TECHNICAL DOCUMENT

Resilient floor coverings

Technical document 99030-01

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10/10/2023

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

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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**
02	**2022/02/21**	**For the whole document, adjustments and clarification are added following the implementation of Linoleum family and standards evolution.**
03	**2023/05/15**	**Replacement of references to standard NF EN 651 by those of standard NF EN ISO 11638 and integration of standard NF EN 13845**
04	**10/10/2023**	**Addition §3.9 Determination of squareness**

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Summary

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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.

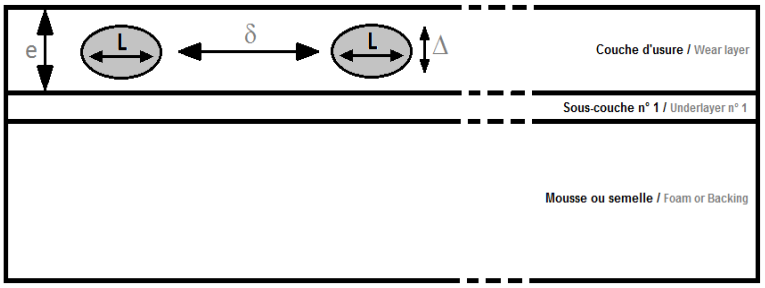
A test result of peel resistance with a value between 35 N/50mm and 50 N/50mm will be tested to the action of the castor chair (according to NF EN ISO 4918 – polyamide castor type H) for checking.

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 for PVC floor coverings:

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 ≥ 0,30 mm ;
- δ < 10 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 :

Epaisseur de la couche d'usure réelle = e - Δ
Real wear layer thickness = e - Δ

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 for PVC floor coverings:

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.

Linoleum floor coverings:

When the measurement is made on a linoleum floor covering, if the composition of linoleum remains exactly the same for the whole thickness, it is considered as a monolayer linoleum. For this type, specifications on individual values of the surface layer (linoleum layer excluding jute) are judged conform since the minimum required for the thickness is fully respected.

Abrasion group classification requirements:

Wear group		T	P	M
Volume loss Fv (mm³)	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.				

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1.1 Classification requirements

1.1.1 Polyvinyl chloride homogenous floor coverings – NF EN ISO 10581

Methods		UPEC classification			
		U2sP3	U3P2	U3P3	U4P3
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%	
Residual indentation	NF EN ISO 24343-1	≤ 0,10 mm			
Castor chair	NF EN ISO 4918	No disturbance with type H polyamide wheels (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)			

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1.1.2 Polyvinyl chloride heterogeneous floor coverings - NF EN ISO 10582

Methods		UPEC classification					
		U2P2	U2sP2	U2sP3	U3P2	U3P3	U4P3
Wear group	NF EN ISO 24346	Minimum total thickness (in mm)					
TYPE I - TYPE II		1,5		2,0			
Wear group	NF EN ISO 24340	Minimum 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
Residual indentation	NF EN ISO 24343-1	≤ 0,10 mm					
Castor chair	NF EN ISO 4918	No disturbance with type H polyamide wheels (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)					

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

Methods		UPEC classification		
		U2sP2	U3P2	U3P3
Minimum Wear layer thickness	NF EN ISO 24340	0,25 mm	0,35 mm	0,50 mm
Peel resistance	NF EN ISO 24345	Average ≥ 50 N/50 mm Individual values ≥ 40 N/50 mm		
Residual indentation	NF EN ISO 24343-1	≤ 0,35 mm	≤ 0,20 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	NF EN ISO 4918	-	No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)	

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 submersion		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

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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
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					
• Indentation after 1 min E1		$E_1 \leq 0{,}30$ mm				
• Differential indentation $E_{10} - E_1$ (E_{10} = indentation after 10 min)		E_1 / $E_{10}-E_1$ 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						
• Indentation after 30 sec		≤ 0,80 mm			≤ 0,65 mm	
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	NF EN ISO 4918	-		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)		

Methods		UPEC classification
		E_2
Dimensional stability in submersion	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

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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

Méthode		Classement UPEC		
		U2P2	U2sP2	U3P2
Wear group	NF EN ISO 24340	Minimum wear layer thickness (in mm)		
Group T		0,20	0,25	0,35
Group P		0,30	0,40	0,50
Wear group	Method M.8	Conventional pattern depth (in mm) :		
Group T		0,15	0,18	0,30
Group P		0,18	0,20	0,30
Backing layer	NF EN ISO 24343-1	Residual indentation		
Jute		≤ 0,50 mm		/
Polyester		≤ 0,40 mm		
Polyester and PVC		≤ 0,35 mm		≤ 0,20 mm
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	NF EN ISO 4918	-		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)

Methods		UPEC classification
		E_2
Dimensional stability in submersion	Method M.2	Variation of length ≤ 0,3% in both directions

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1.1.6 Heterogeneous poly (vinyl chloride) flooring on foam - NF EN ISO 11638

Methods			UPEC classification					
			U2P2	U2sP2	U3P2	U2sP3	U3P3	U4P3
Wear group		NF EN ISO 24340	Minimum wear layer thickness (in mm)					
Type I			0,20	0,25	0,35	0,25	0,50	0,65
Type II			0,40	0,50	0,70	0,50	1,00	1,50
Residual indentation	after application of a statistical load	NF EN ISO 24343-1	≤ 0,35		≤ 0,20			
	measured after 15 s of load application		≥ 0,40		- (No requirement)	≥ 0,40	- (No requirement)	
Curling after exposition to heat		NF EN ISO 23999	≤ 10 mm for rolls ≤ 2 mm for tiles/planks					
Wear group		Method M.8	Conventional pattern depth (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		NF EN ISO 4918	-		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)			

Methods			UPEC classification	
			E_2	E_3
Spread of water		Method M.3	Spread time until one of the edges of the specimen:	
			≥ 16 hours	≥ 7 days
Dimensional stability in submersion		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

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

Methods		UPEC classification					
		U2P2	U2sP2	U3P2	U2sP3	U3P3	U4P3
Wear Group	NF EN ISO 24340	Minimum wear layer thickness (in mm)					
Group T		0,20	0,25	0,35	0,25	0,50	0,65
Group P		0,30	0,40	0,50	0,40	0,65	1,00
Group M		0,45	0,60	0,75	0,60	1,00	1,50
Group F		0,60	0,80	1,00	0,80	1,30	2,00
Residual indentation	NF EN ISO 24343-1 (after 24 hours)	≤ 0,30			≤ 0,20		
Wear Group	Method M.8	Conventional pattern depth (in mm):					
Group T		0,06	0,10	0,14		0,20	0,26
Group P		0,12	0,16	0,20		0,26	0,40
Group M		0,18	0,24	0,30		0,40	0,60
Group F		0,24	0,32	0,40		0,52	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	NF EN ISO 4918	-		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)			

Methods			UPEC classification
			E_3
Tiles	Sizes	NF EN ISO 24342	Size of each sides ≥ 400 mm
	Weld	-	With hot welding

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

Methods		UPEC classification				
		U2P2	U2sP2	U3P2	U3P3	U4P3
Minimum total thickness	NF EN ISO 24346	2,00 mm	2,50 mm		3,00 mm	
Minimum wear layer thickness	NF EN ISO 24340	0,20 mm	0,25 mm	0,35 mm	0,50 mm	0,65 mm
Residual indentation	NF EN ISO 24343-1	≤ 0,30 mm	≤ 0,20 mm			
Lateral capillarity	Method M.4	Inflation < 5 % No disturbance on the top surface				
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	NF EN ISO 4918	-		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)		

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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	
Minimum total thickness	NF EN ISO 24346	2,00 mm	2,50 mm
Minimum wear layer thickness	NF EN ISO 24340	> 0,80 mm	> 1,30 mm
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: 2,0 mm 2,5 mm 3,2 mm 4,0 mm	 Mandrel diameter: 30 mm 40 mm 50 mm 60 mm
Dimensional stability in submersion	Method M.3	Average ≤ 0,8 %	
Castor chair	NF EN ISO 4918	No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)	

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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 ± 0,20 mm Individual: Nominal ± 0,25 mm	
Linoleum thickness	NF EN ISO 24340	2,00 mm	2,50 mm
Thickness of fibrous backing	NF EN ISO 24340	≤ 0,80 mm	
Residual indentation	NF EN ISO 24343-1	≤ 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: Total thickness: / Mandrel diameter: 2,0 mm / 30 mm 2,5 mm / 40 mm 3,2 mm / 50 mm 4,0 mm / 60 mm	
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 ≤ 0,8 %	
Castor chair	NF EN ISO 4918	No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)	

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1.1.11 Polyvinyl chloride floor coverings with particle based enhanced slip resistance – NF EN 13845

Method		UPEC classification					
		U2P2	U2sP2	U3P2	U2sP3	U3P3	U4P3
Dimensions of rolls, tiles and planks	NF EN ISO 24342	Rolls, not less than nominal; ≤ 0,13% until 0,5 mm					
Minimum total thickness (en mm)	NF EN ISO 24346	1,5		2,0	1,5	2,0	
Residual indentation	NF EN ISO 24343-1	≤ 0,10 mm					
Castor chair	NF EN ISO 4918	-		25 000 cycles		25 000 cycles	
		No disturbance with polyamide wheels type H (No detachment and no alteration to the surface other than a slight change in appearance caused by 25000 cycles)					
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		
Effet de la résistance à l'usure	Annex D NF EN 13845	20 000 cycles		30 000 cycles	20 000 cycles	40 000 cycles	50 000 cycles

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

Performance	Conditions	Requirements
Impact sound efficiency (ΔL_w)	Tested batch glued	$\Delta L_{w\ claimed} \geq 15$ dB
Walk noise ($L_{n,e,w}$)	Tested batch glued	$L_{n,e,w} < 65$ 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 ± 2) °C,
- the conditions of control are defined in § 2.1 of this document,
- the placement of the specimens (conditioned 24 hours to (20 ± 2) °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 (corresponds to a A2 spatula), for closed foam underlayer,
  - glued laying realized with an acrylic glue (less than 5% of solvent) of which the spread is around 400 g/m², applied with small fork spatula (corresponds to a B2 spatula), for open foam underlayer,
  - maintained laying realized with a prepared product (spread of 150 ± 20 g/m²), applied with a foam roller.

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

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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 ISO 11638, NF EN 652, NF EN 655, NF EN ISO 24011, NF EN 13845 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 B1 spatula and 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 PVC floor covering is a product with 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.

For LVT-type products with a PU layer on the surface, the batch is deburred using a half-moon blade before the measurement is taken, so that the measurements are not distorted by the PU layer.

For linoleum floor coverings, the cutting is arranged so that only one direction of the jute is visible with the microscope. This cut is made with a straight blade. The technician checks that measuring points can be analysed with the microscope before starting the measurement (no jute fibres that hides the measurement areas, no areas with thin cracks, …). Otherwise, another sample will have to be taken.

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 NF EN 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. This visual check, after the castor chair test, aims to find any delamination defect. After that, samples is notched with a straight blade, at its surface in the

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tested zone to confirm any delamination between layers has appeared. For linoleum, the jute backing may appear by transparency, which 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 ± 100 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 0,36m² and the movement distance of the carriage is 700 mm cumulated on both manufacturing direction.

2.2.8 Identification of linoleum and determination of cement content and ash residue (according to NF EN ISO 26985)

A modification of the sample dimensions may be done on pieces used for powder or granules reduction. This sample cannot be bigger than 6 cm x 6 cm.

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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).

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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 ± 2°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 mm × 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 mm × 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) × 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. Submerse 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%.

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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.

Plates of plexiglass or other rigid and transparent material with minimum dimensions of 260 mm x 260 mm and thickness between 3 mm and 5 mm can be used.

Non-graduated test tubes with a minimum volume of 50 mL and an internal diameter greater than 8 mm can be used.

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.

3.3.9 Test report

The test report should include the following information:

a. a reference to standard NF EN 661;

b. complete identification of the product tested, including type, source, manufacturer's reference numbers;

c. sample history;

d. any deviation from this standard that may have affected the results.

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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:

$$G = [(E - T)/T]x100$$

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.

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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 ⌀ 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 ⌀ 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 ± 0,01 mm.

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

a plate glass (glass thickness ≥ 10 mm), dimensions > 150 × 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.

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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 Ø 25 mm which are regularly spaced on a circle of Ø 125 mm and connected with a steel plate.

Steel ball: Ø 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 ± 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.

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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.

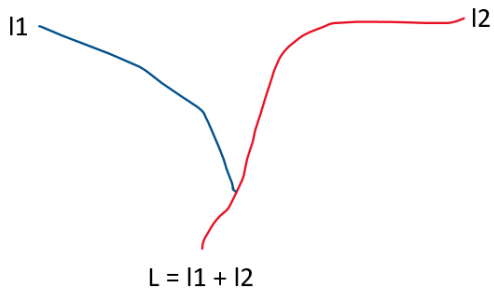

Diagram of fissure calculation

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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 ± 2) °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.

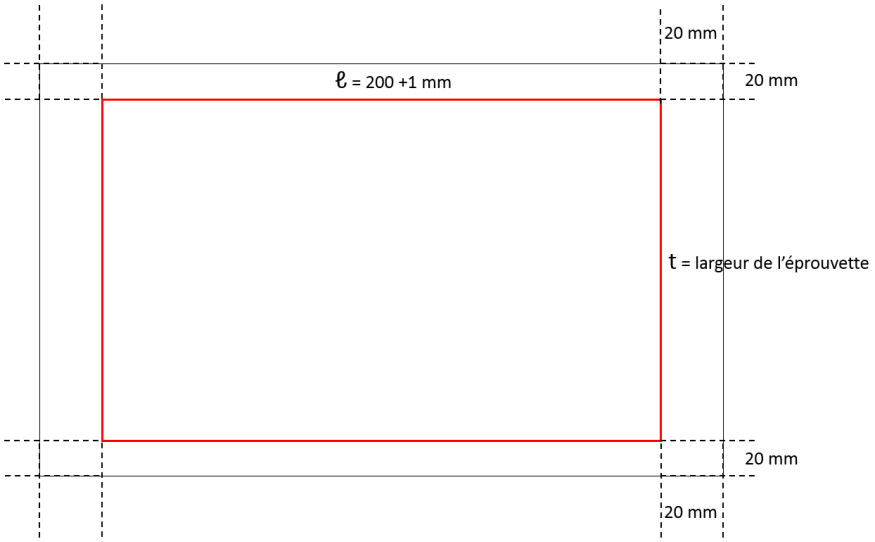
Micrometric stop on support or any other device giving at least a precision of 0,1 mm.

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, dram 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.

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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.

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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.

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3.9 Method M.9 – Determination of squareness using the gauge method

3.9.1 Introduction

See also the 'General Dispositions' in §2.1 and the testing standard NF EN ISO 24342.

3.9.2 Principles

To assess squareness, each corner of a tile/plank is placed within the dihedral of a precision square, and the maximum distance between the leg of the square and the ends of the tile/plank is measured.

3.9.3 Equipment

Metal square

Metal ruler

Set of shims in 0.05 mm increments that can be easily inserted at any point between the L-shaped steel device and the edge of the slab/board.

3.9.4 Sampling and preparation of specimens

According to the corresponding paragraph §6 of the standard NF EN ISO 24342.

3.9.5 Operational mode

To measure the squareness of a floor tile/plank using a thickness gauge, place one edge of the tile/plank against an arm of the square and slide it up to touch the other arm in a maximum of points while taking care not to deform the product. Determine the thickest gauge which can be easily inserted between the second arm of the square/rectangle and the tile/plank at the end of the edge to assess the deviation from the squareness (see Figure 5 of standard NF EN ISO 24342).

3.9.6 Calculation and expression of results

Calculate the greatest deviation at the end of the edge for squareness. Report the values to the nearest 0.05 mm.

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