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An American National Standard

Standard Specification for Copies from Office Copying Machines for Permanent Records¹

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1. Scope

1.1 This specification covers copies from office copying machines where the copied material is expected to have maximum or substantial life expectancy.

1.2 This specification is divided into two parts, paper and imaged copy. The parts appear as follows:

- Part 1—Paper, Sections 6-16
- Part 2—Imaged Copy, Sections 17-22

1.3 Part 1 describes the procurement process for obtaining paper that will have the proper life expectancy for the intended purpose.

1.4 Part 2 describes a procedure for estimating the durability of the image on copy from an office copying machine.

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:²

- D585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product
- D1030 Test Method for Fiber Analysis of Paper and Paperboard
- D1968 Terminology Relating to Paper and Paper Products
- D3424 Practice for Evaluating the Relative Lightfastness and Weatherability of Printed Matter
- D4714 Test Method for Determination of Effect of Moist Heat (50 % Relative Humidity and 90°C) on Properties of Paper and Board
- D4988 Test Method for Determination of Alkalinity of Paper as Calcium Carbonate (Alkaline Reserve of Paper)
- D5625 Test Method for Measuring Length, Width, and Squareness of Sheeted Paper and Paper Products³

¹ 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.

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³ Withdrawn.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

D5634 Guide for Selection of Permanent and Durable Offset and Book Papers

F1319 Test Method for Determination of Abrasion and Smudge Resistance of Images Produced from Business Copy Products (Crockmeter Method)

2.2 TAPPI Standards:

T 236 Kappa Number of Pulp⁴

T 400 Sampling a Single Lot of Paper, Paperboard, Fiberboard, or Related Products⁴

T 401 Fiber Analysis of Paper and Paperboard⁴

T 410 Grammage of Paper and Paperboard (Weight Per Unit Area)⁴

T 411 Thickness (Caliper) of Paper and Paperboard⁴

T 412 Moisture in Paper⁴

T 414 Internal Tearing Resistance of Paper⁴

T 425 Opacity of Paper (15 %/Diffuse Illuminant A, 89 % Reflectance Backing and Paper Backing)⁴

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

T 509 Hydrogen Ion Concentration (pH) of Paper Extracts—Cold Extraction Method⁴

T 511 Folding Endurance of Paper (MIT Tester)⁴

T 544 Effect of Moist Heat on Properties of Paper and Board⁴

2.3 ISO Standard:

ISO 9706 Paper for Documents—Specifications for Permanence—Normative Annex—Special instructions for determining kappa number⁵

3. Terminology

3.1 *Definitions*—Terms used in this specification are defined in accordance with Terminology D1968.⁶

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 above

⁴ Available from the Technical Association of the Pulp and Paper Industry, 15 Technology Parkway South, Norcross, GA 30092.

⁵ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁶ See also *Dictionary of Paper*, Tappi Press.

7 (extract pH usually in the range from 7.5 to 10.0), and containing a reserve buffering capacity that can neutralize acidic materials formed in the paper or acidic gases sorbed from the atmosphere.

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 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 of paper, internally sized, in preparation for a coating or surface sizing operation.

3.1.5 *coated paper, n*—paper which has been coated on one or both sides with a minimum coat weight of 2.5 lb/3300-ft² (3.7 g/m²) of coating material per side.

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

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

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 paper that has resistance to water penetration.

3.1.8 *office copies, quick copies, imaged copies, n*—reproductions made by direct or indirect electrostatic printing, ink jet printing, thermographic processing, or similar processing as contrasted with conventional printing, such as letterpress or offset.

3.1.9 *xerographic paper, n*—a grade of paper suitable for copying by the electrostatic process.

3.1.9.1 *Discussion*—These papers are bond grade and are characterized by a smooth finish, heat stability, noncurling qualities, and brightness.

3.2 Definitions of Terms Specific to This Standard:

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

3.2.2 *life expectancy*⁷, *LE*—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.

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

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

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

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

3.2.3 *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.

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

3.2.4.1 *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, and LE-50.

4. Classification—Types

4.1 Three types of papers for use in office copying machines are described, according to life expectancy level. These life expectancy levels are differentiated by pH and type of filler or sizing, or both. For situations where the copies will be handled frequently, the grade is described as “high referral.” A higher tearing resistance is specified for this category, a folding endurance requirement is optional, and the purchaser may wish to specify all or part cotton or linen.

4.2 *Type I, Maximum Life Expectancy, LE-1000*—Neutral- or alkaline-sized paper made with an alkaline filler, such as calcium carbonate, which will give an extract pH usually in the range from 7.5 to 10.0.

4.2.1 *Grade 1*—Ordinary use.

4.2.2 *Grade 2*—High referral.

4.3 *Type II, High Life Expectancy, LE-100*—Neutral- or alkaline-sized paper with an extract pH, usually in the range from 6.5 to 8.5.

4.3.1 *Grade 1*—Ordinary use.

4.3.2 *Grade 2*—High referral.

4.4 *Type III, Medium Life Expectancy, LE-50*—Paper with a minimum extract pH of 5.5.

4.4.1 *Grade 1*—Ordinary use.

4.4.2 *Grade 2*—High referral.

5. Ordering Information

5.1 Orders shall specify type and grade, dimensions, color, and, if necessary, paper stock and printing requirements. The paper shall perform suitably in the specific copying machine in which it is intended to be used.

PART 1—PAPER (see Note 1)

6. Scope

6.1 Part 1 covers the life expectancy and durability of coated and uncoated papers for permanent records, where these papers are intended to be used in various types of office or quick copy (xerographic) processes.

6.2 It has been shown (1-5)⁸ 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.

⁷ Adapted from American National Standards Institute Committee IT9.1 approved December 1991.

⁸ The boldface numbers in parentheses refer to references at the end of this specification.

6.3 The use of papers with controlled acidity, or of papers manufactured under neutral or alkaline conditions, especially papers with an alkaline filler, such as calcium carbonate that absorbs acidic gases from the atmosphere and can neutralize acidic materials formed in the aging of paper, would be expected to contribute significantly to the life expectancy of paper-based records.

6.4 An accelerated aging procedure is used in this specification to evaluate the stability of coated papers and of papers treated with an alkaline surface size.

6.5 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 [X1.6](#)) paper containing more than 1 % lignin may be employed for many other end uses in paper for records that are required to have a substantial life expectancy.

NOTE 1—A specification for office copy papers, Specification D3460, includes photographic paper. It does not include requirements related to life expectancy.

7. Significance and Use

7.1 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 current knowledge of factors, in terms of paper properties and paper composition, that increases life expectancy. Accelerated aging also may be used.

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

7.2.1 Physical tests to identify potential durability in service,

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

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

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

7.2.2.3 A test for pH, within the limits described in [8.2.4](#).

7.3 Papers with neutral or alkaline pH without a filler of calcium carbonate, 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. In cases of uncertainty, the supplier should provide an affidavit concerning the extract pH of the base paper.

7.4 Optional accelerated aging procedures are described in Section [13](#) and in [X1.3](#).

8. Composition and Chemical Requirements

8.1 *Fiber Analysis*, (see *Test Method D1030*)—The paper shall be made from cotton, linen, or fully bleached chemical pulp. Virgin or recycled fiber may be used in any proportion as agreed upon between the buyer and the seller at time of

purchase, as long as the paper meets the requirements of this specification. The kappa number (from [ISO 9706](#)) shall not exceed five.

8.2 *Hydrogen Ion Concentration (pH) Cold Extraction*—See TAPPI [T 509](#).

8.2.1 *Type I, Maximum Life Expectancy, LE-1000*—7.5 to 10.0.

8.2.2 *Type II, High Life Expectancy, LE-100*—6.5 to 8.5.

8.2.3 *Type III, Medium Life Expectancy, LE-50*—Minimum 5.5.

8.2.4 Some papers may have been given an alkaline surface size or an alkaline coating. The base paper of these papers may be acid and, therefore, of questionable stability, but would exhibit an alkaline extract pH. There is no known procedure for measuring the extract pH of the base paper of a paper to which an alkaline surface size, or alkaline coating, has been applied. The manufacturer should furnish an affidavit that the pH of the base paper conforms to the limits set forth above. The pH test is valid if the analyst can be ensured that the base paper does not have an alkaline surface size or an alkaline coating. The accelerated aging procedure, as described in [X1.3](#), may be used as an indicator of stability.

8.3 *Filler*—Type 1 paper shall contain an alkaline filler such as calcium carbonate. The minimum shall be 2 %, calculated as calcium carbonate, based on the oven-dry weight of the finished paper. Test for the presence and amount of carbonate as described in Test Method [D4988](#).

9. Physical Properties

9.1 *Grammage (Weight per Unit Area)*:

9.1.1 Weight per unit area is not a requirement of this specification, unless agreed upon between the buyer and the seller, but the nominal weight per unit area may be used to assist in describing the paper.

9.1.2 Most copy papers are in the 75-g/m² class (20 lb, 17 × 22 500), but some 60-g (16-lb) and 90-g (24-lb) papers are supplied. If the purchaser specifies a weight per unit area, the variations of test unit averages within a shipment (or lot) should be not more than 5 % above or below the specified weight. If grammage is measured, use TAPPI [T 410](#).

9.2 *Thickness*—Thickness is not a requirement of this specification unless agreed upon between the buyer and the seller. If specified, thickness should be expressed as micrometres (1 × 10⁻⁶ m) or as mils (1 × 10⁻³ in.), and the variation of test unit averages within a shipment (or lot) should be not more than 5 % above or below the specified value. If thickness is measured, use TAPPI [T 411](#).

9.3 *Internal Tearing Resistance*—The average internal tearing resistance in each direction should be not less than that given in [Table 1](#). Tearing resistance shall be measured using Test Method D689 or TAPPI [T 414](#).

9.4 *Directional Reflectance (Brightness)*—For white papers, the average brightness should be not less than 75 %. The brightness requirement does not apply to colored papers. Optical brighteners are not excluded unless specifically stated at time of purchase. Brightness shall be measured in accordance with TAPPI [T 452](#).

9.5 *Opacity*—If the paper is to be printed on both sides, the minimum opacity should be not less than 30 %.