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VX-2X13-5XX-9-XX Series VB-2X13-500-9-XX Series

DuraLynx™ Ball Valve Assemblies Ball Valve Body/Linkage Assemblies

Selection Guide

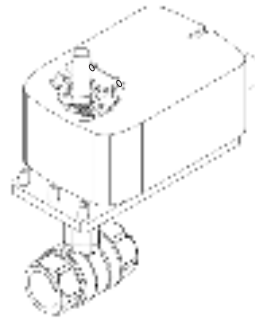
DuraLynx Ball Valve Assemblies

The Invensys VA, VF, and VS-2X13-5XX-9-XX series DuraLynx Ball Valve Assemblies are complete actuator/valve assemblies that accept two-position, floating, or proportional control signals, respectively, from a DDC system or from a thermostat, for control of hot water or chilled water, or solutions of up to 50% Glycol. These valve assemblies consist of direct-coupled spring return or non-spring return actuators mounted on 2-way (1/2" to 3") and 3-way (1/2" to 2") ball valve bodies.

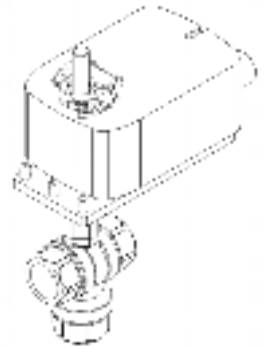
Typical applications include reheat on VAV boxes, fan coil units, hot and chilled water coils in air handling units, and unit ventilators.

DuraLynx Ball Valve Body/Linkage Assemblies

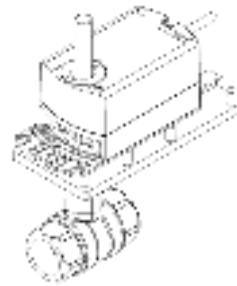
DuraLynx ball valve body/linkage assemblies are also available, to allow the field mounting of DuraDrive actuators.



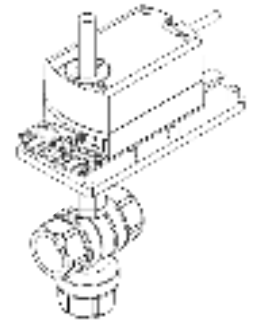
VX-2213-5XX-9-XX
2-Way Ball Valve Assembly with
35 lb-in. Spring Return Actuator



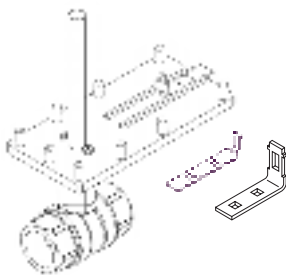
VX-2313-52X-9-XX
3-Way Ball Valve Assembly with
35 lb-in. Spring Return Actuator



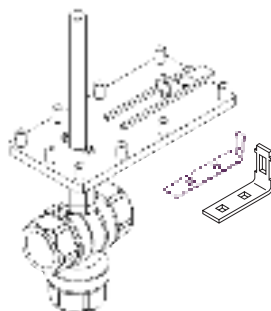
VX-2213-505-9-XX
2-Way Ball Valve Assembly
with 35 lb-in. Non-Spring
Return Actuator



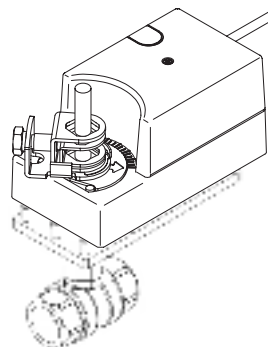
VX-2313-505-9-XX
3-Way Ball Valve Assembly
with 35 lb-in. Non-Spring
Return Actuator



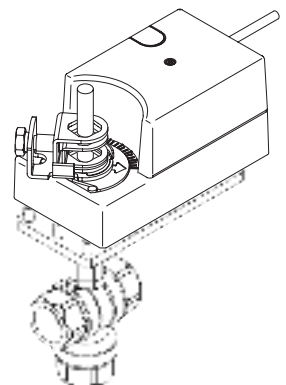
VB-2213-500-9-XX
2-Way Ball Valve
Body/Linkage Assembly



VB-2313-500-9-XX
3-Way Ball Valve
Body/Linkage Assembly



VX-2213-508-9-XX
2-Way Ball Valve Assembly
with 133 lb-in.
Non-Spring Return Actuator



VX-2313-508-9-XX
3-Way Ball Valve Assembly
with 133 lb-in.
Non-Spring Return Actuator

Applicable Literature

F-Number	Description	Audience	Purpose
F-26642	MA40-704X Series, MA4X-707X Series, MA4X-715X Series DuraDrive Series Spring Return Two-Position Actuators General Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the actuator's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26644	MF4X-7XX3, MF4X-7XX3-50X DuraDrive Series Spring Return Floating Actuator General Instructions		
F-26645	MS4X-7XX3, MS4X-7XX3-50X DuraDrive Series Spring Return Proportional Actuator General Instructions		
F-26743	MF40-6083, MF40-6153 DuraDrive Series Non-Spring Return Direct Coupled Actuator General Instructions		
F-26747	MS40-6083, MS40-6153 DuraDrive Series Non-Spring Return Direct Coupled Actuator General Instructions		
F-27003	MX40-704X Series 35 lb-in. Spring Return Actuators Mounting and Wiring Instructions	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the actuator's specifications and possible applications. Provides step-by-step mounting instructions.
F-26646	MX40-6043, MX4X-7XXX, MX40-6XXX Series DuraDrive Actuator Selection Guide	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides actuator specifications and part number cross referencing of phased out actuators with the new Invensys Building Systems direct-coupled actuators.
F-26737	MX-6043 Series Non-Spring Return 35 lb-in. DuraDrive Actuators Specification Data Sheet	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers 	Describes features and specifications of the MX-6043 series actuators.
F-27087	VX-2X13-5XX-9-XX Series DuraLynx Ball Valve Assemblies and VB-2X13-500-9-XX DuraLynx Ball Valve Body/Linkage Assemblies Installation Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the DuraLynx ball valve assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-13755	CA-28 Control Valve Sizing	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides charts, equations, and diagrams to assist in the configuration of valve system applications. TOOL-150, valve sizing slide rule may be purchased separately.
F-26080	EN-205 Water System Guidelines		Describes Invensys Building Systems approved water treatment practices.

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Features and Benefits


Features	Benefits
Close-offs of up to 130 psi.	Can accommodate high-pressure close-off requirements.
Available in full range of line sizes, 1/2 in. to 3 in. for 2-way valves and 1/2 in. to 2 in. for 3-way valves.	Satisfies a wide range of application requirements.
Cv's from 0.68 to 266.	Provides a variety of Cv's for each valve size so that the optimal coil/valve sizing can be made, thus minimizing the need for pipe reducers.
Flow characterizing insert, made of glass-filled Noryl™.	Reduces the ball opening and provides equal percentage control so that the heat output at the coil is linear when compared to the open area of the ball.
Available in both spring return and non-spring return models.	Fulfills all frequently required power loss modes.
Utilizes DuraDrive actuators for two-position, floating, and proportional control.	Models are available for a wide range of application requirements.
All models equipped with pigtail leads.	Eases installation. Reduced electrician costs.
Brushless DC motors used in all floating and proportional spring return models.	Provides better accuracy with longer actuator service life.
Low-friction seals and o-rings.	Allows the use of 35 lb-in. and 133 lb-in. actuators.
Valve body made of forged brass ASTM B283.	Rated for static pressure of 360 psi at fluid temperatures of 20 to 250 °F (-7 to 121 °C).
"Blowout" resistant stem.	Reduces the chance of injury from potentially harmful blowouts.
Universal mounting plate design.	Actuator and mounting plate can be rotated after installation, to accommodate confined spaces and wiring needs.
ANSI Class IV (0.01% of C _v) shutoff with 2-way valves.	Allows accurate control of fluid through coils.
Spring return direction flexibility.	Provides Normally Closed or Normally Open spring return functionality
Thermally isolated mounting plate.	The design of the linkage protects the actuator from cold or excess heat generated by chilled water or hot water passing through the valve. Discourages condensation.
Ball Valve Body/Linkage Assemblies are available separately. They include anti-rotation clips for both spring return and non-spring return DuraDrive actuators.	Easy field assembly of actuator to valve body.

DuraLynx Ball Valve Assemblies and Part Numbering System

DuraLynx Ball Valve Assemblies

V X - 2 X 1 3 - 5 X X - 9 - X X


Control Signal Type
A = Two Position
F = Floating
S = Proportional
B = Valve Body & Linkage (less actuator)

Configuration
2 = 2-Way
3 = 3-Way Mixing 

Connection
3 = Threaded NPT


Port Code


Size	2-Way		3-Way	
	C _V	P Code	C _V ^a	P Code
1/2"	0.68	02	—	—
	—	—	1.0	03
	1.3	03	—	—
	2.6	04	—	—
	—	—	4.3	05
	4.7	05	—	—
3/4"	11.7 ^b	07	—	—
	1.2	13	—	—
	—	—	1.3	13
	—	—	3.8	15
	4.3	15	—	—
	10.1	16	—	—
1"	—	—	12.6 ^b	16
	14.7 ^b	17	—	—
	28.6 ^b	18	—	—
	—	—	3.5	25
	4.4	21	—	—
	—	—	8.6	27
1-1/4"	9.0	22	—	—
	—	—	22.3 ^b	30
	26.1	24	—	—
	—	—	30.8 ^b	31
	54.2 ^b	27	—	—
	—	—	12.7	44
1-1/2"	14.9	43	—	—
	—	—	34.1 ^b	46
	41.1 ^b	45	—	—
	102.3 ^b	46	—	—
	—	—	23.5	54
	41.3	52	—	—
2"	—	—	61.1 ^b	56
	171.7 ^b	54	—	—
	—	—	56.7 ^b	63
	71.1	63	—	—
	266.0 ^b	67	—	—
	—	—	—	—
2-1/2"	55.0	72	—	—
	202.0 ^b	76	—	—
3"	63.0	82	—	—
	145.0 ^b	85	—	—

Actuator Code 				Valves Used On			
Model	Code	Fail Safe	Voltage	1/2" to 1-1/4"		1-1/2" to 3"	1-1/2" to 2"
				2-way	3-way	2-way	3-way
Two-Position							
MA40-7040	522	SR Close	120 Vac	X	X	X	X
MA40-7040	532	SR Open	120 Vac	X	—	X	—
MA40-7043	526	SR Close	24 Vac	X	X	X	X
MA40-7043	536	SR Open	24 Vac	X	—	X	—
Floating							
MF40-6043	505	NSR	24 Vac	X	X	—	—
MF40-6153	508	NSR	24 Vac	—	—	X	X
MF40-7043	526	SR Close	24 Vac	X	X	X	X
MF40-7043	536	SR Open	24 Vac	X	—	X	—
Proportional							
MS40-6043	505	NSR	24 Vac	X	X	—	—
MS40-6153	508	NSR	24 Vac	—	—	X	X
MS40-7043	526	SR Close	24 Vac	X	X	X	X
MS40-7043	536	SR Open	24 Vac	X	—	X	—
Valve Body/Linkage Assembly * 500 (VX-2213-500-9-XX, VX-2313-500-9-XX)							

SR = Spring Return
NSR = Non-Spring Return

* Includes valve body, linkage, and anti-rotation clips for spring return and non-spring

 3-way spring return ball valve assemblies are shipped with ports A to AB normally closed, voltage rise to open.


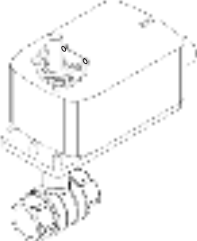
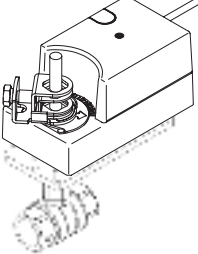
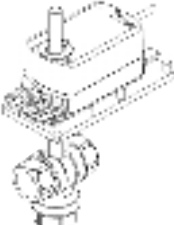
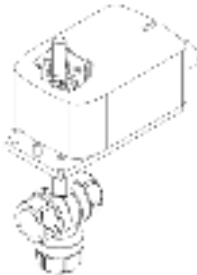
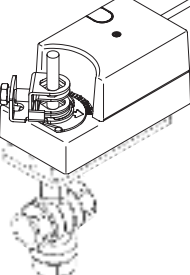
 Only the listed 35 lb-in. and 133 lb-in. DuraDrive actuators are compatible with DuraLynx ball valve assemblies.

^a A to AB port C_V shown. B to AB port C_V's are 80% of the A to AB port C_V.

^b Denotes Full Port valve, without characterizing insert.

Ball Valve Specifications

Table-1 Specifications for Ball Valve Assemblies.

Ball Valve Assemblies		2-Way	3-Way Mixing
		 <p>VX-2213-505-9-P</p>  <p>VX-2213-5XX-9-P</p>  <p>VX-2213-508-9-XX</p>	 <p>VX-2313-505-9-P</p>  <p>VX-2313-52X-9-P</p>  <p>VX-2313-508-9-XX</p>
Applications		Chilled or Hot Water, up to 50% Glycol Solution	Chilled or Hot Water, up to 50% Glycol Solution
Type of End Fitting		NPT Screwed	NPT Screwed
Size		1/2 in. through 3 in.	1/2 in. through 2 in.
Valve Assembly Series		VX-2213-XXX-9-P	VX-2313-XXX-9-P
Flow Type		Equal Percentage	Equal Percentage
Material	Body	Forged Brass (ASTM B283)	Forged Brass (ASTM B283)
	Ball	Nickel/Chromium-Plated Brass	Nickel/Chromium-Plated Brass
	Flow Characterizing Insert	Glass-filled Noryl	Glass-filled Noryl
	Stem	Brass	Brass
	Ball Seals	Reinforced Teflon® Seals with EPDM O-Rings	Reinforced Teflon® Seals with EPDM O-Rings
	Stem Seals	EPDM O-Rings	EPDM O-Rings
	Mounting Plate	Glass-filled Polymer	Glass-filled Polymer
Maximum Static Pressure		360 psig (25 bar)	360 psig (25 bar)
Maximum Operating Differential Pressure		Same as close-off pressures shown in Table-2. Refer to "Cavitation Limitations on Valve Pressure Drop" on page 16.	Same as close-off pressures shown in Table-3. Refer to "Cavitation Limitations on Valve Pressure Drop" on page 16.
Seat Leakage		ANSI Class IV (0.01% of C_v)	ANSI Class IV (0.01% of C_v), piped coil-side outlet to A
Fluid (water) Temperature	Minimum ^a	20 °F (-7 °C)	20 °F (-7 °C)
	Maximum	250 °F (121 °C)	250 °F (121 °C)

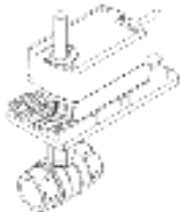
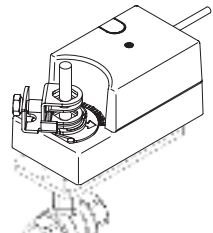
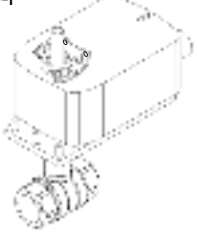
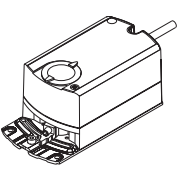
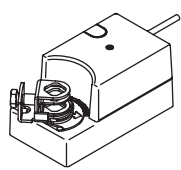
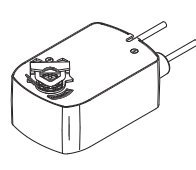
^a Freeze protection required.

Valve/Actuator Combinations

2-Way Ball Valve Assemblies

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut-off

Table-2 2-Way Ball Valve Assemblies — Selection Chart.

2-Way Ball Valve Assemblies						Non-Spring Return ^a		Spring Return
 VX-2213-505-9-P  VX-2213-508-9-P  VX-2213-5XX-9-P								
						Actuator Torque Rating (minimum)		
						35 lb-in (4 N-m)	133 lb-in. (15 N-m)	35 lb-in (4 N-m)
						Actuator Models (Actuator Codes)		
						24 Vac	24 Vac	24 Vac
						Floating MF40-6043 (505) Proportional MS40-6043 (505)	Floating MF40-6153 (508) Proportional MS40-6153 (508)	Two-Position MA40-7043 (526) (N.C.) MA40-7043 (536) (N.O.) Floating MF40-7043 (526) (N.C.) MF40-7043 (536) (N.O.) Proportional MS40-7043 (526) (N.C.) MS40-7043 (536) (N.O.)
								120 Vac
								Two-Position MA40-7040 (522) (N.C.) MA40-7040 (532) (N.O.)
Valve Assembly Part Number	P Code	Valve Size (in.)	Flow Coefficient		Range-ability	Close-Off Pressure (psi)		
			C_v^b	k_{vs}^b				
DuraLynx Ball Valve Assembly VX-2213-XXX-9-P ^c	02	1/2	0.68	0.59	17:1	130	—	130
	03		1.3	1.1	52:1	130	—	130
	04		2.6	2.2	321:1	130	—	130
	05		4.7	4.1	159:1	130	—	130
	07		11.7 ^d	10.1	251:1	130	—	130
	13	3/4	1.2	1.0	52:1	130	—	130
	15		4.3	3.7	159:1	130	—	130
	16		10.1	8.7	390:1	130	—	130
	17		14.7 ^d	12.7	251:1	130	—	130
	18		28.6 ^d	24.7	1503:1	130	—	130
Valve/Linkage Assembly VB-2213-500-9-P	21	1	4.4	3.8	159:1	100	—	100
	22		9.0	7.8	390:1	100	—	100
	24		26.1	22.6	484:1	100	—	100
	27		54.2 ^d	46.9	1207:1	100	—	100
	43	1-1/4	14.9	12.9	1040:1	100	—	100
	45		41.1 ^d	35.6	1207:1	100	—	100
	46		102.3 ^d	88.5	1263:1	100	—	100
	52	1-1/2	41.3	35.7	603:1	—	100	100
	54		171.7 ^d	148.5	558:1	—	100	100
	63	2	71.1	61.5	287:1	—	100	100
	67		266.0 ^d	230.1	877:1	—	100	100
	72	2-1/2	55.0	47.6	599:1	—	100	100
	76		202.0 ^d	174.7	810:1	—	100	100
	82	3	63.0	54.5	571:1	—	100	100
	85		145.0 ^d	125.4	790:1	—	100	100

^a Non-spring return 2-way ball valve assemblies are shipped open, voltage rise to close.

^b $k_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $k_{vs} = C_v / 1.156$ $C_v = gpm / \sqrt{\Delta P}$ (in psi).

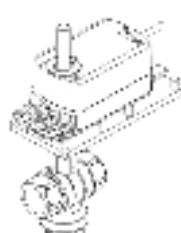
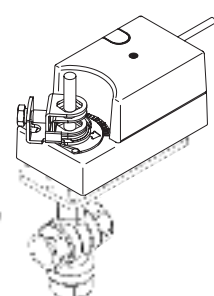
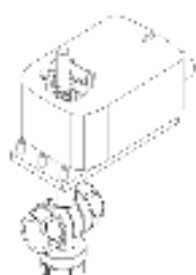
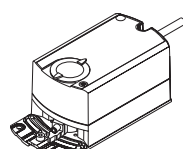
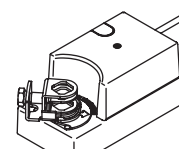
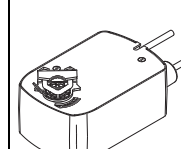
^c To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to the Ball Valve Assembly Part Numbering System chart on page 4.

^d Denotes a full port valve, without the characterized insert.

3-Way Mixing Ball Valve Assemblies

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut off, piped coil-side outlet to A.

Table-3 3-Way Mixing Ball Valve Assemblies — Selection Chart.

3-Way Mixing Ball Valve Assemblies ^{a b}							Non-Spring Return		Spring Return
<div> VX-2313-505-9-P</div> <div> VX-2313-508-9-P</div> <div> VX-2313-52X-9-P</div>									
Actuator Torque Rating (minimum)									
35 lb-in (4 N-m)		133 lb-in. (15 N-m)		35 lb-in (4 N-m)					
Actuator Models (Actuator Codes)									
24 Vac		24 Vac		24 Vac					
Floating MF40-6043 (505) Proportional MS40-6043 (505)		Floating MF40-6153 (508) Proportional MS40-6153 (508)		Two-Position MA40-7043 (526) Floating MF40-7043 (526) Proportional MS40-7043 (526)					
				120 Vac					
				Two-Position MA40-7040 (522)					

Valve Assembly Part Number	P Code	Valve Size (in.)	Flow Coefficient				Close-Off Pressure psi		
			A Port		B Port				
			C _V ^c	k _{VS} ^c	C _V ^c	k _{VS} ^c			
DuraLynx Ball Valve Assembly VX-2313-XXX-9-P ^d Valve/Linkage Assembly VB-2313-500-9-P	03	1/2	1.0	0.86	0.80	0.69	50	—	50
	05		4.3	3.7	3.4	3.0	50	—	50
	13	3/4	1.3	1.1	1.0	0.90	50	—	50
	15		3.8	3.3	3.0	2.6	50	—	50
	16		12.6 ^e	10.9	10.1 ^e	8.7	50	—	50
	25	1	3.5	3.0	2.8	2.4	50	—	50
	27		8.6	7.4	6.9	6.0	50	—	50
	30		22.3 ^e	19.3	17.8 ^e	15.4	50	—	50
	31		30.8 ^e	26.6	24.6 ^e	21.3	50	—	50
	44	1-1/4	12.7	11.0	10.2	8.8	40	—	40
	46		34.1 ^e	29.5	27.3 ^e	23.6	40	—	40
	54	1-1/2	23.5	20.3	18.8	16.3	—	40	40
	56		61.1 ^e	52.8	48.9 ^e	42.3	—	40	40
	63	2	56.7 ^e	49.0	45.4 ^e	39.2	—	40	40

^a Non-spring return 3-way mixing ball valve assemblies are shipped A to AB open, voltage rise to close.

^b Spring return 3-way mixing valves are normally A to AB closed.

^c $k_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $k_{vs} = C_v / 1.156$ $C_v = gpm / \sqrt{\Delta P}$ (in psi)

^d To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to the Ball Valve Assembly Part Numbering System chart on page 4.

^e Denotes a full port valve, without the characterized insert.

Actuator Specifications and Valve Assembly Mounting Dimensions

Note: The DuraLynx Ball Valve Assemblies use the basic MX40-6043, MX40-6153, and MX40-704X actuators. Specifications for the non-standard actuators containing auxiliary switches are provided here for reference. Ball valve assemblies using these non-standard actuators may be field-assembled using ball valve body/linkage assemblies (VB-2X13-500-9-XX).

Valve Assemblies with MF40-6043 and MS40-6043 Non-Spring Return Actuators

Actuator Specifications					
Inputs					
Control Signal	MF40-6043: Floating three-position control, 24 Vac.				
	MS40-6043: Proportional, 0 to 10 Vdc; input resistance 100KΩ Control signal adjustment available with MS40-6043-520 and MS40-6043-522: Start point (offset) — Between 0 and 5 Vdc (factory setting = 0 Vdc) Span — 2 to 30 Vdc				
Power Requirements	All 24 Vac circuits are Class 2.				
	Part Number	Power Input @ 50/60 Hz			
		Voltage	Running VA	Holding VA	Watts
		MF40-6043	24 Vac +20/-15%	2	2
MS40-6043	24 Vac +20/-15%	3	1.3	3.3	
Connections	3 ft. (0.9 m) long, 18 AWG leads, plenum-rated.				
Motor Type	Synchronous				
Outputs					
Electrical	Position output signal: Feedback potentiometer available with MF40-6043-510: 0 to 1000Ω < 10 mA				
	Output voltage: 0 to 10 Vdc				
	Maximum output current: 1 mA				
	Auxiliary Switches: Dual auxiliary switches available with MF40-6043-502 and MS40-6043-502, when these actuators are ordered as separate units. Auxiliary switches are not offered with ball valve assemblies.				
	Voltage: 24 Vac		Contact rating: 4 A resistive, 2 A inductive		
	Switching hysteresis: 3°		Switch Range: Switch A — 0 to 90° range in 5° intervals Recommended range usage — 0 to 45° Factory setting — 5° Switch B — 0 to 90° range in 5° intervals Recommended range usage — 45 to 90° Factory setting — 85°		
Mechanical	Timing: 108 sec. at 50 Hz 90 sec. at 60 Hz				
	Output torque rating: 35 lb-in. (4 N-m)				
	Stroke: Normal angle of rotation is 90°, limited to a maximum of 95°. Field adjustable to limit travel on either end of stroke.				
	Position indicator: Adjustable pointer is provided for position indication.				
Output shaft setscrew: Tightening torque 55 to 60 lb-in. (6.2 to 6.8 N-m).					
Environment					
Temperature Limits	Shipping and storage: -25 to 140 °F (-32 to 60 °C) ambient. Operating: -25 to 130 °F (-32 to 55 °C) ambient.				
Humidity	5 to 95% RH, non-condensing.				
Locations	NEMA Type 2 (IEC IP54).				
Agency Listings (Actuator)					
UL	UL-873, Underwriters Laboratories.				
CSA	Canadian Standards C22.2 No. 24-93.				
European Community	EMC Directive (89/336/EEC). Emissions (EN50081-1). Immunity (EN50081-2).				

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-1)				
			A	B	C	D	E
2-Way VF-2213-505-9-P VS-2213-505-9-P	1/2	0.68, 1.3, 2.6, 4.7, 11.7	2-3/8 (60)	6-5/8 (168)	3 (76)	7-1/2 (190)	3-7/16 (87)
	3/4	1.2, 4.3, 14.7	2-5/8 (67)	6-5/8 (168)	3 (76)	7-3/4 (197)	3-7/16 (87)
		10.1, 28.6	2-5/8 (67)	6-5/8 (168)	3 (76)	7-3/4 (197)	3-11/16 (94)
	1	4.4	3 (77)	6-3/4 (171)	3 (76)	8 (203)	4 (100)
		9.0	3-3/4 (95)	7-1/16 (179)	3 (76)	7-7/8 (200)	3-11/16 (94)
		26.1	4-5/16 (110)	7-1/16 (179)	3 (76)	8-5/8 (219)	4-1/2 (113)
		54.2	3-1/16 (78)	7-9/16 (192)	3 (76)	8 (203)	4-1/2 (113)
	1-1/4	14.9, 41.1	3 (76)	6-11/16 (170)	3 (76)	8-1/4 (210)	4 (100)
		102.3	3-5/8 (92)	6-3/4 (171)	3 (76)	8-5/8 (219)	4-1/2 (113)

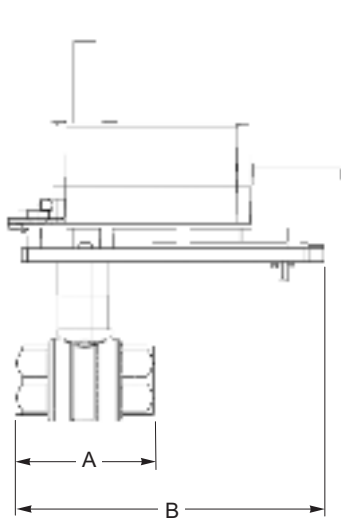


Figure-1 MF40-6043 or MS40-6043 with 2-Way Ball Valve.

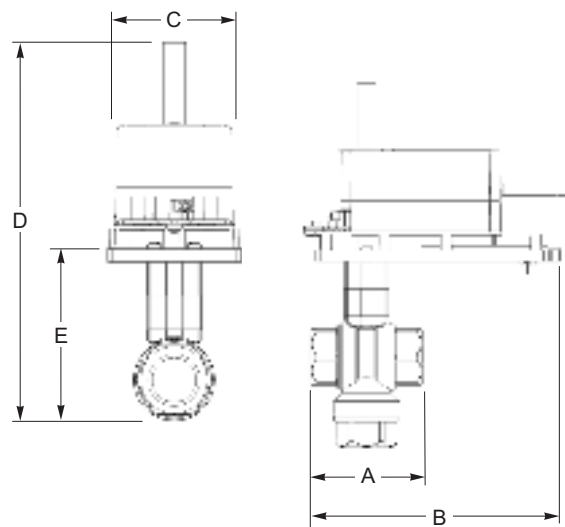


Figure-2 MF40-6043 or MS40-6043 with 3-Way Ball Valve.

3-Way Mixing Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-2)				
			A	B	C	D	E
3-Way VF-2313-505-9-P VS-2313-505-9-P	1/2	1.0, 4.3	2-5/8 (67)	6-1/2 (165)	3 (76)	9-1/8 (231)	5-1/8 (130)
	3/4	1.3, 3.8, 12.6	2-5/8 (67)	6-1/2 (165)	3 (76)	9 (229)	5-1/4 (133)
	1	3.5	3-3/4 (95)	7-1/4 (184)	3 (76)	9-1/2 (241)	6 (152)
		8.6, 22.3	3-1/16 (78)	6-3/4 (171)	3 (76)	9-1/2 (241)	6-1/4 (159)
		30.8	4-5/16 (110)	7-3/4 (197)	3 (76)	10-3/8 (264)	7-1/4 (184)
	1-1/4	12.7, 34.1	3-5/8 (92)	7-1/16 (179)	3 (76)	10-1/4 (260)	6-3/4 (171)

Valve Assemblies with MF40-6153 and MS40-6153 Non-Spring Return Actuators

Actuator Specifications

Inputs

Control Signal	MF40-6153: SPDT floating control 24 Vac.
	MS40-6153: Proportional, 0 to 10 Vdc or 0 to 20 mAdc with a 500 Ω resistor.

Power Requirements	All 24 Vac circuits are Class 2.
---------------------------	----------------------------------

Part Number	Power Input @ 50/60 Hz		
	Voltage	Running VA	Holding VA
MF40-6153	24 Vac +20/-15%	5.8	1.7
MS40-6153	24 Vac +20/-15%	5.8	1.7

Connections	3 ft. (91 cm) long appliance cables, 18 AWG color coded leads.
--------------------	----------------------------------------------------------------

Motor Type	Stepper.
-------------------	----------

Outputs

Electrical	Timing: Approximate timing is 120 seconds.
Mechanical	Output torque rating: 133 lb-in. (15 N-m) minimum, 187 lb-in. (21 N-m) maximum.
	Stroke: Angle of rotation is limited to a maximum of 90°, field adjustable to limit travel on either end of stroke.
	Position indicator: Adjustable pointer with a scale numbered from 1 to 10, provided for position indication.

Environment

Temperature Limits	Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient.
	Operating: 20 to 131 °F (-7 to 55 °C) ambient.

Humidity	5 to 95% RH, non-condensing.
-----------------	------------------------------

Locations	NEMA 2 (IEC IP54). Actuator not in compliance if mounted upside down.
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Agency Listings

UL	UL873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment).
CSA	Canadian Standards C22.2 No. 24-93.
European Community	EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC).

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-1)				
			A	B	C	D	E
2-Way VF-2213-508-9-P VS-2213-508-9-P	1-1/2	41.3, 171.7	4-1/16 (103)	7-7/8 (200)	3-11/16 (94)	9-1/4 (235)	5-3/16 (132)
	2	71.1, 266.0	4-7/8 (124)	7-13/16 (198)	3-11/16 (94)	9-7/8 (251)	5-3/4 (146)
	2-1/2	55.0, 202.0	4-3/4 (121)	7-7/8 (200)	3-11/16 (94)	9-7/8 (251)	5-3/4 (146)
	3	63.0, 145.0	5 (127)	8-1/8 (206)	4 (102) ^a	10-1/8 (257)	5-7/8 (200)

^a Dimension indicates the width of the valve body, which exceeds the width of the actuator.

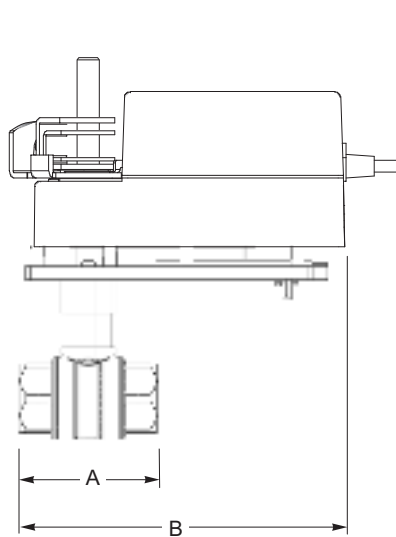


Figure-3 MF40-6153 or MS40-6153 with 2-Way Ball Valve.

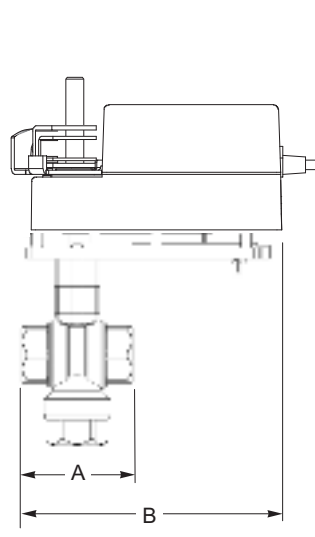
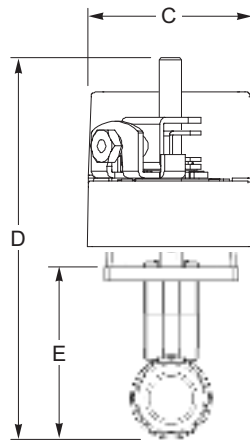


Figure-4 MF40-6153 or MS40-6153 with 3-Way Ball Valve.

3-Way Mixing Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-2)				
			A	B	C	D	E
3-Way VF-2313-508-9-P VS-2313-508-9-P	1-1/2	23.5, 61.1	4-1/16 (103)	7-5/16 (186)	3-11/16 (94)	11 (279)	7 (178)
	2	56.7	3-15/16 (100)	7-5/8 (194)	3-11/16 (94)	11 (279)	7-1/8 (181)

Valve Assemblies with MX40-704X Spring Return Actuators

Note: The DuraLynx Ball Valve Assemblies use the basic MX40-6043 and MX40-704X actuators. Specifications for the non-standard actuators containing auxiliary switches are provided here for reference. Ball valve assemblies using these non-standard actuators may be field-assembled using ball valve body/linkage assemblies (VB-2X13-500-9-XX).

Actuator Specifications									
Inputs									
Control Signal	MA40-704X: ON/OFF SPST control contacts or Triacs (500 mA rated) MS40-7043: Proportional, 2 to 10Vdc or 4 to 20 mAdc with 500 Ohm resistor. MS40-7043 MP/MP5: Proportional 6 to 9 Vdc. MF40-7043: Floating point control, 24 Vac.								
Power Requirements	All 24 Vac circuits are Class 2.								
	Part Number	Voltage 50/60 Hz	Voltage Vdc	Running				Holding	
				50 Hz		60 Hz		50 Hz	60 Hz
				VA	W	VA	W	W	W
	MA40-7043	24 Vac ± 20%	22 to 30	4.4	2.9	4.4	2.9	0.8	0.8
	MS40-7043	24 Vac ± 20%	22 to 30	5.6	4.2	5.6	4.2	2.4	2.4
	MF40-7043	24 Vac ± 20%	22 to 30	5.9	4.4	5.9	4.4	2.9	2.9
	MS40-7043-MP	24 Vac ± 20%	22 to 30	6.9	5.0	6.6	5.0	3.2	3.2
	MS40-7043-MP5	24 Vac ± 20%	22 to 30						
	MA40-7040	120 Vac ± 10%	—	6.4	3.8	4.3	3.4	1.6	1.2
Connections	MA40-704X and MA40-704X-501: 3 ft. (0.9 m) long, appliance cables, 1/2 in. conduit connector. For M20 Metric conduit, use AM-756 adaptor. MF40-7043 and MF40-7043-501, MS40-7043 and MS40-7043-501: 3 ft. (0.9 m) long, plenum rated cables, 1/2 in. conduit connector. For M20 Metric conduit, use AM-756 adaptor.								
Motor Type	MA40-704X: Brush DC. MF40-7043, MS40-7043: Brushless DC.								
Outputs									
Electrical	Auxiliary Switches: Available when actuators are ordered as separate units. Auxiliary switches are not offered with ball valve assemblies. <div><div>MX40-7043-501 and MS40-7043-MP5 One auxiliary switch available. SPDT 6 A resistive @ 24 Vac, adjustable 0 to 95° (0 to 1 scale). Switch meets VDE requirements for 6 (1.5) A, 24 Vac.</div><div>MA40-7040-501 One auxiliary switch available. SPDT 6 A resistive @ 250 Vac, adjustable 0 to 95° (0 to 1 scale). Switch meets VDE requirements for 6 (1.5) A, 250 Vac.</div></div> Position Feedback Voltage "AO": 2 to 10 Vdc (maximum 0.7 mA) output signal for position feedback or operation of up to four slave actuators. Control Mode: Switch provided for selection of direct acting or reverse acting control mode on proportional models. Timing: MA-704X — Approx. 50 sec.; MF- and MS-7043 — Approx. 130 sec. Auxiliary Power Supply: MS40-7043-MP and MS40-7043-MP5 — +20 Vdc @ 25 mA (max.)								
Mechanical	Stroke: Angle of rotation is limited to a maximum of 95°, with mechanical stop. Output torque rating: MX40-704X — 35 lb-in (4 N-m) Position indicator: Visual scale numbered from 0 to 90°, provided for position indication.								
Environment									
Temperature Limits	Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient. Operating: -22 to 140 °F (-30 to 60 °C) ambient.								
Humidity	5 to 95% RH, non-condensing.								
Locations	NEMA Type 2 (IEC IP54)								
Agency Listings (Actuator)									
UL	UL 873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment).								
European Community	EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC).								
CUL	Canadian Standards C22.2 No. 24.								
Australia	This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.								

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-1)				
			A	B	C	D	E
2-Way VA-2213-522-9-P VA-2213-526-9-P VA-2213-532-9-P VA-2213-536-9-P VF-2213-526-9-P VF-2213-536-9-P VS-2213-526-9-P VS-2213-536-9-P	1/2	0.68, 1.3, 2.6, 4.7, 11.7	2-3/8 (60)	7-1/8 (181)	4 (102)	7-1/2 (190)	3-7/16 (87)
	3/4	1.2, 4.3, 14.7	2-5/8 (67)	7-1/8 (181)	4 (102)	7-3/4 (197)	3-7/16 (87)
		10.1, 28.6	2-5/8 (67)	7-1/8 (181)	4 (102)	7-3/4 (197)	3-11/16 (94)
	1	4.4	3-1/16 (78)	7-1/4 (184)	4 (102)	8 (203)	4 (100)
		9.0	3-3/4 (95)	7-9/16 (192)	4 (102)	7-7/8 (200)	3-11/16 (94)
		26.1	4-5/16 (110)	7-9/16 (192)	4 (102)	8-5/8 (219)	4-1/2 (113)
		54.2	3-1/16 (78)	7-9/16 (192)	4 (102)	8 (203)	4-1/2 (113)
	1-1/4	14.9, 41.1	3 (76)	7-1/4 (184)	4 (102)	8-1/4 (210)	4 (100)
		102.3	3-5/8 (92)	7-5/16 (186)	4 (102)	8-5/8 (219)	4-1/2 (113)
	1-1/2	41.3, 171.7	4-1/16 (103)	8 (203)	4 (102)	9-1/4 (235)	5-3/16 (132)
	2	71.1, 266.0	4-7/8 (124)	7-15/16 (202)	4 (102)	9-7/8 (251)	5-3/4 (146)
	2-1/2	55.0, 202.0	4-3/4 (121)	8 (203)	4 (102)	9-7/8 (251)	5-3/4 (146)
	3	63.0, 145.0	5 (127)	8-1/4 (210)	4 (102)	10-1/8 (257)	5-7/8 (200)

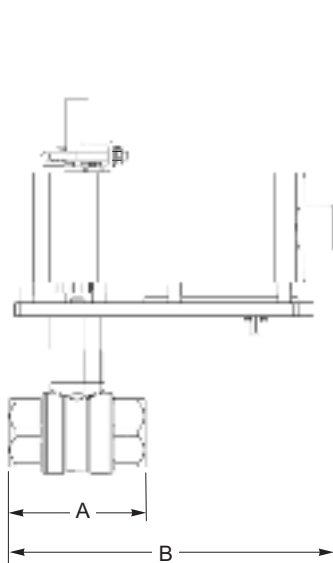


Figure-5 MX40-704X with 2-Way Ball Valve.

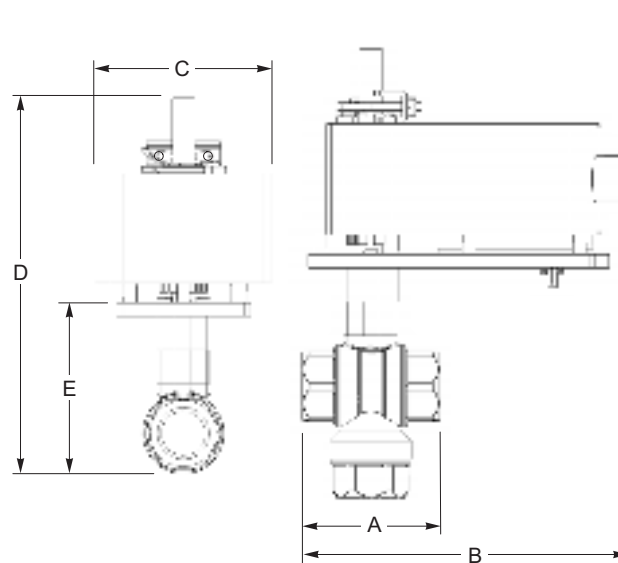


Figure-6 MX40-704X with 3-Way Ball Valve.

3-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	C _v	Valve Dimensions in inches (millimetres) (Refer to Figure-2)				
			A	B	C	D	E
3-Way VA-2313-526-9-P VF-2313-526-9-P VS-2313-526-9-P	1/2	1.0, 4.3	2-5/8 (67)	7 (178)	4 (102)	9-1/8 (231)	5-1/8 (130)
	3/4	1.3, 3.8, 12.6	2-5/8 (67)	7 (178)	4 (102)	9 (229)	5-1/4 (133)
	1	3.5	3-3/4 (95)	7-3/4 (197)	4 (102)	9-1/2 (241)	6 (152)
		8.6, 22.3	3-1/16 (78)	7-1/4 (184)	4 (102)	9-1/2 (241)	6-1/4 (159)
		30.8	4-5/16 (110)	8-1/4 (210)	4 (102)	10-3/8 (264)	7-1/4 (184)
	1-1/4	12.7, 34.1	3-5/8 (92)	7-5/8 (194)	4 (102)	10-1/4 (260)	6-3/4 (171)
	1-1/2	23.5, 61.1	4-1/16 (103)	7-9/16 (182)	4 (102)	11 (279)	7 (178)
	2	56.7	3-15/16 (100)	7-3/4 (197)	4 (102)	11 (279)	7-1/8 (181)

Installation Considerations

Mounting Angle of Valve Assembly

Be sure to allow the necessary clearance around the valve assembly. The valve assembly must be mounted so that the actuator is horizontally even with, or above, the valve. This ensures that any condensate that forms on the valve body will not travel into the actuator, where it may cause corrosion or electrical malfunction. See *VX-2X13-5XX-9-XX Series DuraLynx Ball Valve Assembly Installation Instructions*, F-27087.

Piping

Figure-7 and Figure-8 illustrate how 2-way and 3-way ball valve assemblies are to be piped.

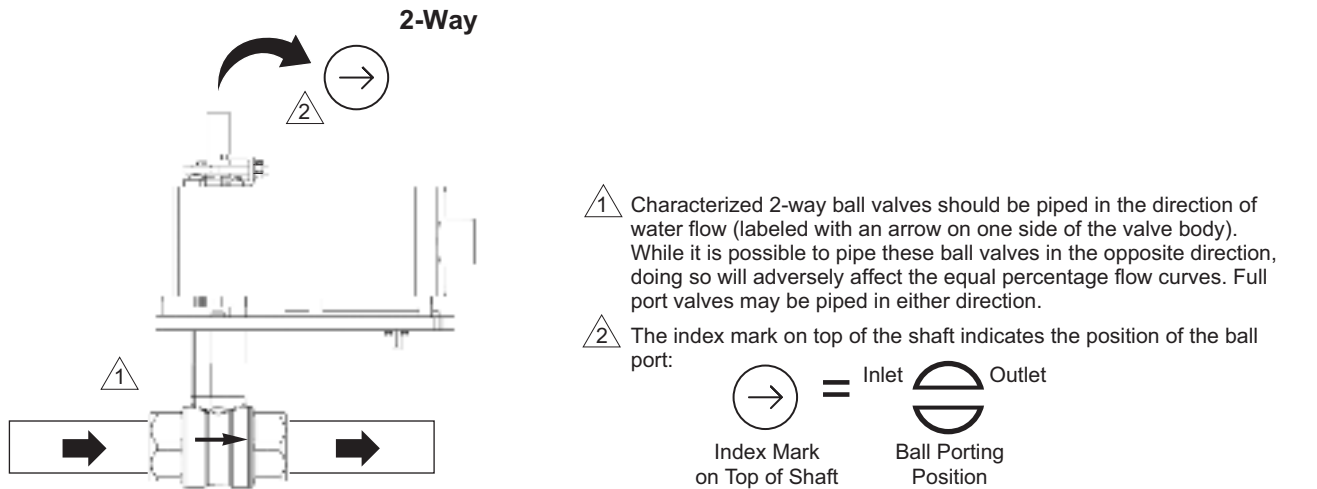


Figure-7 2-Way Valve Assemblies Piping Diagram.

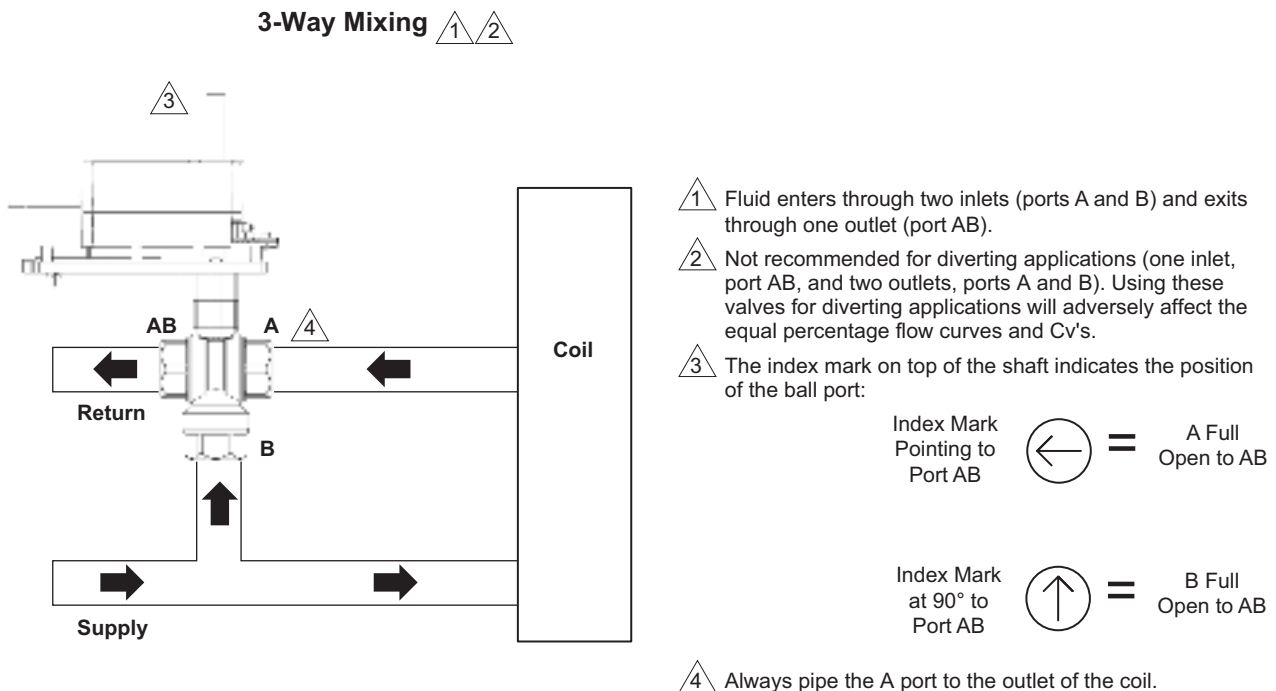


Figure-8 3-Way Mixing Valve Assemblies Piping Diagram.

Actuator Orientation on Ball Valve

If space limitations require it, the actuator and its mounting plate may be repositioned relative to the valve body, in 90° increments. Refer to the *Ball Valve Assembly Installation Instructions*, F-27087, for detailed instructions.

Insulation of Ball Valve Assembly

The ball valve should be completely insulated to minimize the effect of heat transfer and condensation at the actuator.

Caution: The actuator itself must not be insulated. Doing so can result in excess heat or condensation within the actuator.

Temperature Limits for Ball Valve Assembly

When installing the ball valve assembly, observe the minimum and maximum temperature limits. Refer to the valve and actuator specifications on page 5, page 8, page 10, and page 12.

Water System Maintenance

All heating and cooling systems are susceptible to valve and system problems caused by improper water treatment and system storage procedures. Durability of valve stems and packings is dependent on maintaining non-damaging water conditions. Inadequate water treatment or filtration, not in accordance with chemical supplier or ASHRAE handbook recommendations, can result in corrosion, scale, and abrasive particle formation. Scale and particulates can cause scratches in the stem and packing, and can adversely affect packing life and other parts of the hydronic system. Consult *EN-205, Water System Guidelines Engineering Information*, F-26080, for further details.

Sizing and Selection

Two-position Control

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.

Flow Characterization for Proportional and Floating Control

The VX-2X13-5XX-9-XX series ball valve assemblies provide equal percentage flow, which is achieved with a flow characterizing insert (Figure-9). The parabolic shape of the orifice allows a gradual change in flow, so that equal movements of the valve stem, at any point of the flow range, change the existing flow an equal percentage, regardless of the flow rate. As shown in the graph in Figure-10, a ball valve equipped with the flow insert mirrors the flow characteristic of the coil, resulting in linear heat transfer.

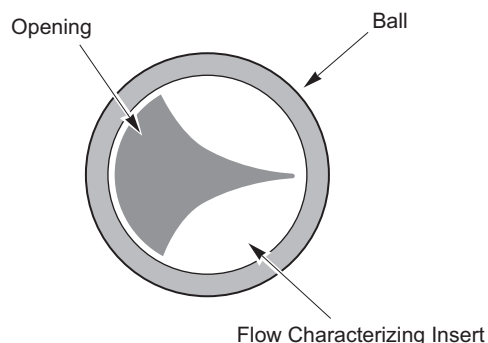


Figure-9 Flow Characterizing Insert

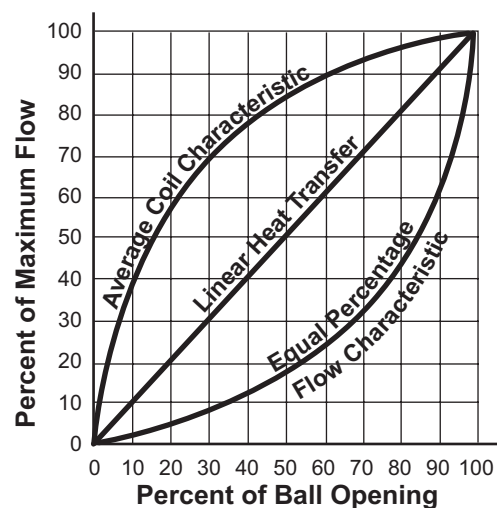


Figure-10 Equal Percentage Flow Control

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 (Table-4).

Table-4 Conventional Heating System.

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 the booster pump head).

Cavitation Limitations on Valve Pressure Drop

A valve selected with too high a pressure drop can cause erosion and/or wire drawing of the flow characterizing insert. 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. Refer to the chart in Figure-11.

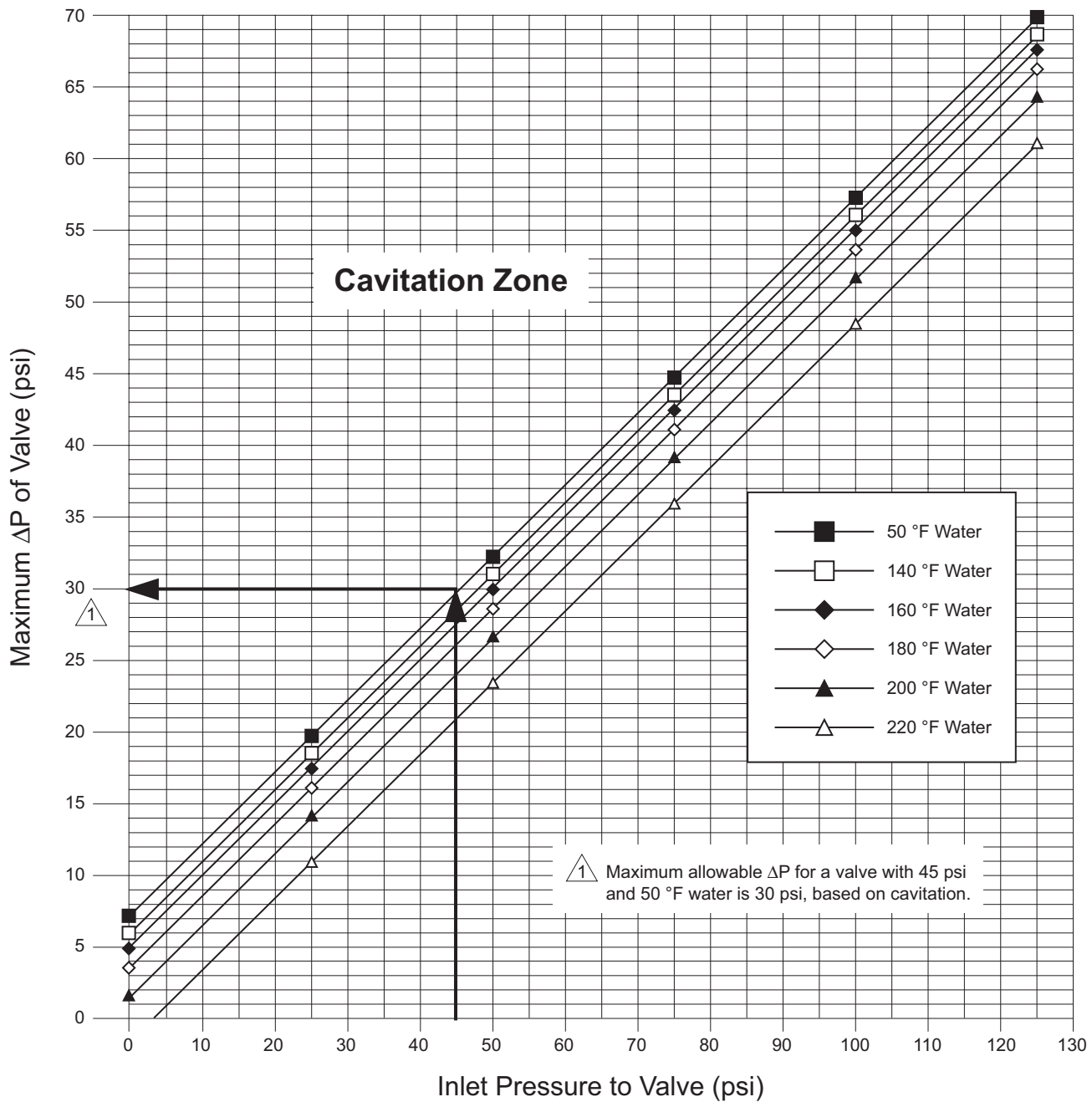


Figure-11 Maximum Allowable Differential Pressure (ΔP) for Water Valves.

Using Pipe Reducers with 2-Way Ball Valve Assemblies

The following table provides estimated effective C_v 's when using pipe reducers with 2-way ball valve assemblies.

Caution: It is strongly recommended that the valve size not be reduced to less than one-half the line size. Installing a valve that is less than one-half the line size can cause a physical weakness in the piping that may result in a failure at the pipe reduction area.

Table-5 Estimated Effective C_v when Using Pipe Reducers with 2-Way Ball Valve Assemblies.

Valve Size (in.)	P Code	C_v	Estimated Effective C_v (k_{vs})									
			Pipe Size - inches (NPT)									
			1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	5
1/2	02	0.68	0.68 (0.59)	0.68 (0.59)	0.68 (0.59)	0.68 (0.59)	—	—	—	—	—	—
	03	1.3	1.3 (1.12)	1.3 (1.12)	1.3 (1.12)	1.3 (1.12)	—	—	—	—	—	—
	04	2.6	2.6 (2.24)	2.5 (2.16)	2.5 (2.16)	2.4 (2.07)	—	—	—	—	—	—
	05	4.7	4.7 (4.06)	4.3 (3.71)	4.1 (3.54)	3.9 (3.37)	—	—	—	—	—	—
	07	11.7 ^a	11.7 (10.1)	7.9 (6.8)	6.7 (5.8)	6.2 (5.4)	—	—	—	—	—	—
3/4	13	1.2	—	1.2 (1.04)	1.2 (1.04)	1.2 (1.04)	1.2 (1.04)	—	—	—	—	—
	14	2.5	—	2.5 (2.16)	2.5 (2.16)	2.5 (2.16)	2.5 (2.16)	—	—	—	—	—
	15	4.3	—	4.3 (3.71)	4.3 (3.71)	4.2 (3.63)	4.2 (3.63)	—	—	—	—	—
	17	14.7 ^a	—	14.7 (12.7)	7.1 (6.1)	6.5 (5.6)	6.2 (5.4)	—	—	—	—	—
	18	28.6 ^a	—	28.6 (24.7)	21.1 (18.2)	17.1 (14.8)	15.4 (13.3)	—	—	—	—	—
1	21	4.4	—	—	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	—	—	—	—
	22	9.0	—	—	9.0 (7.8)	8.9 (7.4)	8.8 (7.6)	8.7 (7.5)	—	—	—	—
	24	26.1	—	—	26.1 (22.5)	24.4 (21.1)	22.4 (19.4)	20.3 (17.5)	—	—	—	—
	27	54.2 ^a	—	—	54.2 (46.8)	42.3 (36.6)	34.1 (29.5)	27.9 (24.1)	—	—	—	—
1-1/4	43	14.9	—	—	—	14.9 (12.9)	14.8 (12.8)	14.5 (12.5)	14.3 (12.3)	—	—	—
	45	41.1 ^a	—	—	—	41.1 (35.5)	39.0 (33.7)	34.3 (29.7)	31.9 (27.5)	—	—	—
	46	102.3 ^a	—	—	—	102.3 (88.5)	79.1 (68.4)	53.3 (46.1)	45.5 (39.3)	—	—	—
1-1/2	52	41.3	—	—	—	—	41.3 (35.7)	39.3 (33.9)	37.2 (32.1)	36.0 (31.1)	—	—
	54	171.7 ^a	—	—	—	—	171.7 (148.3)	101.2 (87.5)	76.6 (66.3)	67.2 (58.0)	—	—
2	63	71.1	—	—	—	—	—	71.1 (61.4)	68.8 (59.5)	65.9 (57.0)	62.4 (53.9)	—
	67	266.0 ^a	—	—	—	—	—	266.0 (229.7)	189.7 (164.1)	146.4 (126.6)	116.7 (100.8)	—
2-1/2	72	55.0	—	—	—	—	—	—	55.0 (47.5)	52.5 (45.3)	50.6 (43.7)	49.7 (42.9)
	76	202.0 ^a	—	—	—	—	—	—	202.0 (174.4)	132.4 (114.5)	109.3 (94.5)	100.6 (87.0)
3	82	63.0	—	—	—	—	—	—	—	63.0 (54.4)	56.7 (49.0)	55.5 (47.9)
	85	145.0 ^a	—	—	—	—	—	—	—	145.0 (125.2)	96.8 (83.7)	90.6 (78.4)

^a Denotes a full port valve, without the characterized insert.

Using Pipe Reducers with 3-Way Ball Valve Assemblies

The following table provides estimated effective C_v 's when using pipe reducers with 3-way ball valve assemblies.

Caution: It is strongly recommended that the valve size not be reduced to less than one-half the line size. Installing a valve that is less than one-half the line size can cause a physical weakness in the piping that may result in a failure at the pipe reduction area.

Table-6 Estimated Effective C_v when Using Pipe Reducers with 3-Way Ball Valve Assemblies.

Valve Size (in.)	P Code	C_v (A Port)	Estimated Effective C_v (k_{vs})						
			Pipe Size - inches (NPT)						
			1/2	3/4	1	1-1/4	1-1/2	2	2-1/2
1/2	03	1.0	1.0 (0.86)	1.0 (0.86)	1.0 (0.86)	—	—	—	—
	05	4.3	4.3 (3.7)	4.0 (3.5)	3.8 (3.3)	—	—	—	—
3/4	13	1.3	—	1.3 (1.12)	1.3 (1.12)	1.3 (1.12)	1.3 (1.12)	—	—
	15	3.8	—	3.8 (3.3)	3.8 (3.3)	3.74 (3.23)	3.7 (3.2)	—	—
	16	12.6 ^a	—	12.6 (10.9)	11.7 (10.1)	10.9 (9.4)	10.4 (9.0)	—	—
1	25	3.5	—	—	3.5 (3.0)	3.5 (3.0)	3.5 (3.0)	3.5 (3.0)	—
	27	8.6	—	—	8.6 (7.4)	8.5 (7.3)	8.4 (7.2)	8.3 (7.2)	—
	30	22.3 ^a	—	—	22.3 (19.2)	21.2 (18.3)	19.9 (17.2)	18.4 (15.9)	—
	31	30.8 ^a	—	—	30.8 (26.6)	28.0 (24.2)	25.2 (21.8)	22.3 (19.3)	—
1-1/4	44	12.7	—	—	—	12.7 (11.0)	12.6 (10.9)	12.4 (10.7)	12.3 (10.6)
	46	34.1 ^a	—	—	—	34.1 (29.4)	32.9 (28.4)	29.9 (25.9)	28.3 (24.4)
1-1/2	54	23.5	—	—	—	—	23.5 (20.3)	23.1 (19.9)	22.7 (19.6)
	56	61.1 ^a	—	—	—	—	61.1 (52.8)	54.9 (47.5)	49.7 (43.0)
2	63	56.7 ^a	—	—	—	—	—	56.7 (49.0)	55.5 (47.9)

^a Denotes a full port valve, without the characterized insert.

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