



Designation: **B584-09a** Designation: **B584 – 11**

Standard Specification for Copper Alloy Sand Castings for General Applications¹

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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the 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, B61, B62, B66, B67, B148, B176, B271, B369, B427, B505/B505M, B763, 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.

2. Referenced Documents

2.1 ASTM Standards:³

- B22 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 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
- B763 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:

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.

*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	Iron	Alum-inum	Man-ganese	Sili-con	Nio-bium	Bis-muth	
Leaded red brass	C83450	...	...	88	2½	2	6½	1	...	...	...	...	...	...
	C83600	B145-4A	85-5-5 or No. 1 composition	85	5	5	5	...	...	...	...	...	...	...
	C83800	B145-4B	commercial red brass, 83-4-6-7	83	4	6	7	...	...	...	...	...	...	...
Leaded semi-red brass	C83800	B145-4B	commercial red brass, 83-4-6-7	83	4	6	7	...	...	...	...	...	...	...
	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	...	...	...	...	...	...	...
	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	...	...	...
Silicon bronze + silicon brass	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	...	...	...
	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	...	...
	C87850 ^A	...	silicon bronze	76	...	...	20.9	...	...	...	...	3	...	...
Bismuth selenium brass	C89510 ^B	...	sebiloy I	87	5	...	5	...	...	...	...	...	...	1.0
	C89520 ^C	...	sebiloy II	86	5½	...	5	...	...	...	...	...	...	1.9
	C89530 ^D	...	...	86.5	4.7	...	8.0	...	...	...	...	...	...	1.5
	C89535	...	...	86.5	3.0	...	7.0	0.65	...	...	...	...	...	1.4
	C89530 ^D	...	...	86.5	4.7	...	8.0	...	...	...	...	...	...	1.5
Bismuth red brass	C89535	...	...	86.5	3.0	...	7.0	0.65	...	...	...	...	...	1.4
	C89833	...	bismuth brass	89	5	...	3	...	...	...	...	...	...	2.2
Bismuth bronze	C89836	...	lead-free bronze	89.5	5.5	...	3.0	...	...	...	...	...	...	2
Bismuth semi-red brass	C89844	...	bismuth brass	84½	4	...	8	...	...	...	...	...	...	3
Tin bronze + leaded tin bronze	C90300	B143-1B	modified "G" bronze, 88-8-0-4	88	8	...	4	...	...	...	...	...	...	...
	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	...	...	...	...	...	...
	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
Nickel-tin bronze + leaded nickel-tin bronze	C94300	B144-3E	71-5-24	71	5	24	...	...	...	...	...	...	...	...
	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	...	...	...	...	...	...
	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 0.12.

^B Selenium 0.5.

^C Selenium 0.9.

^D Selenium 0.20.

 ASME Boiler and Pressure Vessel Code⁴

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

- 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),
- 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.

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.

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