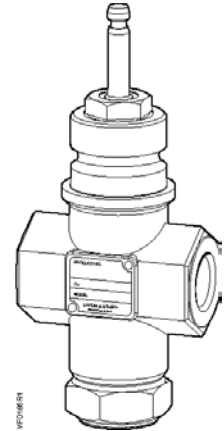


## Flowrite™ 599 Series

### Three-Way Valves

### 1/2 to 2-inch Bronze Body

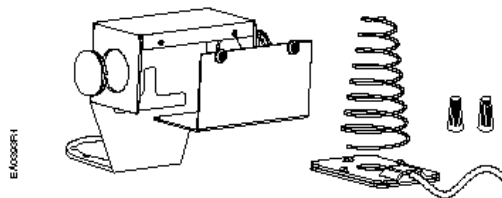


<b>Description</b>	The Flowrite VF 599 Series ANSI Class 250 three-way valves are designed to work with either a pneumatic or electronic actuator with a 3/4-inch (20 mm) stroke.
<b>Features</b>	<ul style="list-style-type: none"><li>• ANSI Leakage Class IV (0.01% of Cv)</li><li>• Cartridge type packing</li><li>• Choice of brass or stainless steel trim</li><li>• Direct-coupled universal bonnet</li></ul>
<b>Application</b>	<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>
<b>Product Numbers</b>	See Table 1.
<b>Ordering a Valve Plus Actuator Assembly</b>	<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 Flowrite Technical Bulletins 155-772 and 155-776 for complete selection procedure and ordering codes.</p> <p>Valve assemblies can be ordered using the valve part numbers in Table 1 and the actuator prefix codes in Table 7.</p>

## Specifications

<b>Material</b>	Line size	1/2 to 2 inches (15 to 50 mm)
	Capacity	See Table 2, Table 3 and Figure 3.
	Body style	Globe style
	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-rings
<b>Operating</b>	Controlled medium	50% water-glycol solutions
	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 Table 5, Table 6, 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)	
<b>Miscellaneous</b>	Canadian Registration Numbers	0H7645.5ADD2 0C0838.9
	Dimensions	See Table 7, Table 8, and Figure 6.
	Valve Weight	See Table 8.

## Accessories



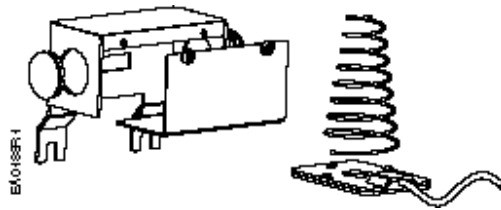
### 599-00417 Packing heating element.

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.

**Figure 1. Packing Heating Element for Use With SKD Actuators.**

Operating Voltage	24 Vac
Heating Output	20 W

**Accessories,  
 Continued**



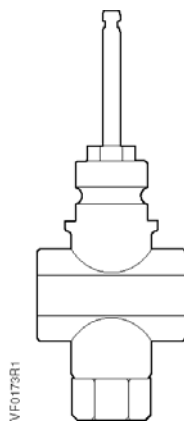
**599-00418:** The packing heating element. The heater allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It prevents ice crystal formation on the stem that can damage the packing.

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

Operating Voltage	24 Vac
Heating Output	20 W

**Service Kits**

Valve packing kit	599-03390
Rebuild/repack kits	See Table 10.



**Table 1. Female NPT x Female NPT (FxF) 3-Way Valves.**

Flow Rate C <sub>v</sub>		Line Size Inch (mm)		Connection	Stainless Steel Trim	Bronze Trim
1	(0.85)	1/2	(15)	FxF	599-03144	599-03198
1.6	(1.37)	1/2	(15)	FxF	599-03145	599-03199
2.5	(2.15)	1/2	(15)	FxF	599-03146	599-03200
4	(3.44)	1/2	(15)	FxF	599-03147	599-03201
6.3	(5.43)	3/4	(20)	FxF	599-03148	599-03202
10	(8.6)	1	(25)	FxF	599-03149	599-03203
16	(13.8)	1-1/4	(32)	FxF	599-03150	599-03204
25	(21.5)	1-1/2	(40)	FxF	599-03151	599-03205
40	(34.4)	2	(50)	FxF	599-03152	599-03206

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

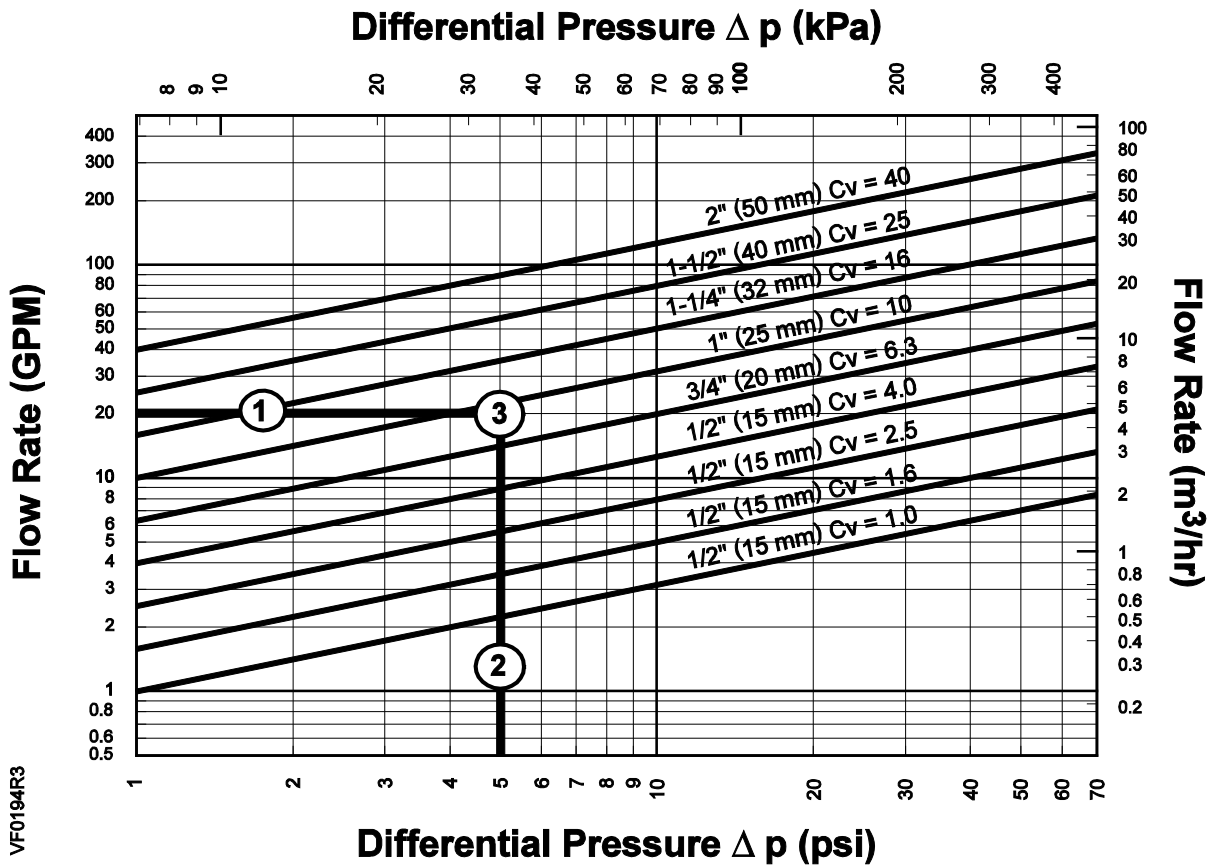
Valve Size in Inches	Pressure Differential - psi															
	Cv\1	2	3	4	5	6	8	10	15	20	25	30	40	50	60	75
1/2	1.0	1.4	1.7	2.0	2.2	2.5	2.8	3.2	3.9	4.5	5.0	5.5	6.3	7.1	7.8	8.7
	1.6	2.3	2.8	3.2	3.6	3.9	4.5	5.1	6.2	7.2	8.0	8.8	10.1	11.3	12.4	13.9
	2.5	3.5	4.3	5.0	5.6	6.1	7.1	7.9	9.7	11.2	12.5	13.7	15.8	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 (m<sup>3</sup>/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	Valve Size Inch (mm)	Spring Range							
		3 to 8 psi ( 21 to 55 kPa)					10 to 15 psi (69 to 103 kPa)		
		4-Inch Actuator	8-Inch Actuator		12-Inch Actuator		4-Inch Actuator	8-Inch Actuator	12-Inch Actuator
		15 psi (103 kPa)	15 psi (103 kPa)	30 psi (207 kPa)	15 psi (103 kPa)	30 psi (207 kPa)	0 psi (0 kPa)	0 psi (0 kPa)	0 psi (0 kPa)
Lower Port (Normally Open)	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)	198 (1365)	250 (1724)	—	—	—
	2 (50)	12 (83)	37 (255)	123 (848)	130 (896)	250 (1724)	—	—	—
Upper Port (Normally Closed)	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. Close-off Pressures for Electronic Actuators.**

Action	Valve Size	SAX	Rack & Pinion	SKD	SKB
	Inch (mm)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)
Lower Port	1/2 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	3/4 (20)	211 (1456)	231 (1593)	250 (1724)	250 (1724)
	1 (25)	137 (945)	149 (1028)	201 (1386)	250 (1724)
	1-1/4 (32)	85 (586)	92 (634)	124 (855)	250 (1724)
	1-1/2 (40)	55 (379)	59 (407)	80 (552)	250 (1724)
	2 (50)	34 (235)	36 (248)	49 (338)	201 (1386)
Upper Port	1/2 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	3/4 (20)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	1 (25)	159 (1097)	173 (1193)	203 (1400)	250 (1724)
	1-1/4 (32)	92 (634)	100 (690)	117 (807)	250 (1724)
	1-1/2 (40)	57 (393)	61 (421)	73 (503)	208 (1334)
	2 (50)	35 (241)	37 (255)	44 (303)	126 (869)

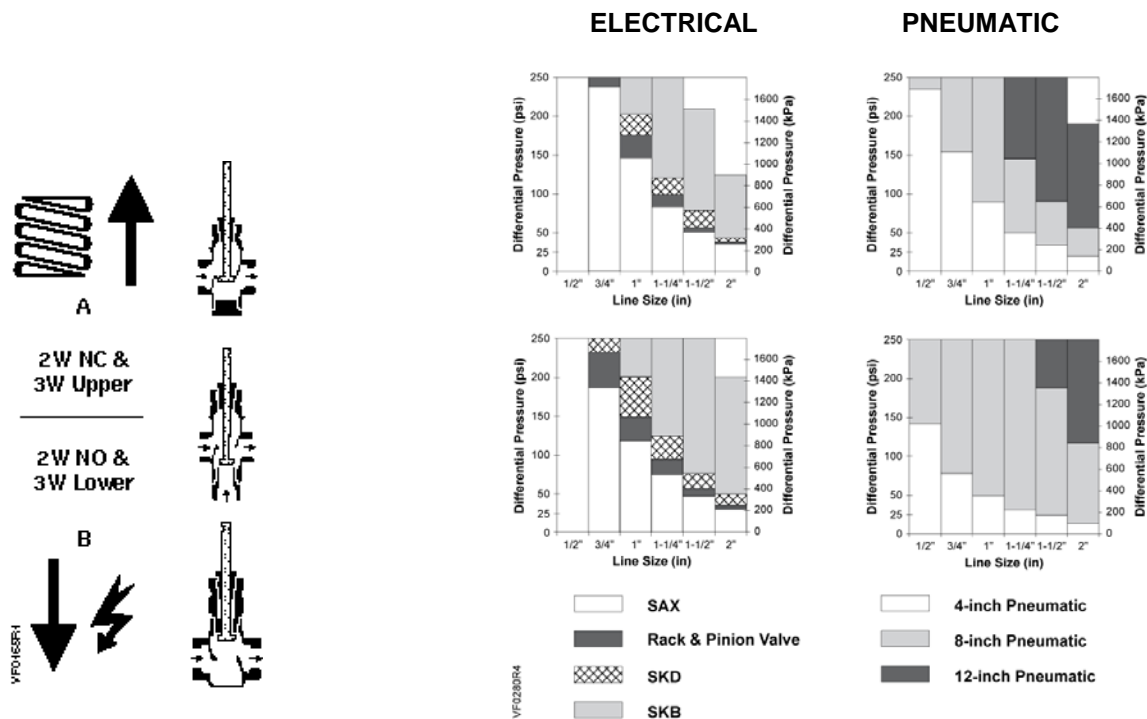


Figure 4. Close-off Pressures.

**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 with the upper port closed and the bottom port open. Non-spring return actuators will hold the last commanded position. See the *Technical Instructions* of the various actuators for additional information.

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

Diverting service with modulating control can use mechanical actuators such as the SAX 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 turned off.



Figure 5.

---

## 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 Table 2 and Table 3 for valve capacities.

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## Mounting and Installation

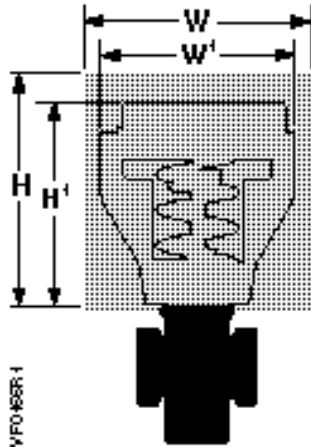
- Install the valve so that the flow follows the direction of the arrow indicated on the valve body.
- For best performance, install the valve assembly with the actuator above the valve body. The valve and actuator can be installed in any position between vertical and horizontal. Siemens Building Technologies 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 8 for valve body dimensions. See Figure 6 and Table 7 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**

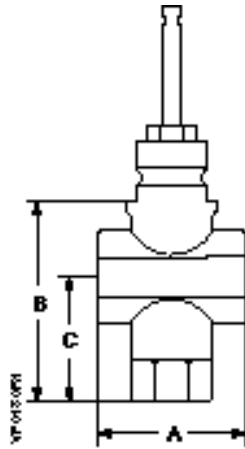
The letters in Figure 6 refer to actuator and service envelope dimensions in Table 7. See Table 8 for valve body dimensions.



**Figure 6.**

**Table 7. Dimensions of the Actuator and Recommended Service Envelope.  
 Dimensions in Inches (millimeters).**

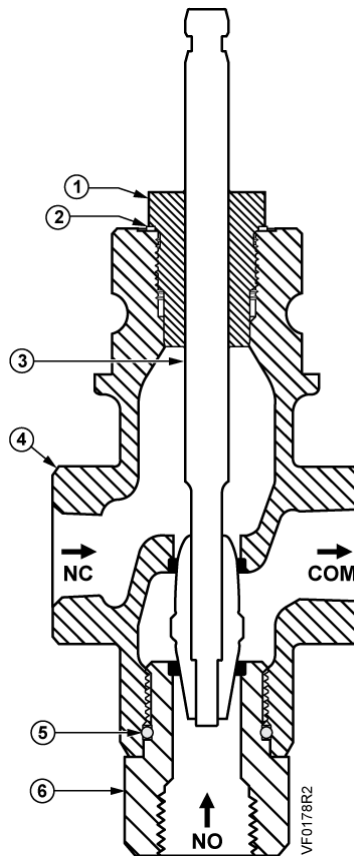
Actuator	Actuator Prefix Code	Actual Height of Actuator H1	Service Height H	Actual Width or Diameter of Actuator W1	Service Width W
4-inch Pneumatic	268, 269 270	5-3/4 (146)	14 (350)	5-1/2 (137) diameter	18 (450)
8-inch Pneumatic	277, 278 283, 284	14-1/8 (359)	26 (660)	8-3/4 (222) diameter	21 (533)
12-inch Pneumatic	279, 285	17-7/8 (454)	30 (762)	15-1/8 (384) diameter	27 (686)
SAX	371, 373	9-9/16 (242)	17-1/4 (442)	4-7/8 (124) Width 5-7/8 (150) Depth	17-4/4 (450)
Rack and Pinion	298, 299	14-1/2 (368)	24-1/2 (622)	5 (127) Width 5-1/8 (131) Depth	13 (331)
SKD	267, 274 275, 276	11-13/16 (300)	19-3/4 (500)	5 (127) Width 6-5/8 (169) Depth	14-1/2 (360)
SKB	289, 290, 291	14-3/4 (375)	22-3/4 (578)	7 (178) Width x 8-15/16 (226) Depth	25 (635)



**Table 8. Female NPT by Female NPT (FxF) 3-Way Valve Dimensions.**

Valve	Valve Size Inches (mm)	Dimensions in Inches (mm)			Weight lbs (kg)
		A	B	C	
3-Way	1/2 (15)	2-7/8 (72)	4-5/16 (110)	2-11/16 (68)	3 (1.4)
	3/4 (20)	3-3/8 (85)	4-5/16 (110)	2-3/4 (69)	4 (1.8)
	1 (25)	3-15/16 (100)	4-1/2 (114)	2-7/8 (72)	5 (2.3)
	1-1/4 (32)	4-15/16 (125)	4-5/8 (116)	2-15/16 (74)	7 (3.2)
	1-1/2 (40)	5-1/8 (130)	4-5/8 (117)	3 (76)	9 (4.1)
	2 (50)	6-1/4 (158)	5-1/8 (130)	3-3/16 (81)	13 (5.9)

**Parts List**



**Table 9. Parts List for 3-Way Bronze Valves.**

Item	Part Name	Part No.	Qty	Material
1	Packing Cartridge Assembly	—	1	—
2	Gasket	—	1	Copper
3	Stem and Plug Assembly	—	1	Bronze or Stainless Steel
4	Valve Body	—	1	Bronze
5	O-ring	—	1	EPDM
6	Lower port	—	1	Bronze
	Packing Kit	599-03390	—	Items 1 and 2
	Rebuild/Repack Kit	See Table 10.	—	Items 1, 2, 3, and 5

## Service Kits

To select the service kit, know your valve body part number and model number. Read down the *Part Number* column until you find the valve body part number and then read to the far right to identify the correct kit.

**NOTE:** The valve body part number and model number are stamped on the metal tag on the valve body.

**Table 10. Rebuild/Repack Service Kits Part Numbers.**

(See Table 9 for Items in Kit.)

Valve Size	Part Number	Valve Description	Model 1 Kit No.	Model 2 Kit No.
1/2-Inch	599-03144	Stainless steel trim 1.0 Cv	599-03372	—
	599-03145	Stainless steel trim 1.6 Cv	599-03373	—
	599-03146	Stainless steel trim 2.5 Cv	599-03374	—
	599-03147	Stainless steel trim 4.0 Cv	599-03375	—
3/4-Inch	599-03148	Stainless steel trim	599-03376	—
1-Inch	599-03149	Stainless steel trim	599-03377	—
1-1/4-Inch	599-03150	Stainless steel trim	599-03378	599-09225
1-1/2-Inch	599-03151	Stainless steel trim	599-03379	599-09226
2-Inch	599-03152	Stainless steel trim	599-03380	599-09227
1/2-Inch	599-03198	Bronze trim 1.0 Cv	599-03381	—
	599-03199	Bronze trim 1.6 Cv	599-03382	—
	599-03200	Bronze trim 2.5 Cv	599-03383	—
	599-03201	Bronze trim 4.0 Cv	599-03384	—
3/4-Inch	599-03202	Bronze trim	599-03385	—
1-Inch	599-03203	Bronze trim	599-03386	—
1-1/4-Inch	599-03204	Bronze trim	599-03387	599-09228
1-1/2-Inch	599-03205	Bronze trim	599-03388	599-09229
2-Inch	599-03206	Bronze trim	599-03389	599-09230

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