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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Mar Resistance of Plastics¹

This standard is issued under the fixed designation D 673; 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.

This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—Section 13, Keywords, was added editorially in February 1995.

1. Scope

1.1 This test method covers the determination of the resistance of plastics to surface marring caused by falling abrasive particles. Materials such as films, molded, or laminated plastics may be evaluated.

1.2 A surface to be tested should be relatively flat and smooth; the damage done by a falling object is a function of the angle at which it strikes. Since deterioration is usually measured optically, the material evaluated is normally of high initial gloss or low initial haze.

1.3 In other than flat form, materials may be compared visually. Care must be exercised to use the same shape of specimen throughout and to have the abrasive fall on the same area at the same angle.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *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.*

NOTE 1—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

D 523 Test Method for Specular Gloss²

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³

D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics³

D 2457 Test Method for Specular Gloss of Plastic Films and Solid Plastics⁴

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

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In 1970, the obsolete gloss method previously used was deleted. Current procedures for determining gloss and haze are specified in 9.4 and 9.5.

² Annual Book of ASTM Standards, Vol 06.01.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.

D 4000 Classification System for Specifying Plastic Materials⁴

3. Summary of Test Method

3.1 A series of abraded spots is made on the surface of the test specimen. Increasing amounts of abrasive material are dropped from a fixed height.

3.2 The change in gloss produced by the abrasive action may be determined optically for plastics with high initial gloss. The haze of abraded transparent materials is measured and compared with the haze originally present.

4. Significance and Use

4.1 This test method provides a relatively mild particle-impingement type of abrasive action where hard sharp particles impact and tumble along a material's surface creating a group of gouges or pits. There is usually an accompanying loss of wear debris from the sample. The test best simulates situations where airborne particulates abrade a material's surface during actual use. Different materials may be ranked in terms of their relative resistance over a range of test severities.

4.2 For many materials, there may be a specification that requires the use of this test method, but with some procedural modifications that take precedence when adhering to the specification. Therefore, it is advisable to refer to that material specification before using this test method. Table 1 of Classification D 4000 lists the ASTM materials standards that currently exist.

5. Apparatus⁵

5.1 *Abrader*, consisting of a tube fitted with a rotatable hopper, as shown in Fig. 1.

5.1.1 *Tube*, glass, metal, or plastic (A, Fig. 1), supported vertically, through which abrasive is dropped a distance of 635 mm on a test specimen supported at an angle of 45° to the axis of the tube. The tube shall conform to the dimensions shown in Fig. 2.

5.1.2 *Hopper* (B, Fig. 1), to distribute the abrasive and

⁵ Complete working drawings of an apparatus that meets the requirements of this test method are obtainable from ASTM Headquarters. Request Adjunct No. 12-406730-00. One such apparatus is the CS-269 Mar Tester, available from Custom Scientific Instruments (CSI), 13 Wing Dr., Cedar Knolls, NJ 07927.

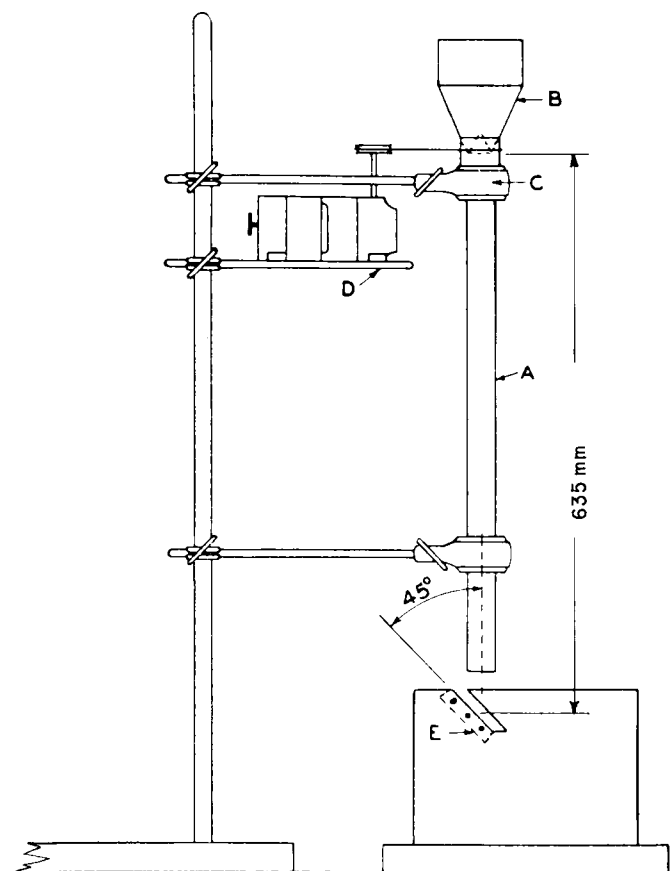


FIG. 1 Abrader

produce on the specimen a uniformly abraded spot about 20 mm in diameter. The hopper shall be rotated at about 7 rpm and feed abrasive at 200 to 250 g/min. Details of construction of the hopper are shown in Fig. 2. It may be formed from thin sheet metal with soldered seams. It shall have a double conical bottom with six holes 1.8 mm in diameter arranged in a 16-mm diameter circle at the bottom edge, and 1 hole 1.8 mm in diameter at the apex of the middle cone. The inside of the hopper should be smooth and highly polished.

5.1.3 *Ball Bearing (C, Fig. 1 and Fig. 2)*, 57 mm in outside diameter and 32 mm in inside diameter, with sealed balls. The outside ring of the bearing shall be rigidly held in position.

5.1.4 *Tube*, brass or copper (see Fig. 2), about 38 mm long fitted tightly into the bearing. The inside diameter shall be slightly over 25 mm to permit the top of tube A to extend into it to just below the lower edge of the hopper. Supports for the hopper shall be soldered to the tube. The portion of the tube above the bearing serves as a pulley for rotating the hopper assembly.

5.1.5 *Electric Motor*, small, for rotating the hopper assembly at a speed of about 7 rpm.

5.1.6 *Receptacle for Abrasive (F, Fig. 1)*, about 200 by 200 by 200 mm. The receptacle may be slotted on two sides at 45° as shown in Fig. 1 to permit sliding sheet specimens past the bottom of Tube A.

5.1.7 *Support for Test Specimen*, plywood, with spring clips, mounted in the receptacle at 45° to the axis of the tube and directly under the tube.

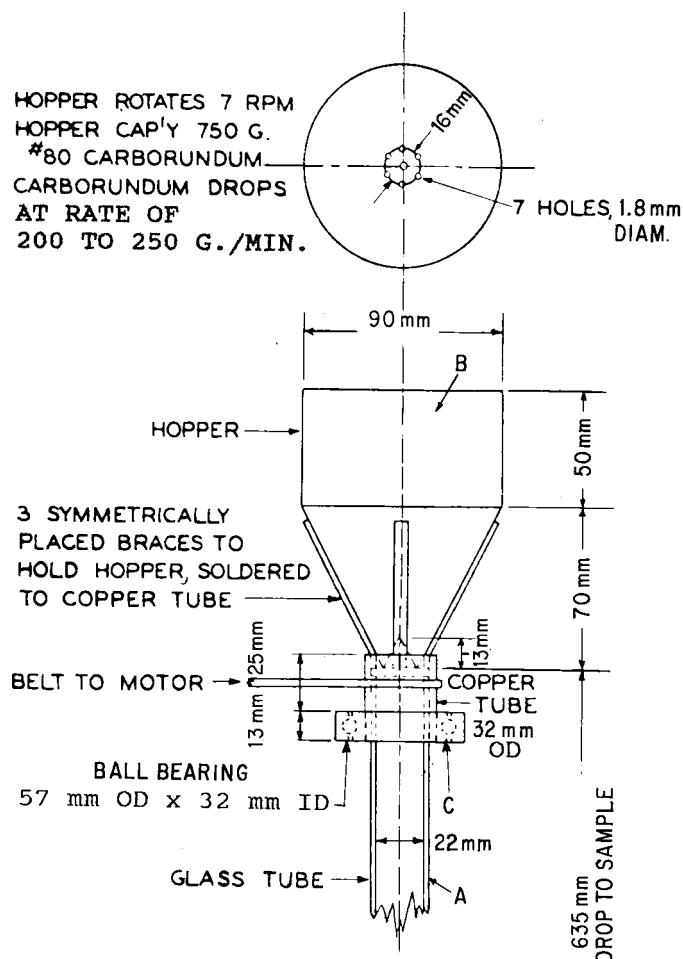


FIG. 2 Details of Hopper Assembly

NOTE 2—In testing specimens that are not self-supporting, a more rigid support may be desirable. The rigidity of the support used can impact the outcome of the test. Therefore, caution is recommended when comparing test results obtained with different support materials.

5.1.8 *Glossmeter or Hazemeter*—Haze shall be measured using an integrating sphere photometer as described in Test Method D 1003. Specular gloss shall be measured with a parallel or converging beam glossmeter as described in Test Method D 523.

6. Materials

6.1 *Abrasive*—No. 80 silicon carbide.

NOTE 3—It has been found that with continued use of the same batch of abrasive, the apparent abrasion resistance of a given material gradually improves. The abrasive particles may break up, or the edges may become dulled. Therefore, it is recommended that no more than 50 tests be made with a given batch of abrasive. It is also advisable to periodically pass the abrasive through a No. 60 (250-μm) sieve and collect it on a No. 120 (125-μm) sieve. This serves to remove extraneous matter and fine particles.

7. Test Specimen

7.1 The test specimen shall have a flat surface at least 50 by 50 mm, for each determination. A sheet 50 by 250 mm will be sufficient for five tests.