International Standard 7263

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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

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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

0 Introduction

The flat crush resistance of laboratory fluted corrugating medium is regarded as a most important property of the material. The corrugating medium is fluted by passing it between heated rollers. Two different test procedures are then widely used

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

b) the fluted paper is conditioned in standard laboratory testing conditions before being compressed.

Procedure a) generally gives considerably higher results but with a 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 so widely used, this International Standard describes both procedures for indicating the potential flat crush resistance of corrugated fibreboard.

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

1 Scope

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

2 Field of application

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

3 References

ISO 186, *Paper and board — Sampling to determine average quality.* [1]

ISO 187, *Paper and board — Conditioning of samples.*

4 Definition

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

flat crush resistance: The maximum force that a test piece will withstand before the flutes collapse under the conditions applied in this method of test.

5 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.

6 Apparatus

6.1 Means of cutting the test pieces.

6.2 Fluter, consisting essentially of two meshing steel corrugating rolls. The rolls are capable of being maintained at a temperature of 175 ± 8 °C. The temperature may be verified by any suitable method.

1) At present at the stage of draft. (Revision of ISO 186-1977.)

One of the rolls is motor-driven at 4,5 ± 1,0 r/min and the other roll is held in mesh by a mechanical device which causes a force of 100 ± 10 N to be exerted between the rolls, under operating conditions. (See the note.)

The essential dimensions of the rolls are

Roll diameter	228,5	± 0,5	mm
Roll thickness	16	± 1	mm
Number of teeth	84		
Radius of teeth at peak	1,5	± 0,1	mm
Radius of teeth at base	2,0	± 0,1	mm
Depth of teeth	4,75	± 0,05	mm

(See figure 1.)

NOTE — 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 any instrument conforms with 6.2, 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.

6.3 Rack and comb.

6.3.1 Rack, at least 19 mm wide with a profile corresponding to the teeth of the corrugating rolls. It has nine teeth and 10 valleys. The tooth spacing is 8,50 ± 0,05 mm, and the height of the teeth 4,75 ± 0,05 mm. (See figures 2 and 3.)

6.3.2 Comb, at least 19 mm wide with 10 prongs, 3,0 ± 0,6 mm high. (See figures 2 and 3.)

NOTE — The rack (6.3.1) and comb (6.3.2) may be replaced with an automatic device.

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

It is essential that the tape be low stretch and of good adhesion, and that it does not transfer moisture during the test.

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

The platens shall be large enough to take a test piece of the selected size (see clause 9) without the test piece projecting beyond the platens. They shall also meet the following requirements:

— deviation from parallel not greater than 1 : 1 000

— lateral play not exceeding 0,05 mm.

The surfaces of the platens shall be covered with a very fine abrasive paper, for example grade 00.

6.5.1 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 ± 2,5 mm/min.

6.5.2 If the tester operates on the principle of beam deflection, the deflection at the moment of collapse shall be between 20 % and 80 % of the maximum range of the beam and dial in use. The force applied by the platens shall be developed at a rate of either

110 ± 23 N/s (preferred)

or

67 ± 23 N/s

when the platens enter into contact with one another.

6.5.3 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.

7 Sampling

Sampling shall be carried out in accordance with ISO 186.

8 Conditioning

Condition the samples for at least 2 h in one of the conditioning atmospheres given in ISO 187 before test piece preparation and keep them in that atmosphere throughout the test.

9 Preparation of test pieces

Cut at least 10 test pieces of width 12,7 ± 0,1 mm and of length 150 mm, the length being cut in the machine direction. Reject any test pieces that contain any physical defects. (See the note.)

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

NOTE — A test piece width of 15,0 ± 0,1 mm may be used as an alternative to the standard width provided that the corrugating roll width is greater than the test piece width. In the event of a test strip width of 15,0 mm being used, the force between the corrugating rolls, as defined in 6.2, shall be adjusted to 118 ± 10 N.

1) A suitable product, available commercially, is 3M's Grade 400. This information is given for the convenience of the user of this International Standard and does not constitute an endorsement of this product by ISO.

10 Procedure

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

Corrugate a test piece by inserting it between the rolls with its longer side perpendicular to the nip. Place the corrugated test piece on the rack so that its ends rest on the flat surfaces at each end of the rack. Place the comb over it and press it firmly into the valleys of the rack. Place a strip of the adhesive tape, about 120 mm long, along the tops of the flutes and apply pressure to the tape in contact with the flute tips, preferably using a flat, rigid block. Carefully withdraw the comb from the flutes and lift the resulting ten-flute test piece out of the rack. Flatten the ends of the corrugated test piece and press them on the tape. (See the note.)

The compression test may be carried out either on the unconditioned. fluted test piece or after conditioning the test piece. For conditioning at 23/50 a time of 30 min is recommended and at 20/65, 60 min is recommended.

If the test is to be carried out on the unconditioned test pieces, the total time between commencement of fluting and the moment of initial application of the crushing force shall be less than 15 s (some recommend 5 to 8 s). In practice, this means that the series of operations should be carried out as quickly as possible.

If the test is to be carried out on conditioned test pieces, the test pieces shall be conditioned for 30 min at 23 °C and 50 % relative humidity or 60 min at 20 °C and 65 % relative humidity.

Perform the flat crush test in the conditioning atmosphere used for conditioning the specimen. Place the test piece on the lower plate of the crush tester with the uncovered flutes upwards and parallel to the beam if a beam type crush 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.

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

11 Expression of results

To assist in the immediate identification of the results, for many purposes it will 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 the time, in minutes, between fluting and crushing.

12 Precision

Only limited information is available at present. Where crushing is commenced 5 to 8 s after completion of fluting, a repeatability of 4,5 % and a reproducibility of 6,5 % have been found for test results each of which is an average of 10 determinations.

13 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 the rate of loading (see 6.5.1);

d) a description and identification of the product tested;

e) width of test piece;

f) the conditioning atmosphere used;

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

h) the arithmetic mean and standard deviation of all replicate test results, to the nearest 5 N;

j) details of any deviation from the test method;

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

Dimensions in millimetres

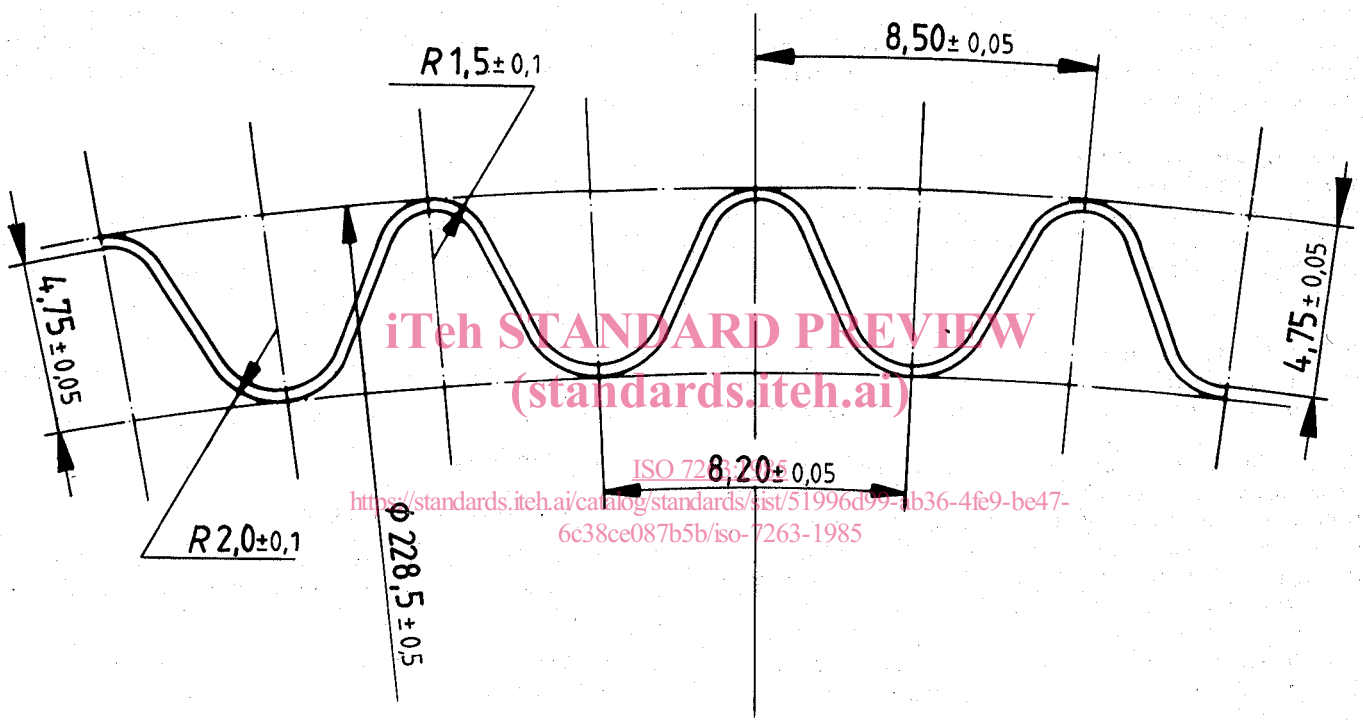


Figure 1 — Profile of fluting rolls

Dimensions in millimetres

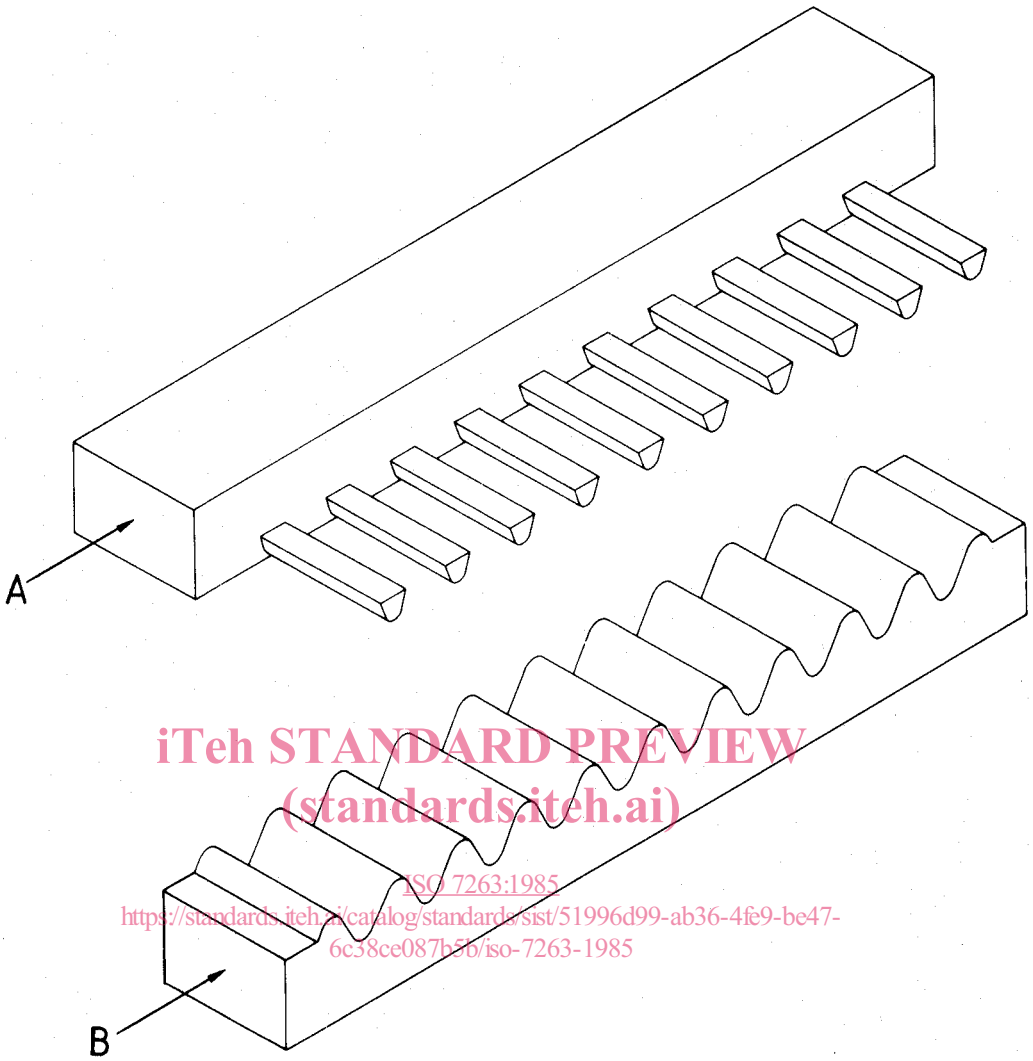
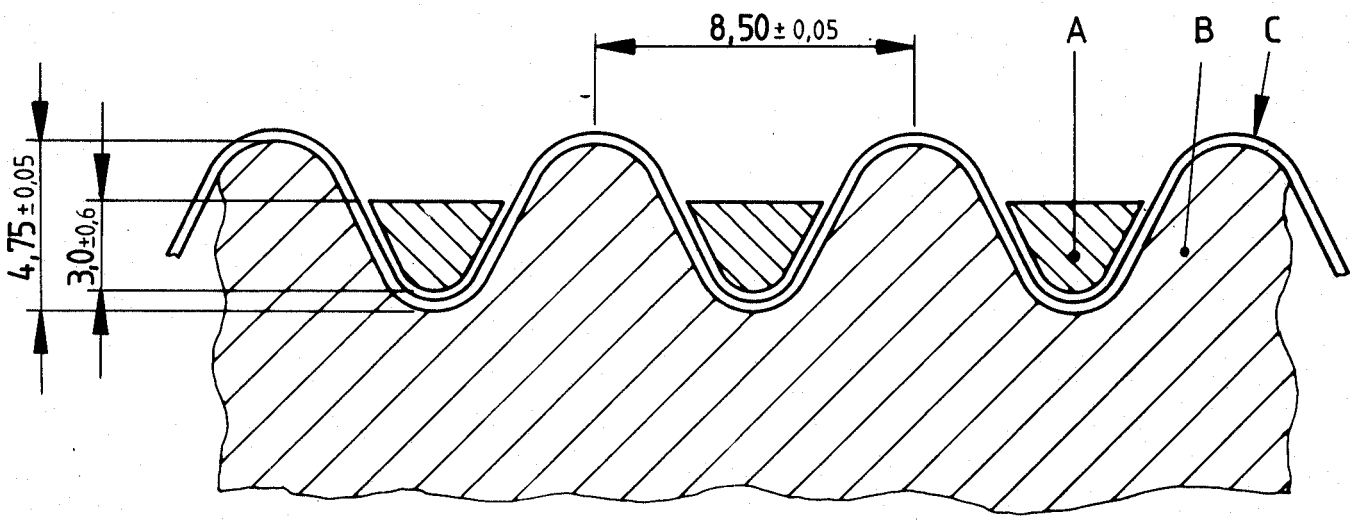


Figure 2 — Profile of comb and rack



A Comb
B Rack
C Paper

Figure 3 — Dimensions of comb and rack