



Designation: E55 – 11 (Reapproved 2022)^{ε1}

Standard Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition¹

This standard is issued under the fixed designation E55; 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.

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

^{ε1} NOTE—Editorial changes were made throughout in December 2022.

1. Scope

1.1 This practice covers the sampling, for the determination of chemical composition (Note 1), of nonferrous metals and alloys that have been reduced to their final form by mechanical working; that is, by such means as rolling, drawing, and extruding.

1.1.1 Refer to Practice E255 for copper and copper alloys.

NOTE 1—The selection of correct portions of material and the preparation of a representative sample from such portions are necessary prerequisites to every analysis, the analysis being of no value unless the sample actually represents the average composition of the material from which it was selected.

1.2 In special cases, when agreed upon by the purchaser and the manufacturer, the heat analysis may be accepted as representative of the composition of the finished product. In such cases, the identity of each heat of metal should be maintained through each stage of the manufacturing process to the final form. This method of sampling is not intended to apply under these conditions.

1.3 Units—The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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 Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

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

3. Terminology

3.1 Definitions—For definitions of terms used in this practice, see Terminology E135.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *portion, n*—this term is used in this practice to designate the selected pieces of material from which the sample is prepared.

3.2.2 *sample, n*—this term is used in this practice to designate the final form of the material submitted for analysis (drillings, millings, etc.). A representative sample is defined as a small part containing the same ingredients in the same proportions as they occur in the original lot or lots of material.

4. Selection of Portion

4.1 A portion representative of the total shipment or order shall be selected at random for the final sample. These portions shall be so taken that minimum wastage of material is incurred, consistent with the required accuracy in sampling.

4.2 Quantities of material withdrawn for sampling shall comply with the requirements of the ASTM standard covering that particular material.

4.3 When portions are to be withdrawn from finished material, it is recommended that arrangements be made for

¹ This practice is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.05 on Cu, Pb, Zn, Cd, Sn, Be, Precious Metals, their Alloys, and Related Metals.

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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.

excess length or amount of material to provide the necessary samples for inspection purposes.

4.4 Broken tension test specimens may be used conveniently in place of specially selected portions when such practice is agreeable to the purchaser.

5. Preparation of Sample

5.1 Samples of material too thin to be handled conveniently for machining (drilling, milling, etc.) may be prepared by clipping. Usually, clippings would be limited to material thinner than 1.02 mm (0.040 in.). Drillings, sawings, or millings shall be taken from material of heavier gage.

5.2 Rods, bars, plates, shapes, tubes, and pipes shall be sampled by milling the entire cross-section or by drilling entirely through the material at several points along the length. Sheets and strips may be folded once or more, by bringing the ends together and closing the bend; the portion may then be milled on the inside sheared edges or drilled entirely through the flat surface. For the lighter gages, several portions may be stacked together before folding.

5.3 Equal weights of drillings, millings, sawings, or clippings shall be taken from each piece representing the lot of material, and these shall be combined into one sample and thoroughly mixed.

5.4 Sometimes, a complete section of the selected portions may be required for spectrometric examination. Sections may therefore be taken and properly marked before using the remainder of the portions for sampling operations; such sections may be supplied, together with the milled, drilled, or sawed sample, at the request of the purchaser.

6. Details of Sampling

6.1 The portions selected for the preparation of samples for chemical analysis, when testing for conformance with specifications, shall be clean and free from scale, dirt, oil, grease, etc. If necessary, the portions may be cleaned in ethyl ether or acetone, rinsed in ethanol, and dried before sampling. Scale and dirt may be removed by suitable mechanical or chemical treatment of the metal; if chemical methods of cleaning are used, however, such operations should not alter the metal surface in any way. When testing for pounds of metal contained, as in the sale of scrap, these provisions do not apply as a general rule.

6.2 The saw, drill, cutter or other tools used for sampling shall be thoroughly cleaned prior to use. Depth of cut, speed of cutting, etc., shall be so regulated that excessive heating and consequent oxidation of the sample shall be avoided.

6.3 The chips obtained by milling, drilling, etc., should be uniformly small in size, particularly when such samples are to be used for spectrometric analyses or for special chemical determinations requiring a relatively finely divided sample. Very fine dust-like material should be avoided. To facilitate the preparations of chips of satisfactory size, V-shaped chip-breaking grooves may be formed in the cutting edge of the tool

by grinding or other convenient means at approximately right angles to the cutting edge. The spacing of the grooves may vary depending upon the tool and would have to be determined for each application. The grooves in adjacent cutting edges should be staggered.

6.4 Lubricants are not required for sampling the majority of wrought metals and alloys. With certain refractory alloys, lubrication may be necessary to avoid excessive oxidation of the sample, to reduce power requirements, or to save labor and time. In such cases, the use and choice of a satisfactory lubricant should be by mutual agreement between the manufacturer and the purchaser. Lubricants should be selected that do not alter or change the composition of the sample during contact. Lubricants should be completely removed as soon as possible after the sampling operation by the use of suitable solvents, such as ethyl ether or acetone, followed by a final rinse in ethanol and drying.

6.5 Drillings, millings, sawings, or clippings of nonmagnetic, nonferrous alloys shall be carefully treated with a strong magnet to remove any particles of iron introduced during sampling. Contamination of this kind should be avoided as much as possible by the use of suitable cutting tools, such as those made of carbide. For some metals, an acid dip may be required if low iron is critical.

6.6 Drillings, millings, sawings, or clippings shall be carefully examined, and any foreign material accidentally introduced during sampling shall be removed.

7. Size of Sample and Storage

7.1 The prepared sample shall weigh three times the amount required for the analysis and shall be divided into three equal parts, each of which shall be placed in a package and sealed, one for the seller, one for the purchaser, and one for an umpire, if necessary.

7.2 Samples that must be stored over long periods, or that are oxidized readily or otherwise altered in composition under varying atmospheric conditions, or that may become seriously contaminated in contact with paper or cardboard, should be kept in wide-mouth glass bottles of approximately 56 g (2 oz) capacity, with tight-fitting screw caps of metal or, preferably, plastic composition. In other cases, tight, leak-proof, paper sample envelopes or cardboard cartons may be used to hold the sample.

8. Resampling

8.1 If dissatisfied, either party may require that the material be resampled in the presence of representatives of the seller and the purchaser. The thoroughly mixed sample shall be divided into three equal parts, each of which shall be placed in a package and sealed, one for the seller, one for the purchaser, and one for an umpire, if necessary.

9. Keywords

9.1 alloys; sampling; wrought nonferrous metals