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Corrugating medium — Determination of the flat crush resistance after laboratory fluting

Papier cannelure pour carton ondulé — Détermination de la résistance à la compression à plat après cannelage en laboratoire

Reference number
ISO 7263:1994(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7263 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*.

This second edition cancels and replaces the first edition (ISO 7263:1985), which has been technically revised.

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Introduction

The flat crush resistance of laboratory-fluted corrugating medium is regarded as an important property because it is an indication of the potential flat crush resistance of corrugated fibreboard made from that medium. The corrugated medium is fluted by passing it between heated rollers. Two different test procedures are then widely used:

a) the fluted paper is compressed immediately after fluting (i.e. within 15 s);

b) the fluted paper is conditioned for 30 min to 35 min under standard laboratory test conditions before being compressed.

Procedure a) generally gives considerably higher results but with greater spread than those obtained with procedure b). The differences in results are claimed to be caused by

— the lower moisture content (and thus higher stiffness) of the unconditioned fluted paper;

— the change in flute profile which occurs during the conditioning period.

Since considerable advantages are claimed for both procedures and both are widely used, this International Standard describes both procedures.

A method of determining the flat crush resistance of manufactured fibreboard is given in ISO 3035:1982, *Single-faced and single-wall corrugated fibreboard — Determination of flat crush resistance.*

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Corrugating medium — Determination of the flat crush resistance after laboratory fluting

1 Scope

This International Standard specifies two methods for the determination of the flat crush resistance of corrugating medium after laboratory fluting.

The procedures are applicable to any paper intended to be used, after fluting, in the manufacture of corrugated fibreboard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 186:1994, *Paper and board — Sampling to determine average quality.*

ISO 187:1990, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples.*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 flat crush resistance: The maximum force that a test piece will withstand before the flutes collapse under the test conditions specified.

4 Principle

Fluting of the paper by passing it between heated rollers and its formation into single-faced corrugated board using pressure-sensitive adhesive tape as the liner. Application of a crushing force in a direction perpendicular to the plane of the paper and determination of the crushing resistance.

5 Apparatus

5.1 Cutting device, for cutting the test pieces.

5.2 Fluter, consisting of a pair of matched steel corrugating rolls.

The rolls shall be capable of being maintained at a temperature of 175 °C ± 8 °C. The temperature may be varied by any suitable method.

NOTE 1 In order to optimize the matching of pairs of rolls, pairs of rolls should be selected in which the differences in dimensions between the two are substantially less than the tolerances shown. A difference of ± 0,1 mm or better is recommended. Prior to first use, the rolls should be run at the operating temperature for about 6 h with a mild abrasive on the teeth. The two rolls should then be marked in some way so that, after removal for cleaning or maintenance, they can be reassembled with exactly the same teeth in mesh.

One roll is motor-driven at 4,5 r/min ± 1,0 r/min and the rolls are held in mesh by a mechanical device which causes a force of 100 N ± 10 N to be exerted between the rolls and to be distributed evenly across the teeth, under test conditions (see note 2).

The essential characteristics of each roll are the following.

Roll diameter	228,5 mm ± 0,5 mm
Roll thickness	16 mm ± 1 mm
Number of teeth	84
Radius of teeth at peak	1,5 mm ± 0,1 mm
Radius of teeth at base	2,0 mm ± 0,1 mm
Depth of teeth	4,75 mm ± 0,05 mm
Distance between teeth (peak to peak around the arc)	8,55 mm ± 0,05 mm

(See figure 1.)

NOTE 2 In some instruments, the force between the rolls is applied by a spring acting in a slide. In such instruments, friction in this device can result in the force which acts upon the test piece being considerably less than the force required to displace the rolls initially. When verifying that an instrument conforms to the requirements given in 5.2, it is therefore necessary to measure the force required to just prevent the undriven roll from moving towards the driven roll, from a position about 200 µm away.

5.3 Rack and comb

5.3.1 Rack, at least 19 mm wide with a profile corresponding to the teeth of the corrugating rolls.

It has nine full teeth and one incomplete tooth at each end so as to form ten valleys. The tooth spacing is 8,50 mm ± 0,05 mm and the height of the teeth is 4,75 mm ± 0,05 mm. (See B in figures 2 and 3.)

5.3.2 Comb, at least 19 mm wide with ten prongs, 3,4 mm ± 0,1 mm high. (See A in figures 2 and 3.)

NOTE 3 The rack (5.3.1) and comb (5.3.2) may be replaced with an automatic device, provided it can be demonstrated that this device will produce the same results.

5.4 Pressure-sensitive adhesive tape[1], at least 15 mm wide.

The tape shall be of low stretch and of good adhesion and it shall not transfer moisture to the substrate during the test.

5.5 Flat crush tester: motor-driven, platen-type compression tester.

a) The platens shall be large enough to take a test piece without it projecting beyond the platens. They shall also meet the following requirements:

   — deviation from parallel shall not be greater than 1:1 000;

   — lateral play shall not exceed 0,05 mm.

b) The surfaces of the platens shall be provided with some means to prevent slippage of the test piece during compression, for example, by means of a matt finish or by being faced with a very fine abrasive paper such as grade 00.

c) If the tester operates with one fixed platen, the other having a direct positive drive, the rate at which the platens approach each other shall be 12,5 mm/min ± 2,5 mm/min.

d) If the tester operates on the principle of beam deflection, the deflection at the moment of collapse shall be between 10 % and 90 % of the maximum range of the beam and dial combination in use. The force applied shall be developed at a rate of 110 N/s ± 10 N/s when the platens enter into contact with one another.

   NOTE 4 A rate of 67 N/s ± 23 N/s may be used, but in such cases the results should not be taken to be similar to those obtained with the standard rate and the rate used should be included in the test report.

e) The force applied to the fluted paper shall be measured using a suitable device. This shall be capable of indicating the applied force to ± 2 N. It shall be checked at appropriate intervals against deadweight loads, calibrated compression springs, a calibrated load cell or other appropriate means. The maximum error shall not exceed 1 % of the indicated force for any value in the normal operating range of the crush tester.

6 Sampling

Sampling shall be carried out in accordance with the specifications given in ISO 186.

7 Conditioning

Condition the samples for at least 4 h in one of the conditioning atmospheres specified in ISO 187.

8 Preparation of test pieces

Cut at least 10 test pieces 12,7 mm ± 0,1 mm wide and of length 150 mm to 160 mm, the length being cut in the machine direction (see note 5).

1) 3M grade 410 tape is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product.

Care should be taken not to damage the edges of the test pieces and they should not be handled more than is necessary.

NOTE 5 A test piece width of 15,0 mm ± 0,1 mm may be used provided the corrugating roll width is greater than the test piece width. In the event of a test width of 15 mm being used, the force between the corrugating rolls, as defined in 5.2, is to be adjusted to 118 N ± 10 N. The use of a 15 mm test piece width is not to be considered as being in accordance with this International Standard and this use is to be stated in the test report.

9 Procedure

Start the motor and heat the corrugating rolls (5.2) to 175 °C ± 8 °C.

Feed a test piece into the corrugating rolls with its longer side perpendicular to the nip, taking care that one edge is flat on the guide. Place on the rack the corrugated test piece which emerges so that approximately equal lengths rest on the flat surfaces at each end of the rack (5.3.1).

Place the comb (5.3.2) over the corrugated test piece and press down so that it is held firmly in the valleys of the rack, ensuring that the test piece is bottomed uniformly in each of the flutes.

NOTE 6 A rolling motion of the comb as it is placed on the test piece aids in forming the test pieces on to the rack.

Flatten the ends of the corrugated test piece taking care that the tape does not adhere to the comb, then place a strip of the adhesive tape (5.4), at least 120 mm long, adhesive side down along the tips of the flutes and apply pressure (preferably by means of a flat rigid block) to the tape in contact with the tips of the flutes and the test piece ends.

Carefully withdraw the comb from the flutes and lift the resulting 10-flute composite test piece out of the rack.

NOTE 7 Care should be taken to avoid distortion of the flutes caused by applying too great a pressure when applying the tape to the tips of the flutes.

The compression test may be carried out either immediately after fluting or after conditioning.

If the test is to be carried out immediately after fluting, the total time between commencement of fluting and the moment of application of the crushing force shall be 15 s ± 3 s.

If the test is to be carried out after conditioning, the composite test piece shall be conditioned for 30 min to 35 min in the conditioning atmosphere used to condition the samples (see clause 7).

Perform the flat crush test in the conditioning atmosphere used to condition the samples.

Place the composite test piece centrally on the lower platen of the crush tester (5.5) with the uncovered flutes upwards and parallel to the beam if a beam-type tester is used. Start the compression and read, to the nearest 5 N, the maximum force registered in completely crushing the flutes.

If the flutes have been pressed askew during the compression or if they have come away from the tape at any point, reject the results.

10 Expression of results

To assist in the immediate identification of the results, for many purposes it may be most convenient to express results in the form

$$CMT_0 = 350\ N$$

$$CMT_{30} = 250\ N$$

where CMT denotes "corrugated medium test" and the subscript denotes the time, in minutes, between fluting and crushing.

11 Precision

Only limited information is available at present. Where a beam-deflection tester is used and crushing commences 15 s ± 3 s after the commencement of fluting, a repeatability of 4,5 % and a reproducibility of 10 % have been found for test results, each of which is an average of 10 determinations.

No information is available for repeatability and reproducibility for fixed platen-type testers or for after conditioning.

12 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) the date and place of testing;

c) the type of tester used and, where applicable, the rate of loading [see 5.5 d)];

d) a description and identification of the product tested;

e) the conditioning atmosphere used;

f) the time, to the nearest minute, between fluting and crushing; for example "immediate" or "after conditioning for 30 min";

g) the number of valid tests, the arithmetic mean and the standard deviation of all replicate test results, to the nearest 5 N;

h) details of any deviation from the test method, including if a test width of 15 mm has been used;

i) any other information that may assist in the interpretation of the test results.

Dimensions in millimetres

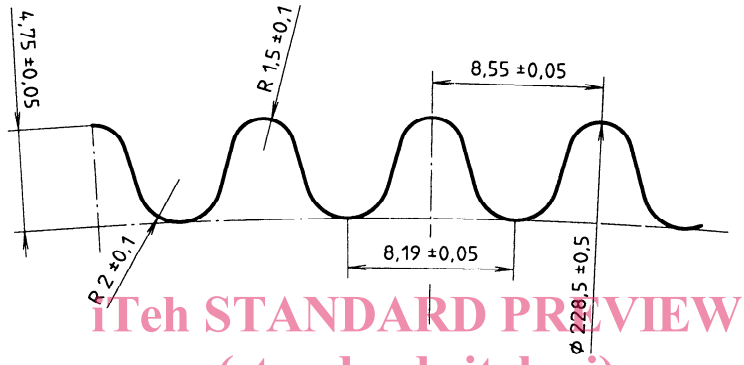

Figure 1 — Profile of corrugating rolls