Vervangt NEN-EN 14771:2003 Ontw.

Nederlandse norm

# NEN-EN 14771 (en)

Bitumen en bitumineuze bindmiddelen - Bepaling van de buigkruipstijfheid - Buigproef Rheometer (BBR)

Bitumen and bituminous binders - Determination of the flexural creep stiffness - Bending Beam Rheometer (BBR)

ICS 75.140; 91.100.50

mei 2005

Als Nederlandse norm is aanvaard:
- EN 14771:2005,IDT

Normcommissie 353 008 "Bitumen"



NEN

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## Nederlands voorwoord

Voor de in deze norm vermelde normatieve verwijzingen bestaan in Nederland de volgende equivalenten:

| vermelde norm | Nederlandse norm | titel |
|---|---|---|
| EN 58 | NEN-EN 58 | Bitumen en bitumineuze bindmiddelen - Monsterneming van bitumineuze bindmiddelen (en) |
| EN 12594 | NEN-EN 12594 | Bitumen en bitumineuze bindmiddelen - Monstervoorbereiding (en) |

EUROPEAN STANDARD

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EUROPÄISCHE NORM

# EN 14771

May 2005

ICS 75.140; 91.100.50

English version

# Bitumen and bituminous binders - Determination of the flexural creep stiffness - Bending Beam Rheometer (BBR)

Bitumes et liants bitumineux - Détermination du module de rigidité en flexion - Rhéomètre à flexion du barreau (BBR)

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Biegekriechsteifigkeit - Biegebalkenrheometer (BBR)



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Ref. No. EN 14771:2005: E

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## Foreword

This document (EN 14771:2005) 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of an identical text or by endorsement, at the latest by November 2005, and conflicting national standards shall be withdrawn at the latest by November 2005.

This European Standard is based on ASTM D 6648-01.

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

## 1 Scope

This European Standard specifies a method for the determination of the flexural creep stiffness of bituminous binders in the range of 30 MPa to 1 GPa by means of the bending beam rheometer.

**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 to determine the applicability of regulatory limitations prior to use.**

## 2 Normative references

The following referenced documents are indispensable for the application of this European Standard. 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 European Standard, the following terms and definitions apply.

**3.1**
**flexural creep stiffness**
S (t)
ratio obtained by dividing the bending stress by the bending strain; the strain will increase with the loading time and therefore the flexural creep stiffness will also be a function of time

**3.2**
**m-value**
the absolute value of the slope of the curve of the logarithm of the stiffness versus the logarithm of time

**3.3**
**contact load**
$P_c$
load required to maintain positive contact between the test specimen, supports and the loading shaft

NOTE The contact load of 25 mN to 45 mN is used in this method.

**3.4**
**test load**
$P_t$
load used to determine the stiffness of the bituminous binder being tested

NOTE The test load of 930 mN to 1030 mN is used in this method.

## 4 Principle

The bending beam rheometer is used to measure the mid-point deflection, in three point bending, of a beam of bituminous binder. A constant load is applied to the mid-point of the test specimen for a defined loading time and the deflection is measured as a function of time. A low temperature liquid bath is used to control the temperature. The stiffness of the test specimen for the specific loading times is calculated from the bending stress and strain.

## 5 Apparatus

**5.1 Bending Beam Rheometer (BBR),** consisting of a loading frame with test specimen supports, a controlled temperature liquid bath and a data acquisition system.

**5.1.1 The loading frame** consists of a set of sample supports, a blunt-nosed shaft to apply the load to the mid-point of the test specimen, a load cell mounted in line with the loading shaft, a means for zeroing the load applied to the specimen, a means for applying a constant load to the test specimen and a deflection measuring transducer attached to the loading shaft. A schematic picture of the device is shown in Figure 1.

**5.1.1.1 The loading system** shall be capable of applying a contact load of 25 mN to 45 mN to the test specimen and maintaining a test load of 930 mN to 1030 mN within ± 10 mN. The rise time from the contact load to the test load shall be less than 0,5 s. Details of the loading pattern are shown in Figure 2.

**5.1.1.2 The loading shaft** shall be continuous and in line with the load cell and deflection measuring transducer with a spherically-shaped end 6,3 mm ± 0,3 mm in radius.

**5.1.1.3 The load cell** shall have a minimum capacity of no less than 2,0 N and a resolution of at least 2,5 mN.

**5.1.1.4 The LVD-transducer**, or other suitable device to measure the deflection of the test specimen shall have a linear range of at least 6 mm, and be capable of resolving linear movement of 2,5 µm.

**5.1.1.5 The sample supports**, shall consist of two non-corrosive metal supports with a 3,0 mm ± 0,3 mm contact radius and spaced 101 mm to 103 mm apart. The spacing of the supports shall be measured to 0,3 mm, see Figure 3.

**5.1.2 A temperature measurement device**, as a calibrated temperature transducer shall be capable of measuring the temperature with the accuracy of ± 0,1 °C over the range of – 36 °C to 0 °C. The measuring head shall be mounted within 50 mm of the mid-point of the test specimen.

**5.1.3 A liquid bath** capable of maintaining the desired test temperature near the test sample within ± 0,2 °C during isothermal conditioning and during test procedure in the range of – 36 °C to 0 °C. Bath liquid shall not affect the properties of the bituminous binder being tested. The density of the liquid shall not exceed 1050 kg/m$^3$ at the test temperature.

NOTE 95 % (volume fraction) ethanol has been found to be suitable as a bath liquid.

**5.1.3.1 A bath agitator** shall be used for maintaining the required temperature homogeneity with agitation intensity such that the fluid currents do not disturb the testing process.

**5.1.3.2 A circulating bath**, an optional separate bath unit, cools the test bath liquid.

**5.1.4 A data acquisition and control system** resolves loads to at least 2,5 mN, test specimen deflection to at least 2,5 µm, and bath liquid temperature to the nearest 0,1 °C. The software shall control the measuring system and record time, load deflection and temperature during the test. All the load and deflection readings shall be an average of at least five points within ± 0,2 s of the reporting time.

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