Designation: B68/B68M – 19

Standard Specification for Seamless Copper Tube, Bright Annealed [1]

This standard is issued under the fixed designation B68/B68M; 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 the requirements for bright annealed seamless copper tube suitable for use in refrigeration, oil lines, gasoline lines, and so forth, where tube with an interior surface essentially free from scale and dirt is required.

1.1.1 Tubes made from any of the following Copper UNS No. designations shall be supplied, unless otherwise specified in the contract or purchase order:

Copper UNS No.[2]	Type of Copper
C10200	Oxygen-free
C10300	Oxygen-free, (OFXLP)
C10800	Oxygen-free, (OFLP)
C12000	Phosphorus deoxidized, low residual phosphorus
C12200	Phosphorus deoxidized, high residual phosphorus

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 *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 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:*[3]

B153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing

B251/B251M Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube

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

B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube

E3 Guide for Preparation of Metallographic Specimens

E8/E8M Test Methods for Tension Testing of Metallic Materials

E112 Test Methods for Determining Average Grain Size

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

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

E2575 Standard Test Method for Determination of Oxygen in Copper and Copper Alloys (Withdrawn 2017)[4]

3. General Requirements

3.1 The following sections of Specification B251/B251M are a part of this specification.

3.1.1 Terminology, General;

3.1.2 Material and Manufacture;

3.1.3 Workmanship, Finish, and Appearance;

3.1.4 Significance of Numerical Limits;

[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] Refer to Practice E527 for explanation of unified numbering system (UNS).

3.1.5 Inspection;
3.1.6 Rejection and Rehearing;
3.1.7 Certification;
3.1.8 Test Reports;
3.1.9 Packaging and Package Marking; and
3.1.10 Supplementary Requirements.

3.2 In addition, when a section with an identical title to that referenced in 3.1, above, appears in this specification, it contains additional requirements which supplement those appearing in Specification B251/B251M.

4. Terminology

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

5. Ordering Information

5.1 Include the following specified choices when placing orders for products under this specification, as applicable:
5.1.1 ASTM designation and year of issue (for example, B68/B68M – 18);
5.1.2 Copper [Alloy] UNS number designation;
5.1.3 Temper (Section 8);
5.1.4 Dimensions, diameter, and wall thickness (Section 16);
5.1.5 How furnished: straight lengths or coils;
5.1.6 Quantity: total weight or length or number of pieces of each size; and
5.1.7 Intended application.

5.2 The following options are available but may not be included unless specified at the time of placing the order, when required:
5.2.1 Heat identification or traceability details,
5.2.2 Elongation test when wall thickness is less than 0.020 in. [0.508 mm],
5.2.3 Embrittlement test,
5.2.4 Expansion test,
5.2.5 Flattening test,
5.2.6 Certification, and
5.2.7 Mill test report.
5.2.8 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements section of this specification or Specification B251/B251M, or the general requirements section, if specified).

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture shall be Copper Alloy UNS Nos. C10200, C10300, C10800, C12000, or C12200 of such purity and soundness as to be suitable for processing into the tubular products described herein.

6.1.2 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 a specific casting analysis with a specific quantity of finished material.

6.2 *Manufacture:*

6.2.1 The tube shall be manufactured by such hot working, cold working, and annealing processes as to produce a uniform wrought structure in the finished product.

6.2.2 The tube shall be cold drawn to the finished size and subsequently bright annealed to meet the temper properties specified.

7. Chemical Composition

7.1 The material shall conform to the chemical composition requirements prescribed in Table 1 for the copper [alloy] UNS No. designation specified in the ordering information.

7.1.1 Results of analysis on a product (check) sample shall conform to the composition requirements within the permitted analytical variance specified in Table 1.

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

8. Temper

8.1 The standard tempers for product described in this specification are as follows

Annealed (O)	Temper Designation
O50	(Light annealed)
O60	(Soft annealed)

8.1.1 Tempers are defined in Classification B601.

9. Grain Size

9.1 Tube in the tempers O50 (light annealed) and O60 (soft annealed) shall conform to the requirements of Table 2.

9.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be within the limits prescribed in Table 2 when determined in accordance with Test Methods E112.

TABLE 1 Chemical Composition

Element	Composition, %				
	Copper UNS No.				
	C10200[A]	C10300	C10800	C12000	C12200
Copper,[B] min	99.95	...	...	99.90	99.9
Copper[B] + phosphorus, min	...	99.95	99.95	...	...
Phosphorus	...	0.001–0.005	0.005–0.012	0.004–0.012	0.015–0.040

[A] Oxygen in C10200 shall be 10 ppm max. in accordance with Test Method E2575.
[B] Silver counting as copper.