



**SLOVENSKI STANDARD**  
**oSIST prEN 12697-45:2009**  
**01-september-2009**

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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: Essai de module en traction après saturation conditionnée (SATS)

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**Ta slovenski standard je istoveten z: prEN 12697-45**

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**ICS:**

93.080.20      Materiali za gradnjo cest      Road construction materials

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**DRAFT**  
**prEN 12697-45**

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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 draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 227.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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COMITÉ EUROPÉEN DE NORMALISATION  
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## Foreword

This document (prEN 12697-45:2009) has been prepared by Technical Committee CEN/TC 227 "Road materials", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This European Standard is one of a series of standards as listed below:

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: 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 specimen by hydro-static method*

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 the air voids content of bituminous mixtures*

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

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 aggregates 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 of bituminous mixtures*

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 specimen*

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

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: Dynamic creep 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 a vibratory compactor*

EN 12697-33, *Bituminous mixtures — Test methods for hot mix asphalt — Part 33: Specimen preparation, slab 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 pre-coated chippings for hot rolled asphalt*

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 of porous asphalt*

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 foreign matter in reclaimed asphalt*

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

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

prEN 12697-45, *Bituminous mixtures — Test methods for hot mix asphalt — Part 45: Saturation ageing tensile stiffness (SATS) conditioning test*

## 1 Scope

This European Standard describes a test method to assess the durability of adhesion in base and binder course asphalt mixtures using the Saturation Ageing Tensile Stiffness (SATS) conditioning regime, to age the specimens in the presence of water, together with a comparative test for assessing performance before and after conditioning. The applicability of this test method is limited to bituminous specimens with consistent air voids contents and hard binder grades. The test is intended to be used as an initial type test for assessment of a combination of aggregate, filler and additives.

NOTE The test was originally developed for use as a screening test to evaluate the aggregate quality in respect of the retained adhesion properties after simulated ageing in a moist atmosphere for lean/stiff base and binder course mixtures in which the binder is replaced by 10/20 hard grade bitumen.

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## 2 Normative references

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The following referenced documents are indispensable for the application 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 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 specimen by hydro-static method*

EN 12697-8, *Bituminous mixtures — Test methods for hot mix asphalt — Part 8: Determination of the air voids content of bituminous mixtures*

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 12697-30, *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 12697-33, *Bituminous mixtures — Test methods for hot mix asphalt — Part 33: Specimen preparation, slab compactor*

EN 13108-20, *Bituminous mixtures — Material specifications — Part 20: Type testing*

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EN 13924, *Bitumen and bituminous binders — Specification for hard paving-grade bitumens*

EN 14769, *Bitumen and bituminous binders — Accelerated long-term ageing — Pressure ageing vessel (PAV)*

**3 Terms and definitions**

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

**3.1 saturation before conditioning**  
the saturation of the mixture, determined as the calculated proportion of air voids filled with water after partial vacuum saturation, prior to conditioning, in per cent

**3.2 unconditioned stiffness**  
the stiffness modulus of the mixture as determined in accordance with EN 12697-26 prior to conditioning

NOTE Annex C is the preferred option.

**3.3 conditioned stiffness**  
the stiffness modulus of the mixture as determined in accordance with EN 12697-26 (using the same Annex as for the unconditioned stiffness) after conditioning

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

**3.5 saturation after conditioning**  
the saturation of the mixture, determined as the calculated proportion of air voids filled with water after conditioning, in per cent

**3.6 precision**  
closeness of agreement between independent test results obtained under stipulated conditions.

NOTE 1 Precision depends only on the distribution of random errors and does not relate to the true value or the specified value.

NOTE 2 The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Less precision is reflected by a larger standard deviation.

NOTE 3 “Independent test results” means results obtained in a manner not influenced by any previous result on the same or similar test object. Quantitative measures of precision depend critically on the stipulated conditions. Repeatability and reproducibility conditions are particular sets of extreme conditions.

**3.7 repeatability**  
precision under repeatability conditions

**3.8 repeatability conditions**  
conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time



### 3.9

#### **repeatability limit**

value less than or equal to which the absolute difference between two test results obtained under repeatability conditions may be expected to be with a probability of 95 %

NOTE The symbol used is  $r$ .

### 3.10

#### **reproducibility**

precision under reproducibility conditions

### 3.11

#### **reproducibility conditions**

conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment

### 3.12

#### **reproducibility limit**

value less than or equal to which the absolute difference between two test results obtained under reproducibility conditions may be expected to be with a probability of 95 %

NOTE The symbol used is  $R$ .

### 3.13

#### **single test result**

value obtained by applying the standard test method fully, once, to a single specimen – may be the mean of two or more observations or the result of a calculation from a set of observations as specified by the standard test method

## 4 Principle

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Nominally identical test specimens are subjected to moisture saturation by using a vacuum system. They are then transferred into a pressurised vessel partially filled with water, where they are subjected to a conditioning procedure at 85 °C temperature and 2,1 MPa pressure for 65 hours. The ratios of comparative test results, before and after conditioning, 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.

## 5 Apparatus

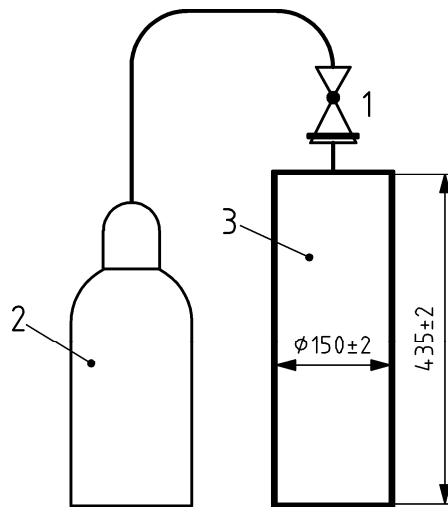
### 5.1 Conditioning regime

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

**5.1.2** Balance with sufficient capacity and accurate to 1,0 g.

**5.1.3** Pressure Vessel having the form and dimensions specified in Figure 1, similar to that described in EN 14769, and of sufficient capacity to accommodate five test specimens, of dimensions in accordance with Clause 7, for a full test.

Dimensions in millimetre

**Key**

- A Pressure Regulator
- B Compressed Air Cylinder
- C Pressure Vessel

**Figure 1 — Schematic and dimensions of typical pressure vessel**  
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**5.1.4** 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** The form and dimensions of the pressure vessel and specimen tray shown in Figures 1 and 2 have been found to yield repeatable results 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 been specifically investigated. However, early work carried out in a standard binder pressure ageing vessel to EN 14769 yielded similar results to those generated using the apparatus described in this standard.