



Designation: B763 – 13

Standard Specification for Copper Alloy Sand Castings for Valve Applications¹

This standard is issued under the fixed designation B763; 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 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 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.

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:

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.),

*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	...	...	...	...	...	...	...
	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	...	...
	C89530	Bismuth-Selenium	86.5	4.7	...	8.0	...	...	...	...	...	1.5	.20
Bismuth brass	C89535	Bismuth	86.5	3.0	...	7.0	.65	...	...	...	...	1.4	...
	C89720 ^A		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		84	...	...	...	2	4	10	...	...	...	...
	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	...	...	...
Leaded nickel bronze	C97300	12 % leaded nickel silver	57	2	9	20	12	...	...	...	...	...	...
	C97600	20 % leaded nickel silver	64	4	4	8	20	...	...	...	...	...	...
	C97800	25 % leaded nickel silver	66	5	2	2	25	...	...	...	...	...	...
Special alloys	C99400		87	...	...	4.4	3.0	3.0	1.6	...	1.0	...	...
	C99500		87	...	...	1.5	4.5	4.0	1.7	...	1.3	...	...

^A Antimony 0.07, Boron 0.001.

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 Chemical analysis of residual elements (**6.3**),

4.2.2 Pressure test or soundness requirements (Specification **B824**),

4.2.3 Approval of weld repair and records of repair (Section **10**),

4.2.4 Certification (Specification **B824**),

4.2.5 Foundry test report (Specification **B824**),

4.2.6 Witness inspection (Specification **B824**),

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

4.2.8 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 $1250 \pm 50^\circ\text{F}$ ($675 \pm 10^\circ\text{C}$) 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.

TABLE 2 Chemical Requirements
Composition, % max, except as indicated

Copper Alloy UNS No.	Major Elements							Residual Elements													
	Copper	Tin	Lead	Zinc	Iron	Nickel incl Cobalt	Aluminum	Manganese	Silicon	Bismuth	Selenium	Iron	Antimony	Nickel incl Cobalt	Sulfur	Phosphorus	Aluminum	Manganese	Silicon	Lead	
C88450	87.0-89.0	2.0-3.5	1.5-3.0	5.5-7.5	...	0.8-2.0	...	...	...	...	...	0.30	0.25	...	0.08	0.03	0.005	...	0.005	...
C88800	82.0-83.8	3.3-4.2	5.0-7.0	5.0-8.0	...	1.0 ^A	...	...	...	...	...	0.30	0.25	...	0.08	0.03	0.005	...	0.005	...
C84400	78.0-82.0	2.3-3.5	6.0-8.0	7.0-10.0	...	1.0 ^A	...	...	...	...	...	0.40	0.25	...	0.08	0.02	0.005	...	0.005	...
C84800	75.0-77.0	2.0-3.0	5.5-7.0	13.0-17.0	...	1.0 ^A	...	...	...	...	...	0.40	0.25	...	0.08	0.02	0.005	...	0.005	...
C85200	70.0-74.0	0.7-2.0	1.5-3.8	20.0-27.0	...	...	...	...	...	...	...	0.6	0.20	...	0.05	0.02	0.005	...	0.05	...
C85400	65.0-70.0	0.50-1.5	1.5-3.8	24.0-32.0	...	...	...	...	...	...	...	0.7	...	...	...	...	0.35	...	0.05	...
C85700	58.0-64.0	0.50-1.5	0.8-1.5	32.0-40.0	...	...	...	...	...	...	...	0.7	...	...	...	...	0.8	...	0.05	...
C86200	60.0-66.0	0.20	0.20	22.0-28.0	2.0-4.0	...	3.0-4.9	2.5-5.0	...	...	...	...	...	...	...	...	...	...	...	...
C86300	60.0-66.0	0.20	0.20	22.0-28.0	2.0-4.0	...	5.0-7.5	2.5-5.0	...	...	...	...	...	...	...	...	...	...	...	...
C86400	56.0-62.0	0.50-1.5	0.50-1.5	34.0-42.0	0.40-2.0	...	0.50-1.5	0.10-1.5	...	...	...	...	...	...	...	...	...	...	...	...
C86500	55.0-60.0	1.0	0.40	36.0-42.0	0.40-2.0	...	0.50-1.5	0.10-1.5	...	...	...	...	...	...	...	...	...	...	...	...
C86700	55.0-60.0	1.5	0.50-1.5	30.0-38.0	1.0-3.0	...	1.0-3.0	1.0-3.5	...	...	...	0.20	...	...	...	...	...	...	...	...
C87300	94.0 min	...	0.09	0.25	...	...	0.8-1.5	3.5-5.0	...	...	...	...	...	...	...	...	...	...	...	...
C87400	79.0 min	...	1.0	12.0-16.0	...	...	...	2.5-4.0	...	...	...	...	...	...	...	...	0.8	...	...	...
C87500	79.0 min	...	0.09	12.0-16.0	...	...	...	3.0-5.0	...	...	...	...	...	...	...	...	0.50	...	...	...
C87600	88.0 min	...	0.09	4.0-7.0	0.20	...	...	3.5-5.5	...	...	...	...	...	...	...	...	...	0.25	...	...
C87610	90.0 min	...	0.09	3.0-5.0	0.20	...	...	3.0-5.0	...	...	...	...	...	...	...	...	...	0.25	...	...
C89530	84.0-89.0	3.5-6.0	.20	7.0-9.0	...	1.0	...	...	1.0-2.0	10-30	...	0.30	.20	...	...	.05	.01	...	.01	...
C89535	84.0-89.0	2.5-5.5	.25	5.0-9.0	...	3.0-1.0	0.35-1.5	...	0.40-1.0	0.50-2.0	...	0.30	.20	...	...	0.40	.01	...	.01	...
C89720 ^B	63.0 min	0.60-1.5	...	26.0-32.0	...	...	...	...	...	...	...	...	...	0.10	...	0.02	...	0.10	...	0.09
C89844	83.0-86.0	3.0-5.0	...	7.0-10.0	...	1.0 ^A	...	...	...	...	...	0.30	0.25	...	0.08	0.05	0.005	...	0.005	0.20
C90300	86.0-89.0	7.5-9.0	0.30	3.0-5.0	...	1.0 ^A	...	...	...	...	...	0.20	0.20	...	0.05	0.05	0.005	...	0.005	...
C90500	86.0-89.0	9.0-11.0	0.30	1.0-3.0	...	1.0 ^A	...	...	...	...	...	0.20	0.20	...	0.05	0.05	0.005	...	0.005	...
C92300	85.0-89.0	7.5-9.0	0.30-1.0	2.5-5.0	...	1.0 ^A	...	...	...	...	...	0.20	0.25	...	0.05	0.05	0.005	...	0.005	...
C92600	86.0-88.5	9.3-10.5	0.8-1.5	1.3-2.5	...	0.7 ^A	...	...	...	...	...	0.20	0.25	...	0.05	0.03	0.005	...	0.005	...
C93200	81.0-85.0	6.3-7.5	6.0-8.0	1.0-4.0	...	1.0 ^A	...	...	...	...	...	0.20	0.35	...	0.08	0.15	0.005	...	0.005	...
C93500	83.0-86.0	4.3-6.0	8.0-10.0	2.0	...	1.0 ^A	...	...	...	...	...	0.20	0.30	...	0.08	0.05	0.005	...	0.005	...
C93700	78.0-82.0	9.0-11.0	8.0-11.0	0.8	...	0.50 ^A	...	...	...	...	...	0.7	0.50	...	0.08	0.10	0.005	...	0.005	...
C93800	75.0-79.0	6.3-7.5	13.0-16.0	0.8	...	1.0 ^A	...	...	...	...	...	0.15	0.8	...	0.08	0.05	0.005	...	0.005	...
C94300	67.0-72.0	4.5-6.0	23.0-27.0	0.8	...	1.0 ^A	...	...	...	...	...	0.15	0.8	...	0.08	0.08	0.005	...	0.005	...
C94700	85.0-90.0	4.5-6.0	0.09 ^C	1.0-2.5	...	4.5-6.0	...	...	...	...	...	0.25	0.15	...	0.05	0.05	0.005	...	0.20	0.005
C94800	84.0-89.0	4.5-6.0	0.30-1.0	1.0-2.5	...	4.5-6.0	...	...	...	...	...	0.25	0.15	...	0.05	0.05	0.005	...	0.20	0.005
C94900	79.0-81.0	4.0-6.0	4.0-6.0	4.0-6.0	...	4.0-6.0	...	...	...	...	...	0.30	0.25	...	0.08	0.05	0.005	...	0.10	0.005
C95200	86.0 min	2.5-4.0
C95300	86.0 min	0.8-1.5
C95400	83.0 min	3.0-5.0
C95410	83.0 min	3.0-5.0
C95500	78.0 min	3.0-5.0
C95600	88.0 min	3.0-5.0
C95600	88.0 min	3.0-5.0
C95600	88.0 min	3.0-5.0
C95600	88.0 min	3.0-5.0
C95800	79.0 min	...	0.03	...	3.5-4.5 ^D	0.10	...
C97300	53.0-58.0	1.5-3.0	8.0-11.0	17.0-25.0	1.5	11.0-14.0	...	...	...	...	...	...	0.35	...	0.08	0.05	0.005	...	0.50	0.15
C97600	63.0-67.0	3.5-4.5	3.0-5.0	3.0-9.0	1.5	19.0-21.5	...	...	...	...	...	...	0.25	...	0.08	0.05	0.005	...	1.0	0.15
C97800	64.0-67.0	4.0-5.5	1.0-2.5	1.0-4.0	1.5	24.0-27.0	...	...	...	...	...	...	0.20	...	0.08	0.05	0.005	...	1.0	0.15
C99400	remainder	...	0.09	0.5-5.0	1.0-3.0	1.0-3.5	0.5-2.0	0.50	0.5-2.0
C99500	remainder	...	0.09	0.5-2.0	3.0-5.0	3.5-5.5	0.5-2.0	0.50	0.5-2.0

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

^B Antimony 0.02-0.20, Boron 0.0005-0.01.

^C 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 %.

^D Iron content shall not exceed the nickel content.