

McSYS®



GATE, GLOBE & CHECK VALVES

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MCSYS® Cast Steel and Stainless Steel valves are available in sizes 2" through 36" and ASME classes 150-1500.

Engineered for rigorous performance, MCSYS® Cast Steel and Stainless Steel valves are cast construction in both Cast Steel and Stainless steel

Designed for a wide range of services. MCSYS® Cast Steel and Stainless Steel valves are suitable for many applications. Refineries, Power Plants Petrochemical / chemical processing Industries, etc

Strict manufacturing processes are adhered to in order to maintain consistent compliance with APL, ASTM, ANSI/ASME or other international standards.

MCSYS' Quality Assurance System is in accordance with ISO 9001 and API Spec Q1

Standards

Valve Design:	API 6D, 600 & 603, ASME B16.34, BS1414 (Gate valve), BS1873 (Globe valve), BS1868 (Check valve)
Face to Face Dimensions:	ASME B 16.10
End Flange Dimensions:	ASME B16.5, ASME B16.47, MSS SP 44
Welding and Dimensions:	ASME B 16.25, BS1414 (Gate valve), BS1873 (Globe valve), BS1868 (Check valve)
Test:	API 6D, 598, 600 & 603

Certificates:

API 6D
API 6A
ISO 9001
API 6FA, API 607

MCSYS®

Manufacturing plants in Korea

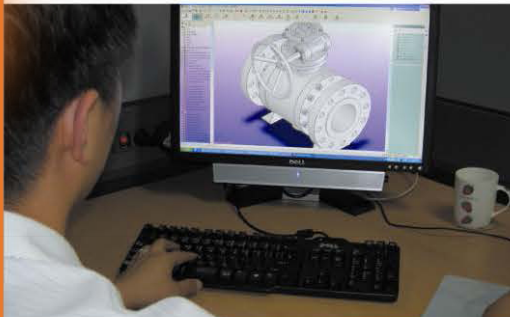


Various machines at manufacturing facilities



Precisely machining by CNC machines

Large inventories for fast shipping



Valve design by 3D modeling

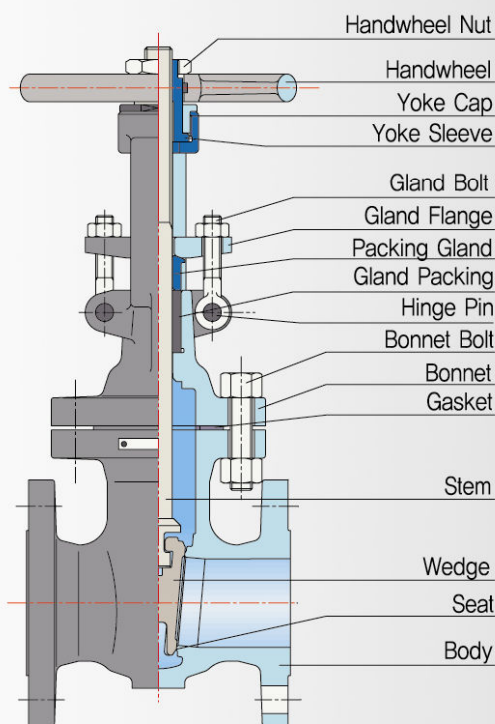
Ball testing by 3D measurement



Gate, Globe & Check Valves

GATE VALVES

STANDARD SPECIFICATIONS



Production Range

API 603 / ASME 16.34		API 600 / BS 1414	
Class	Size	Class	Size
150	2" ~ 24"	150	2" ~ 36"
300	2" ~ 24"	300	2" ~ 36"
600	2" ~ 24"	600	2" ~ 24"
		900	2" ~ 12"
		1500	2" ~ 12"

Design Standards

Pressure-Temperature Rating	ANSI B16.34
Face to Face Dimensions	ANSI B16.10
End Flange Dimensions	ASME B16.5
Testing	API 598 / MSS-SP-41
Bonnet Bolt	ASTM A193 / ASTM A320
Bonnet Nut	ASTM A194
Marking	MSS-SP-25
Light Wall Thickness	API 603 / ANSI B16.34
Heavy Wall Thickness	API 600 / BS 1414

Standard Material Specifications

Part Name	Cast Steel Valves		Stainless Steel Valves		
	WCB	LCB	CF8M	CF8	CF3M
Body	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Wedge	A217-CA15	A351-CF8	A351-CF8M	A351-CF8	A351-CF3M
Seat Ring	A105 + CA15	A182-F304	Integral		
Stem	A479-410	A479-304	A479-316	A479-304	A479-316L
Back Seat Ring	A479-410	A479-304	Integral		
Bonnet	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Bonnet Bolt	A193-B7	A320-L7	A193-B8		
Bonnet Nut	A194-2H	A194-4	A194-8		
Packing Gland	A479-410	A479-304	A479-316	A479-304	A479-316L
Hinge Pin	A576-1020		A479-304		
Gland Packing	GRAPHITE				
Gland Flange	A216-WCB		A351-CF8		
Gland Bolt Nut	A307-B	A194-8	A194-8		
Gasket	SPIRAL WOUND				
Yoke Cap	A576-1020		A576-1020+Zn		
Yoke Sleeve	A439-D2C		A439-D2C		
Handwheel	A197		A193		
Handwheel Nut	A47-32510+Zn		A351-CF8		

Note : 1. We can supply any kind of Gasket and gland packing on request.
2. STL - Stellite

GATE VALVES

DESIGN FEATURES

Body and Bonnet

The body is constructed with uniform sections and generous radius fillets to prevent stress on all sides. The body has a straight through port without recess except between the seats to achieve minimum turbulence, erosion and resistance to flow. The bolted bonnet is fitted with a back seat ring to guide the stem and provide a back seat when the valve is fully open. The yoke is cast integrated with the bonnet.

The body-bonnet joint for ASME Class 150 valves is oval in shape and plain faced. In ASME Class 300 and 600 valves, the bonnet joint is circular in shape and male-female type. Any kinds of gasket materials can be supplied according to customer's requirement.

Wedge

One piece flexible wedge ensures tight seating over a wide range of differential pressures and temperatures. Stress concentrations are minimized due to one piece flexible wedge of which the cross section of the wedge is a tapered H in shape. In addition, the flexible wedge adjusts the movement of body seat.

Seat Ring

Seal welded seat rings are designed to achieve minimum pressure drop and prevent damage by corrosion. Leakage through the path between the seat rings and the body is also eliminated.

Stem

The stem has the 'T' head engaging with the T-slot in the wedge. Its surface is precisely machined and ground to reduce friction to extend stem packing life and ensure perfect tightness. The stem also has a back seat shoulder to match with the back seat ring in the bonnet.

Yoke

The yoke, when not integral with the bonnet, is exactly machined to match the bonnet and insure perfect with the backseat bushing and stem.

Yoke Sleeve

The yoke sleeve has the long thread to ensure accurate alignment of the stem. The yoke sleeve is mounted on thrust bearings to facilitate easy operation for 14" or over in ASME class 150~300, and 6" or over in ASME class 600.

Gland

The gland is self-aligned and comprises a gland flange in cylindrical shape. A shoulder prevents it from pressing the gland packing and getting pushed into the stuffing box.

Stuffing Box

The stuffing box is designed to extend the life of packing rings. Class 300 and above valves are equipped with a lantern ring between the packing rings.

End Connections

The standard flange ends have a raised face serrated finish type which conforms to ASME B16.5 RF. ASME class 600 valves are supplied with RTJ end flanges on request.

Operation

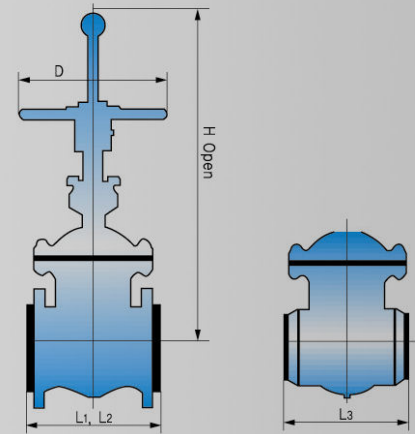
All valves are offered with hand wheel, gear operator, or actuators (electric, hydraulic, or pneumatic) according to customer's requirements.

ASME CLASS 150

DIMENSIONS

Cast steel & Stainless Steel Gate Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem, Non-rising handwheel, Flexible wedge.



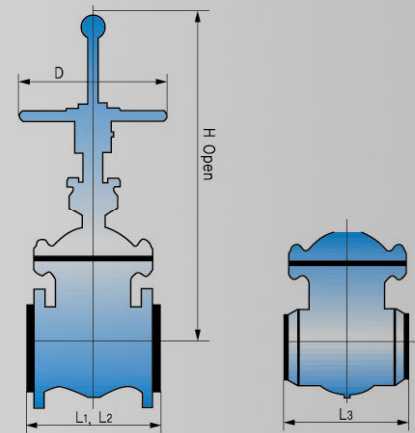
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	178	7	191	7-1/2	216	8-1/2	391	15-2/5	200	7-7/8	333	13-1/9	180	7
65	2-1/2	190	7-1/2	203	8	241	9-1/2	398	15-2/3	200	7-7/8	365	14-3/8	180	7
80	3	203	8	216	8-1/2	282	11-1/8	463	18-2/9	250	9-5/6	410	16-1/7	200	7-7/8
100	4	229	9	241	9-1/2	305	12	566	22-2/7	300	11-4/5	498	19-3/5	250	9-5/6
150	6	267	10-1/2	279	11	403	15-7/8	778	30-5/8	350	13-7/9	683	26-8/9	300	11-4/5
200	8	292	11-1/2	305	12	419	16-1/2	981	38-5/8	400	15-3/4	920	36-2/9	350	13-7/9
250	10	330	13	343	13-1/2	457	18	1182	46-1/2	450	17-5/7	1100	43-1/3	400	15-3/4
300	12	356	14	368	14-1/2	502	19-3/4	1387	54-3/5	500	19-2/3	1194	47	450	17-5/7
350	14	381	15	394	15-1/2	572	22-1/2	1499	59	500	19-2/3	1355	53-1/3	500	19-2/3
400	16	406	16	419	16-1/2	610	24	1692	66-3/5	560	22	1540	60-5/8	560	22
450	18	432	17	445	17-1/2	660	26	1878	74	560	22	1910	75-1/5	560	22
500	20	457	18	470	18-1/2	711	28	2110	83	630	24-4/5	2143	84-3/8	630	24-4/5
600	24	508	20	521	20-1/2	813	32	2485	97-5/6	630	24-4/5	2472	97-1/3	630	24-4/5

ASME CLASS 300

DIMENSIONS

Cast steel & Stainless Steel Gate Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem, Non-rising handwheel, Flexible wedge.



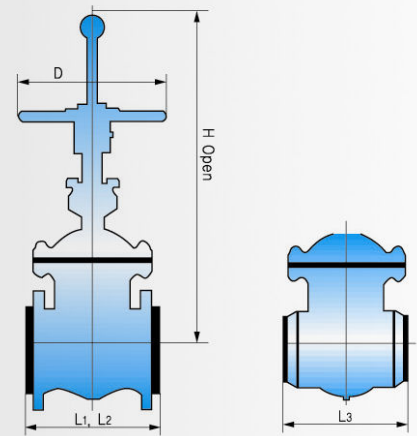
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	216	8-1/2	232	9-1/8	216	8-1/2	391	15-2/5	200	7-7/8	390	15-1/3	200	7-7/8
65	2-1/2	241	9-1/2	257	10-1/8	241	9-1/2	432	17	200	7-7/8	432	17	200	7-7/8
80	3	282	11-1/8	299	11-3/4	282	11-1/8	463	18-2/9	250	9-5/6	491	19-1/3	250	9-5/6
100	4	305	12	321	12-5/8	305	12	567	22-1/3	300	11-4/5	588	23-1/7	300	11-4/5
150	6	403	15-7/8	419	16-1/2	403	15-7/8	800	31-1/2	400	15-3/4	809	31-6/7	400	15-3/4
200	8	419	16-1/2	435	17-1/8	419	16-1/2	1015	40	450	17-5/7	1002	39-4/9	450	17-5/7
250	10	457	18	473	18-5/8	457	18	1191	46-8/9	450	17-5/7	1216	47-7/8	450	17-5/7
300	12	502	19-3/4	518	20-3/8	502	19-3/4	1433	56-3/7	500	19-2/3	1417	55-4/5	500	19-2/3
350	14	762	30	778	30-5/8	762	30	1638	64-1/2	560	22	1636	64-1/2	560	22
400	16	838	33	854	33-5/8	838	33	1758	69-1/5	560	22	1784	70-1/4	560	22
450	18	914	36	930	36-5/8	914	36	1963	77-2/7	630	24-4/5	1972	77-2/3	630	24-4/5
500	20	991	39	1010	39-3/4	991	39	2176	85-2/3	630	24-4/5	2200	86-3/5	630	24-4/5
600	24	1143	45	1165	45-7/8	1143	45	2528	99-1/2	800	31-1/2	2553	100-1/2	630	24-4/5

ASME CLASS 600

DIMENSIONS

Cast steel & Stainless Steel Gate Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem, Non-rising handwheel, Flexible wedge.



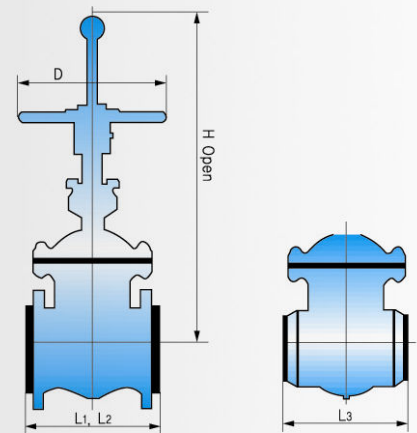
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	292	11-1/2	295	11-5/8	292	11-1/2	440	17-1/3	200	7-7/8	394	15-1/2	200	7-7/8
65	2-1/2	330	13	333	13-1/8	330	13	443	17-4/9	250	9-5/6	427	16-4/5	250	9-5/6
80	3	356	14	359	14-1/8	356	14	490	19-2/7	300	11-4/5	475	18-5/7	300	11-4/5
100	4	432	17	435	17-1/8	432	17	628	24-5/7	350	13-7/9	591	23-1/4	350	13-7/9
150	6	559	22	562	22-1/8	559	22	914	36	500	19-2/3	801	31-1/2	500	19-2/3
200	8	660	26	664	26-1/8	660	26	1072	42-1/5	500	19-2/3	1005	39-4/7	560	22
250	10	787	31	791	31-1/8	787	31	1266	49-5/6	560	22	1192	47	560	22
300	12	838	33	841	33-1/8	838	33	1490	58-2/3	630	24-4/5	1490	58-2/3	630	24-4/5
350	14	889	35	892	35-1/8	889	35	1606	63-2/9	630	24-4/5	1620	63-7/9	630	24-4/5
400	16	991	39	994	39-1/8	991	39	1810	71-1/4	800	31-1/2	1810	71-1/4	750	29-1/2
450	18	1092	43	1095	43-1/8	1092	43	1980	78	800	31-1/2	1980	78	750	29-1/2
500	20	1194	47	1200	47-1/4	1194	47	2120	83-1/2			2230	87-4/5		
600	24	1397	55	1407	55-3/8	1397	55	2710	106-2/3			2710	106-2/3		

ASME CLASS 900 & 1500

DIMENSIONS

Cast steel & Stainless Steel Gate Valve:

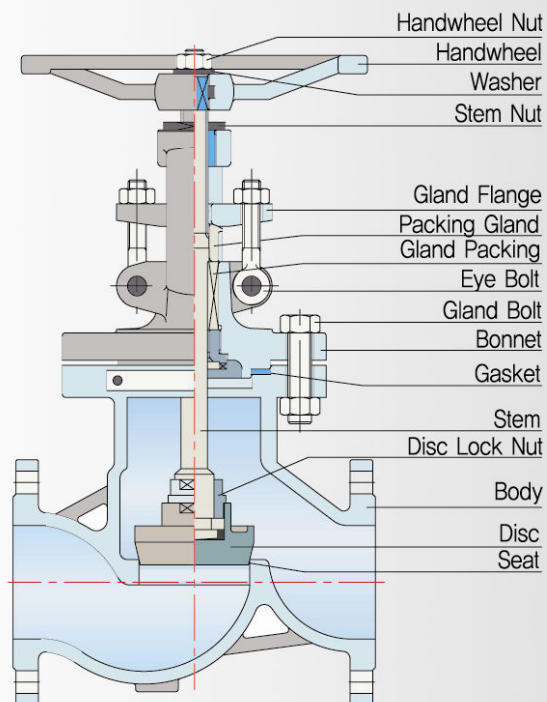
Bolted bonnet, Outside screw-and-yoke, Rising stem, Non-rising handwheel, Flexible wedge.



Size		FACE TO FACE						API 600(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Class 900											
50	2	368	14-1/2	372	14-5/8	368	14-1/2	470	18-1/2	200	7-7/8
80	3	381	15	384	15-1/8	381	15	580	22-5/6	300	11-4/5
100	4	457	18	460	18-1/8	457	18	690	27-1/6	350	13-7/9
150	6	610	24	613	24-1/8	610	24	960	37-4/5	500	19-2/3
200	8	737	29	740	29-1/8	737	29	1300	51-1/6	500	19-2/3
250	10	838	33	841	33-1/8	838	33	1400	55-1/8		
300	12	965	38	968	38-1/8	965	38	1620	63-7/9		
Class 1500											
50	2	368	14-1/2	372	14-5/8	368	14-1/2	561	22	300	11-4/5
80	3	470	18-1/2	473	18-5/8	470	18-1/2	662	26	400	15-3/4
100	4	546	21-1/2	549	21-5/8	546	21-1/2	754	29-2/3	450	17-5/7
150	6	705	27-3/4	711	28	705	27-3/4	1000	39-3/8	500	19-2/3
200	8	832	32-3/4	841	33-1/8	832	32-3/4	1450	57	630	24-4/5
250	10	991	39	1000	39-3/8	991	39				
300	12	1130	44-1/2	1146	45-1/8	1130	44-1/2				

GLOBE VALVES

STANDARD SPECIFICATIONS



Production Range

API 603 / ASME 16.34		API 600 / BS 1414	
Class	Size	Class	Size
150	2" ~ 12"	150	2" ~ 24"
300	2" ~ 12"	300	2" ~ 16"
600	2" ~ 12"	600	2" ~ 12"
		900	2" ~ 12"
		1500	2" ~ 12"

Design Standards

Pressure-Temperature rating	ANSI B16.34
Face to face dimensions	ANSI B16.10
End flange dimensions	ASME B16.5
Testing	API 598 / MSS-SP-41
Bonnet bolt	ASTM A193 / ASTM A320
Bonnet nut	ASTM A194
Marking	MSS-SP-25
Light wall thickness	API 603 / ANSI B16.34
Heavy wall thickness	API 600 / BS 1873

Standard Material Specifications

Part Name	Cast Steel Valves		Stainless Steel Valves		
	WCB	LCB	CF8M	CF8	CF3M
Body	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Disc	A217-CA15	A351-CF8	A351-CF8M	A351-CF8	A351-CF3M
Seat Ring	A105 + CA15	A182-F304	Integral		
Stem	A479-410	A479-304	A479-316	A479-304	A479-316L
Disc Lock Nut	A479-410	A479-304	A479-316	A479-304	A479-316L
Back Seat Ring	A479-410	A479-304	Integral		
Bonnet	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Bonnet Bolt	A193-B7	A320-L7	A193-B8		
Bonnet Nut	A194-2H	A194-4	A194-8		
Packing Gland	A479-410	A479-304	A479-316	A479-304	A479-316L
Hinge Pin	A576-1020		A479-304		
Gland Packing	GRAPHITE				
Gland Flange	A216-WCB		A351-CF8		
Gland Bolt Nut	A307-B	A194-8	A194-8		
Yoke Bush	A439-D2C		A439-D2C		
Handwheel	A197		A197		
Handwheel Nut	A307-8		A194-8		

Note : 1. We can supply any kind of Gasket and gland packing on request.

2. Stellite-faced seat rings are available on request.

GLOBE VALVES

DESIGN FEATURES

Body and Bonnet

The body is cast construction with uniform sections and generous radius fillets to prevent stress on all sides. The body is spherical in shape to prevent minimum turbulence, erosion and resistance to flow. Bonnet flange and yoke are designed to have sufficient strength against stem thrust force. The bolted bonnet is fitted with a back seat ring. The body-bonnet joint is male-female type and circular in shape. Gasket materials can be supplied according to customer's requirement.

Disc

The plug type disc is normally provided. This disc rotates freely on the stem and incorporates a differential angle from that on the seat ring. This design provides the maximum assurance of shut off and is less likely to stick in the body seat. The disc is retained to the stem by a disc lock nut. The guide bar on the upper side of the disc is guided through a bridge cast integral with the seat ring, assuring better arrangement and uniform seating at all times. Long guide hole in seat ring can always make centering of disc.

Seat Ring

The seat ring with a wide taper area provides ample seating. The slot on the seat ring allow easy removal for servicing at site. Three type designs are supplied: integral with body, threaded in body and seal welded on body. They are designed to eliminate resistance to flow. Seating area has proper structure to seal with disc.

Stem

The fine machined and ground finished stem is fitted to the disc by a disc lock nut. Rotating and rising designed stems are normally supplied but a non-rotating type is available as requested by the customer. The accuracy in the dimensions and finishes assure a long life with a perfect tightness in the packing area. All stems have the turning and rising cut ACME threads.

Packing

The packing is designed and arranged to ensure a maximum seal along the stem during operation or while at position, thus allowing for a greater reduction in fugitive emissions.

Gland

The packing gland design is a two-piece self-aligning type. The gland is in contact with the packing which is connected to gland flange through a spherical joint. The gland has a shoulder to restrict the complete entry into the stuffing box. This particular design permits a correct pressure on the packing without any damage to stem due to friction or corrosion.

Stuffing Box

The stuffing box is designed to extend the life of packing rings. Class 300 and above valves are equipped with a lantern ring between the packing rings.

End Connections

The standard flange ends have a raised face serrated finish type which conforms to ASME B16.5 RF. ASME class 600 valves are supplied with RTJ end flanges on request.

Operation

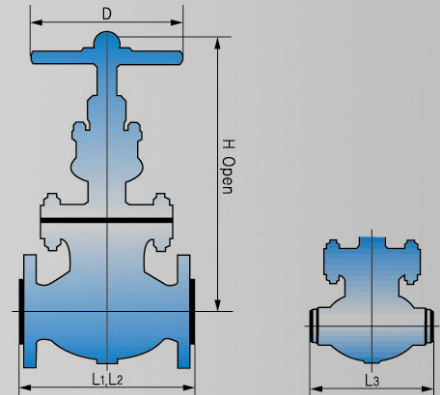
All valves are offered with hand wheel, gear operator, or actuators (electric, hydraulic, or pneumatic) according to customer's requirements.

ASME CLASS 150

DIMENSIONS

Cast steel & Stainless Steel Globe Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem and handwheel, plug disc.



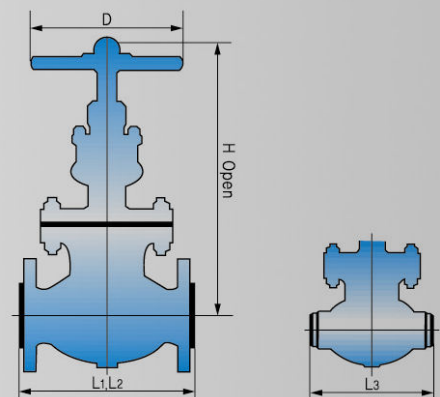
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	203	8	216	8-1/2	203	8	273	10-3/4	200	7-7/8	273	10-3/4	180	7
65	2-1/2	216	8-1/2	229	9	216	8-1/2	314	12-1/3	250	9-5/6	314	12-1/3	180	7
80	3	241	9-1/2	254	10	241	9-1/2	343	13-1/2	250	9-5/6	343	13-1/2	200	7-7/8
100	4	292	11-1/2	305	12	292	11-1/2	368	14-1/2	300	11-4/5	368	14-1/2	250	9-5/6
150	6	406	16	419	16-1/2	406	16	486	19-1/7	450	17-5/7	486	19-1/7	300	11-4/5
200	8	495	19-1/2	508	20	495	19-1/2	565	22-1/4	450	17-5/7	565	22-1/4	450	17-5/7
250	10	622	24-1/2	635	25	622	24-1/2	637	25	450	17-5/7	637	25	450	17-5/7
300	12	698	27-1/2	711	28	698	27-1/2	695	27-1/3	610	24	695	27-1/3	610	24
350	14	787	31	800	31-1/2	787	31	695	27-1/3	610	24	695	27-1/3	610	24
400	16	914	36	927	36-1/2	914	36	1600	63						
450	18	978	38-1/2	991	39	978	38-1/2	1600	63						
500	20	978	38-1/2	991	39	978	38-1/2	1650	65						
600	24	1295	51	1308	51-1/2	1295	51	1650	65						

ASME CLASS 300

DIMENSIONS

Cast steel & Stainless Steel Globe Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem and handwheel, plug disc.



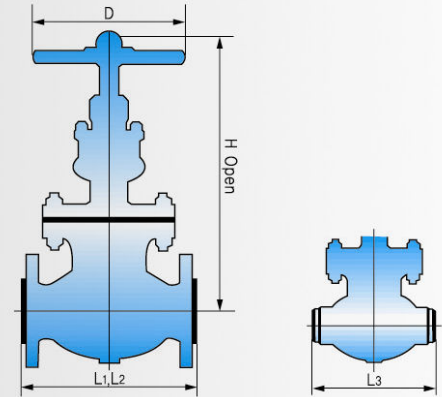
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	267	10-1/2	283	11-1/8	267	10-1/2	329	13	200	7-7/8	329	13	180	7
65	2-1/2	292	11-1/2	308	12-1/8	292	11-1/2	354	14	250	9-5/6	354	14	250	9-5/6
80	3	318	12-1/2	333	13-1/8	318	12-1/2	383	15	250	9-5/6	383	15	250	9-5/6
100	4	356	14	372	14-5/8	356	14	443	17-4/9	300	11-4/5	443	17-4/9	300	11-4/5
150	6	444	17-1/2	460	18-1/9	444	17-1/2	567	22-1/3	450	17-5/7	567	22-1/3	450	17-5/7
200	8	559	22	575	22-2/3	559	22	615	24-1/5	450	17-5/7	615	24-1/5	450	17-5/7
250	10	622	24-1/2	638	25-1/8	622	24-1/2	676	26-3/5	610	24	676	26-3/5	610	24
300	12	711	28	727	28-5/8	711	28	740	29-1/7	610	24	740	29-1/7	610	24
350	14	864	34	778	30-5/8	864	34	1300	51-1/6						
400	16	978	38-1/2	879	34-3/5	978	38-1/2	1500	59						

ASME CLASS 600

DIMENSIONS

Cast steel & Stainless Steel Globe Valve:

Bolted bonnet, Outside screw-and-yoke, Rising stem and handwheel, plug disc.



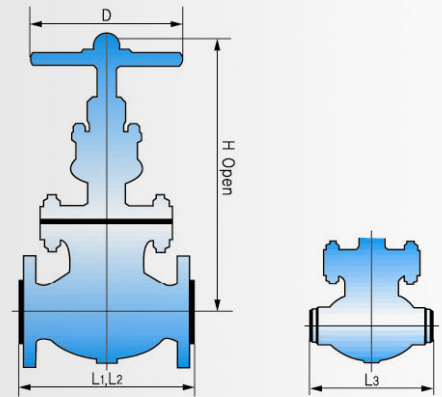
Size		FACE TO FACE						API 600(RF ENDS)				API 603(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	292	11-1/2	295.3	11-5/8	292	11-1/2	394	15-1/2	250	9-5/6	394	15-1/2	180	7
65	2-1/2	330	13	333.4	13-1/8	330	13	450	17-5/7	300	11-4/5	427	16-4/5	200	7-7/8
80	3	356	14	359	14-1/8	356	14	520	20-1/2	350	13-7/9	475	18-5/7	300	11-4/5
100	4	432	17	435	17-1/8	432	17	609	24	350	13-7/9	591	23-1/4	450	17-5/7
150	6	559	22	562	22-1/8	559	22	750	29-1/2	450	17-5/7	801	31-1/2	560	22
200	8	660	26	664	26-1/8	660	26	815	32	610	24	1005	39-4/7	610	24
250	10	787	31	791	31-1/8	787	31	885	34-5/6	610	24	1192	47	610	24
300	12	838	33	841	33-1/8	838	33	955	37-3/5			1490	58-2/3		

ASME CLASS 900 & 1500

DIMENSIONS

Cast steel & Stainless Steel Globe Valve:

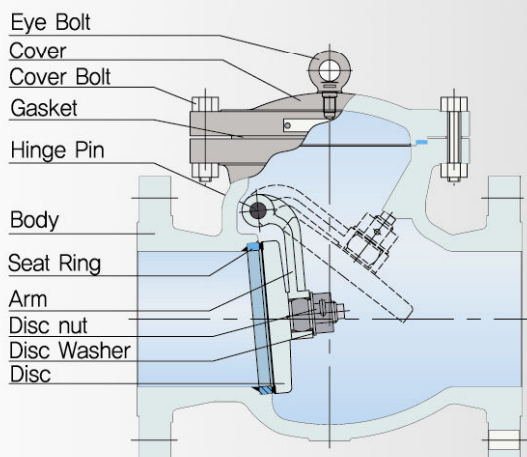
Bolted bonnet, Outside screw-and-yoke, Rising stem and handwheel, plug disc.



Size		FACE TO FACE						API 600(RF ENDS)			
		L1:RF		L2:RTJ		L3:BW		H		D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Class 900											
50	2	368	14-1/2	372	14-5/8	368	14-1/2	450	17-5/7	350	13-7/9
80	3	381	15	384	15-1/8	381	15	535	21	450	17-5/7
100	4	457	18	460	18-1/8	457	18	623	24-1/2	450	17-5/7
150	6	610	24	613	24-1/8	610	24	785	31	610	24
200	8	737	29	740	29-1/8	737	29	860	33-6/7	610	24
250	10	838	33	841	33-1/8	838	33	1350	53-1/7		
300	12	965	38	968	38-1/8	965	38	1500	59		
Class 1500											
50	2	368	14-1/2	372	14-5/8	368	14-1/2	500	19-2/3	350	13-7/9
80	3	470	18-1/2	473	18-5/8	470	18-1/2	550	21-2/3	450	17-5/7
100	4	546	21-1/2	549	21-5/8	546	21-1/2	615	24-1/5	450	17-5/7
150	6	705	27-3/4	711	28	705	27-3/4	790	31-1/9		
200	8	832	32-3/4	841	33-1/8	832	32-3/4	1150	45-2/7		
250	10	900	39	1000	39-3/8	900	39				
300	12	1130	44-1/2	1146	45-1/8	1130	44-1/2				

SWING CHECK VALVES

STANDARD SPECIFICATION



Production Range

API 603 / ASME 16.34		API 600 / BS 1414	
Class	Size	Class	Size
150	2" ~ 24"	150	2" ~ 24"
300	2" ~ 24"	300	2" ~ 24"
600	2" ~ 24"	600	2" ~ 24"
		900	2" ~ 16"
		1500	2" ~ 12"

Design Standards

Pressure-Temperature rating	ANSI B16.34
Face to face dimensions	ANSI B16.10
End flange dimensions	ASME B16.5
Testing	API 598 / MSS-SP-41
Bonnet bolt	ASTM A193
Bonnet nut	ASTM A194
Marking	MSS-SP-25
Light wall thickness	API 603 / ANSI B16.34
Heavy wall thickness	API 600 / BS 1868

Standard Material Specifications

Part Name	Cast Steel Valves		Stainless Steel Valves		
	WCB	LCB	CF8M	CF8	CF3M
Body	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Seat Ring	A105 + CA15	A182-F304	Integral		
Disc	A217-CA15	A351-CF8	A351-CF8M	A351-CF8	A351-CF3M
Disc Nut	A194-8		A194-8M	A194-8	A479-316L
Arm	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Cover	A216-WCB	A352-LCB	A351-CF8M	A351-CF8	A351-CF3M
Cover Bolt	A193-B7	A320-L7	A193-B8		
Cover Nut	A194-2H	A194-4	A194-8		
Hinge Pin	A479-410	A479-304	A479-316	A479-304	A479-316L
Plug Bolt	A307-B	A194-8	A193-B8M	A193-B8	A479-316L
Plug Gasket	Soft Steel	304SS	304SS		
Eye Bolt	A307-B		A193-B8		

Note : 1. We can supply any kind of Gasket and packing on request.

2. Stellite-faced seat rings are available on request.

SWING CHECK VALVES

DESIGN FEATURES

Body and Cover

The body is cast with uniform sections and generous radius fillets to prevent stress on all sides. The body is spherical in shape to prevent minimum turbulence, erosion and resistance to flow. The body-cover joint is male-female in ASME class 150-600 and ring type joint in class 900 and over. The cover material is identical to the body. The check valves are designed to give resistance against water hammer caused by a sudden reverse flow. Gasket materials can be supplied according to customer's requirement.

Disc

The disc is constructed to have one piece to endure severe service conditions. It has a sufficient seating surface area which is ground and lapped to a mirror finish. The disc is of one-piece construction and is heat treated to deliver the required mechanical properties and hardness. It is securely fastened to the hinge by means of a lock nut with a cotter pin.

Seat Ring

The seat rings are designed to prevent any turbulence and damage by corrosion. They are forged or rolled in one piece and then seal welded and overlaid, if required. The forged seat ring is heat-treated to deliver the best mechanical properties and required hardness.

Arm

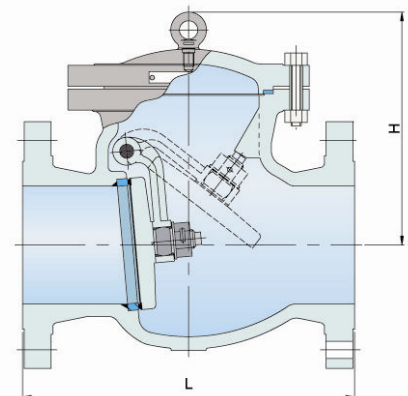
The disc stability is maintained while the disc is lifted by a hydrodynamic force at a flow including pulsating. The arm is designed to minimize water hammer because the disc goes to seat immediately upon cessation of flow due to heavy balanced weight.

Hinge

The hinge is designed to eliminate body penetration and allow ease of maintenance because all parts are accessible from the top. Body penetration is sealed with blind flange and spiral-wound gasket. The hinge pin is located near the disc center of gravity resulting in minimizing sealing surface radius rotation and velocity.

End Connections

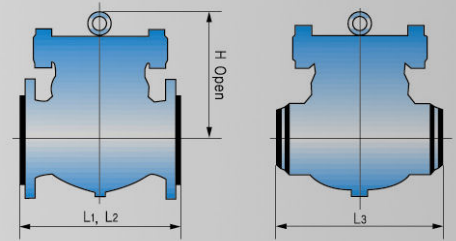
The standard flange ends have a raised face serrated finish type which conforms to ASME B16.5 RF. ASME class 600 valves are supplied with RTJ end flanges on request.



ASME CLASS 150

DIMENSIONS

Cast Steel & Stainless Steel Swing Check Valve:
Bolted cover, Swing type disc.

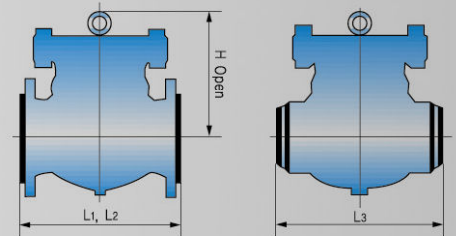


Size		FACE TO FACE						API 600(RF ENDS)		API 603(RF ENDS)	
		L1:RF		L2:RTJ		L3:BW		H		H	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	203	8	216	8-1/2	203	8	153	6	138	5-3/7
65	2-1/2	216	8-1/2	229	9	216	8-1/2	155	6-1/9	155	6-1/9
80	3	241	9-1/2	254	10	241	9-1/2	175	6-8/9	160	6-2/7
100	4	292	11-1/2	305	12	292	11-1/2	202	8	201	8
150	6	356	16	368	14-1/2	406	16	291	11-1/2	248	9-3/4
200	8	495	19-1/2	508	20	495	19-1/2	327	12-7/8	293	11-1/2
250	10	622	24-1/2	635	25	622	24-1/2	360	14-1/6	300	13
300	12	699	27-1/2	711	28	698	27-1/2	417	16-3/7	354	14
350	14	787	31	800	31-1/2	787	31	478	18-5/6	387	15-1/4
400	16	864	36	876	34-1/2	914	36	516	20-1/3	421	16-4/7
450	18	978	38-1/2	991	39	978	38-1/2	554	21-4/5	461	16-1/7
500	20	978	38-1/2	991	39	978	38-1/2	620	24-2/5	526	20-5/7
600	24	1295	51	1308	51-1/2	1295	51	670	26-3/8	568	22-1/3

ASME CLASS 300

DIMENSIONS

Cast Steel & Stainless Steel Swing Check Valve:
Bolted cover, Swing type disc.

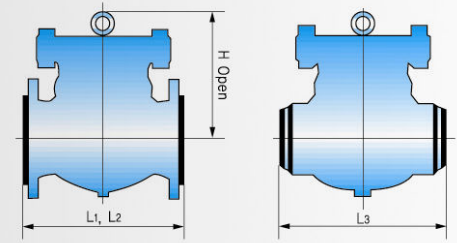


Size		FACE TO FACE						API 600(RF ENDS)		API 603(RF ENDS)	
		L1:RF		L2:RTJ		L3:BW		H		H	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	267	10-1/2	283	11-1/8	267	10-1/2	165	6-1/2	152	6
65	2-1/2	292	11-1/2	308	12-1/8	292	11-1/2	190	7-1/2	164	6-1/2
80	3	318	12-1/2	333	13-1/8	318	12-1/2	186	7-1/3	176	7
100	4	356	14	372	14-5/8	356	14	219	8-5/8	1856	73
150	6	444	17-1/2	460	18-1/8	444	17-1/2	262	10-1/3	262	10-1/3
200	8	533	21	549	21-5/8	533	21	334	13-1/7	312	12-2/7
250	10	622	24-1/2	638	25-1/8	622	24-1/2	398	15-2/3	355	14
300	12	711	28	727	28-5/8	711	28	475	18-5/7	393	15-1/2
350	14	838	33	854	33-5/8	838	33	540	21-1/4	440	17-1/3
400	16	864	34	880	34-5/8	864	34	605	23-5/6	480	18-8/9
450	18	978	38-1/2	994	39-1/8	978	38-1/2	650	25-3/5	535	21
500	20	1016	40	1035	40-3/4	1016	40	715	28-1/7	575	22-2/3
600	24	1346	53	1368	53-7/8	1346	53	964	38	630	24-4/5

ASME CLASS 600

DIMENSIONS

Cast Steel & Stainless Steel Swing Check Valve:
Bolted cover, Swing type disc,

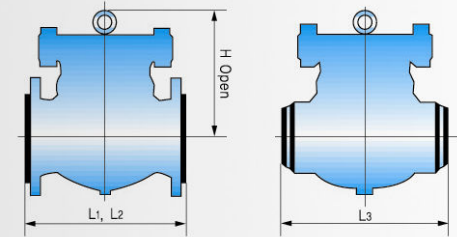


Size		FACE TO FACE						API 600(RF ENDS)		API 603(RF ENDS)	
		L1:RF		L2:RTJ		L3:BW		H		H	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	292	11-1/2	295	11-5/8	292	11-1/2	187	7-1/3	187	7-1/3
65	2-1/2	330	13	333	13-1/8	330	13	200	7-7/8	200	7-7/8
80	3	356	14	359	14-1/8	356	14	210	8-1/4	210	8-1/4
100	4	432	17	435	17-1/8	432	17	256	10	256	10
150	6	559	22	562	22-1/8	559	22	329	13	329	13
200	8	660	26	664	26-1/8	660	26	364	14-1/3	364	14-1/3
250	10	787	31	791	31-1/8	787	31	464	18-1/4	464	18-1/4
300	12	838	33	841	33-1/8	838	33	486	19-1/7	486	19-1/7
350	14	889	35	892	35-1/8	889	35	515	20-2/7	515	20-2/7
400	16	991	39	994	39-1/8	991	39	550	21-2/3	550	21-2/3
450	18	1092	43	1095	43-1/8	1092	43	590	23-2/9	590	23-2/9
500	20	1194	47	1200	47-1/4	1194	47	635	25	635	25
600	24	1397	55	1407	55-3/8	1397	55	680	26-7/9	680	26-7/9

ASME CLASS 900 & 1500

DIMENSIONS

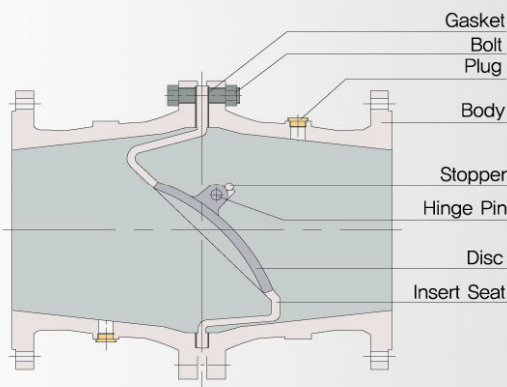
Cast Steel & Stainless Steel Swing Check Valve:
Bolted cover, Swing type disc,



Size		FACE TO FACE						API 600(RF ENDS)	
		L1:RF		L2:RTJ		L3:BW		H	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Class 900									
50	2	368	14-1/2	372	14-5/8	368	14-1/2	270	10-5/8
80	3	381	15	384	15-1/8	381	15	295	11-3/5
100	4	457	18	460	18-1/8	457	18	310	12-1/5
150	6	610	24	613	24-1/8	610	24	340	13-2/5
200	8	737	29	740	29-1/8	737	29	465	18-1/3
250	10	838	33	841	33-1/8	838	33	510	20
300	12	965	38	968	38-1/8	965	38	580	22-5/6
350	14	1029	40-1/2	1038	40-7/8	1029	40-1/2	665	26-1/6
400	16	1130	44-1/2	1140	44-7/8	1130	44-1/2	750	29-1/2
Class 1500									
50	2	368	14-1/2	372	14-5/8	368	14-1/2	290	11-3/7
80	3	470	18-1/2	473	18-5/8	470	18-1/2	315	12-2/5
100	4	545	21-1/2	549	21-5/8	545	21-1/2	380	15
150	6	706	27-3/4	711	28	706	27-3/4	490	19-2/7
200	8	832	32-3/4	841	33-1/8	832	32-3/4	600	23-5/8
250	10	900	39	1000	39-3/8	900	39	730	28-3/4
300	12	1130	44-1/2	1146	45-1/8	1130	44-1/2	850	33-1/2

TILTING DISC CHECK VALVES

STANDARD SPECIFICATIONS



Production Range

Class	Size
150	2 ~ 24"

Design Standards

Pressure-Temperature rating	ANSI B16.34
Face to face dimensions	Maker Standards
End flange dimensions	ANSI B16.5
Body wall thickness	ANSI B16.34

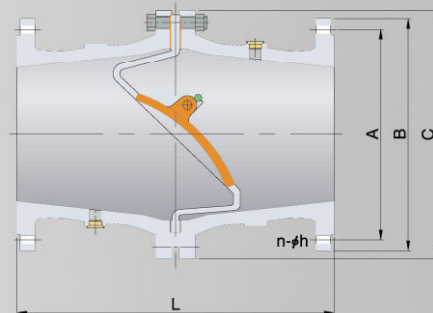
Standard Material Specifications

Part Name	Material
Body	A351-CF8M (CG8M)
Insert Seat	A351-CF8M (CG8M)
Disc	A351-CF8M (CG8M)
Stopper	A240-316 (317)
Hinge Pin	A240-316 (317)
Gasket	PTFE
Body Bolt	A193-B8
Body Nut	A194-8
Plug	A276-316 (317)
Name Plate	A240-304

ASME CLASS 150

DIMENSIONS

Stainless Steel Tilting Disc Check Valve:
Bolted body, Tilting disc and seat



Size		L		A		B		C		n	h	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch		mm	inch
50	2	203	7.99	51	2.01	152	6.00	178	7.00	4	19.1	0.75
80	3	241	9.49	76	2.99	191	7.50	190	7.48	4	19.1	0.75
100	4	292	11.50	102	4.02	229	9.00	229	9.02	8	19.1	0.75
150	6	356	14.02	152	5.98	279	11.00	279	10.98	8	22.4	0.88
200	8	458	18.03	203	7.99	343	13.50	343	13.50	8	22.4	0.88
250	10	552	21.73	254	10.00	406	16.00	406	15.98	12	25.4	1.00
300	12	648	25.51	305	12.01	483	19.00	483	19.02	12	25.4	1.00
350	14	711	27.99	337	13.27	533	21.00	533	20.98	12	28.4	1.12
400	16	762	30.00	387	15.24	597	23.50	597	23.50	16	18.4	1.12
450	18	787	30.98	438	17.24	635	25.00	635	25.00	16	31.8	1.25
500	20	825	32.48	489	19.25	698	27.50	698	27.48	20	31.8	1.25
600	24	864	34.02	591	23.27	813	32.00	813	32.00	20	31.8	1.38

TILTING DISC CHECK VALVES

DESIGN FEATURES

Stainless Steel Tilting Disc Check Valve

Tilting disc check valves are designed with a hinge point moved to the downstream side of the disc in order to increase the sensitivity to pressure and flow and aid the operation at low pressure differentials.

Tilting disc check valves are designed to be stable at low and pulsing flows. Even though tilting disc check valves generally have similar minimum required velocities to that of swing check valves, they can provide stable operation over a wider range of flows due to the hinge point being closer to the center of the disc.

Due to the short disc travel distance to the valve seat, the response of the valves to pressure and flow is fast, reducing the development of reverse flow and therefore minimizing a slam without damage of the body, disc or seat.

Tilting disc check valves have two piece body design that should be removed from the piping system to perform maintenance. They can be installed to prevent reversal of flow in horizontal or vertical pipe lines. In vertical lines, they can be used fluid flow is upward.

To avoid premature wear and noisy operation of the moving part, the proper size of the valve should be considered on the basis of flow conditions.

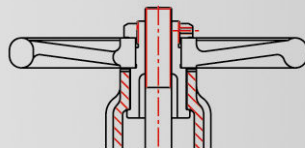


VALVE COMPARISON CHARTS

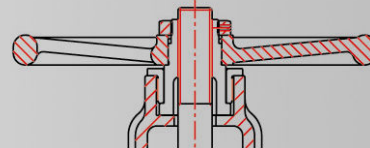
DESIGN FEATURES

Gate Valve Yoke Sleeve

Type A	4" and smaller
Type B	6" and larger



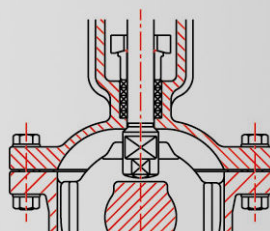
Type A



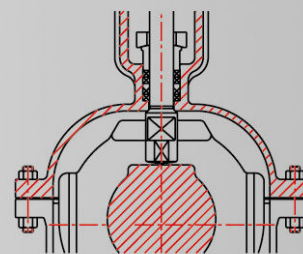
Type B

Gate Valve Bonnet Bolt (Type A)

Class	Size
150	4" and smaller
300	2-1/2" and smaller
600	2-1/2" and smaller



Type A



Type B

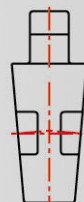
Gate Valve Bonnet Bolt (Type B)

Class	Size
150	6" and larger
300	3" and larger
600	3" and larger

Note: these charts are based on stainless steel valves.

Gate Valve Wedge

Solid Wedge	1-1/2" and smaller
Flexible Wedge	2" and larger



Solid wedge



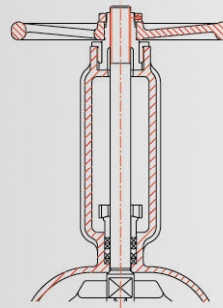
Flexible wedge

VALVE COMPARISON CHARTS

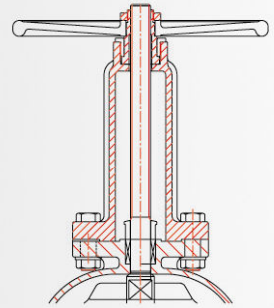
DESIGN FEATURES

Gate Valve Yoke

Integral Yoke	8" and smaller
Separated Yoke	10" and larger



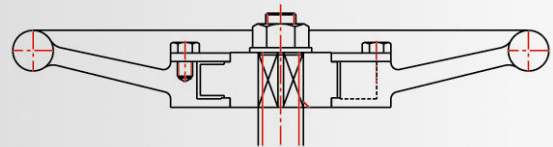
Integral Yoke



Separated Yoke

Gate Valve Handwheel

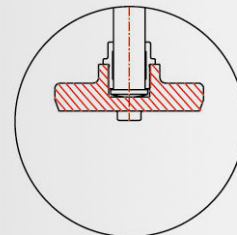
Class	Size
150	10" and larger
300	8" and larger
600	6" and larger
900	4" and larger
1500	3" and larger



Hammer Blow Type

Gate Valve Plug Disc (Normal Type)

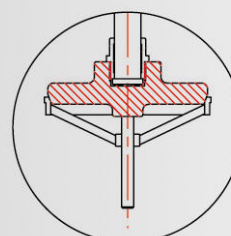
Class	Size
150	8" and smaller
300	8" and smaller
600	6" and smaller



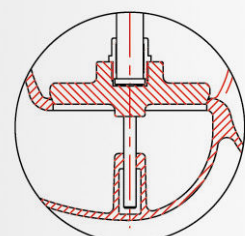
Normal Type

Gate Valve Plug Disc (Guided Type)

Class	Size
150	10" and larger
300	10" and larger
600	8" and larger
900	8" and larger
1500	6" and larger



Cast steel valves



Stainless steel valves

Bottom Guided Type

ENGINEERING DATA

PRESSURE - TEMPERATURE RATINGS

Maximum Allowable Non-Shock Pressure in psig : A351-CF8M, A351-CF3M

Service Temperature(°F)	Class				
	150	300	600	900	1500
-20 to 100	275	720	1440	2160	3600
200	240	620	1240	1660	3095
300	215	560	1120	1680	2795
400	195	515	1030	1540	2570
500	170	480	955	1435	2390
600	140	450	905	1355	2255
650	125	445	890	1330	2220
700	110	430	865	1295	2160
750	95	425	845	1270	2110
800	80	415	830	1245	2075
850	65	405	810	1215	2030
900	50	395	790	1180	1970
950	30	385	775	1160	1930
1000	20	365	725	1090	1820
1050	20	360	720	1080	1800
1100	20	325	645	965	1610
1150	20	275	550	825	1370
1200	20	205	410	620	1030
1250	20	180	365	545	910
1300	20	140	275	410	685
1350	20	105	205	310	515
1400	20	75	150	225	380
1450	20	60	115	175	290
1500	10	40	85	125	205
Hydrostatic Test Procedure					
SHELL	425	1100	2175	3250	5400
SEAT	305	795	1585	2380	3960

Maximum Allowable Non-Shock Pressure in psig : A216-WCB

Service Temperature(°F)	Class				
	150	300	600	900	1500
-20 to 100	285	740	1480	2220	3705
200	260	675	1350	2025	3375
300	230	655	1315	1970	3280
400	200	635	1270	1900	3170
500	170	600	1200	1795	2995
600	140	550	1095	1640	2735
650	125	535	1075	1610	2685
700	110	535	1065	1600	2665
750	95	505	1010	1510	2520
800	80	410	825	1235	2060
850	65	270	535	805	1340
900	50	170	345	515	860
950	35	105	205	310	515
1000	20	50	105	155	260
Hydrostatic Test Procedure					
SHELL	450	1125	2225	3350	5575
SEAT	314	814	1628	2445	4080

Note : For welding end valves only, Flanged end ratings terminate at 1000 °F

ENGINEERING DATA

PRESSURE - TEMPERATURE RATINGS

Maximum Allowable Non-Shock Pressure in psig : A351-CF8

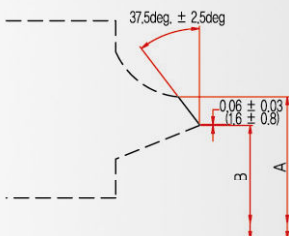
Service Temperature(°F)	Class				
	150	300	600	900	1500
-20 to 100	275	720	1440	2160	3600
200	235	600	1200	1800	3000
300	205	530	1055	1585	2640
400	180	470	940	1410	2350
500	170	435	875	1310	2185
600	140	415	830	1245	2075
650	125	410	815	1225	2040
700	110	405	805	1210	2015
750	95	400	795	1195	1990
800	80	395	790	1180	1970
850	65	390	780	1165	1945
900	50	385	770	1150	1920
950	35	375	750	1125	1870
1000	20	325	645	965	1610
1050	20	310	620	925	1545
1100	20	260	515	770	1285
1150	20	195	390	585	980
1200	20	155	310	465	770
1250	20	110	220	330	550
1300	20	85	165	245	410
1350	20	60	125	185	310
1400	20	50	95	145	240
1450	15	35	70	105	170
1500	10	25	50	70	120
Hydrostatic Test Procedure					
SHELL	425	1100	2175	3250	5400
SEAT	305	795	1585	2380	3960

Maximum Allowable Non-Shock Pressure in psig : A352-LCB

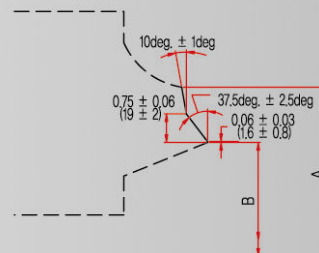
Service Temperature(°F)	Class				
	150	300	600	900	1500
-20 to 100	265	695	1390	2085	3470
200	260	655	1315	1970	3280
300	230	640	1275	1915	3190
400	200	620	1235	1850	3085
500	175	585	1165	1745	2910
600	140	535	1065	1600	2665
650	125	525	1045	1570	2615
700	110	520	1035	1555	2590
750	95	475	945	1420	2365
800	80	390	780	1175	1955
850	65	270	535	805	1340
900	50	170	345	515	860
950	35	105	205	310	515
1000	20	50	105	155	260
Hydrostatic Test Procedure					
SHELL	400	1050	2100	3150	5225
SEAT	292	765	1529	2300	3825

ENGINEERING DATA

BUTTWELDING END DETAILS - ASME B 16.25



Connection pipe wall thickness 7/8" and smaller size



Connection pipe wall thickness larger than 7/8" size

		Pipe Schedule No.	Nominal Pipe Size									
			2-1/2	3	4	5	6	8	10	12	14	16
A	in	All	2.96	3.59	4.62	5.69	6.78	8.78	10.94	12.97	14.25	16.25
	mm		75.18	91.19	117.35	144.53	172.21	223.01	277.88	329.44	361.95	412.75
B	in	STD								12.000	13.250	15.250
	mm									304.80	336.55	387.35
	in	40	2.469	3.068	4.026	5.047	6.065	7.981	10.020	11.938	13.124	15.000
	mm		62.71	77.93	102.26	128.19	154.05	202.72	254.51	303.23	333.35	381.00
	in	XS								11.750	13.000	
	mm									298.45	330.20	
	in	60						7.813	9.750	11.626	12.812	14.688
	mm							198.45	247.65	295.30	325.42	373.08
	in	80	2.323	2.900	3.826	4.813	5.761	7.625	9.562	11.374	12.500	14.312
	mm		59.00	73.66	97.18	122.25	146.33	193.68	242.87	288.90	317.50	363.52
	in	100						7.437	9.312	11.062	12.124	13.938
	mm							188.90	236.52	280.97	307.95	354.03
	in	120			3.624	4.563	5.501	7.187	9.062	10.750	11.812	13.562
	mm				92.05	115.90	139.73	182.55	230.17	273.05	300.02	344.47
	in	140						7.001	8.750	10.500	11.500	13.124
	mm							177.83	222.25	266.70	292.10	333.35
	in	160	2.125	2.624	3.438	4.313	5.187	6.875	8.500	10.126	11.188	12.812
	mm		53.98	66.65	87.33	109.55	131.75	174.63	215.90	257.20	284.18	325.42
	in	XXS	1.771	2.300	3.152	4.063	4.897	6.813				
	mm		44.98	58.42	80.06	103.20	124.38	173.05				

		Pipe Schedule No.	Nominal Pipe Size									
			18	20	22	24	26	28	30	32	34	36
A	in	All	18.28	20.31	22.34	24.38	26.38	28.38	30.38	32.50	34.50	36.50
	mm		464.31	515.87	567.44	619.25	670.05	720.85	771.65	825.50	876.30	927.10
B	in	10					25.376	27.376	29.376	31.376	33.376	35.376
	mm						644.55	695.35	746.15	796.95	847.75	898.55
	in	20					25.000	27.000	29.000	31.000	33.000	35.000
	mm						635.00	685.80	736.60	787.40	838.20	889.00
	in	STD	17.250	19.250	21.250	23.250						
	mm		438.15	488.95	539.75	590.55						
	in	XS	17.000	19.000	21.000	23.000						
	mm		431.80	482.60	533.40	584.20						
	in	30				22.876						
	mm					581.05						
	in	40	16.876	18.812		22.624						
	mm		428.65	477.82		574.65						
	in	60	16.500	18.376	20.250	22.062	26.750	28.750	30.750	32.750	34.750	
	mm		419.10	466.75	514.35	560.37	679.45	730.25	781.05	831.85	882.65	
	in	80	16.124	17.938	19.750	21.562			30.624	32.624	34.500	
	mm		409.55	455.63	501.65	547.67			777.85	828.65	876.30	
	in	100	15.688	17.438	19.250	20.938						
	mm		398.48	442.93	488.95	531.83						
	in	120	15.250	17.000	18.750	20.376						
	mm		387.35	431.80	476.25	517.55						
	in	140	14.876	16.500	18.250	19.876						
	mm		377.85	419.10	463.55	504.85						
	in	160	14.438	16.062	17.750	19.312						
	mm		366.73	407.97	450.85	490.52						

Note : A = Outside diameter of matching pipe, wrought or fabricated component

B = Nominal inside diameter

VALVE FIGURE NUMBER - PART SELECTION CODES

GT	-	03	L	-	10	RF	-	5	A	-	H
1	-	2	3	-	4	5	-	6	7	-	8

1 - Valve Type

Gate Valve	GT
Globe Valve	GL
Swing Check Valve	SC
Tilting Disc Check Valve	TC

2 - Pressure Class

ASME 150	01
300	03
600	06
900	09
1500	15
2500	25

3 - Wall Thickness

Heavy Wall (API 600)	H
Light Wall (API 603, ANSI B16.34)	L

4 - Size

2"	02
2-1/2"	2b
3"	03

4"	04
6"	06
8"	08
10"	10
12"	12
14"	14
16"	16
18"	18
20"	20
24"	24
30"	30
36"	36

5 - End Connection

Raised Face	RF
Flat Face	FF
Ring Type Joint	RJ
Butt Weld Ends	BW

6 - Body / Bonnet Material

A216-WCB	1
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A352-LCC	2
A352-LCB	3
A351-CF8	4
A351-CF8M	5
A351-CF3	6
A351-CF3M	7
Other	0

7 - Trim

(Wedge or Disc Surface / Seat Surface / Stem)

Stellite / Stellite / 316	A
CF8M or 316 / Stellite / 316	B
Stellite / Stellite / 13Cr(410)	C
13Cr(410 or CA15) / Stellite / 316Cr(410)	D
Other	X

8 - Actuation

Bare Stem	B
Gear Operator	G
Handwheel	H
Power Actuator	P

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