



Designation: D2013/D2013M – 21

Standard Practice for Preparing Coal Samples for Analysis¹

This standard is issued under the fixed designation D2013/D2013M; 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.

1. Scope

1.1 This practice² covers the reduction and division of gross or divided samples, and the preparation of composite samples, up to and including the individual portions for laboratory analysis.

1.2 Reduction and division procedures are prescribed for coals of the following groups:

1.2.1 *Group A* includes coals that have been cleaned in all sizes.

1.2.2 *Group B* includes all other coals. Unknown coals are to be considered under Group B.

1.2.3 Group A allows smaller weight laboratory samples to be retained than Group B. These lower weights may be used for particular coals if they have been shown, by using the procedures of [A1.2](#), to give a sample preparation and analysis variance which is no more than 20 % of the total analysis variance.

1.3 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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

¹ This practice is under the jurisdiction of ASTM Committee [D05](#) on Coal and Coke and is the direct responsibility of Subcommittee [D05.23](#) on Sampling.

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² For more detailed explanation of this practice, see Keller, G. E., “Determination of Quantities Needed in Coal Sample Preparation and Analysis,” *Transactions*, Vol. 232, 1965, pp. 218–226.

2. Referenced Documents

2.1 *ASTM Standards*:³

[D121 Terminology of Coal and Coke](#)

[D2234/D2234M Practice for Collection of a Gross Sample of Coal](#)

[D3173/D3173M Test Method for Moisture in the Analysis Sample of Coal and Coke](#)

[D3174 Test Method for Ash in the Analysis Sample of Coal and Coke from Coal](#)

[D3180 Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases](#)

[D3302/D3302M Test Method for Total Moisture in Coal](#)

[D4749 Test Method for Performing the Sieve Analysis of Coal and Designating Coal Size](#)

[D7430 Practice for Mechanical Sampling of Coal](#)

[D7582 Test Methods for Proximate Analysis of Coal and Coke by Macro Thermogravimetric Analysis](#)

[E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E456 Terminology Relating to Quality and Statistics](#)

2.2 *ISO Standard*:⁴

[ISO 13909 Hard Coal and Coke—Mechanical Sampling](#)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*—No terms are used which are specific to this practice. Many terms used in this practice may be found in Terminologies [D121](#) and [E456](#) and in Practice [E177](#).

4. Summary of Practice

4.1 Three processes of sample division and reduction are covered as follows:

³ 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.

⁴ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

4.1.1 *Procedure A*—Manual riffles are used for division of the sample and mechanical crushing equipment for the reduction of the sample.

4.1.2 *Procedure B*—Mechanical sample dividers are used for the division of the sample and mechanical crushing equipment for the reduction of the sample.

4.1.3 *Combined Procedure A and B*—The two procedures may be combined at any stage.

5. Significance and Use

5.1 Other standards are used to collect the gross sample: Practice **D2234/D2234M** allows for one division of the gross sample before crushing. The mass and top size of the gross or divided sample collected by using these guides and practices are usually too large for chemical or physical testing. Practice **D2013/D2013M** provides instructions for reducing and dividing the gross or divided sample, by on-line or off-line processes, or both, to a top size and mass suitable to the performance of testing. Any bias in the gross or divided sample before adherence to this practice will remain in the final sample resulting from use of this practice. Therefore, carefully select the standard to be used to collect the gross sample.

5.2 Division and reduction of a sample may occur at more than one location. Most often, the sample is collected, reduced, and divided (one or more times) by use of a mechanical sampling system. The remaining sample may be further divided on-site to facilitate transporting it to the laboratory where further reduction and division likely occurs before analysis.

5.3 In places, this practice requires air drying the sample before subsequent reduction. Procedures for air drying and air-dry loss determination are provided in Test Method **D3302/D3302M**.

5.4 Most often, samples are reduced and divided to an analysis sample. However, some tests may require a sample of different mass or top size. This procedure may be used to provide a sample of any mass and size consist from the gross or divided sample to, and including, the analysis sample.

5.5 This practice also specifies how to prepare composite samples, if required.

6. Apparatus

6.1 *Crushers or Grinders*—Jaw, cone, or rotary crusher; hammer mill; roll; or other suitable crusher to reduce the sample to pass the sieve designated in **6.4**. Hard steel or chilled iron plate with tamper, sledge, or hand bar may be used for preliminary crushing of any large lumps in the sample before feeding into the crusher. Crushers should be designed and operated in a manner to minimize the effect of induced air circulation and thus the potential for drying the coal.

6.1.1 *Pulverizer or Mill*—For final reduction of laboratory sample to the 250 μm [No. 60] sieve size, the following equipment may be used:

6.1.2 *Hammer Mill*—Completely enclosed to avoid loss of dust or moisture.

6.1.3 *Porcelain-Jar Ball Mill*—This mill shall be approximately 230 mm [9.0 in.] in diameter and 250 mm [10.0 in.] in

height with smooth, hard, well-rounded, flint pebbles, or equivalent, that do not increase ash content of the sample.

6.1.4 *Bucking Board (Chrome Steel) or Mortar (Agate or Equivalent) and Pestle*—Only for reducing the small fraction of sample, not passing a 250 μm [No. 60] sieve after pulverization.

6.2 Sample Dividers:

6.2.1 *Mechanical*—A mechanical sample divider using a reciprocating or rotating cutter, a rotating hopper and spout, a rotating slotted cone, a reciprocating hopper and fixed cutter, bucket cutter with either bottom dump or inverting discharge, slotted belt, rotary disk divider, mechanical stopped or moving belt sweeper, or other acceptable devices for dividing the sample. Typical mechanical sample dividers are shown in **Fig. 1**. These illustrate various designs, but other acceptable designs are available.

6.2.2 *Riffle*—A manual sample divider that splits the coal stream into two parts when it is directed through alternating slots. Riffle slots shall be at least three times the top size of the coal being divided and have an even number of alternating slots, in order to achieve similar mass delivered to each catch pan. Riffles shall be enclosed. The slope of the feed chutes and riffles shall be at least 60°.

6.2.2.1 *Large Riffle*—A manual sample divider with at least fourteen 12.7 mm [$\frac{1}{2}$ in.] to 25.4 mm [1 in.] divisions for dividing subsamples of coal passing 2.36 mm [No. 8], and 4.75 mm [No. 4] sieves. See **Fig. 2**.

6.2.2.2 *Small Riffle*—A manual sample divider with at least twenty-four 6.35 mm [$\frac{1}{4}$ in.] to 9.52 mm [$\frac{3}{8}$ in.] divisions for dividing the subsamples of coal passing 250 μm [No. 60]. See **Fig. 3**.

6.2.2.3 *Feed Scoop*—A feed scoop or pan having straight sides and a width equal to the effective width of the riffle shall be used to feed the riffle.

6.2.2.4 *Feed Chute*—A feed chute shall be used as shown in **Fig. 2**. The minimum discharge opening of the feed chute shall be the same width as the riffle slot opening.

6.3 *Mixing Wheel*—One type of a mechanical device used for mixing the analysis sample. In this device, the samples are in closed containers attached to the rim of a wheel at an angle of 45° with the horizontal wheel shaft. The wheel provides space for a number of containers depending on its diameter and is turned slowly by a small motor and reduction gear. The wheel should be rotated at a speed so that the particles fall gently from top to bottom of the container, mixing the sample thoroughly. The container should be about half full and never more than two-thirds full to obtain good mixing of the sample.

6.4 *Sieves*—A set of sieves whose dimensions are in accordance with Specification **E11**, of the following sizes, with cover and receiver:

No.	Size
4	4.75 mm
8	2.36 mm
20	850 μm
60	250 μm

6.5 *Laboratory Sample Containers*—Heavy vapor-imperious bags, properly sealed, or noncorroding cans such as