Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings

Draft Date 06/2021
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

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.
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This Standard establishes requirements for wrought copper and wrought copper alloy brazed joint seamless pressure fittings designed for use by brazing 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).

Fittings made in accordance with this Standard are intended to be assembled with brazing materials conforming to AWS A5.8M/A5.8.

This Standard is allied to ASME B16.18 for cast copper alloy pressure fittings and ASME B16.22 for wrought fittings that can be used with soldering or brazing.

This Standard provides requirements for fitting ends of suitable depth to only be joined by brazing. Fittings manufactured to this standard are not suitable for joining by soldering. When soldering is the desired joining method, use fittings manufactured to ASME B16.22 or B16.18.

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
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 \( \frac{1}{2} \) or on any fitting where it would damage the brazing surfaces is not required.

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.
The following is a list of publications referenced in this Standard. Unless otherwise specified, the latest edition of ASME publications shall apply. Materials manufactured to other editions of the referenced ASTM standards shall be permitted to be used to manufacture fittings meeting the requirements of this Standard as long as the fitting manufacturer verifies the material meets the requirements of the referenced edition.

ANSI B4.4M, Inspection of Workpieces
Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.org)

ASME B1.20.1, Pipe Threads, General Purpose (Inch)
ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
ASME B31.1, Power Piping
ASME B31.9, Building Services Piping
ASME Boiler and Pressure Vessel Code, Section II, Materials, Part D — Properties
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ASTM B88-16, Standard Specification for Seamless Copper Water Tube
ASTM B280-16, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B819-00 (2011), Standard Specification for Seamless Copper Tube for Medical Gas Systems
ASTM E29-13, Standard Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications
Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

AWS A5.8M/A5.8:2011-AMD 1, Specification for Filler Metals for Brazing and Braze Welding
Publisher: American Welding Society (AWS), 8669 NW 36 Street, No. 130, Miami, FL 33166 (www.aws.org)

ISO 9000:2015, Quality management systems — Fundamentals and vocabulary
ISO 9001:2015, Quality management systems — Requirements
ISO 9004:2009, Managing for the sustained success of an organization — A quality management approach
Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet B, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

MSS SP-25-2013, Standard Marking System for Valves, Fittings, Flanges, and Unions
Publisher: Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, NE, Vienna, VA 22180 (www.msshq.org)
MANDATORY APPENDIX I
REFERENCES

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ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
ASME B31.1, Power Piping
ASME Boiler and Pressure Vessel Code, Section II, Materials, Part D — Properties
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ASTM B88-1620, Standard Specification for Seamless Copper Water Tube
ASTM B280-1620, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B819-00—2011[19], Standard Specification for Seamless Copper Tube for Medical Gas Systems
ASTM E29-13(2019), Standard Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications
Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

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MSS SP-25-20122018, Standard Marking System for Valves, Fittings, Flanges and Unions
Publisher: Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, NE, Vienna, VA 22180 (www.msshq.org)

1 May also be obtained from the American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.