The American Society of Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

FACTORY-MADE WROUGHT BUTTWELDING FITTINGS

ASME B16.9-2003

(Revision of ASME B16.9-2001)

Date of Issuance: February 20, 2004

The next edition of this Standard is scheduled for publication in 2009. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. The interpretations will be included with this edition.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

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

Copyright © 2004 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All Rights Reserved
Printed in U.S.A.

CONTENTS

Foreword iv
Committee Roster v
Correspondence With the B16 Committee vi

1 Scope 1

2 Pressure Ratings 1

3 Size 2

4 Marking 2

5 Material 2

6 Fitting Dimensions 2

7 Surface Contours 3

8 End Preparation 3

9 Design Proof Test 3

10 Production Tests 4

11 Tolerances 4

Figure
1 Maximum Envelope for Welding End Transitions 5

Tables
1 Welding Bevels and Root Face 4
2 Tolerances 6
3 Dimensions of Long Radius Elbows 8
4 Dimensions of Long Radius Reducing Elbows 9
5 Dimensions of Long Radius Returns 10
6 Dimensions of Short Radius Elbows 10
7 Dimensions of Short Radius 180 deg Returns 11
8 Dimensions of Straight Tees and Crosses 11
9 Dimensions of Reducing Outlet Tees and Reducing Outlet Crosses 12
10 Dimensions of Lap Joint Stub Ends 15
11 Dimensions of Caps 16
12 Dimensions of Reducers 17

Mandatory Appendices
I Inch Tables 19
II References 33

Nonmandatory Appendix
A Quality System Program 34

FOREWORD

In 1921, the American Engineering Standards Committee, later the American Standards Association (ASA), organized Sectional Committee B16 to unify and further develop national standards for pipe flanges and fittings (and, later, for valves, gaskets, and valve actuators). Cosponsors of the B16 Committee were The American Society of Mechanical Engineers (ASME), the Heating and Piping Contractors National Association [now the Mechanical Contractors Association of America (MCAA)], and the Manufacturers Standardization Society of the Valve and Fittings Industry (MSS). Cosponsors were later designated as cosecretariat organizations.

Standardization of welding fittings was initiated in 1937 by a subgroup (designated Subgroup 6) of Subcommittee 3. After consideration of several drafts, a standard was approved by the Committee, cosponsors, and ASA, and published with the designation ASA B16.9-1940.

Revisions were made in 1950 and 1955 to add sizes up to NPS 24 and to complete coverage of fittings in some sizes. These revisions were approved and published as ASA B16.9-1951 and ASA B16.9-1958. With the subgroup now designated Subcommittee 6 (later Subcommittee F), further revisions were begun to clarify the intent of the standard, to add angularity tolerances, and to include fittings of different types (long radius reducing elbows and crosses) and smaller sizes (NPS $\frac{1}{4}$ and $\frac{1}{2}$). This revision was published as ASA B16.9-1964 after ASA approval.

After reorganization of ASA, first as the United States of America Standards Institute (USASI), then as the American National Standards Institute (ANSI), with the Sectional Committee being redesignated as an American National Standards Committee, another revision increasing the size range to NPS 48 and revising the text for clarity was approved and published as ANSI B16.9-1971.

In 1975, Subcommittee F began a major revision to bring the standard up to date with current practice and usage. Common fractions were expressed as decimals (but without intending higher precision) and metric dimensional equivalents were added. Provisions for step-wise change of radius for NPS $\frac{3}{4}$ long radius elbows and 180 deg returns were introduced. Following Standards Committee, cosecretariat, and ANSI approval, the revision was published as ANSI B16.9-1978. It was updated by a corrective addendum, B16.9a-1981, issued in February 1982.

In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. In ASME/ANSI B16.9-1986, the text was revised and inch dimensions were established as the standard.

In 1991, the Subcommittee reviewed the document and made a number of revisions that were included in ASME B16.9-1993. Dimensions for short pattern lap joints were also added.

In ASME B16.9-2001, short radius elbows and returns were added, which included all dimensions and tolerances of ASME B16.28-1994. Metric units were provided as an independent but parallel alternative standard to U.S. customary units and a Quality System Program appendix was added.

In 2003, the Subcommittee reviewed the document and made a number of revisions. The scope of the standard was changed to permit fabricated lap joint stub ends employing circumferential or intersection welds.

This Standard was approved as an American National Standard on October 15, 2003 and December 31, 2003.

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.)

OFFICERS

H. R. Sonderegger, *Chair*
M. L. Nayyar, *Vice Chair*
P. A. Reddington, *Secretary*

COMMITTEE PERSONNEL

W. B. Bedesem, ExxonMobil Research & Engineering Co.
M. A. Clark, Nibco Inc.
A. Cohen, Arthur Cohen & Associates
C. E. Floren, Mueller Co.
D. R. Frikken, Consultant
A. Hamilton, ABS Americas
M. L. Henderson, Forgital USA
G. A. Jolly, Vogt Valves/Flowserve
M. Katcher, Haynes International
W. G. Knecht, Consultant
R. Koester, The William Powell Co.
R. D. Manning, U.S. Coast Guard
W. N. McLean, Newco Valves
T. A. McMahon, Fisher Controls International Inc.
M. L. Nayyar, Bechtel Power Corp.
J. D. Page, U.S. Nuclear Regulatory Commission
P. A. Reddington, The American Society of Mechanical Engineers
R. A. Schmidt, Trinity-Ladish
H. R. Sonderegger, Anvil International, Inc.
W. M. Stephan, Flexitallic LP
T. F. Stroud, Ductile Iron Pipe Research Association
R. E. White, Richard E. White & Associates PC
D. A. Williams, Southern Co. Services

SUBCOMMITTEE F — STEEL THREADED AND WELDED FITTINGS

G. A. Jolly, *Chair,* Vogt Valves/Flowserve
A. J. Roby, *Secretary,* The American Society of Mechanical Engineers
A. Appleton, Alloy Stainless Product Co. Inc.
G. A. Cuccio, Capital Manufacturing Co.
J. P. Ellenberger, WFI International
D. R. Frikken, Consultant
R. C. Lafferty, Penna Machine Works Inc.
D. C. Monroe, Consultant
R. A. Schmidt, Trinity-Ladish
H. R. Sonderegger, Anvil International Inc.
K. Umemura, Japan Fittings Association

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.

FACTORY-MADE WROUGHT BUTTWELDING FITTINGS

1 SCOPE

1.1 General

This Standard covers overall dimensions, tolerances, ratings, testing, and markings for wrought factory-made buttwelding fittings in sizes NPS ½ through 48 (DN 15 through 1200).

1.2 Special Fittings

Fittings may be made to special dimensions, sizes, shapes, and tolerances by agreement between the manufacturer and the purchaser.

1.3 Fabricated Fittings

Fabricated laterals and other fittings employing circumferential or intersection welds are considered pipe fabrication and are not within the scope of this Standard.

Fabricated lap joint stub ends are exempt from the above restrictions, provided they meet all the requirements of the applicable ASTM material specification listed in para. 5.

1.4 Standard Units

The values stated in either metric or U.S. customary units are to be regarded separately as standard. Within the text, the U.S. customary units are shown in parentheses. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this Standard.

The designation for size is NPS for both metric and customary dimensioned fittings. Fitting pressure rating is associated with the connecting wall thickness of pipe of equivalent size and material.

1.5 References

1.5.1 Referenced Standards. Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix II. 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 product made in conformance with a prior edition of referenced standards and in all other respects conforming to this Standard will be considered to be in conformance.

1.5.2 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, or rule governing the use of a material at low temperature.

1.6 Service Conditions

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

1.7 Welding

Installation welding requirements are outside the scope of this Standard.

1.8 Quality Systems

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

1.9 Convention

For the purpose of determining conformance with this Standard, the convention for fixing significant digits where limits (maximum or minimum values) are specified shall be rounded off as defined in ASTM E 29. This requires that an observed or calculated value shall be rounded off to the nearest unit in the last right-hand digit used in expressing the limit. Decimal values and tolerances do not imply a particular method of measurement.

1.10 Pressure Rating Designation

Class, followed by a dimensionless number, is the designation for pressure–temperature ratings. Standardized designations for flanges per ASME B16.5 referenced in this Standard are Classes 150, 300, 600, 900, 1500, and 2500.

2 PRESSURE RATINGS

2.1 Basis of Ratings

The allowable pressure ratings for fittings designed in accordance with this Standard may be calculated as for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications) in