SLOVENSKI STANDARD
SIST EN 13302:2018

01-oktober-2018

Nadomešča:
SIST EN 13302:2010

Bitumen in bitumenska veziva - Določanje dinamične viskoznosti bitumenskih veziv z uporabo rotacijskega viskozimetra

Bitumen and bituminous binders - Determination of dynamic viscosity of bituminous binder using a rotating spindle apparatus

Bitumen und bitumenhaltige Bindemittel - Bestimmung der dynamischen Viskosität von bitumenhaltigem Bindemittel mit einem Viskosimeter mit rotierender Spindel

Bitumes et liants bitumineux - Détermination de la viscosité dynamique des liants bituminuex à l'aide d'un viscosimètre tournant

Ta slovenski standard je istoveten z: **EN 13302:2018**

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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EUROPEAN STANDARD
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English Version

Bitumen and bituminous binders - Determination of dynamic viscosity of bituminous binder using a rotating spindle apparatus

Bitumes et liants bitumineux - Détermination de la viscosité dynamique des liants bitumineux à l'aide d'un viscosimètre tournant

Bitumen und bitumenhaltige Bindemittel - Bestimmung der dynamischen Viskosität von bitumenhaltigem Bindemittel mit einem Viskosimeter mit rotierender Spindel

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 13302:2018) 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of an identical text or by endorsement, at the latest by December 2018, and conflicting national standards shall be withdrawn at the latest by December 2018.

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 13302:2010.

The main technical changes in comparison to the previous edition are:

— clarification of the test sample preparation procedure in the case of cut-back and fluxed bituminous binders (subclauses 7.4.1 and 7.4.3);

— subclauses 7.3.8 and 7.4.9 (of EN 13302:2010) on how to determine viscosity in relation to shear rate for non-Newtonian bituminous emulsions and cut-back and fluxed bituminous binders are converted into a more general Note;

— more consistent description and use of radius R1 and R2 in-between Figure 1, subclause 5.1 and Clause 10;

— subclause 5.2: the possibility to use a DSR apparatus has been introduced.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies a method for the determination of the dynamic viscosity of a variety of bituminous binders: modified and unmodified bituminous binders, bituminous emulsions, cut-back and fluxed bituminous binders, by means of a rotating spindle apparatus (a coaxial viscometer).

Standard application temperatures are quoted, although the dynamic viscosity can be measured at other temperatures if required. Similarly, measurements at standard values of shear rate can be replaced or complemented by measurements at additional shear rates if required.

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

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 58, *Bitumen and bituminous binders — Sampling bituminous binders*

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

3 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:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
shear stress
force acting tangentially to a surface divided by the area of the surface

Note 1 to entry: Shear stress is expressed in Newton per square metre ($N \cdot m^{-2}$), kilogram per metre per square second ($kg \cdot m^{-1} \cdot s^{-2}$) or Pascal (Pa).

3.2
shear rate
velocity gradient in a flowing fluid perpendicular to the stress

Note 1 to entry: Shear rate is expressed in units per second (s^{-1}).

Note 2 to entry: The shear rate calculation depends upon the viscometer geometry. This should be mentioned by the viscometer manufacturer.

3.3
dynamic viscosity
ratio between the applied shear stress and the shear rate

Note 1 to entry: Dynamic viscosity is expressed in Pascal second (Pa · s). Millipascal second (mPa · s) is a frequently used sub-unit.

Note 2 to entry: Dynamic viscosity is the measurement of the resistance to flow of a liquid.

3.4
Newtonian fluid
fluid having a viscosity that is independent of the shear rate

Note 1 to entry: The ratio of the shear stress to the shear rate is the viscosity of the fluid. If this ratio is not constant the liquid is non-Newtonian and many fluids exhibit both Newtonian and non-Newtonian behaviour, depending on the temperature and the shear rate.

3.5
apparent viscosity
term used to characterise the resistance to flow of a Newtonian or non-Newtonian fluid

3.6
form factor
specific factor or factors to be applied for the individual equipment in order to obtain the actual viscosity from the readings, mainly due to the geometry of the apparatus

4 Principle

The torque applied to a spindle (e.g. a cylinder) rotating in a special sample container containing the test sample, measures the relative resistance of the spindle to rotation and provides a measure of the dynamic viscosity of the sample. It may be necessary to apply a form factor to yield the actual dynamic viscosity at the test temperature.

Some bituminous materials may exhibit non-Newtonian behaviour under the conditions of this method. Since non-Newtonian viscosity values are not unique material properties, but reflect the behaviour of the fluid and the measurement system, it should be recognized that measurements made by this method may not always predict performance under the conditions of use. Comparisons between non-Newtonian viscosities should be made only for measurements under similar conditions of shear stress and shear rate.

Unlike paving grade bitumen, polymer modified bitumens (PMBs) do not show a straight line on the Heukelom diagram [2]. This implies that, in order to obtain information about the temperature susceptibility of PMBs, viscosity should be measured at different temperatures.

5 Apparatus

Usual laboratory equipment, together with the following:

5.1 Rotating spindle viscometer, dynamic viscosity measurements with rotational viscometers on the bituminous products addressed by this standard may cover wide ranges of shear rates and viscosities:

— Range of shear rate: $1\ s^{-1}$ to $10^4\ s^{-1}$

— Range of dynamic viscosities: 10^{-2} Pa · s to 10^6 Pa · s

In order to cover all product types mentioned in the Scope (Clause 1), under the most usual test conditions, this standard requires rotational viscometer(s) with sample containers and rotating spindles allowing following minimum capabilities:

— Range of shear rate: $1\ s^{-1}$ to $200\ s^{-1}$

— Range of dynamic viscosities: 10^{-2} Pa · s to 10^3 Pa · s

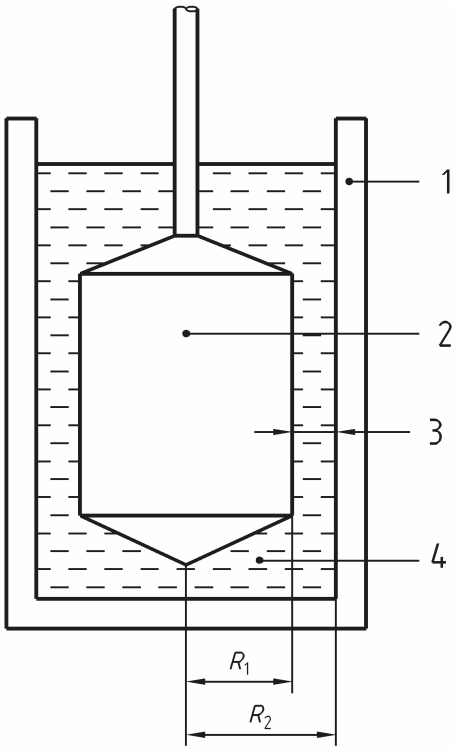
NOTE 1 For rotating cylinders, the following conditions give an indication of correct measuring geometry:

— Ratio of the radius: $R_2/R_1 \geq 1{,}1$ (reference to Figure 1);

— Difference between the radius $R_2 - R_1$ = 1 mm to 6 mm.

NOTE 2 Typical test temperatures are 40 °C for bituminous emulsions, 60 °C to 90 °C for cut-backs and fluxed bitumens, 60 °C to 200 °C for paving grade or polymer modified bituminous binders, 90°C to 230 °C for oxidized grades.

For any given spindle and sample container combination, the operating instructions of the equipment shall allow the operator to select the adequate rotation speed so as to obtain a desired shear rate.



Key

1 sample container
2 spindle
3 thickness of sample being measured
4 sample under test
R_1 spindle radius
R_2 inner radius of the sample container

Figure 1 — Rotational viscometer (principle)

5.2 Appropriate spindle(s), a spindle, or set of spindles, appropriate for the equipment, that will allow, for the materials to be tested and each specific test condition, dynamic viscosities to be measured with an accuracy close to ± 2 % and at least equal to ± 5 %. If achievable accuracy is not known from the information given by the manufacturer of the equipment, the spindles should be selected so as to obtain dynamic viscosity readings under torsion torque values which are between 10 % and 90 % of the maximum possible torsion torque of the spindle for the chosen test conditions.

Whenever possible, to get a maximum of accuracy, the spindle should always be selected so as to obtain dynamic viscosity readings under torsion torque values which are in the upper working range for the chosen test conditions. For low viscosity materials (typically, for viscosities below 100 mPa · s), it may be difficult to fulfil these requirements with existing equipment. Lower accuracy is then permitted but needs to be documented while indicating, in the test report, the actually achieved level of accuracy or, if not known, the position of the reading with regard to the working range of the used spindle (Clause 10).

NOTE When DSR equipment is used, neither achievable accuracy nor torsion torques ranges are known. In this case, validation of the testing conditions is done directly by the equipment software.

5.3 Sample container, specific to the rotating spindle viscometer, that allows the equipment to be used in coaxial mode and therefore enable the control of shear rate.