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Standard Specification for Seamless Copper Water Tube¹

This standard is issued under the fixed designation B 88; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the Department of Defense. Replaces WW-T-799. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers Copper UNS No. C12200 seamless copper water tube suitable for general plumbing, and similar applications for the conveyance of fluids, and commonly used with solder, flared, or compression type fittings. The type of copper water tube suitable for any particular application is determined by the internal or external fluid pressure, by the installation and service conditions, and by local requirements. Means of joining or bending are also factors which affect the selection of the type of tube to be used.²

NOTE 1—Annealed tube is suitable for use with flared or compression fittings, and with solder-type fittings, provided rounding and sizing of the tube ends is performed where needed.

NOTE 2—Drawn temper tube is suitable for use with solder-type fittings. Types K and L tube, in the drawn temper, are suitable for use with certain types and sizes of compression fittings.

NOTE 3—A complete metric companion to Specification B 88 has been developed—B 88M; therefore, no metric equivalents are presented in this specification.

1.2 The assembly of copper plumbing or fire sprinkler systems by soldering is described in Practice B 828.

1.3 Solders for joining copper potable water or fire sprinkler systems are covered by Specification B 32. The requirements for acceptable fluxes for these systems are covered by Specification B 813.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 15, of this specification: *This standard does not purport to address all of the safety problems, 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 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.1.1 ASTM Standards:

B 32 Specifications for Solder Metal³

B 153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing⁴

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast⁴

B 813 Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube⁴

B 828 Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings⁴

E 2 Method of Preparation of Micrographs of Metals and Alloys⁵

E 3 Methods of Preparation of Metallographic Specimens⁶

E 8 Test Methods for Tension Testing of Metallic Materials⁷

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁸

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁹

E 53 Methods for Chemical Analysis of Copper¹⁰

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition¹¹

E 62 Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)¹⁰

E 112 Test Methods for Determining Average Grain Size⁷

E 243 Practice for Electromagnetic (Eddy-Current) Examination of Copper and Copper-Alloy Tubes¹²

E 527 Practice for Numbering Metals and Alloys (UNS)¹³

3. Terminology

3.1 Definitions:

3.1.1 *coil*—a length of the product wound into a series of connected turns. The unqualified term “coil” as applied to tube usually refers to a bunched coil.

3.1.1.1 *bunched*—a coil in which the turns are bunched and held together such that the cross section of the bunched

³ Annual Book of ASTM Standards, Vol 02.04.

⁴ Annual Book of ASTM Standards, Vol 02.01.

⁵ Discontinued, see 1982 Annual Book of ASTM Standards, Part 11. Replaced by Practice E 883.

⁶ Annual Book of ASTM Standards, Vol 03.01.

⁷ Annual Book of ASTM Standards, Vols 02.01 and 03.01.

⁸ Annual Book of ASTM Standards, Vols 02.03 and 03.01.

⁹ Annual Book of ASTM Standards, Vols 02.03 and 14.02.

¹⁰ Annual Book of ASTM Standards, Vol 03.05.

¹¹ Annual Book of ASTM Standards, Vols 02.01 and 03.05.

¹² Annual Book of ASTM Standards, Vols 02.01 and 03.03.

¹³ Annual Book of ASTM Standards, Vols 01.01 and 02.01.

¹ This specification is under the jurisdiction of ASTM Committee B-5 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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² The UNS system for copper and copper alloys (see Practice E 527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix “C” and a suffix “00.” The suffix can be used to accommodate composition variations of the base alloy.

turns is approximately circular.

3.1.1.2 *double layer flat*—a coil in which the product is spirally wound into two connected disk-like layers such that one layer is on top of the other. (Sometimes called “double layer pancake coil” or “double layer spirally wound coil.”)

3.1.1.3 *level or traverse wound*—a coil in which the turns are wound into layers parallel to the axis of the coil such that successive turns in a given layer are next to one another. (Sometimes called “helical coil.”)

3.1.1.4 *single layer flat*—a coil in which the product is spirally wound into a single disk-like layer. (Sometimes called “pancake coil” or “single layer spirally wound coil.”)

3.1.2 *lengths*—straight pieces of the product.

3.1.2.1 *standard*—uniform lengths recommended in a simplified practice recommendation or established as a commercial standard.

3.1.3 *tube, seamless*—a tube produced with a continuous periphery in all stages of the operations.

3.1.3.1 *tube, copper service*—a bendable copper water tube for underground water service.

3.1.3.2 *tube, copper water*—a seamless copper tube conforming to the particular dimensions commercially known as Copper Water Tube and designated as Types K, L, and M.

3.2 *Description of Term Specific to This Standard:*

3.2.1 *capable of*—as used in this specification, the test need not be performed by the producer of the material. However, should subsequent testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Nominal or standard size (Column 1 of Table 1) and whether Type K, L, or M (Sections 3 and 11),

4.1.2 Temper (Sections 5 and 8),

4.1.3 Whether tension tests and grain size determinations are required (Section 8),

4.1.4 Length (see 11.5),

4.1.5 How furnished: straight or coils, and

4.1.6 Quantity (pieces) of each size and type.

4.2 In addition, when material is purchased for agencies of the U.S. Government, it shall conform to the Supplementary Requirements as defined herein when specified in the contract or purchase order.

5. Materials and Manufacture

5.1 The material shall be of such quality and purity that the finished product shall have the properties and characteristics prescribed in this specification, and shall be cold drawn to size.

5.2 The tube shall be finished by such cold-working and annealing operations as are necessary to produce the required temper and surface finish.

5.3 Tube when furnished in coils shall be annealed after coiling.

5.4 Tube when furnished in straight lengths shall normally be in the drawn temper but may be furnished annealed if so specified.

6. Chemical Composition

6.1 The material shall conform to the following chemical

requirements for Copper UNS No. C12200:

Copper (incl silver), min, %	99.9
Phosphorus, max, %	0.015–0.040

6.2 These specification limits do not preclude the presence of other elements. Limits for unnamed elements may be established by agreement between the manufacturer or supplier and the purchaser.

7. Temper

7.1 Seamless copper water tube shall be furnished in the tempers designated below. Current designations as defined in Practice B 601 are shown.

Annealed—O
Drawn—H

8. Mechanical Properties

8.1 The tube shall conform to the mechanical property requirements prescribed in Table 2. Tension tests and grain-size determinations need not be made except when indicated by the purchaser at the time of placing the order. A convenient method of indicating that these tests are to be made is to state that “Test Procedure ‘T’ is required” (see 4.1.3). Where agreement on the Rockwell hardness tests cannot be reached, the tensile strength and grain-size requirements of Table 2 shall be the basis for acceptance or rejection.

9. Expansion Test

9.1 The annealed (O) tube shall be capable of being expanded in accordance with Test Method B 153 with an expansion of the outside diameter in the following amount:

Nominal or Standard Size, in.	Expansion of Outside Diameter, %
3/4 and under	40
Over 3/4	30

The expanded tube shall show no cracking or rupture visible to the unaided eye.

9.2 As an alternative to the expansion test for tube standard sizes 4 in. and over in the annealed condition, a section 4 in. in length shall be cut from the end of one of the lengths for a flattening test. This 4-in. test specimen shall be flattened so that a gage set at three times the wall thickness will pass over the tube freely throughout the flattened part. The tube so tested shall develop no cracks or flaws visible to the unaided eye as a result of this test. In making the flattening test the elements shall be slowly flattened by one stroke of the press.

10. Nondestructive Testing

10.1 Each tube up to and including 3 in. nominal or standard size, 3 3/4 in. outside diameter, or within the capabilities of the eddy-current tester, shall be subjected to an eddy-current test. Testing shall follow the procedures of Practice E 243, except for the determination of “end effect.” Tubes shall be passed through an eddy-current test unit adjusted to provide information on the suitability of the tube for the intended application.

10.1.1 Notch-depth standards, rounded to the nearest 0.001 in., shall be 22 % of the wall thickness. The notch-depth tolerance shall be plus and minus 0.0005 in. Alternatively, at the option of the manufacturer using speed insensitive eddy-current units that are equipped so that a