



Designation: B465 – 04

## Standard Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar<sup>1</sup>

This standard is issued under the fixed designation B465; 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 Department of Defense.*

### 1. Scope\*

1.1 This specification establishes Copper Alloy UNS Nos. C19200, C19210, C19400, C19500, C19700, and C19720 plate, sheet, strip, and rolled bar.

1.2 The values stated in inch-pound units are to be regarded as the standard.

### 2. Referenced Documents

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

**B193** Test Method for Resistivity of Electrical Conductor Materials

**B248** Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

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

**B846** Terminology for Copper and Copper Alloys

**E8** Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

**E54** Test Methods for Chemical Analysis of Special Brasses and Bronzes<sup>4</sup>

**E62** Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)

**E75** Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys

**E76** Test Methods for Chemical Analysis of Nickel-Copper Alloys<sup>4</sup>

**E112** Test Methods for Determining Average Grain Size

**E478** Test Methods for Chemical Analysis of Copper Alloys

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

### 3. General Requirements

3.1 The following sections of Specification **B248** constitutes a part of this specification:

- 3.1.1 Terminology,
- 3.1.2 Materials and Manufacture,
- 3.1.3 Workmanship, Finish, and Appearance,
- 3.1.4 Sampling,
- 3.1.5 Number of Tests and Retests,
- 3.1.6 Specimen Preparation,
- 3.1.7 Test Methods (except chemical analysis),
- 3.1.8 Significance of Numerical Limits,
- 3.1.9 Inspection,
- 3.1.10 Rejection and Reheating,
- 3.1.11 Certification,
- 3.1.12 Test Reports (Mill),
- 3.1.13 Packaging and Package Marking, and
- 3.1.14 Supplementary Requirements.

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 which supplement those appearing in Specification **B248**.

### 4. Terminology

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

### 5. Ordering Information

5.1 Contracts or purchase orders for product under this specification should include the following information:

- 5.1.1 ASTM designation and year of issue (for example B465–XX),
- 5.1.2 Copper Alloy UNS No. designation (for example, C19200),
- 5.1.3 Temper (Section **8**),
- 5.1.4 *Dimensions*—Thickness, width, length, and so forth (Section **13**),
- 5.1.5 *Form*—Plate, sheet, strip, or rolled bar,
- 5.1.6 *How Furnished*—Coils (rolls), specific lengths or stock lengths, with or without ends,

<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 **B05.01** on Plate, Sheet, and Strip.

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<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.

<sup>3</sup> Withdrawn.

<sup>4</sup> Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

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

5.1.7 *Quantity*—total weight each form, temper, and size, and

5.1.8 When material is purchased for agencies of the U.S. government (Section 12).

5.2 The following options are available under this specification and should be specified in the contract or purchase order when required:

5.2.1 *Type of Edge*—Slit, sheared, sawed, square corners, round corners, rounded edges, or full rounded edges,

5.2.2 Width and straightness tolerances (appropriate table in Specification B248),

5.2.3 Heat identification or traceability details,

5.2.4 Certification, and

5.2.5 Mill test report.

## 6. Materials and Manufacture

### 6.1 Material:

6.1.1 The material of manufacture shall be a cast bar, cake, slab, and so forth of Copper Alloy UNS No. C19200, C1921, C19400, C19500, C19700, or C19720 as specified in the ordering information, and 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.

NOTE 1—Because of the discontinuous nature of the processing of castings into wrought products, it is not practical to identify a specific casting analysis with a specific quantity of finished product.

### 6.2 Manufacture:

6.2.1 The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure in the finished product.

6.2.2 The product shall be hot- or cold-worked to the finished size, and subsequently annealed, when required, to meet the temper properties specified.

6.2.3 *Edges*—Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

## 7. Chemical Composition

7.1 The material shall conform to the requirements prescribed in Table 1 for the Copper Alloy UNS No. designation specified in the ordering information.

7.1.1 These composition limits do not preclude the presence of other elements. Limits may be established and analysis

required for unnamed elements by agreement between the manufacturer and the purchaser.

7.2 Copper, when specified as the remainder, may be taken as the difference between the sum of results for specified elements and 100 %.

7.3 When all elements listed in Table 1 for the designated alloy are determined, the sum of results shall be 99.8 % minimum.

## 8. Temper

8.1 As defined in Classification B601, products shall be produced in tempers O60 (soft annealed), O61 (annealed), O50 (light annealed), O82 (annealed to temper - 1/2 hard), H01 (1/4 hard), H02 (1/2 hard), H03 (3/4 hard), H04 (hard), H06 (extra hard), HR02 (1/2 hard), HR04 (hard), H08 (spring), H10 (extra spring), and H14 (super spring).

NOTE 2—The purchaser should confer with the manufacturer or supplier for the availability of product in a specific alloy, temper, and form, since all tempers are subject to manufacturing limitations.

NOTE 3—Properties of special tempers not listed in this specification are subject to agreement between the manufacturer and purchaser.

## 9. Grain Size for Annealed Tempers

9.1 *Grain Size*—No grain size requirements have been established for tempers O50, O60, and O61; however, the product material shall be fully recrystallized when examined in accordance with Test Methods E112.

## 10. Physical Property Requirements

### 10.1 Electrical Resistivity Requirement:

10.1.1 The product furnished shall conform to the requirements of Table 2 for the Copper UNS No. designation and temper specified in the ordering information when determined in accordance with Test Method B193.

10.1.1.1 Products produced in temper O60 from Copper Alloy UNS No. C19400 are not required to conform with the resistivity requirement of Table 2.

## 11. Mechanical Property Requirements

### 11.1 Tensile Requirements:

11.1.1 The product furnished shall conform to the requirements prescribed in Table 3 for the Copper Alloy UNS No. designation and temper specified in the ordering information when subjected to test in accordance with Test Methods E8.

**TABLE 1 Chemical Requirements**

Element	Composition, %					
	Copper Alloy UNS No.					
	C19200	C19210	C19400	C19500	C19700	C19720
Copper	98.5 min	remainder	97.0 min	96.0 min	remainder	remainder
Iron	0.8 to 1.2	0.05 to 0.15	2.1 to 2.6	1.0 to 2.0	0.30–1.2	0.05–0.50
Phosphorus	0.01 to 0.04	0.025 to 0.04	0.015 to 0.15	0.01 to 0.35	0.10–0.40	0.05–0.15
Zinc	0.20 max	...	0.05 to 0.20	0.20 max	0.20 max	0.20 max
Lead, max	0.03	...	0.03	0.02	0.05	0.05 max
Tin	...	...	...	0.10 to 1.0	0.20 max	0.20 max
Cobalt	...	...	...	0.3 to 1.3	0.05 max	...
Aluminum	...	...	...	0.02 max	...	...
Magnesium	...	...	...	...	0.01–0.20	0.06–0.20
Nickel, max	...	...	...	...	0.05	0.10 max
Manganese, max	...	...	...	...	0.05	0.05 max

**TABLE 2 Electrical Resistivity Requirements and Equivalent Conductivity**

Temper	Copper Alloy UNS No.	Resistivity at 20°C (68°F) Ω g/m <sup>2</sup>	Equivalent Conductivity at 20°C (68°F), % IACS
O50, O60 <sup>4</sup> , O61, and O62	C19200	0.235 81 max	65 min
	C19210	0.170 31 max	90 min
	C19400	0.383 26 – 0.204 37	40 – 75
	C19500	0.305 65 max	50 min
	C19700	0.191 60 max	80 min
H01, H02, H03, H04, H06, H08, H10, and H14	C19200	0.255 47 max	60 min
	C19210	0.180 33 max	85 min
	C19400	0.255 47 max	60 min
	C19500	0.340 62 max	45 min
	C19700	0.199 06 max	77 min
	C19720	0.199 06 max	77 min

<sup>4</sup> O60 temper of Copper Alloy UNS No. C19400 is not required to conform with the resistivity requirement of this table.

11.1.1.1 Refer to **Table X1.1, Appendix X1** for SI equivalents for tensile strength.

11.2 **Rockwell Hardness**—The approximate Rockwell values given in **Table 3** are for general information and assistance in testing and shall not be used as a basis for rejection.

NOTE 4—The Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper and tensile strength.

## 12. Purchases for U.S. Government Agencies

12.1 When identified in the contract or purchase order, as product purchased for agencies of the U.S. Government, it shall conform to the special government requirements stipulated in the Supplemental Requirements given in Specification **B248**.

## 13. Dimensions, Mass, and Permissible Variations

13.1 The product furnished under this specification shall conform to the following tables in the Dimensions, Mass, and Permissible Variations section of Specification **B248**:

13.1.1 **Thickness**:

13.1.1.1 **Tolerances**—Table 1.

13.1.2 **Width**:

13.1.2.1 **Tolerances for Slit Metal and Slit Metal with Rolled Edges**—Table 2.

13.1.2.2 **Tolerances for Square-Sheared Metal**—Table 5.

13.1.2.3 **Tolerances for Sawed Metal**—Table 6.

13.1.3 **Length**:

13.1.3.1 **Tolerances for Straight Lengths**—Table 7.

13.1.3.2 **Schedule of Minimum Lengths with Ends**—Table 8.

13.1.3.3 **Tolerances for Squared Sheared Metal**—Table 9.

13.1.3.4 **Tolerances for Sawed Metal**—Table 10.

13.1.4 **Straightness**:

13.1.4.1 **Tolerance for Slit Metal or Slit Metal Either Straightened or Edge Rolled**—Table 11.

13.1.4.2 **Tolerances for Squared Sheared Metal**—Table 12.

13.1.4.3 **Tolerances for Sawed Metal**—Table 13.

13.1.5 **Edges**:

13.1.5.1 **Tolerances for Radius of Square Edges**—Table 14.

13.1.5.2 **Tolerances for Radius of Round Corners**—Table 15.

13.1.5.3 **Tolerances for Radius of Round Edges**—Table 16.

13.1.5.4 **Tolerances for Radius of Full Rounded Edges**—Table 17.

## 14. Test Methods

14.1 **Chemical Analysis**:

14.1.1 Chemical composition shall be determined, in case of disagreement, by the following appropriate method:

Element	Test Method
Aluminum	E478
Copper	E478
Cobalt	E75
Iron	E76
Lead	E478 (AA)
Manganese	E62
Nickel	E478 (Photometric)
Phosphorus	E62
Tin	E478 (Photometric)
Zinc	E478 (AA)

14.1.1.1 Since no recognized test method is known to be published, the determination of magnesium shall be subject to agreement between the manufacturer or supplier and the purchaser.

14.1.2 Test method(s) used for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacture and the purchaser.

14.2 Test methods for all other properties are given in Specification **B248**.

## 15. Keywords

15.1 copper-iron alloy plate; copper-iron alloy rolled bar; copper-iron alloy sheet; copper-iron alloy strip; UNS No. C19200; UNS No. C19210; UNS No. C19400; UNS No. C19500; UNS No. C19700; UNS No. C19720