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Bitumenske zmesi - Preskusne metode - 41. del: Odpornost proti tekočinam za odtajevanje

Bituminous mixtures - Test methods - Part 41: Resistance to de-icing fluids

Asphalt - Prüfverfahren - Teil 41: Widerstand gegen chemische Auftaumittel

Mélanges bitumineux - Méthodes - Partie 41 : Résistance aux agents déverglaçants

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Bituminous mixtures - Test methods - Part 41: Resistance to de-icing fluids

Mélanges bitumineux - Méthodes - Partie 41 : Résistance aux agents déverglaçants

Asphalt - Prüfverfahren - Teil 41: Widerstand gegen chemische Auftaumittel

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12697-41:2023) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by July 2023, and conflicting national standards shall be withdrawn at the latest by July 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12697-41:2013.

EN 12697-41:2023 includes the following significant technical changes with respect to EN 12697-41:2013:

— the title no longer refers to hot mix asphalt;

— [1] examples of de-icing fluids deleted in the Scope;

— [3.1] definition clarified;

— [7.2] completion of recommendation to prepare additional specimens in case of divergence of results;

— [7.4] clarified description for drilling and sawing of test specimen;

— [7.5] NOTE deleted;

— [8.1.3] NOTE amended to normal text;

— [8.1.5] tolerance for storing amended to 70 d ± 1 d;

— [8.2.1] 2nd paragraph of NOTE amended to normal text;

— [9.3 and 9.5] NOTE deleted; reworded to normal text and placed in 7.2;

— [10] density and pH-value reporting deleted;

— [10] example of de-icing fluid “(e.g. potassium acetate)” deleted.

A list of all parts in the EN 12697 series can be found on the CEN website.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

1 Scope

This document specifies a test method to determine the resistance of bituminous materials to de-icing fluids. The procedure determines the surface tensile strength of a specimen of asphalt which has been stored in de-icing fluid.

This document is primarily used as a test on asphalt to be laid on airfields, but it can be used for asphalt to be laid on roads or other paved areas.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 12697-6, *Bituminous mixtures — Test methods — Part 6: Determination of bulk density of bituminous specimens*

EN 12697-27, *Bituminous mixtures — Test methods — Part 27: Sampling*

EN 12697-30, *Bituminous mixtures — Test methods — Part 30: Specimen preparation by impact compactor*

EN 12697-31, *Bituminous mixtures — Test methods — Part 31: Specimen preparation by gyratory compactor*

EN 12697-32, *Bituminous mixtures — Test methods — Part 32: Specimen preparation by vibratory compactor*

EN 12697-33, *Bituminous mixtures — Test method — Part 33: Specimen prepared by roller compactor*

EN 12697-35, *Bituminous mixtures — Test methods — Part 35: Laboratory mixing*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
surface tensile strength
tensile stress at maximum force when testing according to this test method

4 Principle

Testing is performed on a sawn cylindrical specimen of asphalt on which a well-defined test surface has been drilled out in the bituminous mixture to a depth of about 5 mm. A steel plate is bonded to the test surface of each specimen in turn. Four specimens are stored and four are not stored in a de-icing fluid. During testing, the plate is pulled off with a tensile force increasing at a rate of 200 N/s, the force being applied perpendicular to the test specimen surface. The tensile force at failure load and the mode of failure are recorded. The results are compared with those for specimens which have not been stored in de-icing fluid.

5 Apparatus

5.1 Vessel with a tight-fitting lid for storing specimens in the de-icing fluid.

5.2 Vacuum desiccator.

5.3 Vacuum pump for evacuation of the desiccator.

The pump shall be capable of achieving a pressure of 6,7 kPa within 10 min and maintaining this pressure within ±0,3 kPa throughout the vacuum treatment.

5.4 Coring rig (optional).

5.5 Steel plates with a diameter of (50 ± 0,5) mm .

The steel plate shall be attached by suitable means (e.g. screwed) to the tensile test machine. Minimum thickness of steel plate shall be 10 mm from bottom of steel plate to bottom of screw hole.

5.6 Base and holder for fixing the specimen prior to testing (see Figure 1).

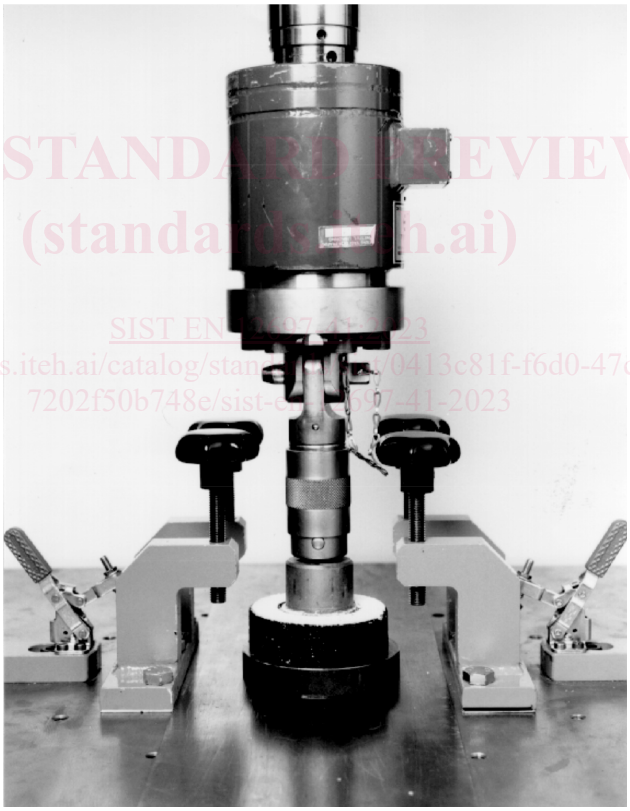

Figure 1 — Example of base, test specimen and tensile test machine

5.7 Tensile test machine, with force increasing rate control and automatic load recording fitted with suitable clamps and base to ensure that the tensile force can be applied without momentum perpendicular to the test specimen.

5.8 Circular saw capable of cutting asphalt with finish that has no imperfections discernible by touch.

5.9 Equipment for drilling out a test surface.

5.10 Conditioning device capable of maintaining a constant temperature of (23 ± 1) °C.

5.11 Heating cabinet capable of maintaining a constant temperature of (40 ± 2) °C.

6 Solvent and other materials

6.1 Epoxy adhesive.

6.2 Desiccator grease.

6.3 De-icing fluid, the concentration of which shall correspond to the highest concentration intended for use on site.

7 Preparation of test specimens

7.1 Prepare a laboratory sample of asphalt mixture in accordance with EN 12697-35 or at an asphalt mixing plant.

7.2 Compact a sample of a height of (60 ± 10) mm by roller compactor in accordance with EN 12697-33 and core out not less than four cylinders from the slab with a diameter of (100 ± 5) mm in accordance with EN 12697-27. Alternatively, one of the following methods of compaction can be used:

— compact not less than four cylinders with a diameter of (100 ± 5) mm and a height of (60 ± 10) mm by impact compactor in accordance with EN 12697-30, by gyratory compactor in accordance with EN 12697-31 or by vibratory compactor in accordance with EN 12697-32; or

— core not less than four cylinders with a diameter of (100 ± 5) mm from a compacted pavement of a thickness of at least 60 mm and trim the top and/or bottom to produce a height of (60 ± 10) mm in accordance with EN 12697-27.

The compaction procedure shall be reported.

It is recommended to prepare additional specimens in case of divergence of results.

7.3 Allow the cylinders to reach room temperature. Mark them with a unique identification number. Store the cylinders with an end face on a flat surface at a temperature of (23 ± 2) °C for (16 ± 4) h. Determine the bulk density for each cylinder according to EN 12697-6. Divide the cylinders into two groups (a wet and a dry group) in which the mean bulk densities of the two groups shall not differ by more than 0,030 Mg/m^3.

7.4 Saw the cylinders in half in a plane perpendicular to its axis to get two test specimens of a height of (30 ± 5) mm. Carefully drill a circular notch centrally into the centre of the cut surface of each specimen with a diameter of (50 ± 2) mm and a depth of (5 ± 1,5) mm .

7.5 Allow the specimens to dry with an end face on a flat surface at an ambient temperature of (23 ± 2) °C between 3 days and 42 days from the time of their manufacture.

7.6 Prepare the test surfaces of all specimens from both groups by gluing a test plate to the test surface of each of the specimens by carefully applying a thin layer of epoxy adhesive. Allow the specimens to cure at a temperature of (23 ± 2) °C for (20 ± 1) h.

8 Procedure

8.1 Storage

8.1.1 Store the specimens from the dry group at a temperature of (23 ± 2) °C.

8.1.2 Place the specimens from the wet group in the desiccator with the test plate facing upwards.

8.1.3 Pour de-icing fluid at a temperature of (23 ± 2) °C into the desiccator to a level 20 mm to 30 mm above the top of the specimen surface. Evacuate to an absolute pressure of (6,7 ± 0,3) kPa within (10 ± 1) min. Keep the absolute pressure at (6,7 ± 0,3) kPa for 3 h ± 10 min.

The evacuation rate and pressure may be adjusted with a valve or rubber hose with clamp.

8.1.4 Turn off the pump and carefully admit air into the desiccator until atmospheric pressure is reached. Take the specimens out of the desiccator.

8.1.5 Continue to store the specimens in a vessel with a tight-fitting lid at a temperature of (40 ± 2) °C for a further 70 d ± 1 d. The specimens shall be placed with the test plate upwards immersed in de-icing fluid to a level 20 mm to 30 mm above the top of the specimen surface.

8.1.6 After storage, condition the specimens to the test temperature (23 ± 1) °C in the de-icing fluid for (20 ± 1) h.

8.2 Test

8.2.1 Take the specimen out of the de-icing fluid and dry the steel plate with paper. Directly fix the specimen in the tensile test machine and the test plate attached to the machine. Apply an increase in tensile force of (200 ± 10) N/s to the test surface until failure occurs. The force shall be applied perpendicular ±5° to the test surface. The test is carried out at (23 ± 1) °C.

It may be checked that any shear force is not greater than tan(5°) = 0,087 5 times the vertical force to ensure that the load is applied perpendicular within the required tolerance.

NOTE The method to check that the load is applied perpendicular within the required tolerance will depend on the equipment used.

8.2.2 Record the tensile force, F_{max} in newtons to one decimal place together with the type of failure (superficial, deep within the asphalt specimen or de-bonding from the glue).

8.2.3 Repeat 8.2.1 and 8.2.2 for the remaining specimens in both the wet and dry groups.

9 Calculation and expression of results

9.1 Calculate the surface tensile stress, in newtons per square millimetre to one decimal place, according to the formula:

$$\sigma = \frac{F_{\max}}{A} \tag{1}$$

where

σ is the tensile stress, in newtons per square millimetre (N/mm²);

$F_{\max}$ is the maximum tensile force recorded, in newtons (N);

A is the area of the test surface, in square millimetres (mm²).

9.2 Calculate the arithmetic mean tensile stresses from the four test specimens in the dry group, σ_{dry}, and from the four test specimens in the wet group, σ_{wet}.

9.3 If the difference between the mean tensile stress and any individual tensile stress exceeds 20 % of the mean tensile stress for either the wet or the dry groups, repeat Clause 7, 8 and 9.1 for two further specimens in each group. Calculate the arithmetic mean of all the values for each group. Reject any individual tensile stress value if it differs from the mean tensile stress for the group by more than 20 % of the mean tensile stress.

9.4 If any additional sample is rejected, recalculate the means for each group and repeat 9.3.

9.5 If either mean is calculated from less than four measurements, repeat Clause 7 to 9.4 for further specimens until the mean of both the dry and wet groups are the average of not less than four determinations.

9.6 Calculate the retained strength after storage in de-icing fluid, β, in per cent with no decimal places according to the formula:

$$\beta = \frac{\sigma_{wet}}{\sigma_{dry}} \times 100 \tag{2}$$

where

β is the retained strength after storage in de-icing fluid in per cent (%);

σ_{wet} is the arithmetic mean wet tensile stress, in newtons per square millimetre (N/mm²);

σ_{dry} is the arithmetic mean dry tensile stress, in newtons per square millimetre (N/mm²).