ASME B16.11-2005
(Revision of ASME B16.11-2001)

Forged Fittings, Socket-Welding and Threaded

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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Three Park Avenue • New York, NY 10016

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The next edition of this Standard is scheduled for publication in 2010. There will be no addenda or written interpretations of the requirements of this Standard issued to this Edition.

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Three Park Avenue, New York, NY 10016-5990

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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 war, 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 four years before arriving at a draft that it felt was acceptable. They also found that ratings were outdated and eliminated the 4000-lb classes of threaded fittings, assigned pressure-temperature ratings for a number of materials, and converted the socket-weld fitting ratings to 3000 and 6000 lb. Following approval by the Sectional Committee and Sponsors, ASA approval was granted on January 28, 1966.

Following designation changes of ASA to ANSI and Sectional Committee to Standards Committee, 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 approach 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 which elicited many additional comments and counter proposals. 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, re-titled "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 in order 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 have been incorporated into this B16.11-2001 edition.

Suggestions for improvement of this Standard are welcome. They should be addressed to the Secretary, ASME B16 Standards Committee, Three Park Avenue, New York, NY 10016.

The Committee incorporated threaded street elbow requirements into the standard starting in 2004. Following approval by the Standards Committee and ASME, this 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.

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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CORRESPONDENCE WITH THE B16 COMMITTEE

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, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

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.

Interpretations. Upon request, the B16 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.

The request for 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.
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. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

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

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, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

FORGED FITTINGS, SOCKET-WELDING AND THREADED

1 SCOPE

1.1 General

This Standard covers ratings, dimensions, tolerances, marking, and material requirements for forged fittings, both socket-welding and threaded, as illustrated in Tables 4 through 8 and Tables I-1 through I-5, inclusive.

1.1.1 Fitting Types/Configuration. Types of fittings covered by this Standard are shown in Table 1, by class and size range. Fittings shown in Tables 4 through 8 and Tables I-1 through I-5 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 para. 4).

1.1.3 Quality Systems. Nonmandatory requirements relating to the product manufacturer's Quality System Program are described in Nonmandatory Appendix A.

1.2 References

1.2.1 Referenced Standards. Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix II, which is part of this Standard. 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 II. 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 addendum to or 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.

1.3 Service Conditions

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

1.4 Welding

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

1.5 Standard Units

The values stated in either metric or inch units are to be regarded separately as standard. Within the text, the inch units are shown in parentheses. The values stated in each system are not exact equivalents; therefore, each

Table 1 Types of Fittings by Class Designation and NPS Size Range

	Socket-Welding			Threaded		
	Class Designation			Class Designation		
Description	3000	6000	9000	2000	3000	6000
45-deg, 90-deg elbows,	1/8–4	1/8–2	1/2–2	1/8–4	1/8–4	1/8–4
tees, crosses, coupling,	1/8–4	1/8–2	1/2–2	1/8–4	1/8–4	1/8–4
half-coupling, and cap	1/8–4	1/8–2	1/2–2	...	1/8–4	1/8–4
	1/8–4	1/8–2	1/2–2	...	1/8–4	1/8–4
Street elbows	...	...	...	...	1/8–2	1/8–2
Square, hex, round plug,	...	...	...	1/8–4 [Note (1)]		
hex, and flush bushing	...	...	...	1/8–4 [Note (1)]		

NOTE:

(1) Plugs and bushings are not identified by class designation. They may be used for ratings up through Class 6000 designation.

Table 2 Correlation of Fittings Class With Schedule Number or Wall Designation of Pipe for Calculation of Ratings

Class Designation of Fitting	Type of Fitting	Pipe Used for Rating Basis [Note (1)]	
		Schedule No.	Wall Designation
2000	Threaded	80	XS
3000	Threaded	160	...
6000	Threaded	...	XXS
3000	Socket-welding	80	XS
6000	Socket-welding	160	...
9000	Socket-welding	...	XXS

NOTE:
(1) This table is not intended to restrict the use of pipe of thinner or thicker wall with fittings. Pipe actually used may be thinner or thicker in nominal wall than that shown in Table 2. When thinner pipe is used, its strength may govern the rating. When thicker pipe is used (e.g., for mechanical strength), the strength of the fitting governs the rating.

system must be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

Tables 4 through 8 show fittings dimensional requirements in millimeters. Tables I-1 through I-5 show the dimensional requirements for inch dimensioned fittings.

2 PRESSURE RATINGS

2.1 General

These fittings 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 of fitting for rating purposes is shown in Table 2. 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 maximum allowable pressure of a fitting shall be that computed for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications). The wall thickness used in such computation shall be that tabulated in ASME B36.10M for the size and applicable schedule of pipe reduced by a 12.5% manufacturing tolerance and other allowances (e.g., threaded allowances). Fittings are not suitable for use at pressures that are calculated for a pipe that requires larger minimum wall thickness. See Note (1), Table 2.

Any corrosion allowance and any variation in allowable stress due to temperature or other design shall be applied to the pipe and fitting alike.

Table 3 Nominal Wall Thickness of Schedule 160 and Double Extra Strong Pipe

NPS	Schedule 160		XXS	
	mm	in.	mm	in.
1/8	3.15	0.124	4.83	0.190
1/4	3.68	0.145	6.05	0.238
3/8	4.01	0.158	6.40	0.252

2.1.2 Nonstandard Pipe Wall Thickness. Since ASME B36.10M does not include Schedule 160 nor Double Extra Strong thickness for NPS 1/8, 1/4, and 3/8, the values in Table 3 may be used as the nominal wall thicknesses of the pipe for rating purposes.

2.1.3 Combination End Fittings. The Class for fittings made with combinations of socket-welding and threaded ends shall be based on the end configuration that has the lowest rating from Table 2.

2.2 Pressure Test Capability

Pressure testing is not required by this Standard, but the fittings shall be capable of withstanding a hydrostatic test pressure required by the applicable piping code for seamless pipe of material equivalent to the fitting forging and of the schedule or wall thickness correlated with the fitting Class and end connection of Table 2.

3 SIZE AND TYPE

3.1 General

NPS, followed by a dimensionless number, is the designation for nominal fitting size. NPS is related to the reference nominal diameter, DN, used in international standards. The relationship is typically as follows:

NPS	DN
1/8	6
1/4	8
3/8	10
1/2	15
3/4	20
1	25
1 1/4	32
1 1/2	40
2	50
2 1/2	65
3	80
4	100

3.2 Reducing Fitting Size

In the case of reducing tees and crosses, the size of the largest run opening shall be given first, followed by the size of the opening at the opposite end of the run.