Designation: B169/B169M – 15

Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar[1]

This standard is issued under the fixed designation B169/B169M; 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[2] establishes the requirements for Copper Alloy UNS Nos. C61300 and C61400 aluminum bronze sheet, strip, and rolled bar.

1.2 The products made to this specification are commonly used for drawing, forming, stamping, and bending applications and are not intended for electrical applications.

NOTE 1—The products produced under this general specification may be used in many applications in which the individual requirements may be too specific to be determined by normal physical or mechanical testing. Therefore, it may be advisable for the purchaser to submit samples or drawings to the manufacturer to be assured that the product furnished is suitable for the intended application.

NOTE 2—Refer to Specification B171/B171M for plate product.

1.3 *Units*—Values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

B171/B171M Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers

B248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

B248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric)

B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

B846 Terminology for Copper and Copper Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

E290 Test Methods for Bend Testing of Material for Ductility

3. General Requirements

3.1 The following sections of Specifications B248 or B248M form a part of this specification:

3.1.1 Terminology,
3.1.2 Workmanship, Finish and Appearance,
3.1.3 Sampling,
3.1.4 Number of Tests and Retests,
3.1.5 Specimen Preparation,
3.1.6 Significance of Numerical Limits,
3.1.7 Inspection,
3.1.8 Rejection and Rehearing,
3.1.9 Certification,
3.1.10 Mill Test Reports,
3.1.11 Packaging and Package Marking,
3.1.12 Supplementary Requirements.

3.2 In addition, when a section with a title identical to that referenced in 3.1, above, appears in this specification, it contains additional requirements which supplement those appearing in Specifications B248 or B248M.

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 product under this specification, as applicable.

5.1.1 ASTM designation and year of issue,
5.1.2 Copper [Alloy] UNS No. designation,
5.1.3 Temper, (Section 8),
5.1.4 Dimensions, thickness, and width (Section 12),
5.1.5 Length,
5.1.6 How furnished, straight lengths or coils,
5.1.7 Quantity—total weight or total length or number of pieces of each size,

[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-169 in Section II of that code.

[3] 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 Document Summary page on the ASTM website.

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

5.1.8 When product is ordered for *ASME Boiler and Pressure Vessel Code* Application, and

5.1.9 When product is ordered for agencies of the U.S. government.

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 Type of edge (for example, slit, sheared, sawed, and so forth),

5.2.2 Heat identification or traceability details,

5.2.3 Bend test,

5.2.4 Certification, and

5.2.5 Mill Test Report.

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture shall be a form (cast bar, cake, slab, etc.) of Copper Alloy UNS No. C61300 or C61400 of such purity and soundness as to be suitable for processing into the products prescribed herein.

6.2 *Manufacture:*

6.2.1 The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure in the finished product. The product shall be hot or cold rolled to finish gage and subsequently annealed, if required, to meet the temper properties specified.

6.2.2 The product shall be hot or cold worked to the finished size, and subsequently annealed when required, to meet the temper properties specified.

6.3 *Edges:*

6.3.1 Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

7. Chemical Composition

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

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

TABLE 1 Chemical Requirements

Element	Composition,%	
	Copper Alloy UNS No.	
	C61300[A]	C61400
Copper (including silver)	remainder	remainder
Lead, max	0.01	0.01
Iron	2.0–3.0	1.5–3.5
Zinc, max	0.10	0.20
Aluminum	6.0–7.5	6.0–8.0
Manganese, max	0.20	1.0
Phosphorus, max	0.015	0.015
Silicon, max	0.10	...
Tin	0.20–0.50	...
Nickel (including cobalt), max	0.15	...

[A] When the product is for subsequent welding applications and is so specified by the purchaser, chromium shall be 0.05 % max, cadmium 0.05 % max, zirconium 0.05 % max, and zinc 0.05 % max.

7.2 For alloys in which copper is listed as "remainder," copper is the difference between the sum of results of all elements determined and 100 %. When all elements in Table 1 for the specified alloy are determined, the sum of the results shall be:

Copper Alloy UNS No.	Sum of Results % min.
C61300	99.8
C61400	99.5

8. Temper

8.1 The standard tempers for products described in this specification are given in Table 2 and Table 3.

8.1.1 Hot-rolled temper M20.

8.1.2 Annealed-to-temper O25 or O60.

NOTE 3—Inquiry should be made to the supplier concerning the availability of the specific temper required.

9. Mechanical Property Requirements

9.1 *Tensile Strength Requirements:*

9.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 2 or Table 3 when tested in accordance with Test Methods E8/E8M. The test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling.

10. Bending Requirements

10.1 When specified in the contract or purchase order, the test specimen shall withstand being bent cold perpendicular to the direction of rolling (rightway bend) through 120° around a mandrel whose radius is equal to the thickness of the product. When the outside surface of the bend is examined with an unaided eye, no sign of fracturing shall be observed.

11. Purchases for U.S. Government Agencies

11.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. government shall conform to the special government stipulations in the Supplementary Requirements section of Specifications B248 or B248M.

12. Dimensions, Mass, and Permissible Variations

12.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 or B248M.

12.2 *Thickness.*

12.3 *Width:*

12.3.1 Slit Metal and Slit Metal with Rolled Edges

12.3.2 Square Sheared Metal

12.4 *Length:*

12.4.1 Length Tolerances for Straight Lengths

12.4.2 Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends

12.4.3 Length Tolerance for Square Sheared Metal

12.4.4 Length Tolerances for Sawed Metal

12.5 *Straightness:*

TABLE 2 Tensile Requirements (Inch-Pound)

Copper Alloy UNS No.	Temper Designation[A]		Thickness, in.	Width, in.	Tensile Strength min, ksi[B]	Yield Strength at 0.5 % Extension Under Load, min, ksi[B]	Yield Strength at 0.2 % Extension Under Load, min, ksi[B]	Elongation in 2 in., min, %
	Standard	Former						
C61300	O25, O60, or M20	soft	½ and under	all widths	75	36	34	35
			Over ½ to 2, incl	all widths	72	32	30	35
			Over 2 to 5, incl	all widths	65	28	26	35
C61400	O25, O60, or M20	soft	½ and under	all widths	72	32	30	35
			Over ½ to 2, incl	all widths	70	30	28	35
			Over 2 to 5, incl	all widths	65	28	26	35

[A] Standard designations defined in Classification B601.
[B] ksi = 1000 psi.

TABLE 3 Tensile Requirements (SI)

Copper Alloy UNS No.	Temper Designation[A]		Thickness, mm	Width, mm	Tensile Strength min, MPa	Yield Strength at 0.5 % Extension Under Load, min, MPa	Yield Strength at 0.2 % Extension Under Load, min, MPa	Elongation in 2 in., min, %
	Standard	Former						
C61300	O25, O60, or M20	soft	12.0 and under	all widths	515	250	235	35
			Over 12.0 to 50.0, incl	all widths	495	220	205	35
			Over 50.0 to 140 incl	all widths	450	195	180	35
C61400	O25, O60, or M20	soft	12.0 and under	all widths	495	220	205	35
			Over 12.0 to 50.0, incl	all widths	485	205	195	35
			Over 50.0 to 140 incl	all widths	450	195	180	35

[A] Standard designations defined in Classification B601.

12.5.1 Slit Metal or Slit Metal Either Straightened or Edge Rolled
12.5.2 Square Sheared Metal
12.5.3 Sawed Metal

12.6 *Edge Contours:*
12.6.1 Square Corners
12.6.2 Rounded Corners
12.6.3 Rounded Edges
12.6.4 Full-Rounded Edges

13. Number of Tests and Retests

13.1 *Tests:*

13.1.1 *Chemical Analysis*—Chemical composition shall be determined in accordance with the element mean of the results of at least two replicate analyses of the sample(s).

13.1.2 *Mechanical Properties*—Tensile strength, yield strength, and elongation shall be reported as the average of results from at least two specimens.

13.1.3 *Bending Requirements*—Two specimens shall be tested and both shall pass.

14. Specimen Preparation

14.1 *Bend Test*—Bend test specimens shall be prepared as directed in Test Methods E290.

15. Test Methods

15.1 *Chemical Analysis:*

15.1.1 In cases of disagreement, tests methods for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser.

15.1.2 Test method(s) to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and purchaser.

15.2 *Other Tests:*

15.2.1 The product furnished shall conform with the specified requirements when subjected to test in accordance with the following table:

Test	Method
Tensile strength	E8/E8M
Yield strength	E8/E8M
Elongation	E8/E8M
Bending	E290

15.2.2 *Yield Strength*—The yield strength shall be determined by the extension under load method of Test Methods E8/E8M. When test results are obtained from both full-size and machined specimens, and they differ, the test results from the full-size specimens shall prevail.

15.2.3 Elongation shall be determined as specified in the first two subsections of the section of Test Methods E8/E8M, entitled "Elongation."

15.2.4 Test results are affected by variations in speed of testing. A considerable range of testing speed is permitted. The rate of stressing to the yield strength should not exceed 100 ksi/min [690 MPa/min.]. Above the yield strength, the movement per minute of the testing machine head under load should not exceed 0.5 in./in [0.5 mm/mm].

16. Certification

16.1 When specified in the purchase order or contract that product is purchased for ASME Boiler and Pressure Vessel Code applications, certification to this specification is mandatory.

17. Keywords

17.1 aluminum bronze; aluminum bronze rolled bar; aluminum bronze sheet; aluminum bronze strip; UNS C61300; UNS C61400

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B169/B169M – 10) that may impact the use of this standard. (Approved May 1, 2015.)

(1) Only minor editing to conform to B05 Standard Guide B950. No technical changes were made that will impact usage of standard.