MARLO INCORPORATED ®

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

MR 150–1050M
TRIPLE
PLC CONTROLLER

COMMERCIAL WATER CONDITIONERS

COMPLETE FOR FUTURE REFERENCE:

MODEL NO:
SERIAL NO:
DATE INSTALLED:
DEALER:

Marlo Incorporated
2227 South Street
P.O. Box 044170
Racine, WI 53404-7003
www.Marlo-Inc.com

8-301 R3

IMPORTANT PLEASE READ:

- Warranty of this product extends to manufacturing defects.
- The information, specifications and illustrations in this manual are based on the latest information available at the time of printing. The manufacturer reserves the right to make changes at any time without notice.
- This product should be installed by a plumbing professional on potable water systems only.
- This product must be installed in compliance with all local and state and municipal plumbing and electrical codes. Permits may be required at the time of installation.
- If operating pressure exceeds 100 psi a pressure reducing valve must be installed. If operating pressure drops below 30 psi a booster pump must be installed.
- Do not install the unit where temperatures may drop below 32°F or rise above 100°F.
- A prefilter should be used on installations in which free solids are present.
- A constant voltage of 120V/60Hz (unless otherwise specified) must be supplied to the controller to maintain proper function.
- Union or flange fittings are recommended at the control valve's inlet, outlet, and drain connections
- 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.

Please Circle and/or Fill in the Appropriate Data for Future Reference:

Softener Model: MR _____

System Size: Single/Twin/Triple/Quad

Meter Size: _____

Configuration: Timeclock/Twin Alt/Parallel/Progressive

Unit Capacity: _____ Grains

Feed Water Hardness: _____ Grains

Treated Water: _____ Gallons/Liters

BW/Regen Time _____ AM/PM or OFF

Additional Notes: _____

_____

_____

_____

_____

TABLE OF CONTENTS

INSTALLATION

OPERATION

MAINTENANCE

PRODUCT WARRANTY

Manufacturer's 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. If within that period any products shall be proven to manufacturer's satisfaction to be defective, those products will be replaced, or the price refunded at manufacturer's option.

Manufacturer'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 manufacturer'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.

Manufacturer 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 the manufacturer 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 manufacturer'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.

SPECIFICATION NOTES

Maximum salting is 15 pounds of salt per cubic foot of resin. This setting gives the longest time between regenerations. It has an efficiency of 2,000 grains of hardness removed per pound of salt. The Brine tank and Regeneration timer are 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.

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

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 30 psi.

Maximum operating pressure is 100 psi.

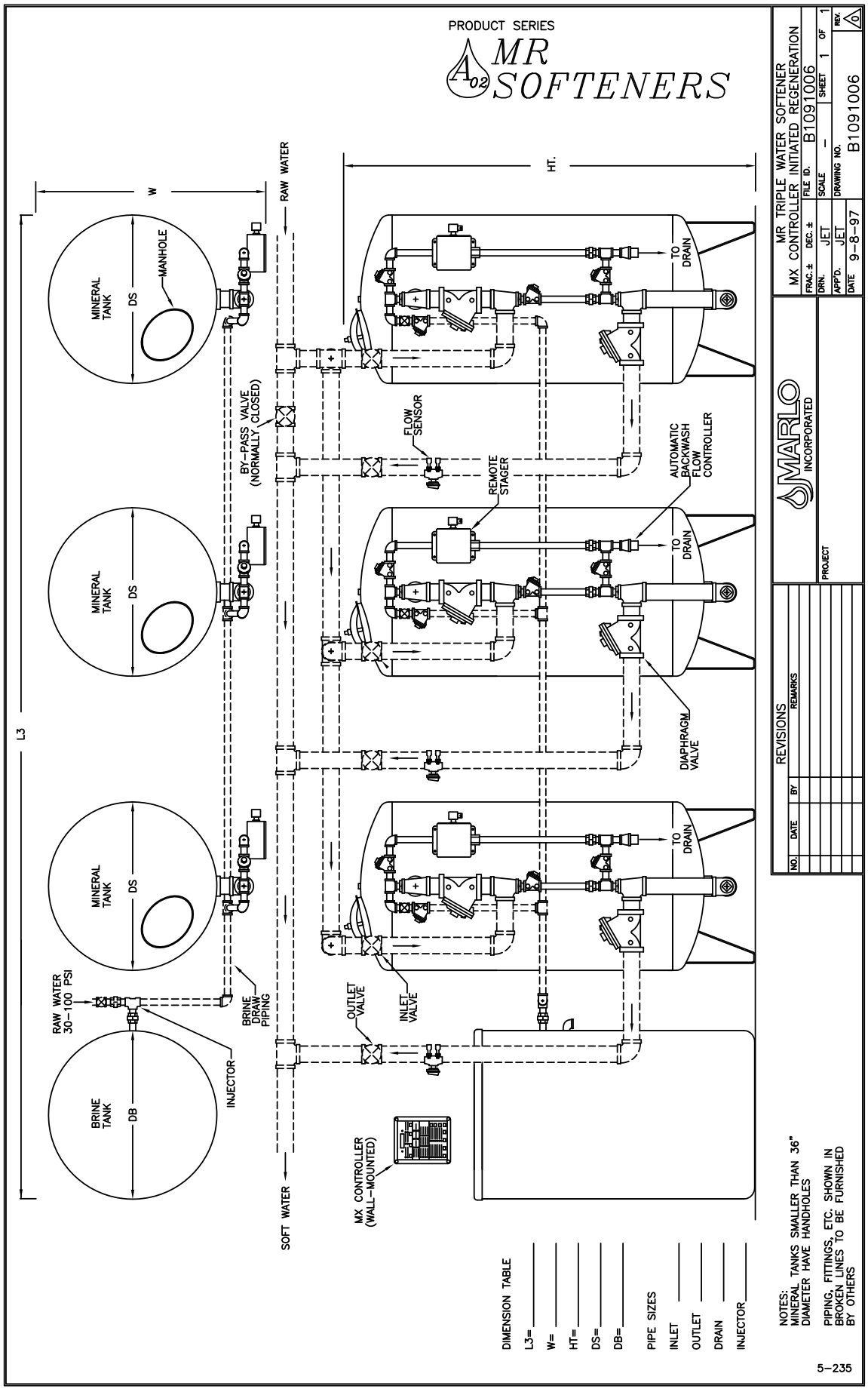
Standard units are designed to soften unheated water in the range is 35-100°F.

Power requirements are 120 Volt, 60 Hertz, Single Phase, 2 amps

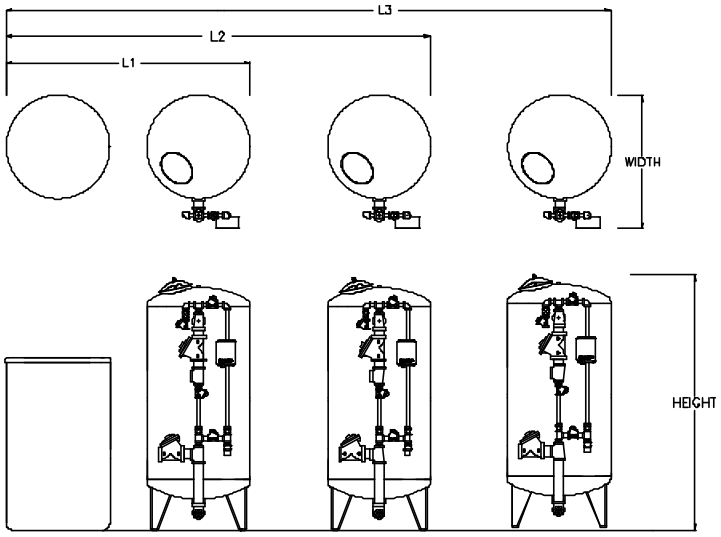
Salt specifications are pelletized or solar salt, 99% pure, containing less than 1% insolubles.

SPECIFICATION TABLE

MODEL		MR	150				210				300				450				600				750			900			1050		
Valve Size		inches	1	1 ¼	1 ½	2	1 ¼	1 ½	2	2 ½	1 ½	2	2 ½	3	1 ½	2	2 ½	3	1 ½	2	2 ½	3	2	2 ½	3	2	2 ½	3	2	2 ½	3
Capacity (Kgrains)		Max	150				210				300				450				600				750			900			1050		
		Min	100				140				200				300				400				500			600			700		
FLOW RATE (GPM)	Service	Cont's.	32	42	45	57	41	64	80	115	68	92	140	165	63	82	120	140	72	110	140	175	90	140	160	105	150	188	95	135	173
		Peak	55	78	69	97	57	86	110	160	92	125	190	230	90	115	170	190	94	125	190	250	116	190	230	133	218	279	124	210	259
	Backwash & Flush		10				15				20				20				30				30			45			45		
	Brine Draw & Rinse		2.5				3.5				5				5				7				7			10			10		
TIMER SETTINGS	Backwash	Minutes	10				10				10				10				10				10			10			10		
	Brine Draw & Rinse	Minutes	60				60				60				60				60				60			60			60		
	Fast Flush	Minutes	6				6				6				6				6				6			6			6		
SOFTENER TANK	Size	Dia x Ht Inches	20x54				24x54				30x54				30x60				36x60				36x72			42x60			42x72		
	Gravel Subfill	Pounds	100				200				300				300				400				400			600			600		
	Resin	Cubic Feet	5				7				10				15				20				25			30			35		
	Freeboard	Inches	23½				24				26½				20				23				26½			19½			25		
BRINE SYSTEM	Tank Size	Dia x Ht Inches	24X50				24x50				24x60				30x60				39x60				39x60			42x60			50x60		
	Injector	Code	2.0-050				3.5-075				5.0-075				5.0-075				7.0-100				7.0-100			10.0-100			10.0-100		
		Color	Red				White				Blue				Blue				Red				Red			White			White		
	Max Salt Storage	Pounds	700				600				600				1000				1900				1700			1900			2300		
	Salt Dosage	Max.	75				105				150				225				300				375			450			525		
		Min.	30				42				60				90				120				150			180			210		
	Regens per Salt Refill	Max.	9				5				4				4				6				4			4			4		
		Min.	23				14				10				11				15				11			10			10		
	Brine Valve Float Height	Max.	12				19				26				26				19				26			26			19		
		Min.	3				8				9				9				8				9			9			8		


PRODUCT SERIES
MR SOFTENERS
MX TRIPLE WATER SOFTENER
MX CONTROLLER INITIATED REGENERATION
FILE ID. B1091006
DRAWING NO. B1091006
MARLO INCORPORATED
REVISIONS
NO. DATE BY REMARKS
PROJECT
MINERAL TANK
BRINE TANK
MANHOLE
RAW WATER
RAW WATER 30–100 PSI
SOFT WATER
BY–PASS VALVE (NORMALLY CLOSED)
FLOW SENSOR
REMOTE STAGER
AUTOMATIC BACKWASH FLOW CONTROLLER
DIAPHRAGM VALVE
TO DRAIN
BRINE DRAW PIPING
OUTLET VALVE
INLET VALVE
INJECTOR
MX CONTROLLER (WALL–MOUNTED)
DIMENSION TABLE
L3=
W=
HT=
DS=
DB=
PIPE SIZES
INLET
OUTLET
DRAIN
INJECTOR
NOTES:
MINERAL TANKS SMALLER THAN 36" DIAMETER HAVE HANDHOLES
PIPING, FITTINGS, ETC. SHOWN IN BROKEN LINES TO BE FURNISHED BY OTHERS
5–235

INSTALLATION DIMENSIONS AND SPECIFICATIONS



MODEL	Approx. Height (inches)	Length			Width (Inches)	Brine Pipe Size (inches)	Drain Pipe Size (inches)	Pipe Size (inches)
		L1 Single	L2 Twin	L3 Triple				
MR-150-1 MR-150-1¼ MR-150-1½ MR-150-2	72	50	88	126	29 30 30 34	¾	1	1 1¼ 1½ 2
MR-210-1¼ MR-210-1½ MR-210-2 MR-210-2½	73	54	96	138	32 32 36 37	¾	1¼	1¼ 1½ 2 2½
MR-300-1½ MR-300-2 MR-300-2½ MR-300-3	76	60	108	156	38 42 43 44	¾	1¼	1½ 2 2½ 3
MR-450-1½ MR-450-2 MR-450-2½ MR-450-3	82	66	114	162	38 42 43 44	¾	1¼	1½ 2 2½ 3
MR-600-1½ MR-600-2 MR-600-2½ MR-600-3	89	81	135	189	44 48 49 50	1	1½	1½ 2 2½ 3
MR-750-2 MR-750-2½ MR-750-3	101	81	135	189	48 49 50	1	1½	2 2½ 3
MR-900-2 MR-900-2½ MR-900-3	94	90	150	218	54 55 56	1	2½	2 2½ 3
MR-1050-2 MR-1050-2½ MR-1500-3	106	98	158	218	54 55 56	1	2½	2 2½

*When less than 4 hours is expected between regeneration's of a twin or triple softener, a brine tank for each softener is required.

SOFTENER INSTALLATION INSTRUCTIONS

GENERAL INFORMATION

Before beginning installation, thoroughly review the following instructions to familiarize yourself with the general placement and identification of all components.

These instructions are written for a single unit installation, but they also generally apply to twin and triple units. Refer to specific equipment layout drawing, water meter installation instruction, and interconnecting electrical wiring diagram for your system.

Minimum operating pressure is 30 psi.
If pressure less then 30 psi is encountered, a pump must be installed.

Maximum operating pressure is 100 psi.
If pressure greater then 100 psi is encountered, a pressure regulator must be installed.

Power requirements are shown on electrical wiring diagram.

Standard units are designed to soften unheated water in the range is 35-100°F.
Special valve assemblies are available to handle heated water supplies exceeding 100°F.
Consult factory if applicable.

Catalog softeners are shipped fully assembled with face piping and controllers. Care must be taken not to damage valves or controllers during uncrating and installation.

During unpacking the brine tank miscellaneous parts are shipped inside the brine tank. These parts include hardness test kit, injectors, extra manuals and other parts that may apply to your particular system. Care should be taken when unpacking the brine tank.

SOFTENER LOCATION

1. Select a position near a floor drain that has adequate carrying capacity to handle the water softener backwash rate. See the Specification Table for the backwash rate of your system.

2. Refer to your specific equipment layout drawing located on page 31 for tank locations. The approximate dimensions required for your particular system is shown on page 4. Make sure the softeners are placed on a level concrete surface.

PIPING INSTALLATION

Note:

- Install the piping conforming to federal, provincial, and local codes.
- Union or flanges are recommended at the control valve's inlet, outlet, and drain connections
- To enhance the monitoring of the system's performance sample valves and pressure gauges can be installed at the inlet and outlet piping to each control valve.
- 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.

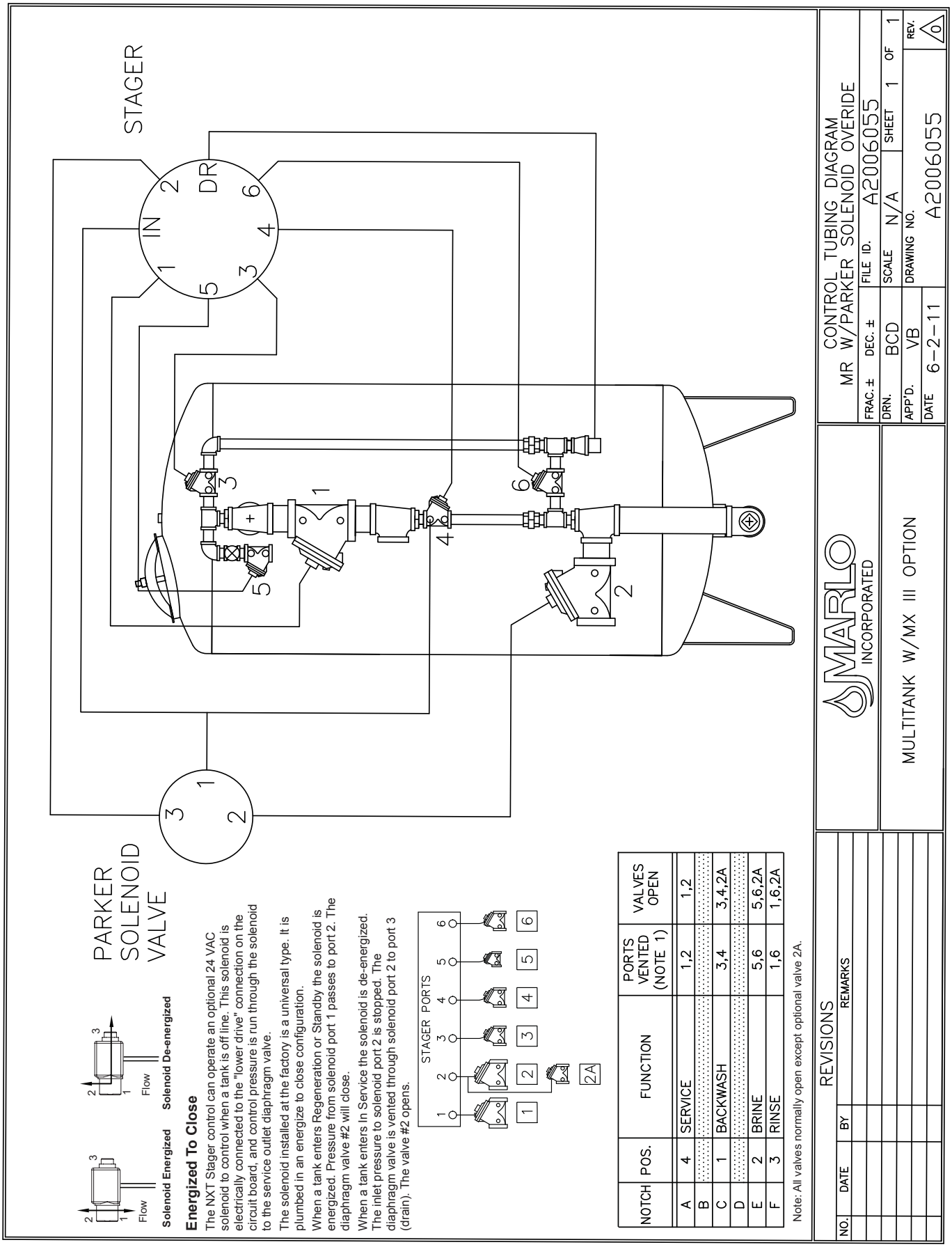
1. Install piping as shown on the layout drawing located on page 31. Include unions and shut-off valves on the inlet and outlet of each softener. Also, include a shut-off valve for each injector provided with the system. It is recommended that a union be installed in each softener drain-line to facilitate cleaning the backwash flow control.

Note: Do **not** reduce drain-line pipe size. Do **not** install a shut off valve in the drain-line. Provide an air gap in the drain line in accordance with local codes (minimum four (4) pipe diameters).

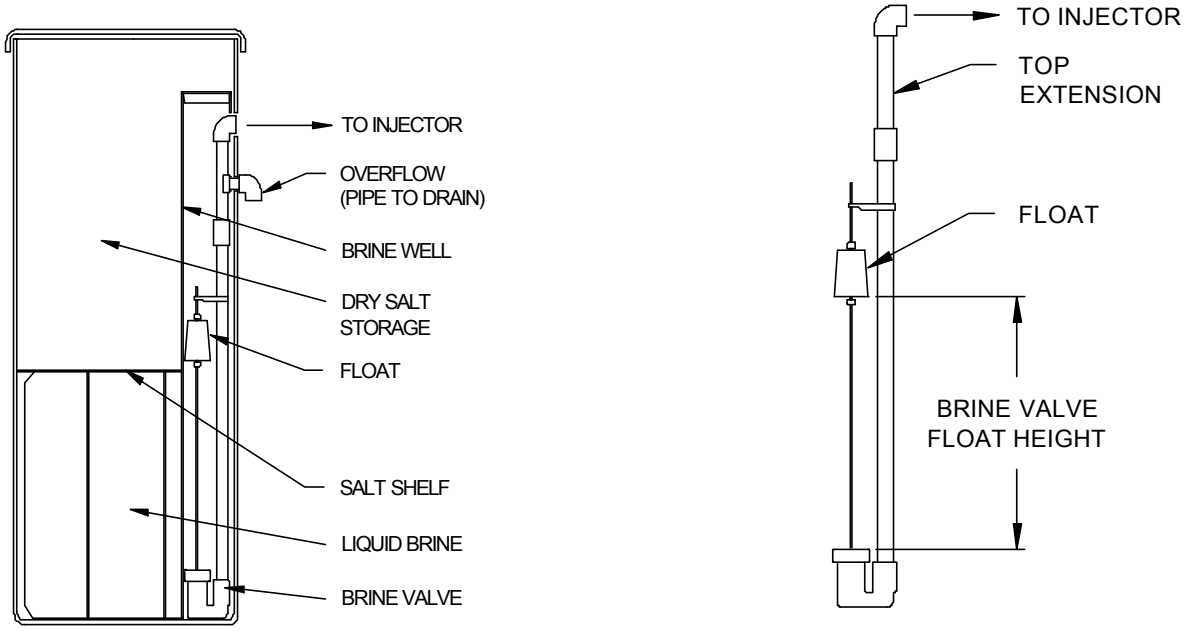
2. If your system has a water meter thoroughly read the meter instructions manual located in the back of this manual before installing any water meters or flow sensors,. Water meters typically must be installed in a particular manner (i.e. horizontal, plane or with recommend pipe lengths) to function properly.

3. After the piping has been completed, make sure to close all isolation valves.

TUBING DIAGRAM - VALVE NEST - MULTITANK



BRINE TANK INSTALLATION



1. The brine tank is placed as shown on the installation drawing, on a smooth level surface. If not, the tank should be placed on a smooth piece of exterior plywood and leveled by placing shims beneath the plywood.

2. Make sure that the salt shelf inside the tank is level and that the brine well is near to vertical as possible. Check the specifications table and make sure that the float setting is the proper height for the model provided. Brine tanks are shipped with the float set for maximum salting. If incorrect, slide the float to the proper setting. Float should be one inch above grid plate.

3. Place brine valve into the brine well and set at the bottom of the brine tank.

Note: If minimum brine draw is desired, remove the pipe nipple and coupling from the brine assembly. Install remaining brine valve assembly into elbow using Teflon tape or Teflon paste, and set float to minimum salt level see Specification Table on page 3 for settings. Place brine valve into brine well. Brine valve assembly will not sit on bottom of brine tank.

4. Connect the brine valve to the brine injector.

5. Open the injector feed water valve and allow the brine tank to fill with water. To speed this process the tank can be filled with hose to about 2” below the platform. The tank will continue to fill until the float rises and shuts of the flow (approximately 1” above the platform).

Note: In the process of making brine for the first regeneration, the solution volume will increase (one gallon of water will be 1.2 gallons of brine). The final level of the liquid will be several inches above the platform.

6. If the refill water shuts off below the platform or too far above the platform, the brine valve should be remove and the float adjusted up or down until is shuts off approximately 1” above the platform. Place the brine well cap seal in place and open the manual valve in the brine line to the softener tank.

SOFTENER TANK LOADING

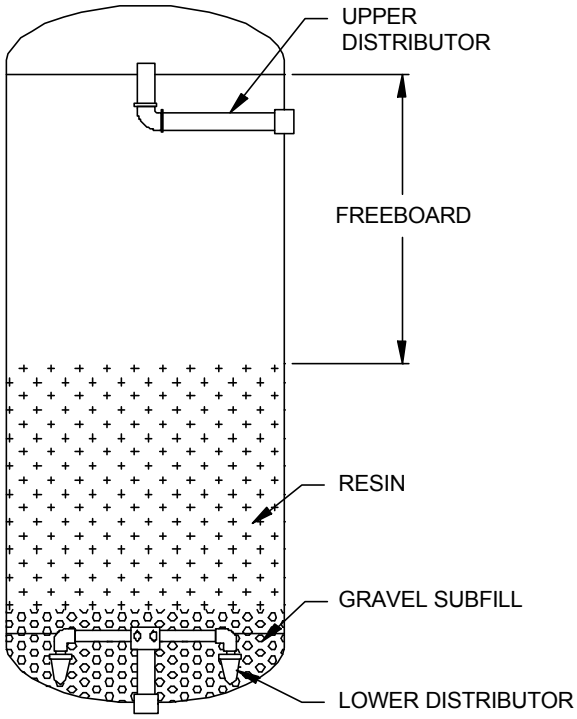
GRAVEL LOADING

1. The gravel should be loaded per the specification table.

2. Before loading, visually check the lower distributor for shipping damage. All radial arms and baskets strainers are in place and pointing downward. Tighten any loose laterals. Do not load tank if there is damage is evident. Call the factory if any damage is observed.

3. Slowly open the inlet valve and fill the tank half way or as full as possible with water. There might be a flow of water to drain.

4. The equipment provided has a plastic lower distributor system. Care should be exercised in the loading of the gravel in order to insure that the distributors are not damaged.



5. Slowly and gently pour the gravel marked for the mineral tank into the unit.

6. Drain the tank down until the gravel and water levels are the same.

7. Carefully level the gravel before loading the resin.

RESIN LOADING

1. Reopen the inlet valve and fill the tank to 1/3 to 1/2 full of water.

2. Pour the quantity of resin marked for the tank in through the top opening.

3. Reopen the inlet valve and fill the tank with water to the top access opening. Close and secure the top access opening.

4. Open inlet valve and continue to fill the tank with water until it is fully pressurized.

START-UP INSTRUCTIONS
PLC PROGESSIVE CONTROLLER

Note: Read the controls description section located in this manual before proceeding.

With all piping and installation complete, and the mineral in the tank, proceed as follow:

1. Open the manual by-pass valve. The manual inlet and outlet valves are to remain closed.

2. Connect the power to the PLC controller. This operator interface display will light up. Advance the operator interface to the **Main Screen.**

3. Open the remote stager enclosure cover on Unit 1 and manually rotate the stager to the #1 (backwash) position. The stager motor will rotate back to the #4 (service) position. This is done to confirm the controller's homing signal is operational.

4. Manually advance the operator interface to the **Presets Screen.** Verify the cycle time and K factor are correct for your unit size. Change if required.

5. Manually advance the operator interface to the **Flow Rate Presets for Progressive Flow.** Verify the flow presets are correct for your unit using the flow chart in this manual. Change if required.

6. Manually advance the operator interface to the **Operator Control 1 Manually Start/Advance Regeneration.**

7. Advance Unit 1 to the backwash step. The unit 1 stager should rotate to the step 1 (backwash) position.

8. Slowly open the manual inlet supply valve. Do not open fully. Full flow of water could cause loss of media. Continue to fill slowly until all air is expelled and only water flows to the drain. Water will enter from the bottom of the resin tank as air is expelled from the top drain. If the system is supplied with an air vent make sure that the valve is open during this process.

9. When only water flows to the drain and out the air vent (if applicable), open the manual inlet valve all of the way. Backwash until the water looks clean when caught in a container.

10. Advance Unit 1 to the brine/slow rinse step. The Unit 1 stager should rotate to the step 2 brine/slow rinse position. There will be a slow flow to the drain.

11. While the Unit 1 is in the Brine/Slow Rinse position, check the level in the brine tank. The level should be dropping at a slow rate (approximately 2” per minute).

12. Advance Unit 1 to the Fast Rinse position. The Unit 1 stager should rotate to the step 3 (Fast rinse) position. There will be a high flow of water to the drain. Allow the water to flow to the drain until clear. During this time, the brine tank will fill with water until the float closes the brine tank valve. Check that all brine fittings are tight and that the water level in the brine tank is according to the unit specifications.

13. Advance Unit 1 to the service position. The unit 1 stager should rotate to the step 4 Service position. There will be no flow of water to the drain.

14. Perform steps 3-13 to the other units.

15. Fill the brine tank with the proper amount and type of salt recommended for use with the system. See RECOMMENDED TYPES OF SALT.

16. Close the manual by-pass valve and open all outlet valves fully. The system is now in service.

TRIPLE PROGRESSIVE SOFTENER
ELECTRICAL CONTROLS OPERATION

General - the main control panel (MCP) contains the programmable logic controller (PLC) and the operator interface (OIT). The system is controlled by the PLC. Operator intervention and control along with some program set point access is through the OIT. The PLC controls the system so that one or more units will be online (in service) based on flow demand. If flow is low then only one unit will be online. If flow increases past the set point for bringing the second unit online then the second unit will come online. When the flow increases above the set point for bringing the third unit online then the third unit will come online. As flow decreases, the additional units that were brought online will be taken offline to standby status. A unit will be automatically regenerated when its gallon batch throughput set point has been reached. A unit can also be manually forced into regeneration by using a pushbutton on the OIT. A regeneration lockout is built into the logic so that only one unit can be in regeneration at a time. This system is also capable of electronically removing any unit from service by putting it into an “OFFLINE” state. When any unit is offline it will not be allowed to go into service for any reason. Once the offline unit is placed back to “AUTO” it will become the third unit in priority.

NOTE:
FOLLOW ALL APPLICABLE CODES AND REGULATIONS WHEN WIRING IN THIS SYSTEM.

CAUTION:
VERIFY ALL POWER IS DISCONNECTED BEFORE SERVICING THE EQUIPMENT

COMMON TO MOST SCREENS:

- To change a value, press the corresponding yellow box. This will bring up a numeric keypad. Use the keypad to enter the desired number. Press enter when done.

- Screen change button - when this button is pressed it will bring up the screen changes screen.

ALL SCREEN ARE UNSECURED

OPERATOR INTERFACE SCREENS

SUMMARY

SCREEN 1- MAIN

SCREEN 2- SCREEN CHANGES

SCREEN 3- CYCLE TIMES (PRESETS 1)

SCREEN 4- MANUAL START/REGENERATION ADVANCE

SCREEN 5- FLOW DELAY PRESETS & FLOW RATE SETPOINTS

SCREEN 6- BATCHES

SCREEN 7- K-FACTORS

SCREEN 8- REGEN MODE & ELAPSED TIME OVERRIDE SETTING

SCREEN 9- TOTALIZERS

SCREEN 10- OFFLINE/AUTO SELECT

SCREEN 11- SYSTEM RESET/CONFIGURATION

SCREEN 12- ALARM BANNER/HISTORY

CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 1 - MAIN SCREEN

The main screen displays the following:

Unit- each unit is identified as A, B, C. The units themselves are referred to as A, B, C in a left to right sequence as you face the units from the front. Each unit's status is displayed under the unit identifier. The status indicates whether the unit is primary, secondary or third status. Primary (1) is the unit that is the first to be in service. As the flow increases the secondary (2) unit will be put into service. As the flow increases beyond adding the third (3) unit set point the third unit will be put into service.

Last Regen Status- directly below the unit identifier is a display that will indicate how that softener went into regen. The three states are:

Last regen was by batch
Last regen was time based
Last regen was manual

Mode- each unit's mode is displayed here. The modes indicate which cycle the unit is in. These can be any one of the following:

SERVICE
STANDBY
BACKWASH
BRINE/ SLOW RINSE
FAST RINSE

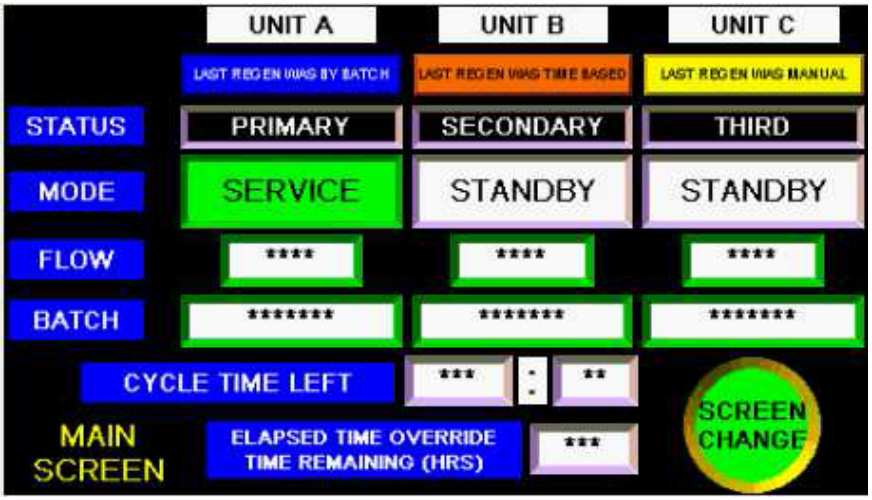
Flow- each units flow rate is shown here in gallons per minute (gpm)

Batch- each units gallons remaining in the batch is displayed here. This display counts the gallons down from the preset to zero.

Regeneration cycle time- in the lower part of the screen the regeneration cycle time remaining will be displayed if a unit is in regeneration.

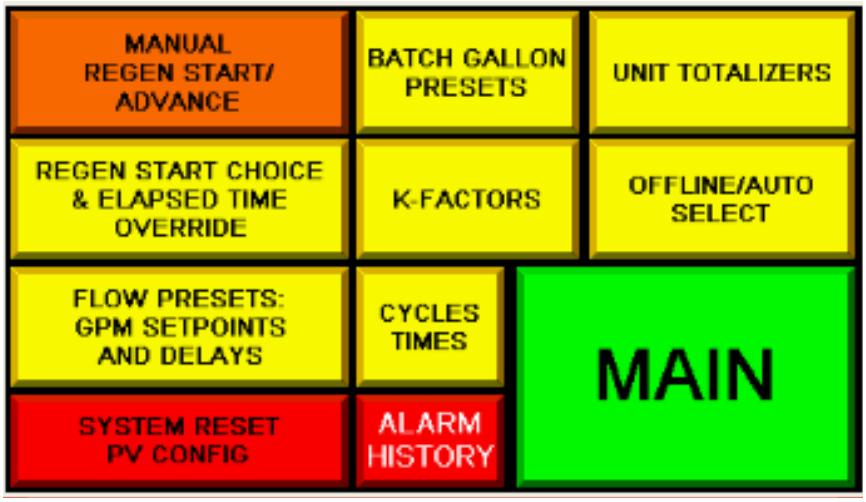
Elapsed Time Override Time Remaining- at the bottom of the screen is a field that will display the time remaining before a regen is initiated on the primary unit due to the elapsed time override time expiring. This will count down to zero if "elapsed time" or "both" is selected as the regen start choice.

CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 1 - MAIN SCREEN cont…



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 2- SCREEN CHANGES

This screen can be used to change to a different screen.



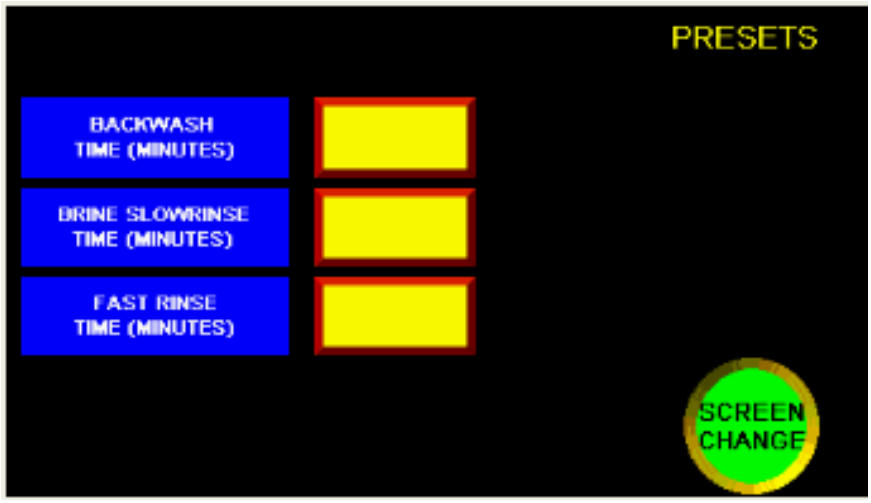
CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 3 - CYCLE TIME PRESETS SCREEN

This screen can be used to change the cycle times:

Backwash time in minutes
Brine Inj/Slow rinse time in minutes
Fast rinse time in minutes

Initial set points were as follows:

Backwash time in minutes = 10
Brine injection time in minutes = 60
Fast rinse time in minutes = 6



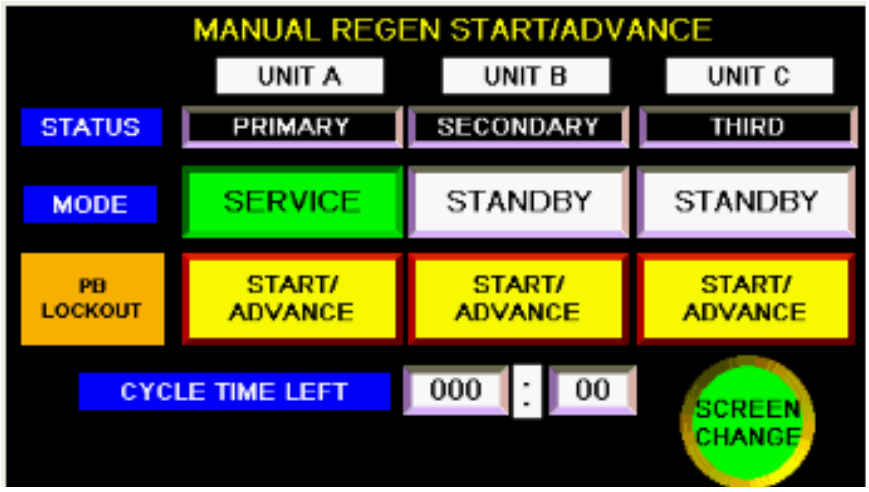
CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 4- MANUAL REGENERATION START/ADVANCE

This is the main screen used for manual operator regeneration start and advance. It is mainly used to manually start and advance a unit through it regeneration steps. Once a manual regeneration start is begun, regeneration cycle timing is automatic and the unit will advance automatically through the regeneration steps.

Below the mode for each unit is a pushbutton. This allows the operator to manually start a regeneration on any of the units.
Once in regeneration this button also allows the operator to manually advance the unit to its next regeneration cycle. Only one unit can be sent into regeneration at a time.

There is a 3 second delay on these buttons to verify operator intent.

If another unit is currently in regeneration the program will not allow another unit to be manually sent into regeneration via its button. There is no memory of this button being depressed if another unit is already in regeneration.



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 5- FLOW DELAY PRESETS & FLOW RATE PRESETS SCREEN

This screen can be used to change the following set points:

Delay time (seconds) before the second unit will be added due to flow exceeding the “add second unit set point”.

Delay time (seconds) before the second unit will be taken off-line due to flow decreasing below the “add second unit set point”.

Delay time (seconds) before the third unit will be added due to flow exceeding the “add third unit set point”.

Delay time (seconds) before the third unit will be taken off-line due to flow decreasing below the “add third unit setpoint”.

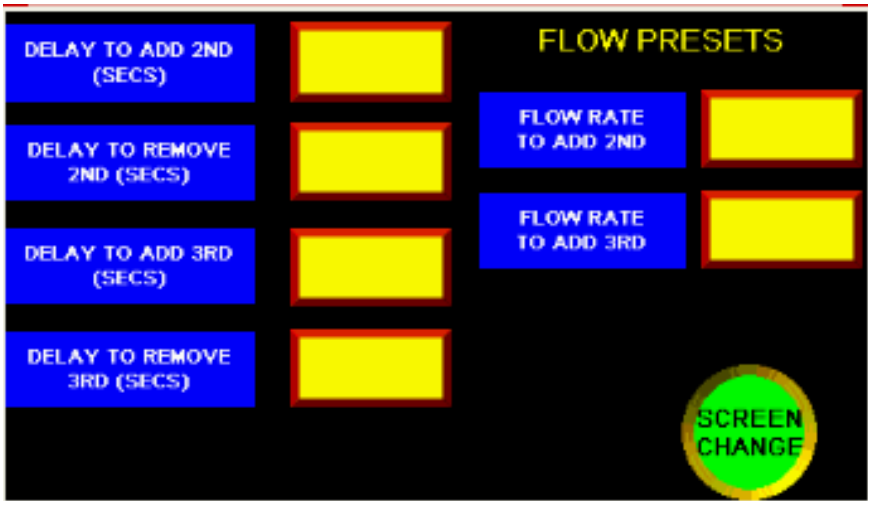
Flow rate to add second unit online-this set point is the value in which the second unit will be brought online. When the flow rate exceeds this flow rate value for the preset delay the second unit will be brought on line. If the total flow rate decreases below set point for a delayed amount of time the second unit will be taken offline.

Flow rate to add third unit online-this set point is the value in which the third unit will be brought online. When the flow rate exceeds this flow rate value for the preset delay the third unit will be brought on line. If the total flow rate decreases below set point for a delayed amount of time the third unit will be taken offline.

Initial flow rate to add 2nd unit = 190 GPM

Initial flow rate to add 3rd unit = 380 GPM

CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 5 - FLOW DELAY PRESETS & FLOW RATE PRESETS SCREEN cont…



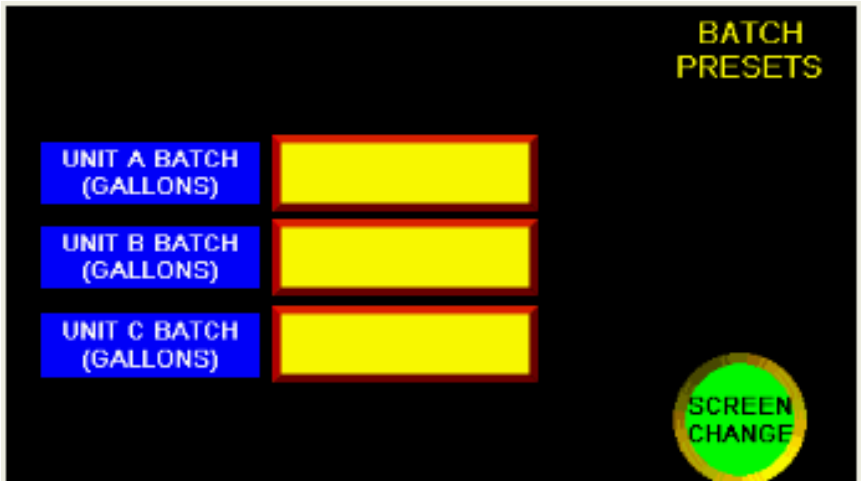
CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 6 - BATCH PRESETS SCREEN

This screen can be used to change the batch setpoints:

Batch- This is the amount of gallons that can pass through a unit before it needs to be regenerated. This needs to be set in the field after knowing the hardness.

Initial set points were as follows:

Batch = 40500



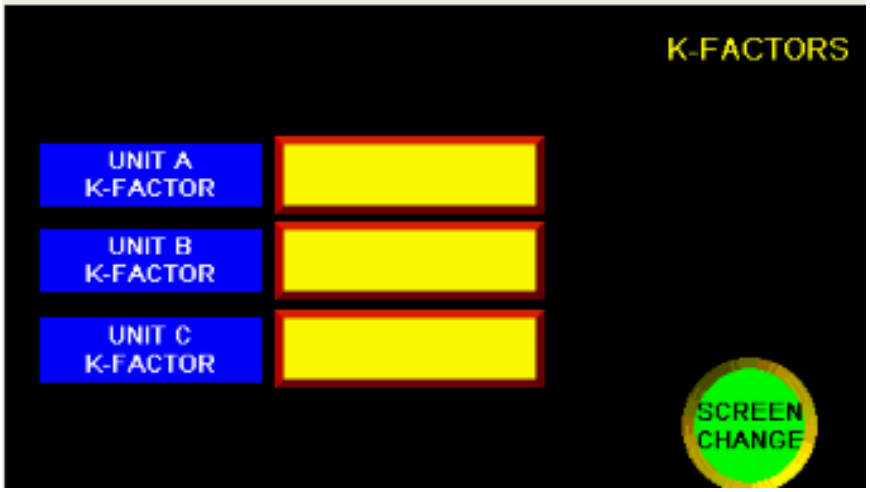
CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 7 - K-FACTOR PRESETS SCREEN

This screen can be used to change the unit K-factor:

K-FACTOR- This is the pulses per gallon that the flow sensor sends to the PLC. It varies according to the type and size of the pipe and the flow sensor fitting.

Initial set points were as follows:

K-factor = 23.22



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 8 – REGENERATION MODE SELECT & ELAPSED TIME OVERRIDE SETTING

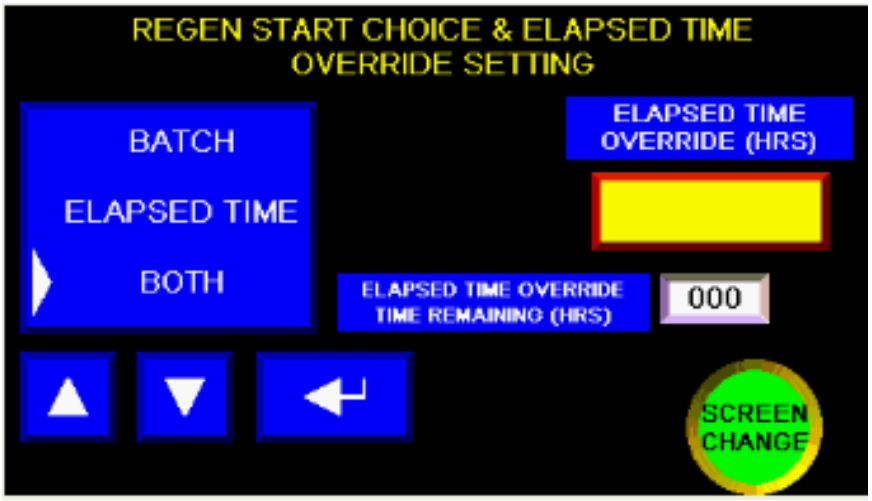
Use this screen to change the regeneration mode of the softener system. The modes are as follows:

Batch– When the unit batch counts down to zero a regeneration will automatically be started on that unit.

Elapsed Time- Regeneration will start once the elapsed time override time entered expires.

Both– Regeneration will start when either the batch or elapsed time override time expires.

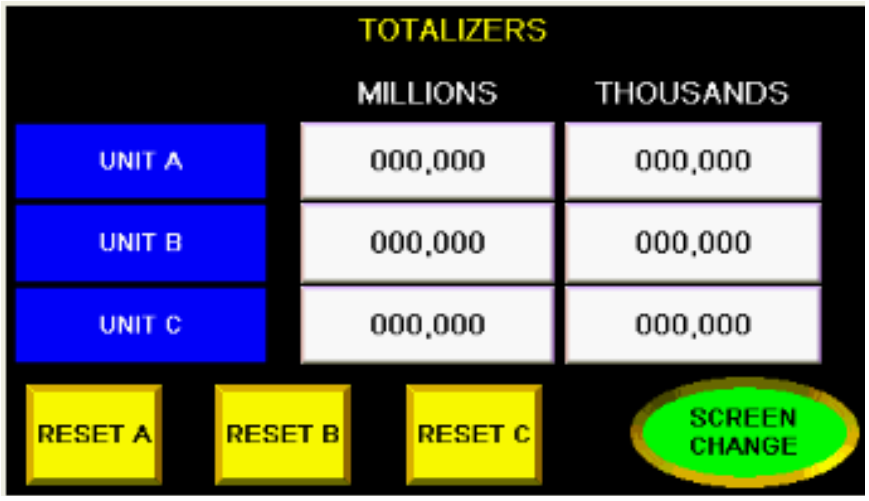
Elapsed Time Override- enter the number of hours that must pass before the primary unit in service goes into regen. This time entry will only be valid if the regen start choice is elapsed time or both. The time remaining is displayed below this entry.



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 9 - TOTALIZERS

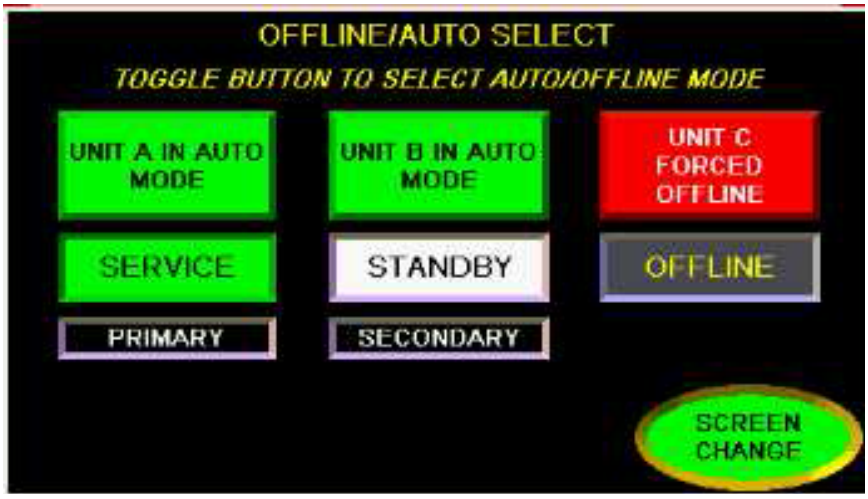
This screen is used to view the number of gallons have passed for any unit while it was in service.

To reset any units' totalizer press the corresponding button at the bottom of the screen.
-There is a 3 second delay on the totalizer reset buttons to verify operator intent.



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 10 - ONLINE/OFFLINE

This screen can be used to remove the unit from service for maintenance purposes. This will take the unit out of the logic rotation. No unit can be forced offline or back online if it or another unit is currently in regeneration.



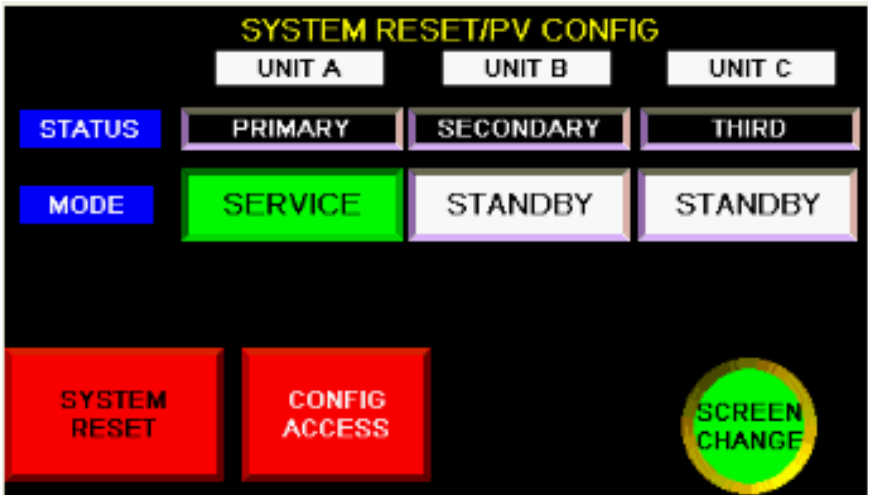
CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 11- SYSTEM RESET & CONFIG ACCESS

This screen allows the system to be reset or allows access to the configuration of the OIT.

System reset- this button when depressed for a minimum of 5 continuous seconds will reset the system. This will take any unit that is currently in regeneration out of regeneration to service or standby.

Unit A will be set as primary, B as secondary and C as third.

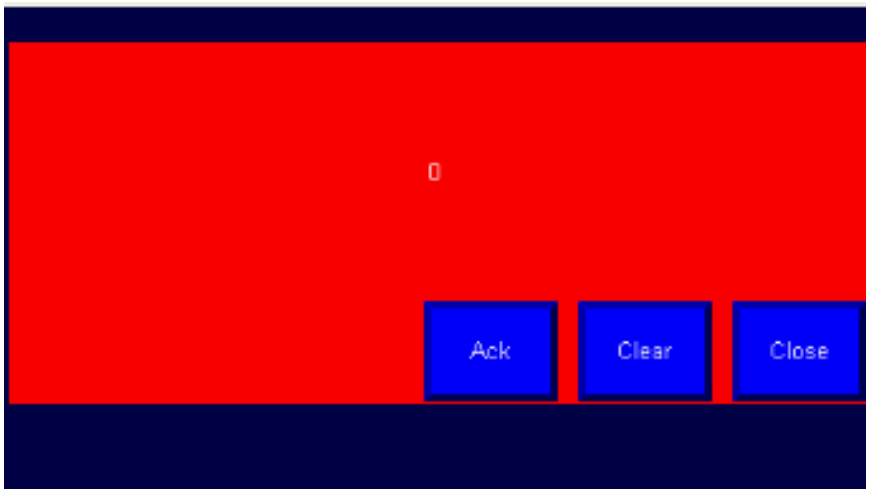
Config access- this allows the operator to go to the OIT configuration menu. This has already been preset and access to this should not be necessary.



CONTROLS CONTINUED:
OPERATOR INTERFACE SCREENS
SCREEN 12- ALARM HISTORYBANNER

The alarm history screen displays the date and time of any fault or alarm. Next to the date will be the actual alarm message.

Press the acknowledge button to acknowledge the alarm.



CONTROLS CONTINUED
OPERATOR INTERFACE SCREENS

Screen Saver- after 10 minutes of no activity on the screen, the screen will go blank. This is the screen saver. Press any key on the OIT and the screens will come back on.

STAGER OPERATION

STAGERS-Each stager is located in its own enclosure on the individual units themselves. They operate the diaphragm vales on the unit. The stager has multiple ports on it to pressurize and vent diaphragm valves in order to open and close them. Pressure to a valve opens the valve. A vent to a valve allows the valve to open. The stager has 4 numbers on its indexing wheel inside of the enclosure. Each position represents a different regeneration cycle. 4= service/standby, 1= backwash, 2= brine/slow rinse, 3= fast rinse.

If for some reason power is disrupted the stager can be manually rotated to the different positions in order to manually regenerate the unit.

Stager Homing- if for some reason the stager gets out of sync with the PLC, the PLC will drive the stager back to its service #4 position. This can occur if someone manually rotates the stager out of service while there is power to the unit. This is designed to correct the situation if someone happens to tamper with the stagers.

SOLENOIDS- there are solenoids mounted on the side of each stager enclosure. They are used to override the stager.

The solenoid is used to override the service outlet valve. It will force the valve shut if flow demand does not call for that unit to be on line.

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. MR-300 has 300,000 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 MR-300-2

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

Using our equation take 300,000 ÷ 20 = 15,000 gallons.

10% reserve capacity = 1500 gallons.

15,000 gallons – 1500 gallons = 13, 500 gallons (batch size)

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 SOFTENER GENERAL OPERATION

Hard water passes through the valve manifold into the top of the softener tank. It flows downward through the mineral bed and out through the bottom of the tank to service. As the water passes through the mineral bed, the hardness present is removed through the process of ion exchange and at the same time sediment present is removed by filtration action of the mineral.

Once the mineral has extracted all the hardness it can, it must be regenerated and have its capacity restored by the following procedure:

1. **Backwash:** The flow through the mineral bed is reversed and allowed to flow to drain. The up-flow action washes any sediment or foreign material collected in the unit out to drain. At the same time the mineral itself is restratified, thereby eliminating any possibility of channeling (approximately 10 minutes).

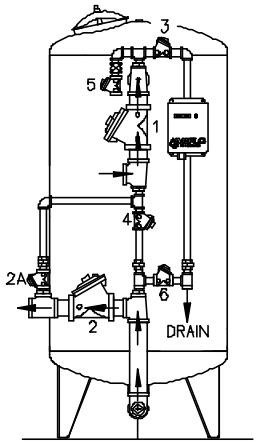
2. **Brine/Rinse:** The flow through the unit is returned to down-flow to drain at a slow controlled rate and during the first stage of this step the brine is injected to react with the mineral and restore its softening capacity. The second stage of this step is a continued slow flow of water to rinse all of the exchanged hardness and salt from the unit before its return to service (approximately 60 minutes).

3. **Fast Flush:** The downward flow to drain in this step is increased to a high rate which will repack the mineral bed and remove the last traces of salt and hardness from the regenerated equipment just before its return to service (approximately 6 minutes).

FLOW DIAGRAM

CYCLE #4 SERVICE

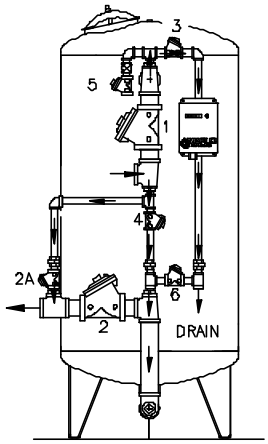
VALVES OPEN: 1,2
VALVES CLOSED: 2A,3,4,5,6



NOTE: BY PASS VALVE 2A IS INCLUDED ON SINGLE UNITS ONLY.

CYCLE #1 BACKWASH

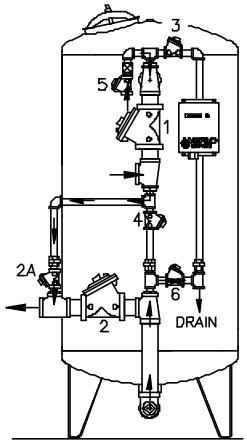
VALVES OPEN: 2A,3,4
VALVES CLOSED: 1,2,5,6



NOTE: BY PASS VALVE 2A IS INCLUDED ON SINGLE UNITS ONLY.

CYCLE #2 BRINE/RINSE

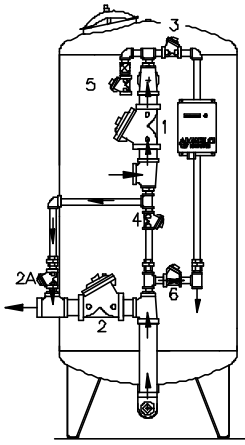
VALVES OPEN: 2A,5,6
VALVES CLOSED: 1,2,3,4



NOTE: BY PASS VALVE 2A IS INLCUDED ON SINGLE UNITS ONLY.

CYCLE #3 FAST FLUSH

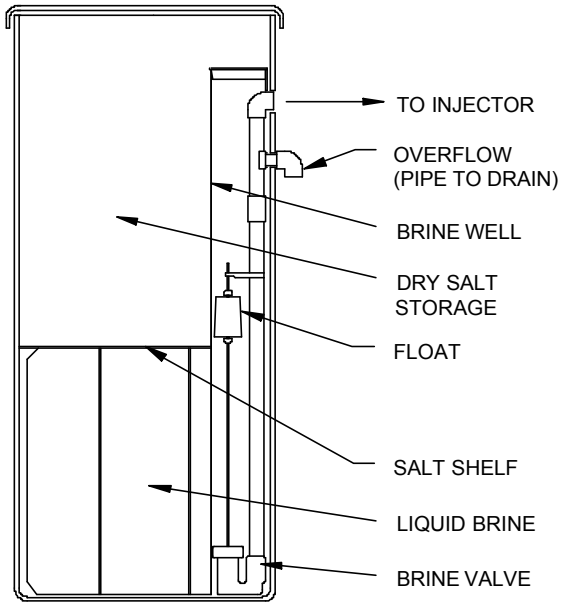
VALVES OPEN: 1,2A,6
VALVES CLOSED: 2,3,4,5



NOTE: BY PASS VALVE 2A IS INCLUDED ON SINGLE UNITS ONLY

BRINE MAKER OPERATION

The brine-maker is an automatic brining system, which is easily adjusted to provide maximum operating efficiency of your water softener. It is a combination salt storage and brine-measuring tank complete with an automatic valve.



The brine-maker consists of:

1. An open brine tank with a platform dividing it into sections:
   - The upper section is used for dry salt storage
   - The lower section for brine storage.

2. An automatic brine valve which is housed in a closed tube or “well”.

After each regeneration, water flows from the brine valve and into the brine tank. When the water level rises slightly above the platform, a float closes the automatic brine valve. Salt slowly dissolves to form concentrated brine.

As brine is formed, the liquid volume increases and the level rises in the salt. The resulting level may be 2 to 10 inches above the platform depending on the amount of salt for regeneration.

During regeneration, the brine injector creates suction, which opens the brine valve and draws into the softener tank. When the brine level falls below the brine valve, the valve seats and prevents air from entering the system.

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.

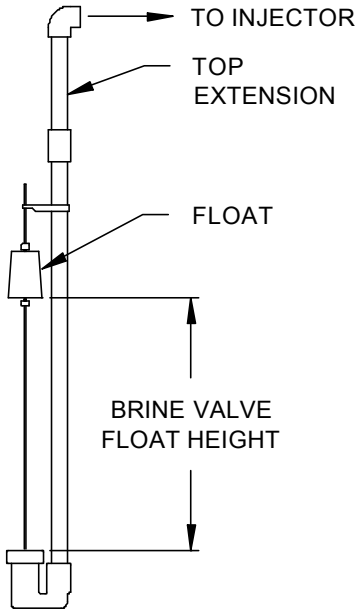
MINIMUM SALTING ADJUSTMENT

Minimum salting is the most efficient use of salt. But it does minimize the capacity of the unit, which will decrease the time between regenerations. **Only** make this adjust after the unit has completed a brine tank refill step and the water level was checked to be above the salt platform. Follow these instructions to adjust your unit to regenerate with minimum salt usage.

- Adjust brine tank refill time to the minimum setting according to the specification table. Refer to the "Setting the regeneration cycle timer page.

- Monitor the water daily for hardness. It may also be necessary to adjust the regeneration frequency, since the capacity of the unit has changed.

1. Remove brine valve assembly from brine well.
2. Remove air check from assembly.
3. Shorten the riser tube by removing the top extension pipe.
4. Reassemble brine valve assembly.
5. Reinstall the assembly into the brine well.
   The assembly will no longer reach the bottom of the brine tank.



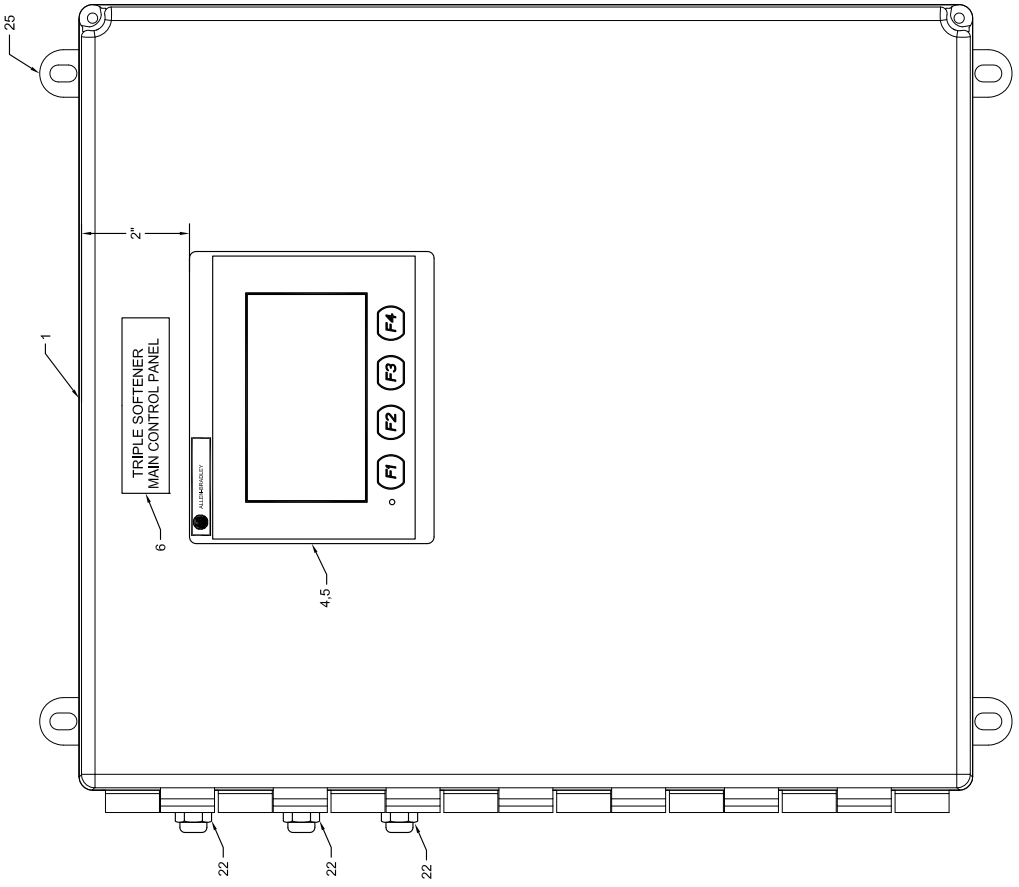
Flow Rate Trip Point Table
Program Values for A, B, C & D

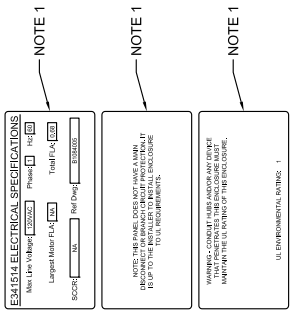
MODEL		Alternating Operation (gpm)		Parallel Operation (gpm)			
		Second Unit Trip Flow Range		Second Unit Trip Flow Range		*Third Unit Trip Flow Range	
Exchange Capacity	Pipe Size	Min **A**	Max **B**	Min **A**	Max **B**	Min **C**	Max **D**
150	1	30	40	7	30	15	60
150	1 1/4	40	60	10	40	20	80
150	1 1/2	50	80	15	50	30	100
150	2	70	100	25	70	50	140
210	1 1/4	40	60	10	40	20	80
210	1 1/2	60	90	15	60	30	120
210	2	80	120	25	80	50	160
210	2 1/2	110	160	30	110	60	220
300	1 1/2	70	100	15	70	30	140
300	2	90	130	25	90	50	180
300	2 1/2	120	190	35	140	70	280
300	3	140	230	50	160	100	320
450	1 1/2	70	90	15	60	30	120
450	2	110	120	25	80	50	160
450	2 1/2	140	170	35	120	70	240
450	3	175	190	50	140	100	280
600	1 1/2	90	100	20	70	40	140
600	2	110	130	25	110	50	220
600	2 1/2	140	190	35	140	70	280
600	3	175	250	50	175	100	350
750	2	90	120	25	90	50	180
750	2 1/2	140	190	35	140	70	280
750	3	160	230	50	160	100	320
900	2	105	140	30	105	60	210
900	2 1/2	150	220	35	150	70	300
900	3	190	280	50	190	100	380
1050	2	95	130	40	95	80	190
1050	2 1/2	145	210	45	145	90	290
1050	3	175	260	50	175	100	350

K FACTOR Table

PIPE SIZE (Inches)	Program values for **XX**				
	TEE Galvanized	TEE PVC	SADDLE Iron	SADDLE PVC	WELDOLET Carbon Steel
1	213	352			
1 1/4	128	177			
1 1/2	94	118			
2	59	67	54	67	
2 1/2		43	38	43	38
3		27	23	27	24
4		15	13	15	14
6			7	8	8

Seqn	Item Number	Vendor No	Qty	Description
1	A2147029	A16148CHSCFG	1	ENCLOSURE 16X14X8 FRP SCREW CVR
2	A2148010	A16P14	1	SUBPANEL 16 X 14
4	A2586066	2711R-T4T	1	PANELVIEW PV800 COLOR TOUC (2711R-T4T)
5	A2325005	1761-CBL-PM02	1	CABLE ASSY 1761-CBL-PM02
6	A2150200	200221 BEVADH	1	NAMEPLATE 7/8X3.25 BLANK W/TAPE WHT
8	A2242132	41D397	1	TRANSFORMER 100VA 120V TO 24VAC(41D397)
9	A2331075	2902992	1	POWER SUPPLY 2.5A (60W) STEP 24VDC UL(2902992)
10	A2554080	FAZ-C5/1-NA-SP	1	CIRCUIT BREAKER UL/CSA 5A C CURVE(FAZ-C5/1-NA-SP)
12	A2331001	1762-L24BWA	1	CONTROL MICRO 1200 PLC 120V BWA
13	A2547018	G75X2WH6	4	DUCT WIRE 3/4 X 2 WHITE (G75X2WH6)
14	A2103154	C.75WH6	4	COVER 3/4 WHITE .75WH6
15	A2307004	1492-F2	47	BLOCK TERMINAL
16	A2318002	1492-N18	2	BARRIER TERMINAL END (1492N18)
17	A2307007	1492-N23	4	ANCHOR END TERMINAL BLOCK
18	A2307056	249-116	4	ANCHOR DIN RAIL WAGO (249-116)
20	A2199009	1171007	8	WASHER #8 FLAT SS
21	A2457007	72522	8	SCREW 8-32X3/8 MACH PH HD SS
22	A2394007	3444-01-W3165	3	GRIP CORD .064-.210 (3444-01)
23	A2173046	MTW18GY	20	WIRE MTW 18 STRANDED GRAY
23	A2173014	MTW18BEX2500	10	WIRE MTW 18 STRANDED BLUE(2500' RL)
23	A2173005	MTW18WE	10	WIRE MTW 18 STRANDED WHITE
23	A2173004	MTW18RD	20	WIRE MTW 18 STRANDED RED(500' RL)
23	A2173003	MTW18GN	1	WIRE MTW 18 STRANDED GREEN
23	A2173002	MTW18BK	1	WIRE MTW 18 STRANDED BLACK
24	A2595003	LAMA2-14-QY	1	LUG GROUND ALUM 2-14AWG 1/4 STUD
25	A2619003	LOT PRICING - Q	4	TAB MOUNT ALUMINUM ELECTR LRG HOLE





NOTES:

1. LOCATE LABEL ON INSIDE OF ENCLOSURE DOOR.
2. REFERENCE DWG. B1047151-B FOR SUB-PANEL LAYOUT.

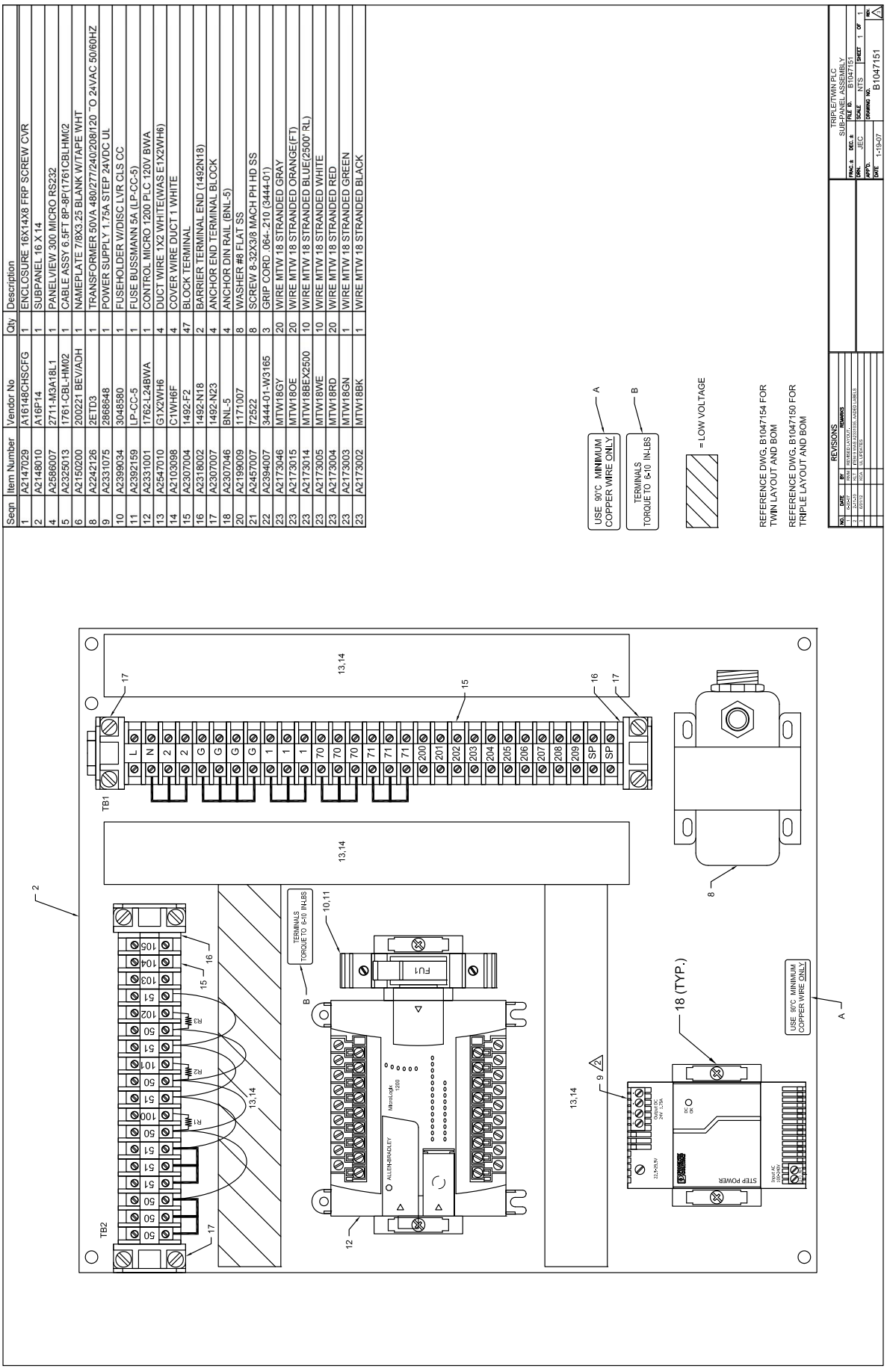
NO.	DATE	BY	REVISIONS REMARKS

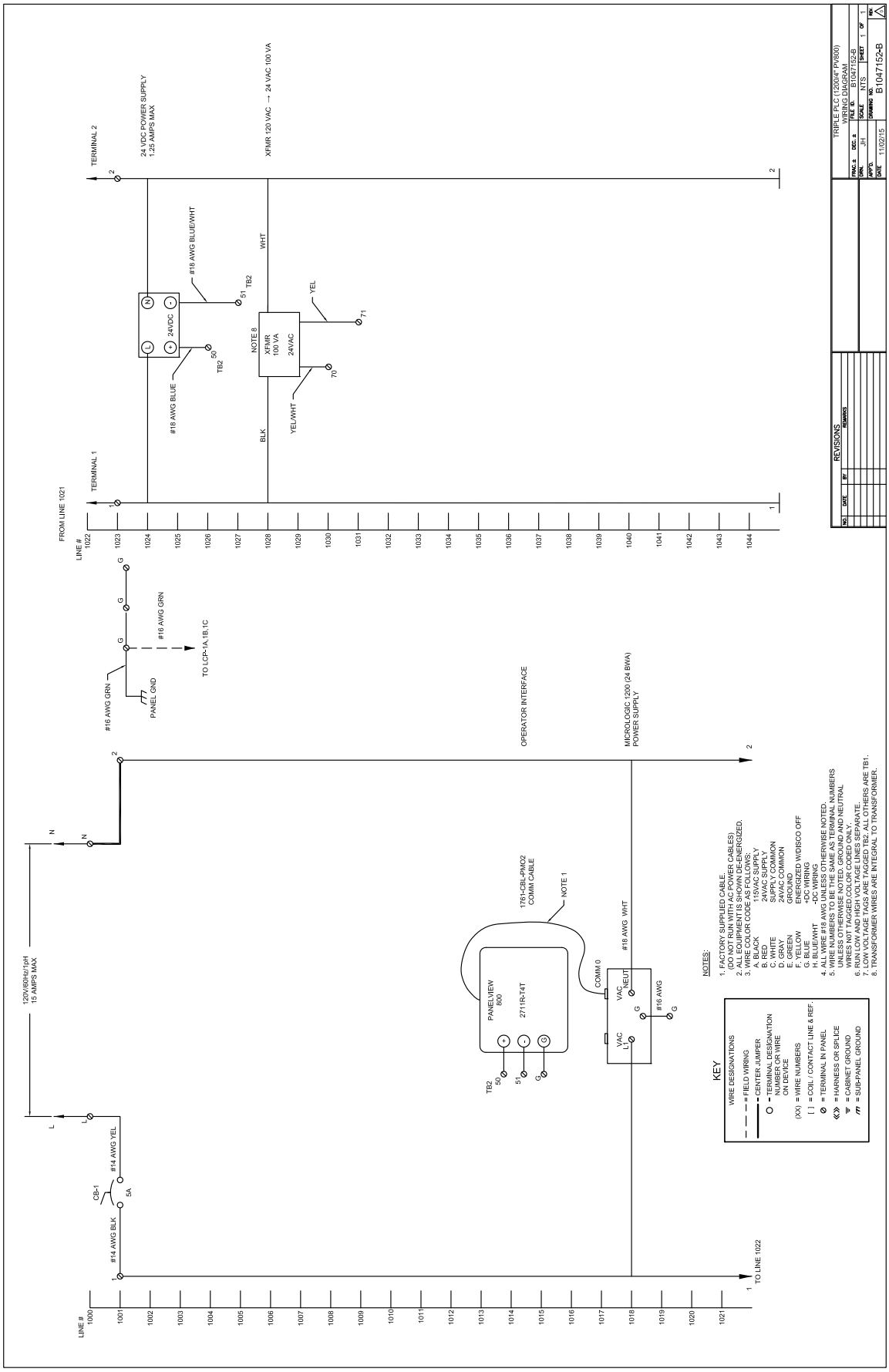
TRIPLE PLC (1200M1 PV800)
ENCLOSURE ASSEMBLY

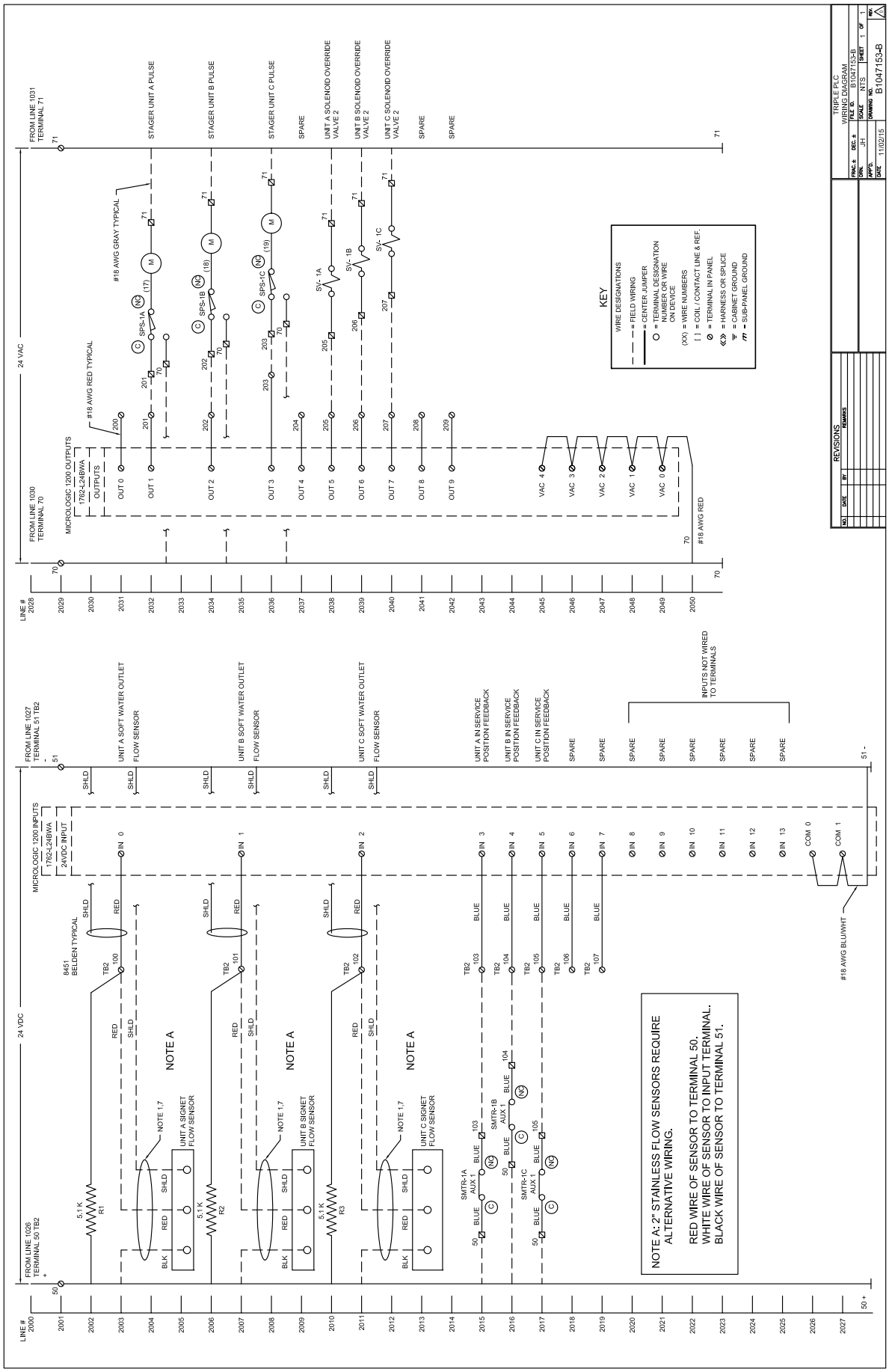
FRAC. ±	DEC. ±	FILE ID	B1047150-B
DRN.	JH	SCALE	NTS
APP'D.		DRAWING NO.	B1047150-B
DATE	11/02/15		

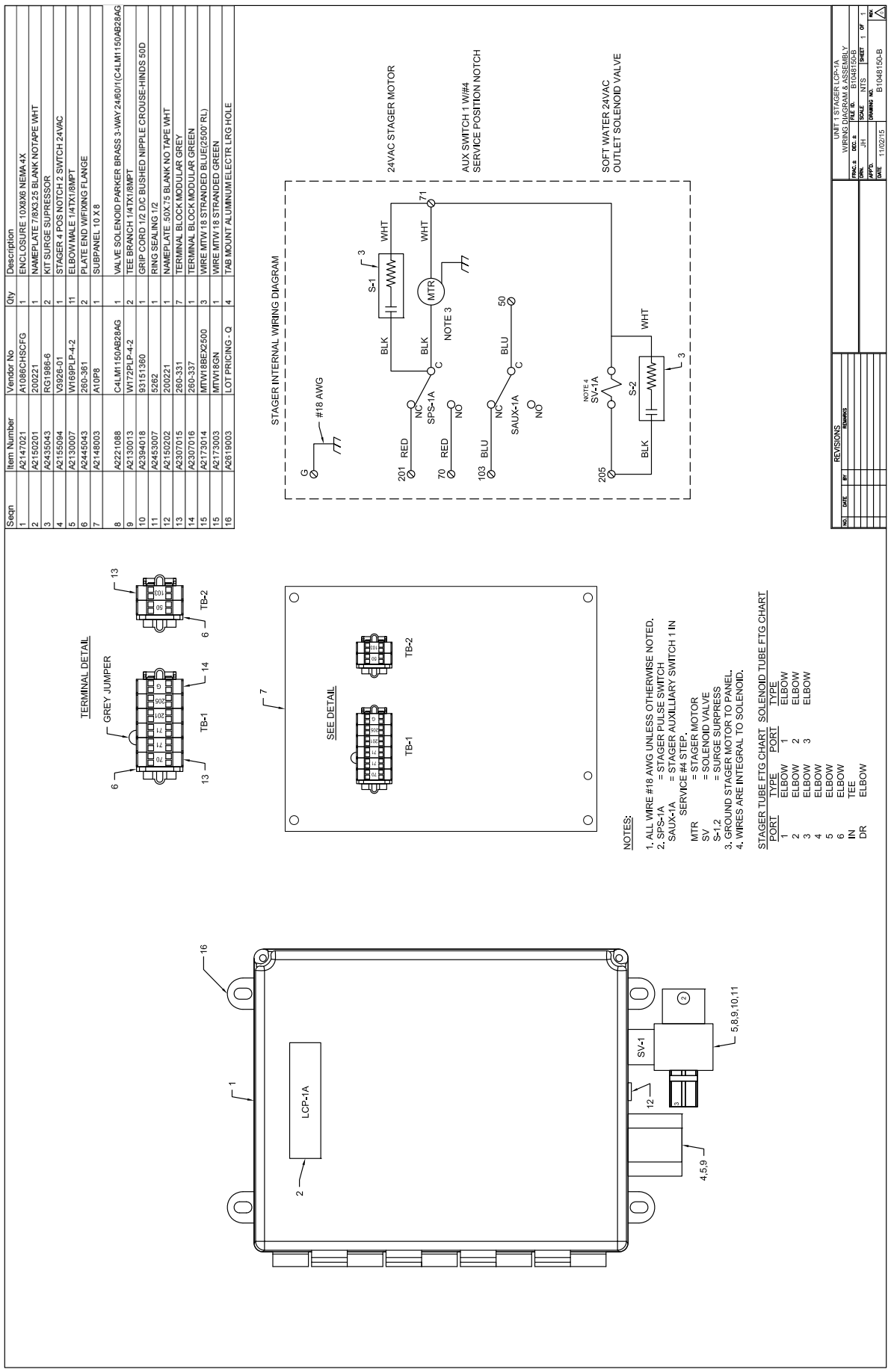
SHEET 1 OF 1
REV A

Seqn	Item Number	Vendor No	Qty	Description
1	A2147029	A16148CHSCFG	1	ENCLOSURE 16X14X8 FRP SCREW CVR
2	A2148010	A16P14	1	SUBPANEL 16 X 14
4	A2586007	2711-M3A18L1	1	PANELVIEW 300 MICRO RS232
5	A2325013	1761-CBL-HM02	1	CABLE ASSY 6.5FT 8P-8P(1761CBLHM02
6	A2150200	200221 BEV/ADH	1	NAMEPLATE 7/8X3.25 BLANK W/TAPE WHT
8	A2242126	2ETD3	1	TRANSFORMER 50VA 480/277/240/208/120 ~O 24VAC 50/60HZ
9	A2331075	2868648	1	POWER SUPPLY 1.75A STEP 24VDC UL
10	A2399034	3048580	1	FUSEHOLDER W/DISC LVR CLS CC
11	A2392159	LP-CC-5	1	FUSE BUSSMANN 5A (LP-CC-5)
12	A2331001	1762-L24BWA	1	CONTROL MICRO 1200 PLC 120V BWA
13	A2547010	G1X2WH6	4	DUCT WIRE 1X2 WHITE(WAS E1X2WH6)
14	A2103098	C1WH6F	4	COVER WIRE DUCT 1 WHITE
15	A2307004	1492-F2	47	BLOCK TERMINAL
16	A2318002	1492-N18	2	BARRIER TERMINAL END (1492N18)
17	A2307007	1492-N23	4	ANCHOR END TERMINAL BLOCK
18	A2307046	BNL-5	4	ANCHOR DIN RAIL (BNL-5)
20	A2199009	1171007	8	WASHER #8 FLAT SS
21	A2457007	72522	8	SCREW 8-32X3/8 MACH PH HD SS
22	A2394007	3444-01-W3165	3	GRIP CORD .064-.210 (3444-01)
23	A2173046	MTW18GY	20	WIRE MTW 18 STRANDED GRAY
23	A2173015	MTW18OE	20	WIRE MTW 18 STRANDED ORANGE(FT)
23	A2173014	MTW18BEX2500	10	WIRE MTW 18 STRANDED BLUE(2500' RL)
23	A2173005	MTW18WE	10	WIRE MTW 18 STRANDED WHITE
23	A2173004	MTW18RD	20	WIRE MTW 18 STRANDED RED
23	A2173003	MTW18GN	1	WIRE MTW 18 STRANDED GREEN
23	A2173002	MTW18BK	1	WIRE MTW 18 STRANDED BLACK

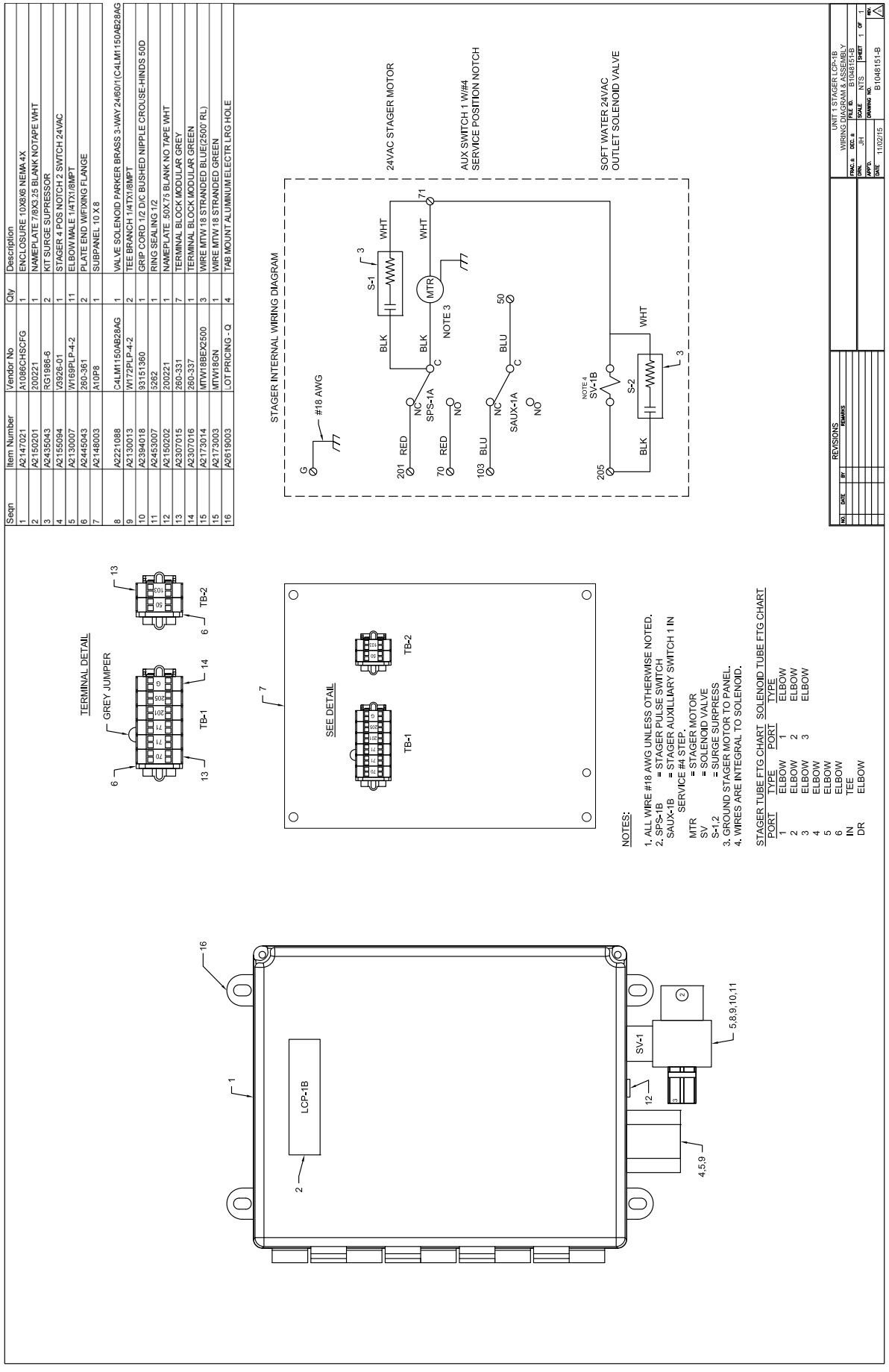



TRIPLE PLC (1200A* PV800)
WIRING DIAGRAM
B1047152-B
REVISIONS
TERMINAL 2
TERMINAL 1
FROM LINE 1021
24 VDC POWER SUPPLY
1.25 AMPS MAX
XFMR 120 VAC → 24 VAC 100 VA
#18 AWG BLUE/WHT
#18 AWG BLUE
YEL/WHT
BLK
WHT
YEL
NOTE 8
XFMR
100 VA
24VAC
24VDC
TB2
50
51
70
71
#16 AWG GRN
PANEL GND
TO LCP-1A,1B,1C
OPERATOR INTERFACE
MICROLOGIC 1200 (24 BWA)
POWER SUPPLY
1761-CBL-PM02
COMM CABLE
NOTE 1
PANELVIEW
800
2711R-T4T
COMM 0
VAC
L1
VAC
NEUT
#18 AWG
#14 AWG BLK
#14 AWG YEL
CB-1
5A
120V/60Hz/1pH
15 AMPS MAX
TO LINE 1022
LINE #
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
KEY
WIRE DESIGNATIONS
= FIELD WIRING
= CENTER JUMPER
= TERMINAL DESIGNATION NUMBER OR WIRE COLOR CODE
(XX) = WIRE NUMBERS
[ ] = COIL / CONTACT LINE & REF.
= TERMINAL IN PANEL
= HARNESS OR SPLICE
= CABINET GROUND
= SUB-PANEL GROUND
NOTES:
1. FACTORY SUPPLIED CABLE. (DO NOT RUN WITH AC POWER CABLES).
2. ALL EQUIPMENT IS SHOWN DE-ENERGIZED.
3. WIRE COLOR CODE AS FOLLOWS:
A. BLACK 115VAC SUPPLY
B. RED 24VAC SUPPLY
C. WHITE SUPPLY COMMON
D. GRAY 24VAC COMMON
E. GREEN GROUND
F. YELLOW ENERGIZED W/DISCO OFF
G. BLUE +DC WIRING
H. BLUE/WHT -DC WIRING
4. ALL WIRE #18 AWG UNLESS OTHERWISE NOTED.
5. WIRE NUMBERS TO BE THE SAME AS TERMINAL NUMBERS UNLESS OTHERWISE NOTED. EXCEPTION: LOW AND NEUTRAL WIRES NOT TAGGED COLOR CODED ONLY.
6. RUN LOW AND HIGH VOLTAGE LINES SEPARATE.
7. LOW VOLTAGE TAGS ARE TAGGED TB2, ALL OTHERS ARE TB1.
8. TRANSFORMER WIRES ARE INTEGRAL TO TRANSFORMER.


TRIPLE PLC WIRING DIAGRAM
FILE ID. B1047153-B
SCALE NTS
DRAWING NO. B1047153-B
DRAWN JH
DATE 11/02/15
REVISIONS
REMARKS
KEY
WIRE DESIGNATIONS
= FIELD WIRING
= CENTER JUMPER
= TERMINAL DESIGNATION NUMBER OR WIRE ON DEVICE
(XX) = WIRE NUMBERS
[ ] = COIL / CONTACT LINE & REF.
= TERMINAL IN PANEL
= HARNESS OR SPLICE
= CABINET GROUND
= SUB-PANEL GROUND
MICROLOGIC 1200 INPUTS
1762-L24BWA
24VDC INPUT
MICROLOGIC 1200 OUTPUTS
1762-L24BWA
OUTPUTS
24 VDC
24 VAC
FROM LINE 1025 TERMINAL 50 TB2
FROM LINE 1027 TERMINAL 51 TB2
FROM LINE 1030 TERMINAL 70
FROM LINE 1031 TERMINAL 71
8451 BELDEN TYPICAL
#18 AWG RED TYPICAL
#18 AWG GRAY TYPICAL
#18 AWG BLU/WHT
NOTE A
NOTE 1.7
UNIT A SIGNET FLOW SENSOR
UNIT B SIGNET FLOW SENSOR
UNIT C SIGNET FLOW SENSOR
UNIT A SOFT WATER OUTLET FLOW SENSOR
UNIT B SOFT WATER OUTLET FLOW SENSOR
UNIT C SOFT WATER OUTLET FLOW SENSOR
UNIT A IN SERVICE POSITION FEEDBACK
UNIT B IN SERVICE POSITION FEEDBACK
UNIT C IN SERVICE POSITION FEEDBACK
SPARE
INPUTS NOT WIRED TO TERMINALS
STAGER UNIT A PULSE
STAGER UNIT B PULSE
STAGER UNIT C PULSE
UNIT A SOLENOID OVERRIDE VALVE 2
UNIT B SOLENOID OVERRIDE VALVE 2
UNIT C SOLENOID OVERRIDE VALVE 2
SMTR-1A AUX 1
SMTR-1B AUX 1
SMTR-1C AUX 1
SPS-1A
SPS-1B
SPS-1C
SV- 1A
SV- 1B
SV- 1C
NOTE A: 2" STAINLESS FLOW SENSORS REQUIRE ALTERNATIVE WIRING.
RED WIRE OF SENSOR TO TERMINAL 50.
WHITE WIRE OF SENSOR TO INPUT TERMINAL.
BLACK WIRE OF SENSOR TO TERMINAL 51.


Seqn | Item Number | Vendor No | Qty | Description
1 | A2147021 | A1086CHSCFG | 1 | ENCLOSURE 10X8X6 NEMA 4X
2 | A2150201 | 200221 | 1 | NAMEPLATE 7/8X3.25 BLANK NOTAPE WHT
3 | A2435043 | RG1986-6 | 2 | KIT SURGE SUPRESSOR
4 | A2155094 | V3926-01 | 1 | STAGER 4 POS NOTCH 2 SWITCH 24VAC
5 | A2130007 | W169PLP-4-2 | 11 | ELBOW MALE 1/4TX1/8MPT
6 | A2445043 | 260-361 | 2 | PLATE END W/FIXING FLANGE
7 | A2148003 | A10P8 | 1 | SUBPANEL 10 X 8
8 | A2221088 | C4LM1150AB28AG | 1 | VALVE SOLENOID PARKER BRASS 3-WAY 24/60/1(C4LM1150AB28AG
9 | A2130013 | W172PLP-4-2 | 2 | TEE BRANCH 1/4TX1/8MPT
10 | A2394018 | 93151360 | 1 | GRIP CORD 1/2 DIC BUSHED NIPPLE CROUSE-HINDS 50D
11 | A2453007 | 5262 | 1 | RING SEALING 1/2
12 | A2150202 | 200221 | 1 | NAMEPLATE .50X.75 BLANK NO TAPE WHT
13 | A2307015 | 260-331 | 7 | TERMINAL BLOCK MODULAR GREY
14 | A2307016 | 260-337 | 1 | TERMINAL BLOCK MODULAR GREEN
15 | A2173014 | MTW18BEX2500 | 3 | WIRE MTW 18 STRANDED BLUE(2500' RL)
15 | A2173003 | MTW18GN | 1 | WIRE MTW 18 STRANDED GREEN
16 | A2619003 | LOT PRICING - Q | 4 | TAB MOUNT ALUMINUM ELECTR LRG HOLE
STAGER INTERNAL WIRING DIAGRAM
#18 AWG
G
24VAC STAGER MOTOR
AUX SWITCH 1 W/#4
SERVICE POSITION NOTCH
SOFT WATER 24VAC
OUTLET SOLENOID VALVE
S-1
WHT
BLK
MTR
NOTE 3
SPS-1A
NC
NO
C
RED
201
70
71
50
103
BLU
SAUX-1A
NOTE 4
SV-1A
S-2
205
3
TERMINAL DETAIL
GREY JUMPER
TB-1
TB-2
SEE DETAIL
NOTES:
1. ALL WIRE #18 AWG UNLESS OTHERWISE NOTED.
2. SPS-1A = STAGER PULSE SWITCH
SAUX-1A = STAGER AUXILLIARY SWITCH 1 IN SERVICE #4 STEP.
MTR = STAGER MOTOR
SV = SOLENOID VALVE
S-1,2 = SURGE SURPRESS
3. GROUND STAGER MOTOR TO PANEL.
4. WIRES ARE INTEGRAL TO SOLENOID.
STAGER TUBE FTG CHART SOLENOID TUBE FTG CHART
PORT TYPE PORT TYPE
1 ELBOW 1 ELBOW
2 ELBOW 2 ELBOW
3 ELBOW 3 ELBOW
4 ELBOW
5 ELBOW
6 ELBOW
IN TEE
DR ELBOW
LCP-1A
SV-1
4,5,9
5,8,9,10,11
12
REVISIONS
NO. DATE BY REMARKS
UNIT 1 STAGER LCP-1A
WIRING DIAGRAM & ASSEMBLY
FRAC.± DEC.± FILE ID. B1048150-B
DRWN JH SCALE NTS SHEET 1 OF 1
APPD. DRAWING NO. B1048150-B REV
DATE 11/02/15

Seqn	Item Number	Vendor No	Qty	Description
1	A2147021	A1086CHSCFG	1	ENCLOSURE 10X8X6 NEMA 4X
2	A2150201	200221	1	NAMEPLATE 78X3.25 BLANK NOTAPE WHT
3	A2435043	RG1986-6	2	KIT SURGE SUPRESSOR
4	A2155094	V3926-01	1	STAGER 4 POS NOTCH 2 SWTCH 24VAC
5	A2130007	W169PLP-4-2	11	ELBOW MALE 1/4TX1/8MPT
6	A2445043	260-361	2	PLATE END WFIXING FLANGE
7	A2148003	A10P8	1	SUBPANEL 10 X 8
8	A2221088	C4LM1150AB28AG	1	VALVE-SOLENOID PARKER BRASS 3-WAY 24/60/1(C4LM1150AB28AG
9	A2130013	W172PLP-4-2	2	TEE BRANCH 1/4TX1/8MPT
10	A2394018	93151360	1	GRIP CORD 1/2 D/C BUSHED NIPPLE CROUSE-HINDS 50D
11	A2453007	3262	1	RING SEALING 1/2
12	A2150202	200221	1	NAMEPLATE .50X.75 BLANK NO TAPE WHT
13	A2307015	260-331	7	TERMINAL BLOCK MODULAR GREY
14	A2307016	260-337	1	TERMINAL BLOCK MODULAR GREEN
15	A2173014	MTW18BEX2500	3	WIRE MTW 18 STRANDED BLUE(2500' RL)
15	A2173003	MTW18GN	1	WIRE MTW 18 STRANDED GREEN
16	A2619003	LOT PRICING - Q	4	TAB MOUNT ALUMINUM ELECTR LRG HOLE



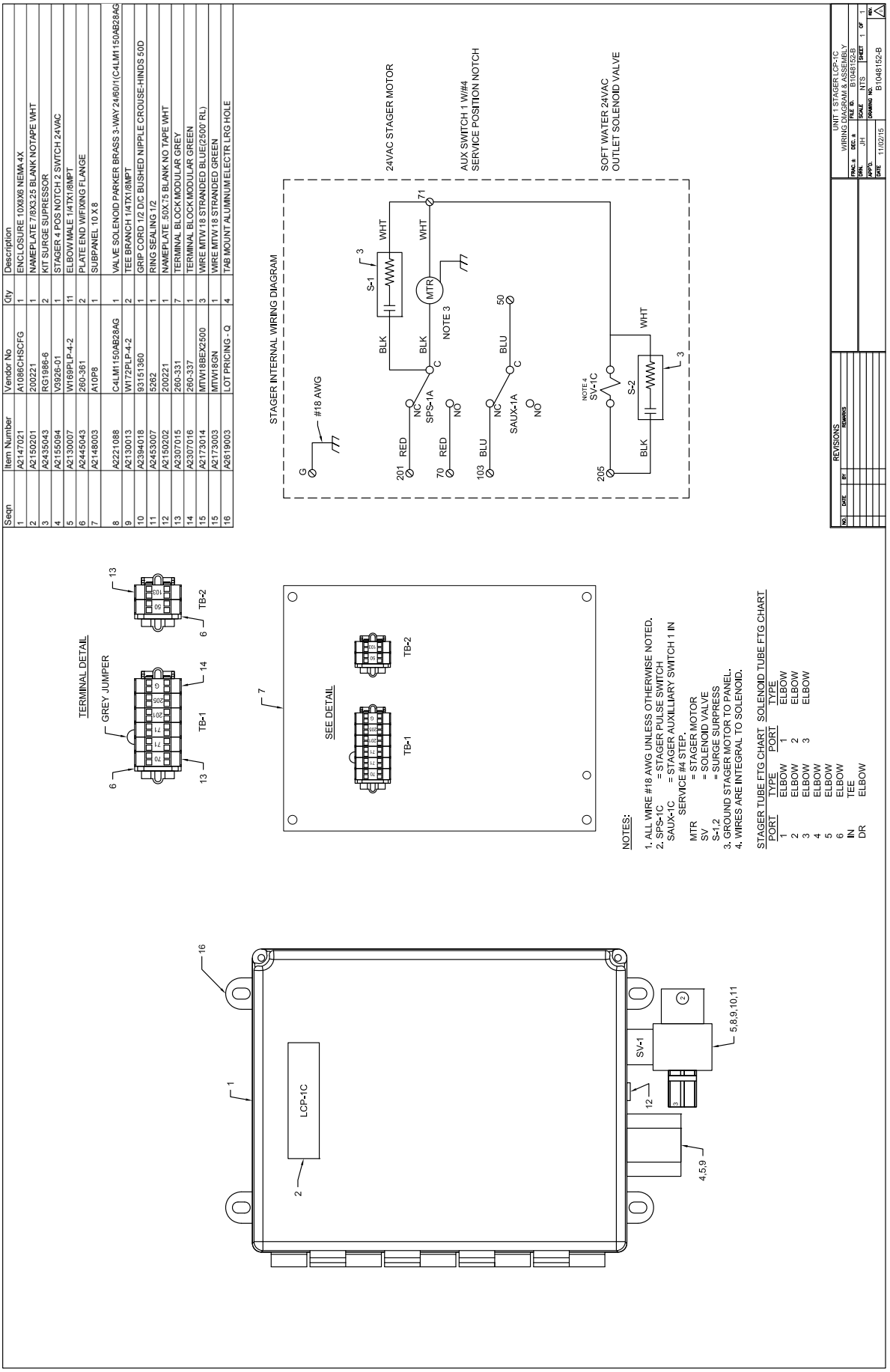
NOTES:

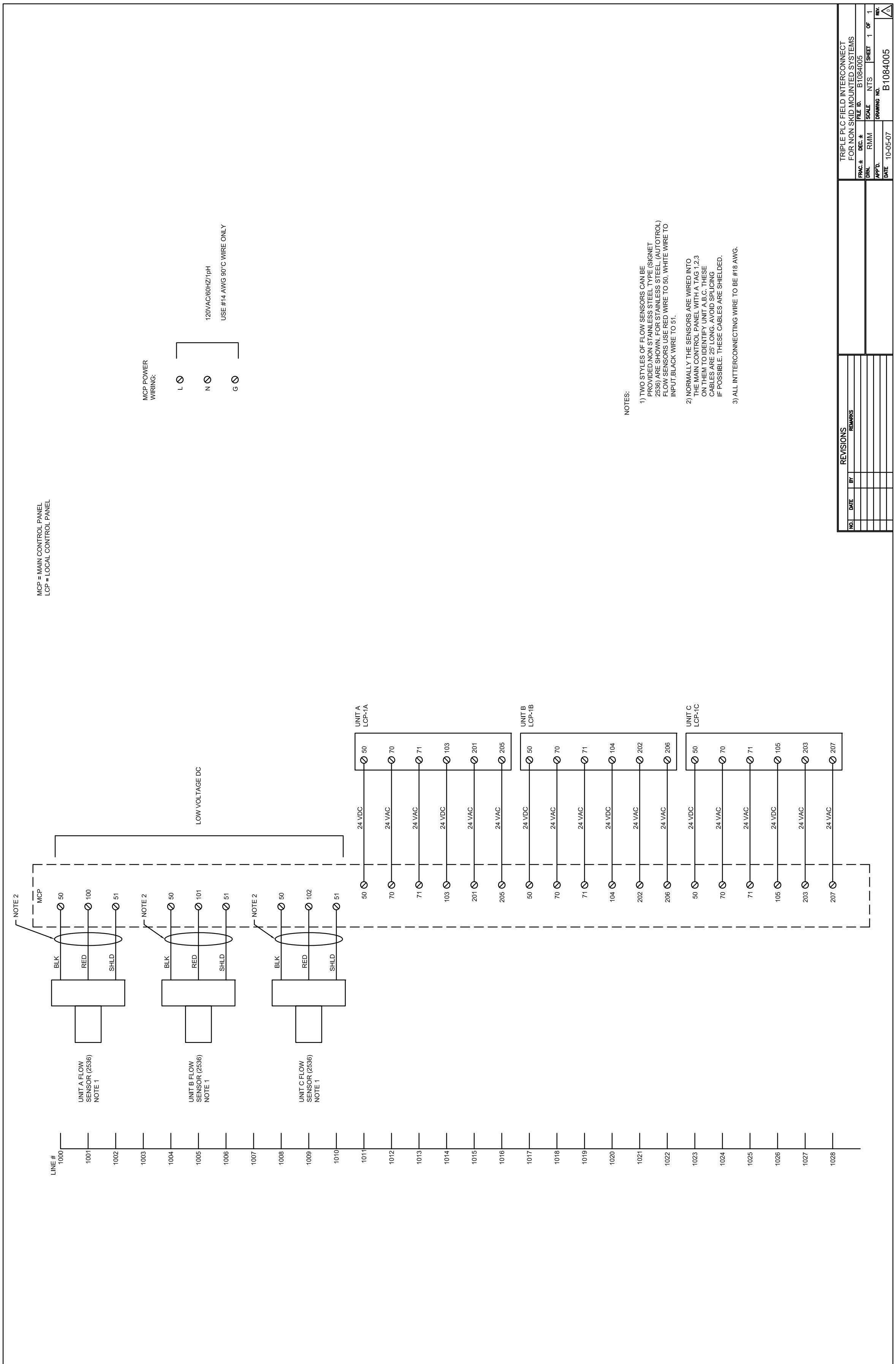
1. ALL WIRE #18 AWG UNLESS OTHERWISE NOTED.
2. SPS-1B = STAGER PULSE SWITCH
   SAUX-1B = STAGER AUXILLIARY SWITCH 1 IN SERVICE #4 STEP.
   MTR = STAGER MOTOR
   SV = SOLENOID VALVE
   S-1,2 = SURGE SURPRESS
3. GROUND STAGER MOTOR TO PANEL.
4. WIRES ARE INTEGRAL TO SOLENOID.

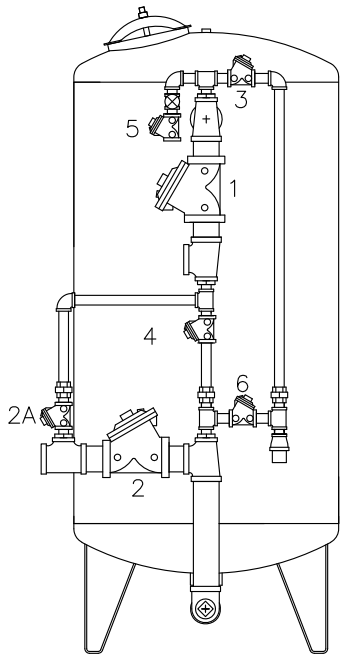
STAGER TUBE FTG CHART SOLENOID TUBE FTG CHART

PORT	TYPE	PORT	TYPE
1	ELBOW	1	ELBOW
2	ELBOW	2	ELBOW
3	ELBOW	3	ELBOW
4	ELBOW		
5	ELBOW		
6	ELBOW		
IN	TEE		
DR	ELBOW		

Seqn	Item Number	Vendor No	Qty	Description
1	A2147021	A1086CHSCFG	1	ENCLOSURE 10X8X6 NEMA 4X
2	A2150201	200221	1	NAMEPLATE 7/8X3.25 BLANK NOTAPE WHT
3	A2435043	RG1986-6	2	KIT SURGE SUPPRESSOR
4	A2155094	V3928-01	1	STAGER 4 POS NOTCH 2 SWTCH 24VAC
5	A2130007	W169PLP-4-2	11	ELBOW MALE 1/4TX1/8MPT
6	A2445043	260-361	2	PLATE END WIFIXING FLANGE
7	A2148003	A10P8	1	SUBPANEL 10 X 8
8	A2221088	C4LM1150AB28AG	1	VALVE SOLENOID PARKER BRASS 3-WAY 24/60/1(C4LM1150AB28AG
9	A2130013	W172PLP-4-2	2	TEE BRANCH 1/4TX1/8MPT
10	A2394018	93151360	1	GRIP CORD 1/2 D/C BUSHED NIPPLE CROUSE-HINDS 50D
11	A2453007	5262	1	RING SEALING 1/2
12	A2150202	200221	1	NAMEPLATE .50X.75 BLANK NO TAPE WHT
13	A2307015	260-331	7	TERMINAL BLOCK MODULAR GREY
14	A2307016	260-337	1	TERMINAL BLOCK MODULAR GREEN
15	A2173014	MTW18BEX2500	3	WIRE MTW 18 STRANDED BLUE(2500' RL)
15	A2173003	MTW18GN	1	WIRE MTW 18 STRANDED GREEN
16	A2619003	LOT PRICING - Q	4	TAB MOUNT ALUMINUM ELECTR LRG HOLE




TRIPLE PLC FIELD INTERCONNECT FOR NON SKID MOUNTED SYSTEMS
FILE NO. B1084005
DRN. RMM
SCALE NTS
SHEET 1 OF 1
DRAWING NO. B1084005
DATE 10-05-07
REVISIONS
NO. DATE BY REMARKS
MCP = MAIN CONTROL PANEL
LCP = LOCAL CONTROL PANEL
MCP POWER WIRING:
L N G
120VAC/60HZ/1pH
USE #14 AWG 90°C WIRE ONLY
NOTES:
1) TWO STYLES OF FLOW SENSORS CAN BE PROVIDED.NON STAINLESS STEEL TYPE (SIGNET 2536) ARE SHOWN. FOR STAINLESS STEEL (AUTOTROL) FLOW SENSORS USE RED WIRE TO 50, WHITE WIRE TO INPUT,BLACK WIRE TO 51.
2) NORMALLY THE SENSORS ARE WIRED INTO THE MAIN CONTROL PANEL WITH A TAG 1,2,3 ON THEM TO IDENTIFY UNIT A,B,C. THESE CABLES ARE 25' LONG. AVOID SPLICING IF POSSIBLE. THESE CABLES ARE SHIELDED.
3) ALL INTTERCONNECTING WIRE TO BE #18 AWG.
LOW VOLTAGE DC
NOTE 2
MCP
UNIT A LCP-1A
UNIT B LCP-1B
UNIT C LCP-1C
24 VDC
24 VAC
BLK
RED
SHLD
UNIT A FLOW SENSOR (2536) NOTE 1
UNIT B FLOW SENSOR (2536) NOTE 1
UNIT C FLOW SENSOR (2536) NOTE 1
LINE #



Replacement Valve Table

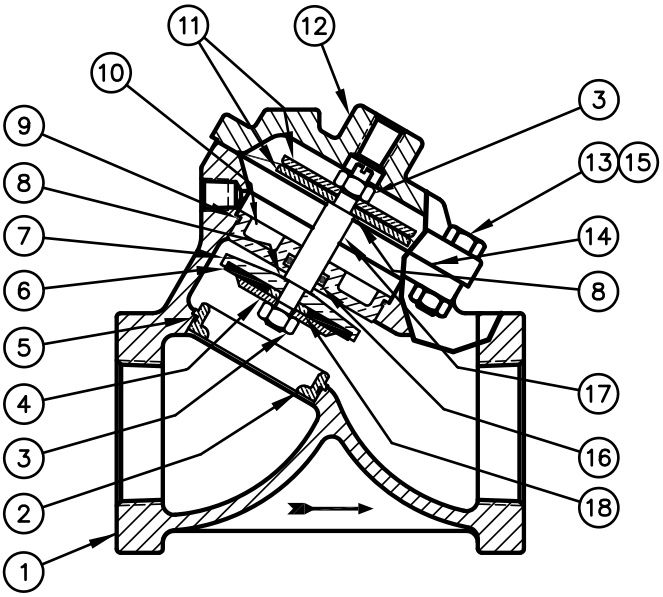
Location#	Function	Position
1	Service Inlet	**NORMALLY OPEN**
2	Service Outlet	**NORMALLY OPEN**
2A	Bypass Valve - Single Systems Only	**NORMALLY CLOSED**
3	Backwash Outlet	**NORMALLY OPEN**
4	Backwash Inlet	**NORMALLY OPEN**
5	Brine Inlet	**NORMALLY OPEN** SPRING ASSIST OPEN
6	Brine/Flush Outlet	**NORMALLY OPEN** SPRING ASSIST OPEN

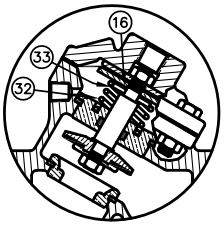
Valve 2A - Is Used on Single Systems Only

MR Model	Pipe Size	Valve 1	Valve 2	Valve 2A	Valve 3	Valve 4	Valve 5	Valve 6
150	1	B2010102B	B2010202B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	1.25	B2010103B	B2010203B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	1.5	B2010104B	B2010204B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2	B2010105B	B2010205B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
210	1.25	B2010103B	B2010203B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	1.5	B2010104B	B2010204B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2	B2010105B	B2010205B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2.5	B2010107B	B2010207B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
300	1.5	B2010104B	B2010204B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2	B2010105B	B2010205B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2.5	B2010107B	B2010207B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	3	B2010108B	B2010208B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
450	1.5	B2010104B	B2010204B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2	B2010105B	B2010205B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	2.5	B2010107B	B2010207B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
	3	B2010108B	B2010208B	A2009001B	A2010001B	B2010201B	A2007001B	A2007001B
600	1.5	B2010104B	B2010204B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
	2	B2010105B	B2010205B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
	2.5	B2010107B	B2010207B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
	3	B2010108B	B2010208B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
750	2	B2010105B	B2010205B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
	2.5	B2010107B	B2010207B	A2009002B	A2010002B	B2010202B	A2007002B	A2007002B
	3	B2010108B	B2010208B	A2009002B	A20100002B	B2010202B	A2007002B	A2007002B
900	2	B2010105B	B2010205B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B
	2.5	B2010107B	B2010207B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B
	3	B2010108B	B2010208B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B
1050	2	B2010105B	B2010205B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B
	2.5	B2010107B	B2010207B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B
	3	B2010108B	B2010208B	A2009002B	A2010003B	B2010203B	A2007002B	A2007002B

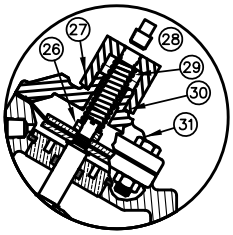
Valve 1 is Drilled and Tapped with 1/4" Female Thread on Boss #1
Valve 2 and 4 are Drilled and Tapped with 1/4" Female Thread on Boss #2

AQUAMATIC REPAIR KITS





SPRING ASSIST OPEN

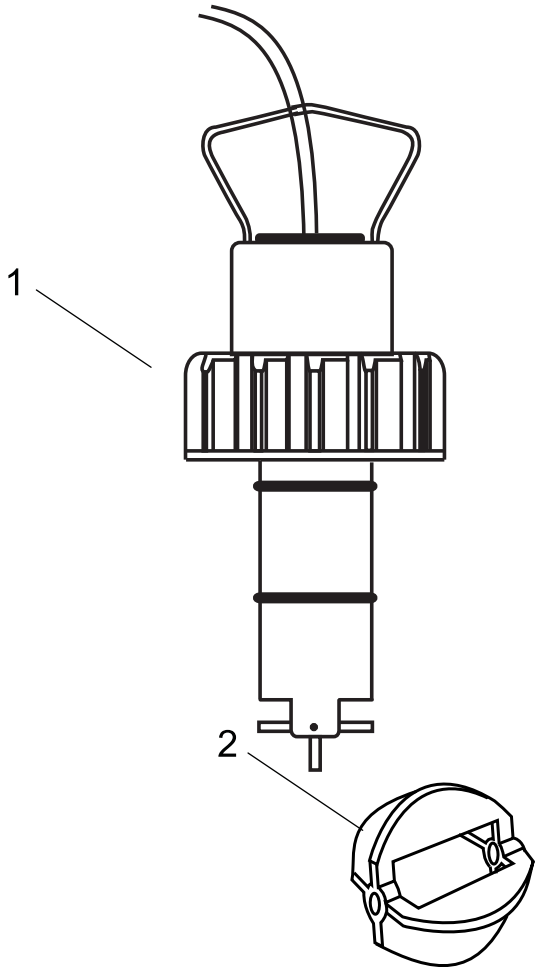


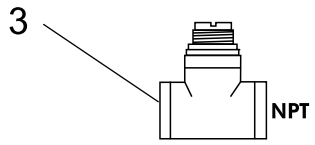
SPRING ASSIST CLOSED

RA - Diaphragm & Seal Kits - Includes Buna N Seals and Diaphragm (Items 3(2),5,6,8(2),9,14&16)
RF - Metal Parts Kit (Normally Open) - (Items 4,7,10,11(2), 17)
RG - Metal Parts Kit (Normally Closed) - (Items 4,7,10,11(2), 23)
SC - Repair Kit (Spring Assist Closed) - (Items 24,27,28)
SO - Repair Kit (Spring Assist Open) - (Items 8,31,32)
GT - Tool - To Install & Remove O-Ring Retainer (Not Shown)

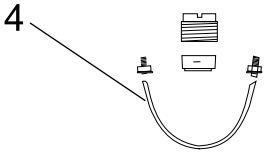
VALVES		REPAIR KITS						SHAFTS	
VALVE SIZE	CASTING #	RA	RF	RG	SC	SO	GT	NO	NC
¾”	421	A2089028	A2089071	A2089078	A2089085	A2089092	A2089098	A2137001	A2137008
1"	421	A2089028	A2089071	A2089078	A2089085	A2089092	A2089098	A2137001	A2137008
1¼	424	A2089029	A2089072	A2089079	A2089086	A2089093	A2089099	A2137002	A2137009
1½	424	A2089029	A2089072	A2089079	A2089086	A2089093	A2089099	A2137002	A2137009
2	425	A2089030	A2089073	A2089080	A2089087	A2089094	N/A	A2137003	A2137010
2½	426	A2089031	A2089074	A2089081	A2089088	A2089095	N/A	A2137004	A2137011
3"	427	A2089032	A2089075	A2089082	A2089089	A2089096	N/A	A2137005	A2137012
3" FLGD	427	A2089032	A2089075	A2089082	A2089089	A2089096	N/A	A2137005	A2137012
4" FLGD	428	A2089033	A2089076	A2089083	A2089090	A2089097	N/A	A2137006	A2137013
6" FLGD	429	A2089034	A2089077	A2089084	A2089091	N/A	N/A	A2137007	A2137014

2536 Standard Mount Sensor





Galvanized Iron Threaded Tee with NPT Threads PVDF Insert



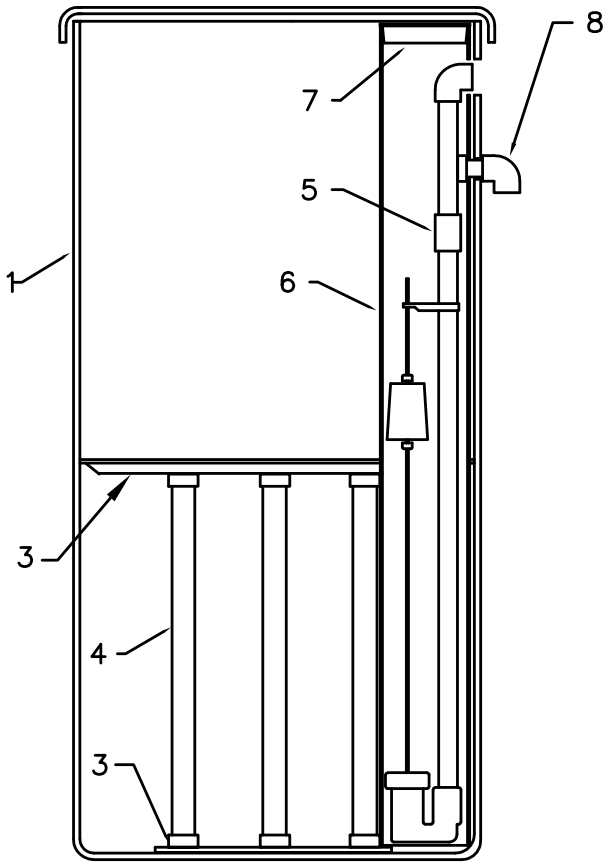
Iron Strap-on Saddle with PVDF Insert

K- Factor Table

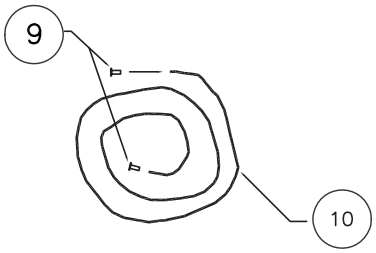
Pipe Size Inches	(Pulses per Gallon)	
	Tee Galvanized	Saddle Iron
1	213	
1-1/4	128	
1-1/2	94	
2	59	54
2-1/2		38
3		**23**

Item Number	Part Number	Description
1	A2296001	FLOW SENSOR
2	A2456004	ROTOR/PADDLE
3	A2294012	TEE INSTALL 1 GALV
	A2294002	TEE INSTALL 1-1/4 GALV
	A2294003	TEE INSTALL 1-1/2 GALV
	A2294004	TEE INSTALL 2 GALV
4	A2295001	SADDLE 2-1/2 IRON
	A2295002	SADDLE 3 IRON

BRINE SYSTEM FOR MGT 150-450



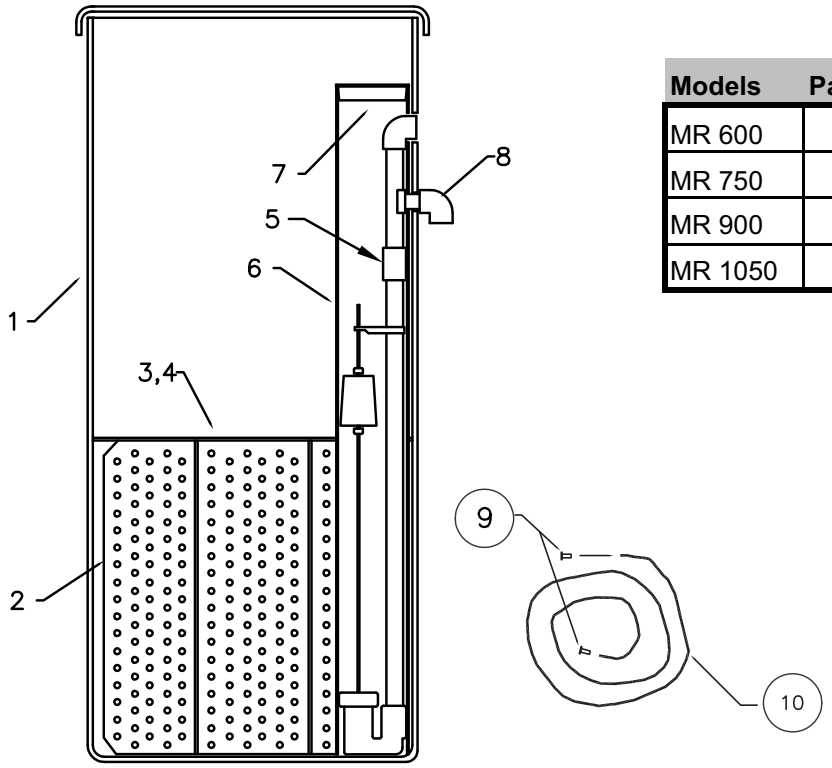
Models	Part Number	Shelf Height
MR 150	B1039001	15"
MR 210	B1039002	22"
MR 300	B1039003	29"
MR 450	B1039009	29"



Item Number	Part Number	Item Description
1	B1002007	BRINE TANK W/HOLES 24x50-**MR 150-210**
	B1002008	BRINE TANK W/HOLES 24x60-**MR 300**
	B1002009	BRINE TANK W/HOLES 39x60-**MR 450**
3	A2284007	GRID PLATE PLASTIC 24DIA 5BW
	A2284010	GRID PLATE PLASTIC 30DIA 5BW
4	A2275007	PIPE 1-1/2 SDR OR SCH40 DWV
5	B1042001	BRINE VALVE ASSEMBLY**-MR 150**
	B1042002	BRINE VALVE ASSEMBLY**-MR 210**
	B1042003	BRINE VALVE ASSEMBLY**-MR 300-450**
6	B1015008	BRINE WELL 5x46 DRILLED
7	A2072001	CAP PLUG RED 5 INCH
8	A21200002	ELBOW OVERFLOW 1/2" W/NUT
9	A2476001	INSERT 1/2 POLY
10	A2165002	TUBING 1/2x3/8 BLACK POLY

BRINE SYSTEM FOR MGT 600-1050

39", 42" & 50" TANK DIAMETERS



Models	Part Number	Shelf Height
MR 600	B1039005	22"
MR 750	B1039005	22"
MR 900	B1039007	29"
MR 1050	B1039008	22"

Item Number	Part Number	Item Description
1	B1002010	BRINE TANK W/HOLES 39x60 - **(MR 600-750)**
	B1002011	BRINE TANK W/HOLES 42x60 - **(MR 900)**
	B1002012	BRINE TANK W/HOLES 50x60 - **(MR 1050)**
2	B1043010	GRID SUPPORT SET 39" DIA, 22" HT - **(MR 600-750)**
	B1043011	GRID SUPPORT SET 42" DIA, 29" HT **- (MR 900)**
	B1043014	GRID SUPPORT SET 50" DIA, 22" HT **- (MR 1050)**
3	B1041003	SALT SHELF 38-1/8" DIA - **(MR 600-750)**
	B1041004	SALT SHELF 41-1/4" DIA - **(MR 900)**
	B1041005	SALT SHELF 49" DIA **- (MR 1050)**
4	B1040003	SALT SCREEN 39" DIA. - **(MR 600-750)**
	B1040004	SALT SCREEN 42" DIA. - **(MR 900)**
	B1040005	SALT SCREEN 50" DIA. - **(MR 1050)**
5	B1042002	BRINE VALVE ASSY 22" GRID - **(MR 600,750,1050)**
	B1042003	BRINE VALVE ASSY 29" GRID - **(MR 900)**
6	B1015008	BRINE WELL 5x46 DRILLED
7	A2250003	ELBOW OVERFLOW 1/2" W/NUT
8	A2072001	CAP PLUG RED 5"
9	A2476001	INSERT 1/2" POLY
10	A2165002	TUBING 1/2"x3/8" BLACK POLY

SERVICE CHART STAGER CONTROLLER

SYMPTOM	PROBABLE CAUSE	HOW TO CORRECT
Softener does not regenerate.	1. No electrical power.	Check circuit. Start a regeneration with Manual Regeneration Lever.
	2. Frequency levers on Time Dial not set properly.	Refer to “How to Set Regeneration Cycle Program 3200 Series Mechanical Timer”.
	3. Faulty timer mechanism or defective timer motor.	Replace.
	4. Defective stager drive motor.	Replace
	5. Defective micro-switch in stager drive assembly.	Replace drive assembly.
Softener regenerates as wrong time.	6. Interrupted electrical power. Time dial set improperly	Reset Time Dial to correct time. Refer to “How to Set Cycle Controller”.
Position dial does not rotate.	7. Stager drive motor burned out.	Replace.
	8. Loose Electrical connections.	Repair.
	9. Jammed stager valve.	Replace.
Softener Diaphragm Valves end regeneration cycle in wrong position.	10. Controller out of sequence due to: A. Turning position dial manually when time switch is not in “OFF” position or turning the cycle adjustment knob too quickly for stager to index.	With time switch mechanism in normally “OFF” position, (Red arrowhead pointing straight down), manually turn Position Dial clockwise to No. 4 "Service” position.
	B Temporary low voltage condition of poor electrical connection.	Check circuitry.
	C. Jammed Stager.	Replace.
	D. Defective time switch assembly.	Replace.
	E. Defective time switch assembly.	Replace.
	F. Defective drive motor.	Replace.
Leak to drain from stager valve during service.	11. Leaky or cut seal in stager valve.	Replace.
Hardness Leakage or Improper cycling or valves. Individual valves not being pressurized or vented correctly.	12. Faulty seal in stager valve.	Replace.
	13. Clogged stager strainer.	Clean strainer.
	14. Clogged or kinked stager tubing.	Replace tubing or clean.

SERVICE CHART WATER SOFTENERS

IMPORTANT: Many softener complaints result from oversights (poor electric connections, out of salt, regenerating at wrong hour etc.) rather than from a mechanical failure. Refer the troubleshooting guide below prior to calling customer service.

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Slight leak to drain.	1. Disconnect tubing at backwash control.	Flow from tubing indicates leaky seal in stager valve.
	2. If stager is not leaking, use soap test kit and check hardness of water at drain.	If water tests soft, Valve #6 is leaking: If hard, Valve #3. See procedures 10, 11, 12 and 13.
High flow to drain during service	3. Check position dial.	If not in position #4, rotate clockwise to this position.
	4. If position dial is in position #4, check for water leakage from Valve #3 or #6 vent holes.	Leakage indicates: 1. Ruptured diaphragm. 2. Loose diaphragm nut.
	5. If vent hole is not leaking, use soap test kit and check hardness of water at drain.	If water tests soft, Valve #6 is open: If hard, Valve #3. See procedures 10, 12 and 13.
Failure to draw brine	6. Check that manual brine valve is open wide.	Valve must be open at all times, except when servicing.
	7. Check water pressure	Water pressure must be a least 30 psi during regeneration.
	8. Turn position dial clockwise to position #2. Break union in suction line to injector and feel for suction.	If there is suction, automatic brine valve may be clogged. No suction indicates: 1. Drain pipe to small or discharging at level too high above floor. 2. Plugged pilot strainer. 3. Plugged injection nozzle. 4. Valve #1, #4, or #2 not closing fully. See items 10, 11 and 13. 5. Plugged backwash controller. 6. Dirty mineral bed.
Slight leak from vent hole.	9. Turn position dial clockwise to a position, which relieves pressure on valve.	If leaking stops leak results from loose diaphragm nut, small Tear in diaphragm or special washer under diaphragm is missing. If leaking does not stop, shaft guide O-ring is damaged, shaft guide is not seated against gasket or shaft is damaged.
Diaphragm valve does not close.	10. Check that vent hole is not plugged.	If vent hole is plugged, air in space between diaphragm and shaft guide will compress and prevent valve from closing.
	11. Check for water leak at vent hole.	See Procedure 9.
	12. Loosen tubing nut at diaphragm cap.	If there is not flow, pilot strainer may be plugged.
	13. Turn off water pressure and dis-assemble diaphragm valve.	1. Seat washer may be dirty, worn or loose. 2. Seat may be eroded.

SERVICE CHART WATER SOFTENERS continued

PROBLEM OR SYMPTOM	CHECK PROCEDURE	CAUSE
Diaphragm valve does not open.	14. Check that vent hole is not plugged.	If vent hole is plugged, a partial vacuum will be created in the space between the diaphragm and shaft guide, preventing valve from opening.
	15. Loosen tubing nut at diaphragm cap.	1. If there is flow, stager valve is leaking. 2. If there is no flow, tubing fitting may be plugged.
Hard water leakage into service lines.	16. Close inlet and outlet valves and inspect by-pass valve.	1. Seat washer may be loose or worn. 2. Seat may be rough. 3. Shaft orifice plugged. 4. Diaphragm ruptured.
	17. Check that valve #4 is seating.	See Procedures 9, 10, 12 and 13.
Restricted or not drain flow during backwash.	18. Either valve #1 or valve #2 is not opening fully. To determine which one: Turn position dial to position #1 and then to position #3. Compare flow at drain.	Flow should be the same for both positions. 1. If no difference is noted, valve #4 is not opening properly. 2. If backwash flow is higher, valve #1 is not opening properly. See procedures 14 and 15.
Restricted or no drain flow during backwash.	19. Turn position dial to position #1 and then position #3. Compare flow at drain.	Flow should be the same. If flow for position also is low. 1. Inlet water pressure may be low. 2. Backwash flow control may be plugged. If position #3 flow rate is higher, either valve #4 or valve #3 is not opening. See procedures 14 and 15.
Losses of softening resin (evidence of resin in drain lines).	20. Open vent in top of softener tank and check for air in tank.	1. If air is present, vent completely and recheck prior to next regeneration. 2. If recheck discloses a recurring build-up of air, check brine system(s) for possible leaks in suction line or brine valve not seating properly. 3. If brine system is functioning properly source of air may be the water supply to unit. Use of an automatic air relief vale is indicated in this situation (consult factory for recommendation).
	21. Check automatic backwash control valve for rate of flow in excess of listed flow (gpm).	Check for excessive inlet water supply pressures – reduce to rated pressure.
Losses of softening resin (evidence of resin and/or gravel in service lines.	22. Check for damage to softener under-drain system.	Investigation of damage to under-drain generally requires unloading of softener tank. Consult factory for recommended procedures before proceeding.