



Designation: **B465**—~~11~~ **B465** – 16

Standard Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar¹

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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification establishes ~~Copper Alloy~~the requirements for copper-iron alloy plate, sheet, strip, and rolled bar for Copper [Alloy] UNS Nos. C19200, C19210, C19400, C19500, C19700, and ~~C19720 plate, sheet, strip, and rolled bar~~C19720.

1.2 ~~Units—Values~~The 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 Alloys—Wrought and Cast

B846 Terminology for Copper and Copper Alloys

E8E8/E8M Test Methods for Tension Testing of Metallic Materials

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes (Withdrawn 2002)³

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)³

E75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys (Withdrawn 2010)³

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 a part of this specification:

3.1.1 ~~Terminology~~Terminology

3.1.2 Materials and ~~Manufacture~~Manufacture

3.1.3 Workmanship, Finish, and ~~Appearance~~Appearance

3.1.4 ~~Sampling~~Sampling

3.1.5 Number of Tests and ~~Retests~~Retests

3.1.6 Specimen ~~Preparation~~Preparation

3.1.7 Test Methods (except chemical ~~analysis~~);analysis)

3.1.8 Significance of Numerical ~~Limits~~Limits

3.1.9 ~~Inspection~~Inspection

3.1.10 Rejection and ~~Rehearing~~Rehearing

3.1.11 ~~Certification~~Certification

3.1.12 Test Reports (~~Mill~~);

3.1.13 Packaging and Package ~~Marking~~ andMarking

3.1.14 Supplementary Requirements.

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 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

3.2 In addition, when a section with a title identical to that referenced in [3.1, above](#), 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 Include the following ~~information-specified choices~~ when placing orders for product under this ~~specification~~:specification, as applicable:

5.1.1 ASTM designation and year of issue (for example ~~issue~~,[B465–XX](#));

5.1.2 Copper Alloy[Alloy] UNS No. designation (for example, [C19200](#));~~designation,~~

5.1.3 Temper (Section [8](#)),

5.1.4 *Dimensions*—Thickness, width, length, and ~~so forth~~ edges (Section [1312](#)),

5.1.5 *Form*—Plate, sheet, strip, or rolled bar;

5.1.5 *How Furnished*—Coils (rolls), ~~specific lengths or stock lengths, with or without ends~~,[Straight lengths or coils](#),

5.1.6 *Quantity*—total weight each form, temper, and or total length or number of pieces of each size, and

5.1.7 ~~When material is purchased for agencies of the U.S. government (Section [Intended application](#),[12](#)).~~

5.2 The following options are available ~~under this specification and should be specified in the contract or purchase~~ but may not be included unless specified at the time of placing of the order when required:

5.2.1 Heat identification or traceability details,

5.2.2 Certification,

5.2.3 Test Report,

5.2.4 *Type of Edge*—~~Slit,~~ Type of edge (slit, sheared, sawed, square corners, round corners, rounded edges, or ~~full rounded edges~~,[full-rounded edges](#)),

5.2.5 Width and straightness tolerances (appropriate ~~table~~ables in Specification [B248](#)), and

5.2.3 Heat identification or traceability details,

5.2.4 Certification, and

5.2.6 Mill test report.[If product is purchased for agencies of the U.S. Government \(see the Supplemental section of Specification \[B248\]\(#\) for additional requirements, if specified\).](#)

6. ~~Material~~Materials and Manufacture

6.1 ~~Material~~:*Materials*:

6.1.1 The material of manufacture shall be a ~~cast form~~ (cast bar, cake, or slab, et cetera), 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~~ ~~When specified in the contract or purchase order that~~ heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 1—~~Because of~~[Due to](#) 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~~:material.

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.~~

6.3 *Edges*:

6.3.1 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 ~~chemical composition~~ requirements ~~prescribed in [Table 1](#) for the Copper Alloy~~[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 ~~These composition limits do not preclude the presence of other elements. By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements.~~

7.3 ~~Copper, when specified as the remainder, may be taken as the~~ ~~For alloys in which copper is listed as “remainder,” copper is the~~ difference between the sum of results for ~~specified~~of all elements ~~determined~~ and 100 %.

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
Iron	0.8–1.2	0.05–0.15	2.1–2.6	1.0–2.0	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
Phosphorus	0.01–0.04	0.025–0.04	0.015–0.15	0.01–0.35	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
Zinc	0.20 max	...	0.05–0.20	0.20 max	0.20 max	0.20 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
Tin	...	...	...	0.10–1.0	0.20 max	0.20 max
Cobalt	...	...	...	0.30 to 1.3	0.05 max	...
Cobalt	...	...	...	0.30–1.3	0.05 max	...
Aluminum	...	...	...	0.02 max	...	...
Magnesium	...	...	...	...	0.01–0.20	0.06–0.20
Nickel, max	...	...	...	...	0.05	0.10 ^A
Manganese, max	...	...	...	...	0.05	0.05

^A Includes cobalt.

7.4 When all elements listed in Table 1 for the designated alloy are determined, the sum of results shall be 99.8 % ~~minimum,min~~, except for C19720 which shall be 99.5 % ~~minimum,min~~.

8. Temper

8.1 As defined in Classification The standard ~~B601~~, products shall be produced in tempers O60 (soft annealed), O61 (annealed), O50 (light annealed), O82 tempers for products described in this specification are given in Tables 2 and 3 (annealed to temper $\frac{1}{2}$ hard), H01 ($\frac{1}{4}$ hard), H02 ($\frac{1}{2}$ hard), H03 ($\frac{3}{4}$ hard), H04 (hard), H06 (extra hard), HR02 ($\frac{1}{2}$ hard and stress relieved), HR04 (hard and stress relieved), HR06 (extra hard and stress relieved), H08 (spring), H10 (extra spring), and H14 (super spring):

8.1.1 Cold-rolled tempers H01 to H14.

8.1.2 Annealed tempers O50, O60, or O82.

8.1.3 Cold-worked and stress-relieved tempers HR02 to HR06.

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:

TABLE 2 Electrical Resistivity Requirements and Equivalent Conductivity

Tempers	Copper Alloy UNS No.	Resistivity at 20°C (68°F) $\Omega \cdot g/m^2$	Equivalent Conductivity at 20°C (68°F), % IACS
Tempers	Copper Alloy UNS No.	Resistivity at 20°C (68°F) g/m^2	Equivalent Conductivity at 20°C (68°F), % IACS
O50, O60 ^A , O61, and O82	C19200	0.235 81 max	65 min
	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, H14, HR02, HR04, and HR06	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.