



**SLOVENSKI STANDARD**  
**SIST EN 12697-11:2006**

**01-januar-2006**

**BUXca Yý U.**  
**SIST EN 12697-11:2004**

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Bituminous mixtures - Test methods for hot mix asphalt - Part 11: Determination of the affinity between aggregate and bitumen

Asphalt - Prüfverfahren für Heiasphalt - Teil 11: Bestimmung der Affinität von Gesteinskörnungen und Bitumen

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné a chaud - Partie 11: Détermination de l'affinité granulats-bitume

**Ta slovenski standard je istoveten z: EN 12697-11:2005**

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**ICS:**

93.080.20      Materiali za gradnjo cest      Road construction materials

**SIST EN 12697-11:2006**      **en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12697-11**

September 2005

ICS 93.080.20

Supersedes EN 12697-11:2003

English Version

## Bituminous mixtures - Test methods for hot mix asphalt - Part 11: Determination of the affinity between aggregate and bitumen

Mélanges bitumineux - Essais pour enrobés à chaud -  
Partie 11: Détermination de la affinité entre granulation et  
bitume

Asphalt - Prüfverfahren für Heiasphalt - Teil 11:  
Bestimmung der Affinität von Gesteinskrnungen und  
Bitumen

This European Standard was approved by CEN on 4 August 2005.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of 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.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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## EN 12697-11:2005 (E)

## Foreword

This European Standard (EN 12697-11:2005) 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 March 2006, and conflicting national standards shall be withdrawn at the latest by March 2006.

This European Standard supersedes EN 12697-11:2003.

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: 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 specimen.*

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: Compactability.*

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

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

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 specimens.*
- EN 12697-21, *Bituminous mixtures — Test methods for hot mix asphalt — Part 21: Indentation using plate specimens.*
- EN 12697-22, *Bituminous mixtures — Test methods for hot mix asphalt — Part 22: Wheel tracking.*
- EN 12697-23, *Bituminous mixtures — Test methods for hot mix asphalt — Part 23: Determination of the indirect tensile strength of bituminous specimens.*
- 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: Specimen preparation by impact compactor.*
- EN 12697-31, *Bituminous mixtures — Test methods for hot mix asphalt — Part 31: Specimen preparation by 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 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: 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 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.*
- prEN 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.*
- prEN 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.*

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.

## EN 12697-11:2005 (E)

## 1 Scope

This European Standard specifies procedures for the determination of the affinity between aggregate and bitumen and its influence on the susceptibility of the combination to stripping. This property is intended to be of assistance to the designer for mixture design rather than as a type test. Susceptibility to stripping, as determined by these procedures, is an indirect measure of the power of a binder to adhere to various aggregates, or of various binders to adhere to a given aggregate. The procedures can also be used to evaluate the effect of moisture on a given aggregate-binder combination with or without adhesion agents including liquids, such as amines, and fillers, such as hydrated lime or cement.

In the rolling bottle method, the affinity is expressed by visual registration of the degree of bitumen coverage on uncompacted bitumen-coated mineral aggregate particles after influence of mechanical stirring action in the presence of water.

NOTE 1 The rolling bottle test is a simple but subjective test and suitable for routine testing. It is not appropriate for aggregates that are highly abrasive.

In the static test method, the affinity is expressed by visual registration of the degree of bitumen coverage on uncompacted bitumen-coated mineral aggregate particles after storage in water.

NOTE 2 The static test is a simple but subjective test that is less precise generally but can cope with high PSV-aggregates.

In the boiling water stripping test method, the affinity is expressed by determining the degree of bitumen-coverage on uncompacted bitumen-coated aggregate after immersion in boiling water under specified conditions.

NOTE 3 The boiling water stripping test is an objective test and has a high precision. However, it is a more specialist test because it requires greater skill of the operatives and uses chemicals as reagent. The latter point may also imply extra health and safety considerations.

NOTE 4 The boiling water stripping test procedure can be used for any binder-aggregate combinations in which the mineral aggregate is calcareous, silico-calcareous or siliceous by nature.

## 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 932-1, *Tests for general properties of aggregates - Part 1: Methods for sampling*

EN 932-2, *Tests for general properties of aggregates - Part 2: Methods for reducing laboratory samples*

EN 1426, *Bitumen and bituminous binders — Determination of needle penetration*

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

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



### 3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

#### 3.1

##### **affinity between aggregate and bitumen**

degree of bitumen coverage visually determined on uncompacted bitumen coated mineral aggregate particles after influence of mechanical stirring action in the presence of water

#### 3.2

##### **percentage of stripping**

average proportion of the surface area of the aggregate particles from which the binder is soaked off due to the action of water, expressed as a percentage

#### 3.3

##### **degree of bitumen coverage**

average proportion of the surface area of the aggregate particles that are covered with bitumen, expressed as a percentage (equal to 100 minus the percentage of stripping)

#### 3.4

##### **completely coated**

aggregate particle is completely coated by binder when there are no visible breaks, however small, in the film of binder covering the particle

#### 3.5

##### **acid/base equivalence factor, $r$**

ratio of the volume of base needed to neutralise 25 ml of acid

#### 3.6

##### **normality, $N$**

molar concentration expressed in hydrogen equivalent

#### 3.7

##### **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.

#### 3.8

##### **repeatability**

precision under repeatability conditions

#### 3.9

##### **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

#### 3.10

##### **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 within probability of 95 %

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NOTE The symbol used is *r*.

**3.11****reproducibility**

precision under reproducibility conditions

**3.12****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

**3.13****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*.

**3.14****single test result**

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

**4 Principle****iTeh STANDARD PREVIEW**

An aggregate is sieved in accordance with EN 12697-2. The 8 mm to 11,2 mm (alternatively 5,6 mm to 8 mm or 6,3 mm to 10 mm) fraction is washed, dried and mixed with bitumen to obtain uniform, total coverage.

For the method described in Part A, the bitumen coated aggregate is placed loosely distributed on a metal plate or silicone coated paper, stored at ambient temperature overnight, and then divided into three part samples for analysis. Each part sample is transferred to a bottle filled with water. The bottle is sealed and placed on a bottle-rolling device. The bottles are rolled at ambient temperature and at a specified speed. At specified time intervals the degree of bitumen coverage on the aggregate particles is visually estimated by two technicians independently.

For the method described in Part B, the bitumen coated aggregate is immersed in distilled water for 48 h and the number of particles that are no longer completely coated assessed.

For the method described in Part C, the aggregate is sieved in accordance with EN 12697-2. The 7 mm to 14 mm fraction (or alternatively another fraction) is washed, dried and mixed with bitumen to obtain uniform, total coverage. The bitumen coated aggregate is subjected to stripping in boiling water under specified conditions, using a simple device in which no local overheating can occur. By contact with a chemical reagent, the consumption of which is proportional to the uncoated surface of the aggregate, the degree of bitumen coverage is determined with reference to a calibration curve established by a well-defined procedure. The reagent used is hydrochloric acid for calcareous aggregates and hydrofluoric acid for silico-calcareous or siliceous aggregates.

## Part A: Rolling Bottle Method

### 5 Equipment

#### 5.1 Test sieves

Square openings conforming to EN 12697-2; 11,2 mm and 8 mm; 8 mm and 5,6 mm; or 6,3 mm and 10 mm.

#### 5.2 Ventilated oven

Thermostatically controlled, adjustable from 100 °C to 180 °C, able to maintain the sample at  $(110 \pm 5)$  °C for drying procedure and at the specified mixing temperature  $\pm 5$  °C (refer to 6.3.1).

#### 5.3 Temperature measuring device:

**5.3.1** Temperature measuring device, capable of measuring the water temperature of 5 °C and 20 °C with an accuracy of  $\pm 1$  °C.

**5.3.2** Temperature measuring device, capable of measuring the aggregate and bitumen temperature at a range of 110 °C to 180 °C with an accuracy of  $\pm 2$  °C.

NOTE The temperature measuring device may be a thermometer or an electronical measuring device.

#### 5.4 Balance

Capacity not less than 600 g, capable of determining an aggregate portion of 510 g with an accuracy of  $\pm 2$  g, and a balance capable of determining a binder test portion of 16 g to 18 g with an accuracy of  $\pm 0,2$  g (see 6.1.3 and 6.3.6).

NOTE A "dual range" type balance may allow to weigh the aggregate and bowl with an accuracy of  $\pm 2$  g and after use of tare-function to determine the mass of binder added into the same mixing bowl with an accuracy of  $\pm 0,2$  g.

#### 5.5 Metal containers (tins)

Suitable size for bitumen heating and addition of adhesion agent.

#### 5.6 Mixing bowl

Glazed porcelain bowl or other bowl with smooth non-absorbent surface, suitable for mixing the specified test portion in accordance with Clause 6.

NOTE A porcelain bowl with diameter of 200 mm and internal height 50 mm may be considered suitable.

#### 5.7 Spatula

Made of metal or other suitable, non-absorbent material for mixing of bitumen and aggregate.

#### 5.8 Silicone coated paper or a flat metal lid

For storage of coated aggregate particles as individual, loose particles when cooling down after mixing.

NOTE A flat metal lid with a rim height of 10 mm and diameter 300 mm may be considered suitable.