



Designation: **D5003—19 D5003/D5003M – 23**

## Standard Test Method for Hardgrove Grindability Index (HGI) of Petroleum Coke<sup>1</sup>

This standard is issued under the fixed designation **D5003/D5003M**; 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.

### INTRODUCTION

Introduction of petroleum coke into the coal market in recent years has necessitated the use of many of the test methods for coal so like data would be available for comparison and blending purposes. Test Method **D409** does not cover petroleum coke in its scope and its statements of precision and bias do not include petroleum coke. This test method provides the procedures and precision and bias data for the hardgrove grindability index (HGI) of petroleum coke. Use of this test method or Test Method **D409** produces the same value for the sample of petroleum coke being analyzed.

### 1. Scope\*

1.1 This test method covers the determination of the hardgrove grindability index (HGI) of those petroleum cokes that contain no dedusting additive. The procedure for this test method is the same as in Test Method **D409**. Sections of this test method contain the significance and use of the HGI of petroleum coke, preliminary sample preparation procedures, and procedure and precision and bias data specific to petroleum coke.

NOTE 1—The size consistency (particle size distribution) of fluid petroleum coke is generally 100 % passing a ~~6.73 mm (No. 3)~~ 6.7 mm [0.265 in.] sieve and greater than 80 % passing a ~~2.00 mm (No. 10)~~ 2 mm [No. 10] sieve. Much of fluid cokes will pass a ~~0.59 mm (No. 30)~~ 600  $\mu$ m [No. 30] sieve. Because of this fineness the HGI value is related to the coarser particles in fluid coke and large samples are required to prepare sufficient material of the correct particle size for Test Method **D409**.

1.2 The values stated in either SI units or inch-pound units are to be regarded as standard. ~~No other units of measurement are included in this 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.

1.2.1 *Exception*—Hardgrove grindability index is unitless.

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

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee **D02** on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee **D02.05** on Properties of Fuels, Petroleum Coke and Carbon Material.

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\*A Summary of Changes section appears at the end of this standard



## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[D409 Test Method for Grindability of Coal by the Hardgrove-Machine Method](#)

[D2013 Practice for Preparing Coal Samples for Analysis](#)

[D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)

[D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants](#)

[D4930 Test Method for Dust Control Material on Calcined Petroleum Coke](#)

[D6970 Practice for Collection of Calcined Petroleum Coke Samples for Analysis](#)

[D8145 Practice for Sampling of Green Petroleum Coke](#)

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [D4175](#).

3.1.2 *calcined petroleum coke, n*—petroleum coke that has been thermally treated to drive off the volatile matter and to develop crystalline structure.

3.1.3 *fluid coke, n*—petroleum coke with a granular, microscopic layered structure resulting from injection of petroleum feedstock into a flowing, loose bed of coke particles.

3.1.4 *Hardgrove Grindability Index, HGI, unitless, n—in petroleum coke technology*, measurement of the relative ease of pulverizing a raw petroleum coke or green petroleum coke in comparison with coal standards. The higher the HGI value, the easier the petroleum coke is to grind.

3.1.5 *petroleum coke, n*—solid, carbonaceous residue produced by thermal decomposition of heavy petroleum fractions or cracked stocks, or both.

3.1.6 *raw petroleum coke, n*—petroleum coke that has not been calcined.

## 4. Summary of Test Method

4.1 The sample of petroleum coke is reduced (crushed) to produce a high yield of particles passing a ~~1.19 mm (No. 16)~~ 1.18 mm [No. 16] sieve and retained on a ~~0.59 mm (No. 30)~~ 600 µm [No. 30] sieve. These particles are reduced in the hardgrove grindability machine according to Test Method [D409](#). The quantity of particles retained on a ~~0.074 mm (No. 200)~~ 75 µm [No. 200] sieve is used to calculate the HGI of the sample.

## 5. Significance and Use

5.1 The HGI is used to predict the ranking of raw petroleum cokes or calcined petroleum cokes in industrial size mills used for crushing operations. The rankings are based on energy required and feed rate or both.

5.2 The HGI is also used to select raw petroleum cokes and coals that are compatible with each other when milled together in a blend so that segregation of the blend does not occur during particle size reduction.

## 6. Hazards

6.1 Calcined petroleum coke is generally coated with a dedusting agent to decrease the occurrence and the quantity of dust during subsequent transporting of the calcined petroleum coke. The dedusting agent is an oil or suitable material. When a dedusting agent is present and is not removed prior to the determination of HGI there can be interference in the sieving step to measure the portions retained on and passing a ~~0.074 mm (No. 200)~~ 75 µm [No. 200] sieve. Removal of the dedusting agent after calcined petroleum coke is reduced to pass the ~~4.76 mm (No. 4)~~ 4.75 mm [No. 4] sieve and before stage crushing to pass the ~~1.19 mm (No. 16)~~ 1.18 mm

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.