Designation: B66 – 15

Standard Specification for Bronze Castings for Steam Locomotive Wearing Parts[1]

This standard is issued under the fixed designation B66; 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 establishes requirements for bronze castings for steam locomotive wearing parts. The following Copper Alloy UNS Nos. are specified: C93200, C93400, C93600, C93700, C93800, C94300, C94400, C94500, and C95400.[2]

NOTE 1—Historically, the alloys in this specification have been used in the applications listed in the Appendix. Actual practice may vary according to locomotive type and service.

1.2 *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 *ASTM Standards:*[3]

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

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 *AAR Standards:*[4]

M-503 Bronze Bearings for Locomotives

3. Terminology

3.1 For definitions of terms related to copper alloys, refer to 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 (Section 3),
4.1.2 Other Requirements (Section 7),
4.1.3 Dimensions, Mass, and Permissible Variations (Section 8),
4.1.4 Workmanship, Finish, and Appearance (Section 9),
4.1.5 Sampling (Section 10),
4.1.6 Number of Tests and Retests (Section 11),
4.1.7 Specimen Preparation (Section 12),
4.1.8 Test Methods (Section 13),
4.1.9 Significance of Numerical Limits (Section 14),
4.1.10 Inspection (Section 15),
4.1.11 Rejection and Rehearing (Section 16),
4.1.12 Certification (Section 17),
4.1.13 Test Report (Section 18), and
4.1.14 Packaging and Package Marking (Section 20).

5. Ordering Information

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

5.1.1 ASTM designation and year of issue (for example, B66–06),
5.1.2 Number of castings or total weight, for each size and form,
5.1.3 Copper Alloy UNS Number (Table 1),
5.1.4 Pattern or drawing number and condition (as cast, machined, and so forth).

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

5.2.1 Pressure test or soundness requirements (Specification B824),
5.2.2 Certification (Specification B824),
5.2.3 Foundry test report (Specification B824),
5.2.4 Witness inspection (Specification B824), and

[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 Association of American Railroads (AAR), 425 Third St., SW, Washington, DC 20024, http://www.aar.org.

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

TABLE 1 Chemical Requirements

Composition, % Max Except as Indicated												
Copper Alloy UNS No.	Copper	Tin	Lead	Zinc	Iron	Nickel (incl. Co)	Aluminum	Manganese	Antimony	Phosphorus[A]	Sulphur	Silicon
C93200	81.0–85.0[B]	6.3–7.5	6.8–8.0	1.0–4.0	0.20	1.0	0.005	...	0.35	0.15	0.08	0.005
C93400	82.0–85.0[B]	7.0–9.0	7.0–9.0	0.8	0.20	1.0	0.005	...	0.50	0.50	0.08	0.005
C93600	79.0–83.0	6.0–8.0	11.0–13.0	1.0	0.20	1.0	0.005	...	0.55	0.15	0.08	0.005
C93700	78.0–82.0	9.0–11.0	8.0–11.0	0.8	0.15	0.50	0.005	...	0.50	0.10	0.08	0.005
C93800	75.0–79.0	6.3–7.5	13.0–16.0	0.8	0.15	1.0	0.005	...	0.8	0.05	0.08	0.005
C94300	67.0–72.0	4.5–6.0	23.0–27.0	0.8	0.15	1.0	0.005	...	0.8	0.05	0.08[C]	0.005
C94400	remainder	7.0–9.0	9.0–12.0	0.80	0.15	1.0	0.005	...	0.8	0.05	0.08	0.005
C94500	remainder	6.0–8.0	16.0–22.0	1.2	0.15	1.0	0.005	...	0.8	0.05	0.08	0.005
C95400	83.0 min	...	...	...	3.0–5.0	1.5	10.0–11.5	0.50	...	...	...	...

[A] For continuous castings, phosphorus shall be 1.5 % max.
[B] In determining copper minimum, copper may be calculated as copper plus nickel.
[C] For continuous castings, sulfur shall be 0.25 %.

5.2.5 Product marking (Section 10).

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture shall be a casting of Copper Alloy UNS Nos. C93200, C93400, C93600, C93700, C93800, C94300, C94400, C94500, or C95400 of such purity and soundness as to be suitable for processing into the products prescribed herein.

6.1.2 In the event heat identification or traceability is required, the purchaser shall specify the details desired.

6.2 *Manufacture*—The product shall be manufactured by such casting methods to produce a uniform finished product.

7. Chemical Composition

7.1 The castings shall conform to the compositional requirements for named elements shown in Table 1 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 the manufacturer or supplier and the purchaser. Copper or zinc 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 1 are analyzed, their sum shall be as specified in Table 2.

8. Casting Repair

8.1 The castings shall not be repaired, plugged, welded, or burned-in.

9. Sampling

9.1 Sampling shall be in accordance with the requirements of Practice E255.

TABLE 2 Sum of Named Elements Analyzed

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C93200	99.0
C93400	99.0
C93600	99.3
C93700	99.0
C93800	99.0
C94300	99.0
C94400	99.0
C94500	99.0
C95400	99.5

10. Test Methods

10.1 Analytical chemical methods are given in Specification B824 (Section 12).

10.1.1 Test methods to be followed for the determination of elements resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

11. Product Marking

11.1 All castings shall have the manufacturer's initial or trademark, the pattern number, and such other marks as are shown on the drawings cast on them. When serial numbers are specified, each 100 castings, or fraction thereof, shall bear the same serial number, commencing with the numeral one (1) at the beginning of the year and continuing consecutively until the end of the year, at each manufacturer's plant.

12. Keywords

12.1 bronze castings; copper-alloy castings; locomotive wearing parts

APPENDIX

(Nonmandatory Information)

X1. APPLICATIONS FOR ALLOYS IN THIS STANDARD

X1.1 The alloys in this specification have historically been used in the applications listed below. Actual practice may vary according to locomotive type and service. This information is provided for "information only" and should not be considered as recommendations.

X1.2 *Copper Alloy UNS No. C93400*—For side rod bushings and cross-head gibs.

X1.3 *Copper Alloy UNS No. C93600*—For side rod bushings.

X1.4 *Copper Alloy UNS No. C93700*—For shoes and wedges.

X1.5 *Copper Alloy UNS No. C93800 (Formerly Hard Bronze)*—General purpose wearing metal, may be cast in either sand or metal molds, for rod bushings, shoes and wedges, cross-head gibs, engine truck, driving boxes and trailer brasses.

X1.6 *Copper Alloy UNS No. C94300 (Formerly Soft Bronze)*—Generally cast in metal molds for driving boxes and special purposes where a soft metal is desired.

X1.7 *Copper Alloy UNS No. C94400 (Formerly Phosphor Bronze)*—Shoes and wedges, floating rod bushings, or other uses where a hard wearing surface is required.

X1.8 *Copper Alloy UNS No. C94500 (Formerly Medium Bronze)*—May be cast in sand or metal molds for driving-box engine and trailer truck brasses, hub liners, and bearings requiring lining metal for facing or lining.

X1.9 *Copper Alloy UNS No. C95400*—For shoes, wedges and hub liners.

SUMMARY OF CHANGES

Committee B05 has identified the principal changes to this specification that have been incorporated since the 2013 issue as follows (Approved Oct. 1, 2015):

(1) Revised Table 1.

(2) Deleted 5.2.1 and 7.3.