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Paper and board — Determination of resistance to bending —

Part 2: Taber-type tester

Papier et carton — Détermination de la résistance à la flexion —

Partie 2: Rigidimètre Taber

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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, *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 2493-2:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

— additional data to be reported in Clause 12;

— several editorial updates.

A list of all parts in the ISO 2493 series can be found on the ISO website.

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.

Paper and board — Determination of resistance to bending —

Part 2: Taber-type tester

1 Scope

This document specifies procedures to measure the bending resistance of paper and paperboard using a Taber-type tester.

This document is used to determine the bending moment required to deflect the free end of a 38 mm wide vertically clamped specimen by 15° when the load is applied at a bending length of 50 mm. For boards that tend to be permanently deformed if bent through 15°, the half bending angle, i.e. 7,5°, can be used. The bending resistance is expressed in terms of the bending moment and parameters set by the manufacturer of the Taber-type tester.

The method is primarily used for papers with a high grammage.

NOTE This document does not cover the low-range version of the Taber-type instrument that uses a bending length of 10 mm (see Reference [5]).

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*

3 Terms and definitions

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

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/

3.1
bending moment
M
torque required to bend a rectangular test piece clamped at one end, measured under the conditions specified in this document

Note 1 to entry: Bending moment is expressed in millinewton metres (mN·m).

3.2
bending resistance
B
mean *bending moment* (3.1) required to bend a rectangular test piece fastened at one end in a clamp, the bending moment being measured under the conditions specified in this document

Note 1 to entry: Bending resistance is expressed in millinewton metres (mN·m).

3.3
bending angle
α
angle through which the clamp rotates while moving from its initial position to the position at which the *bending resistance* (3.2) is measured

Note 1 to entry: The bending angle is 15° or 7,5° (see Clause 10).

3.4
bending length
constant radial distance between the clamp and the position on the test piece at which the force is applied

3.5
bending resistance index
bending resistance (3.2) divided by the grammage to the third power

4 Principle

A test piece of defined dimensions is bent through a specified bending angle (3.3) using a specific type of testing instrument. The resulting bending moment is read from the instrument scale.

For details regarding the test method precision, see Annex A.

5 Apparatus

5.1 Bending resistance tester (see Figure 1), consisting of the following components.

5.1.1 Pendulum, P, rotating around a centre-point, CP, on low-friction bearings, carrying a clamp, C, that has two screws for holding and centring the test piece, TP. At the high end, a centre-line, L, is engraved. At the lower end of the pendulum on its centre-line is a stud, S1, to which weights may be attached and that loads the pendulum at a distance of 100,0 mm ± 0,1 mm from the centre-point. Without added weights, the loading is 10,000 g ± 0,001 g.

5.1.2 Vertical disc, VD, rotating around the centre-point, CP, and driven by a motor, carries two driving arm attachments, DAA, so located as to provide the test piece, TP, with a cantilevered loading length via two driving arms, DA. The bending length (3.4) is 50,0 mm ± 0,1 mm. The driving arms are adjustable by means of screws which enables testing of test pieces of different thicknesses. The ends of the driving arms have rollers as means of transmitting the force to the test piece. It is possible to adjust the length of the arms so that the distance between the test piece and each roller is 0,33 mm ± 0,03 mm.

On the edge of the upper part of the disc, a centre-line mark is engraved. Two reference lines are engraved on the periphery of the vertical disc, VD, at an angular distance of 7,5° and 15° on both sides of the centre-line mark.

A driving mechanism drives the vertical disc, VD, at a nominal constant rate which is allowed to vary between 170° and 210° per minute.

5.1.3 Fixed annular disc, FAD, located around the periphery of the vertical disc, VD. The fixed annular disc has a scale from 0 to 100 on both sides of a centre-line mark, zero. The scale shows the bending

moment required to bend the test piece to the right or to the left (for clarity, only the scale marks 0, 20 and 40 are shown in Figure 1).

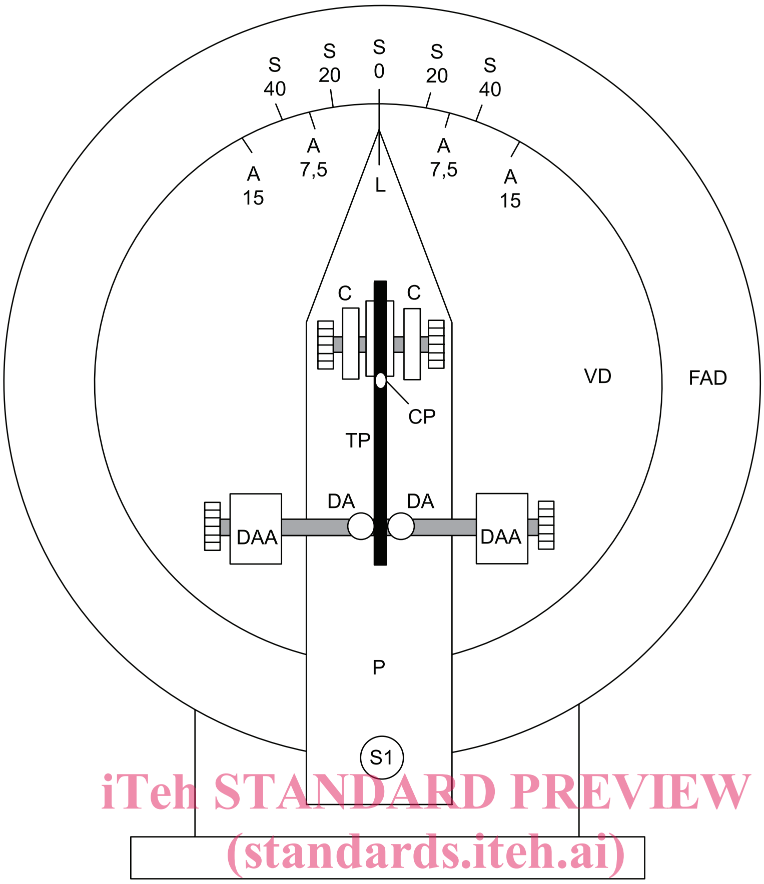
5.1.4 Stand, to support the pendulum, P, the vertical disc, VD, and the fixed annular disc, FAD, equipped with a means for levelling the instrument.

5.1.5 Various loading weights, in stiffness units defined by the manufacturer to be mounted on the stud, S1, to give a maximum bending moment of 490 mN·m.

5.2 Preparation of apparatus

Place the instrument on a firm, flat surface. Set the vertical disc, VD, at zero and place a chosen weight, W, on the stud, S1. Close the clamp, C, so that the faces meet on the centre-line of the pendulum. Level the instrument so that the pendulum is vertical.

Displace the pendulum by 15° and release it to check the bearing friction. It should make at least 20 complete swings before coming to rest.



Key

VD	vertical disc	DAA	driving arm attachments
P	Pendulum	DA	driving arms
TP	test piece	FAD	fixed annular disc
C	clamp	S 0	reference line stiffness 0
CP	centre-point	S 20	reference line stiffness 20
S1	stud	S 40	reference line stiffness 40
A 7,5	reference line, 7,5° deflection	L	centre-line of the pendulum
A 15	reference line, 15° deflection		

Figure 1 — Taber-type tester

6 Calibration

Calibrate the instrument and check the accuracy of the apparatus at regular intervals. The method of calibration depends on the type of instrument and shall be done by following the manufacturer's instructions.

NOTE Spring-steel test pieces are commonly supplied by the manufacturer of the instrument for calibration purposes. Clamps on some instruments are fitted with aluminium faces which are subject to wear. Worn faces change the bending length, producing erroneous results.

7 Sampling

If the tests are being made to evaluate a lot, the sample shall be selected in accordance with ISO 186. If the tests are made on another type of sample, make sure that the test pieces taken are representative of the samples received.

8 Conditioning

Condition the samples of paper or board as specified in ISO 187. Keep them in the conditioning atmosphere throughout the test procedure.

9 Preparation of test pieces

Carry out the preparation of test pieces and the testing in the same conditioning atmosphere as that used to condition the samples.

If the bending resistance index (3.5) is required, determine the grammage in accordance with ISO 536[1].

As required, cut a sufficient number of test pieces, 38,0 mm ± 0,2 mm wide by 70 mm ± 1 mm long, with the length parallel to the machine direction, to enable 5 valid tests to be performed in this direction; and/or cut another set of test pieces with the length parallel to the cross-direction to enable 5 valid tests to be performed in this direction.

Avoid folds, creases, visible cracks or other defects in the area to be tested. If watermarks are present, this shall be noted in the test report.

Highly twisted and curled test pieces may give unreliable results. It is not possible to straighten curled or twisted samples without damaging the material.

10 Procedure

Place a test piece in the clamp, C, with one end approximately level with its top edge and the other end between the rollers at the end of the driving arms, DA.

With the two clamping screws of the clamp, C, align the test piece with the centre-line, L, of the pendulum.

The pressure of the clamping screws may affect the test results. It should be firm enough to hold the test piece, but not so firm as to compress or deform it. The test piece should not be restrained at the free end except by the friction imposed on the surfaces of the free end of the test piece by the driving arms, DA.

Adjust the rollers at the end of the driving arms, DA, so that they are just in contact with the test piece. Adjust the length of one of the driving arms, DA, so that the distance between the test piece and the roller is 0,33 mm ± 0,03 mm.

NOTE 1 It is not necessary for the pendulum to balance at zero with the undeflected test piece in place. Curvature of the test piece will result in a difference between the readings for deflection in the two directions. Readings taken in the two directions are averaged to give the stiffness of the test piece.

Switch on the motor to rotate the vertical disc, VD, to the left and thus deflect the test piece until the centre-line mark, L, on the pendulum is aligned with the 15° mark on the vertical disc VD.

Record the scale reading on the fixed annular disc, FAD, and immediately return the loading disc to zero. Take a similar reading by deflecting the test piece to the right. As required, test at least five machine direction (MD) test pieces and/or at least five cross-direction (CD) test pieces to obtain five valid results, i.e. 10 valid readings, for each required direction.

If the maximum force is obtained before the test piece has been bent through the bending angle 15° (3.3), or a break, kink or crease is observed, the test result should be discarded. If more than 10 % of