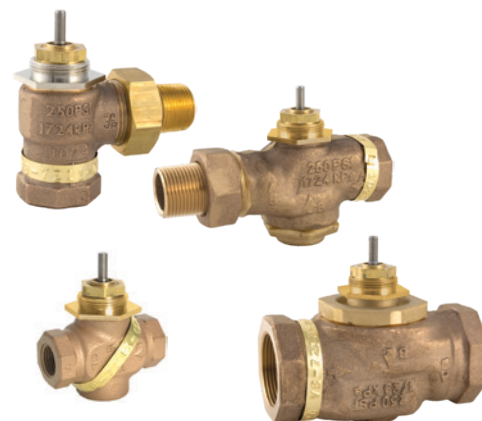


# VB-7200 Two-Way Globe Valve Bodies



## 2-Way and 3-Way Globe Valves

The Venta VB-7200 Series ½"...2" 2-Way globe valves feature the industry's highest performance, most energy efficient control valves for chilled water, hot water and steam applications.

The Venta VB-7300 Series ½"...2" 3-Way globe valves provide efficient control for chilled and hot water applications. Units have a patented precision plug for high rangeability, providing efficient heat transfer over a broad range of HVAC applications.

The Venta seal design provides tight close-off to ensure energy efficiency and provides a high tolerance to high differential pressures.

Venta globe valves are used for two-position, floating or proportional control applications. Valve assemblies may be purchased from the factory or purchased separately, requiring a linked actuator.

Notice: Not for use in combustible gas applications. The VB-7200 series valves are not rated for combustible applications, and if used in these applications, gas leaks and explosions could result.

## Features

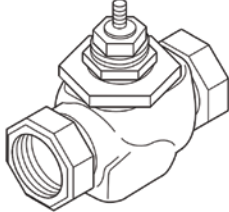
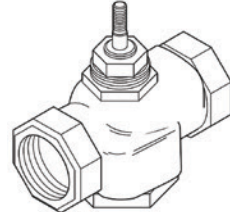
- High rangeability provides fine, accurate control for more efficient, responsive and comfortable regulation.
- Tight sealing with ultra-low energy leakage on shutoff for energy conservation with soft seating.
- High differential-pressure rating of up to 87 psi for reliable operation in demanding applications.
- Very low Cv models (as low as 0.1) for precise control of small and light-load applications.
- Multiple Cv and fitting choices to match loads and piping.
- RoHS compliant product is environmentally friendly and meets ANSI, PED, CRN and other standards.
- Stroke positions are suitable for all Schneider Electric actuators.
- Stem strength exceeds:
  - 600 lb. force on 2-Way and mixing valves
  - 300 lb. force on Diverting valves



Life Is On

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Electric

## Product Selection: Brass Trim Threaded with Soft Seats

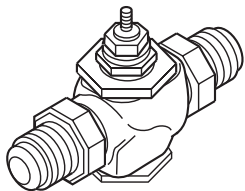
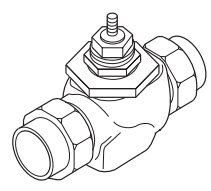
2-Way Brass Trim Body Type				Threaded NPT 	Threaded NPT 
Series Part Number				VB-7213-0-4-	VB-7223-0-4-
Pipe Sizes				1/2" ... 2"	
Stem Action				Up Open	Up Closed
ANSI Pressure Class				250 psi (up to 400 psi below 150°F)	
ANSI Seat Leakage <sup>b</sup>				Designed to ANSI V with ANSI IV above 35 psi (241 kPa) close off. Long term seat leakage dependent on proper water conditioning maintenance of the system.	
Control Media and Temperature				20...281°F (-7 to 138°C) water (up to 60% glycol/water solution), low pressure, saturated, treated steam	
Flow Curve				Modified Equal Percentage	
Allowable ΔP for Water <sup>b</sup>				87 psi (600 kPa) Max. for normal life <sup>a</sup>	
Max. inlet pressure, saturated steam				35 psi (240 kPa)	
Max ΔP for sizing, saturated steam <sup>b</sup>				80% of inlet pressure up to 15 psig and 42% of absolute (gage pressure plus 14.7) inlet pressure above 15 psig inlet	
Max ΔP at close-off, saturated steam <sup>b</sup>				Inlet pressure (35 psi) (actuator must be rated to provide close-off pressure)	
Size	Cv	Kvs	Rangeability greater than	Valve Body Part Numbers	
1/2"	0.4	0.3	100:1	VB-7213-0-4-01	VB-7223-0-4-01
	1.3	1.1	100:1	VB-7213-0-4-02	VB-7223-0-4-02
	2.2	1.9	100:1	VB-7213-0-4-03	VB-7223-0-4-03
	4.4	3.8	100:1	VB-7213-0-4-04	VB-7223-0-4-04
3/4"	5.5	4.8	100:1	VB-7213-0-4-05	VB-7223-0-4-05
	7.5	6.5	100:1	VB-7213-0-4-06	VB-7223-0-4-06
1"	10	8.7	100:1	VB-7213-0-4-07	VB-7223-0-4-07
	14	12.1	100:1	VB-7213-0-4-08	VB-7223-0-4-08
1 1/4"	20	17.3	100:1	VB-7213-0-4-09	VB-7223-0-4-09
1 1/2"	28	24.2	100:1	VB-7213-0-4-10	VB-7223-0-4-10
2"	40	34.6	100:1	VB-7213-0-4-11	VB-7223-0-4-11

a To minimize noise, ensure the flow rate in the piping is less than 10 ft (3M) / Second and the differential pressure is less than 35 psi (241 kPa), operating with differential pressures above 35 psi may result in additional noise but is acceptable up to 87 psi (600 kPa). Operating within the cavitation zone may result in noise and internal valve damage.

b Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected.

c Refer to Seat Leakage Classes table.

## Product Selection: Brass Trim Copper Connection with Soft Seats

2-Way Brass Trim Body Type				5/8" OD 45° SAE Flared		Union Sweat					
											
Series Part Number				VB-7212-0-4-		VB-7222-0-4-		VB-7214-0-4-		VB-7224-0-4-	
Pipe Sizes				½" I.D.				½" ...2"			
Stem Action				Up Open		Up Closed		Up Open		Up Closed	
ANSI Pressure Class				250 psi (up to 400 psi below 150°F)							
ANSI Seat Leakage <sup>a</sup>				ANSI IV				Designed to ANSI V with ANSI IV above 35 psi (241 kPa) close off with long term seat leakage dependent on proper water conditioning maintenance of the system.			
Control Media and Temperature				20...281°F (-7 to 138°C) water (up to 60% glycol/water solution), low pressure, treated steam							
Flow Curve				Modified Equal Percentage							
Allowable ΔP for Water <sup>b</sup>				35 psi (241 kPa) Max. for normal life <sup>a</sup>				87 psi (600 kPa) Max. for normal life <sup>a</sup>			
Max. inlet pressure, saturated steam				35 psi (240 kPa)							
Max ΔP for sizing, saturated steam <sup>b</sup>				80% of inlet pressure up to 15 psig and 42% of absolute (gauge pressure plus 14.7) inlet pressure above 15 psig inlet							
Max ΔP at close-off, saturated steam <sup>b</sup>				Inlet pressure (actuator must be rated to provide close-off pressure)							
Size	Cv	Kvs	Rangeability <sup>c</sup>	Valve Body Part Numbers							
½"	0.4	0.3	5:1	VB-7212-0-4-01	VB-7222-0-4-01	VB-7214-0-4-01 <sup>c</sup>	VB-7224-0-4-01 <sup>c</sup>				
	1.3	1.1	15:1	VB-7212-0-4-02	VB-7222-0-4-02	VB-7214-0-4-02 <sup>c</sup>	VB-7224-0-4-02 <sup>c</sup>				
	2.2	1.9	25:1	VB-7212-0-4-03	VB-7222-0-4-03	VB-7214-0-4-03 <sup>c</sup>	VB-7224-0-4-03 <sup>c</sup>				
	4.4	3.8	40:1	VB-7212-0-4-04	VB-7222-0-4-04	VB-7214-0-4-04 <sup>c</sup>	VB-7224-0-4-04 <sup>c</sup>				
¾"	5.5	4.8	50:1	—	—	VB-7214-0-4-05 <sup>c</sup>	VB-7224-0-4-05 <sup>c</sup>				
	7.5	6.5	60:1	—	—	VB-7214-0-4-06 <sup>c</sup>	VB-7224-0-4-06 <sup>c</sup>				
1"	10	8.7	60:1	—	—	VB-7214-0-4-07 <sup>cd</sup>	VB-7224-0-4-07 <sup>cd</sup>				
	14	12.1	60:1	—	—	VB-7214-0-4-08 <sup>cd</sup>	VB-7224-0-4-08 <sup>cd</sup>				
1¼"	20	17.3	75:1	—	—	VB-7214-0-4-09 <sup>cd</sup>	VB-7224-0-4-09 <sup>cd</sup>				
1½"	28	24.2	75:1	—	—	VB-7214-0-4-10 <sup>cd</sup>	VB-7224-0-4-10 <sup>cd</sup>				
2"	40	34.6	75:1	—	—	VB-7214-0-4-11 <sup>cd</sup>	VB-7224-0-4-11 <sup>cd</sup>				

a,e To minimize noise, ensure the flow rate in the piping is less than 10 ft (3M) / Second and the differential pressure is less than 35 psi (241 kPa), operating with differential pressures above 35 psi may result in additional noise but is acceptable up to 87 psi (600 kPa). Operating within the cavitation zone may result in noise and internal valve damage.

b Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

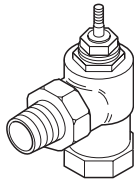
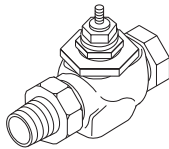
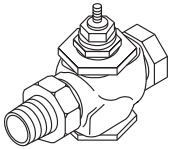
c The VB-7214-0-4- and VB-7224-0-4- 1/2"...2" series valves all have rangeabilities greater than 100:1.

d These part numbers do not have RoHs compliant nuts and tail pieces.

### Seat Leakage Classes

ANSI/FCI 70-2 Leakage Class	Maximum Seat Leakage
Class II	0.5% of rated Cv
Class III	0.1% of Rated Cv
Class IV	0.01% of Rated Cv
Class V	0.0005 ml per minute per inch of orifice diameter per psi differential

## Product Selection: Brass Trim Soft Seat Union for Radiators and Other Applications

2-Way Brass Trim Body Type				Union Angle NPT	Union Straight NPT	Union Straight NPT
						
Series Part Number				VB-7211-0-3-	VB-7211-0-4-	VB-7221-0-4-
Pipe Sizes				½" ...1¼"		
Stem Action				Up Open	Up Open	Up Closed
ANSI Pressure Class				250 psi (up to 400 psig below 150°F)		
ANSI Seat Leakage <sup>a</sup>				Class IV	Designed to ANSI V with ANSI IV above 35 psi (241 kPa) close off with long term seat leakage dependent on proper water conditioning maintenance of the system.	
Control Media and Temperature				20...281°F (-7 to 138°C) water (up to 60% glycol/water solution), low pressure, treated steam		
Flow Curve				Modified Equal Percentage		
Allowable ΔP for Water <sup>b</sup>				35 psi (241 kPa) Max. for normal life <sup>a</sup>	87 psi (600 kPa) Max. for normal lifed	
Max inlet pressure for saturated steam				35 psi (240 kPa)		
Max ΔP for sizing, saturated steam <sup>b</sup>				80% of inlet pressure up to 15 psig and 42% of absolute (gauge pressure plus 14.7) inlet pressure above 15 psig inlet		
Max ΔP at close-off, saturated steam <sup>b</sup>				Inlet pressure (35 psi) (actuator must be rated to provide close-off pressure)		
Size	Cv	Kvs	Rangeability Greater Than <sup>c</sup>	Valve Body Part Numbers		
½"	0.4	0.3	5:1	VB-7211-0-3-01	VB-7211-0-4-01 <sup>c</sup>	VB-7221-0-4-01 <sup>c</sup>
	1.3	1.1	15:1	VB-7211-0-3-02	VB-7211-0-4-02 <sup>c</sup>	VB-7221-0-4-02 <sup>c</sup>
	2.2	1.9	25:1	VB-7211-0-3-03	VB-7211-0-4-03 <sup>c</sup>	VB-7221-0-4-03 <sup>c</sup>
	4.4	3.8	40:1	—	VB-7211-0-4-04 <sup>c</sup>	VB-7221-0-4-04 <sup>c</sup>
	5.0	4.3	40:1	VB-7211-0-3-04	—	—
¾"	5.5	4.8	50:1	VB-7211-0-3-05	VB-7211-0-4-05 <sup>c</sup>	VB-7221-0-4-05 <sup>c</sup>
	7.5	6.5	60:1	—	VB-7211-0-4-06 <sup>c</sup>	VB-7221-0-4-06 <sup>c</sup>
	8.5	7.4	50:1	VB-7211-0-3-06	—	—
1"	10	8.7	60:1	—	VB-7211-0-4-07 <sup>c</sup>	VB-7221-0-4-07 <sup>c</sup>
	14	12.1	60:1	VB-7211-0-3-07	VB-7211-0-4-08 <sup>c</sup>	VB-7221-0-4-08 <sup>c</sup>
	16	13.8	75:1	VB-7211-0-3-08	—	—
1¼"	20	17.3	75:1	—	VB-7211-0-4-09 <sup>c</sup>	VB-7221-0-4-09 <sup>c</sup>
	22	19	75:1	VB-7211-0-3-09	—	—

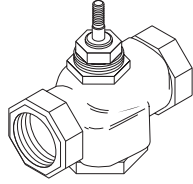
a,d To minimize noise, ensure the flow rate in the piping is less than three meters (10ft)/second and the differential pressure is less than 35 psi (241 kPa). Operating within the cavitation zone or an operating differential pressure above 35 psi (241 kPa) may result in noise and internal valve damage.

b Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

c The VB-7211-0-4-xx and VB-7221-0-4-xx series valves all have rangeabilities greater than 100:1.

e Refer to Seat Leakage Classes table.

## Product Selection: Stainless Steel Trim Threaded with Soft Seats

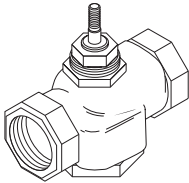
2-Way Stainless Trim (Soft Seal) Body Type				Threaded NPT 	
Series Part Number				VB-7253-0-4-	VB-7263-0-4-
Pipe Sizes				1/2"...2"	1/2"...2"
Stem Action				Up Open	Up Closed
ANSI Pressure Class				250 psi (up to 400 psi below 150°F)	
Seat Leakage <sup>c</sup>				Designed to ANSI V with ANSI IV above 35 psi (241 kPa) close off. Long term seat leakage dependent on proper water conditioning maintenance of the system.	
Control Media and Temperature				20...340°F (-7 to 171°C) water (up to 60% glycol/water solution), low pressure, treated steam	
Flow Curve				Modified Linear	
Allowable ΔP for Water <sup>b</sup>				87 psi (600 kPa) Max. for normal life <sup>a</sup>	
Max. inlet pressure, saturated steam				100 psi (690 kPa)	
Max ΔP for sizing, saturated steam <sup>b</sup>				80% of inlet pressure up to 15 psig and 42% of absolute (gauge pressure plus 14.7) inlet pressure above 15 psig inlet	
Max ΔP at close-off, saturated steam <sup>b</sup>				Inlet pressure (100 psi) (actuator must be rated to provide close-off pressure)	
Size	Cv	Kvs	Rangeability Greater Than	Valve Body Part Numbers	
1/2"	0.1	0.09	13:1	-	VB-7263-0-4-31
	0.22	0.2	18:1	-	VB-7263-0-4-33
	0.4	0.3	100:1	VB-7253-0-4-01	VB-7263-0-4-01
	0.75	0.6	100:1	-	VB-7263-0-4-34
	1.0	0.9	100:1	-	VB-7263-0-4-36
	1.3	1.1	100:1	VB-7253-0-4-02	VB-7263-0-4-02
	1.8	1.6	100:1	-	VB-7263-0-4-28
	2.2	1.9	100:1	VB-7253-0-4-03	VB-7263-0-4-03
	2.9	2.5	100:1	-	VB-7263-0-4-30
	3.25	2.8	100:1	-	VB-7263-0-4-39
3/4"	4.4	3.8	100:1	VB-7253-0-4-04	VB-7263-0-4-04
	5.5	4.8	100:1	VB-7253-0-4-05	VB-7263-0-4-05
	6.3	5.4	100:1	-	VB-7263-0-4-41
	7.5	6.5	100:1	VB-7253-0-4-06	VB-7263-0-4-06
	8.2	7.1	100:1	-	VB-7263-0-4-51
1"	9.0	7.8	100:1	-	VB-7263-0-4-52
	10	8.7	100:1	VB-7253-0-4-07	VB-7263-0-4-07
	12	10.4	100:1	VB-7253-0-4-08	VB-7263-0-4-08
	14	12.1	100:1	-	VB-7263-0-4-61
1 1/4"	16	13.8	100:1	-	VB-7263-0-4-62
	18	15.6	100:1	-	VB-7263-0-4-63
	20	17.3	100:1	VB-7253-0-4-09	VB-7263-0-4-09
	22	19.0	100:1	-	VB-7263-0-4-71
1 1/2"	24	20.8	100:1	-	VB-7263-0-4-72
	28	24.2	100:1	VB-7253-0-4-10	VB-7263-0-4-10
	31	26.8	100:1	-	VB-7263-0-4-81
2"	34	29.4	100:1	-	VB-7263-0-4-82
	40	34.6	100:1	VB-7253-0-4-11	VB-7263-0-4-11

a To minimize noise, ensure the flow rate in the piping is less than 10 ft (3M) / Second and the differential pressure is less than 35 psi (241 kPa), operating with differential pressures above 35 psi may result in additional noise but is acceptable up to 87 psi (600 kPa). Operating within the cavitation zone may result in noise and internal valve damage.

b Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

c Refer to Seat Leakage Classes table.

## Product Selection: Stainless Steel Trim Threaded with Metal to Metal Seats

2-Way Stainless Trim (Metal to Metal) Body Type				Threaded NPT 	
Series Part Number				VB-7273-0-4-	VB-7283-0-4-
Pipe Sizes				1/2" ... 2"	
Stem Action				Up Open	Up Closed
ANSI Pressure Class				250 psi (up to 400 psig below 150°F)	
Seat Leakage <sup>c</sup>				ANSI III	
Control Media and Temperature				20...400°F (-7 to 204°C) water (up to 60% glycol/water solution), low pressure, treated steam	
Flow Curve				Modified Linear	
Allowable ΔP for Water <sup>b</sup>				87 psi (600 kPa) Max. for normal life <sup>a</sup>	
Max Inlet Pressure, saturated steam				150 psi (1034 kPa)	
Max ΔP for sizing, saturated steam <sup>b</sup>				80% of inlet pressure up to 15 psig and 42% of absolute (gauge pressure plus 14.7) inlet pressure above 15 psig inlet	
Max ΔP at close-off, saturated steam <sup>b</sup>				Inlet pressure (150 psi) (actuator must be rated to provide close-off pressure)	
Size	Cv	Kvs	Rangeability	Valve Body Part Numbers	
1/2"	0.4	0.3	5:1	VB-7273-0-4-01	VB-7283-0-4-01
	1.3	1.1	15:1	VB-7273-0-4-02	VB-7283-0-4-02
	2.2	1.9	25:1	VB-7273-0-4-03	VB-7283-0-4-03
	4.4	3.8	40:1	VB-7273-0-4-04	VB-7283-0-4-04
3/4"	5.5	4.8	50:1	VB-7273-0-4-05	VB-7283-0-4-05
	7.5	6.5	60:1	VB-7273-0-4-06	VB-7283-0-4-06
1"	10	8.7	60:1	VB-7273-0-4-07	VB-7283-0-4-07
	12	10.4	75:1	VB-7273-0-4-08	VB-7283-0-4-08
1 1/4"	20	17.3	75:1	VB-7273-0-4-09	VB-7283-0-4-09
1 1/2"	28	24.2	75:1	VB-7273-0-4-10	VB-7283-0-4-10
2"	40	34.6	75:1	VB-7273-0-4-11	VB-7283-0-4-11

a To minimize noise, ensure the flow rate in the piping is less than 10 ft (3M) / Second and the differential pressure is less than 35 psi (241 kPa), operating with differential pressures above 35 psi may result in additional noise but is acceptable up to 87 psi (600 kPa). Operating within the cavitation zone may result in noise and internal valve damage.

b Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

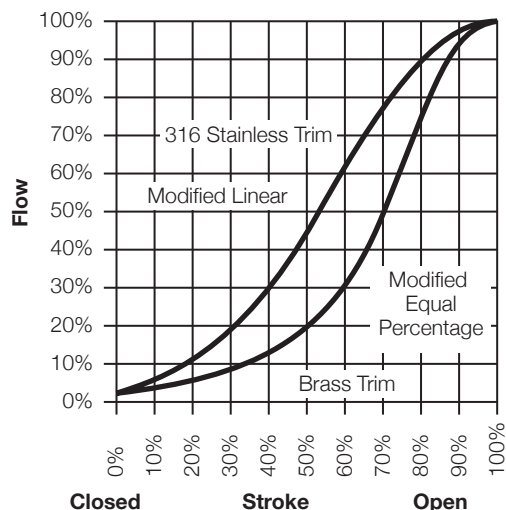
c Refer to Seat Leakage Classes table below.

### Seat Leakage Classes

ANSI/FCI 70-2 Leakage Class	Maximum Seat Leakage
Class II	0.5% of rated Cv
Class III	0.1% of Rated Cv
Class IV	0.01% of Rated Cv
Class V	0.0005 ml per minute per inch of orifice diameter per psi differential

## Flow Characteristics

Two-way valves with brass plugs have modified equal percent-age flow curves and valves with stainless steel plugs have modified linear flow curves. With modified equal percent-age flow curves, for equal increments of valve stem stroke, the change in flow rate with respect to valve stroke may be expressed as a constant percent of the flow rate at the time of the change. The change of flow rate with respect to valve stroke is relatively small when the valve plug is near the valve seat and relatively high when the valve plug is nearly wide open. With modified linear flow curves, the flow is directly proportional to the valve stem position.

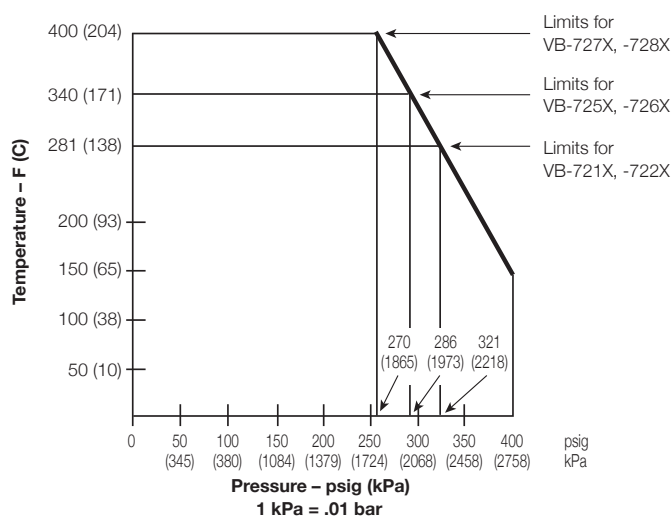


## Temperature Pressure Ratings

Consult the appropriate valve linkage general instruction sheet for the effect of valve body ambient temperatures on specific actuators. Ratings conform with published values and disclaimer.

VB-72xx-0-4-P (Cast Bronze Body)

Standards: Pressure to ANSI B16.15 Class 250 with 400 psig up to 150° F decreasing to 321 psig at 281° F, ASTM B584



Caution: Do not use valves beyond rating of piping system and components. Consult ANSI B16.22 for ratings of solder joint pressure fittings.

## VB-7200 Two-Way Globe Valves Material Specifications

VB-7200 Valve Series		VB-7211-0-4 (1/2" to 1-1/4"), VB-7213, VB-7221-0-4 (1/2" to 1-1/4"), VB-7223, VB-7214, VB-7224, VB-7215, VB-7225	VB-7211-0-3 (1/2" to 1-1/4"), VB-7212 (1/2"), VB-7222 (1/2")	VB-7251-0-3 (1/2" to 1-1/4"), VB-7251-0-4 (1/2" to 1-1/4")	VB-7253, VB-7255, VB-7263, VB-7265	VB-7273, VB-7275, VB-7283, VB-7285
Body		Bronze, ASTM B584				
Seat		Bronze, ASTM B584			316 Stainless Steel	
Stem		316 Stainless Steel				
Plug		Brass		316 Stainless Steel		
Packing		Spring-Loaded PTFE/EPDM				
Seal	1/2" and 3/4"	PTFE	EPDM	PTFE		Metal to Metal 316 Stainless Steel
	1" to 2"	EPDM				

Packing and Seal materials: Polytetrafluoroethylene (PTFE), ethylene propylene diene monomer (EPDM)

## Valve Sizing and Selection

### Sizing for Water

#### Two-position

Two-position control valves are normally selected “line size” to keep pressure drop at a minimum. If it is desirable to reduce the valve below line size, then 10% of “available pressure” (that is, the pump pressure differential available between supply and return mains with design flow at the valve location) is normally used to select the valve.

#### Proportional and Floating

Proportional and floating control valves are usually selected to take a pressure drop equal to at least 50% of the “available pressure.” As “available pressure” is often difficult to calculate, the normal procedure is to select the valve using a pressure drop at least equal to the drop in the coil or other load being controlled (except where small booster pumps are used) with a minimum recommended pressure drop of 5 psi (34 kPa). When the design temperature drop is less than 60°F (33°C) for conventional heating systems, higher pressure drops across the valve are needed for good results.

Do not exceed the maximum recommended pressure drop of the valve.

### Conventional Heating System

Design Temperature Load Drop °F (°C)	Recommended Pressure Drop (% of Available Pressure)	Multiplier on Load Drop
60 (33) or more	50%	1x Load Drop
40 (22)	66%	2x Load Drop
20 (11)	75%	3x Load Drop

Actuator must be rated to provide close off pressure.

Pressure drop is calculated using the following form of the above formula:

$$\Delta P = \left( \frac{m^3/h}{kvs} \right)^2$$

These formulas can be used to calculate one of the three quantities if the other two are known.

### Cv (Flow Coefficient) Determination

The valves' water capacity is based on the following formula:

$$C_v = \frac{GPM}{\sqrt{\Delta P}} \text{ or } C_v = GPM \sqrt{\frac{\text{Specific Gravity}}{\Delta P}}$$

**Where:**  $C_v$  = Coefficient of flow

$C_v$  is defined as the flow in GPM with  $\Delta P = 1$  psi with the valve completely open

GPM = U.S. gallons per minute (60°F, 15.6°C)

$\Delta P$  = Differential pressure in psi (pressure drop)

Other forms of this formula are:

$$\Delta P = \left( \frac{GPM}{C_v} \right)^2$$

and

$$GPM = C_v \sqrt{\Delta P}$$

These formulas can be used to calculate one of the three quantities if the other two are known.

Flow coefficients ( $C_v$ 's) for valve bodies are given on pages 2 to 6.

### Metric (SI) Units

Kvs is defined as the flow in m<sup>3</sup>/h with  $\Delta P = 100$  kPa (1.0 Bar) with the valve completely open.

Flow is calculated using the following formula:

$$m^3/h = kvs \sqrt{\Delta P}$$

**Where:**

$\Delta P$  = Differential pressure (pressure drop) in Bar  
(1 Bar = 100 kPa)

m<sup>3</sup>/h = Cubic metres/hour (15.6 °C)



## Cavitation Limitations on Valve Pressure Drop

A valve selected with too high a pressure drop can cause erosion of seals and/or wire drawing of the seat. In addition, cavitation can cause noise, damage to the valve trim (and possibly the body), and choke the flow.

Do not exceed the maximum differential pressure (pressure drop) for the valve selected.

The following formula can be used on higher temperature water systems, where cavitation could be a problem, to estimate the maximum allowable pressure drop across the valve:

$$P_m = 0.5 (P_1 - P_v)$$

Where:

$P_m$  = Maximum allowable pressure drop (psi)

$P_1$  = Absolute inlet pressure (psia)

$P_v$  = Absolute vapor pressure (psia)

Note: Add 14.7 psi to gauge supply pressure to obtain absolute pressure value. For example, if a valve is controlling 200°F water at an inlet pressure of 18 psig, the maximum pressure drop allowable would be:

$$P_m = 0.5 [(18 + 14.7) - 11.53] = 10.6 \text{ psi}$$

(Vapor pressure of 200°F water is 11.53 psia)

If the pressure drop for this valve is less than 10.6 psi, cavitation should not be a problem. Systems where cavitation is shown to be a problem can sometimes be adjusted to provide higher downstream back pressures. Valves having harder seat materials should be furnished if inlet velocities cannot be lowered.

## Vapor Pressure Of Water Table

Temp (°F)	Pressure (psia)	Temp. (°F)	Pressure (psia)	Temp. (°F)	Pressure (psia)	Temp. (°F)	Pressure (psia)
40	0.12	90	0.70	140	2.89	190	9.34
50	0.18	100	0.95	150	3.72	200	11.53
60	0.26	110	1.28	160	4.74	210	14.12
70	0.36	120	1.69	170	5.99	220	17.19
80	0.51	130	2.22	180	7.51	230	20.78

## Seat Leakage Classes

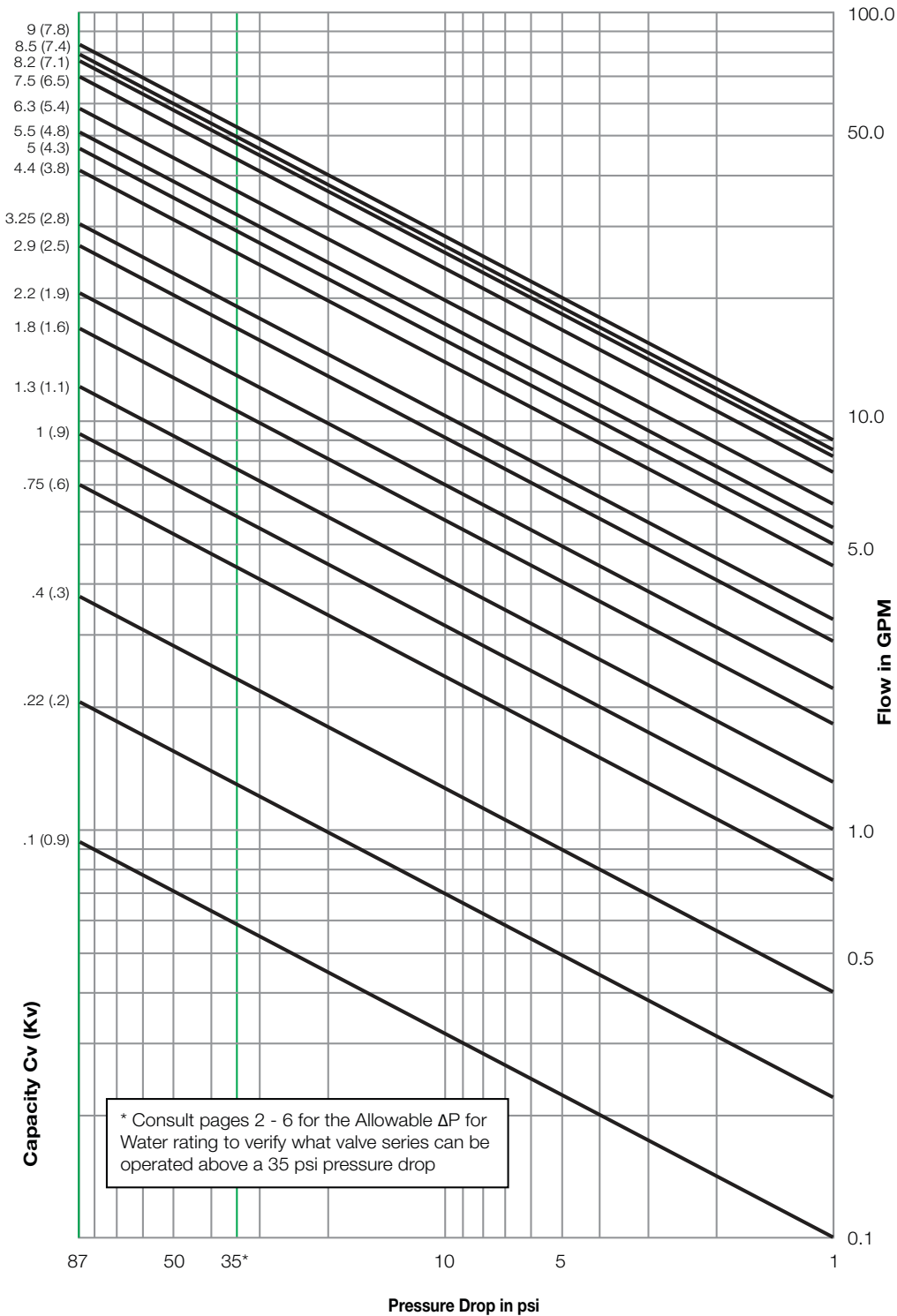
ANSI/FCI 70-2 Leakage Class	Maximum Seat Leakage
Class II	0.5% of rated Cv
Class III	0.1% of Rated Cv
Class IV	0.01% of Rated Cv
Class V	0.0005 ml per minute per inch of orifice diameter per psi differential

## Water Capacity Graph Instructions

To Select the appropriate valve Cv from the Graph:

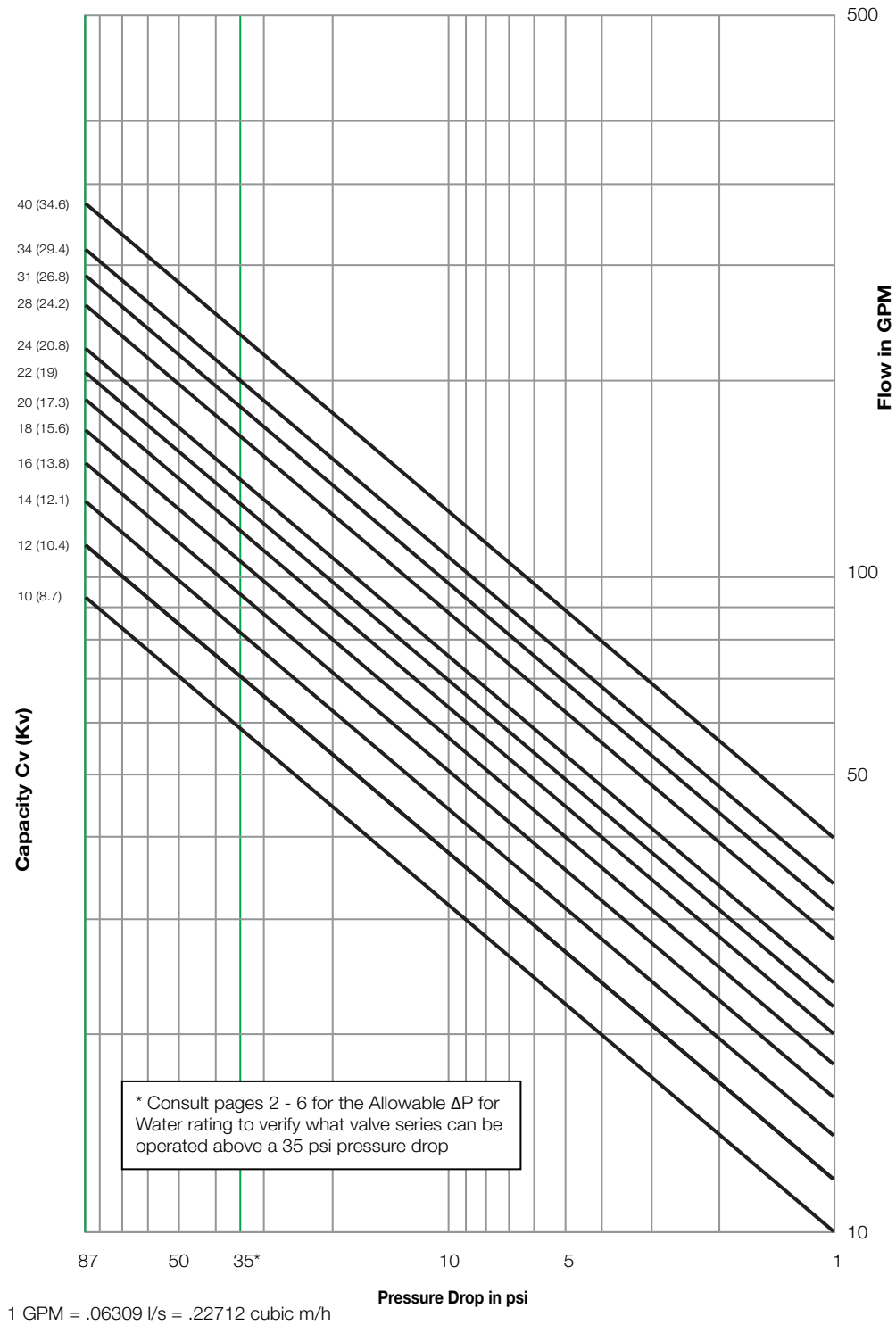
1. Select the required flow from the "Flow in GPM" axis.
2. Select available pressure drop from the "Pressure Drop in psi" axis.
3. Select the appropriate line and follow to the Capacity Cv (Kv) listing to choose the closest valve Cv flow coefficient.
4. Confirm the selection by calculation from the water equations (optional).

## Water Capacity for 0.1 to 9.0 Cv Valves



1 GPM = .06309 l/s = .22712 cubic m/h

# Water Capacity for 10 to 40 Cv Valves



## Sizing for Steam

### Two-position

Two-position zone valves and direct radiation valves are normally sized using a minimum of 10% of inlet pressure (psig).

### Proportional

For low pressure (15 psig or less), use  $\Delta P$  of 80% of gauge inlet pressure.

For steam pressures greater than 15 psig, use  $\Delta P$  of 42% of absolute (gauge plus 14.7 psig) inlet pressure.

Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop), as integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

When the  $C_v$  required is between two valve sizes, select the larger size. Do not size steam valves using a pressure drop greater than 42% of the absolute inlet pressure.

Actuator must be rated to provide close off pressure.

Do not exceed the maximum recommended pressure drop of the valve.

## Additional Valve Sizing Information

- For more information:
- CA-28 Control Valve Sizing, F-13755
- Valve Selection Chart Water, F-11080
- Valve Selection Chart Steam, F-11366

Valve / Actuator Selection Guides with Close Off Pressure Ratings:

- Linked Globe Valve Assemblies Selection Guide (Rack) F-26752
- Linked Globe Valve Assemblies Selection Guide (Linear) F-27252
- Forta/Globe Valve Selection Guide F-27490
- Globe Valve Catalog (Pneumatic / Geartrain) F-27414

## Steam Capacity Table Instructions

To Select the appropriate valve  $C_v$  from the Table:

1. Determine if control is two position or proportional and use left column under Differential Pressure for two position control or the right column under inlet pressure for proportional control.
2. Select table column with the available Inlet Pressure to be maintained.
3. Go down to the desired pounds of Steam Per Hour.
4. Select the closest valve  $C_v$  flow coefficient from the left hand column.

## $C_v$ (Flow Coefficient) Determination

The valves' steam capacity is based on the following formula:

$$C_v = \frac{QK}{3\sqrt{\Delta P \times P_2}}$$

**Where:**  $C_v$  = Coefficient of flow

$Q$  = Lbs per hour of steam

$\Delta P$  = Differential pressure in psi (pressure drop)

$P_2$  = Outlet pressure in psia (absolute)  
psig + 14.7 = psia (absolute)

$K = 1 + (0.0007 \times ^\circ\text{F super-heat})$

**Note:**  $K$  normally is 1 ( $K = 1$  for saturated steam).

Other forms of this formula are:

$$Q = \frac{3C_v\sqrt{\Delta P \times P_2}}{K}$$

**Note:**  $K$  normally is 1.

$$\Delta P = \left( \frac{QK}{3C_v} \right)^2 \times \frac{1}{P_2}$$

**Note:**  $K$  normally is 1.

$$P_2 = \left( \frac{QK}{3C_v} \right)^2 \times \frac{1}{\Delta P}$$

**Note:**  $K$  normally is 1 ( $K = 1$  for saturated steam).

These formulas can be used to calculate one of the quantities if the others are known.

Flow coefficients ( $C_v$ 's) for specific valve bodies are given on specification pages of this document.

## Steam Capacity in Pounds per Hour

Cv	Kv	Inlet Pressure (psig) <sup>a</sup>											
		2 psig Inlet		5 psig Inlet		10 psig Inlet		15 psig Inlet		20 psig Inlet		25 psig Inlet	
		Differential Pressure (psi) <sup>a</sup>											
		Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.
		0.2	1.6	0.5	4	1	8	1.5	12	2	14	2.5	16
0.1	0.09	0.5	1.5	0.9	2.4	1.5	3.5	2.0	4.4	2.4	5.1	2.9	5.8
0.22	0.2	1.2	3.2	2.0	5.2	3.2	7.6	4.3	10	5.3	11	6.4	13
0.4	0.3	2.2	5.9	3.7	9.5	5.8	14	7.8	17	9.7	20	12	23
0.75	0.6	4.1	11	7.0	18	11	26	15	33	18	38	22	44
1	0.9	5.4	15	9.3	24	15	35	20	44	24	51	29	58
1.3	1.1	7.1	19	12	31	19	45	25	57	32	66	38	76
1.8	1.6	10	27	17	43	26	62	35	79	44	92	52	105
2.2	1.9	12	32	20	52	32	76	43	96	53	112	64	129
2.9	2.5	16	43	27	69	42	101	57	127	70	148	84	169
3.25	2.8	18	48	30	77	47	113	63	142	79	166	94	190
4.4	3.8	24	65	41	105	64	153	86	192	107	225	127	257
5	4.3	27	74	46	119	73	173	98	219	121	255	145	292
5.5	4.8	30	81	51	131	80	191	107	240	133	281	159	321
6.3	5.4	34	93	59	150	92	218	123	275	153	322	182	368
7.5	6.5	41	111	70	178	110	260	146	328	182	383	217	438
8.2	7.1	45	121	76	195	120	284	160	359	199	419	237	479
8.5	7.4	46	125	79	202	124	295	166	372	206	434	246	497
9	7.8	49	133	84	214	131	312	176	393	218	460	260	526
10	8.7	54	147	93	238	146	347	195	437	243	511	289	584
12	10.4	65	177	112	285	175	416	234	525	291	613	347	701
14	12.1	76	206	130	333	204	485	273	612	340	715	405	818
16	13.8	87	236	149	380	234	555	312	700	388	817	463	935
18	15.6	98	265	167	428	263	624	351	787	437	919	521	1052
20	17.3	109	295	186	475	292	694	390	874	485	1021	579	1168
22	19	120	324	204	523	321	763	429	962	534	1124	636	1285
24	20.8	131	354	223	571	351	832	468	1049	582	1226	694	1402
28	24.2	153	413	260	666	409	971	546	1224	679	1430	810	1636
31	26.8	169	457	288	737	453	1075	605	1355	752	1583	897	1811
34	29.4	185	501	316	808	497	1179	663	1487	825	1736	984	1986
40	34.6	218	590	372	951	584	1387	780	1749	970	2043	1157	2337

a. Values are for saturated steam (K = 1). Left column under each inlet pressure is for two position control, and right column is for proportional control.

Always select the correct valve series for the inlet steam pressure as shown below:

Valve Series	Max Inlet Pressure for Saturated Steam	Maximum Media Temperature
VB-7273-0-4-, VB-7283-0-4-, VB-7275-0-4-, VB-7285-0-4-	150 psi (1034 kPa)	20 to 400°F (-7 to 204°C)
VB-7253-0-4-, VB-7263-0-4-, VB-7255-0-4-, VB-7265-0-4-	100 psi (690 kPa)	20 to 340°F (-7 to 171°C)
VB-7213-0-4-, VB-7223-0-4-, VB-7215-0-4-, VB-7225-0-4-, VB-7212-0-4-, VB-7222-0-4-, VB-7214-0-4-, VB-7224-0-4-, VB-7211-0-3-, VB-7211-0-4-, VB-7221-0-4-, VB-7251-0-3-, VB-7211-0-4-	35 psi (240 kPa)	20 to 281°F (-7 to 138°C)

1 Pound per Hour = 0.45359 Kilogram Per Hour

## Steam Capacity in Pounds per Hour (continued)

Cv	Kv	Inlet Pressure (psig) <sup>a</sup>											
		30 psig Inlet		35 psig Inlet		40 psig Inlet		50 psig Inlet		75 psig Inlet		100 psig Inlet	
		Differential Pressure (psi) <sup>a</sup>											
		Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.	Two Position	Prop.
		3	18	3.5	20	4	22	5	27	7.5	37	10	48
0.1	0.09	3.4	6.6	3.8	7.3	4.3	8.0	5.2	9.6	7.4	13	9.7	17
0.22	0.2	7.4	14	8.4	16	9.4	18	11	21	16	29	21	37
0.4	0.3	13	26	15	29	17	32	21	38	30	53	39	68
0.75	0.6	25	49	29	55	32	60	39	72	56	99	73	127
1	0.9	34	66	38	73	43	80	52	96	74	132	97	170
1.3	1.1	44	85	50	95	56	105	67	124	97	172	126	221
1.8	1.6	60	118	69	132	77	145	93	172	134	238	175	306
2.2	1.9	74	145	84	161	94	177	114	211	164	291	214	373
2.9	2.5	97	191	111	212	124	233	150	278	216	384	282	492
3.25	2.8	109	214	124	238	139	262	168	311	242	431	315	552
4.4	3.8	148	289	168	322	188	354	228	421	328	583	427	747
5	4.3	168	329	191	366	214	402	259	479	372	662	485	849
5.5	4.8	185	362	210	402	235	443	285	526	410	729	534	934
6.3	5.4	211	414	240	461	269	507	327	603	469	835	612	1069
7.5	6.5	252	493	286	548	320	603	389	718	559	994	728	1273
8.2	7.1	275	539	313	600	350	660	425	785	611	1086	796	1392
8.5	7.4	285	559	324	621	363	684	441	814	633	1126	825	1443
9	7.8	302	592	343	658	385	724	466	861	670	1192	874	1528
10	8.7	336	658	381	731	427	805	518	957	745	1325	971	1697
12	10.4	403	789	458	877	513	966	622	1149	894	1590	1165	2037
14	12.1	470	921	534	1024	598	1127	726	1340	1043	1855	1359	2376
16	13.8	537	1052	610	1170	684	1287	829	1531	1192	2120	1553	2716
18	15.6	604	1184	687	1316	769	1448	933	1723	1341	2385	1747	3055
20	17.3	671	1315	763	1462	854	1609	1037	1914	1490	2649	1941	3395
22	19	738	1447	839	1609	940	1770	1140	2106	1639	2914	2136	3734
24	20.8	805	1578	916	1755	1025	1931	1244	2297	1788	3179	2330	4074
28	24.2	940	1841	1068	2047	1196	2253	1451	2680	2086	3709	2718	4753
31	26.8	1040	2039	1183	2267	1324	2494	1607	2967	2309	4107	3009	5262
34	29.4	1141	2236	1297	2486	1453	2736	1762	3254	2533	4504	3300	5771
40	34.6	1342	2631	1526	2925	1709	3219	2073	3829	2980	5299	3883	6790

a. Values are for saturated steam (K = 1). Left column under each inlet pressure is for two position control, and right column is for proportional control.

Always select the correct valve series for the inlet steam pressure as shown below:

Valve Series	Max Inlet Pressure for Saturated Steam	Maximum Media Temperature
VB-7273-0-4-, VB-7283-0-4-, VB-7275-0-4-, VB-7285-0-4-	150 psi (1034 kPa)	20 to 400°F (-7 to 204°C)
VB-7253-0-4-, VB-7263-0-4-, VB-7255-0-4-, VB-7265-0-4-	100 psi (690 kPa)	20 to 340°F (-7 to 171°C)
VB-7213-0-4-, VB-7223-0-4-, VB-7215-0-4-, VB-7225-0-4-, VB-7212-0-4-, VB-7222-0-4-, VB-7214-0-4-, VB-7224-0-4-, VB-7211-0-3-, VB-7211-0-4-, VB-7221-0-4-, VB-7251-0-3-, VB-7211-0-4-	35 psi (240 kPa)	20 to 281°F (-7 to 138°C)

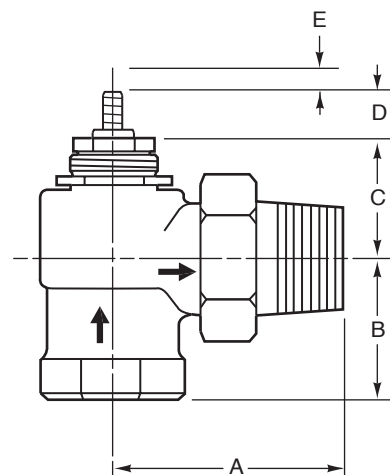
1 Pound per Hour = 0.45359 Kilogram Per Hour

## Dimensions for Stem Up Open Valves

### Union Angle: VB-7211-0-3-P, VB-7251-0-3-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	3-1/8 (79)	1-5/8 (41)	1-5/16 (33)	3/4 (19)	7-16 (11)
05, 06	3/4"	3-5/8 (92)	1-11/16 (43)	1-1/2 (38)		
07, 08	1"	4-1/16 (103)	1-15/16 (49)	2-1/8 (54)		
09	1-1/4"	4-5/16 (110)	2-3/16 (56)	2-1/4 (57)		

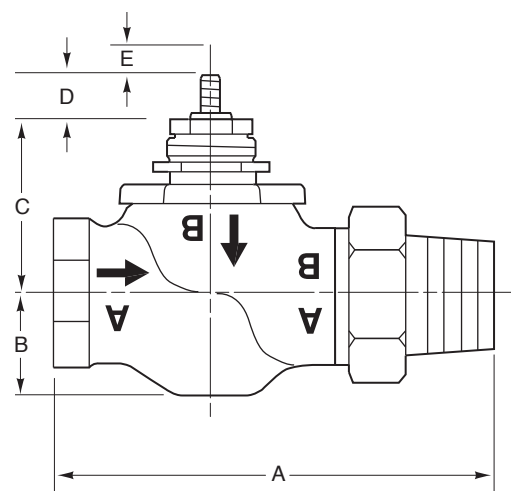
\* Stem down



### Union Straightway: VB-7211-0-4-P, VB-7251-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4-3/16 (106)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)
05, 06	3/4"	4-15/16 (125)		2-3/8 (60)		
07, 08	1"	6 (152)				
09	1-1/4"	6-1/4 (159)	1-3/8 (35)			

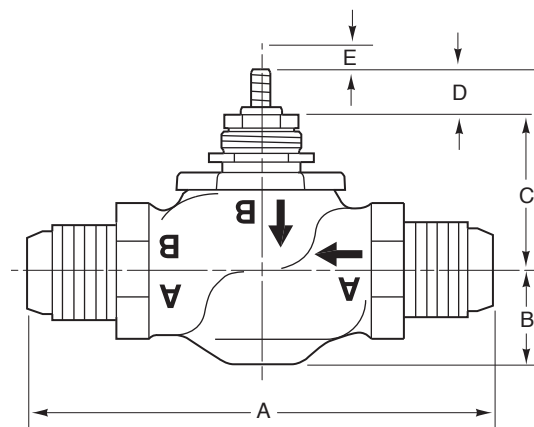
\* Stem down



### SAE Flare: VB-7212-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4 (102)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)

\* Stem down

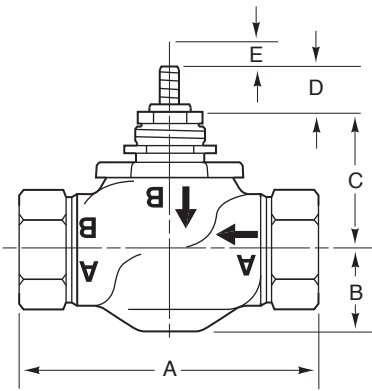


Dimensions for Stem Up Open Valves

Threaded NPT and Rp: VB-7213-0-4-P, VB-7215-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	3-1/16 (78)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7-16 (11)
05, 06	3/4"	3-5/8 (92)		2-3/8 (60)		
07, 08	1"	4-5/8 (118)	1-3/8 (35)			
09	1-1/4"		1-1/2 (38)	2-7/16 (57)		
10	1-1/2"	6-1/8 (156)	1-5/8 (41)	2-3/4 (70)		
11	2"					

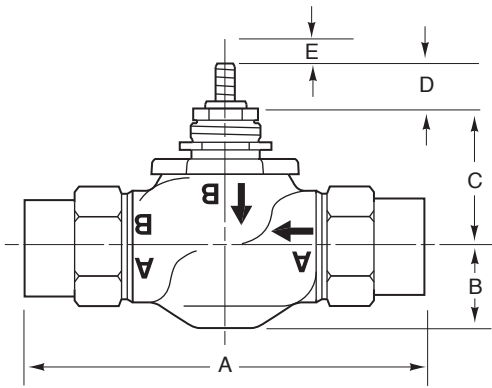
\* Stem down



Union Sweat: VB-7214-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4-3/16 (106)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7-16 (11)
05, 06	3/4"	5-7/16 (138)		1-3/4 (45)		
07, 08	1"	6-5/8 (168)		2 (51)		
09	1-1/4"	6-13/16 (173)	1-1/2 (38)	2-1/8 (54)		
10	1-1/2"	8-5/16 (211)	1-5/8 (41)	2-3/16 (56)		
11	2"	9-3/16 (233)				

\* Stem down



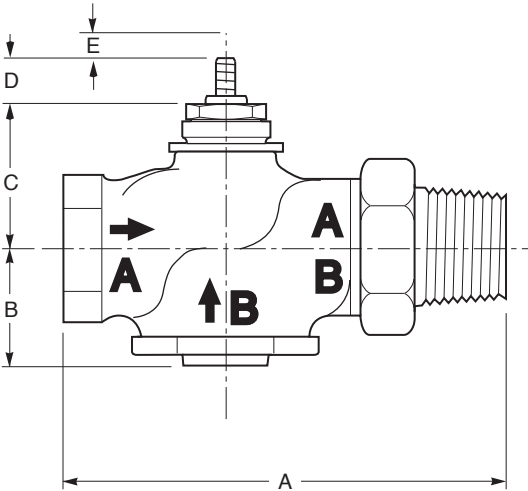


Dimensions for Stem Up Closed Valves

Union Straightway: VB-7221-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4-3/16 (106)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)
05, 06	3/4"	4-15/16 (125)				
07, 08	1"	6 (152)	1-3/4 (45)	1-3/4 (45)		
09	1-1/4"	6-1/4 (159)		2 (51)		

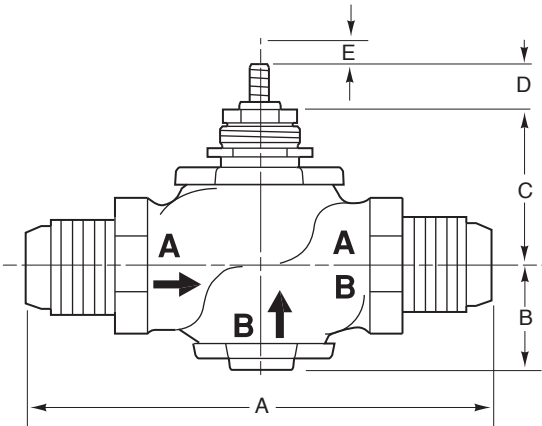
\* Stem down



SAE Flare: VB-7222-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4 (102)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)

\* Stem down



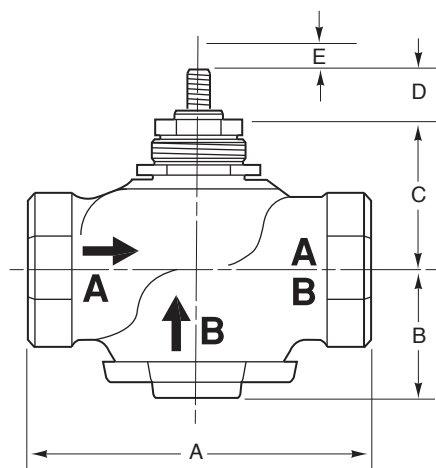
## Dimensions for Stem Up Closed and Stem Up Open Valves

Threaded NPT VB-7223-0-4-P, VB-7253-0-4-P, VB-7263-0-4-P, VB-7273-0-4-P, VB-7283-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04, 28, 30, 31, 33, 34, 36, 39	1/2"	3-1/16 (78)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)
05, 06, 41	3/4"	3-5/8 (92)				
07, 08, 51, 52	1"	4-5/8 (118)	1-3/4 (45)	1-3/4 (45)		
09, 61, 62, 63	1-1/4"			2 (51)		
10, 71, 72	1-1/2"	5-3/8 (137)	1-13/16 (46)	2-1/8 (54)		
11, 81, 82	2"	6-1/8 (156)	2-1/16 (53)	2-3/16 (56)		

\* Stem down

All valve port codes are not available on all valve series

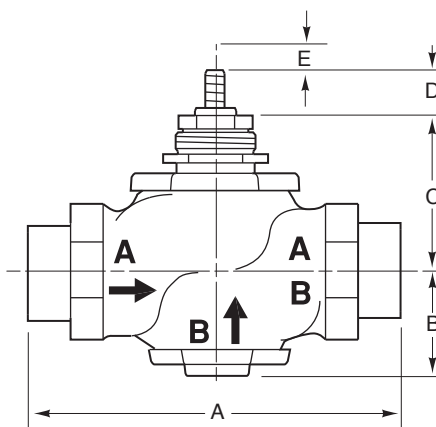


Note - VB-7253-0-4-P, VB-7273-0-4-P up normally open valves have inverted A, B, and AB port embossings

## Union Sweat: VB-7224-0-4-P

Valve Port Code (P)	Valve Size	Dimensions in Inches (mm)				
		A	B	C	D*	E Stroke
01, 02, 03, 04	1/2"	4-3/16 (106)	1-1/4 (32)	1-11/16 (43)	3/4 (19)	7/16 (11)
05, 06	3/4"	5-7/16 (138)				
07, 08	1"	6-5/8 (168)	1-3/4 (45)	1-3/4 (45)		
09	1-1/4"	6-13/16 (173)		2 (51)		
10	1-1/2"	8-5/16 (211)		2-1/8 (54)		
11	2"	9-3/16 (233)	2-1/16 (53)	2-3/16 (56)		

\* Stem down



## Stem and Bonnet Nut Thread Information for All VB-7000 Valve Series

Valve Stem Threads: 1/4"-28 UNF-2A Thread

Bonnet Nut Threads: 1-1/4" -16 Thread

Bonnet Nut Outer Hex Size: 1-5/8" (use 1-5/8" Open End Wrench or equivalent)