



# Standard Specification for Bond and Ledger Papers for Permanent Records<sup>1</sup>

This standard is issued under the fixed designation D 3290; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers bond and ledger papers used in the preparation of records and documents that are expected to have maximum, or substantial, life expectancy.

1.2 It has been shown (1, 2, 3, 4, 5)<sup>2</sup> that life expectancy is at least an approximate function of the pH of an aqueous extract of the paper. Three pH levels, reflecting three levels of life expectancy, are specified.

1.3 The following would be expected to contribute significantly to the life expectancy of books and documents: the use of papers with controlled acidity, or of papers manufactured under neutral or alkaline conditions, especially papers with a calcium carbonate filler that absorbs acidic gases from the atmosphere and can neutralize acidic materials formed in the aging of paper.

1.4 This specification is based on fiber sources used in the production of paper that contains no more than 1 % lignin, for papers used in archives, libraries, and other permanent records. However, under proper conditions, (see X1.5), paper containing more than 1 % lignin may be employed for other end uses in paper for records that are required to have a substantial life expectancy.

1.5 As indicated in Appendix X1.4 and X1.5, this specification may be used as a guide.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

**D 585** Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product

**D 589** Test Method for Opacity of Paper (15° Diffuse Illuminant A, 89 % Reflectance Backing and Paper Backing)

**D 646** Test Method for Grammage of Paper and Paperboard (Mass Per Unit Area)

**D 1030** Test Method for Fiber Analysis of Paper and Paperboard

**D 1968** Terminology Relating to Paper and Paper Products

**D 2176** Test Method for Folding Endurance of Paper by the M.I.T. Tester

**D 3424** Test Methods for Evaluating the Relative Lightfastness and Weatherability of Printed Matter

**D 4714** Test Method for Determination of Effect of Moist Heat (50 % Relative Humidity and 90°C) on Properties of Paper and Board

**D 4988** Test Method for Determination of Alkalinity of Paper as Calcium Carbonate (Alkaline Reserve of Paper)

**D 5625** Test Method for Measuring Length, Width, and Squareness of Sheeted Paper and Paper Products

**D 5634** Guide for Selection of Permanent and Durable Offset and Book Papers

### 2.2 TAPPI Standards:

T 236 Kappa Number of Pulp<sup>4</sup>

T 400 Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, or Related Products<sup>4</sup>

T 401 Fiber Analysis of Paper and Paperboard<sup>4</sup>

T 410 Grammage of Paper and Paperboard (Weight per Unit Area)<sup>4</sup>

T 411 Thickness (Caliper) of Paper and Paperboard<sup>4</sup>

T 412 Moisture in Paper<sup>4</sup>

T 414 Internal Tearing Resistance of Paper<sup>4</sup>

T 425 Opacity of Paper (15°/Diffuse Illuminant A)<sup>4</sup>

T 452 Brightness of Pulp, Paper, and Paperboard (Directional Reflectance at 457 nm)<sup>4</sup>

T 509 Hydrogen Ion Concentration (pH) of Paper Extracts—Cold Extraction Method<sup>4</sup>

T 511 Folding Endurance of Paper (MIT Tester)<sup>4</sup>

T 544 Effect of Moist Heat on Properties of Paper and Board<sup>4</sup>

### 2.3 ISO Standards:

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D06 on Paper and Paper Products and is the direct responsibility of Subcommittee D06.92 on Test Methods.

Current edition approved Sept. 1, 2005. Published September 2005. Originally approved in 1974. Last previous edition approved in 2000 as D 3290 – 00.

<sup>2</sup> The boldface numbers in parentheses refer to the list of references at the end of this specification.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> Available from The Technical Association of The Pulp and Paper Industry, 15 Technology Parkway South, Norcross, GA 30092.

ISO 9706 Paper for Documents. Specifications for Permanence. Normative Annex—Special instructions for determining kappa number.<sup>5</sup>

### 3. Terminology

3.1 *Definitions*—Terms used in this specification are defined in accordance with Terminology **D 1968**.

3.1.1 *acid-sized paper, n*—paper that has been manufactured using a procedure or process at pH values below 7 (usually 4.0 to 6.5) that results in paper that has resistance to water penetration.

3.1.2 *alkaline-filled paper, n*—a paper containing an alkaline filler, such as calcium carbonate having a pH value in excess of 7 (extract pH usually in the range from 7.5 to 10.0), and containing a reserve buffering capacity that can neutralize acidic materials in the paper or acidic gases sorbed from the atmosphere.

3.1.2.1 *Discussion*—Such a paper is alkaline (extract pH usually in the range 7.5 to 10.0) and contains a reserve buffering capacity that can neutralize acidic gases sorbed from the atmosphere, or from the paper during degradation.

3.1.3 *alkaline-sized paper, n*—paper that has been manufactured using a procedure or process at a pH value above 7 (usually 7.5 to 10.0) that results in a paper that has resistance to liquid penetration.

3.1.4 *base paper, n*—the fiber network existent prior to the application of any material onto the surface of that fiber network.

3.1.4.1 *Discussion*—An example is paper, internally sized in preparation for a coating or surface sizing operation.

3.1.5 *bond paper, n*—one of many grades of paper covering a wide range of quality, from grades requiring superior performance, strength and durability to applications where permanence and durability are less important, but in all cases requiring good printing properties, color fidelity, erasability and cleanliness.

3.1.6 *ledger paper, n*—a paper characterized by strength, high tearing resistance, erasability, water resistance, ink receptivity, uniformity of surface, and smoothness.

3.1.6.1 *Discussion*—Originally, ledger paper was used especially for pen and ink records. Most ledger papers are surface sized, frequently subjected to appreciable wear, and must have a high degree of permanence and durability.

3.1.7 *neutral sized paper, n*—paper that has been manufactured using a procedure or process at a pH value of 7 (with a normal range of 6.5 to 7.5) that results in a paper that has resistance to water penetration.

#### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *durability, n—of paper*, the capacity of paper or paperboard to resist the effects of wear in performance situations.

3.2.1.1 *Discussion*—Durability should not be used interchangeably with permanence. For example, paper money should be durable, but maximum permanence is not essential.

3.2.2 *high referral, adj—in paper*, descriptive of any grade of paper designed for use in situations involving frequent handling.

3.2.3 *life expectancy (LE), n—for paper*, length of time a product can be expected to maintain its functional (that is, physical, chemical, appearance and so forth) characteristics when stored under prescribed conditions.

3.2.3.1 *LE designation, n—for paper records*, a rating in years for the life expectancy of paper, under prescribed conditions, primarily for records.

3.2.3.2 *maximum life expectancy (LE-1000), n—for paper*, the document is expected to be usable for 1000 years under prescribed conditions.

3.2.3.3 *high life expectancy (LE-100), n—for paper*, the document is expected to be usable for 100 years under prescribed conditions.

3.2.3.4 *medium life expectancy (LE-50), n—for paper*, the document is expected to be usable for 50 years under prescribed conditions.

3.2.4 *paper with a minimum pH value, n*—as the life expectancy of paper is an approximate function of pH, one approach to describing a permanent paper is to specify a minimum pH value, for example, 5.5; this value can be achieved with a rosin-alum sizing system.

3.2.5 *permanence, n—of paper*, the tendency to resist changes in any or all of its properties with the passage of time.

3.2.5.1 *Discussion*—It is expected that the terms maximum, high, and medium permanence eventually will be replaced with maximum, high and medium life expectancy, or with the LE designations LE-1000, LE-100, LE-50.

### 4. Significance and Use

4.1 The only completely valid way to check the life expectancy of paper is to store it under the relevant conditions for the expected lifetime of the document, perhaps several hundred years. As this is not feasible, one must rely on observations made on historical documents, and on our current knowledge of factors, in terms of paper properties and paper composition, that increases life expectancy. Accelerated aging also may be used.

4.2 In this specification, requirements are given in terms of the following:

4.2.1 Physical tests to identify potential durability in service,

4.2.2 Tests related to composition of the paper that are indicative of stability,

4.2.2.1 For maximum life expectancy, the presence of an alkaline filler, such as calcium carbonate, to serve as a buffering agent,

4.2.2.2 Fiber analysis, or a certificate from the supplier concerning fiber composition, and

4.2.2.3 A test for pH, within the limits described in **7.2.4**.

4.3 Papers with neutral or alkaline pH without a calcium carbonate filler may, or may not, have the expected life expectancy. An acid paper may have been treated with a surface size containing enough calcium carbonate to give an alkaline extract pH. An acid paper may be coated with a formulation containing calcium carbonate, although bond and

<sup>5</sup> Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.