Designation: D 1938 – 02

Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method[1]

This standard is issued under the fixed designation D 1938; 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 the force necessary to propagate a tear in plastic film and thin sheeting (thickness of 1 mm (0.04 in.) or less) by a single-tear method. The method is not applicable for film or sheeting material where brittle failures occur during testing.

NOTE 1—Film has been arbitrarily defined as sheeting having nominal thickness not greater than 0.25 mm (0.010 in.).

1.2 *Constant-Rate-of-Grip Separation Test* —This test method employs a constant rate of separation of the grips holding the test specimen.

1.2.1 Specimen extension may be measured in this test method by grip separation.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.4 *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 2—This standard is similar to ISO 6383-1, but is not considered technically equivalent. The specimen size for ISO 6383-1 is larger, and the method specifies different test speeds.

2. Referenced Documents

2.1 *ASTM Standards:*

D 374 Test Methods for Thickness of Solid Electrical Insulation[2]

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[3]

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting[3]

D 883 Terminology Relating to Plastics[3]

D 4000 Classification System for Specifying Plastic Materials[4]

E 4 Practices for Load Verification of Testing Machines[5]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[6]

2.2 *ISO Standard:*

ISO 6383-1 Film and Sheeting—Determination of Tear Resistance Part 1 Trouser Tear Method[7]

3. Terminology

3.1 *Definitions:* For definitions of terms used in this test method, refer to Terminology D 883.

4. Summary of Test Method

4.1 The force to propagate a tear across a film or sheeting specimen is measured using a constant-rate-of-grip separation machine as described in Test Methods D 882 and is calculated from the load-time chart.

5. Significance and Use

5.1 This test method is of value in rating the tear-propagation resistance of various plastic films and thin sheeting of comparable thickness. For highly extensible film or sheeting the deformation energy of the specimen legs is significantly greater than the tearing energy. The tear-propagation resistance in slightly extensible or non-extensible film or sheeting is distinguished from the tear-propagation resistance in highly extensible film or sheeting by the load-time or load-displacement data, (Fig. 1 and Fig. 2). The tear-propagation force for slightly extensible or non-extensible material is determined from the average tear force versus the initial and peak force for a highly extensible material.

5.2 This test method should be used for specification acceptance testing only after it has been demonstrated that the data for the particular material are acceptably reproducible.

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film and Sheeting.

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[2] *Annual Book of ASTM Standards*, Vol 10.01.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 08.02.

[5] *Annual Book of ASTM Standards*, Vol 03.01.

[6] *Annual Book of ASTM Standards*, Vol 14.02.

[7] Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

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

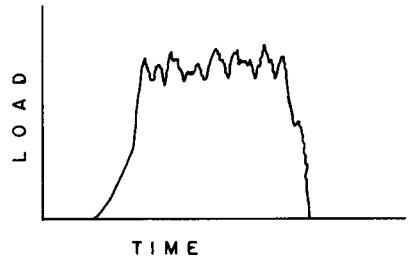

FIG. 1 Load-Time Chart for Low-Extensible Film

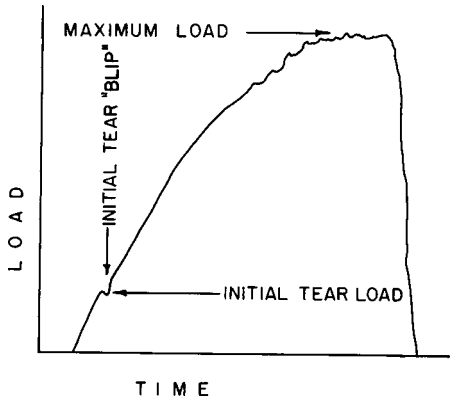

FIG. 2 Load-Time Chart for Highly Extensible Film

5.3 The data obtained by this test method furnish information for ranking the tear-propagation resistance of plastic films and sheeting of similar composition. Actual use performance may not necessarily correlate with data from this test method. Sets of data from specimens of dissimilar thickness are usually not comparable.

5.4 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 System D 4000 lists the ASTM materials standards that currently exist.

6. Apparatus

6.1 *Testing Machine*—A testing machine of the constant rate-of crosshead-movement type and comprising essentially the following:

6.1.1 *Fixed Member*—A fixed or essentially stationary member carrying one grip.

6.1.2 *Movable Member*—A movable member carrying a second grip.

6.1.3 *Grips*—Perferably, a set of self-aligning grips for holding the test specimen between the fixed member and the movable member of the testing machine. The grips should minimize both slippage and uneven stress distribution.

6.1.3.1 Fixed grips are rigidly attached to the fixed and movable members of the testing machine. Fixed grips may be used if extreme care is taken to ensure that the test specimen is inserted and clamped so that the long axis of the test specimen coincides with the direction of pull through the center line of the grip assembly.

6.1.3.2 Self-aligning grips are attached to the fixed and movable member of the testing machine in such a manner that they will move freely into alignment as soon as any load is applied so that the long axis of the test specimen will coincide with the direction of the applied pull through the center line of the grip assembly. The specimens should be aligned as perfectly as possible with the direction of pull so that no rotary motion that may induce slippage will occur in the grips; there is a limit to the amount of misalignment self-aligning grips will accommodate.

NOTE 3—Grips lined with thin rubber have successfully been used. Grips may be of the self-tightening type. In cases where specimens frequently fail at the edge of the grips, the radius of curvature of the edges of the grips may be increased slightly at the point where they come in contact with the specimen.

6.1.4 *Drive Mechanism*—A drive mechanism capable of separating the movable member (grip) from the stationary member (grip) at a controlled velocity of 250 mm (10 in.) ± 5 %/min.

6.1.5 *Load Indicator*—A suitable load-indicating mechanism capable of showing the total tensile load carried by the test specimen held by the grips. The testing machine shall be essentially free from inertia lag at the specified rate of testing and shall indicate the load with an accuracy of ±1 %. The accuracy of the testing machine shall be verified in accordance with Practices E 4.

6.1.6 *Crosshead Extension Indicator*—A suitable extension-indicating mechanism capable of showing the amount of change in the separation of the grips (crosshead movement).

6.2 *Thickness*—A micrometer as prescribed in Test Methods D 374 or an equivalent measuring device, reading to 0.0025 mm (0.0001 in.) or less. The pressure exerted by the gage on the specimen being measured shall not distort or deform the specimen. For thin films, ≤ 0.0025 mm (0.001 in.), or films which exhibit visual deformation during measurement, a maximum pressure of 70 kPa (10 psi) is recommended. For thicker or stiffer films, the pressure shall be between 160 and 185 kPa (23 and 27 psi).

6.3 *Die*—A die having the dimensions shown in Fig. 3 shall be used to cut all specimens. The cutting edge of the die shall have a 5° negative rake, and shall be kept sharp and free from nicks to avoid leaving ragged edges on the specimen. The sample shall rest on a smooth, slightly yielding surface that

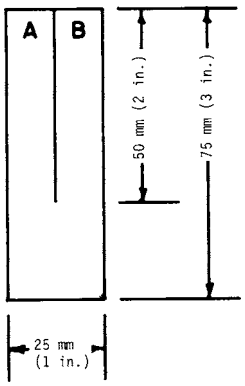

FIG. 3 Single-Tear Specimen