
SERIES 3W/3L

RESILIENT SEATED BUTTERFLY VALVES

TECHNICAL SALES MANUAL



Bray[®]

BRAY.COM

THE HIGH PERFORMANCE COMPANY

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TECHNICAL DATA

OVERVIEW

The Bray Series 3W/3L features an optimized molded-in seat, a profiled disc sealing edge, and stem bearings. These features provide optimized performance and efficient automation solutions for a long cycle life without compromising bubble tight sealing.

SPECIFICATIONS

Size Range	NPS 2 to 24	
	DN 50 to 600	
Temperature Range	-20°F to 250°F	
	-29°C to 121°C	
Maximum Operating Pressure	High Pressure Disc	250 psi 17.2 bar
	Standard Disc	NPS 2-12 (DN 50-300) 175 psi (12 bar)
		NPS 14-24 (DN 350-600) 150 psi (10.3 bar)
	Low Pressure Disc	50 psi 3.4 bar
Body Style	3W - One-piece wafer	
	3L - One-piece lug	
Leakage Rate	Bubble tight	
Vacuum Rating	1 to 0.001 micron	

DESIGN STANDARDS

Valve Design	API 609 Category A
	EN 593
Top Flange	MSS SP-67
	ISO 5211
Flange Drilling	ASME B16.5 Class 125/150
	EN 1092-1 PN 6 10 16
	JIS 10K
	AS 2129 Table D & E
Seat Tightness Test	API 598
	EN 12266-1
	ISO 5208
	MSS SP-61
Face-to-Face	API 609
	EN 558 Series 20



MATERIAL OPTIONS¹

Body	Cast Iron
	Ductile Iron
Disc	Nylon 11 Coated Ductile Iron
	316 Stainless Steel
	Aluminum Bronze
	Duplex Stainless Steel 4A
Stem	416 Stainless Steel
	Stainless Steel (EN 1.4057)
Seat	EPDM
	BUNA-N
	HT-EPDM

NOTES

¹Materials available in ASME and EN grades

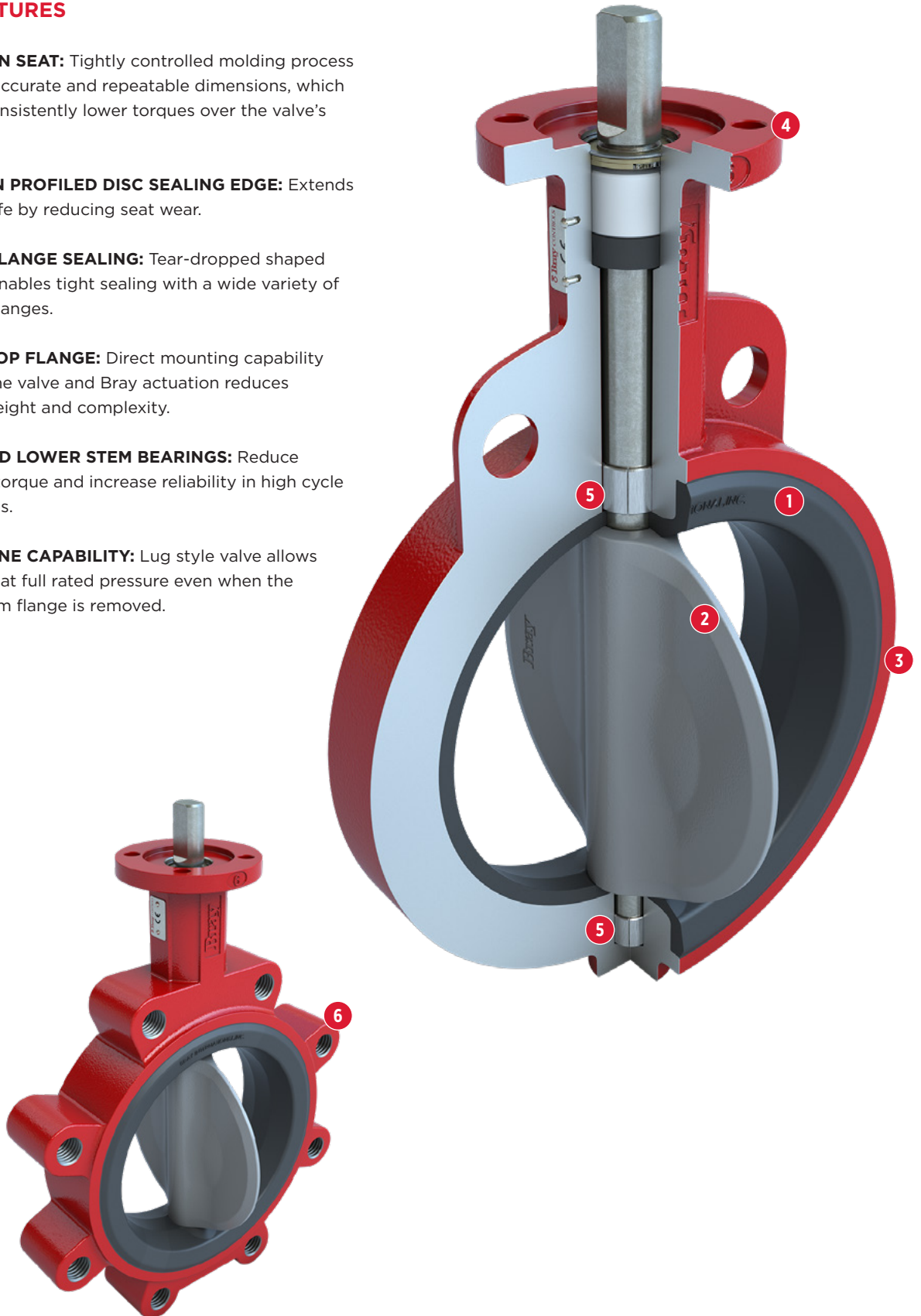
CERTIFICATIONS AND APPROVALS

Certifications	CE/PED
	ANSI/NSF 61 & 372
Approvals	EC 1935
	FDA Food Contact Approved
	ABS Type
	Bureau Veritas Type

FEATURES & BENEFITS

DESIGN FEATURES

- 1 MOLDED-IN SEAT:** Tightly controlled molding process produces accurate and repeatable dimensions, which leads to consistently lower torques over the valve's lifetime.
- 2 PRECISION PROFILED DISC SEALING EDGE:** Extends the valve life by reducing seat wear.
- 3 ROBUST FLANGE SEALING:** Tear-dropped shaped seat face enables tight sealing with a wide variety of industrial flanges.
- 4 ISO 5211 TOP FLANGE:** Direct mounting capability between the valve and Bray actuation reduces package height and complexity.
- 5 UPPER AND LOWER STEM BEARINGS:** Reduce operating torque and increase reliability in high cycle applications.
- 6 END OF LINE CAPABILITY:** Lug style valve allows for sealing at full rated pressure even when the downstream flange is removed.



VALVE PART NUMBERING SYSTEM (ASME)

Select one code from each category to build a complete valve order number.

3X-XXXX-1XXXX-XXX

SERIES 3X		SIZE XXXX		BASE NUMBER 1XXXX		TRIM ¹ XXX			
Code	Body Style	Code	NPS	DN	Code	Description	Code	Item	Material
3W	Wafer	0200	2	50	11010	NPS 2-12 rated to 175 psi (12 bar)	119	Body	Cast Iron, A126 Class B
3L	Lug	0250	2½	65		NPS 14-24 rated to 150 psi (10.3 bar)		Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12
		0300	3	80				Stem	416 Stainless Steel, A582
		0400	4	100	11011	NPS 2-24 rated to 50 psi (3.4 bar)		Seat	EPDM
		0500	5	125	13000	NPS 2-24 rated to 250 psi (17.2 bar)	169	Body	Cast Iron, A126 Class B
		0600	6	150				Disc	316 Stainless Steel, A351 CF8M
		0800	8	200				Stem	416 Stainless Steel, A582
		1000	10	250				Seat	EPDM
		1200	12	300			390	Body	Ductile Iron, A536 Gr. 65-45-12
		1400	14	350				Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12
		1600	16	400				Stem	416 Stainless Steel, A582
		1800	18	450				Seat	EPDM
		2000	20	500			375	Body	Ductile Iron, A536 Gr. 65-45-12
		2400	24	600				Disc	316 Stainless Steel, A351 CF8M
								Stem	416 Stainless Steel, A582
								Seat	EPDM

NOTES:

¹ For a complete list of standard materials and descriptions, refer to MATERIALS OF CONSTRUCTION. Other materials are available, please contact Bray for additional information.

EXAMPLE

3L-1200-11010-390

- > Lug body
- > 12 inch (300 mm)
- > 175 psi (12 bar) rated valve
- > Trim 390

VALVE PART NUMBERING SYSTEM (EN)

Select one code from each category to build a complete valve order number.

3X-XXXX-1XXXX-XXX

SERIES 3X		SIZE XXXX		BASE NUMBER 1XXXX		TRIM ¹ XXX		
Code	Body Style	Code	DN	Code	Description	Code	Item	Material
3W	Wafer	M050	50	1100U	DN50 - 300 rated to 12 bar	D61	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
3L	Lug	M065	65		DN350 - 600 rated to 10.3 bar		Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
		M080	80		Multi-drilled flanges		Stem	Stainless Steel, EN 1.4057
		M100	100				Seat	EPDM
		M125	125	11034	DN50 - 300 rated to 12 bar	D62	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
		M150	150		DN350 - 600 rated to 10.3 bar		Disc	Nylon Coated Ductile Iron
		M200	200		ISO PN10 flanges		Stem	Stainless Steel, EN 1.4057
		M250	250				Seat	EPDM
		M300	300	13035	DN50 - 600 rated to 17.2 bar, ISO PN16 flanges	D63	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
		M350	350				Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
		M400	400				Stem	Stainless Steel, EN 1.4057
		M450	450				Seat	BUNA-N
		M500	500			D64	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
		M600	600				Disc	Nylon Coated Ductile Iron
							Stem	Stainless Steel, EN 1.4057
							Seat	BUNA-N
						1JN	Body	Cast Iron, EN GJL-250 - EN 5.1301 (GG 25)
							Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
							Stem	Stainless Steel, EN 1.4057
							Seat	EPDM
						1JM	Body	Cast Iron, EN GJL-250 - EN 5.1301 (GG 25)
							Disc	Nylon Coated Ductile Iron
							Stem	Stainless Steel, EN 1.4057
							Seat	EPDM
						1JR	Body	Cast Iron, EN GJL-250 - EN 5.1301 (GG 25)
							Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
							Stem	Stainless Steel, EN 1.4057
							Seat	BUNA-N
						1JQ	Body	Cast Iron, EN GJL-250 - EN 5.1301 (GG 25)
							Disc	Nylon Coated Ductile Iron
							Stem	Stainless Steel, EN 1.4057
							Seat	BUNA-N

NOTES:

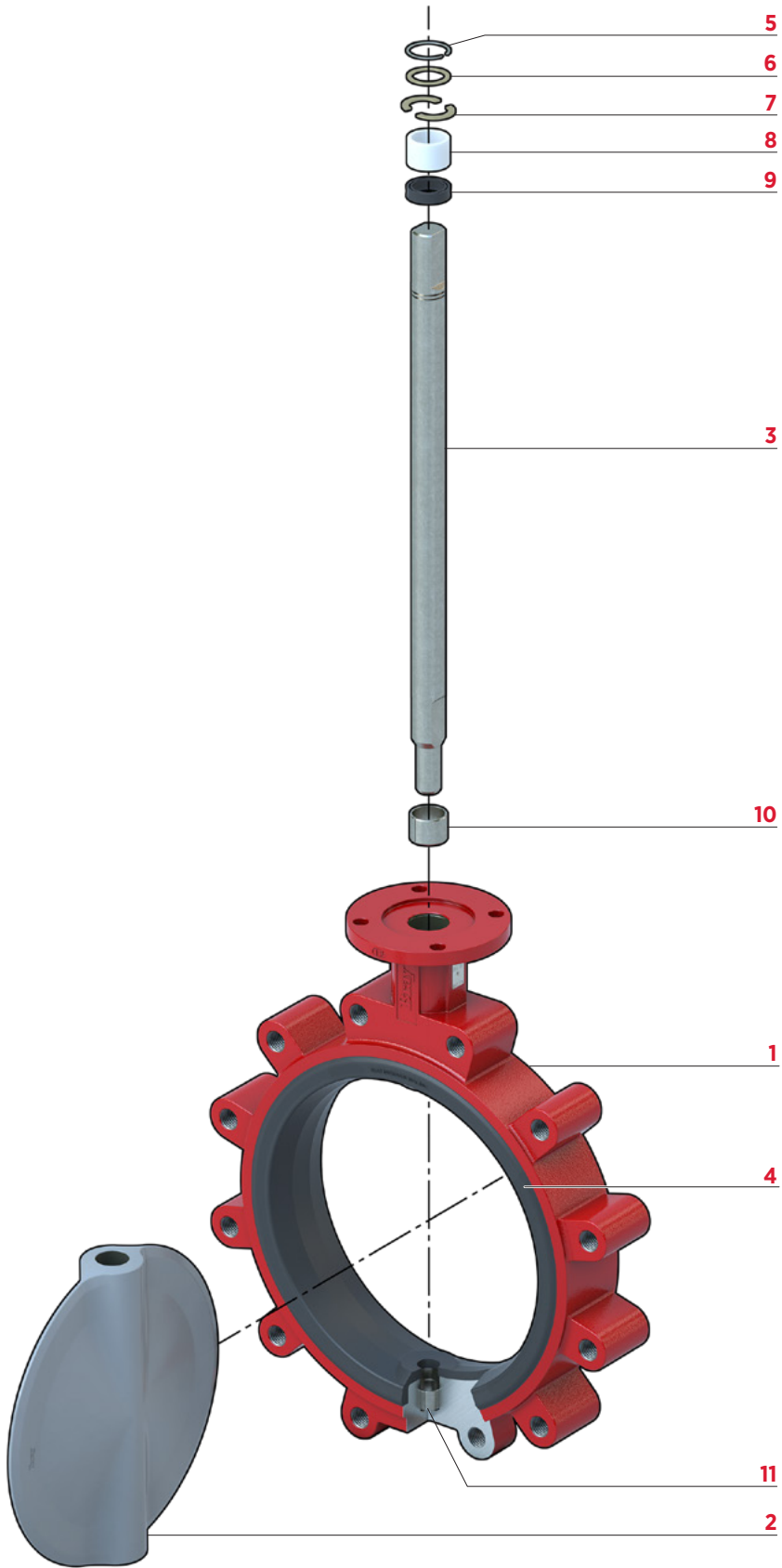
¹ For a complete list of standard materials and descriptions, refer to MATERIALS OF CONSTRUCTION. Other materials are available, please contact Bray for additional information.

EXAMPLE

3L-M050-11034-D61

- > Lug body
- > DN 50
- > PN10 flange drilling
- > Trim D61

PARTS CALLOUT



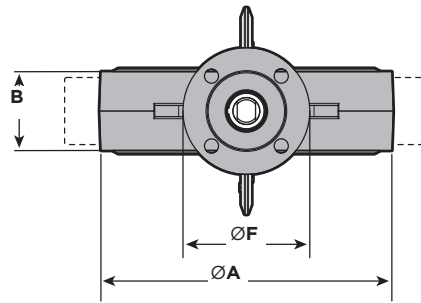
PARTS LIST AND MATERIAL SPECIFICATIONS

ITEM	DESCRIPTION	MATERIAL	
		ASME	EN Grade
1	Body	Cast Iron, A126 Class B	Cast Iron – EN 5.1301
		Ductile Iron, A536 GR. 65-45-12	Ductile Iron – EN 5.3106
2	Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12	Stainless Steel – EN 1.4408
		316 Stainless Steel, A351 CF8M	
3	Stem	416 Stainless Steel, A582	Stainless Steel – EN 1.4057
4	Seat	EPDM	-
		BUNA-N	
		HT-EPDM	
5	Retaining Ring	Stainless Steel	-
6	Thrust Washer	Brass, Stainless Steel	-
7	Split Ring	Brass	-
8	Stem Bushing	Acetal	-
9	Stem Seal	BUNA-N	-
10	Upper Stem Bearing ³	Steel/Bronze + PTFE Self-lubricating	-
11	Lower Stem Bearing ³	Steel/Bronze + PTFE Self-lubricating	-
12	Key (14" and up)	Stainless Steel	-

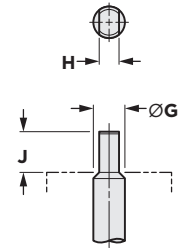
NOTES

- 1 Material specifications provided for reference only, and are subject to change without notice.
- 2 Additional materials available upon request.
- 3 Stainless Steel/TFE available.

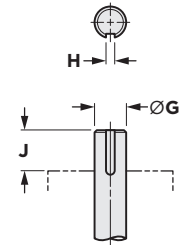
SERIES 3W/3L



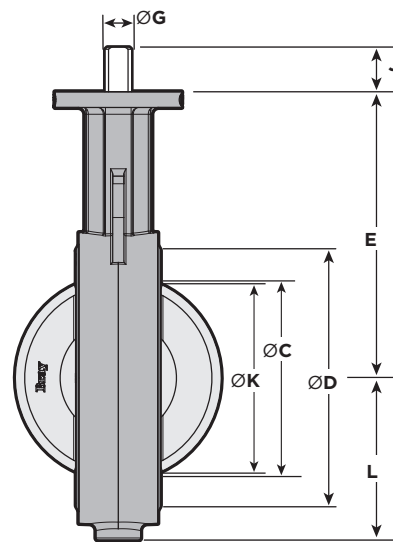
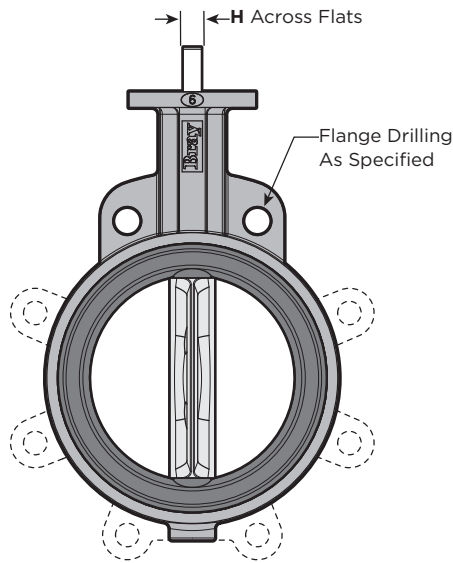
STEM DETAILS



Stem With Flats
≤ NPS 12



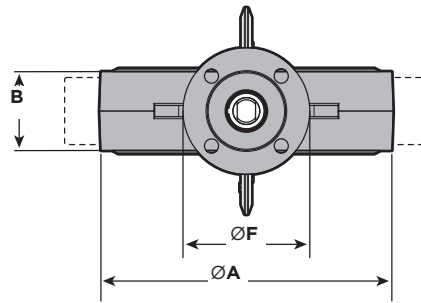
Stem With Keyway
≥ NPS 14



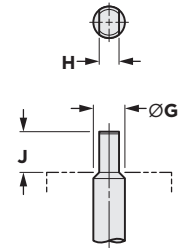
DIMENSIONS (inch)

NPS	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K*	L		Adp. Code	Weight (lb)	
							Bolt Circle	Hole Qty	Hole Dia.					Wafer	Lug		Wafer	Lug
2	3.69	1.69	2.00	2.81	5.50	3.54	2.76	4	0.39	0.55	0.39	1.25	1.25	2.22	2.30	A	6	7
2.5	4.19	1.81	2.50	3.32	6.00	3.54	2.76	4	0.39	0.55	0.39	1.25	1.87	2.47	2.57	A	7	8
3	4.88	1.81	3.00	3.95	6.25	3.54	2.76	4	0.39	0.55	0.39	1.25	2.52	2.81	2.81	A	8	9
4	6.06	2.05	4.06	5.09	7.00	3.54	2.76	4	0.39	0.63	0.43	1.25	3.57	3.41	4.09	B	12	16
5	7.13	2.21	5.04	6.16	7.50	3.54	2.76	4	0.39	0.75	0.51	1.25	4.60	4.03	4.61	C	15	21
6	8.13	2.21	5.75	7.10	8.00	3.54	2.76	4	0.39	0.75	0.51	1.25	5.38	4.53	5.06	C	19	25
8	10.50	2.36	7.75	9.34	9.50	5.91	4.92	4	0.57	0.87	0.63	1.25	7.48	5.75	6.05	D	34	40
10	12.75	2.68	9.79	11.44	10.75	5.91	4.92	4	0.57	1.18	0.87	2.00	9.53	7.12	7.69	E	51	62
12	14.88	3.07	11.75	13.45	12.25	5.91	4.92	4	0.57	1.18	0.87	2.00	11.47	8.12	9.02	E	68	91
14	17.05	3.07	13.25	15.28	13.62	5.91	4.92	4	0.57	1.38	.39x.39	2.00	13.04	9.38	9.93	F	105	122
16	19.21	4.00	15.25	17.41	14.75	5.91	4.92	4	0.57	1.38	.39x.39	2.00	14.85	10.75	11.30	F	150	166
18	21.12	4.49	17.25	19.47	16.00	8.27	6.50	4	0.81	1.97	.47x.39	2.50	16.81	12.00	12.16	G	212	233
20	23.25	5.00	19.25	21.59	17.25	8.27	6.50	4	0.81	1.97	.47x.39	2.50	18.75	14.00	14.00	G	285	340
24	27.94	6.06	23.27	25.60	19.50	8.27	6.50	4	0.81	2.50	.62x.62	4.00	22.65	17.56	17.56	H	410	490

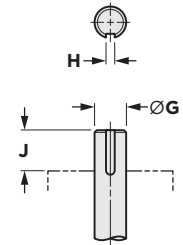
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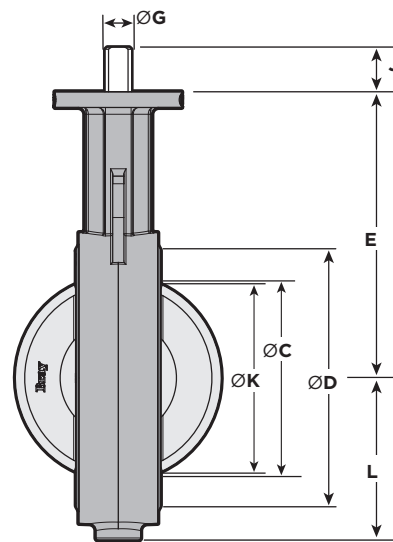
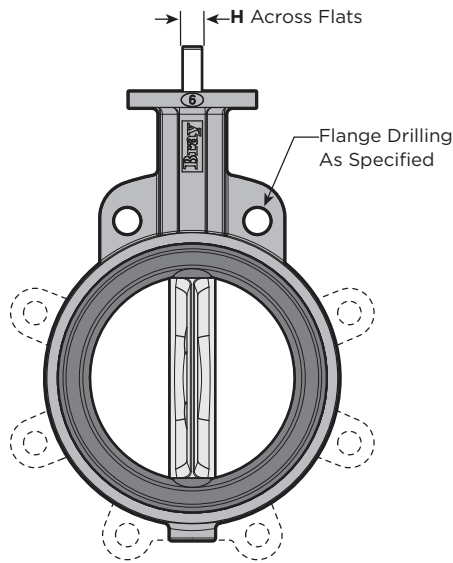
STEM DETAILS



Stem With Flats
≤ DN 300



Stem With Keyway
≥ DN 350



DIMENSIONS (mm)

DN	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K*	L		Adp. Code	Weight (Kg)	
							Bolt Circle	Hole Qty	Hole Dia.					Wafer	Lug		Wafer	Lug
50	94	43	51	71	140	90	70	4	10	14	10	32	32	56	58	A	2.5	3
65	106	46	64	84	152	90	70	4	10	14	10	32	48	63	65	A	3.0	4
80	124	46	76	100	159	90	70	4	10	14	10	32	64	71	71	A	3.5	4
100	154	52	103	129	178	90	70	4	10	16	11	32	91	87	104	B	5.4	6
125	179	56	128	157	191	90	70	4	10	19	13	32	117	102	117	C	6.6	9
150	206	56	146	180	203	90	70	4	10	19	13	32	137	115	129	C	8.7	11
200	267	60	197	237	241	150	125	4	15	22	16	32	190	146	154	D	15.3	18
250	324	68	249	291	273	150	125	4	15	30	22	51	242	181	195	E	23	26
300	378	78	299	342	311	150	125	4	15	30	22	51	291	206	229	E	31	41
350	433	78	337	388	346	150	125	4	14	35	10x10	51	331	238	252	F	48	55
400	488	102	387	442	375	150	125	4	14	35	10x10	51	377	273	287	F	68	75
450	536	114	438	495	406	210	165	4	21	50	12x10	64	427	305	309	G	96	106
500	591	127	489	548	438	210	165	4	21	50	12x10	64	476	356	356	G	129	154
600	710	154	591	650	495	210	165	4	21	64	16x16	102	575	446	446	H	186	222

LOW PRESSURE DISC

Bray offers a low pressure disc for NPS 2-24 (DN 50-600) Series 3W/3L valves. The purpose of reducing the disc diameter is to decrease the seating/unseating torque and extend the seat life in low pressure applications.

By reducing the disc diameter, the interference between the disc outside diameter and seat inside diameter is decreased and the valve pressure rating, which is a function of this interference, is reduced to 50 psi (3.4 bar). Less interference between the disc and seat results in reduced seating/unseating torque. Lower seating/unseating torque may allow for the use of a smaller actuator on the valve. In other applications where abrasive dry bulk materials such as cement, sugar, plastic, pellets, flour, etc., are generally pneumatically conveyed at 50 psi (3.4 bar) or less, the reduced disc diameter not only reduces the seating/unseating torque but, increases the service life of the seat as well.

Bray does the following to differentiate low pressure discs from full diameter discs:

- > Metal discs: An “R” is stamped above the part number to indicate a reduced diameter, low pressure disc.
- > Nylon 11 coated discs: Discs are differentiated by the color of the Nylon 11:
 - > Gray: Standard pressure
 - > White: Low pressure



Gray Nylon 11 (standard pressure) White Nylon 11 (low pressure) Metal Disc “R” stamp (low pressure)

SEATING/UNSEATING TORQUES

Bray has developed seating/unseating torque charts for three classes of service for its valves with standard discs (rated for full pressure), for valves with low pressure discs (rated for 50 psi / 3.4 bar) and for valves with high pressure discs (rated for 250 psi / 17.2 bar).

The guidelines for selecting a class to be used for determining a valve's seating/unseating torque are given below. Each valve application should comply with all five class characteristics in order to be qualified for that class.

Characteristics of Application	Class A Non-Corrosive, Lubricating Service	Class B General Service	Class C Severe Service
Media Type	Lubricating hydrocarbons; aqueous processes and water (See Note 1)	Water; aqueous processes; all other aqueous liquids including salt water; lubricating gases	Dry, non-lubricating such as air, dry gas, cement, pneumatic conveying mediums
Corrosion by Media	Insignificant if any	No major corrosion or deposits from media	Can incur significant corrosion such as ductile iron disc in water
Chemical Reactions of Media with Seat	Insignificant if any	Only minor or insignificant in nature	Reactions causing swelling and hardness occur
Media Temperature	40°F to 160°F (4°C to 71°C)	Within seat temperature limits, not near limits	Near or at seat temperature limits
Frequency of Valve Cycling	Once weekly or more frequently	Minimum once every 3-6 weeks, or more frequently	Infrequently, sometimes not cycled for long periods

NOTES:

- For aqueous processes and water, Class A torques may be used only if a Nylon 11 coated disc is selected and all other Class A characteristics apply. Otherwise, Class B torques should be used.
- If a valve is used strictly in a throttling application, that is, it is never put in the closed position but throttled between 20° and 80°, then Class A torques may be used provided you have checked to see that dynamic torques do not exceed the Class A torque values.
- With the exception of dry, non-lubricating medias, one is usually safe electing to use Class B torques for sizing actuators for all other valve service applications. Seating/Unseating Torque values shown include friction bearing torques for stated differential pressure.
- Dynamic torque values are not considered. See the Dynamic Torque chart in this manual for determination of dynamic torque.
- Do not apply a safety factor to torque values when determining actuator output torque requirement.
- For 3-way assemblies where one valve is opening and another is closing, multiply torque by a 1.25 factor.

TORQUE VALUES (lb-In)

		Valve Differential Pressure (psi)									
		Low Pressure Disc	Standard Disc				High Pressure Disc				
NPS		50	50	100	150	175	50	100	150	200	250
Class A Non-corrosive Lubricating Service	2	85	97	105	113	121	113	121	129	137	145
	2.5	113	113	121	137	145	129	145	169	193	217
	3	145	153	169	185	193	169	201	234	266	298
	4	161	185	217	250	282	217	266	322	395	467
	5	232	258	290	330	370	322	419	515	604	693
	6	346	395	443	487	522	483	604	725	846	966
	8	564	644	789	934	1031	950	1152	1345	1538	1732
	10	926	1168	1369	1570	1691	1554	1901	2247	2609	2988
	12	1409	1546	1868	2191	2376	2078	2650	3221	3785	4349
	14	2174	2859	3479	4107		3592	4309	5058	5807	6554
	16	2899	3946	4897	5919		5017	6008	7023	8021	9028
	18	3624	5211	6628	7913	N/A	6757	8005	9302	10615	11935
	20	4550	6531	8255	9906		8802	10510	12233	13989	15761
24	6862	10381	13723	16977		15100	18523	21946	25449	28993	
Class B General Service	2	93	106	115	124	133	124	133	142	150	159
	2.5	124	124	133	150	159	142	159	186	212	239
	3	159	168	186	204	212	186	221	257	292	327
	4	177	204	239	274	310	239	292	354	434	513
	5	255	283	319	363	407	354	460	566	664	761
	6	381	434	487	531	566	531	664	797	929	1062
	8	620	708	867	1027	1133	1044	1266	1478	1690	1903
	10	1018	1283	1505	1726	1859	1708	2089	2469	2867	3283
	12	1549	1699	2053	2407	2611	2283	2912	3540	4160	4779
	14	2390	3142	3823	4514		3947	4735	5558	6381	7202
	16	3186	4337	5381	6505		5514	6602	7717	8815	9921
	18	3983	5726	7284	8695	N/A	7425	8797	10222	11664	13116
	20	5000	7177	9071	10886		9673	11549	13443	15372	17319
24	7540	11408	15080	18656		16594	20355	24116	27966	31860	
Class C Severe Service	2	116	133	144	155	166	155	166	177	188	199
	2.5	155	155	166	188	199	177	199	232	266	299
	3	199	210	232	254	266	232	277	321	365	409
	4	221	254	299	343	387	299	365	443	542	642
	5	319	354	398	454	509	443	575	708	830	951
	6	476	542	608	664	708	664	830	996	1162	1328
	8	774	885	1084	1283	1416	1305	1582	1847	2113	2378
	10	1272	1604	1881	2157	2323	2135	2611	3086	3584	4104
	12	1936	2124	2567	3009	3263	2854	3640	4425	5199	5974
	14	2987	3927	4779	5642		4934	5918	6947	7976	9003
	16	3983	5421	6726	8131		6892	8253	9647	11018	12401
	18	4978	7157	9104	10869	N/A	9281	10996	12777	14580	16395
	20	6250	8972	11339	13607		12091	14437	16804	19216	21649
24	9425	14260	18851	23320		20742	25444	30145	34958	39825	

TORQUE VALUES (N m)

		Valve Differential Pressure (bar)									
		Low Pressure Disc	Standard Disc				High Pressure Disc				
DN		3.4	3.4	7	10.3	12	3.4	7	10.3	14	17.2
Class A Non-corrosive Lubricating Service	50	10	11	12	13	14	13	14	15	15	16
	65	13	13	14	15	16	15	16	19	22	25
	80	16	17	19	21	22	19	23	26	30	34
	100	18	21	25	28	32	25	30	36	45	53
	125	26	29	33	37	42	36	47	58	68	78
	150	39	45	50	55	59	55	68	82	96	109
	200	64	73	89	106	116	107	130	152	174	196
	250	105	132	155	177	191	176	215	254	295	338
	300	159	175	211	248	268	235	299	364	428	491
	350	246	323	393	464		406	487	571	656	741
	400	328	446	553	669		567	679	794	906	1020
	450	410	589	749	894	N/A	763	905	1051	1199	1349
500	514	738	933	1119		995	1188	1382	1581	1781	
600	775	1173	1551	1918		1706	2093	2480	2876	3276	
Class B General Service	50	11	12	13	14	15	14	15	16	17	18
	65	14	14	15	17	18	16	18	21	24	27
	80	18	19	21	23	24	21	25	29	33	37
	100	20	23	27	31	35	27	33	40	49	58
	125	29	32	36	41	46	40	52	64	75	86
	150	43	49	55	60	64	60	75	90	105	120
	200	70	80	98	116	128	118	143	167	191	215
	250	115	145	170	195	210	193	236	279	324	371
	300	175	192	232	272	295	258	329	400	470	540
	350	270	355	432	510		446	535	628	721	814
	400	360	490	608	735		623	746	872	996	1121
	450	450	647	823	983	N/A	839	994	1155	1318	1482
500	565	811	1025	1230		1093	1305	1519	1737	1957	
600	852	1289	1704	2108		1875	2300	2725	3160	3600	
Class C Severe Service	50	13	15	16	18	19	18	19	20	21	23
	65	18	18	19	21	23	20	23	26	30	34
	80	23	24	26	29	30	26	31	36	41	46
	100	25	29	34	39	44	34	41	50	61	73
	125	36	40	45	51	58	50	65	80	94	108
	150	54	61	69	75	80	75	94	113	131	150
	200	88	100	123	145	160	148	179	209	239	269
	250	144	181	213	244	263	241	295	349	405	464
	300	219	240	290	340	369	323	411	500	588	675
	350	338	444	540	638		558	669	785	901	1017
	400	450	613	760	919		779	933	1090	1245	1401
	450	563	809	1029	1228	N/A	1049	1243	1444	1648	1853
500	706	1014	1281	1538		1366	1631	1899	2171	2446	
600	1065	1611	2130	2635		2344	2875	3406	3950	4500	

MAXIMUM ALLOWABLE STEM TORQUES



MAXIMUM ALLOWABLE STEM TORQUE VALUES

Valve Size		416 Stainless Steel		Stainless Steel (EN 1.4057)	
NPS	DN	lb-in	N m	lb-in	N m
2	50	1005	114	1020	115
2 1/2	65	1005	114	1020	115
3	80	1005	114	1020	115
4	100	1639	185	1664	188
5	125	2484	281	2522	285
6	150	2484	281	2522	285
8	200	4229	478	4293	485
10	250	12525	1415	12716	1437
12	300	12525	1415	12716	1437
14	350	17960	2029	18234	2060
16	400	25708	2905	26101	2949
18	450	49062	5543	49811	5628
20	500	49062	5543	49811	5628
24	600	158365	17893	160782	18166

FIGURE 1 - PRESSURE DISTRIBUTION

In most applications for butterfly valves, especially NPS 20 (DN 500) or smaller, the maximum torque required to operate the valve will be seating/unseating torque. However, dynamic torque should be considered particularly in:

- > Control applications using larger valves (NPS 24 [DN 600] and above) where the disc is maintained in the open position
- > Applications using larger valves (NPS 24 [DN 600] and above) where the velocity is high (16 ft./sec [4.9m/sec]).

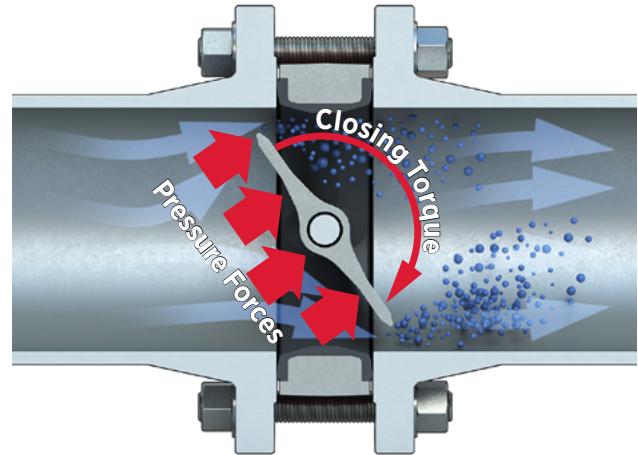
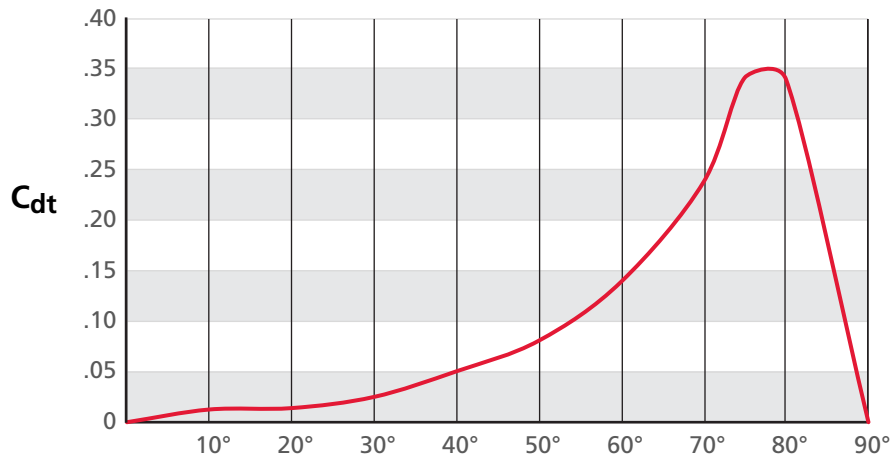


FIGURE 2 - ANGLE OF OPENING

The C_{dt} value for Bray symmetrical disc valves are approximately:

Angle of Opening	0°	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
C_{dt}	0	0.0126	0.0140	0.0251	0.0505	0.0809	0.1394	0.2384	0.3419	0.3400	0



DYNAMIC TORQUE FACTORS

To use the Dynamic Torque Chart, note the following:

- Dynamic torque values include all bearing friction and stem-seal friction torques.
- Dynamic torque values are per 1 psi ΔP (1 bar ΔP). To determine dynamic torque (lb-in) (N m) at a desired angle of opening, multiply the pressure drop ΔP at this angle by the appropriate dynamic torque factor in the charts below.
- Bray recommends sizing control valves between 20° and 70°, with 60° the preferred angle.
- Dynamic torque will tend to close all Bray valves whose disc are symmetrical to the stem.

DYNAMIC TORQUE FACTORS (lb-in/psi)

NPS	Angle of Opening									
	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
2	0.11	0.13	0.23	0.45	0.73	1.25	2.14	3.07	3.05	0.00
2.5	0.22	0.24	0.43	0.87	1.39	2.39	4.09	5.86	5.83	0.00
3	0.37	0.41	0.73	1.47	2.36	4.07	6.95	9.97	9.92	0.00
4	0.86	0.95	1.70	3.43	5.49	9.45	16.17	23.19	23.07	0.00
5	1.65	1.83	3.29	6.61	10.59	18.25	31.22	44.77	44.53	0.00
6	2.49	2.77	4.97	10.00	16.01	27.59	47.19	67.68	67.32	0.00
8	6.60	6.74	12.08	24.30	38.93	67.07	114.71	164.51	163.64	0.00
10	11.99	13.32	23.89	48.06	76.99	132.65	226.86	325.35	323.64	0.00
12	20.89	23.21	41.62	83.74	134.14	231.14	395.30	566.91	563.93	0.00
14	30.04	33.38	59.84	120.40	192.87	332.34	568.37	815.12	810.83	0.00
16	45.65	50.72	90.94	182.97	293.12	505.07	863.76	1238.76	1232.24	0.00
18	65.91	73.23	131.30	264.16	423.18	729.18	1247.04	1788.44	1779.02	0.00
20	91.42	101.57	182.11	366.39	586.95	1011.37	1729.64	2480.55	2467.50	0.00
24	158.36	175.95	315.46	634.69	1016.76	1751.99	2996.23	4297.03	4274.40	0.00

Example: NPS 4 Valve; 60° Open with a 10 psi pressure drop: $[T_d = (9.45)(10) = 94.50 \text{ lb-in}]$

DYNAMIC TORQUE FACTORS (N m/bar)

DN	Angle of Opening									
	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
50	0.19	0.21	0.37	0.74	1.19	2.05	3.51	5.03	5.00	0.00
65	0.35	0.39	0.70	1.42	2.27	3.91	6.69	9.60	9.55	0.00
80	0.60	0.67	1.20	2.41	3.87	6.66	11.39	16.34	16.25	0.00
100	1.40	1.56	2.79	5.61	8.99	15.49	26.49	38.00	37.80	0.00
125	2.70	3.00	5.39	10.84	17.36	29.91	51.16	73.36	72.98	0.00
150	4.09	4.54	8.14	16.38	26.24	45.22	77.33	110.91	110.32	0.00
200	10.82	11.04	19.79	39.82	63.79	109.91	187.97	269.58	268.16	0.00
250	19.65	21.83	39.14	78.75	126.16	217.38	371.76	533.16	530.35	0.00
300	34.24	38.04	68.20	137.22	219.82	378.77	647.77	929.00	924.11	0.00
350	49.23	54.70	98.06	197.29	316.06	544.61	931.38	1335.74	1328.71	0.00
400	74.81	83.12	149.03	299.83	480.33	827.66	1415.46	2029.97	2019.28	0.00
450	108.01	120.01	215.15	432.88	693.46	1194.92	2043.53	2930.72	2915.29	0.00
500	149.80	166.45	298.42	600.40	961.83	1657.34	2834.37	4064.89	4043.50	0.00
600	259.50	288.34	516.94	1040.07	1666.17	2871.00	4909.94	7041.56	7004.49	0.00

Example: DN 100 Valve; 60° Open with a 2 bar pressure drop: $[T_d = (15.49)(2) = 30.98 \text{ N m}]$

VALVE SIZING COEFFICIENTS | Cv Values

Cv stands for **Valve Sizing Coefficient**, sometimes called the **Flow Rate Coefficient**. **Cv** varies with the valve size, angle of opening and the manufacturer's valve style.

- > Cv is defined as the volume of water in USGPM that will flow through a given restriction or valve opening with a pressure drop of one (1) psi at room temperature.

Cv VALUES

NPS	Disc Position (Degrees)								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
2	1	4	15	29	46	66	73	86	87
2.5	1	8	26	44	66	98	141	177	185
3	2	22	43	71	112	171	256	338	360
4	8	37	78	118	192	310	505	689	740
5	9	53	98	170	288	470	759	1131	1218
6	13	86	175	297	479	757	1190	1715	1900
8	19	121	254	429	754	1247	2096	3376	3765
10	37	178	365	728	1215	2005	3342	5814	6661
12	69	240	492	1008	1696	2868	4961	8455	10066
14	110	287	609	1141	1975	3328	5571	9269	11598
16	147	421	844	1547	2651	4440	7412	12214	15395
18	190	470	968	1807	3238	5509	9382	18231	20120
20	230	675	1341	2455	4210	7056	11803	19637	25329
24	317	952	1957	3592	6128	10267	17226	29061	39396

VALVE SIZING COEFFICIENTS | Kv Values

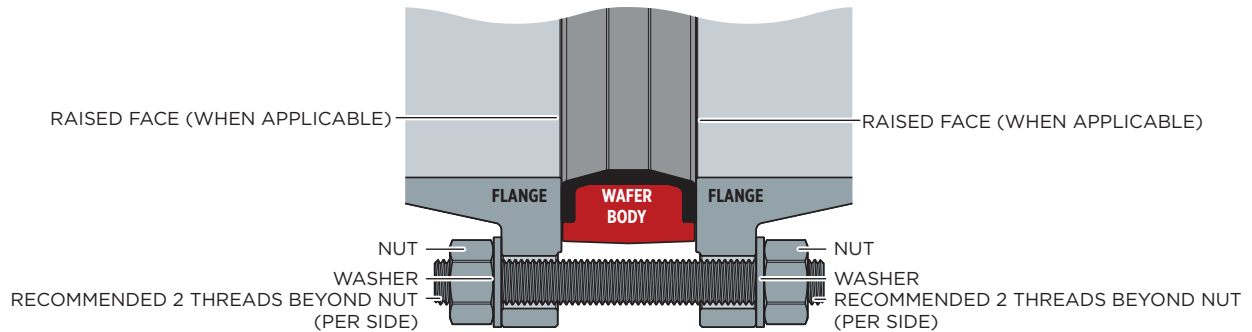
Kv stands for **Valve Sizing Coefficient**, sometimes called the **Flow Rate Coefficient**. **Kv** varies with the valve size, angle of opening and the manufacturer's valve style.

- > **Kv** is defined as the volume of water in cubic meters/hour (m³/hr) that will flow through a given restriction or valve opening with a pressure drop of one (1) bar at room temperature.

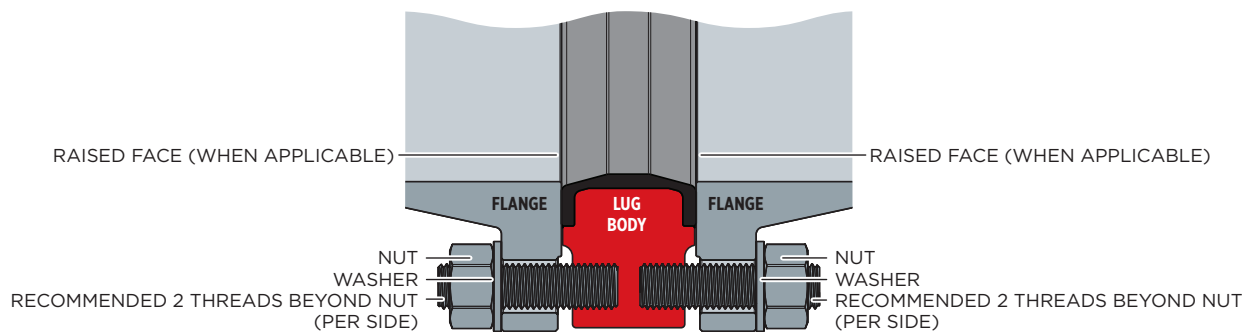
Kv VALUES									
DN	Disc Position (Degrees)								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
50	1	3	13	25	40	57	63	74	75
65	1	7	22	38	57	85	122	153	160
80	2	19	37	61	97	148	221	292	311
100	7	32	67	102	166	268	437	596	640
125	8	46	85	147	249	407	657	978	1054
150	11	74	151	257	414	655	1029	1483	1644
200	16	105	220	371	652	1079	1813	2920	3257
250	32	154	316	630	1051	1734	2891	5029	5762
300	60	208	426	872	1467	2481	4291	7314	8707
350	95	248	527	987	1708	2879	4819	8018	10032
400	127	364	730	1338	2293	3841	6411	10565	13317
450	164	407	837	1563	2800	4766	8115	15770	17404
500	199	584	1160	2124	3642	6103	10210	16986	21910
600	274	823	1693	3107	5301	8881	14900	25138	34078

FLANGE TO VALVE BOLTING DATA

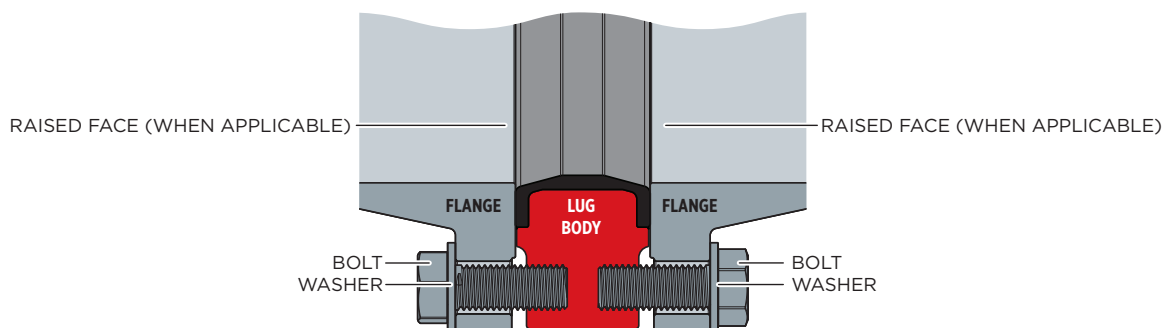
WAFER VALVE WITH THROUGH-STUDS



LUG VALVE WITH STUDS



LUG VALVE WITH HEX HEAD BOLTS



Refer to appropriate Bray dimensional drawings for specific valve drilling information.

- > Pipe flange thickness may vary, therefore no stud/bolt lengths are stated.
- > Lug threads may be tapped from both sides, and therefore tap may not be continuous.
- > Minimum bolt engagement must be equal to the diameter of the bolt.
- > When bolting the valve into the line, use standard bolting torque as recommended by applicable piping standards. Additional force from the flange bolts is not required.

SERIES 3W | THROUGH-STUD

Valve Size		Fastener Size	Through Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty
2	50	5/8-11 UNC	4	—	—	8	8
2½	65	5/8-11 UNC	4	—	—	8	8
3	80	5/8-11 UNC	4	—	—	8	8
4	100	5/8-11 UNC	8	—	—	16	16
5	125	¾-10 UNC	8	—	—	16	16
6	150	¾-10 UNC	8	—	—	16	16
8	200	¾-10 UNC	8	—	—	16	16
10	250	7/8-9 UNC	12	—	—	24	24
12	300	7/8-9 UNC	12	—	—	24	24
14	350	1-8 UN	12	—	—	24	24
16	400	1-8 UN	16	—	—	32	32
18	450	1½-8 UN	16	—	—	32	32
20	500	1½-8 UN	20	—	—	40	40
24	600	1¾-8 UN	20	—	—	40	40

SERIES 3L | STUD

Valve Size		Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
2	50	5/8-11 UNC	4	4	—	—	8	8
2½	65	5/8-11 UNC	4	4	—	—	8	8
3	80	5/8-11 UNC	4	4	—	—	8	8
4	100	5/8-11 UNC	8	8	—	—	16	16
5	125	¾-10 UNC	8	8	—	—	16	16
6	150	¾-10 UNC	8	8	—	—	16	16
8	200	¾-10 UNC	8	8	—	—	16	16
10	250	7/8-9 UNC	12	12	—	—	24	24
12	300	7/8-9 UNC	12	12	—	—	24	24
14	350	1-8 UN	12	12	—	—	24	24
16	400	1-8 UN	16	16	—	—	32	32
18	450	1½-8 UN	16	16	—	—	32	32
20	500	1½-8 UN	20	20	—	—	40	40
24	600	1¾-8 UN	20	20	—	—	40	40

SERIES 3L | BOLTS

Valve Size		Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
2	50	5/8-11 UNC	4	4	—	—	8	—
2½	65	5/8-11 UNC	4	4	—	—	8	—
3	80	5/8-11 UNC	4	4	—	—	8	—
4	100	5/8-11 UNC	8	8	—	—	16	—
5	125	¾-10 UNC	8	8	—	—	16	—
6	150	¾-10 UNC	8	8	—	—	16	—
8	200	¾-10 UNC	8	8	—	—	16	—
10	250	7/8-9 UNC	12	12	—	—	24	—
12	300	7/8-9 UNC	12	12	—	—	24	—
14	350	1-8 UN	12	12	—	—	24	—
16	400	1-8 UN	16	16	—	—	32	—
18	450	1½-8 UN	16	16	—	—	32	—
20	500	1½-8 UN	20	20	—	—	40	—
24	600	1¾-8 UN	20	20	—	—	40	—

PN10 | SERIES 3W | THROUGH-STUD

Valve Size	Fastener Size	Through Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty
50	M16	4	8	8
65	M16	4	8	8
80	M16	8	16	16
100	M16	8	16	16
125	M16	8	16	16
150	M20	8	16	16
200	M20	8	16	16
250	M20	12	24	24
300	M20	12	24	24
350	M20	16	32	32
400	M24	16	32	32
450	M24	20	40	40
500	M24	20	40	40
600	M27	20	40	40

PN10 | SERIES 3L | STUDS

Valve Size	Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	8
65	M16	4	4	—	—	8	8
80	M16	8	8	—	—	16	16
100	M16	8	8	—	—	16	16
125	M16	8	8	—	—	16	16
150	M20	8	8	—	—	16	16
200	M20	8	8	—	—	16	16
250	M20	12	12	—	—	24	24
300	M20	12	12	—	—	24	24
350	M20	16	16	—	—	32	32
400	M24	16	16	—	—	32	32
450	M24	20	20	—	—	40	40
500	M24	20	20	—	—	40	40
600	M27	20	20	—	—	40	40

PN10 | SERIES 3L | BOLTS

Valve Size	Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	—
65	M16	4	4	—	—	8	—
80	M16	8	8	—	—	16	—
100	M16	8	8	—	—	16	—
125	M16	8	8	—	—	16	—
150	M20	8	8	—	—	16	—
200	M20	8	8	—	—	16	—
250	M20	12	12	—	—	24	—
300	M20	12	12	—	—	24	—
350	M20	16	16	—	—	24	—
400	M24	16	16	—	—	32	—
450	M24	20	20	—	—	32	—
500	M24	20	20	—	—	40	—
600	M27	20	20	—	—	40	—

PN16 | SERIES 3W | THROUGH-STUD

Valve Size	Fastener Size	Through Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty
50	M16	4	8	8
65	M16	4	8	8
80	M16	8	16	16
100	M16	8	16	16
125	M16	8	16	16
150	M20	8	16	16
200	M20	12	24	24
250	M20	12	24	24
300	M20	12	24	24
350	M20	16	32	32
400	M24	16	32	32
450	M24	20	40	40
500	M24	20	40	40
600	M27	20	40	40

PN16 | SERIES 3L | STUDS

Valve Size	Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	8
65	M16	4	4	—	—	8	8
80	M16	8	8	—	—	16	16
100	M16	8	8	—	—	16	16
125	M16	8	8	—	—	16	16
150	M20	8	8	—	—	16	16
200	M20	12	12	—	—	24	24
250	M20	12	12	—	—	24	24
300	M20	12	12	—	—	24	24
350	M20	16	16	—	—	32	32
400	M24	16	16	—	—	32	32
450	M24	20	20	—	—	40	40
500	M24	20	20	—	—	40	40
600	M27	20	20	—	—	40	40

PN16 | SERIES 3L | BOLTS

Valve Size	Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	—
65	M16	4	4	—	—	8	—
80	M16	8	8	—	—	16	—
100	M16	8	8	—	—	16	—
125	M16	8	8	—	—	16	—
150	M20	8	8	—	—	16	—
200	M20	12	12	—	—	24	—
250	M20	12	12	—	—	24	—
300	M20	12	12	—	—	24	—
350	M20	16	16	—	—	32	—
400	M24	16	16	—	—	32	—
450	M24	20	20	—	—	40	—
500	M24	20	20	—	—	40	—
600	M27	20	20	—	—	40	—

FLANGE BOLTING TENSIONING

Bray Butterfly Valves with Metal Mating Flanges

A frequently asked question at Bray is “What torque do I apply to the flange bolts to insure the valve is properly installed?”. Initially this seems to be a simple request until all of the factors are analyzed. The installation of a valve requires several components: the valve, mating flanges, nuts, bolts and studs. Each is supplied by different manufacturers and each has different characteristics. The proper torque for one combination may be too much or too little for a second combination. The following is a list of information which needs to be known in order to start calculating the torque requirements.

Valve

- > Type
- > Size
- > Materials of construction (body)
- > Surface finishes / surface conditions

Flange

- > Type
- > Size
- > Finish / both sides
- > Condition of flange / surface contamination

Bolt (or Stud)

- > Type
- > Materials of construction
- > Surface conditions

Nut

- > Type
- > Materials of construction
- > Surface conditions

Lubrication

- > Type
- > Coverage

General Factors

- > Temperature and relative humidity at the time of installation
- > Speed at which bolts are turned

Note: The elastomer valve seat manufactured by Bray also acts as the flange gasket. No additional gaskets are required or recommended. Other valve styles which do not have integral gaskets will need to have this component supplied. The characteristics of this component will also need to be considered.

Complete knowledge of all relevant conditions is almost impossible to obtain. As a result, the computation of the exact torque requirement is not practical. No reputable manufacturer can provide accurate information when so many outside factors are present.

The International Fasteners Institute covers some of the details required to “compute” a torque value. Even with this information the use of a torque wrench is only considered to be 25% accurate. Based on the difficulty and inaccuracy of using this method, Bray recommends the use of the “Turn of the Nut” method.

“Turn of the Nut” Tightening (For Standard Iron and Steel Flanges)

**For Non-Metallic or non-standard flanges, follow the manufacturers installation procedures.

1. The valve and flange faces must be aligned parallel to each other. For rubber seated butterfly valves manufactured by Bray, it is required that the valve be fully opened prior to the tightening of the flange bolts.
2. After aligning the holes in a joint, sufficient bolts shall be placed and brought to a “snug-tight” condition to ensure that the parts of the joint are brought into full contact with each other. “Snug-tight” is the tightness attained by the full effort of a man using a wrench.
3. Following the initial snugging operation, bolts shall be placed in any remaining holes and brought to snug-tightness. Re-snugging may be necessary in large joints.
4. Tighten opposite bolts in sequence to insure even pressure around the entire flange.
5. When all bolts are snug-tight, each bolt in the joint then shall be tightened additionally by the applicable amount of nut rotation given in **Note 1**. During tightening there shall be no rotation of the valve or flange.

Note 1

For bolt lengths **not exceeding**
8 diameters or 8 inches (203.2 mm) = **1/4 turn**

For bolt lengths **exceeding**
8 diameters or 8 inches (203.2 mm) = **1/2 turn**

Disclaimer:

Bray is issuing these recommendations only as a guide to installation. This recommendation is based on the full compliance of all materials supplied to their appropriate specifications. Since many of the components are not manufactured by Bray we can take no responsibility for any damage caused during installation.

Valve Size		Normal Torque Range	
NPS	DN	lb-ft	N m
2	50	30	40
2.5	65	30	40
3	80	35	50
4	100	35 - 40	50 - 55
5	125	35 - 45	50 - 60
6	150	35 - 50	50 - 65
8	200	45 - 55	60 - 75
10	250	55 - 75	75 - 100
12	300	65 - 110	90 - 150
14	350	75 - 120	100 - 165
16	400	75 - 120	100 - 165
18	450	85 - 130	115 - 175
20	500	85 - 130	115 - 175
24	600	100 - 150	135 - 205

Please note that the N m and ft-lbs values are based on bolt size in respective EN and ANSI flanges, i.e. these values are not a direct conversion between N m and ft-lbs.

The values represent average torques needed to ensure full compression of the resilient valves' seats into the valves' bodies when installed in pipeline flanges. The face of both flanges must come into full contact with the valves' metal bodies.

No additional torque is required for proper functioning of the Bray resilient seated valves.

The torque values are based on using new, coarse-threaded, lubricated fasteners. Up to 25% may be added to the normal torque range values when using non-lubricated fasteners.

Torque values specified by flange manufacturers must not be exceeded.

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