



~~Designation: B124/B124M-11b~~ Designation: B124/B124M - 12

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

This standard is issued under the fixed designation B124/B124M; 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 involved:

Copper UNS Nos.	Copper Alloy UNS Nos.
C11000	C35330
C14500	C36500
C14700	C37000
	C37700
	C46400
	C48200
	C48500
	C48600
	C49250
	C49255
	C49260
	C49300
	C49340
	C49350
	C49355
	C49360
	C61900
	C62300
	C63000
	C63200
	C64200
	C64210
	C65500
	C67500
	C67600
	C69300
	C70620
	C71520
	C77400
	C87700
	C87710
	C27450

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NOTE 1—Additional information about forging practice and forgings produced from these alloys is given in Appendix X1 and in Specification B283.

1.2 *Units*—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.*

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, Bar, Wire, Shapes and Forgings.

Current edition approved Oct. April 1, 2011-2012. Published November 2011-April 2012. Originally approved in 1939. Last previous edition approved in 2011 as B124/B124M - 11ab. DOI: 10.1520/B0124_B0124M-11B2.

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

2. Referenced Documents

2.1 ASTM Standards:²

- B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings
- B283 Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)
- E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes
- E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)
- E75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys
- E76 Test Methods for Chemical Analysis of Nickel-Copper Alloys
- E121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys
- E478 Test Methods for Chemical Analysis of Copper Alloys

2.2 Other Standard:

- ISO 3110, Part 2 (TC 26 Ref. No. N 670 E/F) Determination of Aluminum Content: Flame Atomic Absorption Spectrometric Method³
- JIS H 1068:2005 Method for Determination of Bismuth in Copper and Copper Alloys⁴ (Japanese Industrial Standards)

3. General Requirements

3.1 The following sections of Specification B249/B249M, as applicable, constitute 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 In addition, when a section with a title identical to that referenced in 3.1, appears in this specification, it contains additional requirements that supplement those appearing in Specification B249/B249M.

4. Ordering Information

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

- 4.1.1 ASTM designation and year of issue (B124/B124M – XX),
- 4.1.2 Copper or Copper-Alloy UNS No. designation,
- 4.1.3 Form (rod, bar, or shape) and size (Dimensions and Permissible Variations Section),
- 4.1.4 Permissible Variations (Dimensions and Permissible Variations Section),
- 4.1.5 Temper (Temper Section),
- 4.1.6 Length (Dimensions and Permissible Variations Section),
- 4.1.7 Quantity; total weight for each size and form,
- 4.1.8 If the product is purchased for agencies of the U.S. government (see the Supplementary Requirements Section of this specification for additional requirements, if specified.)

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

- 4.2.1 Mechanical Properties for Temper designated (Mechanical Properties Section),
- 4.2.2 Certification (B249/B249M),
- 4.2.3 Test Report (B249/B249M), and
- 4.2.4 When product is ordered for ASME Boiler and Pressure Vessel Code Application (see Certification Section of B249/B249M).
- 4.2.5 Shapes; dimensional tolerances required and agreed upon (see 10.1.3).

5. Materials and Manufacture

5.1 Materials:

² 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from Japanese Industrial Standards, <http://www.JIS.or.jp/>.

5.1.1 The material of manufacture shall be a cast rod, bar, or billet of the designated copper or 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.

NOTE 2—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 product 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 properties specified.

6. Chemical Composition

6.1 The material shall conform to the chemical composition requirements in Table 1 for the 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. By agreement between the manufacturer and the purchaser, limits may be established and analysis required for unnamed elements.

6.2 For alloys in which either copper or zinc is listed as “remainder,” copper or zinc is the difference between the sum of results of all elements 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, % min
C36500, C37000, C46400, C48200, C48500, C48600	99.6
C27450, C35330, C37700, C49255, C49260, C49300, C49340, C49350, C49360, C61900, C62300, C63000, C63200, C64200, C64210, C65500, C67500, C67600, C69300, C70620, C71520, C77400	99.5
<u>C27450, C35330, C37700, C49250, C49255, C49260, C49300, C49340, C49350, C49355, C49360, C61900, C62300, C63000, C63200, C64200, C64210, C65500, C67500, C67600, C69300, C70620, C71520, C77400</u>	99.5
<u>C87700, C87710</u>	99.2

7. Temper

7.1 The standard tempers for products described in this specification are as follows:

7.1.1 H50—Extruded and drawn.

7.1.2 M20—As hot-rolled.

7.1.3 M30—As hot-extruded.

~~7.1.4 O61—Annealed.~~

~~7.1.5 O30—Hot Extruded and Annealed.~~

~~7.1.4 O60—Soft Annealed.~~

~~7.1.5 O61—Annealed.~~

~~7.1.6 O30—Hot Extruded and Annealed.~~

8. Mechanical Property Requirements

8.1 Mechanical property requirements, if any, are to be established by agreement between the manufacturer and the purchaser.

9. Purchases for U.S. Government

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 B249/B249M.

10. Dimensions and Permissible Variations

10.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B249/B249M with particular reference to the following tables and related paragraphs:

10.1.1 *Diameter or Distance Between Parallel Surfaces:*

10.1.1.1 For M30 rod, Copper Alloy UNS Nos. C27450, C35330, C36500, C37000, C37700, C46400, C48200, C48500, C48600, C49250, C49255, C49260, C49300, C49340, C49350, C49355, C49360, C61900, C62300, C63000, C63200, C64200,



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		Phosphorus	Arsenic	Bismuth
C11000	99.90 min ^A	...	...	...	...	...	...	...	...	...	0.40-0.7	...	...	...	...
C14500 ^B	99.90 min ^C	...	...	...	...	...	...	...	...	...	0.004-0.012	...	...	...	...
C14700 ^B	99.90 min ^D	...	...	...	...	...	...	...	...	...	0.002-0.005	...	...	...	...
C27450	60.0-65.0	0.25 max	...	0.35 max	...	...	...	...	remainder	0.20-0.50	...	...	...	...	99.5
C35330	59.5-64.0	1.5-3.5	...	0.15 max	...	...	...	...	remainder	...	...	...	...	...	...
C36500	58.0-61.0	0.25-0.7	0.25 max	0.30 max	...	...	...	...	remainder	...	...	...	0.02-0.25	...	...
C37000	59.0-62.0	0.8-1.5	...	0.15 max	...	...	...	...	remainder	...	...	...	...	...	...
C37700	58.0-61.0	1.5-2.5	...	0.30 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	0.10 max	...	...	...	...	remainder	...	...	...	...	...	99.6
C48500	59.0-62.0	1.3-2.2	0.50-1.0	0.10 max	...	...	...	...	remainder	...	...	...	...	...	99.6
C48600	59.0-62.0	1.0-2.5	0.30-1.5	...	...	...	...	...	remainder	...	...	...	0.02-0.25	...	99.6
C49255 ^E	58.0-61.0	0.09 max	0.30 max	0.50 max	...	...	...	...	remainder	...	...	...	...	1.8-2.4	99.5
C49250 ^F	58.0-61.0	0.09 max	0.30 max	0.50 max	...	...	...	...	remainder	...	...	...	...	1.8-2.4	99.5
C49255 ^F	58.0-60.0	0.01 max	0.50 max	0.10 max	0.10-0.30	0.10 max	...	...	remainder	...	0.10 max	...	...	1.7-2.9	99.5
C49260 ^F	58.0-63.0	0.09 max	0.50 max	0.50 max	...	0.40 max	...	...	remainder	...	0.05-0.15	...	...	0.50-1.8	99.5
C49260 ^G	58.0-62.0	0.01 max	1.0-1.8	0.10 max	1.5 max	0.10 max	0.03 max	0.03 max	remainder	...	0.20 max	...	...	0.50-2.0	99.5
C49300 ^H	60.0-63.0	0.09 max	0.50-1.5	0.12 max	...	0.10 max	...	...	remainder	...	0.20 max	...	...	0.50-2.0	99.5
C49340 ^H	60.0-63.0	0.09 max	1.5-3.0	0.12 max	...	0.10 max	...	...	remainder	...	0.05-0.15	...	...	0.50-2.0	99.5
C49350 ^I	61.0-63.0	0.09 max	1.5-3.0	0.12 max	...	0.30 max	...	...	remainder	...	0.05-0.15	...	...	0.50-2.5	99.5
C49355 ^K	63.0-69.0	0.09 max	1.0-2.0	0.10 max	...	1.0-2.0	0.10 max	0.10 max	remainder	...	0.04-0.15	...	...	0.50-2.5	99.5
C49360	remainder ^A	0.09 max	1.0-2.0	0.10 max	...	2.0-3.5	...	19.0-22.0	...	...	...	...	...	0.50-1.5	99.5
C61900	remainder ^A	0.02 max	0.6 max	3.0-4.5	...	8.5-10.0	...	0.8 max	...	...	...	...	...	...	99.5
C62300	remainder ^A	...	0.6 max	2.0-4.0	1.0 max	8.5-10.0	0.25 max	0.50 max	...	...	...	...	...	...	99.5
C63000	remainder ^A	...	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 ^A	0.02 max	...	3.5-4.3 ^L	4.0-4.8 ^L	8.7-9.5	0.10 max	1.2-2.0	...	...	...	...	...	...	99.5
C64200	remainder ^A	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	...	...	...	0.09 max	...	99.5
C64210	remainder ^A	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	...	...	0.09 max	...	...	99.5
C65500	remainder ^A	0.05 max	...	0.8 max	0.6 max	...	2.8-3.8	0.05-1.3	1.5 max	...	...	...	...	...	99.5
C67500	57.0-60.0 ^A	0.20 max	0.50-1.5	0.8-2.0	...	...	...	0.05-0.50	...	...	...	...	...	...	99.5
C67600	57.0-60.0 ^A	0.50-1.0	0.50-1.5	0.40-1.3	...	...	...	0.05-0.50	...	...	...	...	...	...	99.5
C69300	73.0-77.0 ^A	0.09 max	0.20 max	0.10 max	0.10 max	2.7-3.4	...	0.10 max	remainder	...	0.04-0.15	...	...	...	99.5
C70620 ^M	86.5 min ^A	0.02 max	...	1.0-1.8	9.0-11.0	...	...	1.0 max	remainder	...	0.02 max	...	...	...	99.5
C74520 ^N	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 ^M	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 ^A	0.09 max	...	...	9.0-11.0	...	...	...	remainder	...	...	...	...	...	99.5
C87700 ^L	87.5 min ^A	0.09 max	2.0 max	0.50 max	0.25 max ^M	2.5-3.5	0.8 max	0.8 max	7.0-9.0	...	0.15 max	...	...	...	99.2
C87700 ^M	87.5 min	0.09 max	2.0 max	0.50 max	0.25 max ^M	2.5-3.5	0.8 max	0.8 max	7.0-9.0	...	0.15 max	...	...	...	99.2
C87740 ^L	84 min	0.09 max	2.0 max	0.50 max	0.25 max ^M	3.0-5.0	0.8 max	0.8 max	9.0-11.0	...	0.15 max	...	...	...	99.2
C87710 ^M	84 min	0.09 max	2.0 max	0.50 max	0.25 max ^M	3.0-5.0	0.8 max	0.8 max	9.0-11.0	...	0.15 max	...	...	...	99.2

^A Silver counts as copper.

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

^C This includes copper + silver + tellurium + phosphorus.

^D This includes copper + silver + sulfur + phosphorus.

^E Includes cadmium 0.001% selenium % m-0.02-0.07ax.

^F Includes cadmium 0.061% selenium max 0.02-0.07.

^G Includes cadmium 0.50% max and selenium 0.2001% max.

^H Includes cadmium 0.50% max and selenium 0.2001% max.

^I Includes cadmium 0.02-0.10% max.

^J Includes cadmium 0.02-0.10% max.