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Flexible cellular polymeric materials — Determination of resilience by ball rebound

Matériaux polymères alvéolaires souples — Détermination de la résilience par rebondissement d'une bille

Reference number
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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document 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 8307:2007), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Figure 1 has been modified.

— Annex A has been revised to represent the practical electric measurement.

Flexible cellular polymeric materials — Determination of resilience by ball rebound

1 Scope

This document specifies a method for determining the resilience by ball rebound of flexible cellular polymeric materials.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
open-cell flexible cellular material
flexible cellular material with less than 25 % of its cell volume closed

3.2
closed-cell flexible cellular material
flexible cellular material with more than 25 % of its cell volume closed

4 Principle

A steel ball is dropped on to a test piece from a specified height and the height of rebound is measured.

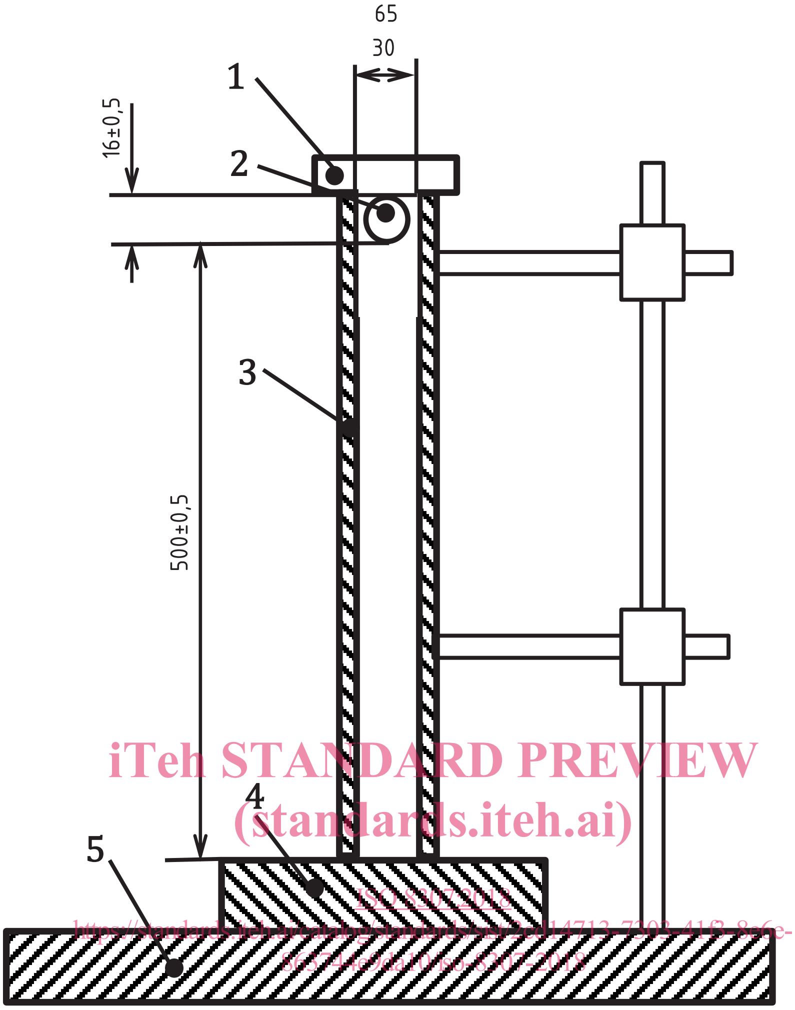
5 Apparatus

5.1 General

The rebound test apparatus (see Figure 1) shall consist of a vertical transparent tube, of inside diameter 30 mm to 65 mm. A steel ball of diameter 16 mm ± 0,5 mm and mass of 16,8 g ± 1,5 g is dropped vertically on the test piece through the tube from a height of 500 mm ± 0,5 mm using a magnet or other suitable device. The steel ball shall be released so that it falls without rotation and is effectively centred.

Measurement errors can arise if the tube is not held in a vertical position, and measurements might be invalid due to contact of the rebounding ball with the inner surface of the tube. It is therefore important to use a spirit level or similar device to ensure that the tube is mounted at right angles to the rigid baseplate, and that the baseplate itself is horizontal.

Dimensions in millimetres



Key

1 magnet or other suitable device
2 steel ball
3 transparent tube
4 test piece
5 rigid baseplate

Figure 1 — Diagrammatic arrangement of test apparatus

5.2 Apparatus with manual reading

The scale on the back of the tube shall be graduated directly in per cent as follows: every 5 % (25 mm) a complete circle shall be scribed and at every 1 % a 120° arc shall be scribed on the tube. The complete circles are an essential part of the apparatus, since they are used to eliminate parallax error.

5.3 Apparatus with automatic reading

A device capable of determining the rebound height of the steel ball by electronic means can also be used, as long as it has been demonstrated to give the same results as the manual-reading apparatus. The rebound height can be calculated from, for example, the rebound velocity or the time interval between the first and second contacts of the ball with the foam surface (see Annex A). The apparatus can be equipped with any such device provided it is capable of determining the rebound height to a

precision of ±1 % of the total drop height (i.e. ±5 mm). For this type of apparatus, the tube does not require graduations.

6 Test pieces

6.1 The test pieces shall have plane, parallel top and bottom surfaces.

6.2 The test pieces shall consist of the entire product sample or a suitable portion of it, except that in no case shall the thickness be less than 50 mm or the area less than 100 mm × 100 mm. Test pieces less than 50 mm thick shall be plied up, without the use of cement, to a minimum of 50 mm. For moulded products, the top skin shall be removed.

Thicker test pieces can be used to avoid spurious results, which can occur with very soft materials due to the influence of the baseplate.

NOTE The minimum test piece thickness of 50 mm cannot be sufficient for very soft materials: if spurious results are obtained, a thicker test piece can be used. Very low density materials can also cause problems due to rebound of the test piece itself. With multiple-ply test pieces, slipping can occur between the plies. This problem can be overcome by using the largest possible area of the test piece.

7 Number of test pieces

Three test pieces per sample shall be tested. The three test pieces may be obtained by using separate items or different locations on a given item.

8 Test conditions and conditioning

Material shall be tested not less than 72 h after manufacture, unless, at either 16 h or 48 h after manufacture, it can be demonstrated that the mean rebound resilience 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.

Prior to the test, the test pieces shall be conditioned undeflected and undistorted for at least 16 h in one of the following atmospheres as given in ISO 23529:

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

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

This period can form the latter part of the period following manufacture.

In the case of quality-control tests, test pieces can be taken a shorter time (down to a minimum of 12 h) after manufacture and testing carried out after conditioning for a shorter period (down to a minimum of 6 h) in one of the atmospheres specified above.

9 Procedure

9.1 Preflex conditioning

Open-cell flexible cellular material as defined in 3.1 shall be subjected to preflex conditioning before testing. Preflex the test piece by compressing it twice to 75 % to 80 % of its original thickness at 0,4 mm/s to 6 mm/s. This operation can be performed manually or by machine. After preflex, allow the test piece to recover for a period of 10 min ± 5 min.

NOTE This preflex conditioning is not applicable to closed-cell flexible cellular material as defined in 3.2.

9.2 Test method

9.2.1 Carry out the test in the atmosphere described in Clause 8 immediately after conditioning the test pieces in the same atmosphere.

9.2.2 Centre the test piece at the base of the tube (see Clause 5) and adjust the height of the tube so that zero rebound is 16 mm ± 0,5 mm above the surface of the test piece. Clamp the tube to make light contact with the test pieces without causing visible compression.

9.2.3 Mount the steel ball on the release mechanism, then drop it and note the maximum rebound height to the nearest percentage point. If the ball strikes the tube on the drop or rebound, the value obtained is invalid. This condition is usually due to the tube not being vertical or to irregularities on the test piece surface. In order to minimize parallax error, the eye-level of the observer shall be such that the markings on the tube in the region where the percentage rebound value is read appear as straight lines. Trial drops might be necessary using spare samples of the same cellular material to establish the correct eye-level prior to performing final measurements.

9.2.4 At least three rebound values in succession within 1 min shall be obtained on each of the three test pieces. To obtain best possible precision for viscoelastic (slow recovery) foams, each drop shall be performed at a new location on the test piece surface. This applies to foam of ball resilience of less than 15 %.

10 Expression of results

For each test piece, determine the median of the three rebound height values, expressed as % value. If any value deviates by more than 20 % (one-fifth) of the median value from the median, make two additional drops and determine the median for all five rebound height values. Using the median values obtained for the three test pieces, determine the overall median value as the rebound resilience value of the material.

If automated measurement is employed, the results shall also be expressed to the nearest integer.

11 Precision

At the present time, precision data are not available for this test method.

12 Test report

The test report shall include the following information:

a) a reference to this document (i.e. ISO 8307:2018);

b) a description of the material tested, including whether open-cell or closed-cell as defined in Clause 3;

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

d) the thickness of the test piece (in mm);

e) whether or not electronic measurement was used;

f) the rebound resilience value as the median of the three test piece medians;

g) the individual rebound height values of the three (or five) tests per test piece;

h) the material lot number or date of manufacture;

i) the date of the test.