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Corrugated fibreboard — Determination of edgewise crush resistance — Waxed edge method

Carton ondulé — Détermination de la résistance à la compression sur chant — Méthode du bord paraffiné

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 6/SC 2, *Test methods and quality specifications for paper and board*.

This second edition cancels and replaces the first edition (ISO 13821:2002), of which it constitutes a minor revision.

The main changes compared to the previous edition are as follows:

— Introduction of an additional group in the Introduction clause;

— Information on sampling of corrugated shipping containers are added in Clause 6;

— Information in 8.2 on the height of the test pieces;

— Introduction of precision data based on TAPPI comparative testing service.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A variety of methods for the determination of edgewise crush resistance are in use in different parts of the world. These can be classified into four groups as follows:

a) Those in which a carefully cut rectangular test piece is tested without any special treatment or modification.

b) Those in which the edges of the test piece to which the force is applied are waxed to prevent the test result from being influenced by “edge effects”.

c) Those in which the test piece edges are not waxed but the shape of the test piece is such that the length is substantially reduced at a point midway between the loading edges in order to induce the failure to occur away from those edges.

d) Those in which carefully cut rectangular pieces are tested with edges clamped to prevent the test result from being influenced by "edge effects".

The dimensions of the test piece vary from one group to the other and, in group c), the methods vary according to the shape and method of reducing the length.

The methods may not give the same numerical results, but it can be shown that most of them can be used to predict the top-to-bottom compression strength which will be achieved when the board is properly converted into a transport package.

This document describes a method from group b) intended to be used for quality measurement and quality specification purposes. This particular method is selected because it correlates well with the top-to-bottom compression strength of the final transport package and provides significantly higher results than unwaxed methods (a) because edge effects are avoided.

Corrugated fibreboard — Determination of edgewise crush resistance — Waxed edge method

1 Scope

This document specifies a method for the determination of the edgewise crush resistance of corrugated fibreboard. The force is applied in the direction of the flute axis.

This method is applicable to single-wall (double-faced), double-wall, and triple-wall corrugated fibreboard. It may also be used to test samples taken from corrugated cases and other converted products.

While the method is applicable to waxed corrugated fibreboard, care must be taken that the heat used in the waxing step does not affect the corrugated structure. This is controlled by observing that failure during the test still occurs away from the loaded edges.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 13820, *Paper, board and corrugated fibreboard — Description and calibration of compression-testing equipment*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

Subjection of a rectangular test piece of corrugated board placed between the platens of a crush tester, with the flutes perpendicular to the platens, to a compressive force until failure occurs. The loading edges of the test piece have been reinforced by paraffin to prevent premature failure at those edges when the load is applied.

Measurement of the maximum force sustained by the test piece.

5 Apparatus and test liquid

5.1 Motor-driven, platen-type compression testing machine. The apparatus described in ISO 13820 shall be used.

5.2 Cutting equipment, enabling the cutting of test pieces according to the requirements specified in 8.2.

5.2.1 Band-saw or **knife and cutting jig** to prepare the test pieces. The equipment shall produce cut edges that are unfrayed, straight and perpendicular to the facings of the board.

5.2.2 Circular saw, equipped with a sharp, no-set (hollow-ground or taper-ground is desirable) saw blade. Ensure that the saw blade is 90° to the table supporting the test piece.

5.2.3 Motorized dual-knife-type cutter with flat, straight, parallel and freshly sharpened blades which should be approximately 0,5 mm thick, sharpened on one side only to a bevel of about 3 mm and mounted so that the plane sides of the blades face each other (i.e. inwards) and are perpendicular to the faces of the board. The blades of such a cutter must be kept in good alignment.

It is recommended that the blades of this type of cutter be replaced after being used more than 100 times.

5.2.4 Other types of test-piece cutters, such as a manual knife used with a guide, can be employed provided it can be shown that they meet the requirements specified in 8.2.

5.3 Guide blocks, consisting of two rectangular, smooth-finished, metal (or wood) blocks of cross-section dimensions 40 mm × 20 mm, and at least 40 mm in length, to support the test piece and keep it perpendicular to the platens. The blocks are cut back by 2 mm, as shown in Figure 1, to avoid contact with the waxed areas.

5.4 Molten paraffin, with a melting point of approximately 52 °C.

Dimensions in millimetres

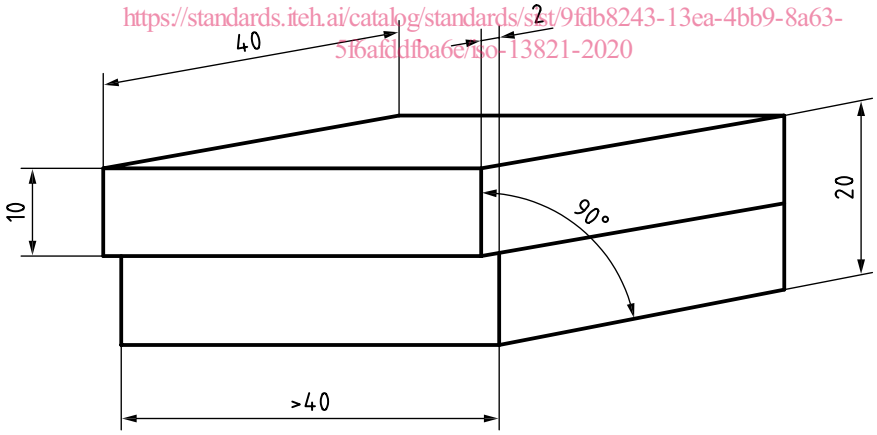

Figure 1 — Guide block

6 Sampling

The specimens, taken in accordance with ISO 186, shall permit the preparation of test pieces free from converting machine marks. If the test specimens are to be taken from corrugated shipping containers, they should be taken from areas away from score lines, joints, and closures. Specimens should be representative of the materials being tested. For example, if roughly 25 % of a box is printed, roughly 25 % of the specimens should be collected from the printed areas. Specimens should not be taken from obviously damaged areas and/or areas not representative of the container as a whole.

7 Conditioning

Condition the sample in accordance with ISO 187.

8 Preparation of test pieces

8.1 General

Prepare test pieces in the standard atmosphere specified in ISO 187.

8.2 Cutting the test pieces

Using the equipment described in 5.2 and 5.3 to ensure parallel cuts, cut from the sample at least 10 rectangular test pieces with the flutes perpendicular (to within 1°) to the width or loading edges, in one of the following sizes:

A-flute, X-flute and typical doublewall and triplewall grades	(50,8 ± 0,8) mm × (50,8 ± 0,8) mm
for C-flute	(38,1 ± 0,8) mm high × (50,8 ± 0,8) mm wide
for B-flute	(32,0 ± 0,8) mm high × (50,8 ± 0,8) mm wide

The tolerances apply to the mean height and width. These heights typically meet the Euler criteria for pure compression failure in a short column for their respective structures. However, for some thin double-wall board (e.g. EB or EF double-wall), different heights may be required to achieve a pure compression failure in the test specimens.

The loading edges shall be cut cleanly and straight. The cleanliness of the cut is judged by inspection without magnification under normal laboratory lighting. Determine that the edges are not frayed and that no loose fibres are visible. The test piece shall be free from converting-machine marks and damage to edges, flutes and test area.

Opposite edges shall be parallel and adjacent edges shall be at right angles. Straightness, parallelism and perpendicularity may be judged by the following procedure:

Stand two test pieces on their cut edges on a plane surface with two of their faces almost touching. With perfectly flat board, the two adjacent faces should appear flat and parallel to each other over their whole surfaces. If the board is warped, this may not be so, but the test pieces are acceptable if they stand vertically on their bottom edges, if the top cut surfaces appear flat and parallel to each other and at right angles to the linear surfaces close to the cut, and if the cut ends of the test pieces appear to be in the same plane. It should not be possible to see light under the cut edge of either test piece when a load of about 1 N (equivalent to light finger pressure) is applied to the top edge.

End-for-end (rotate 180° on its vertical axis) one test piece, then invert the other test piece. In each configuration, the criteria of the preceding paragraph shall apply.

Test other pairs of test pieces in the same way.

8.3 Waxing

Dip each loading edge in molten paraffin (see 5.4) to a depth of 6 mm and hold there until the absorbed paraffin, as determined visually, begins to migrate above the 6 mm dipped zone. Normally, a 3 s dip in molten paraffin at a temperature of 69 °C to 75 °C is satisfactory. If excessively rapid migration is encountered, reduce the temperature of the molten paraffin.

Immediately after dipping, momentarily blot the loading edges of the test piece on paper towelling preheated on a hot plate maintained at 77 °C to 82 °C.