PD CEN/TS 12633:2014

BSI Standards Publication

Method of polishing specimens prior to the measurement of slip and skid resistance

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/507/7, Pedestrian slip resistance.

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

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CEN/TS 12633

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ICS 93.080.20

Supersedes ENV 12633:2003

English Version

Method of polishing specimens prior to the measurement of slip and skid resistance

Méthode de détermination de la valeur de résistance au dérapage/à la glissance d'unités de pavage polies ou non polies

Verfahren zur Bestimmung des Griffigkeitsbeiwertes vor und nach Polierung

This Technical Specification (CEN/TS) was approved by CEN on 10 September 2013 for provisional application.

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Foreword

This document (CEN/TS 12633:2014) has been prepared by Technical Committee CEN/TC 178 “Paving units and kerbs”, the secretariat of which is held by BSI.

This document supersedes ENV 12633:2003.

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Introduction

Health and safety aspects

WARNING: The application of emery polishing agents during the course of the operations described in this Technical Specification can generate particles that could be injurious to health. It is essential to ensure that appropriate precautions are taken, e.g. the use of dust masks and/or dust extracting facilities. It is also essential to ensure that the equipment is electrically safe in wet test conditions.

1 Scope

This Technical Specification describes a laboratory method for polishing paving units using a flat-bed polishing machine prior to the measurement of slip and skid resistance to evaluate the durability of this characteristic. This Technical Specification may not be applicable to profiled paving units: for these types of units the method of polishing does not reflect the polishing in practice.

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 772-20, *Methods of test for masonry units - Part 20: Determination of flatness of faces of aggregate concrete, manufactured stone and natural stone masonry units*

EN 772-1, *Methods of test for masonry units - Part 1: Determination of compressive strength*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

3 Principle

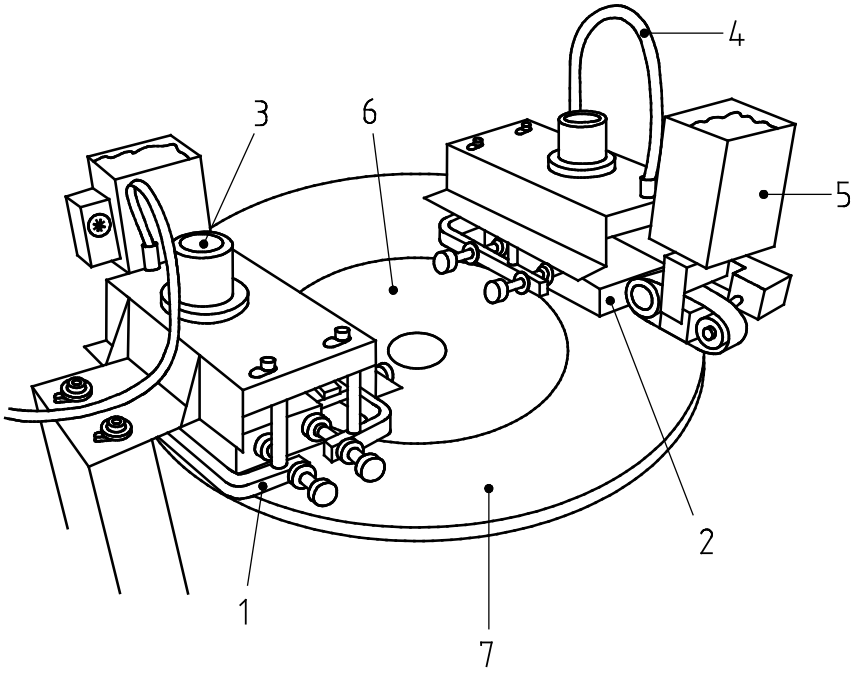
The Technical Specification describes the test method for polishing paving units using an abrasive agent in contact with a rotating resilient mat.

4 Apparatus

4.1 Straight-edge

4.2 Set of feeler gauges with a width of (6 ± 1) mm capable of measuring with an accuracy to 0,05 mm

4.3 Flat-bed polishing machine (see Figure 1) comprising the following:



Key

1	sample holder	5	emery hoppers with adjustable conveyors
2	sample	6	lap wheel
3	adjustable mass	7	rubber annulus
4	water supply		

Figure 1 — Flat-bed polishing machine

a) a machined, flat circular cast iron or steel grinding lap not less than (600 ± 3) mm in diameter, which can be rotated in a horizontal plane at a speed of (29 ± 1) r/min;

b) a flat smooth-surfaced natural rubber annulus of (600 ± 3) mm external diameter, approximately (320 ± 3) mm internal diameter and a thickness of (9 ± 1) mm fixed to the upper surface.

The rubber annulus shall have a hardness from 60 to 75 IRHD in accordance with ISO 48. It shall be covered by a certificate of conformity from the manufacturer which includes the date of manufacture.

It should be stored in the dark at a temperature in the range 5 °C to 25 °C and should be conditioned by bringing to a temperature of (20 ± 5) °C throughout it mass before fixing to the grinding plate. The annulus can be used as long as the hardness remains in the specification.

If glue is used to attach the annulus to the grinding plate, care should be taken to ensure it does not affect the hardness of the rubber.

c) two adjustable metal holders capable of loosely holding in place specimens conforming to Clause 6;

d) means of locating, two specimens within the two holders according to the following configuration:

— with the centre points of their outer edges (270 ± 1) mm from the centre of the lap;

— positioned diametrically opposite to each other;

— with their long sides lying in the direction of rotation of the lap.

The specimens shall be free to move in a vertical plane but be restrained from moving in the horizontal plane.

e) means to ensure that the required load can be applied evenly at the centre of each test specimen and which can move in a vertical direction;

f) weights which permit uniform loading of the test specimen against the surface of the rubber annulus and which, including test specimen, tray (if used) and adjustable weight, will provide a contact stress of (2 250 ± 50) N/m² over the area of the final prepared contact surface;

NOTE This stress corresponds to a total mass of 2,924 kg for an area of 150 mm × 85 mm.

g) separate mechanisms to feed corn emery and emery flour and a means to feed water.

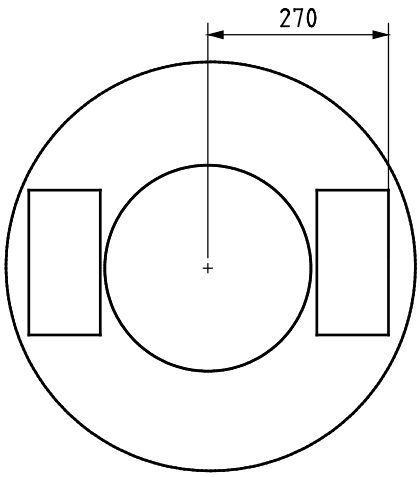


Figure 2 — Position of the units onto the flat-bed polishing machine

4.4 Polishing media, consisting of the following:

a) fresh natural corn emery, of a grading that conforms with Table 1;

Table 1 — Grading requirements for corn emery

Nominal width of sieve aperture µm	**total passing** %
600	98 to 100
500	70 to 100
425	30 to 90
355	0 to 30
300	0 to 5

b) fresh air-floated or water-washed emery flour 95 % of which passes a 50 µm test sieve.

The polishing media shall be used once only.

4.5 Reference material

The reference material is a control stone specimen prepared as described in Annex A.

The control stone specimens may be replaced for internal control by secondary control specimens defined by the laboratory.

5 Sampling of test specimens

Selected specimens shall be representative of the batch in terms of texture and surface finish and show no undue cracks or other blemishes.

Obtain a representative sample of five specimens. Measure the flatness of all specimens according to EN 772-20.

If these specimen are flat with an allowable flatness deviation of 0,5 mm, they can be used without grinding. If not, select additional specimen from a further 5 specimens which are within the flatness criteria.

If 5 flat specimens with an allowable flatness deviation of 0,5 mm, cannot be found from 10 specimens, grind the surface of 5 specimens in accordance with EN 772-1, the minimum necessary to fulfil the allowable flatness deviation of 0,5 mm.

6 Preparation of test specimen

Carry out preparation of the test specimen according to the following:

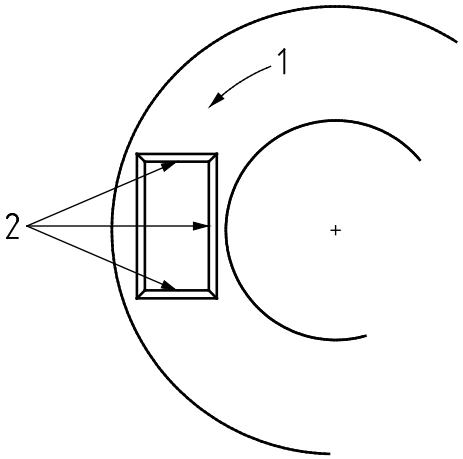
a) before polishing, the contact surface of the specimens shall be (150 ± 5) mm from 80 and 90 mm wide i.e. the chamfer is extra.

Where the surface to be tested is smaller than 150 mm × 85 mm, it is necessary to form a new area by bonding two or more units together. This can be realised by taking two units and, when necessary, grinding flat one side of each, specifically the side which is perpendicular to the visible side. These two units are then placed on a flat surface with the visible side facing downwards. The two sides which have been ground flat are then glued to each other using a construction adhesive in such a fashion that the glued joint has a minimal thickness.

b) The thickness shall be between 30 mm and 85 mm.

NOTE If necessary thinner specimen can be fixed on an adequate support

c) each specimen shall have a chamfer minimum 3 mm at an angle of approximately 45° along each upper surface edges (see Figure 3), to enable the emery polishing agents to access the contact area between the specimens and the rubber annulus more readily. The chamfer may comprise the natural chamfer of the unit or may be specifically ground.



Key

1 direction of polishing

2 chamfer

Figure 3 — Plan view of a test specimen on the rubber annulus

7 Polishing procedure

Calculate the applied load on each specimen necessary to give a contact stress of (2 250 ± 50) N/mm² over the area of the final prepared contact surface.

NOTE 1 The contact area excludes prepared chamfers on the specimens themselves.

NOTE 2 The mass of the specimen is considered to be part of the calculated load.

Carry out accelerated polishing using the flat-bed polishing machine (4.3) at (20 ± 5) °C according to the following procedure:

a) place the test surfaces of two specimens face down in the metal holders (4.3c) on the rubber annulus (4.3b) at positions diametrically opposite each other. Apply the appropriate loads. Set the machine in motion at a rate of (29 ± 1) r/min;

b) feed corn emery of the specified grading (Table 1) onto the surface of the rubber annulus at a rate of (20 ± 2) g/min, spread evenly over the surface immediately in front of each of the test specimens, for (700 ± 10) revolutions. Simultaneously feed water onto the surface just in front of the centre of the test specimens at a rate just sufficient to carry the corn emery under the test specimen without being washed away;

NOTE 3 A water-feed rate of 6 ml/min has been found satisfactory.

c) within 30 min of completing 700 revolutions, remove the specimen from the machine and remove all traces of corn emery under running water using a stiff bristle brush. Remove any corn emery from the surface of the rubber and place the mechanism to feed emery flour of the specified grading (4.4) as the polishing agent onto the machine;

d) Place the specimens in the holders in order to be polished in the opposite direction;

e) apply the flour at a rate of (2 ± 0,2) g/min spread evenly over the surface in front of each of the test specimen with water applied simultaneously just in front of the centre of the test specimen at a rate sufficient to maintain a wet paste under the specimens. Polish the units for a further (700 ± 10) revolutions;

NOTE 4 A water-feed rate in the range (1,0 to 3,0) ml/min has been found satisfactory to maintain a creamy paste.

NOTE 5 In order to assure a regular rate, the flour emery can be dried for a minimum of 30 min at a temperature between 60 °C and 110°C.

f) wash the polished specimens

Verification of the polishing shall be based on monthly control of a reference material. If the period between two tests is greater than one month, control shall be carried out as part of the test.

Secondary control specimens defined by the laboratory may be used as an alternative to reference material (4.5).

8 Validation of polishing procedure

Carry out the test using the reference material (see 4.5) when replacing the rubber annulus or for any new batch of emery corn or flour and at a frequency of one specimen at least once per year.

If the pendulum value of the reference material varies outside the specified range, the test is invalid and the flat-bed polishing equipment and procedure shall be checked and, after any necessary adjustment, the test repeated.

During the transient period of application of this Technical Specification, acceptable specified range should be investigated.

9 Test report

The test report shall include:

1) the name of the organization carrying out the test;

2) the date of the test report;

3) the name of the source providing the sample;

4) the sample reference including the date of production when available;

5) the date of delivery of the sample;

6) the reference to this CEN/TS;

7) information about the grinding of samples;

8) any pertinent remarks about the sample and polishing procedure.

NOTE This report can be included in the slip/skid resistance report.

Annex A
(informative)

Preparation of reference material specimens

A.1 Reference material

An example of a reference material for the validation of polishing procedure is Control Stone from a stock of aggregate held by Transport Research Laboratory (TRL), Old Wokingham Road, Crowthorne, Berkshire RG11 6AU, United Kingdom.

The results measured wet with the pendulum test, in accordance with CEN/TS 16165:2012, Annex C [1]using slider 57, to be obtained on this surface after polishing are in the range [46-52].

Reference material specimens should be prepared according to the following procedure.

A.2 Apparatus and equipment

A.2.1 Two fine-haired brushes, of approximately 3 mm diameter.

A.2.2 A stiff-bristle brush.

A.2.3 A spatula.

A.2.4 Release agent.

A.2.5 Cleaning solvent or a mixture of 90 % acetone and 10 % kerosene by volume.

A.2.6 Polyester resin and hardener.

A.2.7 Container, for mixing resin and hardener.

A.2.8 Clear, flexible plastic sheet or materials, such as acetate or polyethylene.

A.2.9 Fine sand (100 % passing a 212 µm test sieve conforming to ISO 3310 [2]) to prevent the polyester resin from squeezing downwards between the individual pieces of aggregate. Alternatively fine corn sugar may be used.

A.2.10 At least two machined metal moulds, for preparing reference material specimens, manufactured with removable ends and with internal dimensions of (150 ± 2) mm long by (85 ± 2) mm by (20 ± 2) mm deep.

A.2.11 At least two machined flat plates made from 5 mm mild steel plate, sized approximately 170 mm × 110 mm.

A.2.12 Means of holding the flat plate in contact with the mould during the resin curing period.

A.2.13 A 10 mm, square-holed perforated-plate sieve, conforming to ISO 3310 [2].

A.2.14 A 14 mm to 10 mm slotted flake sorting sieve, having a slot width of (7,2 ± 0,1) mm and a slot length of (40 ± 1) mm.

A.2.15 An elongation gauge, with pins of (6 ± 0,1) mm diameter, (25 ± 1) mm height and having a gap between the pins of (14,7 ± 0,2) mm.

A.2.16 A balance, with a capacity of at least 2,5 kg and accurate to ± 0,5 g.

A.2.17 A supply of metal mesh, to reduce shrinkage in the resin sample backing, cut into sections, approximately 149 mm × 89 mm, so that the mesh can fit into moulds.

NOTE Steel wire mesh with wire 0,9 mm diameter with a regular mesh 20 mm by 12 mm has been found to be suitable and is available from Builders Merchants (chicken wire).

A.3 Preparation of reference material specimens

A.3.1 Reduce the sample of reference material to produce a test portion so that when it is sieved in accordance with A.3.2 a minimum of 4 kg is available for preparing the specimens.

A.3.2 Sieve the test portion so that all the aggregate particles pass the 10 mm test sieve and are retained on the 14 mm to 10 mm flake sorting sieve. Wash and dry the retained sample and remove any elongated particles identified by the elongation gauge.

The surfacing texture of the particles which are to be exposed to the polishing action of the rubber annulus should be representative of the typical surface texture of the stone.

A.3.3 Obtain a minimum mass of 2 kg of the reference material by the methods described in A.3.1 and A.3.2.

A.3.4 Lightly coat the internal faces and top edges of the mould with release agent using a fine-haired brush.

A.3.5 From the test portion, select between 95 and 135 aggregate particles and place them in the mould in a single layer with their flattest surfaces lying on the bottom of the mould. Place them as close together as possible so that they cover the entire base of the mould.

A.3.6 Fill the interstices between the pieces of aggregate to approximately three-quarters of their depth with the fine sand and level off with a fine-haired brush or by gently blowing. Suspend the mesh so that it is within 6 mm of the top of the mould. Mix sufficient resin and hardener to fill the mould to overflowing.

A.3.7 Coat one side of the flat plate with the release agent and place it firmly on the mould, coated side down, and hold firmly in position. When the resin has hardened (usually after 30 min), remove the plate and trim off the excess resin with a knife or spatula.

A.3.8 Remove the specimen from the mould and remove the loose sand with a stiff brush. After the resin has completely set and cooled, leave for a further 30 min before subjecting to polishing in accordance with Clause 7.

A.3.9 Check that each finished specimen presents a natural surface of the aggregate, with no sharp projecting edges. Reject specimens with any resin exposed at the surface or with disturbed particles. The exposed surfaces of the aggregate should stand proud of the backing resin.

NOTE Manufactured Control Stone tablets are available from : Thameside Test & Research Limited / Unit C2, Lomer Farm, Wrotham Road, Meopham, Kent GB DA13 0AN / e-mail paul.shrubsole@thamesresearch.com

Bibliography

[1] CEN/TS 16165:2012, *Determination of slip resistance of pedestrian surfaces - Methods of evaluation*

[2] ISO 3310 (all parts), *Test sieves — Technical requirements and testing*

[3] ISO 4662, *Rubber, vulcanized or thermoplastic — Determination of rebound resilience*

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