5. VB-8/9000 Globe Valves Sizing and Selection

Assembly Ordering VB-8/9000

Specifying the Available Four Part Number Fields (1, 2, 4 and 6 below) to Determine the Part Number of a Selected Valve/Actuator Assembly

1) Control Signal — V□□ –
Refer to the guide below.

2) Trim and Valve Configuration — □□□
Refer to the guide below.

3) Pipe End Connections — 3 –
Specify Option 3 (Flanged) for all valves.

4) Actuator or Linkage — □□□
Refer to the following pages for Spring & Non-Spring Return Electric and Pneumatic Spring Return Actuator Codes, part numbers and Linkage part numbers based on required close-off pressure.

5) Pattern Code — –5 –
For water, steam, glycol and similar non flammable, non toxic fluids, choose based on the Capacity Sizing section of this catalog. Below 2½", go to the VB-7000 sections of this catalog.

6) Port Code Cv Value — □□
Specify Option 5 (Flanged) for all valves.

Assembly Ordering VB-8000/VB-9000

V□□–□□□3–□□□–5–□□

A = Two Position
B = Valve Body Only
F = Floating
S = Proportional
K = Pneumatic 0-30 Psi

4 = AK-42309-500 (VK4-xxxx Pneu only)

Pipe Connection End Fitting
3 = Flanged

Connection
5 = Flanged

Trim and Configuration
821 = 2-Way, Stem Up Open, Brass Trim EPDM Seat
822 = 2-Way, Stem Up Closed, Brass Trim EPDM Seat
830 = 3-Way, Mixing or Diverting, Brass Trim (Bottom port is "Common")
931 = 3-Way, Mixing, Brass Trim, Metal-to-Metal (One end port is "Common")

Actuator or Linkage Code
0 = No actuator, valve body (VB) only.
xxx = Replace with actuator code. Place the appropriate control signal code in the second digit and replace xxx with the desired actuator code. Note: Use one zero (0) when ordering valve body only. Use 3-digit code when ordering wi h actuator or linkage assembly.

Port Code
2½"…6" (Cv 56 to 500)
12 = 2½"
13 = 3"
14 = 4"
15 = 5"
16 = 6"

NOTE: Threaded bodies are not available in size 2½" and larger.

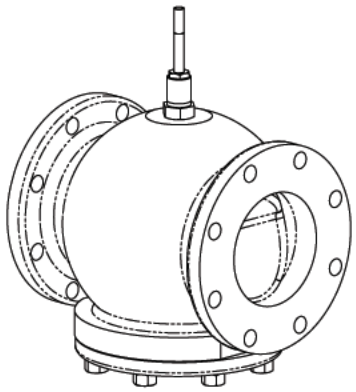
2 and 3-Way VB-8xx3 Flanged Valve Bodies

2-Way and 3-Way Valves

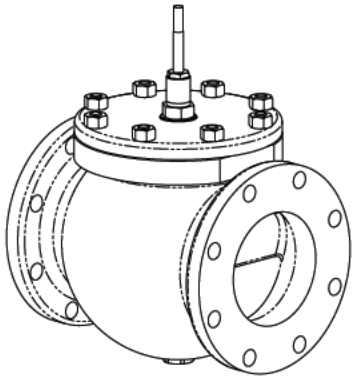
2-Way Stem Up Open or Stem Up Closed

3-Way Mixing/Diverting

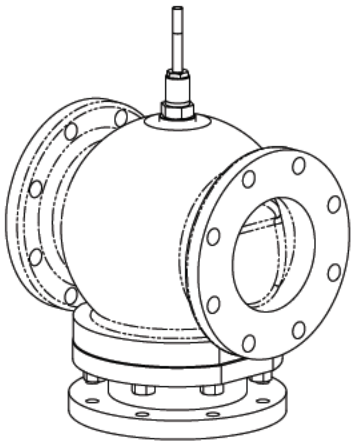
ASA 125 Flanged Cast Iron Body



VB-8213



VB-8223

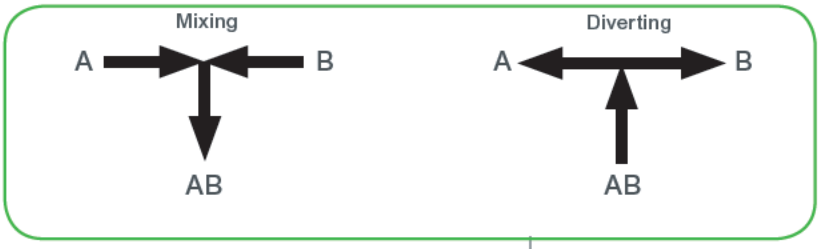


VB-8303

Schneider Electric VB-8213, VB-8223, & VB-8303 Valve Bodies					
Ports		2-Way Flanged		3-Way Flanged	
Application		Chilled or Hot Water, Steam[i]		Chilled or Hot Water[i]	
Size		2½"…6"	2½"…6"	2½"…6"	
Valve Body Part Number		VB-8213-0-5-P	VB-8223-0-5-P	VB-8303-0-5-P	
Valve Body Action		2-Way Stem Open	2-Way Stem Up Closed	3-Way Mixing/Diver ing[a]	
Material	Flow Type	Equal %		Modifier Linear	
	Body	Cast Iron			
	Seat	Forged Brass			
	Stem	Stainless Steel			
	Plug	Forged Brass			
	Packing	Spring Loaded TFE/EPDM			
	Seat Ring	EPDM		None	
ANSI Pressure Class, psig		125 (up to 200 psig below 150°F)			
Maximum Inlet Pressure Steam psig (kPa)		35 psig (241 kPa)		-	
Allowable Control Media Temperature °F (°C)[b]		20°F…281°F (-7°C…138°C)			
Close-Off Pressure, psi (kPa)		125 psi (856 kPa) [d]		35 psi (241 kPa) [c]	
P Code	Valve Size, In.	Cv (kvs)		Cv (kvs) Mixing[e]	Cv (kvs) Diverting[d]
12	2½	56 (48)	56 (48)	80 (69)	95 (82)[e] 115 (99)[f]
13	3	85 (74)	85 (74)	110 (95)	120 (104)[g]
14	4	145 (125)	145 (125)	190 (164)	190 (164)[h]
15	5	240 (208)	240 (208)	290 (251)	290 (251)[h]
16	6	370 (320)	370 (320)	500 (433)	500 (433)[h]

a - VB-8303 valves may be used as mixing or Diverting valves. VB-8303 valves will also operate sufficiently as 2-Way angle valves if either end (side) port is closed off.
b - Freeze protection required for temperatures below 32°F (0 °C). Avoid ice formation on stems.
c -Valve in closed position. See Specifications in following pages for maximum allowable VB-8xxx differential pressure for valve in any open position.
d - Mixing configuration, ports A and B are inlets, port AB is outlet (located on bottom).
e - Diverting configuration, port AB is inlet, ports A and B are outlets. Port AB located on bottom.
f - Diverting configuration, flow AB to A ports.
g - Diverting configuration, flow AB to B ports.
h - All Diverting flow configurations, flow AB to either A or B ports.
i - Glycol up to 50%

VB-8000 3-Way Flow Patterns



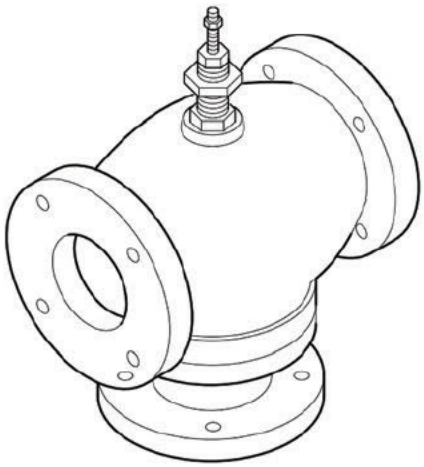
VB-9313 3-Way Mixing Valve Bodies

Application

VB-9313 series 3-Way mixing valves control hot or chilled water in heating or air conditioning systems. These valves must be piped with two inlets ("A" and "B" ports) and one outlet ("AB" port). They are used for two-position or proportional control applications. Valve assemblies require an actuator and a valve linkage that may be factory or field assembled.

Features

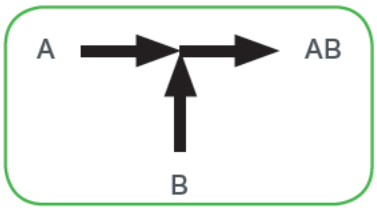
- Valve sizes 2½"…6".
- 125 psig pressure rating per ANSI Standards (B16.1–1993) for flanged cast iron bodies.
- Spring-loaded TFE & EPDM packing.



VB-9313-0-5-P
(Typical)

Specifications				Valve Body Series VB-9313-0-5-P
Application				Chilled or Hot Water [c]
Flow Characteristics				Mixing
Sizes				2½"…6"
Type of End Fitting				125 lb. Flanged
Valve Materials	Body			Cast Iron
	Seat			Bronze
	Stem			Stainless Steel
	Plug			Brass
	Packing			Spring Loaded TFE & EPDM
	Disc			None
ANSI Pressure Class, psig				125 (up to 200 psig below 150°F)
Allowable Control Media Temperature, °F (°C)				40°F …300°F (4°C…149°C)
Allowable Differential Pressure, Water, psi (kPa) [a]				35 psi (241 kPa) Max. for Normal Life
Valve Size, In.	Cv Rating	kvs[b] Rating	Stroke	Complete Valve Body Part Number
2½	74	64	7/8 in. (22 mm)	VB-9313-0-5-12
3	101	87	7/8 in. (22 mm)	VB-9313-0-5-13
4	170	147	7/8 in. (22 mm)	VB-9313-0-5-14
5	290	251	1¾ in. (45 mm)	VB-9313-0-5-15
6	390	337	1¾ in. (45 mm)	VB-9313-0-5-16

a - Maximum recommended differential pressure in open position. Do not exceed the recommended differential pressure (pressure drop) or integrity of parts may be affected Exceeding maximum recommended differential pressure voids the product warranty.
b - $K_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $K_{vs} = C_v / 1.156$ $C_v = gpm / \sqrt{\Delta P}$ (in psi).
c - Glycol up to 50%



VB-93xx 3-Way Mixing Flow Pattern

3-Way Valve Sizing for Water

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.

Conventional Heating System Pressure Drops

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

Reducer Affects

On full flow bodies, offset the affects of directly connected reducer(s) by choosing flow coefficients 6% or more higher.

Cv (Flow Coefficient) Determination

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

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

Where:

C_v = Coefficient of flow

C_v is defined as the flow in GPM with ΔP = 1 psi with the valve completely open

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

ΔP = Differential pressure in psi (pressure drop)

Proportional 3-Way Valves

Recommended Pressure Drop - Bypass Application: 50% of "available pressure," or equal to pressure drop through the load at full flow.
3-Way valves in the return used to control output by throttling water flow to the load (bypass applications) are controlling output in the same manner as throttling 2-Way valves, and must be selected using the same high pressure drops if good control results are to be obtained.
Recommended Pressure Drop - Constant Flow Applications: 20% of "available pressure," or equal to 1/4 of the pressure drop through the load at full flow.
3-Way valves used with individual pumps to control output by varying water temperature to the load (constant flow applications) are controlling output by mixing two water sources at different temperatures and do not require high pressure drops for good control results.

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 and choose the closest valve Cv flow coefficient.
4. Confirm the selection by calculation from the water equations.

Additional Water Valve Sizing Information

For more information, download these documents from our website.

- CA-27 3-Way Valves Application Information
- Valve Selection Table Water, F-11080

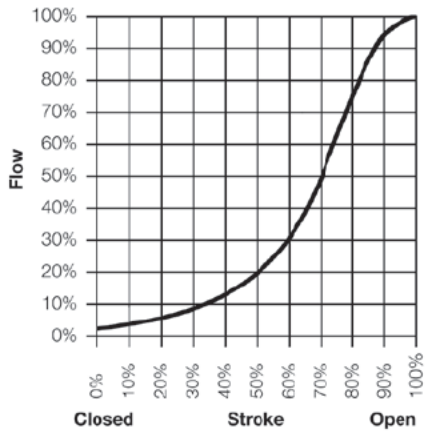
VB-8xx3 Valve Body Characteristics

System Design Considerations

Note: The information in this section describes characteristics of the VB-8xx3 valve bodies, which are used in the Vx-8xx3 valve assemblies.

Control Precision

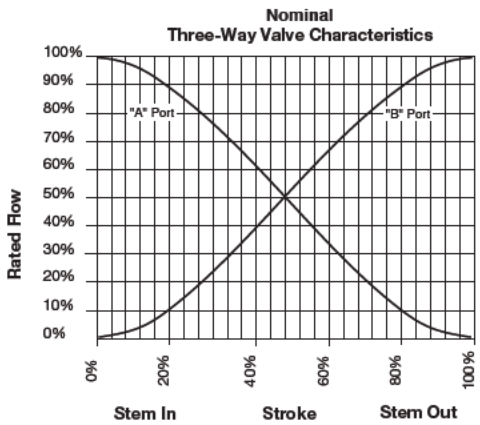
2-Way Valves: The flow curve shown below is representative of all sizes. All valve plugs have lower gain when nearly closed to enhance control at low demand. 2-Way valves are nominally equal percentage and normally used for water and low pressure steam.



Typical Modified Equal Percentage Flow Characteristics

Control Precision

3-Way Valves: 3-Way mixing valves are designed so that the flow from either of the inlet ports to the outlet is nominally linear, which means the total flow from the outlet is almost constant over the stroke of the valve stem. The flow is limited at the initial opening similar to an equal percentage curve to enhance system stability. Typical flow characteristics of the VB-8303 series valve bodies are shown below.



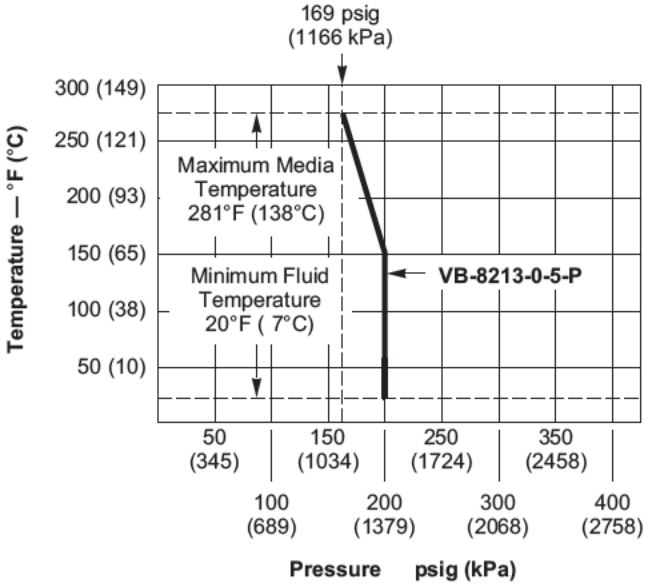
Typical Flow Characteristics

Rangeability

Rangeability is the ratio of rated flow to the minimum controllable flow through a valve. The nominal rangeability of the VB-8xx3 Series is greater than 100:1.

Temperature/Pressure Ratings

Temperature and pressure ratings of 2-Way and 3-Way valves are shown below. Ratings conform with published values and disclaimer.



VB-8xx3-0-5-P (Cast Iron Body with Flanged End Fittings)

Standards: Pressure to ANSI B16.1, Class 125, with 200 psi (1379 kPa) up to 150 °F (65 °C), decreasing to 169 psi (1165 kPa) at 281°F (138 °C).

Materials: Valve body: Cast iron, ASTM A126 Class B.

Trim: Stainless steel stem, forged brass plug, metal-to-metal or EPDM seat ring with TFE/EPDM packing parts and silicone packing grease.

Close-off Ratings

Nominal actuator close-off ratings are based on ANSI IV (0.01% leakage) for valves with EPDM seat rings such as VB-8213 and VB-8223. Metal-to-metal trim valves such as VB-8303 are designed for ANSI III (0.1% leakage).

VB-82x3 Water Flow Coefficient and Capacity

Water Flow Coefficient (Cv)

Sizing a valve requires selecting a flow coefficient (Cv), which is defined as the flow rate in gallons per minute (gpm) of 60°F water that will pass through the fully open valve with a 1 psi pressure drop (ΔP). It is calculated according to the formulas shown in Cv Equation for Water and Cv Equation for Steam.
Since the flow rate through the heat exchanger is usually specified, the only variable normally available in sizing a valve is the pressure drop. The following information can be used to determine what pressure drop to use in calculating a valve Cv. Using the calculated Cv, consult the Water Capacity table on this page or the Steam Capacity to select the valve body with the nearest available Cv.
Caution: Be sure that the anticipated pressure drop across the valve will not exceed the close-off pressure rating and the maximum pressure differential rating listed in the Vx-8xxx Selection Guide, F-27199.

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

Proportional 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 (see the table Conventional Heating System below).

Conventional Heating System Pressure Drops

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

Secondary Circuits with Small Booster Pumps: 50% of available pressure difference (equal to the drop through load, or 50% of booster pump head).

Water Table

Water Capacity in Gallons Per Minute for VB-82x3 Series

Valve Body Part Number	Cv Rating	Differential Pressure (DP in psi)														
		1	2	3	4	5	6	7	8	9	10	15	20	25	30	35
VB-82x3-0-5-12	56	56	79	97	112	125	137	148	158	168	177	217	250	280	307	331
VB-82x3-0-5-13	85	85	120	147	170	190	208	225	240	255	269	329	380	425	466	503
VB-82x3-0-5-14	145	145	205	251	290	324	355	384	410	435	459	562	648	725	794	858
VB-82x3-0-5-15	240	240	339	416	480	537	588	635	679	720	759	930	1073	1200	1315	1420
VB-82x3-0-5-16	370	370	523	641	740	827	906	979	1047	1110	1170	1433	1655	1850	2027	2189

C_v Equation for Water

Where:

C_v = Coefficient of flow.

gpm = Flow rate of water that will pass through fully open valve, measured in U.S. gallons per minute (60 °F (15.6 °C) water).

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

DP = Differential pressure (pressure drop), measured in psi.

VB-82x3 Steam Capacity & Vapor Pressures

Steam

Two-Position

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

Proportional

Proportional control valves are normally sized using:

- For low pressure (15 psig or less), use ΔP of 80% of gauge inlet pressure.
- For steam pressures greater than 15 psig, use ΔP of 42% of absolute (gauge plus 14.7) inlet pressure.
- When the Cv 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.

Steam Table

Steam Capacity in Pounds Per Hour for VB-82x3 Series

Valve Body Part Number	Cv Rating	Differential Pressure (DP in psi)[a]															
		2 psig Inlet		5 psig Inlet		10 psig Inlet		15 psig Inlet		20 psig Inlet		25 psig Inlet		30 psig Inlet		35 psig Inlet	
		0.2	1.6	0.5	4	1	8	1.5	12	2	14	2.5	16	3	18	3.5	20
VB-82x3-0-5-12	56	305	826	520	1331	818	1942	1093	2448	1359	2860	1620	3271	1879	3683	2136	4094
VB-82x3-0-5-13	85	463	1253	790	2021	1241	2947	1658	3716	2062	4341	2459	4965	2852	5590	3242	6214
VB-82x3-0-5-14	145	790	2138	1348	3447	2118	5027	2829	6339	3518	7405	4195	8470	4865	9536	5531	10601
VB-82x3-0-5-15	240	1308	3539	2231	5706	3505	8322	4683	10493	5823	12257	6943	14021	8053	15784	9156	17548
VB-82x3-0-5-16	370	2016	5456	3439	8796	5404	12830	7219	16177	8977	18896	10704	21615	12415	24334	14115	27053

a - Left column shows # per hour with a 10 % pressure drop and right column shows # per hour with an 80% pressure drop.

Cv Equation for Steam

$$C_v = \frac{Q \times K}{3\sqrt{\Delta P \times P2}} \qquad Q = \frac{3C_v\sqrt{\Delta P \times P2}}{K}$$

Where:
Cv = Coefficient of flow.
Q = Flow rate of steam that will pass through fully open valve, measured as pounds per hour of steam.
ΔP = Differential pressure (pressure drop), measured in psi.
P2 = Outlet pressure, measured in psia (absolute pressure). P2 = Inlet pressure + 14.7 – ΔP.
K = 1 + (0.0007 x °F superheat). K = 1 for saturated steam.

VB-82x3 Steam Capacity & Vapor Pressures

Cavitation Limitations on Valve Pressure Drop

A valve selected with too high a pressure drop can cause erosion of discs 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 through the valve.
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:
Pm = 0.5 (P1 – Pv)

Where:
Pm = Maximum allowable pressure drop
P1 = Absolute inlet pressure (psia)
Pv = Absolute vapor pressure (psia)

Note: Add 14.7 psi to the gauge supply pressure to obtain the 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:
Pm = 0.5 [(18 + 14.7) – 11.53] = 10.6 psi (Vapor pressure of 200°F water is 11.53 psi.)
Therefore, 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 redesigned to provide lower inlet velocities. Valves having harder seat materials should be furnished if inlet velocities cannot be lowered.
For additional valve sizing information, see the Vx-8xxx Selection Guide, F-27199.

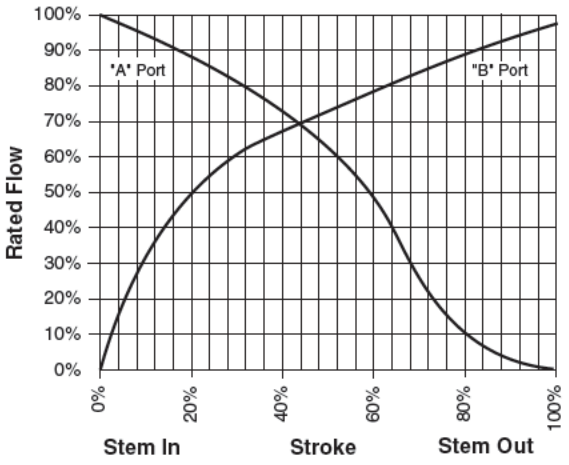
Vapor Pressure of Water Table

Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor 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

VB-9313 Valve Body Characteristics

Flow Characteristics

3-Way mixing valves are designed so that the flow from either of the inlet ports to the outlet is approximately linear, which means the total flow from the outlet is almost constant over the stroke of the valve stem. Typical flow characteristics of
VB-9313 series valve bodies are shown below.



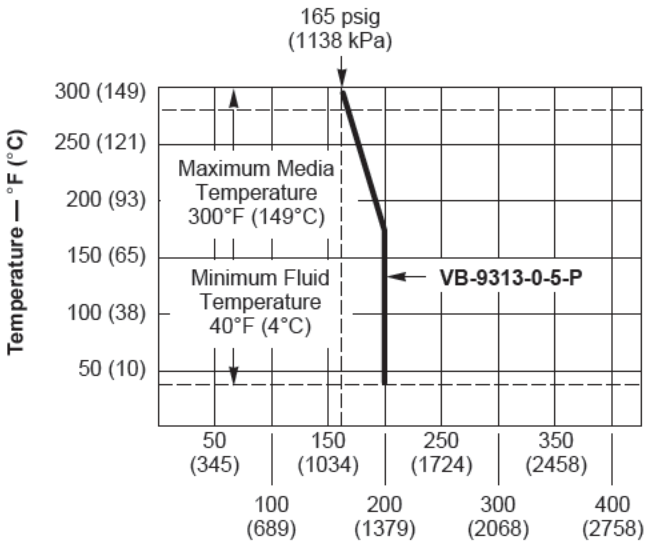
Typical Flow Characteristics

Rangeability

Rangeability is the ratio of rated flow to the minimum controllable flow through a valve. For mixing valves, control begins as soon as plug displacement allows flow. Thus, 3-Way valve rangeability normally exceeds 500:1, which is the reciprocal of 0.2% nominal leakage.

Temperature/Pressure Ratings

VB-9313-0-5-P (Flanged Cast Iron Body)
Standards: ANSI B16.1–1993
Materials: ASTM A126 Class B



Temperature and Pressure Ratings for VB-9313 Series Valve Bodies

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 to Bypass Flow

Proportional mixing valves used to bypass flow are piped on the outlet side of the load to throttle the water flow through the load and therefore control heat output of the load. These 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 (see Conventional Heating System Pressure Drops table below).

Conventional Heating System Pressure Drops

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

* Recommended minimum pressure drop = 5 psi (34 kPa).

Secondary Circuits with Small Booster Pumps:13 50% of available pressure difference (equal to the drop through load, or 50% of booster pump head).

VB-9313 Water Flow Coefficient and Capacity

Proportional to Blend Water Flows

Proportional valves used to blend two water flows control the heat output by varying the water temperature to the load at constant flow. These valves do not require high pressure drops for good control results. They can be sized for a pressure drop of 20% of the "available pressure" or equal to 25% of the pressure drop through the load at full flow.

Water Table

Water Capacity in Gallons Per Minute for VB-9313 Series.

Valve Body Part Number	Cv Rating	Differential Pressure (ΔP in psi)														
		1	2	3	4	5	6	7	8	9	10	15	20	25	30	35
VB-9313-0-5-12	74	74	105	128	148	165	181	196	209	222	234	287	331	370	405	438
VB-9313-0-5-13	101	101	143	175	202	226	247	267	286	303	319	391	452	505	553	598
VB-9313-0-5-14	170	170	240	294	340	380	416	450	481	510	538	658	760	850	931	1006
VB-9313-0-5-15	290	290	410	502	580	648	710	767	820	870	917	1123	1297	1450	1588	1716
VB-9313-0-5-16	390	390	552	675	780	872	955	1032	1103	1170	1233	1510	1744	1950	2136	2307

C_v Equation

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

Where:

C_v = Coefficient of flow
GPM = U.S. gallons per minute (60°F, 15.6°C)
ΔP = Differential pressure in psi (pressure drop)

Cavitation Limitations on Valve Pressure Drop

A valve selected with too high a pressure drop can cause erosion of discs 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 through the valve.
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:

Pm = 0.5 (P1 – Pv)

Where:
Pm = Maximum allowable pressure drop
P1 = Absolute inlet pressure (psia)
Pv = Absolute vapor pressure (psia) (Refer to the table below.)
Note: Add 14.7 psi to the gauge supply pressure to obtain the 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:
Pm = 0.5 [(18 + 14.7) – 11.53] = 10.6 psi (Vapor pressure of 200°F water is 11.53 psi.)
Therefore, 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 redesigned to provide lower inlet velocities. Valves having harder seat materials should be furnished if inlet velocities cannot be lowered.
For additional valve sizing information, see the Vx-8xxx Selection Guide, F-27199.

VB-8xx3/9313 Close-Off Pressure Capability

Vapor Pressure of Water Table

Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor 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

Close-off Ratings (Unless Otherwise Specified)

Nominal actuator close-off ratings are based on ANSI V with EPDM discs; and PTFE discs in steam applications. Metal-to-metal trim, such as brass 3-Way and high-temperature stainless, are designed for ANSI III (0.1-% leakage).

Note: Valve body and actuator size determine the close-off capabilities.

VB-8xx3/9313 Close-Off Ratings

The following tables offer a quick guide to valve actuator combination / close-off ratings. Please refer to specific close-off ratings.

VB-8xx3 and VB-9313 Close-off Ratings

	Spring Return Electric									
Actuator	Mx41-715x				Mx40-717x				Mx61-720x	M900Ax
Linkage	AV-607-1[d]		AV-609-1[e]		AV-607-1[d]		AV-609-1[e]		Included with actuator	AV-822
No Act	Single	Dual	Single	Dual	Single	Dual	Single	Dual	Single	Single
Pipe Size	VB-82x3[a]									
2 ½"	125/35				125/35				125/35	
3"										
4"										
5"										
6"			125/22	125/35			125/25	125/35		
Pipe Size	VB-8303[a]									
2 ½"	35/35				35/35				35/35	
3"										
4"										
5"	32/28				35/31			35/35		
6"		35/35	15/11				16/12	35/31		
Pipe Size	VB-9313[b,f]									
2 ½"	33	70			40	84				24
3"	22	48			27	57				16
4"	12	27			15	33				9
5"				9				10		
6"				6				7		

	Non-Spring Return Electric						Pneumatic Spring Return @15psi air (with 5...10 psi spring)			
Actuator	Mx41-6153		Mx41-6343		M800A	M1500A	MK-6811	MK-8811	MK-6911	MK-8911
Linkage	AV-607-1[d]		AV-609-1[e]		AV-822	AV-822	AV-497[c]	AV-496	AV-497	AV-496
No Act	Single	Dual	Single	Dual	Single	Single	Single	Single	Single	Single
Pipe Size	VB-82x3[a]									
2 ½"						125/35	125/35			
3"						125/35	125/35			
4"						125/35	125/35			
5"						125/35	125/35			
6"			125/25	125/35		125/35			125/35	
Pipe Size	VB-8303[a]									
2 ½"						35/35	35/35			
3"						35/35	35/35			
4"						35/35	35/35			
5"						35/35	35/35			
6"						35/35			35/35	
Pipe Size	VB-9313[b,f]									
2 ½"	33	70	46	96	29	61	40d/30u*	91d/60u*		
3"	22	48	31	66	19	42	27d/20u*	62d/40u*		
4"	12	27	18	38	10	22	14d/10u*	33d/25u*		
5"		9		24		14				20d/15u*
6"		6		17		9				13d/10u*

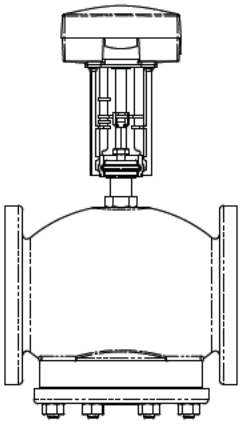
a - VB-8xxx - First value = maximum close off pressure, Second value = maximum operating differential. (Example: 125/35).
b - VB-9213/VB-9223 2-Way valves have the same close offs as VB-9313 valves.
c - VB-8xx3 valves use AV-497 linkage, VB-9313 valves use AV-495 linkage.
d - AV-607-1 (2 ½" - 5" VB-8000 valves or 2 ½" - 4" VB-9313 valves), the Mx41-634x actuator is not compatible with the AV-607-1 linkage.
e - AV-609-1 (6" VB-8000 valves or 5" - 6" VB-9313 valves), the AV-609-1 linkage can be used with the Mx41-634x actuator on 2 ½" - 5" VB-8000 valves or 2- ½" - 4" VB-9313 valves, but the valve will stroke over a shorter portion of the control input signal
f - Stem up (B to AB flow, A port closed. stem down (A to AB flow, B port closed)
*d and u indicate d (stem down) u (stem up)

6. VB-8/9000 Valve and Actuator Assemblies

Vx-8xx3 Series Balanced Plug Valve Assemblies

2-Way and 3-Way Valves

2½"…6" Flanged
2-Way Stem Up Open
2-Way Stem Up Closed
3-Way Mixing/Diverting
Electric/Electronic/Pneumatic
Globe Valve Assemblies



VB-8213 with M1500A Actuator

Vx-8xx3 Series Balanced Plug Valve Assemblies

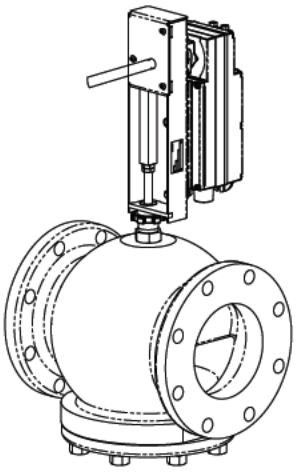
Schneider Electric VA, VF, VK, VK4, VS and VU-8xx3-xxx-5-P series valve assemblies are complete actuator/valve assemblies that accept two-position, floating, and proportional electric/electronic and proportional pneumatic control signals, for control of chilled water, hot water, or low pressure steam. These valve assemblies consist of pneumatic, electric, or electronic valve actuators either direct-coupled or linked to a 2½"…6" 2-Way or 3-Way valve body with ASA flanged end connections.

VB-8xx3 Series Valve Bodies

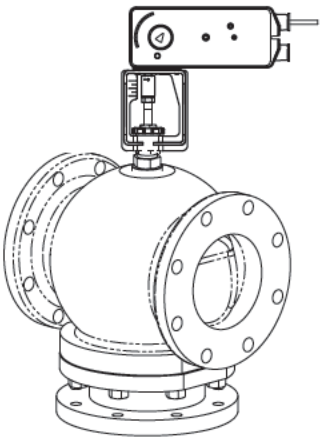
VB-8xx3-0-5-P valve bodies are also available separately to allow field mounting of a variety of Forta, Schneider Electric SmartX or pneumatic actuators using the appropriate linkage.

Features

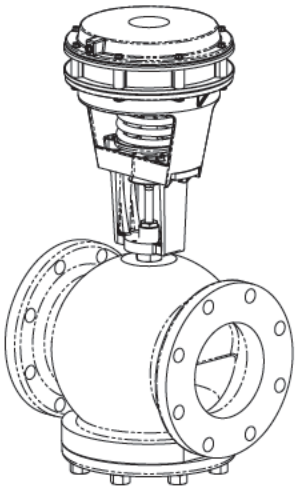
- Balanced plug design provides high close-offs using economical actuation
- Up to 125 psi (856 kPa) close-off on 2-Way models, 35 psi (240 kPa) on 3-Way models
- Universal 3-Way valve can be piped in either mixing or Diverting configurations
- Valve sizes 2½"…6", ASA 125 flanged
- A variety of Forta, Schneider Electric SmartX and pneumatic actuators are available, either as factory assemblies or for field assembly
- ANSI IV shutoff (0.01% of Cv) on 2-Way models, ANSI III (0.1% of Cv) on 3-Way models
- Self-adjusting spring loaded TFE/EPDM packing
- Normally open,normally closed, and non-spring return models available
- Expanded temperature range of 20° to 281°F
- ISO 9001:2000 Certified Quality Management System
- Vx-9313 3-Way mixing valves offer many of the same features as the VB-8xx3 vales and a conventional mixing valve flow pattern.



Vx-82x3 with Mx4x-6343
(2½" – 5" with AV-607-1
6" with AV-609-1)



Vx-8303/Vx-9313 with Mx61-720x
Direct-Mounted Actuator



VK-82xx with MK-6911

Globe Valve Assembly Selection Procedure

Globe Valve Assembly Selection Procedure

When selecting a globe valve assembly, you must determine the applicable codes for the control signal type, valve body configuration, end connection, port size and actuator. Select a globe valve assembly part number as follows:

1. Control Signal Type, Valve Body Configuration and End Connection

Refer to Assembly Ordering and select the appropriate codes for the part-number fields.

2. Valve Size (Flow Coefficient)

If the required flow coefficient (Cv) has not been determined, do so as follows:

a. Refer to Sizing and Selection to calculate the required Cv.

b. Select the nearest available Cv value and corresponding valve body port code from the “Part Numbering System.”

3. Actuator

Select the appropriate actuator and code, according to Assembly Ordering based on the control signal type, required valve normal position, and voltage requirements. For detailed actuator information, refer to the applicable actuator specifications on subsequent pages.

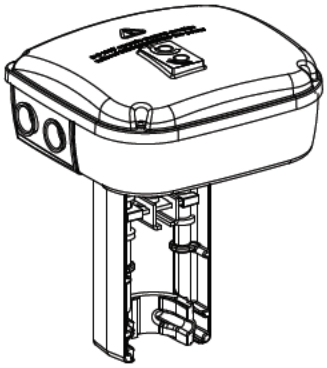
4. Close-off Pressure

Confirm that the selected actuator and valve body combination provides sufficient close-off pressure. If no close-off pressure is shown, the valve body/actuator combination is not valid.

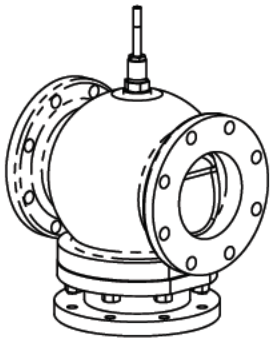
5. Available Space

If available space is a consideration, check the appropriate dimensional figure and its accompanying table for any potential fit issues.

VB-9313 Valves with Forta M900A Actuators & Linkage Assemblies



Assemblies with VB-9313 Valves and Forta M900A



VB-9313

Applications

Schneider Electric Forta M900Axx Series Spring Return Actuators mount directly with AV-822 onto 2½…4" VB-9313 Series flanged globe valve bodies. Applications include chilled or hot water and steam NEMA 1 or 2 (M900Ax) or NEMA 4 (M900AxW) models. Field selectable input signals include reverse and direct acting, floating or proportional 0…10 Vdc, 2…10 Vdc or 4…20 mA, and proportional sequencing input signal ranges.

Applicable Literature

- Forta M900 Datasheet, F-27682
- Forta M900 Installation Instructions, F-27683
- AV-822 Installation Instructions, F-27702
- CA-28 Control Valve Sizing, F-13755

Valve and Actuator Selection Procedure

1. Determine the required flow coefficient (Cv/kvs).

Using the required flow and pressure drop for the application, determine the required flow coefficient (consult CA28, F-13755 if necessary).

2. Determine valve body part number.

Select a flanged VB-9313 valve body having the required flow coefficient, size, body pattern, end connection, and temperature/pressure ratings appropriate for the application. Determine the desired loss of power position of the valve.

3. Select the Forta Actuator

Using the required close-off pressure for the application and the appropriate spring return action and select a Forta actuator having sufficient close-off pressure on the valve body selected in step 2. For valve/actuator combinations using VB-9313 valve bodies, also consult the tables for maximum operating pressure differential limitations.

If necessary, use the dimensional information on the VB-9000 Series
With M900A Series of the Dimensions section to confirm that the valve-actuator assembly will fit in the available space.

4. Determine the Assembly Part Number

If a complete factory valve and actuator assembly is required, consult the tables in this section for the actuator code of the Forta actuator selected in Step 3. For the complete assembly part number:

Change the valve body part number prefix from VB to VU. Insert the actuator code in the third field of the part number. Confirm the factory assembly is available in iPortal.

Example:

Valve body: VB-9313-0-5-14

Actuator: M900AR (actuator code 650 from tables in this section)

Complete assembly: VU-9313-650-5-14

Forta actuators are field configured for the desired control signal type and range plus the desired action. Consult the appropriate Forta Installation Instructions for further information.

VB-82x3 2-Way Flanged Valves with NSR Actuators

Valve/Actuator Combinations and Operating Pressure Differentials

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

2-Way Globe Valve Assemblies with Electric Non-Spring Return Actuators

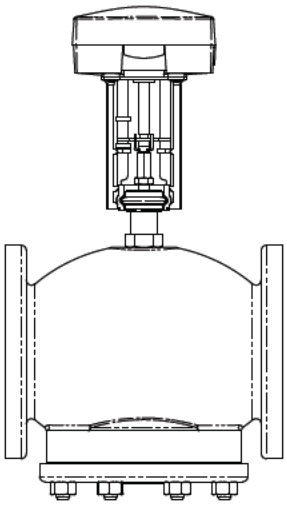
Non-Spring Return (NSR) 2-Way Globe Valve Assemblies					M1500A	Mx41-634x
					Actuator Output Rating (Minimum)	
					337 lbf (1500 N-m)	300 lb-in (34 N-m)
					Actuator Model (Actuator Code)	
					Floating/Proportional M1500A (686)	Floating MF41-6343 Proportional MS41-6340 (512) MS41-6343
					Linkage Kit Part Number	
					AV-822 (2½"…6")	AV-609-1 (6")
Close-off Pressure (psi)					125	
Valve Assembly Part Number[a]	P Code	Valve Size in.	C_v[b]	k_{vs}[b]	Maximum Allowable Operating Differentialc	
					M1500A	Single Actuator / Dual Actuatord
Vx-8213-xxx-5-P Vx-8223-xxx-5-P	12	2½	56	48	35 (240)	-
	13	3	85	74		
	14	4	145	125		
	15	5	240	208		
	16	6	370	320		35 (240) / 35 (240)

a - See *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part no.

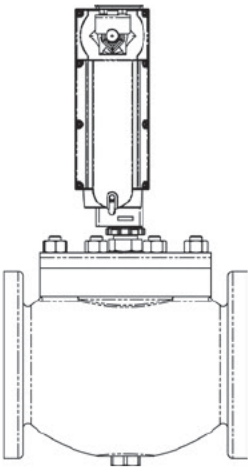
b - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

c - Maximum allowable differential across the valve in any open position. Less than 20 psi recommended for quieter service. Consult close-off pressure ratings.

d - Dual actuators are not available as a factory assembly.



VB-8213 with M1500A Actuator

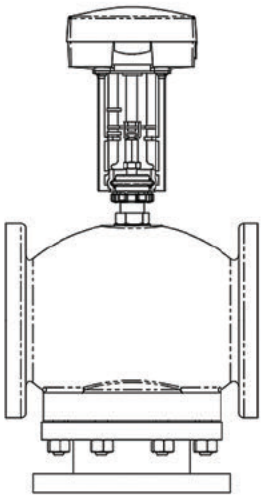


VB-8223 with Mx41-634x Actuator

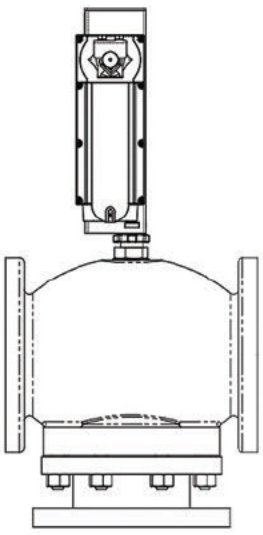
VB-8303 3-Way Flanged Valves with NSR Actuators

3-Way Globe Valve Assemblies

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

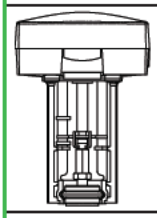
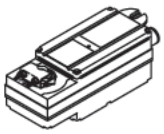


Vx-8303 with M1500A Actuator



Vx-8303 with Mx41-634x Actuator

3-Way Globe Valve Assemblies with Electric Non-Spring Return (NSR) Actuators

Non-Spring Return (NSR) 3-Way Globe Valve Assemblies					M1500A	Mx41-634x	
							
					Actuator Output Rating (Minimum)		
					337 lbf (1500 N-m)	300 lb-in (34 N-m)	
					Actuator Model (Actuator Code)		
					Floating/Proportional M1500A (686)	Floating MF41-6343 (516) Proportional MS41-6340 (512) MS41-6343 (516)	
					Linkage Kit Part Number		
					AV-822 (2½"…6")	AV-609-1 (6")	
Close-off Pressure (psi)					35		
Valve Assembly Part Number[a]	P Code	Valve Size in.	Cv[b]	kvs[b]	Maximum Allowable Operating Differential Pressurec psi (kPa) (Mixing/Diverting)		
					M1500A	Single Actuator	Dual Actuator[d]
Vx-8303-xxx-5-P	12	2½	80[e]	69[e]	35 (240)	-	
			95[f]	82[f]			
			115[g]	99[g]			
	13	3	110[e]	95[e]			
			120[f]	104[f]			
			120[g]	104[g]			
	14	4	190[h]	164[h]			
	15	5	290[h]	251[h]			
	16	6	500[h]	433[h]		32 (219) 28 (192)	35 (240)

a - See *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part number.

b - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

c - Maximum allowable differential across the valve in any open position. Recommend less than 20 psi for quieter service. Consult close-off pressure ratings.

d - Dual actuators are not available as a factory assembly.

e - Mixing configuration, ports A and B are inlets, AB port is outlet.

f - Diverting configuration, flow AB to A port.

g - Diverting configuration, flow AB to B port.

h - All flow configurations, mixing or Diverting.

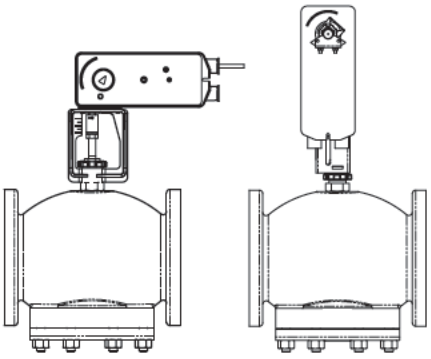
VB-82x3 2-Way Flanged Valves with SR Actuators

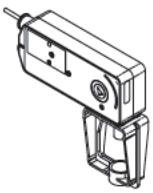
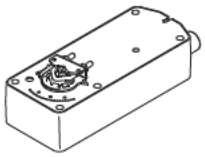
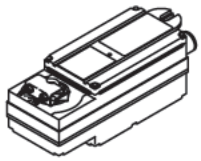
2-Way Globe Valve Assemblies

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

2-Way Globe Valve Assemblies with Electric Spring Return Actuators

Spring Return
2-Way Globe Valve Assemblies



	Mx61-720x	Mx41-715x	Mx40-717x
			
Actuator Output Rating (minimum)			
	220 lbf (979 N-m)	133 lb-in (15 N-m)	150 lb-in (17 N-m)
Actuator Models (Actuator Codes)			
	Two-Position MA61-7200 MA61-7203 (596) Floating MF61-7203 (596) Proportional MS61-7203 (596)	Two-Position MA41-7150 MA41-7151 MA41-7153 (556) Floa ing MF41-7153 (556) Propor ional MS41-7153 (556)	Two-Position MA40-7170 MA40-7171 MA40-7173 (576) Floating MF40-7173 (576) Proportional MS40-7170 MS40-7171 MS40-7173 (576)
Linkage Kit Part Number			
	None (Part of Actuator)	AV-607-1 (2½"…5") AV-609-1 (6")	AV-607-1 (2½"…5") AV-609-1 (6")
Close-off Pressure (psi)		125	

Valve Assembly Part Number[a]	P Code	Valve Size in.	C_v[b]	k_{vs}[a,b]	Maximum Allowable Operating Differential Pressurec, psi (kPa)				
					Mx61-720x	Single Actuator	Dual Actuator[d]	Single Actuator	Dual Actuator[d]
Vx-8213-5xx-5-P Vx-8223-5xx-5-P	12	2½	56	48	35 (240)	35 (240)	-	35 (240)	-
	13	3	85	74					
	14	4	145	125					
	15	5	240	208					
	16	6	370	320	-	22 (151)	35 (240)	25 (171)	35 (240)

a - See *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part number.

b - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

c - Maximum allowable differential across the valve in any open position. Less than 20 psi recommended for quieter service. Consult close-off pressure ratings.

d - Dual actuators are not available as factory assemblies.

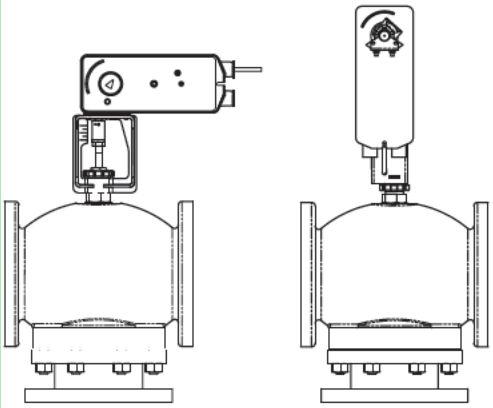
VB-8303 3-Way Flanged Valves with SR Actuators

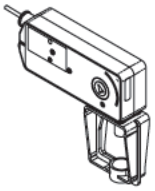
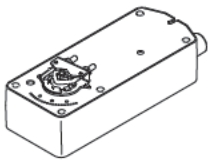
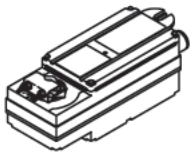
3-Way Globe Valve Assemblies

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

3-Way Globe Valve Assemblies with Electric Spring Return (SR) Actuators

Spring Return (SR)
3-Way Globe Valve Assemblies



Valve Assembly Part Number[a]	P Code	Valve Size in.	Cv[b]	kvs[b]	Mx61-720x	Mx41-715x	Mx40-717x
							
					Actuator Output Rating (minimum)		
					220 lbf (979 N-m)	133 lb-in (15 N-m)	150 lb-in (17 N-m)
					Actuator Models (Actuator Codes)		
					Two-Position MA61-7200 MA61-7203 (596) Floating MF61-7203 (596 Proportional MS61-7203 (596)	Two-Position MA41-7150 MA41-7151 MA41-7153 (556) Floating MF41-7153 Proportional MS41-7153 (556)	Two-Position MA40-7170 MA40-7171 MA40-7173 (576) Floating MF40-7173 (576) Proportional MS40-7170 MS40-7171 MS40-7173 (576)
					Linkage Kit Part Number		
					None (Part of Actuator)	AV-607-1 (2½"…5") AV-609-1 (6")	AV-607-1 (2½"…5") AV-609-1 (6")
Close-off Pressure (psi)					35		
					Maximum Allowable Operating Differential Pressurec, psi (kPa) (Mixing/Diverting)		
					Mx61-720x	Single Actuator	Dual Actuator[d]	Single Actuator	Dual Actuator[d]
Vx-8303-5xx-5-P	12	2½	80[e]	69[e]	35 (240) / 35 (240)	35 (240) / 35 (240)	-	35 (240) / 35 (240)	-
			95[f]	82[f]					
			115[g]	99[g]					
	13	3	110[e]	95[e]					
			120[f]	104[f]					
			120[g]	104[g]					
	14	4	190[h]	164[h]					
	15	5	290[h]	251[h]		32 (219) / 28 (192)	35 (240) / 35 (240)	35 (240) / 31 (212)	35 (240) / 35 (240)
	16	6	500[h]	433[h]	-	15 (103) / 11 (75)	-	16 (110) / 12 (82)	35 (240) / 31 (214)

a - See *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part number.

b - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

c - Maximum allowable differential across the valve in any open position. Recommend less than 20 psi for quieter service. Consult close-off pressures.

d - Dual actuators are not available as factory assemblies.

e - Mixing configuration, ports A and B are inlets, AB port is outlet.

f - Diverting configuration, flow AB to A port.

g - Diverting configuration, flow AB to B port.

h - All flow configurations, mixing or Diverting.

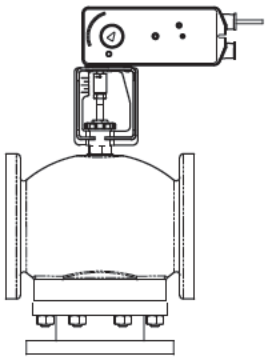
Vx-9313 3-Way Flanged Valves with Linear SR Actuators

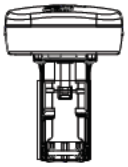
3-Way Linked Globe Valve Assemblies with Linear Series Actuators

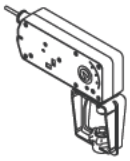
Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

3-Way Linked Globe Valve Assemblies with Linear Series Spring Return Actuators

3-Way Linked Globe Valve Assemblies[a]







Valve Assembly Part Number[b]	P Code	Valve Size in. (mm)	C_v[c]	k_{vs}[c]	Actuator Force Rating: 157 lbf (700 N) — Actuator Close-off Pressure (psi)[ad]	Actuator Force Rating: 220 lbf (979 N) — Actuator Close-off Pressure (psi)[ad]
					Actuator Model (Actuator Code): Floa ing/Proportional (Universal) M900AR (650) Linkage AV-822	Actuator Model (Actuator Code): Two-Position MA61-720x (595) (596) Floating MF61-7203 (596) Proportional MS61-7203 (596)
Vx-9313-xxx-5-P	12	2½ (65)	74.0	64	24	33
	13	3 (80)	101.0	87	16	22
Vx-9313-xxx-5-P	14	4 (N/A)	145.0	125	9	12

a - For piping information refer to the separately available Wiring, Dimensions and Reference document F-28125 from the Exchange Download Center.

b - To determine a specific part number, see *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series.

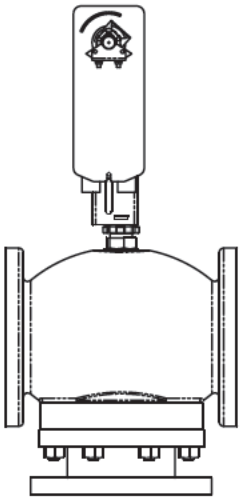
c - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

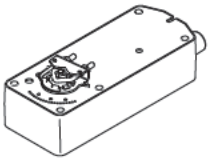
d - Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations. The rating value is the pressure difference between the inlet and outlet ports.

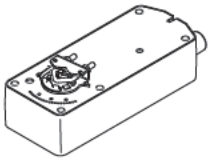
Vx-9313 3-Way Linked Valves with SR Actuators

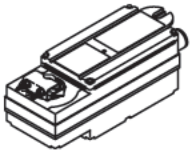
3-Way Linked Globe Valve Assemblies with Spring Return Actuators

Spring Return
3-Way Linked Globe Valve Assemblies[a]









Actuator Torque Rating (minimum)		
60 lb-in (7 N-m)	133 lb-in (15 N-m)	150 lb-in (17 N-m)
Actuator Model (Actuator Code)		
Two-Position MA41-707x (544) Floating MF41-7073 Proportional MS41-7073	Two-Position MA41-715x Floating MF41-7153 Proportional MS41-7153	Two-Position MA40-717x Floating MF40-7173 Proportional MS40-717x (576)
Linkage Kit Part Number		
AV-607-1 (2½"…4")	AV-607-1 (2½"…4") AV-609-1 (5" and 6")	AV-607-1 (2½"…4") AV-609-1 (5" and 6")

Valve Assembly Part Number [b]	P Code	Valve Size in. (mm)	C_v [c]	k_{vs} [c]	Actuator Close-off Pressure (psig)[d]					
					Single Actuator	Dual Actuator[e]	Single Actuator	Dual Actuator[e]	Single Actuator	Dual Actuator [e]
Vx-9313-xxx-5-P	12	2½ (65)	74 0	64	24	52	33	70	40	84
	13	3 (80)	101.0	87	16	35	22	48	27	57
	14	4 (N/A)	145.0	125	9	20	12	27	15	33
	15	5 (N/A)	235.0	203	-			9	-	10
	16	6 (N/A)	350.0	303				6	-	7

a - For piping information refer to the separately available Wiring, Dimensions and Reference document F-28125 from the Exchange Download Center.

b - To determine a specific part number, see *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series.

c - kvs = m^3/h (ΔP = 100 kPa) kvs = Cv / 1.156 Cv = kvs x 1.156

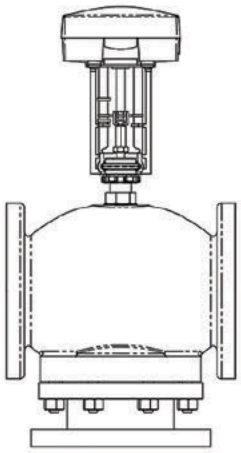
d - Close-off ANSI III (0.1%) for metal-to-metal seats with pressure at inlet (port A).

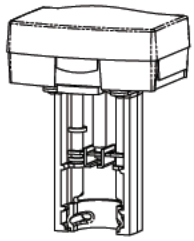
e - Dual actuators are not available as factory assemblies.

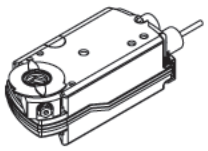
Vx-9313 3-Way Linked Valves with NSR Actuators

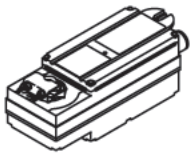
3-Way Linked Globe Valve Assemblies with Non-Spring Return Actuators

Non-Spring Return 3-Way Linked Globe Valve Assemblies[a]









Valve Assembly Part Number[b]	P Code	Valve Size in.	C_v[c]	k_{vs}[c]	Actuator Torque Rating (minimum)					
					180 lb-in (800 N-m)	337 lb-in (1500 N-m)	133 lb-in (15 N-m)		300 lb-in. (34 N-m)	
					Actuator Model (Actuator Code)					
					Universal M800A (680)	Universal M1500A (686)	Floating MF41-6153 Proportional MS41-6153		Floating MF41-6343 Proportional MS41-6343	
					Linkage Kit Part Number					
					AV-822	AV-822	AV-607-1 (2½"…4")		AV-609-1 f (2½"…6")	
					Actuator Close-off Pressure psia[d]					
					AV-822	AV-822	Single Actuator	Dual Actuator[e]	Single Actuator	Dual Actuator[e]
Vx-9313-xxx-5-Pf	12	2½	74.0	64	29	61	33	70	46	96
	13	3	101.0	87	19	42	22	48	31	66
	14	4	145.0	125	10	22	12	27	18	38
	15	5	235.0	203	-	14	-	9	-	24
	16	6	350.0	303	-	9	-	6	-	17

a - For piping information refer to the separately available Wiring, Dimensions and Reference document F-28125 from the Exchange Download Center.
b - To determine a specific part number, see *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series.
c - kvs = m^3/h (ΔP = 100 kPa) kvs = Cv / 1.156 Cv = kvs x 1.156
d - Close-off ANSI III (0.1%) for metal-to-metal seats with pressure at inlet (port A).
e - Dual actuators are not available as factory assemblies.
f - Mx41-634x actuators used on 2½" to 4" Vx-9313 will stroke over a shorter portion of the control input signal.

Floating and Proportional NSR 300, 337 lb-in and Two-Position 220 lbf SR Linear Actuators

Floating and Proportional Non-Spring Return Electric, Schneider Electric Forta and Schneider Electric SmartX Actuators										
Actuator Part Number	Actuator Code	Control Signal Type	Power Input @ 50/60 Hz				Timing, sec.[a]		Output Force or Torque	Manual Override
			Voltage	VA		Watts	50 HZ	60 HZ		
				Running	Holding					
M1500A[b]	686	Floating (SPDT)	24 Vac ±10% 20-30 Vdc	24[c]	-	-	60 or 300 adj.[d]		337 lb-in (1500 N-m)	Yes
		Proportional (Vdc or mAdc)					20 sec[e] 1" of stroke			
MF41-6343	516	Floating (SPDT)	24 Vac ±20%	5.7	4.1	3.9	162	162	300 lb-in (34 N-m)	
			22-30 Vdc	4.1	3.0	4.1				
MS41-6340	512	Proportional (Vdc or mAdc)	120 Vac ±10%	7.5	6.2	4.7	148	148	300 lb-in (34 N-m)	
MS41-6343	516	Proportional (Vdc or mAdc)	24 Vac ±10%	5.6	4.0	3.6	148	148	300 lb-in (34 N-m)	
			22-30 Vdc	3.4	2.2	3.4				

a - Approximate timing @ 70°F (21°C) with no load.
b - Requires AV-822 linkage, if field assembled.
c - Requires a 50 VA transformer.
d - For the floating control signal only.
e - Proportional control.

Two-Position, Floating, and Proportional Spring Return Electric 220 lbf Schneider Electric SmartX Linear Actuators														
Actuator Part Number	Actuator Code	Control Signal Type	Power Input							Timing, Sec.[a]		Output Force, lbf (N)	Manual Override
			Voltage 50/60 Hz	Running				Holding		Powered	Spring Return		
				50 Hz		60 Hz		DC Amp	50 Hz	60 Hz				
				VA	W	VA	W		W	W				
MA61-7200		2-Posi ion (SPST or Triac)	120 Vac ±10%	11.7	8.8	10.0	8.4	-	3.6	5.0	<190	<40	220 (979) minimum 495 (2202) max. stall	Yes
MA61-7203	596		24 Vac ±20% 22-30 Vdc	9.8	7.5	9.7	7.5	0.29	2.8	2.8				
MF61-7203	596	Floating (SPDT)	24 Vac ±20% 22-30 Vdc	9.8	7.7	9.7	7.7	0.3	3.3	3.3				
MS61-7203	596	Proportional (Vdc or mAdc)	24 Vac ±20% 22-30 Vdc	9.8	7.4	9.7	7.4	0.28	2.9	2.9				

a - Approximate timing @ 70°F (21°C) with no load.

Two-Position Floating and Proportional SR 133 lb-in Linkage Kit Assemblies

Two-Position, Floating and Proportional Spring Return Electric 133 lb-in Schneider Electric SmartX Actuators

Actuator Part Number	Actuator Code	Control Signal Type	Power Input								Timing, Seconds[a]		Torque, lb-in (N-m)[b]	Manual Override
			Voltage 50/60 Hz	Running				DC Amp	Holding		Powered	Spring Return		
				50 Hz		60 Hz			50 Hz	60 Hz				
				VA	W	VA	W		W	W				
MA41-7150		2-Position (SPST)	120 Vac ±10%	11.7	8.8	10.0	8.4	-	3.6	5.0	<190	<30	133 (15)	Yes
MA41-7151			230 Vac ±10%	15.5	9.5	10.6	8.5	-	4.6	3.3				
MA41-7153	556		24 Vac ±20% 22-30 Vdc	9.8	7.5	9.7	7.5	0.29	2.8	2.8				
MF41-7153		Floating (SPDT)	24 Vac ±20% 22-30 Vdc	9.8	7.7	9.7	7.7	0.3	3.3	3.3				
MS41-7153	556	Proportional (Vdc or mAdc)	24 Vac ±20% 22-30 Vdc	9.8	7.4	9.7	7.4	0.3	2.9	2.9				

a - Approximate timing @ 70°F (21°C) with no load.
b - De-rating required for spring return actuators at low temperatures.

Linkage Kits and Actuator/Linkage Assemblies

Application	Actuator	Linkage Kit[a]
2½"…5" 2-Way & 3-Way	MK-6811[b]	AV-497 (VB-8000 only) AV-495 (VB-9313 up to 4" only)
6" 2-Way & 3-Way	MK-6911[b]	AV-497 (VB-8000 only)
2½"…4" 3-Way	MK-8811	AV-496 (VB-9313 only)
5"…6" 3-Way	MK-8911	AV-496 (VB-9313 only)
2½"…5" 2-Way and 3-Way (1" nominal stroke)	MA41-7150 MA41-7151 MA41-7153 MA40-7170 MA40-7171 MA40-7173 MF41-6343[a] MF41-7153 MF40-7173 MS41-6340[a] MS41-6343[a] MS41-7153 MS40-7170 MS40-7171 MS40-7173	AV-607-1[c]
6" 2-Way & 3-Way (1¾" nominal stroke)		AV-609-1[d]
2½"…6" 2-Way & 3-Way (1" nominal stroke)	M1500A	AV-822

a - Mx61-720x Actuators require no separate linkage. Mx41-634x is not compatible with AV-607-1. The AV-609-1 linkage can be used with the Mx41-634x actuator on 2½"…5" VB-8000 valves or 2½"…4" VB-9313 valves, but the valve will stroke over a shorter portion of the control input signal.
b - AK-42309-500 (order separately) optional for 2½"…5" valve, required for 6" valve. VK4 valve assemblies include positive positioner.
c - 2½"…5" VB-8000 valves or 2½"…4" VB-9313 valves.
d - 6" VB-8000 valves or 5"…6" VB-9313 valves.

Two Position, Floating and Proportional SR 150 lb-in SmartX Actuators

Two Position, Floating, and Proportional Spring Return Electric 150 lb-in Schneider Electric SmartX Actuators										
Actuator Part Number	Actuator Code	Control Signal Type	Power Input				Approximate Timing, Seconds at 70°F (21°C with no load)		Actuator Output Torque Rating, lb-in (N-m)[a]	Manual Override
			Voltage	VA		Running Watts	Powered	Spring Return		
				Running	Holding					
MA40-7170	572	2-Position (SPST)	120 Vac ±10%	8.4	6.6	6.2	162	72	150 (17)	No
MA40-7171	574		240 Vac ±10%	9.8	8.5	6.5				
MA40-7173	576		24 Vac ±20%	7.4	5.1	5.3				
			22-30 Vdc	5.0	3.0	5.0				
MF40-7173	576	Floating	24 Vac ±20%	8.1	5.3	5.8				
			22-30 Vdc	5.7	3.6	5.7				
MS40-7170	572	Proportional (Vdc or mAdc)	120 Vac ±10%	8.5	5.2	6.4	147	65		
MS40-7171	574		240 Vac ±10%	10.8	9.0	7.2				
MS40-7173	576		24 Vac ±20%	7.8	4.7	5.5				
			22-30 Vdc	5.6	2.5	5.0				

a - De-rating required for spring return actuators at low temperatures.

VB-8xx3/9313 with Forta SR & NSR Actuators

Easily Assembled with VB-8000/9000 Series Globe Valves

The VB-8000/9313 2½"...6" series are available with cast iron flanged stem-up open and stem-up closed 2-Way units and 3-Way mixing and Diverting units. All valves are designed for easy field installation with Forta actuators. For your convenience, popular valve and actuator combinations are available as factory Forta valve and actuator assemblies.

VB-8000/VB-9313 Forta Actuator Application			
Valve Size	M800A* (180 lbf)	M1500A (337 lbf) Size	M900Ax* (157 lbf) Spring Return
2½"	•	•	•
3"	•	•	•
4"	•	•	•
5"		•	
6"		•	

*VB-9313 valves only.

U-Bolt Mount

Forta Actuator Specifications								
Actuator Mounting	Part Number	Power	Input Signal	Spring Return Action	Feedback	Force	Auxiliary Switch	NEMA 4
U-Bolt	M800A*	24 vac 50-60 Hz	Two-Position Floating	N/A	2...10 vdc	180 lbf	None	
	M800A-S2*						2-SPDT	
	M1500A					337 lbf	None	
	M1500A-S2						2-SPDT	
	M900AR*		Proportional	Retract Up	0...5 or 2...10 vdc	157 lbf	None	
	M900ARW*		0...10, 2...10 vdc, or 4...20 ma				None	Yes
	M900ARW-S2*						2 SPDT	
	M900AE*			Extend Down			None	
	M900AEW-S2*						2 SPDT	Yes

*VB-9313 valves only.

VB-9313 3-Way Valves with M900Axx SR Actuators

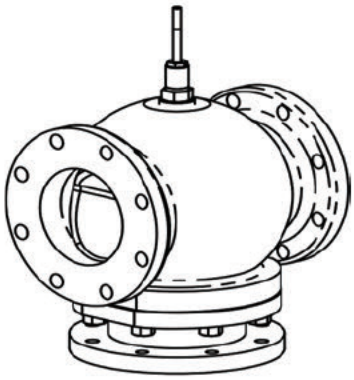
3-Way Valves

3-Way mixing

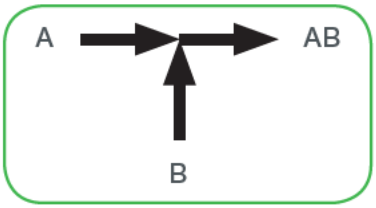
ANSI 125 Flanged

Cast Iron Body

ASA Flanged



VB-9313



VB-9313 3-Way Mixing Flow Pattern

Schneider Electric VB-9313 Valve Bodies		
Application		Chilled or Hot Water
Size		2½"…4"
Valve Body Part Number		VB-9313-0-5-P
Linkage Kit Part Number		AV-822
Material	Flow Characteristic	Nominally Linear
	Body	Cast Iron
	Seat	Bronze
	Stem	Stainless Steel
	Plug	Brass
	Packing	Spring Loaded TFE/EPDM
	Disc	None
ANSI Pressure Class, psig		125
Allowable Control Media Temperature, °F (°C)		40°F…300°F (4°C…149°C)
Allowable Differential Pressure, Water, psi (kPa)[a]		35 psi (241 kPa) Max.
P Code	Valve Size, In.	C_v (k_{vs}) Rating[b]
12	2½	74 (64)
13	3	101 (87)
14	4	170 (147)

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

b - $k_{vs} = m^3/h$ (ΔP = 100 kPa) $k_{vs} = C_v / 1.156$ $Cv = \frac{gpm}{\sqrt{\Delta P}}$ (in psi). $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).

Schneider Electric Forta Actuator Model Table											
Model	Actuator Code	Force	Power	Running Watts	Trans-former Size	Floating Control[a,b]	Proportional Control[b]	Feed-back[a]	(2) SPDT Aux Switches[e]	Linkage[c]	Spring Return Action
M900AR	650	157 lbf (700 N)	24 Vac 50/60 Hz	21 W	50 Va	Yes	0…10 Vdc, 2…10 Vdc, 4…20 mA	2…10 Vdc or 0-5 Vdc	No	AV-822	Return
M900AE[d]	-										Extend
M900ARW	660										Return
M900ARW-S2[d]	-								24 Vac 4a		Return
M900AEW-S2[d]	-										Extend

a - Dip switch selectable.

b - 0…5, 2…6 or 5…10, 6…10 also selectable by dip switch.

c - Order separately.

d - Factory assemblies not offered.

e - S2 auxiliary switches may be added in the field.

Restrictions on Ambient Temperature for Forta Valve Actuators	
Fluid Temperature in Valve Body	Maximum Allowable Ambient Temperature[a]
Chilled Water	122°F (50°C)
281°F (138°C)	113°F (45°C)
300°F (149°C)	107°F (42°C)
340°F (171°C)	100°F (38°C)
366°F (186°C)	90°F (32°C)

a - Minimum allowable ambient operating temperature 14°F (-10°C).

VB-9313 3-Way Valves with M900Axx SR Actuators

Select Valve/Actuator Combination Having Sufficient close-off for Application						
Valve Body	Valve Action	P Code	Cv	Size	Close-off Ratings PSI	Maximum Operating Pressure Differential
					M900Axx[a]	
VB-9313-0-5-P	3 Way	12	67 (58)	2 ½"	29	35
		13	91 (79)	3"	19	35
		14	170 (147)	4"	10	35

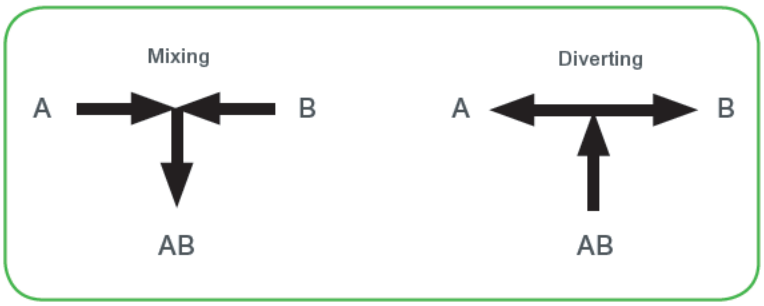
a - Requires AV-822 Linkage Order Separately.

Factory Valve and Actuator Assemblies				
VB-9313 Series Valve Assembly Part Numbers[a]	P Code	Size	Valve Action Stem UP	M900AR (650) or M900ARW (660) Action on Power Loss
VU-9313-6x0-5-P (Mixing):	12	2 ½"	Flow B to AB	Flow B to AB
	13	3"		
	14	4"		

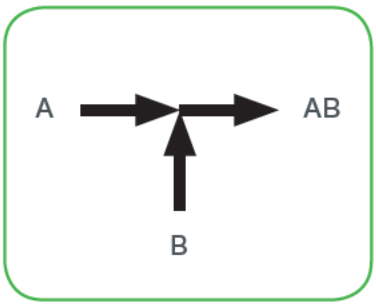
a - 650 = M900AR, 660 = M900ARW.

VB-9313 Valve Body and M900Axx Spring Return Actuator Actions								
			M900ARx			M900AEx		
Valve Body Part Number	Valve Body Description	Valve Body Stem Up Water Flow	Unpowered Valve Assembly Water Flow	Switch 7 off, Loss of Control Signal Only	Switch 7 on, Loss of Control Signal Only	Unpowered Valve Assembly Water Flow	Switch 7 off, Loss of Control Signal Only	Switch 7 on, Loss of Control Signal Only
VB-9313-0-5-P	3-Way Mixing	Flow B to AB	Flow B to AB	Flow B to AB	Flow A to AB	Flow A to AB	Flow A to AB	Flow B to AB

3-Way Flanged Valve Body Flow Patterns



VB-8303 3-Way Flow Patterns
Flow is out AB for Mixing application and in AB for Diverting applications.



VB-9313 3-Way
Mixing Flow Patterns

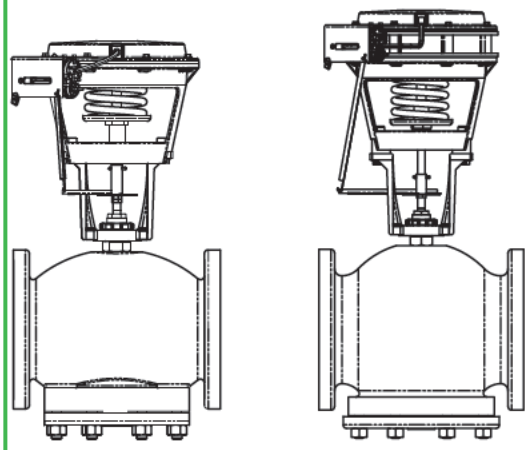
VB-82x3 2-Way Valves with Pneumatic SR Actuators

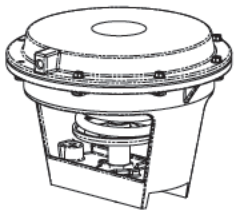
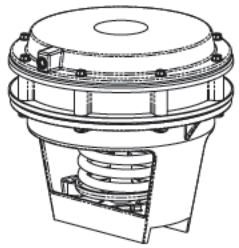
2-Way Valves

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult the table below for close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

2-Way Globe Valve Assemblies with Pneumatic Spring Return Actuators

Pneumatic Spring Return
2-Way Globe Valve Assemblies
(shown with Positive Positioner)



Valve Assembly Part Number[b]	P Code	Valve Size In.	Cv[b]	kvs[b]	MK-6811[b]	MK-6911[b]
						
					Actuator Models (Actuator Codes)	
					MK-6811 (602)	MK-6911 (652)
					Linkage Kit Part Number	
					AV-497	AV-497
					Spring Range, psig (kPa)	
					5…10 (34 to 69)[a]	5…10 (34 to 69)[a]
					125	
VK-8213-602-5-12 VK-8223-602-5-12 VK4-8213-602-5-12 VK4-8223-602-5-12	12	2½	56	48	Maximum Allowable Operating Differential Pressure[d], psi (kPa)	
VK-8213-602-5-13 VK-8223-602-5-13 VK4-8213-602-5-13 VK4-8223-602-5-13	13	3	85	74	35 (240)	-
VK-8213-602-5-14 VK-8223-602-5-14 VK4-8213-602-5-14 VK4-8223-602-5-14	14	4	145	125		
VK-8213-602-5-15 VK-8223-602-5-15 VK4-8213-602-5-15 VK4-8223-602-5-15	15	5	240	208		
VK4-8213-652-5-16 VK4-8223-652-5-16	16	6	370	320	-	35 (240)

a - Spring range field adjustable with positive positioner.
b - AK-42309-500 positive positioner optional for 2½"…5" valve, required for 6" valve. Supplied as standard on VK4 factory valve assemblies. See *Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part number.
c - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).
d - Maximum allowable differential across the valve in any open position. Less than 20 psi recommended for quieter service. Consult close-off pressure ratings.

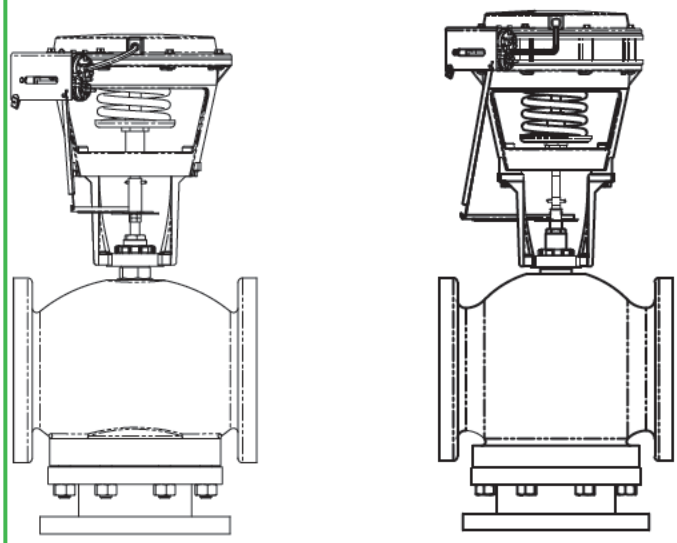
VB-82x3 3-Way Valves with Pneumatic SR Actuators

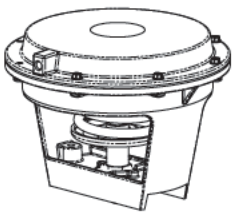
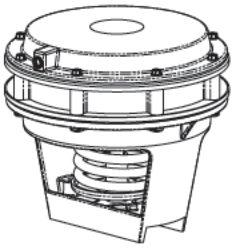
3-Way Valves

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Not all actuator and valve body combinations are offered as factory assemblies.

3-Way Globe Valve Assemblies with Pneumatic Spring Return Actuators

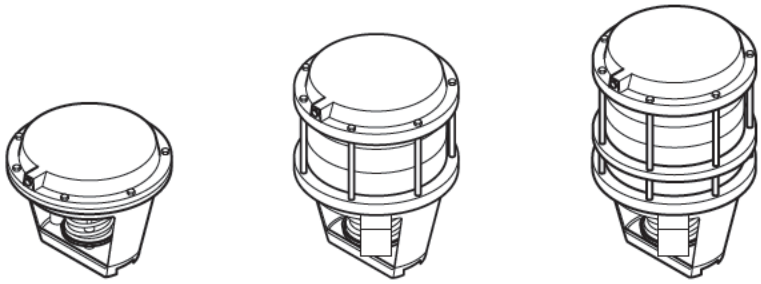
Spring Return
3-Way Globe Valve Assemblies
(shown with Positive Positioner)

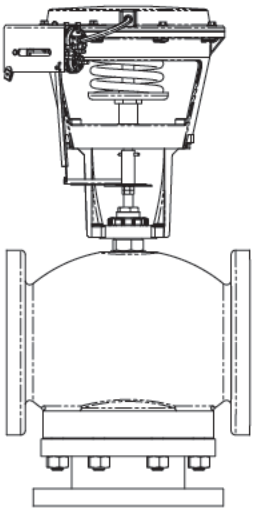


Valve Assembly Part Number[b]	P Code	Valve Size in.	C_v[c]	k_{vs}[c]	MK-6811[b] Maximum Allowable Operating Differential Pressure[d], psi (kPa) (Mixing/Diverting)	MK-6911[b] Maximum Allowable Operating Differential Pressure[d], psi (kPa) (Mixing/Diverting)
						
					Actuator Models (Actuator Codes)	
					MK-6811 (602)	MK-6911 (652)
					Linkage Kit Part Number	
					AV-497	AV-497
					Spring Range, psig (kPa)	
					5…10 (34 to 69)[a]	5…10 (34 to 69)[a]
Close-off Pressure (psi)					35	
VK-8303-602-5-12	12	2½	80[e]	69[e]	35 (240) / 35 (240)	-
			95[f]	82[f]		
			115[g]	99[g]		
VK-8303-602-5-13	13	3	110[e]	95[e]		
			120[f]	104[f]		
			120[g]	104[g]		
VK-8303-602-5-14	14	4	190[h]	164[h]		
VK-8303-602-5-15 VK4-8303-602-5-15	15	5	290[h]	251[h]		-
VK4-8303-652-5-16	16	6	500[h]	433[h]	-	35 (240) / 35 (240)

a - Spring range field adjustable with positive positioner.
b - AK-42309-500 positive positioner optional for 2½"…5" valve, required for 6" valve. Supplied as standard on VK4 factory valve assemblies. See *"Pg. 98, Assembly Ordering VB-8/9000* for the relevant part series to determine a specific part number.
c - $C_v = \frac{gpm}{\Delta P}$ (where ΔP is measured in psi) kvs = Cv / 1.156 $K_{vs} = \frac{m^3/h}{\Delta P}$ (where ΔP is measured in bar; 1 bar = 100 kPa).
d - Maximum allowable differential across the valve in any open position. Less than 20 psi recommended for quieter service. Consult close-off pressure ratings.
e - Mixing configuration, ports A and B are inlets, AB port is outlet.
f - Diverting configuration, flow AB to A port.
g - Diverting configuration, flow AB to B port.
h - All flow configurations, mixing or Diverting.

VB-9313 3-Way Valves with Pneumatic SR Actuators





VK4-9313 with a MK-6811 Pneumatic Actuator and AK-42309-500 Positive Positioner

Select Actuator or Actuator Code (xxx) having sufficient close-off for the application. If selecting component parts, select Positive Positioner, if required. NOTE: For higher close-offs, use VB-8303 balanced valves with common bottom port.

2½"…6" Flanged Globe Valves with Pneumatic Actuators

Actuator				MK-6811			MK-8811			MK-8911		
Effective Area (stroke)				50 Sq. In. (1 " Stroke)			100 Sq. In. (1 " Stroke)			100 Sq. In. (2" Stroke)		
Positive Positioner				AK-42309-500								
Factory Assembly with Positive Positioner				Yes			Yes			Yes		
Actuator Code (xxx)				602[f]			802[e]			812[e]		
Spring Range (psig)				5…10			5…10			5…10		
Actuator Close-Off Pressure Rating (psi)[ab]												
Supply Air Pressure (psig)				15/20	15	20	15/20	15	20	15/20	15	20
Stem Position[c]				SU	SD	SD	SU	SD	SD	SU	SD	SD
Valve Assembly	Valve Body	P Code	Size in.									
VK4-9313-xx2-5-P[d]	VB-9313-0-5-P	-12	2½	30	40	91	60	91	125	-		
		-13	3	20	27	62	40	62				
		-14	4	10	14	33	25	33	73			
VK4-9313-812-5-P[d]	VB-9313-0-5-P	-15	5	-						15	20	45
		-16	6							10	13	30

a - Close-off ratings for mixing valves: (SU = "A", SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B". "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A". Close-off ratings in the table are true only when the indicated supply air pressure is applied to the actuator. A change in air pressure at the actuator alters the actual close-off pressure.
b - Close-off pressure ratings describe only the differential pressure which the actuator can close-off to standards with adequate seating force. Consult valve body specifications for other limitations.
c - SU - Stem Up; SD - Stem Down. For piping information refer to the separately available Wiring, Dimensions and Reference document F-28125 from the Exchange Download Center for flow pattern.
d - Factory valve assemblies are available only with positive positioner.
e - Includes AV-496 linkage.
f - Includes AV-495 linkage.

Optional Input Signal Interface to Pneumatic Actuator

Input Signal Type	Interface Module Required
Two-Position, SPST (Electric)	AL-1xx
Two-Position, SPDT Snap Acting (Electric)	AL-1xx