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Bitumenske zmesi - Preskusne metode za vroče asfaltne zmesi - 45. del: Preskus staranja na zasičenih asfaltnih preskušancih (preskus SATS)

Bituminous mixtures - Test methods for hot mix asphalt - Part 45: Saturation Ageing Tensile Stiffness (SATS) conditioning test

Asphalt - Prüfverfahren für Heißasphalt - Teil 45: Alterungsprüfung an gesättigten Asphalt-Probekörpern (SATS-Prüfung)

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné à chaud - Partie 45: Saturation vieillissant l'essai de tension de la rigidité (SATS)

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Bituminous mixtures - Test methods for hot mix asphalt - Part 45: Saturation Ageing Tensile Stiffness (SATS) conditioning test

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné à chaud - Partie 45 : Essai de module en traction après saturation conditionnée (SATS)

Asphalt - Prüfverfahren für Heißasphalt - Teil 45: Alterungsprüfung an gesättigten Asphalt-Probekörpern (SATS-Prüfung)

This European Standard was approved by CEN on 23 March 2012.

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Foreword

This document (EN 12697-45:2012) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2012, and conflicting national standards shall be withdrawn at the latest by October 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document is one of a series of standards for bituminous mixtures which includes the following:

EN 12697-1, *Bituminous mixtures — Test methods for hot mix asphalt — Part 1: Soluble binder content*

EN 12697-2, *Bituminous mixtures — Test methods for hot mix asphalt — Part 2: Determination of particle size distribution*

EN 12697-3, *Bituminous mixtures — Test methods for hot mix asphalt — Part 3: Binder recovery: Rotary evaporator*

EN 12697-4, *Bituminous mixtures — Test methods for hot mix asphalt — Part 4: Binder recovery: Fractionating column*

EN 12697-5, *Bituminous mixtures — Test methods for hot mix asphalt — Part 5: Determination of the maximum density*

EN 12697-6, *Bituminous mixtures — Test methods for hot mix asphalt — Part 6: Determination of bulk density of bituminous specimens*

EN 12697-7, *Bituminous mixtures — Test methods for hot mix asphalt — Part 7: Determination of bulk density of bituminous specimens by gamma rays*

EN 12697-8, *Bituminous mixtures — Test methods for hot mix asphalt — Part 8: Determination of void characteristics of bituminous specimens*

EN 12697-9, *Bituminous mixtures — Test methods for hot mix asphalt — Part 9: Determination of the reference density*

EN 12697-10, *Bituminous mixtures — Test methods for hot mix asphalt — Part 10: Compactibility*

EN 12697-11, *Bituminous mixtures — Test methods for hot mix asphalt — Part 11: Determination of the affinity between aggregate and binders*

EN 12697-12, *Bituminous mixtures — Test methods for hot mix asphalt — Part 12: Determination of the water sensitivity of specimen*

EN 12697-13, *Bituminous mixtures — Test methods for hot mix asphalt — Part 13: Temperature measurement*

EN 12697-14, *Bituminous mixtures — Test methods for hot mix asphalt — Part 14: Water content*

EN 12697-15, *Bituminous mixtures — Test methods for hot mix asphalt — Part 15: Determination of the segregation sensitivity*

EN 12697-16, *Bituminous mixtures — Test methods for hot mix asphalt — Part 16: Abrasion by studded tyres*

EN 12697-17, *Bituminous mixtures — Test methods for hot mix asphalt — Part 17: Particle loss of porous asphalt specimen*

EN 12697-18, *Bituminous mixtures — Test methods for hot mix asphalt — Part 18: Binder drainage*

EN 12697-19, *Bituminous mixtures — Test methods for hot mix asphalt — Part 19: Permeability of specimen*

EN 12697-20, *Bituminous mixtures — Test methods for hot mix asphalt — Part 20: Indentation using cube or Marshall specimen*

EN 12697-21, *Bituminous mixtures — Test methods for hot mix asphalt — Part 21: Indentation using plate specimen*

EN 12697-22, *Bituminous mixtures — Test methods for hot mix asphalt — Part 22: Wheel tracking test*

EN 12697-23, *Bituminous mixtures — Test methods for hot mix asphalt — Part 23: Indirect tensile test*

EN 12697-24, *Bituminous mixtures — Test methods for hot mix asphalt — Part 24: Resistance to fatigue*

EN 12697-25, *Bituminous mixtures — Test methods for hot mix asphalt — Part 25: Cyclic compression test*

EN 12697-26, *Bituminous mixtures — Test methods for hot mix asphalt — Part 26: Stiffness*

EN 12697-27, *Bituminous mixtures — Test methods for hot mix asphalt — Part 27: Sampling*

EN 12697-28, *Bituminous mixtures — Test methods for hot mix asphalt — Part 28: Preparation of samples for determining binder content, water content and grading*

EN 12697-29, *Bituminous mixtures — Test methods for hot mix asphalt — Part 29: Determination of the dimensions of bituminous specimen*

EN 12697-30, *Bituminous mixtures — Test methods for hot mix asphalt — Part 30: Preparation of specimen by impact compactor*

EN 12697-31, *Bituminous mixtures — Test methods for hot mix asphalt — Part 31: Specimen preparation, gyratory compactor*

EN 12697-32, *Bituminous mixtures — Test methods for hot mix asphalt — Part 32: Laboratory compaction of bituminous mixtures by vibratory compactor*

EN 12697-33, *Bituminous mixtures — Test methods for hot mix asphalt — Part 33: Specimen prepared by roller compactor*

EN 12697-34, *Bituminous mixtures — Test methods for hot mix asphalt — Part 34: Marshall test*

EN 12697-35, *Bituminous mixtures — Test methods for hot mix asphalt — Part 35: Laboratory mixing*

EN 12697-36, *Bituminous mixtures — Test methods for hot mix asphalt — Part 36: Method for the determination of the thickness of a bituminous pavement*

EN 12697-37, *Bituminous mixtures — Test methods for hot mix asphalt — Part 37: Hot sand test for the adhesivity of binder on precoated chippings for HRA*

EN 12697-38, *Bituminous mixtures — Test methods for hot mix asphalt — Part 38: Common equipment and calibration*

EN 12697-39, *Bituminous mixtures — Test methods for hot mix asphalt — Part 39: Binder content by ignition*

EN 12697-40, *Bituminous mixtures — Test methods for hot mix asphalt — Part 40: In situ drainability*

EN 12697-41, *Bituminous mixtures — Test methods for hot mix asphalt — Part 41: Resistance to de-icing fluids*

EN 12697-42, *Bituminous mixtures — Test methods for hot mix asphalt — Part 42: Amount of coarse foreign matters in reclaimed asphalt*

EN 12697-43, *Bituminous mixtures — Test methods for hot mix asphalt — Part 43: Resistance to fuel*

EN 12697-44, *Bituminous mixtures — Test methods for hot mix asphalt — Part 44: Crack propagation by semi-circular bending test*

EN 12697-45, *Bituminous mixtures — Test methods for hot mix asphalt — Part 45: Saturation Ageing Tensile Stiffness (SATS) conditioning test*

EN 12697-46, *Bituminous mixtures — Test methods for hot mix asphalt — Part 46: Low temperature cracking and properties by uniaxial tension tests*

EN 12697-47, *Bituminous mixtures — Test methods for hot mix asphalt — Part 47: Determination of the ash content of natural asphalts*

prEN 12697-48[1)], *Bituminous mixtures — Test methods for hot mix asphalt — Part 48: Inter-layer bond strength*

prEN 12697-49, *Bituminous mixtures — Test methods for hot mix asphalt — Part 49: Skid resistance of asphalt in the laboratory*

prEN 12697-50[1)], *Bituminous mixtures — Test methods for hot mix asphalt — Part 50: Scuffing resistance of surface course asphalt*

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1) In preparation.

1 Scope

This European Standard specifies a test method to assess the durability of adhesion in base and binder course asphalt mixtures. The Saturation Ageing Tensile Stiffness (SATS) conditioning regime is used to age the specimens in the presence of water. A comparative test for assessing their performance before and after conditioning is also conducted. The applicability of this test method is limited to bituminous specimens with consistent air voids contents and hard binder, in particular, to asphalt concrete mixtures with a binder content between 3,5 % and 5,5 %, air voids contents between 6 % and 10 % and 10/20 pen hard paving grade bitumen. The test is intended to be used as a screening test for the assessment of a combination of aggregate, filler and additives with respect to the retained adhesion properties after simulated ageing in a moist atmosphere for lean/stiff base and binder course mixtures.

NOTE Alternative conditions for mixtures with binders other than 10/20 hard grade bitumen or other situations not covered by this European Standard are being developed.

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 12697-5:2009, *Bituminous mixtures — Test methods for hot mix asphalt — Part 5: Determination of the maximum density*

EN 12697-6:2012, *Bituminous mixtures — Test methods for hot mix asphalt — Part 6: Determination of bulk density of bituminous specimens*

EN 12697-8, *Bituminous mixtures — Test methods for hot mix asphalt — Part 8: Determination of void characteristics of bituminous specimens*

EN 12697-26:2012, *Bituminous mixtures — Test methods for hot mix asphalt — Part 26: Stiffness*

EN 12697-30, *Bituminous mixtures — Test methods for hot mix asphalt — Part 30: Preparation of specimen by impact compactor*

EN 12697-31, *Bituminous mixtures — Test methods for hot mix asphalt — Part 31: Specimen preparation by gyratory compactor*

EN 12697-33, *Bituminous mixtures — Test methods for hot mix asphalt — Part 33: Specimen prepared by roller compactor*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12697-5:2009, EN 12637-6:2012 and the following apply.

3.1
saturation before conditioning
saturation of the mixture, determined as the calculated proportion of air voids filled with water after partial vacuum saturation, prior to conditioning by storage under increased pressure and elevated temperature, in percent

3.2
unconditioned stiffness
stiffness modulus of the mixture as determined in accordance with EN 12697-26:2012, Annex C, prior to conditioning by storage under increased pressure and elevated temperature

Note 1 to entry: Alternative comparative tests can be used but should be recorded in the results.

3.3
conditioned stiffness
stiffness modulus of the mixture as determined in accordance with EN 12697-26:2012, Annex C, after conditioning by storage under increased pressure and elevated temperature

3.4
stiffness ratio
ratio of the conditioned stiffness to the unconditioned stiffness

3.5
saturation after conditioning
saturation of the mixture, determined as the calculated proportion of air voids filled with water after conditioning by storage under increased pressure and elevated temperature, in percent

4 Principle

Nominally identical test specimens are subjected to moisture saturation by a vacuum system. They are then transferred into a pressurised vessel partially filled with water where they are subjected to a conditioning procedure by storage at 85 °C temperature and 2,1 MPa pressure for 65 h. The ratios of the stiffness, measured by indirect tension on cylindrical specimens, before and after conditioning by storage under increased pressure and elevated temperature on the individual specimens situated above the water are averaged to determine the sensitivity of the material to ageing and moisture. The whole process is referred to as the Saturation Ageing Tensile Stiffness (SATS) conditioning test. The average ratio is the SATS durability index of the mixture components when the comparative test is the indirect tensile stiffness modulus.

NOTE Tests other than stiffness by indirect tension on cylindrical specimens can be used as the comparative test.

5 Apparatus

5.1 Sample manufacture

5.1.1 Asphalt mixer

5.1.2 Coring equipment

5.1.3 Saw for cutting asphalt

5.2 Conditioning regime

5.2.1 Vacuum desiccator and **vacuum pump**, including manometer or calibrated vacuum gauge in accordance with EN 12697-5.

5.2.2 Balance with a capacity greater than the mass of a sample that is accurate to 0,1 g.

5.2.3 Pressure/temperature vessel designed to operate at (2,1 ± 0,1) MPa between 80 °C and 115 °C and which shall be made from stainless steel, having internal dimensions adequate to contain the specimen tray (see 5.2.7) and an integral temperature control system that is capable of:

a) bringing the loaded pressurised vessel to the desired conditioning temperature ± 0,5 °C, as recorded by a suitable thermometer inside the vessel, within 2 h;

b) maintaining the temperature at all points within the vessel at the ageing temperature ± 0,5 °C.

SAFETY PRECAUTIONS — The pressure ageing vessel operates at high temperatures and high pressures. All safety guidelines issued by equipment manufacturers shall be adhered to.

5.2.4 Pressure controlling devices

5.2.4.1 Pressure release valve, which prevents pressure in the vessel from exceeding 2,5 MPa during the ageing procedure.

5.2.4.2 Pressure regulator, capable of controlling the pressure within the vessel to ± 0,1 MPa and with a capacity sufficient to reduce the pressure from the source of compressed air so that the pressure within the vessel is maintained at the operating pressure of (2,1 ± 0,1) MPa.

5.2.4.3 Slow release bleed valve, which allows the pressure in the vessel at the completion of the test to be reduced from the 2,1 MPa operating pressure, to atmospheric pressure within 20 min to 30 min.

5.2.4.4 Pressure gauge, capable of measuring the pressure within the vessel to within 0,3 MPa during the test. The pressure gauge shall be calibrated to an accuracy of ± 0,1 MPa at appropriate intervals.

5.2.4.5 Porous disc, 5 mm thick by 100 mm diameter, with a permeability substantially greater than that of the asphalt and the capability withstand the maximum vertical pressure likely to be imposed. The discs shall be checked before each use to ensure that they are not clogged by particles. They shall be boiled for at least 10 min in distilled water before use and kept immersed in de-aerated water until required.

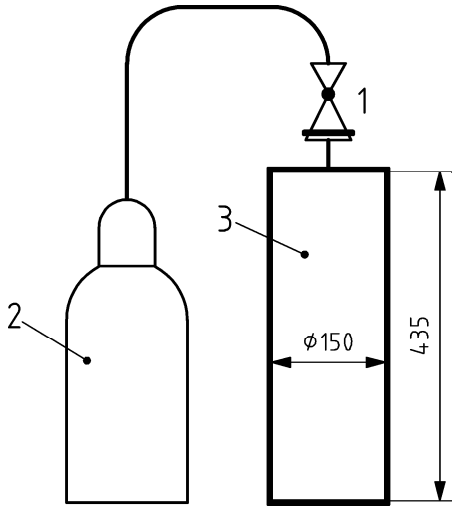
5.2.5 Thermometer, accurate to 0,1 °C, for measuring the temperature inside the pressure vessel.

NOTE A resistance thermal detector (RTD) has been found to be suitable.

5.2.6 Temperature recording device, data acquisition system capable of recording the temperature throughout the test to 0,1 °C.

NOTE The current method of monitoring temperature is via a computerised log of time and temperature. It is assumed the temperature recorded is that which is to be found within every point within the ageing vessel.

Dimensions in millimetres



Key
1 pressure regulator
2 compressed air cylinder
3 pressure vessel

Figure 1 — Schematic diagram and dimensions of typical pressure vessel

5.2.7 Specimen tray, having the form and dimensions specified in Figure 2, to accommodate five test specimens for a full test. The tray shall sit in the pressure vessel on top of a porous disc, as shown in Figure 3.

NOTE 1 The form and dimensions of the pressure vessel and specimen tray shown in Figures 1 and 2 have been found to be practicable in the SATS test when used with different aggregate types. Other forms of pressure vessel and specimen tray may also be suitable, but have not yet been specifically investigated. However, early work carried out in a standard binder pressure ageing vessel in EN 14769 yielded similar results to those generated using the apparatus described in this European Standard.

NOTE 2 The fifth sample is placed so that, unlike the other samples, it is submerged during the test. As such, it is not included in the averaging to produce the overall result. However, the ratio for this sample can be used to provide additional information on the properties of the mixture.