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ISO 11093-9

Second edition
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Paper and board — Testing of cores —

Part 9: Determination of flat crush resistance

Papier et carton — Essais des mandrins —

Partie 9: Détermination de la résistance à l'écrasement à plat

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Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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Contents

Page

iTeh STANDARD PREVIEW
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ISO 11093-9:2006
https://standards.iteh.ai/catalog/standards/sist/8442bdf8-bf65-4099-abb5-4e82e35a067e/iso-11093-9-2006

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11093-9 was prepared by Technical Committee ISO/TC 6, *Papers, board and pulps*.

This second edition cancels and replaces the first edition (ISO 11093-9:1994), which has been technically revised.

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ISO 11093 consists of the following parts, under the general title *Paper and board — Testing of cores*:

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https://standards.iteh.ai/catalog/standards/sist/8442bdf8-bf65-4099-abb5-4e82e35a067e/iso-11093-9-2006

— *Part 1: Sampling*

— *Part 2: Conditioning of test samples*

— *Part 3: Determination of moisture content using the oven drying method*

— *Part 4: Measurement of dimensions*

— *Part 5: Determination of characteristics of concentric rotation*

— *Part 6: Determination of bending strength by the three-point method*

— *Part 7: Determination of flexural modulus by the three-point method*

— *Part 8: Determination of natural frequency and flexural modulus by experimental modal analysis*

— *Part 9: Determination of flat crush resistance*

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Paper and board — Testing of cores —

Part 9: Determination of flat crush resistance

1 Scope

This part of ISO 11093 specifies a method for the determination of the maximum flat crush resistance of wound paper and board cores.

2 Normative references

The following referenced documents are indispensable for the application 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.

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ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 11093-9:2006
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ISO 11093-1, *Paper and board — Testing of cores — Part 1: Sampling*

ISO 11093-2, *Paper and board — Testing of cores — Part 2: Conditioning of test samples*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
flat crush resistance
quantity calculated from the load acting at right angles to the axis of the test piece at the first maximum or levelling off of the crushing force of the load deformation curve

NOTE The flat crush resistance is expressed in kilonewtons per metre.

4 Principle

The test piece is placed between two pressure plates arranged in parallel, so that its axis is parallel with the plane of the pressure plates and compressed at a constant plate rate until the first maximum, or levelling, of the load has been exceeded.

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5 Apparatus

5.1 Compression testing machine, which shall be calibrated and verified to conform to the requirements of ISO 7500-1.

The compression testing machine shall be equipped with flat upper and lower platens held rigidly parallel during testing, permitting movement in a vertical direction only. The speed of the moving platen is the actual rate of travel of the platen while under the load. The force measurement shall have an accuracy of ± 1 % of the smallest crushing load measured.

The switch-off limit for the crushing force ΔF for a testing machine with an automatic break detection is defined by

— 30 N, or

— 3 % from the true value.

The testing machine shall be able to carry out the test so that the plates remain parallel in a range of 2 ‰.

5.2 Cutting device for making test pieces, capable of producing a cut at 90°± 1° to the axis of the core.

The device shall give a clean cut without feathering and shall not cause deformation of the test piece.

To come in line with daily practice and to make the sampling procedure and preparation of test pieces more precise and valid, a circular saw should be used.

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6 Preparation

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6.1 Sampling

Sampling shall be carried out in accordance with ISO 11093-1.

6.2 Number of test pieces

One test piece shall be taken from each specimen, at least 100 mm from the core ends, using the cutting device (5.2).

6.3 Size of test piece

Test pieces cut from cores of nominal internal diameter ⩽ 300 mm shall be (100 ± 1,5) mm long at all points.

Test pieces cut from cores of nominal internal diameter > 300 mm shall be (300 ± 1,5) mm long at all points.

6.4 Conditioning

The test pieces shall be conditioned in accordance with ISO 11093-2.

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7 Procedure

Testing shall be carried out in a standard atmosphere identical to that used for conditioning the test pieces (see 6.4).

Place the test piece centrally between the pressure platens, so that its longitudinal axis is parallel to the platens.

Crushing shall be accomplished by evenly moving one platen towards the other, or both platens in opposite directions towards each other, at a constant relative rate between 50 mm/min and 65 mm/min.

Subject the test piece to a load until the first maximum of the flat crush resistance is markedly exceeded, unless otherwise specified (for example, when determining the flat crush resistance for a specified crushing path).

To make results comparable, all calculated results have to be converted to kilonewtons per metre (kN/m), regardless of the nominal internal diameter of the core (see 6.3).

Repeat this procedure for the remaining test pieces.

8 Calculation

8.1 Calculate the flat crush resistance X_1 of a test piece, expressed in kilonewtons per metre (kN/m), with a nominal internal diameter of $\leqslant$ 300 mm according to Equation (1):

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$$X_1 = \frac{y \times 10}{1\,000} \tag{1}$$

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where y is the measured force, in newtons (N) per (100 ± 1,5) mm length of the test piece.

8.2 Calculate the flat crush resistance X_2 of a test piece, expressed in kilonewtons per metre (kN/m), with a nominal internal diameter of $>$ 300 mm according to Equation (2):

$$X_2 = \frac{y \times 1\,000}{300 \times 1\,000} \tag{2}$$

where y is the measured force, in newtons (N) per (300 ± 1,5) mm length of the test piece.

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9 Test report

The test report shall include the following information:

a) a reference to this part of ISO 11093;

b) type and designation of the cores tested;

c) date and place of sampling;

d) date and place of testing, name and signature of tester;

e) length and number of test pieces tested;

f) individual values and mean (rounded to 1 %) of the flat crush resistance, in kilonewtons per metre length of core;

g) any departure from the procedure specified in this part of ISO 11093 and any circumstances that may have affected the results.

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