ASME B16.11-2021
(Revision of ASME B16.11-2016)

Forged Fittings, Socket-Welding and Threaded

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

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CONTENTS

FOREWORD

The Sectional Committee on the Standardization of Pipe Flanges and Fittings, B16, organized in 1920 under the procedure of the American Standards Association (ASA), appointed a subgroup of Subcommittee 3 (now Subcommittee F) to initiate the standardization of welding fittings in May 1937. The first meeting of this group was held later that month, and at its meeting in December 1938, in New York, it was agreed to undertake the standardization of dimensions of socket-welding fittings and to refer this project to a new drafting subgroup. One of the most important dimensions of this type of fitting requiring standardization was considered to be the dimension from the centerline of the fitting to the bottom of the socket, since from the standpoint of the designing engineer, this dimension governs the location of adjacent pipe with reference to the entire piping layout. Another important item for consideration was the welding fillet dimensions.

The drafting subgroup held meetings in Chicago, Detroit, and New York in March 1939 and May and October 1940, respectively, and at the last named meeting, the completed draft of the proposed standard was discussed, and further revisions were suggested. When applied to the September 1940 draft, these changes produced the May 1941 draft, which was prepared for distribution to industry for criticism and comment.

This distribution resulted in a number of helpful comments. The members of the subgroup agreed by mail that many of the changes suggested should be incorporated in the revised draft (December 1941). Progress on the approval of the standard was delayed by the World War II, after which, a few more changes were added to make the proposal acceptable to all concerned. The revised draft (April 1946) was then submitted to the members of the Sectional Committee for letter ballot vote.

Following the approval of the Sectional Committee, the proposed standard was next approved by the sponsor bodies and presented to the ASA with recommendation for approval as an American Standard. This designation was given on December 9, 1946.

In 1960, it was agreed that the standard needed a complete revision and simultaneously that it should be expanded to cover threaded fittings and plugs, then covered by MSS SP-49 and SP-50. A task force worked diligently for 4 years before arriving at a draft that was acceptable. They also found that ratings were outdated and eliminated the 4,000-lb classes of threaded fittings, assigned pressure-temperature ratings for a number of materials, and converted the socket-weld fitting ratings to 3,000 and 6,000 lb. Following approval by the Sectional Committee and Sponsors, ASA approval was granted on January 28, 1966.

Following the redesignation of ASA as the American National Standards Institute (ANSI) and Sectional Committees as Standards Committees, Subcommittee 6 began consideration of changes in 1969. Early in 1972, changes in the pressure class designations, materials, and clarification of wording were agreed upon and submitted for approval. This was granted on June 20, 1973.

The work of development of the 1980 edition of B16.11 began in 1975 when the Committee began consideration of comments and proposals for change that were received. The development procedure was arduous in that a number of ballots were taken that elicited many additional comments and counterproposals. The major changes included an expanded scope for better definition, requirements for conformance marking, a Nonmandatory Annex with provisions for proof or burst testing, and the inclusion of metric equivalents. Following approval by the Standards Committee and Co-Secretariat, final approval by ANSI was granted on October 6, 1980.

In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. The 1991 edition of the standard, retitled "Forged Fittings, Socket-Welding and Threaded," incorporated forging material listed in Table 1 of ASME B16.34-1988, including Group 3 material that was not previously covered in B16.11. The 1991 edition established U.S. Customary units as the standard. Other clarifying and editorial revisions were made to improve the text. Following approval by the Standards Committee and ASME, final approval by ANSI was granted on March 4, 1991.

In 1996, metric dimensions were added as an independent but equal standard to the inch units. Following approval by the Standards Committee and ASME, this revision to the 1991 edition of this Standard was approved as an American National Standard by ANSI on December 16, 1996, with the new designation ASME B16.11-1996.

In 2000, the Standards Committee, ASME, and ANSI approved an addenda to this Standard to remove partial compliance fittings and nonstandard material requirements. Due to an ASME policy change concerning the publishing of addenda, the intended addenda changes were incorporated into the 2001 edition.

Threaded end street elbow requirements were incorporated into the 2004 edition. Following approval by the Standards Committee and ASME, the revision to the 2001 edition was approved as an American National Standard by ANSI on September 30, 2005, with the designation ASME B16.11-2005.

A number of technical revisions were made along with format and reference revisions, such as material marking requirements. Following approval by the Standards Committee and ASME, the revision to the 2005 edition was approved as an American National Standard by ANSI on July 9, 2009, with the designation ASME B16.11-2009.

ASME B16.11-2011 was approved by ANSI on December 2, 2011.

In ASME B16.11-2016, the text and tables were revised. Following approval by the ASME B16 Standards Committee, ASME B16.11-2016 was approved by ANSI on October 21, 2016.

In ASME B16.11-2021, the U.S. Customary tables formerly in Mandatory Appendix I have been relocated to follow their respective SI tables in the main text. The tables and figures have been redesignated, former Mandatory Appendix I has been deleted, and the subsequent Mandatory Appendix has been redesignated. Cross-references have been updated accordingly. Also, former para. 2.1.2 and Table 9 have been deleted and Tables 1.1.1-1, 6.1-1, 6.1-1C, 6.1-2, 6.1-2C, 6.1-4, 6.1-5, and 6.1-5C (former Tables 7, 1, I-1, 2, I-2, 4, 5, and I-5, respectively) have been revised. Following approval by the ASME B16 Standards Committee, ASME B16.11-2021 was approved by ANSI on December 14, 2021.

ASME B16 COMMITTEE
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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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued to provide alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the B16 Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B16 Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may e-mail the request to the Secretary of the B16 Standards Committee at SecretaryB16@asme.org, or mail it to the above address. The request for an interpretation should be clear and unambiguous. It is further recommended that the Inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry in one or two words.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. Please provide a condensed and precise question, composed in such a way that a “yes” or “no” reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of “Yes” or “No,” with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. The Inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B16 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the B16 Standards Committee.

ASME B16.11-2021
SUMMARY OF CHANGES

Following approval by the ASME B16 Standards Committee and ASME, and after public review, ASME B16.11-2021 was approved by the American National Standards Institute on December 14, 2021.

In ASME B16.11-2021, the U.S. Customary tables formerly in Mandatory Appendix I have been relocated to follow their respective SI tables in the main text. The tables and figures have been redesignated, former Mandatory Appendix I has been deleted, and the subsequent Mandatory Appendix has been redesignated. Cross-references have been updated accordingly. In addition, this edition includes the following changes identified by a margin note, **(21)**. 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	2.1.2	(1) Former para. 2.1.2 deleted and subsequent paragraph redesignated *(18-2628)*
		(2) Table 9 deleted *(18-2628)*
2	4.1	Last sentence deleted *(21-622)*
5	Table 1.1.1-1	Revised in its entirety *(21-622)*
6	Table 6.1-1	Illustrations revised *(18-255)*
7	Table 6.1-1C	(1) Revised *(18-255, 21-622)*
		(2) Minimum body wall thickness for NPS $^{3}/_{4}$, Class 3000, corrected by errata *(17-1158)*
8	Table 6.1-2	(1) Revised *(18-255)*
		(2) Tolerances for laying length *F* corrected to ASME B16.11-2011 values
		(3) End-to-end couplet value and weld ring diameter for NPS 1 corrected by errata *(17-1158)*
9	Table 6.1-2C	Revised *(21-622)*
12	Table 6.1-4	Notes (1) and (2) revised *(18-255)*
14	Table 6.1-5	(1) Revised *(18-255)*
		(2) End-to-end coupling and end-to-end cap values for NPS $^{3}/_{8}$ and weld ring diameter for NPS 3 corrected by errata *(17-1158)*
15	Table 6.1-5C	Revised *(18-255, 21-622)*

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
17-1158	In Table 6.1-1C (former Table I-1), corrected minimum body wall thickness for NPS $^{3}/_{4}$, Class 3000, from 00.154 to 0.154.
	In Table 6.1-2 (former Table 2), corrected end-to-end couplet value for NPS 1 from 47.6 to 42.9 and weld ring diameter for NPS 1 from 42.9 to 33.4.
	In Table 6.1-5 (former Table 5), corrected end-to-end couplet value for NPS $^{3}/_{8}$ from 48 to 38; end-to-end cap value for NPS $^{3}/_{8}$, Class 3000, from 32 to 25; and weld ring diameter for NPS 3 from 114.3 to 88.9.
18-255	In Tables 6.1-1 and 6.1-1C (former Tables 1 and I-1), revised illustrations.
	In Table 6.1-2 (former Table 2), revised minimum socket wall thickness for NPS 2, Class 9000.
	In Table 6.1-4 (former Table 4), corrected cross-references in Notes (1) and (2).
	In Table 6.1-5 (former Table 5), revised illustration of boss; minimum length of thread, L_2, for NPS $1^{1}/_{4}$; and outside diameter couplet values for NPS 2 through 4, Class 6000. Corrected "End-to-End Couplet" and "Weld Ring Diameter" column headings. Corrected cross-reference in General Note (b).
	In Table 6.1-5C (former Table I-5), revised illustration of boss; outside diameter couplet value for NPS $^{1}/_{4}$, Class 3000; and Note (1). Corrected "End-to-End Couplet" column heading. Corrected cross-reference in General Note (b).
18-2628	Deleted para. 2.1.2 and Table 9. Redesignated para. 2.1.3 as 2.1.2.
21-622	Revised Table 1.1.1-1 (former Table 7) to properly align fittings with values.
	Deleted last sentence of para. 4.1.
	In Table 6.1-1C (former Table I-1), revised minimum socket depth and center-to-bottom of socket values.
	In Table 6.1-2C (former Table I-2), revised average socket wall thickness for NPS $^{1}/_{4}$, Class 3000; end-to-end couplet tolerances; weld ring diameters and tolerances; and weld ring lengths.
	In Table 6.1-5C (former Table I-5), revised outside diameter for NPS 3, Class 3000; weld ring diameters; General Notes (a) and (b); and Note (1).

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FORGED FITTINGS, SOCKET-WELDING AND THREADED

1 SCOPE AND GENERAL

1.1 Scope

This Standard covers ratings, dimensions, tolerances, marking, and material requirements for forged fittings, both socket-welding and threaded, as illustrated in Tables 6.1-1 through 6.1-6 (Tables 6.1-1C through 6.1-6C), inclusive.

1.1.1 Fitting Types/Configuration. Types of fittings covered by this Standard are shown by class and size range in Table 1.1.1-1. Fittings shown in Tables 6.1-1 through 6.1-6 (Tables 6.1-1C through 6.1-6C) may also be made with combinations of socket-welding and threaded ends.

1.1.2 Special Fittings. Fittings with special dimensions, threads, or counterbores may be made by agreement between the manufacturer and purchaser. When such fittings meet all other stipulations of this Standard, they shall be considered in compliance therewith, provided they are appropriately marked (see section 4).

1.1.3 Welding. Installation welding requirements are not within the scope of this Standard. Installation welding shall be in accordance with the applicable piping Code or regulation covering the piping system into which the fittings are installed.

1.2 General

1.2.1 Referenced Standards. Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix I. It is not considered practical to identify the specific edition of each standard and specification in the individual references. Instead, the specific edition reference is identified in Mandatory Appendix I. A fitting made in conformance and conforming to this Standard, in all other respects, will be considered to be in conformance to the Standard, even though the edition reference may be changed in a subsequent revision of the Standard.

1.2.2 Codes and Regulations. A fitting used under the jurisdiction of the ASME Boiler and Pressure Vessel Code, the ASME Code for Pressure Piping, or a governmental regulation is subject to any limitation of that code or regulation. This includes any maximum temperature limitation, rule governing the use of a material at low temperature, or provisions for operation at a pressure exceeding the ratings in this Standard.

1.2.3 Service Conditions. Criteria for selection of fitting types and materials suitable for particular fluid service are not within the scope of this Standard.

1.2.4 Quality Systems. Nonmandatory requirements relating to the product manufacturer's quality system program are described in Nonmandatory Appendix A.

1.2.5 Relevant Units. This Standard states values in both SI (Metric) and U.S. Customary units. These systems of units are to be regarded separately as standard. In this Standard, the U.S. Customary units are shown in parentheses or in separate 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. Combining values from the two systems constitutes nonconformance with the Standard.

2 PRESSURE RATINGS

2.1 General

Fittings under this Standard shall be designated as Class 2000, 3000, and 6000 for threaded end fittings and Class 3000, 6000, and 9000 for socket-weld end fittings.

2.1.1 Basis of Rating. The schedule of pipe corresponding to each Class designation of fitting for rating purposes is shown in Table 2.1.1-1. Design temperature and other service conditions shall be limited as provided by the applicable piping code or regulation for the material of construction of the fitting. Within these limits, the minimum wall thickness for pipe to be used with a Table 2.1.1-1 Class-designated fitting shall be computed based on appropriate size straight seamless pipe of equivalent material as the fitting (as shown by comparison of composition and mechanical properties in the respective material specifications). The minimum pipe wall thickness calculation shall include pressure design and all applicable additional allowances (e.g., erosion, corrosion, and thread depth for threaded pipe). The minimum wall thickness for selected pipe, considering manufacturing minus wall thickness tolerance (typically 12.5%), shall not be less than the minimum wall calculation. The fitting is suitable for the application if the wall thickness of the selected pipe equals or is less than the ASME B36.10M Schedule No. or Wall Designation pipe