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Flowseal

Soft Seat

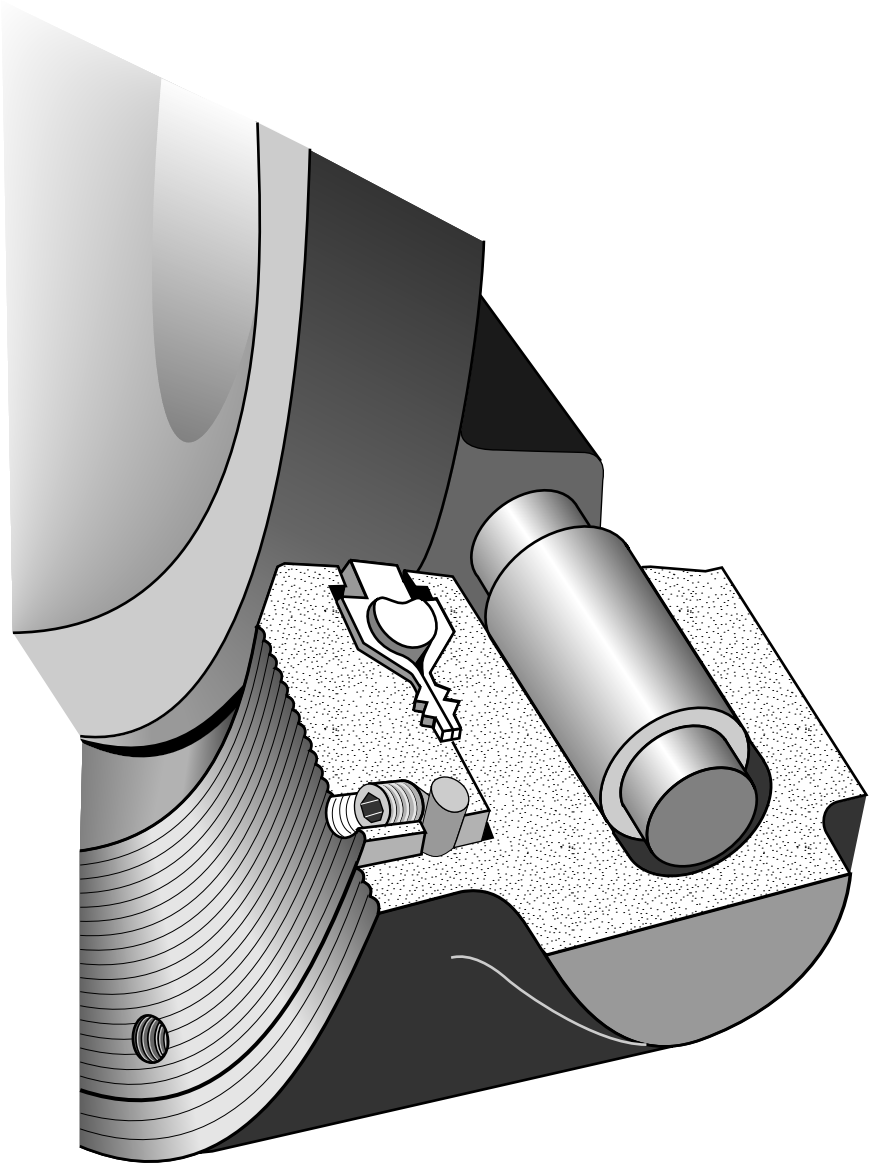
Unique Valve Seat Design

Flowseal is one of the world's leading manufacturers of high performance butterfly vlaves. Based on many years of research, development and field experience, the Flowseal design is superior to and more versatile than the High Performance Butterfly Valve design offered by other manufacturers.

The Flowseal Soft Seat valve prodvides a bi-directional bubble tight shutoff (zero leakage) by the use of a patented seat. This unique seat design creates a self-energized seal in vacuum-to-low pressure applications.

Under higher pressure conditions, the seat is also designed to permit, confine and direct movement of the soft seat against the disc edge, up to the full ANSI Class 150, 300 and 600 Cold Working Pressures.

The Soft Seat is designed for high services with minimal wear and low torque. Seat replacement is a simple operation, requiring no special tools.



Principle of Seat Sealing

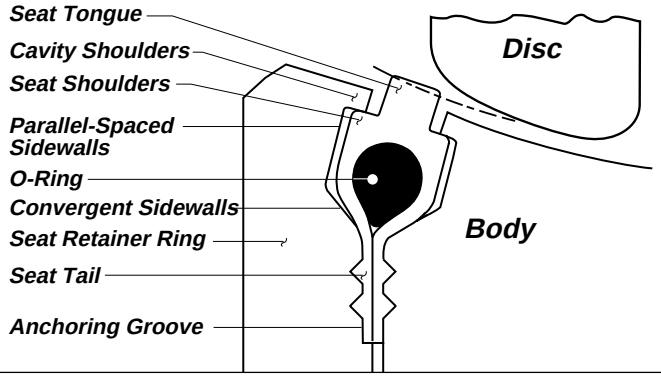
Soft Seat

DISC OPEN

In Figure 1, the disc and seat are not engaged. In this position, the shoulders of the seat are forced against the cavity shoulders by the compression of the o-ring.

The seat is recessed inside the seat cavity and acts as a gasket in the anchoring groove area. The seat cavity is sealed from exposure from the process fluid and protects the seat from abrasion and wear. The o-ring, which is completely encapsulated by the seat, is also isolated from exposure to the process fluid.

Figure 1

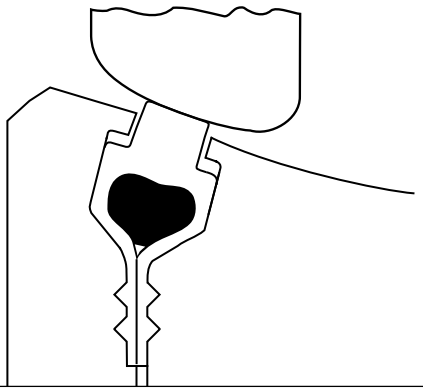


DISC CLOSED, Self-Energized Seal

In Figure 2, the Flowseal disc and seat are engaged, and the process fluid is under low pressure. The edge of the disc, with a larger diameter than the seat tongue, directs movement of the seat radially outward, causing the seat to compress against the convergent sidewalls of the cavity. The elastomeric o-ring imparts a mechanical pre-load between the disc and seat tongue as it is compressed and flattened by the disc; this is the self-energized mode for sealing at vacuum-to-60 psig.

As the seat moves radially outward, the seat shoulders move away from the cavity shoulders and open the cavity to the process media.

Figure 2

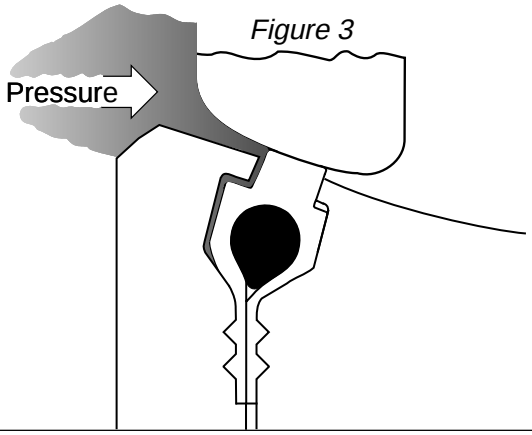


DISC CLOSED, Pressure-Energized Seal (Seat Upstream)

As line pressure increases, the process fluid enters the sidewall area and applies a load against the parallel-spaced sidewall and convergent sidewall of the seat. The seat and cavity design permits the seat to move axially to the downstream sidewall, but confines the movement and directs the movement radially inward towards the disc; the higher the line pressure, the tighter the seal between the disc and seat. Because the o-ring is elastic, it is able to flex and deform under loads and return to original shape after removal of the load; it is the rubber which deforms, not the thermoplastic material.

This dynamic seal, patented by Flowseal, is totally unique among high performance butterfly valves.

Figure 3

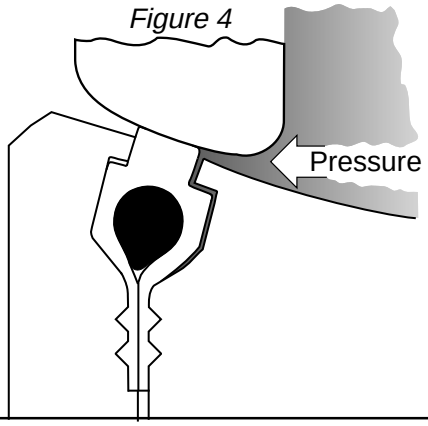


DISC CLOSED, Pressure-Energized Seal (Seat Downstream)

The Flowseal valve is bi-directional (in some instances, modifications may be required to operate this arrangement for dead end service). The cavity and seat sidewalls are symmetrically designed to permit, confine and direct movement of the seat to the disc to dynamically seal with line pressure in the reverse direction. The disc edge is the segment of a sphere, and the seat is angled towards the disc edge to seal with pipeline pressure in either direction.

Recommended installation direction is “SUS” (seat upstream), as in Figure 3.

Figure 4



Soft Seat Valve Components

KEY
Square key valve-to-operator connection provides an externally controlled failure point upon over-torquing.

GLAND FLANGE
Applies load against packing gland to prevent external leakage. Fully adjustable.

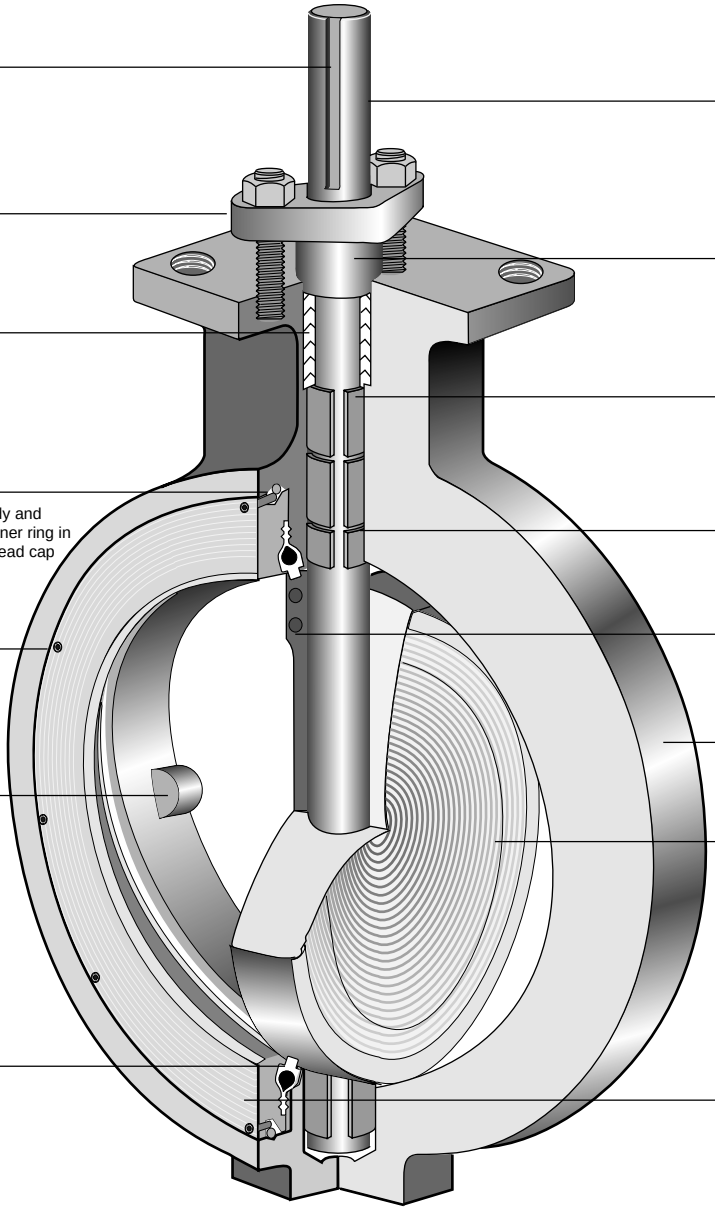
PACKING
Chevron design TFE prevents external leakage out valve neck to full ANSI hydrostatic shell test pressures (150% of C.W.P.).

WEDGE RING
Stainless steel band wedged between valve body and retainer ring by set screws to lock seat and retainer ring in position on valve sizes 2" through 30". Socket head cap screws are used on valve sizes 36" and larger.

SET SCREWS
Cone point screws force wedge ring outward to lock seat retainer in position on valve sizes 2" through 30". Socket head cap screws are used on valve sizes 36" and larger.

OVERTRAVEL STOP
Prevents disc from rotating into wrong quadrant.

SOFT-SEAT
Patented bi-directional seat with encapsulated elastomeric o-ring core for resiliency. Common seat materials include TFE, RTFE and UHMWPE.



SHAFT
Solid shaft provides alignment and rigid support for disc.

PACKING GLAND
Separate part from gland flange, preventing uneven load distribution against packing.

BEARINGS
Both above and below the disc, bearings are of composite design: PTFE bonded to epoxy-glass filament wound ring. Used to align shaft, with high capacity, low wear and low friction coefficient.

DISC SPACERS
Disc is centered by use of thrust spacers around shaft in sizes 2" to 5". Disc position stops or thrust bolt arrangements are used for larger valve sizes.

WEDGE PINS
Provide positive mechanical attachment of disc to shaft.

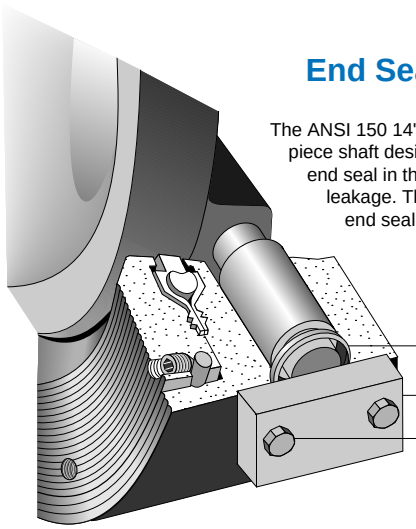
BODY
ANSI B16.34 design in either wafer or lug configuration.

DISC
360° uninterrupted spherical edge for sealing. Profile is designed for maximum flow and equal percentage control.

RETAINER RING
Retains seat in valve. Standard surface finish is 125 to 200 AARH and is compatible with both standard gaskets and spiral wound gasket designs. Outside diameter is recessed within gasket sealing surface to prevent external leakage.

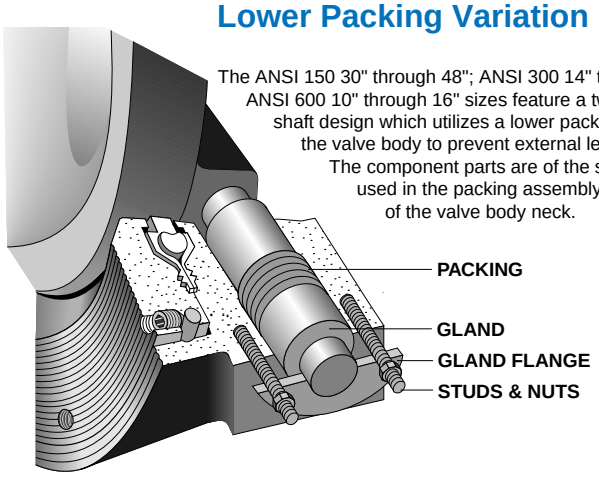
End Seal Variation

The ANSI 150 14" through 24" sizes feature a two-piece shaft design. The lower shaft utilizes an end seal in the body to prevent external leakage. The component parts include an end seal, an end cap and end cap bolts.



Lower Packing Variation

The ANSI 150 30" through 48"; ANSI 300 14" through 30"; ANSI 600 10" through 16" sizes feature a two-piece shaft design which utilizes a lower packing seal in the valve body to prevent external leakage. The component parts are of the same design used in the packing assembly in the top of the valve body neck.



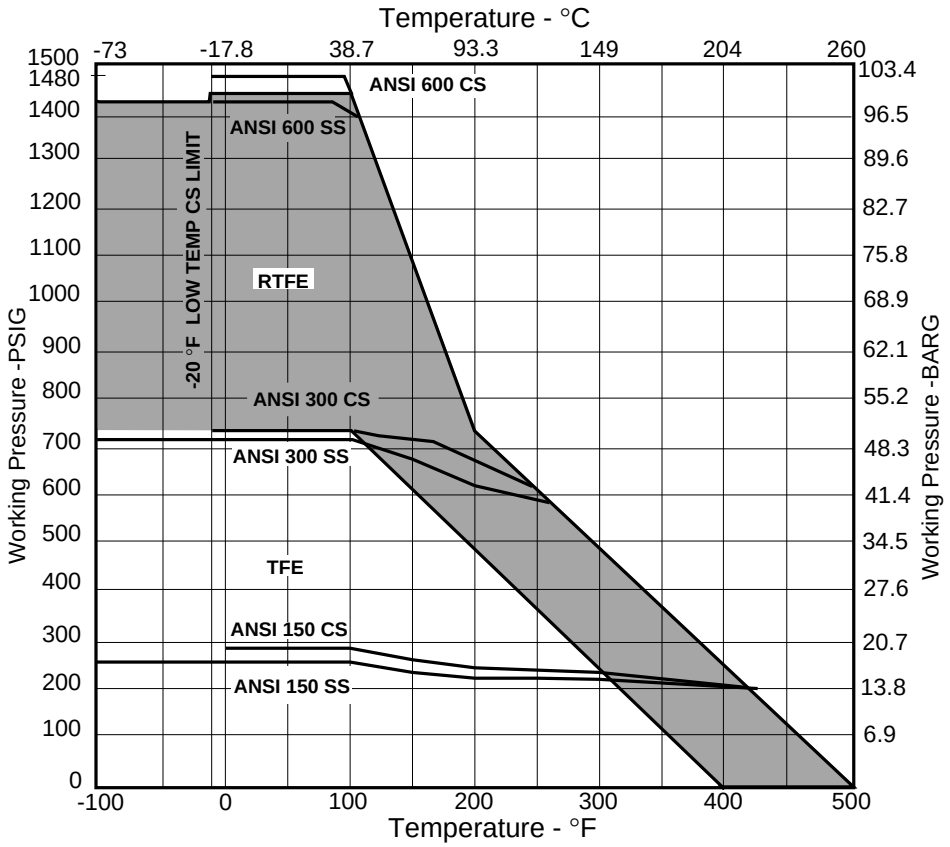
PRESSURE/TEMPERATURE RATINGS

As temperature increases, the pressure retaining capability of materials decreases. The graph below illustrates the pressure/temperature ratings of the Flowseal ANSI Class 150, Class 300 and Class 600.

The heavy lines define the ratings of the carbon steel and stainless steel valve body (or “shell”) in conformance to ANSI B16.34. The shaded areas define the ratings of the TFE and RTFE Seat materials.

Seat ratings are based on differential pressure with the disc in the fully closed position.

ANSI B16.34 Body and Flowseal Soft Seat Pressure - Temperature Ratings



C_V FACTORS

C_V (Coefficient of Volume) is the number of U.S. gallons per minute of water required to pass through a valve with a pressure drop of 1 psi.

The chart below records this C_V factor for the Flowseal valve classes and sizes at ten degree increments between open and closed. The values shown are for the valve installed in the seat upstream ("SUS") position.

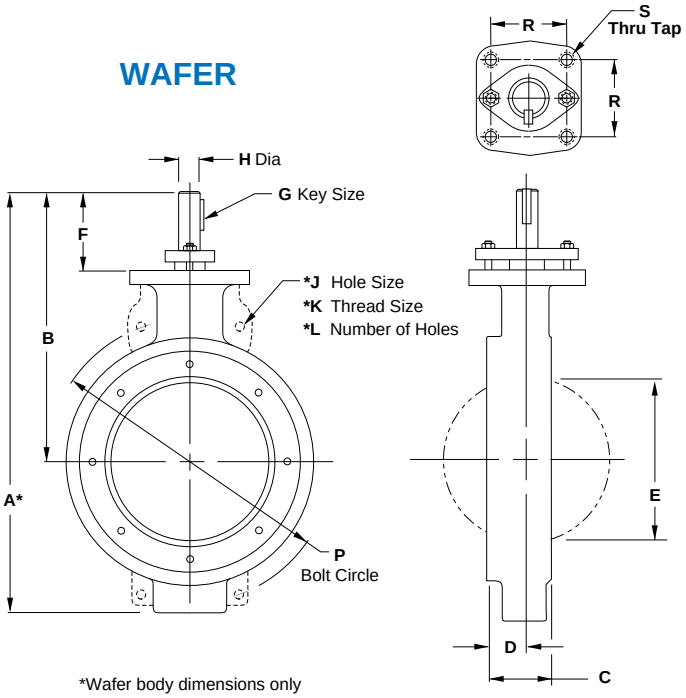
Degree Open % Full C_V		10° 1.5%	20° 6%	30° 14%	40° 25.2%	50° 38%	60° 55%	70° 75%	80° 97%	90° 100%
2"	150	1.5	6	14	25	39	56	76	99	102
	300	1.4	6	13	24	36	52	71	95	100
	600	1.4	5	13	23	35	51	70	90	93
2-1/2"	150	2.2	9	21	37	56	80	110	142	146
	300	2.1	8	19	34	52	75	102	136	143
	600	2.0	8	19	33	51	73	100	130	133
3"	150	3.4	14	32	57	87	125	171	221	228
	300	3.2	13	30	53	81	117	159	212	223
	600	3.1	12	29	52	79	114	156	202	208
3-1/2"	150	5.3	21	49	88	132	192	261	338	349
	300	4.8	19	45	80	121	176	240	320	336
4"	150	6.8	27	63	114	171	248	338	437	451
	300	6.2	25	58	104	157	228	310	414	435
	600	5.8	23	54	98	147	213	290	375	387
5"	150	10.8	43	100	180	271	392	535	692	714
	300	9.8	40	92	165	248	361	491	655	688
6"	150	16.5	66	154	278	419	607	827	1070	1103
	300	14.9	60	139	250	377	546	744	992	1041
	600	14.7	59	137	247	372	538	734	950	979
8"	150	30.9	124	289	520	784	1135	1584	2002	2064
	300	27.3	109	255	459	692	1001	1365	1820	1911
	600	26.8	107	250	451	679	983	1341	1734	1788
10"	150	52.8	211	492	886	1336	1934	2638	3411	3517
	300	45.6	183	426	767	1156	1673	2282	3042	3194
	600	41.2	165	384	692	1044	1511	2060	2665	2747
12"	150	72.6	290	677	1219	1838	2660	3628	4690	4837
	300	63.3	253	590	1063	1602	2319	3163	4217	4428
	600	58.4	233	545	981	1479	2140	2918	3774	3891
14"	150	90	392	914	1646	2481	3592	4898	6530	6857
	300	81	326	760	1368	2063	2986	4072	5430	5702
	600	73	292	682	1228	1838	2680	3655	4727	4873
16"	150	132	531	1230	2229	3361	4865	6634	8845	9287
	300	109	435	1015	1827	2755	3988	5438	7850	8243
	600	96	385	899	1619	2423	3533	4818	6231	6424
18"	150	171	684	1596	3873	4332	6270	8550	11270	11400
	300	139	555	1295	2331	3515	5088	6938	9250	9712
20"	150	207	828	1932	3478	5244	7590	10350	13800	14420
	300	158	630	1470	2646	3990	5775	7875	10150	10658
24"	150	315	1260	2940	5292	7890	11550	15750	21000	22050
	300	242	966	2254	4057	6118	8855	12075	16100	16205
30"	150	491	1965	4585	8253	12445	18012	24563	32750	34388
	300	404	1614	3766	6779	10222	14795	20175	26900	28245
36"	150	707	2830	6602	11884	17920	25938	35370	45745	47160
42"	150	963	3851	8987	16176	24392	35304	48143	62264	64190
48"	150	1258	5030	11738	21128	31859	46111	62881	81324	83840

C_f FACTORS

The critical flow factor, C_f, expresses the valve pressure recovery ratio. It is equivalent to F_L in ISA nomenclature.

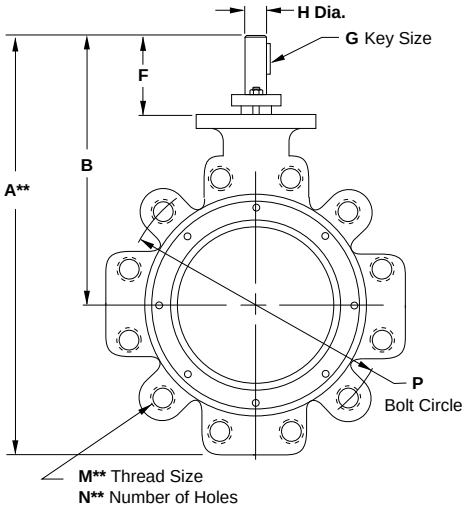
DISC DEGREE OPENING	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
SEAT UPSTREAM	.95	.91	.84	.81	.78	.80	.77	.74	.74	.73	.70	.66	.63	.60	.57	.53
SEAT DOWNSTREAM	.94	.89	.84	.82	.80	.77	.75	.72	.69	.66	.63	.60	.58	.55	.54	.53

WAFER



*Wafer body dimensions only

LUG



**Lug body dimensions only

ANSI Class 150

VALVE SIZE	WAFER A*	LUG A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WEIGHT (LBS.) WAFER	WEIGHT (LBS.) LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	4	4.750	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	5/8-11	4	5.500	2.25	3/8–16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3/16	.625	–	–	–	5/8–11	4	6.000	2.25	3/8–16	11	13
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	5/8–11	8	7.000	2.25	3/8–16	14	17
4"	12.92	13.55	9.42	2.13	1.26	3.62	3.67	3/16	.625	–	–	–	5/8–11	8	7.500	2.25	3/8–16	17	25
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4–10	8	8.500	2.25	3/8–16	20	30
6"	15.69	15.93	10.81	2.31	1.38	5.55	3.81	1/4	.750	–	–	–	3/4–10	8	9.500	2.25	3/8–16	30	35
8"	17.81	17.94	11.93	2.50	1.49	7.28	3.80	3/8	1.000	–	–	–	3/4–10	8	11.750	2.25	3/8–16	44	48
10"	19.85	20.85	12.97	2.81	1.70	9.20	4.09	3/8	1.250	oval	–	2	7/8–9	12	14.250	3.25	3/8–16	71	91
12"	24.96	24.96	15.46	3.23	2.36	11.15	4.83	3/8	1.500	oval	–	2	7/8–9	12	17.000	3.25	3/8–16	110	127
14"	27.14	27.14	16.07	3.62	2.19	12.76	4.82	3/8	1.500	oval	–	4	1–8	12	18.750	3.25	3/8–16	135	183
16"	31.66	31.66	19.61	4.00	2.31	14.58	6.92	1/2	1.750	oval	–	4	1–8	16	21.250	4.25	1/2–13	182	250
18"	34.53	34.53	21.35	4.50	2.45	16.38	7.35	1/2	2.000	thru	–	4	1 1/8–8	16	22.750	4.25	1/2–13	234	305
20"	36.70	36.70	22.76	5.00	2.94	18.38	7.63	3/4	2.250	–	1 1/8–8	4	1 1/8–8	20	25.000	5.00	3/4–10	320	414
24"	41.57	41.57	25.13	6.06	3.12	21.88	7.88	3/4	2.500	–	1 1/4–8	4	1 1/4–8	20	29.500	5.00	3/4–10	505	702
30"	52.08	52.08	29.35	6.75	3.53	28.00	8.73	3/4	3.000	–	1 1/4–8	4	1 1/4–8	28	36.000	5.00	3/4–10	925	1130
36"	64.75	64.75	32.64	8.38	4.34	33.66	8.14	1	3.750	–	1 1/2–8	4	1 1/2–8	32	42.750	7.00	1–8	1630	1890
42"	73.24	73.24	37.62	9.25	5.03	40.31	9.62	1	4.500	–	1 1/2–8	4	1 1/2–8	36	49.500	7.00	1–8	2475	2700
48"	80.13	80.13	41.88	10.62	5.62	45.25	10.63	1 1/4	5.000	–	1 1/2–8	4	1 1/2–8	44	56.000	9.00	1–8	2815	3085

ANSI Class 300

VALVE SIZE	WAFER A*	LUG A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WEIGHT (LBS.) WAFER	WEIGHT (LBS.) LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	12	17
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	3/4-10	8	7.250	2.25	3/8-16	14	19
4"	12.92	13.54	9.42	2.13	1.25	3.62	3.67	3⁄16	.625	–	–	–	3⁄4–10	8	7.875	2.25	3⁄8–16	17	24
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4-10	8	9.250	2.25	3/8-16	20	30
6"	15.93	16.31	10.81	2.29	1.38	5.55	3.81	3⁄8	1.000	–	–	–	3⁄4–10	12	10.625	2.25	3⁄8–16	30	49
8"	18.10	19.50	12.22	2.88	1.54	7.06	4.08	3⁄8	1.250	–	–	–	7⁄8–9	12	13.000	3.25	3⁄8–16	52	80
10"	21.60	22.10	14.22	3.25	1.70	9.00	4.84	3⁄8	1.500	–	1–8	2	1–8	16	15.250	3.25	3⁄8–16	88	115
12"	28.40	28.40	17.90	3.62	1.86	10.72	6.90	1⁄2	1.750	–	11⁄8–8	4	11⁄8–8	16	17.750	4.25	1⁄2–13	153	199
14"	34.31	34.31	19.74	4.62	2.48	12.08	7.36	1⁄2	2.000	–	11⁄8–8	4	11⁄8–8	20	20.250	4.25	1⁄2–13	285	324
16"	38.14	38.14	21.82	5.25	2.59	13.72	7.82	3⁄4	2.250	–	11⁄4–8	4	11⁄4–8	20	22.500	5.00	3⁄4–10	336	401
18"	40.26	40.26	23.00	5.88	3.03	15.56	7.87	3⁄4	2.500	–	11⁄4–8	4	11⁄4–8	24	24.750	5.00	3⁄4–10	393	517
20"	43.62	43.62	25.13	6.31	3.24	17.22	8.74	3⁄4	3.000	–	11⁄4–8	4	11⁄4–8	24	27.000	5.00	3⁄4–10	510	735
24"	49.94	49.94	28.27	7.19	3.62	20.61	8.89	1	3.500	–	11⁄2–8	4	11⁄2–8	24	32.000	7.00	1–8	733	1020
30"	62.40	62.40	31.90	8.88	4.39	27.25	9.02	–	4.500	–	13⁄4–8	4	13⁄4–8	28	39.250	7.00	1–8	1745	2145

ANSI Class 600

VALVE SIZE	WAFER A*	LUG A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WEIGHT (LBS.) WAFER	WEIGHT (LBS.) LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	11	13
2.5"	10.30	10.30	7.59	1.88	1.09	2.14	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	11	13
3"	11.60	12.10	8.60	2.12	1.20	2.50	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	13	18
4"	14.43	14.93	9.81	2.50	1.40	3.43	3.81	1⁄4	.750	–	–	–	7⁄8–9	8	8.500	2.25	3⁄8–16	30	52
6"	17.27	18.46	11.71	3.06	1.68	5.18	4.09	3⁄8	1.250	11⁄8	1-8	2	1–8	12	11.500	3.25	3⁄8–16	42	85
8"	21.35	22.00	13.97	4.00	1.85	6.28	4.84	3⁄8	1.500	–	–	–	11⁄8–8	12	13.750	3.25	3⁄8–16	72	127
10"	31.15	31.15	17.90	4.62	2.00	7.95	6.90	1⁄2	1.750	–	11⁄4–8	4	11⁄4–8	16	17.000	4.25	1⁄2–13	170	233
12"	34.80	34.80	20.13	5.50	2.53	9.68	7.50	3⁄4	2.250	–	11⁄4–8	4	11⁄4–8	20	19.250	5.00	3⁄4–10	245	379
16"	–	44.25	25.38	7.00	3.50	12.60	9.38	3/4	3.000	–	–	–	11/2-8	20	23.750	5.00	3/4-10	–	1170

NOTES:

1. General

a. Standard valves tested to MSS-SP-61. API-598 testing available on request.
b. Valves for installation between DIN and JIS flanges available on application.
c. Dimensions shown are for reference only. Certified drawings available on application.

2. For 2" through 24" sizes:

a. Face-to-face dimensions (C) meet, within specified tolerance, MSS-SP-68 and API-609 requirements.
b. Valves are designed for installation between ANSI B16.5 flanges.

3. For 30" through 48" sizes:

a. Valves are designed for installation between MSS-SP-44 flanges.

4. For MIL SPEC valves, see Flowseal Marine Product Brochure.

5. For ISO valves, see Flowseal ISO Product Brochure.

Unique Valve Seat Design

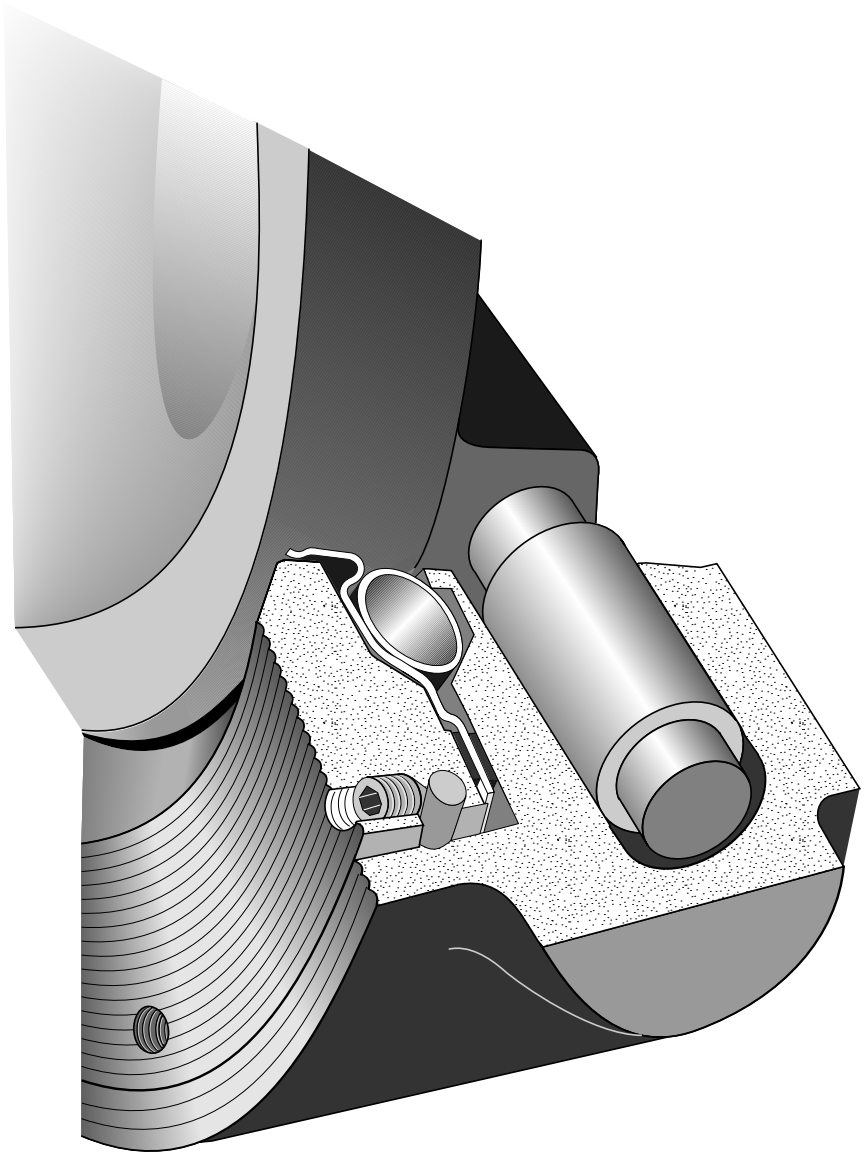
Metal Seat

The Flowseal metal-to-metal seat high performance butterfly valve (HPBFV) incorporates an Inconel seat for higher tensile strength, a 300 series stainless steel back-up ring in the seat cavity for axial seat support, and a disc that is case hardened by nitriding.

The Inconel seat, by its dynamic and flexible design, applies enough force per linear inch against the disc edge (Rockwell Hardness of C66 to C70) to obtain an optimum sealing characteristic while controlling the loads between the metal surfaces.

The Flowseal metal-to-metal seat valve is utilized for temperatures up to 900°F, in compliance with ANSI B16.34 pressure/temperature specifications.

Leakage is rated at Class IV per ANSI FCI 70-2.

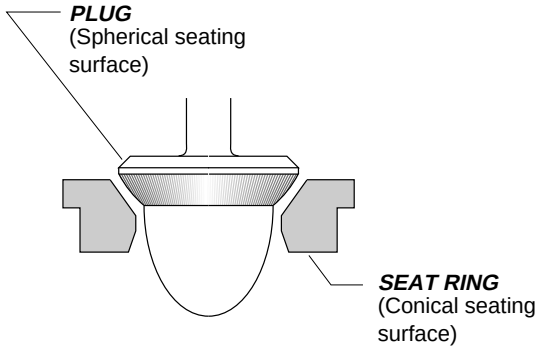


PRINCIPLE OF METAL SEATING

Metal-to-metal sealing is accomplished by the "line contact" between a spherical surface and conical surface. Figure 1 illustrates a typical globe control valve seat and plug. The plug seating surface is the segment of a sphere; when engaged against the seat ring, a line contact seal is achieved.

In a metal seat design, it is necessary to apply enough force per linear inch to maintain a tight metal-to-metal contact between the sealing members; however, high linear thrust can cause a collapse of the seating members ("bearing failure").

Figure 1

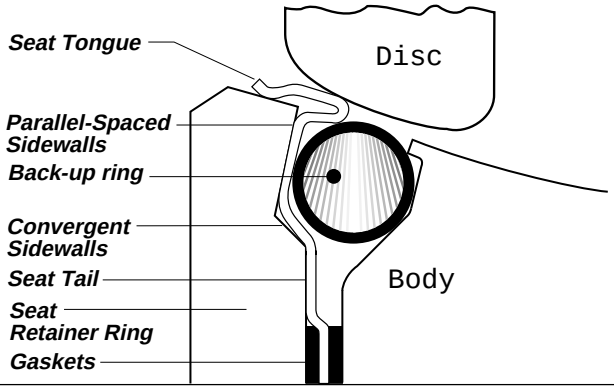


DISC CLOSED, Self-Energized Seal

In Figure 2, the Flowseal disc and seat are engaged, and the process fluid is under low pressure. The spherical edge of the disc, with a larger diameter than the conical seat tongue, imparts a thrust of approximately 600 pounds per linear inch against the seat. The mechanical properties and shape of the Inconel seat allow it to both flex and maintain a constant thrust against the disc.

This controlled loading prevents the occurence of bearing failure and reduces the leakage and wear between the components.

Figure 2

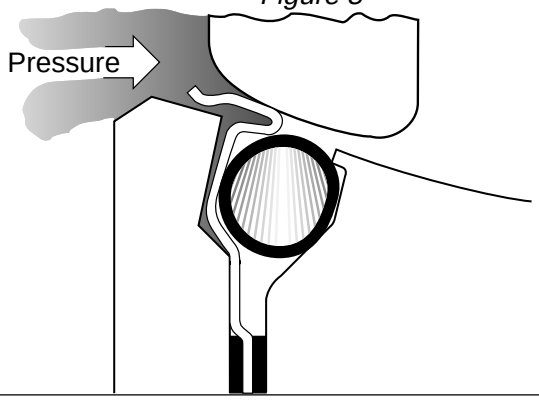


DISC CLOSED, Pressure-Energized Seal (Seat Upstream)

As line pressure increases, the process fluid enters the sidewall area and applies a load against the parallel-spaced sidewall and convergent sidewall of the metal seat. The seat moves towards the downstream sidewall while being supported axially by the support ring, as shown in Figure 3. The cavity shape confines the seat movement and directs the movement radially inward towards the disc; the higher the line pressure, the tighter the line contact between the disc and seat. The Inconel seat, shaped by a special hydroforming process, is able to flex under these loads and return to its original shape after removal of the loads.

This dynamic seal, patented by Flowseal, is totally unique among high performance butterfly valves.

Figure 3

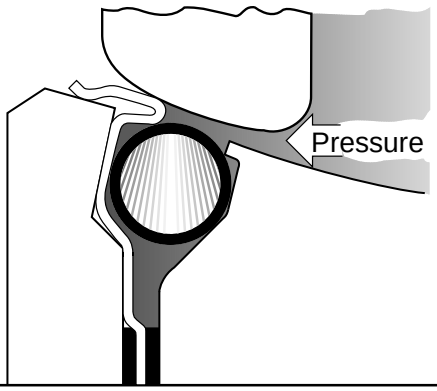


DISC CLOSED, Pressure-Energized Seal (Seat Downstream)

The Flowseal valve is bi-directional (in some instances, modifications may be required to operate this arrangement for dead end service). The cavity and seat sidewalls are symmetrically designed to permit, confine and direct movement of the seat to the disc to dynamically seal with line pressure in the seat downstream direction, as in Figure 4. Recommended installation direction is "SUS" (seat upstream), as in Figure 3.

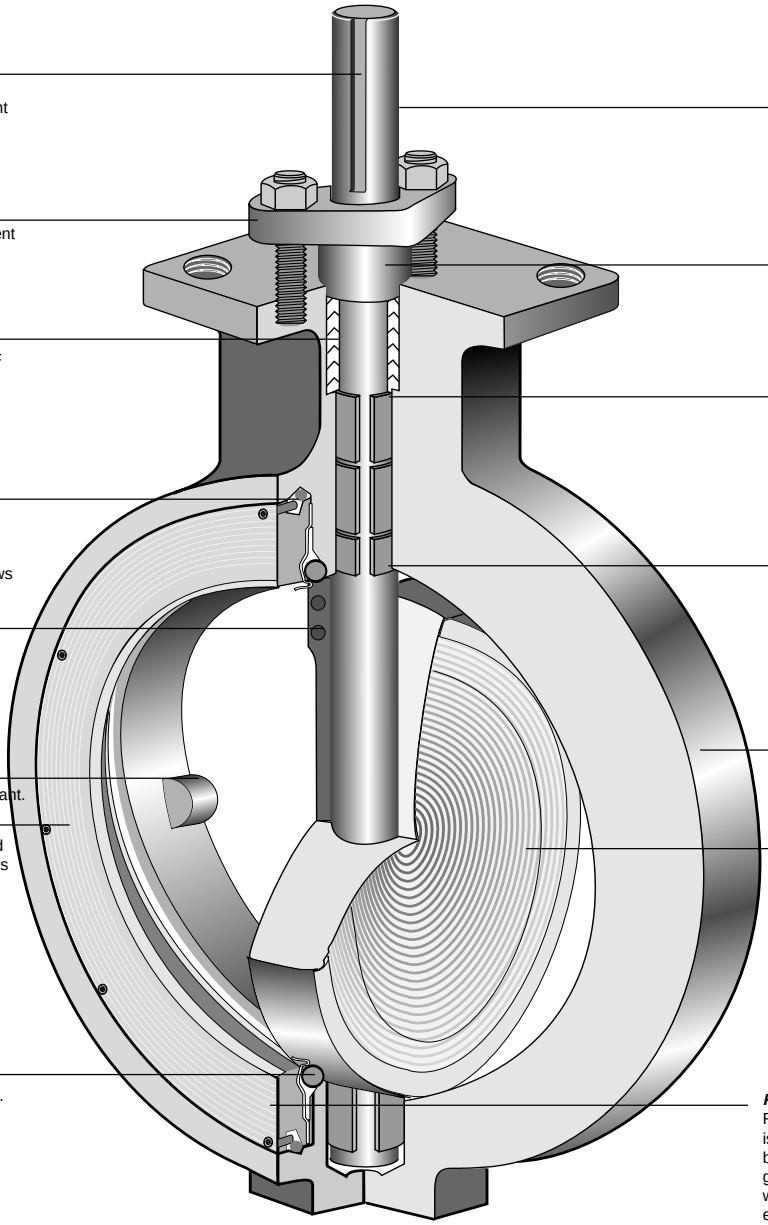
The stainless steel back-up ring interacts dynamically with the metal seat for axial support in seat sealing. Additionally, this ring effectively restricts corrosion and particulate build-up in the cavity.

Figure 4



Valve Components

Metal Seat



KEY
Square key valve-to-operator connection provides an externally controlled failure point upon over-torquing.

GLAND FLANGE
Applies load against packing gland to prevent external leakage. Fully adjustable.

PACKING
Common materials are TFE for up to 500 °F and Graphite for up to 900 °F.

WEDGE RING
Stainless steel band wedged between valve body and retainer ring by set screws to lock seat and retainer ring in position on valve sizes 2" through 30". Socket head cap screws are used on valve sizes 36" and larger.

WEDGE PINS
Provide positive mechanical attachment of disc to shaft.

OVERTRAVEL STOP
Prevents disc from rotating into wrong quadrant.

SET SCREWS
Cone point screws force wedge ring outward to lock seat retainer in position on valve sizes 2" through 30" Socket head cap screws are used on valve sizes 36" and larger.

METAL SEAT
Patented metal seat with metal back-up ring.

SHAFT
Solid shaft provides alignment and rigid support for disc.

PACKING GLAND
Separate part from gland flange, preventing uneven load distribution against packing.

BEARINGS
Both above and below the disc, bearings maintain shaft alignment.
Common materials include:
Glass-backed TFE for up to 500 °F. (Not for steam service.)
Luberized Bronze for up to 750 °F.
300 Series Stainless Steel Nitrided for up to 900 °F.

DISC SPACERS
Disc is centered by use of thrust spacers around shaft in sizes 2" to 5". Disc position stops or thrust bolt arrangements are used for larger sizes.

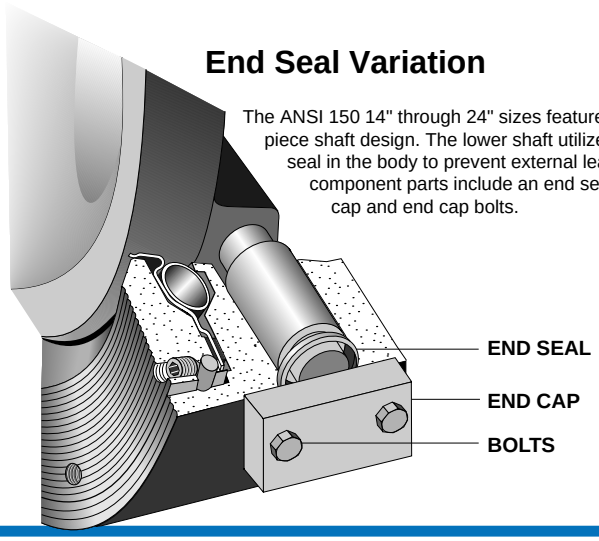
BODY
ANSI B16.34 design in either wafer or lug configuration.

DISC
360° uninterrupted spherical edge for sealing. Profile is designed for maximum flow and equal percentage control. Disc seating surface is Nitrited for enhanced temperature and abrasion resistance

RETAINER RING
Retains seat in valve. Standard surface finish is 125 to 200 AARH and is compatible with both standard gaskets and spiral wound gasket designs. Outside diameter is recessed within gasket sealing surface to prevent external leakage.

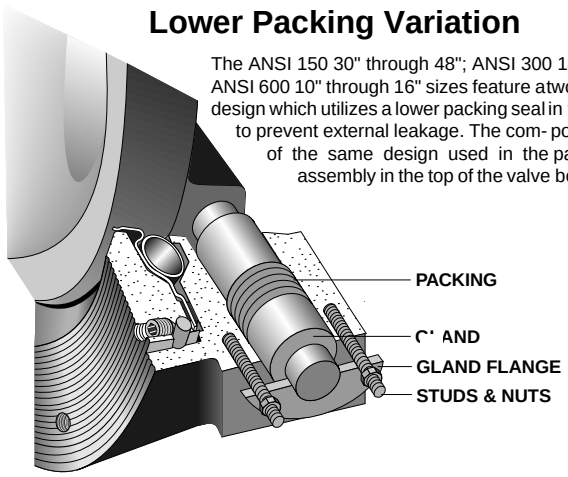
End Seal Variation

The ANSI 150 14" through 24" sizes feature a two-piece shaft design. The lower shaft utilizes an end seal in the body to prevent external leakage. The component parts include an end seal, an end cap and end cap bolts.



Lower Packing Variation

The ANSI 150 30" through 48"; ANSI 300 14" through 30"; ANSI 600 10" through 16" sizes feature atwo-piece shaft design which utilizes a lower packing seal in the valve body to prevent external leakage. The com- ponent parts are of the same design used in the packing assembly in the top of the valve body neck.



Pressure/Temperature Ratings

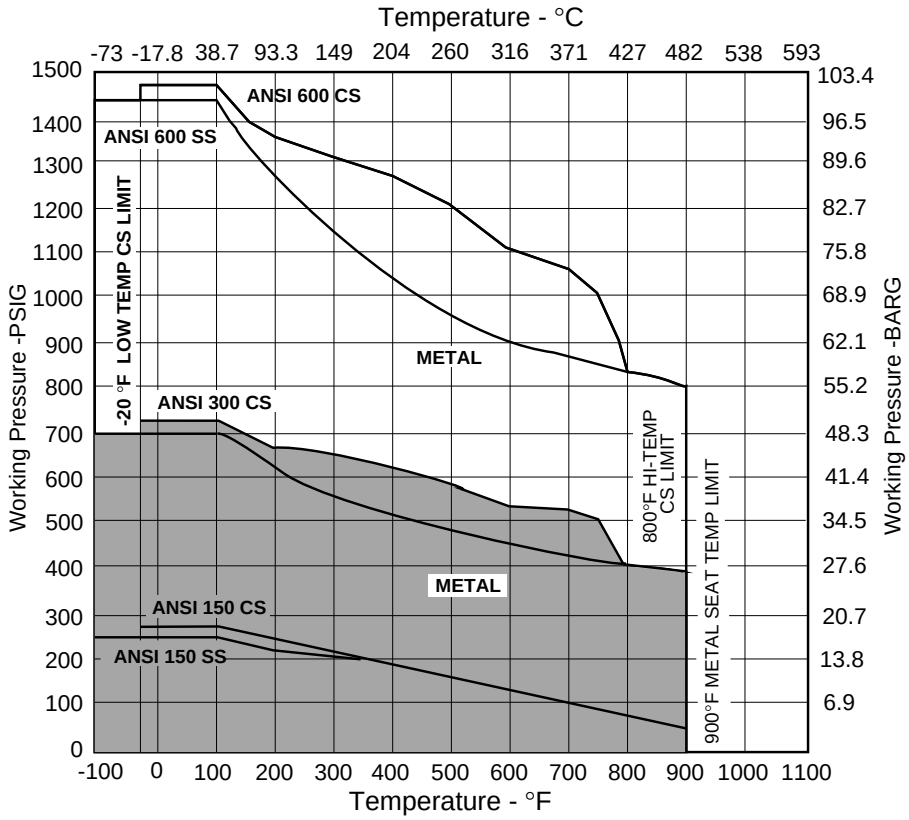
PRESSURE/TEMPERATURE RATINGS

As temperature increases, the pressure retaining capability of materials decreases. The graph below illustrates the pressure/temperature ratings of the Flowseal ANSI Class 150, Class 300 and Class 600.

The heavy lines define the ratings of the carbon steel and stainless steel valve body (or “shell”) in conformance to ANSI B16.34. The shaded areas define the ratings of the metal seat.

Seat ratings are based on differential pressure with the disc in the fully closed position.

ANSI B16.34 Body and Flowseal Metal Seat Pressure - Temperature Ratings



Flow Coefficients — Metal Seat

C_V FACTORS

C_V (Coefficient of Volume) is the number of U.S. gallons per minute of water required to pass through a valve with a pressure drop of 1 psi.

The chart at right records this C_V factor for the Flowseal valve classes and sizes at ten degree increments between open and closed. The values shown are for valves installed in the seat upstream ("SUS") position.

DEGREE OPENING % Full C_V		10° 1.5%	20° 6%	30° 14%	40° 25.2%	50° 38%	60° 55%	70° 75%	80° 97%	90° 100%
2"	150	1.5	6	14	25	39	56	76	99	102
	300	1.4	6	13	24	36	52	71	95	100
	600	1.4	5	13	23	35	51	70	90	93
2 ½"	150	2.2	9	21	37	56	80	110	142	146
	300	2.1	8	19	34	52	75	102	136	143
	600	2.0	8	19	33	51	73	100	130	133
3"	150	3.4	14	32	57	87	125	171	221	228
	300	3.2	13	30	53	81	117	159	212	223
	600	3.1	12	29	52	79	114	156	202	208
3½ "	150	5.3	21	49	88	132	192	261	338	349
	300	4.8	19	45	80	121	176	240	320	336
4"	150	6.8	27	63	114	171	248	338	437	451
	300	6.2	25	58	104	157	228	310	414	435
	600	5.8	23	54	98	147	213	290	375	387
5"	150	10.8	43	100	180	271	392	535	692	714
	300	9.8	40	92	165	248	361	491	655	688
6"	150	16.5	66	154	278	419	607	827	1070	1103
	300	14.9	60	139	250	377	546	744	992	1041
	600	14.7	59	137	247	372	538	734	950	979
8"	150	30.9	124	289	520	784	1135	1584	2002	2064
	300	27.3	109	255	459	692	1001	1365	1820	1911
	600	26.8	107	250	451	679	983	1341	1734	1788
10"	150	52.8	211	492	886	1336	1934	2638	3411	3517
	300	45.6	183	426	767	1156	1673	2282	3042	3194
	600	41.2	165	384	692	1044	1511	2060	2665	2747
12"	150	72.6	290	677	1219	1838	2660	3628	4690	4837
	300	63.3	253	590	1063	1602	2319	3163	4217	4428
	600	58.4	233	545	981	1479	2140	2918	3774	3891
14"	150	90	392	914	1646	2481	3592	4898	6530	6857
	300	81	326	760	1368	2063	2986	4072	5430	5702
	600	Consult Factory								
16"	150	132	531	1230	2229	3361	4865	6634	8845	9287
	300	109	435	1015	1827	2755	3988	5438	7850	8243
	600	Consult Factory								
18"	150	171	684	1596	3873	4332	6270	8550	11270	11400
	300	139	555	1295	2331	3515	5088	6938	9250	9712
20"	150	207	828	1932	3478	5244	7590	10350	13800	14420
	300	158	630	1470	2646	3990	5775	7875	10150	10658
24"	150	315	1260	2940	5292	7890	11550	15750	21000	22050
	300	242	966	2254	4057	6118	8855	12075	16100	16205
30"	150	491	1965	4585	8253	12445	18012	24563	32750	34388
	300	404	1614	3766	6779	10222	14795	20175	26900	28245
36"	150	707	2830	6602	11884	17920	25938	35370	45745	47160
42"	150	963	3851	8987	16176	24392	35304	48143	62264	64190
48"	150	Consult Factory								

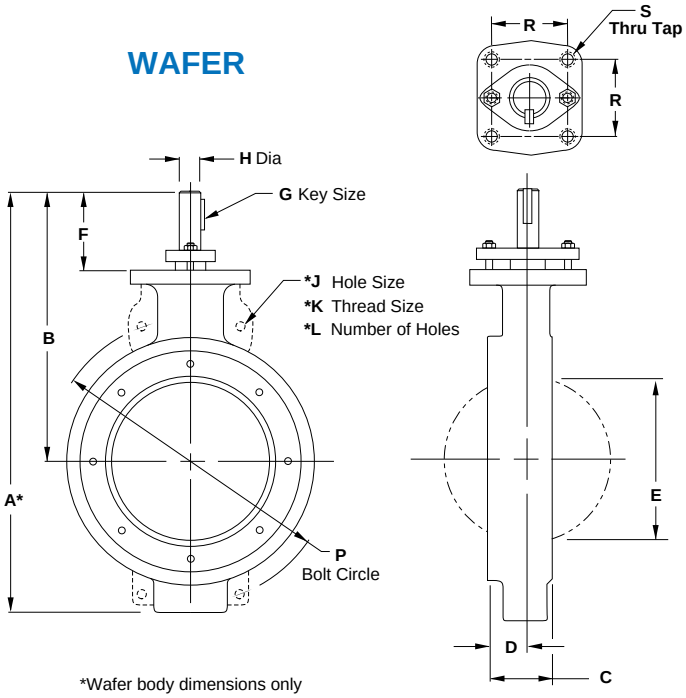
C_f FACTORS

The critical flow factor, C_f, expresses the valve pressure recovery ratio. It is equivalent to F_L in ISA nomenclature.

DISC DEGREE OPENING	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
SEAT UPSTREAM	.95	.91	.84	.81	.78	.80	.77	.74	.74	.73	.70	.66	.63	.60	.57	.53
SEAT DOWNSTREAM	.94	.89	.84	.82	.80	.77	.75	.72	.69	.66	.63	.60	.58	.55	.54	.53

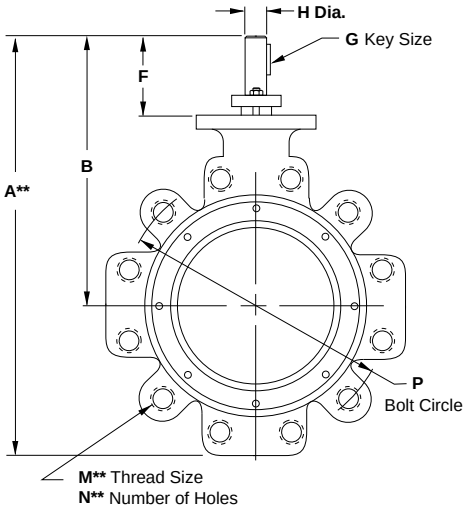
Metal Seat Dimensions

WAFER



*Wafer body dimensions only

LUG



**Lug body dimensions only

ANSI Class 150

VALVE SIZE	WAFER A*	LUG A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WEIGHT (LBS.) WAFER	WEIGHT (LBS.) LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	4	4.750	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	5/8-11	4	5.500	2.25	3/8–16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3/16	.625	–	–	–	5/8–11	4	6.000	2.25	3/8–16	11	13
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	5/8–11	8	7.000	2.25	3/8–16	14	17
4"	12.92	13.55	9.42	2.13	1.26	3.62	3.67	3/16	.625	–	–	–	5/8–11	8	7.500	2.25	3/8–16	17	25
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4–10	8	8.500	2.25	3/8–16	20	30
6"	15.69	15.93	10.81	2.31	1.38	5.55	3.81	1/4	.750	–	–	–	3/4–10	8	9.500	2.25	3/8–16	30	35
8"	17.81	17.94	11.93	2.50	1.49	7.28	3.80	3/8	1.000	–	–	–	3/4–10	8	11.750	2.25	3/8–16	44	48
10"	19.85	20.85	12.97	2.81	1.70	9.20	4.09	3/8	1.250	oval	–	2	7/8–9	12	14.250	3.25	3/8–16	71	91
12"	24.96	24.96	15.46	3.23	2.36	11.15	4.83	3/8	1.500	oval	–	2	7/8–9	12	17.000	3.25	3/8–16	110	127
14"	27.14	27.14	16.07	3.62	2.19	12.76	4.82	3/8	1.500	oval	–	4	1–8	12	18.750	3.25	3/8–16	135	183
16"	31.66	31.66	19.61	4.00	2.31	14.58	6.92	1/2	1.750	oval	–	4	1–8	16	21.250	4.25	1/2–13	182	250
18"	34.53	34.53	21.35	4.50	2.45	16.38	7.35	1/2	2.000	thru	–	4	1 1/8–8	16	22.750	4.25	1/2–13	234	305
20"	36.70	36.70	22.76	5.00	2.94	18.38	7.63	3/4	2.250	–	1 1/8–8	4	1 1/8–8	20	25.000	5.00	3/4–10	320	414
24"	41.57	41.57	25.13	6.06	3.12	21.88	7.88	3/4	2.500	–	1 1/4–8	4	1 1/4–8	20	29.500	5.00	3/4–10	505	702
30"	52.08	52.08	29.35	6.75	3.53	28.00	8.73	3/4	3.000	–	1 1/4–8	4	1 1/4–8	28	36.000	5.00	3/4–10	925	1130
36"	64.75	64.75	32.64	8.38	4.34	33.66	8.14	1	3.750	–	1 1/2–8	4	1 1/2–8	32	42.750	7.00	1–8	1630	1890
42"	73.24	73.24	37.62	9.25	5.03	40.31	9.62	1	4.500	–	1 1/2–8	4	1 1/2–8	36	49.500	7.00	1–8	2475	2700
48"	80.13	80.13	41.88	10.62	5.62	45.25	10.63	1 1/4	5.000	–	1 1/2–8	4	1 1/2–8	44	56.000	9.00	1–8	2815	3085

ANSI Class 300

	WAFER	LUG																WEIGHT (LBS.)	
	A*	A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WAFER	LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	12	17
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	3/4-10	8	7.250	2.25	3/8-16	14	19
4"	12.92	13.54	9.42	2.13	1.25	3.62	3.67	3⁄16	.625	–	–	–	3⁄4–10	8	7.875	2.25	3⁄8–16	17	24
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4-10	8	9.250	2.25	3/8-16	20	30
6"	15.93	16.31	10.81	2.29	1.38	5.55	3.81	3⁄8	1.000	–	–	–	3⁄4–10	12	10.625	2.25	3⁄8–16	30	49
8"	18.10	19.50	12.22	2.88	1.54	7.06	4.08	3⁄8	1.250	–	–	–	7⁄8–9	12	13.000	3.25	3⁄8–16	52	80
10"	21.60	22.10	14.22	3.25	1.70	9.00	4.84	3⁄8	1.500	–	1–8	2	1–8	16	15.250	3.25	3⁄8–16	88	115
12"	28.40	28.40	17.90	3.62	1.86	10.72	6.90	1⁄2	1.750	–	1⅛–8	4	1⅛–8	16	17.750	4.25	1⁄2–13	153	199
14"	34.31	34.31	19.74	4.62	2.48	12.08	7.36	1⁄2	2.000	–	1⅛–8	4	1⅛–8	20	20.250	4.25	1⁄2–13	285	324
16"	38.14	38.14	21.82	5.25	2.59	13.72	7.82	3⁄4	2.250	–	1¼–8	4	1¼–8	20	22.500	5.00	3⁄4–10	336	401
18"	40.26	40.26	23.00	5.88	3.03	15.56	7.87	3⁄4	2.500	–	1¼–8	4	1¼–8	24	24.750	5.00	3⁄4–10	393	517
20"	43.62	43.62	25.13	6.31	3.24	17.22	8.74	3⁄4	3.000	–	1¼–8	4	1¼–8	24	27.000	5.00	3⁄4–10	510	735
24"	49.94	49.94	28.27	7.19	3.62	20.61	8.89	1	3.500	–	1½–8	4	1½–8	24	32.000	7.00	1–8	733	1020
30"	62.40	62.40	31.90	8.88	4.39	27.25	9.02	–	4.500	–	1¾–8	4	1¾–8	28	39.250	7.00	1–8	1745	2145

ANSI Class 600

	WAFER	LUG																	
	A*	A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WAFER	LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	11	13
2.5"	10.30	10.30	7.59	1.88	1.09	2.14	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	11	13
3"	11.60	12.10	8.60	2.12	1.20	2.50	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	13	18
4"	14.43	14.93	9.81	2.50	1.40	3.43	3.81	1⁄4	.750	–	–	–	7⁄8–9	8	8.500	2.25	3⁄8–16	30	52
6"	17.27	18.46	11.71	3.06	1.68	5.18	4.09	3⁄8	1.250	1⅛	1-8	2	1–8	12	11.500	3.25	3⁄8–16	42	85
8"	21.35	22.00	13.97	4.00	1.85	6.28	4.84	3⁄8	1.500	–	–	–	1⅛–8	12	13.750	3.25	3⁄8–16	72	127
10"	31.15	31.15	17.90	4.62	2.00	7.95	6.90	1⁄2	1.750	–	1¼–8	4	1¼–8	16	17.000	4.25	1⁄2–13	170	233
12"	34.80	34.80	20.13	5.50	2.53	9.68	7.50	3⁄4	2.250	–	1¼–8	4	1¼–8	20	19.250	5.00	3⁄4–10	245	379
16"	–	44.25	25.38	7.00	3.50	12.60	9.38	3/4	3.000	–	–	–	11/2-8	20	23.750	5.00	3/4-10	–	1170

NOTES:

1. General

a. Standard valves tested to MSS-SP-61 and ANSI/FCI 70-2, Class IV. API-598 testing available on request.
b. Valves for installation between DIN and JIS flanges available on application.
c. Dimensions shown are for reference only. Certified drawings available on application.

2. For 2" through 24" sizes:

a. Face-to-face dimensions (C) meet, within specified tolerance, MSS-SP-68 and API-609 requirements.
b. Valves are designed for installation between ANSI B16.5 flanges.

3. For 30" through 48" sizes:

a. Valves are designed for installation between MSS-SP-44 flanges.

4. For MIL SPEC valves, see Flowseal Marine Product Brochure.

5. For ISO valves see, Flowseal ISO Product Brochure.

Metal Seat Materials & Specifications

STANDARD MATERIALS OF CONSTRUCTION

Carbon Steel Constructions

COMPONENTS	–20 °F to 500 °F *171MTG CONSTRUCTION*	501 °F to 750 °F *171MGB CONSTRUCTION*	751 °F to 800 °F *172MGS CONSTRUCTION*
BODY	Carbon Steel A216 Gr WCB, or A105	Carbon Steel A216 Gr WCB, or A105	Carbon Steel A216 Gr WCB, or A105
DISC	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided
SHAFT & PINS	17-4 PH Stainless Steel A564 Gr 630	17-4 PH Stainless Steel A564 Gr 630	316 Stainless Steel* A479 Gr 316
SEAT	Inconel	Inconel	Inconel
PACKING	PTFE	Graphite	Graphite
BEARINGS	Glass-Backed PTFE	Bronze	316 Stainless Steel Nitrided

Stainless Steel Constructions

COMPONENTS	–100 °F to 500 °F *271MTG CONSTRUCTION*	501 °F to 750 °F *271MGB CONSTRUCTION*	751 °F to 900 °F *272MGS CONSTRUCTION*
BODY	316 Stainless Steel A351 CF8M, or A182 F316	316 Stainless Steel A351 CF8M, or A182 F316	316 Stainless Steel A351 CF8M, or A182 F316
DISC	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided	316 Stainless Steel A351 CF8M, or A182 F316 Nitrided
SHAFT & PINS	17-4 PH Stainless Steel A564 Gr 630	17-4 PH Stainless Steel A564 Gr 630	316 Stainless Steel* A479 Gr 316
SEAT	Inconel	Inconel	Inconel
PACKING	PTFE	Graphite	Graphite
BEARINGS	Glass-Backed PTFE	Bronze	316 Stainless Steel Nitrided

*** Metal Seat Valves with 316 SS Shafts are rated for maximum pressure differentials of 150 psi for Class 150, 300 psi for Class 300 and 600 psi for Class 600. Monel, Nitronic 50 and Inconel 718 or X750 shafts may be substituted for higher pressure differentials at elevated temperatures. Consult factory for additional information.**

TYPICAL SPECIFICATION

1.0 Scope

This specification covers the design and testing of high pressure offset seat butterfly valves.

2.0 Applicable Standards

The following standards shall apply

ANSI B16.5:	Pipe Flanges and Flanged Fittings (24" size and smaller).
ANSI B16.34:	Valves–Flanged and Buttwelding End.
MSS SP-25:	Standard Marking System for Valves, Fittings, Flanges and Unions.
ANSI/FCI 70-2:	Control Valve Seat Leakage
MSS SP-68:	High Pressure–Offset Seat Butterfly Valves
API 609:	Butterfly Valves, Lug-Type and Wafer-Type.

3.0 Design Requirement

3.1 Valves shall be High Performance Butterfly with offset seat and eccentric shaft. They shall be capable of Class IV sealing in either flow direction.
3.2 Valve seat shall be both self and pressure energized.
3.3 Valves shall have retained top and bottom bearings.
3.4 Shaft design shall be single or dual piece.
3.5 Retainer rings must be recessed in the body so that the line gasket prevents any potential external leakage.
3.6 Valves shall have internal stop to prevent disc over-travel.
3.7 Valves shall be Flowseal or approved equal.

4.0 Materials

4.1 Valves shall be constructed of new material.
4.2 Carbon steel valves shall be constructed from materials below:
4.2.1 Body–ASTM A105 or A216 Gr. WCB.
4.2.2 Disc–ASTM A182 F316 or A351 Gr. CF8M.
4.3 Stainless steel valves shall be constructed from materials below:
4.3.1 Body–ASTM A182 Gr. F316 or A351 Gr. CF8M.
4.3.2 Disc–ASTM A182 Gr. F316 or A351 Gr. CF8M.
4.4 Shafts shall be ASTM A564 type 630 H 1150, or 316 SS.

5.0 Inspection and Test

5.1 Valves shall be hydrostatically shell tested per ANSI B16.34 and MSS SP-61.
5.2 Valves shall be seat tested per ANSI/FCI 70–2, Class IV.

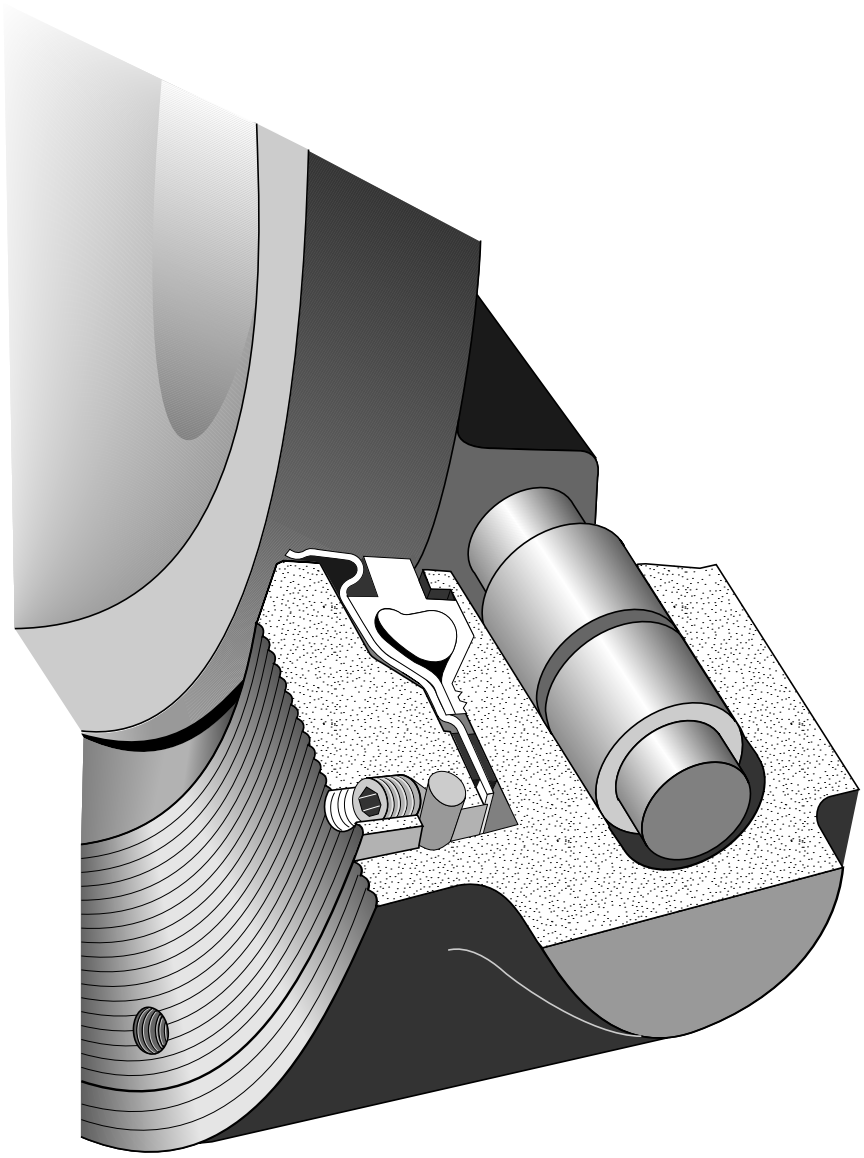
Unique Valve Seat Design

Fire-Flow

The FLowseal Fire-Flow™ high performance butterfly valve(HPBFV) is a fire-safe, soft seat quarter-turn valve. The Fire-Flow™ design incorporates two patented seats which function together to seal off pipeline flow. In normal operation, the soft seat provides a bi-directional “bubble tight” shutoff (zero leakage); the metal seat provides bi-directional shutoff in the event of a fire, in conformance to industry fire-safe requirements.

With little or no pressure, the Fire-Flow seat creates a self-energized seal against the disc. Higher line pressures act on the geometry of both seats to dynamically load them against the disc, creating higher sealing forces in either direction.

The Fire-Flow™ metal seat is made of either Inconel (annealed) plate or 300 series stainless steel plate which is shaped by a proprietary hydroforming process into its unique, patented design. Stainless steel outer bearings are included for post-fire disc and shaft alignment and fireproof packing is used to prevent external shaft leakage.



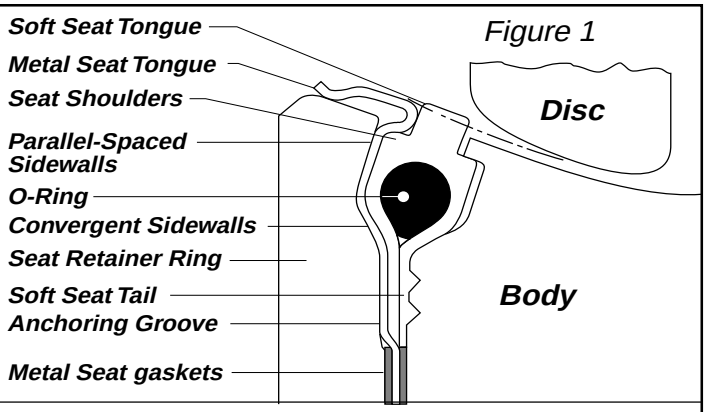
Principle of Seat Sealing

DISC OPEN, Normal Operation

In Figure 1, the disc and seat assembly are not engaged. In this position, the metal seat acts to keep the soft seat inside the seat cavity while the soft seat shoulders seal the cavity from exposure to the process fluid. (The o-ring is under tension and imparts a load against the Soft Seat.)

The soft seat is protected from abrasion and wear because it is recessed inside the seat cavity area. The o-ring is isolated from exposure to the fluid because it is completely encapsulated by the seat tails act as a (soft) gasket in the anchoring groove area.

Figure 1

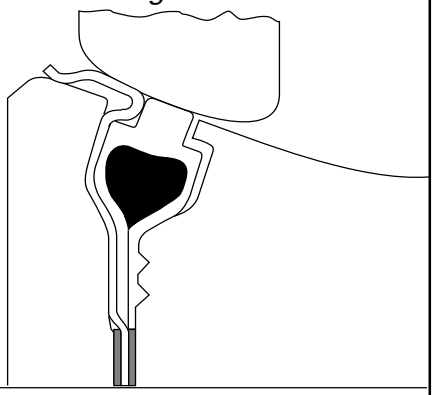


DISC CLOSED, Normal Operation

In Figure 2, the disc and seat assembly are engaged; both the metal seat and the Ssoft seat are in contact with the disc. Under little to no pressure conditions, the metal and soft seats are self-energized. The disc edge, with a larger diameter than the seat tongues, moves the seats radially outward; the metal seat shape, with a mechanical and dynamic flexibility, is designed to be hoop-loaded and impart a spring force against the disc, while the soft seat o-ring is stretched and flattened (without deformation of the thermoplastic material) and imparts a mechanical pre-load against the disc.

With increased line pressure, the process fluid enters the cavity sidewall area and applies loads against the seat sidewalls. The cavity design permits the seats to move toward the downstream sidewalls, but confines and directs the movement radially inward towards the disc; the higher the pressure the tighter the seal between the disc and seats. The symmetrical shape and angle of the cavity permit the seal to be bi-directional.

Figure 2



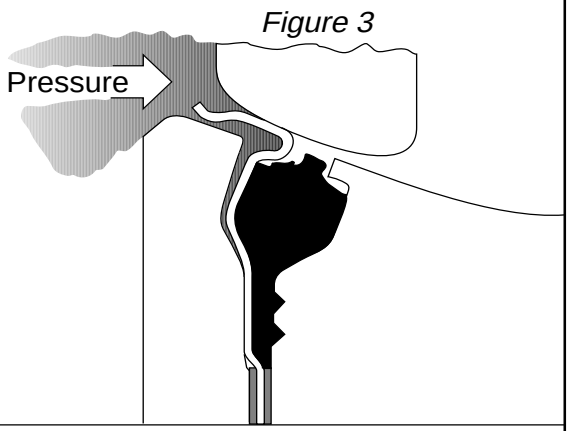
DISC CLOSED, After Fire (Seat Upstream)

After a fire, with partial or complete destruction of the soft seat, the metal seat maintains metal-to-metal contact with the disc and restricts leakage of the process fluid in conformance to industry fire-safe requirements.

With little or no line pressure, the spring force and hoop load of the metal seat maintain a “line contact” seal against the disc edge. Under higher pressures, the process fluid enters the cavity sidewall areas and applies loads against the seat sidewalls (Figure 3). The geometry of the metal seat permits the seat to move axially, but directs the movement radially inward toward the disc; The higher the pressure, the tighter the line contact seal.

Graphite gaskets, on both sides of the metal seat tail, seal the anchoring groove and prevent leakage of the process fluid.

Figure 3

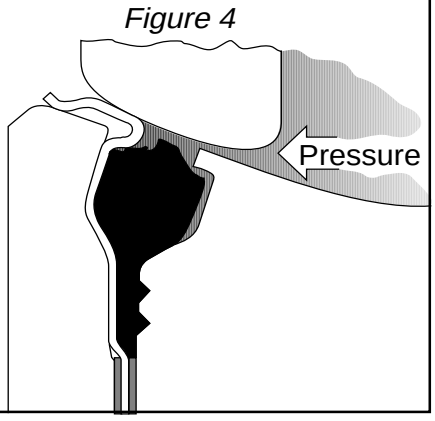


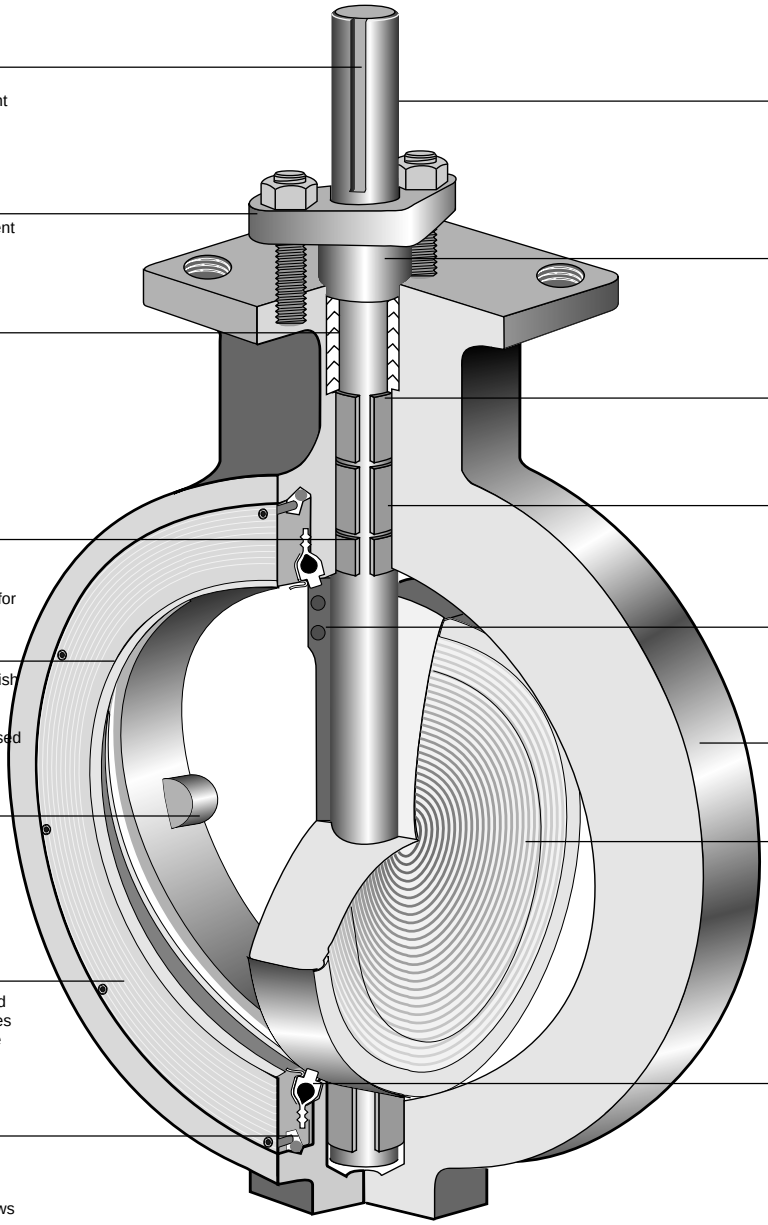
DISC CLOSED, After Fire (Seat Downstream)

The Flowseal Fire-Flow™ valve is bi-directional (in some instances, modifications may be required to operate this arrangement for dead end service). The angle and shape of the cavity and metal seat maintains metal-to-metal contact in the event of partial or complete soft seat destruction with line pressure in the reverse direction (Figure 4).

While the preferred flow direction is “seat upstream” (SUS), the bi-directional seat design is both self-energized and pressure-energized if the flow direction is “seat downstream” (SDS).

Figure 4





KEY
Square key valve-to-operator connection provides an externally controlled failure point upon over-torquing.

GLAND FLANGE
Applies load against packing gland to prevent external leakage. Fully adjustable.

PACKING
Common material is graphite

DISC SPACERS
Disc is centered by use of thrust spacers around shaft in sizes 2" to 5". Disc position stops or thrust bolt arrangements are used for larger valve sizes.

RETAINER RING
Retains seat in valve. Standard surface finish is 125 to 200 AARH and is compatible with both standard gaskets and spiral wound gasket designs. Outside diameter is recessed within gasket sealing surface to prevent external leakage.

OVERTRAVEL STOP
Prevents disc from rotating into wrong quadrant.

SET SCREWS
Cone point screws force wedge ring outward to lock seat retainer in position on valve sizes 2" through 30". Socket head cap screws are used on valve sizes 36" and larger.

WEDGE RING
Stainless steel band wedged between valve body and retainer ring by set screws to lock seat and retainer ring in position on valve sizes 2" through 30". Socket head cap screws are used on valve sizes 36" and larger.

SHAFT
Solid shaft provides alignment and rigid support for disc.

PACKING GLAND
Separate part from gland flange, preventing uneven load distribution against packing.

OUTER BEARINGS
Stainless steel back-up bearings maintain shaft alignment after a fire. (Both above and below disc.)

INNER BEARINGS
Both above and below the disc, bearings are of composite design: TFE bonded to epoxy-glass filament wound ring. Used to align shaft, with high load capacity, low wear and low friction coefficient.

WEDGE PINS
Provide positive mechanical attachment of disc to shaft.

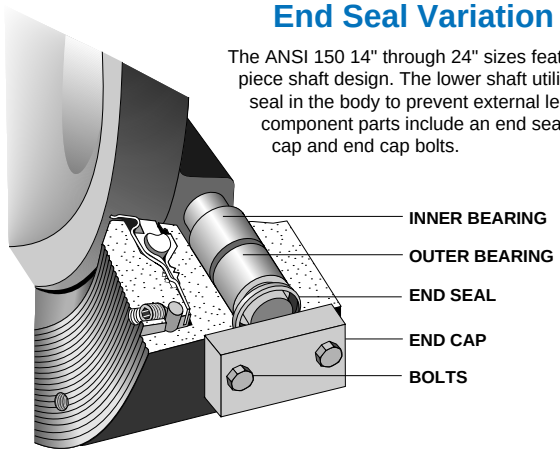
BODY
ANSI B16.34 design in either wafer or lug configuration.

DISC
Fire-Flow disc is electroless nickel plated for enhanced temperature and abrasion resistance.

FIRE–FLOW SEAT
Patented bi-directional soft seat design for zero-leakage in normal operation and a metal-to-metal seal after fire, meeting or exceeding industry “fire-safe” specifications.

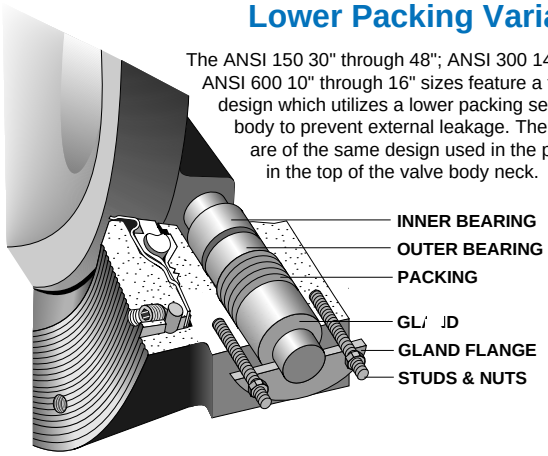
End Seal Variation

The ANSI 150 14" through 24" sizes feature a two-piece shaft design. The lower shaft utilizes an end seal in the body to prevent external leakage. The component parts include an end seal, an end cap and end cap bolts.



Lower Packing Variation

The ANSI 150 30" through 48"; ANSI 300 14" through 30"; ANSI 600 10" through 16" sizes feature a two-piece shaft design which utilizes a lower packing seal in the valve body to prevent external leakage. The component parts are of the same design used in the packing assembly in the top of the valve body neck.



Pressure/Temperature Ratings

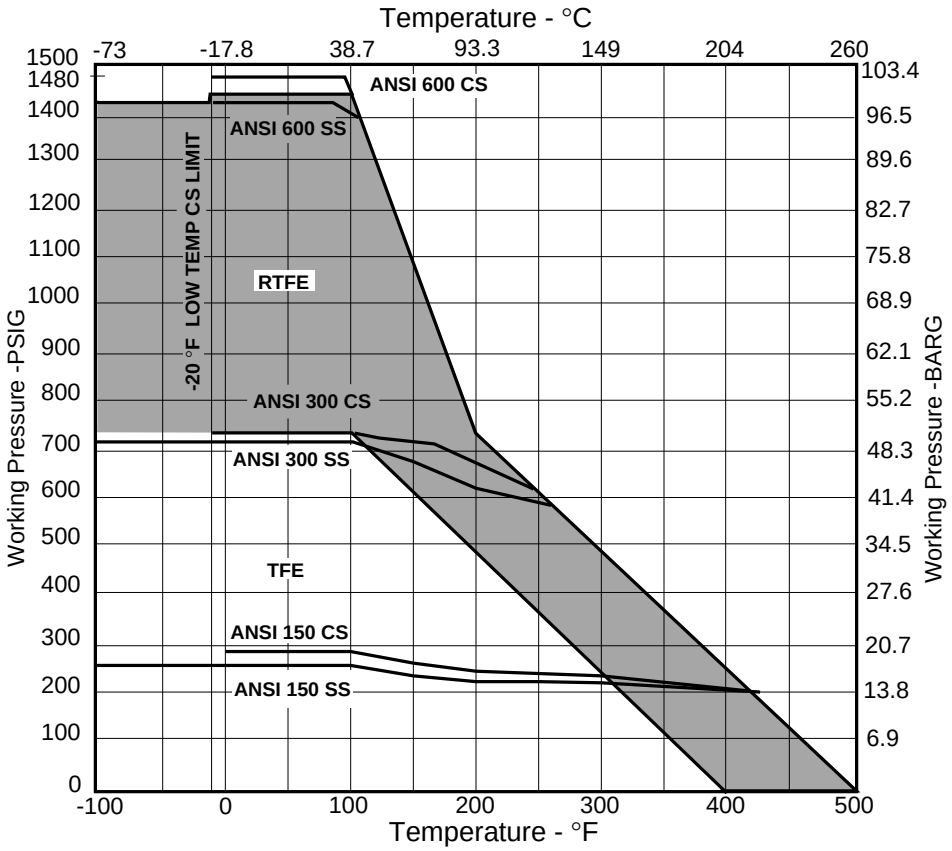
PRESSURE/TEMPERATURE RATINGS

As temperature increases, the pressure retaining capability of materials decreases. The graph below illustrates the pressure/temperature ratings of the Flowseal ANSI Class 150, Class 300 and Class 600.

The heavy lines define the ratings of the carbon steel and stainless steel valve body (or “shell”) in conformance to ANSI B16.34. The shaded areas define the ratings of the soft seat.

Seat ratings are based on differential pressure with the disc in the fully closed position.

ANSI B16.34 Body and Flowseal Soft Seat Pressure - Temperature Ratings



C_V FACTORS

C_V (Coefficient of Volume) is the number of U.S. gallons per minute of water required to pass through a valve with a pressure drop of 1 psi.

The chart at right records this C_V factor for the Flowseal Valve Classes and Sizes at ten degree increments between open and closed. The values shown are for the valve installed in the Seat Upstream ("SUS") position.

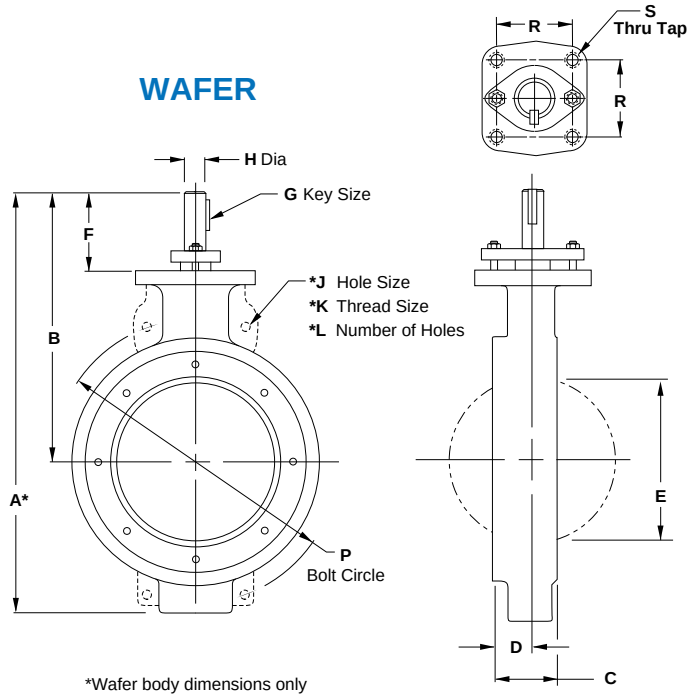
DEGREE OPENING % Full C v		10° 1.5%	20° 6%	30° 14%	40° 25.2%	50° 38%	60° 55%	70° 75%	80° 97%	90° 100%
2"	150	1.5	6	14	25	39	56	76	99	102
	300	1.4	6	13	24	36	52	71	95	100
	600	1.4	5	13	23	35	51	70	90	93
2½"	150	2.2	9	21	37	56	80	110	142	146
	300	2.1	8	19	34	52	75	102	136	143
	600	2.0	8	19	33	51	73	100	130	133
3"	150	3.4	14	32	57	87	125	171	221	228
	300	3.2	13	30	53	81	117	159	212	223
	600	3.1	12	29	52	79	114	156	202	208
3½"	150	5.3	21	49	88	132	192	261	338	349
	300	4.8	19	45	80	121	176	240	320	336
4"	150	6.8	27	63	114	171	248	338	437	451
	300	6.2	25	58	104	157	228	310	414	435
	600	5.8	23	54	98	147	213	290	375	387
5"	150	10.8	43	100	180	271	392	535	692	714
	300	9.8	40	92	165	248	361	491	655	688
6"	150	16.5	66	154	278	419	607	827	1070	1103
	300	14.9	60	139	250	377	546	744	992	1041
	600	14.7	59	137	247	372	538	734	950	979
8"	150	30.9	124	289	520	784	1135	1584	2002	2064
	300	27.3	109	255	459	692	1001	1365	1820	1911
	600	26.8	107	250	451	679	983	1341	1734	1788
10"	150	52.8	211	492	886	1336	1934	2638	3411	3517
	300	45.6	183	426	767	1156	1673	2282	3042	3194
	600	41.2	165	384	692	1044	1511	2060	2665	2747
12"	150	72.6	290	677	1219	1838	2660	3628	4690	4837
	300	63.3	253	590	1063	1602	2319	3163	4217	4428
	600	58.4	233	545	981	1479	2140	2918	3774	3891
14"	150	90	392	914	1646	2481	3592	4898	6530	6857
	300	81	326	760	1368	2063	2986	4072	5430	5702
	600	Consult Factory								
16"	150	132	531	1230	2229	3361	4865	6634	8845	9287
	300	109	435	1015	1827	2755	3988	5438	7850	8243
	600	Consult Factory								
18"	150	171	684	1596	[illegible]	[illegible]332	6270	8550	11270	11400
	300	139	555	1295	2331	3515	5088	6938	9250	9712
20"	150	207	828	1932	3478	5244	7590	10350	13800	14420
	300	158	630	1470	2646	3990	5775	7875	10150	10658
24"	150	315	1260	2940	5292	7890	11550	15750	21000	22050
	300	242	966	2254	4057	6118	8855	12075	16100	16205
30"	150	491	1965	4585	8253	12445	18012	24563	32750	34388
	300	404	1614	3766	6779	10222	14795	20175	26900	28245
36"	150	707	2830	6602	11884	17920	25938	35370	45745	47160
42"	150	963	3851	8987	16176	24392	35304	48143	62264	64190
48"	150	Consult Factory								

C_f FACTORS

The critical flow factor, C_f, expresses the valve pressure recovery ratio. It is equivalent to F_L in ISA nomenclature.

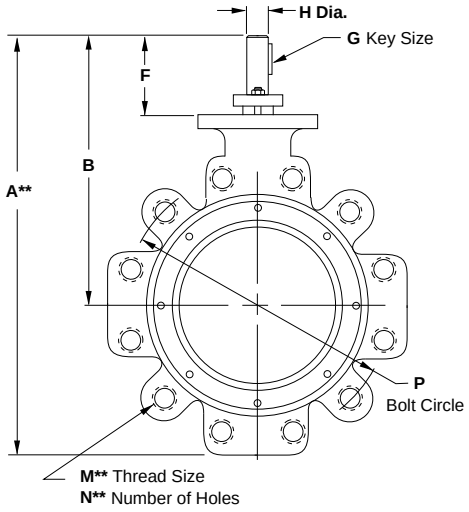
DISC DEGREE OPENING	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
SEAT UPSTREAM	.95	.91	.84	.81	.78	.80	.77	.74	.74	.73	.70	.66	.63	.60	.57	.53
SEAT DOWNSTREAM	.94	.89	.84	.82	.80	.77	.75	.72	.69	.66	.63	.60	.58	.55	.54	.53

WAFER



*Wafer body dimensions only

LUG



**Lug body dimensions only

ANSI Class 150

VALVE SIZE	WAFER A*	LUG A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WEIGHT (LBS.) WAFER	WEIGHT (LBS.) LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	4	4.750	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	5/8-11	4	5.500	2.25	3/8–16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3/16	.625	–	–	–	5/8–11	4	6.000	2.25	3/8–16	11	13
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	5/8–11	8	7.000	2.25	3/8–16	14	17
4"	12.92	13.55	9.42	2.13	1.26	3.62	3.67	3/16	.625	–	–	–	5/8–11	8	7.500	2.25	3/8–16	17	25
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4–10	8	8.500	2.25	3/8–16	20	30
6"	15.69	15.93	10.81	2.31	1.38	5.55	3.81	1/4	.750	–	–	–	3/4–10	8	9.500	2.25	3/8–16	30	35
8"	17.81	17.94	11.93	2.50	1.49	7.28	3.80	3/8	1.000	–	–	–	3/4–10	8	11.750	2.25	3/8–16	44	48
10"	19.85	20.85	12.97	2.81	1.70	9.20	4.09	3/8	1.250	oval	–	2	7/8–9	12	14.250	3.25	3/8–16	71	91
12"	24.96	24.96	15.46	3.23	2.36	11.15	4.83	3/8	1.500	oval	–	2	7/8–9	12	17.000	3.25	3/8–16	110	127
14"	27.14	27.14	16.07	3.62	2.19	12.76	4.82	3/8	1.500	oval	–	4	1–8	12	18.750	3.25	3/8–16	135	183
16"	31.66	31.66	19.61	4.00	2.31	14.58	6.92	1/2	1.750	oval	–	4	1–8	16	21.250	4.25	1/2–13	182	250
18"	34.53	34.53	21.35	4.50	2.45	16.38	7.35	1/2	2.000	thru	–	4	1 1/8–8	16	22.750	4.25	1/2–13	234	305
20"	36.70	36.70	22.76	5.00	2.94	18.38	7.63	3/4	2.250	–	1 1/8–8	4	1 1/8–8	20	25.000	5.00	3/4–10	320	414
24"	41.57	41.57	25.13	6.06	3.12	21.88	7.88	3/4	2.500	–	1 1/4–8	4	1 1/4–8	20	29.500	5.00	3/4–10	505	702
30"	52.08	52.08	29.35	6.75	3.53	28.00	8.73	3/4	3.000	–	1 1/4–8	4	1 1/4–8	28	36.000	5.00	3/4–10	925	1130
36"	64.75	64.75	32.64	8.38	4.34	33.66	8.14	1	3.750	–	1 1/2–8	4	1 1/2–8	32	42.750	7.00	1–8	1630	1890
42"	73.24	73.24	37.62	9.25	5.03	40.31	9.62	1	4.500	–	1 1/2–8	4	1 1/2–8	36	49.500	7.00	1–8	2475	2700
48"	80.13	80.13	41.88	10.62	5.62	45.25	10.63	1 1/4	5.000	–	1 1/2–8	4	1 1/2–8	44	56.000	9.00	1–8	2815	3085

ANSI Class 300

VALVE SIZE	WAFER	LUG																WEIGHT (LBS.)	
	A*	A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WAFER	LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	8	11
2.5"	10.30	10.30	7.59	1.88	1.09	2.09	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	8	11
3"	11.60	11.98	8.60	1.92	1.20	2.75	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	12	17
3.5"	11.97	11.97	8.72	2.05	1.30	3.19	3.60	3/16	.625	–	–	–	3/4-10	8	7.250	2.25	3/8-16	14	19
4"	12.92	13.54	9.42	2.13	1.25	3.62	3.67	3⁄16	.625	–	–	–	3⁄4–10	8	7.875	2.25	3⁄8–16	17	24
5"	14.53	15.16	10.28	2.25	1.34	4.55	3.81	1/4	.750	–	–	–	3/4-10	8	9.250	2.25	3/8-16	20	30
6"	15.93	16.31	10.81	2.29	1.38	5.55	3.81	3⁄8	1.000	–	–	–	3⁄4–10	12	10.625	2.25	3⁄8–16	30	49
8"	18.10	19.50	12.22	2.88	1.54	7.06	4.08	3⁄8	1.250	–	–	–	7⁄8–9	12	13.000	3.25	3⁄8–16	52	80
10"	21.60	22.10	14.22	3.25	1.70	9.00	4.84	3⁄8	1.500	–	1–8	2	1–8	16	15.250	3.25	3⁄8–16	88	115
12"	28.40	28.40	17.90	3.62	1.86	10.72	6.90	1⁄2	1.750	–	1 1⁄8–8	4	1 1⁄8–8	16	17.750	4.25	1⁄2–13	153	199
14"	34.31	34.31	19.74	4.62	2.48	12.08	7.36	1⁄2	2.000	–	1 1⁄8–8	4	1 1⁄8–8	20	20.250	4.25	1⁄2–13	285	324
16"	38.14	38.14	21.82	5.25	2.59	13.72	7.82	3⁄4	2.250	–	1 1⁄4–8	4	1 1⁄4–8	20	22.500	5.00	3⁄4–10	336	401
18"	40.26	40.26	23.00	5.88	3.03	15.56	7.87	3⁄4	2.500	–	1 1⁄4–8	4	1 1⁄4–8	24	24.750	5.00	3⁄4–10	393	517
20"	43.62	43.62	25.13	6.31	3.24	17.22	8.74	3⁄4	3.000	–	1 1⁄4–8	4	1 1⁄4–8	24	27.000	5.00	3⁄4–10	510	735
24"	49.94	49.94	28.27	7.19	3.62	20.61	8.89	1	3.500	–	1 1⁄2–8	4	1 1⁄2–8	24	32.000	7.00	1–8	733	1020
30"	62.40	62.40	31.90	8.88	4.39	27.25	9.02	–	4.500	–	1 3⁄4–8	4	1 3⁄4–8	28	39.250	7.00	1–8	1745	2145

ANSI Class 600

VALVE SIZE	WAFER	LUG																WEIGHT (LBS.)	
	A*	A**	B	C	D	E	F	G	H	J*	K*	L*	M**	N**	P	R	S	WAFER	LUG
2"	10.59	10.59	7.59	1.75	1.06	1.72	3.34	3/16	.500	–	–	–	5/8-11	8	5.000	2.25	3/8-16	11	13
2.5"	10.30	10.30	7.59	1.88	1.09	2.14	3.34	3/16	.500	–	–	–	3/4-10	8	5.880	2.25	3/8-16	11	13
3"	11.60	12.10	8.60	2.12	1.20	2.50	3.60	3⁄16	.625	–	–	–	3⁄4–10	8	6.625	2.25	3⁄8–16	13	18
4"	14.43	14.93	9.81	2.50	1.40	3.43	3.81	1⁄4	.750	–	–	–	7⁄8–9	8	8.500	2.25	3⁄8–16	30	52
6"	17.27	18.46	11.71	3.06	1.68	5.18	4.09	3⁄8	1.250	1 1⁄8	1-8	2	1–8	12	11.500	3.25	3⁄8–16	42	85
8"	21.35	22.00	13.97	4.00	1.85	6.28	4.84	3⁄8	1.500	–	–	–	1 1⁄8–8	12	13.750	3.25	3⁄8–16	72	127
10"	31.15	31.15	17.90	4.62	2.00	7.95	6.90	1⁄2	1.750	–	1 1⁄4–8	4	1 1⁄4–8	16	17.000	4.25	1⁄2–13	170	233
12"	34.80	34.80	20.13	5.50	2.53	9.68	7.50	3⁄4	2.250	–	1 1⁄4–8	4	1 1⁄4–8	20	19.250	5.00	3⁄4–10	245	379
16"	–	44.25	25.38	7.00	3.50	12.60	9.38	3/4	3.000	–	–	–	11/2-8	20	23.750	5.00	3/4-10	–	1170

NOTES:

1. General

a. Standard valve tested to MSS-SP-61. API-598 testing available on request.
b. Modified valves for installation between DIN and JIS flanges available on application.
c. Dimensions shown are for reference only. Certified drawings available on application.

2. For 2" through 24" sizes:

a. Face-to-face dimensions (C) meet, within specified tolerance, MSS-SP-68 and API-609 requirements.
b. Valves are designed for installation between ANSI B16.5 flanges.

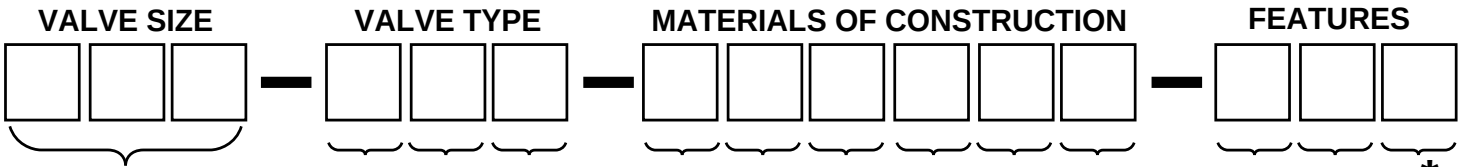
3. For 30" through 48" sizes:

a. Valves are designed for installation between MSS-SP-44 flanges.

4. For MIL SPEC valves, see Flowseal Marine Product Brochure.

5. For ISO valves, see Flowseal ISO Product Brochure.

FLOWSEAL FIGURE NUMBER SYSTEM



1. Size Code

02 = 2"
025 = 2 1/2"
03 = 3"
035 = 3 1/2"
04 = 4"
to
48 = 48"

2. Body Class Code

0 = 150 PSI Max. Diff. Pressure
1 = ANSI 150
3 = ANSI 300
6 = ANSI 600

3. Body Type Code

W = Wafer
L = Lugged

4. Shaft Design Code

A = Straight
2" - 24" ANSI 150
2" - 12" ANSI 300
2" - 8" ANSI 600
C = Balanced
30"- 48" ANSI 150
14"- 30" ANSI 300
10"- 16" ANSI 600

5. Body Material Code

1 = Carbon Steel
2 = 316 SS
3 = Monel
4 = Alloy 20
5 = Alum Bronze MIL-B-24480
8 = Alum Bronze B148 ASTM C958
H = Hastelloy C
X = Special

6. Disc Material Code

0 = Alum Bronze/ENP B148 C958
2 = 316 SS
3 = Monel
4 = Alloy 20
5 = Alum Bronze MIL-B-24480
7 = 316 SS Nitrided
8 = Alum Bronze B148 ASTM C958
9 = 316 SS/ENP
H = Hastelloy C
J = Hastelloy C/ENP
X = Special

7. Shaft Material Code

1 = 17-4PH SS
2 = 316 SS (Note 1)
3 = Monel
4 = Alloy 20
6 = Inconel 718/750
7 = Ferralium A479
0 = Nitronic 50
H = Hastelloy C
X = Special

8. Seat Material Code

T = TFE
R = RTFE
L = Polyethylene (UHMWPE)
F = Fire-Flow (TFE & Metal)
B = Fire-Flow (RTFE & Metal)
M = Inconel
S = 300 SS
C = Fire-Flow (TFE & Monel)
J = Fire-Flow (RTFE & Monel)
H = Fire-Flow (TFE & Hastelloy C)
K = Fire-Flow (RTFE & Hastelloy C)
X = Special

9. Packing Material Code

T = TFE
G = Graphite
F = Fire-Flow
X = Special

10. Bearing Material Code

G = Glass Backed TFE
H = 316 SS Backed TFE
F = Fire-Flow (Garfil & 316 SS)
S = Stainless Steel Nitrided
B = Bronze
K = Monel
J = Hastelloy C Backed TFE
X = Special

11. Actuator Type Code

B = Bare Shaft
H = Ratchet Handle
L = Ratchet Handle w/Lock
T = Throttle
3 = Worm Gear
4 = Pneumatic Double Acting
5 = Pneumatic SR Fail Close
6 = Pneumatic SR Fail Open
7 = Hydraulic
8 = Electric
X = Other

12. Special Feature Code

O = None
A = Oxygen Service
B = Bi-directional
C = Chlorine Service
D = Dead-end Service
F = Flat Face
M = Mil-V-24624
N = NACE Construction
S = 60 to 125 AARH Facing
V = Vacuum Service
X = Special Feature
Further Description Required

13. Series Code

*Factory Assigned

Note 1. *Use of 316 SS shaft may lower shutoff differentials. Consult factory.*

Example: 12 – 1WA – 121TTG – 30G

TYPICAL SPECIFICATION

1.0 Scope
This specification covers the design and testing of high pressure offset seat butterfly valves.

2.0 Applicable Standards
The following standards shall apply
ANSI B16.5: Pipe Flanges and Flanged Fittings (24" size and smaller).
ANSI B16.34: Valves–Flanged and Buttwelding End.
MSS SP-25: Standard Marking System for Valves, Fittings, Flanges and Unions.
MSS SP-61: Pressure Testing of Steel Valves.
MSS SP-68: High Pressure–Offset Seat Butterfly Valves.
API 609: Butterfly Valves, Lug-Type and Wafer-Type.

3.0 Design Requirement
3.1 Valves shall be High Performance Butterfly with offset seat and eccentric shaft. They shall be capable of sealing against full differential pressure in either flow direction.
3.2 Valve seat shall be both self and pressure energized with an elastomeric core. The self energizing member shall be isolated from the line media.
3.3 Valves shall have retained top and bottom low friction bearings.
3.4 Shaft design shall be single or dual piece.
3.5 Retainer rings must be recessed in the body so that the line gasket prevents any potential external leakage.
3.6 Valves shall have internal stop to prevent disc over-travel.
3.7 Valves shall be Flowseal or approved equal.

4.0 Materials
4.1 Valves shall be constructed of new material.
4.2 Carbon steel valves shall be constructed from materials below:
4.2.1 Body–ASTM A105 or A216 Gr. WCB.
4.2.2 Disc–ASTM A182 F316 or A351 Gr. CF8M.
4.3 Stainless steel valves shall be constructed from materials below:
4.3.1 Body–ASTM A182 Gr. F316 or A351 Gr. CF8M.
4.3.2 Disc–ASTM A182 Gr. F316 or A351 Gr. CF8M.
4.4 Shafts shall be ASTM A564 type 630 H 1150 or 316 SS.

5.0 Inspection and Test
5.1 Valves shall be hydrostatically shell tested per ANSI B16.34 and MSS SP-61.
5.2 Valves shall be seat tested per MSS SP-61. No leakage is permitted for resilient seated valves.
5.3 API 598 testing available upon request.

Manual Operator

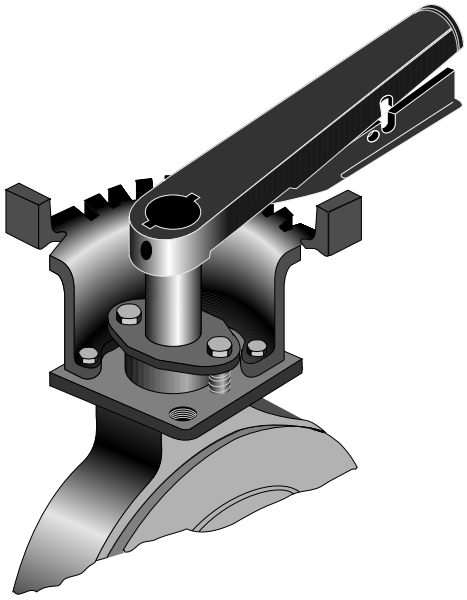
Lever Operator

Lever operators are used for manual operation of the smaller diameter Flowseal HPBFV. The standard lever (or handle) is attached directly to the valve shaft. The lever-to-shaft engagement is a square key; this positive mechanical attachment prevents hysteresis and also is a designed controlled failure point (if the disc and shaft experience extreme over-torquing, this external key is designed to shear...preventing internal valve damage).

The standard lever operator assembly includes a ratchet plate bolted to the valve mounting pad; this plate has 10 notches for engagement of the lever operator. The lever's spring-loaded trigger will lock the valve disc into any one of ten positions from full open to full close.

The standard 10 position lever operator also features a padlock hole for added security.

An optional infinite throttling Lever is also available. Because the Flowseal HPBFV can be used for proportional modulation, the infinite throttling lever can lock the disc into any position between open and closed for extremely precise flow control requirements. A nose piece on the handle has a hole which is aligned with a 90° radial slot in the ratchet plate; a screw and hex nut are inserted through the hole and slot and lock the lever into any desired position. A memory stop screw is also supplied to limit lever rotation to a pre-set position.



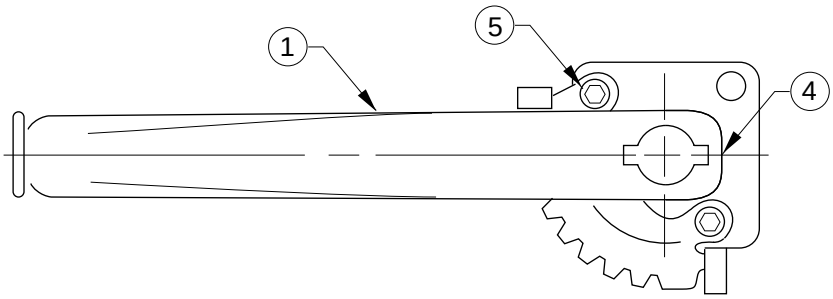
LEVER SIZING RECOMMENDATIONS

To ensure safe operation of the Flowseal HPBFV, the operator selected to open and close the valve must be sufficient for the Seating and Unseating Torque requirements, as well as Dynamic Torque caused by high differential pressures.

Lever operators should be used in accordance with the following guidelines:

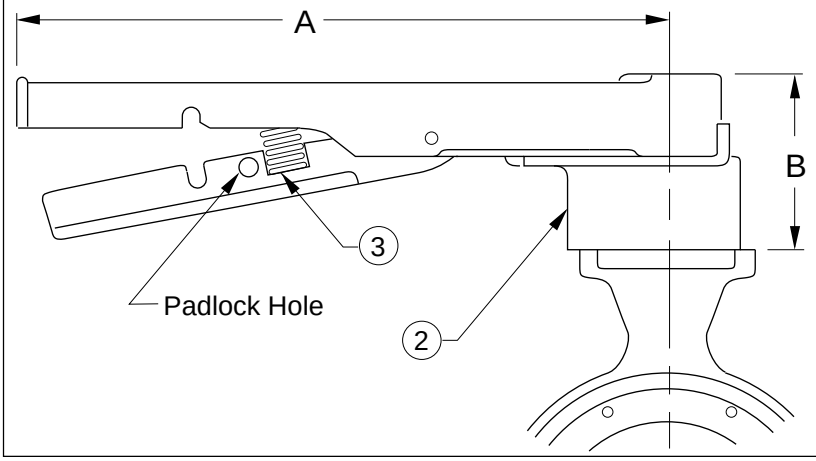
Seat Style	*ANSI Class 150*		*ANSI Class 300*		*ANSI Class 600*	
	Valve Size	*Maximum Differential*	*Valve Size*	*Maximum Differential*	*Valve Size*	*Maximum Differential*
SOFT SEAT	2½" to 4"	285 psi	3" to 4"	300 psi	Not Recommended	
	6" to 8"	150 psi	6"	150 psi		
FIRE–FLOW SEAT	2½" to 4"	285 psi	3" to 4"	300 psi	Not Recommended	
	6" to 8"	150 psi	6"	150 psi		
METAL SEAT	Not Recommended		Not Recommended		Not Recommended	

STANDARD 10 POSITION LEVER



Materials of Construction

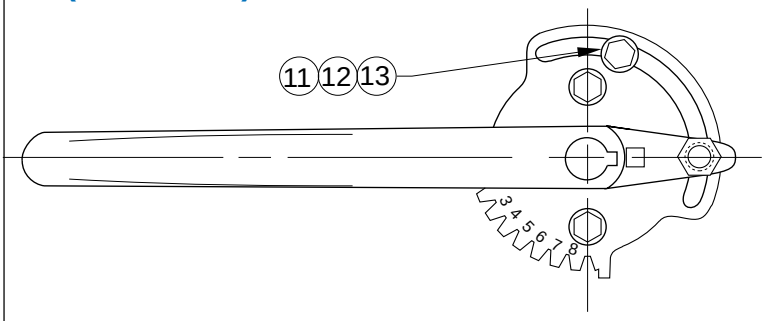
NO.	QTY	DESCRIPTION	MATERIAL
1	1	Lever	Ductile Iron
2	1	Ratchet Plate	Ductile Iron
3	1	Spring	Steel
4	1	Set Screw	Steel
5	3	Soc. Head Cap Screw	Steel

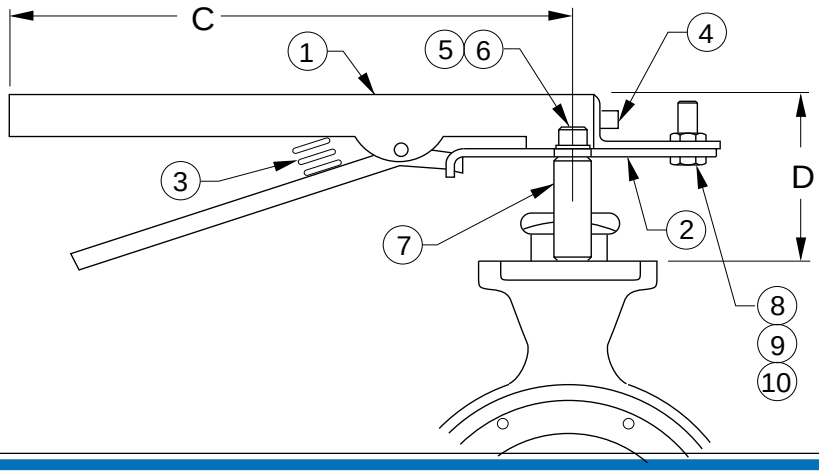


Dimensions

Valve Size and Class	A	B
2½" to 4" Class 150 3" to 4" Class 300	10.9"	3½"
6" to 8" Class 150 6" Class 300	24.1"	4¼"

(OPTIONAL) INFINITE THROTTLING LEVER



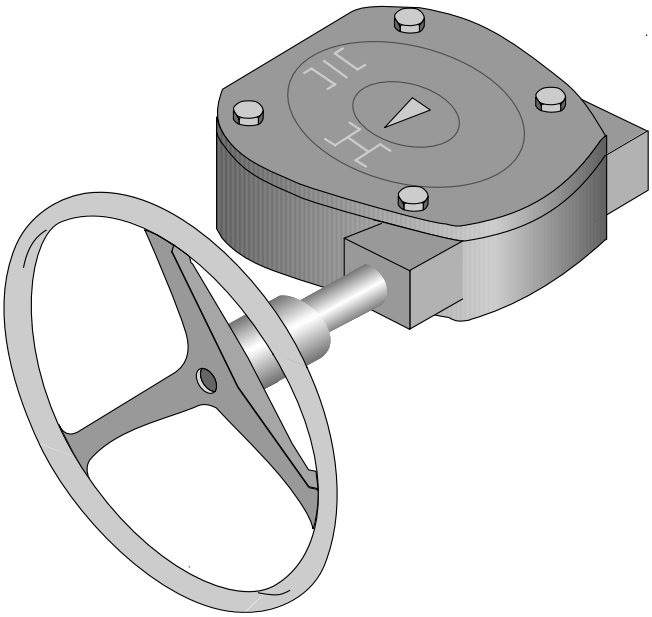


Materials of Construction

NO.	QTY	DESCRIPTION	MATERIAL
1	1	Lever	Ductile Iron
2	1	Throttle Plate	Steel
3	1	Spring	Steel
4	1	Set Screw	Steel
5	2	Soc. Head Cap Screw	Steel
6	2	Lock Washer	Steel
7	2	Spacer	Steel
8	1	Hex Head Screw	Steel
9	1	Hex Nut	Steel
10	1	Lock Washer	Steel
11	1	Soc. Hd Memory Screw	Steel
12	1	Hex Nut	Steel
13	1	Lock Washer	Steel

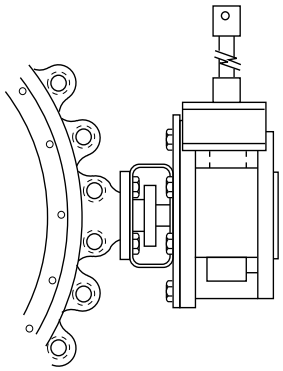
Dimensions

Valve Size and Class	C	D
2½" to 6" Class 150 3" to 4" Class 300	10½"	3½"
8" Class 150 6" Class 300	14"	3¾"



Gear operators are used for manual operation of all sizes of Flowseal HPBFV's. The standard unit is of a worm gear design; a worm gear, engaged to a gear segment inside the operator housing, is turned by rotation of the handwheel and causes the gear segment (or, sector gear) to rotate from zero to ninety degrees. The center of the gear segment has a bore and keyway which is directly attached to the valve shaft and square key. The worm gear design is self locking. A position indicator is standard. End of travel adjustment is made by two stop adjustment screws for precise positioning of the disc in the open and closed positions.

GEAR OPERATOR OPTIONS



Buried Service or Submersible Gear
(For illustration purposes only)

In addition to the standard industrial (weatherproof) design, optional versions are available for a wide variety of special applications. These options include:

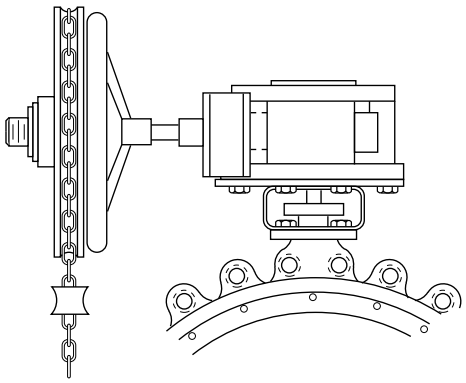
HIGH TEMPERATURE GEAR (for ambient temperatures above 200 °F) with bronze thrust bearings, high temperature grease and seals and metal position indicator. This may be commonly selected for use with Flowseal Metal Seat Valves.

BURIED SERVICE GEAR (for concrete pits)- with 2" square nut, sealed cover with no position indicator.

SUBMERSIBLE GEAR (for fresh water or buried in soil)- primed housing and cover, Stainless Steel input shaft, input shaft seal, sealed cover, grease packed, sealant on stop adjustment nuts, soil pipe adapter and 2" square nut.

MARINE SERVICE GEAR (for salt water)- Bronze housing and cover, Stainless Steel input shaft and screws, sealant on screws, bronze gear and grease packed.

ACCESSORIES OPTIONS



Gear & Chainwheel
(For illustration purposes only)

Note: Worm gear and/or attachments subject to change without notice.

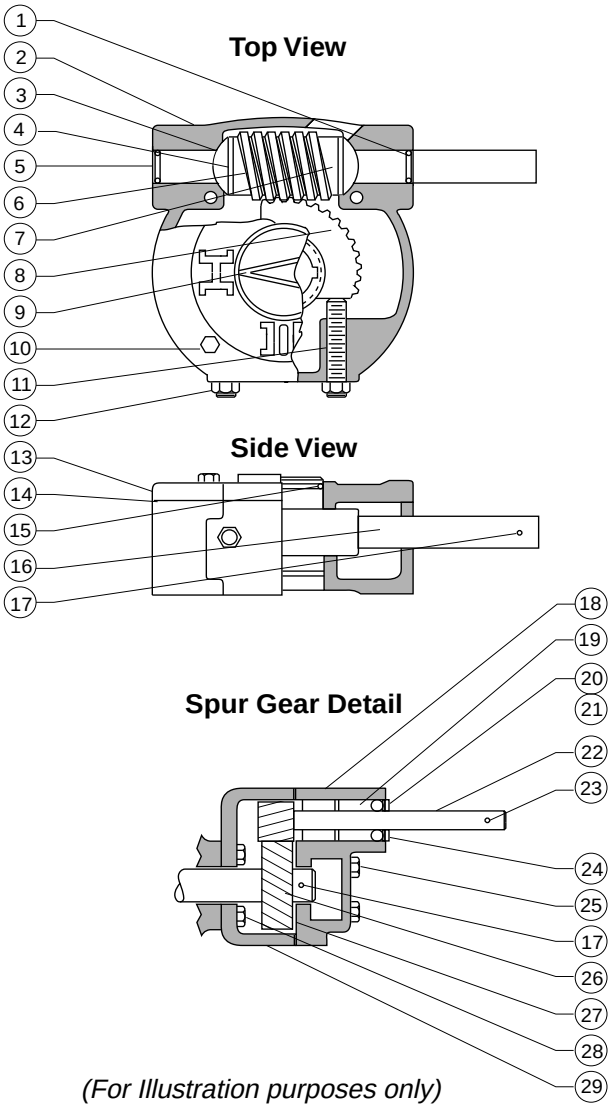
Other options include chainwheels, output shaft (torque tube) extensions, input shaft extensions, operators which conform to military specifications and operators which conform to AWWA specifications.

Standard handwheel is aluminum. Optional ductile Iron handwheel is available on special request; consult factory.

Standard chainwheel assembly includes: cast iron sprocket rim, ductile iron guide arm and brackets for attachment to rim of handwheel. Model #2 fits 8" handwheel; #2½ fits 12" handwheel; #3½ fits 18" handwheel; #4½ fits 24" handwheel; #5 fits 30" handwheel.

Chainwheel assembly should be permanently attached to wormgear input shaft upon installation as a secondary safety device.

Worm Gear Materials of Construction



(For Illustration purposes only)

Item	Qty	Description	Standard Industrial Materials	Marine Service Materials
1	1	Seal-Input Shaft	Buna-N	
2	1	Housing	Cast Iron	Bronze B-61
3	2	Bearing	Glass/TFE Filled Nylon	
4	2	Washer	Hardened Steel	
5	1	Plug	Steel	–
6	1	Worm Gear	Steel	
7	1	Worm Pin	Steel	
8	1	Gear Segment	Duct Iron	Mang. Bronze 430B
9	1	Indicator Cap	Nylon	
10	Var.	Cover Bolt	Steel	Monel
11	2	Stop Adj. Screw	Steel	Monel
12	2	Nut-Hex	Steel	Monel
13	1	Cover	Cast Iron	Bronze B-61
14	1	Gasket-Cover	Fiber	Veg Plant Fiber
15	2	O-Ring	Buna-N	
16	1	Worm Shaft	Steel	Monel
17	1	Roll Pin	Steel	–
18	1	Spur Cover	Cast Iron	–
19	2	Input Bushing	Bronze	–
20	2	Cer Clip	Steel	–
21	1	Input Seal Washer	Nylon	–
22	1	Spur Shaft	Steel	–
23	1	Spur Roll Pin	Steel	–
24	1	Spur Shaft Seal	Buna-N	–
25	4	Spur Cover Bolt	Steel	–
26	1	Spur Gear	Steel	–
27	1	Spur Cover Gasket	Fiber	–
28	4	Spur Housing bolt	Steel	–
29	1	Spur Housing	Cast Iron	–

OPERATION AND MAINTENANCE INSTRUCTIONS

MAINTENANCE PROCEDURE

All units are completely factory lubricated with grease. A periodic check, every six months, should be made to determine condition of the lubricant. Any lubricant equivalent to Esso Nebula EP-1 is acceptable for temperatures 0 to 150 degrees F. For lower temperatures, a grease equal to Esso P-290 is satisfactory. Sufficient grease should be installed to cover all gears. If the unit must be removed from the valve, the position limit stops must be reset in order to insure proper operation.

LIMIT STOP SETTING PROCEDURE

(Note: Limit stop screws can be adjusted to control Open Limit and Closed Limit.) Screws are not marked as to which screw adjusts which Limit because the operator can be mounted in any of the four quadrants around the top flange. Depending on which quadrant the operator is mounted will determine which screw adjusts which Limit.

1. Rotate handwheel until the operator indicator shows the valve to be slightly less than full closed position. (Indicator should read slightly open from the full closed position).

2. Rotate handwheel in the direction which will close the valve disc. Rotate until the gear is against the stop.

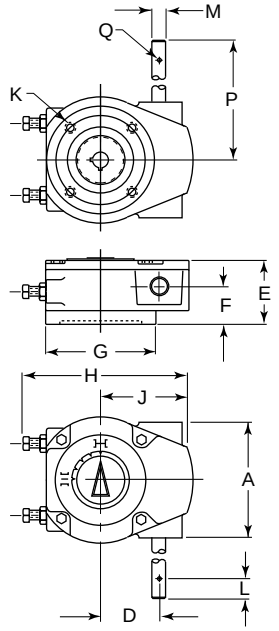
3. Loosen jam nuts on both adjusting screws. Try turning each screw clockwise. The screw which will not turn is the closed stop screw. This screw should be used to Limit close position by turning in (clockwise) to lessen rotation of disc or out (counter-clockwise) to increase rotation of disc.

4. Pointer may not be perfectly aligned with close mark, but should be within 1/8" when fully adjusted. Lock both jam nuts.

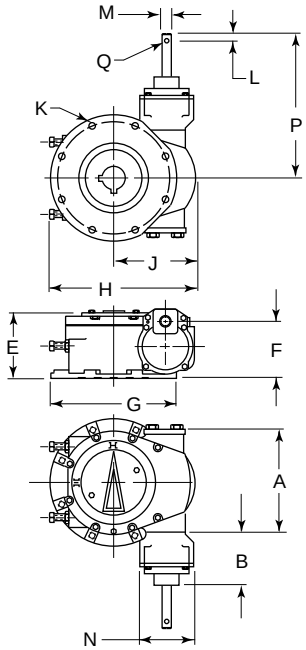
Dimensions

Worm Gear

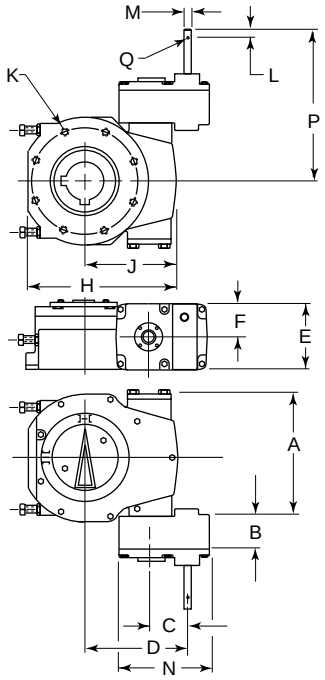
Models: W0, WA, WB, WD & WE



Models: WF& WG



ModeL: WJ



Gear Operator Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	Wt. (Lbs.)
WO	4.12	–	–	1.87	4.00*	3.00*	4.12	6.00	3.37	7/16 Holes 2.25 Sq.	0.75	0.63	–	5.24	0.15	10
WA	4.50	–	–	2.40	2.71	1.58	4.12	6.75	3.61	3/8-16 3.25 BC	0.75	0.63	–	5.25	0.15	11
WB	5.86	–	–	2.40	2.78	1.64	5.58	7.75	3.61	1/2-13 5.00 BC	1.12	0.75	–	9.00	0.18	16
WC	6.50	–	–	3.23	3.65	2.00	6.00	9.50	5.18	1/2-13 5.00 BC	1.12	0.75	–	10.00	0.18	28
WD	7.24	–	–	4.07	4.65	2.51	7.75	10.75	5.62	3/4-10 6.50 BC	1.12	0.87	–	10.00	0.18	42
WE	8.75	–	–	4.66	5.60	2.50	10.00	13.50	6.68	3/4-10 6.50 BC	1.37	1.00	–	10.12	0.38	70
WF	8.75	3.93	–	4.66	5.60	4.14	10.00	13.75	6.75	3/4-10 6.50 BC	1.37	1.00	4.63	13.17	0.38	85
WG	12.00	5.94	–	5.75	7.59	6.46	14.00	16.18	8.93	3/4-10 12.50 BC	1.37	1.00	6.00	16.12	0.38	180
WJ	13.51	5.69	3.94	11.10	7.66	5.44	14.00	20.75	10.00	3/4-10 12.50 BC	1.37	0.87	9.88	16.81	0.18	220

* Includes bracket

PERFORMANCE SPECIFICATIONS

Gear Operator Model	Maximum Rating (Inch Pounds of Torque)		Maximum Bore Diameter	Shaft Engagement	Ratio	Efficiency
	Input	Output				
WO	435	3000	0.75	2.00	30:1	0.23
WA	485	5000	1.25	2.37	43:1	0.24
WB	1066	11000	1.25	2.50	43:1	0.24
WC	1190	18000	2.00	3.37	63:1	0.24
WD	1204	24000	2.25	4.50	83:1	0.24
WE	1288	30000	2.37	4.75	97:1	0.24
WF	947	50000	3.50	4.75	202:1	0.26
WG	1201	140000	4.75	6.75	466:1	0.25
WJ	1176	225000	5.37	6.87	765:1	0.25

Flowseal pneumatic actuators offer high performance in a compact design

The unique rack and pinion operation of Flowseal pneumatic actuators results in excellent linear torque/stroke proportion. With this design, high torque is achieved in a very compact package.

The Flowseal Series 48000 is a double acting pneumatic actuator where compressed air is used to energize the actuator in both directions. The Flowseal Series 43000 is a spring return safe pneumatic actuator which uses air pressure to energize the actuator in one direction. This air pressure is also used to compress springs within the actuator mechanism. The energy stored in these compressed springs is then used to return the actuator to its original position when air pressure is released.

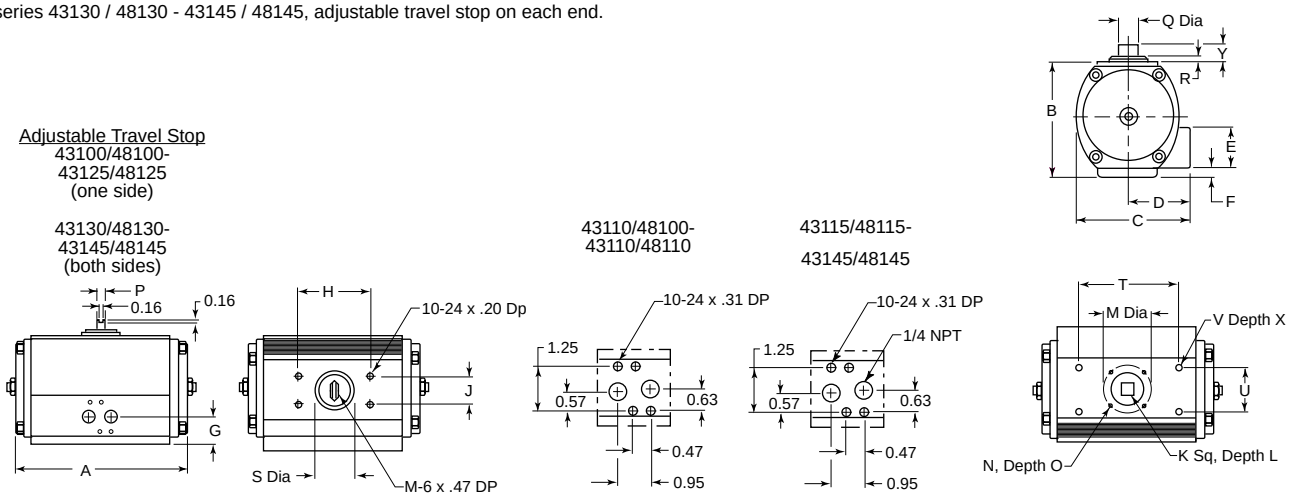
Features:

- Actuator action can easily be reversed by changing piston positions.
- Travel stop adjuster allows for the maximum turning angle of 95°.
- Actuators are internally lubricated for long life and dependability.
- Guide rail and wear pads help to extend service life.
- Series 48000 actuators may be easily converted to Series 43000.
- No changes in outside dimensions.
- End cap screw length allows for easy spring relaxation during disassembly.
- Aluminum housing and end caps are manufactured from hard anodized aluminum for corrosion protection.

Bill of Materials

Part No.	Description	Material
1	Body	Hard Anodized Aluminum
2	Piston	Aluminum
3	Center Gear	Steel
4	End Cap	Hard Anodized Aluminum
5	End Cap Screw	Steel
6	Travel Stop Adjuster*	Steel
7	Nut	Steel
8	End Cap O-Ring	Nitrile Rubber
9	Piston O-Ring	Nitrile Rubber
10	Center Gear O-Ring	Nitrile Rubber
11	End Cap O-Ring	Nitrile Rubber
12	Upper Washer	Nitrile Rubber
13	Lower Washer	Nylon
14	Snap Ring	Steel
15	Wear Pad	Delrin
16	Inner Spring	Steel
17	Outer Spring	Steel
18	Guide Rail	Steel
19	Indicator	PVC

* For series 43130 / 48130 - 43145 / 48145, adjustable travel stop on each end.



Dimensions

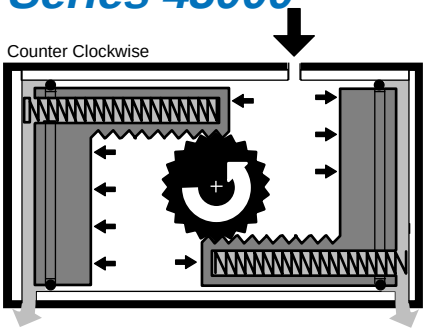
Model		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y
43100/48100	in.	4.51	2.87	2.97	1.71	1.61	-	.81	3.15	1.18	0.35	0.39	1.42	#10-24	0.31	0.45	0.63	0.18	.98	2.87	1.26	10-24	0.31	0.79
	mm	114.55	72.90	75.44	43.43	40.89	-	20.57	80.01	29.97	8.99	9.91	36.07		7.87	11.43	16	4.57	24.89	72.90	32		7.87	20.07
43105/48105	in.	5.24	3.56	3.44	1.87	1.61	-	0.81	3.15	1.18	0.43	0.47	1.65	#10-24	0.31	0.45	0.79	0.18	1.22	2.87	1.26	10-24	0.31	0.79
	mm	133.1	90.42	87.38	47.50	40.89	-	20.57	80.01	29.97	11.00	11.94	41.91		7.87	11.43	20.07	4.57	30.99	72.90	32		7.87	20.07
43110/48110	in.	6.38	4.29	4.13	2.24	1.65	0.3	1.12	3.15	1.18	0.55	0.63	1.97	1/4-20	0.39	0.45	0.79	0.2	1.38	2.87	1.26	1/4-20	0.39	0.79
	mm	162.05	108.97	104.90	56.90	41.91	7.62	28.45	80.01	29.97	14	16	50.04		9.91	11.43	20.07	5.08	35.05	72.90	32		9.91	20.07
43115/48115	in.	7.64	4.67	4.76	2.64	1.69	0.31	1.16	3.15	1.18	0.55	0.63	1.97	1/4-20	0.39	0.45	0.79	0.22	1.81	4.21	1.93	1/4-20	0.39	0.79
	mm	194.06	118.62	120.90	67.06	42.93	7.87	29.46	80.01	29.97	14	16	50.04		9.91	11.43	20.07	5.59	45.97	106.93	49.02		9.91	20.07
43120/48120	in.	8.58	5.53	5.37	2.83	1.69	0.31	1.16	3.15	1.18	0.67	0.75	2.76	5/16-18	0.51	0.75	1.26	0.26	1.97	4.21	1.93	5/16-18	0.39	0.79
	mm	217.93	140.46	136.40	71.88	42.93	7.96	29.46	80.01	29.97	16.99	19.05	70.10		12.95	19.05	32	6.6	50.04	106.93	49.02		9.91	20.07
43125/48125	in.	10.47	6.56	6.14	3.07	1.69	0.33	1.18	3.15	1.18	0.87	0.94	4.02	3/8-16	0.63	0.75	1.26	0.28	2.4	6.34	2.87	5/16-18	0.47	0.79
	mm	265.94	166.62	155.96	77.98	42.93	8.38	29.97	130.05	29.97	22	23.88	102.11		16	19.05	32	7.11	60.96	161.04	72.90		11.94	20.07
43130/48130	in.	13.39	8.17	7.52	3.76	1.69	0.81	1.65	5.12	1.18	1.06	1.14	4.92	1/2-13	0.79	1	1.58	0.28	2.84	8.39	4.02	5/16-18	0.47	0.79
	mm	340.11	207.52	191.01	95.50	42.93	20.51	41.91	130.05	29.97	27	28.96	124.97		20.07	25.4	40.13	7.11	72.14	213.11	102.11		11.94	29.97
43135/48135	in.	14.21	9.84	8.94	4.47	1.69	1.56	2.4	5.12	1.18	1.42	1.5	5.51	5/8-11	0.98	1	1.58	0.28	3.07	8.39	4.02	3/8-16	0.59	1.18
	mm	360.93	249.94	227.08	113.54	42.93	39.62	60.96	130.05	29.97	35.99	38.1	139.95		24.89	25.4	40.13	7.11	77.98	213.11	102.11		14.99	29.97
43140/48140	in.	15.35	11.81	11.02	5.51	1.69	2.22	3.07	5.12	1.18	1.42	1.50	5.51	5/8-11	0.98	1	1.58	0.28	3.07	9.61	4.61	1/2-13	0.87	1.18
	mm	389.89	299.97	279.91	139.95	42.93	56.50	77.98	130.05	29.97	35.99	38.1	139.95		24.98	25.4	40.13	7.11	77.98	244.09	117.09		22.10	29.97
43145/48145	in.	19.53	11.81	11.02	5.51	4.09	2.22	3.5	7.87	3.54	1.81	1.97	6.50	5/8-11	0.87	1.42	2.36	0.55	4.72	9.61	4.61	1/2-13	0.87	1.97
	mm	496.06	299.97	279.91	139.95	103.89	56.50	88.90	199.90	89.92	45.98	50.04	165.10		22.10	36.01	59.94	13.97	119.89	244.09	117.09		22.10	50.04

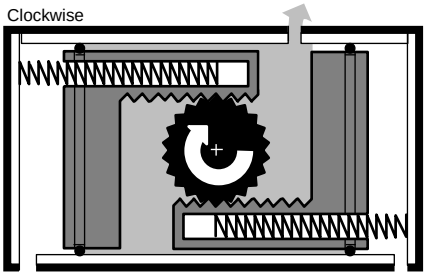
Series 43000 Actuator Torque Data

Spring Return Rack and Pinion Actuator,
Torque Output (In-Lbs)

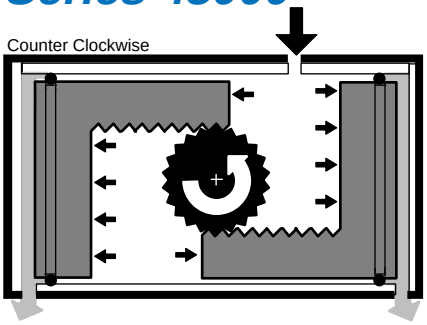
Actuator Model	No. of Springs		Spring Torque		40 PSI		60 PSI		80 PSI		100 PSI		120 PSI	
	Outer	Inner	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
3	1	62	33	65	36									
43100	4	2	87	46			101	60						
	4	4	106	52					144	90	193	139	254	200
3	0	124	69	134	79									
43105	4	0	165	92			212	139						
	4	4	224	122					283	181	384	282	511	409
	3	0	250	138	212	100								
43110	3	2	317	175			350	208						
	4	3	434	240					460	266				
	4	4	467	258							617	408	836	627
	2	2	405	179	399	173								
43115	4	0	563	262			605	304						
	4	3	749	334					822	407				
	4	4	811	356							7087	634	1448	995
	3	0	696	348	595	247								
43120	3	2	871	435			980	544						
	4	3	1190	594					1292	696				
	4	4	1278	637							1721	1080	2310	1669
	4	0	1186	726	1031	571								
43125	4	2	1496	903			1733	1140						
	4	4	1806	1080					2434	1708	3313	2587	4110	3684
	3	1	2576	1305	1989	718								
43130	4	1	3324	1688			3252	1616						
	4	4	4319	2151					4436	2268	6083	3915	8141	5973
	3	2	3400	2204	2952	1756								
43135	4	2	4222	2744			4990	3512						
	4	4	5160	3354					6958	5152	9536	7730	12758	10952
	3	0	4434	3240	4390	3196								
43140	4	1	6630	4833			6613	4816						
	4	4	8780	6373					8888	6481	12703	10296	17472	15065
	8	0	6766	4006	7930	5169								
43145	10	0	11442	7990			9913	6461						
	10	8	14648	9922					13949	9223				
	12	12	17943	11889							17950	11896		

Series 43000





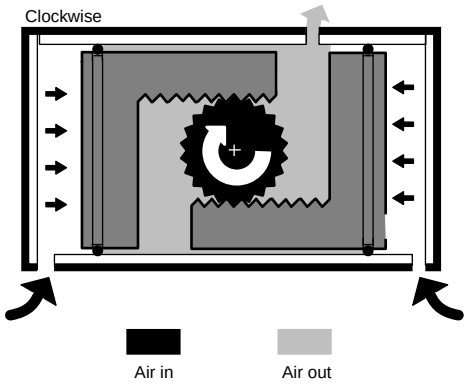
Series 48000



Series 48000 Actuator Torque Data

Double Acting Pneumatic Operator
Torque Output (In Lbs.)

Actuator Model	Air Supply Pressure				
	40 PSI	60 PSI	80 PSI	100 PSI	125 PSI
48100	100	150	195	245	305
48105	200	300	405	505	630
48110	350	525	700	875	1095
48115	575	870	1155	1445	1805
48120	945	1415	1885	2360	2945
48125	1760	2635	3515	4395	5490
48130	3300	4940	6590	8235	10295
48135	5155	7735	10310	12890	16110
48140	7630	11445	15260	19075	23845
48145	11935	17903	23971	30375	44758



Flowseal electric actuators offer a proven design for precise valve actuation

The Flowseal Series 44000 provides a broad range of electric actuators to suit applications requiring precise quarter turn electric actuators.

Flowseal electric actuators are powered by a single phase reversing capacitor motor with thermal over load protection. The gear train within the actuator provides a smooth, continuous rotary power stroke for accurate, automatic valve positioning. Factory set travel limit switches provide precise control of shaft rotation. These cam actuated switches can be field adjusted if required.

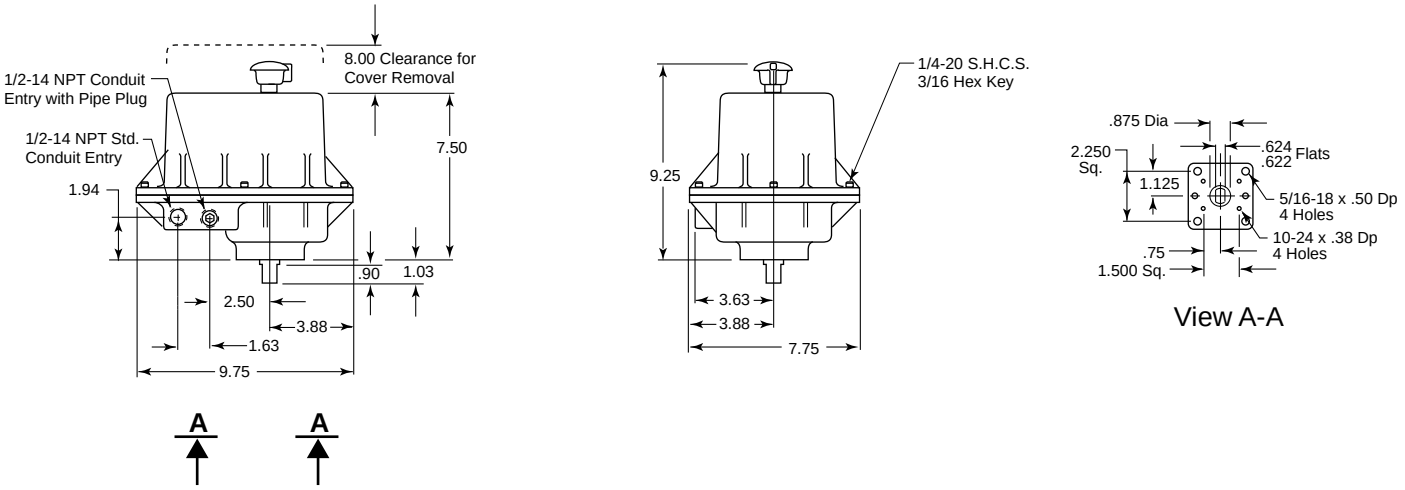
Torque capabilities range up to 10,000 in-lbs. and speed ranges from 30 seconds to 60 seconds open to close. All Series 44000 actuators are rated NEMA IV requirements.

Features:

- Gears and pinions are made from precision machined-hardened steel providing higher torque with substantial safety factors.
- Permanently lubricated gear trains allow for trouble free operation.
- Mechanical brake assures gear locking at precise positions.
- Units have continuous duty motors with high efficiency capacitors and overload protection.
- All Series 44000 actuators are constructed of heavy-duty industrial grade castings to provide for rugged use.

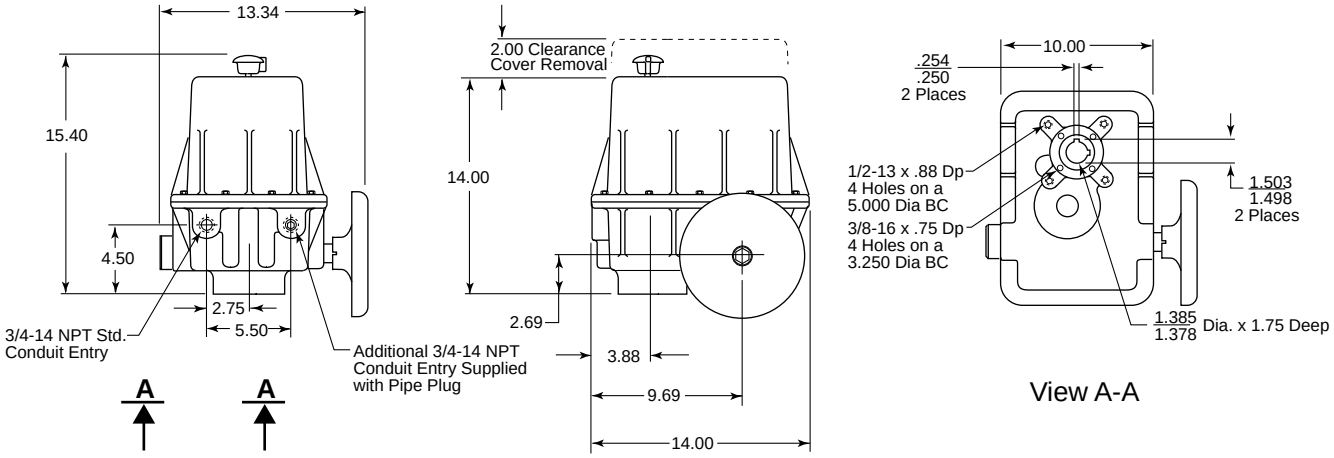
Series 44112 & 44115

Model	Speed 90° (Sec)	Torque (In-lbs)	Current Run (amp)	Draw Locked Rotor (amp)
44112	30	1000	0.52	0.60
44110[1]	15	1600	0.28	0.30



Series 44138 & 44145

Model	Speed 90° (Sec)	Torque (In-lbs)	Current Run (amp)	Draw Locked Rotor (amp)
44138	60	6000	1.43	2.50
44145	30	10000	3.50	4.20



DESCRIPTION OF TORQUE

What is TORQUE?

Torque is any (man or machine) effort which tends to cause rotation or turning. In engineering terms, torque is defined as force acting at some distance from the center of rotation. More correctly: Torque equals force times the perpendicular distance from the center of rotation. The perpendicular distance from the center of turning is sometimes called a "moment arm".

Torque is measured in units of distance and force; for example: inch pounds, or foot pounds. The equation for torque is:

$$T = F \times A$$

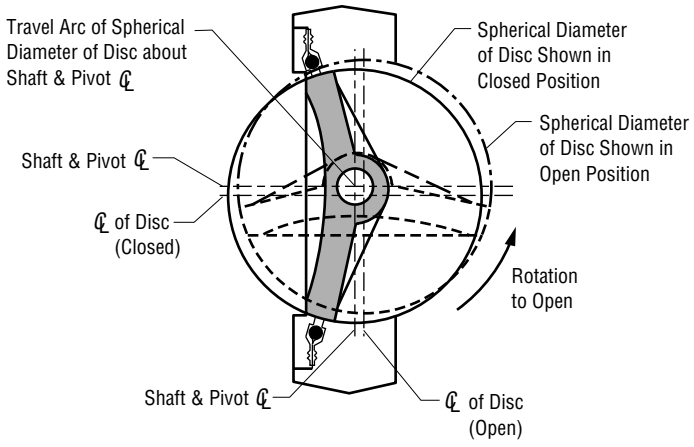
(Torque equals Force times Moment Arm)

HIGH-PERFORMANCE BUTTERFLY VALVE TORQUE

The High-Performance Butterfly Valve (HPBFV) is a “Quarter-Turn” valve design; that is, it rotates one-quarter of a full 360° turn to move from open to closed or from closed to open.

Seating torque is created by contact between the disc and seat as the disc rotates closed. Unseating torque is created by the disc breaking away from the seat as the disc rotates open. The Flowseal seat creates a seal at no-to-low pressure conditions by means of a mechanical "preload" between the disc and the seat; this pre-loading allows the seat seal to be self-energized. When line pressure is introduced, the Flowseal seat is designed to use the line pressure to create an even tighter seal between the disc and the seal (the higher the pressure, the tighter the seal); this dynamic sealing causes the Flowseal seat to be pressure energized. The valve seating and unseating torque increases as the seat seal moves from the self-energized mode to the pressure-energized mode. (Refer to the valve torque tables for the appropriate torque.)

A difference in torque exists between the seat upstream (SUS) and seat downstream (SDS) positions because of the disc and shaft design. All Flowseal HPBFVs have both off-set discs and eccentric shafts. The off-set is applicable to the disc edge seating surface relative to the shaft center line. By off-setting the seating surface from the rotational center line, a contact with the seat is possible throughout the 360° circumference. The shaft is eccentric in the body by 0.060 ins. and this enhances seat life by imparting a camming action to the disc as it rotates both in and out of the seat. Seat wear points are eliminated at the top and bottom of the disc and operating torque is reduced.



FLOWSEAL HPBFV ECCENTRIC SHAFT DESIGN

In the SUS position (preferred pipeline flow direction), the line pressure tends to assist in opening the valve disc. In the SDS position, the line pressure tends to assist in keeping the valve disc closed; also, line pressure acting on the surface of the disc creates more mechanical pre-load between the disc and seat. Therefore, SDS torque values are higher than SUS values.

ANSI Class 150

I. SEATING and UNSEATING TORQUE VALUES

(All Torques are in Inch Pounds)

VALVE SIZE	SOFT SEAT			
	SEAT UPSTREAM (SUS)		SEAT DOWNSTREAM (SDS)	
	0-150 PSIG	285 PSIG	0-150 PSIG	285 PSIG
3"	200	270	200	320
4"	225	470	410	610
6"	540	680	860	1320
8"	910	1620	1620	2580
10"	1620	2530	2630	4550
12"	2530	3600	4160	6350
14"	3720	5970	6200	9000
16"	5530	9180	9000	14700
18"	6840	11900	14500	20100
20"	10020	16970	18000	27200
24"	18330	32290	28100	43000
30"	32330	56930	45500	71800
36"	47000	81000	66000	102000
42"	65000	111000	92000	140000
48"	83000	146000	115000	184000

VALVE SIZE	FIRE-FLOW SEAT			
	SEAT UPSTREAM (SUS)		SEAT DOWNSTREAM (SDS)	
	0-150 PSIG	285 PSIG	0-150 PSIG	285 PSIG
3"	480	540	550	660
4"	645	770	800	1050
6"	1520	1740	2420	3380
8"	2350	2950	4180	4700
10"	4080	5100	6630	9200
12"	5830	7500	9600	13300
14"	9100	11300	15200	17000
16"	11900	16400	19400	26300
18"	17300	22100	36700	37400
20"	23700	34300	42600	55000
24"	36700	59800	56300	79600
30"	61200	89800	86100	113300
36"	C.F.	C.F.	C.F.	C.F.
42"	C.F.	C.F.	C.F.	C.F.

VALVE SIZE	METAL SEAT			
	SEAT UPSTREAM (SUS)		SEAT DOWNSTREAM (SDS)	
	0-150 PSIG	285 PSIG	0-150 PSIG	285 PSIG
3"	900	1250		
4"	1200	1550		
6"	2500	3200		
8"	3800	4700		
10"	6400	8700		
12"	8600	12800	**CONSULT FACTORY**	**CONSULT FACTORY**
14"	11200	15100		
16"	17800	24200		
18"	26100	32300		
20"	33500	47600		
24"	53000	71000		
30"	80500	115000		
36"	C.F.	C.F.		
42"	C.F.	C.F.		

Torques shown are for on/off applications and include sizing margins appropriate to normal liquid and gas applications. For severe services, or unusual fluids or slurries, consult factory.

II. HYDRODYNAMIC TORQUE VALUES

The equal percentage flow characteristics of the Flowseal HPBFV makes it well-suited for proportional control applications. Hydrodynamic valve torques develop as a result of the pipeline process conditions (media, velocity, pressure, temperature, and turbulance) and the shape and degree position of the valve disc. Under certain conditions, hydrodynamic torques can meet or exceed seating and unseating torques; when selecting actuators for throttling services, hydrodynamic torque must be considered to help ensure correct selection of actuation.

The chart below provides a C_t (Torque Coefficient) factor to aid in actuator sizing. The C_t factors are based on water at ambient temperature, and do not take into account other factors such as: cavitation, flashing, noise, vibration, etc.. These considerations should be addressed prior to hydrodynamic torque sizing.

The equation for hydrodynamic torque is:

$$Td = C_t \times \Delta P$$

ΔP = Pressure Drop in PSIG
C_t = Torque Coefficient Factor
Td = Dynamic Torque in Inch Pounds

VALVE SIZE	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Ct = TORQUE COEFFICIENT FACTORS								
3"	1.23	1.59	2.56	4.00	6.25	9.09	14.29	12.99	15.87
4"	2.38	3.03	4.76	7.69	11.49	16.39	25.00	24.39	32.26
6"	5.00	7.69	14.29	24.39	43.48	71.43	111.11	100.00	125.00
8"	12.99	19.23	31.25	55.56	90.91	158.73	256.41	217.39	238.10
10"	22.73	34.48	55.56	100.00	166.67	277.78	454.55	384.62	416.67
12"	33.33	52.63	100.00	166.67	333.33	467.19	625.00	588.24	625.00
14"	35.71	55.56	90.91	158.73	256.41	454.55	714.29	625.00	769.23
16"	66.67	106.38	185.19	322.58	625.00	613.50	1333.33	1219.51	1351.35
18"	83.33	120.48	208.33	357.14	588.24	1000.00	1538.46	1333.33	1428.57
20"	126.58	196.08	344.83	588.24	1136.36	1724.14	2500.00	2272.73	2439.02
24"	200.00	322.58	588.24	1000.00	1960.78	2702.70	4000.00	3571.43	3846.14
30"	333.33	526.32	1000.00	1694.92	3333.33	4761.90	6666.67	5882.35	6250.00

ANSI Class 300

I. SEATING and UNSEATING TORQUE VALUES (All Torques are in Inch Pounds)

VALVE SIZE	SOFT SEAT											
	SEAT UPSTREAM (SUS)						SEAT DOWNSTREAM (SDS)					
	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig
3"	220	300	440	520	595	700	220	350	520	600	675	700
4"	250	520	610	670	790	970	460	675	850	1000	1150	1300
6"	600	750	940	1120	1330	1630	950	1450	1750	2100	2300	2750
8"	1000	1800	1950	2440	2810	3390	1800	2850	3400	4000	4500	5250
10"	1800	2790	3840	4640	5370	6510	2900	5000	5700	6700	7600	8750
12"	2790	4000	6140	7480	8590	11390	4600	7000	8000	9500	11000	12850
14"	4130	6640	8630	10200	12100	14940	8200	11500	14500	17000	18000	22000
16"	6140	10200	14000	17070	19640	24440	14000	17000	23500	26500	30000	35100
18"	7600	13220	17100	20400	23990	29460	17500	24000	30000	34000	38000	44500
20"	11140	18860	25010	31530	36310	42990	23500	32000	40000	44500	51500	59400
24"	20370	35870	48260	58820	71330	85080	38000	52000	61500	70000	79500	90000
30"	35920	63260	88430	109620	125290	156780	80000	110000	135000	155000	182000	200000

VALVE SIZE	FIRE-FLOW SEAT											
	SEAT UPSTREAM (SUS)						SEAT DOWNSTREAM (SDS)					
	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig
3"	550	620	700	750	800	910	688	806	910	975	1040	1183
4"	800	880	1040	1230	1420	1510	1000	1144	1352	1599	1846	1963
6"	1750	2000	2180	2350	2550	3000	2975	3400	3700	4000	4335	5100
8"	2700	3300	3900	4700	5100	5800	4590	5610	6630	8000	8670	9860
10"	4700	5600	6600	7400	8600	9300	7990	9520	11220	12600	14620	15810
12"	6700	8300	10800	12000	14160	17420	11390	14110	18360	20400	24070	29615
14"	9100	11300	13110	17280	20500	25320	14570	19210	22290	29380	34850	43040
16"	11900	16400	22580	27530	31670	39420	20230	27880	38390	46800	53840	67000
18"	17300	22100	28500	34000	40000	49100	29410	37570	48450	57800	68000	83470
20"	23700	34300	45470	57320	66020	78160	40290	58310	77300	97450	112230	132870
24"	36700	59800	80430	98030	118800	141800	55050	83720	112600	137250	166300	198500
30"	61200	89800	126320	156600	179000	224000	91800	125720	176850	219250	250600	313600

VALVE SIZE	METAL SEAT											
	SEAT UPSTREAM (SUS)						SEAT DOWNSTREAM (SDS)					
	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig	0-150 psig	285 psig	400 psig	500 psig	600 psig	700 psig
3"	900	1250	1400	1550								
4"	1200	1550	1700	1850								
6"	2800	3400	4300	5700								
8"	4100	5300	6600	8100								
10"	6800	9200	11300	14500								
12"	9100	13500	17400	23600	CONSULT FACTORY		CONSULT FACTORY					
14"	12100	17900	22600	29800								
16"	19100	26700	31400	38800								
18"	28700	37300	46400	53200								
20"	39200	53400	65100	81000								
24"	67000	83200	97600	109200								
30"	112000	131000	164000	193000								

Torques shown are for on/off applications and include sizing margins appropriate to normal liquid and gas applications. For severe services, or unusual fluids or slurries, consult factory.

II. HYDRODYNAMIC TORQUE VALUES

The chart below provides a C_t (Torque Coefficient) factor to aim in actuator sizing. The C_t factors are based on water at ambient temperature, and do not take in to account other factors such as: cavitation, flashing, noise, vibration, ect. These considerations should be addressed prior to hydrodynamic torque sizing.

The equation for hydrodynamic torque is:

$$Td = C_t \times \Delta P$$

ΔP = Pressure Drop in PSIG
C_t = Torque Coefficient Factor
Td = Dynamic Torque in Inch Pounds

VALVE SIZE	Disc Position in Degrees Open								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Ct = TORQUE COEFFICIENT FACTORS								
3"	0.94	1.23	2.00	3.13	4.76	7.14	10.64	12.99	12.66
4"	1.75	2.22	3.57	5.56	8.33	12.05	18.52	22.73	23.26
6"	3.70	5.88	10.42	17.54	30.30	52.63	78.74	76.92	83.33
8"	9.09	13.70	22.22	38.46	66.67	109.89	185.44	169.49	163.93
10"	15.15	23.26	38.46	66.67	112.36	185.19	303.03	263.16	270.27
12"	23.81	38.46	71.43	117.65	232.56	333.33	454.55	434.78	444.44
14"	33.33	50.00	83.33	144.93	238.10	400.00	625.00	588.24	666.67
16"	62.50	100.00	163.93	277.78	500.00	769.23	1162.79	1098.90	1176.47
18"	66.67	102.04	175.44	285.71	454.78	769.23	1204.82	1190.48	1234.57
20"	102.04	163.93	277.78	476.19	909.09	1315.79	1923.08	1785.71	2040.82
24"	158.73	250.00	454.55	769.23	1369.86	2083.33	3125.00	2777.78	2941.18
30"	357.14	500.00	1010.10	1694.92	3125.00	4545.45	6250.00	5882.35	6060.61

ANSI Class 600

I. SEATING and UNSEATING TORQUE VALUES

(All Torques are in Inch Pounds)

	SOFT SEAT					
	SEAT UPSTREAM (SUS)					
	0-150 psig	**500 psig**	**800 psig**	**1000 psig**	**1200 psig**	**1480 psig**
3"	240	620	720	749	878	1034
4"	341	690	893	1063	1248	1473
6"	710	1330	1861	2215	2601	3065
8"	1423	3079	4498	5444	6476	7714
10"	2371	5469	8124	9894	11825	14142
12"	3795	9357	14124	17302	20758	24929
14"	4860	12312	18699	22957	27600	33176

	SOFT SEAT					
	SEAT DOWNSTREAM (SDS)					
	0-150 psig	**500 psig**	**800 psig**	**1000 psig**	**1200 psig**	**1480 psig**
3"	290	629	760	943	1061	1250
4"	477	1035	1431	1550	1746	2061
6"	994	2196	2850	3101	3640	4291
8"	1992	4310	6297	7622	9066	10800
10"	3319	7657	11374	13852	16555	19800
12"	5313	13100	19774	24223	29075	34900
14"	6804	17237	26180	32140	38640	46446

Torques shown are for on/off applications and include sizing margins appropriate to normal liquid and gas applications. For severe services, or unusual fluids or slurries, consult factory.

FIRE-FLOW SEAT TORQUES : Consult Factory

METAL SEAT TORQUES : Consult Factory

II. HYDRODYNAMIC TORQUE VALUES

Consult Factory

BODY RATING

The charts below reflect the pressure/temperature ratings for carbon steel and stainless steel valves, in accordance with ANSI B16.34. The hydrostatic shell test is performed on the body at 150% of the cold working pressure (C.W.P. is defined as the pressure rating between -20 to 100 °F) and the hydrostatic seat test is performed on the disc and seat at 110% of the cold working pressure.

°F	Maximum Non-Shock Working Pressure–PSI					
	Carbon Steel			316SS		
ANSI Class	150	300	600	150	300	600
HYDROSTATIC SHELL TEST	450	1125	2225	425	1100	2175
HYDROSTATIC SEAT TEST	315	815	1630	305	800	1585
-20 to 100	285	740	1480	275	720	1440
200	260	675	1350	240	620	1240
300	230	655	1315	215	560	1120
400	200	635	1270	195	515	1030
500	170	600	1200	170	480	955
600	140	550	1095	140	450	905
650	125	535	1075	125	445	890
700	110	535	1065	110	430	865
750	95	505	1010	95	425	845
800	80	410	825	80	415	830
850				65	405	810
900				50	395	790
1000				20	365	725

°C	Maximum Non-Shock Working Pressure–Bars					
	Carbon Steel			316SS		
ANSI Class	150	300	600	150	300	600
HYDROSTATIC SHELL TEST	30	77	153	29	75	150
HYDROSTATIC SEAT TEST	22	56.9	112.4	20.9	54.6	109.3
-29 to 38	19.6	51.1	102.1	19.0	49.6	99.3
50	19.2	50.1	100.2	18.4	48.1	96.3
100	17.7	46.4	92.8	16.2	42.2	84.4
150	15.8	45.2	90.5	14.8	38.5	77.0
200	14.0	43.8	87.6	13.7	35.7	71.3
250	12.1	41.7	83.4	12.1	33.4	66.8
300	10.2	38.7	77.5	10.2	31.6	63.3
350	8.4	37.0	73.9	8.4	30.4	60.8
400	6.5	34.5	69.0	6.5	29.1	58.2
425	5.6	28.8	57.5	5.6	28.7	57.3
450				4.7	28.1	56.2
500				2.8	26.8	53.7
525				1.9	25.8	51.6

COMPONENTS RATING

The chart at right reflects the maximum temperature ratings for individual components of the Flowseal HPBFV.

Special care should be taken when specifying component materials for valves at elevated temperatures, especially metal seat valves.

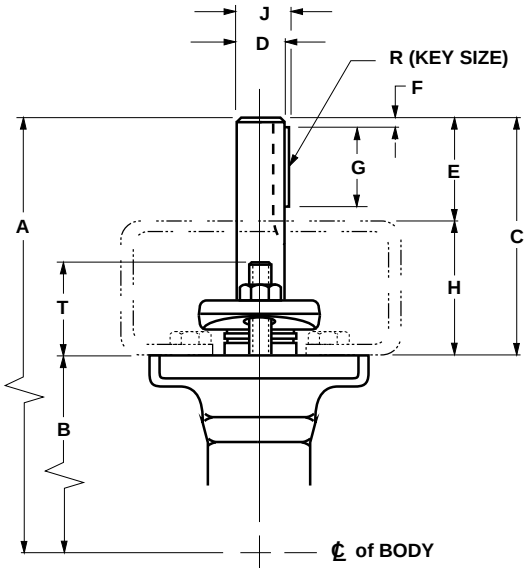
Consult factory if additional information is required regarding the suitability of components for specific pressure/temperature applications.

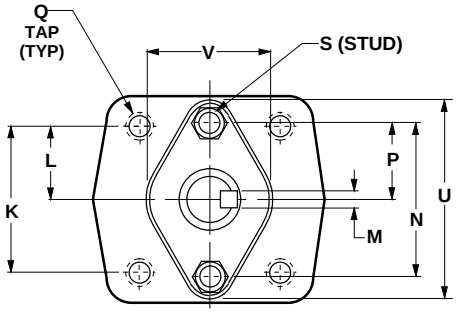
Descrition & Material	Temperature	
	°F	°C
Seat Seal (Soft Seated)		
TFE	-100 to 400	-73 to 204
RTFE	-100 to 500	-73 to 260
UHMWPE	-100 to 200	-73 to 93
Seat Seal (Fire-Flow)		
TFE/Inconel	-100 to 400	-73 to 204
RTFE/Inconel	-100 to 500	-73 to 260
Seat Seal (Metal Seats)		
Inconel 718	-100 to 1150	-73 to 621
316 Stainless Steel	-100 to 1000	-73 to 538
Seat O-Ring		
Silicone (Standard with RTFE)	-100 to 500	-73 to 260
Viton (Standard with TFE)	-50 to 400	-46 to 204
Stem Packing		
TFE	-100 to 500	-73 to 260
Graphite	-100 to 1150	-73 to 621
Shaft		
17-4PH H1150	-100 to 800	-73 to 427
17-4PH H1150M	-100 to 800	-73 to 427
316 Stainless Steel	-100 to 1150	-73 to 621
K-Monel 500	-100 to 1150	-73 to 621
Inconel 718	-100 to 1150	-73 to 621
Bearings		
TFE/Fiberglass Composite	-100 to 500	-73 to 260
RTFE/316 Stainless Steel	-100 to 500	-73 to 260
Bronze	-100 to 750	-73 to 339
Steel	-100 to 1150	-73 to 621
316 Stainless Steel	-100 to 1000	-73 to 538
Disc Treatment		
Electroless Nickel Plating	-100 to 750	-73 to 399
Stellite	-100 to 1150	-73 to 621
Malcomizing	-100 to 900	-73 to 482

Material Descriptions

MATERIAL FORM	DESCRIPTION	GENERIC NAME	SPECIFICATION	GRADE	CONDITIONS / COMMENTS
CASTING	A216 WCB	CARBON STEEL	ASTM A 216	WCB	NORMALIZE & TEMPER
	A351 CF8M	STAINLESS STEEL 316	ASTM A 351	CF8M	SOLUTION ANNEAL
	A351 CN7M	ALLOY 20	ASTM A 351	CN7M	SOLUTION ANNEAL
	A352 LCB	CARBON STEEL TO -50F	ASTM A 352	LCB	QUENCH & TEMPER
	MIL-B-24480	ALUMINUM BRONZE	MIL-B-24480A (SH)		
	QQ-N-288	MONEL	QQ-N-288 / AMO 3	COM P. A	
FORGING	A105	CARBON STEEL	ASTM A 105		
	A182 F316	STAINLESS STEEL 316	ASTM A 182	F316	
	A350 LF2	CARBON STEEL TO -50F	ASTM A 350	LF2	
	QQ-N-281	MONEL	QQ-N-2810 / AMO 2	CLASS A FORM 2	ANNEAL
PLATE & SHEET	A240 316	STAINLESS STEEL 316	ASTM A 240	316	
	A240 321	STAINLESS STEEL 321	ASTM A 240	321	
	A515 70	CARBON STEEL	ASTM A 515	70	
	A516 70	CARBON STEEL TO -50F	ASTM A 516	70	NORMALIZE
	B127	MONEL	ASTM B 127		
	B463 20CB	ALLOY 20	ASTM B 463		
	INC 718	INCONEL 718	ASTM B 670		ANNEAL / AGE HARDEN
BARSTOCK	NITR 50	NITRONIC 50	ASTM A 479	XM19	
	A479 316	STAINLESS STEEL 316	ASTM A 479	316	
	17- 4 H1075	17- 4PH	ASTM A 564	630	H1075
	17- 4 H1150	17- 4PH	ASTM A 564	630	H1150
	B473 20CB	ALLOY 20	ASTM B 473		
	QQ-N-281	MONEL	QQ-N-2810 /AMO 2	CLASS A FORM 1	ANNEAL
	INC 718	INCONEL 718	ASTM A 637	718	
	C.S.	CARBON STEEL	AS AVAILABLE	VARIOUS	LOW C (1018) NON-PRESS. PARTS
	18-8 S.S.	STAINLESS STEEL	AS AVAILABLE	VARIOUS	300 SERIES (304) NON-PRESS. PARTS
TUBULAR	A269	STAINLESS STEEL	ASTM A 269	VARIOUS	300 SERIES SEAMLESS TUBING
	A312 316	STAINLESS STEEL 316	ASTM A 312	316	PIPE
	A511	STAINLESS STEEL	ASTM A 511	VARIOUS	300 SERIES SEAMLESS TUBING
BOLTING	A193-87	ALLOY STEEL	ASTM A 193	B7	
	A193-B8M	STAINLESS STEEL 316	ASTM A 193	B8M	
	ALY STL	ALLOY STEEL	SAE	5	BRACKET & ACCESSORY BOLTING
	18-8 S.S.	STAINLESS STEEL			300 SERIES STAINLESS STEEL

Valve Mounting Pad Dimensions





SIZE	CLASS	SERIES	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V
2	150	G	7.59	4.25	3.34	.500	1.15	.15	.88	2.19	.576	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x .88	5/16-18	1.63	3.13	1.38
	300	G	7.59	4.25	3.34	.500	1.15	.15	.88	2.19	.576	2.25	1.13	.188	2.28	1.19	3/8-16	3/16 x .88	5/16-18	1.63	3.13	1.38
2½	150	G	7.59	4.25	3.34	.500	1.15	.15	.88	2.19	.576	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x .88	5/16-18	1.63	3.13	1.38
	300	G	7.59	4.25	3.34	.500	1.15	.15	.88	2.19	.576	2.25	1.13	.188	2.28	1.19	3/8-16	3/16 x .88	5/16-18	1.63	3.13	1.38
3	150	G	8.60	5.00	3.60	.625	1.41	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
	300	G	8.60	5.00	3.60	.625	1.41	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
	600	G	8.60	5.00	3.60	.625	1.41	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
3½	150	G	8.72	5.12	3.60	.625	1.41	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
	300	G	8.72	5.12	3.60	.625	1.41	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
4	150	G	9.42	5.75	3.67	.625	1.48	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
	300	G	9.42	5.75	3.67	.625	1.48	.15	1.19	2.19	.705	2.25	1.13	.188	2.38	1.19	3/8-16	3/16 x 1.19	5/16-18	1.63	3.13	1.38
	600	G	9.81	6.00	3.81	.750	1.62	.15	1.25	2.19	.854	2.25	1.13	.250	2.38	1.19	3/8-16	1/4 x 1.25	5/16-18	1.88	3.13	1.38
5	150	G	10.28	6.47	3.81	.750	1.62	.15	1.25	2.19	.854	2.25	1.13	.250	2.38	1.19	3/8-16	1/4 x 1.25	5/16-18	1.63	3.13	1.38
	300	G	10.28	6.47	3.81	.750	1.62	.15	1.25	2.19	.854	2.25	1.13	.250	2.38	1.19	3/8-16	1/4 x 1.25	5/16-18	1.63	3.13	1.38
6	150	G	10.81	7.00	3.81	.750	1.62	.15	1.25	2.19	.854	2.25	1.13	.250	2.38	1.19	3/8-16	1/4 x 1.25	5/16-18	1.63	3.13	1.38
	300	G	10.81	7.00	3.81	1.000	1.62	.15	1.25	2.19	1.152	2.25	1.13	.375	2.38	1.19	3/8-16	3/8 x 1.25	5/16-18	1.63	3.13	1.88
	600	G	11.71	7.62	4.09	1.250	1.90	.15	1.50	2.19	1.409	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 1.50	3/8-16	1.63	3.88	2.25
8	150	G	11.94	8.13	3.81	1.000	1.62	.15	1.25	2.19	1.152	2.25	1.13	.375	2.38	1.19	3/8-16	3/8 x 1.25	5/16-18	1.63	3.13	1.88
	300	G	12.22	8.13	4.09	1.250	1.90	.15	1.50	2.19	1.409	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 1.50	3/8-16	1.88	3.88	2.25
	600	G	13.97	9.13	4.84	1.500	2.65	.15	2.25	2.19	1.663	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 2.25	3/8-16	1.88	3.88	2.50
10	150	G	12.97	8.88	4.09	1.250	1.90	.15	1.50	2.19	1.409	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 1.50	3/8-16	1.63	3.88	2.50
	300	G	14.22	9.38	4.84	1.500	2.65	.15	2.25	2.19	1.663	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 2.25	3/8-16	1.88	3.88	2.50
	600	H	17.90	11.00	6.90	1.750	2.90	.15	2.50	4.00	1.964	4.25	2.13	.500	3.00	1.50	1/2-13	1/2 x 2.50	3/8-16	2.38	3.88	2.50
12	150	G	15.47	10.63	4.84	1.500	2.65	.15	2.25	2.19	1.663	3.25	1.63	.375	3.00	1.50	3/8-16	3/8 x 2.25	3/8-16	1.63	3.88	2.50
	300	G	17.90	11.00	6.90	1.750	2.90	.15	2.50	4.00	1.964	4.25	2.13	.500	3.00	1.50	1/2-13	1/2 x 2.50	3/8-16	1.88	3.88	2.50
	600	H	20.26	12.63	7.63	2.250	3.63	.25	3.00	4.00	2.561	5.00	2.50	.750	4.00	2.00	3/4-10	3/4 x 3.00	1/2-13	2.50	5.00	3.75

Installation Instructions

VALVE DESCRIPTION

1. The Flowseal High Performance Butterfly Valve is available in two bodystyles: Wafer (flangeless) and Lug (single flange).

VALVE DESIGN

1. The Flowseal High Performance Butterfly Valve features a double offset (or, double eccentric) shaft design to minimize seat abrasion and lower torque. This double offset design allows the disc to lift off and "cam"away from the seat as it rotates open.
2. The Flowseal valve always rotates clockwise to close (when viewed from above) and counterclockwise to open.
3. The valve body has an overtravel stop which prevents the disc from over rotating into the wrong quadrant. This stop is not to be used as a disc position stop; if the disc contacts the overtravel stop, this means it has rotated beyond the seat.
4. The Flowseal valve is bi-directional, but the preferred installation position is with the seat in the upstream position (SUS). Note the arrow on the metal tag attached to the valve body.

SAFETY PRECAUTIONS

1. Be sure the line is depressurized and drained.
2. Be sure of the pipeline media. Proper care should be taken for protection against toxic and/or flammable fluids.
3. Never install the valve without an operator (manual or automatic) already attached to the valve shaft.
4. Never remove the operator from the valve while the valve is in the pipeline under pressure.
5. Always be sure that the disc is in the full-closed position before installing the valve.
6. Take care in handling the valve; if you treat it like a machine, it will operate like a machine...if you treat it like a piece of pipe, it may work like a piece of pipe.

FLANGE COMPATIBILITY

The Flowseal valve is designed to fit between flanges as follows:

ANSI Class 150	2" to 24"
MSS SP-44 Class 150	30" to 48"
ANSI Class 300	2" to 24"
MSS SP-44 Class 300	30"
ANSI Class 600	2" to 16"

GASKET COMPATIBILITY

The Flowseal valve is designed to accomodate the use of standard fiber gaskets (such as non-asbestos, flexible graphite, asbestos or equivalent gasket materials) of 1⁄16" or less, meeting the dimensional requirements of ANSI B16.21–1978. Thick elastomeric gaskets are not recommended. Metallic wound (Flexitallic) gaskets may also be used.

PIPE SCHEDULE COMPATIBILITY

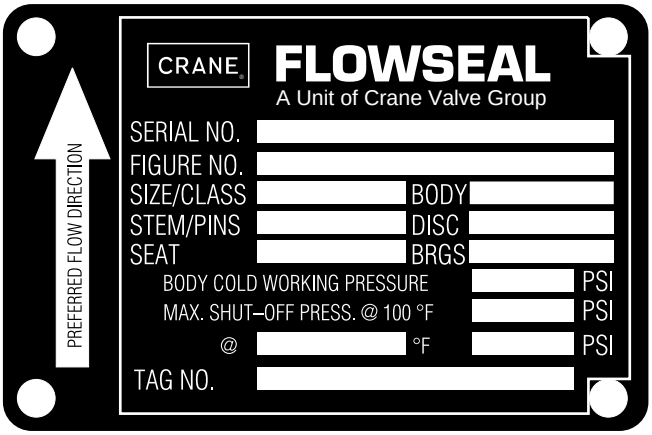
The Flowseal valve is designed to allow the disc edge to rotate into the open position without interference with the pipeline I.D. in the following pipe schedules:

SIZE	ANSI 150	ANSI 300	ANSI 600
2" – 12"	SCH 80	SCH 80	SCH 120
14" – 24"	SCH 40	SCH 80	SCH 120
30"	SCH 30	SCH 80	
36" – 42"	STD WT		
48"	XS		

PRODUCT IDENTIFICATION

1. Every Flowseal valve has a metal identification tag attached to the valve body. Information includes the figure number, the size and pressure class, the materials of construction, and the operating pressures and temperatures.

2. Every Flowseal valve is hydrostatically tested before it is shipped. The metal tag also includes a serial number; this number, unique for each valve, is recorded by the Flowseal Quality Control Department along with the test results and material certification data, for individual traceability and verification of every valve produced.

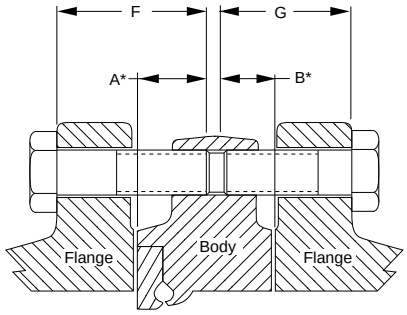


UNPACKING AND STORAGE INSTRUCTIONS

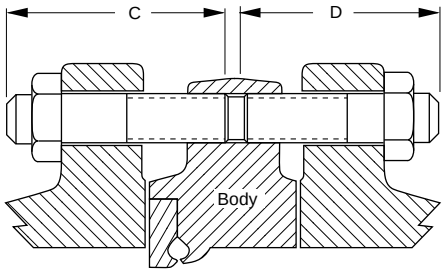
1. Check the packing list against the valve received to verify that the quantities, sizes and materials are correct.
2. Check to make sure that the valve and operator were not damaged during shipment.
3. If the valve is to be stored before being installed, it should be protected from harsh environmental conditions.
4. Store the valve with the disc in the closed position to protect the sealing edge and the seat.
5. Keep the valve in a clean location, away from dirt, debris and corrosive materials.
6. Keep the valve in a dry area with the flange protectors attached.
7. Keep the valve in a cool location if possible, out of direct sunlight.

BOLTING DIMENSIONS

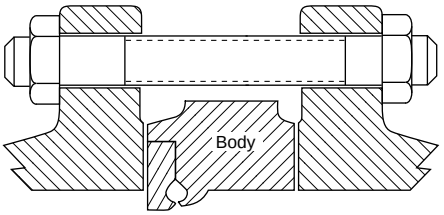
LUG BODY
HEX HEAD MACHINE BOLTS



LUG BODY
STUDS & NUTS



WAFER BODY
STUDS & NUTS



ANSI Class 150 2" – 24"
MSS SP-44 Class 150 30" – 48"

			LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
VALVE SIZE	VALVE SERIES	THREAD SIZE	QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG
			A	A	B	B	C	C	D	D	F	F	G	G	E	E
2"	G	5/8-11	4	.940	4	.570	4	2.50	4	2.12	4	1.75	4	1.50	4	5.00
2 1/2"	G	5/8-11	4	.960	4	.680	4	2.62	4	2.38	4	2.00	4	1.62	4	5.25
3"	G	5/8-11	4	1.139	4	.725	4	3.00	4	3.00	4	1.88	4	1.62	4	6.00
4"	G	5/8-11	8	1.071	8	.745	8	3.00	8	3.00	8	2.00	8	1.62	8	6.00
5"	G	3/4-10	8	1.220	8	.790	8	3.12	8	2.62	8	2.25	8	1.75	8	6.00
6"	G	3/4-10	8	1.401	8	.839	8	3.50	8	2.75	8	2.38	8	1.75	8	6.50
8"	G	3/4-10	8	1.492	8	.948	8	3.75	8	3.00	8	2.50	8	2.00	8	6.50
10"	G	7/8-9	12	1.752	12	1.000	12	4.50	12	3.25	12	2.62	12	2.38	12	7.50
12"	G	7/8-9	12	2.147	12	1.025	12	4.50	12	3.25	12	3.38	12	2.25	12	8.00
14"	G	1-8	12	2.330	12	1.210	12	5.00	12	3.75	12	3.62	12	2.62	12	9.00
16"	G	1-8	16	2.648	16	1.270	16	5.25	16	4.00	16	4.00	16	2.62	16	10.00
18"	G	1 1/8-8	16	2.723	16	1.645	16	5.50	16	4.50	16	4.25	16	3.12	16	10.50
20"	G	1 1/8-8	16	3.396	20	1.434	16	6.25	20	4.50	16	5.12	20	3.19	16	11.00
	G	1 1/8-8	4**	2.325	–	–	4**	5.25	–	–	4**	4.06	–	–	8**	5.25
24"	G	1 1/4-8	20	3.690	20	2.250	20	6.75	20	5.25	20	5.50	20	4.12	20	12.50
30"	H	1 1/4-8	24	3.471	24	3.159	24	7.75	24	7.50	24	6.47	24	6.15	24	15.25
	H	1 1/4-8	4**	1.908	4**	1.592	4**	6.00	4**	5.75	4**	4.91	4**	4.59	8**	6.00
36"	H	1 1/2-8	28	3.760	28	3.740	28	9.00	28	9.00	28	7.19	28	5.25	28	18.25
	H	1 1/2-8	4**	1.760	4**	1.740	4**	6.75	4**	6.75	4**	5.25	4**	5.25	8**	6.75
42"	H	1 1/2-8	32	4.160	32	4.090	32	9.75	32	9.50	32	6.62	32	4.25	32	19.25
	H	1 1/2-8	4**	1.782	4**	1.718	4**	7.25	4**	7.25	4**	4.25	4**	4.25	8**	7.25
48"	H	1 1/2-8	40	5.520	40	4.850	40	11.75	40	11.00	40	9.83	40	9.16	40	21.00
	H	1 1/2-8	4**	2.815	4**	2.190	4**	7.75	4**	7.75	4**	7.12	4**	6.50	8**	7.75

Length of machine bolts based on:
1. Gasket thickness of 0.06 inches.
2. Minimum flange thickness of weld neck flanges per ANSI B16.5.

Every effort is made to provide accurate information, but no liability for claims arising from erroneous data will be accepted by Flowseal.

BOLTING DIMENSIONS

ANSI Class 300 2" – 24"
MSS SP-44 Class 300 30"

VALVE SIZE	VALVE SERIES	THREAD SIZE	LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
			QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH
			A	A	B	B	C	C	D	D	F	F	G	G	E	E
2"	G	5/8-11	8	.940	8	.570	8	2.25	8	2.62	8	1.50	8	2.00	8	5.25
2 1/2"	G	5/8-11	8	.970	8	.670	8	2.75	8	3.00	8	1.75	8	2.00	8	5.75
3"	G	3/4-10	8	1.034	8	.826	8	3.00	8	3.00	8	2.12	81	.75	8	6.00
4"	G	3/4-10	8	1.196	8	.870	8	3.50	8	3.25	8	2.50	8	2.00	8	6.50
5"	G	3/4-10	8	1.220	8	.790	8	5.25	8	3.62	8	2.25	8	2.75	8	7.00
6"	G	3/4-10	12	1.301	12	.929	12	3.75	12	3.50	12	2.75	12	2.25	12	7.00
8"	G	7/8-9	12	1.702	12	1.128	12	4.50	12	4.00	12	3.25	12	2.75	12	8.25
10"	G	1-8	16	1.867	16	1.300	16	5.00	16	4.50	16	3.25	16	3.12	14	9.25
	G	1-8	–	–	–	–	–	–	–	–	–	–	–	–	4**	5.00
12"	G	1 1/8-8	16	2.057	16	1.475	16	5.50	16	5.00	16	4.00	16	3.38	12	10.00
	G	1 1/8-8	–	–	–	–	–	–	–	–	–	–	–	–	8**	5.25
14"	H	1 1/8-8	16	2.442	16	2.118	16	6.00	16	5.75	16	4.62	16	4.25	16	11.50
	H	1 1/8-8	4**	1.608	4**	1.267	4**	5.25	4**	4.75	4**	3.75	4**	3.44	8**	5.25
16"	H	1 1/4-8	16	2.562	16	2.628	16	6.50	16	6.50	16	4.88	16	4.88	16	13.00
	H	1 1/4-8	4**	1.538	4**	1.588	4**	5.25	4**	5.25	4**	3.88	4**	4.25	8**	5.25
18"	H	1 1/4-8	20	2.870	20	2.890	20	7.00	20	7.00	20	5.25	20	5.25	20	14.00
	H	1 1/4-8	4**	1.657	4**	1.437	4**	5.50	4**	5.50	4**	4.00	4**	3.88	8**	5.50
20"	H	1 1/4-8	20	3.184	20	3.006	20	7.50	20	7.25	20	5.69	20	5.69	20	14.50
	H	1 1/4-8	4**	1.681	4**	1.750	4**	5.75	4**	5.50	4**	4.19	4**	4.00	8**	5.75
24"	H	1 1/2-8	20	3.560	20	3.510	20	8.25	20	8.25	20	6.31	20	6.25	20	16.50
	H	1 1/2-8	4**	1.800	4**	1.750	4**	6.25	4**	6.25	4**	4.56	4**	4.50	8**	6.25
30"	H	1 3/4-8	24	4.331	24	4.429	24	10.25	24	10.50	24	7.88	24	7.88	24	20.50
	H	1 3/4-8	4**	2.039	4**	2.071	4**	8.00	4**	8.00	4**	5.44	4**	5.47	8**	8.00

ANSI Class 600 3" – 14"

VALVE SIZE	VALVE SERIES	THREAD SIZE	LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
			QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH
			A	A	B	B	C	C	D	D	F	F	G	G	E	E
3"	G	3/4-10	8	1.034	8	1.026	8	3.50	8	3.50	8	2.25	8	2.38	8	7.00
4"	G	7/8-9	8	1.274	8	1.165	8	3.50	8	3.25	8	2.75	8	2.75	8	7.75
6"	G	1-8	12	1.274	12	1.306	12	4.75	12	4.75	12	3.25	12	3.25	12	9.50
8"	G	1 1/8-8	12	1.794	12	1.795	12	5.75	12	5.75	12	4.12	12	4.12	12	11.50
10"	H	1 1/4-8	12	2.495	12	2.000	12	6.75	12	6.25	12	5.00	12	4.50	12	13.00
	H	1 1/4-8	4**	1.375	4**	2.000	4**	5.50	4**	6.25	4**	3.88	4**	4.50	8**	6.25
12"	H	1 1/4-8	16	2.683	16	2.697	16	7.00	16	7.00	16	5.38	16	5.38	16	14.00
	H	1 1/4-8	4**	1.325	4**	1.765	4**	5.25	4**	6.00	4**	4.00	4**	4.38	8**	6.00
14"	H	1 3/8-8	16	2.994	16	2.996	16	7.50	16	7.50	16	CF	16	CF	16	15.00
	H	1 3/8-8	4**	1.506	4**	1.869	4**	6.00	4**	6.50	4**	CF	4**	CF	8**	6.50

* Bolt lengths “A” & “B” are from face of valve body to minimum depth in lug. Flange & gasket thickness must be added to calculate minimum bolt length.

** Special length required for tapped blind holes on either side of the valve shaft at the top and bottom ends of the valve body.

PRE – INSTALLATION PROCEDURE

1. Remove the protective face covers from the valve.
2. Inspect the valve to be certain the waterway is free from dirt and foreign matter. Be certain the adjoining pipeline is free from any foreign material such as rust and pipe scale or welding slag that could damage the seat and disc sealing surfaces.
3. Actuators should be mounted on the valve prior to installation to facilitate proper alignment of the disc in the valve seat.
4. The valve should be in the **closed position**. Make sure the open and closed positions of the actuator correspond to the counter-clockwise to open direction of rotation of the valve.
5. Cycle the valve to the fully open position, then back to the fully closed position, checking the actuator travel stop settings for proper disc alignment.
6. Check the valve identification tag for valve class, materials, and operating pressure to be sure they are correct for the application.

WARNING! Personal injury or property damage may result if the valve is installed where service conditions could exceed the valve ratings.

7. Check the flange bolts or studs on both sides of the valve for proper size, threading, and length.

VALVE INSTALLATION PROCEDURE

The Flowseal High Performance Butterfly Valve can be installed in the pipeline with the shaft in the vertical, horizontal, or other intermediate position. Based on applications experience, however, in media with concentrations of solid or abrasive particles or media subject to solidification buildup, valve performance and service life will be enhanced by mounting the valve with the shaft in the horizontal position.

All Flowseal valves are bi-directional (in some instances, modifications may be required to operate this arrangement for dead end service) and can be mounted in the pipeline in either flow direction; however, the preferred flow direction for all seat styles and materials is with the seat retainer ring located upstream (sus) to provide maximum seat protection.

1. For Wafer style (flangeless) valves:
   a. Loosely install the lower flange bolts to form a cradle between the flanges. See Figure 1.
   b. Noting the flow direction arrow on the tag, place the valve and flange gaskets between the flanges, making sure the arrow on the tag points in the direction of the flow.
   c. Install the remaining flange bolts, shifting the valve as necessary to permit the bolts to pass by or through the valve body.
2. For Lug style (single flange) valves:
   a. Noting the flow direction arrow on the tag, place the valve between the flanges, making sure the arrow on the tag points in the direction of the flow.
   b. Install the lower flange bolts loosely, leaving space for the flange gaskets.
   c. After inserting the flange gaskets, install the remaining bolts.
3. Using the sequence shown in Figure 2, tighten the flange bolts evenly to assure uniform gasket compression.

Caution: The Flowseal valve should be centered between the flanges and gaskets to prevent damage to the disc edge and shaft as a result of the disc striking the flange, gasket, or pipe.

4. If an actuator is to be used, air hoses or electricity should be connected to the unit as specified by the actuator manufacturer.
5. The valve is now ready for operation.

***Remember:* Install the valve with the disc in the full-closed position!**

Figure 1

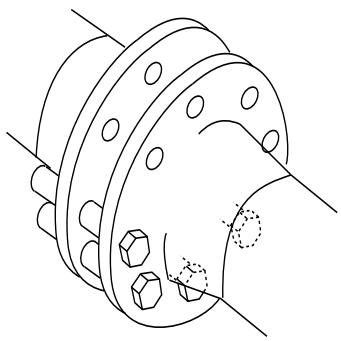


Figure 2