SLOVENSKI STANDARD
SIST EN 1426:2007

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Nadomeġļa:
SIST EN 1426:2000

Bitumen in bitumenska veziva - Doloļanje penetracije z iglo

Bitumen and bituminous binders - Determination of needle penetration

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Nadelpenetration

Bitumes et liants bitumineux - Détermination de la pénétrabilité a l'aiguille

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ICS:

75.140	Voski, bitumni in drugi naftni proizvodi	Waxes, bituminous materials and other petroleum products
91.100.50	Veziva. Tesnilni materiali	Binders. Sealing materials

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Bitumen and bituminous binders - Determination of needle penetration

Bitumes et liants bitumineux - Détermination de la pénétrabilité à l'aiguille

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Nadelpenetration

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Foreword

This document (EN 1426:2007) has been prepared by Technical Committee CEN/TC 336 “Bituminous binders”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2007, and conflicting national standards shall be withdrawn at the latest by September 2007.

This document supersedes EN 1426:1999.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies a method for determining the consistency of bitumen and bituminous binders. Normal procedure is described for penetrations up to 330 × 0,1 mm, but for penetrations above this value, up to 500 × 0,1 mm, different operating parameters are necessary.

WARNING — Use of this European Standard may involve hazardous materials, operations and equipment. This European Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this European Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 Normative references

The following referenced documents are indispensable for the application 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 58, *Bitumen and bituminous binders – Sampling bituminous binders*

EN 1425, *Bitumen and bituminous binders – Characterization of perceptible properties*

EN 1427, *Bitumen and bituminous binders – Determination of the softening point – Ring and Ball method*

EN 10088-3, *Stainless steels – Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

EN 12594, *Bitumen and bituminous binders – Preparation of test samples*

EN 12597, *Bitumen and bituminous binders – Terminology*

ISO 6508-1, *Metallic materials – Rockwell hardness test – Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12597 and the following applies.

3.1
penetration
consistency, expressed as the distance in tenths of a millimetre that a standard needle will penetrate vertically into a sample of the material under specified conditions of temperature, load and loading duration

4 Principle

The penetration of a standard needle into a conditioned test sample shall be measured. For penetrations up to approximately 330 × 0,1 mm the operating parameters shall be a test temperature of 25 °C, an applied load of 100 g, and a loading duration of 5 s. For penetrations expected above approximately 330 × 0,1 mm, the test temperature shall be reduced to 15 °C but the operating parameters of the applied load and the loading duration remain unchanged.

5 Apparatus

Usual laboratory apparatus and glassware, together with the following:

5.1 Penetrometer; apparatus that permits a needle holder to move vertically without measurable friction and enables the needle penetration to be determined to the nearest 0,1 mm. The needle holder shall be readily detachable from the apparatus and shall have a mass of (47,50 ± 0,05) g. A weight of (50,00 ± 0,05) g suitable for attachment to the needle holder shall be provided if not already fixed to the needle holder. The stand upon which the specimen container, or transfer dish rests shall be flat and horizontal. The 50 g weight shall be fixed underneath the support (see Figure 1).

NOTE An example of a suitable penetrometer is shown in Figure 1. To facilitate levelling, the penetrometer should be provided with level adjustment screws.

Equipment that controls the penetration time automatically may also be used. Such equipment shall be checked regularly for correct penetration time (see 5.6).

5.2 Penetration needle, (see Figure 2), made from fully hardened, tempered and polished stainless steel of type X105CrMo17 (1.4125), conforming to EN 10088-3, taking into account that it is not necessary to comply with the minimum content of molybdenum specified in that standard, and of Rockwell hardness C54 to C60 determined in accordance with ISO 6508-1. The cylindrical body of the needle shall have a diameter of 1,00 mm to 1,02 mm and one end shall be symmetrically tapered by grinding to a cone with an angle of 9 ° (10 ± 30) ' over the entire cone length. The cone shall be co-axial with the cylindrical body of the needle; the total axial variation of the intersection between the conical and cylindrical surfaces shall not exceed 0,2 mm. The conical tip of the needle shall be ground square to the axis of the needle within 2 ° until the diameter at the tip is between 0,14 mm and 0,16 mm. The edge of the ground tip shall be sharp and free from burrs.

For penetrations up to 330 × 0,1 mm the length of the needle shall be approximately 50 mm. For penetrations between 330 × 0,1 mm and 500 × 0,1 mm, use needles that shall conform to the requirements given for mass and dimensions, but which are longer in length so that the ferrule into which the needle is fixed does not penetrate the material undergoing testing.

The needle shall be rigidly mounted in a brass or stainless steel ferrule with 5 mm to 10 mm of the needle inside the ferrule. The run-out of the needle tip or any part of the needle relative to the ferrule axis shall not exceed 1,0 mm. The ferrule shall be (3,20 ± 0,05) mm in diameter and (38 ± 1) mm in length.

The mass of the ferrule and needle assembly shall be (2,50 ± 0,05) g.

NOTE 1 A drill hole at the end of the ferrule or a flat on the side is possible to control the mass.

Individual identification marking shall be engraved or stamped on the ferrule of each needle; the same marking shall not be repeated by the manufacturer within a 3 year period.

The needle shall be inspected visually for corrosion and shape and the masses of the needle and spindle checked sufficiently regularly to assure satisfactory condition.

NOTE 2 The mass of the needle plus needle holder together with the additional mass of the weight provides a moving load of 100 g.

It is important that initial and continued compliance with the stringent requirements for the needle is maintained. Certification of compliance can be obtained through the needle supplier or a qualified agency.

NOTE 3 For information concerning tolerances of the needle (Figure 2), see ISO 286-1, ISO 1829, ISO 1101 and ISO 1302.

5.3 Test sample container, metal or glass, cylindrical, flat-bottomed. The internal depth of the container shall be appropriate in order to contain a bituminous sample of which the depth shall be at least 10 mm greater than the expected penetration, and not less than 35 mm. The internal diameter of the container shall be at least 55 mm and shall not exceed 70 mm.

NOTE 1 Recommended dimensions of the test sample container are given in Table 1.

Table 1 — Recommended dimensions of the test sample container

Penetration (0,1 mm)	Internal depth (mm)	Internal diameter (mm)
penetration < 160	35	55
160 ≤ penetration ≤ 330	45	70

If insufficient binder is available (e.g. if it was obtained by extraction of a bituminous mix core or while monitoring short- or long-term ageing development) use a small stainless steel container. In order to fulfil the requirements of 7.4.2, the container shall have an inner diameter of at least 35 mm and a wall thickness between 1,5 mm and 2,0 mm. For penetrations lower than 100 x 0,1 mm, the inner height of the container shall be at least 20 mm. For penetrations from 100 x 0,1 mm up to 200 x 0,1 mm, the inner height of the container shall be at least 30 mm. To ensure a good stable temperature during testing, the container shall be placed in a brass ring with an inner diameter within 0,5 mm of the outer diameter of the sample container and a height of (21 ± 1) mm or (31 ± 1) mm.

NOTE 2 The precision of the penetration values determined using the metal ring can be different from those given in Clause 9.

5.4 Water bath (constant temperature bath), with a capacity of at least 10 l, and able to maintain the temperature of the test sample within ± 0,15 °C. The bath shall have a perforated shelf supported in a position not less than 50 mm from the bottom and not less than 100 mm below the liquid level in the bath. If penetration tests are to be made in the bath itself, an additional shelf, strong enough to support the penetrometer shall be provided.

NOTE The use of distilled or deionized water is recommended for the bath. Care should be taken to avoid contamination of the bath water by active surface agents or any other material that can affect the penetration values.

5.5 Transfer dish, for tests outside the water bath. The dish shall have a capacity of at least 350 ml and shall be deep enough to ensure that the test sample container is completely covered with water.

The bottom of the transfer dish shall be constructed so that the dish cannot be rocked when it is placed on the stand of the penetrometer. Similarly the surface on which the test sample container rests shall be made so that the test sample container cannot rock during penetration of the test sample.

For temperatures lower than 25 °C, the capacity of the transfer dish shall be 1,5 l.

5.6 Timing device, accurate to within 0,1 s.

5.7 Thermometers, solid stem, as specified in Annex A.

Other temperature measuring devices may be used instead of mercury stem thermometers, however, the mercury stem thermometer is the reference device and any alternative device employed shall be calibrated to provide the same readings as a mercury stem thermometer, recognising and allowing for change of thermal response compared with Hg thermometer.

NOTE 1 When measuring and controlling nominally constant temperatures, as in the method described, alternative devices can indicate greater cyclic variations than mercury thermometers, to an extent depending on the cycle time of heating and the power of the controlled heat input.

NOTE 2 In order to obtain the relevant precision (± 0,15 °C), reading of the temperature on thermometer should be performed with a lens

6 Sampling

6.1 Take the laboratory sample in accordance with EN 58, taking all necessary safety precautions, and ensuring that the test sample is representative of the laboratory sample from which it is taken. Ensure that the laboratory sample is homogeneous and is not contaminated (see EN 1425).

6.2 Remove a sufficient amount of the laboratory sample, if necessary using a warmed knife, and transfer it to a suitable container (see EN 12594).

6.3 Raise the material to the required temperature, i.e. 80 °C to 90 °C above the expected softening point (see EN 1427) and fill one clean (free of dust, grease, rust, etc...) test sample container (5.3). Fill the container to a depth so that, when the test sample is cooled to the test temperature, the depth is 10 mm greater than the depth to which the needle is expected to penetrate.

For polymer modified bitumen, the temperature may not exceed 200 °C irrespective of the softening point.

6.4 Immediately after filling, loosely cover the test sample container with a container such as a lipped beaker of suitable size.

NOTE 1 This assists in eliminating any air bubbles and it is a convenient way of providing protection against dust.

Allow the test sample to cool at an ambient temperature between 15 °C and 30 °C; for test samples less than or equal to 45 mm deep, cool for 60 min to 90 min and for test samples more than 45 mm to 60 mm deep, cool for 90 min to 120 min provided the volume of the test sample does not exceed 180 ml; for test samples of more than 180 ml, cool for 60 min to 90 min for each 100 ml of test sample, then, place the test sample in the constant temperature bath for a similar period to that used for cooling, and start testing.

NOTE 2 For measurement at temperatures lower than 25 °C, longer cooling times can be required.

6.5 When test conditions are not specified, for penetration values below approximately 330 × 0,1 mm, the temperature, total applied load (see 5.2 Note 2) and loading duration shall be 25 °C, 100 g and 5 s. For penetration values above approximately 330 × 0,1 mm, the test shall be carried out at conditions of 15 °C, 100 g and 5 s.

When other conditions are used, the details shall be reported in full.

NOTE In this case, the precision can be different from that stated in Clause 9.

7 Procedure

7.1 Preparation of the needle holder and needles

Examine the needle holder and its guide to check that it is free of water and other extraneous matter. Ensure that the needle holder moves freely in its guide. Clean a penetration needle with toluene or other suitable solvent, dry with a clean cloth and insert the needle into the needle holder. Unless otherwise specified, add the 50 g weight and ensure that the total applied load is (100,00 ± 0,10) g.

Erratic results can be obtained with bitumen's from certain sources. In such cases the needles shall be pre-treated by immersing for 5 min in a 1% solution of oleic acid in toluene prior to drying.