SLOVENSKI STANDARD
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Bitumenske zmesi - Preskusne metode - 49. del: Ugotavljanje tornih sposobnosti po poliranju

Bituminous mixtures - Test methods - Part 49: Determination of friction after polishing

Asphalt - Prüfverfahren - Teil 49: Messung der Griffigkeit nach dem Polieren

Mélanges bitumineux - Méthodes d'essai - Partie 49 : Détermination du frottement après polissage

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93.080.20 Materiali za gradnjo cest Road construction materials

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EUROPEAN STANDARD

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English Version

Bituminous mixtures - Test methods - Part 49: Determination of friction after polishing

Mélanges bitumineux - Méthodes d'essai - Partie 49 : Détermination du frottement après polissage

Asphalt - Prüfverfahren - Teil 49: Messung der Griffigkeit nach dem Polieren

This European Standard was approved by CEN on 15 November 2021.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 12697-49:2022) has been prepared by Technical Committee CEN/TC 227 “Road materials”, 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of an identical text or by endorsement, at the latest by August 2022, and conflicting national standards shall be withdrawn at the latest by August 2022.

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

This document supersedes EN 12697-49:2014.

The main changes compared to the previous edition are listed below:

— The title no longer refers to hot mix asphalt;

— [Introduction] added, giving the general context of the test method and the need to improve it;

— [1] Possibility of following Friction After Polishing (FAP) evolution as a function of the number of polishing passes. NOTE deleted since the Wehner and Schulze method is now mentioned in the Introduction;

— [2] and [5.1.4.5] Change of normative reference to ISO 48-4 for the determination of Shore hardness;

— [3.1.1] Rewording of the definition of pass, and information given as a Note to entry;

— [3.1.2] Definition of FAP added;

— [3.2] Title completed;

— [3.2] Introduction of the symbol μ, and rewording of μ_{ref} and μ_{FAP} definition;

— [3.2] Deletion of the symbol Ø;

— [5.1.1] Addition of reference to Annex A;

— [5.1.1] Completed with obligation to work in specified temperature and humidity room conditions;

— [5.1.2.3] Requirements for H modified (value and tolerance);

— [5.1.2.3] Figure 2 corrected (D_1 and D_2);

— [5.1.2.3] Introduction of additional requirements for polishing rollers storage;

— [5.1.2.3] Modification of requirement for the number of conditioning passes;

— [5.1.2.5] Addition of a clause about the washing device;

— [5.1.4] Rewording of title;

— [5.1.4.2] Rewording of title, and deletion of the requirement for inertia moment;

— [5.1.4.3] Modification the title. And “moment” replaced by “torque” in all the document;

— [5.1.4.3] Modification of the tolerance for torque measurement;

— [5.1.4.5] Modification of the criteria for resilience of sliding blocks. Deletion of Table 1 and following paragraph. Following tables renumbered accordingly;

— [5.1.4.5] Figure 4 corrected since it was mirror inverted. Correction of the rotation radius value;

— [5.2] Rewording of title, definition of μ_{ref} value transferred to 3.2;

— [5.3] Additional requirements for sand-blasting equipment;

— [6.1] Additional recommendations for quartz powder;

— [6.2] Additional requirements for water/quartz-powder mixture;

— [6.3] Addition of a footnote about the supplier of corundum;

— [7.1.1] Addition of a new sub-heading “7.1.1 General”. Following subclauses renumbered accordingly;

— [7.1.1] Achievement – or not – of sandblasting according to the test and/or product context;

— [7.1.2] Rewriting of sandblasting procedure, and change of storage position;

— [7.1.3] Modification of thickness requirement and change of storage position;

— [7.1.4] New clause added for the conditioning of specimens;

— [7.2] Polishing procedure completed for conditioning, water/quartz-powder mixture, washing;

— [7.2] Clause now subdivided in tree sub clauses;

— [7.2.3] Clarification of the number of passes for “other applications”;

— [7.2.3] Requirement for the consistency of torque value imported from 5.1.2.3;

— [7.3.1] Obligation of pre-test check for each specimen;

— [7.3.2] Additional dispositions about water introduction, torque values recording and control plate test;

— [8.1] Title modified and Clause totally rewritten for more clarity and consistency;

— [8.1] Formula (1) modified;

— [8.2] Formula (2) moved to 8.1 Formula (3);

— [8.2] Rewording of the criterion for validating the test, and possibility of a curve FAP against passes;

— [9] Information to be reported simplified. Added references to Clauses 8.1 and 8.2 for the calculation;

— [10] Update of the precision values;

— [Annex A] In Figure A.1, correction of the key line 4;

— [Annex B] New informative annex added to provide results from the curve FAP against passes;

— [Annex C] New informative annex added to provide information about national experiences;

— [Bibliography] Updated.

A list of all parts in the EN 12697 series can be found on the CEN website.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

Regarding skid resistance of road surfaces, the test of the polished stone value, PSV according to EN 1097-8 has long been a reference [1]. It characterizes a curved specimen of a coarse aggregate, but cannot alone predict the adhesion of a bituminous mixture once it is in place. A second limit is that it characterizes one surface state of the coarse aggregate, but does not provide any information about its speed of evolution under a polishing action.

In the 1960s Pr B. Wehner and K.-H. Schulze developed testing devices, able to polish and characterize the skid resistance of a flat specimen, of coarse aggregate, sand, or bituminous mixture, and to follow its evolution as a function of the number of polishing passes [2]. After different developments of the so-called “Wehner and Schulze apparatus”, this test method, applied to bituminous mixtures, became in 2014 the European Standard EN 12697-49, *Bituminous mixtures - Test methods for hot mix asphalt - Part 49: Determination of friction after polishing*. It characterizes one surface state of a bituminous mixture after a fixed number of polishing passes.

The use of this standard in different European countries (see Annex C) in recent years, in contexts of tenders and/or research, brought to light the need to improve it in both metrological and operating aspects. It is the subject of this document, which should accordingly lead to improve the reproducibility of the test.

1 Scope

This document specifies a method to determine the friction at 60 km/h after polishing during a fixed number of passes on surfaces of bituminous mixtures samples, or to follow its evolution as a function of the number of polishing passes.

The samples used are either produced in a laboratory or are cores taken from the site.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 12697-27, *Bituminous mixtures - Test methods - Part 27: Sampling*

EN 12697-33, *Bituminous mixtures - Test method - Part 33: Specimen prepared by roller compactor*

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

ISO 48-4, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 4: Indentation hardness by durometer method (Shore hardness)*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org/

3.1.1
pass
passage of a single roller of the polishing head on one given point of the sample surface

Note 1 to entry: A complete revolution of the rotating polishing head is equivalent to three roller passes on one given point of the sample surface.

3.1.2
FAP
average of two or more single results μ_{FAP}

3.2 Symbols and abbreviated terms

μ	friction coefficient
μ_m	friction coefficient at 60 km/h
μ_{km}	mean value of the control plate before and after the friction measurement
μ_{ref}	moving average of the last 50 friction measurements on the control plate
μ_{FAP}	single result of friction measurement on a single specimen
FAP	Friction After Polishing

4 Principle

The sample is polished and the friction force is determined. The device comprises a polishing unit and a unit for measuring the friction. The polishing unit, which is continuously supplied with a mixture of water and quartz powder, contains three polishing rollers that can be lowered in order to move across the test surface at a predefined vertical force.

In the measuring unit, a rotating measuring head is lowered onto the test surface while water is being added. The measuring head is fitted with three sliding blocks. The torque generated by the contact between the sliding blocks and the test surface is continuously measured and recorded until the measuring head comes to a standstill. The Friction After Polishing, FAP, is subsequently calculated from the torque measured at 60 km/h.

5 Equipment

5.1 Test device

5.1.1 General

The test device consists of a unit to polish the sample, a specimen clamping system and a unit for determining its friction coefficient. (See an example of polishing head and friction unit in Annex A, Figure A.1.) The test device shall be operated in a room with ambient temperature of (20 ± 5) °C.

5.1.2 Polishing unit

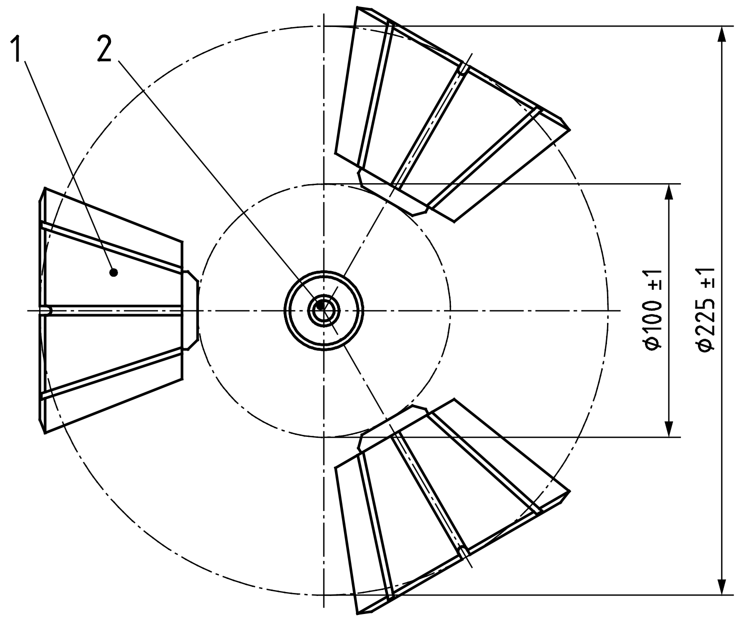
5.1.2.1 General

The polishing unit includes a polishing head with polishing rollers and a water-quartz powder mixture projection system.

5.1.2.2 Polishing head

A polishing head equipped with three polishing rollers as indicated on Figure 1, able to be lowered onto the test surface with loading force calibrated in static of (392 ± 3) N. The polishing head shall move on the surface of the specimen during the polishing procedure and rotate at a rotation speed of (500 ± 5) r/min.

Dimensions in millimetres



Key

1 polishing roller

2 water quartz powder projection device

Figure 1 — Polishing head (view from below)

5.1.2.3 Polishing rollers

The rollers, as shown in Figure 2, consist of a circular, cone-shaped metal carrier housing covered with a layer of rubber with a Shore hardness of (65 ± 3) Shore A at a temperature of (23 ± 2) °C, according to ISO 48-4.

The polishing rollers shall have the following initial dimensions:

— diameter D_1: (36 ± 1) mm and D_2: (80 ± 1) mm;

— height H: (57,5 ± 0,5) mm;

— thickness of the rubber layer: (8,5 ± 0,5) mm.

Eight equally spaced profile grooves, as shown in Figure 2, are cut into the rubber layer with the following initial groove dimensions:

— depth: (4,5 ± 0,5) mm;

— width: (3,5 ± 0,5) mm.

Any new polishing rollers not used shall be packed in film and stored, until the first use, in a dark and dry place at a temperature of 4 °C to 10 °C for less than two years after the date of the manufacture.

When new polishing rollers have been fitted, they shall be conditioned using an (old) test sample subject to between 475 000 and 525 000 passes of the rollers in the polishing unit with water/quartz powder mixture according to 6.2. Record the date of first use of each polishing roller.

Once the polishing rollers are used they shall be protected from UV-light when they are not operating in a test. If the polishing rollers are not used, for a period not longer than two months, they shall be dismantled and stored as new polishing rollers.