



Standard Test Method for Ball-Pan Hardness of Activated Carbon¹

This standard is issued under the fixed designation D 3802; 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 method provides a procedure for determining the ball-pan hardness number of granular activated carbons. For the purpose of this test, granular activated carbons are those having particles 90 % of which are larger than 80 mesh (180 μm) as determined by Test Method D 2862.

1.2 *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:

B 19 Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks (Blanks)²

B 150 Specification for Aluminum Bronze Rod, Bar, and Shapes²

D 2652 Terminology Relating to Activated Carbon³

D 2854 Test Method for Apparent Density of Activated Carbon³

D 2862 Test Method for Particle Size Distribution of Granular Activated Carbon³

D 2867 Test Method for Moisture in Activated Carbon³

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁴

E 300 Practice for Sampling Industrial Chemicals⁵

3. Terminology

3.1 *General*—Terms applicable to this standard are defined in Terminology D 2652.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *nominal particle size: natural, granular, and irregularly shaped particle carbons*—that particle size range, expressed in terms of Specification E 11 sieve sizes, whose small end excludes not more than 5 % of the particle size distribution, and whose large end excludes not more than 5 % of the distribution, on a weight basis.

3.2.2 *nominal particle size: pelleted carbons*—that particle size range, expressed in terms of Specification E 11 sieve sizes, whose small end excludes not more than 10 % of the particle size distribution, and whose large end excludes not more than 5 % of the distribution, on a weight basis.

3.2.3 *small end nominal particle size*—that particle size, expressed by its equivalent Specification E 11 sieve, which defines the excluded portion of the particle size distribution at its small particle size end in accordance with 3.2.1 or 3.2.2.

4. Summary of Test Method

4.1 A screened and weighed sample of the carbon is placed in a special hardness pan with a number of stainless steel balls, then subjected to a combined rotating and tapping action for 30 min. At the end of this period, the amount of particle size degradation is determined by measuring the quantity of carbon, by weight, which is retained on a sieve whose openings are closest to one half the openings of the sieve that defines the minimum nominal particle size of the original sample.

5. Significance and Use

5.1 Several methods have been employed in the past for determining the resistance of activated carbons to particle size degradation under service conditions, including the ball-pan method, the stirring bar method, and the dust elutriation method. None of these has proved completely satisfactory for all applications, and all have been questioned by ASTM Committee D-28 on Activated Carbon as tests for establishing degradation resistance. However, the ball-pan method has been used widely in the past and has a broad history in the activated carbon industry for measuring the property loosely described as “hardness.” In this context the test is useful in establishing a measurable characteristic of a carbon. Conceding the fact that the test does not actually measure in-service resistance to degradation, it can be used to establish the comparability of lots ostensibly of the same grade of carbon.

6. Apparatus and Materials

6.1 *Mechanical Sieve Shaker*, designed to produce from 140 to 160 taps and from 280 to 320 rotating motions per minute in a stack of standard Specification E 11 sieves.⁶ Adjust the sieve shaker to accommodate the desired number of sieves, receiver

¹ This test method is under the jurisdiction of ASTM Committee D-28 on Activated Carbon and is the direct responsibility of Subcommittee D28.04 on Gas Phase Evaluation Tests.

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² *Annual Book of ASTM Standards*, Vol 02.01.

³ *Annual Book of ASTM Standards*, Vol 15.01.

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

⁵ *Annual Book of ASTM Standards*, Vol 15.05.

⁶ The Tyler Ro-Tap Sieve Shaker, Model RX-29, available from W.S. Tyler, Inc., 3200 Bessemer City Rd., P.O. Box 8900, Gastonia, NC 28053, has been found to be satisfactory.