

BS EN 13892-3:2014



BSI Standards Publication

Methods of test for screed materials

Part 3: Determination of wear resistance —
Böhme

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National foreword

This British Standard is the UK implementation of EN 13892-3:2014. It supersedes BS EN 13892-3:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CB/300, Screeds and in-situ floorings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Methods of test for screed materials - Part 3: Determination of wear resistance - Böhme

Méthodes d'essai des matériaux pour chapes - Partie 3:
Détermination de la résistance à l'usure Böhme

Prüfverfahren für Estrichmörtel und Estrichmassen - Teil 3:
Bestimmung des Verschleißwiderstandes nach Böhme

This European Standard was approved by CEN on 16 November 2014.

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Foreword

This document (EN 13892-3:2014) has been prepared by Technical Committee CEN/TC 303 "Floor screeds and screed materials", the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by June 2015 and conflicting national standards shall be withdrawn at the latest by June 2015.

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

This document supersedes EN 13892-3:2004.

In comparison with the previous edition, changes have been made in:

- Clause 6, 2nd paragraph and Table 2;
- Clause 7, 2nd paragraph.

EN 13892, *Methods of test for screed materials*, is divided in the following parts:

- *Part 1: Sampling, making and curing specimens for test;*
- *Part 2: Determination of flexural and compressive strength;*
- *Part 3: Determination of wear resistance – Böhme [the present document];*
- *Part 4: Determination of wear resistance-BCA;*
- *Part 5: Determination of wear resistance to rolling wheel of screed material for wearing layer;*
- *Part 6: Determination of surface hardness;*
- *Part 7: Determination of wear resistance to rolling wheel of screed material with floor coverings;*
- *Part 8: Determination of bond strength.*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies a method for determining the wear resistance of moulded specimens made from cementitious screed material, primarily for hard aggregate wearing screed materials or optionally for other screed materials. The method is also suitable for specimens cut from floor screed. This method is unsuitable for synthetic resin screed materials.

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.

EN 459-2, *Building lime - Part 2: Test methods*

EN 13813, *Screed material and floor screeds - Screed material - Properties and requirements*

EN 13892-1, *Methods of test for screed materials - Part 1: Sampling, making and curing specimens for test*

ISO 565, *Test sieves - Metal wire cloth, perforated metal plate and electroformed sheet - Nominal sizes of openings*

3 Principle

Cast specimens are placed on the Böhme abrader, on the test track of which standard abrasive is strewn, the disk then being rotated and the specimens subjected to an abrasive load of 294 N for a given number of cycles.

4 Symbols and abbreviations

$A = \Delta V$ is the wear resistance-Böhme in cm^3 per 50 cm^2 and the loss in volume after 16 cycles

$\Delta l = l_0 - l_{16m}$ is the mean reduction in mm after 16 cycles

l_0 is the mean thickness of the specimen in mm from the measurements made at all nine measuring points prior to testing

l_{16m} is the mean thickness of the specimen in mm from the measurements made at all nine measuring points after completion of the test

Δm is the reduction in mass in g after 16 cycles

ρ_R is the density of the specimen in g/cm^3 or, in the case of multi-layer specimens, the density of the wearing layer

5 Apparatus

The Böhme abrader as shown in Figure 1 consists of a rotating table with a defined test track to receive the abrasive, a specimen holder and a loading device.

The rotating table shall have a diameter of approximately 750 mm and be flat and positioned horizontally. When loaded, its speed shall be $(30 \pm 1) \text{ r/min}$.

The table shall be provided with a revolution counter and a device that switches off the rotating table automatically after 22 revolutions.

The test track shall be annular, with an inside radius of approximately 120 mm and an outside radius of approximately 320 mm to give a width of (200 ± 5) mm, and be replaceable.

The track shall be made of cast iron with a perlitic structure, a phosphorus content not exceeding 0,35 % and a carbon content of more than 3 %. The track shall have a Brinell hardness of 190 HB to 220 HB 2,5/187,5 determined as the mean from measurements taken at not less than 10 points along the edge of the track.

The face of the track in contact with the specimen shall be fine finished (surface roughness of $6 \mu\text{m}$ to $16 \mu\text{m}$). The track should be designed so as to permit both sides to be used.

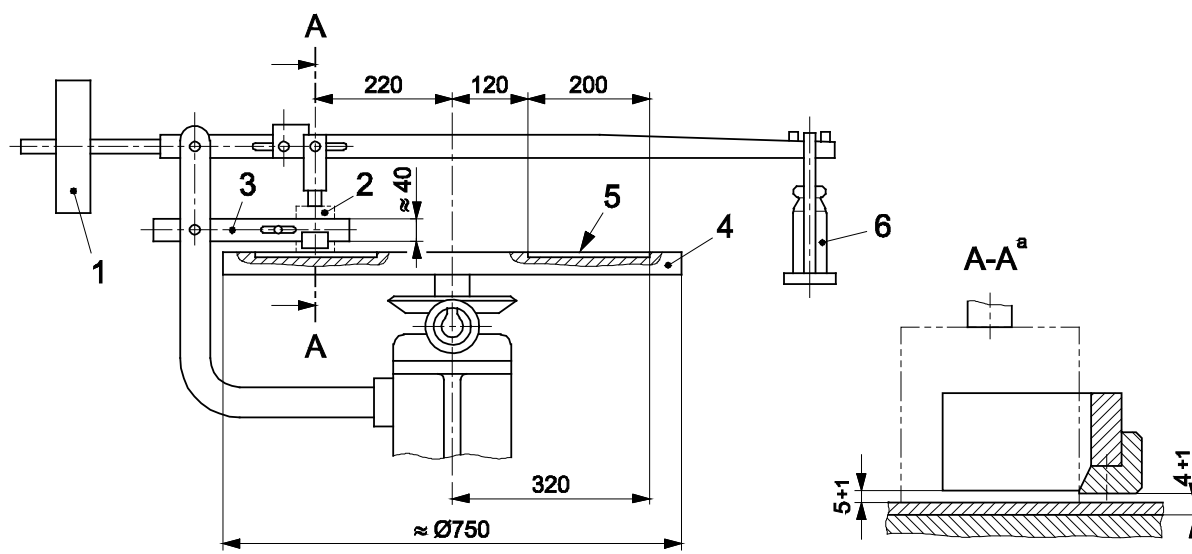
The track surface is subject to wear in service; the resulting reduction in thickness shall not exceed 0,3 mm and any grooves not be deeper than 0,2 mm. If these values are exceeded, the track shall be replaced or refinished. When the track has been refinished three times, its hardness shall be determined anew.

The specimen holder shall consist of a U frame approximately 40 mm thick, with a clear distance of (5 ± 1) mm from the test track. The frame shall be positioned so that the centreline distance between specimen and rotating table is 220 mm and the angle bead of the specimen holder, which supports the specimen, is located at a distance of (4 ± 1) mm above the rotating table. The mounting of the specimen holder shall ensure that, during testing, no vibration occurs.

The loading device shall consist of a lever of two arms of different length, a loading weight and a counterweight, the lever being pivoted with as little friction as possible and positioned almost horizontally during the test. The system shall be designed to ensure that the load is transferred vertically via the plunger to the centre of the specimen. The self-weight of the lever is balanced by the counter-weight and the scale arm to receive the loading weight. The force acting on the specimen results from the loading weight multiplied by the leverage ratio, the mass of the weight being selected to produce a test force of (294 ± 3) N (corresponding to about $0,06 \text{ N/mm}^2$ compressive stress), which shall be verified by calculation.

To establish the reduction in thickness of the specimen it shall be placed on a measuring table. A template (see Figure 2) shall be placed over the specimen in a marked orientation, to identify the nine measuring points. A dial gauge rigidly attached to the measuring table is used to measure, to an accuracy of 0,01 mm, the vertical position at any measuring point. The dial gauge is fitted with a plunger with a spherical end-bearing of 3 mm diameter.

Dimensions in millimetres



Key

- 1 counterweight
- 2 specimen
- 3 specimen holder
- 4 rotating disk
- 5 test track
- 6 loading weight
- a Section A-A (enlarged)

Figure 1 — Principle of Böhme disk abrader

Dimensions in millimetres

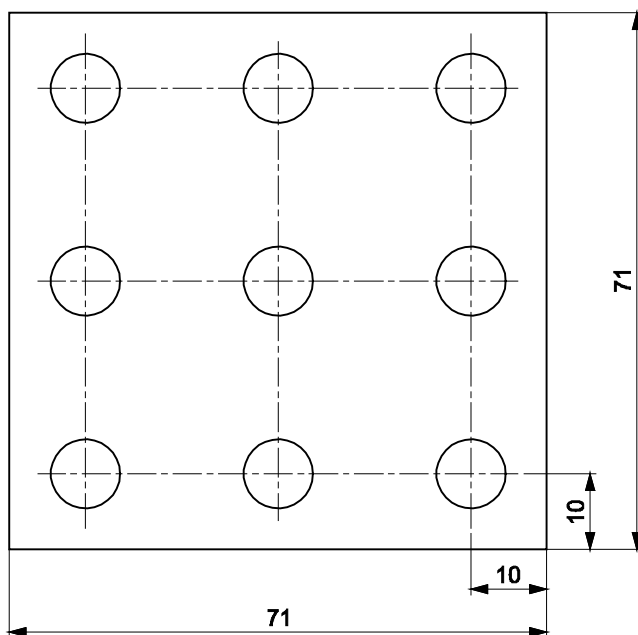


Figure 2 — Template for identifying measuring points

6 Abrasive material

The standard abrasive material used shall be an artificial corundum¹⁾ designed to produce an abrasive wear of 1,10 mm to 1,30 mm when testing standard granite²⁾ specimens and of 4,20 mm to 5,10 mm when testing standard limestone²⁾ specimens. The tolerances of the chemical composition of the abrasive material is given in Table 1. Conformance to these requirements, the homogeneity of the material and the uniformity of bulk density and grading of the abrasive shall be checked before use.

Table 1 — Standard requirements of the chemical composition

Constituent	Content mass percentage
corundum (crystallized aluminium oxide Al ₂ O ₃)	≥ 99,3

The loose density of the standard abrasive grit shall be between $(1,48 \pm 0,1)$ kg/dm³. The loose density is determined according to the test method described in EN 459-2 whereby the filling container of the apparatus is to be filled with 2 kg of the grit.

The mass percentage of material on each sieve shall correspond to the particle size distribution of Table 2.

Table 2 — Sieve analysis

Test sieve according to ISO 565	Percentage passing by mass
63	< 5
125	≥ 90

7 Preparation of specimens

The wear resistance Böhme is measured on the top surface as cast of 3 specimens made in accordance with EN 13892-1 or cut from floor screed.

Cubes with edge length of $(71 \pm 1,5)$ mm shall be used as specimens. Alternatively square blocks, of the same edge length, but a minimum thickness of 30 mm including any support slab may be used. The test specimen shall be dried at (110 ± 5) °C until constant mass.

In order to avoid the influence of the preparation each specimen shall undergo four cycles before starting the test.

1) Information on source of supply of standard abrasives and on impartial testing laboratories can be obtained from Materialprüfungsamt Nordrhein-Westfalen, Marsbruchstraße 186, D-44287 Dortmund, Deutschland.

2) The standard material is stocked by the laboratory responsible for the inspection of standard abrasives.

The contact face, that is the face to be tested and the bottom face of the specimen shall be parallel and flat. For determining the reduction in thickness the bottom face shall, if appropriate, be ground parallel or otherwise machined so as to be parallel.

8 Testing

8.1 General

The wear resistance Böhme shall be determined as loss in volume, calculated from changes in mass. In the case of multi-layer specimen the wear resistance is determined as a reduction in thickness. In case of the chosen determination, one of the following procedures shall be undertaken.

8.2 Determination of density

To determine the loss in volume, prior to testing, the density of the specimen, ρ_R , shall be determined by measurements, to the nearest 0,1 mm, and by weighing, to the nearest 0,1 g.

8.3 Procedure

Prior to testing each specimen shall be measured by mass or by thickness, as appropriate. For mass each specimen shall be weighed to an accuracy of 0,1 g. For reduction in thickness each specimen shall be placed contact face up on a measuring table, and readings taken from the dial gauge at a total of nine measuring points arranged as shown in Figure 2, the results being given to the nearest 0,01 mm.

Each specimen shall undergo testing for 16 cycles, each consisting of 22 revolutions.

20 g of standard abrasive shall be strewn evenly on the test track and the specimen, clamped into the holder and with the test contact face facing the track, loaded centrally with (294 ± 3) N.

The rotating table shall then be rotated, taking care that the abrasive on the track remains evenly distributed over an area traversed by the specimen.

After each cycle, both rotating table and contact face shall be cleaned, and the specimen turned progressively through 90° and new abrasive strewn on the track.

After each cycle the contact area shall be inspected visually and any significant changes noted.

After completion of the test and careful cleaning, each specimen shall be remeasured, as appropriate.

Measurements after every 4 cycles may provide useful information on the rate of wear.

9 Expression of results

The wear resistance Böhme A after 16 cycles shall be determined as the loss in specimen volume ΔV , using Formula (1).

$$A = \Delta V = \frac{\Delta m}{\rho_R} = \Delta l \times 5 \text{ in cm}^3 \text{ per } 50 \text{ cm}^2 \quad (1)$$

10 Test report

The test report shall include the following information:

- a) number, title and date of issue of this European Standard;

- b) name and address of the laboratory carrying out the tests and name and address of the laboratory preparing the samples (if different);
- c) identification number of the test report;
- d) name and address of the manufacturer or supplier of the product;
- e) name and identification marks or batch number of the product;
- f) date of supply of the product;
- g) method of sampling (by reference to EN 13892-1 and by which organization);
- h) place, date and time of sampling;
- i) identification of the screed samples, including type, origin and designation of the screed material by reference to the relevant product standard EN 13813;
- j) preparation (mixing, casting) and storage (curing) conditions by reference to EN 13892-1;
- k) date and time of preparing samples for test (i.e. date and time of any mixing, casting, moulding or demoulding procedure, if appropriate);
- l) age of screed material when tested;
- m) density, to the nearest $0,01 \text{ g/cm}^3$, of each individual test sample;
- n) test method used (reference manual or alternative method, if appropriate), and details of test specimens including number, dimensions, mass, etc. if appropriate;
- o) date of test and the identification number of the apparatus or details of the test equipment used, including the make, type and capacity and the calibrations details;
- p) test results (individual values to the nearest $0,05 \text{ cm}^3$ per 50 cm^2 and corresponding mean value stated to the nearest $0,1 \text{ cm}^3$ per 50 cm^2);
- q) remarks;
- r) date of test report and signature.

Bibliography

- [1] EN 13454-2, *Binders, composite binders and factory made mixtures for floor screeds based on calcium sulphate - Part 2: Test methods*

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