INTERNATIONAL STANDARD

ISO 1856

Third edition
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Flexible cellular polymeric materials — Determination of compression set

Matériaux polymères alvéolaires souples — Détermination de la déformation rémanente après compression

Reference number
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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 1856 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products,* Subcommittee SC 4, *Products (other than hoses).*

This third edition cancels and replaces the second edition (ISO 1856:1980), which has been technically revised.

Flexible cellular polymeric materials — Determination of compression set

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies three methods for determining the compression set of flexible cellular materials.

At present, this International Standard applies only to latex and polyurethane foams of thickness greater than 2 mm. Methods for other materials will be added as required.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document 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 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions.*

3 Term and definition

For the purposes of this International Standard, the following term and definition apply.

3.1
compression set
the difference between the initial thickness and the final thickness of a test piece of the cellular material after compression for a given time at a given temperature and after a given recovery time, the difference being referred to the initial thickness

4 Principle

A test piece is maintained for a specified time at a specified temperature under constant deflection and the effect on the thickness of the test piece noted after release.

5 Apparatus

5.1 Compression device, consisting of two flat plates having dimensions larger than those of the test pieces, with spacers and clamps such that the plates are held parallel to each other and the space between the plates is adjustable to the required deflected height.

For testing thin materials, the requisite number of square photographic glass mounting slides shall be provided. The thickness of the slides shall be between 1 mm and 1,5 mm and the length of the side shall be between 50 mm and 55 mm.

5.2 Means of measuring the dimensions of test pieces in accordance with ISO 1923.

6 Test pieces

6.1 Requirements

Test pieces shall have parallel top and bottom surfaces and essentially vertical sides. They shall be (50 ± 1) mm long, (50 ± 1) mm wide and (25 ± 1) mm thick. All test pieces shall be free from contamination and skin on the vertical sides.

When thin materials are to be tested, sufficient test pieces, of dimensions (50 × 50) mm, shall be taken so that the sum of their thicknesses before compression is at least 25 mm. The test pieces shall be plied together and, where the number of plies is greater than two, interleaved with the photographic mounting slides, and the complete assembly shall be treated during the test as a single thick test piece.

6.2 Samples showing orientation

Normally, testing is carried out in that direction in which the finished product will be stressed under service conditions. If samples show orientation of the cellular structure, the direction in which the compression is to be carried out shall be agreed between the interested parties.

6.3 Number of test pieces

Five 25-mm-thick test pieces, or five assemblies in the case of thin materials, shall be tested.

6.4 Conditioning

Materials shall not be tested for at least 72 h after manufacture. Prior to the test, the test pieces shall be conditioned for at least 16 h in one of the following atmospheres:

(23 ± 2) °C and (50 ± 5) % relative humidity;

(27 ± 2) °C and (65 ± 5) % relative humidity.

7 Procedure

7.1 General

The test may be carried out by method A, method B or method C, or by all three. The three methods may, however, give different results.

7.2 Method A (compression at 70 °C)

After the test piece has been conditioned as specified in 6.4, measure its initial thickness in accordance with ISO 1923. In the case of thin materials, calculate the thickness of the foam d_0 by deducting the aggregate thickness of the glass slides from the total thickness of the assembly of glass slides and test pieces measured with the assembly in the horizontal position.

Place the test piece or assembly between the plates of the compression device; compress it by either 50 % or 75 % of its thickness and maintain it under this condition. In special cases, a compression of 90 % may be agreed upon.

Within 15 min, place the compressed test piece or assembly in an oven at (70 ± 1) °C and leave it for 22 h.

Remove the apparatus from the oven and within 1 min remove the test piece from the apparatus and place it on a surface of low thermal conductivity, such as wood. The surface shall be at laboratory temperature. Allow the test piece to recover for 30 min at the same temperature as that used for conditioning.

Remeasure its thickness d_r. In the case of thin materials, take care not to disturb the assembly: calculate the thickness d_r by deducting the aggregate thickness of the glass slides from the measured total thickness of the assembly of glass slides and test pieces.

7.3 Method B (compression at standard conditioning temperature)

Use the procedure specified for method A, but maintain the test piece under compression for 72 h at the same temperature as that used for conditioning the test piece.

7.4 Method C (compression under specifically specified conditions)

Use the procedure specified for method A, using a time, temperature and level of compression agreed between the interested parties.

8 Calculation and expression of results

8.1 The compression set, expressed as a percentage, is given by the formula:

$$\text{c.s.} = \frac{d_0 - d_r}{d_0} \times 100$$

where

d_0 is the original thickness of the test piece;

d_r is the thickness of the test piece after recovery.

8.2 Report the value of the compression set, followed by the test conditions, in parentheses, in the order: level of compression, time, temperature.

For example: c.s. % (50 %, 22 h, 70 °C).

9 Precision

No precision data are available.

10 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) a description of the material;

c) the temperature and humidity at which the test piece was conditioned;

d) the method used;

e) the thickness of the test piece, if other than that specified;

f) all the values of the compression set, calculated and expressed in accordance with clause 8;

g) the median value of the compression set, in percent;

h) any deviations from this International Standard;

i) the date of the test.