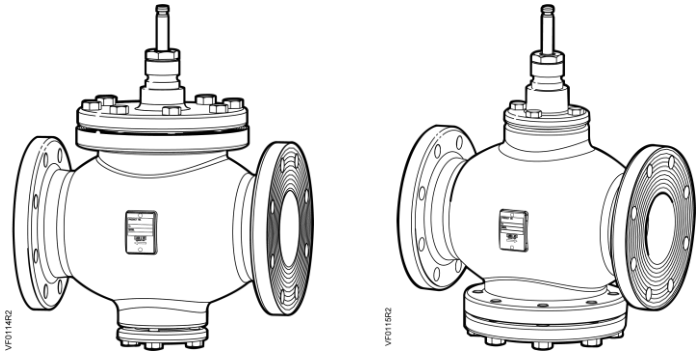
SIEMENS

Technical Instructions
Document Number 155-159P25
VF 599-1
June 14, 2019

Flowrite™ VF 599 Series

Two-Way Valves
2-1/2 to 6-inch Flanged Iron Body



Description	The Flowrite VF 599 series two-way valves are designed to work with either a pneumatic or electronic actuator. They are available in both ANSI Class 125 and 250 for normally closed or normally open action.
Features	• Valve flange face-to-face dimensions meet ISA 75.03 standards • Direct coupled universal bonnet • Two flow characteristics (equal percentage or linear) • Choice of bronze or stainless steel trim • ANSI Leakage Class IV (0.01% of Cv) • Cartridge type packing
Application	These Flowrite valves are generally recommended for water, steam, and glycol solutions to 50%. • Water inlet pressures up to ANSI 125 and ANSI 250 cast iron body rating • Water modulating differential pressure up to 25 psi (172 kPa) for bronze trim and 50 psi (345 kPa) for stainless steel trim • Steam inlet to 100 psig and modulating differential pressure up to 50 psi (345 kPa)
Product Numbers	See Table 1 and Table 2.
Ordering a Valve Plus Actuator Assembly	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™ 599 Series - 2-1/2 to 6-Inch Valve, Two-Way & Three-Way, and Actuator Assembly Selection Technical Bulletin* (155-776 [TB 256])for selection procedure and ordering codes. Valve assemblies can be ordered using the numbers in Table 1 and Table 2.

Specifications

	Line size	2-1/2 to 6-inch (65 to 150 mm)
	Capacity	See Table 4 through Table 7, and Figure 2
	Body style	Flanged
	Seat style	Single seat, metal-to-metal
	Action	Normally Closed (NC)
		Normally Open (NO)
	Stem travel (stroke)	
	2-1/2 and 3-inch	3/4-inch (20 mm)
	4, 5, and 6-inch	1-1/2 inch (40 mm)
	Valve body rating	ANSI Class 125 and 250; see Table 3
Material	Body	Cast iron ASTM A126 Class B
	Body trim	See Table 1 and Table 2.
	Stem	Stainless steel ASTM A582 Type 303
	Packing	
	Normal duty packing	Double EPDM O-rings
	Steam packing	Teflon® V-rings/EPDM O-ring
	Controlled medium	Saturated steam, water, glycol solutions to 50%
	Medium temperature range	
	Normal duty packing	20°F to 250°F (–7°C to 120°C)
	Steam packing	337°F (170°C) maximum
Operating	Maximum inlet pressure	
	Water	See Table 3.
	Steam	100 psig (689 kPa)
	Maximum recommended differential pressure for modulating service	

	Bronze Trim	Stainless Steel Trim
Liquid	25 psi (173 kPa)	50 psi (345 kPa)
Steam	15 psi (103 kPa)	50 psi (345 kPa)

	Rangeability	>100:1
	Close-off pressures	See Table 8 and Table 9, and Figure 3.
	Close-off ratings	According to ANSI/FCI 70-2
	Leakage rate	Class IV (0.01% of Cv)
	Flow characteristics	See Table 1 and Table 2.
Miscellaneous	Canadian Registration Numbers	0H7645.5… 0C0838.9…
	Mounting location	NEMA 1 (interior only)
	Flange mounting according to ANSI B16.1	See *Cast Iron Flange Dimensions for 2-1/2 through 6-inch Valves Technical Bulletin* (*155-303P25 [TB 248])*
	Dimensions	See Table 13 and Table 14, and Figure 7.
	Face-to-face dimensions	ANSI/ISA S75.03
	Valve weight	See Table 14.

Table 1. Product Numbers for ANSI 125 Valve Assemblies.

Action	Flow Rate		Nominal Line Size		Stroke		Equal Percentage		Linear	
							Stainless Steel Trim	Bronze Trim	Stainless Steel Trim	
	Cv	(Kvs)	Inch	(mm)	Inch	(mm)	Normal Duty Packing		Normal Duty Packing	Steam Packing
Normally Open	63	(54)	2-1/2	(65)	3/4	(20)	599-05960	599-05980	599-06060	599-06040
	100	(85)	3	(80)	3/4	(20)	599-05961	599-05981	599-06061	599-06041
	160	(137)	4	(100)	1-1/2	(40)	599-05962	599-05982	599-06062	599-06042
	250	(214)	5	(125)	1-1/2	(40)	599-05963	599-05983	599-06063	599-06043
	400	(340)	6	(150)	1-1/2	(40)	599-05964	599-05984	599-06064	599-06044
Normally Closed	63	(54)	2-1/2	(65)	3/4	(20)	599-05970	599-05990	599-06070	599-06050
	100	(85)	3	(80)	3/4	(20)	599-05971	599-05991	599-06071	599-06051
	160	(137)	4	(100)	1-1/2	(40)	599-05972	599-05992	599-06072	599-06052
	250	(214)	5	(125)	1-1/2	(40)	599-05973	599-05993	599-06073	599-06053
	400	(340)	6	(150)	1-1/2	(40)	599-05974	599-05994	599-06074	599-06054

Table 2. Product Numbers for ANSI Class 250 Valve Assemblies.

Action	Flow Rate		Nominal Line Size		Stroke		Equal Percentage		Linear	
							Stainless Steel Trim	Bronze Trim	Stainless Steel Trim	
	Cv	(Kvs)	Inch	(mm)	Inch	(mm)	Normal Duty Packing		Normal Duty Packing	Steam Packing
Normally Open	63	(54)	2-1/2	(65)	3/4	(20)	599-05920	599-05940	599-06140	599-06120
	100	(85)	3	(80)	3/4	(20)	599-05921	599-05941	599-06141	599-06121
	160	(137)	4	(100)	1-1/2	(40)	599-05922	599-05942	599-06142	599-06122
	250	(214)	5	(125)	1-1/2	(40)	599-05923	599-05943	599-06143	599-06123
	400	(340)	6	(150)	1-1/2	(40)	599-05924	599-05944	599-06144	599-06124
Normally Closed	63	(54)	2-1/2	(65)	3/4	(20)	599-05930	599-05950	599-06150	599-06130
	100	(85)	3	(80)	3/4	(20)	599-05931	599-05951	599-06151	599-06131
	160	(137)	4	(100)	1-1/2	(40)	599-05932	599-05952	599-06152	599-06132
	250	(214)	5	(125)	1-1/2	(40)	599-05933	599-05953	599-06153	599-06133
	400	(340)	6	(150)	1-1/2	(40)	599-05934	599-05954	599-06154	599-06134

Accessories

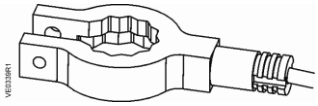


Figure 1. Stem Heating Element.

ASZ6.6 The stem heating element prevents the formation of ice on the stem when the medium temperature drops below 32°F (0°C). It is suited for universal use with valves having a stem or spindle diameter of 10 or 14 mm.

Operating Voltage 24 Vac/dc ± 20%

Power consumption ≤ 40 VA/30W

Service Kits

Valve packing kit	
Normal duty packing	599-08020
Steam packing	599-08021
Rebuild/repack kits	See Table 10.
Flange gasket and bolt kit	See Table 12.
Stem retainer kit: 2-1/2 inch and 3-inch valves	599-10048
Stem retainer kit: 4-inch, 5-inch, and 6-inch valves	599-10049

Tables

Table 3. Cast Iron Valve Body Ratings.

Temperature		Pressure psig (kPa)			
°F	°C	ANSI Class 125		ANSI Class 250	
–20 to 150	–30 to 66	200	(1387)	500	(3447)
200	93	190	(1310)	460	(3171)
250	121	175	(1206)	415	(2861)
300	149	165	(1137)	375	(2585)
400	204	140	(965)	290	(1999)
450	232	125	(861)	250	(1723)

Table 4. 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
2-1/2	63	89	109	126	141	154	178	199	244	282	315	345	398	445	488	546
3	100	141	173	200	224	245	283	316	387	447	500	548	632	707	775	866
4	160	226	277	320	358	392	453	506	620	716	800	876	1012	1131	1239	1386
5	250	354	433	500	559	612	707	791	968	1118	1250	1369	1581	1768	1936	2165
6	400	566	693	800	894	980	1131	1265	1549	1789	2000	2191	2530	2828	3098	3464

Table 5. 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
65	5.4	17.1	24	30	34	38	42	48	54	66	76	94	108	121
80	8.5	27	38	47	54	60	66	76	85	104	120	147	170	190
100	14	43	61	75	87	97	106	123	137	168	194	237	274	306
125	21	68	96	117	135	151	166	191	214	262	303	371	428	479
150	34	108	153	187	216	242	265	306	342	419	484	592	684	765

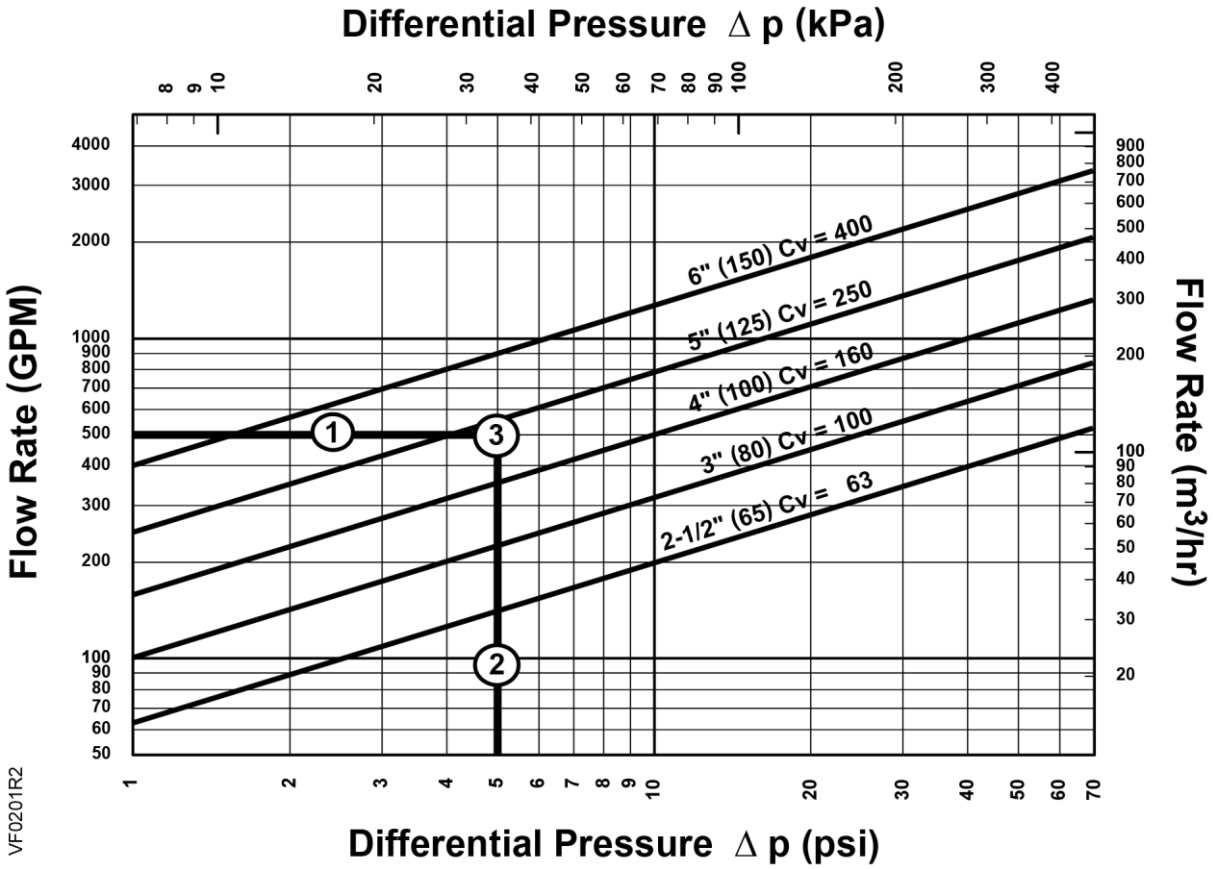


Figure 2. Water Capacity Graph.

Selection Example	Select a valve given: 1 = Required flow = 500 gpm 2 = Desired pressure drop = 5 psi 3 = Select a 5-inch (125 mm) valve, Cv 250.

Table 6. Steam Capacity - Pounds Per Hour.

Line Size in Inches	Inlet Pressure - psig																
	2		5			10			15			25		50		100	
	Pressure Differential - psi																
	1	2	3	4	5	6	8	10	9	12	15	15	20	30	32.5	50	57.5
2-1/2	753	1048	1383	1574	1735	2135	2408	2626	2818	3155	3405	4112	4552	7225	7225	12530	13152
3	1195	1664	2194	2499	2754	3389	3822	4168	4473	5008	5405	6527	7225	11468	11468	19889	20875
4	1913	2663	3511	3998	4407	5422	6115	6669	7156	8013	8649	10443	11561	18348	18348	31823	33401
5	2988	4160	5486	6247	6885	8472	9554	10421	11181	12521	13514	16317	18064	28669	28669	49723	52189
6	4781	6657	8778	9996	11016	13555	15287	16674	17890	20034	21622	26108	28902	45870	45870	79556	83502

Table 7. Steam Capacity - Kilograms Per Hour.

Line Size in mm	Inlet Pressure - kPa																
	50		100			150			200			500			1000		
	Pressure Differential - kPa																
	10	25	10	20	50	15	30	75	20	40	100	50	100	250	100	200	500
65	5413	8559	5413	7655	12104	6630	9376	14825	7655	10826	17118	12104	17118	27066	17118	24209	38277
80	8521	13473	8521	12050	19053	10436	14758	23335	12050	17042	26945	19053	26945	42604	26945	38106	60251
100	13733	21715	13733	19422	30709	16820	23787	37611	19422	27467	43429	30709	43429	68667	43429	61418	97110
125	21452	33919	21452	30338	47969	26274	37156	58749	30338	42905	67838	47969	67838	107261	67838	95937	151690
150	34284	54207	34284	48484	76660	41989	59381	93889	48484	68567	108414	76660	108414	171418	108414	153321	242421

Table 8. Close-off Pressures for Pneumatic Actuators.

Action	Valve Size Inches (mm)	3 to 8 psi (21 to 55 kPa) Spring Range			
		8" Actuator		12" Actuator	
		15 psi (103 kPa)	30 psi (207 kPa)	15 psi (103 kPa)	30 psi (207 kPa)
Normally Open	2-1/2 (65)	31 (213)	100 (689)	95 (655)	304 (2096)
	3 (80)	20 (44)	66 (144)	63 (434)	200 (1378)
	4 (100)	—	—	40 (275)	129 (889)
	5 (125)	—	—	26 (179)	82 (565)
	6 (150)	—	—	18 (124)	57 (393)
Normally Closed	Valve Size Inches (mm)	8 to 13 psi (55 to 90 kPa) Spring Range			
		8" Actuator		12" Actuator	
		0 psi (0 kPa)		0 psi (0 kPa)	
	2-1/2 (65)	36 (248)		114 (786)	
	3 (80)	23 (158)		74 (510)	
	4 (100)	—		46 (317)	
	5 (125)	—		29 (199)	
	6 (150)	—		20 (137)	

Table 9. Close-off Pressures for Electronic Actuators.

Action	Valve Size In. (mm)	SKB/C		SKD		Rack & Pinion Spring Return		SAX Non-Spring Return	
		psi	(kPa)	psi	(kPa)	psi	(kPa)	psi	(kPa)
Normally Open	2-1/2 (65)	153	(518)	38	(262)	26	(179)	26	(179)
	3 (80)	101	(342)	25	(172)	17	(117)	17	(117)
	4 (100)	65	(448)	—	—	—	—	—	—
	5 (125)	42	(289)	—	—	—	—	—	—
	6 (150)	29	(199)	—	—	—	—	—	—
Normally Closed	2-1/2 (65)	97	(668)	34	(234)	26	(179)	26	(179)
	3 (80)	63	(434)	22	(152)	17	(117)	17	(117)
	4 (100)	39	(268)	—	—	—	—	—	—
	5 (125)	25	(172)	—	—	—	—	—	—
	6 (150)	17	(117)	—	—	—	—	—	—

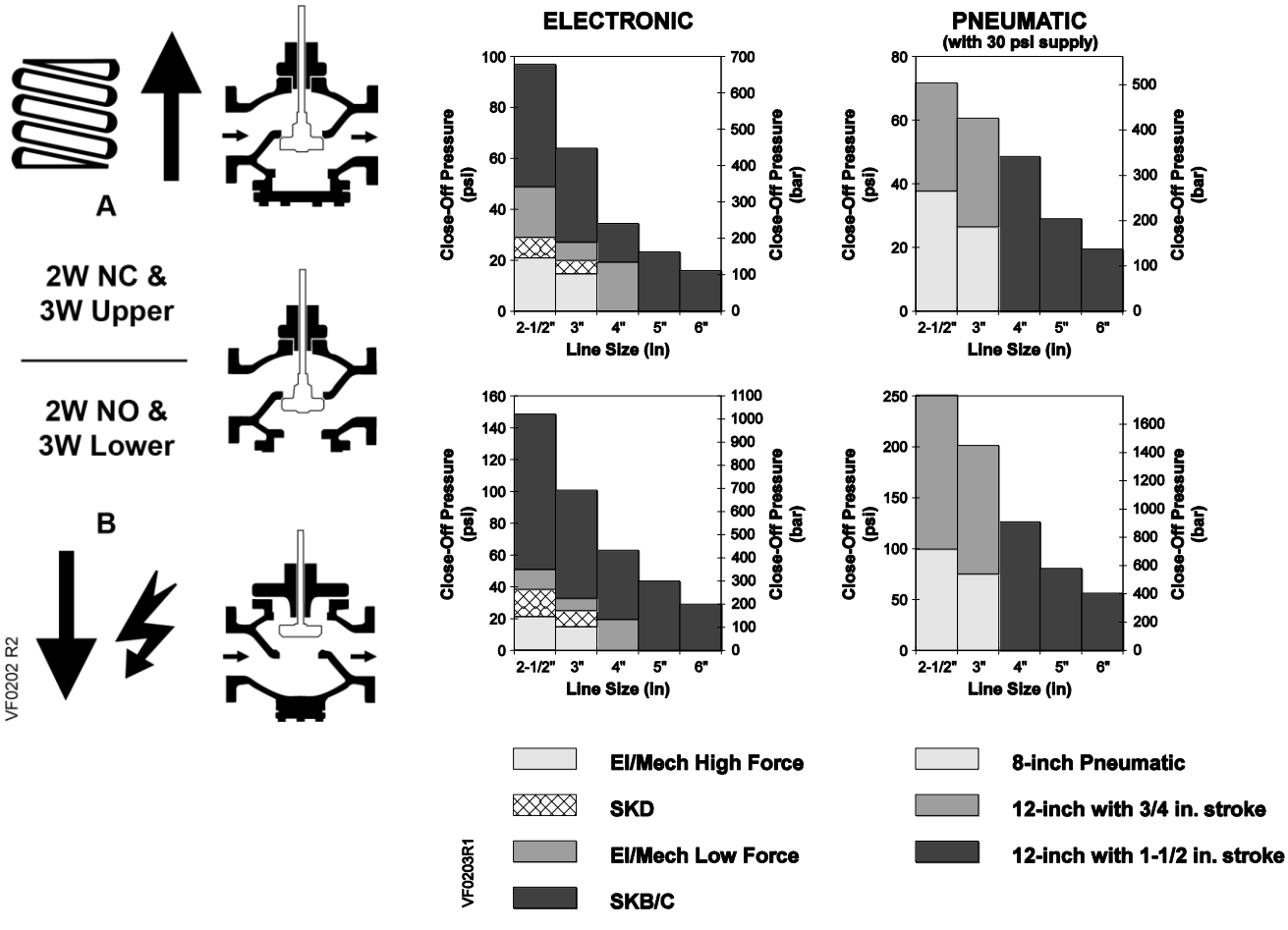
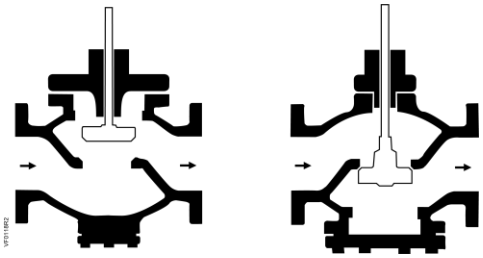


Figure 3. Close-off Pressures.

Operation

Figure 4 shows the normally open valve in the open or full flow position and the normally closed valve in the closed or zero flow position. The actuator spring provides the necessary force to hold the stem in the raised or normal position.

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.



Normally Open **Normally Closed**

Figure 4. Operation.

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 may initiate cycling, and the seat and throttling plug may 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 which must be determined are:

- The medium to be controlled: steam, 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 that the valve actuator must close against.

See AB-1 *Control Valve Selection and Sizing* (Document Number 140-0038) for further recommendations.

See Table 4 through Table 7, and Figure 2 for valve capacities.

Installation

- Install the valve so that the flow follows the direction of the arrow indicated on the valve body identification tag.
- 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. It is not recommended to install the valve assembly below horizontal or upside down.
- For flange dimensions and bolt hole information, see *Cast Iron Flange Dimensions for 2-1/2 through 6" Valves Technical Bulletin* (155-303P25 [TB 248]).
- Allow sufficient space for servicing the valve and actuator. See Table 14 for valve body dimensions. See Table 13 and Figure 7 for dimensions of the service envelope recommended around the actuator.

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

Service Kits

Table 10. Rebuild/Repack Service Kits Part Numbers.

Valve Description		ANSI Class 125 Valve No.	ANSI Class 250 Valve No.	Kit No.
Stainless Steel Trim	NO 2-1/2 (65), = %	599-05960	599-05920	**599-10130**
	NO 3 (85), = %	599-05961	599-05921	**599-10131**
	NO 4 (100), = %	599-05962	599-05922	**599-10132**
	NO 5 (125), = %	599-05963	599-05923	**599-10133**
	NO 6 (150), = %	599-05964	599-05924	**599-10134**
	NC 2-1/2 (65), = %	599-05970	599-05930	**599-10140**
	NC 3 (85), = %	599-05971	599-05931	**599-10141**
	NC 4 (100), = %	599-05972	599-05932	**599-10142**
	NC 5 (125), = %	599-05973	599-05933	**599-10143**
	NC 6 (150), = %	599-05974	599-05934	**599-10144**
Bronze Trim	NO 2-1/2 (65), = %	599-05980	599-05940	**599-10135**
	NO 3 (85), = %	599-05981	599-05941	**599-10136**
	NO 4 (100), = %	599-05982	599-05942	**599-10137**
	NO 5 (125.), = %	599-05983	599-05943	**599-10138**
	NO 6 (150), = %	599-05984	599-05944	**599-10139**
	NC 2-1/2 (65), = %	599-05990	599-05950	**599-10145**
	NC 3 (85), = %	599-05991	599-05951	**599-10146**
	NC 4 (100), = %	599-05992	599-05952	**599-10147**
	NC 5 (125), = %	599-05993	599-05953	**599-10148**
	NC 6 (150), = %	599-05994	599-05954	**599-10149**
Linear, Steam Packing	NO 2-1/2 (65)	599-06040	599-06120	**599-10110**
	NO 3 (85)	599-06041	599-06121	**599-10111**
	NO 4 (100)	599-06042	599-06122	**599-10112**
	NO 5 (125)	599-06043	599-06123	**599-10113**
	NO 6 (150)	599-06044	599-06124	**599-10114**
	NC 2-1/2 (65)	599-06050	599-06130	**599-10115**
	NC 3 (85)	599-06051	599-06131	**599-10116**
	NC 4 (100)	599-06052	599-06132	**599-10117**
	NC 5 (125)	599-06053	599-06133	**599-10118**
	NC 6 (150)	599-06054	599-06134	**599-10119**
Linear, Normal Duty Packing	NO 2-1/2 (65)	599-06060	599-06140	**599-10100**
	NO 3 (85)	599-06061	599-06141	**599-10101**
	NO 4 (100)	599-06062	599-06142	**599-10102**
	NO 5 (125)	599-06063	599-06143	**599-10103**
	NO 6 (150)	599-06064	599-06144	**599-10104**
	NC 2-1/2 (65)	599-06070	599-06150	**599-10105**
	NC 3 (85)	599-06071	599-06151	**599-10106**
	NC 4 (100)	599-06072	599-06152	**599-10107**
	NC 5 (125)	599-06073	599-06153	**599-10108**
	NC 6 (150), Linear	599-06074	599-06154	**599-10109**

Construction of the Two-Way Valve

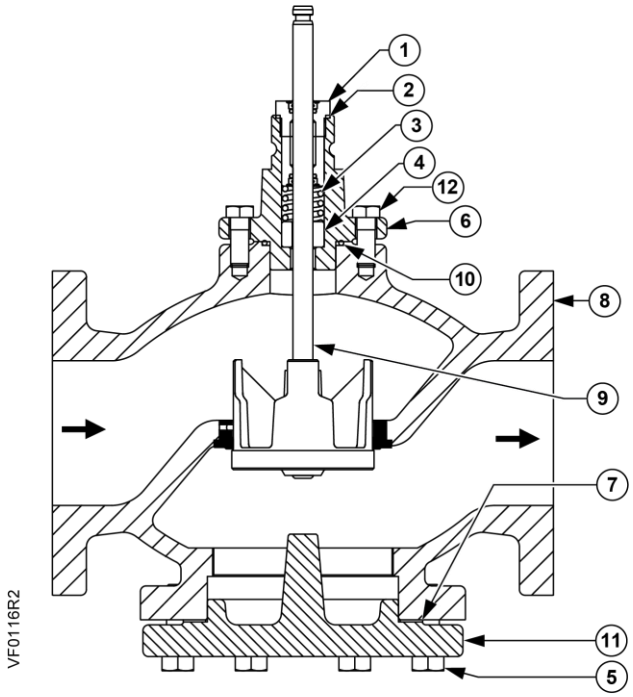


Figure 5. Two-Way Normally Closed.

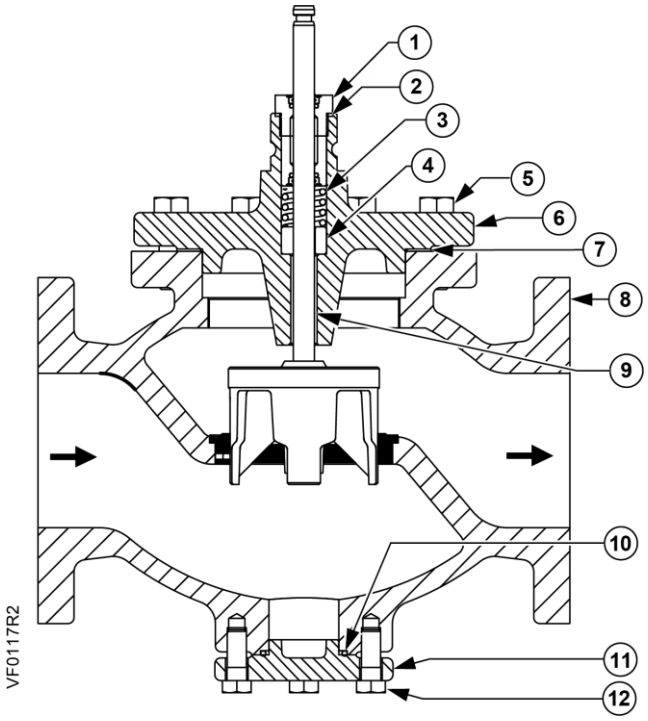


Figure 6. Two-Way Normally Open.

Parts List

Table 11. Parts List for Two-Way Flanged Valves.

Item	Part Name	Part No.	Qty	Material
1	Packing Cartridge Assembly	–	1	–
2	Gasket	–	1	Copper
3	Packing Spring	–	1	Stainless Steel
4	Packing Bearing	–	1	Bronze
5	Cap Screw		4 - 8	Plated Steel
6	Bonnet	–	1	Cast Iron
7	Gasket		1	-
8	Valve Body	–	1	Cast Iron
9	Stem and Plug Assembly	–	1	Bronze or Stainless Steel
10	O-ring	–	1	EP
11	Cap	–	1	Cast Iron
12	Cap Screw	–	4	Plated Steel
	Packing Kit Normal Duty Service Steam Service	 599-08020 599-08021	–	Items 1 and 2
	Rebuild/Repack Kit Normally Closed	Table 10	–	Items 1, 2, 3, 4, 7, 9, and 10
	Rebuild/Repack Kit Normally Open	Table 10	–	Items 1, 2, 3, 4, 7, and 9
	Flange Gasket and Cap Screw Replacement Kit	Table 12		Items 5 and 7

Service Kits

Table 12. Flange Gasket and Cap Screw Replacement Kits.

Description	Line Size Inch (mm)	Kit Part Number	Cap Screw Size - Inch
ANSI Class 125	2-1/2 (65)	599-09236	5/8 – 11 × 1-1/2
	3 (80)	599-09237	5/8 – 11 × 1-3/4
	4 (100)	599-09238	5/8 – 11 × 2
	5 (125)	599-09239	3/4 – 10 × 2
	6 (150)	599-09240	3/4 – 10 × 2
ANSI Class 250	2-1/2 (65)	599-09241	3/4 – 10 × 2
	3 (80)	599-09242	3/4 – 10 × 2-1/2
	4 (100)	599-09243	3/4 – 10 × 2-1/2
	5 (125)	599-09244	3/4 – 10 × 2-3/4
	6 (150)	599-09245	3/4 – 10 × 3

Dimensions

NOTE: See Table 13 for actuator and recommended service envelope dimensions and Table 14 for actual valve dimensions.

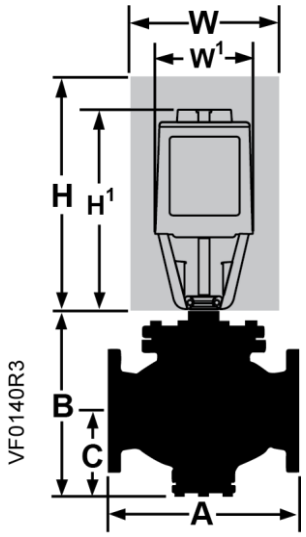


Figure 7. Dimensions.

Table 13. 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
8" Pneumatic	277 278 283 284	14-1/8 (359)	26 (660)	8-3/4 (222) diameter	21 (533)
12" Pneumatic	279 281 285 287	17-7/8 (454)	30 (762)	15-1/8 (384) diameter	27 (686)
SKB/C with handle closed	289 290 291 292 293 294	14-3/4 (375)	22-3/4 (578)	7 (178) width × 8-15/16 (226) depth	25 (635)
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)

Table 14. Valve Dimensions and Weight.

Valve Action	Nominal Valve Size inches (mm)	ANSI Class 125				ANSI Class 250			
		Dimensions in Inches (mm)			Weight lbs. (kg)	Dimensions in Inches (mm)			Weight lbs. (kg)
		A	B	C		A	B	C	
Normally Open	2-1/2 (65)	10-7/8 (276)	11 (281)	4-7/8 (123)	60 (27)	11-1/2 (292)	11 (281)	4-7/8 (123)	76 (34)
	3 (80)	11-3/4 (299)	12-1/4 (312)	5-5/16 (135)	76 (34)	12-1/2 (318)	12-1/4 (312)	5-5/16 (135)	99 (45)
	4 (100)	13-7/8 (352)	13-9/16 (345)	6-5/16 (160)	124 (56)	14-1/2 (368)	13-5/8 (344.7)	6-5/16 (160)	160 (73)
	5 (125)	15-3/4 (400)	15-3/16 (385)	7 (177)	155 (70)	16-5/8 (422)	15-3/16 (385)	7 (177)	208 (94)
	6 (150)	17-3/4 (451)	16-3/4 (426)	7-7/8 (200)	212 (96)	18-5/8 (473)	16-3/4 (426)	7-7/8 (200)	302 (137)
Normally Closed	2-1/2	10-7/8	10-5/8	4-7/8	58	11-1/2	11	5-3/8	74
	(65)	(276)	(269)	(125)	(26)	(292)	(279)	(135)	(34)
	3	11-3/4	11-15/16	5-5/8	75	12-1/2	12-7/16	6	98
	(80)	(299)	(303)	(142)	(34)	(318)	(315)	(154)	(44)
	4	13-7/8	13-15/16	6-5/8	123	14-1/2	14-3/8	7	159
	(100)	(352)	(354)	(168)	(56)	(368)	(364)	(178)	(72)
	5	15-3/4	15-1/4	7-1/2	153	16-5/8	15-3/4	7-3/4	207
	(125)	(400)	(388)	(185)	(69)	(422)	(399)	(196)	(94)
	6	17-3/4	17-1/16	8-3/16	209	18-5/8	17-1/2	8-5/8	299
	(150)	(451)	(433)	(207)	(95)	(473)	(444)	(218)	(136)