SLOVENSKI STANDARD
kSIST-TS FprCEN/TS 15963:2013

01-oktober-2013

Bitumen in bitumenska veziva - Določanje temperature lomne žilavosti s tritočkovnim upogibnim preskusom

Bitumen and bituminous binders - Determination of the fracture toughness temperature by a three point bending test on a notched specimen

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Bruchwiderstandstemperatur mittels eines Drei-Punkt-Biegeversuches an einem gekerbten Probekörper

Bitumes et liants bitumineux - Détermination de la température de résistance à la fissuration par un essai de flexion 3 points sur un barreau entaillé

Ta slovenski standard je istoveten z: **FprCEN/TS 15963**

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

kSIST-TS FprCEN/TS 15963:2013 **en,fr,de**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

FINAL DRAFT
FprCEN/TS 15963

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ICS 91.100.50

Will supersede CEN/TS 15963:2010

English Version

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This draft Technical Specification is submitted to CEN members for formal vote. It has been drawn up by the Technical Committee CEN/TC 336.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (FprCEN/TS 15963:2013) has been prepared by Technical Committee CEN/TC 336 “Bituminous binders”, the secretariat of which is held by AFNOR.

This document is currently submitted to the Formal Vote.

This document will supersede CEN/TS 15963:2010.

1 Scope

This Technical Specification specifies a method for the determination of the Fracture Toughness temperature, T_{FT}, of bituminous binders by means of a three point bending test on a notched binder sample.

WARNING — The use of this Technical Specification can involve hazardous materials, operations and equipment. This Technical Specification does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Technical Specification to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use. For environmental reasons, it is recommended to limit the use of products, solvents and energy to minimum in order to reduce the emissions to air, water and soil.

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 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.

3.1
maximum force
F
highest force measured during the bending test

Note 1 to entry: The test is done in the brittle state or close to that, so that the maximum force is considered as the onset of the crack propagation.

Note 2 to entry: Force is expressed in Newtons (N).

3.2
displacement at maximum force
D
bending of the test beam from the beginning of the test (from the zero point) to the break point

Note 1 to entry: Displacement is expressed in millimetres (mm).

3.3
work
W
area under the force-displacement curve from the beginning of the test to the break of the sample, i.e. at the maximum force

Note 1 to entry: Work is expressed in Newtons.metres (N·m) or in Joules (J).

3.4
Fracture Toughness temperature
T_{FT}
temperature at which the displacement at the maximum force is 0,3 mm (from the zero point)

Note 1 to entry: Fracture Toughness temperature is expressed in degrees Celsius (°C).

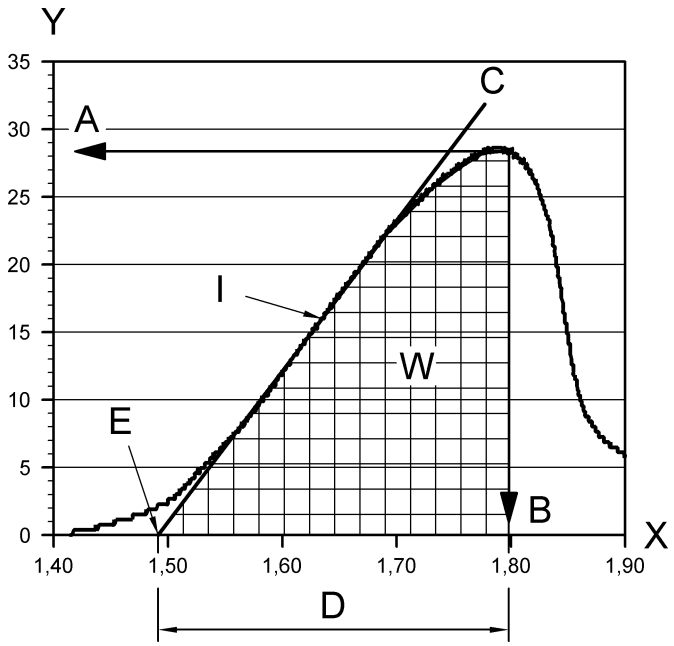
3.5
initial stiffness
S
value calculated as the slope of the tangent of the force-displacement curve at the inflection point

Note 1 to entry: See Figure 1.

Note 2 to entry: Stiffness is expressed in Newtons per millimetre (N/mm).

3.6
zero point
intersection of the x-axis and the tangent of the force-displacement curve at the inflection point expressed in millimetres (mm)

Figure 1 presents an example of the Force versus displacement curve at a temperature *T* close to T_{FT}.



Key

X displacement, in millimetres (mm)
Y force, in Newtons (N)
A maximum force (defined as *F)*
B X point at maximum force
C tangent at the inflection point
D displacement at maximum force, (*D* = B - E*)*
E zero point
W work as defined in 3.3
I inflection point of *F* versus displacement

Figure 1 — Example of a Force versus displacement curve at temperature *T* (close to T_{FT})

4 Principle

The notched three point bending test is used to measure cracking performance of unmodified and modified bituminous binder samples. The test sample is a beam with a notch in the middle of one side of the beam. The sample is conditioned in a temperature controlled bath. The beam is placed on two supports with the notch facing downwards and a vertical downward force is applied on the middle of the upper face of the sample. The beam is loaded until failure with a specified displacement rate, whereby force is recorded versus displacement.

NOTE 1 The fracture properties of bituminous binders are strongly dependent on test temperature, loading rate and sample preparation method.

NOTE 2 This test is based on the work done by S. Hesp for the Ministry of Transportation in Ontario, Canada [1].

5 Apparatus

5.1 Testing apparatus

5.1.1 Tension-compression device

A universal tension-compression device, which is capable of sustaining a constant, predetermined displacement rate.

5.1.2 Bending rig

A bending rig consisting of two cylindrical specimen supports, a cylindrical-nosed shaft to apply the load to the mid-point of the test specimen and a load cell mounted in line with the loading shaft.

The dimensions and tolerances of the loading frame are given in Table 1.

5.1.3 Loading system

A loading system, which is capable of applying a rate of displacement of 0,01 mm/s. The specified displacement rate shall fluctuate by no more than ± 10 % over time. The maximum stroke of the instrument shall be at least 20 mm for this test.

5.1.4 Loading shaft

A loading shaft, which is continuous and in line with the load cell and deflection measuring transducer. The T-shape shaft shall have a cylindrical-shaped loading pin in the end. The diameter of the pin shall be (10,0 ± 0,1) mm.

5.1.5 Load cell

A load cell having a minimum capacity of no less than 500 N and an accuracy of ± 1 % above 5 N with a minimum resolution of at least 100 m·N is required. The load cell shall allow the measurement of the force at any time during the test.

5.1.6 LVD-transducer

An LVD transducer or other suitable device to measure the deflection of the sample is necessary. It shall have a linear range of at least 5 mm with an accuracy of 2 µm. The deflection may be measured using this separate transducer or by measuring the vertical movement of the tension/compression device.

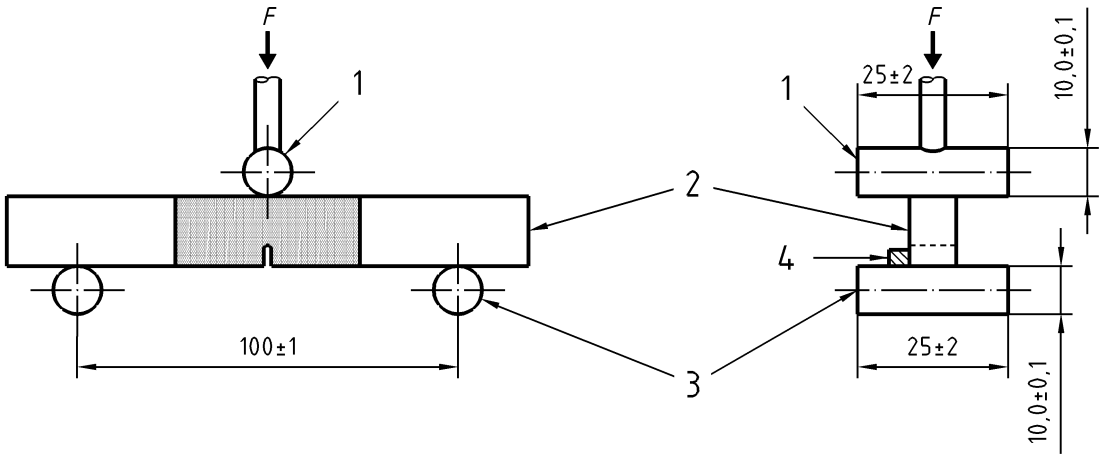
5.1.7 Specimen supports

Specimen supports which shall consist of two non-corrosive metal half-rounds or cylinders with a diameter of (10,0 ± 0,1) mm that are spaced (100 ± 1) mm apart (cylinder centre point to cylinder centre point). The specimen shall be placed perpendicular to the supports and the loading pin. To facilitate that, two vertical alignment pins of 2 mm to 4 mm in diameter can be provided at the back of each support. A schematic diagram of the sample supports is shown on Figure 2.

5.1.8 Ventilated oven, capable of maintaining a temperature up to 200 °C, with an accuracy of ± 1 °C.

The specified temperature shall only be assessed in the surroundings of the sample (see 6.3).

Dimensions in millimetres



Key

1 cylindrical loading shaft pin
2 specimen (see details on Figure 3)
3 specimen supports
4 alignment pin
F force applied

Figure 2 — Bending rig

Table 1 — Measurement and tolerances of the rig

Dimension	Size, mm	Tolerance, mm
Loading shaft pin length	25	± 2
Loading shaft diameter	10,0	± 0,1
Specimen support length	25	± 2
Specimen support diameter	10,0	± 0,1
Specimen support span	100	± 1

5.1.9 Temperature measurement device

A calibrated temperature transducer capable of measuring the temperature with the accuracy of ± 0,1 °C over the range of - 40,0 °C to 0,0 °C. The temperature measuring head shall be mounted in the near vicinity of the specimen, at a distance of not more than 25 mm from the middle of the specimen.

5.1.10 Liquid bath

A liquid bath shall be capable of maintaining the required test temperature near the test specimen within ± 0,2 °C during the isothermal conditioning and the test procedure, enabling to reach the lower temperature required for testing the specimen.

Bath liquid shall not affect the properties of the bituminous binder being tested.

NOTE 95 % volume ethanol or a 40 % to 50 % mass potassium acetate-water solution has been found to be suitable as a bath liquid.

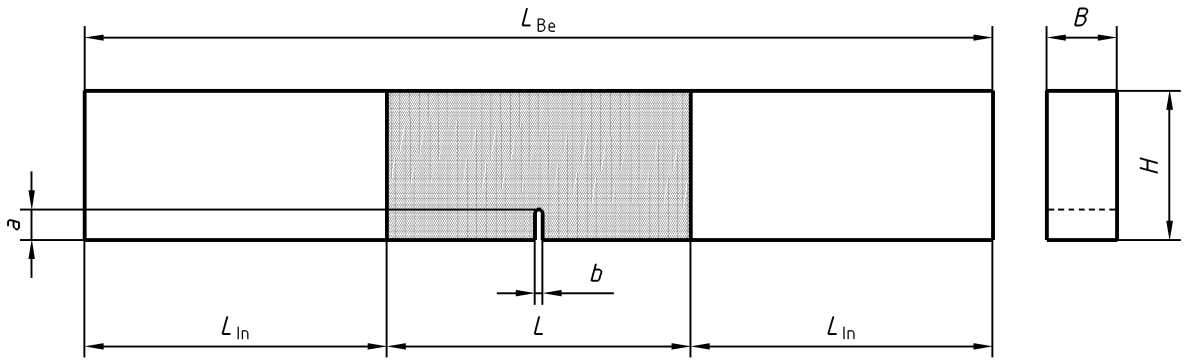
5.1.11 Data acquisition

The data acquisition system shall resolve loads to the nearest 100 mN, record specimen deflection to the nearest 0,5 µm, record time to the nearest 0,1 second and temperature around the sample to the nearest 0,1 °C. The software shall control the measuring system and record time, load, deflection and temperature during the test. Sampling rate of force and displacement should be at least 0,1 s^{-1} (10 Hz).

5.2 Test specimen

A test specimen as shown on Figure 3 is used. The sample is moulded from the bituminous binder to be assessed. Two aluminium inserts are installed at the ends of the mould. The notch is made by installing two sheets of silicone paper into the pre-notched mould frame.

NOTE Silicone paper with a weight of 135 g/m^2 has been found suitable.



Key

L_{Be} beam length
L specimen length
L_{In} insert length
H specimen height
B specimen thickness
a notch depth
b notch thickness

Figure 3 — Specimen geometry