Designation: F735 – 06

Standard Test Method for Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method[1]

This standard is issued under the fixed designation F735; 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 determines the resistance of transparent plastics and transparent coatings utilized in windows or viewing ports, to surface abrasion using oscillating sand.

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:*[2]

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

D618 Practice for Conditioning Plastics for Testing

D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Summary of Test Method

3.1 The test method consists of measuring and recording the haze and light transmission of a test specimen, mounting the specimen so that it forms part of the bottom tray (sand cradle), covering the specimen with abrading media, and subjecting the cradle to a specific number of oscillations. After exposure to the abrasion, the haze and light transmission are remeasured to determine any change in these values.

3.2 At the stroke velocity specified in this practice, the entire mass of sand shifts significantly within the sand cradle because of its inertia; therefore the relative motion between sand and specimen at the interface is large.

3.3 The thickness or height of the sand resting on top of the test specimen remains relatively constant during the motion of the cradle. Therefore, the average pressure of the sand also remains constant, giving highly reproducible results over the entire surface of the test specimen.

3.4 The degree of abrasion is measured by the amount of change in luminous transmission and haze after exposure to the test.

4. Significance and Use

4.1 Plastic materials, when used as transparencies, covers, or enclosures, are subject to wiping, cleaning, or other types of rubbing actions that cause abrasion. It is the intent of this test method to provide a means of estimating the resistance of such materials to this type and degree of abrasion.

5. Apparatus

5.1 *Abrader*—The abrader consists of a specimen holder, sand cradle, drive mechanism, variable power supply and counter. One such example is shown in Fig. 1.

5.1.1 The specimen holder shall have a cutout approximately 100 by 100 mm (4 by 4 in.) to receive the specimen. The specimen shall be mounted flush to within 1 mm (0.04 in.) high with the specimen holder.

5.1.2 The specimen holder forms the bottom of the sand cradle.

5.1.3 Sufficient abradent will be used to fill the sand cradle 13-mm (0.50 in.) above the sample surface..

5.1.4 A drive mechanism shall provide 300 strokes per minute of reciprocating motion of approximately 100-mm (4-in.) travel. Motion in one direction is defined as one stroke. One forward stroke and one reverse stroke is defined as one oscillation.

5.1.5 A variable power supply shall be utilized to control the abrader motor to operate at 300 strokes per minute.

5.1.6 A counter shall record the number of strokes during a test.

[1] This test method is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.08 in Transparent Enclosures and Materials.

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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.

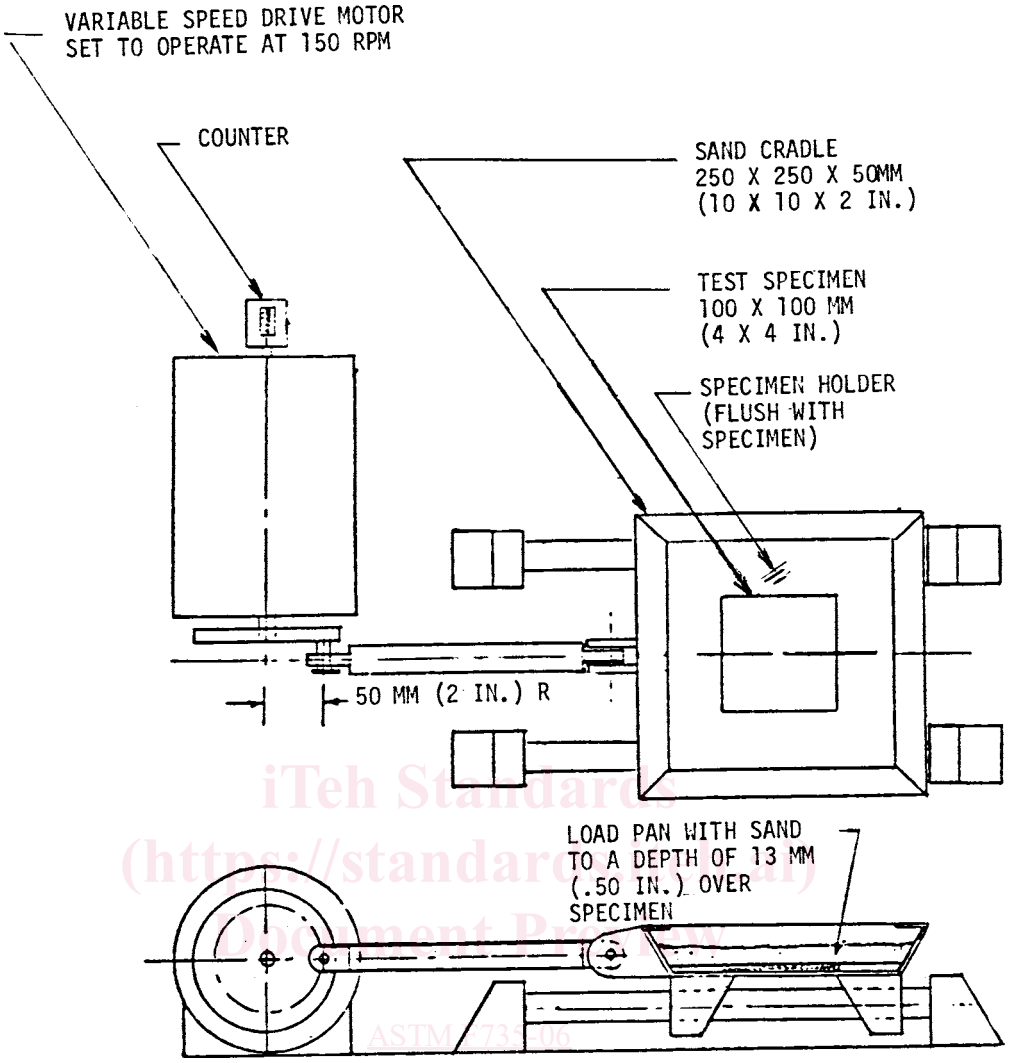

FIG. 1 Oscillating Sand Abrader

5.2 *Photometer*—An integrating sphere photoelectric photometer, described in Test Method D1003, shall be used to measure the light scattered by the abraded surface.

6. Reagents and Materials

6.1 *Abrading Medium—Quartz Sand*[3]—The sand shall be quartz silica, graded 4/10, and shall meet the following requirements:

6.1.1 *Properties*—See Table 1.

6.1.2 *Test Methods*:

NOTE 1—These tests need be applied only when qualifying a new supply of sand.

6.1.2.1 Perform sieve analysis in accordance with Test Method C136.

TABLE 1 Properties

E11 Sieve Designation		Mean % on Sieve	Standard Deviation, %	Cululative % Retained, Mean
U.S. No	mm			
4	4.75	0		0
6	3.35	7.6		7.6
7	2.8	22.3		29.9
8	2.36	45.1		75.0
10	2.00	21.9		96.9
12	1.70	2.6		99.5
Pan	...	0.5		100.0

[A] Roundness 0.6+; Sphericity 0.6+; Hardness 7.0; S.G. 2.65, Loss on Ignition 0.1; MP 2800°/3100°; Color Tan/White; pH 6.9-7.0.
Typical Chemical Content (%); SiO_2 99.48; Fe_2O_3 0.06; Al_2O_3 0.21; MgO < 0.01; CaO < 0.01; and TiO_2< 0.01.

6.1.2.2 Plot the cumulative percent retained, on logarithmic probability paper.

6.1.2.3 Read from the plot the sizes in millimetres at 40, 50, and 90 % retained.

6.1.2.4 Calculate the uniformity coefficient as the ratio (millimetres at 40 %/millimetres at 90 %).

6.1.2.5 Count out 100 grains, taking care to be nonselective, and weigh to ± 10 mg.

[3] The sole source of supply of the sand known to the committee at this time is Oglebay Norton Industrial Sands, Brady, TX 76825. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.