INTERNATIONAL STANDARD

ISO 1209-1

Third edition
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Rigid cellular plastics — Determination of flexural properties —

Part 1: Basic bending test

Plastiques alvéolaires rigides — Détermination des propriétés de flexion —

Partie 1: Essai simple de flexion

Reference number
ISO 1209-1:2007(E)

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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.

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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 1209-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This third edition cancels and replaces the second edition (ISO 1209-1:2004), which has been technically revised.

ISO 1209 consists of the following parts, under the general title *Rigid cellular plastics — Determination of flexural properties*:

— *Part 1: Basic bending test*

— *Part 2: Determination of flexural strength and apparent flexural modulus of elasticity*

Rigid cellular plastics — Determination of flexural properties —

Part 1: Basic bending test

1 Scope

This part of ISO 1209 specifies a simple method for assessing the behaviour of a bar of rigid cellular plastic under the action of three-point bending.

It may be used to determine

— either the load for a specified deformation;

— or the load at break.

The version of the method specified in this part of ISO 1209 uses small test specimens and does not produce pure bending. Hence it does not permit the calculation of the flexural strength or the apparent flexural modulus (modulus of elasticity). The user is referred to ISO 1209-2 for the determination of these parameters.

The method is not applicable to cellular plastics in which significant crushing is observed. Numerical values should be compared only when determined on materials of similar physical properties and dimensions.

The method is limited to materials of 20 mm thickness or greater.

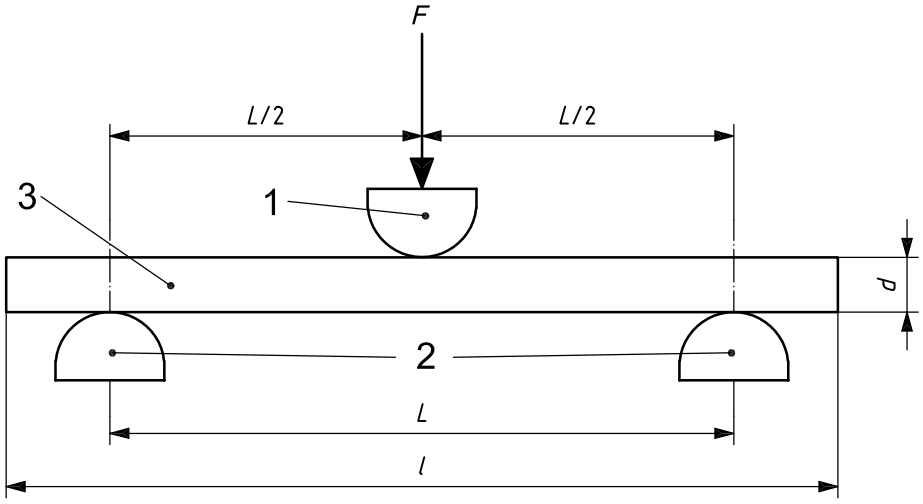
2 Normative references

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.

ISO 1923, *Cellular plastics and rubbers — Determination of linear dimensions*

3 Principle

A load is applied at a uniform rate by means of a loading edge to a test specimen supported at two positions. The load is applied perpendicularly to the specimen at a position midway between the supporting positions (see Figure 1). The load at a specified deflection or at break is recorded.



Key

1 loading edge with cylindrical edge having a radius of (15 ± 1) mm
2 support edges with cylindrical edge having a radius of (15 ± 1) mm
3 test specimen
L distance between support edges
l test specimen length
d test specimen thickness
F applied force

Figure 1 — Side view of test specimen and support edges

4 Apparatus

4.1 Test machine, consisting of

— either a universal mechanical-testing machine

— or a bending-test machine,

capable of operating at a constant rate of movement of the moveable head.

The range of the test machine shall be such that the applied load can be measured with an accuracy of $\pm$ 1 %.

4.2 Test specimen support, consisting of two parallel cylindrical support edges set in the same horizontal plane, each having an edge radius of (15 ± 1) mm. The length of the support edges shall be greater than the width of the test specimens.

The span between the support edges shall be (100 ± 1) mm.

4.3 Test specimen loading edge, having the same shape and dimensions as the support edges. The loading edge shall be located midway between and parallel to the support edges.

4.4 Dial-gauge micrometer, as described in ISO 1923.

5 Test specimens

5.1 Shape and dimensions

Each test specimen shall be a rectangular parallelepiped having the following dimensions:

length: $(120 \pm 1{,}20)$ mm

width: $(25 \pm 0{,}25)$ mm

thickness: $(20 \pm 0{,}20)$ mm

5.2 Preparation

Test specimens shall be cut without deformation of the original cell structure. The test specimens may have a skin on one or more sides. If so, this fact shall be recorded.

5.3 Number

At least five specimens shall be tested for each sample. When testing materials which are suspected of being anisotropic, duplicate sets of test specimens shall be prepared having axes respectively parallel to and normal to the suspected direction of anisotropy.

When testing specimens with only one surface skin, unless otherwise specified, duplicate sets of test specimens shall be tested, one set with the skin in tension and one set with the skin in compression. Report the results separately.

5.4 Conditioning and test conditions

Condition the test specimens for a minimum of 6 h at the conditions under which testing will be carried out. Normal test conditions are

(23 ± 2) °C and (50 ± 10) % R.H.;

(23 ± 5) °C and 50^{+20}_{-10} % R.H.;

(27 ± 5) °C and 65^{+20}_{-10} % R.H.

Temperatures of -196 °C, -70 °C, -10 °C, 0 °C and 40 °C are preferred alternative temperatures, although other conditions may be used, for example those reflecting end use.

6 Procedure

Determine the dimensions of the test specimens in accordance with ISO 1923. Place a test specimen symmetrically upon the support edges so that the direction of loading is perpendicular to the longitudinal axis of the specimen (see Figure 1).

Bring the loading edge into contact with the test specimen, ensuring that only a minimum force is applied.

Note this as the zero-deflection point.

Apply a force by means of the loading edge moving at a rate of (10 ± 2) mm/min.

Record the force, in newtons, corresponding to a deflection of $(20 \pm 0{,}2)$ mm.

If the test specimen fractures before the deflection of 20 mm is reached, record the breaking force and deflection at the breaking point.

7 Expression of results

The results shall be reported as

— either the force, in newtons, at 20 mm deflection;

— or the breaking force, in newtons, and the corresponding deflection, in millimetres.

8 Precision

An interlaboratory test was performed with 10 laboratories in 1993. Four products with different flexural characteristics were tested, three of which were used for statistical evaluation of the reproducibility (two test results for each product) while one product was used for statistical evaluation of the repeatability (five test results).

The results, analysed in accordance with ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests* (now withdrawn), are given in Table 1.

Table 1 — Results of interlaboratory testing

Bending strength	
Repeatability limit (95 % confidence level)	**Reproducibility limit** (95 % confidence level)
Approximately 5 %	Approximately 15 %

9 Test report

The test report shall include the following information:

a) a reference to this part of ISO 1209;

b) a description and identification of the material;

c) the presence or absence of skins or facings on the test specimens and, if applicable, on which faces;

d) the conditioning procedure used;

e) the test conditions (temperature, humidity);

f) the direction of application of the force with respect to any anisotropy;

g) the presence of any crushing, if observed;

h) the individual test results;

i) the arithmetic mean of the test results and the standard deviation;

j) details of any deviation from this part of ISO 1209, and of any incident that may have influenced the results;

k) the date of the test.

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