ASME B16.5-2025

(Revision of ASME B16.5-2020)

Pipe Flanges and Flanged Fittings

NPS ½ Through NPS 24 Metric/Inch Standard

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers
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FOREWORD

In 1920, the American Engineering Standards Committee [later the American Standards Associations (ASA) and currently the American National Standards Institute (ANSI)] organized Sectional Committee B16 to unify and further develop standards for pipe flanges and fittings (and later for valves and gaskets). Cosponsors of the B16 Committee were The American Society of Mechanical Engineers (ASME), the Heating and Piping Contractors National Association [now Mechanical Contractors Association of America (MCAA)], and the Manufacturers Standardization Society of the Valves and Fittings Industry (MSS). Cosponsors were later designated as cosecretariat organizations.

The Committee soon recognized the need for standardization of steel pipe flanges. In May 1923, Subcommittee 3 was organized to develop such standards for pressures in the 250-psi to 3,200-psi range and for elevated temperatures. Active work began in October, including on steel flanged fittings. The first proposed standard was submitted to the Committee in April 1926 and approved by letter ballot in December. After favorable review by the three sponsor organizations, the Standard was approved as American Tentative Standard B16e in June 1927.

Experience in using the Standard showed the need for hub dimensions of companion flanges and for other changes, including rerating of 250-lb and 1,350-lb flanges and development of flanged fittings with integral bases. An investigation was made into the factors determining stiffness of flanges and flange hubs. The revised edition was approved as ASA B16e-1932.

A revision was initiated in 1936, stimulated by suggestions from Committee members and industrial users. The resulting 1939 edition contained standards for welding neck flanges (completed in March 1937), 1,500-lb flanges in the 14-in. through 24-in. range, 2,500-lb flanges and flanged fittings in the $\frac{1}{2}$-in. through 12-in. range, and dimensions for a full line of ring joint flanges developed by the American Petroleum Institute. Pressure–temperature ratings for alloy steel flanges and fittings, developed by Subcommittee 4, were included for the first time.

In August 1942, the War Production Board requested a review of measures to conserve vital materials in piping components. A special War Committee of B16 was appointed and, operating under War Standard Procedure, developed revised pressure–temperature ratings for all materials and pressure classes. The ratings were published as American War Standard B16e5-1943. In 1945, under normal procedures, Subcommittees 3 and 4 reviewed the 1939 standard and 1943 ratings and recommended adoption of the wartime ratings. Their report was approved as Supplement No. 1 to B16e-1939 and published as ASA B16e6-1949. In addition to ratings, the supplement updated material specification references and added a table of metal wall thickness for welding-end valves.

Subcommittee 3 then began a revision of the entire standard. Technically, the 1949 Supplement was absorbed, new materials were recognized, a general rating method was developed and added as an appendix, and welding end preparations were expanded. Editorially, a new style of presentation was worked out, including tables rearranged for easier use. Approval by Sectional Committee, cosponsors, and ASA resulted in the publication of ASA B16.5-1953 (designation changed from B16e).

Work soon began on further revisions. Class B ratings were deleted, and Class A ratings were clarified as the standard. An appendix defined qualifications for gaskets, other than ring joint, which would merit the ratings. Another appendix defined the method for calculating bolt lengths, including the measurement of stud bolt length between thread ends instead of points. Pressure–temperature ratings for several new materials were added, the table of welding end dimensions was expanded, and the temperatures used in determining ratings were redefined. The resulting new edition, after approval, was published as ASA B16.5-1957.

The more modest revision approved as ASA B16.5-1961 changed the text to clarify the intent or to make requirements easier to administer. The next revision began in 1963 with nearly 100 comments and suggestions. No fundamental changes were made, but the text was further clarified, and wall thicknesses less than $\frac{1}{4}$ in. for flanged fittings were recognized in the 1968 edition.

A new joint study of ratings between Subcommittees 3 and 4 was initiated before the next revision. Based on the Subcommittee 4 report, the rating procedure was revised, and a rating basis for Class 150 (150-lb) flanges was developed. New product forms, bar and plate, were added for special applications, including fabricated flanged valves and fittings. Reference to welding-end valves was not included, because a separate standard for them was planned. Bolt length calculations based on worst case tolerances led to a revision of tabulated lengths. Testing of valves subsequently published by Subcommittee 15 closure members was added to the test requirements. Following final approval on October 23, the Standard was published as ANSI B16.5-1973.

Subcommittee N (formerly 15) was assigned responsibility for all valve standards in late 1973. Subcommittee C (formerly 3) continued to have responsibility for flange standards. A revision was accordingly initiated to remove all references to valves. At the same time, comments from users and changes in the ASME Boiler and Pressure Vessel Code (BPVC) led to significant revisions in the Class 150 rating basis and in the ratings of stainless steel and certain alloy steel flanges and flanged fittings in all rating classes. Extensive public review comments led to the addition of considerations for bolting and gaskets for flanged joints and of marking requirements. To avoid having to make frequent and confusing changes to the ratings as a result of further changes to the BPVC-allowable stresses, Subcommittees C and N agreed that ratings would be left alone unless the relevant BPVC stress values were changed by more than 10%. After final approval by the Standards Committee, cosponsors, and ANSI, ANSI B16.5-1977, Steel Pipe Flanges and Flanged Fittings, was published on June 16, 1977.

In 1979, work began on another new edition. Materials coverage was expanded by the addition of nickel and nickel alloys. Bolting rules were revised to cover nickel alloy bolts. Bolt hole and bolting were changed to provide interchangeability between inch and metric dimensions. Metric dimensional tables were made informational rather than alternative requirements of the Standard. Final approval was granted for ANSI B16.5-1984, Pipe Flanges and Flanged Fittings, on August 14.

In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. The 1988 edition of the Standard extended nickel alloy ratings to higher temperatures, clarifying flat face flange requirements, and included other minor revisions. The Committee determined that any metric standard for flanges would stand alone, with metric bolting and gaskets; hence, metric equivalents were deleted. Following approval by the Standards Committee and ASME, approval as an American National Standard was given by ANSI on April 7, 1988, with the new designation ASME/ANSI B16.5-1988.

The 1996 edition allowed flanges marked with more than one material grade or specification, revised flange facing finish requirements, revised pressure–temperature ratings for several material groups, added a nonmandatory quality system annex, and included several other revisions. The 1996 edition was approved by ANSI on October 3, 1996, with the new designation ASME B16.5-1996.

The 2003 edition included metric units as the primary reference units while maintaining U.S. Customary units in either parenthetical or separate forms. New materials were added, some materials were shifted from one group to another, and new material groups were established.

All pressure–temperature ratings were recalculated using data from the latest edition of ASME BPVC, Section II, Part D. Annex F was added to cover pressure–temperature ratings and dimensional data for Classes 150 through 2500 flanges and Classes 150 and 300 flanged fittings in U.S. Customary units. Table and figure numbers in Annex F were prefixed by the letter F and corresponded to table and figure numbers in the main text for the metric version, with the exception of some table and figure numbers that were not used in Annex F. Of note, the flange thickness designations for Classes 150 and 300 were revised with reference to their raised faces. For these classes, the flange thickness dimensional reference planes were altered; however, required flange thickness remained unchanged. The minimum flange thickness designation was changed from C to t_f, and it did not include 2.0 mm (0.06 in.) raised face for Classes 150 and 300 raised face flanges and flanged fittings. Because of diminished interest, flanged end fittings conforming to ASME Class 400 and higher were listed only with U.S. Customary units in Annex G. In addition, straight hub welding flanges were incorporated as a new set of flanges in Classes 150 through 2500. Also, there were numerous requirement clarifications and editorial revisions. The 2003 edition was approved by ANSI on July 9, 2003, with the designation ASME B16.5-2003.

The 2009 edition added new materials, updated some pressure–temperature ratings, and designated the annexes as mandatory and nonmandatory appendices. The mandatory appendices were numbered using roman numerals, and the nonmandatory appendices were referenced using capital letters. The 2009 edition was approved by ANSI on February 19, 2009, with the designation ASME B16.5-2009.

The 2013 edition included a revision to para. 5.1 and the addition of perpendicularity tolerances. Additional errata and clarifying revisions were also applied. Following approval of the Standards Committee and ASME, approval for the 2013 edition was granted by ANSI on February 5, 2013.

The 2017 edition included the use of bar stock for blind flanges without hubs; added requirements for forgings, size NPS 22; and updated materials and working pressures.

In the 2020 edition, the U.S. Customary tables in former Mandatory Appendix II were relocated to the main text and redesignated with a “C” suffix (e.g., Table II-2-1.1 became Table 2-1.1C) and U.S. Customary figures were merged with SI figures. Former Mandatory Appendix II was deleted and the subsequent Mandatory Appendix redesignated. Cross-references were updated accordingly. Following approval by the ASME B16 Standards Committee, ASME B16.5-2020 was approved by ANSI as an American National Standard on January 5, 2021.

In the 2025 edition, various ASTM materials; a new appendix for determining minimum temperature limits; and definitions for *may*, *shall*, and *should* were added. After adopting revised ceiling values (Nonmandatory Appendix A, Tables A-1 and A-2), pressure–temperature ratings were revised. Lastly, various revisions to variables were made.

Following approval by the ASME B16 Standards Committee, ASME B16.5-2025 was approved by ANSI as an American National Standard on April 10, 2025.

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Standardization of Valves, Flanges, Fittings, and Gaskets

(The following is the roster of the committee at the time of approval of this Standard.)

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This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

(1) to permit early implementation of a revision based on an urgent need

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

(4) to permit the use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Standard.

(c) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Standard and the paragraph, figure, or table number

(4) the editions of the Standard to which the proposed case applies

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

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ASME B16.5-2025
SUMMARY OF CHANGES

Following approval by the ASME B16 Standards Committee and ASME, and after public review, ASME B16.5-2025 was approved by the American National Standards Institute on April 10, 2025.

In ASME B16.5-2025, titles of complementary tables have been editorially revised to indicate the applicable system of units. ASME B16.5-2025 also includes the following changes identified by a margin note, **(25)**. The Record Numbers listed below are explained in more detail in the "List of Changes in Record Number Order" following this Summary of Changes.

Page	*Location*	*Change (Record Number)*
2	1.11	Added *(22-2279)*
2	2.2	In second sentence, “must” revised to “shall” *(22-2279)*
2	2.4	Revised *(21-1888)*
3	2.5.3	Revised *(21-1888)*
3	2.6	Revised *(21-1849)*
5	Table 1.1-1	(1) Revised *(16-1229, 21-1888, 23-2509)* (2) For Material Group 3.1, Nominal Composition 35Ni–35Fe–20Cr–Cb, Forgings and Plates specifications corrected by errata *(21-1145)* (3) For Material Group 3.6, Nominal Composition 33Ni–42Fe–21Cr, second specification under Forgings and Plates added by errata *(21-1145)* (4) For Material Group 3.12, Nominal Composition 46Fe–24Ni–21Cr–6Mo–Cu–N, first specification under Plates corrected by errata *(21-1145)*
8	5.1.2	Revised *(21-1888)*
8	5.3.4	Last sentence deleted *(21-1888)*
8	5.3.5	In subpara. (a), second sentence revised *(22-2279)*
9	Table 1.1-2	(1) Under Intermediate Strength, Spec. No. A320, Grade L7M added; under Nickel and Special Alloy, Spec Nos. B511, B572, and B637 added *(22-651)* (2) Notes revised and reordered *(21-1888, 21-2211, 22-651)*
10	6.1.1	Second sentence revised *(22-2279)*
14	7.3	Editorially revised
15	8.1	Revised *(21-1849)*
15	Figure 1	General Note (b) revised *(22-567)*
15	Figure 2	General Note (b) revised *(22-567)*
20	Figure 7	Hub height, *H*, and Note (1) added, and subsequent Note redesignated *(22-2183)*
21	Figure 8	Hub height, *H*, and Note (1) added, and subsequent Note redesignated *(22-2183)*
23	Figure 12	U.S. Customary values added by errata *(21-1122)*
25	Table 2-1.1	Revised *(21-1888, 22-564, 23-2509)*
26	Table 2-1.1C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) Notes revised and reordered *(23-2509)*

Page	*Location*	*Change (Record Number)*
27	Table 2-1.2	Revised *(21-1888, 22-564, 23-2509)*
28	Table 2-1.2C	Revised *(21-1888, 23-2509)*
29	Table 2-1.3	Revised *(21-1888, 22-564, 23-2509)*
30	Table 2-1.3C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) Notes revised and reordered *(21-1888, 23-2509)*
31	Table 2-1.4	Revised *(21-1888, 22-564, 23-2509)*
32	Table 2-14C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) Note (2) revised *(21-1888, 23-2509)*
33	Table 2-1.5	Revised *(21-1888, 22-564, 23-2509)*
34	Table 2-1.5C	(1) Revised *(21-1888, 23-2509)* (2) Temperature in Note (1) corrected to Fahrenheit by errata *(21-1145)*
35	Table 2-1.7	Revised *(21-1888, 23-2509)*
36	Table 2-1.7C	Revised *(21-1888, 23-2509)*
37	Table 2-1.9	Revised *(21-1888, 22-564, 23-2509)*
38	Table 2-1.9C	Revised *(21-1888, 23-2509)*
39	Table 2-1.10	Revised *(21-1888, 22-564, 23-2509)*
40	Table 2-1.10C	Revised *(21-1888, 23-2509)*
41	Table 2-1.11	Revised *(21-1888, 22-564, 23-2509)*
42	Table 2-1.11C	Revised *(21-1888, 23-2509)*
43	Table 2-1.13	Revised *(21-1888, 23-2509)*
44	Table 2-1.13C	Revised *(21-1888, 23-2509)*
45	Table 2-1.14	Revised *(21-1888, 23-2509)*
46	Table 2-1.14C	Revised *(21-1888, 23-2509)*
47	Table 2-1.15	Revised *(21-1888, 23-2509)*
48	Table 2-1.15C	Revised *(21-1888, 23-2509)*
49	Table 2-1.17	Revised *(21-1888, 22-564, 23-2509)*
50	Table 2-1.17C	Revised *(21-1888, 23-2509)*
51	Table 2-1.18	Revised *(21-1888, 22-564, 23-2509)*
52	Table 2-1.18C	Revised *(21-1888, 23-2509)*
53	Table 2-2.1	Revised *(21-1888, 22-564, 23-2509)*
54	Table 2-2.1C	Revised *(21-1888, 23-2509)*
55	Table 2-2.2	Revised *(21-1888, 22-564, 23-2509)*
56	Table 2-2.2C	Revised *(21-1888, 23-2509)*
57	Table 2-2.3	Revised *(21-1888, 22-564, 23-2509)*
58	Table 2-2.3C	(1) Under Forgings and Plates, references to Note (1) added *(23-2509)* (2) Under Temp., °F, first entry revised *(21-1888)* (3) Note (1) revised and Note (2) added *(21-1888, 23-2509)*
59	Table 2-2.4	Revised *(21-1888, 22-564, 23-2509)*
60	Table 2-2.4C	Revised *(21-1888, 23-2509)*
61	Table 2-2.5	Revised *(21-1888, 22-564, 23-2509)*
62	Table 2-2.5C	Revised *(21-1888, 23-2509)*
63	Table 2-2.6	Revised *(21-1888, 23-2509)*
64	Table 2-2.6C	Revised *(21-1888, 23-2509)*
65	Table 2-2.7	Revised *(21-1888, 22-564, 23-2509)*

Page	*Location*	*Change (Record Number)*
66	Table 2-2.7C	Revised *(21-1888, 23-2509)*
67	Table 2-2.8	Revised *(21-1888, 22-564, 23-2509)*
67	Table 2-2.8C	Revised *(21-1888, 23-2509)*
68	Table 2-2.9	Revised *(21-1888, 22-564, 23-2509)*
69	Table 2-2.9C	Revised *(21-1888, 23-2509)*
70	Table 2-2.10	Revised *(21-1888, 23-2509)*
71	Table 2-2.10C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) For 1,000°F, Working Pressure for Classes 400 through 2500 revised *(23-2509)* (3) Note (2) added *(21-1888)*
72	Table 2-2.11	Revised *(21-1888, 23-2509)*
73	Table 2-2.11C	Revised *(21-1888, 23-2509)*
74	Table 2-2.12	Revised *(21-1888, 23-2509)*
75	Table 2-2.12C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) For 1,000°F, Working Pressure for Classes 400 through 2500 revised *(23-2509)* (3) Note (2) added *(21-1888)*
76	Table 2-2.13	Added *(21-1888, 23-2509)*
77	Table 2-2.13C	Added *(21-1888, 23-2509)*
78	Table 2-3.1	Revised *(21-1888, 23-2509)*
78	Table 2-3.1C	Revised *(21-1888, 23-2509)*
79	Table 2-3.2	Revised *(21-1888, 23-2509)*
79	Table 2-3.2C	Revised *(21-1888)*
80	Table 2-3.3	Revised *(21-1888, 23-2509)*
81	Table 2-3.3C	Revised *(21-1888, 23-2509)*
82	Table 2-3.4	Revised *(21-1888, 23-2509)*
83	Table 2-3.4C	(1) Castings materials and Note (2) added *(21-1888, 23-2509)* (2) Under Temp., °F, first entry revised *(21-1888)*
84	Table 2-3.5	Revised *(21-1888, 23-2509)*
85	Table 2-3.5C	Revised *(21-1888, 23-2509)*
86	Table 2-3.6	(1) Revised *(21-1888, 23-2509)* (2) For Nominal Designation 33Ni–42Fe–21Cr, entries for Forgings and Plates corrected by errata *(21-1145)*
87	Table 2-3.6C	(1) Revised *(21-1888, 23-2509)* (2) For Nominal Designation 33Ni–42Fe–21Cr, entries for Forgings and Plates corrected by errata *(21-1145)*
88	Table 2-3.7	Revised *(16-1229, 21-1888, 23-2509)*
88	Table 2-3.7C	Revised *(21-1888, 23-2509)*
89	Table 2-3.8	Revised *(16-1229, 21-1888, 22-564, 23-2509)*
90	Table 2-3.8C	Revised *(21-1888, 23-2509)*
91	Table 2-3.9	Revised *(21-1888, 23-2509)*
92	Table 2-3.9C	(1) Revised *(21-1888, 23-2509)* (2) Under Forgings, references to Note (2) added by errata *(21-1145)*
93	Table 2-3.10	Revised *(21-1888, 23-2509)*
93	Table 2-3.10C	Revised *(21-1888)*
94	Table 2-3.11	Revised *(21-1888, 23-2509)*

Page	*Location*	*Change (Record Number)*
94	Table 2-3.11C	(1) Under Temp., °F, first entry revised *(21-1888)* (2) Note (2) revised *(21-1888, 23-2509)*
95	Table 2-3.12	(1) Revised *(16-1229, 21-1888, 23-2509)* (2) For Nominal Designation 46Fe–24Ni–21Cr–6Mo–Cu–N, entry for Castings corrected by errata *(21-1145)*
96	Table 2-3.12C	(1) Revised *(21-1888, 23-2509)* (2) For Nominal Designation 46Fe–24Ni–21Cr–6Mo–Cu–N, entry for Castings corrected by errata *(21-1145)*
97	Table 2-3.13	Revised *(16-1229, 21-1888, 23-2509)*
97	Table 2-3.13C	Revised *(21-1888, 23-2509)*
98	Table 2-3.14	Revised *(16-1229, 21-1888, 22-564, 23-2509)*
99	Table 2-3.14C	Revised *(21-1888, 23-2509)*
100	Table 2-3.15	Revised *(21-1888, 23-2509)*
101	Table 2-3.15C	Revised *(21-1888, 23-2509)*
102	Table 2-3.16	Revised *(21-1888, 23-2509)*
103	Table 2-3.16C	Revised *(21-1888, 23-2509)*
104	Table 2-3.17	Revised *(21-1888, 23-2509)*
104	Table 2-3.17C	Revised *(21-1888)*
105	Table 2-3.19	Revised *(21-1888, 23-2509)*
106	Table 2-3.19C	Revised *(21-1888, 23-2509)*
114	Table 5	For Class 2500 NPS 2½, groove depth *E* corrected by errata from 9.522 to 9.53 *(21-1372)*
122	Table 5C	Under NPS 24, dimensionless row deleted and table alignment corrected by errata *(22-1148)*
131	Table 7	For NPS 20, outside diameter of flange, *O*, corrected by errata from 693 to 698 *(21-1134)*
133	Table 8	(1) Figure revised *(21-579, 22-2183, 23-628)* (2) For NPS 14, outside diameter of flange, *O*, corrected by errata from 553 to 533 *(21-1133)* (3) Note (2) added and subsequent Notes redesignated *(22-2183)*
136	Table 8C	(1) Figure revised *(21-579, 22-2183, 23-628)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
153	Table 11	(1) Figure revised *(21-579, 22-2183, 23-628)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
156	Table 11C	(1) Figure revised *(21-579, 22-2183, 23-628)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
169	Table 14	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
171	Table 14C	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
175	Table 16	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
178	Table 16C	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
183	Table 18	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
186	Table 18C	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*

Page	*Location*	*Change (Record Number)*
191	Table 20	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
193	Table 20C	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
197	Table 22	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
199	Table 22C	(1) Figure revised *(21-579, 22-2183)* (2) Note (2) added and subsequent Notes redesignated *(22-2183)*
203	Mandatory Appendix II	Updated *(23-2265)*
209	Table A-1	Revised *(21-1888, 22-2110)*
210	Table A-2	Revised *(21-1888, 22-2110)*
247	Nonmandatory Appendix G	Added *(21-1888)*

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
16-1229	Added ASTM B462 and ASTM B564 forging specification materials in Tables 1.1-1, 2-3.7, 2-3.8, 2-3.12, 2-3.13, 2-3.14, II-2-3.7, II-2-3.8, and II-2-3.12 through II-2-3.14.
21-579	Revised “B” dimension for slip-on, socket welding, welding neck, lapped flange figures in Tables 8, 11, 14, 16, 18, 20, and 22 (Tables 8C, 11C, 14C, 16C, 18C, 20C, and 22C).
21-1133	Errata correction. See Summary of Changes for details.
21-1134	Errata correction. See Summary of Changes for details.
21-1145	Errata corrections. See Summary of Changes for details.
21-1372	Errata correction. See Summary of Changes for details.
21-1849	Revised requirements in paras. 2.6 and 8.1 for system hydrostatic testing.
21-1888	Added guidance in paras. 2.4, 2.5.3, 5.1.2, and 5.3.4; General Notes in Tables 1.1-1 and 1.1-2, Tables 2-1.1 through 2-3.19 (Tables 2-1.1C through 2.3.19C), A-1, and A-2; and Nonmandatory Appendix G for determining minimum temperature for materials.
21-2211	Revised language to clarify “corresponding material” in Table 1.1-2 Notes (6) and (11).
22-564	Revised metric temperatures to the nearest degree in notes in Tables 2-1.1 through 2-1.5, 2-1.9 through 2-1.11, 2-1.17, 2-1.18, 2-2.1 through 2-2.5, 2-2.7 through 2-2.9, 2-3.8, and 2-3.14.
22-567	Revised General Note (b) in Figures 1 and 2.
22-651	Added ASTM A320 L7M, ASTM B511 N08830, ASTM B572 N06230, ASTM B637 N07740, and ASTM B637 N07718 materials in Table 1.1-2.
22-1148	Errata correction. See Summary of Changes for details.
22-2110	Revised ceiling pressures in Tables A-1 and A-2.
22-2183	Revised method to determine the minimum hub height in Figures 7 and 8 and Tables 8, 11, 14, 16, 18, 20, 22 (Tables 8C, 11C, 14C, 16C, 18C, 20C, and 22C).
22-2279	Added para. 1.11 to define “may,” “shall,” and “should. Revised paras. 5.3.4 and 6.1.1 to align with the added definitions.
23-628	Revised Table 8 (Table 8C) Class 150 threaded figure to have the threads continue to the flanged face. Revised Table 11 (Table 11C) Class 300 threaded figures to include a counterbore.
23-2265	Updated references in Mandatory Appendix II.
23-2509	Revised pressure–temperature ratings in Tables 2-1.1 through 2-3.19 (Tables 2-1.1C through 2-3.19C). Added Table 2-2.13 (Table 2-2.13C) for group material 2.13 for duplex materials. Revised Table 1.1-1.

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PIPE FLANGES AND FLANGED FITTINGS
NPS ½ Through NPS 24 Metric/Inch Standard

1 GENERAL

1.1 Scope

(a) This Standard covers pressure–temperature ratings, materials, dimensions, tolerances, marking, testing, and methods of designating openings for pipe flanges and flanged fittings. Included are

(1) flanges with rating class designations 150, 300, 400, 600, 900, and 1500 in sizes NPS ½ through NPS 24 and flanges with rating class designation 2500 in sizes NPS ½ through NPS 12, with requirements given in both metric and U.S. Customary units with diameter of bolts and flange bolt holes expressed in inch units

(2) flanged fittings with rating class designation 150 and 300 in sizes NPS ½ through NPS 24, with requirements given in both metric and U.S. Customary units with diameter of bolts and flange bolt holes expressed in inch units

(3) flanged fittings with rating class designation 400, 600, 900, and 1500 in sizes NPS ½ through NPS 24 and flanged fittings with rating class designation 2500 in sizes ½ through NPS 12 that are acknowledged in Nonmandatory Appendix E in which only U.S. Customary units are provided

(b) This Standard is limited to

(1) flanges and flanged fittings made from cast or forged materials

(2) blind flanges and certain reducing flanges made from cast, forged, or plate materials (see Tables 1.1-1 through 1.1-3)

Also included in this Standard are requirements and recommendations regarding flange bolting, gaskets, and joints.

1.2 References

Codes, standards, and specifications, containing provisions to the extent referenced herein, constitute requirements of this Standard. These reference documents are listed in Mandatory Appendix II.

1.3 Time of Purchase, Manufacture, or Installation

The pressure–temperature ratings in this Standard are applicable upon its publication to all flanges and flanged fittings within its scope, which otherwise meet its requirements. For unused flanges or flanged fittings maintained in inventory, the manufacturer of the flange or flanged fittings may certify conformance to this edition, provided that it can be demonstrated that all requirements of this edition have been met. Where such components were installed in accordance with the pressure–temperature ratings of an earlier edition of this Standard, those ratings are applicable except as may be governed by the applicable code or regulation.

1.4 User Accountability

This Standard cites duties and responsibilities that are to be assumed by the flange or flanged fitting user in the areas of, for example, application, installation, system hydrostatic testing, operation, and material selection.

1.5 Quality Systems

Requirements relating to the product manufacturer's Quality System Program are described in Nonmandatory Appendix D.

1.6 Relevant Units

This Standard states values in both SI (Metric) and U.S. Customary units. As an exception, diameter of bolts and flange bolt holes are expressed in inch units only. These systems of units are to be regarded separately as standard. Within the text, the U.S. Customary units are shown in parentheses or in separate tables following the SI tables. The values stated in each system are not exact equivalents; therefore, it is required that each system of units be used independently of the other. Except for diameter of bolts and flange bolt holes, combining values from the two systems constitutes nonconformance with the Standard. Nonmandatory Appendix F describes how the values expressed in SI units were established.

1.7 Selection of Materials

Criteria for selection of materials suitable for particular fluid service are not within the scope of this Standard.

1.8 Convention

For determining conformance with this Standard, the convention for fixing significant digits where limits (maximum and minimum values) are specified shall be as defined in ASTM E29. This requires that an observed