BULLETIN 800
JULY 2011

DeZURIK
APCO | WILLAMETTE

APCO SLANTING DISC CHECK VALVES

Series 800, 800B, 800T

APCO Slanting Disc Check Valve

With decades of experience to guarantee reliability and outstanding performance, our Slanting Disk Check Valves are ruggedly designed with minimal head loss and maximum anti-hammer characteristics.

The APCO Slanting Disc Check Valve, because of its very unique two piece design and slant disc position, has superior flow characteristics (lowest head loss) when compared to any hinged disc type check valve available. Our two piece body design allows for a 40% expanded cross sectional flow area, so the area occupied by the mass of the disc is more than compensated for by the expanded flow area.

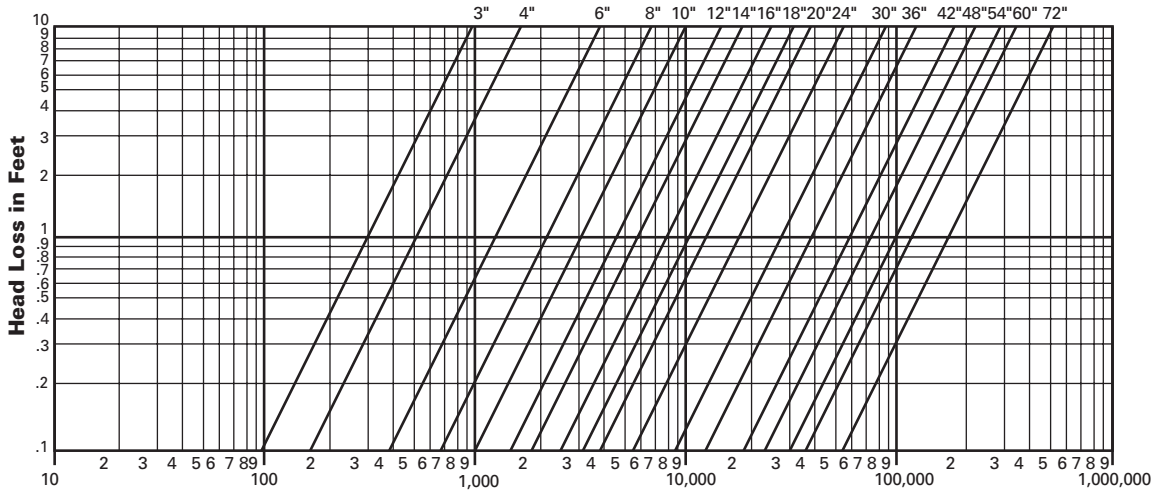
Also the airfoil design of the disc, like the wing on a plane, offers minimal resistance to flow while lifting and stabilizing in the full open position. Flow characteristics are further improved because the long laying length of the valve body allows water to smoothly enter and pass through without turbulence, eddys or cavitation.

The slant disc position is a most important feature of this valve. It offers minimum resistance to flow while minimizing water column reversal and slamming on shut down due to the short distance the slant disc travels to shut-off position.

The off center pivot of the slant disc works to your advantage. The surface disc area above the pivot point resists closing because it must close against the reversing water column. This counteracts the closing force to the disc area below the pivot point. The result is no slam or minimal slam depending on column reversal velocity.

The unbalanced weight (heavier below the pivot point) causes the slant disc to free fall into shut-off position with minimal reverse flow. A slight pressure differential will cause the slant disc to open. It has the lowest friction head loss of all conventional swing check valves. Due to this very low head loss the APCO Slanting Disc is even suitable for heavy duty rotary air blower service. The APCO Slanting Disc Check Valve pays for itself many times over in reduced power consumption and greater pumping efficiency to the user. See the energy savings comparisons on the last page of this bulletin.

Actual Flow Test For Head Loss Characteristics

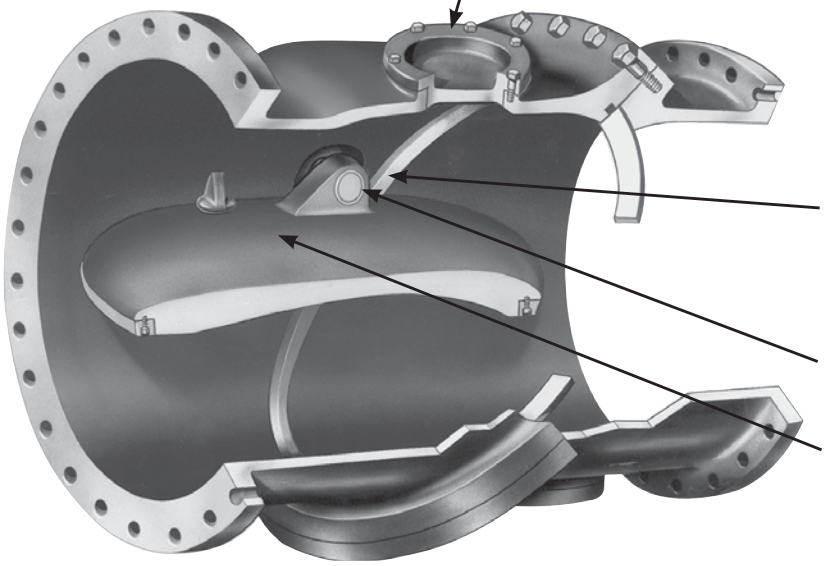


Certified Flow Tests Conducted At Utah State University Water Research Laboratory, Logan, Utah, 1991.

Figures shown are based on certified flow tests conducted at Utah State University, Water Research Laboratory, report no. 299. Valves sizes 8" & 14" (200 & 350mm). Actual field conditions may vary from these curves.

Note: When comparing similar competitors' published data, only use certified flow test data.

Setting New Standards . . . With These Features, No Extra Cost!



* Two accessory openings – one in each body half

Double O-ring seals – each side of body seat.

Seat and disc rings hand replaceable without machining in the field.

Precise pivot clearance ensures self-centering and guarantees against valve sticking closed.

Metal to metal seating per AWWA standards.

Highly wear-resistant stainless steel press fit bushing and special alloy pivot pin.

Ductile iron disc. Valve disc position indicator mounted on the pivot pin cover. (See picture below).

* Two accessory openings (1) each body half and ductile iron disc permits specifying a check valve with control features for your project. Future installation of top or bottom mount available

Optional Controls

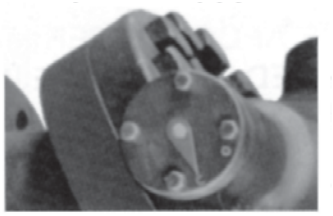
Free opening and controlled closing (Page 5)

Slow opening and controlled closing (Page 6)

Signal switch (Page 6)

Flow by-pass (Page 6)

No Extra Cost

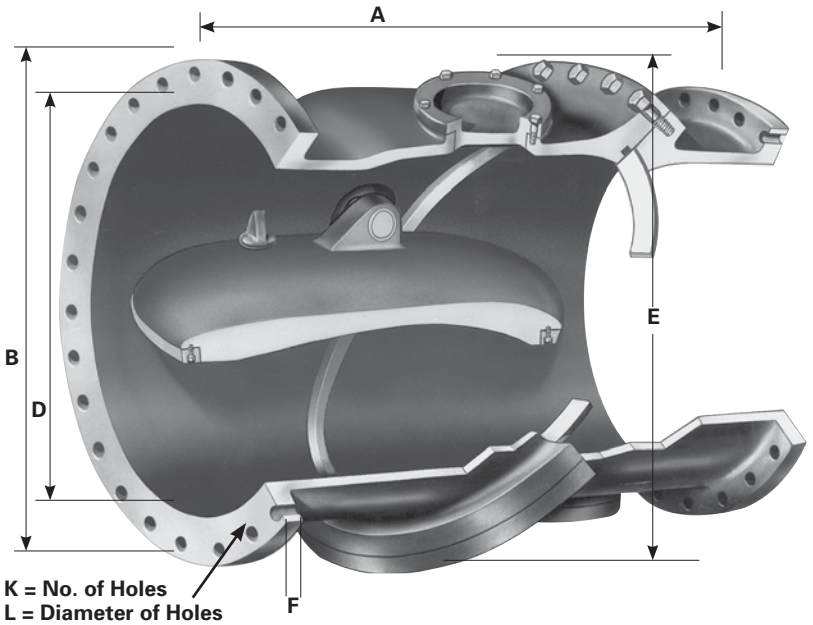


Indicator shows valve disc position

Indicator shows valve disc position and may be used to trip a micro switch or counting device. Not available 2" - 3" & 4" (50, 80 & 100 mm) sizes.

Dimensions

APCO Slanting Disc Check Valves close with slight clearance around pivot pins, ensuring 360° seating between the concentric disc ring and body seat ring. These rings are precisely machined and move together or apart with minimum rubbing, thus eliminating wearing and leakage for many years of service. This movement allows "tight" seating to meet AWWA standards for metal to metal seated valves.



Series 800																					
Model	Size	125# Flange										250# Flange									
		A	B	D	E	F	G	K	L	M	Weight	A	B	D	E	F	G	K	L	M	Weight
803	3" / 80	9.5" / 241	7.5" / 191	3" / 76	8.5" / 216	.75" / 19	9" / 229	4" / 102	.75" / 19	6" / 152	55 / 25	12.5" / 318	8.25" / 210	3" / 76	8.5" / 216	1.125" / 29	9" / 229	8" / 203	.875" / 22	5.625" / 143	65 / 29
804	4" / 100	11.5" / 292	9" / 229	4" / 102	9.75" / 248	.938" / 24	11" / 279	8" / 203	.75" / 19	7.5" / 191	82 / 37	11.5" / 292	10" / 254	4" / 102	9.75" / 248	1.25" / 32	11" / 279	8" / 203	.875" / 22	7.875" / 200	93 / 42
806	6" / 150	15" / 381	11" / 279	6" / 152	13.75" / 349	1" / 25	17.5" / 445	8" / 203	.875" / 22	9.5" / 241	164 / 74	15" / 381	12.5" / 318	6" / 152	13.25" / 337	1.438" / 37	17.5" / 445	12" / 305	.875" / 22	10.625" / 270	199 / 90
808	8" / 200	19.5" / 495	13.5" / 343	8" / 203	15.5" / 394	1.125" / 29	22" / 559	8" / 203	.875" / 22	11.75" / 298	265 / 120	19.5" / 495	15" / 381	8" / 203	15.5" / 394	1.625" / 41	22" / 559	12" / 305	1" / 25	13" / 330	357 / 162
810	10" / 250	24.5" / 622	16" / 406	10" / 254	18" / 457	1.188" / 30	25.5" / 648	12" / 305	1" / 25	14.25" / 362	510 / 231	24.5" / 622	17.5" / 445	10" / 254	18" / 457	1.875" / 48	25.5" / 648	16" / 406	1.125" / 29	15.25" / 387	573 / 260
812	12" / 300	24" / 610	19" / 483	12" / 305	21" / 533	1.25" / 32	27" / 686	12" / 305	1" / 25	17" / 432	650 / 295	24" / 610	20.5" / 521	12" / 305	21" / 533	2" / 51	27" / 686	16" / 406	1.25" / 32	17.75" / 451	693 / 314
814	14" / 350	30" / 762	21" / 533	14" / 356	25" / 635	1.375" / 35	33" / 838	12" / 305	1.125" / 29	18.75" / 476	1044 / 474	30" / 762	23" / 584	14" / 356	25" / 635	2.125" / 54	33" / 838	20" / 508	1.25" / 32	20.25" / 514	1179 / 535
816	16" / 400	30" / 762	23.5" / 597	16" / 406	28" / 711	1.438" / 37	36" / 914	16" / 406	1.125" / 29	21.25" / 540	1050 / 476	30" / 762	25.5" / 648	16" / 406	28" / 711	2.25" / 57	36" / 914	20" / 508	1.375" / 35	22.5" / 572	1600 / 726
818	18" / 450	33" / 838	25" / 635	18" / 457	30" / 762	1.563" / 40	38" / 965	16" / 406	1.25" / 32	22.75" / 578	1535 / 696	33" / 838	28" / 711	18" / 457	30" / 762	2.375" / 60	38" / 965	24" / 610	1.375" / 35	24.75" / 629	1890 / 857
820	20" / 500	32" / 813	27.5" / 699	20" / 508	31.5" / 800	1.688" / 43	41" / 1041	20" / 508	1.25" / 32	25" / 635	1685 / 764	32" / 813	30.5" / 775	20" / 508	31.5" / 800	2.5" / 64	41" / 1041	24" / 610	1.375" / 35	27" / 686	2100 / 953
824	24" / 600	38" / 965	32" / 813	24" / 610	36.5" / 927	1.875" / 48	48" / 1219	20" / 508	1.375" / 35	29.5" / 749	2650 / 1202	38" / 965	36" / 914	24" / 610	36.5" / 927	2.75" / 70	48" / 1219	24" / 610	1.625" / 41	32" / 813	3300 / 1497
830	30" / 750	52" / 1321	38.75" / 984	30" / 762	46.5" / 1181	2.125" / 54	57" / 1448	28" / 711	1.375" / 35	36" / 914	5850 / 2654	52" / 1321	43" / 1092	30" / 762	46.5" / 1181	3" / 76	57" / 1448	28" / 711	2" / 51	39.25" / 997	6800 / 3084
836	36" / 900	59.5" / 1511	46" / 1168	36" / 914	51" / 1295	2.375" / 60	62.5" / 1588	32" / 813	1.625" / 41	42.75" / 1086	7600 / 3447	59.5" / 1511	50" / 1270	36" / 914	51" / 1295	3.375" / 86	62.5" / 1588	32" / 813	2.25" / 57	46" / 1168	8300 / 3765
842	42" / 1100	62.5" / 1588	53" / 1346	42" / 1067	58" / 1473	2.625" / 67	63" / 1600	36" / 914	1.625" / 41	49.5" / 1257	9000 / 4082	62.5" / 1588	57" / 1448	42" / 1067	58" / 1473	3.688" / 94	63" / 1600	36" / 914	2.25" / 57	52.75" / 1340	10500 / 4763
848	48" / 1200	65" / 1651	59.5" / 1511	48" / 1219	67.5" / 1715	2.75" / 70	72" / 1829	44" / 1118	1.625" / 41	56" / 1422	14000 / 6350	65" / 1651	65" / 1651	48" / 1219	67.5" / 1715	4" / 102	72" / 1829	40" / 1016	2.25" / 57	60.75" / 1543	18000 / 8165
854	54" / 1400	78" / 1981	66.25" / 1683	54" / 1372	71" / 1803	3" / 76	77" / 1956	44" / 1118	2" / 51	62.75" / 1594	16000 / 7257	78" / 1981	*	54" / 1372	71" / 1803	*	77" / 1956	*	*	*	21000 / 9525
860	60" / 1500	87" / 2210	73" / 1854	60" / 1524	84" / 2134	3.125" / 79	90" / 2286	52" / 1321	2" / 51	69.25" / 1759	28241 / 12810	87" / 2210	*	60" / 1524	84" / 2134	*	90" / 2286	*	*	*	34000 / 15422
872	72" / 1800	106" / 2692	86.5" / 2197	72" / 1829	102" / 2591	3.5" / 89	125" / 3175	60" / 1524	2" / 51	82.5" / 2096	44000 / 19958	106" / 2692	*	72" / 1829	102" / 2591	*	125" / 3175	*	*	*	55000 / 24948

Inch / Lbs
Millimeter / Kg

150# and 300# class dimensions same as above — Except 12" (300 mm) A = 27½" (699 mm) for higher pressure class see page 8.
Tight seating per AWWA standards.
*** To be supplied by customer**

1. Series 800B - With Bottom Mounted Buffer (Free Opening and Controlled Closing)

This unique buffer arrangement allows the valve disc (10) to open fully without interference and to close freely for approximately 90% of its stroke. After the disc is 90% closed, it comes in contact with the buffer rod (33), at this point final control speed of the last 10% (adjustable) of closing is established.

The flow control valve (41) on the cylinder (39) is easily adjusted to allow slow closure to suit pipeline flow conditions. This prevents or minimizes slamming which greatly reduces pressure surges.

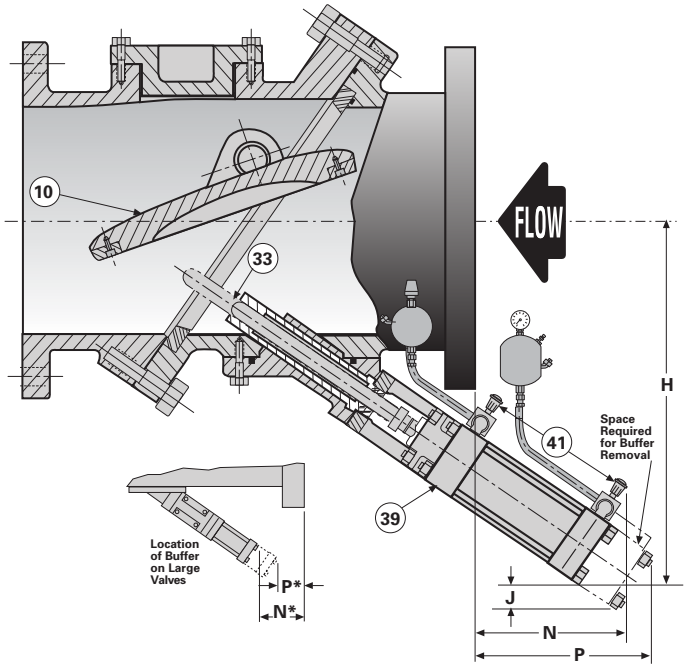
Did You Know?

Any APCO controlled movement valve can be modified in the field to suit specific conditions.

Good pump station design encourages at least 3 pipe diameters of straight pipe down stream of a check valve (in some cases the upstream side).

The APCO Buffer may be added to a valve in the field.

APCO offers factory trained engineers for field start up.



Valve Dimensions For 800B (Bottom Mounted Buffer) & 800T (Top Mounted Dashpot)

Size	800T	800B			
	G	H	N	J	P
6" / 150	21.375" / 543	13.375" / 340	8.625" / 219	2.75" / 70	11.5" / 292
8" / 200	28.625" / 727	14.75" / 375	7.75" / 197	3.625" / 92	11" / 279
10" / 250	30.625" / 778	16.5" / 419	5" / 127	4.125" / 105	9" / 229
12" / 300	31.875" / 810	17.875" / 454	7.125" / 181	5.125" / 130	11" / 279
14" / 350	35.875" / 911	19.75" / 502	4.75" / 121	5.375" / 137	9" / 229
16" / 400	43.5" / 105	21.625" / 549	4.625" / 117	5.25" / 133	9" / 229
18" / 450	44.875" / 1140	23.5" / 597	2.875" / 73	5.5" / 140	7" / 178
20" / 500	48.25" / 1226	26.25" / 667	5.25" / 133	7.125" / 181	12" / 305
24" / 600	60.875" / 1546	28.375" / 721	1.688" * / 43	6" / 152	3" / 76
30" / 750	69.625" / 1768	34.5" / 876	2.063" / 52	8.25" / 210	5" / 127
36" / 900	79.188" / 2011	39.25" / 997	8.75" * / 222	7.75" / 197	2" * / 51
42" / 1100	91" / 2311	46.5" / 1181	9.75" / 248	3.5" / 89	2" * / 51
48" / 1200	102" / 2591	50" / 1270	.5" * / 13	2.5" / 64	2" / 51
54" / 1400	122" / 3099	60" / 1524	3.25" * / 83	7" / 178	.75" * / 19
60" / 1500	124" / 3150	62.5" / 1588	11.375" * / 289	8" / 203	4" * / 102
72" / 1800	147" / 3734	73" / 1854	8" * / 203	3.5" / 89	3" / 76

Inch
Millimeter

*** Protrudes beyond the inlet flange**

About the Buffer

Bottom Mounted Buffers have been used successfully for decades to eliminate slamming of the valve disc and resultant water hammer.

Recommended where rapid flow reversal (caused by a hydro-pneumatic surge tank or a critical slope of discharge pipeline) is so fast that a free closing check valve cannot shut prior to reverse flow and therefore slams. The buffer will stop the disc at approximately 90% (adjustable) of closure and control close the disc to shut-off without slamming. This is accomplished with minimal pressure rise. The buffer system is self contained. Auxillary equipment is not required.

2. Series 800T - with Top Mounted Oil Dashpot (Slow Opening and Controlled Closing)

The Top Mounted Oil Dashpot System is highly recommended when slow open and full control closure of the disc (10) is essential. Slow gradual opening and control closing of the valve disc will prevent or greatly reduce surge pressures (water hammer) that can cause damage to the pipeline each time the pump starts and stops or when you experience power failure.

The system shown below works as follows:

1. **Slow Gradual Opening**
   Slow gradual opening is accomplished as the piston inside the cylinder (59) moves upwards pushing oil through the upper control valve (64).
2. **Full Control Closing Two (2) Stages**
   1st Stage: Closing control occurs as the piston moves downward pushing oil through the lower control valve (64). 2nd Stage: Final control stage occurs as the piston approaches the bottom of the cylinder and enters the internal cushion chamber, built into the cap of the cylinder.

By simply regulating each flow control valve (64), a slow gradual opening of the disc (10) can be achieved as well as variable control closing of the disc. Closing time adjustments can be made in the field to best suit your installation. This is a desirable feature because times for opening and closing computed during design of a pump station and pipeline may not coincide with actual field conditions.

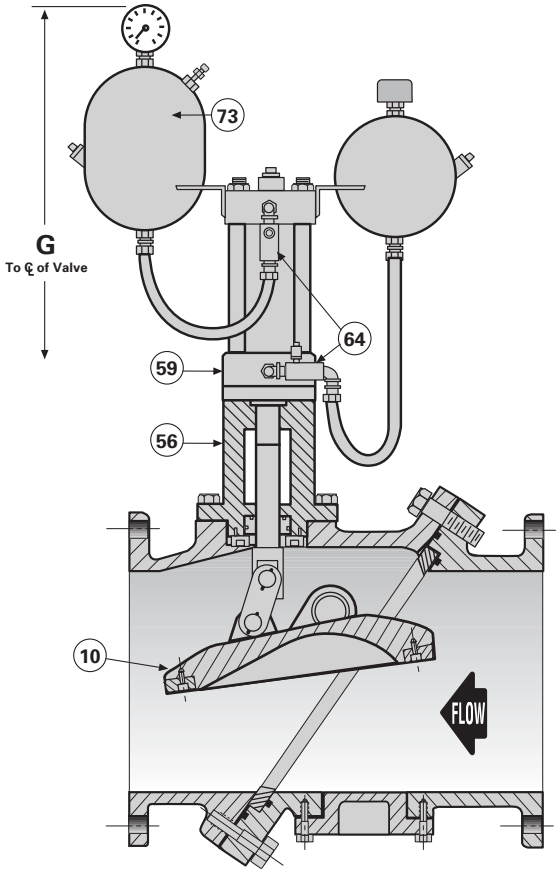
Once correct open and close times have been set, the flow control valves can be locked in position. A slightly pressurized hydro-pneumatic tank (73) serves as power to start the disc closing immediately when pumping stops.

Oil Dashpot System

The system described above is oil operated. We have found the oil system to be relatively trouble free and easier to maintain than water dashpot systems.

Oil is used to create an independent and closed system, completely separated from the main line media by a positive air gap spacer (56).

Therefore, the risk of oil contaminating potable water in the main line is eliminated. Oil also prevents problems such as corrosion, electrolysis, silt or mineral deposits from fouling up the cylinder and controls.



Top mounted valves are excellent for vertical turbine pumps without a Variable Frequency Drive.

3. Signal Switch

Electrical signal switches are available mounted on the indicator cover to give a local or remote signal indicating if the valve disc is open or closed.

4. Flow By-Pass

By-pass piping with a manual shut-off is readily available to permit flow around the disc when the check valve is closed (to drain system, etc.).

Series 800 – High Pressure Cast Steel Construction for Higher Pressure

Materials*

Bodies
Cast Steel ASTM A216 GR WCB

Disc
(2" - 10") (50 - 250mm) – Stainless Steel ASTM A351 CF8M
(12" And Up) – Cast Steel ASTM A216 GR WCB

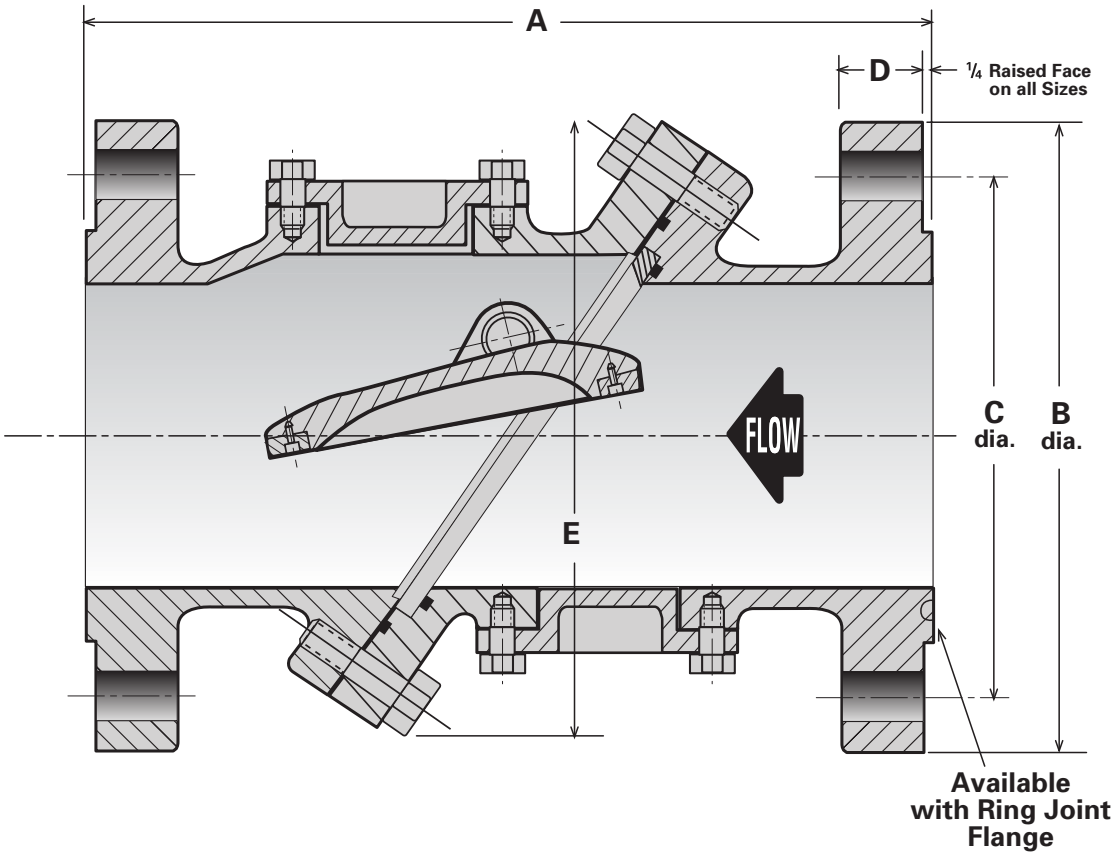
Body Seat Ring
Stainless Steel ASTM A351 CF8M

Disc Seat Ring
(12" And Up) (300 mm and up) – Stainless Steel ASTM A351 CF8M

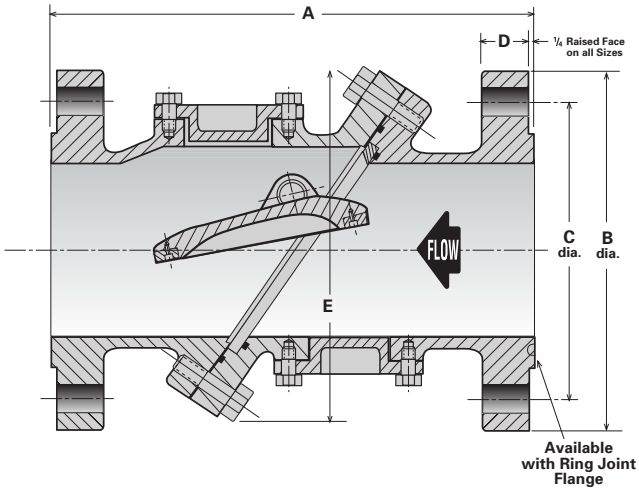
Pivot Pin
Stainless Steel ASTM A582 T303

Pivot Pin Bushing
(12" And Up) (300 mm and up) – Stainless Steel ASTM A269 T304

*Other materials available to suit pressure-temperature or corrosive applications



Series 800 High Pressure – Dimensions



Note:
dimensions for butt weld end valves and pressures up to 2500# class readily available from the APCO engineering department.

Dimensions for 400# Class Valves						
Size	**A**	**B**	**C**	**D**	**E**	**Weight**
3"	16"	8.25"	6.625"	1.5"	11"	125
80	406	210	168	38	279	57
4"	16.75"	10"	7.875"	1.625"	12"	150
100	425	254	200	41	305	68
6"	16.75"	12.5"	10.625"	1.875"	16"	275
150	425	318	270	48	406	125
8"	21.5"	15"	13"	2.125"	16.5"	450
200	546	381	330	54	419	204
10"	24.5"	17.5"	15.25"	2.375"	21.5"	675
250	622	446	387	60	546	306
12"	29.25"	20.5"	17.75"	2.5"	24.5"	825
300	743	521	451	64	622	374
14"	33.25"	23"	20.25"	2.625"	29"	1400
350	845	584	514	67	737	635
16"	35"	25.5"	22.5"	2.75"	32"	1700
400	889	648	572	70	813	771
18"	36.75"	28"	24.75"	2.875"	34.5"	2250
450	933	711	629	73	876	1021
20"	42.5"	30.5"	27"	3"	35"	2550
500	1080	775	686	76	889	1157
24"	44"	36"	32"	3.25"	42"	3700
600	1118	914	813	83	1067	1678

Inch Lbs
Millimeter Kg

Dimensions for 600# Class Valves						
Size	**A**	**B**	**C**	**D**	**E**	**Weight**
3"	16"	8.25"	6.625"	1.5"	11"	175
80	406	210	168	38	279	79
4"	17"	10.75"	8.5"	1.75"	12"	200
100	432	273	216	44	305	91
6"	17.25"	14"	11.5"	2.125"	16"	325
150	438	356	292	54	406	147
8"	22.125"	16.5"	13.75"	2.438"	16.5"	525
200	562	419	349	62	419	238
10"	25.25"	20"	17"	2.75"	21.5"	750
250	641	508	432	70	546	340
12"	30"	22"	19.25"	2.875"	24.5"	925
300	762	559	489	73	622	420
14"	34"	23.75"	20.75"	3"	29"	1600
350	864	603	527	76	737	726
16"	36"	27"	23.75"	3.25"	32"	1950
400	914	686	603	83	813	885
18"	38"	29.25"	25.75"	3.5"	34.5"	2500
450	965	743	654	89	876	1134
20"	40"	32"	28.5"	3.75"	35"	2900
500	1016	813	724	95	889	1315
24"	46"	37"	33"	4.25"	42"	4000
600	1168	940	838	108	1067	1814

Inch Lbs
Millimeter Kg

ANSI Pressure - Temperature Ratings

Maximum Non-Shock Service Pressure, PSI/kPa																							
Temp °F °C	**Cast Iron ASTM A126 CL B**						**Ductile Iron ASTM A536**		**Carbon Steel ASTM A216 GR WCB**							**Stainless Steel ASTM A351 CF 8M**							
	Class 125#			**Class 250#**			**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	400	600	900	1500	2500	150	300	400	600	900	1500	2500
0–150 -18–66	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-20–100 -29–38	—	—	—	—	—	—	250 1724	640 4413	285 1965	740 5102	990 6826	1480 10204	2220 15306	3705 25545	6170 42541	275 1896	720 4964	960 6619	1440 9928	2160 14893	3600 24821	6000 41369
-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	2122 14631	3540 24407	5897 40658	257 1772	670 4619	892 6150	1340 9239	2010 13858	3347 23077	5580 38473
200 93	190 1310	135 931	115 793	460 3172	280 1931	250 1724	235 1620	600 4137	260 1793	675 4654	900 6205	1350 9308	2025 13962	3375 23270	5625 38783	240 1655	620 4275	825 5688	1240 8549	1860 12824	3095 21339	5160 35577
250 121	175 1207	125 862	85 586	415 2861	260 1793	200 1379	225 1551	582 4013	245 1689	665 4585	887 6116	1332 9184	1997 13769	3327 22939	5547 38245	227 1565	590 4068	785 5412	1180 8136	1770 12204	2945 20305	4910 33853
300 149	165 1138	110 758	50 345	375 2586	240 1655	150 1034	215 1482	565 3896	230 1586	655 4516	875 6033	1315 9067	1970 13583	3280 22615	5470 37714	215 1482	560 3861	745 5137	1120 7722	1680 11583	2795 19271	4660 32130
Seat Test PSI kPa	200 1379	150 1034	150 1034	500 3447	300 2068	300 2068	275 1896	720 4964	315 2172	815 5619	1090 7515	1630 11238	2445 16858	4075 28096	6790 46815	305 2103	795 5481	1060 7308	1585 10928	2380 16410	3960 27303	6600 45505
Shell Test PSI kPa	300 2068	230 1586	230 1586	750 5171	450 3103	450 3103	400 2758	975 6722	450 3103	1125 7757	1500 10342	2225 15341	3350 23097	5575 38438	9275 63949	425 2930	1100 7584	1450 9997	2175 14996	3250 22408	5400 37232	9000 62053

F° PSI Inch
C° kPa Millimeter

Specifications - Series 800 Slanting Disc Check Valves

The body shall be a heavy two piece cast iron or ductile iron. The two body halves and body seat shall be O-ring sealed and bolted together in a manner to sandwich the body seat on a 55° angle. Each body half must have an access covered hole for internal inspection and each body half and disc fully machined to accept future attachments of a Bottom Buffer or Top Mounted Oil Dash Pot. The seat ring and disc ring must be of the design that permits replaceability in the field without need for special tools or machining. The pivot pins in the body and the bushings in the disc lugs must be stainless steel, but of different hardness to prevent galling. The bushings shall be press fit to prevent wear. An indicator shall be provided to show the position of the disc. The area throughout the valve body must be equal to full pipe area. The area through the seat section shall be 40% larger than the inlet and outlet of the valve to achieve low head loss.

Valve materials shall be certified conforming to following ASTM specifications:

Bodies	Cast Iron	ASTM A126 GR. B
	Ductile Iron	ASTM A536 GR 65-45-12
Disc (3" - 10", 80 - 250mm)	Bronze	Alloy C90700
Disc (12" & Larger, 300 mm & Larger)	Ductile Iron	ASTM A536
Seat Ring & Disc Ring	Bronze	ASTM B16 C36000
Pivot Pins	Stainless Steel	ASTM A582 T303
Pivot Pin Bushings	Stainless Steel	ASTM A269 T304
Exterior Paint	Universal Metal Primer	FDA Approved for Potable Water Contact

Valve to be APCO Series 800 Slanting Disc Check Valve.

Optional (Page 5) Series 800B with Bottom Mounted Buffer

For free open and positive non-slam closing, the valve must have a bottom mounted buffer. The buffer shall be designed to contact the disc during the last 10% (adjustable) of closure and control the final closing of the valve to prevent water hammer. The rate of closure to be externally adjustable and variable.

Optional (Page 6) Series 800T with Top Mounted Dashpot

For slow open and non-slam closing, a top mounted oil dashpot must be provided with slow opening and full control closing features to prevent surge and water hammer. Dashpot must have (2) control closing flow rates. (1) 90% primary adjustable rate (2) 10% adjustable slow rate during final disc closure. The dashpot must be a self contained oil system, separate and independent from the water line media. The oil reservoir for closing cycle shall be open to atmosphere with an air breather cap to prevent dust and other media from contaminating the oil. The oil reservoir for opening cycle must be hermetically sealed to contain pressure if necessary (air over oil) and be equipped with a pressure gauge and pneumatic air valve.

Specifications - Series 800
Slanting Disc Check Valves

Size of Pipe		3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"	60"	72"
Area Sq. In.		7.07	12.57	28.27	50.27	78.54	113.1	153.9	201.1	254.5	314.2	452.4	705.9	1017.9	1385.4	1809.6	2290.2	2827.4	4071.5
Area Sq. Ft.		.0491	.0873	.1964	.3491	.5454	.785	1.069	1.396	1.767	2.182	3.142	4.909	7.069	9.621	12.566	15.904	19.63	28.27
U.S. G.P.M.	C.F.S.	Velocity Ft./Sec.																	
60	.13	2.7	1.5	.07	0.4														
120	.27	5.4	3.1	1.4	0.8	0.5													
240	.53	10.9	6.1	2.7	1.5	1.0	0.7												
360	.80	16.3	9.2	4.1	2.3	1.5	1.02	.08											
480	1.07	21.8	12.3	5.5	3.1	2.0	1.4	1.0											
600	1.34	27.2	15.3	6.8	3.8	2.5	1.7	1.3	1.0										
900	2.01		23.0	10.2	5.7	3.7	2.6	1.9	1.4	1.1									
1200	2.78		30.6	13.6	7.7	4.9	3.4	2.5	1.9	1.5	1.2								
1800	4.01			20.4	11.5	7.4	5.1	3.8	2.9	2.3	1.8	1.3							
2400	5.35			27.2	15.3	9.8	6.8	5.0	3.8	3.0	2.5	1.7	1.1						
3000	6.69			34.0	19.2	12.3	8.5	6.3	4.8	3.8	3.1	2.1	1.4						
3600	8.02				23.0	14.7	10.2	7.5	5.7	4.5	3.7	2.5	1.6	1.1					
4200	9.36				26.8	17.2	11.9	8.8	6.7	5.3	4.3	3.0	1.9	1.3					
4800	10.70				30.6	19.6	13.6	10.0	7.7	6.1	4.9	3.4	2.2	1.5	1.1				
5400	12.03					22.1	15.3	11.3	8.6	6.8	5.5	3.8	2.5	1.7	1.3				
6000	13.37					24.5	17.0	12.5	9.6	7.6	6.1	4.3	2.7	1.9	1.4	1.1			
7200	16.05					29.4	20.4	15.0	11.5	9.1	7.4	5.1	3.3	2.3	1.7	1.3			
8400	18.72					34.3	23.8	17.5	13.4	10.6	8.6	6.0	3.8	2.6	1.9	1.5			
9600	21.39						27.2	20.0	15.3	12.1	9.8	6.8	4.4	3.0	2.2	1.7			
10800	24.07						30.6	22.5	17.2	13.6	11.0	7.7	4.9	3.4	2.5	1.9			
12000	26.74						34.1	25.0	19.2	15.1	12.3	8.5	5.4	3.8	2.8	2.1			
18000	40.11							37.5	28.7	22.7	18.4	12.8	8.2	5.7	4.2	3.2	2.6		
24000	53.49								38.3	30.3	24.5	17.0	10.9	7.6	5.6	4.3	3.5	2.7	
30000	66.86									37.8	30.6	21.3	13.6	9.5	6.9	5.3	4.4	3.4	
36000	80.23										36.8	25.5	16.3	11.4	8.3	6.4	5.0	4.1	2.8
42000	94.0													13.2	9.7	7.4	5.9	4.8	3.3
48000	108.0													15.1	11.1	8.5	6.7	5.4	3.8
54000	103.0													17.0	12.5	9.5	7.5	6.1	4.2
60000	133.6														13.9	10.6	8.7	6.8	4.7

Size of Pipe (mm)		80	100	150	200	250	300	350	400	450	500	600	750	900	1100	1200	1400	1500	1800
Area cm²		46	81	182	324	507	730	993	1297	1642	2027	2919	4554	6567	8938	11675	14775	18241	26268
Area m²		.0046	.0081	.0182	.0324	.0507	.0730	.0993	.1297	.1642	.2027	.2919	.4554	.6567	.8938	1.1675	1.4775	1.8241	2.6268
L.P.M.	m³/s	Velocity - Metres Per Second																	
227	.004	.82	.46	.02	.12														
454	.008	1.6	.94	.43	.24	.15													
908	.015	3.3	1.9	.82	.46	.30	.21												
1363	.023	5.0	2.8	1.2	.70	.46	.31	.02											
1817	.030	6.6	3.7	1.7	.94	.61	.43	.30											
2271	.038	8.3	4.7	2.1	1.2	.76	.52	.40	.30										
3407	.057		7.0	3.1	1.7	1.1	.79	.58	.43	.34									
4542	.076		9.3	4.1	2.3	1.5	1.0	.76	.58	.46	.37								
6814	.114			6.2	3.5	2.3	1.6	1.2	.88	.70	.55	.40							
9085	.151			8.3	4.7	3.0	2.1	1.5	1.2	.91	.76	.52	.34						
11356	.189			10.4	5.9	3.7	2.6	1.9	1.5	1.2	.94	.64	.43						
13627	.227				7.0	4.5	3.1	2.3	1.7	1.4	1.1	.76	.49	.34					
15899	.265				8.2	5.2	3.6	2.7	2.0	1.6	1.3	.91	.58	.40					
18170	.303				9.3	6.0	4.1	3.0	2.3	1.9	1.5	1.0	.67	.46	.34				
20441	.341					6.7	4.7	3.4	2.6	2.1	1.7	1.2	.76	.52	.40				
22712	.379					7.5	5.2	3.8	2.9	2.3	1.9	1.3	.82	.58	.43	.34			
27255	.454					9.0	6.2	4.6	3.5	2.8	2.3	1.6	1.0	.70	.52	.40			
31797	.530					10.5	7.3	5.3	4.1	3.2	2.6	1.8	1.2	.79	.58	.46			
36340	.606						8.3	6.1	4.7	3.7	3.0	2.1	1.3	.91	.67	.52			
40882	.681						9.3	6.9	5.2	4.1	3.4	2.3	1.5	1.0	.76	.58			
45425	.757						10.4	7.6	5.9	4.6	3.7	2.6	1.6	1.2	.85	.64			
68137	1.136							11.4	8.7	6.9	5.6	3.9	2.5	1.7	1.3	.98	.79		
90850	1.514								11.7	9.2	7.5	5.2	3.3	2.3	1.7	1.3	1.1	.82	
113562	1.893									11.5	9.3	6.5	4.1	2.9	2.1	1.6	1.3	1.0	
136275	2.271										11.2	7.8	5.0	3.5	2.5	2.0	1.5	1.2	.85
158987	2.650													4.0	3.0	2.3	1.8	1.5	1.0
181700	3.028													4.6	3.4	2.6	2.0	1.6	1.2
204412	3.407													5.2	3.8	2.9	2.3	1.9	1.3
227125	3.785														4.2	3.2	2.7	2.1	1.4

Comparisons

Check Valves merely selected for lowest initial purchase cost can quickly become an extremely expensive choice compared to Slanting Disc Check Valves which have lower head loss and are extremely efficient.

Energy Cost Saving Evaluation

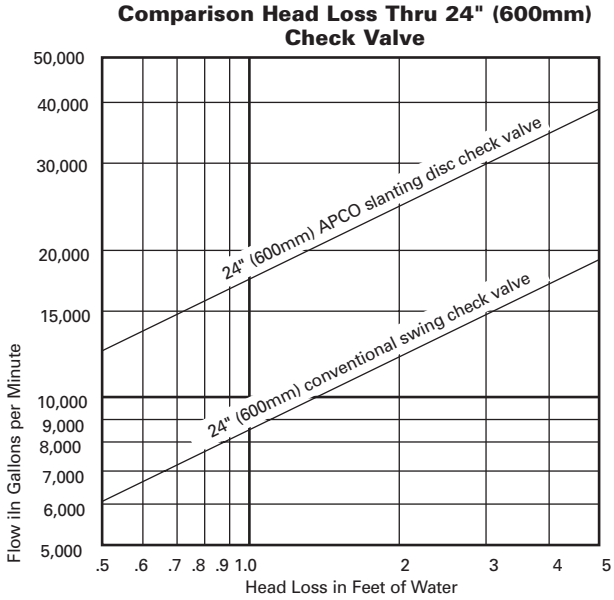
1) A 24" size pipeline to deliver water (Sp.Gr.=1) by pump with combined motor and pump efficiency (Ec) of 72% has a first year average delivery of 15,000 GPM and average energy cost of $0.08 per Kilowatt/Hour (cost may vary accordingly to local utility rates).

2) Using a conventional Swing Check Valve, head loss (HL) at 15,000 GPM is 3 feet of water.

3) Using an APCO Slanting Disc Check Valve, head loss (HL) at 15,000 GPM is 0.718 feet of water [Certified Tests conducted at Utah State University, Logan Utah Water Research Laboratory].
Energy cost dispensed for first year of check valve (Py) is:

$$Py = \frac{GPM \times HL \times Sp.\ Gr. \times .746 \times Cost \times 24\ Hour \times 365\ Days}{3960 \times Ec}$$

Since GPM, Sp. Gr., cost/KW-Hr, Ec, are common in the determination of Py for both valves.
Py = 2750.404 x HL



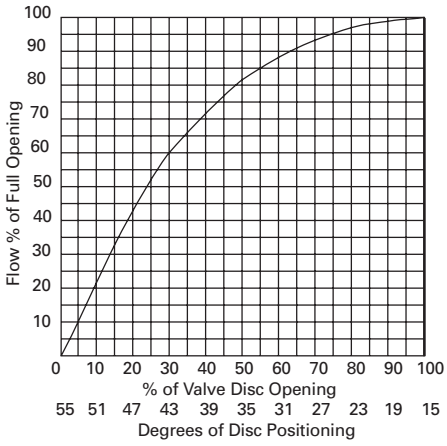
$8,251.21 - Energy cost using Conventional Swing Check Valve end of first year

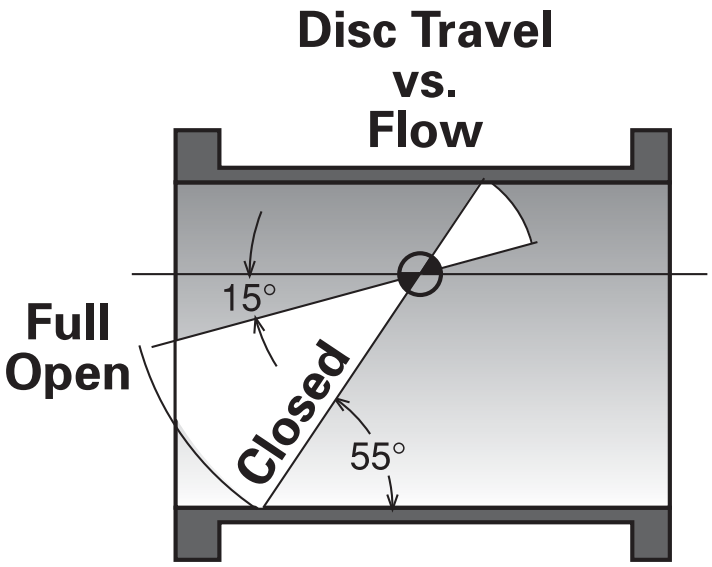
$1,974.76 - Energy cost using APCO Slanting Disc Check Valve end of first year

$6,276.45 - Energy cost saving using APCO Slanting Disc Check Valve end of first year

Average service life for an APCO Valve is 30 years and projecting a 2% future increase for water demand and energy cost will reflect estimated savings as follows:

Year	Yearly Savings	Cumulative Savings
1st	$6,276.45	$6,276.45
5th	6,793.80	32,662.75
10th	7,500.91	68,725.07
20th	9,143.56	152,500.55
30th	11,145.95	254,622.39





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Printed in the U.S.A.