



Standard Practice for Expanded Welded and Silver Brazed Socket Joints for Pipe and Tube¹

This standard is issued under the fixed designation F 1076; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes expanded welded and silver brazed socket joints for use on shipboard piping systems.

1.2 Expanded welded and silver brazed socket joints are to be used to join two pipes or tubes having the same NPS (see Note 1) without using a fitting or butt weld.

1.3 Brazed socket type joints are not intended for use on systems containing flammable or combustible fluids in areas where fire hazards exist or where the service temperature exceeds 425°F (205°C).

1.4 Brazed joints depending solely upon a fillet weld rather than primarily upon brazing material between pipe/tube and socket, are not covered by this practice.

NOTE 1—The dimensionless designator nominal pipe size (NPS) has been substituted in this practice for such traditional terms as “nominal diameter,” “size,” and “nominal size,” and “iron pipe size.”

1.5 The values stated in inch-pound units are to be regarded as the standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

A 312/A312M Specification for Seamless and Welded Austenitic Stainless Steel Pipe²

B 75 Specification for Seamless Copper Tube³

B 88 Specification for Seamless Copper Water Tube³

B 466 Specification for Seamless Copper-Nickel Pipe and Tube³

2.2 Military Standards:

MIL-P-1144 Pipe, Corrosion-Resistant, Stainless Steel, Seamless and Welded⁴

MIL-T-16420 Tube, Copper-Nickel Alloy, Seamless and Welded⁴

MIL-T-24107 Tube, Copper (Seamless)⁴

2.3 ASME Standard:

ASME Boiler Code⁵

2.4 Federal Standard:

Title 46 Code of Federal Regulations⁴

2.5 NAVSEA Document:

0900-LP-001-7000 Fabrication and Inspection of Brazed Piping Systems⁴

3. Significance and Use

3.1 Expanded welded socket joints may be used with the following pipe and tube:

3.1.1 *Seamless Copper Tube*—2.375-in. (60-mm) outside diameter through 6.625-in. (170-mm) outside diameter.

3.1.2 *Seamless Copper-Nickel Tube*—2.375-in. (60-mm) outside diameter through 6.625-in. (170-mm) outside diameter.

3.1.3 *Seamless Copper Water Tube*—2.125-in. (55-mm) outside diameter through 4.125-in. (105-mm) outside diameter.

3.1.4 *Seamless Stainless Steel Pipe*—2 NPS through 6 NPS, Schedules 5 and 10.

3.2 Expanded silver brazed socket joints may be used with the following tube:

3.2.1 *Seamless Copper Tube*—2.375-in. (60-mm) outside diameter through 6.625-in. (170-mm) outside diameter.

3.2.2 *Seamless Copper-Nickel Tube*—2.375-in. (60-mm) outside diameter through 6.625-in. (170-mm) outside diameter.

3.2.3 *Seamless Copper Water Tube*—2.125-in. (55-mm) outside diameter through 4.125-in. (105-mm) outside diameter.

3.3 Expanded welded and silver brazed socket joints may be used where experience or test has demonstrated that the joint is safe and suitable for design and operating conditions, and where adequate provision is made to prevent separation of the joint.

¹ This practice is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.13 on Piping Systems.

Current edition approved Aug. 28, 1987. Published October 1987.

² *Annual Book of ASTM Standards*, Vol 01.01.

³ *Annual Book of ASTM Standards*, Vol 02.01.

⁴ Available from U.S. Government Printing Office, Washington, DC 20402.

⁵ Available from American Society of Mechanical Engineers, Headquarters, Three Park Ave., New York, NY 10016-5990.

4. Materials and Manufacture

4.1 *Welded Socket Joint:*

4.1.1 *Seamless Copper Tube*—Specification B 75, UNS Number C12200 and MIL-T-24107, UNS Number C12200, light drawn (see 5.3).

4.1.2 *Seamless Copper-Nickel Tube (90-10)*—Specification B 466, UNS Number C70600 and MIL-T-16420, UNS Number C70600, Class 200, annealed.

4.1.3 *Seamless Copper-Nickel Tube (70-30)*—Specification B 466, UNS Number C71500 and MIL-T-16420, UNS Number C71500, Class 200, annealed.

4.1.4 *Seamless Copper Water Tube*—Specification B 88, Type K, UNS Number C71500, drawn (see 5.3).

4.1.5 *Seamless Stainless Steel Pipe*—Specification A 312/A 312M, UNS Number S30400 and S31600. MIL-P-1144, UNS Number S30400 and S31600, Schedules 5 and 10.

4.2 *Silver-Brazed Socket Joint:*

4.2.1 *Seamless Copper Tube*—Specification B 75, UNS Number C12200 and MIL-T-24107, UNS Number C12200, light drawn (see 5.3).

4.2.2 *Seamless Copper-Nickel Tube (90-10)*—Specification B 466, UNS Number C70600 and MIL-T-16420, UNS Number C70600, Class 200, annealed.

4.2.3 *Seamless Copper-Nickel Tube (70-30)*—Specification B 466, UNS Number C71500 and MIL-T-16420, UNS Number C71500, Class 200, annealed.

TABLE 1 Expanded Welded Socket Joint

NOTE 1—1 in. = 25.4 mm. °F = (°C × 9/5) + 32.

| Material | System Size | | Wall Thickness | | Maximum Design Pressure and Temperature | |
|--|-------------|----------------------------|----------------------------|---|---|------------------------------------|
| | Size (NPS) | Tube Outside Diameter, in. | T Minimum as Procured, in. | T ₁ Minimum After Expansion, in. | Commercial System Class II ^A | MIL-Specification System, Class P2 |
| Seamless light drawn copper tube, Specification B 75, UNS Number C12200 and MIL-T-24107, Alloy 122. | 2 | 2.375 | 0.065 | 0.061 | 200 psi at 406°F | 200 psi at 425°F |
| | 2½ | 2.875 | 0.065 | 0.062 | | |
| | 3 | 3.500 | 0.065 | 0.062 | | |
| | 4 | 4.500 | 0.065 | 0.063 | | |
| | 5 | 5.563 | 0.068 | 0.066 | | |
| | 6 | 6.625 | 0.081 | 0.079 | | |
| Seamless annealed copper-nickel tubing (90-10), Specification B 466, UNS Number C70600 and MIL-T-16420, Alloy 706, Class 200. | 2 | 2.375 | 0.083 | 0.077 | 200 psi at 450°F | 200 psi at 450°F |
| | 2½ | 2.875 | 0.083 | 0.078 | | |
| | 3 | 3.500 | 0.095 | 0.089 | | |
| | 4 | 4.500 | 0.109 | 0.103 | | |
| | 5 | 5.563 | 0.125 | 0.119 | | |
| | 6 | 6.625 | 0.134 | 0.128 | | |
| Seamless annealed copper-nickel tubing (70-30), Specification B 466, UNS Number C71500 and MIL-T-16420, Alloy 715, Class 200. | 2 | 2.375 | 0.083 | 0.077 | 200 psi at 450°F | 200 psi at 450°F |
| | 2½ | 2.875 | 0.083 | 0.078 | | |
| | 3 | 3.500 | 0.095 | 0.089 | | |
| | 4 | 4.500 | 0.109 | 0.103 | | |
| | 5 | 5.563 | 0.125 | 0.119 | | |
| | 6 | 6.625 | 0.134 | 0.128 | | |
| Seamless drawn copper water tube, Specification B 88, Type K, UNS Number C12200. | 2 | 2.125 | 0.083 | 0.076 | 200 psi at 406°F | ... |
| | 2½ | 2.625 | 0.095 | 0.088 | | |
| | 3 | 3.125 | 0.109 | 0.101 | | |
| | ... | 3.625 | 0.120 | 0.112 | | |
| | 4 | 4.125 | 0.134 | 0.125 | | |
| | ... | ... | ... | ... | | |
| Seamless stainless steel pipe, Specification A 312/A 312M, UNS Number S30400 and S31600, MIL-P-1144, Alloy 304 and 316, Schedule 5. | 1 | ... | ... | ... | 300 psi at 650°F | 300 psi at 650°F |
| | 1¼ | ... | ... | ... | | |
| | 1½ | ... | ... | ... | | |
| | 1¾ | ... | ... | ... | | |
| | 2 | 2.375 | 0.065 | 0.061 | | |
| | 2½ | 2.875 | 0.083 | 0.078 | | |
| | 3 | 3.500 | 0.083 | 0.079 | | |
| | 4 | 4.500 | 0.083 | 0.080 | | |
| | 5 | 5.563 | 0.109 | 0.104 | | |
| | 6 | 6.625 | 0.109 | 0.105 | | |
| Seamless stainless steel pipe, Specification A 312/A 312M, UNS Number S30400 and S31600, MIL-P-1144, Alloy 304 and 316, Schedule 10. | 1 | ... | ... | ... | 300 psi at 650°F | 300 psi at 650°F |
| | 1¼ | ... | ... | ... | | |
| | 1½ | ... | ... | ... | | |
| | 1¾ | ... | ... | ... | | |
| | 2 | 2.375 | 0.109 | 0.099 | | |
| | 2½ | 2.875 | 0.120 | 0.110 | | |
| | 3 | 3.500 | 0.120 | 0.111 | | |
| | 4 | 4.500 | 0.120 | 0.113 | | |
| 5 | 5.563 | 0.134 | 0.127 | | | |
| 6 | 6.625 | 0.134 | 0.128 | | | |

TABLE 1 *Continued*

| Material | System Size | | Wall Thickness | | Maximum Design Pressure and Temperature | |
|--|-------------|----------------------------|------------------------------|------------------------------------|---|------------------------------------|
| | Size (NPS) | Tube Outside Diameter, in. | T Minimum as Procured, in. | T_1 Minimum After Expansion, in. | Commercial System Class II ^A | MIL-Specification System, Class P2 |
| Seamless light drawn copper tube, Specification B 75, UNS Number C12200 and MIL-T-24107, Alloy 122. | 2 | 2.375 | 0.065 | 0.061 | 200 psi at 406°F | 200 psi at 425°F |
| | 2½ | 2.875 | 0.065 | 0.062 | | |
| | 3 | 3.500 | 0.065 | 0.062 | | |
| | 4 | 4.500 | 0.065 | 0.063 | | |
| | 5 | 5.563 | 0.068 | 0.066 | | |
| Seamless annealed copper-nickel tubing (90-10), Specification B 466, UNS Number C70600 and MIL-T-16420, Alloy 706, Class 200. | 2 | 2.375 | 0.083 | 0.077 | 200 psi at 425°F | 200 psi at 425°F |
| | 2½ | 2.875 | 0.083 | 0.078 | | |
| | 3 | 3.500 | 0.095 | 0.090 | | |
| | 4 | 4.500 | 0.109 | 0.104 | | |
| | 5 | 5.563 | 0.125 | 0.119 | | |
| Seamless annealed copper-nickel tubing (70-30), Specification B 466, UNS Number C71500 and MIL-T-1 6420, Alloy 715, Class 200. | 2 | 2.375 | 0.083 | 0.077 | 200 psi at 425°F | 200 psi at 425°F |
| | 2½ | 2.875 | 0.083 | 0.078 | | |
| | 3 | 3.500 | 0.095 | 0.090 | | |
| | 4 | 4.500 | 0.109 | 0.104 | | |
| | 5 | 5.563 | 0.125 | 0.119 | | |
| Seamless drawn copper water tube, Specification B 88, Type K, UNS Number C12200. | 2 | 2.125 | 0.083 | 0.077 | 200 psi at 406°F | ... |
| | 2½ | 2.625 | 0.095 | 0.088 | | |
| | 3 | 3.125 | 0.109 | 0.102 | | |
| | ... | 3.625 | 0.120 | 0.112 | | |
| | 4 | 4.125 | 0.134 | 0.126 | | |

^ASee 5.3.

4.2.4 *Seamless Copper Water Tube*—Specification B 88, Type K, UNS Number C12200, drawn (see 5.3).

5. Procedure

5.1 Install no more than two expanded joints in any 36-in. (915-mm) long section of pipe/tube and in no case allow a pipe/tube expanded at both ends in lengths of less than 36 in.

5.2 Fabricate expanded joints on the ends of the pipe/tube by use of an expanding machine.

5.3 Expanded joints shall not be used on Class I piping systems as defined in 46CFR56.04 for United States Coast Guard inspected and certified vessels.

5.4 Perform a minimum of three expansions to ensure the degree of expansion.

5.5 Bevel the unexpanded end of pipe/tube 30 to 40° for copper-nickel alloy and 10 to 20° for stainless steel.

5.6 Clean the pipe/tube ends to be inserted into the silver-brazed expanded pipe/tube socket and the interior of the socket itself to a bright metal before insertion.

5.7 Align pipe/tube ends concentrically as accurately as possible, and preserve this alignment during the welding process.

5.8 Provide a gap of approximately 1/16 in. (1.5 mm) (expanded welded socket joint, Fig. 1) and 1/8 in. (3 mm) (expanded silver-brazed joint, Fig. 2) between the end of the pipe/tube and the bottom of the socket by bottoming the pipe/tube and backing off slightly before tacking.

5.9 The minimum insertion length shall be 1 in. (25 mm).

5.10 For United States Navy Application (see NAVSEA Document 0900-LP-001-7000), on the pipe/tube inserted into the expanded joint make a light scribe line a distance of 2 in.

(50 mm) from the end of the unexpanded pipe/tube. This scribe line shall be visible at the time of final inspection.

5.11 The filler metal used in brazing shall be a nonferrous metal or alloy having a melting point above 1000°F (537°C) and below that of the metal being joined.

5.12 The brazing material shall have a shearing strength of at least 10 000 psi (68 950 KPa).

6. Dimensions and Tolerances

6.1 Dimensions are as indicated in Fig. 1.

6.2 The inside diameters of pipe/tube in socket joints must be aligned as accurately as practicable. Alignment must be preserved during welding.

6.3 Pipe/tube ends in socket joints shall provide a maximum radial clearance between pipe/tube outside radius and socket inside radius of the following:

6.3.1 *Welded Socket Joints*—0.012 in. (0.305 mm) maximum.

6.3.2 *Silver-Brazed Joints*—0.002 to 0.006 in. (0.050 to 0.150 mm).

6.4 Wall thickness thinning shall be less than 10 % for all sizes, and in no case shall the minimum wall thickness after expansion be less than the values for T_1 in Table 1.

7. Welding and Brazing

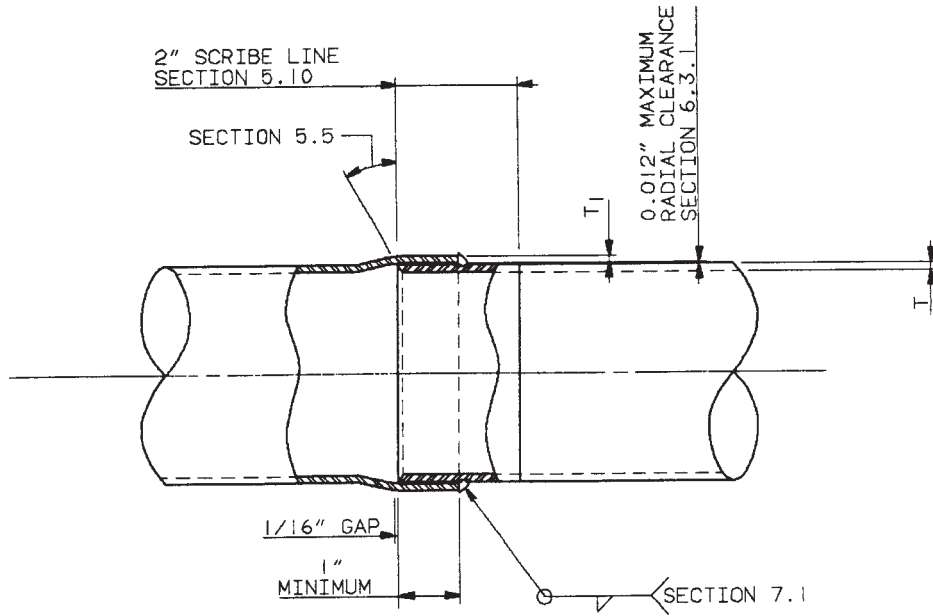
7.1 Welding shall be as shown on Fig. 1.

7.2 Brazing shall be as shown on Fig. 2.

7.3 Welding and brazing shall be in accordance with Section IX of the ASME Boiler Code.

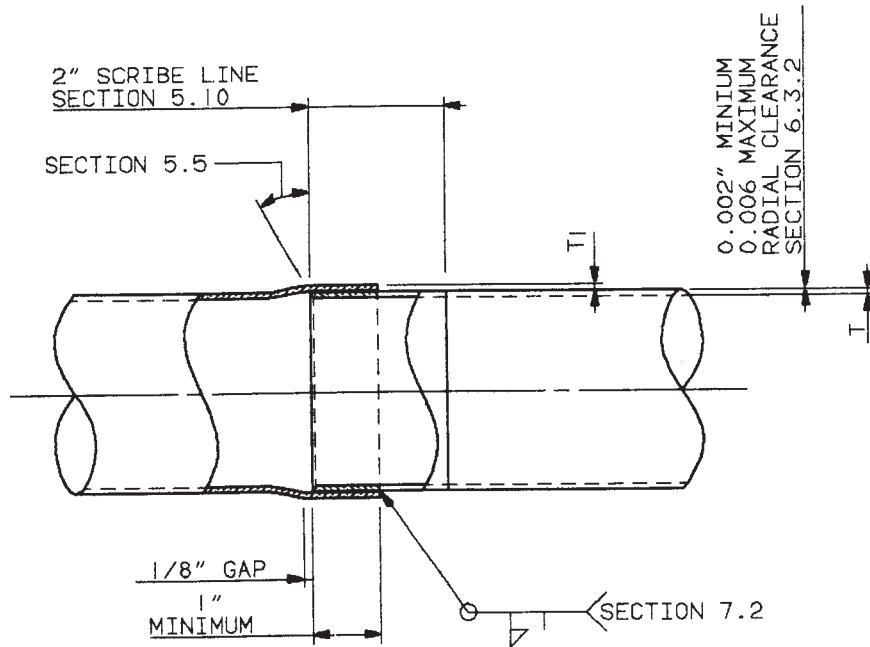
8. Workmanship, Finish, and Appearance

8.1 Surface areas and pipe/tube ends shall be free of weld spatter, burrs, sharp corners, and edges hazardous to personnel.



NOTE—1 in. = 25.4 mm.

FIG. 1 Expanded Welded Socket Joint



NOTE—1 in. = 25.4 mm.

FIG. 2 Expanded Silver-Brazed Joint

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).