Designation: B30 – 16

Standard Specification for Copper Alloys in Ingot Form[1]

This standard is issued under the fixed designation B30; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification establishes the requirements for copper alloys in ingot form for remelting for the manufacturing of castings having the Copper Alloy UNS No. designation, commercial designations and nominal composition shown in Table 1 and Table 2.

1.2 A cross reference of Copper Alloy UNS Nos. and copper alloy casting specifications is given in Table 3.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B22/B22M Specification for Bronze Castings for Bridges and Turntables

B61 Specification for Steam or Valve Bronze Castings

B62 Specification for Composition Bronze or Ounce Metal Castings

B66 Specification for Bronze Castings for Steam Locomotive Wearing Parts

B67 Specification for Car and Tender Journal Bearings, Lined

B148 Specification for Aluminum-Bronze Sand Castings

B176 Specification for Copper-Alloy Die Castings

B194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

B208 Practice for Preparing Tension Test Specimens for Copper Alloy Sand, Permanent Mold, Centrifugal, and Continuous Castings

B271/B271M Specification for Copper-Base Alloy Centrifugal Castings

B369 Specification for Copper-Nickel Alloy Castings

B427 Specification for Gear Bronze Alloy Castings

B505/B505M Specification for Copper Alloy Continuous Castings

B584 Specification for Copper Alloy Sand Castings for General Applications

B763/B763M Specification for Copper Alloy Sand Castings for Valve Applications

B770 Specification for Copper-Beryllium Alloy Sand Castings for General Applications

B806 Specification for Copper Alloy Permanent Mold Castings for General Applications

E8/E8M Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes (Withdrawn 2002)[3]

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[3]

E76 Test Methods for Chemical Analysis of Nickel-Copper Alloys (Withdrawn 2003)[3]

E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

E478 Test Methods for Chemical Analysis of Copper Alloys

E581 Test Methods for Chemical Analysis of Manganese-Copper Alloys

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.05 on Castings and Ingots for Remelting.

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[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] The last approved version of this historical standard is referenced on www.astm.org.

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

TABLE 1 Nominal Compositions

Alloy Name	Copper Alloy UNS No.	Previously Used Designation	Commercial Designation	Nominal Composition, %												
				Copper	Tin	Lead	Zinc	Nickel	Sulfur	Iron	Aluminum	Manganese	Antimony	Silicon	Niobium	Bismuth
Leaded red brass	C83450	...		88	2.5	2	6.5	1	...	...	...	...	...	...	...	...
Low-lead sulfur tin bronze	C83470	...		93	4	...	2	0.5	0.5	...	...	...	...	...	...	...
Leaded red brass	C83600	4A	85-5-5-5 or No. 1 composition	85	5	5	5	...	...	...	...	...	...	...	...	...
	C83800	4B	commercial red brass, 83-4-6-7	83	4	6	7	...	...	...	...	...	...	...	...	...
Low-lead semi-red brass	C84020	...		85.5	3	...	9	1.2	0.38	...	...	...	...	...	...	...
	C84030	...		85.5	3	...	9	1.2	0.38	...	...	...	0.8	...	...	...
Leaded semi-red brass	C84200	...	semi-red brass, 80-5-2-13	80	5	2	13	...	...	...	...	...	...	...	...	...
	C84400	5A	valve composition 81-3-7-9	81	3	7	9	...	...	...	...	...	...	...	...	...
	C84800	5B	semi-red brass, 76-2½-6½-15	76	2.5	6.5	15	...	...	...	...	...	...	...	...	...
Leaded yellow brass	C85200	6A	high-copper yellow brass	72	1	3	24	...	...	...	...	...	...	...	...	...
	C85400	6B	commercial No. 1 yellow brass	67	1	3	29	...	...	...	...	...	...	...	...	...
Yellow brass	C85470[A]	...		62.5	2.5	...	34.3	...	...	...	0.5	...	...	...	...	...
Leaded yellow brass	C85700	6C	60–40 leaded yellow (naval) brass	61	1	1	37	...	...	...	...	...	...	...	...	...
	C85800	...	die-cast yellow brass	62	1	1	36	...	...	...	...	...	...	...	...	...
	C86100	...	high-strength manganese bronze	67	...	...	21	...	...	3	5	4	...	...	...	...
Leaded high-strength yellow brass and high-strength yellow brass	C86200	8B	high-strength manganese bronze	63	...	...	27	...	...	3	4	3	...	...	...	...
	C86300	8C	high-strength manganese bronze	61	...	...	27	...	...	3	6	3	...	...	...	...
	C86400	7A	leaded manganese bronze	58	1	1	38	...	...	1	0.5	0.5	...	...	...	...
	C86500	8A	No. 1 manganese bronze	58	...	...	39	...	...	1	1	1	...	...	...	...
	C86700	...	leaded manganese bronze	58	1	1	34	...	...	2	2	2	...	...	...	...
Silicon bronze	C87300	...	silicon bronze	95	...	...	...	...	...	...	...	1	...	4	...	...
Silicon brass	C87400	13A	silicon brass	82	...	0.5	14	...	...	...	...	...	...	3.5	...	...
	C87500	13B		82	...	...	14	...	...	...	...	...	...	4	...	...
Silicon bronze	C87600	...	silicon bronze	91	...	...	5	...	...	...	...	...	...	4	...	...
	C87610	...	silicon bronze	92	...	...	4	...	...	...	...	...	...	4	...	...
	C87700	...	silicon bronze	88.5	...	...	8	...	...	...	...	...	...	3	...	...
	C87710	...	silicon bronze	86	...	...	10	...	...	...	...	...	...	4	...	...
Silicon brass	C87800	...	die-cast silicon brass	82	...	...	14	...	...	...	...	...	...	4	...	...
	C87845[B]	...		76	...	...	21.26	...	...	...	...	...	...	2.7	...	...
	C87850[C]	...	Silicon brass	76	...	...	20.9	...	...	...	...	...	...	3	...	...
Bismuth tin bronze	C89320[D]	...	lead-free bronze	89	6	...	...	...	...	...	...	...	...	...	...	...
Bismuth selenium brass	C89510[E]	...	lead-free bronze	87	5.0	...	5.0	...	...	...	...	...	...	...	...	1.0
	C89520[F]	...	lead-free brass	86	5.5	...	5	...	...	...	...	...	...	...	...	1.9
	C89530[G]	...		86.5	4.7		8.0	...	...	...	...	...	...	...	...	1.5
	C89535[G]	...		86.5	3.0		7.0	.65	...	...	...	...	...	...	...	1.4
Bismuth brass	C89537	...		85.0	4.5	...	9.0	...	...	...	...	...	...	0.9	...	1.7
Bismuth selenium yellow brass	C89540[H]	...	lead-free yellow brass	61	0.8	...	36	0.5	...	0.3	0.4	...	...	...	...	0.9
Bismuth brass	C89570[I]	...		60.5	0.8	...	36.5	0.32	...	...	0.5	...	...	...	...	1.0
	C89720[J]	...		67.5	1	...	29.8	...	...	...	0.5	...	...	0.5	...	0.7
Bismith red brass	C89833	...	Lead-free brass	89	5	...	3	...	...	...	...	...	...	...	...	2.2
Bismuth Bronze	C89836	...	lead-free bronze	89.5	5.5	...	3.0	...	...	...	...	...	...	...	...	2.0
Bismuth semi-red brass	C89844	...	cast bismuth brass	84.5	4	...	8	...	...	...	...	...	...	...	...	3
Tin bronze and leaded tin bronze	C90300	1B	88-8-0-4 or modified “G” bronze	88	8	...	4	...	...	...	...	...	...	...	...	...
Low-lead tin bronze	C90420	...		87.5	8	...	3	...	0.38	...	...	...	...	...	...	...
Tin bronze and leaded tin bronze	C90500	1A	88-10-0-2 or “G” bronze	88	10	...	2	...	...	...	...	...	...	...	...	...
	C90700	...	89-11 gear bronze	89	11	...	...	...	...	...	...	...	...	...	...	...
	C90800	...	88-12 gear bronze	88	12	...	...	...	...	...	...	...	...	...	...	...
	C91000	...	85-15 tin bronze	85	15	...	...	...	...	...	...	...	...	...	...	...
	C91100	...	84-16 tin bronze	84	16	...	...	...	...	...	...	...	...	...	...	...
	C91300	...	81-19 tin bronze or bell metal	81	19	...	...	...	...	...	...	...	...	...	...	...
	C91600	...	nickel gear bronze	88	10.5	...	...	1.5	...	...	...	...	...	...	...	...
	C91700	...	nickel gear bronze	86.5	12	...	...	1.5	...	...	...	...	...	...	...	...
	C92200	2A	steam or valve bronze-Navy “M”	88	6	1.5	4.5	...	...	...	...	...	...	...	...	...
	C92210	...	...	88	5	2	4	1	...	...	...	...	...	...	...	...

TABLE 1 *Continued*

Alloy Name	Copper Alloy UNS No.	Previously Used Designation	Commercial Designation	Nominal Composition, %												
				Copper	Tin	Lead	Zinc	Nickel	Sulfur	Iron	Aluminum	Manganese	Antimony	Silicon	Niobium	Bismuth
	C92300	2B	87-8-1-4 Navy P-C	87	8	1	4	...	...	...	...	...	...	...	...	...
	C92500	...	87-11-1-0-1 leaded gear bronze	87	11	1	...	1	...	...	...	...	...	...	...	...
	C92600	...	87-10-1-2 leaded tin bronze	87	10	1	2	...	...	...	...	...	...	...	...	...
	C92700	...	88-10-2-0 leaded tin bronze	88	10	2	...	...	...	...	...	...	...	...	...	...
	C92800	...	79-16-5 leaded tin bronze	79	16	5	...	...	...	...	...	...	...	...	...	...
	C92900	...	leaded gear bronze	84	10	2.5	...	3.5	...	...	...	...	...	...	...	...
High-leaded tin bronze	C93200	3B	83-7-7-3	83	7	7	3	...	...	...	...	...	...	...	...	...
	C93400	...	84-8-8	84	8	8	...	...	...	...	...	...	...	...	...	...
	C93500	3C	85-5-9-1	85	5	9	1	...	...	...	...	...	...	...	...	...
	C93600	...	81-7-12	81	7	12	...	...	...	...	...	...	...	...	...	...
	C93700	3A	80-10-10	80	10	10	...	...	...	...	...	...	...	...	...	...
	C93800	3D	78-7-15	78	7	15	...	...	...	...	...	...	...	...	...	...
	C93900	...	77-6-16-1 high-lead-tin bronze	77	6	16	1	...	...	...	...	...	...	...	...	...
	C94000	...	72-13-15	72	13	15	...	...	...	...	...	...	...	...	...	...
	C94100	...	journal bronze	75	5	18	2	...	...	...	...	...	...	...	...	...
	C94300	...	71-5-24	71	5	24	...	...	...	...	...	...	...	...	...	...
	C94400	...	81-8-11	81	8	11	...	...	...	...	...	...	...	...	...	...
	C94500	...	73-7-20	73	7	20	...	...	...	...	...	...	...	...	...	...
Nickel-tin bronze and leaded nickel tin bronze	C94700	...	nickel-tin bronze Grade “A”	88	5	...	2	5	...	...	...	...	...	...	...	...
	C94800	...	leaded nickel-tin bronze Grade “B”	87	5	1	2	5	...	...	...	...	...	...	...	...
	C94900	...	leaded nickel-tin bronze Grade “C”	80	5	5	5	5	...	...	...	...	...	...	...	...
Aluminum bronze	C95200	9A	Grade A	88	...	...	...	...	...	3	9	...	...	...	...	...
	C95300	9B	Grade B	89	...	...	...	...	...	1	10	...	...	...	...	...
	C95400	9C	Grade C	86	...	...	...	...	...	4	10	...	...	...	...	...
	C95410	...		84	...	...	...	2	...	4	10	...	...	...	...	...
	C95500	9D	Grade D	81	...	...	...	4	...	4	11	...	...	...	...	...
	C95520	...	nickel-aluminum bronze	78.5	...	...	...	5.5	...	5.0	11	...	...	...	...	...
Silicon aluminum bronze	C95600	9E	silicon-aluminum bronze	91	...	...	...	...	...	...	7	...	...	2	...	...
Manganese aluminum bronze	C95700	9F	manganese-aluminum bronze	75	...	...	...	2	...	3	8	12	...	...	...	...
Nickel aluminum bronze	C95800	...	nickel-aluminum bronze	81	...	...	...	4.5	...	4	9	1.5	...	...	...	...
Aluminum bronze	C95900	...	aluminum bronze	82.5	...	...	...	...	...	4.5	13	...	...	...	...	...
Cupro-nickel	C96200	...	90-10 cupro-nickel	87	...	...	...	10	...	1.5	...	1	...	...	1	...
	C96400	...	70-30 cupro-nickel	66	...	...	...	30.5	...	0.5	...	1	...	...	1	...
	C96800	...	spinodal alloy	82	8	...	...	10	...	...	...	...	...	...	0.2	...
Leaded nickel bronze	C97300	10A	12 % leaded nickel silver	57	2	9	20	12	...	...	...	...	...	...	...	...
	C97600	11A	20 % leaded nickel silver	64	4	4	8	20	...	...	...	...	...	...	...	...
	C97800	11B	25 % leaded nickel silver	66	5	2	2	25	...	...	...	...	...	...	...	...
Special alloys	C99400	...		87	...	...	4.4	3.0	...	3.0	1.6	...	...	1.0	...	...
	C99500	...		87	...	...	1.5	4.5	...	4.0	1.7	...	...	1.3	...	...
White brass	C99700	...		58	...	1.5	22.5	5.0	...	...	1.0	12	...	...	...	...
	C99750	...		58	...	1.0	20.0	...	...	...	1.0	20	...	...	...	...

[A] Phosphorus 0.13.
[B] Phosphorus 0.04.
[C] Phosphorus 0.12.
[D] Bismuth 5.0.
[E] Selenium 0.5.
[F] Selenium 0.9.
[G] Selenium 0.20.
[H] Selenium 0.03.
[I] Phosphorus 0.1
[J] Antimony 0.07, Boron 0.001.

2.3 *JIS Standard*[4]

JIS H1068 Methods for Determination of Bismuth in Copper and Copper Alloys

[4] Available from Japanese Standards Association (JSA), Mita MT Bldg., 3-13-12 Mita, Minato-ku, Tokyo, 108-0073, Japan, http://www.jsa.or.jp.

3. Ordering Information

3.1 Orders for ingot should include the following information:

3.1.1 ASTM designation and year of issue (for example, B30 – 05),

TABLE 2 Nominal Compositions

Alloy Name	Copper Alloy UNS No.	Previous Designation	Copper	Nickel	Iron	Silicon	Beryllium	Cobalt	Chromium	Zirconium	Titanium	Manganese
Copper beryllium	C81400	70C	99.1	...	...	...	0.06	...	0.8	...	...	...
	C82000	10C	97	...	...	...	0.5	2.5	...	...	...	...
	C82200	3C, 14C	98	1.5	...	...	0.5	...	...	...	...	...
	C82400[A]	165C, 165CT[A]	97.8	...	...	...	1.7	0.5	...	...	...	...
	C82500[A]	20C, 20CT[A]	97.2	...	...	0.3	2.0	0.5	...	...	...	...
	C82510	21C	96.6	...	...	0.3	2.0	1.1	...	...	...	...
	C82600[A]	245C, 245CT[A]	96.8	...	...	0.3	2.4	0.5	...	...	...	...
	C82800[A]	275C, 275CT[A]	96.6	...	...	0.3	2.6	0.5	...	...	...	...
	C96700	72C	67.2	31.0	0.6	...	1.2	...	...	0.3	0.3	0.6

[A] When fine grained castings are specified, 0.02–0.12 titanium is added.

3.1.2 Copper Alloy UNS No. (for example, C83450 and Table 1, Table 2, Table 4, and Table 5),

3.1.3 Quantity; total weight, and

3.1.4 When purchase is for agencies of U.S. government.

3.2 The following options are available under this specification and shall be specified in the contract or purchase order when required:

3.2.1 Mechanical requirements, when specified in the purchase order (Section 7).

3.2.2 Nickel content in Copper Alloys UNS Nos. C90300, C90500, C92200, and C92300 (Table 4).

3.2.3 Weldability test for Copper Alloys UNS Nos. C96200 and C96400 (Section 8).

3.2.4 Lot consisting of ingots from more than a single heat or melt (Section 10.1.1).

3.2.5 Place of inspection (Section 14).

3.2.6 Type of ingot surface (5.1).

4. Material and Manufacture

4.1 *Material*—Any material may be used which when melted will produce an alloy of the required chemical composition and mechanical requirements.

4.2 *Manufacture:*

4.2.1 Any manufacturing process may be used that will yield ingot of uniform composition that is free of defects of a nature that would render the ingot unsuitable for remelting.

4.2.2 Each heat or lot of ingot shall maintain heat identification numbers.

5. Workmanship, Finish, and Appearance

5.1 The ingots shall have the surface specified in the purchase order (3.2.6).

6. Chemical Composition

6.1 The ingot shall conform to the requirements given in Table 4 or Table 5 for the specified alloy. Ingot is an intermediate product, therefore the limits listed in Table 4 and Table 5 may be more restrictive than those applicable for cast products produced from the ingot after remelting.

NOTE 1—Table 5 contains the requirements for copper-beryllium alloys.

6.1.1 Since no recognized test method is known to be published, the determination of boron shall be subject to agreement between the manufacturer or supplier and the purchaser.

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

6.2 For alloys in which copper is designated as the remainder, copper may be taken as the difference between the sum of results for specified elements and 100 %.

7. Mechanical Properties

7.1 Ingot is an intermediate product intended for remelting by the purchaser, therefore, mechanical properties are not applicable.

NOTE 2—However, when specified in the purchase order, ingot when remelted and cast into tension test coupons shall meet the mechanical requirements of a specified casting specification. The place of remelting and testing shall be as agreed upon between the purchaser and the manufacturer. Mechanical requirements for those Copper Alloy UNS Numbers for which no mechanical requirements are given in the applicable casting specification shall be by agreement between the purchaser and the manufacturer.

7.2 Table 3 provides a cross reference between the Copper Alloy UNS Nos. in this specification and the casting specifications in which they appear.

8. Performance Requirements

8.1 *Weldability*—When specified in the contract or purchase order, ingots produced from Copper Alloys No. C96200 and C96400 shall pass the weldability test requirements when subjected to test in accordance with the Weldability Test Section 8 of Specification B369.

9. Purchases for Agencies of the U.S. Government

9.1 When a purchase is specified in the contract or purchase order to be for an agency of the U.S. government, the material shall conform to the Special Government Requirements as stipulated in the Supplementary Requirements section.

10. Sampling

10.1 The lot size, portion size, and selection of portion pieces shall be as follows:

10.1.1 *Lot Size*—An inspection lot shall be all ingots subject to inspection which are produced from a single furnace charge during one casting period.

10.1.2 *Portion Size*—The portion size shall be not less than 100 lbs (45.5 kg).

TABLE 3 Alloy/Specification Cross Reference

Copper Alloy UNS No.	ASTM Copper Alloy Casting Specification															
	B22/B22M	B30	B61	B62	B66	B67	B148	B176	B271/B271M	B369	B427	B505/B505M	B584	B763/B763M	B770	B806
C81400	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82000	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82200	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82400	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82500	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82510	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82600	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C82800	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C83450	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C83470	...	X	...	...	...	...	...	...	...	...	...	X	X	...	...	...
C83600	...	X	...	X	...	...	...	...	X	...	...	X	X	...	...	...
C83800	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C84020	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C84030	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C84200	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C84400	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C84800	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C85200	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C85400	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C85470	...	X	...	...	...	...	...	X	X	...	...	X	X	X	...	X
C85700	...	X	...	...	...	...	...	X	X	...	...	X	X	X	...	...
C85800	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...
C86100	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C86200	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C86300	X	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C86400	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C86500	...	X	...	...	...	...	...	X	X	...	...	X	X	X	...	...
C86700	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C87300	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C87400	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C87500	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	X
C87600	...	X	...	...	...	...	...	...	X	...	...	...	X	X	...	...
C87610	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C87700	...	X	...	...	...	...	...	...	...	...	...	X	X	...	...	...
C87710	...	X	...	...	...	...	...	...	...	...	...	X	X	...	...	...
C87800	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	X
C87845	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C87850	..	X	...	...	...	...	...	...	...	...	...	..	X	..	..	X
C89320	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C89510	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C89520	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C89530	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C89535	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C89537	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	X
C89540	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	X
C89570	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	X
C89720	...	X	...	...	...	...	...	...	...	...	...	X	X	X	...	...
C89833	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C89836	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C89844	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C90300	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C90420	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C90500	X	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C90700	...	X	...	...	...	...	...	...	...	...	X	X	...	...	...	...
C90800	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...
C91000	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C91100	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C91300	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C91600	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...
C91700	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...
C92200	...	X	X	...	...	...	...	...	X	...	...	X	X	...	...	...
C92210	...	...	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C92300	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C92500	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C92600	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C92700	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C92800	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C92900	...	X	...	...	...	...	...	...	...	...	X	X	...	...	...	...
C93200	...	X	...	...	X	...	...	...	X	...	...	X	X	X	...	...
C93400	...	X	...	...	X	...	...	...	...	...	...	X	...	...	...	...
C93500	...	X	...	...	...	...	...	...	X	...	...	X	X	X	...	...
C93600	...	X	...	...	X	...	...	...	X	...	...	X	...	...	...	...
C93700	X	X	...	...	X	...	...	...	X	...	...	X	X	X	...	...

TABLE 3 *Continued*

Copper Alloy UNS No.	ASTM Copper Alloy Casting Specification															
	B22/ B22M	B30	B61	B62	B66	B67	B148	B176	B271/ B271M	B369	B427	B505/ B505M	B584	B763/ B763M	B770	B806
C93800	...	X	...	...	X	...	...	...	X	...	...	X	X	X	...	...
C93900	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C94000	...	X	...	...	...	...	...	...	...	...	...	X	...	...	...	...
C94100	...	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...
C94300	...	X	...	...	X	...	...	...	X	...	...	X	X	X	...	...
C94400	...	X	...	...	X	...	...	...	...	...	...	...	...	...	...	...
C94500	...	X	...	...	X	...	...	...	...	...	...	...	...	...	...	...
C94700	...	X	...	...	...	...	...	...	...	...	...	X	X	X	...	...
C94800	...	X	...	...	...	...	...	...	...	...	...	X	X	X	...	...
C94900	...	X	...	...	...	...	...	...	...	...	...	...	X	X	...	...
C95200	...	X	...	...	...	...	X	...	X	...	...	X	...	X	...	...
C95300	...	X	...	...	...	...	X	...	X	...	...	X	...	X	...	X
C95400	...	X	...	...	X	...	X	...	X	...	...	X	...	X	...	X
C95410	...	X	...	...	...	...	X	...	X	...	...	X	...	X	...	X
C95500	...	X	...	...	...	...	X	...	X	...	...	X	...	X	...	X
C95520	...	X	...	...	...	...	X	...	X	...	...	X	...	...	...	...
C95600	...	X	...	...	...	...	X	...	...	...	...	...	...	X	...	...
C95700	...	X	...	...	...	...	X	...	...	...	...	X	...	...	...	...
C95800	...	X	...	...	...	...	X	...	X	...	...	X	...	X	...	X
C95900	...	X	...	...	...	...	X	...	X	...	...	X	...	...	...	...
C96200	...	X	...	...	...	...	...	...	...	X	...	...	...	...	...	...
C96400	...	X	...	...	...	...	...	...	...	X	...	X	...	...	...	...
C96700	...	X	...	...	...	...	...	...	...	...	...	...	...	...	X	...
C96800	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...
C97300	...	X	...	...	...	...	...	X	...	...	...	X	X	X	...	...
C97600	...	X	...	...	...	...	...	X	...	...	...	X	X	X	...	...
C97800	...	X	...	...	...	...	...	X	...	...	...	X	X	X	...	...
C99400	...	X	...	...	...	...	...	...	...	...	...	...	...	X	...	...
C99500	...	X	...	...	...	...	...	...	...	...	...	...	...	X	...	...
C99700	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...
C99750	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...

10.1.3 *Selection of Portion Pieces*—The sample ingot(s) shall be randomly selected.

10.2 *Chemical Analysis:*

10.2.1 The sample for chemical analysis shall be taken in accordance with Practice E255 from the piece(s) selected in 10.1.2. The minimum weight of the composite sample shall be 150 g.

10.2.2 Instead of sampling in accordance with Practice E255, the manufacturer shall have the option of sampling at the time the ingots are poured and at least two samples shall be taken during the pouring period.

10.2.2.1 When chemical composition is determined during the course of manufacture, sampling and analysis of the finished product is not required.

10.3 *Tension Testing:*

10.3.1 Tension test coupons, when required by the purchase order, shall be cast to the form and dimensions of the applicable figure in Practice B208 as prescribed in the applicable casting specification.

10.3.2 Tension test coupons for those Copper Alloy UNS Nos. for which no applicable figure in Practice B208 is prescribed in the applicable casting specification shall be as agreed upon between the manufacturer or supplier and the purchaser.

11. Number of Tests and Retests

11.1 *Tests:*

11.1.1 *Chemical Analysis*—Chemical composition shall be determined as the average of results from at least two determinations for each element with a limiting value listed in Table 4 or Table 5 for the specified copper alloy.

11.1.2 *Weldability Test*—When required, Copper Alloy UNS Nos. C96200 and C96400 shall meet the requirements of the weldability test.

11.2 *Retests:*

11.2.1 When requested by the manufacturer or supplier, a retest may be permitted should test results obtained by the purchaser fail to conform with the requirements of Table 4 or Table 5 for the specified alloy.

11.2.1.1 The retest shall be as directed in 11.1.2 except the number of replicate determinations shall be twice that of the first test. All determinations shall conform to specification requirements and failure to comply shall be cause for lot rejection.

12. Specimen Preparation

12.1 *Chemical Analysis*—Preparation of the analytical specimen shall be the responsibility of the reporting laboratory.

13. Test Methods

13.1 Test methods used for quality control or production control, or both, for determining conformance to product property requirements are discretionary.

TABLE 4 Ingot Chemical Requirements

Classification	Copper Alloy UNS No.	Composition, % max except as indicated														Corresponding ASTM Casting Specifications[A]
		Copper	Tin	Lead	Zinc	Iron	Antimony	Nickel (incl Cobalt)	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Bismuth	Other	
Leaded red brass	C83450	87.0–89.0[B,C]	2.2–3.0	1.5–2.5	5.8–7.5	0.25	0.25	0.8–1.5	0.08	0.03	0.005	...	0.005	...	...	B584 (C83450) B763/B763M (C83450)
Low-lead sulfur tin bronze	C83470	90.0–96.0[B,D]	3.0–5.0	0.09	1.0–3.0	0.50	0.20	1.0	0.20–0.6	0.10	0.01	...	0.01	...	...	B584 (C83470)
Leaded red brass	C83600	84.0–86.0[B,C]	4.3–6.0	4.0–5.7	4.3–6.0	0.25	0.25	0.8	0.08	0.03	0.005	...	0.005	...	...	B62 (C83600) B271/B271M (C83600) B505/B505M (C83600) B584 (C83600)
	C83800	82.0–83.5[B,C]	3.5–4.2	5.8–6.8	5.5–8.0	0.25	0.25	0.8	0.08	0.02	0.005	...	0.005	...	...	B584 (C83800) B271/B271M (C83800) B505/B505M (C83800) B763/B763M (C83800)
Low-lead semi-red brass	C84020	82.0–89.0[C]	2.0–4.0	0.09	5.0–14.0	0.40	0.02	0.50–2.0	0.10–0.65	0.05	0.005	0.20	0.005	...	B 0.10 C 0.10 Ti 0.10 Zr 0.10	B584 (C84020)
	C84030	82.0–89.0[C]	2.0–4.0	0.09	5.0–14.0	0.40	0.10–1.5	0.50–2.0	0.10–0.65	0.05	0.005	0.20	0.005	...	B 0.10 C 0.10 Ti 0.10 Zr 0.10	B584 (C84030)
Leaded semi-red brass	C84200	78.0–82.0[B,C]	4.3–6.0	2.0–2.8	10.0–16.0	0.35	0.25	0.8	0.08	0.02	0.005	...	0.005	...	...	B505/B505M (C84200)
	C84400	79.0–82.0[B,C]	2.5–3.5	6.3–7.7	7.0–10.0	0.35	0.25	0.8	0.08	0.02	0.005	...	0.005	...	...	B584 (C84400) B271/B271M (C84400) B505/B505M (C84400) B763/B763M (C84400)
	C84800	75.0–76.7[B,C]	2.3–3.0	5.5–6.7	13.0–16.0	0.35	0.25	0.8	0.08	0.02	0.005	...	0.005	...	...	B584 (C84800) B271/B271M (C84800) B505/B505M (C84800) B763/B763M (C84800)
Leaded yellow brass	C85200	70.0–73.0[B,E]	0.8–1.7	1.5–3.5	21.0–27.0	0.50	0.20	0.8	0.05	0.01	0.005	...	0.05	...	...	B271/B271M (C85200) B584 (C85200) B763/B763M (C85200)
	C85400	66.0–69.0[B,F]	0.50–1.5	1.5–3.5	25.0–31.0	0.50	...	0.8	...	...	0.005	...	0.05	...	...	B271/B271M (C85400) B584 (C85400) B763/B763M (C85400)
Yellow brass	C85470	60.0–65.0[D]	1.0–4.0	0.09	Rem	0.20	...	...	...	0.02–0.25	0.10–1.0	...	0.40–1.0	...	...	B176 (C85470) B271/B271M (C85470) B505/B505M (C85470) B584 (C85470) B763/B763M (C85470) B806 (C85470)
Leaded yellow brass	C85700	58.0–63.0[B,G]	0.50–1.5	0.8–1.5	33.0–40.0	0.50	...	0.8	...	...	0.80	...	0.05	...	...	B271/B271M (C85700) B176 (C85700) B584 (C85700) B763/B763M (C85700) B763/B763M (C85710)
	C85800	57.0 min[B,G]	1.5	1.5	31.0–41.0	0.50	0.05	0.50	0.05	0.01	0.50	0.25	0.25	...	0.05 As	B176
	C86100	66.0–68.0[B,H]	0.10	0.10	remainder	2.0–4.0	...	...	...	...	4.5–5.5	2.5–5.0	...	...	...	
High-strength yellow brass	C86200	60.0–66.0[B,H]	0.10	0.10	22.0–28.0	2.0–4.0	...	0.8	...	...	3.0–4.9	2.5–5.0	...	...	...	B271/B271M (C86200) B505/B505M (C86200) B584 (C86200) B763/B763M (C86200)
	C86300	60.0–66.0[B,H]	0.10	0.10	22.0–28.0	2.0–4.0	...	0.8	...	...	5.0–7.5	2.5–5.0	...	...	...	B22/B22M (C86300) B271/B271M (C86300) B505/B505M (C86300) B584 (C86300) B763/B763M (C86300)

TABLE 4 *Continued*

Classification	Copper Alloy UNS No.	Composition, % max except as indicated													Corresponding ASTM Casting Specifications[A]
		Copper	Tin	Lead	Zinc	Iron	Antimony	Nickel (incl Cobalt)	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Bismuth	Other	
	C86400	56.0–62.0[B,H]	0.50–1.0	0.50–1.3	34.0–42.0	0.40–2.0	...	0.8	...	...	0.50–1.5	0.10–1.0	...	...	...	B271/B271M (C86400) B584 (C86400) B763/B763M (C86400)
	C86500	55.0–60.0[B,H]	1.0	0.30	36.0–42.0	0.40–2.0	...	0.8	...	...	0.50–1.5	0.10–1.5	...	...	...	B271/B271M (C86500) B176 (C86500) B505/B505M (C86500) B584 (C86500) B763/B763M (C86500)
	C86700	55.0–60.0[B,H]	1.5	0.50–1.5	30.0–38.0	1.0–3.0	...	0.8	...	...	1.0–3.0	1.0–3.5	...	...	...	B584 (C86700) B271/B271M (C86700) B763/B763M (C86700)
Silicon bronze and silicon brass	C87300	94.0 min[D]	...	0.09	0.25	0.20	...	...	...	...	...	0.8–1.5	3.5–4.5	...	...	B271/B271M (C87300) B584 (C87300) B763/B763M (C87300)
	C87400	79.0 min[I]	...	1.0	12.0–16.0	...	...	...	...	...	0.5	...	2.5–4.0	...	...	B271/B271M (C87400) B584 (C87400) B763/B763M (C87400)
	C87500	79.0 min[D]	...	0.09	12.0–16.0	...	...	...	...	...	0.50	...	3.0–5.0	...	...	B271/B271M (C87500) B806 (C87500) B763/B763M (C87500) B584 (C87500)
	C87600	88.0 min[D]	...	0.09	4.0–7.0	0.20	...	...	...	...	...	0.25	3.5–5.5	...	...	B584 (C87600) B271/B271M (C87600) B763/B763M (C87600)
	C87610	90.0 min[D]	...	0.09	3.0–5.0	0.20	...	...	...	...	...	0.25	3.0–5.0	...	...	B584 (C87610) B763/B763M (C87610)
	C87700	87.5 min[I]	2.0	0.09	7.0–9.0	0.50	0.10	0.25	...	0.15	...	0.80	2.5–3.5	...	...	B505/B505M (C87700)
	C87710	84.0 min[I]	2.0	0.09	9.0–11.0	0.50	0.10	0.25	...	0.15	...	0.80	3.0–5.0	...	...	B584 (C87710)
	C87800	80.0 min[D]	0.25	0.09	12.0–16.0	0.15	0.05	0.20	0.05	0.01	0.15	0.15	3.8–4.2	...	As 0.05 Mg 0.01	B176 (C87800) B806 (C87800)
	C87845	75.0–78.0[D]	0.10	0.02	remainder	0.10	0.015	0.20	...	0.03–0.06	0.09	0.10	2.5–2.9	...	As 0.015 Cr 0.015	B584 (C87845)
	C87850	75.0–78.0[D]	0.30	0.09	remainder	0.10	0.10	0.20	...	0.05–0.20	...	0.10	2.7–3.4	...	...	B584 (C87850) B806 (C87850)
Bismuth tin bronze	C89320	87.0–91.0[D]	5.0–7.0	0.09	1.0	0.20	0.35	1.0	0.08	0.30	0.005	...	0.005	...	Bi 4.0–6.0	B505/B505M (C89320)
Bismuth selenium brass	C89510	86.0–88.0[D]	4.0–6.0	0.09	4.0–6.0	0.20	0.25	1.0	0.08	0.05	0.005	...	0.005	0.5–1.5[J]	Se[J] 0.35–0.75	
	C89520	85.0–87.0[D]	5.0–6.0	0.09	4.0–6.0	0.20	0.25	1.0	0.08	0.05	0.005	...	0.005	1.6–2.2[K]	Se[K] 0.8–1.1	B584 (C89520)
	C89530	84.0–89.0[L]	3.5–6.0	.20	7.0–9.0	.30	.20	1.0	...	.05	.01	...	.01	1.0–2.0	Se .10–.30	
	C89535	84.0–89.0[L]	2.5–5.5	.25	5.0–9.0	.30	.20	.30–1.0	...	.40	.01	...	.01	.8–2.0	Se .50	
Bismuth brass	C89537	84.0–86.0[D]	3.0–6.0	0.09	5.0–13.0	0.50	...	...	...	...	...	...	0.6–1.2	0.50–3.0	B 0.0005–0.0020 Mg 0.01–0.10	B584 (C89537) B763/B763M (C89537)
Bismuth selenium yellow brass	C89540	58.0–64.0[D]	1.2	0.10	32.0–38.0	0.50	...	1.0	...	...	0.10–0.60	...	...	0.6–1.2	Se 0.10	B806 (C89540)
Bismuth brass	C89570	58.0–63.0[D]	0.20–1.5	0.09	35.0–38.0	0.50	...	0.15–0.50	...	0.50–0.15	0.10–1.0	...	...	0.50–1.5	B 0.0001–0.0020	B584 (C89570) B763/B763M (C89570)

TABLE 4 *Continued*

Classification	Copper Alloy UNS No.	Composition, % max except as indicated														Corresponding ASTM Casting Specifications[A]
		Copper	Tin	Lead	Zinc	Iron	Antimony	Nickel (incl Cobalt)	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Bismuth	Other	
	C89720	63.0 min[D]	0.6–1.5	0.09	26.0–32.0	0.10	0.02–0.20	0.10	. . .	0.02	0.35–1.5	0.10	0.40–1.0	0.50–2.0	Boron 0.0005 – 0.01	B505/B505M (C89720) B584 (C89720) B763/B763M (C89720)
Bismuth red brass	C89833	86.0–91.0[C]	4.0–6.0	0.09	2.0–6.0	0.30	0.25	1.0	0.08	0.050	0.005	. . .	0.005	1.7–2.7	. . .	B584 (C89833)
Bismuth bronze	C89836	87.0–91.0[D]	4.5–7.0	0.25	2.0–4.0	0.35	0.25	0.90	0.08	0.06	0.005	...	0.005	1.5–2.5	. . .	
Bismuth semi-red brass	C89844	83.0–86.0[B,C]	3.0–5.0	0.20	7.0–10.0	0.30	0.25	1.0	0.08	0.05	0.005		0.005	2.0–4.0	. . .	B584 (C89844) B763/B763M (C89844)
Tin Bronze and leaded tin bronze	C90300	86.0–89.0[B,M]	7.8–9.0	0.25	3.5–5.0	0.15	0.20	0.8	0.05	0.03	0.005	. . .	0.005	. . .	. . .	B271/B271M (C90300) B763/B763M (C90300) B505/B505M (C90300) B584 (C90300)
Low-lead tin bronze	C90420	86.0–89.0[C]	7.5–8.5	0.09	1.0–5.0	0.40	0.02	1.0	0.10–0.65	0.05	0.005	0.20	0.005	. . .	B 0.10 C 0.10 Ti 0.10 Zr 0.10	B584 (C90420)
Tin Bronze and leaded tin bronze	C90500	86.0–89.0[B,N]	9.5–10.5	0.25	1.5–3.0	0.15	0.20	0.8	0.05	0.03	0.005	. . .	0.005	. . .	. . .	B22/B22M (C90500) B271/B271M (C90500) B763/B763M (C90500) B505/B505M (C90500) B584 (C90500)
	C90700	88.0–90.0[B,M]	10.3–12.0	0.50[O]	0.50[O]	0.15	0.20	0.50[O,P]	0.05	0.30	0.005	. . .	0.005	. . .	. . .	B505/B505M (C90700) B427 (C90700)
	C90800	85.0–89.0[B,Q,M]	11.3–13.0	0.25	0.25	0.15	0.10	0.50	0.05	0.30	0.005	. . .	0.005	. . .	. . .	B427 (C90800)
	C91000	84.0–86.0[B,M]	14.3–16.0	0.20	1.5	0.10	0.10	0.8	0.05	0.03	0.005	. . .	0.005	. . .	. . .	B505/B505M (C91000)
	C91100	82.0–85.0[B,M]	15.3–17.0	0.25	0.25	0.15	0.20	0.50	0.05	1.0	0.005	. . .	0.005	. . .	. . .	B22/B22M (C91100)
	C91300	79.0-82.0[M]	18.0-20.0	0.25	0.25	0.25	0.20	0.50	0.05	1.0	0.005	---	0.005	---	---	
	C91600	86.0–89.0[B,J,M]	10.0–10.8	0.25	0.25	0.15	0.10	1.2–2.0	0.05	0.25	0.005	. . .	0.005	. . .	. . .	B427 (C91600)
	C91700	84.0–87.0[B,Q,M]	11.5–12.5	0.25	0.25	0.15	0.10	1.2–2.0	0.05	0.30	0.005	. . .	0.005	. . .	. . .	B427 (C91700)
	C92200	86.0–89.0[B,D]	5.8–6.5	1.0–1.8	3.5–5.0	0.20	0.20	0.8	0.05	0.03	0.005	. . .	0.005	. . .	. . .	B61 (C92200) B271/B271M (C92200) B505/B505M (C92200) B584 (C92200)
	C92210	86.0–89.0[C]	4.5–5.5	1.7–2.5	3.0–4.5	0.25	0.20	.7–1.0	0.05	0.03	0.005	---	0.005	---	---	
	C92300	85.0–89.0[B,C]	7.8–9.0	0.30–0.9	3.0–5.0	0.20	0.20	0.8	0.05	0.03	0.005	. . .	0.005	. . .	. . .	B271/B271M (C92300) B763/B763M (C92300) B505/B505M (C92300) B584 (C92300)
	C92500	85.0–88.0[B,C]	10.3–12.0	1.0–1.5	0.50	0.20	0.20	0.8–1.5	0.05	0.30	0.005	. . .	0.005	. . .	. . .	B505/B505M (C92500)
	C92600	86.0–88.5[B,C]	9.3–10.5	0.8–1.5	1.3–2.5	0.20	0.25	0.7	0.05	0.03	0.005	. . .	0.0050	. . .	. . .	B584 (C92600) B763/B763M (C92600)
	C92700	86.0–89.0[B,C]	9.3–11.0	1.0–2.3	0.8	0.15	0.20	0.8	0.05	0.25	0.005	. . .	0.005	. . .	. . .	B505/B505M (C92700)
	C92800	78.0–82.0[B,C]	15.3–17.0	4.0–5.7	0.8	0.15	0.20	0.8	0.05	0.05	0.005	. . .	0.005	. . .	. . .	B505/B505M (C92800)
	C92900	82.0–86.0[B,Q,C]	9.3–11.0	2.0–3.0	0.25	0.15	0.10	2.8–4.0	0.05	0.50	0.005	. . .	0.005	. . .	. . .	B427 (C92900) B505/B505M (C92900)
High-lead tin bronze	C93200	82.0–84.0[B,H]	6.5–7.5	6.5–7.7	2.5–4.0	0.20	0.30	0.8	0.08	0.03	0.005	. . .	0.005	. . .	. . .	B66 (C93200) B271/B271M (C93200) B763/B763M (C93200) B505/B505M (C93200) B584 (C93200)
	C93400	82.0–85.0[B,H]	7.3–9.0	7.0–8.7	0.8	0.20	0.30	0.8	0.08	0.03	0.005	. . .	0.005	. . .	. . .	B505/B505M (C93400)

TABLE 4 *Continued*

Classification	Copper Alloy UNS No.	Composition, % max except as indicated														Corresponding ASTM Casting Specifications[A]
		Copper	Tin	Lead	Zinc	Iron	Antimony	Nickel (incl Cobalt)	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Bismuth	Other	
	C93500	83.0–85.0[B,H]	4.5–5.5	8.5–9.7	0.50–1.5	0.10	0.30	0.8	0.08	0.04	0.005	...	0.005	...	...	B66 (C93400) B271/B271M (C93500) B763/B763M (C93500) B505/B505M (C93500) B584 (C93500)
	C93600	79.0–82.0[C]	6.3–7.7	11.3–13.0	1.0	0.15	0.50	0.8	0.08	0.05	0.005	...	0.005	...	...	B271/B271M (C93600) B505/B505M (C93600) B66 (C93600)
	C93700	78.0–81.0[B,H]	9.3–10.7	8.3–10.7	0.8	0.10	0.50	0.50	0.08	0.05	0.005	...	0.005	...	...	B22/B22M (C93700) B66 (C93700) B763/B763M (C93700) B271/B271M (C93700) B505/B505M (C93700) B584 (C93700)
	C93800	76.0–79.0[H]	6.5–7.5	14.0–16.0	0.8	0.10	0.50	0.8	0.08	0.05	0.005	...	0.005	...	...	B66 (C93800) B763/B763M (C93800) B271/B271M (C93800) B505/B505M (C93800) B584 (C93800)
	C93900	76.5–79.5[F]	5.3–7.0	14.0–17.7	1.5	0.35	0.50	0.8	0.08	0.05	0.005	...	0.005	...	...	B505/B505M (C93900)
	C94000	69.0–72.0[G]	12.3–14.0	14.0–15.7	0.50	0.25	0.50	0.50–1.0	0.08	0.05	0.005	...	0.005	...	...	B505/B505M (C94000)
	C94100	74.0–79.0[G]	4.7–6.5	15.0–21.7	1.0	0.10	0.7	0.8	0.08	0.05	0.005	...	0.005	...	...	B67 (C94100) B505/B505M (C94100)
	C94300	69.0–72.0[B,H]	4.7–5.8	23.0–27.0	0.8	0.10	0.7	0.8	0.08	0.05	0.005	...	0.005	...	...	B66 (C94300) B763/B763M (C94300) B271/B271M (C94300) B505/B505M (C94300) B584 (C94300)
	C94400	78.0–82.0[H]	7.3–9.0	9.0–11.7	0.8	0.10	0.7	0.8	0.08	0.05	0.005	...	0.005	...	...	B66 (C94400)
	C94500	70.0–75.0[H]	6.3–8.0	16.0–21.5	1.0	0.10	0.7	0.8	0.08	0.05	0.005	...	0.005	...	...	B66 (C94400)
Nickel tin bronze and leaded nickel tin bronze	C94700	86.0–89.0[G]	4.7–6.0	0.08[R]	1.3–2.5	0.20	0.10	4.5–6.0	0.05	0.05	0.005	0.20	0.005	...	...	B505/B505M (C94700) B584 (C94700) B763/B763M (C94700)
	C94800	85.0–89.0[G]	4.7–6.0	0.30–0.9	1.3–2.5	0.20	0.10	4.5–6.0	0.05	0.05	0.005	0.20	0.005	...	...	B505/B505M (C94800) B763/B763M (C94800)
	C94900	79.0–81.0[M]	4.3–6.0	4.0–5.7	4.3–6.0	0.25	0.25	4.5–6.0	0.08	0.05	0.005	0.10	0.005	...	...	B584 (C94800) B763/B763M (C94900) B584 (C94900)
Aluminum bronze	C95200	86.0 min[H]	...	...	...	2.5–4.0	...	...	...	...	8.5–9.5	...	...	...	...	B148 (C95200) B763/B763M (C95200) B271/B271M (C95200) B505/B505M (C95200)
	C95300	86.0 min[H]	...	...	...	0.8–1.5	...	...	...	...	9.0–11.0	...	...	...	...	B148 (C95300) B763/B763M (C95300) B271/B271M (C95300) B505/B505M (C95300) B806 (C95300)
	C95400	83.0 min[D]	...	...	...	3.0–5.0	...	1.5 max	...	...	10.0–11.5	0.50	...	...	...	B148 (C95400) B66 (C95400) B763/B763M (C95400) B271/B271M (C95400) B505/B505M (C95400) B806 (C95400)
	C95410	83.0 min[D]	...	...	...	3.0–5.0	...	1.5–2.5	...	...	10.0–11.5	0.50	...	...	...	B148 (C95410) B763/B763M (C95410) B271/B271M (C95410) B505/B505M (C95410) B806 (C95410)
	C95500	78.0 min[D]	...	...	...	3.0–5.0	...	3.0–5.5	...	...	10.0–11.5	3.5	...	...	...	B148 (C95500) B763/B763M (C95500) B271/B271M (C95500) B505/B505M (C95500) B806 (C95500)
	C95520	74.5 min[S,D]	0.25	0.03	0.30	4.0–5.5	...	4.2–6.0	...	...	10.5–11.5	1.5	0.15	...	...	B148 (C95520) B271/B271M (C95520) B505/B505M (C95520)

TABLE 4 *Continued*

Classification	Copper Alloy UNS No.	Composition, % max except as indicated													Corresponding ASTM Casting Specifications[A]
		Copper	Tin	Lead	Zinc	Iron	Antimony	Nickel (incl Cobalt)	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Bismuth	Other	
	C95600	88.0 min[H]	. . .	. . .	. . .	. . .	. . .	0.25	. . .	. . .	6.0–8.0	. . .	1.8–3.3	. . .	. . .	B148 (C95600) B763/B763M (C95600)
	C95700	71.0 min[D]	. . .	0.03	. . .	2.0–4.0		1.5–3.0	. . .	. . .	7.0–8.5	11.0–14.0	0.10	. . .	. . .	B148 (C95700) B505/B505M (C95700)
	C95800	79.0 min[D]	. . .	0.02	. . .	3.5–4.5[T]	. . .	4.0–5.0[T]	. . .	. . .	8.5–9.5	0.8–1.5	0.05	. . .	. . .	B148 (C95800) B763/B763M (C95800) B271/B271M (C95800) B505/B505M (C95800) B806 (C95800)
	C95900	remainder[D]	. . .	. . .	. . .	3.0–5.0	. . .	0.50	. . .	. . .	12.0–13.5	1.5	. . .	. . .	. . .	B148 (C95900) B271/B271M (C95900) B505/B505M (C95900)
Cupronickel	C96200	84.5–87.0[D]	. . .	0.005	. . .	1.0–1.8	. . .	9.0–11.0	0.02	0.02	. . .	0.8–1.5	0.25	. . .	0.05 C 1.0 Nb	B369 (C96200)
	C96400	65.0–67.0[D]	. . .	0.005	. . .	0.25–1.0	. . .	29.5–31.5	0.02	0.02	. . .	0.8–1.5	0.30–0.50	. . .	0.05 C 0.50–1.5 Nb	B369 (C96400) B505/B505M (C96400)
	C96800	remainder[L]	7.5–8.5	0.005	1.0	0.50	0.02	9.5–10.5	0.0025	0.005	0.10	0.05–0.30	0.05	0.001	0.005–0.15 Mg 0.10–0.30 Nb 0.001 B –0.01 Ti	B584 (C96800)
Leaded nickel bronze	C97300	53.0–58.0[H]	1.5–3.0	8.0–11.0	17.0–25.0	1.0	0.35	11.0–14.0	0.08	0.05	0.005	0.50	0.05	. . .	. . .	B584 (C97300) B176 (C97300) B505/B505M (C97300) B763/B763M (C97300)
	C97600	63.0–66.0[N]	3.5–4.5	3.5–5.0	3.0–9.0	1.0	0.25	19.5–21.0	0.08	0.05	0.005	1.0	0.05	. . .	. . .	B584 (C97600) B176 (C97600) B763/B763M (C97600) B505/B505M (C97600)
	C97800	64.0–67.0[U]	4.5–5.5	1.0–2.0	1.0–4.0	1.0	0.20	24.0–26.0	0.08	0.05	0.005	1.0	0.05	. . .	. . .	B584 (C97800) B176 (C97800) B763/B763M (C97800)
Special alloys	C99400	remainder[N]	. . .	0.09	0.50–5.0	1.0–3.0	. . .	1.0–3.5[P]	. . .	. . .	0.50–2.0	0.50	0.50–2.0	. . .	. . .	B763/B763M (C99400)
	C99500	remainder[N]	. . .	0.09	0.50–2.0	3.0–5.0	. . .	3.5–5.50[P]	. . .	. . .	0.50–2.0	0.50	0.50–2.0	. . .	. . .	B763/B763M (C99500)
White brass	C99700	54.0 min[N]	1.0	2.0	19.0–25.0	1.0	. . .	4.0–6.0[P]	. . .	. . .	0.50–3.0	11.0–15.0	. . .	. . .	. . .	B176 (C99700)
	C99750	55.0–61.0[N]	. . .	0.50–2.5	17.0–23.0	1.0	. . .	5.0[P]	. . .	. . .	0.25–3.0	17.0–23.0	. . .	. . .	. . .	B176 (C99750)

[A] *Annual Book of ASTM Standards,* Vol 02.01.
[B] In determining copper minimum, copper may be calculated as copper plus nickel.
[C] Copper plus sum of named elements, 99.3 %.
[D] Copper plus sum of named elements, 99.5 % min.
[E] Copper plus sum of named elements, 99.1 %.
[F] Copper plus sum of named elements, 98.9 %.
[G] Copper plus sum of named elements, 98.7 %.
[H] Copper plus sum of named elements, 99.0 % min.
[I] Copper plus sum of named elements, 99.2 %.
[J] Experience favors bismuth:selenium > =2:1.
[K] bismuth:selenium > = 2:1.
[L] Copper plus sum of named elements, 99.5 % min.
[M] Copper plus sum of named elements, 99.4 %.
[N] Copper plus sum of named elements, 99.7 %.
[O] Total lead, zinc, and nickel = 1 % max.
[P] Not including cobalt.
[Q] Copper plus tin plus lead plus nickel plus phosphorus = 99.5 % min.
[R] The mechanical requirements of Copper Alloy UNS No. C94700 (Heat Treated) may not be attained if the lead content exceeds 0.01 %.
[S] Chromium shall be 0.05 max and cobalt 0.20 max.
[T] Iron content shall not exceed nickel content.
[U] Copper plus sum of named elements, 99.6 %.

TABLE 5 Chemical Requirements

Classification	Copper Alloy UNS No.	Composition, % max except as indicated												
		Copper[A]	Beryllium	Cobalt	Nickel	Iron	Silicon	Zirconium	Titanium	Zinc	Chromium	Lead	Manganese	Aluminum	Tin
Copper beryllium[B]	C81400	remainder	0.05–0.10	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.6–1.0	. . .	. . .	. . .	. . .
	C82000	remainder	0.5–0.8	2.40–2.70	0.20	0.10	0.15	. . .	. . .	0.10	0.09	0.02	. . .	0.10	0.10
	C82200	remainder	0.40–0.8	0.30	1.0–2.0	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
	C82400[C]	remainder	1.65–1.85	0.20–0.65	0.20	0.20	. . .	. . .	. . .	0.10	0.09	0.02	. . .	0.15	0.10
	C82500[C]	remainder	1.95–2.25	0.35–0.70	0.20	0.25	0.20–0.35	. . .	. . .	0.10	0.09	0.02	. . .	0.15	0.10
	C82510	remainder	1.95–2.15	1.00–1.20	0.20	0.25	0.20–0.35	. . .	. . .	0.10	0.09	0.02	. . .	0.15	0.10
	C82600[C]	remainder	2.3–2.55	0.35–0.65	0.20	0.25	0.20–0.35	. . .	. . .	0.10	0.09	0.02	. . .	0.15	0.10
	C82800[C]	remainder	2.55–2.85	0.35–0.70	0.20	0.25	0.20–0.35	. . .	. . .	0.10	0.09	0.02	. . .	0.15	0.10
	C96700	remainder	1.10–1.20	. . .	29.0–33.0	0.40–1.0	0.15	0.15–0.35	0.15–0.35	. . .	. . .	0.01	0.40–1.0	. . .	. . .

[A] Copper plus sum of named elements, 99.5 %.
[B] Copper-beryllium alloys appear in Specification B770, *Annual Book of ASTM Standards,* Vol 02.01.
[C] When fine grained castings are specified, 0.02–0.12 titanium is added for grain refinement, usually in the remelt ingot.

13.1.1 Test methods used to obtain data for the preparation of certification or test report shall be made available to the purchaser on request.

13.2 *Chemical Analysis*—In case of disagreement, the test method to be followed for a specific element and range or maximum concentration shall be as indicated in Table 6 for alloys listed in Table 4.

13.2.1 Refer to the Annex of Specification B194 for test methods to be followed in the analysis of Copper-Beryllium alloys listed in Table 5.

13.2.2 The determination of magnesium, niobium, zirconium, and titanium, for which no recognized test method is known to be published, shall be subject to agreement between the manufacturer or supplier and the purchaser.

TABLE 6 Chemical Test Methods

Element	Range or Max %	Test Method
Aluminum (Al)	0.005–13.5	E478
Antimony (Sb)	0.05–0.70	E62
	0.02–1.5	Atomic Absorption
Arsenic (As)	0.50	E62
Bismuth	0.1–6	JIS H1068
Boron	0.10	ICP Mass Spectrometry
Carbon (C)	0.5	E76
Copper (Cu)	50–99.75	E478
Iron (Fe)	0.003–1.25	E478
	5	E54
Lead (Pb)	0.002–15	E478; Atomic Absorption
	2–30	E478; Titrimetric
Manganese (Mn)	0.10–12	E62
	12–23	E581
Nickel (Ni) (incl Cobalt (Co))	5	E478; Photometric
	4–35	E478; Gravimetric
Phosphorus (P)	0.01–1.0	E62
Silicon (Si)	0.005–5.5	E54; Perchloric Acid Dehydration
Sulfur (S)	0.05–0.08	E76; Direct Combustion
	0.10–0.65	Leco Carbon/Sulfur Determinator
Tin (Sn)	0.01–1	E478; Photometric
	0.5–20	E478; Titrimetric
Titanium	0.10	Atomic Absorption
Zinc (Zn)	0.02–2	E478; Atomic Absorption
	2–40	E478; Titrimetric
Zirconium	0.10	Atomic Absorption

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

13.3 *Tension Testing*—When mechanical requirements are specified in the purchase order tension testing shall be performed in accordance with Test Methods E8/E8M.

14. Significance of Numerical Limits

14.1 For purposes of determining compliance with the specified limits for chemical composition an observed or calculated value shall be rounded as indicated in accordance with the rounding-off method of Practice E29.

Property	Rounded Limit for Observed or Calculated Value
Chemical composition	nearest unit in the last right-hand significant digit used in expressing the limiting value

15. Inspection

15.1 The manufacturer shall inspect and make tests necessary to verify that the product furnished conforms to specification requirements.

15.2 The purchaser may have a representative inspect or witness the inspection and testing of the product prior to shipment. Such an arrangement shall be made by the purchaser and the manufacturer as part of the contract or purchase order. When such inspection or witness of inspection and testing is agreed upon, the manufacturer shall afford the purchaser's representative all reasonable facilities necessary to confirm that the product meets the requirements of the contract or purchase order. The purchaser's inspection and tests shall be conducted in such a manner that they will not interfere unnecessarily with the manufacturer's operation.

16. Rejection and Rehearing

16.1 *Rejection:*

16.1.1 Product which fails to conform to the requirements of this specification when inspected or tested by the purchaser or purchaser's agent may be rejected.

16.1.2 Rejection shall be reported to the manufacturer, or supplier, promptly and in writing.

16.1.3 When dissatisfied with test results upon which rejection was based, the manufacturer, or supplier, may make claim for a rehearing.

16.2 *Rehearing:*

16.2.1 As a result of product rejection, the manufacturer or supplier may make claim for a retest to be conducted by the manufacturer or supplier and the purchaser.

16.2.2 Ingots selected for sampling shall be twice that specified in Section 10. Sampling of the randomly selected ingots shall be in accordance with Practice E255.

16.2.2.1 The composite sample shall be analyzed by both parties using the test methods identified in this specification for each element to be determined, or, alternatively, upon agreement by both parties, an independent laboratory may be selected for the test(s) using the test method prescribed in this specification.

17. Certification

17.1 The purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met.

18. Test Report (Foundry)

18.1 When tension testing is performed by the manufacturer because of purchase order requirements a report of the test results shall be furnished. The test report shall indicate what type of tension test bar casting was used (sand cast, permanent mold, and so forth).

19. Product Marking

19.1 The designating mark of the manufacturer shall be marked for identification on each ingot.

20. Packaging and Package Marking

20.1 *Packaging*—The product shall be prepared for shipment in such a manner as to ensure acceptance by common carrier for transportation and to afford protection from normal hazards of transportation.

20.2 *Package Marking*—Each shipping unit shall be legibly marked with the contract or purchase order number, Copper Alloy UNS No. designation, heat number, gross and net weight, and name of supplier. The specification number shall be shown when specified in the contract or purchase order.

21. Keywords

21.1 copper alloy; copper alloy castings; copper-base alloys; copper-base alloy castings; ingot

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. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S1.1.1 *ASTM Standards:*

B900 Practice for Packaging of Copper and Copper Alloy Mill Products for U.S. Government Agencies

S1.1.2 *Federal Standards:*[5]

Fed. Std. No. 102 Preservation, Packaging and Packing Levels

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

Fed. Std. No. 185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S1.1.2 *Military Standard:*[5]

MIL-STD-129 Marking for Shipment and Storage

S2. Quality Assurance

S2.1 *Responsibility for Inspection:*

S2.1.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or order, the manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in the specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

S3. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with Fed. Std. No. 185 except that the ASTM specification number and the alloy number shall be used.

S4. Preparation for Delivery

S4.1 *Preservation, Packaging, Packing:*

S4.1.1 *Military Agencies*—The material shall be separated by size, composition, grade, or class and shall be preserved and packaged, Level A or C, packed, Level A, B, or C, as specified in the contract or purchase order, in accordance with the requirements of B900.

S4.1.2 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S4.2 *Marking:*

[5] Available from DLA Document Services, Bldg. 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil/.

S4.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S4.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B30 – 14a) that may impact the use of this standard. (Approved Oct. 1, 2016.)

(1) Added missing Specification B369 section reference in 8.1.