BULLETIN 2200/2600
JULY 2011

DeZURIK
APCO | WILLAMETTE

WILLAMETTE BALL AND CONE VALVES

List 22
Series 2200
Metal Seated Cone Valves

List 26
Series 2600
AWWA Metal Seated
Ball Valves

List 26 Series 2600 Ball Valves

When You Can't Afford a Lesser Valve, Specify the Best . . .

Series 2600 — A Valve That Will Last for Decades.

The Willamette List 26 Metal Seated Ball Valve is the absolute premium quality valve for municipal applications. Water and sewage districts the world over recognize it as the best valve available for performance and reliability in critical service applications. List 26 valves are designed for standard pipe sizes from six to sixty inches. Standard design pressures are up to 300 psig (2068kpa), certain special designs are available for pressures in excess of 400 psig (2758kpa).

The List 26 is a heavy duty Ball Valve built especially for pump stop and check, pressure regulating, flow control and critical shut-off service in municipal systems. It is a superior valve because of its unique design features, uncompromising use of quality materials and the precision of its fabrication and assembly. The valve consists of four main elements: the body, the ball, the torque unit and the operator.

The body is a pressure vessel that houses the ball sub-assembly. It is cast in four pieces: two body halves and two adaptors, which are sealed together with O-rings to prevent leakage. The adaptors carry the body seats, made of 400 Series monel, and also serve as flanges for connecting the valve to the line.

The ball controls flow through the valve. It is, in effect, two intersecting cylinders, one being the full ported waterway, the other retaining the seats. The ball rotates on support trunnions that are integrally cast with the ball, ensuring maximum rigidity in the body. An operating shaft connects with one trunnion and extends through the body of the valve to the torque unit. Due to the trunnion mounted arrangement, the shaft acts as a rotating element only. Therefore, Willamette valve shafts do not fall victim to fatigue. They are made of 17-4PH high strength stainless steel. Other materials are available. Attached to the ball are 300 series stainless steel seats. The stainless steel seats have a flexible outer rim which deflects slightly to contact the mating monel body seat when the valve is closed.

The torque unit provides the multiplication of leverage to rotate the ball. It utilizes a lever attached to the ball operating shaft and a pair of metal links which work with a crosshead to rotate the ball its full ninety degrees. This link/lever action provides a large mechanical advantage when seating/unseating the valve. It also produces a variable ball rotation speed as the valve opens or closes, minimizing hazardous surge and water hammer.

The standard list of operators offered by Willamette is documented later in this brochure. Each one of them is fully capable of meeting the demands of any specific application.

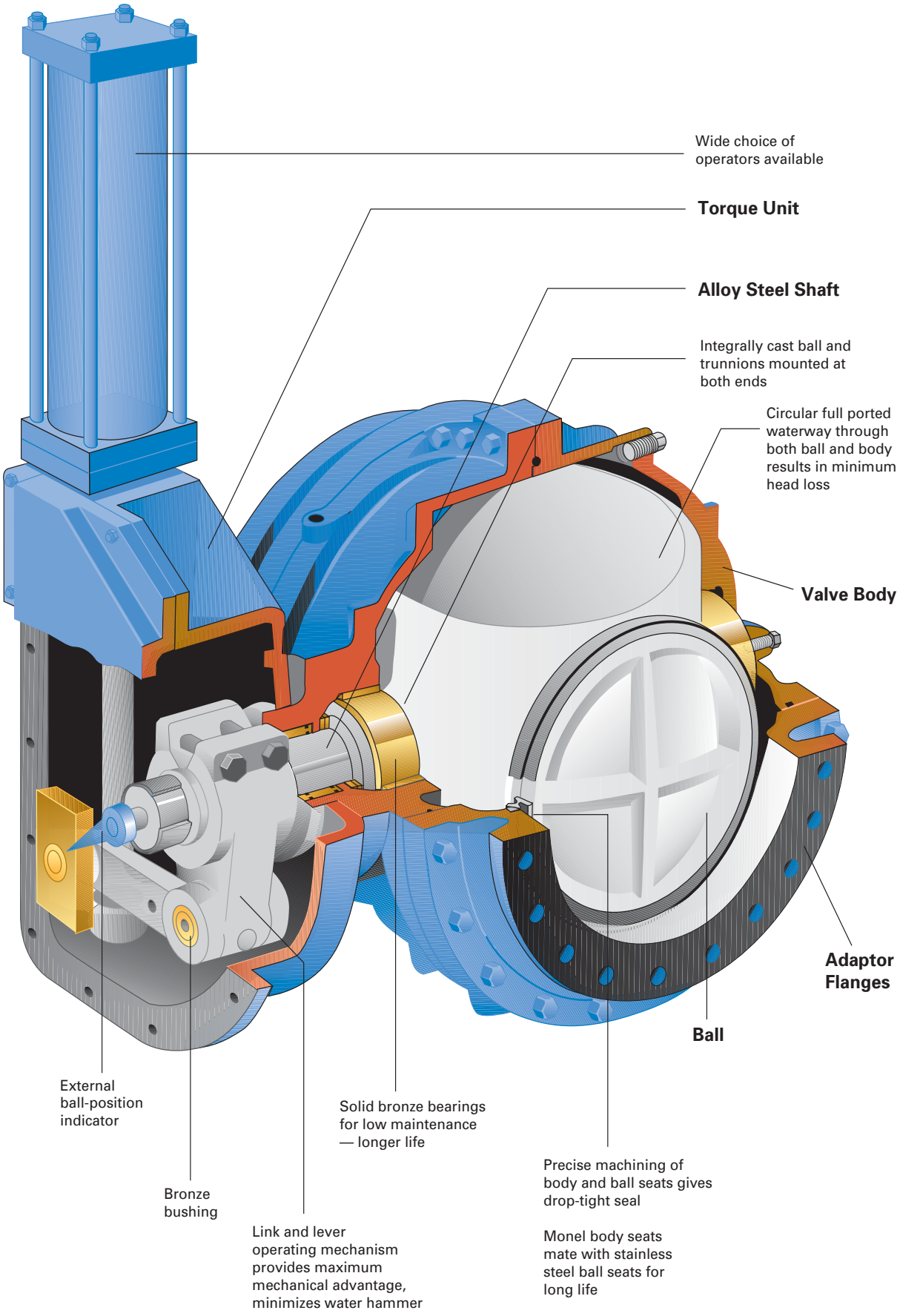
List 26 With Limitorque "T" Unit Direct Drive Operator

List 26 With Link and Lever Torque Unit

List 26 With Limitorque Direct Drive Operator

List 26

Cutaway View Metal Seated Ball Valve



List 26 Series 2600 Ball Valves

Metal Seated Ball Valve with Link and Lever Torque Unit

A.
Full Closed

B.
50% Stroke

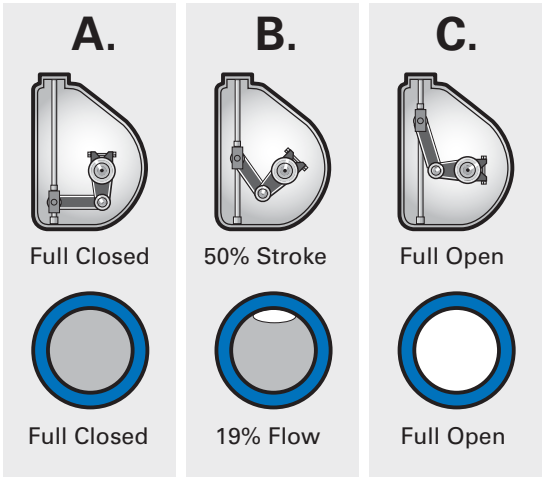
C.
Full Open

Torque Unit Controls Pump Start-Up and Shut-Down Surges

Precise Flow Regulation

The Willamette Link and Lever valve operating mechanism is designed to minimize water pressure surges and water hammer. In closing, 81% of the flow area is cut off during the first 50% of the operating stroke. The final 19% of the flow area is then slowly closed in the last 50% of the stroke. By shutting off the majority of the flow quickly, then slowly reducing the last 19% of the flow area, water hammer and system shock are virtually eliminated. The opposite occurs in the opening cycle, with a slow ball movement during the first half of the operating stroke.

These drawings illustrate the desirable effects of the List 26 Link and Lever Torque Unit. The variable plug rotation speed and mechanical advantage are obtained from the constant, linear operator movement. When the valve is closed, the links are at right angles to the lever. In theory, this arrangement provides a maximum mechanical advantage.



Lower Operator Torque

The Willamette Link and Lever Torque Unit has two other basic functions. First, it provides the ball shaft with a maximum amount of torque with a minimum amount of input. Operator torque requirements are reduced and easier operation is the result. Secondly, the torque unit provides adjustable mechanical stop, limiting devices for positioning the seats for final sealing and also ensuring a full port opening through the valve.

Link and Lever Torque Unit

List 26 Series 2600 Ball Valves

Advanced Components

These top and side views clearly define each component part that goes into the making of a Willamette List 26 AWWA Ball Valve.

Top View/Section

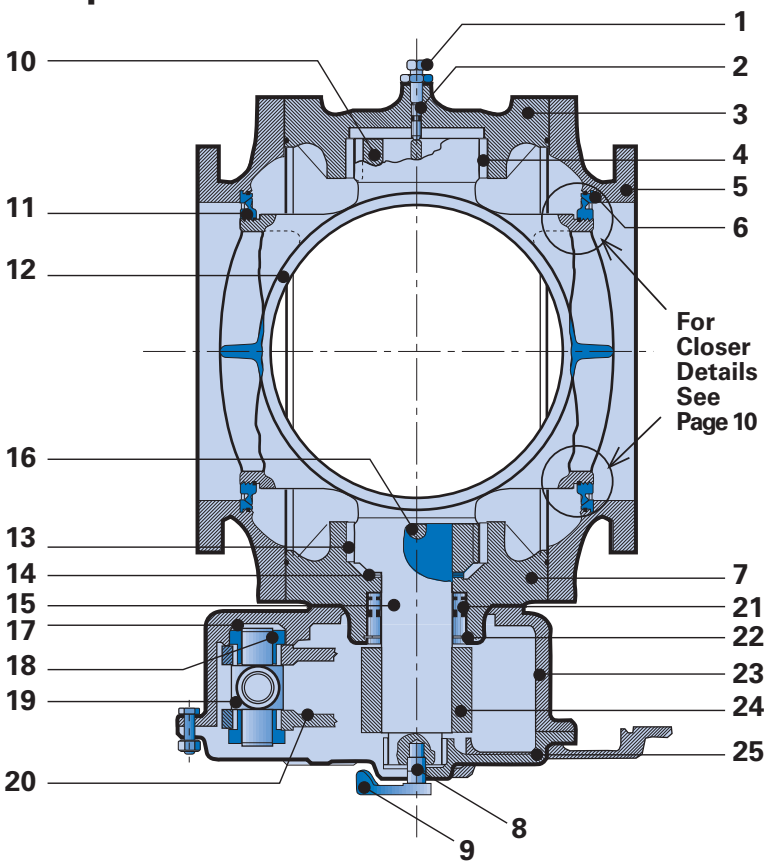
1. Thrust Screw . . . . . Steel
2. Thrust Pin . . . . . Bronze
3. Body – Trunnion End . . . . Cast or Ductile Iron
4. Body Bushing . . . . . Bronze
5. Adaptor . . . . . Cast or Ductile Iron
6. Adaptor Seat . . . . . Monel
7. Body – Operator End . . . . Cast or Ductile Iron
8. Indicator Shaft . . . . . Steel
9. Indicator . . . . . Cast Steel
10. Ball Journal . . . . . Bronze
11. Ball Seat Ring . . . . . Stainless Steel
12. Ball . . . . . Cast or Ductile Iron
13. Ball Journal . . . . . Bronze
14. Thrust Washers . . . . . Bronze
15. Ball Shaft . . . . . Steel
16. Torque Pin . . . . . Steel
17. Lock Ring . . . . . Steel
18. Sidemember . . . . . Cast Bronze
19. Crosshead . . . . . Cast Bronze
20. Link . . . . . Cast Steel – Bronze Bushed
21. O-Ring Retainer . . . . . Cast Bronze
22. Lock Ring . . . . . Cadmium Plated Steel
23. Torque Unit Housing . . . Cast Iron
24. Lever . . . . . Cast Steel
25. Torque Unit Cover . . . . Cast Iron

Note:
For ASTM numbers and materials for higher pressure class valves, see specifications on pages 26 and 27.

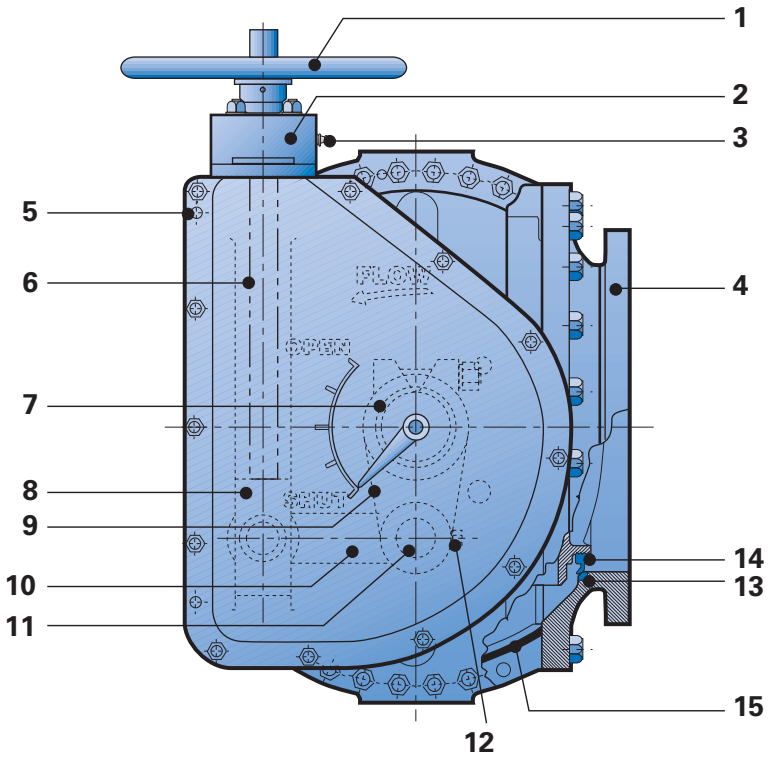
Side View

1. Handwheel . . . . . Cast Iron
2. Thrust Collar . . . . . Cast Iron
3. Grease Fitting . . . . . Stainless Steel
4. Adaptor . . . . . Cast or Ductile Iron
5. Dowel Pin . . . . . Steel
6. Leadscrew . . . . . Stainless Steel
7. Torque Key . . . . . Steel
8. Sidemember . . . . . Cast Bronze
9. Lever . . . . . Cast Steel
10. Links . . . . . Cast Steel – Bronze Bushed
11. Link Pin . . . . . Stainless Steel
12. Lock Screw . . . . . Steel
13. Adaptor Seat . . . . . Monel
14. Ball Seat Ring . . . . . Stainless Steel
15. O-Ring . . . . . Rubber

Top View/Section



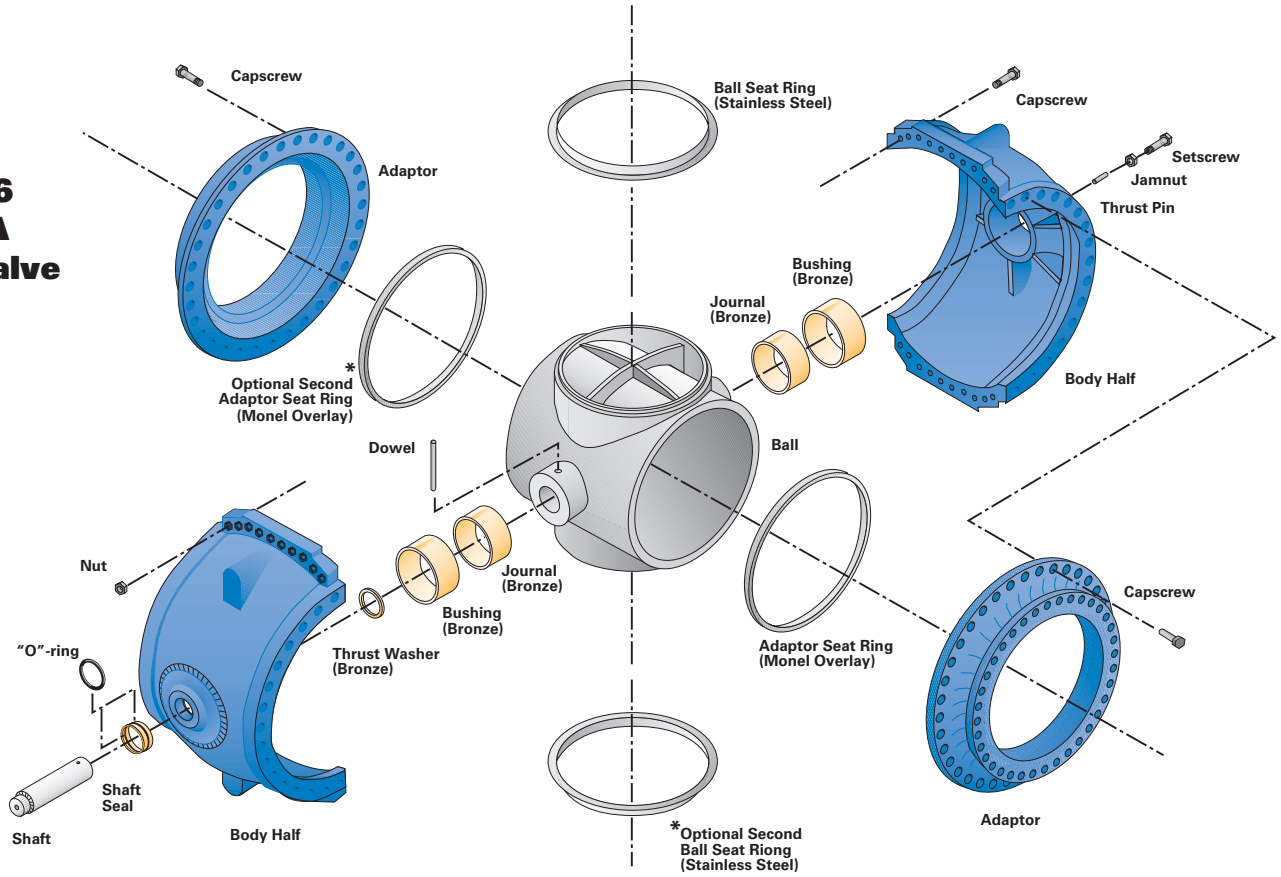
Side View



List 26 Series 2600 Ball Valves

Exploded Views

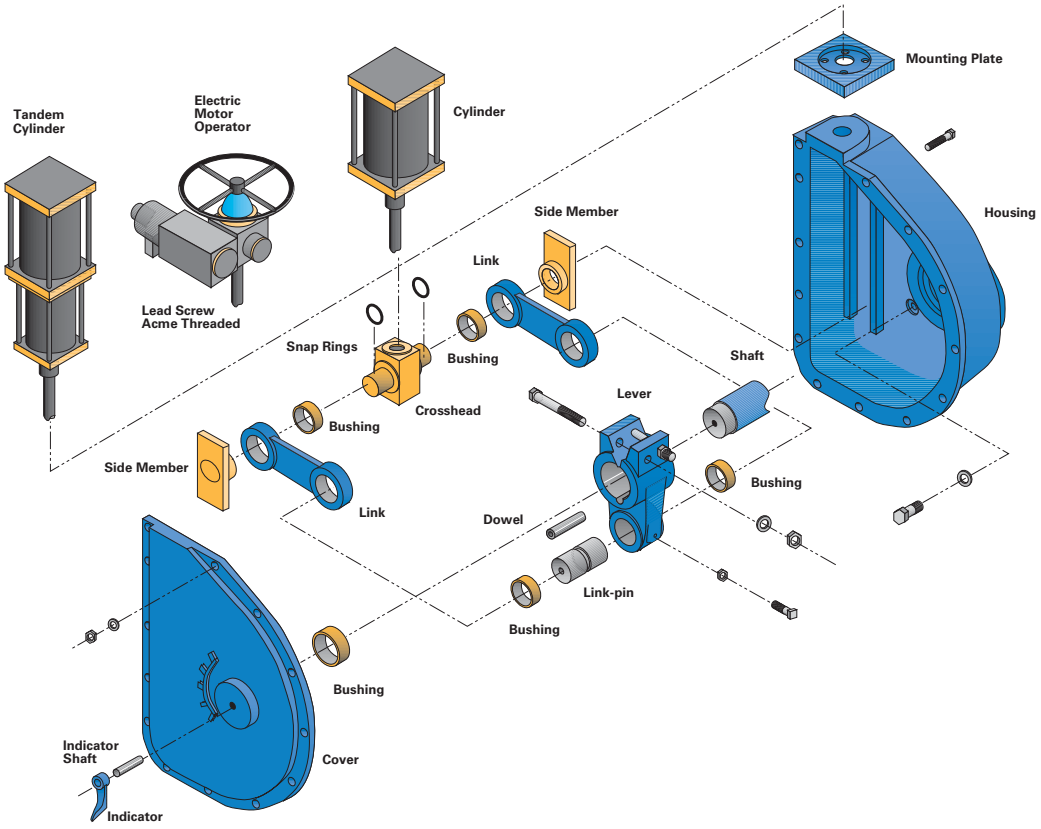
List 26 AWWA Ball Valve



Four piece body and ball sub-assembly of the Willamette List 26 Ball Valve (except the 6", 8", 48", 54" and 60" valves), (150, 200, 1200, 1400, 1500mm)

*** The overwhelming majority of metal seated ball valve applications are for single seated valves.**

Standard Link and Lever Torque Unit



List 26 Series 2600 Ball Valves

Cost/Performance Characteristics

100% Full Port Design Cuts Costs

Full ported valves are far more cost effective than other valve types, mainly because of lower head loss. This table shows annual power costs for different valve types. All amounts are based on $.09/kWh, continuous pumping (8,760 hours/year) at 70% overall efficiency with a line velocity of 16 ft/sec.

Example: When using a typical butterfly/swing check valve pump control combination for a 36" (900mm) diameter system, the check valve costs $22,284.00/year and the butterfly costs $8,969.00/year, compared to List 26 costs of $1279.00/year—a savings of $149,870.00 over five years.

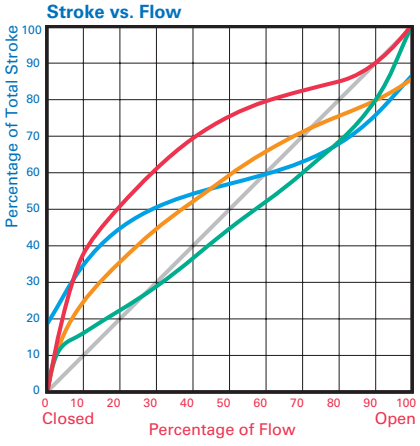
Estimated Annual Power Costs (in U.S. Dollars)					
Valve Diameter	Ball & Cone Valve	Gate Valve	Swing Check Valve	Butterfly Valve	Globe Valve
6" / 150	119	133	885	800	6,046
8" / 200	171	216	1,475	1,312	9,916
10" / 250	206	369	2,322	1,611	15,667
12" / 300	236	494	3,060	2,160	20,976
14" / 350	321	671	4,158	2,573	28,533
16" / 400	418	874	5,434	2,739	37,233
18" / 450	437	1,025	6,396	3,203	43,500
20" / 500	523	1,264	7,889	3,956	53,748
24" / 600	711	1,821	11,369	5,695	77,378
30" / 750	977	2,610	15,476	6,226	105,837
36" / 900	1,279	3,576	22,284	8,969	152,396
42" / 1100	1,615	4,645	28,828	11,645	197,738
48" / 1200	2,112	5,935	37,675	15,210	258,232
54" / 1400	2,278	7,336	45,601	18,259	310,100
60" / 1500	2,433	9,032	56,328	22,546	382,648

Inch
Millimeter

Full Port Design Makes Sense!

Variable Ball Rotation Controls Surge

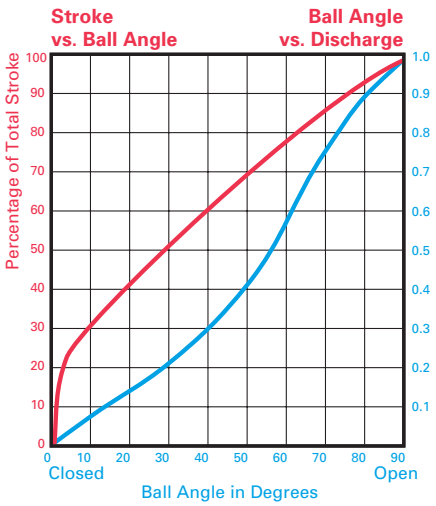
This graph compares Willamette List 26 opening characteristics with the opening characteristics of other major valve types. The curves show that the opening flow through a List 26 is an optimum accelerating pattern, slow at first, then smoothly increasing to full port. Closing is just the reverse, with the first 50% of the stroke reducing flow by 81%, and the final 50% closing the valve completely. This flow pattern is more effective at controlling water hammer and surge than any other valve. It constitutes one of the major design advantages of the List 26.



List 26
Cone Valve
Butterfly Valve
Gate Valve
Needle & Globe Valve

Ball Angle, Flow Area Accelerate During Stroke

This graph shows the relationships of stroke, ball angle and valve discharge rate during the List 26 opening rotation. As the ball rotates slowly early in the stroke, discharge rate is low and highly controlled. As the stroke continues, the ball angle accelerates, allowing a corresponding increase in discharge rate. At full port, discharge is at maximum and flow obstruction is near zero. This function, which minimizes pressure changes, is accomplished on the List 26 without complicated variable speed operators or controls.



Total Stroke vs. Ball Angle
Ball Angle vs. Coefficient of Discharge

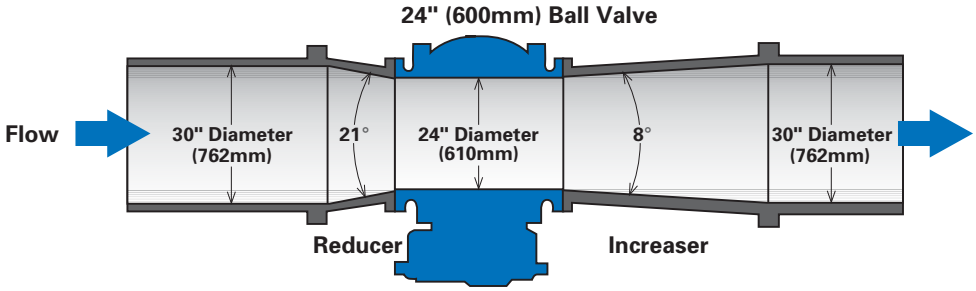
List 26 Series 2600 Ball Valves

Cost/Performance Characteristics

Venturi Allows Smaller-Than-Line-Size Valve Use

The venturi-type installation allows effective use of the List 26 in smaller-than-line-size applications, such as distribution systems, pressure reducing service and gravity mains. The List 26 is ideal for these applications because of its unobstructed waterway. In many venturi installations, it can be specified one or two sizes smaller than normal line size.

The user benefits from the superior operating and maintenance features of the List 26 at a cost competitive with the larger obstructed-waterway valves. In some cases, headloss resulting from the venturi-List 26 combination is actually less than from the larger obstructed-waterway valves. Tests have shown a 24" (600mm) venturi, for example, to produce less head loss than a 30" (750mm) gate or butterfly valve in certain applications.



APPROXIMATE C_v VALUES
APCO Willamette Ball Valve for Closed Loop System Plug Angle in Degrees from Closed

Valve Size (inches)	5°	10°	30°	50°	70°	Fully Open
6" / 150	34	70	226	484	1,043	3,400
8" / 200	61	124	401	859	1,853	6,688
10" / 250	96	194	627	1,343	2,896	11,942
12" / 300	137	280	902	1,934	4,170	19,300
14" / 350	187	381	1,229	2,633	5,676	26,300
16" / 400	245	497	1,605	3,440	7,414	34,400
18" / 450	310	629	2,031	4,353	9,383	47,890
20" / 500	382	777	2,508	5,375	11,586	59,900
24" / 600	550	1,119	3,612	7,740	16,683	88,900
30" / 750	860	1,748	5,643	12,092	26,065	147,800
36" / 900	1,238	2,517	8,126	17,413	37,535	222,000
42" / 1100	1,685	3,426	11,060	23,699	51,085	316,000
48" / 1200	2,201	4,475	14,445	30,954	66,723	413,000
54" / 1400	2,786	5,664	18,282	39,176	84,447	565,880
60" / 1500	3,439	6,993	22,571	48,367	104,257	752,300

Inch
Millimeter

Improved Valve Flow Coefficients

C_v values are based on the amount of flow through a full ported ball valve in a closed loop system at 1.0 psig (6.9 kpa) constant pressure drop.

C_V calculations based on:

$$C_V = Q \times \sqrt{\frac{SG}{\Delta P}}$$

Q = Flow in U.S. gallons per minute (GPM)
ΔP = Pressure drop (PSI)
SG = Specific gravity of fluid (Water = 1.0)
C_V = Valve flow coefficient

Note:
For more specific flow information, please contact your DeZURIK APCO Willamette representative.

List 26 Series 2600 Ball Valves

Metal to Metal Seats

Spring Seat Design

Closing Action

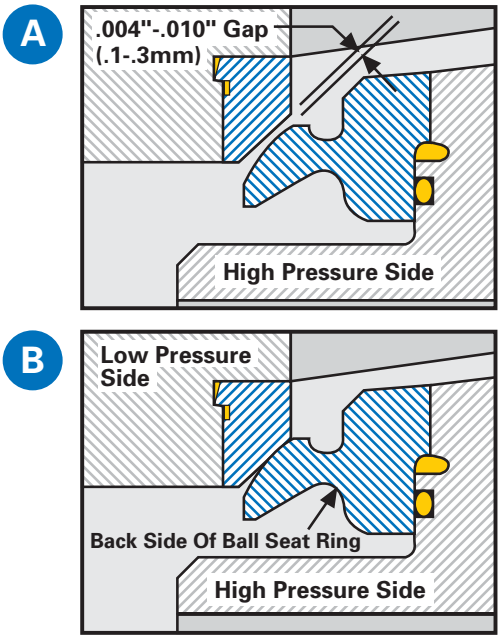
The ball is fully rotated and positioned for final sealing using positive mechanical stops in the valve actuating mechanism. **(Figure A)**

Closed and Seated

The differential pressure (high pressure/low pressure) acting on the back side of the ball seat ring causes the outer rim to deflect slightly, causing the ball and ball seat ring to move forward and make contact with the body seat ring. **(Figure B)**

Opening Action

The ball is rotated to open the valve by the valve actuating mechanism. After the ball rotates approximately one half degree, the offset eccentric action is sufficient to pull the ball seat back far enough to overcome the ball seat ring deflection. Seats never again make contact during rotation of the ball. The ball stays in the open position using positive mechanical stops in the valve actuating mechanism to form a smooth, unobstructed water passage.



Metal to Metal Seats Last Decades Longer Than Rubber Seats

Rubber seated valves that are initially less expensive, can become very costly and inconvenient when your system is shut down due to inevitable rubber seat repair and/or replacement. Our design has resulted in metal-to-metal seats that can handle tough applications and provide long maintenance-free life without wedging, galling, scraping or seat replacement.

Metal to Metal Seats Are Designed For Severe Throttling Service. Rubber Seats Are Not!

48" (1200mm) 300# Class Turbine Guard Valve with High Pressure Accumulator Installed in Northern California. Hydro Electric Project Emergency Shut-Off Valve

List 26 Series 2600 Ball Valve Features

Precise Flow Regulation

List 26 Ball Valves will control pressure differentials and flow rates to extremely close limits without hunting, vibrating or excessive noise. List 26 valves act as an energy absorber in any throttled position due to the back pressure inside the valve body and around the ball. This, together with durable metal to metal seats which allow line velocities in excess of 100 ft./sec. (30 m/sec.), make Willamette Ball Valves ideal for throttling applications.

Virtually Maintenance Free

Thousands of Willamette Ball Valves have been in service for over a 40 year period almost completely trouble-free.

Self Cleaning, Non-Clogging Design

When the valve is opening or closing, flow goes through and around the ball, flushing out debris. This makes the List 26 ideally suited for raw sewage service, assuring complete closing of the valve.

Drop-Tight Shutoff

Metal to metal seats mate precisely, maintaining a drop-tight seal. The seal lasts the life of the valve because of the durability of the metal and the eccentric motion of the seats. (Standard leakage is defined as 1oz. (29.57 mL) per nominal inch size per hour.)

No Measurable Head Loss

True full port opening results in no more head loss than an equivalent length of pipe.

Trunnion Mounted

The trunnion mounted ball allows the majority of the hydraulic load to be supported by the trunnions, resulting in low bearing pressure and no shaft fatigue.

Longer Bearing Life

Bearing materials are made of different degrees of hardness preventing galling and extending life. Bearing pressures are low compared to similar valves (900 psig (6205kpa) for 150# class and 1500 psig (10342kpa) for 250# class). Solid bronze construction means longer, trouble-free service, and like our metal seats, the bearings will last the life of the valve.

Lifetime Seats

Our competitors say their seats are easily replaceable because they have to replace their seats. Under normal operating conditions you won't have to replace List 26 metal seats.

Engineering Reminders

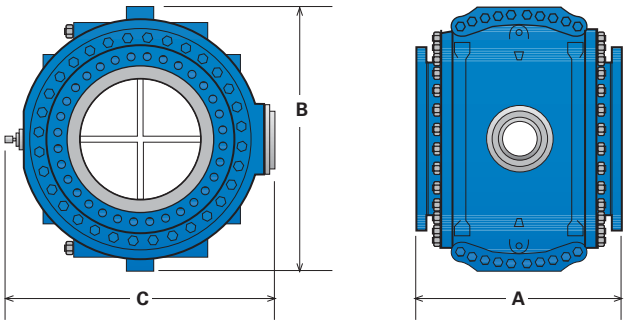
1. **Metal seated ball valves and adjacent pipe must be independently supported.**
2. **Valve supports are not intended for use as anchors.**
3. **Due to the fact that alignment between the valve and adjacent pipe should be stress free, it is recommended that a flexible connection be installed on the valve seat side.**

Coastal Water Authority, Houston, TX
Lynchburg Pump Station
Air/Oil Tandem Cylinders

Hydraulic Water Cylinder Actuated
List 26

List 26 Series 2600 Ball Valves

Valve and Operating Mechanism Dimensions



Envelope dimensions of the ball valve assembly (valve and operating mechanism) are shown below.

For more specific dimensions, please contact your DeZURIK APCO Willamette representative.

Dimensions and specifications given in this publication were correct at time of printing, but should not be used in lieu of certified drawings.

Note: All Dimensions For Class 250# Valves Also Apply to Class 300# Valves.

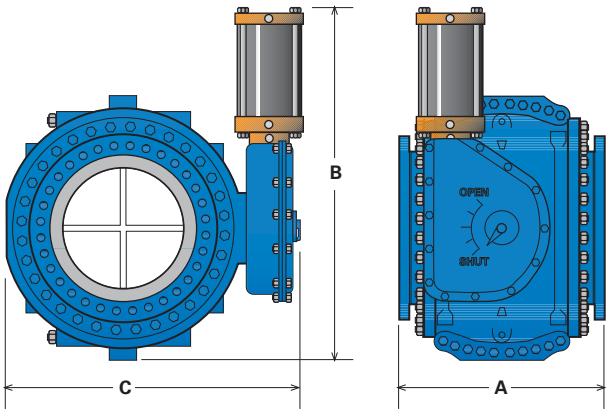
APCO Willamette List 26 Ball valves are manufactured to AWWA C-507 standard for ball valves 6" - 48" (150 - 1200mm) 150, 250 and 300psi pressure classes. 54" - 60" (1400 - 1500mm) also available.

List 26 – AWWA Metal Seated Ball Valve

Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	14 356	14 356	15.125 384	15.125 384	382 173	422 191
8" 200	15 381	15.25 387	17.5 445	17.5 445	19.125 486	19.125 486	432 196	492 223
10" 250	18.5 470	20.125 511	22.25 565	22.25 565	21.5 546	21.5 546	812 368	802 364
12" 300	19.5 495	21.375 543	26 660	26 660	23.125 587	23.125 587	982 445	1012 459
14" 350	22.125 562	26.5 673	29.5 749	29.5 749	28.25 718	28.25 718	1432 650	1502 681
16" 400	25 635	27 686	31.25 794	31.25 794	29.25 743	29.25 743	1882 854	2082 944
18" 450	28.5 724	31 787	38.5 978	38.5 978	37 940	37 940	2273 1031	2404 1090
20" 500	30 762	34 864	38.5 978	38.5 978	37 940	37 940	2973 1349	2944 1335
24" 600	35.375 899	39.125 994	46 1168	46 1168	41.875 1064	41.875 1064	4124 1871	6227 2825
30" 750	44.25 1124	47.25 1200	57.5 1461	57.5 1461	53 1346	53 1346	7227 3278	10506 4765
36" 900	53 1346	55 1397	67 1702	67 1702	59.875 1521	59.875 1521	11227 5092	15556 7056
42" 1100	59.5 1511	63 1600	78 1981	78 1981	68.75 1746	68.75 1746	15076 6838	18850 8550
48" 1200	72 1829	74.5 1892	89.5 2273	89.5 2273	94.625 2403	94.625 2403	15125 6861	24250 11000

Inch
Millimeter

Hydraulic Cylinder Operator



Torque unit (valve operating mechanism) complete with appropriate operator is shown in its customary vertical orientation, (perpendicular to pipeline), however, torque unit complete with operator may be rotated in any of 90° increments (parallel with pipe-line) if so desired to suit installation requirements.

Valve accessories such as control piping, limit switches, etc., not shown.

List 26 – Hydraulic Cylinder Operator

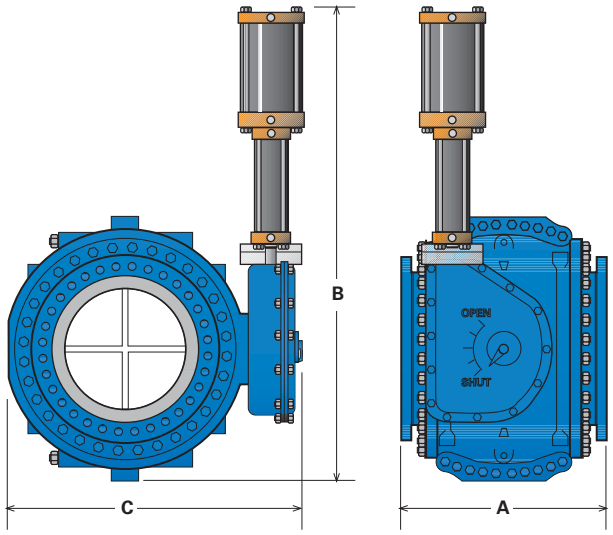
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	32 813	32 813	23.5 597	23.5 597	600 272	640 290
8" 200	15 381	15.25 387	33.75 857	33.75 857	27.5 699	27.5 699	750 340	810 367
10" 250	18.5 470	20.125 511	36.125 918	42.875 1089	29.875 759	29.625 752	1200 544	1290 585
12" 300	19.5 495	21.375 543	38 965	44.75 1137	31.5 800	31.25 794	1500 680	1630 739
14" 350	22.125 562	26.5 673	46.5 1181	46.5 1181	36.375 924	36.375 924	2200 998	2270 1030
16" 400	25 635	27 686	47.375 1203	58.125 1476	37.375 949	40.5 1029	2500 1134	2700 1225
18" 450	28.5 724	31 787	61.75 1568	68.75 1746	48.25 1226	50.375 1280	3200 1451	3700 1678
20" 500	30 762	34 864	61.75 1568	68.75 1746	48.25 1226	50.375 1280	4000 1814	4300 1950
24" 600	35.375 899	39.125 994	72.5 1842	79.625 2022	55.25 1403	56.125 1426	5700 2585	9200 4173
30" 750	44.25 1124	47.25 1200	85.375 2169	90.125 2289	67.25 1708	70.25 1784	10000 4536	14150 6418
36" 900	53 1346	55 1397	90.125 2289	94.875 2410	74.125 1883	77.125 1959	14500 6577	19200 8709
42" 1100	59.5 1511	63 1600	100.375 2550	111.625 2835	86 2184	92.5 2350	20800 9435	26800 12156
48" 1200	72 1829	74.5 1892	107.875 2740	119.125 3026	111.875 2842	118.375 3007	29000 13154	32600 14787

Inch
Millimeter

List 26 Series 2600 Ball Valves

Valve and Operating Mechanism Dimensions

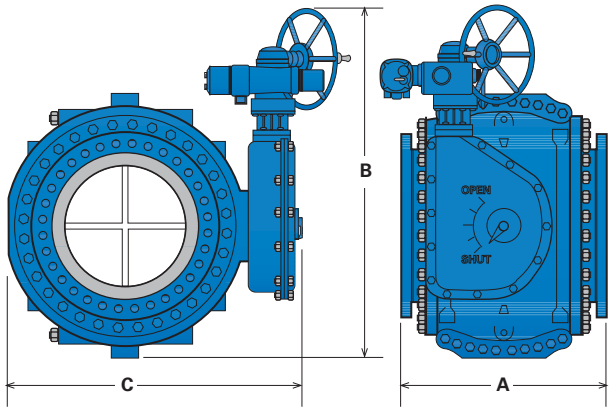
Air/Oil Tandem Cylinder Operator



List 26 – Air/Oil Tandem Cylinder Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	45.5 1156	45.5 1156	23.5 597	23.5 597	675 306	715 324
8" 200	15 381	15.25 387	47.25 1200	47.25 1200	27.5 699	27.5 699	900 408	960 435
10" 250	18.5 470	20.125 511	49.625 1260	58.125 1476	29.875 759	29.625 752	1400 635	1500 680
12" 300	19.5 495	21.375 543	51.5 1308	60 1524	31.5 800	31.25 794	1800 816	1930 875
14" 350	22.125 562	26.5 673	61.75 1568	61.75 1568	36.375 924	36.375 924	2600 1179	2680 1216
16" 400	25 635	27 686	62.625 1591	78.625 1997	37.375 949	40.5 1029	2800 1270	3000 1361
18" 450	28.5 724	31 787	82.25 2089	93.75 2381	48.25 1226	50.375 1280	3500 1588	4000 1814
20" 500	30 762	34 864	82.25 2089	93.75 2381	48.25 1226	50.375 1280	4400 1996	4660 2114
24" 600	35.375 899	39.125 994	97.5 2477	108.125 2746	55.25 1403	56.125 1426	6200 2812	10475 4751
30" 750	44.25 1124	47.25 1200	113.875 2892	120.625 3064	67.25 1708	70.25 1784	11100 5035	15300 6940
36" 900	53 1346	55 1397	118.625 3013	125.375 3185	74.125 1883	77.125 1959	16000 7257	20350 9231
42" 1100	59.5 1511	63 1600	130.875 3324	147.125 3737	86 2184	92.5 2350	23500 10659	29500 13381
48" 1200	72 1829	74.5 1892	138.375 3515	154.625 3927	111.875 2842	118.375 3007	32000 14515	35600 16148

Inch
Millimeter

Motor Operator



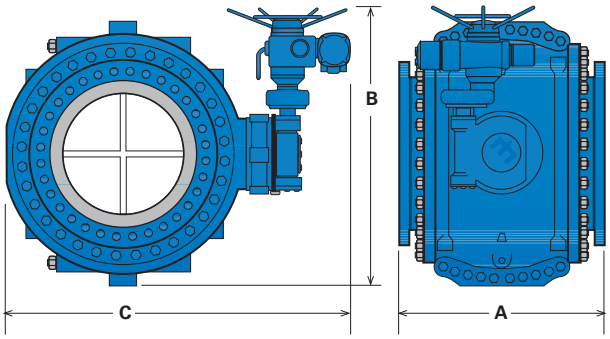
List 26 – Motor Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	34 864	34 864	23.5 597	23.5 597	600 272	640 290
8" 200	15 381	15.25 387	35.75 908	35.75 908	27.5 699	27.5 699	750 340	810 367
10" 250	18.5 470	20.125 511	38.125 968	40.875 1038	29.875 759	29.625 752	1200 544	1290 585
12" 300	19.5 495	21.375 543	40 1016	42.75 1086	31.5 800	31.25 794	1500 680	1630 739
14" 350	22.125 562	26.5 673	44.5 1130	49.5 1257	36.375 924	36.375 924	2200 998	2270 1030
16" 400	25 635	27 686	50.375 1280	54.875 1394	37.375 949	40.5 1029	2500 1134	2700 1225
18" 450	28.5 724	31 787	58.5 1486	59.75 1518	48.25 1226	50.375 1280	3200 1451	3700 1678
20" 500	30 762	34 864	58.5 1486	59.75 1518	48.25 1226	50.375 1280	4000 1814	4300 1950
24" 600	35.375 899	39.125 994	63.5 1613	67.625 1718	55.25 1403	56.125 1426	5700 2585	9200 4173
30" 750	44.25 1124	47.25 1200	73.125 1857	75.375 1915	67.25 1708	70.25 1784	10000 4536	14150 6418
36" 900	53 1346	55 1397	77.875 1978	80.125 2035	74.125 1883	77.125 1959	14500 6577	19200 8709
42" 1100	59.5 1511	63 1600	85.625 2175	91.875 2334	86 2184	92.5 2350	20800 9435	26800 12156
48" 1200	72 1829	74.5 1892	93.125 2365	99.375 2524	111.875 2842	118.375 3007	29000 13154	32600 14787

Inch
Millimeter

List 26 Series 2600 Ball Valves

Valve and Operating Mechanism Dimensions

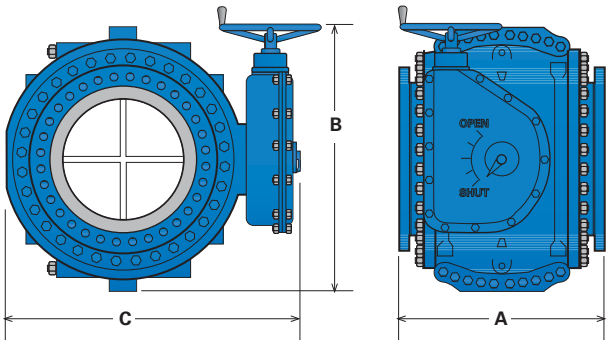
Electric Motor Operator with 90° Direct Drive



List 26 – Motor Operator with 90° Direct Drive								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	27 686	27 686	37.625 956	37.625 956	441 200	481 218
8" 200	15 381	15.25 387	28.75 730	28.75 730	41.625 1057	41.625 1057	491 223	551 250
10" 250	18.5 470	20.125 511	35.125 892	35.125 892	45.25 1149	45.25 1149	871 395	961 436
12" 300	19.5 495	21.375 543	37 940	37 940	46.875 1191	46.875 1191	1041 472	1121 508
14" 350	22.125 562	26.5 673	38.75 984	38.75 984	52 1321	52 1321	1541 699	1611 731
16" 400	25 635	27 686	40.125 1019	40.125 1019	55 1397	55 1397	1991 903	2241 1017
18" 450	28.5 724	31 787	43.75 1111	43.75 1111	62.75 1594	62.75 1594	2589 1174	2988 1355
20" 500	30 762	34 864	43.75 1111	43.75 1111	62.75 1594	62.75 1594	3289 1492	3528 1600
24" 600	35.375 899	39.125 994	54 1372	54 1372	71.875 1826	71.875 1826	4708 2136	7076 3210
30" 750	44.25 1124	47.25 1200	59.75 1518	59.75 1518	83 2108	83 2108	8076 3663	11922 5408
36" 900	53 1346	55 1397	67.5 1715	67.5 1715	89.875 2283	89.875 2283	12076 5478	16972 7698
42" 1100	59.5 1511	63 1600	76 1930	76 1930	98.75 2508	98.75 2508	16492 7481	22492 10202
48" 1200	72 1829	74.5 1892	81 2057	81 2057	126.625 3216	126.625 3216	24292 11019	27892 12652

Inch
Millimeter

Manual Operator



List 26 – Manual Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	14 356	14.875 378	22.75 578	22.75 578	23.5 597	23.5 597	500 227	540 245
8" 200	15 381	15.25 387	24.5 622	24.5 622	27.5 699	27.5 699	550 249	610 277
10" 250	18.5 470	20.125 511	26.875 683	31.875 810	29.875 759	29.625 752	930 422	1020 463
12" 300	19.5 495	21.375 543	28.75 730	33.75 857	31.5 800	31.25 794	1100 499	1230 558
14" 350	22.125 562	26.5 673	35.5 902	35.5 902	36.375 924	36.375 924	1650 748	1720 780
16" 400	25 635	27 686	36.375 924	42 1067	37.375 949	40.5 1029	2100 953	2300 1043
18" 450	28.5 724	31 787	45.625 1159	47.625 1210	48.25 1226	50.375 1280	2800 1270	3280 1488
20" 500	30 762	34 864	45.625 1159	47.625 1210	48.25 1226	50.375 1280	3500 1588	3820 1733
24" 600	35.375 899	39.125 994	51.375 1305	56.25 1429	55.25 1403	56.125 1426	5000 2268	7500 3402
30" 750	44.25 1124	47.25 1200	62 1575	67.625 1718	67.25 1708	70.25 1784	8500 3856	12630 5729
36" 900	53 1346	55 1397	66.75 1695	72.375 1838	74.125 1883	77.125 1959	12500 5670	17680 8020
42" 1100	59.5 1511	63 1600	77.875 1978	84.125 2137	86 2184	92.5 2350	17200 7802	23200 10523
48" 1200	72 1829	74.5 1892	85.375 2169	91.625 2327	111.875 2842	118.375 3007	25000 11340	28600 12973

Inch
Millimeter

List 26 Ball Valves and List 22 Cone Valves

Operator Characteristics

Operators

Willamette List 26 Ball Valves can be supplied with standard manual, electric motor or cylinder operators for most applications. Other operator control accessories can be supplied that allow the user to tailor the List 26 to specific performance requirements.

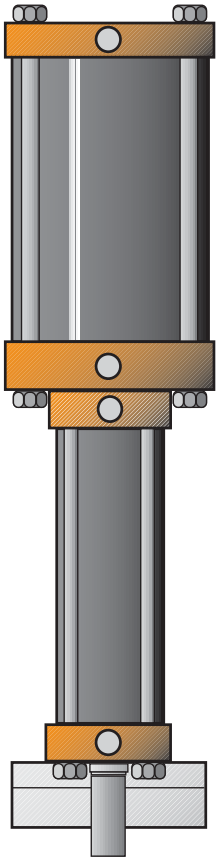
These same operators are used with the List 22 Cone Valves described in the second part of this brochure.

Cylinder Operators

Cylinder operators are specified for automatic operations.

Hydraulic Cylinder

This operator uses a double-acting piston which opens and closes the valve when pressure is introduced. This is a standard cylinder powered by water or oil, designed per AWWA C540.

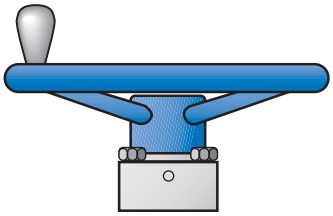


Air/Oil Tandem Cylinder

The tandem cylinder above is our preferred operator. This air/oil system eliminates the installation of a costly hydraulic accumulator system by using a compressed air supply for a power source. This supply of compressed air also furnishes an accumulated source of energy to provide an emergency closure of the valve during power failure or other unexpected conditions.

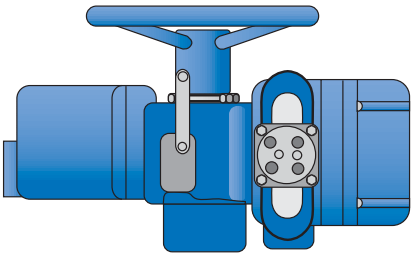
A clean reliable source of air (for best results, 85-125 psig (586 - 862kpa) is provided to the upper cylinder to power the valve. The lower cylinder is oil filled and is used to provide control of the opening and closing times with the smooth operation of oil.

For all valves, emergency fast closing function can be provided for rapid closure in the event of loss of power.



Manual Operator

The manual operator is used for any stop service where dependability is critical and where automation is not necessary. Since the valve can be easily operated by one person, no bypass is necessary. The operator is supplied with a standard AWWA handwheel or 2" (50mm) square operating nut.



Motor Operator

For applications requiring motor operated valves, we will gladly make recommendations and supply the dimensions and characteristics for the valve, operator and controls required.

On the List 26, the electric motor operator is also available with a 90° direct drive unit (instead of our standard link and lever torque unit) for remote modulating, flow control applications requiring a more direct 1 to 1 ratio of opening and closing.

Buried and Submersible Service

The operating mechanism is permanently lubricated and can be sealed making it suitable for submersible service to approximately 20 feet (6m) for extended periods of time. A complete range of stem extensions, valve street boxes complete with indicators as well as floor stands are also available.

List 26 Ball Valves And List 22 Cone Valves

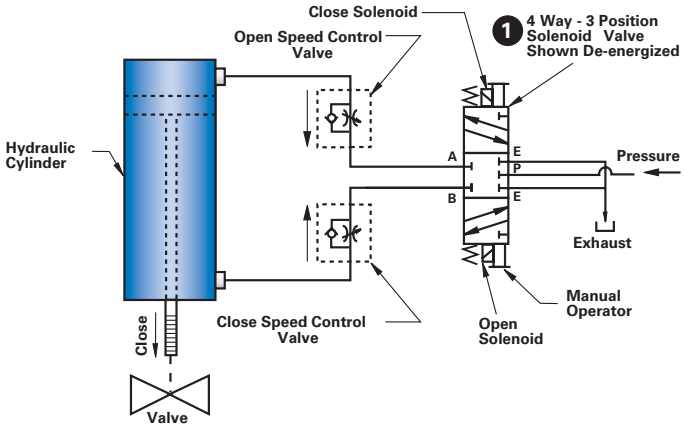
Schematic/Standard Controls

Hydraulic Cylinder (Oil or Water) for Modulating Control

Operation:

1. Normal Opening of Valve
   A. Open solenoid valve **(1)** (4 way/3 position) is energized
   B. Pressure (P) to port B
   C. Port A exhausts to E
2. Normal Closing of Valve
   A. Close solenoid valve **(1)** (4 way/3 position) is energized
   B. Pressure (P) to port A
   C. Port B exhausts to E

Manual Override — Push in and rotate knob fully clockwise. There is a manual operator for both opening and closing functions. Both must be rotated fully counterclockwise for normal electrical operation.

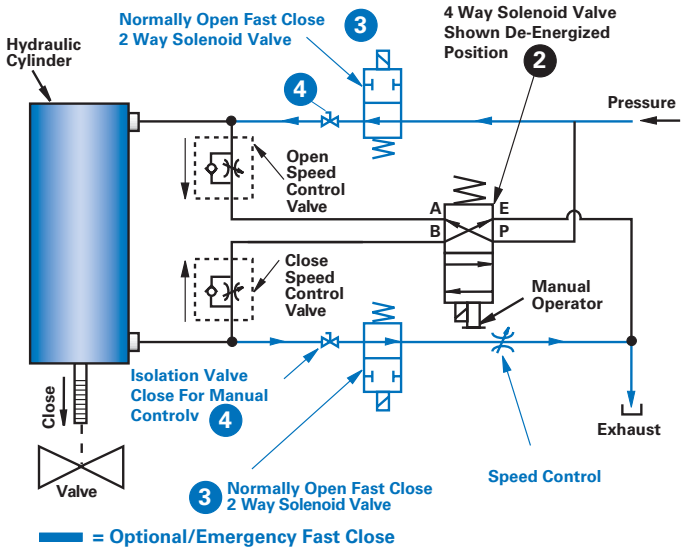


Hydraulic Cylinder (Oil or Water) with 2 Fast Close Solenoids

Operation:

1. Normal Opening of Valve
   A. Solenoid valve **(2)** (4 way/2 position) is energized. Pressure (P) to port B and A exhausts to E.
   B. Solenoid valves **(3)** (2 way normally open) are energized. No flow.
2. Normal Closing of Valve
   A. Solenoid valve **(2)** (4 way/2 position) is de-energized. Pressure (P) to port A and B exhausts to E.
   B. Solenoid valves **(3)** (2 way normally open) are energized. No flow.
3. Emergency Close
   A. Solenoid valve **(2)** (4 way/2 position) is de-energized. Pressure (P) to port A and B exhausts to E.
   B. Solenoid valves **(3)** (2 way normally open) are de-energized. Cylinder extends to close valve at high speed rate.

Manual Override — Rotate fully clockwise for opening function (lifts solenoid plunger to its energized position). Rotate fully counter-clockwise for closing function. Rotate fully counterclockwise before operating electrically. Close ball valves **(4)** when operating manually.

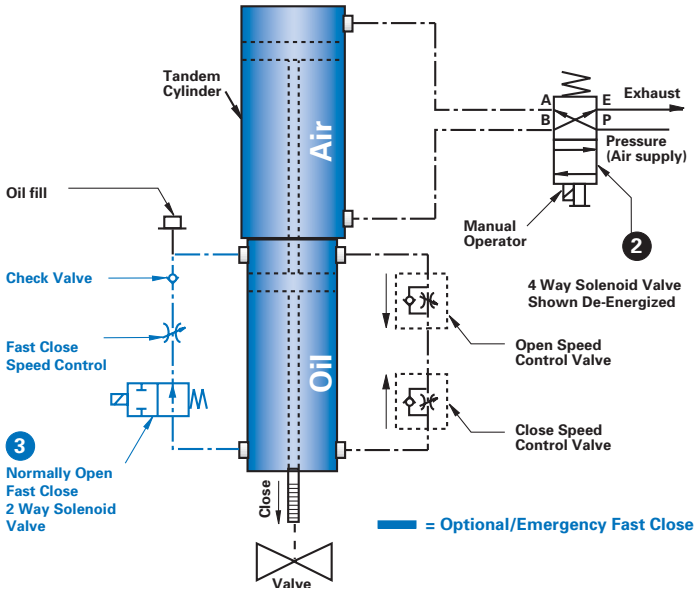


Tandem Air/Oil Cylinder for Pump Stop and Check with Emergency Close Loop

Operation:

1. Normal Opening of Valve
   A. Solenoid valve **(2)** (4 way) is energized. Pressure (P) to port B and A exhausts to E.
   B. Solenoid valve **(3)** (2 way normally open) is energized. No flow.
2. Normal Closing of Valve
   A. Solenoid valve **(2)** (4 way) is de-energized. Pressure (P) to port A and B exhausts to E.
   B. Solenoid valve **(3)** (2 way normally open) is energized. No flow.
3. Emergency Close
   A. Solenoid valve **(2)** (4 way) is de-energized. Pressure (P) to port A and B exhausts to E.
   B. Solenoid valve **(3)** (2 way normally open) is de-energized. Cylinder extends to close valve at high speed rate.

Manual Override — Same as hydraulic cylinder with 2 fast close solenoids described above.



List 22 Series 2200 Cone Valves

Proven Dependability

Series 2200

Valves That will Last for Decades.

Willamette List 22 Cone Valves are built tough to last under the most severe conditions. They are 100% full port, conical plug-type valves with a circular waterway through both body and plug in the fully open position. Each valve consists of: a tapered cone (plug) that fits precisely into a mating body, cover, valve operating mechanism and actuating unit.

The valve body has weld-overlayed monel seats around the bore. After welding, they are accurately machined and ground. In operation, they engage the seat rings on the plug when the plug is seated. Bronze pivot bearings are provided on the plug trunnions.

The plug has two pairs of monel seats; one pair mates with the body seat in the open position, while the other pair mates in the closed position (rotated 90 degrees). In operation, the plug is first lifted to separate the plug seat from the valve body seat. It is then rotated 90° to the open or closed position. The plug is then lowered to reseat in the desired position. Monel body and plug seats provide a solid, dependable and drop-tight closure.

Willamette offers standard List 22 Cone Valves of cast gray iron or ductile iron construction with ANSI B16.1, class 125/150 lb. flanges for working pressures to 175 psig (1207kpa). For working pressures to 275 psig (1896kpa), we offer cast ductile iron construction with ANSI B16.1, class 250/300 lb. flanges. Cone Valves of cast steel construction are available with ANSI B16.5, class 150 lb. and class 300 lb. flat-face and raised-face flanges for working pressures to 720 psig (4964kpa). Valves are provided with a skirted plug.

The valve operating mechanism is mounted on the head cover and has a removable cover for inspection, adjustment or repairs. This mechanism consists of a crosshead to lift, rotate and lower the plug; this is connected to an independent link and lever arrangement. Lifting the plug is accomplished by means of a lift nut and rotation is accomplished by means of a rotator lever. A position indicator on the outside of the mechanism lets you know the orientation of the plug at a glance.

Thousands of installations have proven the design quality and reliability of the Willamette Cone Valve. Continuous design improvements by Willamette have produced the best Cone Valves currently available in the marketplace. Every valve is designed and built for precise operation, long life and low maintenance. Our history proves it. Willamette Cone Valves have been in operation for over 60 years, demonstrating that they stay on the job and require minimum maintenance.

Willamette is proud of the excellence of the List 22 Cone Valve. It confirms again the position of leadership in design and manufacture of fluid control apparatus that the company has held throughout this century.

30" (750mm) 150#CL. Cone Valve

MWD of Southern California
54" (1400mm) Cone Valve Etiwanda Project

MWD of Southern California
42" (1100mm) Cone Valve Etiwanda Project

List 22 Series 2200 Cone Valves

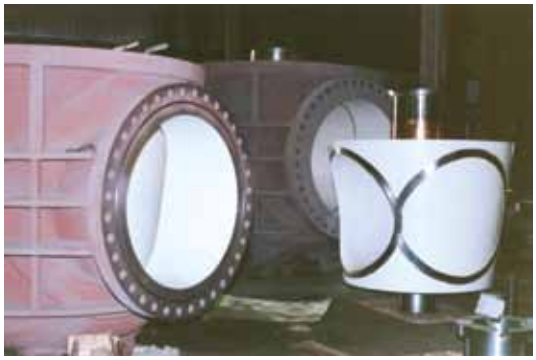
Unsurpassed Performance

Metal to Metal Seats

List 22 Cone Valves feature wide, weld-on monel metal seats which eliminate the erosion and abrasion failures common to polymer and elastomer seals in other types of valves.

Under normal conditions the metal to metal monel seats do not require replacement or preventive maintenance and guarantee dependable operation.

Metal to metal seating allows the valve to be installed in tough applications where velocities are high and continuous throttling is necessary.



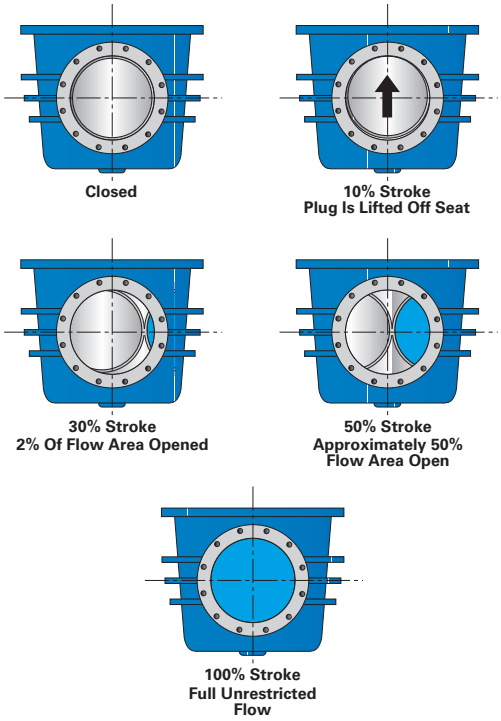
Cone Valve Body & Plug Seats

List 22's Unique Operating Cycle

The unique operating mechanism of the List 22 unseats the plug axially without rotation then smoothly rotates the plug 90°. After rotation, crosshead travel reseats the plug creating a full port unobstructed waterway. This operation provides positive protection for the seats at all times assuring long, maintenance free service.

The progressive effects of this movement are as follows:

- Actuator input shaft moves the crosshead assembly.
- Motion from crosshead is coupled through a link and lever to a threaded lift nut. As the crosshead moves, it causes the lift nut to rotate. This action causes the threaded stem to rise which lifts the plug off its seat.
- As crosshead continues to travel, it engages the rotator which causes the plug stem to rotate. This action slowly opens the valve.
- Valve pointer always indicates the position of the valve plug.
- At the end of the opening cycle, rotator stop screw contacts actuator housing which stops all rotation of the plug.
- Further travel of crosshead causes the threaded lift nut to lower the plug to engage the valve body and plug seats.



Cone Valve Link and Lever Torque Unit

The mechanism is totally enclosed in its own housing separate from the valve itself and is easily accessible for stem packing replacement or inspection maintenance. Maintenance does not require shut-down of the pipeline. Included in the mechanism housing is an external valve position indicator.

The operating mechanism is designed to allow slight repositioning of the seats in case of future wear.

List 22 Series 2200 Cone Valves

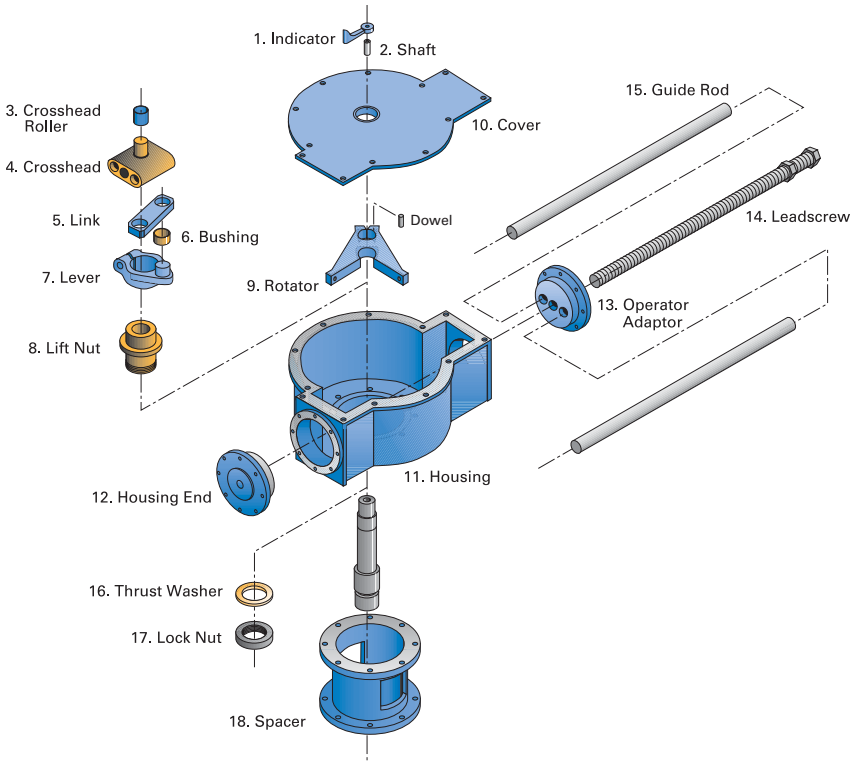
Advanced Components/Exploded Views

The cutaway view on page 20 can be used in conjunction with the exploded views on this page to identify every part that composes a List 22 Cone Valve.

List 22 Torque Unit

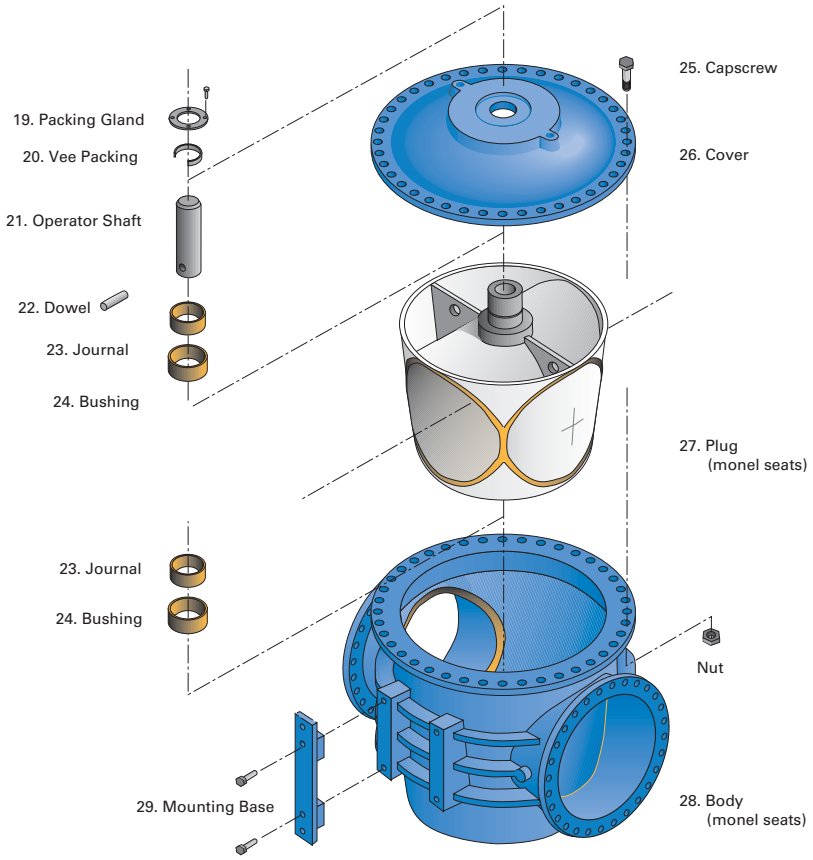
1. Indicator . . . . . Cast Steel
2. Shaft . . . . . Steel
3. Crosshead Roller . . . Steel
4. Crosshead . . . . . Cast Bronze
5. Link . . . . . Cast Steel
6. Bushing . . . . . Bronze
7. Lever . . . . . Cast Steel
8. Lift Nut . . . . . Bronze
9. Rotator . . . . . Cast Steel
10. Cover . . . . . Cast or Ductile Iron
11. Housing . . . . . Cast or Ductile Iron
12. Housing End . . . . . Cast or Ductile Iron
13. Operator Adaptor . . . Cast Iron
14. Leadscrew . . . . . Stainless Steel
15. Guide Rod . . . . . Stressproof Steel
16. Thrust Washer . . . . Bronze
17. Lock Nut . . . . . Steel
18. Spacer . . . . . Steel

Note:
For ASTM designations and for higher pressure class valves, see specifications on page 27.



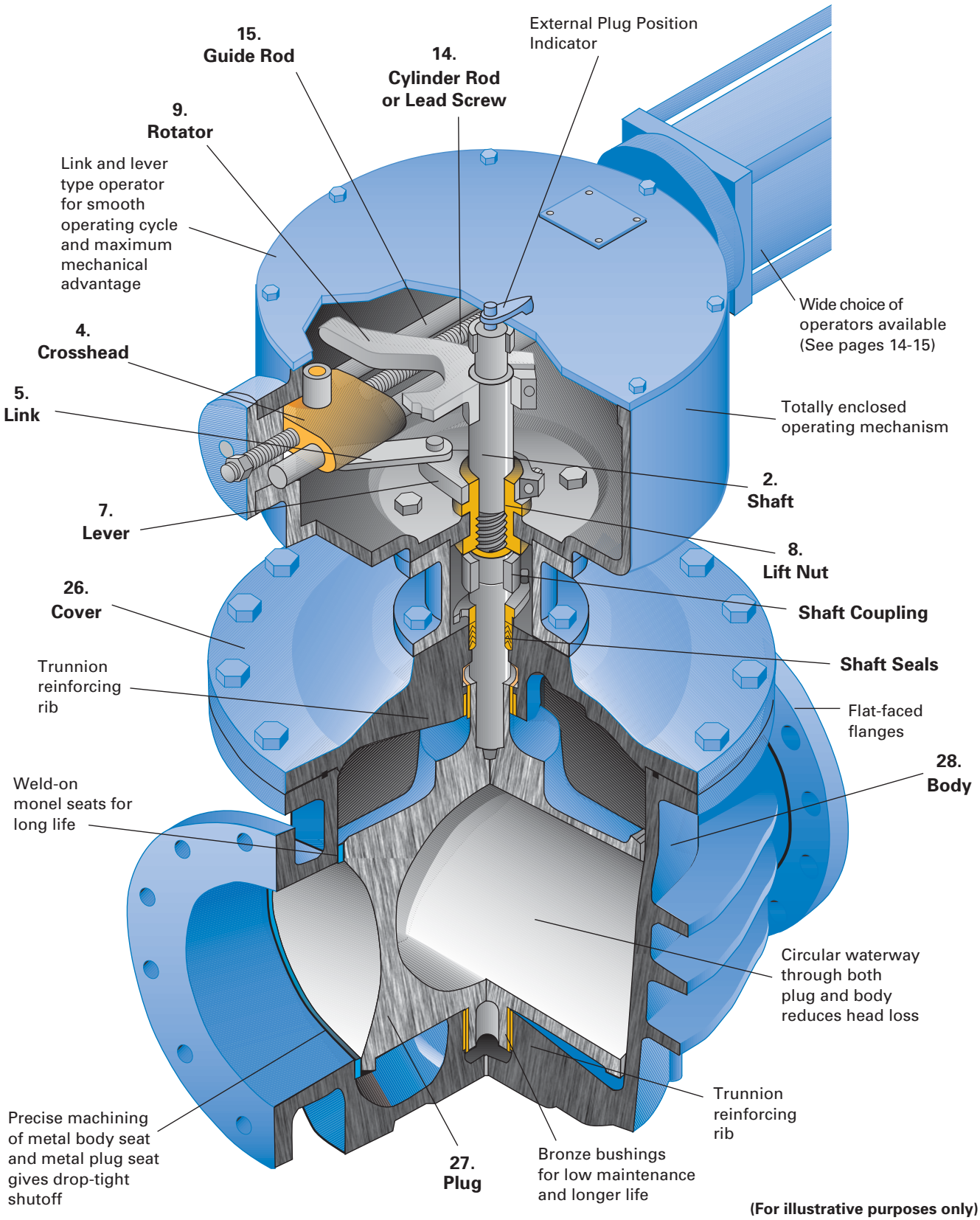
List 22 Cone Valve

19. Packing Gland . . . . Steel
20. Vee Packing . . . . . Nitrile Elastomer
21. Operator Shaft . . . . Steel
22. Dowel . . . . . Steel
23. Journal . . . . . Bronze
24. Bushing . . . . . Bronze
25. Capscrew . . . . . Steel
26. Cover . . . . . Cast or Ductile Iron
27. Plug . . . . . Cast or Ductile Iron
28. Body . . . . . Cast Or Ductile Iron
29. Mounting Base . . . . Cast Iron



List 22 Series 2200 Cone Valves

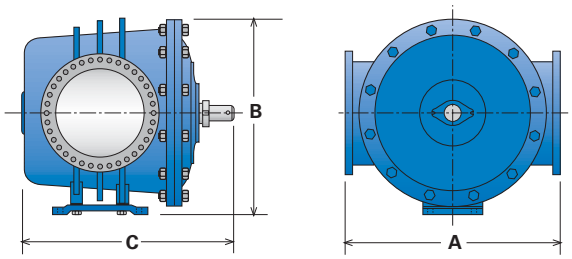
Cutaway View



(For illustrative purposes only)

List 22 Series 2200 Cone Valves

Valve And Operating Mechanism Dimensions



Envelope dimensions of the cone valve assembly (valve and operating mechanism) are shown below.

For more specific dimensions, please contact your DeZURIK APCO Willamette representative.

Dimensions and specifications given in this publication were correct at time of printing, but should not be used in lieu of certified drawings.

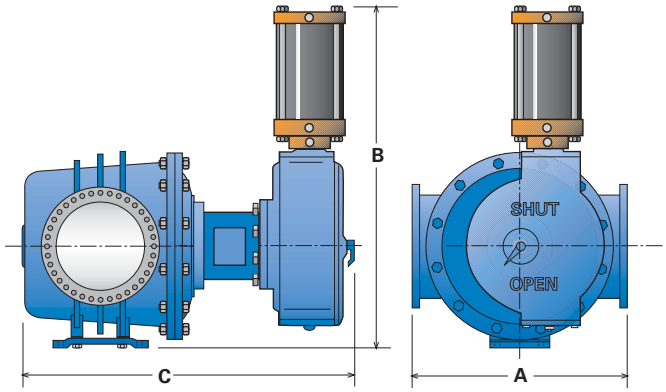
Note: A ll dimensions for class 250# valves also apply to class 300# valves.

Flat-faced flanges per ANSI B16.1, class 125 lb. or 250 lb. are normally furnished. Other flange facing is available. Consult your DeZURIK APCO Willamette representative.

List 22 – Metal Seated Cone Vavle								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	16.5 419	20 508	17 432	17 432	17.5 445	17.5 445	450 204	500 227
8" 200	21.5 546	25 635	21.75 552	21.75 552	22.5 572	22.5 572	800 363	900 408
10" 250	26 660	30.5 775	27 686	27 686	25.125 638	25 635	1100 499	1150 522
12" 300	28 711	32.5 826	29.125 740	29.125 740	26.5 673	26.5 673	1400 635	1500 680
14" 350	33 838	40 1016	31.375 797	31.375 797	30.125 765	30.125 765	2500 1134	2800 1270
16" 400	37.5 953	44 1118	36.125 918	36.125 918	33.25 845	33 838	3000 1361	3300 1497
18" 450	41.75 1060	48 1219	40 1016	40 1016	37.5 953	37.5 953	4000 1814	4300 1950
20" 500	47 1194	51 1295	43.25 1099	43.25 1099	40.125 1019	40 1016	5100 2313	5500 2495
24" 600	56 1422	60 1524	51.375 1305	51.375 1305	56.625 1438	46.625 1184	7750 3515	8000 3629
30" 750	64 1626	72 1829	62.5 1588	62.5 1588	55.125 1400	55.125 1400	12500 5670	14000 6350
36" 900	77.5 1969	85.5 2172	74.5 1892	74.5 1892	62.875 1597	62.875 1597	20000 9072	21500 9752
42" 1100	89 2261	96 2438	84.25 2140	84.25 2140	72.25 1835	72 1829	29750 13494	31500 14288
48" 1200	102 2591	112 2845	98.75 2508	98.75 2508	83.25 2115	83.25 2115	42000 19051	44500 20185

Inch
Millimeter

Hydraulic Cylinder Operator



Torque unit (valve operating mechanism) complete with appropriate operator is shown in its customary vertical orientation, (perpendicular to pipeline), however, torque unit complete with operator may be rotated in any of 90° increments (parallel with pipeline) if so desired to suit installation requirements.

Valve accessories such as control piping, limit switches, etc., not shown.

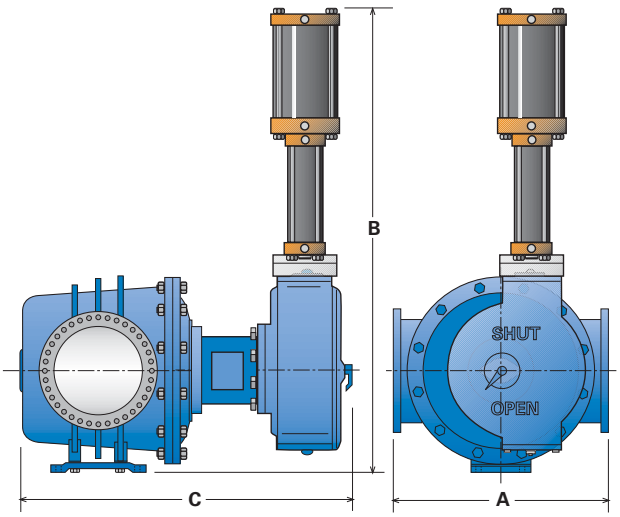
List 22 – Air/Oil Tandem Cylinder Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	16.5 419	20 508	39.125 994	39.125 994	26.75 679	26.75 679	590 268	620 281
8" 200	21.5 546	25 635	41.125 1045	41.125 1045	31.75 806	31.75 806	960 435	1020 463
10" 250	26 660	30.5 775	43.625 1108	43.625 1108	34.375 873	34.375 873	1280 581	1350 612
12" 300	28 711	32.5 826	44.625 1133	63.5 1613	35.75 908	50.75 1289	1670 757	1770 803
14" 350	33 838	40 1016	46.125 1172	65 1651	39.375 1000	54.375 1381	2850 1293	3000 1361
16" 400	37.5 953	44 1118	67 1702	78 1981	57.5 1461	64 1626	3400 1542	3600 1633
18" 450	41.75 1060	48 1219	69 1753	80 2032	61.75 1568	68.25 1734	4350 1973	4600 2087
20" 500	47 1194	51 1295	71 1803	82 2083	64.375 1635	70.875 1800	5550 2517	5850 2654
24" 600	56 1422	60 1524	86 2184	86 2184	77.375 1965	77.375 1965	8300 3765	8750 3969
30" 750	64 1626	72 1829	92 2337	94.75 2407	85.875 2181	92.125 2340	13700 6214	14400 6532
36" 900	77.5 1969	85.5 2172	99.75 2534	127 3226	99.875 2537	110.375 2804	21250 9639	22250 10092
42" 1100	89 2261	96 2438	133 3378	133 3378	119.75 3042	119.75 3042	31500 14288	32900 14923
48" 1200	102 2591	112 2845	174 4420	174 4420	129.25 3283	129.25 3283	44700 20276	46500 21092

Inch
Millimeter

LIST 22 SERIES 2200 Cone Valves

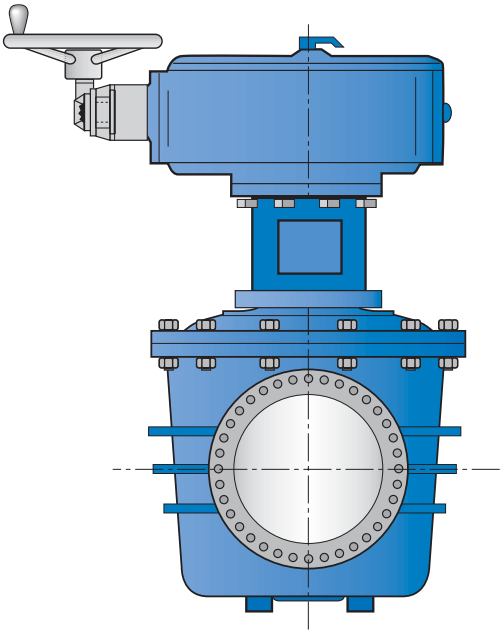
Valve and Operating Mechanism Dimensions

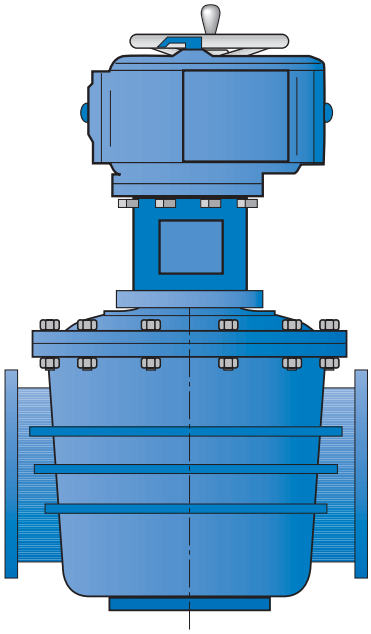
Air/Oil Tandem Cylinder Operator



List 22 – Air/Oil Tandem Cylinder Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	16.5 419	20 508	54.625 1387	54.625 1387	26.75 679	26.75 679	650 295	665 302
8" 200	21.5 546	25 635	56.625 1438	56.625 1438	31.75 806	31.75 806	1000 454	1065 483
10" 250	26 660	30.5 775	59.125 1502	59.125 1502	34.375 873	34.375 873	1370 621	1425 646
12" 300	28 711	32.5 826	60.125 1527	78.875 2003	35.75 908	50.75 1289	1825 828	1900 862
14" 350	33 838	40 1016	61.625 1565	80.375 2042	39.375 1000	54.375 1381	3030 1374	3100 1406
16" 400	37.5 953	44 1118	90.25 2292	99.75 2534	57.5 1461	64 1626	3600 1633	3750 1701
18" 450	41.75 1060	48 1219	92.25 2343	101.75 2584	61.75 1568	68.25 1734	4470 2028	4725 2143
20" 500	47 1194	51 1295	94.25 2394	103.75 2635	64.375 1635	70.875 1800	5775 2619	6000 2722
24" 600	56 1422	60 1524	113.5 2883	113.5 2883	77.375 1965	77.375 1965	8600 3901	9100 4128
30" 750	64 1626	72 1829	119.5 3035	127 3226	85.875 2181	92.125 2340	14400 6532	14675 6656
36" 900	77.5 1969	85.5 2172	130.75 3321	159.25 4045	99.875 2537	110.375 2804	22075 10013	22660 10278
42" 1100	89 2261	96 2438	178.5 4534	178.5 4534	119.75 3042	119.75 3042	32700 14832	33575 15229
48" 1200	102 2591	112 2845	216.5 5499	216.5 5499	129.25 3283	129.25 3283	46500 21092	47775 21670

Inch
Millimeter





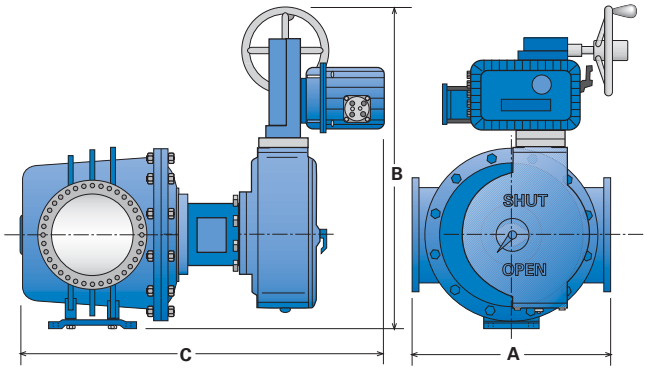
Envelope dimensions of the cone valves on these pages show the valve positioned with operator in a vertical position. The drawings above show how the valve will look when operators must be in a horizontal position.

Dimensions and specifications will be supplied on request.
Please consult your DeZURIK APCO Willamette representative.

LIST 22 SERIES 2200 Cone Valves

Valve and Operating Mechanism Dimensions

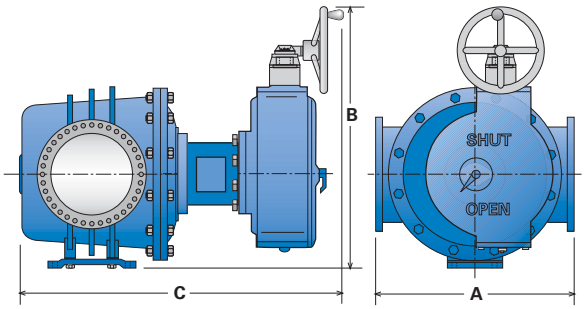
Motor Operator



List 22 – Motor Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	16.5 419	20 508	36.625 930	36.625 930	47.75 1213	47.75 1213	590 268	620 281
8" 200	21.5 546	25 635	38.625 981	38.625 981	52.75 1340	52.75 1340	960 435	1020 463
10" 250	26 660	30.5 775	41.125 1045	41.125 1045	55.375 1407	55.375 1407	1280 581	1350 612
12" 300	28 711	32.5 826	42.125 1070	50 1270	56.75 1441	68.75 1746	1670 757	1770 803
14" 350	33 838	40 1016	43.625 1108	51.5 1308	60.375 1534	72.375 1838	2850 1293	3000 1361
16" 400	37.5 953	44 1118	53.5 1359	64.25 1632	75.5 1918	82.75 2102	3400 1542	3600 1633
18" 450	41.75 1060	48 1219	55.5 1410	66.25 1683	79.75 2026	87 2210	4350 1973	4600 2087
20" 500	47 1194	51 1295	57.5 1461	68.25 1734	82.375 2092	89.625 2276	5550 2517	5850 2654
24" 600	56 1422	60 1524	72.25 1835	71.5 1816	96.125 2442	96.875 2461	8300 3765	8750 3969
30" 750	64 1626	72 1829	77.5 1969	76 1930	105.375 2677	107.125 2721	13700 6214	14400 6532
36" 900	77.5 1969	85.5 2172	81 2057	94.25 2394	114.875 2918	127 3226	21250 9639	22250 10092
42" 1100	89 2261	96 2438	100.25 2546	100.25 2546	132.375 3362	136.375 3464	31500 14288	32900 14923
48" 1200	102 2591	112 2845	115.75 2940	115.75 2940	143.375 3642	143 3632	44700 20276	46500 21092

Inch
Millimeter

Manual Operator



List 22 – Manual Operator								
Dia.	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" 150	16.5 419	20 508	37.875 962	37.875 962	39.5 1003	39.5 1003	510 231	560 254
8" 200	21.5 546	25 635	39.875 1013	39.875 1013	44.5 1130	44.5 1130	890 404	960 435
10" 250	26 660	30.5 775	42.375 1076	42.375 1076	47.125 1197	47.125 1197	1160 526	1250 567
12" 300	28 711	32.5 826	43.375 1102	51.25 1302	48.5 1232	60.5 1537	1460 662	1590 721
14" 350	33 838	40 1016	44.875 1140	52.75 1340	52.125 1324	64.125 1629	2600 1179	2850 1293
16" 400	37.5 953	44 1118	57.75 1467	63.5 1613	67.25 1708	73.5 1867	3120 1415	3400 1542
18" 450	41.75 1060	48 1219	59.75 1518	65.5 1664	71.5 1816	77.75 1975	4190 1901	4430 2009
20" 500	47 1194	51 1295	61.75 1568	67.5 1715	74.125 1883	80.375 2042	5250 2381	5630 2554
24" 600	56 1422	60 1524	71.5 1816	71.5 1816	86.875 2207	86.875 2207	7900 3583	8300 3765
30" 750	64 1626	72 1829	78 1981	76.75 1949	97 2464	99.5 2527	12760 5788	14030 6364
36" 900	77.5 1969	85.5 2172	87.75 2229	101 2565	107.375 2727	115.5 2934	20150 9140	21700 9843
42" 1100	89 2261	96 2438	107 2718	107 2718	124.875 3172	124.875 3172	29900 13562	32000 14515
48" 1200	102 2591	112 2845	122.5 3112	122.5 3112	135.875 3451	131.5 3340	42300 19187	44800 20321

Inch
Millimeter

List 22 Series 2200 Cone Valves

Performance Characteristics

APPROXIMATE C_V VALUES
APCO Willamette Cone Valve for Closed Loop System Plug Angle in Degrees from Closed

Valve Size (inches)	10°	20°	30°	60°	80°	90°	Fully Open
6" 150	27	90	150	575	1,975	3,110	4,230
8" 200	48	162	265	1,025	3,510	5,525	6,620
10" 250	75	253	415	1,600	5,480	8,630	10,740
12" 300	107	364	598	2,304	7,900	12,430	13,400
14" 350	145	495	813	3,136	10,750	16,920	17,600
16" 400	190	647	1,063	4,096	14,040	22,100	23,000
18" 450	240	819	1,345	5,184	17,770	27,970	32,200
20" 500	297	1,011	1,661	6,400	21,940	34,530	38,200
24" 600	428	1,456	2,392	9,216	31,600	49,720	56,200
30" 750	670	2,275	3,740	14,400	49,400	77,700	102,000
36" 900	962	3,275	5,380	20,800	71,100	112,000	152,000
42" 1100	1,310	4,460	7,325	28,200	96,700	152,000	211,000
48" 1200	1,710	5,825	9,570	36,900	126,000	200,000	292,000
54" 1400	2,165	7,370	12,100	46,700	160,000	252,000	435,000
60" 1500	2,670	9,100	15,000	57,600	197,000	311,000	567,000

List 22 CV Values

This C_V table shows flow in gallons per minute through an APCO Willamette List 22 Cone Valve in a closed loop system at 1.0 psig (6894kpa) constant pressure drop. Valve sizes from 6" - 60" (150 - 1500mm) and plug angles from 10° to fully open are shown.

Note:
For more specific flow information, please contact your DeZURIK APCO Willamette representative.

Estimated Annual Power Costs

Valve Diameter (inches)	Ball & Cone Valve	Gate Valve	Swing Check Valve	Butterfly Valve	Globe Valve
6" 150	119	133	885	800	6,046
8" 200	171	216	1,475	1,312	9,916
10" 250	206	369	2,322	1,611	15,667
12" 300	236	494	3,060	2,160	20,976
14" 350	321	671	4,158	2,573	28,533
16" 400	418	874	5,434	2,739	37,233
18" 450	437	1,025	6,396	3,203	43,500
20" 500	523	1,264	7,889	3,956	53,748
24" 600	711	1,821	11,369	5,695	77,378
30" 750	977	2,610	15,476	6,226	105,837
36" 900	1,279	3,576	22,284	8,969	152,396
42" 1100	1,615	4,645	28,828	11,645	197,738
48" 1200	2,112	5,935	37,675	15,210	258,232
54" 1400	2,278	7,336	45,601	18,259	310,100
60" 1500	2,433	9,032	56,328	22,546	382,648

Low Head Loss — Power Cost Savings

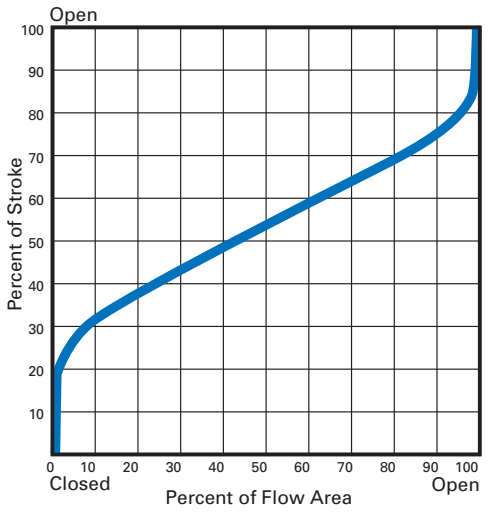
Full ported valves are far more cost effective than other valve types, mainly because of lower head loss. List 22 Cone Valves are 100% full ported. There is no more head loss through the valve than there would be in an equivalent length of pipe of the same diameter. Full ported List 22 Cone Valves can even be pigged.

This table shows annual power costs for different valve types. All amounts are based on $.09/kWh, continuous pumping (8,760 hours/year) at 70% overall efficiency with a line velocity of 16 ft/sec (4.9 m/sec). Power costs are much lower than with restricted-port valves such as the butterfly, check, plug or globe valves.

Smooth Operation Gives Precise Flow and Pressure Regulation

The smooth operating cycle of the List 22 is highly effective in controlling surge and water hammer while providing precise flow regulation. The operating cycle is shown in the graph at right. Notice that only 2% of the flow area is opened with nearly 20% of actuator stroke. This is due to the lifting of the conical plug prior to rotation.

Percentage of Fow Area vs. Percentage of Stroke



LIST 22 SERIES 2200 Cone Valves

Features

Metal to Metal Seats

List 22 Cone Valves feature wide, weld-on monel metal seats which eliminate the erosion and abrasion failures common to polymer and elastomer seals in other types of valves. Under normal conditions the metal to metal monel seats do not require replacement or preventive maintenance and guarantee dependable operation. Metal to metal seating allows the valve to be installed in tough applications where velocities are high and continuous throttling is necessary.

Virtually Maintenance Free

Thousands of APCO Willamette Cone Valves have been in service up to 60 years and have proven to be almost completely trouble-free.

Drop-Tight Shutoff

Metal to Metal Seats mate firmly and accurately to maintain a drop-tight seal.* Under normal operating conditions, the seal will last the life of the valve. *0.4 oz/minute/inch of diameter, (13.3mL/minute/inch of diameter)

Solid Bronze Bearings

List 22 valves are built with solid bronze bearings at the upper and lower trunnion of the plug. Solid bronze construction means longer, trouble-free service.

Wide Range of Sizes

List 22 valves are designed for a wide range of sizes and applications. Standard design pressures up to 350 psig (2413kpa). Certain special configurations are available for pressures of more than 720 psig (4964kpa).

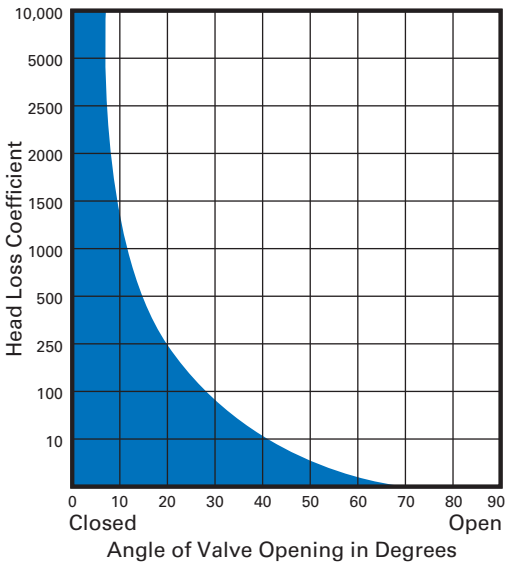
Easily Operated by One Person

One person can always operate the valve — even one that has been static for several years.

Reduced Pressure Loss

This graph shows the head loss between 5 and 70% of the valve opening angle. This is caused by the smooth operation and long stroke of the valve actuator in rotating the valve plug. The result is precise flow and pressure control with no hunting. For additional List 22 Cone Valve head loss characteristics, contact your DeZURIK APCO Willamette representative.

Head Loss vs. Valve Opening



Ten 24" (600mm) Cone Valves Southern Nevada Water Supply

24" (600mm) Cone Valve for Birmingham, Alabama

Suggested Specifications

List 26 Series 2600 Awwa Ball Valves

1.0 Valve Construction

1.1 General

Each ball valve shall consist of four main elements: A pressure vessel (body), a rotatable closing element (ball), a torque unit, and an operator. Standard ball valves shall be furnished in either cast iron ASTM A48 CL-35(150# class); ductile iron ASTM A536(250# class); GR65-45-12 or cast steel ASTM A27 GR65-35(300# class). Ball valve construction shall be in complete accordance with AWWA specifications C507 for ball valves 6" thru 48" with metal seats per specification section 3.2.3.2.

1.2 Body

The "Standard" body shall have ANSI B16.1 CL. 125/150 or CL. 250/300 flanges and shall house the ball. The body shall have integrally cast, bronze bushed trunnions. It shall provide rigid means for supporting the torque unit without the necessity of additional supports. There shall be two (2) pipe connections, one for an air vent and the other for drain. The body shall have rigidly attached corrosion resistant metal seat(s) made of 400 series monel. Maximum seat bearing pressure shall not exceed 1,000 lb/sq. inch.

1.3 Ball

The ball shall have integrally cast, bronze bushed trunnions. An extension of one trunnion, called the operating shaft, shall pass through a sealing device (o-ring retainer) and connect to the torque unit. The operating shaft shall be 17-4PH high strength stainless steel. The sealing device shall be capable of being removed and having its seals replaced without removing the valve from the line. The ball shall have corrosion resistant metal seat(s) of 300 series stainless steel rigidly attached and fully adjustable to provide drop-tight sealing (1 oz. per inch per hour exceeding AWWA C507 standards). The ball shaft shall be so designed that the factor of safety for all combined stresses shall be at least five to one. Maximum torsional deflection shall not exceed 1/6 degree per foot of unsupported length using a seat coefficient of friction of 0.5 and a bearing coefficient of friction of 0.3.

1.4 Torque Unit (Valve Operating Mechanism)

The torque unit shall employ a traveling crosshead to impart positive rotary movement to the ball by means of a link and lever connected to the ball shaft. A ball shaft support bearing shall be connected to the ball shaft. The torque unit shall be designed so that during the first 50 percent of stroke in closing, the flow area is reduced by approximately 81 percent. The remaining flow area shall be gradually reduced to a complete shutoff throughout the last 50 percent of closing stroke. All materials of the torque unit subject to rubbing shall be of different hardness. The torque unit shall be capable of being inspected, lubricated, removed and repaired without removing the valve proper from the line. The torque unit shall also be designed so that the o-ring seals on the main shaft can be replaced without removing the torque unit housing and while the valve is in the line.

1.5 Bearings

For prolonged bearing life, bearing loading shall not exceed 900 psi (6205kpa) at 150 psig (1034kpa) differential pressure, nor 1,500 psi (10342kpa) at 250 psig (1724kpa) differential pressure, shall be long life bronze, of low zinc content, of dissimilar hardness to prevent galling, and shall not be constructed of synthetic materials. Bronze bushing for body is ASTM B271-C95400; bronze journal for ball is ASTM B584-C93200.

2.0 Types of Operation

Manual operator (handwheel or AWWA square nut), electric motor (local or remote controls), or cylinder per AWWA C540 Standard for hydraulic or pneumatic control.

3.0 Testing

As per AWWA specification #C507. (Ball valve only)

4.0 Experience and Design Standard

The valve shall be the latest standard product of a manufacturer regularly engaged in the production of equipment of this nature. The valve manufacturer shall be experienced in the design and construction of Ball Valves for a period of not less than five years. The valve shall be Willamette Ball Valves or approved equal.

Suggested Specifications

List 22 Series 2200 Cone Valves

1.0 Valve Construction

The cone valve shall be of the conical plug type employing axial motion to unseat the plug, followed by a rotary motion to open or close the valve, and then followed by an axial motion to reseat the plug.

The valve shall be the latest standard product of a manufacturer regularly engaged in the production of equipment of this nature. The valve manufacturer shall be experienced in the design and construction of Cone Valves for a period of not less than five years. The valve shall be Willamette Cone Valves or approved equal.

1.1 Valve Components

The valve shall consist essentially of four main parts:

a. A valve body having waterway inlet and outlet diameters equal to the nominal size of the valve.

b. A conical plug having a clear waterway diameter equal to the nominal size of the valve.

c. A head cover to enclose the plug in the body.

d. An operating mechanism mounted on the head cover.

1.2 Materials

Standard Cone Valve shall be furnished in either cast gray iron ASTM A48 CL-35(125# class); ductile iron ASTM A536(250# class); GR65-45-12 or cast steel ASTM A27 GR65-35(300# class).

2.0 Body

The cast or ductile iron body of the valve shall consist of a housing having flanged inlet and outlet waterways and a head flange opening. The head flange opening shall permit removal of the plug. Waterway flanges shall conform to the dimensions and drilling of ANSI B16.1, class 125/150 lb. or 250/300 lb. and shall be flat faced. Inside the cast iron body of the valve, two monel seat rings shall be provided to engage the seat rings on the plug when the plug is seated. A bronze pivot bearing (ASTM B271-C95400) shall be provided for the plug trunnion.

2.1 Plug

The cast or ductile iron plug shall have the shape of a frustum of a cone with a clear waterway opening through it. The plug shall rotate on large diameter, integrally cast, bronze bushed (ASTM B584-C93200), top and bottom trunnions. The operating shaft shall be securely attached to the plug to transmit the lifting force and operating torque. The operating shaft shall be 17.4PH high strength stainless steel. The plug shall be provided with monel seats to engage the monel seat rings on the body when seated in both open and/or closed positions.

2.2 Head Cover

The valve shall be provided with a cast iron head cover to close the body head flange opening. The head cover shall make a registered connection with the valve body. A bronze pivot bearing (ASTM B271-C95400) in an integrally cast trunnion shall be provided for the plug.

3.0 Operating Mechanism

The operating mechanism shall be mounted on the head cover and shall be provided with a removable cover which shall permit inspection, adjustment and repair of the operating mechanism. The mechanism of the valve shall consist of a crosshead device which will lift, rotate and lower the plug. The crosshead shall travel in a straight line and shall operate through an independent link and lever arrangement, so that lifting shall be accomplished by means of a lift nut and rotation shall be accomplished by means of a rotator lever. The operating shaft shall be of sufficient strength to withstand any stresses to which it may be subjected under the design operating conditions. The valve shall be provided with a rotational position indicator which will at all times indicate the position of the valve plug.

4.0 Types of Operation

Manual operator (handwheel or AWWA square nut), electric motor (local or remote controls), or cylinder per AWWA C540 Standard for hydraulic or pneumatic control.

DeZURIK, Inc. hereby reserves the right to change any component parts which, in the opinion of its engineering department, will improve the product or increase its serviceability.

Sales and Service

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