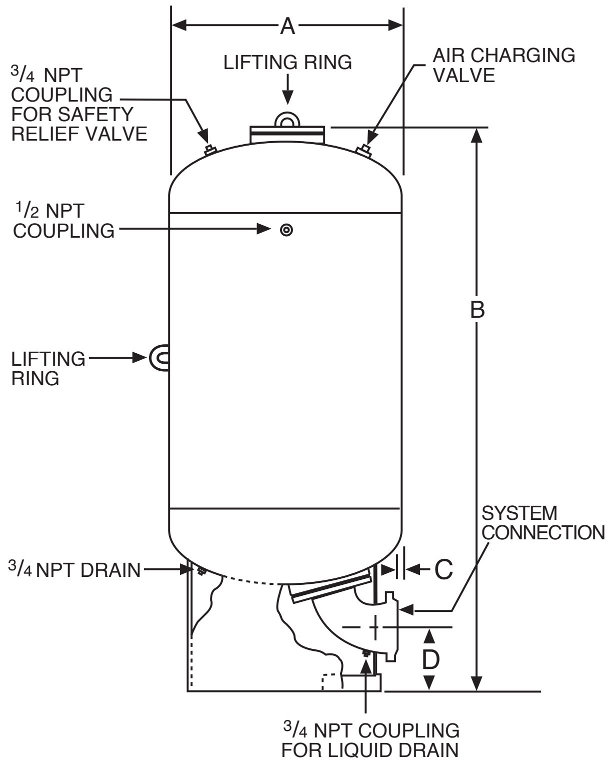
AMTROL®

SIZING THE DIATROL®

For Elimination of Water Hammer Problems

SIDE VIEW



Operation

The bladder type shock suppressor eliminates water hammer by storing the kinetic energy in the form of a compressed gas. An ample air cushion, precharged at the factory, of calculated volume and pressure is retained and controlled by a mechanically sealed-in, heavy-duty butyl bladder. This combination of air cushion and flexible bladder accepts live surges before any damaging shock waves can develop.

Water is contained in an NSF61 listed bladder. This provides a completely non-metallic water reservoir, eliminating any contact of system water with metal.

When a sudden valve closure occurs, the resulting pressure surge travels back from the valve to the bladder type shock suppressor forcing the bladder to expand into the air cushion.

The shock is absorbed by the compression of the air. After absorption of the shock, the system water pressure and the air chamber pressure equalize at the static pressure level.

Maximum System Conditions

- Static Pressure – 100 psig
- Temperature
  - Continuous - 160°F
  - Intermittent - 200°F (1 hour)
- Shock Pressure – 150 psig
- Compatible Liquid – water
- Velocity – 6 ft./sec.

The above limiting factors should all be obvious except for the velocity. For every one (1) ft./sec. of water velocity that is stopped, there is a potential pressure rise of 60 psig. To maintain this pressure within the structural adequacy of the bladder type shock suppressor, a maximum velocity of six (6) ft./sec. has been specified.

Sizing Procedure

The size of the bladder type shock suppressor is calculated by relating the energy of the system to the amount of energy stored in one (1) cubic foot of compressed air.

To determine the total kinetic energy of a system, the following information is required:

- **Pipe Size** – All pipe diameters in inches from the quick closing valve to the water source, i.e., water meter, storage tank, or main line where kinetic energy is not significant.
- **Effective Pipe Length** – The total length in feet of a given pipe diameter. All lengths of various pipe diameters are to be considered until the kinetic energy is negligible.
- **Maximum Flow** – The flow through the system measured in gallons per minute.
- **Static Pressure** – The system pressure with no water flowing measured in psig.
- **Flow Pressure** – The pressure in psig at the point of the bladder type shock suppressor installation while water is flowing.
- **Maximum Shock Pressure** – The design pressure of the system. The Plumbing and Drainage Institute (P.D.I.) recommends using 150 psig.

With the above information, select the proper size bladder type shock suppressor using the following procedure:

- Determine the system velocity from Figure 1.
- Determine the kinetic energy (KE) per lineal foot of pipe from Figure 2.
- Obtain total kinetic energy (KE) from the equation:

Total Kinetic Energy = KE x Effective Pipe Length

- Determine pressure factor from Table A at intersection of Flow Pressure and Maximum Allowable Shock Pressure.

Installation

The bladder type shock suppressor should be installed as close to the quick closing valve as possible.

- Determine required bladder type shock suppressor volume in gallons from the equation.

$$(V)\ \text{Volume} = \frac{(7.48)\ \text{Total Kinetic Energy}}{\text{Pressure Factor}}$$

- Determine the shock suppressor acceptance factor from Table B or the equation.

$$\text{A.F.} = 1 - \frac{P_1 + 14.7}{P_2 + 14.7}$$

Where: P_1 = flow pressure – psig

P_2 = static pressure – psig

- Multiply the acceptance factor by the determined bladder type shock suppressor volume (V) to obtain the acceptance volume.

Acceptance Volume = (A.F.) x V

- Select the model shock suppressor by checking both the total volume and the maximum acceptance volume. To ensure long bladder life, the maximum recommended acceptance volume must not be exceeded. Several smaller tanks may be used to meet this requirement.
- Determine the shock suppressor precharge pressure by making it two (2) psig below the flow pressure at the point of installation.

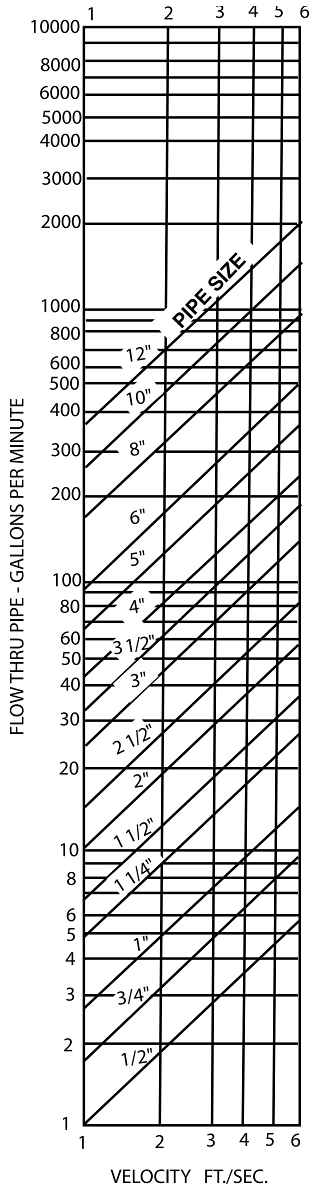


Figure 1

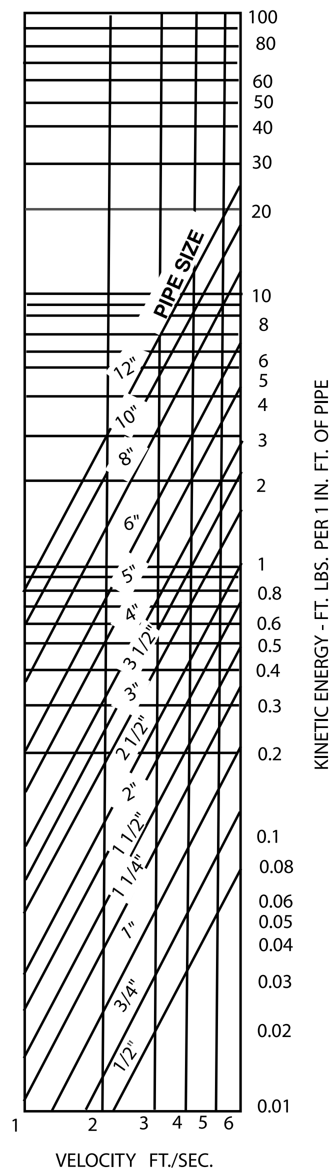


Figure 2

Pressure Factors

Table A

Max. Shock Pressure PSI	Line Pressure PSI – Water Flowing									
	20	30	40	50	60	70	80	90	100	110
100	2500	2130	1730	1265	880	445	230			
110	2880	2490	2075	1700	1210	780	505	230		
120	3110	2800	2420	1980	1525	1110	805	460	130	
130	3430	3110	2740	2275	1930	1470	1100	690	375	160
140	3780	3430	3065	2600	2275	1785	1385	900	600	375
150	4080	3730	3415	3070	2650	2160	1760	1310	900	635

Acceptance Factors

Table B

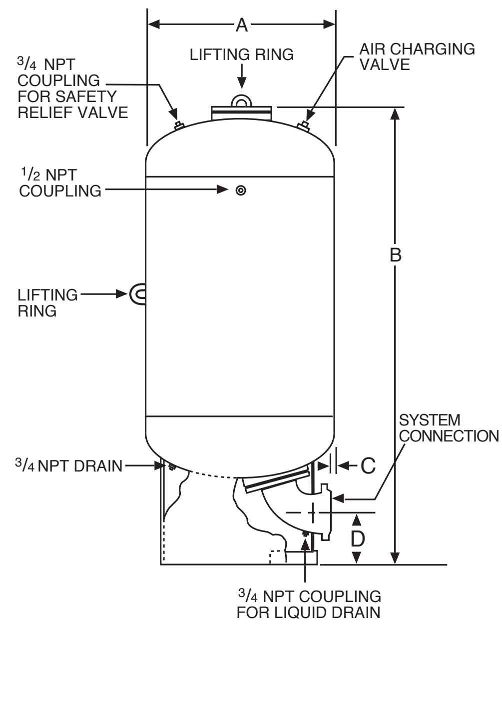
Static Pressure – PSIG	Flow Pressure – PSIG														
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
30	.22														
35	.30	.20													
40	.37	.27	.18												
45	.42	.34	.25	.17											
50	.46	.39	.31	.23	.15										
55	.50	.43	.36	.29	.22	.14									
60	.54	.47	.40	.33	.27	.20	.13								
65		.50	.44	.38	.31	.25	.19	.13							
70		.53	.47	.41	.35	.30	.24	.18	.12						
75			.50	.45	.39	.33	.28	.22	.17	.11					
80			.53	.48	.42	.37	.32	.26	.21	.16	.11				
85				.50	.45	.40	.35	.30	.25	.20	.15	.10			
90				.53	.48	.43	.38	.33	.29	.24	.19	.14	.10		
95					.50	.46	.41	.36	.32	.27	.23	.18	.14	.09	
100					.52	.48	.44	.39	.35	.31	.26	.22	.17	.13	.09

Diatrol® D-Series Models

Model No.	Volume		A Diameter		B Height		System Conn NPTF	C Sys. Conn. Inset	D Sys. Conn. Centerline	Ship Weight	
	Lit.	Gal.	mm	In.	mm	In.	In	In.	In.	kg	Lb.
D-7	200	53	610	24	1245	49	4	$1\frac{9}{16}$	$8\frac{3}{16}$	167	367
D-11	300	80	610	24	1600	63	4	$1\frac{9}{16}$	$8\frac{3}{16}$	209	459
D-14	400	106	610	24	1956	77	4	$1\frac{9}{16}$	$8\frac{3}{16}$	282	618
D-18	500	132	610	24	2311	91	4	$1\frac{9}{16}$	$8\frac{3}{16}$	333	731
D-21	600	158	762	30	1893	75	4	$1\frac{3}{8}$	$7\frac{1}{4}$	433	950
D-28	800	211	762	30	2365	93	4	$1\frac{3}{8}$	$7\frac{1}{4}$	513	1125
D-35	1000	264	914	36	2086	85	6	$3\frac{1}{4}$	$7\frac{1}{2}$	693	1520
D-42	1200	317	914	36	2465	97	6	$3\frac{1}{4}$	$7\frac{1}{2}$	784	1720
D-50	1400	370	914	36	2781	110	6	$3\frac{1}{4}$	$7\frac{1}{2}$	866	1900
D-56	1600	422	1220	48	2178	86	8	$1\frac{3}{4}$	$10\frac{7}{8}$	1049	2300
D-70	2000	528	1220	48	1220	100	8	$1\frac{3}{4}$	$10\frac{7}{8}$	1231	2700

Notes: Allow 18" (460mm) minimum clearance.
Constructed per ASME Code Section VIII, Division 1.

SIDE VIEW



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MADE IN USA

MC 2760 Part #: 9017-101 (01/14)