

W68 Series Control Valves

Application

W68 valves are used in flow and pressure control applications. These valves are pneumatically or manually operated.

Materials

Product Wetted: ASTM 316L (UNS-S31603); (DIN-1.4404)
 Non-Product: ASTM 304 (UNS-S30400); (DIN-1.4301)
 Seat Material: Metal or Tri Ring
 Elastomer: FKM
 EPDM
 Finish: $\leq 32Ra$ ($\leq .8\mu m$) Other finishes available upon request.

Pressure Ratings

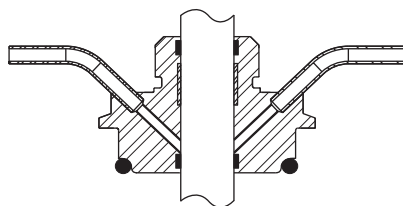
Valve Size Tube OD w/ pressure at	1.0/1.5"	2.0"	2.5"	3.0"	4.0"
70°F (20°C)	500 psi (34.5 bar)	450 psi (31 bar)	400 psi (28 bar)	350 psi (24 bar)	200 psi (14 bar)
160/180°F (71/82°C)	375 psi (26 bar)	350 psi (24 bar)	300 psi (21 bar)	250 psi (17 bar)	150 psi (10 bar)
250°F (121°C)	250 psi (17 bar)	250 psi (17 bar)	200 psi (14 bar)	150 psi (10 bar)	125 psi (8 bar)



W68-T

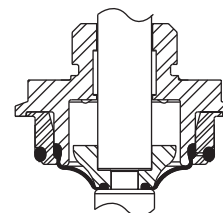
Optional Models

Throttling valves are also available in W88 Stem Flush or W98 Diaphragm Stem options:



W80 adapter

The W80 Series Valve is a W60 Series Valve with a Stem Flush Adapter replacing the standard W60 adapter piece. Ideal for aseptic applications, this valve series uses a stainless steel stem flush adapter to provide a liquid or steam barrier around the valve stem. WCB Single Seat Valves are modular in design therefore maintaining W60 dimensions.

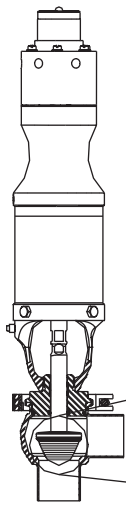


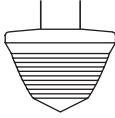
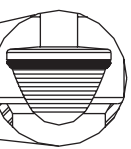
W90 adapter

The W90 Series Valve is a W60 Series Valve with a diaphragm stem seal replacing the standard W60 adapter piece. It is ideal for the extended shelf life applications. The diaphragm stem seal prevents contamination from air or other external contaminants by keeping the stem from exiting the product.

Refer to DS1204 – W Series Single Seat Valve Key for available valve configurations.

Seat Options



Seat Type	Maximum Temperature
Metal Seat (M) 	375°C (190°)
Tri Ring Seat* (TR) 	Oper. 280°F (137°C) EPDM Steril. 275°F (135°C) EPDM Oper. 350°F (176°C) FKM Steril. Consult Factory FKM

*Tri-Ring seat not available on CV1.75, 2.5, 5.0 & 7.5 and 5ALD & 5ALDP actuated valves.

Cv Factor

% of valve stroke	Valve Size - Inches Tube OD														% of valve stroke
	1.0" - 1.5"				1.5"		2"		2.5"		3"		4"		
	Cv 1.75	Cv 2.5	Cv 5.0	Cv 7.5	Cv 10	Cv 35	Cv 30	Cv 70	Cv 60	Cv 120	Cv 90	Cv 150	Cv 110	Cv 210	
10	.175	.25	.50	.75	1	3.5	3	7	6	12	9	15	11	21	10
20	.35	.50	1	1.5	2	7	6	14	12	24	18	30	22	42	20
30	.53	.75	1.5	2.25	3	10.5	9	21	18	36	27	45	33	63	30
40	.70	1	2	3.0	4	14	12	28	24	48	36	60	44	84	40
50	.88	1.25	2.5	3.75	5	17.5	15	35	30	60	45	75	55	105	50
60	1.05	1.5	3	4.5	6	21	18	42	36	72	54	90	66	126	60
70	1.22	1.75	3.5	5.25	7	24.5	21	49	42	84	63	105	77	147	70
80	1.4	2	4	6.0	8	28	24	56	48	96	72	120	88	168	80
90	1.58	2.25	4.5	6.75	9	31.5	27	63	54	108	81	135	99	189	90
100	1.75	2.5	5	7.5	10	35	30	70	60	120	90	150	110	210	100

The Valve Flow Coefficient Cv is the standard measure of valve flow capacity. Preliminary valve sizing may be done with the following formulas:

Formula for water and other products with a specific gravity equal to 1.0:

$$Cv = \frac{GPM}{\sqrt{\Delta P (PSI)}}$$

Formula for products where specific gravity with vary from water:

$$Cv = \frac{GPM}{\sqrt{\Delta P (PSI)/SG}}$$

If the viscosity of the flowing fluid is below 100 Saybolt Seconds Universal (SSU) or 20 Centistokes, the viscosity effect may be disregarded. Beyond these limits, viscosity correction should be made. Contact Waukesha Cherry-Burrell Application Engineering. After the Cv factor for a specific application has been calculated, select the size valve where the Cv factor is closest to 50% of stroke for the valve size selected. 50% stroke is the optimum operating point. Optimum operating range is 20%-80% stroke.

See Page 12:12 for a valve sizing example for flow control.

Where:

GPM=Product flow rate in gallons per minute
 SG=Specific gravity of product
 P=Pressure drop across valve in PSI
 (Inlet pressure minus outlet pressure)
 Cv =Valve Flow Coefficient

Metric Conversions:

$$Cv = 1.156 (Kv) \quad Kv = \frac{m^3/hr}{\sqrt{\Delta P (Bar)/SG}}$$

1bar = 14.5 PSI

1m³/hr = 4.4 GPM

Actuator Types

Air to Spring, Piston Actuator

For use in a wide range of product pressures, including high pressure applications. Control Air Supply Pressure is 18 psi (1.24 bar) to 42 psi (2.90 bar). (See Figure 1) Maximum air pressure is 150 psi (10.34 bar).

Available in Air-to-Raise (AR) or Air-to-Lower (AL).

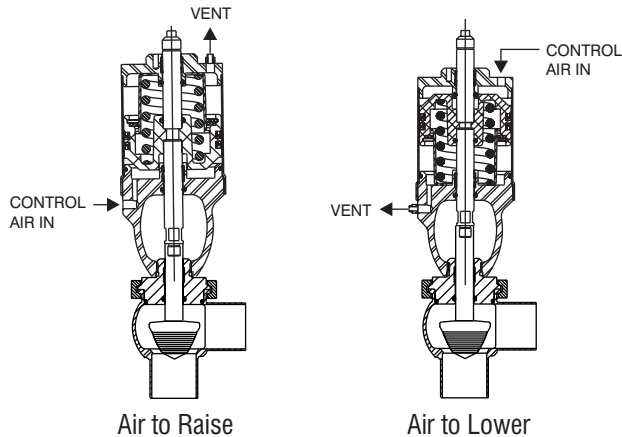
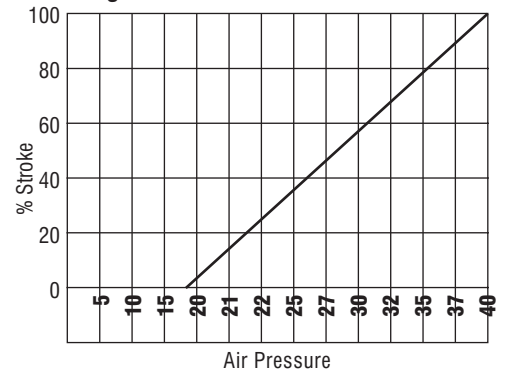


Figure 1—Air Pressure vs. % Stroke*

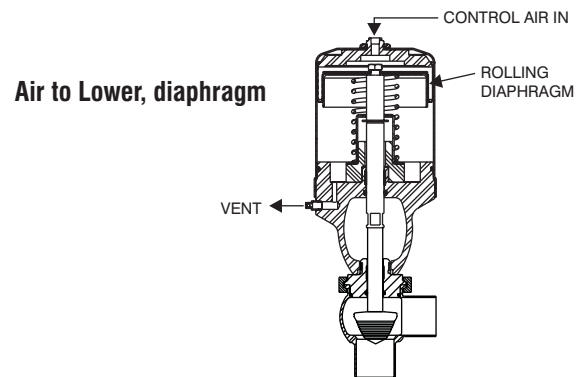


*For Air to Spring Actuators (without positioner). Percent stroke based on 4" & 5" standard springs and 6" light springs.

Rolling Diaphragm Actuator

For use in low product pressure applications. Eliminates breakaway friction and increases sensitivity of the actuator to pressure change. Control Air Supply Pressure is 3 psi (.21 bar) to 15 psi (1.03 bar) Maximum air pressure is 45 psi (3.10 bar).

Available in Air-to-Lower (ALD).



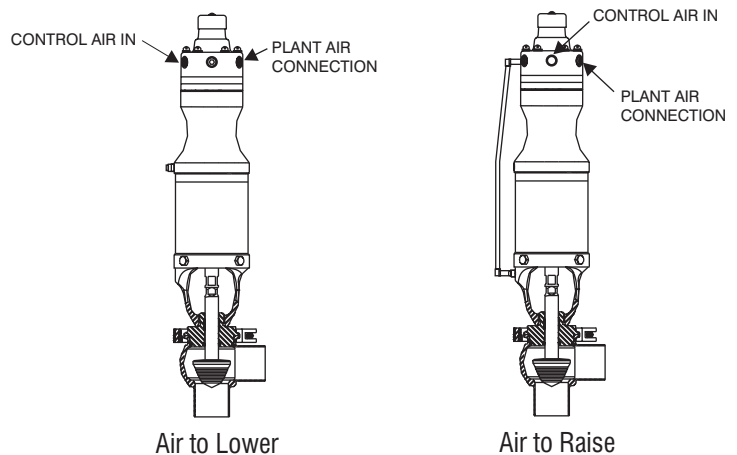
Actuators with Positioner

Where exacting control of flow or pressure is required. Positioners operate using a pneumatic control signal and a plant air supply. Positioners hold the stem in position regardless of product flow or pressure. Control Air Supply Pressure is 3 psi (.21 bar) to 15 psi (1.03 bar)

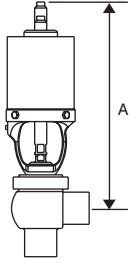
Air to Spring actuators are available in both Air-to-Raise (ARP) and Air-to-Lower (ALP), with direct acting positioner.

Air Supply Pressure is 70 psi (4.83 bar) minimum to 100 psi (6.90 bar) maximum.

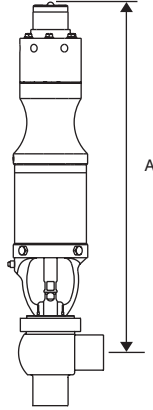
Rolling diaphragm actuators are available Air-to-Lower only (ALDP). Specify direct or reverse acting positioner on order. Maximum air pressure is 45 psi (3.10 bar).



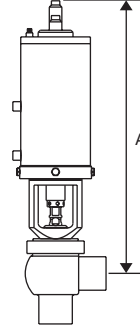
Actuator Options



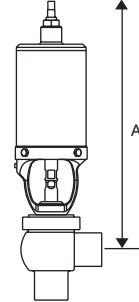
- 4AR – 4” Air to Raise
- 4AL – 4” Air to Lower
- 4AA – 4” Air to Air
- 5AR – 5” Air to Raise
- 5AL – 5” Air to Lower
- 5ALD – 5” Air to Lower, diaphragm
- 5AA – 5” Air to Air
- 6LAR – 6” Light Spring, Air to Raise
- 6LAL – 6” Light Spring, Air to Lower
- 6AA – 6” Air to Air



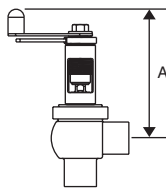
- 4ARP – 4” Air to Raise Positioner
- 4ALP – 4” Air to Lower Positioner
- 5ARP – 5” Air to Raise Positioner
- 5ALP – 5” Air to Lower Positioner
- 5ALDP – 5” Air to Lower, Diaphragm Positioner
- 6LARP – 6” Light Spring, Air to Raise Positioner
- 6LALP – 6” Light Spring, Air to Lower Positioner



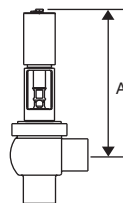
4AR3 – 4” Air to Raise, 3 position



4AL3 – 4” Air to Lower, 3 position



H – Hand Lock



M – Micrometer

Stroke Length – Inches (mm)

Valve Size Inch	W68/W68R	W682
1.0	.85 (22)	-
1.5	.85 (22)	.68 (17)
2.0	.85 (22)	.68 (17)
2.5	.85 (22)	.68 (17)
3.0	.85 (22)	.68 (17)
4.0	.85 (22)	.68 (17)

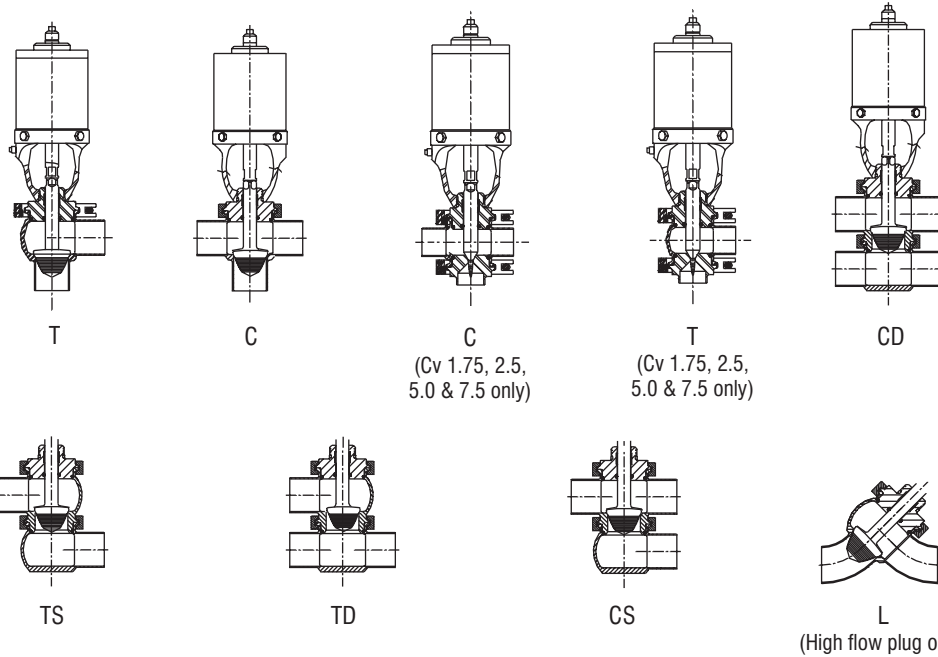
“A” Dimensions* – Inches (mm)

Valve Size Inch	4 AR 4 AL 4 AA	5 AR 5 AL 5 AA	6 AR 6 AL 6 AA	H	M	4AL3	4AR3	4ARP 4ALP	5ARP 5ALP	6ARP 6ALP	5ALD	5ALDP
1.0	12.58 (320)	13.89 (352)	15.65 (397)	8.65 (220)	9.7 (246)	14.68 (372)	16.07 (408)	20.01 (509)	21.32 (542)	23.08 (587)	11.99 (305)	17.73 (450)
1.5	12.58 (320)	13.89 (352)	15.65 (397)	8.65 (220)	9.7 (246)	14.68 (372)	16.07 (408)	20.01 (509)	21.32 (542)	23.08 (587)	11.99 (305)	17.73 (450)
2.0	12.83 (326)	14.14 (359)	15.90 (404)	8.90 (226)	9.9 (251)	14.93 (379)	16.32 (415)	20.26 (515)	21.57 (548)	23.33 (593)	12.24 (311)	17.98 (457)
2.5	13.08 (332)	14.39 (366)	16.15 (410)	9.15 (232)	10.2 (259)	15.1 (383)	16.57 (421)	20.51 (521)	21.82 (555)	23.58 (599)	12.49 (317)	18.23 (463)
3.0	13.33 (339)	14.64 (372)	16.40 (417)	9.40 (239)	10.4 (264)	15.3 (388)	16.82 (427)	20.76 (528)	22.07 (561)	23.83 (605)	12.74 (324)	18.48 (469)
4.0	13.81 (351)	15.12 (384)	16.88 (429)	9.88 (250)	10.9 (277)	15.8 (401)	17.30 (439)	21.24 (540)	22.55 (573)	24.31 (618)	13.22 (336)	18.96 (482)

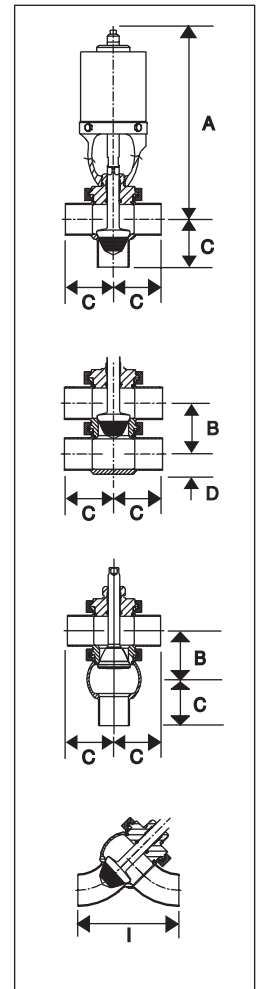
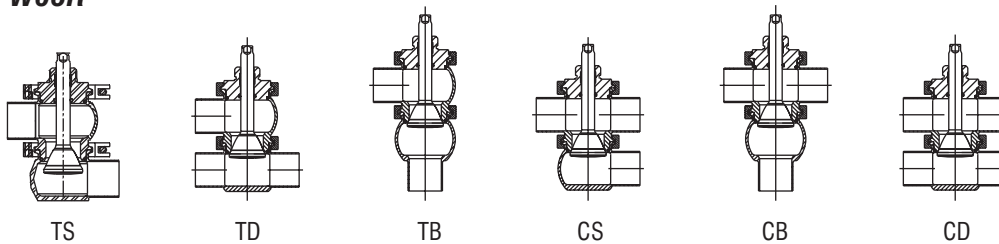
Note: For all valves with control tops add 3.23" (82mm) Standard
*“A” Dimension is in fully extended (open) position.

Body Configurations (1 of 2)

W68



W68R

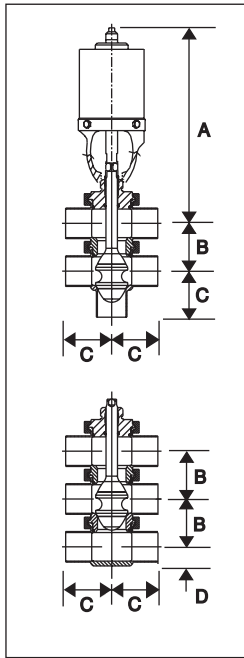


Valve Dimensions – Inches (mm)

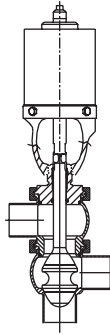
Valve Size Inch	A	B	C		D	I	
			Buttweld	S-Line		Buttweld	S-Line
1.0*	See page 4:12 for Actuator Options	2.63 (67)	2.00 (51)	3.12 (79)	.69 (18)	3.90 (120)	6.12 (155)
1.5		2.63 (67)	2.25 (57)	2.75 (70)	.94 (24)	4.76 (120)	5.73 (146)
2.0		3.13 (79.5)	3.00 (76)	3.50 (89)	1.19 (30)	6.23 (158)	7.21 (183)
2.5		3.63 (92)	3.00 (76)	3.50 (89)	1.44 (30)	7.69 (195)	8.67 (220)
3.0		4.13 (105)	3.25 (83)	3.75 (95)	1.69 (43)	9.15 (232)	10.13 (257)
4.0		5.11 (130)	3.88 (99)	4.50 (114)	2.32 (59)	11.95 (303)	13.17 (335)

*1" size throttling valves are only available for CV 1.75, 2.5, 5.0 & 7.5 in T or C body configurations.

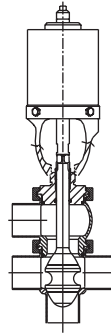
Body Configurations (2 of 2)



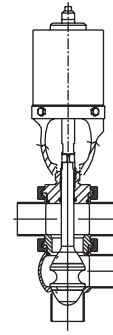
W682 Divert



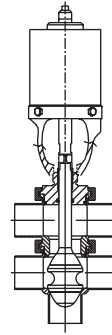
TT



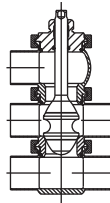
TC



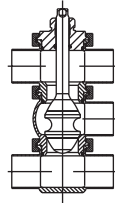
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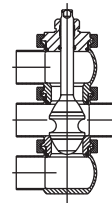
CC



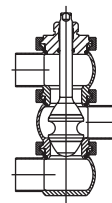
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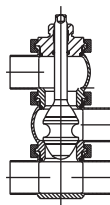
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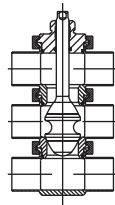
TCS



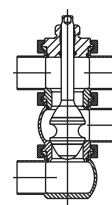
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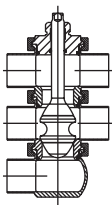
TTD



CCD



CTS



CCS

Valve Dimensions – Inches (mm)

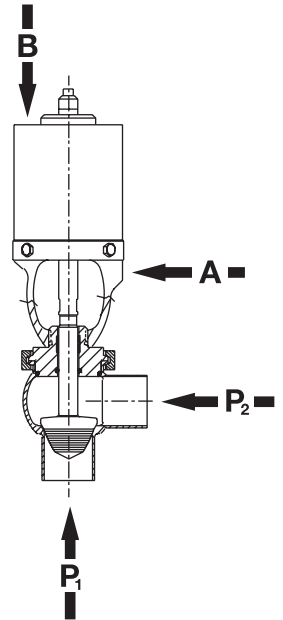
Valve Size Inch	A	B	C Buttweld	C S-Line	D
1.5	See page 4:12 for Actuator Options	2.63 (67)	2.25 (57)	2.75 (70)	.94 (24)
2.0		3.13 (79.5)	3.00 (76)	3.50 (89)	1.19 (30)
2.5		3.63 (92)	3.00 (76)	3.50 (89)	1.44 (30)
3.0		4.13 (105)	3.25 (83)	3.75 (95)	1.69 (43)
4.0		5.11 (130)	3.88 (99)	4.50 (114)	2.32 (59)

W68 Holding Pressure Charts

W68 AR (air-to-raise)

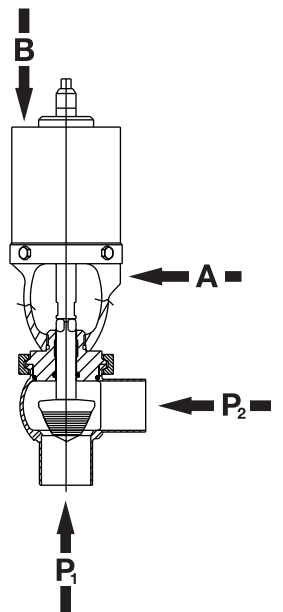
		Actuator	Valve Size Tube OD - Inches					Pressure in PSI*
			1"	1.5"	2"	2.5"	3"	
Port P1, actuator spring holds closed against:		4AR	160	125	70	45	31	18
		5AR	251	220	124	79	55	31
		6LAR	347	317	178	114	79	45
Port P2, Air to Port A, will open against:	50PSI	4AR	223	270	132	80	54	29
	50PSI	5AR	356	398	195	118	79	43
	50PSI	6LAR	-	-	278	168	113	61

Note: 1" size throttling valves are only available for CV 1.75, 2.5, 5.0 & 7.5



W68 AL (air-to-lower)

		Actuator	Valve Size Tube OD - Inches					Pressure in PSI*
			1" *	1.5"	2"	2.5"	3"	
Port P2, actuator spring opens stem against:		4AL	288	335	164	99	67	36
		5AL	-	-	216	131	88	47
		6LAL	-	-	260	157	106	57
		5ALD	-	61	30	18	12	7
Port P1, Air to Port B, will hold closed against:	50PSI	4AL	111	76	43	27	19	11
	50PSI	5AL	218	187	105	67	47	27
	50PSI	6LAL	383	353	198	127	88	50
	15PSI	5ALD	-	109	61	39	27	15

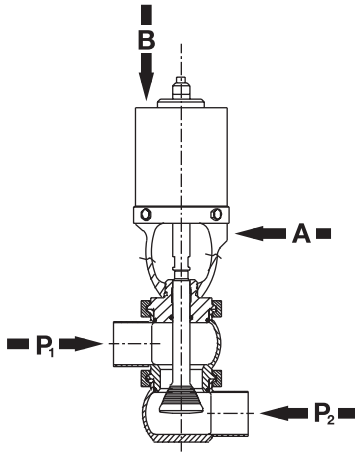


If pressure rating is higher than documented in tables consult factory before exceeding.
Normal air supply requirement: 50 psi for 4 and 5 inch actuator, 6 inch light spring actuators.
15 psi for 5ALD actuators.

*1Bar = 14.5 psi

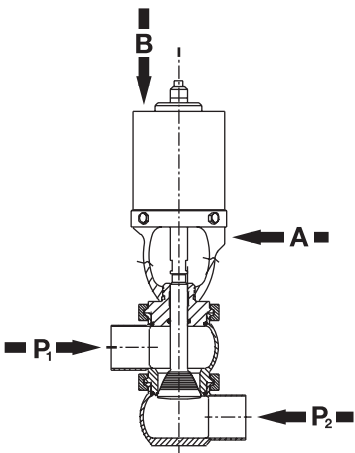
W68R Holding Pressure Charts

W68R AR (air-to-raise)



	Actuator	Valve Size Tube OD - Inches Pressure in PSI*				
		1.5"	2"	2.5"	3"	4"
Port P2, stem raised, actuator spring will open against:	4AR	253	142	91	63	37
	5AR	333	187	120	83	48
	6LAR	426	239	153	106	61
Port P1, Air to Port A, will hold valve closed against:	50PSI 4AR	99	48	29	20	10
	50PSI 5AR	247	121	73	49	26
	50PSI 6LAR	421	206	125	84	45

W68R AL (air-to-lower)



	Actuator	Valve Size Tube OD - Inches Pressure in PSI*				
		1.5"	2"	2.5"	3"	4"
Port P1, actuator spring holds closed against:	4AL	164	81	49	33	17
	5AL	290	142	86	58	31
	6LAL	385	189	114	77	41
	5ALD	47	23	14	9	5
Port P2, Air to Port B, will open against:	50PSI 4AL	204	115	73	51	30
	50PSI 5AL	300	169	108	75	43
	50PSI 6LAL	462	260	166	115	66
	15PSI 5ALD	120	67	43	30	17

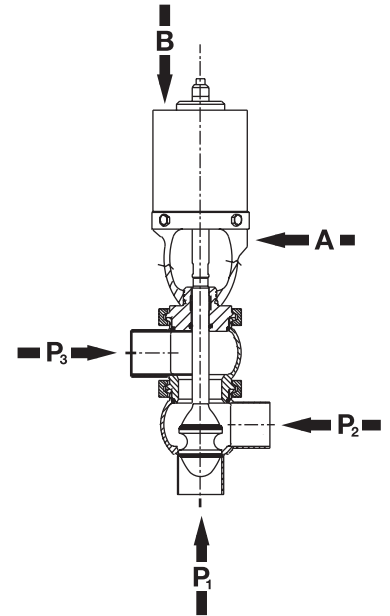
If pressure rating is higher than documented in tables consult factory before exceeding.
Normal air supply requirement: 50 psi for 4 and 5 inch actuator, 6 inch light spring actuators.
15 psi for 5ALD actuators.

*1Bar = 14.5 psi

W68 Holding Pressure Charts

W682 AR (air-to-raise)

		Actuator	Valve Size Tube OD - Inches Pressure in PSI*				
			1.5"	2"	2.5"	3"	4"
Port P1, actuator spring holds closed against:		4AR	125	70	45	31	19
		5AR	220	124	79	55	32
		6LAR	317	178	114	79	45
Port P2, Air to actuator (with stem raised), spring will lower against:		4AR	253	142	91	63	37
		5AR	333	187	120	83	48
		6LAR	-	239	153	106	61
Port P2, Air to Port A, will raise stem (opens) against:	50PSI	4AR	270	132	80	54	28
	50PSI	5AR	398	195	118	79	42
	50PSI	6LAR	-	278	168	113	61
Port P3, Air to Port A. (with stem raised will hold against:	50PSI	4AR	99	48	29	20	10
	50PSI	5AR	247	121	73	49	26
	50PSI	6LAR	421	206	125	84	45

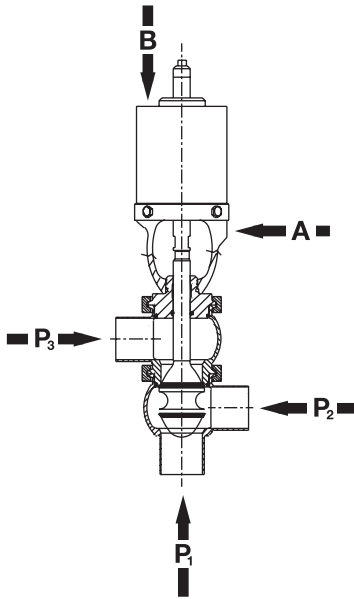


If pressure rating is higher than documented in tables consult factory before exceeding.
Normal air supply requirement: 50 psi for 4 and 5 inch actuator, 6 inch light spring actuators.
15 psi for 5ALD actuators.

*1Bar = 14.5 psi

W68 Holding Pressure Charts

W682 AL (air-to-lower)



		Actuator	Valve Size Tube OD - Inches Pressure in PSI*				
			1.5"	2"	2.5"	3"	4"
Port P1, Air to Port B, will hold against:	50PSI	4AL	76	43	27	19	16
	50PSI	5AL	187	105	67	47	27
	50PSI	6LAL	353	198	127	88	50
	15PSI	5ALD	109	61	39	27	15
Port P2, (stem lowered), spring opens stem against:	4		335	164	99	67	31
	5		441	216	131	88	47
	6LAL		-	260	157	106	57
	5ALD		61	30	18	12	7
Port P2, Air to Port B, (With stem raised), will close stem against:	50PSI	4	204	115	73	51	32
	50PSI	5	301	169	108	75	43
	50PSI	6LAL	-	260	166	115	66
	15PSI	5ALD	120	67	43	30	17
Port P3, (stem raised) actuator spring holds against:	4		164	81	49	33	15
	5		290	142	86	58	31
	6LAL		385	189	114	77	41
	5ALD		47	23	14	9	5

If pressure rating is higher than documented in tables consult factory before exceeding.
Normal air supply requirement: 50 psi for 4 and 5 inch actuator, 6 inch light spring actuators.
15 psi for 5ALD actuators.

*1Bar = 14.5 psi

Air Assist Charts

Air Boost for Port B

See Figure 1

Chart shows additional product holding pressure per 1 psi of air applied to port B to: (1) air assist spring holding force ¹ (spring to close) (2) calculate holding power on air to air actuator (3) calculate additional holding power above the nominal air requirement of the actuator ³	Actuator Size	Product Ratio per Valve Size (PSI)* Inches					
		1"	1.5"	2"	2.5"	3"	4"
	4"	6.5	6.5	3.7	2.4	1.6	0.9
	5"	10.4	10.4	5.8	3.7	2.6	1.5
	6"	15.0	15.0	8.4	5.4	3.7	2.1
	5ALD	-	10.4	5.8	3.7	2.6	1.5

Air Boost for Port A

See Figure 2

Chart shows additional product holding pressure per 1 psi of air applied to port A to: (1) air assist spring holding force ² (spring to close) (2) calculate holding power on air to air actuator (3) calculate additional holding power above the nominal air requirement of the actuator ³	Actuator Size	Product Ratio per Valve Size (PSI)* Inches					
		1"	1.5"	2"	2.5"	3"	4"
	4"	8.7	8.7	4.3	2.6	1.7	1.0
	5"	13.8	13.8	6.8	4.1	2.8	1.5
	6"	19.8	19.8	9.7	5.9	3.9	2.2

¹ Refer to W68 holding pressure charts for spring only holding force.

² Refer to W682 & W68R holding pressure charts for spring only holding force.

³ Air requirements: 50 psi to actuate 4", 5", & 6" Light Spring Actuators (refer to holding pressure charts for holding power)
15 psi to actuate 5ALD Actuators (refer to holding pressure charts for holding power). Max 45 psi to actuator.

*1Bar = 14.5 psi

Example:
W68T-3" with 5" Air to Raise (Spring to Close) actuator required to hold against 75 psi product pressure.

Holding pressure required: **75 psi**

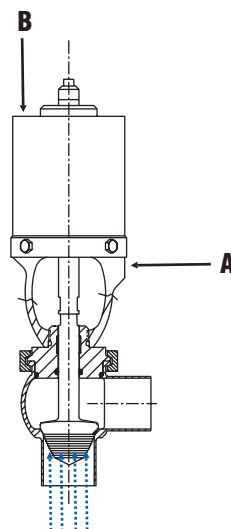
Minus Spring only holding force: **-55 psi**
(From page 7:12)

Add'l holding power required: **20 psi**

$$\text{Air Assist pressure required} = \frac{\text{Add'l holding power required}}{\text{Product Ratio from chart above}}$$

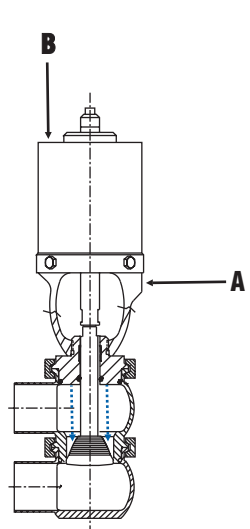
$$\text{Air Assist pressure required} = \frac{20}{2.6} = 7.79 \text{ PSI Air Required to Port B}$$

Figure 1



Product pressure applied to bottom of plug

Figure 2



Product pressure applied to top of plug

Valve Sizing

Throttling valves control flow rate based on the differential pressure expected across the valve, therefore, **flow rate and differential pressure are required to size a throttling valve.**

$\Delta P = 30-14$ psi

$\Delta P = 16$ psi

Illustration note: A properly sized throttling valve may not necessarily be the same physical size as the line in which it will be installed.

To calculate Cv for the process:

$$Cv = \frac{GPM}{\sqrt{\Delta P/SG}}$$

Cv = Valve flow Coefficient
GPM = Flow in Gallons Per Minute
SG = Specific Gravity
 ΔP = Differential Pressure

$$Cv = \frac{20}{\sqrt{16/1.0}}$$

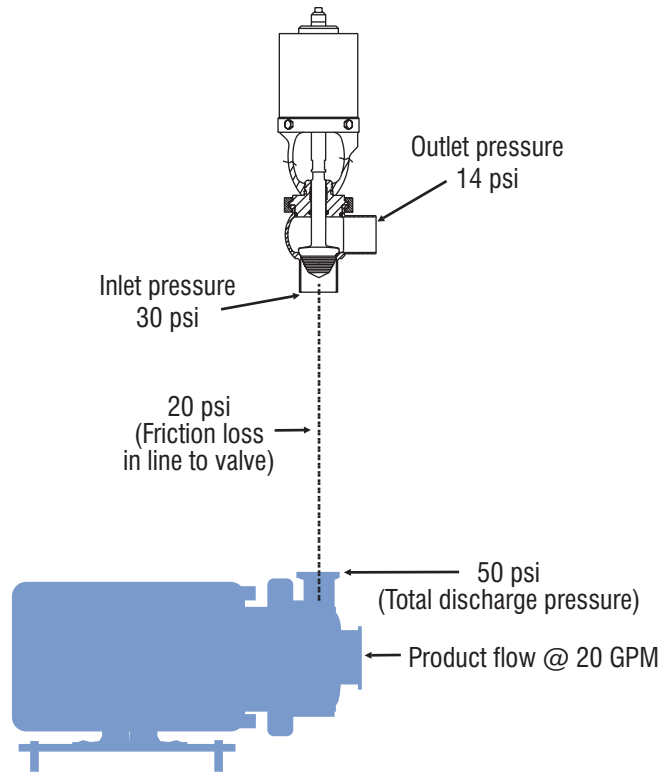
Product = Water
Cv = 5
GPM = 20
SG = 1.0
 $\Delta P = 16$ (valve inlet pressure minus outlet pressure)

Cv = 5

To choose a Throttling Valve for a process Cv of 5, find this value in the Cv Factor Table below.

This will determine the valve size and valve Cv factor to be used for this application.

Throttling Valves should operate between 20–80% stroke, with 50% being the optimum operating point.



The correct valve to use with this application is a W68, 1.5" size with a Cv10 plug, operating at 50% stroke.

Cv Factor

Optimum Operating Range Point	% of valve stroke	Valve Size - Inches Tube OD														% of valve stroke
		1.0" - 1.5"				1.5"	2"		2.5"		3"		4"			
		Cv 1.75	Cv 2.5	Cv 5.0	Cv 7.5	Cv 10	Cv 35	Cv 30	Cv 70	Cv 60	Cv 120	Cv 90	Cv 150	Cv 110	Cv 210	
10	.175	.25	.50	.75	1	3.5	3	7	6	12	9	15	11	21	10	
20	.35	.50	1	1.5	2	7	6	14	12	24	18	30	22	42	20	
30	.53	.75	1.5	2.25	3	10.5	9	21	18	36	27	45	33	63	30	
40	.70	1	2	3.0	4	14	12	28	24	48	36	60	44	84	40	
50	.88	1.25	2.5	3.75	5	17.5	15	35	30	60	45	75	55	105	50	
60	1.05	1.5	3	4.5	6	21	18	42	36	72	54	90	66	126	60	
70	1.22	1.75	3.5	5.25	7	24.5	21	49	42	84	63	105	77	147	70	
80	1.4	2	4	6.0	8	28	24	56	48	96	72	120	88	168	80	
90	1.58	2.25	4.5	6.75	9	31.5	27	63	54	108	81	135	99	189	90	
100	1.75	2.5	5	7.5	10	35	30	70	60	120	90	150	110	210	100	