

PMMI B155-TR2.2-2011

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

**TOLERANCES FOR SCORED AND SLOTTED
CORRUGATED SHEETS AND TRAYS**

**Registered: July 17, 2011
by the American National Standards Institute, Inc.**

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.**



*Leading companies.
Leading solutions.*



Fibre Box Association

ANSI Technical Reports

Publication of this Technical Report that has been registered with ANSI has been approved by the Accredited Standards Developer (PMMI). This document is registered as a Technical Report according to the procedures for the Registration of Technical Reports with ANSI. This document is not an American National Standard and the material contained herein is not normative in nature. Comments on the content of this document should be sent to the Packaging Machinery Manufacturers Institute, 11911 Freedom Drive, Suite 600, Reston, VA 20190-5629, USA.

ANSI Technical Reports are developed through a consensus process. Consensus is established when substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority. Consensus requires that all views and objections be considered, and that a concerted effort be made toward resolution. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this Technical Report. While PMMI administers the process and establishes procedures to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate or verify the accuracy or completeness of any information or the soundness of any judgments contained in its Technical Reports or guidelines.

ANSI Technical Reports are promulgated through ANSI for voluntary use; their existence does not in any respect preclude anyone, whether they have approved the Technical Report or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the guidelines contained in this Technical Report.

The American National Standards Institute does not develop standards or Technical Reports and will in no circumstances give an interpretation of a Technical Report. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the Secretariat (PMMI).

NOTICE: This Technical Report supersedes all previous editions and may be revised or withdrawn at any time. The development procedures of PMMI require that action be taken periodically to reaffirm, revise, or withdraw this Technical Report. You may contact the Secretariat for current status information on this Technical Report.

PMMI and the Fibre Box Association (FBA) make no warranty, either expressed or implied as to the fitness of merchantability or accuracy of the information contained within this Technical Report, and disclaims and make no warranty that the information in this Technical Report will fulfill any of your particular purposes or needs. PMMI/FBA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, application or reliance on this Technical Report. PMMI/FBA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this Technical Report, nor does it take any position with respect to the validity of any patent rights asserted in connection with the items which are mentioned in or are the subject of this Technical Report, and PMMI/FBA disclaims liability for the infringement of any patent resulting from the use of or reliance on this Technical Report. Users of this Technical Report are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

In publishing or making this Technical Report available, PMMI is not undertaking to render professional or other services for or on behalf of any person or entity, nor is PMMI undertaking to perform any duty owed by any person or entity to someone else. Anyone using this Technical Report should rely on his or her own independent judgment, or as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. In addition to performing the risk assessment described by this Technical Report, the responsible personnel must also make an independent determination as to whether a machine, activity or condition complies with the applicable legal requirements in the relevant jurisdiction(s).

PMMI/FBA has no power, nor does it undertake to police or enforce conformance to this Technical Report. PMMI does not certify, test or inspect products, designs, or installations for performance, safety or health purposes. Any certification or other statement of conformance to any container specification, machine performance, health or safety-related information in this Technical Report shall not be attributable to PMMI/FBA and is solely the responsibility of the certifier or maker of the statement.

Published by:

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

Copyright © 2011 by PMMI & FBA

All rights reserved. Printed in the United States of America

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

CONTENTS

0	FORWARD	4
1	SCOPE	5
1.1	PURPOSE	5
1.2	SCOPE	5
2	INFORMATIVE REFERENCES	5
3	DEFINITIONS	5
4	DIMENSIONS	7
4.1	INSIDE/OUTSIDE DIMENSIONS	7
4.2	LENGTH, WIDTH AND DEPTH (FINISHED CONTAINER)	7
4.3	PANELS	7
4.4	SCORE ALLOWANCE	7
4.5	LIMITATIONS	8
5	TOLERANCES	8
5.1	DIMENSIONS	8
5.2	WARP	8
6	INQUIRIES	9
	Figure 1 Scored and Slotted Sheet for a Tray	6
	Figure 2 Scored and Slotted Sheet	6
	Figure 3 Tab Lock Die Cut Tray	7
	Figure 4 RSC Flat Blank	7
	Figure 5 Measuring Slots	8
	Figure 6 Measuring Warp	8

0 Forward

The Packaging Machinery Manufacturers Institute (PMMI) is a “standards developing organization” (SDO) accredited by the American National Standards Institute (ANSI). This Technical Report has been approved by the B155 TR2 accredited standards committee of PMMI. This document is registered as a Technical Report according to the Procedures for the Registration of Technical Reports with ANSI. This document is not an American National Standard and the material contained herein is not normative in nature. Comments on the content of this document should be sent to Director of Technical Services, Packaging Machinery Manufacturers Institute, 11911 Freedom Drive, Suite 600, Reston, VA 20190-5629, USA.

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

The information in this Technical Report was originally published as Tolerances for Scored and Slotted Corrugated Fibreboard Sheets Used with Automatic Packaging Equipment in April 1968. The document was revised and published in May 1982, May 1989 and January 1996.

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.

PMMI B155 TR-2 Committee

Chairman

Andy Lovell - Piab USA, Inc

Secretary

Fred Hayes - Packaging Machinery Manufacturers Institute, VA

Committee members

Dave Carlson – Fibre Box Association

Cornell Carey - Kraft Foods

William Chu – Wexxar Packaging Inc.

Steve Dann – ConAgra

Mike T Goetz – Temple-Inland (delegate)

Jeff Lenarz – Douglas Machine Inc

Ron Pauly – General Mills

Michael Reichert – A-B-C Packaging Machine Corp.

Leo Robertson – Pearson Packaging Systems

John Rutherford – Temple-Inland (alternate)

Mike Scanlan - Green Bay Packaging Inc.

Chuck Schaeufele – Smurfit-Stone Container Corporation

Tom Staal – Advance Packaging Corporation

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 guideline 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 guideline specifies the tolerances for:

- Scored and slotted singlewall and doublewall corrugated fiberboard sheets/trays,
- for which no panel dimension is more than 25inches (63.5 cm) or less than 4inches (10.2 cm), except for trays, where the minimum tray depth is 1 ½inches (3.8cm) (see figure 1 and 2)
- that are to be formed, assembled or used 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.
- The corrugated container will run on the automatic forming, filling and closing equipment for which it was designed.
- Properly formed 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 839 Edge Crush Test – Clamp Method
- TAPPI T 811 Edge Crush Test – Wax Method (Item 222/Rule 41)
- 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)

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

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

3.5

doublewall corrugated fiberboard: three sheets of linerboard, with two interleaved and glued corrugated mediums.

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)

3.7

flaps: extensions of the panels that usually form the sides of a container. Flaps are usually defined by one score line and three edges. When folded, flaps serve to position the product in a container, and close the open end of a container. (see figure 2)

3.8

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

3.9

linerboard: Paperboard used for the flat outer facings of combined corrugated fiberboard.

3.10

panel: a section of a scored and slotted sheet defined by four scorelines or three scorelines and one edge. A panel usually becomes one of the sides of a container. (see figure 2)

3.11

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

3.12

scored and slotted sheet: a sheet of corrugated fiberboard with one or more scores, slots or slits. A scored and slotted sheet may be further defined by:

- a container style made from a single sheet of corrugated fiberboard;
- a container piece or part; a tray (see figure 1) or wraparound (see figure 2);
- a partition piece;
- an inner packing piece or some other designation.

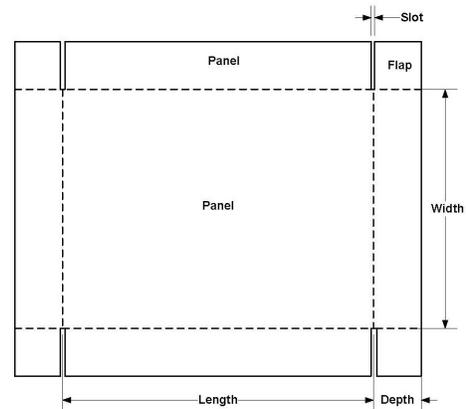


Figure 1 Scored and Slotted Sheet for a Tray

The length and width are not less than 4 inches (102 mm) and the depth cannot be less than 1 1/2 inches (38 mm)

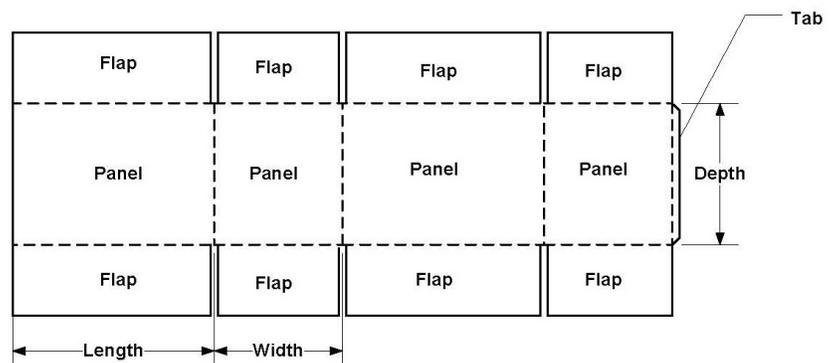


Figure 2 Scored and Slotted Sheet for a RSC (Wrap-around)

3.13

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

3.14

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

3.15

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

3.16

slit: a cut made in a sheet without removal of material.

3.17

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.

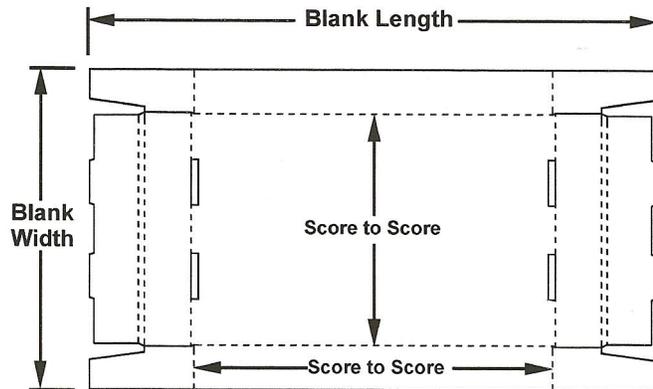


Figure 3 Tab Lock Die Cut Tray

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. Flaps are measured from the center of the scoreline to the parallel edge. (see figure 3 and 4) Slot depth is measured from the edge of the sheet to the base of the slot. (see figure 5)

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 forming, loading, sealing, palletization and distribution. (see figure 4)

4.2 Length, Width and Depth (finished container)

Length is the larger of the two dimensions of the open face of a container as it is formed for loading. Width is the smaller dimension of the open face. Depth is the distance perpendicular to the length and width. (see figure 2)

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 formed. This dimension is a scoring allowance (see definitions 3.10).

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).

The blank dimensions, measured from the inside of the sheet, will include scoring allowances

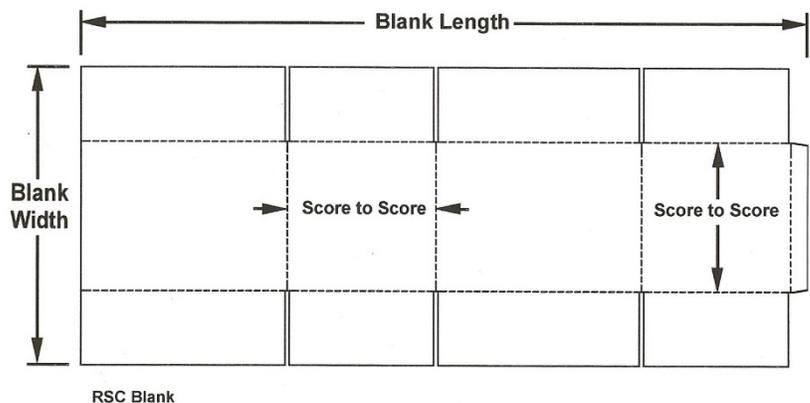


Figure 4 RSC Flat Blank

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

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

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 $\pm 1/16$ inches (1.5 mm), and variation in the overall dimensions of the flat sheet should not exceed $\pm 1/8$ inches (3 mm). (see figures 3 & 4)

5.1.2 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.

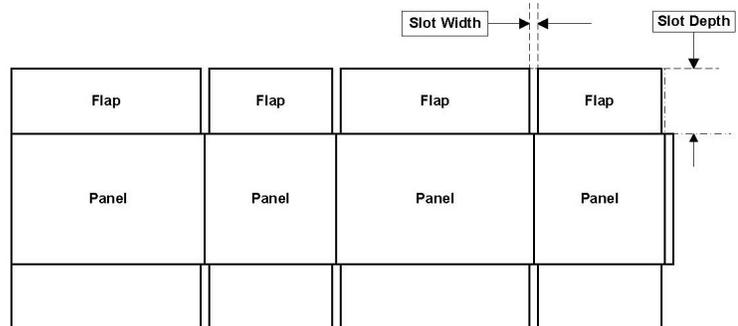


Figure 5 Measuring Slots

5.1.3 Slots

Variations in slot depth should be no greater than $\pm 1/8$ inches (3mm) from the center line of the flap score line. Slots should be centered within $1/16$ inches (1.5 mm) of the center of the aligning scores. (see figure 5)

5.2 Warp

5.2.1 Allowable warp

The amount of warp should not exceed:

- $1/4$ inches (6.4 mm) overall in 12 inches (305 mm)
- $1/2$ inches (12.7mm) overall in 24 inches (610 mm)
- $3/4$ inch (19.0 mm) overall in 36 inches (915 mm)
- 1 inch (25.4 mm) overall in 48 inches (1219 mm)

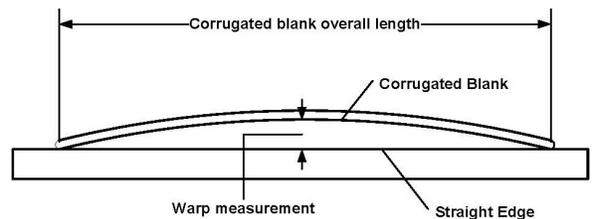


Figure 6 Measuring Warp

5.2.2 High speed allowable warp

For high speed applications (50+ per minute), the amount of warp should not exceed:

- $3/16$ inches (4.8 mm) overall in 12 inches (305 mm)
- $3/8$ inches (12.7mm) overall in 24 inches (610 mm)

The end user should inform the supplier that the application is high speed.

5.2.3 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 6. The warp may not exceed the limits listed in 5.2.1 or 5.2.2.

6 Inquiries

Inquiries regarding this document may 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

PMMI B155 TR2.2

TOLERANCES FOR SCORED AND SLOTTED CORRUGATED SHEETS



*Leading companies.
Leading solutions.*

**Packaging Machinery Manufacturers Institute
11911 Freedom Drive, Suite 600
Reston, VA 20190-5629, U.S.A.**



Fibre Box Association

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