Standard Practice for
Collection of a Gross Sample of Coal[1]

INTRODUCTION

Data obtained from coal samples are used in establishing price, controlling mine and cleaning plant operations, allocating production costs, and determining plant or component efficiency. The task of obtaining a sample of reasonable weight to represent an entire lot presents a number of problems and emphasizes the necessity for using standard sampling procedures.

Coal is one of the most difficult of materials to sample, varying in composition from noncombustible particles to those which can be burned completely, with all gradations in between. The task is further complicated by the use of the analytical results, the sampling equipment available, the quantity to be represented by the sample, and the degree of precision required.

This practice gives the overall requirements for the collection of coal samples. The wide varieties of coal-handling facilities preclude the publication of detailed procedures for every sampling situation. The proper collection of the sample involves an understanding and consideration of the physical character of the coal, the number and weight of increments, and the overall precision required.

1. Scope

1.1 This practice covers procedures for the collection of a sample under various conditions of sampling. The sample is to be crushed and further prepared for analysis in accordance with Practice D2013. However, the procedures for dividing large samples before any crushing are given in this practice. For the sampling of coal using mechanical sampling systems see D7430 Practice for the Mechanical Sampling of Coal.

1.2 This practice describes general and special purpose sampling procedures for coals *(1)* by size and condition of preparation (for example, mechanically cleaned coal or raw coal) and *(2)* by sampling characteristics.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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:*[2]
D2013 Practice for Preparing Coal Samples for Analysis
D7430 Practice for Mechanical Sampling of Coal

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *accuracy:*

3.1.1.1 *generally*—a term used to indicate the reliability of a sample, a measurement, or an observation.

3.1.1.2 *specifically*—a measure of closeness of agreement between an experimental result and the true value. Example: the observed and true sulfur content of a coal consignment. This measure is affected by chance errors as well as by bias.

3.1.2 *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.

3.1.3 *increment*—a small portion of the lot collected by one operation of a sampling device and normally combined with other increments from the lot to make a gross sample.

3.1.4 *probability sample*—a sample collected using a sampling process such that at each stage of the process, a specified non-zero probability of being selected for the sample can be attached to every sampling unit in the lot to be sampled. Given adequate information about the sample results obtained using probability sampling, the probability distribution of sampling errors can be estimated.

3.1.5 *sample*—a quantity of material taken from a larger quantity for the purpose of estimating properties or composition of the larger quantity.

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

4. Summary of Practice

4.1 The general-purpose sampling procedures are intended to provide, in 19 of 20 cases, dry ash results that are within an interval of $\pm\frac{1}{10}$ of the average dry ash results that would be obtained in hypothetical repeated sampling.

4.2 Special-purpose sampling procedures apply to the sampling of coal when other precision limits are required, or when other constituents are used to specify precision, or for performance tests.

4.3 For coals of known size and condition of preparation, tables are given for the determination of the number and weight of increments required for a gross sample for both general and special-purpose sampling.

4.4 The procedures appear in the following order:

Test Method	Section
Sampling of Coals Based on Size and Condition of Preparation	8.1
General-Purpose Sampling Procedure	8.1.1
Number and Weight of Increments	8.1.1.2
Number of Gross Samples	8.1.1.4
Special-Purpose Sampling	8.1.2
Number and Weight of Increments	8.1.2.2
Number of Gross Samples	8.1.2.3
Division of the Gross Samples Before Crushing	8.2
Sampling of Coal for Total Moisture Determination	8.3
Types of Moisture Samples	8.3.1
Entire Gross Samples	8.3.1.1
Special Moisture Subsamples	8.3.1.2
Other Subsamples for Moisture Testing	8.3.1.3
Special Precautions	8.3.2
Weight of Increments	8.3.3
Number of Increments	8.3.4
Moisture Sampling Based Only on Size	8.3.4.1

5. Significance and Use

5.1 It is intended that this practice be used to provide a sample representative of the coal from which it is collected. Because of the variability of coal and the wide variety of sampling equipment, caution should be used in all stages of sampling from system specifications and equipment procurement to equipment acceptance testing and actually taking the final sample.

5.2 After further processing (Practice D2013), the sample may be analyzed for a number of different parameters. These parameters may affect the lot's value, its ability to meet specifications, its environmental impact, as well as other properties.

6. Increment Collection Classification

6.1 The type of selection, the conditions under which individual increments are collected, and the method of spacing of increments from the coal consignment or lot are classified according to the following descriptions and Table 1. These designations are to be used for sampling specifications and for descriptions of sampling programs and sampling equipment.

6.2 *Types of Increments*—The types of selection of increments are based on whether or not there is human discretion in the selection of the pieces of coal or portions of the coal stream.

TABLE 1 Increment Types, Conditions, and Spacing

Condition of Increment Collection from the Main Body of Coal	Type I No Human Discretion Is Used		Type II Human Discretion Is Used	
	1. Systematic	2. Random	1. Systematic	2. Random
Condition A, stopped belt cut	I-A-1	I-A-2	II-A-1	II-A-2
Condition B, full-stream cut	I-B-1	I-B-2	II-B-1	II-B-2
Condition C, part-stream cut	I-C-1	I-C-2	II-C-1	II-C-2
Condition D, stationary sampling	I-D-1	I-D-2	II-D-1	II-D-2

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6.2.1 *Type I,* in which specific pieces or portions are not subject to selection on a discretionary basis. This includes that in which the increment is collected in precise accord with previously assigned rules on timing or location that are free of any bias. Type I selection increments generally yield more accurate results.

6.2.2 *Type II,* in which some measure of human discretion is exercised in the selection of specific pieces of coal or of specific portions of the stream, pile, or shipment.

6.3 *Conditions of Increment Collection*—The conditions under which individual increments are collected are the conditions of the main body of coal relative to the portion withdrawn. Four conditions are recognized:

6.3.1 *Condition A (Stopped-Belt Cut),* in which a loaded conveyor belt is stopped and a full cross-section cut with parallel sides is removed from the coal stream. The distance between the parallel faces shall be not less than three times the normal top size of the coal.

6.3.2 *Condition B (Full-Stream Cut),* in which a full cross-section cut is removed from a moving stream of coal.

6.3.3 *Condition C (Part-Stream Cut),* in which a portion, not a full cross section, is removed from a moving stream of coal.

6.3.4 *Condition D (Stationary Coal Sampling),* in which a portion of coal is collected from a pile, a rail car, a barge, or a shiphold.

6.4 *Spacing of Increments*—The spacing of increments pertains to the kind of intervals between increments. Two spacing methods are recognized: systematic and random. Systematic spacing is usually preferable.

6.4.1 *Systematic Spacing 1,* in which the movements of individual increment collection are spaced evenly in time or in position over the lot.

6.4.2 *Random Spacing 2,* in which the increments are spaced at random in time or in position over the lot.

7. Organization and Planning of Sampling Operations

7.1 This practice provides definitive procedures for the collection of a gross sample. Parties claiming to use this practice must adhere to the procedures as set out in this standard. If the sampling is not done in accordance with the procedures set out in this practice then that sample may not be suitable for comparison with a sample collected by the procedures described in this practice. Since it may be impracticable or impossible to take another sample of a given lot of coal it is essential that parties agree on sampling procedures prior to undertaking sampling.

7.2 *Selection of Appropriate Sampling Procedure*—Variations in coal-handling facilities make it impossible to publish rigid rules covering every sampling situation in complete and exact details. Proper sampling involves an understanding and proper consideration of the minimum number and weight of increments, the size consist of the coal, the condition of preparation of the coal, the variability of the constituent sought, and the degree of precision required.

7.2.1 *Number and Weight of Increments*—The number and weight of increments required for a given degree of precision depends upon the variability of the coal. This variability increases with an increase in free impurity. A coal high in inherent impurity and with comparatively little free impurity may exhibit much less variability than a coal with a low inherent impurity and a relatively high proportion of free impurity. For most practical purposes, an increase in the ash content of a given coal usually indicates an increase in variability. It is imperative that not less than the minimum specified number of increments of not less than the minimum specified weight be collected from the lot. For Condition D, the increments shall be of equal weight.

7.2.2 *Increment Collection Method to Be Used*—To obtain complete representation of all sizes, it is most desirable that the sample increments be withdrawn from the full cross section of the stream. The best possible increment is a full cross-section cut removed from a stopped belt, Classification I-A-1 in Table 1. The best possible increment from a flowing stream of coal is one obtained by moving a cutter device entirely across the stream at a uniform speed, the same for each increment, into one side of the stream and out of the other, without allowing the receptacle to overflow (Classification I-B-1 in Table 1). For the sampling of coal under Classification I-B-I see D7430 Practice for the Mechanical Sampling of Coal. Classification methods given in Table 1 are listed in order of decreasing reliability. The highest possible classification method, wherever feasible, should be used. Details of sampling procedures should be agreed upon in advance by all parties concerned. Whenever circumstances dictate utilization of increment collection classifications "Condition C" or "Condition D" or "Type II," details of sampling procedure shall be agreed upon in advance by all parties concerned.

7.3 *Distribution of Increments*—It is essential that the increments be distributed throughout the lot to be sampled. This distribution is related to the entire volume of the lot, not merely its surface or any linear direction through it or over it. If circumstances prevent the sampler from applying this principle, the lot is sampled only in part, and the gross sample is representative only of this part. The spacing of the increments shall be varied if the possibility exists that increment collection may get "in phase" with the sequence of coal variability. Example: routine sampling of commercial coal from a continuous stream (conveyor belt) in which increment collection is automatic and its sequence coincides with the "highs" or "lows" in the content of fines.

7.4 *Dimensions of Sampling Device*—The opening of the sampling device shall be no less than 2.5 times the nominal top size of the coal and no less than 30 mm [1.25 in.]. The sampling device shall be of sufficient capacity to completely retain or entirely pass the increment without spillage at the maximum rate of coal flow.

7.5 *Characteristics and Movement of Sampling Device*—In sampling from moving streams of coal, the sampling device shall be designed to collect each increment with no selective rejection of material by size and with no contamination by nonsample material.

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