Designation: B 96/B 96M – 01

Standard Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels[1]

This standard is issued under the fixed designation B 96/B 96M; 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 Department of Defense.

1. Scope *

1.1 This specification establishes the requirements for copper-silicon alloy plate, sheet, strip, and rolled bar for drawing, forming, stamping, bending, and general engineering applications, and for pressure vessel applications. The alloys involved are copper alloys UNS Nos. C65100, C65400, and C65500.

1.2 When product is ordered for ASME Boiler and Pressure Vessel Code applications, consult the Code[2] for applicable alloys.

1.3 The values stated in inch-pound or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values in each system are not exactly equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.4 The following safety hazard caveat pertains only to the test methods described in Section 11 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.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar [Metric][3]

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast[3]

B 846 Terminology for Copper and Copper Alloys[3]

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes[4]

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)[4]

E 118 Test Methods for Chemical Analysis of Copper-Chromium Alloys[4]

E 478 Test Methods for Chemical Analysis of Copper Alloys[5]

3. General Requirements

3.1 The following sections of either Specification B 248 or B 248M constitute a part of this specification:

3.1.1 Terminology,
3.1.2 Materials and Manufacture,
3.1.3 Dimensions, Mass, and Permissible Variations,
3.1.4 Workmanship, Finish, and Appearance,
3.1.5 Sampling,
3.1.6 Number of Tests and Retests,
3.1.7 Test Specimens,
3.1.8 Test Methods,
3.1.9 Significance of Numerical Limits,
3.1.10 Inspection,
3.1.11 Rejection and Rehearing,
3.1.12 Certification,
3.1.13 Packing and Package Marking,
3.1.14 Mill Test Report, and
3.1.15 Supplementary Requirements.

3.2 In addition, when a section with a title identical to that referenced in 3.1 appears in this specification, it contains additional requirements which supplement those appearing in either Specification B 248 or B 248M.

4. Ordering Information

4.1 Include the following information when placing orders for products under this specification:

4.1.1 ASTM designation and year of issue,

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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[2] For *ASME Boiler and Pressure Vessel Code* applications, see related Specification SB–96 in Section 11 of that Code.

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

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] *Annual Book of ASTM Standards*, Vol 03.06.

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

4.1.2 Copper Alloy UNS No. (Section 1),

4.1.3 Temper (Section 6),

4.1.4 Dimensions: Thickness, Width, and Length (Section 9),

4.1.5 Finish (Section 10),

4.1.6 Type of edge, if required: slit, sheared, sawed, square corners, rounded corners, rounded edges or full rounded edges (9.6),

4.1.7 How furnished (straight lengths or coils),

4.1.8 Weight (9.7),

4.2 The following options are available, and when required, are to be specified in the contract or purchase order at the time of placing of the order:

4.2.1 Mill test (Specifications B 248 or B 248M),

4.2.2 Certification (Specifications B 248 or B 248M),

4.2.3 Product identification (Specifications B 248 or B 248M),

4.2.4 Pressure vessel use, if applicable[2] (1.2, 9.1, 9.2.1, and 9.7.1),

4.2.5 Whether 0.2 % yield strength is required, and

4.2.6 When product is purchased for agencies of the U.S. Government (Section 8).

5. Chemical Composition

5.1 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.

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

5.2.1 Copper may be taken as the difference between the sum of all the elements analyzed and 100 %.

5.2.2 When all the elements in Table 1 are analyzed, their sum shall be 99.5 % min.

6. Temper

6.1 Tempers, as defined in Practice B 601 available under this specification are:

6.1.1 O61 (annealed),

6.1.2 O50 (light annealed),

6.1.3 H01 (quarter hard),

6.1.4 H02 (half-hard),

6.1.5 H03 (three-quarter hard),

6.1.6 H04 (hard),

6.1.7 H06 (extra-hard),

6.1.8 H08 (spring),

6.1.9 H10 (extra-spring),

6.1.10 H14 (super-spring),

6.1.11 M20 (as hot-rolled), and

6.1.12 M25 (as hot-rolled and rerolled).

6.2 Refer to Table 2 for the copper alloy UNS No. involved for each temper.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Copper Alloy UNS No.		
	C65100	C65400	C65500
Copper, incl silver	remainder	remainder	remainder
Silicon	0.8–2.0^{A}	2.7–3.4	2.8–3.8
Manganese	0.7 max	. . .	0.50–1.3
Tin	. . .	1.2–1.9	. . .
Chromium	. . .	0.01–0.12	. . .
Zinc, max	1.5	0.50	1.5
Iron, max	0.8	. . .	0.8
Nickel, max	. . .	. . .	0.6
Lead, max	0.05	0.05	0.05

^{A}An alloy containing as high as 2.6 % silicon is acceptable providing the sum of all named elements other than copper, silicon, and iron does not exceed 0.3 %.

7. Mechanical Property Requirements

7.1 *Tensile Requirements*—The tension test shall be the standard test for all tempers of rolled, annealed, and hot-rolled materials. Acceptance or rejection based on mechanical properties shall depend only on the tensile properties, which shall conform to the requirements prescribed in Table 2 or Table 3. Tension test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling.

7.1.1 For Pressure Vessel Code Applications, the tensile requirements are prescribed in Table 3.

7.1.2 For general purpose applications, the tensile requirements are prescribed in Table 2.

7.2 *Rockwell Hardness*—The approximate Rockwell hardness values given in Tables 2 and 3 are for general information and assistance in testing and shall not be used as a basis for product rejection.

7.3 *Grain Size*—The approximate grain size values for annealed tempers given in Tables 2 and 3 are for general information and shall not be used as a basis for product rejection.

8. Purchases for U.S. Government Agencies

8.1 If the product ordered is for an agency of the U.S. Government, when specifically stipulated in the contract or purchase order, the product furnished shall conform to the conditions specified in the Supplementary Requirements section of Specifications B 248 or B 248M.

9. Dimensions, Mass, and Permissible Variations

9.1 The dimensions and tolerances for product described by this specification shall be as specified in Specifications B 248 or B 248M with particular reference to the following tables and related paragraphs in that specification (exceptions for *ASME Pressure Vessel Code* applications are noted):

9.2 *Thickness*—Table 2.

9.2.1 *Pressure Vessel Code Applications*—The thickness of any place or sheet shall not be more than 0.01 in. under the thickness specified.

9.3 *Width*:

9.3.1 *Slit Metal and Slit Metal with Rolled Edges*—Table 4.

9.3.2 *Square-Sheared Metal*—Table 5.

9.3.3 *Sawed Metal*—Table 6.

9.4 *Length*:

9.4.1 *Schedule of Lengths (Specific and Stock) With Ends*—Table 7.

9.4.2 *Length Tolerances for Square-Sheared Metal*—Table 9.

9.4.3 *Length Tolerances for Sawed Metal*—Table 10.