BS EN 12697-2:2015

BSI Standards Publication

Bituminous mixtures — Test methods

Part 2: Determination of particle size distribution

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National foreword

This British Standard is the UK implementation of EN 12697-2:2015. It supersedes BS EN 12697-2:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/510/1, Asphalt products.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Bituminous mixtures - Test methods - Part 2: Determination of particle size distribution

Mélanges bitumineux - Méthode d'essai - Partie 2: Granulométrie

Asphalt - Prüfverfahren - Teil 2: Korngrößenverteilung

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Foreword

This document (EN 12697-2:2015) 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of an identical text or by endorsement, at the latest by October 2015 and conflicting national standards shall be withdrawn at the latest by October 2015.

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 supersedes EN 12697-2:2002+A1:2007.

The following is a list of changes since the previous edition:

— the series title no longer makes the method exclusively for hot mix asphalt;

— clarification of what defines constant mass to be consistent with EN 933-1;

— limit size of sample to less than 1 kg;

— clarification of procedure when washing the aggregate is required.

This European Standard is one of a series of standards as follows:

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

— EN 12697-2, *Bituminous mixtures — Test methods — 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 — 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 12697-10, *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 aggregate 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 cylindrical specimens (CY)*

— 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 method for hot mix asphalt — Part 29: Determination of the dimensions of a 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 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: 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 foreign matter 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*

— EN 12697-49, *Bituminous mixtures — Test methods for hot mix asphalt — Part 49: Determination of friction after polishing*

— prCEN/TS 12697-50, *Bituminous mixtures — Test methods for hot mix asphalt — Part 50: Resistance to Scuffing*[1)]

— FprCEN/TS 12697-51, *Bituminous mixtures — Test methods — Part 51: Surface shear strength test*

— CEN/TS 12697-52, *Bituminous mixtures — Test methods — Part 52: Conditioning to address oxidative ageing*

— prEN 12697-53, *Bituminous mixtures — Test methods — Part 53: Cohesion increase by spreadability-meter method* [2)]

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1) Currently at Enquiry stage.

2) Currently at drafting stage.

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, Former Yugoslav Republic of Macedonia, 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 Scope

This European Standard specifies a procedure for the determination of the particle size distribution of the aggregates of bituminous mixtures by sieving. The test is applicable to aggregates recovered after binder extraction in accordance with EN 12697-1 or EN 12697-39.

The applicability of this European Standard is described in the product standards for bituminous mixtures.

NOTE Fibres, solid (non-soluble during extraction) additives and (some) binder modifiers influence the test result.

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 932-6, *Tests for general properties of aggregates — Part 6: Definitions of repeatability and reproducibility*

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

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

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

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 3310-2, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate*

3 Terms and definitions

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

3.1
particle size distribution
portion of aggregate on specified sieves expressed as cumulative percentages by mass passing those sieves

3.2
D
upper sieve size of the aggregate in the bituminous mixture in millimetre (mm) according to the relevant material specification standard

4 Significance and use

The composition of a bituminous mixture in terms of binder content and aggregates grading is a significant quality parameter. The European Standard for bituminous mixtures contains some grading specifications. Controlling the mixture grading is an important instrument for product quality management.

5 Principle

The test consists of the determination of the particle size distribution of the aggregates in the bituminous mixture by sieving and weighing. A granulometric analysis of the aggregate is performed after binder extraction.

6 Apparatus

6.1 Unless stated otherwise, the apparatus as required in EN 933-1 shall be used.

6.2 Sieves with aperture size up to and including 2,8 mm shall be in accordance with ISO 3310-1.

6.3 Sieves with aperture size of 4 mm and larger shall be in accordance ISO 3310-2.

7 Sample preparation

The test shall be carried out on the material recovered after completion of the test as specified in EN 12697-1 or EN 12697-39.

It should be ensured visually that all aggregate is recovered from the mixture and that no binder remained adhering.

The recovered aggregate shall be dried to constant mass. Particles shall be separated completely.

NOTE 1 “Constant mass” is defined as successive weighings after drying at least 1 h apart not differing by more than 0,1 %.

NOTE 2 Other regimes for achieving constant mass can be used provided that they can demonstrate that they give the same results as drying at (110 ± 5) °C.

8 Procedure

The test shall be carried out on the aggregate according to EN 933-1. When less material to be tested is available than required in this European Standard, the total amount of material available shall be tested. However the minimum amount of material shall be the lesser of 50 D g and 1 000 g.

When the aggregate is visually greasy after carrying out the test in accordance with EN 12697-1, a decrement of the surface tension may be required by adding some peptizing additive.

When this test is carried out after a binder extraction procedure in which a sieving stage is incorporated containing the applicable sieves, and when the aggregate is thoroughly washed during the execution of test EN 12697-1, or when the aggregate remains from EN 12697-39, the particle size distribution may be determined by dry sieving only. However, where the proportion of material passing the 0,063 mm sieve remaining with the aggregate is found to be greater than 1,0 % of the total aggregate, the particle size distribution shall be re-determined after washing the aggregate.

If the aggregate has already been washed, the effectiveness of re-washing should be considered.

If one size portion contains visually different aggregate types, this variation should be reported and the type aggregate shall be described.

9 Calculation

The calculation shall be in accordance with EN 933-1.

Where the binder content of the bituminous mixture is determined by difference, the total mass of the material passing 0,063 mm shall be obtained by adding the mass of the material recovered from the centrifuge or filter apparatus to the mass of the aggregate passing 0,063 mm in the particle size distribution.

Where the binder content of the bituminous mixture is determined directly, the total mass of the material passing 0,063 mm shall be calculated as follows:

$$M_F = M - M_W - M_B - M_C \quad (1)$$

where

M_F is the total mass of material passing 0,063 mm sieve, in grams (g);

M is the total mass of un-dried sample, in grams (g);

M_W is the mass of water, in grams (g);

M_B is the mass of total binder, in grams (g);

M_C is the mass of material retained on the 0,063 mm sieve, in grams (g).

10 Report

The test report shall include at least the following information:

a) reference to this European Standard;

b) identification of the laboratory;

c) identification of the specimen;

d) particle size distribution by mass for all portions to nearest whole percentages, however the mass on 0,063 mm to nearest single decimal place;

e) description (colour, porosity) of the particles in each aggregate type if more than one type of aggregate is visually identified in the test portion;

f) date of the test.

11 Precision

The precision data of this test are as follows:

	Standard deviation	**Precision**
Repeatability	σ_r = 0,4 %	r = 1,0 %
Reproducibility	σ_R = 0,6 %	R = 1,7 %

where

r is the repeatability limit under repeatability *r* conditions according to EN 932-6: $r = 2{,}77 \times \sigma_r$

R is the reproducibility limit under reproducibility R conditions according to EN 932-6: $R = 2{,}77 \times \sigma_R$

σ_r the standard deviation of the test results obtained under repeatability conditions according to EN 932-6 (the repeatability standard deviation)

σ_R the standard deviation of the test results obtained under reproducibility conditions according to EN 932-6 (the reproducibility standard deviation)

NOTE The precision data as mentioned are estimated from Dutch investigations. The comparable sieving test for aggregates (EN 933-1) does not mention precision data.

Bibliography

[1] EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures*

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