BRITISH STANDARD

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12697-18:2004

Bituminous mixtures — Test methods for hot mix asphalt —

Part 18: Binder drainage

The European Standard EN 12697-18:2004 has the status of a British Standard

ICS 93.080.20

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee B/510, Road materials, to Subcommittee B/510/1, Coated macadam and hot asphalt, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 12, an inside back cover and a back cover.

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Bituminous mixtures - Test methods for hot mix asphalt - Part 18: Binder drainage

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné à chaud - Partie 18: Essai d'égouttage du liant

Asphalt - Prüfverfahren für Heißasphalt - Teil 18: Bestimmung des Ablaufens

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Foreword

This document (EN 12697-18:2004) 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of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

This document 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*

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*

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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*

prEN 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 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*

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*

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*

prEN 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*

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*

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1 Scope

This document describes two test methods:

— **basket method** (see clause 4),

— **Schellenberg method** (see clause 5).

The **basket method** (see clause 4) describes a method for determining binder drainage of bituminous mixtures. This method directly measures binder drainage, but when carried out on bituminous mixtures with fibres or mixtures whose mortar content is higher than in porous asphalt some clogging of the holes in the drainage baskets can occur, limiting the drainage of the binder. Basket method can be used either for determining the binder drainage for different binder content, or with a single binder content, eliminating the successive repetitions. It also enables the effects of varying fine aggregate types or including any anti-draining additive to be quantified.

The **Schellenberg method** (see clause 5) describes a method for determining binder drainage of bituminous mixtures. It is applicable to asphalt materials that are not porous asphalt or for those porous asphalt incorporating fibres. It can be used either for determining the binder drainage for different binder content, or with a single binder content, eliminating the successive repetitions. It also enables the effects of varying fine aggregate types or including any anti-draining additive to be quantified.

2 Normative references

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

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

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
binder drainage
binder, fine particles and additives, if any, separated from the mixture after the mixing process or during transport of the mixture to the site

4 Basket method

4.1 Principle

The quantity of material lost by drainage, after 3 h at the test temperature (see 4.4.1) is measured in mixtures placed on baskets made out of perforated metal plates.

4.2 Materials

Sufficient aggregates and binder to manufacture at least 4 kg of asphalt material. If more than one binder content is going to be tested, aggregates and binder to manufacture 2,5 kg of asphalt material per each additional binder content shall be provided. The aggregates shall be dried to constant mass and graded in the fractions appropriate to the specified grading.

The test can be carried out with samples taken during the factory production control. In that case, sampling shall be in accordance with EN 12697-27.

4.3 Apparatus

4.3.1 Oven with closed ventilation system, vibration free, fitted with thermostatic control to maintain the temperature in the vicinity of the samples to $\pm$ 2 °C in the range of 80 °C to 200 °C.

4.3.2 Drainage baskets, constructed from 3,15 mm perforated plate sieves, in accordance with ISO 3310-2, on sides and base to form (100 $\pm$ 2) mm cubes, with feet, at each corner of the base, of (3.0 $\pm$ 0.5) mm diameter and (5 $\pm$ 1) mm height (see Figure 1).

4.3.3 Balances, of suitable capacity and accuracy able to weigh to 0,1 g.

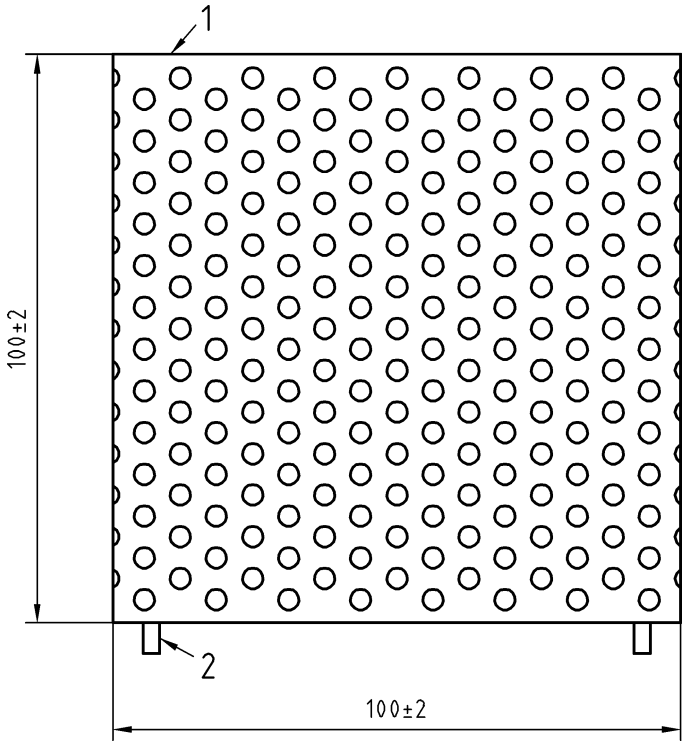
4.3.4 Thermometer, able to measure the temperature to 1 °C.

4.3.5 Metal trays, approximately 150 mm square and 10 mm deep.

4.3.6 Metal boxes, approximately 150 mm by 150 mm by 150 mm.

4.3.7 Aluminium foil.

Dimensions in millimetres



Key

1 Perforated stainless steel cube with an open top and perforations of 3,15 mm diameter

2 Foot, 3 mm diameter × 5 mm (according to ISO 3310-2)

Figure 1 — Binder drainage test basket (side elevation)

4.4 Procedure

4.4.1 For paving grade bitumen carry out the test at the temperature of mixing giving in prEN 12697-35 plus 25 °C. For modified bitumen carry out the test at the reference mixing temperature defined by the supplier plus 15 °C.

4.4.2 For aggregates with density between 2,65 Mg/m^3 and 2,75 Mg/m^3 weigh three batches of 1,1 kg aggregate, in the proportions for each fraction, to the nearest 1 g to give the specified grading. For other aggregates make the necessary corrections in order to obtain a similar volume of aggregate. Place each batch in a separate metal box.

4.4.3 Wrap three trays (see 4.3.5) with aluminium foil. Weigh each tray with foil to the nearest 0,1 g (mass W_1).

4.4.4 Mix, according to prEN 12697-35, a 1,1 kg batch of aggregate with the required amount of binder, weighed to the nearest 0,5 g. When additives are to be used, carry out the incorporation in accordance with additive supplier's instructions.

4.4.5 Discard the first mixture.

4.4.6 Repeat step 4.4.4 for the second batch of aggregate.

4.4.7 Transfer the material to a basket (see 4.4.2), ensuring that the mixer bowl and whisk are scraped thoroughly using the spatula. Carry out this operation as rapidly as possible to minimise heat losses.

4.4.8 Place the basket with the mixture on a pre-wrapped tray in the oven at the test temperature for between 3 h and 3 h 15 min.

4.4.9 Remove the basket and tray from the oven. Remove the basket from the drainage tray. When the tray has cooled sufficiently, weigh the tray and aluminium foil to the nearest 0,1 g (mass W_2).

4.4.10 After placing the first mixture in the oven, repeat the procedure in steps 4.4.6 to 4.4.9 for a duplicate sample at the same binder content.

4.4.11 If different binder contents are tested, start the test with the minimum binder content considered. Repeat the procedure in steps 4.4.1 to 4.4.10, but increasing the binder content by 0,3 % by mass, each time. In the repetitions prepare just two batches of aggregate eliminating the discarding of the first mixture. If plant produced mixture is used, start the procedure from 4.4.3, eliminating the mixing in 4.4.4.

4.5 Calculation and expression of results

4.5.1 For each mixture, calculate the drained material D from

$$D = 100 \times \frac{(W_2 - W_1)}{(1100 + B)} \quad (1)$$

where:

D is the drained material, in percent (%);

W_1 is the initial mass of the tray and foil, in grams (g) (see 4.4.3);

W_2 is the mass of the tray and foil, in grams (g) finally with the drained material (see 4.4.9);

B is the initial mass of binder in the mixture, in grams (g).

4.5.2 If, for any pair of mixtures at the same binder content, the difference in drained material D exceeds 0,5 %, repeat the test procedure and calculation, for the pair of mixtures at the same binder content.

4.5.3 Calculate the average value of at least two single results of drained material, for each binder content. Round the result to the closest 0,1 %.

4.5.4 If several binder contents are tested plot the mean drained materials against the initial mixed binder contents.

4.6 Test report

The test report shall include the following information:

a) Identification of the samples;

b) date of testing;

c) reference to this document;

d) target test temperature;

e) the average binder drainage D for each binder content.

4.7 Precision

The precision of this test has not yet been established officially.

NOTE The following precision data, in absolute terms, have been estimated from normal practice at binder contents that do not exhibit excessive drainage:

— Repeatability r = 0,1 %;

— Reproducibility R = 0,2 %.

5 Schellenberg method

5.1 Principle

The quantity of material lost by drainage, after 1 h at a temperature representative for the maximum mixing temperature expected at the mixing plant (see 4.4.1), is determined by the residue left after turning over a beaker containing the specific mixture.

5.2 Materials

Aggregates and binder sufficient to manufacture at least 3 kg of asphalt material per binder content tested. The aggregates shall be dried to constant mass and graded in the fractions appropriate to the specified grading.

The test can be carried out with samples taken during the Factory Production Control. In that case, sampling shall be in accordance with EN 12697–27.

5.3 Apparatus

5.3.1 Oven with closed ventilation system, vibration free, fitted with thermostatic control to maintain the temperature in the vicinity of the samples to ± 2 °C in the range of 80 °C to 200 °C.

5.3.2 Glass beakers, three or more with a capacity of 800 ml, (100 ± 5) mm diameter base.

5.3.3 Balances of suitable capacity and accuracy able to weigh to 0,1 g.

5.3.4 Metal boxes, approximately 150 mm by 150 mm by 150 mm.

5.3.5 Thermometer, able to measure the temperature to 1 °C in the range 80 °C to 200 °C.

5.3.6 Stop-watch.

5.3.7 1 mm sieve according to ISO 3310–1.

5.3.8 Suitable solvent.

5.3.9 Markers.

5.4 Procedure

5.4.1 For paving grade bitumen carry out the test at the temperature of mixing giving in prEN 12697-35 plus 25 °C. For modified bitumen carry out the test at the reference mixing temperature defined by the supplier plus 15 °C.

5.4.2 For aggregates with density between 2,65 Mg/m^3 and 2,75 Mg/m^3 weigh three batches of 1 kg aggregate per binder content, in the proportions for each fraction, to the nearest 1 g to give the specified grading. For other aggregates make the necessary corrections in order to obtain a similar volume of aggregate. Place each batch in a separate metal box.

5.4.3 Number three beakers (see 5.3.2 and 5.3.3) and put them in the oven at the test temperature for at least 15 min. Then weigh the beakers to the nearest 0,1 g (mass W_1).

5.4.4 Mix, according to prEN 12697-35, a 1 kg batch of aggregate with the required amount of binder. When additives are to be used, carry out the incorporation in accordance with additive supplier's instructions.

5.4.5 Immediately remove a numbered beaker from the oven, transfer the batch to it and weigh (mass W_2) to the nearest 0,1 g. Place it back in the oven. Ensure that the beaker is not outside the oven for more than 60 s. Record the time and beaker number.

5.4.6 Repeat 5.4.4 and 5.4.5 for the other two batches.

NOTE It is useful, for practical reasons, to maintain a fixed time between successive batches placed in the oven, e.g. 4 min or 5 min.

5.4.7 Remove the first beaker from the oven after (60 ± 1) min and measure the batch temperature. Discard this batch.

5.4.8 Remove the remaining two beakers after each has been in the oven for (60 ± 1) min. Immediately after removal from the oven, upturn them smoothly and hold them upside down for (10 ± 1) s. After cooling, weigh the beakers with the remaining contents to the nearest 0,1 g (mass W_3).

5.4.9 If the remaining mixture is more than 0,5 % of the original mixture's mass, and it is obviously not only drained binder, but mortar and/or aggregate particles, wash it with solvent over a 1 mm sieve. Dry and weigh the material on the sieve to the nearest 0,1 g (mass W_4).

NOTE With some modified binders a significant part of the aggregate particles (more than 5 % of the mixture) can remain stuck to the beaker after 10 s. If this occurs, the test should be repeated with a new batch increasing the test temperature 5 °C and, if the binder drained is less than before, it should be stated in the report.

5.4.10 If different binder contents are tested, start the procedure with the minimum binder content considered. Repeat the procedure in steps 5.4.2 to 5.4.9, but increasing the binder content by 0,3 % by mass, each time. If plant produced mixture is used, start the procedure from 5.4.3, eliminating the mixing in 5.4.4.

5.5 Calculation and expression of results

5.5.1 For each mixture, calculate the drained materials D, and if applicable the residue R on the 1 mm sieve, from:

$$D = 100 \times \frac{(W_3 - W_1 - W_4)}{(W_2 - W_1)} \quad (2)$$

and

$$R = 100 \times \frac{W_4}{(W_2 - W_1)} \quad (3)$$

where

D is the drained material, in percent (%);

R is the residue on the sieve, in percent (%);

W_1 is the mass of the empty beaker, in grams (g);

W_2 is the mass of the beaker plus batch, in grams (g);

W_3 is the mass of the beaker plus retained material after upturning, in grams (g);

W_4 is the mass of the dried residue retained on the sieve, in grams (g).

5.5.2 If, for any pair of mixtures at the same binder content, the difference in drained material D exceeds 0,5 %, repeat the test procedure (taking in consideration 4.4.9) and calculation, for the pair of mixtures at the same binder content.

5.5.3 Calculate the average value of at least 2 single results of drained material, for each binder content. Round the result to the closest 0,1 %.

5.5.4 If several binder contents are tested plot the mean drained materials against the initial mixed binder contents.

5.6 Test report

The test report shall include the following information:

a) Identification of the samples;

b) date of testing;

c) reference to this document;

d) target test temperature;

e) temperature in the mixture after 60 min of heat storage in the oven;

f) the average binder drainage D;

g) if applicable, the average residue on the sieve R.

5.7 Precision

The precision of this test has not yet been established officially.

NOTE The following precision data, in absolute terms, have been estimated from normal practice at binder contents that do not exhibit excessive drainage:

— Repeatability r = 0,2 %;

— reproducibility R = 0,3 %.

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