



Designation: **B 124—99B 124/B 124M – 00**

Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B 124/B 124M; 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 and copper alloy rod, bar, and shapes intended for hot forging. The following coppers and copper alloys are ~~included:~~ involved:

Copper UNS Nos.	Copper Alloy UNS Nos.
C11000	C36500
C11000	C36500
C14500	C37700
C14500	C37000
C14700	C46400
<u>C14700</u>	C37700
	C48200
	C46400
	C48500
	C48200
	C61900
	<u>C48500</u>
	C62300
	C61900
	C63000
	C62300
	C63200
	C63000
	C64200
	C63200
	C64210
	C64200
	C65500
	C64210
	C67500
	<u>C65500</u>
	C70620
	C67500
	C71520
	C67600
	C70620
	C70620
	C71520
	C77400

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

~~1.3 This specification is standard. Within the companion to Specification B 124M; therefore, no text, the SI-equivalents units are presented shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independent of the other. Combining values from the two systems may result in nonconformance with the specification.~~

1.4³ *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 use.*

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 B05.02 on Rod, Bar, Wire, Shapes and Forgings.

Current edition approved April 10, ~~1999~~; 2000. Published ~~July 1999~~; May 2000. Originally published as B 124 – 39 T. Last previous edition B 124 – 969.

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

2. Referenced Documents

2.1 ASTM Standards:

B 124M² Specification for General Requirements for Wrought Copper and Copper-Alloy Forging Rod, Bar, Shapes, and Shapes [Metric] Forgings²

B 249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings [Metric]²

B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)²

~~B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast~~²

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes³

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)³

E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys³

E 76 Test Methods for Chemical Analysis of Nickel-Copper Alloys³

E 121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys³

E 478 Test Methods for Chemical Analysis of Copper Alloys⁴

2.2 ISO Standard:

No. 3110, Part 2 (TC 26 Ref. No. N 670 E/F) Determination of Aluminum Content: Flame Atomic Absorption Spectrometric Method⁵

3. General Requirements

3.1 The following sections of Specifications B 249 or B 249M form a part of this specification:

3.1.1 Terminology,

3.1.2 Material 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 Reports,

3.1.13 Packaging and Package Marking, and

3.1.14 Supplementary Requirements.

~~3.2 An identical~~

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 that supplements those r appefareineed-seetg ion-of Specifications B 249 or B 249M.

4. Ordering Information

~~4.1 The contract or purchase order for product under this specification should include~~

~~4.1 Include the following information in orders for products:~~

~~4.1.1 ASTM designation and year of issue (B 124*/B 124M-XX),~~

~~4.1.2 Copper or Copper-Alloy UNS No. (Section 5), designation,~~

~~4.1.3 Form (Section 10);~~

~~4.1.4 Diameter (rod, bar, or distance between parallel surfaces shape) and size,~~

~~4.1.4 Dimensions, Mass, and Permissible Variations (Section 10),~~

~~4.1.5 Tolerances~~

~~4.1.5 Temper (Section 10), 7),~~

~~4.1.6 Length (Section 10),~~

~~4.1.7 Quantity; total weight for each size and form,~~

~~4.1.8 When purchase the product is intended purchased for agencies of the U.S. Government agency. Government.~~

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

² Annual Book of ASTM Standards, Vol 02.01.

³ Annual Book of ASTM Standards, Vol 03.05.

⁴ Available from American National

⁴ Annual Book of ASTM Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036., Vol 03.06.

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

- 4.2.1 Temper;
- 4.2.2 ~~Mechanical~~ Properties for Temper designated,
- 4.2.32 Certification, and
- 4.2.43 Test Report.

5. Materials and Manufacture

5.1 Materials:

5.1.1 ~~Product under this specification~~

5.1.1 The material of manufacture shall be ~~produced from one~~ a cast rod, bar, or billet of the following Copper designated copper or Copper Alloy UNS Nos.: C11000, C14500, C14700, C36500, C37700, C46400, C48200, C48500, C61900, C62300, C63000, C63200, C64200, C64210, C65500, C67500, C70620, C71520, C77400. copper-alloy of such purity and soundness to be suitable for processing in to the products prescribed herein.

5.1.2 In the event that heat identification or traceability is required, the purchaser shall specify the details desired. It should be noted that due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify a specific casting analysis with a specific quantity of finished material.

5.2 ~~Manufacture:~~

5.2.1 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.

5.2.2 The product shall be hot or cold worked to the finished size and subsequently annealed, when required, to meet the temper designated, and mechanical properties agreed upon.

6. Chemical Composition

6.1 The material shall conform to the chemicals compositional requirements in Table 1 for the specified copper or copper alloy UNS No. designation specified in the ordering information.

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

6.2 When the value of an element for a specified copper alloy is identified as the “Remainder,” that “Remainder” value shall be determined as the difference between the sum of results for specified elements and 100 %.

6.3 For alloys in which either copper or zinc is listed as “remainder,” copper or zinc is the difference between the sum of results determined and 100 %. When all elements in Table 1 for the specified copper alloy are determined, the sum of results shall be as follows:

Copper Alloy UNS No.	Sum of Results Percent, % min
Copper Alloy UNS No.	Sum of Results, % min
C36500, C46400, C48200, C48500	99.6
C36500, C37000, C46400, C48200, C48500	99.6
C37700, C61900, C62300, C63000,	99.5
C63200, C64200, C64210, C65500,	
C67500, C70620, C71520, C77400	
C37700, C61900, C62300, C63000, C63200,	99.5
C64200, C64210, C65500, C67500, C67600,	
C70620, C71520, C77400	

7. Temper

7.1 ~~Product temper shall be subject to agreement between the manufacturer and the purchaser.~~

7.1.1 ~~Product~~

7.1 The standard temper normally available under for products described in this specification and as defined in Practice B-601 are M30, M20, as follows:

7.1.1 H50—Extruded and H50 drawn.

7.1.2 M20—As hot-rolled.

7.1.3 M30—As hot-extruded.

8. Mechanical Property Requirements

8.1 Mechanical properties, if any, are subject to agreement between the manufacturer and the purchaser.

9. ~~Purchases for U.S. Government~~ Other Requirements

9.1 When specified in the contract or purchase order, products purchased for agencies of the U.S. Government shall conform to the special governmental regulations specified in the Supplementary Requirements sections of this specification and of B 249 or B 249M.

TABLE 1 Chemical Requirements

Copper or Copper Alloy UNS No.	Composition, %													Copper Plus Elements with Specific Limits Present, min
	Copper	Lead	Tin	Iron	Nickel (incl Co)	Aluminum	Silicon	Manganese	Zinc	Sulfur	Tellurium	Phos- phorus	Arsenic	
C11000	99.90 min ^A	...	...	...	...	...	...	...	...	...	...	...	...	...
C14500 ^B	99.90 min ^C	...	...	...	...	...	...	...	...	...	0.40–0.7	0.004– 0.042 ^D	...	...
C14500 ^B	99.90 min ^C	...	...	...	...	...	...	...	...	...	0.40–0.7	0.004– 0.012	...	...
C14700 ^E	99.90 min ^F	...	...	...	...	...	...	...	...	0.20–0.50	...	...	...	...
C14700 ^B	99.90 min ^D	...	...	...	...	...	...	...	...	0.20–0.50	...	0.002– 0.005	...	...
C36500	58.0–61.0	0.25–0.7	0.25 max	0.15 max	...	...	...	...	remainder	...	...	...	...	.6
C36500	58.0–61.0	0.25–0.7	0.25 max	0.15 max	...	...	...	...	remainder	...	...	...	...	99.6
C37000	59.0–62.0	0.8–1.5	...	0.15 max	...	...	...	...	remainder	...	...	...	...	99.6
C37700	58.0–61.0	1.5–2.5	...	0.30 max	...	...	...	...	remainder	...	...	...	...	...
C37700	58.0–61.0	1.5–2.5	...	0.30 max	...	...	...	...	remainder	...	...	...	...	99.5
C46400	59.0–62.0	0.20 max	0.50–1.0	0.15 max	...	...	...	...	remainder	...	...	...	...	...
C46400	59.0–62.0	0.20 max	0.50–1.0	0.10 max	...	...	...	...	remainder	...	...	...	...	99.6
C48200	59.0–62.0	0.40–1.0	0.50–1.0	0.15 max	...	...	...	...	remainder	...	...	...	...	...
C48200	59.0–62.0	0.40–1.0	0.50–1.0	0.10 max	...	...	...	...	remainder	...	...	...	...	99.6
C48500	59.0–62.0	1.3–2.2	0.50–1.0	0.15 max	...	...	...	...	remainder	...	...	...	...	...
C48500	59.0–62.0	1.3–2.2	0.50–1.0	0.10 max	...	...	...	...	remainder	...	...	...	...	99.6
C61900	remainder	0.02 max	0.6 max	3.0–4.5	...	8.5–10.0	...	...	0.8 max	...	...	...	...	99.5
C62300	remainder	...	0.6 max	2.0–4.0	4.0 max	8.5–11.0	0.25 max	0.50 max	...	...	...	...	...	99.5
C62300	remainder	...	0.6 max	2.0–4.0	1.0 max	8.5–10.0	0.25 max	0.50 max	...	...	...	...	...	99.5
C63000	remainder	...	0.20 max	2.0–4.0	4.0–5.5	9.0–11.0	0.25 max	1.5 max	0.30 max	...	...	...	...	99.5
C63200	remainder	0.02 max	...	3.5–4.3 ^G	4.0–4.8	8.7–9.5	0.10 max	1.2–2.0	...	...	...	...	...	...
C63200	remainder	0.02 max	...	3.5–4.3 ^F	4.0–4.8 ^F	8.7–9.5	0.10 max	1.2–2.0	...	...	...	...	...	99.5
C64200	remainder	0.05 max	0.20 max	0.30 max	0.25 max	6.3–7.6	1.5–2.2	0.10 max	0.50 max	...	...	...	0.15 max	99.5
C64210	remainder	0.05 max	0.20 max	0.30 max	0.25 max	6.3–7.0	1.5–2.0	0.10 max	0.50 max	...	...	...	0.15 max	99.5
C65500	remainder	0.05 max	...	0.8 max	0.6 max	...	2.8–3.8	0.50–1.3	1.5 max	...	...	...	...	99.5
C67500	57.0–60.0	0.20 max	0.50–1.5	0.8–2.0	...	0.25 max	...	0.05–0.50	remainder	...	...	...	...	.5
C67500	57.0–60.0 ^A	0.20 max	0.50–1.5	0.8–2.0	...	0.25 max	...	0.05–0.50	remainder	...	...	...	...	99.5
C67600	57.0–60.0 ^A	0.50–1.0	0.50–1.5	0.40–1.3	...	...	...	0.05–0.50	remainder	...	...	...	...	99.5
C70620 ^H	86.5 min ^A	0.02 max	...	1.0–1.8	9.0–11.0	...	...	1.0 max	0.50 max	0.02 max	...	0.02 max	...	99.5
C70620 ^F	86.5 min ^A	0.02 max	...	1.0–1.8	9.0–11.0	...	...	1.0 max	0.50 max	0.02 max	...	0.02 max	...	99.5
C71520 ^H	65.0 min ^A	0.02 max	...	0.40–1.0	29.0–33.0	...	...	1.0 max	0.50 max	0.02 max	...	0.02 max	...	99.5
C71520 ^F	65.0 min ^A	0.02 max	...	0.40–1.0	29.0–33.0	...	...	1.0 max	0.50 max	0.02 max	...	0.02 max	...	99.5
C77400	43.0–47.0	0.20 max	...	...	9.0–11.0	...	...	...	remainder	...	...	...	...	...
C77400	43.0–47.0 ^A	0.20 max	...	...	9.0–11.0	...	...	...	remainder	...	...	...	...	99.5

^ASilver counts as copper.

^BThis includes oxygen-free tellurium deoxidized grades with deoxidizers (such as phosphorus, boron, lithium, or others) in amount agreed upon.

^CThis includes copper + silver + tellurium.

^DThis includes copper + silver + sulfur + phosphorus, in which case phosphorus need not be present.

^EIron deoxidizer-free shall not be deoxidized grades with deoxidizers (such as phosphorus, boron, lithium, or others) in amount agreed upon.

^FThis includes copper plus silver plus sulfur.

^GIron content shall not exceed nickel content.

^HCarbon shall be 0.05 %.

10. Dimensions, Mass, and Permissible Variations

10.1 Except for shapes, length, and straightness, the dimensions and tolerances for products produced under this specification shall be as prescribed in the section titled “Diameter or Distance Between Parallel Surfaces” in Specification B 249 or B 249M as follows:

10.1.1 Diameter or Distance Between Parallel Surfaces:

10.1.1.1 For M30 rod, Copper Alloy UNS Nos. C36500, C37000, C37700, C46400, C48200, C48500, C61900, C62300, C63000, C63200, C64200, C64210, C67500, C67600, C70620, and C71520, refer to Table 4.

10.1.1.2 For M30 rod, Copper UNS Nos. C11000, C14500, and C14700 and Copper Alloy UNS Nos. C65500 and C77400, refer to Table 5.

10.1.1.3 For M20, round rod, refer to Table 6.

10.1.1.4 For M30, bar, refer to Table 4 for width tolerances for Copper Alloy UNS Nos. C36500, C37000, C37700, C46400, C48200, C48500, C61900, C62300, C63000, C63200, C64200, C64210, C67500, C67600, C70620, and C71520.

10.1.1.5 For M30 bar refer to Table 5 for width tolerances for Copper UNS Nos. C11000, C14500, and C14700 and Copper Alloy UNS Nos. C65500 and C77400.

10.1.1.6 For H50; rod, refer to Table 1 for Copper Alloy UNS Nos. C11000, C14500, C14700, and Copper Alloy UNS Nos. C46400, C48200, and C48500.

10.1.1.7 For H50; rod, refer to Table 2 for Copper Alloy UNS Nos. C36500, C37000, C37700, C61900, C62300, C63000, C63200, C64200, C64210, C65500, C67500, C67600, C70620, C71520, and C77400.

10.1.1.8 For H50; bar, refer to Tables 7 and 10 for Copper Alloy UNS Nos. C11000, C14500, and C14700.

10.1.1.9 For H50; bar, refer to Tables 8 and 10 for Copper Alloy UNS Nos. C46400, C48200, and C48500.

10.1.1.10 For H50, bar, refer to Tables 9 and 11 for Copper Alloy UNS Nos. C36500, C37000, C37700, C61900, C62300, C63000, C63200, C64200, C64210, C65500, C67500, C67600, C70620, C71520, and C77400.

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

10.3 *Length*—Rod, bar, and shapes for forging, when ordered to any length, will be furnished in stock lengths, unless it is specifically stated in the purchase order that the lengths are to be specific.

10.3.1 Stock lengths for all rod, bar, and shapes for forging up to and including 1 in. (25 mm) in diameter shall be as listed in Table 2, but the weight of lengths less than the length ordered length, shall not exceed 40 % of any one shipment. The tolerance for the full-length pieces shall be plus 1 in. (25 mm).

10.3.2 For rod and bar for forging over 1 in. (25 in.) up to and including 2 in. (50 mm) in diameter, the lengths shall be random lengths, from 4 to 12 ft (1.2 to 3.7 m).

10.3.3 Rod and bar for forging, over 2 in. (50 mm) in diameter shall be ordered in special lengths.

10.4 *Straightness*— The material shall be straight, within 1 in. (25 mm) maximum depth of arc in 6 ft (1.8 m).

11. Test Methods

~~11.1 The test method(s) used for quality control or production control, or both, for the determination of conformance with product property requirements are discretionary.~~

~~11.1.1 The test method(s) used to obtain data for the preparation of certification or test report, or both,~~

~~11.1 *Chemical Analysis:*~~

~~11.1.1 *Chemical composition* shall be made available to the purchaser on request.~~

~~11.2 *Chemical Analysis:*~~

~~11.2.1 *Chemical composition* shall, determined, in case of disagreement, be determined as follows:~~

TABLE 2 Stock Lengths

Ordered Length		Shortest Permissible Length	
ft	m	ft	m
42	4	6	
12	4	6	2
40	3	6	
10	3	6	2
8	2	4	
8	2	4	1
6		4	
6		4	

Element Element	Range, % Range, %	Test Method Method Method
Aluminum	0.005–12	ISO No. 3110 (AA)
Aluminum	0.005–12	ISO No. 3110 (AA)
	6–12	E 478
	6–12	E 478
Arsenic	0–0.15	E 62
Arsenic	0–0.15	E 62
Copper	43–99.9	E 478
Copper	43–99.9	43–99.9
Carbon		43–99.9
Iron	0.15–5	E 54, E 75 for CuNi
Lead	0.02–3	E 478 (AA)
Manganese	0.10–2.0	E 62, E 75 for CuNi
Phosphorus	0.004–0.7	E 62
Nickel	0–5	E 478 (Photometric)
	>5	E 478 (Gravimetric)
Silicon	0.10–4	E 62
Phosphorous	0.004–0.7	E 62
Sulfur	0–0.5	E 76 (Gravimetric)
Silicon	0.10–4	E 62
Tellurium	0.40–4	E 124
Sulfur	0–0.5	E 76 (Gravimetric)
Tin	0.2–1.5	E 478 (Photometric)
Tellurium	0.40–1	E 121
Zinc	0.3–1.5	E 478 (AA)
Tin	0.2–1.5	E 478 (Photometric)
	2–40	E 478 (Titrametric)
Zinc	0.3–1.5	E 478 (AA)
	2–40	E 478 (Titrametric)

11.2.1.2 Test methods for the determination of elements resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer, or supplier, and the purchaser.

12. Keywords

12.1 brass forging shapes; brass forgings; bronze forging shapes; ~~bronze forgings~~; copper alloy forging bar; ~~copper alloy forging materials~~; ~~copper alloy forging rod~~; copper alloy forgings; ~~copper forging bar~~; copper alloy forging materials; shapes; copper forging rod; copper forging bar; copper forging shapes; copper alloy forgings; copper forgings; hot forging stock; nickel silver forging shapes; nickel silver forgings; copper nickel forging rod; copper nickel forgings

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order for agencies of the U.S. Government.

S1. Supplementary requirements S1, S2, and S4 of Specification B 249 or B 249M shall apply.

S2. *Identification Marking*—Forging stock shall be marked with the producer's name or trademark, this ASTM specification number, the UNS number, and the heat number or ~~serial~~ lot number. Marking shall be by low stress die stamps; or vibroetching.

APPENDIX
(Nonmandatory Information)
X1. FORGING PRACTICE

X1.1 The data in Table X1.1 do not constitute a part of this specification. The suggested forging temperatures give the range suitable for hot forging of the alloys and the forgeability ratings illustrate the relative difference in ease of forging, with forging brass being the most readily forgeable. For the relative strength of these alloy forgings, as hot pressed, see Specification B 283, Appendix 2, Table 4.

SUMMARY OF CHANGES

Committee ~~B-5~~ B05 has identified the location of selected changes to this specification since the last ~~version~~ issue (B 124-99) that may impact its use:

~~B 124-96: the use of this standard.~~

~~(1) A change was) Incorporated SI units and made in the composition of lead for C36500 in Table 1.~~

~~B 124-99: into a dual standard.~~

~~(1) Alloys C70620 and C71520 and their respective chemical composition requirements were added to the scope, Table 1, material and manufacture, and chemical composition.~~

~~(2) Temper M50 was changed to H50.) Added alloys C37000 and C67600 throughout text.~~

~~(3) Corrected alloy composition requirements for Copper UNS No. C14700.~~

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TABLE X1.1 Forging Temperatures and Forgeability

Copper or Copper Alloy UNS No.	Name	Suggested Forging Temperatures		Forgeability Rating ^A
		°F	K	
C11000	Copper	1400–1700	1030–1200	65
C14500	Copper-tellurium	1350–1650	1010–1170	65
C14700	Copper-sulfur	1400–1600	750–875	65
C36500	Leaded muntz metal, uninhibited	1200–1450	920–1060	100
C37000	Free-cutting muntz metal	1200–1450	920–1060	100
C37700	Forging brass	1200–1450	920–1060	100
C46400	Naval brass	1200–1500	920–1090	90
C48200	Medium leaded naval brass	1200–1500	920–1090	90
C48500	Leaded naval brass	1200–1500	920–1090	90
C61900	Aluminum bronze	1300–1600	980–1140	75
C62300	Aluminum bronze, 9 %	1300–1600	980–1140	75
C63000	Aluminum-nickel bronze	1450–1700	1060–1200	75
C63200	Aluminum-nickel bronze	1450–1700	1060–1200	75
C64200	Aluminum-silicon bronze	1300–1600	980–1140	75
C64210	Aluminum-silicon bronze, 6.7 %	1300–1600	980–1140	75
C65500	High-silicon bronze (A)	1300–1600	980–1140	40
C67500	Manganese bronze (A)	1350–1550	1010–1120	80
C67600	Leaded manganese bronze A	1350–1550	1010–1120	80
C70620	Copper-nickel 90–10	1550–1750	1120–1230	75
C71520	Copper-nickel 70–30	1700–1900	1030–1310	40
C77400	Nickel silver, 45–10	1300–1500	980–1090	85

^ARelative forgeability rating takes into consideration such variable factors as pressure, die wear, and plasticity (hot). Since it is impracticable to reduce these variables to common units, calibration in terms of a percentage of the most generally used alloy, forging brass (100 %), is considered the most practical basis for such ratings. The values shown represent the general opinion and are intended for information to enable the designer to better understand the forging characteristics of these various alloys. Intricate parts are more likely to be available in alloys having a high rating.