



Designation: ~~B150/B150M-03~~ Designation: B 150/B 150M - 08

## Standard Specification for Aluminum Bronze Rod, Bar, and Shapes<sup>1</sup>

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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 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.~~ **Warning—Mercury** has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/faq.htm>) for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.

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:*<sup>2</sup>

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

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

~~B 249/B 249M Specification for General Requirements for Wrought Copper and Copper Alloy Rod, Bar and Forgings<sup>2</sup>~~  
Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

B 601 ~~Practice~~ Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

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

E 8 Test Methods for Tension Testing of Metallic Materials

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

~~E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>3</sup>~~ Test Methods for Rockwell Hardness of Metallic Materials

~~E 53 Test Methods for Chemical Analysis of Copper—Test Method for Determination of Copper in Unalloyed Copper by Gravimetry~~

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

E 118 Test Methods for Chemical Analysis of Copper—Chromium Alloys

E 478 Test Methods for Chemical Analysis of Copper Alloys

### 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,

<sup>1</sup> 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, Bar, Wire, Shapes and Forgings.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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.

- 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

**TABLE 1 Chemical Requirements**

Elements	Composition, %									
	C61300	C61400	C61900	C62300	Copper Alloy UNS No.		C63020	C63200	C64200	C64210
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 <sup>A</sup>	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 <sup>A</sup>	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 <sup>B</sup>	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 <sup>B</sup>	c									

<sup>A</sup> Iron content shall not exceed nickel content.

<sup>B</sup> 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.

<sup>C</sup> Chromium shall be 0.05 max and cobalt shall be 0.20 max.

#### 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, as applicable:

4.1.1 ~~ASTM specification designation and year of issue (B150/B150M--02), issue,~~

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 (See Table 2),~~

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,~~

4.1.7 ~~If product is being purchased for agencies of the U.S. government.~~

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

4.2.1 ~~If Copper Alloy C61300 material is intended for subsequent welding applications (See Note B, Table 2,~~

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),~~



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## TABLE 2 Tensile Requirements

Temper Designation		Diameter or Distance Between Parallel Surfaces, <sup>A</sup> 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, % <sup>B</sup>					
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				
M20 M30 O20 O25 O30 HR50	M20 as hot rolled M30 as hot extruded O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed HR50 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					} <i>shapes, all sizes</i>	}	75 [515]	30 [205]	20
M20 M30 O20 O25 O30 HR50	M20 as hot rolled M30 as hot extruded O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed HR50 drawn and stress relieved	} <i>shapes, all sizes</i>	}					—	—	—
				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	

**TABLE 2** *Continued*

Temper Designation		Diameter or Distance Between Parallel Surfaces, <sup>A</sup> 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, % <sup>B</sup>	
Code	Name					
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	over 2 [50]	75 [515]	3020 [205]
M20 M30 O20 O25 O30 HR50	M20 as hot rolled—over 2 [50] M30 as hot extruded O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed HR50 drawn and stress relieved		75 [515]	30 [205]	20	
<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	
O20		hot forged and annealed hot rolled and annealed hot extruded and annealed	<i>rod (hexagonal and octagonal) and bar:</i>			
O20			O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed			
O25		½ [12] to 5 [125], incl	90 [620]	90 [620]	35 [240]	35 [240]
O30		<i>shapes, all sizes</i> <i>shapes, all sizes</i>	90 [620] 90 [620]	35 [240] 35 [240]	12 12	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	1— <i>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] 80 [550]	42.5 [295] 40 [275]	10 12
M20 M30 O20 O25 O30 HR50		M20 as hot rolled M30 as hot extruded O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed HR50 drawn and stress relieved	— — over 3 [80] to 4 [100], incl over 4 [100]	— — 85 [585] 80 [550]	— — 42.5 [295] 40 [275]	— — 10 12



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**TABLE 2 Continued**

Temper Designation		Diameter or Distance Between Parallel Surfaces, <sup>A</sup> 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, % <sup>B</sup>															
Code	Name																			
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]	— — over 2 [50] to 4 [100], incl over 4 [100]	— — 85 [585] 80 [550]	— — 42.5 [295] 40 [275]	10 12														
M20 M30 O20 O25 O30 HR50							} M20 as hot rolled M30 as hot extruded O20 hot forged and annealed O25 hot rolled and annealed O30 hot extruded and annealed HR50 drawn and stress relieved	— — over 2 [50] to 4 [100], incl over 4 [100]	— — 85 [585] 80 [550]	— — 42.5 [295] 40 [275]	— — 10 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	— — 85 [585] 85 [585]	— — 42.5 [295] 42.5 [295]	— — 10 10					
HR50																drawn and stress relieved	2—high strength <i>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																quench hardened and temper annealed	} over 3 [80] to 5 [125], incl	100 [690]	50 [345]	10
O32																hot extruded and temper annealed				
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] <sup>C</sup> 95 [650] <sup>C</sup> 90 [620] <sup>C</sup>	6 6 6															
Copper Alloy UNS No. C63200																				
TQ50	quench hardened and temper annealed	} <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]	50 [345]	15															
TQ55	quench hardened, temper annealed, drawn, and stress relieved		90 [620]	45 [310]	15															
			90 [620]	40 [275]	15															
			90 [620]	40 [275]	15															
O20 O25	hot forged and annealed hot rolled and annealed	} bar and shapes all sizes	90 [620]	40 [275]	15															
O20 O25	O20 hot forged and annealed O25 hot rolled and annealed					} bar and shapes all sizes	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 over 1 [25] to 2 [50], incl	90 [620] 85 [585] 80 [550]	45 [310] 45 [310] 42 [290]	9 12 12															

**TABLE 2** *Continued*

Temper Designation		Diameter or Distance Between Parallel Surfaces, <sup>A</sup> 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, % <sup>B</sup>		
Code	Name						
		over 2 [50] to 3 [80], incl	75 [515]	35 [240]	15		
M10 M20 M30	as hot forged—air cooled as hot rolled as hot extruded	}	over 3 [80] to 4 [100] incl over 4 [100]	70 [485] 70 [485]	30 [205] 25 [170]	15 15	
M10 M20 M30	M10 as hot forged—air cooled M20 as hot rolled M30 as hot extruded		}	— over 3 [80] to 4 [100] incl over 4 [100]	70 [485] 70 [485]	30 [205] 25 [170]	15 15
M30	as hot extruded			<i>shapes, all sizes</i>	70 [485]	30 [205]	15

<sup>A</sup> For rectangular bar, the Distance Between Parallel Surfaces as used in this table refers to the thickness.

<sup>B</sup> 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.

<sup>C</sup> Yield strength at 0.2 % offset.

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

4.2.4 Residual stress test (Performance Requirements section)

4.2.4.1 Ammonia Vapor Test or Mercurous Nitrate Test,

4.2.4.2 For Ammonia Vapor Test, pH value other than 10.

4.2.5 If piston finish or shafting is required, (Performance Requirements and Workmanship sections), and

4.2.6 When tensile test is required for alloys with hardness requirements in Table 3 (see 8.1.1-8.2.1).

## 5. Materials and Manufacture

### 5.1 Manufacture:

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

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

5.1.1.3 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.

**TABLE 3 Rockwell Hardness Requirements<sup>A</sup> 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
StarCodarde	FerName	
f		
<i>Copper Alloy UNS No. C63020</i>		
TQ30	Quench hardened and tempered	all sizes
		C 26 min
<i>Copper Alloys UNS Designations C64200 and C64210</i>		
HR50 HR50	drawn and stress-relieved drawn and stress-relieved	0.5 [12] to 1.0 [25], incl. 0.5 [12] to 1.0 [25], incl. over 1.0 [25] to 2.0 [50], incl. over 1.0 [25] to 2.0 [50], incl. over 2.0 [50] to 3.0 [80], incl. over 2.0 [50] to 3.0 [80], incl.
		80–100 B 80–100 80–100 B 80–100 70–95 B 70–95
M30 M30	as hot-extruded as hot-extruded	over 3.0 [80] to 4.0 [100], incl. over 3.0 [80] to 4.0 [100], incl. over 4.0 [100] over 4.0 [100] <i>shapes, all sizes</i> <i>shapes, all sizes</i>
		65–95 B 65–95 65–95 B 65–95 65–95 B 65–95

<sup>A</sup> Rockwell hardnesses are not established for diameters less than 0.5 in. [12 mm].