

Changzhou

Sinhan Intelligent Technology  
Co., Ltd.



CI-TECH

► Ceramic device

valves, pipes and other special designs  
for abrasive/corrosive and non-metal application



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## Ceramic Ball Valves

### Full Lined Ceramic Ball Valve

Due to the significant corrosion and abrasion resistant, Foyo series fully lined ceramic ball valves have the best performances in all kinds of excessively corrosive and abrasive applications as an on/off or a control valve.

A standard fully lined ceramic ball valve is designed with a flanged 3-pieces body for PN16—63(ASME Class 150—600), and in sizes DN15—DN300(1/2"—12"), while DN15—DN100(1/2"—4") has a floating ball and DN125—DN300(5"—12") has a trunnion ball. The valves made of special materials are available on customers' request.

### Features

#### Construction

The three pieces design of the valves allows direct connection to the existing pipelines without pipe reducers in front and behind the valve. We can fulfill all your special requirements of Face-to-Face and flange type.

All the ceramic components are assembled within the forged metal body which absorbs the physical load and vibration from the piping lines.

Actuator is connected by a yoke interface that meets ISO 5211. Most pneumatic and electric actuators of ball valves are 1/4 turn actuators. The yoke interface is removable and able to be easily modified to accommodate special applications. Manual hand levers and gear boxes are also available.



### Corrosion Resistant

Cold Isostatic Pressing(CIP) and high-temperature sintering nanometer high-purity 99.5% alumina and zirconia ceramics will not interact with almost all organic and inorganic chemicals, nor contaminate the process media. Their physically and chemically stability against most acids and alkalis will last for many years with little or no corrosive degradation.

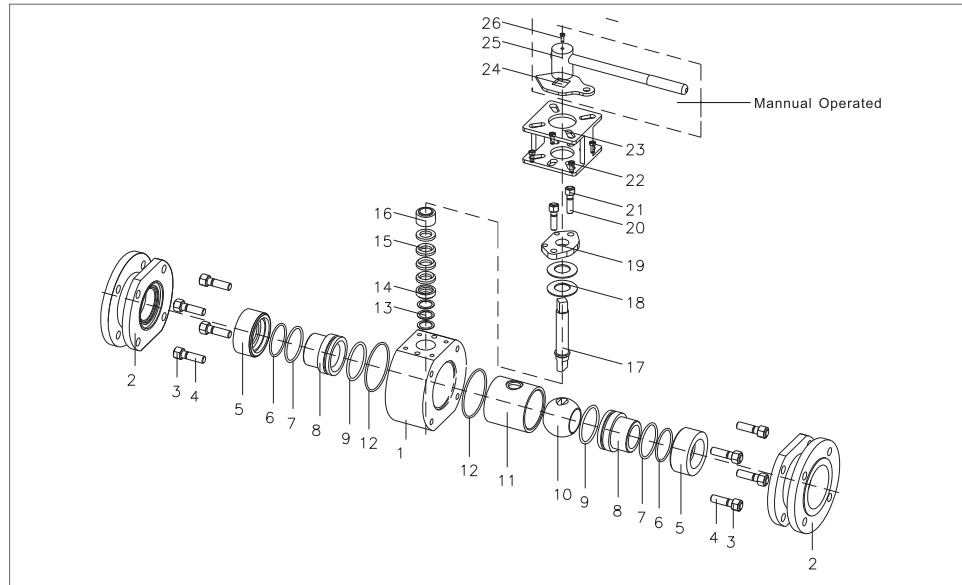
### Abrasion Resistant

The hardness of 99.5% alumina ceramics is about HRA88 or above, harder than zirconia (about HRA85), about 8 times harder than stainless steel. As valve core, ceramic components make the valve done well in the most severe abrasive conditions, such as pneumatic conveying to transport silicon powder.



## Ceramic Ball Valves

### Exploded View

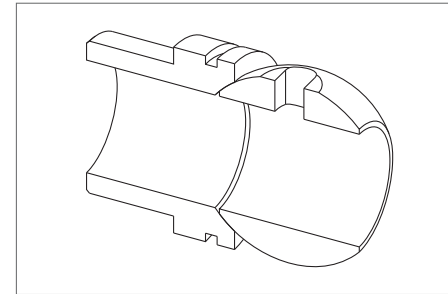


### Parts List

Item	Part Name	Material
1	Body	A105N, SS304, SS316, SS304L, SS316L
2	End Flange	A105N, SS304, SS316, SS304L, SS316L
3	Nuts	A194-2H/8
4	Studs	A193-B7/B8
5	Clamp Ring	Ceramics
6	O-Ring	Viton
7	O-Ring	Viton
8	Seat	Ceramics
9	O-Ring	Viton
10	Ball	Ceramics
11	Housing	Ceramics
12	O-Ring	Viton
13	Washer	PTFE

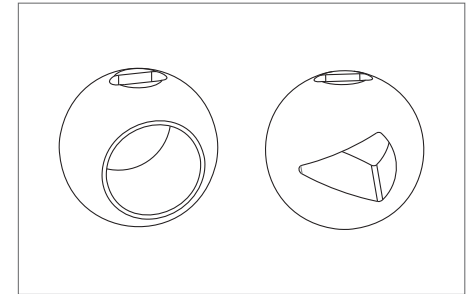
Item	Part Name	Material
14	Sleeve	SS304/SS316L/Hastelloy C276
15	Packing	Graphit/PTFE
16	Gland	SS304
17	Stem	17-4PH/SS316/Hastelloy C276
18	Disc Spring	SS304
19	Gland Flange	A351 CF8
20	Studs	ASTM A193-B7/B8
21	Nuts	ASTM A194-2H/8
22	Bolts	SS304
23	Yoke	A351CF8
24	Stopper	SS304
25	Handle Lever	SS304
26	Bolt	Stainless Steel

## Ceramic Ball Valves



### Ceramic-to-Ceramic Spherical Seal

The perfect spherical seal between the ceramic ball and seat ensure a Class VI shutoff. There is no clearance between the ball and seat, which prevent the deep sealing surface being marred and scratched by particles, and the ceramic ball will not be stuck anyway.



### Round and V-port balls

Foyo offers each line size two different balls: Round-port and V-Port. In general, the round-port ceramic ball valve is often used as a on-off valve. If precise and stable control performance are highly required in any application, the equal percent V-port ceramic ball valve is the best choice.

### Technical Specifications

#### Size Range

DN15,20,25,32,40,50,65,80,100,125,150,200,250,300  
NPS 1/2",3/4,1",1 1/4",1 1/2",2",2 1/2",3",4",5",6",8",10",12"

#### Size Range

PN16,25,40,63  
ANSI Class150,300,600

#### Face-to-Face Dimensions

According to ASME B16.10. Or on customers' request.

#### Temperature Range

-30°C—230°C(Standard Valves)  
Max.600°C(High-temperature design)

#### Valve Tightness

ANSI B16.104 Class VI(Zero Leakage)

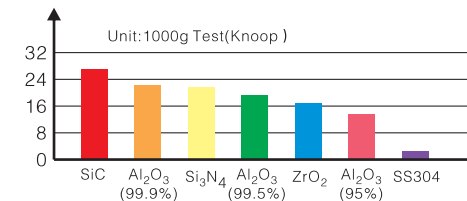
#### Materials

Body—A105N,SS304,SS316,SS304L,SS316L  
Trim—High pure ceramics(99.5%Al<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub>)  
Stem—17-4PH,SS316,SS316L,Hastelloy C276  
Packing—Graphite, PTFE

### Cv Values

Size	Cv max.	
	O-Port	V-Port
1/2"	15	8
3/4"	34	18
1"	45	18
1 1/4"	63	35
1 1/2"	114	87
2"	227	122
2 1/2"	316	175
3"	482	240
4"	810	406
5"	1140	485
6"	1900	610
8"	2350	—
10"	3870	—
12"	5200	—

### Hardness Chart



## Ceramic Ball Valves

### Ceramics Performance

Items \ Materials	Unit	99.5% Al <sub>2</sub> O <sub>3</sub>	Y-ZrO <sub>2</sub>	Ce-ZrO <sub>2</sub>
Bulk Density	g/cm <sup>3</sup>	3.9	6.0	5.5
Flexural Strength	Mpa	400	950	800
Elastic Modulus	Gpa	300	200	250
Hardness	HRA	88	85	86
Max. Temperature	°C	1500	500	500
Linear Expansion Coefficient	10 <sup>-6</sup> /°C	7.5	9.6	9.6

### Corrosion Resistance

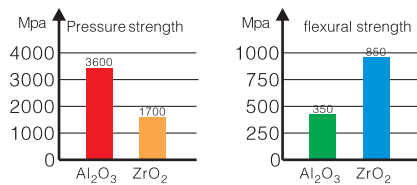
Compared to most materials, ceramics used in Foyo valves have more universal and much higher corrosion resistance, including in majority high-temperature acids and alkalis. But please be well noted that ceramics is sensitive in some certain media with different mixtures, state, pressure and temperature. Experienced application engineers from Foyo is willing to supply professional technical support for you.

Corrosion Resistance Chart					
Media	Temp.	Al <sub>2</sub> O <sub>3</sub> 99.5%	ZrO <sub>2</sub>	SS316	HC 276
20%HCL	60°C	A	A	C	B
20%HCL	90°C	A	A	X	C
60%H <sub>2</sub> SO <sub>4</sub>	60°C	A	A	C	B
60%H <sub>2</sub> SO <sub>4</sub>	90°C	A	A	C	C
10%HF	60°C	B	C	C	B
50%HF	90°C	C	X	X	C
60%HNO <sub>3</sub>	60°C	A	A	A	C
60%HNO <sub>3</sub>	90°C	B	A	B	C
30%NaOH	60°C	A	A	A	A
30%NaOH	90°C	B	B	B	A

A—Negligible or no corrosion, recommended for valve use  
 B—Little or slight corrosion, fitness for valve use  
 C—Significant corrosion, not recommended for valve use  
 X—Violent corrosion, not allowed for valve use

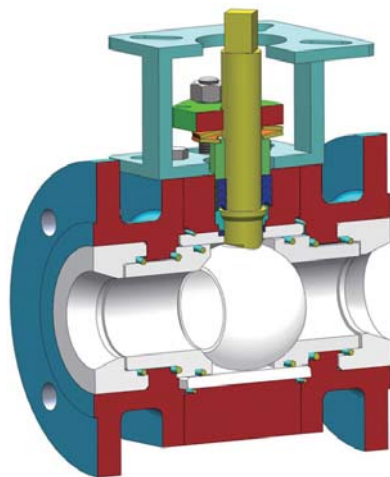
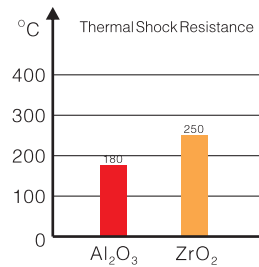
### Mechanical properties

The mechanical properties of ceramics are very different from metals. The pressure resistance of all ceramics is many times higher than metals, but the tensile and the flexural strength is lower. Due to the high torque load, ceramic valve balls require materials with high flexural strength. In most applications, zirconia ceramics is used for valve balls.



### High-Temp.&Thermal Shock Resistance

High pure alumina and stabilized zirconia components could maintain their shape, structure, mechanical strength as well as other physical and(or) chemical characteristics up to high temperature that more than 1000° C. In addition to the material dependency, the thermal shock resistance is also highly different depending on the shape. In general, some simple shapes such as pipes and tablets have better thermal shock resistance than components that have complex construction. therefore, all related conditions must be closely conserved .

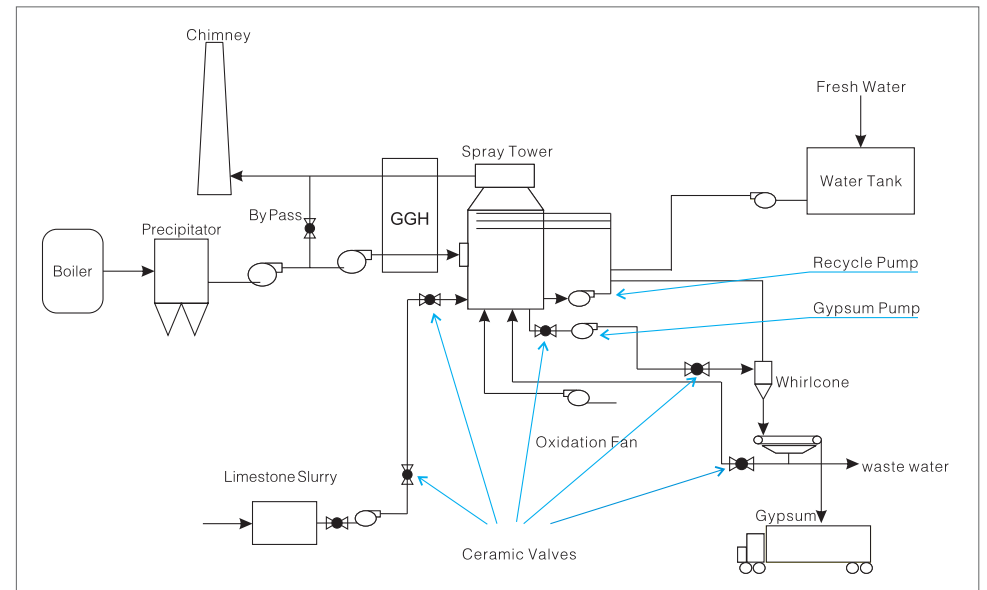


## Ceramic Ball Valves

### Typical Applications for Ceramic Ball Valves

#### Flue Gas Desulfurization,FGD

FGD is a process of treating flu gases with limestone slurry to remove SO<sub>x</sub>, NO<sub>x</sub> and other pollutants and produce gypsum slurry as a by-product. One of the technological challenges in FGD system is the highly corrosion and abrasion of the slurry to the pipe lines and valves. Severe corrosion and abrasion can result in unacceptably high costs for replacement and maintenance. Therefore, by choosing the best corrosion and abrasion resistant ceramic ball valves and pipes will ensure that FGD can be cost-effective and stabilized.



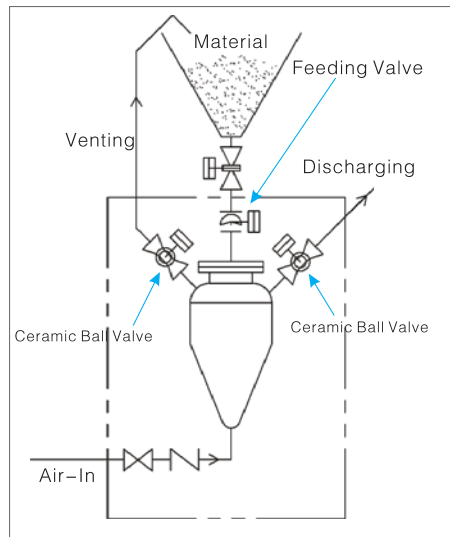
## Ceramic Ball Valves

### Powder Pneumatic Conveying

As the most popular transportation method for powder materials all over the world, Pneumatic conveying is more efficient, but the wear and abrasion problems normally occur in the pipe bends and valves, where the conveyed material is subject to a high degree of turbulence, and the system's efficiency will be reduced.

When alumina and zirconia ceramics are used in pipes, bends and valves, things get better. Foyo ceramic ball valves have a unique structure with ceramics lining the flow path, which ensures wear and abrasion are avoided significantly. Generally, the service life of Foyo fully lined ceramic ball valve used in powder pneumatic conveying is about 3 times longer than other valves.

### Diagram of Pneumatic Conveying<sup>1</sup>



Main Industries served:

- Silicon powder
- Alumina powder
- Dry coal powder
- limestone powder
- Cement
- Coal powder injection
- Magnesium powder
- Quartz sand
- Metallurgical dust
- Petroleum solid catalyst
- Kaolin



Notes:

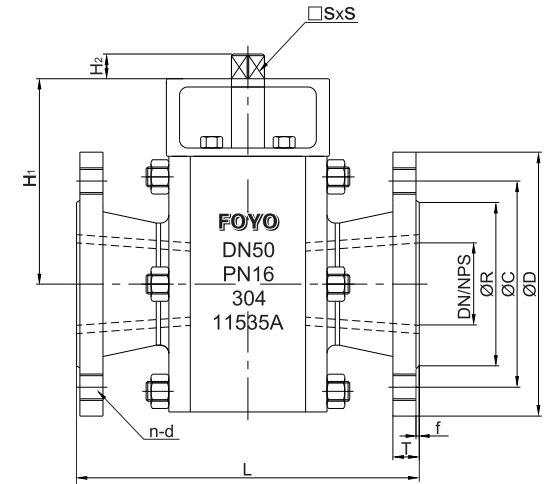
- (1) This is a typical system, and others are also applicable.
- (2) Foyo ceramic double-disc valve will be a good choice as a feeding valve.

Foyo fully lined ceramic ball valves are widely used in all kinds of powder and solid materials including:

Powder  
Resins  
Pellets  
Flakes  
Fiber

## Ceramic Ball Valves

### Installation Dimensions



Size		(GB/T 9113.1 PN16,RF)								(ASME B1.5 Class 150,RF)							
		Installation Dim.								Installation Dim.							
DN	NPS	L	ΦD	ΦC	n-d	ΦR	T	f		L	ΦD	ΦC	n-d	ΦR	T	f	
DN15	1/2"	108	95	65	4-M12	46	14	2		108	90	60.3	4-M12	34.9	11.6	2	
DN20	3/4"	117	105	75	4-M12	56	16	2		117	100	69.9	4-M12	42.9	13.2	2	
DN25	1"	127	115	85	4-M12	65	16	2		127	110	79.4	4-M12	50.8	14.7	2	
DN32	1 1/4"	140	140	100	4-M16	76	18	2		140	115	88.9	4-M12	63.5	16.3	2	
DN40	1 1/2"	165	150	110	4-M16	84	18	2		165	125	98.4	4-M12	73.0	17.9	2	
DN50	2"	178	165	125	4-M16	99	20	2		178	150	120.7	4-M16	92.1	19.5	2	
DN65	2 1/2"	190	185	145	4-M16	118	20	2		190	180	139.7	4-M16	104.8	22.7	2	
DN80	3"	203	200	160	8-M16	132	20	2		203	190	152.4	4-M16	127.0	24.3	2	
DN100	4"	229	220	180	8-M16	156	22	2		229	230	190.5	8-M16	157.2	24.3	2	
DN125	5"	356	250	210	8-M16	184	22	2		356	255	215.9	8-M20	185.7	24.3	2	
DN150	6"	394	285	240	8-M20	211	24	2		394	280	241.3	8-M20	215.9	25.9	2	
DN200	8"	457	340	295	12-M20	266	24	2		457	345	298.5	8-M20	269.9	29.0	2	
DN250	10"	533	405	355	12-M24	319	26	2		533	405	362.0	12-M24	323.8	30.6	2	
DN300	12"	610	460	410	12-M24	370	28	2		610	485	431.8	12-M24	381.0	32.2	2	

Note: The data above is standard dimension, valves with other special dimension are available on request.

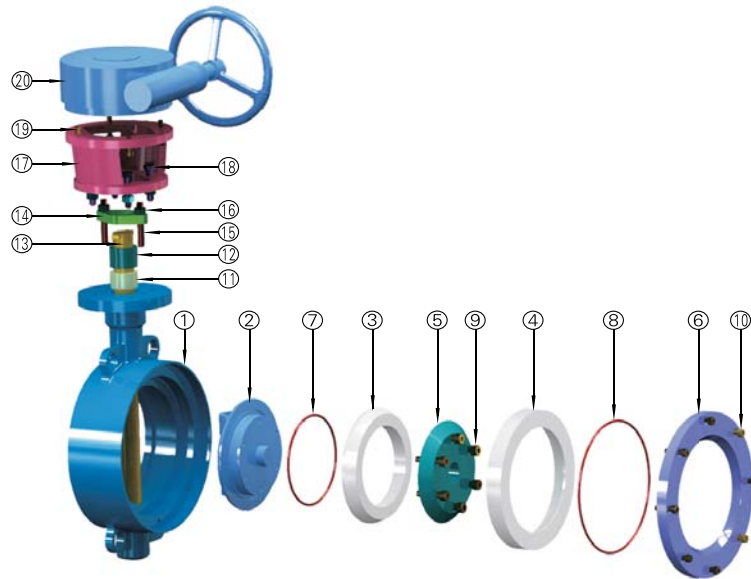
### Actuation Installation Dimensions

Size	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150	DN200	DN250	DN300
ISO5211 F-xx <sup>(1)</sup>	F-05	F-05	F-05	F-05	F-05	F-07	F-07	F-07	F-10	F-10	F-10	F-12	F-14	F-14
H1		94	94	102.5	108	135	146	160	196	213	235	270	330	350
H2	12	12	12	14	15	15	18	20	27	27	27	40	40	50
□SxS	9x9	9x9	9x9	11x11	11x11	14x14	19x19	19x19	22x22	27x27	27x27	36x36	36x36	46x46
Torque <sup>(2)</sup>	19	25	25	30	40	50	90	130	220	260	350	550	1800	1800

- Note: (1) Actuator connection is done by a yoke interface that meets the dimensional standards of ISO5211.  
(2) Recommended torque of the actuators in N · M. Safety factor is not included.

## Ceramic Butterfly Valve

### Exploded view



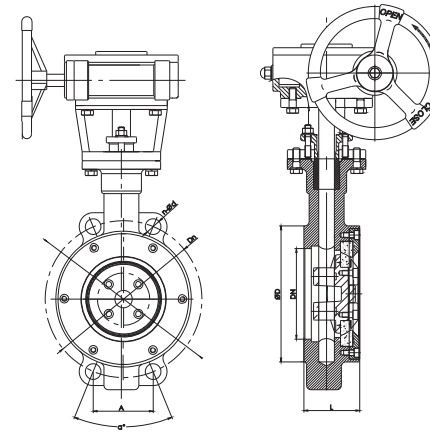
### Parts List

No.	Part name	Material	No.	Part name	Material	No.	Part name	Material
01	Body	CF8/WCB	09	Screw	A193-B8	17	Yoke	CF8
02	Disc	CF8/WCB	10	Screw	A193-B8	18	Bolt	A193-B8
03	Sealing Ring	Ceramics	11	Packing	Graphit	19	Bolt	A193-B8
04	Seat	Ceramics	12	Gland	SS316	20	Actuator	Component
05	Disc Cap	CF8/WCB	13	Stem	17-4PH			
06	Seat Holder	CF8/WCB	14	Gland Flange	CF8/WCB			
07	O-ring	Viton	15	Bolt	A193-B8			
08	O-ring	Viton	16	Nut	A194-8			

Note: Material selection according to specific conditions may vary, the above data is for reference only.

## Ceramic Butterfly Valve

### Specifications and Main Dimensions



Size	ΦD	ΦDn	n-Φd	a	A	B	L
DN							
DN80	132	160	4-Φ18	45°	61.2	147	64
DN100	156	180	4-Φ18	45°	68.9	166	64
DN125	184	210	4-Φ18	45°	80.4	194	70
DN150	211	240	4-Φ22	45°	91.8	221	76
DN200	266	295	4-Φ22	30°	76.4	284	89
DN250	319	355	4-Φ26	30°	91.9	342	114
DN300	370	410	4-Φ26	30°	106.1	396	114

### Features

1. The material of the moving parts is structural ceramics. Eccentric structure is used to reduce the friction of the moving parts and prolong the life of the valves.
2. The materials of the ceramic seal rings, O-rings, disc and pivots can be replaced if necessary. The ceramic butterfly valves are applicable to the environment of high wear, high temperature, and high corrosion.

### Materials

Valve Body: WCB、CF8、 Sealing Material: Ceramics( $Al_2O_3/ZrO_2$ )

### Design Standards

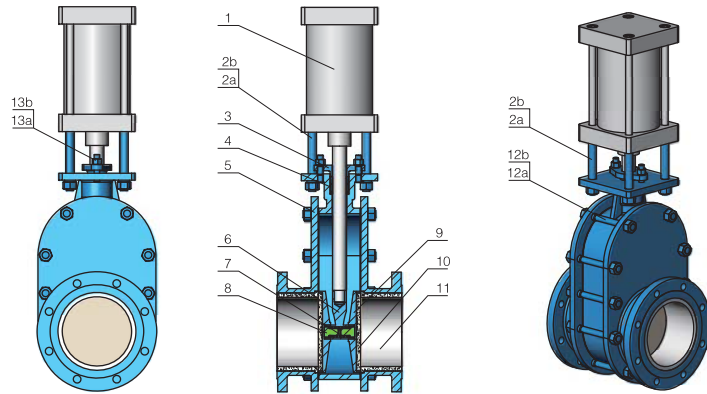
1. Connecting dimension of flange: EN1092-1/ASME B16.5
2. Face to face dimension: Manufacturer's Standard
3. Valve inspection and testing: API 598
4. Design and manufacturing: ASME B16.34/Manufacturer's Standard



## Ceramic Double Disc Valve

### Pneumatic Ceramic Double Disc Valve

#### Technical Description



#### Parts List

Item	Part Name	Material	
1	Pneumatic Cylinder	Components(Aluminum Body)	
2a	Bolt(Yoke)	AISI 1045	ASTM A193 B8
2b	Nut	AISI 1035	ASTM A194 8
3	Packing Gland	ASTM A216 WCB	ASTM A351 CF8
4	Packing	Flexible Graphite	Flexible Graphite
5	Body	ASTM A216 WCB	ASTM A351 CF8
6	Disc Driver	ASTM A216 WCB	ASTM A351 CF8
7	Spring	60Si2Mn	17-7PH
8	Disc Adjusting Block	AISI 1045	13%Cr
9	Metal Disc	Q235A	SS304
10	Ceramic Disc	Al2O3 Ceramics	ZrO2 Ceramics
11	Ceramic Seat	Al2O3 Ceramics	ZrO2 Ceramics
12a	Body Bolt	AISI 1045	ASTM A193 B8
12b	Body Nut	AISI 1035	ASTM A194 8
13a	Gland Bolt	AISI 1045	ASTM A193 B8
13b	Gland Nut	AISI 1035	ASTM A194 8

#### Specification

##### Product type

Ceramics seated, parallel double disc valve  
Flanged type, Wafer type is optional.  
Three pieces body  
Self cleaning design.

##### Pressure ratings

PN10,16 and 40; ASME Class 150, 300.

##### Size range

DN 50~300 / 2"~12"(Full bore).  
Redced bore is optional.

##### Temperature range

-29℃ ~ +200 ℃ (+500 ℉)  
-20 ℉ ~ +390 ℉ (+930 ℉F).

##### Valve tightness

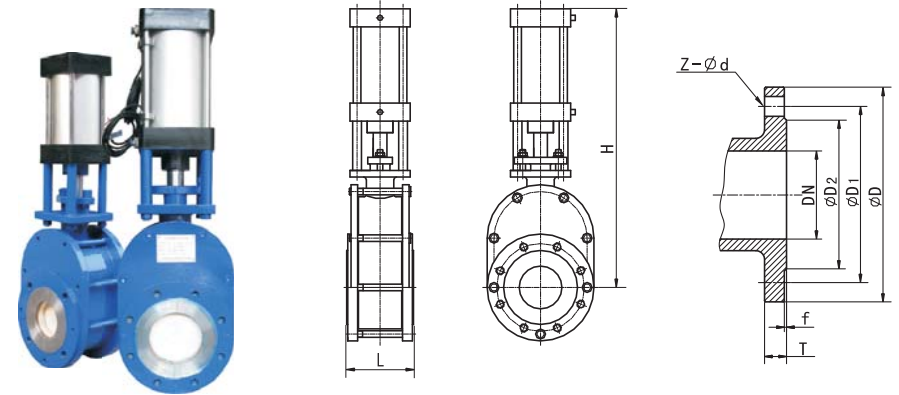
ISO 5208 rate D  
Other tightness rates upon request.

##### Design standards

Valve body ASME B16.34  
Face-to-Face Manufacturer's Standard, or on customers' request.  
Valve flanges EN 1092-1, ASME B16.5  
Valve Testing API 598

## Ceramic Double Disc Valve

### Wafer Type Ceramic Double Disc Valve



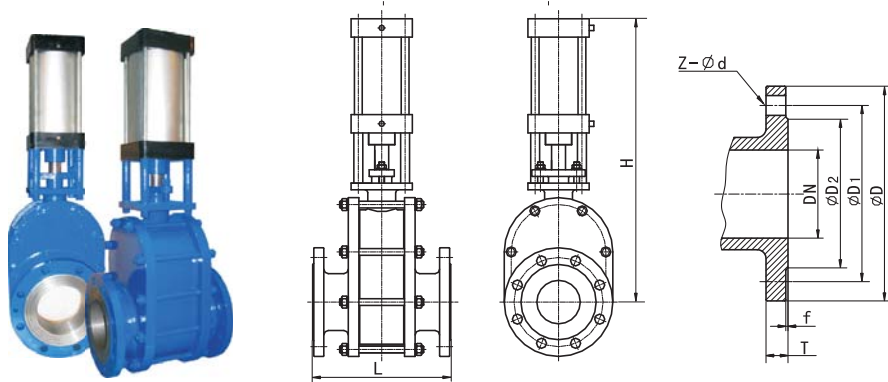
#### Main Dimensions

Pressure Rating	Size(DN)	L	D	D1	D2	T	f	H	Z-Φd
PN1.0MPa	40	120	145	110	85	16	3	373	4-16
	50	120	160	125	100	16	3	422	4-16
	65	120	180	145	120	18	3	468	4-16
	80	120	195	160	135	20	3	509	8-16
	100	130	215	180	155	20	3	643	8-16
	125	160	245	210	185	22	3	678	8-16
	150	160	280	240	210	22	3	788	8-20
	200	180	335	295	265	24	3	950	8-20
	250	200	390	350	320	26	3	1090	12-20
PN1.6MPa	300	200	440	400	368	26	4	1260	12-20
	50	120	165	125	102	18	3	480	4-19
	65	120	185	145	122	19	3	560	4-19
	80	120	200	160	138	20	3	650	8-19
	100	130	220	180	158	22	3	780	8-19
	125	160	250	210	188	22	3	960	8-19
	150	160	285	240	212	24	3	950	8-22
	200	180	340	295	268	24	3	1050	12-22
	250	200	405	355	320	26	3	1180	12-26

	Size(NPS)	L	D	D1	D2	T	f	H	Z-Φd
Class 150	2"	120	150	120.7	92.1	16.5	2	480	4-19
	2 1/2"	120	180	139.7	104.8	18	2	560	4-19
	3"	120	190	152.4	127	19.5	2	650	4-19
	4"	130	230	190.5	157.2	24.5	2	780	8-19
	5"	160	255	215.9	185.7	24.5	2	960	8-22
	6"	160	280	241.3	215.9	26	2	950	8-22
	8"	180	345	298.5	269.9	29	2	1050	8-22
	10"	200	405	362.0	323.8	31	2	1180	12-26
	12"	200	485	431.8	381	33	2	1260	12-26

## Ceramic Double Disc Valve

### Flanged Type Ceramic Double Disc Valve

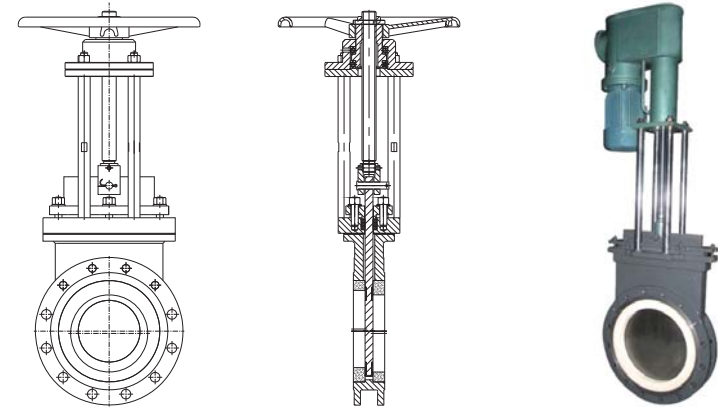


#### Main Dimensions

Pressure Rating	Size(DN)	L	D	D1	D2	T	f	H	Z-Φd
PN1.0MPa	50	250	160	125	100	16	3	422	4-18
	65	260	180	145	120	18	3	468	4-18
	80	260	195	160	135	20	3	509	8-18
	100	280	215	180	155	20	3	613	8-18
	125	300	245	210	185	22	3	678	8-18
	150	300	280	240	210	22	3	788	8-23
	200	360	335	295	265	24	3	950	8-23
	250	365	390	350	320	26	3	1090	12-23
PN1.6MPa	300	400	440	400	368	26	4	1260	12-23
	50	245	165	125	102	18	3	480	4-19
	65	245	185	145	122	19	3	560	4-19
	80	260	200	160	138	20	3	650	8-19
	100	260	220	180	158	22	3	780	8-19
	125	285	250	210	188	22	3	960	8-19
	150	285	285	240	212	24	3	950	8-22
	200	305	340	295	268	24	3	1050	12-22
	250	305	405	355	320	26	3	1180	12-26
	300	350	460	410	378	28	4	1260	12-26

	Size(NPS)	L	D	D1	D2	T	f	H	Z-Φd
Class 150	2"	245	150	120.7	92.1	16.5	2	480	4-19
	2 1/2"	245	180	139.7	104.8	18	2	560	4-19
	3"	260	190	152.4	127	19.5	2	650	4-19
	4"	260	230	190.5	157.2	24.5	2	780	8-19
	5"	285	255	215.9	185.7	24.5	2	960	8-22
	6"	285	280	241.3	215.9	26	2	950	8-22
	8"	305	345	298.5	269.9	29	2	1050	8-22
	10"	305	405	362.0	323.8	31	2	1180	12-26
	12"	350	485	431.8	381	33	2	1260	12-26

## Knife gate valve series



#### Main Features

1. Face-to-Face dimensions adopt short series, and light weight valve body is adopted, so as to save pipe supporter.
2. During the opening and closing of the valve, the gate disc can automatically scrape off the adhered medium and is beneficial to sealing.
3. The blade type gate disc helps medium cut off and residue discharge so that the valve can be operated without blocking.
4. The valve adopts wafer type connection.
5. The wedge type limit stopper can provide sealing force, reliable sealing.
6. The guide nail can provide good guiding function.
7. The anti-abrasive bushings of different materials can be provided according to service requirements so as to prolong the service life of the valve, mostly ceramics is used as anti-abrasive bushings and seats.
8. Actuators (electric, gear box, Pneumatic, hydraulic) can be freely selected.

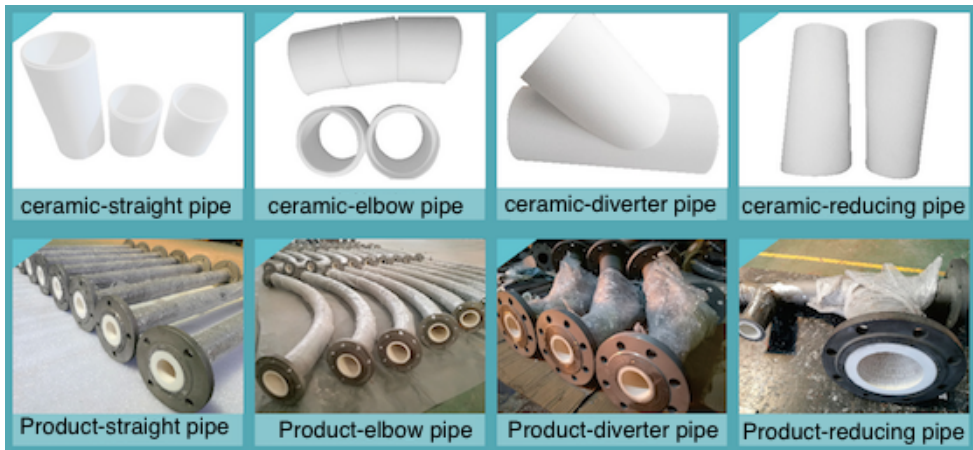
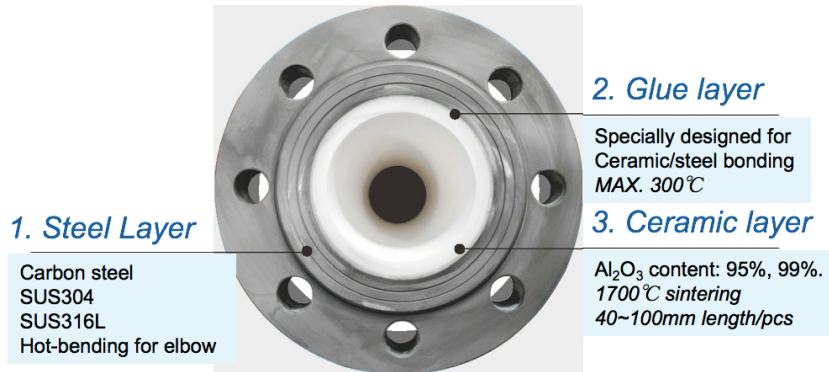
#### Product Specification

Product Spec.	Design spec.	Face to Face	Flange	Test & Check	Marking	Packing
	JB/T8691	GB/T12221	JB/T79	JB/T8691	GB/T12220	JB/T7928
	MSS SP-81	MSS SP-81	ASME B16.5	MSS SP-81	MSS SP-25	MSS SP-81

#### Main Part Material

Part Name	Main Material	
Body / Bonnet	A216 WCB	A351 CF8/CF8M/CF3M
Disc	SS304	SS304/SS316/SS316L
Stern	2Cr13/SS304/17-4PH/SS316/F51	SS304/17-4PH/SS316/F51
Packing	ASB / PTFE / Graphite	
Applicable Temp.	-29~+425℃	
Applicable Medium	Paper pulp、Mixture of sewage、Coal slurry、Ash、Seriflux、etc.	

### Steel + Ceramic Pipe



**Size Range: from DN25-DN450**

**Type: Straight, elbow, diverter, reducing types**

### PRODUCTS USED IN LITHIUM-ION BATTERY MATERIALS PROJECTS



### Product Features

※**Super abrasion resistant**  
Hardness only less than diamond  
20 times life longer than steel

※**Zero ferrous impurities**  
Up to 99% Al<sub>2</sub>O<sub>3</sub> lining prevent any direct friction between materials and steel

※**Good corrosion resistant**  
Fully surrounded by ceramic with good resistance for acid and alkali

※**Excellent adhesion structure**  
Good glue with embedded edge of ceramic pipes will lead to strong bonding between steel and ceramic units.

## Ceramic Pipe & Fittings



## Ball Valve Series



**Gate Valve Series  
Globe Valve Series  
Check Valve Series**



**Butterfly Valve Series**

