

Magnum Cv Series

Installation and Service Manual

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1.0 Installation Profile Summary

Installation Date: _____

Installation Location: _____

Installer(s): _____

Phone Number: _____

Valve Number: _____

Application Type: (Softener) (Filter) (Dealkalizer)

Water Source:

(Public Well) (Private Well)

(Surface Supply)

(Other)

Water Test Results:

Hardness: _____ Iron: _____

Other: _____

Misc:

Capacity: _____ Flow Rates: _____ min. _____ max.

Tank Size: Diameter _____ Height: _____

Resin or Media Volume: _____

Resin or Media Type: _____

Brine Tank Volume: _____

Salt Setting per Regeneration: _____

Control Valve Configuration:

Valve Type: _____

(Co-current) (Countercurrent)

(Hard Water Bypass) (No Hard Water Bypass)

Refill Control: _____ gpm

Injector Control: _____ gpm

Backwash Control: _____ gpm

Manual Control:

(Softener) (Filter)

Mechanical Timeclock:

(7 day) (12 day)

Salt Setting: _____

Regeneration Frequency:

S M T W T F S

1 2 3 4 5 6 7 8 9 10 11 12

Impulse

(480) (Other) _____

Salt Setting: _____

Electronic Demand Settings

P1 Time of Day _____

P2 Time of Day Regen _____

P3 Hardness of Water _____

P4 Salt Amount _____

P5 Capacity of Unit _____

P6 Refill Control Value _____

P7 Brine Draw Value _____

P9 Backwash Time _____

P10 Slow Rinse Time _____

P11 Fast Rinse Time _____

P12 Units of Measure _____

P13 Clock Mode _____

P14 Calendar Override _____

P15 Reserve Type _____

P16 Fixed Reserve Cap.
or Initial Ave. Value _____

P17 Operation Type _____

P18 Salt Change Lock Out _____

P19 Flow Sensor Size _____

P20 *FACTORY USE ONLY*

Twin Parallel

Triple Parallel

Regeneration Type (P15): _____

3 = Fixed Reserve with
Immediate Regeneration

Fixed Reserve (P16): _____ % (0% only)

Twin Alternating

Regeneration Type (P15): _____

0 = Immediate Regen
1 = Delayed Regen

Fixed Reserve (P16): _____ %

2.0 Introduction to the Magnum Cv Series

The Magnum Cv™ Series valves offer a high degree of installation simplicity and flexibility. Figure 2.1 provides an overview of the major components and connections of the 1-1/2-inch (3.81-cm) Magnum Cv valve.

The Magnum Cv Series is available in either a 1-1/2-inch (3.81-cm) (Magnum Cv™) or a 2-inch (5.08-cm) (Magnum Cv™ Plus) configuration. Throughout this manual, the 1-1/2-inch (3.81-cm) Magnum Cv is shown in illustrations where the model type is irrelevant to what is being demonstrated.

Magnum Cv™ Series Valve

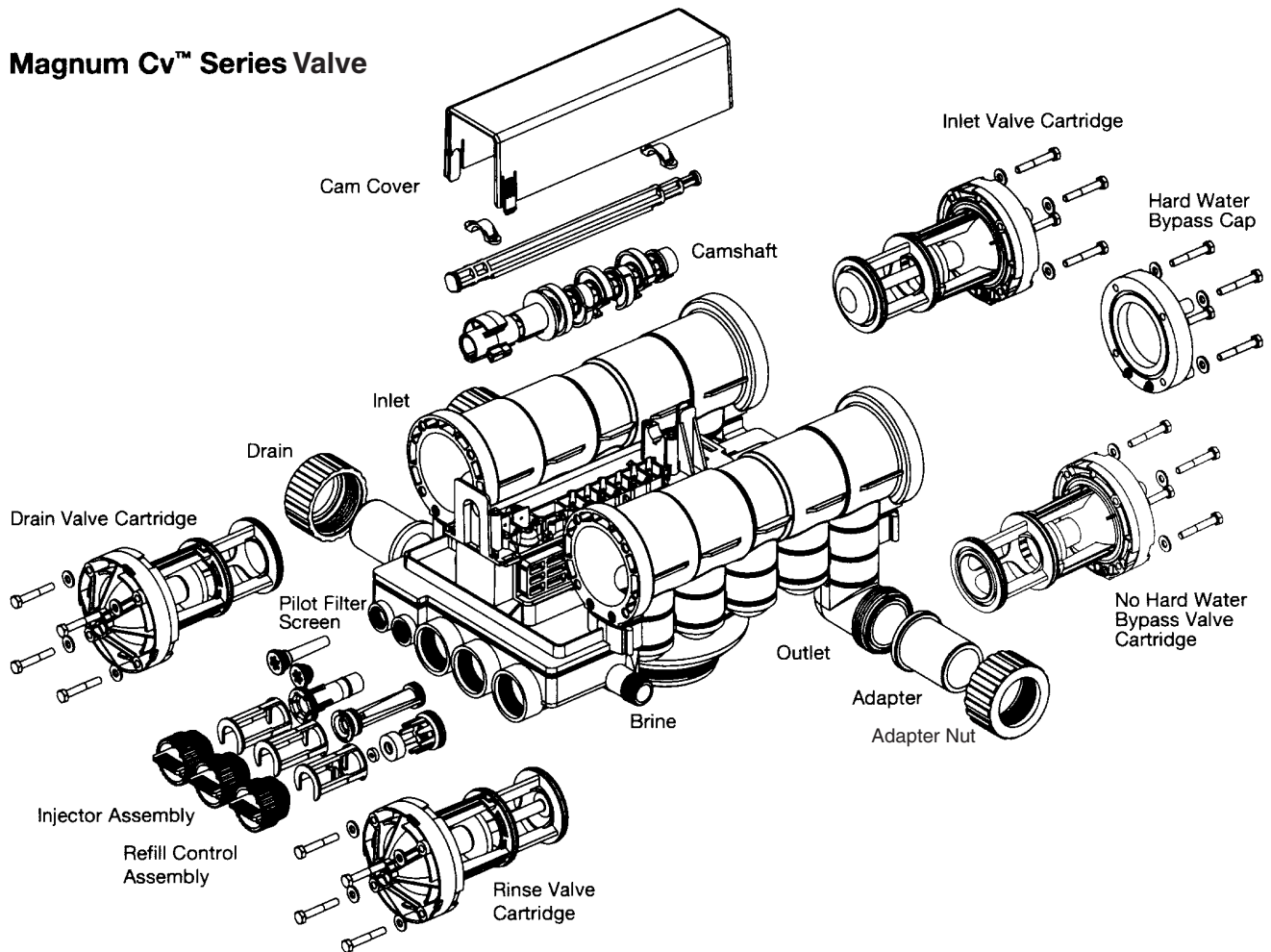


Figure 2.1

2.1 Assembling the Control to the Magnum Cv Series Valve

The control and the Magnum Cv series valve work together as an integral system to ensure synchronization. Follow the steps outlined below to install the control on the Magnum Cv series valve.

Remove Cam Cover

Remove the cam cover by pressing in on the cover release tabs (Figure 2.2). Note the cover locking tab and the slot in the top plate. When you reassemble the cover, the locking tab is placed in the slot first and the cover lowered into position.

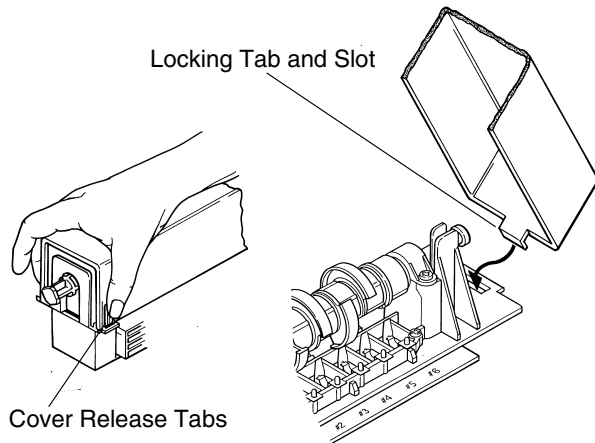


Figure 2.2

Align Camshaft

The camshaft is keyed and should only be engaged or disengaged when in the position illustrated (Figure 2.3). If the camshaft is not in the proper position, rotate the cam assembly counterclockwise until the keyway is in the position shown (6 o'clock position or 180° from the top).

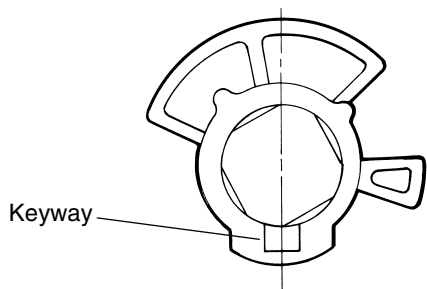


Figure 2.3

Slide Camshaft

Slide the camshaft toward the back of the valve by pressing on the release tab and pulling on the back end of the camshaft (Figure 2.4). The front end of the camshaft will be flush with the mounting plate.

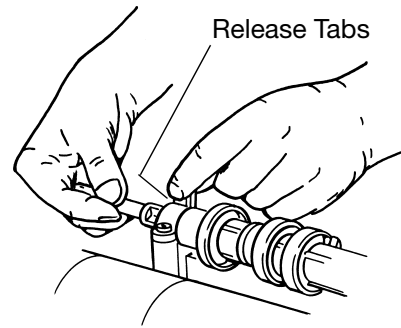


Figure 2.4

Mount Control

Mount the control onto the valve by sliding the mounting tabs over the mounting plate. Note that all models of Magnum Cv Series controls mount to the valve in the same manner (Figure 2.5).

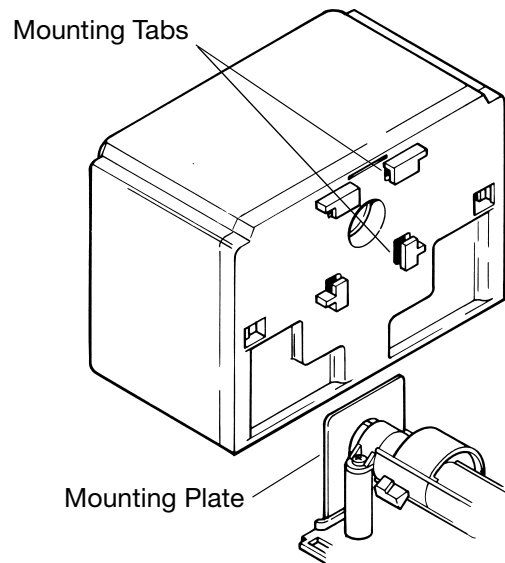


Figure 2.5

Engage Assembly

Engage the control by pressing on the release tab and pushing the camshaft into the control (Figure 2.6). Do not force the camshaft. If the camshaft does not slide freely into the control, check the alignment of the camshaft to ensure it is in the proper position (Figure 2.3). The control indicator must be in the **REGENERATION COMPLETE** position for the 942, 942Man, 952, and 962 when engaging the camshaft into the control. The control indicator must be in the **BACKWASH COMPLETE** position for the 942F, 942FMan 952F, and 962F when engaging the camshaft into the control. The control indicator must be in the midpoint of the **SERVICE** position for the 962M and 962S when engaging the camshaft into the control.

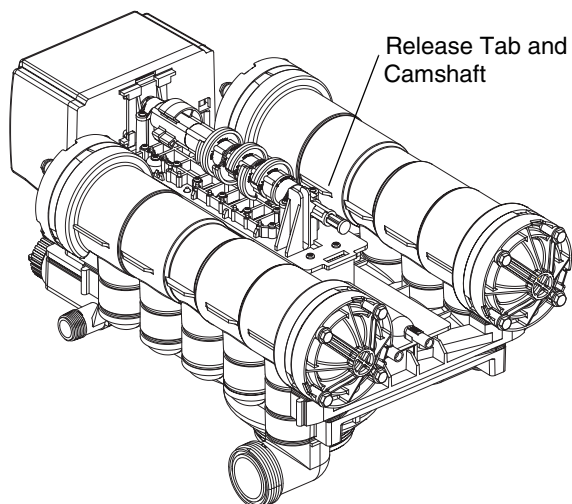


Figure 2.6

Important:

When 942, 942Man, 952, or 962 controls are installed, control dials must be in the REGENERATION COMPLETE position.

When 942F, 9042FMan, or 952F controls are installed, control dials must be in the BACKWASH COMPLETE position.

When 962M or 962S controls are installed, control dials must be in the SERVICE position.

To disassemble the control from the valve, reverse the assembling procedure.

Inlet, Outlet and Drain Connections

The inlet, outlet, and drain connections are designed to accept an Osmonics supplied CPVC or brass adapter (Figure 2.7). The adapters provide a convenient union for the three connection ports on the valve. In addition, they incorporate a positive O-ring face seal for ease of installation and leak free operation. DO NOT OVERTIGHTEN THE ADAPTERS. As a general guideline, hand tightening the nut onto the valve will be adequate. If additional tightening is required, never exceed a quarter turn beyond the hand tight position.

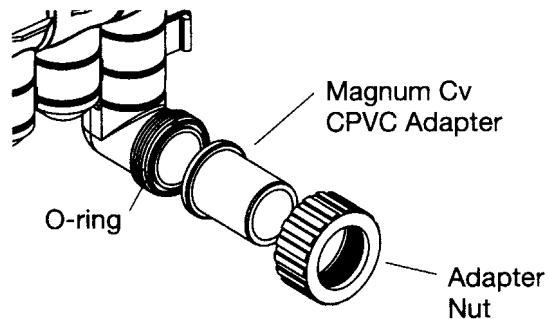


Figure 2.7

No Hardwater Bypass Feature

The Magnum Cv Series control valve may be configured for “Hard Water Bypass” or “No Hard Water Bypass”. With Hard Water Bypass, unsoftened or unfiltered water is allowed to bypass the Magnum Cv Series control valve during regeneration or backwash. With No Hard Water Bypass, a valve cartridge ensures that no unsoftened or unfiltered water bypasses the valve during regeneration or backwash.

It is easy to observe which option is installed in the valve. Note that the Hard Water Bypass End Cap has much longer standoffs than the No Hard Water Bypass cartridge. The No Hard Water Bypass assembly will look identical to the other three valve cartridges on the valve and will have a label identifying the cartridge assembly (Figure 2.8).

*No Hard Water Bypass
No Unfiltered Water Bypass*

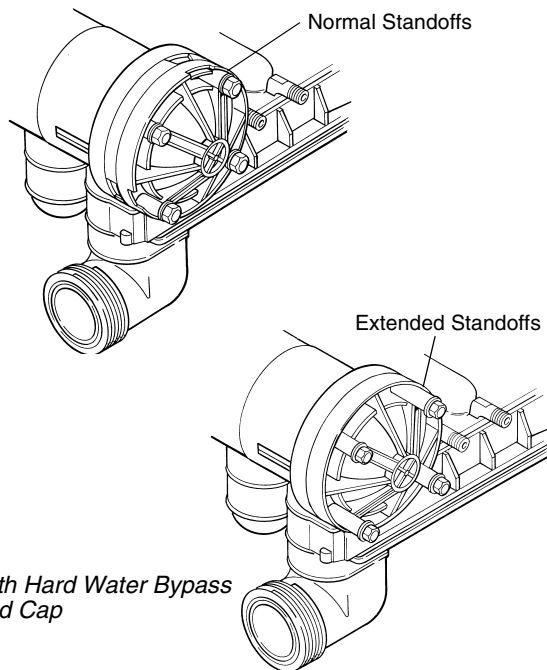


Figure 2.8

Hydraulic Output Signal

An optional hydraulic output signal is available on the valve. An optional cam lobe on pilot valve #6 is used on the camshaft assembly to initiate the hydraulic output signal during regeneration or backwash (Figure 2.9). The hydraulic line pressure signal will be available through the 1/4-inch connection on the back of the valve marked "AUX". (Remove the tube cap installed for shipping.)

Optional cam lobes available are:

- P/N 1000553 Provides a hydraulic signal from the beginning of BACKWASH through the start of REFILL.
- P/N 1000554 Provides a hydraulic signal from the beginning of BACKWASH through the end of REFILL.
- P/N 1001622 **Used on Twin Alternating Systems Only.** Provides a hydraulic signal from the beginning of BACKWASH through and during STANDBY.
- P/N 1041064 Breakaway cam. Can be programmed to send a hydraulic signal at any time during the REGENERATION or BACKWASH cycle. Note: The camshaft must be turning for the signal to change states, i.e. switch from OFF to ON, or from ON to OFF.

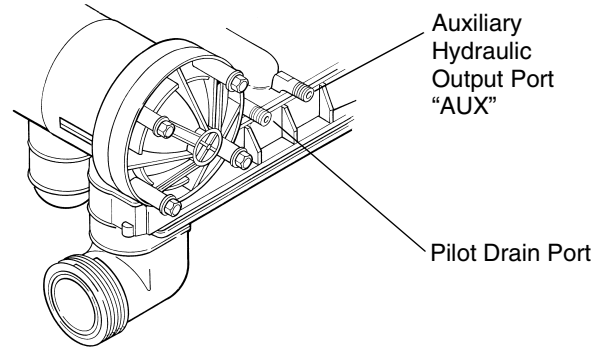


Figure 2.10

Magnum Cv Series Tank Adapter

The tank adapter on the control valve is designed to be compatible with a 4 inch-8UN (8 threads per inch) tank opening. In addition, the adapter is designed to accept a full 1-1/2-inch (3.81-cm) riser pipe with outside diameter of 1.90 to 1.91 inches (48.26 to 48.51 mm) (Figure 2.11). The riser pipe is sealed by an O-ring on the inside of the tank adapter, Figure 2.11. It is recommended that the riser pipe extend beyond the top of the tank by 5/8 inch, + or - 1/8 inch (16 mm + or - 3 mm). (However, the Magnum Cv Series control valve will mount on a riser pipe that is cut flush with the top of the tank.)

For hydraulic output signal install one of following cam lobes:

- 1000553
- 1000554
- 1001622
- 1041064

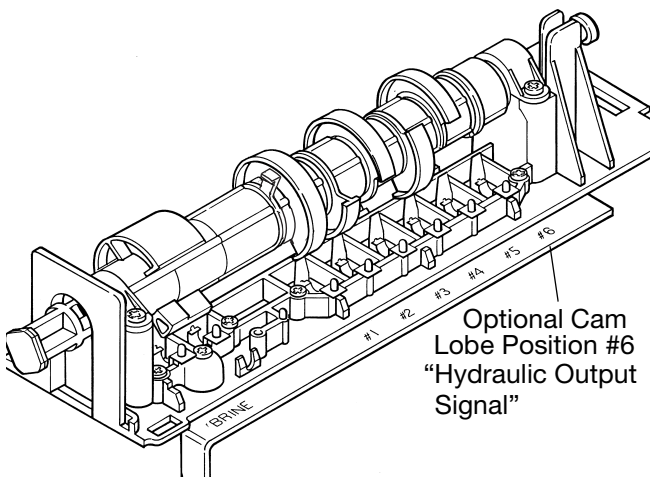


Figure 2.9

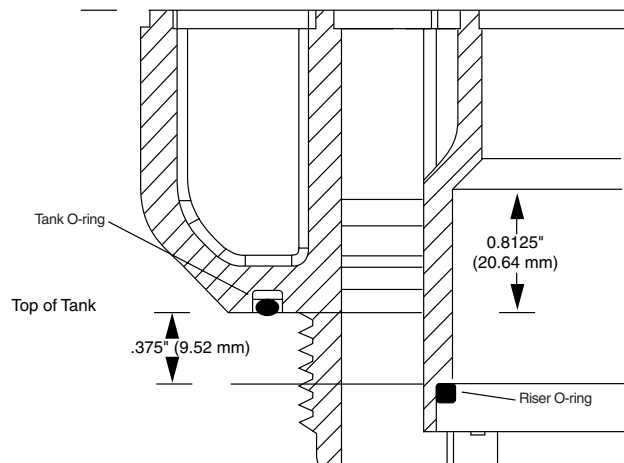


Figure 2.11

Optional Switch Assembly

On single, twin parallel, and triple parallel tank configurations, a single optional feedback switch kit is available to provide an electrical signal during the entire regeneration or backwash cycle (Figure 2.12). The switch may be wired in the "Normally Open" or "Normally Closed" position and is rated for 0.1 amp at 125 volts AC. An optional 5.0 amp switch at 1/10 HP 125/250 volts AC is available upon request.

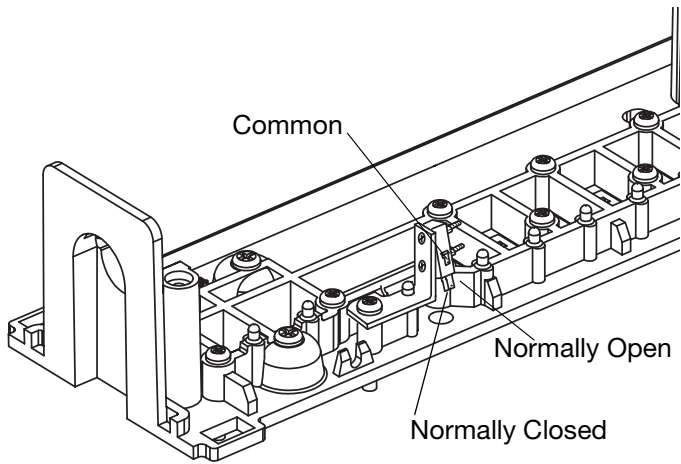


Figure 2.12

On **ALL** Magnum Cv Series tank configurations, optional multi-switch kits are available to provide additional electrical or switch closure signals during the regeneration or backwash cycles. Coupled with the optional breakaway cams, signals can be sent to external system equipment at virtually any time while the control/camshaft motor is running. Consult the “Just Add Water” bulletin covering the multi-switch option for additional application and programming information.

2.2 Magnum Cv Series General Specifications

Operating and Environmental

Operating Pressure	25 to 125 psig (172 to 862 kPa) 100 psig (688kPa) maximum in Canada
Operating Water Temperature Range.....	34 to 100°F (1 to 36°C)
Ambient Temperature Range.....	34 to 120°F (1 to 50°C)
Cap Bolt Torque	35-40 inch lbs. (3.95 to 4.51 N _m)

Connections

Inlet and Outlet.....	1-1/2 inch-Magnum Cv 2-inch-Magnum Cv PLUS
Tank.....	4-inch-8UN
Brine.....	3/4-inch NPT
Pilot Drain and Auxiliary Hydraulic Out	1/4-inch tube fitting
Riser Pipe Fitting	1-1/2-inch (3.81-cm)
Drain.....	1-1/2-inch (3.81-cm)

Physical

Dimensions.....	Refer to drawings on pages 8 and 9
Approximate Weight (Valve and Control).....	23.3 lbs. (10.6 kg.)

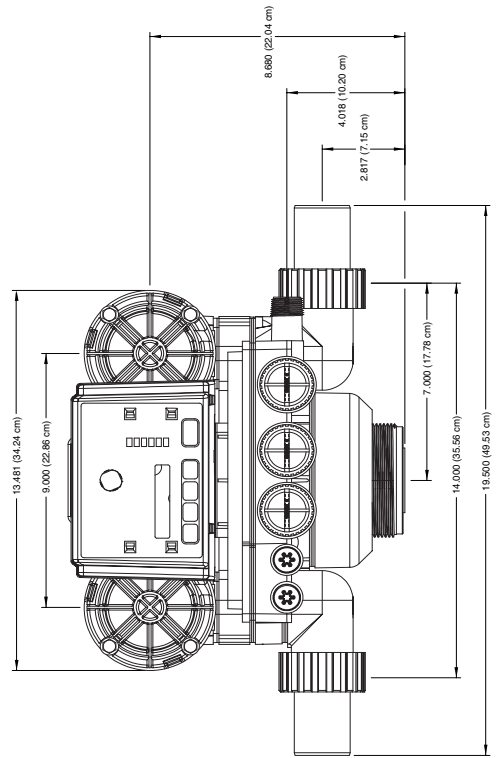
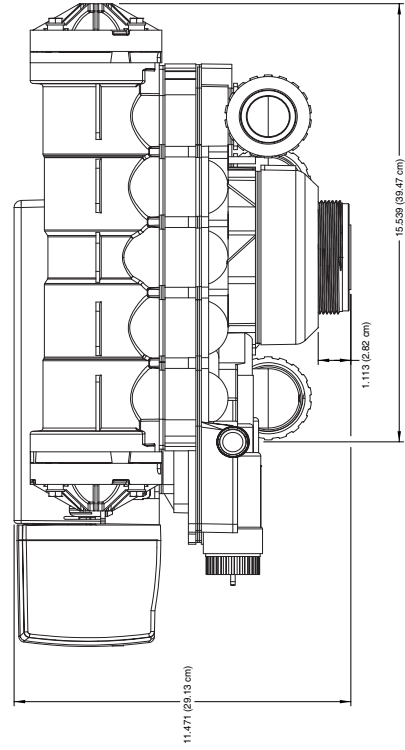
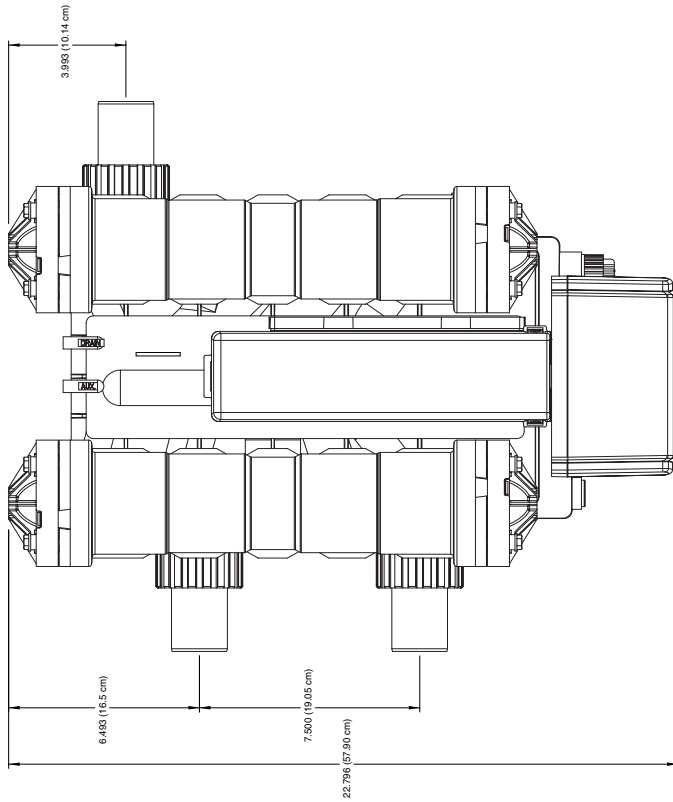
Electrical*

Voltage - 962 Series Control	12 VAC wall mount transformer only
Voltage - 942 Series Control	120 VAC, 12 VAC wall mount transformer
Voltage - 952 Series Control	24 VAC, 120 VAC
Power Draw.....	4.5 volt-amps

*See section on Electronic Controls for alternative electrical configurations.

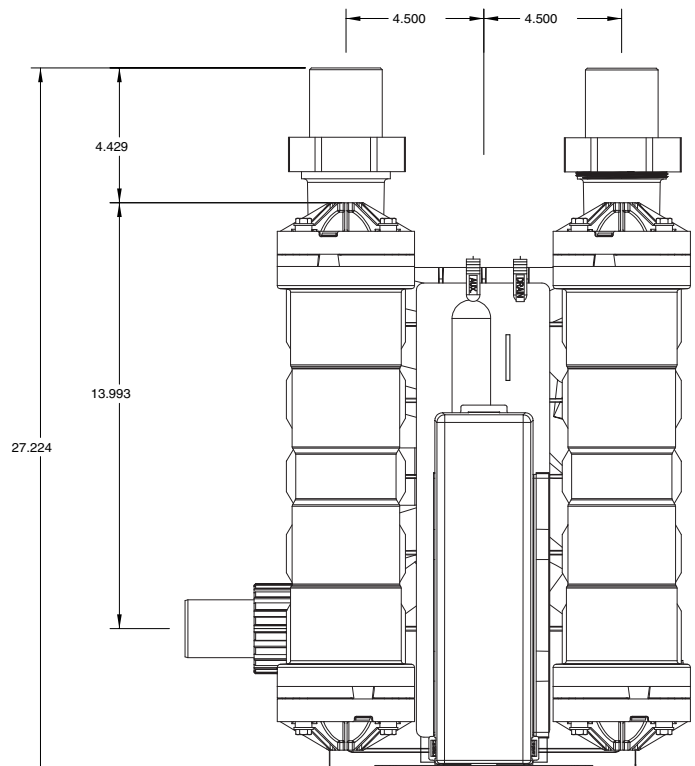
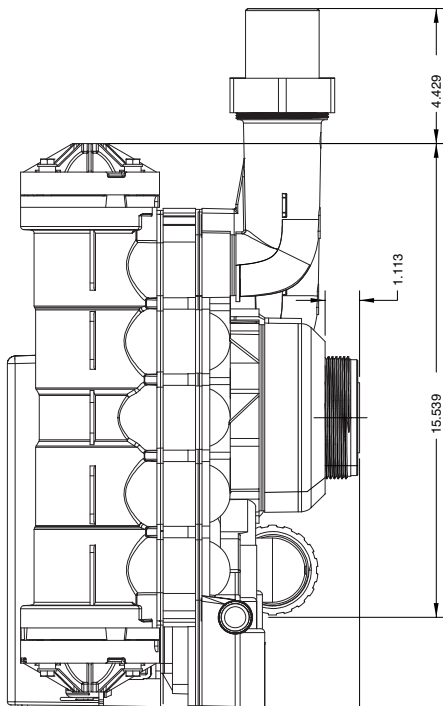
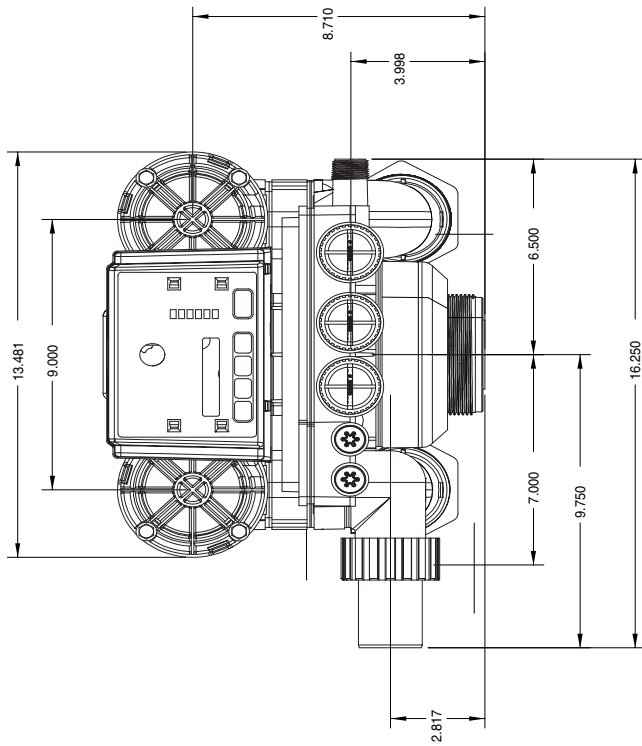
2.3 Magnum Cv Dimensional Specifications

1 1/2-inch Inlet, Outlet and Drain



Magnum Cv PLUS Dimensional Specifications

2-Inch Inlet and Outlet, 1 1/2-Inch Drain



3.0 General Installation Information

Please review the following items thoroughly to ensure an efficient and safe installation of the water treatment system. Page 12 shows typical installation line drawings for the Magnum Cv Series.

Operating Conditions - A minimum dynamic operating water pressure of 25 psig (172 kPa) is required for the Magnum Cv Series control valve to operate properly. Water pressure is not to exceed 125 psig (862 kPa). In Canada, water pressure is not to exceed 100 psig (688 kPa). Water temperature is not to exceed 100°F (36°C). Do not subject the valve to freezing conditions.

Space Requirements - Allow adequate space for the water treatment system and associated piping. The **General Specifications** section (pages 7-9) provides the overall dimensions of the control valve as well as the dimensional reference information for each of the connection ports. A minimum of 4 1/2 inches (11.5 cm) front and rear clearance is required for cartridge assembly and removal.

Plumbing - Always follow good plumbing practices and conform to local codes. Check existing pipes for lime and/or iron buildup. Replace piping if heavy buildup exists and initiate the proper treatment to prevent additional occurrences. Locate the equipment close to a drain that is capable of handling the maximum drain flow rate during backwash.

Flexible Connectors - Some tanks expand and contract over the acceptable range of operating water pressures of the Magnum Cv Series control valve. The use of flexible connectors is recommended on polywound or fiberglass tank installations of 24-inch (60.96-cm) diameter and larger.

Inlet and Outlet Piping - Inlet and outlet plumbing should be adequately supported to avoid excessive loads on the valve. Install a manual bypass system to provide for occasions when the water conditioner must be bypassed for servicing.

Drain Line Piping - To prevent mineral loss during backwash, and to ensure proper operation of the Magnum Cv Series control valve, **A DRAIN LINE FLOW CONTROL** must be plumbed into the drain line prior to placing the valve in the service mode. Flow controls from 5 to 40 gpm (18.92 to 151.4 Lpm) are available from Osmonics and can be easily installed in the drain line (Figure 3.1). Flow controls greater than 40 gpm (151.4 Lpm) must be plumbed externally. Selection of the proper drain line flow control will depend on the tank size and media used for the installation. See Table 10.3 on page 55.

The following general drain line piping guidelines should be observed:

- 1 inch (2.54 cm) or larger piping
- Should not exceed 20 feet (6.1 m)
- Should not be elevated higher than the control valve
- No shut-off valves should be installed in drain line
- Minimal number of elbows and fittings should be installed in drain line
- Piping must be self-supporting
- Install air gap to provide a siphon break
- Flow control should be installed as close to the Magnum Cv Series control valve as possible if an external flow control is used

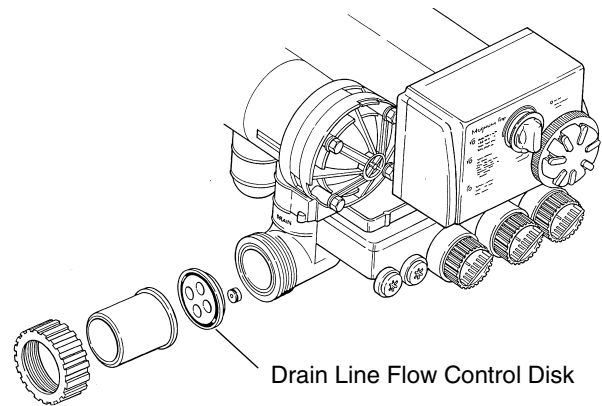


Figure 3.1

Brining System - The Magnum Cv Series control valve utilizes timed water refill to add water to the salt tank. A refill tube with check ball is required in the brine tank that will not restrict the refill or brine draw flow rate capabilities of the valve. Although not required, a separate brine valve (safety float) system is recommended for use with Magnum Cv Series installations. Select a “High-Flow” brine valve that will not restrict the refill or brine draw flow rate capabilities of the valve. The “Performance Data and Charts” section (Section 10.0) of this manual contains flow rate information for various size injectors and refill controllers.

Pilot Drain - During regeneration, a small amount of water (200 ml or 1 cup) is discharged from the 1/4-inch (6.3-mm) tube fitting on the back of the valve marked DRAIN (Figure 3.2). To prevent this water from being discharged to the floor, plumb this connection to a non-pressurized drain or to the brine tank. **Do not plug or apply back pressure to the pilot drain at any time.**

Crimping the pilot drain line or installing the line to go up, which causes backpressure, will prevent the

diaphragm cartridges from shifting properly through the cycles of regeneration or backwash.

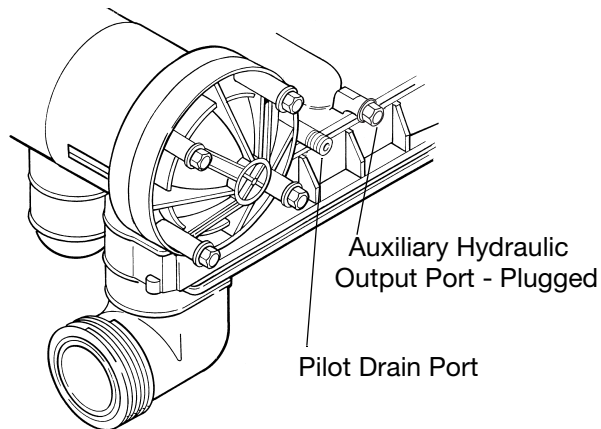


Figure 3.2

Electrical

1. Electrical requirements for the installation will depend on the configuration of the control.
2. The standard North American Series 962 electronic control is supplied with a 12 volt wall mount transformer. Optional wall mount transformers are available in the following configurations: Japanese plug @ 100 volts/50 or 60 Hz, Australian/Argentine plug @ 240 volts/50 Hz, British plug @ 240 volts/50 Hz, European/Italian plug @ 230 volts/50 Hz. Optional transformers must be ordered separately for all international 12 VAC configurations.
3. The standard North American Series 952 impulse controls use 120 VAC or 24 VAC/50 or 60 Hz power.

3.1 Typical Installation Drawings

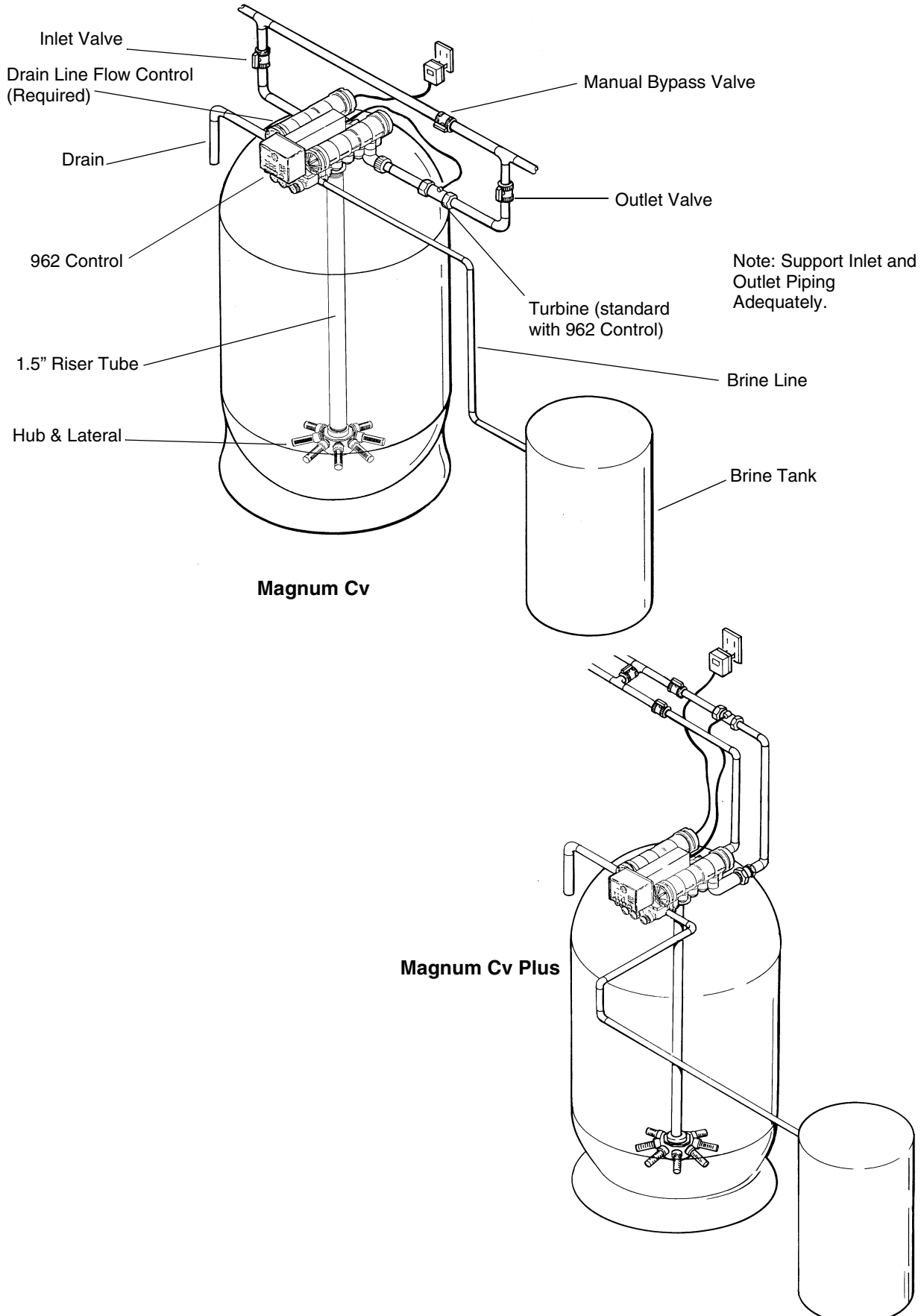


Figure 3.3 Magnum Cv and Cv Plus, Single Tank Softener Units with 962 Electronic Control

4.0 Flow Diagrams

The Magnum Cv Series control valve utilizes a series of pilot valves to properly position the diaphragm valve cartridges (Figure 4.1). The pilot valves are activated by the camshaft (Figure 4.2). The flow diagrams that follow represent the **Service Cycle** for a 5-cycle softener, 3-cycle filter, and 5-cycle twin alternating softener

configuration. Both the Hardwater Bypass and No Hardwater Bypass service flow diagrams are presented.

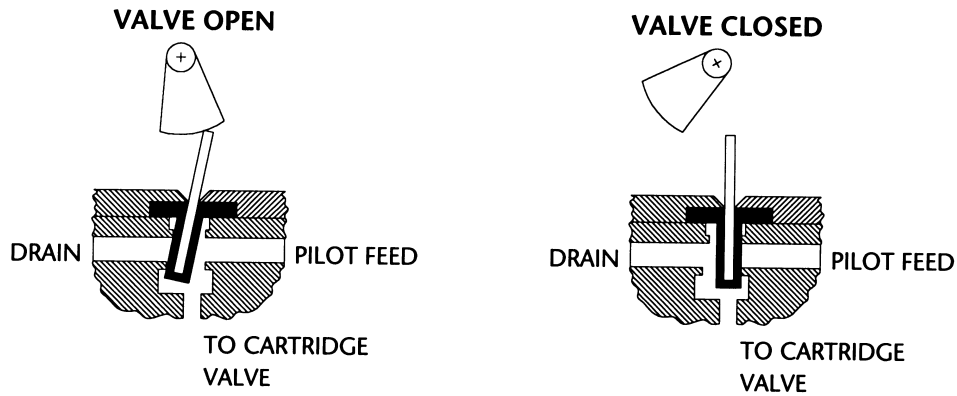


Figure 4.1 Pilot Valve Principle of Operation

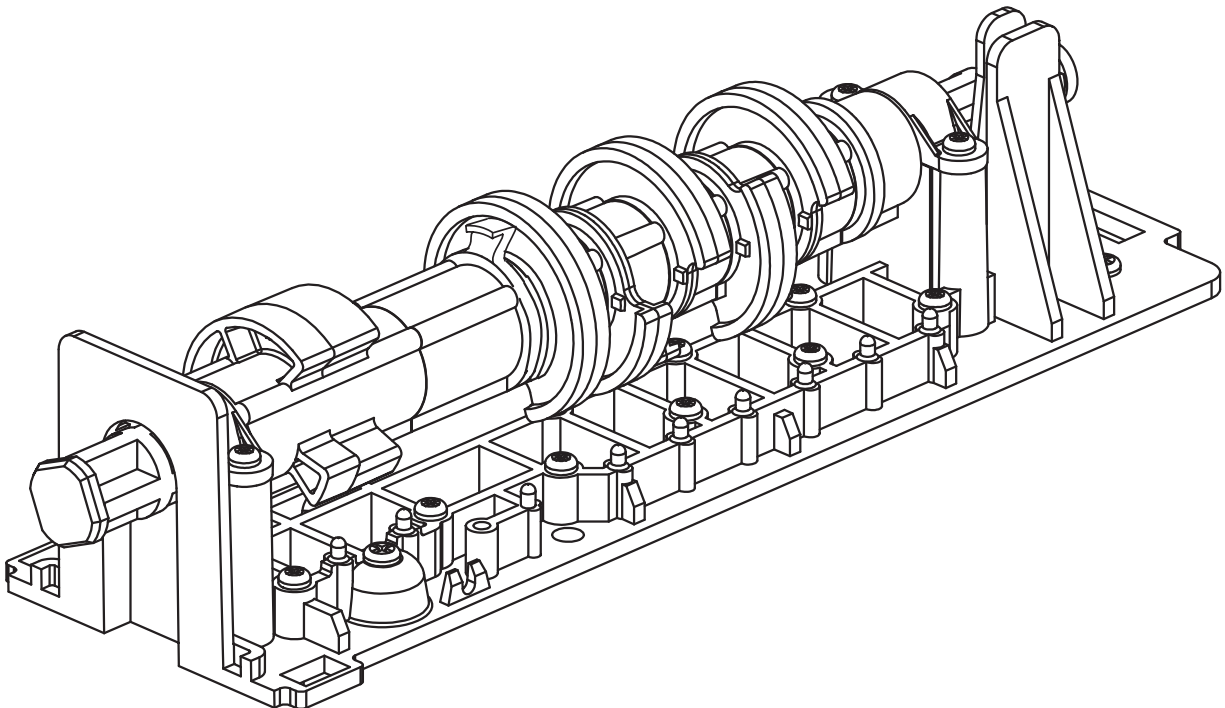
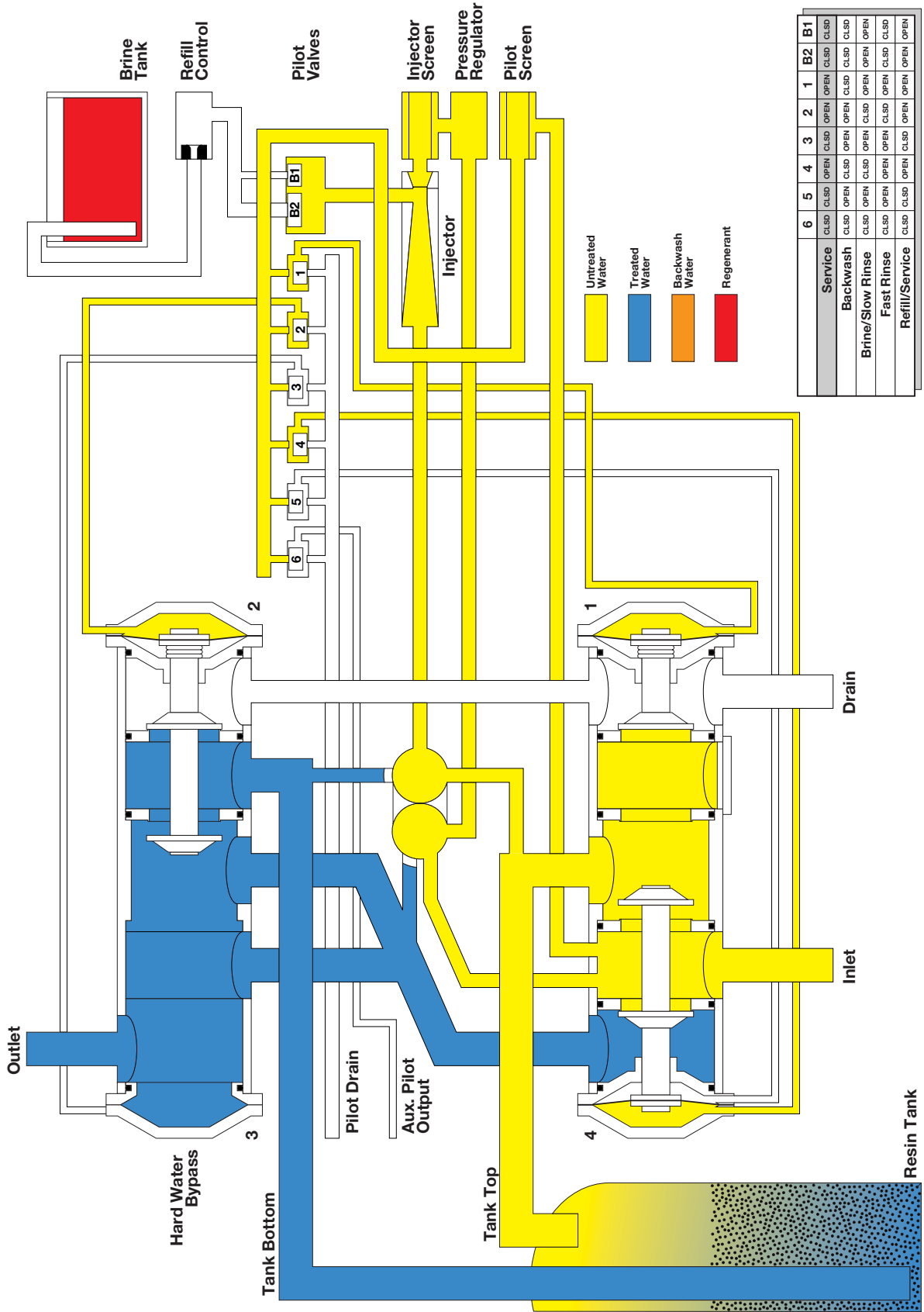


Figure 4.2 Cam Assembly

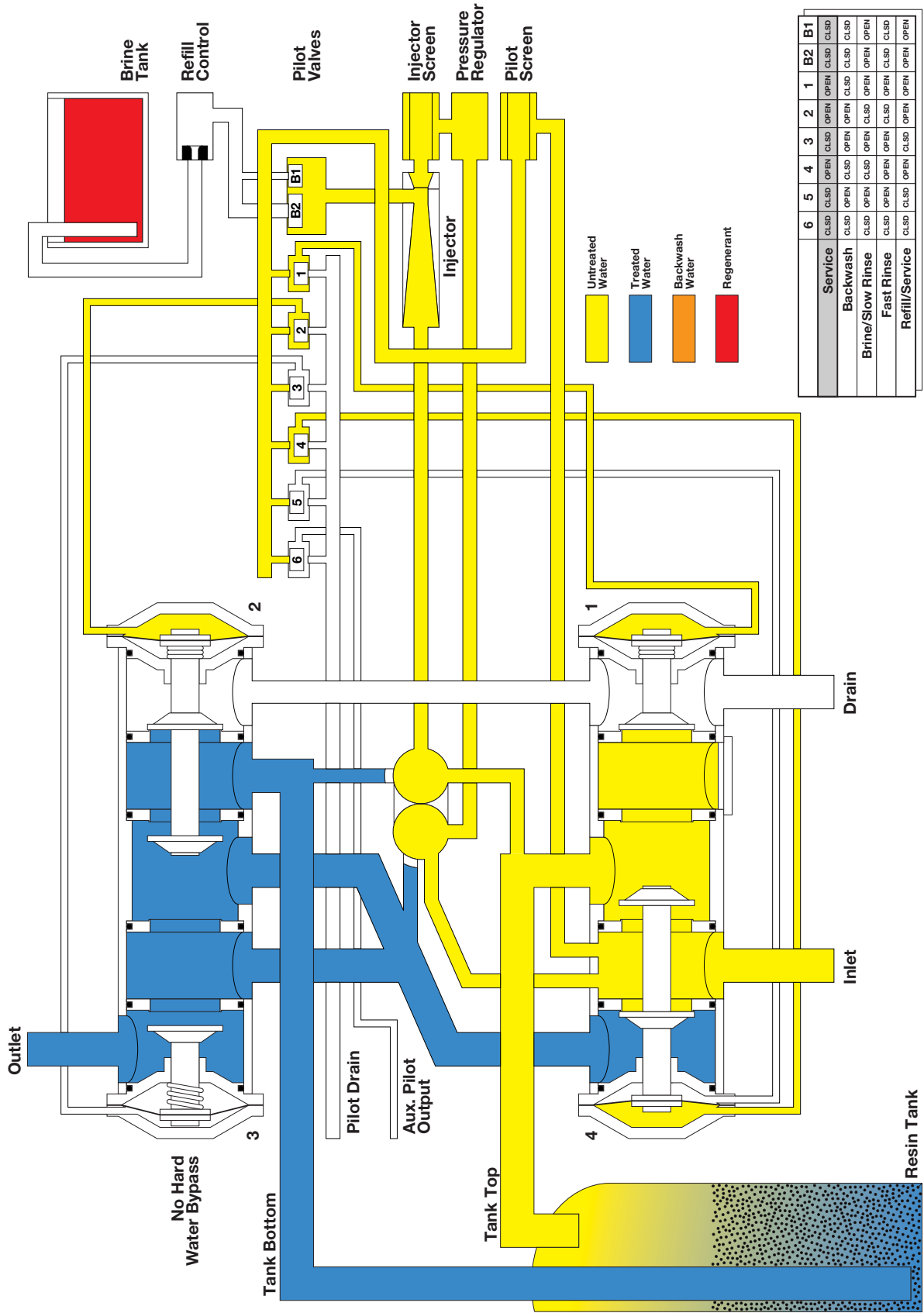
Magnum Cv

5 Cycle - Co-current - Hard Water Bypass - Softener Service Cycle



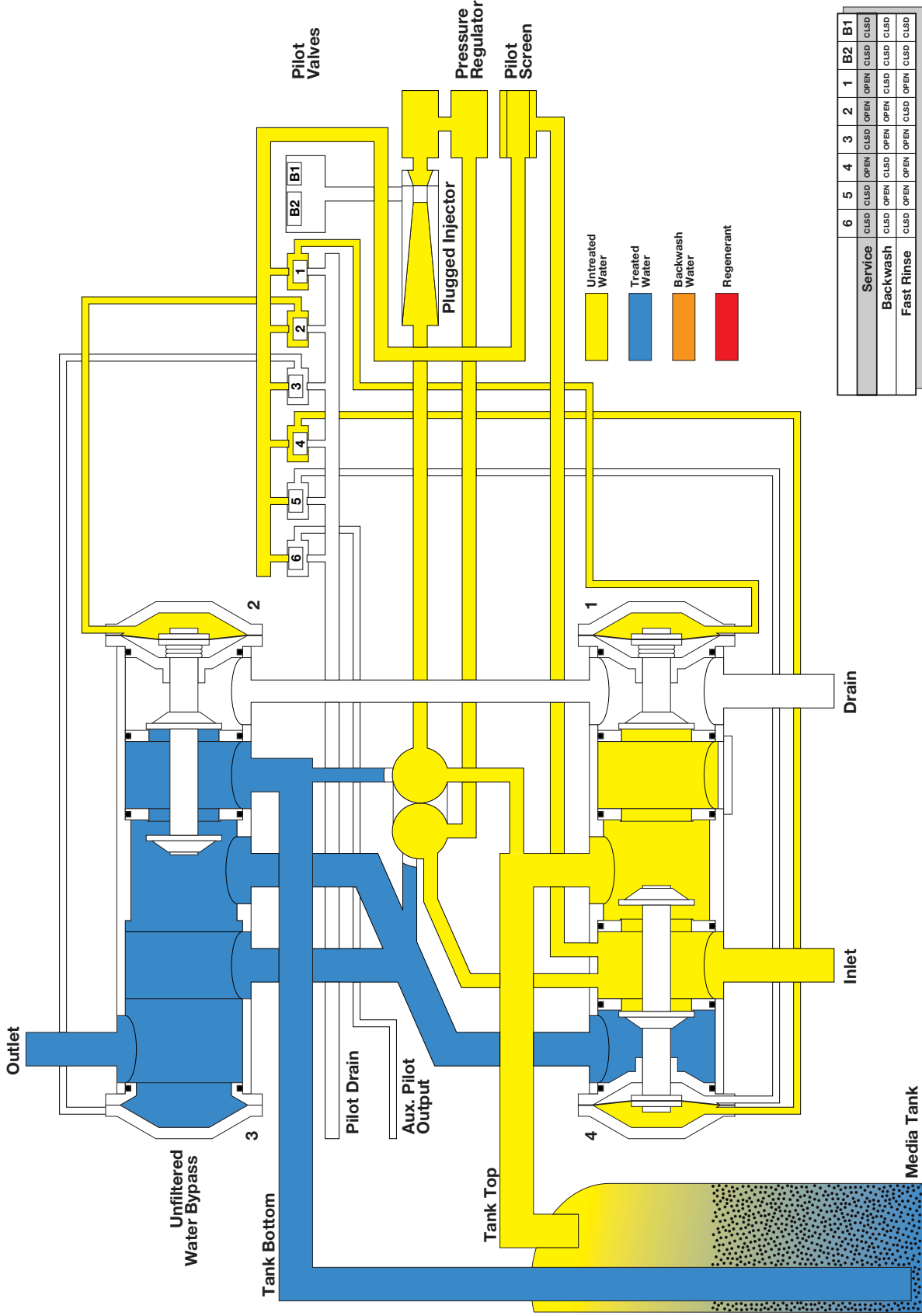
Magnum Cv

5 Cycle - Co-current - No Hard Water Bypass - Softener Service Cycle



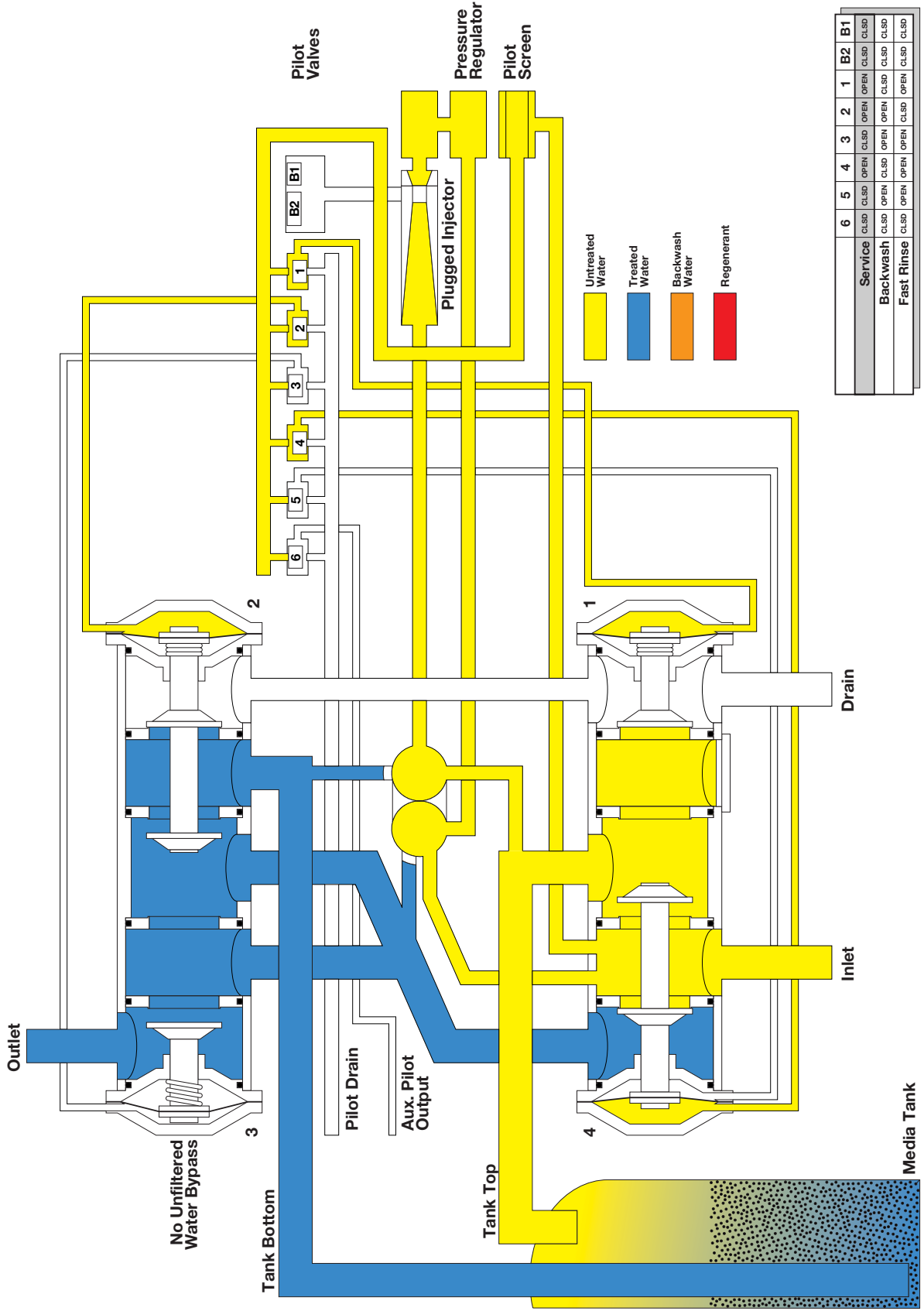
Magnum Cv

3 Cycle - Unfiltered Water Bypass - Filter Service Cycle



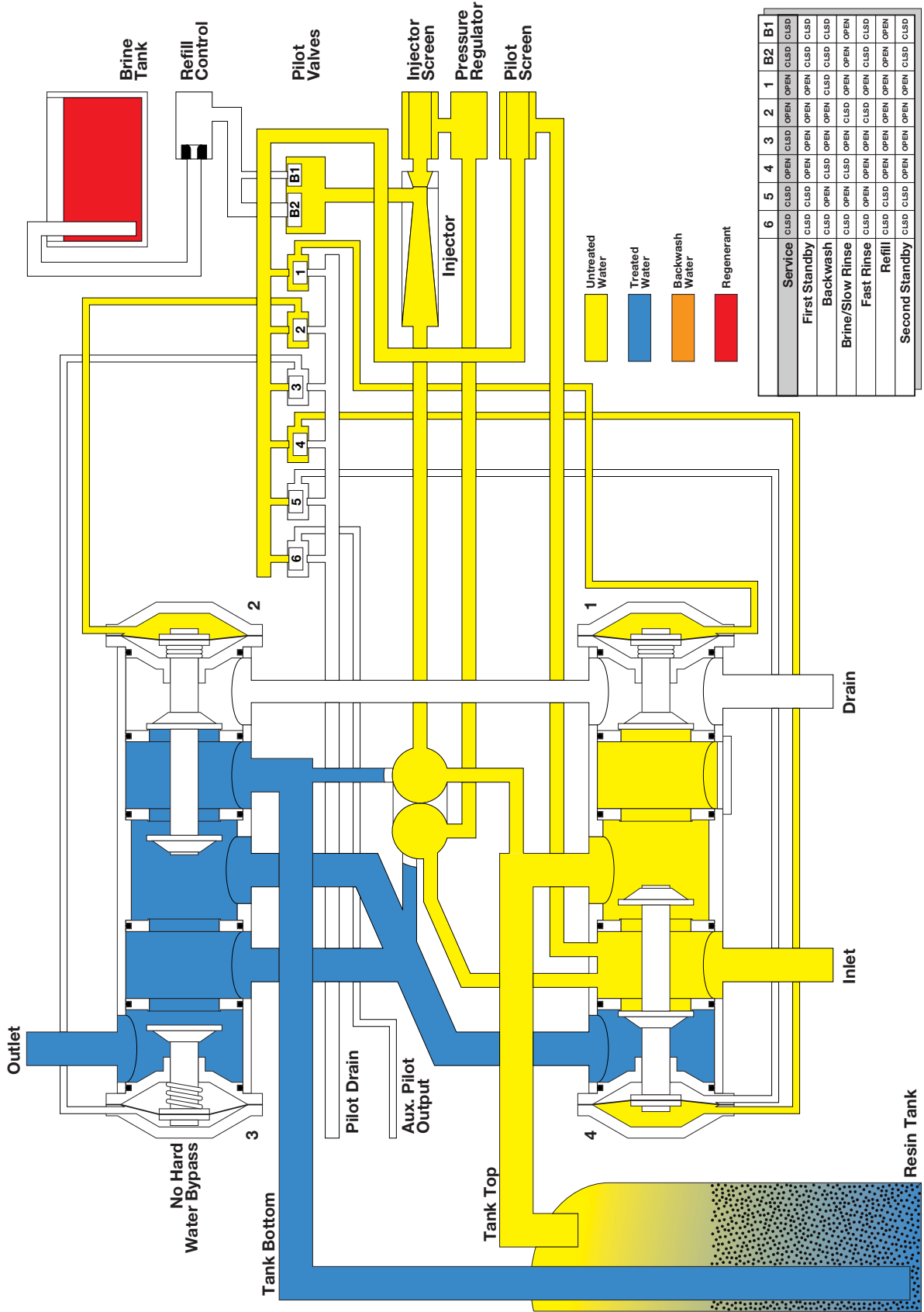
Magnum Cv

3 Cycle - No Unfiltered Water Bypass - Filter Service Cycle



Magnum Cv

5 Cycle - Co-current - Twin Alternating Softener Service Cycle



5.0 Control Settings

5.1 Manual

Series 942Man Controls

The 942Man represents the maximum in versatility and ease of operation for the manual control valve system. Upgrade to an automatic system is easily accomplished by switching the manual control to a clock or demand control.

DO NOT TURN THE INDICATOR KNOB CLOCKWISE AT ANY TIME.

Regeneration Instructions

1. Move indicator knob **COUNTERCLOCKWISE** from the **Regeneration Complete** position to the center of the **Backwash** (Figure 5.1) position. **DO NOT** turn the knob clockwise.

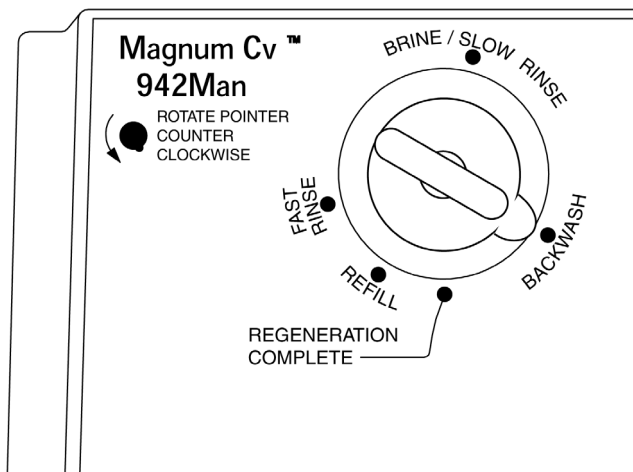


Figure 5.1

2. The indicator knob should remain in the **Backwash** position for the appropriate amount of time. Specific backwash times are determined by the inlet water quality (i.e.: the amount of iron, manganese, turbidity), the amount of time between regenerations, water pressure, and flow. The typical backwash time is 10-15 minutes*. The unit should be in backwash until water at the drain is clear.
3. When the backwash is complete, move the indicator knob **COUNTERCLOCKWISE** to the center of the **Brine/Slow Rinse** position (Figure 5.2). See the "Suggested Brine Draw/Slow Rinse Table" to determine the correct draw/rinse time. Please note that the tables are given at three salting levels and four pressures. The indicator knob should remain in the **Brine/Slow Rinse** position for the time* indicated in the table.

*Note: The times given are only general guidelines. Adjustment of the times may be necessary for specific applications and conditions.

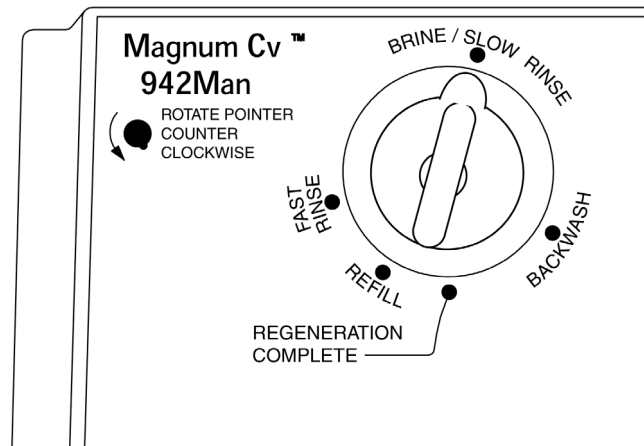


Figure 5.2

4. When the slow rinse is complete, move the indicator knob **COUNTERCLOCKWISE** to the center of the **Fast Rinse** position (Figure 5.3). The indicator knob should remain in the **Fast Rinse** position for the appropriate amount of time. Specific fast rinse times are determined by water quality, clarity of drain water, water pressure, and flow. Fast rinse serves to eliminate excess salt and repack the resin bed for the service run. Typically fast rinse should continue for 5 - 15 minutes*.

Important: If excessive fast rinse time is required to return the service effluent to quality, there could be an underlying cause, such as low pressure, fouled resin bed, fouled injector, etc.

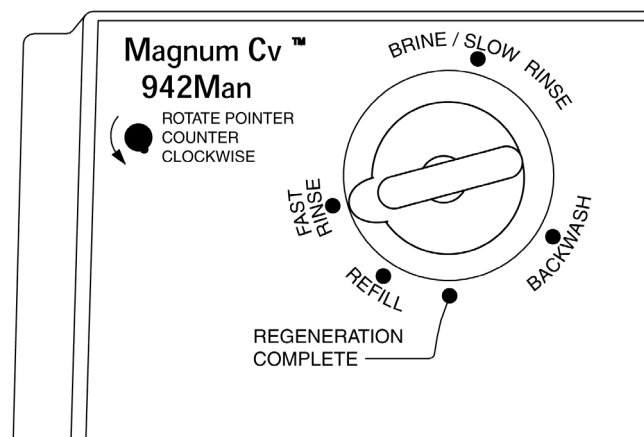


Figure 5.3

5. When the fast rinse is complete, move the indicator knob **COUNTERCLOCKWISE** to the **Refill** position (Figure 5.4). Determine the correct refill time* from Table 5.1 below. The indicator knob should remain in the **Refill** position for the time indicated in the table.

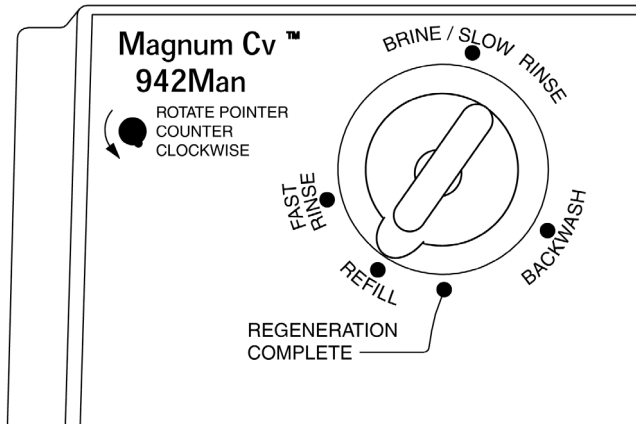


Figure 5.4

Table 5.1 Suggested Refill Times

Tank Diameter	Resin cu.ft.	Refill PN	Refill Flow Rate gpm (lpm) @ 60 psig (414 kPa)	Minimum Salting (6 lbs/ft ³) (96.1 kg/m ³)	Medium Salting (10 lbs/ft ³) (160.18 kg/m ³)	Maximum Salting (15 lb/ft ³) (240.27 kg/m ³)
14 in (35.5 cm)	3	1040679	0.7 (2.6 lpm)	9 minutes	15 minutes	22 minutes
16 in (40.6 cm)	4	1040680	0.8 (3 lpm)	10 minutes	17 minutes	25 minutes
18 in (45.7 cm)	5	1040681	1.0 (3.8 lpm)	10 minutes	17 minutes	25 minutes
21 in (53.5 cm)	7	1040682	1.4 (5.31 lpm)	10 minutes	17 minutes	25 minutes
24 in (60.9 cm)	10	1040683	2.0 (7.6 lpm)	10 minutes	17 minutes	25 minutes
30 in (76.2 cm)	15	1040684	3.0 (11.4 lpm)	10 minutes	17 minutes	25 minutes
36 in (91.4 cm)	20	1040685	5.0 (18.9 lpm)	8 minutes	14 minutes	20 minutes

6. When the refill is complete move the indicator knob COUNTERCLOCKWISE to the **Regeneration Complete** position (Figure 5.5). The unit will now provide softened water.

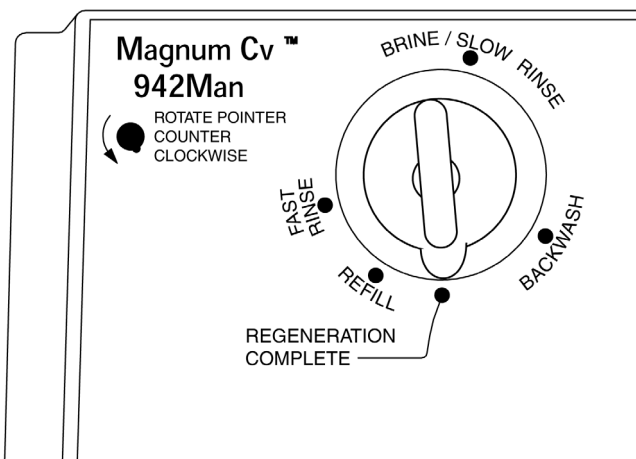


Figure 5.5

*Note: The times given are only general guidelines. Adjustment of the times may be necessary for specific applications and conditions.

Regenerating Iron Filters - Model 942Man

Refer to **Regenerating Iron Filters Model 942** in **Section 5.2** for information on this type of system application. All common control settings, control regenerant settings, and regenerant usage which apply to the 942Man control are the same as those used on the 942 control.

When using the 942Man control however, the time of each cycle cannot be predicted exactly. Note the following regeneration cycle parameters:

- Backwash the filter until the drain water flows clear, typically 5 - 15 minutes.
- Regenerant draw continues until the check ball closes to end draw.
- **Slow Rinse** should continue until there is NO pink color to the drain water flow. This is typically four times that of the regenerant draw time.
- **Fast Rinse** time continues until there is no pink color to the drain water flow, typically 5 - 15 minutes.
- Refill time is determined by the size of the refill flow control and the amount of regenerant required for a particular size system. Refer to **Regenerant Use Table** in **Section 5.2**.

Table 5.2 Suggested Brine Draw/Slow Rinse Times Based on 25 psi and 2.5 Bed Volumes of Slow Rinse

Tank Size in. (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Resin Vol. cu. ft. (cu m)	3 (0.085)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Brine/ Rinse Time	78 min	72 min	85 min	73 min	79 min	89 min	77 min
Total Lb. Salt [Min.] (kg)	18 (6.72)	24 (8.96)	30 (11.2)	42 (15.68)	60 (22.39)	90 33.59)	120 (44.79)
Capacity (kgr)	60	80	100	140	200	300	400
Brine/Rinse Time	87 min	83 min	98 min	87 min	89 min	100 min	86 min
Total Lb. Salt [Mid] (kg)	30 (11.2)	40 (14.93)	50 (18.66)	70 (21.13)	100 (37.32)	150 (55.99)	200 (74.65)
Capacity (kgr)	75	100	125	175	250	375	500
Brine/Rinse Time	99 min	98 min	113 min	103 min	102 min	114 min	98 min
Total Lb. Salt [Max]	45 (16.8)	60 (22.39)	75 (27.99)	105 (39.19)	150 (55.99)	225 (83.98)	300 (111.97)
Capacity (kgr)	90	120	150	210	300	450	600
Injector Number	1000441	1000442	1000443	1000444	1000445	1000446	1000447

Table 5.3 Suggested Brine Draw/Slow Rinse Times Based on 50 psi and 2.5 Bed Volumes of Slow Rinse

Tank Size in. (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Resin Vol. cu. ft. (cu m)	3 (0.085)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Brine/ Rinse Time	65 min	58 min	70 min	65 min	66 min	76 min	68 min
Total Lb. Salt [Min.] (kg)	18 (6.72)	24 (8.96)	30 (11.2)	42 (15.68)	60 (22.39)	90 33.59)	120 (44.79)
Capacity (kgr)	60	80	100	140	200	300	400
Brine/Rinse Time	74 min	70 min	83 min	77 min	77 min	87 min	77 min
Total Lb. Salt [Mid] (kg)	30 (11.2)	40 (14.93)	50 (18.66)	70 (21.13)	100 (37.32)	150 (55.99)	200 (74.65)
Capacity (kgr)	75	100	125	175	250	375	500
Brine/Rinse Time	99 min	85 min	98 min	94 min	90 min	101 min	89 min
Total Lb. Salt [Max]	45 (16.8)	60 (22.39)	75 (27.99)	105 (39.19)	150 (55.99)	225 (83.98)	300 (111.97)
Capacity (kgr)	90	120	150	210	300	450	600
Injector Number	1000441	1000442	1000443	1000444	1000445	1000446	1000447

Table 5.4 Suggested Brine Draw/Slow Rinse Times Based on 75 psi and 2.5 Bed Volumes of Slow Rinse

Tank Size in. (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Resin Vol. cu. ft. (cu m)	3 (0.085)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Brine/ Rinse Time	55 min	52 min	61 min	57 min	58 min	66 min	55 min
Total Lb. Salt [Min.] (kg)	18 (6.72)	24 (8.96)	30 (11.2)	42 (15.68)	60 (22.39)	90 (33.59)	120 (44.79)
Capacity (kgr)	60	80	100	140	200	300	400
Brine/Rinse Time	64 min	64 min	73 min	70 min	69 min	76 min	64 min
Total Lb. Salt [Mid] (kg)	30 (11.2)	40 (14.93)	50 (18.66)	70 (21.13)	100 (37.32)	150 (55.99)	200 (74.65)
Capacity (kgr)	75	100	125	175	250	375	500
Brine/Rinse Time	75 min	79 min	88 min	85 min	82 min	90 min	75 min
Total Lb. Salt [Max]	45 (16.8)	60 (22.39)	75 (27.99)	105 (39.19)	150 (55.99)	225 (83.98)	300 (111.97)
Capacity (kgr)	90	120	150	210	300	450	600
Injector Number	1000441	1000442	1000443	1000444	1000445	1000446	1000447

Table 5.5 Suggested Brine Draw/Slow Rinse Times Based on 100 psi and 2.5 Bed Volumes of Slow Rinse

Tank Size in. (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Resin Vol. cu. ft. (cu m)	3 (0.085)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Brine/ Rinse Time	50 min	48 min	56 min	53 min	54 min	59 min	50 min
Total Lb. Salt [Min.] (kg)	18 (6.72)	24 (8.96)	30 (11.2)	42 (15.68)	60 (22.39)	90 (33.59)	120 (44.79)
Capacity (kgr)	60	80	100	140	200	300	400
Brine/Rinse Time	59 min	60 min	68 min	65 min	64 min	69 min	59 min
Total Lb. Salt [Mid] (kg)	30 (11.2)	40 (14.93)	50 (18.66)	70 (21.13)	100 (37.32)	150 (55.99)	200 (74.65)
Capacity (kgr)	75	100	125	175	250	375	500
Brine/Rinse Time	70 min	75 min	83 min	81 min	77 min	82 min	70 min
Total Lb. Salt [Max]	45 (16.8)	60 (22.39)	75 (27.99)	105 (39.19)	150 (55.99)	225 (83.98)	300 (111.97)
Capacity (kgr)	90	120	150	210	300	450	600
Injector Number	1000441	1000442	1000443	1000444	1000445	1000446	1000447

Minimum salting: 6 lb. salt = 20 kgr/cu. ft.

Medium salting: 10 lb. salt = 25 kgr/cu. ft.

Maximum salting: 15 lb. salt = 30 kgr/cu. ft.

942FMan - Manual Filter Control for the Magnum Cv Valve

The 942FMan represents the maximum in versatility and ease of operation for the manual control valve system. Upgrade to an automatic system is easily accomplished by switching the manual control to a clock or demand control.

DO NOT TURN THE INDICATOR KNOB CLOCKWISE AT ANY TIME.

Backwash Instructions:

1. Move the indicator knob **COUNTERCLOCKWISE** from the **Backwash Complete** position to the center of the **Backwash** (Figure 5.6) position. **DO NOT** turn the knob clockwise. The knob should remain in the **Backwash** position for 5 to 20 minutes*, or until the water runs clear at the drain.

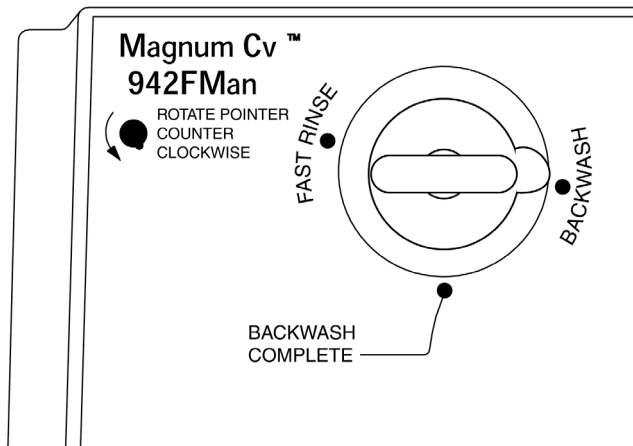


Figure 5.6

2. When the backwash is finished, move the indicator knob **COUNTERCLOCKWISE** to the center of the **Fast Rinse** position (Figure 5.7). The knob should remain in the **Fast Rinse** position for 5 to 20 minutes*, or until the water runs clear at the drain.

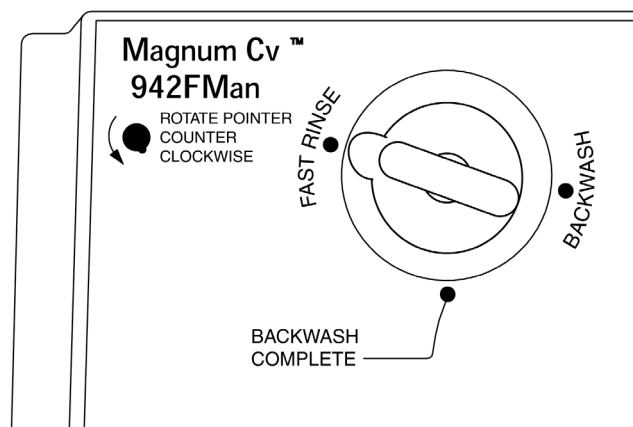


Figure 5.7

3. After the fast rinse is complete, return the filter to service by rotating the indicator knob **COUNTERCLOCKWISE** to the **Backwash Complete** position (Figure 5.8).

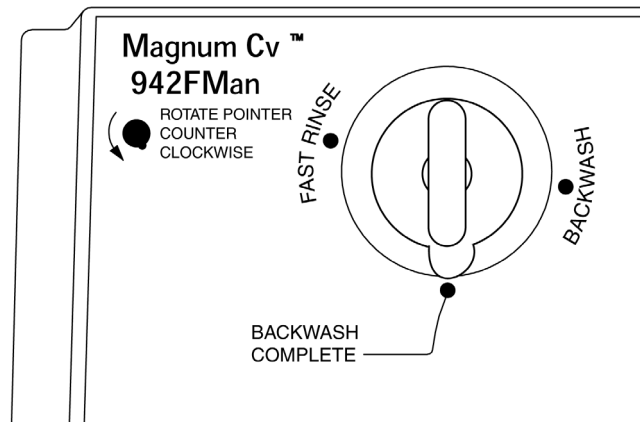


Figure 5.8

*Note: the times given are only general guidelines. Adjustment of the times may be necessary for specific applications and conditions.

5.2 Mechanical

Series 942 Mechanical Controls

The Series 942 mechanical controls provide mechanical timeclock function for water softening and filter applications; 942 model for softening applications, (Figure 5.9) 942F model for filtering applications. Identification of the specific model is provided on the front of the control. The controls are very similar in appearance, function, and settings. However, they require different gear drives and camshafts to function properly. The softener and filter camshafts are identified in the **Assembly Drawings** and **Parts List** section of this manual (page 72).

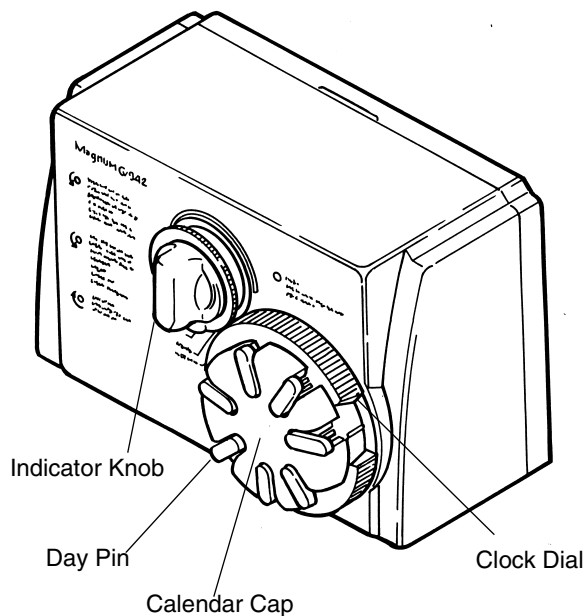


Figure 5.9

5.2.1 Common Settings

Setting the Time of Day, the Days of Regeneration or Backwash and performing manual regenerations or backwashing are the same for 942 and 942F controls.

Setting the Time of Day

Rotate the Clock Dial **clockwise** until the pointer indicates the correct time of day. With the time of day set, the conditioner will regenerate at approximately 2:00 a.m. If it is desired to have the unit regenerate at an earlier or later time, simply offset the current time of day accordingly. For example, to have the unit regenerate at 4:00 a.m., set the Clock Dial 2 hours earlier than the actual current time of day.

Note: Do not rotate the Calendar Cap by hand. The Clock Dial indexes the Calendar Cap daily. To manually index the Calendar Cap, rotate the Clock Dial **clockwise** one complete turn for every day to be indexed. Day pins should be in the outward position during Clock Dial rotation to prevent an undesired

regeneration. Reset day pins when completed.

Setting the Days of Regeneration

Setting the days that the conditioner will regenerate is accomplished in two simple steps:

1. Pull all of the day pins outward.
2. Push in the day pin(s) for the day(s) on which a regeneration or backwash is desired.

NOTE: The NEXT DAY pin is noted on the control face. Pushing this pin will insure a regeneration the next day at approximately 2:00 a.m. since the Calendar Cap progresses in a clockwise direction, pushing the day pin immediately following the NEXT DAY pin counterclockwise will insure a regeneration occurs the following day at approximately 2:00 a.m. This progression is noted on the control face as "FUTURE DAYS".

Manual Regeneration

Excessive water usage or other service related issues may create the need to manually regenerate the conditioner. This function is performed by rotating the Indicator Knob **COUNTERCLOCKWISE** to the "START" position. Once in this position, the conditioner will begin a regeneration or backwash within a few minutes. The normal schedule, established with the pushed in day pins, will not be disrupted by a manual regeneration or backwash.

24 Hour Clock

All Magnum Cv Series 942 and 942F controls utilize a 24 hour clock dial. This is typically referred to as "Military Time". The hours of the day between 12:00 a.m. (midnight) and 12:00 p.m. (noon) are designated on the clock dial by the numbers 1 through 12, with 1 being 1:00 a.m. The hours of the day between 12:00 p.m. (noon) and 12:00 a.m. (midnight) are designated on the clock dial by the numbers 13 through 24, with 13 being 1:00 p.m. Be sure to set the correct time of day accordingly.

Adjusting the Salt Setting - Model 942

The Salt Dial (Figure 5.10) controls the total amount of salt used per regeneration. With the Indicator Knob in the **REGENERATION COMPLETE** position, rotate the Salt Dial **counterclockwise** at least one full turn to cancel out the current setting. A light clicking sound will be replaced by a heavier clicking sound when the previous setting is cancelled. Once the heavier clicking is heard, the new setting may be set by rotating the Salt Dial **counterclockwise** to the desired setting.

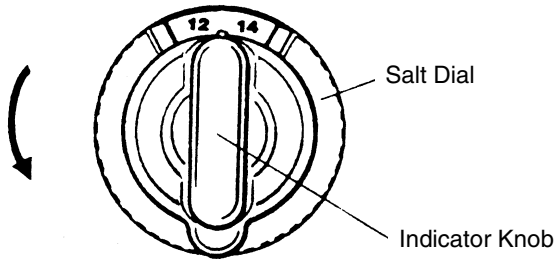


Figure 5.10 Regeneration Complete

It is important to note that the numbers on the Salt Dial represent “MINUTES” of water refill time. To determine the total pounds of salt that will be used for a regeneration, it is necessary to know the refill control that is used in the conditioner. The refill control determines the flow rate of water into the salt tank during the refill cycle. Refer to the Salt Use Table 5.8 on page 26 to determine the total pounds of salt used per regeneration for the various size tanks.

Table 5.6 Cycle Times for 942 Control

Cycle	Time (Minutes)
Backwash	17
Brine/Slow Rinse	95
Purge	9
Refill	2 to 24

5.2.2 Regenerating Iron Filters - Model 942

Filter medias used in the water treatment industry generally require only a periodic backwashing with water to maintain their filtering efficiencies. These type of filters would use the 942F control described in the next section. Manganese greensand media, typically used for iron removal, requires regular regeneration with an oxidizing chemical, potassium permanganate (KMNO₄) similar to the regeneration of a water softener with salt. This application requires the use of the Model 942 control.

Common Settings

Setting the Time of Day, Days of Regeneration, and the initiation of a Manual Regeneration are as previously described in this section.

Adjusting The Regenerant Setting - Model 942

Refer back to the previous heading in this section **Adjusting the Salt Setting - Model 942**. Setting the number of “MINUTES” of refill time determines the amount of regenerant chemical used per regeneration. Refer to the **Regenerant Use Table 5.9** on page 27 for the proper setting based on tank size and the number of cubic feet of media used.

NOTE: Only two sizes of refill flow controls are recommended when the Magnum Cv Series control valve is used in a manganese greensand filter system. The Magnum Cv control valve must be ordered with the proper size refill flow control or changed in the field. The incorrect refill flow control could underfill or overfill the regenerant tank resulting in a system malfunction.

5.2.3 Backwashing Filter - Model 942F

Adjusting the Backwash Setting

The Backwash Dial (Figure 5.11) controls the backwash time. With the Indicator Knob in the BACKWASH COMPLETE position, rotate the Backwash Dial counterclockwise at least one full turn to cancel out the current setting. A light clicking sound will be replaced by a heavier clicking sound when the previous setting is cancelled. Once the heavier clicking is heard, the new setting may be set by rotating the Backwash Dial to the desired setting. The numbers on the Backwash Dial represent “MINUTES” of backwash time.

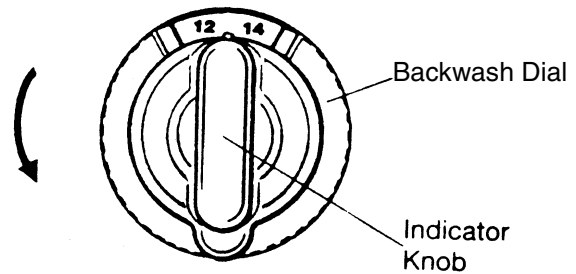


Figure 5.11 Backwash Complete

Table 5.7 Cycle Times for 942F Control

Cycle	Time (Minutes)
Backwash	8 - 30
Purge	9

5.2.4 Salt Use Table

Table 5.8 Model 942, 952, 952QC - Salt Used per Regeneration

Tank Size/Dia. inches (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Resin Volume cu. ft. (cu. m.)	3 (0.85)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Refill Flow Rate GPM (LPM)	0.7 (2.65)	0.8 (3.03)	1.0 (3.78)	1.4 (5.30)	2.0 (7.57)	3.0 (11.36)	5.0 (18.93)
Salt Dial Setting (Minutes)	Approximate Pounds of Salt per Regeneration						
8	18	--	--	--	--	--	120
10	21	24	30	42	60	90	150
12	25	29	36	50	72	108	180
14	29	34	42	59	84	126	210
16	34	38	48	67	96	144	240
18	38	43	54	76	108	162	270
20	42	48	60	84	120	180	300
22	45	53	66	92	132	198	--
24	--	60	75	105	150	225	--

Notes:

1. Flow rates for refill controls are based on 60 psig (414 kPa) inlet pressure.
2. Take into account the type of brine system used when determining the actual amount of salt delivered during regeneration. (i.e. dry salt/grid plate or wet salt)
3. Salt Use Table reflects minimum salting of 6 lbs./cu.ft. (96.11 kg/m³) through maximum salting of 15 lbs./cu.ft. (240.27 kg/m³).
4. To use potassium chloride (KCl) increase salt dosage by approximately 25%.
5. Chloride/Anion dealkalizers regenerate with 5 lbs./cu.ft. (80.09 kg/m³) salt (NaCl) which yields approx. 7500 gr/cu. ft. Injecting sodium hydroxide (NaOH) i.e. caustic soda, at a rate of 1/10 that of the salt dosage, during the brine draw cycle, increases capacity to approx. 10000 gr./cu. ft. Exact capacity, based on tank size, must be calculated using water analysis and resin manufacturer's capacity curves.

5.2.5 Regenerant Use Table - Potassium Permanganate (KMnO₄)

Table 5.9 Model 942, 952, 952QC - Regenerant Used Per Regeneration

Tank Size/Dia. inches (cm)	14 (35.5)	16 (40.6)	18 (45.7)	21 (53.3)	24 (60.9)	30 (76.2)	36 (91.4)
Media Volume cu. ft. (cu. m.)	3 (0.085)	4 (0.113)	5 (0.142)	7 (0.200)	10 (0.283)	15 (0.425)	20 (0.566)
Refill Flow Rate GPM (LPM)	0.8 (3.03)	0.8 (3.03)	0.8 (3.03)	1.0 (3.78)	1.0 (3.78)	1.0 (3.78)	1.0 (3.78)
Salt Dial Settings (minutes)	4	6	7	7	10	15	20
KMnO₄ oz. (grams)	12(340)	16 (454)	20 (567)	28 (794)	40 (1134)	60 (1701)	80 (2268)
Refill Water gal. (liters)	3 (11.36)	4 (15.14)	5 (18.93)	7 (26.50)	10 (37.85)	15 (56.78)	20 (75.71)

Notes:

1. Chemical dosage recommendations typify requirements for single batch regenerations.
2. When combining batch regeneration with continual feed of either chlorine or potassium permanganate, reduce recommended chemical dosages above by 50%.
3. Table above reflects a 4 oz./ cu. ft. of media, regenerant dosage, dissolved in 1 gallon of water / cu. ft. of media. Dosage rates will vary with various media manufacturers' recommendations. Check manufacturers' specifications for dosage recommendations.

5.3 Impulse

Series 952 Impulse Controls

The Series 952 impulse controls initiate a regeneration, or backwash, upon receiving an external line powered switch closer signal for a minimum of three minutes. The three models available are:

Control	Description
952	5 Cycle Softener
952F	3 Cycle Filter
952QC	5 Cycle Softener with Quick-Connect Cables

Once the external signal is received, the control automatically steps the valve through the appropriate cycles. Cycle positions are identified by the Indicator Knob.

Once the control has reached the **REGENERATION COMPLETE** position, the 952 control will be ready for the next external line powered switch closure signal. If a switch closure signal is received during a regeneration or backwash, it will be ignored.

Adjusting the Salt Setting - Model 952 and 952QC

The Salt Dial (Figure 5.12) controls the total amount of salt used per regeneration. With the Indicator Knob in the **REGENERATION COMPLETE** position, rotate the Salt Dial **COUNTERCLOCKWISE** at least one full turn to cancel out the current setting. A light clicking sound will be replaced by a heavier clicking sound when the previous setting is cancelled. Once the heavier clicking is heard, the new setting may be set by rotating the Salt Dial **counterclockwise** to the desired setting.

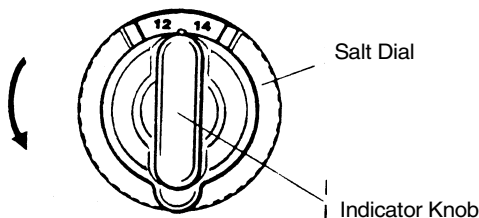


Figure 5.12 Regeneration Complete.

It is important to note that the numbers on the Salt Dial represent “MINUTES” of water refill time. To determine the total pounds of salt that will be used for a regeneration, it is necessary to know the refill control that is used in the conditioner. The refill control determines the flow rate of water into the salt tank during the refill cycle. Reference the **Salt-Use Table** on page 26 to determine the total pounds of salt used per regeneration for various size tanks.

Table 5.10 Cycle Times for 952 Control

Cycle	Time (Minutes)
Backwash	17
Brine/Slow Rinse	95
Purge	9
Refill	2 - 24

Regenerating Iron Filters - Model 952

Refer to the heading **Regenerating Iron Filters - Model 942** in **Section 5.2** for information on this type of system application. All common control settings, control regenerant settings, and regenerant usage which apply to the 942 control are the same as those used on the 952 control. This iron filter information applies to potassium permanganate regenerated manganese greensand filter systems only.

Adjusting the Backwash Setting - Model 952F

The Backwash Dial (Figure 5.13) controls the backwash time. With the Indicator Knob in the **BACKWASH COMPLETE** position, rotate the Backwash Dial **counterclockwise** at least one full turn to cancel out the current setting. A light clicking sound will be replaced by a heavier clicking sound when the previous setting is cancelled. Once the heavier clicking is heard, the new setting may be set by rotating the Backwash Dial to the desired setting. The numbers on the Backwash Dial represent “MINUTES” of backwash time.

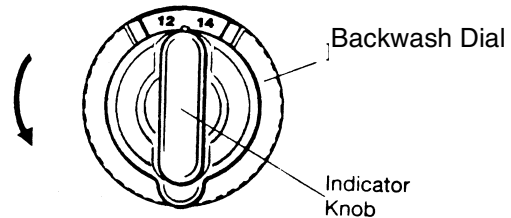


Figure 5.13 Backwash Complete.

Table 5.11 Cycle Times for 952F Control

Cycle	Time (Minutes)
Backwash	8 - 30
Purge	9

Wiring the 952 Series Controls

The 952 and 952F controls come with 21-foot (6.4-m) of wire for connection to the external signaling device. Refer to wiring illustration in the Wiring Diagram Section of this manual for further installation information. The 952QC is pre-wired with a standard 7-foot (2.13-m) cable assembly designed to plug directly into an Autotrol 480QC. Optional 14-foot (4.27-m) and 21-foot (6.4-m) cable assemblies are available. An optional feed back switch assembly, mounted on the Magnum Cv control valve, is required, when operating in the 952QC configuration.

5.4 Electronic

Series 962 Electronic Controls

The Series 962 Electronic Controls provide sophisticated, demand-based water conditioning by combining a microprocessor with a flow meter to electronically monitor the amount of water used. This fully programmable series of controls provide the ability to fine tune the conditioner's operation to meet the application requirements. There are four basic 962 models available:

Control	Description
962	Single or Multi Tank Softener
962F	Single or Multi Tank Filter
962M	Main Control for Twin Alternating
962S	Secondary Control for Twin Alternating

This section of the manual defines the basic operating and programming features for each of these models.

Special Features of the Series 962 Controls

- **Memory Retention** - During a power outage, critical operating information is stored in memory. This information includes all programming data and the number of days since the last regeneration. When power is restored, the information is returned to the microprocessor and operation resumes as if an outage never occurred. The time of day will be late by the length of the power outage and must be reset. No other reprogramming is necessary. An optional rechargeable battery backup will allow the control to keep track of time and water usage for up to three days during a power outage. *The control will not initiate a regeneration or backwash while on battery backup.*
- **Programmable Cycles** - The control is flexible in defining the appropriate cycles of operation.
- **Double Regeneration** - For single tank applications (Model 962 and 962F) the control automatically calls for a second regeneration or backwash the following day if the current operating cycle exceeds the defined capacity by 150% or more.
- **Capacity and Salt Setting Lockout** - The control can be programmed to lock the values for Salt Amount and Capacity so they cannot be altered after installation.

Reserve Type	Control
Specific time of day regeneration	962 and 962M
Immediate regeneration	962 and 962M
Fixed reserve	962
Variable reserve	962

- **U.S. or Metric Units of Measure** - To meet your display and programming requirements, the 962 control uses grains per gallon of hardness, pounds of salt and kilograins of capacity for U.S. units, or, parts per million of hardness, kilograms of salt and kilograms of capacity for metric units. The 962 control displays capacity as gallons or cubic meters.
- **Calendar Override** - If the volume of water used has not caused a regeneration, the 962 control can be set to regenerate every one to thirty days.
- **Manual Regeneration** - A separate REGEN button is provided for manual regenerations. A double manual regeneration feature is included that allows back-to-back regenerations.
- **Operating Histories** - Important operating data is stored in memory and is retrievable upon demand. The historical data includes peak flow rate as well as average daily water usage for each day of the week.
- **Remote Regeneration** - A set of terminals is provided as a standard feature on the 962 control that allows for a regeneration to be initiated from a remote location. This feature can be used to facilitate manual regeneration requirements or assist in further automating the control system.
- **Selectable Automatic Regenerations/ Backwashes** - There are two automatic regeneration/backwash methods - immediate and delayed. Immediate regeneration is used to start automatic regenerations/backwashes when the softening capacity is exceeded. Delayed regeneration is used to start automatic regenerations/backwashes at a predetermined time of day. A regeneration/backwash will start at the programmed regeneration time when the remaining capacity falls below the reserve capacity, which may be fixed or variable.
- **Selectable Reserve Options** - To meet the conditioned water requirements of the application, the 962 control allows selection of one of two reserve types:
 - **Fixed Reserve** - The reserve is fixed at a programmable percentage (30% factory preset) of the total softening capacity.
 - **Variable Reserve** - The controller monitors the daily water usage and at the programmed time of regeneration, calculates the average water used for each day of the week. The reserve capacity is set to 120% of the average water usage for the next day.
- **Delayed Regeneration on Twin-alternating Systems** - The twin-alternating system does not use a reserve capacity. The service tank switches

when the softening capacity is exhausted. Regeneration of the exhausted tank will occur at the specified time of day when using the delayed regeneration feature.

- **Immediate Regeneration on Twin and Triple Parallel Systems** - The twin and triple parallel systems use a reserve capacity of “0” along with immediate regeneration. Regeneration of an exhausted tank in the system, will occur immediately after reaching its maximum capacity, IF, there are no other tanks, within the system, already regenerating.

Normal Display Mode

In the normal operating mode the Series 962 control will alternate between **Capacity Remaining** (gallons or m³) and Flow Rate (gallons per minute or m/hr). In the event of power loss, the display will alternate between **Time of Day** and **Capacity Remaining** once power has been restored. The control will remain in this display mode until the Time of Day is reset or until any button is pressed.

Programming the Series 962 Controls

This section contains common aspects of programming the 962, 962F, and 962M controls and retrieving historical operating data. The 962S control is a secondary unit that always works in conjunction with the 962M main control for twin alternating tank applications. The operating values for the 962S are the same as the operating values in the 962M control. An adhesive installation label is provided with each 962, 962F, and 962M control. It is recommended that this be filled out with programming parameters on start-up and placed on the inside of the cam cover.

Factory Default Values - The control is shipped from the factory with a default value for Salt Amount of 10 lb. (4 kg for metric units). **Capacity, Hardness, Refill and Brine Draw values are set to 0 and must be changed to appropriate values before the control will operate. “Err 4” will be displayed until a valid number is entered for each of these items.** Program variable P12 is preset at the factory to define the U.S. units of measure for North American application or metric units of measure for application outside North America.

Program Levels - The Series 962 controls have been designed to facilitate different levels of programming requirements. Level I includes program variables that are frequently referenced by users, operators, installers, and service personnel, and is accessible without the requirement of codes. Level II includes variables that are most typically used at the time of installation and initial setup and is accessible with special access codes. Level III locations are used primarily for accessing operating history information. Level III parameters also require access codes.

Programming levels are further defined in Tables I, II, and III.

Levels	Access Code
I	None required
II	Press and hold the ↑ ↓ for approximately 3 seconds
III	Press and hold the ← ↑ arrow buttons for approximately 3 seconds

Table I on page 34 lists the Level I program values for the 962, 962F, and 962M controls.

Table IIA on page 35 lists the Level II program values for the 962 controls.

Table IIB on page 36 lists the Level II program values for the 962F controls.

Table IIC on page 37 lists the Level II program values for the 962 parallel controls.

Program Values and Locations - The P values that are programmed into the Series 962 controls are listed in the Level I and Level II tables.

Locating a Program Value - To locate and display a P value in Level I press the UP [↑] or DOWN [↓] arrow button until the desired value is displayed.

To locate and display a P value in Level II, simultaneously press the UP [↑] and DOWN [↓] arrow buttons for 3 seconds to gain access. Press the UP [↑] or DOWN [↓] arrow buttons until the desired location is displayed. Press LEFT [←] to display a value in P locations.

To locate and display an L value in Level III, simultaneously press the LEFT [←] and DOWN [↓] arrow buttons for 3 seconds to gain access and the press the UP [↑] or DOWN [↓] arrows buttons until the desired location is displayed. Press LEFT [←] to display value in the L location.

Changing a Program Value - Once the P value you want to change is displayed, press the LEFT [←] arrow button to display the current entry for that value. To change or modify the value, press the SET button. The character on the right hand side of the display will begin to flash. Use the UP [↑] or DOWN [↓] arrow buttons to select the desired entry. Once the desired entry is obtained, press the LEFT [←] button to move to the next character and change as needed. Once you have completed the appropriate changes, press the SET button. When you press the SET button the new entry is stored and the control automatically scrolls to the next P value. If a beep sounds, the new entry was not accepted. Tables I and II list the range available for a specific program value.

Exit Mode - To exit the Level II programming mode, simultaneously press and hold the UP [↑] and DOWN [↓] arrow buttons for 3 seconds, or wait 30 seconds without pressing a button, and the display will return to alternate between Capacity Remaining and Flow Rate.

Level I Program Values (Table I)

Level I Program Values are identified by the legend on the faceplate of the control. Each Level I P value has a green LED that is illuminated when displayed.

Following are the Level I P values:

- Time of Day P1
- Time of Regen P2
- Hardness P3
- Salt Amount P4
- Capacity P5

Time of Day

Press the SET button. The display will show the Time of Day with the minutes digit blinking. To change this number press the UP [↑] arrow button to increase the number or the DOWN [↓] arrow button to decrease the number. To skip the number without changing, press the LEFT [←] arrow button. The first digit will stop flashing and the next digit will start flashing. You can only change the flashing number. When the far left digit is reached, pressing the LEFT [←] arrow button returns the flashing to the far right digit. Continue changing numbers until the desired Time of Day is displayed. Press the SET button to enter the value.

Use the same procedure to modify any of the other Level I or Level II P values.

Level II Program Values (Tables IIA, IIB, IIC, and III)

The Level II Parameters are defined as P6 through P20. The available range for the Refill Controller (P6), and the Brine Draw Value (P7), may be found in the section entitled **Performance Data and Charts Section** (pages 51-54) of this manual.

Table III on 38 lists the Level II programming values for the 962M alternating controls.

Table IV on page 39 lists the Level III historical data.

Manual Regeneration or Backwash

To initiate a manual regeneration or backwash, simply press and hold the REGEN button for 3 seconds. If an immediate second regeneration or backwash is desired, wait for at least one minute after the first regeneration or backwash begins and then press and hold the REGEN button for 3 seconds. A second regeneration or backwash will be performed immediately following the first. The display will freeze and only show the Regeneration Time Remaining as an indication that the second regeneration or backwash will be initiated. When the first regeneration or backwash is complete, the second regeneration or backwash will begin and the display will alternate

between Flow Rate and Regeneration Time Remaining.

Note: Series 962M and 962S Twin Alternating Systems have a two minute time period, after the manual regeneration button is pressed, where the standby unit drives to service. If an immediate second regeneration is required of the OTHER unit in the system, wait for at least three minutes after pressing the manual regeneration button the first time, then press and hold the REGEN button for three seconds.

Optional Battery Backup

If the optional battery backup is provided with the Series 962 control, make sure that it is properly connected. Reference pages 32 and 33. The battery is a lead acid type that will provide up to 3 days of backup for the 962 control. Water usage and time of day will be maintained. The control has a trickle charge circuit that will recharge the battery in the event it is depleted by a power outage.

Important: When connecting the optional battery backup, the black wire should be connected first! Connecting the red wire first could result in serious damage to the circuit board.

IMPORTANT

Remember, all lead-acid batteries are recyclable. Proper disposal of batteries is very important to protecting the environment. Please do your part by disposing of lead-acid batteries with an E.P.A. certified battery recycler. Thank you.

5.4.1 Connecting the 962 Control

When the 962 control is used for single tank applications, two standard connections are required for operation: the power transformer and the flow sensor. Figure 5.14 outlines these standard features as well as how to connect the optional battery backup and the optional remote regeneration feature.

Important: When connecting the optional battery backup, the black wire should be connected first! Connecting the red wire first could result in serious damage to the circuit board.

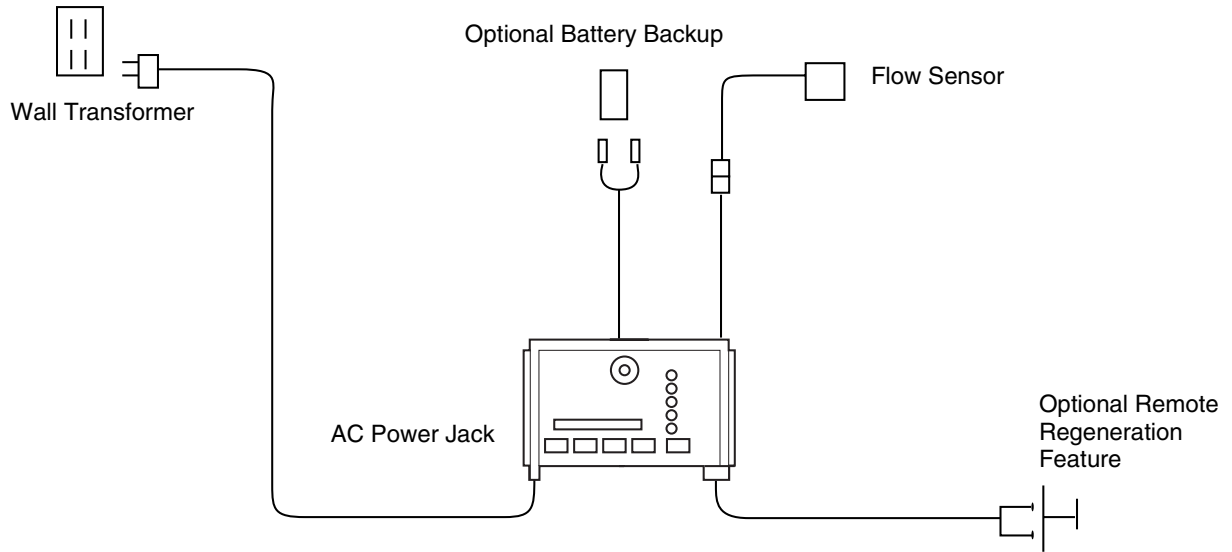


Figure 5.14

5.4.2 Connecting the 962M and the 962S Control

The 962M and 962S controls are used for twin alternating tank applications. Five standard connections are required for operation: the power transformer, the flow sensor, feedback switches and the connection between the 962M and 962S controls. Figure 5.15 outlines these standard features as well as the optional battery backup and the optional remote regeneration feature.

Important: When connecting the optional battery backup, the black wire should be connected first!

Connecting the red wire first could result in serious damage to the circuit board.

Important: The normally-closed position of the feedback switch is protected with a rubber boot. DO NOT REMOVE. The normally-closed position is not available to provide an auxiliary electrical signal.

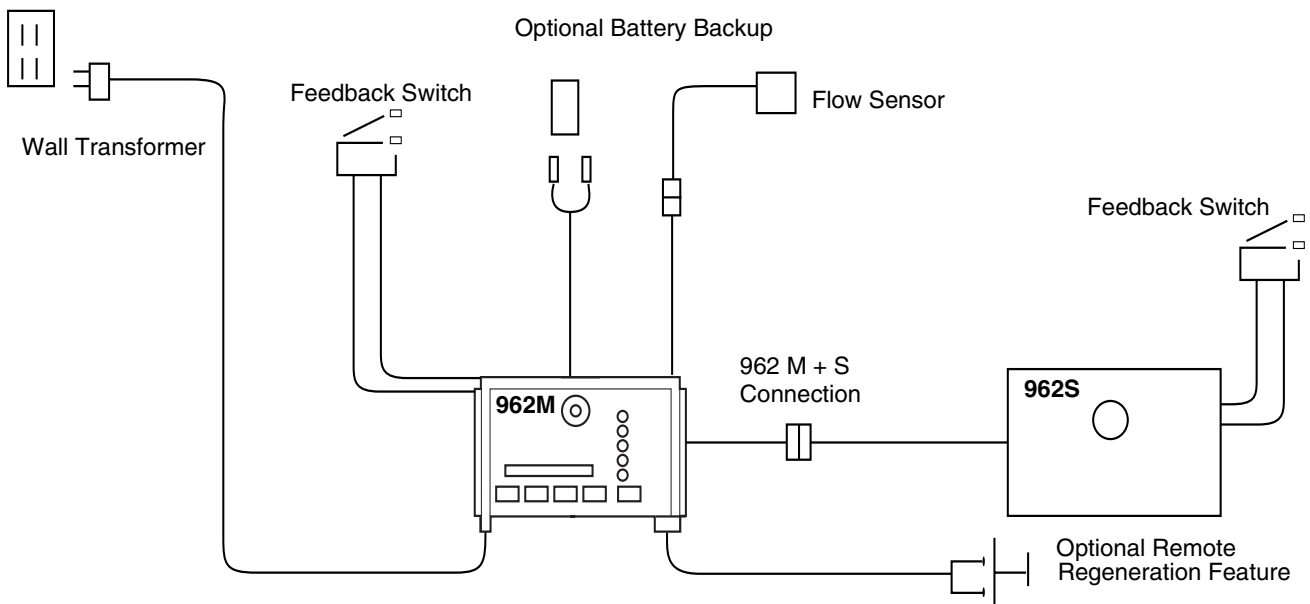
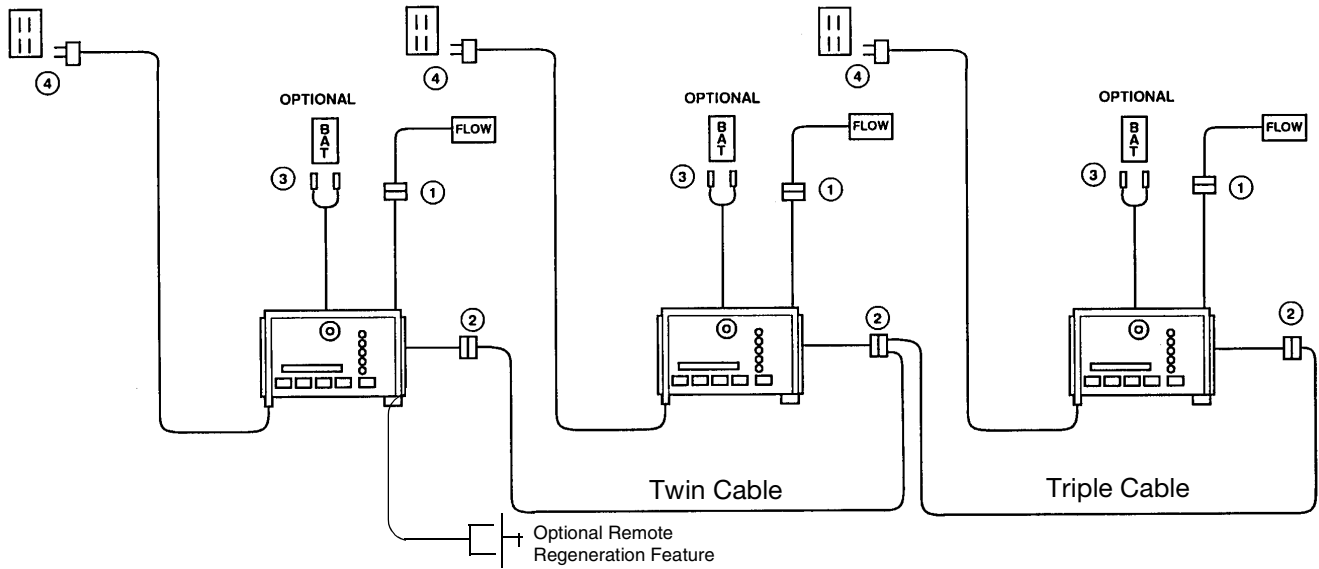


Figure 5.15

5.4.3 Connecting the 962 Twin and Triple Parallel Control

The 962 control can be used for twin and triple tank applications, operating in a parallel mode. Six standard connections are required for twin parallel operations; the power transformer and flow sensor for each control and the twin interconnecting cable between the

controls. Nine standard connections are required for triple parallel operation: the power transformer and flow sensor for each control and the triple interconnecting cable between the controls. Figure 5.16 outlines these standard features, as well as the optional battery backup and the optional remote regeneration feature.



PARALLEL SYSTEM CONNECTION PROCEDURE

- ① Connect turbine flow meters
- ② Connect interlock cables
- ③ Attach optional batteries
- ④ Plug transformers into outlets on common circuit

PARALLEL INTERCONNECT CABLES

- PN 1034312 - Twin System Cable - 10 feet
- PN 1035587 - Triplex System Cable - 10 feet each
- PN 1035593 - Extension Cable - 2 feet

Important: When connecting the optional battery backup, the black wire should be connected first! Connecting the red wire first could result in serious damage to the circuit board.

Figure 5.16

6.0 Programming Tables

6.1 Table I - Level 1 Values

Level I Program Values for 962, 962F and 962M Controls

	Description of Program Values	Range of Values	Min. Increment	Setting	Default	Units of Measure	Notes
P1	Time of day	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P2	Time of day to start regeneration	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13 For 962M, used only if P15 = 1
P3	Hardness of water	3-250 30-2500	1 10		0 0	grains/gallon (ppm)	Unit of measure depends on value selected for P12
P4	Salt amount	5-1250 2-500	5 2		10 4	pounds (kilograms)	Unit of measure and default depends on value selected for P12
P5	Capacity of unit	1-2600 0.1-260.0	1 0.1		0 0	kilograins (kilograms)	Unit of measure depends on value selected for P12

Level II, III values on following pages.

6.2 Table IIA

Level II Program Values - 962 Single Tank Softener or Dealkalizer (P17=0)

	Description of Program Values	Range of Values	Min. Increment	Setting	Default	Units of Measure	Notes
P1	Time of day	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P2	Time of day to start regeneration	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P3	Hardness of water	3-250 30-2500	1 10		0 0	grains/gallon (ppm)	Unit of measure depends on value selected for P12
P4	Salt amount	5-1250 2-500	5 2		10 4	pounds (kilograms)	Unit of measure and default depends on value selected for P12
P5	Capacity of unit	1-2600 0.1-260.0	1 0.1		0 0	kilograins (kilograms)	Unit of measure depends on value selected for P12
P6	Refill controller	2-99	1		0		Selected from chart in Performance Data Sections
P7	Brine draw value	2-99	1		0		Selected from chart in Performance Data Sections
P9	Backwash time	4-30	1		14	minutes	
P10	Slow rinse	7-125	1		40	minutes	
P11	Fast rinse	2-19	1		4	minutes	
P12	Units of measure	0-1	1		0		0 = US 1 = (Metric)
P13	Clock mode	0-1	1		0		0=12 hour clock am/pm 1 =24 hour clock
P14	Calendar override	0-30	1		0	days	0=no calendar overrides
P15	Reserve type	0-3	1		0		0=Variable reserve 1=Fixed reserve 2=Variable reserve with immediate regen 3=Fixed reserve with immediate regen
P16	Fixed reserve or initial average	0-70	1		30		Percent of total capacity
P17	Operation type	0-2	1		0		0=5 cycle co-current 1=Not Used 2=5 cycle twin alternating
P18	Salt/capacity change lock out	0-1	1		0		0=none 1=Salt/Capacity Change Locked Out
P19	Flow sensor or turbine size	1.0, 1.5, 2.0, 3.0	0.5		2.0		1.0=1" Autotrol Turbine 1.5=1.5" Data Industrial 2.0=2" Autotrol Turbine 3.0=3.0" Data Industrial
P20	Factory default configuration	0-6	1		9		Factory use only - DO NOT CHANGE

6.3 Table IIB

Level II Program Values - 962F Single Tank Filter (P17 = 0)

	Description of Program Values	Range of Values	Recommended Setting	Min. Increment	Default	Units of Measure	Notes
P1	Time of day	1:00 - 12:59 AM/PM 00:00 - 23:59	Set	1	None	hour:minute	Range depends on value selected for P13
P2	Time of day to start regeneration	1:00 - 12:59 AM/PM 00:00 - 23:59	Set	1	None	hour:minute	Range depends on value selected for P13
P3	Hardness of water	3-250 30-2500	10 100	1 10	0 0	grains/gallon (ppm)	Unit of measure depends on value selected for P12
P4	Salt amount	5-1250 2-500	5	5 2	10 4	pounds (kilograms)	Unit of measure and default depends on value selected for P12
P5	Capacity of unit	1-2600 .1-260.0	Set (1)	1 .1	0 0	kilograins (kilograms)	Unit of measure depends on value selected for P12
P6	Refill controller	2-99	99	1	0		Selected from chart in Performance Data Sections
P7	Brine draw value	2-99	99	1	0		Selected from chart in Performance Data Secs.
P9	Backwash time	4-30	Set	1	14	minutes	
P10	Slow rinse	7-125	7	1	40	minutes	
P11	Fast rinse	2-19	Set	1	4	minutes	
P12	Units of measure	0-1	0	1	0		0 = US 1 = (Metric)
P13	Clock mode	0-1	0	1	0		0=12 hour clock am/pm 1=24 hour clock
P14	Calendar override	0-30	Set (2)	1	0	days	0=no calendar overrides
P15	Reserve type	0-3	0 (3)	1	0		0=Variable reserve 1=Fixed reserve 2=Variable reserve with immediate regen 3=Fixed reserve with immediate regen
P16	Capacity that must be left on tank to permit delayed regeneration	0-70	30	1	30	percent of total capacity	Used only if P15 = 1
P17	Operation type	0-2	0	1	0		0=5 cycle co-current 1=Not Used 2=5 cycle twin alternating
P18	Salt/capacity change lock out	0-1	0	1	0		0=none, 1=Salt/Capacity Change Locked Out
P19	Flow Sensor or Turbine size	1.0, 1.5, 2.0, 3.0	Set	0.5	2.0		1.0=1" Autotrol Turbine 1.5=1.5" Data Industrial 2.0=2" Autotrol Turbine 3.0=3.0" Data Industrial
P20	Factory default configuration	0-6		1	9		Factory use only - DO NOT CHANGE

(1) Enter filter capacity (gallons) / 100 or (cubic meters)/10

(2) When set other than zero, number = maximum number of days between backwash

(3) Refer to page 29: Selectable Automatic Regenerations/Backwashes and Selectable Reserve Options

6.4 Table IIC - Twin Parallel

Level II Program Values - 962 Twin and Triple Parallel (P17=0)

	Description of Program Values	Range of Values	Min. Increment	Setting	Default	Units of Measure	Notes
P1	Time of day	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P2	Time of day to start regeneration	1:00 - 12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P3	Hardness of water	3-250 30-2500	1 10		0 0	grains/gallon (ppm)	Unit of measure depends on value selected for P12
P4	Salt amount	5-1250 2-500	5 2		10 4	pounds (kilograms)	Unit of measure and default depends on value selected for P12
P5	Capacity of unit	1-2600 0.1-260.0	1 0.1		0 0	kilograins (kilograms)	Unit of measure depends on value selected for P12
P6	Refill controller	2-99	1		0		Selected from chart in Performance Data Sections
P7	Brine draw value	2-99	1		0		Selected from chart in Performance Data Sections
P9	Backwash time	4-30	1		14	minutes	
P10	Slow rinse	7-125	1		40	minutes	
P11	Fast rinse	2-19	1		4	minutes	
P12	Units of measure	0-1	1		0		0 = US 1 = (Metric)
P13	Clock mode	0-1	1		0		0=12 hour clock am/pm 1=24 hour clock
P14	Calendar override	0-30	1		0	days	0=no calendar overrides
P15	Reserve type	0-3	1		0		0=Variable reserve 1=Fixed reserve 2=Variable reserve with immediate regen 3=Fixed reserve with immediate regen
P16	Fixed reserve or initial average	0-70	1		30		Percent of total capacity
P17	Operation type	0-2	1		0		0=5 cycle co-current 1=Not Used, 2=5 cycle twin alternating
P18	Salt/capacity change lock out	0-1	1		0		0=none 1=Salt/Capacity Change Locked Out
P19	Flow sensor or turbine size	1.0, 1.5, 2.0, 3.0	0.5		2.0		1.0=1" Autotrol Turbine 1.5=1.5" Data Industrial 2.0=2" Autotrol Turbine 3.0=3.0" Data Industrial
P20	Factory default configuration	0-6	1		9		Factory use only - DO NOT CHANGE

6.5 Table III - Twin Alternating

Level II Program Values - 962M Twin Tank Alternating (P17=2)

	Description of Program Values	Range of Values	Min. Increment	Setting	Default	Units of Measure	Notes
P1	Time of day	1:00 -12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13
P2	Time of day to start regeneration	1:00 -12:59 AM/PM 00:00 - 23:59	1		None	hour:minute	Range depends on value selected for P13 Used only if P15=1
P3	Hardness of water	3-250 30-2500	1 10		0 0	grains/gallon (ppm)	Unit of measure depends on value selected for P12
P4	Salt amount	5-1250 2-500	5 2		10 4	pounds (kilograms)	Unit of measure and default depends on value selected for P12
P5	Capacity of unit	1-2600 0.1-260.0	1 0.1		0 0	kilograins (kilograms)	Unit of measure depends on value selected for P12
P6	Refill controller	2-99	1		0		Selected from chart in Performance Data Sections
P7	Brine draw value	2-99	1		0		Selected from chart in Performance Data Sections
P9	Backwash time	4-30	1		14	minutes	
P10	Slow rinse	7-125	1		40	minutes	
P11	Fast rinse	2-19	1		4	minutes	
P12	Units of measure	0-1	1		0		0 = US 1 = (Metric)
P13	Clock mode	0-1	1		0		0=12 hour clock am/pm 1=24 hour clock
P14	Calendar override	0-30	1		0	days	0=no calendar overrides
P15	Regeneration delay	0-1	1		0		0=Immediate Regen 1=Regen delayed until P2 time reached
P16	Capacity that must be left on 2nd tank to permit delayed regeneration of 1st tank	0-70	1		30	percent of total capacity	Used only if P15 = 1
P17	Operation type	0-2	1		0		0=5 cycle co-current 1=Not Used 2=5 cycle twin alternating
P18	Salt/capacity change lock out	0-1	1		0		0=none 1=Salt/Capacity Change Locked Out
P19	Flow sensor or turbine size	1.0, 1.5, 2.0, 3.0	0.5		2.0		1.0=1" Autotrol Turbine 1.5=1.5" Data Industrial 2.0=2" Autotrol Turbine 3.0=3.0" Data Industrial
P20	Factory default configuration	0-6	1		9		Factory use only - DO NOT CHANGE

Level III Memory Locations

To assist in troubleshooting the Water Conditioning System, the contents of the controller memory can be examined to determine the status of the control and the history of water usage. To view the controller's memory locations "L1" to "L15" described in Table IV, the location viewing mode must be selected. This mode can be selected by simultaneously pressing the LEFT (←) and the UP (↑) buttons. The control will then

show "L1" on the display. Locations can be stepped through in the same method as described for Level II programming. However, the [SET] button is inactive except for L4. **If [SET] is pressed when L4 is displayed, Peak Flow is reset to zero.** If [SET] is pressed when any other location is displayed, the control will beep.

6.6 Table IV - Historical Data

Level III Historical Data

Location	Range	Description
L1	1 - 7	Day
L2	0 - 255	Days since last regeneration
L3	1:00-12:59 AM/PM 0:00-23:59	Time of day that peak flow occurred
L4	0-200 (0-50.0)	Peak Flow in gallons per minute (m ³ /hr) since location reset
L5	0-655360(0-6553.6)	Water used today in gallons (m ³) since time of regeneration
L6	0-655360(0-6553.6)	Water used since last regeneration in gallons (m ³)
L7	0-655360(0-6553.6)	Average water usage for Day 1 in gallons (m ³)
L8	0-655360(0-6553.6)	Average water usage for Day 2 in gallons (m ³)
L9	0-655360(0-6553.6)	Average water usage for Day 3 in gallons (m ³)
L10	0-655360(0-6553.6)	Average water usage for Day 4 in gallons (m ³)
L11	0-655360(0-6553.6)	Average water usage for Day 5 in gallons (m ³)
L12	0-655360(0-6553.6)	Average water usage for Day 6 in gallons (m ³)
L13	0-655360(0-6553.6)	Average water usage for Day 7 in gallons (m ³)
L14	0-999990(0-99999.9)	Total water used since controller installed in gallons or (m ³)(least significant digits)
L15	0-167(0-16)	Total water used since controller installed in gallons x 10 ⁶ or (m ³)(most significant digits)

6.7 Table V

Model 962 Error Messages

Indication	Description	Cause	Solution
Err1	Electronics failure	a. control settings need reprogramming	a. Press any key to load default values. Refer to Programming the Series 962 Control
Err2	Improper finish of regeneration. Improper finish of a regeneration (control indicates that it is in either standby, service, or regeneration complete and it <u>should not</u> be) Regeneration failure (no start)	a. Valve camshaft has been manually rotated during a regeneration b. Faulty motor or gears c. Faulty motor drive d. Faulty switch	a. Press any key to silence the alarm. (Note: alarm automatically clears at "TIME OF REGEN") b. Replace control c. Replace control d. Replace control
Err3	Improper start of regeneration. Regeneration was not completed within calculated time. Improper start of a regeneration (control cycle position pointer indicates that it is in regeneration and it <u>should</u> be in either standby, service, or regeneration complete.)	a. Valve camshaft has been manually rotated out of "regeneration complete" position b. Faulty motor or gears c. Faulty motor drive d. Faulty switch	a. The control will turn the motor on and drive the camshaft to the proper location b. Replace control c. Replace control d. Replace control
Err4	Improper control settings	a. One or more settings out of the allowable range	a. Hardness: Adjust range: 3 to 250 (30-2500) Capacity: Adjust range: .1-260.0 (.1-260.0) Refill Control: Adjust range: 2-99 Brine Draw Value: Adjust range: 2-99

7.0 Multi-Tank

7.1 Twin Alternating Systems

The Magnum Cv Series is available in a preconfigured twin-alternating package which assure the flow of

softened water at all times. One tank provides service water while the other is in regeneration or standby.

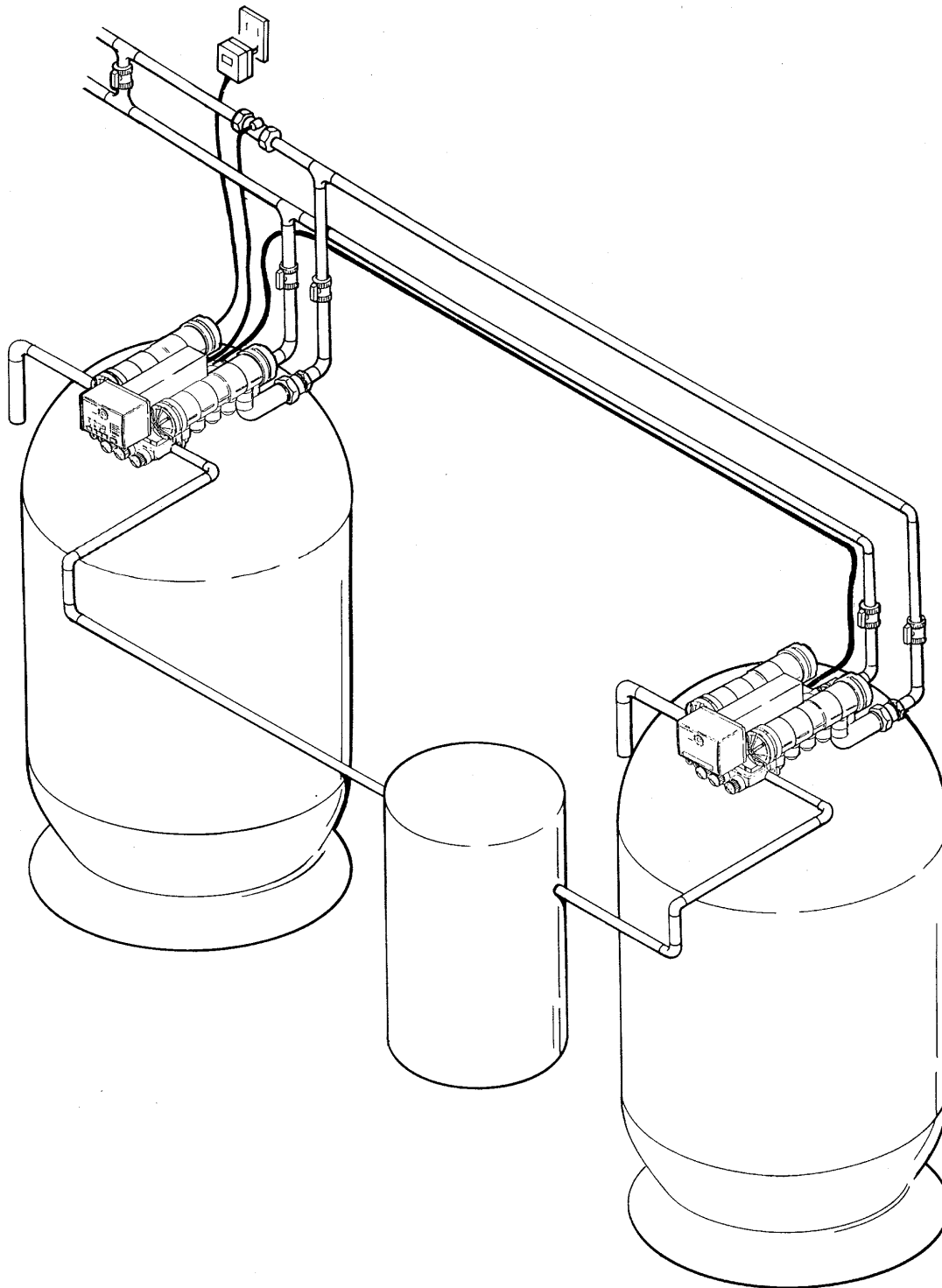


Figure 7.1 Magnum Cv Twin Alternating System with 962M and 962S (Main and Secondary) Controls

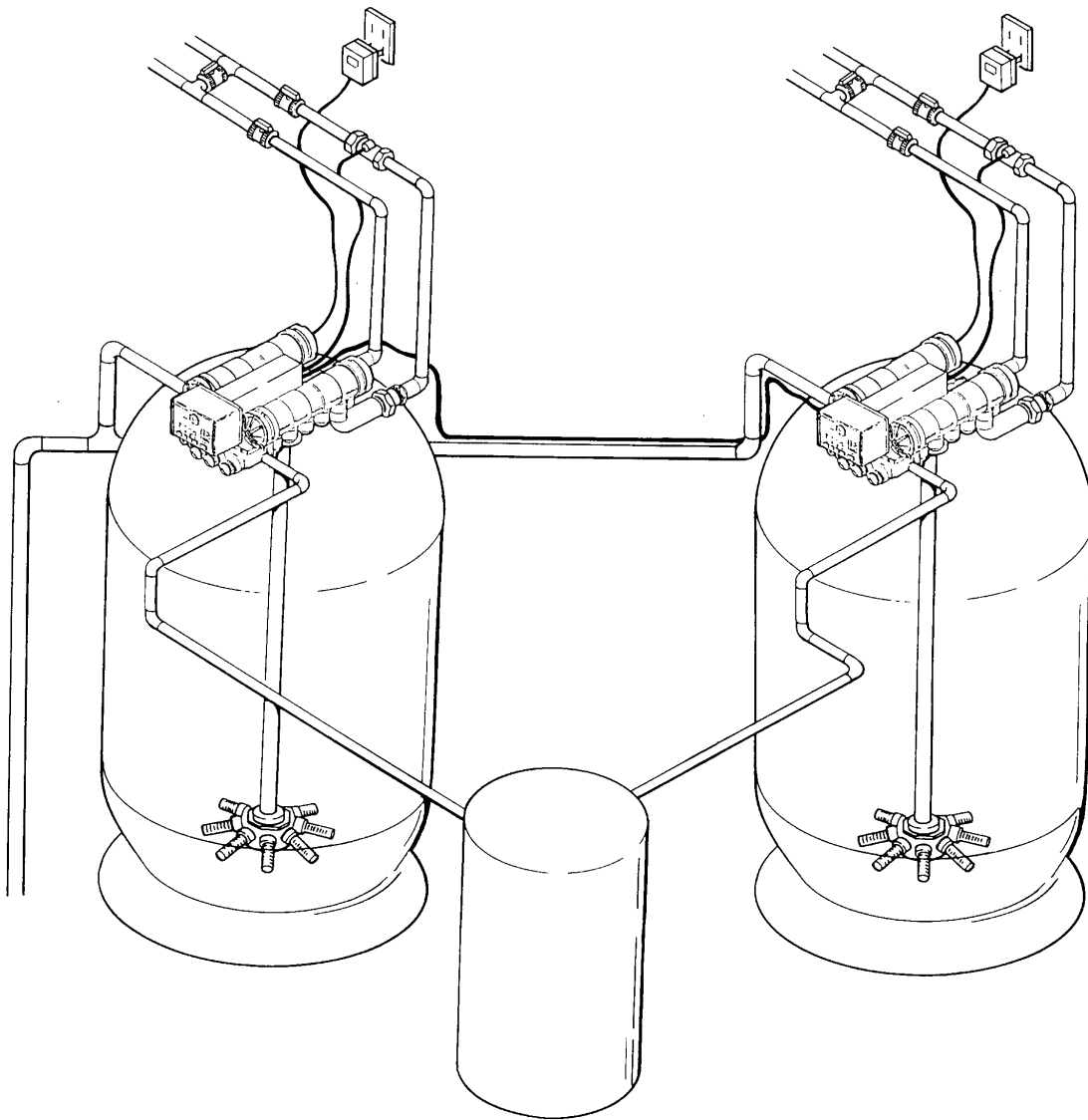


Figure 7.2 Magnum Cv PLUS Twin Alternating System with 962M and 962S (Main and Secondary) Controls

7.1.1 Twin Alternating Control Set-Up

Task	962M Main Control Position Tank 1	962S Secondary Control Position Tank 2
1. Open manual bypass valve		
2. Close manual inlet and outlet valves		
3. Mount 962M main and 962S secondary controls [962M and 962S controls must be in the midpoint of the SERVICE position before inserting camshaft]	SERVICE	SERVICE
4. Connect 12VAC power supply to 962M control	SERVICE	SERVICE
5. Program the 962M main control. (See page 39 and Table III) for programming parameters.) [LED will show ERR4 message indicating controls require programming]	SERVICE	SERVICE
6. Exit programming mode. Depress up and down buttons for 3 seconds or wait 30 seconds	SERVICE	SERVICE
7. Disconnect 12VAC power supply from 962M control	SERVICE	SERVICE
8. Manually rotate camshafts to REFILL	REFILL	REFILL
9. Connect external cam switches	REFILL	REFILL
10. Connect 962M main and 962S secondary controls with factory-installed 4-pin connector.	REFILL	REFILL
11. Reconnect 12VAC power supply and optional battery backup to the 962M	REFILL	REFILL
<p>Important: When connecting the optional battery backup, the <u>black wire</u> should be connected first! Connecting the red wire first could result in serious damage to the circuit board.</p>		
12. Observe controls for proper operation. [Tank 1 control will rotate to the STANDBY position followed by Tank 2]	STANDBY	REFILL
13. Observe controls for proper operation. [962M will remain in STANDBY . 962S will rotate to SERVICE]	STANDBY	SERVICE
14. System is now ready for operation	STANDBY	SERVICE

7.1.2 Additional Checks:

Task	962M Main Control Position Tank 1	962S Secondary Control Position Tank 2
1. Initiate Manual Regeneration (Press and hold REGEN button for 3 seconds). LED display will alternate between Tank 2 FLOW and Tank 2 REGEN TIME REMAINING for 2 minutes. After two minutes, Tank 1 will rotate to SERVICE position and Tank 2 will begin BACKWASH cycle. LED will display Tank 1 FLOW and Tank 2 REGEN TIME REMAINING .	STANDBY	SERVICE
2. Observe for proper operation. After 2 minutes, manually rotate the 962S secondary control (Tank 2) through the entire regeneration cycle. To continue operational checks, go to the next step.	SERVICE	BACKWASH BRINE / SLOW RINSE FAST RINSE REFILL
3. Manually rotate 962S control (Tank 2) cam shaft to STANDBY . LED display will show ERR2 indicating the regeneration on Tank 2 ended too soon.	SERVICE	STANDBY
4. Clear ERR2 by pressing LEFT button [←]. LED display will alternate between Tank 1 FLOW and CAPACITY .	SERVICE	STANDBY
5. Test the optional battery power by momentarily disconnecting the AC power jack. Reconnect power jack. When power jack is reconnected, LED display should continue to alternate between Tank 1 FLOW and CAPACITY . If the control is not getting power, the LED display will alternate between CAPACITY and TIME OF DAY .	SERVICE	STANDBY

MANUAL REGENERATION

The 962M main control allows the operator to select the tank to be regenerated by pressing the left arrow [←] button. When the desired tank is shown in the LED display (far left character), a regeneration of the displayed tank can be initiated by depressing the **REGEN** button for 3 seconds. If the tank that is currently in **SERVICE** is selected, the opposite tank will rotate from **STANDBY** to **SERVICE** while the selected tank is regenerating. Depressing the **REGEN** button for 3 seconds while the selected tank is regenerating will initiate a regeneration on the opposite tank once the selected tank has completed its regeneration cycle.

7.2 Twin or Triple Systems

The Magnum Cv Series Electronic Controls may be configured as a twin parallel or triple parallel system which assures, through an electrical interlock built into the 962 controls, that only one unit will regenerate at a time. Compared to a single system, the parallel system also provides twice the available service flow rate when both units are on line in a twin system and three times the available service flow rate when all three units are

on line in a triple system. When the capacity of one of the units in a parallel system has been exhausted, the 962 control takes the unit “off-line”, regenerates the unit, then returns the unit to “on-line” status while preventing the other units in the system from regeneration through an internal electrical lockout.

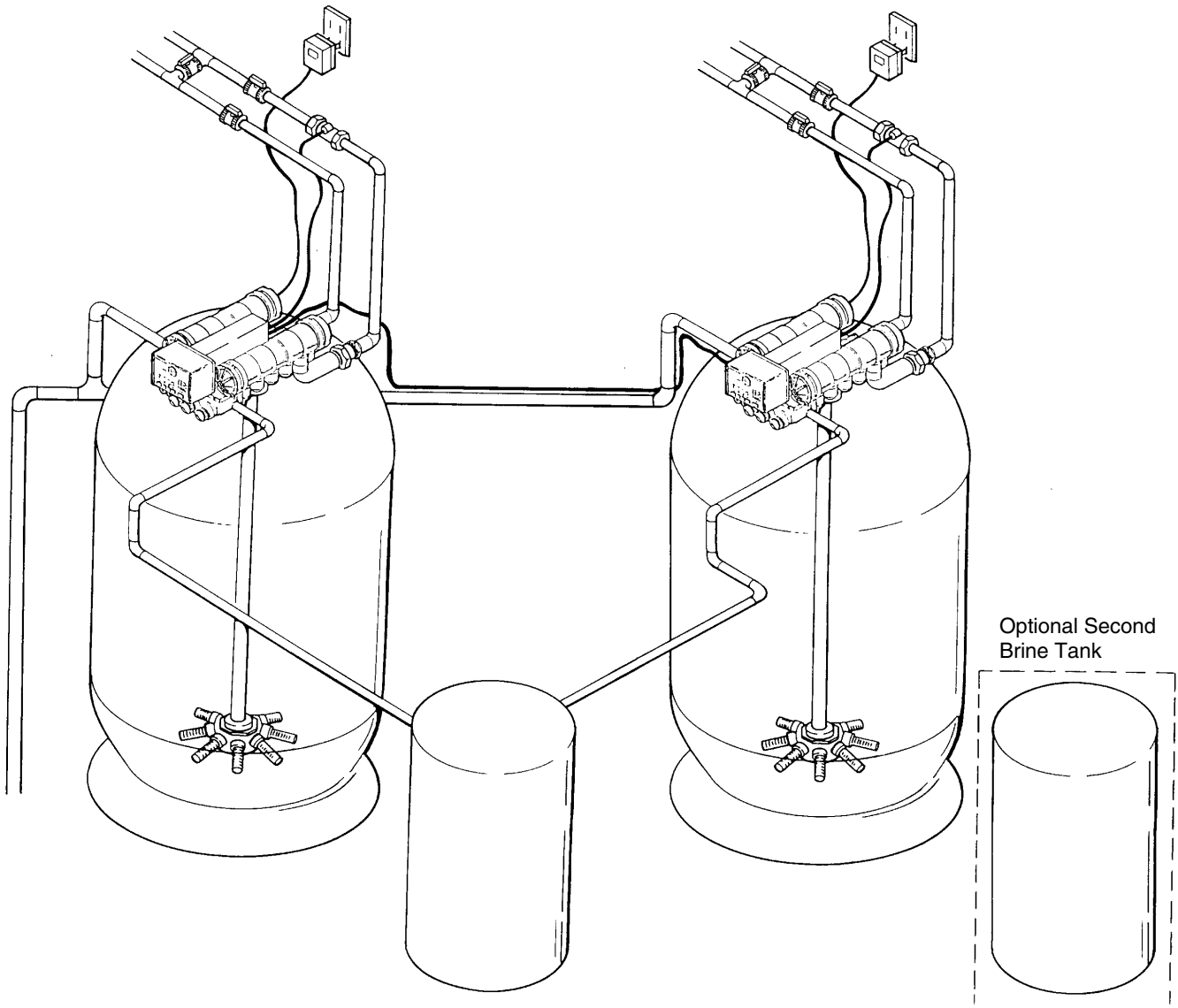


Figure 7.3 Magnum Cv Plus Twin Parallel Configuration

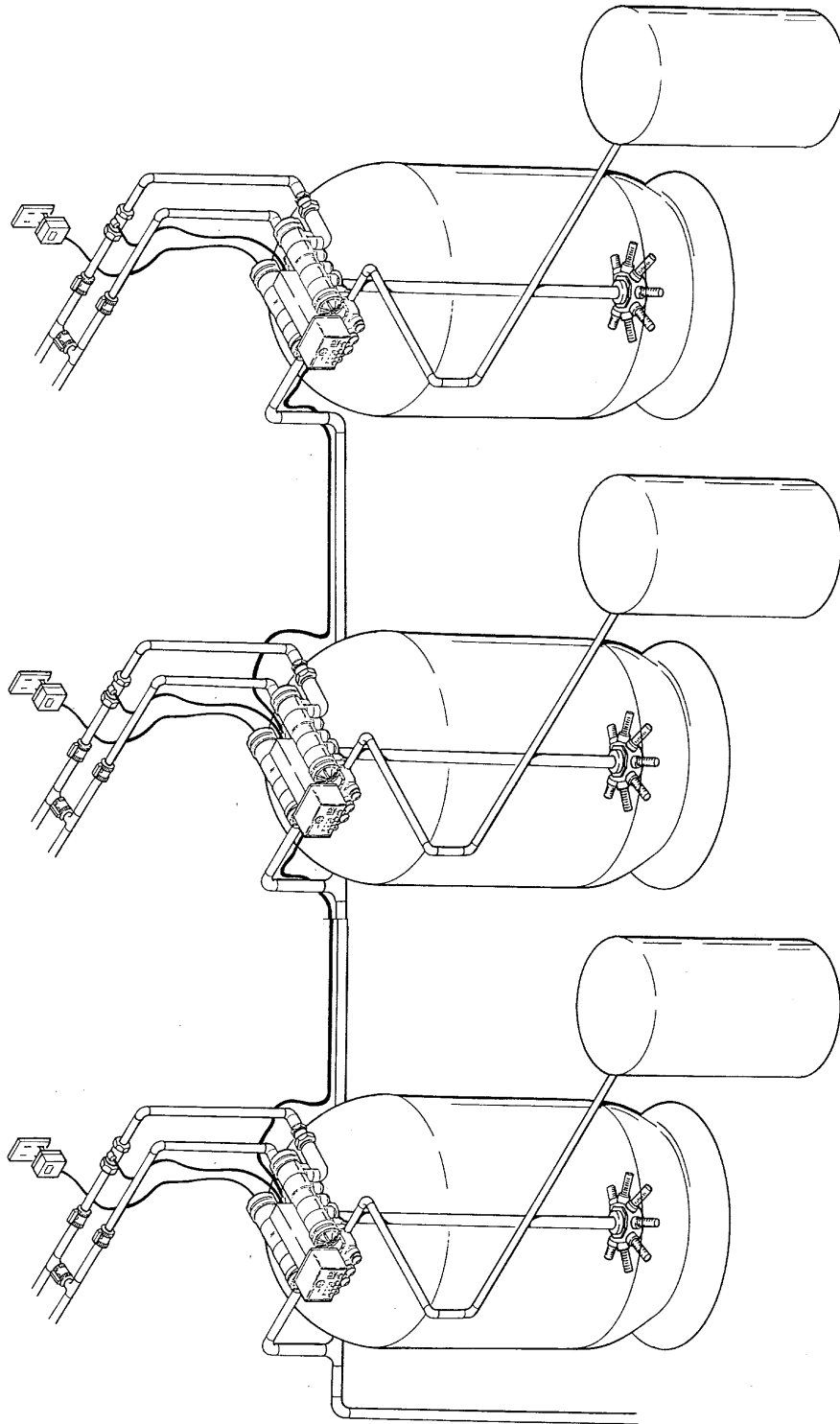


Figure 7.4 Magnum Cv Plus Triple Parallel Configuration

7.2.1 Parallel Control Set-Up

Initial Setup

- It is advantageous to perform all control programming prior to start up of the entire water treatment system.
- Open the system manual bypass valve and close all inlet and outlet valves.
- Mount all 962 controls on the valves. All controls must indicate that they are in the REGENERATION COMPLETE position before inserting the camshaft.
- Connect the 12VAC power supply to each control.
- Connect the interconnect cable provided with the system to the factory installed 4 pin connector on each control. Also connect the optional battery back-up if provided.

IMPORTANT: When connecting the optional battery backup, the black wire should be connected first! Connecting the red wire first could result in serious damage to the circuit board.

- Program each 962 control in the system. See **Table IIC** and **Special Programming** below for programming parameters. On initial power-up, the LED display will show an **ERR4** message which indicates that one or more of the programming parameters are not set or is out of the allowable range. Enter and exit the programming mode by depressing the UP [↑] and DOWN [↓] buttons for 3 seconds. The programming mode can also be exited by not pressing a button for 30 seconds.

Special Programming

- Set P5-Capacity - below actual capacity - a reserve sufficient to provide two hours of service flow is recommended. This provides soft water when regeneration is delayed because another unit is already in regeneration.
- Set P15-Reserve Type - "3" - fixed reserve with immediate regeneration. This causes the control to do an immediate regeneration when the gallons remaining reaches zero.
- Set P16-Fixed Reserve - "0" - zero reserve. This prevents the control from initiating a regeneration at the programmed time, P2.

- Set all other parameters, 1 through 20, except those identified above, as you would a standard 962 single control.

Additional Conditions

- Each 962 control requires its own 12-volt transformer. They should all be plugged into the same power circuit. Power loss to only one transformer within the system may cause the system to malfunction.
- Each control valve should be equipped with a no hard-water bypass cartridge.
- The flow through each control valve should be balanced.
- The programming for all controls should be the same.
- Three brine tanks are recommended on triple parallel systems. This will provide adequate salt brine for all regenerations and eliminates concern for lack of brine strength when utilizing a single brine tank, should back to back regenerations take place.

8.0 Start-Up Procedure

The following steps provide general guidelines for the start-up of a water conditioning system with a Magnum Cv Series control valve. Start up only one unit at a time. It is advantageous to perform all 962, 962F, or 962M programming prior to start-up.

1. Disconnect the electric power to the Magnum Cv control. Fill the brine tank with 6 inches of water but do not add salt to the brine tank at this time.
2. The manual inlet and outlet valves should remain closed with the manual bypass valve open.
3. Remove the cam cover to reveal camshaft. Verify that the correct cam is inserted all the way into the control. Access to the camshaft is required to manually index the control valve to the desired cycles of operation.
4. Advance the control to the **Backwash** position by turning the camshaft **COUNTERCLOCKWISE**. (Pilot flappers #2, #3, and #5 are OPEN.) THE PROPER SIZE DRAIN LINE FLOW CONTROL FOR THE SYSTEM BEING STARTED UP MUST BE INSTALLED IN THE DRAIN LINE AS CLOSE TO THE CONTROL VALVE AS POSSIBLE.
5. Slowly open the manual inlet valve. Water will begin to flow to drain. Water pressure must build to approximately 20 pounds per square inch (psi) (137 kPa) in the control valve and tank for the pilot/diaphragm valve system to operate properly. Continue to open the manual inlet valve slowly. (Note: large capacity systems will flow an extremely large amount of water to drain while pressure builds within the system). A definite change in the flow to drain and sound, as the diaphragm cartridges shift into position, will indicate that adequate pressure has been built up in the system. When the control valve does shift into the backwash position, the air in the tank will be pushed out through the drain line. Monitor the drain line closely during this time. If backwash flow during start-up is too high, resin or mineral could be pushed out of the tank through the drain line. The manual inlet valve can be closed slightly to prevent resin loss, however, a minimum pressure must be maintained within the system for continued pilot/diaphragm valve operation.
6. After all the air has been purged from the tank, allow the backwash water to flow to drain until clear.
7. Advance the control camshaft to the Brine/ Rinse position by rotating the camshaft **COUNTERCLOCKWISE**. (Pilot flappers #B1, #B2, #1, #3, and #5 are OPEN on softeners only--this cycle is skipped on 3-cycle filters.) The water flow to drain should reduce significantly and brine draw should be observed. Reference the **Performance Data and Charts** section.
8. Advance the control to the **Fast Rinse** position by turning the camshaft **COUNTERCLOCKWISE**. (Pilot flappers #1, #3, #4, and #5 are OPEN.) The water flow to drain should increase significantly, to approximately the same as the backwash flow.
9. Advance the control valve to the **Refill** position by rotating the camshaft **COUNTERCLOCKWISE**. (Pilot Flappers #B1, #B2, #1, #2, and #4 are OPEN. Pilot Flapper #3 on Twin Alternating systems is also OPEN. This cycle is skipped on 3-cycle filters). A flow of water should be filling the brine tank. The brine tank can be filled to the proper level if the water height is known. There should be NO water flow to drain. Reference the **Performance Data and Charts** section.
10. Advance the control valve to a position just before the **Regeneration Complete** position (softener) or the **Backwash Complete** position (filter). Connect electrical power to the controller. Allow the control to drive the camshaft to the home position. Note: See the special section 7.1.1 for Twin Alternating control set-up.
11. Open the manual outlet valve completely and close the manual bypass valve. Perform any 942 or 942F control programming if necessary. Check the effluent for soft or iron-free water. Add salt to the brine tank.

Note: There are times when the system has a difficult time building enough pressure for proper pilot/diaphragm valve operation, such as low pressure applications and larger pipe sizes. If water flows to drain in all cycles and does not shut off in service, typically, either the inlet valve is not open far enough or the drain line flow control has not been installed in the drain line.

9.0 Service Instructions

Symptom	Possible Cause	Solution
1. Water conditioner fails to regenerate. No soft water.	<ul style="list-style-type: none"> a. Power supply to Magnum Cv control has been interrupted. b. Water pressure lost. c. For 942 series control, day pins are not pushed in. d. For 962 series control, improper or no initial programming. e. For 952 series control, no start of regeneration signal received or length of signal is insufficient. f. Defective control. g. No salt in brine tank. h. Manual bypass valve is open. i. For 962 series control, turbine meter is clogged or restricted. j. Leak at riser pipe seal. k. Insufficient brine. l. Plugged injector or injector screen. 	<ul style="list-style-type: none"> a. Determine reason for power interruption and correct. Reset time of day. b. Restore water pressure. c. Push day pins in for desired regeneration days. d. Check programming values in 962 control and correct as needed. e. Test source signal to ensure positive closure and length of signal. A minimum signal length of 3 minutes is required. f. Replace control assembly. g. Add salt and regenerate. h. Close manual bypass valve. i. Inspect turbine meter assembly, clean or replace. j. Insure that riser pipe is properly sealed at tank adapter o-ring. Inspect pipe for cracks. k. Check refill control and clean if necessary. Check control settings. Check flow rate capabilities of safety float and air check assembly. l. Inspect and clean injector and/or injector screen.
2. No Brine Draw.	<ul style="list-style-type: none"> a. Plugged injector or injector screen. b. Insufficient water pressure. c. Obstructed drain line. 	<ul style="list-style-type: none"> a. Inspect and clean injector and/or injector screen. b. Increase water pressure above 25 psig (172 kPa) minimum. c. Remove obstruction.
3. Insufficient brine draw.	<ul style="list-style-type: none"> a. Partially clogged injector or injector screen. b. Restricted flow rate in brine line. c. Insufficient water pressure. d. Excessive back pressure on injector due to elevated drain line. e. Partially restricted drain line. 	<ul style="list-style-type: none"> a. Inspect and clean injector and/or injector screen assembly. b. Check flow rate capabilities of the safety float/aircheck assembly. c. Increase water pressure above 25 psig (172kPa) minimum. d. Reduce drain line elevation to height of valve. e. Remove restriction.
4. Insufficient Refill to Brine Tank.	<ul style="list-style-type: none"> a. Restricted flow rate in brine line. b. P6 (Refill) value incorrectly set. c. P7 (Brine Draw) value incorrectly set. 	<ul style="list-style-type: none"> a. Check flow rate capabilities of the safety float/aircheck assembly. b. Reprogram P6. c. Reprogram P7.
5. Excessive Water in Brine Tank.	<ul style="list-style-type: none"> a. Plugged drain line flow control. b. Plugged injector and/or injector screen. c. Incorrect refill control. 	<ul style="list-style-type: none"> a. Clean flow control. b. Inspect and clean injector and/or screen. c. Install correct control.

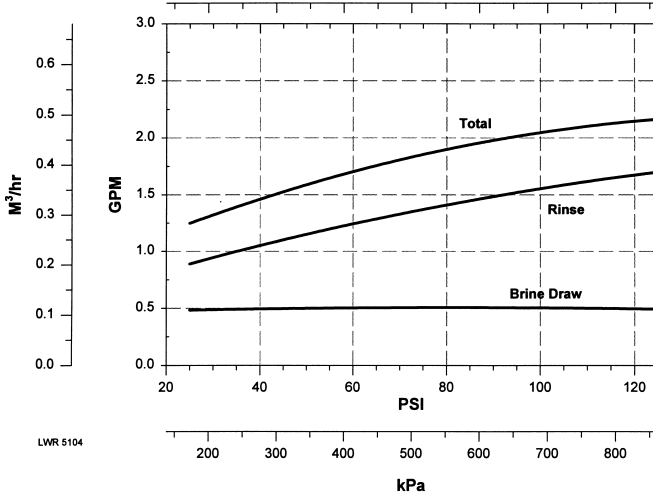
Symptom	Possible Cause	Solution
6. Leak to Drain.	<ul style="list-style-type: none"> a. No flow control installed in drain line. b. Insufficient water pressure. c. Plugged injector and/or injector screen. d. Back pressure on pilot drain port. 	<ul style="list-style-type: none"> a. Install drain line flow control. b. Increase water pressure above 25 psig (172 kPa) minimum. c. Inspect and clean injector and/or injector screen. d. Plumb pilot drain line to atmospheric position (i.e. brine tank).
7. Loss of Media to Drain.	<ul style="list-style-type: none"> a. No flow control installed in drain line. 	<ul style="list-style-type: none"> a. Install drain line flow control.
8. Loss of Water Pressure.	<ul style="list-style-type: none"> a. Fouled resin bed due to iron accumulation. b. Slots in riser pipe or laterals are filled with resin fines. 	<ul style="list-style-type: none"> a. Clean Magnum Cv Series control valve and mineral bed with cleaner. b. Inspect and clean distributor pipe slots as needed.
9. Salt in Water to Service After Regeneration.	<ul style="list-style-type: none"> a. Injector is too small for system size. b. Brine draw time excessively long due to low water pressure. c. Restricted drain line. d. Insufficient rinse volume. e. Plugged injector and/or injector screen. 	<ul style="list-style-type: none"> a. Install correct injector. b. Increase water pressure above 25 psig (172 kPa) minimum. c. Remove drain line restriction. d. Increase slow rinse time, fast rinse time, or both. e. Inspect and clean injector and/or injector screen.
10. Err1, Err2, Err3, Err4.	<ul style="list-style-type: none"> a. See Table V on page 40. 	<ul style="list-style-type: none"> a. See Solution in Table V on page 40.
11. Both tanks of Twin Alternating system in Standby.	<ul style="list-style-type: none"> a. Defective cam switch. b. Miswired cam switch. 	<ul style="list-style-type: none"> a. Replace cam switch. b. Replace wiring.
12. Display shows flow on tank in Standby.	<ul style="list-style-type: none"> a. Cams were turned manually. 	<ul style="list-style-type: none"> a. Follow procedure in Section 7.1.1 to synchronize controls.

10.0 Performance Data and Charts

10.1 Magnum Cv Injector Data

Injector # 1000441

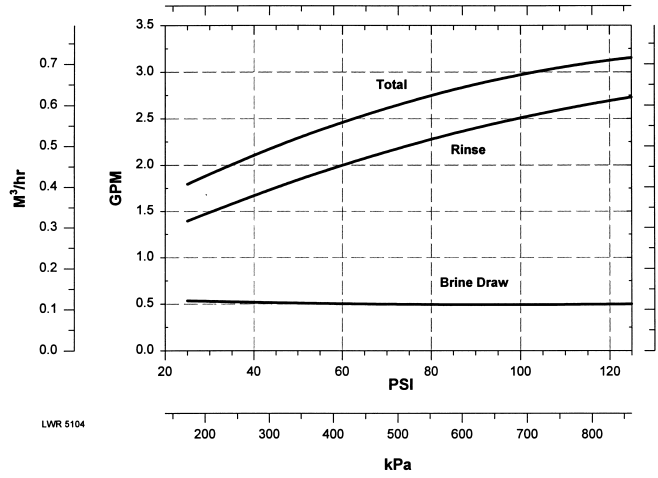
Typical for 14 inch tank *



LWR 5104

Injector # 1000442

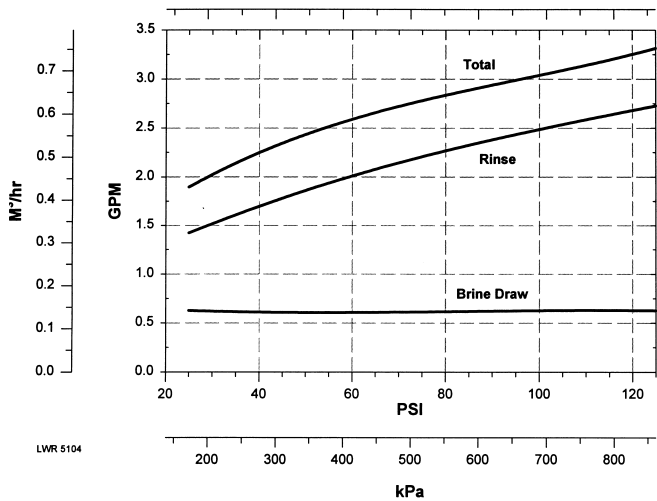
Typical for 16 inch tank *



LWR 5104

Injector # 1000443

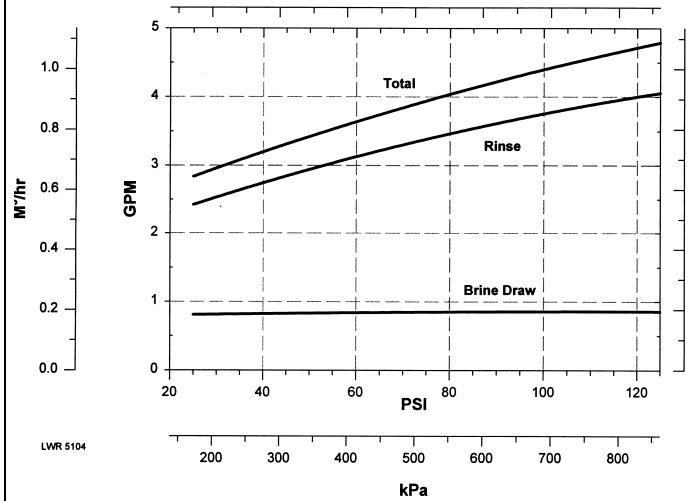
Typical for 18 inch tank *



LWR 5104

Injector # 1000444

Typical for 21 inch tank *



LWR 5104

Injector # 1000445

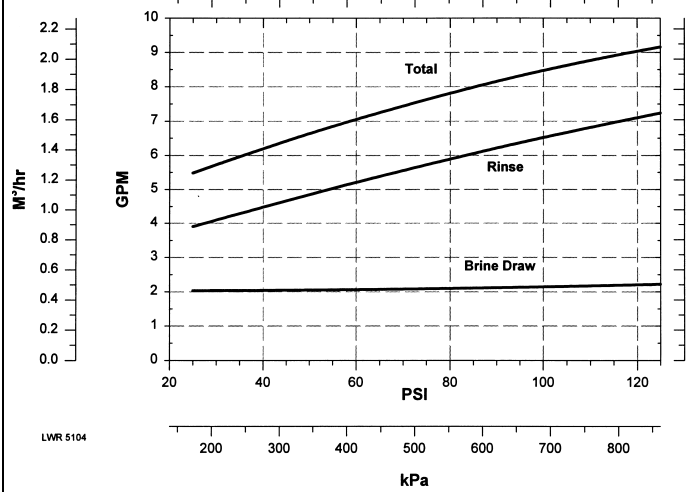
Typical for 24 inch tank *



LWR 5104

Injector # 1000446

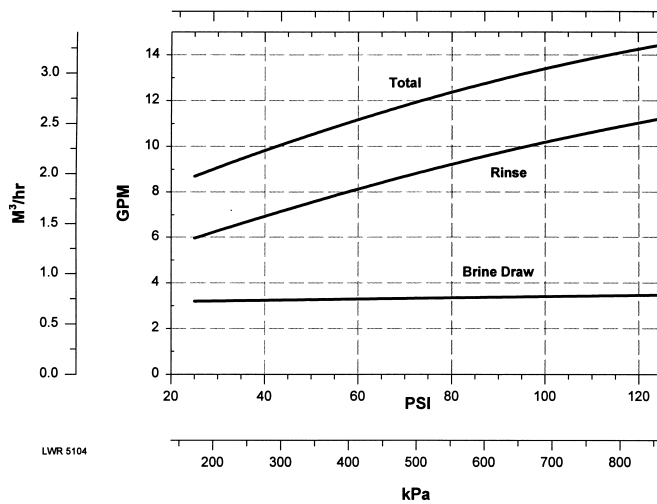
Typical for 30 inch tank *



LWR 5104

Injector # 1000447

Typical for 36 inch tank *



LWR 5104

* Brine draw and Rinse rates on empty tank

10.2 Magnum Cv Flow Controls

Refill Control Identification

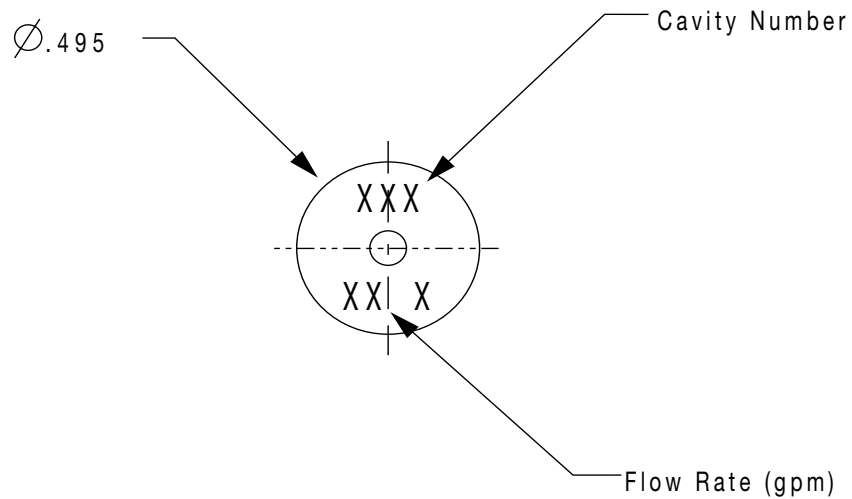


Table 10.1 Magnum Cv Refill Control Chart (P/N Indicates 3-Pack)

Part Number	Tank Diameter In. (cm)	Flow Rate GPM (LPM)	Program P6 Value
1040679	14 (35.6)	0.7 (2.65)	7
1040680	16 (40.6)	0.8 (3.03)	8
1040681	18 (45.7)	1.0 (3.79)	10
1040682	21 (53.3)	1.4 (5.30)	14
1040683	24 (61.0)	2.0 (7.57)	20
1040684	30 (76.2)	3.0 (11.36)	30
1040685	36 (91.4)	5.0 (18.93)	50

Note: All flow rates are based on an inlet pressure of 60 psig (413 kPa). Actual rates will vary with pressure, temperatures and other system variables.

10.3 Magnum Cv Injector Controls

Injector Identification

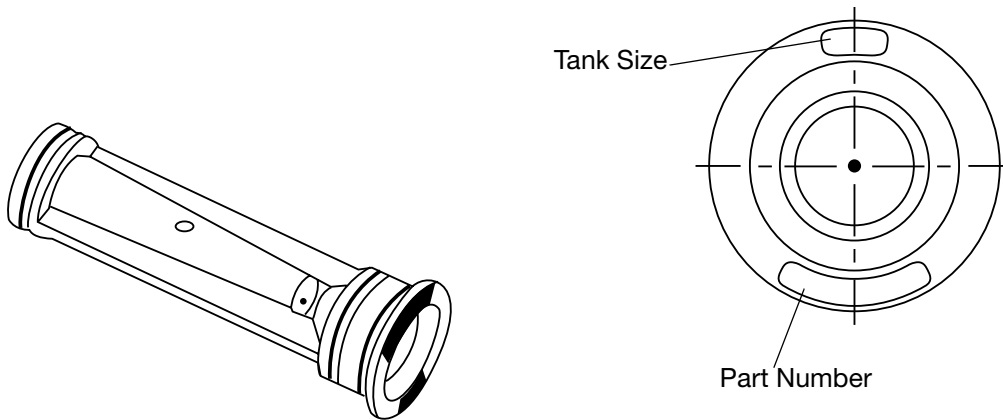


Table 10.2 Magnum Cv Injector Chart

Part Number	Part Number with O-rings	Tank Diameter In. (cm)	Draw Rate GPM (LPM)	Program P7 Value
1000441	1040670	14 (35.6)	0.5 (1.89)	5
1000442	1040671	16 (40.6)	0.5 (1.89)	5
1000443	1040672	18 (45.7)	0.6 (2.27)	6
1000444	1040673	21 (53.3)	0.9 (3.41)	9
1000445	1040674	24 (61.0)	1.4 (5.30)	14
1000446	1040675	30 (76.2)	2.0 (7.57)	20
1000447	1040676	36 (91.4)	3.3 (12.5)	33
1000448	1040677	Blank	0.0	Filter Application Only

Note: All flow rates are based on an inlet pressure of 60 psig (413 kPa). Actual rates will vary with pressure, temperatures and other system variables.

10.4 Drain Line Flow Control

Table 10.3 Recommended Backwash Flow Rates for Various Media

Media	Tank Diameter						
	14 in (35.6 cm) Tank	16 in (40.6 cm) Tank	18 in (45.7 cm) Tank	21 in (53.3 cm) Tank	24 in (61.0 cm) Tank	30 in (76.2 cm) Tank	36 in (91.4 cm) Tank
Cubic Feet of Media/Drain Line Flow Control in GPM							
*Softening Resin (4.5 gpm/ft ²) (1.1 Lph/cm ²)	3/5	4/6	5/8	7/12	10/15	15/25	20/30
*Fine Mesh Softening Resin (3.4 gpm/ft ²) (.83 Lph/cm ²)	3/4	4/5	5/6	7/8	10/10	15/17	20/15
Multi Layer (15 gpm/ft ²) (3.66 Lph/cm ²)	3/15	4/20	5/25	6/30	7/50	10/70	15/105
Birm, Greensand, Carbon (10 gpm/ft ²) (2.44 Lph/cm ²)	3/10	4/15	5/17	7/20	10/30	15/50	20/70

*60 °F (15 °C) water temperature, 50% bed expansion

10.5 Autotrol Drain Line Flow Control

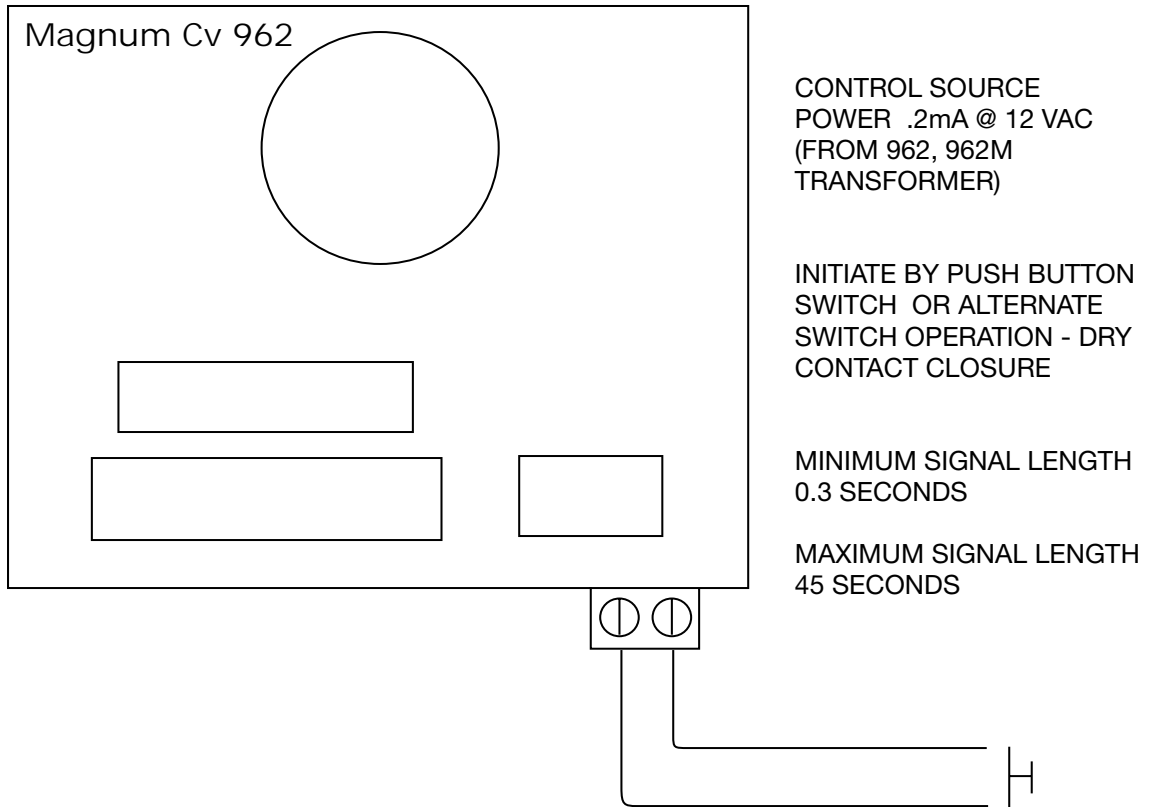
Table 10.4 Autotrol Drain Line Flow Controls (5 gpm - 40 gpm)

Part Number	Flow Control Disk		Insert 1	Insert 2	Insert 3	Insert 4
	gpm	m ³ /h				
1040720	5	1.135	Blue	Black	Black	Black
1040721	6	1.362	Red	Black	Black	Black
1040722	7	1.589	Brown	Black	Black	Black
1040723	8	1.816	Green	Black	Black	Black
1040724	9	2.043	White	Black	Black	Black
1040725	10	2.27	Blue	Blue	Black	Black
1040726	11	2.497	Red	Blue	Black	Black
1040727	12	2.724	Red	Red	Black	Black
1040728	13	2.951	Brown	Red	Black	Black
1040729	14	3.178	Brown	Brown	Black	Black
1040740	15	3.405	Blue	Blue	Blue	Black
1040741	16	3.632	Green	Green	Black	Black
1040742	17	3.859	White	Green	Black	Black
1040743	18	4.086	White	White	Black	Black
1040744	19	4.313	White	Orange	Black	Black
1040745	20	4.54	Blue	Blue	Blue	Blue
1040746	21	4.767	Brown	Brown	Brown	Black
1040747	22	4.994	Green	Green	Red	Black
1040748	23	5.221	Green	Green	Brown	Black
1040749	24	5.448	Red	Red	Red	Red
1040730	25	5.675	Green	Green	White	Black
1040731	26	5.902	White	White	Green	Black
1040732	27	6.129	White	White	White	Black
1040733	28	6.356	Brown	Brown	Brown	Brown
1040734	29	6.583	Brown	Brown	Brown	Green
1040735	30	6.81	Orange	Orange	Orange	Black
1040736	31	7.037	Green	Green	Green	Brown
1040737	32	7.264	Green	Green	Green	Green
1040738	33	7.491	Green	Green	Green	White
1040739	34	7.718	Green	Green	Green	Orange
1040750	35	7.945	White	Green	Green	Green
1040751	36	8.172	White	White	White	White
1040752	37	8.399	White	White	White	Orange
1040753	38	8.626	Orange	Orange	Orange	Green
1040754	39	8.853	Orange	Orange	Orange	White
1040755	40	9.08	Orange	Orange	Orange	Orange

Note: Drain Line Flow Controls above 40 gpm require external control installed in drain line.

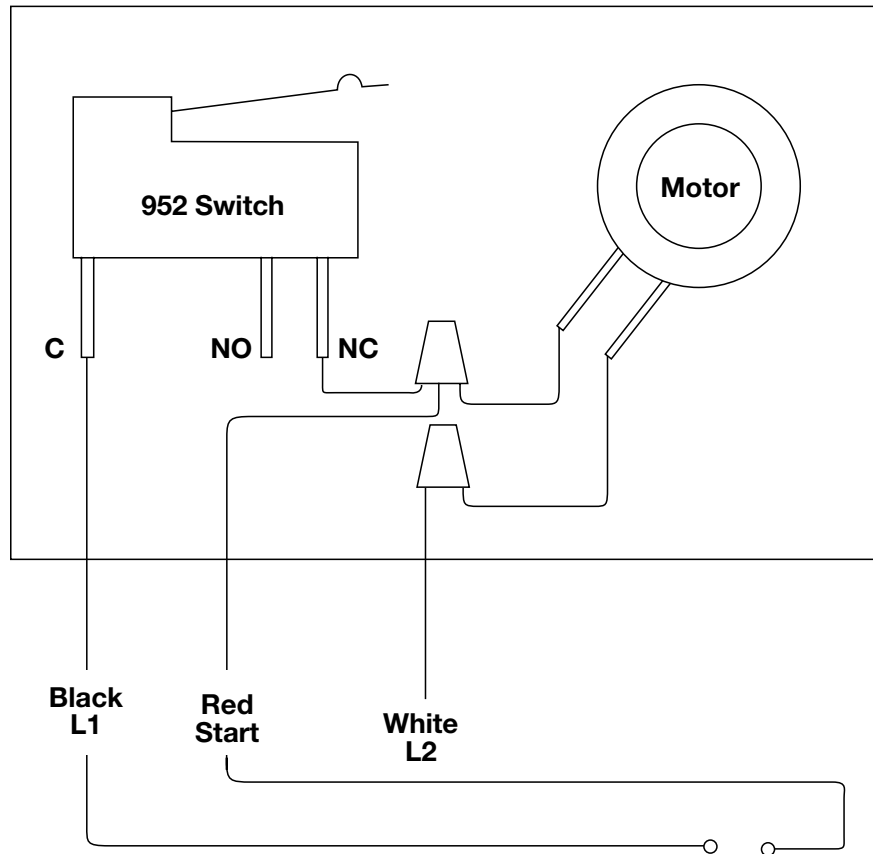
11.0 Wiring Diagrams

11.1 Model 962 Series Electronic Control Remote Regeneration Initiation



NOTE: The 962 Series Electronic Control is not recommended for pressure differential initiation or sequential regeneration of multiple tank systems. Please consult Osmonics for these applications.

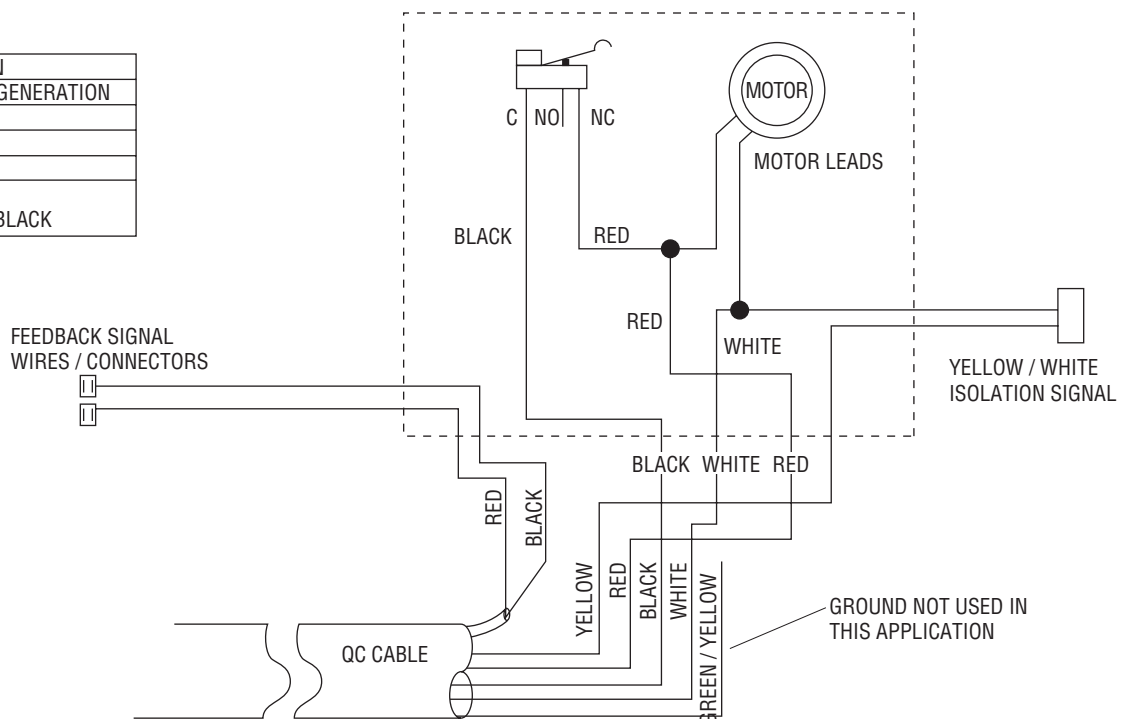
11.2 Model 952 Twin Series Impulse Control



11.3 Model 952QC Impulse Control

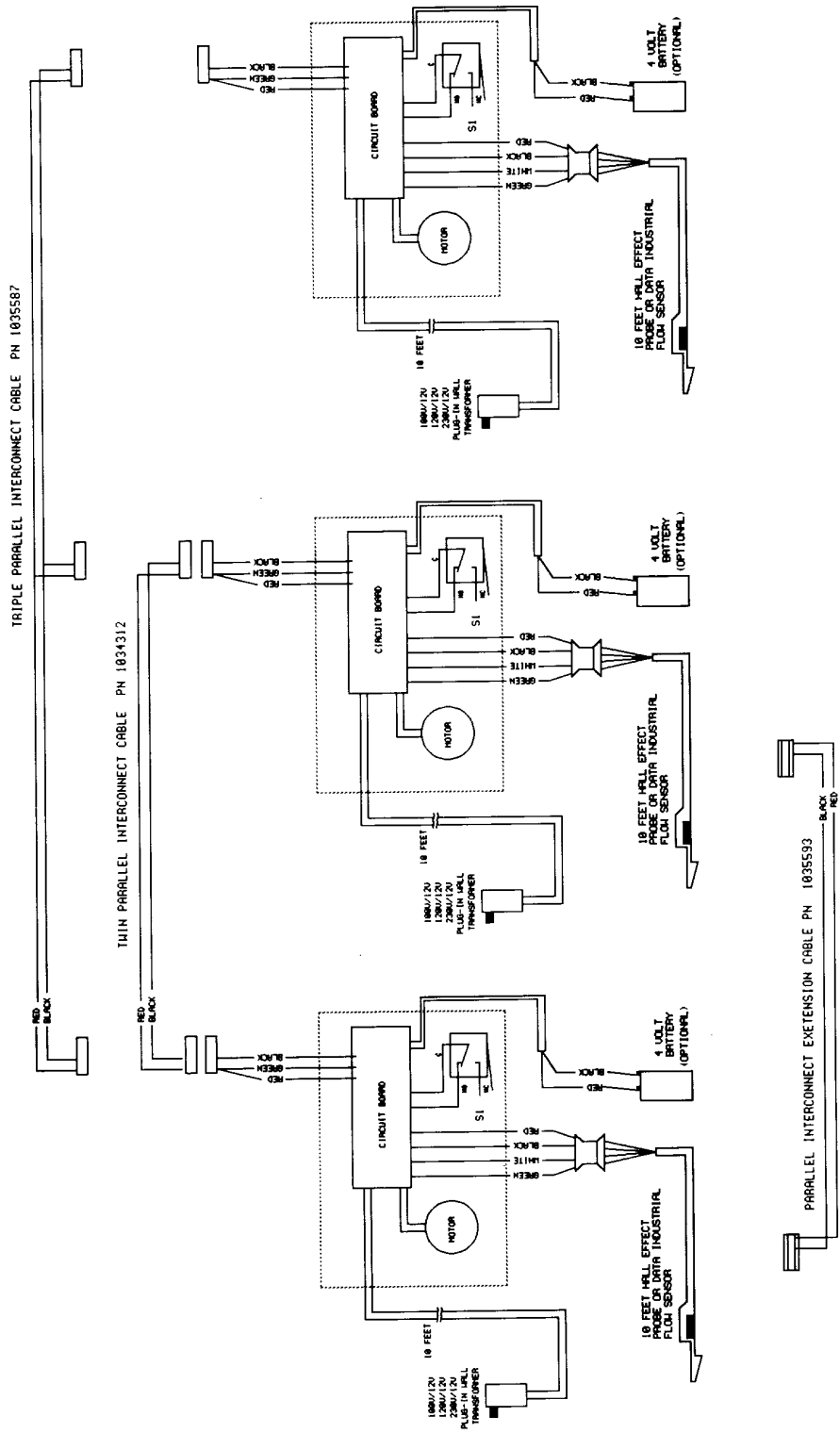
LEGEND

YELLOW	ISOLATION
RED	START REGENERATION
BLACK	HOT
WHITE	NEUTRAL
GRN/YEL	GROUND
FEEDBACK CABLE	RED AND BLACK

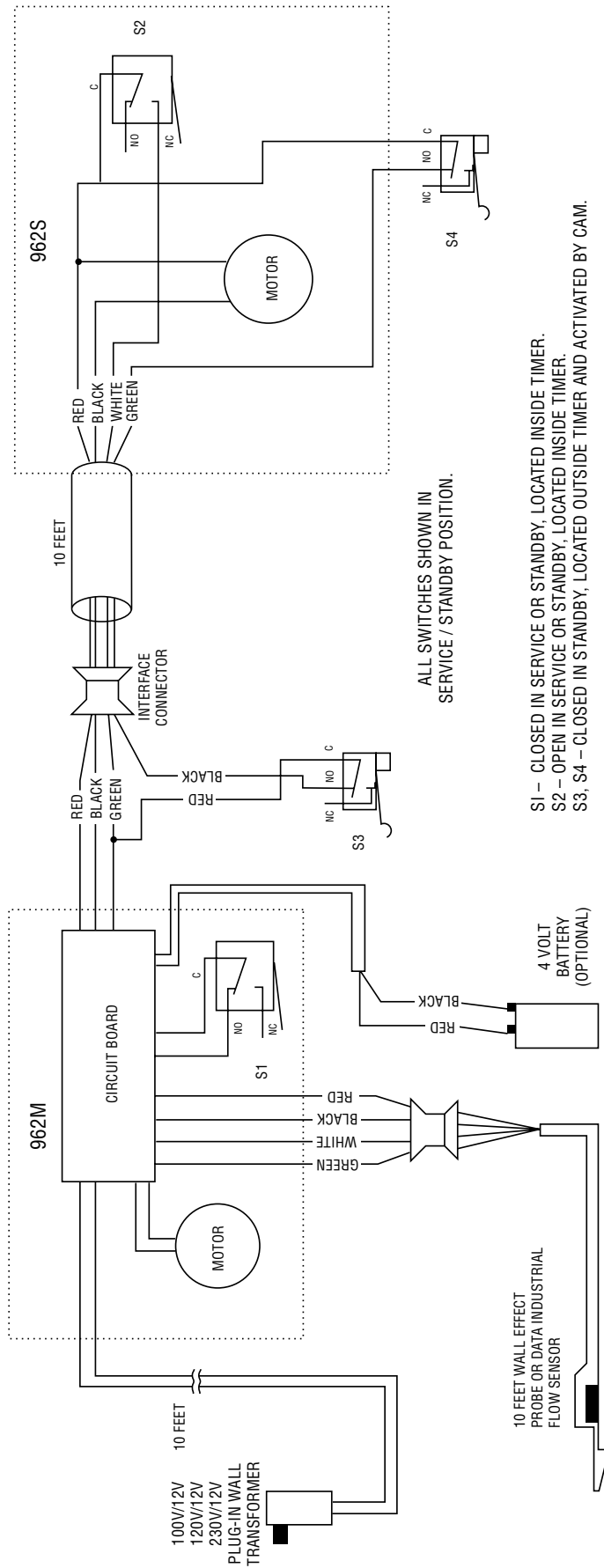


11.4 Triple Parallel Wiring

Model 962 Twin or Triple Parallel Wiring Schematic



11.5 Model 962 Twin Alternating System Main/Secondary Wiring Schematic



12.0 Assembly Drawings and Parts List

Magnum Cv Controls

12.1 Manual Controls

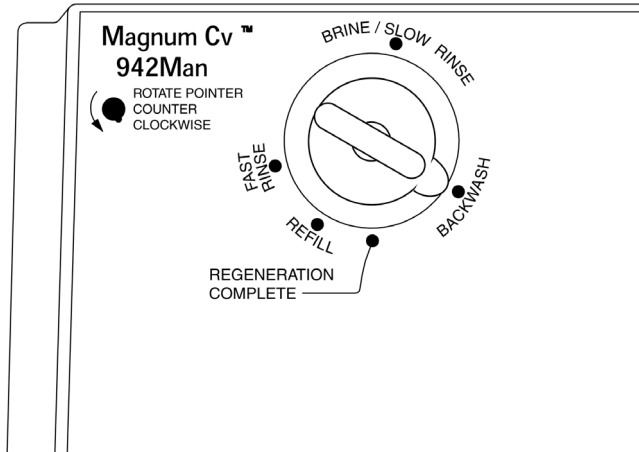


Figure 12.1 Magnum Cv 942MAN

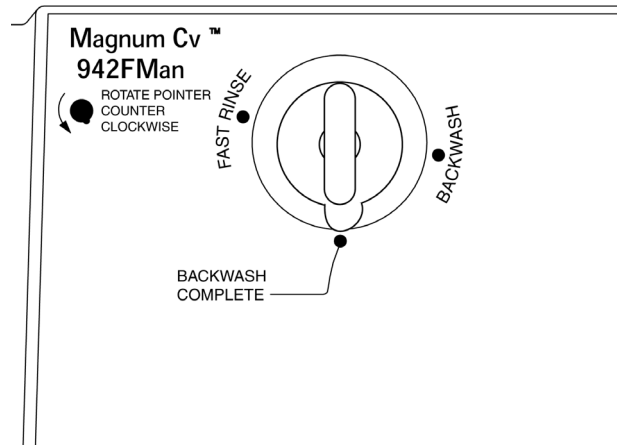


Figure 12.2 Magnum Cv 942FMAN

Table 12.1 942 Manual Control Configurations

Part Number	Description
1034398	Manual Control/942Man Softener/English
1034399	Manual Control/942FMan Filter/English

12.2 Mechanical Timeclock Controls

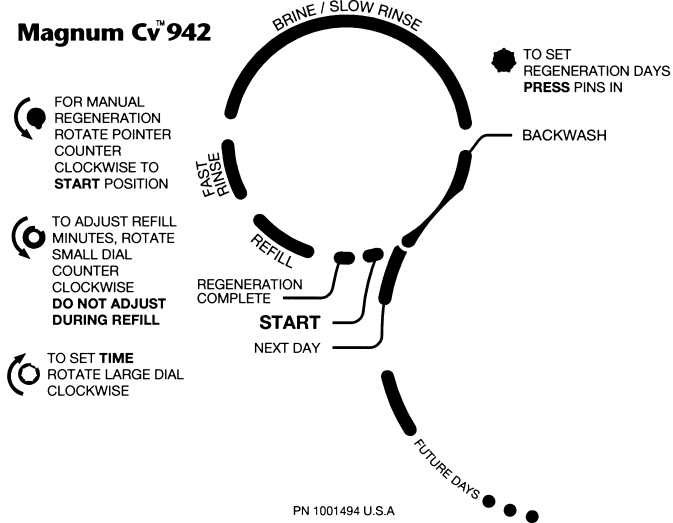


Figure 12.3 Magnum Cv 942 (Softener)

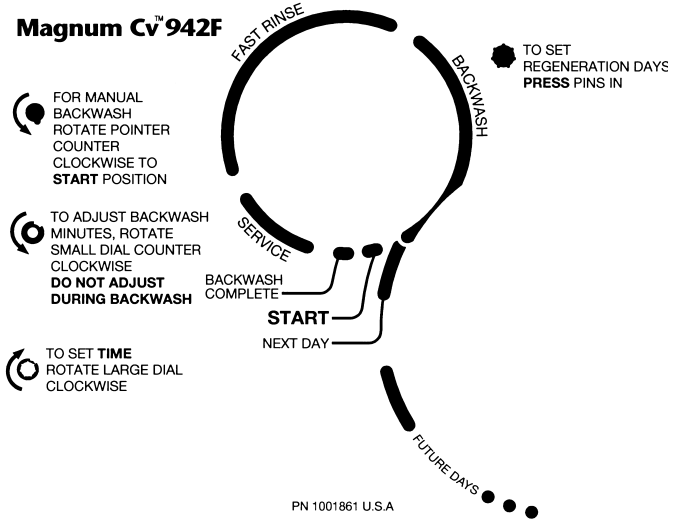


Figure 12.4 Magnum Cv 942F (Filter)

Table 12.2 Mechanical Timeclock 12V/50 Hz Configurations

Part Number	Description
1046850	Timeclock Control/942 Softener/7 Day/24 Hour/12 VAC/50 Hz
1046851	Timeclock Control/942 Softener/12 Day/24 Hour/12 VAC/50 Hz
1046852	Timeclock Control/942F Filter/7 Day/24 Hour/12 VAC/50 Hz
1046853	Timeclock Control/942F Filter/12 Day/24 Hour/12 VAC/50 Hz

Table 12.3 942 Mechanical Timeclock 12V/60 Hz Configurations

Part Number	Description
1046868	Timeclock Control/942 Softener/7 Day/24 Hour/12 VAC/60 Hz
1046869	Timeclock Control/942 Softener/12 Day/24 Hour/12 VAC/60 Hz
1046870	Timeclock Control/942F Filter/7 Day/24 Hour/12 VAC/60 Hz
1046871	Timeclock Control/942F Filter/12 Day/24 Hour/12 VAC/60 Hz

Table 12.4 942 Mechanical Timeclock 120V/60 Hz Configurations

Part Number	Description
1046317	Timeclock Control/942 Softener/7 Day/24 Hour/120 VAC/60 Hz
1046318	Timeclock Control/942 Softener/12 Day/24 Hour/120 VAC/60 Hz
1046319	Timeclock Control/942F Filter/7 Day/24 Hour/120 VAC/60 Hz
1046320	Timeclock Control/942F Filter/12 Day/24 Hour/120 VAC/60 Hz

12.3 Impulse Controls

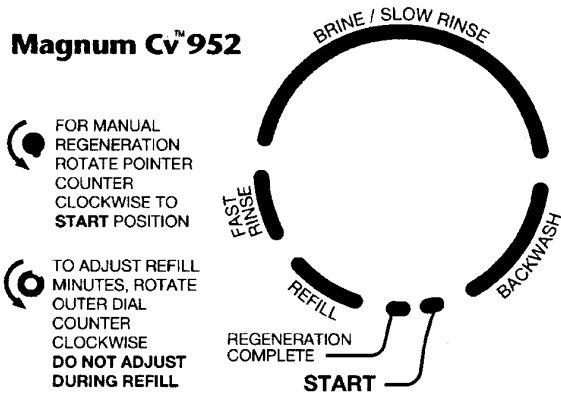


Figure 12.5 Magnum Cv 952

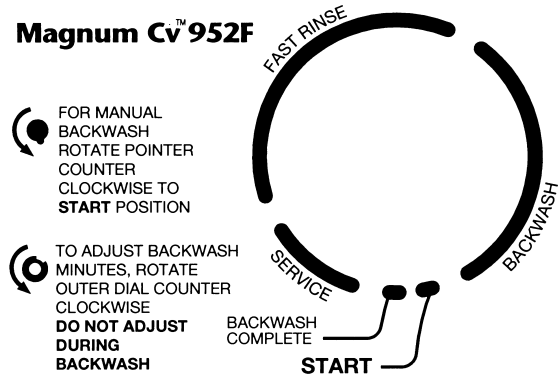


Figure 12.6 Magnum Cv 952F

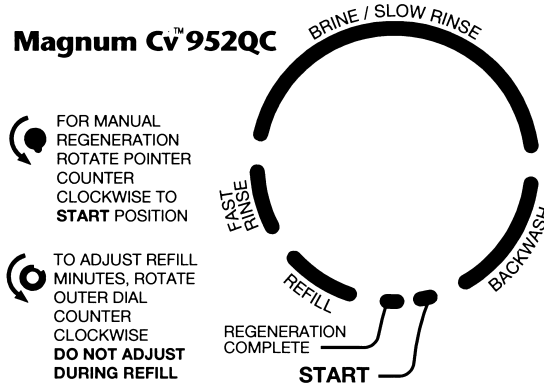


Figure 12.7 Magnum Cv 952QC

Table 12.5 952 Impulse Control 50 Hz Configurations

Part Number	Description
1046854	Impulse Control/952 Softener/24 VAC/50 Hz
1046855	Impulse Control/952F Filter/24 VAC/50 Hz
1046856	Impulse Control/952QC Softener/24 VAC/50 Hz - 7 foot (2.1 m) Cable
1046857	Impulse Control/952QC Softener/24 VAC/50 Hz - 14 foot (4.2 m) Cable
1046858	Impulse Control/952QC Softener/24 VAC/50 Hz - 21 foot (6.3 m) Cable

Table 12.6 Impulse Control 60 Hz Configurations

Part Number	Description
1046321	Impulse Control/952 Softener/120 VAC/60 Hz
1046323	Impulse Control/952F Filter/120 VAC/60 Hz
1046322	Impulse Control/952 Softener/24 VAC/60 Hz
1046324	Impulse Control/952F Filter/24 VAC/60 Hz
1046325	Impulse Control/952QC Softener/24 VAC/60 Hz - 7 foot (2.1 m) Cable
1046336	Impulse Control/952QC Softener/24 VAC/60 Hz - 14 foot (4.2 m) Cable
1046337	Impulse Control/952QC Softener/24 VAC/50 Hz - 21 foot (6.3 m) Cable

12.4 Electronic Controls

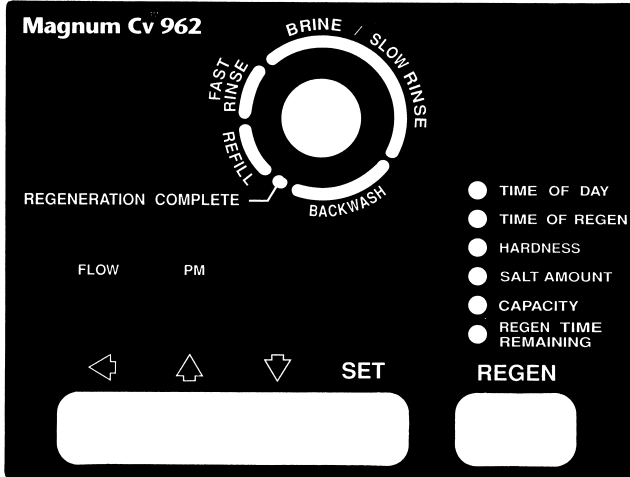


Figure 12.8 Magnum Cv 962

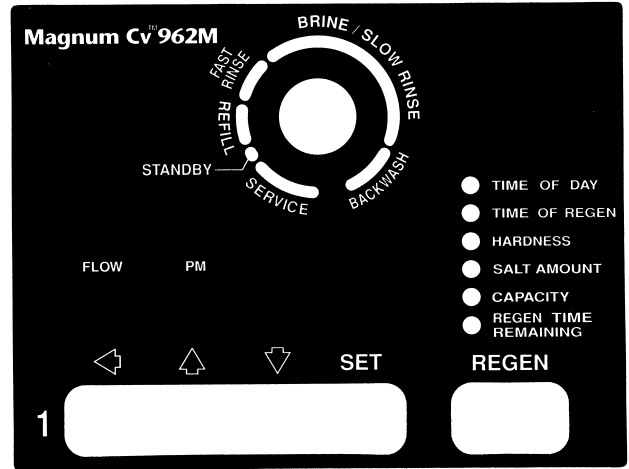


Figure 12.10 Magnum Cv 962M

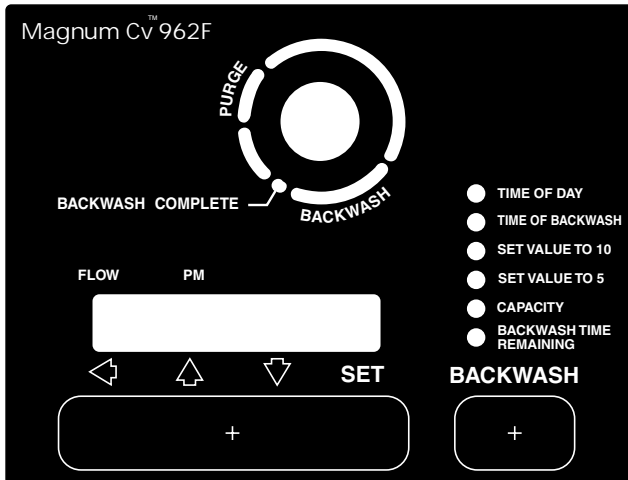


Figure 12.9 Magnum Cv 962F



Figure 12.11 Magnum Cv 962S

Table 12.7 962 Electronic Control 12V/50 Hz Configurations

Part Number	Description
1046859	Electronic Control/962 Softener/12 VAC/50 Hz
1046860	Electronic Control/962 Softener/Battery Backup/12 VAC/50 Hz*
1046861	Electronic Control/962M Main/12 VAC/50 Hz
1046862	Electronic Control/962M Main/Battery Backup/12 VAC/50 Hz*
1046863	Electronic Control/962S Secondary/12 VAC/50 Hz
1046872	Electronic Control/962F Filter/12 VAC/50 Hz
1046873	Electronic Control/962F Filter/Battery Backup/12 VAC/50 Hz*

* Battery Not Included.

Table 12.8 962 Electronic Control 12 V/ 60 Hz Configurations

Part Number	Description
1046326	Electronic Control/962 Softener/12 VAC/60 Hz
1046327	Electronic Control/962 Softener/Battery Backup/12 VAC/60 Hz*
1046328	Electronic Control/962M Main/12 VAC/60 Hz
1046329	Electronic Control/962M Main/Battery Backup/12 VAC/60 Hz*
1046330	Electronic Control/962S Secondary/12 VAC/60 Hz
1046866	Electronic Control/962F Filter/12 VAC/60 Hz
1046867	Electronic Control/962F Filter/Battery Backup/12 VAC/60 Hz*

* Battery Not Included.

Table 12.9 Transformers

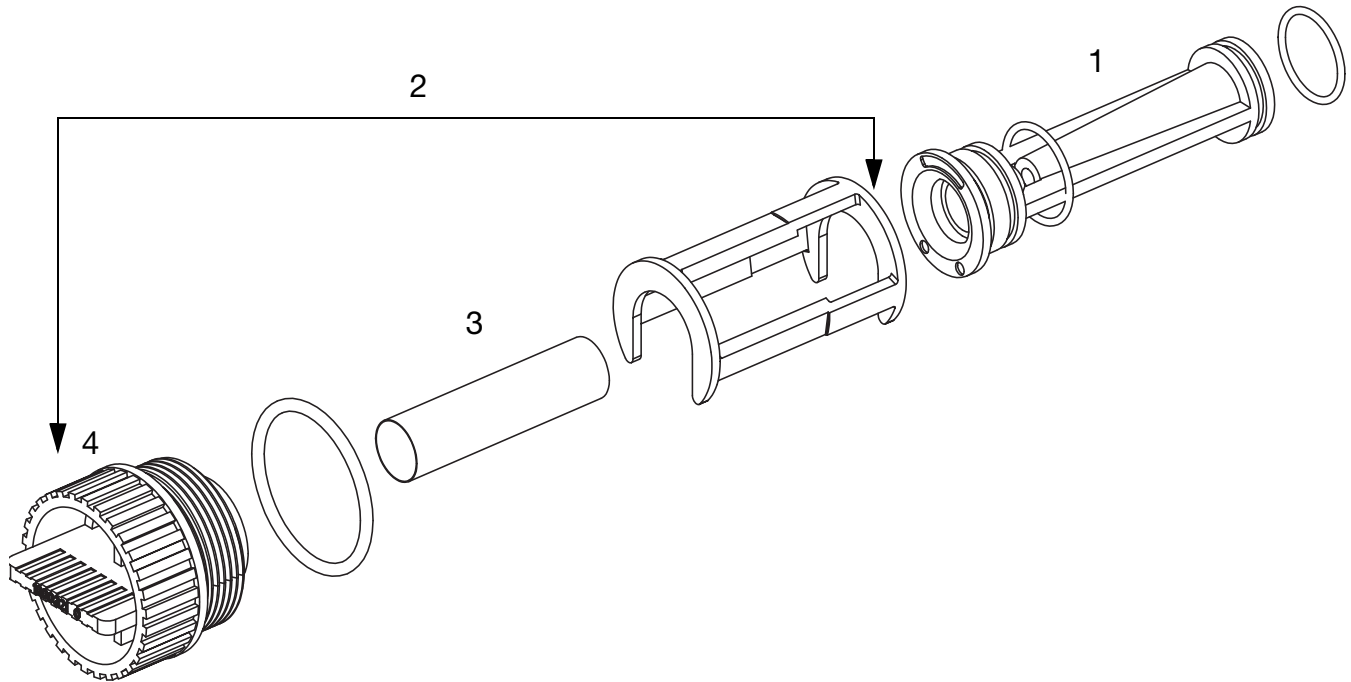
Part Number	Description
1000810	12 V Wall Mount Transformer/100 VAC/50/60 Hz/150 mA/Japanese Plug
1000811	12 V Wall Mount Transformer/120 VAC/60 Hz/150 mA/North American Plug
1000812	12 V Wall Mount Transformer/240 VAC/50 Hz/150 mA/Australian/Arentine Plug
1000813	12 V Wall Mount Transformer/240 VAC/50 Hz/150 mA/British Plug
1000814	12 V Wall Mount Transformer/230 VAC/50 Hz/150 mA/European/Italian Plug

Table 12.10 Miscellaneous Parts

Part Number	Description
1007201	Battery
1009097	Battery Cap
1000396	Battery Bracket

12.5 Magnum Cv Flow Controls

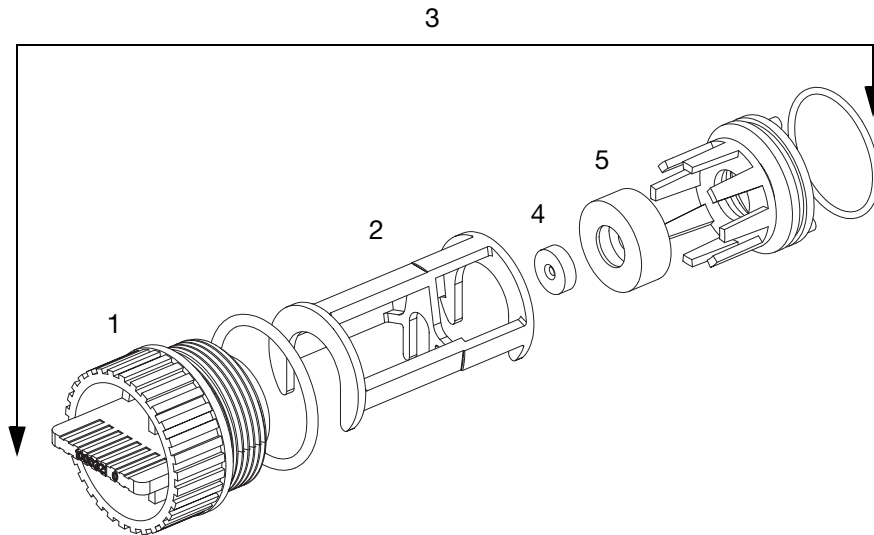
Injector Assembly



Item	Part Number	Description
1	1040670	Injector for 14-inch (35.6 cm) Tank - 0.5 GPM (1.9 LPM) (includes O-rings)
1	1040671	Injector for 16-inch (40.6 cm) Tank - 0.5 GPM (1.9 LPM) (includes O-rings)
1	1040672	Injector for 18-inch (45.7 cm) Tank - 0.6 GPM (2.27 LPM) (includes O-rings)
1	1040673	Injector for 21-inch (53.3 cm) Tank - 0.9 GPM (3.41 LPM) (includes O-rings)
1	1040674	Injector for 24-inch (61.0 cm) Tank - 1.4 GPM (5.3 LPM) (includes O-rings)
1	1040675	Injector for 30-inch (76.2 cm) Tank - 2.0 GPM (7.57 LPM) (includes O-rings)
1	1040676	Injector for 36-inch (91.4 cm) Tank - 3.3 GPM (12.5 LPM) (includes O-rings)
1	1040669	Injector, Blank (includes O-rings)
2	1040677	Injector Assembly (Less Injector)
3	1040678	Injector Screen (3 pack)
4	1040688	Plug for Injector, Refill and Pressure Regulator Ports (including O-rings)

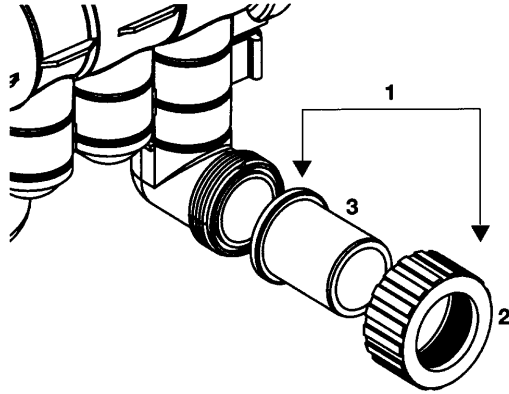
12.6 Magnum Cv Flow Controls

Refill Control Assembly



Item	Part Number	Description
4	1040679	Refill Flow Control for 14-inch (35.6 cm) Tank - 0.7 GPM (2.6 LPM) (3 pack)
4	1040680	Refill Flow Control for 16-inch (40.6 cm) Tank - 0.8 GPM (3.0 LPM) (3 pack)
4	1040681	Refill Flow Control for 18-inch (45.7 cm) Tank - 1.0 GPM (3.8 LPM) (3 pack)
4	1040682	Refill Flow Control for 21-inch (53.3 cm) Tank - 1.4 GPM (5.3 LPM) (3 pack)
4	1040683	Refill Flow Control for 24-inch (61.0 cm) Tank - 2.0 GPM (7.6 LPM) (3 pack)
4	1040684	Refill Flow Control for 30-inch (76.2 cm) Tank - 3.0 GPM (11.4 LPM) (3 pack)
4	1040685	Refill Flow Control for 36-inch (91.4 cm) Tank - 5.0 GPM (19.0 LPM) (3 pack)
5	1040686	Refill Flow Control Cage (3 pack)
3	1040687	Refill Assembly (Less Refill Flow Control)
1	1040688	Plug for Injector, Refill and Pressure Regulator Ports (includes O-ring)

12.7 Installation Adapters



Adapters- Magnum Cv

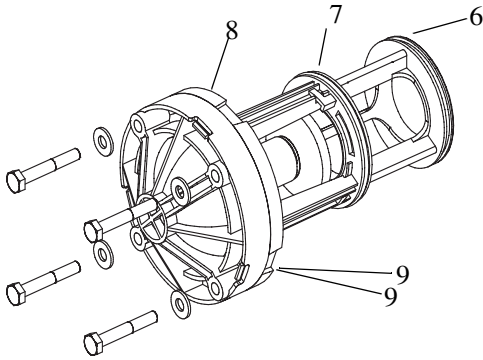
Item	Part Number	Description
Not Shown	1001657	Magnum Cv 1.5-inch Adapter Kit - Brass NPT for inlet, outlet, drain
Not Shown	1001658	Magnum Cv 1.5-inch Adapter Kit - Brass BSP for inlet, outlet, drain
1	1001655	Magnum Cv 1.5-inch Adapter Kit - CPVC for inlet, outlet, drain
Not Shown	1040544	1.5-inch NPT Brass Adapter with Glass Filled Noryl Nut (24 Pack)
Not Shown	1040555	1.5-inch BSP Brass Adapter with Glass Filled Noryl Nut (24 Pack)
1	1050556	1.5-inch CPVC Adapter with Glass Filled Noryl Nut (24 Pack)
2	1000356	Glass Filled Noryl Nut for 1.5-inch Adapter
Not Shown	1000360	1.5-inch Brass NPT Adapter
Not Shown	1000361	1.5-inch Brass BSP Adapter
3	1000356	1.5-inch CPVC Adapter
Not Shown	1001995	1-1/2-inch Brass NPT Adapter with Drilled and Tapped 1/4-inch NPT Port
Not Shown	1001996	1-1/2-inch Brass BSP Adapter with Drilled and Tapped 1/4-inch BSP Port

Adapters-Magnum Cv PLUS

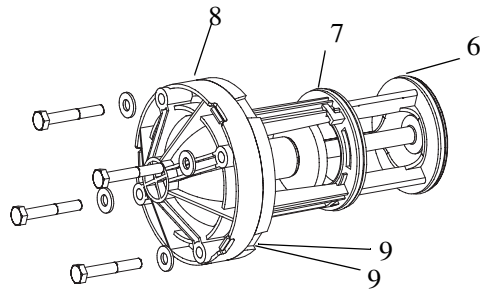
Item	Part Number	Description
Not Shown	1040782	Magnum Cv PLUS Adapter Kit - Brass NPT for inlet, outlet, drain
Not Shown	1040783	Magnum Cv PLUS Adapter Kit - Brass BSP for inlet, outlet, drain
Not Shown	1040784	Magnum Cv PLUS Adapter Kit - CPVC for inlet, outlet, drain
Not Shown	1040786	2-inch NPT Brass Adapter with Zinc Diecast Nut (24 Pack)
Not Shown	1040787	2-inch BSP Brass Adapter with Zinc Diecast Nut (24 Pack)
Not Shown	1040788	2-inch CPVC Adapter with Zinc Diecast Nut (24 Pack)
Not Shown	1030664	2-inch Cast Zinc Diecast Nut
Not Shown	1030663	2-inch Brass NPT Adapter
Not Shown	1033863	2-inch Brass NPT Adapter with Drilled and Tapped 1/4-inch NPT Port

Item	Part Number	Description
Not Shown	1030665	2-inch Brass BSP Adapter
Not Shown	1033864	2-inch Brass BSP Adapter with Drilled and Tapped 1/4-inch BSP Port
Not Shown	1030666	2-inch CPVC Adapter
Not Shown	1030667	63-mm Metric PVC Adapter
Not Shown	1002906	1.5-inch to 2-inch Brass Bell Reducer Coupling
Not Shown	1010160	1.5-inch Adapter O-Ring
Not Shown	1010165	2.0-inch Adapter O-Ring

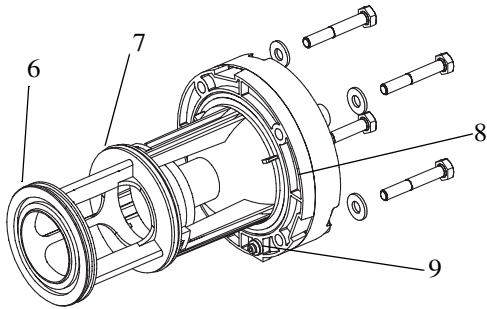
12.8 Magnum Cv Valve Cartridges



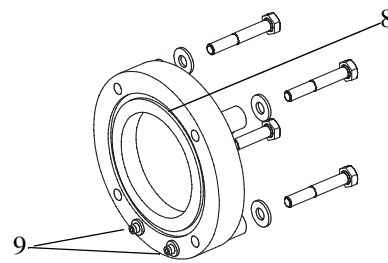
1 - Drain Valve Cartridge



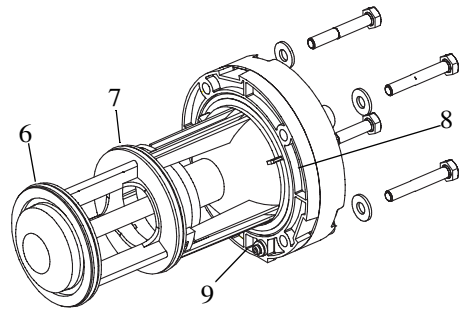
2 - Rinse Valve Cartridge



3 - No Hard Water Bypass Valve Cartridge



4 - Hard Water Bypass Cap

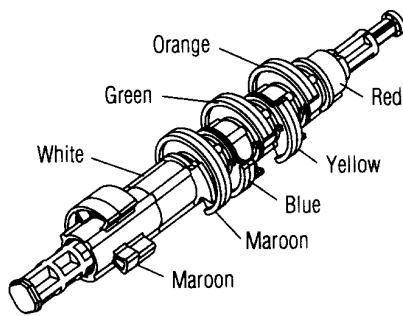
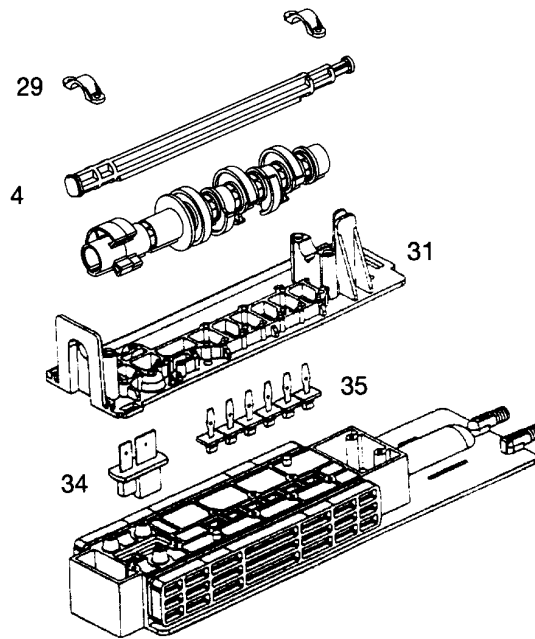


5 - Inlet Valve Cartridge

Item	Part Number	Description
1	1000366	Drain Valve Cartridge
2	1000365	Rinse Valve Cartridge
3	1000366	No Hardwater Bypass Valve Cartridge
4	1000336	Hardwater Bypass Cap
5	1000317	Inlet Valve Cartridge
6	1010157	O-Ring
7	1010158	O-Ring
8	1010159	O-Ring
9	1010116	O-Ring (qty. 2 per Cartridge)

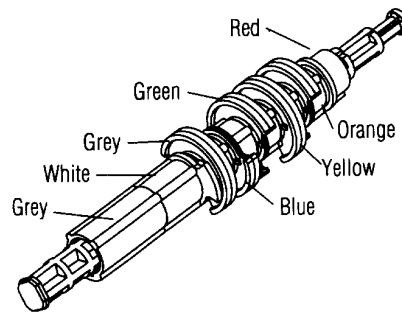
Note: Items 1 and 2 are identical valve cartridges.

12.9 Cam and Pilot Valve Assembly



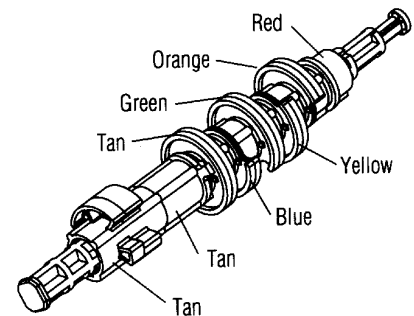
5-Cycle Softener

1



3-Cycle Filter

2



Twin Alternating

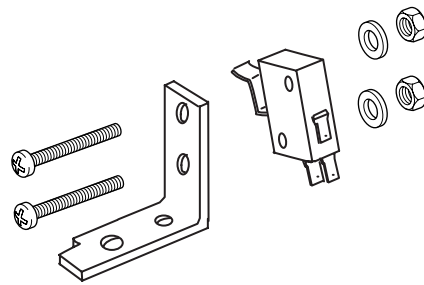
3

Item	Part Number	Description
1	1000535	Camshaft Assembly - 5 Cycle Softener
2	1000538	Camshaft Assembly - 3 Cycle Filter
3*	1001751	Camshaft Assembly - Twin Alternating
4	1000341	Camshaft
5	1000461	Brine Cam - Co-current 5 Cycle Softener (Maroon)
6	1000462	Universal Cam Switcher (White)
7	1000464	Pilot Cam - Co-current 5 Cycle Softener #1 (Maroon)
8	1000465	Pilot Cam - Co-current 5 Cycle Softener #2 (Blue)

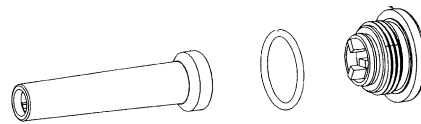
Item	Part Number	Description
9	1000466	Pilot Cam - Co-current 5 Cycle Softener #3 (Green)
10	1000467	Pilot Cam - Co-current 5 Cycle Softener #4 (Yellow)
11	1000468	Pilot Cam - Co-current 5 Cycle Softener #5 (Orange)
12	1000469	Pilot Cam - Co-current 5 Cycle Softener #6 (Red)
13	1000460	Spacer Cam - 3 Cycle Filter (Grey)
14	1000462	Universal Cam Switcher (White)
15	1000470	Pilot Cam - 3 Cycle Filter #1 (Grey)
16	1000471	Pilot Cam - 3 Cycle Filter #2 (Blue)
17	1000472	Pilot Cam - 3 Cycle Filter #3 (Green)
18	1000473	Pilot Cam - 3 Cycle Filter #4 (Yellow)
19	1000474	Pilot Cam - 3 Cycle Filter #5 (Orange)
20	1000469	Pilot Cam - 3 Cycle Filter #6 (Red)
21	1000499	Brine Cam - Twin Alternating (Tan)
22	1001750	Universal Cam Switcher (Tan)
23	1001620	Pilot Cam - Twin Alternating #1 (Tan)
24	1001621	Pilot Cam - Twin Alternating #2 (Blue)
25	1001622	Pilot Cam - Twin Alternating #3 (Green)
26	1001623	Pilot Cam - Twin Alternating #4 (Yellow)
27	1001624	Pilot Cam - Twin Alternating #5 (Orange)
28	1000469	Pilot Cam - Twin Alternating #6 (Red)
29	1000589	Pillow Block Cap
Not Shown	1006095	Pillow Block Cap Screw (4) (not shown)
31	1000339	Top Plate
Not Shown	1006093	Top Plate Screw - Short (5) (not shown)
Not Shown	1006095	Top Plate Screw - Long (9) (not shown)
34	1000391	Brine Flapper Valve
35	1000328	Pilot Flapper Valve
Not Shown	1000553	Cam for Auxiliary output, shuts off at end of refill
Not Shown	1000554	Cam for Auxiliary output, shuts off at beginning of refill
Not Shown	1001580	Flapper Return Spring
Not Shown	1000343	Cam Cover

* For use with 962M and 962S controls only.

12.10 Kits and Assemblies



Switch Kit



Pilot Filter Screen Assembly

Part Number	Description
1041049	Switch Kit Assembly 0.1 amp rating (also used on 962M and 962S Controls)
1041063	Switch Kit Assembly - 5 amp rating
1000226	Pilot Screen Assembly (includes Pilot Screen, Pilot Screen Cap and O-ring)
1040691	Valve O-ring Kit (tank adapter O-ring, (3) O-rings for 1-1/2-inch inlet, outlet, drain and distributor O-ring)
1040692	Pilot Flapper Kit (pilot, brine and springs)
1040668	External Pilot Feed Adapter (separate source pilot water)
1000878	Outdoor Cover (962 control)
1040589	Top Stacking Distributor
1006095	Top Plate Screws (15 req'd)
1006093	Top Plate Screws (5 req'd)
1034312	Twin Parallel Interface Cable (10 feet) (3 m)
1035587	Triple Parallel Interface Cable (10 feet) (3 m)
1035593	Parallel Interconnect Extension Cable (Used to connect two 10-foot cables)
1010162	Tank Adapter O-ring
1010160	Riser Tube O-ring

12.11 962 Optional Switch Kits

Part Number	Description	Items Included
1041037	Switch Kit for Twin Alt 962 Controls .1 amp	(2) SPDT Switches with gold cross contacts hardware to mount 3 switches (6) crimp on connectors (2) breakaway switch cams (1) short twin/alt switch cam (1) instruction sheet
1041038	Switch Kit for Twin Alt 962 Controls 5 amp	(2) SPDT Switches with standard contacts hardware to mount 3 switches (6) crimp on connectors (2) breakaway switch cams (1) short twin/alt switch cam (1) instruction sheet
1041039	Switch Kit for Single Tank 962 Controls .1 amp	(3) SPDT Switches with gold cross contacts hardware to mount 3 switches (9) crimp on connectors (1) switch bracket (3) breakaway switch cams (1) instruction sheet (1) bracket screw
1041048	Switch Kit for Single Tank 962 Controls 5 amp	(3) SPDT Switches with standard contacts hardware to mount 3 switches (9) crimp on connectors (1) switch bracket (3) breakaway switch cams (1) instruction sheet (1) bracket screw
1041049	Switch Kit for Single Tank Controls .1 amp	(1) SPDT Switch with gold cross contacts hardware to mount 1 switch (3) crimp on connectors (1) switch bracket (1) instruction sheet (1) bracket screw
1041063	Switch Kit for Single Tank Controls 5 amp	(1) SPDT Switch with standard contacts hardware to mount 1 switch (3) crimp on connectors (1) switch bracket (1) instruction sheet (1) bracket screw
1041064	Pilot Flapper Breakaway Kit	(1) Breakaway pilot cam (1) Spacer (1) instruction sheet
1041065	10-foot Switch Cable Assembly	(1) 10-foot cable with fast-on switch connector housing
1041066	20-foot Switch Cable Assembly	(1) 20-foot cable with fast-on switch connector housing

