



Designation: B770 – 21

# Standard Specification for Copper-Beryllium Alloy Sand Castings for General Applications<sup>1</sup>

This standard is issued under the fixed designation B770; 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 ( $\epsilon$ ) 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 requirements for sand castings produced from copper-beryllium alloys. The following alloys are covered:

Copper Alloy UNS No.	Designation	Copper	Nickel	Beryllium
C81400	70C	99.1	...	0.06
C82000	10C	97	...	0.5
C82200	3C, 14C	98	2.0	0.5
C82400 <sup>A</sup>	165C, 165CT <sup>A</sup>	97.8	...	1.7
C82500 <sup>A</sup>	20C, 20CT <sup>A</sup>	97.2	...	2.0
C82510	21C	96.6	...	2.0
C82600 <sup>A</sup>	245C, 245CT <sup>A</sup>	96.8	...	2.4
C82800 <sup>A</sup>	275C, 275CT <sup>A</sup>	96.6	...	2.6
C96700	72C	67.2	31.0	1.2

<sup>A</sup> When fine-grained castings are specified, 0.02 to 0.12 titanium is added for grain refinement, usually in the remelt ingot. See Specification B30.

1.2 *Units*—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.

1.3 The following safety hazard caveat pertains only to the test methods described in this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory requirements prior to use.*

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.*

<sup>1</sup> 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. Referenced Documents

2.1 The following documents in the current issue of the *Annual Book of ASTM Standards* form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:<sup>2</sup>

B30 Specification for Copper Alloys in Ingot and Other Remelt Forms

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

B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

B824 Specification for General Requirements for Copper Alloy Castings

B846 Terminology for Copper and Copper Alloys

B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

## 3. General Requirements

3.1 The following sections of Specification B824 constitute a part of this specification:

3.1.1 Terminology

3.1.2 Material and Manufacture

3.1.3 Chemical Composition,

3.1.4 Dimensions and Permissible Variations

3.1.5 Workmanship, Finish, and Appearance

3.1.6 Sampling

3.1.7 Number of Tests and Retests

3.1.8 Specimen Preparation

3.1.9 Test Methods

3.1.10 Significance of Numerical Limits

3.1.11 Inspection

3.1.12 Rejection and Reheating

3.1.13 Certification,

<sup>2</sup> 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

### 3.1.14 Test Reports

### 3.1.15 Packaging and Package Marking

3.2 In addition, when a section with a title identical to that referenced in 3.1 appears in this specification, it contains additional requirements that supplement those appearing in Specification B824.

## 4. Terminology

4.1 For definitions of terms relating to copper and copper alloys, refer to Terminology B846.

## 5. Ordering Information

5.1 Include the following specified choices when placing orders for product under this specification, as applicable:

5.1.1 ASTM designation and year of issue

5.1.2 Copper Alloy UNS No.

5.1.3 Temper (Section 8)

5.1.4 Quantity – total number of pieces

5.1.5 Pattern or drawing number and condition (cast, machined, and so forth)

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

5.2.1 Mechanical requirements (Section 10)

5.2.2 Hydrostatic test (Specification B824)

5.2.3 Soundness (Specification B824)

5.2.4 Certification

5.2.5 Test report

5.2.6 Witness inspection

5.2.7 Product marking

5.2.8 If product is purchased for agencies of the U.S. government, see the Supplementary Requirements of Specification B824 for additional requirements, if specified.

## 6. Materials and Manufacture

### 6.1 Materials:

6.1.1 The materials of manufacture shall be castings of Copper Alloy UNS Nos. C81400, C82000, C82200, C82400, C82500, C82510, C82600, C82800, or C96700 as specified in the purchase order or contract, and of such purity and soundness as to be suitable for the products prescribed herein.

### 6.2 Manufacture:

6.2.1 The product shall be manufactured by casting and thermal treatment to meet the properties specified.

## 7. Chemical Composition

7.1 The castings shall conform to the chemical composition requirements in Table 1 for the copper alloy UNS number designation specified in the ordering information.

7.2 These composition limits do not preclude the presence of other elements. By agreement between manufacturer and purchaser, limits may be established and analysis required for unnamed elements.

7.3 For alloys in which copper is listed as “remainder,” copper is the difference between the sum of results of all elements determined and 100 %.

7.4 When all elements in Table 1 are determined, the sum of results shall be 99.5 % minimum.

## 8. Temper

8.1 The standard tempers for products described in this specification are given in Table 2. See Classification B601.

8.1.1 Cast, solution heat treated, and precipitation heat treated temper TF00.

8.1.2 As-sand-cast temper M01.

8.1.3 Special or non-standard tempers are subject to agreement between supplier and purchaser.

## 9. Heat Treatment

9.1 For the purpose of determining conformance to the appropriate requirement in Table 2, the castings and test specimens shall be precipitation heat-treated at a uniform temperature from the solution heat-treated condition. Solution heat-treatment and precipitation heat-treatments are listed in Table 3. Other treatment times and temperatures may be preferable for end products made from this material.

9.2 Special combinations of properties such as increased ductility, electrical conductivity, dimensional accuracy, and endurance life may be obtained by special precipitation heat treatments. The mechanical requirements of Table 2 do not apply to such special heat treatments. Specific test requirements as needed shall be agreed upon between the manufacturer or supplier and purchaser.

## 10. Mechanical Property Requirements

### 10.1 Tensile Strength Requirements:

10.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 2, when tested in accordance with Test Methods E8/E8M.

10.1.2 Separately cast test-bar specimens shall be used to determine mechanical properties in the as-cast or solution heat-treated and precipitation heat-treated condition.

## 11. Casting Repair

11.1 The castings shall not be weld repaired without approval of the purchaser.

11.2 The castings shall not be impregnated without approval of the purchaser.

## 12. Sampling

### 12.1 Lot Size:

12.1.1 A lot shall consist of all castings produced from one furnace melt or crucible melt.

12.1.2 When two or more furnace melts or crucible melts, or both, are used to charge a ladle for pouring, the castings produced therefrom shall constitute a lot.

12.1.3 A lot may consist of such groups of melts as agreed upon by the manufacturer and purchaser, and in such case a lot shall consist of not more than 1000 lb (455 kg) of castings (gates and risers removed).

12.1.4 Test bar specimens for the Copper Alloy UNS Nos. in this specification shall be cast to the form and dimensions shown in Fig. 1, Fig. 2, Fig. 3, or Fig. 4 in Practice B208.

## 13. Keywords

13.1 copper alloy castings; copper-base alloy castings; copper beryllium castings

**TABLE 1 Chemical Requirements**

Composition, % max, except as indicated

Copper Alloy UNS No.	Copper, min	Beryllium	Cobalt	Nickel	Silicon	Zirconium	Titanium	Manganese	Iron	Zinc	Chromium	Lead	Aluminum	Tin
C81400	remainder	0.02–0.10	...	...	...	...	...	...	...	...	0.6–1.0	...	...	...
C82000	remainder	0.45–0.8	2.40–2.70	0.20	0.15	...	...	...	0.10	0.10	0.09	0.02	0.10	0.10
C82200	remainder	0.35–0.8	0.30	1.0–3.0	0.15	...	...	...	...	...	...	...	...	...
C82400 <sup>B</sup>	remainder	1.60–1.85	0.20–0.65	0.20	...	...	...	...	0.20	0.10	0.09	0.02	0.15	0.10
C82500 <sup>B</sup>	remainder	1.90–2.25	0.35–0.70	0.20	0.20–0.35	...	...	...	0.25	0.10	0.09	0.02	0.15	0.10
C82510	remainder	1.90–2.15	1.0–1.2	0.20	0.20–0.35	...	...	...	0.25	0.10	0.09	0.02	0.15	0.10
C82600 <sup>B</sup>	remainder	2.25–2.55	0.35–0.65	0.20	0.20–0.35	...	...	...	0.25	0.10	0.09	0.02	0.15	0.10
C82800 <sup>B</sup>	remainder	2.50–2.85	0.35–0.70	0.20	0.20–0.35	...	...	...	0.25	0.10	0.09	0.02	0.15	0.10
C96700	remainder	1.10–1.20	...	29.0–33.0 <sup>A</sup>	0.15	0.15–0.35	0.15–0.35	0.40–1.0	0.40–1.0	...	...	0.01	...	...

<sup>A</sup> Nickel + cobalt.

<sup>B</sup> When fine-grained castings are specified, 0.02–0.12 titanium is added for grain refinement, usually in the remelt ingot. See Specification B30.