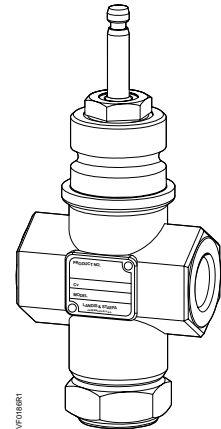


Flowrite™ VF 599 Series

Three-Way Valves 1/2 to 2-inch Bronze Body



Description	The Flowrite VF 599 Series ANSI Class 250 three-way valves are designed to work with either a pneumatic or electronic actuator with a 3/4-inch (20 mm) stroke.
Features	<ul style="list-style-type: none"> • Direct coupled universal bonnet • Choice of bronze or stainless steel trim • ANSI Leakage Class IV (0.01% of Cv) • Cartridge type packing
Application	<p>A typical application for the Flowrite three-way valve is the mixing of two different temperatures of water supplies.</p> <p>The valve can also be used for throttling or bypass coil control applications. A pump is recommended on the coil circuit to improve the heat transfer characteristics of the coil and for freeze protection.</p>
Product Numbers	See Table 1.
Ordering a Valve Plus Actuator Assembly	<p>To order a complete valve plus actuator assembly from the factory, combine the actuator prefix code with the suffix of the valve assembly product number. See <i>TB 249 Flowrite 599 Series Valve and Actuator Assembly Selection Technical Bulletin</i> (155-304P25) for selection procedure and ordering codes.</p> <p>Valve assemblies can be ordered using the numbers in Table 1.</p>

Specifications

Material	Line size	1/2 to 2 inches (15 to 50 mm)
	Capacity	See Tables 2 and 3 and Figure 3
	Body style	Globe style control valve with two connection options; see Table 1
	Seat style	Metal-to-metal
	Action	Three-way mixing
	Valve body rating	ANSI Class 250; see Table 4
	Stem travel (Stroke)	3/4-inch (20 mm)
	Body	UNS CA 844 bronze
	Body trim	See Table 1
	Stem	Stainless steel ASTM A582 Type 303
Packing	EPDM O-ring	
Operating	Controlled medium	Water, glycol solutions to 50%
	Medium temperature range	20°F to 250°F (-7°C to 120°C)
	Maximum inlet pressure	See Table 4
	Maximum recommended differential pressure for modulating service	
	Bronze trim	25 psi (173 kPa)
	Stainless Steel trim	50 psi (345) kPa)
	Rangeability	> 100:1
	Close-off pressures	See Tables 5, 6, and 7 and Figure 4
	Close-off ratings	According to ANSI/FCI 70-2
	Leakage rate	Class IV (0.01% of Cv)
Flow characteristics	Equal percentage for NC Linear for NO	
Mounting location	NEMA 1 (interior only)	
Miscellaneous	Canadian Registration Numbers	0H7645.5 0C0838.9
	Dimensions	See Tables 8 and 9 and Figure 6
	Valve Weight	See Table 9

Accessories

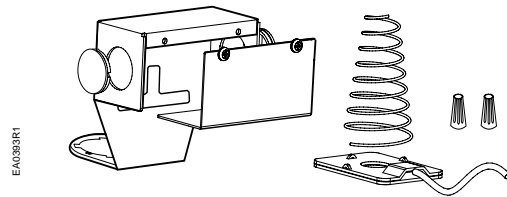


Figure 1. Packing Heating Element for Use With SKD and SQX Actuators.

599-00417 Packing heating element.

The heater allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It reduces ice crystal formation on the stem that can damage the packing.

Operating Voltage	24 Vac
Heating Output	20 W

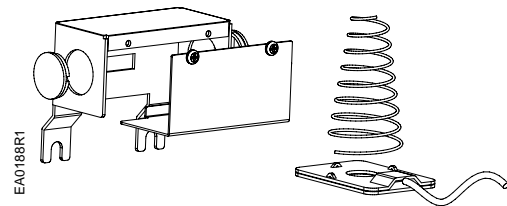


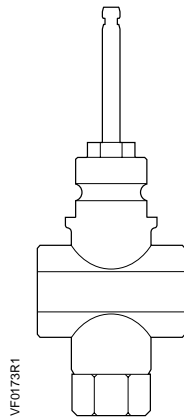
Figure 2. Packing Heating Element for Use With SKB/C and 8-inch Actuators.

599-00418: The packing heating element. The heater allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It prevents ice crystal formation on the stem that can damage the packing.

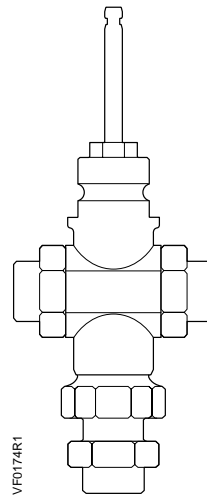
Operating Voltage	24 Vac
Heating Output	20 W

Service Kits

Valve packing kit	599-03390
Rebuild/repack kits	See Table 10
Sealing rings for union valves (package of 25)	
1/2-inch (15 mm)	599-03394
3/4-inch (20 mm)	599-03395
1 inch (25 mm)	599-03396
1-1/4 inch (32 mm)	599-03397
1-1/2 inch (40 mm)	599-03398
2 inch (50 mm)	599-03399
Union Tailpiece kit (one tailpiece, one union nut, one gasket)	
1/2-inch (15 mm) male	599-09181
3/4-inch (20 mm) male	599-09182
1 inch (25 mm) male	599-09183
1-1/4 inch (32 mm) male	599-09184
1/2-inch (40 mm) female	599-09185
3/4-inch (20 mm) female	599-09186
1 inch ((25 mm) female	599-09187
1-1/4 inch (32 mm) female	599-09188
1-1/2 inch (40 mm) female	599-09189
2 inch (50 mm) female	599-09190



**Female NPT x Female
 NPT FxF**



**Union Female x Union
 Female UFxUF**

Table 1. 3-Way Valves.

Flow Rate C _v	K _{vs}	Line Size Inch (mm)		Connection	Stainless. Steel Trim	Bronze Trim
1	(0.85)	1/2	(15)	FxF	599-03144	599-03198
				UFxUF	599-03153	599-03207
1.6	(1.37)	1/2	(15)	FxF	599-03145	599-03199
				UFxUF	599-03154	599-03208
2.5	(2.15)	1/2	(15)	FxF	599-03146	599-03200
				UFxUF	599-03155	599-03209
4	(3.44)	1/2	(15)	FxF	599-03147	599-03201
				UFxUF	599-03156	599-03210
6.3	(5.43)	3/4	(20)	FxF	599-03148	599-03202
				UFxUF	599-03157	599-03211
10	(8.6)	1	(25)	FxF	599-03149	599-03203
				UFxUF	599-03158	599-03212
16	(13.8)	1-1/4	(32)	FxF	599-03150	599-03204
				UFxUF	599-03159	599-03213
25	(21.5)	1-1/2	(40)	FxF	599-03151	599-03205
				UFxUF	599-03160	599-03214
40	(34.4)	2	(50)	FxF	599-03152	599-03206
				UFxUF	599-03161	599-03215

Table 2. Maximum Water Capacity - U.S. Gallons per Minute.

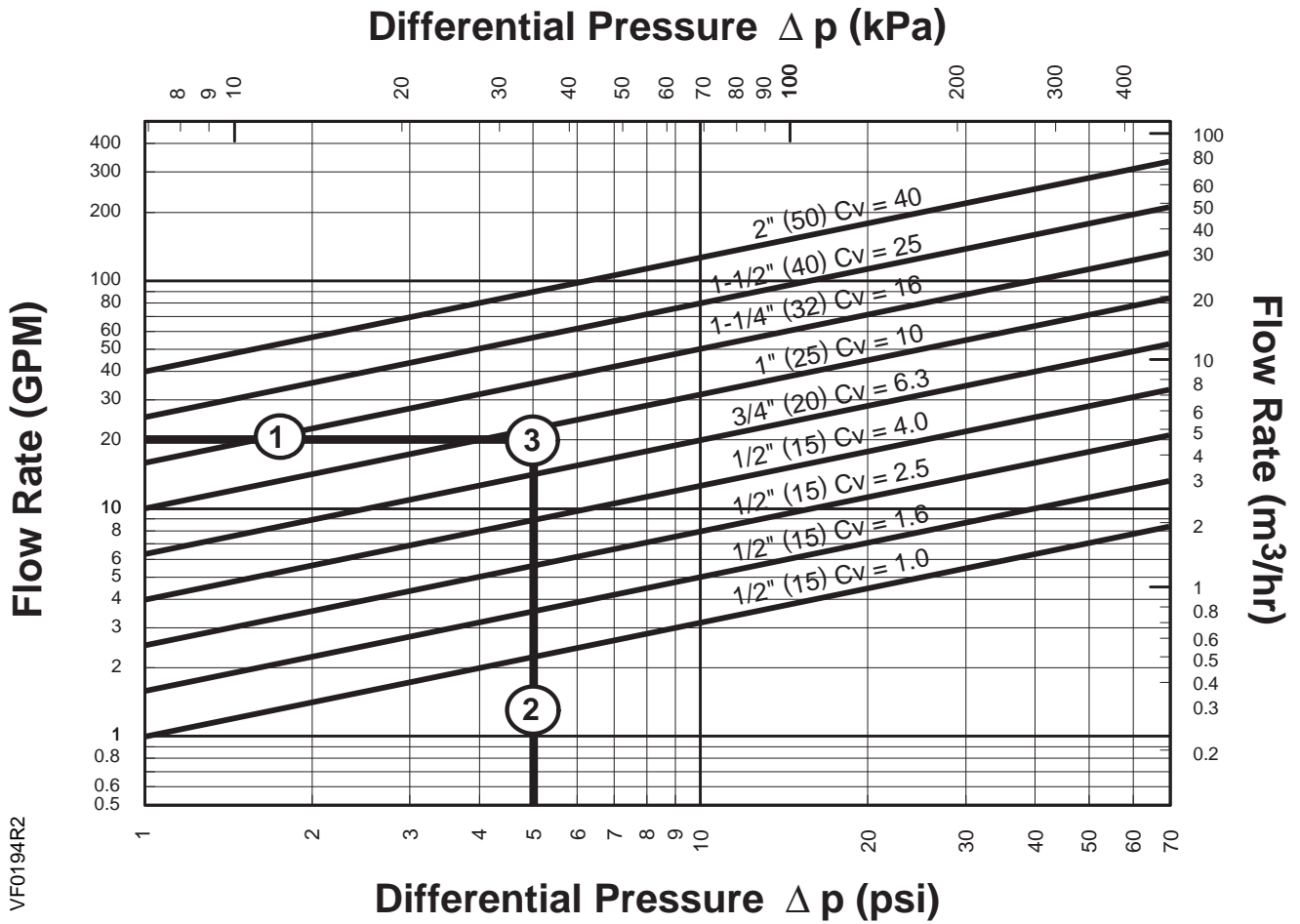
Valve Size in inches	Pressure Differential - psi															
	Cv/1	2	3	4	5	6	8	10	15	20	25	30	40	50	60	75
1/2	1.0	1.4	1.7	2.0	2.2	2.5	2.8	3.2	3.9	4.5	5.0	5.5	6.3	7.1	7.8	8.7
	1.6	2.3	2.8	3.2	3.6	3.9	4.5	5.1	6.2	7.2	8.0	8.8	10.1	11.3	12.4	13.9
	2.5	3.5	4.3	5.0	5.6	6.1	7.1	7.9	9.7	11.2	12.5	13.7	15.8	17.7	19.4	22
	4	5.7	7	8.0	8.9	10	11.3	12.6	15.5	17.9	20.0	21.9	25	28	31	35
3/4	6	8.9	10.9	12.6	14.1	15.4	17.8	20	24	28	32	35	40	45	49	55
1	10	14.1	17.3	20	22	24	28	32	39	45	50	55	63	71	77	87
1-1/4	16	23	28	32	36	39	45	51	62	72	80	88	101	113	124	139
1-1/2	25	35	43	50	56	61	71	79	97	112	125	137	158	177	194	217
2	40	57	69	80	89	98	113	126	155	179	200	219	253	283	310	346

Table 3. Maximum Water Capacity - Cubic Meters per Hour (m³/hr).

Valve Size in mm	Pressure Differential - kPa														
	1	10	20	30	40	50	60	80	Kvs/100	150	200	300	400	500	
15	0.09	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	1.7	1.9	
	0.14	0.4	0.6	0.8	0.9	1.0	1.1	1.2	1.4	1.7	1.9	2.4	2.7	3.1	
	0.2	0.7	1.0	1.2	1.4	1.5	1.7	1.9	2.2	2.6	3.0	3.7	4.3	4.8	
	0.3	1.1	1.5	1.9	2.2	2.4	2.7	3.1	3.4	4.2	4.9	6.0	6.9	7.7	
20	0.5	1.7	2.4	3.0	3.4	3.8	4.2	4.9	5.4	6.7	7.7	9.4	10.9	12.1	
25	0.9	2.7	3.8	4.7	5.4	6.1	6.7	7.7	8.6	10.5	12.2	14.9	17.2	19.2	
32	1.4	4.4	6.2	7.6	8.7	9.8	10.7	12.3	13.8	16.9	19.5	23.9	27.6	30.9	
40	2.2	6.8	9.6	11.8	13.6	15.2	16.7	19.2	22	26	30	37	43	48	
50	3.4	10.9	15.4	18.8	22	24	27	31	34	42	49	60	69	77	

Table 4. Body Temperature-Pressure Rating.

Valve Body	Temperature		Pressure	
	°F	°C	psig	(kPa)
Bronze	-20 to +150	(-30 to 66)	400	(2758)
	+200	(93)	385	(2655)
	+250	(121)	365	(2586)
	+300	(149)	335	(2300)
	+350	(177)	300	(2068)



Selection Example

Select a valve given:

1. Required flow = 20 gpm.
2. Desired pressure drop = 5 psi.
3. Select a 1 inch (25 mm) valve, Cv 10.

Table 5. Maximum Available Close-off Pressures for Pneumatic Actuators, Action, Upper Port.

NC (Upper port)	Valve Size Inch (mm)	10 to 15 psi (69 to 103 kPa) spring range		
		4-inch Actuator	8-inch Actuator	12-inch Actuator
		0 psi (0 kPa)	0 psi (0 kPa)	0 psi (0 kPa)
	1/2 (15)	236 (1627)	250 (1724)	—
	3/4 (20)	155 (1069)	250 (1724)	—
	1 (25)	91 (627)	250 (1724)	250 (1724)
	1-1/4 (32)	52 (359)	148 (1020)	250 (1724)
	1-1/2 (40)	32 (331)	92 (634)	250 (1724)
	2 (50)	20 (138)	55 (379)	185 (1776)

Table 6. Maximum Available Close-off Pressures for Pneumatic Actuators, Action, Bottom Port.

NO (Bottom port)	Valve Size Inch (mm)	3 to 8 psi (21 to 55 kPa) spring range				
		4-inch Actuator	8-inch Actuator		12-inch Actuator	
		15 psi (103 kPa)	15 psi (103 kPa)	30 psi (207 kPa)	15 psi	30 psi
	1/2 (15)	142 (979)	250 (1724)	250 (1724)	—	—
	3/4 (20)	80 (552)	231 (1593)	250 (1724)	—	—
	1 (25)	52 (359)	150 (1034)	250 (1724)	250 (1724)	250 (1724)
	1-1/4 (32)	32 (221)	93 (641)	250 (1724)	250 (1724)	250 (1724)
	1-1/2 (40)	20 (138)	60 (414)	198 (1365)	250 (1724)	250 (1724)
	2 (50)	12 (83)	37 (255)	123 (848)	130 (896)	250 (1724)

Table 7. Close-off Pressures for Electronic Actuators.

Action	Valve Size	SKB	SKD	SQX	EI/Mech Low Force	Rack & Pinion Valve
	Inch (mm)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)
NC	1/2 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	3/4 (20)	250 (1724)	250 (1724)	221 (1524)	238 (1640)	250 (1724)
	1 (25)	250 (1724)	203 (1400)	130 (896)	140 (965)	173 (1193)
	1-1/4 (32)	250 (1724)	117 (807)	75 (517)	81 (558)	100 (690)
	1-1/2 (40)	208 (1334)	73 (503)	46 (317)	50 (345)	61 (421)
	2 (50)	126 (869)	44 (303)	28 (193)	31 (214)	37 (255)
NO	1/2 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	3/4 (20)	250 (1724)	250 (1724)	173 (1193)	186 (1282)	231 (1593)
	1 (25)	250 (1724)	201 (1386)	112 (772)	121 (834)	149 (1028)
	1-1/4 (32)	250 (1724)	124 (855)	69 (476)	75 (517)	92 (634)
	1-1/2 (40)	250 (1724)	80 (552)	44 (303)	48 (331)	59 (407)
	2 (50)	201 (1386)	49 (338)	27 (186)	30 (207)	36 (248)

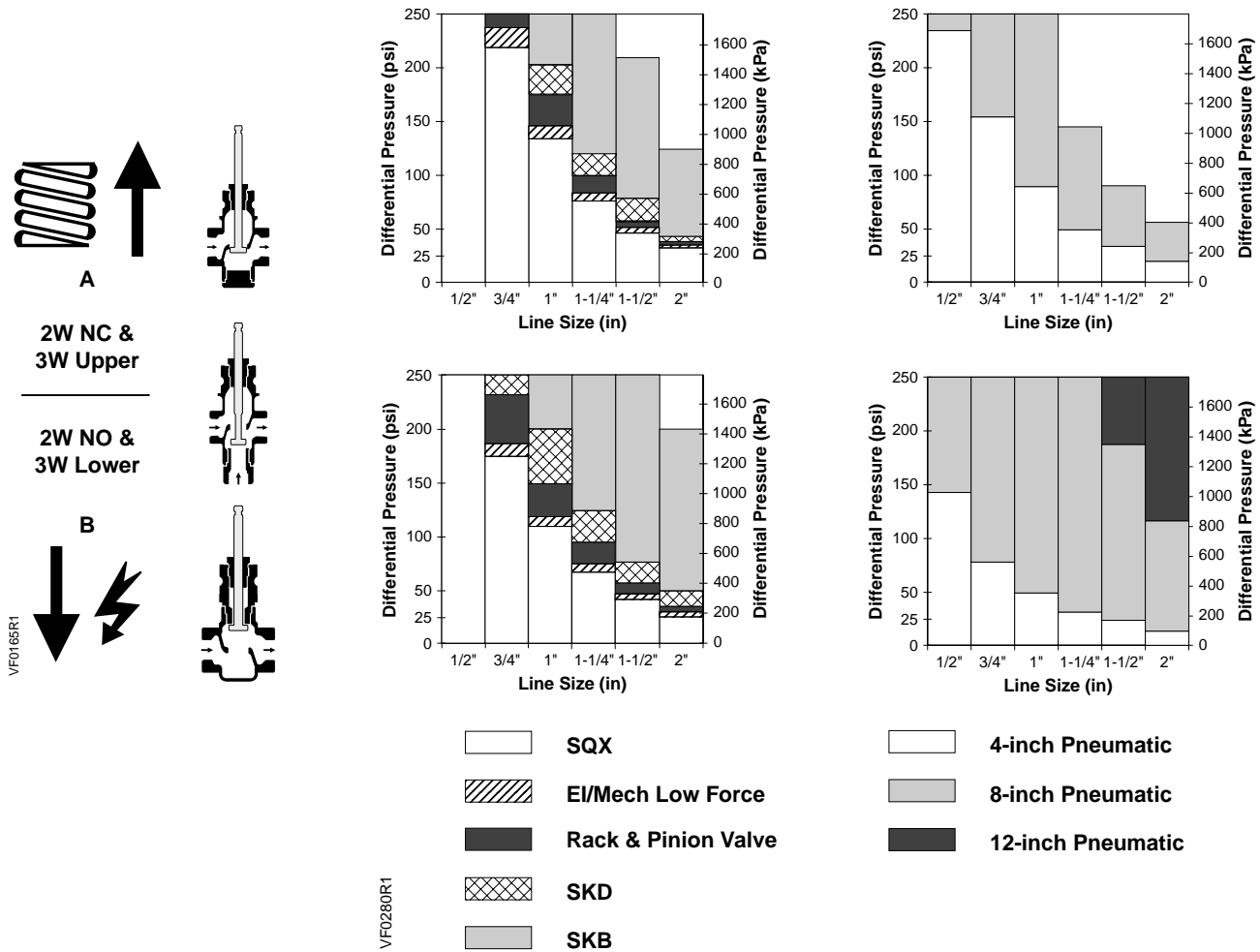


Figure 4. Close-off Pressures.

Operation

As the valve stem moves downward, the flow through the NO port decreases and the flow through the NC port increases. As the valve stem moves upward, the flow through the NO port increases and the flow through the NC port decreases.

In the event of power failure, a spring return actuator returns the valve to its normal position. Non-spring return actuators will hold the last commanded position. See the *Technical Instructions* of the various actuators for additional information.

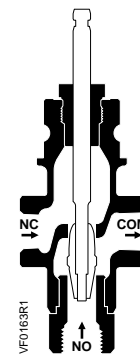


Figure 5.

**Operation,
continued**

If this valve is used in diverting applications, the following conditions apply:

Diverting service with modulating control can use mechanical actuators such as the SQX and SKB/D. The differential pressure must not exceed 90% of the maximum differential pressure specified for the three-way valve in mixing service.

Diverting service with a pneumatic actuator can only be used with two-position control. To change over from one port to another there must be no system pressure. The pump is tuned off.

Sizing

The sizing of a valve is important for correct system operation. An undersized valve will not have sufficient capacity at maximum load. An oversized valve can initiate cycling, and the seat and throttling plug can be damaged because of the restricted opening. Correct sizing of the control valve for *actual expected conditions* is considered essential for good control.

Some variables that must be determined are:

- The medium to be controlled, such as water, etc.
- The maximum inlet temperature and pressure of the medium at the valve.
- The pressure differential that will exist across the valve under maximum load demand.
- The maximum capacity the valve must deliver.
- The maximum line pressure differential the valve actuator must close against.
- See the *Control Valve Selection and Sizing (AB-1) section of HVAC Systems/Controls Reference Data (125-1853)* for further recommendations.

See Tables 2 and 3 for valve capacities.

**Mounting and
Installation**

- Install the valve so that the flow follows the direction of the arrow indicated on the valve body.
- For best performance, install the valve assembly with the actuator above the valve body. The valve and actuator can be installed in any position between vertical and horizontal. Siemens Building Technologies does not recommend installing the valve assembly so that the actuator is below horizontal or upside down.
- Allow sufficient space for servicing the valve and actuator. See Table 9 for valve body dimensions. See Figure 6 and Table 8 for dimensions of the service envelope recommended around the actuator.

NOTE: Instructions for field mounting an actuator, wiring diagrams, and start-up are covered in the *Technical Instructions* and *Installation Instructions* for each actuator.

Dimensions

The letters in Figure 6 refer to actuator and service envelope dimensions in Table 7. See Table 8 for valve body dimensions.

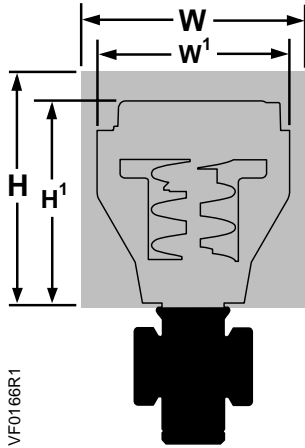
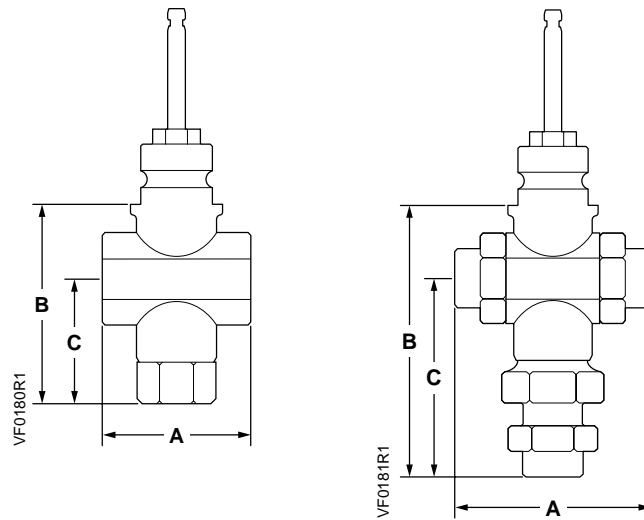


Figure 6.

Table 8. Dimensions of the Actuator and Recommended Service Envelope.
 Dimensions in Inches (millimeters).

Actuator	Actuator Prefix Code	Actual Height of Actuator H1	Service Height H	Actual Width or Diameter of Actuator W1	Service Width W
4-inch Pneumatic	268, 269 270	5-3/4 (146)	14 (350)	5-1/2 (137) diameter	18 (450)
8-inch Pneumatic	277, 278 283, 284	14-1/8 (359)	26 (660)	8-3/4 (222) diameter	21 (533)
12-inch Pneumatic	279, 285	17-7/8 (454)	30 (762)	15-1/8 (384) diameter	27 (686)
SKB	285, 190, 291	14-3/4 (375)	22-3/4 (578)	14x9 (335 x228)	25 (635)
SKD	274, 275 276	11-13/16 (300)	19-3/4 (500)	5 (127) Width 6-5/8 (169) Depth	14-1/2 (360)
SQX	271, 272 273	8-7/8 (226)	17 (430)	5-17/32 (140) W 4-3/8 (111) Depth	13-1/2 (340)
EI/Mech with linkage	295, 296 297	11 (280)	22 (559)	5-3/4 (144) Width x 8-7/8 (225) Depth	25-3/4 (654)



**Female NPT by Female NPT
FxF**

**Union Female x Union
Female UFxUF**

Table 9. 3-Way Valve Dimensions.

Valve	Valve Size inch (mm)	Dimensions in inches (mm)						Weight lb (kg)	
		FxF Female NPT x Female NPT			UFxUF Union Female x Union Female			FxF	UFxUF
		A	B	C	A	B	C		
3-Way	1/2 (15)	2-7/8 (72)	4-5/16 (110)	2-11/16 (68)	4-11/16 (119)	6-1/4 (159)	4-5/8 (117)	3 (1.4)	4 (1.8)
	3/4 (20)	3-3/8 (85)	4-5/16 (110)	2-3/4 (69)	6-3/8 (163)	6-15/16 (176)	5-1/4 (134)	4 (1.8)	6 (2.7)
	1 (25)	3-15/16 (100)	4-1/2 (114)	2-7/8 (72)	7-1/16 (180)	7 (178)	5-3/8 (136)	5 (2.3)	7 (3.2)
	1-1/4 (32)	4-15/16 (125)	4-5/8 (116)	2-15/16 (74)	7-1/2 (190)	6-3/4 (170)	5-1/16 (129)	7 (3.2)	11 (5)
	1-1/2 (40)	5-1/8 (130)	4-5/8 (117)	3 (76)	7-13/16 (199)	6-15/16 (176)	5-5/16 (135)	9 (4.1)	13 (5.9)
	2 (50)	6-1/4 (158)	5-1/8 (130)	3-3/16 (81)	9-1/16 (231)	7-1/2 (191)	5-9/16 (141)	13 (5.9)	19 (8.6)

Parts List

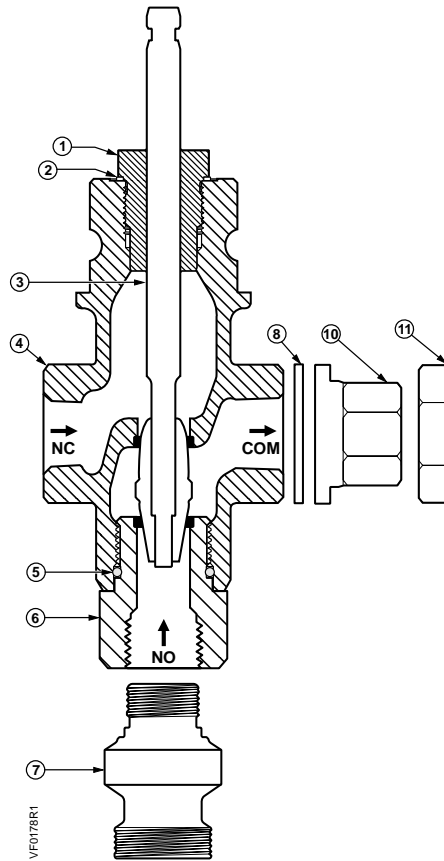


Table 10. Parts List for 3-Way Bronze Valves.

Item	Part Name	Part No.	Quantity		Material
			FxF	UFxUF	
1	Packing Cartridge	—	1	1	—
2	Gasket	—	1	1	Copper
3	Stem and Plug Assembly	—	1	1	Bronze or Stainless Steel
4	Valve Body	—	1	1	Bronze
5	O-ring	—	1	1	EPDM
6	Lower port	—	1	—	Bronze
7	Lower port union	—	—	1	Bronze
8	Gasket	—	—	3	Fiber
10	Female tail piece	—	—	3	Brass
11	Union Nut	—	—	3	Brass
	Packing Kit	599-03390	—	—	Items 1 and 2
	Rebuild/Repack Kit	See Table 11	—	—	Items 1, 2, 3, and 5

Service Kits

To select the service kit, know your valve body assembly number and the type of connection. Read down the *Connection* column until you find the valve body assembly number and then read to the far right to identify the correct kit.

NOTE: The valve body assembly number and model number are stamped on the tag on the valve body.

Table 11. Rebuild/Repack Service Kits Part Numbers. (See Table 10 for Items in Kit.)

Connection		Valve Description	Model 1 Kit No.	Model 2 Kit No.
FxF	UFxUF			
599-03144	599-03153	1/2" Stainless steel trim 1.0 Cv	599-03372	—
599-03145	599-03154	1/2" Stainless steel trim 1.6 Cv	599-03373	—
599-03146	599-03155	1/2" Stainless steel trim 2.5 Cv	599-03374	—
599-03147	599-03156	1/2" Stainless steel trim 4.0 Cv	599-03375	—
599-03148	599-03157	3/4" Stainless steel trim	599-03376	—
599-03149	599-03158	1" Stainless steel trim	599-03377	—
599-03150	599-03159	1-1/4" Stainless steel trim	599-03378	599-09225
599-03151	599-03160	1-1/2" Stainless steel trim	599-03379	599-09226
599-03152	599-03161	2" Stainless steel trim	599-03380	599-09227
599-03198	599-03207	1/2" Bronze trim 1.0 Cv	599-03381	—
599-03199	599-03208	1/2" Bronze trim 1.6 Cv	599-03382	—
599-03200	599-03209	1/2" Bronze trim 2.5 Cv	599-03383	—
599-03201	599-03210	1/2" Bronze trim 4.0 Cv	599-03384	—
599-03202	599-03211	3/4" Bronze trim	599-03385	—
599-03203	599-03212	1" Bronze trim	599-03386	—
599-03204	599-03213	1-1/4" Bronze trim	599-03387	599-09228
599-03205	599-03214	1-1/2" Bronze trim	599-03388	599-09229
599-03206	599-03215	2" Bronze trim	599-03389	599-09230

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