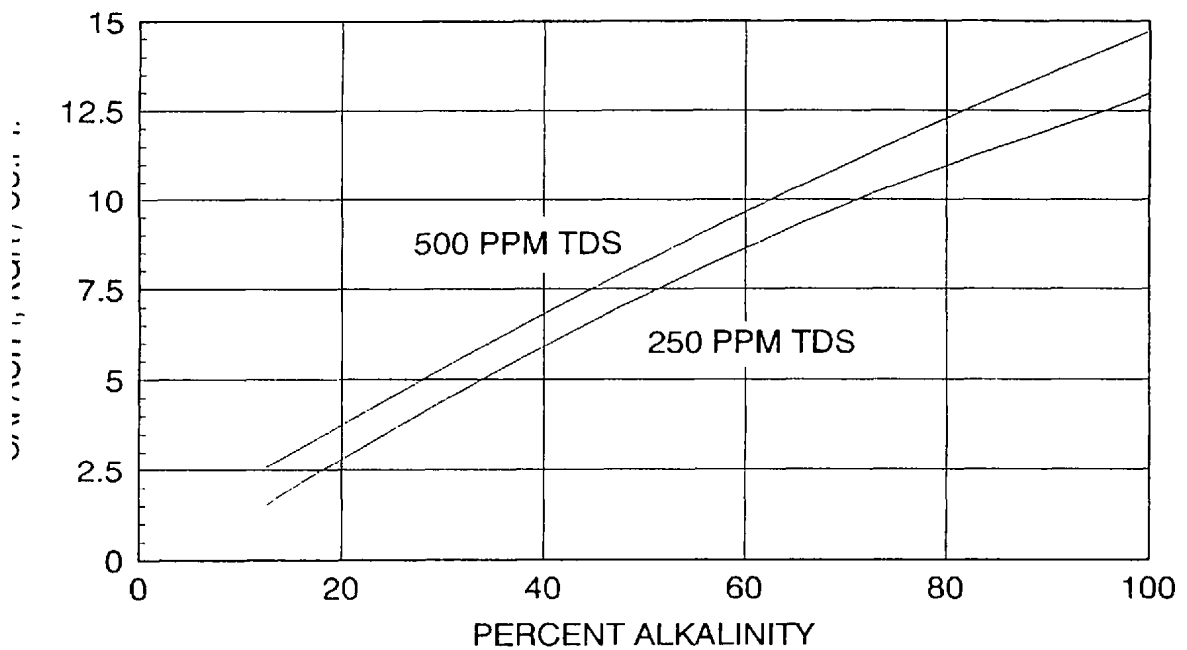
# IONAC ASB-2

## DEALKALIZATION



5 LBS 100% NaCl / CU.FT.

## DEALKALIZATION



LBS 100% NaCl AND 0.25 LBS 100% NaOH

## LOCATE DEALKALIZER

1. Select a location that is accessible and near a floor drain that has adequate carrying capacity to handle the backwash flow. See specification table for the flow rate.
2. Erect the mineral tanks on a concrete or other firm foundation and level.
3. Position the brine tank according to the illustration and supplementary brine tank information. Keep the brine tank as close as possible to the mineral tanks.

**Note:** The distance between the mineral tanks and brine tanks will affect the brine injector performance, as the distance increases the injector performance decreases. This may cause an inadequate regeneration.

4. A grounded electric receptacle is required for the control valves.

## LOAD DEALKALIZER TANK

1. On tank sizes 12 inches and smaller the media has been pre-loaded at the factory. Skip this section and go to "Mount Control Valve Assembly".
2. Fill tank approximately 1/3 full of water using a hose, bucket, etc. Plug the PVC distributor manifold pipe using a plastic cap, cork, rag, etc. **No** gravel or resin should go into this distributor manifold pipe.
3. Verify the distributor manifold is center in the tank with the distributor resting on the bottom of the tank. Verify the riser pipe is still plugged.

**Note:** Reference the specification table in the front of this manual for the correct quantities of gravel and resin. These quantities are for each tank. Make sure you have the required amounts on site before you begin.

4. With care not to damage any lateral, pour in the gravel provided for each tank through the top opening in the tank and level out evenly. This will cover the distributor assembly.

**Note:** Wetting the gravel in the bags before loading will eliminate the normal amount of dust.

5. When gravel is loaded and leveling is completed, proceed as follows:
6. With the distributor riser pipe still plugged, add the proper amount of resin supplied for each tank through the top opening in the tank.

**Caution:** The softener resin is very slippery. Take care when stepping on any spilled resin. Remove spilled resin from standing surface immediately.

7. When loading is complete, remove plastic cap, cork, or rag that was used to plug the distributor riser pipe. Be careful not to let any foreign debris fall into the pipe. The result could be damage to system.
8. Repeat instruction steps 1-7 for each softener.

## **MOUNTING CONTROL VALVE ASSEMBLY**

1. On the right side tank, verify that the distributor riser pipe is not plugged.
2. Lubricate the distributor o’ring on the bottom of the control valve with silicone.
3. Screw the control valve into top opening of tank making sure the distributor riser pipe slides easily through the distributor o’ring. Care must be taken not to “nick” this o’ring as hard water leakage could result.
4. Tighten down the control valve to ensure positive o’ring seal at top of tank.
5. On the left side tank, verify that the distributor riser pipe is not plugged on the second softener tank.
6. Lubricate the distributor o’ring on the bottom of the second tank adapter assembly with silicone.
7. Screw the second tank adapter assembly into top opening of tank making sure the distributor riser pipe slides easily through the distributor o’ring. Care must be taken not to “nick” this o’ring as hard water leakage could result.
8. Attach the second tank adapter assembly to the control valve.
9. A grounded electric receptacle is required for the control valve.

## **MOUNTING WATER METER ASSEMBLY**

1. Locate the water meter. The water meter has a flow arrow stamped on it. The flow arrow on the meter should be pointing away from the control valve. Attach the meter to the control valve's water outlet.
2. The digital water meter is connected to the control valve with a transducer wire cable. Attach the one end of the cable with a small rectangular box on it into the dome of the meter. Secure the transducer with attached screw clamp on the top of the meter dome. Wire the other end of this cable to the control valve's terminal strip. Reference the electrical wiring diagram located in the back of this manual.

## INSTALLATION OF CONNECTION PIPING

### Note:

- Use thread sealing tape on all threaded piping connections.
- Install the piping conforming to federal, provincial, and local codes.
- Unions or flanges are recommended at the control valve's inlet and outlet connections
- To enhance the monitoring of the system's performance sample valves and pressure gauges can be installed at the inlet and outlet piping of the softening unit.
- If distance of drain line is over a 10 ft. vertical or 25 ft. horizontal run, increase drain line one pipe size over that provided on the control valve.
- Do not make a direct connection to the drain. Provide an air gap of at least four times the diameter of the pipe to conform to sanitation codes and to permit observation of the flow.
- It is not recommended that an overhead or a long horizontal drain run be used. The increase of backpressure will cause problems when drawing brine.

**Caution:** All piping must be properly supported. The tank and valve assemblies are not meant to support the connecting piping.

1. Install piping as shown on installation diagram. It is recommended that unions be installed before the inlet and outlet valves to facilitate service of unit. Be sure piping is free of thread chips and other foreign matter. The connecting piping should be the same size or larger than the service inlet and outlet of the control valve.
3. Verify that the flow arrow stamped on the flow controller is pointing away from the control valve. See installation diagram or valve manual for the location. Install a drain line from backwash control assembly to an appropriate drain using a minimum of elbows. Install a union near the backwash control to facilitate cleaning.

**Note:** Do **not** install a valve on the drain line.

3. Connect the brine line tubing to the control valve and to the brine tank. Verify that the brine line tubing is not kinked or restricted
4. Run flexible tubing from the brine tank's over flow fitting to an appropriate, non-elevated, open drain.

## CAUSTIC PUMP INSTALLATION

Refer to the pump installation, operation, and maintenance manual located in the back of this manual.

### START-UP

1. Again, make sure all plumbing is complete and tight including drain line and brine line. Make all electrical connections per wiring diagrams provided.
2. Using a bucket or hose, fill brine tank with water to 2" above salt platform. Do **not** add salt at this time.
3. Make sure inlet and outlet isolation valves are closed then connect electrical power to the control valve by plugging in the valve. Once the Valve is powered it will drive to the service position.
4. During cold weather it is recommended that the installer warm the timer up to room temperature before operating.
5. Program the XT controller by following Option Setting Level #1 Programming Chart of the 3200 XT Timer Service Manual found in the manual.

**Note:** Start up only one (1) tank at a time.

## WATER DEALKALIZER GENERAL OPERATION

**Backwash:** The cycle duration is factory set at 10 minutes for clean feed water applications. Increase time duration to 15 minutes when turbidity is present in the feed water.

**Brine/Rinse:** The cycle duration is factory is set at 60 minutes to assure the required amount of brine is introduced and rinsed from the resin. Increase time duration when the injector feed pressure is below 40 psi.

**Flush:** The cycle duration is factory set at 10 minutes to rinse chlorides from the resin prior to the softener is placed online. Increase time duration to 15 minutes if traces of chlorides are present in the service outlet water.

**Brine Tank Refill:** The cycle duration is factory set at the maximum valve to achieve maximum softener capacity..

**Cycle End:** The cycle duration is factory set at 4 minutes. Its purpose is to identify the end of regeneration and advance the softener control valve to the standby cycle.

**Note:** Brine Draw / Slow Rinse step is actually two events. The brine is suctioned from the brine tank until the level falls to the bottom of the brine valve. An air check in the valve will close once the brine is to low. This is the end for the Brine Draw step and should last about twenty (20) minutes. The rest of the time in Step 2 is Slow Rinse. The caustic injection is simultaneous to the Brine Draw step.



## RECOMMENDED TYPES OF SALT

Only purified salt should be used in the brining system. Palletized salt (“Button”, “Nugget”, and “Pellet”) or block salt (free binders) is recommended. Do **not** use granulated salt, as it will fall through the platform screen.

Rock salt is not normally recommended. Most rock salt contains sludge-forming insoluble that collect on the platform and prevents proper salt-water contact.

Only salt containing 0.5% or less of insolubles will provide continued satisfactory operation. If, salt with more insolubles is used, the brine maker will require periodic cleaning.

## DEALKALIZATION EXAMPLE CALCULATION

The Water Analysis

Total Alkalinity as CaCO <sub>3</sub>		200 ppm
Chloride as Cl	100 ppm x 1.41	141 ppm
Sulfate as SO <sub>4</sub>	5 ppm x 0	52 ppm as CaCO <sub>3</sub>
TDS as CaCO <sub>3</sub>		400 ppm
pH		7.8
Total Hardness as CaCO <sub>3</sub>		350 ppm

## SALT REGENERATION

1. The water should be softened prior to dealkalization.
2. The percentage of alkalinity as a function of total anions.

$$\frac{\text{T.A.}}{\{ \text{T.A.} + \text{Cl} + \text{SO}_4 \}} \times 100 = 51\%$$

T.A.	=	Total Alkalinity
Cl	=	Chloride
SO <sub>4</sub>	=	Sulfate

3. Convert ppm as CaCO<sub>3</sub> to grains / gallon.

$$200 / 17.1 = 11.7 \text{ grains / gallon}$$

17.1 is a constant that converts ppm to grains / gallon

4. From the capacity chart Figure 1 for Ionac ASB-2 using 50% alkalinity and 400 TDS the capacity is approximately 5 kgr / cu.ft.

This should be downgraded by 10%. 5 kgr x .9 = 4.5 kgr / cu.ft.

5. To calculate the throughput capacity

$$(4.5 \text{ kgr} \times 1000) / 11.7 \text{ grains / gallon} = 385 \text{ gallons / cu.ft.}$$

6. Leakage will be approximately 10% of the influent alkalinity or 20 ppm as CaCO<sub>3</sub> salt and caustic regeneration.

## SALT and CAUSTIC REGENERATION

Steps 1 - 3 are the same in this calculation.

4. From the capacity chart Figure 2 for Ionac ASB-2 using 50% alkalinity and 400 TDS the capacity is approximately 8 kgr / cu.ft.

This should be downgraded by 10%  $8 \text{ kg-r} \times .9 = 7.2 \text{ kgr / cu.ft.}$  5.

5. To calculate the throughput capacity

$(7.2 \text{ kgr} \times 1000) / 11.7 = 615 \text{ gallons / cu.ft.}$

6. Leakage will be approximately 10 % of the influent alkalinity, 20 ppm CO, or HCO<sub>3</sub> as CaCO<sub>3</sub>.

The calculation to determine total carbonate alkalinity leakage when caustic soda is used as part of the regenerant is as follows:

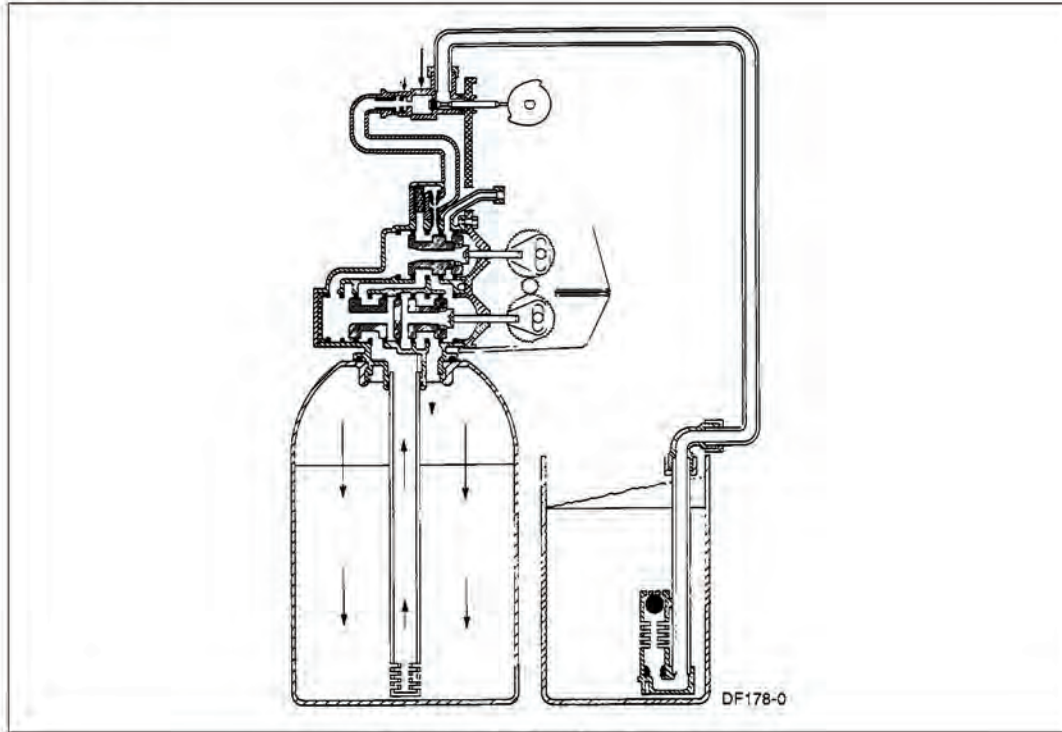
2 x P alkalinity	=	Carbonate present
MO alkalinity - (2 x P alkalinity)	=	Bicarbonate present
Carbonate alk. + Bicarbonate alk.	=	Total Carbonate Alkalinity Leakage

For immediate regeneration type meter control the meter setting would be at 15,000 gallons. Commonly this value is adjusted to 90 percent of the actual value (in this example 13,500 gallons) to assure not over-running the softener.

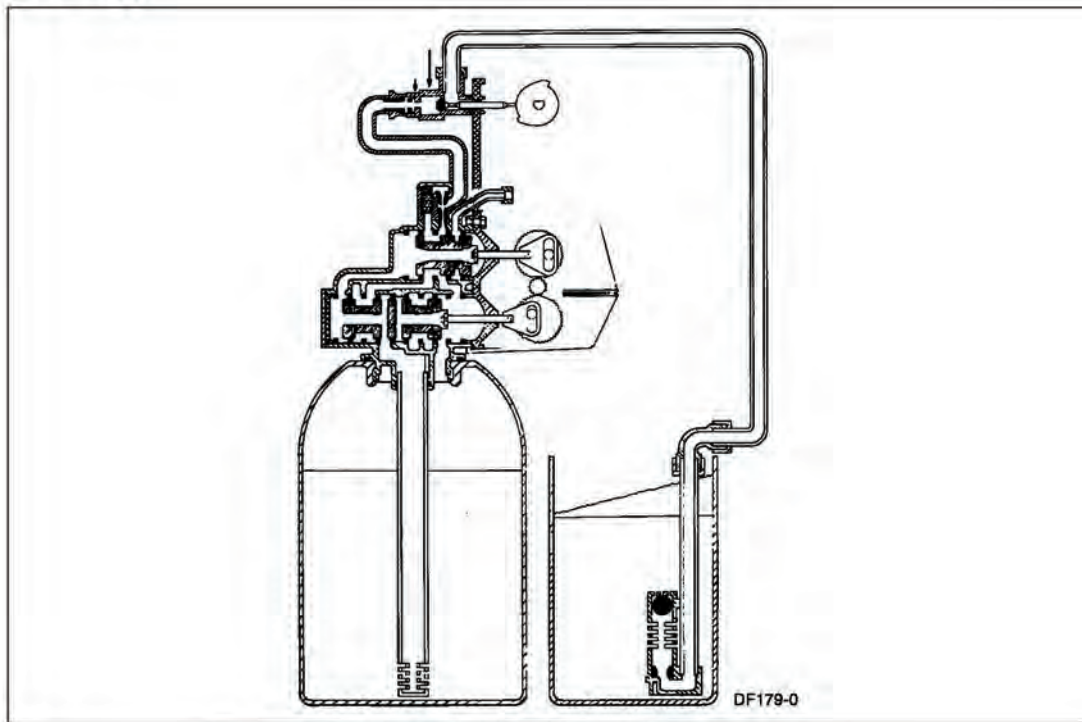
For time delay type meters the amount of gallons is determined as in our example except an additional amount of gallons must be deducted from the actual gallons to allow soft water to be available until the softener regenerates at he selected delay time of day or night. This compensation is necessary since the meter will indicate regeneration-required time prior to the set delay time.

**WATER CONDITIONER FLOW DIAGRAMS**

**In Service Position**

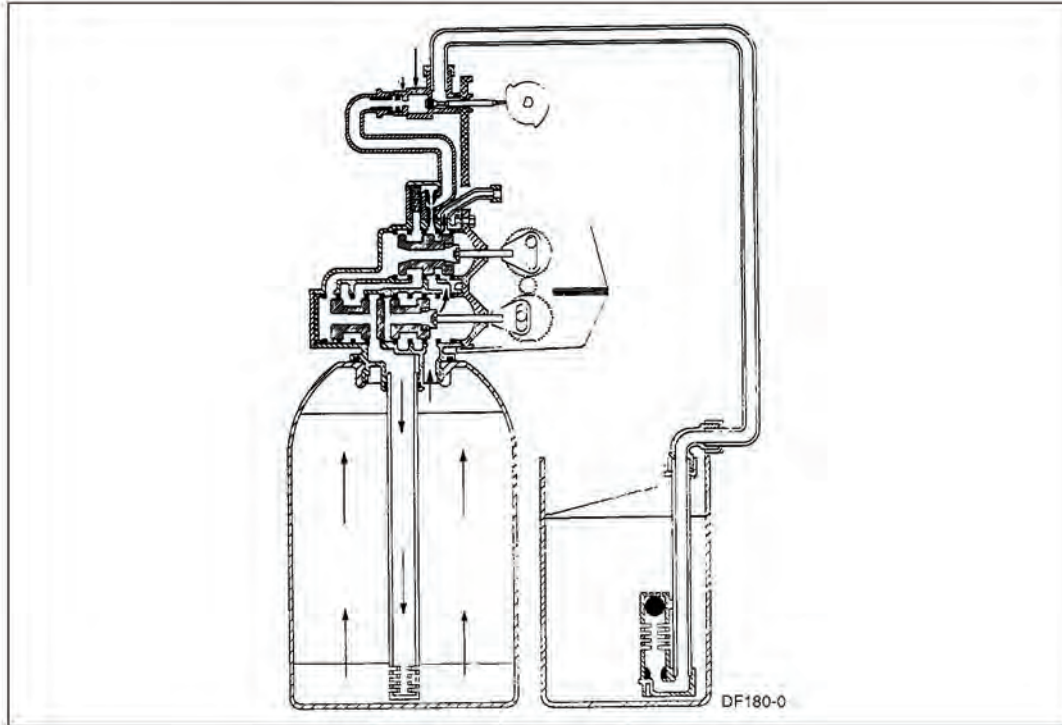


**Tanks Switching**

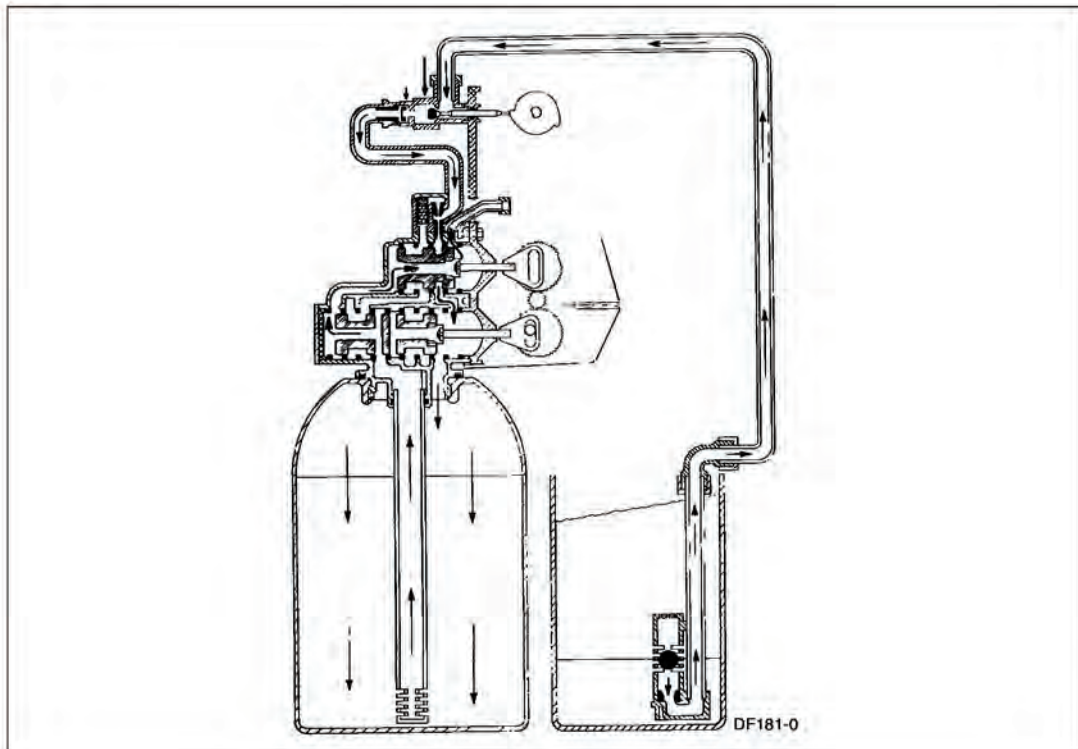


**WATER CONDITIONER FLOW DIAGRAMS**

**Backwash**

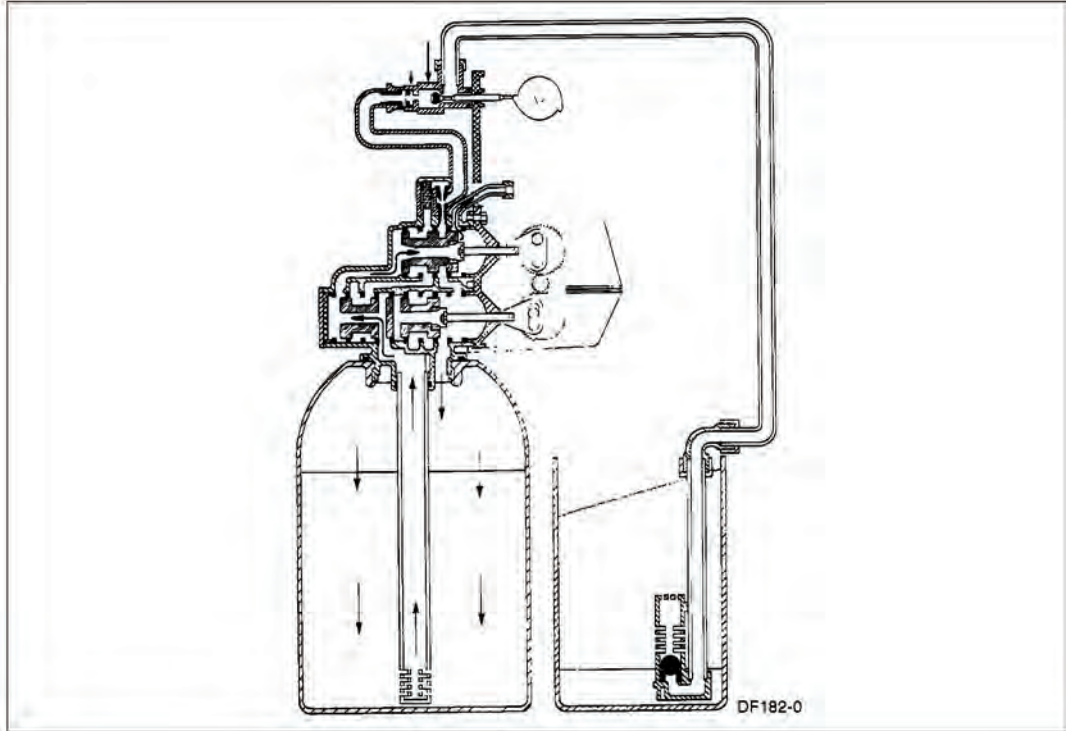


**Brine Draw**

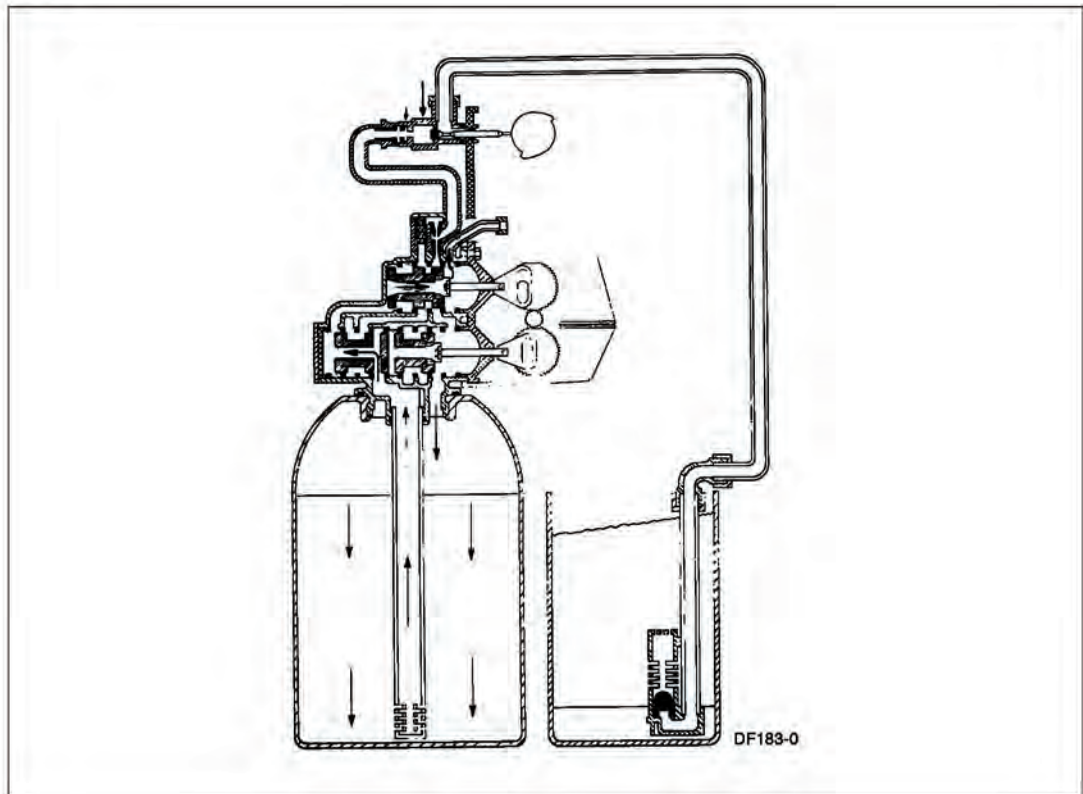


**WATER CONDITIONER FLOW DIAGRAMS**

**Slow Rinse**



**Rapid Rinse**



## Setting Specification Sheet

**NOTE: Some options may not be available depending on valve model or other options chosen.**

**Circle and/or Fill in the Appropriate Data for Future Reference.**

**System Type:** Meter Immediate / Time Clock Delayed / Twin Tank / Volume Override Delay  
Volume Override Immediate / Remote Signal Start Delayed  
Remote Signal Start Immediate / Meter Delayed Week Reserve  
Meter Delayed Variable Reserve / Meter Delay Fixed Reserve

**Valve Type:** 2510/2850 2750 2900 3150 3900 9000/9100/9500 Proprietary A B E

**Regenerant Flow:** Down Flow / UF Variable Fill / UF Brine First  
Downflow DB BW / UF Backwash / Back Wash Filter

**Initial Tank:** Tank 1 or Tank 2

**Remote Signal Start:** On or Off

**Display Format:** U.S. or Metric (French Degrees, German Degrees, or PPM)

**Unit Capacity:** \_\_\_\_\_ Grains/French Degrees/German Degrees/PPM

**Water Hardness:** \_\_\_\_\_ Grains/French Degrees/German Degrees/PPM

**Capacity Safety Factor:** Zero or \_\_\_\_\_ %

**Volume Override:** \_\_\_\_\_ (Gallons or M<sup>3</sup>)

**Regeneration Day Override:** Off or Every \_\_\_\_\_ Days

**Regeneration Time:** Delayed \_\_\_\_\_ AM/PM or \_\_\_\_\_ Immediate

**Regeneration Cycle Step #1:** \_\_ : \_\_ : \_\_  
**Regeneration Cycle Step #2:** \_\_ : \_\_ : \_\_  
**Regeneration Cycle Step #3:** \_\_ : \_\_ : \_\_  
**Regeneration Cycle Step #4:** \_\_ : \_\_ : \_\_  
**Regeneration Cycle Step #5:** \_\_ : \_\_ : \_\_

**Media Volume:** \_\_\_\_\_ (CuFt or Liter)

**Salt Dosage:** \_\_\_\_\_ (lbs/CuFt or grams/Liter)

**BLFC Size:** \_\_\_\_\_ gpm

**Auxiliary Relay:** Enabled or Disabled

**Auxiliary Relay Start 1:** \_\_ : \_\_ : \_\_  
**Auxiliary Relay End 1:** \_\_ : \_\_ : \_\_  
**Auxiliary Relay Start 2:** \_\_ : \_\_ : \_\_  
**Auxiliary Relay End 2:** \_\_ : \_\_ : \_\_

**Chemical Pump:** Enabled or Disabled

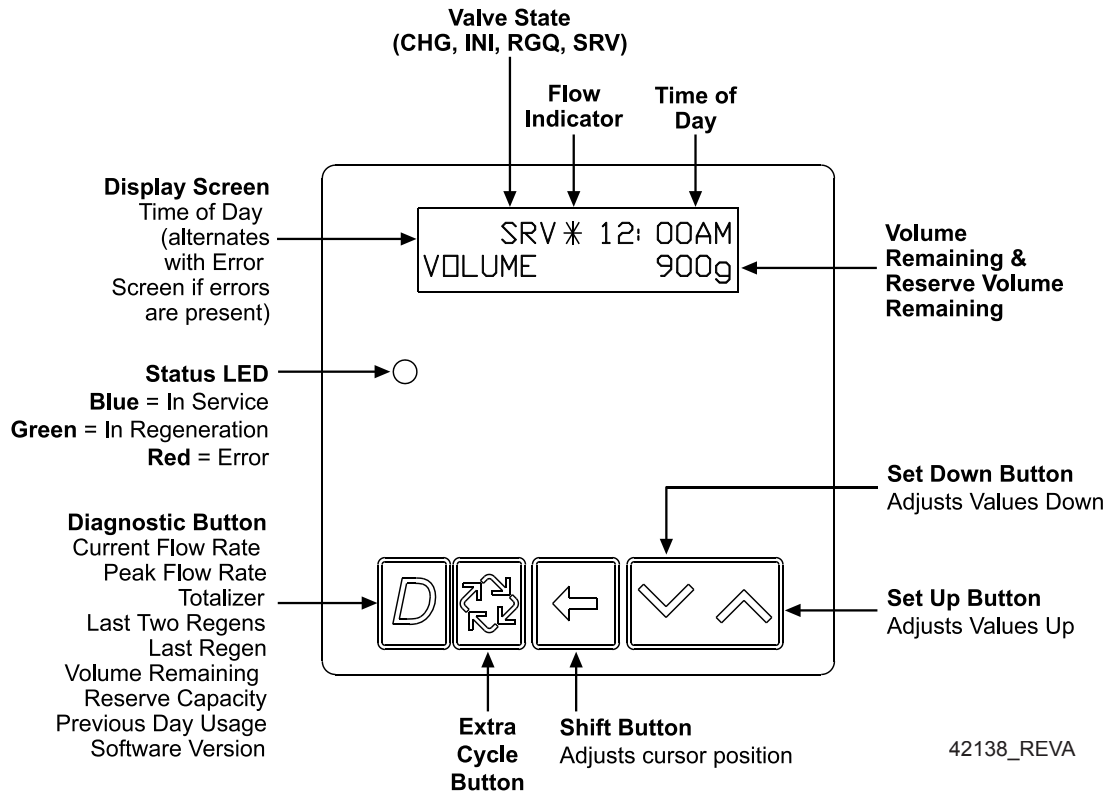
**CPO Aux Relay Volume:** \_\_\_\_\_ (Gallons or M<sup>3</sup>)

**CPO Aux Relay:** \_\_ : \_\_ : \_\_

**Flow Meter Size:** Paddle: .75" 1.0" 1.5" 2.0" 3.0"  
Turbine: .75" 1.0" 1.5"

**Generic Flow Meter:** Maximum Flow Rate: Add \_\_ Gallons every \_\_ Pulses

## Timer Operation



### Valve State:

#### CHG (Change of State)

CHG will be displayed when the lower drive changes from one state to another in dual piston valves.

#### INI (Initializing)

INI will display on the screen for 30 to 45 seconds when initializing after a power failure reset or programming.

#### RGQ (Regeneration Queued)

RGQ indicates that the reserve has been entered in a delayed system and regeneration has been queued. When in the main screen, press the Shift button to toggle service (SRV) with RGQ.

#### Service (SRV)

SRV will display when the unit is in service.

### LED Status Lights:

#### Blue LED:

Illuminates while the unit is in service and no errors exist. The unit will always be in service unless a regeneration trigger has occurred (green LED light will be displayed).

#### Green LED:

Illuminates when the unit is in Regeneration mode, unless an error condition exists.

#### Red LED:

Illuminates when there is an error.

### Flow Indicator:

A rotating line (appearing as a rotating star shape) will display on the screen when flow is going through the the meter.

## *Timer Operation*

### **Regeneration:**

- A time initiated control valve regenerates when the number of programmed days has been reached
- A flow initiated control valve regenerates when the volume count is zero or is below reserve capacity

<b>System Type</b>	<b>Regeneration Trigger</b>
Time Clock Delayed	A) Day override parameter is reached and B) the time of day matches the regeneration day override time
Meter Immediate	Regenerates as soon as the volume remaining has been depleted
Meter Delayed Fixed Reserve	A) Volume remaining has been depleted to the fixed reserve volume and B) the regeneration time has been reached
Meter Delayed Variable Reserve	A) Volume remaining has been depleted to the variable reserve volume and B) the regeneration time has been reached
Meter Delayed Weekly Reserve	A) Volume remaining has been depleted to the weekly variable reserve volume and B) the regeneration time has been reached
Remote Signal Start Immediate	Immediately once a valid remote signal is asserted continuously for the programmed period of time
Remote Signal Start Delayed	Once a valid RSS signal is asserted continuously for the programmed period of time and regeneration time has been reached
Volume Override Immediate	As soon as the programmed volume remaining has been depleted from the tank
Volume Override Delayed	As soon as soon as the programmed volume remaining has been depleted from the tank and the regeneration time has been reached
Twin Tank	Regenerates immediately once volume remaining has been depleted



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## Timer Operation

---

### Setting the Time of Day

1. Press and hold the Up or Down button for 2 seconds.
2. Press the Shift button to select the digit you want to modify.
3. Press the Up or Down buttons to adjust the value.
4. Press the Extra Cycle button to return to the normal display screen, or after a 5 second timeout.

**NOTE: The “D” button (Diagnostic) can be pressed to exit without saving.**

### Manually Initiating a Regeneration

1. When timer is in service, press the Extra Cycle button for 5 seconds on the main screen.
2. The timer advances to Regeneration Cycle Step #1, and begins programmed time count down.
3. Press the Extra Cycle button once to advance valve to Regeneration Cycle Step #2 (if active).
4. Press the Extra Cycle button once to advance valve to Regeneration Cycle Step #3 (if active).
5. Press the Extra Cycle button once to advance valve to Regeneration Cycle Step #4 (if active).
6. Press the Extra Cycle button once to advance valve to Regeneration Cycle Step #5 (if active).
7. Press the Extra Cycle button once more to advance the valve back to in service.

**NOTE:** A manually initiated or queued regeneration can be cleared by pressing the Extra Cycle button for less than 5 seconds. A system queued regeneration can only be cleared by stepping through a manual regeneration. If regeneration occurs for any reason prior to the delayed regeneration time, the manual regeneration request shall be cleared. Pressing the Extra Cycle button while in regeneration will cause the upper drive to advance to the next step immediately.

### Queued Regeneration (RGQ)

From the display screen, while the unit is in service, hold down the Extra Cycle button until “RGQ” displays. The valve will regenerate when the set regeneration time has been reached.

### Timer Operation During Regeneration

In the main display screen, the timer shows the current regeneration cycle and the time for that step. The **green LED light** will display when the unit is in regeneration. Once all regeneration steps are complete, the timer returns to in service, displays a **blue LED light**, and resumes normal operation.

### Timer Operation During Programming

The timer enters program mode (unit must be in service). While in the program mode the timer continues to operate normally, monitoring water usage. Timer programming is stored in memory permanently upon a normal exit from programming mode.

### Timer Operation During A Power Failure

All program settings are stored in permanent memory. Current valve position, cycle step time elapsed, and time of day are stored during a power failure, and will be restored upon power re-application. Time is kept during a power failure, and time of day is adjusted upon power up (as long as power is restored within 12 hours).

**NOTE:** The time of day on the main display screen will flash for 5 minutes when there has been a power outage. The flashing of the time of day can be stopped by pressing any button on the display.

### Regeneration Day Override Feature

If the Day Override option is turned on and the valve reaches the set Regeneration Day Override value, the Regeneration Cycle starts at the programmed regeneration time.

---

***Timer Operation***

---

**Flow Meter Equipped Timer**

As treated water is used, the Volume Remaining display counts down from the calculated system capacity, less the reserve volume. Once capacity reaches zero or reserve, if the immediate system the unit will regenerate immediately. If it is a Fixed, Variable, or Weekly reserve, the unit will queue a regeneration (RGQ) and count down Reserve Volume until the set regeneration time.

**NOTE: Reserve Volume is only available in a RGQ system.**

**Volume Remaining  
(Less Reserve)**

SRV * 08:45AM
VOLUME 1000G

**Reserve  
Volume**

RGQ * 09:32AM
VOLUME 100G



**WARNING**

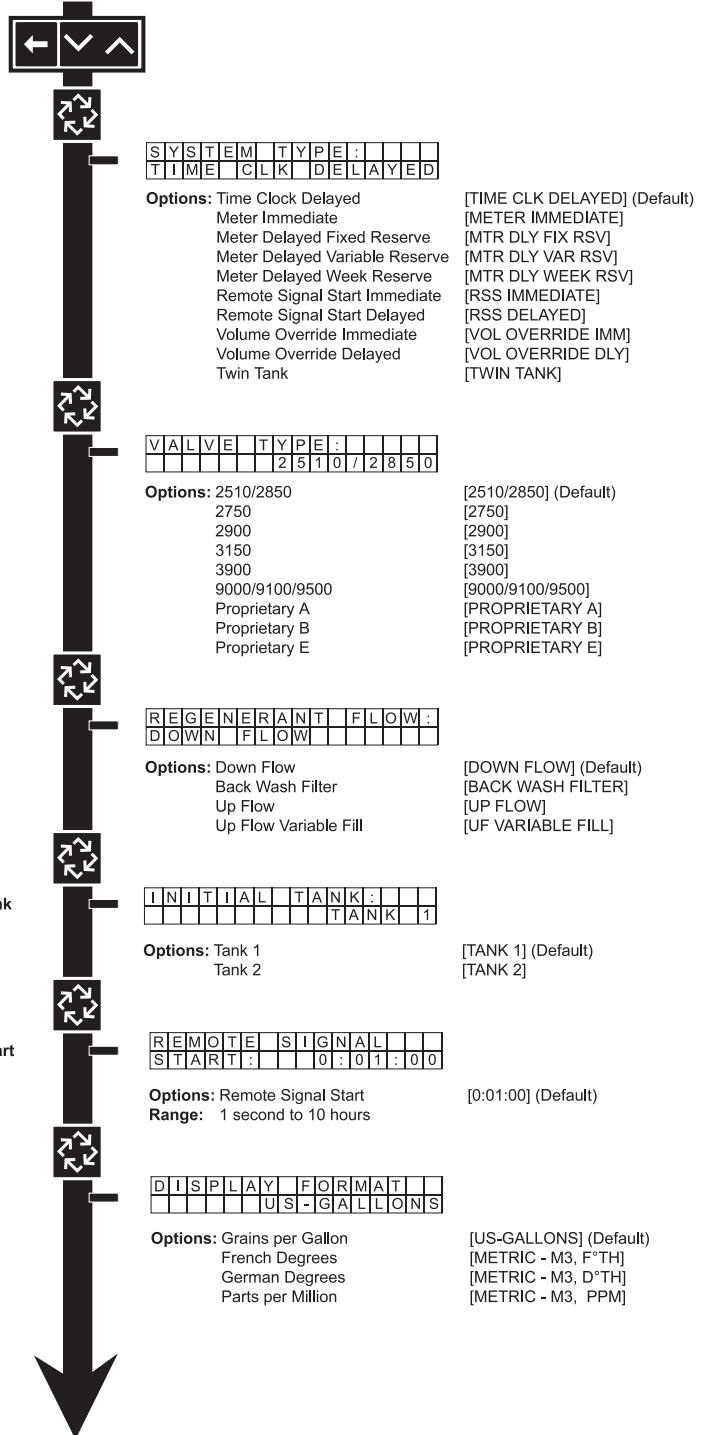
Transformer must be grounded and ground wire must be terminated to the back plate where grounding label is located before installation.

## Master Programming Mode Flow Chart

NOTE: Depending on current option settings, some displays cannot be viewed or set.

### Entering Master Programming Mode:

1. Press and hold the Shift and Up buttons for 5 seconds.  
OR
2. Set the Time of Day display to **12:01 PM** or **12:01HR** (See the User Programming Section). Then go to the main display screen, press and hold the Up and Down buttons at the same time for 5 seconds.



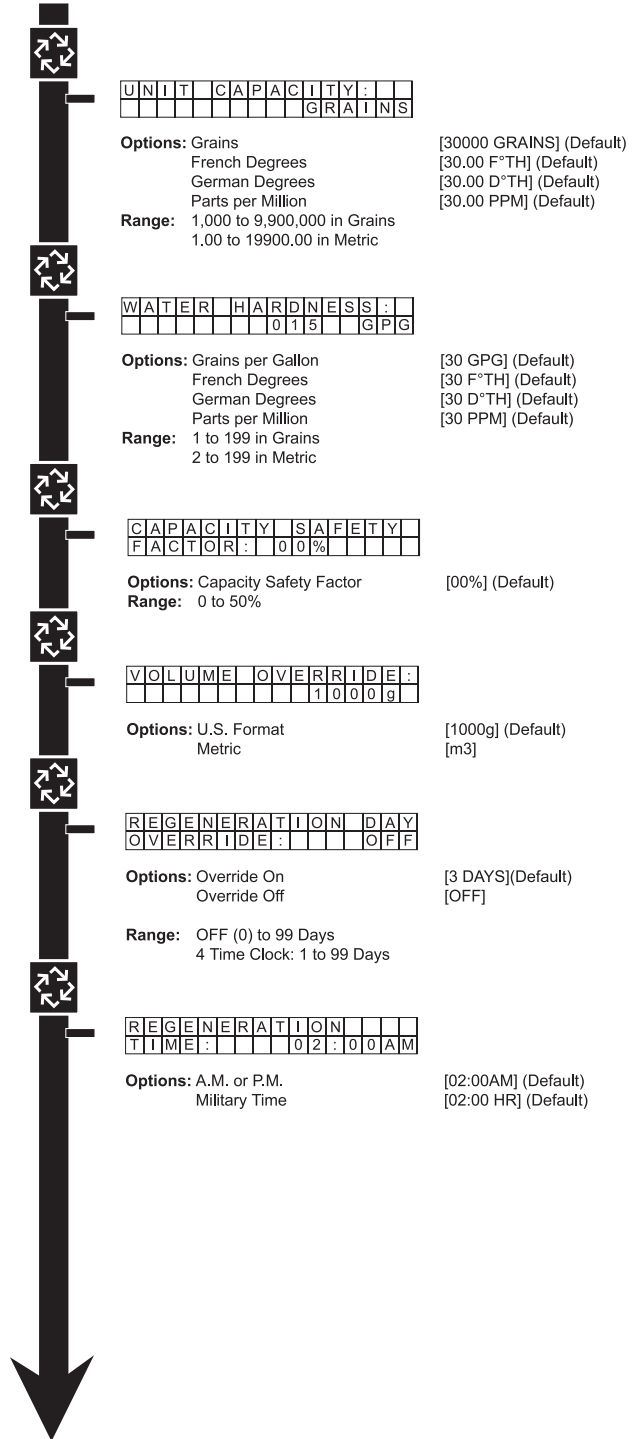
CAUTION: Before entering Master Programming, please contact your local professional water dealer.

## Master Programming Mode Flow Chart

NOTE: Depending on current option settings, some displays cannot be viewed or set.

NOTE: Only shown when System Type is Meter Delayed Fixed Reserve or Volume Override Delayed

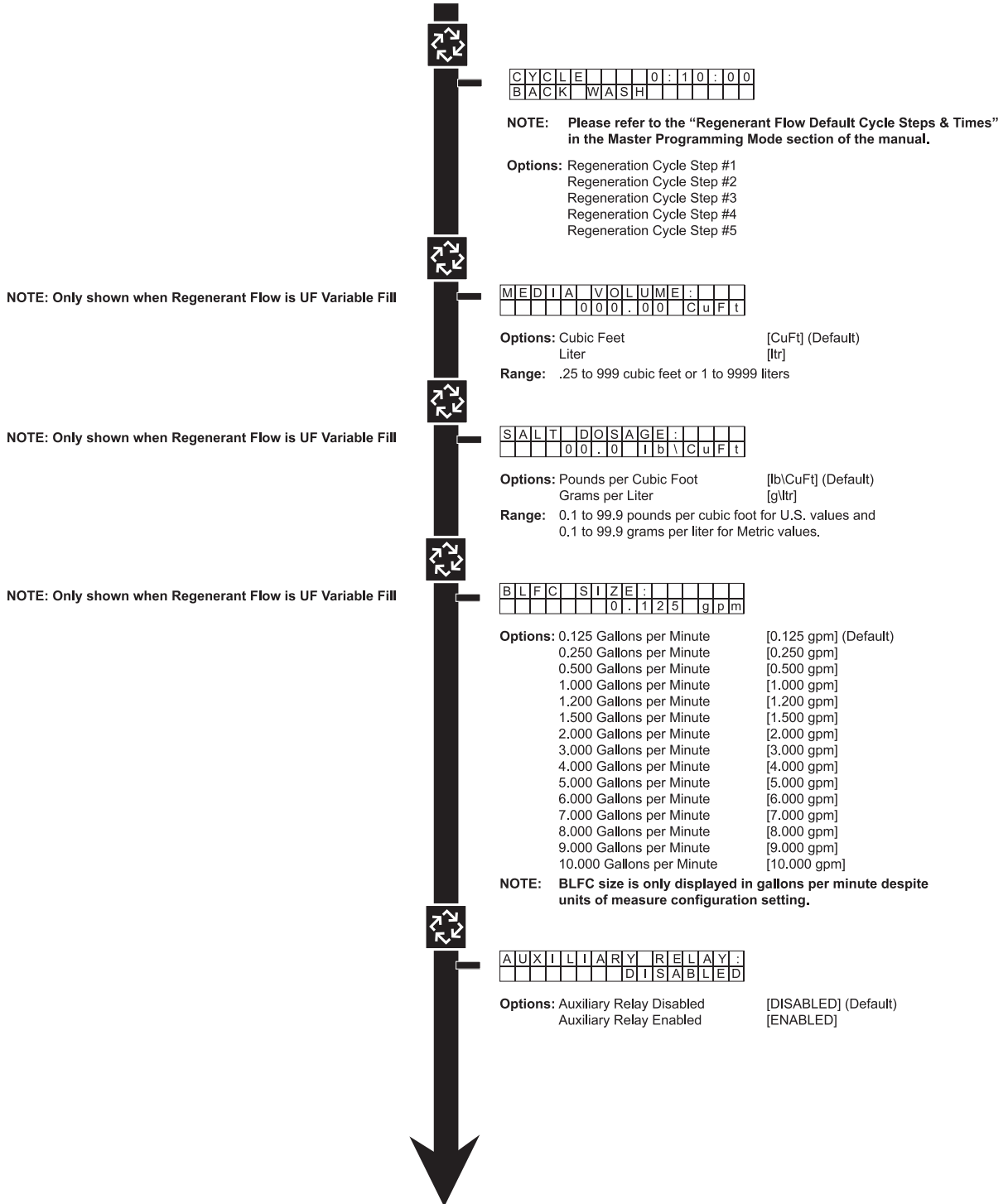
NOTE: Only shown when System Type is Volume Override Immediate or Volume Override Delayed



CAUTION: Before entering Master Programming, please contact your local professional water dealer.

## Master Programming Mode Flow Chart

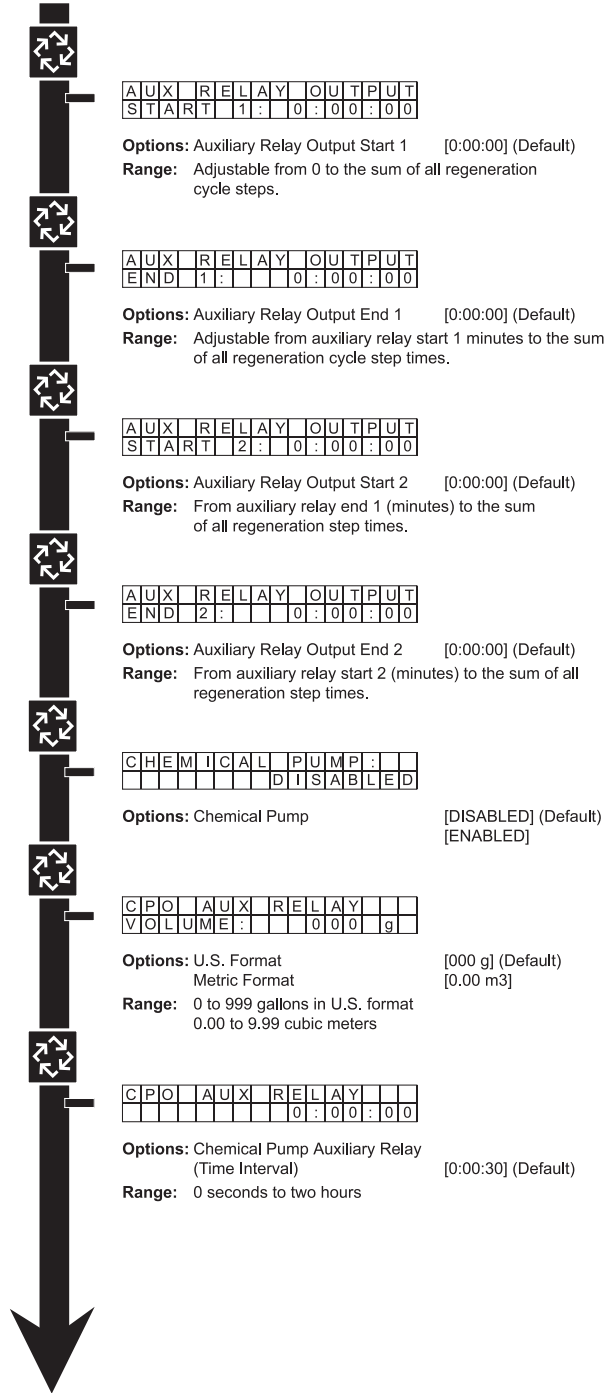
NOTE: Depending on current option settings, some displays cannot be viewed or set.



CAUTION: Before entering Master Programming, please contact your local professional water dealer.

## Master Programming Mode Flow Chart

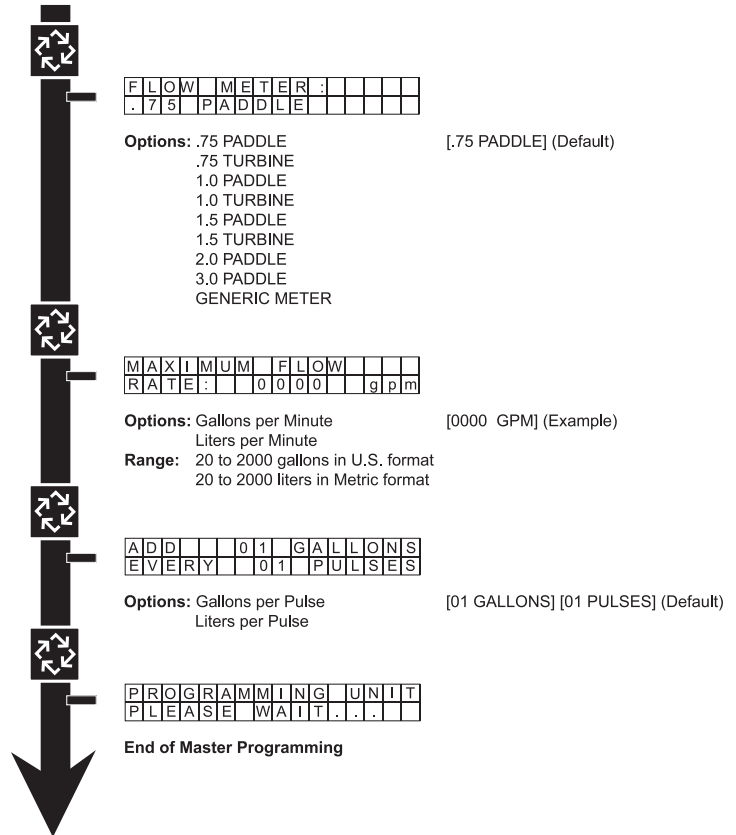
**NOTE:** Depending on current option settings, some displays cannot be viewed or set.



**CAUTION:** Before entering Master Programming, please contact your local professional water dealer.

## Master Programming Mode Flow Chart

**NOTE:** Depending on current option settings, some displays cannot be viewed or set.



**CAUTION:** Before entering Master Programming, please contact your local professional water dealer.

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## Master Programming Mode

---

When the Master Programming Mode is entered, parameters can be set to make the timer function as needed.

**NOTE: Depending on current option settings, some displays cannot be viewed or set.**

### Entering Master Programming Mode:

1. Press and hold the Shift and Up buttons for 5 seconds.  
OR
2. Set the time of day display to **12:01 PM or 12:01HR** (See the User Programming section to learn how to do this). Then go to the main display screen, press the Up and Down buttons at the same time for 5 seconds.

### Exiting Master Programming Mode:

1. Press the Extra Cycle button once per display until all are viewed. Master Programming Mode is exited and the normal display screen appears.
2. To exit the Master Programming Mode without saving, press the Diagnostic button.

**NOTE: If no keypad activity is made for 5 minutes while in the Master Programming Mode, or if there is a power failure, no changes will be made, and the unit will go back to the main display screen.**

### Resets:

**Soft Reset:** Press and hold the Up and Down buttons for 25 seconds until 12:00PM (or 12:00HR) appears. This resets all parameters except for the flow meter totalizer volume.

**Master Reset:** Hold the Extra Cycle button while powering up the unit. This resets all of the parameters in the unit. Check and verify the choices selected in Master Programming Mode.

### 1. System Type

This program step selects the system type.

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
SYSTEM TYPE:  4
TIME CLK DELAYED
```

### 2. Valve Type

This program step selects the valve type.

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
VALVE TYPE:
2510/2850
```

### 3. Regenerant Flow

This program step selects how the regenerant flows through the tank (must match cam). The selections available will vary depending on the previously chosen valve model.

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
REGENERANT FLOW:
DOWN FLOW
```

**CAUTION: Before entering Master Programming, please contact your local professional water dealer.**



---

## Master Programming Mode

---

### 4. Display Format

This program step selects the display format.

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
DISPLAY FORMAT:  
US - GALLONS
```

### 5. Unit Capacity

This program step selects the timer's total capacity of hardness that can be removed.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
UNIT CAPACITY:  
0030000 GRAINS
```

### 6. Feed Water (Hardness)

This program step is used to set the feed water hardness. The system will automatically calculate volume remaining based on the unit capacity, capacity safety factor (reserve systems only), and feed water hardness entered.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
WATER HARDNESS:  
030 GPG
```

### 7. Capacity Safety Factor

This program step is used to set the reserve capacity of the unit. This is a percentage by which the unit's capacity is reduced.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
UNIT CAPACITY:  
0030000 GRAINS
```

### 8. Volume Override

This program step is used to set the volume override of the unit.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

**CAUTION: Before entering Master Programming, please contact your local professional water dealer.**

## Master Programming Mode

### 9. Regeneration Day Override

This program step sets the maximum amount of time (in days) the unit can be in service without a regeneration.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```

REGENERATION DAY
OVERRIDE:01 DAYS
    
```

### 10. Regeneration Time

This program step sets the time of day for the regeneration to occur in delayed systems.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```

REGENERATION
TIME:      02:00AM
    
```

### 11. Regeneration Cycle Step Programming

This program step programs the Regeneration Cycle step times 1 through 5. Please refer to the chart below for regenerant flow default cycle steps and times.

```

CYCLE 1 00:10:00
BACK WASH
    
```

Regenerant Flow	Cycle 1	Time	Cycle 2	Time	Cycle 3	Time	Cycle 4	Time	Cycle 5	Time
Down Flow	Back Wash	10 Minutes	Brine & Slow Rinse	1 Hour	Rapid Rinse	10 Minutes	Brine Tank Fill	12 Minutes	N/A	N/A
Back Wash Filter	Back Wash	15 Minutes	Draw	0	Settling Rinse	10 Minutes	Refill	0	N/A	N/A
UF Back Wash	Backwash	10 Minutes	Brine & Slow Rinse	1 Hour	Rapid Rinse	10 Minutes	Brine Tank Fill	12 Minutes	N/A	N/A
UF Variable Draw	Brine & Slow Rinse	10 Minutes	Pause & Delay	1 Hour	Variable Rapid Rinse	N/A	Brine Tank Fill	12 Minutes	Rapid Rinse	10 Minutes
UF Brine First	Brine & Slow Rinse	1 Hour	Back Wash	10 Minutes	Rapid Rinse	10 Minutes	Brine Tank Fill	12 Minutes	N/A	N/A
Down Flow DB BW	Back Wash	10 Minutes	Brine & Slow Rinse	1 Hour	Back Wash	10 Minutes	Rapid Rinse	10 Minutes	Brine Tank Fill	12 Minutes

**CAUTION:** Before entering Master Programming, please contact your local professional water dealer.

---

## Master Programming Mode

---

### 12. Media Volume

This program step sets the volume of the media in the resin tank.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
MEDIA VOLUME:
  000.00 CuFt
```

### 13. Salt Dosage

This program step sets the salt dosage in the unit.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
SALT DOSAGE:
  00.0 lb/CuFt
```

### 14. Brine Line Flow Control Size

This program step allows the selection of the desired brine line flow control size in the unit (must match physical brine line flow control).

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
BLFC SIZE:
  0.125 gpm
```

### 15. Auxiliary Relay Output

The next two displays are part of a series of settings used to program the optional relay output. The first setting turns the output on/off during regeneration only. The second turns the output on during service only, every time a set volume of water used has accumulated.

**NOTE: When auxiliary outputs are in the OFF (default) setting, press the Up or Down buttons to set the first setting. Then press the Extra Cycle button to advance to the second setting.**

#### a. Timed Auxiliary Relay Output Window (Start & End Time Setting)

This option setting consists of two displays. The first display sets the turn-on time of the output, referenced to the start of the first regeneration cycle. The second display sets the output turn-off time, referenced again to the start of the first regeneration cycle. An OFF setting cancels this setting. All settings are in minutes and output timing is synchronized with regeneration cycle timing.

**Start Time:** Any time during regeneration.

**End Time:** At start time, and anytime during the regeneration cycle.

```
AUXILIARY RELAY:
  DISABLED
```

**CAUTION: Before entering Master Programming, please contact your local professional water dealer.**

---

## Master Programming Mode

---

### b. Chemical Pump Auxiliary Relay Output Window

This option setting consists of two displays. The first display sets the volume of water flow at which the output turns on. The second display sets the on time (in seconds) of the output.

- Activate output after volume set is reached.
- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
CHEMICAL PUMP:
      DISABLED
```

### 16. Flow Meter Size

This program step sets the size of the flow meter.

- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

```
FLOW METER:
.75 TURBINE
```

### 17. Maximum Flow Rate

This program step sets maximum flow rate of the generic flow meter.

- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

### 18. Pulses per Gallon/Liter

This program step sets the pulses per gallon/liter for generic flow meters.

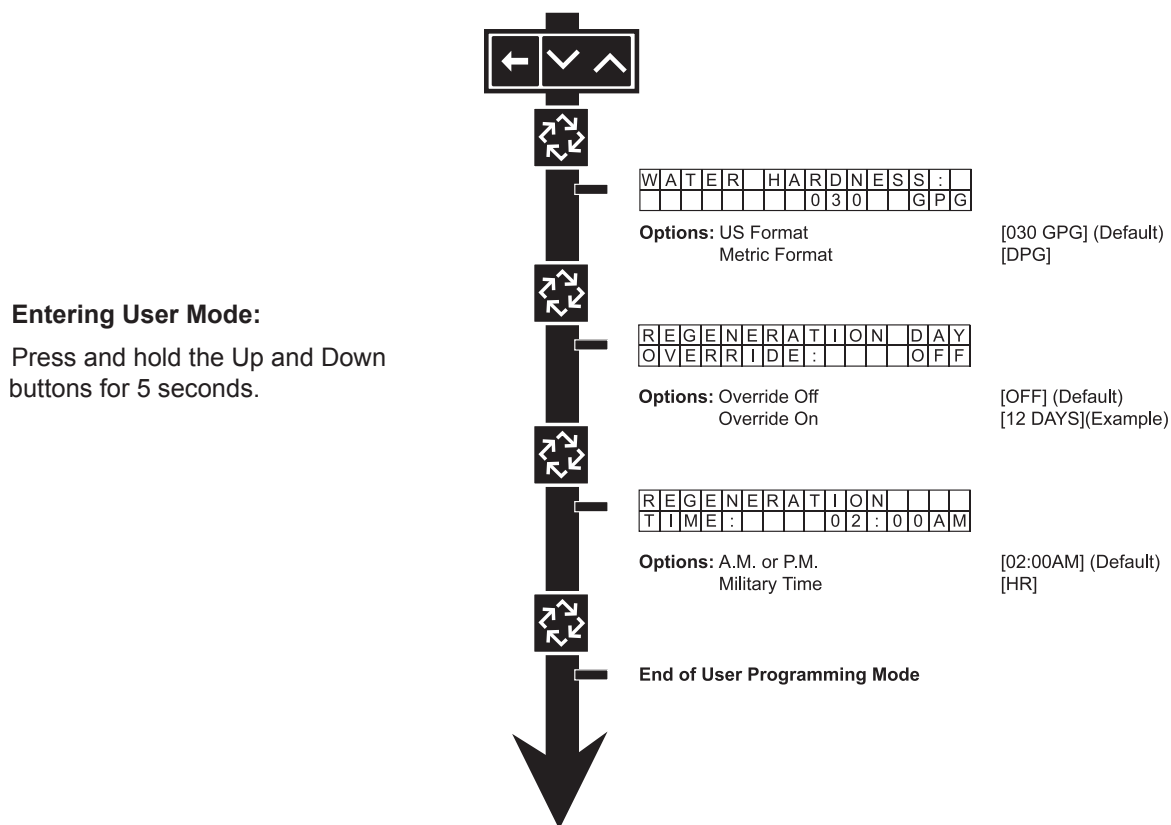
- Press the Shift button to select the digit you want to modify.
- Press the Up or Down buttons to adjust this value.
- Press the Extra Cycle button.

### 19. End of Master Programming Mode

**CAUTION:** Before entering Master Programming, please contact your local professional water dealer.

## User Programming Flow Chart & Mode

**NOTE:** Depending on current option settings, some displays cannot be viewed or set.



**NOTE:** Depending on current option settings, some displays cannot be viewed or set.

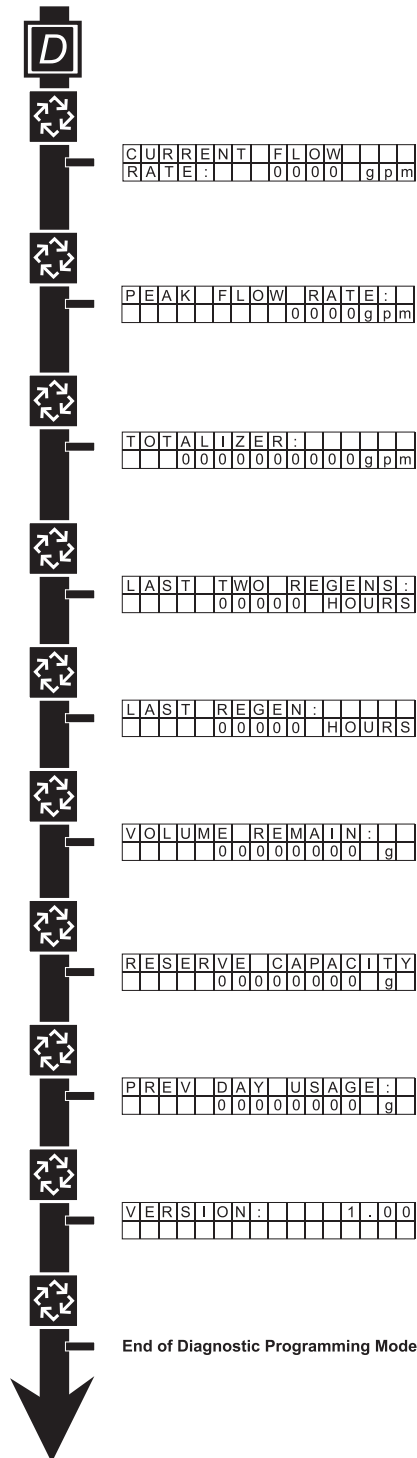
- 1. Enter User Mode**
  - Press and hold the Up and Down buttons for 5 seconds.
- 2. Set Feed Water Hardness**
  - Press the Shift, Up, and Down buttons to move the cursor and change the value of the numbers.
  - Press the Extra Cycle button to proceed to the next step.
  - NOTE: Only displayed when a metered option is chosen under System Type.**
- 3. Set Regeneration Day Override**
  - To turn on and set the days, press the Down button.
  - Press the Shift, Up, and Down buttons to move the cursor and change the value of the numbers.
  - Press the Extra Cycle button to proceed to the next step.
- 4. Regeneration Time**
  - Press the Shift, Up, and Down buttons to move the cursor and change the value of the numbers.
  - Press the Extra Cycle button
- 5. End of User Programming Mode**

## Diagnostic Programming Mode Flow Chart

**NOTE:** Depending on current option settings, some displays cannot be viewed or set.

### Entering Diagnostic Mode:

1. Press and release the “D” button.
2. Press the Extra Cycle button once per display until all displays are viewed and the normal display screen appears.
3. Press and release the “D” button during this mode to exit the Diagnostic Mode.
4. Depending on current option settings, some displays cannot be viewed.



---

## ***Diagnostic Programming Mode***

---

**NOTE:** Depending on current option settings, some displays cannot be viewed.

### **Overview Diagnostic Mode**

The current Diagnostic Programming Mode screen will display until either the Extra Cycle button is pressed through for each screen, or the Diagnostic button is pressed. In the event of regeneration occurring while in the Diagnostic Programming Mode, the regeneration step and time remaining will be displayed. When regeneration completes, the display will return to the normal time of day display screen.

### **Entering and Exiting Diagnostic Mode**

Press and release the “D” button to enter the Diagnostic Programming Mode. Pressing the Extra Cycle button will move to the next diagnostic screen. Press the Extra Cycle button once per display until all are viewed. Pressing the Diagnostic button while in Diagnostic Mode will cause the unit to leave the Diagnostic Mode and return to the normal time of day display screen.

#### **1. Current Flow Rate**

This program step displays the calculated flow rate for the timer. The below flow rates are the maximum flow rate the timer will read for each meter.

<b>.75” Paddle:</b>	15 gpm (0.06 m3/m)	<b>.75” Turbine:</b>	15 gpm (0.06 m3/m)
<b>1” Paddle:</b>	40 gpm (0.15 m3/m)	<b>1” Turbine:</b>	90 gpm (0.34 m3/m)
<b>1.5” Paddle:</b>	180 gpm (0.68 m3/m)	<b>1.5” Turbine:</b>	90 gpm (0.34 m3/m)
<b>2” Paddle:</b>	350 gpm (1.32 m3/m)		
<b>3” Paddle:</b>	500 gpm (1.89 m3/m)		

— Press the Extra Cycle button.

#### **2. Peak Flow Rate**

This program step displays the peak flow rate since the last regeneration.

— Press the Extra Cycle button.

#### **3. Totalizer**

This program step displays the total volume of treated water that passes through the meter.

— Reset to zero by holding the Up and Down buttons for five seconds while in the totalizer screen.

— Press the Extra Cycle button.

#### **4. Hours Between Last Two Regenerations**

This program step displays the time between the last two regenerations saved.

— Press the Extra Cycle button.

#### **5. Hours Since Last Regeneration**

This program step displays the hours since the last regeneration.

— Press the Extra Cycle button.

#### **6. Volume Remaining**

This program step displays the volume remaining. The timer will regenerate if the volume remaining is set to zero. The maximum ranges are the same as the maximum volume calculated on the main screen.

— Press the Extra Cycle button.

#### **7. Reserve Capacity**

This program step displays the reserve capacity, ensuring soft water is available at all times.

— Press the Extra Cycle button.

#### **8. Previous Day’s Water Usage**

This program step displays the previous day’s water usage.

— Press the Extra Cycle button.

#### **9. Software Version**

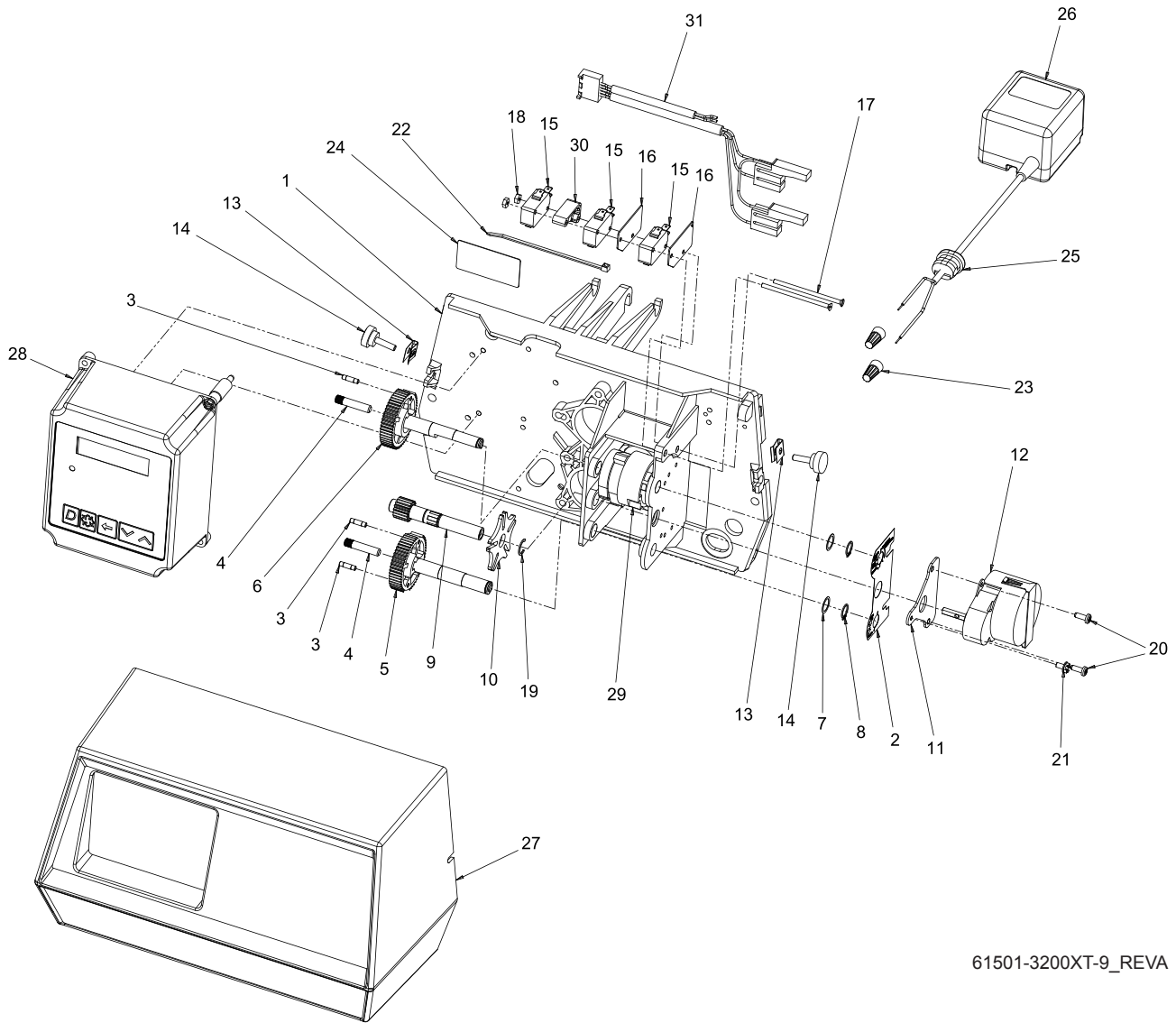
This program step displays the timer’s software program version number.

— Press the Extra Cycle button to exit.

**NOTE:** Diagnostic Programming Mode will stop if the system goes into a regeneration.

---

**9500 Power Head Assy**



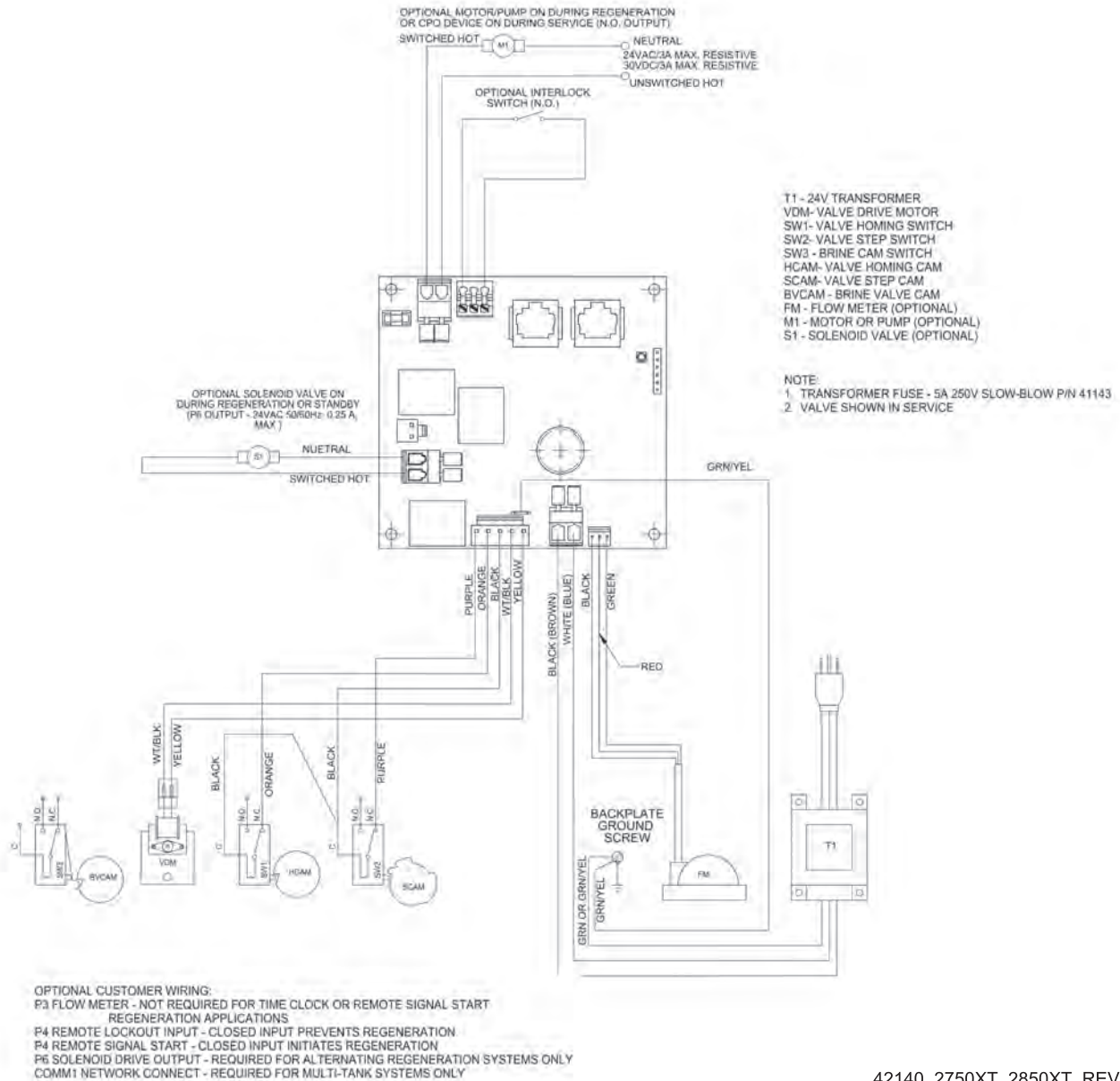
61501-3200XT-9\_REVA



## 9500 Power Head Assy

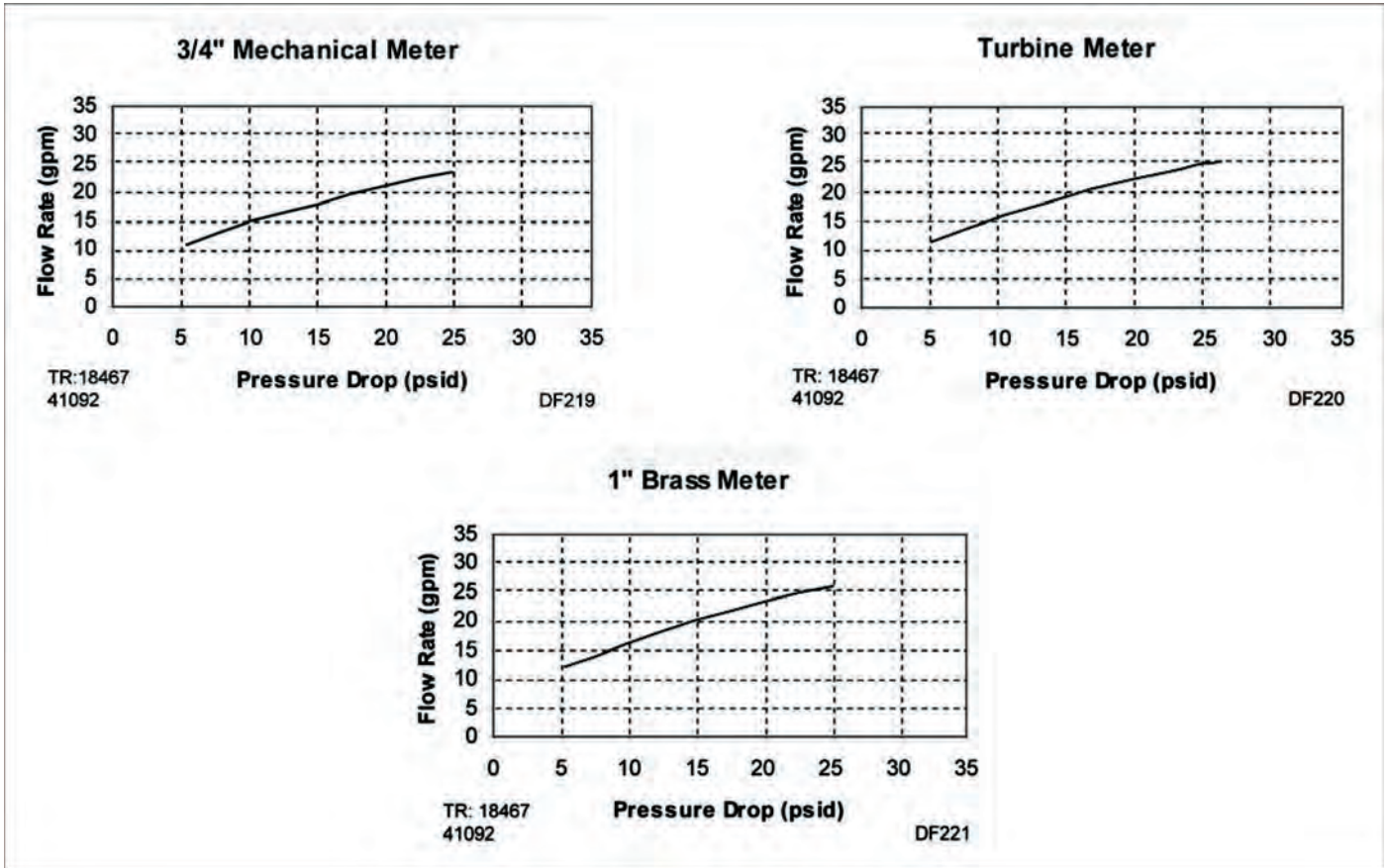
Item No.	Quantity	Part No.	Description
1	1	17784-05	Panel, Control, 9000/9500, ET
2	1	15175	Label, Shaft Position
3	3	15209	Pin, Roll, 1/8 x 1/2 SS
4	2	15367	Pin, Dowel, 9000
5	1	17869	Gear, Drive, 1/2" Stroke
6	1	17868	Gear, Drive, 3/4" Stroke, 9000
7	2	15692	Washer, Plain, 3/8"
8	2	14917	Ring, Retaining
9	1	15135	Gear, Drive, 9000
10	1	14896	Wheel, Geneva
11	1	15199	Plate, Ground, 9000/9500
12	1	18737	Motor, 24V, 50/60 Hz, 1 RPM
13	2	18728	Nut, Tinneman, U Type, 8-32
14	2	19367	Screw, Designer Cover, Thumb
15	3	16433	Switch, Miniature
16	2	10302	Insulator, Limit Switch
17	2	16442	Screw, Slot Flat Hd, 4-40 x 2.12"
18	2	10339	Nut, Hex, 4-40 Zinc Plated
19	1	15810	Ring, Retaining
20	2	19160	Screw, Phil Pan, Thread, 6-32 x 3/8
21	1	14430	Screw, Hex Wsh St, 6 x 1/4
22	1	14044	Tie, Cable, Heyco VNT# 4-18
23	2	40422	Nut, Wire, Tan
24	1	41587	Label, Serial Number, Stock
25	1	13547-01	Strain Relief, Euro Round Cord
26	1	19674	Transformer, 24V, 9.6VA
27	1	60232-112	Cover, Designer, 1 Pc Black
28	1	42466-01	Timer Assy, XT, Left Hand
29	1	17765	Cam Assy, Aux Switch, 9500
30	1	18803-01	Spacer, Switch, Machd
31	1	42197	Wire Harness, 5066

## 9500XT Wiring

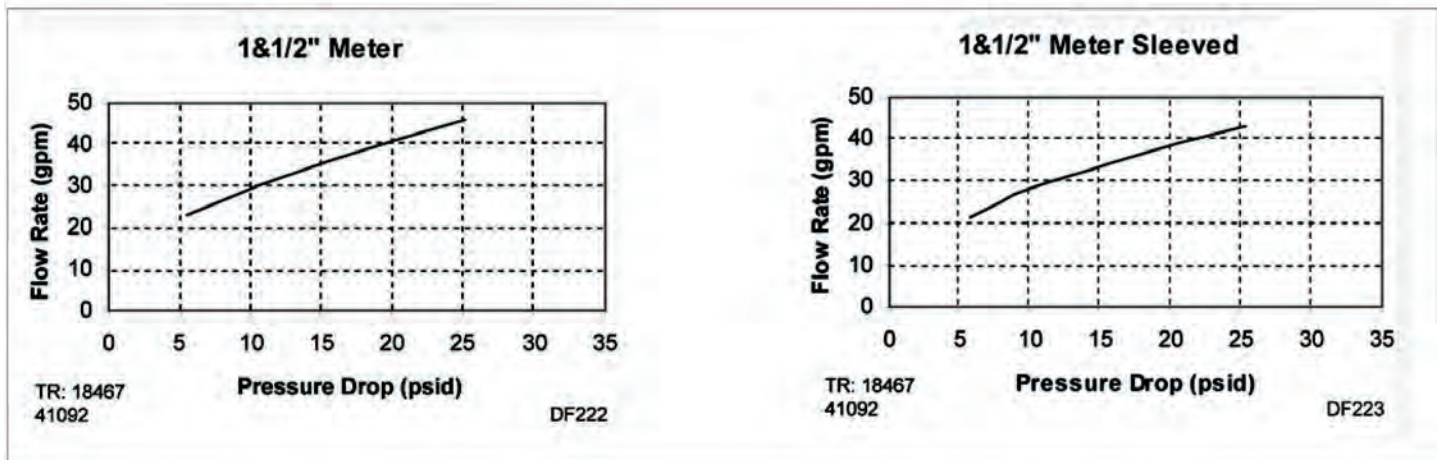


42140\_2750XT\_2850XT\_REVA

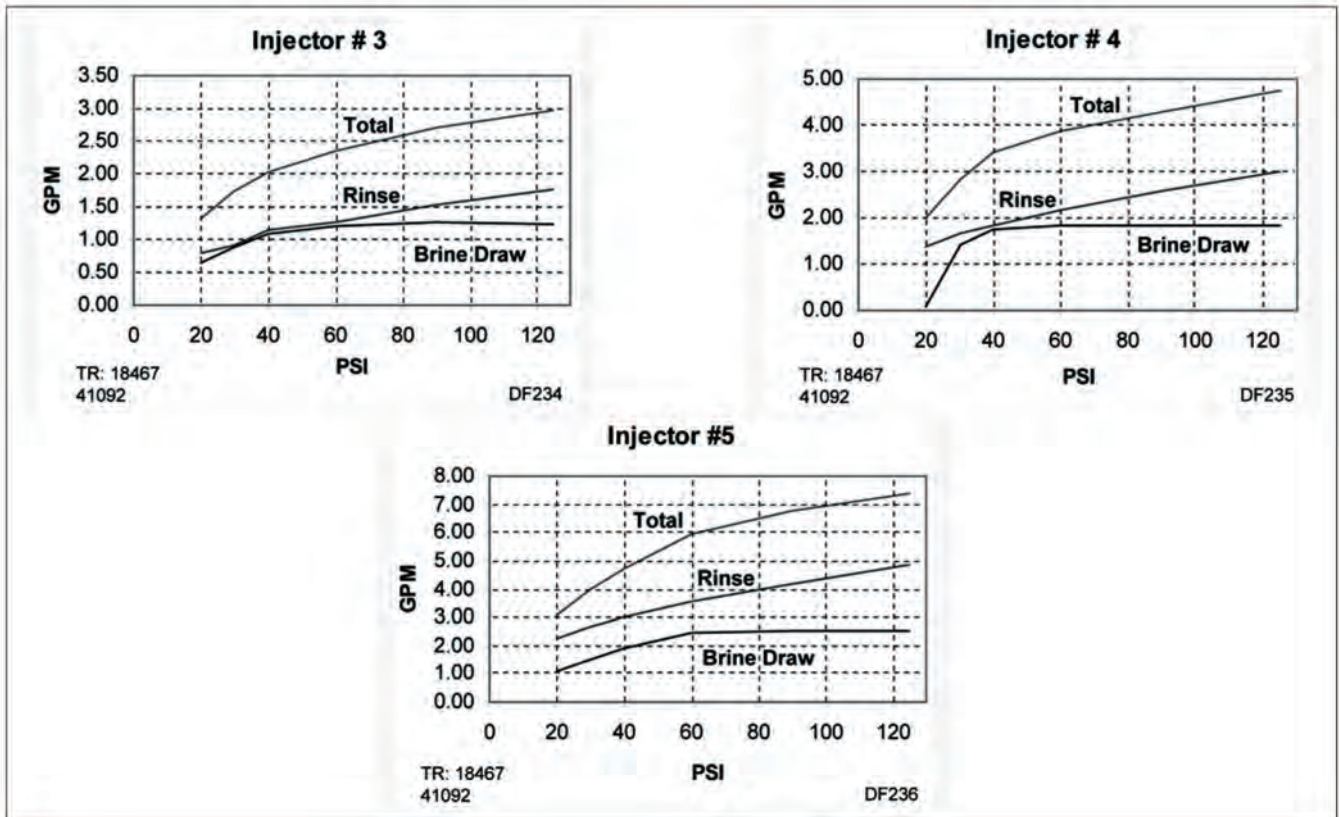
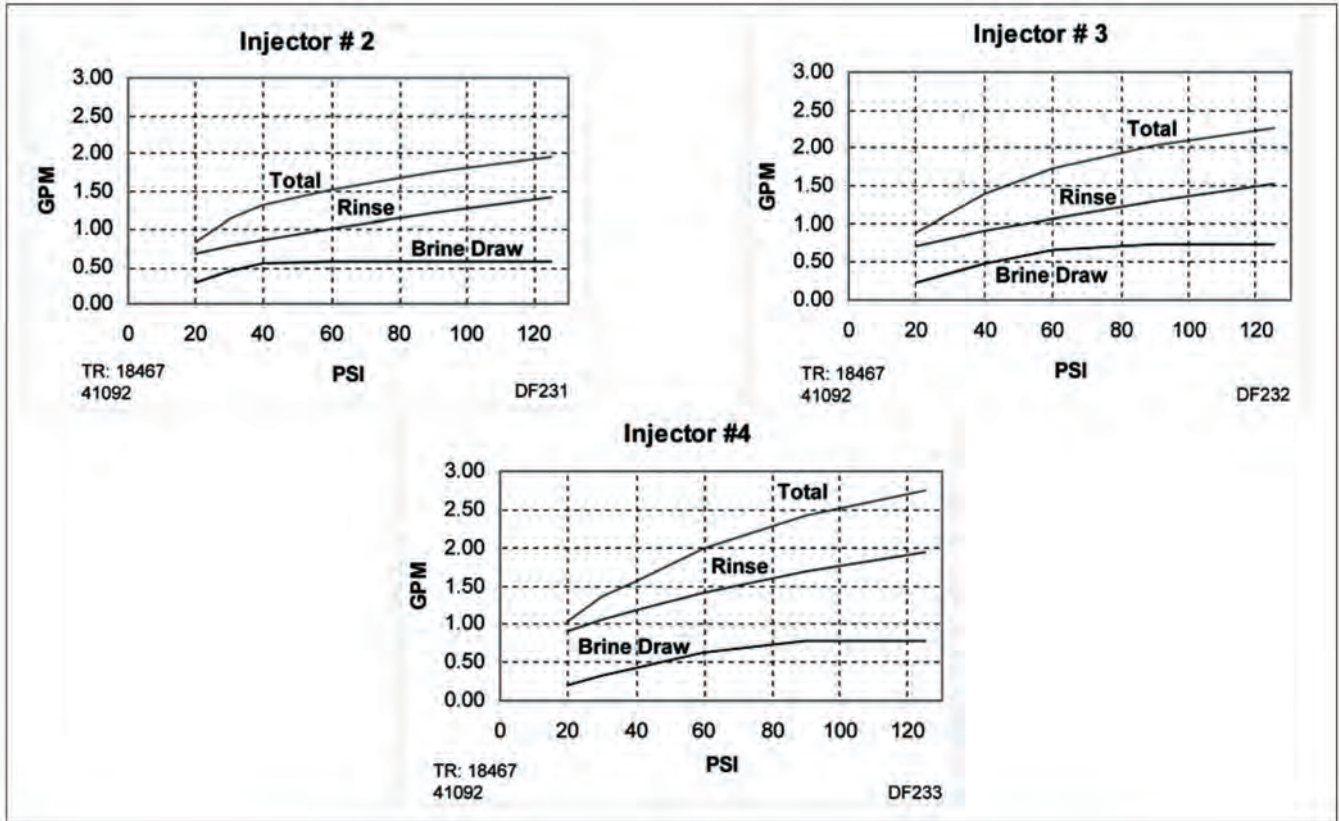
**9100**



**9500**



9500



**9500 Control Valve Assembly**

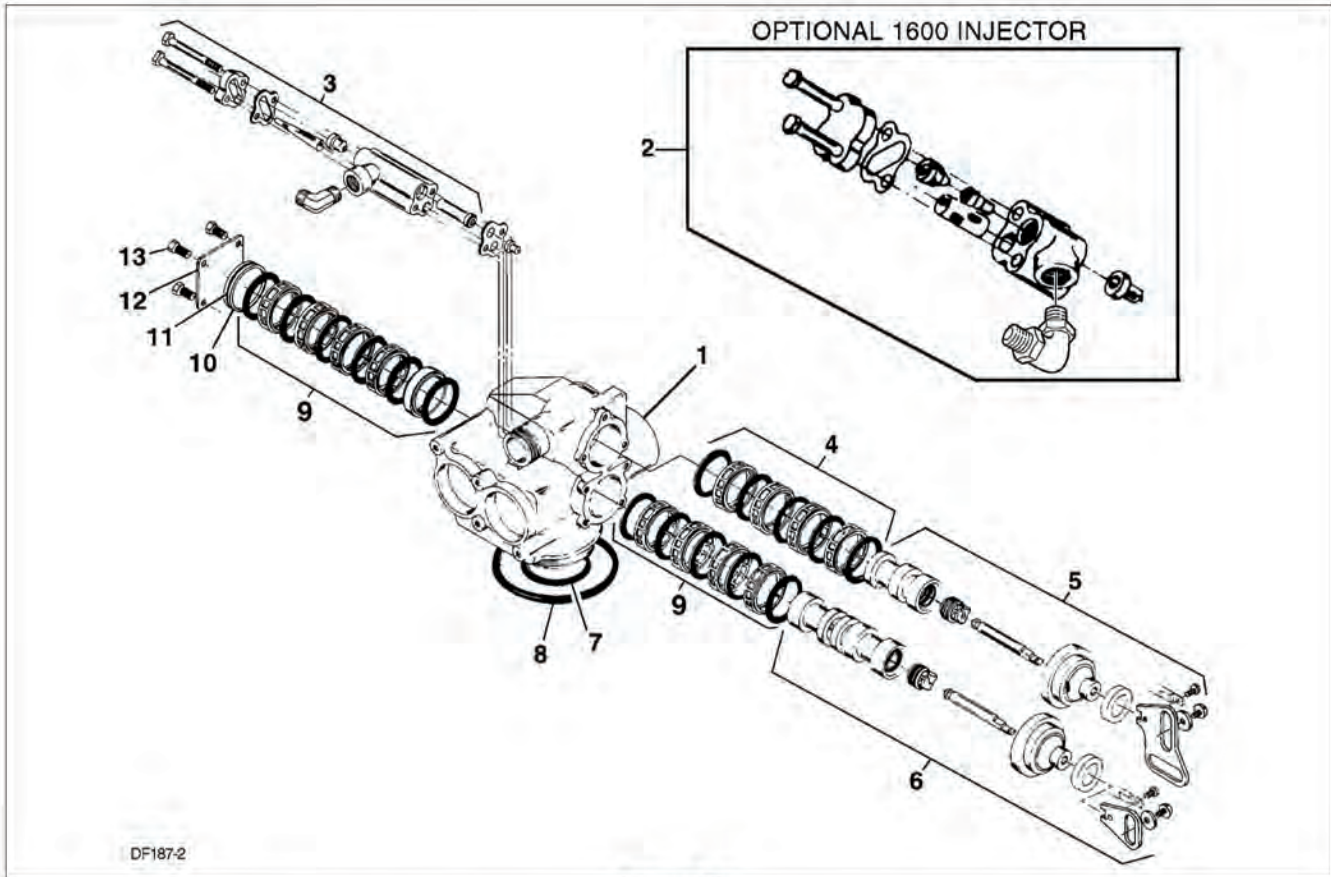
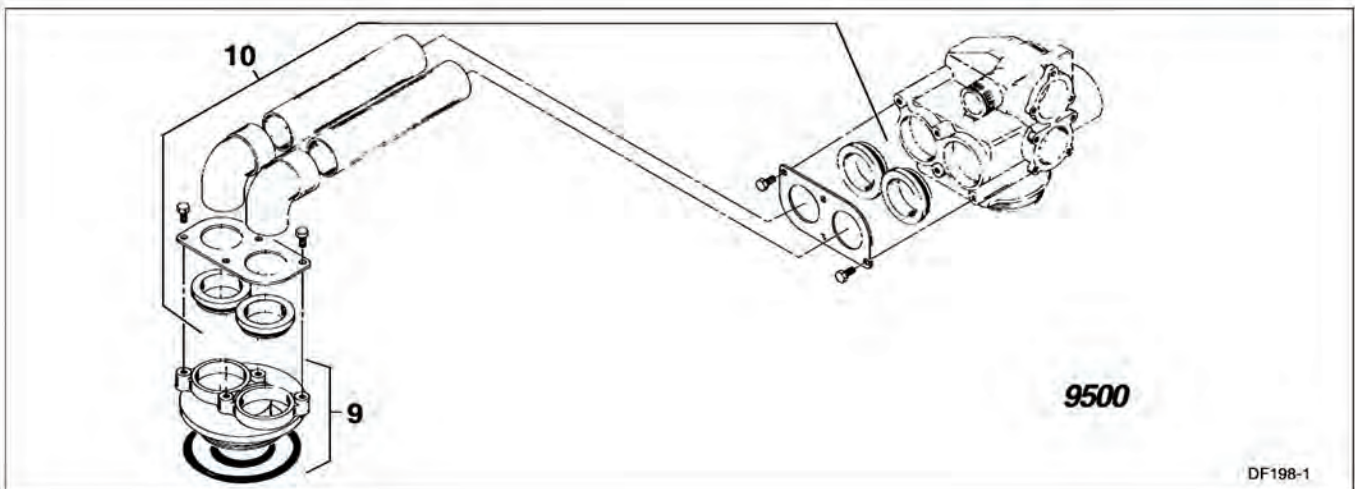
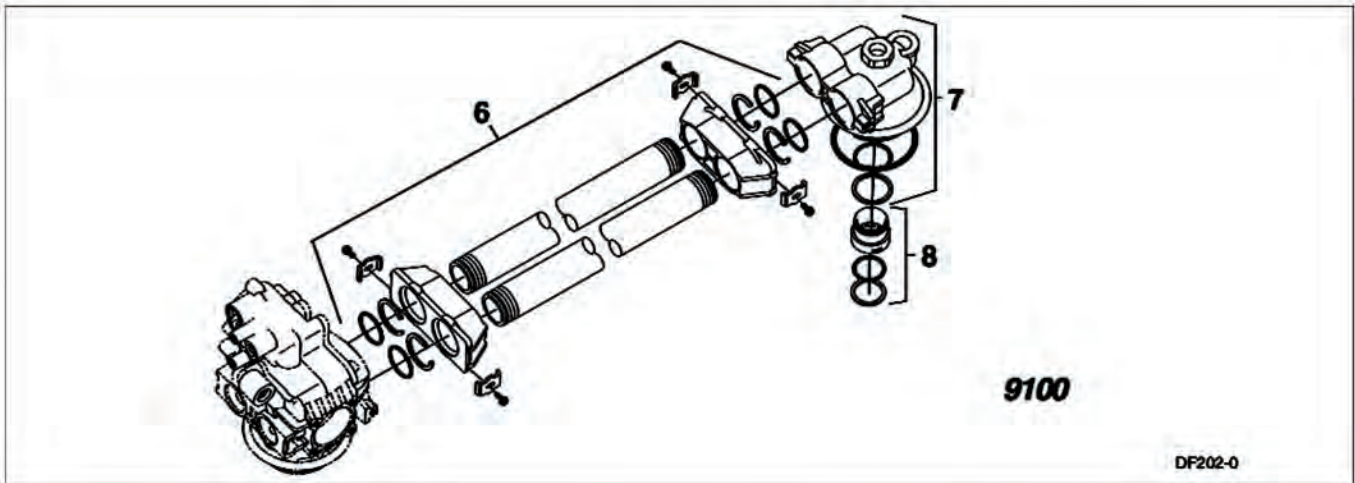
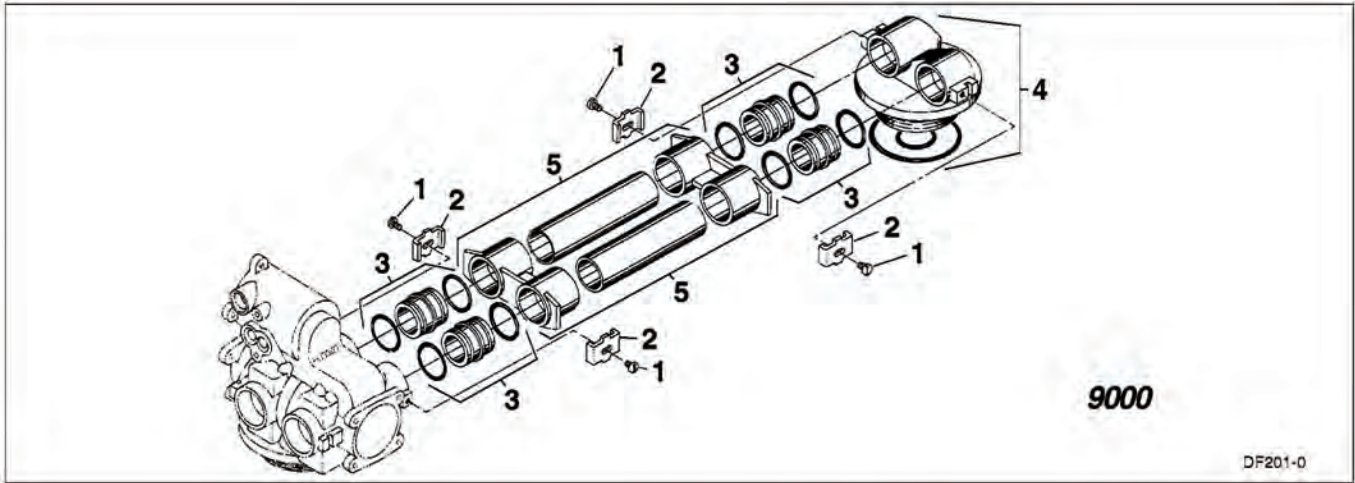


Figure 25

Item	Quantity	Part Number	Description
1	1	16919-01	valve body <b>9500</b> NPT, mechanical base
		16919-01NP	valve body <b>9500</b> NPT, mechanical base, nickel-plated
		16919-21	valve body <b>9500</b> BSP/Metric, mechanical base
		16919-21NP	valve body <b>9500</b> BSP/Metric, mechanical base, nickel-plated
2	1	60080-XX	injector assembly (see chart for dash numbers)
3	1	60039-XX	injector assembly (see chart for dash numbers)
			<i>injector number</i>
			blue #2 02
			yellow #3 03
			green #4 04
			white #5 05
4	1	60134	seal and spacer kit, top
		60134-01	seal and spacer kit, top, hot water
		60134	seal and spacer kit, top, silicone
5	1	60108	piston assembly, top
		60108-01	piston assembly, top, hot water
6	1	60109	piston assembly, bottom
		60109-01	piston assembly, bottom, hot water
7	1	60133	seal and spacer kit, bottom
		60133-01	seal and spacer kit, bottom, hot water
		60133-10	seal and spacer kit, bottom, silicone
8	1	16455	O-ring, 347
9	1	13577	O-ring, 226
10	1	16955	end plug
11	1	16394	O-ring, 029
12	1	14906	end plate
13	4	15137	screw, hex washer machine, 1-24 x 3/8
		17657	screw, hex M5-40, Metric
<i>Not Shown</i>			
14		16516	tool, seal and spacer stuffer
15		17623	tool, spacer puller

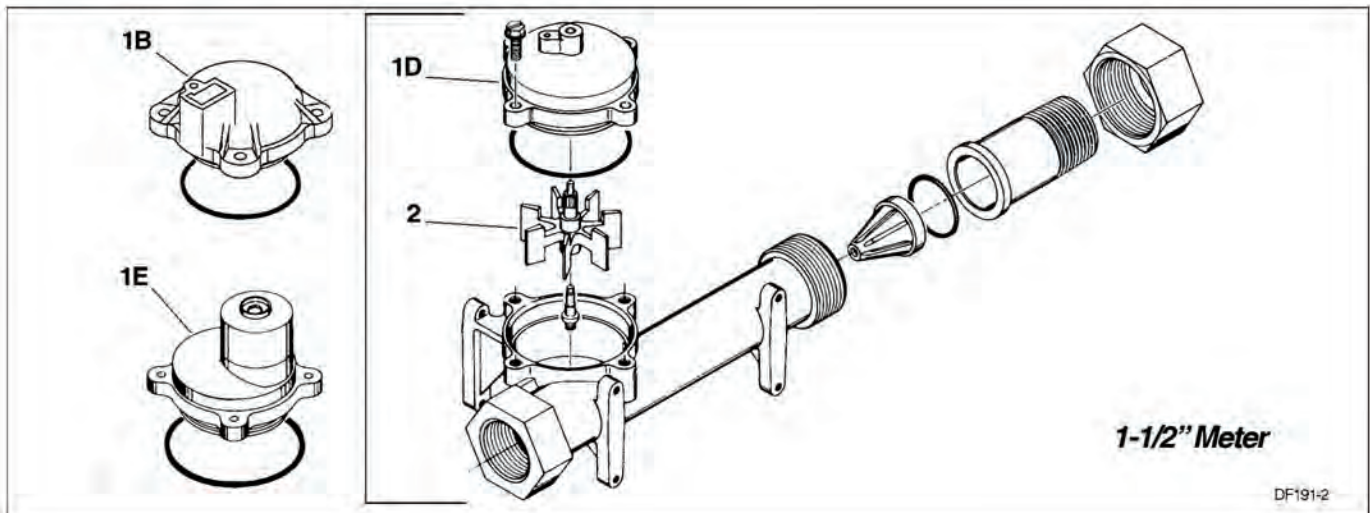
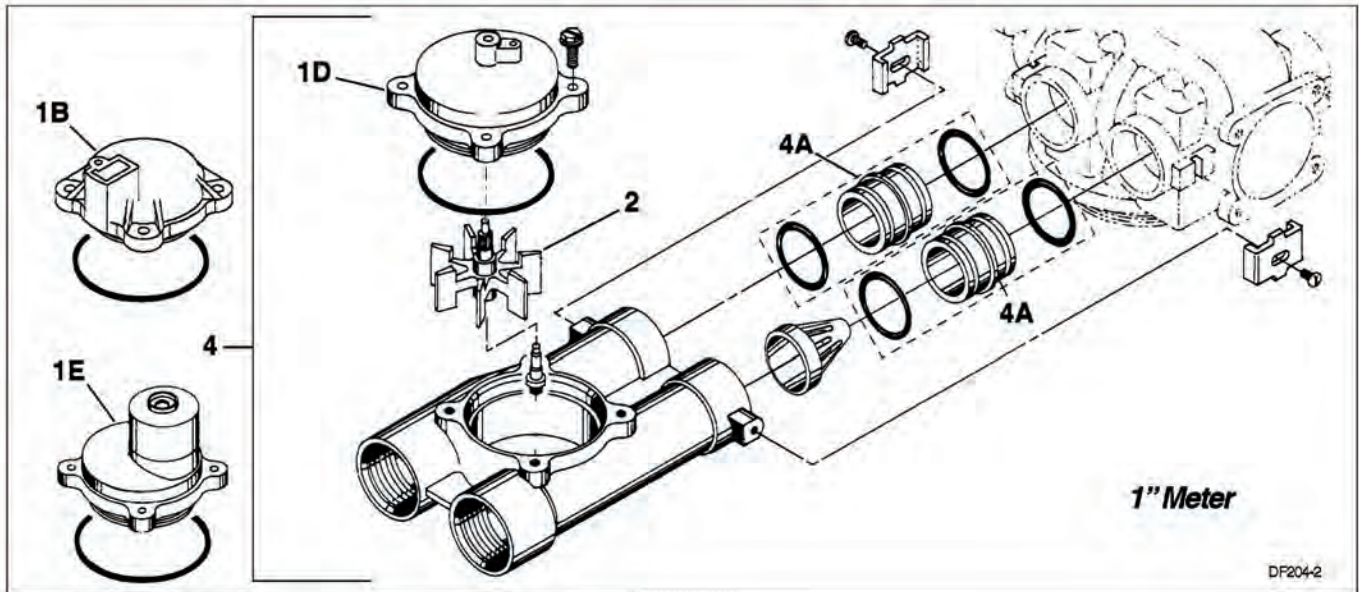
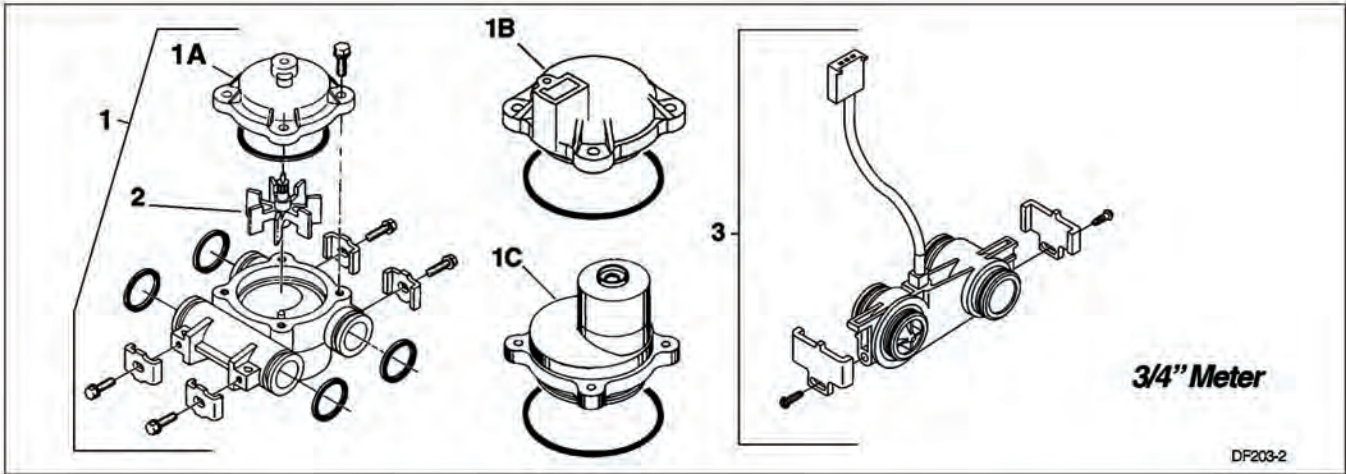
**Second Tank Assemblies**



## Second Tank Assemblies

<i>Item</i>	<i>Quantity</i>	<i>Part Number</i>	<i>Description</i>
<b>9000 second tank assembly</b>			
1	4	14202-01	screw, hex head #8-32
2	4	13255	clip, hold-down
3	4	15078-01	coupling assembly, <b>9000</b>
4	1	14864-01	second tank adapter assembly, <b>9000</b>
5	1	14864-01NP	second tank adapter assembly, <b>9000</b> , nickel-plated
		15823-06	yoke assembly 6" tanks, 6" tubes
		15823-06NP	yoke assembly 6" tanks, 6" tubes, nickel-plated
		15823-12	yoke assembly 12" tanks, 8-1/2" tubes
		15823-12NP	yoke assembly 12" tanks, 8-1/2" tubes, nickel-plated
		15823-14	yoke assembly 14" tanks, 10-1/2" tubes
		15823-14NP	yoke assembly 14" tanks, 10-1/2" tubes, nickel-plated
		15823-16	yoke assembly 16" tanks, 12-1/2" tubes
		15823-16NP	yoke assembly 16" tanks, 12-1/2" tubes, nickel-plated
<b>9100 second tank assembly</b>			
6	1	60425-12	plastic tube assembly, <b>9100</b> , up to 12" tanks
		60425-16	plastic tube assembly, <b>9100</b> , up to 16" tanks
7	1	14865	second tank adapter assembly, <b>9100</b>
8	1	61419	distributors adapter kit, <b>9100</b> , 1.05"
<b>9500 second tank assembly</b>			
9	1	16919-01	second tank adapter assembly, <b>9500</b>
		16919-01NP	second tank adapter assembly, <b>9500</b> , nickel-plated
		16919-21	second tank adapter assembly, <b>9500</b> , BSP/Metric
		16919-21NP	second tank adapter assembly, <b>9500</b> , BSP/Metric, nickel-plated
10	1	60715-16	tube assembly 16" tanks
		60715-16NP	tube assembly 16" tanks, nickel-plated
		60715-20	tube assembly 20" tanks
		60715-20NP	tube assembly 20" tanks, nickel-plated
		60715-24	tube assembly 24" tanks
60715-24NP	tube assembly 24" tanks, nickel-plated		

**Meter Assemblies**



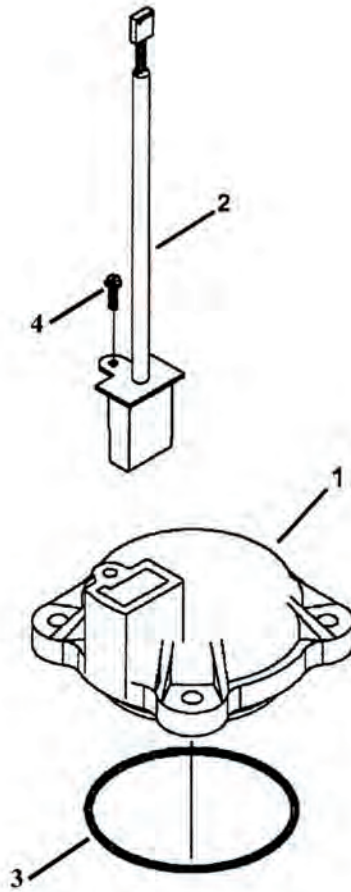


## Meter Assemblies

<i>Item</i>	<i>Quantity</i>	<i>Part Number</i>	<i>Description</i>
<b>9000 meter assembly</b>			
1	1	60086	3/4" meter assembly, standard range
		60086-50	3/4" meter assembly, electronic ( <b>ET</b> )
		60087	3/4" meter assembly, extended range
1A	1	14038	meter cap assembly, standard range
1B		14716	meter cap assembly, electronic ( <b>ET</b> )
1C		15150	meter cap assembly, extended range
1D	1	15218	meter cap assembly, brass standard range
		15218NP	meter cap assembly, brass nickel-plated standard range
1E		15237	meter cap assembly, brass extended range
		15237NP	meter cap assembly, brass nickel-plated extended range
2	1	13509	impeller
		13509-01	impeller, hot water
3	1	19797	3/4" turbine meter assembly, less clips and screws
		60626	3/4" turbine meter assembly with clips, screws, meter cable
		60626-01	3/4" turbine meter assembly, with clips and screws
4	1	60389	1" meter assembly, standard range
		60389NP	1" meter assembly, standard range
	1	60389-20	1" meter assembly, standard range, BSP
		60390	1" meter assembly, extended range
		60390NP	1" meter assembly, extended range, nickel-plated
		60390-20	1" meter assembly, extended range, BSP
		60612	1" meter assembly, standard range, hot water
		60622	1" meter assembly, electronic
4A	1	15078	1" adapter coupling
5	1	60610-01	1-1/2" meter assembly, standard range
		60610-01NP	1-1/2" meter assembly, standard range, nickel-plated
		60610-02	1-1/2" meter assembly, extended range
		60610-02NP	1-1/2" meter assembly, extended range, nickel-plated
		60610-21	1-1/2" meter assembly, standard range, BSP
		60610-21NP	1-1/2" meter assembly, standard range, BSP, nickel-plated
		60610-22	1-1/2" meter assembly, extended range, BSP
		60610-22NP	1-1/2" meter assembly, extended range, BSP, nickel-plated
		60611-01	1-1/2" meter assembly, standard range, with 1" sleeve
		60611-01NP	1-1/2" meter assembly, standard range, with 1" sleeve, nickel-plated
		60611-02	1-1/2" meter assembly, extended range, with 1" sleeve
		60611-02NP	1-1/2" meter assembly, extended range, with 1" sleeve, nickel-plated
<i>Not Shown</i>			
6*		17790	1-1/2" meter sleeve reduced to 1"
7		60460	meter checker kit, standard range
8		60461	meter checker kit, extended range

\* when reducing 1-1/2" meter to 1" program wheel and timer settings must be changed to 1" meter size

**3/4", 1" or 1 1/2" Paddle Wheel Meter Cap Assembly**



ET039-0

Item No.	No. Req'd	Part No.	Description
1	1	14716	assembly, meter cap
2	1	19121-01	harness assembly, flow meter
3	1	13847	O-ring, -137, STD/5600CD
4	1	17798	screw, slot hex wsh HD

## Brine Valve Systems (1600 and 1700 Series)

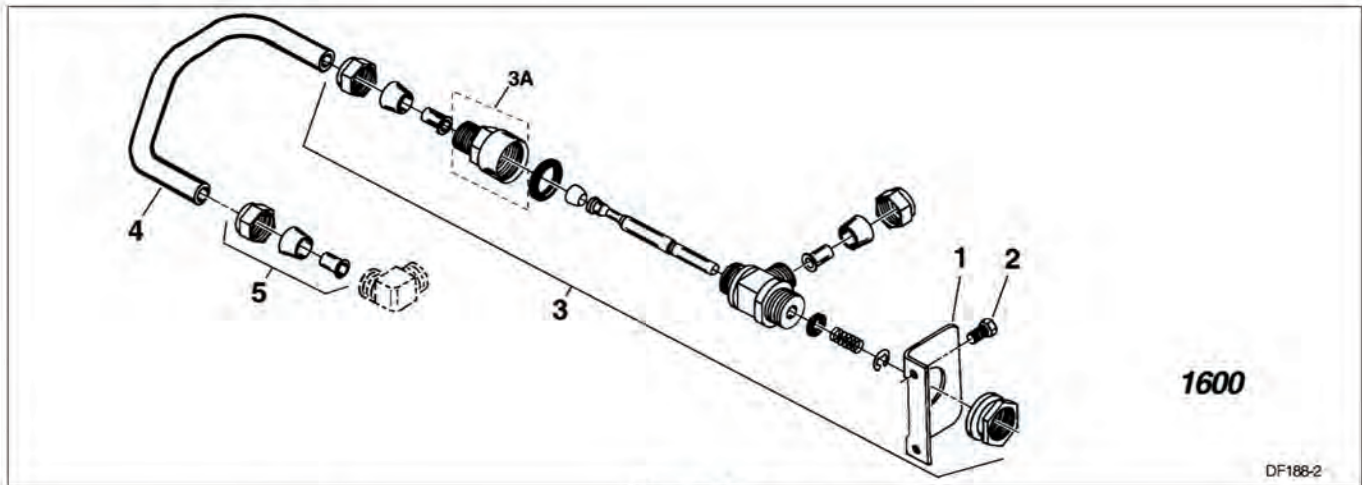


Figure 26

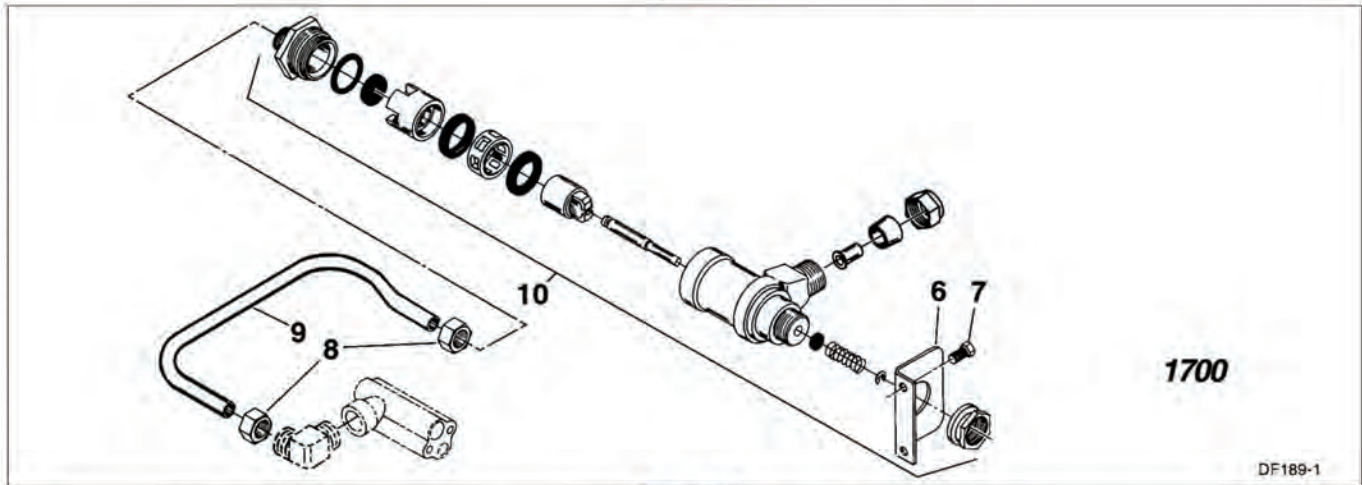


Figure 27

Item	Quantity	Part Number	Description	
1	1	16922	bracket, brine valve	<b>1600 Series Brine System</b>
2	2	15137	screw, brine valve bracket	
3	1	60037-610	brine valve assembly, 0.25 gpm	
		60020-620	brine valve assembly, 0.50 gpm	
		60020-630	brine valve assembly, 1.00 gpm	
		60020-690	brine valve assembly, blank	
		60037HW	brine valve assembly, hot water	
3A	1	60020-25	brine line flow control assembly, 0.25 gpm	
		60020-50	brine line flow control assembly, 0.50 gpm	
		60020-100	brine line flow control assembly, 1.00 gpm	
4	1		tube, brine valve	
5	1		adapter kit	
6	1	16922	bracket, brine valve	<b>1700 Series Brine System</b>
7	2	15137	screw, brine valve bracket	
8	2	15414	nut, tube	
9	1	16959	tube, brine valve	
10	1	60039-00	brine valve assembly, blank	
		60039-10	brine valve assembly, 1.0 gpm	
		60039-12	brine valve assembly, 1.2 gpm	
		60039-15	brine valve assembly, 1.5 gpm	
		60039-20	brine valve assembly, 2.0 gpm	
		60039-24	brine valve assembly, 2.4 gpm	
		60039-30	brine valve assembly, 3.0 gpm	
		60039-35	brine valve assembly, 3.5 gpm	
		60039-40	brine valve assembly, 4.0 gpm	

**9500, 2350 Safety Brine Valve**

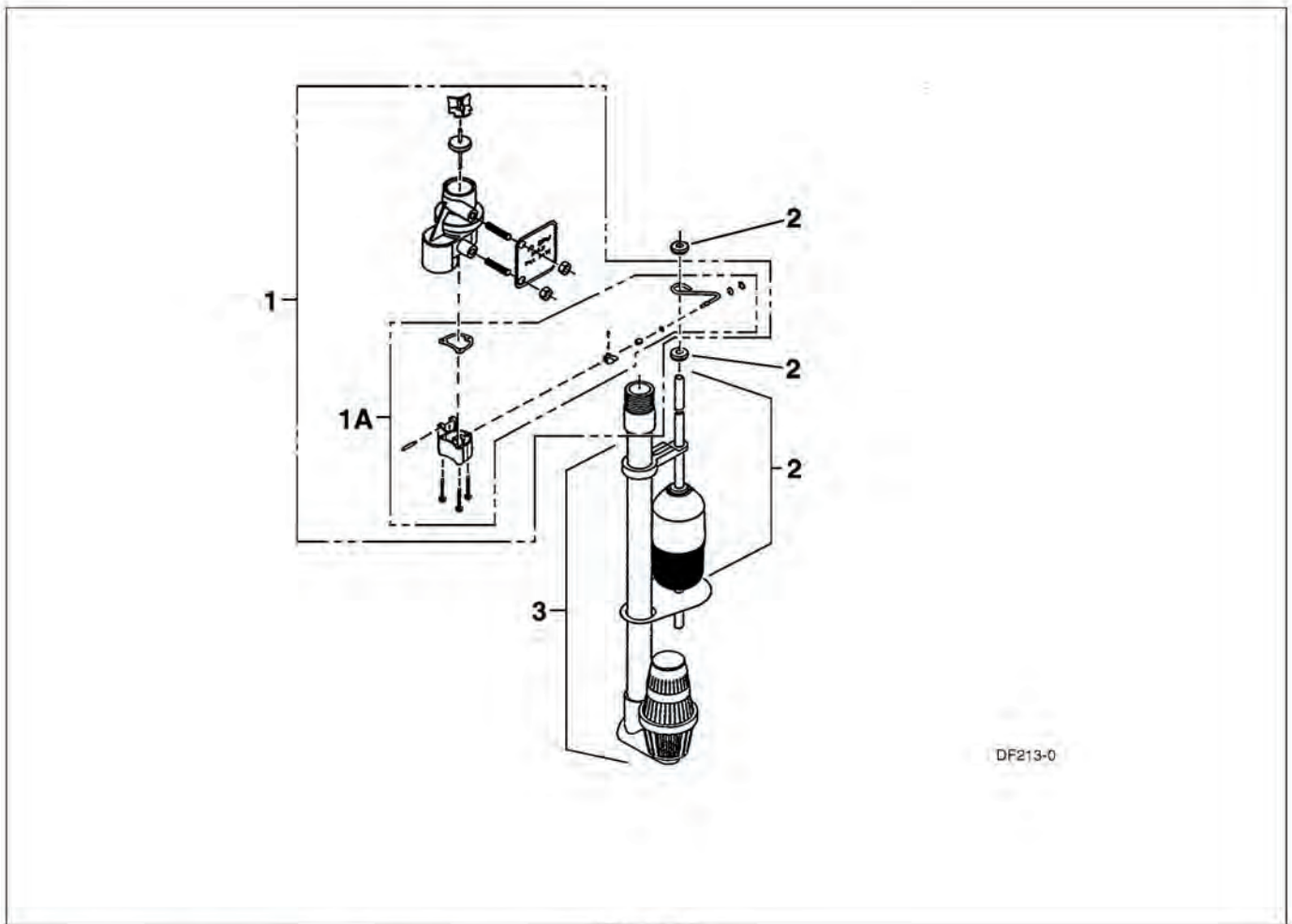
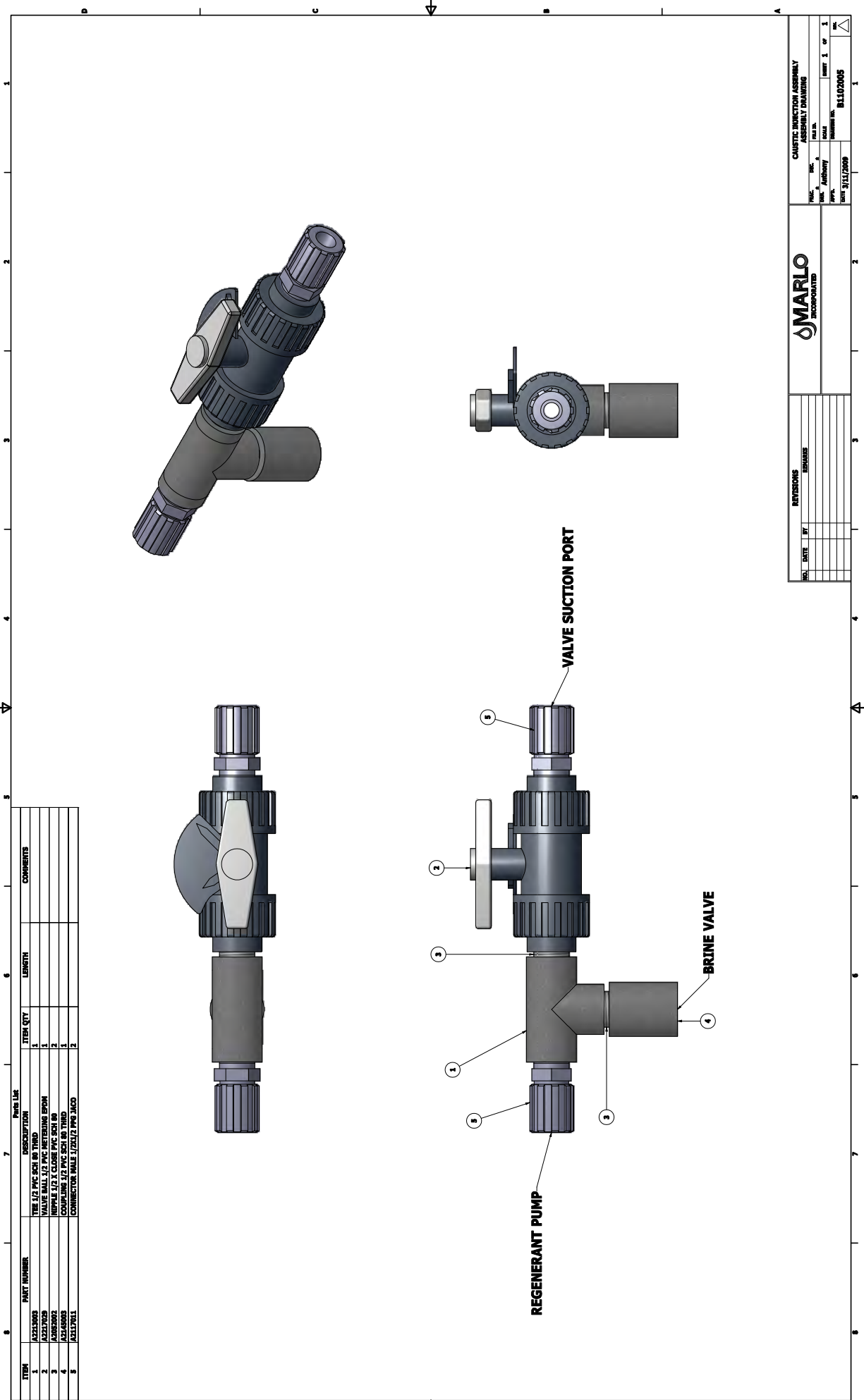


Figure 36

Item	Quantity	Part Number	Description
1	1	60038	2350 safety brine valve
1A	1	61024	2350 actuator assembly
2	1	60026-30	float assembly red/white
		60076-30SAN	float assembly green/green (hot water)
3	1	60009-00	#900 air check
	1	60009-01	#900 air check hot water
<i>Not Shown</i>			
4		18603	2350 fittings for 1700 brine system
5		18604	#900 fittings for 1700 brine system



ITEM	PART NUMBER	DESCRIPTION	ITEM QTY	LENGTH	COMMENTS
1	A22L0003	1/2" PVC SCH 80 TYPED	1		
2	A22L7009	VALVE BALL 1/2" PVC METERING EPDM	1		
3	A22E2002	NIPPLE 1/2" X CLOSE PVC SCH 80	2		
4	A33L0003	COUPLING 1/2" PVC SCH 80 TYPED	1		
5	A21L7001	CONNECTOR MALE 1/2"X1/2" TYP D400	2		

REV. DATE		BY	REVISIONS
			REVISE
		CAUSTIC INJECTION ASSEMBLY DRAWN BY: J. DANIELS DATE: 11/11/2009 SCALE: AS SHOWN SHEET 1 OF 1 NUMBER: B1102005	

## Troubleshooting

PROBLEM	CAUSE	CORRECTION
1. Softener fails to regenerate.	A. Electrical service to unit has been interrupted. B. Timer is defective.	A. Assure permanent electrical service (check fuse, plug, pull chain or switch). B. Replace timer.
2. Hard water.	A. Bypass valve is open. B. No salt in brine tank. C. Injector screen plugged. D. Insufficient water flowing into brine tank. E. Hot water tank hardness. F. Leak at distributor tube. G. Internal valve leak.	A. Close bypass valve. B. Add Salt to brine tank and maintain salt level above water level. C. Clean injector screen. D. Check brine tank fill time and clean brine line flow control if plugged. E. Repeated flushing of the hot water tank is required. F. Make sure distributor tube is not cracked. Check O-Ring and tube pilot. D. Replace seals and spacers and/or piston.
3. Unit used too much salt.	A. Improper salt setting. B. Excessive water in brine tank.	A. Check salt usage and salt setting. B. See Problem No. 7.
4. Loss of water pressure.	A. Iron buildup in line to water conditioner. B. Iron buildup in water conditioner. C. Inlet of control plugged due to foreign material broken loose from pipe by recent work done on plumbing system.	A. Clean line to water conditioner. B. Clean control and add mineral cleaner to mineral bed. Increase frequency of regeneration and/or backwash time. C. Remove pistons and clean control.
5. Loss of mineral through drain line.	A. Air in water system. B. Drain line flow control too large.	A. Assure that well system has proper air eliminator control. Check for dry well condition. B. Check to ensure drain line flow control is sized properly for your mineral tank.
6. Iron in conditioned water.	A. Fouled mineral bed.	A. Check backwash, brine draw and brine tank fill. Increase frequency of regeneration.
7. Excessive water in brine tank.	A. Plugged drain line flow control. B. Plugged injector system. C. Timer not cycling. D. Foreign material in brine valve. E. Foreign material in brine line flow control. F. Power loss during brine fill.	A. Check flow control. B. Clean injector and screen. C. Replace timer. D. Replace brine valve seat and clean valve. E. Clean brine line flow control. F. Check power source.

## Troubleshooting

PROBLEM	CAUSE	CORRECTION
8. Softener fails to draw brine.	A. Drain line flow control is plugged. B. Injector is plugged. C. Injector screen plugged. D. Line pressure is too low.  E. Internal Control Leak	A. Clean drain line flow control. B. Clean injector. C. Clean screen. D. Increase line pressure to 25 psi min. E. Change seals, spacers and piston assembly.
9. Control cycles continuously.	A. Broken or shorted switch.	A. Determine if switch or timer is faulty and replace it, or replace complete power head.
10. Drain flows continuously.	A. Valve is not programming correctly.  B. Foreign material in control.  C. Internal control leak.	A. Check timer program and positioning of control. Replace power head assembly if not positioning properly. B. Remove power head assembly and inspect bore, remove foreign material and check control in various regeneration positions. C. Replace seals and piston assembly.

### General Service Hints

#### Problem: Softener delivers hard water

PROBLEM	CAUSE	CORRECTION
Softener delivers hard water.	Reserve capacity has been exceeded.  Program wheel is not rotating with meter output.  Meter is not measuring flow.	Check salt dosage requirements and reset program wheel to provide additional reserve.  Pull cable out of meter cover and rotate manually. Program wheel must move without binding and cycle actuator must start the cycle before the clutch releases.  Check output by observing rotation of small gear on front of timer  (Note: Program wheel must not be against regeneration stop for this check)  Each tooth is approximately 75 gallons on 1-1/2" installations. If not performing properly, replace meter.

## Troubleshooting - Timer

If an error is detected, an error screen will alternate with the main display screen every few seconds, and the **LED light will be red**.

During an error condition, the unit continues to monitor the flow meter and update the remaining capacity. Once an error condition is corrected, the unit returns to the operating status it was in prior to the error, and regeneration resumes according to normal programming. If an error is cleared by reprogramming the unit in the Master Programming Mode, the volume remaining may be reset to the full unit capacity (as though it had just regenerated). If an error is present, a regeneration can only occur manually by pressing and holding the Extra Cycle button for 5 seconds. If the unit was in regeneration when the error occurred, it will complete the regeneration cycle and go into service.

When the problem is corrected, and the error no longer displays (it may take several seconds for the unit to stop displaying the error message), the unit will return to normal operation. The **LED light** will no longer be **red**, and will turn **Green** if the unit is regenerating, or **Blue** if the unit is in service.

Problem	Correction
A. Flashing/blinking display	A. Power outage has occurred. Either wait 5 minutes for blinking to stop, or press any key on the keypad.
B. Unit not responding after going into regeneration	B. Verify the unit is configured correctly (ex: wiring valve type). Perform a Master Reset by holding the Extra Cycle button and cycling power. Check and verify the choices selected in Master Programming Mode.
C. Unit displays "ERROR CODE: REPLACE UNIT" (corrupted UAP)	C. Contact your local water treatment professional.

### Error Codes

Error Code	Display Message	Correction
01	ERROR CODE: PROGRAM UNIT	Go through all screens in Master Programming Mode.
02	ERROR CODE: PROGRAM UNIT	Go through all screens in Master Programming Mode.
03	ERROR CODE: SERVICE UNIT	Perform a Master Reset by holding the Extra Cycle button and cycling power. Go through all screens in Master Programming Mode. Manually initiate a regeneration cycle by pressing the Extra Cycle button for 5 seconds.
04	ERROR CODE: SERVICE UNIT	Perform a Master Reset by holding the Extra Cycle button and cycling power. Go through all screens in Master Programming Mode. Manually initiate a regeneration cycle by pressing the Extra Cycle button for 5 seconds.
05	ERROR CODE: SERVICE UNIT	Call your local water treatment professional as soon as possible. Leave the unit running (do not unplug).

**NOTE: If the above corrections do not work, please contact your local water treatment professional.**

### Error Display Screen Examples

E	R	R	O	R		C	O	D	E	:				
S	E	R	V	I	C	E		U	N	I	T			

E	R	R	O	R		C	O	D	E	:				
P	R	O	G	R	A	M		U	N	I	T			

E	R	R	O	R		C	O	D	E	:				
R	E	P	L	A	C	E		U	N	I	T			



## NOTES

# PULSAtron® Series A PLUS

## Electronic Metering Pumps



### Key Features

- **Manual Control** by on-line adjustable stroke rate and stroke length.
- **Agency approved** for demanding **OUTDOOR** and indoor applications.
- **Highly Reliable** timing circuit.
- **Water Resistant** excellent for **OUTDOOR** and indoor applications.
- **Internally Dampened To Reduce Noise**, very acceptable for household installations.
- **Guided Ball Check Valve Systems**, to reduce back flow and enhance outstanding priming characteristics.
- **Premium Standard Wetted Component Materials.**
- **Few Moving Parts** and **Wall Mountable.**
- **Safe & Easy Priming** with durable leak-free **bleed valve assembly** (standard).
- **Optional Control:** External pace with auto/manual selection.

### Complete Economical Selection

Six distinct models are available, having pressure capabilities to 250 PSIG, and flow capacities to 48 GPD, with a turndown ratio of 100:1. Metering performance is reproducible to within  $\pm 3\%$  of maximum capacity.

Please refer to the reverse side for Series A PLUS specifications.

### Operating Benefits

**Reliable metering performance.** Our guided check valves, with their state-of-the-art seat and ball designs, provide precise seating, and excellent priming and suction lift characteristics. Our timing circuit is highly reliable and, by design, virtually unaffected by temperature, EMI and other electrical disturbances.

**Rated "hot" for continuous duty.** Series A PLUS pumps continue to meet their specifications for pressure and capacity even during extended use. That's because of our high quality solenoid and special enclosure that effectively dissipates heat.

**High viscosity capability.** A straight flow path and ample clearance between the diaphragm and head enable standard PULSAtron pumps to handle viscous chemicals up to a viscosity of 1000 CPS.

**Leak-free, sealless, liquid end.** Our diaphragms are of superior construction—PTFE-faced, bonded to a composite of Hypalon and fabric layers, and reinforced with a metal insert for optimum flexibility and durability.

For additional information about PULSAtron's full-featured Series MP & Series E PLUS, refer to Technical Sheet No. EMP-027 & EMP-021, about the mid-range Series E & Series D refer to Technical Sheet No. EMP-022 & EMP-023. For information about the economical Series C PLUS & Series C, refer to Technical Sheet No. EMP-026 & EMP-024.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

### System Compatibility

**A wide variety of chemicals can be pumped.** Liquid end materials include glass-filled polypropylene (GFPPL), PVC, styrene-acrylonitrile (SAN), Polyvinylidene Fluoride (PVDF), PTFE, Hypalon, Viton, ceramic, alloys and 316SS.

**Immediate installation and start-up.** Included as standard accessories with all models are an injection/back pressure valve assembly and a foot valve/strainer assembly\*, including discharge and suction tubing.

**Safe and easy priming and valve maintenance.** Included as a standard accessory is a bleed valve assembly, including return tubing (available only on those models with tubing connections).

**Quick and economical liquid end maintenance.**

Available for every model is a unique KOPkit®, a convenient, economically priced, package containing new cartridge check valves and other important spare parts.



technology  
innovation diversity  
excellence

# PULSAtron Series A PLUS Specifications

Series A PLUS - Six model selections. Digit 1 and 2 (LB) signify product class, digit 3 and 4 signify pressure flow. For full model selection information refer to Price Schedule EMP-PS LP.

## Pressure and Flow Rate Capacity

Capacity, nominal	GPH	0.25	0.45	0.50	1.00	1.25	2.00
	GPD	6	11	12	24	30	48
	LPH	0.9	1.7	1.9	3.8	4.7	7.6
Pressure, max PSIG/Bar							
250/17	---	LBC3	---	---	---	---	---
150/10	LB02	---	LB03	---	---	---	---
100/7	---	---	---	LB04	LB64	---	---
50/3.3	---	---	---	---	---	LBC4	---

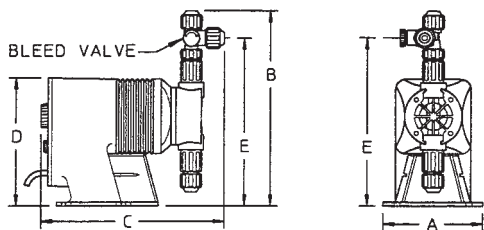
Connections:	Tubing	1/4" ID X 3/8" OD 3/8" ID X 1/2" OD 3/16" ID X 5/16" OD
	Piping	1/4" FNPT
Reproducibility at max. capacity		+/- 3%
Viscosity Max CPS		1000
Stroke Frequency Max SPM		125
Stroke Frequency Turn-Down Ratio		10:1
Stroke Length Turn-Down Ratio		10:1
Power Input		115 VAC/50-60 HZ/1 ph 230 VAC/50-60 HZ/1 ph
Average Current Draw @ 115 VAC: Amps		0.6
@ 230 VAC: Amps		0.3
Peak Input Power Watts		130
Average Input Power @ max SPM: Watts		50

## Liquid End Materials

Series	Pump Head	Diaphragm	Check Valves		Fittings	Bleed Valve	Injection Valve Assembly Foot Valve Assembly	Tubing
			Seats/O-Rings	Balls				
A PLUS	GFPP PVC SAN PVDF 316 SS	PTFE-faced Hypalon-backed	PTFE, Hypalon, Viton	Ceramic, PTFE, 316SS, Alloy C	GFPP PVC PVDF	Same as fitting and check valve selected, except 316SS	Same as fitting and check valve selected	Clear PVC White PE

**Important:** Material Code— GFPP = Glass-filled Polypropylene, PVC = Polyvinyl Chloride, SAN = Styrene-Acrylonitrile, PE = Polyethylene, PVDF = Polyvinylidene Fluoride. Hypalon and Viton are registered trademarks of E.I. DuPont Company. PVC wetted end recommended for sodium hypochlorite.

## Dimensions



Series A PLUS Dimensions (inches)						
Model No.	A	B	C	D	E	Shipping Weight (lbs.)
LB02	5.0	9.6	9.5	6.5	8.2	10
LBC3	5.0	9.9	9.5	6.5	8.5	10
LB03	5.0	9.9	9.5	6.5	8.5	10
LB04	5.0	9.9	9.5	6.5	8.5	10
LB64	5.0	9.9	9.5	6.5	8.5	10
LBC4	5.0	9.9	9.5	6.5	8.5	10

Note: Inches x 2.54=cm

### KOPkit®

Available for every model, the KOPkit provides an economically priced package of parts required for routine maintenance. The kit typically contains new valve cartridges with o-rings, head, diaphragm, secondary o-ring seal, head screws and washers.

For further KOPkit information, refer to Technical Sheet No. GB-045.



An ISO Certified Company



A Unit of IDEX Corporation

### Standard Product Operations

27101 Airport Road • Punta Gorda, Florida 33982  
TEL (941) 575-3800 • TEL 800-333-6677  
FAX (941) 575-4085 • FAX 800-456-4085  
spottech@pulsa.com • www.pulsa.com

### 8.3 RETURNS

The Customer Service Department will issue a Return Authorization (RA) number for all returns. The following information will be required:

1. Billing and a ship-to address.
2. Model and serial number.
3. Contact name and phone number.
4. Reason for return.
5. Purchase order (where applicable).
6. RA number on outside of the carton.

All material must be returned freight prepaid. All merchandise must be properly packaged and free of any corrosive, toxic or otherwise hazardous chemical. All items returned must reference Return Authorization.

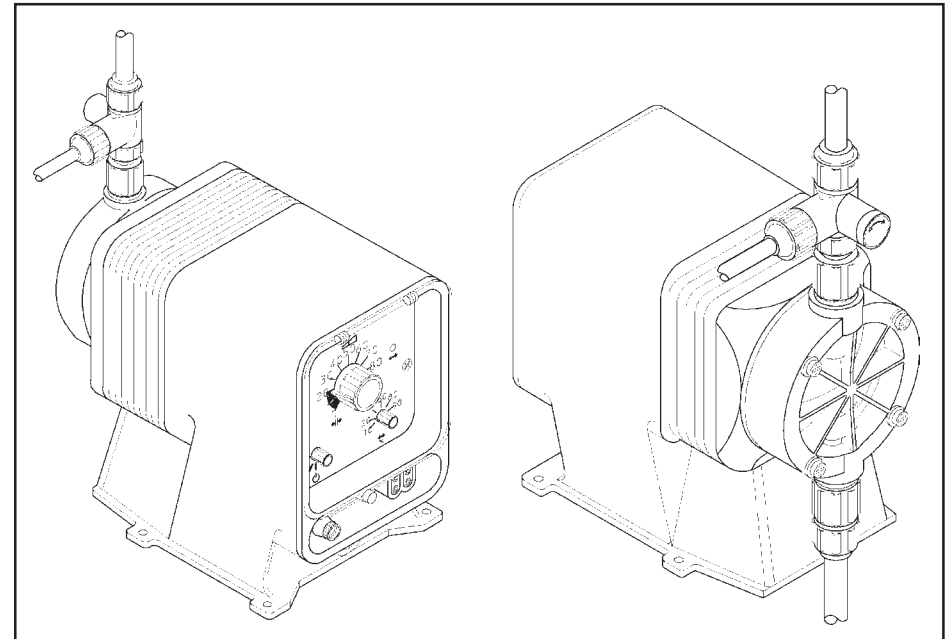
### 8.4 CREDITS

No equipment will be accepted beyond six months after date of shipment from the factory. Only unused and undamaged equipment will be accepted for return to stock. All credits are based on acceptance of materials as new and unused by our inspection personnel. A restocking fee will apply. All equipment returned for credit must have a RA number and be returned freight prepaid.

# Electronic Metering Pumps

Series C, C PLUS, A PLUS, E, E-DC and E PLUS

## Installation Operation Maintenance Instruction



**READ ALL WARNINGS CAREFULLY  
BEFORE INSTALLING**

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## 8.0 POLICIES AND PROCEDURES

### 8.1 MANUFACTURERS PRODUCT WARRANTY

The manufacturer warrants its equipment of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for eighteen (18) months from the date of purchase or one (1) year from date of installation or whichever comes first. The manufacturer's liability is limited to repair or replacement of any device or part, which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through use of its products.

The above warranty is in lieu of any other warranty, either expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to make any warranty other than the above.

For warranty and service matters within the European Union, contact the seller first or:

Fagotpad 2  
3822 CN Amersfoort  
The Netherlands

### 8.2 EUROPEAN TECHNICAL FILE LOCATION

P.O. Box 91  
Washington  
NE371YH  
United Kingdom

## 7.0 TROUBLESHOOTING cont'd.

PROBLEM	PROBABLE CAUSE	REMEDY
<b>PUMP LOSES PRIME</b>	1. Dirty check valve.	1. Remove and replace or clean off any scale or sediment.
	2. Ball checks not seating or not sealing properly.	2. Check seat and ball checks for chips, clean gently. If deformity or deterioration is noted, replace part with proper material. Resulting crystals can hold check valves open, therefore, the valves must be disassembled and cleaned.
	3. Solution container allowed to run dry.	3. Refill the tank with solution and prime. See 5.0 (Start-Up and Operation Section).
	4. Chemical Outgassing.	4. Bleed gas, use flooded suction and maintain chemical at room temperature (approx. 20°F) to minimize outgassing.
<b>PUMP WILL NOT PRIME</b>	1. Too much pressure at discharge.	1. Turn off all pressure valves, relieve system pressure then loosen outlet tubing connection at discharge point. Remove discharge valve cartridge. Dampen ball check and valve seats with a few drops of solution. Set pump dial to maximum rate. When pump is primed, reconnect all tubing connectors.
	2. Check valves not sealing.	2. Disassemble, clean & check for deterioration, damage or swelling. Reassemble and wet the valve assembly, then prime. See 5.0 (Start-Up & Operating Section).
	3. Output dials not set at maximum.	3. Always prime pump with output dial set at maximum rated capacity.
	4. Suction lift height too much. Maximum 5 ft (1.5 m)	4. Decrease suction lift or pull vacuum on pump discharge until pump is primed.
	5. Pump equipped with spring loaded high viscosity valves.	5. Loosen discharge valve to aid in priming, take necessary safety precautions for spills, or apply vacuum to pump discharge.

## 1.0 SAFETY INSTRUCTIONS



When using chemical feed pumps, basic safety precautions should always be followed to reduce risk of fire, electric shock, and personal injury. Failure to follow these instructions could result in death or serious injury.



READ ALL INSTRUCTIONS

### 1.1 GENERAL SAFETY CONSIDERATIONS

- Always wear protective clothing including gloves and safety goggles when working on or near chemical metering pumps.
- Inspect tubing regularly when replenishing chemical solution for cracking or deterioration and replace as necessary. **(Always wear protective clothing and safety glasses when inspecting tubing.)**
- When pump is exposed to direct sunlight use U.V. resistant tubing.
- Follow directions and warnings provided with the chemicals from the chemical manufacturer. User is responsible for determining chemical compatibility with chemical feed pump.
- Secure chemicals and metering pumps, making them inaccessible to children and pets.
- Make sure the voltage on the chemical metering pump matches the voltage at the installation site.
- Do not cut plug or the ground lug off of the electrical cord – consult a licensed electrician for proper installation.
- Pump is **NOT** to be used to handle flammable liquids.

### 1.2 SAFETY OPERATING PROCEDURES

Each Electronic Metering Pump has been tested to meet prescribed specifications and safety standards.

Proper care in handling, installation and operation will help in ensuring a trouble free installation.

Please read all these cautionary notes prior to installation and start-up of your metering pump.

**Important:** Pump must be installed and used with supplied back pressure/injection valve. Failure to do so could result in excessive pump output.

- Handle the pump with care. Dropping or heavy impact causes not only external damage to the pump, but also to electrical parts inside.
- Install the pump in a place where the ambient temperature does not exceed 104°F (40°C). The pump is water resistant and dust proof by construction and can be use outdoors, however **do not operate the pump submerged**. To avoid high internal pump temperatures, do not operate in direct sunlight.

**CAUTION** Solenoid housing, head and pump housing may be hot to touch 160°F(70°C).

- Install the pump in a place convenient for its future maintenance and inspection, and then secure it to prevent vibration.
- Protective caps must be removed prior to installing tubing onto valve assemblies. Use tubing of specified size. Connect the tubing to the suction side securely to prevent the entrance of outside air. Make sure that there is no liquid leakage on the discharge side.
- Be careful to check that the voltage of the installation matches voltage indicated on the pump data label. Most pump models are equipped with a three-prong plug. Always be sure the pump is grounded. To disconnect, do not pull wire but grip the plug with fingers and pull out. Do not use the receptacle in common with heavy electrical equipment, which generates surge voltage. It can cause failure of the electronic circuit inside the pump.
- Tampering with electrical devices can be potentially hazardous. Always place chemicals and pump installation well out of the reach of children.
- Never repair or move the metering pump while operating. Always disconnect electrical power. **For safety, always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps.**
- An air bleed valve is available for most models with tubing connections. Air purges should be performed when the pump-chamber contains no fluid at the time of start-up. As a safety measure, connect the return tubing to the air bleed valve and bypass fluid back to storage tank or a suitable drain.
- For accurate volume output, the pump must be calibrated under typical operating conditions.

## 7.0 TROUBLESHOOTING cont'd.

PROBLEM	PROBABLE CAUSE	REMEDY
<b>LOSS OF CHEMICAL RESIDUAL</b>	<ol style="list-style-type: none"> <li>1. Pump setting too low.</li> <li>2. Scale at injection point.</li> <li>3. Solution container allowed to run dry</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust to higher setting (pump must be operating to adjust stroke length knob).  Clean injection parts with 8% muriatic acid or undiluted vinegar. (Also, see Maintenance Section).</li> <li>2. Refill the tank with solution and prime. (See Start-up and Operation Section).</li> </ol>
<b>TOO MUCH CHEMICAL</b>	<ol style="list-style-type: none"> <li>1. Pump setting too high.</li> <li>2. Chemical in solution tank too rich.</li> <li>3. Siphoning of chemical into well or main line.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lower pump setting (pump must be operating to adjust stroke length knob).</li> <li>2. Dilute chemical solution. NOTE: For chemical that reacts with water, it may be necessary to purchase a more dilute grade of chemical direct from chemical supplier.</li> <li>3. Test for suction or vacuum at the injection point. If suction exists, install an anti-siphon valve.</li> </ol>
<b>LEAKAGE AT TUBING CONNECTIONS</b>	<ol style="list-style-type: none"> <li>1. Worn tube ends.</li> <li>2. Chemical attack.</li> </ol>	<ol style="list-style-type: none"> <li>1. Cut off end of tubing (about 1 in/2.5 cm) and then reconnect as before.</li> <li>2. Consult your seller for alternate material.</li> </ol>
<b>LEAKAGE AT FITTING</b>	<ol style="list-style-type: none"> <li>1. Loose fittings.</li> <li>2. Broken or twisted gasket.</li> <li>3. Chemical attack.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten hand tight. Replace gasket if hand tightening does not stop leakage.</li> <li>2. Check gaskets and replace if broken or damaged.</li> <li>3. Consult your pump supplier for alternate material.</li> </ol>

## 7.0 TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
<b>FAILURE TO PUMP</b>	1. Leak in suction side of pump.	1. Examine suction tubing. If worn at the end, cut approximately one inch (2.5 cm) off and reconnect.
	2. Valve seats not sealing.	2. Clean valve seats if dirty or replace with alternate material if deterioration is noted.
	3. Low setting on pump.	3. When pumping against pressure, the dial should be set above 20% capacity for a reliable feed rate.
	4. Low suction level.	4. Solution must be above foot valve strainer.
	5. Diaphragm ruptured.	5. Replace diaphragm as shown in 6.0 "Maintenance Section". Check for pressure above rated maximum at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head.
	6. Pump head cracked or broken.	6. Replace pump head as shown in 6.0 "Maintenance Section". Make sure fittings are hand tight only. Using pliers and wrench can crack pump head. Also, chemical incompatibility can cause cracking and subsequent leakage.
	7. Pump head contains air or chlorine gas.	7. Bleed pump head, see 5.0 "Start-up and Operation".
	8. Breakdown or disconnection of wiring.	8. Connect wiring properly. Check fuse or circuit breaker.
	9. Voltage drop.	9. Take measures after investigation of cause.
	10. Malfunction of electronic control board.	10. Contact supplier.

- Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children and others. We cannot be responsible for the misuse of chemicals being fed by the pump. Always have the material safety data sheet (MSDS) available for any fluid being pumped.
- All pumps are pretested with water before shipment. Remove head and dry thoroughly if you are pumping a material that will react with water, (i.e. sulfuric acid, polymers). Valve seats, ball checks, gaskets, and diaphragm should also be dried. Before placing pump into service, extreme care should be taken to follow this procedure.
- Valve cartridges are stamped to indicate fluid flow direction. Always install so that markings read from top to bottom, with the arrow pointing in the direction of flow.
- When metering hazardous material **DO NOT** use plastic tubing, strictly use proper rigid pipe. Consult supplier for special adapters or valve assemblies.
- **Pump is NOT to be used to handle or meter flammable liquids or materials.**
- Standard white discharge tubing is not recommended for installations exposed to direct sunlight. Consult supplier for special black tubing.
- Factory will not be held responsible for improper installation of pump, or plumbing. All cautions are to be read thoroughly prior to hookup and plumbing. For all installations a professional plumber should be consulted. Always adhere to local plumbing codes and requirements.
- When using pump with pressurized systems, make sure the pressure of the system does not exceed the maximum pressure rating on the pump data label. Be sure to depressurize system prior to hook up or disconnecting a metering pump.
- Electronic power modules are equipped with automatic reset thermal overload devices and may reset unexpectedly.



## 2.0 UNPACKING THE PUMP

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages or damages should be reported immediately to the carrier and to the seller of the equipment.

The carton should contain:

- Metering Pump
- Clear Flexible Suction Tubing\*
- Stiff White Discharge Tubing\*
- Foot valve/Strainer Assembly
- Backpressure Injection Valve Assembly
- Manual
- Bleed Valve Assembly\*
- Strainer Weight\*

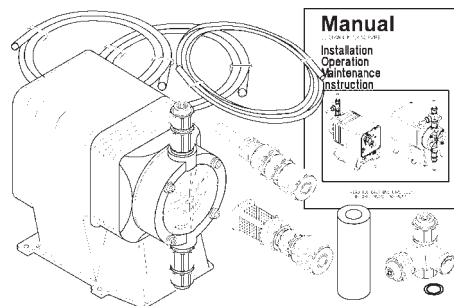


FIGURE 1

\*Items may or may not be included depending on model.

Make sure that all items have been removed from the shipping carton before it is discarded.

## 3.0 INTRODUCTION

These installation, operation and maintenance instructions cover your electronic metering pump. Refer to the pump data label to determine the actual model.

### 3.1 PRINCIPLE OF OPERATION

Diaphragm metering pumps are used to dispense chemicals or fluids. This is achieved by an electromagnetic drive mechanism (solenoid), which is connected to a diaphragm. When the solenoid is pulsed by the control circuit it displaces the diaphragm, which, through the use of check valves, moves the fluid out the discharge under pressure. When the solenoid is de-energized it returns the diaphragm and pulls more fluid into the pump head and the cycle repeats.

The pump stroke rate is controlled by an internal circuit and is changed by turning the rate knob. The mechanical stroke length is controlled by the stroke length knob. Some models do not allow stroke rate control and do not have the stroke rate knob.

### 3.2 MATERIALS OF CONSTRUCTION

The wetted materials (those parts that contact the solution being pumped) available for construction are FPP (glass filled polypropylene), PVC, SAN, Hypalon, Viton, PTFE or FTF, 316 Stainless Steel, PVDF, Ceramic and Alloy C. These materials are very resistant to most chemicals. However, there are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as the diaphragm, valve seats, or head.

## 6.3 DIAPHRAGM REPLACEMENT cont'd.

- Apply grease to areas of the diaphragm that contact the deflection plate.
- Slide the diaphragm deflection plate onto the back of the diaphragm stud, radius side towards the diaphragm. Next slide two shims onto the diaphragm threaded stud and screw the diaphragm into the EPM unit. Refer to Figure 14. Turn diaphragm clockwise until deflection plate and shims are tight against solenoid shaft and the diaphragm stops turning. If there is a gap between the adaptor and diaphragm, repeat the procedure removing one shim each time until the diaphragm just touches the adaptor or is slightly recessed.
- If not already done, adjust stroke length to 50%. Place the pump head onto the adaptor with valve flow arrows pointing up and install and tighten pump head screws. Tighten screws until pump head pulls up against adaptor.

**NOTE: Adjust stroke length only when pump is running!**

- Adjust stroke length back to 100% for easier priming and place pump back into service.

## 6.4 VALVE REPLACEMENT

- Flush pump to clean any chemical from pump head.
- Unplug pump, release system pressure, and disconnect tubing or piping.
- Unscrew valve cartridges and discard. Also remove o-rings down inside the pump head.
- Install new valve cartridges with stamped letters reading from top to bottom, and the arrow pointing in the direction of flow. Hand tighten only, do not use wrenches or pliers. This is especially important when the pump head is made of SAN material.
- Reconnect tubing or piping and reinstall the pump.
- Check for leaks around newly installed fittings.

- If the pump has been out of service for a month or longer, clear the pump head valve assemblies by pumping fresh water for approximately 30 minutes. If the pump does not operate normally after this “purging run”, replace cartridge valve assemblies.

## 6.2 DISASSEMBLY AND ASSEMBLY DIAPHRAGM REMOVAL

Flush pump head and valve assemblies out by running pump with water or other suitable neutralizing solution. Wash outside of pump if chemical has dripped on pump. Set stroke length knob of pump to 0% and unplug pump.

Depressurize the system and disconnect tubing or piping from the pump. Remove the four pump head screws and then remove the pump head assembly.

Remove the diaphragm by grasping it at the outer edge and turning it counter clockwise until it unscrews from the electronic power module (EPM). Don't lose the deflector plate or diaphragm shims which are behind the diaphragm, they are needed for re-assembly. Note shim quantity may be from 0 to 2.

Inspect diaphragm, if it is intended to be used again look for indications of the PTFE face being overstretched, (localized white areas) or the elastomer on the back of the diaphragm being worn. Excessive amounts of either condition require diaphragm replacement.

## 6.3 DIAPHRAGM REPLACEMENT

- When replacing the diaphragm, it is always a good idea to replace the valve cartridges and other worn parts. A kit is available from your supplier with all parts necessary to completely rebuild your pump's wet end. All your supplier needs to know is the “KOPkit No.” on your pump's data label to supply this kit.
- Set pump stroke length at 50% and unplug the pump.
- If you kept the shims from the original diaphragm or know the original quantity you can avoid the next step for shimming the diaphragm.

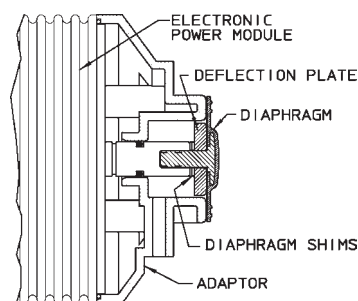


FIGURE 14

## 3.2 MATERIALS OF CONSTRUCTION cont'd.

Consult a Chemical Resistance Guide or Supplier for information on chemical compatibility.

Various manufacturers of plastics, elastomers and pumping equipment publish guidelines that aid in the selection of wetted materials for pumping commercially available chemicals and chemical compounds. Two factors must always be considered when using an elastomer or plastic part to pump chemicals. They are:

- The temperature of service: Higher temperatures increase the effect of chemicals on wetted materials. The increase varies with the material and the chemical being used. A material quite stable at room temperature might be affected at higher temperatures.
- Material choice: Materials with similar properties may differ greatly from one another in performance when exposed to certain chemicals.

## 4.0 INSTALLATION

The metering pump should be located in an area that allows convenient connections to both the chemical storage tank and the point of injection. The pump is water resistant and dust proof by construction and can be used outdoors, however, **do not operate submerged**. Avoid continuous temperatures in excess of 104°F (40°C). To do otherwise could result in damage to the pump.

### 4.1 MOUNTING

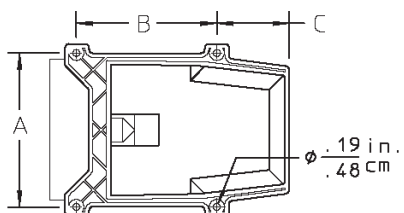
Typical mounting arrangements are shown in Figures 3, 4, and 5.

**Important:** Injection point must be higher than the top of the solution supply tank to prohibit gravity feeding, unless suitable backpressure is always present at the injection point. Installation of an antisiphon valve will prohibit gravity feeding.

- For wall or shelf mounting refer to Figure 3. Connect suction tubing to suction valve of chemical pump. Suction valve is the lower valve. Tubing should be long enough so that the foot valve/strainer assembly hangs about 1-2 inches (2-5 cm) above the bottom of chemical tank. To keep chemical from being contaminated, the tank should have a cover.

- Flooded suction mounting (installing the pump at the base of the chemical storage tank, Figure 4) is the most trouble free type of installation and is recommended for very low output requirements. Since the suction tubing is filled with chemical, priming is accomplished quickly and the chance of losing prime is reduced.

To mount pump, drill four holes of .25" (6 mm) diameter in the shelf as shown in the dimension drawing (Figure 2). Attach pump securely using four #10 (M5) bolts and nuts.



**MOUNTING HOLE DIMENSIONS**

HOUSING SIZE	DIMENSIONS (in./cm.)		
	A	B	C
HSG.#1	4.50/11.4	3.00/7.6	1.75/4.4
HSG.#2	4.81/12.2	4.38/11.1	2.19/5.6
HSG.#3	5.56/14.1	4.38/11.1	2.19/5.6

FIGURE 2

- The pump can be mounted on top of a solution tank as shown in Figure 5. Install chemical pump on the cover. Insert suction tubing through the center hole and cut tubing so foot valve/strainer hangs about 1 or 2 inches (2-5 cm) above the bottom of the tank. Mount the chemical pump rigidly by drilling four .25" (6 mm) holes and using four #10 (M5) screws and nuts.
- USE AN ANTI-SIPHON VALVE IN THE DISCHARGE LINE whenever the fluid pressure in the discharge line is below atmospheric pressure. This can occur if the injection point is on the suction side of a water pump or against a "negative" head such as when feeding down into a well.

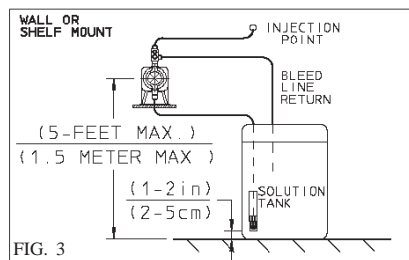


FIG. 3

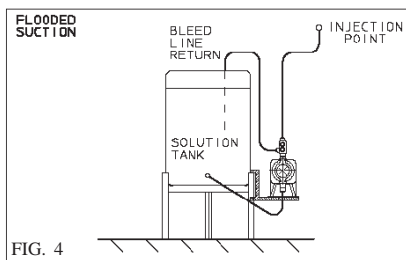


FIG. 4

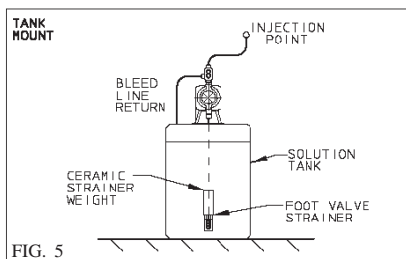


FIG. 5

### 5.5.3 4-20mA DC INPUT FUNCTION cont'd.

- The signal cord polarity is:  
Black = Common  
White = Positive  
Wrong polarity can result in excess flow.
- Signal input impedance is 124 ohms.
- Remove cap from pump socket labeled 4-20 mA, use polarized cord supplied with pump to connect control circuit to pump. Plug cord into pump socket labeled 4-20 mA.

## 6.0 MAINTENANCE



**Before performing any maintenance or repairs on chemical metering pumps, be sure to disconnect all electrical connections, insure that all pressure valves are shut off and pressure in the pump and lines has been bled off.**

**Always wear protective clothing, gloves and safety glasses when performing any maintenance or repairs on chemical metering pumps.**

### 6.1 ROUTINE MAINTENANCE

- Routinely check the physical operating condition of the pump. Look for the presence of any abnormal noise, excessive vibration, low flow and pressure output or high temperatures [when running constantly at maximum stroke rate, the pump housing temperature can be up to 160°F (70°C)].
- For optimum performance, cartridge valves should be changed every 6-12 months. Depending on the application, more frequent changes may be required. Actual operating experience is the best guide in this situation.
- Repeated short-term deterioration of valve seats and balls usually indicates a need to review the suitability of wetted materials selected for the application. Contact the supplier for guidance.
- Check for leaks around fitting or as a result of deteriorating tubing e.g. when standard white translucent discharge tubing is exposed to direct sunlight. Take appropriate action to correct leak by tightening fittings or replacing components.
- Keep the pump free of dirt and debris as this provides insulation and can lead to excessive pump temperatures.

- When the “ON” signal pulse is input, the pump operates one stroke and the fluid is discharged. In addition, the pump can be operated continuously at a rate of up to 125 strokes/min. by repeated input of “ON” and “OFF” signals.
- After receiving an input signal, the pump generates the necessary power pulse to actuate the solenoid. The external signal input is debounced by the pump circuit. The pump will not stroke in response to a spurious or erratic input signal that follows at a rate greater than 125 spm. If the external signal rate exceeds 125 spm, the pump will stroke at half the external signal rate to prevent overdosing and to protect the pump from overheating.
- The input signal must be in the form of closure of a mechanical relay, other mechanical switching device, or of a solid-state switching device. Voltage signals are prohibited. The switching resistance of either mechanical or solid-state devices must be 100 ohms or below when ON and 1 megohm or above when OFF. If any type of solid-state device is employed, it must be installed with proper polarity, if required for the device; and leakage current must not exceed 200 microamperes to prevent false triggering in the OFF state.
- Cycle rate of the input signal should not exceed 125 times per minute.
- Typical wiring is shown at right for use with switch closure flowmeters. (Figure 12)
- 10 millisecond contact time required for each “ON” input signal.

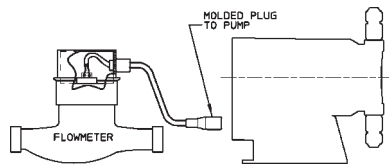


FIGURE 12

### 5.5.3 4-20mA DC INPUT FUNCTION (E Plus only)

The pump’s stroke rate can also be controlled by a 4-20 mA DC signal to the terminal marked [4-20 mA].

- For the 4-20 mA input to have any effect on the pump output rate, the AUTO/OFF/MANUAL switch must be in the AUTO position.
- The 4-20 mA input signal affects the pump’s outputs as per the graph below:

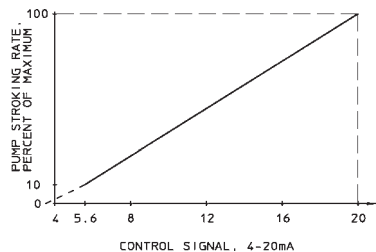


FIGURE 13

## 4.2 PIPING

- Use provided tubing of specified size for connection. Connect tubing securely to prevent leakage of chemical and the entrance of air. Since plastic nuts are used for fittings, they should not be tightened excessively (i.e. hand tighten only). NPT suction and discharge valves must **NOT** be over tightened. Hold fitting in place while adding piping and fittings. NPT suction and discharge valves should only be tightened 25 to 35 in. lbs. (4.5-6.3 kg/cm).
- If the air bleed valve assembly is being used, a return line (tubing) should be securely connected and routed back to the storage tank. **To avoid possible injury from chemicals do not attempt to prime using a bleed valve without installing a return line.**
- When pump is shelf mounted or top mounted on tank, suction tubing should be kept as short as possible.
- To maintain metering performance, a backpressure/injection valve is provided. The spring in the standard injection valve typically adds 17 - 20 PSI (1.17 - 1.38 BAR) to the line pressure, with the exception of the H8 pump, which adds 8 - 10 PSI (.55 - .69 BAR). The injection valve must be installed in the discharge line. Best practice is to install the injection valve at the point of chemical injection.
- If the discharge tubing is going to be exposed to direct sunlight, black tubing should be used instead of the standard white translucent tubing supplied with each pump. To obtain, contact supplier.
- To prevent clogging or check valve malfunction always install a strainer assembly to the end of the suction tubing (Figure 5). This foot valve/strainer assembly should always be installed 1 to 2 inches (2-5 cm) above the bottom of the chemical tank. This will help prevent clogging the strainer with any solids that may settle on the tank bottom. The chemical tank and foot valve/strainer should be cleaned regularly, to ensure continuous trouble free operation. If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (e.g. calcium hydroxide), a mixer should be used in the chemical tank. These are readily available in many motor configurations and mounting. To obtain, contact supplier.
- A flooded suction (tank liquid level always at a higher elevation than the pump) is recommended when pumping solutions such as sodium hypochlorite (NaOCl), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), etc., which are likely to produce air bubbles. Maintaining a low liquid temperature will also help eliminate this problem.
- Pipe corrosion can result if dilution at the injection point does not occur rapidly. This problem is easily prevented by observing this simple rule: install injection fitting so that the end is in the center of the flow stream of the line being treated. Trim injector tip as required. See Figure 6. Note: Extended injection assemblies are available for large water lines. Consult your supplier for more information.

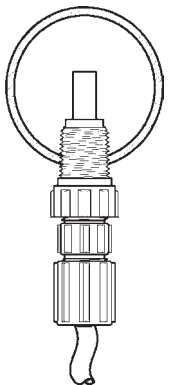



FIGURE 6

### 4.3 WIRING

-  **WARNING**—Risk of electrical shock. This pump is supplied with a three-prong grounding type power plug. To reduce risk of electric shock, connect only to a properly grounded, grounding type receptacle.
- The metering pump should be wired to an electrical source, which conforms to those on the pump data label. Applying higher voltage than the pump is rated for will damage the internal circuit.
- In the electronic circuit of the control unit, measures for surge voltage are made by means of surge absorbing elements and high voltage semiconductors. Nevertheless, excessive surge voltage may cause failure in some areas. Therefore, the receptacle should not be used in common with heavy electrical equipment, which generates high voltage. If this is unavoidable however, measures should be taken by (a) the installation of a surge-absorbing element (varistor of min. surge resistance 2000A) to the power supply connection of the pump, or (b) the installation of a noise suppression transformer.

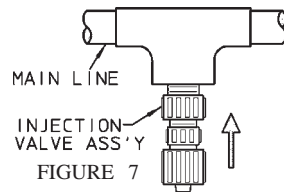


- Signal input to the external pulse signal input terminals ([EXTERNAL], [STOP]) must be a no-voltage signal from relay-contacts etc. and the input of other signals is prohibited. (In the case of relay contacts, 100 ohms or below when ON and 1-meg ohms or above when OFF). The pulse duration of the input signal must be 10 milliseconds or over and the frequency of the input signal must not exceed 125 times per minute. Signal cord is provided with the pump.

### 4.4 WELL PUMP SYSTEM INSTALLATION

Ensure that the metering pump voltage matches the voltage of the well pump. Typical well pump electrical circuits are shown in Figure 8. All electric wiring should be installed in accordance to local codes by a licensed electrician.

Install the backpressure/injection (Figure 7) on the discharge side of the metering pump into a tee which is installed into the water line going to the pressure tank.





Pumps carrying the or "ETL Sanitation" (tested to NSF Standard-50) marks are listed for swimming pools, spas and hot tubs, and when proper materials are selected, are capable of handling but not limited to the following chemical solutions:


12% ALUMINUM SULPHATE,	5% SODIUM CARBONATE,
2% CALCIUM HYPOCHLORITE,	10% SODIUM HYDROXIDE,
12.5% SODIUM HYPOCHLORITE,	10% HYDROCHLORIC ACID

### 5.5 OPERATION BY EXTERNAL INPUT SIGNALS (Options):

The pump can be controlled by three types of input signals. All are fully isolated from AC input and from earth ground. The input socket connections are located at the bottom of the control panel face and the signal cords are provided with the pump. Remove rubber plugs to access plug sockets.

#### 5.5.1 STOP FUNCTION (E Plus, A Plus, C Plus & C only)


Operation of the pump can be stopped by an external signal input. When the external signal is input to the terminal marked  which is provided at the bottom of the control panel, the  lamp (red) lights up and operation of the pump is stopped. The stop function overrides both manual settings and external input.


 **CAUTION** Operation of more than one pump from the same contact closure will damage the pump circuits. When such operation is required, the pump circuits must be electrically isolated from one another by means of a multicontact control relay or similar means.

- The input signal must be in the form of closure of a mechanical relay or other mechanical switching device, or solid-state relay or other solid-state switching device. Voltage signals are prohibited. The switching resistance of either mechanical or solid-state devices must be 100 ohms or below when ON and 1 megohm or above when OFF. If any type of solid-state device is employed, it must be installed with the proper polarity, if required for the device; and leakage current must not exceed 200 microamperes to prevent false triggering in the OFF state.

The stop function is commonly used in conjunction with a tank float switch. The float switch contacts are normally open but when the tank level falls past a certain point the contacts close and the pump stops.

#### 5.5.2 EXTERNAL PACING FUNCTION (E Plus, A Plus, C Plus & C only)

The pump's stroke rate can be controlled by an external signal input. When the input signal line is connected and the EXTERNAL /OFF /MANUAL switch is in the external position and a contact signal is input to the terminal marked , the pump makes one discharge stroke.

 **CAUTION** Operation of more than one pump from the same contact closure will damage the pump circuits. When such operation is required, the pump circuits must be electrically isolated from one another by means of a multicontact control relay or similar means.

### 5.3.3 Controlling Procedure cont'd.

<u>Example</u>	Selected Model	=	LPD4
	Set Stroke Length	=	100%
	Set Stroke Rate	=	100%
	Output Capacity (Rated Pressure)	=	21 gallons per day (GPD)*
	Desired Flow	=	15 GPD
	Adjust Stroke Rate to 80%		
	Output Capacity	=	0.80 x 21 = 16.8 GPD*
	Stroke Length Setting	=	$\frac{15}{21} \times 100 = 90\%$ approximate 16.8

Thus to obtain the desired flow, stroke length is set at 90% and stroke rate is set at 80% i.e. output capacity = 0.90 x 0.80 x 21 = 15.12 GPD\*

**\*IMPORTANT!**

**Check these values by measurement. Output capacity is higher when feeding against less than rated pressure**

### 5.4 CONTROL PANEL SYMBOLS

The pumps come with universally accepted symbols, the following is provided for your convenience.

	= MANUAL CONTROL (FOR 'LB' & 'LD' MODEL PUMPS ONLY)
	= AUTO CONTROL (EXTERNAL INPUT)
	= STROKE RATE PERCENT (FOR MANUAL OPERATION ONLY)
	= PERCENT STROKE LENGTH
	= STAND-BY (PUMP WILL NOT OPERATE)
	= LOCK
	= UNLOCK
	= STOP
	= STROKE
	= 4-MILLIAMP to 20-MILLIAMP CONTROL CIRCUIT INPUT.
	= HOLD TO RUN (OPERATES PUMP AT 125-SPM (STROKES PER MINUTE)) (FOR 'LC' MODEL PUMPS ONLY)

	TAGS:		STOP/EXTERNAL SIGNAL SOCKET ID. LABEL

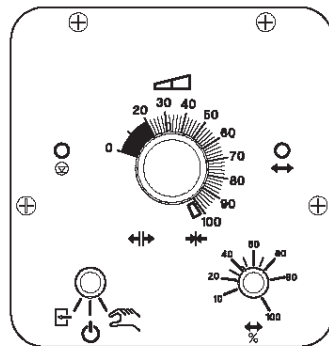


FIGURE 11

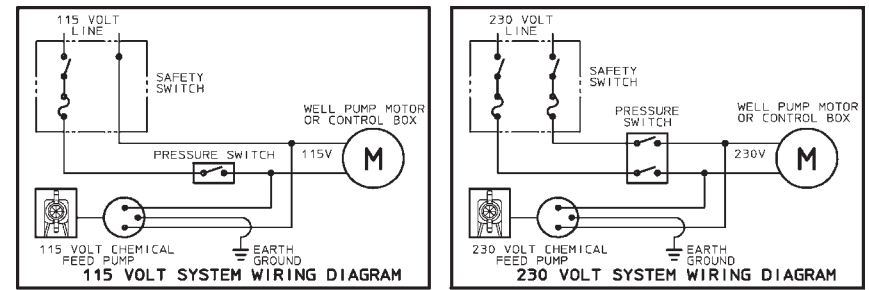


FIGURE 8

## 5.0 START UP AND OPERATION

### 5.1 POWER

All metering pumps are available in 115 and 230 volts at 50/60 Hertz, single phase. In addition, certain models are available in 12 volt DC. Prior to start-up always check to insure that the pump voltage/frequency/phase matches that of the power supply.

**CAUTION** If pump is fitted with a PVC pump head (7<sup>th</sup> position of model number is "V" or "W". Note: PVC is gray, not black), uniformly hand tighten the four head screws before use, 18-22 in. lbs. (3.2-3.9 kg/cm). Periodically tighten after installation.

### 5.2 PRIMING

**CAUTION** When working on or around a chemical metering pump installation, protective clothing and gloves and safety glasses should be worn at all times.

All pumps are tested with water. If the chemical to be pumped reacts when mixed with water (e.g. sulfuric acid, polymer) the pump head should be removed and dried thoroughly along with the diaphragm and valve seats.

- Turn on the power to the pump. The green LED (not available on all models) will light up and flash off each time the pump strokes.
- Adjust the stroke rate knob to the 100% setting mark (for more information see Section 5.3, Capacity Control).
- Adjust the stroke length knob to the 100% setting mark if applicable (for more information see Section 5.3, Capacity Controls).
- If the discharge line is connected directly to a pressurized system it should be temporarily bypassed during priming of the pump. A bleed valve will simplify this operation by allowing easy bypass of the discharge fluid. Air must be purged from the pumphead before the pump will operate against pressure. (See Figure 9)

**Air Bleed Operation:**

- While pump is running, turn adjustment knob counterclockwise.
- Run with valve open until a solid stream of fluid comes out of the bypass tubing with no air bubbles.
- Close air bleed valve by turning adjustment screw clockwise.

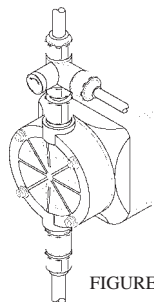


FIGURE 9

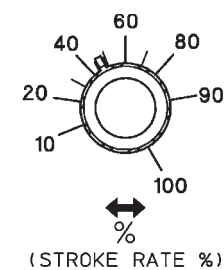
- Chemical should reach the pump head after a few minutes of operation. If not, remove the discharge fitting and moisten the discharge valve area (ball check and valve seats) with a few drops of **chemical being fed to the metering pump**. For safety, always use protective clothing and gloves, wear safety glasses and use a proper container to hold the chemical.
- If the pump continues not to prime, refer to Section 7.0, Troubleshooting, of these instructions.
- Once the pump has been primed and is pumping the chemical through the head, turn off the power, reconnect the discharge tubing (if it had been removed) and immediately clean any spilled chemical that is on the pump housing or head.
- Turn the power on once more and adjust the pump flow to the desired rate (see Section 5.3.3, Controlling Procedure).
- Always check the calibration of the pump after start-up. It's best to calibrate the pump under your typical use conditions.

## 5.3 CAPACITY CONTROL

Capacity can be controlled by means of the stroke length adjusting knob and/or stroke rate adjusting knob (except model C pumps). Control knobs provide coarse adjustment; use a calibration column for accurate calibration. Contact your pump supplier for proper calibration equipment.

### 5.3.1 Stroke Frequency Adjustment (E, E-DC, E Plus, A Plus & C Plus only)

- Stroke frequency can be controlled from 10 to 100% (12 to 125 strokes per minute) by means of the electronic circuit.
- Stroke frequency can be set by means of the stroke rate adjusting knob even while the pump is in operation. (See Figure 10)



(STROKE RATE %)

### 5.3.2 Stroke Length Adjustment

- Stroke length can be controlled within 0 to 100% of the diaphragm displacement. It should be controlled within 20 to 100% for practical use.
- Stroke length can be set by means of the stroke length adjusting knob while the pump is in operation. **Do not turn the knob while the pump is stopped.**

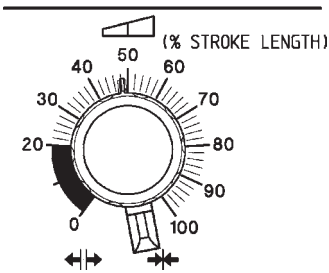


FIGURE 10

### 5.3.3 Controlling Procedure

Proper set points for stroke length and stroke frequency should be determined after consideration of the pump and characteristics of the fluid. The following procedure is recommended from the viewpoint of pump performance. **Note: The closer the stroke length is to 100%, the better the pump performance will be.**

- Set the stroke length to 100% then adjust the stroke frequency for coarse capacity control.
- Measure the capacity.
- When the measured capacity is less than the required value, increase the stroke frequency and measure the capacity again.
- Then, adjust the stroke length for fine capacity control.
- Finally, measure the capacity and make sure that the required value is obtained.