ASME B16.50-2018
(Revision of ASME B16.50-2013)

Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME B16.50-2018
(Revision of ASME B16.50-2013)

Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: August 31, 2018

The next edition of this Standard is scheduled for publication in 2023.

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.

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

CONTENTS

FOREWORD

In 1994, the ASME B16 Standards Committee authorized Subcommittee J, Standardization, to develop a standard for wrought copper and copper alloy braze-joint pressure fittings. These fittings are intended for use with seamless copper tube conforming to the standard specifications ASTM B88 (for water and general plumbing systems), ASTM B280 (for air conditioning and refrigeration service), and ASTM B819 (for medical gas systems). Following approval by the Standards Committee and ASME, this Standard was approved as an American National Standard on October 11, 2001, with the designation ASME B16.50-2001.

In the 2013 edition, references to ASME standards were revised to no longer list specific edition years; the latest edition of ASME publication applies, unless stated otherwise. Also in the 2013 edition, Tables 3 and I-3 included a maximum cup length under the column heading shown as "Depth, *G*." Following approval by the B16 Standards Committee and the ASME supervisory board, and after public review, the 2013 edition of the Standard was approved as an American National Standard by the American National Standards Institute (ANSI) on May 28, 2013.

In this 2018 edition, the U.S. Customary tables formerly in Mandatory Appendix I have been merged with the SI tables in the main text; the tables and figures have been redesignated, Mandatory Appendix I has been deleted, and the cross-references have been updated accordingly. In addition, all reference standards in what was formerly Mandatory Appendix II were updated; no additional/technical changes were made to the Standard. Following approval by the ASME B16 Standards Committee, approval as an American National Standard was given by ANSI on July 27, 2018, with the new designation ASME B16.50-2018.

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

R. Bojarczuk, *Chair*
C. Davila, *Vice Chair*
C. R. Ramcharran, *Secretary*

STANDARDS COMMITTEE PERSONNEL

A. Appleton, Alloy Stainless Products Co., Inc.
J. E. Barker, Dezurik Water Controls
K. Barron, Ward Manufacturing, LLC
D. C. Bayreuther, Metso Automation
W. Bedesem, Consultant
R. Bojarczuk, ExxonMobil Research and Engineering Co.
A. Cheta, Qatar Shell GTL
M. Clark, Consultant
G. A. Cuccio, Capitol Manufacturing Co.
J. D'Avanzo, Fluoroseal Valves
C. Davila, Crane Energy
K. S. Felder, Valero Energy
D. Frikken, Becht Engineering Co.
D. Hunt, Jr., Fastenal
G. Jolly, Samshin Ltd.
E. J. Lain, Exelon Nuclear
T. A. McMahon, Emerson Process Management
R. C. Merrick, Fluor Enterprises
M. Nayyar, NICE
W. H. Patrick, The Dow Chemical Co.
D. Rahoi, Consultant
C. R. Ramcharran, The American Society of Mechanical Engineers
D. F. Reid, WSP Technologies
R. Schmidt, Canadoil
J. Tucker, Flowserve
F. Volgstadt, Volgstadt & Associates, Inc.
F. Feng, *Delegate,* China Productivity Center for Machinery National Technical Committee
R. Barnes, *Contributing Member,* Anric Enterprises, Inc.
P. V. Craig, *Contributing Member,* Jomar Group
B. G. Fabian, *Contributing Member,* Pennsylvania Machine Works
A. G. Kireta, Jr., *Contributing Member,* Copper Development Association, Inc.

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

A. G. Kireta, Jr., *Chair,* Copper Development Association, Inc.
M. Clark, *Vice Chair,* Consultant
J. Oh, *Secretary,* The American Society of Mechanical Engineers
J. Atkinson, Mueller Industries
J. A. Ballanco, JB Engineering and Code Consulting, PC
S. L. Cavanaugh, Cavanaugh Consulting
W. E. Chapin, Professional Code Consulting, LLC
D. Frikken, Becht Engineering Co.
C. A. Mueller, Mueller Industries, Inc.
F. Shingleton, Viega, LLC
G. Morgan, *Alternate,* Viega, LLC

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, 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 B16.50-2018
SUMMARY OF CHANGES

Following approval by the ASME B16 Standards Committee and ASME, and after public review, ASME B16.50-2018 was approved by the American National Standards Institute on July 27, 2018.

In ASME B16.50-2018, the U.S. Customary tables formerly in Mandatory Appendix I have been merged with the SI tables in the main text; the tables and figures have been redesignated, Mandatory Appendix I has been deleted, and the cross-references have been updated accordingly. In addition, this edition includes the following changes identified by a margin note, **(18)**. The Record Number listed below is explained in more detail in the "List of Changes in Record Number Order" following this Summary of Changes.

Page	*Location*	*Change (Record Number)*
1	2.1	Title updated editorially for consistency with other B16 standards
2	6	Editorially revised
4	Table 3.1-1	Under "Internal End" column, SI value for minimum "Inside Diameter, *F*" revised
10	Mandatory Appendix I	Formerly Mandatory Appendix II, updated *(18-801)*
11	Nonmandatory Appendix A	In the nomenclature, definition of *t* editorially revised

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
18-801	Updated references in Mandatory Appendix I, formerly Mandatory Appendix II.

INTENTIONALLY LEFT BLANK

WROUGHT COPPER AND COPPER ALLOY BRAZE-JOINT PRESSURE FITTINGS

1 SCOPE

This Standard establishes requirements for wrought copper and wrought copper alloy braze-joint seamless fittings designed for use with seamless copper tube conforming to ASTM B88 (for water and general plumbing systems), ASTM B280 (for air conditioning and refrigeration service), and ASTM B819 (for medical gas systems).

This Standard covers joints assembled with brazing materials conforming to AWS A5.8M/A5.8.

This Standard is allied to ASME B16.18 and ASME B16.22. It provides requirements for fitting ends suitable for brazing. This Standard covers

(a) pressure–temperature ratings
(b) abbreviations for end connections
(c) size and method of designating openings of fittings
(d) marking
(e) material
(f) dimensions and tolerances
(g) testing

2 GENERAL

(18) 2.1 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. Within the text, 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.

2.2 References

Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix I, 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 I.

2.3 Quality Systems

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

3 PRESSURE–TEMPERATURE RATINGS

3.1 Rating of System

The internal pressure–temperature rating for a braze joint system is dependent on not only fitting and tube strength but also selection of valves and appurtenances. Pressure–temperature ratings for fittings and braze joints to the dimensions of Table 3.1-1, made with typical commercial brazing materials, shall be considered equal to the values given in Table 3.1-2.

The internal pressure–temperature rating of the system shall be the lowest of the values shown in Table 3.1-2 and those of the tube, valves, or appurtenances.

3.2 Fitting Bursting Strength

Fittings manufactured to this Standard shall have an ambient-temperature bursting strength of at least 4 times the 38°C (100°F) internal pressure rating as shown in Table 3.1-2.

4 SCOPE

4.1 Size

The size of the fittings shown in Table 3.1-1 corresponds to standard water tube size as shown in ASTM B88. The size of the threaded ends corresponds to nominal pipe size as shown in ASME B1.20.1. Fittings are designated by the size of the openings in the sequence illustrated in Figure 4.1-1.

4.2 Abbreviations

The following symbols are used to designate the type of fitting end:

C*:* braze-joint fitting end made to receive copper tube diameter (female)

F*:* internal ANSI standard taper pipe-thread end (female) NPTI FT

FTG*:* braze-joint fitting end made to copper tube diameter (male)

M*:* external ANSI standard taper pipe-thread end (male) NPTE

4.3 Definitions

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

ovality: the elliptical condition associated with out-of-roundness.

5 MARKING

Each fitting shall be permanently marked with the manufacturer's name or trademark in accordance with MSS SP-25 and the letters "BZ" in uppercase. Marking on fittings less than size ½ or on any fitting where it would damage the brazing surfaces is not required.

(18) 6 MATERIAL

(a) Fittings shall be made from copper UNS No. C10200, C12000, or C12200 or copper alloy UNS No. C23000, for which allowable stresses are found in ASME B31.1, ASME B31.9, or ASME Boiler and Pressure Vessel Code, Section II, Part D.

(b) Other coppers and copper alloys are permitted, provided

(1) they meet the chemical requirements of 84% minimum copper and 16% maximum zinc

(2) the fittings produced from the copper alloy meet all the mechanical and corrosion-resistant properties for the end purposes of the fittings

The composition of the copper alloys shall contain nothing that will inhibit joining to the tube or to other fittings.

7 LAYING LENGTHS

Due to widely varying manufacturing processes, meaningful laying length requirements of fittings cannot be established. Consult the manufacturer for these dimensions.

8 TUBE STOPS

Except for repair couplings, fittings shall be manufactured with a tube stop. Repair couplings shall not require a tube stop. The tube stop shall control joint length, even with an external (FTG) end having the minimum outside diameter shown in Table 3.1-1. Examples of various tube stop configurations are shown in Figure 8-1.

9 INSPECTION TOLERANCE

9.1 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.

9.2 Linear Dimensions

An inspection tolerance, as shown in Table 9.2-1, shall be allowed on center-to-shoulder, center-to-center, center-to-threaded-end, and shoulder-to-threaded-end dimensions on all fittings having internal (C) braze ends, as well as on center-to-braze-end and braze-end-to-threaded-end dimensions on all fittings having external (FTG) braze ends. Coupling inspection limits for shoulder-to-shoulder and shoulder-to-end dimensions shall be double those shown in Table 9.2-1, except that the minus tolerance applied to dimension L (Figure 4.1-1) shall not result in a dimension less than 1.5 mm (0.06 in.). The largest opening in the fitting shall govern the tolerance to be applied to all openings.

9.3 Ovality of Fitting End (C or FTG)

Maximum ovality of the fitting braze-joint end shall not exceed 1% of the maximum diameters shown in Table 3.1-1. The average of the maximum and minimum diameters shall be within the dimensions shown in the table.

9.4 Inside Diameter of Fitting

The minimum cross-sectional area of the inside diameter through the fitting body shall not be less than the theoretical minimum area defined by diameter O in Table 3.1-1. The out-of-roundness condition of the cross-sectional area shall not exceed the value shown in Table 3.1-1.

For reducer or adapter fittings, the smallest end diameter shall apply, provided that this diameter does not restrict the other outlets.

9.5 Wall Thickness

The minimum wall thickness shall not be less than shown in Table 3.1-1.

10 THREADED ENDS

Fitting threads shall be right-hand, conforming to ASME B1.20.1. They shall be taper threads (NPT).

10.1 Countersink or Chamfer

All internal threads shall be countersunk a distance no less than one-half the pitch of the thread, at an angle of approximately 45 deg with the axis of the thread. All external threads shall be chamfered at an angle of 30 deg to 45 deg from the axis. Countersinking and chamfering shall be concentric with the threads.

The length of threads shall be measured to include the countersink or chamfer.

10.2 Threading Tolerances

Tapered pipe threads (NPT) shall be checked by use of plug or ring gages in either standard or limit types. When gaging internal taper threads, the plug gage shall be screwed hand-tight into the fitting. The reference point for gaging internal product threads depends on the chamfer diameter. When the internal chamfer diameter exceeds the major diameter of the internal thread, the reference point shall be the last thread scratch on the chamfer cone. Otherwise, when the internal chamfer diameter does not exceed the major diameter of the internal thread, the reference point shall be the end of the fitting. In gaging external taper threads, the ring gage shall be screwed hand-tight on the external thread. On the external thread, the ring gage shall be flush with the end of the thread.

Tolerance for an internally threaded end having an internal shoulder shall be from the gage reference point (notch) to one turn small. Tolerance for an internally threaded end without a shoulder, and for an externally threaded end, shall be from one turn small to one turn large.

10.3 Design of Threaded Ends

The wrenching section of internally threaded ends shall be polygonal, and the wrenching section of externally threaded ends shall be furnished with either polygon or flats, at the manufacturer's option.

11 ALIGNMENT

The maximum allowable deviation in the angular alignment of any end from the specified axis position shall be $\frac{1}{2}$ deg (1 deg total) (see Figure 11-1).

12 GAGING

12.1 Preferred Gaging Method of Braze-Joint Ends

The preferred method of gaging the diameter tolerances for external and internal ends shall be by the use of plain plug and ring gages designed to hold the product within the limits established in Table 3.1-1. Gage tolerances shall be Class ZM, as defined in ANSI B4.4M.

12.2 Optional Gaging Method of Braze-Joint Ends

For gaging the diameter tolerance of external and internal ends, the use of direct reading instruments instead of ring and plug gages as specified in para. 12.1 shall be permitted. When gaging the diameters of external and internal ends using direct reading instruments, refer to para. 9.3.

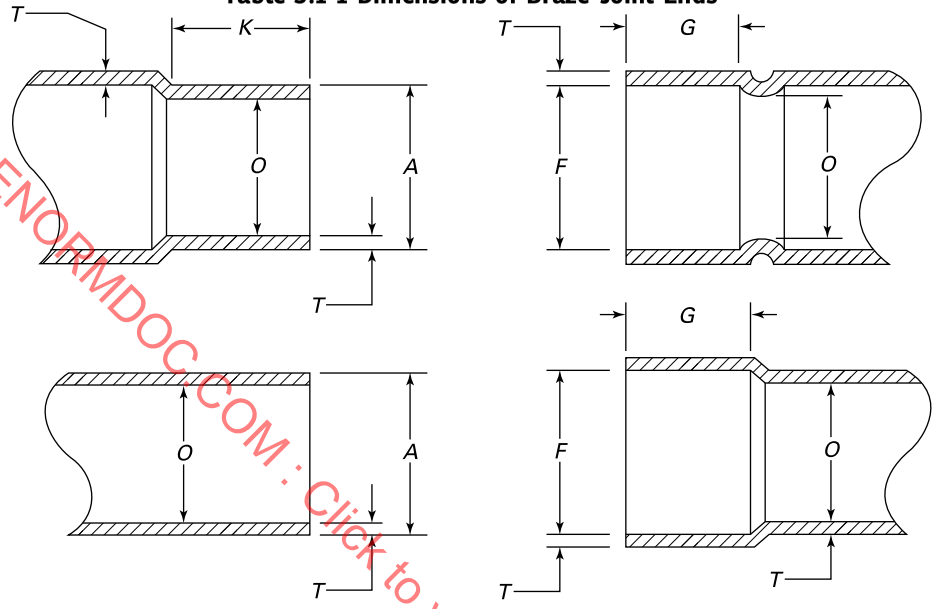
12.3 Standard Gaging Method of Threaded Ends

The standard method of gaging the externally and internally threaded ends shall be in accordance with the requirements of ASME B1.20.1.

NOTE: In gaging pipe threads, it is acceptable and common practice to rap or tap the part to ensure proper seating of the gage. However, it is first necessary to clean both the gage and product threads to ensure that they are free of chips, burrs, abrasives, or other foreign materials.

(18)

Table 3.1-1 Dimensions of Braze-Joint Ends



MALE END (FTG)

FEMALE END (C)

Standard Water Tube Size [Note (1)]	External End: Outside Diameter, *A*, mm (in.) [Note (2)] Min.	External End: Outside Diameter, *A*, mm (in.) [Note (2)] Max.	External End: Minimum Length, *K*, mm (in.) [Note (3)]	Internal End: Inside Diameter, *F*, mm (in.) [Note (2)] Min.	Internal End: Inside Diameter, *F*, mm (in.) [Note (2)] Max.	Internal End: Depth, *G*, mm (in.) [Note (4)] Min.	Internal End: Depth, *G*, mm (in.) [Note (4)] Max.	Minimum Wall Thickness, *T*, mm (in.)	Inside Diameter of Fitting, *O*, mm (in.) Minimum Diameter	Inside Diameter of Fitting, *O*, mm (in.) Maximum Out-of-Round
1/8 [Note (5)]	6.30 (0.248)	6.38 (0.251)	5.1 (0.20)	6.40 (0.252)	6.50 (0.256)	3.8 (0.15)	5.70 (0.23)	0.48 (0.019)	4.6 (0.18)	0.5 (0.02)
3/16 [Note (6)]	7.87 (0.310)	7.95 (0.313)	5.1 (0.20)	7.98 (0.314)	8.08 (0.318)	4.1 (0.16)	6.15 (0.24)	0.58 (0.023)	6.1 (0.24)	0.6 (0.02)
1/4	9.47 (0.373)	9.55 (0.376)	5.8 (0.23)	9.58 (0.377)	9.68 (0.381)	4.3 (0.17)	6.45 (0.26)	0.58 (0.023)	7.6 (0.30)	0.8 (0.03)
3/8	12.62 (0.497)	12.73 (0.501)	6.6 (0.26)	12.75 (0.502)	12.85 (0.506)	5.1 (0.20)	7.65 (0.30)	0.66 (0.026)	9.9 (0.39)	1.0 (0.04)
1/2	15.80 (0.622)	15.90 (0.626)	7.1 (0.28)	15.93 (0.627)	16.03 (0.631)	5.6 (0.22)	8.40 (0.33)	0.74 (0.029)	13.2 (0.52)	1.3 (0.05)
5/8	18.97 (0.747)	19.08 (0.751)	7.6 (0.30)	19.10 (0.752)	19.20 (0.756)	6.1 (0.24)	9.15 (0.36)	0.79 (0.031)	16.0 (0.63)	1.6 (0.06)
3/4	22.15 (0.872)	22.25 (0.876)	7.9 (0.31)	22.28 (0.877)	22.38 (0.881)	6.4 (0.25)	9.60 (0.38)	0.84 (0.033)	18.8 (0.74)	1.9 (0.07)
1	28.50 (1.122)	28.63 (1.127)	8.6 (0.34)	28.65 (1.128)	28.75 (1.132)	7.1 (0.28)	10.65 (0.42)	1.02 (0.040)	24.9 (0.98)	2.5 (0.10)
1 1/4	34.85 (1.372)	34.98 (1.377)	9.4 (0.37)	35.00 (1.378)	35.10 (1.382)	7.9 (0.31)	11.85 (0.47)	1.12 (0.044)	31.2 (1.23)	3.1 (0.12)
1 1/2	41.17 (1.621)	41.33 (1.627)	10.2 (0.40)	41.35 (1.628)	41.48 (1.633)	8.6 (0.34)	12.90 (0.51)	1.30 (0.051)	37.3 (1.47)	3.7 (0.15)

Table 3.1-1 Dimensions of Braze-Joint Ends (Cont'd)

Standard Water Tube Size [Note (1)]	External End			Internal End				Minimum Wall Thickness, *T*, mm (in.)	Inside Diameter of Fitting, *O*, mm (in.)	
	Outside Diameter, *A*, mm (in.) [Note (2)]		Minimum Length, *K*, mm (in.) [Note (3)]	Inside Diameter, *F*, mm (in.) [Note (2)]		Depth, *G*, mm (in.) [Note (4)]			Minimum Diameter	Maximum Out-of-Round
	Min.	Max.		Min.	Max.	Min.	Max.			
2	53.87 (2.121)	54.03 (2.127)	11.9 (0.47)	54.05 (2.128)	54.18 (2.133)	10.2 (0.40)	15.30 (0.60)	1.50 (0.059)	49.3 (1.94)	4.9 (0.19)
2½	66.57 (2.621)	66.73 (2.627)	13.5 (0.53)	66.75 (2.628)	66.88 (2.633)	11.9 (0.47)	17.85 (0.71)	1.70 (0.067)	61.5 (2.42)	6.1 (0.24)
3	79.27 (3.121)	79.43 (3.127)	15.0 (0.59)	79.45 (3.128)	79.58 (3.133)	13.5 (0.53)	20.25 (0.80)	1.91 (0.075)	73.4 (2.89)	7.3 (0.29)
3½	91.97 (3.621)	92.13 (3.627)	16.5 (0.65)	92.15 (3.628)	92.28 (3.633)	14.0 (0.59)	21.00 (0.89)	2.18 (0.086)	85.6 (3.37)	8.6 (0.34)
4	104.67 (4.121)	104.83 (4.127)	18.3 (0.72)	104.85 (4.128)	104.98 (4.133)	16.3 (0.64)	24.45 (0.96)	2.44 (0.096)	97.5 (3.84)	9.8 (0.38)
5	130.07 (5.121)	130.23 (5.127)	20.6 (0.81)	130.25 (5.128)	130.38 (5.133)	18.5 (0.73)	27.75 (1.10)	2.82 (0.111)	119.4 (4.70)	11.9 (0.47)
6	155.47 (6.121)	155.63 (6.127)	23.9 (0.94)	155.65 (6.128)	155.78 (6.133)	21.1 (0.83)	31.65 (1.25)	3.15 (0.124)	145.3 (5.72)	14.5 (0.57)
8	206.22 (8.119)	206.43 (8.127)	32.5 (1.28)	206.45 (8.128)	206.58 (8.133)	29.7 (1.17)	44.55 (1.76)	4.39 (0.173)	191.8 (7.55)	19.2 (0.76)

GENERAL NOTE: Drawings and designs of fittings are illustrative only. Dimensions herein shall govern in all cases.

NOTES:
(1) For size designation of fittings, see para. 4.1.
(2) For ovality, see para. 9.3.
(3) The distance from the point of tangency, at the gage I.D. to the gage line, shall be equal to the dimension shown under "Length, *K*."
(4) The distance from the point of tangency, at the gage O.D. to the gage line, shall be equal to the dimension shown under "Depth, *G*."
(5) ⅛ nominal size is ¼ O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.
(6) 3⁄16 nominal size is 5⁄16 O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.

Table 3.1-2 Internal Pressure–Temperature Ratings for Copper Fittings, kPa (psi)

Standard Water Tube Size [Note (1)]	−29°C to 38°C (−20°F to 100°F)	66°C (150°F)	93°C (200°F)	121°C (250°F)	149°C (300°F)	177°C (350°F)	204°C (400°F)
1/8 [Note (2)]	9 690 (1,405)	8 240 (1,195)	7 750 (1,125)	7 750 (1,125)	7 590 (1,100)	6 460 (935)	4 840 (700)
3/16 [Note (3)]	7 630 (1,105)	6 490 (940)	6 110 (885)	6 110 (885)	5 980 (865)	5 090 (735)	3 810 (550)
1/4	6 280 (910)	5 340 (770)	5 020 (725)	5 020 (725)	4 920 (710)	4 190 (605)	3 140 (455)
3/8	5 360 (775)	4 560 (660)	4 290 (620)	4 290 (620)	4 200 (610)	3 570 (515)	2 680 (385)
1/2	4 970 (720)	4 220 (610)	3 980 (575)	3 980 (575)	3 890 (565)	3 310 (480)	2 480 (360)
5/8	4 350 (630)	3 700 (535)	3 480 (505)	3 480 (505)	3 410 (490)	2 900 (420)	2 170 (315)
3/4	4 010 (580)	3 410 (490)	3 210 (465)	3 210 (465)	3 140 (455)	2 670 (385)	2 000 (290)
1	3 400 (490)	2 890 (420)	2 720 (395)	2 720 (395)	2 660 (385)	2 270 (325)	1 700 (245)
1 1/4	3 020 (435)	2 570 (370)	2 420 (350)	2 420 (350)	2 370 (340)	2 010 (290)	1 510 (215)
1 1/2	2 810 (405)	2 390 (345)	2 250 (325)	2 250 (325)	2 200 (315)	1 870 (270)	1 400 (200)
2	2 500 (360)	2 130 (305)	2 000 (290)	2 000 (290)	1 960 (280)	1 670 (240)	1 250 (180)
2 1/2	2 310 (335)	1 960 (285)	1 850 (265)	1 850 (265)	1 810 (260)	1 540 (220)	1 150 (165)
3	2 180 (315)	1 850 (265)	1 740 (250)	1 740 (250)	1 710 (245)	1 450 (210)	1 090 (155)
3 1/2	2 090 (300)	1 770 (255)	1 670 (240)	1 670 (240)	1 630 (235)	1 390 (200)	1 040 (150)
4	2 020 (290)	1 710 (245)	1 610 (230)	1 610 (230)	1 580 (225)	1 340 (195)	1 010 (145)
5	1 850 (265)	1 570 (225)	1 480 (215)	1 480 (215)	1 450 (210)	1 230 (175)	920 (130)
6	1 720 (250)	1 460 (210)	1 380 (200)	1 380 (200)	1 350 (195)	1 150 (165)	860 (125)
8	1 860 (270)	1 580 (225)	1 490 (215)	1 490 (215)	1 460 (210)	1 240 (180)	930 (135)

GENERAL NOTES:

(a) The fitting pressure–temperature rating applies to the largest opening of the fitting.

(b) The fitting pressure–temperature rating is calculated, as shown in Nonmandatory Appendix A, then rounded down to the nearest unit of 10.

NOTES:

(1) For size designation of fittings, see para. 4.1.

(2) 1/8 nominal size is 1/4 O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.

(3) 3/16 nominal size is 5/16 O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.

Figure 4.1-1 Method of Designating Laying Lengths of Fittings and Openings of Reducing Fittings

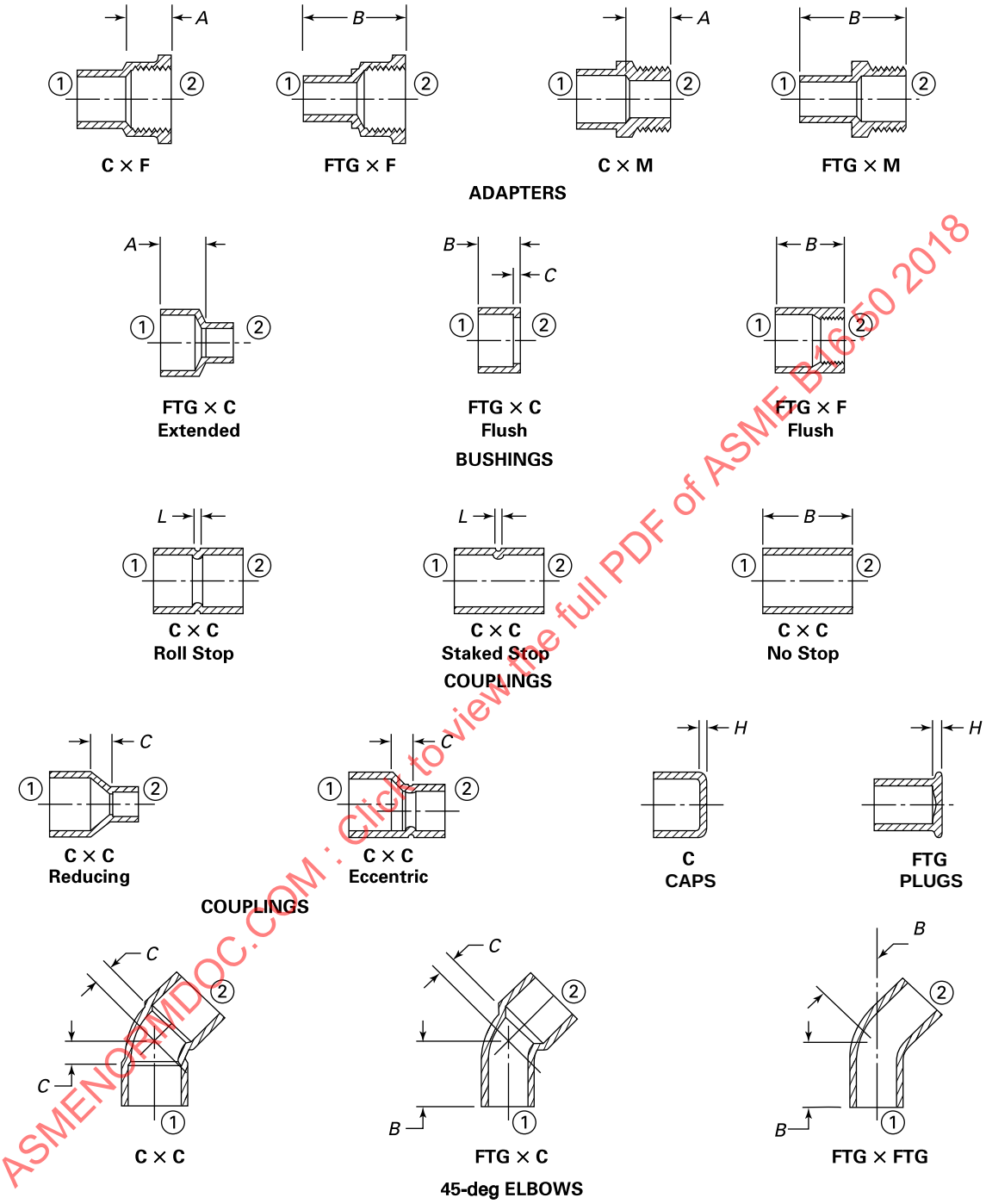
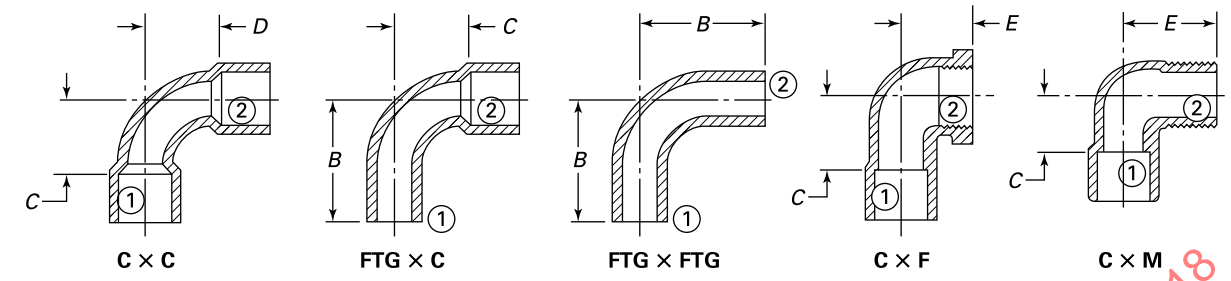
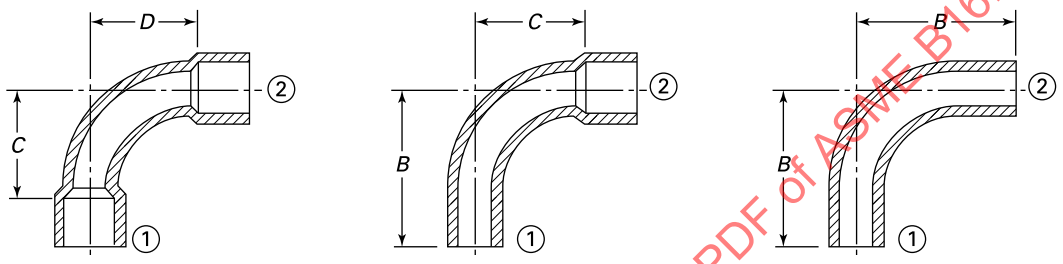


Figure 4.1-1 Method of Designating Laying Lengths of Fittings and Openings of Reducing Fittings (Cont'd)



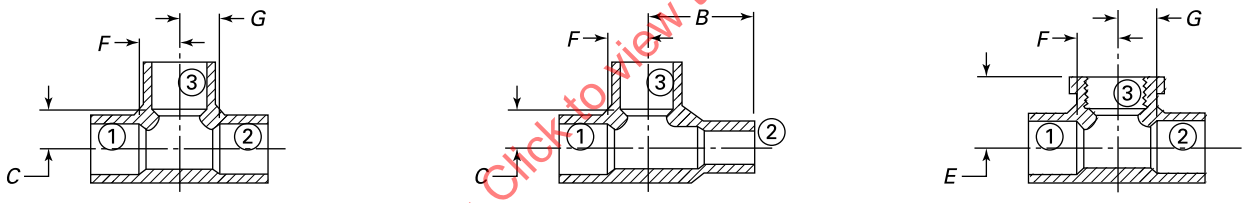
C × C FTG × C FTG × FTG C × F C × M

90-deg ELBOWS — SHORT RADIUS



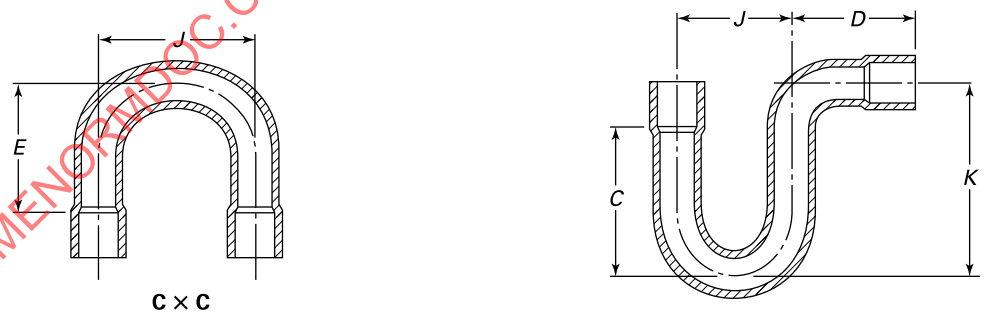
C × C FTG × C FTG × FTG

90-deg ELBOWS — LONG RADIUS



C × C × C C × FTG × C C × C × F

TEES

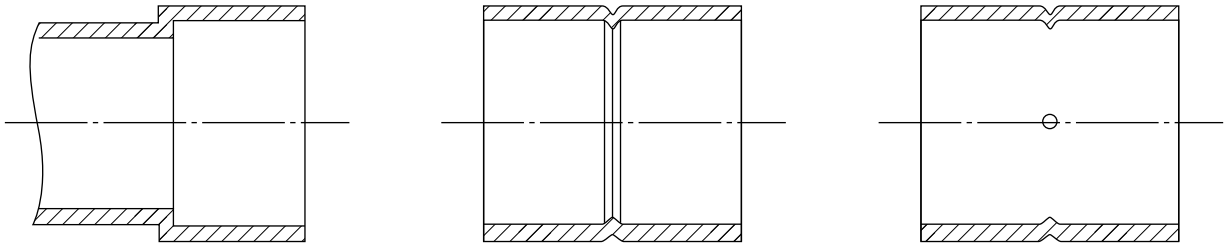


C × C RETURN BENDS

C × C SUCTION LINE P-TRAPS

GENERAL NOTES:
(a) Fittings are designated by size in the order: 1 × 2 × 3.
(b) Fitting designs and drawings are illustrative only.

Figure 8-1 Tube Stops



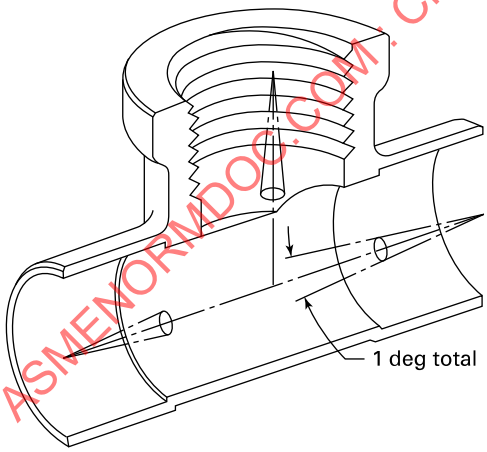
GENERAL NOTES: Figure 8-1 is for information only; the shape and number of abutments are at the manufacturer's discretion.

Table 9.2-1 Inspection Tolerance

Standard Water Tube and Pipe Thread Sizes	Tolerance, Plus or Minus, mm (in.)
1/8 [Note (1)], 3/16 [Note (2)], 1/4, 3/8	1.3 (0.05)
1/2, 5/8, 3/4	1.5 (0.06)
1, 1 1/4, 1 1/2, 2	2.0 (0.08)
2 1/2, 3, 3 1/2	2.8 (0.11)
4 and 5	3.0 (0.12)
6 and 8	4.1 (0.16)

NOTES:
(1) 1/8 nominal size is 1/4 O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.
(2) 3/16 nominal size is 5/16 O.D. seamless copper tube for refrigeration service, etc., as listed in ASTM B280.

Figure 11-1 Alignment



GENERAL NOTE: Figure 11-1 is for illustration only.