INTERNATIONAL STANDARD

ISO 24335

First edition
2006-03-01

Laminate floor coverings — Determination of impact resistance

Revêtements de sol stratifiés — Détermination de la résistance aux chocs

Reference number
ISO 24335:2006(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 24335 was prepared by Technical Committee ISO/TC 219, *Floor coverings*.

Laminate floor coverings — Determination of impact resistance

1 Scope

This International Standard specifies how to determine the impact resistance of laminate floor covering elements. The test described measures the ability of the surface layer to withstand impact from both small and large objects dropped on the floor covering. The testing is destructive by means of the impact on the surface layer from one small and one larger steel ball simulating different scenarios. The force of the small steel ball and the drop height of the larger steel ball are used to define the ability for a laminate floor covering element to withstand impact.

The precision of the method is not known. When interlaboratory data becomes available, a precision statement will be added in subsequent revisions.

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 291, *Plastics — Standard atmospheres for conditioning and testing*

3 Apparatus

3.1 Conditioning chamber, in accordance with ISO 291, with a standard atmosphere of (23 ± 2) °C and relative humidity (50 ± 5) %.

3.2 Polyethylene foam, thickness (2 ± 0,5) mm, density (35 ± 5) kg/m^3.

3.3 Small-diameter ball apparatus

3.3.1 Impact tester, consisting of an impact bolt with a 5 mm steel ball mounted at one end, which is projected once against the surface under test by the release of a compression spring.

The spring compression force before release can be adjusted continuously from 0 N to 90 N by means of a force-setting barrel (see Figure 1).

The newton-metre (N·m) scale also provided on the tester is only to be used for orientation, as the introduction of a non-linear scale involves relatively great inaccuracies.

The compression spring is 100 mm long when released and has a constant of (1 962 ± 50) N/m. It is compressed by drawing back the impact bolt and is held in the loaded position by a retainer which engages in the bolt. It is released to deliver the impact blow by a release unit that withdraws the retainer.

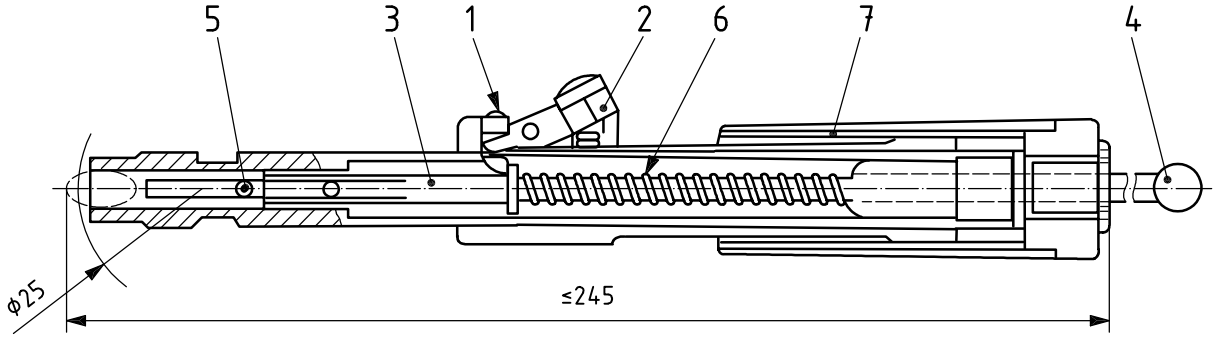
3.3.2 Force-producing arrangement, (for example, a scale-pan and weights) capable of being suspended from the impact bolt to exert a compressive force on the spring.

3.3.3 Support fixture, which clamps to the shaft of the impact tester and provides a convenient mounting of sufficient mass for the tester to be held at right angles to the surface of the specimen and to avoid recoil following the release of the impact bolt (see Figure 2).

3.3.4 Steel plate, having dimensions of approximately 300 mm × 300 mm × 50 mm.

3.3.5 Contrast medium, e.g. graphite, talcum, or solution of dye in alcohol, to contrast with the colour of the surface layer of the element under test.

Dimensions in millimetres

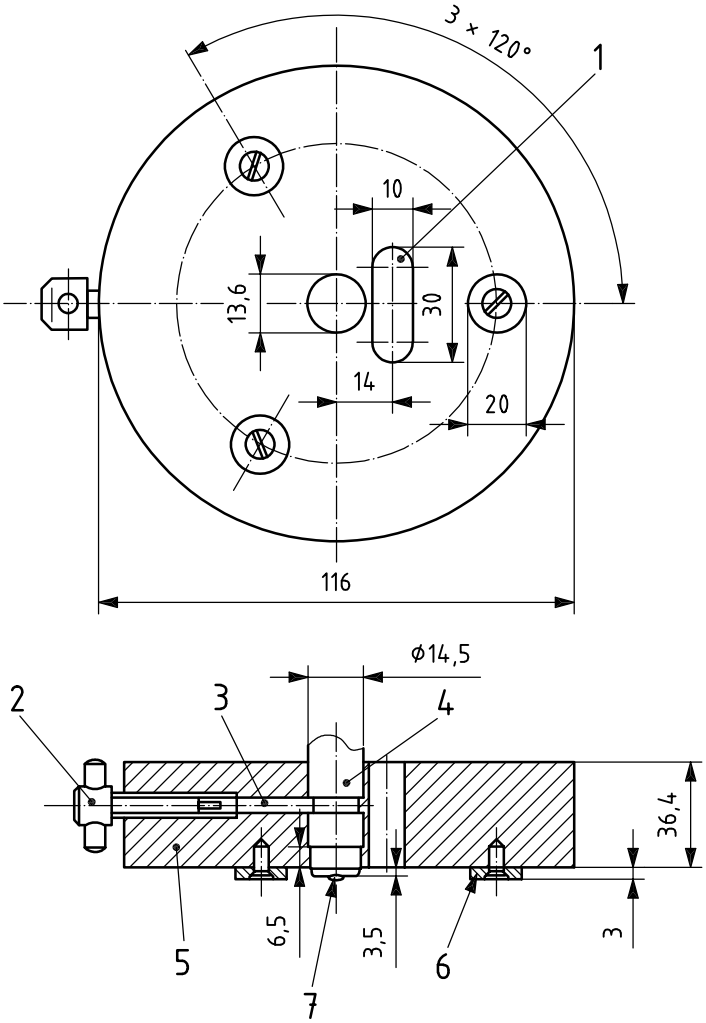


Key

1 retainer
2 release lever
3 impact bolt
4 knob
5 steel ball
6 compression spring
7 force-setting barrel (housing)

Figure 1 — Impact tester (shown with spring compressed)

Dimensions in millimetres



Key

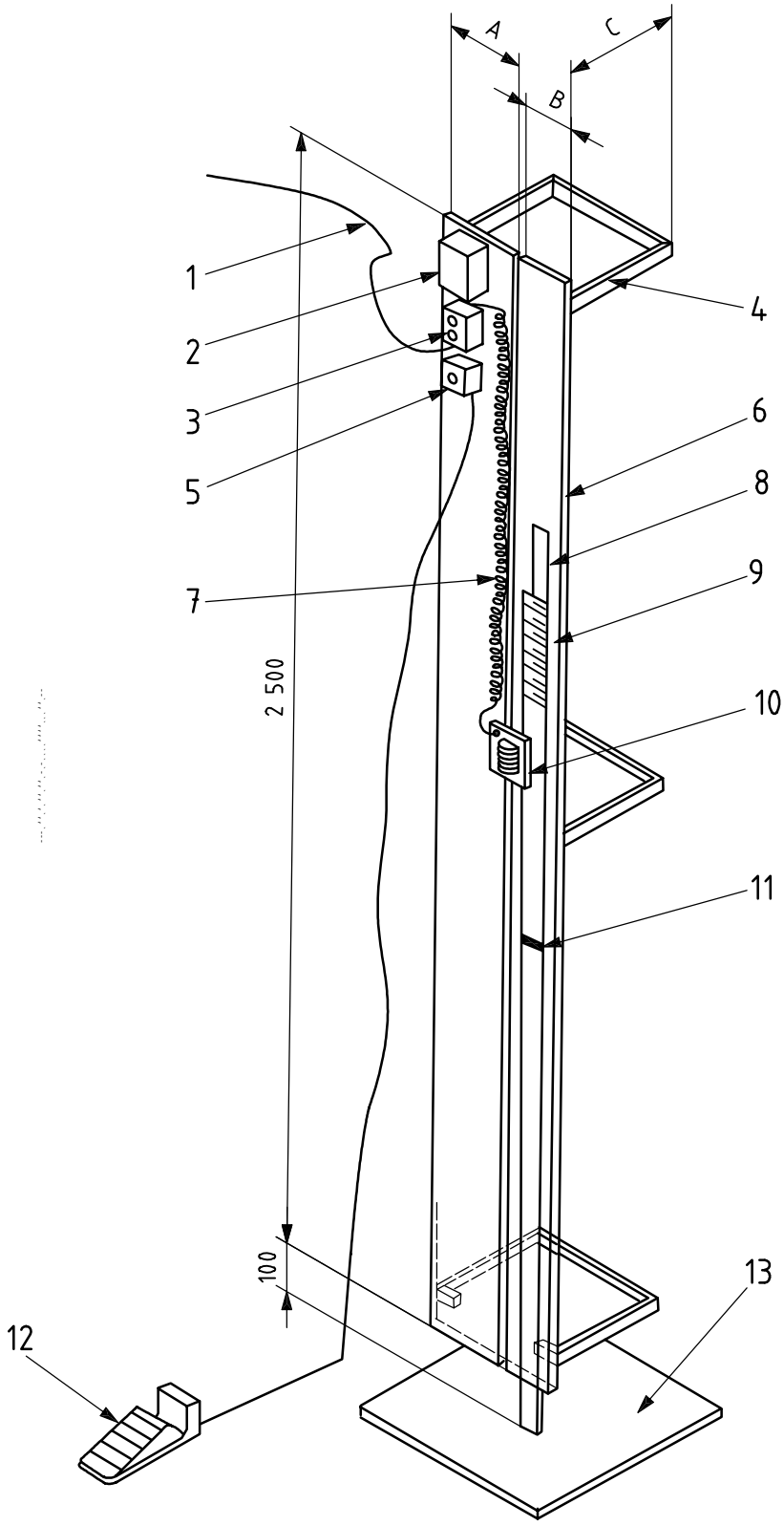
1 observation slot
2 clamp screw
3 pressure bolt
4 shaft of impact tester
5 3 000 g
6 foot
7 steel ball

Figure 2 — Support fixture for impact tester

3.4 Large-diameter ball apparatus

3.4.1 Free-fall test apparatus, of the type shown in Figure 3, or the equivalent.

Dimensions in millimetres



Key

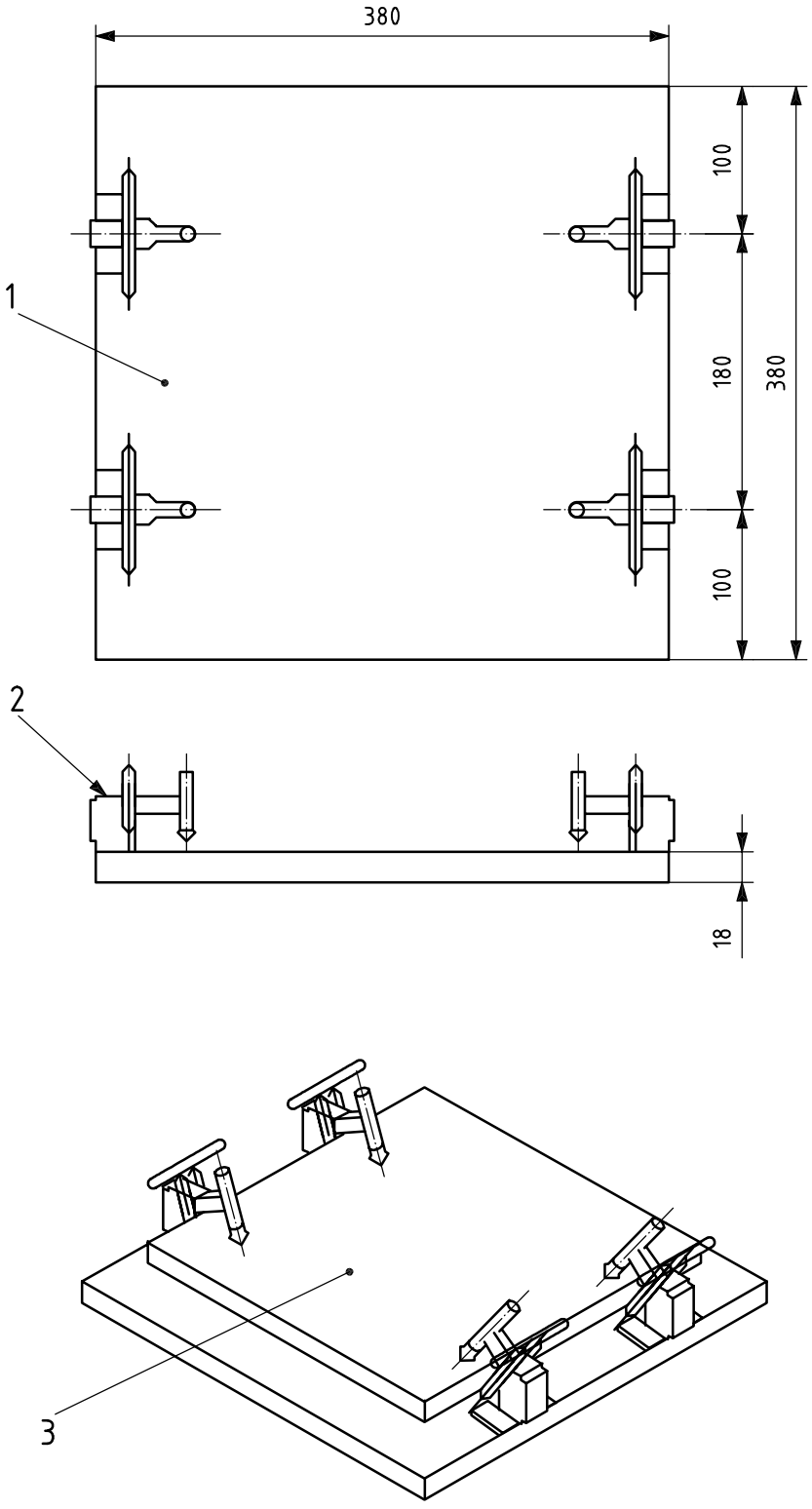
1 power supply
2 transformer and rectifier
3 junction box with duplex receptacle
4 angle iron brackets (Attach firmly to wall or column. Shall be plumb and perpendicular to the base plate.)
5 junction box with indicator light
6 19-mm mounting board for test apparatus — medium or high density board
7 coiled wire lead
8 6,5-mm wide slot
9 machinist's steel sliding scale, 1 800 mm long
10 electromagnet on sliding mount
11 wing nut
12 foot switch
13 460 mm × 460 mm × 19 mm steel plate base levelled and set firmly to the floor

Figure 3 — Free-fall test apparatus

3.4.2 Polished stainless steel ball, with a mass of (224 ± 3) g, a diameter of 38,1 mm and no damaged or flattened surfaces.

3.4.3 Clamping jig, capable of holding the test specimen flat or the equivalent. See Figure 4.

Dimensions in millimetres



Key

1 base
2 clamps
3 test specimen

Figure 4 — Example of clamping jig

3.4.4 Marking pen, black, water-washable marking pen (suitable for overhead transparencies).

3.4.5 Cloth, clean, damp, soft, white cloth.

3.4.6 Fluorescent light, overhead white fluorescent lights with bulb(s) positioned parallel to the line of sight and providing an intensity of 800 lx to 1 100 lx (75 foot-candles to 100 foot-candles) on the specimen surface.

4 Test specimens

4.1 General

Take, from five laminate floor covering elements, the materials to be tested. If the laminate floor covering element is equipped with a factory-applied underlay, all tests shall be carried out with this material kept on, i.e. no pre-attached underlay material must be taken off prior to testing. The material shall be tested in accordance with the manufacturer's intention for installation in order to simulate as real *in situ* situations as possible.

4.2 Specimens for the small-diameter ball test

Take, from each of the five elements, one test specimen having dimensions of approximately 180 mm $\times$ 180 mm. In the case of width smaller than 180 mm, the dimensions shall be w (in millimetres) by 180 mm.

4.3 Specimens for the large-diameter ball test

Take, from each of the five elements, one test specimen having dimensions of approximately 300 mm $\times$ 300 mm, with a joint if needed.

4.4 Conditioning

Test specimens are normally measured in the received state. For type approval or verification purposes, the test specimens shall be stabilized to a constant mass in an atmosphere of (23 $\pm$ 3) °C and (50 $\pm$ 5) % relative humidity. Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0,1 % of the mass of the test specimens. If there is any deviation from this conditioning, it shall be stated in the test report.

5 Procedure

5.1 Impact by small-diameter ball

5.1.1 Principle

The specimens from the laminate floor covering are subjected to the impact from a 5-mm steel ball mounted at one end of a spring-loaded bolt. The minimum spring force needed to cause visible damage is used as a measure of resistance to impact by small-diameter ball.

5.1.2 Calibration of the impact tester

a) Suspend the impact tester (3.3.1) with the impact bolt pointing upwards so that its longitudinal axis is free to hang vertically under gravity.

b) Set the force-setting barrel, which serves to vary the impact force, to zero on the scale. Compress the spring by a force F_e (calibration force) using a suitable arrangement (for example, weights in a scale-pan)

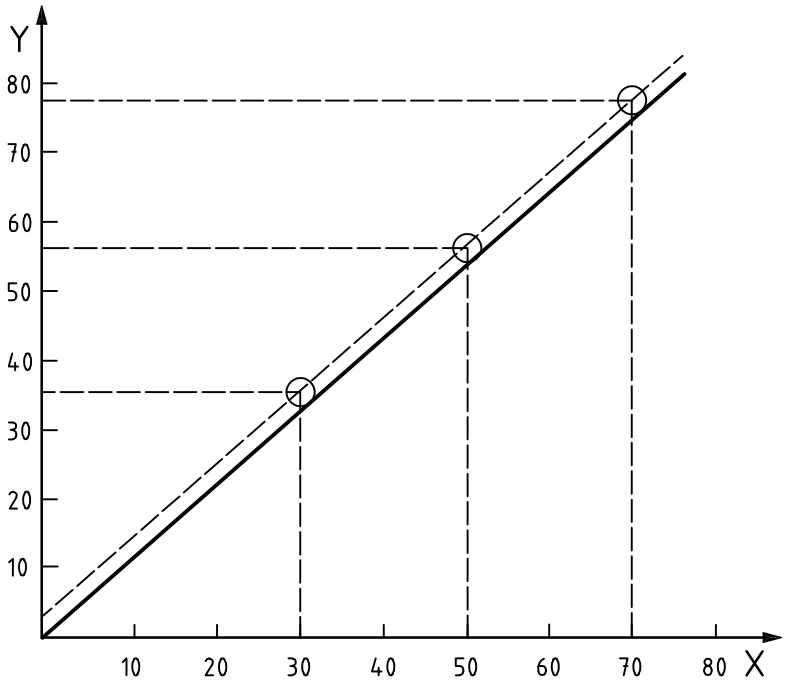
suspended from the knob used to draw back the impact bolt, ensuring that the bolt is clear of the retainer of the release unit.

c) Turn the force-setting barrel until the retainer of the release unit is just in contact with the impact bolt. This position can be determined by increasing or decreasing the compressing force very slightly to observe whether the retainer is just in contact. Record the indicated force, F_x, on the scale of the instrument corresponding to the calibration force, F_e.

d) Repeat this calibration procedure for various values of F_x in the range required, and draw a graph relating values of the scale reading F_x to values of the calibration force, F_e (see Figure 5 for an example).

e) The graph will be an approximately straight line which will not pass through the origin, because a constant but undetermined force is exerted during the calibration procedure by the mass of the impact bolt and any suspension arrangement (for example, a scale-pan). Draw a second line passing through the origin and parallel to the first line. This second line is the calibration graph of the instrument and shall be used to correct every indicated force, F_x, employed in testing.

f) Prepare a new calibration graph after every 500 tests.



Key

X calibration force, F_e, in newtons
Y scale reading on instruments, in newtons

Figure 5 — Example of calibration graph relating actual force to scale value

5.1.3 Testing

a) The test shall be carried out in the laboratory atmosphere.

b) Place the steel plate (3.3.4) on a convenient rigid horizontal surface and locate the specimen on it with its surface layer uppermost. The specimen shall be configured on the test apparatus using the underlay material that is recommended by the supplier and delivered with the sample. If the sample already contains pre-attached underlay material, it is tested as delivered. If the supplier does not specify any underlay material or no underlay material is pre-attached to the elements, the test shall be carried out using the polyethylene foam described in 3.2 as the underlay material. The test specimen shall be loosely clamped on the steel plate so as to immobilize the specimen but not to compress the underlay material.

c) Fix the impact tester (3.3.1) in its support fixture (3.3.3), load the tester, place the assembly on the specimen and release the impact bolt. Start the preliminary test with a spring force of 8 N and increase by 5 N on each occasion to determine the minimum spring force at which the surface of the specimen shows damage due to impact stress.

d) Test each of the remaining four specimens for the final determination of the maximum force at which no damage occurs. For this purpose, start with the spring force determined in the preliminary test and reduce it in suitable stages, for example 1 N, after every five strikes.

e) To make any damage more easily visible, the surface of the specimen shall be rubbed with a contrast medium (3.3.5) after the test.

f) The distance between points of impact shall be at least 20 mm and the distance between points of impact and the edge of the specimen at least 30 mm.

g) Examine the surface tested for damage at the points of impact. For the purpose of this test, damage is defined by the presence of fine hairline cracks (which are frequently concentric), continuous cracks or flaking of the decorative surface. Indentations without cracks do not count as damage. Examine the test specimen by viewing it at an eye-to-specimen distance of approximately 750 mm to 900 mm and at an angle of approximately 45° to 75° from the horizontal (table surface). The specimen shall be viewed from all directions. Direct sunlight or other angle light sources, which will accentuate or minimize the effect, shall be avoided.

h) If the test is conducted only to determine whether the impact strength of a material exceeds a limiting value, the specimen shall sustain no damage after five successive individual impact strikes with the prescribed spring force.

5.1.4 Factors influencing accuracy of the test

a) Damaged or flattened balls shall never be used.

b) The test specimen shall be completely supported on the steel plate. Warped specimens or lack of support can affect results.

c) The conditioning of test specimens can affect the results.

5.2 Impact by large-diameter ball

5.2.1 Principle

The specimens from the laminate floor covering are subjected to the impact from a 38,1 mm steel ball with a mass of (224 ± 3) g. The ball is dropped as a free fall from different heights. The maximum height needed to cause visible damage is used as a measure of resistance to impact by large-diameter ball.

5.2.2 Testing

a) The test shall be carried out in the laboratory atmosphere.

b) The test specimen shall be loosely clamped in the jig so as to immobilize the specimen but not to compress the underlay material. The specimen shall be configured on the test apparatus using the underlay material that is recommended by the supplier and delivered with the sample. If the sample already contains pre-attached underlay material, it is tested as delivered. If the supplier does not specify any underlay material or no underlay material is pre-attached to the elements, the test shall be carried out using the polyethylene foam described in 3.2 as underlay material.

c) Adjust the height scale so that it touches the face of the test specimen. If the test specimen contains a joint or seam, the impact test area shall have a minimum distance of 25 mm from these areas.

d) Position the electromagnet at any arbitrary height above the test specimen.

e) Place the ball on the electromagnet and drop the ball. Catch the ball on the first rebound so that multiple impacts do not occur. The space between impact points must be at least 50 mm from the edge of the specimen.

f) Use the marking pen (3.4.4) to ink over impact points caused by the ball. Use the clean, damp, soft, white cloth (3.4.5) to wipe each impact point. Fractures may appear as hairline cracks, concentric circles, or chips.

g) Examine the impact spot for cracks and determine the result. Examine the test specimen by viewing it at an eye-to-specimen distance of approximately 750 mm to 900 mm and at an angle of approximately 45° to 75° from the horizontal (table surface). The specimen shall be viewed from all directions. Direct sunlight or other angle light sources, which will accentuate or minimize the effect, shall be avoided.

h) Raise or lower the electromagnet height as necessary and repeat steps e) through g) until the maximum height at which no cracking occurs is determined.

i) Drop the ball from the height determined in step h) two additional times in different locations on the test specimen. If any of these drop fails, reduce the height by 25 mm and continue testing until a total of three successful results have been obtained at the same height.

j) Repeat the proceeding with the other four specimens. The final result will be the average value of the five specimens.

5.2.3 Factors influencing accuracy of the test

a) Damaged or flattened balls shall never be used.

b) The test specimen and clamping jig shall be completely supported on the solid base. Warped specimens or lack of support can affect results by as much as 100 %.

c) The fall path of the ball shall be precisely perpendicular to the specimen’s surface.

d) The conditioning of test specimens can affect the results.

6 Expression of results

6.1 Small-diameter ball

The impact resistance to small-diameter ball is the maximum value of the spring force, in newtons (N), for which no damage occurs in a series of five successive strikes at the same spring force. The final result will be the average value from the maximum values obtained from the last four specimens tested, expressed to the nearest 1 N.

To prove compliance with a specified limit value, it is only necessary to carry out the test at that specified force.

6.2 Large-diameter ball

The impact resistance to large-diameter ball is the maximum value of the drop height in millimetres (mm), for which no damage occurs in a series of three successive strikes at the same height. The final result will be the average value from the maximum values obtained from the five specimens tested, expressed to the nearest 50 mm.

To prove compliance with a specified limit value, it is only necessary to carry out the test at that specified drop height.

7 Test Report

The test report shall include the following information:

a) the reference to this International Standard (ISO 24335:2006);

b) the name, type and nominal thickness of the product;

c) a clear description of the underlay material used. It shall be clear if it was pre-attached, supplied by the manufacturer, or if the standard polyethylene foam was used;

d) when necessary, the name, type and nominal thickness of the underlay material used;

e) for specimens containing a joint, the position of the joint shall be described;

f) the four individual average results and the final result in newtons (N) of the small-diameter ball test;

g) the five individual average results and the final result in millimetres (mm) of the large-diameter ball test;

h) any deviation from the specified procedures;

i) the date of the test.

Bibliography

[1] EN 438-2:2005, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called Laminates) — Part 2: Determination of properties*

[2] EN 13329, *Laminate floor coverings — Specifications, requirements and test methods*

[3] NEMA LD 3-2000[1)], *High-Pressure Decorative Laminates*

1) NEMA = National Electrical Manufacturers Association, U.S.A.

ICS 97.150

Price based on 11 pages