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National foreword

This standard has been prepared by Technical Committee ISO/TC 45 “Rubber and rubber products” in collaboration with Technical Committee CEN/TC 249 “Plastics”, (Secretariat: NBN, Belgium).

The responsible German body involved in its preparation was the *Normenausschuss Materialprüfung* (Materials Testing Standards Committee), Technical Committee NA 062-04-37 AA *Prüfung weich-elastischer Schaumstoffe.*

The DIN Standard corresponding to the International Standard referred to in clause 2 of the EN is as follows:

ISO 23529 DIN ISO 23529

Amendments

This standard differs from DIN EN ISO 8307:1998-04 as follows:

a) The standard has been editorially revised.

b) Figure 1 showing the test apparatus has been updated.

Previous editions

DIN 53573: 1985-02
DIN EN ISO 8307: 1998-04

National Annex NA
(informative)

Bibliography

DIN ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

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Flexible cellular polymeric materials - Determination of resilience by ball rebound (ISO 8307:2007)

Matériaux polymères alvéolaires souples - Détermination de la résilience par rebondissement d'une bille (ISO 8307:2007)

Weich-elastische polymere Schaumstoffe - Bestimmung der Kugel-Rückprallelastizität (ISO 8307:2007)

This European Standard was approved by CEN on 24 November 2007.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN ISO 8307:2007) has been prepared by Technical Committee ISO/TC 45 "Rubber and rubber products" in collaboration with Technical Committee CEN/TC 249 “Plastics” the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 8307:1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 8307:2007 has been approved by CEN as a EN ISO 8307:2007 without any modification.

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

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 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.

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

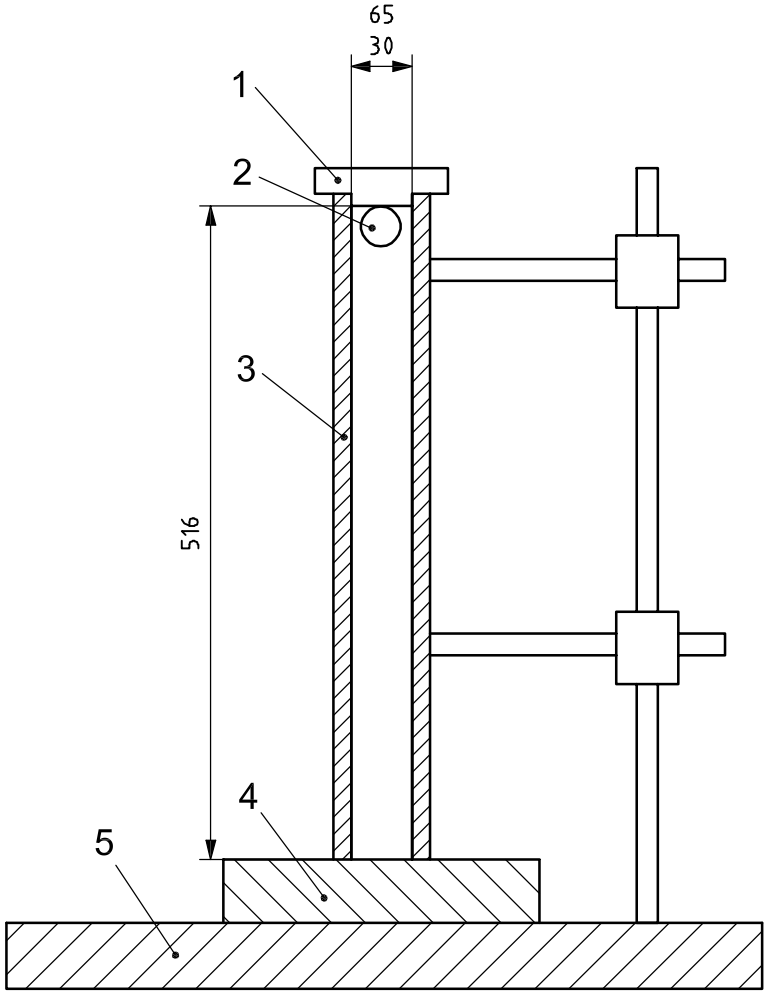
5.1 General

The ball rebound test apparatus (see Figure 1) shall consist of a 30 mm to 65 mm inside diameter vertical transparent tube, into which a 16 mm $\pm$ 0,5 mm diameter steel ball with a mass of 16,8 g $\pm$ 1,5 g is released by a magnet or other suitable device. The steel ball shall be released so that it falls without rotation and is

effectively centred. The height of the drop shall be 500 mm ± 0,5 mm. Since it is most convenient to note the position of the top of the ball on rebound, the top of the ball shall be 516 mm above the surface of the test piece. Thus, “zero” rebound shall be the diameter of the ball above the specimen surface.

Measurement errors can arise if the tube is not held in a vertical position, and measurements may be invalid due to contact of the rebounding ball and 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.

NOTE The minimum test piece thickness of 50 mm may not be sufficient for very soft materials: if spuriously high results are obtained, a thicker test piece can be used. Very low density materials may 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 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

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 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, then allow the test piece to recover for a period of 10 min ± 5 min.

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

9.2 Test method

9.2.1 Carry out the test immediately after conditioning, preferably in the same atmosphere as was used to condition the test pieces (see Clause 8).

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 are necessary in order to establish the correct eye-level.

9.2.4 At least three rebound values in succession within 1 min shall be obtained on each of the three test pieces.

10 Expression of results

For each test piece, determine the median of the three rebound height values. 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 International Standard;

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) whether or not electronic measurement was used;

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

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

g) the material lot number or date of manufacture;

h) the date of the test.

Annex A
(informative)

Example of electronic measurement procedure

The basic construction of the apparatus is as shown in Figure 1. In addition, a light barrier for time measurement is mounted at the lower end of the tube. The time measurement starts with the first contact of the steel ball with the test piece surface and stops with the second contact. The time interval is given by the equation

$$t_{\text{tot}} = 2\sqrt{\frac{2h}{g}}$$

where

t_{tot} is the time between the two contacts, expressed in seconds;

h is the ball rebound height, expressed in millimetres;

g is the acceleration due to gravity, expressed in millimetres per second squared.

Rearranging the equation gives the ball rebound height h:

$$h = \frac{g \times {t_{\text{tot}}}^2}{8}$$

The percentage rebound value R can then be calculated from the equation

$$R = \frac{h}{h_{\text{max}}} \times 100$$

where h_{max} is the height of the drop (500 mm).