



Standard Test Method for Grindability of Coal by the Hardgrove-Machine Method¹

This standard is issued under the fixed designation D 409; 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 test method² covers the determination of the relative grindability or ease of pulverization of coals in comparison with coals chosen as standards. A prepared and sized sample receives a definite amount of grinding energy in a miniature pulverizer, and the size consist of the pulverized product is determined by sieving. The resultant size consist is used to produce an index relative to the ease of grinding (Hardgrove Grindability Index (HGI)).

1.1.1 Some coals, such as some high-volatile bituminous, subbituminous, and lignite coals, can undergo physical change as the natural or seam moisture is released during handling and preparation. This change is often sufficient to alter the grindability characteristics that will be reported when tested in the laboratory and could produce different indices dependent on the conditions of drying and the moisture level of the 1.18-mm by 600-μm (No. 16 × No. 30) (see Test Method D 4749) materials used for the test. Therefore, the repeatability and reproducibility cited in this test method may not apply for these high-volatile bituminous, subbituminous, and lignite coals.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses may be approximate.

1.3 It is recognized that the term *weight* is considered equivalent to *mass* as used in this test method.

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.*

¹ This test method is under the jurisdiction of ASTM Committee D05 on Coal and Coke and is the direct responsibility of D05.07 on Physical Characteristics of Coal.

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² For information concerning the experimental work on which this test method is based, see paper by Hardgrove, R. M., “Grindability of Coal,” *Transactions, American Society of Mechanical Engineers*, Vol 54, F.S.P., p. 37, 1932.

D05.07.02 on Grindability is conducting ongoing investigations in regard to quality control during preparation, distribution, and use of standard reference materials and during preparation and testing of actual samples.

2. Referenced Documents

2.1 ASTM Standards:

- D 2013 Method of Preparing Coal Samples for Analysis³
- D 2234 Practice for Collection of a Gross Sample of Coal³
- D 4749 Test Method for Performing the Sieve Analysis of Coal and Designating Coal Size³
- E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁴

3. Significance and Use

3.1 This test method develops a measurement of grinding or pulverizing characteristics that can be used to evaluate the yield, or energy input, or both, required in a grinding or pulverizing process.

4. Apparatus

4.1 *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, in which case ambient temperature shall be used. In the case of easily oxidized coals, the temperature shall not be over 10°C (18°F) above room temperature unless ambient temperature is above 37°C (100°F) in which case ambient temperature shall be used. Air changes shall be at the rate of 1 to 4 air volumes of oven capacity per minute.

4.2 *Drying Pans*—Drying 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. The pans shall be nonreactive with coal and unaffected by the method of air drying selected.

4.3 *Balances*—Two balances may be required: one with a sensitivity of 10 mg and a minimum capacity of 800 g and one with a sensitivity of 0.5 g in 1000 g and sufficient capacity to weigh a ≥1000-g sample along with the drying pan. A single balance meeting these specifications is permitted.

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

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

