

Water Hammer Arrestors

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PICTORIAL INDEX



MATERIALS and FINISHES

Zurn Bronze is a semi-red brass conforming to ASTM Specification for Copper Alloy Sand Casting B 584-90, Copper Alloy No. 844. The exposed surface is normally supplied possessing a satin sheen texture which allows it to blend unobtrusively with surrounding finishes. When the application requires, Zurn Bronze can be polished to a high gloss.

Zurn Stainless Steel castings are normally produced in Type CF8 (304) which is an 18-8 Austenitic Stainless possessing excellent corrosion resistant qualities. For some applications where conditions demand, Type CF8M (316) stainless steel can be supplied. Items formed from stainless steel sheet and other stainless steel products are regularly furnished in Type 304 with 316 as an optional material.

SHOKTROL® OFFERS UNLIMITED CAPACITIES FOR AN INFINITE RANGE OF APPLICATIONS

Zurn Shoktrols are available in a variety of sizes to fill a variety of needs. Their 3-1/2" maximum diameter makes possible ready concealment between 2" x 4" studs without furring. Full range provides complete protection against water hammer in common pipe diameters for varying pipe lengths wherever flow velocity is subject to sudden change – in quick closing, solenoid-actuated valves used with lavatories and sinks, dishwashers, and residential automatic washers; in improperly adjusted water closet flush valves; in pumping systems, and in drinking fountains or similar installations where water flow is valved for intermittent operation.

Superior Quality

Each Shoktrol has its shock-absorbing air cushion hermetically sealed within the unit. Unlike piston or O-ring type shock absorbers, there is no loss of air from the Shoktrol due to leakage past worn elastomeric sealing surfaces nor due to permeation through elastomeric features. In addition, the Shoktrol's 18-8 stainless steel construction makes it virtually immune to attack and degradation by high levels of chloramine and other common waterborne chemicals which quickly degrade elastomeric components.

Note: For applications requiring larger capacity units, such as commercial laundry equipment, specify Zurn Accumutrol Z1712 on the following pages.

Regularly Furnished

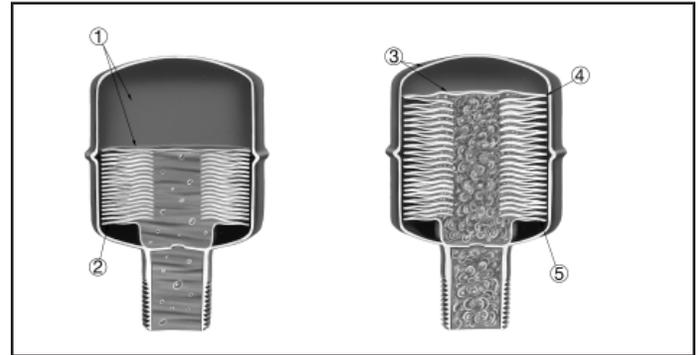
Zurn Shoktrols are regularly furnished in all-stainless steel construction. Pipe threads are accurately machined to assure tight connection. 1" male I.P.S. inlet is standard for all capacities except the 100 and 200 sizes, which use 3/4" male I.P.S. inlet.

Recommended Specification

Where required in piping systems, properly sized water hammer arrestors shall be Zurn Z1700 (specify size) with nesting type bellows contained within casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Both casing and bellows are constructed of 18-8 stainless steel.

In Normal Position

Water enters interior of all-welded nesting bellows. Energy displacement area shown in upper chamber.



- ① **All-Stainless-Steel Construction** – When sized properly, the Shoktrol's bellows cannot take a permanent set even if expanded by static line pressure for prolonged periods, nor split or tear under stress. Exterior requires no additional treatment to blend with surroundings on exposed installations.
- ② **All-Welded Bellows** – Fusion-welded under argon-gas shield with controlled constant conditions. Resultant weld stronger than parent metal.

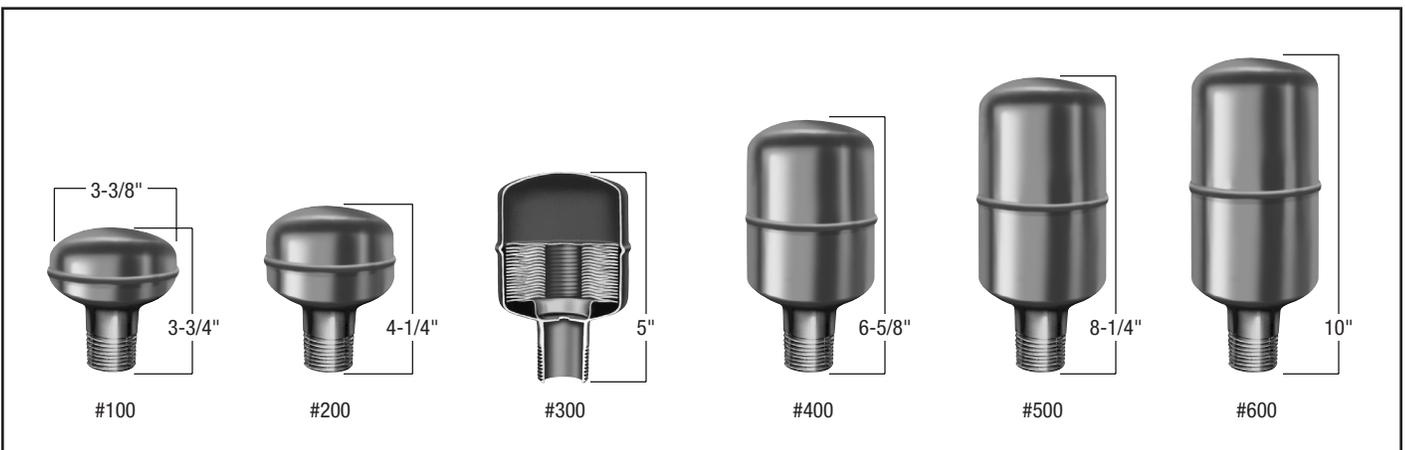
Under Shock Pressure

When sized properly, the Shoktrol's bellows expand to absorb shock revealing no stress points and no danger of flexing bellows beyond elastic limit.

- ③ **No Corrosion** – Non-corrosive properties permit use in many systems handling liquids other than water. Unaffected by hot water temperatures up to 300° Fahrenheit, or atmospheric corrosion in all localities.
- ④ **Pressure and Temperature Requirements**
 Max. Working Pressure: 125 psi
 Max. Static Pressure: 250 psi
 Max. Temperature: 300°F

Conditions beyond these limits will cause a decrease to Shoktrol life expectancy.

Zurn Shoktrol Water Hammer Arrestors are approved by P.D.I. to Standard WH201 and by A.S.S.E. to Standard 1010.



SHOKTROL® INSTALLATION INSTRUCTIONS

All stainless steel Zurn Shoktrols incorporate advanced design bellows that absorb water hammer shock indefinitely, packing more shock absorbing capacity into less space than possible with conventional units or with outmoded "air chambers."

When a unit of equipment is located at the remote end of a long run of piping, the Zurn Shoktrol should be placed as close to the point of valve closure as possible. At this location, the Shoktrol will control any developed energy and prevent shock waves from surging through the piping system as shown in Illustration 1. Properly sized Shoktrols should be selected for such installations using Tables I-A and I-B (below).

How To Properly Locate Zurn Shoktrols

Multiple Fixtures – Branch Line Less Than 20' Long (Illustration 2)

The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures served when the branch lines do not exceed 20' in length, from the start of the horizontal branch line to the last fixture supply on this line.

Multiple Fixtures – Branch Line More Than 20' Long (Illustration 3)

On branch lines over 20' in length, use two Shoktrols whose capacities total the requirements of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

Multiple Fixtures – Extremely Long Branch Line (Illustration 4)

In unusual instances where a very long branch line is involved, the water supply is generally fed to some midpoint or other location on the branch line.

Notes: Zurn Shoktrols should always be mounted in a vertical position and installed on a horizontal water supply line (Illustration 1).

Shoktrol water hammer arrestors require no maintenance as their charge is permanently sealed and their internal working parts experience minimal wear due to the cushioning action of non-toxic mineral oil. Thus, if local plumbing codes allow, the Zurn Shoktrol may be installed in concealed locations without the need for access panels.

Failures can occur due to unforeseen circumstances and should this happen without access panels, the wall would have to be opened up and then repaired. Therefore, Zurn recommends that access panels be used.

Illustration 1: Remote Installations

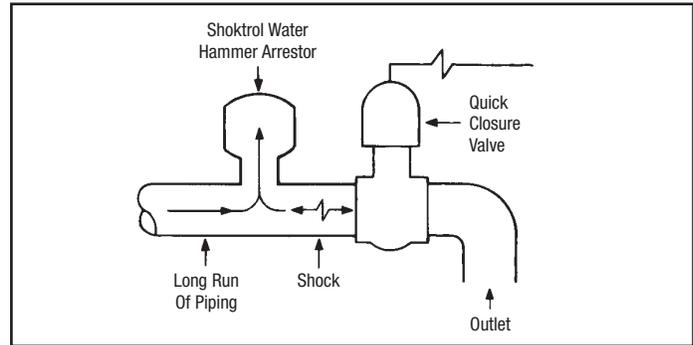


Illustration 2: Example of P.D.I. Rule 1

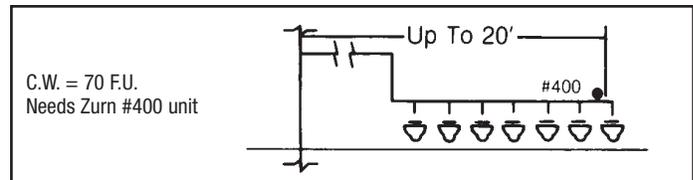


Illustration 3: Example of P.D.I. Rule 2

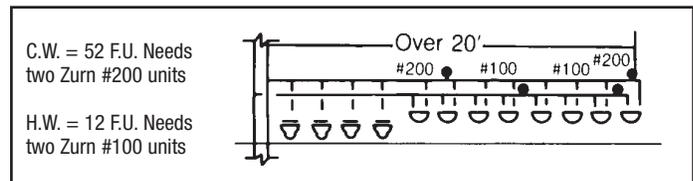


Illustration 4: Example of P.D.I. Rule 1 and Rule 2

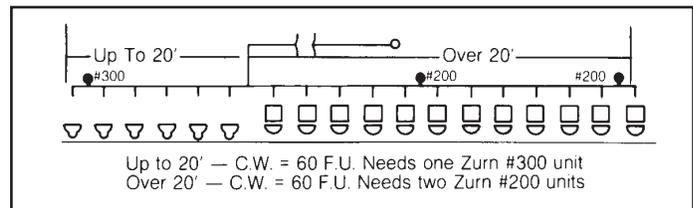


Table I-A. For Pressure Up To 65 psig

Length of Pipe	Z1700 Series Zurn Shoktrol Water Hammer Arrestors Nominal Pipe Diameters					
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
25	One #100	One #100	One #200	One #300	One #400	One #500
50	One #100	One #200	One #300	One #400	One #500	One #600
75	One #200	One #300	One #400	One #100 & One #500	One #600	One #500 & One #600
100	One #300	One #400	One #500	One #600	One #300 & One #600	Two #600
125	One #300	One #400	One #600	One #100 & One #600	One #500 & One #600	One #500 & Two #600
150	One #400	One #500	One #600	One #400 & One #600	Two #600	Three #600

For further sizing information, see "Plumbing & Drainage Institute Standard WH-201."

Table I-B. For Pressure 65 psig to 85 psig

Length of Pipe	Z1700 Series Zurn Shoktrol Water Hammer Arrestors Nominal Pipe Diameters					
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
25	One #200	One #200	One #300	One #400	One #500	One #600
50	One #200	One #300	One #400	One #500	One #600	One #300 & One #600
75	One #300	One #400	One #500	One #600	One #300 & One #600	Two #600
100	One #400	One #500	One #600	One #300 & One #600	One #500 & One #600	One #500 & Two #600
125	One #400	One #500	One #300 & One #600	One #400 & One #600	Two #600	One #200 & Three #600
150	One #500	One #600	One #300 & One #600	Two #600	One #400 & Two #600	Four #600

For further sizing information, see "Plumbing & Drainage Institute Standard WH-201."

SIZING AND SELECTION IN ACCORDANCE WITH INTERNATIONAL STANDARD P.D.I.-WH201

A Standardized Sizing System

In an effort to arrive at a uniform method of sizing water hammer arrestors, members of the Plumbing and Drainage Institute (P.D.I.) sponsored a comprehensive testing program which lasted four years. As a result, there is now an industry-wide standard, P.D.I.-WH201, and the all-stainless-steel Zurn Shoktrol conforms with every aspect of this newly available information.

A Simplified Sizing System

Basically, the new standards establish six categories for water hammer arrestors (A, B, C, D, E, F). Each category sets down specific size and capacity requirements necessary to control shock in piping systems. "A" represents the smallest-sized unit; "F" denotes the largest size.

A Universal Base

Standard P.D.I.-WH201 bases its sizing data upon the well-known fixture-unit formula. Since most engineers and specifiers utilize fixture-units in their daily calculations, it was appropriate to employ this method for quick, concise water hammer arrestor sizing.

A Fixture-Unit

"A quantity in terms of which the load producing effects on the plumbing system of different kinds of plumbing fixtures are expressed on some arbitrarily chosen scale." This fixture-unit table below (Table II) conforms with this definition and is derived from the National Plumbing Code, A.S.A. A-40-8.

Sizing Data

Using Table II (below), determine the "weight in fixture-units" for cold and hot water branch lines serving a group of fixtures, either for public or private installations. When the "weight in" has been established, the data is then applied to the selection Table III.

In most installations where there are several fixtures, normally one fixture valve will be closed at a time. On rare occasions two or more could be closed at the same instant. The sizing factors established in Table III take into consideration all the elements of valve closure probability, in addition to pipe size, length, flow pressure, and velocity. As a result, you can select the properly sized Shoktrol easily and accurately, with full knowledge that all factors for safe sizing have been calculated.

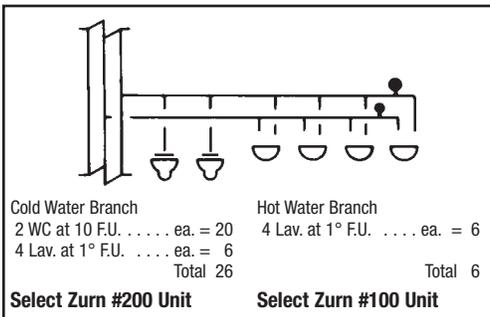
Selection Data

Using the "weight in fixture-units" obtained from Table II, select the properly sized Shoktrol from Table III. If the water pressure in the line exceeds 65 PSIG, select the next larger size Shoktrol. If the fixture-unit total contains "1/2" fraction, round it up to the next larger or whole number. (Example: If total is 11-1/2 fixture-units, change it to 12 fixture-units).

Examples

The examples below show the relative ease with which sizing can be accomplished using Tables II and III.

Example 1



Example 2

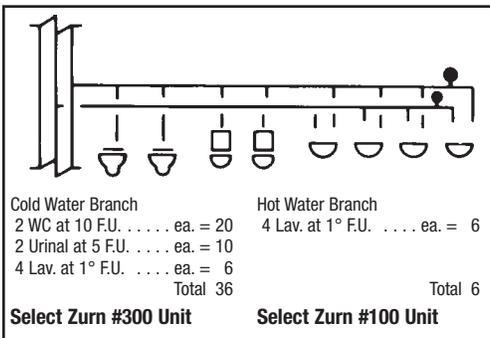


Table II

Fixture	Type of Supply Control	Weight in Fixture-Units					
		Public			Private		
		Total	C.W.	H.W.	Total	C.W.	H.W.
Water Closet	Flush Valve	10	10	-	6	6	-
Water Closet	Flush Tank	5	5	-	3	3	-
Pedestal Urinal	Flush Valve	10	10	-	-	-	-
Stall or Wall Urinal	Flush Valve	5	5	-	-	-	-
Stall or Wall Urinal	Flush Tank	3	3	-	-	-	-
Lavatory	Faucet	2	1-1/2	1-1/2	1	1	1
Bathtub	Faucet	4	2	3	2	1-1/2	1-1/2
Shower Head	Mixing Valve	4	2	3	2	1	2
Bathroom Group	Flush Valve	-	-	-	8	8	3
Closet							
Bathroom Group	Flush Tank	-	-	-	6	6	3
Closet							
Separate Shower	Mixing Valve	-	-	-	2	1	2
Service Sink	Faucet	3	3	3	-	-	-
Laundry Tubs (1-3)	Faucet	-	-	-	3	3	3
Combination Fixture	Faucet	-	-	-	3	3	3

Table III

Zurn Shoktrol Size Z1700 Series	#100	#200	#300	#400	#500	#600
P.D.I. Units	A	B	C	D	E	F
Fixture-Units	1-11	12-32	33-60	61-113	114-154	155-330

Approved By:



Z1712 ACCUMUTROL ... ENGINEERED FOR HIGH-CAPACITY and SEVEREST WATER HAMMER APPLICATIONS

Z1712 is the most advanced water hammer arrestor available. It contains only one moving part: a micrometrically sized spherical piston which “floats” inside the surge chamber to accept in-line hydrodynamic concussions which result in “water hammer.” When line is out of service, piston rests on a permanentized Viton seat to seal in air charge. Simplicity of design permits years of effective, trouble-free operation.

Zurn Accumutrol is compact – not large and bulky like the commonly known air chamber, therefore it can be installed quickly and economically. And unlike other arrestor designs (such as piston, diaphragm, and bellows type), the Zurn Accumutrol eliminates the possibility of wear, rupture, and fatigue failures.

Controlled by installation of Zurn Z1712 Accumutrol, complete with floating stainless steel spherical piston, surge chamber, and valve and gauge assembly. Sizes and locations shall be required to dissipate generated kinetic energy based on selection from the Zurn Accumutrol Selector.

Regularly Furnished Bronze surge chamber with non-corrosive stainless steel spherical piston, Viton valve seat, and bronze air charge and gauge assembly.

Optional Variations Stainless steel surge chamber.

Sizing and Selection Information Sizing and selection are customized to each specific application, based on scientific data accumulated by Zurn research and development technicians. Zurn engineering does the rest, providing you with a scientifically designed unit that eliminates water hammer – with none of the disadvantages of conventional type air chambers.

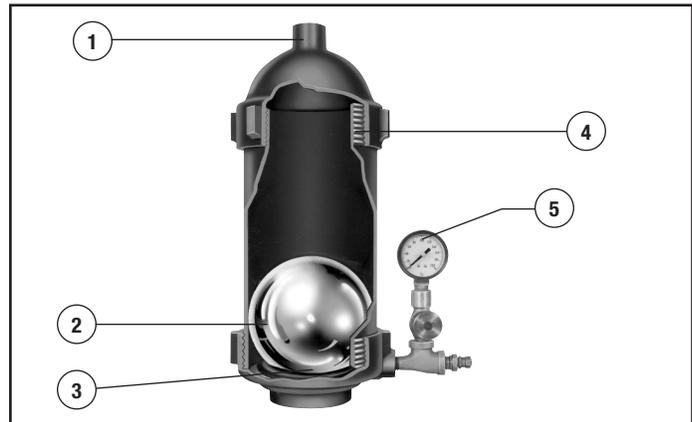
Easy Start Up

1. With shut-off valve closed, close drain valve and open gauge valve.
2. Operate equipment to establish normal flow in the supply line. Open shut-off valve, read pressure on gauge, close shut-off valve and slowly shut off flow in the supply line. The pressure read on the gauge is the flowing (residual) pressure. This entire operation should be accomplished in a manner that will not allow the quick closing valve to close rapidly or in a manner that can cause water hammer in the system.
3. With shut-off valve closed and drain valve open, open gauge valve and introduce air or nitrogen into the Accumutrol to bring the pressure to 75% of the flowing pressure as read in 2 above.
4. Close both the drain and gauge valves, open the shut-off valve and the Accumutrol will be in operation.

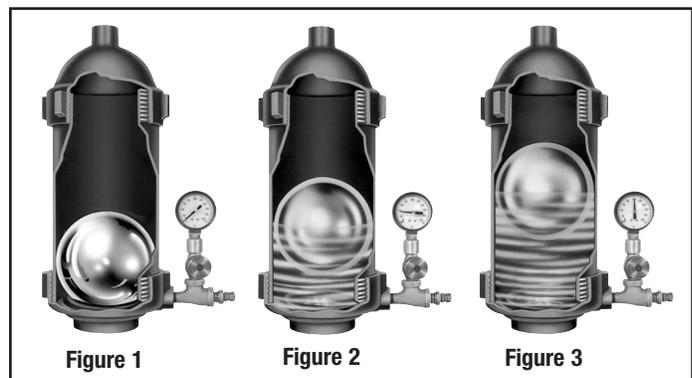
Operational Maintenance

1. It is recommended that the precharge pressure, as established in 3 above, be checked periodically. This should be done daily just after start-up and once a week thereafter. This only involves closing the shut-off valve, opening the gauge and drain valves, and reading the pressure. If the precharge pressure is low, add air; if it is above the flowing pressure, as determined in 2 above, bleed air out of the Accumutrol. Close both gauge and drain valves and open the shut-off valve to put the unit back in service. Such adjustment should be required very infrequently.
2. If at any time it appears the unit is not holding its precharge pressure, close the shut-off valve, open the drain valve, and bleed off the air from the unit. Remove the bottom cap of the Accumutrol and inspect the Viton seat and the spherical piston and if damaged replace them.* Any other loss of precharge pressure should be traceable to leaks in the system.

***Note:** Brass insert in Viton seat should be installed with inside chamber up.



- 1 **Protective Cap** – Prevents damage to spherical piston in event unit is placed in operation without air charge in chamber. Tapping in top of cap simplifies mounting.
- 2 **Durable, Precision-Like Piston** – Hollow, stainless steel, spherical piston is sufficiently rugged to withstand in-service pressures, yet light enough to “float” at its midpoint inside surge chamber. Moves freely without high friction normally attending piston motion. No piston rings, or O-rings, to prevent the free movement.
- 3 **Permanentized Viton Seat** – Supported internally and externally to prevent extrusion even under severe overpressure.
- 4 **Rugged Cylindrical Surge Chamber** – Designed to withstand severe overpressures. Closed at top, open at bottom for connection to tee in supply line.
- 5 **Built-In Valve and Gauge Assembly** – Simplified charging and recharging procedure.



Before Charging (Figure 1)

Spherical piston rests on Viton seat only prior to introduction of air into surge chamber; keeping seat wear to an absolute minimum.

In Normal Position (Figure 2)

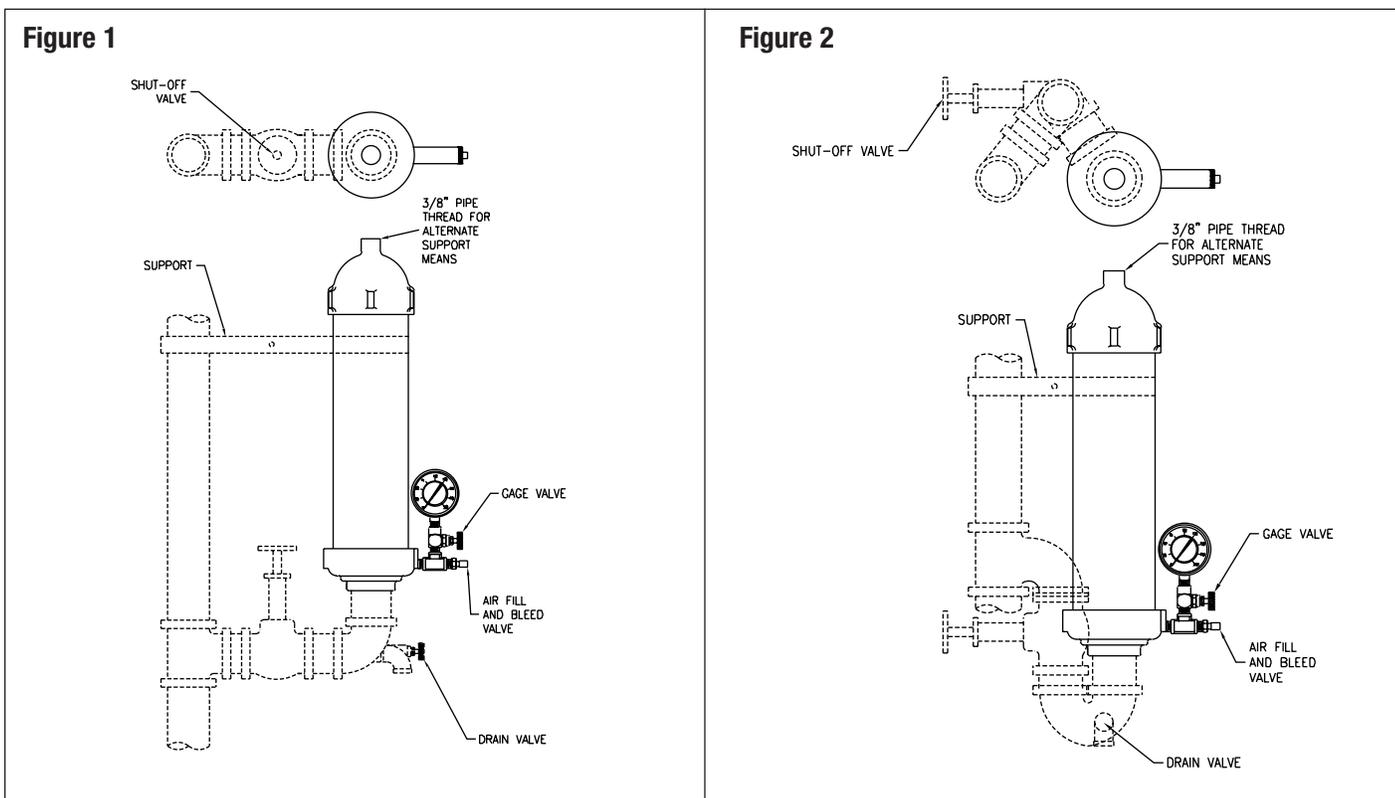
After surge chamber is charged and put in service, the spherical piston “floats” inside the chamber, ready to accept in-line hydrodynamic shock.

During Operation (Figure 3)

When valve closes quickly, flow in line is diverted into Accumutrol; it compresses the air charge and gradually stops.

Z1712 ACCUMUTROL SERIES INSTALLATION

1. The Accumutrol should be located upstream from, but close to, the washer or other quick closing valve. It should always be mounted in an upright position with its long axis vertical.
2. Installation should be as shown schematically in Figure 1 or Figure 2. In most cases, an arrangement per Figure 1 is satisfactory. In cases where the system will be drained frequently, the arrangement of Figure 2 is recommended to prevent trapping of excess air in the Accumutrol at each re-filling of the system as this could require occasional bleeding of the excess air from the unit. Thus, Figure 2 arrangement will eliminate the need for more frequent checking of the precharge pressure in the unit when the system is to be drained each night or over weekends. Note the shut-off valve and drain valve are necessary to facilitate precharging and maintenance of the unit.
3. Keep shut-off valve closed and drain valve open until system is ready to be put in operation.
4. Be sure all supply piping is securely anchored. With high flow rates through solenoid or other automatic valves, any accumulator will allow some pressure surge in the line when the valve closes. The Accumutrol should keep this pressure surge below dangerous levels, but even a slight surge will tend to cause movement of the piping. Therefore, the Accumutrol and supply lines in the system must be well supported and anchored to prevent pipe movement and undue stress on pipe and fittings.

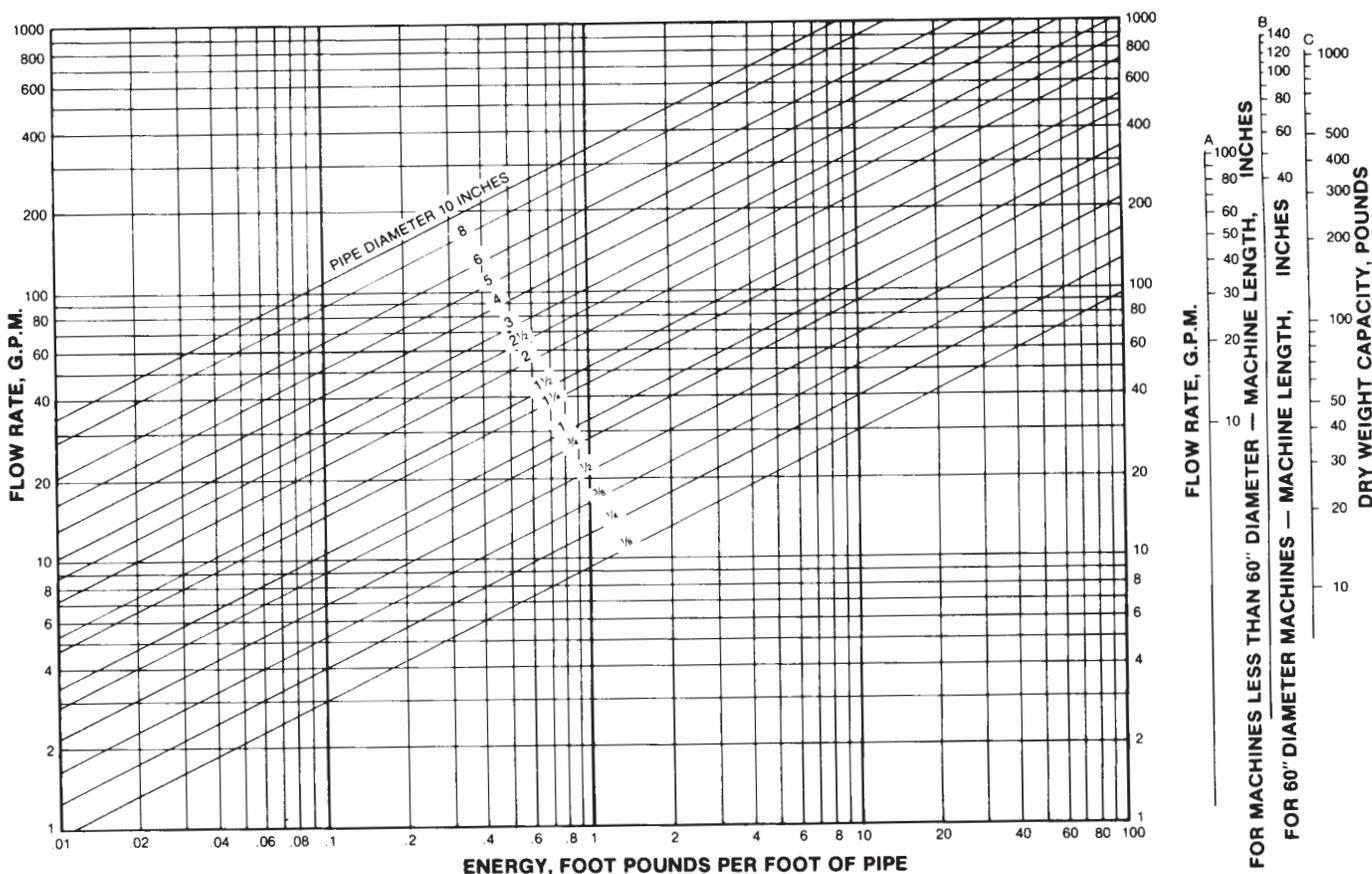


NOTE: Dotted lines indicate items by others. Accumutrol shown on vertical supply line. On horizontal supply, mount Accumutrol vertically and use same fitting and valve arrangement.

ACCUMUTROL SIZE SELECTION

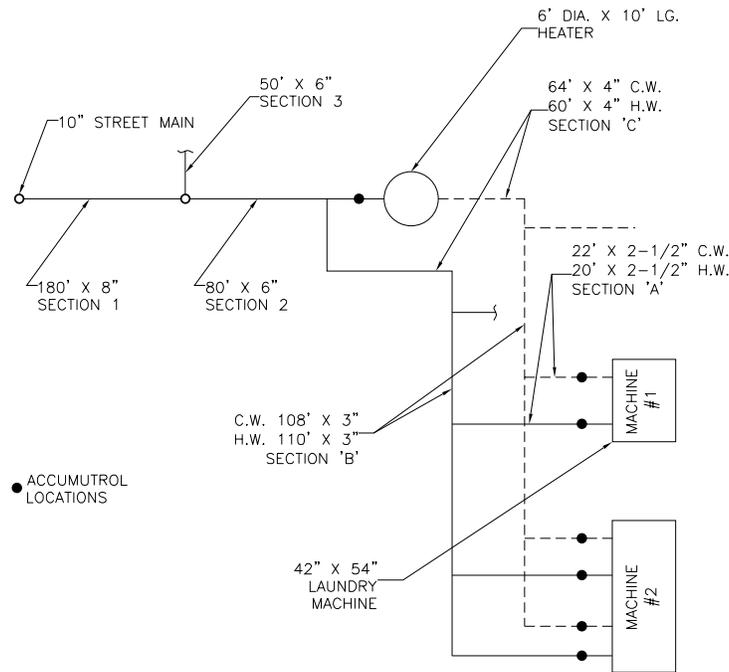
Size selection is customized to each application by use of the Zurn Accumutrol selector. This nomograph converts factors of unit sizes to demands in G.P.M. When the flow rate in G.P.M. is known through any size pipe, the foot pounds energy generated per foot of pipe can be determined by reading down from the intersection of G.P.M. and applicable pipe size to bottom line on chart.

Once the foot pounds energy per foot is determined, multiply fpe/ft by length of the applicable pipe size. When more than one pipe size is used from source of supply to valve, then the above should be repeated for each length of each applicable pipe size. When all lengths are multiplied by fpe/ft then simply add each multiplied length of the applicable sizes, the total represents the total foot pound energy to be displaced. To determine proper size add "0" to total fpe. Example: T= 1160 fpe, add "0" = 11600; therefore, select nearest larger size number 12,000 Accumutrol. Standard Accumutrol sizes provide displacement capacities from 200 fpe to 1600 fpe. Capacity requirements beyond 1600 fpe should be met by placement of multiple units in manifold. Installation and operation should be in strict accordance with Zurn's recommended installation, operation, and maintenance guidelines displayed in this manual.



*Chart based on 85 psig maximum operating pressure.

TYPICAL EXAMPLE – Piping Layout and Data Required for Sizing Zurn Accumutrols



Piping Data (From Machine to Heater)

Section	HOT WATER		COLD WATER	
	Length	Diameter	Length	Diameter
A	20'	2-1/2"	22'	2-1/2"
B	110'	3"	108'	3"
C	60'	4"	64'	4"
D				
E				

Piping Data (From Heater to Main)

Section	Length	Diameter
1	180'	8"
2	80'	6"
3	50'	6"
4		

Use Area Below to Sketch Your Piping Layout

INFORMATION REQUIRED FOR SELECTION OF ZURN ACCUMUTROL SHOCK ABSORBERS

(A separate form must be completed for each machine.)

Customer's Name _____ Date _____

Street Address _____

City _____ State _____ Zip _____

Name of Person Supplying Information _____

Order or Inquiry Number _____

Show Sketch of Piping Layout Per Example On Next Page

Laundry Machine Data

(At least one entry is required for each line below.)

Machine No. _____

Manufacturer _____

Laundry Capacity _____ Pounds (Dry Wt.) Measured Flow _____ GPM Size _____

Number of hot water supply pipes to machine _____

Number of cold water supply pipes to machine _____

Piping Data (From Machine to Heater)

Section	HOT WATER		Do Not Write In Spaces Below				COLD WATER		Do Not Write In Spaces Below			
	Length	Diameter					Length	Diameter				
A												
B												
C												
D												
E												

Heater Data

(At least one entry must be made on line below.)

Volume _____ Gallons Size _____
Diameter x Length

Piping Data (From Heater to Main)

(At least one entry must be made on line below.)

Section	Length	Diameter
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____