Tolerances for Corrugated Regular Slotted Containers (RSCs)

Purpose

This Voluntary Standard specifies the tolerances for:
- top-opening and end-opening regular slotted containers (RSCs),
- made from B- or C- flute singlewall corrugated board,
- with a burst strength of 150 to 275 psi or an edge crush test (ECT) value of 26 to 44 lbs. per inch,
- for which no panel dimension is more than 25" (approx. 635 mm) or less than 4" (approx. 102 mm),
- that are to be set up, filled and closed by hand or on automatic packaging equipment.

Boxes manufactured within these tolerances ensure, to the greatest extent possible:
- the packaging is usable and can fulfill its intended function,
- knocked down boxes will run smoothly on the automatic setup, filling and closing equipment for which it was designed or will set up and close easily by hand,
- and filled boxes will stack squarely during palletization, storage and shipment.

These Voluntary Standards were developed after careful study by the Fibre Box Association (FBA) and the Packaging Machinery Manufacturers Institute (PMMI) to enhance understanding among their member manufacturers and the users of their members’ products—corrugated packaging and packaging machinery. The Standards are entirely voluntary and are not intended to prevent manufacturers from furnishing containers of any agreed upon dimensions, styles or tolerances beyond those given in the standard.

Definitions

**Burst strength**: The force required to rupture corrugated combined board with a rubber diaphragm; relates indirectly to a box’s ability to withstand external or internal forces.

**Corrugated board**: The structure formed on a corrugator by gluing one or more sheets of fluted corrugating medium to one or more flat facings of linerboard.

**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 box.

**End-loading/opening regular slotted container**: An RSC designed to be filled from the side by sliding the product into the box. The flute direction is normally vertical when the box is in its end-opening position.
Flaps: Extensions of the panels that form the four side 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.

*Knocked down (KD) box: A flat, unopened box whose manufacturer’s joint has been sealed. A KD box may be designated as “right hand” when the longer panel appears on the right or as “left hand” when it appears on the left.

*NOTE: Edited for Combi Case Erectors*

Manufacturer’s joint: A joint (seal) made by the box manufacturer, who folds the scored and slotted box 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 material. When a narrow tab extends from the end panel to overlap the side panel. It is fastened with adhesive or wire stitches (staples).

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.

Regular slotted container (RSC): A box style manufactured from a single sheet of corrugated board. The sheet is scored and slotted to permit folding. Flaps extending from the side and end 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) or parallel to the length of the sheet (usually for end-opening RSCs).

Score: A well-defined impression or crease in corrugated or solid fiberboard made to position and facilitate folds.

Set Up: Boxes that have been squared with one set of end flaps sealed, ready to be filled with product.
**Sheet**: A rectangle of corrugated board, untrimmed or trimmed, and sometimes scored across the corrugations when that operation is done on the corrugator.

**Singlewall corrugated board**: The structure formed by gluing two sheets of linerboard, one to each side, to a sheet of fluted corrugating medium.

**Slot**: A pair of closely spaced parallel cuts including removal of the strip of material between the cuts, made in a sheet of corrugated board, usually to form flaps and permit folding without bulges caused by the thickness of the material.

**Top-opening regular slotted container**: An RSC designed to be filled from the top and remain upright. The flute direction is normally vertical, providing maximum stacking strength.

**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. Box manufacturing is based on this fit. The outside dimensions of the finished box must be considered for proper palletization and distribution.

Length is always the larger of the two dimensions of the open face of a box as it is set up for filling (that is, after the KD box has been squared and the bottom panels have been folded and sealed). Width is the smaller dimension of the open face. Depth is the distance perpendicular to the length and width.

End-opening boxes are measured as though they were top-opening.

The dimensions of the panels of a flat box blank (scored and slotted sheet) are larger than the inside dimensions of the set-up box because the thickness of the board requires wide score lines whose dimensions are lost in the corners of the box when it is set up. The additional dimensional allowances are called scoring allowances.

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

Thicker or heavier board, or larger or smaller dimensions than those specified in the Purpose stated above, may result in variations that exceed the tolerances that follow. Nevertheless, these boxes can still be designed and manufactured to perform satisfactorily on automatic packaging equipment.

The tolerances in this Voluntary Standard may be adapted to other box styles and sizes at the discretion of the box manufacturer.

Tolerances

1. Dimensions

   • Panels

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

   • Slots

   a. The amount of gap at the manufacturer’s joint measured at the flap scorelines, shall not vary more than ± one board thickness from the lot average.

   b. Variations in the width of gap at the manufacturer’s joint on the same box (skewed or fishtailed) shall not exceed ± 1/8" (approx. 3 mm) when measured at the flap scorelines.

   c. No gap measured at the flap scorelines shall be less than:

      i. 1/16" (approx. 1.5 mm) when the joint is taped or when the glued or stitched tab is affixed to the inside of the adjacent panel

      or

      ii. 1/8" (approx. 3 mm) when the tab is affixed to the outside of the adjacent panel.
d. The gap at the manufacturer’s joint measured at the ends of the flaps, shall be not less than 1/16" (approx. 1.5 mm).

e. Variations in slot depth shall be no greater than ± 1/8" (approx. 3mm) from some agreed upon average dimension.

f. Slots shall be centered within 1/16" (approx. 1.5 mm) of the center of aligning scores or any other specified alignment.

2. Warp (KD Box)

The amount of warp upon delivery to the customer’s plant shall not exceed 1/4" for one foot of measurement (approx. 6 mm per 305 mm). Warp shall be measured by placing a 12" straight edge ruler against the most concave surface of the blank. The distance from the ruler to the concave surface shall then be measured.

3. Flap Gap (Finished Box)

The major flaps of a closed box should not overlap and the gap between these flaps should not exceed the thickness of the corrugated board, unless some other tolerance is agreed upon between the box customer and the box manufacturer.

Publishers' Statement

The Packaging Machinery Manufacturers Institute (PMMI), an industry organization representing the manufacturers of packaging equipment, is of the opinion that boxes that do not exceed the above tolerances will run satisfactorily through automatic case forming and loading equipment built by its members. The Fibre Box Association (FBA), an industry organization representing manufacturers of corrugated and solid fiber packaging and other products, believes that its members are capable of manufacturing packaging on a commercial basis within these tolerances.

Satisfactory performance of boxes and equipment presupposes proper handling and storage of KD boxes, and qualified operating personnel who provide adequate maintenance and adjustment of the machinery. If for any reason packaging does not run satisfactorily, save the packaging material, record all relevant information and contact the packaging manufacturer or the packaging machinery manufacturer. These professionals are concerned with identifying and solving packaging problems, including those associated with manufacturing tolerances.
EDITION

This Voluntary Standard was published in 1998; updating and combining two earlier documents previously issued jointly by the Fibre Box Association and the Packaging Machinery Manufacturers Institute. The two documents that were combined are Voluntary Standard: Tolerances for Top-Opening Regular Corrugated Fibreboard Slotted Containers (RSC), published in April 1967 and revised in May 1976, and Voluntary Standard: 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.

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