DeZURIK

BULLETIN 2600
FEBRUARY 2022

WILLAMETTE AWWA METAL SEATED BALL VALVES (VBL)

A Valve That Will Last for Decades

The Willamette AWWA Metal Seated Ball Valve (VBL) 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. The Willamette Metal Seat Ball Valve is available in sizes 6-60" (150-1500mm). Standard design pressures are up to 300 psi (2068 kPa).

No Measurable Head Loss For Reduced Pumping Costs

True full port opening results in no more head loss than an equivalent length of pipe. Pumping costs are the largest operating cost of water utilities – making a metal seated ball valve an economical choice over other types of pump control valves.

Built for Critical Shut-Off Service

The VBL Metal Seated Ball Valve is a heavy-duty valve built especially for pump stop and check, pressure regulating, flow control and critical shut-off service. It is a superior valve because of its unique design features, uncompromising use of quality materials and the precision of its fabrication and assembly.

Design & Construction Features

The valve typically 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. The cast body pieces are sealed together with o-rings to prevent leakage. The adaptors carry the body seats and also serve as flanges for connecting the valve to the line.

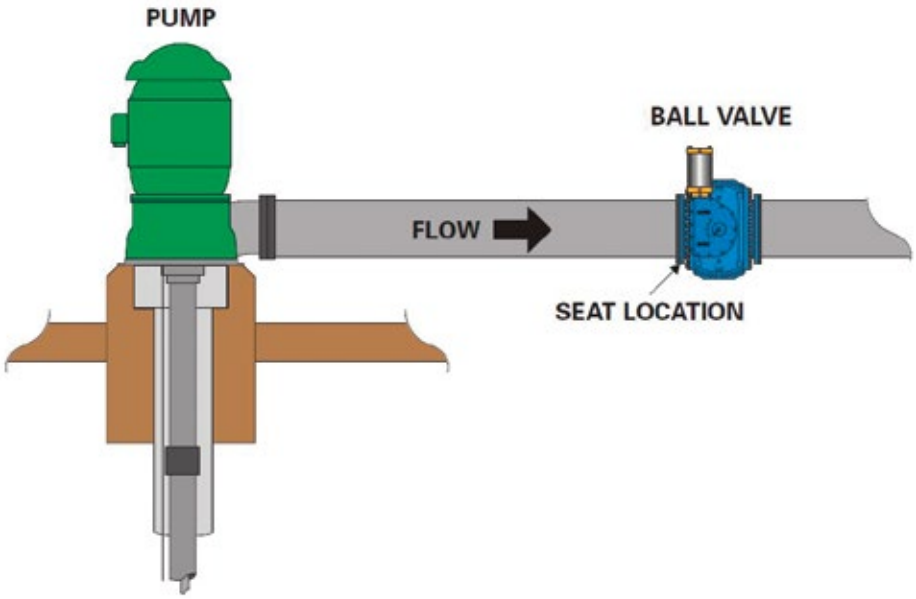
The ball controls flow through the valve. It is, in effect, two intersecting cylinders, one being the full ported waterway, the other retaining the seats. The ball rotates on support trunnions that are integrally

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, the valve shafts do not fall victim to fatigue. On 10-60" valve sizes, shafts are made of 17-4 PH high-strength stainless steel; 6-8" valves have a carbon steel or stainless steel shaft integrally cast with the ball housing. When carbon steel shaft is specified, it will be chrome plated. Attached to the ball are 316 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.

Single-Seated Ball Valves for Pump Control

Pump control is the primary use of single-seated VBL, and the seat always is on the pump side of the valve. When the pump is off, there is low or zero pressure on pump side of valve. At the same time, there is full pressure in the system side. The system pressure holds the ball tight against the seat to prevent backflow. The valve does not operate when the pump is turned off and there is system pressure. When the pump turns on, it generates pressure higher than the system pressure, causing enough differential pressure to unseat the ball and the valve can begin opening.

Properly adjusted pump control valves will close while the pump is still running and creating pressure. There is always pressure from the pump pushing the ball away from the seat. When the valve finally closes, then the pump turns off. The system pressure takes over and holds the ball tight against the seat. Seat shutoff pressure in psi to be specified when order is entered. Setting for actual operating conditions to be set after final shop test.



VBL with Manual Worm Gear Actuator

VBL with Link and Lever Torque Unit

VBL with Manual Worm Gear Activator

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

Pump Station Application
Air/Oil Tandem Cylinders

Precise Flow Regulation

Willamette Metal Seated Ball Valves will control pressure differentials and flow rates to extremely close limits without hunting, vibrating or excessive noise. These valves act as energy absorbers 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 with virtually trouble-free performance.

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 Willamette Metal Seated Ball Valve ideally suited for raw sewage service, assuring complete closing of the valve.

Long-Lasting Seat Seal

Metal-to-metal seats mate precisely, maintaining shutoff per AWWA C507. The seal lasts the life of the valve because of the durability of the metal and the eccentric motion of the seats.

Trunnion Mounted Ball

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.

Hydraulic Water Cylinder Actuated
Metal Seated Ball Valve

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 psi (6205 kPa) for 150 Class and 1500 psi (10342 kPa) for 250 Class. Solid bronze construction means longer, trouble-free service, and like the metal seats, the bearings will last the life of the valve.

Lifetime Seats

Other metal seated ball valve manufacturers say their seats are easily replaceable because they have to replace their seats. Under normal operating conditions, Willamette VBL metal seats won't need to be replaced.

Meets AWWA C507 Standards

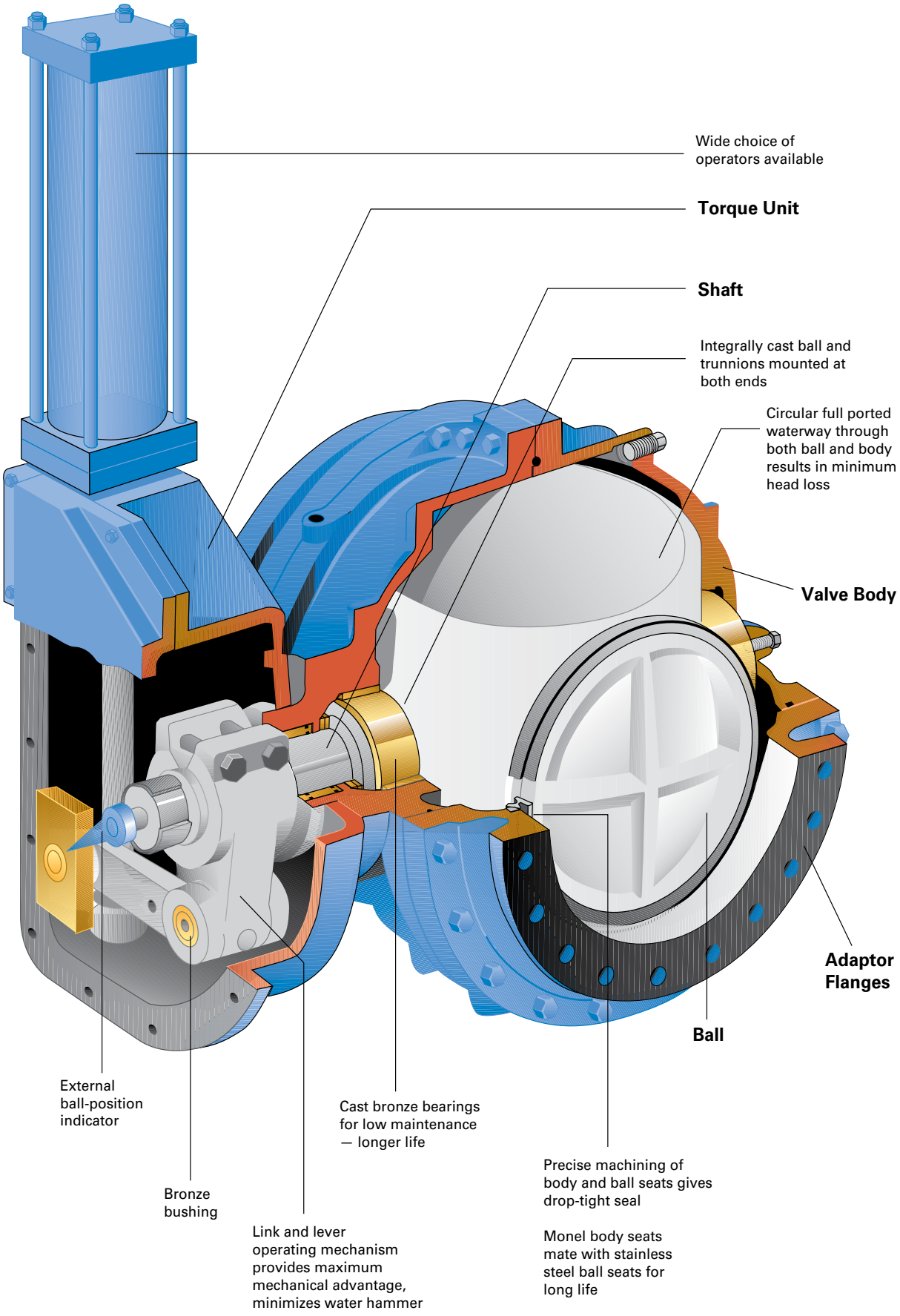
Willamette Metal Seated Ball Valves are designed and manufactured to meet AWWA C507 Standards. The body is available with ASME B16.42 Class 125/150 or Class 250/300 flanges.

Torque Unit Enhances Smooth Operation

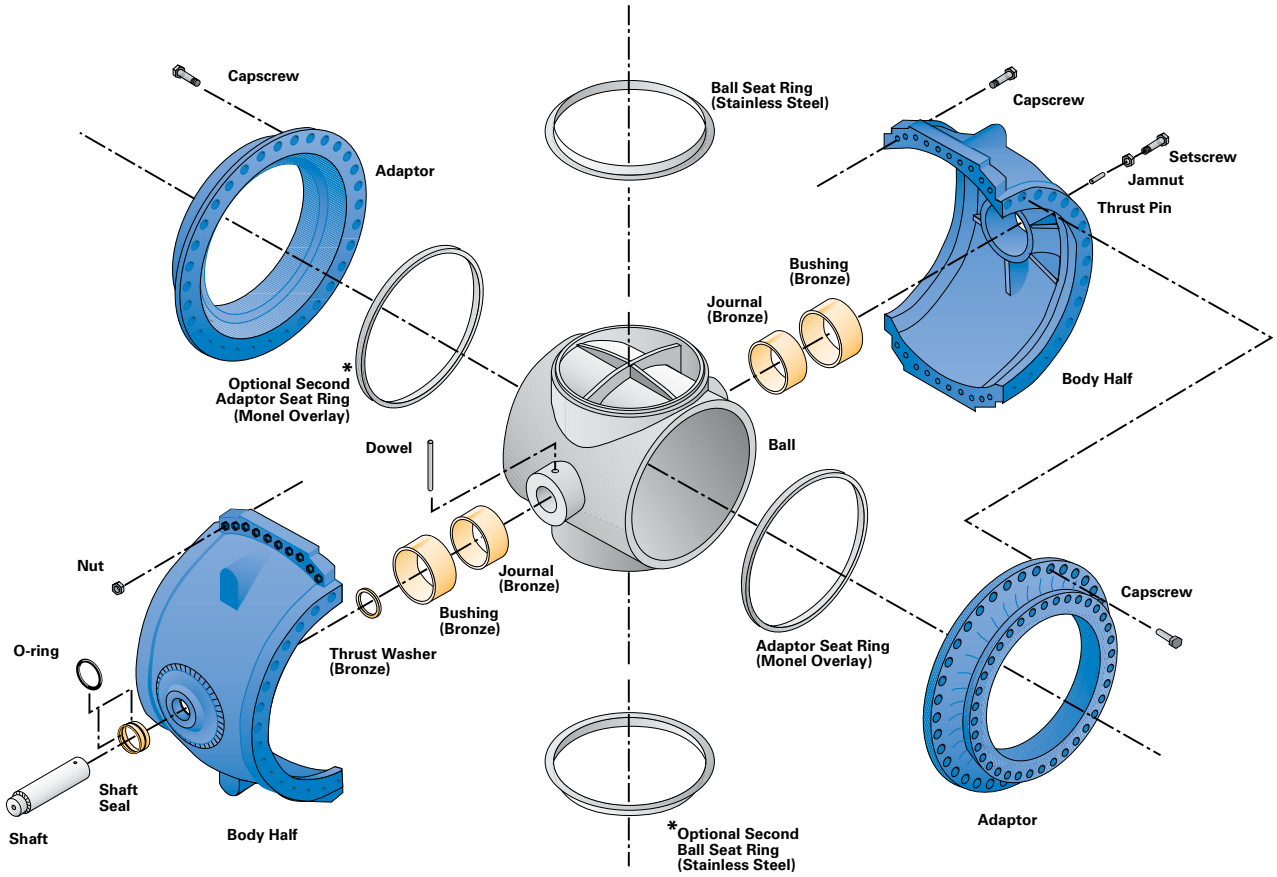
The torque unit provides the multiplication of leverage to rotate the ball. It utilizes a lever attached to the ball operating shaft and a pair of metal links which work with a crosshead to rotate the ball its full ninety degrees. This link/lever action provides a large mechanical advantage when seating/unseating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

A variety of operators are available including manual, cylinder and electric motor. Each one of them is fully capable of meeting the demands of any specific application.

Cutaway View



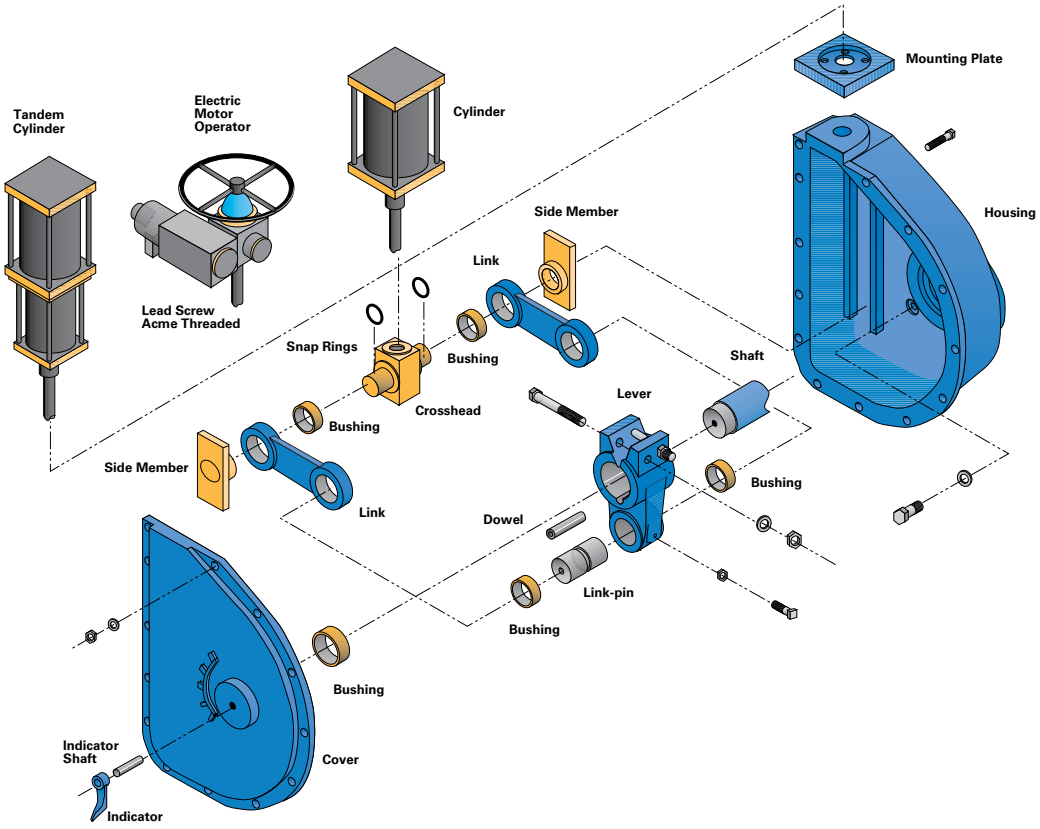
Exploded Views



Four-piece body and ball sub-assembly of the Willamette VBL Ball Valve except the 6", 8", 48", 54" and 60" valves, (150, 200, 1200, 1400, 1500mm). These sizes have a two-piece body.

Pump Control Valves are single seated. Double seats are only required for isolation service when sealing is necessary in both directions.

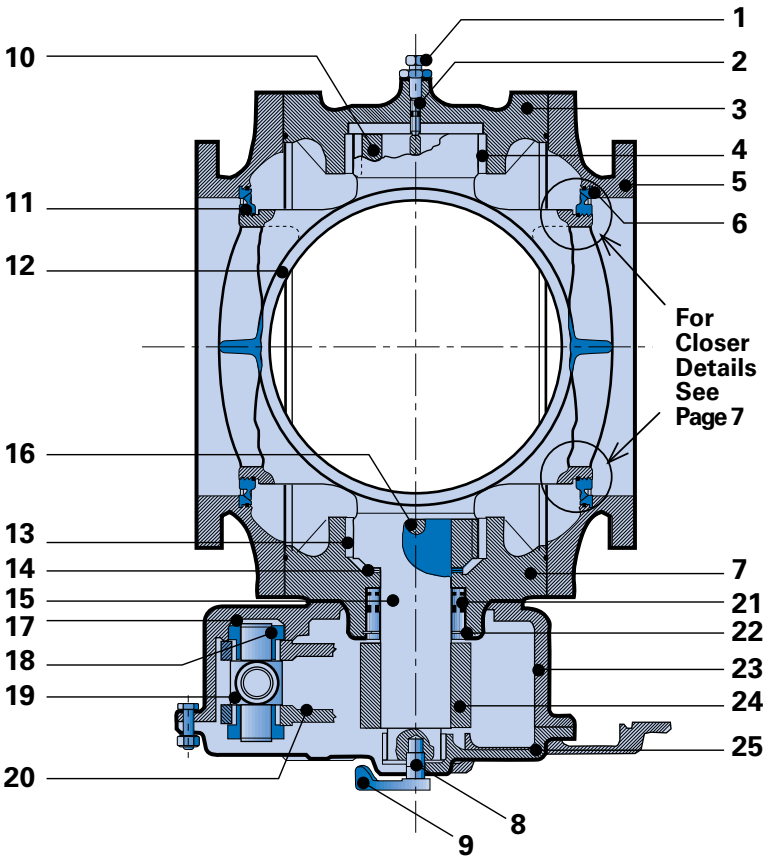
Standard Link and Lever Torque Unit



Materials of Construction

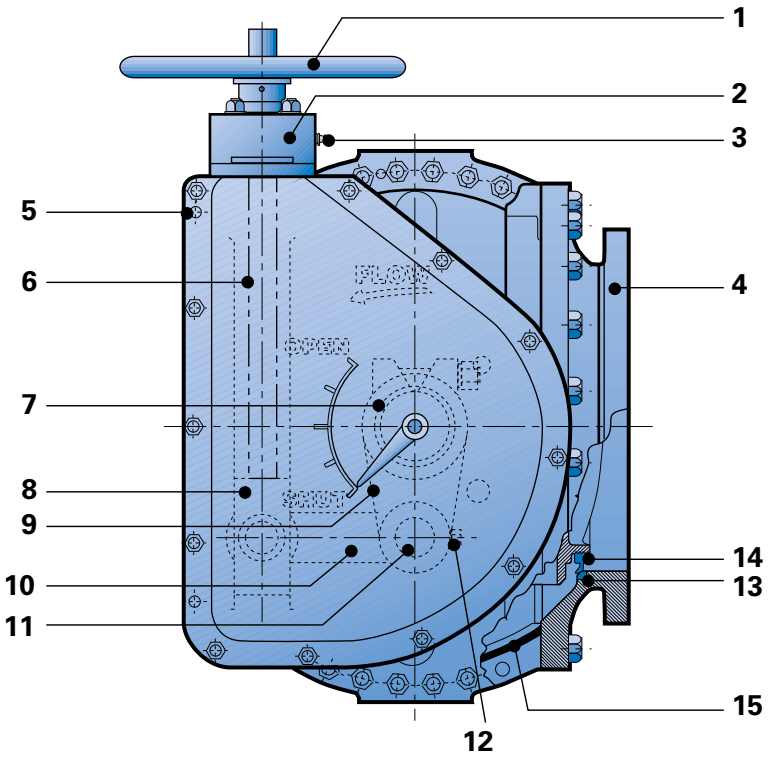
Top View/Section

1. Thrust Screw	Steel
2. Thrust Pin	Aluminum Bronze
3. Body – Trunnion End	Ductile Iron, ASTM A536 Grade 65-45-12
4. Body Bushing	Bronze, ASTM 271-C95400
5. Adaptor	Ductile Iron
6. Adaptor Seat	Monel
7. Body – Operator End	Ductile Iron
8. Indicator Shaft	Steel
9. Indicator	Cast Steel
10. Ball Journal	Bronze, ASTM B584-C93200
11. Ball Seat Ring	316 Stainless Steel
12. Ball	Ductile Iron, Carbon Steel or 316 Stainless Steel
13. Ball Journal	Bronze
14. Thrust Washers	Bronze
15. Ball Shaft	Steel
16. Torque Pin	Steel
17. Retaining Ring	Steel
18. Sidemember	Cast Bronze
19. Crosshead	Cast Bronze
20. Link	Cast Steel – Bronze Bushed
21. O-Ring Retainer	Cast Bronze
22. Retaining Ring	Stainless Steel
23. Torque Unit Housing	Cast Iron
24. Lever	Cast Steel
25. Torque Unit Cover	Cast Iron



Side View

1. Handwheel	Cast Iron
2. Thrust Collar	Cast Iron
3. Grease Fitting	Stainless Steel
4. Adaptor	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



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.

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.

Opening Action

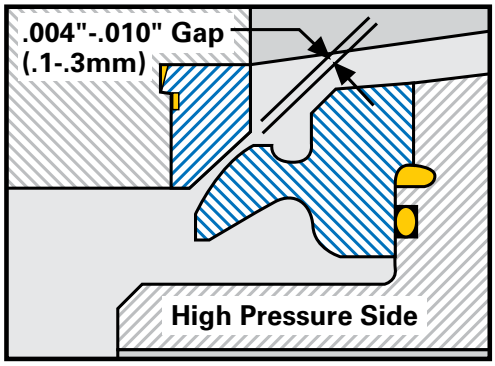
The ball is rotated to open the valve by the valve actuating mechanism. After the ball rotates approximately one half degree, the offset eccentric action is sufficient to pull the ball seat back far enough to overcome the ball seat ring deflection. Seats never again make contact during rotation of the 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

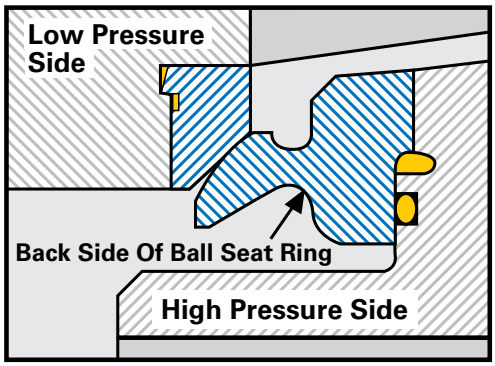
Rubber seated valves that are initially less expensive can become very costly and inconvenient when the system is shut down due to inevitable rubber seat repair and/or replacement. The VBL design has metal-to-metal seats that can handle tough applications and provide long maintenance-free life without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

Unlike rubber seats, metal-to-metal seats are designed for severe throttling service.

Closing Action



Closed and Seated



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

Valve Selection

Cost/Performance Characteristics

100% Full Port Design Reduces Operating Costs

Full-ported valves are far more cost effective than other valve types, mainly because of lower head loss. Willamette VBL 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 metal seated ball valves can even be pigged.

Full Port Pump Control Valves Provide Significant Lifetime Energy Savings

This table shows the estimated power cost over the life of a pump station. All amounts are based on $.14/kWh, four pumps running 12 hours per day over a typical pump station life of 20 years. The calculations are based on 70% 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.

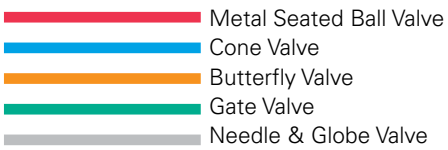
For example, when using a typical butterfly/swing check valve pump control combination for a 36" (900mm) diameter system, the lifetime power costs for a check valve are $346,640 and the butterfly valve costs $139,520, compared to a Metal Seated Ball Valves that costs only $19,900 - a lifetime savings of $466,260!

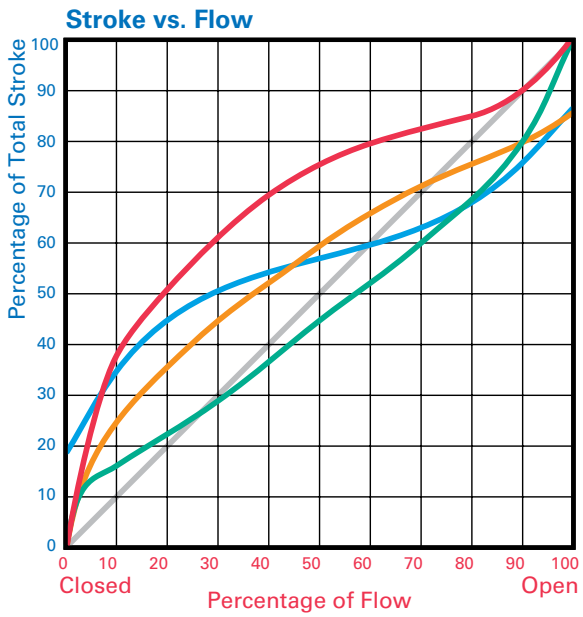
Estimated Lifetime Power Costs (in U.S. Dollars)

Valve Size	Ball & Cone Valve	Gate Valve	Swing Check Valve	Butterfly Valve	Globe Valve
6" 150mm	$1,850	$2,070	$13,770	$12,440	$94,050
8" 200mm	$2,660	$3,360	$22,940	$20,410	$154,250
10" 250mm	$3,200	$5,740	$36,120	$25,060	$243,710
12" 300mm	$3,670	$7,680	$47,900	$33,600	$326,290
14" 350mm	$4,990	$10,440	$64,680	$40,020	$443,850
16" 400mm	$6,500	$13,600	$84,530	$42,610	$579,180
18" 450mm	$6,790	$15,940	$99,490	$49,820	$676,670
20" 500mm	$8,140	$19,660	$122,720	$61,540	$836,080
24" 600mm	$11,060	$28,320	$176,850	$88,590	$1,203,660
30" 750mm	$15,190	$40,600	$240,740	$96,850	$1,646,350
36" 900mm	$19,900	$55,660	$346,640	$139,520	$2,370,600
42" 1100mm	$25,120	$72,260	$448,440	$181,140	$3,075,920
48" 1200mm	$32,850	$92,320	$586,060	$236,600	$4,016,940
54" 1400mm	$35,440	$114,120	$709,350	$284,030	$4,823,780
60" 1500mm	$37,850	$140,500	$876,210	$350,720	$5,952,300

Variable Ball Rotation Controls Surge

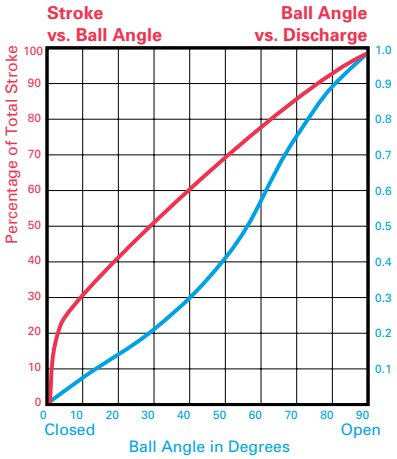
This graph compares Metal Seated Ball Valve opening characteristics with other major valve types. The curves show that the opening flow through a Metal Seated Ball Valve is an optimum accelerating pattern, slow at first then smoothly increasing to full port. Closing is just the reverse, with the first 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 Metal Seated Ball Valve.





Ball Angle, Flow Area Accelerate During Stroke

This graph shows the relationships of stroke, ball angle and valve discharge rate during the 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 Metal Seated Ball Valve without complicated variable speed operators or controls.

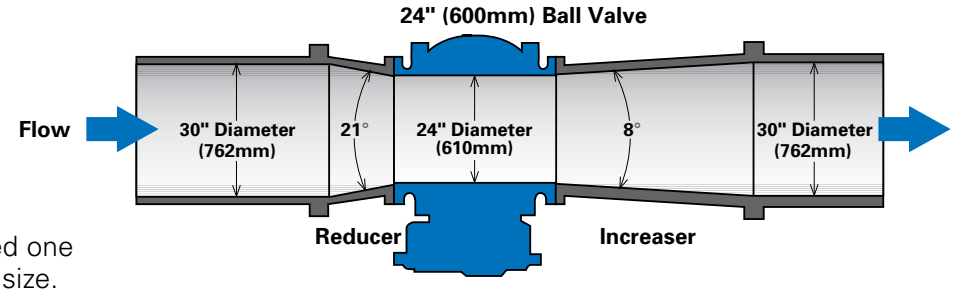


Total Stroke vs. Ball Angle
Ball Angle vs. Coefficient of Discharge

Valve Selection

Venturi Allows Smaller-Than-Line-Size Valve Use

The venturi-type installation allows effective use of the Metal Seated Ball Valve in smaller-than-line-size applications, such as distribution systems, pressure reducing service and gravity mains. The VBL 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 VBL at a cost competitive with the larger obstructed-waterway valves. In some cases, headloss resulting from the venturi-VBL 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
Closed Loop System Plug Angle in Degrees from Closed

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

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

Ordering

To order, simply complete the valve order code from information shown. An ordering example is shown for your reference.

Valve Style
Give valve style code as follows:

VBL = AWWA Metal Seated Ball Valves

Valve Size
Give valve size code as follows:

6	=	6"	(150mm)	24	=	24"	(600mm)
8	=	8"	(200mm)	30	=	30"	(750mm)
10	=	10"	(250mm)	36	=	36"	(900mm)
12	=	12"	(300mm)	42	=	42"	(1100mm)
14	=	14"	(350mm)	48	=	48"	(1200mm)
16	=	16"	(400mm)	54	=	54"	(1400mm)
18	=	18"	(450mm)	on application: 60	=	60"	(1500mm)
20	=	20"	(500mm)				

Body Style
Give body style code as follows:

SS = Single Seated
DS = Double Seated

End Connection
Give end connection code as follows:

F1 = Flanged ASME 125/150
F2 = Flanged ASME 250/300

Body Material
Give body material code as follows:

DI = Ductile Iron

AWWA C507 PRESSURE
Give pressure code as follows:

150 = Class 150
250 = Class 250
300 = Class 300 (F2 end connection only)

NOTES: 1. 6", 8", 48" & 54" are 2-piece construction. 10-42" are 4-piece construction.
2. 48-60" include side mounted base plates (mounting feet).

Body/Adaptor Seat Ring Material
Give body/adaptor seat ring material code as follows:

ML = Monel

Ball/Shaft Material
Give ball/shaft material code as follows:

CS = Carbon Steel (6" & 8")
S2 = 316 Stainless Steel (6" AWWA Pressure 150 only) (8" AWWA Pressure 150 or 250)
DIS5 = Ductile Iron Ball & 17-4PH Stainless Steel Shaft (10-54")

NOTE: 6" & 8" Valves have the shaft integrally cast with the ball housing. Chrome plating is used on the shaft when CS is specified.

Ball Seat Ring
Give ball seat ring material code as follows:

S2 = 316 Stainless Steel

Shut Off Setting
Give Pressure code as follows:

SH = Seat Shut Off Pressure in psi. Setting for actual operating conditions to be specified as 2nd line information on the order (To be set after final shop test)

NOTE: Contact application engineering for double seated (DS) valves with different pressure in each direction.

Flow Velocity
Give flow velocity code as follows:

FR = Flow Velocity (in feet per second) Specify as 2nd line information on the order

NOTE: Contact DeZURIK for double seated (DS) valves with different pressure in each direction.

Options
Give Option code as follows:

DTR = DeZURIK Standard Certified Production Hydrostatic Shell & Seat Test Report

Ordering Example:
VBL,12,SS,F1,DI,150,ML-DIS5-S2,SH,FR*actuator
Seat Shutoff Pressure to be 150 psi

Engineering Reminders

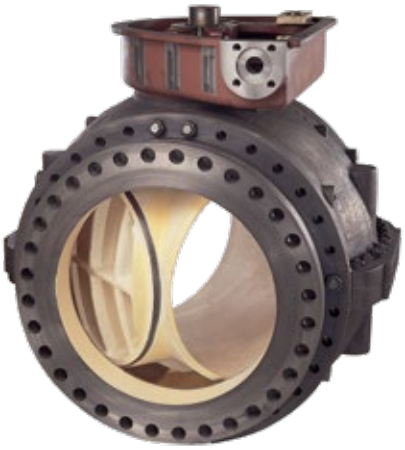
1. Metal seated ball valves and adjacent pipe must be independently supported.

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.

Metal Seated Ball Valve with Link and Lever Torque Unit

A.
Full Closed



B.
50% Stroke

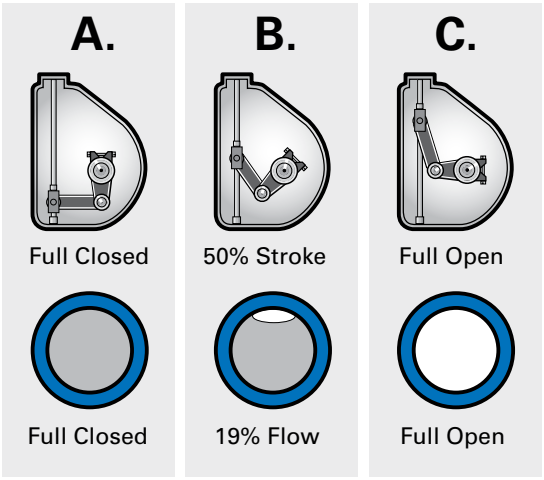
C.
Full Open

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

Precise Flow Regulation

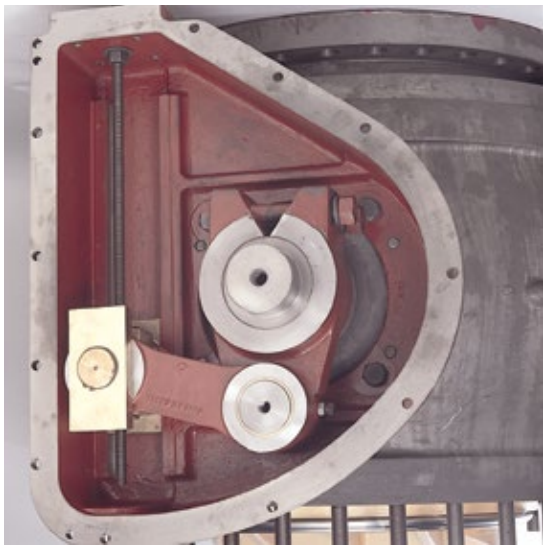
The Willamette Link and Lever valve operating mechanism is designed to minimize water pressure surges and water hammer. In closing, 81% of the flow area is cut off during the first 50% of the operating stroke. The final 19% of the flow area is then slowly closed in the last 50% of the stroke. By shutting 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 VBL 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

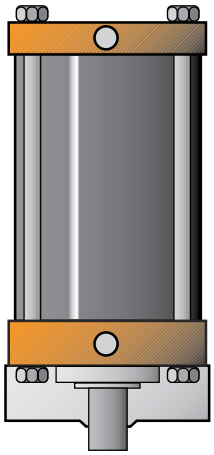
Operator Characteristics

Operators

Willamette 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 valve to specific performance requirements.

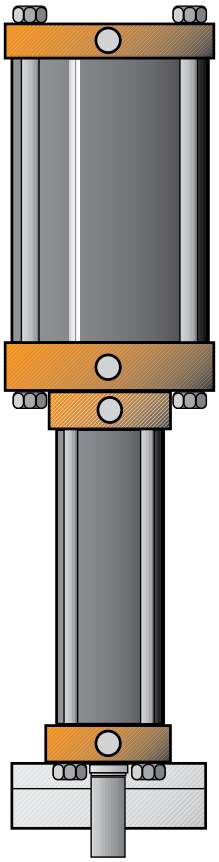
Cylinder Operators

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.

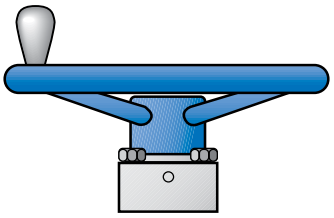


Air/Oil Tandem Cylinder

The tandem cylinder 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.

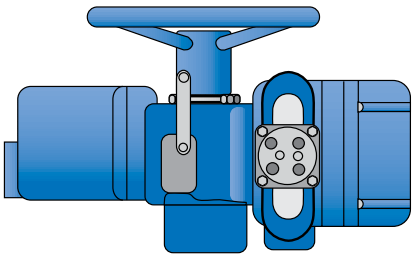
A clean reliable source of air (for best results, 85-125 psig (586-862 kPa) is provided to the upper cylinder to power the valve. The lower cylinder is oil filled and is used to provide control of the opening and closing times with the smooth operation of oil.

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

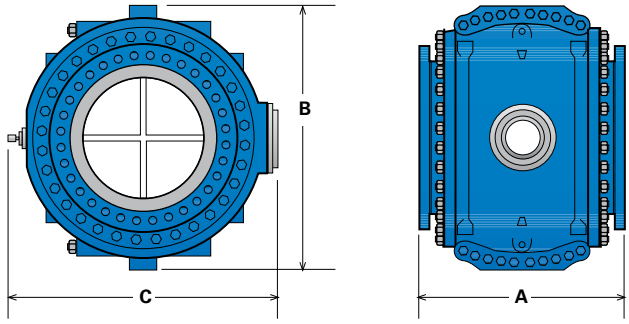
The electric motor operator is available with a 90° direct drive unit (instead of the standard link and lever torque unit) for remote modulating, flow control applications requiring a more direct 1-to-1 ratio of opening and closing.

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 and valve boxes are available with indicators as well as floor stands.

Dimensions

Basic Valve



Note: All dimensions for Class 250 Valves also apply to Class 300 Valves.

Contact DeZURIK for actuator dimensions.

Valve Size	A (Length)		B (Height)		C (Width)		Weight (Approx. lbs/kg)	
	125#	250#	125#	250#	125#	250#	125#	250#
6" / 150	14 / 356	14.9 / 378	14 / 356	14 / 356	15.1 / 384	15.1 / 384	382 / 173	422 / 191
8" / 200	15 / 381	15.3 / 387	17.5 / 445	17.5 / 445	19.1 / 486	19.1 / 486	432 / 196	492 / 223
10" / 250	18.5 / 470	20.1 / 511	22.3 / 565	22.3 / 565	21.5 / 546	21.5 / 546	812 / 368	802 / 364
12" / 300	19.5 / 495	21.4 / 543	26 / 660	26 / 660	23.1 / 587	23.1 / 587	982 / 445	1012 / 459
14" / 350	22.1 / 562	26.5 / 673	29.5 / 749	29.5 / 749	28.3 / 718	28.3 / 718	1432 / 650	1502 / 681
16" / 400	25 / 635	27 / 686	31.3 / 794	31.3 / 794	29.3 / 743	29.3 / 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	35.4 / 899	39.1 / 994	46 / 1168	46 / 1168	41.9 / 1064	41.9 / 1064	4124 / 1871	6227 / 2825
30" / 750	44.3 / 1124	47.3 / 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	59.9 / 1521	59.9 / 1521	11227 / 5092	15556 / 7056
42" / 1100	59.5 / 1511	63 / 1600	78 / 1981	78 / 1981	68.8 / 1746	68.8 / 1746	15076 / 6838	18850 / 8550
48" / 1200	72 / 1829	74.5 / 1892	89.5 / 2273	89.5 / 2273	94.6 / 2403	94.6 / 2403	15125 / 6861	24250 / 11000
54 & 60" / 1400 & 1500	Contact DeZURIK							

Inch
Millimeter

Sales and Service

For information about our worldwide locations, approvals, certifications and local representative:
Web Site: www.dezurik.com E-Mail: info@dezurik.com

DeZURIK

250 Riverside Ave. N. Sartell, Minnesota 56377 • Phone: 320-259-2000 • Fax: 320-259-2227

Printed in the U.S.A.