

## High-performance Butterfly Valves



# ACE VALVE



## High-performance Butterfly Valves



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## Specification of High-performance Butterfly valves

The valve shall be capable of bi-directional flow and provide bubble tight shut-off at full rated pressure

### TYPE NUMBERING SYSTEM

- AV-HWR High-performance WAFER type Rubber seat Butterfly valves
- AV-HSR High-performance SEMI-LUG type Rubber seat Butterfly valves
- AV-HLR High-performance LUG type Rubber seat Butterfly valves
- AV-HFR High-performance FLANGE type Rubber seat Butterfly valves
- AV-HWT High-performance WAFER type Teflon seat Butterfly valves
- AV-HST High-performance SEMI-LUG type Teflon seat Butterfly valves
- AV-HLT High-performance LUG type Teflon seat Butterfly valves
- AV-HFT High-performance FLANGE type Teflon seat Butterfly valves
- AV-MHW High-performance WAFER type Metal seat Butterfly valves
- AV-MHS High-performance SEMI-LUG type Metal seat Butterfly valves
- AV-MHL High-performance LUG type Metal seat Butterfly valves
- AV-MHF High-performance FLANGE type Metal seat Butterfly valves
- AV-FHW High-performance WAFER type Fire safe seat Butterfly valves
- AV-FHS High-performance SEMI-LUG type Fire safe seat Butterfly valves
- AV-FHL High-performance LUG type Fire safe seat Butterfly valves
- AV-FHF High-performance FLANGE type Fire safe seat Butterfly valves

### STANDARD COMPLIANCE

The face to face dimension shall be in accordance with API 609, ISO 5752, KSV 7490, JIS F 7480, BS 5155 or MSS SP-68

### PRODUCTION RANGE

- SIZE : DN 50mm (2 inch) ~ DN 1500mm (60 inch)
- WORKING PRESSURE : Up to 50 bar
- WORKING TEMPERATURE : -55 °C ~ +250 °C (Soft seat)  
-100 °C ~ +400 °C (Metal seat)

### APPLICABLE FLANGE

- KS/JIS 5K, 10K, 16K, 20K, 30K
- ASME B 16.5 Class 150LB, 300LB
- EN 1092 PN6, PN10, PN16, PN25
- ISO 7005 PN6, PN10, PN16, PN20, PN25



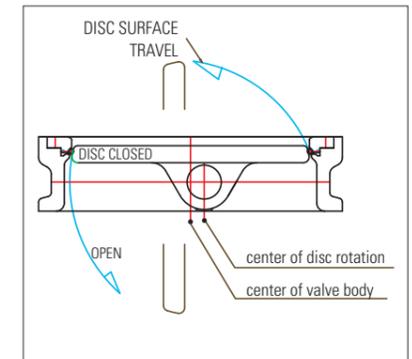
## High-performance Butterfly Valves

### The High-performance Design

The axis of disc rotation is double eccentric offset to the seat ring. When the disc rotates, it unseats at a small turning angle by this cam effect. This prevents seat abrasion and provides perfect seal for a long period.

### Application

- Marine tankers-shipbuilding
- Offshore/Onshore plants, Oil&Gas production platform
- Chemical and Petro-chemical plants
- Water treatment-purification
- Steel and metal plants
- Military application
- Foundry
- Pulp and paper plants
- Food plants
- Textile industry
- Sugar refining
- Fire safe piping system
- LPG



### Classification by Connection type

Appearance	Type	General Characteristics
	WAFER	<ul style="list-style-type: none"> <li>• The valve to be installed with long bolts between the flanges at adjacent pipe without flange on the valve.</li> <li>• Easy handling and light weight.</li> <li>• Less quantity of bolt and easy installation.</li> <li>• Convenient maintenance of adjacent pipe.</li> </ul>
	SEMI-LUG	<ul style="list-style-type: none"> <li>• Similar as wafer type except a pair of the thread bolt hole in way of the upper and lower sides for easy maintenance of adjacent pipe.</li> <li>• Easy handling and light weight.</li> <li>• Less quantity of hole and easy installation.</li> <li>• Keep liquid remained during repairing adjacent pipe.</li> </ul>
	FULL LUG	<ul style="list-style-type: none"> <li>• Ring shape bolt hole for bolting with flange.</li> <li>• Keep pressure inside during repairing adjacent one side pipe.</li> <li>• Different flange shape.</li> <li>• Possible damage on full face gasket.</li> <li>• Hard repairing corroded bolt.</li> <li>• More man-hour for installation.</li> <li>• Heavy weight and more cost.</li> </ul>
	FLANGE	<ul style="list-style-type: none"> <li>• Both ends with complete flange.</li> <li>• Suitable for general pipe flange.</li> <li>• Suitable for shipside valve in the ship.</li> <li>• Heavy weight and more cost.</li> <li>• More man-hour for installation.</li> </ul>

# High-performance Butterfly Valves

## Schema of High-performance type

This product is of heavy load designed for high pressure flow application. It is widely adopted for cargo valves of product and chemical tankers, steam and air conditioning in buildings, chemical and petro-chemical plants, nuclear power plants and high pressure piping system in general.

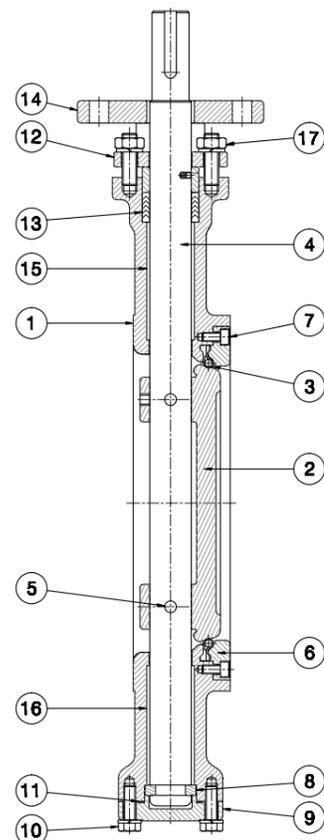
## Operations

The following operation of the valves are possible, the choice is depending upon the valve location and the type of work and service for which the valve is used.

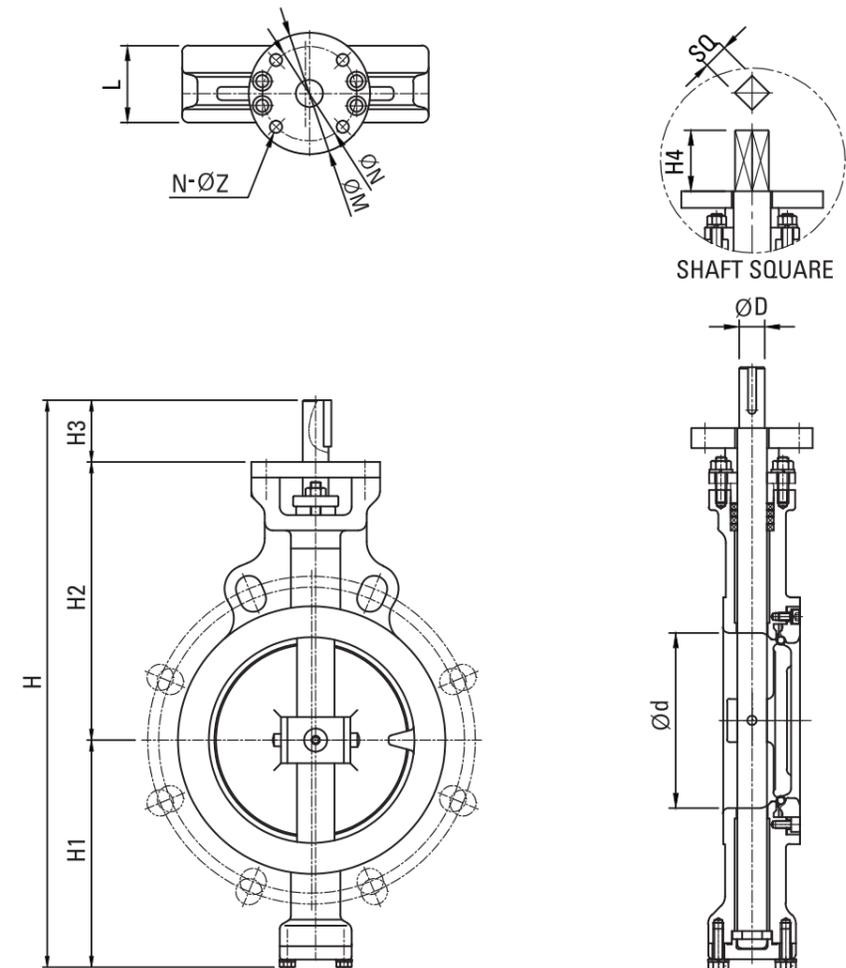
- Manual lever operation
- Manual worm gear operation
- Pneumatic actuator operation
- Hydraulic actuator operation
- Electric motor actuator operation

## Construction of Materials

NO.	PART NAME	MATERIAL
1	BODY	CAST IRON / DUCTILE IRON / CAST STEEL STAINLESS STEEL / AL-BRONZE
2	DISC	CAST STEEL / STAINLESS STEEL / AL-BRONZE
3	SEAT	STAINLESS STEEL / TEFLON / RUBBER
4	STEM	STAINLESS STEEL (304, 316, 316L, 630, 17-4PH, Monel)
5	DISC PIN	STAINLESS STEEL
6	RETAINER	STAINLESS STEEL / AL-BRONZE / MILD STEEL
7	RETAINER BOLT	STAINLESS STEEL
8	THRUST PLATE	BRONZE / STAINLESS STEEL
9	BOTTOM COVER	STAINLESS STEEL / AL-BRONZE / MILD STEEL
10	BOTTOM BOLT	STAINLESS STEEL / MILD STEEL
11	BOTTOM GASKET	TEFLON / GRAPHITE / RUBBER
12	PACKING GLAND	STAINLESS STEEL / AL-BRONZE / MILD STEEL
13	PACKING	TEFLON / GRAPHITE / RUBBER
14	ACTUATOR STAND	MILD STEEL
15	STEM BEARING	TEFLON / STAINLESS STEEL / BRONZE
16	STEM BEARING	TEFLON / STAINLESS STEEL / BRONZE
17	BOLT & NUT	STAINLESS STEEL / MILD STEEL
18	GLAND RING	STAINLESS STEEL / AL-BRONZE / MILD STEEL
19	ANTI STATIC DEVICE	STAINLESS STEEL / MILD STEEL / IF NECESSARY



# High-performance Wafer Type

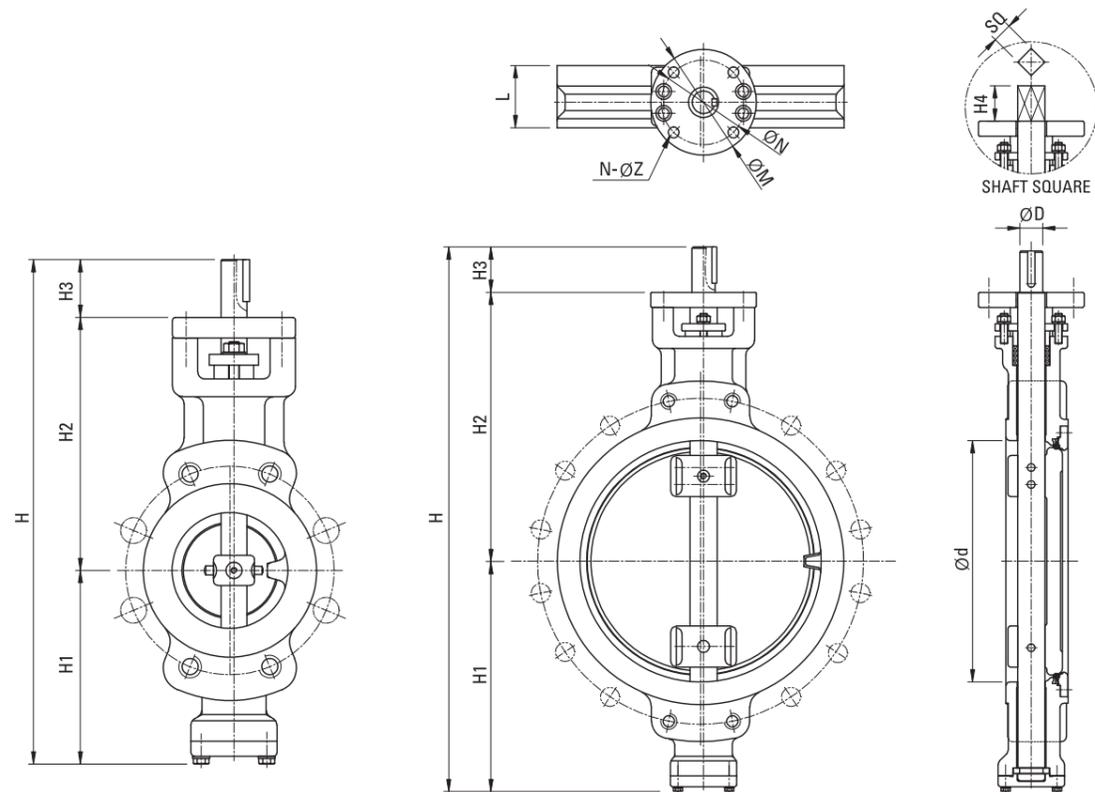


## VALVE DIMENSIONS

unit : mm

SIZE		Ø d	L	H	H1	H2	H3	STEM			TOP FLANGE			WEIGHT (APPROX.) (kg)		
inch	mm							Ø D	KEY SIZE	SQUARE	TYPE	Ø N	Ø M		N-Ø Z	
								SQ	H4							
2"	50	50	43	331	118	168	45	16	5x5	12	33	F07	70	90	4-9	4.5
2.5"	65	65	46	355	133	177	45	16	5x5	12	33	F07	70	90	4-9	5.5
3"	80	80	48	374	144	185	45	19	6x6	12	33	F07	70	90	4-9	9.0
4"	100	100	54	409	164	200	45	19	6x6	12	33	F07	70	90	4-9	10.0
5"	125	125	57	450	188	217	45	19	6x6	12	33	F07	70	90	4-9	13.0
6"	150	150	57	490	205	240	45	19	6x6	12	33	F07	70	90	4-9	17.0
8"	200	200	64	553	223	270	60	25	8x7	17	55	F10	102	125	4-12	26.0
10"	250	250	71	655	275	320	60	25	8x7	22	55	F10	102	125	4-12	40.0

## High-performance Semi-lug Type

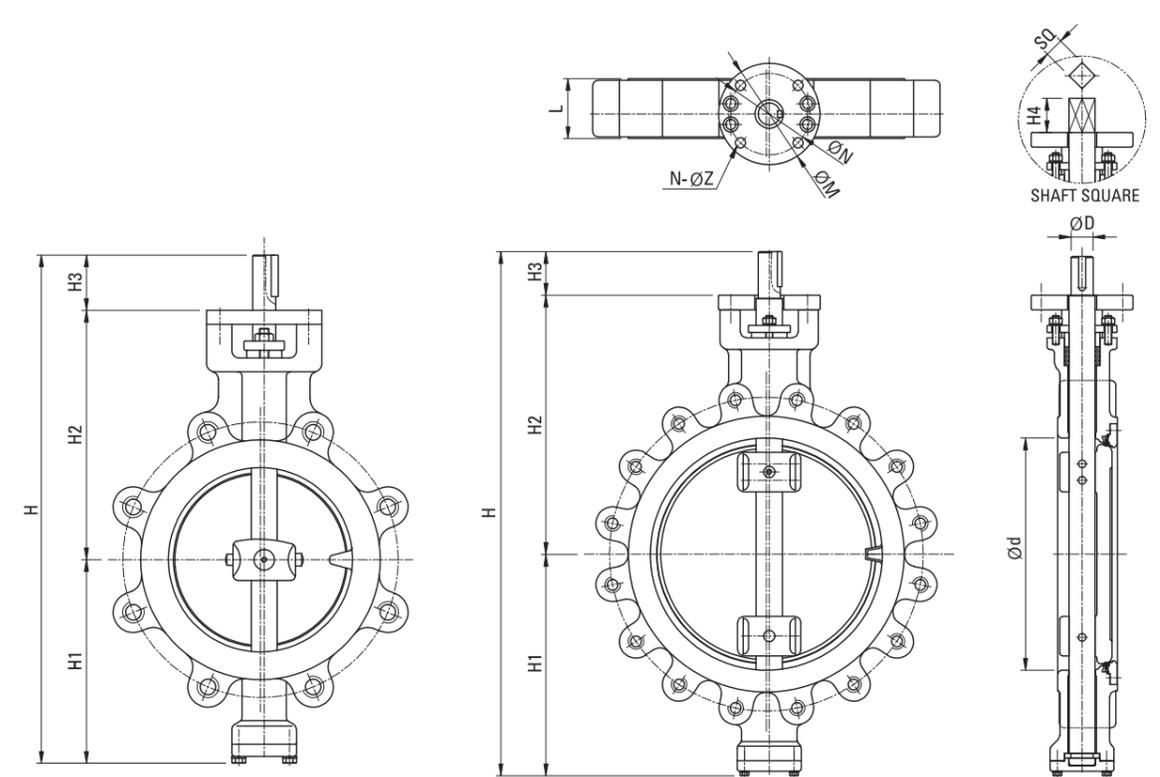


### VALVE DIMENSIONS

unit : mm

SIZE		Ø d	L	H	H1	H2	H3	STEM			TOP FLANGE			WEIGHT (APPROX.) (kg)		
inch	mm							Ø D	KEY SIZE	SQUARE SQ	H4	TYPE	Ø N		Ø M	N-Ø Z
2"	50	50	43	331	118	168	45	16	5x5	12	33	F07	70	90	4-9	5
2.5"	65	65	46	355	133	177	45	16	5x5	12	33	F07	70	90	4-9	6.5
3"	80	80	48	374	144	185	45	19	6x6	12	33	F07	70	90	4-9	10.5
4"	100	100	54	409	164	200	45	19	6x6	12	33	F07	70	90	4-9	15
5"	125	125	57	450	188	217	45	19	6x6	12	33	F07	70	90	4-9	18
6"	150	150	57	490	205	240	45	19	6x6	12	33	F07	70	90	4-9	25
8"	200	200	64	553	223	270	60	25	8x7	17	55	F10	102	125	4-12	36
10"	250	250	71	655	275	320	60	25	8x7	22	55	F10	102	125	4-12	56
12"	300	300	81	718	308	350	60	32	10x8	27	55	F10	102	125	4-12	68
14"	350	350	92	816	346	395	75	38	12x8	27	65	F14	140	175	4-18	93
16"	400	400	102	905	385	445	75	38	12x8	27	65	F14	140	175	4-18	121
18"	450	450	114	1000	410	490	100	50	14x9	36	90	F16	165	210	4-22	144
20"	500	500	127	1048	448	500	100	50	14x9	36	90	F16	165	210	4-22	160
22"	550	550	154	1123	488	535	100	65	20x12	50	90	F16	165	210	4-22	228
24"	600	600	154	1180	515	565	100	65	20x12	50	90	F16	165	210	4-22	284
26"	650	650	165	1271	551	620	100	65	20x12	-	-	F25	300	254	8-18	327
28"	700	700	165	1346	596	650	100	65	20x12	-	-	F25	300	254	8-18	388
30"	750	750	190	1415	620	695	100	80	22x14	-	-	F25	300	254	8-18	462
32"	800	800	190	1515	645	720	150	80	22x14	-	-	F30	350	298	8-32	607
36"	900	900	203	1665	710	805	150	85	22x14	-	-	F30	350	298	8-32	860
40"	1000	1000	216	1815	770	870	175	100	28x16	-	-	F35	415	356	8-32	1180
44"	1100	1100	240	1945	835	930	180	120	32x18	-	-	F40	475	406	8-38	1298
48"	1200	1200	254	2095	895	1000	200	125	32x18	-	-	F40	475	406	8-38	1661
52"	1300	1300	350	2215	945	1050	220	135	36x20	-	-	F40	475	406	8-38	2510
54"	1350	1350	350	2445	1010	1195	240	140	36x20	-	-	F48	560	483	12-38	3595
56"	1400	1400	390	2505	1035	1220	250	150	36x20	-	-	F48	560	483	12-38	4344
60"	1500	1500	390	2610	1090	1270	250	160	40x22	-	-	F48	560	483	12-38	5409

## High-performance Lug Type

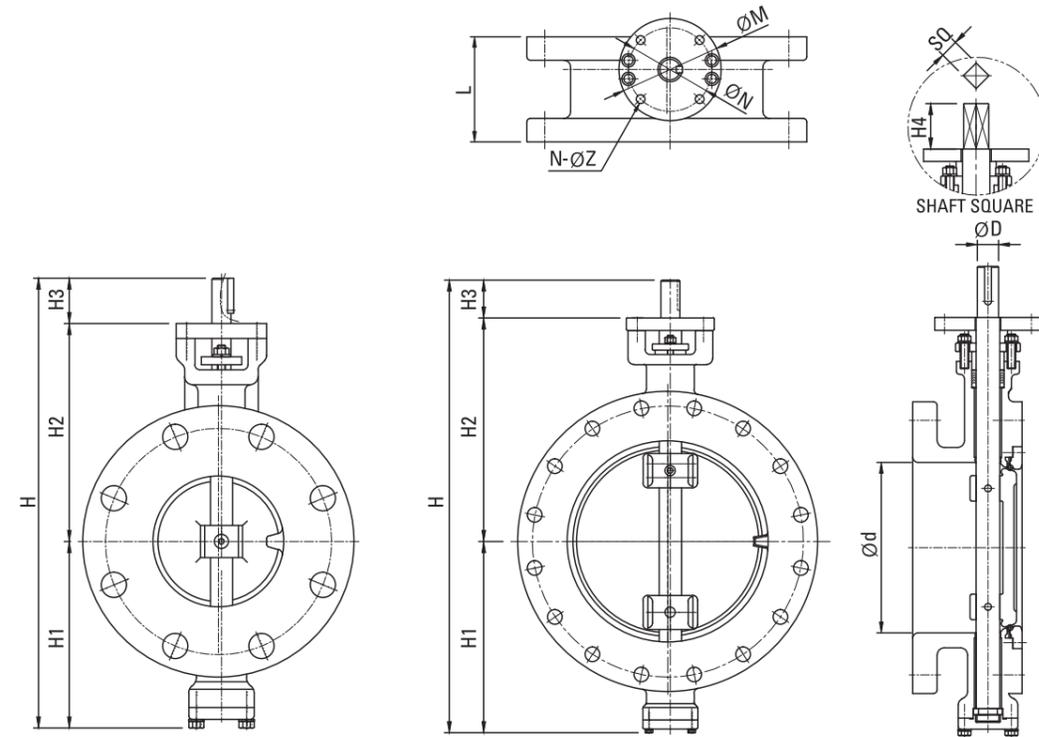


### VALVE DIMENSIONS

unit : mm

SIZE		Ø d	L	H	H1	H2	H3	STEM			TOP FLANGE			WEIGHT (APPROX.) (kg)		
inch	mm							Ø D	KEY SIZE	SQUARE SQ	H4	TYPE	Ø N		Ø M	N-Ø Z
2"	50	50	43	331	118	168	45	16	5x5	12	33	F07	70	90	4-9	8
2.5"	65	65	46	355	133	177	45	16	5x5	12	33	F07	70	90	4-9	9
3"	80	80	48	374	144	185	45	19	6x6	12	33	F07	70	90	4-9	12
4"	100	100	54	409	164	200	45	19	6x6	12	33	F07	70	90	4-9	15
5"	125	125	57	450	188	217	45	19	6x6	12	33	F07	70	90	4-9	20
6"	150	150	57	490	205	240	45	19	6x6	12	33	F07	70	90	4-9	29
8"	200	200	64	553	223	270	60	25	8x7	17	55	F10	102	125	4-12	44
10"	250	250	71	655	275	320	60	25	8x7	22	55	F10	102	125	4-12	65
12"	300	300	81	718	308	350	60	32	10x8	27	55	F10	102	125	4-12	80
14"	350	350	92	816	346	395	75	38	12x8	27	65	F14	140	175	4-18	130
16"	400	400	102	905	385	445	75	38	12x8	27	65	F14	140	175	4-18	144
18"	450	450	114	1000	410	490	100	50	14x9	36	90	F16	165	210	4-22	191
20"	500	500	127	1048	448	500	100	50	14x9	36	90	F16	165	210	4-22	226
22"	550	550	154	1123	488	535	100	65	20x12	50	90	F16	165	210	4-22	278
24"	600	600	154	1180	515	565	100	65	20x12	50	90	F16	165	210	4-22	339
26"	650	650	165	1271	551	620	100	65	20x12	-	-	F25	300	254	8-18	418
28"	700	700	165	1346	596	650	100	65	20x12	-	-	F25	300	254	8-18	519
30"	750	750	190	1415	620	695	100	80	22x14	-	-	F25	300	254	8-18	620
32"	800	800	190	1515	645	720	150	80	22x14	-	-	F30	350	298	8-32	783
36"	900	900	203	1665	710	805	150	85	22x14	-	-	F30	350	298	8-32	1102
40"	1000	1000	216	1815	770	870	175	100	28x16	-	-	F35	415	356	8-32	1450
44"	1100	1100	240	1945	835	930	180	120	32x18	-	-	F40	475	406	8-38	1763
48"	1200	1200	254	2095	895	1000	200	125	32x18	-	-	F40	475	406	8-38	2170
52"	1300	1300	350	2215	945	1050	220	135	36x20	-	-	F40	475	406	8-38	3212
54"	1350	1350	350	2445	1010	1195	240	140	36x20	-	-	F48	560	483	12-38	4365
56"	1400	1400	390	2505	1035	1220	250	150	36x20	-	-	F48	560	483	12-38	5300
60"	1500	1500	390	2610	1090	1270	250	160	40x22	-	-	F48	560	483	12-38	6542

## High-performance Flanged Type

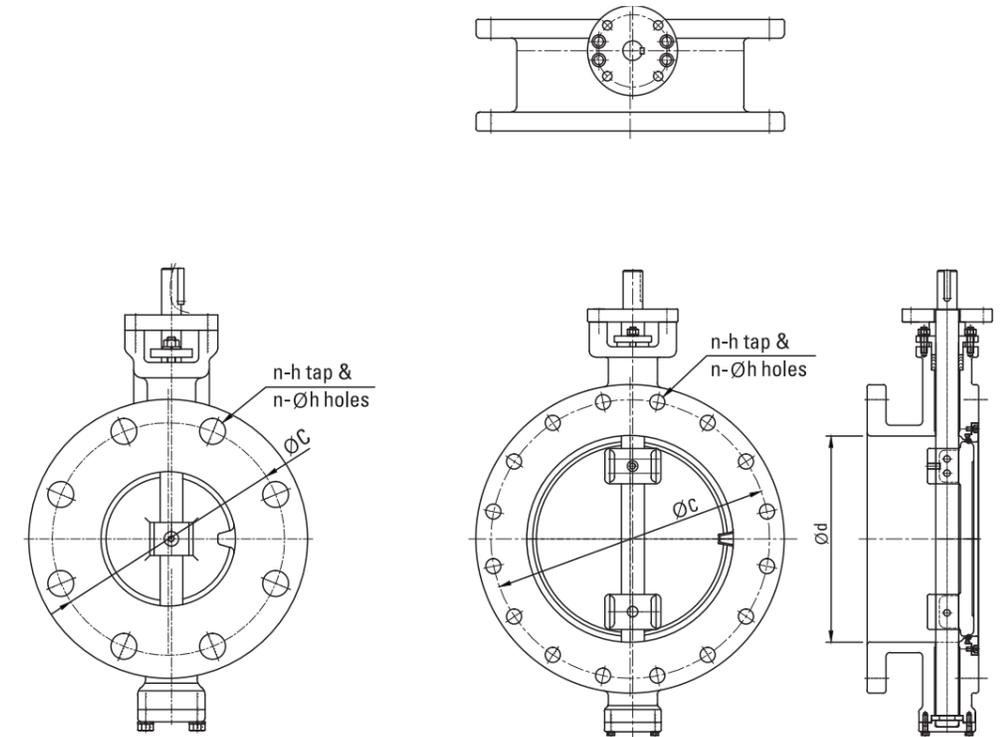


### VALVE DIMENSIONS

unit : mm

SIZE		Ø d	L	H	H1	H2	H3	STEM			TOP FLANGE			WEIGHT (APPROX.) (kg)		
inch	mm							Ø D	KEY SIZE	SQUARE SQ H4	TYPE	Ø N	Ø M		N-Ø Z	
2"	50	50	108	331	118	168	45	16	5x5	12	33	F07	70	90	4-9	14
2.5"	65	65	112	355	133	177	45	16	5x5	12	33	F07	70	90	4-9	18
3"	80	80	114	374	144	185	45	19	6x6	12	33	F07	70	90	4-9	22
4"	100	100	127	409	164	200	45	19	6x6	12	33	F07	70	90	4-9	28
5"	125	125	140	450	188	217	45	19	6x6	12	33	F07	70	90	4-9	37
6"	150	150	140	490	205	240	45	19	6x6	12	33	F07	70	90	4-9	44
8"	200	200	152	553	223	270	60	25	8x7	17	55	F10	102	125	4-12	64
10"	250	250	165	655	275	320	60	25	8x7	22	55	F10	102	125	4-12	87
12"	300	300	178	718	308	350	60	32	10x8	27	55	F10	102	125	4-12	123
14"	350	350	190	816	346	395	75	38	12x8	27	65	F14	140	175	4-18	155
16"	400	400	216	905	385	445	75	38	12x8	27	65	F14	140	175	4-18	224
18"	450	450	222	1000	410	490	100	50	14x9	36	90	F16	165	210	4-22	255
20"	500	500	229	1048	448	500	100	50	14x9	36	90	F16	165	210	4-22	321
22"	550	550	229	1123	488	535	100	65	20x12	50	90	F16	165	210	4-22	410
24"	600	600	267	1180	515	565	100	65	20x12	50	90	F16	165	210	4-22	475
26"	650	650	267	1271	551	620	100	65	20x12	-	-	F25	300	254	8-18	565
28"	700	700	292	1346	596	650	100	65	20x12	-	-	F25	300	254	8-18	685
30"	750	750	292	1415	620	695	100	80	22x14	-	-	F25	300	254	8-18	818
32"	800	800	318	1515	645	720	150	80	22x14	-	-	F30	350	298	8-32	1050
36"	900	900	330	1665	710	805	150	85	22x14	-	-	F30	350	298	8-32	1350
38"	950	950	410	1755	740	840	175	100	28x16	-	-	F35	415	356	8-32	1200
40"	1000	1000	410	1815	770	870	175	100	28x16	-	-	F35	415	356	8-32	1720
44"	1100	1100	410	1945	835	930	180	120	32x18	-	-	F40	475	406	8-38	2010
48"	1200	1200	470	2095	895	1000	200	125	32x18	-	-	F40	475	406	8-38	2450
52"	1300	1300	470	2215	945	1050	220	135	36x20	-	-	F40	475	406	8-38	3350
54"	1350	1350	470	2445	1010	1195	240	140	36x20	-	-	F48	560	483	12-38	4545
56"	1400	1400	530	2505	1035	1220	250	150	36x20	-	-	F48	560	483	12-38	5450
60"	1500	1500	530	2610	1090	1270	250	160	40x22	-	-	F48	560	483	12-38	6534

## Flange Dimensions



### FLANGE SIZE

unit : mm

SIZE		JIS 10K			JIS 16K			JIS 20K			ASME 150LB			ASME 300LB			BS 4504 PN 10			BS 4504 PN 16		
inch	mm	Ø C	n	Ø h	Ø C	n	Ø h	Ø C	n	Ø h	Ø C	n	Ø h	Ø C	n	Ø h	Ø C	n	Ø h	Ø C	n	Ø h
2"	50	120	4	19	120	8	19	120	8	19	120.5	4	3/4	127	8	3/4	125	4	18	125	4	18
2.5"	65	140	4	19	140	8	19	140	8	19	139.5	4	3/4	149	8	7/8	145	4	18	145	4	18
3"	80	150	8	19	160	8	23	160	8	23	152.5	4	3/4	168	8	7/8	160	8	18	160	8	18
4"	100	175	8	19	185	8	23	185	8	23	190.5	8	3/4	200	8	7/8	180	8	18	180	8	18
5"	125	210	8	23	225	8	25	225	8	25	216	8	7/8	235	8	7/8	210	8	18	210	8	18
6"	150	240	8	23	260	12	25	260	12	25	241.5	8	7/8	270	12	7/8	240	8	22	240	8	22
8"	200	290	12	23	305	12	25	305	12	25	298.5	8	7/8	330	12	1	295	8	22	295	12	22
10"	250	355	12	25	380	12	27	380	12	27	362	12	1	387.5	16	1 1/2	350	12	22	355	12	26
12"	300	400	16	25	430	16	27	430	16	27	432	12	1	451	16	1 1/4	400	12	22	410	12	26
14"	350	445	16	25	480	16	33	480	16	33	476	12	1 1/2	514.5	20	1 1/4	460	16	22	470	16	26
16"	400	510	16	27	540	16	33	540	16	33	539.5	16	1 1/2	571.5	20	1 3/8	515	16	26	525	16	30
18"	450	565	20	27	605	20	33	605	20	33	578	16	1 1/4	628.5	24	1 3/8	565	20	26	585	20	30
20"	500	620	20	27	660	20	33	660	20	33	635	20	1 1/4	686	24	1 3/8	620	20	26	650	20	33
22"	550	680	20	33	720	20	39	720	20	39	692.2	20	1 3/8	692.2	20	1 3/8	-	-	-	-	-	-
24"	600	730	24	33	770	24	39	770	24	39	749.3	20	1 3/8	749.3	20	1 3/8	725	20	30	770	20	36
26"	650	780	24	33	820	24	39	850	24	48	806.4	24	1 3/8	806.4	24	1 3/4	-	-	-	-	-	-
28"	700	840	24	33	875	24	42	900	24	48	863.6	28	1 3/8	863.6	28	1 3/4	840	24	30	840	24	36
30"	750	900	24	33	935	24	42	970	24	56	914.4	28	1 3/8	914.4	28	1 3/8	-	-	-	-	-	-
32"	800	950	28	33	990	24	48	1030	24	56	977.9	28	1 3/8	977.9	28	2	950	24	33	950	24	39
36"	900	1050	28	33	1090	28	48	1140	28	56	1085.8	32	2 1/2	1085.8	32	2 1/2	1050	28	33	1050	28	39
38"	950	-	-	-	-	-	-	-	-	-	1149.4	32	1 3/8	1092.2	32	1 3/8	1160	28	36	1170	28	42
40"	1000	1160	28	39	1210	28	56	-	-	-	1200.2	36	1 3/8	1200.2	36	1 3/4	-	-	-	-	-	-
44"	1100	1270	28	39	1310	32	56	-	-	-	1314.4	40	1 3/8	1314.4	40	1 3/8	-	-	-	-	-	-
48"	1200	1380	32	39	1420	32	56	-	-	-	1422.4	44	1 3/8	1422.4	44	2	1380	32	39	1390	32	48
52"	1300	-	-	-	1530	32	62	-	-	-	1536.7	44	1 7/8	1536.7	44	2 1/2	-	-	-	-	-	-
54"	1350	1540	36	46	1590	32	62	-	-	-	1593.8	44	1 7/8	1593.8	44	2 3/8	-	-	-	-	-	-
56"	1400	-	-	-	1640	36	62	-	-	-	1651	48	1	1651	48	2	1590	36	42	1590	36	48
60"	1500	1700	40	46	1750	36	62	-	-	-	1759	52	1 7/8	1759	52	2 3/8	-	-	-	-	-	-

## Design Features

### Teflon Seat

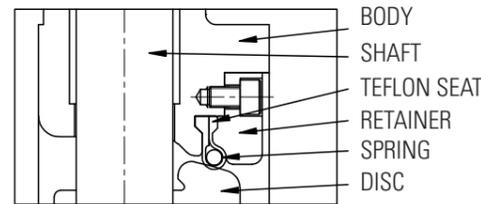
In soft seated models the PTFE seat is mechanically forcing onto the disc by means of the seat energizer which acts as a plate spring.

#### MATERIAL

PTFE(Polytetrafluoroethylene)  
RTFE(Reinforced polytetrafluoroethylene)

#### APPLICATIONS

Petro-chemicals, water, jet fuel, Saturated steam, chlorine, ammonia, natural gas oxygen, nitrogen  
Abrasives, suspended solids, scaling mediums



### Rubber Seat

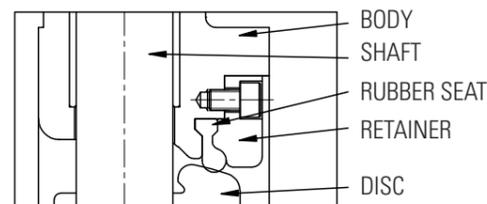
In soft seated models the Rubber seat have good flexibility and sealing performance by means of ball shape design.

#### MATERIAL

NBR, EPDM, VITON

#### APPLICATIONS

Cargo oil System in the tanker, Water ballast, Sea water, Fresh water system, Tank cleaning system, Fuel oil and Diesel oil system, cargo tank ventling and Inert gas system, Bilge and Drainage system, Other piping system where applicable



### Fire Safe

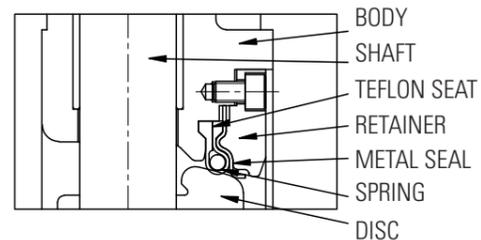
In fire safe models, the energized metal seal is extended so as to form a secondary sealing device in the event of soft seal destruction.

#### MATERIAL

PTFE(Polytetrafluoroethylene)  
RTFE(Reinforced polytetrafluoroethylene)  
Stainless steel

#### APPLICATIONS

Fire-safe applications, abrasives, slurries, steam



### Metal Seat

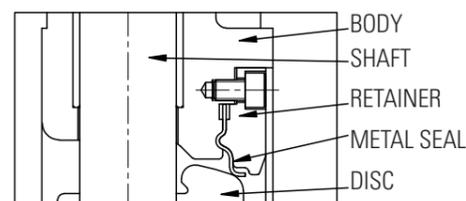
For high temperature or abrasive applications, the metal seat is placed instead of soft seat.

#### MATERIAL

Stainless Steel

#### APPLICATIONS

High temperature, low temperature, abrasives, fly ash, slurries.



## Pressure / Temperature Ratings

Temperature		ASME 150LB				ASME 300LB				ASME 600LB				ASME 900LB			
°F	°C	Carbon steel		Stainless Steel		Carbon steel		Stainless Steel		Carbon steel		Stainless Steel		Carbon steel		Stainless Steel	
		barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig
100-200	-29-38	19.6	285	18.9	275	51	740	49.6	720	102	1480	99.3	1440	153.1	2220	148.9	2160
200	93	17.9	260	16.5	240	46.5	675	42.7	620	93.1	1350	85.5	1240	139.6	2025	128.2	1860
300	149	15.8	230	14.8	215	45.1	655	38.6	560	90.6	1315	77.2	1120	135.8	1970	115.8	1680
400	204	13.7	200	13.4	195	43.7	635	35.5	515	87.5	1270	71	1030	131	1900	106.2	1540
500	260	11.7	170	11.7	170	41.3	600	33.1	480	82.7	1200	65.8	955	123.7	1795	98.9	1435
600	316	9.6	140	9.6	140	37.9	550	31	450	75.5	1095	62.4	905	113.1	1640	93.4	1355
650	343	8.6	125	8.6	125	36.8	535	30.6	445	74.1	1075	61.3	890	111	1610	91.7	1330
700	371	7.5	110	7.5	110	36.8	535	29.6	430	73.3	1065	59.6	865	110.3	1600	89.3	1295
750	399	6.5	95	6.5	95	34.8	505	29.3	425	69.6	1010	58.2	845	104.1	1510	87.5	1270
800	427	5.5	80	5.5	80	28.2	410	28.6	415	56.8	825	57.2	830	85.1	1235	85.8	1245
850	454	4.4	65	4.4	65	18.6	270	27.9	405	36.8	535	55.8	810	55.5	805	83.7	1215
900	482	3.4	50	3.4	50	11.7	170	27.2	395	23.7	345	54.4	790	35.5	515	81.3	1180
950	510	2.4	35	2.4	35	7.2	105	26.5	385	14.1	205	53.4	775	21.3	310	80	1160
1000	538	1.3	20	1.3	20	3.4	50	25.1	365	7.2	105	50	725	10.6	155	75.1	1090
1050	566	-	-	1.3(1)	20(1)	-	-	24.8	360	-	-	49.6	720	-	-	74.4	1080
1100	593	-	-	1.3(1)	20(1)	-	-	22.4	325	-	-	44.4	645	-	-	66.5	965
1150	621	-	-	1.3(1)	20(1)	-	-	18.9	275	-	-	37.9	560	-	-	56.8	825
1200	649	-	-	1.3(1)	20(1)	-	-	14.1	205	-	-	28.2	410	-	-	42.7	620

Note

WCB permissible but not recommended for prolonged use above 426°C (800°F)  
for welding end valves only, flanged end ratings terminates at 538°C (1000°F)

## Torques Required to Operate Valve

Actuator torques can be calculated by using the following formulas.

$$T_a = T_b + T_s + T_h = 1.2T_b \pm T_d$$

$$T_s = C_s D^2$$

$$T_b = 4.17 D^2 d_{fp}$$

$$T_d = C_f D^3 P$$

$$T_h = 3.06 D^4$$

$$V = C_f v / P = Q / 0.785 D^2$$

•  $T_a$ : The required actuator torque (lb-ft)

•  $T_s$ : Seat or unseating torque (lb-ft)

•  $T_d$ : Dynamic torque (lb-ft)

•  $Q$ : Flow (cubic feet per second)

•  $V$ : Velocity (feet per second)

•  $D$ : Diameter of valve (feet)

•  $d$ : Diameter of shaft (inch)

•  $P$ : Pressure drop across valve (psi)

•  $C_s$ : Coefficient of seating or unseating torque

•  $C_t$ : Coefficient of dynamic torque

•  $C_f$ : Coefficient of friction

•  $f$ : Bearing friction coefficient

### TORQUE TABLE

SIZE		WORKING PRESSURE (bar)								
inch	mm	5 bar			10 bar			16 bar		
		kgf-m	Nm	lbf.ft	kgf-m	Nm	lbf.ft	kgf-m	Nm	lbf.ft
2"	50	1.12	11.00	8.12	1.36	13.32	9.82	2.13	20.85	15.38
2.5"	65	1.65	16.21	11.96	2.25	22.01	16.23	2.72	26.64	19.65
3"	80	2.36	23.16	17.08	3.43	33.59	24.77	4.73	46.33	34.17
4"	100	4.37	42.85	31.61	5.79	56.75	41.86	7.56	74.12	54.67
5"	125	7.68	75.28	55.53	9.45	92.65	68.34	12.41	121.61	89.69
6"	150	13.00	127.40	93.97	18.91	185.31	136.68	24.82	243.22	179.39
8"	200	29.55	289.55	213.56	34.27	335.87	247.73	41.36	405.36	298.98
10"	250	37.82	370.62	273.35	53.18	521.18	384.40	65.00	637.00	469.83
12"	300	52.00	509.60	375.86	72.09	706.49	521.08	92.00	901.60	664.99
14"	350	73.27	718.07	529.62	102.82	1007.62	743.18	129.00	1264.20	932.43
16"	400	96.91	949.71	700.47	137.09	1343.49	990.91	173.00	1695.40	1250.46
18"	450	117.00	1146.60	845.69	178.45	1748.85	1289.89	230.00	2254.00	1662.46
20"	500	152.45	1494.05	1101.96	248.18	2432.18	1793.89	300.00	2940.00	2168.43
22"	550	205.64	2015.24	1486.36	281.27	2756.47	2033.07	404.00	3959.20	2920.16
24"	600	263.55	2582.75	1904.94	329.00	3224.20	2378.05	497.00	4870.60	3592.37
26"	650	328.55	3219.75	2374.76	405.00	3969.00	2927.38	614.00	6017.20	4438.06
28"	700	395.91	3879.91	2861.67	484.00	4743.20	3498.40	734.00	7193.20	5305.43
30"	750	475.09	4655.89	3434.01	554.00	5429.20	4004.37	941.00	9221.80	6801.65
32"	800	569.64	5582.44	4117.39	800.09	7840.89	5783.14	1218.45	11940.85	8807.12
34"	850	633.45	6207.85	4578.68	933.18	9439.18	6961.98	1562.36	15311.16	11292.93
36"	900	702.00	6879.60	5074.13	1129.82	11072.22	8166.45	1908.64	18704.64	13795.83
40"	1000	958.45	9392.85	6927.81	1499.73	14697.33	10840.19	2542.09	24912.49	18374.51
44"	1100	1275.18	12496.78	9217.15	1974.82	19353.22	14274.20	3336.27	32695.47	24114.94
48"	1200	1654.55	16214.55	11959.23	2542.09	24912.49	18374.51	4299.45	42134.65	31076.92
52"	1300	1861.12	18239.00	13452.40	3556.91	34857.73	25709.74	5591.81	54799.73	40418.20
56"	1400	2464.33	24150.45	17812.46	4706.05	46119.27	34015.83	7396.25	72483.27	53460.91
60"	1500	3023.89	29634.09	21856.98	5754.61	56395.18	41594.95	9031.50	88508.73	65280.68

# Basic Formulas for obtaining Cv-Value

Rated flow coefficient (Cv) is a number which represents a valve's ability to pass flow. The bigger Cv, the more flow can pass the valve with a given pressure drop. Rate Cv means the volume of water in united states gallons per minute that will pass through a given valve opening with a pressure drop of 1 pound square inch.

**For Liquids**  

$$C_v = 1.72Q \sqrt{\frac{G}{\Delta P}}$$

**For Gases**  
 When  $\Delta P < \frac{P_1}{2}$   

$$C_v = \frac{Q}{272} \sqrt{\frac{G(273+T)}{\Delta P(P_1+P_2)}}$$

When  $\Delta P \geq \frac{P_1}{2}$   

$$C_v = \frac{\sqrt{G(273+T)}}{236P_1}$$

**For Steam**  
 When  $\Delta P < \frac{P_1}{2}$   

$$C_v = \frac{WK}{13.5 \sqrt{\Delta P(P_1+P_2)}}$$

When  $\Delta P \geq \frac{P_1}{2}$   

$$C_v = \frac{WK}{11.9P_1}$$

**For Steam In general**  

$$C_v = \frac{W}{1210} \sqrt{\frac{V_1+V_2}{\Delta P}}$$

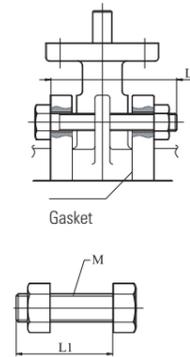
Q : Volume rate of flow (liquid m<sup>3</sup>/h, gas N m<sup>3</sup>/h) [ ※ 1ft<sup>3</sup>/h = 0.02832m<sup>3</sup>/h ]  
 W : Volume rate of flow (steam kg/h) [ ※ 1lb = 0.45359kg ]  
 P1 : Inlet pressure (liquid kgf/cm<sup>2</sup>, gas / steam kgf/cm<sup>2</sup> abs) [ ※ 1mpa = 10.2kgf/cm<sup>2</sup> ]  
 P2 : Outlet pressure (liquid kgf/cm<sup>2</sup>, gas / steam kgf/cm<sup>2</sup> abs) [ ※ 1psi = 0.07kgf/cm<sup>2</sup> ]  
 $\Delta P$  : Pressure drop P1 - P2 (kgf/cm<sup>2</sup>)  
 G : Specific gravity of fluid (water = 1, air =1)  
 T : Temperature of fluid (°C) [ ※ °C = 5/9 (°F - 32) ]  
 K : 1+ (0.0013 × TSH)  
 TSH (°C) : Total Temperature minus saturation Temperature  
 V1 : Specific volume (cm<sup>3</sup>/g...P1) [ ※ 1ft<sup>3</sup>/lb = 62.4cm<sup>3</sup>/g ]  
 V2 : Specific volume (cm<sup>3</sup>/g...P2)  
 Notes : When P2  $\frac{1}{2}$  P1 use  $\frac{P_1}{2}$  instead of  $\Delta P$   
 For V2, use V2 in accordance with  $\frac{P_1}{2}$

## FLOW COEFFICIENT

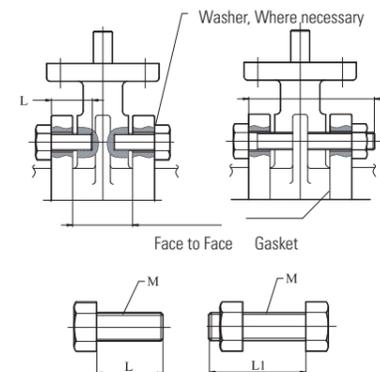
SIZE		DISC OPENING																		
		10°		20°		30°		40°		50°		60°		70°		80°		90°		
inch	mm	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	
2"	50	1.7	2	9.5	11	12.9	15	27.6	32	41.4	48	50.9	59	56.0	65	71	71.6	83		
2.5"	65	3.4	4	11.2	13	18.1	21	29.3	34	45.7	53	69.0	80	95.7	111	120.7	140	131.9	153	
3"	80	6.0	7	15.5	18	30.2	35	50.0	58	77.6	90	118.1	137	155.2	180	203.4	236	225.0	261	
4"	100	12	14	30	35	54	63	95	110	145	168	191	222	254	295	341	395	397	460	
5"	125	19	22	50	58	91	105	151	175	227	263	345	400	461	535	569	660	647	750	
6"	150	28	32	95	110	155	180	241	280	353	410	500	580	690	800	875	1015	948	1100	
8"	200	50	58	138	160	250	290	379	440	603	700	858	995	1207	1400	1595	1850	1810	2100	
10"	250	73	85	198	230	379	440	578	670	905	1050	1293	1500	1879	2180	2457	2850	2802	3250	
12"	300	103	120	276	320	500	580	819	950	1293	1500	1897	2200	2629	3050	3466	4020	3879	4500	
14"	350	161	187	414	480	845	980	1155	1340	1983	2300	2543	2950	3724	4320	4397	5100	5216	6050	
16"	400	207	240	534	620	1138	1320	1569	1820	2491	2890	3586	4160	5198	6030	6991	8110	8190	9500	
18"	450	260	302	690	800	1345	1560	2060	2390	3259	3780	4603	5340	6681	7750	8603	9980	10328	11980	
20"	500	328	380	849	985	1722	1997	2505	2906	3966	4600	5626	6526	8326	9658	11276	13080	13879	16100	
24"	600	457	530	1207	1400	2310	2680	3569	4140	5759	6680	8293	9620	11121	12900	15862	18400	18819	21830	
28"	700	672	780	1853	2150	3362	3900	5440	6310	8608	9985	12069	14000	17250	20010	22586	26200	25862	30000	
30"	750	724	840	1931	2240	3897	4520	5862	6800	9401	10905	14526	16850	18996	22035	25147	29170	29741	34500	
32"	800	905	1050	2759	3200	4888	5670	7707	8940	11940	13850	17707	20540	24224	28100	29483	34200	34483	40000	
36"	900	1103	1280	2948	3420	5905	6850	9914	11500	15517	18000	21552	25000	31034	36000	38578	44750	46720	54195	
40"	1000	1629	1890	3879	4500	8319	9650	13750	15950	19741	22900	27931	32400	39698	46050	50690	58800	59526	69050	
44"	1100	1879	2180	4474	5190	9594	11129	15857	18394	22766	26409	32211	37365	45781	53106	58457	67810	68647	79630	
48"	1200	2391	2774	5694	6605	12210	14164	20181	23410	28975	33611	40996	47555	58267	67590	74399	86303	87369	101348	
52"	1300	2950	3421	7023	8146	15060	17469	24891	28874	35737	41455	50563	58653	71865	83364	91763	106445	107759	125000	
56"	1400	3407	3952	8111	9409	17393	20176	28749	33348	41275	47879	58398	67742	83001	96281	105982	122939	124457	144370	
60"	1500	4205	4877	10011	11613	21468	24903	35484	41161	50945	59097	72080	83613	102447	118839	130812	151742	153615	178194	

# Bolting Dimensions

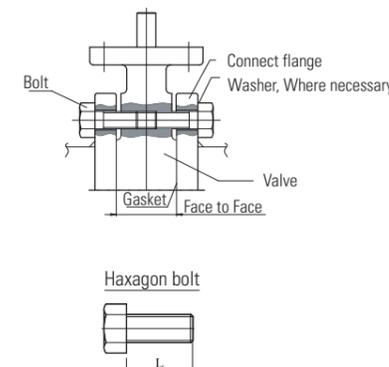
## WAFER TYPE



## SEMI-LUG TYPE



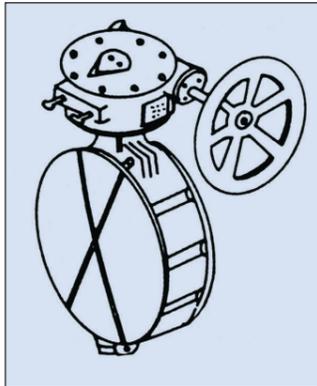
## LUG TYPE



SIZE		FACE TO FACE	JIS 10K				JIS 16K			
inch	mm		BOLT SIZE	NUT (T)	PIPE FLANGE(T)	BOLT Q'TY	BOLT SIZE	NUT (T)	PIPE FLANGE(T)	BOLT Q'TY
2"	50	43	M16	13	16	4	M16	13	16	8
2.5"	65	46	M16	13	18	4	M16	13	18	8
3"	80	48	M16	13	18	8	M20	16	20	8
4"	100	54	M16	13	18	8	M20	16	22	8
5"	125	57	M20	16	20	8	M22	18	22	8
6"	150	57	M20	16	22	8	M22	18	24	12
8"	200	64	M20	16	22	12	M22	18	26	12
10"	250	71	M22	18	24	12	M24	19	28	12
12"	300	81	M22	18	24	16	M24	19	30	16
14"	350	92	M22	18	26	16	M30	24	34	16
16"	400	102	M24	19	28	16	M30	24	38	16
18"	450	114	M24	19	30	20	M30	24	40	20
20"	500	127	M24	19	30	20	M30	24	42	20
22"	550	154	M30	24	32	20	M36	29	44	20
24"	600	154	M30	24	32	24	M36	29	46	24
26"	650	165	M30	24	34	24	M36	29	48	24
28"	700	165	M30	24	34	24	M39	31	50	24
30"	750	190	M30	24	36	24	M39	31	52	24
32"	800	190	M30	24	36	28	M45	36	54	24
34"	850	203	M30	24	36	28	M45	36	56	24
36"	900	203	M30	24	38	28	M45	36	58	28
40"	1000	216	M36	29	40	28	M52	42	62	28
44"	1100	240	M36	29	42	28	M52	42	66	32
48"	1200	254	M36	29	44	32	M52	42	70	32
54"	1350	350	M42	32	48	36	M56	45	76	36
60"	1500	390	M42	32	50	40	M56	45	80	36

SIZE		FACE TO FACE	JIS 10K				JIS 16K			
inch	mm		BOLT SIZE	PIPE FLANGE(T)	BOLT Q'TY	BOLT SIZE	PIPE FLANGE(T)	BOLT Q'TY		
2"	50	43	M16	16	4	M16	16	8		
2.5"	65	46	M16	18	4	M16	18	8		
3"	80	48	M16	18	8	M20	20	8		
4"	100	54	M16	18	8	M20	22	8		
5"	125	57	M20	20	8	M22	22	8		
6"	150	57	M20	22	8	M22	24	12		
8"	200	64	M20	22	12	M22	26	12		
10"	250	71	M22	24	12	M24	28	12		
12"	300	81	M22	24	16	M24	30	16		
14"	350	92	M22	26	16	M30	34	16		
16"	400	102	M24	28	16	M30	38	16		
18"	450	114	M24	30	20	M30	40	20		
20"	500	127	M24	30	20	M30	42	20		
22"	550	154	M30	32	20	M36	44	20		
24"	600	154	M30	32	24	M36	46	24		
26"	650	165	M30	34	24	M36	48	24		
28"	700	165	M30	34	24	M39	50	24		
30"	750	190	M30	36	24	M39	52	24		
32"	800	190	M30	36	28	M45	54	24		
34"	850	203	M30	36	28	M45	56	24		
36"	900	203	M30	38	28	M45	58	28		
40"	1000	216	M36	40	28	M52	62	28		
44"	1100	240	M36	42	28	M52	66	32		
48"	1200	254	M36	44	32	M52	70	32		
54"	1350	350	M42	48	36	M56	76	36		
60"	1500	390	M42	50	40	M56	80	36		

## Method for Carrying & Keeping



- Be careful not to scratch Disc and Seat ring. The flange must be protected by protection cover when carrying valve.
- Valve must not be shocked and shaken too much. (It may cause the breaking neck, lever, handle, and body)
- It is recommended to keep and carry the valve under the condition of opening above 10°C in general.
- The suitable temperature is over -10°C and humidity is less than 60% while keeping valve.
- In keeping valve, must check the operation once every one (1) Month

### Installation Instructions

#### General

- Valves can be installed in the pipe line in any position.
- Before installing valves, the pipe line must be cleaned from dirt and welding residues. otherwise, seat may be damaged.
- Also the pipeline must be free from tension and electric current.
- When handling valves, be careful to avoid contact with or impact by other equipment.
- Check carefully whether valve seat / disc surface, as well as mating face, are all clean.
- Tighten again, if any, all bolts loosened during transport and / or handling.
- Open and close valves to check proper operation.
- Do not put a weight on the lever or gear handle during valve operation.
- If possible, install valves in the direction of arrow mark on it for easier access and maintenance.
- Do not use valve as a substitute for jack when putting pipes in alignment.
- The span of pipeline having connection between valve and pipe should be free from such excessive loading as may cause serious bending.
- Do not weld the piping around the valve area under the condition that the valve is installed.

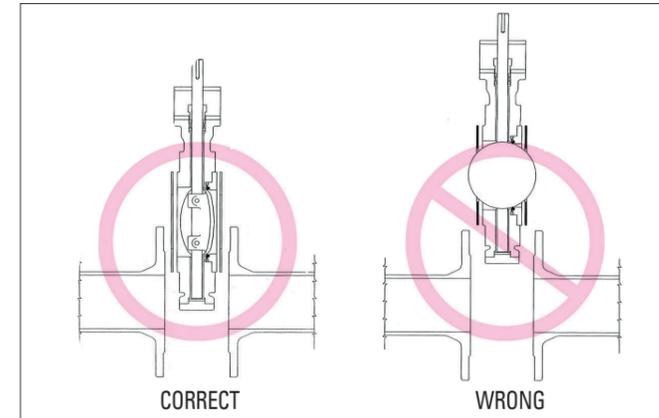
#### Installation on new pipeline

- Shut partially valve disc until disc profile is at least 10mm within the body.
- Align the two flanges with the valve body.
- Flange gaskets should be positioned, aligned with bore.
- Span the body with some flange-bolts and tighten the bolts partially. Finish tightening by uniform cross bolting.
- Use the flange-valve-flange unit for pipe centering.
- Tack-weld the flanges to the pipe.
- Remove the bolts and the valve from the flanges. Just perform tack-welding only when the valve is inserted, as high heat temperature can damage valve seat.
- Weld flanges to the pipe and wait until completely cooled down.
- Install the valve in accordance with the instruction.

#### Replacement of Packing

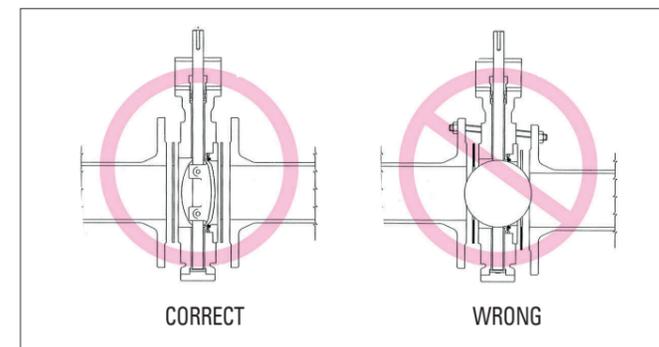
- Before replacing gland packing or a seat ring, close upstream valve and detach the valve from the piping.

## How to Install Butterfly Valve



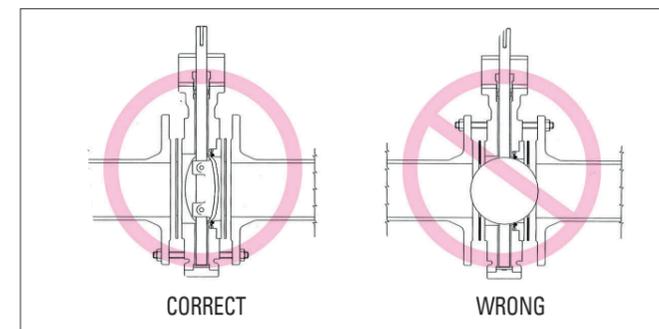
### Centering & Flanging of Valve

- Spread both flanges enough to allow the valve with disc in semi-closed position. This prevents the damage of disc and seat during installation.



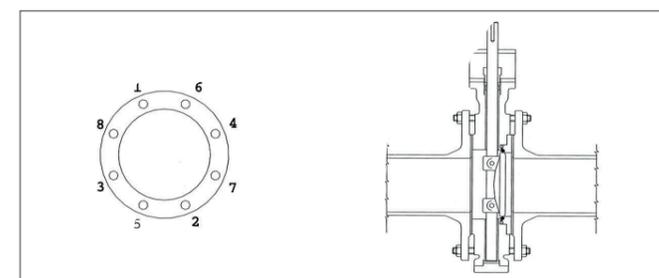
### Aligning of Flange Gaskets

- Flange gaskets should be positioned aligned with valve bore. Pipe misalignment may cause interference between disc edge and flange face, creating leakage and excessive torque to open valve.



### Aligning of Flange bolts

- Insert bolts through the two bottom pipe flange holes to rest valves on during installation. Disc should be in full open position after flange alignment and before evenly tightening flange bolts.



### Bolt Tightening

- Tighten the flange bolts evenly to prevent the leakage between flange and valve.