



Standard Specification for Aluminum Bronze Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B 150/B 150M; 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 aluminum bronze rod, bar, and shapes for Copper Alloys UNS Nos. C61300, C61400, C61900, C62300, C62400, C63000, C63020, C63200, C64200, and C64210.

NOTE 1—Product intended for hot forging is described in Specification B 124/B 124M.

NOTE 2—**Warning**—Mercury is a definite health hazard in use and in disposal.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. 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.

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 and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

B 124/B 124M Specification for Copper and Copper Alloy Forging Rod, Bar and Shapes²

B 154 Test Method for Mercurous Nitrate Test for Copper and Copper Alloys²

B 249/B 249M Specification for General Requirements for Wrought Copper and Copper Alloy Rod, Bar and Forgings²

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast²

B 858 Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys²

E 8 Test Methods for Tension Testing of Metallic Materials³
E 8M Test Methods for Tension Testing of Metallic Materials [Metric]³
E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials³
E 53 Test Methods for Chemical Analysis of Copper⁴
E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)⁴
E 118 Test Methods for Chemical Analysis of Copper—Chromium Alloys⁴
E 478 Test Methods for Chemical Analysis of Copper Alloys⁴

3. General Requirements

3.1 The following sections of Specifications B 249/B 249M constitute a part of this specification:

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

3.2 In addition, when a section with a title identical to those referenced in 3.1, appears in this specification, it contains additional requirements that supplement those appearing in Specification B 249/B 249M.

4. Ordering Information

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

¹ This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.02 on Rod, Bars, Wire, Shapes and Forgings.

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² *Annual Book of ASTM Standards*, Vol 02.01.

³ *Annual Book of ASTM Standards*, Vol 03.01.

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

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

TABLE 1 Chemical Requirements

Elements	Composition, %									
	C61300	C61400	C61900	C62300	Copper Alloy UNS No.		C63020	C63200	C64200	C64210
					C62400	C63000				
Aluminum	6.0–7.5	6.0–8.0	8.5–10.0	8.5–10.0	10.0–11.5	9.0–11.0	10.0–11.0	8.7–9.5	6.3–7.6	6.3–7.0
Copper, incl silver	remainder	remainder	remainder	remainder	remainder	remainder	74.5 min	remainder	remainder	remainder
Iron	2.0–3.0	1.5–3.5	3.0–4.5	2.0–4.0	2.0–4.5	2.0–4.0	4.0–5.5	3.5–4.3 ^A	0.30 max	0.30 max
Nickel, incl cobalt	0.15 max	...	...	1.0 max	...	4.0–5.5	4.2–6.0	4.0–4.8 ^A	0.25 max	0.25 max
Manganese	0.20 max	1.0 max	...	0.50 max	0.30 max	1.5 max	1.5 max	1.2–2.0	0.10 max	0.10 max
Silicon	0.10 max	...	...	0.25 max	0.25 max	0.25 max	...	0.10 max	1.5–2.2	1.5–2.0
Tin	0.20–0.50	...	0.6 max	0.6 max	0.20 max	0.20 max	0.25 max	...	0.20 max	0.20 max
Zinc, max	0.10 ^B	0.20	0.8	...	...	0.30	0.30	...	0.50	0.50
Lead, max	0.01	0.01	0.02	...	...	...	0.03	0.02	0.05	0.05
Arsenic, max	...	...	...	...	...	...	...	...	0.15	0.15
Phosphorus, max	0.015	0.015	...	...	...	...	...	...	...	...
Other named elements ^B							^C			

^A Iron content shall not exceed nickel content.

^B 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.

^C Chromium shall be 0.05 max and cobalt shall be 0.20 max.

4.1.1 ASTM specification designation and year of issue (B 150/B 150M - 02),

4.1.2 Copper alloy UNS No. (See Table 1),

4.1.3 Temper (see Temper section),

4.1.3.1 When Alloy UNS No. C63000 is specified, specify standard strength or high strength temper,

4.1.4 Product cross-section (for example round, hexagonal, square, and so forth),

4.1.5 Dimensions (diameter or distance between parallel surfaces and length) and permissible variations (Section 10),

4.1.5.1 When product of Copper Alloy UNS No. C63020 is specified, the tolerances for diameter, thickness, width, and length shall be part of the contract or purchase order and shall be agreed upon between the supplier and the purchaser.

4.1.5.2 *Shapes*—When product is shapes, the dimensional tolerances shall be as agreed upon between the manufacturer and the purchaser and shall be specified.

4.1.6 Quantity, total weight, footage, or number of pieces for each size.

4.1.7 When product is purchased for agencies of the U.S. government.

4.2 The following options are available and should be specified at the time of placing orders when required:

4.2.1 If the material is intended for welding applications,

4.2.2 Certification,

4.2.3 Mill test reports,

4.2.4 Mercurous Nitrate Test, (see 9.1),

4.2.5 Ammonia Vapor Test, (see 9.2),

4.2.6 If piston finish is required, (see 9.3), and

4.2.7 When tensile test is required for alloys with hardness requirements in Table 3 (see 8.1.1.1).

5. Materials and Manufacture

5.1 *Copper Alloy UNS C63020*—Rod and Bar shall be heat-treated to 26 Rockwell hardness (C scale) (HRC) minimum as follows:

5.1.1 Heat to 1550°/1650°F [850/900°C] for 2 h minimum and quenched in water.

5.1.2 Temper at 900°/1000°F [480/540°C] for 2 h minimum and air cool to room temperature.

5.2 *Copper Alloy UNS C63200*—Rod and Bar shall be heat-treated as follows:

5.2.1 Heat to 1550°F [850°C] minimum for 1 h minimum at temperature and quench in water or other suitable medium,

5.2.2 Temper anneal at 1300 ± 25°F [700 ± 15°C] for 3 to 9 h at temperature as required to obtain desired mechanical properties, and

5.2.3 Heat treatment is not mandatory for sections that exceed 12 in. [300 mm] in diameter or thickness.

6. Chemical Composition

6.1 The material shall conform by alloy to the chemical composition requirements specified in Table 1.

6.1.1 Copper, when specified as the remainder and not determined directly, shall be taken as the difference between the sum of all elements with limiting values analyzed and 100 %.

6.2 The sum of specified elements, when analyzed, shall be 99.5 % minimum for all alloys except C61300 which shall be 99.8 % min.

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

7. Temper

7.1 Tempers available under this specification, and as defined in Practice B 601, and HR50, M10, M20, M30, O20, O25, O30, O32, TQ30, TQ50 and TQ55.

8. Mechanical Property Requirements

8.1 The product shall conform to the mechanical property requirements given in Table 2 and Table 3 for the Copper Alloy UNS No. designation specified in the ordering information.

8.1.1 *Rockwell Hardness*—For the alloys and tempers listed, product 0.5 in. [12 mm] and over in diameter or distance



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TABLE 2 Tensile Requirements

Temper Designation		Diameter or Distance Between Parallel Surfaces, ^A in. [mm]	Tensile Strength, min ksi [MPa]	Yield Strength, min ksi [MPa], at 0.5 % Extension Under Load	Elongation in 4 × Diameter or Thickness of Specimen min, % ^B								
Code	Name												
Copper Alloy UNS No. C61300													
HR50	drawn and stress relieved	<i>rod (round only):</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2.0 [50] incl over 2 [50] to 3 [80], incl	80 [550] 75 [515] 72 [495] 70 [485]	50 [345] 45 [310] 40 [275] 35 [240]	30 30 30 30								
HR50	drawn and stress relieved	<i>rod (hexagonal and octagonal) and bar:</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl	80 [550] 75 [515] 70 [485]	40 [275] 35 [240] 32 [220]	30 30 30								
Copper Alloy UNS No. C61400													
HR50	drawn and stress relieved	<i>rod (round only):</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	80 [550] 75 [515] 70 [485] 70 [485]	40 [275] 35 [240] 32 [220] 30 [205]	30 30 30 30								
Copper Alloy UNS No. C61900													
HR50	drawn and stress relieved	<i>rod (round only):</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	90 [620] 88 [605] 85 [585] 78 [540]	50 [345] 44 [305] 40 [275] 37 [255]	15 15 20 25								
M20	as hot rolled	over 3 [80]	75 [515]	30 [205]	20								
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved	} <i>shapes, all sizes</i>	75 [515]	30 [205]	20								
Copper Alloy UNS No. C62300													
HR50	drawn and stress relieved					<i>rod (round only):</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	90 [620] 88 [605] 84 [580] 76 [525]	50 [345] 44 [305] 40 [275] 37 [255]	12 15 15 20				
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved					} over 3 [80]	75 [515]	30 [205]	20				
HR50	drawn and stress relieved									<i>rod (hexagonal and octagonal) and bar:</i> 1 [25] and under over 1 [25] to 2 [50], incl	80 [550] 78 [540]	35 [240] 32 [220]	15 15
M20	as hot rolled									over 2 [50]	75 [515]	30 [205]	20
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved	} <i>shapes, all sizes</i>	75 [515]	30 [205]	20								
Copper Alloy UNS No. C62400													
HR50	drawn and stress relieved									<i>rod (round only):</i> ½ [12] and under over ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	95 [655] 95 [655] 90 [620] 90 [620]	45 [310] 45 [310] 43 [295] 40 [275]	10 12 12 12
M20 M30	as hot rolled as hot extruded					over 3 [80] to 5 [125] incl	90 [620]	35 [240]	12				

TABLE 2 *Continued*

Temper Designation		Diameter or Distance Between Parallel Surfaces, ^A in. [mm]	Tensile Strength, min ksi [MPa]	Yield Strength, min ksi [MPa], at 0.5 % Extension Under Load	Elongation in 4 × Diameter or Thickness of Specimen min, % ^B
Code	Name				
O20 O25 O30	hot forged and annealed hot rolled and annealed hot extruded and annealed	<i>rod (hexagonal and octagonal) and bar:</i> ½ [12] to 5 [125], incl <i>shapes, all sizes</i>	90 [620]	35 [240]	12
			90 [620]	35 [240]	12
TQ50	quench hardened and temper annealed	<i>rod (round only):</i> over 3 [80] to 5 [125], incl	95 [655]	45 [310]	10
Copper Alloy UNS No. C63000					
HR50	drawn and stress relieved	<i>1—standard strength rod:</i> ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	100 [690] 90 [620] 85 [585]	50 [345] 45 [310] 42.5 [295]	5 6 10
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved	over 3 [80] to 4 [100], incl over 4 [100]	85 [585]	42.5 [295]	10
			80 [550]	40 [275]	12
HR50	drawn and stress relieved	<i>bar:</i> ½ [12] to 1 [25], incl over 1 [25] to 2 [50], incl	100 [690] 90 [620]	50 [345] 45 [310]	5 6
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved	over 2 [50] to 4 [100], incl over 4 [100]	85 [585]	42.5 [295]	10
			80 [550]	40 [275]	12
M20 M30 O20 O25 O30 HR50	as hot rolled as hot extruded hot forged and annealed hot rolled and annealed hot extruded and annealed drawn and stress relieved	<i>shapes, all sizes</i>	85 [585]	42.5 [295]	10
HR50	drawn and stress relieved	<i>2—high strength rod:</i> 1 [25] and under over 1 [25] to 2 [50], incl over 2 [50] to 3 [80], incl	110 [760] 110 [760] 105 [725]	68 [470] 60 [415] 55 [380]	10 10 10
TQ50 O32	quench hardened and temper annealed hot extruded and temper annealed	over 3 [80] to 5 [125], incl	100 [690]	50 [345]	10
Copper Alloy UNS No C63020					
TQ30	quenched hardened and tempered	<i>rod and bar:</i> up to 1 [25] incl over 1 [25] to 2 [50], incl over 2 [50] to 4 [100], incl	135 [930] 130 [890] 130 [890]	100 [690] ^C 95 [650] ^C 90 [620] ^C	6 6 6
Copper Alloy UNS No. C63200					
TQ50 TQ55	quench hardened and temper annealed quench hardened, temper annealed, drawn, and stress relieved	<i>rod and bar:</i> up to 3 [80], incl over 3 [80] to 5 [125], incl over 5 [125] to 12 [300], incl <i>shapes, all sizes</i>	90 [620] 90 [620] 90 [620] 90 [620]	50 [345] 45 [310] 40 [275] 40 [275]	15 15 15 15
O20 O25	hot forged and annealed hot rolled and annealed		<i>bar and shapes</i> <i>all sizes</i>	90 [620]	40 [275]	15
Copper Alloy UNS Nos. C64200 and C64210					
HR50	drawn and stress relieved	<i>rod and bar:</i> ½ [12] and under over ½ [12] to 1 [25], incl	90 [620] 85 [585]	45 [310] 45 [310]	9 12

TABLE 2 *Continued*

Temper Designation		Diameter or Distance Between Parallel Surfaces, ^A in. [mm]	Tensile Strength, min ksi [MPa]	Yield Strength, min ksi [MPa], at 0.5 % Extension Under Load	Elongation in 4 × Diameter or Thickness of Specimen min, % ^B
Code	Name				
		over 1 [25] to 2 [50], incl	80 [550]	42 [290]	12
		over 2 [50] to 3 [80], incl	75 [515]	35 [240]	15
M10	as hot forged—air cooled	over 3 [80] to 4 [100] incl over 4 [100]	70 [485]	30 [205]	15
M20	as hot rolled				
M30	as hot extruded				
M30	as hot extruded	<i>shapes, all sizes</i>	70 [485]	30 [205]	15

^A For rectangular bar, the Distance Between Parallel Surfaces as used in this table refers to the thickness.

^B Elongation values are based on 5.65 times the square root of the area for dimensions greater than 0.10 in. [2.5 mm]. In any case, a minimum gage length of 1 in. [25 mm] shall be used.

^C Yield strength at 0.2 % offset.

TABLE 3 *Rockwell Hardness Requirements^A for Copper Alloy UNS No. Designations C64200 and C64210*

Temper Designation		Diameter or Distance Between Parallel Surfaces, in. [mm]	Rockwell B Hardness Determined on the Cross Section Midway Between Surface and Center
Standard	Former		
HR50	drawn and stress relieved	0.5 [12] to 1.0 [25], incl.	80–100
		over 1.0 [25] to 2.0 [50], incl.	80–100
		over 2.0 [50] to 3.0 [80], incl.	70–95
M30	as hot-extruded	over 3.0 [80] to 4.0 [100], incl.	65–95
		over 4.0 [100]	65–95
		<i>shapes, all sizes</i>	65–95

^A Rockwell hardnesses are not established for diameters less than 0.5 in. [12 mm].

between parallel surfaces shall conform with the requirements given in Table 3, when tested in accordance with Test Methods E 18.

8.1.1.1 For the alloys and tempers listed in Table 3, Rockwell hardness shall be the basis of acceptance or rejection for mechanical properties except when the tensile test is specified in the contract or purchase order.

8.1.2 *Tensile Strength*—The product shall conform with the requirements of Table 2 when tested in accordance with Test Methods E 8 or E 8M.

9. Other Requirements

9.1 *Mercurous Nitrate Test*—Material furnished in any temper may, when specified, be required to pass the test in accordance with Test Method B 154.

9.2 *Ammonia Test*—Material furnished in any temper may, when specified, be required to pass the test in accordance with Test Method B 858. Test severity requirements shall be established by agreement between manufacturer and purchaser.

9.3 *Piston Finish*—When specified, round rod over 0.5 in. [12 mm] in diameter shall be furnished piston finished. Refer to Specification B 249/B 249M.

10. Dimensions, Mass and Permissible Variations

10.1 Refer to the appropriate paragraphs in Specification B 249/B 249M with particular attention to the following tables of that specification:

10.1.1 *Diameter or Distance between Parallel Surfaces:*

10.1.1.1 *Rod: Round, Hexagonal, Octagonal*—Refer to applicable table on Tolerances for Diameter or Distances Between Parallel Surfaces of Cold-Drawn Rod.

10.1.1.2 *Rod, M30, O30, and O32*—Refer to table on Tolerances for Diameter or Distance Between Parallel Surfaces of As-Extruded Rod and Bar.

10.1.1.3 *Round Rod, M20*—Refer to table on Diameter Tolerances for Hot-Rolled Round Rod.

10.1.1.4 *Piston Finish Rod*—Refer to table on Diameter Tolerances for Piston-Finished Rod.

10.1.2 *Bar:*

10.1.2.1 *Rectangular and Square*—Refer to table on Thickness Tolerances for Rectangular and Square Bar, and table on Width Tolerances for Rectangular Bar.

10.1.2.2 *Bar, M30, O30, and O32*—Refer to table on Tolerances for Diameter or Distance Between Parallel Surfaces of As-Extruded Rod and Bar.

10.1.3 *Length of Rod, Bar and Shapes*—Refer to table on Length Tolerances for Rod, Bar, and Shapes, and table on Schedule of Lengths (Specific and Stock) with Ends for Rod and Bar.

10.1.4 *Straightness:*

10.1.4.1 *Rod and Bar*—Refer to table on Straightness Tolerances for Rod, Bar, and Shapes.

10.1.4.2 *Shafting Rod*—Refer to table on Straightness Tolerances for Shafting.

10.1.4.3 *Rod, Bar and Shapes of M20, M30, O30, and O32 Temper*—They shall be of sufficient straightness to meet the requirements of the intended application.

10.1.5 *Edge Contours*—Refer to section entitled, “Edge Contours.”

10.2 *Shapes*—The dimensional tolerances for shapes shall be as agreed upon between the manufacturer and the purchaser.

11. Workmanship, Finish and Appearance

11.1 When specified in the contract or purchase order, round rod over ½ in. [12 mm] in diameter shall be furnished as piston finish rod or shafting.

12. Test Methods

12.1 Chemical Composition, in case of disagreement, shall be determined using the following methods:

Element	ASTM Test Methods
Aluminum	E 478, Titrimetric
Arsenic	E 62
Copper	E 478
Iron	E 478, Photometric
Lead	E 478, Atomic absorption
Manganese	E 62
Nickel	E 478, Photometric
Phosphorous	E 62

Silicon	E 62
Tin	E 478, Photometric
Zinc	E 478, Atomic absorption
Cadmium	E 53
Chromium	E 118

12.2 Test methods for other specified elements shall be by agreement between the purchaser and the supplier.

13. Keywords

13.1 aluminum bronze bar; aluminum bronze rod; aluminum bronze shapes

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B 150/B 150M – 02) that may impact the use of this standard. (Approved May 10, 2003.)

- (1) Additions were made to Section 4, adding 4.1.7 and 4.2.7.
- (2) Temper O32 was added for UNS Alloy No. C63000.
- (3) The temper name was corrected for temper TQ30 for UNS Alloy No. C63020.

Committee B05 has identified the location of selected changes to this standard since the last issue (B 150 – 98^{e2}) that may impact the use of this standard. (Approved Apr. 10, 2002.)

- (1) A comprehensive five-year review was conducted. B 150 and B 150M were combined.
- (2) The General Requirements section incorporated sections with references only to specification B 249/B 249M, and those sections were eliminated.
- (3) The Materials and Manufacture section was updated to incorporate processing information previously located in the General Requirements section.
- (4) An option for the use of B 858, Ammonia Vapor Test was added. (See Ordering Information and Other Requirements sections).
- (5) Alloy UNS No. C60600 was removed. This alloy has been cancelled.

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