INTERNATIONAL STANDARD

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Flexible cellular polymeric materials — Determination of creep in compression

Matériaux polymères alvéolaires souples — Détermination du fluage en compression

Reference number
ISO 10066:1991(E)

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.

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.

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Flexible cellular polymeric materials — Determination of creep in compression

1 Scope

This International Standard describes the procedure for determining the creep of a flexible cellular polymeric material when compressed by a static force, intended primarily for quality assurance in packaging applications.

NOTE 1 The test may also be used to obtain design data. For example, a material that shows excessive creep is not likely to be selected for the manufacture of cushions to support packaged items because of the possibility of slippage during storage. The amount of creep and safe static stress that can be allowed depends on cushion thickness, package life and storage conditions.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 percentage creep strain: The change in compressive strain after 72 h exhibited by a test piece under the specified static stress as determined by measurements 15 min and 72 h after applying the stress.

3.2 compression stress: The static force per unit area of the original cross-section of the test piece.

3.3 percentage compression after recovery: The percentage loss in test piece thickness after 72 h under static stress followed by a 30 min recovery period.

4 Principle

The change in deformation under a static stress with time is measured.

5 Apparatus

The apparatus shall consist of two flat, smooth, but not polished, plates, at least one of which shall be self-aligning, so arranged that they compress the test piece evenly in the vertical direction. The plates shall be capable of being loaded so that during the period of test the static stress does not change by more than $\pm$ 1 %, and the separation of the plates shall be capable of being measured to within 0,1 mm. The compression stress required varies with the material, but is usually less than 10 kPa. The apparatus shall be placed on a substantial support to minimize the effects of vibration.

6 Test piece

6.1 The test piece shall be a right parallelepiped with the following dimensions:

length: 50 mm $\pm$ 1 mm

width: 50 mm $\pm$ 1 mm

mean thickness: within the range 20 mm to 30 mm

The thickness of the test piece shall be subject to a tolerance of $\pm$ 1 mm about the selected mean value.

The dimensions shall be measured in accordance with ISO 1923.

6.2 The thickness of the test piece may, where necessary, be achieved by plying up, without the use of adhesives, two or three sheets each not less than 10 mm thick, provided that a minimum of 10 cell diameters are included in each ply. Such sheets shall be cut to identical shapes and sizes and shall be of the same orientation with respect to any known direction of anisotropy.

6.3 The test piece shall be cut by any suitable means that does not alter the compression characteristics, for example a bandsaw or a sharp knife. A hot wire shall not be used for cutting test pieces.

6.4 The presence of skin on the test piece may affect the test result. Where a horizontal skin will form an integral part of the article in use, such a skin shall be included in the test piece and a note included in the test report. Skin shall not be present on a vertical side of the test piece.

7 Number of test pieces

Two test pieces per sample shall be tested.

8 Test conditions

8.1 Material shall not be tested less than 72 h after manufacture, unless it can be demonstrated that the creep values obtained do not differ by more than ± 10 % from those obtained after 72 h. Testing is permitted at either 16 h or 48 h if, at the selected time, the above criterion has been satisfied.

8.2 Unless otherwise specified, the test shall be carried out at the standard conditions of:

a) 23 °C ± 2 °C and (50 ± 5) % relative humidity for temperate climates;

b) 27 °C ± 2 °C and (65 ± 5) % relative humidity for tropical climates.

8.3 Prior to test, the test pieces shall be stored for at least 16 h under the standard conditions given in 8.2. This period of conditioning can form the latter part of the period following manufacture prior to test (see 8.1).

9 Procedure

9.1 Measure the original thickness d_0 of the test piece in accordance with 6.1. For tests at temperatures other than standard (see 8.2), condition the test piece at the test temperature for a period of at least 1 h following the measurement of the original thickness d_0.

9.2 Place the test piece in the apparatus and apply the appropriate compression stress rapidly and smoothly to the test piece in such a manner as to avoid impact. The magnitude of the applied compression stress shall be as agreed between the purchaser and supplier. The stress chosen shall produce a creep strain of (2,5 ± 0,125) %.

NOTE 2 The stress applied will usually be between 0,5 kPa and 10 kPa.

9.3 Measure the thickness (d_1) of the test piece after 15 min ± 1 min, at the test temperature, without removing the compression stress and repeat the measurement (d_2) after 72 h ± 0,25 h, at the test temperature, again without removing the compression stress. At the end of the test, remove the compression stress and remeasure the thickness (d_R) after the test piece has been allowed to recover for 30 min ± 2 min at the standard conditions (see 8.2).

10 Expression of results

10.1 The average of the test results from the two test pieces shall be used in the calculation of the result.

10.2 Calculate the percentage creep strain C from the equation

$$C = \frac{d_1 - d_2}{d_1} \times 100$$

where

d_1 is the thickness, in millimetres, under compression stress after 15 min;

d_2 is the thickness, in millimetres, under compression stress after 72 h.

10.3 Calculate the percentage compression after recovery R_c from the equation

$$R_c = \frac{d_0 - d_R}{d_0} \times 100$$

where

d_0 is the original thickness, in millimetres, of the test piece;

d_R is the thickness, in millimetres, of the test piece after recovery.

11 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) a description of the material tested;

c) the conditioning and test conditions;

d) the magnitude of the applied compression stress, in kilopascals;

e) the percentage creep strain value;

f) the percentage compression after recovery;

g) the individual results for e) and f);

h) whether or not the samples were plied and the location of any skin.

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