



Standard Test Method for Total Energy Impact of Plastic Films By Dart Drop¹

This standard is issued under the fixed designation D4272; 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 describes the determination of the total energy impact of plastic films by measuring the kinetic energy lost by a free-falling dart that passes through the film.

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

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 and health practices and determine the applicability of regulatory limitations prior to use.*

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

NOTE 2—This test method and ISO 7765–2 address the same subject matter, but differ in technical content (and results cannot be directly compared between the two test methods). The ISO test method calls for a direct readout of energy by using a load cell as part of the impactor head, while Test Method D4272 calls for a constant weight impactor, then measuring the time of travel through a given distance to get energy values.

2. Referenced Documents

2.1 ASTM Standards:²

- D618 Practice for Conditioning Plastics for Testing
- D883 Terminology Relating to Plastics
- D1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method
- D3420 Test Method for Pendulum Impact Resistance of Plastic Film
- D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens
- D6988 Guide for Determination of Thickness of Plastic Film Test Specimens
- E171 Practice for Conditioning and Testing Flexible Barrier Packaging

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, Sheeting, and Molded Products.

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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.

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

2.2 ISO Standard:³

ISO 7765–2 Plastics Film and Sheeting—Determination of Impact Resistance by the Free Falling Dart Method—Part 2: Instrumented Puncture Test

3. Terminology

3.1 *Terminology*—For definitions, see Terminology D883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *free-fall time*—the measured time required for the dart to travel through the sensing area with no film specimen in the clamp.

3.2.2 *missile mass (SI units)*—the total mass of the dart (kg) including any attached incremental weights and the locking collar.

3.2.3 *missile weight (in.-lb units)*—the total weight of the dart (lb) including any attached incremental weights and the locking collar.

3.2.3.1 *Discussion*—In the energy calculation, the weight is divided by the gravitational constant, “g” to obtain the mass.

3.2.4 *test-fall time*—the measured time for the dart to travel through the sensing area with a film specimen in the clamp.

4. Summary of Test Method

4.1 The velocity of a freely falling dart of specified shape that has passed through a sheet of plastic film is determined by means of a photoelectric speed trap. The kinetic energy corresponding to this velocity is calculated and compared with the kinetic energy of the same dart measured without a plastic film in place. The loss in kinetic energy of the dart due to rupturing of the film is used as an index of impact resistance.

5. Significance and Use

5.1 Evaluation of the impact toughness of film is important in predicting the performance of a material in applications such as packaging, construction, and other uses. The test simulates the action encountered in applications where moderate-velocity blunt impacts occur in relatively small areas of film.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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