



Designation: **B22/B22M—14 B22/B22M – 15**

Standard Specification for Bronze Castings for Bridges and Turntables¹

This standard is issued under the fixed designation B22/B22M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification establishes requirements for bronze castings for turntables, movable bridges and bridge parts, and bronze castings suitable for use in bridges and other structures for fixed and expansion bearings in which motion is slow and intermittent. The following Copper Alloys are specified: UNS No. C86300, C90500, C91100, C91300, and C93700.

NOTE 1—Historically, the alloys in this specification have been used in the applications listed in [Appendix X1](#). Actual practice may vary.²

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

~~1.3 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 and health practices and determine the applicability of regulatory limitations prior to use.~~

1.3 The following safety hazard caveat pertains only to the test method(s) described in this specification:

~~1.3.1 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 and health practices and determine the applicability of regulatory limitations prior to use.~~

2. Referenced Documents

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

2.2 *ASTM Standards*:³

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

B824 Specification for General Requirements for Copper Alloy Castings

B846 Terminology for Copper and Copper Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

E9 Test Methods of Compression Testing of Metallic Materials at Room Temperature

E10 Test Method for Brinell Hardness of Metallic Materials

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)

3. Terminology

~~3.1 For definitions of terms related to copper alloys, refer to Terminology B846.~~

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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This specification was prepared in cooperation with representatives of the American Association of State Highway Officials and the American Railway Engineering Association.

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

3. General Requirements

3.1 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.

- 3.1.1 ~~Terminology (Section 3); Terminology,~~
- 3.1.2 ~~Other Requirements (Section 7); Requirements,~~
- 3.1.3 ~~Dimensions, Mass, and Permissible Variations (Section 8); Variations,~~
- 3.1.4 ~~Workmanship, Finish, and Appearance (Section 9); Appearance,~~
- 3.1.5 ~~Sampling (Section 10); Sampling,~~
- 3.1.6 ~~Number of Tests and Retests (Section 11); Retests,~~
- 3.1.7 ~~Specimen Preparation (Section 12); Preparation,~~
- 3.1.8 ~~Test Methods (Section 13); Methods,~~
- 3.1.9 ~~Significance of Numerical Limits (Section 14); Limits,~~
- 3.1.10 ~~Inspection (Section 15); Inspection,~~
- 3.1.11 ~~Rejection and Rehearing (Section 16); Rehearing,~~
- 3.1.12 ~~Certification (Section 17); Certification,~~
- 3.1.13 ~~Test Report (Section 18); Report,~~
- 3.1.14 ~~Product Marking (Section 19); Marking,~~
- 3.1.15 ~~Packaging and Package Marking (Section 20); Marking,~~
- 3.1.16 ~~Keywords (Section 21); Keywords, and~~
- 3.1.17 ~~Supplementary Requirements.~~

4. Terminology

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

5. Ordering Information

5.1 Include the following ~~information-specified choices when placing order orders for castings-products covered under this specification; specification, as applicable:~~

- 5.1.1 ~~ASTM designation and year of issue (for example, B22B22/B22M-95);-14),~~
- 5.1.2 ~~Number of castings or total weight, for each size and form,~~
- 5.1.3 ~~Copper Alloy UNS Number-No. designation (see Table 1), and~~
- 5.1.4 ~~Temper,~~
- 5.1.5 ~~Pattern or drawing number and condition (as-cast, machined, and so forth).~~

5.1.6 When material is purchased for agencies of the U.S. government, the Supplementary Requirements in Specification **B824** may be specified.

5.2 The following ~~are optional and should be specified in the purchase options are available but may not be included unless specified at the time of placing of the order when required:~~

- 5.2.1 ~~Chemical analysis of residual elements (see 7.6);~~
- 5.2.1 ~~Soundness requirements (Specification B824),~~
- 5.2.2 ~~Certification (Specification B824),~~
- 5.2.3 ~~Foundry test report-Test Report (Specification B824),~~
- 5.2.4 ~~Witness inspection-Inspection (Specification B824), and~~
- 5.2.5 ~~Product marking (Specification B824);-, and~~
- 5.2.6 ~~Heat identification or traceability details.~~

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Composition, % max, except as indicated											
	Copper	Tin	Lead	Zinc	Iron	Nickel Including Cobalt	Aluminum	Manganese	Antimony	Sulfur	Phosphorus	Silicon
C86300	60.0–66.0	0.20	0.20	22.0–28.0	2.0–4.0	1.0 ^A	5.0–7.5	2.5–5.0
C90500	86.0–89.0	9.0–11.0	0.30	1.0–3.0	0.20	1.0 ^A	0.005	...	0.20	0.05	0.05 ^B	0.005
C91100	82.0–85.0	15.0–17.0	0.25	0.25	0.25	0.50 ^A	0.005	...	0.20	0.05	1.0 ^B	0.005
C91300	79.0–82.0	18.0–20.0	0.25	0.25	0.25	0.50 ^A	0.005	...	0.20	0.05	1.0 ^B	0.005
C93700	78.0–82.0	9.0–11.0	8.0–11.0	0.8	0.7 ^C	0.50 ^A	0.005	...	0.50	0.08	0.10 ^B	0.005

^A In determining copper minimum, copper may be calculated as copper plus nickel.

^B For continuous castings, phosphorus shall be 1.5 % max.

^C Iron shall be 0.35 % max. when used for steel-backed.

6. Materials and Manufacture

6.1 Material(s):

6.1.1 The material of manufacture shall be a casting of Copper Alloy UNS No.(s) C86300, C90500, C91100, C91300, or C93700 of such purity and soundness as to be suitable for processing in to the products prescribed herein.

6.1.2 ~~In the event~~ When specified in the contract or purchase order, that heat identification or traceability is required, the purchaser shall specify the details desired.

6.2 Manufacture:

6.2.1 The product shall be manufactured by such casting methods to produce a uniform finished product.

7. Chemical Composition

7.1 ~~The castings material shall conform to the compositional requirements for named elements as shown~~ chemical composition requirements in Table 1 for the Copper Alloy UNS Numbers ~~copper alloy UNS No. designation specified in the purchase order.~~ ordering information. [Table 2](#)

TABLE 2 Sum of All Named Elements Analyzed

Copper Alloy UNS No. Copper Plus Named	Elements, % min
C86300	99.0
C90500	99.7
C91100	99.4
C91300	99.4
C93700	99.0

7.2 ~~These specification~~ composition limits do not preclude the presence of other elements. Limits ~~By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements agreed upon between the manufacturer or supplier and the purchaser.~~ elements.

7.3 ~~Copper~~ For UNS No. C86300 copper or zinc may be taken as the difference between the sum of all the results of all other elements determined and 100 % for Copper Alloy UNS No. C86300. 100 %.

7.4 ~~Copper~~ For UNS No. C90500, C91100, C91300, and C93700 copper may be taken as the difference between the sum of the results of all elements determined and 100 % for Copper Alloy UNS Nos. C90500, C91100, C91300, and C93700. 100 %.

7.5 ~~When all named elements listed in Table 1 are determined their sum~~ determined, the sum of the results shall be as given shown in Table 2.

7.6 ~~It is recognized that residual elements may be present in cast copper-base alloys. Analysis shall be made for residual elements only when specified in the inquiry or purchase order.~~

8. Temper

8.1 The standard tempers for products described in this specification are given in [Table 3A](#), [Table 3B](#), and [Table 3C](#).

8.1.1 As Sand Cast M01.

8.1.2 As Centrifugal Cast M02.

8.1.3 As Continuous Cast M07.

9. Mechanical Property Requirements

8.1 ~~Mechanical properties shall be determined from castings (continuous casting method) or separately cast test bars (sand, centrifugal, etc., casting methods) and shall meet the requirements shown in~~ [Table 3](#).

8.2 ~~The deformation limit in compression shall be determined as that load which produces a permanent set of 0.001 in. [0.025 mm] in the compression test specimen described in~~ [9.3](#).

9.1 ~~The yield strength in tension 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. [50.8 mm].~~ Tensile Strength Requirement:

9.1.1 For Copper Alloy UNS Nos. C86300, C90500, and C93700 furnished under this specification shall conform to the tensile strength requirements, yield strength at .5 % extension requirements, and elongation percent in a gage length of 2 in. [50 mm] requirements in [Table 3](#), when tested in accordance with Test Methods [E8/E8M](#).

9.1.2 Acceptance or rejection based upon mechanical properties shall depend on tensile strength, yield strength at .5 % extension, and an elongation percent in a gage length of 2 in. [50 mm].

9.2 ~~Finished castings in Copper Alloy UNS No. C86300 shall be tested for Brinell hardness.~~ Compression Deformation Requirement: