



Designation: D689 – 17 (Reapproved 2024)

Standard Test Method for Internal Tearing Resistance of Paper¹

This standard is issued under the fixed designation D689; 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 U.S. Department of Defense.

1. Scope

1.1 This test method measures the force perpendicular to the plane of the paper required to tear multiple sheets of paper through a specified distance after the tear has been started, using an Elmendorf-type tearing tester. The measured results can be used to calculate the approximate tearing resistance of a single sheet. In the case of tearing a single sheet of paper, the tearing resistance is measured directly.

NOTE 1—Similar procedures for making Elmendorf-type tear measurements are found in ISO 1974 and TAPPI T414.

1.2 This test method is not suitable for determining the cross-directional tearing resistance of highly directional boards and papers.

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

D646 Test Method for Mass Per Unit Area of Paper and Paperboard of Aramid Papers (Basis Weight) (Withdrawn 2022)³

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.01 on Electrical Insulating 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.

³ The last approved version of this historical standard is referenced on www.astm.org.

D685 Practice for Conditioning Paper and Paper Products for Testing

D1749 Practice for Interlaboratory Evaluation of Test Methods Used with Paper and Paper Products (Withdrawn 2010)³

E178 Practice for Dealing With Outlying Observations

2.2 *ISO Standard:*⁴

ISO 1974 Paper—Determination of Tearing Resistance (Elmendorf method)

2.3 *TAPPI Standard:*⁵

TAPPI T414 Internal Tearing Resistance of Paper

3. Summary of Test Method

3.1 One or more sheets of the sample material are torn together through a fixed distance by means of the pendulum of an Elmendorf-type tearing tester. The work done in tearing is measured by the loss in potential energy of the pendulum. The instrument scale is calibrated to indicate the average force exerted when a certain number of plies are torn together (work done divided by the total distance torn).

4. Significance and Use

4.1 This test method is widely used within the paper industry, in conjunction with other tests of strength, as a predictor of end-use performance of a wide range of grades of papers.

5. Apparatus

5.1 *Elmendorf-type Tearing Tester*—Several types are available and in use throughout the world, principally those of Australian, British, German, Swedish, and United States manufacture. In addition, testing practices also vary.

5.2 *Instrumental and Procedural Variables*—Instruments and practices in use vary in at least two major respects:

5.2.1 *The Design of the Specimen Clamps*—Together with the structural characteristics of the paper governing the nature of the tear with respect to its splitting tendencies during the

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

⁵ Available from the Technical Association of the Pulp and Paper Industrial, P.O. Box 105113, Atlanta, GA 30348.