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# Resilient, laminate and textile floor coverings — Measurement of dynamic coefficient of friction on dry floor surfaces

The European Standard EN 13893:2002 has the status of a  
British Standard

ICS 59.080.60; 97.150

## National foreword

This British Standard is the official English language version of EN 13893:2002.

The UK participation in its preparation was entrusted to Technical Committee PRI/60, Resilient floor coverings, which has the responsibility to:

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This British Standard, having been prepared under the direction of the Materials and Chemicals Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 28 November 2002

### Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

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### Amendments issued since publication

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ICS 59.080.60; 97.150

English version

## Resilient, laminate and textile floor coverings - Measurement of dynamic coefficient of friction on dry floor surfaces

Revêtements de sol résilients, stratifiés et textiles -  
Détermination du coefficient de frottement dynamique sur  
la surface des sols secs

Elastische, laminierte und textile Bodenbeläge - Messung  
des Gleitreibungskoeffizienten von trockenen  
Bodenbelagsoberflächen

This European Standard was approved by CEN on 26 August 2002.

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## **Foreword**

This document (EN 13893:2002) has been prepared by Technical Committee CEN/TC 134 "Resilient, textile and laminate floor coverings", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2003, and conflicting national standards shall be withdrawn at the latest by May 2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

In this European Standard the annex A is normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

Dynamic friction testing is a means of assessing the slipperiness of floors. Many test devices have been constructed but these give different results since the design and construction methods differ and because different test parameters are chosen.

CEN/TC 134 therefore decided not to standardize a particular device for testing slipperiness properties of floor coverings. The aim is to fix and standardize the principle of testing and specify the parameters to be followed when designing a test device and when testing with it.

## 1 Scope

This European Standard specifies the method for the measurement of dynamic coefficient of friction ( $\mu$ ) on surfaces of resilient, laminate and textile floor coverings, usually walked on with shoes.

Relief floor coverings with a displacement volume  $\leq 4 \text{ cm}^3/\text{dm}^2$  are covered by this standard.

The measurements are made in a laboratory on ex-factory dry floor covering surfaces only. The method described is not suitable for testing on wet or contaminated surfaces.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 522:1998, *Adhesives for leather and footwear materials — Bond strength — Minimum requirements and adhesive classification*.

EN 12466:1998, *Resilient floor coverings — Vocabulary*.

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:1985)*.

## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions of EN 12466:1998 together with the following apply.

### 3.1 dynamic coefficient of friction, $\mu$

quotient of the horizontal frictional force and the vertical load during motion at a constant speed between the slider and the horizontal floor covering

### 3.2 displacement volume

open volume of a relief floor covering beneath the wear surface

NOTE The method for determination of this property is given in annex A.

## 4 Principle

Sliders made from the defined material and having a definite shape are loaded to impose a specified force on the floor covering. The loaded sliders are pulled parallel to the surface of the floor covering at a constant speed. The horizontal force applied to pull the sliders is recorded over the length of a trace. The horizontal force is divided by the vertical force to obtain the dynamic coefficient of friction.

## 5 Apparatus and materials

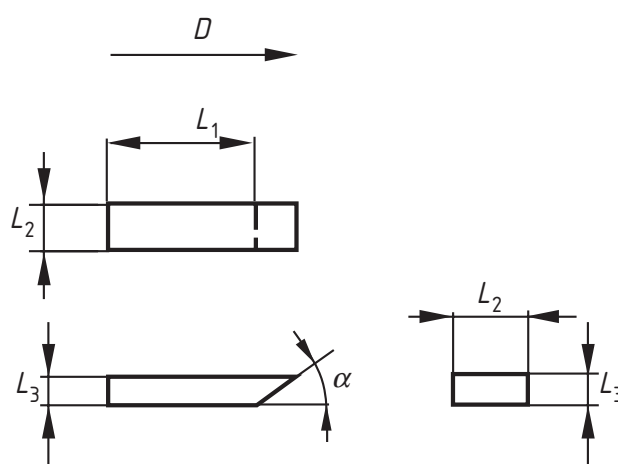
### 5.1 Apparatus

**5.1.1 A pulling device**, able to pull a loaded slider assembly at a constant speed, to a tolerance of 0,01 m/s, within the range of 0,20 m/s to 0,30 m/s along a length which allows a stable measurement reading for at least 0,30 m.

**5.1.2 A measuring device**, capable of measuring the horizontal force with an error limit of 1 %.

**5.1.3 A slider assembly**, with two leather sliders and one shoe rubber slider of shape and dimensions specified in Figure 1, arranged on the assembly as shown in Figure 2. The three sliders shall be of similar thickness within the range 2 mm to 6 mm, to ensure that they are all capable of being in contact with a flat surface, and shall be firmly fixed to the assembly by means of a contact adhesive. The slider assembly shall be loaded with a mass such that the total mass of the loaded slider assembly is  $(10,0 \pm 0,1)$  kg.

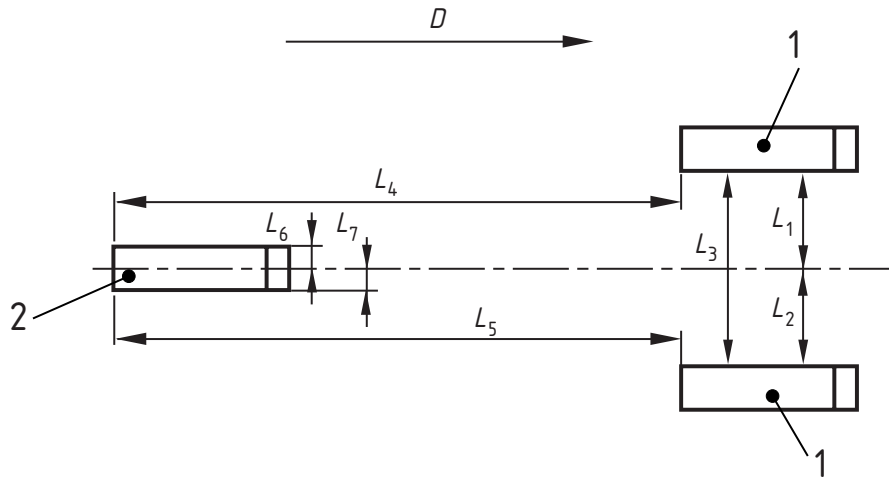
Dimensions in millimetres



#### Key

$D$	Direction of movement	
$L_1$	Length	$(37,5 \pm 2,5)$ mm
$L_2$	Width	$(10 \pm 0,5)$ mm
$L_3$	Uniform thickness	within the range 2 mm to 6 mm
$\alpha$	Chamfer angle	$(35 \pm 5)^\circ$

**Figure 1 — Slider shape and dimensions**



**Key**

1	Leather sliders
2	Shoe rubber slider
<i>D</i>	Direction of movement
$L_3$	$(46 \pm 2)$ mm
$L_4$	$(130 \pm 3)$ mm
$L_1$ minus $L_2$	$(0 \pm 0,3)$ mm
$L_4$ minus $L_5$	$(0 \pm 0,3)$ mm
$L_6$ minus $L_7$	$(0 \pm 0,3)$ mm

**Figure 2 — Typical arrangement of sliders on slider assembly (bottom view)**

NOTE The use of a template is recommended to ensure the slider dimensions fall within the stated tolerances.

## 5.2 Sliders

**5.2.1 Leather slider**, consisting of pit-tanned leather of density  $(1,0 \pm 0,1)$  g/cm<sup>3</sup> and Shore D hardness  $60 \pm 10$  according to EN ISO 868.

**5.2.2 Shoe rubber slider**, consisting of reference test material SBR 1 based on styrene-butadiene rubber of Shore A hardness 95, as specified in EN 522:1998.

## 5.3 Balance

The balance shall be capable of measuring the mass of the loaded slider assembly to the nearest 10 g.

## 5.4 Calibrated weights

Three calibrated weights with different masses within the range 2 kg to 7 kg, (e.g. 2 kg, 4 kg and 7 kg) for calibrating the test device.

## 5.5 Abrasive paper

60 grade and 320 grade abrasive papers fitted to a plain rigid surface with a width greater than that of the slider assembly.



## 5.6 Clean cotton cloth and/or brush

# 6 Calibration

## 6.1 Calibration by weights

Measure and record the mass of the loaded slider assembly using the balance (5.3).

Place the test device in a vertical position to allow it to pull a calibrated weight (5.4) against the measuring device (5.1.2) without friction, parallel to the bottom of the device.

Take three measurements with each of the three calibrated weights. Record the three average results (calculated and indicated by the test device).

Compare each of these three average results with the theoretical value. i.e.:

$$\frac{\textit{mass of calibrated weight}}{\textit{known total load including sliders}}$$

The average deviation from the theoretical value shall be  $\leq 0,01$ .

## 6.2 Other calibration methods

For machines of special construction that cannot be calibrated by weights, use the calibration procedure recommended by the manufacturer.

# 7 Sampling and preparation of test pieces

Take test pieces, from both production (machine) and cross-machine directions, of dimensions approximately 100 cm by 50 cm from a sample of the floor covering. If known, mark the machine direction on the test piece. Assemble panels and tiles so as to enable both machine and cross-machine directions to be measured.

Condition the test pieces for at least 24 h at the standard atmosphere ( $23 \pm 2$ ) °C and ( $50 \pm 5$ ) % relative humidity or alternatively at ( $20 \pm 2$ ) °C and ( $65 \pm 5$ ) % relative humidity.

Clean the surface of laminate and resilient floor covering test pieces with the clean dry cotton cloth and use the brush to clean the surface of textile floor coverings. Do not use any cleaning agent.

Relief floor coverings within the scope of CEN/TC 134 may be regarded as having a displacement volume of  $\leq 4$  cm<sup>3</sup>/dm<sup>2</sup>. For verification of this, determine the displacement volume as specified in annex A.

# 8 Preparation of sliders

Plane-grind the surface of new sliders with 60 grade abrasive paper (5.5) to ensure uniform thickness and then clean and plane-grind the surface of the sliders before testing using a 320 grade abrasive paper. During the plane-grinding the abrasive paper shall be in contact with all three sliders. The abrasive strokes shall be uniformly to-and-from in the length direction of the sliders, with the final two strokes against the direction of slider motion.

Remove any dust from the sliders. Repeat this preparation for every new set of 5 measurements.

## 9 Procedure

Condition the test device in the standard atmosphere for at least 24 h.

Take the measurements in the machine direction and the cross-machine direction. If this is not known, take measurements in the direction of the lowest dynamic friction, verified by a sufficient number of preliminary tests.

Take five measurements using the test device (5.1). For each measurement pull the slider along a new trace.

The first two measurements can be non-representative and they shall be ignored. Record the horizontal forces over 0,30 m for the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> measurements for each direction.

## 10 Calculation and expression of results

Record the  $\mu$  value for traces 3 to 5 to the nearest 0,01 according to the following equation:

$$\mu = \frac{F}{M}$$

where

- $\mu$  is the dynamic coefficient of friction;
- $F$  is the average horizontal force (in Newton);
- $M$  is the total vertical load on the sliders (in Newton).

Calculate the mean of the three measurements in each direction and express the result as the lower of the two mean values.

NOTE The  $\mu$  value can be calculated directly by the device using a built-in computer.

## 11 Test report

The test report shall contain the following information:

- a) reference to this standard i.e. EN 13893:2002;
- b) complete identification of the product tested, including type, source, colour, and manufacturer's reference numbers;
- c) date of the test;
- d) method of sampling;
- e) temperature and relative humidity for conditioning and during the tests;
- f) the three individual  $\mu$  values and the average  $\mu$ -value;
- g) any deviation from this standard which can have affected the results.

## Annex A (normative)

### Determination of displacement volume of a relief floor covering

#### A.1 Principle

The relief surface of a floor covering is filled up with a suitable material (usually in paste form) with a known density to the upper level of the wear surface. The volume of the profile is determined by difference weighing without and with the material.

#### A.2 Sampling and preparation of test pieces

Take five test pieces approximately 100 mm by 100 mm from the sample. Take care that the profile of the test pieces is representative for the floor covering.

#### A.3 Material and apparatus

**A.3.1 A suitable filling material (paste)**, to fill the displacement volume of the floor covering.

**A.3.2 Balance**, capable of measuring to the nearest 0,05 g

**A.3.3 Plate**, with a smooth surface

**A.3.4 Tape**, to seal the edges of the test piece

**A.3.5 An adjustable frame**

#### A.4 Determination of the density of the filling material

Pour the filling material (**A.3.1**) into a tared flask of known volume and weigh the filled flask to obtain the net mass of the filling material.

Calculate the density of the filling material as

$$\text{Density} = \frac{\text{net weight of the paste}}{\text{volume of the paste}}$$

#### A.5 Procedure

Place the test piece upside down on a smooth surface. Seal the edges of the test piece with a tape plane to its upper surface, i.e. to the level of the plate. Take off the test piece and weigh together with the tape to 0,1 g.

Place the test piece upside down on the plate and mount the frame around it. Turn up the test piece and fill up the surface with the paste. Take off the surplus paste to the upper level of the frame and ensure that there is no paste on the upper wear surface and that the surface of the paste is smooth. Weigh the test piece without frame immediately to avoid evaporation from the paste.

## A.6 Calculation and expression of results

Calculate the displacement volume of the profile in each test piece from the mass of the paste divided by its density. Calculate the average volume from the five test pieces to the nearest 0,5 cm<sup>3</sup> and express the result relative to the area of the test pieces in cm<sup>3</sup>/dm<sup>2</sup>.



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