Bitumen and bituminous binders - Determination of complex shear modulus and phase angle - Dynamic Shear Rheometer (DSR)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 14770:2023 sisaldab Euroopa standardi EN 14770:2023 ingliskeelset teksti.	This Estonian standard EVS-EN 14770:2023 consists of the English text of the European standard EN 14770:2023.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 05.07.2023.	Date of Availability of the European standard is 05.07.2023.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 75.140, 91.100.50

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 14770

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Supersedes EN 14770:2012

English Version

Bitumen and bituminous binders - Determination of complex shear modulus and phase angle - Dynamic Shear Rheometer (DSR)

Bitumes et liants bitumineux - Détermination du module complexe en cisaillement et de l'angle de phase à l'aide d'un rhéomètre à cisaillement dynamique (DSR)

Bitumen und bitumenhaltige Bindemittel - Bestimmung des komplexen Schermoduls und des Phasenwinkels - Dynamisches Scherrheometer (DSR)

This European Standard was approved by CEN on 28 May 2023.

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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 CEN-CENELEC Management Centre has the same status as the official versions.

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

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European foreword

This document (EN 14770:2023) 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 January 2024, and conflicting national standards shall be withdrawn at the latest by January 2024.

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 14770:2012.

In comparison with the previous edition, the main technical changes are:

a) restriction of particle size added in the scope;

b) reference to outdated standards IP PM CM-02 and XPT 66-065 removed;

c) integration of “complex compliance” removed;

d) use of the terms “shear strain” and “shear stress” unified;

e) use of the term “bituminous binder” unified;

f) reference to EN 1427 moved from Clause 2 to Bibliography; references to EN 12607-1, EN 14023 and EN 14769 added to Bibliography;

g) definitions “shear strain controlled mode” and “shear stress controlled mode” added;

h) use of the term “range of linear viscoelastic behaviour” unified;

i) use of the term “complex shear modulus” together with the corresponding symbol $|G^*|$ unified; description of the complex shear modulus revised;

j) 6.1, 7.1 and 8.1 added with reference to Annex E;

k) information on different plate diameters relocated from 5.1 to new 6.2; information about different plate diameters in 6.2 updated and plate diameter of 4 mm added;

l) deviation for rheometer specification removed in 5.1;

m) suitable dimensions for silicone moulds added in 5.2;

n) vials for preparation of test specimen removed in 5.2, 7.2, 7.3 and 8.2;

o) use of the term “specimen” unified;

p) 6.4 “Zero gap setting” revised and clarified;

q) heating procedure in 7.2 simplified with reference to EN 12594;

r) paring of specimen at room temperature removed in 7.3;

s) storage conditions and storage duration of specimens revised in 7.3;

t) 8.2 “Specimen placing into the rheometer” and 8.3 “Gap setting” revised;

u) gap compensation added in 8.4;

v) explanation of different testing procedures added in 8.5;

w) isochrones added Clause 9;

x) calculation of TX and δ_{TX} added in Clause 9 and new Annex D;

y) Clause 10 revised and complemented with new precision data, instead of coefficient of variation repeatability *r* and reproducibility *R* are now used;

z) terms c) and d) added in Clause 11;

aa) revision of Annex C “Determination of the linear viscoelastic (LVE) range”;

bb) Annex E “Flow Chart” added.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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

1 Scope

This document specifies a general method of using a dynamic shear rheometer (DSR) for measuring the rheological properties of bituminous binders. The procedure involves determining the complex shear modulus and phase angle of binders over a range of test frequencies and test temperatures when tested in oscillatory shear.

From the test, the complex shear modulus, $|G^*|$, and its phase angle, δ, at a given temperature and frequency are calculated, as well as the components G' and G'' of the complex shear modulus.

This method is applicable to un-aged, aged, stabilized and recovered bituminous binders. The test procedure in accordance with this document is not applicable for bituminous binders with particles larger than 250 µm (e.g. filler material, granulated rubber).

WARNING — The use of this document can 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 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 terminology databases for use in standardization at the following addresses:

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

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

3.1
shear strain controlled mode
rheometer control mode where a demand angular displacement is applied to the specimen and the corresponding torque is measured

Note 1 to entry: Using the shear strain factor of the measuring geometry, a specimen shear strain can be calculated from the applied angular displacement. Using the shear stress factor of the measuring geometry, a specimen shear stress can be calculated from the measured torque. Additional corrections can be applied to calculate true specimen shear strain and true specimen shear stress. These corrections are automatically carried out by the instrument software and are not the responsibility of the operator.

3.2
shear stress controlled mode
rheometer control mode where a demand torque is applied to the specimen and the corresponding angular displacement is measured

Note 1 to entry: Using the shear stress factor of the measuring geometry, a specimen shear stress can be calculated from the applied torque. Using the shear strain factor of the measuring geometry, a specimen shear strain can be calculated from the measured angular displacement. Additional corrections can be applied to calculate true