

Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries

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Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries

1 Scope

This standard specifies the requirements for a series of compact gate, globe, and check valves for petroleum and natural gas industry applications.

It covers valves of the nominal pipe sizes DN:

— 8, 10, 15, 20, 25, 32, 40, 50, 65, 80, and 100;

corresponding to nominal pipe sizes NPS:

— $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, and 4;

and applies to pressure class designations:

— 150, 300, 600, 800, and 1500.

Class 800 is not a listed class designation, but is an intermediate class number widely used for welded and threaded end compact valves.

It includes provisions for the following valve characteristics:

- outside screw with rising stems (OS and Y), in sizes $8 \leq DN \leq 100$ ($\frac{1}{4} \leq NPS \leq 4$) and pressure designations including class 800;
- inside screw with rising stems (ISRS), in sizes $8 \leq DN \leq 65$ ($\frac{1}{4} \leq NPS \leq 2\frac{1}{2}$) and pressure designations of classes ≤ 800 ;
- socket welding or threaded ends, in sizes $8 \leq DN \leq 65$ ($\frac{1}{4} \leq NPS \leq 2\frac{1}{2}$) and pressure designations of class 800 and class 1500;
- flanged or butt-welding ends, in sizes $15 \leq DN \leq 100$ ($\frac{1}{2} \leq NPS \leq 4$) and pressure designations of class 150 through class 1500, excluding flanged end class 800;
- bonnet joint construction—bolted, welded, and threaded with seal weld for classes ≤ 1500 and union nut for classes ≤ 800 ;
- extended body, in sizes $15 \leq DN \leq 50$ ($\frac{1}{2} \leq NPS \leq 2$) and pressure designations of class 800 and class 1500;
- bellows stem seal, in sizes $8 \leq DN \leq 50$ ($\frac{1}{4} \leq NPS \leq 2$) and pressure designations of $\leq$ class 1500;
- bellows stem seal testing requirements;
- standard and full-bore body seat openings;

- materials, as specified;
- testing and inspection.

This standard is applicable to valve end flanges in accordance with ASME B16.5, valve body ends having tapered pipe threads to ASME B1.20.1, valve body ends having socket weld ends to ASME B16.11, and butt-weld connections per the requirements described within this standard.

This edition of API 602 states values in both metric and U.S. Customary units of measure. These systems of units are to be regarded separately. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems constitutes nonconformance with this standard.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Standard 598, Valve Inspection and Testing

API Standard 624, Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions

ASME B1.1,¹ *Unified Inch Screw Threads (UN and UNR Thread Form)*

ASME B1.5, *Acme Screw Threads*

ASME B1.8, *Stub Acme Screw Threads*

ASME B1.13M, *Metric Screw Threads: M Profile*

ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard*

ASME B16.10, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.11, *Forged Fittings, Socket-welding and Threaded*

ASME B16.25, *Buttwelding Ends*

ASME B16.34, *Valves-Flanged, Threaded and Welding End*

ASME B31.3, *Process Piping*

ASME B36.10, *Welded and Seamless Wrought Steel Pipe*

ASME B36.19, *Stainless Steel Pipe*

¹ ASME International, 2 Park Avenue, New York, New York 10016-5990, www.asme.org.

ASME Boiler and Pressure Vessel Code (BPVC), Section IX: Welding and Brazing Qualifications

ASTM A217,² *Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service*

ASTM A307, *Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength*

ISO 5752,³ *Metal valves for use in flanged pipe systems—Face-to-face and centre-to-face dimensions*

ISO 15649, *Petroleum and natural gas industries—Piping*

MSS SP-117,⁴ *Bellows Seals for Globe and Gate Valves*

NACE MR 0103,⁵ *Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments*

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1

class

An alphanumeric designation that is used for reference purposes relating to valve pressure/temperature capability, taking into account valve material mechanical properties and valve dimensional characteristics. It comprises the word “Class” followed by a dimensionless whole number. The number following “Class” do not represent a measurable value and are not used for calculation purposes, except where specified in this standard. The allowable pressure for a valve having a class number depends on the valve material and its application temperature, and is to be found in tables of pressure/temperature ratings.

3.2

diameter nominal

DN

An alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters “DN” followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connection as appropriate. The dimensionless number following “DN” does not represent a measurable value and is not used for calculation purposes, except where specified in this standard.

3.3

nominal pipe size

NPS

An alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters “NPS” followed by a dimensionless number indirectly related to

² ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

³ International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.

⁴ Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park Street, NE, Vienna, Virginia 22180- 4602, www.mss-hq.com.

⁵ NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77084-4906, www.nace.org.

the physical size of the bore or outside diameter of the end connection as appropriate. The dimensionless number may be used as a valve size identifier without the prefix “NPS.” The dimensionless size identification number does not represent a measurable value and is not used for calculation purposes.

4 Pressure/Temperature Ratings

4.1 Valve Ratings

4.1.1 Applicability

The pressure/temperature ratings applicable to valves specified in this standard shall be in accordance with those specified in the tables of ASME B16.34 for standard class for the applicable material specification and class designation.

4.1.2 Applicable Valve Materials

Not all materials contained in ASME B16.34 are applicable to this standard. The acceptable forging and casting construction materials for ASME B16.34 Material Group 1, Material Group 2, and Material Group 3 are listed in Table 1a, Table 1b, and Table 1c, respectively. The Table 1a, Table 1b, and Table 1c notes apply to the applicable valve material where noted.

4.1.3 Interpolated Ratings

The pressure/temperature ratings for Intermediate class 800 valves shall be as shown in Table 2a, Table 2b, Table 2c, Table 2d, Table 2e, and Table 2f. The pressure/temperature ratings in Table 2a, Table 2b, Table 2c, Table 2d, Table 2e, and Table 2f are a linear interpolation of Standard class 600 and Standard class 900 pressure/temperature ratings listed in ASME B16.34 for the appropriate valve material.

Table 1a—ASME B16.34 Material Group 1, Forging and Casting Descriptions

Group	Forgings/Forged Bar	Castings
1.1	A105 ^{a,b} , A350 LF2 ^a , A350 LF3 ^d , A350 LF6 Cl. 1 ^c	A216 WCB ^a
1.2	A350 LF6 Cl. 2 ^c	A352 LC2 ^d , A352 LC3 ^d , A216 WCC ^a , A352 LCC ^d
1.3	N/A	A352 LCB ^d , A217 WC1 ^{e,f,s} , A352 LC1 ^d
1.4	A350 LF1 ^a	N/A
1.5	A182 F1 ^e	N/A
1.7	A182 F2 ^g	A217 WC4 ^{f,g,s} , A217 WC5 ^f
1.9	A182 F11 Cl. 2 ^{f,i}	A217 WC6 ^{f,h,s}
1.10	A182 F22 Cl. 3 ⁱ	A217 WC9 ^{f,h,s}
1.11	A182 F21 ⁱ	N/A
1.13	A182 F5 ^a	A217 C5 ^{f,s}
1.14	A182 F9	A217 C12 ^{f,s}
1.15	A182 F91	A217 C12A ^s
1.17	A182 F12 Cl. 2 ^{f,i} , A182 F5	N/A
1.18	A182 F92 ^r	N/A
NOTE General notes and footnotes for this table follow Table 1c.		

Table 1b—ASME B16.34 Material Group 2, Forging and Casting Descriptions

Group	Forgings/Forged Bar	Castings
2.1	A182 F304 ^j , A182 F304H	A351 CF3 ^k , A351 CF8 ^j , A351 CF10
2.2	A182 F316 ^j , A182 F316H, A182 F317 ^j	A351 CF3M ^t , A351 CF8M ^j , A351 CF3A ^d , A351 CF8A ^d , A351 CG8M ^g , A351 CF10M, A351 CG3M ^t
2.3	A182 F304L ^k , A182 F316L, A182 F317L	N/A
2.4	A182 F321 ^g , A182 F321H ^l	N/A
2.5	A182 F347 ^g , A182 F347H ^l , A182 F348 ^g , A182 F348H ^l	N/A
2.7	A182 F310H	N/A
2.8	A182 F44, A182 F51 ^m , A182 F53 ^m , A182 F55	A351 CK3MCuN, A995 CE8MN ^m , A995 1B, CD4MCuN, A995 6A CD3MWCuN, A995 4A CD3MN
2.10	N/A	A351 CH8 ^j , A351 CH20 ^j
2.11	N/A	A351 CF8C ^j
2.12	N/A	A351 CK20 ^j
NOTE General notes and footnotes for this table follow Table 1c.		

Table 1c—ASME B16.34 Material Group 3, Forging and Casting Descriptions

Group	Forgings/Forged Bar	Castings
3.1	B462 N08020 ⁿ A182 N08020 ^o	
3.2	B564 N02200 ⁿ	
3.4	B564 N04400 ⁿ —	A494 M35–1 ⁿ A494 M35–2 ⁿ
3.5	B564 N06600 ⁿ	
3.6	B564 N08800 ⁿ A182 N08800 ^o	
3.7	B462 N10665 ⁿ B564 N10665 ⁿ B462 N10675 ⁿ B564 N10675 ⁿ	
3.8	B462 N10276 ^{o p} B564 N10276 ^{o p} B564 N06625 ^{n q} B564 N08825 ^{n g} B462 N06022 ^{o p} B564 N06022 ^{o p} B462 N06200 ^{o p} B564 N06200 ^{o p}	
3.12	B462 N08367 ^o A182 N08367 ^o B564 N06035 ^{o k}	A351 CN3MN ^o
3.13	B564 N08031 ⁿ	
3.15	B564 N08810 ^o A182 N08810 ^o — —	— — A494 N-12MV ^{o g} A494 CW-12MW ^{o g}
3.17	—	A351 CN7M ^o

NOTE 1 ASME Boiler and Pressure Vessel Section II material that also meet the requirements of the listed ASTM specification may also be used.

NOTE 2 Material limitation, restriction, and special requirements are noted (superscripts) in Table 1a, Table 1b, and Table 1c. See footnotes.

^a Upon prolonged exposure to temperatures above 425 °C (800 °F), the carbide phase of steel may be converted to graphite. Permissible, but not recommended for prolonged use above 425 °C (800 °F).

^b Only killed steel shall be used above 455 °C (850 °F).

^c Not to be used over 260 °C (500 °F).

^d Not to be used over 345 °C (650 °F).

^e Upon prolonged exposure to temperatures above 470 °C (875 °F), the carbide phase of steel of carbon-molybdenum steel may be converted to graphite. Permissible, but not recommended for prolonged use above 470 °C (875 °F).

^f Use normalized and tempered material only.

^g Not to be used over 538 °C (1000 °F).

^h Not to be used over 595 °C (1100 °F).

ⁱ Permissible, but not recommended for prolonged use above 595 °C (1100 °F).

^j At temperatures over 538 °C (1000 °F), use only when the carbon content is 0.04 % or higher.

^k Not to be used over 425 °C (800 °F).

^l At temperatures over 538 °C (1000 °F), use only if the material is heat treated by heating to a minimum temperature of 1095 °C (2000 °F).

^m This steel may become brittle after service at moderately elevated temperatures. Not to be used over 315 °C (600 °F).

ⁿ Use annealed material only.

^o Only use solution annealed material.

^p Not to be used over 675 °C (1250 °F).

^q Not to be used over 645 °C (1200 °F). Alloy N06625 in the annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 538 °C (1000 °F) to 760 °C (1400 °F).

^r Application above 620 °C (1150 °F) is limited to tubing of maximum outside diameter of 88.9 mm (3½ in.).

^s The deliberate addition of any element not listed in Table 1 of ASTM A217 is prohibited, except that calcium (Ca) and Manganese (Mn) may be added for deoxidation.

^t Not to be used over 455 °C (850 °F).

Table 2a—Class 800 Pressure/Temperature Ratings (SI Units)

ASME B16.34 Material Group 1 (MPa)														
Temperature (°C)	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.11	1.13	1.14	1.15	1.17	1.18
–29 to 38	13.62	13.79	12.81	11.35	12.81	13.79	13.79	13.79	13.79	13.79	13.79	13.79	13.79	13.79
50	13.37	13.79	12.66	11.14	12.81	13.79	13.79	13.79	13.79	13.79	13.79	13.79	13.73	13.79
100	12.43	13.74	12.09	10.36	12.78	13.74	13.73	13.74	13.74	13.74	13.74	13.74	13.45	13.74
150	12.02	13.38	11.72	10.02	12.62	13.38	13.26	13.38	13.38	13.38	13.38	13.38	12.85	13.38
200	11.68	12.96	11.34	9.71	12.21	12.96	12.79	12.96	12.96	12.96	12.96	12.96	12.34	12.96
250	11.18	12.36	10.87	9.31	11.87	12.36	12.36	12.36	12.36	12.36	12.36	12.36	11.95	12.36
300	10.62	11.43	10.32	8.85	11.43	11.43	11.43	11.43	11.43	11.43	11.43	11.43	11.43	11.43
325	10.32	11.02	10.02	8.60	11.02	11.02	11.02	11.02	11.02	11.02	11.02	11.02	11.02	11.02
350	10.02	10.67	9.71	8.33	10.73	10.73	10.73	10.73	10.73	10.73	10.73	10.73	10.73	10.73
375	9.70	10.09	9.32	8.10	10.35	10.35	10.35	10.35	10.35	10.35	10.35	10.35	10.35	10.35
400	9.26	9.26	8.70	7.82	9.76	9.76	9.76	9.76	9.76	9.76	9.76	9.76	9.76	9.76
425	7.67	7.67	7.28	6.87	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
450	6.13	6.13	5.76	5.70	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02
475	4.65	4.56	4.18	3.76	8.45	8.45	8.45	8.45	8.45	7.43	8.45	8.45	7.43	8.45
500	3.14	3.09	2.95	2.75	6.42	7.12	6.86	7.53	6.28	5.70	7.53	7.53	5.70	7.53
538	1.57	1.57	1.57	1.57	3.02	3.72	3.97	4.92	3.02	3.65	4.67	6.68	3.65	6.68
550	—	—	—	—	—	3.36	3.39	4.17	3.02	3.21	4.00	6.65	3.21	6.65

ASME B16.34 Material Group 1 (MPa)														
Temperature (°C)	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.11	1.13	1.14	1.15	1.17	1.18
575	—	—	—	—	—	1.91	2.35	2.81	2.68	2.17	2.79	6.38	2.35	6.38
600	—	—	—	—	—	—	1.63	1.84	1.89	1.66	1.91	5.20	1.62	5.71
625	—	—	—	—	—	—	1.14	1.19	1.41	1.07	1.32	3.89	1.07	4.88
650	—	—	—	—	—	—	0.76	0.76	0.82	0.63	0.94	2.65	0.63	3.53
675	—	—	—	—	—	—	—	—	—	—	—	—	—	—
700	—	—	—	—	—	—	—	—	—	—	—	—	—	—
725	—	—	—	—	—	—	—	—	—	—	—	—	—	—
750	—	—	—	—	—	—	—	—	—	—	—	—	—	—
775	—	—	—	—	—	—	—	—	—	—	—	—	—	—
800	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2b—Class 800 Pressure/Temperature Ratings (USC Units)

ASME B16.34 Material Group 1 (psi)														
Temperature (°F)	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.11	1.13	1.14	1.15	1.17	1.18
−20 to 100	1975	2000	1860	1645	1860	2000	2000	2000	2000	2000	2000	2000	2000	2000
200	1810	2000	1760	1505	1860	2000	2000	2000	2000	2000	2000	2000	1965	2000
300	1745	1940	1700	1455	1765	1940	1925	1940	1940	1940	1940	1945	1865	1940
400	1690	1875	1640	1405	1765	1880	1850	1880	1880	1880	1880	1880	1780	1880
500	1610	1775	1565	1340	1710	1775	1775	1775	1775	1775	1775	1775	1725	1775
600	1515	1615	1470	1260	1615	1615	1615	1615	1615	1615	1615	1615	1615	1615
650	1465	1570	1420	1220	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
700	1415	1480	1365	1180	1515	1515	1515	1515	1515	1515	1515	1515	1515	1515
750	1350	1350	1270	1140	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420
800	1100	1100	1045	980	1355	1355	1355	1355	1355	1355	1355	1355	1355	1355
850	850	850	795	795	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
900	615	595	540	460	1200	1200	1200	1200	1195	995	1200	1200	995	1200

ASME B16.34 Material Group 1 (psi)														
Temperature (°F)	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.11	1.13	1.14	1.15	1.17	1.18
950	365	365	365	365	750	840	850	1025	750	735	1005	1035	735	1030
1000	225	225	225	225	440	540	575	710	440	530	675	970	530	970
1050	—	—	—	—	—	420	385	465	440	385	460	960	385	960
1100	—	—	—	—	—	—	255	295	295	265	300	805	255	860
1150	—	—	—	—	—	—	175	180	220	165	200	595	165	735
1200	—	—	—	—	—	—	110	110	120	95	140	385	95	510
1250	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1300	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1350	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1400	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1450	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2c—Class 800 Pressure/Temperature Ratings (SI Units)

ASME B16.34 Material Group 2 (MPa)										
Temperature (°C)	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.10	2.11	2.12
–29 to 38	13.24	13.24	11.03	13.24	13.24	13.24	13.79	12.36	13.24	12.36
50	12.75	12.83	10.67	12.95	13.00	12.90	13.79	11.86	13.00	11.86
100	10.90	11.25	9.28	11.80	12.08	11.57	13.51	10.01	12.08	10.01
150	9.87	10.27	8.37	10.93	11.32	10.67	12.25	9.31	11.32	9.31
200	9.19	9.51	7.78	10.21	10.65	10.03	11.38	8.94	10.65	8.94
250	8.67	8.90	7.32	9.61	10.08	9.54	10.79	8.69	10.08	8.69
300	8.24	8.43	6.95	9.10	9.63	9.19	10.36	8.46	9.63	8.46
325	8.06	8.24	6.79	8.88	9.43	9.03	10.18	8.32	9.43	8.32
350	7.90	8.09	6.68	8.69	9.27	8.88	10.04	8.15	9.27	8.15
375	7.74	7.97	6.60	8.54	9.12	8.76	9.96	7.96	9.12	7.96

ASME B16.34 Material Group 2 (MPa)										
Temperature (°C)	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.10	2.11	2.12
400	7.58	7.85	6.48	8.43	9.04	8.65	9.76	7.76	9.04	7.76
425	7.47	7.77	6.36	8.30	8.96	8.57	—	7.56	8.96	7.56
450	7.31	7.69	6.24	8.22	8.92	8.45	—	7.36	8.92	7.36
475	7.18	7.64	—	8.14	8.45	8.33	—	7.13	8.45	7.13
500	7.07	7.53	—	7.53	7.53	7.53	—	6.89	7.53	6.89
538	6.52	6.68	—	6.68	6.68	6.68	—	6.22	6.68	6.22
550	6.28	6.65	—	6.65	6.65	6.65	—	5.84	6.65	6.12
575	5.56	6.38	—	6.38	6.38	5.91	—	4.93	6.38	5.78
600	4.50	5.31	—	5.40	5.71	4.47	—	3.87	5.28	5.17
625	3.68	4.21	—	4.21	4.88	3.33	—	3.05	3.70	4.49
650	3.00	3.38	—	3.37	3.77	2.50	—	2.37	2.75	3.75
675	2.49	2.75	—	2.63	3.35	1.93	—	1.86	2.12	3.07
700	2.14	2.23	—	2.11	2.65	1.47	—	1.51	1.49	2.34
725	1.80	1.87	—	1.69	2.06	1.16	—	1.22	1.06	1.69
750	1.54	1.56	—	1.33	1.56	0.91	—	0.93	0.83	1.19
775	1.21	1.21	—	1.06	1.21	0.71	—	0.68	0.66	0.84
800	0.93	0.93	—	0.84	0.93	0.55	—	0.54	0.54	0.61

Table 2d—Class 800 Pressure/Temperature Ratings (USC Units)

ASME B16.34 Material Group 2 (psi)										
Temperature (°F)	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.10	2.11	2.12
−20 to 100	1920	1920	1600	1920	1920	1920	2000	1790	1920	1790
200	1600	1655	1365	1730	1765	1695	1985	1465	1765	1465
300	1435	1495	1215	1585	1645	1545	1780	1350	1645	1350
400	1325	1370	1120	1470	1535	1445	1640	1295	1535	1295
500	1240	1275	1050	1375	1445	1370	1545	1255	1445	1255
600	1180	1205	990	1300	1375	1320	1485	1215	1375	1215

ASME B16.34 Material Group 2 (psi)										
Temperature (°F)	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.10	2.11	2.12
650	1150	1180	975	1265	1350	1295	1460	1190	1350	1190
700	1125	1160	960	1240	1325	1275	1445	1160	1325	1160
750	1100	1140	940	1220	1310	1255	1420	1125	1310	1125
800	1080	1125	920	1205	1300	1240	—	1095	1300	1095
850	1055	1115	900	1190	1295	1220	—	1060	1295	1060
900	1035	1105	—	1180	1200	1200	—	1025	1200	1025
950	1020	1030	—	1030	1030	1030	—	985	1030	985
1000	945	970	—	970	970	970	—	900	970	900
1050	865	960	—	960	960	940	—	780	960	865
1100	685	815	—	830	860	695	—	595	830	780
1150	545	630	—	630	735	500	—	460	555	665
1200	440	495	—	495	550	365	—	345	405	545
1250	355	390	—	375	485	275	—	265	300	440
1300	300	310	—	295	365	200	—	210	200	320
1350	250	255	—	225	275	155	—	165	140	220
1400	200	200	—	175	200	120	—	120	110	145
1450	155	155	—	140	155	90	—	85	85	100
1500	110	110	—	100	110	65	—	70	70	70

Table 2e—Class 800 Pressure/Temperature Ratings (SI Units)

ASME B16.34 Material Group 3 (MPa)											
Temperature (°C)	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.12	3.13	3.15	3.17
–29 to 38	13.79	8.83	11.03	13.79	13.24	13.79	13.79	12.36	13.79	11.03	11.03
50	13.79	8.83	10.73	13.79	13.01	13.79	13.79	12.15	13.79	10.84	10.7
100	13.56	8.83	9.58	13.74	12.17	13.74	13.74	11.34	12.84	10.08	9.41
150	13.05	8.83	9.00	13.38	11.73	13.38	13.38	10.70	12.21	9.56	8.54

ASME B16.34 Material Group 3 (MPa)											
Temperature (°C)	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.12	3.13	3.15	3.17
200	12.58	8.83	8.72	12.96	11.41	12.96	12.89	9.95	11.62	9.05	7.83
250	12.13	8.43	8.69	12.36	11.13	12.36	12.36	9.31	11.06	8.60	7.26
300	11.43	7.80	8.69	11.43	10.89	11.43	11.43	8.83	10.5	8.20	6.77
325	11.02	5.01	8.69	11.02	10.75	11.02	11.02	8.62	10.25	8.02	6.51
350	10.73	—	8.68	10.73	10.60	10.73	10.73	8.43	10.06	7.85	—
375	10.35	—	8.64	10.35	10.35	10.35	10.35	8.27	9.91	7.66	—
400	9.74	—	8.55	9.76	9.76	9.76	9.76	8.11	9.76	7.54	—
425	9.34	—	8.44	9.34	9.34	9.34	9.34	7.96	9.34	7.38	—
450	—	—	7.17	9.02	9.02	—	9.02	—	—	7.26	—
475	—	—	5.54	8.45	8.45	—	8.45	—	—	7.14	—
500	—	—	—	7.53	7.53	—	7.53	—	—	7.02	—
538	—	—	—	4.41	6.68	—	6.68	—	—	6.68	—
550	—	—	—	3.72	6.65	—	6.65	—	—	6.65	—
575	—	—	—	2.52	6.38	—	6.38	—	—	6.38	—
600	—	—	—	1.77	5.71	—	5.71	—	—	5.71	—
625	—	—	—	1.37	4.88	—	4.88	—	—	4.88	—
650	—	—	—	1.26	3.77	—	3.75	—	—	3.77	—
675	—	—	—	—	2.74	—	3.07	—	—	3.35	—
700	—	—	—	—	1.48	—	2.34	—	—	2.65	—
725	—	—	—	—	1.08	—	—	—	—	2.06	—
750	—	—	—	—	0.81	—	—	—	—	1.56	—
775	—	—	—	—	0.66	—	—	—	—	1.21	—
800	—	—	—	—	0.58	—	—	—	—	0.93	—
816	—	—	—	—	0.51	—	—	—	—	0.77	—

Table 2f—Class 800 Pressure/Temperature Ratings (USC Units)

ASME B16.34 Material Group 3 (psi)											
Temperature (°F)	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.12	3.13	3.15	3.17
-20 to 100	2000	1280	1600	2000	1920	2000	2000	1790	2000	1600	1600
200	1980	1280	1400	2000	1775	2000	2000	1660	1875	1470	1380
300	1895	1280	1305	1940	1700	1940	1940	1555	1775	1385	1240
400	1820	1280	1260	1880	1655	1880	1860	1435	1675	1305	1125
500	1745	1210	1260	1775	1605	1775	1775	1335	1585	1235	1035
600	1615	1100	1260	1615	1570	1615	1615	1260	1500	1175	960
650	1570	—	1260	1570	1540	1570	1570	1225	1465	1145	—
700	1515	—	1255	1515	1515	1515	1515	1205	1440	1115	—
750	1420	—	1240	1420	1420	1420	1420	1180	1420	1095	—
800	1355	—	1220	1355	1355	1355	1355	1150	1355	1065	—
850	—	—	1005	1300	1300	—	1300	—	—	1050	—
900	—	—	735	1200	1200	—	1200	—	—	1030	—
950	—	—	—	970	1030	—	1035	—	—	1015	—
1000	—	—	—	640	970	—	970	—	—	970	—
1050	—	—	—	415	960	—	960	—	—	935	—
1100	—	—	—	275	860	—	860	—	—	860	—
1150	—	—	—	200	735	—	735	—	—	735	—
1200	—	—	—	180	550	—	545	—	—	550	—
1250	—	—	—	—	385	—	440	—	—	485	—
1300	—	—	—	—	180	—	320	—	—	365	—
1350	—	—	—	—	145	—	—	—	—	275	—
1400	—	—	—	—	100	—	—	—	—	200	—
1450	—	—	—	—	95	—	—	—	—	155	—
1500	—	—	—	—	70	—	—	—	—	110	—

4.2 Temperature Constraints

4.2.1 The temperature for a corresponding pressure rating is the maximum temperature of the pressure-containing shell of the valve. In general, this temperature is the same as that of the contained fluid. The use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user.

4.2.2 Restrictions of temperature and pressure (e.g., those imposed by special soft seals, special trim materials, packing, or bellows stem seals) shall be marked on the valve identification plate (see 7.4).

4.2.3 For temperatures below the lowest temperature listed in the pressure/temperature rating tables (see 4.1), the service pressure shall be no greater than the pressure for the lowest listed temperature. The use of valves at lower than the lowest listed temperature is the responsibility of the user. Consideration shall be given to the loss of ductility and toughness of many materials at low temperature. ASME B31.3 and ASME B31T may be used as guidance. Additional information for cryogenic service valves with body/bonnet extensions can be found in MSS SP-134 and ISO 28921-1.

5 Design

5.1 Reference Design

5.1.1 Requirements for extended body valves are given in Annex B and requirements for bellows stem seals are given in Annex C and Annex D. Other configurations and types of material may be provided when specified in accordance with Annex F.

5.1.2 Valve parts are identified in Annex E.

5.1.3 The reference design (the design to be provided when the purchaser does not specify otherwise or does not use Annex F) for sizes $DN \leq 100$ ($NPS \leq 4$) is for standard bore, bolted-bonnet or cover construction, an outside stem thread for gate and globe valves, and a conical disc for globe valves. The reference design for threaded-end valves uses taper pipe threads in accordance with ASME B1.20.1. In addition, for valves $DN \leq 50$ ($NPS \leq 2$), the reference design is to have a body and bonnet or cover of forged material.

5.2 Flow Passageway

5.2.1 The flow passageway includes the seat opening and the body ports leading to that opening. The body ports are the intervening elements that link the seat opening to the end connection (e.g., socket or flange).

5.2.2 The minimum cross-sectional area requirement for the standard bore flow passageway applies for both the valve body ports and the seat opening in the absence of the valve disc. The minimum flow passageway cross-sectional area shall not be less than that obtained using the diameters in Table 3.

5.2.3 The minimum cross-sectional area requirement for the full-bore flow passageway applies for both the valve body ports and the seat opening in the absence of the valve disc. The minimum flow passageway cross-sectional area shall not be less than that obtained using the diameters in Table 4. This standard does not provide for extended body valves (see Annex B) with full-bore openings.

5.3 Wall Thickness

5.3.1 Except as provided for in 5.3.2 through 5.3.6, the minimum wall thickness values for valve bodies, bonnets, and check valve covers shall be in accordance with Table 5. The manufacturer—taking into account such factors as bonnet bolting loads, rigidity needed for stem alignment, valve design details,

and the specified operating conditions— is responsible for determining if a larger wall thickness is required.

Table 3—Minimum Diameter of Equivalent Flow Passageway for Standard⁽¹⁾, (2) Bore Valves

DN	Minimum Diameter mm (in.)			NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500		
		Gate, Globe, or Check Valves	Gate Valves	
8	6 (¹ / ₄)	6 (¹ / ₄)	5 (³ / ₁₆)	¹ / ₄
10	6 (¹ / ₄)	6 (¹ / ₄)	5 (³ / ₁₆)	³ / ₈
15	9 (³ / ₈)	9 (³ / ₈)	8 (⁵ / ₁₆)	¹ / ₂
20	12 (¹ / ₂)	12 (¹ / ₂)	9 (³ / ₈)	³ / ₄
25	17 (¹¹ / ₁₆)	15 (⁵ / ₈)	14 (⁹ / ₁₆)	1
32	23 (¹⁵ / ₁₆)	22 (⁷ / ₈)	20 (¹³ / ₁₆)	1 ¹ / ₄
40	28 (1 ¹ / ₈)	27 (1 ¹ / ₁₆)	25 (1)	1 ¹ / ₂
50	36 (1 ⁷ / ₁₆)	34 (1 ³ / ₈)	27 (1 ¹ / ₁₆)	2
65	44 (1 ³ / ₄)	38 (1 ¹ / ₂)	34 (1 ³ / ₈)	2 ¹ / ₂
80	50 (2)	47 (1 ⁷ / ₈)	42 (1 ¹¹ / ₁₆)	3
100	69 (2 ³ / ₄)	63 (2 ¹ / ₂)	58 (2 ⁵ / ₁₆)	4

NOTE 1 The minimum diameter dimensions shown in this table are identical to the inch dimensions shown in API 602, 9th edition, and identical to the millimeter dimensions shown in API 602, 8th and 9th editions.

NOTE 2 Either the metric or U.S. Customary dimension may be used to determine the acceptability of the flow passageway.

Table 4—Minimum Diameter of Equivalent Flow Passageway for Full-bore⁽¹⁾, (2) Valves

DN	Minimum Diameter mm (in.)			NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500		
	Gate, Globe, or Check Valves	Gate Valves	Globe or Check Valves	
8	6 (¹ / ₄)	6 (¹ / ₄)	4 (³ / ₁₆)	¹ / ₄
10	9 (³ / ₈)	9 (³ / ₈)	7 (⁵ / ₁₆)	³ / ₈
15	12 (¹ / ₂)	12 (¹ / ₂)	9 (³ / ₈)	¹ / ₂
20	17 (¹¹ / ₁₆)	15 (⁵ / ₈)	14 (⁹ / ₁₆)	³ / ₄
25	22 (¹⁵ / ₁₆)	22 (⁷ / ₈)	19 (¹³ / ₁₆)	1
32	28 (¹ / ₈)	26 (¹ / ₁₆)	25 (1)	¹ / ₄

DN	Minimum Diameter mm (in.)			NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500		
	Gate, Globe, or Check Valves	Gate Valves	Globe or Check Valves	
40	35 (1 ⁷ / ₁₆)	34 (1 ³ / ₈)	26 (1 ¹ / ₁₆)	1 ¹ / ₂
50	44 (1 ³ / ₄)	38 (1 ¹ / ₂)	34 (1 ³ / ₈)	2
65	50 (2)	47 (1 ⁷ / ₈)	42 (1 ¹¹ / ₁₆)	2 ¹ / ₂
80	69 (2 ³ / ₄)	63 (2 ¹ / ₂)	58 (2 ⁵ / ₁₆)	3
100	95 (3 ³ / ₄)	92 (3 ⁵ / ₈)	87 (3 ⁷ / ₁₆)	4

NOTE 1 Some full-port values meeting the listed diameters may not meet the “full port” requirements of API 603 or API 600 gate valves.

NOTE 2 Either the metric or U.S. Customary dimension may be used to determine the acceptability of the flow passageway.

Table 5—Minimum Wall Thickness for Valve Bodies, Bonnets, and Check Valve Covers

DN	Minimum Wall Thickness mm (in.)		NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500	
8	3.3 (0.13)	3.8 (0.15)	$\frac{1}{4}$
10	3.6 (0.14)	4.3 (0.17)	$\frac{3}{8}$
15	4.1 (0.16)	4.8 (0.19)	$\frac{1}{2}$
20	4.8 (0.19)	6.1 (0.24)	$\frac{3}{4}$
25	5.8 (0.23)	7.1 (0.28)	$\frac{3}{4}$
32	6.1 (0.24)	8.4 (0.33)	$\frac{3}{4}$
40	6.6 (0.26)	9.7 (0.38)	$1\frac{1}{2}$
50	7.4 (0.29)	11.9 (0.47)	2
65	8.4 (0.33)	14.2 (0.56)	$2\frac{1}{2}$
80	9.7 (0.38)	16.5 (0.65)	3
100	11.9 (0.47)	21.3 (0.84)	4

NOTE 1 If the "minimum flow passage and/or 0.9 x basic inside diameter at valve end" > NPS, the wall thickness determination shall be per ASME B16.34, Section 6 rules.

NOTE 2 Wall thickness values listed for class 150, class 300, and class 600 are those required for class 800 on the assumption that flanged end and butt-welding end valve bodies of these lower nominal pressures would have extensions added (integral or welded) to class 800 valve bodies.

5.3.2 Valve body end connection minimum wall thickness shall be in accordance with 5.4.2, 5.4.3, 5.4.4, or 5.4.5 as applicable.

5.3.3 Extended body valves shall have body extension minimum wall thickness in accordance with Annex B.3.