



Designation: B216 – 97 (Reapproved 2003)

Standard Specification for Tough-Pitch Fire-Refined Copper—Refinery Shapes¹

This standard is issued under the fixed designation B216; 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 tough-pitch fire-refined copper wire bars, cakes, slabs, and billets for fabricating into wrought products and ingot and ingot bars for use in the manufacture of copper and copper alloy castings. This copper is not intended for electrical purposes.

1.2 Copper under this specification corresponds to the designation “FRTP” (UNS C12500) as shown in Classification B224. This copper may also be used to produce copper, corresponding to the designation “DPTE” (UNS C14520).

1.3 Although this specification includes certain UNS designations as described in Practice E527, these designations are for cross reference only and are not specification requirements. Therefore, in case of conflict, this ASTM specification shall govern.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 The following safety hazard caveat pertains only to the test method described in the annex of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

B224 Classification of Coppers

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials

¹ This test method is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.07 on Refined Copper.

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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.

E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry

E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

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

3. Terminology

3.1 For definitions of terms in this specification, refer to Classification B224.

4. Ordering Information

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

4.1.1 ASTM designation and year of issue,

4.1.2 Shape and Size: wire bar, cake, slab, billet, ingot, or ingot bar,

4.1.3 Quantity: total weight or number of pieces for each shape and size, and

4.2 When material is purchased for the U.S. government, this shall be specified in the contract or purchase order, and the material shall conform to the supplementary requirements as defined herein.

4.3 The following options are available and should be specified in the contract or purchase order when required:

4.3.1 Certification (Section 16),

4.3.2 Test Report (Section 17).

5. Material

5.1 Any copper may be used that will yield a product with a chemical composition conforming to the requirements of Table 1.

6. Chemical Composition

6.1 The product material shall conform to the requirements of Table 1.

6.2 These specification limits do not preclude the presence of other elements. Limits may be established and analysis required by agreement between the manufacturer or supplier and the purchaser.

7. Dimensions, Mass, and Permissible Variations

7.1 A permissible variation of $\pm 5\%$ in weight and $\pm 1/4$ in. (6.35 mm) in any dimension from the manufacturer’s published list or the purchaser’s specified size shall be considered

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

TABLE 1 Chemical Requirements^A

| Element | Composition, % |
|--------------------------------|----------------|
| Copper (including silver), min | 99.88 |
| Arsenic, max | 0.012 |
| Antimony, max | 0.003 |
| Bismuth, max | 0.003 |
| Lead, max | 0.004 |
| Nickel, max | 0.05 |
| Selenium + Tellurium, max | 0.025 |

^A Analytical variance is not incorporated into the specified limits, refer to 10.1.

good delivery; provided, however, that cakes may vary $\pm 3\%$ 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.

8. Workmanship, Finish, and Appearance

8.1 Shapes intended for fabrication 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.

9. Sampling

9.1 For routine sampling, the sampling practice shall be at the discretion of the sampler.

9.2 In case of dispute the lot size, portion size, and selection of pieces shall be as follows:

9.2.1 *Lot Size*—An inspection lot shall consist of all pieces the same shape and size from the same production lot or fraction thereof.

9.2.2 *Portion Size*—The portion shall be four or more pieces randomly selected to be representative of the lot. Should the lot consist of less than five pieces, each piece shall be sampled.

9.3 Chemical Analysis:

9.3.1 In case of dispute the sample for chemical analysis shall be taken from the pieces selected in 9.2.2 and combined into one composite sample in accordance with Practice E255 for a product in its final form. The minimum weight of the composite sample shall be 150 g.

9.3.2 Instead of sampling in accordance with 9.2.2, the manufacturer shall have the option of taking samples at the time the castings are poured.

9.3.2.1 When composition of the material has been determined during the course of manufacture, sampling of the finished product by the manufacturer is not required.

9.3.3 The number of samples to be taken for determination of chemical composition shall be as follows:

9.3.3.1 When sampled at the time the castings are poured, at least two samples, one soon after the start of the pour and one near the end of the pour, shall be taken for each group of castings poured from the same source of molten metal.

10. Number of Tests and Retests

10.1 *Tests*—The chemical composition shall be determined as the average of results obtained from at least two replicate analyses for each specified element.

10.2 Retests:

10.2.1 When requested by the manufacturer or supplier, a retest shall be permitted when test results obtained by the purchaser fail to conform with the product specification requirement(s).

10.2.2 Retesting shall be as directed in the product specification for the initial test except for the number of test specimens which shall be twice that required for the original test. Test results for all specimens shall conform to the product specification requirement(s) in retest and failure to comply shall be cause for lot rejection.

11. Specimen Preparation

11.1 The preparation of the analytical specimen is the responsibility of the reporting laboratory.

12. Test Methods

12.1 For routine analysis, the method of analysis shall be at the discretion of the reporting laboratory.

12.2 In case of dispute concerning copper content, the method of analysis shall be in accordance with Test Methods E53.

12.3 In case of dispute concerning antimony, arsenic, bismuth, lead, nickel, selenium, or tellurium content, the method of analysis shall be by electrothermal atomization atomic absorption spectrometry as described in the Annex.

12.4 Test method(s) for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

13. Significance of Numerical Limits

13.1 Calculated values shall be rounded to the nearest unit in the last right-hand significant digit used in expressing the limiting value in accordance with the rounding method in Practice E29.

14. Inspection

14.1 The producer shall inspect the product and conduct such tests as are necessary to verify that the specified requirements are met.

15. Rejection and Rehearing

15.1 Rejection:

15.1.1 Product that fails to conform to the requirements of the product specification may be rejected.

15.1.2 Rejection shall be reported to the manufacturer, or supplier, promptly and in writing.

15.1.3 In case of disagreement or dissatisfaction with the results of the test upon which rejection was based, the manufacturer or supplier may make claim for a rehearing.

15.2 *Rehearing*—As a result of product rejection, the manufacturer or supplier may make claim for retest to be conducted by the manufacturer or supplier and the purchaser. Samples of the rejected product shall be taken in accordance with the product specification and tested by both parties as directed in the product specification, or, alternatively, upon agreement by both parties, an independent laboratory may be selected for the tests using the test methods prescribed in the product specification.

16. Certification

16.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been tested and inspected as directed in the product specification and the requirements have been met.

17. Test Report

17.1 When specified in the purchase order or contract, the manufacturer or supplier shall furnish to the purchaser a manufacturer's test report showing the results of the required tests.

18. Product Marking

18.1 All shapes intended for fabrication shall be identified with the producer's brand, furnace charge, or other identifying number.

18.2 Ingots and ingot bars shall have a brand identification but need have no other number.

19. Packing and Package Marking

19.1 The producer shall arrange carload or lots so that, as far as possible, each shall contain shapes bearing a single identifying number.

20. Keywords

20.1 fire refined copper; refinery shapes; tough pitch copper

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. government.

S1. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

- S1.1.1 *Federal Standards*:³
Fed. Std. No. 102 Preservation, Packaging and Packing Levels.
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)
Fed. Std. No. 185 Identification Marking of Copper and Copper-Base Alloy Mill Products

- S1.1.2 *Military Standard*:³
MIL-STD-129 Marking for Shipment and Storage
- S1.1.3 *Military Specification*:³
MIL-C-3993 Packaging of Copper and Copper-Base Alloy Mill Products

S2. Quality Assurance

S2.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the

purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to ensure that the material conforms to prescribed requirements.

S3. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with Fed. Std. No. 185 except that the ASTM specification number and the alloy number shall be used.

S4. Preparation for Delivery

S4.1 *Preservation, Packaging, Packing*:
S4.1.1 *Military Agencies*—The material shall be separated by size, composition, grade, or class and shall be preserved and packaged, Level A or C, packed, Level A, B, or C as specified in the contract or purchase order, in accordance with the requirements of MIL-C-3993.

S4.1.2 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S4.2 *Marking*:

S4.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S4.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

³ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.