



Designation: D2658 – 18 (Reapproved 2023)

Standard Test Method for Determining Dimensions of Fiberboard Boxes¹

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1. Scope

1.1 This test method covers the determination of the interior and exterior dimensions of regular slotted or special slotted styles of single-wall corrugated, double-wall corrugated and solid fiberboard boxes.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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

- D685 Practice for Conditioning Paper and Paper Products for Testing
- D996 Terminology of Packaging and Distribution Environments
- D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing
- D4727/D4727M Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes
- D5118/D5118M Practice for Fabrication of Fiberboard Shipping Boxes

¹ This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.27 on Fiberboard Shipping Containers, Containerboard and Related Structures and Materials.

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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 ANSI Standard:³

B46.1 Surface Texture Surface Roughness, Waviness and Lay

2.3 TAPPI Standards:⁴

T400 Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product

T827 Box Blank Dimensioning, Test Method

2.4 FBA/PPMI:⁵

Tolerances for Corrugated Regular Slotted Containers (RSCs) Voluntary Industry Standard (See also ANSI Technical Report PMMI B155 TR2.1³)

2.5 FBA/FEFCO:⁶

Common Footprint Specifications

2.6 GMA/ISO:⁷

Standard Pallet Size (most common)

3. Terminology

3.1 *Definitions*—General terms in this test method are defined in Terminology D996.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *blank, n*—flat sheet of containerboard or combined board that has been cut, scored and slotted as preliminary operations to making a box.

3.2.2 *caliper, n*—containerboard or combined board thickness.

3.2.3 *depth, n*—the distance between the innermost surfaces of the box measured perpendicular to the length and width.

3.2.4 *exterior dimensions, n*—the measurement of the outer most surfaces of the length, width and depth of a box.

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

⁴ Available from Technological Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Suite 115, Peachtree Corners, GA 30092, <http://www.tappi.org>.

⁵ Available from the Fibre Box Association Suite 985, 500 Park Blvd, Itasca, IL 60143, or PPMI 11911 Freedom Dr #600, Reston, VA 20190.

⁶ Available from the FBA and FEFCO (European Federation of Corrugated Manufacturers) Avenue Louise 250, B-1050 Brussels, Belgium.

⁷ Available from ISO Central Secretariat, Chemin de Blandonnet 8, CP 401-1214 Vernier, Geneva, Switzerland (historic document from Grocery Manufacturer's Association).

3.2.5 *fishtail (or skew)*, *n*—variation in the width of the manufacturer’s joint, the difference between the width of top and bottom gaps measured at the score line.

3.2.6 *interior dimensions*, *n*—the shortest distances between opposite walls of a box.

3.2.7 *KD box – knock down (flat)*, *n*—a box blank that has been folded and the manufacturer’s joint has been sealed but which has not been erected.

3.2.8 *length*, *n*—the larger of the two dimensions of the open face of a box.

3.2.9 *panel*, *n*—a face or side of a box

3.2.10 *regular slotted*, *n*—one-piece box with all flaps the same length and outer flaps meeting. Inner flaps may or may not meet, but do not overlap.

3.2.11 *slot*, *n*—a cut made to remove a narrow strip of material in a fiberboard sheet in order to form flaps and facilitate folding without bulging while making a box.

3.2.12 *special slotted*, *n*—one-piece box with all flaps meeting or not meeting but not overlapping.

3.2.13 *width*, *n*—the lesser of the two dimensions of the open face of a box.

4. Significance and Use

4.1 Dimensions are important properties in the general construction of a box, and accurate methods of measurement are required for research work, routine control, and acceptance testing for conformance to specifications. For packages to carry and protect their contents effectively and efficiently, boxes and interior components must be properly and consistently sized. Correctly dimensioned and well-made boxes can be more easily set up by hand or be erected using automatic equipment. “Square” boxes (rectangular parallelepipeds) will stack better to accept load and improve stability during storage and shipment.

4.1.1 Interior dimensions of boxes are critical when the contents of the box are intended to fill or nearly fill the box with little unused side and head space. The inside dimension by tape method are the size values most often cited in box design (see 9.1, and TAPPI T827). The interior size of a box can be estimated from the score to score measurements when the scoring allowance is taken into account (see Appendix X2). The actual inside dimensions can be measured directly using the box gauge method (see 9.2). Either method can be used to measure interior box dimensions.

4.1.2 Exterior dimensions may be the critical design criteria when attempting to optimize use of the shipping platform area and overall stack height based on transportation and storage limitations. Exterior dimensions are also key design elements when making common footprint boxes.⁵ The exterior dimensions of a box can be measured directly using the exterior dimensions by tape method (see Appendix X1).

4.2 *Measuring a Lot Quantity of Boxes*—This method determines if a lot (that is, production run) is within specified tolerance for each dimension (length, width, and depth as are shown in Practice D5118/D5118M). A minimum of five

specimens are measured. The test result for each dimension is the individual measurements of that dimension on all specimens (see 9.3).

4.3 *Measuring Single Boxes*—Determines if one particular box is within specified tolerance for each dimension. The test result for each dimension is the average of all measurements of that dimension (see 9.4).

5. Apparatus

5.1 Types of Apparatus:

5.1.1 *For Box Dimensions by Tape Method* (see 9.1)—Use a standard metal or similar measuring tape with resolution to at least 1/16 in. (1.6 mm) and a straight edge that exceeds than the nominal width or depth dimension of the box (whichever is longer).

5.1.2 *Estimating Interior Box Dimensions by Tape Method* (see Appendix X2)—Use a standard metal or similar measuring tape with resolution to at least 1/16 in. (1.6 mm).

5.1.3 *Interior Box Dimensions by Method* (see 9.2)—Use a gauge specific to this standard. The gauge involves a degree of human judgment and assumes careful and accurate placement and reading of specified apparatus.

5.1.3.1 *Measuring Equipment*, consisting of two flat metal plates mounted on each end and at right angles to a telescoping spacing bar (Fig. 1).

(1) *Metal Plates*—The metal plates shall be not less than 3/16 in. (4.8 mm) thick and shall have length and width dimensions of 4 in. by 3 in. (102 mm by 76 mm) with a maximum surface roughness height of 64 μ in. (1.63 μm), in accordance with ANSI B46.1. All sharp edges shall be relieved and corners shall be rounded with approximately 1/4 in. (6.35 mm) radius. The plates shall be mounted firmly at each end of the telescoping bar and must be parallel to each other within 0.02 in. (0.5 mm).

(2) *Spacing Bar*—Provision shall be made for adjusting and locking the spacing bar at the linear distance between the two plane surfaces. If the spacing bar incorporates a built-in scale for convenience in reading measurements, it shall be accurate to one half of the minimum measurement unit; that is, if the minimum measurement unit is 1/16 in. (1.6 mm), the instrument must be accurate to 1/16 in. (1.6 mm), etc.

(3) *Size and Weight Ranges*—Correct weight of the measuring instrument is important. Weights of instruments for three basic size ranges shall conform to the specifications given in Table 1.

6. Sampling

6.1 Select specimens at random in accordance with good practice or sampling procedures.

6.2 Boxes used for measurement should first be inspected to see if they meet quality requirements for “squareness” (see Voluntary Standards – Tolerances). If “square” boxes are not available to be measured this outcome should be clearly shown in the test report. If the boxes to be measured cannot be set up so that the opposing panels and the tops and bottoms are parallel planes, then meaningful measurement is impossible for the box gauge method (see 9.3). Exterior box measurements for out of square boxes also have limited utility and should not be