Product Bulletin
21.1:Cryogenic-Rotary
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Fisher® POSI-SEAL™ A31A Cryogenic High Performance Butterfly Valve

Description

The Fisher A31A Cryogenic High Performance Butterfly Valve (HPBV) is designed for extreme temperature cryogenic services and features a valve body extension which positions the packing system and the actuator away from the extreme temperatures. The NPS 3 through 12 valves feature a unique one-piece investment cast extension housing (see figures 1 and 2). The NPS 14 through 24 valves employ a two-piece fabricated extension housing. The valve also features a metal NOVEX seal as standard providing tight shutoff, low operating torques and the rugged durability needed for cryogenic service.

The A31A Cryogenic HPBV has been developed as a valve/actuator package with a Double D drive shaft (standard for NPS 3 through 12) to allow easy, direct mounting to the Fisher 1035 Rack and Pinion actuator, eliminating the need for external coupling systems. Also available are keyed shaft (standard for NPS 14 through 24) and splined drive shafts to allow easy mounting to other Fisher actuators.

The A31A Cryogenic HPBV is available in either flangeless (wafer) or single flange styles, and S31600 (316 SST) is the standard valve body and disc material. This valve is offered in full rated CL150 and CL300 pressure classes.

Contents

W7451

Figure 1. Fisher POSI-SEAL A31A Cryogenic Valve with 1035 Actuator

Specifications

Valve Body Sizes and Ratings

NPS ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12
CL150 and 300
■ NPS 14 through 24 valves are also available in CL150 and 300.

End Connection Style

■ Flangeless, wafer-style or ■ single flange valve body designed to fit between raised-face mating flanges per ASME B16.5 CL150 or 300

Maximum Inlet Pressure/Temperature(1)

Consistent with CL150 and CL300 pressure/temperature ratings per ASME B16.34, except that 38°C (100°F) rating is applicable to −254°C (−425°F). NOVEX seal maximum pressure/temperature rating is the same as the valve body. See figure 4 for rating of CTFE seal.

Temperature Range(1)

−234 to 260°C (−425 to 500°F)

Available Seal Configurations

See figure 3 and table 2

Standard Construction Materials

Valve Body and Disc: ASTM grades of S31600 stainless steel
Disc Coating: Hardcoating Standard (Chrome or Nickel)
Shaft: ■ ASTM grade of S17400 H1150M SST, ■ N05500 (Optional), ■ N07718 (Optional)
Seal Ring: ■ S31600 (316 SST) NOVEX Std for CL 150, ■ S21800 NOVEX Std for CL300, ■ CTFE(2) optional, or ■ CTFE(2) with Aluminum Back-up ring optional
Packing: ■ PTFE V-ring, or ■ graphite (optional)
Bearings: ■ PTFE Composition, or ■ bronze (optional)

Valve Body Classification

Face-to-face dimensions are in compliance with MSS SP68 and API 609 standards; valve bodies are designed for installation between ASME B16.5 CL150 or 300 raised-face flanges

Shutoff Classification

Unidirectional Reverse flow. Per ANSI/FCI 70-2 and IEC 60534-4 at ambient temperature

NOVEX Seal: Class VI

CTFE Seal: 1/10 of Class IV

CTFE Seal with Aluminum back-up ring: Class VI

Flow Characteristic

Modified equal percentage

Flow Coefficients

See the section titled Coefficients in this bulletin

Noise Levels

See Catalog 12 for sound pressure level prediction

Available Actuators

■ Rack and Pinion 1035 for NPS 3 through 12,
■ Bettis G Series for keyed shaft NPS 14 through 24 or
■ Rotary Diaphragm 1051 and 1052 for splined shafts

Disc Rotation

Clockwise to close

Valve Dimensions and Approximate Weights

See figures 6, 7, 8, 9, 10, 11, 12, and 13 and tables 1, 3, 4, 5, 6, 7, 8, 9 and 10.

1. The pressure/temperature limits in this bulletin, and any application code or standard limitation, should not be exceeded.
2. CTFE not recommended for fast cycling, less than 2 seconds.

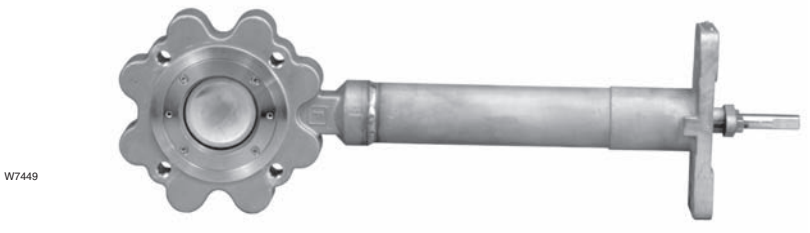

Figure 2. Fisher A31A Cryogenic Valve, Single Flange Style

Table 1. Approximate Weights

VALVE SIZE, NPS	WAFER CL150		SINGLE FLANGE CL150		WAFER CL300		SINGLE FLANGE CL300	
	kg	lbs	kg	lbs	kg	lbs	kg	lbs
3	12	27	16	36	12	27	16	35
4	21	46	22	48	21	46	24	52
6	24	53	28	61	24	53	28	61
8	34	75	40	89	47	104	52	115
10	57	125	67	148	80	176	100	220
12	74	164	93	206	103	227	135	298
14	87	191	120	265	142	314	249	548
16	133	294	182	401	213	470	325	716
18	170	374	231	510	259	570	434	956
20	210	463	302	665	401	884	582	1282
24	326	719	455	1004	512	1128	863	1903

Features

- **Cryogenic Seal Improvement—** The NOVEX pressure-assisted metal seal design provides tight shutoff (ANSI Class VI, ambient) and permits the use of smaller, less expensive actuators in applications requiring full ASME B16.34 shutoff capabilities. The NOVEX seal is standard on all A31A Cryogenic valves.

- **Direct Actuation—**The A31A Cryogenic NPS 3 through 8 Double D shaft allows direct mounting with the 1035 actuator, eliminating the need for a coupler.

- **Excellent Shutoff Integrity—**Concentric rotation enables the valve disc to remain in the closed position in spite of line pressure surges or actuator failure.

- **Safety—**Redundant shaft retention provides added protection. The packing follower and shaft step interact to hold the shaft securely in the valve body. The NPS 3 through 12 valves use a one-piece packing follower, and the NPS 14 through 24 valves use a two-piece follower (see figure 5).

- **Strength—** The cast S31600 one-piece extensions are welded directly onto the NPS 3 through 8 valves for greater strength under service conditions.

- **Easy Installation—**The valve body self-centers on the line flange bolts as a fast, accurate means of centering the valve in the pipeline.

- **Reliable Flange Gasketing Surface—**Seal retainer screws are located so there is no interference with the sealing function of either flat sheet or spiral wound line flange gaskets.

Installation

Recommended installation for the A31A Cryogenic valve is with the shaft upstream of the seal (reverse flow).

Dimensions for wafer-style and single-flange valves are shown in figures 6, 7, 8, 9, 10, 11, 12, and 13 and tables 3, 4, 5, 6, 7, 8, 9 and 10.

For assistance in selecting the appropriate combination of actuator action and open valve position, consult your Emerson Process Management sales office.

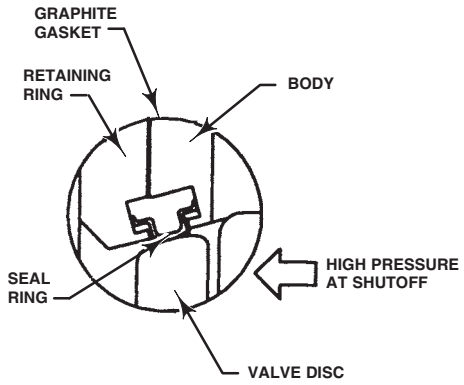

Figure 3. Available Seal Configurations

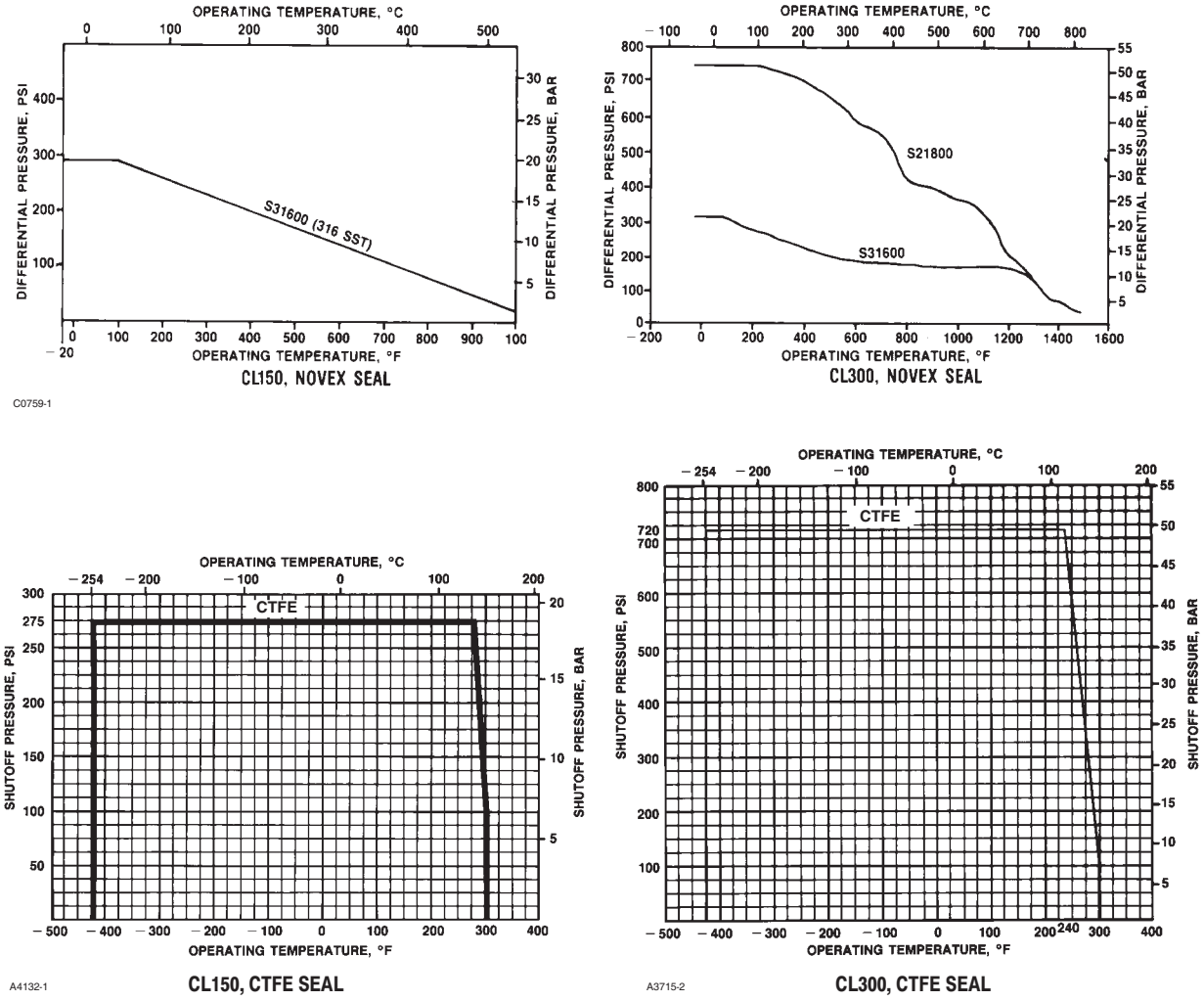

Figure 4. Maximum Pressure/Temperature Ratings

Table 2. Material Temperature Ratings

COMPONENT AND MATERIAL OF CONSTRUCTION		TEMPERATURE RANGE	
		°C	°F
Valve Body			
CF8M (316 SST) CL150 and 300		–254 to 260	–425 to 500
Disc			
CF8M (316 SST)		–254 to 260	–425 to 500
Disc Coating			
Hard Coating(1)		–254 to 260	–425 to 500
Shaft			
S17400 H1150M (standard)		–196 to 260	–320 to 500
N05500		–198 to 260	–325 to 500
N07718		–254 to 260	–425 to 500
Bearings			
PTFE Composition Rexnord (standard)		–254 to 163	–425 to 325
Bronze		–254 to 260	–425 to 500
Packing			
PTFE Packing (standard)		–254 to 232	–425 to 450
Graphite		–254 to 260	–425 to 500
Seal Ring	NOVEX S31600 Seal Ring (CL150) (standard)	–254 to 260	–425 to 500
	NOVEX S21800 Seal Ring (CL300) (standard)	–254 to 260	–425 to 500
	CTFE Cryogenic Seal Ring	–254 to 149	–425 to 300

1. The material for hard coating on the disc is either hard chrome plating or Electroless Nickel Coating (ENC) depending upon availability.

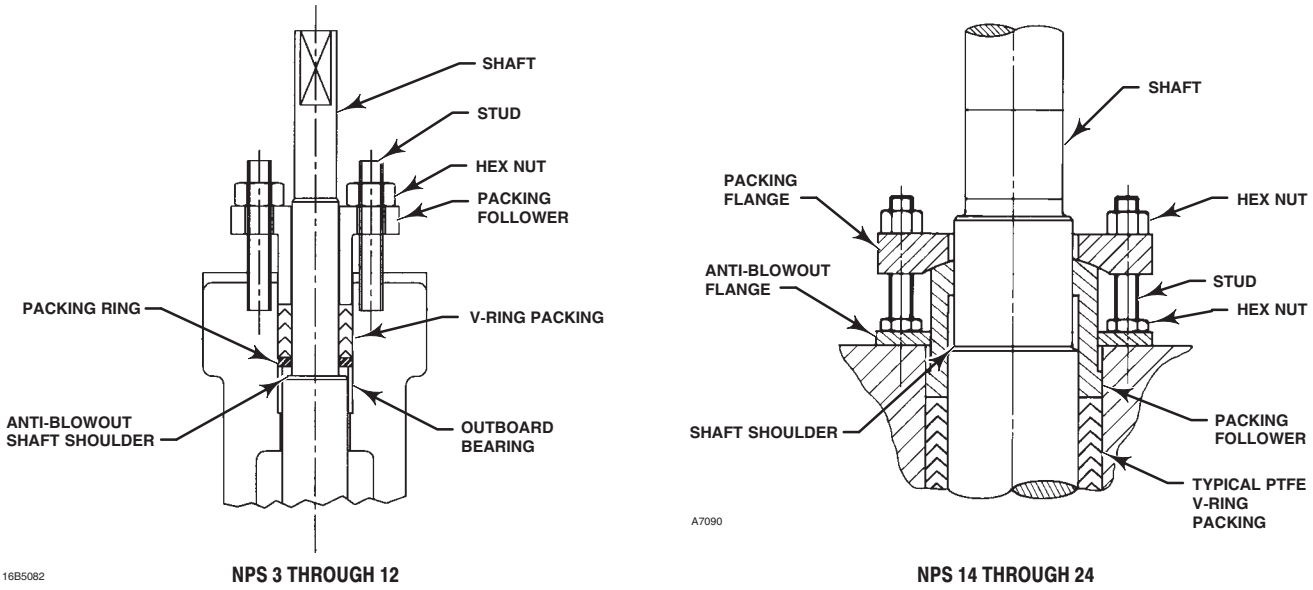

Figure 5. Anti-Blowout Protection

Table 3. Dimensions, Wafer Style Valves, CL150, NPS 3 through 8

VALVE SIZE, NPS	A	D	E	F	F1	G	J	K	M(2)	R(1)	S	T	U	V	FLAT LENGTH	FLAT SIZE
	mm															
3	48	87	83	10	19	79	146	375	71	133	16	152	32	117	25	11
4	54	113	83	22	25	95	178	451	94	171	19	152	32	117	25	14
6	57	165	83	41	51	127	248	489	148	219	25	152	32	117	25	17
8	64	210	83	65	68	152	- - -	679	197	273	25	152	32	117	25	17
	Inches															
3	1.88	3.44	3.25	0.38	0.75	3.13	5.75	14.75	2.82	5.25	0.625	6.0	1.25	4.63	1.0	0.436
4	2.13	4.44	3.25	0.88	1.0	3.75	7.0	17.75	3.69	6.75	0.75	6.0	1.25	4.63	1.0	0.561
6	2.25	6.50	3.25	1.63	2.0	5.0	9.75	19.25	5.82	8.63	1	6.0	1.25	4.63	1.0	0.687
8	2.50	8.25	3.25	2.57	2.69	6.0	- - -	26.75	7.75	10.75	1	6.0	1.25	4.63	1.0	0.687

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.

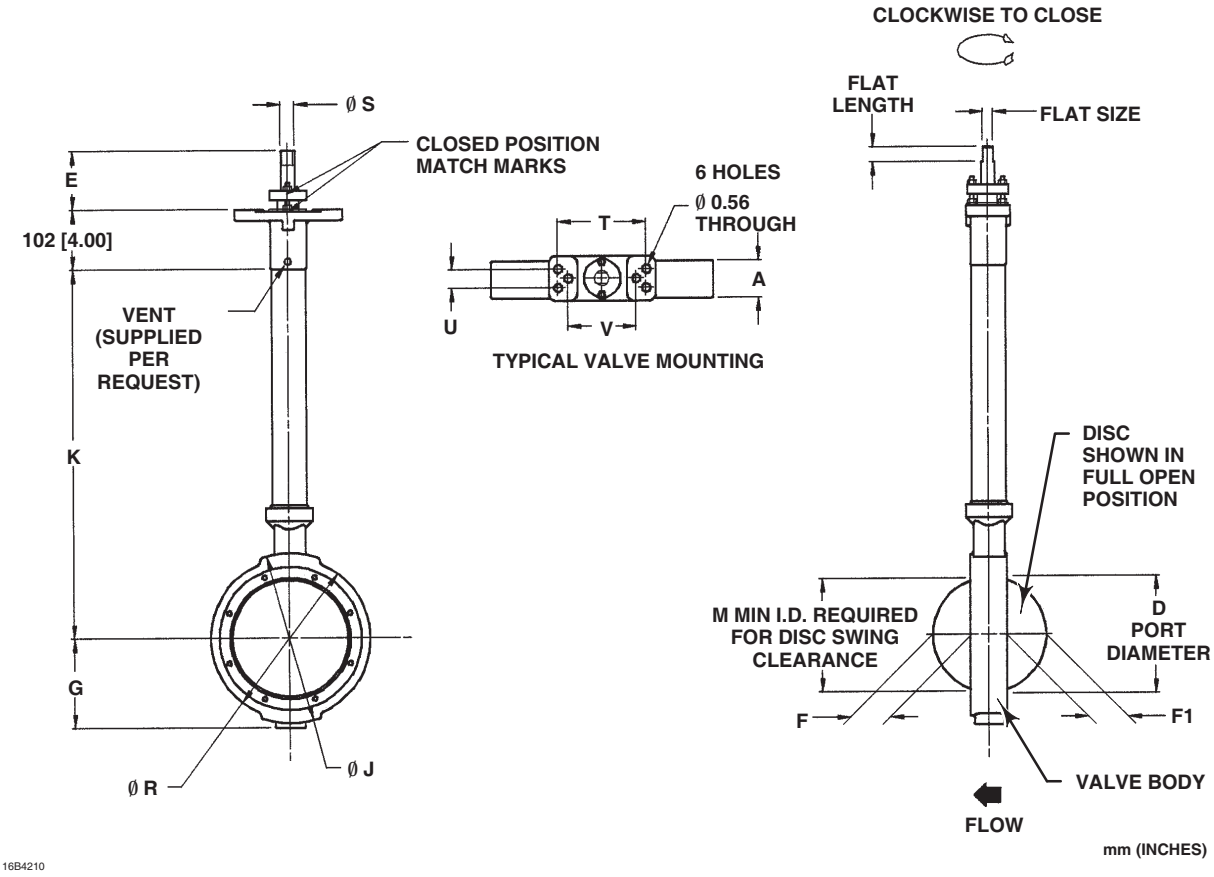

Figure 6. Dimensions, Wafer Style Valves, CL150, NPS 3 through 8 (also see table 3)

Table 4. Dimensions, Single Flange Style Valves, CL150, NPS 3 through 8

VALVE SIZE, NPS	A	D	E	F	F1	J	K	M(2)	R(1)	S	T	U	V	W	FLAT LENGTH	FLAT SIZE
	mm															
3	48	87	83	10	19	152	375	71	207	16	152	32	117	See thread information below	25	11
4	54	113	83	22	25	191	451	94	238	19	152	32	117		25	14
6	57	165	83	41	51	241	489	148	308	25	152	32	117		25	17
8	64	210	83	65	68	298	679	197	336	25	152	32	117		25	17
	Inches															
3	1.88	3.44	3.25	0.375	0.75	6.0	14.75	2.82	8.25	0.625	6.0	1.25	4.63	0.625-11 4 holes	1.0	0.436
4	2.13	4.44	3.25	0.875	1.0	7.5	17.75	3.69	9.38	0.75	6.0	1.25	4.63	0.625-11 8 holes	1.0	0.561
6	2.25	6.50	3.25	1.63	2.0	9.5	19.25	5.82	12.13	1	6.0	1.25	4.63	0.75-10 8 holes	1.0	0.687
8	2.50	8.25	3.25	2.57	2.69	11.75	26.75	7.75	13.25	1	6.0	1.25	4.63	0.75-10 8 holes	1.0	0.687

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.

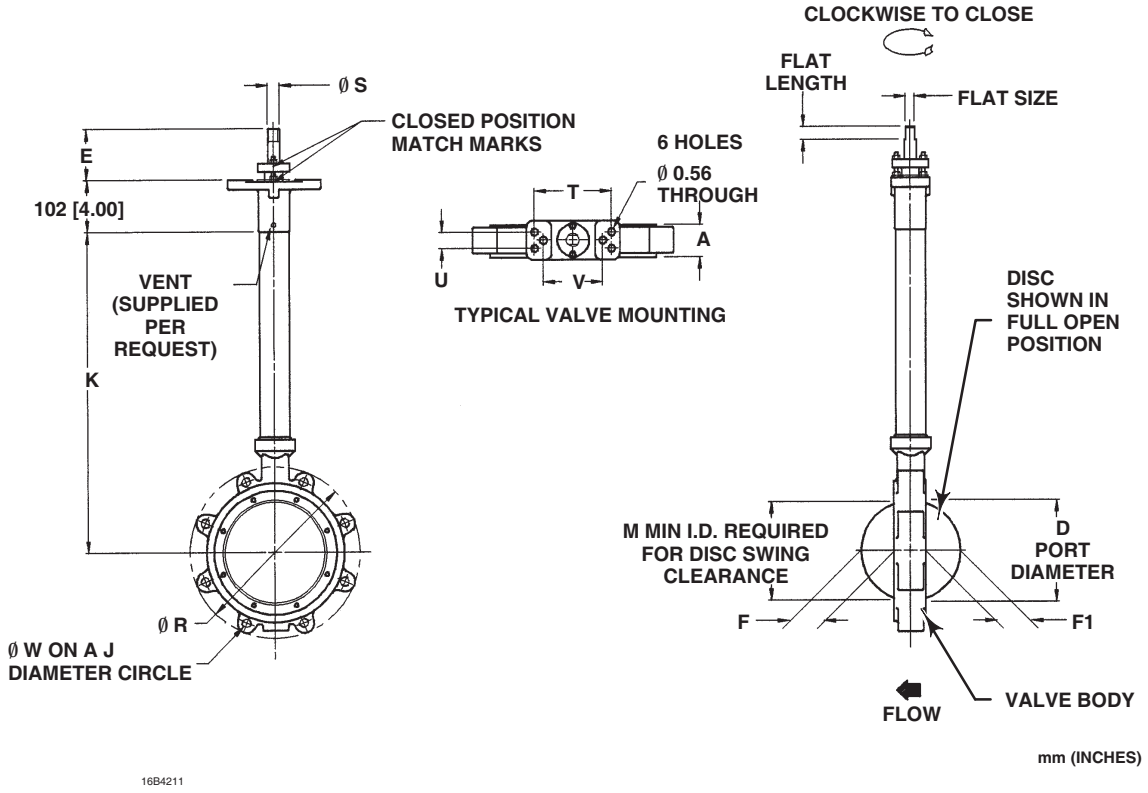

Figure 7. Dimensions, Single Flange Style Valves, CL150, NPS 3 through 8 (also see table 4)

Table 5. Dimensions, Wafer Style valves, CL300, NPS 3 through 6

VALVE SIZE, NPS	A	D	E	F	F1	G	J	K	M(2)	R(1)	S	T	U	V	FLAT LENGTH	FLAT SIZE
	mm															
3	48	87	83	10	19	79	146	375	71	133	16	152	32	117	25	11
4	54	113	83	22	25	95	178	451	94	171	19	152	32	117	25	14
6	57	164	83	41	48	127	248	489	146	219	25	152	32	117	25	17
	Inches															
3	1.88	3.44	3.25	0.375	0.75	3.13	5.75	14.75	2.81	5.25	0.625	6.0	1.25	4.63	1.0	0.436
4	2.13	4.44	3.25	0.875	1.0	3.75	7.0	17.75	3.69	6.75	0.75	6.0	1.25	4.63	1.0	0.561
6	2.25	6.44	3.25	1.63	1.88	5.0	9.75	19.25	5.75	8.63	1	6.0	1.25	4.63	1.0	0.687

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.

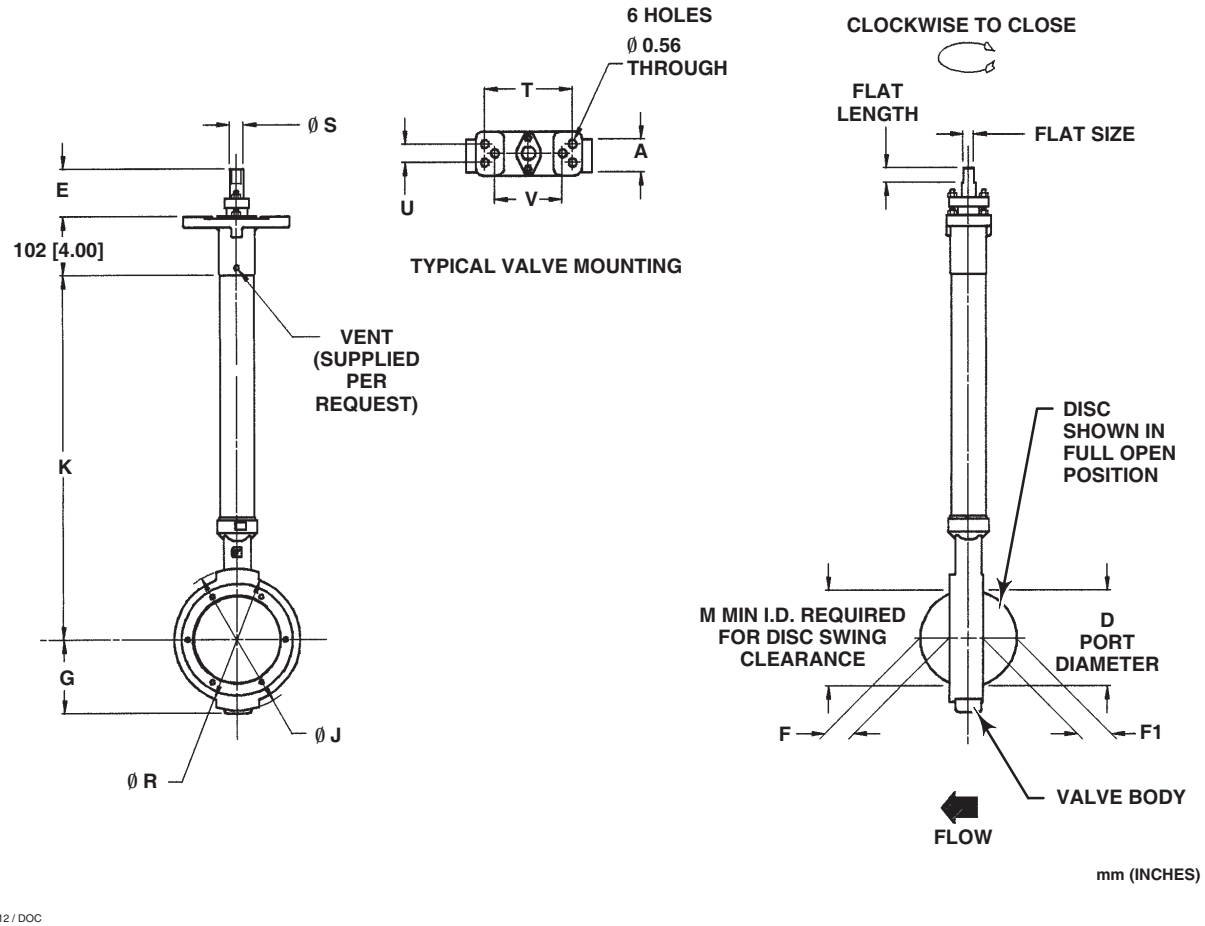

Figure 8. Dimensions, Wafer Style valves, CL300, NPS 3 through 6 (also see table 5)

Table 6. Dimensions, Single Flange Style Valves, CL300, NPS 3 through 6

VALVE SIZE, NPS	A	D	E	F	F1	J	K	M(2)	R(1)	S	T	U	V	W	FLAT LENGTH	FLAT SIZE
	mm															
3	48	87	83	10	19	168	375	71	207	16	152	32	117	See thread information below	25	11
4	54	113	83	22	25	200	451	94	238	19	152	32	117		25	14
6	57	164	83	41	48	270	489	146	308	25	152	32	117		25	17
	Inches															
3	1.88	3.44	3.25	0.375	0.75	6.63	14.75	2.81	8.13	0.625	6.0	1.25	4.63	0.75-10 8 holes	1.0	0.436
4	2.13	4.44	3.25	0.875	1.0	7.88	17.75	3.69	9.75	0.75	6.0	1.25	4.63	0.75-10 8 holes	1.0	0.561
6	2.25	6.44	3.25	1.63	1.88	10.63	19.25	5.75	12.63	1	6.0	1.25	4.63	0.75-10 12 holes	1.0	0.687

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.

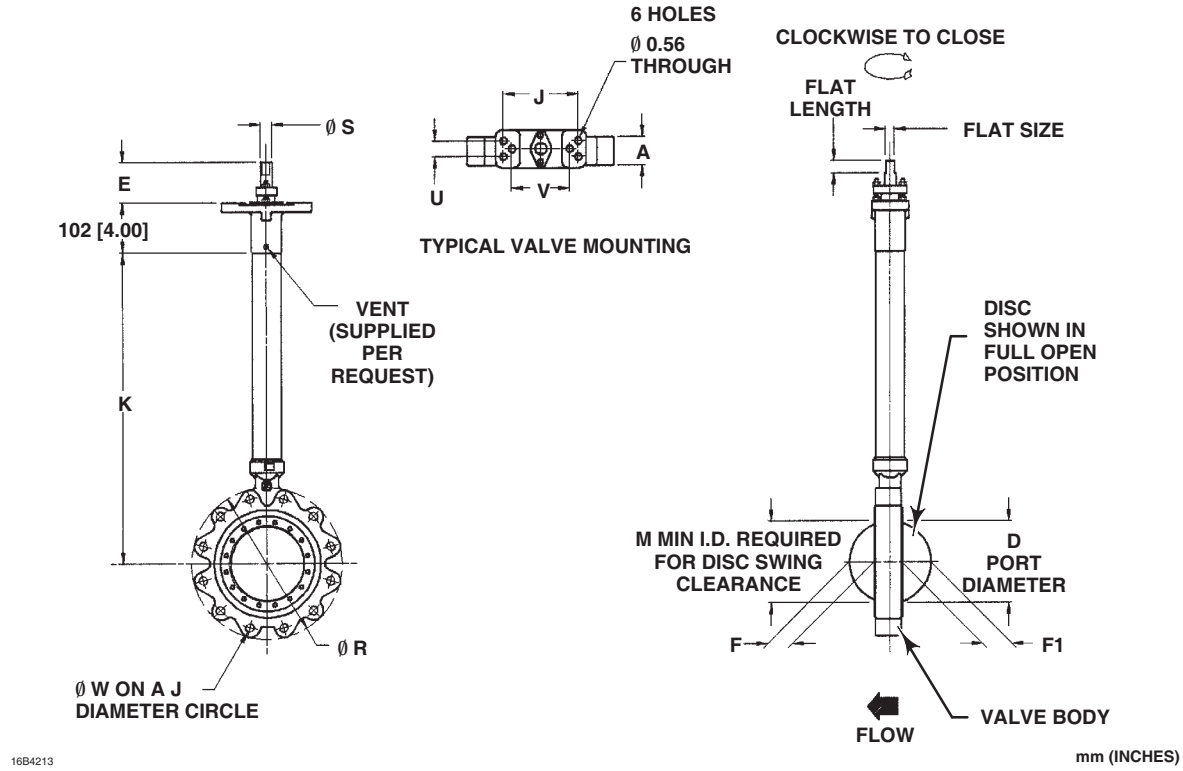

Figure 9. Dimensions, Single Flange Style Valves, CL300, NPS 3 through 6 (also see table 6)

Table 7. Dimensions, Wafer Style Valve, CL150, NPS 10 through 24

VALVE SIZE, NPS	A(1)	D	E	F	F1	G	J	K	M(2)	R	S(3)	T	U	W
	mm													
10	71	265	89	83	98	187	- - -	724	254	337	32	235	46.0	- - -
12	81	316	89	105	113	224	406	851	298	381	38	235	46.0	- - -
14	92	338	102	122	117	240	476	914	330	448	30.2	235	46.0	29
16	102	384	102	143	133	276	540	914	378	511	31.8	235	46.0	29
18	114	432	102	162	149	341	578	914	429	533	38.1	273	50.8	32
20	127	479	102	182	162	375	635	914	470	584	44.5	273	50.8	32
24	154	594	102	227	203	432	749	914	575	692	57.2	337	76.2	35
	Inches													
10	2.82	10.44	3.5	3.25	3.81	7.38	- - -	28.5	10	13.25	1.25	9.25	1.81	- - -
12	3.19	12.44	3.5	4.13	4.44	8.82	16.0	33.5	11.75	15.0	1.5	9.25	1.81	- - -
14	3.6	13.3	4	4.80	4.61	9.45	18.75	36	13	17.64	1.1875	9.25	1.81	1.125
16	4	15.1	4	5.63	5.25	10.87	21.25	36	14.88	20.11	1.25	9.25	1.81	1.125
18	4.5	17	4	6.38	5.87	13.43	22.75	36	16.89	21	1.5	10.75	2.00	1.25
20	5	18.86	4	7.17	6.38	14.75	25	36	18.5	23	1.75	10.75	2.00	1.25
24	6.06	23.38	4	8.94	8	17	29.5	36	22.64	27.25	2.25	13.25	3.00	1.375

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.
3. Shaft diameter at key.

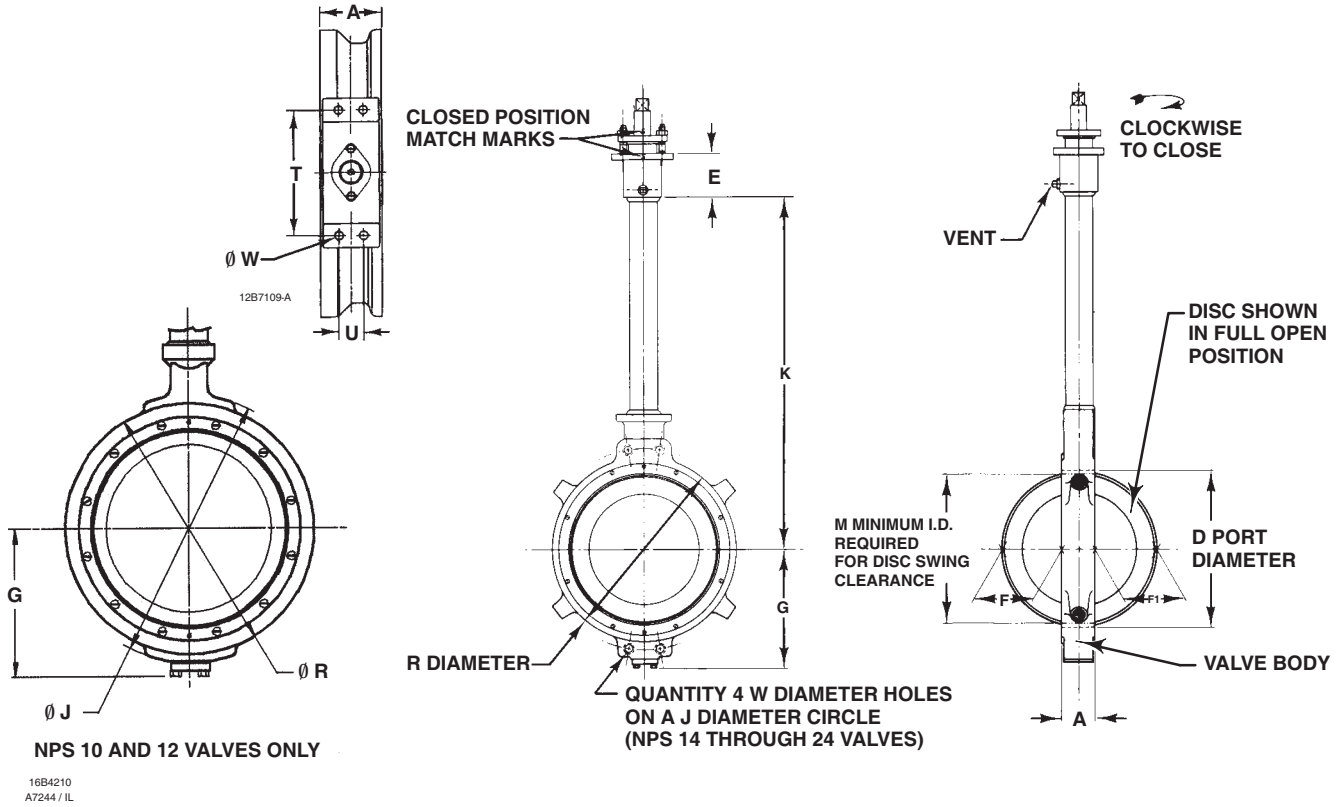

Figure 10. Dimensions, Wafer Style Valve, CL150, NPS 10 through 24 (see also table 7)

Table 8. Dimensions, Single Flange Style Valve, CL150, NPS 10 through 24

VALVE SIZE, NPS	A(1)	D	E	F	F1	G	J	K	M(2)	R	S(3)	T	U	W
	mm													
10	71	265	89	83	98	- - -	362	724	254	406	32	235	46.0	See thread information below
12	81	316	89	105	113	- - -	432	851	298	476	32	235	46.0	
14	92	338	102	122	117	240	476	914	330	533	30.2	235	46.0	
16	102	384	102	143	133	316	540	914	378	597	31.8	235	46.0	
18	114	432	102	162	149	341	578	914	429	635	38.1	273	50.8	
20	127	479	102	182	162	375	635	914	470	705	44.5	273	50.8	
24	154	594	102	227	203	432	749	914	575	813	57.2	337	76.2	
	Inches													
10	2.82	10.44	3.5	3.25	3.82	- - -	14.25	28.5	10.0	16.0	1.25	9.25	1.81	0.875-9 12 holes
12	3.19	12.44	3.5	4.13	4.38	- - -	17.0	33.5	11.75	18.75	1.25	9.25	1.81	0.875-9 12 holes
14	3.62	13.30	4	4.8	4.60	9.45	18.75	36	13	21	1.1875	9.25	1.81	1-8 12 holes
16	4	15.12	4	5.63	5.25	12.44	21.25	36	14.88	23.5	1.25	9.25	1.81	1-8 16 holes
18	4.5	17	4	6.38	5.86	13.43	22.75	36	16.89	25	1.5	10.75	2.00	1.125-8 16 holes
20	5	18.85	4	7.17	6.38	14.75	25	36	18.50	27.75	1.75	10.75	2.00	1.125-8 20 holes
24	6.06	23.38	4	8.94	8	17	29.50	36	22.64	32	2.25	13.25	3.00	1.25-8 20 holes

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.
3. Shaft diameter at key.

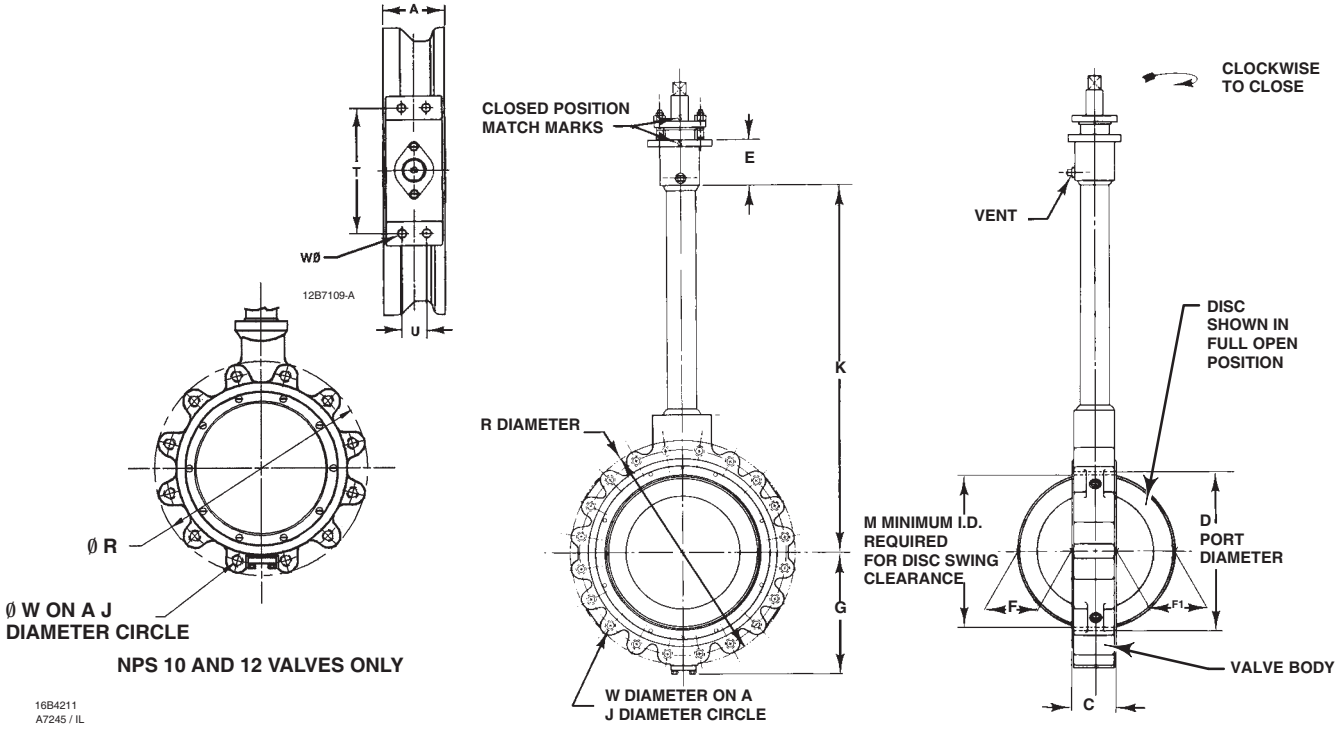

Figure 11. Dimensions, Single Flange Style Valve, CL150, NPS 10 through 24 (see also table 8)

Table 9. Dimensions, Wafer Style Valve, CL300, NPS 8 through 24

VALVE SIZE, NPS	A(1)	D	E	F	F1	G	J	K	M(2)	R	S(3)	T	U	W
	mm													
8	73	195	89	51	62	173	305	679	186	279	32	235	46.0	See thread information below
10	85	246	89	75	75	265	387	724	230	349	38	235	46.0	
12	94	292	89	93	99	281	451	851	282	394	44	273	50.8	
14	117	321	102	100	97	314	514	914	305	432	44.5	273	50.8	
16	133	367	102	117	105	348	572	914	349	489	44.5	273	50.8	
18	149	413	152	129	125	379	629	914	391	546	57.2	337	76.2	
20	159	468	152	149	146	410	686	914	442	600	69.9	337	76.2	
24	181	551	152	176	173	476	813	914	523	711	69.9	337	76.2	
	Inches													
8	2.88	7.69	3.5	2.0	2.44	6.81	12.0	26.75	7.31	11.0	1.25	9.25	1.81	- - -
10	3.36	9.69	3.5	2.94	2.94	10.44	15.25	28.5	9.06	13.75	1.5	9.25	1.81	1-8
12	3.70	11.5	3.5	3.88	3.88	11.06	17.75	33.5	11.09	15.5	1.75	10.75	2.00	1.125-8
14	4.60	12.64	4	3.93	3.82	12.36	20.25	36	12	17	1.75	10.75	2.00	1.125-8
16	5.25	14.45	4	4.60	4.13	13.7	22.50	36	13.75	19.25	1.75	10.75	2.00	1.25-8
18	5.86	16.25	6	5.08	4.92	14.92	24.75	36	15.40	21.5	2.25	13.25	3.00	1.25-8
20	6.25	18.43	6	5.86	5.75	16.14	37	36	17.40	23.62	2.75	13.25	3.00	1.25-8
24	7.13	21.69	6	6.93	16.81	18.75	32	36	20.59	28	2.75	13.25	3.00	1.5-8

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.
3. Shaft diameter at key.

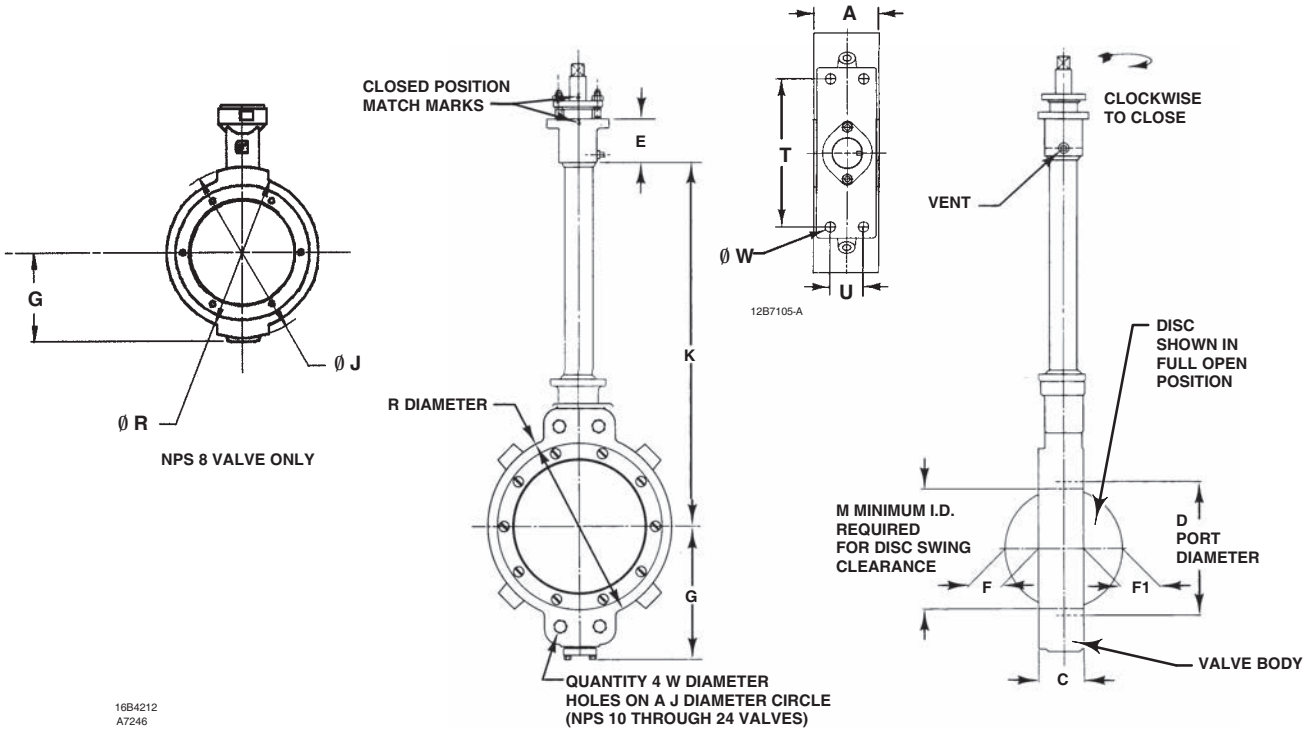

Figure 12. Dimensions, Wafer Style Valve, CL300, NPS 8 through 24 (also see table 9)

Table 10. Dimensions, Single Flange Style Valve, CL300, NPS 8 through 24

VALVE SIZE, NPS	A(1)	D	E	F	F1	G	J	K	M(2)	R	S(3)	T	U	W
	mm													
8	73	195	89	51	62	214	330	679	186	375	32	235	46.0	See thread information below
10	85	246	89	75	75	265	387	724	230	438	38	235	46.0	
12	94	292	89	93	99	281	451	851	282	514	47.6	273	50.8	
14	117	321	102	100	97	314	514	914	305	584	44.5	273	50.8	
16	133	367	102	117	105	348	572	914	349	648	44.5	273	50.8	
18	149	413	152	129	125	379	629	914	391	711	57.2	337	76.2	
20	159	468	152	149	146	410	686	914	442	775	69.9	337	76.2	
24	181	551	152	176	173	476	813	914	523	914	69.9	337	76.2	
	Inches													
8	2.88	7.69	3.5	2.0	2.44	8.44	13.0	26.75	7.32	14.75	1.25	9.25	1.81	0.875-9 12 holes
10	33.6	9.69	3.5	2.94	2.94	10.44	15.25	28.5	9.06	17.25	1.5	9.25	1.81	1-8 16 holes
12	3.70	11.5	3.5	3.69	3.88	11.06	17.75	33.5	11.09	20.25	1.875	10.75	2.00	1.125-8 16 holes
14	4.60	12.63	4	3.94	3.82	12.36	20.25	36	12	23	1.75	10.75	2.00	1.125-8 20 holes
16	5.25	14.45	4	4.60	4.13	13.70	22.50	36	13.75	25.5	1.75	10.75	2.00	1.25-8 20 holes
18	5	16.25	6	5.08	4.92	14.92	24.75	36	15.39	28	2.25	13.25	3.00	1.25-8 24 holes
20	6.25	18.43	6	5.87	5.75	16.14	37	36	17.40	30.5	2.75	13.25	3.00	1.25-8 24 holes
24	7.13	2121.69	6	6.93	6.81	18.75	32	36	20.59	36	2.75	13.25	3.00	1.5-8 24 holes

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disc swing clearance.
3. Shaft diameter at key.

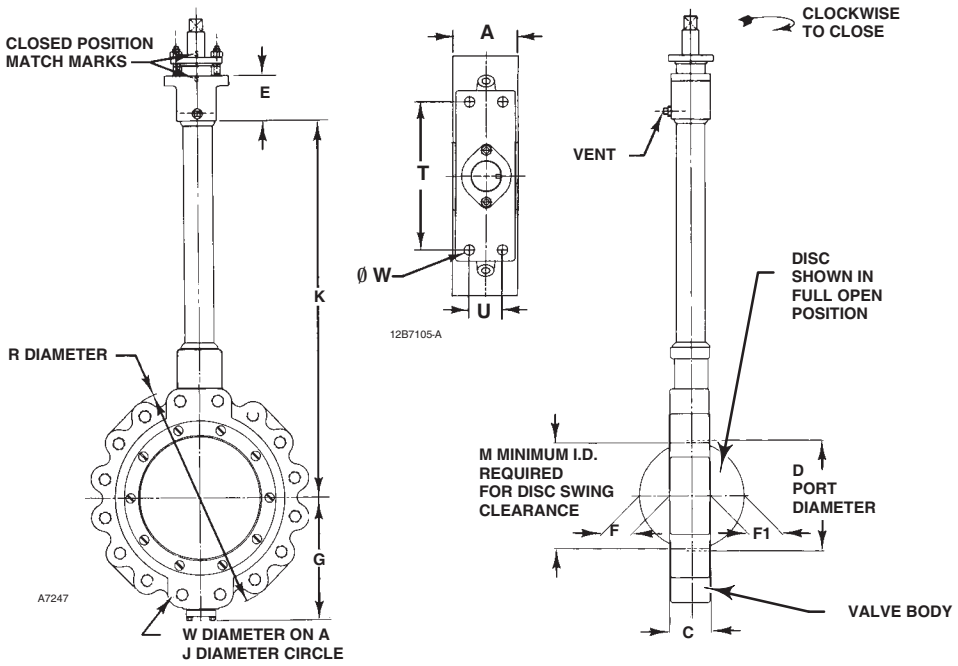

Figure 13. Dimensions, Single Flange Style Valve, CL300, NPS 8 through 24 (also see table 10)

Coefficients

Table 11. Fisher A31A Cryogenic-Valve CL150, Reverse Flow, NPS 3 through 18

Coefficients	Valve Size, NPS	Valve Rotation, Degrees								
		10	20	30	40	50	60	70	80	90
C_v	3	6	14	29	50	77	111	143	167	188
K_v		5.19	12.1	25.1	43.3	66.6	96.0	124	144	163
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
Cv	4	12	30	63	107	165	238	307	359	404
Kv		10.4	26.0	54.5	92.6	143	206	266	311	349
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	6	32	81	167	285	441	635	818	957	1080
K_v		27.7	70.1	144	247	381	549	708	828	934
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
Cv	8	34	113	248	429	677	1020	1420	1830	2260
K_v		29.4	97.7	215	371	586	882	1228	1583	1955
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	10	47	159	349	604	953	1430	2000	2580	3180
K_v		40.7	138	302	522	824	1237	1730	2232	2751
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	12	74	247	543	939	1480	2220	3110	4000	4940
K_v		64.0	214	470	812	1280	1920	2690	3460	4273
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	14	95	316	695	1200	1900	2840	3980	5120	6320
K_v		82.2	273	601	1038	1643	2457	3443	4429	5467
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	16	129	430	946	1640	2580	3870	5420	6970	8600
K_v		112	372	818	1419	2232	3348	4688	6029	7439
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	18	166	553	1220	2100	3320	4970	6960	8950	11,050
K_v		144	478	1055	1817	2872	4299	6020	7742	9558
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23

Table 12. Fisher A31A Cryogenic-Valve CL150, Reverse Flow, NPS 20 and 24

Coefficients	Valve Size, NPS	Valve Rotation, Degrees								
		10	20	30	40	50	60	70	80	90
C_v	20	208	692	1520	2630	4160	6230	8730	11,220	13,850
K_v		180	599	1315	2275	3598	5389	7551	9705	11,980
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23
C_v	24	322	1080	2370	4080	6450	9670	13,540	17,410	21,500
K_v		277	934	2050	3529	5579	8365	11,712	15,060	18,598
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.77	0.79	0.81	0.81	0.78	0.73	0.68	0.60	0.52
X_T		0.50	0.53	0.55	0.55	0.51	0.45	0.39	0.30	0.23

Table 13. Fisher A31A Cryogenic-Valve CL300, Reverse Flow, NPS 3 through 18

Coefficients	Valve Size, NPS	Valve Rotation, Degrees								
		10	20	30	40	50	60	70	80	90
C_v	3	6	14	29	50	77	111	143	167	188
K_v		5.19	12.1	25.1	43.3	66.6	96.0	124	144	163
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	4	12	30	63	107	165	238	307	359	404
K_v		10.4	26.0	54.5	92.6	143	206	266	311	349
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	6	32	81	167	285	441	635	818	957	1080
K_v		27.7	70.1	144	247	381	549	708	828	934
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	8	40	100	206	352	545	784	1010	1180	1330
K_v		34.6	86.5	178	304	471	677	874	1020	1150
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	10	71	178	367	628	971	1400	1800	2110	2370
K_v		61.4	154	317	543	840	1211	1557	1825	2050
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	12	110	276	570	975	1510	2170	2800	3280	3680
K_v		95.2	239	493	843	1306	1877	2422	2837	3183
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	14	136	341	704	1200	1860	2680	3450	4050	4550
K_v		118	295	609	1038	1609	2318	2984	3503	3936
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	16	169	422	873	1490	2310	3320	4280	5010	5630
K_v		146	365	755	1289	1998	2872	3702	4334	4870
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.47	0.40	0.33	0.26	0.26	0.23
C_v	18	247	617	1280	2180	3370	4860	6260	7330	8230
K_v		214	534	1107	1886	2915	4204	5415	6340	7119
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23

Table 14. Fisher A31A Cryogenic-Valve CL300, Reverse Flow, NPS 20 and 24

Coefficients	Valve Size, NPS	Valve Rotation, Degrees								
		10	20	30	40	50	60	70	80	90
C_v	20	286	714	1480	2520	3910	5620	7240	8480	9530
K_v		247	618	1280	2180	3382	4861	6263	7335	8243
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23
C_v	24	375	938	1940	3320	5130	7380	9510	11,140	12,500
K_v		324	811	1678	2872	4437	6384	8226	9636	10,821
F_d		0.090	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.70
F_L		0.78	0.81	0.81	0.79	0.75	0.69	0.62	0.56	0.52
X_T		0.51	0.55	0.55	0.53	0.47	0.40	0.33	0.26	0.23

A31A Cryogenic Valve

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Note

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