



Designation: B 641 – 93

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St. Philadelphia, Pa 19103
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Standard Specification for Seamless and Welded Copper Distribution Tube (Type D)¹

This standard is issued under the fixed designation B 641; 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 specification covers seamless and welded copper distribution tube. It is suitable for the conveyance of fluids in hot and cold water distribution systems, in wet heating and cooling systems, also in condensate drain lines, above ground. It is joined with commonly used solder type fittings. The distribution tube used for any particular application is determined by the internal or external fluid pressure, by the installation and service conditions, and by local requirements. It is not intended for bending. The temper is "hard"-cold-worked.

1.2 The following coppers are suitable for use to make the product of this specification.

Copper UNS Nos ²	Previously Used Designations ⁴	Type of Copper
C10100	OFE	oxygen-free electronic
C10200	OF	oxygen-free
C10300	...	oxygen-free, extra low phosphorus
C10800	...	oxygen-free, low phosphorus
C12000	DLP	phosphorus deoxidized, low residual phosphorus
C12200	DHP	phosphorus deoxidized high residual phosphorus

⁴ Designation listed in Classification B 224.

1.3 Unless otherwise specified, any of the deoxidized or the oxygen-free Copper UNS Nos. C10100, C10200, C10300, C10800, C12000, and C12200 may be furnished at the supplier's option. The copper tube shall be supplied in hard-cold-worked straight lengths.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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 153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing³

B 170 Specification for Oxygen-Free Electrolytic Copper Refinery Shapes³

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.

Current edition approved Jan. 15, 1993. Published March 1993. Originally published as B 641 – 78. Last previous edition B 641 – 92.

² The UNS system for copper and copper alloys 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.

³ Annual Book of ASTM Standards, Vol 02.01.

B 224 Classification of Coppers³

E 3 Methods of Preparation of Metallographic Specimens⁴

E 8 Test Methods of Tension Testing of Metallic Materials⁵

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁶

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁷

E 53 Methods for Chemical Analysis of Copper⁸

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition⁹

E 62 Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)⁸

E 112 Test Methods for Determining Average Grain Size⁵

E 243 Practice for Electromagnetic (Eddy-Current) Examination of Copper and Copper-Alloy Tubes¹⁰

3. Terminology

3.1 Definitions:

3.1.1 *distribution tube (Type D)*—seamless or welded copper tube conforming to the particular dimensions commercially known as copper distribution tube (Type D).

3.1.1.1 Discussion—The dimensions are designed to accept solder-type fittings and to meet an internal working pressure of 200 psi (1.38 MPa) up to a temperature of 250°F (121°C).

3.1.2 *flash*—metal that protrudes at the weld, both on the pressure applied when a forge-type seam is produced. The two types of flash are internal flash and external flash.

3.1.3 *lengths*—straight pieces of the product.

3.1.4 *lengths, standard*—uniform lengths recommended in a Simplified Practice Recommendation or established as a Commercial Standard.

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

3.1.6 *tube, welded*—tube made by processing strip into a tubular shape and welding the edges to make a longitudinal seam.

4. Ordering Information

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

4.1.1 Nominal or standard size (Column I of Table 1),

4.1.2 Type of copper (if required),

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vols 02.01 and 03.01.

⁶ Annual Book of ASTM Standards, Vols 02.03 and 03.01.

⁷ Annual Book of ASTM Standards, Vol 14.02.

⁸ Annual Book of ASTM Standards, Vol 03.05.

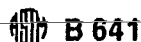
⁹ Annual Book of ASTM Standards, Vols 02.01 and 03.05.

¹⁰ Annual Book of ASTM Standards, Vols 02.01 and 03.03.



Documents

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4.1.3 Whether tension tests are required (Section 7),

4.1.4 Quantity (pieces) of each size,

4.1.5 Length (see 13.5),

NOTE 1—Twenty-foot straight lengths are normally produced and readily available. Lengths other than 20 ft (6.10 m) are to be as specified.

4.1.6 Unless otherwise specified the manufacturer shall have the option of supplying seamless or welded.

4.1.7 Specification number and year of issue.

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-worked to size.

5.2 *Manufacture-Seamless*—Seamless tube may be made by any seamless method that will yield a product meeting the requirements of this specification.

5.3 *Manufacture-Welded*:

5.3.1 Welded tube shall be made from flat-rolled product by an automatic welding process that will yield a product meeting the requirements of this specification.

5.3.2 Welded tubes shall have the internal and external flash removed, if present, and subsequently cold-worked over a plug or mandrel to conform to the specified size and temper.

6. Chemical Composition

6.1 The material shall conform to the chemical requirements specified in Table 2.

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

7. Mechanical Properties

7.1 The tube shall conform to the mechanical property requirements prescribed in Table 3. Tension tests need not

TABLE 1 Dimensions, Weights, and Tolerances for Diameter and Wall Thickness for Nominal or Standard Copper Distribution Tube Sizes (All tolerances in this table are plus and minus except as otherwise indicated)

NOTE—Conversion factors are 1 in. = 25.4 mm, 1 lb/ft = 1.49 kg/m.

Nominal or Standard Size, in.	Outside Diameter, in.	Average Outside Diameter ^A Tolerance, in.	Wall Thickness and Tolerances, in. ^B		Theoretical Weight, lb/ft
			Drawn	Wall Thickness Tolerance ^B	
1/4	0.375	0.001	0.013	0.0015	0.057
3/8	0.500	0.001	0.016	0.0015	0.094
1/2	0.625	0.001	0.018	0.002	0.133
5/8	0.750	0.001	0.020	0.002	0.178
3/4	0.875	0.001	0.021	0.002	0.218
1	1.125	0.0015	0.027	0.003	0.361
1 1/4	1.375	0.0015	0.032	0.003	0.523
1 1/2	1.625	0.002	0.038	0.004	0.734
2	2.125	0.002	0.050	0.006	1.263
2 1/2	2.625	0.002	0.060	0.006	1.874
3	3.125	0.002	0.070	0.006	2.604

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

^B Maximum deviation at any one point.

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 requirements of Table 3 shall be the basis for acceptance or rejection.

8. Expansion Test

8.1 An annealed test specimen shall be capable of being expanded on a hardened and ground, tapered steel pin having an included angle of 60° to the following amounts:

Nominal or Standard Size, in.	Expansion in Outside Diameter, %
3/4 and under	30
Over 3/4	25

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

NOTE 3—The term "unaided eye" as used herein permits the use of corrective spectacles necessary to obtain normal vision.

9. Nondestructive Testing

9.1 The manufacturer shall subject the tube to the following test:

9.1.1 *Eddy-Current Test*—Each tube up to and including 3 in. nominal or standard size, 3 1/8 in. (79.4 mm) 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.

9.1.1.1 Notch-depth standards, rounded to the nearest 0.001 in. (0.025 mm), shall be 22 % of the wall thickness. The notch-depth tolerance shall be ± 0.0005 in. (0.013 mm). At the option of the manufacturer using speed insensitive eddy-current units that are equipped so that a fraction of the maximum unbalance signal can be selected, the following percent maximum unbalance signals may be used:

Standard Tube Size, in.	Maximum % Unbalance Signal Magnitude
Up to and incl 3/4	0.2
1/2 to 2 incl	0.3
Over 2 to 3 incl	0.4

9.1.1.2 Tubes that do not actuate the signalling device of the eddy-current testers shall be considered as conforming to the requirements of this test. Tubes with discontinuities indicated by the testing unit, may at the option of the manufacturer, be reexamined or retested to determine whether the discontinuity is cause for rejection. Signals that are found to have been caused by minor mechanical damage, soil or moisture, shall not be cause for rejection of the tubes provided the tube dimensions are still within prescribed limits and the tube is suitable for its intended application.

10. Microscopical Examination

10.1 Tubes furnished to this specification shall be free of cuprous oxide as determined by microscopical examination at a magnification of 75 diameters. When the tube is made from UNS Nos. 10800, or 12200, microscopical examination for cuprous oxide is not required.