



Designation: **B 169/B 169M – 9501**

Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar¹

This standard is issued under the fixed designation B 169/B 169M; 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 This specification is under the jurisdiction of ASTM Committee ~~B-5~~ B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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1. Scope*

1.1 This specification² establishes the requirements for UNS Copper Alloy UNS Nos. C61300 and C61400 aluminum bronze sheet, strip, and rolled bar.

~~1.1.1 The~~

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.

~~1.2 This specification is the companion to SI Specification B 169M; therefore, no metric equivalents are presented in this specification.~~

NOTE 1—The products produced under this general specification may be used in many applications where 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 in order to be assured that the product furnished is suitable for the intended application.

NOTE 2—Refer to Specification B 171/B 171M for plate product.

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

2. Referenced Documents

2.1 The following documents in the current Book of Standards form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

~~B 16971/B 171M Specification for Aluminum Bronze Plate, Sheet, Strip~~ Copper Alloy Plate and Rolled Bar (Metric) Sheet for Pressure Vessels, Condensers and Heat Exchangers³

~~B 171 Specification for Copper Alloy Plate and Sheet for Pressure Vessels, Condensers and Heat Exchangers³~~

~~B 248 Specification 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip and Rolled Bar³~~

~~B 601 Practice 248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip and Rolled Bar [Metric]³~~

B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast³

B 846 Terminology for Copper and Copper Alloys³

E 8 Test Methods for Tension Testing of Metallic Materials⁴

E 8M Test Methods for Tension Testing of Metallic Materials [Metric]⁴

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes⁵

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric)⁵

~~E 478 Test 290 Test Methods for Chemical Analysis of Copper Alloys⁵~~ Bend Testing for Ductility⁴

~~E 290478 Test Methods for Semi-Guided Bend Test for Ductility Chemical Analysis of Metallic Materials⁴~~ Copper Alloys⁵

3. General Requirements

3.1 The following sections of Specifications B 248 or B 248M form a part of this specification:

3.1.1 Terminology,

3.1.2 Workmanship, Finish and Appearance,

3.1.3 Sampling,

3.1.4 Significance of Numerical Limits,

3.1.5 Inspection,

3.1.6 Rejection and Rehearing,

3.1.7 Certification,

3.1.8 Mill Test Reports,

3.1.9 Packaging and Package Marking,

3.1.10 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 Specifications B 248 or B 248M.

4. Terminology

4.1 For definitions of terms related to copper and copper alloys, refer to Terminology B 846.

5. Ordering Information

35.1 Orders for products under this specification should include the following information:

² For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-169 in Section II of that code.

³ Annual Book of ASTM Standards, Vol 02.01.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vol 03.05.

- 35.1.1 ASTM designation and year of issue (for example, B 169/B 169M – 9500),
- 35.1.2 Copper Alloy UNS No. (for example, C61300),
- 35.1.3 Temper (for example, Section 6 8),
- 35.1.4 Dimensions, thickness, and width (for example, Section 102),
- 35.1.5 Length,
- 35.1.6 How furnished, flat or rolls,
- 35.1.7 Total weight, each size,
- 35.1.8 When product is purchased for ASME Boiler and Pressure Vessel Code Application, and
- 35.1.9 When product is purchased for agencies of the U.S. government.
- 35.2 The following options are available and should be specified when required:
 - 35.2.1 Type of edge, edge (for example, slit, sheared, sawed, and so forth),
 - 35.2.2 Heat identification or traceability details,
 - 35.2.3 Bend test,
 - 35.2.4 Certification, and
 - 35.2.5 Mill Test Report.

46. Materials and Manufacture

46.1 *Material:*

46.1.1 The material of manufacture shall be from cast slabs (also termed cakes or ingots) of Copper Alloy UNS Numbers C61300 or C61400 of such purity and soundness as to be suitable for processing into the products prescribed herein.

46.2 *Manufacture:*

46.2.1 The products 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 invoked.

46.2.2 *Edges:*

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

57. Chemical Composition

57.1 The specified copper alloy shall conform to the requirements of Table 1.

~~5.1.1 These specification~~

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

57.2 When all elements in Table 1 for the specified alloy are determined, the sum of the results shall be:

<u>Alloy UNS No.</u> <u>Copper Alloy UNS</u> <u>No.</u>	<u>Sum of Results % min.</u> <u>Sum of Results % min.</u>
C61300	99.8
C61400	99.5

68. Temper

68.1 Products in both alloys shall be available in the following tempers as defined in Practice B 601: annealed tempers O25, O60, and hot-rolled temper M20.

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

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.

79. Mechanical Property Requirements

79.1 The product furnished shall conform to the requirements of Table 2 for the specified alloy, temper, and dimensions prescribed.

8. Bending Requirements

8.1 When specified in the contract or purchase order, the test specimen shall withstand being bent cold, perpendicular to the direction of rolling (right way 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.

9. U.S. Government Orders

9.1 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 Specification B 248.

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 B 248 or B 248M.

12. Dimensions, Mass, and Permissible Variations

102.1 The dimensions and tolerances for material described by this specification shall be as specified in the current edition of Specifications B 248 with particular reference to the following tables and related paragraphs in that specification:

TABLE 2 Tensile Requirements

Copper Alloy UNS No.	Temper Designation ^A		Thickness, in. [mm]	Width, in.	Tensile Strength min, ksi ^B [MPa]	Yield Strength at 0.5 % Extension Under Load, min, ksi ^B [MPa]	Yield Strength at 0.2 % Extension Under Load, min, ksi ^C [MPa] 0.2 % Extension Under Load, min, ksi]	Elongation in 2 in., min, %
	Standard	Former						
G61300 C61300	O25, O60, or M20	soft	½ and under	all widths	75	36	34	35
	O25, O60, or M20	soft	½ and under [12.0 and under]	all widths	75 [515]	36 [255]	34 [235]	35
			Over ½ to 2, incl	all widths	72	32	30	35
			Over ½ to 2, incl [Over 12.0 to 50.0, incl]	all widths	72 [495]	32 [220]	30 [210]	35
			Over 2 to 5, incl	all widths	65	28	26	35
			Over 2 to 5, incl Over 2 to 5, incl Over 2 to 5, incl	all widths	65 [450]	28 [195]	26 [180]	35
G61400 C61400	O25, O60, or M20	soft	½ and under	all widths	72	32	30	35
	O25, O60, or M20	soft	½ and under [12.0 and under]	all widths	72 [495]	32 [220]	30 [205]	35
			Over ½ to 2, incl	all widths	70	30	28	35
			Over ½ to 2, incl [Over 12.0 to 50.0, incl]	all widths	70 [485]	30 [205]	28 [195]	35
			Over 2 to 5, incl	all widths	65	28	26	35
			Over 2 to 5, incl Over 2 to 5, incl Over 2 to 5, incl	all widths	65 [450]	28 [195]	26 [180]	35

^A Standard designations defined in Practice B 601.

^B ksi = 1000 psi.

^C See 11.1.10.

~~10.1.1 or B 248M.~~

~~12.1.1 Thickness—Table 2.~~

~~10.1.2—~~

~~12.1.2 Width:~~

~~102.1.2.1 Slit Metal and Slit Metal with Rolled Edges—Table 4.~~

~~10.1.2.2—~~

~~12.1.2.2 Square Sheared Metal—Table 5.~~

~~10.1.2.3—~~

~~12.1.2.3 Sawed Metal—Table 6.~~

~~10.1.3—~~

~~12.1.3 Length:~~

~~102.1.3.1 Length Tolerances for Straight Lengths—Table 7.~~

~~10.1.3.2—~~

~~12.1.3.2 Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends—Table 8.~~

~~10.1.3.3—~~

~~12.1.3.3 Length Tolerance for Square Sheared Metal—Table 9.~~

~~10.1.3.4—~~

~~12.1.3.4 Length Tolerances for Sawed Metal—Table 10.~~

~~10.1.4—~~

~~12.1.4 Straightness:~~

~~102.1.4.1 Slit Metal or Slit Metal Either Straightened or Edge Rolled—Table 11.~~

~~10.1.4.2—~~

~~12.1.4.2 Square Sheared Metal—Table 12.~~

~~10.1.4.3—~~

~~12.1.4.3 Sawed Metal—Table 13.~~

~~10.1.5—~~

~~12.1.5 Edges:~~

~~102.1.5.1 Square Edges—Table 14.~~

~~10.1.5.2—~~

~~12.1.5.2 Rounded Corners—Table 15.~~

~~10.1.5.3—~~

~~12.1.5.3 Rounded Edges—Table 16.~~

~~10.1.5.4—~~

~~12.1.5.4 Full Rounded Edges—Table 17.~~

11. General Requirements

11.1 The following sections of Specification B 248 form a part of this specification:

11.1.1 Terminology;

11.1.2 Workmanship, Finish and Appearance;

11.1.3 Sampling;

11.1.4 Significance of Numerical Limits;

11.1.5 Inspection;

11.1.6 Rejection and Rehearing;

11.1.7 Certification;

11.1.8 Mill Test Reports;

11.1.9 Packaging and Package Marking;

11.1.10 Supplementary Requirements.

11.2 An identical section in this specification is supplementary to the referenced section in Specification B 248.

~~12.—~~

13. Number of Tests and Retests

123.1 Tests:

123.1.1 Chemical Analysis:

123.1.1.1 Composition shall be determined as the average of at least two replicate determinations for each element in Table 1 for the specified alloy.

123.1.2 Mechanical Properties:

123.1.2.1 Tensile strength, yield strength, and elongation shall be reported as the average of results from at least two specimens.

123.1.3 Bending Requirements:

123.1.3.1 Two specimens shall be tested and both shall pass.

123.2 Retests:

123.2.1 Chemical Analysis:

123.2.1.1 Should the results for one or more of the elements in the specified alloy fail to conform with the requirements in Table 1, a retest may be made with a new composite made up from the pieces originally selected.

123.2.2 Mechanical Properties:

123.2.2.1 Should the test results obtained from the specified product fail to conform to the requirements of Table 2, a retest shall be permitted on two specimens made from the remaining pieces selected.

123.2.3 Referee (Umpire) Tests:

123.2.3.1 Refer to section entitled “Rejection and Rehearing” in Specifications B 248 or B 248M.

134. Specimen Preparation

134.1 Chemical Analysis:

134.1.1 Preparation of the analytical specimen shall be the responsibility of the reporting laboratory.

134.2 Mechanical Properties:

134.2.1 Tensile and yield test specimens shall be prepared in accordance with Test Methods E 8 or E 8M.

134.2.1.1 The tensile test specimen shall be taken so that the longitudinal axis is parallel to the direction of rolling.

134.3 Bend Test:

134.3.1 Bend test specimens shall be prepared as directed in Test Method E 290.

145. Test Methods

145.1 Chemical Analysis:

145.1.1 The chemical composition shall be determined, in case of disagreement, as follows:

Element	ASTM Method
Copper	
Copper	E 478
Iron	E 478
Lead	E 478 (AA)
Zinc	E 478 (Titrimetric)
Zinc	E 478 (titrimetric)
Aluminum	E 478
Manganese	E 62
Phosphorus	E 62
Silicon	E 54 (Sulfuric Acid)
Silicon	E 54 (sulfuric acid)
Tin	E 478 (Photometric)
Tin	E 478 (photometric)
Nickel	E 478 (Photometric)
Nickel	E 478 (photometric)

145.1.2 Test method(s) for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the supplier and purchaser.

145.2 Other Tests:

145.2.1 The product furnished shall conform with the mechanical and other requirements enumerated in this specification when tested in accordance with the following appropriate method:

Test	Method
Tensile Strength	E 8
Tensile strength	E 8
Yield Strength	E 8
Yield strength	E 8
Elongation	E 8
Bending	E 290

145.2.1.1 Yield strength shall be determined in accordance with the “Extension-~~u~~Under Load Method” of Test Methods E 8.

145.2.1.2 Elongation shall be determined as specified in the first two subsections of the section of Test Methods E 8, or E 8M, entitled “Elongation~~2.~~”

145.2.1.3 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.

15. Certification

~~15.1 When the contract or purchase order specifies the product to be for ASME Boiler and Pressure Vessel application, certification is mandatory in/in [0.5 mm/mm].~~

16. Certification

16.1 When the contract or purchase order specifies the product to be for ASME Boiler and Pressure Vessel application, certification is mandatory.

17. Keywords

167.1 aluminum bronze; aluminum bronze sheet; rolled bar; aluminum bronze strip; sheet; aluminum bronze rolled bar strip

SUMMARY OF CHANGES

This section identifies

Committee B05 has identified the location of selected changes to this specification that have been incorporated standard since the 1985a issue. This section March 1995 publication that may also include descriptions of impact the changes or reasons for the changes, or both.

- ~~(1) The specification has been completely revised to conform with Committee requirements for style and form.~~
- ~~(2) Plate has been deleted as one use of the products available under this specification as the products involved are not for plate applications (see Specification B 171 for plate products).~~
- ~~(3) The General Requirements standard.~~
- ~~(1) A section on Keywords has been revised to identify those sections in Specification B-248 which form a part of this specification.~~
- ~~(4) The Number of Tests added.~~
- ~~(2) B 169 and Retests section has B 169M have been revised to more clearly state the minimum requirements.~~
- ~~(5) The Test Methods section has been revised to identify individual test methods, combined into one specification.~~

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