

Methods of test for screed materials —

Part 4: Determination of wear resistance-BCA

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National foreword

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Methods of test for screed materials - Part 4: Determination of wear resistance-BCA

Méthodes d'essais des matériaux pour chapes - Partie 4:
Détermination de la résistance à l'usure BCA

Prüfverfahren für Estrichmörtel - Teil 4: Bestimmung des
Verschleißwiderstands nach BCA

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Foreword

This document (EN 13892-4:2002) has been prepared by Technical Committee CEN/TC 303, "Floor screeds and in-situ floorings in buildings", the secretariat of which is held by DIN.

It was prepared by Working Group 2 "Screed materials and floor screeds – Test methods" taking into account the proposals submitted by Working Group 1 "Screed materials and floor screeds – Definitions, properties and requirements".

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of an identical text or by endorsement, at the latest by May 2003, and conflicting national standards shall be withdrawn at the latest by May 2003.

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1 Scope

This European Standard specifies a method for determining the wear resistance of test specimens made from cementitious- or synthetic resin screed material or optionally for other screed materials. The method is also suitable for floor screeds.

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

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

3 Principle

The wear resistance-BCA of the screed surface is assessed by measuring the mean depth of wear caused by a machine with three hardened steel wheels rotating over a ring shaped area for a fixed number of revolutions under a standard load. The mean depth of wear within the ring pattern is used to indicate the wear resistance of the screed surface at the test location.

4 Symbols

AR is the wear resistance-BCA, which is the mean depth of wear in m.

d_o is the mean depth of the measurements made at all eight measuring points prior to testing in m.

d_w is the mean depth of the measurements made at all eight measuring points after completion of the test in m.

5 Apparatus

5.1 BCA abrasion test machine

The test machine has the following features, see Figure 1.

- a) An abrasion head consisting of three through hardened steel wheels as described in e), tangentially mounted onto a circular steel plate at equal radial intervals so the wheels can freely rotate in a circular path with a nominal mean diameter of (225 ± 1) mm. The wheels are not free to rotate about their vertical axes.
- b) An abrasion head is connected by a shaft to an electric motor and gear box capable of rotating the abrasion head at a manufacturer's rated speed of $(180 \pm 15) \text{ min}^{-1}$ for (2850 ± 10) revolutions.

Variations in the motor parameters, phase and supply voltage may cause marginal variations in rotational speed during operation. The test duration of (2850 ± 10) revolutions of the abrasion head approximates to 15 min.

- c) A circular steel plate, to which additional weights are fixed so that the total load distributed to the wheels is (65,0 0,5) kg. The plate is connected to the motor by a shaft that allows it to move vertically.
- d) A steel frame on which the motor and abrasion head are mounted. The frame has 4 feet bearing onto the floor surface. The frame is restrained from lateral movement during the test by two steel pins inserted through two nominal 10 mm diameter holes drilled in the floor coincident with locating holes in the feet of the frame at the base of diagonally opposite legs.
- e) Steel wheels to the following specification:

Diameter	76,00 mm maximum
Width	20,0 mm to 20,1 mm with chamfers of 0,2 mm to 0,3 mm.
Vickers hardness	≥ 735 HV (throughout at least the outer 1,5 mm of the radius)

This can be achieved by manufacturing the wheels from tool steel, with the following heat treatment:

Pre-heat	750 °C to 800 °C
Harden in air or oil	980 °C to 1030 °C
Double temper from	500 °C to 520 °C

and grinding to the exact specification. Other methods of hardening may be used as long as the specified hardness of the wearing surface is obtained: The wheels shall have a minimum diameter of 73,0 mm at any point across the wheel tread. Wheels shall be replaced in complete sets.

5.2 Marking out template

A circular template (see Figure 1) is used to mark out the position of the depth gauge feet and the holes to be drilled for locating the frame. These restraining pin holes are 456 mm apart and equidistant from the centre of the wheel track. The holes in the template are positioned at an equal radial spacing of 45° so that when the depth gauge is placed on the floor, with its feet on the marks, the gauge slider rests on the centre line of the wheel track.

5.3 Depth gauge

The gauge used to measure the depth of wear shall be capable of being read to the nearest 10 μm . The distance between the feet of the gauge shall enable it to straddle the wheel track of the test machine. The end of the slider contacting the floor shall be rounded.

A steel shim of 1,50 mm to 2,00 mm thickness is used to set the initial position of the gauge slider from which subsequent readings are taken. Alternatively, a set of standard feeler gauges may be used. The depth gauge may then be accurately reset if necessary during the course of the testing and checked again at the end of testing in the event of battery power failure, etc.

6 Preparation of specimens

The wear resistance BCA shall be measured on 3 specimens made in accordance with EN 13892-1.

Square slabs with a minimum edge length of 500 mm and a minimum thickness of 50 mm shall be used as specimens.

Where the screed material is not designed to be applied at this thickness it should be applied onto a concrete substrate according to EN 13892-1.

The contact face and the opposite face of the specimen shall be parallel and flat.

It shall be ensured that the test specimen is surface dry and free of contaminants. Any dust, dirt or debris shall be removed with a brush or by vacuuming.

7 Procedure

7.1 Depth gauge

The depth gauge shall be placed on a suitable flat surface: the marking out template can be used. The positions of the three feet of the gauge shall be marked so that it can be repositioned for later readings. Insert the 1,50 mm–2,00 mm steel shim under the end of the slider, ensuring that the shim is in contact with the surface and that the end of the slider is in contact with the shim. The reading of the gauge shall be set to zero. This enables depth readings to be recorded as positive values. The shim shall be removed and it shall be checked that the gauge reads the shim thickness correctly when the end of the slider is in contact with the flat surface. Alternatively, if a special jig is supplied with the gauge, the manufacturer's instructions shall be followed.

7.2 Setting up

The marking out template shall be placed in position on the screed surface and mark the locations of the gauge feet through the 24 holes using a marker pen. The locations of the two restraining pins shall be marked through the holes on the bar of the template. The template shall be removed, the test reference number shall be written on the specimen at the centre of the test area and the number of the gauge positions 1 to 8 shall be marked on the specimen. The marks and numbers shall be capable of being clearly seen before and after the test is carried out.

The depth gauge shall be placed accurately at each of the 8 measuring positions on the specimen and the initial readings shall be recorded to the nearest 0,1 mm.

Two nominal 10 mm diameter restraining-pin holes shall be drilled at the marked positions. The debris and dust shall be removed with a brush or by vacuuming.

The test machine shall be assembled at the test location and the restraining pins shall be inserted through the feet into the holes in the test specimen. It shall be checked that the abrasion head is free to rotate.

The test specimen with the machine attached may, if required, be placed onto a bed of sand or other conformable material such that it is fully supported and cannot move laterally.

7.3 Test operation

The test shall be run for (2850 ± 10) revolutions of the abrasion head using a suitable revolution counter.

NOTE Screed surfaces with a poor resistance to abrasion may wear rapidly under the test. The surface matrix may sometimes be lost within a few minutes and where a very rough exposed aggregate texture results, the test machine may be subject to severe vibration which could cause damage. If this happens, or if the wear reaches the concrete substrate, the test shall be stopped immediately. In this case, include the number of revolutions and other relevant information in the test report.

The restraining pins shall be removed and the test machine shall be moved away from the test position. Any dust or debris created by the test shall be removed by brushing or vacuuming.

The depth gauge shall be placed accurately at each of the 8 measuring positions on the specimen and the readings shall be recorded to the nearest 10 μm .

The mean depth of wear shall be calculated, e. g. the wear resistance BCA, using following equation:

$$AR = d_w - d_0$$

The result shall be expressed to the nearest 10 μm .

Some screed surfaces may be subject to little or no wear from the test. In those circumstances the depth readings may be of the same order as the accuracy of the depth gauge (10 μm) and as slight errors may occur in repositioning the depth gauge, values lower than the zero reading may sometimes occur. Where this occurs the depth of wear should be recorded as zero and not as a negative value.

A photograph of the wear pattern vertically from above may be taken to provide information on the abraded surface.

8 Test report

The test report shall include the following information:

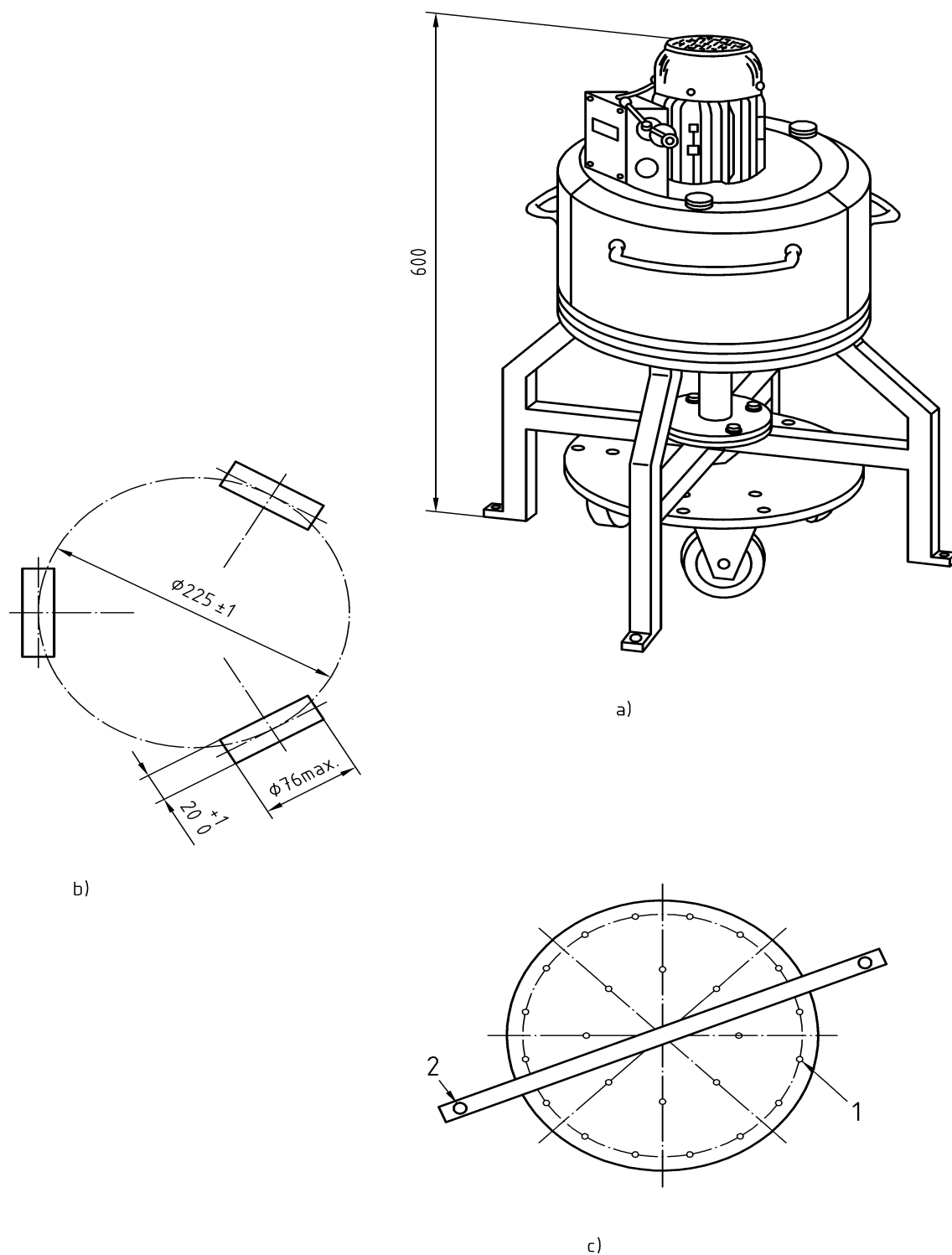
- a) number, title and date of issue of this European Standard;
- b) name and address of the laboratory carrying out the tests and name and address of the laboratory preparing the samples (if different);
- c) identification number of the test report;
- d) name and address of the manufacturer or supplier 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 organisation;
- 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, preparation of the substrate, use of the bonding agent, if appropriate) and storage (curing) conditions by reference to EN 13892-1;
- k) date and time of preparing specimens 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) test method used (reference manual or alternative method, if appropriate), and details of test specimens including number, dimensions, mass, etc. if appropriate;

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- n) 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;
- o) test results stated to the nearest 10 μm ;
- p) remarks;
- q) date of test report and signature.

NOTE A photograph of the wear pattern of each test may accompany the test report.

Dimensions in millimetres

**Key**

- a) Abrasion test machine
 b) Wheel arrangement
 c) marking out template

- 1) 24 holes spaced to suit tripod legs of the depth measuring device
 2) 2 holes with a diameter of 10 mm spaced to suit legs of frame

Figure 1 - BCA abrasion test machine, wheel arrangement and marking out template

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