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ANSI Technical Report for packaging machinery
prepared by Packaging Machinery Manufacturers Institute

TOLERANCES FOR REGULAR SLOTTED CONTAINERS (RSCs)

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Secretariat:

Packaging Machinery Manufacturers Institute
11911 Freedom Drive, Suite 600
Reston, VA 20190-5629, USA

Collaborating Organization:

Fibre Box Association
25 Northwest Point Blvd. Suite 510
Elk Grove Village, IL 60007, U.S.A.

Fibre Box Association

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This Technical Report was promulgated by the Packaging Machinery Manufacturers Institute (PMMI) in collaboration with the Fibre Box Association (FBA) as a Technical Report to establish guidelines for tolerances for regular slotted containers (RSCs).

The information in this Technical Report was published as a "voluntary standard" in 1998. That edition updated and combined two earlier documents previously issued by the Fibre Box Association and the Packaging Machinery Manufacturers Institute: Technical report: Tolerances for Top-Opening Regular Corrugated Fibreboard Slotted Containers (RSC), published in April 1967 and revised in May 1976; and Technical report: Tolerances for End-Loading 175 Lb.—200 Lb. B Flute and C Flute Regular Slotted Corrugated Fibreboard Containers (RSC), published in April 1968 and revised in December 1976 and May 1989.

Metric Policy - Dimensions and other units of measure will be given in English followed by metric (SI) units in parentheses (soft conversion from English to Metric units will be permitted (e.g.: 5 ¾ (14.6 cm). "Soft Metric" means the result of mathematical conversion of inch-pound measurements to metric equivalents in specifications. The physical dimensions are not changed.[1]

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1 U.S. General Services Administration Acquisition Manual Part 511.001 definitions

1 Scope

1.1 Purpose

This Technical Report was developed by the Fibre Box Association (FBA), the Packaging Machinery Manufacturers Institute (PMMI) and the users of corrugated containers with the intent to enhance understanding between the associations' member manufacturers and the users of the members' products. This Technical Report is voluntary and is not intended to prevent manufacturers from furnishing containers of any agreed-upon dimensions, styles or tolerances beyond those given in this Technical Report.

1.2 Scope

This Technical Report specifies the tolerances for:

- top-opening and end-opening regular slotted containers (RSCs)[2],
- made from B- or C-flute singlewall corrugated fiberboard,
- certified to a burst strength of 150 to 275 psi (1034 to 1896 kPa) or an edge crush test (ECT) value of 26 to 44 pounds force per inch (lbf/in)[4.5 to 7.7 kiloNewtons per meter (kN/m)]
- for which no panel dimension is more than 25inches (63.5 cm) or less than 4inches (10.2 cm),
- that are to be erected, filled and closed on automatic packaging machinery.

Corrugated containers manufactured within these tolerances provide a reasonable expectation that:

- The corrugated container is usable and can fulfill its intended function.
- Knocked-down corrugated containers will run on the automatic set-up, filling, and closing equipment for which it was designed.
- Properly erected and filled corrugated containers should stack squarely during palletization.

2 Informative References

The following documents contain provisions or guidelines which constitute additional resources available to the user of this Technical Report. These documents contain requirements the user of this Technical Report should be aware of regarding the application of this Technical Report. All standards/documents are subject to revision, and parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- Fibre Box Handbook (Corrugated industry reference)
- Fibre Box Association:
  - Understanding the Performance Requirements of Your Customer's Packaging
  - Edge Crush Test (ECT) – Application and Reference Guide for Combined Corrugated Board
  - How To Get The Best Box
- TAPPI T 811 Edge Crush Test – Wax Method (Item 222/Rule 41)
- TAPPI T 839 Edge Crush Test – Clamp Method
- TAPPI T 810 Bursting Strength of Corrugated or Solid Fiberboard

3 Definitions

3.1

basis weight / grammage – weight of the paper board expressed in pounds per thousand square feet (lb/msf) or grams per square meter (g/m^2)

2 See the International Fibreboard Case Codes numbers 0200 through 0206 – Fibre Box Handbook

3.2
burst strength test/Mullen test - the force required to rupture corrugated fiberboard with a rubber diaphragm; relates indirectly to a box's ability to withstand external or internal forces. The referee test method for burst (Mullen) measurement is TAPPI T 810.

3.3
checking: surface breaks of the outer component ply that do not completely fracture the liner

3.4
corrugated fiberboard: The structure formed on a corrugator by gluing one or more layers of fluted corrugating medium to one or more flat facings of linerboard.

3.5
corrugating medium: the type of paperboard used in forming the fluted portion of corrugated board.

3.6
edge crush test (ECT) value: The amount of force needed to cause compressive failure of an on-edge specimen of corrugated board; a primary factor in predicting the compression strength of a completed corrugated container. (TAPPI T-839 Clamp method most commonly used however TAPPI T 811 (wax dip method) is acknowledged as the "referee" test and is required when measuring ECT for compliance with carrier regulations)

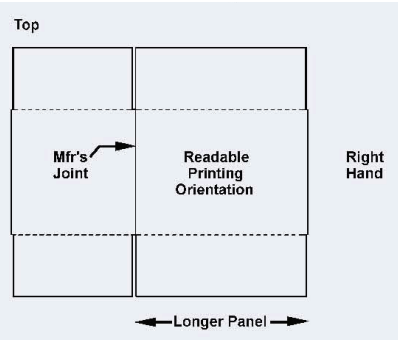


Figure 1 RSC Right Hand

3.7
end-loading/opening regular slotted container: an RSC designed to be filled from the side by sliding the product into the corrugated container. The flute direction may vary based on the application. (see figure 5)

3.8
flaps: extensions of the panels that form the four walls of a box. Flaps are usually defined by one score line and three edges. When folded and sealed with tape, adhesive or wire stitches, flaps close the remaining openings of a box. Regular slotted containers have eight flaps.

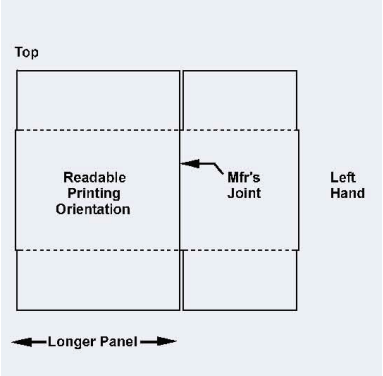


Figure 2 RSC Left Hand

3.9
fracture: a surface break of the facing that completely splits through the liner.

3.10
knocked-down (KD) corrugated container: a flat, unopened corrugated container whose manufacturers' joint has been sealed. A KD box is designated as "right hand" (see figure 1) when the longer panel appears on the right or as "left hand" (see figure 2) when it appears on the left. The "hand" of the container is a critical parameter that must be agreed upon between the end user and packaging machine manufacturer.

3.11
linerboard: paperboard used for the flat outer facing of combined corrugated fiberboard.

3.12
manufacturers' joint: a joint made by the container manufacturer, who folds the scored and slotted container blank in two places, brings one side panel and one end panel together and joins them with adhesive, tape or staples. A taped joint simply connects the two panels, with no overlapping corrugated material.

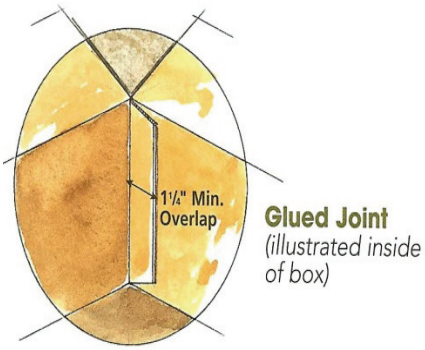


Figure 3 Manufacturer's Glue Joint

3.13
manufacturer's joint – inside / outside - when a narrow tab extends from the end panel to overlap the side panel, it is fastened with adhesive or wire stitches (staples). The tab may be located outside or inside of the corrugated container.(see figure 3)

3.14
manufacturers joint – extended - when the manufacturer's joint tab is extended past the scoreline into the flaps. (see figure 4)

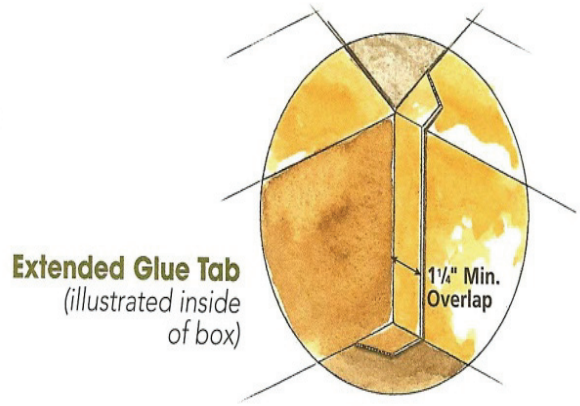


Figure 4 Manufacturer's Glue Joint - Extended

3.15
panel: a "face" or side of a box, usually defined on a scored and slotted sheet (box blank) by four score lines or three score lines and one edge. Regular slotted containers have four panels. (see figure 7)

3.16
regular slotted container (RSC): a corrugated container style manufactured from a single sheet of corrugated board. The sheet is scored and slotted to permit folding. Flaps extending from the panels form the top and bottom of the box. All flaps are the same size from the edge of the sheet to the flap score lines. The two outer flaps (normally the lengthwise flaps) are one-half the container's width so that they meet at the center of the box when the user folds them. Flute direction may be either perpendicular to the length of the sheet (usually for top-opening RSCs – see figure 6) or parallel to the length of the sheet (usually for end-opening RSCs – see figure 5).

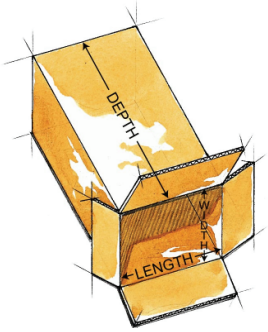


Figure 5 RSC End Load

3.17
score: a well-defined crease in corrugated fiberboard made to position and facilitate folds.

3.18
scoring allowances – additional dimensional allowances added to panel dimensions to account for the thickness of the corrugated material when folded.

3.19
set-up container: containers that have been erected, sometimes with one set of end flaps sealed, ready to be filled with product.

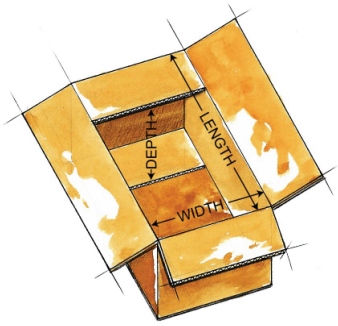


Figure 6 RSC Top Load

3.20
sheet: a rectangle (usually) of corrugated fiberboard, trimmed or untrimmed and sometimes scored across the corrugations.

3.21
singlewall corrugated fiberboard: the structure formed by gluing two linerboards, one to each side, to fluted corrugating medium.

3.22
slot: a pair of closely spaced cuts made in a sheet that facilitates removal of a narrow strip of material, usually to form flaps and permit folding without bulges caused by the thickness of the material.

3.23
top / bottom opening regular slotted container: an RSC designed to be filled from the top or bottom and remain upright. The flute direction is normally vertical, providing maximum stacking strength. (see figure 6)

4 Dimensions

Panels are measured from the center of one scoreline to the center of the next parallel scoreline or to the edge of the sheet. (see figure 7) Flaps are measured from the center of the scoreline to the parallel edge. Slot depth is measured from the edge of the sheet to the base of the slot. (see figure 9)

4.1 Inside/Outside Dimensions

Inside dimensions are given in the sequence of length, width and depth. (International organizations may use the words length, breadth and height.) The **inside** dimensions of a finished box are critical for proper fit around the product. The **outside** dimensions of the finished box must be considered for proper erecting, loading, sealing, palletization and distribution.

4.2 Length, Width and Depth

Length is always the larger of the two dimensions of the open face of a box as it is erected for loading (that is, after the KD box has been erected and the bottom panels have been folded). Width is the smaller dimension of the open face. Depth is the distance perpendicular to the length and width. (see figure 7)

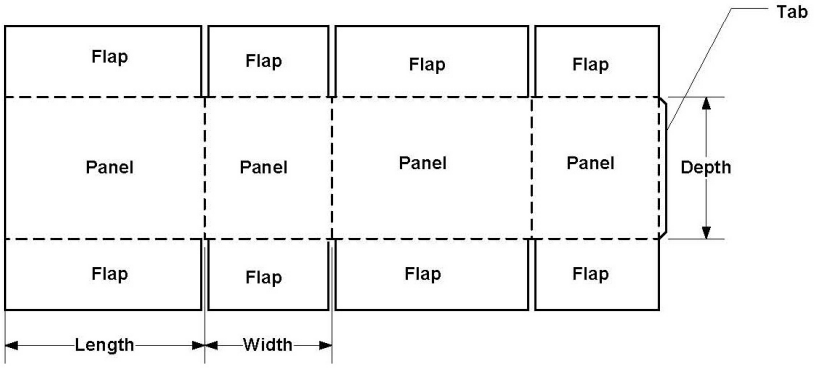


Figure 7 RSC Flat Blank

4.3 Panels

The dimensions of the panels of a flat container blank (scored and slotted sheet) are larger than the inside dimensions of the set-up container because the thickness of the board requires score lines whose dimensions are lost in the corners of the container when it is erected. This dimension is a scoring allowance (see definitions 3.18).

4.4 Score Allowance

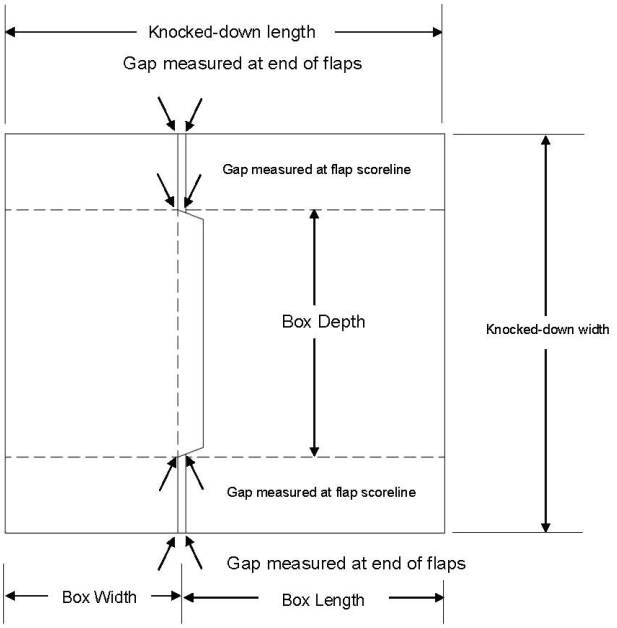
Depending on the flute size, basis weights of the corrugated board's components (linerboard and medium) and the pattern used to make the score, the width of the score can range from about one-tenth to several tenths of an inch. The corrugated container designer adjusts the overall dimensions of the box blank to accommodate the score lines and material thickness (the scoring allowance).

4.5 Limitations

Thicker or heavier board, combined board outside of those specified in the Scope, or larger or smaller dimensions than those specified in the Scope, may result in variations that exceed the tolerances that follow. Nevertheless, these corrugated containers can still be designed and manufactured to perform satisfactorily on automatic packaging machinery.

5 Tolerances

RSC containers should be inspected and measured to determine if they meet the commercial acceptable specifications upon delivery to the customer's facility. The RSC containers should also be inspected and measured to the same commercial acceptable specifications just prior to being used on automatic packaging machinery.



KD (knocked-down) regular slotted container showing points of measurement for gap at manufacturer's joint.

Figure 8 Measuring Gap

5.1 Dimensions

5.1.1 Panels

Variations in the individual panel dimensions, as measured scoreline to scoreline on the finished blank when flat (as a scored and slotted sheet), should not exceed ± 1/16 inches (1.5 mm), and variation in the overall dimensions of the flat sheet should not exceed ± 1/8inches (3 mm). (see figure 7)

5.1.2 Manufacturers Joint

The amount of gap at the manufacturers' joint, measured at the flap scorelines, should not be less than 1/8inches (3mm) or greater than ½inches (12.7mm). (see figure 8)

Variations in the width of gap at the manufacturers' joint on the same box (skew or fishtail) should not exceed 3/16inches (4.5 mm) when measured at the flap scorelines. However, the gap at the manufacturers' joint measured at the ends of the flaps, should be not less than 1/16inches (1.5 mm).

The flap score alignment (the alignment of the corrugators scores at the manufacturer's joint) should not exceed 3/16inches.

5.1.3 Slots

Variations in slot depth should be no greater than ± 1/8inches (3mm) from the center line of the flap score line.

Slots should be centered within 1/16inches (1.5 mm) of the center of the aligning scores. (see figure 9)

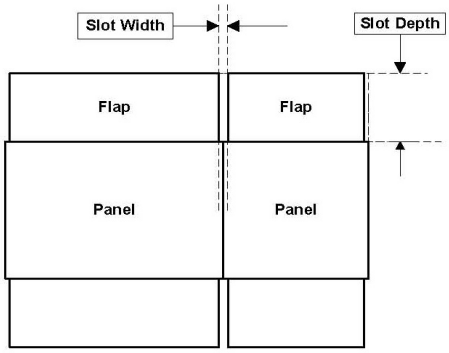


Figure 9 Measuring Slots

5.1.4 Scores

Scores must be sufficiently deep to give 180 degree fold (90 degrees left and 90 degrees right from unfolded orientation) without exhibiting fracture or continuous checking.

5.2 Flap Gap

The dimensions of the container should be designed so that the major flaps of a closed corrugated container should not overlap and the gap between these flaps should not exceed ¼inches (6.4mm).

5.3 Warp

5.3.1 Allowable warp

The amount of warp should not exceed:

- ¼ inches (6.4 mm) overall in 12 inches (305 mm)
- ½inches (12.7mm) overall in 24inches (610 mm)
- ¾ inch (19 mm) overall in 36 inches (915 mm)
- 1 inch (25.4 mm) overall in 48 inches (1219 mm)

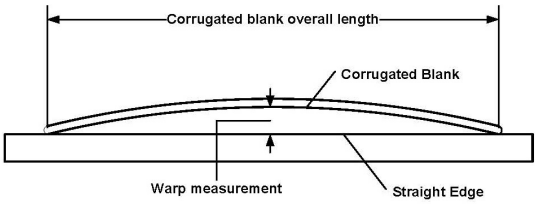


Figure 10 Measuring Warp

5.3.2 Measuring warp

Warp can be measured in many ways. One method is to place the RSC vertically against a straight edge. Measure the maximum horizontal distance (warp). See figure 10. The warp may not exceed the limits listed in 5.3.1.

6 Inquiries

Inquiries regarding this document should be directed to:

Packaging Machinery Manufacturers Institute (PMMI)
11911 Freedom Drive, Suite 600
Reston, VA 20190-5629, USA
Telephone: 703-243-8555
Fax: 703-243-8556
www.pmmi.org

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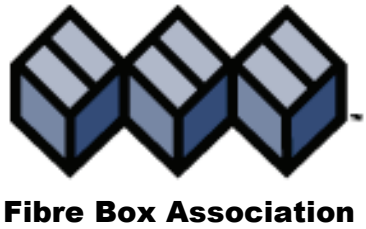

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Elk Grove Village, IL 60007, U.S.A.