AMERICAN NATIONAL STANDARD ANSI/ASTM B 4 - 79

Standard Specification for TOUGH-PITCH LAKE COPPER—REFINERY SHAPES[1]

This standard is issued under the fixed designation B 4; 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.

1. Scope

1.1 This specification covers tough-pitch lake copper wire bars, cakes, slabs, billets, ingots, and ingot bars.

1.2 Two types of copper are included as follows:

1.2.1 Low-resistance lake copper (UNS C11300, C11400, C11500, and C11600*) (Sections 4 and 5).

1.2.2 High-resistance lake copper (Sections 4 and 5).

1.3 Although this specification includes certain UNS designations as described in Recommended Practice E 527, these designations are for cross reference only and are not specification requirements. Therefore, in case of conflict, this ASTM specification shall govern.

NOTE 1—Low-resistance lake copper under this specification corresponds to the designations "FRHC" and "FRTP" as shown in Classification B 224. This copper may also be used to produce copper corresponding to designations "ATP," "STP," "FRSTP," "DHP," "DHPS," "DPA," and "DPTE."

NOTE 2—High-resistance lake copper under this specification corresponds to the designation "ATP" as shown in Classification B 224.

1.4 In order to be classified as lake copper, the copper must originate on the northern peninsula of Michigan, U.S.A.

NOTE 3—This specification has been drawn to cover the peculiar trade situation that has classified the large production of copper from this geographical district as a product in a class by itself.

NOTE 4—The values stated in U.S. customary units are to be regarded as the standard.

2. Applicable Documents

2.1 *ASTM Standards:*

B 193 Test for Resistivity of Electrical Conductor Materials[2]

B 224 Classification of Coppers[3]

E 53 Chemical Analysis of Copper (Electrolytic Determination of Copper)[4]

E 54 Chemical Analysis of Special Brasses and Bronzes[4]

E 62 Photometric Methods for Chemical Analysis of Copper and Copper Alloys[4]

E 527 Recommended Practice for Numbering Metals and Alloys (UNS)[5]

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

3.1.1 Type of copper (1.2),

3.1.2 If cakes, slabs, or billets are ordered for electrical use, it must be so stated (Table 2),

3.1.3 Silver content, if desired (4.1 and Note 5),

3.1.4 Shape and dimensions of each piece, and

3.1.5 Quantity.

4. Chemical Requirements

4.1 Copper of each type shall conform to the requirements as to chemical composition prescribed in Table 1.

NOTE 5—By agreement between the manufacturer and the purchaser, the addition of silver up to a nominal 30 troy oz/short ton (0.102 %) will be considered within the specifications; silver being

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[1] This specification is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys.

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* New designation established in accordance with ASTM E 527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys (UNS).

[2] *Annual Book of ASTM Standards*, Parts 6, 7, and 44.

[3] *Annual Book of ASTM Standards*, Parts 6 and 8.

[4] *Annual Book of ASTM Standards*, Part 12.

[5] *Annual Book of ASTM Standards*, Parts 1 to 10.

counted as copper in the chemical analysis, with no individual silver analysis to exceed 35 troy oz/short ton (0.12 %).

5. Physical Requirements

5.1 *Electrical Resistivity*—Copper of each type shall conform to the requirements for electrical resistivity prescribed in Table 2.

NOTE 6—"Resistivity" is used in place of "conductivity." The value of 0.15328 $\Omega \cdot g/m^2$ at 20°C (68°F) is the International Annealed Copper Standard for the resistivity of annealed copper equal to 100 % conductivity. The value of 0.15694 $\Omega \cdot g/m^2$ is for annealed copper of 97.66 % conductivity.

6. Dimensions, Weights, and Permissible Variations

6.1 *Standard Sizes and Shapes of Wire Bars:*

6.1.1 One size of mold shall be used for casting 200 to 230-lb (91 to 104-kg) wire bars, the bottom width of these bars to be 3½ in. (89 mm), the listed weights being 200 and 225 lb (91 to 102 kg) (Fig. 1).

6.1.2 One size of mold shall be used for casting 240 to 300-lb (109 to 136-kg) wire bars, the bottom width of these bars to be 4 in. (102 mm), the listed weights being 250, 265, 275, and 300 lb (113, 120, 125, and 136 kg) (Fig. 2).

6.1.3 All bars shall be 54 in. (1.372 m) in length. The side draft or taper shall be ⅜ in. (9.5 mm) in 4 in. (102 mm) (3/16 in. (4.8 mm) in 4 in. on each side of the bar). The radius of the corners at the bottom of the bars shall be ⅝ in. (15.9 mm). The end taper at the bottom shall be 6 in. (152.4 mm) in overall length and approximately 2 in. (50.8 mm)/ft (304.8 mm). The end taper of the side shall be approximately 2¼ in. (57.1 mm)/ft, and the end of the bar shall be approximately 3⅜ in. (85.7 mm) in depth at the point.

6.1.4 Wire bars not conforming to the requirements of Fig. 1 or Fig. 2, but otherwise meeting the requirements of this specification, may be supplied by agreement between manufacturer and the purchaser.

6.2 *Permissible Variations in Weight and Dimensions*—A permissible variation of ±5 % in weight or ±¼ in. (6.3 mm) in any dimension from the manufacturer's published list or the purchaser's specified size shall be considered good delivery; provided, however, that wire bars may vary in length ±1 % from the listed or specified length, and cakes may vary ±3 % from the listed or specified size in any dimension greater than 8 in. (203.2 mm). The weight of copper in ingots and ingot bars shall not exceed that specified by more than 10 %, but otherwise its variation is not important.

7. Workmanship, Finish, and Appearance

7.1 Wire bars, cakes, slabs, and billets shall be substantially free of shrink holes, cold sets, pits, sloppy edges, concave tops, and similar defects in set or casting. This requirement shall not apply to ingots or ingot bars in which physical defects are of no consequence.

8. Specimen Preparation

8.1 Each resistivity test specimen shall originate normally as a casting of suitable size poured during the casting period of the furnace.

8.2 Alternatively, after the end of the casting period, the specimen may originate as a single piece of appropriate size cut from the cast refinery shape.

8.3 The specimen taken in accordance with 8.1 or 8.2 shall be forged or hot rolled and cold drawn into wire about 0.080 in. (2.03 mm) in diameter.

8.4 The wire prior to determination of resistivity shall be annealed at approximately 500°C (932°F) for 30 min.

9. Test Methods

9.1 *Chemical Analysis*—In event of dispute, analysis for determining the minimum purity of copper shall be made in accordance with Method E 53. Analysis for determination of arsenic content, if required, shall be made in accordance with Methods E 54 or E 62.

9.2 *Resistivity Test*—Resistivity shall be determined in accordance with Method B 193.

10. Rejection and Rehearing

10.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

10.2 Rejection shall be considered as follows:

10.2.1 Chemical composition by furnace charges, ingot lots, or ingot-bar lots.

10.2.1.1 *Chemical Composition*—Each party shall select a sample of three pieces from the