
6]li a Yb`]b`V]li a Ybg_Uj Ynj] UË`8c`c Yj Ub`Y`X]bUa] bYj]g_cnbcgh`a cX]Z]WfUb]`
V]li a bcj `È`%`XY. `AYfcXUg`_cbi gca `]b`d`cý c

Bitumen and bituminous binders - Determination of dynamic viscosity of modified bitumen - Part 1: Cone and plate method

Bitumen und bitumenhaltige Bindemittel - Bestimmung der dynamischen Viskosität von modifizierten Bitumen - Teil 1: Platte-Kegel-Verfahren

Bitumes et liants bitumineux - Détermination de la viscosité dynamique des bitumes modifiés - Partie 1: Méthode cône et plateau

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Ta slovenski standard je istoveten z: EN 13702-1:2003

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

SIST EN 13702-1:2004

en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13702-1

December 2003

ICS 91.100.50

English version

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This European Standard was approved by CEN on 21 November 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

This document EN 13702-1:2003 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 June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This European Standard consists of the following parts under the general title Bitumen and bituminous binders – Determination of dynamic viscosity of modified bitumen.

Part 1 – Cone and plate method

Part 2 – Coaxial cylinders method

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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EN 13702-1:2003 (E)**1 Scope**

This European Standard specifies a method for determining the dynamic viscosity of a modified bituminous binder over a range of temperatures by means of a cone and plate viscometer. Although the method has been developed for modified binders, it is also suitable for other bituminous binders.

NOTE Unlike penetration grade bitumen, polymer modified bitumens (PMBs) may not show a straight line on the Heukelom-Diagram. This implies that in order to obtain information about the temperature susceptibility of PMBs, viscosity should be measured at different temperatures.

WARNING — The 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

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 58¹⁾, *Bitumen and bituminous binders – Sampling bituminous binders.*

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

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3 Principle

The sample is placed on a plate, a cone is pressed onto the sample and the system is brought to the test temperature. A stress is applied to the sample by rotation. The torque is measured from the applied shear rate and dynamic viscosity is calculated by:

$$\eta = \tau / \dot{\gamma}$$

where $\dot{\gamma}$ is the shear rate in s^{-1}

and τ is the stress in Pa, calculated by:

$$\tau = A \times M_d$$

where A is the cone factor in m^{-3}

and M_d the torque in N.m

NOTE The advantages of this method are the use of a very small sample and the speed of the method, especially regarding thermal conditioning of the specimen.

1) In course of revision

4 Apparatus

Cone and plate viscometer, with the following minimum capabilities:

- range of shear rate: $5 \times 10^{-2} \text{ s}^{-1}$ to $5 \times 10^2 \text{ s}^{-1}$;
- range of viscosity: $5 \times 10^{-2} \text{ Pa}\cdot\text{s}$ to $10^5 \text{ Pa}\cdot\text{s}$;
- range of temperature: $60 \text{ }^\circ\text{C}$ to $150 \text{ }^\circ\text{C}$;
- the sample temperature shall be maintained within $\pm 0,5 \text{ }^\circ\text{C}$ up to $100 \text{ }^\circ\text{C}$ and $\pm 1,0 \text{ }^\circ\text{C}$ above $100 \text{ }^\circ\text{C}$.

5 Sampling

Take the sample in accordance with EN 58 and prepare the sample in accordance with EN 12594.

6 Procedure

Select the appropriate size (diameter and angle) of cone to allow measurement at the selected shear rate.

Place the sample on the plate and press the selected cone onto the sample. Remove any surplus sample and bring the system to the test temperature.

Commence the first measurement at the lowest temperature:

- Temperature: $60 \text{ }^\circ\text{C} \pm 0,5 \text{ }^\circ\text{C}$;
- Shear rate: $5 \times 10^2 \text{ s}^{-1}$.

Check the reading after a delay of 15 min when reaching the temperature and note the temperature, cone size, speed and reading.

Repeat the test and calculate the result as an average of two tests.

Replace the specimen and increase the temperature to the next test temperature. Commence the second measurement:

- Temperature: $100 \text{ }^\circ\text{C} \pm 0,5 \text{ }^\circ\text{C}$;
- Shear rate: $5 \times 10^2 \text{ s}^{-1}$.

Replace the specimen and increase the temperature to the next test temperature. Commence the third measurement:

- Temperature: $150 \text{ }^\circ\text{C} \pm 1,0 \text{ }^\circ\text{C}$;
- Shear rate: $5 \times 10^2 \text{ s}^{-1}$.

NOTE 1 It should be ensured that the complete specimen has reached the test temperature before starting the test.

NOTE 2 The sample should not contain any filler.

NOTE 3 In addition to these test temperatures and shear rates any other temperature and shear rate can be used.

EN 13702-1:2003 (E)**7 Expression of results**

Record the results of the measurement of dynamic viscosity with the corresponding shear rate and the test temperature.

Express the viscosity values in Pa.s as follows: $(1,000 \times 10^x)$ Pa.s

8 Precision

NOTE The following precision data are the best currently estimated and are proposed until results of further round robin tests are available.

8.1 Repeatability

The difference between two successive results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of the test method, differ by more than 5% in only one case in twenty.

8.2 Reproducibility

The difference between two single and independent results, obtained by different operators working in different laboratories on identical test material would, in the long run, in the normal and correct operation of the test method, differ by more than 15% in only one case in twenty.

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9 Test report

The test report shall contain at least the following information:

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- a) the type and complete identification of the sample under test;
- b) a reference to this European Standard;
- c) the temperature, shear rate and the result of the test (see clause 7);
- d) diameter and angle of the cone;
- e) the date of the test;
- f) any deviation, by agreement or otherwise, from the specified procedure.