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**Resilient floor coverings - Polyvinyl
chloride floor coverings with particle based
enhanced slip resistance - Specification**

EUROPEAN STANDARD

EN 13845

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2017

ICS 97.150

Supersedes EN 13845:2005

English Version

Resilient floor coverings - Polyvinyl chloride floor coverings with particle based enhanced slip resistance - Specification

Revêtements de sol résilients - Revêtements de sol en chlorure de polyvinyle à résistance accrue au glissement - Spécification

Elastische Bodenbeläge - Polyvinylchlorid-Bodenbeläge mit partikelbasiertem erhöhten Gleitwiderstand - Spezifikation

This European Standard was approved by CEN on 22 May 2017.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 6 September 2017.

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Contents

Page

European foreword.....	3
Introduction	4
1 Scope.....	5
2 Normative references.....	5
3 Terms and definitions	6
4 Requirements	6
4.1 General requirements	6
4.2 Classification requirements	6
5 Marking.....	10
Annex A (informative) Optional properties	11
Annex B (informative) Additional methods of test	12
Annex C (normative) Determination of slip resistance.....	13
C.1 Scope.....	13
C.2 Referenced documents.....	13
C.3 Principle	13
C.4 Operator	13
C.5 Test footwear.....	13
C.6 Apparatus.....	14
C.7 Test fluid.....	14
C.8 Test piece	14
C.9 Procedure.....	14
C.10 Evaluation	15
C.11 Calibration	15
C.12 Test report.....	15
Annex D (normative) Determination of wear resistance.....	16
D.1 Scope.....	16
D.2 Principle	16
D.3 Apparatus.....	16
D.4 Test specimen.....	16
D.5 Conditioning.....	17
D.6 Procedure.....	17
D.7 Expression of result.....	17
D.8 Test report.....	18
Bibliography.....	19

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European foreword

This document (EN 13845:2017) has been prepared by Technical Committee CEN/TC 164 “Resilient, textile and laminate floor coverings”, 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of an identical text or by endorsement, at the latest by February 2018, and conflicting national standards shall be withdrawn at the latest by February 2018.

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

This document supersedes EN 13845:2005.

The main technical changes compared to EN 13845:2005 are:

- a) Where EN standards have been superseded by equivalent ISO standards these have been substituted in the document;
- b) The pendulum slip test has been added to the General Requirements in Table 1.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The ramp test is a means of assessing the slipperiness of floors under wet conditions. Ramps of different designs exist and CEN/TC 134 therefore decided not to standardise on a ramp design. The aim of this European Standard is to establish and standardise the principle of testing and specify the parameters to be followed when designing a ramp device and when testing with it.

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1 Scope

This European Standard specifies the characteristics of floor coverings with sustainable enhanced slip resistant characteristics under specified conditions based on polyvinyl chloride and modifications thereof, supplied in either tile or roll form.

To encourage the consumer to make an informed choice, this European Standard includes a classification system (see EN ISO 10874) based on intensity of use, which shows where resilient floor coverings should give satisfactory service.

In addition, this European Standard details the requirements for the information to be included on the packaging labels.

The slip measurements are made in a laboratory on ex-factory floor covering surfaces only. The method described is suitable for testing on wet surfaces.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 425, *Resilient and laminate floor coverings — Castor chair test*

EN 660-2, *Resilient floor coverings — Determination of wear resistance — Part 2: Frick-Taber test*

EN 684, *Resilient floor coverings — Determination of seam strength*

EN 12466:1998, *Resilient floor coverings — Vocabulary*

CEN/TS 16165:2016, *Determination of slip resistance of pedestrian surfaces — Methods of evaluation*

EN ISO 105-B02, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test (ISO 105-B02)*

EN ISO 10874, *Resilient, textile and laminate floor coverings — Classification (ISO 10874)*

EN ISO 23997, *Resilient floor coverings — Determination of mass per unit area (ISO 23997)*

EN ISO 23999, *Resilient floor coverings — Determination of dimensional stability and curling after exposure to heat (ISO 23999)*

EN ISO 24341, *Resilient and textile floor coverings — Determination of length, width and straightness of sheet (ISO 24341)*

EN ISO 24342, *Resilient and textile floor-coverings — Determination of side length, edge, straightness and squareness of tiles (ISO 24342)*

EN ISO 24343-1, *Resilient and laminate floor coverings — Determination of indentation and residual indentation — Part 1: Residual indentation (ISO 24343-1)*

EN ISO 24344, *Resilient floor coverings — Determination of flexibility and deflection (ISO 24344)*

EN ISO 24346, *Resilient floor coverings — Determination of overall thickness (ISO 24346)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12466:1998 and the following apply.

3.1 enhanced slip resistance

capacity of a floor covering to counteract slipping under wet conditions

3.2

floor covering with particle based enhanced slip resistance

floor covering with a wear surface modified to provide sustainable enhanced slip resisting properties under specified conditions. The floor covering can have other solid layers which may differ in composition and/or design and may contain a reinforcement. This type of floor covering contains various aggregate or identifiable particles of different hardness to the surface layer such as cork which are to be present in the surface layer throughout the normal wear life of the product. They do not necessarily form a distinctive, measurable surface layer and have specific tests designed to measure the performance

3.3

polyvinyl chloride floor covering

floor covering with surface layers produced using polyvinyl chloride and modifications thereof as binder

3.4

aggregate

natural or synthetically coloured mineral granules, such as quartz and aluminium trioxide, that can be used to provide and maintain the surface roughness of a resilient floor covering

3.5

wet-loaded area

area in which the floor coverings are generally wet and walked on. These are in buildings used by the public and for industrial purposes, such as for example in baths, changing rooms, washrooms, toilets, sluice rooms, kitchens, etc.

3.6

barefoot area

area where the floor is primarily intended for barefoot use such as in shower trays and pool surrounds

3.7

footwear area

area where the floor is intended for use with shoes and other types of footwear

4 Requirements

4.1 General requirements

Floor coverings described in this European Standard shall comply with the appropriate general requirements specified in Table 1, when tested in accordance with the methods given therein.

4.2 Classification requirements

Floor coverings described in this European Standard shall be classified as suitable for different levels of use in accordance with the performance requirements specified in Table 2, when tested with the methods given therein. Classification shall conform to the scheme established in EN ISO 10874.

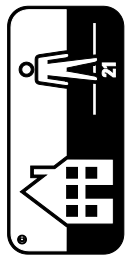
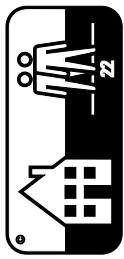
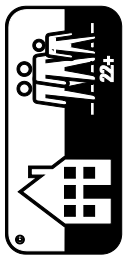

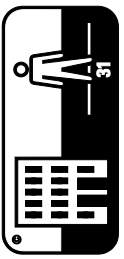
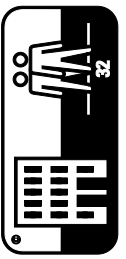
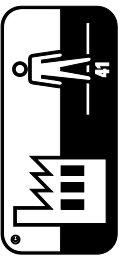
Table 1 — General requirements

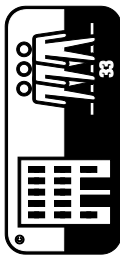
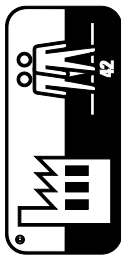
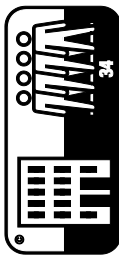
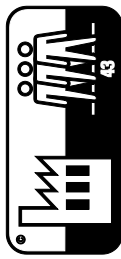
Characteristic	Requirement	Test method
Roll form: length (m) width (mm)	Not less than the nominal values	EN ISO 24341
Tiles: side length (mm) squareness and straightness for side length ≤ 400 mm > 400 mm > 400 mm (intended for welding)	Deviation ± 0,13 % of nominal length up to 0,5 mm maximum Deviation allowed at any point ≤ 0,25 ≤ 0,35 ≤ 0,50	EN ISO 24342
Total mass per unit area (average) (g/m ²)	Nominal value + 13 % - 10 %	EN ISO 23997
Overall thickness: (mm) Average Individual results	Nominal + 0,13 - 0,10 average value ± 0,15	EN ISO 24346
Slip classification : Class ESf (footwear) : Class ESb (barefoot)	≥ 20° (Ramp test) ≥ 36 (Pendulum friction test) ≥ 15° (Ramp test) ≥ 36 (Pendulum friction test)	Annex C (Ramp test) CEN/TS 16165:2016 Annex C, (Pendulum friction Test)
Residual indentation (average) (mm)	≤ 0,1	EN ISO 24343-1
Dimensional stability: (%) sheets and tiles (intended for welding) tiles (intended for dry-joint laying)	Variation in each direction ≤ 0,4 % ≤ 0,25 %	EN ISO 23999
Curling: (mm) Sheets and tiles to be bonded Sheets and tiles un-bonded	(See footnote ^a) ≤ 2	
Flexibility:	Test using a 20 mm mandrel.	EN ISO 24344 Method A
Colour fastness to artificial light	6 minimum	EN ISO 105-B02, Method 3 ^b

^a The test need not be carried out for fully bonded and welded materials. If supplied in tile form and dry joint laid the material shall meet the requirement (2 mm).

^b Expose a full size test sample. Store a further test sample in the dark, which will constitute the reference standard for assessment of change in colour.

Table 2 — Classification requirements for level of use

Class	Symbol	Level of use	Minimum overall thickness ^a Nominal value, mm	Impact of wear Resistance ^{b c}	Effect of a castor chair	Seam strength N/50 mm
21		domestic moderate/ light	1,0	20 000 cycles	No Requirement	No Requirement
22 22+	 	domestic general/ moderate domestic general	1,5			
23		domestic heavy	1,5			
31		commercial moderate	2,0	30 000 cycles	If tested for verification, no disturbance to the surface other than slight change due to flatter appearance and no delamination shall occur.	When welded in accordance with the manufacturers instructions average value \geq 240. Individual values values \geq 180
32		commercial general				
41		industrial moderate				

Class	Symbol	Level of use	Minimum overall thickness ^a Nominal value, mm	Effect of wear resistance ^{b,c}	Effect of a castor chair	Seam strength N/50 mm
33		commercial heavy	2,0	40 000 cycles		When welded in accordance with the manufacturers instructions average value \geq 240. Individual values values \geq 180
42		industrial general				
34		commercial very heavy	2,0	50 000 cycles		
43		industrial heavy			EN 425	
Test method			EN ISO 24346	Annex D	EN 425	EN 684

^a The average value shall be the nominal value $\begin{matrix} +0,13 \\ -0,10 \end{matrix}$ mm. No individual value shall vary more than $\pm 0,15$ mm from the average value.

^b After testing to the required number of cycles the reduction in identifiable particles should be ≤ 10 %.

^c Floor coverings for barefoot use only need not be tested and are automatically applied a classification 21/31.

5 Marking

Floor coverings covered by this standard and/or their packaging shall bear the following marking:

- a) number and date of this European Standard;
- b) manufacturer's or supplier's identification;
- c) product name;
- d) colour/pattern, and batch and roll number if applicable;
- e) classes/symbols appropriate for the product;
- f) for rolls: the length, width and thickness;
- g) for tiles: the dimensions of a tile and the area in square metres contained in a package;
- h) for rolls: a statement that the material shall be fully bonded to the subfloor;
- i) slip resistance classification.

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Annex A
(informative)

Optional properties

Where the following properties are requested for specific applications, the floor covering should be tested in accordance with the appropriate methods:

- electrical resistance (EN 1081);
- electrostatic propensity (EN 1815);
- effect of stains (EN ISO 24937);
- heavy swivel castor.

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Annex B
(informative)

Additional methods of test

The following test methods are also available for this type of product but do not form part of the specification:

- effect of simulated movement of a furniture leg (EN 421);
- peel resistance (EN ISO 24345);
- shear force (EN 432);
- spreading of water (EN 661);
- curling on exposure to moisture (EN 662);
- conventional pattern depth (EN 663);
- volatile loss;
- exudation of plasticizers (EN 665);
- gelling (EN 666);
- mass/unit area of a reinforcement or backing.

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Annex C (normative)

Determination of slip resistance

C.1 Scope

The method used in this European Standard is used to determine and assess the slip resisting properties of floor coverings, which are intended for use in wet loaded areas. The method can be applied with the test person barefoot or wearing standard test shoes.

C.2 Referenced documents

CEN/TS 16165, Determination of slip resistance of pedestrian surfaces — Methods of evaluation, Annex A (Barefoot Ramp Test) and Annex B (Shod Ramp Test)

C.3 Principle

An operator moves backwards and forwards in an upright position on the floor covering to be tested, the angle of which, starting from the horizontal is increased up to the point (angle of inclination) at which the operator becomes insecure. The angle of inclination is determined on a floor covering, which is subjected to a continuous stream of water containing a wetting agent. The angle of inclination is used to assess the enhanced slip resistant properties.

C.4 Operator

The operators shall include at least two adults. Age, weight and pertinent physical limitations of the subjects shall be included in the test report. The feet or footwear of each operator shall have been wetted for (10 ± 1) min prior to the test in water. The water should be at a similar temperature as the solution to be used on the ramp (15 °C to 23 °C). The operator shall be protected from falling by means of a safety device, which permits the operator to move freely on the floor covering being tested.

It is important that the operators are fully trained and familiar with the test procedure and specific apparatus to be used prior to any tests being carried out. It is recommended that the calibration panels are used to aid the training procedure. As it is important that the gait and step timing are consistent during the test it is recommended that a timing device (such as an electronic metronome) and step markers adjacent to the test panel are used. These can provide a guide to the test subject in terms of step length until such time that they become familiar with the test procedure. Before any set of tests are carried out on floor coverings it is recommended that each operator is checked against the expected results from the calibration panels. If this check test gives a result that differs by more than $\pm 2^\circ$ from the calibration panel, the operator should not be used for testing until the cause has been identified and/or further training carried out.

C.5 Test footwear

Each operator shall wear a pair of flat-soled shoes without a heel soled with Four S¹ sole material. Any well fitting commercially available shoe is suitable providing it has a flat sole and no defined heel area. The Four S Rubber, in 3 mm sheet form, is adhered to the sole and trimmed to size. Prior to use the shoe

¹ Can be sourced from RAPRA Technology Shawbury Shrewsbury Shropshire SY4 4NR United Kingdom.

sole should be plane-grinded to an even finish using P400 silicon carbide paper in an orbital sander. Remove any dust from the shoe sole and repeat this procedure prior to any new test programme, or if the shoe sole has become damaged during the tests.

C.6 Apparatus

The test device is a level and torsion free platform at least 600 mm wide and 2 000 mm long, which can be adjusted to gradients between 0° and 45° in the longitudinal direction preferably by a centre pivot. The drive unit achieves a platform angular lifting speed of maximum 1 s, so that at least 45 s are required to adjust to the maximum angle of 45°. The lifting stroke is controlled by the operator. An angle indicator on the test device displays the platform angle from horizontal at an accuracy of $0,5^\circ \pm 0,2^\circ$. The angle indicator cannot be seen by the operator during testing. For safety reasons the operator shall wear a suitable fall arrest harness and railings are fitted along the longitudinal sides of the test apparatus. A second operator is used to record the angle and monitor the flow of the wetting solution. A suitable apparatus is described in CEI 16165, A.2.1.

C.7 Test fluid

The test fluid used is the aqueous solution of a neutral wetting agent. Sodium Dodecyl Sulphate (Sodium Lauryl Sulphate Standard Laboratory Grade) should be used at a concentration of 0,1 %. It is important that the test solution is prepared immediately before the test using tap water and is used within a test period of 1 h. The test fluid is pumped at 6 l/min to wet the whole surface of the test floor. The temperature of the solution shall be between 15 °C and 23 °C.

C.8 Test piece

The test piece shall be a minimum of 1 000 mm x 500 mm and shall be taken from the floor coverings to be tested. The floor coverings to be tested shall either be fastened or bonded onto level base-plates made of a load-bearing, warp-free material. The surface to be tested shall be clearly recognisable as such or be marked as such.

Floor coverings with directional profiles or roughness shall be positioned in such a way that the direction of minimum slip resistance corresponds to the direction of movement of the operator. Where the direction is not obvious testing of the slip resistance in directions at 90° to each other may be required.

Floor coverings, which are rectangular in shape without directional profiles or roughness, shall be positioned in such a way that the short edge is parallel to the rotary axis of the test apparatus.

The upper surface of the floor coverings shall be cleaned before testing to remove manufacturing residues, dirt, stripping agents or rough edges by scrubbing with the test fluid and a soft bristle brush and then allowing the lubricant to flow over the surface prior to the test being carried out.

The test piece shall be prepared to correspond to the use in practice of this type of covering.

Condition the test samples for 24 h in the same ambient conditions as for the test apparatus 15 °C to 23 °C.

C.9 Procedure

Ensure a continuous and uniform stream of test fluid at $6 (\pm 1)$ l/min over the test piece during the test. In the case of absorbent floor coverings ensure uniform wetting of the top surface by preliminary soaking.

The operator shall move backwards and forwards in an upright position on the floor covering being tested, taking steps corresponding to approximately half the operators foot length. Step rates should be

144 (± 10) steps/min. It is important that the operator looks down at their feet when conducting the test. The foot should be lifted clear of the test surface during each step. The operator should move backwards and forwards twice on the test surface without pausing at the top or bottom. Then, whilst stationary, the operator increases the platform angle by approximately 1° and repeats the test. The process is repeated until the angle of inclination (the critical angle) at which the operator reaches the limit of safe movement (i.e. a definite slip occurs) is reached. The operators may repeat the movement around the critical angle to satisfy themselves the result is valid. The critical angle shall be determined four times, returning to the horizontal position between each test. The procedure is then repeated by the second operator.

C.10 Evaluation

Calculate the arithmetic mean from the eight individual values. If any individual values deviate by more than 2° from the mean, repeat the test and calculate the mean from the 16 individual values.

C.11 Calibration

As there are no absolute standard floor covering surfaces available in the form of resilient vinyl floor coverings, calibration of the apparatus and test subjects can be based on the method outlined in CEN/TS 16165, Annex A.²

C.12 Test report

The test report shall indicate the following:

- a) reference to this European Standard, i.e. EN 13845;
- b) designation, manufacturer, product, quality classification and dimensions of products used for the floor covering;
- c) surface characteristics (e.g. smooth, profiled);
- d) sampling;
- e) joint width of floor covering tested;
- f) mean angle of inclination rounded to the nearest 1° , if necessary for every profile direction tested;
- g) test location;
- h) any deviation from this standard that may have affected the results;
- i) date of test;
- j) slip classification.

² It is proposed that further work will be carried out to develop the calibration method so that is more appropriate to the conditions of the test procedure proposed. This may be based on the use of the reference tile used for calibration within DIN 51097. This will enable the calibration plates to be used as a quick check before any test programme.

Annex D
(normative)

Determination of wear resistance

D.1 Scope

This method is used for classifying floor coverings with enhanced slip resistance by the reduction of identifiable particles in the surface.

D.2 Principle

To measure the loss of particles in the surface after a defined number of wear test cycles.

D.3 Apparatus

The apparatus shall be in accordance with that specified in EN 660-2.

D.4 Test specimen

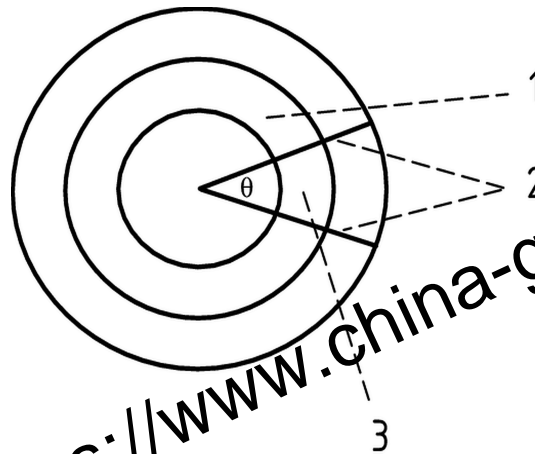
Three test specimens of diameter 100 mm shall be made. One of them shall be kept in reserve. A circular hole, with the same diameter as the journal in the centre of the specimen holder table, shall be cut in the middle of each specimen.

When the test specimen is rotating in a test the two wheels shall be rolling on it, following a circular path with an area of about 3 000 mm². Mark an area on the test specimen by two radial lines. Choose the angle θ so that the number of particles in the area restricted by the lines and the wear pattern will be about 100 (Figure D.1, area (a).)

To simplify particle counting a transparent squared matrix may be used. Mark the centre and the radial lines on the matrix. When counting particles align the matrix on the test specimen.

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Key

- 1 wear pattern (initial 20 revolutions)
- 2 marking lines
- 3 area (a)

Figure D.1 — Test specimen

D.5 Conditioning

The product conditioning shall be as specified in EN 660-2.

D.6 Procedure

Use the wear test procedure specified in EN 660-2. Start the procedure with the test specimen marked according to Figure D.1.

After 20 revolutions, take the sample out and count the number of particles (N_1) in the area (a) that is limited by the marked lines and the wear pattern (see Figure D.1). Use a pocket lens or a microscope with a magnification of X7-10. After counting the particles subject the specimen to the appropriate number of wear cycles specified in Table D.1 and count the remaining particles (N_2).

D.7 Expression of result

Express the reduction of identifiable particles as a percentage loss according to the following formula

$$\frac{N_1 - N_2}{N_1} \times 100 \tag{D.1}$$

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Table D.1 — Wear classes

Wear class	Revolutions	Reduction in identifiable particles
21/22/22+/23/31	20 000	≤ 10 %
32/41	30 000	≤ 10 %
33/42	40 000	≤ 10 %
34/43	50 000	≤ 10 %

D.8 Test report

The test report shall indicate the following:

- a) reference to this European Standard, i.e., EN 13845;
- b) product designation, manufacturer, quality classification and dimensions of products e.g. thickness;
- c) surface characteristics;
- d) any deviation from standard that may have affected the result;
- e) number of revolutions tested and the wear class achieved;
- f) date of the test.

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Bibliography

- [1] EN 424, *Resilient floor coverings — Determination of the effect of simulated movement of a furniture leg*
- [2] EN 432, *Resilient floor coverings — Determination of shear force*
- [3] EN 661, *Resilient floor coverings — Determination of the spreading of water*
- [4] EN 662, *Resilient floor coverings — Determination of curling exposure to moisture*
- [5] EN 663, *Resilient floor coverings — Determination of conventional pattern depth*
- [6] EN 665, *Resilient floor coverings — Determination of exudation of plasticizers*
- [7] EN 666, *Resilient floor coverings — Determination of gelling*
- [8] EN 1081, *Resilient floor coverings — Determination of the electrical resistance*
- [9] EN 1815, *Resilient and laminate floor coverings — Assessment of static electrical propensity*
- [10] EN ISO 26987, *Resilient floor coverings — Determination of staining and resistance to chemicals (ISO 26987)*
- [11] EN ISO 24345, *Resilient floor coverings — Determination of peel resistance (ISO 24345)*

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