Designation: ~~B747 – 15~~ B747 – 20

Standard Specification for Copper-Zirconium Alloy Sheet and Strip [1]

This standard is issued under the fixed designation B747; 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.

1. Scope*

1.1 This specification establishes the requirements for Copper Alloy UNS C15100 sheet and strip.

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~~units that are provided for information only and are not considered standard.

1.2.1 *Exception*—Values given in inch-pound units are the standard except for grain size, which is stated in SI units.

1.3 *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.*

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
E3 Guide for Preparation of Metallographic Specimens
E8/E8M Test Methods for Tension Testing of Metallic Materials
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry
E112 Test Methods for Determining Average Grain Size
E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition
E478 Test Methods for Chemical Analysis of Copper Alloys

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 Workmanship, Finish, and ~~Appearance,~~Appearance
3.1.3 ~~Sampling,~~Sampling
3.1.4 Number of Tests and ~~Retests,~~Retests
3.1.5 Specimen ~~Preparation,~~Preparation
3.1.6 Significance of Numerical ~~Limits,~~Limits
3.1.7 ~~Inspection,~~Inspection
3.1.8 Rejection and ~~Rehearing,~~Rehearing
3.1.9 ~~Certification,~~Certification
3.1.10 Test ~~Report,~~Report
3.1.11 Packaging and Package ~~Marking, and~~Marking
3.1.12 Supplementary ~~Requirements.~~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~~standard's Document Summary page on the ASTM website.

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

4. Terminology

4.1 For definition of terms related to copper and copper alloys, refer to Terminology B846.

5. Ordering Information

5.1 Include the following specified choices when placing orders for product under this specification, as applicable:

5.1.1 ASTM designation ~~number~~ and year of issue,

5.1.2 Copper [Alloy] UNS ~~No. designation,~~No.,

5.1.3 ~~Temper,~~Temper (Section 8),

5.1.4 Dimensions (thickness, width, length, if applicable),

5.1.5 How ~~furnished (rolls, specific lengths with or without ends, stock lengths with or without ends),~~furnished: straight lengths or coils,

5.1.6 Quantity–total weight or total length or number of pieces of each size,

5.1.7 Type of edge, if required (slit, sheared, sawed, square corners, rounded corners, rounded edges, or full-rounded edges),

5.1.8 Type of width and straightness tolerances, if required (slit metal tolerances, square sheared metal tolerances, sawed metal tolerances, straightened or edge-rolled metal tolerances), and

5.1.9 Intended application.

5.2 The following options are available 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 If product specification number must be shown on package marking, and

5.2.5 If product is purchased for agencies of the U.S. Government (See Supplemental Requirements section of Specification B248 for additional requirements).

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture shall be a form (cast bar, cake, slab, ~~etcetera)~~etc.) of Copper Alloy UNS No. C15100 of such purity and soundness as to be suitable for processing into the products prescribed herein.

6.1.2 When specified in the contract or purchase order, that heat identification or traceability is required, the purchaser shall specify the details desired.

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

6.2 *Manufacture:*

6.2.1 The product shall be manufactured by such ~~hot-working, cold-working,~~ 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-~~hot or ~~cold-worked~~ cold worked to the finished size, and subsequently annealed, when required, to meet the temper properties specified.

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 in Table 1.

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 When all elements in Table 1 are determined, the sum of the results shall be 99.9 % min.

TABLE 1 Chemical Requirements

Element	Composition, %
	Copper Alloy UNS No. C15100
Copper (including Ag)	99.80 % min
Zirconium	0.05–0.15
~~Cu + sum of named elements~~	~~99.9 % min~~

8. Temper

8.1 The standard tempers for products described in this specification are given in Table 2.

8.1.1 Cold rolled tempers H01 to H08.

8.1.2 Annealed temper OS015.

9. Grain Size for Annealed Temper

9.1 Grain size shall be the standard requirement for all product in the annealed ~~tempers.~~temper.

9.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be within the limits prescribed in Table 2 when determined 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 electrical mass resistivity requirement prescribed in Table 3 when tested in accordance with Test Method B193.

11. Mechanical Property Requirements

11.1 *Tensile Strength Requirements:*

11.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 2, when tested in accordance with Test Methods E8/E8M.

11.1.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

12. Dimensions, Mass, and Permissible Variation

12.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 with particular reference to the following tables and related paragraphs:

12.2 *Thickness.*

12.3 *Width:*

12.3.1 *Slit Metal and Slit Metal with Rolled Edges*—Table 4.

12.3.2 *Square Sheared Metal*—Table 5.

12.3.3 *Sawed Metal*—Table 6.

12.4 ~~The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 with particular reference to the following tables and related paragraphs as noted to Specification B747 in the table title:~~*Length:*

12.4.1 ~~*Thickness.*~~ *Length Tolerance for Straight Lengths*—Table 7.

~~12.1.2 *Width:*~~

~~12.1.2.1 *Slit Metal and Slit Metal with Rolled Edges.*~~

~~12.1.2.2 *Square Sheared Metal.*~~

~~12.1.2.3 *Sawed Metal.*~~

12.4.2 ~~*Length:*~~ *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends*—

~~12.1.3.1 *Length Tolerance for Straight Lengths.*~~ Table 8.

TABLE 2 Tensile Strength and Grain Size Requirements

Temper Designation[A]		Tensile Strength, ksi[B] (MPa)[C]		Grain Size, mm[D]
Code	Name	Min	Max	
OS015	annealed	...	...	0.030 max
H01	quarter hard	40 (275)	45 (310)	...
H02	half hard	43 (295)	51 (350)	...
H03	three-quarter hard	47 (325)	56 (385)	...
H04	hard	53 (365)	62 (425)	...
H06	extra hard	59 (405)	65 (450)	...
H08	spring	64 (440)	71 (490)	...

[A] Standard designations defined in Classification B601.

[B] ksi = 1000 psi.

[C] See Appendix X1.

[D] Although no minimum grain size is required, this material must be fully recrystallized.

TABLE 3 Electrical Resistivity

Temper	Electrical Resistivity at ~~20°C (68°F),~~20 °C (68 °F), max, Ω·g/m^2	Equivalent Conductivity at ~~20°C (68°F),~~20 °C (68 °F), % IACS, min
Annealed (OS015)	0.16136	95
Rolled (H01, H02, H03, H04, H06, H08)	0.17031	90

~~12.1.3.2 *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends.*~~

~~12.1.3.3 *Length Tolerance for Square Sheared Metal.*~~

~~12.1.3.4 *Length Tolerance for Sawed Metal.*~~

12.4.3 ~~*Straightness:*~~ *Length Tolerance for Square Sheared Metal*—

~~12.1.4.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled.*~~ Table 9.

~~12.1.4.2 *Square Sheared Metal.*~~

~~12.1.4.3 *Sawed Metal.*~~

12.4.4 ~~*Edges Contours:*~~ *Length Tolerance for Sawed Metal*—

~~12.1.5.1 *Square Corners.*~~ Table 10.

~~12.1.5.2 *Rounded Corners.*~~

~~12.1.5.3 *Rounded Edges.*~~

~~12.1.5.4 *Full-Rounded Edges.*~~

12.5 *Straightness:*

12.5.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled*—Table 11.

12.5.2 *Square Sheared Metal*—Table 12.

12.5.3 *Sawed Metal*—Table 13.

12.6 *Edges Contours:*

12.6.1 *Square Corners*—Table 14.

12.6.2 *Rounded Corners.* Table 15.

12.6.3 *Rounded Edges*—Table 16.

12.6.4 *Full-Rounded Edges*—Table 17.

13. Workmanship, Finish, and Appearance

13.1 The product shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable. It shall be ~~well-cleaned~~ well cleaned and free of dirt. A superficial film of residual light lubricant is normally present and is acceptable unless otherwise specified.

13.2 The surface finish and appearance shall be the normal commercial quality for the alloy, thickness, and temper ordered. When application information is provided with the purchase order, the surface shall be that commercially producible for the application. Superficial films of discoloration, or lubricants, or tarnish inhibitors are permissible unless otherwise specified.

14. Sampling

14.1 *Sampling*—The lot size, portion size, and selection of sample pieces shall be as follows:

14.1.1 *Lot Size*—An inspection lot shall be 40 000 lb (18 144 kg) or less, of the same mill form, alloy, temper, and nominal dimensions, subject to inspection at one time.

14.1.2 *Portion Size*—The portion shall be eight or more pieces selected so as to be representative of each lot. Should the lot consist of less than eight pieces, representative samples shall be taken from each piece.

14.2 *Chemical Analysis:*

14.2.1 The sample for chemical analysis shall be taken in accordance with Practice E255 for product in its final form from the pieces selected in 14.1.2 and combined into one composite sample. The minimum weight of the composite sample shall be 150 g.

14.2.2 Instead of sampling as directed in 14.2.1, the manufacturer shall have the option of sampling at the time castings are poured or from the semifinished product. When samples are taken during the course of manufacture, sampling of the finished product by the manufacturer is not required. The number of samples taken for the determination of composition shall be as follows:

14.2.2.1 When samples are taken at the time the castings are poured, at least one sample shall be taken for each group of castings poured from the same source of molten metal.

14.2.2.2 When samples are taken from semifinished product, a sample shall be taken to represent each 10 000 ~~lbs~~lb (5000 kg) or fraction thereof, except that not more than one sample shall be required per piece.