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Standard Guide for Dusting Attrition of Granular Activated Carbon[1]

This standard is issued under the fixed designation D5159; 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 guide presents a procedure for evaluating the resistance to dusting attrition of granular activated carbons. For the purpose of this guide, the dust attrition coefficient, DA, is defined as the weight (or calculated volume) of dust per unit time, collected on a preweighed filter, in a given vibrating device during a designated time per unit weight of carbon. The initial dust content of the sample may also be determined. Granular activated carbon is defined as a minimum of 90 % being larger than 80 mesh (0.18 mm) (see Test Methods D2867).

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.3 *This guide 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 guide to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2854 Test Method for Apparent Density of Activated Carbon

D2867 Test Methods for Moisture in Activated Carbon

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E300 Practice for Sampling Industrial Chemicals

3. Summary of Guide

3.1 A known volume of known weight of the granular activated carbon is placed in a sample holder and vibrated at constant acceleration (*g*) for a known time. The dust is carried by an air stream passing through the vibrating sample and is then collected on a preweighed filter. The quantities of dust collected in six 10-min intervals are determined by weighings on an analytical balance.

4. Significance and Use

4.1 Three forces can mechanically degrade a granular activated carbon: impact, crushing, and attrition. Of these three, attrition, or abrasion, is the most common cause of dust formation in actual service. Published test procedures to determine the "hardness" of activated carbons produce results that in general cannot be correlated with field experience. For example, the ball-pan hardness test applies all three forces to the sample in a variable manner determined by the size, shape, and density of the particles. The "stirring bar" abrasion test measures attrition so long as the particle size is smaller than 12 mesh. There is some evidence, however, that the results of this test method are influenced by particle geometry. The procedure set forth in this guide measures the effect of friction forces between vibrating or slowly moving particles during the test and may be only slightly dependent on particle size, shape and density effects.

5. Apparatus

5.1 *Vibrating Table*[3], capable of providing an RMS (root mean square) acceleration of 40 m/s/s (4 *g*).

5.2 *Test Cell,* such as shown in Fig. 1, preferably made of aluminum or other electrically conductive material.

5.3 *Piezoelectric Accelerometer*[4], capable of measuring an RMS acceleration chosen by the user. A value of 40 m/s/s (4 *g*) is suitable when using the apparatus in Fig. 1 and Fig. 2.

5.4 *Signal Conditioner*[5], to interface the accelerometer with an AC millivolt meter, capable of producing a linear output voltage from 0 to 1 V-ac, proportional to the acceleration.

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

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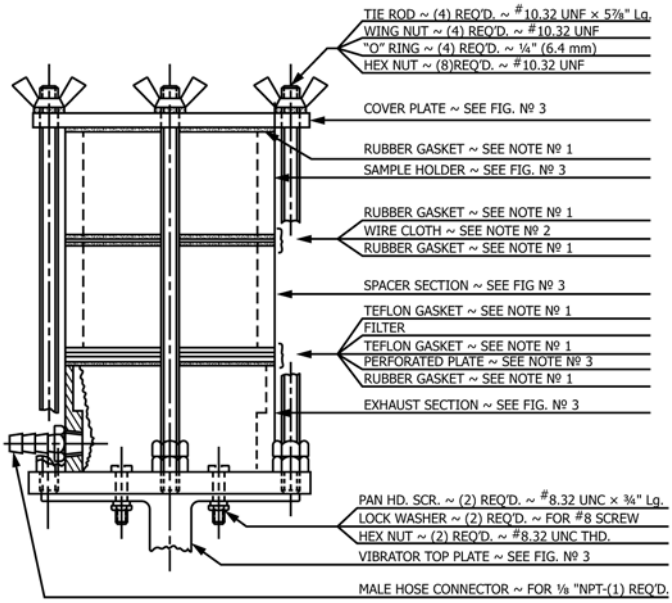
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] A Buffalo Dental Manufacturing Co., (Underhill Blvd., Syosset, NY 11791) vibrator, Model No. 1, rated 40 W at 115 V, 60 Hz, and a Syntron Model J-1A vibrating jogger, rated 30 W at 115 V, 60 Hz, have been found suitable for this purpose.

[4] An Endevco accelerometer, Model No. 2251, has been found suitable for this purpose.

[5] An Endevco Model 4416 signal conditioner, battery operated, has been found suitable for this purpose.

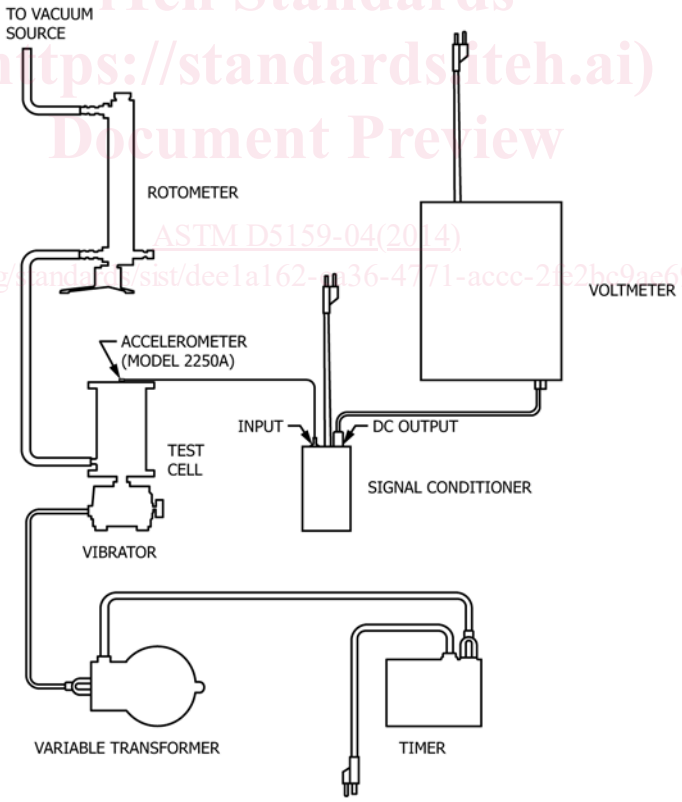


NOTE 1—2¾ in. (69.9 mm) inside diameter by 3 in. (76.2 mm) outside diameter by 1⁄16 in. (1.6 mm) thick.

NOTE 2— Specification E11 wire cloth, 250 µm, stainless wire, 3 in. (76.2 mm) diameter.

NOTE 3—37 % open area, fabricated from 24 gage stainless steel with 0.45 in. (11.4 mm) diameter holes on 0.066 in. (1.68 mm) centers, square grid 3 in. (76.2 mm) diameter.

FIG. 1 Dust Attrition Cell (full scale)



NOTE 1—An Endevco accelerator, Model 2250A, has been found satisfactory for this purpose.

FIG. 2 Apparatus Assembly