



Designation: F735 – 22

Standard Test Method for Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method¹

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 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.*

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

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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 on 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.

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. At specified intervals, the test specimen is cleaned then the haze and light transmission are remeasured to determine any change in these values. The degree of surface abrasion is determined by the amount of change in light transmission and haze.

3.2 At the stroke velocity specified in this test method, 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.

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, and counter. One such example is shown in Fig. 1.

5.1.1 The specimen holder shall have a cutout approximately 100 mm by 100 mm to receive the specimen. Alternative specimen holders can be used to test other specimen sizes as long as they can be used within the testing limitations defined in this test method.

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

5.1.3 The sand cradle shall be approximately 250 mm × 250 mm × 50 mm, with the sides set at an angle of 60°.

5.1.4 A drive mechanism shall provide 300 strokes per minute of reciprocating motion of approximately 100 mm

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

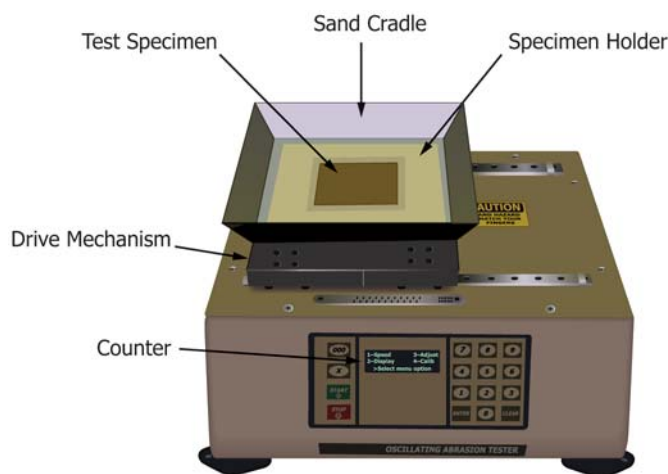


FIG. 1 Oscillating Sand Abrader

travel. Motion in one direction is defined as one stroke. One forward stroke and one reverse stroke are defined as one oscillation or cycle.

5.1.5 A counter shall record the number of strokes (or cycles) during a test.

5.2 *Photometer*—An integrating sphere photoelectric photometer (hazemeter), described in Test Method D1003, shall be used to measure light transmission and haze.

6. Reagents and Materials

6.1 *Abrading Medium—Quartz Sand*³—The sand shall be quartz silica, graded 6/9, and shall meet the following requirements:

6.1.1 *Properties (typical)*—See Table 1 for sieve analysis percent retained.

NOTE 1—The use of quartz silica sand 6/12 or 4/10 specified in previous versions of this test method can still be used if available. See Appendix X1 for additional details

³ The sole source of supply of the sand known to the committee at this time is Premier Silica LLC, 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.

TABLE 1 Properties

E11 Sieve Designation		Individual % Weight Retained
U.S. No.	mm	
5	4.00	0 – 7
6	3.36	2 – 11
7	2.83	15 – 25
8	2.38	30 – 50
10	2.00	20 – 40
12	1.68	1 – 7
Pan	...	< 1 – 5

Physical Analysis: 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 Neutral 7.0. Chemical Content (%): SiO₂ 99.48; Fe₂O₃ 0.06; Al₂O₃ 0.21; MgO < 0.01; CaO < 0.01; and TiO₂ < 0.01.

7. Test Specimens

7.1 The specimens shall be clean, transparent plates, 100 mm square, having both sides substantially plane and parallel, unless otherwise specified and defined in 5.1.1. Three specimens shall be tested. Any specimen thickness can be utilized provided the specimen is flush with the specimen holder when mounted (see 9.2).

NOTE 2—A protective backing material may be applied to the unabraded side of the specimen to prevent scratching during testing and handling. Prior to measuring light transmission and haze, remove the backing material and clean the specimen thoroughly according to 9.1.

8. Conditioning

8.1 Where conditioning of the test specimen is required, utilize Procedure A of Practice D618.

8.2 Tests shall be conducted in the Standard Laboratory Atmosphere of 23 ± 2 °C and 50 ± 5 % relative humidity, unless otherwise specified.

9. Procedure

9.1 Prior to testing, clean the specimen using the following procedure. Handle specimen by edges only. Wash both sides of the specimen with 50:50 isopropyl alcohol (IPA) / distilled water and a clean 100 % lint free cotton cloth. Soak the cloth first, and then use a linear motion to wipe the test specimen; first wipe the specimen vertically, then wipe the specimen horizontally, and as a final step, wipe the edges. Dry by blowing lightly with filtered air or nitrogen. Alternative acceptable cleaning methods can be used if agreed between the interested parties.

9.2 Measure the specimen's initial average light transmission and haze. Using a photoelectric, integrating sphere photometer and Test Method D1003, measure the percentage of transmitted light and percent of haze in three different locations on the specimen. The abraded side of the specimen shall be placed against the entrance port of the integrating sphere of the photometer (facing away from the light source). Report as the average.