



**SLOVENSKI STANDARD**  
**SIST EN 12697-23:2004**  
**01-junij-2004**

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Bituminous mixtures - Test methods for hot mix asphalt - Part 23: Determination of the indirect tensile strength of bituminous specimens

Asphalt - Prüfverfahren für Heißasphalt - Teil 23: Bestimmung der indirekten Zugfestigkeit von Asphalt-Probekörpern

Mélanges bitumineux - Méthodes d'essai pour enrobés a chaud - Partie 23:  
Détermination de la résistance a la traction indirecte des éprouvettes bitumineuses

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12697-23**

July 2003

ICS 93.080.20

English version

**Bituminous mixtures - Test methods for hot mix asphalt - Part  
23: Determination of the indirect tensile strength of bituminous  
specimens**

Mélanges bitumineux - Méthodes d'essai pour enrobés à  
chaud - Partie 23: Détermination de la résistance à la  
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Asphalt - Prüfverfahren für Heiasphalt - Teil 23:  
Bestimmung der indirekten Zugfestigkeit von Asphalt-  
Probekrpern

This European Standard was approved by CEN on 7 May 2003.

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 Management Centre 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 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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## Foreword

This document (EN 12697-23:2003) 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of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by August 2005.

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: Bitumen recovery: Rotary evaporator.*

EN 12697-4, *Bituminous mixtures — Test methods for hot mix asphalt — Part 4: Bitumen 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: Compactability.*

prEN 12697-11, *Bituminous mixtures — Test methods for hot mix asphalt — Part 11: Determination of the compatibility between aggregate and bitumen.*

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

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

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

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

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

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

prEN 12697-21, *Bituminous mixtures — Test methods for hot mix asphalt — Part 21: Indentation using plate specimens.*

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

prEN 12697-23, *Bituminous mixtures — Test methods for hot mix asphalt — Part 23: Determination of the indirect tensile strength of bituminous specimens.*

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

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

prEN 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 a bituminous specimen.*

prEN 12697-30, *Bituminous mixtures — Test methods for hot mix asphalt — Part 30: Specimen preparation, impact compactor.*

prEN 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.*

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

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

prEN 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.*

prEN 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.*

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

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

prEN 12697-40, *Bituminous mixtures — Test methods for hot mix asphalt — Part 40: Void content, compaction and hydraulic conductivity of material in the layer.*

prEN 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 matters in reclaimed asphalt.*

prEN 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: Binder content of mixtures with modified binders.*

This European Standard forms a part of a series of tests for mechanical and physical properties of bituminous mixtures.

The applicability of this European Standard is described in the product standards for bituminous materials, prEN 13108.

It does not replace any existing European Standard.

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

## 1 Scope

This European Standard specifies a test method for determining the (splitting) indirect tensile strength of cylindrical specimens of bituminous mixtures.

NOTE Determination of the water sensitivity of bituminous specimens in accordance with prEN 12697-12 is based on determination of the indirect tensile strength in accordance with this test method.

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## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

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

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

prEN 12697-30, *Bituminous mixtures – Test methods for hot mix asphalt – Part 30: Specimen preparation, impact compactor.*

prEN 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.*

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

prEN 12697-34, *Bituminous mixtures – Test methods for hot mix asphalt – Part 34: Marshall test.*

**EN 12697-23:2003 (E)****3 Terms and definitions**

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

**3.1****indirect tensile strength, *ITS***

maximum (calculated) tensile stress applied to a cylindrical specimen loaded diametrically until break at the specified test temperature and speed of displacement of the compression testing machine

**3.2****cylindrical specimen**

laboratory-made (e.g. gyratory or impact-compacted) cylindrical moulded specimen or core taken from a bituminous layer or slab

**3.3****precision**

the 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.

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**3.4****repeatability**

precision under repeatability conditions

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**3.5****repeatability conditions**

conditions in which 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

**3.6****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 %

NOTE The symbol used for repeatability limit is  $r$ .

**3.7****reproducibility**

precision under reproducibility conditions

**3.8****reproducibility conditions**

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

**3.9****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 for reproducibility limit is  $R$ .



### 3.10

#### 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

The cylindrical specimen to be tested is brought to the specified test temperature, placed in the compression testing machine between the loading strips, and loaded diametrically along the direction of the cylinder axis with a constant speed of displacement until it breaks. The indirect tensile strength is the maximum tensile stress calculated from the peak load applied at break and the dimensions of the specimen.

## 5 Apparatus

### 5.1 Compression testing machine

Compression testing machine, Marshall-type conforming to prEN 12697-34, or similar apparatus, having a recommended minimum capacity of 28 kN and capable of applying loads to test specimens at a constant rate of deformation of  $(50 \pm 2)$  mm/min after a transitory period less than 20% of the loading time. The rate of deformation is to be maintained.

NOTE For testing at low standard temperature ( $5^\circ\text{C}$ ), an ordinary 28 kN Marshall compression testing machine as described above may probably not be able to produce sufficient load, especially when 150 mm or 160 mm specimens are tested. In such cases, high-load 40 kN Marshall compression testing machines or other, more powerful types should be preferred. When testing 160 mm diameter modified asphalt specimens a load capacity up to as much as 320 kN may be required. However, when determining the indirect tensile strength at  $25^\circ\text{C}$  as part of determining the water sensitivity of bituminous specimens in accordance with prEN 12697-12, the standard 28 kN Marshall compression testing machine may be sufficient. Compression testing machines with S-shaped load cell may be more prone to horizontal movements and therefore less suitable.

### 5.2 Testing head with loading strips

Testing head for indirect tensile strength test equipped with loading strips of hardened steel having a concave surface with a radius of curvature corresponding to the nominal radius of the specimen (see Figure 1).

Loading strips for testing of cylindrical specimens shall have a radius of curvature fitting the specimen under test and a width as shown in Table 1.

Table 1 — Loading strip width

	Dimensions mm		
	100 ± 3	150 ± 3	160 ± 3
Specimen diameter	100 ± 3	150 ± 3	160 ± 3
Loading strip width	12,7 ± 0,2	19,1 ± 0,2	20,0 ± 0,2

The loading strips shall have a length of at least the length of the specimen to be tested.

NOTE 1 It is recommended that the edges of the loading strips are rounded by grinding to remove the sharp edges in order not to cut the sample during testing.

NOTE 2 Exactly fitting loading strips may be obtained using the values in Table 2.