



Designation: B763/B763M – 15 (Reapproved 2022)

Standard Specification for Copper Alloy Sand Castings for Valve Applications¹

This standard is issued under the fixed designation B763/B763M; 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 copper alloy sand castings for valve applications. Nominal compositions of the alloys defined by this specification are shown in [Table 1](#).²

NOTE 1—This specification does not cover Copper Alloy UNS Nos. C83600, C92200, C96200, and C96400. These alloys are also used in valve applications. They are covered by the following specifications:

C83600: [B62](#)
C92200: [B61](#)
C96200: [B369](#)
C96400: [B369](#)

1.2 The castings produced under this specification are used in products which may be manufactured in advance and supplied for sale from stock by the manufacturer.

1.3 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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.*

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.

2. Referenced Documents

2.1 *ASTM Standards*:³

[B61](#) Specification for Steam or Valve Bronze Castings

[B62](#) Specification for Composition Bronze or Ounce Metal Castings

[B208](#) Practice for Preparing Tension Test Specimens for Copper Alloy Sand, Permanent Mold, Centrifugal, and Continuous Castings

[B369](#) Specification for Copper-Nickel Alloy Castings

[B824](#) Specification for General Requirements for Copper Alloy Castings

[E10](#) Test Method for Brinell Hardness of Metallic Materials

[E527](#) Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

3. General Requirements

3.1 The following sections of Specification [B824](#) form a part of this specification.

3.1.1 Terminology,

3.1.2 Other Requirements,

3.1.3 Dimensions, Mass, and Permissible Variations,

3.1.4 Workmanship, Finish, and Appearance,

3.1.5 Sampling,

3.1.6 Number of Tests and Retests,

3.1.7 Specimen Preparation,

3.1.8 Test Methods,

3.1.9 Significance of Numerical Limits,

3.1.10 Inspection,

3.1.11 Rejection and Rehearing,

3.1.12 Certification,

3.1.13 Test Report,

3.1.14 Product Marking,

3.1.15 Packaging and Package Marking, and

3.1.16 Supplementary Requirements.

4. Ordering Information

4.1 Include the following information when placing orders for product under this specification, as applicable:

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.	Commercial Designation	Copper	Tin	Lead	Zinc	Nickel	Iron	Aluminum	Manganese	Silicon	Bismuth	Selenium
Leaded red brass	C83450		88	2½	2	6½	1	...	...	...	...	...	...
	C83800	83-4-6-7 or commercial red brass	83	4	6	7	...	...	...	...	...	...	...
Leaded semi-red brass	C84400	81-3-7-9 or valve composition	81	3	7	9	...	...	...	...	...	...	...
	C84800	76-2½-6½-15, or semi-red brass	76	2½	6½	15	...	...	...	...	...	...	...
Leaded yellow brass	C85200	high-copper yellow brass	72	1	3	24	...	...	...	...	...	...	...
	C85400	commercial No. 1 yellow brass	67	1	3	29	...	...	...	...	...	...	...
Yellow brass	C85470 ^A	yellow brass	62.5	2.5	...	34.5	...	...	0.5	...	...	...	...
Leaded yellow brass	C85700	leaded naval brass	61	1	1	37	...	...	...	...	...	...	...
High-strength yellow brass	C86200	high-strength manganese bronze	63	...	...	27	...	3	4	3	...	...	...
	C86300	high-strength manganese bronze	61	...	...	27	...	3	6	3	...	...	...
	C86400	leaded manganese bronze	58	1	1	38	...	1	½	½	...	...	...
	C86500	No. 1 manganese bronze	58	...	...	39	...	1	1	1	...	...	...
	C86700	leaded manganese bronze	58	1	1	34	...	2	2	2	...	...	...
Silicon bronze and silicon brass	C87300	silicon bronze	95	...	...	...	...	...	...	1	4	...	...
	C87400	silicon brass	82	...	½	14	...	...	...	...	3½	...	...
	C87500	silicon brass	82	...	...	14	...	...	...	...	4	...	...
	C87600	silicon bronze	89	...	...	6	...	...	...	...	5	...	...
	C87610	silicon bronze	92	...	...	4	...	...	...	...	4	...	...
Bismuth brass	C89530	Bismuth-Selenium	86.5	4.7	...	8.0	...	...	...	...	...	1.5	.20
	C89535	Bismuth	86.5	3.0	...	7.0	.65	...	...	...	...	1.4	...
	C89537	bismuth brass	85	4.5	...	9	...	...	...	...	0.9	1.7	...
	C89570 ^B	bismuth brass	60.5	0.8	...	36.5	0.32	...	0.5	...	...	1.0	...
	C89720 ^C	bismuth brass	67.5	1	...	29.8	...	...	0.5	...	0.5	0.7	...
Bismuth semi-red brass	C89844	bismuth brass	84½	4	...	8	...	...	...	...	3	...	
Tin bronze and leaded tin bronze	C90300	88-8-0-4, or modified "G" bronze	88	8	...	4	...	...	...	...	...	...	...
	C90500	88-10-0-2, on "G" bronze	88	10	...	2	...	...	...	...	...	...	...
	C92300	87-8-1-4, or Navy PC	87	8	1	4	...	...	...	...	...	...	...
	C92600	87-10-1-2	87	10	1	2	...	...	...	...	...	...	...
	C93200	83-7-7-3	83	7	7	3	...	...	...	...	...	...	...
High-lead tin bronze	C93500	85-5-9-1	85	5	9	1	...	...	...	...	...	...	...
	C93700	80-10-10	80	10	10	...	...	...	...	...	...	...	...
	C93800	78-7-15	78	7	15	...	...	...	...	...	...	...	...
	C94300	71-5-24	71	5	24	...	...	...	...	...	...	...	...
	C94700	nickel-tin bronze grade "A"	88	5	...	2	5	...	...	...	...	...	...
Nickel-tin bronze and leaded nickel-tin bronze	C94800	leaded nickel-tin bronze grade "B"	87	5	1	2	5	...	...	...	...	...	...
	C94900	leaded nickel-tin bronze grade "C"	80	5	5	5	5	...	...	...	...	...	...
Aluminum bronze	C95200	Grade A	88	...	...	...	...	3	9	...	...	...	...
	C95300	Grade B	89	...	...	...	...	1	10	...	...	...	...
	C95400	Grade C	85	...	...	...	...	4	11	...	...	...	...
	C95410	Grade D	84	...	...	...	2	4	10	...	...	...	...
Silicon aluminum bronze	C95600	Grade E	91	...	...	...	...	7	2	...	...	...
Nickel aluminum bronze	C95500	Grade D	81	...	...	...	4	4	11	...	...	...	...
	C95800		81.3	...	...	...	4.5	4	9	1.2	...	...	...
	C97300	12 % leaded nickel silver	57	2	9	20	12	...	...	...	...	...	...
Leaded nickel bronze	C97600	20 % leaded nickel silver	64	4	4	8	20	...	...	...	...	...	...
	C97800	25 % leaded nickel silver	66	5	2	2	25	...	...	...	...	...	...
	C99400		87	...	...	4.4	3.0	3.0	1.6	...	1.0	...	...
Special alloys	C99500		87	...	...	1.5	4.5	4.0	1.7	...	1.3	...	...

^A Phosphorus 0.13

^B Phosphorus 0.1

^C Antimony 0.07, Boron 0.001.

- 4.1.1 Specification title, number, and year of approval;
- 4.1.2 Quantity of castings;
- 4.1.3 Copper Alloy UNS Number and temper (as-cast, heat-treated, etc.);
- 4.1.4 Pattern or drawing number and condition (as-cast, machined, etc.);
- 4.1.5 When castings are purchased for agencies of the U.S. Government, the Supplementary Requirements of Specification B824 may be specified.

- 4.2 The following requirements are optional and should be specified in the purchase order when required.
 - 4.2.1 Pressure test or soundness requirements (Specification B824),
 - 4.2.2 Approval of weld repair and records of repair (Section 10),
 - 4.2.3 Certification (Specification B824),
 - 4.2.4 Foundry test report (Specification B824),
 - 4.2.5 Witness inspection (Specification B824),

4.2.6 Product marking (Specification **B824**),

4.2.7 Castings for seawater service (**5.1**).

5. Materials and Manufacture

5.1 For better corrosion resistance in sea water applications, castings in Copper Alloy UNS No. C95800 shall be given a temper anneal heat treatment at $1250\text{ }^{\circ}\text{F} \pm 50\text{ }^{\circ}\text{F}$ [$675\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$] for 6 h minimum. Cooling shall be by the fastest means possible that will not cause excessive distortion or cracking.

5.2 Copper Alloy UNS Nos. C94700, C95300, C95400, C95410, and C95500 may be supplied in the heat-treated condition to obtain the higher mechanical properties shown in **Table 4**. Suggested heat treatments for these alloys and copper alloy UNS No. C95520 are given in **Table 5**. Actual practice may vary by manufacturer.

5.3 Separately cast test bar coupons representing castings made in Copper Alloy UNS Nos. C94700HT, C95300HT, C95400HT, C95410HT, and C95500HT shall be heat treated with the castings.

6. Chemical Composition

6.1 The castings shall conform to the requirements for major elements shown in **Table 2**.

6.2 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 2** are analyzed, their sum shall be as specified in **Table 3**.

7. Mechanical Properties

7.1 Mechanical properties shall be determined from separately cast test bars, and shall conform with the requirements shown in **Table 4**.

8. Sampling

8.1 Copper Alloy UNS Nos. C86200, C86300, C86400, C86500, C86700, C95200, C95300, C95400, C95410, C95500, C95600, C95800, C99400, and C99500 test bar

castings shall be cast to the form and dimensions shown in Figs. 1 or 2 of Practice **B208**. For all other alloys listed in this specification test bars shall be cast to the form and dimensions shown in Figs. 2, 3 or 4 of Practice **B208**.

9. Test Methods

9.1 Analytical chemical methods are given in Specification **B824** (Test Methods section).

9.2 Brinell hardness readings, if specified on the purchase order, shall be taken in the grip end of the tension test bar and shall be made in accordance with Test Method **E10**, except that a 3000 kg load shall be used.

10. Casting Repair

10.1 Copper Alloy UNS Nos. C95200, C95300, C95400, C95410, C95500, C95600, and C95800 included in this specification are generally weldable. Weld repairs may be made at the manufacturer's discretion provided each excavation does not exceed 20 % of the casting section or wall thickness or 4 % of the casting surface area.

10.2 Excavations that exceed those described in **10.1** may be made at the manufacturer's discretion except that when specified in the ordering information (**4.2.2**), the weld procedure shall be approved by the purchaser and the following records shall be maintained:

10.2.1 A sketch or drawing showing the dimensions, depth, and location of excavations,

10.2.2 Post-weld heat treatment, when applicable,

10.2.3 Weld repair inspection results,

10.2.4 Casting identification number,

10.2.5 Weld procedure identification number,

10.2.6 Welder identification, and

10.2.7 Name of inspector.

10.3 The casting shall not be impregnated without approval of the purchaser.

10.4 The castings shall not be plugged.

10.5 Other Copper Alloy UNS Numbers in this specification are not weldable.

11. Keywords

11.1 copper alloy castings; copper-base alloy castings; valve castings

TABLE 2 Chemical Requirements

Composition, % max, except as indicated

Copper Alloy UNS No.	Copper	Tin	Lead	Zinc	Nickel incl Cobalt	Aluminum	Manganese	Silicon	Bismuth	Selenium	Iron	Antimony	Sulfur	Phosphorus
C93450	87.0-89.0	2.0-3.5	1.5-3.0	5.5-7.5	0.8-2.0	0.005	...	0.005	...	...	0.30	0.25	0.08	0.03
C93800	82.0-83.8	3.3-4.2	5.0-7.0	5.0-8.0	1.0 ^A	0.005	...	0.005	...	...	0.30	0.25	0.08	0.03 ^B
C94400	78.0-82.0	2.3-3.5	6.0-8.0	7.0-10.0	1.0 ^A	0.005	...	0.005	...	...	0.40	0.25	0.08	0.02 ^B
C94800	75.0-77.0	2.0-3.0	5.5-7.0	13.0-17.0	1.0 ^A	0.005	...	0.005	...	...	0.40	0.25	0.08	0.02 ^B
C95200	70.0-74.0	0.7-2.0	1.5-3.8	20.0-27.0	1.0	0.005	...	0.05	...	...	0.6	0.20	0.05	0.02
C95400	65.0-70.0	0.50-1.5	1.5-3.8	24.0-32.0	1.0	0.35	...	0.05	...	...	0.7	...	...	...
C95470	60.0-65.0	1.0-4.0	0.09	Rem	...	0.10-1.0	...	...	...	...	0.20	...	...	0.02-0.25
C95700	58.0-64.0	0.50-1.5	0.8-1.5	32.0-40.0	1.0	0.8	...	0.05	...	...	0.7	...	...	...
C96200	60.0-66.0	0.20	0.20	22.0-28.0	1.0	3.0-4.9	2.5-5.0	...	...	...	2.0-4.0	...	...	...
C96300	60.0-66.0	0.20	0.20	22.0-28.0	1.0	5.0-7.5	2.5-5.0	...	...	...	2.0-4.0	...	...	...
C96400	56.0-62.0	0.50-1.5	0.50-1.5	34.0-42.0	1.0	0.50-1.5	0.10-1.5	...	...	...	0.40-2.0	...	...	...
C96500	55.0-60.0	1.0	0.40	36.0-42.0	1.0	0.50-1.5	0.10-1.5	...	...	...	0.40-2.0	...	...	...
C96700	55.0-60.0	1.5	0.50-1.5	30.0-38.0	1.0	1.0-3.0	1.0-3.5	...	...	...	1.0-3.0	...	...	...
C97300	94.0 min	...	0.09	0.25	...	...	0.8-1.5	3.5-4.5	...	...	0.20	...	...	...
C97400	79.0 min	...	1.0	12.0-16.0	...	0.8	2.5-4.0	...	...	...	...	...	...	...
C97500	79.0 min	...	0.09	12.0-16.0	...	0.50	3.0-5.0	...	...	...	...	...	...	...
C97600	88.0 min	...	0.09	4.0-7.0	...	...	0.25	3.5-5.5	...	...	0.20	...	...	...
C97610	...	...	0.09	3.0-5.0	...	...	0.25	3.0-5.0	...	...	0.20	...	...	...
C99530	84.0-89.0	3.5-6.0	.20	7.0-9.0	1.0	0.01	...	0.01	1.0-2.0	.10-.30	.30	.20	...	.05
C99535	84.0-89.0	2.5-5.5	.25	5.0-9.0	.30-1.0	0.01	...	0.01	.8-2.0	.50	.30	.20	...	.40
C99537 ^C	84.0-86.0	3.0-6.0	0.09	5.0-13.0	...	...	...	0.6-1.2	0.50-3.0	...	0.50	...	...	0.05-0.15
C99570 ^D	58.0-63.0	0.20-1.5	0.09	35.0-38.0	0.15-0.50	...	...	...	0.50-1.5	...	0.50	0.02-0.20	...	0.02
C99720 ^E	63.0 min	0.60-1.5	0.09	26.0-32.0	0.10	0.35-1.5	0.10	0.40-1.0	0.50-2.0	...	0.10	...	...	0.05
C99844	83.0-86.0	3.0-5.0	0.20	7.0-10.0	1.0 ^A	...	...	0.005	2.0-4.0	...	0.30	0.25	0.08	0.05
C990300	86.0-89.0	7.5-9.0	0.30	3.0-5.0	1.0 ^A	0.005	...	0.005	...	...	0.20	0.20	0.05	0.05 ^B
C990500	86.0-89.0	9.0-11.0	0.30	1.0-3.0	1.0 ^A	0.005	...	0.005	...	...	0.20	0.20	0.05	0.05 ^B
C92300	85.0-89.0	7.5-9.0	0.30-1.0	2.5-5.0	1.0 ^A	0.005	...	0.005	...	...	0.25	0.25	0.05	0.05 ^B
C92600	86.0-88.5	9.3-10.5	0.8-1.5	1.3-2.5	0.7 ^A	0.005	...	0.005	...	...	0.20	0.25	0.05	0.03 ^B
C93200	81.0-85.0	6.3-7.5	6.0-8.0	1.0-4.0	1.0 ^A	0.005	...	0.005	...	...	0.20	0.35	0.08	0.15 ^B
C93500	83.0-86.0	4.3-6.0	8.0-10.0	2.0	1.0 ^A	0.005	...	0.005	...	...	0.20	0.30	0.08	0.05 ^B
C93700	78.0-82.0	9.0-11.0	8.0-11.0	0.8	0.50 ^A	0.005	...	0.005	...	...	0.7	0.50	0.08	0.10 ^B
C93800	75.0-79.0	6.3-7.5	13.0-16.0	0.8	1.0 ^A	0.005	...	0.005	...	...	0.15	0.8	0.08	0.05 ^B
C94300	67.0-72.0	4.5-6.0	23.0-27.0	0.8	1.0 ^A	0.005	...	0.005	...	...	0.15	0.8	0.08 ^F	0.08 ^B
C94700	85.0-90.0	4.5-6.0	0.09 ^G	1.0-2.5	4.5-6.0	0.005	0.20	0.005	...	...	0.25	0.15	0.05	0.05
C94800	84.0-89.0	4.5-6.0	0.30-1.0	1.0-2.5	4.5-6.0	0.005	0.20	0.005	...	...	0.25	0.15	0.05	0.05
C94900	79.0-81.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	0.005	0.10	0.005	...	...	0.30	0.25	0.08	0.05
C95200	86.0 min	...	...	...	...	8.5-9.5	...	...	...	...	2.5-4.0	...	...	...
C95300	86.0 min	...	...	...	...	9.0-11.0	...	...	...	...	0.8-1.5	...	...	...
C95400	83.0 min	...	...	...	1.5	10.0-11.5	0.50	...	...	...	3.0-5.0	...	...	...
C95410	83.0 min	...	...	...	1.5-2.5	10.0-11.5	0.50	...	...	...	3.0-5.0	...	...	...
C95500	78.0 min	...	...	...	3.0-5.5	10.0-11.5	3.5	...	...	...	3.0-5.0	...	...	...
C95600	88.0 min	...	...	...	0.25	6.0-8.0	...	1.8-3.2	...	...	...	...	...	...
C95800	79.0 min	...	0.03	...	4.0-5.0 ^H	8.5-9.5	0.8-1.5	0.10	...	...	3.5-4.5	...	...	...
C97300	53.0-58.0	1.5-3.0	8.0-11.0	17.0-25.0	11.0-14.0	0.005	0.50	0.15	...	...	1.5	0.35	0.08	0.05
C97600	63.0-67.0	3.5-4.5	3.0-5.0	3.0-9.0	19.0-21.5	0.005	1.0	0.15	...	...	1.5	0.25	0.08	0.05
C97800	64.0-67.0	4.0-5.5	1.0-2.5	1.0-4.0	24.0-27.0	0.005	1.0	0.15	...	...	1.5	0.20	0.08	0.05
C99400	remainder	...	0.09	0.50-5.0	1.0-3.5	0.50-2.0	0.50	0.50-2.0	...	...	1.0-3.0	...	...	...
C99500	remainder	...	0.09	0.50-2.0	3.5-5.50	0.50-2.0	0.50	0.50-2.0	...	...	3.0-5.0	...	...	...

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

^B For continuous castings, P shall be 1.5% Max.

^C Boron 0.0005-0.0020, Magnesium 0.01-0.10.

^D Boron 0.0001-0.0020.

^E Boron 0.0005-0.01.

^F For continuous castings, S shall be 0.25% Max.

^G It is possible that the mechanical requirements of Copper Alloy UNS No. C94700 (heat treated) will not be obtained if the lead content exceeds 0.01%.

^H Iron content shall not exceed the nickel content.