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Standard Guide for Validating Recycled Content in Packaging Paper and Paperboard[1]

This standard is issued under the fixed designation D5663; 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 guide provides an approach for both the calculation and the substantiation of recycled content of finished packaging paper and paperboard products. A mass balance approach is recommended for use by manufacturers since no physical or chemical test method is currently available to determine absolute recycled content of a finished paper product. Calculations are based on time weighted average flows which are based on furnish component flow rates and consistency. Recommended approaches to the calculations include by batch or by time weighted average for a specific grade or similar grades. It is not recommended that average recycle content be allocated by mathematical apportionment rather than by actual fiber content. That is, if 50 % recycled fiber is used over time that is the time weighted average. One cannot use this same data to report 50 % of the production is 100 % recycled.

1.1.1 Percentage calculations are based on lb/ton or kg/tonne with the time frame constrained by machine and grade (see 10.1.1.1 and 10.1.1.2).

1.1.2 Pulping and recycling yields are not used in these calculations. The calculations of recycled fiber content in the finished product is solely a function of type of fibers in the furnish flows, the volume of flow and the time period considered.

1.2 This guide covers (*1*) recycled content of packaging paper and paperboard products that contain any amount or kind of recycled fiber; and (*2*) methods to calculate and substantiate the level(s) of recycled fiber content claimed by an agreement between the buyer and the seller.

1.2.1 This guide may be used with or without modification to calculate or substantiate the recycled content of packaging paper and paperboard products when recovered nonfibrous materials (for example, filler) are a part of the recycled fiber furnish. Limited guidance is provided for appropriate modifications to this guide for the determination of amount of recycled nonfibrous materials in paper products.

1.3 This guide does not recommend either an amount or a kind of recycled fiber or material to use since (*1*) the amount and kind of recycled content in a packaging paper or paperboard product should be agreed upon between the buyer and the seller, and (*2*) the calculation and substantiation procedures recommended may be used for any amount or kind of recycled material agreed upon between the buyer and the seller.

1.4 The mass balance calculation method recommended by this guide may or may not comply with applicable federal, state, or local laws for recycled content statements intended to be received by consumers. Limited guidance on content statements is in Appendix X1.

1.5 The following safety hazards caveat pertains only to the test method portion, Section 10, of this guide: *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.*

1.6 *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]

D685 Practice for Conditioning Paper and Paper Products for Testing

D996 Terminology of Packaging and Distribution Environments

[1] This guide is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.19 on Sustainability & Recycling.

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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.

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3. Terminology

3.1 *Definitions*—Definitions shall be in accordance with Terminology D996 and the *Dictionary of Paper*.[3]

4. Classification

4.1 The buyer and seller may agree to packaging paper and paperboard product classes and types of their choice, which may be from among the following classes and types:

4.1.1 Classes include, but are not limited to, any of the following packaging paper and paperboard products: folding boxboard, set-up boxboard; linerboard and corrugating medium for use in corrugated containers; tubestock; carrier board, bag paper, and other related packaging paper and paperboard products.

4.1.2 Two types of products are included: those containing no virgin fiber and those containing a mixture of recycled and virgin fiber.

5. Ordering Information

5.1 The buyer and seller of packaging paper and paperboard products with recycled content should agree upon at least the following information:

5.1.1 Class(es) and type(s) of product(s) (see 4.1),

5.1.2 Percent of recycled fiber, by air dry or conditioned weight fiber dry weight, and, if appropriate, recycled material, by air dry or conditioned weight, to be incorporated into a product (see 6.5 and 10.1 through 10.6),

5.1.3 Degree of variation in recycled fiber or material content allowable in shipped product (see 6.2),

5.1.4 Time period during which recycled content is to be calculated (see 10.1.1),

5.1.5 Method of substantiation used to support the agreed-upon recycled content claim for the packaging paper or paperboard product,

5.1.6 Format and frequency of recycled content substantiation and reporting, and

5.1.7 Type and frequency of review by the buyer (see 12.1) of procedures and data used by the seller to monitor compliance with the agreed-upon recycled content of product(s) under contract.

6. Composition

6.1 Recycled content of packaging paper and paperboard products supplied in accordance with this guide should be agreed upon between the buyer and the seller (see 5.1).

6.2 The average recycled content for a packaging paper or paperboard product shipped from the seller to the buyer within a specified time period (see 10.1.1 through 10.1.1.3) should be at least equal to the contracted recycled content or be within a degree of variation (see 6.3) of that content.

6.3 The buyer and the seller may agree to a degree of variation in the recycled content in shipped product from the seller to the buyer when multiple shipments will take place over the contract period; however, any degree of variation for recycled content greater than 10 % is not recommended. In addition, recycled content of a shipment of product that exceeds the degree of variation agreed upon by the buyer and the seller should be reported by the seller to the buyer in an agreed-upon manner.

6.4 Recycled content of packaging products composed of two or more components should be reported as the weighted mean recycled content of the multiple components (see 10.2).

6.5 All measures of recycled content should be on an air dry or conditioned weight basis as specified by the buyer (see 5.1.2).

7. Physical Attributes

7.1 The average value of physical characteristics, workmanship, dimensions, and appearance for any product should meet the requirements agreed upon by the buyer and the seller with reference to appropriate ASTM or standards of other organizations.

8. General Attributes

8.1 Acceptable defect levels and quality levels should be agreed upon between the buyer and the seller. The use of recycled fiber or other recycled material should not restrict the usefulness of the products covered under this guide, nor should it cause a product to not meet all specified requirements agreed upon between the buyer and the seller.

9. Bid Samples

9.1 When requested, the bidder should submit a representative product sample for examination purposes and data to support the claimed recycled content. An explanation should be included of the specific method(s) used to substantiate that content, with indication over what time period the measurements will be made. A separate sample should be submitted for each class and type of packaging paper and paperboard product being bid on, along with supportive data and explanatory information for each. Each sample should be clearly marked with the bidder's name and address, bid number, and manufacturer's name or code number.

10. Measurement Procedure

10.1 Recycled fiber content should be calculated as the ratio of recycled fiber weight to total fiber weight in a given quantity of packaging paper or paperboard product and expressed as a percentage. The basic calculation method is as follows (see Appendix X1 for an example, see 10.4.1 Eq 3 and Eq 4 when mill paper machine broke is used):

$$RF_C, \% = (RF_U \times 100)/(VF_U + RF_U) \quad (1)$$

where:

RF_C = recycled fiber content, %,
RF_U = weight recycled fiber used (for example, kg fiber component per *t* of final product), and
VF_U = weight virgin fiber used.

10.1.1 The calculation of recycled content should be for a fixed time period agreed upon between the buyer and the seller.

10.1.1.1 It is recommended that a monthly or quarterly time period be used, as appropriate to the duration of the contract

[3] Available from the Technical Association of the Pulp and Paper Industry, P.O. Box 105113, Atlanta, GA 30348.

and production runs, for monitoring compliance of shipped product with its claimed level of recycled content during the term of the buyer-seller agreement. An alternative time period, however, may be agreed upon between the buyer and the seller.

10.1.1.2 When multiple products of varying recycled content are manufactured within a specified time period on a single paper machine, then the recycled content for a specific product should be calculated based upon those time intervals within that time period during which that specific product was manufactured.

NOTE 1—For example, if a calculation of monthly recycled content in a paperboard product is needed, and that product is manufactured for 10 of the 30 days within that month on a specific paper machine, then only the amount and kinds of various recycled and virgin materials used to make that paper product on that paper machine during that 10-day period should be used to calculate the recycled content for that product using Eq 1.

10.1.1.3 When the same product of an agreed upon recycled content is manufactured within a specified time period on several paper machines, then the recycled content for that specific product should be calculated based only upon those intervals within that time period, for each paper machine used, during which that specific product was manufactured. For example, if a calculation of monthly recycled content in a paperboard product is needed, and that product is manufactured for 10 of the 30 days within that month on one paper machine and for 15 of the 30 days within that month on a second paper machine, then only the amount and kinds of various recycled and virgin materials used to make that paper product during those 10 and 15-day periods on the respective paper machines should be used to calculate the recycled content for that product by using Eq 1.

10.2 The recycled content for a composite packaging paper or paperboard product composed of two or more components (for example, corrugating medium plus liner board) should be calculated as the weighted mean recycled content of each of its components, as follows (see Appendix X1.4 for an example):

$$[(X_1)(P_1)+(X_2)(P_2)+\ldots+(X_n)(P_n)]\times 100 = \text{recycled content, \%} \quad (2)$$

where:

n = number of components in the composite paper packaging material,
X_n = weight percent of recycled material in the nth component calculated using Eq 1, and
P_n = weight percent of the nth component in a composite packaging material, %.

10.2.1 An individual calculation of recycled content within a given time period (see 10.1.1 through 10.1.1.3) for each component should be made and recorded.

10.3 The amount of recycled material in a given quantity of paper product (that is, used in Eq 1) should be determined by the method in 10.3.1 or 10.3.2, as follows:

10.3.1 When the paper manufacturer processes non-virgin material into recycled fiber, then the recycled content of a specific paper product made from that recycled fiber should be calculated using the amount of recycled fiber obtained after processing that recovered material.

10.3.1.1 If several types of recovered or recycled material are used in the manufacture of a recycled content packaging paper or paperboard product, then the recycled content of that specific paper product should be calculated by Method 1 or 2, as follows:

(1) Method for Processing Individually—For situations where one, or more, of the several types of recovered materials to be used are processed individually into their respective recycled fibers, the recycled content of the resultant paper product should be calculated using the amounts of each of those recycled fibers obtained after processing their respective recovered materials in both the numerator and denominator of Eq 2, that is, from the actual weights of recycled fiber used in the paper product furnish. For example, recovered old newsprint and used office writing paper may be processed separately to acquire recycled groundwood and Kraft fiber, respectively. The yields of each of these fibers should be used to calculate the recycled fiber weights to be used in Eq 1.

(2) Method for Processing Together—For situations where all of the several types of recovered materials used are processed together into recycled fibers, the recycled content of the resultant paper product should be calculated from the amount of recycled fiber obtained after processing the mixture of recovered materials; that is, from the actual yield of recycled fiber used in the paper product furnish. For example, recovered old newsprint and used office writing paper may be processed together to acquire a mixture of recycled fiber. The yield of mixed recycled fiber should be used in Eq 1.

10.3.2 When the paper manufacturer uses recycled fiber processed by a recycled pulp supplier, that pulp supplier should substantiate the amount of recycled fiber in its recycled pulp. This may be calculated using the amount of recycled fiber obtained after processing that recovered material. The recycled-pulp supplier's substantiated amount of recycled fiber content should be used to determine recycled content in a specified paper product made from that fiber by the packaging paper or paperboard manufacturer.

10.4 The amount of virgin fiber used in a given quantity of paper product (that is, used in Eq 1), if present, should be determined by the method in 10.4.1 or 10.4.2, as follows:

10.4.1 The paper manufacturer may utilize mill paper machine broke in the manufacture of a paper product. If the amount of material added as broke is significant, the recycled and virgin materials can be included in the final calculation of total recycled content.

10.4.1.1 Typically, broke is reused very quickly and typically it comprises a relatively small fraction of the total fiber furnish used. Most often the ratio of virgin to recycled fiber in broke is similar in the major flows being added. In this case, the ratio in the broke is not needed for the calculation. This is true unless the broke is from other machines with different virgin recycle blend ratios or unless the broke is held for a substantial time prior to use. If the broke used comprises 5 % or less of the fiber used (on a fiber weight basis) it is not necessary to include broke as a separate category for the calculation of total virgin fiber or total recycled fiber content.

10.4.1.2 If the broke fiber content exceeds 5 % or if the broke is from a different machine or time frame, the amount of

virgin and recycled fiber obtained from the broke after processing may be calculated by multiplying the weight of the virgin fiber portion of mill broke.

(1) Use in Eq 1 for VF_U only if broke is considered:

$$VF_U = VF_P + (TF_B)(PV_B) \quad (3)$$

where:

VF_U = weight of virgin fiber used in total process,
VF_P = weight of virgin fiber used in machine process,
TF_B = total weight of fiber in mill broke process, and
PV_B = weight percent virgin fiber used in broke.

(2) Use in Eq 1 for RF_U only if broke is considered:

$$RF_U = RF_P + (TF_B)(PR_B) \quad (4)$$

where:

RF_U = weight recycled fiber used in total process,
RF_P = weight recycled fiber used in machine process,
TF_B = total weight fiber in mill broke process, and
PR_B = weight percent recycled fiber used in broke.

10.4.2 When the paper manufacturer uses virgin fiber processed by a pulp supplier, that pulp supplier should substantiate the amount of virgin fiber in its pulp material. The pulp supplier's substantiated amount of virgin fiber content should be used in Eq 1.

10.5 Furnish flow and consistency data may be derived from one or more of the following records:

10.5.1 Periodic records of recovered paper material, virgin fiber portion of mill broke, recycled fiber or virgin fiber used, and levels of loss for each in preparation of fibers for inclusion in the paper manufacturing process,

10.5.2 Periodic records of calibrated flowmeters and consistency regulators which monitor known fiber sources used in the paper manufacturing process, or

10.5.3 Periodic records of flow rates and fiber consistencies of the various fiber sources used in the paper manufacturing process. Fiber consistencies may be determined by routine analysis of samples taken from the fiber furnish stock tanks that feed into the paper machine.

10.6 Other methods of calculating fiber levels in the paper products are permissible, provided they can be documented and standardized to the satisfaction of the buyer.

11. Inspection of Recycled Content Substantiation Procedure

11.1 The buyer may request to review the procedures used to substantiate the recycled content of a packaging paper or paperboard product being bid upon or purchased.

11.1.1 Inspection time(s) and frequency should be agreed upon between the buyer and the seller.

12. Rejection and Rehearing

12.1 If an inspection (see 11.1) or supplied substantiation data with explanation fails to meet the bid award or other purchase specifications agreed upon between the buyer and the seller, the entire shipment of the class and type of product may be subject to rejection, and the seller should be notified by the buyer. Further procedures may be subject to prior agreement between the buyer and the seller.

13. Packaging, Marking, and Shipping

13.1 Packaging paper and paperboard products conforming to this guide (if not in roll form) should be packed and shipped in containers of the type, size, and kind commonly used for that purpose and in a manner that will ensure acceptance by common carrier and safe delivery to the point of destination. Further specifications may be subject to prior agreement between the buyer and the seller.

14. Keywords

14.1 beverage carriers; boxboard cuttings; corrugating medium; double-lined Kraft cuttings (DLK); filler; folding boxboard; grocery bags; high-grades; linerboard; mass balance; multi-wall bags; old corrugated (OCC); old magazines (OMG); old newsprint (ONP); packaging paper; paperboard; post-consumer recovered material; pre-consumer recovered material; recovered paper material; recycled content; sacks; solid bleached Kraft paperboard; tubestock; unbleached Kraft paperboard

APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL INFORMATION AND COMPUTATIONAL EXAMPLES

X1.1 This guide aids in the development of complete specifications for the purchase of packaging paper or paperboard products with recycled content by institutions, government bodies, and industries and is not intended to be in itself a complete specification for the product.

X1.2 This guide was principally intended to provide standardization to the calculation and subsequent substantiation of recycled fiber content of finished packaging paper and paperboard products. On occasion, nonfibrous recovered material, such as fillers or coatings, may be present in paper products with recycled content. The presence of nonfibrous recovered material in these products may be unintentional (for example, due to inefficient processing of nonvirgin material into recycled fiber) or intentional (for example, deliberate recovery of nonfibrous material for recycling into products).

X1.2.1 Low levels of unintentional nonfibrous materials, as a result of its close association with fibrous material, may form part of the recycled fiber weight used to calculate recycled fiber content. The amount of this material can sometimes be quantified (for example, clays by ash content), but the levels

may vary greatly between lots or recycled fiber because of variation of the source of materials processed; hence, additional analysis may be necessary to substantiate nonfibrous material levels. Recycled material with a nonfibrous content of 5 %, or less, of the total fiber weight may not be worthy of efforts consider. If the nonfibrous content exceeds 5 % of the total, then RNF_U can be added to the denominator of Eq X1.1 to provide a more accurate estimate of the recycled fiber content of the finished product.

X1.2.2 In contrast, when intentional addition of nonfibrous recovered material is made to paper products with recycled content, there may be a need to quantify the percent composition of this material. Eq 1, Eq 2, Eq 3, and Eq 4 and procedures recommended for their use could be modified for paper products containing nonfibrous recycled materials. If recycled nonfibrous material content is to be substantiated in a product, then it is recommended that the percent of recycled nonfibrous material content be calculated based on the total amount of nonfibrous material contained in the product and expressed or labeled as a percentage of total nonfibrous content to avoid confusing buyers with the fibrous recycled content of the product. The following modification of Eq 1 is recommended:

$$RNF_C = RNF_U \times 100/(VF_U + RF_U + RNF_U) \qquad (X1.1)$$

where:

RNF_C = recycled nonfibrous material, %,
RNF_U = weight of recycled nonfibrous material used,
RF_U = weight recycled fiber used, and
VF_U = weight of virgin material used.

X1.3 A sample calculation for determining recycled content of a simple (single-component) product (see Eq 1) is provided in Table X1.1. Note that the yield factors used are provided to carry out computations and provide clarity in the example. Each manufacturer is responsible for determining the yield factors appropriate for its plant(s) and process(es) if this guide is used.

TABLE X1.1 Calculation for 1000 Tons of Recycled Content Linerboard

Fiber Input Type	Net Fiber, tons
DLK cuttings	180
Old corrugated	120
Recovered paper fiber	300 (recycled fiber)
Virgin fiber portion of mill broke	700 (virgin fiber)
Total fiber	1000

$$\frac{(300 \text{ tons recycled fiber}) \times 100}{(700 \text{ tons virgin fiber}) + (300 \text{ tons recycled fiber})}$$

$$= 30\ \%\ \text{Recycled Fiber Content}$$

X1.4 A sample calculation for determining recycled fiber content of a composite (multiple-component) product (see section 10.1.1.2) is shown in Eq X1.2. The weighted mean recycled content should be calculated as the sum of each component's recycled content multiplied by its respective proportion, by weight, in the composite product. For example, if a composite paper packaging product is composed of Component A, paper consisting of 50 % recycled content and representing 20 % of the composite material by fiber weight, and of Component B, paperboard consisting of 80 % recycled content and representing 80 % of the composite material by fiber weight, then the weighted recycled content would be calculated as follows:

$$\frac{(50 \times 20) + (80 \times 80)}{100} = 74\ \%\ \text{recycled fiber content} \qquad (X1.2)$$

X1.5 The Federal Trade Commission has published *Guidelines for Use of Environmental Marketing Claims.*[4]

[4] Available from the Federal Trade Commission, The Public Reference Branch, Room 130, 6th St. and Pennsylvania Ave. NW, Washington, DC 20580.

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