FLOWSERVE

TECHNICAL BULLETIN

Valtek® Multi-Z
Severe Service Valves



Experience In Motion

Eliminate cavitation in high pressure drop applications

Operators in the power generation, oil and gas, and chemical industries are frequently confronted with extreme pressure differentials in their processes. To combat this, they need valves with continuous, steady-state flow curves with appropriate flow characteristics, long service life and low maintenance costs.

The Valtek® Multi-Z axial flow control valve eliminates cavitation often associated with high pressure drops. It is ideal for processes with entrained solids and in services where high rangeability is required.

Available in globe and angle configurations as well as a variety of standard materials, the Multi-Z valve:

- Effectively minimizes noise levels
- Passes solids up to 24.7 mm (1.0 in) without plugging
- Utilizes long strokes for finer control resolution

In addition to standard trims, a wide range of engineered trims are available with customized capacity and cavitation resistance for unusual or difficult applications.

Avoid costly safety recertification

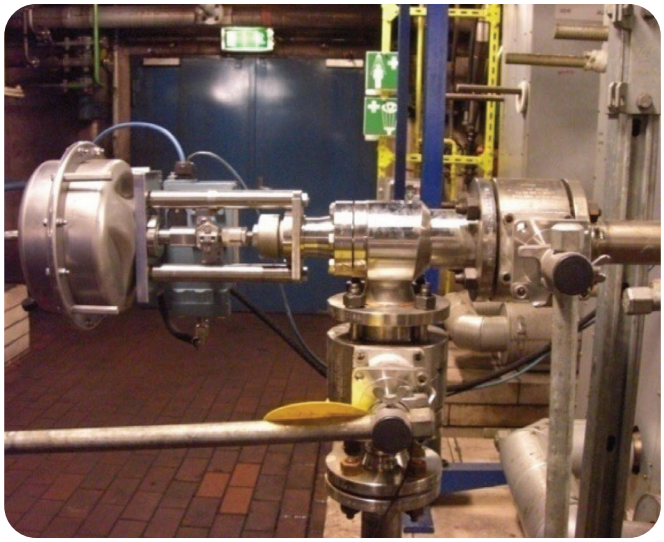
Operators can avoid an expensive and time-consuming re-evaluation of safety relief systems in a maintenance of certification (MOC) review by choosing the Valtek Multi-Z valve with standard trim to replace existing equipment.

That's because verified valve flow capacities (Cv) of the Multi-Z valve exactly match commonly accepted industry standard capacities.

Solids and cavitation completely under control

Flowserve designed the Valtek Multi-Z valve to accommodate solids in liquid media, minimize high sound levels, tolerate high temperatures, eliminate cavitation formation and with a variety of materials to resist corrosion. The Multi-Z valve reduces cavitation by employing the following pressure drop mechanisms:

- Directional changes
- Frictional losses in small passages
- Mutual impingement of opposing streams
- Sudden expansion and contraction
- Turbulent mixing



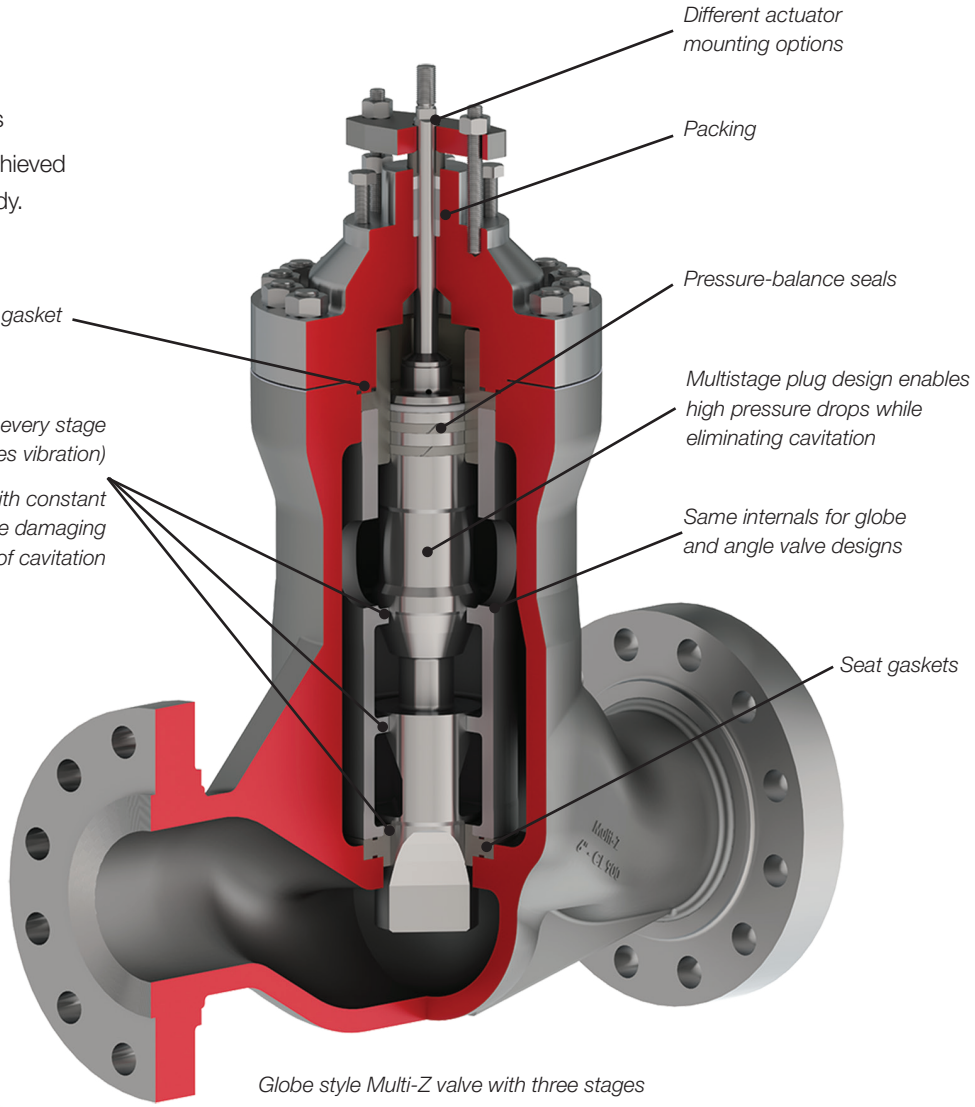
Specifications*

Size	ANSI 1 to 8 in (globe and angle cast)
Pressure class	Size 1 to 6 NPS: Class 300 to 2500 Size 8 NPS: Class 300 to 1500
Body materials	Carbon steel (WCC or A105) Low-temperature carbon steel (LCC) Stainless steel (CF8M or 316SS) Chrome Moly (WC9) Duplex 22%
Body type	Globe and angle
End connections	Flanged RTJ Buttweld Socket weld
Trim type	Balanced or unbalanced Three to six stages of pressure reduction, as required by the service conditions
Shutoff	ANSI Class IV and V
Flow characteristic	Linear or modified equal percentage
Stem sealing	PTFE Graphite SAS 225 SureSeal HP LL SureSeal HP 325 SureGuard XT PTFE/Graphite V-ring
Actuator	Piston type VL / VL-C / VL-ES Spring diaphragm type KP (stainless steel) Spring diaphragm type FlowAct (carbon steel) Electric Hydraulic Manual
Certifications	PED (EU), TR CU (Russia), CRN (Canada) Fugitive emissions ISO 15848-1 SIL 3 capable

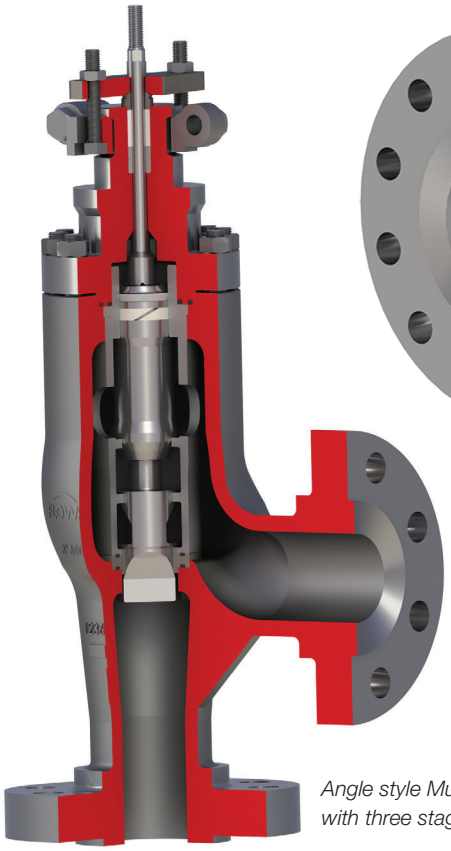
**These options are suitable for the majority of applications. For custom applications, a wide variety of trims, materials and options are available.*

Features

- Tolerance to solids in the medium
- Eliminates cavitation
- Reduces noise
- Balanced and unbalanced designs
- The angle valve configuration is achieved with only a change in the valve body.



Globe style Multi-Z valve with three stages



Angle style Multi-Z valve with three stages

Principle of cavitation elimination

Cavitation, the rapid formation and collapse of vapor bubbles in a liquid, occurs when the pressure of the medium temporarily drops below the vapor pressure and then rapidly recovers. Cavitation creates erosion of valve body walls and other components, ultimately leading to the degradation of performance and valve life.

The Multi-Z valve trim prevents cavitation by controling the pressure drop as the system medium is directed through multiple trim stages (i.e., three to six, depending on the application). The Multi-Z valve trim designs are optimized to ensure the medium pressure does not drop below the vapor pressure of the process fluid. The computational fluid dynamics (CFD) plot below illustrates the pressure drop across the Multi-Z valve trim. The trim design adheres to ISA-RP75.23.

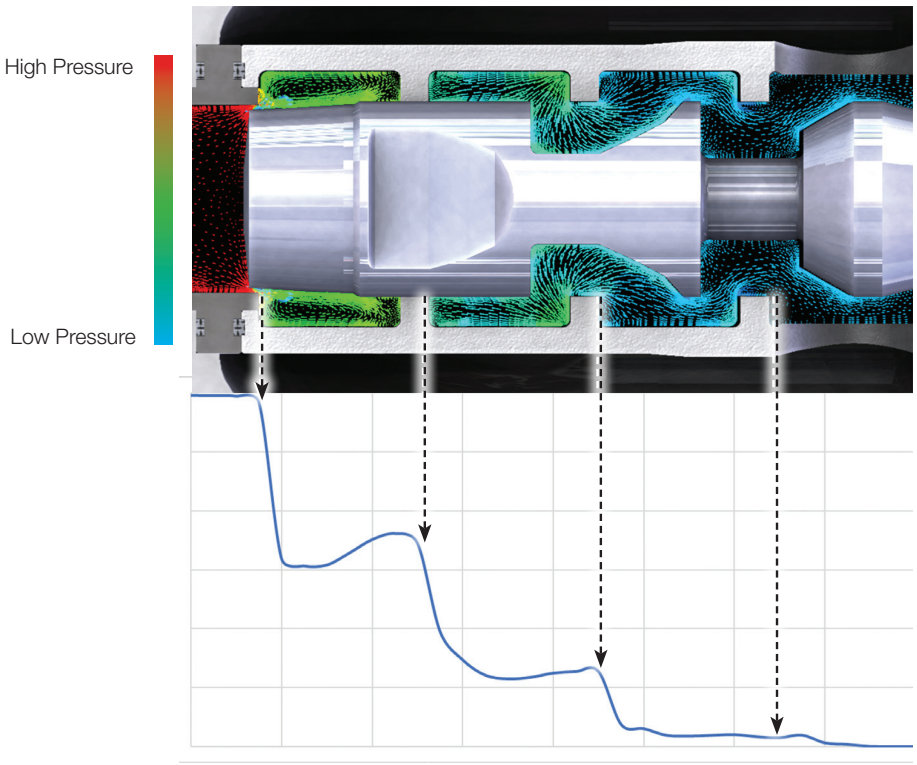


Figure 1: *CFD analysis illustrates pressure drop across number of trim stages.*

The trim is available with linear or modified equal percentage characteristics. Custom plug contours are available for unusual applications. The Multi-Z valve utilizes long stroke lengths through the complete product range, providing better control resolution.

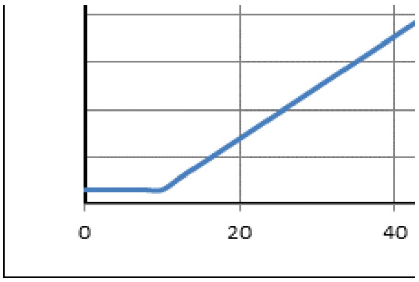


Figure 2: *Flow curve*

When the Multi-Z valve first opens, the staging is held closed. This allows the seating surfaces to open wide, preventing seat damage (see Figure 2).

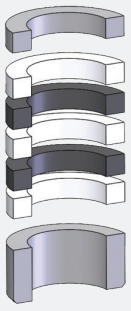
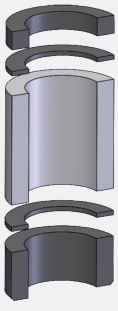
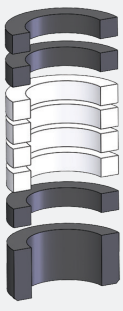
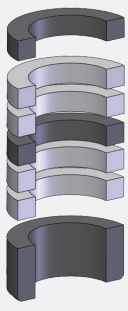
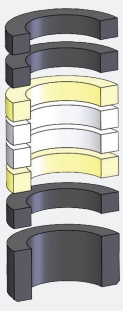
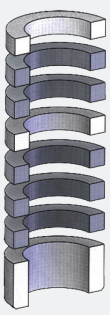
Industry applications[1]

Refinery	Charge pump recirculation
	Amine letdown
	Cold high-pressure letdown
Oilfield	Produced water injection
	High-pressure injection control
Power	Boiler feed water recirculation
	Boiler feed water startup
All Plants	High pressure drop applications
	Water letdown

[1] Multi-Z valves are not suitable for oxygen applications.

Packing options

Table 1: Packing

Description	PTFE	Graphite SAS 225	SureSeal HP LL	Graphite SAS402-4 (BAM)	SureSeal HP 325 LL	SureGuard XT (fire-safe option)	PTFE/ Graphite V-ring
Material	PTFE Rope and PTFE With Graphite	Graphite	PTFE/ Graphite	Graphite	PTFE/Graphite/ Nomex	Perfluoro-elastomer	Spring-loaded PTFE
Maximum Temperature, °C (°F)	220 (428)	550 (1,020)	280 (536)	550 (1,020)	220 (428)	288 (550)	220 (428)
Maximum Pressure at Ambient Temperature, bar (psi)	400 (5,800)	500 (7,250)	280 (4,061)	500 (7,250)	400 (5,800)	276 (4,000)	325 (4,713)
Certifications	None	None	ISO 15848 Class A (Class B; Class C) TA-Luft	BAM Certificate for Oxygen Service	TA-Luft	None	BAM Certificate for Oxygen Service
Reference Image							

Note: Metal bellows seal option available upon request.

Standard trim design

Table 2: Cavitation protection, flow capacity and maximum particulate size

Trim Label	Sigma MR	Stages	Size	1 in	1.5 in	2 in	3 in	4 in	6 in	8 in*2
			Stroke mm (in)	10 (0.39)	15 (0.59)	15 (0.59)	25 (0.98)	40 (1.58)	60 (2.36)	60 (2.36)
CC3	1.041	3*1	Max. Cv	2.0	3.8	9.0	20	34	65	135
			Min. Control Cv	0.12	0.29	0.29	0.59	0.92	1.5	2.1
			Max. Part. Size mm (in)	2.2 (0.09)	2.1 (0.08)	6.3 (0.25)	8.9 (0.35)	11.3 (0.45)	14.4 (0.57)	24.7 (0.97)
CA4	1.008	4	Max. Cv	1.0	1.9	4.5	10	16.5	34	70
			Min. Control Cv	0.09	0.23	0.23	0.49	0.75	1.2	1.7
			Max. Part. Size mm (in)	0.3 (0.01)	0.3 (0.01)	0.9 (0.04)	1.4 (0.05)	1.6 (0.06)	2.4 (0.09)	3.9 (0.15)
CB4	1.012		Max. Cv	1.4	2.5	6.0	13	22	45	90
			Min. Control Cv	0.09	0.23	0.23	0.49	0.75	1.2	1.7
			Max. Part. Size mm (in)	0.5 (0.02)	0.5 (0.02)	1.3 (0.05)	1.9 (0.07)	2.3 (0.09)	3.4 (0.13)	5.5 (0.22)
CC4	1.018		Max. Cv	1.7	3.2	7.5	16.5	28	56	115
			Min. Control Cv	0.09	0.23	0.23	0.49	0.75	1.2	1.7
			Max. Part. Size mm (in)	0.7 (0.03)	0.7 (0.03)	2.1 (0.08)	3.0 (0.12)	3.6 (0.14)	5.3 (0.21)	9.1 (0.36)
CA6	1.004	6	Max. Cv	0.8	1.4	3.5	7.5	12	25	50
			Min. Control Cv	0.07	0.18	0.18	0.37	0.58	0.95	1.3
			Max. Part. Size mm (in)	0.4 (0.01)	0.3 (0.01)	0.9 (0.04)	1.3 (0.05)	1.5 (0.06)	2.2 (0.09)	3.5 (0.14)
CB6	1.006		Max. Cv	1.0	1.8	4.5	9.5	16	35	65
			Min. Control Cv	0.07	0.18	0.18	0.37	0.58	0.95	1.3
			Max. Part. Size mm (in)	0.4 (0.02)	0.4 (0.02)	1.2 (0.05)	1.6 (0.06)	2.0 (0.08)	3.2 (0.13)	4.9 (0.19)
CC6	1.012		Max. Cv	1.4	2.5	6.0	13	22	45	91
			Min. Control Cv	0.07	0.18	0.18	0.37	0.58	0.95	1.3
			Max. Part. Size mm (in)	0.7 (0.03)	0.7 (0.03)	2.0 (0.08)	2.7 (0.11)	3.3 (0.13)	4.9 (0.19)	8.7 (0.34)

*1: Three-stage trim is not available as standard for Class 2500 designs.
*2: 8 in and larger sizes are not available as standard in Class 2500 designs.
Contact factory to discuss available options for custom applications.

Parts list

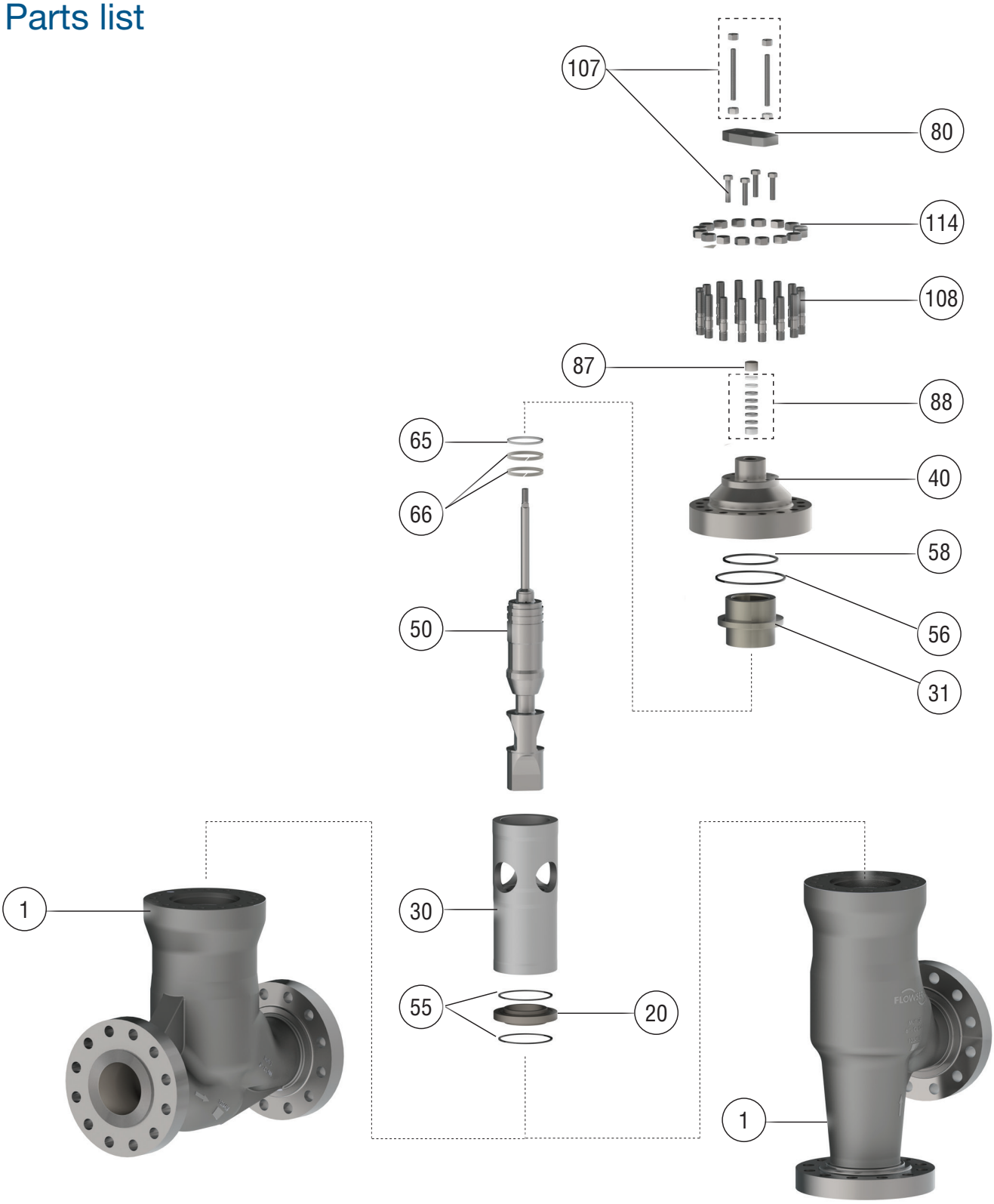
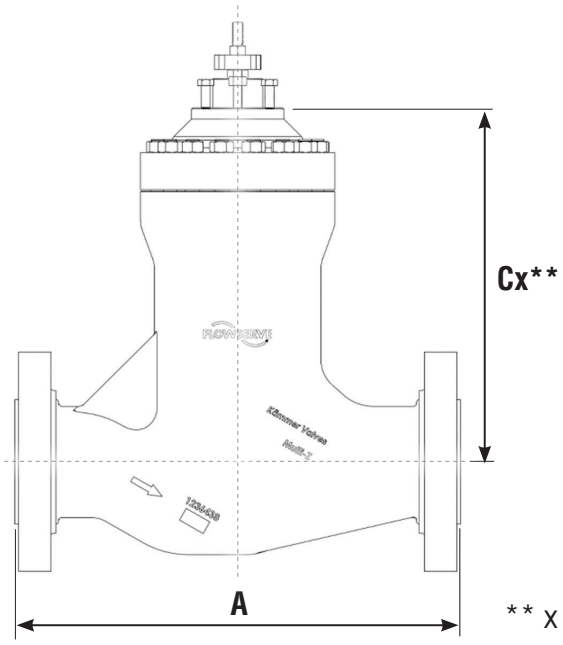


Table 3: Materials of construction

Item Number	Component	Material Details		
1	Body	**Material**	**Temperature Range**	
		WCC (CS cast)	-29ºC to 427ºC	-20ºF to 800ºF
		A352 LCC	-254ºC to 454ºC	-425ºF to 85ºF
		CF8M (316 SS cast)	-29ºC to 593ºC	-20ºF to 1,100ºF
		WC9	-46ºC to 343ºC	-50ºF to 650ºF
		Duplex SS 22% Cr	-29ºC to 316ºC	-20ºF to 600ºF
40	Bonnet	Carbon Steel	-29ºC to 427ºC	-20ºF to 800ºF
		Low-temperature CS	-254ºC to 454ºC	-425ºF to 850ºF
		316 SS	-29ºC to 593ºC	-20ºF to 1,100ºF
		Cr-Mo WC9; F22	-46ºC to 343ºC	-50ºF to 650ºF
		Duplex SS 22% Cr	-29ºC to 316ºC	-20ºF to 600ºF
50	Plug	**Standard**	**NACE**	
		1.4112	1.4462	
		416 SS HT	Duplex 22% Cr	
		420 SS HT	Inconel® 718	
		17-4PH H1025	Nitronic® 50	
		-	17-4PH H1150D	
51	Stem	**Standard**	**NACE**	
		1.4112	1.4462	
		416 SS HT	Duplex 22% Cr	
		420 SS HT	Inconel 718	
		-	Nitronic 50	
		-	17-4PH H1150D	
30/31	Liner/PB Sleeve	**Standard**	**NACE**	
		1.4112	1.4462	
		416 SS HT	Duplex 22% Cr	
		420 SS HT	Inconel 718	
		-	Nitronic 50	
		-	17-4PH H1150D	
20	Seat Ring	**Standard**	**NACE**	
		1.4112	1.4462	
		416 SS HT	Duplex 22% Cr	
		420 SS HT	Inconel 718	
		-	Nitronic 50	
		-	17-4PH H1150D	
88	Packing	See Table 1		
65	Pressure Balance Seal	**Material**	**Max. Temp.**	
		PTFE V-ring	250°C	480°F
		O-ring Energized PTFE	250°C	480°F
		Metallic Piston Rings	400°C	750°F
56	Bonnet Gasket	-	-	-
58	Sleeve Gasket	-	-	-
66	Guide Rings	-	-	-
80	Gland Flange	-	-	-
87	Packing Gland	-	-	-
88	Packing	-	-	-
107	Upper Bolting Kit	-	-	-

® Inconel is a registered trademark of the International Nickel Co., Inc.
® Nitronic is a registered trademark of AK Steel.

Dimensions



** x = number of stages

Table 4: Globe valves, ANSI

Valve Size ANSI	Class 300					Class 600					Class 900				
	A1[1]	A2[2]	C3	C4	C6	A1	A2	C3	C4	C6	A1	A2	C3	C4	C6
1	197 (7.75)	197 (7.75)	170 (6.69)	192 (7.56)	236 (9.29)	292[3] (11.50)	292[3] (11.50)	170 (6.69)	192 (7.56)	236 (9.29)	292 (11.50)	292 (11.50)	170 (6.69)	192 (7.56)	236 (9.29)
1.5	235 (9.25)	235 (9.25)	247 (9.72)	277 (10.91)	337 (13.27)	311[3] (12.25)	311[3] (12.25)	247 (9.72)	277 (10.91)	337 (13.27)	311[3] (12.25)	311[3] (12.25)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)
2	267 (10.50)	270 (10.62)	247 (9.72)	277 (10.91)	337 (13.27)	375[3] (14.75)	378[3] (14.88)	247 (9.72)	277 (10.91)	337 (13.27)	375 (14.75)	378 (14.88)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)
3	318 (12.50)	321 (12.62)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)	441[3] (17.38)	445[3] (17.50)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)	441 (17.38)	445 (17.50)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)
4	368 (14.50)	371 (14.62)	415 (16.34)	487 (19.17)	631 (24.81)	511[3] (20.12)	514[3] (20.25)	415 (16.34)	487 (19.17)	631 (24.84)	511 (20.12)	514 (20.25)	470.2 (18.51)	542.2 (21.35)	686.2 (27.02)
6	473 (18.62)	476 (18.75)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)	768[3] (30.25)	772[3] (30.38)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)	768[3] (30.25)	772[3] (30.38)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)
8	568 (22.38)	572 (22.50)	724.7 (28.53)	837.2 (32.96)	1,062.2 (41.82)	914[3] (36.00)	917[3] (36.12)	724.7 (28.53)	837.2 (32.96)	1,062.2 (41.82)	914 (36.00)	917 (36.12)	730.2 (28.75)	842.7 (33.18)	1,067.7 (42.04)

Valve Size ANSI	Class 1500					Class 2500				
	A1[1]	A2[2]	C3	C4	C6	A1	A2	C3	C4	C6
1	292 (11.50)	292 (11.50)	170 (6.69)	192 (7.56)	236 (9.29)	308[3] (12.12)	308[3] (12.12)	Note 4	198 (7.80)	242 (9.53)
1.5	311[3] (12.25)	311[3] (12.25)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)	359[3] (14.12)	359[3] (14.12)	Note 4	320.5 (12.62)	385.5 (15.18)
2	375 (14.75)	378 (14.88)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)	413 (16.25)	416 (16.38)	Note 4	320.5 (12.62)	385.5 (15.18)
3	460 (18.12)	464 (18.25)	349.5 (13.76)	394.5 (15.53)	484.5 (19.07)	498[3] (19.62)	502[3] (19.75)	Note 4	493.2 (19.42)	587.2 (23.12)
4	530 (20.88)	533 (21.00)	470.2 (18.51)	542.2 (21.35)	686.2 (27.02)	737 (29.00)	746 (29.38)	Note 4	650 (25.59)	801 (31.54)
6	768 (30.25)	778 (30.62)	648.2 (25.52)	753.2 (29.65)	963.2 (37.92)	819[3] (32.25)	832[3] (32.75)	Note 4	782.2 (30.80)	997.2 (39.26)
8	972 (38.25)	981 (38.62)	730.2 (28.75)	842.7 (33.18)	1,067.7 (42.04)	Note 4				

Primary dimension shown in millimeters; secondary dimension noted in parentheses shown in inches.

1. A1 End connections: Flanged RF/RFSF
2. A2 End connections: Flanged RTJ
3. Noted dimensions are 'Flowserve Standard' alternates; ANSI/ISA standard dimensions are also available for all sizes/classes.
4. Three-stage trim and 8 in sizes not available as standard for Class 2500 designs. Contact factory for custom designs.

Dimensions

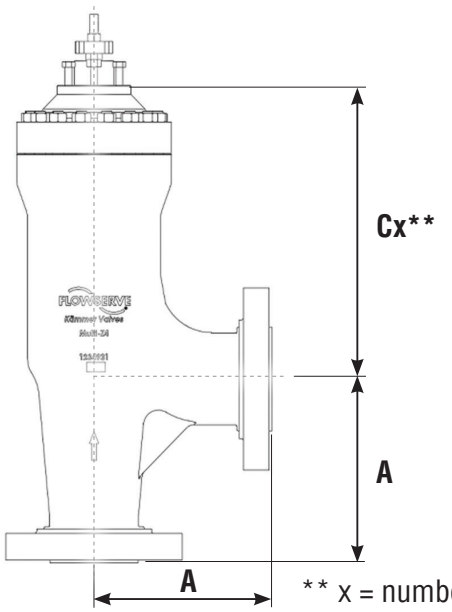


Table 5: Angle valves, ANSI

Valve Size ANSI	Class 300					Class 600					Class 900				
	A1	A2	C3	C4	C6	A1	A2	C3	C4	C6	A1	A2	C3	C4	C6
1	98 (3.88)	98 (3.88)	170 (6.69)	192 (7.56)	236 (9.29)	146[3] (5.75)	146[3] (5.75)	170 (6.69)	192 (7.56)	236 (9.29)	146 (5.75)	146 (5.75	170 (6.69)	192 (7.56)	236 (9.29)
1.5	117 (4.63)	117 (4.63)	247 (9.72)	277 (10.91)	337 (13.27)	156[3] (6.13)	156[3] (6.13)	247 (9.72)	277 (10.91)	337 (13.27)	156[3] (6.13)	156[3] (6.13)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)
2	133 (5.25)	135 (5.31)	247 (9.72)	277 (10.91)	337 (13.27)	187[3] (7.38)	189[3] (7.44)	247 (9.72)	277 (10.91)	337 (13.27)	187 (7.38)	189 (7.44)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)
3	159 (6.25)	160 (6.31)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)	221[3] (8.69)	222[3] (8.75)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)	221 (8.69)	222 (8.75)	316.5 (12.46)	361.5 (14.23)	451.5 (17.78)
4	184 (7.25)	186 (7.31)	415 (16.34)	487 (19.17)	631 (24.84)	256[3] (10.06)	257[3] (10.13)	415 (16.34)	487 (19.17)	631 (24.84)	256 (10.06)	257 (10.13)	470.2 (18.51)	542.2 (21.35)	686.2 (27.02)
6	236 (9.31)	238 (9.38)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)	384[3] (15.13)	386[3] (15.19)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)	384[3] (15.13)	386[3] (15.19)	614.2 (24.18)	719.2 (28.31)	929.2 (36.58)
8	284 (11.19)	286 (11.25)	724.7 (28.53)	837.2 (32.96)	1,062.2 (41.82)	457[3] (18.00)	459[3] (18.06)	724.7 (28.53)	837.2 (32.96)	1,062.2 (41.82)	457 (18.00)	459 (18.06)	730.2 (28.75)	842.7 (33.18)	1,067.7 (42.04)

Valve Size ANSI	Class 1500					Class 2500				
	A1	A2	C3	C4	C6	A1	A2	C3	C4	C6
1	146 (5.75)	146 (5.75)	170 (6.69)	192 (7.56)	236 (9.29)	154[3] (6.06)	154[3] (6.06)	Note 4	198 (7.80)	242 (9.53)
1.5	156[3] (6.13)	156[3] (6.13)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)	179[3] (7.06)	179[3] (7.06)	Note 4	320.5 (12.62)	385.5 (15.18)
2	187 (7.38)	189 (7.44)	269.5 (10.61)	299.5 (11.79)	359.5 (14.15)	206 (8.13)	208 (8.19)	Note 4	320.5 (12.62)	385.5 (15.18)
3	230 (9.06)	232 (9.13)	349.5 (13.76)	394.5 (15.53)	484.5 (19.07)	249[3] (9.81)	251[3] (9.88)	Note 4	493.2 (19.42)	587.2 (23.12)
4	265 (10.44)	267 (10.50)	470.2 (18.51)	542.2 (21.35)	686.2 (27.02)	368 (14.50)	373 (14.69)	Note 4	650 (25.59)	801 (31.54)
6	384 (15.13)	389 (15.31)	648.2 (25.52)	753.2 (29.65)	963.2 (37.92)	410[3] (16.13)	416[3] (16.38)	Note 4	782.2 (30.80)	997.2 (39.26)
8	486 (19.13)	490 (19.31)	730.2 (28.75)	842.7 (33.18)	1,067.7 (42.04)	Note 4				

Primary dimension shown in millimeters; secondary dimension noted in parentheses shown in inches.

1. A1 End connections: Flanged RF/RFSF
2. A2 End connections: Flanged RTJ
3. Noted dimensions are 'Flowserve Standard' alternates; ANSI/ISA standard dimensions are also available for all sizes/classes.
4. Three-stage trim and 8 in sizes not available as standard for Class 2500 designs. Contact factory for custom designs.

The use of non-piston actuators may change the dimension Cx.

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