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Resilient, textile and laminate floor coverings — Castor chair test

Revêtements de sol textiles, résilients ou stratifiés — Essai à l'appareil à roulettes

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Foreword

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The committee responsible for this document is ISO/TC 219, *Floor coverings*.

This second edition cancels and replaces the first edition (ISO 4918:2009), which has been technically revised.

Resilient, textile and laminate floor coverings — Castor chair test

1 Scope

This International Standard specifies methods for determining the change of appearance and stability of a textile floor covering or any damage caused by detachment of layers, opening of joints, or crazing of a resilient or laminate floor covering under the movement of a castor chair.

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.

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 1957, *Machine-made textile floor coverings — Selection and cutting of specimens for physical tests*

ISO 2424, *Textile floor coverings — Vocabulary*

ISO 9405, *Textile floor coverings — Assessment of changes in appearance*

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

EN 12466, *Resilient floor coverings — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2424 and EN 12466 apply.

4 Principle

A floor covering, including one or more joints, treated or welded where necessary, is submitted for a prescribed number of cycles to the action of three castors. The castors move in epicyclical paths with multiple changes of direction, stops and starts, and the frequency of passage varies from area to area.

For textile floor coverings, three different assessment methods are specified:

a) the change in appearance of a textile floor covering is assessed after 5 000 cycles and 25 000 cycles, in accordance with ISO 9405 (Test A),

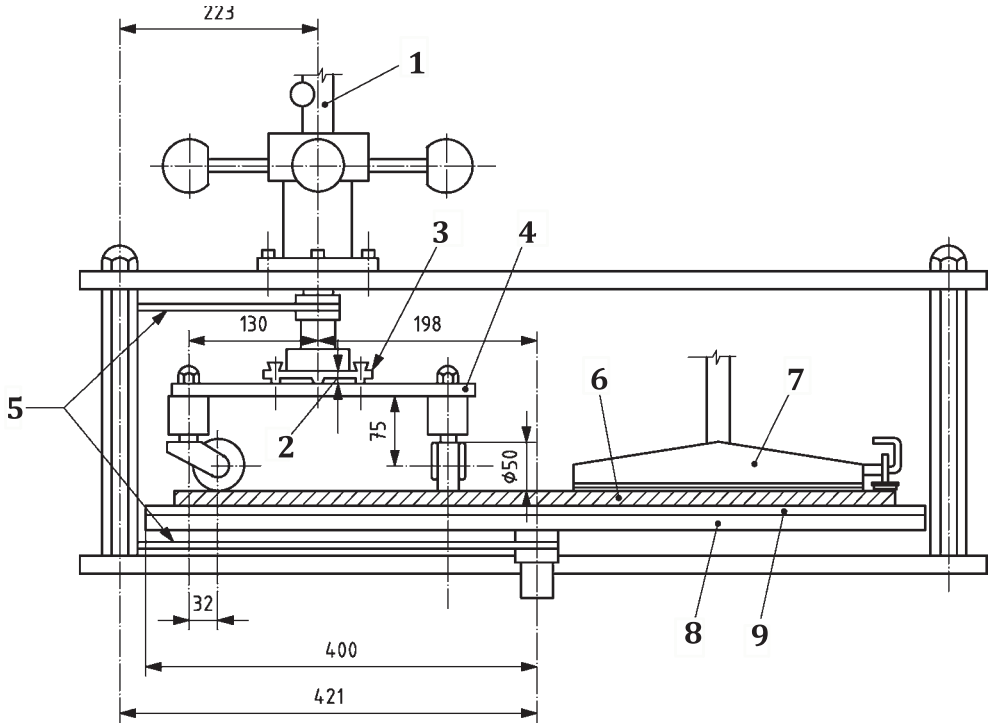
b) the change in colour is assessed by means of grey scales after 750 cycles (Test B),

c) the extent of deterioration of the specimen is assessed after 10 000 cycles or 25 000 cycles (Test C).

For resilient and laminate floor coverings, any damage caused by detachment of layers, opening of joints, or crazing of the specimen is assessed.

5 Apparatus

Dimensions in millimetres



Key

1	total mass 90 kg	6	specimen
2	distance >3 mm	7	suction device with height regulation
3	load/drive plate	8	test platform
4	castor mounting plate	9	specimen support
5	chain		

Figure 1 — Typical castor chair apparatus

5.1 Rotating circular test platform.

The rotating circular test platform on which the specimen is placed shall have a diameter of minimum 800 mm.

5.2 Castor assembly.

This assembly comprises a vertical shaft, set in a bearing, and a plate on which the castors are mounted (Figure 2, item 1). This castor assembly is offset at a distance of (198 ± 1) mm from the centre of the rotating test platform.

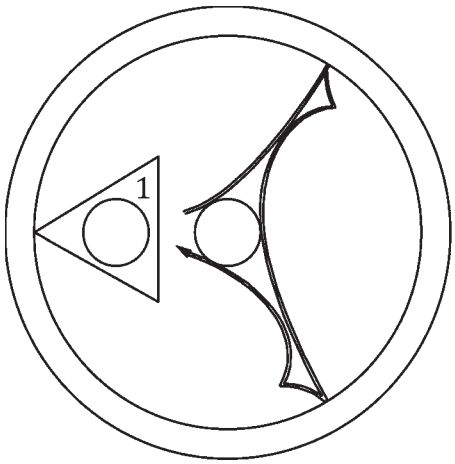
The three castors are each arranged concentrically at 120° intervals around the centre of the plate at a distance of (130 ± 1) mm from the centre of the plate, and are free to rotate, so that they follow the rotation of the castor assembly.

The tested area of the specimen is determined by the distance between the axes of revolution of the castor chair assembly and the specimen table and by the distance of the castors from the centre of the plate. This area is approximately 0,3 m^2.

The apparatus is provided with a lifting device to raise the castor assembly above the testing platform when the apparatus is stopped.

The castor assembly is loaded with a mass of (90 ± 1) kg equally divided over the three castors.

The distance (under load) between the castor mounting plate and the load/drive plate shall be >3 mm.



Key

1 castor assembly

Figure 2 — Path of castors

5.3 Drive mechanism.

The drive to the specimen plate and to the castor assembly is interlocked and fitted with a reversing mechanism. The number of cycles is set by means of a pre-set counter. The rotational speed of the rotating platform shall be (19 ± 2) r/min and that of the castor assembly (50 ± 5) r/min.

After (180 ± 10) s of rotation, the platform shall stop and remain in the stop position for (5 ± 2) s, after which time the direction of rotation of the rotating platform shall reverse.

The relationship between the rotational speed of the specimen plate and that of the castor assembly causes a sharp reverse movement of the castors within the stressed area (see Figure 2).

5.4 Suction device.

A suction device (Figure 1, item 7) is mounted over the entire width of the stressed area, the height of this device above the specimen being adjustable. The suction capacity shall be at least 25 l/s to 30 l/s.

5.5 Castors.

5.5.1 General

Single-wheel swivel castors shall be used having the following dimensions (see Figure 3):

a) diameter: (50 ± 2) mm;

b) width: (20 ± 2) mm;

c) radius of curvature, *R*, of castor tread: (130 ± 5) mm;

d) crank distance: (32 ± 2) mm.

The distance between any two castor mountings shall be (225 ± 5) mm.

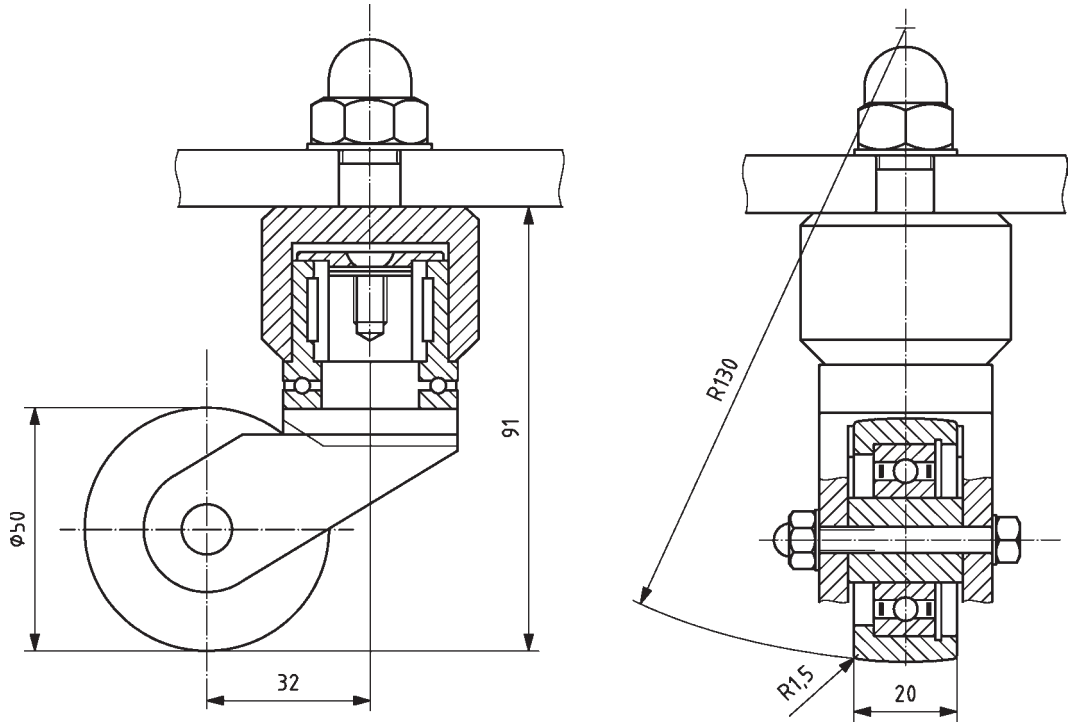


Figure 3 — Single-wheel swivel castors (nominal dimensions in mm)

5.5.2 Type H castors, suitable for textile, resilient, and laminate floor coverings.

Type H, polyamide castors have plain wheels and a hard tread, shore hardness 90 ± 5. The wheels shall be one colour over their entire surface. The castor treads are made from polyamide and shall be replaced after maximum 2 000 000 cycles of the test platform.

The castor treads shall be examined after each test to verify that they are still smooth, without any deep scoring or encrusted hard particles. The tread shall be replaced if the dimensions of the wheel fall outside the tolerances given in 5.5.1.

5.5.3 Type W castors, suitable for resilient and laminate floor covering.

Type W, polyurethane covered castor wheels, shore hardness 85 ± 5. The surface of the castor wheels shall be replaced after maximum 1 000 000 cycles of the test platform.

The castor treads shall be examined after each test to verify that they are still smooth, without any deep scoring or encrusted hard particles. The tread shall be replaced if the dimensions of the wheel fall outside the tolerances given in 5.5.1.

5.6 Lifting device, to raise the castor assembly above the testing platform when the apparatus is stationary.

5.7 Cycle counter, for setting the number of cycles of the testing platform.

5.8 Fastening system.

Flooring samples shall be securely held in place using glue, tape, or other suitable means. For loose-laid installations, panel shall be secured at the outer perimeter to prevent samples, which may include a flooring product and an underlayment, from shifting during the test using tape, a hold down ring, or other suitable means. Take care not to use mechanical horizontal fastening force.

5.9 Specimen support.

The specimen shall be placed on a circular sheet of rigid plastic [e.g. poly(methyl methacrylate)] or suitable substrate with a thickness of (7 ± 2) mm and a diameter of (800 ± 5) mm.

The support itself shall be laid on the test platform and holes made in the support in order to engage the platform studs, to prevent slippage.

5.10 Vacuum cleaner, upright, with rotating brush driven by an independent motor for textile floor coverings, and without rotating brush for resilient and laminate floor coverings.

5.11 Illumination device (not to be used for textile floor coverings).

Illumination shall be provided by sufficient fluorescent tubes mounted at a height above the viewing table to give an intensity of light across the viewing platform of (1 500 ± 300) lx and in such a way as to illuminate the specimen vertically from above and allow uninterrupted viewing of the table (minimum height 1 600 mm above table). The surroundings shall be neutral and darkened.

The intensity of the light shall be checked prior to each assessment series by the use of a lux meter. The lifetime of the fluorescent tubes, as given by the manufacturer, shall not be exceeded.

5.12 Rotary viewing table (not to be used for textile floor coverings).

A rotary viewing table enabling the specimens to be rotated so that they may be viewed from all directions under the standard illumination.

The diameter of the viewing table shall be at least 1 000 mm to enable the test specimens and the reference scales to be laid side-by-side. The table colour shall be matt dark grey or matt black. The table shall be constructed in such a way that its surface is as close as possible to the floor, in order to achieve a 45° angle to the eyes of the assessor.

5.13 Set of thickness gauges, ranging from 0,05 mm to 0,10 mm in steps of 0,01 mm and from 0,10 mm to 0,50 mm in steps of 0,05 mm.

5.14 Calliper gauge or a depth gauge, with a scale interval of 0,05 mm.

6 Materials

6.1 White cotton, in pad, cloth, or paper form.

6.2 Adhesive scrim, double-sided adhesive tape or adhesive.

6.3 Denatured ethanol.

7 Sampling

7.1 Textile floor coverings

Take specimens from the sample in accordance with ISO 1957.

Prepare the specimens as follows.

a) For Test A

Cut from each sample either three semi-circles or six quadrants with a radius of approximately 350 mm. The quadrant edges shall be either parallel to or at right angles to the direction of manufacture. Cut also a reference specimen of 200 mm × 200 mm. In all cases, mark the direction of manufacture.

If testing only one textile floor covering, a third specimen is required to fill the gap left by removal of the 5 000-cycle specimen (see 9.1.5.2).

b) For Test B

If possible, test samples of different batches/colour during each test.

Cut from each batch/colour either one semi-circle or one quadrant of radius 350 mm. Cut also a reference specimen, with dimensions of 200 mm × 200 mm. In all cases, mark the specimens with the direction of manufacture.

If testing only one textile floor covering, specimens are required to fill in the gaps.

c) For Test C

Cut two semi-circles from each sample with a radius of 350 mm.

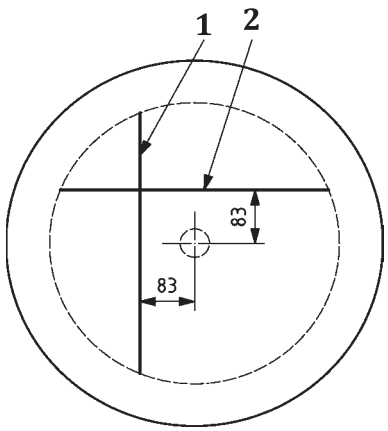
If testing only one textile floor covering, a third specimen is required to fill the gap left by removal of the 10 000-cycle specimen (see 9.1.5.5).

7.2 Resilient floor covering

Take a representative sample from the available material. For rolls, the test should include at least one side joint in the path of the castor. For tiles, the test should include at least two joints crossed in the path of the castor. In any case, the sample should allow mounting according to Figure 4.

The sample diameter shall be at least 750 mm.

Dimensions in millimetres



Key

1 first joint for rolls and tiles

2 second joint for tiles

Figure 4 — Position of joint(s)

7.3 Laminate floor coverings

Take a representative sample from the available material. The test area shall include at least one short side joint in the path of the castor when the specimens are assembled according to the manufacturer's instructions. An example of an assembled test area is shown in Figure 5. The dimension, *l*, shall be at least 300 mm.

The diameter of the test area shall be at least 750 mm.

Dimensions in millimetres

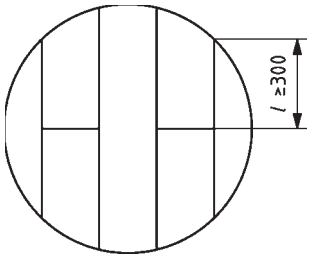


Figure 5 — Example of an assembled test area of laminate floor coverings

8 Conditioning

8.1 Textile floor coverings

Condition the test specimens in the standard atmosphere for testing as defined in ISO 139 for a minimum of 24 h.

8.2 Resilient and laminate floor coverings

Condition the test specimens at a relative humidity of (50 ± 5) % and temperature of (23 ± 2) °C, for a minimum of 24 h.

9 Procedure

9.1 Textile floor coverings

9.1.1 General

The tests shall be performed in the standard atmosphere for textiles as defined in ISO 139.

9.1.2 Mounting of the specimens

Mount two semi-circular specimens or four quadrant specimens on the specimen support using double-sided adhesive tape or adhesive net, applying the tape or net over the whole area of the specimen support plate. Ensure that there are no gaps between the specimens and top tape or ring clamp, as needed, to prevent movement or shifting of specimens while under test load conditions.

If testing over underlay or testing loose-lay tiles, use suitable tape at the perimeter of the test panel in addition to use of the clamping ring to hold the specimens in place.

Prior to testing, clean the specimens with the upright vacuum cleaner, making four forward and four backward passes and ensuring that all the area is covered.

9.1.3 Verifications of the castors

Check that the castors rotate and swivel freely. If necessary, remove any debris or fibres which may be trapped, e.g. with compressed air.

9.1.4 Preparing of the apparatus

Place the specimen support (on which the test specimens are mounted) onto the testing platform, ensuring that the holes in the specimen support engage the studs on the testing platform.

Lower the castor assembly slowly until the castors come into contact with the specimens and the wheel of the lifting device becomes idle. Place the suction device as close as possible to the specimen without touching it. Start the suction device and leave it to operate throughout the whole test, except for Test C — Stage 1.

9.1.5 Test procedures for textile floor coverings

9.1.5.1 Test A — Stage 1

Set the counter at 5 000 cycles and start the machine.

When the machine stops after 5 000 cycles of the testing platform, inspect the specimen(s) for any delamination and then remove those specimens intended for assessment after 5 000 cycles.

NOTE Inspection for delamination prior to removing from the plate is important, as the material can become damaged just by the action of removing the specimen.

Clean the removed 5 000-cycle specimen(s) immediately on removal from the machine, using the external vacuum cleaner with rotating brush, making four passes in each direction along the length of the specimen, the last pass being in the direction of the pile.

Condition the 5 000-cycle specimen(s) in the standard atmosphere for testing textiles as defined in ISO 139 for at least 24 h before assessing, laying the specimen(s) flat with the use surface uppermost, or hanging them freely.

9.1.5.2 Test A — Stage 2

Mount unworn specimens of the floor covering on the specimen support in place of the removed 5 000-cycle specimens.

Set the number of cycles on the counter to 20 000 and start the machine.

When the machine stops after 20 000 cycles, inspect the specimen(s) for any delamination, remove all the specimens, discard the 20 000-cycle specimen(s), and proceed with only the 25 000-cycle specimen(s). If delamination occurs, stop the test and record this fact.

Clean the test specimen(s) immediately on removal from the machine with the external vacuum cleaner with rotating brush making four passes in each direction along the length of the specimen, the last pass being in the direction of the pile.

Condition the 25 000-cycle specimen(s) in the standard atmosphere for testing textiles as defined in ISO 139 for at least 24 h before assessing, laying the specimen(s) flat with the use surface uppermost, or hanging them freely.

9.1.5.3 Test B

Set the number of cycles on the counter to 750 and start the machine.

When the machine stops after 750 cycles, inspect the specimen(s) for any delamination and remove the specimen(s).

Condition the 750-cycle specimen(s) in the standard atmosphere for testing textiles as defined in ISO 139 for at least 24 h before assessing, laying the specimen(s) flat with the use surface uppermost, or hanging them freely.

9.1.5.4 Test C — Stage 1

Set the number of cycles on the counter to 10 000 and start the machine with the suction device turned off.

When the machine stops after 10 000 cycles of the testing platform, inspect the specimen(s) for any delamination and remove those specimen(s) intended for assessment after 10 000 cycles. If delamination occurs, stop the test and record this fact.

Condition these 10 000-cycle specimen(s) in the standard atmosphere for testing textiles as defined in ISO 139 for at least 24 h before assessing, laying the specimen(s) flat with the use surface uppermost, or hanging them freely.

9.1.5.5 Test C — Stage 2

Mount unworn specimens of the floor covering on the specimen support in place of the removed 10 000-cycle specimen(s).

Set the number of cycles to 15 000 and then start the machine.

When the machine stops, inspect the specimen(s) for any delamination and remove all the specimens. Discard the 15 000-cycle specimen(s) and proceed with only the 25 000-cycle specimen(s). If delamination occurs, stop the test and record this fact.

Condition the 25 000-cycle specimen(s) in the standard atmosphere for testing textiles as defined in ISO 139 for at least 24 h before assessing, laying the specimen(s) flat with the use surface uppermost, or hanging them freely.

NOTE Inspection prior to removing from the plate is important, as the material can become damaged just by the action of removing the specimen.

9.2 Resilient and laminate floor coverings

9.2.1 General

Carry out the test within the temperature range of 18 °C to 25 °C.

9.2.2 Mounting of the specimen

For resilient floor covering, take specimen and install it on the specimen support, using either double-sided adhesive tape or with adhesive alone in accordance with the manufacturer's instructions. The product shall be tested with the pre-attached or the prescribed underlay by manufacturer if underlay is recommended.

For laminate floor covering, take the specimen and install, floating on the specimen support in accordance with the manufacturer's instructions. The product shall be tested with the pre-attached or the prescribed underlay by manufacturer. In case no underlay is prescribed, the product shall be tested with an underlay with thickness = 2 mm ± 0,5 mm and compressive stress CS = 60 kPa ± 10 kPa in accordance with CEN/TS 16354.

Specimen shall be securely held in place using glue, tape, or other suitable means. For loose-laid installations, panel shall be secured at the outer perimeter to prevent samples, which may include a flooring product and an underlayment, from shifting during the test using tape, a hold down ring, or other suitable means. Take care not to use mechanical horizontal fastening force.

Prior to testing, clean the specimens with the upright vacuum cleaner.

Where necessary, joints should be treated in accordance with the manufacturer's instructions. An example of positioning of the joint(s) is shown in Figures 4 and 5.

9.2.3 Verification of the castors

Inspect the surface of the castors and, if necessary, clean them with a cotton pad or paper which has been immersed in denatured ethanol and dry them.

9.2.4 Preparing the apparatus

Place the specimen support (on which the test specimens are mounted) onto the testing platform, ensuring that the holes in the specimen support engage the studs on the testing platform.

Lower the castors slowly until they come into contact with the specimens and until the wheel becomes idle. Place the suction device as close as possible to the specimen without touching it. Start the vacuum cleaner and leave it to operate throughout the whole of the test.

9.2.5 Test procedure for resilient and laminate floor coverings

9.2.5.1 Resilient floor covering

Set the number of cycles on the counter to 25 000 and start the machine with the suction device being operated continuously.

9.2.5.2 Laminate floor covering

Set the number of cycles on the counter to the requested number of cycles as defined by the appropriate specification standard for laminate floor covering.

10 Assessment

10.1 Textile floor coverings

10.1.1 General

Use the assessment conditions specified in ISO 9405. In cases where the test has produced uneven appearance changes in the form of rings, due to non-uniform action of the castors (usually at the inner and outer boundaries of the stressed area, but sometimes elsewhere also), perform the appearance assessment in 10.1.3 on parts of the stressed area unaffected by the rings described, using an evaluation template (Figure 6). In all cases, the direction of the manufacture of fatigued and unfatigued specimens should be aligned.

Dimensions in millimetres

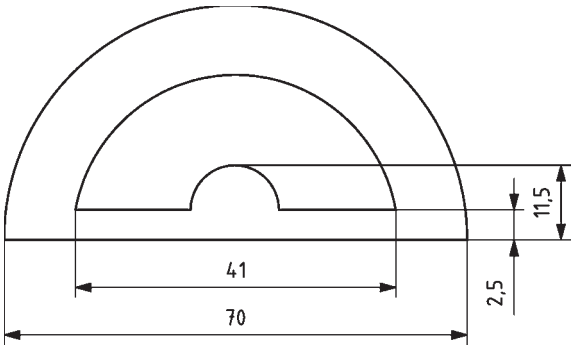


Figure 6 — Evaluation template

10.1.2 Test A — Structural integrity assessment

Examine the tested specimens to observe any delamination or breakdown of the structure caused during the test. Do not include any damage caused by removal of the material from the plate.

10.1.3 Test A — Appearance retention assessment

Lay the specimens tested at 5 000 cycles and 25 000 cycles side by side, together with the unfatigued reference specimen.

Assess the appearance retention grade by comparing the contrast between the unfatigued specimens and each of the two fatigued specimens with the contrast shown by the digital image reference scale nearest in type to the tested floor covering. Assign grades of appearance retention, to the nearest 0,5 grades.

In case of flat needled floor coverings, assess the change of colour by comparing the contrast between the unfatigued and the fatigued specimens with the contrast shown by the large grey scales. Assign grades of colour change, to the nearest 0,5 grades.

10.1.4 Test B — Colour change assessment

Lay the specimens tested at 750 cycles next to the unfatigued reference specimens.

Assess the change in colour by comparing the contrast between the unfatigued and the fatigued specimens with the contrast shown by the large grey scales. Assign grades of colour change, to the nearest 0,5 grades.

10.1.5 Test C — Structural integrity assessment

Examine the specimens tested at 10 000 cycles and at 25 000 cycles to detect any physical damage. Do not include any damage caused by removal of the material from the plate.

Examples of types of damage to be observed are the following:

— loosening, swelling, or tearing of the covering;

— delamination;

— flaking or delamination of foam backing;

— loss of cohesion and/or powdering of binders;

— any destruction of the material as a whole.

10.2 Resilient floor coverings

Examine the test specimen for structural change, using the illumination device (5.11), from a distance of approximately 800 mm at an approximate angle of 45° and from all directions by slowly rotating the viewing table (5.12). Record any damage caused by detachment of layers, opening of joints, or crazing. Ignore any flattening or change in appearance, e.g. change in gloss.

10.2.1 Resilient floor covering with click joints for floating installation

Measure the maximum openings/height differences of the complete long and shorts joints on the test specimen using the set of thickness gauges (5.13) for the openings or calliper gauge or a depth gauge (5.14) for height differences.

10.3 Laminate floor coverings

a) Examine the test specimen for structural change, using the illumination device (5.11), from a distance of approximately 800 mm at an approximate angle of 45° and from all directions by slowly

rotating the viewing table (5.12). Record any damage caused by detachment of layers, opening of joints, or crazing. Ignore any flattening or change in appearance, e.g. change in gloss.

b) Measure the maximum openings/height differences of the complete long and shorts joints on the test specimen using the set of thickness gauges (5.13) for the openings or calliper gauge or a depth gauge (5.14) for height differences.

11 Calculations and expression of results

11.1 Textile floor coverings

Record the assessment, as assessed in 10.1.3, for the test specimen.

Record the type of damage, as assessed in 10.1.2 and 10.1.5, for the test specimen.

Record the colour change, as assessed in 10.1.4, for the test specimen.

11.1.1 Optional results for textile floor coverings

In complement to the assessments in 10.1.3, a castor chair index is sometimes used, which can be calculated from the median values of the assessments after 5 000 cycles and after 25 000 cycles using Formula (1):

$$r = 0{,}75\ a_1 \text{°} + 0{,}25\ a_2 \quad (1)$$

where

r is the castor chair index, calculated to one decimal point;

a_1 is the median assessment after 5 000 cycles;

a_2 is the median assessment after 25 000 cycles.

11.2 Resilient floor coverings

Record the type of damage, as assessed in 10.2, for the test specimen.

If applicable, record the maximum openings and the height differences of the joints, as assessed in 10.2.1.

11.3 Laminate floor coverings

Record the type of damaged, as assessed in 10.3, for the test specimen and record the maximum openings and the height differences of the joints.

12 Test report

The test report shall include the following information:

General

— reference to this International Standard, i.e. ISO 4918:—;

— complete identification of the product tested, including type, source, colour, and manufacturer's reference numbers;

— previous history of the sample;

— date of the test;

— type of wheels used;

— type of adhesive or adhesive tape, if used in the test;

— the complete identification of underlay, if used in the test;

— any deviation from this International Standard or observation of factors which may have affected the result.

Textile floor covering

— type of test carried out (Test A, B, or C);

— if the test specimen(s) exhibited damage at the end of the test, the nature of the damage;

— the appearance retention grade and/or castor chair index, colour change, structural integrity after 5 000 cycles and 25 000 cycles, or other number of cycles if specified.

Resilient floor covering

— if the test specimen(s) exhibited damage at the end of the test, the nature of the damage;

— for floating tiles and planks with click joints, the maximum opening and height differences of the joints rounded to the nearest 0,01 mm.

Laminate floor covering

— if the test specimen(s) exhibited damage at the end of the test, the nature of the damage;

— for floating tiles and planks with click joints, the maximum opening and height differences of the joints rounded to the nearest 0,01 mm.

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