Invensys Building Systems
1354 Clifford Avenue (Zip 61111)
P.O. Box 2940
Loves Park, IL 61132-2940
United States of America

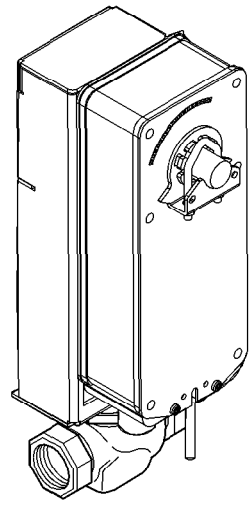
VX-7000 Series
MX-XXXX Series

Linked Globe Valve Assemblies
Actuator/Linkage Assemblies
Selection Guide

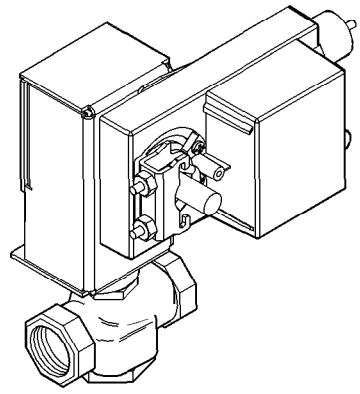
Linked Globe Valve Assemblies

The Siebe Environmental Controls (SEC) VA, VF, and VS-7000 series Linked Globe Valve Assemblies are complete actuator/valve assemblies that accept two position, floating, or proportional control, respectively, from a DDC system or from a thermostat, for control of hot water, chilled water and steam coils. These valve assemblies consist of direct-coupled spring-return and non-spring return actuators mounted on 1/2" to 2" (15 mm to 50 mm) VB-7000 series two-way and three-way globe valve bodies, using a specially designed linkage assembly. This linkage uses a rack and pinion mechanism to translate the rotary motion of the direct-mount actuator into the linear motion necessary to lift or lower the valve stem.

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



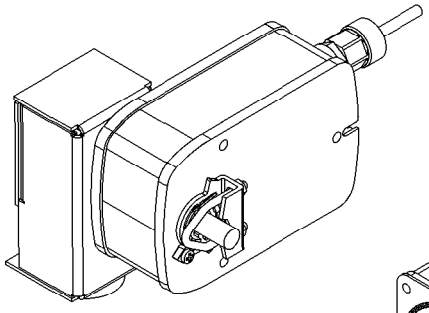
Two-Way Linked Globe Valve Assembly
(VX-72XX Series shown)



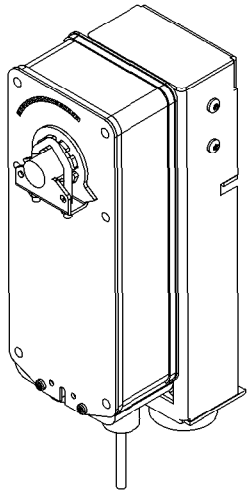
Three-Way Linked Globe Valve Assembly
(VX-73XX Series shown)

Actuator/Linkage Assemblies

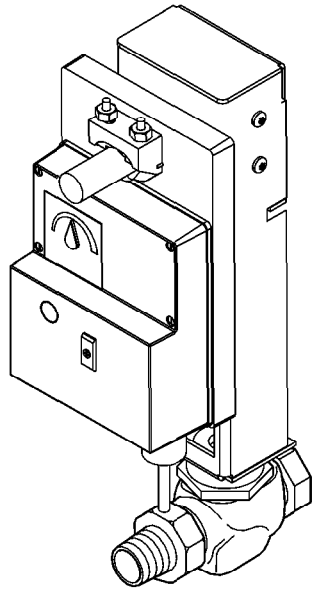
The Actuator/Linkage Assemblies consist of MA, MF, and MS actuators pre-assembled to linkages designed to be fitted onto VB-7000 series valve bodies.



Actuator/Linkage Assembly
(MS-7103-200 Series shown)



Actuator/Linkage Assembly
(MA-7X0X-200 Series shown)



Union Straightway Linked Globe Valve Assembly
(VX-7211 Series shown)

Printed in U.S.A. 11-99

Applicable Literature

F-Number	Description	Audience	Purpose
F-25683	Siebe Environmental Controls Catalog	– Sales Personnel – Application Engineers	Provides descriptions of Siebe Environmental Controls component products, in one convenient location, to aid in their selection.
F-26635	MA-XXXX-2XX, MF-XXXX-2XX, MS-XXXX-2XX Series Actuator/Linkage Assemblies General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the actuator/linkage assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-25091	MF-6633, MF-6733 Actuators General Instructions	– 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-25092	MS-6633, MS-6733 Actuators General Instructions		
F-26006	MA-720X, MA-720X-500, MX-750X, MA-750X-502 Actuators General Instructions		
F-26062	MS-7203, MS-7433 Actuators General Instructions		
F-26093	MF-6203, MF-6233 Actuators General Instructions		
F-26461	MS-6103 Actuator General Instructions		
F-26462	MF-6103 Actuator General Instructions		
F-26463	MA-710X, MA-710X-500 Series Actuators General Instructions		
F-26464	MS-7103, MS-7103-500 Actuators General instructions		
F-26465	MF-7103, MF-7103-500 Actuators General Instructions		
F-26503	MS-6203, MF-6233 Actuators General Instructions		
F-26080	EN-205 Water System Guidelines	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes Siebe Environmental Controls approved water treatment practices.
F-13755	CA-28 Control Valve Sizing		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-11080	Valve Selection Chart Water		
F-11366	Valve Selection Chart Steam (two-way valves only)		
F-24380	VB-7211 Series 1/2" to 1-1/4" Union Straightway NPT Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the valve's features, specifications, and possible applications. Provides step-by-step mounting, installation, and checkout instructions.
F-24384	VB-7221 Series 1/2" to 1-1/4" Union Straightway NPT Stem Up Closed, Two-Way Valves General Instructions		
F-26073	VB-7223 Series 1/2" to 2" Screwed NPT Stem Up Closed, Two-Way Valves General Instructions		
F-26074	VB-7313 Series 1/2" to 2" Screwed NPT Three-Way Mixing Valves General Instructions		
F-26075	VB-7213 Series 1/2" to 2" Screwed NPT Stem Up Open, Two-Way Valves General Instructions		
F-26076	VB-7323 Series 1/2" to 2" Screwed NPT Three-Way Diverting Valves General Instructions		
F-26077	VB-7215 Series 15 mm to 50 mm Screwed Rp Stem Up Open, Two-Way Valves General Instructions		
F-26078	VB-7315 Series 15 mm to 50 mm Screwed Rp Three-Way Mixing Valves General Instructions		
F-26079	VB-7225 Series 15 mm to 50 mm Screwed Rp Stem Up Closed, Two-Way Valves General Instructions		

Using this Selection Guide

This selection guide contains the following sections:

Features and Benefits

This section discusses the beneficial features of the linked globe valve assemblies and actuator/linkage assemblies.

Linked Globe Valve Assembly and Actuator/Linkage Assembly Part Numbering System

This section explains the part numbering system used with the linked globe valve assemblies. This section also list the specifications and available models for the actuator/linkage assemblies.

System Design Considerations

This section contains information related to the linked globe valve assemblies' flow characteristics, rangeability, close-off ratings, and temperature/pressure ratings.

Installation Considerations

Installation requirements to be considered when installing linked globe valve assemblies are given in this section.

Linked Globe Valve Assembly Sizing and Selection

Use this section to choose the appropriate globe valve assembly for the application.

Valve Specifications

Refer to this section for specifications data pertaining to the two-way and three-way valves used in the linked globe valve assemblies.

Actuator Specifications and Linked Valve Assembly Mounting Dimensions

Refer to this section for specifications data related to the actuators used in the linked valve assemblies, as well as mounting dimensions for the valve assemblies.

Features and Benefits

Features	Benefits
Six Sigma, Lean Manufacturing, and ISO 9001 Certification.	Ensures that the product meets stringent quality and delivery requirements.
Thermal isolation.	Protects the actuator from heat generated by hot water or steam passing through the valve.
Valve sizes 1/2" to 2" and 15 mm to 50 mm (Union Straightway, NPT, Metric) 2-Way and 3-Way.	Satisfies a wide range of application requirements.
Spring-loaded TFE packing.	Resistance to cold flow at the seals and seats. Better close-off. Greater lubricity, therefore requiring less torque to operate the valve.
250 psig valve body static pressure rating per ANSI Standards (B16.15—1985) for screwed cast bronze bodies.	Meets most demanding pressure requirements.
Brushless DC motors.	Provides better accuracy with longer actuator service life.
Robust structural steel linkage and stainless steel shaft.	Ensures precise alignment of the shaft to the valve stem for extended life of assembly.
Optional manual operating lever on non-spring return assemblies.	Allows manual positioning of the valve.
Optional built-in auxiliary switch interfacing.	Provides safety interfacing and signaling.
31 to 250 psig (214 to 1724 kPa) close-off.	Meets variety of close-off requirements.
3 ft. (91 cm) Appliance cable and/or conduit connector.	Eases installation.
Overload protection.	Eliminates excessive stem force and over heating of actuator.
Position indicator.	Allows for quick check of valve position.
Spring return models with normally open or normally closed configurations.	Meets all fail safe mode applications.

Linked Globe Valve Assembly Part Numbering System

Linked Globe Valve Assemblies

V (Control Type) - 7 (2-Way or 3-Way) (Valve Type) (Connection) - (Actuator) - 4 - (Port Code (Cv *))

* Use Port Code in table below.

V X - 7 X X X - X X X - 4 - X X

Type
Two Position = A
Floating = F
Proportional = S

Configuration
721 = 2-Way, Stem Up Open
722 = 2-Way, Stem Up Closed
731 = 3-Way, Mixing
732 = 3-Way, Diverting

Connection
Union Straightway= 1
Thread NPT = 3
Metric (Rp) = 5

Actuator

Two Position
MA-7101 = 326
MA-7101-500 = 327
MA-7103 = 328
MA-7103-500 = 329
MA-7201 = 330
MA-7201-500 = 331
MA-7203 = 332
MA-7203-500 = 333
MA-7501 = 334
MA-7501-502 = 335
MA-7503 = 336
MA-7503-502 = 337
MA-7505 = 338
MA-7505-502 = 339

Floating
MF-6103 = 315
MF-6203 = 314
MF-6633 = 311
MF-7103 = 318
MF-7103-500 = 319

Proportional
MS-6103 = 452
MS-6203 = 453
MS-6633 = 450
MS-7103 = 395
MS-7103-500 = 396
MS-7203 = 390
MS-7433 = 391

Port Code

	2-Way		3-Way	
Size	Cv	P Code	Cv	P Code
1/2"	0.4	1	—	
	1.3	2	2.2	2
	2.2	3	—	
	4.4	4	4.4	4
3/4"	5.5	5	—	
	7.5	6	7.5	6
1"	10.0	7	—	
	14.0	8	14.0	8
1-1/4"	20.0	9	20.0	9
1-1/2"	28.0	10	28.0	10
2"	40.0	11	41.0	11
	kvs		kvs	
15 mm	0.3	1	—	
	1.1	2	1.9	2
	1.9	3	—	
	3.8	4	3.8	4
20 mm	4.8	5	—	
	6.5	6	6.5	6
25 mm	8.7	7	—	
	12.0	8	12.0	8
32 mm	17.0	9	17.0	9
40 mm	24.0	10	24.0	10
50 mm	35.0	11	35.0	11

Valve Assemblies	Valve Body Action	Factory Shipped Position		Action
		Valve Stem	Flow	
VX-721X-XXX-4-P	2-Way Stem Up Open	Up	Open	A to AB Flow decreases as actuator rotates CW
VX-722X-XXX-4-P	2-Way Stem Up Closed	Up	Closed	A to AB Flow increases as actuator rotates CW
VX-731X-XXX-4-P	3-Way Mixing	Up	Flow B to AB	A to AB Flow increases as actuator rotates CW B to AB Flow decreases as actuator rotates CW
VX-732X-XXX-4-P	3-Way Diverting	Up	Flow B to AB	B to A Flow increases as actuator rotates CW B to AB Flow decreases as actuator rotates CW

Actuator/Linkage Assembly Part Numbering System

Actuator/Linkage Assembly Part Numbers	Actuator Power Input				SPDT Auxiliary Switches	Approximate Timing in Seconds 0 to 133 lb.-in. (0 to 15 N-m)			Output Torque Rating lb.-in. (N-m)
	Voltage @ 50/60 Hz	VA	Watts			Powered	Spring Return		
			Running	Holding			@-4 to 122° F (-20 to 50° C)	@ -22° F (-30° C)	
MA-7101-200	120 Vac ± 10%	7.5	5.5	3.5	No	<40 to 75	<25	<60	35 (4)
MA-7101-201					One[a]				
MA-7103-200	24 Vac ± 20% or 24 Vdc ± 10%	7	5	2.5	No				
MA-7103-201					One[a]				
MA-7201-200	120 Vac ± 20%	11	6	3.5	No	<75	<60 Above -4° F (-20° C)	N/A	60 (6.8)
MA-7201-201					One[b]				
MA-7203-200	24 Vac ± 20% or 24 Vdc ± 10%	8	5	2.6	No				
MA-7203-201					One[b]				
MA-7501-200	120 Vac ± 10%	10	6	2.3	No	150 (constant)	<20	N/A	133 (15)
MA-7501-202					Two[c]				
MA-7503-200	24 Vac ± 20% or 24 Vdc ± 10%	10	5	1.5	No				
MA-7503-202					Two[c]				
MA-7505-200	230 Vac ± 14%	11	6.5	2.5	No				
MA-7505-202					Two[c]				
MF-6103-200	24 Vac ± 20% or 24 Vdc ± 10%	3	2		No	80 to 110	N/A	N/A	35 (4)
MF-6203-200	24 Vac ± 20% or 24 Vdc ± 10%	3.5	2		No	75 to 150			70 (8)
MF-6633-200	24 Vac ± 20% or 24 Vdc ± 10%	3.3	1.8		No	90 to 150	N/A	N/A	133 (15)
MF-7103-200	24 Vac ± 20% or 24 Vdc ± 10%	5	2.5		No	150	<25	<60	35 (4)
MF-7103-201					One[a]				
MS-6103-200	24 Vac ± 20% or 24 Vdc ± 10%	3	2		No	80 to 110	N/A	N/A	35 (4)
MS-6203-200	24 Vac ± 20% or 24 Vdc ± 10%	3.5	1.3		No	0 to 150	N/A	N/A	70 (8)
MS-6633-200	24 Vac ± 20% or 24 Vdc ± 10%	5	2.9		No	100 to 200	N/A	N/A	133 (15)
MS-7103-200	24 Vac ± 20% or 24 Vdc ± 10%	5	2.5	1	No	150 (constant)	N/A	<60	35(4)
MS-7103-201					One[a]		<25	N/A	
MS-7203-200	24 Vac ± 20% or 24 Vdc ± 10%	8	5	2.6	No	<75	<60	N/A	60 (6.8)
MS-7433-200	24 Vac ± 20% or 24 Vdc ± 10%	10	6	2	No	150 (constant)	<20	N/A	133 (15)

[a] One adjustable from 0 to 95° rotation.
[b] One adjustable 5° to 85°.
[c] One adjustable from 0 to 85° rotation and one set to operate @ 5° fixed.

System Design Considerations

Two-Way Valve Assemblies

Note: The information in this section describes characteristics of the VB-7XXX valve bodies, which are used in the VX-7XXX valve assemblies. This information is also useful when installing the MX-XXXX-2XX series actuator/linkage assemblies onto these valve bodies.

Flow Characteristics

Two-Way Valves: All valves have modified equal percentage flow characteristics. That is, for equal increments of valve stem stroke, the change in flow rate with respect to valve stroke may be expressed as a constant percent of the flow rate at the time of the change. The change of flow rate with respect to valve stroke is relatively small when the valve plug is near the valve seat and relatively high when the valve plug is nearly wide open. See Figure-1 for typical modified equal percentage flow characteristics of VB-72XX series valves.

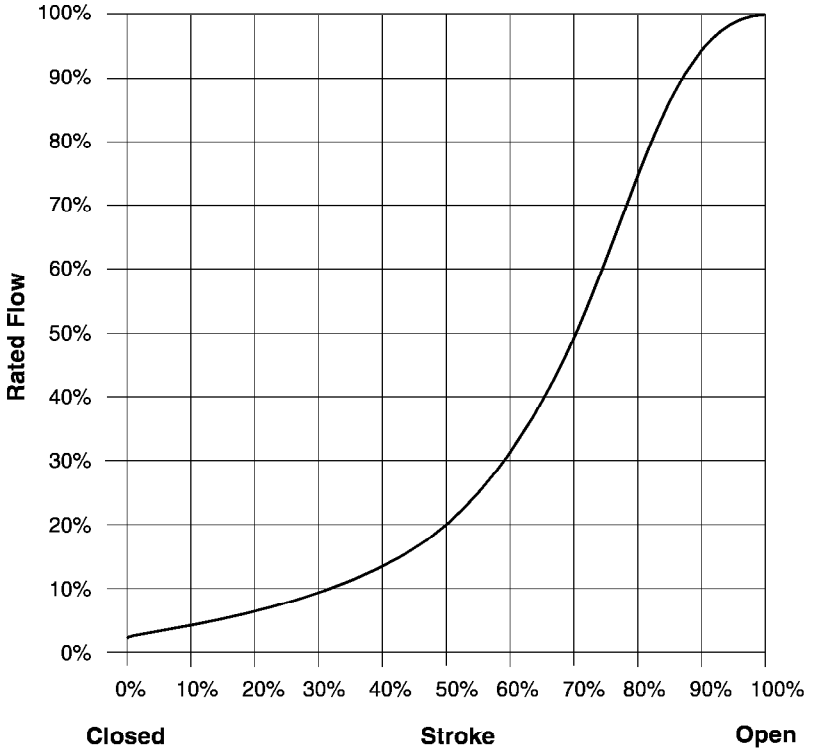


Figure-1 Typical Modified Equal Percentage Flow Characteristics.

Three-Way Valves: Three-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. See Figure-2 for typical flow characteristics of the VB-731X series valve bodies.

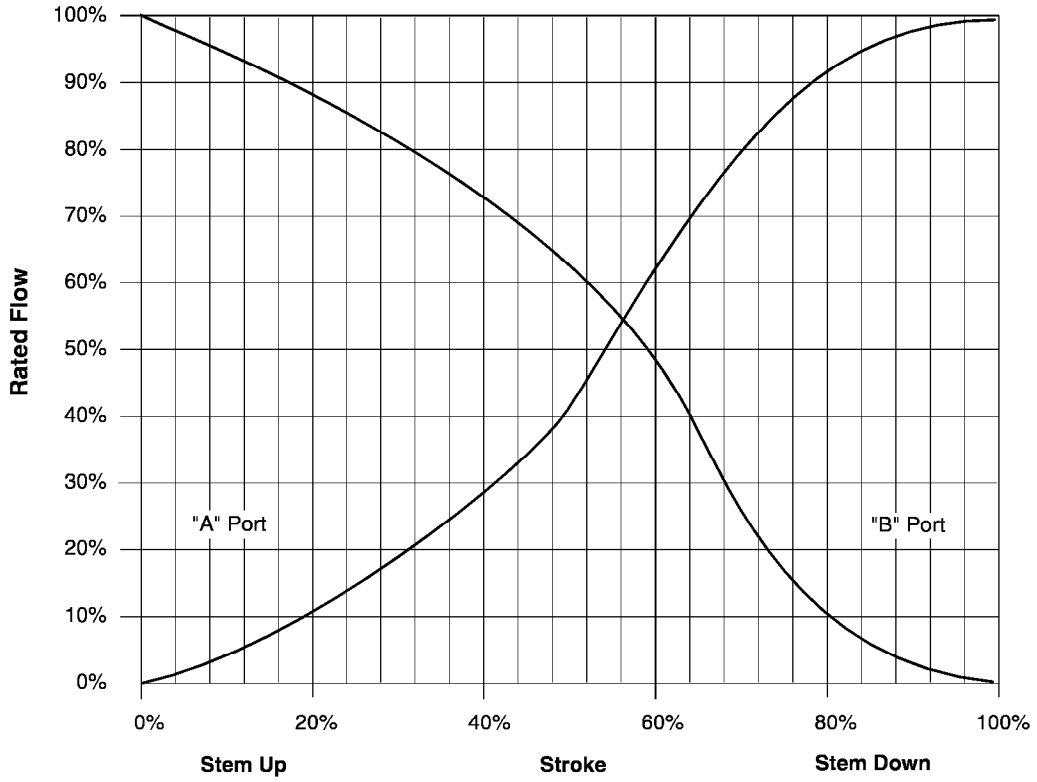


Figure-2 Typical Flow Characteristics.

Rangeability

Rangeability is the ratio of rated flow to the minimum controllable flow through a valve.

Two-Way Valves: Table-1 lists the rangeability for VB-72XX series globe valves. Refer to the model charts on the following pages for detailed valve information.

Table-1 Rangeability.

Nominal Valve Size		Port Code (P)	Nominal Rangeability
Standard	Metric		
1/2"	15 mm	1	5:1
		2	15:1
		3	25:1
		4	40:1
3/4"	20 mm	5	50:1
		6	60:1
1"	25 mm	7	60:1
		8	75:1
1-1/4"	32 mm	9	75:1
1-1/2"	40 mm	10	75:1
2"	50 mm	11	75:1

Three-Way Valves: For mixing valves, control begins as soon as plug displacement allows flow. Thus, the rangeability of three-way valves normally exceeds 500:1, which is the reciprocal of 0.2% nominal leakage.

Temperature/Pressure Ratings

See Figure-3 for temperature and pressure ratings of two-way and three-way valves. Ratings conform with published values and disclaimer.

VB-7XXX-0-X-P (Cast Bronze Body)

Standards: Pressure to ANSI B16.15 Class 250 with 400 psig (2758 kPa) up to 150°F (65 °C), decreasing to 321 psig (2218 kPa) at 281°F (138 °C).

Materials: Bronze, ASTM B584.

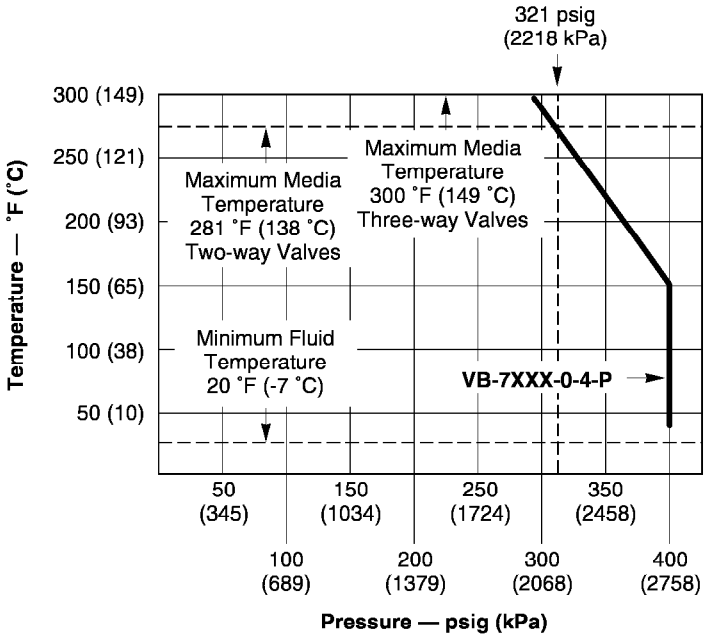


Figure-3 Temperature and Pressure Ratings for VB-7XXX Series Globe Valves.

Close-off Ratings

Nominal actuator close-off ratings are based on ANSI IV (0.01% leakage) with EPDM discs and PTFE discs in steam applications. Metal-to-metal trim such as brass three-way and high temperature stainless are designed for ANSI III (0.01% leakage). Seat leakage for reduced port versions of metal-to-metal seats may match the full port versions allowing up to 1% on the 0.4 C_V plugs.

Consult factory for actuator requirements for ANSI VI, virtually bubble tight for EPDM and PTFE applications.

Installation Considerations

Mounting Angle of Valve Assembly

Be sure to allow the necessary clearance around the globe valve assembly. The globe valve assembly must be mounted so that the valve stem is above the horizontal. This ensures that any condensate that forms on the valve body will not travel into the linkage or actuator, where it may cause corrosion. On steam applications, where the ambient temperature approaches the limit of the actuator, the globe valve assembly must be mounted 45° from vertical. See *Actuator/Linkage Assemblies General Instructions, F-26635* for details.

Insulation of Linked Globe Valve Assembly

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

Caution: The actuator/linkage must not be insulated. Doing so will result in excess heat buildup within the actuator.

Temperature Limits

When installing the globe valve assembly, observe the minimum and maximum temperature limits given in the *Actuator Specifications and Valve Assembly Mounting Dimensions* (page 20 through page 32) section of this document.

Linked Globe Valve Assembly Sizing and Selection

Water

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.

Proportional 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-2).

Table-2 Conventional Heating System.

Design Temperature Load Drop °F (°C)	Recommended Pressure Drop[a] (% 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

[a] Recommended minimum pressure drop = 5 psi (34 kPa).

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

Three-Way Proportional Mixing Valves Used to Bypass Flow

When three-way proportional linked globe valve assemblies are used to control flow through a heating or cooling coil, the valve assembly is piped on the outlet side of the load to throttle the water flow through the load, and therefore control the heat output of the load (Figure-4).

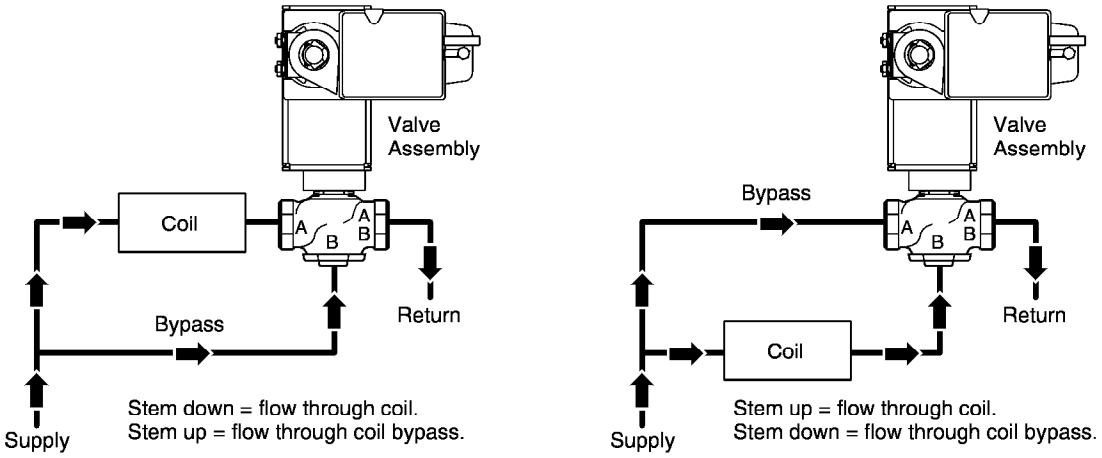


Figure-4 Typical Piping of Three-Way Mixing Valve for Control of Heating or Cooling Coil.

Three-Way Proportional Mixing Valves Used to Blend Water Flows

Proportional three-way mixing valves used to blend two water flows (Figure-5) 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.

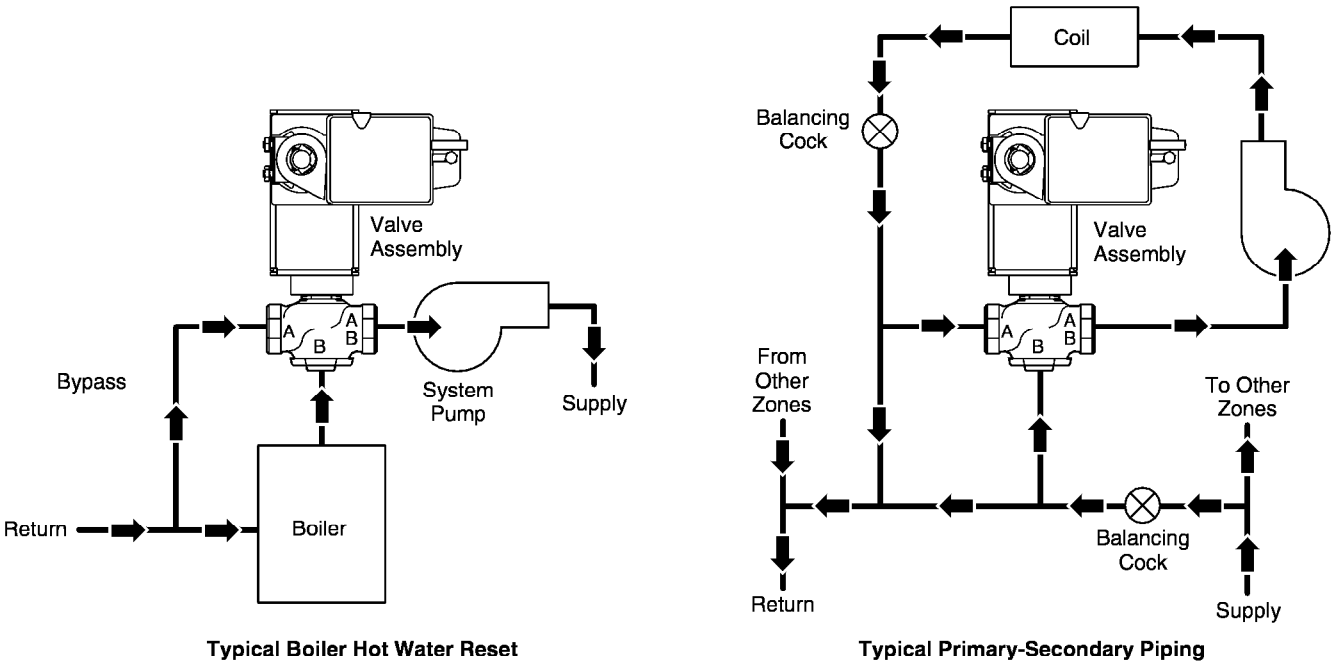


Figure-5 Typical Three-Way Mixing Valve Piping for Proportional Control Used to Blend Two Water Flows.

Three-Way Diverting Valves

Proportional and two-position three-way diverting linked globe valve assemblies are used to control the flow of hot or chilled fluids in heating systems, cooling coils, or other load by diverting the flow to either the load or a bypass. The valve must piped with one inlet and two outlets. (Figure-6).

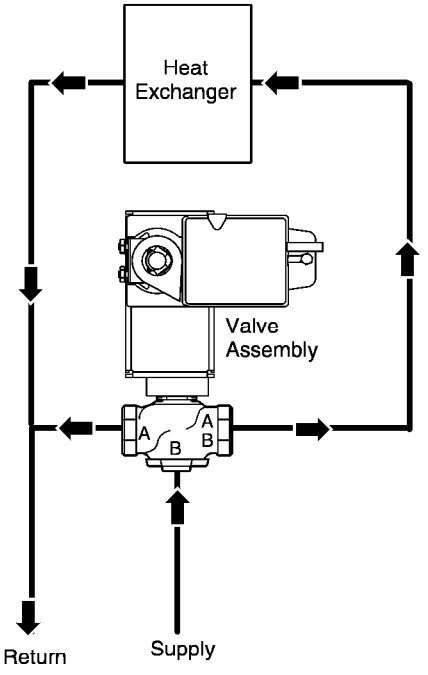


Figure-6 Typical Three-Way Diverting Valve Piping.

Water Capacity

Refer to Table-3 for water capacities of VB-72XX series two-way and VB-73XX series three-way globe valves.

Table-3 Water Capacities in Gallons Per Minute for VB-7XXX Series Globe Valves.

Valve Body Part Number	Rating		Differential Pressure in psi[a]												
Two-Way Valves															
	C_v	k_{vs}	1	2	3	4	5	6	7	8	9	10	15	20	35
VB-72XX-0-4-1	0.4	0.35	0.40	0.57	0.69	0.80	0.89	0.98	1.06	1.13	1.20	1.26	1.55	1.79	2.37
VB-72XX-0-4-2	1.3	1.12	1.30	1.84	2.3	2.6	2.9	3.2	3.4	3.7	3.9	4.1	5.0	5.8	7.7
VB-72XX-0-4-3	2.2	1.9	2.2	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.6	7.0	8.5	9.8	13
VB-72XX-0-4-4	4.4	3.8	4.4	6.2	7.6	8.8	9.8	11	12	12	13	14	17	20	26
VB-72XX-0-4-5	5.5	4.8	5.5	7.8	9.5	11	12	13	15	16	17	17	21	25	33
VB-72XX-0-4-6	7.5	6.5	7.5	11	13	15	17	18	20	21	23	24	29	34	44
VB-72XX-0-4-7	10	8.7	10	14	17	20	22	24	26	28	30	32	39	45	59
VB-72XX-0-4-8	14	12.1	14	20	24	28	31	34	37	40	42	44	54	63	83
VB-72XX-0-4-9	20	17.3	20	28	35	40	45	49	53	57	60	63	77	89	118
VB-72XX-0-4-10	28	24.2	28	40	48	56	63	69	74	79	84	89	108	125	166
VB-72XX-0-4-11	40	34.6	40	57	69	80	89	98	106	113	120	126	155	179	237
Three-Way Valves															
	C_v	k_{vs}	1	2	3	4	5	6	7	8	9	10	15	20	35
VB-731X-0-4-2	2.2	1.9	2.20	3.11	3.81	4.40	4.92	5.39	5.82	6.22	6.60	6.96	8.52	9.84	13.02
VB-731X-0-4-4	4.4	3.8	4.40	6.22	7.6	8.8	9.8	10.8	11.6	12.4	13.2	13.9	17.0	19.7	26.0
VB-731X-0-4-6	7.5	6.5	7.5	10.6	13.0	15.0	16.8	18.4	19.8	21.2	22.5	23.7	29.0	33.5	44.4
VB-731X-0-4-8	14	12.1	14	20	24	28	31	34	37	40	42	44	54	63	83
VB-731X-0-4-9	20	17.3	20	28	35	40	45	49	53	57	60	63	77	89	118
VB-731X-0-4-10	28	24.2	28	39	48	56	63	69	74	79	84	89	108	125	166
VB-731X-0-4-11	41	35.5	41	58	71	82	92	100	108	116	123	130	159	183	243
Diverting Valves															
	C_v	k_{vs}	1	2	3	4	5	6	7	8	9	10	15	20	35
VB-731X-0-4-4	4.4	3.8	4.40	6.22	7.6	8.8	9.8	10.8	11.6	12.4	13.2	13.9	17.0	19.7	26.0
VB-731X-0-4-6	7.5	6.5	7.5	10.6	13.0	15.0	16.8	18.4	19.8	21.2	22.5	23.7	29.0	33.5	44.4
VB-731X-0-4-8	15	13.0	15	21	26	30	34	37	40	42	45	47	58	67	89
VB-731X-0-4-9	20	17.3	20	28	35	40	45	49	53	57	60	63	77	89	118
VB-731X-0-4-10	28	24.2	28	40	48	56	63	69	74	79	84	89	108	125	166
VB-731X-0-4-11	40	34.6	40	57	69	80	89	98	106	113	120	126	155	179	237

[a] kPa = psi x 6.89476 L/s = gpm x 15.85.

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 at 60°F (15.6°C)
ΔP = Differential pressure (pressure drop) in psi

k_{vs} Equation

$$Q = k_{vs} \bullet \sqrt{\Delta P} \qquad \Delta P = \left(\frac{Q}{k_{vs}}\right)^2 \qquad k_{vs} = \frac{Q}{\sqrt{\Delta P}}$$

Where:

Q = Flow in cubic metres per hours (m^3/h)
k_{vs} = Flow in cubic metres per hour at a 1 Bar (100 kPa) pressure drop (ΔP)
ΔP = Differential pressure in Bar (pressure drop)

Steam (Two-Way Valves Only)

Two-position Control

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

Proportional Control

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 pressure plus 14.7 psi) inlet pressure.
- When the C_v required is between two valve sizes, select the larger size. Do not size steam valves using a pressure drop greater than 42% of the absolute inlet pressure.

Steam Capacity

See Table-4 for the steam capacities of VB-72XX series valves.

Table-4 Steam Capacity in Pounds Per Hour for VB-72XX Series.

Valve Body Part Number	Rating		Differential Pressure in psi [a] [b]															
			2 psig Inlet		5 psig Inlet		10 psig Inlet		15 psig Inlet		20 psig Inlet		25 psig Inlet		30 psig Inlet		35 psig Inlet	
	C_v	k_{vs}	0.2	1.6	0.5	4	1	8	1.5	12	2	14	2.5	16	3	18	3.5	20
VX-72XX-XXX-4-1	0.4	0.35	2.2	5.9	3.7	9.5	5.8	13.9	7.8	17.5	9.7	20.4	11.6	23.4	13.4	26.3	15.3	29.2
VX-72XX-XXX-4-2	1.3	1.12	7.1	19.2	12.1	30.9	19.0	45.1	25.4	56.8	31.5	66.4	37.6	75.9	43.6	85.5	49.6	95.1
VX-72XX-XXX-4-3	2.2	1.9	12.0	32.4	20.4	52.3	32.1	76.3	42.9	96.2	53.4	112	63.6	129	73.8	145	83.9	161
VX-72XX-XXX-4-4	4.4	3.8	24.0	64.9	40.9	105	64.3	153	85.9	192	107	225	127	257	148	289	168	322
VX-72XX-XXX-4-5	5.5	4.8	30.0	81.1	51.1	131	80.3	191	107	240	133	281	159	321	185	362	210	402
VX-72XX-XXX-4-6	7.5	6.5	40.9	111	69.7	178	110	260	146	328	182	383	217	438	252	493	286	548
VX-72XX-XXX-4-7	10	8.6	54.5	147	93	238	146	347	195	437	243	511	289	584	336	658	381	731
VX-72XX-XXX-4-8	14	12.1	76.3	206	130	333	204	485	273	612	340	715	405	818	470	921	534	1024
VX-72XX-XXX-4-9	20	17.3	109	295	186	475	292	694	390	874	485	1021	579	1168	671	1315	763	1462
VX-72XX-XXX-4-10	30	25.9	153	413	260	666	409	971	546	1224	679	1430	810	1636	939	1841	1068	2047
VX-72XX-XXX-4-11	40	34.6	218	590	372	951	584	1387	780	1749	970	2043	1157	2337	1342	2631	1526	2925

[a] Values are for saturated steam (K = 1). The left column under each inlet pressure is for two-position control, and the right column is for proportional control.
[b] kPa = PSI x 6.89476 kg/h = lb/hr x 2.2

C_v Equation

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

Where:
C_v = Coefficient of flow
Q = Lbs. per hour of steam
ΔP = Differential pressure in psi (pressure drop)
P2 = Outlet pressure in psia (absolute) (P2 = Inlet pressure + 14.7 – ΔP)
K = 1 + (0.0007 x °F superheat) (K = 1 for saturated steam)

k_{vs} Equation

$$Q = \frac{0.229 \bullet kvs \bullet \sqrt{\Delta P \bullet P2}}{K} \qquad k_{vs} = \frac{QK}{0.229 \bullet \sqrt{\Delta P \bullet P2}}$$

Where:
Q = Steam flow in kilograms per hour (kg/h)
k_{vs} = Coefficient of flow
ΔP = Differential pressure in kPa (pressure drop)
P2 = Outlet pressure in kPa (absolute) (P2 = Inlet pressure in kPa + 101.3 – ΔP)
K = 1 + (0.0026 x °C superheat) (K = 1 for saturated steam)

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:

$Pm = 0.5 (P_1 - Pv)$

Where:
Pm = Maximum allowable pressure drop (psi or kPa)
P_1 = Absolute inlet pressure (psia or Kpa)
Pv = Absolute vapor pressure (psia or Kpa) (refer to Table-5)

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 (94°C) 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 psia.)

Pm = 0.5 [(125 + 101.3) – 81] = 72 kPa
(Vapor pressure of 94°C water is 81 kPa)

If the pressure drop for this valve is less than 10.6 psi (72 kPa), 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.

Table-5 Vapor Pressure of Water.

Water Temp. °F (°C)	Vapor Pressure psia (kPa)	Water Temp. °F (°C)	Vapor Pressure psia (kPa)	Water Temp. °F (°C)	Vapor Pressure psia (kPa)	Water Temp. °F (°C)	Vapor Pressure psia (kPa)
40 (4)	0.12 (.81)	90 (34)	0.70 (5.3)	140 (64)	2.89 (24)	190 (94)	9.34 (81)
50 (10)	0.18 (1.2)	100 (40)	0.95 (7.4)	150 (70)	3.72 (31)	200 (100)	11.53 (101)
60 (16)	0.26 (1.8)	110 (46)	1.28 (10)	160 (76)	4.74 (40)	210 (106)	14.12 (125)
70 (22)	0.36 (2.6)	120 (52)	1.69 (14)	170 (82)	5.99 (51)	220 (112)	17.19 (153)
80 (28)	0.51 (3.8)	130 (58)	2.22 (18)	180 (88)	7.51 (65)	230 (116)	20.78 (175)

Additional Valve Sizing Information

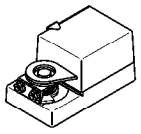
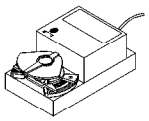
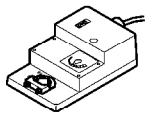
For additional valve sizing information, refer to the “Applicable Literature” section for a list of documents pertaining to valve sizing.

Two-Way Linked Globe Valve Assemblies

Non-Spring Return Models

Note: Choose a valve assembly having a close-off pressure capability sufficient for the application.

Table-6 Two-Way Linked Globe Valve Assemblies with Non-Spring Return Actuators — Selection Chart.

Non-Spring Return Two-Way Linked Globe Valve Assemblies							 MF-6633  MS-6633
					Actuator Torque Rating (minimum)		
					35 lb-in (4 N-m)	70 lb-in (8 N-m)	**Single-Mount** 133 lb-in (15 N-m)
					Actuator Model (Actuator Code)		
					On-Off/Floating MF-6103 (**315**) **Proportional** MS-6103 (**452**)	**Two-Position or Floating** MF-6203 (**314**) **Proportional** MS-6203 (**453**)	**Two-Position or Floating** MF-6633 (**311**) **Proportional** MS-6633 (**450**)
Valve Assembly Part Number [a]	**P Code**	**Valve Size in. (mm)**	**C_v** [b]	**k_{vs}** [b]	**Close-off Pressure psig** [c d]		
VX-7211-XXX-4-P **VX-7213-XXX-4-P** **VX-7215-XXX-4-P**[e] **VX-7221-XXX-4-P** **VX-7223-XXX-4-P** **VX-7225-XXX-4-P**[e]	**1**	1/2 (15)	0.4	0.3	250	—	—
	2		1.3	1.1	250	—	—
	3		2.2	1.9	250	—	—
	4		4.4	3.8	250	—	—
	5	3/4 (20)	5.5	4.8	206	—	—
	6		7.5	6.5	206	—	—
	7	1 (25)	10.0	8.7	96	215	—
	8		14.0	12	96	215	—
	9	1-1/4 (32)	20.0	17	59	135	214
	10	1-1/2 (40)	28.0	24	—	92	147
	11	2 (50)	40.0	35	—	50	81

[a] To determine a specific part number, see the "Linked Globe Valve Assembly Part Numbering System", presented on page 5 of this document.

[b] $k_{vs} = m^3/h$ (ΔP = 100 kPa) $k_{vs} = C_v / 1.156$ $C_v = k_{vs} \times 1.156$

[c] Close-off ANSI IV (.01%) for soft seats. Ratings for stem up open valves are with indicated supply air pressure applied to actuator. Ratings for stem up closed valves are within 1 psi or less applied to actuator (for kPa multiply Cv by 6.895). For seat leakage ratings see "Applicable Literature" section for the list of literature on specific valve bodies.

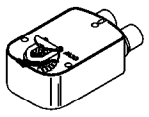
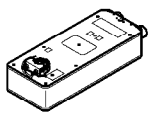
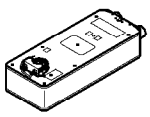
[d] Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations. The rating value is the pressure difference between the inlet and outlet ports.

[e] Metric thread 15 to 50 mm (Rp 1/2 to Rp 2).

Spring-Return Models

Note: Choose a valve assembly having a close-off pressure capability sufficient for the application.

Table-7 Two-Way Linked Globe Valve Assemblies with Spring-Return Actuators — Selection Chart.

Spring-Return Two-Way Linked Globe Valve Assemblies							
					Actuator Torque Rating (minimum)		
					35 lb-in (4 N-m)	60 lb-in (6.8 N-m)	**Single-Mount** 133 lb-in (15 N-m)
					Actuator Model (Actuator Code)		
					Two-Position MA-7101 (**326**) MA-7101-500 (**327**) **Two-Position or Floating** MA-7103 (**328**) MA-7103-500 (**329**) MF-7103 (**318**) MF-7103-500 (**319**) **Proportional** MS-7103 (**395**) MS-7103-500 (**396**)	**Two-Position** MA-7201 (**330**) MA-7201-500 (**331**) MA-7203 (**332**) MA-7203-500 (**333**) **Proportional** MS-7203 (**390**)	**Two-Position** MA-7501 (**334**) MA-7501-502 (**335**) MA-7503 (**336**) MA-7503-502 (**337**) MA-7505 (**338**) MA-7505-502 (**339**) **Proportional** MS-7433 (**391**)
Valve Assembly Part Number [a]	**P Code**	**Valve Size (in.)**	**C_v** [b]	**k_{vs}** [b]	**Close-off Pressure psig** [c d]		
VX-7211-XXX-4-P **VX-7213-XXX-4-P** **VX-7215-XXX-4-P**[e] **VX-7221-XXX-4-P** **VX-7223-XXX-4-P** **VX-7225-XXX-4-P**[e]	**1**	1/2 (15)	0.4	0.35	250	—	—
	2		1.3	1.12	250	—	—
	3		2.2	1.9	250	—	—
	4		4.4	3.8	250	—	—
	5	3/4 (20)	5.5	4.8	206	—	—
	6		7.5	6.5	206	—	—
	7	1 (25)	10.0	8.6	96	140	—
	8		14.0	12	96	140	—
	9	1-1/4 (32)	20.0	17	59	87	—
	10	1-1/2 (40)	28.0	26	—	59	147
	11	2 (50)	40.0	35	—	31	81

[a] To determine a specific part number, see the Linked Globe Valve Assembly Part Numbering System, presented on page 5 of this document.

[b] $k_{vs} = m^3/h$ (ΔP = 100 kPa) $k_{vs} = C_v / 1.156$ $C_v = k_{vs} \times 1.156$

[c] Close-off ANSI IV (.01%) for soft seats. Ratings for stem up open valves are with indicated supply air pressure applied to actuator. Ratings for stem up closed valves are within 1 psi or less applied to actuator (for kPa multiply Cv by 6.895). For seat leakage ratings see "Applicable Literature" section for the list of literature on specific valve bodies.

[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.

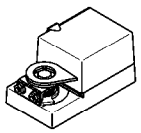
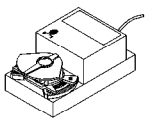
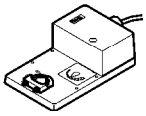
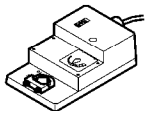
[e] Metric thread 15 to 50 mm (Rp 1/2 to Rp 2).

Three-Way Linked Globe Valve Assemblies

Non-Spring Return Models

Note: Choose a valve assembly having a close-off pressure capability sufficient for the application.

Table-8 Three-Way Linked Globe Valve Assemblies with Non-Spring Return Actuators — Selection Chart.

Non-Spring Return Three-Way Linked Globe Valve Assemblies [a]							 MF-6633  MS-6633
					Actuator Torque Rating (minimum)		
					35 lb-in (4 N-m)	70 lb-in (8 N-m)	**Single-Mount** 133 lb-in (15 N-m)
					Actuator Model (Actuator Code)		
					On-Off/Floating MF-6103 (**315**) **Proportional** MS-6103 (**452**)	**Two-Position or Floating** MF-6203 (**314**) **Proportional** MS-6203 (**453**)	**Two-Position or Floating** MF-6633 (**311**) **Proportional** MS-6633 (**450**)
Valve Assembly Part Number [b]	**P Code**	**Valve Size in. (mm)**	**C_v [c]**	**k_{vs} [c]**	**Close-off Pressure psig [d]**		
VX-7313-XXX-4-P VX-7315-XXX-4-P[e]	**2**	1/2 (15)	2.2	1.9	250	—	—
	4		4.4	3.8	250	—	—
	6	3/4 (20)	7.5	6.9	206	—	—
	8	1 (25)	14.0	12.1	96	215	—
	9	1-1/4 (32)	20.0	17.3	59	135	—
	10	1-1/2 (40)	28.0	28.5	—	92	147
	11	2 (50)	41.0	43.2	—	50	81
VX-7323-XXX-4-P	**4**	1/2 (15)	4.4	3.8	250	—	—
	6	3/4 (20)	7.5	6.5	250	—	—
	8	1 (25)	15	13.0	250	250	—
	9	1-1/4 (32)	20	17.3	250	250	—
	10	1-1/2 (40)	28	24.2	200	250	250
	11	2 (50)	40	34.6	150	250	250

[a] Refer to Figure-4 and Figure-5 for typical piping diagram for three-way linked globe valve assemblies.

[b] To determine a specific part number, see the Linked Globe Valve Assembly Part Numbering System, presented on page 5 of this document.

[c] $k_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $k_{vs} = C_v / 1.156$ $C_v = k_{vs} \times 1.156$

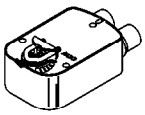
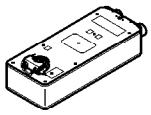
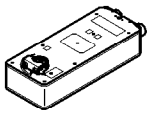
[d] Close-off ANSI III for metal-to-metal seats with pressure at inlet (port A). Ratings for stem up open valves are with indicated supply air pressure applied to actuator. Ratings for stem up closed valves are within 1 psi or less applied to actuator (for kPa multiply Cv by 6.895). For seat leakage ratings see "Applicable Literature" section for the list of literature on specific valve bodies.

[e] Metric thread 15 to 50 mm (Rp 1/2 to Rp 2).

Spring-Return Models

Note: Choose a valve assembly having a close-off pressure capability sufficient for the application.

Table-9 Three-Way Linked Globe Valve Assemblies with Spring-Return Actuators — Selection Chart.

Spring-Return Three-Way Linked Globe Valve Assemblies [a]							
					Actuator Torque Rating (minimum)		
					35 lb-in (4 N-m)	60 lb-in (6.8 N-m)	**Single-Mount** 133 lb-in (15 N-m)
					Actuator Model (Actuator Code)		
					Two-Position MA-7101 (**326**) MA-7101-500 (**327**) **Two-Position or Floating** MA-7103 (**328**) MA-7103-500 (**329**) MF-7103 (**318**) MF-7103-500 (**319**) **Proportional** MS-7103 (**395**) MS-7103-500 (**396**)	**Two-Position** MA-7201 (**330**) MA-7201-500 (**331**) MA-7203 (**332**) MA-7203-500 (**333**) **Proportional** MS-7203 (**390**)	**Two-Position** MA-7501 (**334**) MA-7501-502 (**335**) MA-7503 (**336**) MA-7503-502 (**337**) MA-7505 (**338**) MA-7505-502 (**339**) **Proportional** MS-7433 (**391**)
Valve Assembly Part Number [b]	**P Code**	**Valve Size (in.)**	**C_v [c]**	**k_{vs} [c]**	**Close-off Pressure psig [d]**		
VX-7313-2XX-4-P VX-7315-XXX-4-P[e] VX-7323-XXX-4-P	**2**	1/2 (15)	2.2	1.9	250	—	—
	4		4.4	3.8	250	—	—
	6	3/4 (20)	7.5	6.9	206	—	—
	8	1 (25)	14.0	12.1	96	140	—
	9	1-1/4 (32)	20.0	17.3	59	87	—
	10	1-1/2 (40)	28.0	28.5	—	59	147
	11	2 (50)	41.0	43.2	—	31	81
VX-7323-XXX-4-P	**4**	1/2 (15)	4.4	3.8	250	—	—
	6	3/4 (20)	7.5	6.5	250	—	—
	8	1 (25)	15	13.0	250	250	—
	9	1-1/4 (32)	20	17.3	250	250	—
	10	1-1/2 (40)	28	24.2	200	250	250
	11	2 (50)	40	34.6	150	250	250

[a] Refer to Figure-4 and Figure-5 for typical piping diagram for three-way linked globe valve assemblies.

[b] To determine a specific part number, see the Linked Globe Valve Assembly Part Numbering System, presented on page 5 of this document.

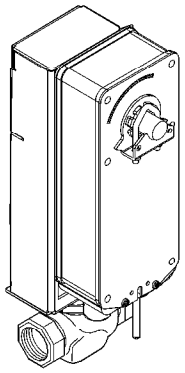
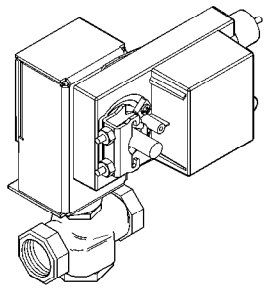
[c] $k_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $k_{vs} = C_v / 1.156$ $C_v = k_{vs} \times 1.156$

[d] Close-off ANSI III for metal-to-metal seats with pressure at inlet (port A). Ratings for stem up open valves are with indicated supply air pressure applied to actuator. Ratings for stem up closed valves are within 1 psi or less applied to actuator (for kPa multiply Cv by 6.895). For seat leakage ratings see "Applicable Literature" section for the list of literature on specific valve bodies.

[e] Metric thread 15 to 50 mm (Rp 1/2 to Rp 2).

Linked Globe Valve Assemblies — Specifications

Table-10 Specifications for Linked Globe Valve Assemblies.

Linked Globe Valve Assemblies		Two-Way	Three-Way
			
Applications		Chilled or Hot Water, or Steam	Chilled or Hot Water
Type of End Fitting		NPT, Rp Screwed, Union Straightway	NPT, Rp Screwed
Size		1/2 in. through 2 in. 15 mm through 50 mm	1/2 in. through 2 in. 15 mm through 50 mm
Action		Stem Up Open or Stem Up Closed	Mixing or Diverting
Valve Assembly Series		**VX-72XX-XXX-4-P**	**VX-73XX-XXX-4-P**
Flow Type		Equal Percentage [a]	Linear [a] (mixing only)
Valve Body Materials	**Body**	Bronze	Bronze
	Seat	Bronze	Bronze
	Stem	Stainless Steel	Stainless Steel
	Plug	Brass	Brass
	Packing	Spring-loaded TFE	Spring-loaded TFE
	Disc	EPDM	—
Linkage Materials	**Housing**	Zinc Coated Steel	Zinc Coated Steel
	Rack & Pinion	Hardened Steel	Hardened Steel
ANSI Pressure Class (Figure-3)		250 psig (4137 kPa), up to 400 psig (6619 ,Pa) below 150°F (66 °C) [b]	250 psig (4137 kPa), up to 400 psig (6619 ,Pa) below 150°F (66 °C) [b]
Pressure Class (VB-7XX5)		PN16	PN16
STEAM			
Inlet Pressure — Maximum		35 psig (241 kPa)	—
Fluid Temperature — Maximum		281 °F (138 °C)	—
Allowable Differential Pressure[c]		20 psi (138 kPa)	—
WATER			
Fluid Temperature — Minimum		20 °F (-7 °C)	20 °F (-7 °C)
Fluid Temperature — Maximum		281 °F (138 °C)	281 °F (138 °C)
Allowable Differential Pressure[c]		35 psi (241 kPa) Max. for Normal Lifespan (refer to “Cavitation Limitations on Valve Pressure Drop”, on page 14)	35 psi (241 kPa) Max. for Normal Lifespan (refer to “Cavitation Limitations on Valve Pressure Drop”, on page 14)

[a] See “Flow Characteristics” for two-way valves (page 7) or three-way valves (page 8), for a detailed description of the flow.

[b] Do not apply the above pressure rating to the piping system.

[c] Maximum recommended differential pressure. Do not exceed the recommended differential pressure (pressure drop) or the integrity of valve parts may be affected. Exceeding the maximum recommended differential pressure voids the product warranty.

Actuator Specifications and Valve Assembly Mounting Dimensions

Valve Assemblies with MF-6103 and MS-6103 Actuators

Actuator Specifications	
Inputs	
Control Signal	**MF-6103** — On-off floating point control, 24 V. **MS-6103** — Proportional, 2 to 10 Vdc.
Power Requirements	24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 3.0 VA, 2.0 W. All 24 Vac circuits are Class 2.
Connections	3 ft. (91 cm) long, 18 AWG leads, plenum rated (UL CL2P).
Outputs	
Electrical	Direction of Rotation Switch (L/R): Used to reverse the direction of rotation.
Mechanical	Output torque rating: 35 lb-in. (4 N-m).
	Stroke: Angle of rotation is 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.
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2 (IP 54).
Agency Listings	
UL	UL-873, 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).
Accessories	
AM-695-100	Manual override handle.

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Valve Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-7 and Figure-9)				Three-Way (Refer to Figure-8)		
		A	B	C [a]	E	A	C	E
VF-7211-315-4-P VF-7221-315-4-P VS-7211-452-4-P VS-7221-452-4-P	1/2	4-3/16 (106)	2-11/16 (68)	1-11/16 (43)	6-3/8 (162)	N/A	N/A	N/A
	3/4	4-15/16 (125)	3-3/16 (81)	1-11/16 (43)	6-3/8 (162)	N/A	N/A	N/A
	1	6 (152)	3-5/8 (92)	1-1/8 (29)	7-1/16 (179)	N/A	N/A	N/A
	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	7-1/16 (179)	N/A	N/A	N/A
VF-7223-315-4-P[a] VF-7225-315-4-P[a] VF-7XXX-315-4-P VS-7223-452-4-P[a] VS-7225-452-4-P[a] VS-7XXX-452-4-P	1/2	3 (76)	N/A	1-1/16 (27)	5-3/8 (137)	3 (76)	1-3/8 (35)	6-3/8 (162)
	3/4	3-5/8 (92)	N/A	1-1/16 (27)	5-3/8 (137)	3-5/8 (92)	1-11/16 (43)	6-3/8 (162)
	1	4-5/8 (117)	N/A	1-1/8 (29)	7-1/16 (179)	4-5/8 (117)	1-3/4 (44)	6-7/16 (164)
	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	7-1/16 (179)	4-5/8 (117)	1-5/8 (41)	6-11/16 (170)

[a] Use 3-way C dimension for VX-7223 and VX-7225 valve assemblies.

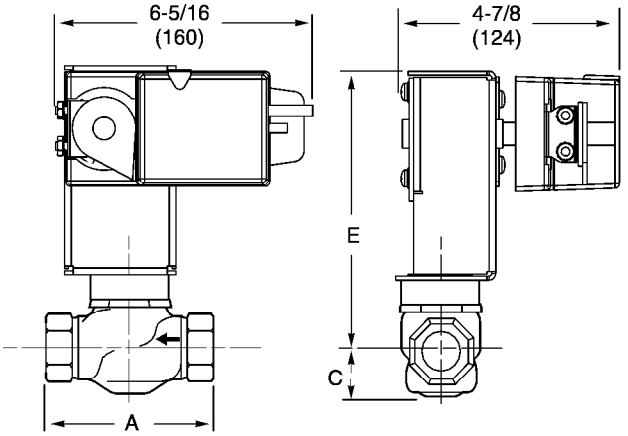


Figure-7 MF-6103 or MS-6103 with Two-Way Valve.

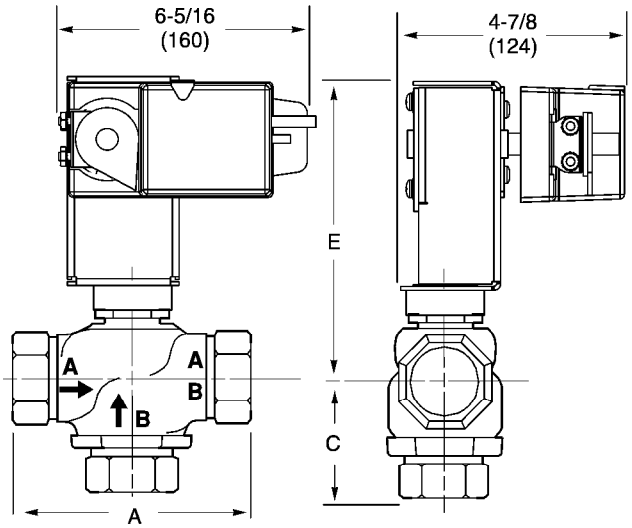


Figure-8 MF-6103 or MS-6103 with Three-Way Valve.

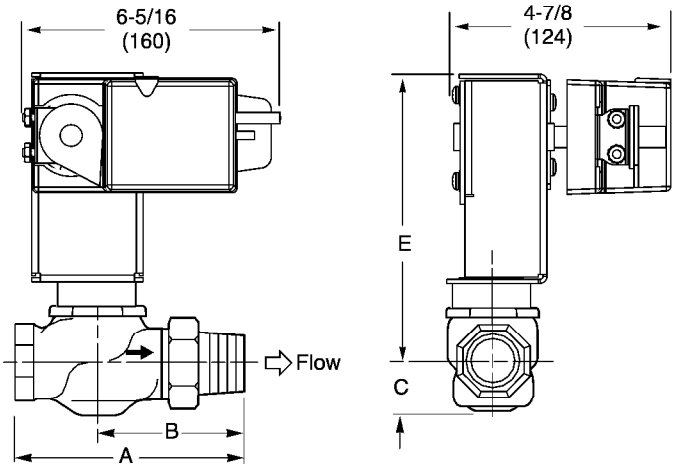


Figure-9 MF-6103 or MS-6103 with Two-Way Union Straightway Valve.

Valve Assemblies with MF-6203 and MS-6203 Actuators

Actuator Specifications	
Inputs	
Control Signal	**MF-6203** — SPDT floating control output or 2 SPST control contacts for two-position control. **MS-6203** — Proportional, 2 to 10 Vdc.
Power Requirements	24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 3.5 VA, 2.0 W. All 24 Vac circuits are Class 2.
Connections	3 ft. (91 cm) long, 18 AWG leads, plenum rated (UL CL2P). **MF-6203 and MS-6203** include a conduit connector.
Outputs	
Electrical	Direction of Rotation Switch (L/R): Used to reverse the direction of rotation.
Mechanical	Output torque rating: 70 lb-in. (8 N-m).
	Stroke: Angle of rotation is 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.
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2/IP 54.
Agency Listings	
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).
Accessories	
AM-695-100	Manual override handle.

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-10 and Figure-12)				Three-Way (Refer to Figure-11)		
		A	B	C[a]	E	A	C	E
VF-7211-314-4-P VF-7221-314-4-P VS-7211-453-4-P VS-7221-453-4-P	1	6 (152)	3-5/8 (92)	1-1/8 (29)	7-1/16 (179)	N/A	N/A	N/A
	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	7-1/16 (179)	N/A	N/A	N/A
VF-7223-314-4-P[a] VF-7225-314-4-P[a] VF-7XXX-314-4-P VS-7223-453-4-P[a] VS-7225-453-4-P[a] VS-7XXX-453-4-P	1	4-5/8 (117)	N/A	1-1/8 (29)	7-1/16 (179)	4-5/8 (117)	1-3/4 (44)	6-7/16 (164)
	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	7-1/16 (179)	4-5/8 (117)	1-5/8 (41)	6-11/16 (170)
	1-1/2	5-3/8 (137)	N/A	1-1/2 (38)	7-1/8 (181)	5-3/8 (137)	1-5/8 (41)	6-13/16 (173)
	2	6-1/8 (156)	N/A	1-9/16 (40)	7-3/8 (187)	6-1/8 (156)	1-7/8 (48)	6-7/8 (175)

[a] Use 3-way C dimension for VX-7223 and VX-7225 valve assemblies.

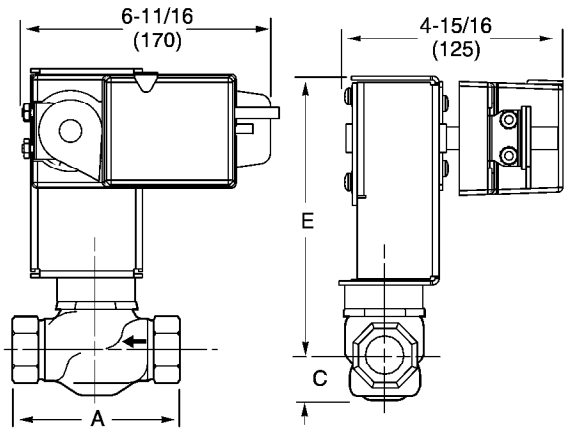


Figure-10 MF-6203 or MS-6203 with Two-Way Valve.

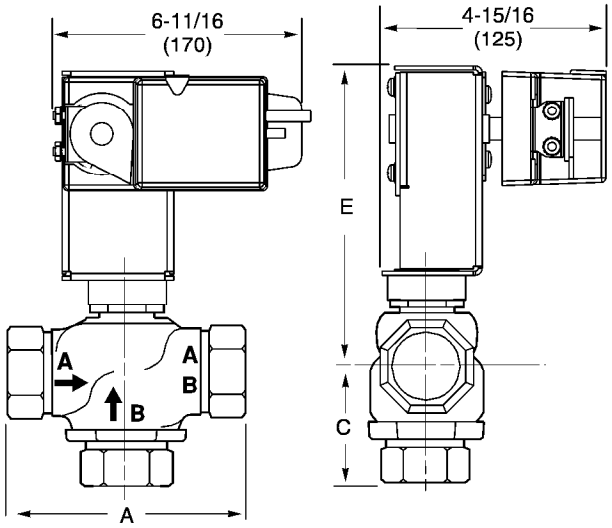


Figure-11 MF-6203 or MS-6203 with Three-Way Valve.

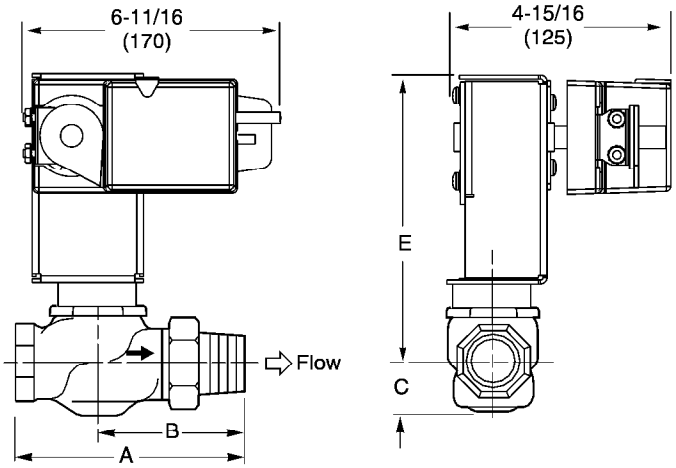


Figure-12 MF-6203 or MS-6203 with Two-Way Union Straightway Valve.

Valve Assemblies with MF-6633 Actuators

Actuator Specifications	
Inputs	
Control Signal	SPDT floating control output or 2 SPST control contacts for two-position control.
Power Requirements	24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz. All 24 Vac circuits are Class 2.
Connections	3 ft. (91 cm) long, 18 AWG leads with 1/2 in. conduit connector.
Outputs	
Electrical	Direction of Rotation Switch (A/B): Used to reverse the direction of rotation.
Mechanical	Output torque rating: 133 lb-in. (15 N-m) minimum, 180 lb-in. (20 N-m) maximum.
	Stroke: Angle of rotation is limited to a maximum of 95°.
	Position indicator: Adjustable pointer with a scale numbered from 0 to 10, provided for position indication.
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2.
Agency Listings	
UL	UL-873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment).
Accessories	
AM-695	Manual override handle.

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-13 and Figure-15)				Three-Way (Refer to Figure-14)		
		A	B	C[a]	E	A	C	E
VF-7211-311-4-P VF-7221-311-4-P	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	12-15/16 (329)	N/A	N/A	N/A
VF-7X13-311-4-P VF-7223-311-4-P[a] VF-7225-311-4-P[a]	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	12-7/8 (327)	4-5/8 (117)	1-5/8 (41)	12-1/2 (318)
	1-1/2	5-3/8 (137)	N/A	1-1/2 (38)	13 (330)	5-3/8 (137)	1-5/8 (41)	12-11/16 (322)
	2	6-1/8 (156)	N/A	1-9/16 (40)	13-1/4 (337)	6-1/8 (156)	1-7/8 (48)	12-3/4 (324)

[a] Use 3-way C dimension for VX-7223 and VX-7225 valve assemblies.

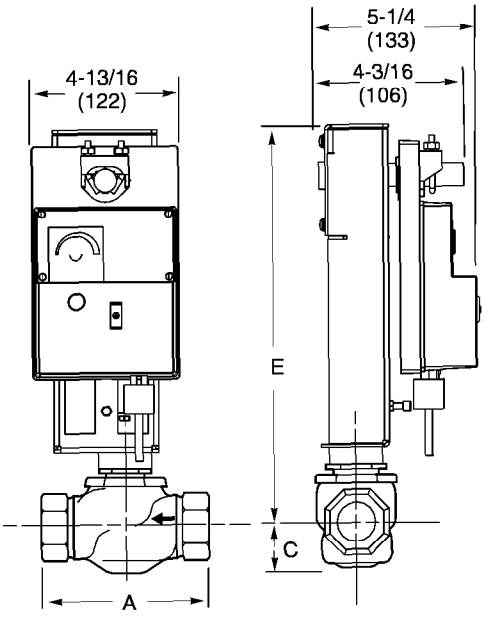


Figure-13 MF-6633 with Two-Way Valve.

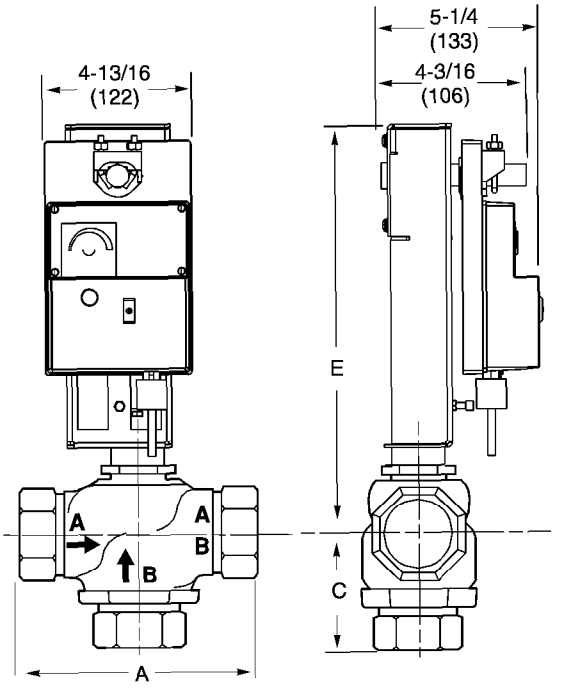


Figure-14 MF-6633 with Three-Way Valve.

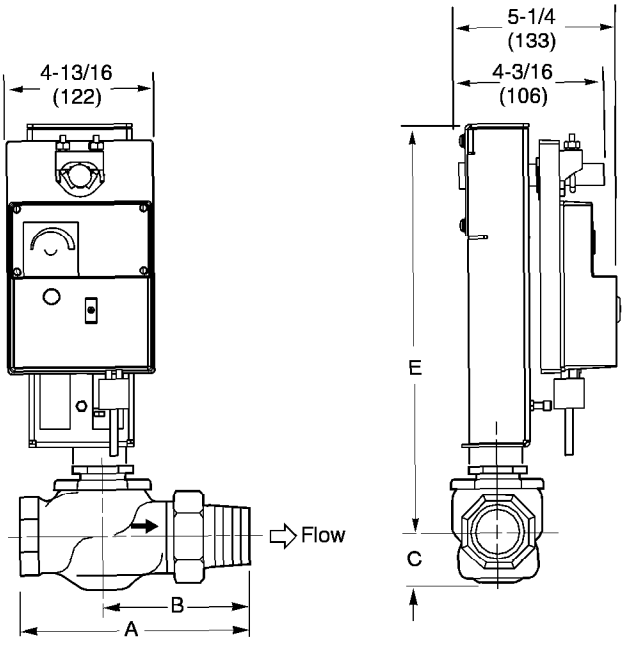


Figure-15 MF-6633 with Two-Way Union Straightway Valve.

Valve Assemblies with MS-6633 Actuators

Actuator Specifications

Inputs	
Control Signal	2 to 10 Vdc operating span, 100 k Ohm (0.1 mA). 2 to 10 V phase cut, 8 k Ohm (50 mW). 4 to 20 mA, 500 Ohm.
Power Requirements	24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz. All 24 Vac circuits are Class 2.
Connections	3 ft. (91 cm) long, 18 AWG leads with 1/2 in. conduit connector.
Outputs	
Electrical	Direction of Rotation Switch (A/B): Used to reverse the direction of rotation.
	Position feedback voltage "U": 2 to 10 Vdc (maximum 0.5 mA) output signal for position feedback or operation of a slave actuator.
Mechanical	Output torque rating: 133 lb-in. (15 N-m) minimum, 180 lb-in. (20 N-m) maximum.
	Stroke: Angle of rotation is limited to a maximum of 95°.
	Position indicator: Adjustable pointer with a scale numbered from 0 to 10, provided for position indication.
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2.
Agency Listings	
UL	UL-873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment).
Accessories	
AM-695	Manual override handle.

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-16 and Figure-18)				Three-Way (Refer to Figure-17)		
		A	B	C	E	A	C	E
VS-7211-450-4-P VS-7221-450-4-P	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	12-15/16 (329)	N/A	N/A	N/A
VS-722X-450-4-P VS-7X13-450-4-P	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	12-7/8 (327)	4-5/8 (117)	1-5/8 (41)	12-1/2 (318)
	1-1/2	5-3/8 (137)	N/A	1-1/2 (38)	13 (330)	5-3/8 (137)	1-5/8 (41)	12-11/16 (322)
	2	6-1/8 (156)	N/A	1-9/16 (40)	13-1/4 (337)	6-1/8 (156)	1-7/8 (48)	12-3/4 (324)

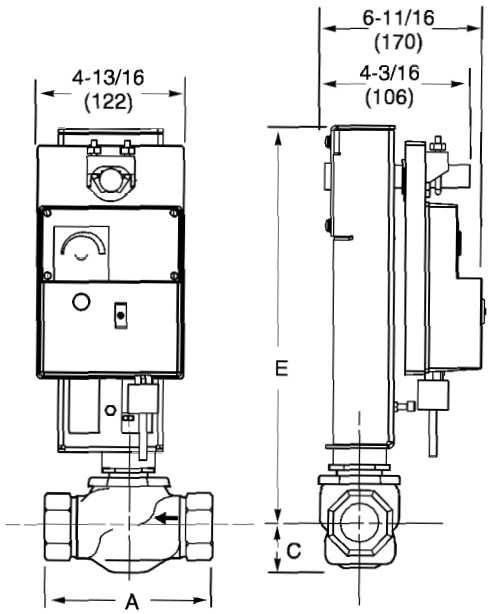


Figure-16 MS-6633 with Two-Way Valve.

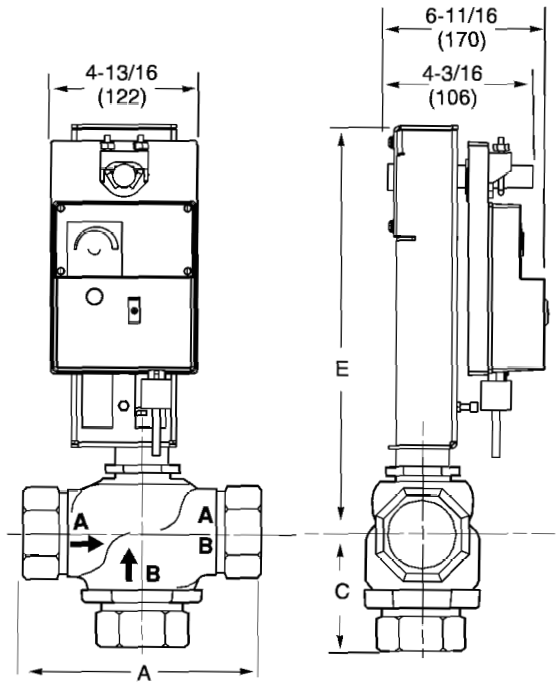


Figure-17 MS-6633 with Three-Way Valve.

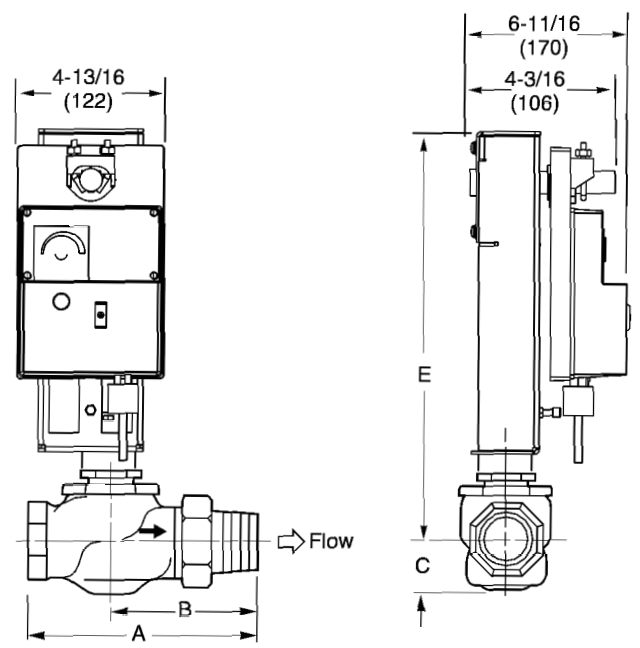


Figure-18 MS-6633 with Two-Way Union Straightway Valve.

Valve Assemblies with MA-710X, MF-7103, and MS-7103 Series Actuators

Actuator Specifications

Inputs	
Control Signal	Spring return, on-off.
Power Requirements	**MA-7101 and MA-7101-500** — 120 Vac ±10% @ 50/60 Hz, 7.5 VA, 5.5 W (running) and 3.5 W (holding). **MA-7103 and MA-7103-500** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 7.0 VA, 5.0 W (running) and 2.5 W (holding). **MF-7103 and MF-7103-500** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 5.0 VA, 2.5 W (running). **MS-7103 and MS-7103-500** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 5.0 VA, 2.5 W (running) and 1.0 W (holding). All 24 Vac circuits are Class 2.
Connections	3 ft. (91 cm) long, plenum rated cable for MX-710X and 3 ft. long, 18 AWG appliance cable for MX-710X-500 with 1/2 in. conduit connector.
Outputs	
Electrical	Direction of rotation: — cw or ccw rotation is available through reversible mounting.
	Auxiliary switch (**MX-710X-500**): One SPDT 6 A (1.5 A) @ 250 Vac, UL listed, adjustable 0 to 95° (double insulated).
Mechanical	Output torque rating: 35 lb-in. (4 N-m).
	Stroke: Rotation is limited to a maximum of 95°, adjustable with a mechanical stop.
	Position indicator: Visual indicator, 0 to 95° (0° is the spring-return position).
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2/IP 54.
Agency Listings	
UL	UL-873, 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).

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-19 and Figure-20)				Three-Way (Refer to Figure-21)		
		A	B	C	E	A	C	E
VX-72X1-318-4-P VX-72X1-319-4-P VX-72X1-326-4-P through VX-72X1-329-4-P VX-72X1-395-4-P VX-72X1-396-4-P	1/2	4-3/16 (106)	2-11/16 (68)	1-11/16 (43)	6-7/8 (175)	N/A	N/A	N/A
	3/4	4-15/16 (125)	3-3/16 (81)	1-11/16 (43)	6-7/8 (175)	N/A	N/A	N/A
	1	6 (152)	3-5/8 (92)	1-1/8 (29)	7-1/2 (191)	N/A	N/A	N/A
	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	7-1/2 (191)	N/A	N/A	N/A
VX-7XXX-318-4-P VX-7XXX-319-4-P VX-7XXX-326-4-P through VX-7XXX-329-4-P VX-7XXX-395-4-P VX-7XXX-396-4-P	1/2	3 (76)	N/A	1-1/16 (27)	6-7/8 (175)	3 (76)	1-3/8 (35)	6-7/8 (175)
	3/4	3-5/8 (92)	N/A	1-1/16 (27)	6-7/8 (175)	3-5/8 (92)	1-11/16 (43)	6-7/8 (175)
	1	4-5/8 (117)	N/A	1-1/8 (29)	7-1/2 (191)	4-5/8 (117)	1-3/4 (44)	6-15/16 (176)
	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	7-1/2 (191)	4-5/8 (117)	1-5/8 (41)	7-3/16 (183)

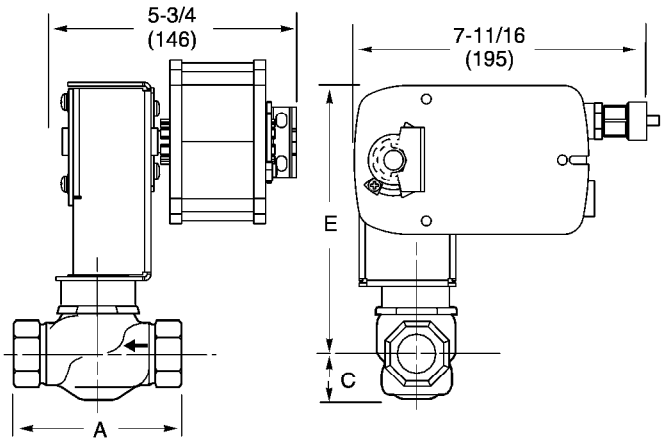


Figure-19 MX-710X Series with Two-Way Valve.

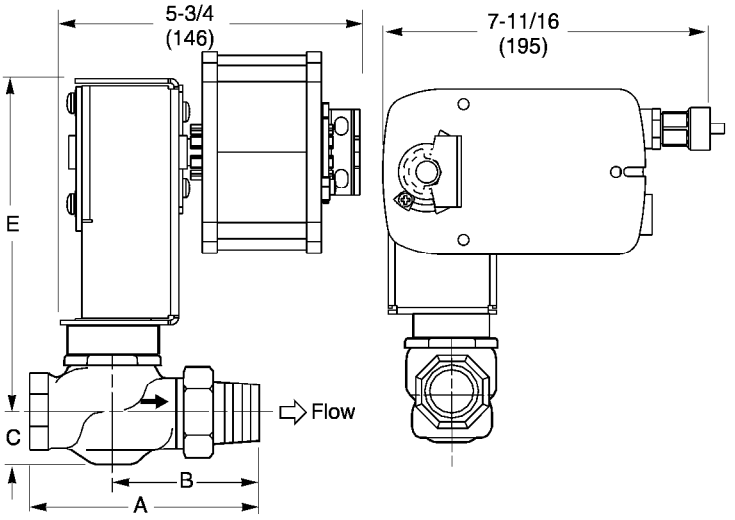


Figure-20 MX-710X Series with Two-Way Union Straightway Valve.

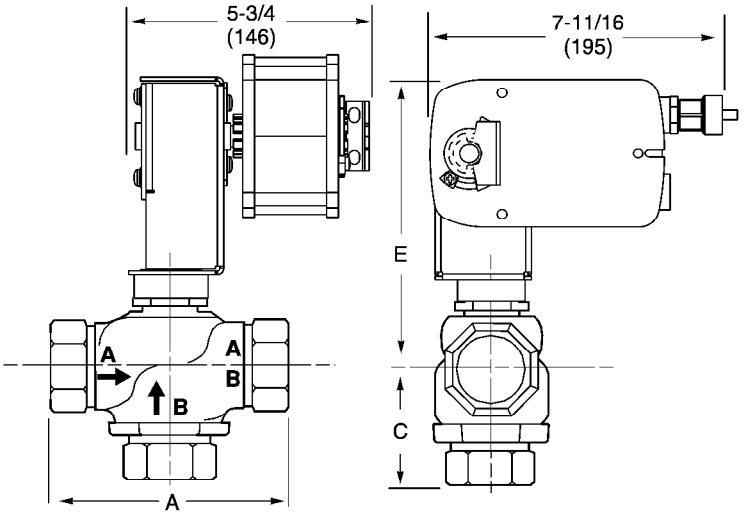


Figure-21 MX-710X Series with Three-Way Valve.

Valve Assemblies with MA-720X Series, MS-7203, MS-7433, and MA-750X Series Actuators

Actuator Specifications	
Inputs	
Control Signal	**MA-720X, MA-720X-500, MA-750X, and MA-750X-502** — Spring return, on-off. **MS-7203 and MS-7433** — Spring return, proportional, 2 to 10 Vdc or 4 to 20 mAdc. MS-7433 also accepts 0 to 20 Vdc phasecut input signal.
Power Requirements	**MA-7201, MA-7201-500, MA-7501, and MA-7501-502** — 120 Vac ±20% @ 50/60 Hz, 11.0 VA, 6.0 W (running) and 3.5 W (holding). **MA-7203 and MA-7203-500** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 8.0 VA, 5.0 W (running) and 2.6 W (holding). **MA-7503 and MA-7503-502** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 10.0 VA, 5.0 W (running) and 1.5 W (holding). **MA-7505 and MA-7505-502** — 230 Vac ±14% @ 50/60 Hz, 11.0 VA, 6.5 W (running) and 2.5 W (holding). **MS-7203** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 8.0 VA, 5.0 W (running) and 2.6 W (holding). **MS-7433** — 24 Vdc ±10% or 24 Vac ±20% @ 50/60 Hz, 10.0 VA, 6.0 W (running) and 2.0 W (holding). All 24 Vac circuits are Class 2.
Connections	3 ft. long, 18 AWG cable with 1/2 in. conduit connector.
Outputs	
Electrical	Direction of rotation: Cw or ccw rotation is available through reversible mounting.
	MA-720X-500: One SPDT auxiliary switch, adjustable from 5 to 85°, rated at 7.0 A non-inductive @ 250 Vac and 2.5 A inductive @ 240 Vac.
	MA-750X-502: Two SPDT auxiliary switches, one operating @ 5° fixed and one operating @ 25 to 85° adjustable. Switches are rated at 7.0 A non-inductive @ 250 Vac and 2.5 A inductive @ 240 Vac.
	MS-7203 and MS-7433: Position feedback voltage "U", 2 to 10 Vdc (maximum 0.5 mA) output signal for position feedback or operation of up to five slave actuator.
Mechanical	Output torque rating: **MA-7201, MA-7201-500, MA-7203, MA-7203-500, and MS-7203** — 60 lb-in. (6.8 N-m). **MA-7501, MA-7501-502, MA-7503, MA-7503-502, MA-7505, MA-7505-502, and MS-7433** — 133 lb-in. (15 N-m).
	Stroke: Rotation is limited to a maximum of 95°. MS-7203 and MS-7433 are adjustable from 30 to 95° with AM-689 rotation limiter installed.
	Position indicator: Pointer and scale are provided for position indication (0° is the normal, or spring-return, position).
Environment	
Temperature Limits	Shipping and storage: -40 to 176 °F (-40 to 80 °C) ambient. Operating Minimum allowable valve fluid temperature: 20 °F (-7 °C). Maximum allowable ambient: 115 °F (46 °C) maximum ambient at maximum valve fluid temperature of 281 °F (138 °C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 2/IP 54.
Agency Listings	
UL	UL-873, 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).

Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	Dimensions in inches (millimetres)						
		Two-Way (Refer to Figure-22 and Figure-24)				Three-Way (Refer to Figure-23)		
		A	B	C	E	A	C	E
VA-72X1-330-4-P through VA-72X1-339-4-P VS-72X1-390-4-P VS-72X1-391-4-P	1	6 (152)	3-5/8 (92)	1-1/8 (29)	13-5/16 (338)	N/A	N/A	N/A
	1-1/4	6-1/4 (159)	3-15/16 (100)	1-3/8 (35)	13-5/16 (338)	N/A	N/A	N/A
VA-7XXX-330-4-P through VA-7XXX-339-4-P VS-7XXX-390-4-P VS-7XXX-391-4-P	1	4-5/8 (117)	N/A	1-1/8 (29)	13-5/16 (338)	4-5/8 (117)	1-3/4 (44)	12-11/16 (322)
	1-1/4	4-5/8 (117)	N/A	1-3/8 (35)	13-5/16 (338)	4-5/8 (117)	1-5/8 (41)	12-15/16 (329)
	1-1/2	5-3/8 (137)	N/A	1-1/2 (38)	13-3/8 (340)	5-3/8 (137)	1-5/8 (41)	13-1/32 (331)
	2	6-1/8 (156)	N/A	1-9/16 (40)	13-5/8 (346)	6-1/8 (156)	1-7/8 (48)	13-3/32 (333)

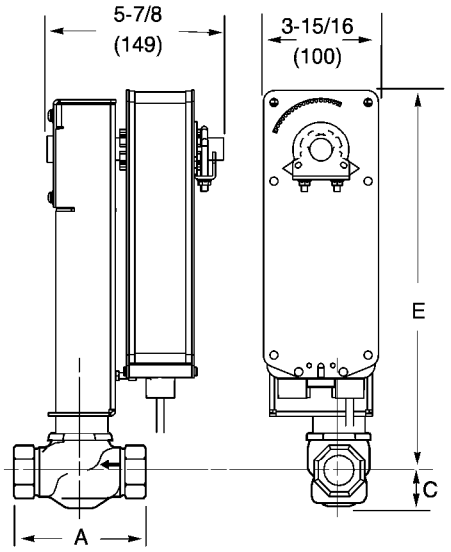


Figure-22 MA-720X Series, MS-7203, MS-7433, or MA-750X Series with Two-Way Valve.

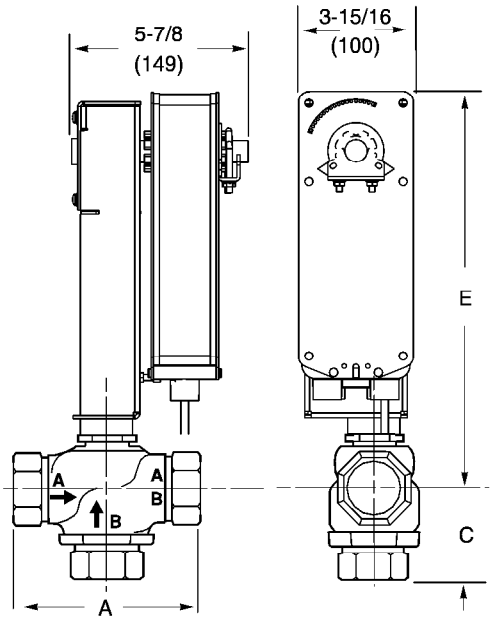


Figure-23 MA-720X Series, MS-7203, MS-7433, or MA-750X Series with Three-Way Valve.

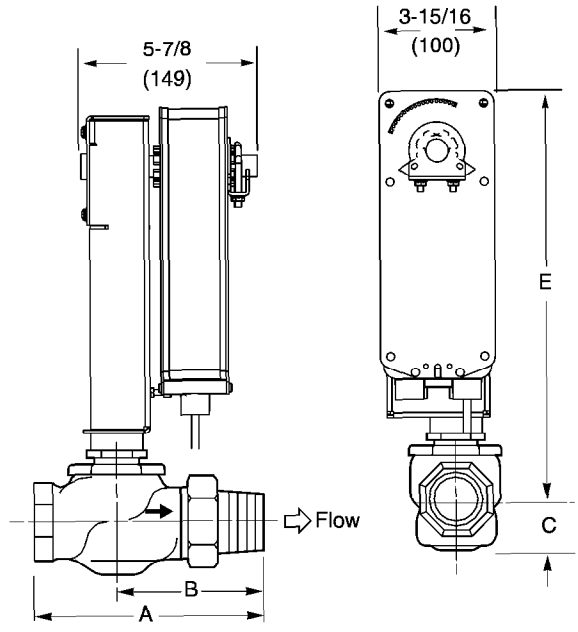


Figure-24 MA-720X Series, MS-7203, MS-7433,
or MA-750X Series with Two-Way Union Straightway Valve.