



MAT 15M-120M MECHANICAL TIMER

3/4"–1" AUTOMATIC WATER CONDITIONERS

INSTALLATION, OPERATION, AND
MAINTENANCE MANUAL

FILL IN FOR FUTURE REFERENCE

MODEL NO:
SERIAL NO:
DATE INSTALLED:
DEALER:

Marlo Incorporated
2227 South Street
P.O. Box 044170
Racine, WI 53404-7003
Ph. (262) 681-1300
Fax (262) 681-1318
www.Marlo-Inc.com

TABLE OF CONTENTS

Product Warranty and Water Softener Guarantee 1
 General Arrangement Drawing..... 2
 Specification Notes 3
 Specification Table 4

INSTALLATION

Softener Installation Instructions 5
 Softener Layout Requirements 5
 Softener Tank Loading 6
 Mounting Control Valve Assembly..... 7
 Mounting Water Meter Assembly 7
 Installation of Connection Piping..... 8

OPERATION

Start-Up Procedure 9
 Calculation of Softeners Capacity 11
 How to Set the Water Meter Gallonage..... 12
 How to Manually Regenerate Your Water Conditioner at Any Time 12
 How to Set the Regeneration Program Timer 13
 Water Softener General Operation..... 14

MAINTENANCE

Flow Diagram 15
 Wiring Diagram 19
 Timer Assembly Parts Breakdown 20
 Powerhead Assembly Parts Breakdown 22
 Control Valve Assembly Parts Breakdown 24
 Service Assemblies Parts Breakdown..... 26
 Second Tank Adapter Assembly Parts Breakdown 27
 Brine System..... 28
 1" Meter Assembly Parts Breakdown 30
 3/4" Meter Assembly Parts Breakdown 31
 Troubleshooting Tips..... 32

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 their 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.

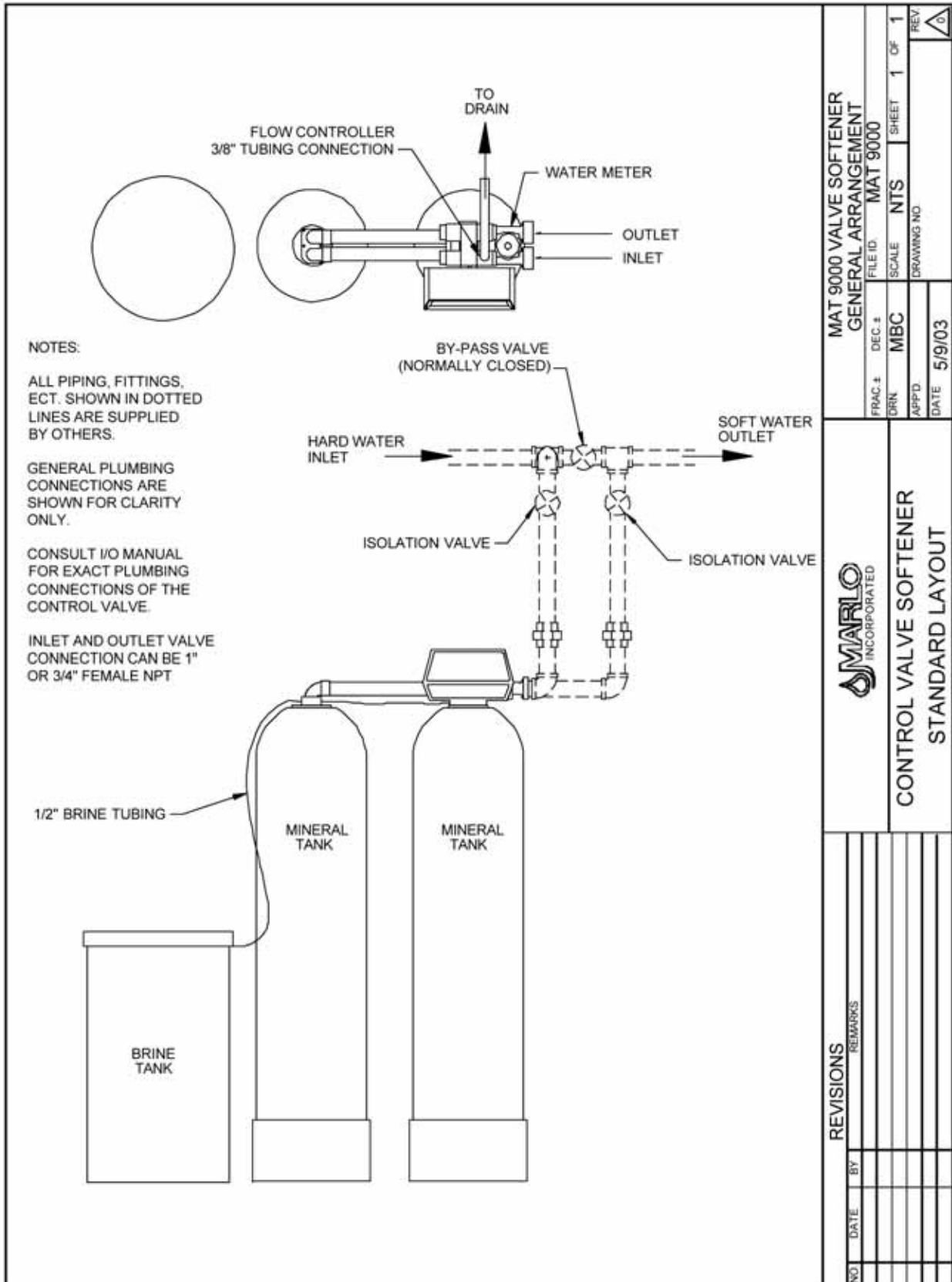
Labor charges, changebacks or handling charges are excluded from Marlo Inc.'s warranty provisions.

WATER SOFTENER GUARANTEE

Under normal operating conditions:

1. The softener effluent shall be zero soft as determined by a soap test.
2. The loss of softening resin through attrition during the first three (3) years shall not exceed 3% per year.
3. The softening resin shall not be washed out of the system during backwash.
4. 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.

GENERAL ARRANGEMENT DRAWING



SPECIFICATION NOTES

Maximum salting is 15 pounds of salt per cubic foot of resin. This setting gives the longest time between regenerations and the highest capacity. It has an efficiency of 2,000 grains of hardness removed per pound of salt. The regeneration timer is setup for maximum salting at the factory.

Minimum salting is 6 pounds of salt per cubic foot of resin. It has an efficiency of 3,300 grains of hardness removed per pound of salt.

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

On peak flow rates pressure loss does not exceed 25 psig.

Minimum operating pressure is 25 psi.

Maximum operating pressure is 120 psi.

Standard units are designed to soften unheated water within the range of 35-100°F.

Power requirements are 120 Volt, 60 Hertz, Single Phase, 2 amps non-interrupted.

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

Salt specifications are pelletized or solar salt, 99% pure, containing less than 1% insolubles.

The Pinwheel Setting time intervals are factory set and user adjustable.

The 1" water meter has a capacity range of 1,550 – 26,350 gallons and a flow range of 0.7 – 40 GPM with accuracy $\pm 5\%$.

The $\frac{3}{4}$ " water meter has a capacity range of 625 – 10,625 gallons and a flow range of 0.25 – 15 GPM with accuracy $\pm 5\%$.

SPECIFICATION TABLE

MODEL	MAT	15	22	30	45	60	60	90	120	
Valve Size	inches	3/4	3/4	3/4	3/4	3/4	1	1	1	
Capacity (Kgrains)	Maximum	15	22	30	45	60	60	90	120	
	Minimum	10	15	20	30	40	40	60	80	
FLOW RATE (GPM)	Service	Continuous	12	13	14	13	14	16	17	18
		Peak	16	17	19	18	19	1	22	23
	Backwash & Fast Flush	1.2	1.6	2.0	2.4	3.5	3.5	5.0	6.0	
	Brine Draw & Rinse	0.31	.045	.045	1.0	1.0	1.0	1.0	1.2	
	Brine Tank Refill	0.25	0.25	0.50	1.0	1.0	1.0	1.0	1.0	
TIMER SETTINGS	Backwash	Minutes	10	10	10	10	10	10	10	
	Brine Draw & Rinse	Minutes	60	60	60	60	60	60	60	
	Fast Flush	Minutes	10	10	10	10	10	10	10	
	Brine Tank Refill	Minutes	10	16	10	8	10	10	16	20
SOFTENER TANK	Size	Dia x Height Inches	7x44	8x44	9x40	10x54	12x52	12x52	14x65	16x65
	Gravel Subfill	Pounds	0	0	0	0	0	0	30	35
	Resin	Cubic Feet	1/2	3/4	1	1 1/2	2	2	3	4
	Freeboard	Inches	17	15	8	17	16	16	21	21
BRINE SYSTEM	Tank Size	Dia x Height Inches	18x33	18x33	18x33	18x40	18x40	18x40	18x40	24x40
	Injector	Code	0	1	1	3	3	3	3	4
		Color	RED	WHT	WHT	YEL	YEL	YEL	YEL	GRN
	Maximum Salt Storage	Pounds	290	290	290	320	320	320	270	550
	Salt Dosage	Maximum	7.5	11.3	15	22.5	30	30	45	60
		Minimum	3	4.5	6	9	12	12	18	24
	Refill Time	Maximum	10	16	10	8	10	10	16	20
		Minimum	4	4	4	4	4	4	6	8
Regeneration per Salt Refill	Maximum	40	25	20	15	10	10	6	9	
	Minimum	100	64	50	38	26	26	15	23	
Regeneration Waste Volume	Gallons	40	52	64	116	126	126	156	188	

INSTALLATION INSTRUCTIONS

1. Minimum operating pressure is 25 psi.
If pressure less than 25 psi is 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 pressure greater than 120 psi is encountered, a pressure regulator must be installed.
3. Power requirements are shown on a voltage sticker on the motor inside cover of the control valve. You can also tell by wire color on the motor: Black wires are 115 volt. Yellow wires are 220 volt. Blue wires are 24 volt
4. Standard units are designed to soften 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 softener 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 prior to loading media.

LAYOUT REQUIREMENTS

1. Select a location that is accessible and near a floor drain that has adequate carrying capacity to handle the softener regeneration flow. See specification table for the flow rate. Allow a minimum of 24" above the tank for loading media.
2. Erect each the softener tanks on a concrete or other firm foundation and level.

Note: If the system is skid mounted, it will be prepiped and preloaded at the factory. Skip the following instructions and go to the section "Installation of Connection Piping".

3. Position the brine tank according to the illustration and supplementary brine tank information.
Keep the brine tank as close as possible to the softener tanks.

Note: The distance between the softener and brine tanks will affect the brine injector performance, as the distance increases the injector performance decreases. This may cause an inadequate regeneration. Maximum recommended distance is 5 ft.

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

INSTALLATION INSTRUCTIONS

Note: If the system is skid mounted, it will be prepiped and preloaded at the factory. Skip the following instructions and go to the section of “Installation of connection piping”.

1. On Models MAT-15, 30, 45, and 60 the softening media has been pre-loaded at the factory. Skip this section and go to “Mounting Control Valve Assembly”.
2. Fill a 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 the second softener tank.

INSTALLATION INSTRUCTIONS

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 oring as hard water leakage could result.
8. Attach the second tank adapter assembly to the control valve.

MOUNTING WATER METER ASSEMBLY

1. Locate the electromechanical 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.
2. Attach the meter to the control valve’s outlet water connection.
3. Interconnect meter cable between the control valve timer and water meter dome.

INSTALLATION INSTRUCTIONS

INSTALLATION OF INTERCONNECTING PIPES

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 (not provided).
- If distance of drain line is over 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.

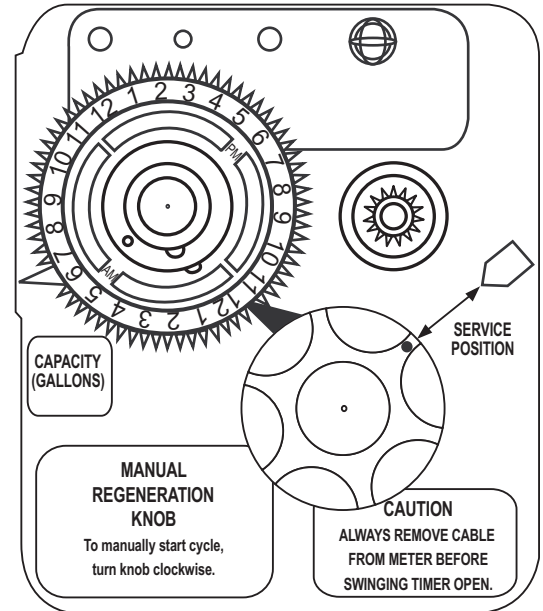
1. Install piping as shown on installation diagram. It is recommended that unions be installed before the inlet and outlet valves to facilitate service of unit. Be sure piping is free of thread chips and other foreign matter. The connecting piping should be the same size or larger than the service inlet and outlet of the control valve.
2. Verify that the flow arrow stamped on the drain 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. Do not install a valve on the drain line.
3. Interconnect the brine line tubing between the control valve and the brine tank. Verify that the brine line tubing is not kinked or restricted
4. Run flexible tubing (not provided) from the brine tank's over flow fitting to an appropriate, non-elevated, open drain.

START-UP

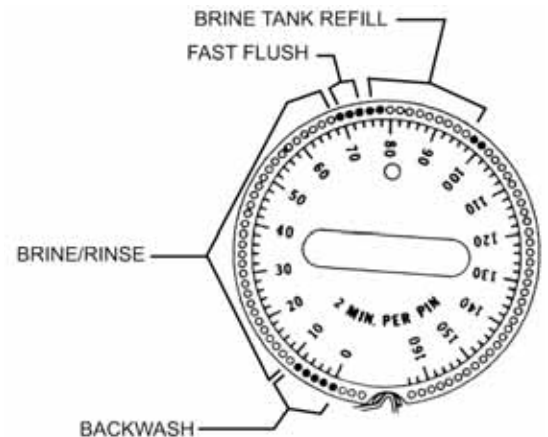
1. Again, make sure all plumbing is complete and tight including drain line and brine line. Make sure all electrical connections are complete per wiring diagrams provided.
2. Using a bucket or hose, fill brine tank with water to 2" above salt platform. Do not add salt at this time.
3. Make sure inlet and outlet isolation valves are closed. Align the Service Position Indicator with the Time of Day pointer (see Fig 2). Turn on power to the system.

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

4. Remove the black plastic cover from the control valve. Pull out the meter cable from the meter dome. The regeneration timer is secured to the backplate of the control valve. The timer is hinged on the right side. Grab the upper left corner of the timer and pull towards you. The timer will swing out to the right. The backside of the timer has a program wheel with holes and pins in it. Each hole or pin represents two (2) minutes. The holes and pins control the regeneration cycle times as follows



- Step 1 (Backwash) First group of pins
- Step 2 (Brine Draw/ Slow Rinse) First group of holes
- Step 3 (Fast Rinse) Second group of pins
- Step 4 (Brine Tank Refill) Second group of holes
- Return to Service Third group of pins



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.

5. Locate the manual regeneration knob on the front side of the timer. Slightly turn the knob clockwise. The softener control valve will advance to Backwash position. Be patient this will take several minutes.

START-UP continued

6. Remove electrical power from unit, and then slowly open inlet water valve approximately half open. Water will begin to fill through bottom distributor into tank. When tank is full, water will begin to flow out of drain line. Slowly open inlet valve until full open. Allow water to flow from drain line for approximately 15 minutes.

Warning: Monitor this drain water flow carefully. There is a problem if you see softener resin in the drain water. Turn off inlet water immediately and then consult factory.

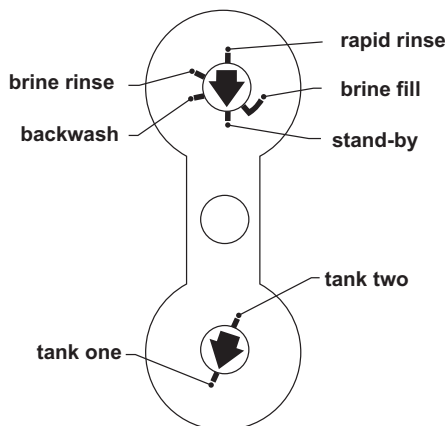
7. Restore electrical power to unit. Advance the control valve to Brine Draw / Slow Rinse position, using the same method as step 5. Make sure unit draws water from brine tank. There should also be reduced flow at the drain line.

8. Advance the control valve to the Fast Rinse position. Remove electrical power to the unit. Let water run to drain position for approximately 5 minutes or until water runs clear.

9. Restore electrical power to unit. Advance the control valve to Brine Refill position. Water should begin to refill brine tank. Allow the brine tank to refill until water in salt tank is again 2" above the salt platform. There should be no flow to drain in this valve position.

10. Advance control valve to Service position. Brine tank refill should stop. Open outlet valve and run water at the nearest cold water faucet to the water softener system for approximately 5 minutes.

11. Repeat instruction steps 1-10 for each softener tank.



12. Determine the gallons of soft water your softener can produce reference page 11.

13. Set the gallonage determined in step 12, reference page 12.

14. Consult the specification table, and then add salt to the brine tank. Use pelletized or solid salt, 99.0 – 99.8% pure salt containing less than 0.5% insoluble.

15. Use the test kit provided to check water for softness. Check the water hardness daily the first week in order to establish how often the softener should be regenerated.

HOW TO CALCULATE SOFTENERS CAPACITY

“Batch size” is the term used for the amount of water passing through and being softened by the water softener between regenerations. This is a simple calculation provided two pieces of information are known:

- Size of the water softener in grains (gr.) (i.e. MAT-60 has 60,000 grains capacity per tank).
- Hardness of the raw water being treated by the water softener.

BATCH SIZE EQUATION

Grain capacity of softener divided by the grains of hardness equals batch size.

SAMPLE CALCULATION

Assume: unit is a MAT-60

Assume: the hardness of the water was measured to be 20 grains

Using our equation take $60,000 / 20 = 3,000$ gallons.

10% reserve capacity = 300 gallons.

$3,000$ gallons – 300 gallons = 2,700 gallons (batch size)

For immediate regeneration type meter control the meter setting would be at 3,000 gallons. Commonly this value is adjusted to 90 percent of the actual value (in this example 2,700 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 the 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.

HOW TO SET THE WATER METER GALLONAGE

Set the gallons required by lifting the gallon dial and rotating it so that the number of gallons required is aligned with the white dot on the program wheel gear. Release the gallon dial and check for firm engagement with the gear.

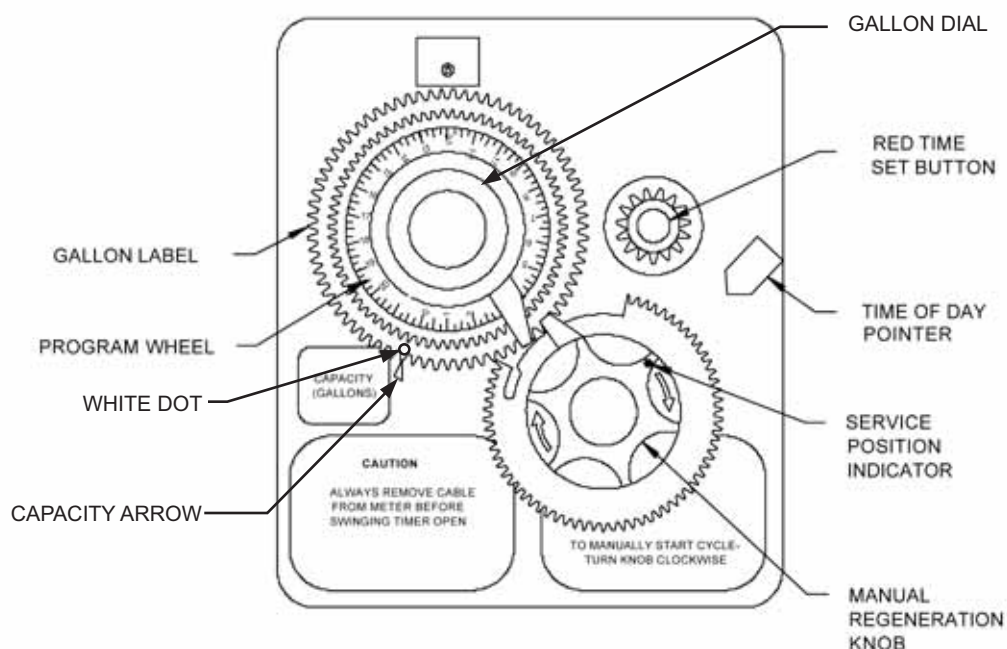
Note: To set meter capacity at the initial start-up, either:

- Rotate the manual regeneration knob one full revolution.
- Rotate the program wheel manually clockwise and align the white dot with the capacity arrow.

HOW TO MANUALLY REGENERATE YOUR WATER CONDITIONER AT ANY TIME

Turn the manual regeneration knob clockwise.

This slight movement of the manual regeneration knob engages the program wheel and starts the regeneration program. The manual regeneration knob will make one revolution in approximately three hours and stop in the position shown in the drawing. Even though it takes three hours for this center knob to complete one revolution, the regeneration cycle of your unit might be set only half of this time. In any event, conditioned water may be drawn after rinse water stops flowing from the water conditioner drain line.



HOW TO SET THE REGENERATION PROGRAM TIMER

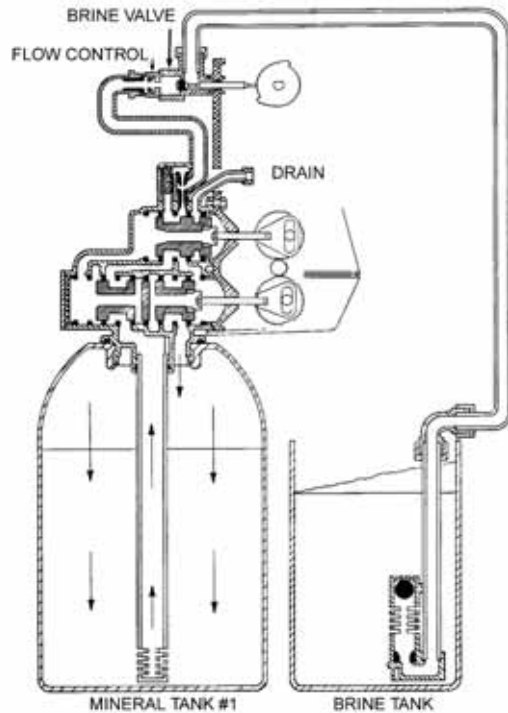
The regeneration program on your water softener has been factory set. However, portions of the program may be lengthened or shortened in time to suit local conditions.

REGENERATION STEPS

- **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 Draw/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.
- **Fast 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 salt to achieve maximum softener capacity. The published minimum salt can be programmed to reduce salt consumption by 50% and reduced softening capacity by 30%.
- **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 position.

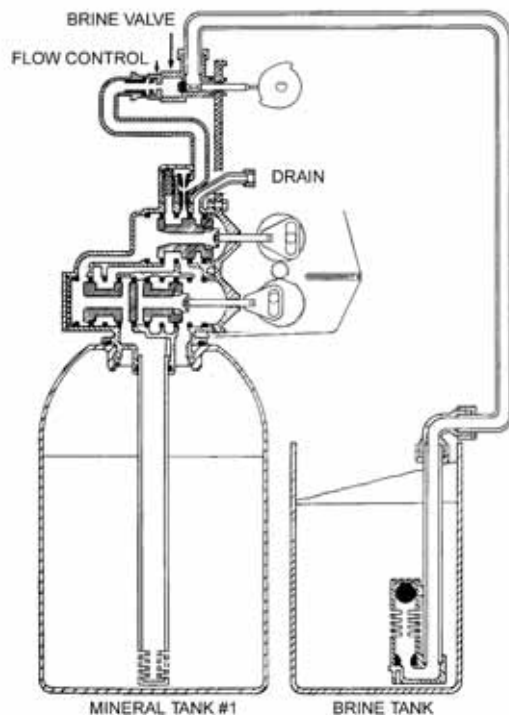
Remove the black plastic cover from the control valve. Pull out the meter cable from the meter dome. The regeneration timer is secured to the backplate of the control valve. The timer is hinged on the right side. Grab the upper left corner of the timer and pull towards you. The timer will swing out to the right. The backside of the timer has a program wheel with holes and pins in it.

MAT FLOW DIAGRAMS



1 - SERVICE POSITION

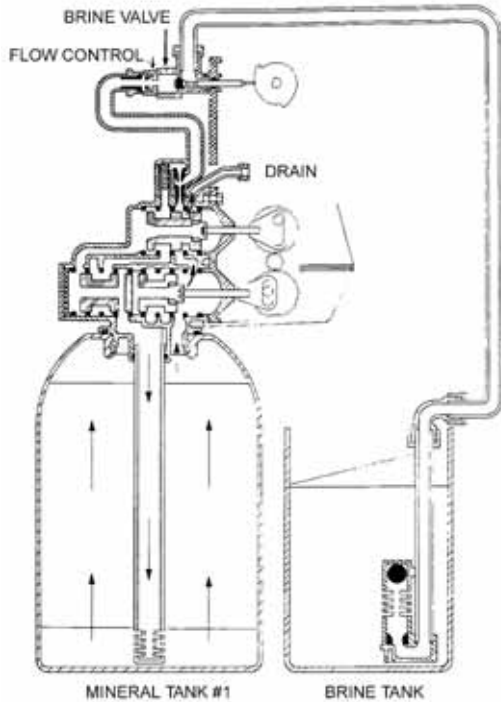
Hard water enters the unit at the valve inlet, flows around the lower piston, and down through the mineral in the first tank. Conditioned water enters the center tube through the bottom distributor, flows up through the center tube, around the lower piston, through the meter, and out the valve outlet. The second mineral tank is regenerated and on standby.



2 - TANKS SWITCHING
(the meter has initiated a regeneration)

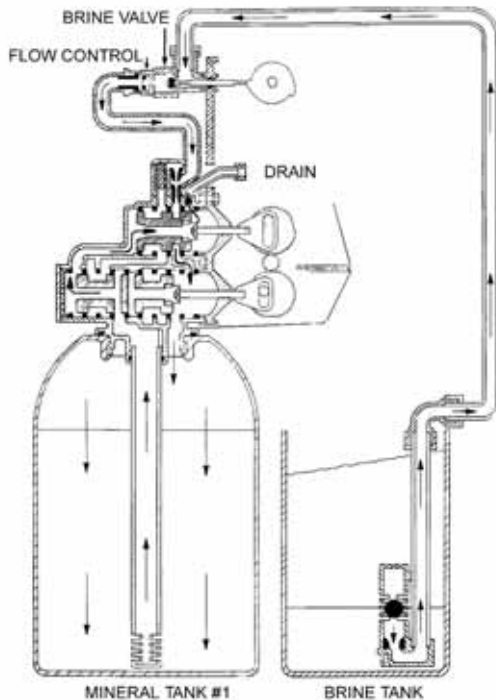
Hard water enters the unit at the valve inlet, flows around the lower piston, through the pipe leading to the second mineral tank, and down through the mineral in the second tank. Conditioned water enters the center tube of the second tank through the bottom distributor, flows up through the center tube, through the pipe leading back to the main valve, around the lower piston, through the meter, and out the valve outlet. The depleted first mineral tank is out of the flow path, and ready for regeneration.

MAT FLOW DIAGRAMS



3 - BACKWASH

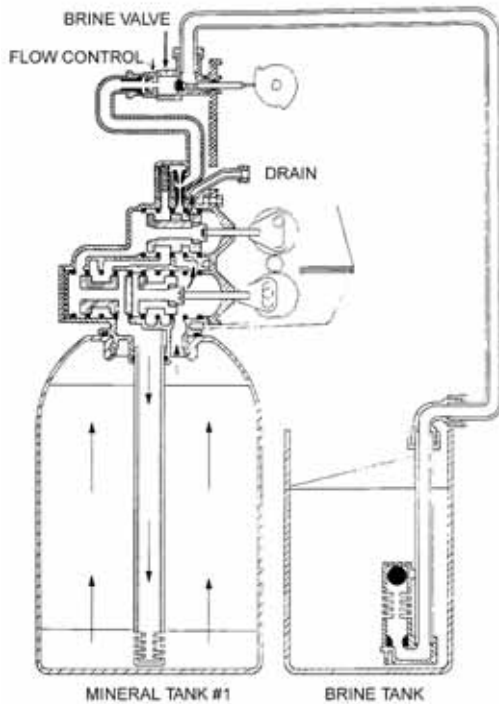
Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, through the center of the lower piston, down the center tube, up through the mineral, around the upper piston, and out the drain line.



4 - BRINE DRAW

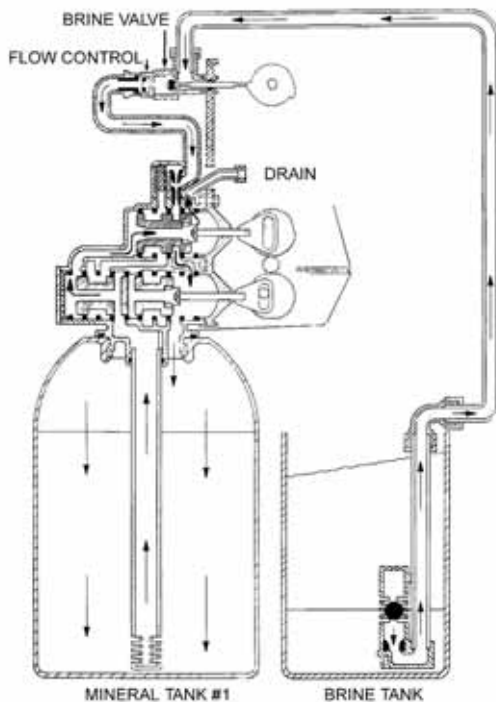
Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, and down through the nozzle and throat to draw brine from the brine tank. Brine flows around the upper piston, down through the mineral, into the center tube through the bottom distributor, up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.

MAT FLOW DIAGRAMS



5 - SLOW RINSE

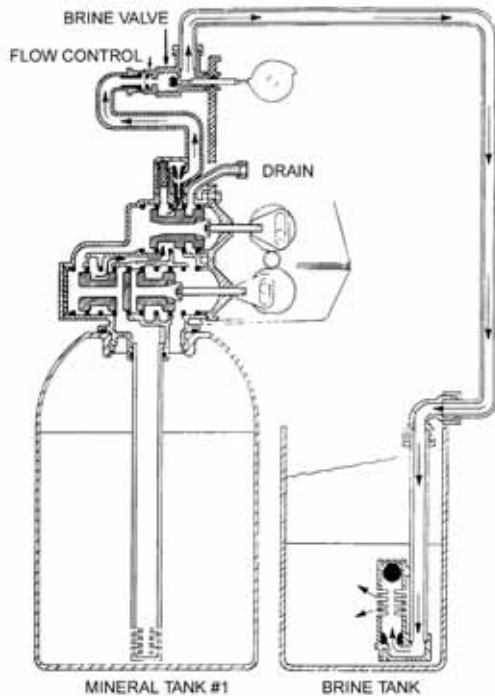
Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, down through the nozzle and throat, around the upper piston, down through the mineral, into the center tube through the bottom distributor, up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.



6 - RAPID RINSE

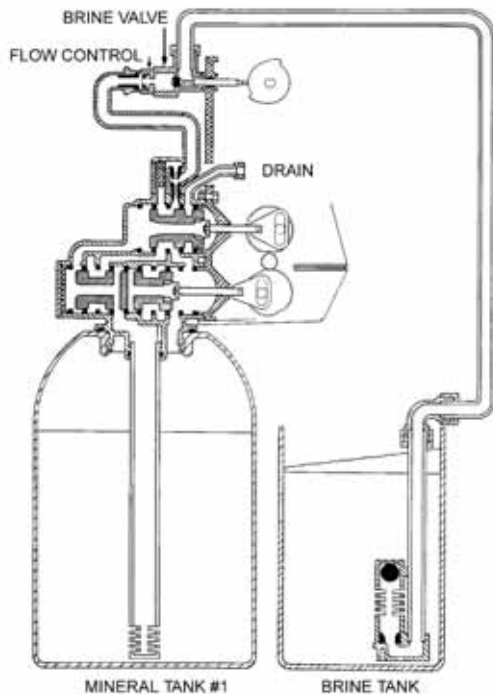
Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, and down through the mineral in the first tank. Rinse water from the mineral bed enters the center tube through the bottom distributor, flows up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.

MAT FLOW DIAGRAMS



7 - BRINE TANK FILL POSITION

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, through the brine line flow control, through the brine valve, and into to brine tank. No water flows through the first mineral tank.

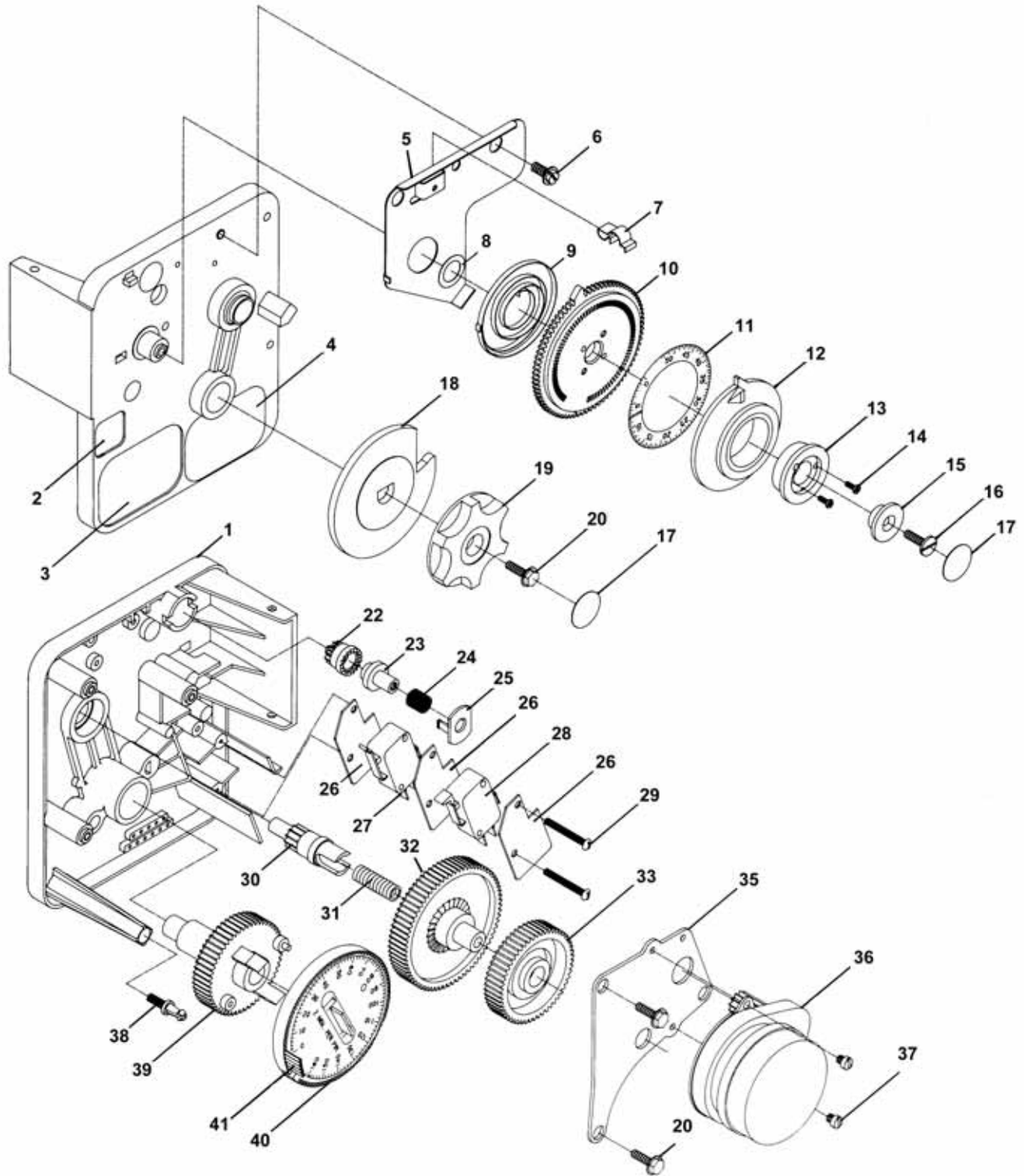


8 - SERVICE (TANKS SWITCHED)

Hard water enters the unit at the valve inlet, flows around the lower piston, through the pipe leading to the second mineral tank, and down through the mineral in the second tank. Conditioned water enters the center tube of the second tank through the bottom distributor, flows up through the center tube, through the pipe leading back to the main valve, around the lower piston, through the meter, and out the valve outlet. The regenerated first mineral tank is out of the flow path, and ready for use when the second mineral tank becomes depleted.

ELECTROMECHANICAL TIMER ASSEMBLY

(See opposite page for parts list)



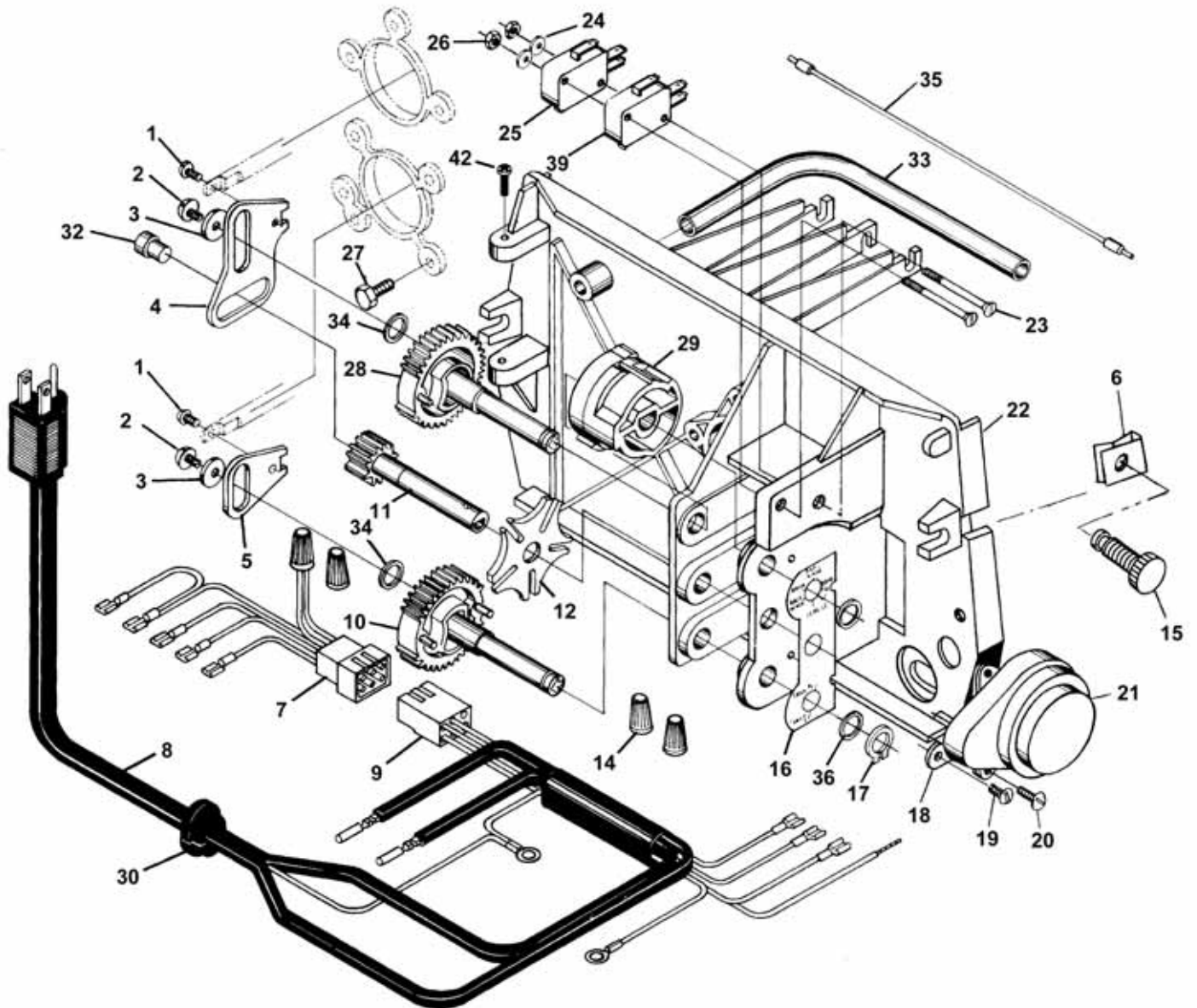
ELECTROMECHANICAL TIMER ASSEMBLY

Parts List

Item No.	Quantity	Part No.	Description
1	1	13870-03	Timer Housing Assy.
2	1	17870	Label - Capacity Gallons
3	1	15465	Label - Caution
4	1	16930	Label - Instruction
5	1	15227	Actuator Plate
6	1	10300	Screw, Hex Washer #8
7	1	17513	Spring Clip
8	1	15407	Washer, Plain #4
9	1	15228	Spring
10	1	15224-01	Drive Gear - Program Wheel
11	1	15967	Gallon Label 3/4" Meter
		15968	Gallon Label 3/4" Meter - Ext. Range
		15969	Gallon Label 1" Meter
		15970	Gallon Label 1" Meter - Ext. Range
12	1	15956	Adjusting Disc
13	1	16218	Program Wheel Cover
14	2	17054	Screw, #4-40
15	1	13806	Program Wheel Retainer
16	1	13748	Screw, Flat Hd #6-20
17	2	11999	Button Decal
18	1	15223	Cycle Actuator Gear
19	1	13886-01	Knob
20	4	13296	Screw, Hex Washer #6-20
22	1	17724	Drive Pinion
23	1	17723	Drive Pinion Clutch
24	1	14276	Spring - Meter Clutch
25	1	14253	Retainer
26	3	14087	Insulator
27	1	15314	Switch
28	1	15320	Switch
29	2	11413	Screw, Pan Hd #4-40
30	1	13018	Idler Shaft
31	1	18563	Spring - Idler Shaft
32	1	13017	Idler Gear
33	1	13164	Drive Gear
35	1	13887	Motor Mtg. Plate
36	1	18743	Motor - 120V 60 Hz. - 1/30 RPM
		18824	Motor - 220V 50 Hz. - 1/30 RPM
		19170	Motor - 120V 60 Hz. - 1/15 RPM
		18825	Motor - 220V 50 Hz. - 1/15 RPM
		19169	Motor - 24V 60Hz - 1/15 RPM
		19168	Motor - 24V 50Hz - 1/15 RPM
37	2	13278	Screw, #6-32
38	1	14265	Spring Clip
39	1	15055	Main Drive Gear
40	1	19210-05	Program Wheel Assembly - 180 min.
1		19210-02	Program Wheel Assembly - 90 min.
41	23	15493	Roll Pin
42			Not Assigned
43	1	14430	Screw, Hex Washer, #6 (Ground, Nut Shown)
		15203	Harness
		12681	Wire Nuts

9000 VALVE POWERHEAD ASSEMBLY

(See opposite page for parts list)



9000 VALVE POWERHEAD ASSEMBLY

Parts List

Item No.	Quantity	Part No.	Description
1.....	2	11335	Screw, #4-40
2.....	2	18564	Screw, Hex Washer #6-20
3.....	2	13363	Washer
4.....	1	14921	Piston Rod Link, Upper
5.....	1	15019	Piston Rod Link, Lower
6.....	2	18728	Nut, Clip, #8-32
7.....	1	15203	Wiring Harness - Timer
8.....	1	11838	Power Cord
9.....	1	15202	Wiring Harness - Drive
10.....	1	15134	Drive Gear, Assembly, Lower
11.....	1	15135	Drive Gear
12.....	1	14896	Geneva Wheel
14.....	4	12681	Wire Connector
15.....	2	19367	Cover Screw Assembly
16.....	1	15175	Position Decal
17.....	2	14917	Retaining Ring
18.....	1	15199	Ground Plate
19.....	1	14430	Screw, Hex Washer #6
20.....	2	13602	Screw, Round Hd #6-32
21.....	1	18739	Drive Motor - 220V., 50 Hz
.....	1	18738	Drive Motor - 120V., 60 Hz
.....	1	18737	Drive Motor 24V., 50-60 Hz
22.....	1	15131	Control Panel
23.....	2	15172	Screw, Flat Hd #4-40
24.....	2	10340	Washer, Lock #4
25.....	1	10218	Micro Switch
26.....	2	10339	Nut, Hex #4-40
27.....	7	15331	Screw, Hex Washer #10-24
28.....	1	15133	Drive Gear, Assembly, Upper
29.....	1	15132	Triple Cam
30.....	1	13547	Strain Relief
31.....	1	15810	Retaining Ring, Drive Gear (not shown)
32.....	1	15323	Guide Pin Upper Piston Rod Link
33.....	1	15368	Cable Guide
34.....	2	15372	Washer, Thrust
35.....	1	15216	Meter Cable Assy. - 1" Meter
.....	1	15425	Meter Cable Assy. - 3/4" Meter
36.....	2	15692	Spacer
37.....	1	10302	Insulator (not shown)
38.....			Not Assigned
39.....	1	16433	Micro Switch, Program
40.....	1	18699-XX	Cover, Top (Now Shown)
41.....	1	14779-XX	Cover, Bottom (Not Shown)
1.....		19291-020	Cover, 1 Piece, Black
42.....	2	15173	Screw

9000 VALVE ASSEMBLY

Parts List

Item No.	Quantity	Part No.	Description
1.....	1	14861-01.....	Valve Body
2.....	1	14914.....	Piston, Upper
3.....	2	14309.....	Piston Rod Retainer
4.....	2	16590.....	Piston Rod Retainer, HW
5.....	1	14919.....	Piston Rod, Upper
5.....	2	13446.....	End Plug Assy.
.....	2	13446-01.....	End Plug Assy., HW
6.....	12.....	14241.....	Spacer
.....	12.....	14241-01.....	Spacer, HW
7.....	16.....	13242.....	Seal
.....	16.....	18759.....	Seal, HW
8.....	1	14920.....	Piston Rod, Lower
9.....	1	14905.....	Piston, Lower
10.....	1	11710.....	O-Ring, -215
11.....	1	12281.....	O-Ring, -338
12.....	1	11981-01.....	Retaining Ring
13.....	1	16098.....	Washer, Brine Valve (Nylon)
14.....	1	11973.....	Spring, Brine Valve
15.....	1	13165.....	Brine Valve Cap
16.....	3	13302.....	O-Ring, -014
17.....	1	12550.....	Quad Ring, -009
18.....	1	13167.....	Brine Valve Spacer
19.....	1	14925.....	Brine Valve Stem
20.....	1	12626.....	Brine Valve Seat
21.....	1	15215.....	Injector Body
22.....	1	10914.....	Injector Throat - Specify Size pg. 24
.....	.....	10226.....	Injector Throat, SS
23.....	1	10913.....	Injector Nozzle, Specify Size pg. 24
.....	.....	10225.....	Injector Nozzle, SS
24.....	1	13303.....	O-Ring, -021
25.....	1	13166.....	Injector Cover
26.....	1	16595.....	Spacer
27.....	1	13387.....	Screw, Hex Hd #10-24
28.....	1	13361.....	Spacer, Injector
29.....	2	13301.....	O-Ring, -011
30.....	1	13497.....	Air Disperser
31.....	1	15348.....	O-Ring, -563
32.....	1	10227.....	Injector Screen
33.....	.....	.....	Not Assigned
34.....	1	13244.....	B.L.F.C. Fitting
37.....	1	16173.....	B.L.F.C. Fitting - Bored*
35.....	1 .....	.....	B.L.F.C. Button - Specify Size pg. 24
36.....	1	13245.....	B.L.F.C. Button Retainer
1.....	.....	12977.....	O-Ring, -015
38.....	1 .....	.....	D.L.F.C. Button - Specify Size pg. 24
39.....	1	13173.....	D.L.F.C. Button Retainer
40.....	1	10332.....	Tube Insert - 3/8"
1.....	.....	15415.....	Tube Insert - 1/2"*
41.....	1	10330.....	Ferrule - 3/8"
1.....	.....	16124.....	Ferrule - 1/2"*
42.....	1	10329.....	Tube Nut - 3/8"
1.....	.....	16123.....	Tube Nut - 1/2"*
43.....	1	14928.....	Stub End Plug
44.....	1	14906.....	End Plate
45.....	4	15137.....	Screw, Hex Washer, #10-24
46.....	1	16140.....	Adapter, 1/2" T to 1/4" P (not shown)*
47.....	1	15471.....	Brine Valve Stand Off
48.....	1	13315.....	Screw, Hex Washer, #10-24

Note:	For Hot Water Delete Items
	41 & 42 and use
	18698. . Nut & Sleeve Assy. 3/8"
15414. . Nut & Sleeve Assy. 1/2"	
* These parts are used with #4	
Injector and 2 GPM or larger	
Brine Line Flow Control	
(B.L.F.C.). Items 34, 35 and 36	
are not used.	

9000 VALVE SERVICE ASSEMBLIES

60022-25 BLFC .25 GPM

60022-50 BLFC .50 GPM

60022-100 BLFC 1.0 GPM

For Illustration, See Page 21

- 1..... 12094.... Flow Washer .25 GPM
- 12095.... Flow Washer .50 GPM
- 12097.... Flow Washer 1.0 GPM
- 1..... 2977..... O-Ring - 015
- 1..... 13244.... Adapter, BLFC
- 1..... 13245.... Retainer, BLFC Button

60350.... Brine Valve Assy, 9000

For Illustration, See Page 21

- 1..... 11973 Spring, Brine Valve
- 1..... 11981 Retaining Ring
- 1..... 16095.... Washer, Plain #10 Nylon
- 1..... 12550.... Quad Ring, -009
- 1..... 12626.... Seat, Brine Valve
- 1..... 13165.... Cap, Brine Valve
- 1..... 13167.... Spacer, Brine Valve
- 2..... 13302.... O-Ring, -014
- 1..... 14925.... Brine Valve Stem, 9000

60385-XXXX..... Injector/Drain Assy

60086.... 3/4" Meter, Standard Range

60087.... 3/4" Meter, Extended Range

For Illustration and Parts See Page 26

60389... 1" Meter, Standard Range

60390.... 1" Meter, Extended Range

For Illustration and Parts See Page 27

60401.... Piston Assy, 9000 Lower

For Illustration and Parts See Page 21

- 1..... 11335 Screw, Fil Hd Mach 4-40 x 3/16
- 1..... 13446.... End Plug Assy White
- 1..... 14309.... Retainer, Piston Rod
- 1..... 14905.... Piston, Lower 9000
- 1..... 14920.... Piston Rod, Lower
- 1..... 15019.... Link, Piston Rod

60400.. Piston Assy, 9000 Upper

For Illustration, See Page 21

- 1..... 11335 Screw, Fil Hd Mach 4-40 X 3/16
- 1..... 13446.... End Plug, White Assy
- 1..... 14309.... Retainer, Piston Rod
- 1..... 14914.... Piston, Upper 9000
- 1..... 14919.... Piston Rod, Upper
- 1..... 14921 Link, Piston Rod

60125.... Seal & Spacer Kit, 9000 - Upper

For Illustration, See Page 21

- 5..... 13242.... Seal
- 4..... 14241 Spacer

60421.... Seal & Spacer Kit, 9000 -Lower

For Illustration, See Page 21

- 11..... 13242.... Seal
- 8..... 14241 Spacer
- 1..... 16595.... Spacer, 9000

60412..... 9000 Powerhead Assembly

60375-XX9000, Timer 1/15 RPM

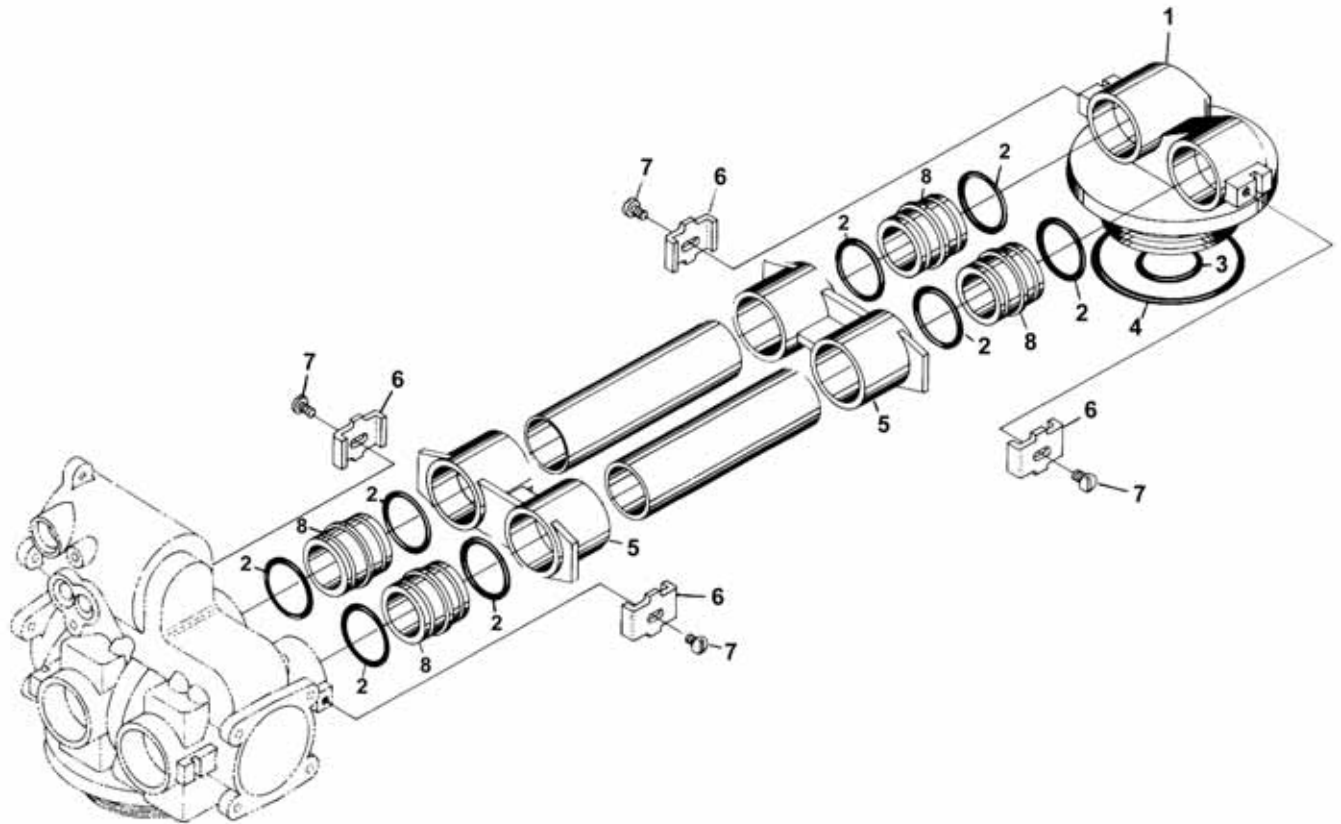
60376-XX9000, Timer 1/30 RPM

60136-9000..... 9000 Service Repair Kit

DLFC, Flow Washers

- 12085.....** Flow Washer, 1.2 GPM
- 12086.....** Flow Washer, 1.5 GPM
- 12087.....** Flow Washer, 2.0 GPM
- 12088.....** Flow Washer, 2.4 GPM
- 12089.....** Flow Washer, 3.0 GPM
- 12090.....** Flow Washer, 3.5 GPM
- 12091.....** Flow Washer, 4.0 GPM
- 12092.....** Flow Washer, 5.0 GPM
- 12408.....** Flow Washer, 7.0 GPM

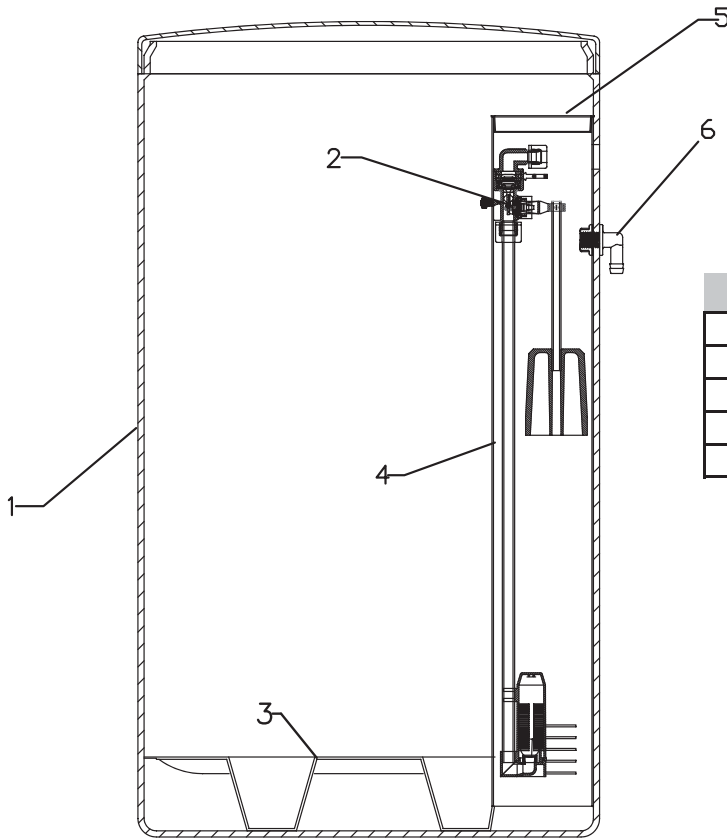
9000 SECOND TANK ADAPTER ASSEMBLY



PARTS LIST

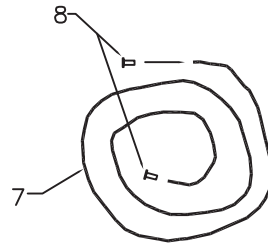
Item No.	Quantity	Part No.	Description
1.....	1.....	14864-01.....	2nd Tank Adapter
2.....	8.....	13305.....	O-Ring, -119
3.....	1.....	11710.....	O-Ring, -215
4.....	1.....	12281.....	O-Ring, -338
5.....	2.....	13708-40.....	Yoke
.....	1.....	15823-XX.....	Yoke Assy. Specify Tank Size
6.....	4.....	13255.....	Hold-Down Clip
7.....	4.....	14202.....	Screw, Hex Hd #8-32
8.....	4.....	15078.....	Coupling
9.....	2.....	.....	Pipe - 1" Copper Cut to Length

BRINE SYSTEM FOR MAT 15M-90M



**BRINE TANK ASSEMBLIES
MAT 15M-90M**

Models	Part Number
MAT 15	A2042062
MAT 30	A2042062
MAT 45	A2042064
MAT 60	A2042064
MAT 90	A2042064



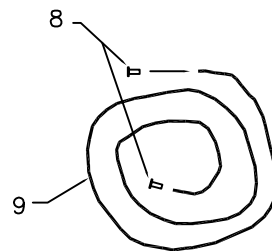
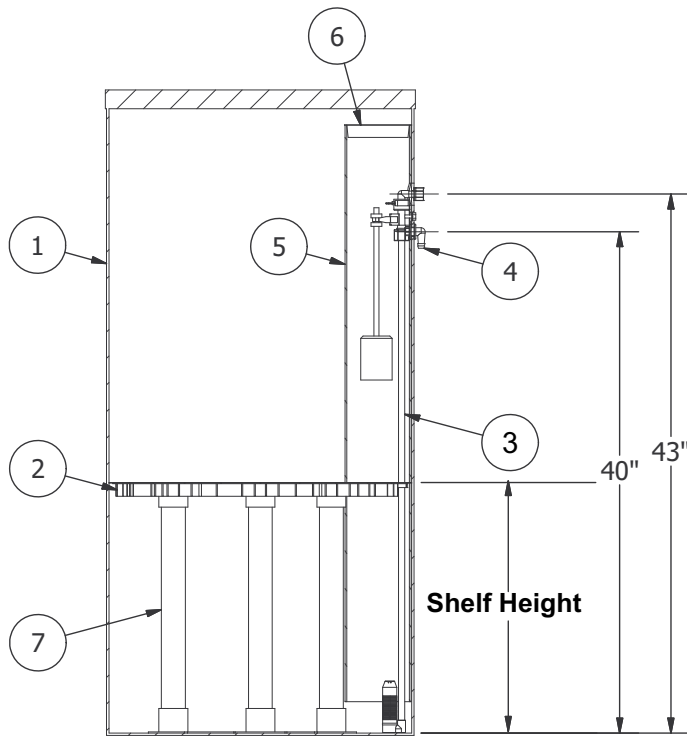
PARTS LIST

Item Number	Part number	Item Description
1	A2042020	TANK BRINE 18 X 33 BLACK MLD CVR
	A2042028	TANK BRINE 18 X 40 BLACK MLD CVR
2	B1180011	BRINE VALVE ASSY 474 W/AIR CHECK - MAT 15-30
	B1179005	BRINE VALVE ASSY 474 W/AIR CHECK - MAT 45-90
3	A2284017	GRID PLATE PLASTIC 18D 4BW 3HIGH - MAT 15-30
	A2284002	GRID PLATE PLASTIC 18D 4BW 5HIGH - MAT 45-90
4	A2071005	BRINE WELL 4 X 28 SLOTTED - MAT 15-30
	A2071003	BRINE WELL 4 X 36 SLOTTED - MAT 45-90
5	A2072003	CAP BRINE WELL 4 IN
6	A2250003	ELBOW OVERFLOW 1/2 W/NUT 2PC SET
7	B1020001	TUBING BRINE LINE
8	A2207018	INSERT 3/8 TUBE BRASS

BRINE SYSTEM FOR MAT 120M-300M

BRINE TANK ASSEMBLIES

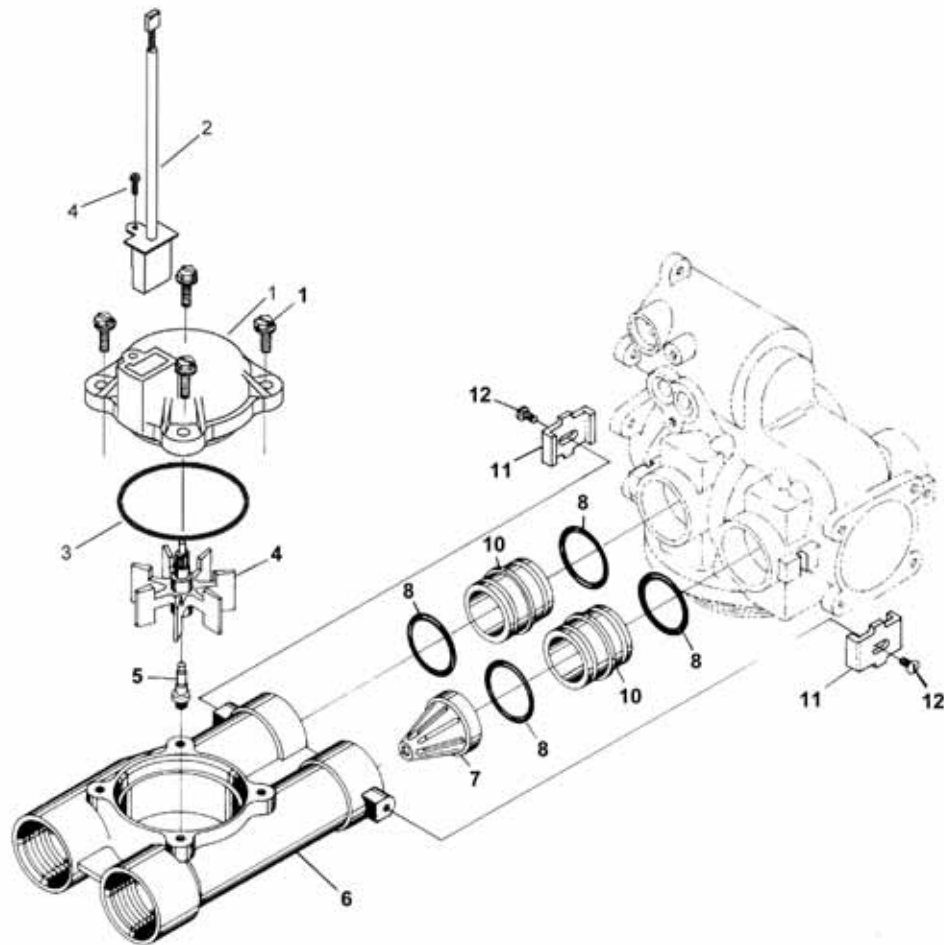
Models	Part Number	Shelf Height
MAT 120	B1295015	10"
MAT 150	B1295016	13"
MAT 180	B1295017	15"
MAT 210	B1295018	18"
MAT 240	B1295019	20"
MAT 270	B1295020	23"
MAT 300	B1295021	26"



PARTS LIST

Item Number	Part Number	Item Description
1	B1002039	BRINE TANK W/HOLES 24x41 MAT 120
	B1002016	BRINE TANK W/HOLES 24x50 MAT 150-300
2	A2284007	GRID PLATE PLASTIC 24DIA 5BW
3	B1180015	VALVE BRINE (474) MAT/MGT 120
	B1180016	VALVE BRINE (474) MAT/MGT 150
	B1180017	VALVE BRINE (474) MAT/MGT 180
	B1180018	VALVE BRINE (474) MAT/MGT 210
	B1180019	VALVE BRINE (474) MAT/MGT 240
	B1180020	VALVE BRINE (474) MAT/MGT 270
	B1180021	VALVE BRINE (474) MAT/MGT 300
4	A2250003	ELBOW OVERFLOW 1/2" W/NUT
5	B1015008	BRINE WELL 5x46 DRILLED
6	A2072001	CAPPLUG RED 5 INCH
7	A2275007	PIPE 1-1/2 SDR OR SCH40 DWV
8	A2476001	INSERT 1/2 POLY
9	A2165002	TUBING 1/2x3/8 BLACK POLY

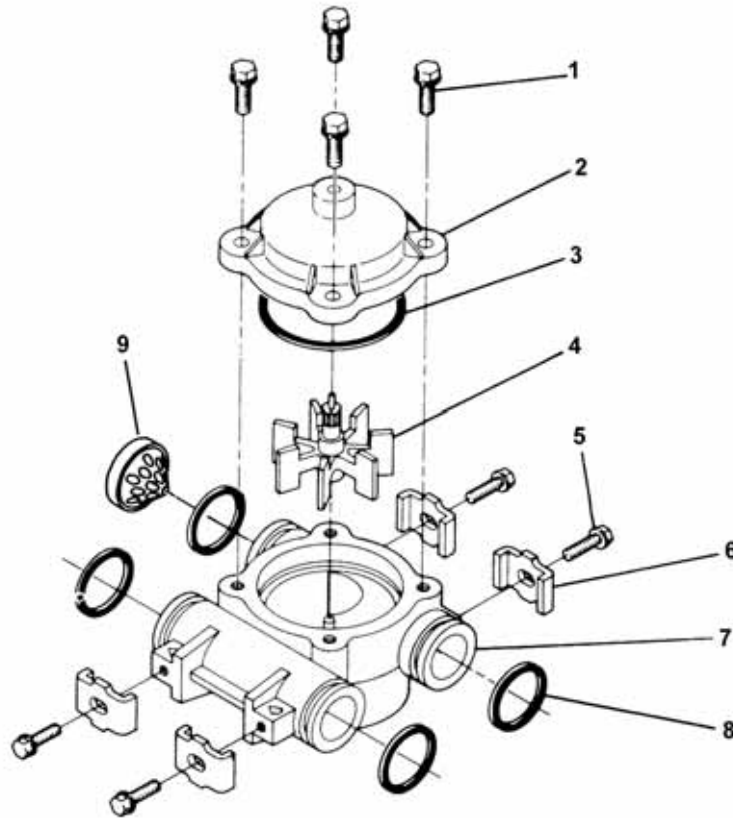
1" METER ASSEMBLY



PARTS LIST

Item No.	Quantity	Part No.	Description
1.....	4	12112.....	Screw, Hex Hd #10-24
2.....	1	15218.....	Meter Cover Assy.
		15237.....	Meter Cover Assy. (Ext. range)
3.....	1	13847.....	O-Ring, -137
4.....	1	13509.....	Impeller
1.....		13509-01	Impeller, HW
5.....	1	13882.....	Impeller Post
6.....	1	15043.....	Meter Body 1" - 11-1/2 N.P.T.
1.....		15043-10	Meter Body 1" - 11 B.S.P.
7.....	1	14960.....	Flow Straightener
8.....	4	13305.....	O-Ring, -119
9.....			Not Assigned
10.....	2	15078.....	Coupling
11.....	2	13255.....	Adapter Clip
12.....	2	14202.....	Screw, Hex Hd #8-32

3/4" METER ASSEMBLY



PARTS LIST

Item No.	Quantity	Part No.	Description
1.....	4.....	12473.....	Screw, Hex Washer #10-24
2.....	1.....	14038.....	Meter Cover Assembly - Standard
		15150.....	Meter Cover Assembly - Extended Range
3.....	1.....	13847.....	O-Ring, -137
4.....	1.....	13509.....	Impeller
5.....	4.....	13314.....	Screw, Hex Washer #8-18
6.....	4.....	13255.....	Adapter Clip
7.....	1.....	13821.....	Meter Body
8.....	4.....	13305.....	O-Ring, -119
9.....	1.....	14613.....	Flow Straightener

TROUBLESHOOTING TIPS

PROBLEM	CAUSE	CORRECTION
1. Softener Fails To Regenerate.	A. Electrical Service To Unit Has Been Interrupted.	A. Assure Permanent Electrical Service (Check Fuse, Plug, Pull Chain or Switch).
	B. Timer Is Defective.	B. Replace Timer.
2. Hard Water.	A. By-Pass Valve is Open.	A. Close By-Pass Valve.
	B. No Salt in Brine Tank.	B. Add Salt To Brine Tank and Maintain Salt Level Above Water
	C. Injector Screen Plugged.	C. Clean Injector Screen.
	D. Insufficient Water Flowing Into Brine Tank	D. Check Brine Tank Fill Time And Clean Brine Line Flow Control If Plugged.
	E. Hot Water Tank Hardness.	E. Repeated Flushings Of The Hot Water Tank is Required.
	F. Leak At Distributor Tube.	F. Make Sure Distributor Tube Is Not Cracked. Check O-Ring And Tube Pilot.
	G. Internal Valve Leak.	G. Replace Seals and Spacers And/Or Piston.
3. Unit Used Too Much Salt.	A. Improper Salt Setting.	A. Check Salt Usage and Salt Setting.
	B. Excessive Water in Brine Tank.	B. See Problem No. 7.
4. Loss Of Water Pressure.	A. Iron Buildup In Line To Water Conditioner.	A. Clean Line To Water Conditioner.
	B. Iron Buildup In Water Conditioner.	B. Clean Control and Add Mineral Cleaner to Mineral Bed. Increase Frequency of Regeneration and/or Backwash Time.
	C. Inlet of Control Plugged Due to Foreign Material Broken Loose From Pipes By Recent Work Done On Plumbing System.	C. Remove Pistons and Clean Control.
5. Loss of Mineral Through Drain Line.	A. Air In Water System.	A. Assure That Well System Has Proper Air Eliminator Control. Check For Dry Well Condition.
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.	A. Clean Flow Control.
	B. Plugged Injector System.	B. Clean Injector and Screen.
	C. Timer Not Cycling.	C. Replace Timer.

TROUBLESHOOTING TIPS (cont'd)

PROBLEM	CAUSE	CORRECTION
8. Softener Fails To Draw Brine.	D. Foreign Material In Brine Valve.	D. Replace Brine Valve Seat And Clean Valve.
	E. Foreign Material In Brine Line Flow Control.	E. Clean Brine Line Flow Control.
	F. Power Loss During Brine Fill.	F. Check Power Source.
	A. Drain Line Flow Control Is Plugged.	A. Clean Drain Line Flow Control.
	B. Injector Is Plugged.	B. Clean Injector.
	C. Injector Screen Plugged.	C. Clean Screen.
9. Control Cycles Continuously.	D. Line Pressure Is Too Low.	D. Increase Line Pressure To 25 P.S.I. Min.
	E. Internal Control Leak.	E. Change Seals, Spacers and Piston Assembly.
10. Drain Flows Continuously.	A. Broken or Shorted Switch.	A. Determine If Switch or Timer Is Faulty and Replace it or Replace Complete Power Head.
	A. Valve Is Not Programming Correctly.	A. Check Timer Program and Positioning of Control. Replace Power Head Assembly If not Positioning Properly.
	B. Foreign Material In Control.	B. Remove Power Head Assembly And Inspect Bore, Remove Foreign Material and Check Control In Various Regeneration Positions.
	C. Internal Control Leak.	C. Replace Seals and Piston Assembly.

General Service Hints

Problem: Softener Delivers Hard Water.

Cause could be that . . . Reserve Capacity Has Been Exceeded.

Correction: Check salt dosage requirements and reset program wheel to provide additional reserve.

Cause could be that . . . Program Wheel Is Not Rotating With Meter Output.

Correction: 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.

Cause could be that . . . Meter Is Not Measuring Flow.

Correction: 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" installations. If not performing properly, replace meter.

Cause could be that . . . Trip Dog On Program Wheel Is Beyond Cycle Actuator Arm.

- Correction:**
1. If power failed during regeneration; reset program wheel and cycle manually.
 2. If exceeding system capacity before regeneration was completed; either a) increase system capacity, b) restrict flow rates, or c) change timer from 164 min./cycle to 82 min./cycle.
 3. If defective timer; replace timer.

NOTES



Marlo Incorporated
2227 South Street
P.O. Box 044170
Racine, WI 53404-7003
Ph. (262) 681-1300
Fax (262) 681-1318
www.Marlo-Inc.com