~~Designation:B465–04~~ Designation: B465 – 09

# Standard Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar[1]

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 (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*

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

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

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

1.2 *Units*—Values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units, which are provided for information only and are not considered standard.

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

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 AlloysWrought and Cast

B846 Terminology for Copper and Copper Alloys

E8 Test Methods for Tension Testing of Metallic Materials [3]

~~E54~~

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes

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 ~~E76Test Methods for Chemical Analysis of Nickel-Copper Alloys~~

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 constitute~~s~~ 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 Rehearing,

[1] 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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[2] 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.

[3] Withdrawn.

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

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

~~5.1Contracts or purchase orders for product under this specification should include the following information:~~
5.1 Include the following information when placing orders for product under this specification:
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,
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~~ Material and Manufacture

6.1 *Material*:
~~6.1.1The~~6.1.1 The material of manufacture shall be a cast bar, cake, or slab, ~~and so forth~~ of Copper Alloy UNS No. C19200, C19210, 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.~~ for the designated alloy are determined, the sum of results shall be 99.8 % minimum, except for C19720 which shall be 99.5 % minimum.

## 8. Temper

~~8.1As defined in Classification~~
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 - ½ hard), H01 (¼ hard), H02 (½ hard), H03 (¾ hard), H04 (hard), H06 (extra hard), HR02

**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~~ |
| Lead, max | 0.03 | . . . | 0.03 | 0.02 | 0.05 | 0.05 |
| Tin | . . . | . . . | . . . | 0.10 to 1.0 | 0.20 max | 0.20 max |
| ~~Cobalt~~ | ~~. . .~~ | ~~. . .~~ | ~~. . .~~ | ~~0.3 to 1.3~~ | ~~0.05 max~~ | ~~. . .~~ |
| Cobalt | . . . | . . . | . . . | 0.30 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~~ |
| Nickel, max | . . . | . . . | . . . | . . . | 0.05 | 0.10 |
| ~~Manganese, max~~ | ~~. . .~~ | ~~. . .~~ | ~~. . .~~ | ~~. . .~~ | ~~0.05~~ | ~~0.05 max~~ |
| Manganese, max | . . . | . . . | . . . | . . . | 0.05 | 0.05 |

(½ ~~hard), HR04 (hard), H08 (spring), H10 (extra spring), and H14 (super spring).~~ hard and stress relieved), HR04 (hard and stress relieved), 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~~to 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.

~~11.1.1.1Refer to~~

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.

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

| Tempers | Copper Alloy UNS No. | Resistivity at 20°C (68°F) Ω g/m$^2$ | Equivalent Conductivity at 20°C (68°F), % IACS |
|---|---|---|---|
| O50, O60[A], 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 |

[A] O60 temper of Copper Alloy UNS No. C19400 is not required to conform with the resistivity requirement of this table.