BS EN 15468:2016

BSI Standards Publication

Laminate floor coverings — Elements with directly applied printing and resin surface layer — Specifications, requirements and test methods

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National foreword

This British Standard is the UK implementation of EN 15468:2016. It supersedes BS EN 15468:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/60, Resilient and Laminate Floor Coverings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Laminate floor coverings - Elements with directly applied printing and resin surface layer - Specifications, requirements and test methods

Revêtements de sol stratifiés - Éléments comportant une couche d'impression appliquée directement et une couche de surface à base de résine - Spécifications, exigences et méthodes d'essai

Laminatböden - Direktbedruckte Elemente mit Kunstharz-Deckschicht - Spezifikationen, Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 27 November 2015.

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European foreword

This document (EN 15468:2016) has been prepared by Technical Committee CEN/TC 134 “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of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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 15468:2007.

Compared to EN 15468:2007, the following changes have been made:

a) general definition for laminate floor coverings included;

b) test method for abrasion resistance based on falling sand method and requirements based on this test method added;

c) defined underlay for impact resistance test with the large diameter ball added;

d) Table 1 (classification requirements) changed in accordance with EN 13329:2016, Table 2 (classification requirements);

e) technical characteristic micro-scratch resistance added.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies characteristics, states requirements and gives test methods for laminate floor coverings (as defined in 3.1).

It includes a classification system, based on EN ISO 10874, providing practical requirements for areas of use and levels of use, to indicate where laminate floor coverings will give satisfactory service and to encourage the consumer to make an informed choice. It also specifies requirements for marking and packaging.

Laminate floor coverings are considered for domestic and commercial levels of use, e.g. in domestic kitchens. This standard does not specify requirements relating to areas that are subject to frequent wetting, such as bathrooms, laundry rooms or saunas.

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 322, *Wood-based panels - Determination of moisture content*

EN 424, *Resilient floor coverings - Determination of the effect of simulated movement of a furniture leg*

EN 425:2002, *Resilient and laminate floor coverings - Castor chair test*

EN 438 (all parts), *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called Laminates)*

EN 13329:2016, *Laminate floor coverings — Elements with a surface layer based on aminoplastic thermosetting resins — Specifications, requirements and test methods*

EN 16094, *Laminate floor coverings - Test method for the determination of micro-scratch resistance*

CEN/TS 16354, *Laminate floor coverings - Underlays - Specification, requirements and test methods*

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

EN ISO 868:2003, *Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

ISO 24334, *Laminate floor coverings — Determination of locking strength for mechanically assembled panels*

ISO 24336, *Laminate floor coverings — Determination of thickness swelling after partial immersion in water*

ASTM D785, *Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials*

FEPA standard 42-D, *Grains of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications*

FEPA standard 44-D, *Grains of fused aluminium oxide, silicon carbide and other abrasive materials. Determination of bulk density*

3 Terms and definitions

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

NOTE This European Standard specifies characteristics, requirements and test methods for laminate floor coverings with directly applied printing and resin surface layer as defined in 3.1 and 3.2.

3.1
laminate floor covering
rigid floor covering, typically in a plank or tile format, with a multiple layer structure: e.g. backer, substrate and décor

Note 1 to entry: The planks/tiles have worked edges that allow the product to be joined together to form a larger integral unit. The product may vary in surface texture and gloss level.

Note 2 to entry: Laminate flooring does not include products having a resilient, stone, textile, wood, leather or metal top surfacing material(s).

3.2
resin based surface layer
upper decorative layer intended to be the visible side when the floor is installed, consisting of resins (usually acrylate, methacrylate or similar) which are cured using UV radiation or other curing methods

Note 1 to entry: It can exhibit impregnated and coated materials (generally décor paper), or at least one paint or varnish layer applied direct on the board using indirect printing, direct printing or digital printing. The combination of the multi-layered surface produced with this technique is called Printed Décor Laminate (PDL).

3.3
substrate
core material of the laminate floor covering

Note 1 to entry: It is generally a particleboard, as defined in EN 309, or a Dry process fibreboard (MDF) as defined in EN 316 or a so called High Density Fibreboard (HDF) which is a MDF-board with a density ≥ 800 kg/m^3.

3.4
backer
layer opposite to the surface layer used to balance and stabilize the product

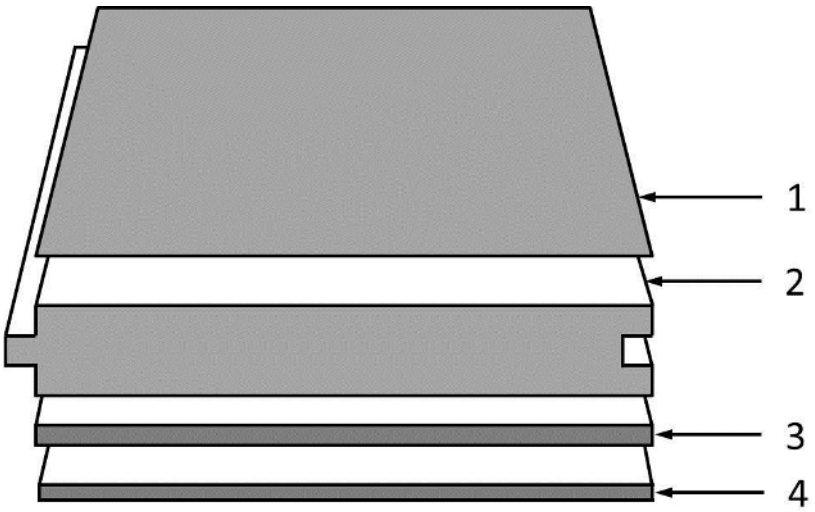
Note 1 to entry: The backer is generally made of impregnated papers

3.5
underlay
layer placed between the laminate floor covering and the subfloor to impart specific properties

Note 1 to entry: Some laminate floor covering products have the underlay pre-attached directly to the backer.

3.6
laminate floor covering element
piece of the floor covering with profiled edges to facilitate assembly at installation

Note 1 to entry: See Figure 1.



Key

1 surface layer

2 substrate

3 backer

4 underlay (optional)

Figure 1— Laminate floor-covering element

4 Requirements

4.1 General requirements

Laminate floor coverings according to this standard shall conform to the general requirements given in EN 13329:2016 when tested by the methods given therein.

For special applications, such as decorative pattern effects, tighter tolerances might be required.

The tolerances of the tongue and groove shall be such that when, for testing, the elements are assembled without glue, the maximum permissible opening and height difference values are not exceeded.

To determine the capability of laminate floor coverings to withstand ambient humidity variations, a laboratory test in controlled conditions shall be made.

4.2 Classification requirements

Laminate floor coverings using the PDL technologies, according to this standard, shall be classified as suitable for different levels of use according to the classification requirements specified in Table 1, when tested by the methods given therein. Classification shall conform to the scheme specified in EN ISO 10874.

For the big ball impact test a standard EPS foam of (1,8 ± 0,2) mm thickness, with a CS value of (60 ± 10) kPa and with PC-value of (0,9 ± 0,1) mm shall be used. The three parameters of the foam shall be determined according to CEN/TS 16354.[1)]

1) The product "Selitflex 1,6 mm" made by Selit Dämmtechnik GmbH is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of this product. Equivalent products may be used if they can be shown to lead to the same results.

Table 1 — Classification requirements and levels of use for floor coverings using PDL technologies

	Levels of use						**Test method**
	Domestic			**Commercial**			
	Moderate	**General**	**Heavy**	**Moderate**	**General**	**Heavy**	
Class:	**21**	**22**	**23**	**31**	**32**	**33**	
Abrasion resistance	AC1	AC2	AC3		AC4	AC5	EN 13329:2016, **Annex E**
Alternative: Abrasion resistance	AC1	AC2	AC3		AC 4	AC 5	**Annex A**
Impact resistance **Small ball**	≥ 8 *N*				≥ 12 *N*	≥ 15 *N*	EN 13329:2016, **Annex H**
Big ball	≥ 500 mm				≥ 750 mm	≥ 1 000 mm	
Resistance to staining	4, (groups 1 and 2) 3, (group 3)	5, (groups 1 and 2) 4, (group 3)					EN 438–2
Effect of a furniture leg	—	No damage shall be visible, when tested with foot type 0					EN 424
Effect of a castor chair	—	25 000 cycles, No damage[a]					EN 425:2002 [b]
Thickness swelling	≤ 20 %	≤ 18 %				≤ 15 %	ISO 24336
Locking Strength	-				$f_{l0,2}$ ≥ 1 kN/m (length) $fs_{0,2}$ ≥ 2 kN/m (width)		ISO 24334
Surface soundness	≥ 1,0 N/mm²				≥ 1,25 N/mm²		EN 13329:2016, **Annex D**

[a] No visible damage on the surface of the assembled test area caused by detachment of layers, opening of joints, or crazing. Ignore any flattening or change in appearance, e.g. change in gloss.

[b] Using soft castor wheels W PU (95 ± 5) Shore A.

4.3 Additional technical characteristics

When any of the characteristics given in Table 2 are requested for specific applications, the laminate floor coverings shall be tested by the methods given therein. The properties stated in Table 3 are considered important for some specific products or applications.

Table 2 — Additional technical characteristics

Characteristic	Comment	Test method
Humidity at dispatch from the manufacturer	The elements shall have a moisture content of 4 % to 10 %. Any single batch shall be homogeneous with $H_{max.} - H_{min.} \leq 3$ %.	EN 322
Appearance, surface defects	Minor surface defects as defined in the EN 438 series are permitted.	EN 438–2
Micro-scratch resistance	Can be declared as microscratch resistance classes according to procedure A and/or B.	EN 16094

5 Marking and packaging

5.1 Marking

NOTE For CE- marking see EN 14041.

Laminate floor coverings which comply with the requirements of this standard shall have the following information clearly marked by the manufacturer, either on their packaging, or on a label or information sheet included in the packaging:

a) a reference to this European Standard;

b) manufacturer's and/or supplier's identification;

c) product name;

d) colour/pattern and batch number;

e) level of use symbols appropriate to EN ISO 10874 and in accordance with Table 3;

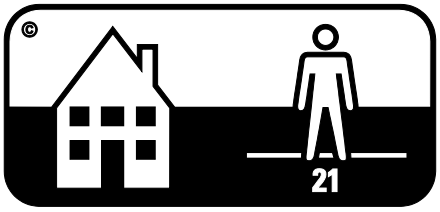
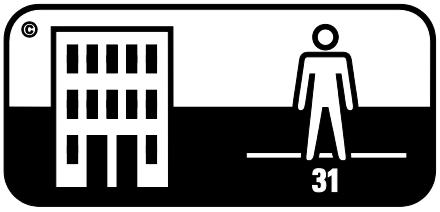
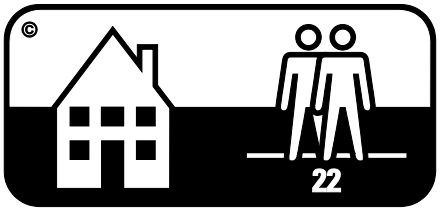
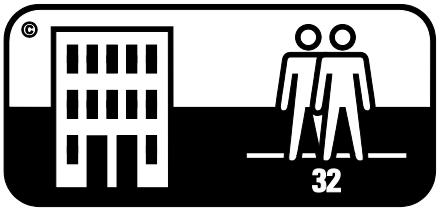
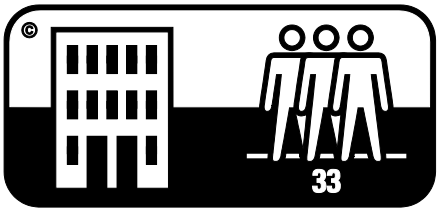
f) declaration which abrasion method (EN 13329:2016, Annex E or EN 15468, Annex A) was used for declaration of level of use;

g) nominal dimensions of one floor covering element in millimetres; if relevant: nominal thickness of pre-attached underlay, nominal thickness of products with pre-attached underlay e.g. 10 (8 + 2) mm;

h) number of elements contained in a package;

i) area contained in a package in square meters.

Table 3 — Classification symbols

Intensity of use according to EN ISO 10874	Domestic	Commercial
Moderate		
General		
Heavy		

5.2 Packaging

Laminate floor coverings shall be delivered in packages designed to protect the corners, edges and surfaces of the product, under normal conditions of transport and handling. Installation, cleaning and maintenance instructions shall be delivered together with the product.

6 Test report

The test report shall include at least the following information:

a) the name and address of the test laboratory;

b) date of test report;

c) a reference to this standard and the used abrasion test method;

d) full description of the product tested;

e) sampling information;

f) test results;

g) all deviations from this standard.

Annex A
(normative)

Determination of abrasion resistance

A.1 General

This European Standard specifies two methods (EN 13329:2016, Annex E and EN 15468:2016, Annex A) for measuring abrasion of laminate floor covering elements. The tests described measure the ability of the surface layer to resist abrasive wear-through. Abrasion according to EN 13329:2016, Annex E is achieved by rotating a test specimen in contact with a pair of loaded cylindrical wheels covered with specified abrasive paper. The resistance to wear according to EN 15468:2016, Annex A is evaluated by abrading the face of test pieces with a specified abrasive applied by means of two loaded wheels. The number of revolutions of the test specimen required to cause a defined degree of abrasion is measured by both methods.

A.2 Sampling

One laminate floor covering element is needed. Take from this element three test specimens, measuring approximately 100 mm x 100 mm:

— two centred 10 mm in from the short edges; and

— one exactly in the centre of the element (see Figure A.1).

Machined edges and machined surfaces shall be avoided in the specimens. If the thickness of the specimens exceeds 8 mm the specimens shall be milled down from the backside to 7,5 ± 0,5 mm to ensure a horizontal load of the abrader arms. Make sure that specimens are uniformly flat and parallel after milling.

If the dimension of the elements makes the described sampling impossible, the test specimens shall be sampled from the nearest available area. If the elements measure less than 100 mm, then a joint is necessary. The joint shall be positioned in the middle of the 100 mm x 100 mm specimen.

Dimensions in millimetres

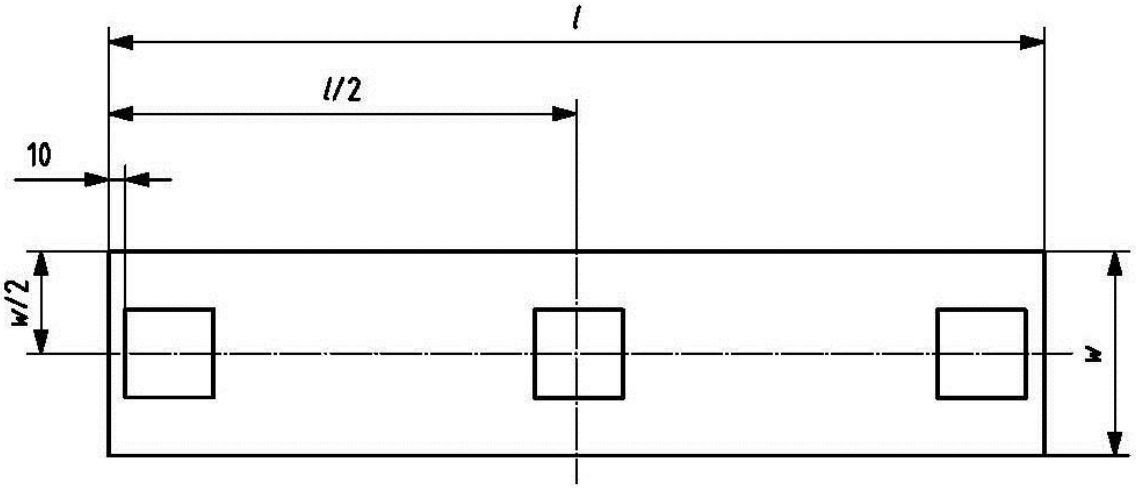


Figure A.1 — Sampling from one floor covering element

Drill a (7,2 ± 0,1) mm centre hole into the test specimen.

A.3 Conditioning

Precondition the test specimens for at least 24 h in the conditioning chamber (A.4.3.2).

A.4 Apparatus

A.4.1 Testing machine.

The testing machine shall consist of the following items (see Figure A.2).

A.4.1.1 Test specimen holder.

In form of a disc with a diameter of approximately 105 mm (7 in Figure A.2) which rotates in a horizontal plane with a permitted deviation of ± 2 mm/m at a frequency of 58 r/min to 62 r/min and to which the test specimen (6 in Figure A.2) can be clamped with a clamping screw (5 in Figure A.2).

A.4.1.2 Holding and lifting device.

Holding and lifting device (8 in Figure A.4) for the abrasive wheels, so constructed that each wheel exerts a force of (10 ± 0,2) N on the test specimen.

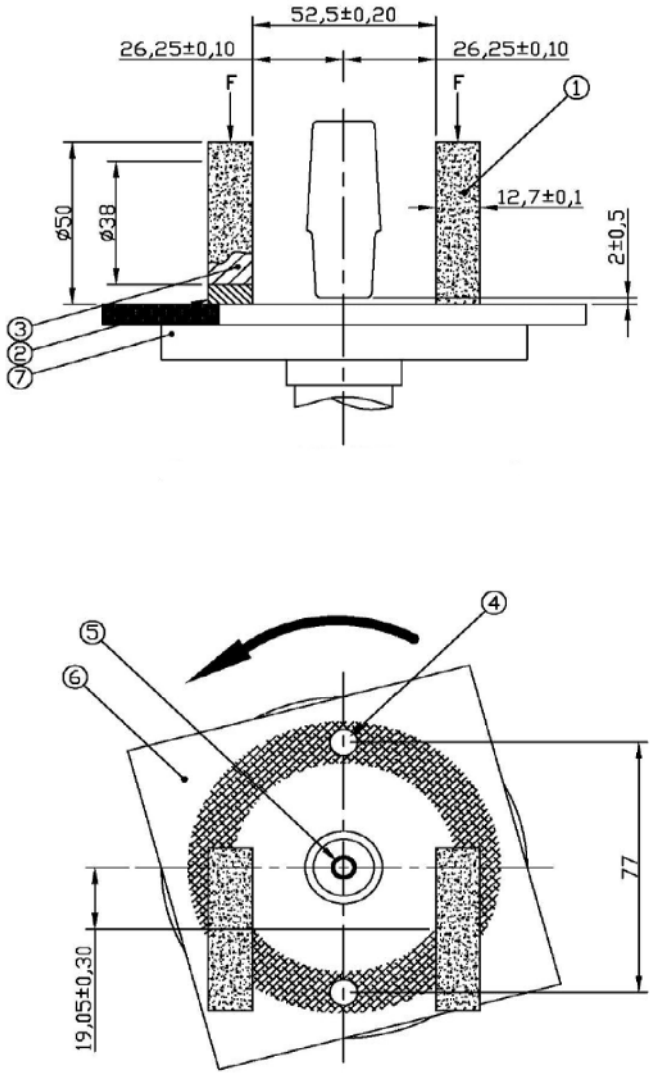
A counterweight of (150 ± 3) g is required to counterbalance the mass of the leather abrading wheel (A.4.2.3). A second pair of leather abrading wheels may be used for this purpose.

The calibration and maintenance of the Taber abrader arms should be carried out according to EN 13329:2016, Annex F.

A.4.1.3 Revolution-counter.

A revolution counter is needed to record the number of revolutions of the specimen holder.

Dimensions in millimetres



Key

1 abrasive paper
2 rubber
3 abrasive wheel
4 suction nozzle
5 clamping screw
6 specimen
7 specimen holder disc

Figure A.2 — Abrasion resistance testing machine

A.4.2 Grit feeder and accessories.

A Grit feeder shall have a minimum storage capacity of about 200 g of grit. It shall be possible to open it at the top and at the bottom. The bottom opening shall be positioned (10 ± 1) mm above the face of the test piece and have a length of (16 ± 1) mm and width of (3,18 ± 0,38) mm. The length of the bottom opening shall be installed radially to the test specimen holder. To make sure of a regular flow, a device shall be provided in the grit feeder to ensure a regular flow. A further device ensuring an immediate stop of the feeding is also required (see Figure A.3 and Figure A.4).

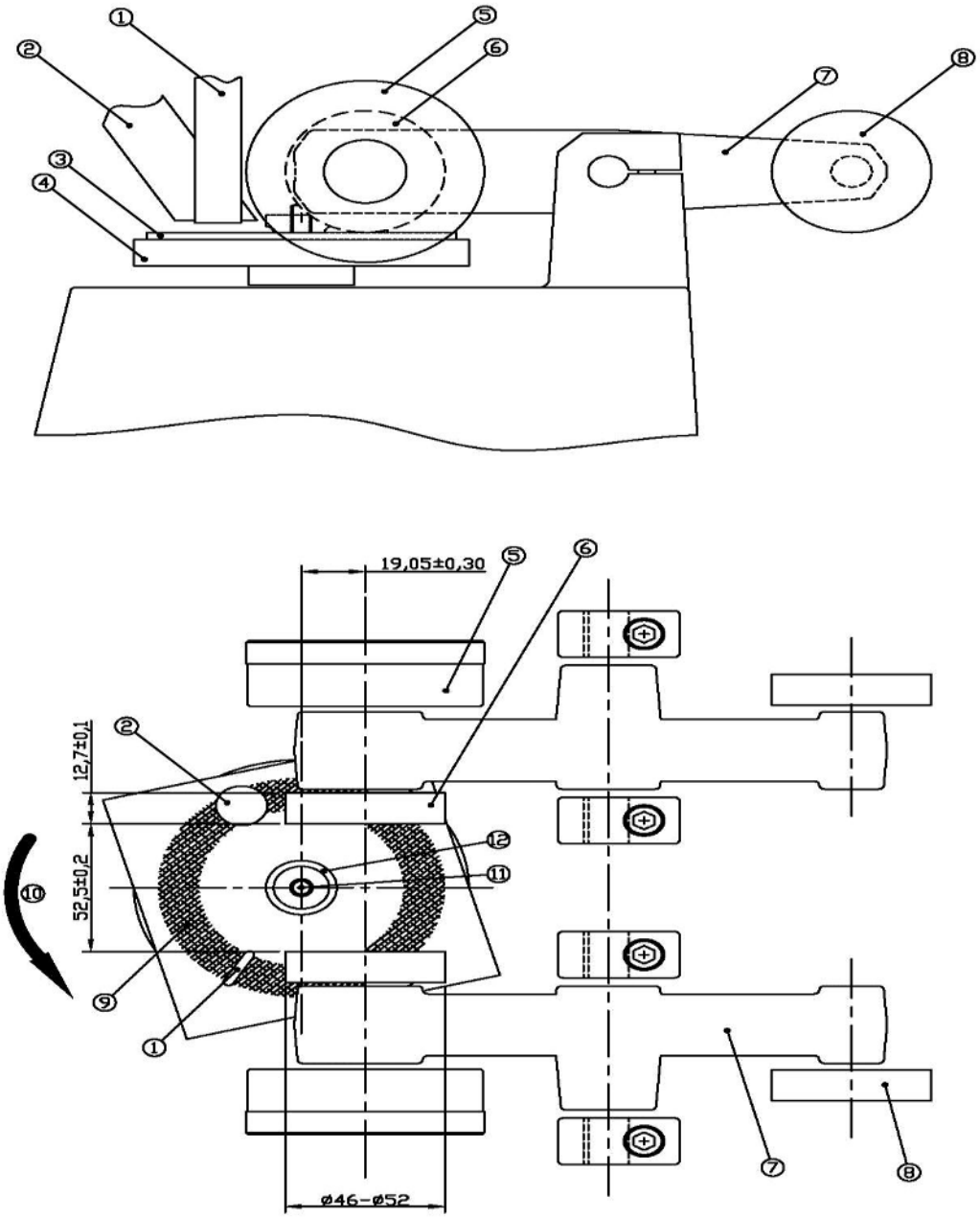
A.4.2.1 Vacuum cleaning device.

A suction nozzle positioned (3 ± 2) mm above the track to be worn, shall be installed in the axial vertical plane on the left wheel after the abrasive grit passes under the wheel (relative to the rotation direction; see Figure A.4). Vacuum power shall be set on a level to remove all dust and debris.[2)]

Figure A.3 — Example of a Taber Abrader with Grit Feeder

2) Equipment of this type, Taber Abrader and Taber Grit Feeder, are made by TABER Industries, 455 Bryant Street, North Tonawanda, New York 14120 USA. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN-CENELEC of this product.

Dimensions in millimetres



Key

1	grit nozzle	7	abrader arm
2	suction nozzle	8	counterweight
3	test piece	9	wearing surface
4	specimen holder	10	direction of rotation
5	testing weight	11	clamping screw
6	abrading wheel	12	nut

Figure A.4 — Drawing of an abrader with grit feeder

A.4.2.2 Abrading material.

Electric arc furnaced Aluminium Oxide, bauxite based abrasive grain with a chemical composition according to Table A.1. The abrasive mineral has a specific gravity of 3,96 g/cm^3 and a hardness of 21 kN/mm^2 (Knoop). The medium grain shape of the mineral has a bulk density according to FEPA standard 44-D in the range of 1,51 to 1,62 g/cm^3. Particle size distribution ranges between 45 µm and 75 µm with a reduced fines portion according to Table A.2 determined according to FEPA standard 42-D.

Table A.1 — Chemical composition

Chemicals	Al_2O_3	Fe_2O_3	SiO_2	TiO_2	CaO	ZrO_2	MgO
Chemical proportion in %	> 95	< 0,30	< 0,90	2,4–3,0	< 0,30	< 0,30	< 0,30

Table A.2 — Grain distribution

Sieve No.	170	200	270	270 to 325	>325
Grading in µm	90	75	53	45	
Grain distribution in %	0	0 to 5	≥ 45	≥ 80	0 to 10

The abrading material are be used only once. Do not sieve the abrading material before use.[3)]

The abrading material shall be stored in a dry place.

A.4.2.3 Leather abrading wheels.

Two cylindrical wheels free to turn on their axis with nominal diameter and width of respectively 44,4 mm and 12,7 mm. They are fitted with a leather strip having a width of (12,7 ± 0,1) mm and a minimum thickness of 1,5 mm. The overall diameter of the wheels, with leather strips shall not exceed 50,8 mm or be less than 47,4 mm.

The hardness of the leather strips shall be suitable for the purpose. It is measured according to the procedure in EN ISO 868 with a Shore-Durometer of Type A with the following deviations:

— The Shore-A hardness is measured at four points in the middle of the tire tread of abrading wheels (instead of the demands in EN ISO 868:2003, 5.1, 5.2 and 8.1).

— The hardness of the leather is suitable if all the results are contained within the range A/1:85 – A/1:95.

The distance between the internal faces of the wheels shall be (52,5 ± 0,2) mm, their common axis being set, by (19,05 ± 0,3) mm nominally, off the axis of the specimen holder. The axis of rotation of the test piece shall be equidistant from the two wheels.

Prior to testing, new abrading wheels shall be preconditioned: Subject new wheels to an initial 2,000 cycle test following the procedure described in A.5.4.2.[4)]

A.4.2.4 Stopwatch.

A stopwatch accurate to ± 0,1 s.

3) The abrading material **"ALODUR ESK 240 (EN 14354)"**, made by Imerys Fused Minerals Villach GmbH, Seebach 2, P.O. Box 1,9523 Villach, Austria, is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN-CENELEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4) The abrading wheels **"S-39"**, made by TABER Industries are an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN-CENELEC of this product. Equivalent products may be used if they can be show to lead to the same results.

A.4.2.5 Grit collection container.

A container of known mass to collect the grit when calibrating the grit feeder.

A.4.2.6 Calibration plates.

Calibration plates made of cell-cast acrylics with Rockwell Hardness M 94 according to ASTM D785.[5)]

A.4.2.7 Transparent template to evaluate the wear of the abraded area.

Transparent template for visual observation of wear through. Each quadrant is divided into four sectors of 22,5° (see Figure A.5).

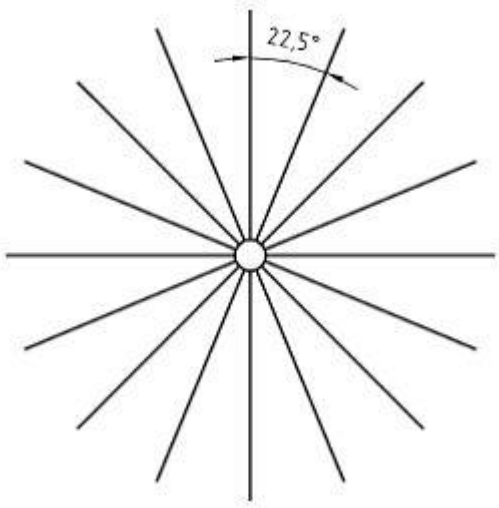


Figure A.5 — Transparent template for visual observation of wear through

A.4.3 Additional material or equipment.

A.4.3.1 Weighing equipment.

For determining the mass loss of the zinc plate by the sand paper or calibrating the grit flow of the abrading material, weighing equipment with an accuracy of ± 1mg is needed.

A.4.3.2 Conditioning chamber.

The conditioning chamber shall be able to maintain a standard climate of (23 ± 2) °C and (50 ± 5) % relative humidity.

A.5 Procedure

A.5.1 General

A specified loose abrasive is fed continuously on to the face of the test piece, in the track of the loaded wheels. As the specimen rotates the rub / wear action of the wheels and abrasive grit causes abrasion on the test piece. After passing under both wheels, the loose abrasive is removed by a vacuum.

5) The calibration plates **"S38"**, made by TABER Industries, is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN-CENELEC of this product Equivalent products may be used if they can be shown to lead to the same results.

A.5.2 Maintenance of the abrading wheels

The abrading wheels can be used as long as the specifications described in A.4.2.3 are complied with. When they are not, the wheels shall be removed and replacement shall be carried out.

A.5.3 Operation of the abrader

To start the wear test:

— fix the test piece on the specimen holder;

— position the vacuum cleaning nozzle, start the vacuum; vacuum power shall be set on a level to remove all dust and debris but shall not influence the flow of falling grit;

— position the bottom opening of the grit feeder;

— set the revolution counter (A.4.1.3) to zero;

— lower the abrading wheels to the surface of the test piece;

— open the grit feeder, with the rate of grit flow calibrated per A.5.4.1;

— start rotation of the test piece.

To halt the wear test:

— stop rotation of the test piece;

— close the grit feeder;

— stop the vacuum;

— raise the abrading wheels;

— record the number of revolutions.

A.5.4 Calibration

A.5.4.1 Rate of grit flow

Before each test, calibrate the grit flow from the grit feeder by means of:

— the container specified in A.4.2.5,

— a stopwatch as specified in A.4.2.4,

— weighing equipment as specified in A.4.3.1.

The grit flow shall last for (60 ± 1) s.

Collect and weigh the quantity of grit that flowed from the grit feeder. Be certain to subtract the mass of the container from this measurement.

The grit feeder is properly calibrated if the measured mass is (21 ± 3) g.

This calibration shall be repeated after each test specimen or 5 000 revolutions or each break that lasts longer than 30 min.

A.5.4.2 Abrading capacity

For every new package of abrading material, the abrading capacity shall be checked. Start a wear test in accordance with the procedure defined in A.5.3, the test piece being replaced by the calibration plate specified in A.4.2.6.

Wipe clean the calibration plate with a soft cloth that has been dampened with an antistatic spray. Measure the initial mass of the calibration plate, and then secure the calibration plate to the specimen holder.

Operate the abrader for 2 000 revolutions. Replenish the abrading material as necessary.

Determine the difference between the initial mass of the calibration plate and the mass after 2 000 revolutions.

Repeat the test two additional times with an untested side of a calibration plate (each side of the plate can be used only one time).

Calculate the average of the three mass loss measurements.

The result is acceptable if:

— the average loss of mass is (145 ± 20) mg

— no individual measurement is beyond the range (145 ± 25) mg.

Calculate the calibration factor as follows:

Calibration factor = Average of mass loss in g / 0,145 g

NOTE The lowest calibration factor can be 0,86 and the highest factor 1,14.

A.5.5 Abrasion of test specimen

Prior to the wear test, condition the three test specimens as specified in A.2.

Run the abrader as specified in A.5.3 until wear through has occurred. Using the transparent template (A.4.2.7), wear through occurs when the test specimen shows:

— wear in 12 sectors of 16 and

— wear at least in 1 sector per quadrant (see Figure A.6).

Inspect the test piece after every 200 revolutions. When the test nears its end, inspect after every 100 revolutions.

a) Insufficient wear **b) Ideal wear** **c) Excessive wear**

Figure A.6 — Example of wear pictures

At specimens with a joint, wear through within 10 mm of the centre joint shall be disregarded.

A.6 Expression of results

For each specimen tested, multiply the number of total revolutions with the calibration factor determined in A.5.4.2 to obtain corrected single test values.

Calculate the average of corrected single test values for the three test specimens. Round the number of revolutions to the nearest hundred.

Express the abrasion resistance of a laminate floor covering as one of the abrasion classes (AC1 to AC5) according to Table A.3.

Table A.3 — Abrasion classes

Abrasion class	AC1	AC2	AC3	AC4	AC5
Average IP-value from three test specimens	≥ 1 000	≥ 1 000	≥ 2 000	≥ 4 000	≥ 6 000

A.7 Test report

The test report shall include the following information:

a) a reference to this European Standard (EN 15468:2016, Annex A);

b) the name and type of product;

c) the result of abrasion resistance, corrected single values and calibration factor;

d) any deviation from the specified procedure; and

e) the date of the test.

Bibliography

[1] EN 309, *Particleboards - Definition and classification*

[2] EN 316, *Wood fibre boards - Definition, classification and symbols*

[3] EN 14041, *Resilient, textile and laminate floor coverings - Essential characteristics*

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

[5] EN ISO 4545-4, *Metallic materials - Knoop hardness test - Part 4: Table of hardness values (ISO 4545-4)*

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