



APCO SILENT CHECK VALVES



Series 600
Globe Style
Sizes 3" Through 42"



Series 300
Wafer Style
Size 1" Through 10"

Water Hammer

Hydraulics engineers are concerned in increasing numbers with the problem of water hammer. At best it is a noise nuisance while in its most virulent form it can tear the finest pumping system apart.

What Causes Water Hammer?

The conditions responsible for this phenomenon are well known; they occur when a quantity of energy is suddenly released in a confined space. Energy is a function of mass times velocity and relating this to practical hydraulics engineering means that water hammer occurs when a body of water in motion in a pipe is suddenly stopped.

One of the circumstances under which this phenomenon most commonly occurs is when a pump is shut down and the forward flow of water reverses under the influence of gravity and commence to run the opposite way until stopped by a check valve.

Recognizing this, it becomes obvious that one secret to preventing water hammer due to flow reversal in a system is to provide a check valve which will close before this reversal of flow can take place. APCO Silent Check Valves perform excellently in these applications.

The following briefly outlines the characteristics of various types of check valves:

Swing Checks

The common Swing Check Valve is so designed that it often sees the reversal of flow before closing. This means that the body of water is already in motion and has to be stopped abruptly as the Swing Check Valve closes.

Silent Check Valves

It was to meet this steadily growing problem that the Silent Check Valve evolved. In designing this valve all other characteristics were subordinated to the principal need that it must positively close before a reversal of flow takes place, silently.

The Silent Check Valve was designed to open at approximately $\frac{1}{4}$ to $\frac{1}{2}$ psi (2 - 3 kpa), which means that when a pump is shut down, a Silent Check Valve will completely close while there is still positive head on the inlet side of approximately $\frac{1}{2}$ psi (3 kpa).

In this simple manner reverse flow, which is a major cause of water hammer, never gets a chance to start (in contrast to the swing check).

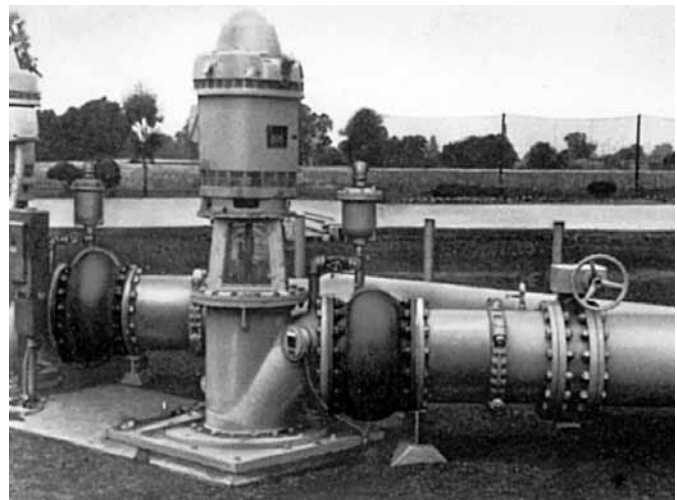
Experienced engineers know that it is only possible

to achieve perfection in one characteristic in a design at the expense or compromise with other characteristics. We feel that we would be remiss if we did not draw the engineer's attention to the compromise that has been made in perfecting the silent virtues of the Silent Check Valve and elaborate to some extent on the significance of this compromise.

This compromise is higher head loss than swing check type valves. The graph on the next page shows the relative head losses for three popular types of check valves. It can be clearly seen that Silent Check Valves do not suffer badly in comparison, especially when it is recognized that slightly higher head loss in the Silent Check Valves means a little more electrical power is used during pumping operation. When comparison is made with prevailing rates for commercial power, this head loss may become an academic rather than a practical concern.

These facts show why more engineers are specifying APCO Silent Check Valves for their customers' protection.

Typical Silent Check Valve Installation on Vertical Turbine Pumps



Los Angeles County Sanitary District
Los Coyotes Plant 2-16" (400mm) 125# Class Silent Check Valves

Factory Mutual System Approved

ISO flanges available

Wide variety of materials and pressure classes

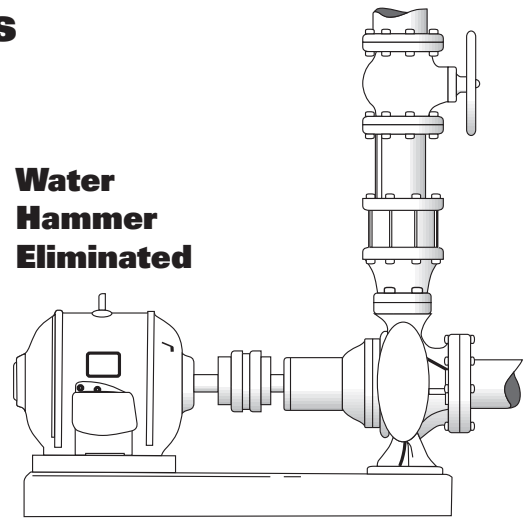
Specifying Silent Check Valves

Installing Silent Check Valves on Discharge Side of the Pump Stops Reverse Flow and Water Hammer Before it Starts

Water hammer can be both destructive and annoying. It is caused when a pump is shut down and the forward flow of water is allowed to reverse and is suddenly stopped by the check valve.

By positioning a Silent Check Valve on the discharge side of the pump, the reverse flow (which is one cause of water hammer) never has a chance to start. This is because APCO Silent Check Valves are designed to open at approximately 1/4 to 1/2 psi (2 - 3 kpa) and to completely close before the flow can reverse itself.

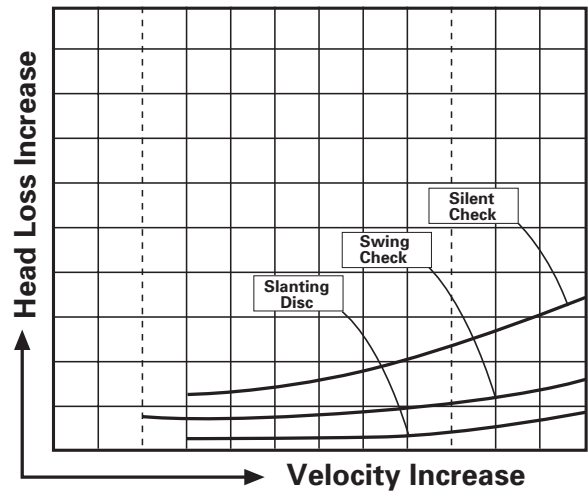
Short face-to-face dimensions of APCO Silent Check Valves also contribute to compactness in equipment room piping.



Typical Silent Check Valve Installation

Note: APCO Silent Check Valves can be installed in any position.

Check Valves Comparison Head Loss Curves



Maximum Non-Shock Service Pressure, PSI/kPa																		
Temp °F °C	Cast Iron ASTM A126 GR.B						Ductile Iron ASTM A536		Bronze ASTM B62		Carbon Steel ASTM A216 GR WCB				Stainless Steel ASTM A351 CF 8M			
	Class 125#			Class 250#			Pressure Class		Pressure Class		Pressure Class				Pressure Class			
	1-12" 25-300	14-24" 350-600	30" ≥ 750 ≥	1-12" 25-300	14-24" 350-600	30" ≥ 750 ≥	150	300	150	300	150	300	400	600	150	300	400	600
0-150 -18-66	—	—	—	—	—	—	—	—	225 1551	500 3447	—	—	—	—	—	—	—	—
-20-100 -29-38	—	—	—	—	—	—	250 1724	640 4413	—	—	285 1965	740 5102	990 6826	1480 10204	275 1896	720 4964	960 6619	1440 9928
-20-150 -29-66	200 1379	150 1034	150 1034	500 3447	300 2068	300 2068	242 1669	620 4275	—	—	272 1875	707 4875	945 6516	1415 9756	257 1772	670 4619	892 6150	1340 9239
200 93	190 1310	135 931	115 793	460 3172	280 1931	250 1724	235 1620	600 4137	210 1448	465 3206	260 1793	675 4654	900 6205	1350 9308	240 1655	620 4275	825 5688	1240 8549
250 121	175 1207	125 862	85 586	415 2861	260 1793	200 1379	235 1620	582 4013	195 1344	425 2930	245 1689	665 4585	887 6116	1332 9184	227 1565	590 4068	785 5412	1180 8136
300 149	165 1138	110 758	50 345	375 2586	240 1655	150 1034	215 1482	565 3896	180 1241	390 2689	230 1586	655 4516	875 6033	1315 9067	215 1482	560 3861	745 5137	1120 7722
Seat Test PSI kPa	200 1379	150 1034	150 1034	500 3447	300 2068	300 2068	275 1896	720 4964	300 2068	1000 6895	315 2172	815 5619	1090 7515	1630 11238	305 2103	795 5481	1060 7308	1585 10928
Shell Test PSI kPa	300 2068	230 1586	230 1586	750 5171	450 3103	450 3103	400 2758	975 6722	450 3103	1500 10342	450 3103	1125 7757	1500 10342	2225 15341	425 2930	1100 7584	1450 9997	2175 14996

°F PSI Inch
°C kPa Millimeter

Wafer Style Series 300

Full Flow Area Approximately 3% Greater Than Pipe Size

Standard Construction

Ductile Iron Body

Stainless Steel Trim

Stainless Steel Spring

Optional Construction

Stainless Steel

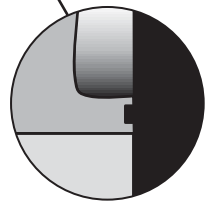
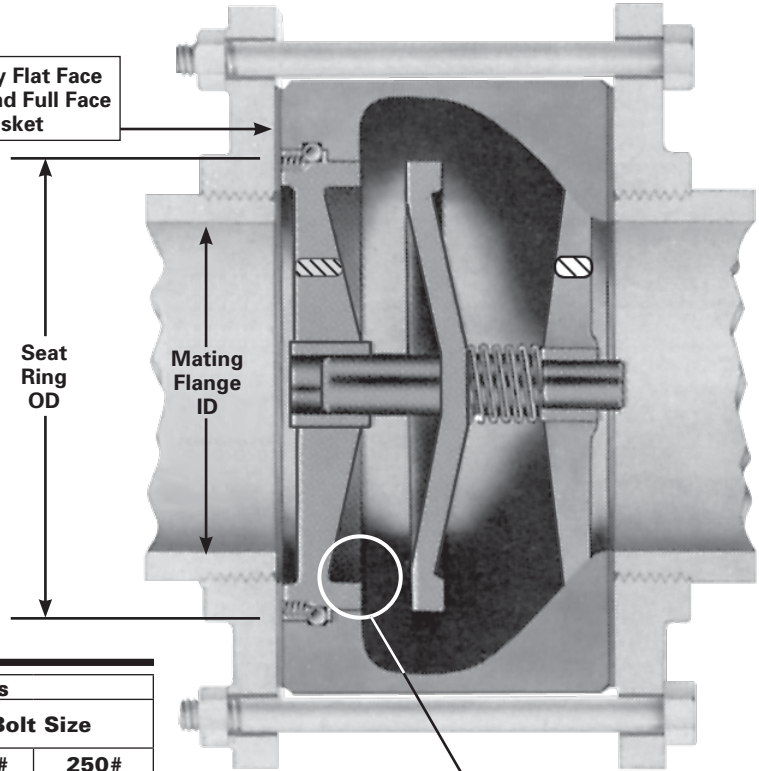
Cast Steel Body with Bronze or Stainless Steel Trim

Resilient Seating (Buna-N)

See Figure 1 (Optional)

Note: ID of mating flange (seat side only) should never be greater than seat ring OD.

Use Only Flat Face Flange and Full Face Gasket



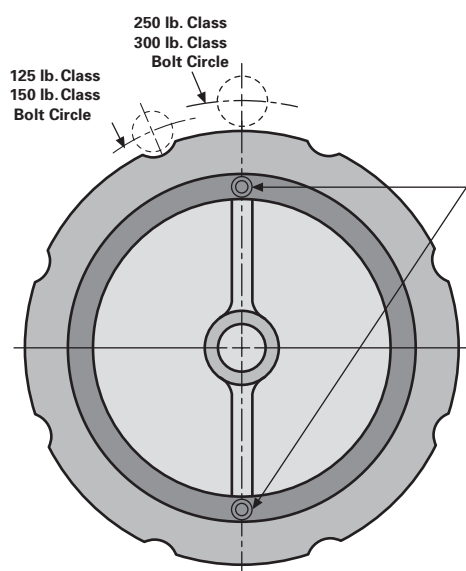
Resilient Seat Detail
Figure 1 optional for both Wafer or Globe Styles

Factory Mutual System
★ APPROVED

Dimensions for 125#/250# Class Valves								
Model	Size	Face to Face	No. of Bolts		Bolt Circle		Bolt Size	
			125#	250#	125#	250#	125#	250#
301	1" / 25	2.063" / 52	4	4	3.125" / 79	3.5" / 89	.5" x 4.25" / 13 x 108	.625" x 4.5" / 16 x 114
301.25	1.25" / 30	2.063" / 52	4	4	3.5" / 89	3.875" / 98	.5" x 4.25" / 13 x 108	.625" x 4.5" / 16 x 114
301.5	1.5" / 40	2.375" / 60	4	4	3.875" / 98	4.5" / 114	.5" x 4.75" / 13 x 121	.75" x 5.25" / 19 x 133
302	2" / 50	2.625" / 67	4	8	4.75" / 121	5" / 127	.625" x 5.25" / 16 x 133	.625" x 5.5" / 16 x 140
302.5	2.5" / 65	2.875" / 73	4	8	5.5" / 140	5.875" / 149	.625" x 5.75" / 16 x 146	.75" x 6.5" / 19 x 165
303	3" / 80	3.125" / 79	4	8	6" / 152	6.625" / 168	.625" x 6.25" / 16 x 159	.75" x 7" / 19 x 179
304*	4" / 100	4" / 102	8	8	7.5" / 191	7.875" / 200	.625" x 7" / 16 x 178	.75" x 8" / 19 x 203
305	5" / 125	4.625" / 117	8	8	8.5" / 216	9.25" / 235	.75" x 7.75" / 19 x 197	.75" x 9" / 19 x 229
306*	6" / 150	5.5" / 140	8	12	9.5" / 241	10.625" / 270	.75" x 8.75" / 19 x 222	.75" x 10" / 19 x 254
125 lb. ANSI Pressure Class								
308*	8" / 200	6.5" / 165	8	—	11.75" / 298	—	.75" x 10" / 19 x 254	—
310*	10" / 250	8.25" / 210	12	—	14.25" / 362	—	.875" x 12.5" / 22 x 318	—
250 lb. ANSI Pressure Class								
358	8" / 200	6.5" / 165	—	12	—	13" / 330	—	.875" x 11.25" / 22 x 286
360	10" / 250	8.25" / 210	—	16	—	15.25" / 387	—	1" x 13.75" / 25 x 349

Inch
Millimeter

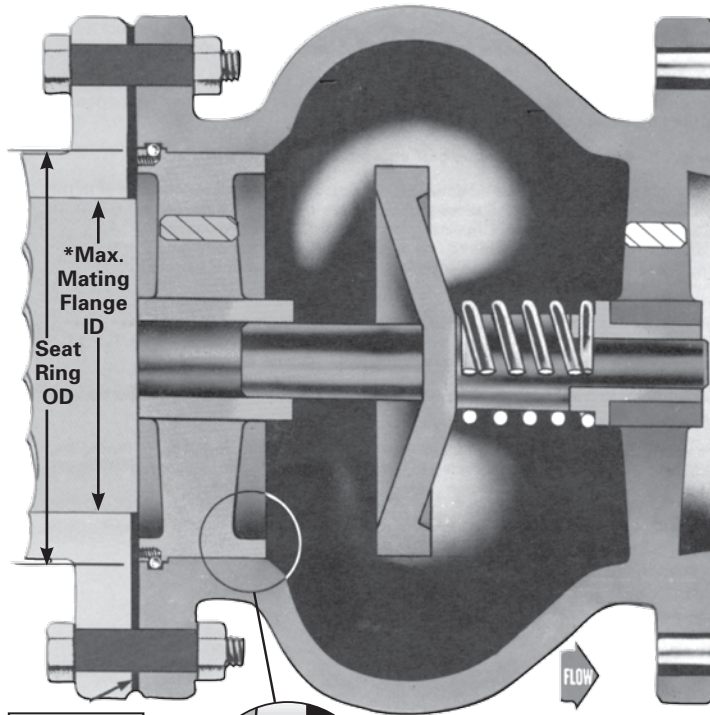
Operating pressure to 1500 lb. class is available. Please contact factory for higher pressure classes.



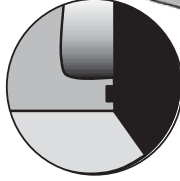
Pressure joint is effected after installation. Applies to both wafer and globe styles. Screw retains seat during handling and shipping.

Globe Style Series 600

Full Flow Area Approximately 10% Greater Than Pipe Size



Use Only Flat Face Flange and Full Face Gasket



Resilient Seat Detail

Standard Construction

- Ductile Iron Body
- Stainless Steel Trim thru 24" (600mm)
- Stainless Steel Spring

Optional Construction

- Stainless Steel
- Cast Steel Body with Bronze or Stainless Steel Trim
- Duplex Stainless Steel
- Resilient Seating (Buna-N)
- Compression molded (not glued or chemically bonded) onto the seat allowing metal to metal contact with drop tight resilient shut-off

Note: If special mating flanges are used, ID of mating flange (seat side only) should never be greater than seat ring OD.

125# & 150# ANSI Pressure Cassettes							
Model	Size	Flange Dia.	Face to Face	Bolt Circle Dia.	Bolt Size	No. of Bolts	*Max Mating Flange ID
603	3" 80	7.5" 191	6" 152	6" 152	.625" 16	4	3.375" 86
604*	4" 100	9" 229	7.25" 184	7.5" 191	.625" 16	8	4.75" 121
605*	5" 125	10" 254	8.5" 216	8.5" 216	.75" 19	8	5.5" 140
606*	6" 150	11" 279	9" 229	9.5" 241	.75" 19	8	6.5" 165
608*	8" 200	13.5" 343	10.125" 257	11.75" 298	.75" 19	8	8.5" 216
610*	10" 250	16" 406	12" 305	14.25" 362	.875" 22	12	10.75" 273
612*	12" 300	19" 483	14.25" 362	17" 432	.875" 22	12	12.875" 327
614	14" 350	21" 533	15.75" 400	18.75" 476	1" 25	12	14.75" 375
616	16" 400	23.5" 597	17.625" 448	21.25" 540	1" 25	16	16.5" 419
618*	18" 450	25" 635	18.75" 476	22.75" 578	1.125" 29	16	18.75" 476
620	20" 500	27.5" 699	20.625" 524	25" 635	1.125" 29	20	20.625" 524
624	24" 600	32" 813	24" 610	29.5" 749	1.25" 32	20	24.75" 629
630	30" 750	38.75" 984	29.25" 743	36" 914	1.25" 32	28	29.5" 749
636	36" 900	46" 1168	45" 1143	42.75" 1086	1.5" 38	32	36" 914
642	42" 1100	53" 1346	50" 1270	49.5" 1257	1.5" 38	36	42" 1067

250# & 300# ANSI Pressure Cassettes							
Model	Size	Flange Dia.	Face to Face	Bolt Circle Dia.	Bolt Size	No. of Bolts	*Max Mating Flange ID
653	3" 80	8.25" 210	6" 152	6.625" 168	.75" 19	8	3.375" 86
654	4" 100	10" 254	7.25" 184	7.875" 200	.75" 19	8	4.75" 121
655	5" 125	11" 279	8.5" 216	9.25" 235	.75" 19	8	5.5" 140
656	6" 150	12.5" 318	9" 229	10.625" 270	.75" 19	12	6.5" 165
658	8" 200	15" 381	10.125" 257	13" 330	.875" 22	12	8.5" 216
660	10" 250	17.5" 445	12" 305	15.25" 387	1" 25	16	10.75" 273
662	12" 300	20.5" 521	14.25" 362	17.75" 451	1.125" 29	16	12.875" 327
664	14" 350	23" 584	15.75" 400	20.25" 514	1.125" 29	20	14.75" 375
666	16" 400	25.5" 648	17.625" 448	22.5" 572	1.25" 32	20	16.5" 419
668	18" 450	28" 711	18.75" 476	24.75" 629	1.25" 32	24	18.75" 476
670	20" 500	30.5" 775	20.625" 524	27" 686	1.25" 32	24	20.625" 524
674	24" 600	36" 914	24" 610	32" 813	1.5" 38	24	24.75" 629
680	30" 750	43" 1092	29.25" 743	39.25" 997	1.75" 44	28	29.5" 749
686	36" 900	50" 1270	45" 1143	46" 1168	2.125" 54	32	36" 914
692	42" 1100	57" 1448	50" 1270	52.75" 1340	2.25" 57	36	42" 1067

Inch
Millimeter

Inch
Millimeter

Operating pressure to 1500 lb. class is available. Please contact factory for higher pressure classes.

What Makes the APCO Silent Check Valve So Outstanding?

Performance Guarantee

The graph below shows the comparative head loss through different manufacturers' Silent Check Valves. The figures used to construct this graph were obtained from certified independent laboratory tests for the APCO valves and compared against other available published data.

The lower losses of APCO Silent Check Valve as indicated by this graph frequently gives rise to the question "How does APCO manage to keep its losses below those of the other valves examined?"

Superior performance is never accidental and this question is best answered by the following details.

First, every APCO valve is designed with the initial premise that the minimum cross-sectional area shall exceed that of the pipe it serves. In every APCO valve the full cross-sectional area of the most critical points, is greater than the cross-sectional area of the pipe. This is clearly illustrated on the valve drawing of a 5" APCO Silent Check Valve on the adjacent page.

Secondly, APCO has designed many types of valves for hydraulic service for over sixty years and our engineers are especially conscious of the importance of good hydraulic flow lines. Again, an examination of the drawing on the next page will show how very carefully the contours have been worked out to give the best possible hydraulic flow results.

Even small details such as streamlining the spokes have been given due consideration. This devotion to design detail makes it readily obvious why the APCO Silent Check Valve can reasonably be expected to have the most favorable flow characteristics of any Silent Check Valve.

Pressure Loss Curve Comparison Between Apco Silent Check Valves and Other Similar Makes (Actual Tests Shown for a Particular Size)

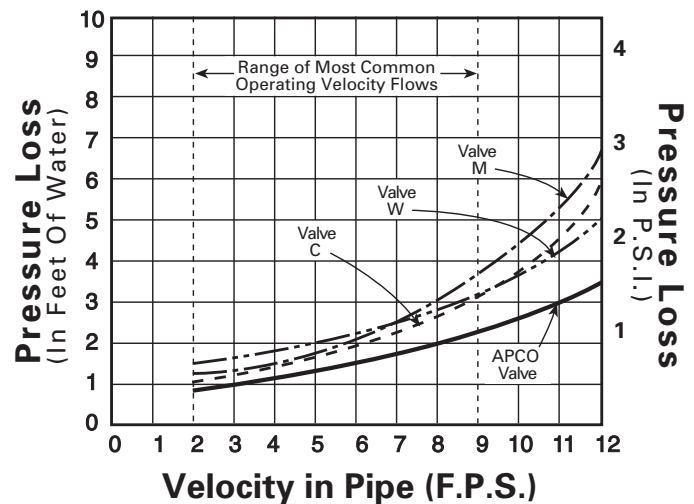
Construction

The superior performance characteristics of the APCO Silent Check Valve are matched by its equally superior quality of construction as the following design details will show.

The seat is held by stainless steel screws so that it can be taken apart after years of service as easily as the day it was made.

Electrolytic action is eliminated by having the shaft of the plug ride in bushings made of the same material as the shaft itself.

A simple loose guide bushing for the shaft is provided and made of the same material as the shaft. This bushing is held in place by the spring so that in the event it is considered necessary to take the valve apart in the field, the bushings can be easily removed by hand.





APCO Silent Check Valves have been thoroughly tested by Factory Mutual Research Corp. As a result, the 300 Series and 600 Series Valves can be used on hazardous fire fighting equipment and fire protection systems with assurance of performance. For such applications, insist on the Factory Mutual Guarantee Label of Approval on your Silent Check Valve. Available on sizes as indicated.

Materials of Construction

All the materials used in APCO valves are clearly referred to by their appropriate ASTM numbers.

APCO offers ductile iron as a standard on sizes thru 24" (600mm).

A brief technical explanation of the qualities is given below.

The Advantages of Ductile Iron

Ductile iron, contrary to its name, is not really a cast iron at all but an alloy developed by the International Nickel Company.

Cast iron has graphite present in lenticular flakes which causes it to be brittle and have a relatively low tensile strength.

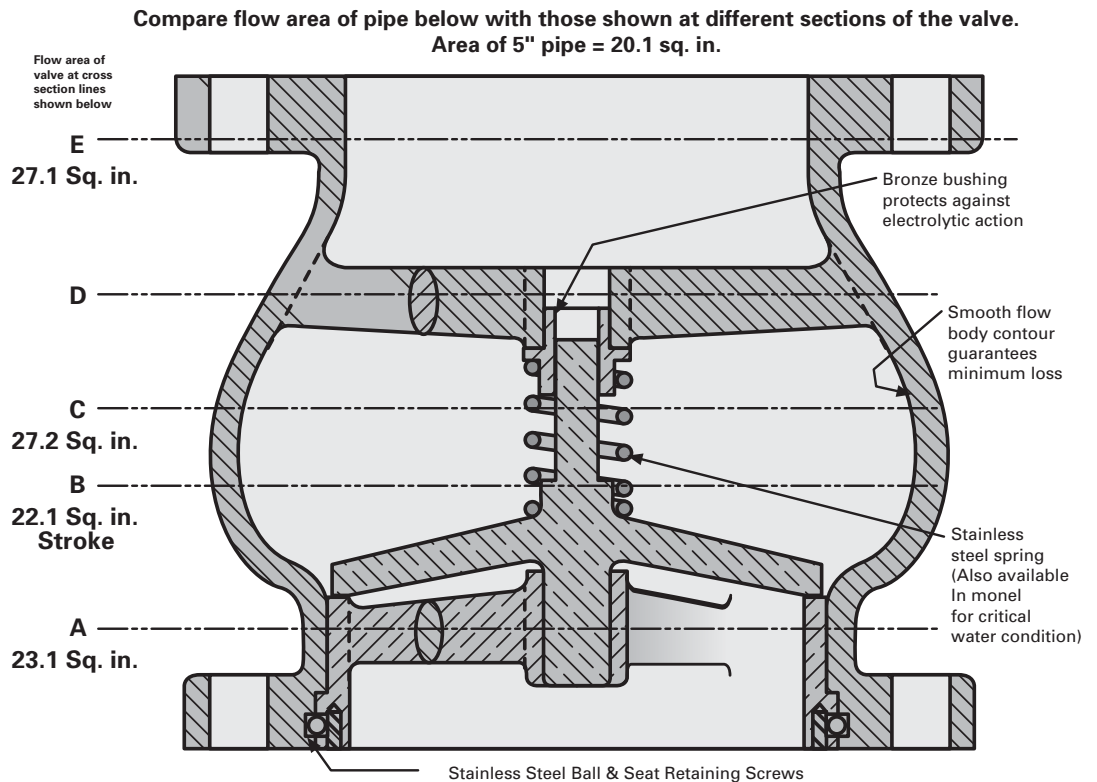
The graphite in ductile iron is present in spheroidal shape making it ductile with a much higher tensile strength.

Various types of ductile iron are available and we use the one especially recommended for valves. This is Type 65-45-12 ductile iron ASTM A536 strength of 65 to 80,000 psi and a yield strength of 45 to 60,000 psi, equivalent to carbon steels, yet retaining the anti-corrosion properties of iron.

5" (127mm) APCO Series 600 Silent Check Valve with Minimum 10% Greater Flow Area.

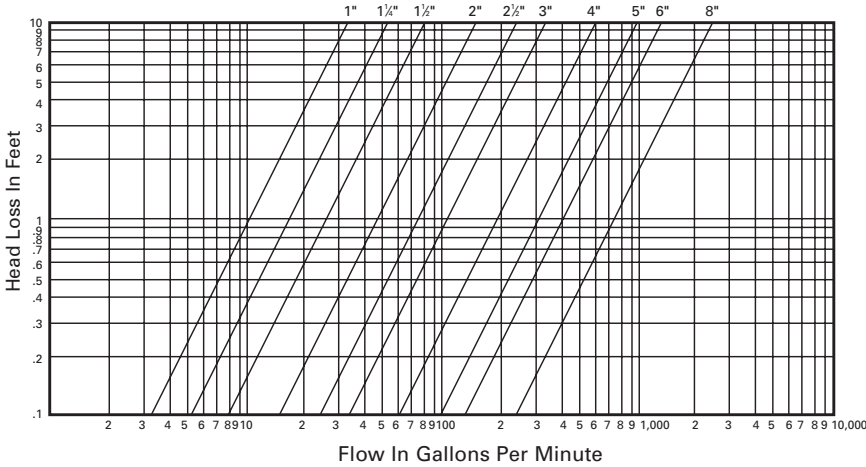


All APCO Silent Check Valves 100% hydrostatically tested to ANSI standards

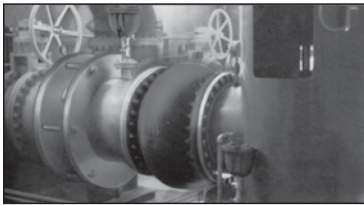
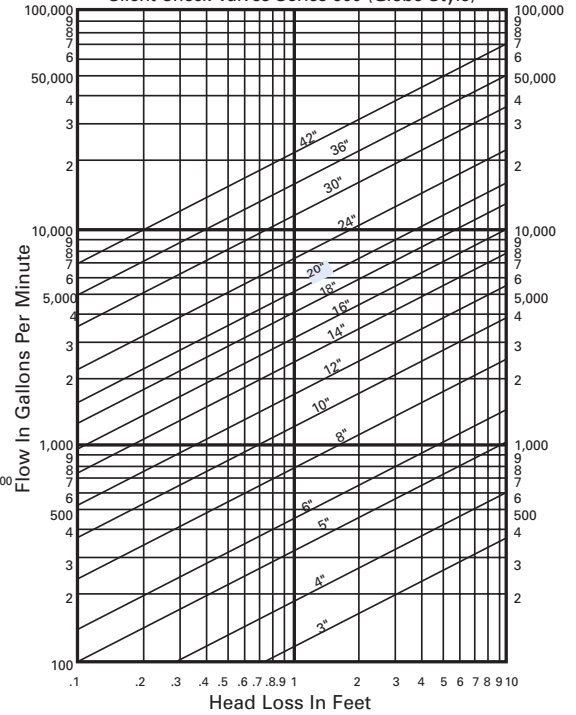


Specifications

Head Loss Characteristics For
Silent Check Valves Series 300 (Check Style)



Head Loss Characteristics For
Silent Check Valves Series 600 (Globe Style)



At Left: Typical Silent Check Valve application on vertical turbine pumps (30"). Utah Valley Water Treatment Plant, Orem, Utah.



Series 300 Wafer Style Silent Check Valve

Wafer Style Silent Check Valves shall be designed with ductile iron bodies, and stainless steel seat, plug and spring. The valve plug must be center guided at both ends with a through integral shaft and spring loaded for guaranteed silent shut-off operation.

The spring must be helical or conical. Seat and plug shall be hand replaceable in the field for ease of maintenance. The flow area through the body shall be equal to or greater than the cross-section area of the equivalent pipe size.

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

Body	Ductile Iron	ASTM A536 65-45-12
Plug & Seat	Stainless Steel	ASTM A276 T304
Spring	Stainless Steel	ASTM A276 T316
Exterior Paint	Universal Metal Primer	FDA approved for potable water contact

Valve to be APCO Series 300 - 1"-10" (25-250mm) Silent Check Valve - Wafer Style, Factory Mutual Approved - sizes 4" (100mm), 6" (150mm), 8" (200mm) and 10" (250mm) (125 Lb. Class), sizes 4" (100mm), 6" (150mm), (250 Lb. Class).



Series 600 Globe Style Silent Check Valve

Globe Style Silent Check Valve shall be designed with ductile iron bodies, and stainless steel seat, plug and spring. The valve plug must be center guided at both ends with a through integral shaft.

The spring must be helical or conical. The seat and plug shall be hand replaceable in the field for ease of maintenance. The flow area through the body shall be equal to or greater than the cross-sectional area of the equivalent pipe size.

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

Body	Ductile Iron	ASTM A536 65-45-12
Plug & Seat	Stainless Steel	ASTM A276 T304
Spring	Stainless Steel	ASTM A276 T316
Exterior Paint	Universal Metal Primer	FDA approved for potable water contact

Valve to be APCO Series 600 - 3"-42" (80-1100mm) Silent Check Valves - Factory Mutual Approved - sizes 4" (100mm), 6" (150mm), 8" (200mm) and 10" (250mm), 12" (300mm) and 18" (450mm).

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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