



Standard Test Method for Bulk Density and Porosity of Granular Refractory Materials by Mercury Displacement¹

This standard is issued under the fixed designation C 493; 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 covers the determination of bulk density and total porosity of granular materials, whether susceptible to hydration or not.

NOTE 1—A test method employing water displacement, which is limited to materials not susceptible to hydration, is given in Test Method C 357.

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.* This test method involves the use of the hazardous material mercury.

2. Referenced Documents

2.1 ASTM Standards:

C 135 Test Method for True Specific Gravity of Refractory Materials by Water Immersion²

C 357 Test Method for Bulk Density of Granular Refractory Materials²

E 11 Specification for Wire-Cloth Sieves for Testing Purposes³

3. Significance and Use

3.1 Bulk density and porosity are properties that characterize the quality or consistency of quality of granular refractory material when determining its suitability for usage.

3.2 This test method can be used as one of the process or quality control tests in the manufacture or mining of refractory grain raw materials. This test method can be used also for evaluating the potential use of refractory grain raw materials.

3.3 This test method can be used to determine the consistency of quality and the potential use of purchased refractory grain raw materials.

3.4 This test method is a primary standard method and thus is suitable for use in specifications, quality control, and research and development. It can also serve as a referee test

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² *Annual Book of ASTM Standards*, Vol 15.01.

³ *Annual Book of ASTM Standards*, Vol 14.02.

method in purchasing contracts or agreements and as a base for development of more rapid, secondary test methods for use in quality control on manufactured refractory raw materials.

3.5 Fundamental assumptions inherent in this test method are that the sample is representative of the material in general and the particle size of the sample is within the range specified by the test method. Deviation from any of these assumptions negates the usefulness of the test results.

3.6 In interpreting the results of this test method, it must be recognized that the specific gravity of the material as well as the porosity affects the value obtained for bulk density. Thus, comparisons of results should only be made between like materials, or with full recognition of inherent differences between the materials being compared.

4. Apparatus

4.1 *Mercury Volumeter*, as shown in Fig. 1 and Fig. 2.

4.1.1 The vacuum is not critical. It is used to help empty the sample chamber before filling so that a shorter length of rubber tubing may be used.

4.1.2 A rubber band is snapped on hooks to hold units together while vibrating.

4.2 *Standard Sieves*, No. 4 (4.75-mm) and No. 10 (2.00-mm), conforming to Specification E 11.

NOTE 2—The Nos. 4 and 10 ASTM sieves are equivalent to 4 and 9 mesh, respectively, of the Tyler Standard Series.

4.3 *Vibrating System*, consisting of a vibrator with controls.⁴

5. Preparation of Sample

5.1 Remove the fraction retained on the No. 4 (4.75-mm) sieve from the material to be tested, and crush it to pass a No. 4 sieve in a manner to obtain a maximum amount of coarse material. Recombine with the portion passing the No. 4 sieve and screen the resultant sample to remove all material passing the No. 10 (2.00-mm) sieve.

5.1.1 If no material is retained on the No. 4 sieve, crushing is not necessary in the preparation of the sample; however, absence of this size in the original sample should be noted.

5.2 Thoroughly blend and dry the No. 4 to No. 10 sieve-size specimen to a constant weight. In the case of hydratable

⁴ A suitable vibrator is Syntron Model V-2-A, Style 2176, 115 V, 60 Hz, with a controller, Syntron Type VC-2, Style 4593, 115 V, 60 Hz, ½ A max, available from Syntron Div., 702 Lexington Ave., Homer City, PA 15748.