



Designation: B584 – 22

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 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

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.

[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](#)

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 |
|--|----------------------|----------------------|------------------------------------|--------|-----|------|------|--------|--------|------|----------|-----------|----------|---------|---------|------------|---------|
| High-lead tin bronze | C92300 | B143-2B | 87-5-1-4, Navy PC | 87 | 8 | 1 | 4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | C92600 | ... | 87-10-1-2 | 87 | 10 | 1 | 2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | 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 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Spinodal alloy Leaded nickel bronze | 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 0.13.
^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.

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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) |
| | Solution treatment (not less than 2 h followed by water quench) | Precipitation hardening (5 h) |
| C94700 | 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 | Aluminum | Manganese | Silicon | Bismuth | Selenium | Antimony | Sulfur | Phosphorus | Boron | Zirconium | Carbon | Titanium |
|----------------------|------------------------|----------|----------|----------------|----------|-----------------------|----------|-----------|----------|-----------|-----------|----------|-----------|-------------------|---------------|-----------|--------|----------|
| 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 | 0.0020 | ... | ... | ... |
| 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 | ... | 0.005 | 2.0-0.9 | ... | 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 | 0.05 | ... | ... | ... | ... |
| 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 | 0.03 | ... | ... | ... | ... |
| 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 | ... | ... | ... | ... |