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Designation: ~~B302 – 12~~ B302 – 17

Standard Specification for Threadless Copper Pipe, Standard Sizes[1]

This standard is issued under the fixed designation B302; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification establishes requirements for threadless, seamless, deoxidized copper pipe (TP) in straight lengths, in all nominal or standard pipe sizes, for piping systems that are assembled with brazed-joint pipe fittings. The pipe shall be produced from either of coppers UNS Nos. C10300 or C12200.

1.2 *Units*—~~Values~~ The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units, which are provided for information only and are not considered standard.

~~1.3 The following safety hazard caveat pertains only to the test methods described Section 16 of this specification: *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 its use.*~~

1.3 The following safety hazard caveat pertains only to the test methods described in Section 16 of this specification.

1.3.1 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to its use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B577 Test Methods for Detection of Cuprous Oxide (Hydrogen Embrittlement Susceptibility) in Copper
B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast
B846 Terminology for Copper and Copper Alloys
B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys
~~E8~~E8/E8M Test Methods for Tension Testing of Metallic Materials
E18 Test Methods for Rockwell Hardness of Metallic Materials
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry
E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[3]
E243 Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes
E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

3. Terminology

3.1 For definitions of terms related to copper and copper alloys, refer to Terminology B846.

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[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the ~~standard's~~standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

***A Summary of Changes section appears at the end of this standard**

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4. Ordering Information

4.1 Include the following specified choices when placing orders for product under this specification, as applicable:
4.1.1 ASTM designation and year of issue,
4.1.2 Copper UNS No. designation,
4.1.3 Nominal or standard size (Table 1), and
4.1.4 *Quantity*—Total length, total weight, or number of pieces of each size.

4.2 The following options are available, but may not be included unless specified at the time of placing of the order when required:
4.2.1 Tension test (Mechanical Property Requirements Section),
4.2.2 Hydrostatic test (Other Requirements Section),
4.2.2.1 Test Pressure over 1000 psi (6.9 MPa),
4.2.3 Pneumatic test (Other Requirements Section),
4.2.4 Heat identification or traceability requirements (5.1.1),
4.2.5 Certification (Section 20),
4.2.6 ~~Mill test~~ Test report (Section 21).
4.2.7 Source inspection requirement (18.2), and
4.2.8 When the specification number must be shown on the shipping unit (Section 22).

5. Materials and Manufacture

5.1 *Material*—The material of manufacture shall be cast billets, bars, or tubes of copper UNS No. C10300 or C12200 of such purity and soundness as to be suitable for processing into finished lengths of pipe to meet the properties prescribed herein.

TABLE 1 Dimensions and Weights and Tolerance in Diameter and Wall Thickness for Copper Threadless Pipe (TP) Sizes

Nominal or Standard Pipe Size, in.	Outside Diameter, in. (mm)	Inside Diameter, in. (mm),	Wall Thickness, in. (mm)	Cross-Sectional Area of Bore, in.^{2} (cm^2)	Theoretical Weight, lb/ft (kg/m)	Tolerances, in. (mm)	
						Average Outside Diameter,[A] All Minus	Wall Thickness Plus and Minus
~~¼~~	~~0.540 (13.7)~~	~~0.410 (10.4)~~	~~0.065 (1.65)~~	~~0.132 (0.852)~~	~~0.376 (0.559)~~	~~0.004 (0.10)~~	~~0.0035 (0.089)~~
¼	0.540 (13.7)	0.410 (10.4)	0.065 (1.65)	0.132 (0.852)	0.376 (0.559)	0.004 (0.10)	0.0035 (0.089)
~~⅜~~	~~0.675 (17.1)~~	~~0.545 (13.8)~~	~~0.065 (1.65)~~	~~0.233 (1.50)~~	~~0.483 (0.719)~~	~~0.004 (0.10)~~	~~0.004 (0.10)~~
⅜	0.675 (17.1)	0.545 (13.8)	0.065 (1.65)	0.233 (1.50)	0.483 (0.719)	0.004 (0.10)	0.004 (0.10)
~~½~~	~~0.840 (21.3)~~	~~0.710 (18.0)~~	~~0.065 (1.65)~~	~~0.396 (2.55)~~	~~0.613 (0.912)~~	~~0.005 (0.13)~~	~~0.004 (0.10)~~
½	0.840 (21.3)	0.710 (18.0)	0.065 (1.65)	0.396 (2.55)	0.613 (0.912)	0.005 (0.13)	0.004 (0.10)
~~¾~~	~~1.050 (26.7)~~	~~0.920 (23.4)~~	~~0.065 (1.65)~~	~~0.665 (4.29)~~	~~0.780 (1.16)~~	~~0.005 (0.13)~~	~~0.004 (0.10)~~
¾	1.050 (26.7)	0.920 (23.4)	0.065 (1.65)	0.665 (4.29)	0.780 (1.16)	0.005 (0.13)	0.004 (0.10)
~~1~~	~~1.315 (33.4)~~	~~1.185 (30.1)~~	~~0.065 (1.65)~~	~~1.10 (7.10)~~	~~0.989 (1.47)~~	~~0.005 (0.13)~~	~~0.004 (0.10)~~
1	1.315 (33.4)	1.185 (30.1)	0.065 (1.65)	1.10 (7.10)	0.989 (1.47)	0.005 (0.13)	0.004 (0.10)
~~1¼~~	~~1.660 (42.2)~~	~~1.530 (38.9)~~	~~0.065 (1.65)~~	~~1.84 (11.9)~~	~~1.26 (1.87)~~	~~0.006 (0.15)~~	~~0.004 (0.10)~~
1¼	1.660 (42.2)	1.530 (38.9)	0.065 (1.65)	1.84 (11.9)	1.26 (1.87)	0.006 (0.15)	0.004 (0.10)
~~1½~~	~~1.900 (48.3)~~	~~1.770 (45.0)~~	~~0.065 (1.65)~~	~~2.46 (15.9)~~	~~1.45 (2.16)~~	~~0.006 (0.15)~~	~~0.004 (0.10)~~
1½	1.900 (48.3)	1.770 (45.0)	0.065 (1.65)	2.46 (15.9)	1.45 (2.16)	0.006 (0.15)	0.004 (0.10)
~~2~~	~~2.375 (60.3)~~	~~2.245 (57.0)~~	~~0.065 (1.65)~~	~~3.96 (25.5)~~	~~1.83 (2.72)~~	~~0.007 (0.18)~~	~~0.006 (0.15)~~
2	2.375 (60.3)	2.245 (57.0)	0.065 (1.65)	3.96 (25.5)	1.83 (2.72)	0.007 (0.18)	0.006 (0.15)
~~2½~~	~~2.875 (73.0)~~	~~2.745 (69.7)~~	~~0.065 (1.65)~~	~~5.92 (38.2)~~	~~2.22 (3.30)~~	~~0.007 (0.18)~~	~~0.006 (0.15)~~
2½	2.875 (73.0)	2.745 (69.7)	0.065 (1.65)	5.92 (38.2)	2.22 (3.30)	0.007 (0.18)	0.006 (0.15)
~~3~~	~~3.500 (88.9)~~	~~3.334 (84.7)~~	~~0.083 (2.11)~~	~~8.73 (56.3)~~	~~3.45 (5.13)~~	~~0.008 (0.20)~~	~~0.007 (0.18)~~
3	3.500 (88.9)	3.334 (84.7)	0.083 (2.11)	8.73 (56.3)	3.45 (5.13)	0.008 (0.20)	0.007 (0.18)
~~3½~~	~~4.000 (102)~~	~~3.810 (96.8)~~	~~0.095 (2.41)~~	~~11.4 (73.5)~~	~~4.52 (6.73)~~	~~0.008 (0.20)~~	~~0.007 (0.18)~~
3½	4.000 (102)	3.810 (96.8)	0.095 (2.41)	11.4 (73.5)	4.52 (6.73)	0.008 (0.20)	0.007 (0.18)
~~4~~	~~4.500 (114)~~	~~4.286 (109)~~	~~0.107 (2.72)~~	~~14.4 (92.9)~~	~~5.72 (8.51)~~	~~0.010 (0.25)~~	~~0.009 (0.23)~~
4	4.500 (114)	4.286 (109)	0.107 (2.72)	14.4 (92.9)	5.72 (8.51)	0.010 (0.25)	0.009 (0.23)
~~5~~	~~5.562 (141)~~	~~5.298 (135)~~	~~0.132 (3.40)~~	~~22.0 (142)~~	~~8.73 (13.0)~~	~~0.012 (0.30)~~	~~0.010 (0.25)~~
5	5.562 (141)	5.298 (135)	0.132 (3.40)	22.0 (142)	8.73 (13.0)	0.012 (0.30)	0.010 (0.25)
~~6~~	~~6.625 (168)~~	~~6.309 (160)~~	~~0.158 (4.01)~~	~~31.3 (202)~~	~~12.4 (18.5)~~	~~0.014 (0.36)~~	~~0.010 (0.25)~~
6	6.625 (168)	6.309 (160)	0.158 (4.01)	31.3 (202)	12.4 (18.5)	0.014 (0.36)	0.010 (0.25)
~~8~~	~~8.625 (219)~~	~~8.215 (209)~~	~~0.205 (5.21)~~	~~53.0 (342)~~	~~21.0 (31.2)~~	~~0.018 (0.46)~~	~~0.014 (0.36)~~
8	8.625 (219)	8.215 (209)	0.205 (5.21)	53.0 (342)	21.0 (31.2)	0.018 (0.46)	0.014 (0.36)
~~10~~	~~10.750 (273)~~	~~10.238 (260)~~	~~0.256 (6.50)~~	~~82.3 (531)~~	~~32.7 (48.7)~~	~~0.018 (0.46)~~	~~0.016 (0.41)~~
10	10.750 (273)	10.238 (260)	0.256 (6.50)	82.3 (531)	32.7 (48.7)	0.018 (0.46)	0.016 (0.41)
~~12~~	~~12.750 (324)~~	~~12.124 (308)~~	~~0.313 (7.95)~~	~~115 (742)~~	~~47.4 (70.5)~~	~~0.018 (0.46)~~	~~0.020 (0.51)~~
12	12.750 (324)	12.124 (308)	0.313 (7.95)	115 (742)	47.4 (70.5)	0.018 (0.46)	0.020 (0.51)

[A] The average outside diameter of a tube is the average of the maximum and minimum outside diameters, as determined at any one cross section of the tube.

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5.1.1 When specified in the contract or purchase order, that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 1—Due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify specific casting analysis with a specific quantity of finished product.

5.2 *Manufacture:*

5.2.1 The pipe shall be manufactured by such hot extrusion or piercing and subsequent cold working as to produce a uniform, seamless wrought structure in the finished product.

5.2.2 The product shall be cold worked to the finished size so as to meet the temper properties specified.

6. Chemical Composition

6.1 The material shall conform to the chemical composition requirements in Table 2 for the copper UNS No. designation specified in the ordering information.

6.2 These composition limits do not preclude the presence of other elements. By agreement between the manufacture and purchaser, limits may be established and analysis required for unnamed elements.

7. Temper

7.1 The product shall be furnished in the H58 (drawn general purpose) temper as defined in Classification B601.

8. Mechanical Property Requirements

8.1 *Tensile Strength Requirement:*

8.1.1 Product in all sizes and coppers shall have a minimum tensile strength of 36 ksi (250 MPa) when tested in accordance with Test Methods ~~E8~~E8/E8M.

8.1.2 The tension test need not be performed except when specified by the purchaser in the ordering information at the time of placing of the order.

8.2 *Rockwell Hardness Requirement*—Product in all sizes and coppers shall have a minimum Rockwell F hardness of 55 when tested in accordance with Test Methods E18.

9. Performance Requirements

9.1 *Microscopical Examination*—The pipe shall be made from copper free from cuprous oxide, as determined by microscopical examination at a magnification of 75 diameters according to Test Method A of Test Methods B577. When copper UNS No. C12200 is supplied, microscopical examination for cuprous oxide is not required.

10. Other Requirements – Nondestructive Test Requirements

10.1 *Electromagnetic (Eddy-Current) Test:*

10.1.1 Each tube up to and including 2½-in. nominal pipe size shall be subjected to an eddy-current test. Testing shall follow the procedures of Practice E243 and 16.2.3.

10.1.1.1 *Hydrostatic Test Alternative*—As an alternative to the eddy-current test for tubes of diameters above 1.25 in. ~~(32 mm),~~ (32 mm), the manufacturer shall perform the hydrostatic test to the requirements of 10.2.

10.1.1.2 The provisions for the determination of "end-effect" in Practice E243 shall not apply.

10.1.2 The tested tubes, which do not actuate the signaling device of the testing unit, shall be considered as conforming to the requirements of the test.

10.1.3 Either notch depth or drilled hole standards shall be used.

10.1.3.1 Notch depth standards shall be 10 % of the nominal wall thickness.

10.1.3.2 The sizes of drilled hole standards shall be determined in accordance with Table X1.2 of Practice E243.

10.2 *Hydrostatic Test:*

10.2.1 When specified in the contract or purchase order, or as an alternative to the eddy-current test for tubes above ~~1.25 in.~~ 1.25 in. (32 mm) in diameter (see 10.1.1.2), each tube shall stand, without showing evidence of leakage, an internal hydrostatic pressure sufficient to produce a fiber stress of 6000 psi ~~(41 MPa)~~ (41 MPa) as determined by the following equation for thin hollow cylinders under tension:

TABLE 2 Chemical Requirements

Copper UNS No.	Composition, %	
	Copper (Incl Silver), min	Phosphorus
C10300	99.95[A]	0.001 to 0.005
C12200	99.9	0.015 to 0.040

[A] Copper + silver + phosphorus.

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