



## Standard Practice for Manual Sampling of Coal from Tops of Barges<sup>1</sup>

This standard is issued under the fixed designation D 6315; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> NOTE—Paragraph 6.3.3 has been editorially corrected by adding Eq 1 in January 2001.

### 1. Scope

1.1 This practice covers procedures for obtaining a manual gross sample from the surface of coal contained in barges. These procedures are used to provide gross samples for general analysis and for estimating quality and total moisture. The gross sample is to be crushed and further prepared for analysis in accordance with Test Method D 2013.

1.2 The user is cautioned that samples of this type do not satisfy the minimum requirements for probability sampling and, as such, cannot be used to calculate such statistical inferences as the precision, standard error, or bias.

1.3 This sampling method is used only when sampling by methods that provide a probability sample is not possible.

1.4 The quantities stated in either acceptable SI units or in inch-pound units are regarded separately as standard. The quantities stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining quantities in any way.

1.5 *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 121 Terminology of Coal and Coke<sup>2</sup>

D 2013 Method of Preparing Coal Samples for Analysis<sup>2</sup>

D 2234 Practice for Collection of a Gross Sample of Coal<sup>2</sup>

D 4749 Test Method for Performing the Sieve Analysis of Coal and Designating Coal Size<sup>2</sup>

E 105 Practice for Probability Sampling of Materials<sup>3</sup>

### 3. Terminology

#### 3.1 Definitions

3.1.1 For definitions used in this test method, refer to Terminology D 121.

### 4. Summary of Practice

4.1 Obtaining a manual sample of a stationary lot of barge coal is accomplished by collecting increments from the surface layer(s) of coal in the barge for the purpose of acquiring a gross sample.

### 5. Significance and Use

5.1 The guidelines, cautions, and suggested procedures presented here are intended to aid in the proper planning of barge top sampling of coal transported in barges, taking into account the wide variety of conditions that may be encountered.

5.2 When agreed upon by all interested parties, these guidelines provide procedures for collecting gross samples from the top layer(s) of coal in barges; these samples then being further processed to provide subsamples for required laboratory estimations.

5.3 This guide provides instructions for sampling only the top 18 to 24 in. (46 to 61 cm) of a barge. The user is cautioned that samples so obtained do not typify material below the point of penetration. If a barge is already loaded with coal and the user suspects different coals or quality were layered during different passes or stages of loading, the barge should only be sampled as it is unloaded using Conditions A or B in Practice D 2234.

### 6. Procedure

6.1 Whenever sampling is conducted using this practice, all parties with an interest in the outcome of the results should agree upon all the relevant details of this process. These include, but are not limited to: lot size; number and mass of increments; the size, shape, and manipulation of the increment collection devices; location of increment collection site or sites; circumstances under which increments are not to be collected or can be suspended; and safety precautions. It is preferable that such agreements be in writing.

6.2 *Lot Size*—All interested parties shall agree before sampling begins to the size of the lot to be represented by one gross sample. Section 7 of Practice D 2234 is the proper reference for obtaining a probability sample and, for the purpose of uniformity, may be used as a guide for barge top sampling.

6.3 *Increments*—Before sampling a lot of coal, a visual

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 05.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 14.02.

inspection for size distribution and possible size segregation within each barge should be performed. Notes should be made in a sampling log to reflect these observations. The notes could be useful in understanding differences of analytical test results or in identifying changes in loading characteristics. (For the purpose of uniformity it is recommended that Table 1 be used in barge top sampling to establish minimum weight and number of increments). Test Method D 4749 may be used to determine the coal top size.

6.3.1 The top size of the coal and lot size to be represented by each gross sample must be ascertained to determine if Table 1 is used to determine the minimum number and weight of increments. It is recommended that the increment weight should be no less than specified in Table 1, and all increments be of approximately equal mass.

6.3.2 For a lot of up to 1000 net tons [908 metric tons] [908 Mg], for the purpose of uniformity, it is suggested that the number of increments collected to typify that lot be no less than specified in Table 1.

6.3.3 For a lot of more than 1000 tons, where one gross sample will be used, for the purpose of uniformity, the following equation may be used to determine the recommended number of increments to be collected:

$$N_2 = N_1 \sqrt{\frac{\text{total lot size (tons or Mg)}}{1000 \text{ tons or } 908 \text{ Mg}}} \quad (1)$$

where:

$N_1$  = number of increments specified in Table 1 and

$N_2$  = number of increments required.

6.3.4 A lot can consist of more than one barge. The minimum number of increments to be collected from each barge can be determined by dividing the total minimum number of required increments by the number of barges in the lot. It is recommended that fractions of increments for each barge be mathematically rounded upward to the next whole number. (Example: Six barges containing 1500 net tons [1362 Mg] of raw coal per barge would require a minimum of 45 increments or 7.5 increments per barge, rounded upward to 8 increments per barge.)

6.3.5 Daily barge top sampling regimes may produce samples whose increments typify only part of a larger lot of coal, for example, two barges out of a total of six barges are sampled and prepared each day for three days producing three samples representing a six-barge lot. In these cases, each sample may be composited proportionately with the other samples to make one analysis sample to represent the whole lot, or each sample may be analyzed separately and a calculated weighted composite analysis of the whole lot may be obtained. In either case, increments proportional to the whole lot may be collected from each barge or day's loading and then be composited either physically or calculated by weight to represent the lot. It is recommended that each smaller lot be

referred to as a subplot. When the sample representing the barge subplot is analyzed and reported separately, it is recommended that it be referred to as a barge subplot sample.

6.4 *Collection Devices*—The top size of the coal to be sampled should be ascertained to determine the size of the increment collection device (a minimum of two-and-one-half times the top size of the coal). Sampling implements should be agreed upon by all interested parties before commencement of sampling. Pointed end shovels and scoops made from shovels are some commonly used increment collection implements.

6.5 *Increment Collection*—Increments are collected from holes or trenches dug to a depth of at least 18 in. (46 cm). The angles of the sides of the holes or trenches should be less than the angle of repose. The coal that is removed from the holes or trench is placed away from the sampling area. The increment is then removed from the bottom of the hole or trench and placed into its container, avoiding any spillage. All increments collected should be promptly sealed and identified in their containers and prepared for analyses in accordance with Method D 2013.

6.5.1 In extremely cold weather, coal can become frozen inside the barges. Do not attempt to collect increments manually from frozen coal. Wait until it thaws. If sampling is necessary while coal is frozen, make note of the coal's condition when it was sampled. It will be extremely difficult or even impossible to collect increments properly.

6.5.2 The user is cautioned that, during the removal of increments, spillage of coal from the sampling device is to be avoided.

6.6 *Sampling Pattern*—The configuration of increment collection over the surface of the coal in a barge should be agreed upon by all interested parties before commencement of sampling. Appendix X1 illustrates examples of a methodology to determine typical barge top sampling patterns; however, these are examples only, and the user may be guided but is not bound by these patterns. It is recommended that the user develop, by test, the pattern(s) that work best for the types of coal the user samples.

6.7 *Storage of Increments*—It is recommended that sample increments be adequately protected from moisture variation by the use of moisture-tight containers. Care must be taken to ensure that the integrity of the container, including any moisture seal, is not compromised during handling.

6.7.1 It is recommended that storage containers should be both waterproof and strong enough to be removed from the tops of the barges and transported to the preparation facility without damage. (For example, a commonly used container is a combination of a heavy woven plastic or heavy cotton outer bag with a plastic inner liner bag of at least 4-mil (0.1-mm) thickness). Both bags need to be sealed (for example, with drawstrings or twist-ties). Ten- or 12-gal (38- or 45-L) metal containers or 5-gal (19-L) plastic pails with similar plastic bag inner liners and tight-fitting lids may also be used where appropriate.

6.7.2 Each storage container must be fully identified to keep it separate from any other container. Waterproof marking pens and tags are useful for this purpose. Two tags are recommended, each fully marked with all identifying information for

**TABLE 1 Minimum Weight and Number of Increments**

Top Size	5/8 in. (16 mm)	2 in. (50 mm)	6 in. (150 mm)
Minimum number of increments	15	15	15
Minimum weight of increments, lb.	2	6	15
Minimum weight of increments, kg	1	3	7

each container, one placed inside the inner liner plastic bag and one placed on the outside of the container.

6.8 *Segregation and Stratification*—The difficulty of collecting increments from the surface of coal in a barge in such a manner as to preserve the correct proportionality of all the variable constituents of the coal increases as the irregularities in elevations on the surface increase. This is due to natural segregation as the coal is deposited in the barge. Not only must increments be appropriately distributed over the surface according to some preselected sampling pattern as addressed in 6.6, but care must be taken that increments are collected among the valleys, peaks, and slopes, and this is largely a matter of judgement that the sampler must exercise under field conditions. These difficulties make manual barge samples inappropriate for size consist analysis.

6.8.1 It is essential that the increments be removed from throughout the lot to be sampled. If the possibility exists that increment patterns are in phase with the sequence of coal variability the sampling pattern should be reversed or varied. (Example—Routine barge top sampling in which increment patterns coincide with the “high” or “lows” in the content of fines.)

6.8.2 Frequently, barges are loaded in multiple passes or stages. Different coals can be loaded during different passes or

stages. If manual sampling is used during the loading process, samples should be collected from the surface of each pass or stage using an acceptable sampling pattern. If each pass or stage typifies a known tonnage, the sample from each could either be prepared and analyzed separately and all analyses weight averaged to determine the quality of the lot, or all samples representing a lot could be composited to form one sample that is prepared and analyzed.

6.9 Field situations often dictate on-site modifications of a sampling procedure. These modifications should only be made by personnel with an understanding of and a sense of responsibility for the potential effects of the sampling procedure variation upon the sample.

## 7. Precision and Bias

7.1 The samples obtained using this practice are nonprobability samples and as such they may not be used to calculate statistical inferences such as the levels of precision and bias. The user of this practice is referred to Practice E 105 for further information concerning probability sampling of materials.

## 8. Keywords

8.1 barges; manual sampling

## APPENDIXES

### (Nonmandatory Information)

#### X1. SAMPLING PATTERN SELECTION

##### X1.1 *Increment Positions:*

X1.1.1 Sampling pattern and increment placement should be agreed upon by all concerned parties. To determine potential positions of increments, use of one of the following options is recommended:

X1.1.2 *Option 1*—Divide the barge length into as many equal sections as the required number of increments and divide the barge width into three, four, five, or six equal sections, depending on which number is common to the required number of increments per barge. An imaginary grid is formed dividing the surface of the barge into equal rectangular sections which are the potential positions for the removal of increments.

X1.1.3 *Example*—For the lot and barge combination described in 6.3.4, the grids according to X1.1.2 for the 1500-ton barges could be 18 long by 3 wide

- 18 long by 4 wide
- 18 long by 5 wide
- 18 long by 6 wide

X1.1.4 *Option 2*—Divide the barge width into two, three, four, five, or six equal sections, depending on which number is divisible and desirable, into the required number of increments per barge. Divide the required number of increments by this number to determine the number of equal length sections that

will be required. An imaginary grid is formed dividing the surface of the barge into equal rectangular sections which are the potential positions for the removal of increments.

X1.1.5 *Example*—For the lot and barge combination described in 6.3.4, the grids according to X1.1.4 for the 1500-ton barges could be 9 long by 2 wide

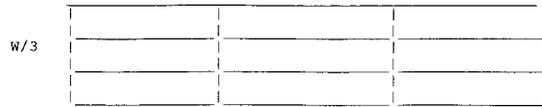
- 6 long by 3 wide
- 3 long by 6 wide

X1.2 Fig. X1.1 provides some illustrations of imaginary grid patterns.

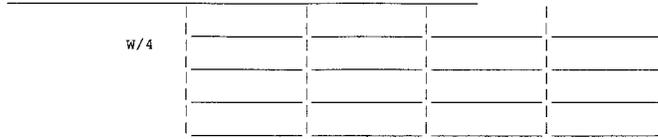
X1.3 When increment positions are selected by a pattern in which the number of grid sections is greater than the number of increments required, ensure that an equal number of increments are collected from each width section and each length section throughout the lot being sampled. If multiple barges are to be sampled in the lot, the sampling pattern should be reversed after each pattern cycle.

X1.4 When 15 or more increments are collected from a barge, it can be helpful to the sampler to establish the grid by referencing to the ribs in the barge or by placing chalk marks along the barge coaming or gunnel.

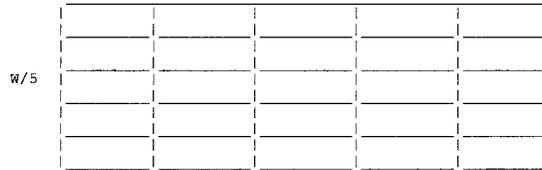
L/3



L/4



L/5



L/6



FIG. X1.1 Illustration of Imaginary Grids

## X2. RATIONALE

X2.1 A need in industry was identified to provide some estimate of the quality of coal transported in barges when obtaining a probability sample (Conditions A or B in Practice D 2234) is not physically or economically feasible, or both. The procedures described here are designed to provide guidelines for meeting this criteria.

of coal from barges that provides a reasonable estimate of the quality of the lot from which it was taken presents some unique problems. This sample only represents the top layer(s) of coal in barges, this sampling guide should not be considered as a substitute for a more reliable sampling method, for example, full stream mechanical sampling.

X2.2 It is recognized that obtaining a sample of a single lot

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