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## Rigid cellular plastics — Determination of shear strength

*Plastiques alvéolaires rigides — Détermination de la résistance au  
cisaillement*



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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 1922 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This third edition cancels and replaces the second edition (ISO 1922:1981), which has been technically revised.

Annex A forms a normative part of this International Standard.

# Rigid cellular plastics — Determination of shear strength

## 1 Scope

This International Standard specifies a method of determining the shear strength of rigid cellular plastics. It also provides for the optional determination of shear modulus.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions*.

## 3 Principle

A shear stress is applied to a test specimen of defined shape by means of metal supports bonded to the specimen.

## 4 Apparatus

### 4.1 Test machine

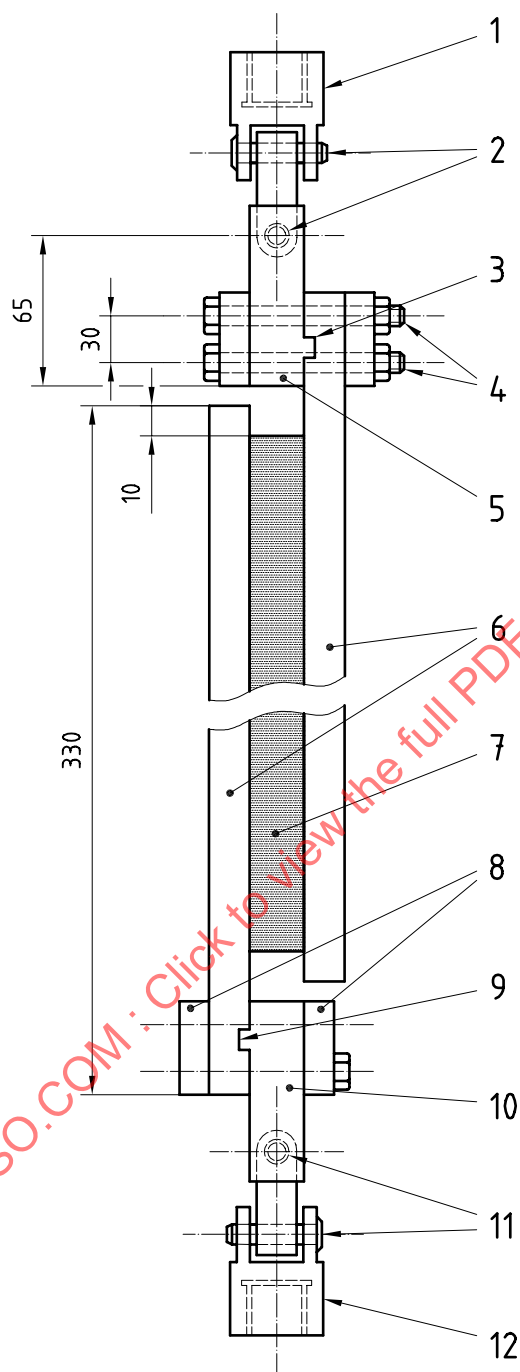
The test machine (see Figure 1) shall be such that:

- a test specimen having the form and dimensions specified in clause 5 is held vertically between two fixing devices each comprising a metal support, one of these devices being fixed and the other movable, and the stress being transmitted along the longitudinal axis of the specimen;
- the movable grip will be moved away from the fixed grip at a constant rate of  $(1 \pm 0,5)$  mm per minute in a direction parallel to the longitudinal axis of the specimen;
- the force exerted on the specimen shall be known with a maximum error of 1 %, and the distance between the grips shall be known with a maximum error of 0,01 mm, by means of recording devices.

### 4.2 Metal supports

These shall consist of flat, rectangular-sectioned, mild-steel plates, machined on one side, with a thickness of  $(16 \pm 1)$  mm and a width of  $50^{+1}_0$  mm.

They shall be attached to the grips by the method shown in Figure 1.



**Key**

- 1 Fixed machine grip
- 2 Universal-joint connection pins, allowing rotation about axis
- 3 Tongue and groove
- 4 Nut and bolt supports,  $\varnothing$  10 mm
- 5 Adaptor
- 6 Metal supports
- 7 Test specimen
- 8 Load-spreading plates measuring (50 × 50 × 5) mm
- 9 Tongue and groove
- 10 Adaptor
- 11 Universal-joint connection pins, allowing rotation about axis
- 12 Movable machine grip

**Figure 1 — Test assembly**

The thickness of the adaptors that connect the metal supports to the test machine grips shall be equal to the thickness of the test specimen.

### 4.3 Adhesive

The adhesive used to fix the metal supports to the test specimen shall be such that the shear strength and modulus of the adhesive film are significantly greater than that of the cellular material under test, so as to ensure ultimate failure in the cellular material rather than at the adhesive interface. The adhesive shall also be compatible with the material under test. Details of a suitable adhesive and the method of application are given in annex A.

## 5 Test specimens

5.1 The test specimens shall be right parallelepipeds of the following dimensions:

- a) length:  $250 \begin{smallmatrix} 0 \\ -5 \end{smallmatrix}$  mm;
- b) width:  $50 \begin{smallmatrix} 0 \\ -1 \end{smallmatrix}$  mm;
- c) thickness:  $(25 \pm 0,5)$  mm.

The distance between two parallel surfaces shall not vary by more than 1 %.

Measure the dimensions in accordance with the principles specified in ISO 1923.

5.2 Prepare test specimens without moulding skins. Machine their surfaces without modifying the original structure.

Bond the two machined surfaces of the metal supports to the larger surfaces of the dust-free test specimens so that the edges of the two metal supports are parallel to each other, as shown in Figure 1.

## 6 Number of test specimens

Test a set of five specimens. When testing materials suspected of being anisotropic, prepare sets of specimens having their major axes parallel with and normal to the suspected directions of anisotropy.

Reject specimens that fail at the adhesive interface before failure of the cellular material and test additional specimens so that the number of significant results is not less than five.

## 7 Conditioning and test temperature

Condition specimens immediately before testing for a period of not less than 16 h at a temperature of  $(23 \pm 2)$  °C and at  $(50 \pm 5)$  % relative humidity, in accordance with ISO 291.

Conduct the test at a temperature of  $(23 \pm 2)$  °C.

## 8 Procedure

Attach a test specimen to the grips of the test machine and apply a force by separating the movable grip from the fixed grip at a rate of  $(1 \pm 0,5)$  mm per minute, with a variation not greater than 10 % during the test.

Record the force-deflection diagram.

Repeat the test on the remaining specimens.

NOTE The following procedure is suggested to correct for the force imposed on the specimen by the metal supports and their attachments:

Before attaching the test assembly to the machine attachments, adjust the test machine to zero force.

If the force-measuring device is in the upper position, correct for the force exerted by one metal support and its attachments by determining their weight and subtracting it from the recorded force.

If the force-measuring device is in the lower position, correct for the force imposed by one metal support and its attachments by determining their weight and adding it to the recorded force.

## 9 Calculation and expression of results

### 9.1 Shear strength

The shear strength  $q$  of the specimen, expressed in kilopascals, is given by the equation

$$q = \frac{1000 \times F_m}{l \times b}$$

where

$l$  is the initial length, in millimetres, of the specimen;

$b$  is the initial width, in millimetres, of the specimen;

$F_m$  is the maximum force, in newtons, applied to the specimen.

### 9.2 Shear modulus

If desired, calculate the shear modulus  $G$  of the specimen, in kilopascals, using the equation

$$G = \frac{1000 \times \delta \times \theta}{l \times b}$$

where

$\delta$  is the thickness, in millimetres, of the specimen;

$\theta$  is the slope of the linear portion of the force-deflection diagram, expressed in newtons per millimetre;

$l$  is the initial length, in millimetres, of the specimen;

$b$  is the initial width, in millimetres, of the specimen.

## 10 Precision and bias

The precision of this method is unknown, and data obtained by the method shall not be used in resolving disputes between suppliers and users.

## 11 Test report

The test report shall include the following particulars:

- a) a reference to this International Standard;
- b) all details necessary for complete identification of the material tested;
- c) where applicable, the direction of application of the force with respect to any anisotropy;
- d) the individual shear strength test results and the average shear strength for each direction of test;
- e) if calculated, the individual shear modulus values and the average shear modulus values for each direction of test;
- f) the mode of failure;
- g) any deviation from the method specified, any operational details not specified in this International Standard, and any circumstances liable to have had an influence upon the results;
- h) the date of testing.

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