



Standard Specification for CLASSIFICATION OF COALS BY RANK¹

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1. Scope

1.1 This specification covers the classification of coals by rank, that is, according to their degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite.

2. Applicable Documents

2.1 ASTM Standards:

- D 1412 Test for Equilibrium Moisture of Coal at 96 to 97 Percent Relative Humidity and 30 C²
- D 1756 Test for Carbon Dioxide in Coal²
- D 1757 Test for Sulfur in Coal Ash²
- D 2013 Preparing Coal Samples for Analysis²
- D 2015 Test for Gross Calorific Value of Solid Fuel by the Adiabatic Bomb Calorimeter²
- D 2234 Collection of a Gross Sample of Coal²
- D 3173 Test for Moisture in the Analysis Sample of Coal and Coke²
- D 3174 Test for Ash in the Analysis Sample of Coal and Coke²
- D 3175 Test for Volatile Matter in the Analysis Sample of Coal and Coke²
- D 3177 Test for Total Sulfur in the Analysis Sample of Coal and Coke²
- D 3180 Calculating Coal and Coke Analyses from As-Determined to Different Bases²
- D 3286 Test for Gross Calorific Value of Solid Fuel by the Isothermal-Jacket Bomb Calorimeter²

3. Basis of Classification

3.1 Classification is according to fixed carbon and calorific value (expressed in Btu/lb) calculated to the mineral-matter-free

basis. The higher-rank coals are classified according to fixed carbon on the dry basis; the lower-rank coals are classed according to calorific value on the moist basis. Agglomerating character is used to differentiate between certain adjacent groups.

4. Classification by Rank

4.1 *Fixed Carbon and Calorific Value*—Coals shall be classified by rank in accordance with Table 1. Classify coals having calorific values of 14,000 Btu/lb or more on the moist, mineral-matter-free basis, and coals having fixed carbon of 69 percent or more on the dry, mineral-matter-free basis, according to fixed carbon on the dry, mineral-matter-free basis; classify coals having calorific values less than 14,000 Btu/lb on the moist, mineral-matter-free basis according to calorific value on the moist, mineral-matter-free basis, provided the fixed carbon on the dry, mineral-matter-free basis is less than 69 percent.

4.2 *Agglomerating Character*—Classify coals having 86 percent or more fixed carbon on the dry, mineral-matter-free basis, if agglomerating, in the low volatile group of the bituminous class. Classify coals having calorific values in the range 10,500 to 11,500 Btu/lb on the moist, mineral-matter-free basis according to their agglomerating character (Table 1).

¹ This specification is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.18 on Classification of Coals.

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² *Annual Book of ASTM Standards*, Part 26.

5. Symbols for Expressing Classification

5.1 Express the position of a coal in the scale of rank in condensed form as, for example (62 - 146), in which the parentheses signify that the contained numbers are on the mineral-matter-free basis. The first number represents fixed carbon on the dry basis, reported to the nearest whole percent. The second number represents calorific value on the moist basis, expressed as hundreds of Btu/lb to the nearest hundred; for example, 14,580 Btu/lb would be represented as 146.

4.2 Where it is desired to abbreviate the designation of the ranks of coal by group, the following abbreviations shall be used:

ma—meta-anthracite
 an—anthracite
 sa—semianthracite
 lvb—low volatile bituminous
 mvb—medium volatile bituminous
 hvAb—high volatile A bituminous
 hvBb—high volatile B bituminous
 hvCb—high volatile C bituminous
 subA—subbituminous A
 subB—subbituminous B
 subC—subbituminous C
 ligA—lignite A
 ligB—lignite B

6. Sampling

6.1 *Bed Samples*—Classify a coal bed, or part of a coal bed, in any locality based on the average analysis and calorific value (and agglomerating character where required) of not less than three and preferably five or more face samples taken in different and uniformly distributed localities, either within the same mine or closely adjacent mines representing a continuous and compact area not greater than approximately four square miles in regions of geological uniformity. In regions where conditions indicate that the coal probably varies rapidly in short distances, the spacing of sampling points and grouping of analyses to provide average values shall not be such that coals of obviously different rank will be used in calculating average values.

6.1.1 Take samples in accordance with the U. S. Bureau of Mines method⁴ or its equivalent and place in moisture-tight containers in the mine.

6.1.2 Analyses of samples from outcrops or from weathered or oxidized coal shall not be used for classification by rank.

6.1.3 In case the coal is likely to be classified on the “moist” basis, that is, inclusive of its natural complement of inherent or bed

moisture, take samples in a manner most likely to preserve inherent moisture for purposes of analysis. Samples of low-rank coals which appear dry at the time of collection frequently give off moisture which condenses on the inner surface of the sample containers before they are opened for analysis. In the case of coals which were free from visible surface moisture when sampled, but which show moisture on the inner surface of the containers when opened, weigh both the container and the coal before and after air-drying, and report the total loss in weight as air-drying loss.

6.1.4 If it is impossible to sample the coal without including visible surface moisture, or if there may be other reason to question the accuracy of inherent moisture content determinable from the sample, and the coal is likely to be classified on the “moist” basis, the sampler shall include the following statement in the description: “Moisture questionable.” Samples so marked shall not be used for classification on a moist basis unless brought to a standard condition of moisture equilibrium at 30 C in a vacuum desiccator containing a saturated solution of potassium sulfate (97 percent humidity) as specified in Method D 1412. Analyses of such samples that have been treated in this manner shall be designated as “samples equilibrated at 30 C and 97 percent humidity.”

6.2 *Tipple or Shipment Samples*—The apparent rank of “run of mine” coal and prepared sizes of coal shall be based on representative samples taken in accordance with Section 7 of Method D 2234.

6.2.1 In case the coal is likely to be classified on the “moist” basis, take samples at the tipple or preparation plant and protect against loss of moisture as specified in 10.2 of Method D 2234. Take samples that appear dry at the time of collection in accordance with 6.1.3 to ensure correct determination of total air-drying loss. Mark samples that have visible surface moisture on the coal when sampled, and that are likely to be classified on the “moist” basis, in accordance with 6.1.4.

⁴J. A. Holmes, “The Sampling of Coal in the Mine,” U.S. Bureau of Mines, *Technical Paper No. 1* (1911). A version is included in J. M. Schopf, “Field Description and Sampling of Coal Beds,” U. S. Geological Survey *Bulletin No. 1111-B* (1960).