INTERNATIONAL STANDARD

ISO 1209-2

Third edition
2007-05-01

Rigid cellular plastics — Determination of flexural properties —

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

Plastiques alvéolaires rigides — Détermination des propriétés de flexion —

Partie 2: Détermination de la résistance à la flexion et du module apparent d'élasticité en flexion

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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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 1209-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This third edition cancels and replaces the second edition (ISO 1209-2:2004), 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 2: Determination of flexural strength and apparent flexural modulus of elasticity

1 Scope

This part of ISO 1209 specifies a method for determining the flexural strength and the apparent flexural modulus of elasticity of rigid cellular plastics.

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/deformation curve is recorded. From the curve, the flexural strength and the apparent flexural modulus of elasticity are calculated.

4 Apparatus

4.1 Test machine, consisting of a universal mechanical-testing 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 %.

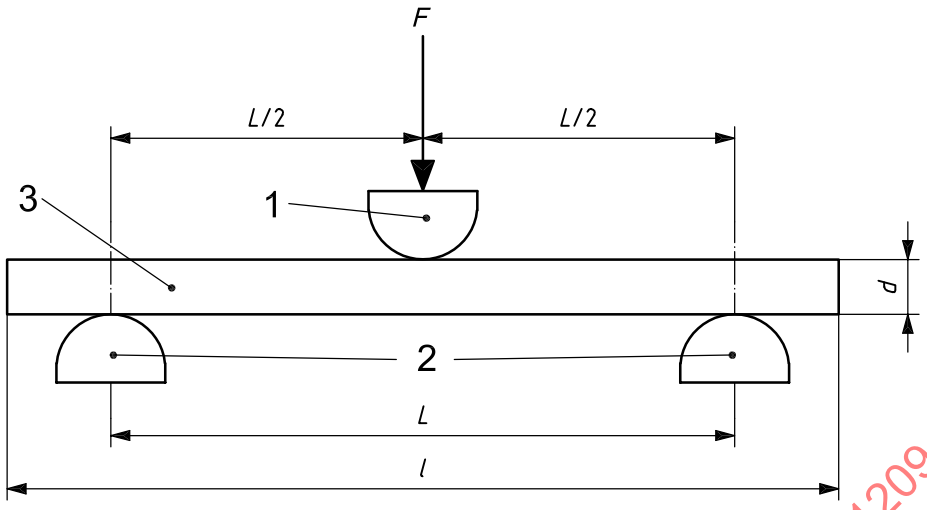
The machine shall include a device for simultaneous recording of force and the corresponding deformation.

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 L between the support edges shall be adjustable in the range 200 mm to 450 mm. The recommended span is 300 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.



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

5 Test specimens

5.1 Shape and dimensions

Each test specimen shall be a rectangular parallelepiped having the dimensions given, together with the corresponding values of the span L between the support edges, in Table 1.

Table 1

Dimension	Recommended value	Limit(s) on value
	mm	mm
Length	350	$\geqslant (L + 50)$
Width b	$4d$	$\geqslant 2d$
Thickness d	25	15 to 38
Span L	300	$12d$ to $16d$

NOTE At high thickness values, it will be necessary to select a span value at the low end of the range $12d$ to $16d$ in view of the limits on the adjustment of the span (see 4.2, second paragraph). Conversely, at low thickness values, it will be necessary to select a span value at the high end of the range $12d$ to $16d$.

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.

6 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.

7 Procedure

Determine the dimensions of the test specimens in accordance with ISO 1923. Place a test specimen symmetrically upon the support edges and apply an increasing force perpendicular to the longitudinal axis of the specimen by moving the loading edge at a constant speed of:

(20 ± 1) mm/min for the determination of the apparent flexural modulus;

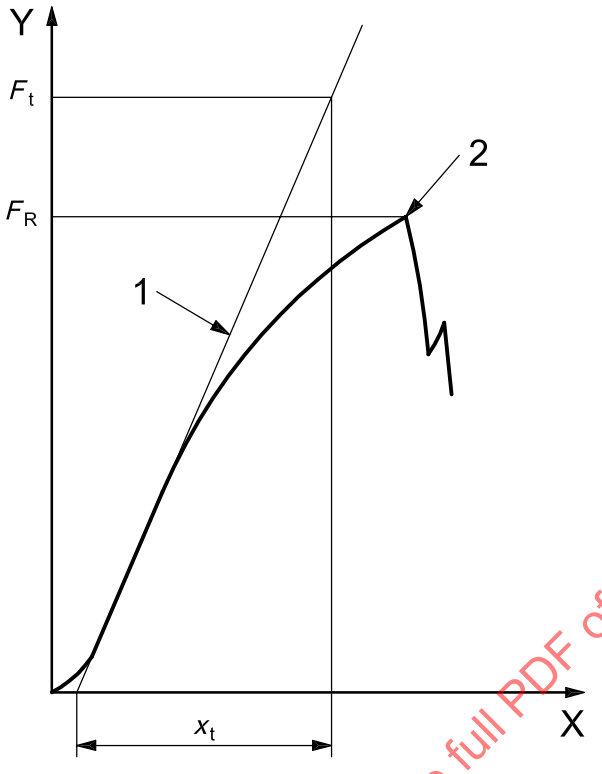
either (20 ± 1) mm/min or (100 ± 10) mm/min for the determination of other flexural properties.

Record the force/deformation curve and draw a line tangential to the steepest part of the curve (see Figure 2).

Record the breaking load when the break occurs before 5 % deflection is reached. It is normally not necessary to continue the test beyond a flexural strain of 5 %.

NOTE With the recommended test specimen and loading arrangement, the strain is at 5 % when the deflection reaches 30 mm.

Inspect the test specimen for any sign of crushing. If any crushing is found, disregard the flexural strength value.



Key

X	deflection (mm)
Y	force (kN)
1	tangent
2	break

Figure 2 — Typical force/deformation diagram

8 Expression of results

8.1 The flexural strength R is given, in kilopascals, by the equation:

$$R = 1{,}5F_R \times \frac{L}{bd^2} \times 10^6$$

where

F_R is the maximum force applied, in kilonewtons;

L is the span between the support edges, in millimetres;

b is the test specimen width, in millimetres;

d is the test specimen thickness, in millimetres.

8.2 The apparent flexural modulus of elasticity E is given, in kilopascals, by the equation:

$$E = \frac{L^3}{4bd^3} \times \frac{F_t}{x_t} \times 10^6$$