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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*

www.iso.org



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Fax + 41 22 749 09 47  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 4918 was prepared by Technical Committee ISO/TC 219, *Floor coverings*.

It cancels and replaces ISO/TR 4918:1990, which has been technically revised.

# Resilient, textile and laminate floor coverings — Castor chair test

## 1 Scope

This International Standard specifies methods for

- a) assessment of the wear behaviour of textile floor coverings,
- b) assessment of the change in colour (glossing) of needled floor coverings without a pile,
- c) assessment of the general structural integrity of textile floor coverings,
- d) determination of susceptibility to surface crazing, of construction integrity and of joint stability for resilient or laminate floor coverings, including joints.

The methods involve subjecting a test specimen to the movement of a castor chair.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. 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*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2424 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 tests 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),

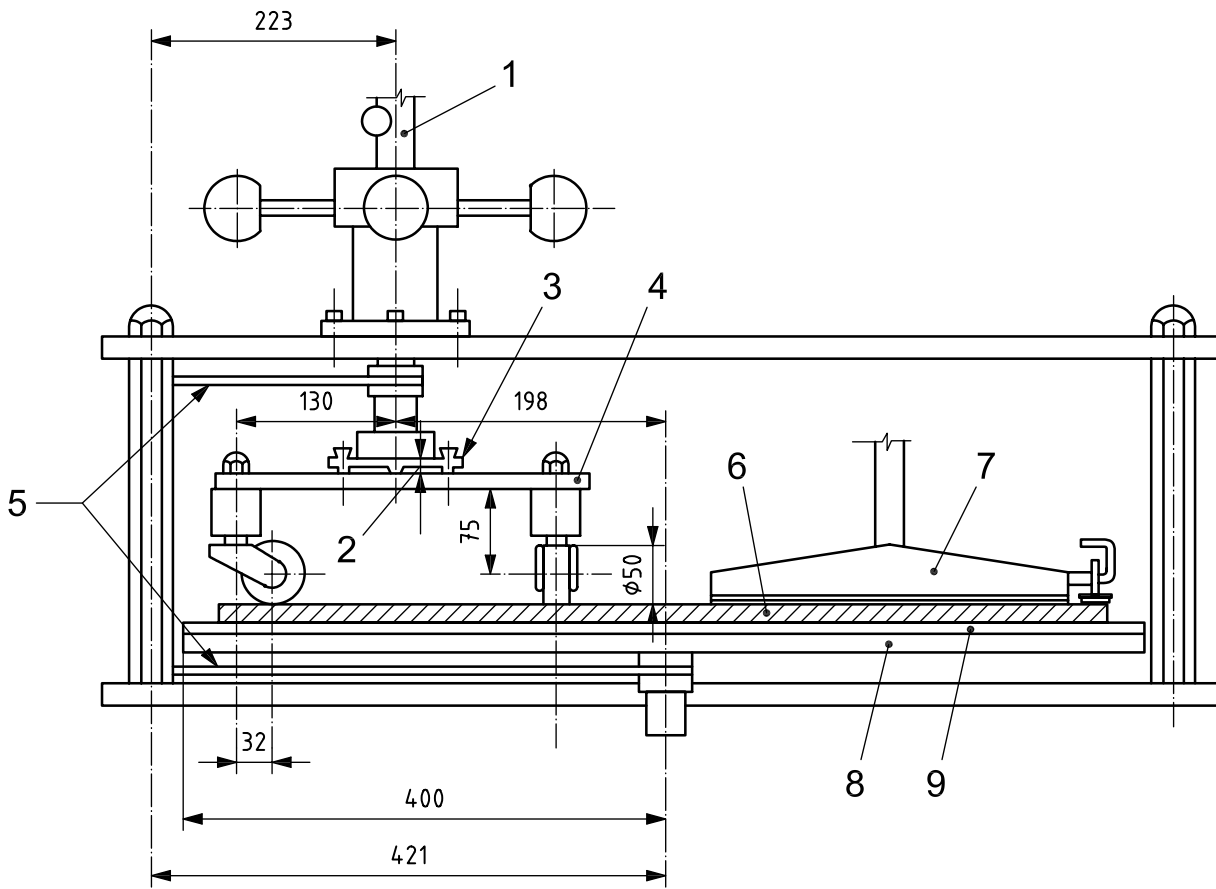
- b) the change in colour is assessed by means of grey scales after 750 cycles (Test B),
- c) the extent of deterioration of the specimen is assessed after 10 000 or 25 000 cycles (Test C).

**5 Apparatus** (see Figure 1)

**5.1 Rotating circular test platform**, on which the test specimens are placed.

The diameter of the platform shall be a minimum of 750 mm.

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 testing platform                      |
| 4 castor mounting plate | 9 specimen support                      |
| 5 chain                 |   |

**Figure 1 — Typical castor chair apparatus**

## 5.2 Castor assembly (see Figures 1 and 2).

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

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

The stressed area of the specimen under test 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  $0,3 \text{ m}^2$ .

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  $(90 \pm 1)$  kg equally divided over the three castors.

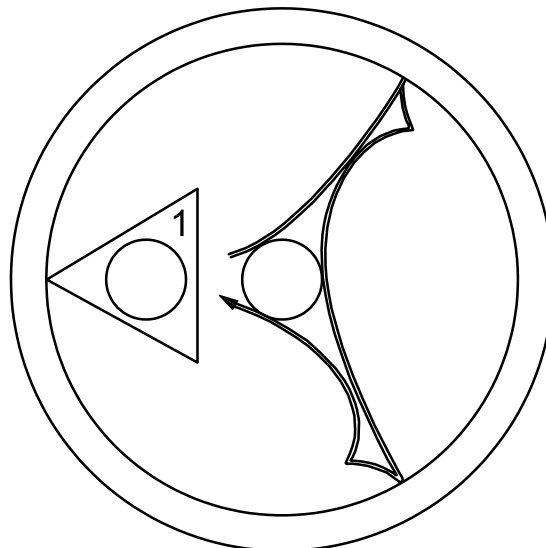
The distance (under load) between the castor mounting plate and the load/drive plate shall be  $> 3$  mm.

## 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  $(19 \pm 1)$  r/min and that of the castor assembly  $(50 \pm 1)$  r/min.

After  $(180 \pm 10)$  s of rotation, the platform shall stop and remain in the stop position for  $(5 \pm 2)$  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).



### Key

1 castor assembly

Figure 2 — Path of castors

**5.4 Suction device.**

A suction device (item 7 in Figure 1) 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.

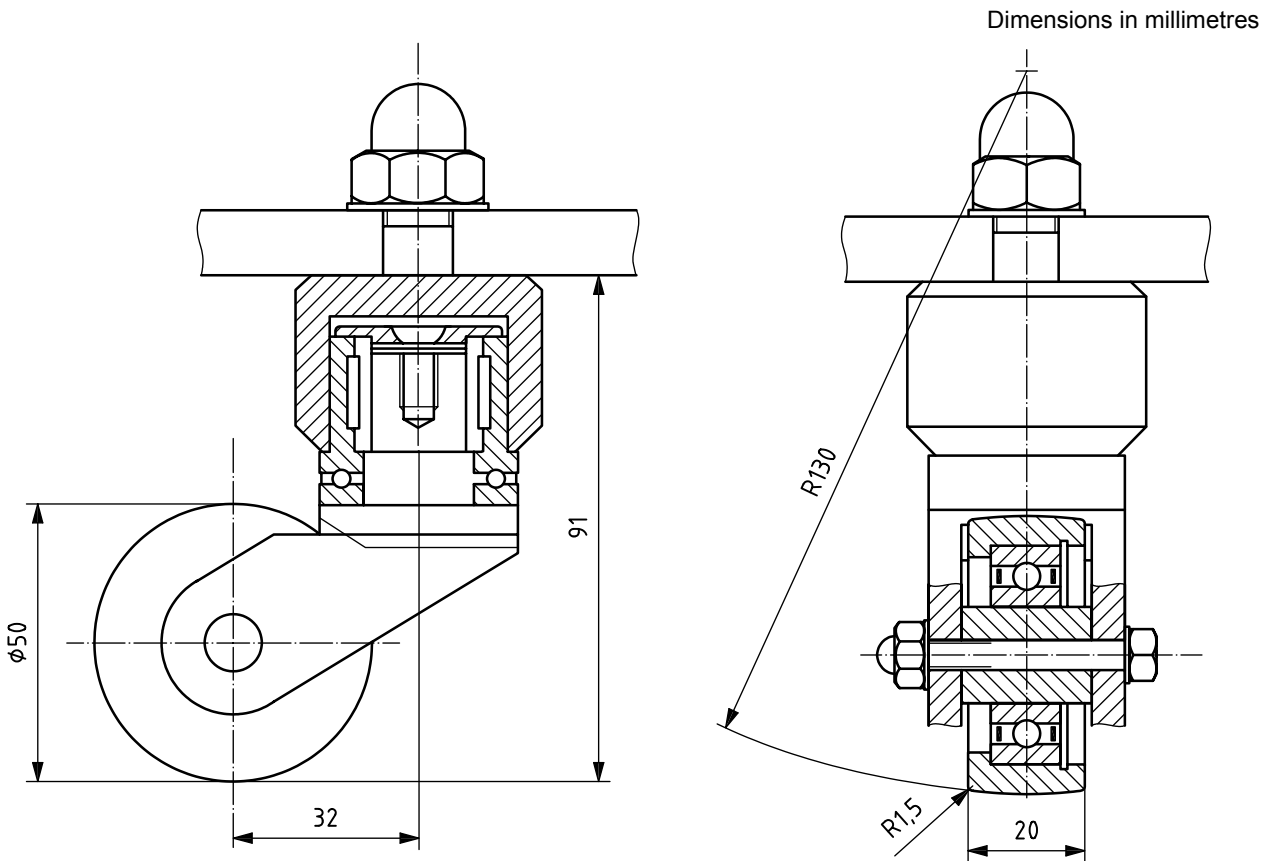
**5.5 Castors.**

**5.5.1 General**

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

- diameter:  $(50 \pm 2)$  mm;
- width:  $(20 \pm 2)$  mm;
- radius of curvature  $R$  of castor tread:  $(130 \pm 5)$  mm;
- crank distance:  $(32 \pm 2)$  mm.

The distance between any two castor mountings shall be  $(225 \pm 5)$  mm.



**Figure 3 — Single-wheel swivel castors**

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

Type H castors have plain wheels and a hard tread. The wheels shall be one colour over their entire surface. The castor treads are made from polyamide having a Shore A hardness of  $(95 \pm 5)$ , and shall be replaced after 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 coverings.

Type W castors have resilient-tyred wheels and a soft tread. The castor treads are made from polyurethane, with surface hardness of  $(95 \pm 5)$  Shore A. The surface of the castor wheels shall be replaced after 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**, such as metal taping or a metal ring (for loose-laid installation) at the outer perimeter to secure specimens in position during the test.

**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  $(7 \pm 2)$  mm and a diameter of  $(800 \pm 5)$  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.**

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  $(1\ 500 \pm 300)$  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 luxmeter. The lifetime of the fluorescent tubes, as given by the manufacturer, shall not be exceeded.

**5.12 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  $45^\circ$  angle to the eyes of the assessor.

## 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 3 semi-circles or 6 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  $(350 \pm 3)$  mm. Cut also a reference specimen, with dimensions of  $(200 \pm 2)$  mm ×  $(200 \pm 2)$  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.

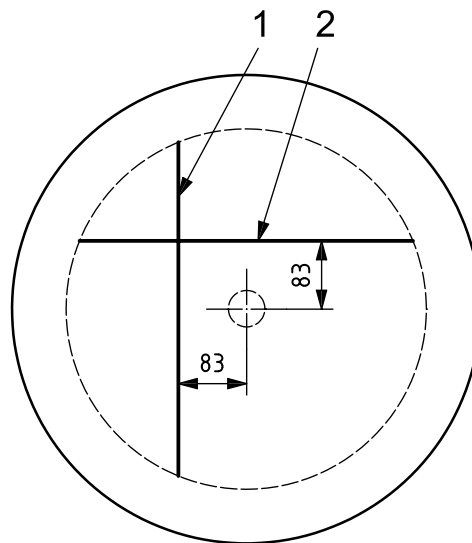
If testing only one textile floor covering, a third specimen is required to fill the gap left by removal of the 10 000-cycle specimen (see 9.1.5.5).

### 7.2 Resilient floor coverings

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

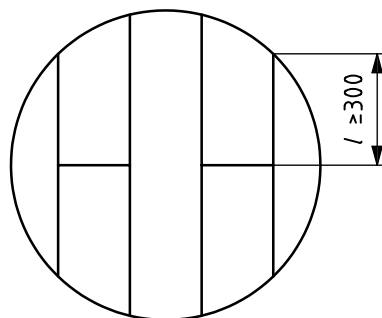
**Figure 4 — Position of joint(s)**

**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.



**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 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 specimens

For resilient flooring, take the specimen and install it on the specimen support, using either double-sided adhesive tape or with adhesive alone, or in accordance with the manufacturer's instructions.

For laminate flooring, take the specimen and install it, floating on the specimen support, in accordance with the manufacturer's instructions.

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 Figure 4.

### 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

Set the counter to the appropriate number of cycles and start the machine. Refer to the appropriate product specification for the number of required cycles. The product should be tested with the attached or prescribed underlay. In the case no underlay is prescribed, the product shall be tested with an underlay of  $(2 \pm 0,5)$  mm expanded polyethylene foam of density  $(35 \pm 5)$  kg/m<sup>3</sup>.

## 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.

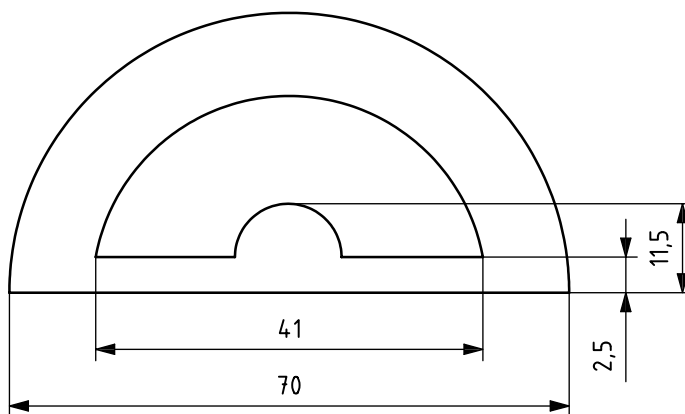


Figure 6 — Evaluation template

#### 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 (see ISO 9405) nearest in type to the tested floor covering. Assign grades of appearance retention, to the nearest 0,5 grade.

#### 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 grade.

#### 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

- 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 and laminate 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.

## 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.

### 11.2 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 the following formula:

$$r = 0,75 a_1 + 0,25 a_2$$

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.

### 11.3 Resilient and laminate floor coverings

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

## 12 Test report

The test report shall include the following information:

- a) reference to this International Standard;
- b) type of test carried out for textile floor coverings (Test A, B or C), or number of cycles in test for resilient and laminate floor coverings;
- c) complete identification of the product tested, including type, source, colour and manufacturer's reference numbers;
- d) previous history of the sample;
- e) date of the test;
- f) type of wheels used;



- g) type of adhesive, if used in the test (for resilient and laminate floor coverings);
- h) if the test specimen(s) exhibited damage at the end of the test, the nature of the damage;
- i) the appearance retention grade and/or castor chair index for textile floor covering (after 5 000 cycles and 25 000 cycles, or other number of cycles if specified);
- j) type of damage for resilient and laminate floor coverings (see 10.2);
- k) any deviation from this International Standard or observation of factors which may have affected the result.



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