



Designation: E 255 – 91 (Reapproved 1997)

Standard Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition¹

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1. Scope

1.1 This practice describes the sampling of copper (except electrolytic cathode) and copper alloys in either cast or wrought form for the determination of composition.

1.2 Cast products may be in the form of cake, billet, wire bar, ingot, ingot bar, or casting.

1.3 Wrought products may be in the form of flat, pipe, tube, rod, bar, shape, or forging.

1.4 This practice is not intended to supersede or replace existing specification requirements for the sampling of a particular material.

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

1.6 *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. A specific precautionary statement appears in Appendix X4.*

2. Terminology

2.1 Definitions of Terms Specific to This Standard:

2.1.1 *casting, n*—a general term for a metal object produced at or near-finished shape by pouring or otherwise introducing molten metal into a mold and allowing it to solidify.

2.1.2 *wrought, adj*—a general term referring to a metal object produced by either hot-working or cold-working operations such as forming, bending, cupping, drawing, and hot pressing.

2.1.3 *lot, n*—as used in this practice, the unit to be sampled, in pounds or pieces.

2.1.4 *gross sample, n*—the total amount of all test pieces selected to represent the lot.

¹ This practice is under the jurisdiction of ASTM Committee E-1 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.07 on Cu and Cu Alloys.

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2.1.5 *test piece, n*—an individual product selected at one time from a lot.

2.1.6 *test sample, n*—a composite of material taken by approximate proportional weight from each of the test pieces and from which the test portion shall be taken.

2.1.7 *test portion, n*—the quantity of material taken from the test sample which is subjected to an analytical procedure.

NOTE 1—Appendix X1 describes the refinery shapes. Appendix X2 describes the fabricators' forms.

3. Significance and Use

3.1 This practice is intended primarily for the sampling of copper and copper alloys for compliance with compositional specification requirements.

3.2 The selection of correct test pieces and the preparation of a representative sample from such test pieces are necessary prerequisites to every analysis. The analytical results will be of little value unless the sample represents the average composition of the material from which it was prepared.

4. Selection of Test Pieces

4.1 Casting:

4.1.1 Finished Product or Shipment Sample:

4.1.1.1 A shipping lot shall consist of all castings of the same configuration and size necessary to comply with the requirements of a single purchase order.

4.1.1.2 Castings are frequently produced in advance of orders and manufacturer's or foundry lots may intermingle in stock.

4.1.1.3 Since the size and configuration of castings vary, the number of test pieces to be selected shall be subject to agreement between the manufacturer or supplier and the purchaser.

4.1.2 Manufacturer's or Foundry Sample:

4.1.2.1 For routine sampling and at the option of the manufacturer, a lot shall consist of the following:

(a) All of the metal poured from a single furnace or crucible melt, or

(b) All of the metal poured from two or more furnaces into a single ladle, or

(c) All of the metal poured from a continuous melting furnace between charges, or

(d) All of the metal poured from an individual melting furnace, or group of melting furnaces, having a uniform melting stock, operating during the course of one-half shift, not to exceed 5 h.

4.1.2.2 The sample taken for lot analysis shall be obtained during the pouring of the liquid metal into the mold, or molds, in such a manner as to be representative of the lot and able to be drilled or used in solid form.

4.1.2.3 Plant sampling practices should be developed and implemented which will give homogeneous samples representative of the cast or heat, and free of porosity. Analytical results are frequently obtained by an optical emission technique and, depending upon the metallurgical history of the sample, results may vary. Therefore, it is advisable to cool or quench the sample in a reproducible manner.

4.1.2.4 When foundry lot traceability is specified in the purchase order, additional samples shall be taken, identified, and set aside when so requested by the purchaser.

4.2 Cast Product:

4.2.1 For routine sampling and at the option of the manufacturer, a lot shall consist of all of the metal poured from a single furnace melt or all of the metal poured from a continuous melting furnace during a single casting cycle.

4.2.2 Unless otherwise agreed between the manufacturer and the purchaser, sampling of a single lot shall be as follows:

4.2.2.1 *Single Furnace Charge*—The number of samples required depends on the size of the melting furnace and homogeneity of the melt. A small well-stirred, alloying furnace such as one inductively heated and of less than 50 000 lb (22 680 kg) shall require but one sample taken midway in the pour. A large mechanically stirred furnace shall require a minimum of three samples taken, one each at the beginning, middle, and end of the casting period.

4.2.2.2 *Continuous Melting Furnace*—A minimum of one sample shall be taken for each 3 h of the casting cycle.

4.3 Wrought Products:

4.3.1 Finished Product or Shipment Sample:

4.3.1.1 The lot size, gross sample size, and selection of test pieces shall be as follows:

(a) *Lot Size*—An inspection lot shall be 10 000 lb or less of the same mill form, alloy, temper, and nominal dimensions, subject to inspection at one time; or it shall be the product of one cast bar from a single melt charge, whose weight shall not exceed 20 000 lb, which was continuously processed and subject to inspection at one time.

(b) *Gross Sample*—The gross sample shall be four or more pieces selected to be representative of the lot. Should the lot consist of four pieces or less, the entire lot shall constitute the gross sample.

(c) *Test Piece*—Each test piece shall be selected so as to be representative of the lot.

4.3.1.2 When possible, test pieces shall be selected in a manner that will represent correctly the material furnished but also avoid needless destruction of finished product (such as when samples representative of the material are available from other sources).

4.3.2 Manufacturer's or Foundry Sample:

4.3.2.1 For routine sampling, the manufacturer shall have the option of taking samples during the course of manufacture. Samples may be taken at the time castings are poured or from the semifinished product.

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

4.3.2.3 When samples are taken from the semifinished product, a sample shall be taken to represent each 10 000 lb, or fraction thereof, except that not more than one sample shall be required per piece. Only one sample need be taken from the semifinished product of one cast bar from a single melt charge continuously processed.

5. Sampling

5.1 General Considerations:

5.1.1 The saw, drill bit, cutter, or other tool used shall be thoroughly cleaned prior to use. The speed of sampling shall be so regulated that excessive heating and consequent oxidation is avoided. Carbide-tipped tools are recommended. Steel tools, when used, must be magnetizable to assist in the removal of extraneous iron. Only carbide-tipped or other wear-resistant tools shall be used to sample metal which contains a magnetic phase.

5.1.1.1 In the rare instance where tool lubricant is necessary to obtain a satisfactory sample, the lubricant must be one that will not react with the metal. The lubricant must be completely removed immediately after the sampling operation by washing with a solvent which also does not react with the metal.

5.1.2 The test pieces shall be clean and free from scale, dirt, oil, grease, and other extraneous contaminants before sampling.

5.1.3 Test pieces taken from product not subject to significant segregation shall be sampled by drilling, milling, or sawing each test piece. Sampling may also be carried out by clipping in the case of thin or small pieces.

5.1.4 Test pieces taken from product subject to significant segregation shall be sampled by drilling or sawing completely through each test piece, or by milling the entire cross section of each test piece.

5.2 Finished Product or Shipment Sampling:

5.2.1 Castings:

5.2.1.1 Different parts of a casting may vary in composition. Therefore, a sample from a single casting must be taken with care if it is to be representative of that casting. To obtain a sample representative of a lot of the finished product a number of test pieces should be sampled individually. In any case, the sample should be taken so as to be representative and large enough to suffice for all of the required determinations.

5.2.1.2 Where possible, depending on size and configuration, the casting shall be sampled by drilling five holes equally spaced around or along the casting. The drilling shall be done dry and the drill size shall be the largest practical, but not less than 1/4 in. (6.4 mm). Care shall be exercised that no dirt, scale, or other foreign material is included with the drillings.

5.2.1.3 When limited by size or configuration, or both, the castings shall be sampled by milling the entire cross-section,