Designation: D 2013 – 00

Standard Method of Preparing Coal Samples for Analysis[1]

This standard is issued under the fixed designation D 2013; 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 method[2] covers the reduction and division of gross or divided samples, collected in accordance with Test Methods D 2234, 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 weights of 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 procedure of Annex A1.2 to give a sample preparation and analysis variance which is no more than 20 % of the total allowable variance.

1.3 Two methods are given for preparing the analysis sample for making the moisture determinations:

1.3.1 *Referee Method*—This method shall be used where the possibility of unaccounted changes in moisture content during the reduction and division of the gross or divided sample must be held to a minimum. It is intended to be used for evaluation of nonreferee methods and for testing of equipment. Only under certain conditions will this referee method be directly applicable to routine test programs.

1.3.2 *Nonreferee Method*—This method may be used for routine work.

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

2. Referenced Documents

2.1 *ASTM Standards:*

D 197 Test Method for Sampling and Fineness Test of Pulverized Coal[3]

D 410 Method for Sieve Analysis of Coal[4]

D 431 Method for Designating the Size of Coal from its Sieve Analysis[4]

D 2234 Test Methods for Collection of a Gross Sample of Coal[3]

D 3173 Test Method for Moisture in the Analysis Sample of Coal and Coke[3]

D 3174 Test Method for Ash in the Analysis Sample of Coal and Coke from Coal[3]

D 3302 Test Method for Total Moisture in Coal[3]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[5]

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[5]

3. Significance and Use

3.1 This method is intended to provide an analysis sample of coal from a gross or divided sample that has been collected in accordance with Test Methods D 2234. In addition, a method to determine the percent air dried moisture loss of the sample is provided. The analysis sample can be used to determine the value of the coal represented, its ability to meet specifications, its environmental impact, as well as for other purposes.

4. Definitions of Terms Specific to This Standard

4.1 *air drying*—a process of partially drying coal to bring moisture near to equilibrium with the atmosphere in the room in which further reduction and division of the sample is to take place.

4.2 *analysis sample*—final subsample prepared from the original gross or divided sample but reduced to 100 % through No. 60 (250-μm) sieve and divided to not less than 50 g.

[1] This method 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 method see Keller, G. E., "Determination of Quantities Needed in Coal Sample Preparation and Analysis," *Transactions*, Vol 232, 1965, pp. 218–226.

[3] *Annual Book of ASTM Standards,* Vol 05.06.

[4] *Discontinued; see 1988 Annual Book of ASTM Standards,* Vol 05.05.

[5] *Annual Book of ASTM Standards,* Vol 14.02.

4.3 *bias (systematic error)*—an error that is consistently negative or consistently positive. The mean of errors resulting from a series of observations which does not tend towards zero.

4.4 *C test*—a standard statistical test for homogeneity of variance.[6]

4.5 *divided sample*—a sample that has been reduced in quantity.

4.6 *gross sample*—a sample representing one lot of coal and composed of a number of increments on which neither reduction nor division has been performed.

4.7 *laboratory sample*—the sample, not less than the permissible weight given in Table 1, delivered to the laboratory for further preparation and analysis.

4.8 *precision*—a term used to indicate the capability of a person, an instrument, or a method to obtain repeatable results; specifically, a measure of the chance error as expressed by the variance, the standard error, or a multiple of the standard error (see Practice E 177).

4.9 *representative sample*—a sample collected in such a manner that every particle in the lot to be sampled is equally represented in the gross sample.

4.10 *riffle*—a hand-feed sample divider device that divides the sample into two parts of approximately the same weight.

4.11 *sample division*—the process whereby a sample is reduced in weight without significant change in particle size.

4.12 *sample preparation*—the process that may include air drying, crushing, division, and mixing of a gross sample for the purpose of obtaining an unbiased analysis sample.

4.13 *sample reduction*—the process whereby a sample is reduced in particle size by crushing or grinding without significant change.

4.14 *significant loss*—any loss that introduces a bias in final results that is of appreciable economic importance to concerned parties.

4.15 *size consist*—the particle size distribution of a coal.

4.16 *standard deviation*—the square root of the variance.

4.17 *subsample*—a sample taken from another sample.

4.18 *systematic error* (see *bias*, 4.3).

4.19 *top size*—the opening of the smallest screen in the series upon which is retained less than 5 % of the sample (see Method D 431).

4.20 *unbiased sample (representative sample)*—a sample free of bias.

[6] Details appear in standard texts. A good text for this purpose is Grubbs, F. E., "An Introduction to Some Precision and Accuracy of Measurement Problems," JTEVA, Vol 10, No. 4, July 1982, pp 133–143.

TABLE 1 Preparation of Laboratory Sample

Crush to Pass at Least 95 % Through Sieve	Divide to a Minimum Weight of, g[A]	
	Group A	Group B
No. 4 (4.75-mm)	2000	4000
No. 8 (2.36-mm)	500	1000
No. 20 (850 μm)	250	500
No. 60 (250 μm) (100 % through)	50	50

[A] If a moisture sample is required, increase the quantity of No. 4 (4.75-mm) or No. 8 (2.36-mm) sieve subsample by 500 g.

5. Summary of Method

5.1 Three processes of sample division are covered in this method as follows:

5.1.1 *Procedure A*—Riffles are used for division of the sample and mechanical crushing equipment for the reduction of the sample.

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

5.1.3 *Combined Procedure A and B*—The two procedures may be combined at any stage of the preparation procedure.

5.2 These procedures include methods to be used whenever residual or total moisture or both are to be determined or whenever other laboratory analyses or tests are to be made.

5.3 Preparation of gross or divided samples for analyses or tests consists of air drying (where necessary), particle size reduction, mixing, and dividing the gross or divided sample in stages to a small analysis sample representative of the original gross sample.

6. Apparatus

6.1 *Air Drying*—The following apparatus may be used:

6.1.1 *Air-Drying Oven*—A device for passing slightly heated air over the sample. The oven shall be capable of maintaining a temperature of 10 to 15°C (18 to 27°F) above room temperature with a maximum oven temperature of 40°C (104°F) unless ambient temperature is above 40°C (104°F), in which case, ambient temperature shall be used. In case of easily oxidized coals, the temperature shall not be over 10°C (18°F) above room temperature. Air changes shall be at the rate of 1 to 4/min. A typical oven is shown in Fig. 1.

6.1.2 *Drying Floor*—A smooth clean floor in a room free of dust and excessive air currents.

6.1.3 *Drying Pans*—Noncorroding metal pans of sufficient size so that the sample may be spread to a depth of not more than 25 mm (1.0 in.) with sides not more than 38 mm (1.5 in.) high.

6.1.4 *Scale-Gross Sample*—A scale of sufficient capacity and sensitive to 0.023 kg (0.05 lb) in 45.46 kg (100 lb).

6.1.5 *Balance-Laboratory Sample*—A balance of sufficient capacity to weigh the sample and container with a sensitivity of 0.5 g in 1000 g.

6.2 *Crushers or Grinders*—Jaw, cone, or rotary crusher, hammer mill, or other suitable crusher to reduce the sample to pass the sieve designated in Table 1. Hard-steel or chilled-iron plate with tamper, sledge, or hand bar for preliminary crushing of any large lumps in the sample before feeding into the crusher.

6.3 *Pulverizer or Mill*—For final reduction of laboratory sample to pass the No. 60 (250-μm) sieve, the following equipment may be used:

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

6.3.2 *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 appreciably increase the ash content of the sample.