

VB200R / VB210R & VB300R / VB310R Ball Valves with MB3 and MB6 Series Actuators



Application

The DuraDrive VB210R and VB310R Series Ball valves are Two-Way or Three-way, 1/2" or 3/4" characterized control valves. The VB200R and VB300R models are full port uncharacterised valves for isolation and shut off.

The MB series actuators directly couple to the valves using a unique quick,secure and simple 'pop top' connection. Actuators are available for two-position, floating or proportional control signals.

Typical applications include hot and chilled water control in VAV reheat, fan coil units, and air handling units.

Actuator

Supply Voltage (Proportional and Floating)	..... 24 Vac +25%, -15% @ 50/60 Hz.
Supply Voltage (Two-Position)	..... 24 Vac 50/60, (+25%, -15%). 24V DC (+/-20%)
Manual Operation	
Floating / Modulation	..... Hand lever
Two Position	..... Hex Key (5/32")
Control Signal	... 2-Position, Floating, or Proportional; 0-10V,0-5V, 5-10V, 4-20mA
	Direct or reverse acting
Materials	.....Thermoplastic base and cover. Approved for use in air plenums.
Electrical Connection	.....Terminal Block
Cable Gland (M20)	..... 5-9mm O/D
Shipping & Storage Temp. Limits	..... -40 to 76°C
Operating Temperature Range (at media temp. limits).	
Floating	.....0 to 60 °C
Proportional	.....0 to 60 °C
Two-Position	..... 0 to 76°C
Humidity	.....5 to 95% relative humidity, non-condensing.
Enclosure Rating (Horizontal and Vertical Mounting)	..... IP31.

Specifications

Valve

Service ^a	..... Hot and chilled water, up to 60% glycol.
System Static Pressure Limit	..... PN40.
Media Temperature Limits	.....-7 to 120°C.
Close-off Pressure ^b	..... 895 kPa Two-Way; 480 kPa, Three-Way
ΔPm	..... 205 kPa normal operation, 135 kPa psi quiet operation.
Seat Leakage ^c	.....ANSI class IV (0.01%)
End Connections	.....Rp threaded
Body Material	..... Forged UNC 37700 brass.
Stem Material	..... Stainless steel anti-blow out stem with dual Viton™ o-rings.
Ball Material	..... 304 Stainless steel
Seat Material	.....PTFE.
Characterized Insert	..... Glass-filled PEEK.

a. Not rated for steam service.

b. Close-off is defined as the maximum allowable pressure drop to which a valve may be subjected while fully closed.

c. Seat Leakage in normal direction of flow only

Note: It is the responsibility of the end user to confirm material compatibility with fluid media.

Product Selection: Valve Bodies

VB210R Two-Way Control Valves

Size	Part Number	Part Designation	Thread	kvs
15 mm	VB210R-15BS01	VB210R-15BS 0.25T 00	Rp 1/2	0.25
	VB210R-15BS03	VB210R-15BS 0.6T 00		0.6
	VB210R-15BS04	VB210R-15BS 1.0T 00		1.0
	VB210R-15BS05	VB210R-15BS 1.8T 00		1.8
	VB210R-15BS07	VB210R-15BS 3.0T 00		3.0
	VB210R-15BS08	VB210R-15BS 4.0T 00		4.0
	VB210R-15BS09	VB210R-15BS 6.3T 00		6.3
20 mm	VB210R-20BS08	VB210R-20BS 4.0T 00	Rp 3/4	4.0
	VB210R-20BS09	VB210R-20BS 6.3T 00		6.3

VB200R Two-Way Full Port Valves

Size	Part Number	Part Designation	Thread	kvs
15 mm	VB200R-15BS	VB200R-15BS 8.7T 00	Rp 1/2	8.7
20 mm	VB200R-20BS	VB200R-20BS 8.7T 00	Rp 3/4	8.7

VB310R Three-way Control Valves

Size	Part Number	Part Designation	Thread	kvs
15 mm	VB310R-15BS03	VB310R-15BS 0.52T 00	Rp 1/2	0.52
	VB310R-15BS04	VB310R-15BS 0.86T 00		0.86
	VB310R-15BS05	VB310R-15BS 1.6T 00		1.6
	VB310R-15BS07	VB310R-15BS 2.5T 00		2.5
	VB310R-15BS08	VB310R-15BS 4.0T 00		4.0
	VB310R-15BS09	VB310R-15BS 6.3T 00		6.3
20 mm	VB310R-20BS08	VB310R-20BS 4.0T 00	Rp 3/4	4.0
	VB310R-20BS09	VB310R-20BS 6.3T 00		6.3

VB300R Three-way Full Port Valves

Size	Part Number	Part Designation	Thread	kvs
15 mm	VB300R-15BS	VB300R-15BS 8.7T 00	Rp 1/2	8.7
20 mm	VB300R-20BS	VB300R-20BS 8.7T 00	Rp 3/4	8.7

Application Note for Two-Way and Three-way Valves

The VB210R and VB310R are Characterized Control Ball Valves. They are designed so that flow thru the A-port exhibits equal percentage flow (see Page 8). Thus, the A-port is the control port.

In a Three-way valve, the B-port is the bypass port. Flow thru the B-port is designed to be less than that of the A-port. In most applications, this reduced flow compensates for the pressure drop that is seen by the coil supplied by the A-port.

The VB300R and VB310R should only be used in Mixing applications, and not in Diverting applications

Product Selection: Actuators

Two-Position Actuators

Part Number	Type Designation	Spring Return Action (Valve Normal Position)	Stroke Time, sec. 50/60 Hz	Spring Return Time, sec. 50/60 Hz	VA @ 24V AC/DC	Power Consumption AC/DC
MB6-SO-24T	MB6 SRO-24T T31 00	Normally Open	50 sec.	35	3.5/1.8	2.3/1.6 W
MB6-SC-24T	MB6 SRC-24T T31 00	Normally Closed				

Three Point Floating Actuators (Increase/Decrease)

Part Number	Type Designation	Spring Return Action (Valve Normal Position)	Stroke Time, sec. 50/60 Hz	Time-out Delay, sec. 50/60 Hz	VA	Power Consumption
MB3-24F	MB3-24F T31 00	None	160/135	N/A ^a	2.3	2.5 W
MB3-24F-T3	MB3-24F T31 T3	None		217/181	2.5 ^b	
MB3-SO-24F	MB3 SRO-24F T31 T3	Normally Open		3.2 ^b	3.0 W	
MB3-SC-24F	MB3 SRC-24F T31 T3	Normally Closed				

a. No Time-out feature. Controller must provide time-out after 3 minutes on time.

b. Size transformer for each spring actuators at 10VA

Proportional Actuators (0-10V, 0-5V, 5-10V, 4-20mA)

Part Number	Type Designation	Spring Return Action (Valve Normal Position)	Stroke Time, sec. 50/60 Hz	Time-out Delay, sec. 50/60 Hz	VA	Power Consumption
MB3-24M	MB3-24M T31 00	None	160/135	200/166	2.7 ^c	2.5 W
MB3-SO-24M	MB3 SRO-24M T31 00	Normally Open			2.7 ^c	
MB3-SC-24M	MB3 SRC-24M T31 00	Normally Closed				

c. Size transformer for each spring actuators at 10VA

Function

The DuraDrive Ball Valves and actuator assemblies are designed for flow control based on the control signal input. The actuators are not intended for continuous use in zero dead band control systems.

Spring Return Actuators (all types):

When powered, the actuator moves to the desired position, tensioning the spring return mechanism. When power is removed the actuator returns to the normal position as driven by the Spring Return mechanism. Actuator variants are available which will either open or close a valve when the power supply is removed.

Proportional Actuators:

The control signal input and action is selected by means of the input signal jumpers on the actuator circuit board. All actuators are shipped with the input signal jumper set for a 0 to 10 Vdc control signal and the control action jumper set for direct action (DA; valve opens with an increase in control signal). Multiple actuators may be connected to a single controller. Do not exceed the maximum current draw of the controller or transformer. When using a 4 to 20 mA dc control signal, a separate isolation transformer must be used with each actuator.

Proportional Actuators perform a self-calibration cycle on power-up. The actuator will run to the open direction for approximately 20 seconds and then closed direction for approximately 2 ½ min (60 Hz) or 3 ½ min (50Hz). See Table-2 for exact timing. Once this cycle is complete, the actuator will then accept and respond to the control signal.

Manual positioning of the actuator while power is applied is NOT recommended. If the actuator is manually positioned while power is applied, the calibration cycle will need to be completed again for the actuator to function properly. To recalibrate the actuator, cycle power off for more than 6 seconds.

Floating Actuators:

Spring Return and Non-Spring Return floating actuators with the time-out feature ('T3' in designation code) will automatically limit the running time of the actuator. The time-out feature automatically cuts off the control signal to the valve after three minutes (see Table-1) of continuous operation. Upon change in control signal direction, the actuator will resume operation.

The controller or thermostat used to operate the Non-Spring Return Floating actuator must be configured to turn off the control signal after being continuously on for three minutes. Multiple actuators may be connected to a single controller. Do not exceed the maximum current draw of the controller or transformer.

The Spring return feature should not be used for routine, normal operation

Two Position Spring Return Actuators:

The MB6 is a two position, spring return actuator. It is designed not to falsely spring return in the event of brief power cuts or a low voltage drop below 18V DC. A solenoid disengages the spring return mechanism from the the gear train; After 2 seconds power loss the SR mechanism will activate; subsequently, there is a 3 second delay after power returning before the actuator will accept the control signal.

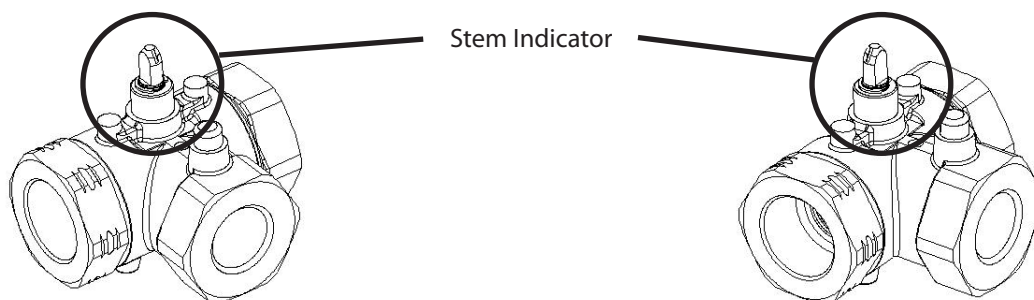
Power/Failure Action

	Control Signal	Position upon loss of power		
		Non-Spring Return Actuator	Spring Return Open Actuator - Fail Open	Spring Return Closed Actuator - Fail Closed
Floating	Power to "Open" terminal will open A to AB	Maintain last position	Will spring A to AB open	Will spring A to AB closed
Proportional	DA jumpered - increase in control signal will open A to AB	Maintain last position	Will spring A to AB open	Will spring A to AB closed
	RA jumpered - increase in control signal will close A to AB	Maintain last position	Will spring A to AB open	Will spring A to AB closed
	Control Signal	Spring Return Open Actuator	Spring Return Closed Actuator	
2-Position	Power On	A to AB Closed	A to AB Open	
	Power Off	A to AB Open	A to AB Closed	

* Two-Way valve operation described. For a Three-way valve, A to AB operation is the same. B to AB operation is opposite that of A to AB operation.

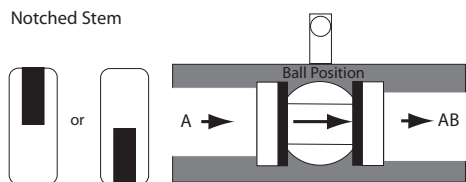
Flow Direction

A notch is cut into the tip of the valve stem and is an external indicator for the closed portion of the ball within the valve.



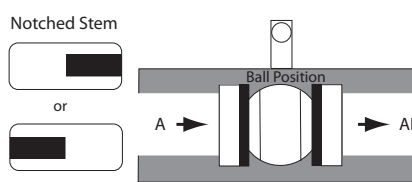
The drawings below mark indicate the stem notch position and ball valve flow path

Notched Stem



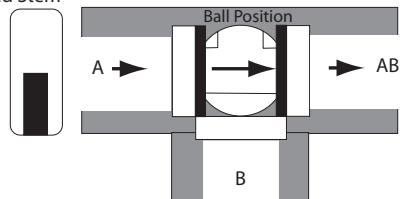
Two-Way Open

Notched Stem



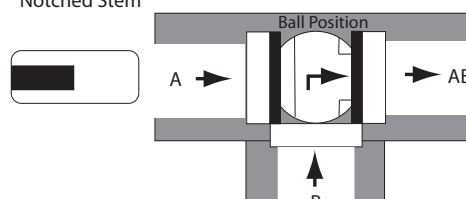
Two-Way Closed

Notched Stem



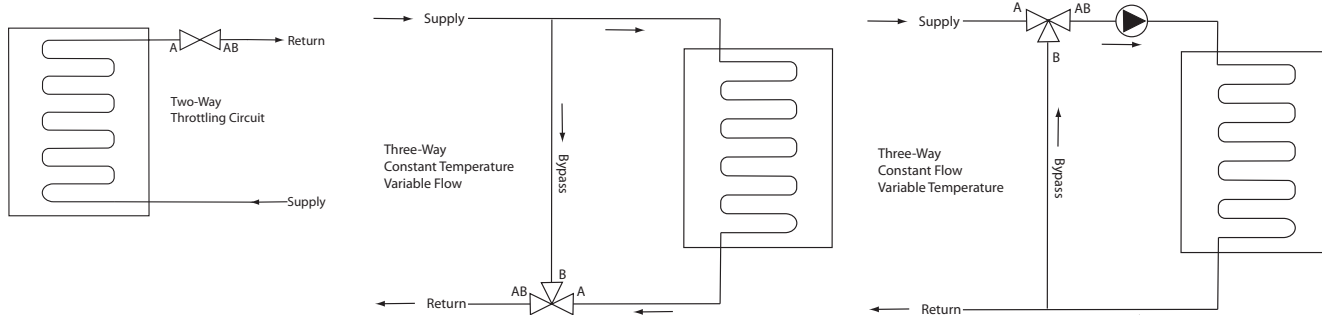
Three-Way, A-Port Open, B-Port Closed

Notched Stem



Three-Way, A-Port Closed, B-Port Open

Application Schematics

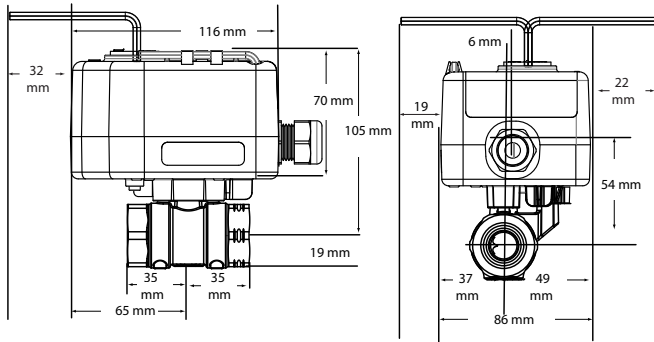


Note:

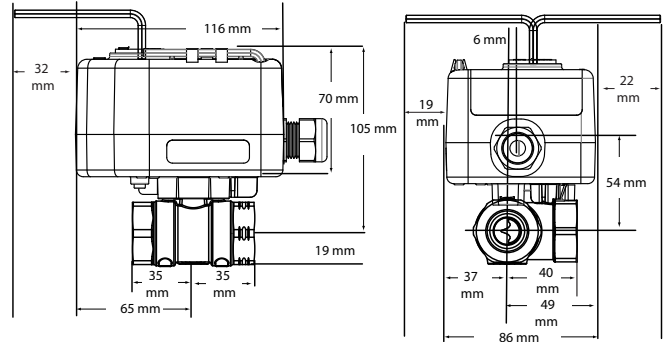
Typical Applications

For simplicity, Balancing Valves and control devices not shown
3 way valves to be used in mixing applications, not diverting.

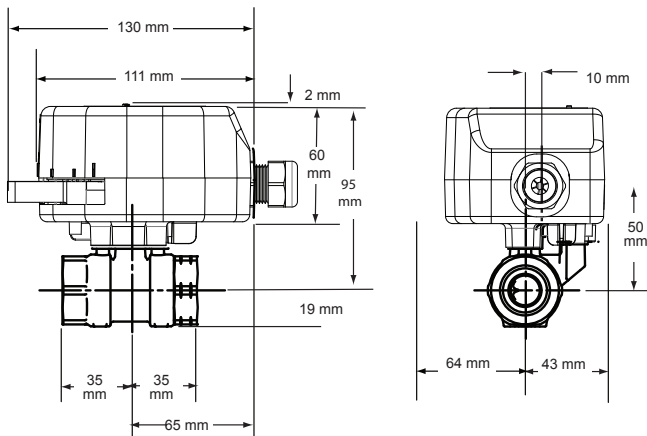
Dimensions and Weights



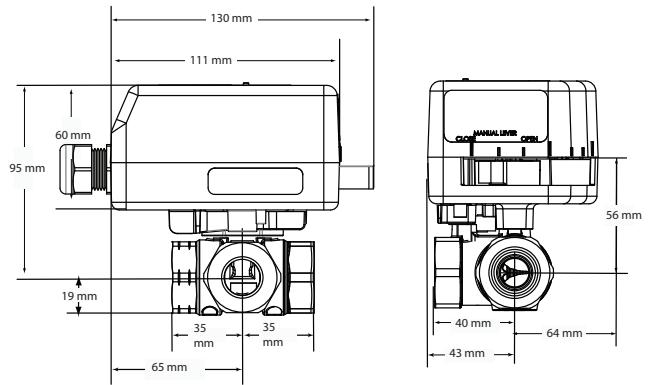
Two-Way Spring Return Two Position Assembly
Weight - 1.054 Kg



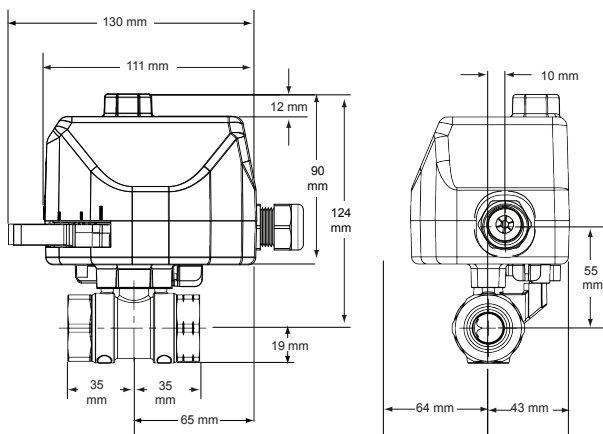
Three-Way Spring Return Two Position Assembly
Weight - 1.225 Kg



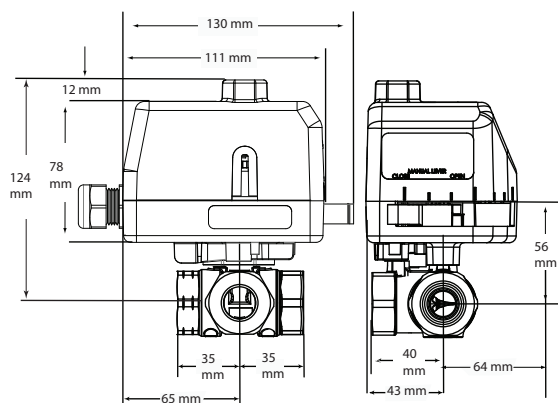
Two-Way Floating/Proportional Non-Spring Return Assembly
Weight: 0.782 Kg



Three-Way Floating/Proportional Non-Spring Return Assembly
Weight: 0.953 Kg



Two-Way Spring Return Floating/Proportional Spring Return Assembly
Weight: 0.873 Kg

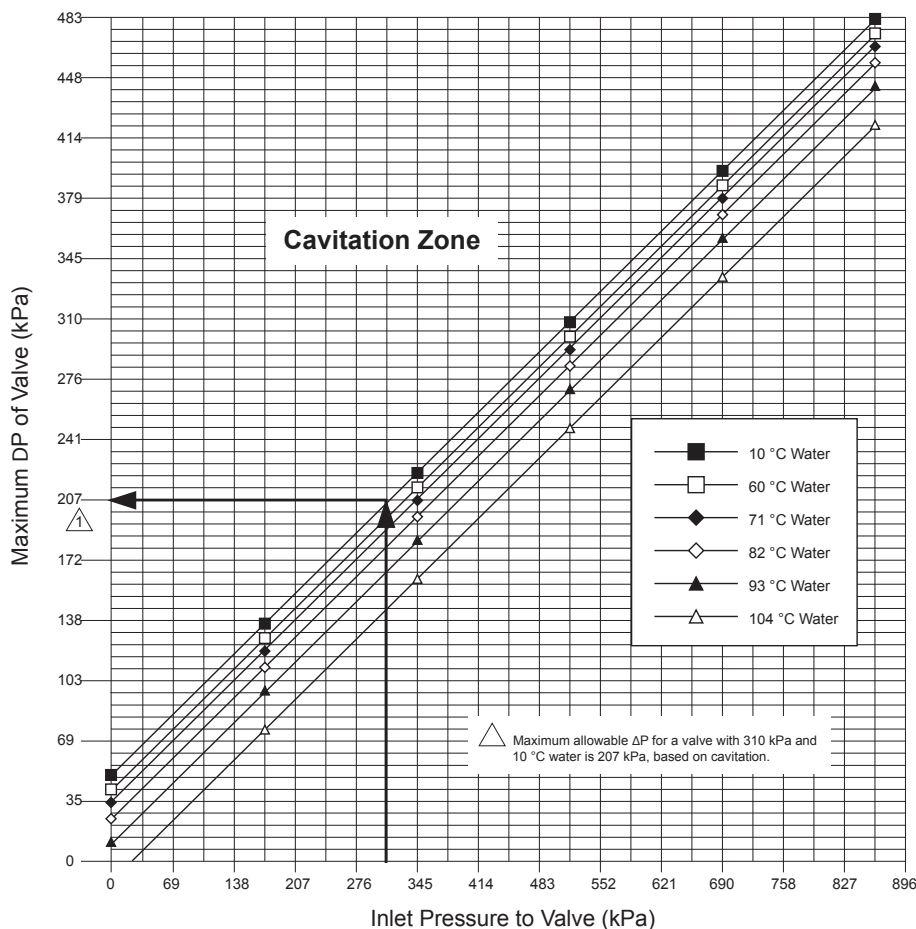


Three-Way Floating/Proportional Spring Return Assembly
Weight 1.044 Kg

An additional 25 mm is required to remove the actuator from the valve.

Cavitation limits on valve pressure drop

A valve selected with a pressure drop that is too high can cause cavitation erosion (or wire drawing) of the flow characterizing insert. In addition, cavitation can cause noise, damage to the valve trim (and possibly the valve body), and turbulent flow through the valve. Do not exceed the maximum differential pressure for the valve selected.



Pressure Drop Selection

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

Pressure Drop

Design Temperature Load Drop °K	Recommended Pressure Drop (% of available pressure)	Multiplier on Load Drop
33	50%	1 x Load Drop
22	69%	2 x Load Drop
11	70%	3 x Load Drop

Flow Coefficient Selection

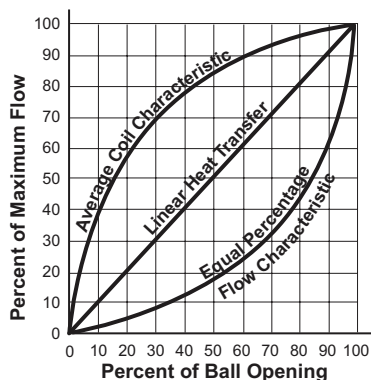
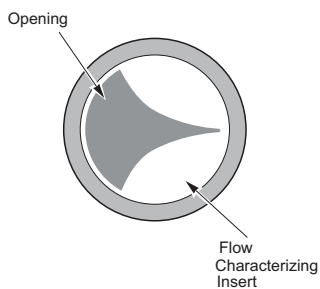
When sizing a valve, you must select a flow coefficient (Kv).

It is calculated using the formula:

$$Kv = (m^3/h) / (\sqrt{\Delta P}) \quad (\Delta P \text{ is in bar})$$

Flow Characteristics

The VB210R and VB310R ball valve assemblies provide equal percentage flow, which is achieved with a flow characterising insert. 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, a ball valve equipped with the characterised flow insert mirrors the flow characteristic of the coil, resulting in linear heat transfer.



Using Pipe Reducers with Ball Valves

This chart provides estimated effective Kvs when using pipe reducers with ball valve assemblies. Use these estimated effective Kv's in place of the rated Kvs when reducers or increasers are located within 6 pipe diameters upstream and 3 pipe diameters downstream of the valve.



Caution

Do not reduce the valve size to less than one-half the line size, as this may weaken the pipe reduction area. Physical injury can result if the weakened piping fails.

Two-Way Valves

Valve Size	Valve Body	Kv	Estimated Effective Kv				
			Pipe Size in Inches				
	RP Threaded		1/2	3/4	1	1-1/4	1-1/2
15 mm	VB210R-15BS03	0.6	0.6	0.6	0.6	–	–
	VB210R-15BS04	1.0	1.0	1.0	1.0	–	–
	VB210R-15BS05	1.8	1.8	1.8	1.8	–	–
	VB210R-15BS07	3.0	3.0	2.8	2.7	–	–
	VB210R-15BS08	4.0	4.0	3.8	3.5	–	–
	VB210R-15BS09	6.3	6.3	5.7	4.8	–	–
	VB200R-15BS	8.7	8.7	7.4	6.0	–	–
20 mm	VB210R-20BS08	4.0	–	4.0	4.0	3.9	3.8
	VB210R-20BS09	6.3	–	6.3	6.3	6.3	6.2
	VB200R-20BS	8.7	–	8.7	8.2	7.8	6.2

Three-Way Valves

Valve Size	Valve Body	Kv	Estimated Effective Kv				
			Pipe Size in Inches				
	RP Threaded		1/2	3/4	1	1-1/4	1-1/2
15 mm	VB310R-15BS03	0.52	.52	.52	.52	–	–
	VB310R-15BS04	0.85	.85	.85	.85	–	–
	VB310R-15BS05	1.6	1.6	1.6	1.6	–	–
	VB310R-15BS07	2.5	2.5	2.5	2.4	–	–
	VB310R-15BS08	4.0	4.0	3.6	3.3	–	–
	VB310R-15BS09	6.3	6.3	5.3	4.4	–	–
	VB300R-15BS	8.7	8.7	7.4	6.0	–	–
20 mm	VB310R-20BS08	4.0	–	4.0	3.8	3.7	3.6
	VB310R-20BS09	6.3	–	6.3	6.1	5.9	4.1
	VB300R-20BS	8.7	–	8.7	8.2	7.8	6.2

Agency Listings

RoHS Compliant	VB valves and MB actuators comply with European Directive 2002/95. Please consult factory for part number specific compliance.
REACH Compliant	Compliant as defined in Article 33 of the REACH regulation No. 1907/2006.
EMC / LVD	EMC Directive MB3 (89/336/EEC), MB6 (2004/108/EEC). Low Voltage Directive (72/23/EEC).
Plenum Rating	Plenum rated per UL E9429 Vol 2 Section 40.
CRN Number	#OCO970.9087TN.
PED	Approved to SEP, article 1 of PED

Water System Maintenance

All heating and cooling systems are susceptible to valve and system problems caused by improper water treatment and system storage procedures. The following guidelines are to help avoid valve and water system problems resulting from improperly treated water or storage procedures, and to obtain maximum life from the valves. To maintain non-damaging conditions, clean the system prior to start up. Use a nitrite or molybdate based treatment program. Use filtration equipment where needed. Properly store off-line systems and monitor water treatment results using corrosion test coupons. Durability of valve stems, balls, seats, and packing is dependent on maintaining non-damaging water conditions. Inadequate water treatment or filtration, not in accordance with chemical supplier/ASHRAE handbook recommendations, can result in corrosion, scale, and abrasive particle formation. Scale and particulates can result in stem and packing scratches, and can adversely affect packing life and other parts of the hydronic system. Follow the advice of a water treatment professional.

Maintenance

The ball valve assembly itself requires no maintenance. The stem and packing design eliminates the need for packing adjustment for the life of the valve. However, regular maintenance of the total heating and cooling system is recommended to ensure sustained optimum performance.

Field Repair

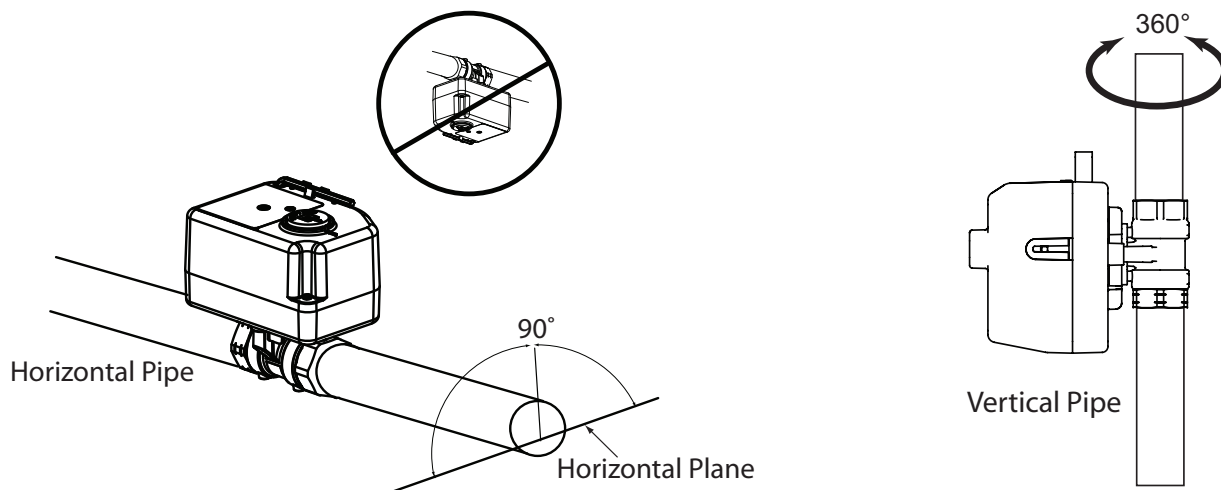
Neither valve nor actuator are field repairable. Replace entire unit as necessary.

Patents

US Patents for VB1/VB2 Series Valves and MB3/MB6 Series Actuators: 5815365, 6044857, 6073907, 7111643, 7131635, 7367544, 7559531. Other US and foreign patents pending.

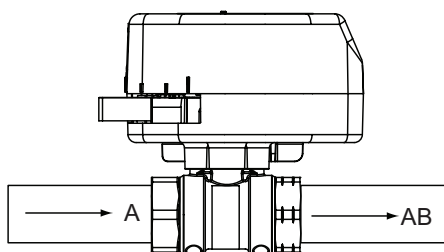
Mounting

The valves can be mounted in horizontal or vertical piping. When installed in horizontal piping, the actuator must be above the valve body. When installed in horizontal piping the actuator can be tilted left or right but it must not be tilted below 90° from vertical.

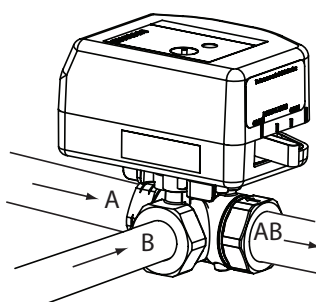


Piping

These valves must be piped so the flow is in the direction of the diagrams below. Flow is from A (and/or B) to AB.



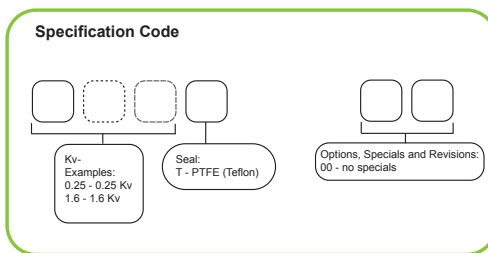
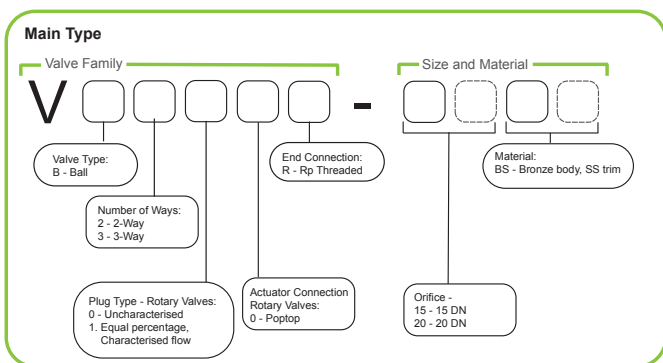
Two-Way Valve: Flow A to AB



Three-Way Valve: Mixing Only
A and/or B to AB.

Type Designation Guide

Valve Bodies



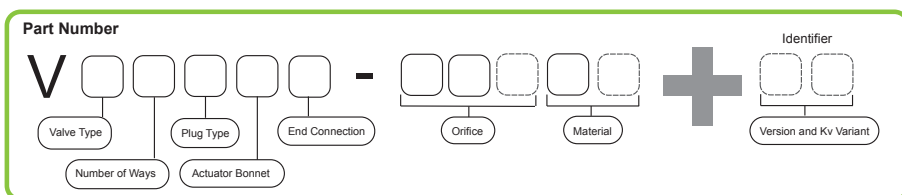
Construction Guide:

The designation covering the two-way, 15mm ball valve with Rp threads and a 1.0 kv:

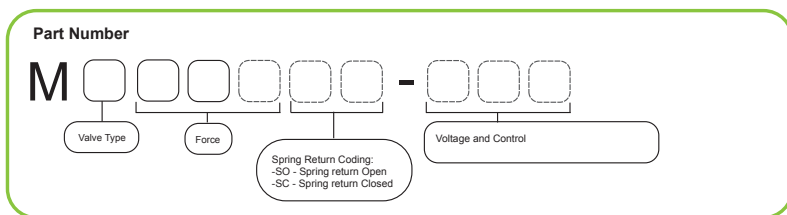
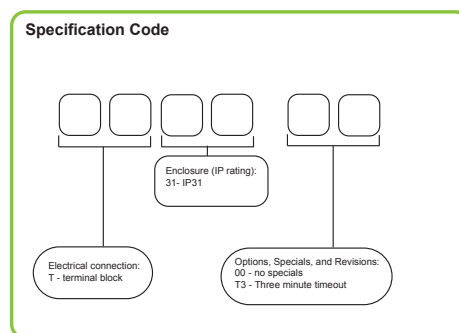
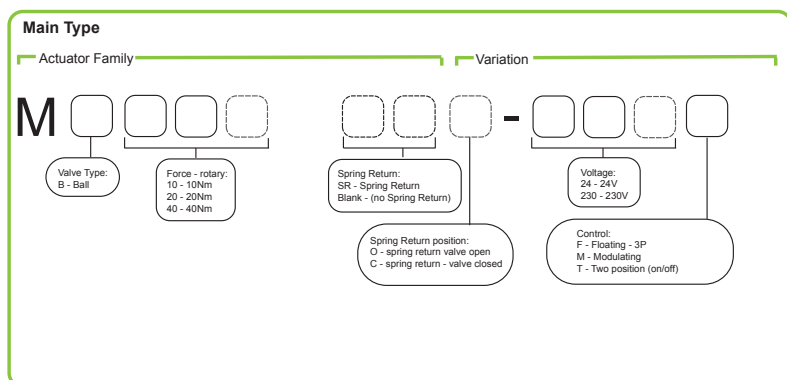
Full Type Designation:
VB210R-15BS 1.0T 00

Family:
VB210R

Part Number
VB210R-15BS04



Actuators



Construction Guide:

The Two-Position , normally-open ball valve Actuators looks as follows:

Full Type Designation:
MB6 SRO-24T T31 00

Family:
MB6

Part Number:
MB6-SO-24T