V-Series Two-way and Three-way Globe Valve Bodies, Components and Assemblies

Features:

- Heating and cooling applications for non-corrosive fluids
- Steam and hot water flow control
- Complete valve assemblies or components available
- Electric or hydraulic actuators and linkages
- Two-way flow and three-way mixing and diverting valves
- 1/2" to 6" valve sizes

The high quality V-Series two-way and three-way globe valves are manufactured to exact specifications and are designed to provide years of reliable service. The assemblies are designed for heating/cooling applications using steam, water, glycol or other non-corrosive fluids. **The V-Series assemblies should not be used with combustible fluids such as natural gas.** The V-Series products are available as complete assemblies but most users purchase the bodies, actuators and linkages separately for convenient local assembly.

Valve Bodies

Valve bodies are available in the two-way configuration with stem-up open (normally open) and stem-up closed (normally closed) versions. Three-way mixing and diverting valve bodies are also available. Valve body sizes range from 1/2 inch to 6-inch pipe and 5/8" O.D. copper tube size. Valve body styles include; screw thread, union and flared in cast bronze, flanged in cast iron.

Actuators

Depending upon the application, three classes of our actuators are suitable for use with our valve bodies; linear stroke hydraulic, linear stroke electric and rotary stroke box style actuators. See the Actuators section of this catalog for complete details.

Linkage kits

Most actuators require mechanical linkage kits specifically designed to couple them to the valve bodies. Several varieties of linkage kits are available to match the valve bodies to our range of actuators for various applications. Complete assembly instructions are supplied with each kit.

Complete Valve Assemblies

Complete valve assemblies consist of a valve body and selected actuator coupled by a matching linkage kit. Usually customers order the body, actuator and linkage kit individually and easily assemble their own valve assemblies. However, among the many possible combinations of bodies, actuators and linkages, there are several standard ones that may be ordered from the factory as completely pre-assembled valve assemblies.

Valve Model Code

Refer to the sample valve model code below for the format to use when specifying model numbers. When valve bodies only are being specified, the Control Form field will always be specified as "VB" and the Actuator field will always be "000". When a complete factory assembled valve is being specified, the Control Form field will change to one of five options (VA, VC, VF, VP, or VS), depending upon the type of control action delivered by the selected actuator. The actuator and matching linkage for this Control Form are then identified in the Actuator field by replacing the "000" with a prescribed three-digit code identifier for the selected combination. This three-digit code is only used when specifying available factory assembled valves. A description of available 3-digit codes for the Actuator field, which specifies factory assembled valves is given in the Valve Assembly Tables beginning on page 3–27.

Sample Ordering Codes for Valves:

Control Form		Body		End Fitting	Actuator	Pattern	Valve Size
	–		–		–		–		

Control Form

Valve Body	
VB	Valve body only, no actuator
Valve Assemblies	
VA	Actuator with two position ON-OFF spring return
VC	Actuator with two position ON-OFF nonspring return
VF	Actuator with floating control non-spring return
VP	Actuator with proportional control and slidewire feedback
VS	Actuator with proportional control and analog input

Body

Two-Way	
721	Stem up open, brass trim with disc, 1/2" to 2"
921	Stem up open, brass trim with disc, 2-1/2" to 6"
722	Stem up closed, brass trim with disc, 1/2" to 2"
725	Stem up open, s.s trim with disc, 1/2" to 2"
726	Stem up closed, s.s trim with disc, 1/2" to 2"
727	Stem up open, s.s trim, 1/2" to 2"
728	Stem up closed, s.s trim, 1/2" to 2"
Three-Way	
731	Mixing, 1/2" to 2"
931	Mixing, 2-1/2" to 6"
732	Diverting, 1/2" to 2"
932	Diverting, 2-1/2" to 6"

End Fitting

1	Union
2	Flared
3	Screwed or flanged
4	Union sweat

Actuator

000	None, valve body only
XXX	Actuator/linkage assembly code for factory assembled units

Pattern

3	Angle
4	Straightaway
5	Globe, flanged

Valve Size Port PP Code*

01	1/2 inch, reduced port	08	1 inch
02	1/2 inch, reduced port	09	1 1/4 inch
03	1/2 inch, reduced port	10	1 1/2 inch
04	1/2 inch	11	2 inch
05	3/4 inch, reduced port	12	2 1/2 inch
06	3/4 inch	13	3 inch
07	1 inch, reduced port	14	4 inch
		15	5 inch
		16	6 inch

* Size codes 01-16 for 1/2" to 6" valve size

Valve Selection

How to Select a Valve

Each valve assembly consists of a valve body, an actuator and a linkage kit. The instructions and tables in this catalog will guide you in selecting the proper components or factory assemblies.

1. Determine the Application Criteria

Flow type required

two-way, equal % or modified linear

three-way, mixing or diverting

Fluid type (hot water, steam, glycol, etc.)

Fluid temperature

Inlet pressure required

Existing piping or tubing size

2. Determine Valve Control Form Required

The Control Form specifies the type of control action for the valve assembly. There are six different control forms. Form VB specifies the valve body only. Determine the desired Control Form for the valve assembly in your application from the table below.

3. Determine Required C_v

General information and guidance on valve sizing is presented in pages 3–35 to 3–43. Sizing the valve is the most important valve selection criteria

For Control Form VA and VC (ON-OFF), C_v value does not affect valve body selection. Use the largest C_v available in the desired pipe size to size the valve.

For Control Form VF, VP and VS (floating and proportional control), go to the section in this catalog on valve sizing (pages 3–35 to 3–43) to determine the C_v needed for the application. To determine C_v , the following parameters must be identified:

inlet pressure

fluid temperature

fluid specific gravity

fluid flow rate in GPM (liquid) . . or

fluid flow rate in lbs./hr (steam)

Valve Assembly Control Form

Form	Control Action	Spring	Actuator*	Input Signal
VB	None	None	None	Valve body only
VA	Two Position, ON-OFF	Spring Return (NO/NC)	RSE	Dry contact, single input
VC	Two Position, ON-OFF	Non-Spring Return	RSE	Dry contact, dual input
VF	Floating	Non-Spring Return	LSE	Dry contact, dual input
VP	Proportional, slidewire feedback	Spring Return (NO/NC)	RSE	Dry contact, dual input
VP	Proportional, slidewire feedback	Non-Spring Return	RSE	Dry contact, dual input
VS	Proportional, analog input	Spring Return	RSE	Analog
VS	Proportional, analog input	Spring Return	LSH	Analog
VS	Proportional, analog input	Non-Spring Return	RSE, LSE	Analog

* LSE: linear stroke electric
LSH: Linear stroke hydraulic
RSE: Rotary stroke electric

Valve Selection

4. Select Valve Body

For Control Form VA or VC (ON-OFF), use the criteria identified in (1.) above to select the desired valve body. Make sure the valve body selected has a pressure rating suitable to the fluid pressure. Specify the largest C_v rating in the desired pipe or tubing size for that selected valve body. Remember that ON-OFF control action requires an electric actuator that uses the stem-up open version of the valve body only. If the selected electric actuator is a spring return type, the valve can be configured normally open or normally closed as determined by assembly of the actuator linkage.

For Control Form VF (floating), only an electric actuator and only the stem-up open version of the valve body that meets the application criteria may be used. Make sure the valve body selected has a pressure rating equal to or greater than the fluid pressure. For the chosen valve body, select a valve size (PP code) whose C_v is nearest to the C_v determined from valve sizing. In some cases this choice may require the piping size to be reduced to fit the selected valve.

For Control Form VP or VS (proportional control applications) using electric actuators, you may select only the stem-up open version of the valve body that meets the application criteria (stem-up closed actuators require a hydraulic actuator). Make sure the valve body selected has a pressure rating equal to or greater than the fluid pressure. If the selected actuator is a spring return type, the valve can be configured normally open or normally closed as determined by the selection of the actuator. For the chosen valve body, select a valve size (PP code) whose C_v is nearest to the C_v determined from valve sizing. In some cases this choice may require the piping size to be reduced to fit the selected valve.

For Control Form VS (proportional control applications) using hydraulic actuators, select either the stem-up open or stem-up closed valve body that meets the application criteria Make sure the valve body selected has a pressure rating suitable to the fluid pressure. For the chosen valve body, select a valve size (PP code) whose C_v is nearest to the C_v determined from valve sizing. . Remember hydraulic actuators may only be used with valve sizes up to 2". This choice may require the piping size to be reduced to fit the selected valve.

5. Select the Actuator

For the chosen Control Form, consult the actuator selection table on page 3–18 for an overview of the actuator types, control action, torque and travel time to assist in determining the full actuator specification. Note that there are many models of actuators available from the company in our catalog, but only those with 180° of travel and those with available linkage kits may be used for control of our valves.

Control Form V A
Electric Rotary Actuator, two position with spring return and single contact input

For an electric actuator with two-position ON-OFF control action and spring return, select the EA12 actuator. The EA12 may be configured for normally open or normally closed operation by the selection of the appropriate actuator linkage. Check the close-off pressure table on page 3–22 to determine if the EA12 actuators have enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. Check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–20.

Control Form V C
Electric Rotary Actuator, two position with non-spring return and single contact input

For an electric actuator with two-position ON-OFF control action and non-spring return, select the EA31 actuator. Check the close-off pressure table on page 3–23 to determine if the EA31 actuators have enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. Check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–20.

Valve Selection

Control Form VF
Electric Linear Actuator, floating control with non-spring return and dual contact input

For floating control action the MF-63103 or MF-63123 actuator style must be selected. Check the close-off pressure table on page 3–24 to determine if these actuators have enough force to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–21.

Control Form VP
Electric Rotary Actuator, proportional control with slidewire feedback, spring return and dual contact input. Note that floating control action can be accomplished in Control Form VP if slidewire feedback is ignored.

For spring return proportional control action, the box style Models EA42 or EA44 low torque electric actuator may be used.

These actuators may be configured for normally open or normally closed operation by the assembly of the appropriate actuator linkage. Check the close-off pressure table on page 3–22 to determine if the EA4x actuator has enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–20.

Electric Rotary Actuator, proportional control with slidewire feedback, non-spring return and dual contact input.

For proportional control action with non-spring return, the medium torque models EA52, EA54, EA56 and EA58 and high torque EA76 electric actuators with dual contact input may be used.

Check the close-off pressure tables on page 3–22 to 3–24 to determine if the EA5x or EA76 actuator has enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature tables on pages 3–19 and 3–20.

Control Form VS
Electric Rotary Actuator, proportional control, spring return, analog input

The new EAxx-A Series of box style actuators with integral microprocessor based electronics are available with analog input and switch selectable 180° stroke. The EA42-A and EA44-A are low torque spring return actuators and are selected for normally open or normally closed operation. Check the close-off pressure table on page 3–22 to determine if the EA42-A or EA44-A actuators have enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. Check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–20.

Electric Rotary Actuator, proportional control, non-spring return, analog input

The new EAxx-A Series of box style actuators with integral microprocessor based electronics are also available in non-spring return versions. The EA52-A, EA54-A, EA56-A and EA58-A medium torque actuators and EA76-A high torque actuators have non-spring return action and accept analog input signals. Check the close-off pressure table on pages 3–22 to 3–24 to determine if the EAxx-A actuators have enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature tables on pages 3–19 and 3–20.

Valve Selection

Electric Linear Actuator, floating control with non-spring return and optional analog input.

The MF-63123 non-spring return linear stroke electric actuator with floating input (Control Form VF) may be converted to an analog input actuator (Control Form VS) by the addition of an optional analog input card (MFC-420 for current or MFC-8000 for voltage). Check the close-off pressure table on page 3–24 to determine if the MF-63123 actuator with analog input has enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature tables on page 3–21.

Hydraulic Linear Actuator, proportional control, spring return, analog input

For proportional control action the EA81 hydraulic actuator accepts a 4-20mA input signal and is our most economical actuator for smaller valve assemblies. Note that the EA81 should not be used with fluid temperatures below 40°F. Check the close-off pressure table on page 3–25 to determine if the EA81 actuator has enough torque to shut the valve against the expected inlet pressure criteria at the valve size selected. This pressure rating must be higher than the fluid inlet pressure in the application criteria. Also check any temperature restrictions on use of this actuator as noted on the temperature table on page 3–19.

Options

Note that options can be specified in the actuator model code, even though they are not listed in the Actuator Selection Table on page 3–18. Unless noted as available factory assemblies in the Valve Assembly Tables commencing on page 3–27, selecting actuators with options requires that the actuator, valve body and linkage kit be purchased as separate items.

6. Select the Linkage Kit

The suitable valve/actuator combinations are listed in detail with part numbers in the Valve Assembly Tables beginning on page 3–27. These tables provide the part number of the mechanical linkage kit that couples the selected actuator to the desired valve body for that application. The MF-63000 series, when used with 2" or smaller valves, requires no linkage.

7. Valve Assemblies vs Valve Components

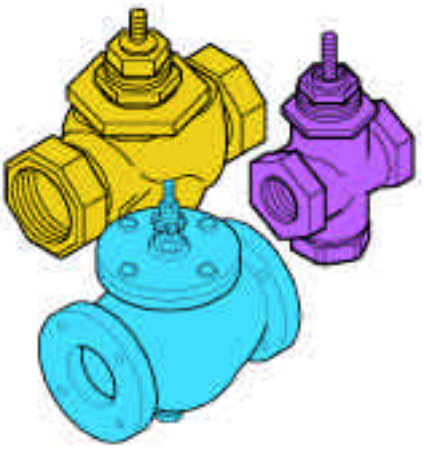
Once the valve body, actuator and linkage are selected, they may be ordered in one of two ways. It may be ordered fully assembled if the combination is an available factory valve assembly. Available factory assemblies are noted in the Valve Assembly Tables commencing on page 3–27. The part number will commence with the code that designates the Control Form (VA, VC, VF, VP, VS). Only those entries in the column “Available factory assemblies” may be ordered as full assemblies. Note that the actuator received with this assembly must conform to the configuration of the actuator specified for that entry. Any other actuator configuration of options not specifically delineated cannot be ordered as a factory assembled valve.

If the selected assembly is not listed as an available factory assembly, the valve assembly must be ordered as body, actuator and linkage components and assembled locally using the complete instructions provided with the linkage kit. When ordering the valve body, actuator and linkage separately, the full model numbers for these components must be specified (see the Actuators section of this catalog).

8. Examples

See the valve slection examples beginning on page 3–51

Two-Way Valve Bodies



Introduction

Valve bodies are available in two-way configuration with stem-up open and stem-up closed configurations. Stem-up closed models are restricted to use with hydraulic actuators. The linkages used with electric actuators are only compatible with stem-up open bodies. Sizes range from 1/2" to 6" pipe size or 5/8" O.D. SAE 45° copper tube.

Selecting the proper valve body requires the following data:

- Fluid type
- Fluid temperature
- Port size (C_v rating)

Selecting the proper port size requires the following data:

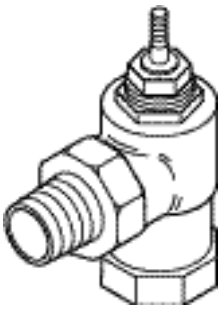
- Inlet pressure
- Required flow rate in either GPM (liquid) or lbs/hr (steam).

If the customer is using on-off control, just select the valve body with the largest port size in the requested pipe size. Remember the following rule when sizing the valve for floating or proportional control. "At least one-half of the available pressure must drop across the valve body when the valve is fully open." An oversized valve body will result in very nonlinear control action. It is better to have too small of a valve body than too large of one. Please refer to the section on valve sizing (pages 35–43) for complete data.

Model: VB-7211-000-3-PP
Union Angle Mount Two-Way Valve

The VB-7211-000-3-PP series valve body has a right angle flow pattern. The inlet has a female pipe thread. The outlet has a union for easy installation.

These valves are available in 1/2 inch through 1-1/4 inch pipe size. Stem-up open is the only configuration offered. The factory assembled valves are available with hydraulic actuators only.



Fluid Type	Chilled or hot water 281°F max, steam 35 psig max
Stem-up open	VB-7211-000-3-PP
Stem-up closed	Not available
Size	1/2 to 1-1/4"
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250(up to 400 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature range	20 to 281°F
Maximum. differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pressure requirements.

Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20							

** Reduced port*

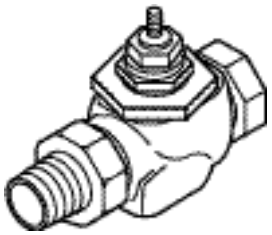
Two-Way Valve Bodies

Model: VB-7211-000-4-PP
Model: VB-7221-000-4-PP
Union Straightway mount two-way valve

This series has a straight flow pattern. The inlet has a female pipe thread. The outlet has a union for easy installation. These valves are available in 1/2" through 1-1/4" pipe size.

Model VB-7211 is configured stem-up open.
Model VB-7221 is configured stem-up closed

Factory assembled valves are available with hydraulic actuators.



Fluid Type	Chilled or hot water 281°F max, steam 35 psig max
Stem-up open	VB - 7211 - 000 - 4 - PP
Stem-up closed	VB - 7221 - 000 - 4 - PP
Size	1/2 to 1-1/4"
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure, seam	35 psig
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution:Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.

Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20							

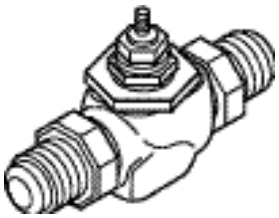
** Reduced port*

Model: VB-7212-000-4-PP
Model: VB-7222-000-4-PP
Flared straightaway mount two-way valve

This series is designed for connection to copper tubing rather than pipe. Mounting is designed for tube with a 5/8" O.D. SAE 45° flare. Four C_V ratings from .4 to 4.4 are available.

Model VB-7212 is configured stem-up open.
Model VB-7222 is configured stem-up closed

Factory assembled valves are available with hydraulic actuators.



Fluid Type	Chilled or hot water 281°F max, steam 35 psig max
Stem-up open	VB - 7212 - 000 - 4 - PP
Stem-up closed	VB - 7222 - 000 - 4 - PP
Size	5/8" 0.D. SAE 45°
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution:Solder and tubing must meet or exceed working static pressure requirements.

Valve PP code	01*	02*	03*	04	05	06	07	08	09	10	11	12	13	14	15	16
Copper tube (in.)	1/2**															
Port size (C_v rating)	.4	1.3	2.2	4.4												

** Reduced port*

*** 5/8" O.D. SAE 45°*

Two-Way Valve Bodies

Model: VB-7213-000-4-PP
Model: VB-7223-000-4-PP
Screwed NPT straightaway mount two-way valve

This is our most popular series. The valve body has female pipe thread at both inlet and outlet. These valves are available in 1/2" through 2" pipe size.

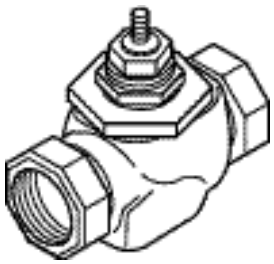
Model VB-7213 is configured stem-up open.
Model VB-7223 is configured stem-up closed

VB-7213 factory assembled valves are available with hydraulic and electric actuators. VB-7223 factory assembled valves are available with hydraulic actuators only.

Fluid Type	Chilled or hot water 281°F max, Steam 35 psig max
Stem-up open	VB - 7213 - 000 - 4 - PP
Stem-up closed	VB - 7223 - 000 - 4 - PP
Size	1/2 to 2"
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pressure requirements.



Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20	30	40					

** Reduced port*

Model: VB-7214-000-4-PP
Model: VB-7224-000-4-PP
Union Sweat straightaway mount two-way valve

These valves have unions designed to be sweated to copper pipe. The valves are available in 1/2" through 2" pipe size.

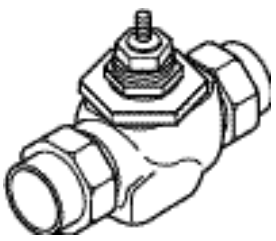
Model VB-7214 is configured stem-up open.
Model VB-7224 is configured stem-up closed

VB-7214 factory assembled valves are available with hydraulic and electric actuators. VB-7224 factory assembled valves are available with hydraulic actuators only.

Fluid Type	Chilled or hot water 281°F max, Steam 35 psig max
Stem-up open	VB - 7214 - 000 - 4 - PP
Stem-up closed	VB - 7224 - 000 - 4 - PP
Size	1/2 to 2"
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution:Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pressure requirements.



Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20	30	40					

** Reduced port*

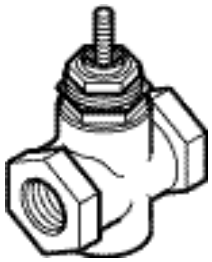
Two-Way Valve Bodies

Model: VB-9213-000-4-PP
Screwed NPT straightaway mount two-way valve

This is a continuation of our popular VB-7213 series. The valve body has female pipe thread at both inlet and outlet. This valve is available in 2-1/2" and 3" pipe size.

Model VB-9213 is configured stem-up open.

VB-9213 factory assembled valves are available with electric actuators only.



Fluid Type	Chilled or hot water 281°F max, Steam 35 psig max
Stem-up open	VB - 9213 - 000 - 4 - PP
Size	2-1/2 to 3"
Flow type	Equal %
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature range	40 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.

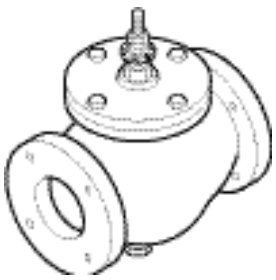
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)												65	85			

Model: VB-9213-000-5-PP
Flange mount two-way valve

This valve has a cast iron body and 125 lb pipe flange at both inlet and outlet. It is available in 2-1/2" through 6" pipe size.

Model VB-9213 is configured stem-up open.

VB-9213 factory assembled valves are available with electric actuators only.



Fluid Type	Chilled or hot water 281°F max, Steam 35 psig max
Stem-up open	VB - 9213 - 000 - 5 - PP
Size	2-1/2 to 6"
Flow type	Equal %
Body	Cast Iron
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	Composition
Static pressure rating	125 (up to 200 psig below 150°F)
Maximum inlet pressure for steam	35 psig
Fluid temperature	40 to 281°F
Maximum differential pressure for water	35 psi
Maximum differential pressure for steam	20 psi

Caution:Freezer protection required for fluid temperature below 32°F (0°C)

Caution:Fittings and piping schedules must meet or exceed working static pres - sure requirements.

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)												56	85	145	235	350

Two-Way Valve Bodies

Model: VB-7253-000-4-PP
Model: VB-7263-000-4-PP
Screwed NPT straightaway mount two-way valve

These valves are an upgrade of our popular VB-7213 and VB-7223 series rated for higher inlet pressure and fluid temperature. These valves are available in 1/2" through 2" pipe size.

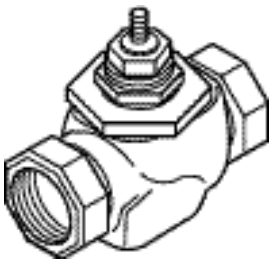
Model VB-7253 is configured stem-up open.
Model VB-7263 is configured stem-up closed

VB-7253 factory assembled valves are available with hydraulic and electric actuators. VB-7263 factory assembled valves are available with hydraulic actuators only.

Fluid Type	Hot water 300°F max, Steam 100 psig max
Stem-up open	VB - 7253 - 000 - 4 - PP
Stem-up closed	VB - 7263 - 000 - 4 - PP
Size	1-1/2 to 2"
Flow type	Modified linear
Body	Bronze
Seat	Stainless steel
Stem	Stainless steel
Plug	Stainless steel
Packing	Spring loaded TFE
Disc	Teflon
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	100 psig
Fluid temperature range	20 to 340°F
Maximum differential pressure for water	35 psi for normal life
Maximum differential pressure for steam	35 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution:Fittings and piping schedules must meet or exceed working static pres - sure requirements.



Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20	30	40					

** Reduced port*

Model: VB-7273-000-4-PP
Model: VB-7283-000-4-PP
Screwed NPT straightaway mount two-way valve

These valves are an upgrade of our popular VB-7213 and VB-7223. They have the highest rating for inlet pressure and fluid temperature of all the valves we offer. They do not have a disk and will have up to 2% closed state leakage. These valves are available in 1/2" through 2" pipe size.

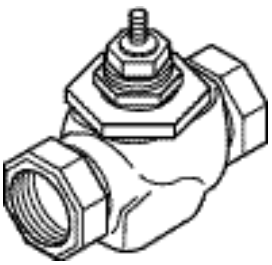
Model VB-7273 is configured stem-up open.
Model VB-7283 is configured stem-up closed

VB-7273 factory assembled valves are available with hydraulic and electric actuators. VB-7283 factory assembled valves are available with hydraulic actuators only.

Fluid Type	Hot water 366°F max, Steam 150 psig max
Stem-up open	VB - 7273 - 000 - 4 - PP
Stem-up closed	VB - 7283 - 000 - 4 - PP
Size	1-1/2 to 2"
Flow type	Modified linear
Body	Bronze
Seat	Stainless steel
Stem	Stainless steel
Plug	Stainless steel
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum inlet pressure for steam	150 psig
Fluid temperature range	20 to 400°F
Maximum differential pressure for water	35 psi for normal life
Maximum differential pressure for steam	50 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

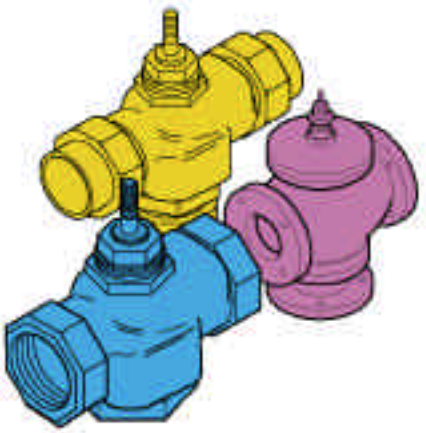
Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.



Valve PP code	01*	02*	03*	04	05*	06	07*	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)	.4	1.3	2.2	4.4	5.5	7.5	10	14	20	30	40					

** Reduced port*

Three-Way Valve Bodies



Introduction

Valve bodies are available in three-way configuration as mixing and diverting valves. Sizes range from 1/2" to 6" pipe size or 5/8" O.D. SAE 45º copper tube.

Selecting the proper valve body requires the following data:

- Fluid type
- Fluid temperature
- Port size (C_v rating)

Selecting the proper port size requires the following data:

- Inlet pressure
- Required flow rate in either GPM (liquid) or lbs/hr (steam).

If the customer is using on-off control, just select the valve body with the largest port size in the requested pipe size. Remember the following rule when sizing the valve for proportional control. "At least one-half of the available pressure must drop across the valve body when the valve is fully open." An oversized valve body will result in very nonlinear control action. It is better to have too small of a valve body than too large of one. Please refer to the section on valve sizing (page 35–43) for complete data.

Model: VB-7312-000-4-PP
Flared straightaway mount three-way mixing valve

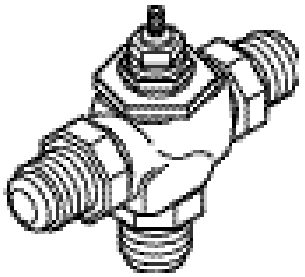
Mixing valves have two inlets and one outlet and are configured for combining two fluids. This series is designed for connection to copper tubing rather than pipe. Mounting is designed for tube with a 5/8" O.D. SAE 45° flare. C_v ratings of 2.2 and 4.4 are available.

Factory assembled valves are available with hydraulic actuators only.

Fluid Type	Chilled or hot water 281°F max
	VB - 7312 - 000 - 4 - PP
Flow type	Mixing
Size	5/8" O.D. SAE 45°
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Maximum fluid temperature	20 to 281°F
Maximum differential pressure for water	35 psi

Caution:Freezer protection required for fluid temperature below 32°F (0°C)

Caution:Solder and tubing must meet or exceed working static pressure requirements.



Valve PP code	01	02*	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Copper tube (in.)	1/2**															
Port size (C_v rating)		2.2		4.4												

* *Reduced port*

** *(5/8" O.D. SAE 45°)*

Three-Way Valve Bodies

Model: VB-7313-000-4-PP
Screwed NPT straightaway mount three-way mixing valve

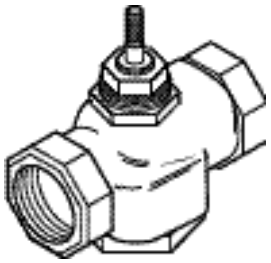
Mixing valves have two inlets and one outlet and are configured for combining two fluids. This is our most popular series of mixing valves. The valve body has female pipe thread at both inlets and the outlet. These valves are available in 1/2" through 2" pipe size.

Factory assembled valves are available with hydraulic and electric actuators.

Fluid Type	Chilled or hot water 281°F max
VB - 7313 - 000 - 4 - PP	
Flow type	Mixing
Size	1-1/2 to 2"
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.



Valve PP code	01	02*	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)		2.2		4.4		7		14	20	30	40					

** Reduced port*

Model: VB-7314-000-4-PP
Union sweat straightaway three-way mixing valve

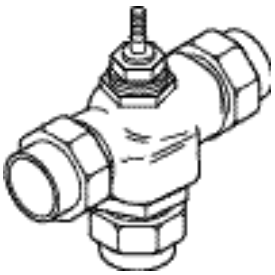
Mixing valves have two inlets and one outlet and are configured for combining two fluids. These valves have unions designed to be sweated to copper pipe. These valves are available in 1/2" through 2" pipe size.

Factory assembled valves are available with hydraulic and electric actuators.

Fluid Type	Chilled or hot water 281°F max
	VB - 7314 - 000 - 4 - PP
Flow type	Mixing
Size	1-1/2 to 2"
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.



Valve PP code	01	02*	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)		2.2		4.4		7		14	20	30	40					

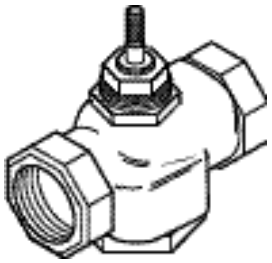
** Reduced port*

Three-Way Valve Bodies

Model: VB-7323-000-4-PP
Screwed NPT straightaway mount three-way diverting valve

Diverting valves have one inlet and two outlets and are configured for diverting a fluid to two different locations. The valve body has female pipe thread at both outlets and the inlet. These valves are available in 1/2" through 2" pipe size.

Factory assembled valves are available with hydraulic and electric actuators.



Fluid Type	Chilled or hot water 281°F max
	VB - 7323 - 000 - 4 - PP
Flow type	Diverting
Size	1-1/2 to 2"
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Fluid temperature range	20 to 281°F
Maximum differential pressure for water	35 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

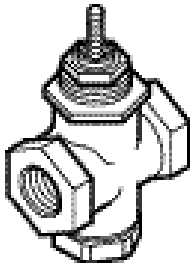
Caution: Fittings and piping schedules must meet or exceed working static pressure requirements.

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)				6		8		14	20	30	40					

Model: VB-9313-000-4-PP
Screwed NPT straightaway mount three-way mixing valve

Mixing valves have two inlets and one outlet and are configured for combining two fluids. This is a continuation of our popular VB-7313 series. The valve body has female pipe thread at both inlets and the outlet. These valves are available in 2-1/2" and 3" pipe size.

Factory assembled valves are available with electric actuators only.



Fluid Type	Chilled or hot water 300°F max
	VB - 9313 - 000 - 4 - PP
Flow type	Mixing
Size	2-1/2 to 3"
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Bronze
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	250 (up to 400 psig below 150°F)
Fluid temperature range	40 to 281°F
Maximum differential pressure for water	35 psi

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pressure requirements.

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)												67	91			

Three-Way Valve Bodies

Model: VB-9313-000-5-PP
Flange mount three-way mixing valve

Mixing valves have two inlets and one outlet and are configured for combining two fluids. These valves have cast iron bodies and 125 lb pipe flanges at both inlets and the outlet. They are available in 2-1/2" through 6" pipe size.

Factory assembled valves are available with electric actuators only.

Fluid Type	Chilled or hot water 300°F max
	VB - 9313 - 000 - 5 - PP
Flow type	Mixing
Size	2-1/2 to 6"
Flow pattern stem-up	Flow B to AB, closed port A
Flow pattern stem-down	Flow A to AB, closed port B
Body	Cast iron
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring loaded TFE
Disc	None
Static pressure rating	125 (up to 200 psig below 150°F)
Fluid temperature range	40 to 300°F
Maximum differential pressure for water	35 psi

Caution:Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size (C_v rating)												74	101	170	290	390

Model: VB-9323-000-5-PP
Flange mount three-way diverting valve

Diverting valves have one inlet and two outlets and are configured for diverting a fluid to two different locations. These valves have cast iron bodies and 125 lb pipe flanges at both outlets and the inlet. They are available in 2-1/2" through 6" pipe size.

Factory assembled valves are available with electric actuators only.

Fluid Type	Chilled or hot water 300°F max
	VB - 9323 - 000 - 5 - PP
Flow type	Diverting
Size	2-1/2 to 6"
Flow pattern stem-up	Flow C to L, closed port U
Flow pattern stem-down	Flow C to U, closed port L
Body	Cast iron
Seat	Bronze
Stem	Stainless steel
Plug	Brass
Packing	Spring Loaded TFE
Disc	None
Static pressure rating	125 (up to 200 psig below 150°F)
Fluid temperature range	40 to 300°F
Maximum differential pressure for water	35 psig

Caution: Freezer protection required for fluid temperature below 32°F (0°C)

Caution: Fittings and piping schedules must meet or exceed working static pres - sure requirements.

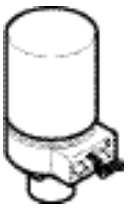
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Port size "U" port (C_v rating)												65	85	160	195	250
Port size "L" port (C_v rating)												75	95	180	220	275

Valve Actuators

The three classes of actuators that are suitable for use on our valves are linear stroke hydraulic actuators, linear stroke electric actuators and rotary stroke electric actuators.

Linear Stroke Hydraulic Actuators

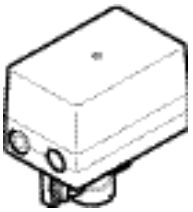
Linear stroke hydraulic actuators such as the model EA81 are an excellent choice for smaller size valves, up to 2 inches. They can be applied to either stem-up open or stem-up closed valve bodies. The spring loading sets the valve to the stem-up position.



Linear stroke hydraulic actuator

Linear Stroke Electric Actuators

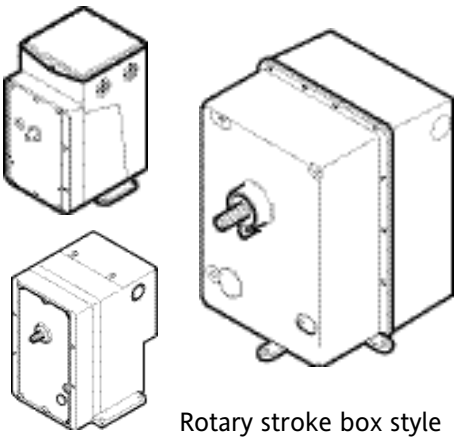
Linear stroke electric actuators such as our CE approved MF-63000 series mount directly on the valve body. No linkage is required for valves of 2 inch or smaller size. These are floating control units that stay in position when power is removed. The MF-63123 can be converted to full proportional control with the addition of a plug-in analog input board.



Linear stroke electric actuator

Rotary Stroke Box Style Actuators

Rotary stroke actuators such as our cUL approved EA series box style units are the most common form used for valves. The rotary action is converted to a linear stroke by the linkage kit. Only actuators with a 180° stroke can be used. These actuators must be coupled to a stem-up open valve body. Attempting to use these with stem-up closed valve bodies will result in physical damage.



Rotary stroke box style actuators

Valve Actuators

Selection of Actuator

The actuators in the selection table below may be used on valve assemblies. For details on the actuator specifications, consult the actuator section of this catalog All actuators may be ordered as components and assembled to the valve body component using the appropriate linkage kit component. However, actuators with a three-digit Actuator code below may also be ordered as complete valve assemblies. Those actuators are identified as part of an available factory assembly by using the (1) three digit Actuator code in place of the "000" and (2) the Control Form code for an assembled valve in place of the "VB" (valve body only) code in the complete valve assembly model code.

In the table the Control Form defines the kind of control action the actuator will execute. Other than "VB", this Control Form will only ever appear in the valve model code in the case of complete factory valve assemblies.

The table also provides important specifications to help select the correct actuator for an application. These specifications include actuator torque (in-lb) or force (lb) and travel time in sec.

Actuators may use different linkage kits, depending on the valve body to which the actuator is coupled. The available linkage kits for a particular combination of valve body and actuator is defined in the Valve Assembly Tables commencing on page 3–27.

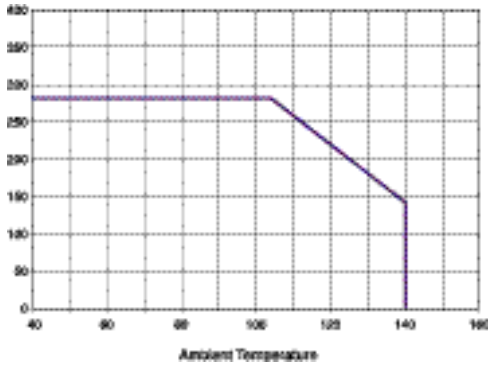
ACTUATOR SELECTION TABLE

ACTUATOR	SPRING	CONTROL FORM	ACTUATOR CODE	TORQUE IN-LB (FORCE LB)	TRAVEL TIME (SEC)
EA12 (N.O.)	SR	VA	321	60	20
EA12 (N.C.)	SR	VA	322	60	20
EA31	NSR	VC	417	220	30
EA31 with AV-352(2)	NSR	VC	465	220	30
EA42	SR	VP(3)	317	50	90
EA44	SR	VP(3)	318	50	90
EA52	NSR	VP(3)		60	25 adj.
EA52-A0370-003	NSR	VS		60	25 adj.
EA54	NSR	VP(3)		60	25
EA54-A0370-003	NSR	VS		60	25
EA56	NSR	VP(3)		220	80
EA56-A0370-003	NSR	VS		220	80 adj.
EA56 with AV-352(2)	NSR	VP(3)		220	80 adj.
EA56-A0370-003 with AV-352(2)	NSR	VS		220	80 adj.
EA58	NSR	VP(3)	423	220	80
EA58-A0370-003	NSR	VS		220	80
EA58 with AV-352(2)	NSR	VP(3)	466	220	80
EA58-A0370-003 with AV-352(2)	NSR	VS		220	80
EA76	NSR	VP(3)	952	1300	115
EA76-A0370-003	NSR	VS		1300	115
EA81-1106	SR	VS	268	15	60
MF-63103	NSR	VF	301	(210(1))	120
MF-63103-500	NSR	VF		(210(1))	120
MF-63123	NSR	VF	303	(210(1))	120
MF-63123 (w/MFC-420 or MFC-8000)	NSR	VS		(210(1))	120
MF-63123-500	NSR	VF		(210(1))	120
MF-63123-500 (w/MFC-420 or MFC-8000)	NSR	VS		(210(1))	120

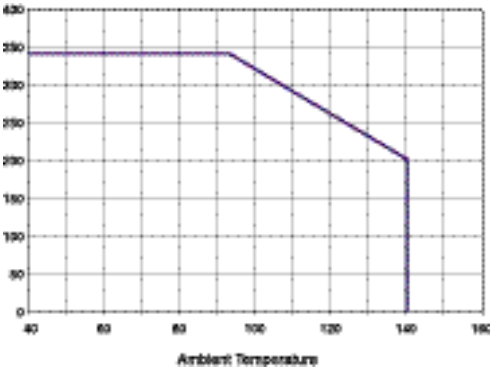
(1) Force in pounds.
(2) AV-352 is a unique linkage kit. A separate actuator code is required for a factory assembly using the AV-352.
(3) VP Control Form can accomodate floating control if slidewire feedback is ignored.

Valve Actuators—Ambient Temperature Restrictions

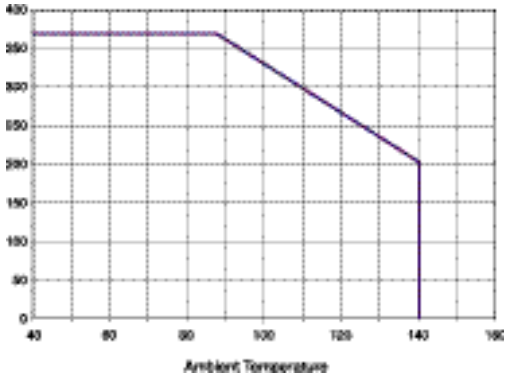
Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7211-000-3-PP VB-7221-000-4-PP VB-7212-000-4-PP VB-7222-000-4-PP VB-7213-000-4-PP VB-7223-000-4-PP	EA81	140°F	140°F
VB-7214-000-4-PP VB-7224-000-4-PP VB-7312-000-4-PP VB-7313-000-4-PP VB-7314-000-4-PP VB-7323-000-4-PP		103°F	281°F



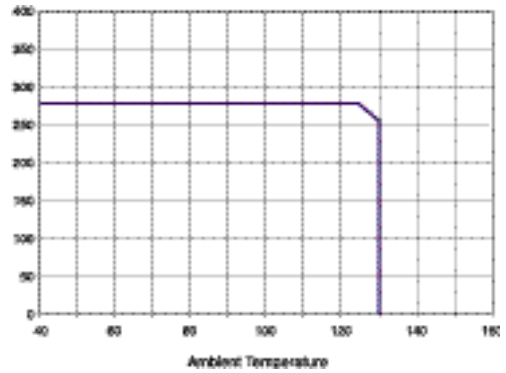
Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7253-000-4-PP	EA81	140°F	140°F
VB-7263-000-4-PP		93°F	340°F



Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7273-000-4-PP	EA81	140°F	140°F
VB-7283-000-4-PP		88°F	366°F

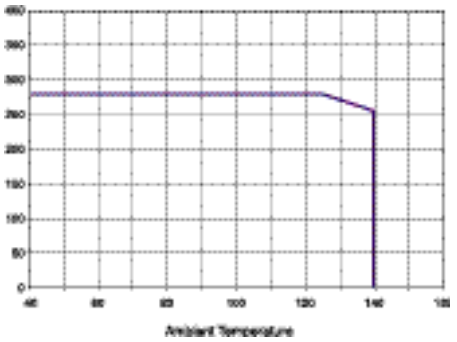


Valve Bodies	Actuator	Ambient	Max. Fluid Temperature
VB-9213-000-5-PP	EA76	130°F	260°F
VB-9313-000-5-PP	EA76-A	125°F	281°F

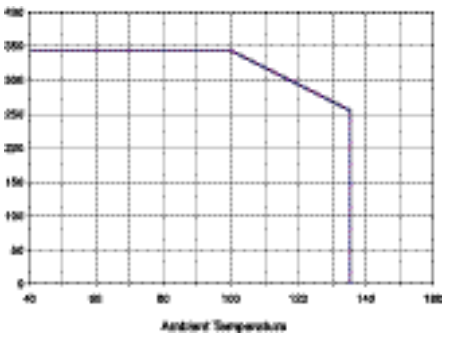


Valve Actuators—Ambient Temperature Restrictions

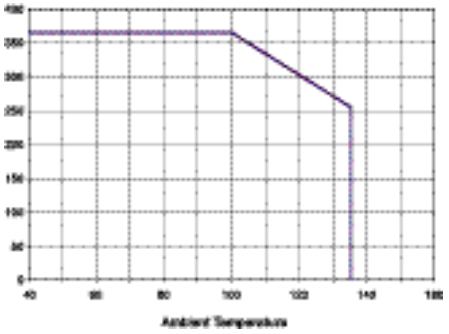
Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7211-000-3-PP VB-7221-000-4-PP VB-7212-000-4-PP VB-7222-000-4-PP VB-7213-000-4-PP VB-7223-000-4-PP VB-7214-000-4-PP VB-7224-000-4-PP	EA12 EA31 EA42 EA42-A EA44 EA44-A EA52	136°F	260°F
VB-7312-000-4-PP VB-7313-000-4-PP VB-7314-000-4-PP VB-7323-000-4-PP VB-9213-000-4-PP VB-9213-000-5-PP VB-9223-000-4-PP VB-9223-000-5-PP	EA52-A EA54 EA54-A EA56 EA56-A EA58 EA58-A	125°F	281°F



Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7253-000-4-PP VB-7263-000-4-PP	EA12/EA31 EA42/EA42-A EA44/EA44-A	136°F	260°F
	EA52/EA52-A EA54/EA54-A EA56/EA56-A EA58/EA58-A	100°F	340°F

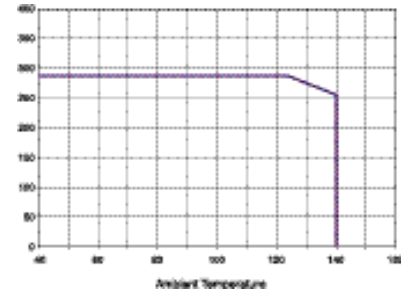


Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7273-000-4-PP VB-7283-000-4-PP	EA12, EA31 EA42/EA42-A EA44/EA44-A	136°F	260°F
	EA52/EA52-A EA54/EA54-A EA56/EA56-A EA58, EA58-A	100°F	366°F

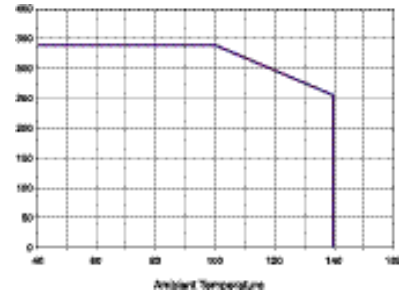


Valve Actuators—Ambient Temperature Restrictions

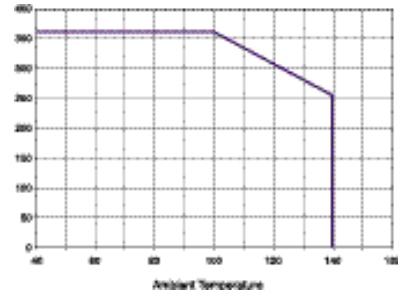
Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7211-000-3-PP VB-7221-000-4-PP VB-7212-000-4-PP VB-7222-000-4-PP VB-7213-000-4-PP VB-7223-000-4-PP VB-7214-000-4-PP VB-7224-000-4-PP VB-7312-000-4-PP VB-7313-000-4-PP VB-7314-000-4-PP VB-7323-000-4-PP VB-9213-000-4-PP VB-9213-000-5-PP VB-9223-000-4-PP VB-9223-000-5-PP	MF-63103 MF-63123	140 125°F	260°F 281°F



Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7253-000-4-PP	MF-63103	140°F	260°F
VB-7263-000-4-PP	MF-63123	100	340°F



Valve Bodies	Actuator	Ambient Temperature	Max. Fluid Temperature
VB-7273-000-4-PP	MF-63103	140°F	260°F
VB-7283-000-4-PP	MF-63123	100	366°F

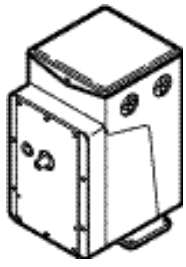


Valve Close-Off Pressure Tables

Every valve assembly has a finite ability to close-off against inlet pressure, the pressure of the controlled fluid at the inlet of the valve body. The following tables list the maximum pressure at which each valve body actuator combination is rated. Note that these values are not the recommended operating pressures. High differential pressure across the valve body may result in excessive cavitation of the valve seat, even though it does not exceed the close-off pressure rating listed here. Please refer to the section on cavitation limitations in the valve sizing section of this catalog, page 3–39.

This table lists the rated maximum close-off pressure in psig for valves with rotary box style actuators that have 50 to 60 in-lbs of torque. *Note: The differential pressure across the valve when closed off is, in nearly all cases, equal to the absolute inlet pressure.* The following actuators are in this group:

EA12
EA42 EA42-A
EA44 EA44-A
EA52 EA52
EA54 EA54-A

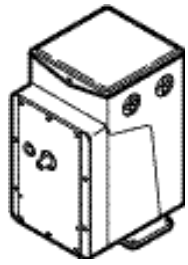


Close-off pressure rating for valves with rotary actuators rated at 50 or 60 in-lb of torque (psig)																
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit	AV-391-000-0-01											AV-395 or AV-329				
Valve body																
VB-7211-000-3-PP	250	250	250	250	250	250	150	150	90							
VB-7211-000-4-PP	250	250	250	250	250	250	150	150	90							
VB-7212-000-4-PP	250	250	250	250												
VB-7213-000-4-PP	250	250	250	250	250	250	150	150	90	60	35					
VB-7214-000-4-PP	250	250	250	250	250	250	150	150	90	60	35					
VB-7253-000-4-PP	250	250	250	250	250	250	150	150	90	60	35					
VB-7273-000-4-PP	250	250	250	250	250	250	150	150	90	60	35					
VB-7313-000-4-PP		250		250		250		150	90	60	35					
VB-7314-000-4-PP		250		250		250		150	90	60	35					
VB-7323-000-4-PP				250		250		250	250	250	250					
VB-9213-000-4-PP												20	12			
VB-9213-000-5-PP												20	12	6		
VB-9313-000-4-PP												20	12			
VB-9313-000-5-PP												20	12	6		
VB-9323-000-5-PP												125	125			

Valve Close-Off Pressure Tables

This table lists the rated maximum close-off pressure in psig for valves with rotary box style actuators that have 220 in-lb of torque. *Note: The differential pressure across the valve when closed off is, in nearly all cases, equal to the absolute inlet pressure.* The following actuators are in this group

EA31
EA56 EA56-A
EA58 EA58-A

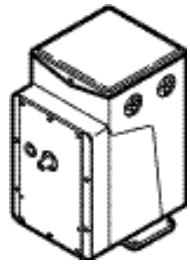


Close-off pressure rating for valves with rotary actuators rated at 220 in-lb of torque (psig)

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit	AV-393-000-0-01											AV-396 or AV-330				
Valve body																
VB-7211-000-3-PP	250	250	250	250	250	250	250	250	200							
VB-7211-000-4-PP	250	250	250	250	250	250	250	250	200							
VB-7212-000-4-PP	250	250	250	250												
VB-7213-000-4-PP	250	250	250	250	250	250	250	250	200	140	80					
VB-7214-000-4-PP	250	250	250	250	250	250	250	250	200	140	80					
VB-7253-000-4-PP	250	250	250	250	250	250	250	250	200	140	80					
VB-7273-000-4-PP	250	250	250	250	250	250	250	250	200	140	80					
VB-7313-000-4-PP		250		250		250		250	200	140	140					
VB-7314-000-4-PP		250		250		250		250	200	140	140					
VB-7323-000-4-PP				250		250		250	250	250	250					
VB-9213-000-4-PP												50	35			
VB-9213-000-5-PP												50	35	17		
VB-9313-000-4-PP												50	35			
VB-9313-000-5-PP												50	35	17		
VB-9323-000-5-PP												125	125	125	125	125

This table lists the rated maximum close-off pressure in psig for valves with rotary box style actuators that have 220 in-lb of torque and an AV-352 linkage kit. *Note: The differential pressure across the valve when closed off is, in nearly all cases, is equal to the absolute inlet pressure.* The following actuators are in this group

EA31
EA56 EA56-A
EA58 EA58-A



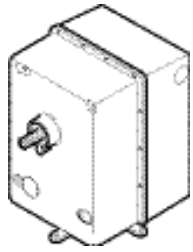
Close-off pressure rating for valves with rotary actuators rated at 220 in-lb of torque and AV-352 linkage kits (psig)

Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit												AV-352				
Valve body																
VB-9213-000-4-PP												110	70			
VB-9213-000-5-PP												110	70	40	18	11
VB-9313-000-4-PP												110	70			
VB-9313-000-5-PP												110	70	40	18	11

Valve Close-Off Pressure Tables

This table lists the rated maximum close-off pressure in psig for valves with actuators that have 1300 in-lb of torque. *Note: The differential pressure across the valve when closed off is, in nearly all cases, equal to the absolute inlet pressure.* The following actuators are in this group:

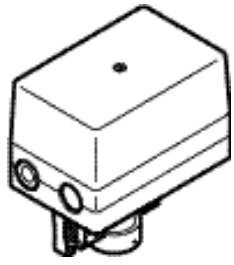
EA76 EA76-A



Close-off pressure rating for valves with rotary actuators rated at 1300 in-lb of torque (psig)																
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit															AV-358	
Valve body																
VB-9213-000-5-PP															60	40
VB-9313-000-5-PP															60	40

This table lists the rated maximum close-off pressure in psig for valves with linear stroke actuators that have 210 lb of force. *Note: The differential pressure across the valve when closed off is, in nearly all cases, equal to the absolute inlet pressure.* The following act-uators are in this group

MF-63103
MF-63123

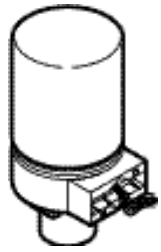


Close-off pressure rating for valves with linear stroke actuators rated at 210 lb of force (psig)																
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit	none required											AV-672				
Valve body																
VB-7211-000-3-PP	250	250	250	250	250	250	240	240	150							
VB-7211-000-4-PP	250	250	250	250	250	250	240	240	150							
VB-7212-000-4-PP	250	250	250	250												
VB-7213-000-4-PP	250	250	250	250	250	250	240	240	150	100	50					
VB-7214-000-4-PP	250	250	250	250	250	250	240	240	150	100	50					
VB-7253-000-4-PP	250	250	250	250	250	250	240	240	150	100	50					
VB-7273-000-4-PP	250	250	250	250	250	250	240	240	150	100	50					
VB-7313-000-4-PP		250		250		250		230	140	90	50					
VB-7314-000-4-PP		250		250		250		230	140	90	50					
VB-7323-000-4-PP				250		250		250	250	250	250					
VB-9213-000-4-PP												35	25			
VB-9213-000-5-PP												35	25	13		
VB-9313-000-4-PP												35	25			
VB-9313-000-5-PP												35	25	13		

Valve Close-Off Pressure Tables

This table lists the rated maximum close-off pressure in psig for valves used with the EA81 linear stroke hydraulic actuator. *Note: The differential pressure across the valve when closed off is, in nearly all cases, equal to the absolute inlet pressure.*

EA81

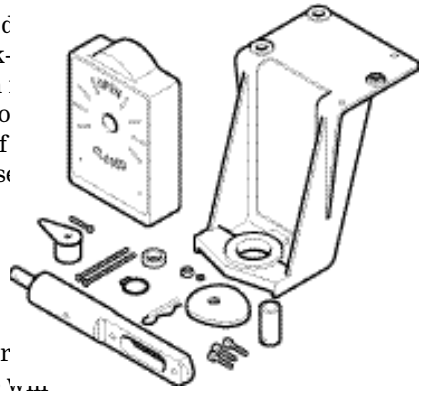


Close-off pressure rating for valves with hydraulic actuator (psig)																
Valve PP code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Pipe size (in.)	1/2				3/4		1		1-1/4	1-1/2	2	2-1/2	3	4	5	6
Linkage Kit	AV-611															
Valve body																
VB-7211-000-3-PP	130	130	130	130	80	80	40	40	25							
VB-7211-000-4-PP	130	130	130	130	80	80	40	40	25							
VB-7212-000-4-PP	130	130	130	130												
VB-7213-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7214-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7221-000-4-PP	130	130	130	130	80	80	40	40	25							
VB-7222-000-4-PP	130	130	130	130												
VB-7223-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7224-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7253-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7263-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7273-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7283-000-4-PP	130	130	130	130	80	80	40	40	25	15	6					
VB-7312-000-4-PP		100		100												
VB-7313-000-4-PP		70		70		50		30	20	15	10					
VB-7314-000-4-PP		70		70		50		30	20	15	10					
VB-7323-000-4-PP				250		250		250	250	250	250					

Linkage Kits

Most Actuators require linkage kits to couple them to the valve bodies. This is particularly true of the box style actuators. Selecting the proper linkage kit is critical to ensure proper operation. Physical damage to the valve may occur with the wrong linkage. All linkage kits are mounted in any upright position with the actuator above the centerline of the valve body .

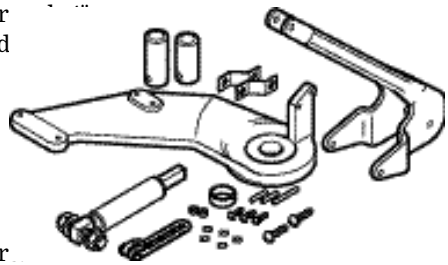
AV-39X Series



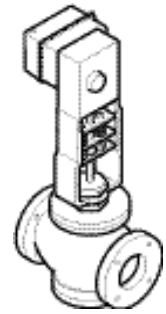
The AV-391-000-0-01 c cast aluminum link- age with indication intended for actuato with 50 to 60 in-lb of available torque. Us it with EA12, EA42/EA42-A, EA44/EA44-A, EA52/EA52-A, and EA54/EA54-A on valve bodies of 2" or smaller. The AV-395 w mount these actuators to 2-1/2" through 4" valves. The AV-393-000-0-01 is intended for use with actuators with 220- in-lb of available torque. It can be used with models EA31, EA56/EA56-A and EA58/EA58-A on valve bodies of 2" or smaller. The model AV-396 will mount these actuators to 2-1/2" through 4" valves. All AV-39X linkages may be field assembled for NO or NC operation by setting cams.

AV-352

The AV-352 is a unique linkage for gear train actuators that provides a mechanical advantage to more than double the close-off pressure rating of some valve assemblies. It can be used with 220 in-lb actuators to double close-off pressure rating for 2-1/2" thr valve bodies and pressure for 5" and 6" valve bodies. Use it with the EA31, EA56/ EA56-A, and EA58/ EA58-A actuator



AV-358

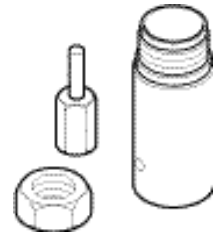


The AV-358 linkage for electric actuators is for use with the EA76/EA76-A actuators on 5" and 6" valve bodies.

AV-611

The AV-611 linkage may be used to couple the EA81 hydraulic actuator to 1/2" through 1-1/4" valve bodies. When using the AV-611 in steam applications only, mount the actuator above the valve body at 45° from vertical. In hot water applications, mount the actuator above the centerline of the valve body

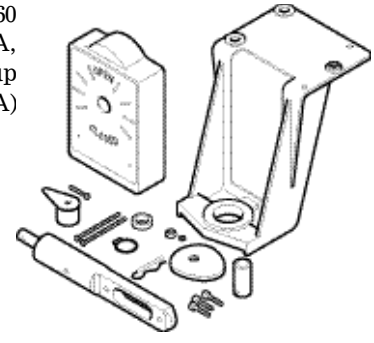
AV-672



The AV-672 linkage couples the MF-63000 series of electric actuators to 2-1/2" through 4' valve bodies.

AV-329 and AV-330

The AV-329 linkage kit is used to couple 50-60 EA42/42A, EA44/44A, AV-330 is used to coup EA56/56A, EA58/58A) to 2-1/2" and 3" diverting valves.



Valve Assembly Tables

Control Form VA, Two Position with Spring Return, Rotary Stroke Electric Actuator

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way, NO	VB-7211-000-3-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NC	VB-7211-000-3-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NO	VB-7211-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NC	VB-7211-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NO	VB-7212-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*								
	2 Way, NC	VB-7212-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*								
VA-7213-321-4-PP	2 Way, NO	VB-7213-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VA-7213-322-4-PP	2 Way, NC	VB-7213-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2 Way, NO	VB-7214-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VA-7253-321-4-PP	2 Way, NO	VB-7253-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VA-7253-322-4-PP	2 Way, NC	VB-7253-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VA-7273-321-4-PP	2 Way, NO	VB-7273-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VA-7273-322-4-PP	2 Way, NC	VB-7273-000-4-XX	EA12	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	3 Way, mix	VB-7312-000-4-XX	EA12		AV-391*		AV-391*								
VA-7313-321-4-PP	3 Way, mix	VB-7313-000-4-XX	EA12		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3 Way, mix	VB-7314-000-4-XX	EA12		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
VA-7323-321-4-PP	3 Way, div	VB-7323-000-4-XX	EA12				AV-391*		AV-391*		AV-391*				
VA-9213-321-4-PP	2 Way, NO	VB-9213-000-4-XX	EA12										AV-395		
VA-9213-322-4-PP	2 Way, NC	VB-9213-000-4-XX	EA12										AV-395		
VA-9213-321-5-PP	2 Way, NO	VB-9213-000-5-XX	EA12										AV-395	AV-395	
VA-9213-322-5-PP	2 Way, NC	VB-9213-000-5-XX	EA12										AV-395	AV-395	
VA-9313-321-4-PP	3 Way, mix	VB-9313-000-4-XX	EA12										AV-395		
VA-9313-321-5-PP	3 Way, mix	VB-9313-000-5-XX	EA12										AV-395	AV-395	
VA-9323-322-5-PP	3 Way, div	VB-9323-000-5-XX	EA12										AV-329		

* Full part number for AV-391 must be ordered as AV-391-000-0-01

Additional Assemblies: EA12's with any available option may be used on the valve bodies or valve assemblies listed here - Refer to the Actuators section of this catalog for available options. EA12's with options are not available as factory assemblies unless specifically delineated above.

Control Form VC, Two Position without Spring Return, Rotary Stroke Electric Actuator

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way	VB-7211-000-3-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*				
	2 Way	VB-7211-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*				
	2 Way	VB-7212-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*								
VC-7213-417-4-PP	2 Way	VB-7213-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*			
	2 Way	VB-7214-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*			
VC-7253-417-4-PP	2 Way	VB-7253-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*			
VC-7273-417-4-PP	2 Way	VB-7273-000-4-XX	EA31	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*	AV-393*			
	3 Way, mix	VB-7312-000-4-XX	EA31		AV-393*		AV-393*								
VC-7313-417-4-PP	3 Way, mix	VB-7313-000-4-XX	EA31		AV-393*		AV-393*		AV-393*		AV-393*	AV-393*			
	3 Way, mix	VB-7314-000-4-XX	EA31		AV-393*		AV-393*		AV-393*		AV-393*	AV-393*			
VC-7323-417-4-PP	3 Way, div	VB-7323-000-4-XX	EA31				AV-393*		AV-393*		AV-393*				
VC-9213-417-4-PP	2 Way	VB-9213-000-4-XX	EA31										AV-396		
VC-9213-465-4-PP	2 Way	VB-9213-000-4-XX	EA31										AV-352	AV-352	AV-352
VC-9213-417-5-PP	2 Way	VB-9213-000-5-XX	EA31										AV-396	AV-396	
VC-9213-465-5-PP	2 Way	VB-9213-000-5-XX	EA31										AV-352	AV-352	AV-352
VC-9313-417-4-PP	3 Way, mix	VB-9313-000-4-XX	EA31										AV-396		
VC-9313-417-5-PP	3 Way, mix	VB-9313-000-5-XX	EA31										AV-396	AV-396	
VC-9313-465-5-PP	3 Way, mix	VB-9313-000-5-XX	EA31										AV-352	AV-352	AV-352
VC-9323-417-5-PP	3 Way, div	VB-9323-000-5-XX	EA31										AV-330	AV-330	AV-352

* Full part number for AV-393 must be ordered as AV-393-000-0-01

Additional Assemblies EA31's with any available option may be used on the valve bodies or valve assemblies listed here - Refer to the Actuators section of this catalog for available options. EA31's with options are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VF, Floating Control, Non-Spring Return, Linear Stroke Electric Actuator

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way	VB-7211-000-3-XX	MF-63103	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*				
	2 Way	VB-7211-000-4-XX	MF-63103	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*				
	2 Way	VB-7212-000-4-XX	MF-63103	NLR*	NLR*	NLR*	NLR*								
VF-7213-301-4-PP	2 Way	VB-7213-000-4-XX	MF-63103	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
	2 Way	VB-7214-000-4-XX	MF-63103	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR			
VF-7253-301-4-PP	2 Way	VB-7253-000-4-XX	MF-63103	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
VF-7273-301-4-PP	2 Way	VB-7273-000-4-XX	MF-63103	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
	3 Way, mixing	VB-7312-000-4-XX	MF-63103		NLR*		NLR								
VF-7313-301-4-PP	3 Way, mixing	VB-7313-000-4-XX	MF-63103		NLR*		NLR*		NLR*		NLR*	NLR*			
	3 Way, mixing	VB-7314-000-4-XX	MF-63103		NLR*		NLR*		NLR*		NLR*	NLR*			
VF-7323-301-4-PP	3 Way, diverting	VB-7323-000-4-XX	MF-63103				NLR*		NLR*		NLR*	NLR*			
VF-9213-301-4-PP	2 Way	VB-9213-000-4-XX	MF-63103										AV-672		
VF-9213-301-5-PP	2 Way	VB-9213-000-5-XX	MF-63103										AV-672	AV-672	
VF-9313-301-4-PP	3 Way, mixing	VB-9313-000-4-XX	MF-63103										AV-672		
VF-9313-301-5-PP	3 Way, mixing	VB-9313-000-5-XX	MF-63103										AV-672	AV-672	
	2 Way	VB-7211-000-3-XX	MF-63123	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*				
	2 Way	VB-7211-000-4-XX	MF-63123	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*				
	2 Way	VB-7212-000-4-XX	MF-63123	NLR*	NLR*	NLR*	NLR*								
VF-7213-303-4-PP	2 Way	VB-7213-000-4-XX	MF-63123	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
	2 Way	VB-7214-000-4-XX	MF-63123	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR			
VF-7253-303-4-PP	2 Way	VB-7253-000-4-XX	MF-63123	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
VF-7273-303-4-PP	2 Way	VB-7273-000-4-XX	MF-63123	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*	NLR*			
	3 Way, mixing	VB-7312-000-4-XX	MF-63123		NLR*		NLR								
VF-7313-303-4-PP	"3 Way, mixing	VB-7313-000-4-XX	MF-63123		NLR*		NLR*		NLR*		NLR*	NLR*			
	3 Way, mixing	VB-7314-000-4-XX	MF-63123		NLR*		NLR*		NLR*		NLR*	NLR*			
VF-7323-303-4-PP	3 Way, diverting	VB-7323-000-4-XX	MF-63123				NLR*		NLR*		NLR*	NLR*			
VF-9213-303-4-PP	2 Way	VB-9213-000-4-XX	MF-63123										AV-672		
VF-9213-303-5-PP	2 Way	VB-9213-000-5-XX	MF-63123										AV-672	AV-672	
VF-9313-303-4-PP	3 Way, mixing	VB-9313-000-4-XX	MF-63123										AV-672		
VF-9313-303-5-PP	3 Way, mixing	VB-9313-000-5-XX	MF-63123										AV-672	AV-672	

* NLR - No linkage required

Additional Assemblies

MF-63103-500 or MF-63123-500 may be used with the valve bodies or assemblies listed here.
MF-63123 or MF-63123-500 can be converted to analog input proportional control with an optional plug-in circuit board - See Control Form VS.
MF-63000 Series with options are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VP, Proportional Control with Slidewire Feedback, Rotary Stroke Actuators

Section 1, valves with spring return actuators

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way, NC	VB-7211-000-3-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NC	VB-7211-000-3-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NO	VB-7211-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NC	VB-7211-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 Way, NO	VB-7212-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*								
	2 Way, NC	VB-7212-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*								
VP-7213-317-4-PP	2 Way, NC	VB-7213-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VP-7213-318-4-PP	2 Way, NO	VB-7213-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2 Way, NO	VB-7214-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2 Way, NC	VB-7214-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VP-7253-317-4-PP	2 Way, NC	VB-7253-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VP-7253-318-4-PP	2 Way, NO	VB-7253-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VP-7273-317-4-PP	2 Way, NC	VB-7273-000-4-XX	EA42	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
VP-7273-318-4-PP	2 Way, NO	VB-7273-000-4-XX	EA44	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	3 W, mix, SD	VB-7312-000-4-XX	EA42		AV-391*		AV-391*								
	3 W, mix, SU	VB-7312-000-4-XX	EA44		AV-391*		AV-391*								
VP-7313-317-4-PP	3 W, mix, SD	VB-7313-000-4-XX	EA42		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
VP-7313-318-4-PP	3 W, mix, SU	VB-7313-000-4-XX	EA44		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3 W, mix, SD	VB-7314-000-4-XX	EA42		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3 W, mix, SU	VB-7314-000-4-XX	EA44		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
VP-7323-317-4-PP	3 W, div, SD	VB-7323-000-4-XX	EA42				AV-391*		AV-391*		AV-391*				
VP-7323-318-4-PP	3 W, div, SU	VB-7323-000-4-XX	EA44				AV-391*		AV-391*		AV-391*				
VP-9213-317-4-PP	2 Way, NC	VB-9213-000-4-XX	EA42										AV-395		
VP-9213-318-4-PP	2 Way, NO	VB-9213-000-4-XX	EA44										AV-395		
VP-9213-317-5-PP	2 Way, NC	VB-9213-000-5-XX	EA42										AV-395	AV-395	
VP-9213-318-5-PP	2 Way, NO	VB-9213-000-5-XX	EA44										AV-395	AV-395	
VP-9313-317-4-PP	3 W, mix, SD	VB-9313-000-4-XX	EA42										AV-395		
VP-9313-318-4-PP	3 W, mix, SU	VB-9313-000-4-XX	EA44										AV-395		
VP-9313-317-5-PP	3 W, mix, SD	VB-9313-000-5-XX	EA42										AV-395	AV-395	
VP-9313-318-5-PP	3 W, mix, SU	VB-9313-000-5-XX	EA44										AV-395	AV-395	
VP-9323-317-5-PP	3 W, div, SD	VB-9323-000-5-XX	EA42										AV-329		
VP-9323-318-5-PP	3 W, div, SU	VB-9323-000-5-XX	EA44										AV-329		

* Full part number for AV-391 must be ordered as AV-393-000-0-01

Additional Assemblies: EA42'sand EA44's with any available option may be used on the valve bodies or valve assemblies listed here - Refer to the Actuators section of this catalog for available options.
EA42's and EA44's with options are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VP, Proportional Control with Slidewire Feedback, Rotary Stroke Actuators

Section 2, valves without spring return actuators

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way	VB-7211-000-3-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-3911	AV-3911	AV-3911	AV-3911				
	2 Way	VB-7211-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-3911	AV-3911	AV-3911	AV-3911				
	2 Way	VB-7212-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]								
	2 Way	VB-7213-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7214-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7253-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7273-000-4-XX	EA52	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	3 Way , mix	VB-7312-000-4-XX	EA52		AV-391[1]		AV-391[1]								
	3 Way, mix	VB-7313-000-4-XX	EA52		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7314-000-4-XX	EA52		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, div	VB-7323-000-4-XX	EA52				AV-391[1]		AV-391[1]		AV-391[1]				
	2 Way	VB-9213-000-4-XX	EA52										AV-395		
	2 Way	VB-9213-000-5-XX	EA52										AV-395	AV-395	
	3 Way, mix	VB-9313-000-4-XX	EA52										AV-395		
	3 Way, mix	VB-9313-000-5-XX	EA52										AV-395	AV-395	
	3 Way, div	VB-9323-000-5-XX	EA52										AV-329		
	2 Way	VB-7211-000-3-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7211-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7212-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]								
	2 Way	VB-7213-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7214-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7253-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7273-000-4-XX	EA54	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	3 Way , mix	VB-7312-000-4-XX	EA54		AV-391[1]		AV-391[1]								
	3 Way, mix	VB-7313-000-4-XX	EA54		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7314-000-4-XX	EA54		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, div	VB-7323-000-4-XX	EA54				AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	2 Way	VB-9213-000-4-XX	EA54										AV-395		
	2 Way	VB-9213-000-5-XX	EA54										AV-395	AV-395	
	3 Way, mix	VB-9313-000-4-XX	EA54										AV-395		
	3 Way, mix	VB-9313-000-5-XX	EA54										AV-395	AV-395	
	3 Way, div	VB-9323-000-5-XX	EA54										AV-329		
	2 Way	VB-7211-000-3-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7211-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7212-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]								
	2 Way	VB-7213-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7214-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7253-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7273-000-4-XX	EA56	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	3 Way , mix	VB-7312-000-4-XX	EA56		AV-393[2]		AV-393[2]								
	3 Way, mix	VB-7313-000-4-XX	EA56		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, mix	VB-7314-000-4-XX	EA56		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, div	VB-7323-000-4-XX	EA56				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	2 Way	VB-9213-000-4-XX	EA56										AV-396		
	2 Way	VB-9213-000-5-XX	EA56										AV-396	AV-396	
	3 Way, mix	VB-9313-000-4-XX	EA56										AV-396		
	3 Way, mix	VB-9313-000-5-XX	EA56										AV-396	AV-396	
	3 Way, mix	VB-9313-000-5-XX	EA56										AV-352	AV-352	AV-352
	3 Way, div	VB-9323-000-5-XX	EA56										AV-330	AV-352	AV-352

. . . Continued on next page

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VP, Proportional Control with Slidewire Feedback, Rotary Stroke Actuators

Section 2, valves without spring return actuators

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way	VB-7211-000-3-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7211-000-4-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7212-000-4-XX	EA58	AV-393*	AV-393*	AV-393*	AV-393*								
VP-7213-423-4-PP	2 Way	VB-7213-000-4-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7213-424-4-PP	2 Way	VB-7213-000-4-XX	EA58-00003	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7213-425-4-PP	2 Way	VB-7213-000-4-XX	EA58-00005	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7213-426-4-PP	2 Way	VB-7213-000-4-XX	EA58-00001	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7214-000-4-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7253-423-4-PP	2 Way	VB-7253-000-4-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7253-424-4-PP	2 Way	VB-7253-000-4-XX	EA58-00003	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7253-425-4-PP	2 Way	VB-7253-000-4-XX	EA58-00005	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7253-426-4-PP	2 Way	VB-7253-000-4-XX	EA58-00001	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7273-423-4-PP	2 Way	VB-7273-000-4-XX	EA58	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7273-424-4-PP	2 Way	VB-7273-000-4-XX	EA58-00003	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7273-425-4-PP	2 Way	VB-7273-000-4-XX	EA58-00005	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
VP-7273-426-4-PP	2 Way	VB-7273-000-4-XX	EA58-00001	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	3 Way , mix	VB-7312-000-4-XX	EA58		AV-393[2]		AV-393[2]								
VP-7313-423-4-PP	3 Way, mix	VB-7313-000-4-XX	EA58		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7313-424-4-PP	3 Way, mix	VB-7313-000-4-XX	EA58-00003		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7313-425-4-PP	3 Way, mix	VB-7313-000-4-XX	EA58-00005		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7313-426-4-PP	3 Way, mix	VB-7313-000-4-XX	EA58-00001		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, mix	VB-7314-000-4-XX	EA58		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7323-423-4-PP	3 Way, div	VB-7323-000-4-XX	EA58				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7323-424-4-PP	3 Way, div	VB-7323-000-4-XX	EA58-00003				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7323-425-4-PP	3 Way, div	VB-7323-000-4-XX	EA58-00005				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-7323-426-4-PP	3 Way, div	VB-7323-000-4-XX	EA58-00001				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
VP-9213-423-4-PP	2 Way	VB-9213-000-4-XX	EA58										AV-396		
VP-9213-424-4-PP	2 Way	VB-9213-000-4-XX	EA58-00003										AV-396		
VP-9213-425-4-PP	2 Way	VB-9213-000-4-XX	EA58-00005										AV-396		
VP-9213-426-4-PP	2 Way	VB-9213-000-4-XX	EA58-00001										AV-396		
VP-9213-466-4-PP	2 Way	VB-9213-000-4-XX	EA58										AV-352		
VP-9213-423-5-PP	2 Way	VB-9213-000-5-XX	EA58										AV-396	AV-396	
VP-9213-424-5-PP	2 Way	VB-9213-000-5-XX	EA58-00003										AV-396	AV-396	
VP-9213-425-5-PP	2 Way	VB-9213-000-5-XX	EA58-00005										AV-396	AV-396	
VP-9213-426-5-PP	2 Way	VB-9213-000-5-XX	EA58-00001										AV-396	AV-396	
VP-9213-466-5-PP	2 Way	VB-9213-000-5-XX	EA58										AV-352	AV-352	AV-352
VP-9313-423-4-PP	3 Way, mix	VB-9313-000-4-XX	EA58										AV-396		
VP-9313-424-4-PP	3 Way, mix	VB-9313-000-4-XX	EA58-00003										AV-396		
VP-9313-425-4-PP	3 Way, mix	VB-9313-000-4-XX	EA58-00005										AV-396		
VP-9313-426-4-PP	3 Way, mix	VB-9313-000-4-XX	EA58-00001										AV-396		
VP-9313-423-5-PP	3 Way, mix	VB-9313-000-5-XX	EA58										AV-396	AV-396	
VP-9313-424-5-PP	3 Way, mix	VB-9313-000-5-XX	EA58-00003										AV-396	AV-396	
VP-9313-425-5-PP	3 Way, mix	VB-9313-000-5-XX	EA58-00005										AV-396	AV-396	
VP-9313-426-5-PP	3 Way, mix	VB-9313-000-5-XX	EA58-00001										AV-396	AV-396	
VP-9313-466-5-PP	3 Way, mix	VB-9313-000-5-XX	EA58										AV-352	AV-352	AV-352
VP-9323-423-5-PP	3 Way, div	VB-9323-000-5-XX	EA58										AV-330	AV-352	AV-352
VP-9323-424-5-PP	3 Way, div	VB-9323-000-5-XX	EA58-00003										AV-330	AV-352	AV-352
VP-9323-425-5-PP	3 Way, div	VB-9323-000-5-XX	EA58-00005										AV-330	AV-352	AV-352
VP-9323-426-5-PP	3 Way, div	VB-9323-000-5-XX	EA58-00001										AV-330	AV-352	AV-352
VP-9213-952-5-PP	2 Way	VB-9213-000-5-XX	EA76												AV-358
VP-9313-952-5-PP	3 Way, mix	VB-9313-000-5-XX	EA76												AV-358

1. Full part number for AV-391 must be ordered as AV-391-000-0-01, 2. Full part number for AV-393 must be ordered as AV-393-000-0-01

Additional Assemblies EA5x or EA76 with any available option may be used on the valve bodies or valve assemblies listed here Refer to the Actuator Section of this catalog for available options. EA5x or EA76 with options are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VS, Proportional Control with Analog Input, Rotary and Linear Stroke Actuators

Section 1 - 2-way valves with spring return actuators, NO and NC
Section 1 - 3-way valves with spring return actuators, mixing and diverting, stem-up and stem-down

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2W - NO	VB-7211-000-3-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2W - NC	VB-7211-000-3-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2W - NO	VB-7211-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2W - NC	VB-7211-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*				
	2 W- NO	VB-7212-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*								
	2 W- NC	VB-7212-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*								
	2W - NO	VB-7213-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W- NC	VB-7213-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W - NO	VB-7214-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W - NC	VB-7214-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W - NO	VB-7253-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W - NC	VB-7253-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W- NO	VB-7273-000-4-XX	EA44-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	2W - NC	VB-7273-000-4-XX	EA42-A	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*	AV-391*			
	3W mix,SD	VB-7312-000-4-XX	EA42-A		AV-391*		AV-391*								
	3W mix,SU	VB-7312-000-4-XX	EA44-A		AV-391*		AV-391*								
	3W mix, SD	VB-7313-000-4-XX	EA42-A		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3W mix, SU	VB-7313-000-4-XX	EA44-A		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3W mix, SD	VB-7314-000-4-XX	EA42-A		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3W mix, SU	VB-7314-000-4-XX	EA44-A		AV-391*		AV-391*		AV-391*		AV-391*	AV-391*			
	3W div, SD	VB-7323-000-4-XX	EA42-A				AV-391*		AV-391*		AV-391*	AV-391*			
	3W div, SU	VB-7323-000-4-XX	EA44-A				AV-391*		AV-391*		AV-391*	AV-391*			
	2W - NO	VB-9213-000-4-XX	EA44-A										AV-395		
	2W - NC	VB-9213-000-4-XX	EA42-A										AV-395		
	2W - NO	VB-9213-000-5-XX	EA44-A										AV-395	AV-395	
	2W - NC	VB-9213-000-5-XX	EA42-A										AV-395	AV-395	
	3W mix, SD	VB-9313-000-4-XX	EA42-A										AV-395		
	3W mix, SU	VB-9313-000-4-XX	EA44-A										AV-395		
	3W mix, SD	VB-9313-000-5-XX	EA42-A										AV-395	AV-395	
	3W mix, SU	VB-9313-000-5-XX	EA44-A										AV-395	AV-395	
	3W mix, SD	VB-9323-000-5-XX	EA42-A										AV-329		
	3W mix, SU	VB-9323-000-5-XX	EA44-A										AV-329		
VS-7213-268-4-PP	2W NO	VB-7213-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7223-268-4-PP	2W NC	VB-7223-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7253-268-4-PP	2W NO	VB-7253-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7263-268-4-PP	2W NC	VB-7263-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7273-268-4-PP	2W NO	VB-7273-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7283-268-4-PP	2W NC	VB-7283-000-4-XX	EA81	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611	AV-611			
VS-7313-268-4-PP	3W, mix	VB-7313-000-4-XX	EA81		AV-611		AV-611		AV-611		AV-611	AV-611			
VS-7323-268-4-PP	3W, div	VB-7323-000-4-XX	EA81				AV-611		AV-611		AV-611	AV-611			

* Full part number for AV-391 must be ordered as AV-391-000-0-01

Additional Assemblies — EA42-A , EA44-A and EA81 with any available option may be used on the valve bodies or valve assemblies listed here. Refer to the Actuator Section of this catalog for available options.
EA42-A, EA44-A or EA-81 with options are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve Assembly Tables

Control Form VS, Proportional Control with Slidewire Feedback, Rotary Stroke Actuators

Section 2 - valves with non-spring return actuators

Available Factory Assembly	Valve Type	Valve Body	Actuator	Linkage Kit for Port Size PP = 01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	2 Way	VB-7211-000-3-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7211-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7212-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]								
	2 Way	VB-7213-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7214-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7253-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7273-000-4-XX	EA52-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7312-000-4-XX	EA52-A		AV-391[1]		AV-391[1]								
	3 Way, mix	VB-7313-000-4-XX	EA52-A		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7314-000-4-XX	EA52-A		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, div	VB-7323-000-4-XX	EA52-A				AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	2 Way	VB-9213-000-4-XX	EA52-A										AV-395		
	2 Way	VB-9213-000-5-XX	EA52-A										AV-395	AV-395	
	3 Way, mix	VB-9313-000-4-XX	EA52-A										AV-395		
	3 Way, mix	VB-9313-000-5-XX	EA52-A										AV-395	AV-395	
	3 Way, div	VB-9323-000-5-XX	EA52-A										AV-329		
	2 Way	VB-7211-000-3-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7211-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]				
	2 Way	VB-7212-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]								
	2 Way	VB-7213-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7214-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7253-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	2 Way	VB-7273-000-4-XX	EA54-A	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7312-000-4-XX	EA54-A		AV-391[1]		AV-391[1]								
	3 Way, mix	VB-7313-000-4-XX	EA54-A		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, mix	VB-7314-000-4-XX	EA54-A		AV-391[1]		AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	3 Way, div	VB-7323-000-4-XX	EA54-A				AV-391[1]		AV-391[1]		AV-391[1]	AV-391[1]			
	2 Way	VB-9213-000-4-XX	EA54-A										AV-395		
	2 Way	VB-9213-000-5-XX	EA54-A										AV-395	AV-395	
	3 Way, mix	VB-9313-000-4-XX	EA54-A										AV-395		
	3 Way, mix	VB-9313-000-5-XX	EA54-A										AV-395	AV-395	
	3 Way, div	VB-9323-000-5-XX	EA54-A										AV-329		
	2 Way	VB-7211-000-3-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7211-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7212-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]								
	2 Way	VB-7213-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7214-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7253-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7273-000-4-XX	EA56-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	3 Way, mix	VB-7312-000-4-XX	EA56-A		AV-393[2]		AV-393[2]								
	3 Way, mix	VB-7313-000-4-XX	EA56-A		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			

. . . Continued on next page

Valve Assembly Tables

Control Form VS, Proportional Control with Analog Input, Rotary Stroke Actuators

Section 2 - valves with non-spring return actuators (Continued...)

Available Factory Assembly	Valve Type	Valve Body	Actuator	01	02	03	04	05	06	07	08-09	10-11	12-13	14	15-16
	3 Way, mix	VB-7314-000-4-XX	EA56-A		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, div	VB-7323-000-4-XX	EA56-A				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	2 Way	VB-9213-000-4-XX	EA56-A										AV-396		
	2 Way	VB-9213-000-5-XX	EA56-A										AV-396	AV-396	
	3 Way, mix	VB-9313-000-4-XX	EA56-A										AV-396		
	3 Way, mix	VB-9313-000-5-XX	EA56-A										AV-396	AV-396	
	3 Way, div	VB-9323-000-5-XX	EA56-A										AV-330	AV-352	AV-352
	2 Way	VB-7211-000-3-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7211-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]				
	2 Way	VB-7212-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]								
	2 Way	VB-7213-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7214-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7253-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	2 Way	VB-7273-000-4-XX	EA58-A	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]	AV-393[2]			
	3 Way, mix	VB-7312-000-4-XX	EA58-A		AV-393[2]		AV-393[2]								
	3 Way, mix	VB-7313-000-4-XX	EA58-A		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, mix	VB-7314-000-4-XX	EA58-A		AV-393[2]		AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, div	VB-7323-000-4-XX	EA58-A				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	3 Way, div	VB-7323-000-4-XX	EA58-A				AV-393[2]		AV-393[2]		AV-393[2]	AV-393[2]			
	2 Way	VB-9213-000-4-XX	EA58-A										AV-396		
	2 Way	VB-9213-000-5-XX	EA58-A										AV-396	AV-396	
	2 Way	VB-9213-000-4-XX	EA58-A										AV-352		
	2 Way	VB-9213-000-5-XX	EA58-A										AV-352	AV-352	AV-352
	3 Way, mix	VB-9313-000-4-XX	EA58-A										AV-396		
	3 Way, mix	VB-9313-000-5-XX	EA58-A										AV-396	AV-396	
	3 Way, mix	VB-9313-000-5-XX	EA58-A										AV-352	AV-352	AV-352
	3 Way, div	VB-9323-000-5-XX	EA58-A										AV-330	AV-352	AV-352
	3 Way, mix	VB-9313-000-5-XX	EA76-A												AV-358

1 Full part number for AV-391 must be ordered as AV-391-000-0-01
2 Full part number for AV-393 must be ordered as AV-393-000-0-01

Additional Assemblies — EA5x with any available option may be used on the valve bodies or valve assemblies listed here Refer to the Actuator Section of this catalog for available options. EA5x's with options, however, are not available as factory assemblies unless specifically delineated above.

Color Codes Blue: Available as components for field assembly and available as factory assemblies, Black: Available as components for field assembly but not available as factory assemblies, Red: Available as components for field assembly, but not recommended.

Valve General Information

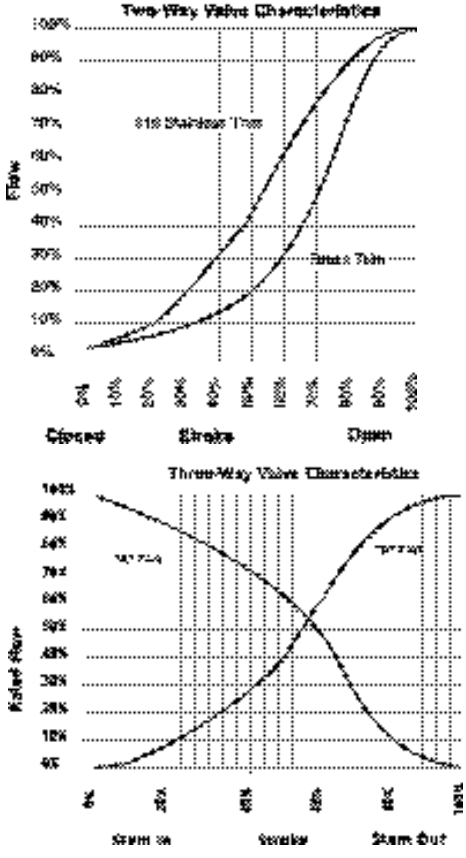
Flow Curves

Flow curves shown below are representative of all sizes.

All valve plugs have lower gain when nearly closed to enhance control at low demand. Mixing and diverting valves are nominally linear. Separate curves shown for "A" or "B" ports are not directly additive. Total flow with both ports contributing is rated C_v.

Two-way valves with brass trim are nominally equal percentage in the composition disc types and normally used for water and low pressure steam.

Two-way valves with stainless trim are nominally linear in the TFE and metal-to-metal disc types, and normally used for higher temperature water and steam.



Rangeability

Rangeability is defined as the ratio of rated to minimum controllable flow.

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

For two-way valves, modulation occurs when plug displacement allows flow through the area between the plug and the port. The rangeability value is achieved by accurately machining the plug and port diameters for appropriate clearance. The following are normal values, with 25% tolerances.

TABLE 8. Two-way Valve Rangeability.

Nominal Size		Port Code (P)	Nominal Ratio
Standard	Metric		
1/2"	15 mm	01 02 03 04	05:1 15:1 25:1 40:1
3/4"	20 mm	05 06	50:1 60:1
1"	25 mm	07 08	60:1 75:1
1-1/4"	32 mm	09	75:1
1-1/2"	40 mm	10	75:1
2"	50 mm	11	75:1
2-1/2"	65 mm	12	75:1
3"	80 mm	13	75:1
4"	—	14	75:1
5"	—	15	75:1
6"	—	16	75:1

Guidelines

Valve Packing Life

Valve packings are designed to provide many years of useful life before they must be replaced. The actual life, under the standard specified conditions, will vary depending on the frequency of valve cycle and the condition of the fluid controlled. The more frequently the valve is cycled and the more contaminated the fluid is with dirt and harsh chemicals, the shorter the life of the packing

Water System Guidelines

All heating and cooling systems are susceptible to valve and system problems caused by improper water treatment and system storage problems. These guidelines are provided to help avoid valve and water system problems from improperly treated water or storage procedures in cooling and hot water systems in cooling and hot water systems, and to obtain maximum life from the valves. While all cooling and heating systems are susceptible to problems, closed chilled water systems, including those containing brine or glycol, are especially prone to system and valve problems. The best way to avoid problems is to follow the advice of a professional water treatment and control specialist.

Leak Prevention. Durability of valve stems and packing is dependent on maintaining non-damaging water conditions. Inadequate water treatment or filtration, not in accordance with the recommendations of a qualified water treatment specialist or the ASHRAE handbook, can result in corrosion, scaling, or abrasive particle formation. Scale and corrosion products can migrate from pipe walls to control valves, resulting in stem and packing scratches, and can adversely affect packing life and other parts of the hydronic system. This condition can be avoided by the use of proper cleaning, treatment chemicals, and storage procedures.

To maintain non-damaging conditions, the system should be cleaned prior to start-up. Filtration equipment should be used where needed, and regularly scheduled program of water condition monitoring and/or treatment should be followed.

Control valve operation should be stable and not hunt at any time. Excessive stroking of the valve stem due to improper system setup can result in premature wear.

Cleaning. New systems usually contain dirt, solder flux, and weld and pipe scale. Thorough flushing with a 1% to 2% solution of trisodium phosphate and rinsing is recommended.

Wet Storage. If the system is stored wet, it should be completely filled with properly treated water and isolated to avoid slow leaks which can contribute to serious corrosion problems.

Dry Storage. If drained, the system should be air dried, sealed, and treated with a desiccant to prevent atmospheric corrosion of pipes – a major source of pipe scale. Pipe scale is dried rust which will slough off the pipe walls as abrasive particles and migrate through the system.

Strainers and Filters. Many closed systems have slow leaks or seepage, resulting in water loss without particulate removal. Consequently, particulate solids often build up in those systems, resulting in deposits. In open systems like cooling towers, particulate solid build-up is not as common because continuous blowdown is used to remove solids from the system.

Side stream filtration is often needed in closed systems because there is no regular blowdown to remove pipe scale, sand, grit, and other abrasive or sticky particulate matter. Abrasive particles must not be allowed to circulate through the system.

To determine whether a filtration system is required, perform a visual inspection of the water. Flush a line with turbulence to assure that a repre-

sentative water sample is collected and observe the turbidity. Let the water settle for five minutes and inspect for particulate that has dropped out.

If chip scale and particulate are found in circulation, install some type of filtration device such as a "Y" strainer, a cartridge filter, and automatic backwashing side stream sand filter, or a chemical pot feeder packed with cheesecloth that can be replaced periodically. Backwashing sand filters (sized at 1% to 3% of system circulation rate) are often a good choice because they are simple, inexpensive, and effective.

Lines carrying water to and from the filtration system should be sized for high flow rates to make sure the particulate matter is carried into the filtration system.

Filtration is often necessary when chemical treatment is started in a system which has not previously been chemically treated. The treatment often dislodges old deposits which then migrate to heat exchangers and valves unless removed by filtration.

Before installing a sophisticated filtration system, make sure strainer baskets are emptied regularly. Also make sure the baskets have not been permanently removed – a common practice when they fill up quickly and too much work is required to keep them clean.

Before installing filters or strainers in systems containing glycol, consult the glycol vendor for proper type.

Chemical Water Treatment. If the make-up water hardness is greater than 300 ppm as calcium carbonate, the water should be softened or a treatment should be used that contains a polymeric dispersant material which forms a soft sludge instead of allowing the formation of hard scales.

Make-up water iron should be less than 1.0 ppm. Manganese should be less than 0.5 00 ppm (0.05 ppm if the system has significant leakage). If not, an iron/manganese removal system or a new water source should be used.

Water treatment control addresses four problem areas: corrosion, scale, deposition, and bacteria. For control, a nitrite or molybdate based program is typically used in conjunction with testing and monitoring.

The corrosion control program most commonly used is 600 to 1220 ppm sodium nitrite or 100 to 300 ppm molybdate, at a pH of 9.5 to 10.5. Include a copper corrosion inhibitor such as Tolytriazol (TTA) or Benzotriazole (BZT) since uncontrolled copper corrosion can lead to corrosion of steel.

Note – The addition of glycol, especially automotive antifreeze, does not assure corrosion protection. Refer to the manufacturer's literature for specific requirements, including concentrations and materials of construction.

Control of bacteria is important because bacteria can break down the nitrites. The level of bacteria should be kept at less than 10,000 CFUs (colony forming units) per ml of water. Follow your supplier's instructions for bacterial control.

Operate your chemical treatment program within the guidelines set by your water treatment supplier. Monitor results monthly, switching to weekly if problem resolution is necessary.

Control Loop Operation. Valves should not be oversized. Set the control system operating parameters so that hunting does not occur, even at light load conditions such as Fall, Spring, and morning operation. Valves which cycle often or continuously require a preventive maintenance program to replace worn parts.

Valve Sizing Information For Water

GENERAL INFORMATION REQUIRED

1. Fluid controlled:
   - Chilled water, hot water, or steam.
2. Temperature limitations:
   - Fluid, maximum, and minimum.
   - Ambient for actuator.
3. Pressure:
   - Static.
   - Close-off - Fully closed.
   - Differential - Pressure drop across the valve in the fully open position.
4. End fitting:
   - Union end.
   - Globe screwed.
   - Flared.
   - Flanged.
   - Flangeless.
5. For return to a known position (i.e., normally open or normally closed): Specify spring return actuator.
6. Dimensional data.
7. C_V (flow coefficient) requirement is calculated from flow rate and differential pressure. Refer to formulas and tables.

For additional sizing and selection background information, contact the factory:

RECOMMENDED PRESSURE DROPS FOR WATER

Refer to specific valve data in this catalog for maximum allowable pressure drops and close-off ratings.

A. Two-Position Valves

Two-position valves are normally selected "line size" to keep pressure drop at a minimum. The differential pressure in psi should be no more than 10% of available inlet pressure in psia.

B. Proportional Two-Way Valves

These are usually selected to take a pressure drop equal to at least 50% of the "available pressure" (i.e., the pump pressure differential available between supply and return mains with design flow at the valve location). 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), but never less than 5 psi (34 kPa).

When design temperature drop is less than 60°F (33°C) for conventional heating systems, higher pressure drops across the valve are needed for good control results. Refer to the following table.

Conventional Heating Systems

Design Temp. Drop °F (°C)	Recom. 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 drop through load, or 50% of booster pump head)

C. Proportional Three-Way Valves

Recommended Pressure Drop - Bypass Application: 50% of "available pressure", or equal to pressure drop through the load at full flow.

Three-way valves in the return used to control heat output by throttling water flow to the load (bypass applications) are controlling output in the same manner as throttling two-way valves, and must be selected using the same high pressure drops if good control results are to be obtained.

Recommended Pressure Drop - Constant Flow Applications: 20% of "available pressure", or equal to 1/4 of the pressure drop through the load at full flow.

Three-way valves used with individual pumps to control heat output by varying water temperature to the load (constant flow applications) are controlling output by mixing two water sources at different temperatures, and do not require high pressure drops for good control results.

Valve Sizing Information For Water

In most cases the required C_v falls between two valve sizes. If the pressure drop of the smaller is acceptable for the application, select the smaller valve.

CAVITATION LIMITATIONS ON VALVE PRESSURE DROP

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

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

The following formula can be used on higher temperature water systems, where cavitation could be a problem, to estimate the maximum allowable pressure drop across the valve: $Pm = 0.5 (P1 - Pv)$

Pm = Maximum allowable pressure drop
P1 = Absolute inlet pressure (psia)
Pv = Absolute vapor pressure (refer to Vapor Pressure of Water Table or Steam Table)

Note: Add 14.7 psi to gauge supply pressure to obtain absolute pressure value.

For example, if a valve is controlling 200°F water at an inlet pressure of 18 psig, the maximum pressure drop allowable would be:

Pm = 0.5 [(18 + 14.7) - 11.53] = 10.6 psi
(Vapor pressure of 200°F water is 11.53 psi)

If the pressure drop for this valve is less than 10.6 psi, cavitation should not be a problem.

Systems where cavitation is shown to be a problem can sometimes be redesigned to provide lower inlet velocities. Valves having harder seat materials should be furnished if inlet velocities cannot be lowered.

C_v (FLOW COEFFICIENT) DETERMINATION

The Water Valve Sizing Table or Slide Rule (refer to the following page) is based on the following formula:

$$C_v = \frac{GMP}{\sqrt{\Delta P}} \quad \text{or} \quad C_v = GMP\sqrt{\frac{\text{specific gravity}}{\Delta P}}$$

Where: C_v = Coefficient of flow

C_v is defined as the flow in GPM with $\Delta P = 1$ psi
GPM = US gallons per minute (60°F, 15.6°C)
ΔP = Differential pressure in psi (pressure drop)

Other forms of this formula are:

$$\Delta P = (GPM/C_v)^2 \text{ and}$$

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

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

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

Metric (SI) Units

K_{vs} is defined as the flow in m^3/h with $\Delta P = 100$ kPa (1.0 Bar) with the valve completely open.

Flow is calculated using the following formula:

$$m^3/h = K_{vs}\sqrt{\Delta P} \qquad \text{Where:}$$

ΔP = Differential pressure (pressure drop) in Bar (1 Bar = 100 kPa)
m^3/h = Cubic meters/hour (15.6 °C)

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

$$\Delta P = \frac{(m^3/h)^2}{(K_{vs})^2}$$

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

Vapor Pressure of Water Table.

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

Valve Sizing Information For Water

WATER VALVE SIZING TABLES

WATER CAPACITY IN GALLONS PER MINUTE										
C_v[a]	Differential Pressure (psi) ΔP									
	2	3	4	5	10	15	20	25	30	35
0.4	0.57	0.69	0.80	0.89	1.26	1.55	1.79	2.0	2.2	2.4
0.95	1.3	1.7	1.9	2.12	3.0	3.7	4.3	4.8	5.2	5.6
1.3	1.8	2.2	2.6	2.9	4.1	5.0	5.8	6.5	7.1	7.7
1.4	2.0	2.4	2.8	3.1	4.4	5.4	6.3	7.0	7.7	8.3
1.7	2.4	2.9	3.4	3.8	5.4	6.6	7.6	8.5	9.3	10.1
2	2.8	3.5	4.0	4.5	6.3	7.8	8.9	10	11	12
2.2	3.1	3.8	4.4	4.9	7.0	8.5	9.8	11	12	13
2.4	3.4	4.2	4.8	5.4	7.6	9.3	10.7	12	13	14
2.5	3.5	4.3	5.0	5.6	7.9	10	11	13	14	15
3.3	4.7	5.7	6.6	7.4	10.4	13	15	17	18	20
3.6	5.1	6.2	7.2	8.1	11.4	14	16	18	20	21
3.8	5.4	6.6	7.6	8.5	12.0	15	17	19	21	22
4	5.7	6.9	8.0	8.9	12.7	15	18	20	22	24
5	7.1	8.7	10	11	15	19	22	25	27	30
5.5	7.9	9.5	11	12	17	21	25	28	30	33
6	8.5	10.4	12	13	19	23	27	30	33	36
6.2	8.8	10.7	12	14	20	24	28	31	34	37
6.8	9.6	11.8	14	15	22	26	30	34	37	40
7.4	10.5	12.8	15	17	23	29	33	37	41	44
7.5	10.6	13.0	15	17	24	29	34	38	41	44
8	11.3	13.9	16	18	25	31	36	40	44	47
8.2	11.6	14.2	16	18	26	32	37	41	45	49
8.5	12.0	14.7	17	19	27	33	38	43	47	50
9	12.7	15.6	18	20	28	35	40	45	49	53
10.5	15	18	21	23	33	41	47	53	58	62
11	16	19	22	25	35	43	49	55	60	65
12	17	21	24	27	38	46	54	60	66	71
15	21	26	30	34	47	58	67	75	82	89
16	23	28	32	36	51	62	72	80	88	95
17.4	25	30.1	35	39	55	67	78	87	95	104
30	42	52	60	67	95	116	134	150	164	177
33	47	57	66	74	104	128	148	165	181	195
35.8	51	62	72	80	113	139	160	179	196	212
40	57	69	80	89	126	155	179	200	219	237
42	59	73	84	94	133	163	188	210	230	248
45	64	78	90	101	142					
55	78	95	110	123	174	213	246	275	301	325
56	79	97	112	125	177	217	250	280	307	331
65	92	113	130	145	206	251	291	325	356	385
67	95	116	134	150	212	259	300	335	367	396
68	96	118	136	152	215	263	250	340	372	402
70	99	121	140	157	221	271	313	350	383	414
74	105	128	148	165	234	287	331	370	405	438
75	106	130	150	168	237	290	335	375	411	444
85	120	147	170	190	269	329	380	425	466	503
91	129	158	182	203	288	352	407	455	498	538
100	141	173	200	224	316	387	447	500	548	592
101	143	175	202	226	319	391	452	505	553	598
109	154	189	218	244	345	422	487	575	597	645
115	163	199	230	257	364	445	514	575	630	680
145	205	251	290	324	459	562	648	725	794	858
160	226	277	320	358	506	620	716	800	876	947
170	240	294	340	380	538	658	760	850	931	1006
179	253	310	358	400	566	693	801	895	980	1059
195	276	338	390	436	617	755	872	975	1068	1154
200	283	346	400	447	632	775	894	1000	1095	1183
235	332	407	470	525	743	910	1051	1175	1287	1390
250	354	433	500	559	791	968	1118	1250	1369	1479
275	389	476	550	615	870	1065	1230	1375	1506	1627
290	410	502	580	648	917	1123	1297	1450	1588	1716
300	424	520	600	671	949	1162	1342	1500	1643	1775
350	495	606	700	783	1107	1356	1565	1750	1917	2071
390	552	676	780	872	1233	1510	1744	1950	2136	2307
425	601	736	850	950	1344	1646	1901	2125	2328	2514
440	622	762	880	984	1391	1704	1968	2200	2410	2603
640	905	1108	1280	1431	2024	2479	2862	3200	3505	3786
680	962	1178	1360	1521	2150	2634	3041	3400	3725	4023
1125	1591	1949	2250							
1150	1626	1992	2300							
1750	2475	3031	3500							
1850	2616	3204	3700							
2600	3677	4503	5200							

Note: This table is based on water at 60°F (16°C)

Valve Sizing Information For Steam

RECOMMENDED PRESSURE DROPS FOR STEAM

Refer to specific valve data in this catalog for maximum allowable drops and close-off ratings.

A. Two Position Zone Valves and Direct Radiator Valves

Use a minimum of 10% of inlet pressure (psig).

B. Proportional Control Valves

Low pressure (15 psig or less): of 80% of gauge inlet pressure.

When C_V required is between two valve sizes and closer to the smaller valve size, re-size for C_V using 42% of the absolute inlet pressure as pressure drop. Use the valve that is larger than the calculated C_V .

For steam pressures greater than 15 psig: 42% of the absolute inlet pressure.

When C_V required is between two valve sizes, select the larger size.

Note: Do not size steam valves on higher system pressures using a pressure drop greater than 42% of the absolute inlet pressure.

C_V (FLOW COEFFICIENT) DETERMINATION

The Steam Capacity Tables or Slide Rule (refer to this and the following two pages) is based on the following formula:

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

Where:

C_V = Coefficient of flow
Q = Lbs per hour of steam
ΔP = Differential pressure in psi (pressure drop)
P_2 = Outlet pressure in psia (absolute) psig + 14.7 = psia (absolute)
$K = 1 + (0.0007 \times {}^{\circ}F$ super-heat)

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

Other forms of the formula are:

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

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

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

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

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

Flow coefficients (C_V's) for specific valve bodies are given on specification pages of this catalog.

Valve Sizing For Steam

STEAM CAPACITY IN POUNDS PER HOUR

Note: Table is based on saturated steam.

Inlet Pressure	2 psig		5 psig		10 psig		15 psig		20 psig		25 psig		40 psig		50 psig		75 psig		100 psig	
ΔP* (psi) / Cv	0.2[1]	1.6[2]	0.5[1]	4[2]	1[1]	8[2]	1.5[1]	12[2]	2[1]	14[2]	2.5[1]	16[2]	4[1]	23[2]	5[1]	27[2]	7.5[1]	37[2]	10[1]	48[2]
0.4	2.2	5.9	3.7	9.5	5.9	13.9	7.8	17.5	9.7	20.4	11.6	23.4	17.1	32.4	20.7	38.3	29.8	53	38.8	68
0.95	5.2	14	8.8	22.6	13.9	32.9	18.5	41.5	23	48.5	27.5	55.5	40.6	77	49.2	90.9	70.8	126	92.2	161
0.99	5.4	14.6	9.2	23.5	14.5	34.3	19.3	43.3	24	50.6	28.6	57.8	42.3	80.2	51.3	94.8	73.7	131	96.1	168
1.1	6	16.2	10.2	26.2	16.1	38.1	21.5	48.1	26.7	56.2	31.8	64.3	47	89.1	57	105.3	81.9	146	106.8	187
1.3	7.1	19.2	12.1	31	19	45.1	25.4	56.8	31.5	66.4	37.6	75.9	55.5	24.3	67.4	124.4	96.8	172	126.2	221
1.8	9.8	27	18.7	43	26.3	62.4	35.1	78.7	43.7	91.9	52.1	105.2	76.9	145.8	93.3	172.3	134.1	238	174.7	306
2.2	12	32.4	20.4	52	32	76	43	96	53	112	63.6	128.5	94	178	114	210.6	164	291	213.6	373
2.5	13.6	37	23	59	37	87	49	109	61	128	72	146	107	203	130	239	186	331	342	424
3.3	18	49	31	79	48	114	64	144	80	169	95	193	141	267	171	316	246	437	320	560
3.6	19.6	53	34	86	53	125	70	157	87	184	104	210	154	292	187	345	268	477	349	611
3.8	20.7	56	35	90	56	132	74	166	92	194	110	222	162	308	197	364	283	503	369	645
4.0	22	59	37	95	58	139	78	175	47	204	116	234	171	324	207	383	298	530	388	679
5	27	74	47	119	73	173	98	219	121	255	145	292	214	405	259	479	372	662	485	848
5.5	30	81	51	131	80	191	107	240	1334	281	159	321	235	446	285	526	410	728	534	934
6	33	89	56	143	88	208	117	262	146	306	174	351	256	486	311	574	447	795	582	1018
6.2	34	91	58	147	91	215	121	271	150	317	179	362	265	502	321	593	462	821	602	1052
7.4	40	109	69	176	108	257	144	324	180	378	214	432	316	599	384	708	551	980	718	1256
7.5	41	111	70	178	110	260	146	328	182	383	217	438	320	608	389	718	559	994	728	1273
8.2	45	121	76	195	120	284	160	359	199	419	237	479	350	664	425	785	811	1086	796	1392
8.5	46	125	79	202	124	295	166	372	206	434	246	497	363	689	441	814	633	1126	825	1443
9	49	133	84	214	131	312	176	393	218	460	260	526	385	729	466	861	670	1192	874	1528
10.5	57	155	98	250	153	364	205	459	255	536	304	613	449	851	544	1005	782	1391	1019	1782
11	60	162	102	262	161	381	215	481	267	562	318	643	470	891	570	1053	819	1457	1068	1867
15	82	221	139	357	219	520	293	656	304	766	434	876	641	1215	777	1436	1117	1987	1456	2546
16	87	236	149	380	234	555	312	700	388	817	463	935	684	1296	829	1531	1192	2120	1553	2716
17.4	95	257	162	414	254	603	340	761	422	889	503	1016	743	1409	902	1665	1296	2305	1689	2954
25	136	369	232	594	365	867	488	1093	607	1277	723	1460	1068	2025	1296	2393	1862	3312	2427	4244
35.8	195	528	333	851	523	1241	699	1565	867	1828	1036	2091	1529	2900	1856	3427	2667	4742	3475	6077
40	218	590	372	951	584	1387	780	1749	970	2043	1157	2337	1709	3240	2073	3829	2980	5299	3883	6790
45	245	664	418	1070	657	1560	878	1967	1092	2298	1302	2629	1923	3645	2332	4307	3352	5961	4368	7639

[1] For two-position control

[2] For proportional or floating control

* ΔP = pressure drop across the valve in psi

Continued on next page...

Valve Sizing For Steam

STEAM CAPACITY IN POUNDS PER HOUR

Note: Table is based on saturated steam.

(Continued from previous page)

Inlet Pressure	2 psig		5 psig		10 psig		15 psig		20 psig		25 psig		40 psig		50 psig		75 psig		100 psig	
ΔP* (psi) / Cv	0.2[1]	1.6[2]	0.5[1]	4[2]	1[1]	8[2]	1.5[1]	12[2]	2[1]	14[2]	2.5[1]	16[2]	4[1]	23[2]	5[1]	27[2]	7.5[1]	37[2]	10[1]	48[2]
56	305	826	521	1331	818	1942	1093	2448	1359	2860	1620	3271	2392	4536	2903	5360	4171	7418	5436	9506
65	354	958	604	1545	949	2254	1268	2842	1577	3320	1881	3797	2777	5265	3369	6221	4842	8611	6310	11034
70	381	1032	651	1664	1022	2427	1366	3061	1698	3575	2025	4089	2991	5670	3628	6670	5214	9273	6795	11882
75	409	1106	697	1783	1095	2601	1463	3279	1820	3830	2170	4381	3204	6075	3887	7179	5587	9935	7280	12731
85	463	1253	790	2021	1241	2947	1658	3716	2062	4341	2459	4966	3631	6885	4406	8136	6332	11260	8251	14429
100	545	1475	930	2377	1460	3468	1951	4372	2426	5107	2893	5842	4272	8101	5183	9571	7449	13247	9707	16975
115	627	1696	1069	2734	1680	3988	2244	5028	2790	5873	3327	6718	4913	9316	5961	11007	8566	15234	11163	19521
145	790	2138	1348	3447	2118	5028	2829	6340	3518	7405	4195	8471	6195	11746	7516	13878	10801	19208	14075	24613
170	926	2507	1580	4042	2483	5895	3317	7433	4124	8682	4918	9931	7263	13771	8811	16271	12663	22519	16502	28857
200	1090	2949	1859	4755	2921	6935	3902	8744	4852	10214	5786	11684	8544	16201	10366	19143	14898	26494	19414	33950
235	1281	3465	2184	5587	3432	8149	4585	10275	5701	12002	6799	13729	10040	19036	12180	22493	17505	31130	22812	39891
275	1499	4055	2556	6538	4016	9536	5366	12024	6672	14044	7956	16065	11749	22277	14254	26321	20484	36429	26695	46681
350	1907	5161	3253	8321	5112	12136	6829	15303	8491	17875	10126	20447	14953	28352	18141	33500	26071	46264	33975	59412
425	2316	6267	3950	10104	6207	14737	8292	18582	10311	21705	12296	24828	18157	34427	22028	40678	31658	56300	41256	72143
440	2398	6488	4090	10461	6426	15257	8585	19238	10675	22471	12730	25704	18798	35642	22806	42114	32775	58287	42712	74689
640	3488	9437	5949	15215	9347	22192	12487	27982	15527	32685	18516	37388	27342	51844	33172	61257	47672	84781	62126	108639
680	3706	10027	6321	16166	9931	23579	13268	29731	16498	34728	19673	39725	29051	55084	35245	65085	50652	90080	66009	115429
1125	6131	16589	10457	26746	16430	39010	21950	49187	27294	57454	32547	65722	48063	91131	58310	107678	83799	149029	109206	190967
1150	6267	16958	10689	27340	16796	39877	22438	50280	27900	58731	33271	67182	49131	93156	59606	110071	85661	152341	111633	195210
1750	9537	25805	16267	41604	25558	60682	34145	76513	42457	89373	50629	102234	74764	141760	90705	167499	130354231823		169876	297059
1850	10082	27280	17196	43982	27019	64150	36096	80885	44883	94481	53522	108076	79036	149860	95888	177070	137803245070		179583	314034
2600	14169	38339	24167	61812	37972	90157	50730	113677	63079	132783	75220	151890	111078	210614	134762	248855	193669344422		252388	441345
2650	14442	39076	24632	63001	38703	91890	51706	115863	64292	135337	76667	154811	113214	214665	137353	253641	197394351046		257241	449832
3400	18529	50136	31604	80831	49656	117897	66339	148654	82488	173640	98365	198625	145256	275419	176227	325426	253260450398		330045	577143
4500	24524	66356	41828		65722		87802		109175		130189									
5400	29429	79628	50194		78866		105362													
7000	38148		65066		102234															
10000	54498		92952																	

[1] For two-position control

[2] For proportional or floating control

* ΔP = pressure drop across the valve in psi

Valve Sizing and Dimensions

Valve Assembly Dimensional Drawings in Inches(mm)

VALVE BODY INCHES (MM)		DIMENSIONS INCHES (MM)				ACTUATOR TYPE AND DIMENSION IN									
						EA81		EA12		EA31, EA40/40A, EA50/50A		EA76/76A		MF-631XX	
Series	Size "	A	B	C	D	E	Fig.	E	Fig.	E	Fig.	E	Fig.	E	Fig.
	1/2	3-1/2 (89)	2-5/8 (67)	1-5/8 (41)		9-9/16 (243)									
VB-7211-000-3	3/4	3-13/16 (97)	2-3/4 (70)	1-3/4 (44)		9-3/4 (248)	1								
	1	4-1/4 (108)	3-1/8 (79)	2 (51)		10-1/4 (260)									
	1-1/4	4-3/8 (111)	3-3/8 (86)	2-1/8 (54)		10-9/16 (268)									
	1/2	4-1/4 (108)	2-3/4 (70)	1-1/16 (27)		9-15/16 (252)									
VB-7211-000-4	3/4	4-3/4 (121)	2-15/16 (75)	1-1/16 (27)		9-15/16 (252)	2								
	1	6-1/8 (156)	3-13/16 (97)	1-3/4 (44)		10-5/8 (270)									
	1-1/4	6-3/8 (162)	4-1/16 (103)	1-3/8 (35)		10-5/8 (270)									
VB-7212-000-4	5/8	4 (102)		1-1/16 (37)		9-15/16 (252)	3								
	1/2	4-1/4 (108)	2-3/4 (70)	1-1/16 (27)		9-15/16 (252)									
VB-7221-000-4	3/4	43/4 (121)	2-15/16 (75)	1-1/16 (27)		9-15/16 (252)	2								
	1	6-1/8 (156)	3-13/16 (97)	1-3/4 (44)		10-5/8 (270)									
	1-1/4	6-3/8 (162)	4-1/16 (103)	1-3/8 (35)		10-5/8 (270)									
VB-7222-000-4	5/8	4 (102)		1-3/16 (30)		9-15/16 (252)	3								
	1/2	3	4-3/16 (106)	1-1/16 (27)		8-3/4 (222)		12-13/16 (325)		13-1/2 (343)				7-1/8 (181)	
VB-7213-000-4	3/4	3-5/8 (92)	5-7/16 (138)	1-1/16 (27)		8-3/4 (222)		12-13/16 (325)		13-1/2 (343)				7-1/8 (181)	
VB-7214-000-4	1	4-5/8 (117)	6-5/8 (168)	1-1/8 (29)		10-5/8 (270)	4	13-1/2 (343)	7	14-3/16 (360)	13			7-13/16 (198)	26
VB-7253-000-4	1-1/4	4-5/8 (117)	6-13/16 (173)	1-3/8 (35)		10-5/8 (270)		13-1/2 (343)		14-13/16 (376)				7-13/16 (198)	
VB-7273-000-4	1-1/2	5-3/8 (137)	8-5/16 (211)	1-1/2 (38)		10-11/16 (271)		13-9/16 (344)		14-1/4 (362)				7-7/8 (200)	
	2	6-1/8 (156)	9-3/16 (233)	1-9/16 (40)		10-15/16 (278)		13-13/16 (351)		14-1/2 (368)				8-1/8 (206)	
	1/2	3 (76)	4-3/16 (106)	1-1/4 (32)		8-3/4 (222)									
VB-7223-000-4	3/4	3-5/8 (92)	5-7/16 (138)	1-1/4 (32)		8-3/4 (222)									
VB-7224-000-4	1	4-5/8 (117)	6-5/8 (168)	1-3/4 (44)		10 (254)	4								
VB-7263-000-4	1-1/4	4-5/8 (117)	6-13/16 (173)	1-3/4 (44)		10-1/4 (260)									
VB-7283-000-4	1-1/2	5-3/8 (137)	8-5/16 (211)	1-13/16 (46)		10-3/8 (264)									
	2	6-1/8 (156)	9-3/16 (233)	2-1/16 (52)		10-7/16 (265)									
VB-7312-000-4	5/8	4 (102)		7/16 (37)		7-13/16 (198)	5								
	1/2	3 (76)	4-3/16 (106)	1-3/8 (35)	2-5/16 (59)	9-15/16 (252)		12-13/16 (325)		13-9/16 (344)				11-1/4 (286)	
	3/4	3-5/8 (92)	5-7/16 (138)	1-11/16 (43)	2-5/8 (67)	9-15/16 (252)		12-13/16 (325)		13-9/16 (344)				11-1/4 (286)	
VB-7313-000-4	1	4-5/8 (117)	6-5/8 (168)	1-9/16 (40)	3-1/8 (79)	10 (254)	6	12-7/8 (327)	8	13-5/8 (346)	14			11-5/16 (287)	27
VB-7314-000-4	1-1/4	4-5/8 (117)	6-13/16 (173)	1-5/8 (41)	3-7/16 (87)	10-1/4 (260)		13-1/8 (333)		13-7/8 (352)				11-9/16 (294)	
VB-7323-000-4	1-1/2	5-3/8 (137)	8-5/16 (211)	1-9/16 (40)	3-3/4 (95)	10-3/8 (264)		13-1/4 (337)		14 (356)				11-11/16 (297)	
	2	61/8 (156)	9-3/16 (233)	1-7/8 (48)	4-3/16 (106)	10-7/16 (265)		13-5/16 (338)		14-1/16 (357)				11-3/4 (298)	
VB-9213-000-4	2-1/2	8-1/2 (216)		3-3/4 (95)				15-15/16 (405)	9	16-5/8 (422)	15/			10-3/8 (264)	28
	3	9-1/2 (241)		4 (102)				16-3/8 (416)		17-1/8 (435)	*16			10-13/16 (275)	
	2-1/2	8-1/2 (216)		3-1/2 (89)				15-1/8 (384)		15-13/16 (402)				9-9/16 (243)	
	3	9-1/2 (241)		3-3/4 (95)				16-5/8 (422)		17-5/16 (440)				11-1/16 (281)	29
VB-9213-000-5	4	11-1/2 (292)		4-1/2 (114)				17-1/2 (445)	10	18-3/16 (462)	17/			3-3/4 (349)	
*with AV-352	5	13 (330)		5 (127)				18-5/8 (473)		9-1/4 (489)	*18	24-1/8 (613)	24		
	6	14 (356)		5-1/2 (140)				19-5/16 (491)		20 (508)		251/8 (638)			
VB-9313-000-4	2-1/2	8-1/2 (216)		4-5/8 (117)				15-15/16 (405)	11	16-11/16 (424)	19/			10-3/8 (264)	30
*with AV-352	3	9-1/2 (241)		5 (127)				16-3/8 (416)		17-1/8 (435)	*20			10-13/16 (275)	
	2-1/2	8-1/2 (216)		5-3/8 (137)				15-1/8 (384)		15-7/8 (403)				10-1/4 (260)	
	3	9-1/2 (241)		6-3/8 (162)				16-5/8 (422)	12	17-3/8 (441)				10-1/2 (267)	31
VB-9313-000-5	4	11-1/2 (292)		8-1/2 (216)				17-1/2 (445)		18-1/4 (464)	21/			11-1/4 (286)	
*with AV-352	5	13 (330)		8-3/4 (222)						18 (457)	*22	24-3/8 (619)	25		
	6	14 (356)		9-3/4 (248)						18-1/2 (470)		25-1/8 (638)			
	2-1/2	9 (229)		7 (178)				17-1/2 (445)		17-1/2 (445)				13-7/16 (341)	
	3	10 (254)		8 (203)				18 (457)	12	18 (457)	19/			13-13/16 (351)	31
VB-9323-000-5	4	12 (305)		10 (254)						18-3/4 (476)	*23			14-7/16 (367)	
*with AV-352	5	13 (330)		10-1/2 (267)						19-3/8 (492)					
	6	14-1/8 (359)		11-1/8 (283)						20 (508)					

Dimensions are shown in figures 1 through 31 on following pages (3–45 to 3–48).

Valve Sizing and Dimensions

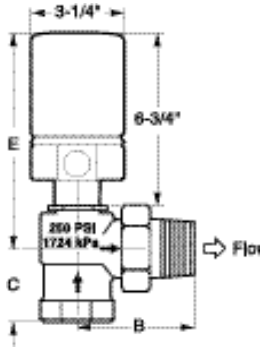


Figure 1

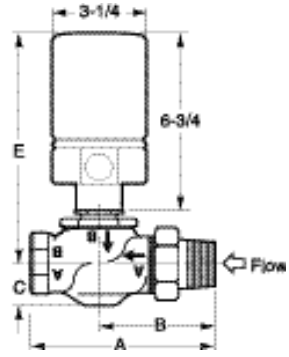
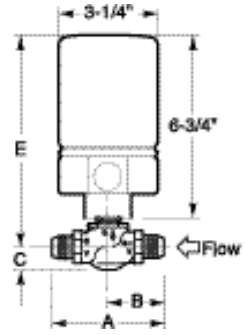


Figure 2



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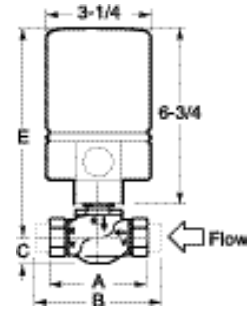

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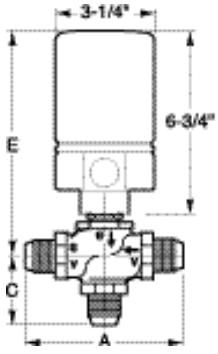

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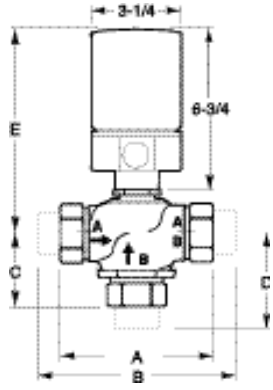
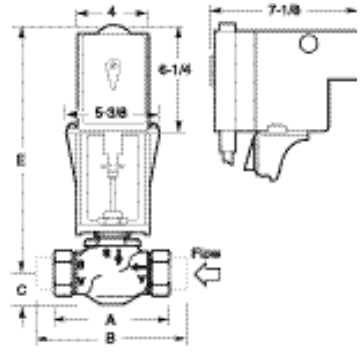


Figure 6



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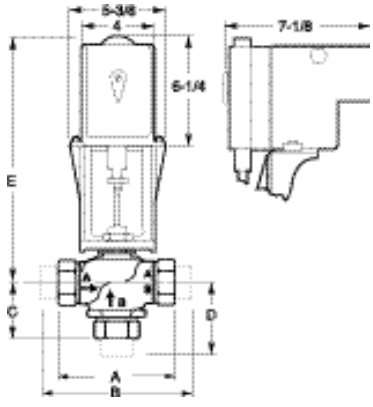


Figure 8

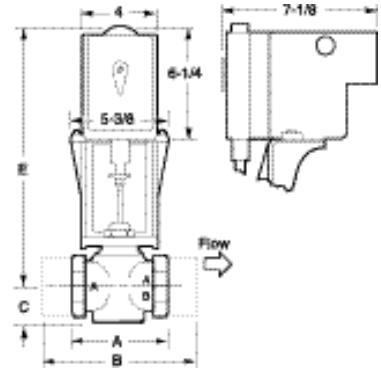


Figure 9

Valve Sizing and Dimensions

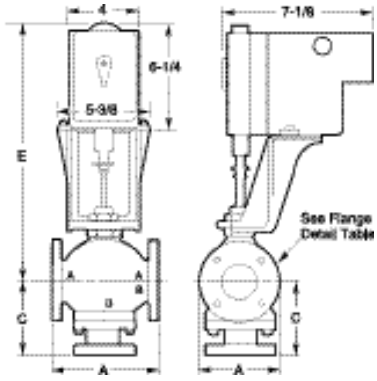


Figure 10

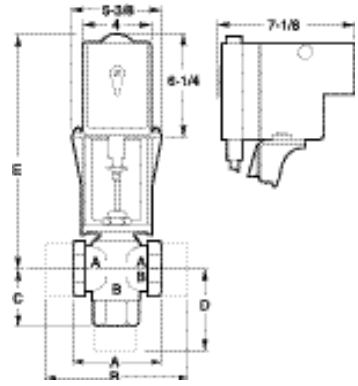


Figure 11

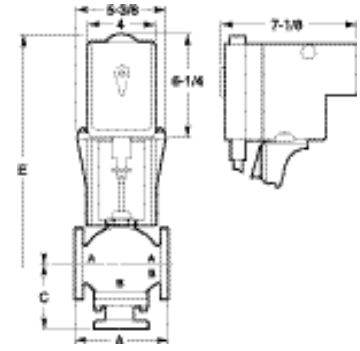


Figure 12

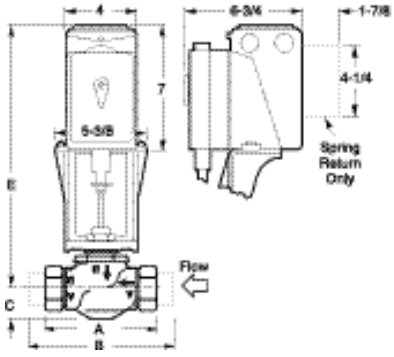


Figure 13

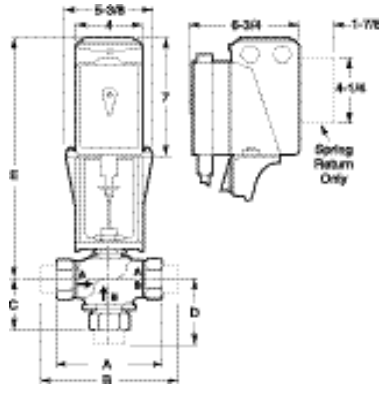
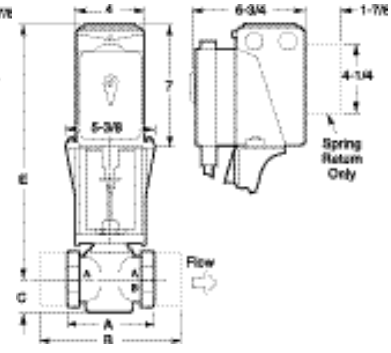


Figure 14



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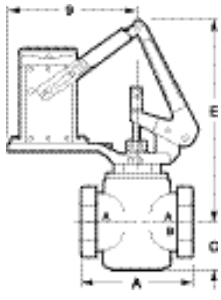


Figure 16

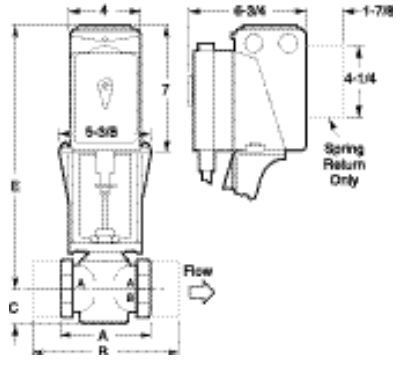


Figure 17

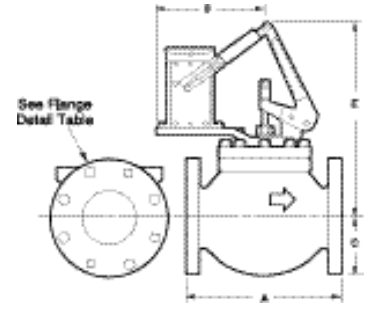


Figure 18

Valve Sizing and Dimensions

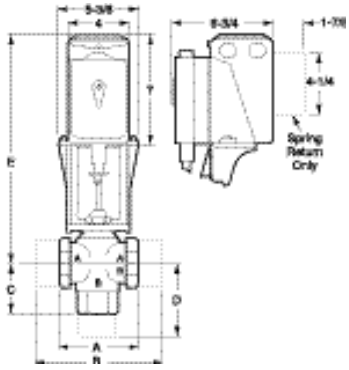
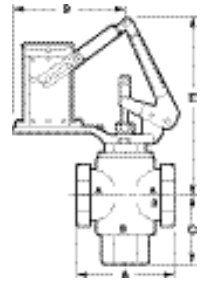


Figure 19



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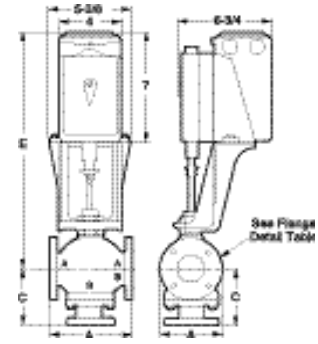

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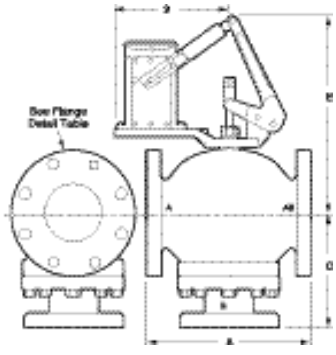

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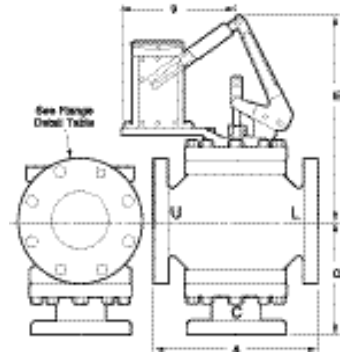

Figure 23

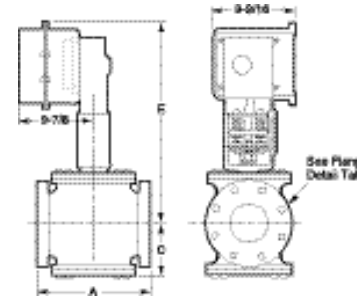

Figure 24

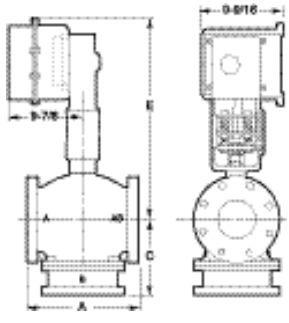

Figure 25

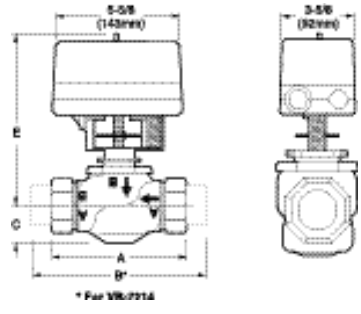

Figure 26

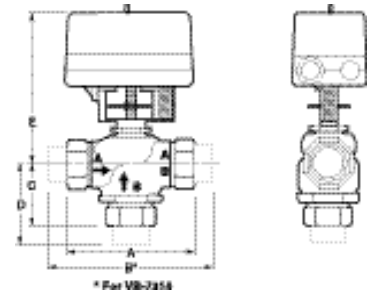

Figure 27

Valve Sizing and Dimensions

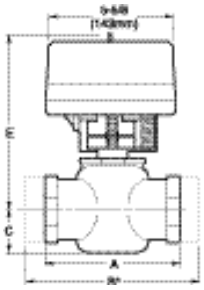

Figure 28

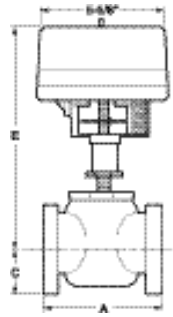

Figure 29

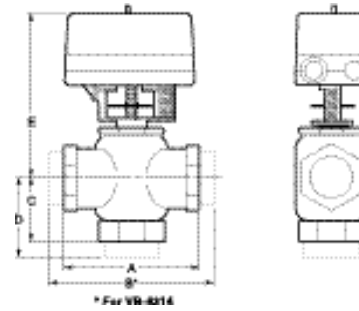

Figure 30

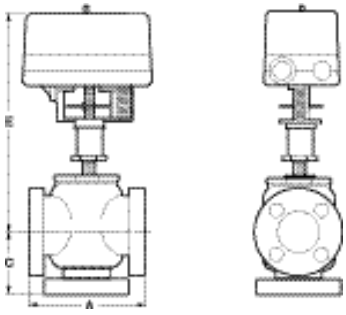

Figure 31

Replacement Parts and Accessories for Valve Assembly and Maintenance

Repair Kits

Valve Body Series	PP Code	Repair Kit
VB-7211-000-3- VB-7211-000-4- VB-7213-000-4- VB-7214-000-4-	01	RYB-721-01
	02	RYB-721-02
	03	RYB-721-03
	04	RYB-721-04
	05	RYB-721-05
	06	RYB-721-06
	07	RYB-721-07
	08	RYB-721-08
	09	RYB-721-09
	10	RYB-721-10
	11	RYB-721-11

Valve Body Series	PP Code	Repair Kit
VB-7221-000-4- VB-7223-000-4- VB-7224-000-4-	01	RYB-722-01
	02	RYB-722-02
	03	RYB-722-03
	04	RYB-722-04
	05	RYB-722-05
	06	RYB-722-06
	07	RYB-722-07
	08	RYB-722-08
	09	RYB-722-09
	10	RYB-722-10
	11	RYB-722-11

Valve Body Series	PP Code	Repair Kit
VB-7253-000-4-	01	RYB-725-01
	02	RYB-725-02
	03	RYB-725-03
	04	RYB-725-04
	05	RYB-725-05
	06	RYB-725-06
	07	RYB-725-07
	08	RYB-725-08
	09	RYB-725-09
	10	RYB-725-10
	11	RYB-725-11

Valve Body Series	PP Code	Repair Kit
VB-7263-000-4-	01	RYB-726-01
	02	RYB-726-02
	03	RYB-726-03
	04	RYB-726-04
	05	RYB-726-05
	06	RYB-726-06
	07	RYB-726-07
	08	RYB-726-08
	09	RYB-726-09
	10	RYB-726-10
	11	RYB-726-11

Valve Body Series	PP Code	Repair Kit
VB-7273-000-4-	01	RYB-727-01
	02	RYB-727-02
	03	RYB-727-03
	04	RYB-727-04
	05	RYB-727-05
	06	RYB-727-06
	07	RYB-727-07
	08	RYB-727-08
	09	RYB-727-09
	10	RYB-727-10
	11	RYB-727-11

Valve Body Series	PP Code	Repair Kit
VB-7283-000-4-	01	RYB-728-01
	02	RYB-728-02
	03	RYB-728-03
	04	RYB-728-04
	05	RYB-728-05
	06	RYB-728-06
	07	RYB-728-07
	08	RYB-728-08
	09	RYB-728-09
	10	RYB-728-10
	11	RYB-728-11

Valve Body Series	PP Code	Repair Kit
VB-7312-000-4- VB-7313-000-4- VB-7314-000-4-	02	RYB-731-02
	04	RYB-731-04
	06	RYB-731-06
	08	RYB-731-08
	09	RYB-731-09
	10	RYB-731-10
	11	RYB-731-11

Valve Body Series	PP Code	Repair Kit
VB-7323-000-4-	04	RYB-732-04
	06	RYB-732-06
	08	RYB-732-08
	09	RYB-732-09
	10	RYB-732-10
	11	RYB-732-11

Valve Body Series	PP Code	Repair Kit
VB-9213-000-4- VB-9213-000-5-	12	RYB-921-12
	13	RYB-921-13
	14	RYB-921-14
	15	RYB-921-15
	16	RYB-921-16

Valve Body Series	PP Code	Repair Kit
VB-9313-000-4- VB-9313-000-5-	12	RYB-931-12
	13	RYB-931-13
	14	RYB-931-14
	15	RYB-931-15
	16	RYB-931-16

Replacement Parts and Accessories for Valve Assembly and Maintenance

Replacement Stainless Steel Seats and Seat Replacement Tools

Valve Body Series	PP Code	Stainless Steel Seats	Seat Tool Kit
	01–04	NYBA-7253-101-0-04	TOOL-7253-101-0-00
VB-7253-000-4-	05–06	NYBA-7253-101-0-06	TOOL-7253-101-0-00
VB-7263-000-4-	07-08	NYBA-7253-101-0-08	TOOL-7253-101-0-00
VB-7273-000-4-	09	NYBA-7253-101-0-09	TOOL-7253-101-0-00
VB-7283-000-4-	10	NYBA-7253-101-0-10	TOOL-7253-101-0-00
	11	NYBA-7253-101-0-11	TOOL-7253-101-0-00

Tail Piece and Union Nuts

Valve Body Series	PP Code	Tail Piece	Union Nut
	01-04	YBA-657-04	YBA-656-04
	05-06	YBA-657-06	YBA-656-06
VB-7214-000-4-	07-08	YBA-657-08	YBA-656-08
VB-7314-000-4-	09	YBA-657-09	YBA-656-09
	10	YBA-657-10	YBA-656-10
	11	YBA-657-11	YBA-656-11

Other Tools and Parts

1-5/8"Pump Wrench to mount linkage kits to VB-7000 series valve bodies (Service wrench with 9/32" thick head available in tool supply stores)	TOOL-37
Packing Wrench to install new packing on an RYB series repair kit (Custom product not available elsewhere)	TOOL-20-1
Cartridge and packing assembly for VB-7000 series valve bodies (Included in RYB-700 series repair kits)	YBA-622-1
Packing Kit for VB-9213 and VB-9313 valve bodies (Included in RYB-900 series repair kits)	YBA-651-1

Valve Selection Examples

Selecting a valve is not an exact science with firm rules, but rather a collection of guidelines, operating limits and choices. The customer is encouraged to become familiar with the various selection criteria, technical data and specifications found in this catalog section. The general information on pages 3–35 to 3–41 should be reviewed prior to valve selection. Below are three examples illustrating the principles of valve selection which will assist you in understanding the material in this catalog.

Example 1:

Step 1: List the requirements

A customer has an application for control of water flow with the following characteristics:

Fluid:	Water
Designated pipe size	1-1/2" with female pipe threads
Specific gravity	1
Desired valve type	2-Way flow through pattern
Fluid temperature	85°F
Control action	ON-OFF
Ambient temperature	105°F
Spring action required	Spring return
Inlet pressure	20 psig
Supply volts	120 Vac, 60 Hz
Required flow rate	22 gpm
Options	None

Step 2: Select the valve body

When determining the valve size for ON-OFF control, use the valve body with the largest C_v rating in the desired pipe size. Check the selection of 2-Way valve bodies in the catalog on pages 3–8 through 3–12 for the ones that accommodate a 1-1/2" pipe size and have the specified female pipe threads. Since an electric actuator is to be used, only valves with Stem-up Open configuration may be selected. The valve bodies that meet the requirements are the VB-7213, VB-7253 and VB-7273. From the valve body specifications, it is seen that the one that most closely matches the temperature/pressure specifications above is the VB-7213. Although all three will work, the VB-7213 is the best choice for the price.

Step 3: Determine the C_v and confirm the flow rate capacity

The specification table for the VB-7213 on page 3–10 shows that a 1-1/2" valve has a Port code of 10 and a C_v of 30.

The valve-sizing table for water on page 3–40 may be used. Consult the recommended pressure drops for water across a two-position valve on page 3–38. It states that no more than 10% of the available pressure should be dropped across the valve when fully open. For an inlet pressure of 20 psig (34.7psia), the differential pressure across the valve should be no more than 3.5 psi. According to the valve-sizing table for water on 3–40, the water flow capacity is interpolated to be 56 gpm for a differential pressure of 2 psi and a C_v of 30. This more than meets the requirement for 22 gpm required above. The VB-7213 is confirmed as a good choice for this application.

Step 4: Determine the Control Form and actuator

The model number breakout on page 3–3 indicates that on-off control with spring return is Control Form code “VA”, which is discussed in more detail on page 3–5. The actuator selection table on page 3–18 indicates that the EA12 actuator should be used.

Step 5: Confirm the actuator environmental characteristics

The ambient temperature chart for the VB-7213 valve body with the EA12 actuator is on page 3–20. It shows that the requirements for 105°F ambient temperature and 85°F fluid temperature are well

within the maximum allowable ratings of 136ºF and 260ºF respectively. This confirms we are in a safe environment.

The close-off pressure table on page 3–22 shows that the EA12 can close-off against an inlet pressure up to 60 psig. Our customer requirement for 20 psig inlet pressure is well within this close-off limit and the EA12 is again confirmed as a good choice.

Step 6: Select the linkage kit

The valve assembly table for Control Form VA on page 3–27 shows that the model AV-391-000-0-01 is the proper linkage kit for a VB-7213 and an EA12. The AV-391-000-0-01 is shown on page 3–26. Note the linkage kit can be assembled for normally open or normally closed action, depending on the position of a cam.

Step 7: Order the valve

The Valve Assembly Table on 3–27 also shows that the valve is available as a factory assembled unit. You can order this assembly in three different ways:

As components (faster delivery and lower cost), order 1 each of EA12 actuator, AV-391-000-0-01 linkage kit and VB-7213-000-4-10 valve body. Assemble the valve according to the instructions with the linkage kit.

As a normally open factory assembly, order VA-7213-321-4-10.

As a normally closed factory assembly, order VA-7213-322-4-10.

Note that if any options for the EA12 are required, the valve must be ordered as components.

Example 2:

Step 1: List the requirements

A customer has an application for the control of steam flow that requires a valve to close during a power failure and will have the following characteristics:

Fluid:	Steam
Designated pipe size	1" with female pipe threads
Specific gravity	1
Desired valve type	2-Way flow through pattern
Fluid temperature	307°F
Control action	Floating control
Ambient temperature	95°F
Spring action required	Spring return
Inlet pressure	60 psig
Supply volts	120 Vac, 60 Hz
Required flow rate	450 lb/hr
Options	NEMA 4 cover

Step 2: Select the valve body

Check the selection of 2-Way valve bodies in the catalog on pages 3–8 through 3–12 for the ones that accommodate a 1" pipe size and have the specified female pipe threads. Only valves with Stem-up Open configuration may be selected since an electric actuator is to be used. The valve bodies that meet the requirements are the VB-7213, VB-7253 and VB-7273.

From page 3–41, floating (or proportional control) of steam above 15 psig usually requires that a design target of 42% of the available absolute inlet pressure be dropped across the valve body when fully open. The absolute inlet pressure is 60 psig + 14.7 = 74.7 psia. The differential pressure across the valve should be 31.4 psi. From the valve specifications on page 3–10, this differential pressure exceeds the maximum differential pressure for the VB-7213 series. The specifications on page 3–12 show that both of the other valve bodies have stainless steel seats and a maximum allowable pressure drop of 35 psi, which is greater than 42% of the absolute inlet pressure. Both valves are operating in a mid-range of their design specifications, are properly sized and have acceptable differential pressure ratings. Therefore excessive cav-

itation will not be a problem with either model. Both are also the same price. However, the VB-7273, from page 3–12, may have up to 2% off-state leakage. Therefore, the VB-7253 is the best selection.

Step 3: Determine the C_v and confirm the flow rate capacity

The formula for calculating C_v for steam applications is on page 3–41. For the above example the calculated C_v is as follows:

Q = 450 lb/hr,
K = 1,
Δp = 31.4 psi
P2 = (74.7– 31.4) = 43.3 psia
$C_v = 450 / 3 \times (31.4 \times 43.3)^{1/2} = 4.1$

The VB-7253 valve body in a 1" pipe size has a C_v of at least 10 according to the specification on page 3–10. Remember the rules on page 3–8: “never use an oversize valve body with floating or proportional control". For the selected valve, a C_v of 4.4 is the closest available valve size and the model number becomes VB-7253-000-4-04. However, this C_v is for a 1/2" pipe size valve body. Therefore, the customer will have to use reducing couplings to step down his 1" pipe to a 1/2" size.

According to the valve sizing table for steam on page 3–42, for a differential pressure of 31.4 psi and a C_v of 4.4, the steam flow capacity is interpolated to be 493 lb/hr. This more than meets the requirement for a flow of 450 lb/hr in the specification above, and hence the VB-7253 will handle the capacity requirement easily and is confirmed as a good choice for this application.

Step 4: Determine the control form and actuator

The specification calls for floating control with spring return. The actuator selection table on page 3–18 indicates that the floating control actuators are all part of the MF-630000 series. However, this series of actuators are all 24Vac units, not available as NEMA 4 and are non-spring return only. The control form can, therefore, not be “VF”, as described on page 3–6.

Consulting the actuator section of the catalog for the EA box style actuators it will be found that the EA40 series proportional actuator (Form “VP”), can be operated as a floating control unit if the slidewire feedback is not used. An EA44 will provide a normally closed spring return on power down. An EA42 will provide the same floating control and spring return, but has normally open action on power down. Select the EA44.

The customer requires NEMA 4 protection also. The actuator section of this catalog confirms that the requirements are met by an actuator model number of EA44-00370-000-0-00 with control form “VP”, but used in floating control mode.

Step 5: Confirm the actuator environmental characteristics

Consult the ambient temperature chart on page 3–20 for the VB-7253 to confirm the selection for ambient and fluid temperatures. It shows that we are well within specifications for ambient and fluid temperatures for steam. The close-off pressure table on page 3–22 shows that the EA44 can close-off against a maximum inlet pressure of 250 psig, well above the specified inlet pressure of 60 psig, confirming the EA44 is a good choice.

Step 6: Select the linkage kit

The valve assembly table for Control Form VP on page 3–29 shows that the proper linkage kit for a VB-7253 with port code 04 and an EA44 actuator is a model AV-391-000-0-01. Th AV-391-000-0-01 is shown on page 3–26.

Step 7: Order the valve

The actuator has a NEMA 4 option requirement. The note on the bottom of the table on page 3–29 indicates that if the EA44 actuator has options, it is not available as a factory assembly. This application can only be satisfied if components are ordered.

Order 1 each of EA44-00370-000-0-00 actuator, AV-391-000-0-01 linkage kit and VB-7253-000-4-04 valve body. Assemble the valve according to the instructions with the linkage kit.

Example 3:

Step 1: List the requirements

A customer has a "bypass valve" application for control of water flow, which is not a constant flow situation. The requirements have the following characteristics:

Fluid:	Water
Designated pipe size	4", with flange mount
Specific gravity	1
Desired valve type	3-Way mixing pattern
Fluid temperature	65°F
Control action	Proportional, 4-20mA input
Ambient temperature	80°F
Spring action required	Non-spring return
Inlet pressure	20 psig
Supply volts	240 Vac, 60 Hz
Required flow rate	750 gpm
Options	NEMA 4 cover Retransmitting slidewire

Step 2: Select the valve body

Check the selection of 3-Way mixing valve bodies in the catalog on pages 3–13 through 3–16 for a flange-mount valve body pattern in a 4" pipe size. The only valve body available that meets the requirements and supports an electric actuator is the VB-9313-000-5-14.

Step 3: Determine the C_v and confirm the flow rate capacity

From page 3–16, the selected valve above has a C_v of 170. Refer to Section C on page 3–38 for proportional 3-way valves in bypass applications. It says that at least 50% of the available inlet pressure should be dropped across the valve body at full flow.

The formula for calculating C_v for water applications is on page 3–39. The calculated Δp for this water flow application is as follows:

Inlet Pressure = 20 psig + 14.7 = 34.7 psia

$C_v = 170$

GPM = 750 gpm

$\Delta p = (GPM/ C_v)^2 = (750/170)^2 = 19.5$ psi

A pressure drop of 19.5 psi is 56% of the inlet pressure (34.7 psia). This meets the criteria that at least 50% of the inlet pressure be dropped across the valve at full flow. This confirms that the VB-9313-000-5-14 is ideal for the application.

Step 4: Determine the control form and actuator

The model number breakout table on page 3-3 indicates that proportional control action with an analog input (4-20mA) actuator is Control Form "VS". This is discussed in more detail on page 3–6. The actuator selection table on page 3–18 indicates that the selected actuator should be one of the Series EA50-A or the EA76-A.

Use the pressure close-off tables to narrow the selection. The table on 3–22 for actuators with 50/60 in-lbs. of torque shows that for this valve, they will close off against only a 6 psig inlet pressure. This is inadequate, eliminating the EA52-A and the EA54-A actuator. The upper table on page 3–23 for actuators with 220 in-lbs. of torque shows a close off rating of 17 psig inlet pressure. This is also inadequate and eliminates the EA56-A and EA58A with those linkages.

The lower table on page 3–23, shows that the either an EA56-A or and EA58-A with 220 in-lbs. of torque can close-off against 40 psig when coupled with the AV-352 linkage kit. This is more than adequate to meet the application. The close-off table on page 3–24 shows that the high torque EA76-A actuator is not available for a 4" valve body. The actuator choice has therefore narrowed to an EA56-A or and EA58-A actuator.

Go to the actuator section of the catalog and observe that the difference between the EA56-A and EA58-A is the speed of adjustment. The EA58-A has a fixed travel time of 80 seconds. The EA56-A actuator has an adjustable travel time between 80 and 800 seonds. Either solution is acceptable, depending upon customer preference. Assume for this example that the EA58-A is selected.

Build the actuator model number:

EA58-A	Actuator with built-in 4-20mA input card.
EA58-A031	Retransmitting slidewire and NEMA 4 weather resistant cover
EA58-A0313	240Vac, 60Hz motor
EA58-A0313-003	1000Ω slidewire is required for a 4-20mA input circuit

Step 5: Confirm the actuator environmental characteristics

Consult the ambient temperature chart on page 3–20 for the VB-9313-000-5-14. It shows that we are in a safe environment for the specified ambient and water fluid temperatures. The EA58-A is confirmed as a good choice.

Step 6: Select the linkage kit

The valve assembly table for Control Form VS on page 3–34 shows that the proper linkage kit for a VB-9313 at Port size 14 and an EA58-A actuator is a model AV-352. The AV-352, which doubles the allowable close-off pressure for the EA58-A at the 4" size is described on page 3–26.

Step 7: Order the valve

The valve assembly table on page 3–34 shows that this combination of valve body, actuator and linkage is not available as a factory assembly. It must be ordered as separate components.

Order 1 each of EA58-A0313-003 actuator, AV-352 linkage kit and VB-9313-000-5-14 valve body. Assemble the valve according to the instructions with the linkage kit.