SIERRA
Engineering & Manufacturing

7500

ECCENTRIC DISC BUTTERFLY VALVE

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The GCF / SIERRA model 7500 is a double flanged eccentric disc seated valve. This model is suitable for high-pressure waterworks applications.

The 7500 butterfly valve is an excellent valve for isolation purposes. It might also be used for throttling purposes under certain conditions.

7500 | SCOPE OF SUPPLY & DESIGN STANDARDS

RANGE OF SIZES:	DN100 - DN2600
PRESSURE RATINGS:	PN10, PN16 AND PN25
TEMPERATURE RANGE:	-20°C TO +70°C
DESIGN AND TYPE TO:	EN593
(WHICH REPLACES DIN3354 AND BS5155)	
FACE-TO-FACE DIMENSIONS:	
BASIC SERIES 13 TO EN558 (ISO5752 AND BS5155 SHORT SERIES)	
BASIC SERIES 14 TO EN558 (ISO5752 AND BS5155 LONG SERIES)	
FLANGE DIMENSIONS:	EN1092-2 (DIN2501) ASME B 16.5 Class 150lb, 300lb (Upon Request)
ACTUATOR FLANGE DIMENSIONS:	ENISO 5210 - 5211
HYDROSTATIC TESTING:	EN12266 AND ISO5208
ACTUATION:	MANUAL WITH GEARBOX
	ELECTRICALLY OR PNEUMATICALLY ACTUATED
TYPE TESTING TO:	EN1074

7500 | FIELDS OF APPLICATIONS

- Municipal Water and irrigation pipeline mains and distribution networks
- Pumping Stations and Intakes
- Ground reservoirs and elevated tanks
- Water treatment plants
- Primary and secondary cooling for Power stations

DESIGN FEATURES

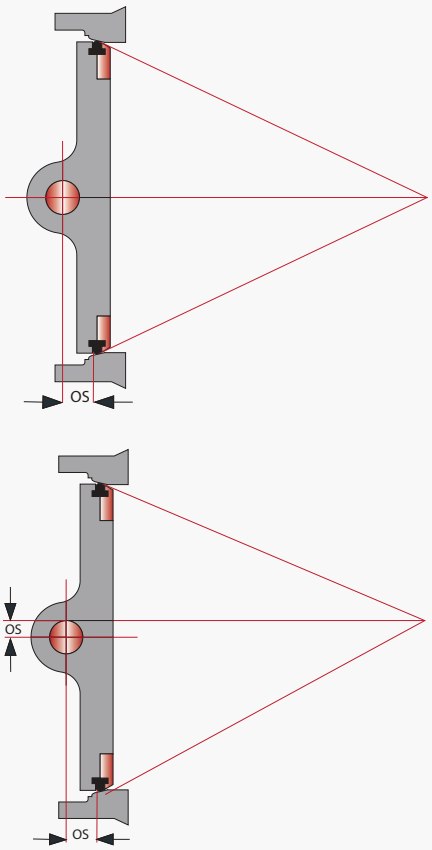
1- SINGLE AND DOUBLE ECCENTRICITY

THE 7500 ECCENTRIC BUTTERFLY VALVES IS OFFERED WITH SINGLE OR DOUBLE ECCENTRIC VALVE DISC.

A) In the single eccentric design:
The axis of rotation of the disc is offset away from the sealing surface thus providing a full uninterrupted rubber seal. Accordingly there is no leakage between the shaft and disc and the seal is evenly compressed.

B) In the double eccentric design:

The second eccentricity is obtained by offsetting the axis of the disc from the axis of the valve. This prevents high friction between the rubber seal and seat in the body during the first few degrees of opening and closing of the valve, normally requiring the highest torque. The double eccentric design hence prolongs the life of the rubber seal.



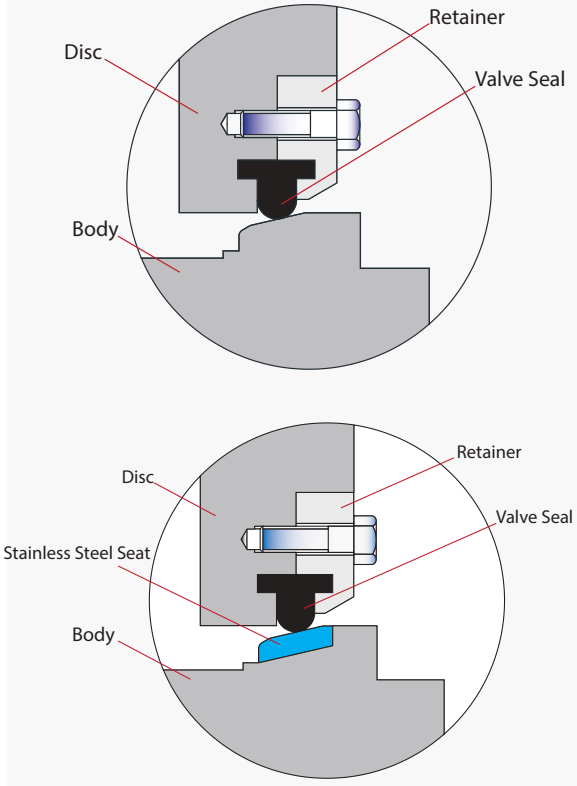
2- SEAT DESIGN

THE 7500 ECCENTRIC BUTTERFLY VALVES ARE OFFERED WITH TWO DIFFERENT SEAT DESIGNS.

A) The integral seat design has a machined and epoxy coated ductile iron seat integrated in the body.

B) The stainless steel seat design is welded and precisely machined inside the valve body hence:

- Providing a lower coefficient of friction during operation. A major advantage of using a Stainless steel seat is to avoid sticking of the seal ring to seat surface when the valves are kept closed for a long period of time.
- Providing high corrosion and wear resistance

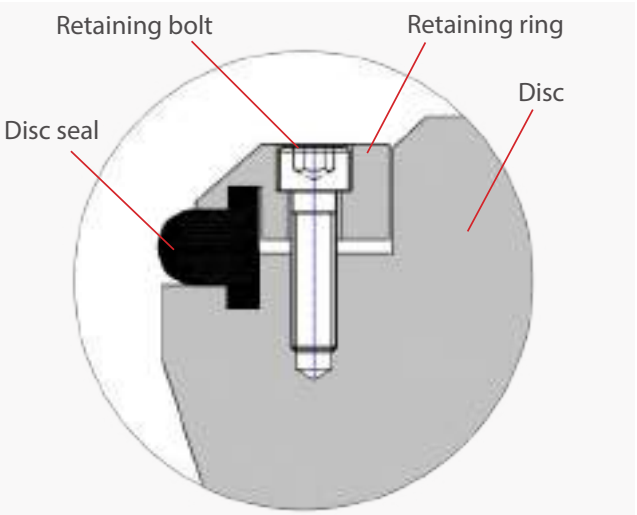


DESIGN FEATURES

3- RUBBER SEAL & RETAINER MECHANISM

PRESSURE ACTIVATED RUBBER SEAL, MOLDED IN ONE PIECE (NO GLUED JOINT) IS MECHANICALLY ATTACHED TO A HIGHLY SECURED RETAINER SEALING MECHANISM

The rubber sealing is secured in place by means of a ductile iron or stainless steel retainer ring that is fixed to the disc by means of stainless steel bolts. Several profiles of seals are provided, all of which settle in machined registers in the disc & retainer offering a very secure locking mechanism.

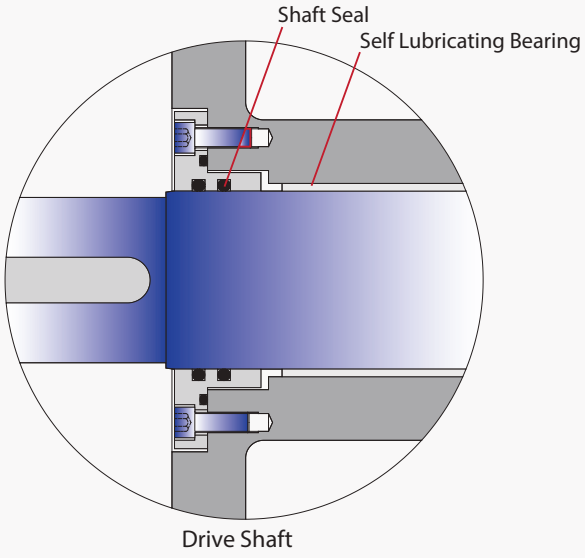


4- SELF-LUBRICATING BEARING

The PTFE lined bearing surface provides a very low friction coefficient thus reducing the valve operating torque and offering longer life without the need for replacement.

5- SHAFT SEALING MECHANISM

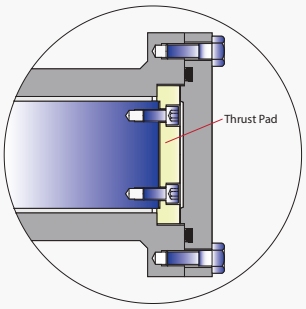
A gland with O-Rings (or V packing) provides excellent shaft sealing, has a long service life and minimizes operating torque. The gland design enables O ring replacement while the valve is operating under pressure.



DESIGN FEATURES

6- THRUST PAD

A thrust pad is used to center the disc along the shaft axis and reduces friction.



7- LIFTING EYES AND INTEGRAL SEATS

Valves are furnished with integral seats (feet) for easy storage and lifting eyes for safe handling on site.

8- CORROSION PROTECTION

Body and disc are fully coated with blue electrostatic powder Epoxy.

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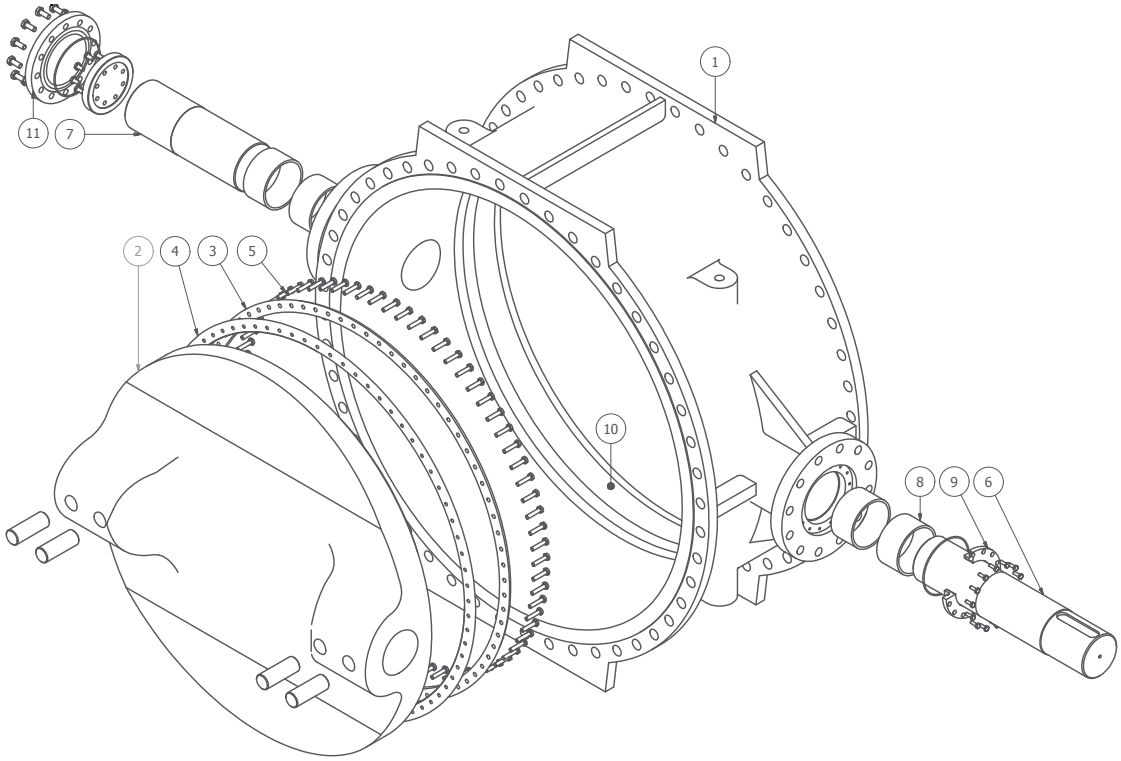
ECCENTRIC DISC BUTTERFLY VALVE

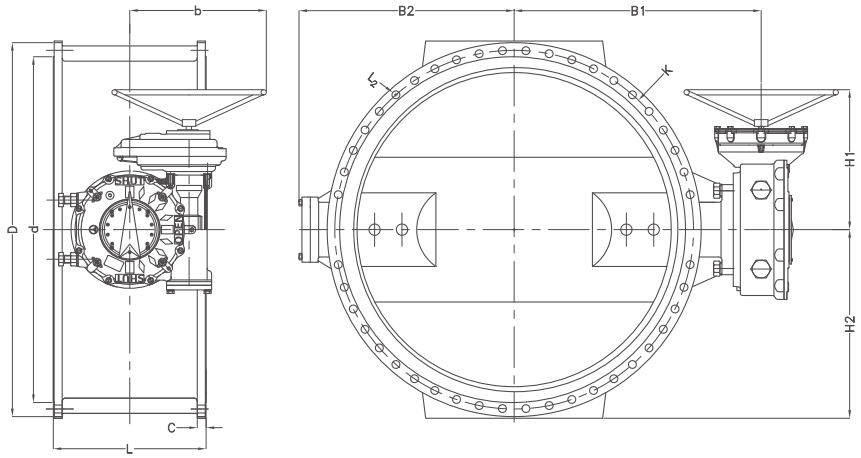
MATERIAL STANDARDS



ITEM NO	ITEM DESCRIPTION	MATERIAL		STANDARDS
		STANDARD	OPTION	
1	Valve Body	Ductile Iron EN-GJS-500/7	Ductile Iron EN-GJS-400/12	EN1563
2	Valve Disc	Ductile Iron EN-GJS-500/7	Ductile Iron EN-GJS-400/12	EN1563
3	Retainer Ring (A)	Ductile Iron EN-GJS-500/7	Ductile Iron EN-GJS-400/12	EN1563
	Retainer Ring (B)	SS304	SS316	EN10088
4	Disc Seal	EPDM	NBR	
5	Retainer Bolts	SS304		EN10088
6	Driving Shaft	X20Cr13 (AISI 420)	SS316	EN10088
7	Stub Shaft	X20Cr13 (AISI 420)	SS316	EN10088
8	Bearing	Self-lubricating PTFE/ Steel/Tin		
9	Gland	Ductile Iron EN-GJS-500/7	Ductile Iron EN-GJS-400/12	EN1563
10	Body Seat	SS316	Integrated in valve body	
11	Bottom Cover	Steel 37		EN10025

* DIFFERENT MATERIAL GRADES ARE AVAILABLE UPON REQUEST

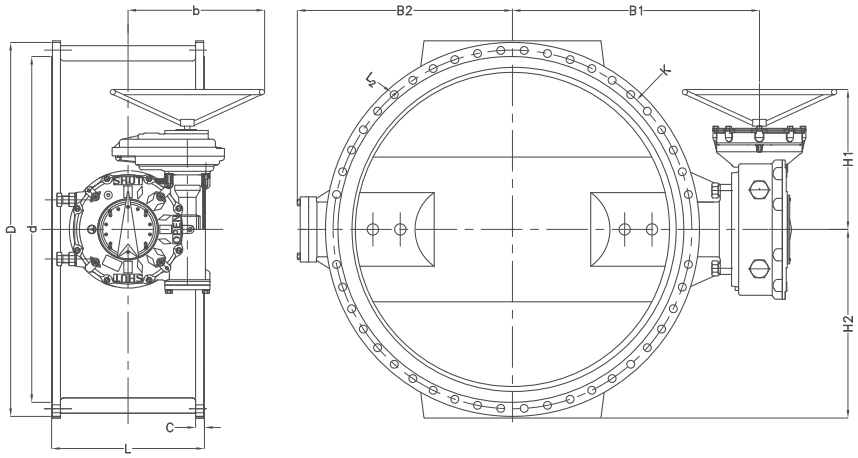
DIMENSION TABLE FOR PN10 BUTTERRLY VALVES WITH GEARBOXES



DN	FACE TO FACE			MAIN VALVE DIMENSIONS					PN10 BAR FLANGE DIMENSIONS						
	SERIES 20	SERIES 13	SERIES 14	H1	H2	B1	B2	b	D	d	C	K	N	L_2	BOLTS
100	52	127	190	155	110	210	110	133	220	156	19	180	8	19	M16
150	56	140	210	193	145	260	143	184	285	211	19	240	8	23	M20
200	60	152	230	193	175	305	170	184	340	266	20	295	8	23	M20
250	68	165	250	220	215	315	240	200	400	319	22	350	12	23	M20
300	78	178	270	220	215	360	280	200	455	370	24.5	400	12	23	M20
350	78	190	290	220	275	390	315	200	505	429	24.5	460	16	23	M20
400	102	216	310	260	305	430	350	270	565	480	24.5	515	16	28	M24
450	114	222	330	260	325	475	375	270	615	530	26.5	565	20	28	M24
500	127	229	350	260	356	500	415	270	670	582	26.5	620	20	28	M24
600	154	267	390	330	430	560	475	340	780	682	30	725	20	31	M27
700	165	292	430	370	460	645	510	350	895	794	32.5	840	24	31	M27
800	190	318	470	370	540	700	565	350	1015	901	35	950	24	34	M30
900	203	330	510	420	600	800	630	380	1115	1001	37.5	1050	28	34	M30
1000	216	410	550	500	640	870	685	580	1230	1112	40	1160	28	37	M33
1100	216	410	590	610	700	950	840	680	1340	1215	42.5	1270	32	37	M33
1200	254	470	630	610	770	1000	890	680	1455	1328	45	1380	32	40	M36
1400	279	530	710	610	900	1100	970	680	1675	1530	46	1590	36	43	M39
1500	279	530	750	610	970	1160	1020	680	1785	1640	47.5	1700	36	43	M39
1600	318	600	790	660	1030	1275	1130	780	1915	1750	49	1820	40	49	M45
1800	356	670	870	660	1100	1400	1230	780	2115	1950	52	2020	44	49	M45
2000	406	760	950	970	1180	1540	1340	840	2325	2150	56	2230	48	49	M45
2200	465	760	1030	1000	1300	1710	1480	930	2550	2370	59	2440	52	56	M45
2400	535*	850*	1110*	1000	1400	1810	1580	930	2750	2570	62	2650	56	56	M52
2500	535*	850*	1110*	1100	1460	1880	1635	980	2860	2670	65	2750	56	56	M52
2600	535*	850*	1110*	1100	1510	1940	1690	980	2960	2780	65	2850	60	56	M52

*Specific dimensions designed by the Manufacturer, Not described in the standards

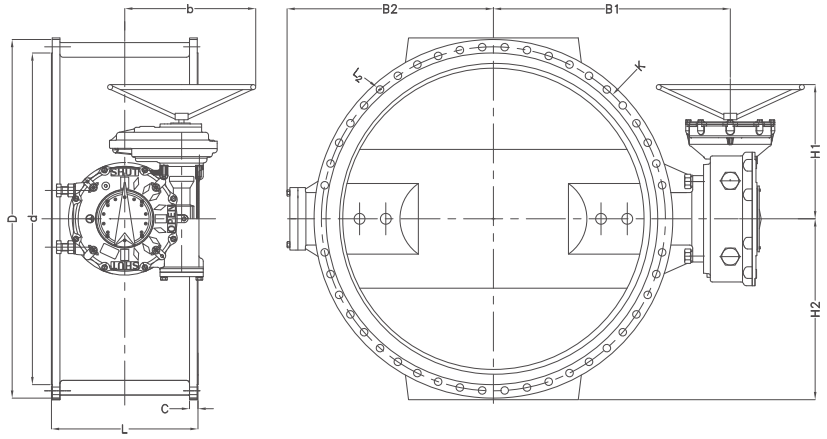
DIMENSION TABLE FOR PN16 BUTTERRLY VALVES WITH GEARBOXES



DN	FACE TO FACE			MAIN VALVE DIMENSIONS					PN16 BAR FLANGE DIMENSIONS						
	SERIES 20	SERIES 13	SERIES 14	H1	H2	B1	B2	b	D	d	C	K	N	L_2	BOLTS
100	52	127	190	155	110	210	110	133	220	156	19	180	8	19	M16
150	56	140	210	193	145	260	143	184	285	211	19	240	8	23	M20
200	60	152	230	193	175	305	170	184	340	266	20	295	12	23	M20
250	68	165	250	220	215	315	240	200	400	319	22	355	12	28	M24
300	78	178	270	220	215	360	280	200	455	370	24.5	410	12	28	M24
350	78	190	290	220	275	390	315	270	520	429	26.5	470	16	28	M24
400	102	216	310	260	305	430	350	340	580	480	28	525	16	31	M27
450	114	222	330	330	325	475	375	340	640	548	30	585	20	31	M27
500	127	229	350	330	356	500	410	350	715	609	31.5	650	20	34	M30
600	154	267	390	370	430	560	475	380	840	720	36	770	20	37	M33
700	165	292	430	420	460	645	510	580	910	794	39.5	840	24	37	M33
800	190	318	470	500	540	700	565	580	1025	901	43	950	24	40	M36
900	203	330	510	500	600	800	630	680	1125	1001	46.5	1050	28	40	M36
1000	216	410	550	610	640	870	685	680	1255	1112	50	1170	28	43	M39
1100	216	410	590	610	700	950	840	680	1355	1215	53.5	1270	32	43	M39
1200	254	470	630	660	770	1000	890	780	1485	1328	57	1390	32	49	M45
1400	279	530	710	970	900	1100	970	840	1685	1530	60	1590	36	49	M45
1500	279	530	750	970	970	1160	1020	840	1820	1640	62.5	1710	36	56	M52
1600	318	600	790	970	1030	1275	1130	840	1930	1750	65	1820	40	56	M52
1800	356	670	870	970	1100	1400	1230	840	2130	1950	70	2020	44	56	M52
2000	406	760	950	1000	1180	1540	1340	840	2345	2150	75	2230	48	62	M56
2200	465	760	1030	1000	1300	1710	1480	930	2555	2370	80	2440	52	62	M56
2400	535*	850*	1110*	1000	1400	1810	1580	930	2765	2570	86	2650	56	62	M56
2500	535*	850*	1110*	1100	1460	1880	1635	980	2870	2670	86	2750	60	62	M56
2600	535*	850*	1110*	1100	1510	1940	1690	980	2965	2780	91	2850	60	62	M56

*Specific dimensions designed by the Manufacturer, Not described in the standards

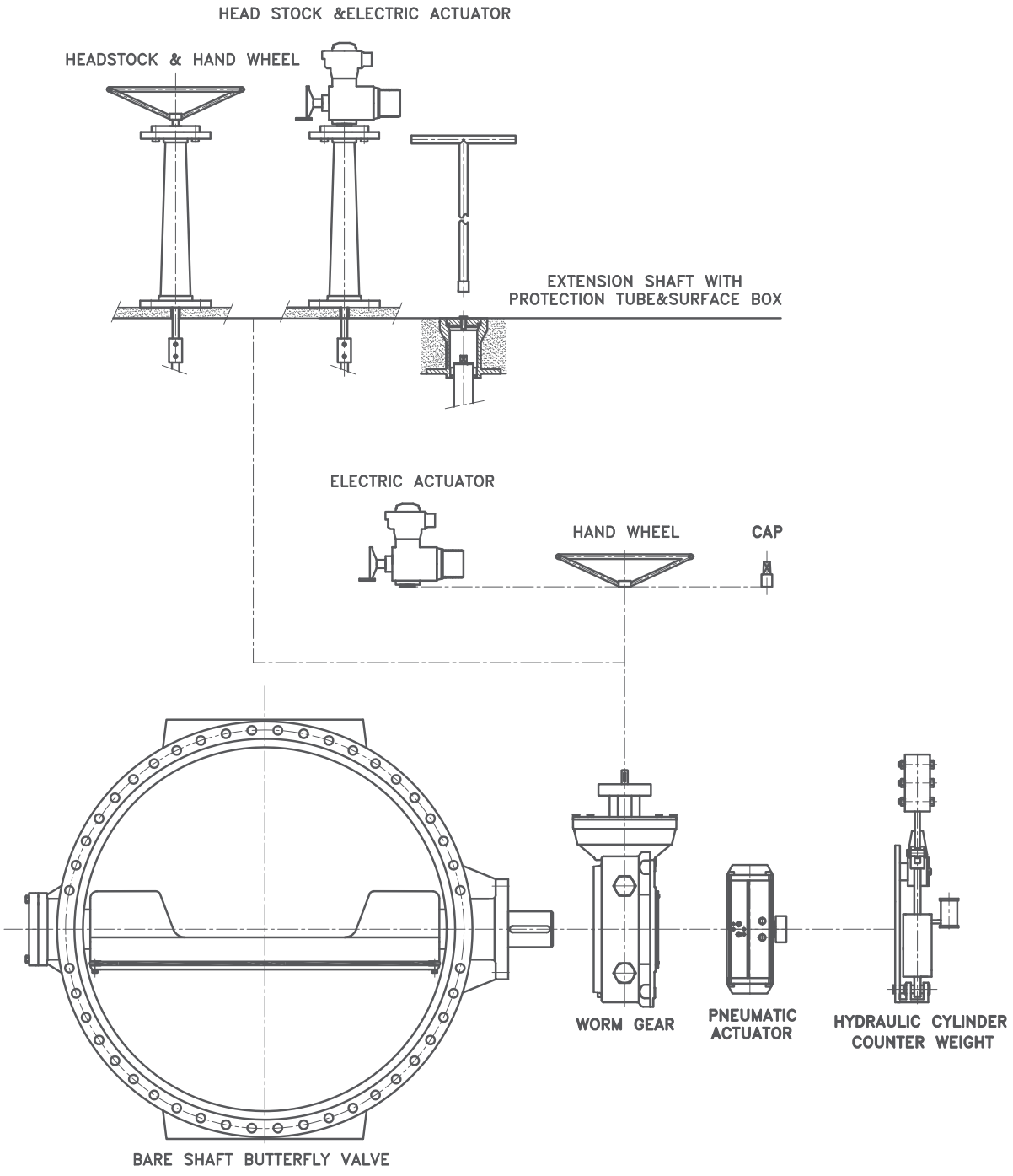
DIMENSION TABLE FOR PN25 BUTTERRLY VALVES WITH GEARBOXES



DN	FACE TO FACE		MAIN VALVE DIMENSIONS					PN25 BAR FLANGE DIMENSIONS						
	SERIES13	SERIES14	H1	H2	B1	B2	b	D	d	C	K	N	L_2	BOLTS
100	127	190	155	110	210	110	133	235	156	19	190	8	23	M20
150	140	210	193	145	260	143	184	300	211	20	250	8	28	M24
200	152	230	193	175	305	170	184	360	274	22	310	12	28	M24
250	165	250	260	215	340	240	340	425	330	24.5	370	12	31	M27
300	178	270	330	215	475	280	340	485	389	27.5	430	16	31	M27
350	190	290	330	275	500	315	350	555	448	30	490	16	34	M30
400	216	310	370	305	560	350	380	620	503	32	550	16	37	M33
450	222	330	420	325	645	375	580	670	548	32	600	20	37	M33
500	229	350	500	356	700	415	580	730	609	36.5	660	20	37	M33
600	267	390	500	430	800	475	680	845	720	42	770	20	40	M36
700	292	430	610	460	870	510	680	960	820	46.5	875	24	43	M39
800	318	470	660	540	1000	565	780	1085	928	51	990	24	49	M45
900	330	510	970	600	1100	630	840	1185	1028	55.5	1090	28	49	M45
1000	410	550	970	640	1160	685	840	1320	1140	60	1210	28	56	M52
1200	470	630	970	770	1275	890	840	1530	1350	69	1420	32	56	M52

ACTUATION

Sierra can supply butterfly valves for a wide range of actuation types. Due to the quarter-turn control, butterfly valves are easy to operate and suited for automated processes.
Upon customer's request butterfly valves can be supplied with manual, pneumatic, electric, or hydraulic actuation both with OPEN/CLOSE or full position control.



ECCENTRIC DISC BUTTERFLY VALVE OPERATION

1- MANUAL OPERATION

ALL GEARBOX MODELS ARE MADE OF DUCTILE CAST IRON WITH THE FOLLOWING FEATURES

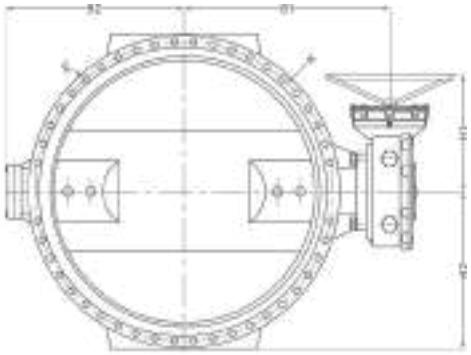
- Stable Self-Locking Design.
- Superior Gear Contact Ratio.
- Changeable Bushing enables Gearbox installation in any position
- Visual position indicator
- High mechanical advantage

2- PNEUMATIC OPERATION

PNEUMATIC ACTUATORS ARE USED FOR FAST AND FREQUENT OPENING AND CLOSING, WHERE THE VALVE PRESSURE IS LESS THAN 6BAR AND THE VALVE SIZE IS NOT LARGER THAN DN800 WHICH IS TYPICAL USED FOR WATER TREATMENT SYSTEM VALVES

A- Function :
Double or Single acting pneumatic actuator
B- Fail-safe function in case of single acting
C- Actuating pressure 6bar (0.6MPa), other actuating pressure upon request
D- Suitable for high duty cycles
E- Fast opening and closing times
F- Few moving parts: increases operational safety
G- The following accessories are available for mounting on pneumatic actuators:

- Limit switches box for open/close
- NAMUR solenoid valves
- Valve positioners
- Position indicator
- Exhaust silencer with throttling function
- Declutch able gear for emergency operation (manual override)



3- ELECTRIC OPERATION

ELECTRIC ACTUATORS PROVIDED ON OUR VALVES COVERS A WIDE RANGE OF TORQUES. SOME OPTIONAL FEATURES FOR ELECTRIC ACTUATORS:

- Wide range of voltage options
- All actuators are provided with torque limiter and two switches for stroke limiter
- Mechanical position indicator showing the position of the disc
- ON/OFF and modulating duty
- Thermal protection
- Emergency hand wheel
- Positioner and feedback signal (4-20mA) for:
  * modulating duty
  * Integrated control panel
  * Extra limit switches
  * Different protection classes (IP68 or IP67)

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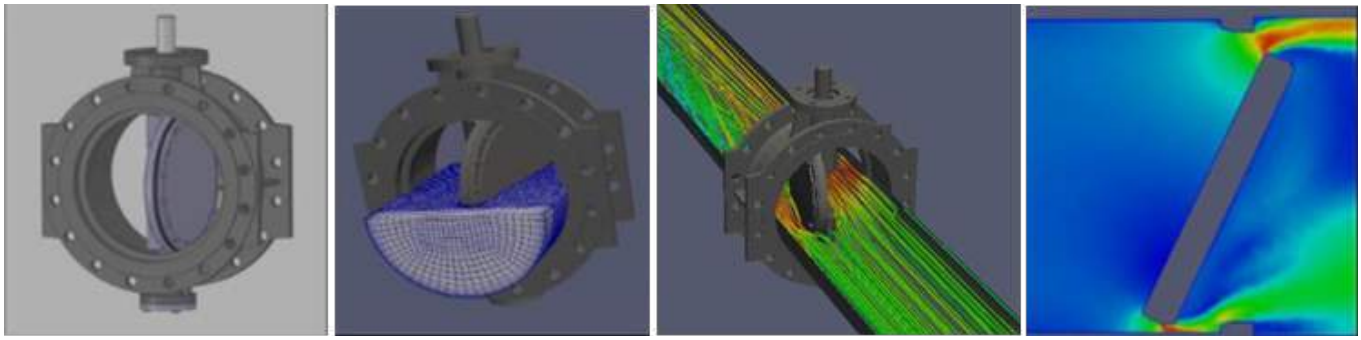
ECCENTRIC DISC BUTTERFLY VALVE

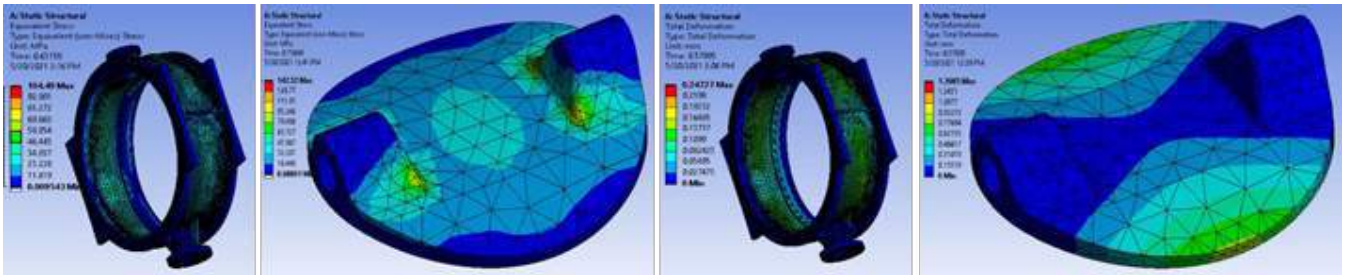
ENGINEERING DATA



SIERRA FEM calculations and CFD valve simulations

Sierra Design & Development team always has the latest approaches at its disposal to make your future valves more durable and efficient.

With FEM (Finite Eelement Method) simulation, the optimal distribution of force to the component or the stress behavior of a flow on the valve components optimized and visualized. FEM also makes it possible to adapt the calculation models to the real load conditions, making it possible to carry out an exact strength analysis even in the case of complex stresses. Valves are used to regulate the fluid (gas, liquid) flows, by partially or completely blocking or modifying its path. CFD (Computational Fluid Dynamics) shall be the most effective method to estimate valves aerodynamic or hydraulic performance.



CFD Valve simulation outcomes for better valve design

On all horizontal pump discharge applications (Figure Above), the seat end should be towards the pump to allow seat adjustment with system pressure against the disc to provide tight shut-off of the valve.

- Reduce pressure loss by identifying separations and blockages.
- Optimized geometry for fluid flow
- Reduced noise
- Reduce risk of cavitation and choked flow.
- Deeper look into the operation of the valve
- Testing extreme conditions (high pressure applications)

CFD Valve simulation outputs

Some of CFD outputs shall be:

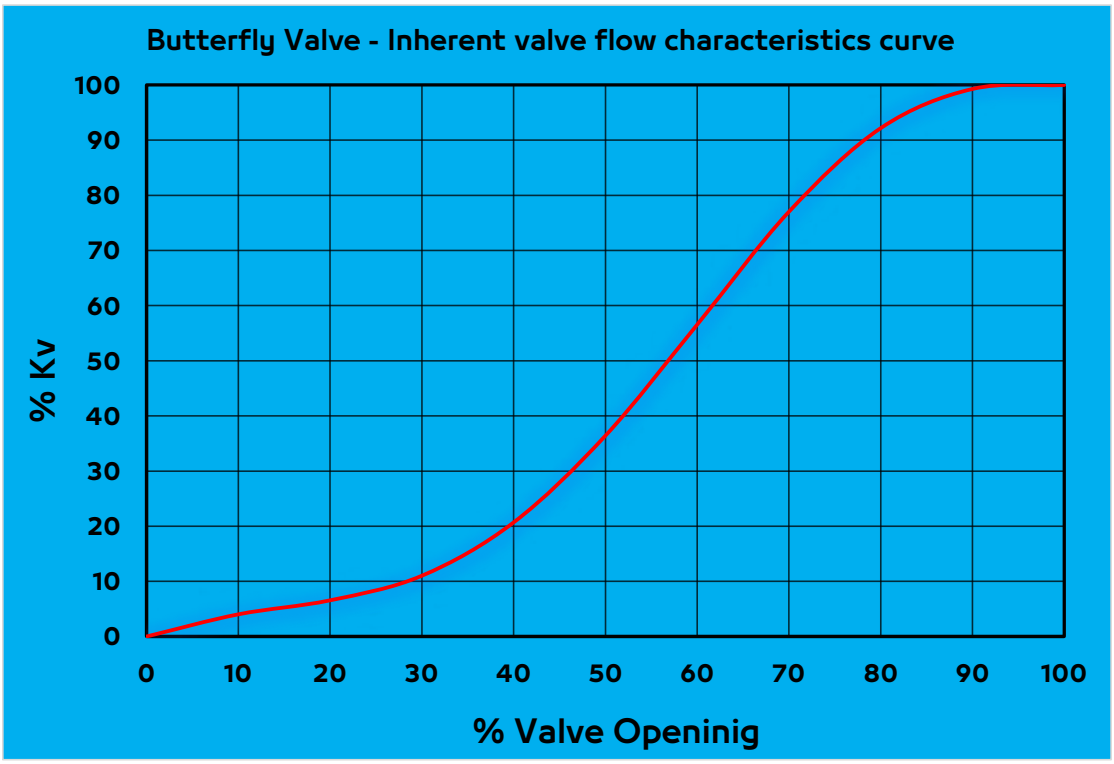
- Valve flow coefficient
- Valve inherent flow characteristics curve (valve Kv versus % valve disc opening position)
- Valve resistance coefficient (Resistance coefficient versus % valve disc opening position)

ENGINEERING DATA

FLOW COEFFICIENT (KV)

The Kv-value [m^3 per hour] is a measure of the valves ability to pass flow. It is defined as the flow of water at a temperature of 5°C to 30°C at ΔP of 1 bar through a fully open valve.

KV = Q / √ΔP (FOR WATER APP)
Q : FLOW RATE MEASURED IN M3/HOUR
ΔP : DIFFERENTIAL PRESSURE ACROSS THE VALVE MEASURED IN BARS
CV : FLOW COEFFICIENT IN US GALLON/MIN = 1.16 KV



DN	250	300	350	400	450	500	600	700	800	900	1000	1100
KV	2560	3600	5620	7752	11337	16560	22216	31448	42699	54911	68084	78123

DN	1200	1400	1500	1600	1800	2000	2200	2400	2500	2600
KV	100480	144600	159200	188510	242198	324150	395600	406900	505300	627400

ENGINEERING DATA

VELOCITY LIMITS

THE MAXIMUM FLOW RATES FOR BUTTERFLY VALVES ARE PRESCRIBED IN EN593.

Butterfly Valves are designed to safely open and close at the highest differential pressure acting on the closed valve disc at the rated pressure. However in case of excessive flow velocities the dynamic torque acting on the valve components might damage the valve even if the rated pressure is not exceeded. Thus valve ratings should be selected according to both pressure and flow.

Pressure	Maximum flow rate (m/sec)
Up to 6 bars	2.5
10	3
16	4
25	5

If the actual velocity exceeds the corresponding pressure value, it is necessary to select a higher pressure rating or a different valve type which is more suitable for such an application.

HEAD LOSS CHARACTERISTICS

The head loss characteristics show how much pressure (Head) is lost through a fully open valve. Each valve has its own head loss factor which is used to calculate the total pressure drop at a given flow rate and using the following formula.

$\Delta H = K*(V^2/2G)$ ΔH = HEAD LOSS (M)

V = AVERAGE VELOCITY (M/SEC) K = RESISTANCE COEFFICIENT

DN	250	300	350	400	450	500	600	700	800	900	1000	1100
K	0.53	0.52	0.5	0.47	0.47	0.42	0.37	0.33	0.3	0.27	0.25	0.24

DN	1200	1400	1500	1600	1800	2000	2200	2400	2500	2600
K	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.20	0.20

USING BUTTERFLY VALVES FOR THROTTLING PURPOSES

If a butterfly valve is intended for use in a throttling application, there are a number of parameters that must be considered so as to avoid damaging the valve or other pipeline components.

in case a modulating valve is required to control flow, pressure, or level it is highly recommend using an automatic control valve that is specifically designed for such applications. for details, please refer to our automatic control valves catalogue.

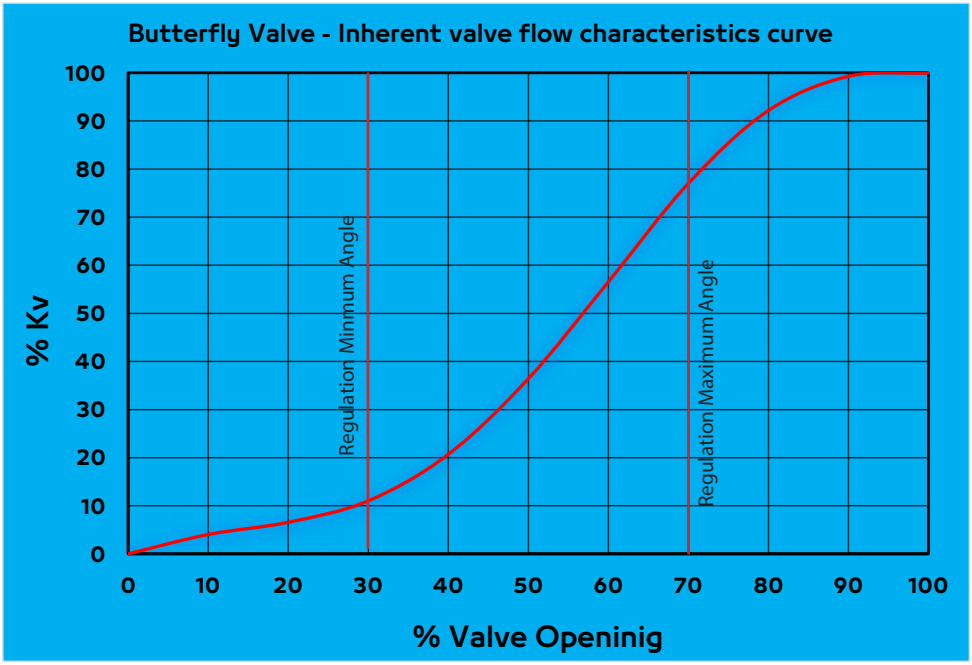
USING BUTTERFLY VALVES FOR THROTTLING

1) OPERATING RANGE

The approximate effective throttling range for a butterfly valve is 30° to 70° open, but the range can vary based on application. Throttling at lower angles may cause erosion due to excessive velocities or cavitation. Throttling at higher angles may provide limited control, because the valve has little effect on the system flow in most applications

BUTTERFLY VALVE FLOW CHARACTERISTICS

The flow characteristic of a valve is the relationship between the flow rate through the valve and the valve travel as the travel is varied from 0 to 90 degrees.



2) CAVITATION

When a butterfly valve is used for throttling or modulating flow, the operating conditions should be evaluated to determine whether significant cavitation will occur.

"Cavitation is the vaporization and subsequent violent condensation of a fluid caused by localized areas of low pressure in a piping system1"When water flows through a partially open butterfly valve, a localized low-pressure zone may occur immediately downstream of the valve disc because of sudden changes in flow velocity and flow separation. When pressure in this zone falls below the vapor pressure of the fluid, the liquid vaporizes, forming a vapor pocket or vapor bubbles. As the bubbles flow downstream and the pipeline pressure recovers, the bubbles violently collapse or implode. As the bubbles collapse near a boundary, valve component, fitting or pipe wall may result in pitting and material removal. Measurements have shown that localized pressure of 690MPa can be generated by the implosion of bubbles. Cavitation produces an unmistakable noise and vibration that sound like gravel flowing through the pipe.

RECOMMENDATIONS TO PROTECT THE PIPELINE IN CASE OF CAVITATION

To reduce cavitation and protect the valve and pipeline components a number of measures might be undertaken:

A) Increase the downstream pressure by providing additional restriction downstream using another valve or permanent restriction such as an orifice.

B) Decrease the differential pressure using two or more valves in series

C) Install air inlet ports immediately downstream of the valve shaft to admit air and reduce the zone of pressure differential in the pipe. Provision should be made to remove the air from the pipeline.

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12A Hassan Sabry St.Zamalek,Cairo, Egypt

+20227369991 +20227369909

info@sierra-eg.com

www.Sierra-eg.com

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