Designation: B584 – 22

Standard Specification for Copper Alloy Sand Castings for General Applications[1]

This standard is issued under the fixed designation B584; 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 covers requirements for copper alloy sand castings for general applications. Nominal compositions of the alloys defined by this specification are shown in Table 1.[2] This is a composite specification replacing former documents as shown in Table 1.

NOTE 1—Other copper alloy castings are included in the following ASTM Specifications: B22/B22M, B61, B62, B66, B67, B148, B176, B271/B271M, B369/B369M, B427, B505/B505M, B763/B763M, B770, and B806.

1.2 Component part castings produced to this specification may be manufactured in advance and supplied from stock. In such cases the manufacturer shall maintain a general quality certification of all castings without specific record or date of casting for a specific casting.

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.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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
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/B369M Specification for Copper-Nickel Alloy Castings
B427 Specification for Gear Bronze Alloy Castings
B505/B505M Specification for Copper Alloy Continuous Castings
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
B824 Specification for General Requirements for Copper Alloy Castings
B846 Terminology for Copper and Copper Alloys
E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *ASME Code:*[4]
ASME Boiler and Pressure Vessel Code

[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] The UNS system for copper and copper alloys (see Practice E527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix "C" and a suffix "00." The suffix can be used to accommodate composition variations of the base alloy.

[3] 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.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

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

TABLE 1 Nominal Compositions

Classification	Copper Alloy UNS No.	Previous Designation	Commercial Designation	Copper	Tin	Lead	Zinc	Nickel	Sulfur	Iron	Aluminum	Manganese	Antimony	Silicon	Niobium	Phosphorus	Bismuth
Leaded red brass	C83450	...	...	88	2½	2	6½	1	...	...	...	...	...	...	...		...
Low-lead sulfur tin bronze	C83470	...	...	93	4	...	2	0.5	0.5	...	...	...	...	...	...	...	...
Leaded red brass	C83600	B145-4A	85-5-5-5 or No. 1 composition	85	5	5	5	...	...	...	...	...	...	...	...	...	...
	C83800	B145-4B	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	C84400	B145-5A	valve composition, 81-3-7-9	81	3	7	9	...	...	...	...	...	...	...	...	...	...
	C84800	B145-5B	semi-red brass, 76-2½-6½-15	76	2½	6½	15	...	...	...	...	...	...	...	...	...	...
Leaded yellow brass	C85200	B146-6A	high-copper yellow brass	72	1	3	24	...	...	...	...	...	...	...	...	...	...
	C85400	B146-6B	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	B146-6C	leaded naval brass	61	1	1	37	...	...	...	...	...	...	...	...	...	...
High-strength yellow brass	C86200	B147-8B	high-strength manganese bronze	63	...	...	27	...	...	3	4	3	...	...	...	...	...
	C86300	B147-8C	high-strength manganese bronze	61	...	...	27	...	...	3	6	3	...	...	...	...	...
	C86400	B147-7A	leaded manganese bronze	58	1	1	38	...	...	1	½	½	...	...	...	...	...
	C86400	B 132-A	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	C86500	B147-8A	No. 1 manganese bronze	58	...	...	39	...	...	1	1	1	...	...	...	...	...
	C86700	B 132-B	leaded manganese bronze	58	1	1	34	...	...	2	2	2	...	...	...	...	...
Silicon bronze + silicon brass	C87300	B198-12A	silicon bronze	95	...	...	...	...	...	...	...	1	...	4	...	...	...
	C87400	B198-13A	silicon brass	82	...	½	14	...	...	...	...	...	...	3½	...	...	...
	C87500	B198-13B	silicon brass	82	...	...	14	...	...	...	...	...	...	4	...	...	...
	C87600	B198-13C	silicon bronze	91	...	...	5	...	...	...	...	...	...	4	...	...	...
	C87610	B198-12A	silicon bronze	92	...	...	4	...	...	...	...	...	...	4	...	...	...
	C87710	...	silicon bronze	86	...	...	10	...	...	...	...	...	...	4	...	...	...
	C87845[B]	...	silicon bronze	76	...	...	21.26	...	...	...	...	...	...	2.7	...	...	...
	C87850[C]	...	silicon brass	76	...	...	20.9	...	...	...	...	...	...	3	...	...	...
Bismuth selenium brass	C89510[D]	...	sebiloy I	87	5	...	5	...	...	...	...	...	...	...	...	...	1.0
	C89520[E]	...	sebiloy II	86	5½	...	5	...	...	...	...	...	...	...	...	...	1.9
	C89530[F]	...	...	86.5	4.7	...	8.0	...	...	...	...	...	...	...	...	...	1.5
	C89535	...	...	86.5	3.0	...	7.0	0.65	...	...	...	...	...	...	...	...	1.4
Bismuth brass	C89537	...	...	85.0	4.5	...	9.0	...	...	...	...	...	...	0.9	...	...	1.7
	C89545[G]	...	...	69.0	...	...	29.0	0.5	...	...	1.0	...	...	...	...	0.13	0.55
	C89570[H]	...	...	60.5	0.8	...	36.5	0.32	...	...	0.5	...	...	...	...	...	1.0
	C89720[I]	...	...	67.5	1	...	29.8	...	...	...	0.5	...	...	0.5	...	...	0.7
Bismuth red brass	C89833	...	bismuth brass	89	5	...	3	...	...	...	...	...	...	...	...	...	2.2
Bismuth bronze	C89836	...	lead-free bronze	89.5	5.5	...	3.0	...	...	...	...	...	...	...	...	...	2
Bismuth brass	C89838	...	...	81.5	2.75	...	15.0	...	...	...	...	...	...	...	...	...	0.55
Bismuth semi-red brass	C89844	...	bismuth brass	84½	4	...	8	...	...	...	...	...	...	...	...	...	3
	C89845	...	...	85.0	4.0	...	7.5	2.0	...	...	...	...	...	...	...	...	1.5
Tin bronze + leaded tin bronze	C90300	B143-1B	modified "G" bronze, 88-8-0-4	88	8	...	4	...	...	...	...	...	...	...	...	...	...
Low-lead tin bronze	C90420	...	...	87.5	8	...	3	...	0.38	...	...	...	...	...	...	...	...
Tin bronze + leaded tin bronze	C90500	B143-1A	"G" bronze, 88-10-0-2	88	10	...	2	...	...	...	...	...	...	...	...	...	...
	C92200	B143-2A	steam or valve bronze-Navy "M"	88	6	1½	4½	...	...	...	...	...	...	...	...	...	...
	C92210	...	...	88	5	2	4	1	...	...	...	...	...	...	...	...	...

TABLE 1 *Continued*

Classification	Copper Alloy UNS No.	Previous Designation	Commercial Designation	Copper	Tin	Lead	Zinc	Nickel	Sulfur	Iron	Aluminum	Manganese	Antimony	Silicon	Niobium	Phosphorus	Bismuth
	C92300	B143-2B	87-5-1-4, Navy PC	87	8	1	4	...	...	...	...	...	...	...	...	...	...
	C92600	...	87-10-1-2	87	10	1	2	...	...	...	...	...	...	...	...	...	...
High-lead tin bronze	C93200	B144-3B	83-7-7-3	83	7	7	3	...	...	...	...	...	...	...	...	...	...
	C93500	B144-3C	85-5-9-1	85	5	9	1	...	...	...	...	...	...	...	...	...	...
	C93700	B144-3A	80-10-10	80	10	10	...	...	...	...	...	...	...	...	...	...	...
	C93800	B144-3D	78-7-15	78	7	15	...	...	...	...	...	...	...	...	...	...	...
	C94300	B144-3E	71-5-24	71	5	24	...	...	...	...	...	...	...	...	...	...	...
Nickel-tin bronze + leaded nickel-tin bronze	C94700	B 292-A	nickel-tin bronze Grade “A”	88	5	...	2	5	...	...	...	...	...	...	...	...	...
	C94800	B 292-B	leaded nickel-tin bronze Grade “B”	87	5	1	2	5	...	...	...	...	...	...	...	...	...
	C94900	...	leaded nickel-tin bronze Grade “C”	80	5	5	5	5	...	...	...	...	...	...	...	...	...
Spinodal alloy	C96800	...	...	82	8	...	...	10	...	...	...	...	...	...	0.2	...	...
Leaded nickel bronze	C97300	B149-10A	12 % leaded nickel silver	57	2	9	20	12	...	...	...	...	...	...	...	...	...
	C97600	B149-11A	20 % leaded nickel silver	64	4	4	8	20	...	...	...	...	...	...	...	...	...
	C97800	B149-11B	25 % leaded nickel silver	66	5	2	2	25	...	...	...	...	...	...	...	...	...

[A] Phosphorus 0.13.
[B] Phosphorus 0.04.
[C] Phosphorus 0.12.
[D] Selenium 0.5.
[E] Selenium 0.9.
[F] Selenium 0.20.
[G] Phosphorus 0.05.
[H] Phosphorus 0.1.
[I] Antimony 0.07, Boron 0.001.

3. Terminology

3.1 Definitions of terms relating to copper alloys can be found in Terminology B846.

4. General Requirements

4.1 The following sections of Specification B824 form a part of this specification. In the event of a conflict between this specification and Specification B824, the requirements of this specification shall take precedence.

4.1.1 Terminology,
4.1.2 Other Requirements,
4.1.3 Dimensions, Mass, and Permissible Variations,
4.1.4 Workmanship, Finish, and Appearance,
4.1.5 Sampling,
4.1.6 Number of Tests and Retests,
4.1.7 Specimen Preparation,
4.1.8 Test Methods,
4.1.9 Significance of Numerical Limits,
4.1.10 Inspection,
4.1.11 Rejection and Rehearing,
4.1.12 Certification,
4.1.13 Test Report,
4.1.14 Product Marking,
4.1.15 Packaging and Package Marking, and
4.1.16 Supplementary Requirements.

5. Ordering Information

5.1 Orders for castings under this specification should include the following information:

5.1.1 Specification title, number, and year of issue;
5.1.2 Quantity of castings;
5.1.3 Copper alloy UNS Number (Table 1) and temper (as-cast, heat treated, and so forth);
5.1.4 Pattern or drawing number, and condition (as-cast, machined, etc.);
5.1.5 *ASME Boiler and Pressure Vessel Code*compliance (Section 10); and
5.1.6 When material is purchased for agencies of the U.S. government, the Supplementary Requirements of Specification B824 may be specified.

5.2 The following options are available and should be specified in the purchase order when required:

5.2.1 Chemical analysis of residual elements (7.3),
5.2.2 Pressure test or soundness requirements (Specification B824),
5.2.3 Approval of weld repair or impregnation, or both (Section 9),
5.2.4 Certification (Specification B824),
5.2.5 Foundry test report (Specification B824),
5.2.6 Witness inspection (Specification B824), and
5.2.7 Product marking (Specification B824).

6. Manufacture

6.1 Copper alloy UNS Nos. C94700 and C96800 may be supplied in the heat treated condition to obtain the higher mechanical properties shown in Table 2. Suggested heat treatments for these alloys are given in Table 3. Actual practice may vary by manufacturer.

TABLE 2 Mechanical Requirements

Copper Alloy UNS No.	Tensile Strength, min		Yield Strength,[A] min		Elongation in 2 in. or 50 mm, min, %
	ksi[B]	MPa[C]	ksi[B]	MPa[C]	
C83450	30	207	14	97	25
C83470	28	195	14	97	15
C83600	30	207	14	97	20
C83800	30	207	13	90	20
C84020	38	262	16	110	22
C84030	34	234	16	110	17
C84400	29	200	13	90	18
C84800	28	193	12	83	16
C85200	35	241	12	83	25
C85400	30	207	11	76	20
C85470	50	345	21	150	15
C85700	40	276	14	97	15
C86200	90	621	45	310	18
C86300	110	758	60	414	12
C86400	60	414	20	138	15
C86500	65	448	25	172	20
C86700	80	552	32	221	15
C87300	45	310	18	124	20
C87400	50	345	21	145	18
C87500	60	414	24	165	16
C87600	60	414	30	207	16
C87610	45	310	18	124	20
C87710	47	324	24	165	10
C87845	52	359	18	124	29
C87850	59	407	22	152	16
C89510	26	184	17	120	8
C89520	25	176	17	120	6
C89530	28	195	13[D]	90[D]	15
C89535	32	220	16[D]	110[D]	15
C89537	14	100	13	90	5
C89545	31	215	10	70	20
C89570	50	350	26	180	10
C89720	30	210	16	110	15
C89833	30	207	14	97	16
C89836	33	229	14	97	20
C89838	28	195	10	70	15
C89844	28	193	13	90	15
C89845	28	195	15	100	15
C90300	40	276	18	124	20
C90420	41	283	22	152	17
C90500	40	276	18	124	20
C92200	34	234	16	110	22
C92210	32	225	15	103	20
C92300	36	248	16	110	18
C92600	40	276	18	124	20
C93200	30	207	14	97	15
C93500	28	193	12	83	15
C93700	30	207	12	83	15
C93800	26	179	14	97	12
C94300	24	165	. . .	. . .	10
C94700	45	310	20	138	25
C94700 (HT)	75	517	50	345	5
C94800	40	276	20	138	20
C94900	38	262	15	103	15
C96800	125	862	100[D]	689[D]	3
C96800 (HT)	135	931	120[D]	821[D]	. . .
C97300	30	207	15	103	8
C97600	40	276	17	117	10
C97800	50	345	22	152	10

[A] Yield strength shall be determined as the stress producing an elongation under load of 0.5 %, that is, 0.01 in. (0.254 mm) in a gage length of 2 in. or 50 mm.
[B] ksi = 1000 psi.
[C] See Appendix X1.
[D] Yield strength 0.2 %, offset.

6.2 Separately cast test bar coupons representing castings made in copper alloy UNS Nos. C94700HT and C96800HT shall be heat treated with the castings.

TABLE 3 Suggested Heat Treatments

Copper Alloy UNS No.	Solution Treatment (not less than 1 h followed by water quench)	Annealing Treatment (not less than 2 h followed by air cool)
C96800	1500 °F (815 °C)	(Age to develop properties) 660 °F (350 °C) Precipitation hardening (5 h)
C94700	Solution treatment (not less than 2 h followed by water quench) 1425 °F–1475 °F (775 °C–800 °C)	580 °F–620 °F (305 °C–325 °C)

7. Chemical Composition

7.1 The castings shall conform to the compositional requirements for named elements as shown in Table 4 for the copper alloy UNS numbers specified in the purchase order.

7.2 These specification limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements agreed upon between manufacturer or supplier and purchaser. Copper or zinc, when zinc is 20 % or greater, may be given as remainder and may be taken as the difference between the sum of all elements analyzed and 100 %. When all named elements in Table 4 are analyzed, their sum shall be as specified in Table 5.

7.3 It is recognized that residual elements may be present in cast copper alloys. Analysis shall be made for residual elements only when specified in the purchase order.

8. Mechanical Properties

8.1 Mechanical properties shall be determined from separately cast test bar castings, and shall meet the requirements shown in Table 2.

9. Casting Repair

9.1 The castings shall not be weld repaired without approval of the purchaser (5.2.3).

9.2 The castings shall not be impregnated without approval of the purchaser (5.2.3).

10. ASME Requirements

10.1 When specified in the purchase order to meet ASME Boiler and Pressure Vessel Code requirements, castings in copper alloy UNS Nos. C92200, C93700, and C97600 shall comply with the following:

10.1.1 Certification requirements of Specification B824.

10.1.2 Foundry test report requirements of Specification B824.

10.1.3 Castings shall be marked with the manufacturer's name, the copper alloy UNS number, and the casting quality factor. In addition, heat numbers or serial numbers that are traceable to heat numbers shall be marked on all pressure-containing castings individually weighing 50 lb (22.7 kg) or more. Pressure-containing castings weighing less than 50 lb (22.7 kg) shall be marked with either the heat number or a serial number that will identify the casting as to the month in which it was poured. Marking shall be in such a position as to not impair the usefulness of the casting.

TABLE 4 Chemical Requirements

	Composition, % Max Except as Indicated																	
Copper Alloy UNS No.	Copper	Tin	Lead	Zinc	Iron	Nickel Incl. Cobalt	Alumi-num	Manga-nese	Silicon	Bismuth	Sele-nium	Anti-mony	Sulfur	Phos-phorus	Boron	Zirco-nium	Car-bon	Tita-nium
C83450	87.0–89.0[A]	2.0–3.5	1.5–3.0	5.5–7.5	0.30	0.75–2.0[A]	0.005	...	0.005	...	...	0.25	0.08	0.05	...	...	...	...
C83470	90.0–96.0[A]	3.0–5.0	0.09	1.0–3.0	0.50	1.0	0.01	...	0.01	...	...	0.20	0.20–0.6	0.10[B]	...	...	...	...
C83600	84.0–86.0[A]	4.0–6.0	4.0–6.0	4.0–6.0	0.30	1.0[A]	0.005	...	0.005	...	...	0.25	0.08	0.05	...	...	...	...
C83800	82.0–83.8[A]	3.3–4.2	5.0–7.0	5.0–8.0	0.30	1.0[A]	0.005	...	0.005	...	...	0.25	0.08	0.03	...	...	...	...
C84020	82.0–89.0	2.0–4.0	0.09	5.0–14.0	0.40	0.50–2.0	0.005	0.20	0.005	...	...	0.02	0.10–0.65	0.05	0.10	0.10	0.10	0.10
C84030	82.0–89.0	2.0–4.0	0.09	5.0–14.0	0.40	0.50–2.0	0.005	0.20	0.005	...	...	0.10–1.5	0.10–0.65	0.05	0.10	0.10	0.10	0.10
C84400	78.0–82.0[A]	2.3–3.5	6.0–8.0	7.0–10.0	0.40	1.0[A]	0.005	...	0.005	...	...	0.25	0.08	0.02	...	...	...	...
C84800	75.0–77.0[A]	2.0–3.0	5.5–7.0	13.0–17.0	0.40	1.0[A]	0.005	...	0.005	...	...	0.25	0.08	0.02	...	...	...	...
C85200	70.0–74.0[A]	0.7–2.0	1.5–3.8	20.0–27.0	0.6	1.0[A]	0.005	...	0.05	...	...	0.20	0.05	0.02	...	...	...	...
C85400	65.0–70.0[A]	0.50–1.5	1.5–3.8	24.0–32.0	0.7	1.0[A]	0.35	...	0.05	...	...	...	...	...	...	...	...	...
C85470	60.0–65.0	1.0–4.0	0.09	Remain der	0.20	...	0.10–1.0	...	...	...	...	...	...	0.02–0.25	...	...	...	...
C85700	58.0–64.0[A]	0.50–1.5	0.8–1.5	32.0–40.0	0.7	1.0[A]	0.80	...	0.05	...	...	...	...	...	...	...	...	...
C86200	60.0–66.0[A]	0.20	0.20	22.0–28.0	2.0–4.0	1.0[A]	3.0–4.9	2.5–5.0	...	...	...	...	...	...	...	...	...	...
C86300	60.0–66.0[A]	0.20	0.20	22.0–28.0	2.0–4.0	1.0[A]	5.0–7.5	2.5–5.0	...	...	...	...	...	...	...	...	...	...
C86400	56.0–62.0[A]	0.50–1.5	0.50–1.5	34.0–42.0	0.40–2.0	1.0[A]	0.50–1.5	0.10–1.0	...	...	...	...	...	...	...	...	...	...
C86500	55.0–60.0[A]	1.0	0.40	36.0–42.0	0.40–2.0	1.0[A]	0.50–1.5	0.10–1.5	...	...	...	...	...	...	...	...	...	...
C86700	55.0–60.0[A]	1.5	0.50–1.5	30.0–38.0	1.0–3.0	1.0[A]	1.0–3.0	1.0–3.5	...	...	...	...	...	...	...	...	...	...
C87300	94.0 min	...	0.09	0.25	0.20	...	...	0.8–1.5	3.5–4.5	...	...	...	...	...	...	...	...	...
C87400	79.0 min	...	1.0	12.0–16.0	...	...	0.80	...	2.5–4.0	...	...	...	...	...	...	...	...	...
C87500	79.0 min	...	0.09	12.0–16.0	...	...	0.50	...	3.0–5.0	...	...	...	...	...	...	...	...	...
C87600	88.0 min	...	0.09	4.0–7.0	0.20	...	...	0.25	3.5–5.5	...	...	...	...	...	...	...	...	...
C87610	90.0 min	...	0.09	3.0–5.0	0.20	...	...	0.25	3.0–5.0	...	...	...	...	...	...	...	...	...
C87710	84.0 min	2.0	0.09	9.0–11.0	0.50	0.25	...	0.80	3.0–5.0	...	...	0.10	...	0.15	...	...	...	...
C87845[C]	75.0–78.0	0.10	0.02	Remain-der	0.10	0.20	0.09	0.10	2.5–2.9	...	...	0.015	...	0.03–0.06	...	...	...	...
C87850	75.0–78.0	0.30	0.09	Remain-der	0.10	0.20	...	0.10	2.7–3.4	...	...	0.10	...	0.05–0.20	...	...	...	...
C89510	86.0–88.0	4.0–6.0	0.09	4.0–6.0	0.20	1.0	0.005	...	0.005	0.5–1.5	0.35–0.70	0.25	0.08	0.05	...	...	...	...
C89520	85.0–87.0	5.0–6.0	0.09	4.0–6.0	0.20	1.0	0.005	...	0.005	1.6–2.2	0.8–1.1	0.25	0.08	0.05	...	...	...	...
C89530	84.0–89.0	3.5–6.0	0.20	7.0–9.0	0.30	1.0	0.01	...	0.01	1.0–2.0	0.10–0.30	0.20	...	0.05	...	...	...	...
C89535	84.0–89.0	2.5–5.5	0.25	5.0–9.0	0.30	0.30–1.0	0.01	...	0.01	0.8–2.0	0.50	0.20	...	0.40	...	...	...	...
C89537[D]	84.0–86.0	3.0–6.0	0.09	5.0–13.0	0.50	...	...	...	0.6–1.2	0.50–3.0	...	...	...	...	0.0005–0.0020	...	...	...
C89545	66.0–72.0	0.50	0.09	27.0–31.0	0.30	1.0	0.6–1.5	0.30	0.30	0.20–0.09	...	...	...	0.01–0.15	0.02	...	...	...
C89570	58.0–63.0	0.20–1.5	0.09	35.0–38.0	0.50	0.15–0.50	0.10–1.0	...	...	0.50–1.5	...	...	...	0.05–0.15	0.0001–0.0020	...	...	...
C89720	63.0 min	0.6–1.5	0.09	26.0–32.0	0.10	0.10	0.35–1.5	0.10	0.40–1.0	0.50–2.0	...	...	...	0.02	0.0005–0.01 %	...	...	...
C89833	86.0–91.0	4.0–6.0	0.09	2.0–6.0	0.30	1.0	0.005	...	0.005	1.7–2.7	...	0.25	0.08	0.050	...	...	...	...
C89836	87.0–91.0	4.5–7.0	0.25	2.0–4.0	0.35	0.90	0.005	...	0.005	1.5–2.5	...	0.25	0.08	0.06	...	...	...	...
C89838	78.0–85.0	1.5–4.0	0.09	12.0–18.0	0.30	0.50	0.01	...	0.01	0.20–0.9	...	0.05	...	0.05	...	...	...	...
C89844	83.0–86.0	3.0–5.0	0.20	7.0–10.0	0.30	1.0[A]	0.005	...	0.005	2.0–4.0	...	0.25	0.08	0.05	...	...	...	...
C89845	82.5–87.5	3.0–4.0	0.09	6.0–9.0	0.30	1.5–2.5	0.01	...	0.01	1.0–2.0	...	0.25	...	0.05	...	...	...	...
C90300	86.0–89.0[A]	7.5–9.0	0.30	3.0–5.0	0.20	1.0[A]	0.005	...	0.005	...	...	0.20	0.05	0.05	...	...	...	...
C90420	86.0–89.0	7.5–8.5	0.09	1.0–5.0	0.40	1.0	0.005	0.20	0.005	...	...	0.02	0.10–0.65	0.05	0.10	0.10	0.10	0.10
C90500	86.0–89.0[A]	9.0–11.0	0.30	1.0–3.0	0.20	1.0[A]	0.005	...	0.005	...	...	0.20	0.05	0.05	...	...	...	...
C92200	86.0–90.0[A]	5.5–6.5	1.0–2.0	3.0–5.0	0.25	1.0[A]	0.005	...	0.005	...	...	0.25	0.05	0.05	...	...	...	...
C92210	86.0–89.0[A]	4.5–5.5	1.7–2.5	3.0–4.5	0.25	0.7–1.0[A]	0.005	...	0.005	...	...	0.20	0.05	0.03	...	...	...	...
C92300	85.0–89.0[A]	7.5–9.0	0.30–1.0	2.5–5.0	0.25	1.0[A]	0.005	...	0.005	...	...	0.25	0.05	0.05	...	...	...	...
C92600	86.0–88.5[A]	9.3–10.5	0.8–1.5	1.3–2.5	0.20	0.7[A]	0.005	...	0.005	...	...	0.25	0.05	0.03	...	...	...	...

TABLE 4 *Continued*

Copper Alloy UNS No.	Composition, % Max Except as Indicated																	
	Copper	Tin	Lead	Zinc	Iron	Nickel Incl. Cobalt	Alumi-num	Manga-nese	Silicon	Bismuth	Sele-nium	Anti-mony	Sulfur	Phos-phorus	Boron	Zirco-nium	Car-bon	Tita-nium
C93200	81.0–85.0[A]	6.3–7.5	6.0–8.0	2.0–4.0	0.20	1.0[A]	0.005	...	0.005	...	...	0.35	0.08	0.15	...	...	...	...
C93500	83.0–86.0[A]	4.3–6.0	8.0–10.0	2.0	0.20	1.0[A]	0.005	...	0.005	...	...	0.30	0.08	0.05	...	...	...	...
C93700	78.0–82.0	9.0–11.0	8.0–11.0	0.8	0.15	0.50[A]	0.005	...	0.005	...	...	0.50	0.08	0.10[B]	...	...	...	...
C93800	75.0–79.0	6.3–7.5	13.0–16.0	0.8	0.15	1.0[A]	0.005	...	0.005	...	...	0.80	0.08	0.05	...	...	...	...
C94300	67.0–72.0	4.5–6.0	23.0–27.0	0.8	0.15	1.0	0.005	...	0.005	...	...	0.80	0.08	0.05	...	...	...	...
C94700	85.0–90.0	4.5–6.0	0.09[E]	1.0–2.5	0.25	4.5–6.0	0.005	0.20	0.005	...	...	0.15	0.05	0.05	...	...	...	...
C94800	84.0–89.0	4.5–6.0	0.30–1.0	1.0–2.5	0.25	4.5–6.0	0.005	0.20	0.005	...	...	0.15	0.05	0.05	...	...	...	...
C94900	79.0–81.0	4.0–6.0	4.0–6.0	4.0–6.0	0.30	4.0–6.0	0.005	0.10	0.005	...	...	0.25	0.08	0.05	...	...	...	...
C96800[F]	remainder	7.5–8.5	0.005	1.0	0.50	9.5–10.5	0.10	0.05–0.30	0.05	0.001	...	0.02	0.0025	0.005	...	...	...	...
C97300	53.0–58.0	1.5–3.0	8.0–11.0	17.0–25.0	1.5	11.0–14.0	0.005	0.50	0.15	...	...	0.35	0.08	0.05	...	...	...	...
C97600	63.0–67.0	3.5–4.5	3.0–5.0	3.0–9.0	1.5	19.0–21.5	0.005	1.0	0.15	...	...	0.25	0.08	0.05	...	...	...	...
C97800	64.0–67.0	4.0–5.5	1.0–2.5	1.0–4.0	1.5	24.0–27.0	0.005	1.0	0.15	...	...	0.20	0.08	0.05	...	...	...	...

[A] In determining copper minimum, copper may be calculated as copper plus nickel.
[B] For continuous castings, phosphorus shall be 1.0 % max.
[C] Arsenic 0.015 max; Chromium 0.015 max.
[D] Magnesium 0.01–0.10.
[E] It is possible that the mechanical requirements of copper alloy UNS No. C94700 (heat treated) will not be obtained if the lead content exceeds 0.01 %.
[F] Niobium 0.10–0.30 % max, and magnesium 0.005–0.15 % max.

TABLE 5 Sum of All Named Elements Analyzed

Copper Alloy UNS Number	Copper Plus Sum of Named Elements, % Minimum
C83450	99.3
C83470	99.5
C83600	99.3
C83800	99.3
C84020	99.3
C84030	99.3
C84400	99.3
C84800	99.3
C85200	99.1
C85400	98.9
C85470	99.5
C85700	98.7
C86200	99.0
C86300	99.0
C86400	99.0
C86500	99.0
C86700	99.0
C87300	99.5
C87400	99.2
C87500	99.5
C87600	99.5
C87610	99.5
C87710	99.2
C87845	99.5
C87850	99.5
C89510	99.3
C89520	99.3
C89530	99.5
C89535	99.5
C89537	99.5
C89545	99.5
C89570	99.5
C89720	99.5
C89833	99.3
C89836	99.5
C89838	99.5
C89844	99.3
C89845	99.5
C90300	99.4
C90420	99.3
C90500	99.7
C92200	99.3
C92210	99.3
C92300	99.3
C92600	99.3
C93200	99.2
C93500	99.4
C93700	99.0
C93800	98.9
C94300	99.0
C94700	99.3
C94800	99.3
C94900	99.2
C96800	99.5
C97300	99.0
C97600	99.7
C97800	99.6

10.2 The castings shall not be repaired, plugged, welded, or "burned in" unless permission from the purchaser has been previously secured. This will be given only when the defects are such that after the approved repair the usefulness and strength of the castings has not been impaired.

10.3 Alloys in this specification are generally weldable. Preparation for repair welding shall include inspection to ensure complete removal of the defect. Repairs shall be made utilizing welding procedures qualified in accordance with Section IX if the ASME code and repair welding shall be done by welders or welding operators meeting the qualification requirements of ASME Section IX. The following records shall be maintained:

10.3.1 A sketch or drawing showing the dimensions, depth, and location of excavations,

10.3.2 Postweld heat treatment, when applicable,

10.3.3 Weld repair inspection results,

10.3.4 Casting identification number,

10.3.5 Weld procedure identification number,

10.3.6 Welder identification, and

10.3.7 Name of inspector.

11. Sampling

11.1 Test bar castings for copper alloy UNS Nos. C86200, C86300, C86400, C86500, and C86700 shall be cast to the form and dimensions shown in Figs. 1 or 2 of Practice B208. Test bar castings for all other alloys listed in this specification shall be cast to the form and dimensions shown in Figs. 2, 3, or 4 of Practice B208.

11.2 When castings are specified to meet the requirements of the ASME Boiler and Pressure Vessel Code, for small remelts the lot size shall not exceed 1000 lb (455 kg) of castings and shall consist of all of the metal from a single master heat poured from an individual melting unit or group of melting units operating during the course of one-half shift, not to exceed 5 h.

12. Test Methods

12.1 Analytical chemical methods are given in Specification B824.

13. Keywords

13.1 copper alloy castings; copper-base alloy castings; sand castings

APPENDIX

(Nonmandatory Information)

X1. METRIC EQUIVALENTS

X1.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force that when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ($N = kg \cdot m/s^2$). The derived SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since 1 ksi = 6 894 757 Pa, the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B584 – 14 (2022)) that may impact the use of this standard. (Approved Oct. 1, 2022.)

(1) Added UNS Alloy Nos. C89545, C89838, and C89845 to Table 1, Table 2, Table 4, and Table 5.