BULLETIN 7000
JULY 2011

DeZURIK
APCO | WILLAMETTE

APCO HYDRAULICALLY CONTROLLED AIR/VACUUM VALVES

Series 7000

Types of Air Valves

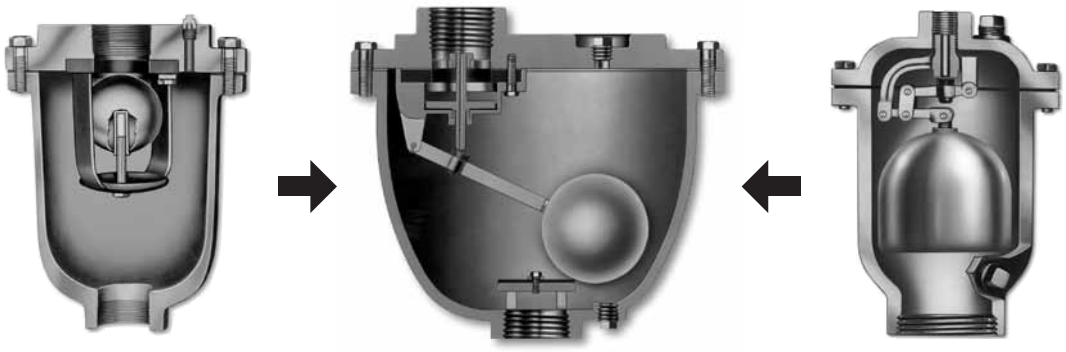
There are basically only two types of standard air valves:

1. Air/Vacuum Valves

An Air/Vacuum Valve has a large venting orifice and is used to exhaust large volumes of air from a pipeline when being filled or a deep well pump column when the pump is started. Once the line is filled, the Air/Vacuum Valve closes and remains closed until the pipeline is drained. The Air/Vacuum Valve will then immediately open to allow air to re-enter the line and prevent a vacuum from forming and possible collapse of the pipeline.

2. Automatic Air Release Valves

An Automatic Air Release Valve has a small venting orifice and is used wherever a high point occurs on a pipeline or system. The Automatic Air Release Valve has the ability to open while the pipeline or system is under pressure and allow the small pockets of air which accumulate at each high point to escape. This eliminates resistance to flow and maintains full capacity and efficiency of the pipeline or system.



Combining the two basic air valves results in what is commonly referred to as a Combination Air Valve.

Hydraulically Controlled Air/Vacuum Valve

The APCO Hydraulically Controlled Air Valve is an air/vacuum valve with an externally mounted hydraulic dashpot system to control the rate at which the air valve will close.

Hydraulically Controlled Air Valves vs. Float Operated Air Valves

Both the conventional float-operated air vacuum valves and the Hydraulically Controlled Air Vacuum Valve will give adequate protection against vacuum conditions within the pipeline because both valves will respond immediately to a negative pressure and open to allow air to enter the pipeline. However, if the negative pressure condition in the pipeline is the result of a surge condition, the return to positive pressure in the pipeline can be extremely rapid causing the conventional air vacuum valve to close suddenly, encouraging a correspondingly high pressure rise and possible damage to the pipeline. Whereas, in the Hydraulically Controlled Air Vacuum Valve sudden closure cannot occur and the pressure surge is practically eliminated because the infinitely adjustable hydraulic dashpot controls the rate of closure while the surge wave is dissipated through the valve.

How They Work

The addition of a hydraulic dashpot to our float operated air vacuum valve makes it impossible for the air valve to close suddenly. By adjusting the hydraulic controls on the dashpot, the float is prevented from sudden closure, therefore, the surge following the negative pressure condition will be dissipated through the open valve.

The hydraulic dashpot is designed not to cause any restriction to the air when it is called upon to open. The opening sequence is immediate and free. However, the closing sequence is infinitely adjustable so that as the pressure in the pipeline rises, the open air valve will permit the regulated discharge of water at a pre-set closing time. This will drastically reduce the potential pressure surge.

Damage to a pipeline occurs predominantly during initial filling and testing of the line. Usually the damage is due to filling the line too rapidly. With the APCO Hydraulically Controlled Air/Vacuum Valve, this condition is prevented because the air valve will not close at the rate of filling. Instead, it closes at the pre-set rate of the hydraulic dashpot.

When to Use Them

In addition to standard air valves, many pipelines require one or more Hydraulically Controlled Air & Vacuum Valves for protection against secondary surges when, for example, the following conditions exist:

- A disturbance to the pipeline causes a negative pressure wave in the pipeline.
- At the air valve location, the pressure gradient goes below zero at which point water column separation takes place.
- The air valve opens and allows air to enter the pipeline.
- The returning (secondary) surge due to the rejoining of the previously separated water column is dissipated through the open air valve when a hydraulic dashpot is provided. Without dashpot control, the conventional air vacuum valve will slam shut encouraging a severe secondary surge.
- With the Hydraulically Controlled Air & Vacuum Valve, the water discharging through the air valve is slowly and gradually shut off at a rate compatible with the hydraulic conditions of the pipeline.

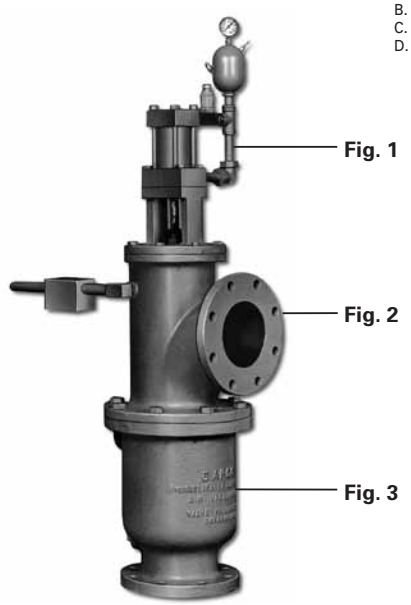


Fig. 1

Fig. 2

Fig. 3

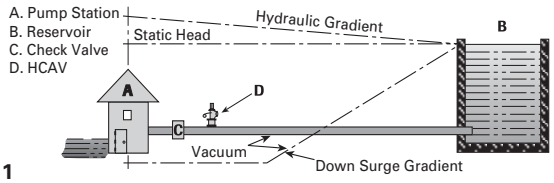


Fig. 1
Hydraulically Controlled Air Valve installation where vacuum can be experienced on too rapid check valve closure or on power failure to electric motor driven pumps. Pipeline is horizontal, but the characteristics are such that a vacuum can be found near the pump house.

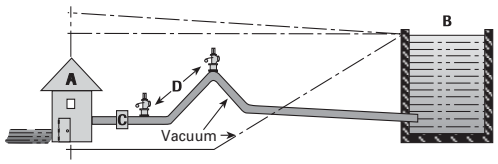


Fig. 2
Hydraulically Controlled Air Valve installation where conditions are same as Fig. 1, except pipeline is not horizontal and has a high point requiring a second Hydraulically Controlled Air Valve.

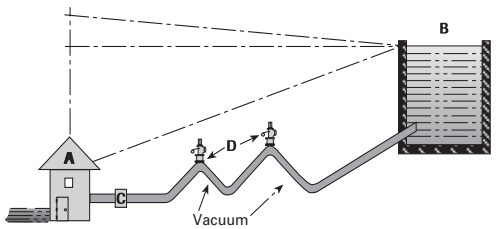


Fig. 3
Hydraulically Controlled Air Valve installation where there are multiple high points at which vacuum occurs on power failure on pumps, with outlet pressure remaining above atmospheric. Pipeline has two high points, but conditions are such that no vacuum is found at the pump house in Figures 1 & 2.

Above illustrations are examples of layouts of pump stations, pipelines and reservoirs where the Hydraulically Controlled Air Valve can eliminate dangerous surges due to separation of water column under vacuum conditions.

CAUTION: Vacuum conditions must not exceed pipeline design collapse pressure.

How to Install

The APCO Hydraulically Controlled Air/Vacuum Valve should be installed vertically [plumb] on the high points of the pipeline. It is recommended that air valves be isolated from the main pipeline with an DeZURIK Butterfly Valve or Gate Valve. The isolation valve will permit adjustment, timing, inspection and maintenance of the air valve without disruption to the flow of the main pipeline.

Hydraulically Controlled Air Valve installations are made at critical points in a pipeline where vacuum conditions will occur. Most often a single valve will suffice (Fig 4). When additional capacity is needed, pairs can be installed as in Fig. 5.

An Air Release Valve, type 200A, is recommended for each Hydraulically Controlled Air Valve or cluster to remove air accumulations at the high points of the pipeline when under pressure.

All Hydraulically Controlled Air Valves should have an isolation valve, as shown.

Field Start Up

It is recommended that an APCO factory engineer be present during initial start-up of the pipeline to insure trouble-free operation and to give instruction to operation personnel.

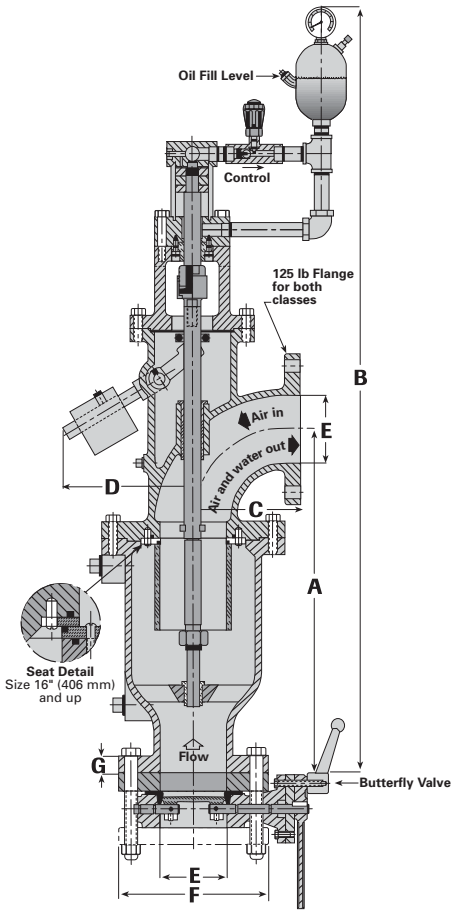
Figure 4

Figure 5

Series 7000

Model	Size	A	B	C	D	Bolt Holes		BC	E	F	G	Wt.
						No.	Size					
125# Class												
7004.1	4" 100	20.5" 521	45.5" 1156	6.5" 165	8.5" 216	8	.75" 19	7.5" 191	4" 102	9" 229	.938" 24	225 102
7006.1	6" 150	24" 610	47" 1194	8" 203	16.25" 413	8	.875" 22	9.5" 241	6" 152	11" 279	1" 25	300 136
7008.1	8" 200	27.75" 705	59.75" 1518	9.75" 248	18.25" 464	8	.875" 22	11.75" 298	8" 203	13.5" 343	1.125" 29	625 283
7010.1	10" 250	34.625" 879	76.125" 1934	12" 305	21" 533	12	1" 25	14.25" 362	10" 254	16" 406	1.188" 30	850 386
7012.1	12" 300	39.625" 1006	83" 2108	14" 356	24.25" 616	12	1" 25	17" 432	12" 305	19" 483	1.25" 32	1575 714
7014.1	14" 350	44" 1118	91.5" 2324	16.25" 413	25" 635	12	1.125" 29	18.75" 476	14" 356	21" 533	1.375" 35	2225 1009
7016.1	16" 400	48" 1219	96" 2438	18.5" 470	34" 864	16	1.125" 29	21.25" 540	16" 406	23.5" 597	1.438" 37	2400 1090
7018.1	18" 450	52" 1321	102" 2591	20" 508	18" 457	16	1.25" 32	22.75" 578	18" 457	25" 635	1.563" 40	2800 1270
7020.1	20" 500	56" 1422	108" 2743	22" 559	20" 508	20	1.25" 32	25" 635	20" 508	27.5" 699	1.688" 43	4900 2223
250# Class												
7004.2	4" 100	20.5" 521	45.5" 1156	7" 178	8.5" 216	8	.875" 22	7.875" 200	4" 102	10" 254	1.25" 32	235 107
7006.2	6" 150	24" 610	47" 1194	8.5" 216	16.25" 413	12	.875" 22	10.625" 270	6" 152	12.5" 318	1.438" 37	350 159
7008.2	8" 200	27.75" 705	59.75" 1518	10" 254	18.25" 464	12	1" 25	13" 330	8" 203	15" 381	1.625" 41	680 308
7010.2	10" 250	34.625" 879	76.125" 1934	12" 305	21" 533	16	1.125" 29	15.25" 387	10" 254	17.5" 445	1.875" 48	950 431
7012.2	12" 300	39.625" 1006	83" 2108	14" 356	24.25" 616	16	1.25" 32	17.75" 451	12" 305	20.5" 521	2" 51	1675 760
7014.2	14" 350	44" 1118	91.5" 2324	16.25" 413	25" 635	20	1.25" 32	20.25" 514	14" 356	23" 584	2.125" 54	2375 1077
7016.2	16" 400	48" 1219	96" 2438	18.5" 470	34" 864	20	1.375" 35	22.5" 572	16" 406	25.5" 648	2.25" 57	2800 1270
7018.2	18" 450	52" 1321	102" 2591	20" 508	18" 457	24	1.375" 35	24.75" 629	18" 457	28" 711	2.375" 60	3100 1409
7020.2	20" 500	56" 1422	108" 2743	22" 559	20" 508	24	1.375" 35	27" 686	20" 508	30.5" 775	2.5" 64	5300 2404

Inch lbs
Millimeter kg



Replace Shut-Off Valves with DeZURIK Butterfly Valves.

Costs to excavate pipeline trenches can be greatly reduced by using DeZURIK Butterfly Valves for isolation instead of gate valves.

DeZURIK Butterfly Valves are economical, reliable and much shorter, permitting a reduction in depth of trench or height of the vault.

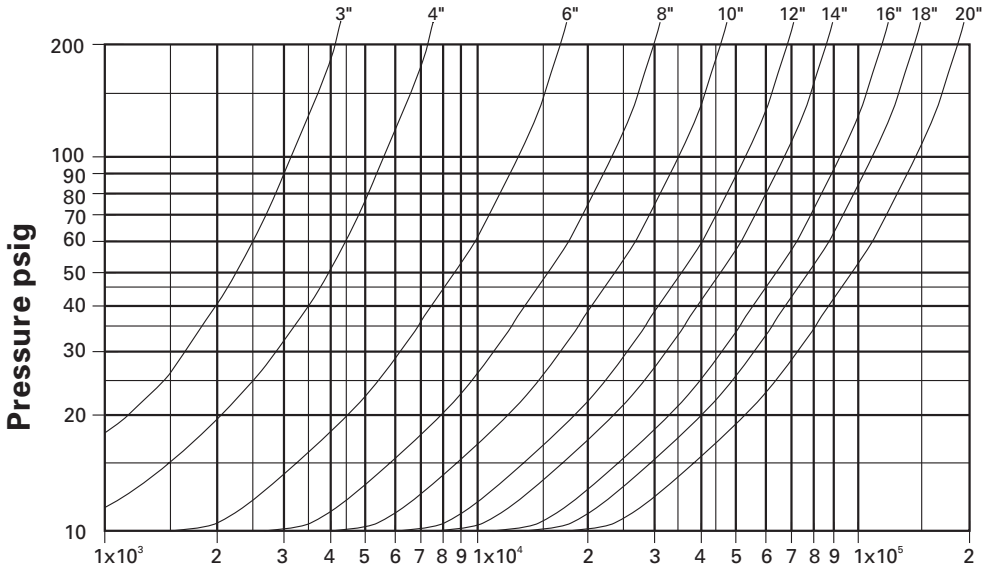
For size selection use DeZURIK/APCO air valve computer.

Hydraulically Controlled Air/Vacuum Valve Discharge Flow Rates in GPM at Various Pressures

psi/kpa	gpm/lpm									
	3" 80	4" 100	6" 150	8" 200	10" 250	12" 300	14" 350	16" 400	18" 450	20" 500
5 34	328 1242	582 2203	1310 4959	2327 8809	3637 13768	5235 19817	7128 26982	9310 35242	11786 44615	14553 55089
10 69	468 1772	832 3149	1872 7086	3327 12594	5199 19680	7485 28334	10190 38573	13309 50380	16849 63780	20805 78755
20 138	661 2502	1175 4448	2644 10009	4698 17784	7341 27789	10568 40004	14388 54465	18792 71135	23790 90055	29376 111200
30 207	813 3078	1444 5466	3250 12303	5775 21861	9025 34163	12991 49176	17688 66956	23102 87451	29246 110708	36113 136703
40 276	936 3543	1664 6299	3745 14176	6655 25192	10399 39364	14969 56664	20381 77150	26619 100764	33698 127561	41611 157515
50 345	1047 3963	1867 7067	4186 15846	7439 28160	11625 44005	16734 63345	22783 86243	29756 112639	37670 142596	46516 176082
60 414	1146 4338	2037 7711	4584 17352	8146 30836	12729 48185	18324 69364	24948 94438	32589 123363	41249 156144	50936 192814
70 483	1237 4683	2199 8324	4948 18730	8792 33281	13739 52008	19778 74868	26928 101934	35170 133133	44523 168538	54978 208114
80 552	1322 5004	2350 8896	5288 20017	9396 35568	14682 55577	21135 80005	28776 108929	37583 142267	47579 180106	58751 222397
90 621	1407 5326	2501 9467	5627 21301	10000 37854	15625 59147	22492 85141	30624 115924	39997 151405	50634 191671	62524 236679
100 689	1480 5602	2630 9956	5918 22402	10516 39807	16433 62206	23656 89548	32208 121921	42066 159237	53253 201585	65758 248921
110 758	1553 5879	2760 10448	6209 23504	11034 41768	17242 65268	24819 93950	33792 127917	44134 167065	55872 211499	68992 261163
120 827	1622 6140	2883 10913	6486 24552	11525 43627	18000 68137	58924 223052	35297 133614	46100 174507	58360 220917	72064 272792
130 896	1686 6382	2997 11345	6743 25525	11982 45357	18723 70874	26952 102024	36696 138909	47927 181423	60674 229676	74921 283607
140 965	1750 6624	3111 11776	7000 26498	12439 47087	19437 73577	27980 105916	38095 144205	49755 188343	62987 238432	77778 294422
150 1034	1813 6863	3223 12200	7252 27452	12887 48783	20138 76231	28988 109732	39463 149384	51548 195130	65257 247025	80581 305032

Inch psi gpm
Millimeter kpa lpm

Air Flow at Various Line Pressures



Discharge in SCFFAM
(CFM at Standard Temperature Pressure)

For inflow capacity please contact factory for assistance.

Specifications

The main body shall be three piece construction having a flanged inlet and flanged outlet. The float shall be non-collapsible heavy cast bronze, precision guided at both ends with a one piece stainless steel shaft. The shut-off seating must be metal to metal with a Buna-N seal. The Buna-N seal must be compression molded into the seat (not glued), to prevent the seal from being sucked out and allow drop tight shut-off.

The valve shall freely vent large volumes of air during filling of the pipeline without restriction. Water velocity upon entering the valve shall cause the float to shut-off into a resilient seat at a controlled rate. During this time of controlled closure, the water will discharge from the valve and slowly shut-off drop tight.

A top mounted hydraulic cylinder must be provided to control the closing speed of the valve to prevent surge or water hammer. Also, the valve will open at zero gauge pressure to prevent a vacuum. The dashpot cylinder must have two controlling stages in the closing cycle. The primary control is to be located in the external piping and handles the first 90% of float travel and the secondary control is to be located in the cylinder itself which can be set at a different rate of closing for the last 10% of float travel.

The primary and secondary control mechanisms shall be infinitely adjustable and shall be located externally and easily accessible so that adjustments can be made without need of dismantling any portion of the valve and without shutting off the pipeline.

Upon demand of a negative pressure in the pipeline, the hydraulic control closing system shall not interfere and the valve shall open freely, allowing large volumes of air to enter the system and break the vacuum. Returning secondary surge waves shall not cause the valve to quickly close, instead the returning surge wave will be dissipated through the open valve.

The heavy cast bronze float shall be counter-balanced as to virtually be in a state of equilibrium.

The valve manufacturer shall have flow tested the valve and present a testing report to substantiate flow discharge capacities.

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

Valve to be APCO Series 7000 Hydraulically Controlled Slow Closing Air/Vacuum Valve.

Sales and Service

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