



APCO SURGE RELIEF VALVES FOR SEWAGE OR WATER



Series 3000
Angle Surge Relief Valve
2" - 8" (50 - 200 mm)

Pressure Surge Control (Combined With Correct Check or Control Valve and Air Valve Selection)

In recent years pumping systems have become more complex than ever before. As a result, design engineers must resort to detailed water hammer and pressure surge analysis to insure the system will not be damaged due to negative or positive pressure surges. Water hammer is caused by sudden changes in flow (ie; the rapid opening or closing of a main line valve or the starting and stopping of a pump).

One method most often used by engineers to prevent damage to the system is to spill some of the media from the system, thereby dissipating the pressure surges.

Typically, for this type solution, APCO can provide various Controlled Closing Check Valves, Hydraulic Air Valves or two spilling types of Surge Relief Valves, Models 3000 and 6500.

Where conventional check valve closure is determined to be undesirable, Series 800 or Series 6100 with a hydraulic dashpot, Series 8000 or APCO Ball and Cone Valves with appropriate controls all offer excellent surge control. All can have fail-safe hydraulic controls to protect the pipeline even during power failure. Additionally, the Series 8000, as well as the Ball and Cone Valve, can have electric motor control for total valve control from a remote station. Where conventional air valve closure is determined to be undesirable, the Series 7000 Hydraulic Air Valve provides excellent surge control.

Control type Check Valves, or Ball and Cone Valves combined with Controlled Air Valves, with either spill type valve Series 3000 or 6500 Surge Relief Valves, will provide water hammer control for your pumping system.

The more elaborate and complex a water hammer control system design is, the more need for rigid and regular operator training and equipment maintenance. APCO valves are easy to operate and require minimal operator training or maintenance.

For practical and theoretical knowledge about pipeline surge protection contact our engineering department. We can assist with your pipeline design and selection of: Conventional Check Valves, Pump Control Valves, Conventional or Controlled Air Valves and spill type Surge Relief Valves.

Don't invest in an expensive water hammer control system for surge pressure protection until you have examined the feasibility of trying APCO Surge Control Valves together with APCO Control Check Valves.

How They Work

Both styles of APCO Surge Relief Valves operate in like manner, opening when the system pressure exceeds the set shut-off pressure of the valve disc (10). As the disc opens, the surge pressure rise that caused it to open is spilled and dissipated through the open valve. When system pressure drops below the set shut-off pressure, the valve disc (10) slowly closes against the oil contained in the cushion chamber (20 or 58) and cylinder (33). Disc closing time is adjustable by regulating control valves (59 or 35). Both style valves are designed with a smooth flow and minimal obstruction to flow for efficient surge relief. The disc (10) is the only part in contact with flow, thereby eliminating fouling problems of the internal parts. The Angle Surge Relief Valve Series 3000 has a much higher pressure relief rating than the Globe Surge Relief Valve Series 6500 because of the direct acting piston design and wide range of spring selections.

Surge Relief Capacity				
Size	Total Main Line Flow gpm/lpm Flow	Maximum Relief Pressure, psi/kpa		Approx. Open Seat Area Through Valve, in ² /cm ²
		3000*	6500	
2" 50	up to 600 up to 2271	175 1207	150 1034	3" 19
2.5" 65	up to 800 up to 3028	175 1207	125 862	4.5" 29
3" 80	up to 1000 up to 3785	175 1207	100 689	7" 45
4" 100	1000 to 2250 3785 to 8517	175 1207	75 517	13" 84
6" 150	2250 to 4700 8517 to 17791	175 1207	35 241	26" 168
8" 200	4700 to 8250 17791 to 31230	150 1034	18 124	50" 323
10" 250	8250 to 15000 31230 to 56781	100 689	12 83	79" 510
12" 300	15000 to 20000 56781 to 75708	100 689	7.5 52	113" 729
14" 350	20000 to 30000 75708 to 113562	100 689	—	154" 994
16" 400	30000 to 36000 113562 to 136275	75 517	—	201" 1297
18" 450	36000 to 45000 136275 to 170344	75 517	—	255" 1645
20" 500	45000 to 55000 170344 to 208198	50 345	—	314" 2026

Inch
Millimeter

* Higher relief pressures available

Note: For unusual applications or sizing information contact our engineering department.

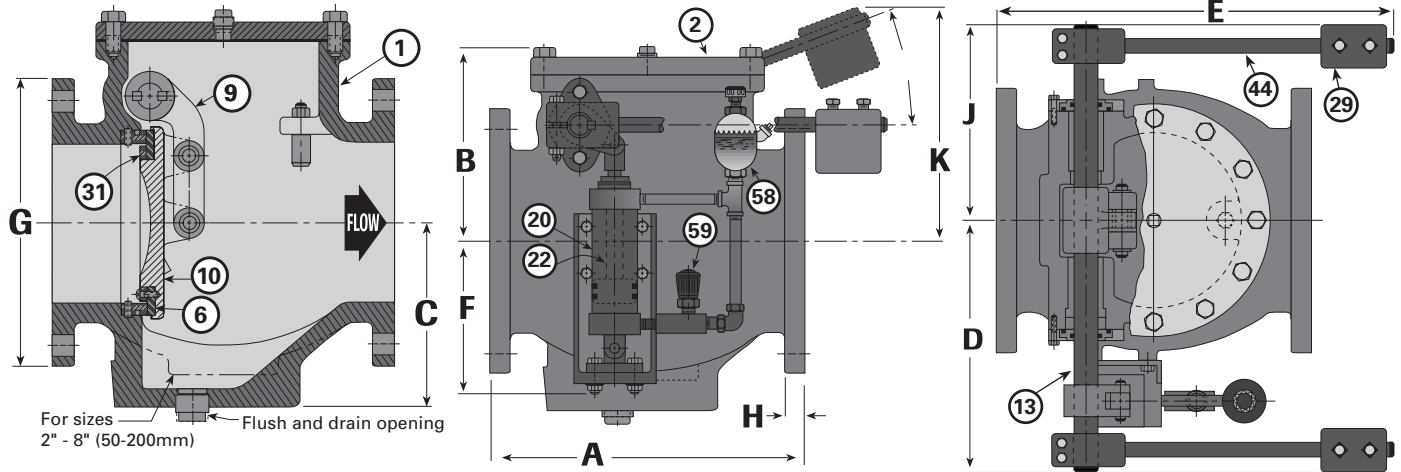
Series 6500 Globe Surge Relief Valves

Pressure Setting

The Globe Surge Relief Valve Series 6500 is easily set by moving weights (29) along the arms (44). Moving the weights toward the open end of the arms increases the pressure relief point. Moving the weights toward the closed end of the arms decreases the pressure relief point. Lock weights in place by tightening cap screws with a wrench.

Materials of Construction

1	Body	Cast Iron ASTM A126 GR. B
2	Cover	Cast Iron ASTM A126 GR. B
6	Disc seat	Buna-N
9	Disc arm	Ductile Iron ASTM A536 or Steel
10	Disc	Cast Iron ASTM A126 GR. B
13	Pivot shaft	Stainless Steel ASTM A582 T303
20	Hydraulic cylinder	Steel
29	Counter weight	Cast Iron ASTM A126 GR. B
31	Seat retaining ring	Aluminum Bronze
44	Counter weight arm	Steel AISI C1018
58	Oil reservoir	Steel
59	Control valve	Brass



Specify if other than horizontal installation.
Angle of weight lever and oil reservoir must be changed.

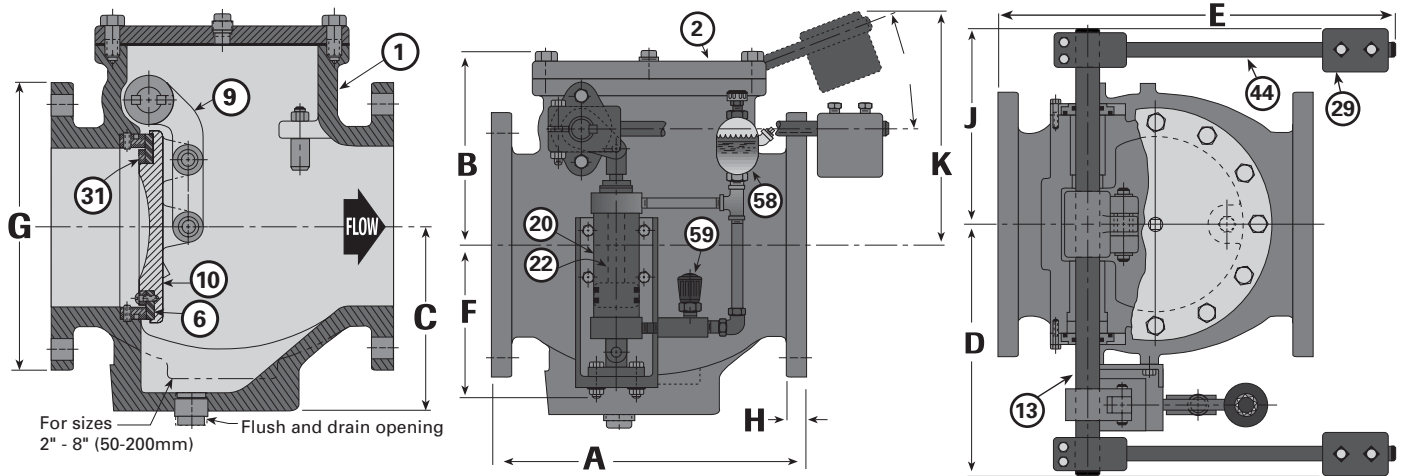
Size	Model	A	B	C	D	E	F	G	H	J	Flange Holes			K	Max. Opening Pressure psi/kpa
											No.	Dia.	BCD		
2" 50	6502	9" 229	5.75" 146	3.5" 89	16" 406	26" 660	10.75" 273	6" 152	.625" 16	5" 127	4	.75" 19	4.75" 121	25" 635	150 1034
2.5" 65	6502.5	12" 305	6.875" 175	4" 102	17" 432	27" 686	10.25" 260	7" 178	.688" 17	5.25" 133	4	.75" 19	5.5" 140	27" 686	125 862
3" 80	6503	12" 305	7" 178	4.125" 105	17" 432	27" 686	10" 254	7.5" 191	.75" 19	12.5" 318	4	.75" 19	6" 152	28" 711	100 689
4" 100	6504	13" 330	7.5" 191	5" 127	16" 406	42" 1067	10.5" 267	9" 229	.938" 24	13" 330	8	.75" 19	7.5" 191	39" 991	75 517
6" 150	6506	17.5" 445	10" 254	6.5" 165	21" 533	48" 1219	14" 356	11" 279	1" 25	17" 432	8	.875" 22	9.5" 241	43" 1092	35 241
8" 200	6508	18" 457	12" 305	7.5" 191	20" 508	56" 1422	12.5" 318	13.5" 343	1.125" 29	16" 406	8	.875" 22	11.75" 298	53" 1346	18 124
10" 250	6510	23" 584	14.25" 362	14" 356	22" 559	63" 1600	16" 406	16" 406	1.188" 30	17" 432	12	1" 25	14.25" 362	59" 1499	12 83
12" 300	6512	28" 711	16" 406	16" 406	23.5" 597	72" 1829	16" 406	19" 483	1.25" 32	20.5" 521	12	1" 25	17" 432	66" 1676	7.5 52

Inch
Millimeter

* Consult factory when opening pressure exceeds those listed.

Note: Sizes 2" (50mm) and 2.5" (65mm) have only one counterweight (right side).

Series 6500 Globe Surge Relief Valves



For sizes 2" - 8" (50-200mm) Flush and drain opening

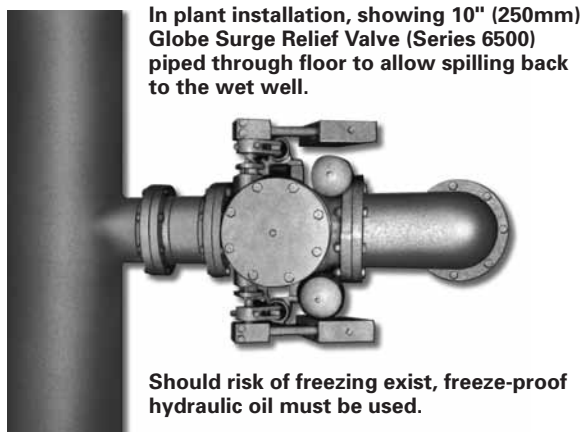
Specify if other than horizontal installation. Angle of weight lever and oil reservoir must be changed.

Operation

When system pressure rises above the set pressure on the valve, the disc (10) immediately free opens, rotating the shaft, lifting the weights while simultaneously raising the piston (22), allowing oil to flow from the oil reservoir (58), through the control valve (59), into the hydraulic cylinder. As pressure drops below the surge valve setting, the disc (10) starts to close, pushing the piston (22) downward forcing oil out of the hydraulic cylinder (20). The control valve (59) regulates the flow of oil being displaced, thereby controlling the closing speed. (Restrict the control valve for slower closing; open control valve for faster closing.) We recommend slow closing speed while testing and gradually increased closing speed to suit your system.

Field Installation

All Surge Relief Valves are delivered to the jobsite factory adjusted and ready for installation. The valves need only to be bolted to the pipe flange connection and the Surge Relief Valve is operational. APCO tests all Surge Relief Valves at the factory for quick opening at the desired relief pressure specified. However, final field adjustments to weights and springs may be required to suit actual field conditions. Always install the Surge Relief Valve with the replaceable resilient seat of the disc facing the system pressure. The valve outlet must be piped to discharge into the wet well or into a spillway (see illustration). Angle Surge Relief Valves may be installed vertically or horizontally, discharge downwards, thus eliminating cost for an elbow fitting. Oil reservoir must be mounted vertically, regardless of valve installation.



In plant installation, showing 10" (250mm) Globe Surge Relief Valve (Series 6500) piped through floor to allow spilling back to the wet well.

Should risk of freezing exist, freeze-proof hydraulic oil must be used.

Series 3000 Angle Surge Relief Valves

The Angle Surge Relief Valve Series 3000 is set by tightening or loosening the bolt or nuts (22). Greater tension on the helical spring increases the pressure relief point and less tension decreases the pressure relief point. Lock nuts hold the setting in place.

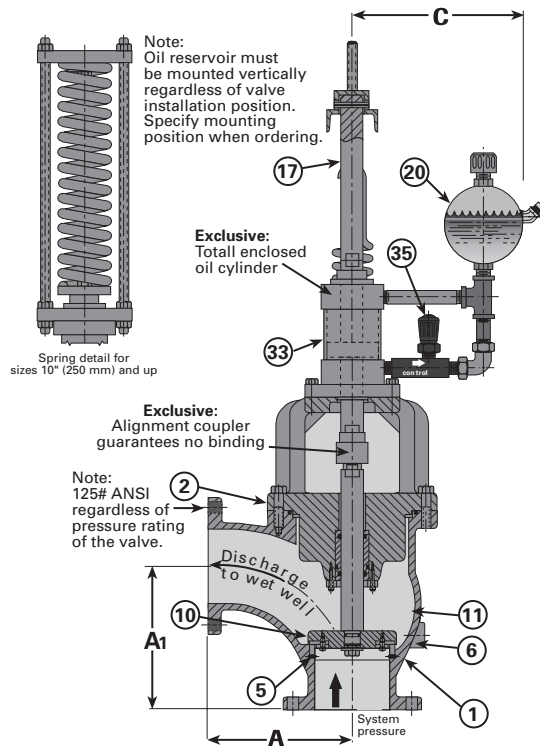
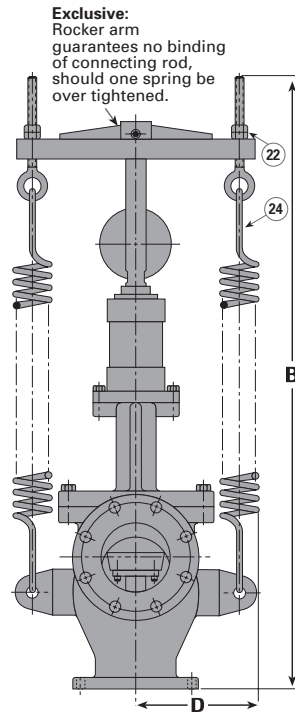
Note: Higher pressure classes available. Spring enclosures and other spring configurations are available. Contact factory.

Operation

Helical springs (24) hold the disc (10) closed. When the system pressure rises above the set pressure on the springs, the disc (10) moves freely open, raising the piston inside the cylinder (33), allowing oil from the reservoir (20) to enter below the piston. When the disc (10) closes, it does so at a slow controlled rate regulated by the control valve (35). As the system pressure drops below the surge valve setting, the disc (10) starts controlled closing, pushing the cylinder piston downward, forcing oil from the bottom of the cylinder chamber (33). The control valve (35) regulates the flow of oil being displaced, thereby controlling the closing speed. (Restrict the control valve for slower closing, open the control valve for faster closing.) We recommend slow closing speed while testing, and gradually increased closing speed to suit your system.

Note: Optional metal spring covers available

- Compression springs available
- Short height styles available on request
- Inline surge relief valves available



Standard 125# Class ANSI Flanges							
Size	Model	A	A ¹	B	C	D	Estimated Shipping Weight
2" 50	3002	6.5" 165	6.5" 165	37.75" 959	7" 178	7.375" 187	225 102
3" 80	3003	9" 229	9" 229	52.75" 1340	7" 178	6.5" 165	300 136
4" 100	3004	10" 254	10" 254	54.5" 1384	8" 203	9" 229	400 181
6" 150	3006	11.5" 292	11.5" 292	60.5" 1537	8" 203	11" 279	500 227
8" 200	3008	14" 356	14" 356	69.625" 1768	8" 203	13" 330	550 249
10" 250	3010	16.5" 419	16.5" 419	84" 2134	11" 279	11" 279	650 295
12" 300	3012	19" 483	19" 483	95" 2413	13" 330	13" 330	1100 499
14" 350	3014	21.5" 546	21.5" 546	102" 2591	16" 406	16" 406	1600 726
16" 400	3016	24" 610	24" 610	109" 2769	23" 584	16.5" 419	1900 862
18" 450	3018	24.75" 629	20" 508	112.75" 2864	24" 610	20.25" 514	2600 1179
20" 500	3020	25.5" 648	20" 508	138" 3505	30" 762	21.5" 546	3200 1451

Inch lbs
Millimeter kg

Materials of Construction

1	Body	C.I. ASTM A126 GR. B
2	Cover/spacer	D.I. ASTM A536
5	Body seat ring	AL. BR. C95200
6	Disc seat	Buna-N
10	Disc	Steel ASTM A36
11	Stem	S.S. Type 303
17	Connecting rod	Steel cold finish 1042
20	Oil reservoir	S.S. Type 304
22	Eye bolt nut	Steel commercial
24	Spring	Steel
33	Dashpot cylinder	Steel commercial
35	Flow control valve	Brass commercial

APCO Surge Relief Valve Sizing

1. What is **maximum allowable pressure** in line, P_L in pounds per square inch?
2. What is **maximum velocity**, V_L in feet per second? For gravity line flow: Find maximum flow rate to determine velocity. For pressure lines: Maximum velocity is the velocity water would be pumped through the line at maximum flow.
3. Divide V_L by P_L .
4. Enter graph with V_L/P_L . Find intersection with curve representing your pipeline diameter.
5. From the intersection of V_L/P_L and line size curve, go horizontally over to Surge Relief Valve size. For non-standard sizes, use next larger size valve, or use a combination of smaller valves equal in area to the size from the graph.

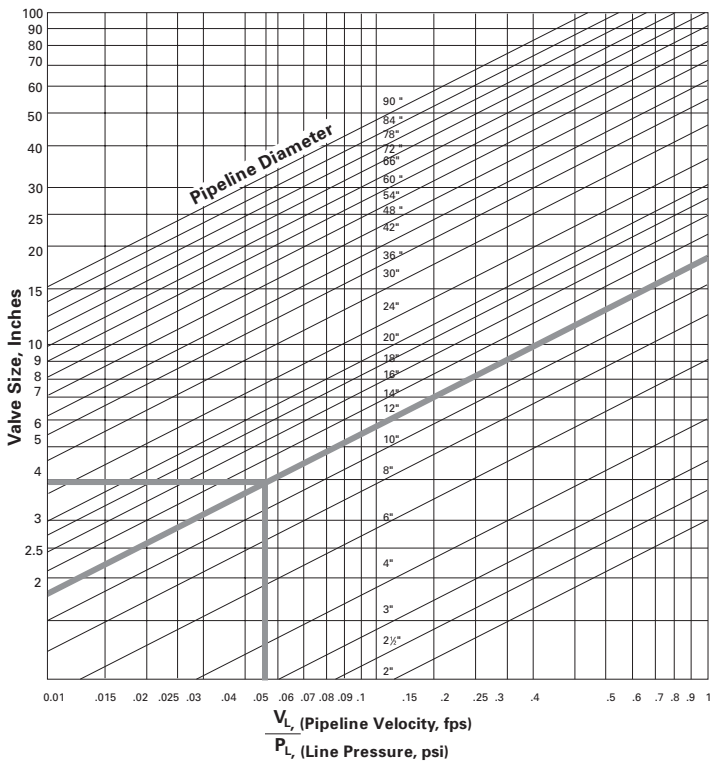
Example:

Data: 12" Line, 3000 gpm, Maximum System Pressure – 185 psi.

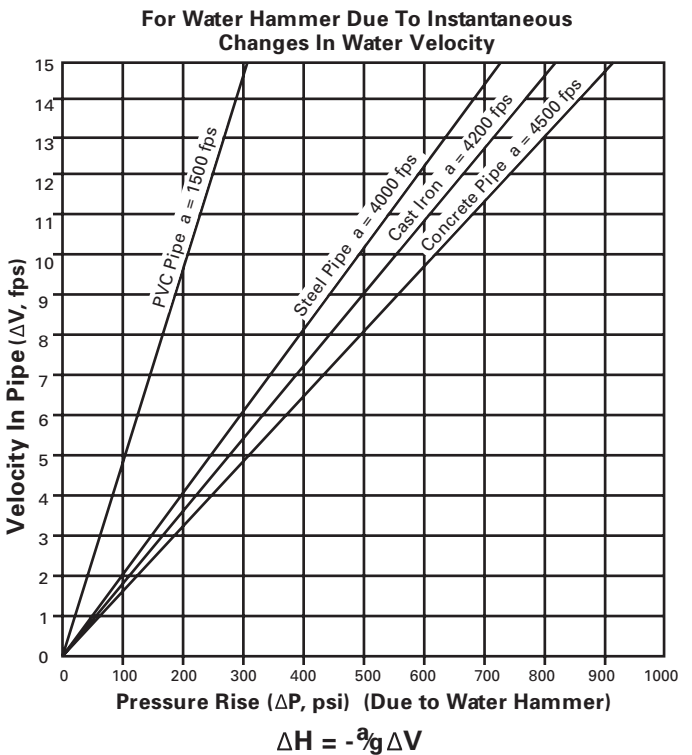
Sizing Steps:

1. Determine Line Velocity, in this case 8.5 fps.
2. Divide Velocity by Relief Pressure: $8.5/185 = 0.05$
3. Find this on bottom scale – follow vertically to intersection with curve for 12" line.
4. Go horizontally to point on vertical scale to find valve size, in this case – a 4" Valve. Model 3004.

Sizing Graph



Incremental Pressure vs. Flow Velocity



Note: This sizing chart is based on present engineering practice for use on pipelines whose operation conditions are not considered unusual. Due to the many unforeseen hydraulic conditions associated with pipeline operation, no guarantees are intended or otherwise implied.

Specifications

Series 3000 Angle Surge Relief Valves

The Angle Surge Relief Valve shall be heavily constructed cast iron body with a ductile iron cover/spacer to withstand severe shock conditions. The body shape shall be 90° angle pattern to permit side or downward discharge.

The cover/spacer shall provide an air gap between the surge valve and the hydraulic cylinder. The valve stem shall be connected to the hydraulic cylinder by means of a self-aligning universal connector to ensure smooth positive opening without binding during shock opening of the valve.

The hydraulic cylinder shall be removable from the valve, without dismantling or removing the valve from the line.

Closing speed shall be externally adjustable by means of a micrometer control valve.

The valve disc shall be normally closed against the system operating pressure by means of a spring or springs. When the system pressure exceeds the normal operating pressure by 10% the Angle Surge Relief Valve shall open immediately to relieve the pressure surge and close slowly as the system pressure returns to normal, by means of the hydraulic cylinder. The hydraulic cylinder shall be capped on both ends (totally enclosed) to prevent dirt or dust from fouling up the cylinder operation. It shall be fitted with an atmospheric oil reservoir.

The shut-off pressure shall be set at the factory, but additional adjustment can be made in the field by increasing or decreasing the tension on the externally adjustable springs.

Valve exterior to be painted with universal metal primer as accepted by the FDA for use in contact with potable water.

All materials of construction shall be certified in writing to ASTM specifications as follows:

Body	Cast Iron	ASTM A126 Gr.B
Cover/Spacer	Ductile Iron	ASTM A536 Gr.65-45-12
Body Seat Ring	Aluminum Bronze	C95200
Disc Seat	Buna-N	
Disc Seat (16", 400mm)	Aluminum Bronze with Molded Buna-N	
Disc	Steel	ASTM A36
Heavy Duty Hydraulic Cylinder	Steel	

Valve to be APCO Series 3000 Angle Surge Relief Valve, as manufactured by DeZURIK Inc., Sartell, Minnesota, U.S.A.

Specifications

Series 6500 Globe Surge Relief Valves

The Globe Surge Relief Valve shall be heavily constructed cast iron valve body with integral end flanges and a full unobstructed flow through area.

The disc shall be cast iron having a replaceable resilient Buna-N seat for tight shut-off. The pivot shaft shall be Type 303 stainless steel and be a single unit (not stubs), extending through the valve body with a weight and lever mounted on one or both ends.

The Globe Surge Relief Valve shall be adjusted at the factory to hold closed against the normal operating system pressure. When the system pressure exceeds this setting, the Globe Surge Relief Valve shall open immediately to relieve the pressure rise, but close slowly at an adjustable rate as the system pressure returns to normal.

A heavy duty oil dashpot system shall be externally mounted on the valve to control the rate of closure to positively prevent any slam. The oil shall be stored in a stainless steel reservoir maintaining a constant head on the dashpot to immediately fill the dashpot when the valve opens, insuring non-slam closure. The closing rate shall be externally and infinitely adjustable through a coded flow control valve with a locking device. Specify Pressure Class _____ and relief pressure setting _____.

Valve exterior to be painted with universal metal primer as accepted by the FDA for use in contact with Potable Water.

All materials of construction shall be certified in writing to ASTM specifications as follows:

Body	Cast iron	ASTM A126, Gr. B
Cover	Cast iron	ASTM A126, Gr. B
Disc seat	Buna-N	
Disc	Cast iron	ASTM A126, GR. B
Pivot shaft	Stainless steel	ASTM A582 T303

Valve to be APCO Series 6500 Globe Surge Relief Valve, as manufactured by DeZURIK Inc., Sartell, Minnesota, U.S.A.

Sales and Service

For information about our worldwide locations, approvals, certifications and local representative:

Web Site: www.dezurik.com E-Mail: info@dezurik.com



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