FORUM ENERGY TECHNOLOGIES

ABZ VALVE

EXTREME SERIES

BIDIRECTIONAL ZERO-LEAKAGE TRIPLE OFFSET VALVE

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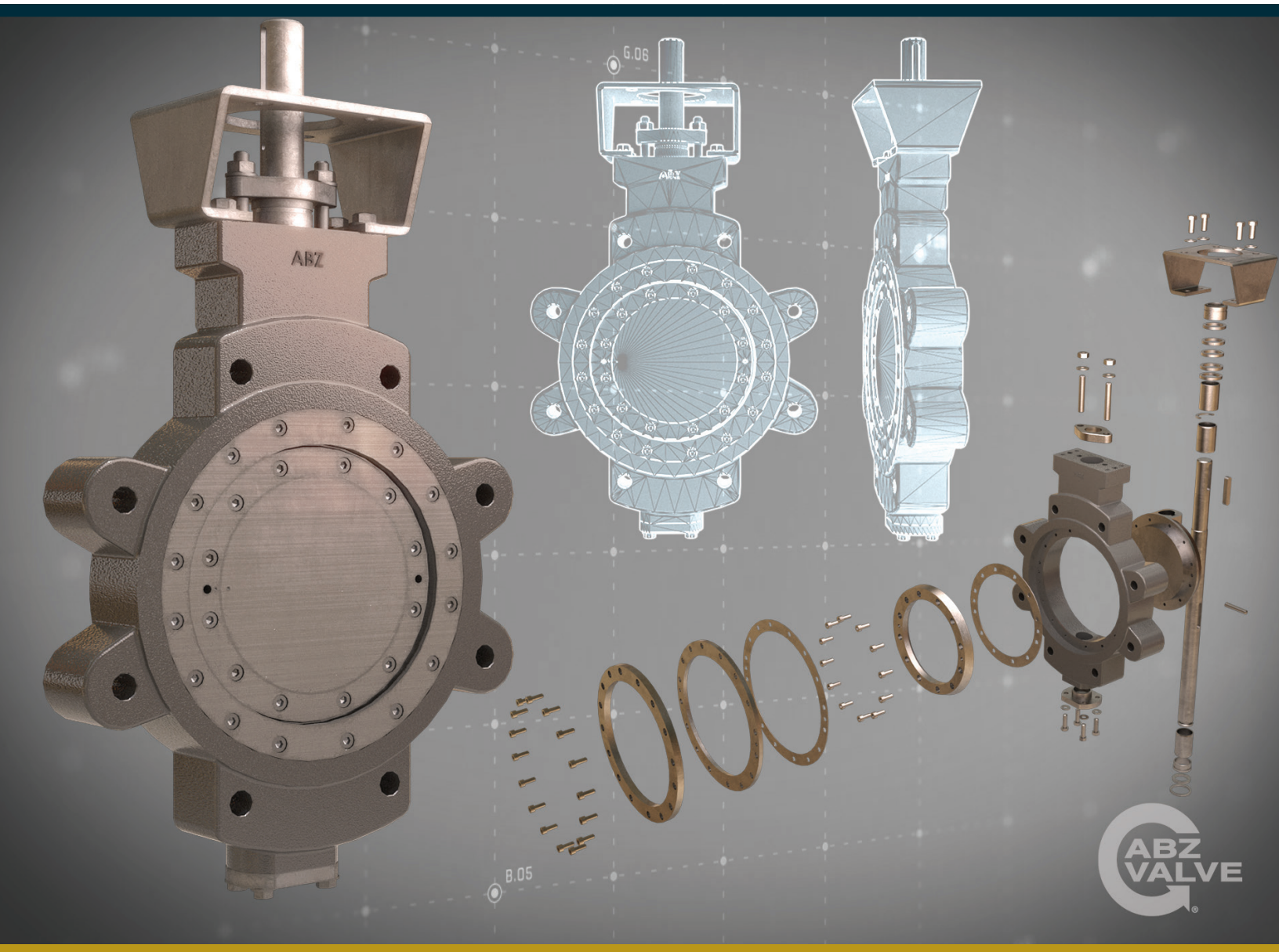


Overview

Forum's ABZ Extreme 6000 Triple Offset Valve is an ideal solution for positive shut-off or control applications when used in erosive, corrosive and critical applications under ambient, high heat or cryogenic temperatures. The Extreme 6000 is dependable in severe service and comes with maintainable bolt-in seats and seals, which help increase a plants efficiency as well as reduce the overall cost of ownership.

Rather than the concentric bore design of standard valves, the Extreme 6000 sealing geometry is an ellipsis, which provides a friction free design with torque seating. Since the valves bore and disc are not a perfect circle, the sealing mechanism is allowed to unseat itself with less torque, which results in a lower dynamic torque. Unlike other valves, the ABZ Extreme 6000 Triple Offset is available with multiple end connections and body configurations: lug, wafer, double flange long and short as well as buttweld or custom engineering. The sealing components are inherently fire-safe with metal-to-metal seating while also guaranteeing a bidirectional zero-leakage bubble-tight shutoff.

Engineering is continually reviewing the latest technology changes in both design and material to ensure ABZ is at the forefront of providing an applicable valve to the market.

Principle of Triple Offset Valve Design

1st Offset

The axis of the shaft is placed behind the centerline of the sealing points. The seat and seal are designed conically and on center. Sealing relies on the friction of a soft seat, which can be affected by temperature and pressure.

Purpose: To provide positive sealing and increased sealing capacity

2nd Offset

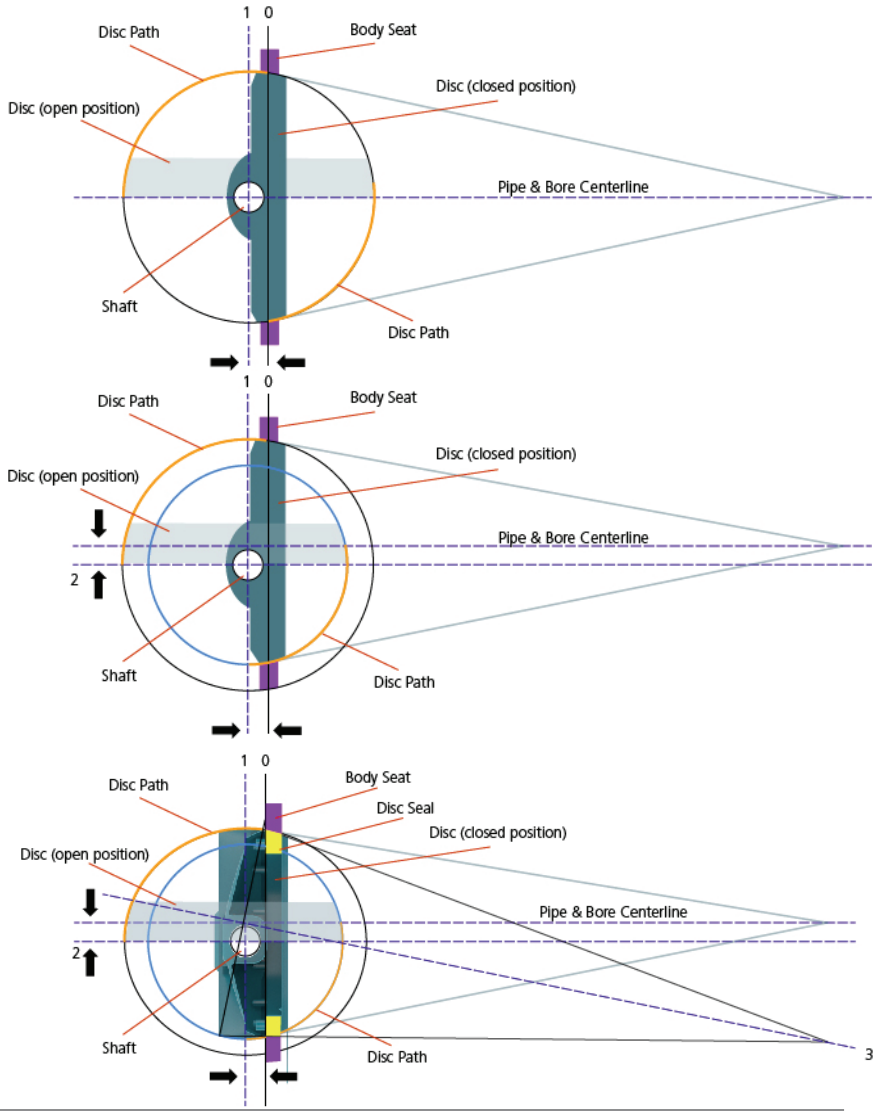
The axis of the shaft is eccentric to the centerline of the sealing points as well as the center of the pipe. The seat and seal remain conically on center and still rely on friction, but it is reduced. Seat materials can still be affected by temperature and pressure, but to a lesser extent.

Purpose: To reduce the running torque and the friction between the disc and seat

3rd Offset

The axis of the shaft remains eccentric to the centerline of the sealing points & pipe. The seat and seal cone is rotated away from the center of the pipe, completely eliminating seat and seal friction. The bore, disc, seat and seal are all machined as an ellipse, which helps creates a zero-leakage seal in higher pressure & temperature ranges. Inherently fire-safe.

Purpose: To achieve uniform compression from the disc seal around body seat.



Principle of Sealing

The basic sealing principle of a triple off valve is to utilize a conical seating system.

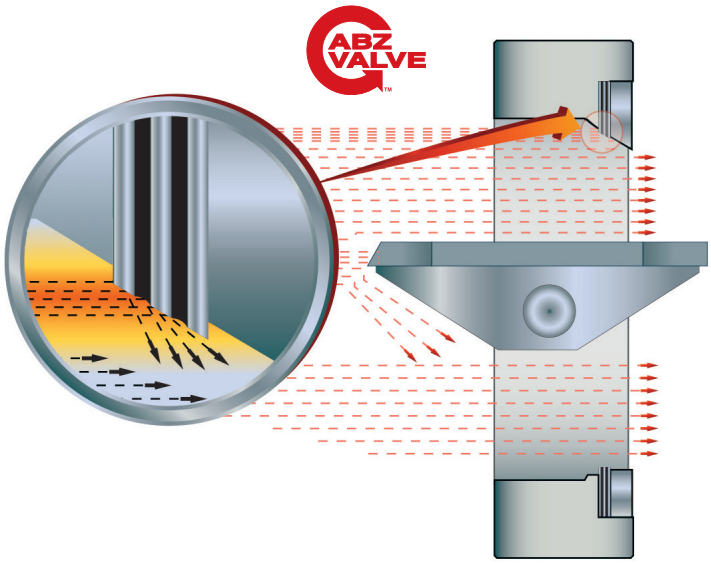
Many valve designs have a weld overlay on valve body and a laminated seat located on the leading edge of the disc, which is directly in the media's flow path. The ABZ body seat design puts the laminated seat in the bore of the valve with a solid replaceable seal on the disc. This reduces direct exposure from media flow to the laminated surfaces, this unique design also allows for field maintainable body seats and disc seals without special tooling.

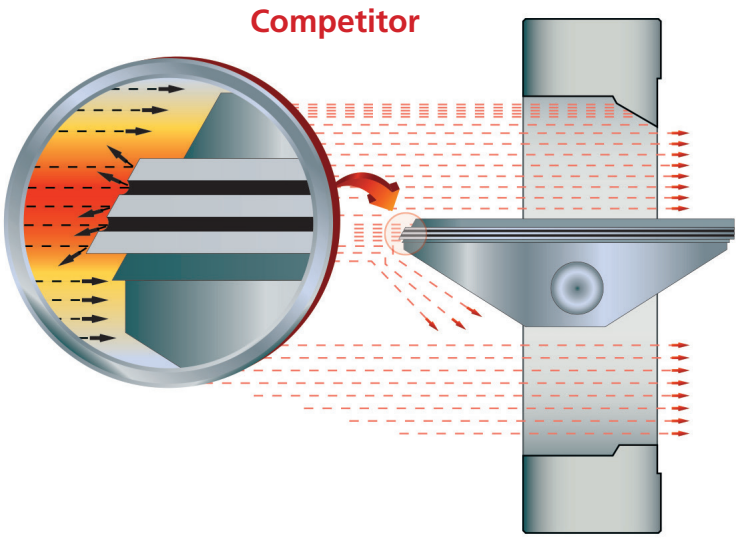
ABZ Body Seat Design

- Laminated body seat is moved away from the media's direct flow path thus reducing it's susceptibility to delamination and erosion.
- Solid disc seal (Replaceable)

Competitors Disc Seat Design

- Laminated body seat is positioned directly in media's flow path, which causes susceptibility to delamination and erosion.
- Solid seal is integral to the body. (Non-replaceable, weld overlay damage will require machining)





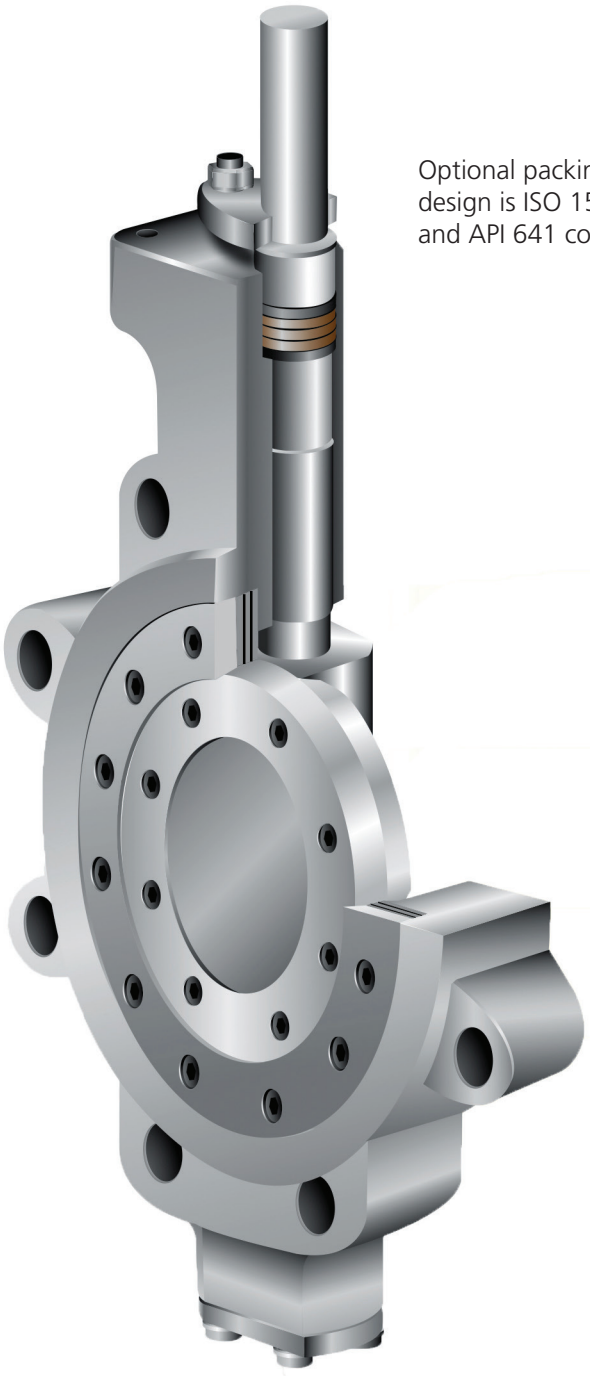
	Body Seat Design (ABZ)	Disc Seat Design (Competition)
Body Seat	Metal + Graphite-Laminate	Weld Overlay
Field Maintainable	Body Seat & Disc Seal	Disc Seat only

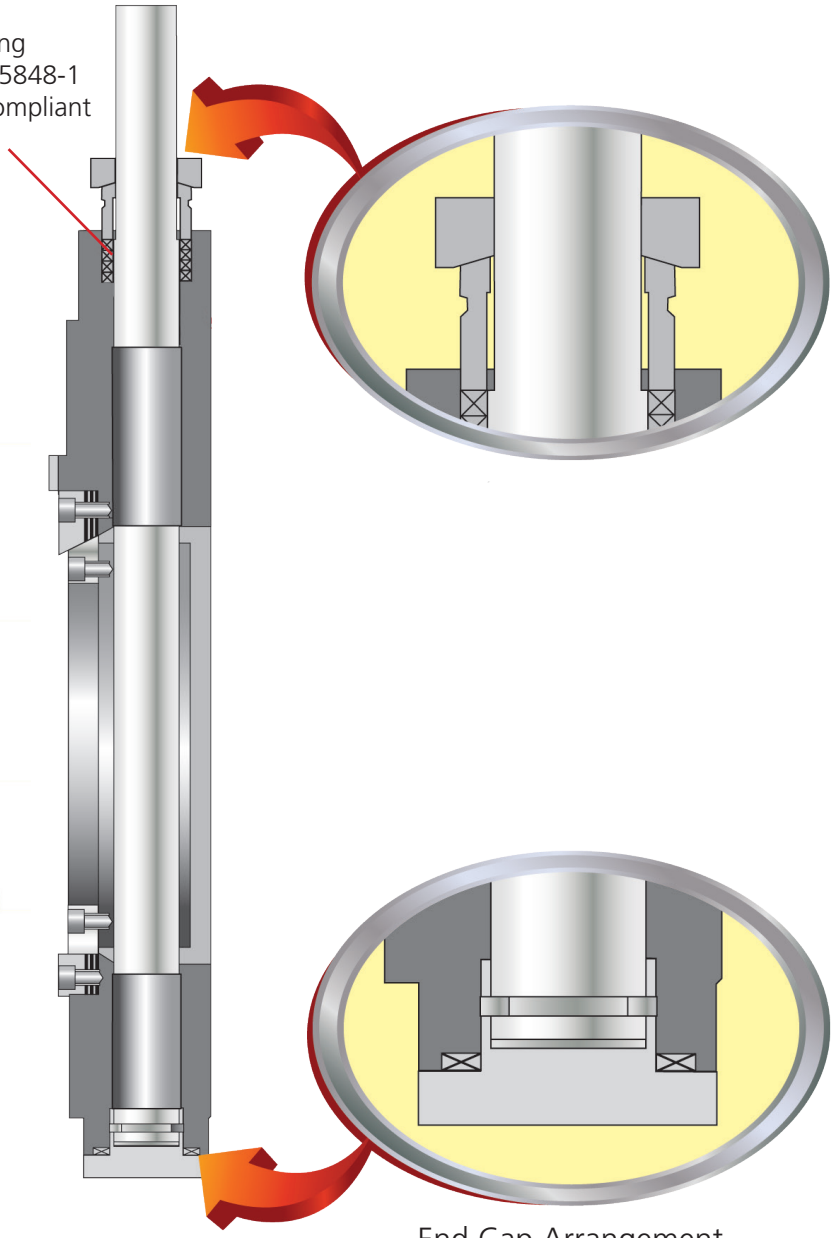
Sealing System

All sealing components (disc seal, body seat and retainer plate) are geometrically machined to an ellipse. Adjusting from a circular design helps reduces friction on the sealing surfaces and provides a tight shut off for long term service. This geometry also reduces the running torque, which provides a lower cost of ownership.

Fugitive Emissions

High temperature graphite packing provides constant compression for a positive seal around the shaft. The one-piece shaft enables the valve to withstand full bidirectional pressure as well as vacuum service. All Extreme 6000 Series valves are designed to API 609 standards. API 641 and ISO 15848-1 compliance is available with API 622 certified packing.





End Cap Arrangement

Design Comparisons

Alternative for Gate and Globe Valve

The Extreme 6000 Triple Offset has excellent sealing capabilities at high pressures and temperatures. These valves are popular with plant personal when replacing gate valves for isolation. Triple Offsets also have throttling capabilities, which can be utilized when replacing globe valves.

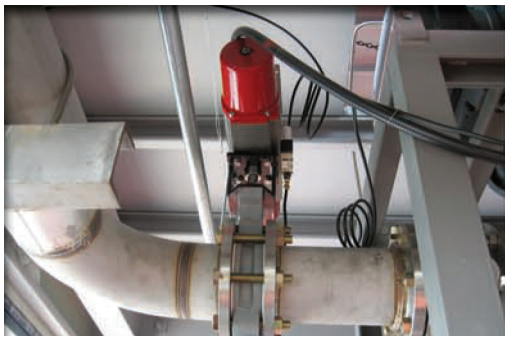
Long Pattern Triple

Gate valve face-to-face

Tight Shut-off at full rating

The Extreme 6000 Series provides fully rated zero-leakage in both directions in air, gas and liquid applications. They are widely used for isolation when tight shut-off is required.

High Temp. Vacuum service-1

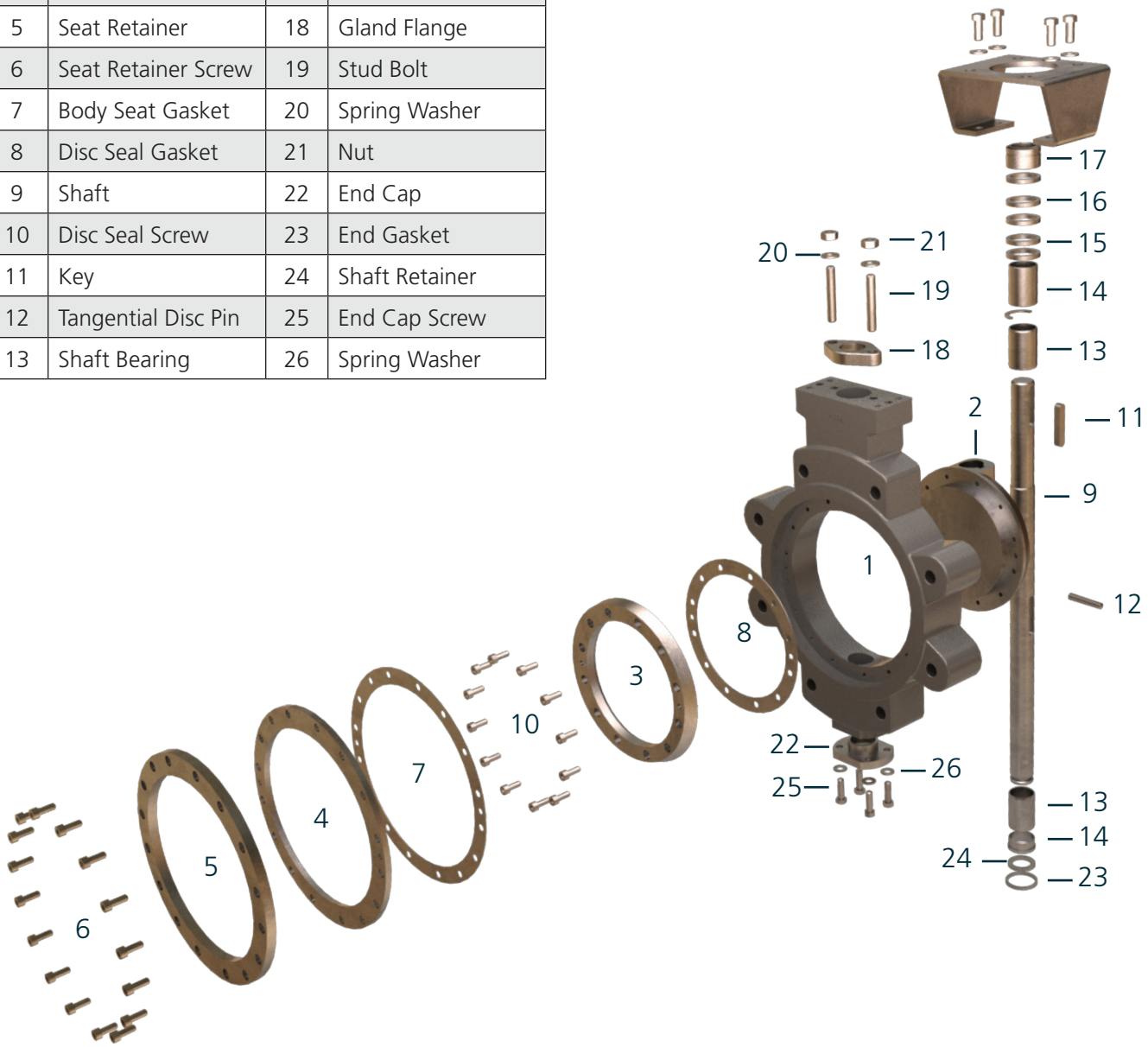


High Temp. Vacuum Service-2

Comparison with other type of Valves				
Features	**Triple offset valve**	**Globe valve**	**Gate valve**	**Ball valve**
End Connection	Wafer, Lugged, Flanged, Buttweld End	Flanged, Screwed, Welded	Flanged, Welded	Flanged, Welded
Weight	Light	Heavy	Heavy	Heavy
Face-to-Face	Short or Long	Long	Long	Long
Working Temperature	High	High	High	High
Sealing Performance	Tight shut off ISO 5208 Rate A	Tight shut off or Class IV	Tight shut off or Class IV	Tight shut off or Class IV
Seat Friction	Low	High	High	High
Bi-Directional	Yes	No	Yes	Yes
Fire Safe	Yes	Yes	Yes	Yes
Torque	Low	High	High	High
Field Maintenance	Easy	Difficult	Difficult	Difficult

Construction of Extreme 6000 Series

Construction & Diagram			
No.	**Description**	**No.**	**Description**
1	Body	14	Collar
2	Disc	15	Packing Retainer
3	Disc Seal	16	Packing
4	Body Seat	17	Packing Gland
5	Seat Retainer	18	Gland Flange
6	Seat Retainer Screw	19	Stud Bolt
7	Body Seat Gasket	20	Spring Washer
8	Disc Seal Gasket	21	Nut
9	Shaft	22	End Cap
10	Disc Seal Screw	23	End Gasket
11	Key	24	Shaft Retainer
12	Tangential Disc Pin	25	End Cap Screw
13	Shaft Bearing	26	Spring Washer



Design Standards

Design	API Std 609, ANSI/ASME B16.34
Classes	Class 150 - Class 900
Size	3" (80mm) - 56" (1400mm)
Body Style	Lugged, Wafer, Short and Long Pattern Flanged, Buttweld
Flange Drilling	ANSI/ASME B16.5, ANSI/ASME B16.47, ISO 7005, DIN2501
Face to Face Dimensions	ANSI/ASME B16.10, API 609, ISO5752, BS5155
Applicable Temperature Range	~ + 800°F (427°C) for Standard*
Pressure Tests	API 598, ISO 5208 Rate A Bidirectionally
Operator	Manual, Electric, Pneumatic, Hydraulic
Fire-safe	API 607 7th Edition, ISO 10497 3rd Edition

*1. Applicable temperatures varies with material.
2. 750°F(400°C) or less in an oxidized atmosphere.
3. Up to 1500°F(815°C) with special materials.
4. Down to -425°F(-253°C) with special construction and materials.

Standard Materials & Specifications

Part #	Description	Material	Material
1	Body	A216-WCB	A351-CF8M
2	Disc	A216-WCB	A351-CF8M
3	Disc Seal	Stainless Steel 316	Stainless Steel 316
4	Body Seat	Laminated Stainless Steel 316/ Graphite	Laminated Stainless Steel 316/ Graphite
5	Seat Retainer	Steel	Stainless Steel 316
6	Seat Retainer Screw	Stainless Steel 304	Stainless Steel 316
7	Body Seat Gasket	Graphite	Graphite
8	Disc Seal Gasket	Graphite	Graphite
9	Shaft	A564-630 H1100	A564-630 H1100
10	Disc Seal Screw	Stainless Steel 304	Stainless Steel 316
11	Key	630 SS	630 SS
12	Disc Pin	Stainless Steel 316	Stainless Steel 316
13	Shaft Bearing	Stainless Steel 316 + ENP	Stainless Steel 316 + ENP
14	Collar	Stainless Steel 304	Stainless Steel 316
15	Packing Retainer	Stainless Steel 316	Stainless Steel 316
16	Packing	Graphite	Graphite
17	Packing Gland	Stainless Steel 304	Stainless Steel 316
18	Gland Flange	Stainless Steel 304	Stainless Steel 316
19	Stud Bolt	Stainless Steel 304	Stainless Steel 316
20	Spring Washer	Stainless Steel 304	Stainless Steel 316
21	Nut	Stainless Steel 304	Stainless Steel 316
22	End Cap	Steel	Stainless Steel 316
23	End Gasket	Graphite	Graphite
24	Shaft Retainer	Stainless Steel	316 Stainless Steel 316
25	End Cap Screw	Stainless Steel 304	Stainless Steel 316
26	Spring Washer	Stainless Steel 304	Stainless Steel 316

Available Materials

- Hastelloy
- Duplex 2205
- ALX6N
- SMO 254/255
- Monel
- Other materials available on request

Optional Upgrades (depicted by service conditions)

Body Seat	Duplex Graphite-Laminate, Inconel Graphite-Laminate, Hastelloy Graphite-Laminate, Monel Graphite-Laminate
Disc Seal Hardfacing	Stellite®
Bearings	Stainless Steel 316 + HCr

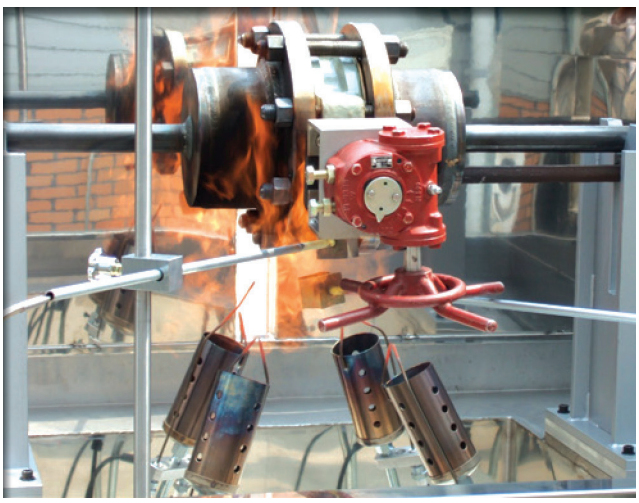
Cryogenic

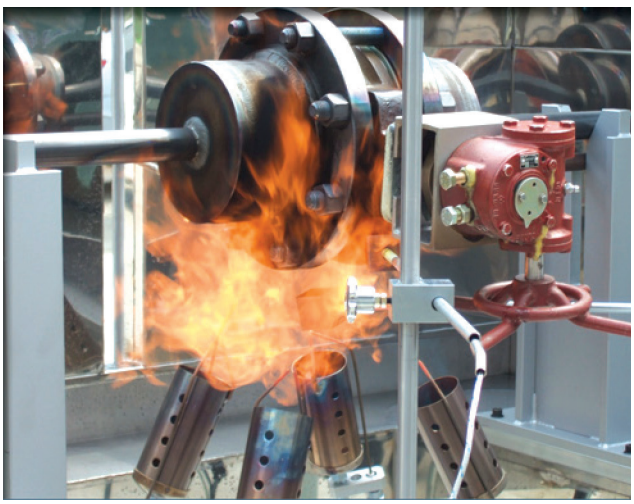
The Extreme 6000 also offers a cryogenic option for temperatures as low as -425°F (-235°C).

This valve design meets requirements for BS6364 and EN12567. All parts and materials are under strict quality management and go through cryogenic treatment before being machined. They are then placed in liquid nitrogen and cooled to -320°F (-196°C) where the shell and seat are tested with helium gas in both directions.

Fire Safe Design

The Extreme 6000 Valve is tested & certified to API 607 and ISO 10497; Valves hold to zero leakage before, during and after the fire.

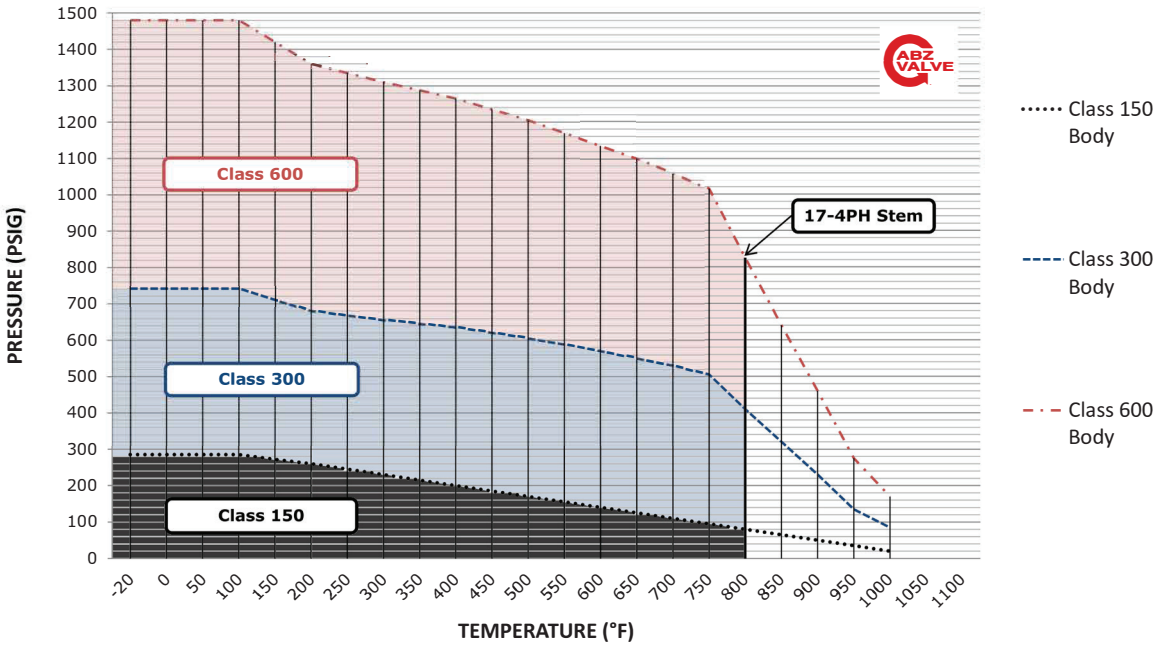




ABZ 6000-1000

Triple Offset High Performance

Pressure/Temperature Rating (A216 Gr. WCB)

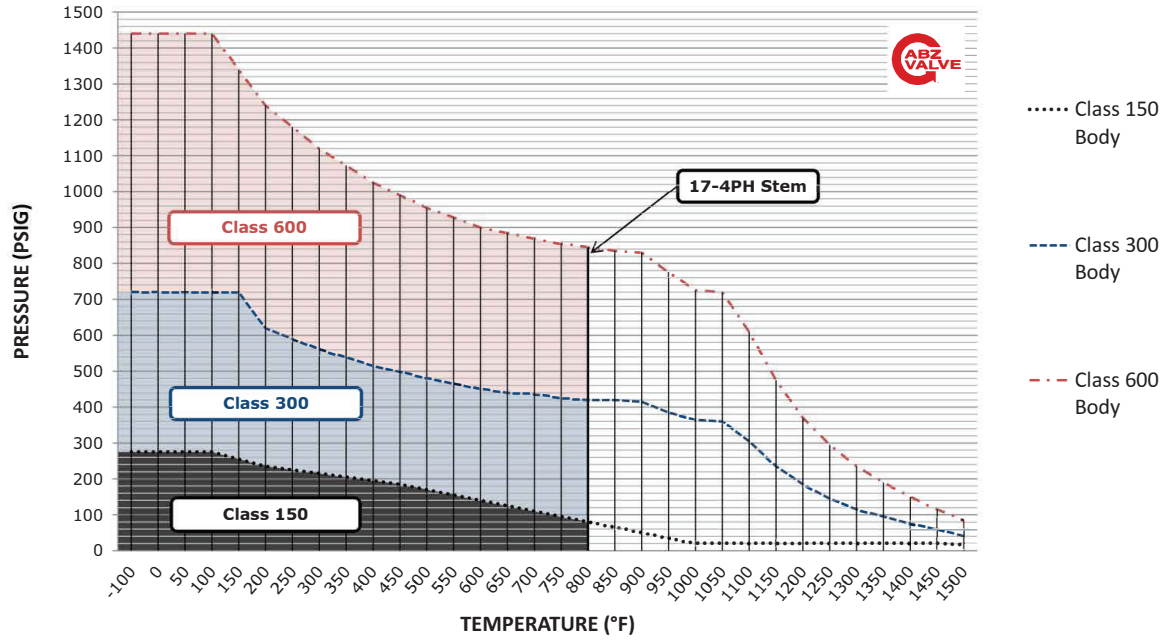


Maximum applicable Temperature for Stem & Seat:
STEM: 17-4PH: -100°F ~ 800°F
SEAT: 316SS/Graphite: -425°F ~ 1000°F

ABZ 6000-2000

Triple Offset High Performance

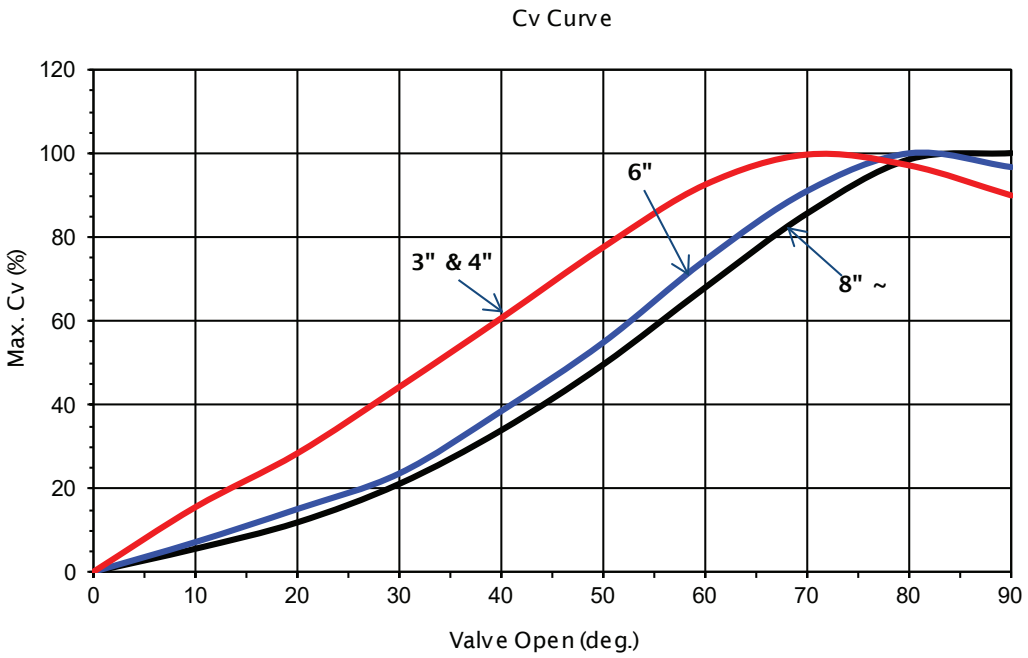
Pressure/Temperature Rating (A351 Gr. CF8M)



Maximum applicable Temperature for Stem & Seat:
STEM: 17-4PH: -100°F ~ 800°F
SEAT: 316SS/Graphite: -425°F ~ 1000°F

Technical Information

Extreme Series 6000 Cv Curve



Cv Value Series 6000 Triple Offset Valve - Class 150

Size		Valve Opening (°)								
inch	mm	10	20	30	40	50	60	70	80	90
3	80	16	29	45	62	79	95	102	99	92
4	100	30	55	86	118	151	180	194	189	175
6	150	51	108	182	276	394	536	654	719	695
8	200	79	170	303	488	715	980	1236	1422	1444
10	250	128	275	489	787	1152	1580	1992	2292	2327
12	300	210	451	803	1293	1893	2597	3274	3768	3825
14	350	271	581	1034	1665	2438	3344	4216	4851	4925
16	400	367	787	1401	2255	3303	4530	5711	6572	6672
18	450	494	1061	1888	3039	4450	6104	7695	8855	8990
20	500	605	1298	2310	3718	5445	7469	9416	10835	11000
24	600	822	1763	3137	5049	7394	10143	12787	14714	14938
26	650	1064	2283	4062	6539	9576	13135	16559	19055	19345
28	700	1331	2856	5082	8180	11979	16432	20715	23837	24200
30	750	1579	3388	6030	9706	14214	19498	24581	28285	28716
32	800	1861	3993	7107	11439	16752	22979	28970	33335	33843
36	900	2309	4954	8816	14189	20780	28504	35935	41350	41980
40	1000	3003	6443	11466	18455	27027	37073	46738	53781	54600
42	1050	3201	6868	12222	19672	28809	39518	49819	57327	58200
48	1200	4279	9180	16338	26296	38511	52826	66597	76633	77800

Cv Value Series 6000 Triple Offset Valve - Class 300

Size		Valve Opening (°)								
inch	mm	10	20	30	40	50	60	70	80	90
3	80	16	29	45	62	79	95	102	99	92
4	100	30	55	86	118	151	180	194	189	175
6	150	44	93	157	238	340	463	565	620	600
8	200	67	143	255	410	600	823	1037	1194	1212
10	250	120	257	458	737	1079	1480	1866	2147	2180
12	300	188	402	716	1153	1688	2316	2920	3360	3411
14	350	248	532	947	1524	2232	3062	3861	4442	4510
16	400	327	702	1249	2010	2943	4037	5090	5857	5946
18	450	446	956	1702	2739	4012	5503	6938	7983	8105
20	500	548	1176	2094	3370	4935	6770	8534	9820	9970
24	600	759	1628	2898	4664	6831	9370	11813	13593	13800
26	650	976	2094	3726	5998	8784	12049	15190	17479	17745
28	700	1130	2425	4315	6945	10171	13951	17588	20239	20547
30	750	1332	2857	5084	8183	11984	16439	20725	23848	24211
32	800	1656	3552	6321	10174	14900	20438	25766	29649	30100
36	900	2140	4590	8169	13148	19256	26413	33298	38317	38900
40	1000	3003	6443	11466	18455	27027	37073	46738	53781	54600
42	1050	3201	6868	12222	19672	28809	39518	49819	57327	58200
48	1200	4279	9180	16338	26296	38511	52826	66597	76633	77800

Cv Value Series 6000 Triple Offset Valve - Class 600

Size		Valve Opening (°)								
inch	mm	10	20	30	40	50	60	70	80	90
4	100	25	46	73	100	128	152	164	160	148
6	150	41	87	147	223	318	433	528	580	561
8	200	52	111	197	318	465	638	805	926	940
10	250	88	189	336	540	791	1085	1368	1574	1598
12	300	146	313	557	896	1313	1801	2270	2612	2652
14	350	215	461	820	1320	1933	2651	3343	3846	3905
16	400	285	612	1089	1753	2567	3521	4438	5107	5185
18	450	392	840	1495	2407	3524	4834	6095	7013	7120
20	500	501	1074	1911	3076	4505	6179	7790	8964	9100
24	600	693	1487	2646	4259	6237	8555	10786	12411	12600

Our Core Values

No one gets hurt

The safety of our employees and customers is our first priority coupled with a healthy respect for the environment.

Integrity

In everything we do, in every interaction, both internally and externally, we strive to operate with the utmost integrity and mutual respect.

Customer focused

Our products enhance our customer's performance and we listen to their needs and work with them to solve their challenges.

Good place to work

We are committed to creating a workplace that fosters innovation, teamwork and pride. Every team member is integral to our success and is treated equally and fairly.

FORUM® ENERGY TECHNOLOGIES

Forum Energy Technologies

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