

**ASME B16.51-2021**  
(Revision of ASME B16.51-2018)

# **Copper and Copper Alloy Press-Connect Pressure Fittings**

---

**AN AMERICAN NATIONAL STANDARD**



**The American Society of  
Mechanical Engineers**

**ASME B16.51-2021**  
(Revision of ASME B16.51-2018)

# **Copper and Copper Alloy Press-Connect Pressure Fittings**

---

**AN AMERICAN NATIONAL STANDARD**



**The American Society of  
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: February 28, 2022

The next edition of this Standard is scheduled for publication in 2026.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME B16 Committee may be published as Cases. Cases and interpretations are published on the ASME website under the Committee Pages at <http://cstools.asme.org/> as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at <http://cstools.asme.org/>. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

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  
Two Park Avenue, New York, NY 10016-5990

Copyright © 2022 by  
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
All rights reserved

# CONTENTS

|   |          |
|---|----------|
| Foreword .....  | v        |
| Committee Roster .....  | vi       |
| Correspondence With the B16 Committee .....   | vii      |
| Summary of Changes .....  | ix       |
| List of Changes in Record Number Order .....  | x        |
| <b>1</b> <b>Scope</b> .....   | <b>1</b> |
| <b>2</b> <b>General</b> .....   | <b>1</b> |
| <b>3</b> <b>Terminology</b> .....   | <b>1</b> |
| <b>4</b> <b>Size</b> .....  | <b>2</b> |
| <b>5</b> <b>Marking</b> .....   | <b>2</b> |
| <b>6</b> <b>Material</b> .....  | <b>2</b> |
| <b>7</b> <b>Laying Lengths</b> .....  | <b>2</b> |
| <b>8</b> <b>Tube Stops</b> .....  | <b>2</b> |
| <b>9</b> <b>Design</b> .....  | <b>3</b> |
| <b>10</b> <b>Threaded Ends</b> .....  | <b>3</b> |
| <b>11</b> <b>Alignment</b> .....  | <b>3</b> |
| <b>12</b> <b>Gaging</b> .....   | <b>3</b> |
| <b>13</b> <b>Installation Instructions</b> .....  | <b>4</b> |
| <b>14</b> <b>Design Qualification</b> .....   | <b>4</b> |
| <b>Mandatory Appendix</b>   |          |
| I        References .....   | 15       |
| <b>Nonmandatory Appendix</b>  |          |
| A        Quality System Program .....   | 16       |
| <b>Figures</b>  |          |
| 3.1-1    Method of Designating Laying Lengths of Fittings and Openings of Reducing Fittings ..... | 6        |
| 8-1      Tube Stops .....   | 10       |
| 11-1     Alignment .....  | 10       |
| 14.2.1-1 Test Setup for Pressure Test .....   | 10       |
| 14.4.1-1 Test Setup for Static Torque Test .....  | 11       |
| 14.5.1-1 Test Setup for Bending Test .....  | 12       |
| 14.8.1-1 Test Setup for Vibration Test .....  | 13       |
| 14.9.1-1 Test Setup for Thermocycling Test .....  | 14       |
| 14.10.1-1 Test Setup for Dynamic Torque Test .....  | 14       |

**Tables**

|          |  |    |
|----------|--|----|
| 9.1-1    | Dimensions of Press-Connect Ends . . . . . | 8  |
| 14.2.2-1 | Maximum Slippage . . . . .                 | 11 |
| 14.4.1-1 | Torque . . . . .                           | 11 |
| 14.5.1-1 | Concentrated Load . . . . .                | 12 |

# FOREWORD

Standardization of cast and wrought press-connect pressure fittings was initiated by Subcommittee J of the ASME B16 Committee in 2000. The first draft of the Standard was based on International Association of Plumbing and Mechanical Officials (IAPMO) Interim Guide Criteria IGC 137-2000. The general requirements of ASME B16.22-2000 and ASME B16.24-1998 were added to the first draft. The development of the Standard was necessary to regulate the strength of the joint in copper press-connect fittings. The performance test requirements of this Standard are an important aspect for determining the quality of the fittings.

Following approval by the Standards Committee and the ASME Board on PTCS, approval as an American National Standard was given by the American National Standards Institute (ANSI) on December 21, 2011 with the designation ASME B16.51-2011.

In the 2013 edition, provisions were included to recognize low-lead alloys to comply with an amendment to the U.S. Safe Drinking Water Act that went into effect in January 2014. Following approval by the ASME B16 Standards Committee, approval as an American National Standard was given by ANSI on July 29, 2013 with the designation ASME B16.51-2013.

In the 2018 edition, the acceptance criteria for the maximum slippage of the fitting during hydrostatic testing was revised for the  $\frac{3}{4}$ -in. nominal size to reflect the appropriate correlation to tube diameter used for all other fitting sizes. Also, in response to an inquiry on the test requirements for the elastomeric sealing components, para. 6.3 was revised to change the durometer values from a nominal value with tolerances to an absolute minimum value of 55 points on the Shore A scale. In addition, tolerances were added to all of the dimensional requirements shown in the figures throughout the Standard. The U.S. Customary tables formerly in Mandatory Appendix I were merged with the SI tables in the main text; the tables and figures were redesignated, Mandatory Appendix I was deleted, and the cross-references were updated accordingly. In addition, all reference standards in what was formerly Mandatory Appendix II were updated. Following approval by the ASME B16 Standards Committee, ASME B16.51-2018 was approved by ANSI on September 6, 2018.

In this 2021 edition, paras. 3.2, 6.1, and 6.3 have been revised and the references in Mandatory Appendix I have been updated. Following approval by the ASME B16 Standards Committee, ASME B16.21-2021 was approved by ANSI on November 12, 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.)

### STANDARDS COMMITTEE OFFICERS

**C. E. Davila**, *Chair*  
**R. M. Bojarczuk**, *Vice Chair*  
**S. J. Rossi**, *Secretary*

### STANDARDS COMMITTEE PERSONNEL

|   |  |
|---|--|
| <b>A. Appleton</b> , Alloy Stainless Products Co., Inc.         | <b>T. A. McMahon</b> , Emerson Automation Solutions  |
| <b>J. E. Barker</b> , DeZURIK, Inc.                             | <b>R. C. Merrick</b> , Consultant  |
| <b>R. W. Barnes</b> , ANRIC Enterprises, Inc.                   | <b>W. H. Patrick</b> , Dow Chemical Co.  |
| <b>D. C. Bayreuther</b> , Neles Corp.                           | <b>D. W. Raho</b> , CCM 2000   |
| <b>W. B. Bedesem</b> , Consultant                               | <b>D. F. Reid</b> , VSP Technologies   |
| <b>R. M. Bojarczuk</b> , Retired                                | <b>S. J. Rossi</b> , The American Society of Mechanical Engineers                            |
| <b>A. M. Cheta</b> , Shell Global Solutions (U.S.)              | <b>R. A. Schmidt</b> , Canadoil  |
| <b>M. A. Clark</b> , NIBCO, Inc.                                | <b>J. Sekerak</b> , CSA Group  |
| <b>G. A. Cuccio</b> , Capitol Manufacturing Co.                 | <b>F. R. Volgstadt</b> , Volgstadt and Associates, Inc.                                      |
| <b>C. E. Davila</b> , Crane Chempharma and Energy               | <b>F. Feng</b> , <i>Delegate</i> , China Productivity Center for Machinery                   |
| <b>K. S. Felder</b> , Valero Energy                             | <b>J. D. Grant</b> , <i>Alternate</i> , DeZURIK, Inc.  |
| <b>D. R. Frikken</b> , Becht Engineering Co., Inc.              | <b>P. V. Craig</b> , <i>Contributing Member</i> , Jomar Group                                |
| <b>J. R. Holstrom</b> , Val-Matic Valve and Manufacturing Corp. | <b>B. G. Fabian</b> , <i>Contributing Member</i> , Pennsylvania Machine Works                |
| <b>D. Hunt, Jr.</b> , Fastenal                                  | <b>A. G. Kireta, Jr.</b> , <i>Contributing Member</i> , Copper Development Association, Inc. |
| <b>G. A. Jolly</b> , Samshin, Ltd.                              |  |
| <b>E. J. Lain</b> , Exelon Nuclear                              |  |

### SUBCOMMITTEE J — COPPER AND COPPER ALLOY FLANGES, FLANGED FITTINGS, AND SOLDER-JOINT FITTINGS

|  |  |
|--|--|
| <b>A. G. Kireta, Jr.</b> , <i>Chair</i> , Copper Development Association, Inc.         | <b>D. Hunt, Jr.</b> , Fastenal                               |
| <b>W. E. Chapin</b> , <i>Vice Chair</i> , Professional Code Consulting, LLC            | <b>R. Kelsey</b> , NIBCO, Inc.                               |
| <b>R. R. Rahaman</b> , <i>Secretary</i> , The American Society of Mechanical Engineers | <b>C. A. Mueller</b> , Mueller Streamline Co.                |
| <b>J. A. Ballanco</b> , JB Engineering and Code Consulting, PC                         | <b>F. Shingleton</b> , Viega, LLC                            |
| <b>D. R. Frikken</b> , Becht Engineering Co., Inc.                                     | <b>J. C. Gast</b> , <i>Alternate</i> , Mueller Fittings      |
|  | <b>J. Atkinson</b> , <i>Contributing Member</i> , Consultant |

# 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 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](mailto: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 B16.51-2021

## SUMMARY OF CHANGES

Following approval by the ASME B16 Standards Committee and ASME, and after public review, ASME B16.51-2021 was approved by the American National Standards Institute on November 12, 2021.

ASME B16.51-2021 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.

| <i>Page</i> | <i>Location</i>      | <i>Change (Record Number)</i>   |
|-------------|----------------------|---|
| 1           | 3.2                  | (1) First sentence editorially revised<br>(2) Definition of <i>wrought</i> added (18-106) |
| 2           | 6.1                  | In subpara. (b), first sentence revised (18-106)  |
| 2           | 6.3                  | Subparagraph (b) revised (18-1388)  |
| 15          | Mandatory Appendix I | References updated (20-300)   |

## LIST OF CHANGES IN RECORD NUMBER ORDER

| <u>Record Number</u> | <u>Change</u>   |
|----------------------|---|
| 18-106               | Added definition of <i>wrought</i> in para. 3.2, and revised the material requirements in para. 6.1(b) to allow the use of a forged, lead-free, copper alloy. |
| 18-1388              | Revised the special requirements (Z2) for compression set testing on elastomers (seals) in para. 6.3(b).  |
| 20-300               | Updated references in Mandatory Appendix I.   |

# COPPER AND COPPER ALLOY PRESS-CONNECT PRESSURE FITTINGS

## 1 SCOPE

This Standard establishes requirements for cast copper alloy, wrought copper, and wrought copper alloy press-connect pressure fittings for use with hard-drawn seamless copper water tube conforming to ASTM B88 for piping systems conveying water. The press-connect system (tube, fitting, and joint) conforming to this Standard is for use at a maximum pressure of 1 380 kPa (200 psi) over the temperature range from 0°C to 93°C (32°F to 200°F).

This Standard provides requirements for fittings suitable for press-connect joining and covers the following:

- (a) terminology
- (b) size designations
- (c) marking
- (d) material
- (e) dimensions and tolerances
- (f) required installation instructions
- (g) pressure-temperature ratings
- (h) design qualification

## 2 GENERAL

### 2.1 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 or calculated value be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerances do not imply a particular method of measurement.

### 2.2 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. 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.

## 2.3 References

Codes, standards, and specifications containing provisions to the extent referenced herein constitute requirements of this Standard. These referenced documents are listed in [Mandatory Appendix I](#).

## 2.4 Quality Systems

Requirements relating to the product manufacturer's Quality System Program are described in [Nonmandatory Appendix A](#).

## 3 TERMINOLOGY

### 3.1 Abbreviations

The following abbreviations are used to designate the type of fitting end as shown in [Figure 3.1-1](#):

F = internal ASME B1.20.1 taper pipe-thread end (NPTI)

FTG = solder-joint fitting end made to copper tube outside diameter

M = external ASME B1.20.1 taper pipe-thread end (NPTE)

P = internal press-connect joint end made to receive copper tube diameter

### 3.2 Definitions

(21)

The following defines the terms used in this Standard:

*joining, press-connect*: the act of joining a fitting or piping component to a tube by use of a tool that mechanically compresses the wall of the fitting end over the tubing, encasing an elastomeric seal between the mating surfaces.

*out-of-roundness*: the maximum measured diameter minus the minimum measured diameter.

*press-connect fitting*: a type of piping component (e.g., coupling, tee, elbow) used to connect tubing or other accessories by mechanically compressing the wall of the fitting end over the tube, using an elastomeric material to provide a seal between the inside surface of the fitting and the outside surface of the tube.

*wrought*: describing metal that is worked in solid form to form shapes or individual parts including but not limited to tubular shapes, bars, and forgings.