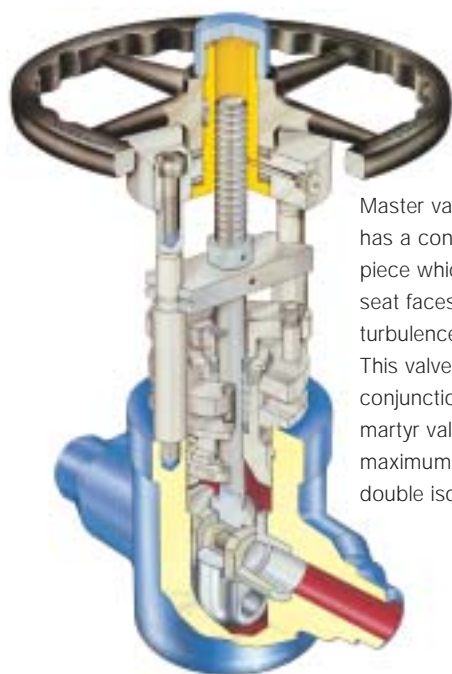


HIGH PERFORMANCE DRAIN VALVES

For extreme service conditions such as on superheated steam drain lines, Hopkinsons have developed a new range of high performance parallel slide gate valves. They give extended service life and continued tight shut off when subject to frequent operation, two phase flow, thermal shock and large pressure drops. Unique features of the valves include square discs (gates) and 'winged' seats. These provide accurate gate guidance, low seat contact stresses and enhanced wear resistance for repeatedly handling large pressure drops in the part open position.

The valves can be installed singly but for maximum effect, two valves operating in a martyr valve and master valve configuration are recommended.

- Winged seats - the seating area is extended in the opening direction providing greater contact area with the gates.
- Square gates - provide greater contact area and support during operation. Titanium nitride coating gives improved erosion resistance.

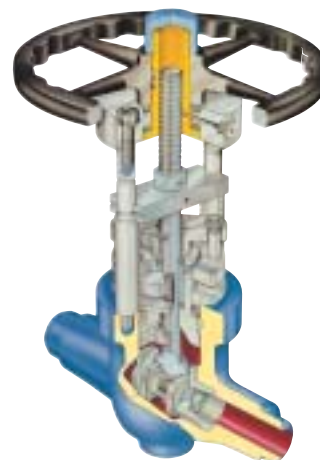


Master valve - has a connecting eye-piece which protects the seat faces and avoids turbulence in the valve. This valve used in conjunction with the martyr valve produces maximum benefits of double isolation.

High Performance Drain Valves

Ratings:	ASME Class 900 to 3600
Sizes:	20 to 100 mm ¾ to 4 in
Materials:	Carbon Steel, Alloy Steel.
End Connection:	Butt weld and socket weld.

Martyr valve - incorporates a 'V' port outlet seat and is ideal for regulating the flow. The 'V' port is set back from the sealing face and any wear associated with high velocities and throttling is confined to this and not the sealing face.



OPERATION

Manual or Actuated - Motorising frequently operated valves is essential for modern plant operation. Actuators can ensure the master valve is opened first and closed last, and that it is opened to its full open position.

OPTIONAL EXTRAS

Pipework - Pairs of valve can be supplied with a joining piece of pipework welded and tested thereby simplifying site installation.

Alternative 'V' ports - the standard 50% 'V' port provides excellent all round performance and is appropriate for the majority of applications. Where necessary, 'V' ports from 20% to 80% area, and parallel ports from 5% to 30% area for linear regulation can be selected for specific applications.

PRESSURE/TEMPERATURE RATINGS

PN 420 Rated Valves - Fig No: M218420W, M268420W, Sizes 20 - 50mm.
 ASME Class 2500 Valves - Fig No. A21825W, A26825W, Sizes 1 - 2½ inch.
 Body Material: Carbon Steel ASTM-105, ASTM-A216-WCB.
 In accordance with ASME B16.34 Limited Class 2500

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Pressure bar	431.0	431.0	431.0	431.0	431.0	431.0	415.5	401.1	393.6	359.4	299.6*	208.7*	141.1*	123.1*					
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100			
Pressure lb/in	6250	6250	6250	6250	6250	5940	5825	5780	5250	4285*	2785*	1785*							

PN 520 Rated Valves - Fig No: M218520W, M268520W, Sizes 20 - 50mm.
 ASME Class 3100 Valves - Fig No. A21831W, A26831W, Sizes 1 - 2½ inch.
 Body Material: Alloy Steel ASTM A182-F22, WC9.
 In accordance with ASME B16.34 Limited Class 3100

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Pressure bar	534.5†	534.5†	534.5†	534.5†	534.5†	527.1†	525.5†	524.8†	522.0†	518.9†	513.5†	487.6†	441.9†	-	378.9	378.9	243.7	174.3	117.3
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Pressure lb/in	7750†	7750†	7750†	7750†	7620†	7620†	7620†	7575†	7528†	7440†	7000†	6200	5097	3938	2961	1685	-	-	-

ASME Class 1500 Valves - Fig No. A21815W, A26815W, Sizes 1 - 2½ inch.
 Body Material: Carbon Steel ASTM- 105, ASTM A216-WCB.
 In accordance with ASME B16.34 Limited Class 1500

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Pressure bar	258.6	258.6	258.6	258.6	258.6	258.6	249.3	240.6	236.2	215.6	179.7*	125.2*	84.7*	73.8*	-	-	-	-	-
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Pressure lb/in	3750	3750	3750	3750	3750	3565	3495	3470	3150	2570*	1670*	1070*	-	-	-	-	-	-	-

ASME Class 1500 Valves - Fig No. A21815W, A26815W, Sizes 1 - 2½ inch.
 Body Material: Alloy Steel ASTM A182-F22.
 In accordance with ASME B16.34 Limited Class 1500

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Pressure bar	258.6	258.6	258.6	258.6	258.6	255.0	254.2	253.8	252.5	251.1	248.3	235.9	213.8	-	180.9	142.9	109.2	78.3	52.2
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Pressure lb/in	3750	3750	3750	3750	3685	3685	3685	3665	3645	3600	3385	3000	2411	1784	1330	758	-	-	-

ASME Class 900 Valves - Fig No. A21809W, A26809W, Sizes 1 - 2½ inch.
 Body Material: Carbon Steel ASTM-105,ASTM A216-WCB.
 In accordance with ASME B16.34 Limited Class 900

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
855.1	155.1	155.1	155.1	155.1	155.1	149.6	144.4	141.7	129.4	107.8*	75.1*	50.8*	44.4*	-	-	-	-	-	-
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	1000	1050	1100	-	-	-	-
Pressure lb/in	2250	2250	2250	2250	2250	2140	2100	2080	1890	1545*	1005*	645*	-	-	-	-	-	-	-

ASME Class 900 Valves - Fig No. A21809W, A26809W, Sizes 1 - 2½ inch.
 Body Material: Alloy Steel ASTM A182-F22.
 In accordance with ASME B16.34 Limited Class 900

Temperature °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Pressure bar	155.1	155.1	155.1	155.1	155.1	153.0	152.5	152.3	151.5	150.7	149.1	141.5	128.3	-	107.9	84.3	63.8	45.5	30.4
Temperature °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Pressure lb/in	2250	2250	2250	2250	2210	2210	2210	2200	2185	2160	2030	1800	1433	1045	774	442	-	-	-

PRESSURES AND TEMPERATURES SHOWN IN THE BAR: °C TABLE ARE CONVERSIONS FROM lb/in²: °F RATINGS. FOR INTERMEDIATE VALUES IT IS RECOMMENDED THAT THEY ARE OBTAINED BY LINEAR INTERPOLATION USING THE TABLE OF lb/in²: F RATINGS. * ASTM A105 MATERIAL TEMPERATURE LIMITATIONS: USE AT TEMPERATURES ABOVE 425°C (800°F) IS PERMISSIBLE BUT IS NOT RECOMMENDED FOR PROLONGED USE. SHORT EXCURSIONS UP TO 482°C (900°F) ARE PERMISSIBLE.
 † RESTRICTED SEATING: MAX PRESSURE DIFFERENTIAL ACROSS THE CLOSURE MEMBER IS LIMITED TO 431 BAR (6250 lb/in²).

HIGH PERFORMANCE DRAIN VALVES

ASME Class 2500 Valves - Fig No. A21825W, A26825W, Sizes 3 and 4 inch.
 Body Material: Carbon Steel ASTM-105, ASTM A216-WCB.
 In accordance with ASME B16.34 Class 2500

Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	425.4	417.1	386.5	376.9	365.1	347.6	327.7	308.0	303.8	287.5	239.7*	167.0*	112.9*	98.6*	-	-	-	-	-
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	6170	5625	5470	5280	4990	4560	4475	4440	4200	3430*	2230*	1430*	-	-	-	-	-	-	-

ASME Class 3600 Valves - Fig No. A21836W, A26836W, Sizes 3 and 4 inch.
 Body Material: Alloy Steel ASTM A182-F22.
 In accordance with ASME B16.34 Class 3600

Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	620.6†	614.4†	588.5†	559.5†	538.1†	530.6†	508.5†	482.8†	465.5†	439.0†	421.1	405.7	399.9	-	333.7	263.1	196.4	140.6	75.8
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	9000†	8591†	8120†	7776†	7676†	7256†	7061†	6812†	6377†	6089	5845	5392	4528	3209	2389	1360	-	-	-

ASME Class 1500 Valves - Fig No. A21815W, A26815W, Sizes 3 and 4 inch.
 Body Material: Carbon Steel ASTM- 105, ASTM A216-WCB.
 In accordance with ASME B16.34 Class 1500

Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	255.5	250.4	231.9	226.0	219.2	208.7	193.6	184.8	182.3	172.5	143.9*	100.3*	67.9*	59.3*	-	-	-	-	-
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	3705	3375	3280	3170	2995	2735	2685	2665	2520	2060*	1340*	860*	-	-	-	-	-	-	-

ASME Class 1500 Valves - Fig No. A21815W, A26815W, Sizes 3 and 4 inch.
 Body Material: Alloy Steel ASTM A182-F22.
 In accordance with ASME B16.34 Class 1500

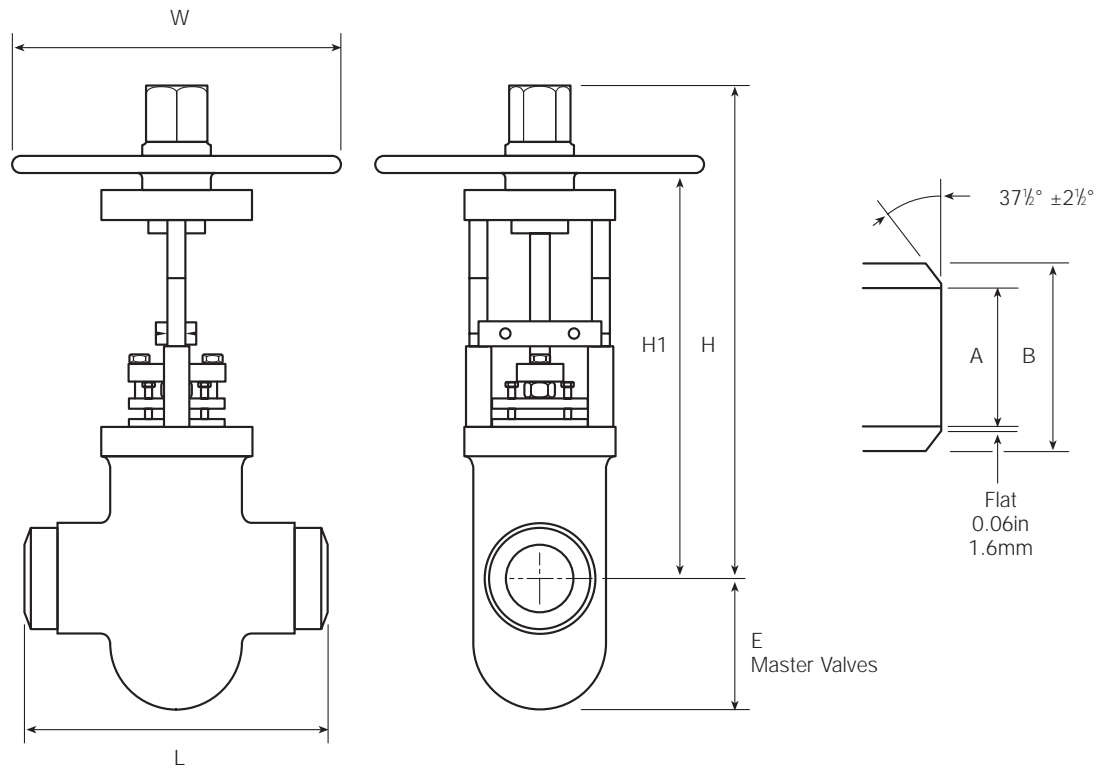
Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	258.6	256.0	245.2	233.2	224.2	221.1	211.9	201.1	194.1	183.1	175.6	169.0	158.2	-	138.9	109.7	81.9	58.5	39.0
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	3750	3580	3385	3240	3200	3025	2940	2840	2660	2540	2435	2245	1885	1340	995	565	-	-	-

ASME Class 900 Valves - Fig No. A21809W, A26809W, Sizes 3 and 4 inch.
 Body Material: Carbon Steel ASTM-105, ASTM A216-WCB.
 In accordance with ASME B16.34 Class 900

Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	153.1	150.1	139.2	135.7	131.4	125.1	116.1	110.8	109.4	103.4	86.3*	60.2*	40.7*	35.5*	-	-	-	-	-
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	2220	2025	1970	1900	1795	1640	1610	1600	1510	1235*	805*	515*	-	-	-	-	-	-	-

ASME Class 900 Valves - Fig No. A21809W, A26809W, Sizes 3 and 4 inch.
 Body Material: Alloy Steel ASTM A182-F22.
 In accordance with ASME B16.34 Class 900

Temp. °C	-29 to 38	50	100	150	200	250	300	350	375	400	425	450	475	482	500	525	550	575	593
Press. bar	155.1	153.6	147.2	139.8	134.6	132.7	127.2	120.7	116.5	109.8	105.4	101.4	95.1	-	90.4	65.8	49.1	35.0	23.4
Temp. °F	-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	-	-	-
Press. lb/in	2250	2150	2030	1945	1920	1815	1765	1705	1595	1525	1460	1350	1130	805	595	340	-	-	-



CLASS PN420 & PN520

Nominal Size	A	B PN420	B PN520	E	H	H1	L	W
mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
20 (¾)	20 (0.79)	35 (1.38)	40 (1.57)	78 (3.07)	321 (12.75)	277 (10.9)	254 (10)	280 (11)
25 (1)	25 (0.98)	42 (1.65)	46 (1.81)	78 (3.07)	321 (12.75)	277 (10.9)	254 (10)	280 (11)
32 (1¼)	32 (1.26)	57 (2.24)	60 (2.36)	110 (4.33)	401 (15.75)	349 (13.75)	305 (12)	380 (15)
40 (1½)	38 (1.5)	65 (2.56)	68 (2.68)	110 (4.33)	401 (15.75)	349 (13.75)	305 (12)	380 (15)
50 (2)	47 (1.85)	85 (3.35)	85 (3.35)	130 (5.12)	430 (17)	368 (14.5)	330 (13)	330 (13)

CLASS 900 & 1500

Nominal Size	A Cl.900	A Cl.1500	B	E	H	H1	L	W
mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
20 (¾)		15.44 (0.61)	28 (1.1)	65 (2.56)	264 (10.38)	242 (9.5)	186 (7.31)	178 (7)
25 (1)		20.7 (0.81)	35 (1.38)	65 (2.56)	264 (10.38)	242 (9.5)	186 (7.31)	178 (7)
32 (1¼)		29.46 (1.16)	43 (1.69)	78 (3.07)	321 (12.63)	277 (10.9)	232 (9.13)	260 (11)
40 (1½)		33.98 (1.34)	52 (2.05)	110 (4.33)	401 (15.75)	349 (13.75)	279 (11)	380 (15)
50 (2)		42.9 (1.69)	62 (2.44)	110 (4.33)	401 (15.75)	349 (13.75)	279 (11)	380 (15)
65 (2½)	54 (2.13)	54 (2.13)	73 (2.87)	130 (5.12)	430 (17)	368 (14.5)	254 (10)	330 (13)
80 (3)	66.65 (2.63)	66.65 (2.63)	89 (3.5)	130 (5.12)	436 (17.17)	374 (14.75)	305 (12)	330 (13)
100 (4)	87.32 (3.44)	87.32 (3.44)	114 (4.49)	175 (6.89)	618 (24.3)	519 (20.4)	356 (14)	330 (13)

HIGH PERFORMANCE DRAIN VALVES

DIMENSIONS**CLASS 2500, 3100 & 3600**

Nominal Size		A		B		E		H		H1		L		W	
mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)
25	(1)	15.21	(0.60)	35	(1.38)	65	(2.56)	264	(10.38)	242	(9.5)	186	(7.31)	178	(7)
32	(1¼)	22.75	(0.89)	46	(1.81)	78	(3.07)	321	(12.63)	277	(12.63)	232	(9.13)	280	(11)
40	(1½)	27.94	(1.10)	55	(2.17)	110	(4.33)	401	(15.75)	349	(13.75)	279	(11)	380	(15)
50	(2)	38.17	(1.50)	65	(2.56)	110	(4.33)	401	(15.75)	349	(13.75)	279	(11)	380	(15)
65	(2½)	45	(1.77)	73	(2.87)	130	(5.12)	430	(17)	368	(14.5)	330	(13)	380	(15)
80	(3)	58	(2.28)	89	(3.50)	130	(5.12)	436	(17.17)	375	(14.75)	368	(14.5)	330	(13)
100	(4)	80	(3.15)	114	(4.48)	175	(6.89)	618	(24.3)	519	(20.4)	457	(18)	470	(18.5)

VALVE AVAILABILITY

Martyr Valves - Fig No. M218520W, M218420W, A21831W, A21825W, A21815W, A21809W Master Valves - Fig No. M268520W, M268420W, A26831W, A26825W, A26815W, A26809W Combined Valves - as Master Valves - with 'V' port			
Figure Number	Rating	Material	Sizes
M218520W, M268520W	PN520	F22/WC9	20mm to 50mm
M218420W, M268420W	PN420	A105/WCB	20mm to 50mm
A21831W, A26831W	ASME Class 3100*	F22/WC9	1" to 4" nom.
A21825W, A26825W	ASME Class 2500	A105/WCB, F22/WC9	1" to 4" nom.
A21815W, A26815W	ASME Class 1500	A105/WCB, F22/WC9	¾" to 4" nom
A21809W, A26809W	ASME Class 900	A105/WCB, F22/WC9	2½", 3", 4" nom

* 3" AND 4" SIZES (80mm AND 100mm) AVAILABLE IN CLASS 3600 AS FIGURE NO. A21836W. PLEASE CONSULT US FOR OTHER SIZES OR PRESSURE CLASSES.

SOCKET WELD ENDS AVAILABLE ON SIZES UP TO AND INCLUDING 2½". DIMENSIONS IN THE TABLES OPPOSITE ARE FOR BUTT WELD ENDS. 2½" SIZE AND ABOVE ARE FITTED WITH SPLIT STEM GUIDE.

FULL BORE & VENTURI PARALLEL SLIDE GATE VALVES

The Hopkinsons Full Bore & Venturi design of stop valve are our standard recommendation when a gate valve is required for steam or feedwater duty in the medium and high pressure ranges.

MAIN APPLICATIONS

- General purpose stop valve
- Main steam and feedwater isolation
- Boiler circulating pump isolation
- The basic design is also incorporated in valves for other duties such as:
 - Feedwater heater protection
 - Feed pump leak-off
 - Nuclear Applications (ASME Section III, Class 1,2 & 3) (Described in other publications available on request)
 - Regulating duty with V-ported seat

SPECIAL FEATURES

Valves can be offered to incorporate features such as quick closure, live loaded gland, double stuffing box with lantern ring and bleed-off point, back seat, seal welded body/cover joint.

MAIN ADVANTAGES

- Fluid tightness achieved by fluid pressure - not from mechanical wedging action thus eliminating thermal binding*
- Complete flow isolation in either direction
- Minimum pressure drop
- Freedom from leakage independent of temperature or pressure changes
- Self-aligning fully supported discs
- Inherent self-cleaning action
- In-line maintenance

*Thermal Binding is associated with Wedge Gate Valves and occurs when a Wedge Gate Valve is closed at high temperature and is allowed to cool before attempting opening. Thermal binding cannot occur with a parallel slide gate valve.

Parallel Slide Gate Valves

Ratings:	ASME Class 150 to 4500
Sizes:	15 to 1200 mm ½ to 48 in
Temperature Ratings:	-29°C to 593°C -20°F to 1100°F
Materials:	Carbon Steel, Alloy Steel, Stainless Steel, Bronze.
End Connections:	Flanged, butt weld, socket weld.

PRESSURE/TEMPERATURE RATINGS

Pressure/Temperature ratings are in accordance with ASME B16.34 1996. Alternatively, valves can be supplied to other national standards. Details will be supplied on request.



Full bore parallel slide gate valves in low carbon steel for a nuclear power plant.



Volume production of gate valves for low/medium general purpose industrial duties.

PARALLEL SLIDE ACTION

FULL BORE

The outstanding feature of the parallel slide design is that of maintaining fluid-tightness without the aid of wedging action. No mechanical stress is exerted between the discs, and there are no problems associated with cool-down of the fluid.

Specially designed non-corrodible springs ensure the discs maintain contact with the seats when the valve is not under pressure. When the valve is closed and the system pressurized, isolation is achieved by the pressure acting on the outlet disc against its seat face.

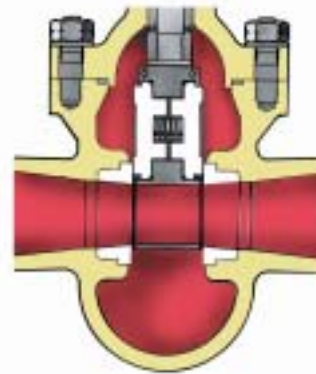
The sliding action of the discs during opening and closing removes any loose foreign matter from the seat faces. A Sliding stem stop guide provides external guidance and indication of disc position. When the stem guide comes to rest against the shoulders of the pillars, no further operating effort is necessary.

The Full Bore design is used when minimum pressure drop is paramount. The design is based on the seat bore having a diameter approximately equal to 90% of the bore of the connecting pipe.

VENTURI DESIGN

The Venturi design is used when a slightly higher pressure drop is acceptable. The well established principle of fluid flow through a Venturi is used in order to minimise pressure drop. Venturi valves incorporate the design feature of an eye follower. In the fully open position the eye follower bridges the gap between the seats thus giving a smooth flow path and completing the Venturi profile.

Valve Travel and components being smaller than a comparative Full Bore Valve results in a compact superstructure - an advantage where space is restricted. A considerable saving in weight and actuator costs is also achievable due to the reduced seat size. A further advantage is that the design lends itself to steam purging operation without the need to introduce sacrificial valves.

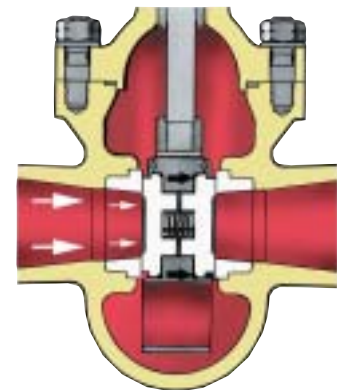


Valve Open

Gives unobstructed flow. 'eye -piece' bridges gap to complete Venturi form passage and protect seat faces.

Valve Closed

Fluid pressure (indicated by arrows) holds disc on outlet side in contact with seat.



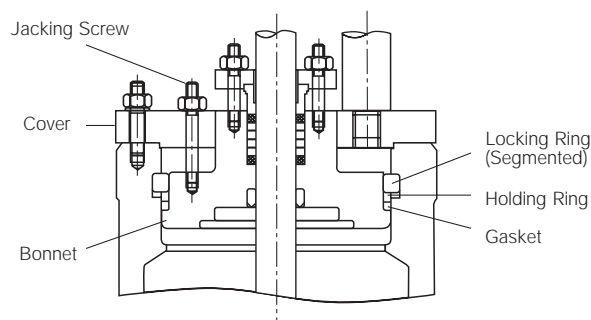
BONNET CLOSURES

CLASS 150 - 600

The bonnet to body closure joint is achieved by a bolted bonnet design incorporating an exfoliated graphite gasket for classes 150 and 300. Ideal for low pressure applications. Class 600 incorporates an exfoliated graphite filled spiral wound gasket. Ideal for medium pressure applications.

CLASS 1000 - 3100

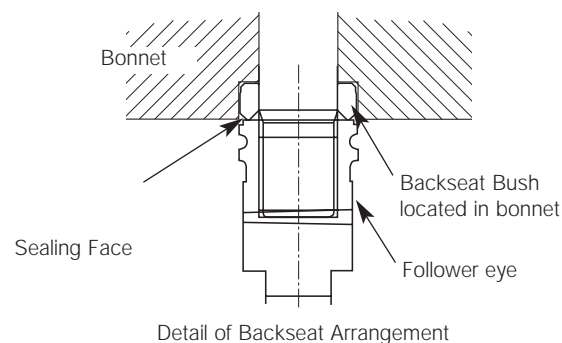
On class 1000 and above a pressure sealed bonnet is incorporated. Hydrostatic pressure acting on the bonnet activates a resilient gasket of exfoliated graphite and thus forms the bonnet seal. This is a very effective seal for high pressure valves.



BACK SEATS

Both Full Bore and Venturi design of valve incorporate a Back Seat. This feature can only be utilised when the valve is in the fully open position with the handwheel wound back until the Eye Follower contacts the mechanical Stop which incorporates the Back Seating facility.

The principle of Back Seating should only be utilised in the unlikely event of gland leakage to isolate the gland from the system pressure until such time that the plant is shut down and repairs may be carried out. Under no circumstances should Back Seating of a valve be carried out with the intention of repairing the faulty gland while the system is pressurized. Under normal operation the valve should only be opened to within 3mm of the Back Seat.

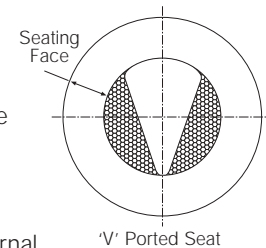


GLAND PACKINGS

High efficiency materials such as exfoliated graphite and carbon fibre are used for gland packings and sealing gaskets. Live loaded gland packing system designed for attention-free stem sealing is available as an extra.

REGULATING DUTIES

Parallel slide gate valves can be supplied with V-ported outlet seat making them ideally suitable for regulating duties.



STEM GUIDE

On a Parallel slide valve, an external Stem Guide serves two important functions:-

- Stem anti-rotation device
- Visual indicator of disc position relative to Seat Bore.

To prevent damage to the stem guide and internal fittings of a parallel slide valve particularly on smaller size and those valves which are electrically or gear operated the concept of position seating to effect closure should always be adhered to. For example,

- When isolating a hand operated valve, once the discs have been moved to the closed position, the handwheel should be turned back to eliminate the backlash.
- Electrically operated valves should always be set to function on the 'LIMIT' switches and never on TORQUE otherwise extensive damage can be caused through overstressing of the valve components

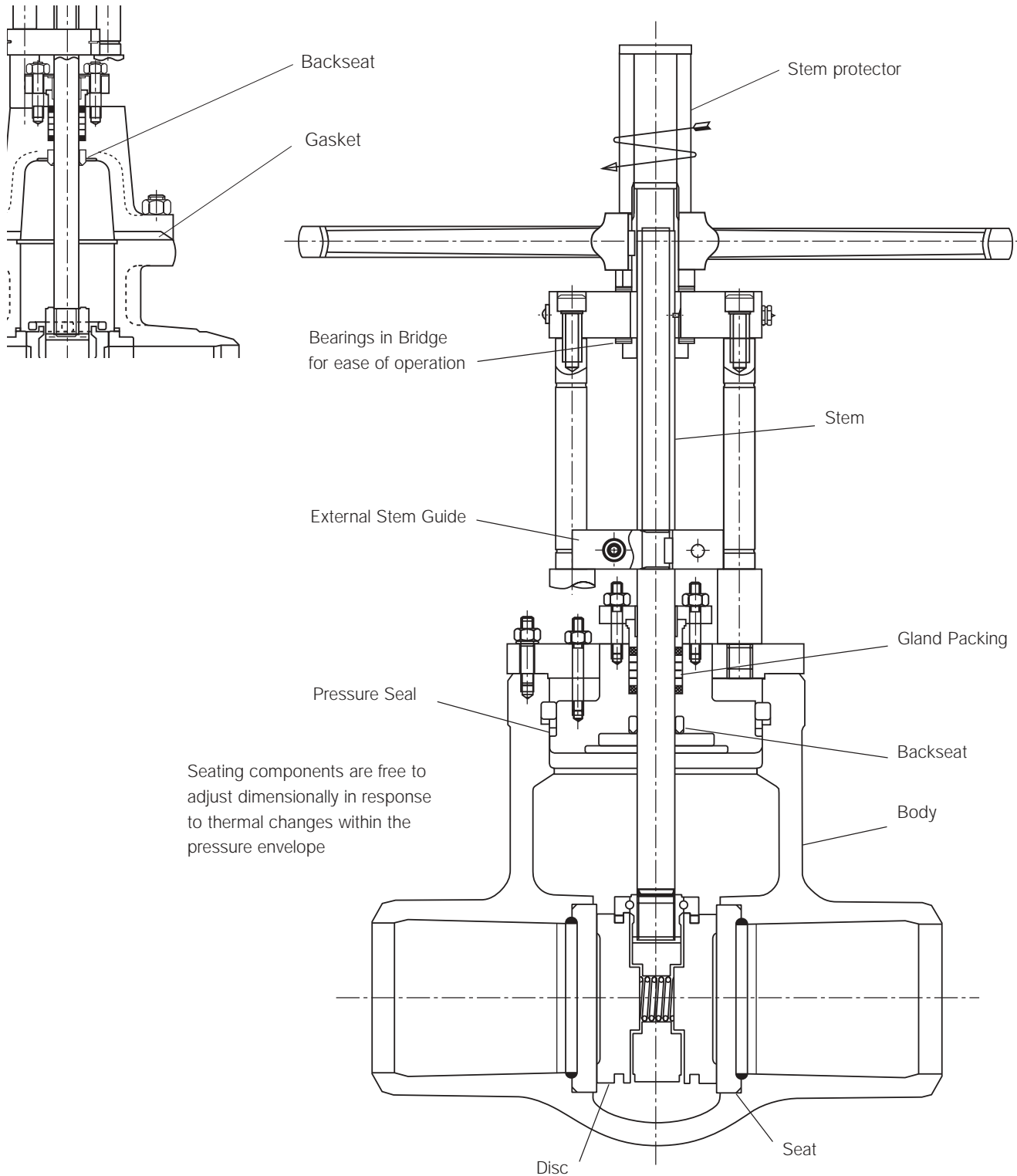
DISC AND SEATS

Disc and seats are of all metal design and suitable for a wide range of temperatures. Where sealing surfaces are produced by depositing hard faced materials a generous thickness is allowed. This allows for many re lapping operations during maintenance.

FULL BORE PARALLEL SLIDE VALVE

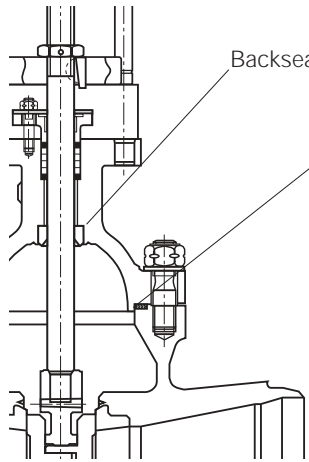
Bolted bonnet on Class 150 - 600
(Excluding Class 600 Modified 9% Cr
valves). Diagram shows 150 Class valve.

Pressure sealed bonnet on
Class 1000 and above.
Class 600 Modified 9% Cr valves.



VENTURI PARALLEL SLIDE VALVE

Bonnet bolted (as shown)
on valves Class 600



Pressure sealed bonnet on
Class 1000 and above & Class 600
Modified 9% Cr valves
(shown below)

