

Resilient floor coverings

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The English version is provided for information. In case of doubt or dispute, the French version only is valid.

CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT

84 avenue Jean Jaurès – Champs-sur-Marne – 77447 Marne-la-Vallée Cedex 2

Tél. +33 (0)1 64 68 82 82 – www.cstb.fr

MARNE-LA-VALLÉE / PARIS / GRENOBLE / NANTES / SOPHIA-ANTIPOLIS

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MODIFICATION HISTORY

Revision no.	Application date	Modifications
00	2019/01/01	Update to the document presentation and reference. Modification of particular testing methods.
01	2021/04/16	Update of document Linoleum integration

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1 Precision on applied standards for resilient floor coverings

Determination of the peel resistance (according to NF EN ISO 24345) for PVC floor coverings:

For poly vinyl chloride floor coverings, the low limit value for peel resistance is set at 35 N/50mm (individual value 25 N/50mm).

The conformity of product shall not be allowed if the peel value is strictly less than 35 N/50mm.

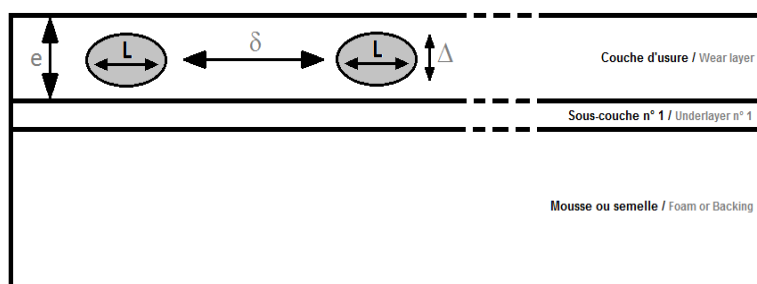
A test result of peel resistance with a value between 35 N/50mm and 50 N/50mm will be tested to the action of the castor chair (according to ISO 4918 – polyamide castor type H) for checking.

The conformity with product standard cannot be issued in this case.

Determination of the thickness of layers (according to NF EN ISO 24340):

Presence of bubbles in the wear layer:

When two bubbles, larger than 0,30 mm inside the wear layer, are spaced by less than 10 mm (periphery to periphery), the thickness of the wear layer is reduced by the transversal dimension of the larger bubble between the two.



Lorsque les deux conditions suivantes sont réunies :
 When this both following conditions are gathered :

- $L \geq 0,30 \text{ mm}$;
- $\delta < 10 \text{ mm}$;

On appliquera la formule suivante pour le calcul de l'épaisseur de la couche d'usure réelle :
 We apply the following formula for calculating the real wear layer thickness :

$$\text{Épaisseur de la couche d'usure réelle} = e - \Delta$$

Real wear layer thickness = $e - \Delta$

Schéma 1 - Vue en coupe d'un revêtement de sol résilient
 Schema 1 - View of a section of resilient floor covering

Measurement of the wear layer thickness:

The measurement of layers is essential for concerned products families.

Therefore, if the measurement cannot be performed (ex: same layer colours, same aspect...), the manufacturer has to implement a way to distinguish the layers (ex: colour one of the layers).

The coating layer is not considered as part of the wear layer. Thus, it is not included in measurement of wear layer thickness.

Abrasion group classification requirements:

Wear group		T	P	M
Volume loss Fv (mm ³)	EN 660-2	Fv ≤ 2,0	2,0 < Fv ≤ 4,0	4,0 < Fv ≤ 7,5
Floor coverings with a transparent wear layer are a priori group T and do not need to be tested.				

1.1 Classification requirements

1.1.1 Polyvinyl chloride homogenous floor coverings – NF EN ISO 10581

Methods		UPEC classification			
		U2sP3	U3P2	U3P3	U4P3
Requirements from NF EN ISO 10581 standard for the following classes:		31	32	33	34
Wear group	NF EN ISO 24346	Total thickness (in mm)			
TYPE I + T, P ou M		1,5	1,5	2,0	2,0
TYPE II + T, P ou M		1,5	1,5	2,0	2,0
TYPE III or other cases		1,5	2,0	2,0	2,5
Tensile strength	Method M.1	Average pulling module: ≥ 40 N/50 mm			≥ 70 N/50 mm
		For a lengthening of:			1%
Castor chair	ISO 4918	No disturbance with type H polyamide wheels			

1.1.2 Polyvinyl chloride heterogeneous floor coverings - NF EN ISO 10582

Methods		UPEC classification					
		U2P2	U2sP2	U2sP3	U3P2	U3P3	U4P3
Requirements from NF EN ISO 10582 standard for the following classes:		22	23	31	32	33	34
Wear group	NF EN ISO 24346	Total thickness (in mm)					
TYPE I - TYPE II		1,5	2,0				
Wear group	NF EN ISO 24340	Wear layer thickness (in mm)					
TYPE I + T		0,20	0,30	0,40	0,55	0,70	
TYPE I + P		0,35	0,45	0,55	0,70	1,00	
TYPE II or other cases		0,50	0,65	0,80	1,00	1,50	
Wear group	Method M.8	Conventional pattern depth (in mm)					
TYPE I + T		0,08	0,12	0,16	0,22	0,28	
TYPE I + P		0,12	0,16	0,20	0,26	0,32	
TYPE II or other cases		0,18	0,24	0,30	0,40	0,48	
Castor chair	ISO 4918	No disturbance with type H polyamide wheels					

1.1.3 Expanded (cushioned) poly(vinyl chloride) floorcovering – NF EN ISO 26986

Methods		UPEC classification		
		U2sP2	U3P2	U3P3
Requirements from NF EN ISO 26986 standard for the following classes:		31	32	33
Total thickness	NF EN ISO 24346	Average result	Nominal value	+ 0,18 mm/ - 0,15 mm
		Individual value	Average result	+/- 0,20 mm
Wear layer thickness	NF EN ISO 24340	Average result	Nominal value	+ 13%/- 10% (0,1 mm max)
		Individual value	Average result	-15% (- 0,05 mm max)
Peel resistance	NF EN ISO 24345	Average		≥ 50 N/50 mm
		Individual values		≥ 40 N/50 mm
Effect of simulated movement of a furniture leg	NF EN ISO 16581	Foot of 32 kg and 0,1 mm edge Foot of 100 kg and 2 mm edge		Foot of 100 kg and 0,1 mm edge
Castor chair	ISO 4918	-	No disturbance with polyamide wheels type H	

Methods			UPEC classification	
			E ₂	E ₃
Spreading of water	Method M.3	Spread time until one of the edges of the specimen:		
		≥ 16 hours	≥ 7 days	
Dimensional stability in immersion	Method M.2	Variation of length ≤ 0,3% in both directions		
Tiles	Sizes	NF EN ISO 24342	-	Size of each sides ≥ 400 mm
	Weld	-	-	With hot welding

1.1.4 Semi-flexible/vinyl composition (VCT) poly(vinyl chloride) floor tiles – NF EN ISO 10595

Methods		UPEC classification				
		U2P2	U2sP2	U3P2	U3P3	U4P3
Requirements from NF EN ISO 10595 standard for the following classes:		22	23	32	33	34
Squareness/straightness	NF EN ISO 24342	Side length		Allowed deviation	≤ 0,25 ≤ 0,35	
Mass per unit area	NF EN ISO 23997	Average result		Nominal value	+ 13%/- 10%	
Conventional pattern depth	Method M.8	Visual preservation for thickness loss (in mm):				
		-	0,40	0,52	0,64	
Ball hardness at 25°C	Method M.5	E ₁ ≤ 0,30 mm				
• Indentation after 1 min E ₁		E ₁ E ₁₀ -E ₁				
• Differential indentation E ₁₀ - E ₁ (E ₁₀ = indentation after 10 min)		0,10 mm		≤ 0,05 mm		
		0,22 mm		≤ 0,12 mm		
		0,30 mm		≤ 0,14 mm		
		With linear interpretation between the results				
Ball hardness at 46°C		≤ 0,80 mm			≤ 0,65 mm	
• Indentation after 30 sec						
Impact ball height of drop (in mm)	Method M.6	L (length of splits) ≤ 20 mm for at least 7 specimens of 9				
		125	175	200	240	400
Castor chair	ISO 4918	-		No disturbance with polyamide wheels type H		

Methods		UPEC classification				
		E ₂				
Dimensional stability in immersion	Method M.2	thickness of 1,6 mm variation of length ≤ 0,15 % in both directions				
		thickness 2 to 3,2 mm variation of length ≤ 0,10% in both directions				

1.1.5 Polyvinyl chloride floor coverings on jute backing or on polyester felt backing or on polyester felt with polyvinyl chloride backing - NF EN 650

Methods		UPEC classification		
		U2P2	U2sP2	U3P2
Requirements from NF EN 650 standard for the following classes:		22	23	32
Wear group	Method M.8	Conventional pattern depth (in mm):		
Group T		-	-	-
Group P		-	-	0,30
Effect of simulated movement of a furniture leg	NF EN ISO 16581	No disturbance (neither scratches nor tears on all layers) Foot of 32 kg and 0,1 mm edge Foot of 100 kg and 2 mm edge		
Castor chair	ISO 4918	-		No disturbance with polyamide wheels type H

Methods		UPEC classification
		E ₂
Dimensional stability in submersion	Method M.2	Variation of length ≤ 0,3% in both directions

1.1.6 Polyvinyl chloride floor coverings with foam layer - NF EN 651

Methods		UPEC classification					
		U2P2	U2sP2	U3P2	U2sP3	U3P3	U4P3
Requirements from NF EN 651 standard for the following classes:		22	23	32	31	33	34
Residual indentation	NF EN ISO 24343-1	-			≤ 0,20		
Wear Group	Method M.8	Visual preservation for thickness loss (in mm):					
Group T		0,06	0,10	0,14	0,10	0,20	0,26
Group P		0,08	0,12	0,16	0,12	0,22	0,28
Group M		0,12	0,18	0,24	0,18	0,33	0,42
Effect of simulated movement of a furniture leg	NF EN ISO 16581	Foot of 32 kg and 0,1 mm edge Foot of 100 kg and 2 mm edge			Foot of 100 kg and 0,1 mm edge		
Castor chair	ISO 4918	-		No disturbance with polyamide wheels type H			

Methods		UPEC classification		
		E ₂	E ₃	
Spreading of water	Method M.3	Spread time until one of the edges of the specimen:		
		≥ 16 hours	≥ 7 days	
Dimensional stability in immersion	Method M.2	Variation of length ≤ 0,3% in both directions		
Tiles	Sizes	NF EN ISO 24342	-	Size of each sides ≥ 400 mm
	Total thickness	NF EN ISO 24346	In premise P ₃ E ₂ , edge to edge laying of tiles if: Individual values = average value ± 0,10 mm	With hot welding

1.1.7 Polyvinyl chloride floor coverings with cork-based backing – NF EN 652

Methods		UPEC classification					
		U2P2	U2sP2	U3P2	U2sP3	U3P3	U4P3
Requirements from NF EN 652 standard for the following classes:		22	23	32	31	33	34
Residual indentation	NF EN ISO 24343-1 (after 24 hours)	≤ 0,30			≤ 0,20		
Wear Group Group T Group P Group M Group F	Method M.8	Conventional pattern depth (in mm):					
		0,06	0,10	0,14	0,20	0,26	0,26
		0,12	0,16	0,20	0,26	0,40	0,40
		0,18	0,24	0,30	0,40	0,60	0,60
		0,24	0,32	0,40	0,52	0,80	0,80
Effect of simulated movement of a furniture leg	NF EN ISO 16581	Foot of 32 kg and 0,1 mm edge Foot of 100 kg and 2 mm edge			Foot of 100 kg and 0,1 mm edge		
Castor chair	ISO 4918	-		No disturbance with polyamide wheels type H			

Methods			UPEC classification
			E ₃
Tiles	Sizes	NF EN ISO 24342	Size of each sides ≥ 400 mm
	Weld	-	With hot welding

1.1.8 Tiles of agglomerated composition cork with polyvinyl chloride wear layer – NF EN 655

Methods		UPEC classification				
		U2P2	U2sP2	U3P2	U3P3	U4P3
Requirements from NF EN 655 standard for the following classes:		22	23	32	33	34
Lateral capillarity	Method M.4	Inflation < 5 % No disturbance on the top surface				
Castor chair	ISO 4918	-		No disturbance with polyamide wheels type H		

1.1.9 Plain and decorative linoleum– NF EN ISO 24011

Method		UPEC classification	
		U2sP2	U4P3
Identification test	NF EN ISO 26985	Linoleum cement > 30 % Ash residue < 50 %	
Total thickness	NF EN ISO 24346	2,00 mm	2,50 mm
Wear layer thickness	NF EN ISO 24340	0,80 mm	1,30 mm
Castor chair	ISO 4918	No disturbance with polyamide wheels type H	
Residual indentation	NF EN ISO 24343-1	≤ 0,15 mm	
Flexibility of rolls	NF EN ISO 24344 Method A	Without cracks with a 20 mm mandrel diameter If non-conform, use of:	
		Total thickness:	Mandrel diameter:
		2,0 mm	30 mm
		2,5 mm	40 mm
		3,2 mm	50 mm
		4,0 mm	60 mm
Dimensional stability in submersion	Method M.3	Average ≤ 0,8 %	

1.1.10 Plain and decorative linoleum on a foam backing– NF EN 686

Method		UPEC classification											
		U2sP2	U4P3										
Identification test	NF EN ISO 26985	Linoleum cement > 30 % Ash residue < 50 %											
Total thickness	NF EN ISO 24346	Average: Nominal $\pm 0,20$ mm Individual: Nominal $\pm 0,25$ mm											
Linoleum thickness	NF EN ISO 24340	2,00 mm	2,50 mm										
Thickness of fibrous backing	NF EN ISO 24340	$\leq 0,80$ mm											
Residual indentation	NF EN ISO 24343-1	$\leq 0,30$ mm											
Flexibility of rolls	NF EN ISO 24344 Method A	Without cracks with a 20 mm mandrel diameter If non-conform, use of: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Total thickness:</td> <td style="width: 50%;">Mandrel diameter:</td> </tr> <tr> <td>2,0 mm</td> <td>30 mm</td> </tr> <tr> <td>2,5 mm</td> <td>40 mm</td> </tr> <tr> <td>3,2 mm</td> <td>50 mm</td> </tr> <tr> <td>4,0 mm</td> <td>60 mm</td> </tr> </table>		Total thickness:	Mandrel diameter:	2,0 mm	30 mm	2,5 mm	40 mm	3,2 mm	50 mm	4,0 mm	60 mm
Total thickness:	Mandrel diameter:												
2,0 mm	30 mm												
2,5 mm	40 mm												
3,2 mm	50 mm												
4,0 mm	60 mm												
Castor chair	ISO 4918	No disturbance with polyamide wheels type H											
Peel resistance	NF EN ISO 24345	Average ≥ 50 N/50 mm Individual values ≥ 40 N/50 mm											
Dimensional stability in submersion	Method M.3	Average $\leq 0,8$ %											

1.2 Products with acoustic improvement (ΔL_w and $L_{n,e,w}$)

Performance	Conditions	Requirements
Impact sound efficiency (ΔL_w)	Tested batch glued	$\Delta L_w \text{ claimed} \geq 15 \text{ dB}$
Walk noise ($L_{n,e,w}$)	Tested batch glued	$L_{n,e,w} < 65 \text{ dB}^{(*)}$

Test conditions:

Test station conforms to the standards NF EN ISO 10 140-1 et 5, NF EN ISO 12999-1 and NF S 31-074.

As complement of the standard NF EN ISO 10 140-3 and NF S 31-074, the following points are given:

- the temperature in the middle of the upper tile surface should be $(20 \pm 2) \text{ }^\circ\text{C}$,
- the conditions of control are defined in § 2.1 of this document,
- the placement of the specimens (conditioned 24 hours to $(20 \pm 2) \text{ }^\circ\text{C}$) on the tile is realized by glued laying or maintained laying as specified below:
 - glued laying realized with an acrylic glue (less than 5% of solvent) of which the spread is between 250 and 300 g/m², applied with small fork spatula,
 - maintained laying realized with a prepared product (spread of $150 \pm 20 \text{ g/m}^2$), applied with a foam roller.

The calculation method is stated in the standard NF EN ISO 717/2.

(*) Currently some European works (in the TC126 framework) targeting the improvement of the reproducibility of the walking noise (according to NF S 31-074) are in progress. A tolerance of 1 decibel on the upper of $L_{n,e,w}$ will be accepted.

2 Standardised test methods

The following methods describe the operational mode to be followed for the measurement or evaluation of a characteristic of identification or use performance of PVC floor coverings (in accordance with the product standards NF EN ISO 10581, NF EN ISO 10582, NF EN ISO 26986, NF EN ISO 10595, NF EN 650, NF EN 651, NF EN 652, NF EN 655, NF EN ISO 24011 and NF EN 686), when they are not covered by the standards.

2.1 General dispositions

Test atmosphere and settings

- Temperature: (23 ± 2) °C;
- Relative humidity: (50 ± 5) %.

The specimens should be placed in these conditions at least 24 hours prior to the test. The samples should come from the batches without any treatment (maintenance product or others) after the production.

Glue used for the test model

At CSTB, when samples need to be glued down, it is made with the acrylic glue Thomsit K188, applied with an A2 trowel, for polyvinyl chloride products and foam linoleum. For plain and decorative linoleum (NF EN ISO 24011), the gluing is made with a specific glue for linoleum and respecting the peel resistance value superior to 0,7N/mm (according to ISO 22631).

2.2 Special dispositions with the standardised test methods

2.2.1 Determination of thickness of layers (according to NF EN ISO 24340)

The device used must have an uncertainty of 0,01mm at maximum, as written in the NF EN ISO 24340 standard. This must be valid for every colour and designs of products.

If the product has multiple layers, the transparent layer, the coloured layer and the total of both layers is measured. The tolerance on the results is applied for the transparent layer and the total of both layers

2.2.2 Determination of residual indentation after static loading (according to NF EN ISO 24343-1)

The total load applied during the test is between 499,5 N and 510,0 N.

2.2.3 Embossed product (products with round dots hills or high emboss)

For this type of products, the total thickness (according to NF EN ISO 24346) and the thickness of wear layer (according to NF EN ISO 24340) will be measured on the top of the embossing.

The residual indentation (according to NF EN ISO 24343-1) will be performed on the worst point (ex: on the top of the embossing).

2.2.4 Determination of the action of castor chair (according to ISO 4918)

The polyamide wheels type H with a Shore A with hardness of 95 ± 5 will be used instead of the polyurethane wheels of type W, as defined in the standard.

Test platform used to put samples for castor chair test should have a diameter superior or equal to 790mm.

Visual aspect of the sample is not evaluated on an observation table with brightness conditions settled as described in the standard, but with usual brightness conditions of the brand laboratory. Samples is notched at its surface in the tested zone to observe also if any delamination between layers has appeared, which may be non-visible at the surface after the test. For linoleum, the jute backing may appear by transparency will be written down but will not be taken into account for the conformity analysis of the product.

2.2.5 Tolerance of density test result (according to NF EN ISO 23996)

The tolerance applied to the density test result is $\pm 100 \text{ kg/m}^3$.

2.2.6 Measurement of curling after exposure to heat (according to NF EN ISO 23999)

The initial measurement of curling is performed for reference and will not be taken into account for the calculation of curling.

Only the final measurement after heating in the oven will be taken into account. The result is the measured value minus the average total thickness of the tested product.

Curling average results are specified with a 0,1 mm accuracy but rounded to the nearest whole number when analysing the results. For example, for result analysis: requirement of 8 mm (without the precision), an 8,4 mm result is conform. An 8,5 mm result is rounded up to 9 mm for result analysis and, then, non-compliant.

2.2.7 Determination of the effect of simulated movement of a furniture leg (according to NF EN ISO 16581)

The sample surface for test is $0,36\text{m}^2$ and the movement distance of the carriage is 700 mm cumulated on both manufacturing direction.

3 Complementary test methods

3.1 Method M.1 - Determination of tensile strength

3.1.1 Introduction

See also the 'General Dispositions' in §2.1.

3.1.2 Definitions

'Tensile Strength': a material has a tensile strength as bigger as the constraint, necessary to cause a determined elongation (1% for example), is higher.

"Traction module" (for X% of elongation): constraint per length unit (related to the width of specimen) which causes an elongation of X% (generally 1% if X is not specified).

3.1.3 Principles

To determine the characteristics of the material: draw the elongation/load curve in the defined conditions of the specimen dimensions and the deformation velocity and then measure the constraint which causes a determined elongation (= modulus).

3.1.4 Equipment

Traction testing machine with a recording device which allows to multiply the elongation of the specimen by 2 at least and of which each centimetre of the load scale does not represent more than 3 daN;

- Initial distance between jaws: (250 ± 1) mm,
- Separation velocity: (50 ± 2) mm/min,
- Deformation velocity: 20 %/min.

3.1.5 Sampling and preparation of specimens

Take twelve specimens per sample (six for initial test and the other six for check test when necessary). Six of them have to be cut following manufacturing direction and six others following transversal direction.

The specimens will get a minimal length of 300 mm and a width of (50 ± 1) mm.

Draw two marks with a marker from a distance of 250 mm of each length side of the specimen.

3.1.6 Operational mode

- Verify the used load scale and the report "paper velocity/velocity of the movable jaws".
- Place the specimen between the jaws, making sure that the specimen remains being rectilinear after tightening.
- Start the dynamometer and the recording device.
- Stop the test when an elongation of 5 % is reached.

3.1.7 Calculation and expression of results

Read out on the elongation/load curve, the loads which correspond to an elongation of 1% and relate them to the width of the specimen by N/50 mm with one decimal.

Determine the averages of the three obtained results for every direction.

Indicate if, during the test, some cracking was observed.

The sample is characterised by the lower one of the two averages (manufacturing direction or transversal direction).

If one of the samples does not satisfy the specification, test three new specimens for the concerned direction; the sample is characterised by the average of six results (the three initial specimens and the three others used for the counter-test).

3.2 Method M.2 - Determination of the dimensional stability in submersion

3.2.1 Introduction

See also the 'General Dispositions' in §2.1.

3.2.2 Principles

To determine the relative variation of the distance between the marks drawn in advance on the specimen after immersion in water in the laboratory condition ($23 \pm 2^\circ\text{C}$).

The measurement may be made:

- either between marks drawn on the specimen,
- or (but only for the semi-flexible coverings) by contact with extremities of the specimen.

3.2.3 Equipment - Supply

Bath, equipped with movable or perforated shelves, to support every specimen,

Measurement table with a size of 200 mm and an accuracy of 0,02 mm,

Vernier calliper or device which indicates directly the variation of the length completed by two plane metallic plates of 290×100 mm, 8 mm thickness between which the specimens are placed during the measurement,

Test solution: demineralised water with addition of 0,03% in mass of sodium alkyl sulfate.

3.2.4 Sampling and preparation of specimens

Before cutting the specimens, lay out the sample and locate the manufacturing direction.

For flexible materials, take three specimens of 250×250 mm, where their edges are perpendicular or parallel to the manufacturing direction, on which four widths of (200 ± 1) mm and about 25 mm from edges are drawn.

For semi-flexible tiles, four specimens of 300 mm (in the transversal direction) \times 100 mm (manufacturing direction) of which the end edges are rectified (by rubbing an edge against that of another specimen) to obtain a complete contact with the device.

3.2.5 Operational mode

Measure initial distances between landmark or note indication of the comparator. Submerge the specimens on the support for 24 hours in the bath.

The specimens are taken out from the water on the supports. About three minutes later, they are dried vertically with one of their horizontally disposed diagonals. As soon as the continuous water trickle becomes intermittent (by drip fast enough), the dimensional measurements "after submersion" will be made.

3.2.6 Calculation and expression of results

For every measured direction, note the variations, for six measurements of the width (two readings from three specimens). Calculate the relative variation of initial lengths. Calculate the mean value of six obtained results expressed in percentage by about 0,05%.

3.3 Method M.3 - Determination of the spread of water

3.3.1 Introduction

See also the "General Dispositions" in §2.1 and in test standard NF EN 661.

3.3.2 Principles

To measure the horizontal diffusion velocity of water on resilient floor covering with a non-absorbent support.

3.3.3 Preparation of specimens

Identify the sample layer susceptible to cause horizontal water spreading.

In the middle of every specimen, perforate the layer(s) on a surface of 100 mm² until it is reached but not penetrated.

3.3.4 Equipment

See also the corresponding paragraph of the standard NF EN 661.

3.3.5 Sampling and preparation of specimens

See also corresponding paragraph of the standard NF EN 661.

3.3.6 Conditioning

See also corresponding paragraph of the standard NF EN 661.

3.3.7 Operational mode

See also corresponding paragraph of the standard NF EN 661.

3.3.8 Calculation and expression of results

See also corresponding paragraph of the standard NF EN 661.

3.4 Method M.4 - Determination of the lateral capillarity

3.4.1 Introduction

See also the "General Dispositions" in §2.1.

3.4.2 Principles

To measure the moisture expansion and observe the coloured liquid diffusion in the wear layer.

3.4.3 Equipment - Supply

Thickness device (thickness gauge) as described in the standard NF EN ISO 24346 for the cork coverings.

Ruler of 10 cm graduated in millimetre.

Test solution: demineralised water with addition of 1,5 % in mass of sodium alkyl sulfate and 0,6 % in mass of colouring agent (mercurochrome diluted to 1/10).

Adhesive plastic band.

3.4.4 Sampling and preparation of specimens

Take 24 specimens per sample of dimensions of 160 x 40 mm. Twelve specimens of them should be cut in the manufacturing direction along one tile side and the other twelve pieces in the transversal direction along one tile side.

Dispose of the specimens 2 by 2 in the direction of length, edge to edge but with a seal of 0,4 mm between them:

- 3 x 2 specimens taken in the manufacturing direction and 3 x 2 specimens taken in the transversal direction, non-cut edge to non-cut edge, which will be used as reference sample.
- 3 x 2 specimens taken in the manufacturing direction and 3 x 2 specimens taken in the transversal direction, cut edge to cut edge.

Assemble each pair with the adhesive band on the back of the product.

3.4.5 Operational mode

For two weeks, the seal is moistened twice a day with the test solution on 3 to 5 mm wide.

Every two times the excessive water is wiped after one hour.

After two weeks, measure the thickness of every specimen according to the principle of the standard NF EN ISO 24346 in 4 positions at 5 mm from edge of the specimen which forms the seal.

3.4.6 Calculation & expression of results

3.4.6.1 Moisture expansion

For every measured direction, calculate the average thickness obtained with all specimens (with an accuracy of 0,01 mm):

- one part of exposed test specimens with cut edge "E".
- and the other part of exposed reference specimens with original edge "T".

Calculate the relative thickness variation after exposure in test solution:

$$G = [(E - T)/T] \times 100$$

3.4.6.2 Diffusion of colouring agent

Note all visually change of appearance in the decoration in connection with diffusion of the colouring agent; if necessary, specify the extent (in mm) of the diffusion compared with exposed specimen edge: distance of the edge at the point of the maximal diffusion.

3.5 Method M.5 - Determination of the ball hardness

3.5.1 Introduction

See also the "General Dispositions" in §2.1.

3.5.2 Principles

To measure the deformation of a specimen on which a ball of defined diameter is applied statically with a determined load, two temperatures and a time of application.

3.5.3 Equipment - Supply

the equipment (in general known by the designation of "MAC BURNEY" device) comprises essentially:

- a vertical rod with a half-sphere end of \varnothing 6,35 mm and connected with a movable pole, weight of the assembly is 910 g.
- an additional mass of 12,7 kg which can be supported by the pole by operating a steering wheel.
- a seat (or leg) on plane base rectified of about \varnothing 85 mm, centralized around the rod and supporting the steering wheel and a comparator to measure the movement of the rod.
- a comparator which permits the measurement of the indentation depth with an accuracy of $\pm 0,01$ mm.

a thermostatic bath of which the temperature can be kept at 25 or 46 °C $\pm 0,5$ °C; effective depth ≥ 18 cm.

a plate glass (glass thickness ≥ 10 mm), dimensions $> 150 \times 150$ mm, placed at bottom of the bath.

a chronometer.

3.5.4 Sampling and preparation of specimens

Take six specimens per sample (three for each temperature tested) of about 150 x 150 mm.

Each specimen is used for two measurements.

3.5.5 Operational mode

3.5.5.1 Operational mode at 25 °C (± 2 °C)

Place the specimen in the water bath for 20 minutes (- 5 minutes + 10 minutes).

Place the specimen on the plate with wearing surface on the top, then place the equipment on the specimen and reset the comparator to zero.

Apply the load smoothly in 2 or 3 seconds and start the chronometer within 2 seconds.

Record the value on the comparator after 1 minute (- 0 + 3 seconds) and 10 minutes (- 0 + 15 seconds).

Uplift the load, move the equipment to another position at least 25 mm far from the previous position and apply the load again.

Repeat the test on the remaining specimens.

3.5.5.2 Operational mode at 46 °C (± 2 °C)

Operation as above but read the indentation within 30 seconds (- 0 + 3 seconds) after application of the load.

3.5.6 Calculation and expression of results

For each measured place (indentation after 1 minute, 30 seconds and differential indentation (E10 - E1), calculate the average value of the six obtained results and express the results to about 0,01 mm.

3.6 Method M.6 - Determination of the ball impact resistance

3.6.1 Introduction

See also the "General Dispositions" in §2.1.

3.6.2 Principles

Repeated and controlled fall of a ball of defined weight on a specimen freely supported at three points.

Inspection of eventual disorders occurred on the specimen after the fall of the ball (the height varying according to the tile thickness).

3.6.3 Equipment - Supply

Rigid support of a weight of at least 4,5 kg, formed by 3 steel spheres of \varnothing 25 mm which are regularly spaced on a circle of \varnothing 125 mm and connected with a steel plate.

Steel ball: \varnothing 25,1 mm and weight of 65 g.

Device (e.g. electromagnet) which allows the control of the ball drop so that the fall is completed perpendicularly to the plane created by the top of the 3 spheres and the middle of the triangle they are forming, and of an adjustable height between 125 and 400 mm.

Guiding pipe of the ball with inside diameter of 26 mm which should not hinder the fall of the ball and positioned so that the ball can be taken back before rebound.

A thermostatic bath of which the temperature can be kept at $(25 \pm 0,5)$ °C.

Indelible red ink marker (black for the red samples). The rhodamine B of solution markers are most frequently used for this test.

Micrometric magnifying glass of 10 times magnification, scale between 0 and 15 mm, split in 0,1 mm, vision range of 30 mm diameter at minimum.

3.6.4 Sampling and preparation of specimens

Nine specimens per sample, dimensions of about 150 x 150 mm, coming from different tiles.

3.6.5 Operational mode

Place the specimen in the bath for 20 minutes (- 5 minutes, + 10 minutes).

Take the specimen out of the bath and place it immediately on the support with wear surface on the top.

3.6.5.1 Shock

Let the ball drop onto the specimen 4 times in succession and without rebound, the falling height is determined according to the claimed classification.

3.6.5.2 Revelation of fissures

Mark some signs on the wear surface with the marker at the level of the impact zone.

Leave the ink in contact with the specimen for at most 30 seconds.

Clean with soft rag impregnated with alcohol for 30 to 60 seconds at most.

Inspect the surface of the specimen with the micrometric magnifying glass under direct lighting, the specimen should remain without deformation, and verify if the wear surface presents one or more fissures or not.

3.6.6 Calculation & expression of results

Small simple or ramified (star type) fissures are taken into account.

If the wear surface presents cracks, measure the length of each of the two longest branches with the micrometric magnifying glass.

Calculate the characteristic length of the cracks L from the sum of these two lengths as shown below.

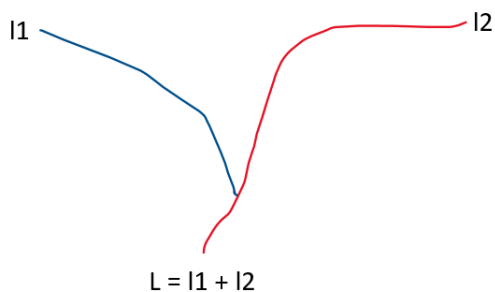


Diagram of fissure calculation

3.7 Method M.7 – Determination of dimensional stability and curling after exposition to heat for plank dimension

3.7.1 Introduction

See also the “General Dispositions” in §2.1 and the testing standard NF EN ISO 23999.

3.7.2 Principles

For dimensional stability: determination of the relative change in distance between marks drawn in advance on the specimen, after exposure to a heat treatment under specified conditions.

For curling: measurement of the vertical deformation appearing on the specimen after exposure to a heat treatment under specified conditions.

3.7.3 Equipment

Oven thermostatically controlled and ventilated, capable of being maintained at a uniform temperature of $(80 \pm 2) ^\circ\text{C}$ and of which the radiation from the heating element does not directly reach the test specimens or support plates.

Full and rectified metallic support plates

The shapes and dimensions of these two-previous apparatus shall be such as:

- curling can be measured without removing the test specimens from the support plates,
- the clearance between the plates and the vertical walls of the oven should not be less than 50 mm,
- the vertical clearance between the support plates and between the plates and the oven should not be less than 100 mm,

Optical bench of a 200 mm range with a precision of 0,02 mm.

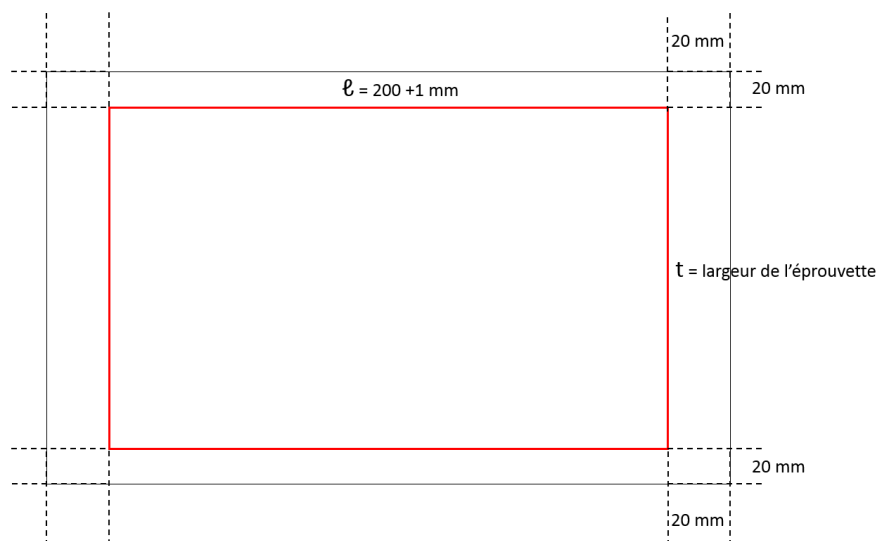
Micrometric stop on support or any other device giving at least a precision of 0,1 mm.

3.7.4 Sampling and test specimen’s preparation

Lay out the specimens as flat as possible and mark the manufacturing direction.

On each plank, take one specimen of longitudinal dimension between 225 and 250 mm, their edges shall be parallel to the manufacturing direction. The distance between the outer edge of the sample and nearest edge of the specimen shall be at least 100 mm.

About 20 mm from the longitudinal edges of each specimen, draw two lines (ℓ) of a distance of (200 ± 1) mm and measure them with an optical bench. About 20 mm from transversal edges of each specimen, draw two lines (t) corresponding to the width of the specimen and measure them with the optical bench.



If necessary, measure the initial curl before doing the test.

3.7.5 Operational mode

Identical to the corresponding paragraph in the testing standard NF EN ISO 23999.

3.7.6 Calculation and expression of results

Identical to the corresponding paragraph in the testing standard NF EN ISO 23999. In the case of curling measurement, the result is the measured value minus the average total thickness of the tested product.

3.8 Method M.8 – Determination of conventional pattern depth

3.8.1 Introduction

See also the 'General Dispositions' in §2.1 and the testing standard NF EN 663.

3.8.2 Principles

The thickness of the product's pattern is directly measured by an optical technique.

3.8.3 Equipment

Microscope, preferably binocular with 40 to 50 times magnifying and an incorporated micrometric scale allowing a 0,1 mm accuracy on reading or equipped with a micrometre with a precision of 0,01mm in displacement.

Holding device for specimens.

Lamp with adjustable convergence collector and diaphragm.

Thin and sharp blade.

Metallic ruler.

3.8.4 Sampling and preparation of specimens

According to the corresponding paragraph of the standard NF EN ISO 24340.

3.8.5 Operational mode

Place the specimen on the holding device to expose its thickness.

Adjust the holding device in such a way that the centre of the cross of sight (middle of the graduated scale) or zero on the scale is located on the outer edge of the surface layer (factory finish included).

Set the comparator to zero and move the centre of the cross of sight to the limit of disappearance of the pattern to the layer.

Note the value with a precision of 0,01 mm.

Repeat the procedure on the other test specimens.

3.8.6 Calculation and expression of results

Identify the minimum value from the measurements and state the result with a precision of 0,01 mm.