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BSI Standards Publication

Cold applied joint sealants — Test methods

Part 4: Determination of the change in mass and volume after immersion in test fuels and liquid chemicals

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National foreword

This British Standard is the UK implementation of EN 14187-4:2017. It supersedes BS EN 14187-4:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/510/3, Materials for concrete roads.

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Cold applied joint sealants - Test methods - Part 4: Determination of the change in mass and volume after immersion in test fuels and liquid chemicals

Mastics pour joints appliqués à froid - Méthodes d'essai - Partie 4 : Détermination de la variation de masse et de volume après immersion dans des carburants d'essai et des produits chimiques liquides

Kalt verarbeitbare Fugenmassen - Prüfverfahren - Teil 4: Bestimmung der Massen- und Volumenänderung nach Lagerung in Prüfkraftstoffen und flüssigen Chemikalien

This European Standard was approved by CEN on 6 February 2017.

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

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European foreword

This document (EN 14187-4:2017) 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of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

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 14187-4:2003.

Apart from editorial changes the following major changes have been made in this revision:

a) Change of the title;

b) Table 1, Change of the test fuels and addition of de-icing liquids in accordance with new technical requirements.

This European Standard is one of a series of standards as listed below:

EN 14187-1, *Cold applied joint sealants — Test methods — Part 1: Determination of rate of cure*.

EN 14187-2, *Cold applied joint sealants — Test methods — Part 2: Determination of tack free time*.

EN 14187-3, *Cold applied joint sealants — Test methods — Part 3: Determination of self-levelling properties*.

EN 14187-4, *Cold applied joint sealants — Test methods — Part 4: Determination of the change in mass and volume after immersion in test fuels and liquid chemicals*.

EN 14187-5, *Cold applied joint sealants — Test methods — Part 5: Determination of the resistance to hydrolysis*.

EN 14187-6, *Cold applied joint sealants — Test methods — Part 6: Determination of the adhesion/cohesion properties after immersion in test fuels and liquid chemicals*.

EN 14187-7, *Cold applied joint sealants — Test methods — Part 7: Determination of the resistance to flame*.

EN 14187-8, *Cold applied joint sealants — Test methods — Part 8: Determination of resistances to artificial weathering by UV-irradiation*.

EN 14187-9, *Cold applied joint sealants — Test methods — Part 9: Function testing of joint sealants*.

WARNING — Attention is drawn to the health and safety at work and the need to ensure that this test is carried out under suitable environmental conditions to provide adequate protection to persons against the risk of contact or inhalation of toxic liquid chemicals.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard describes a test method for determining the resistance of cold applied joint sealants to the action of liquid chemicals by measuring the change in mass and volume after immersion in test fuels or in liquid chemicals.

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 14188-4, *Joint fillers and sealants - Part 4: Specifications for primers to be used with joint sealants*

EN ISO 6927, *Buildings and civil engineering works - Sealants - Vocabulary (ISO 6927)*

EN ISO 8340, *Building construction - Sealants - Determination of tensile properties at maintained extension (ISO 8340)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 6927 apply.

4 Principle

Test specimens cut from (2 ± 0,1) mm thick sheets of the cured cold applied joint sealant are immersed for a required period of time in the test fuel or liquid chemical. Changes in mass and volume of the test specimens after immersion are determined.

5 Apparatus and materials

5.1 Stoppered glass bottle or tube of such dimension that the suspended test specimens remain completely immersed in the specified volume of the test liquid and are freely exposed on all surfaces without restraint.

5.2 Balance, capable of weighing the suspended test specimens immersed in distilled water and accurate to ≤ 1 mg.

5.3 Mould from aluminium or brass with an internal diameter of (150 ± 10) mm and a depth of (2,0 ± 0,1) mm.

5.4 A convection type oven, controllable at temperatures between 35 °C and 50 °C with an accuracy of 2 °C.

5.5 Test liquids with compositions as given in Table 1. In addition the relevant jet fuel, hydraulic oil, engine oil, defrosting fluid, glycol or any other liquid chemical can be used as required from the intended application (see Annex A).

Table 1 — Composition of test liquids and liquid chemicals

Chemical liquid	**Test fuel I in accordance with** EN 228 **with maximum content of 20 % bioalcohol** Vol-%	**Test fuel II** Vol-%	**Test liquid DC Ground** W-%	**Test liquid DC Aircraft** W-%	**other liquid chemical**
Isooctane	25,0	70	—	—	in accordance with Annex A, Table A.1
Toluene	42,5	30	—	—	
Ethanol	5,0	—	—	—	
Diisobutylene	12,0	—	—	—	
Methanol	15,0	—	—	—	
Water	0,5	—	60	60	
Sodium formate [a]	—	—	40	—	
Ethylene glycol	—	—	—	40	

[a] With pH buffer, pH < 10,5 Vol-% percent by volume W-% percent by weight

6 Preparation of test specimens

Prepare sheets of the cold applied joint sealant of (2,0 ± 0,1) mm thickness in the mould (5.3) in such a way that air bubbles are avoided. For each test three test specimens with a diameter of (30 ± 1) mm are cut from the sheet.

7 Conditioning

Condition the test specimens in accordance with EN ISO 8340 either method A or method B. If method B is used, after conditioning store the test specimens 24 h at (23 ± 2) °C and (50 ± 5) % relative humidity before immersion in test fuel or other liquid chemical.

8 Procedure

8.1 Temperature of immersion

Carry out the immersion of the specimens in the stoppered glass bottle or tube (5.1) at one or more of the following temperatures:

— (23 ± 2) °C;

— (35 ± 2) °C;

— (50 ± 2) °C.

8.2 Time of immersion

Carry out the immersion of the specimens for one or more of the following periods of time:

— 8 h;

— 24 h;

— 72 h;

— 7 days;

— 21 days.

8.3 Test procedure

8.3.1 After conditioning weigh each test specimen with the balance (5.2) in air to the nearest milligram, m_1, and then weigh again each test specimen in distilled water at standard laboratory temperature, m_2.

8.3.2 Place the test specimens in the stoppered glass bottle or tube (5.1) in the test fuel or other liquid chemical. The test fuel or liquid chemical should be kept for the required time of immersion (8.2) at the temperature of immersion (8.1).

8.3.3 At the end of the period of immersion, bring the test specimens to standard laboratory temperature of (23 ± 2) °C by quickly transferring them to a fresh sample of the test liquid at this temperature for a period of 10 min to 30 min. Remove surplus test liquid from the surface of each test specimen. Immediately determine the mass of each test specimen in air, m_3, to the nearest milligram, and then weigh them in distilled water, m_4, at the standard laboratory temperature.

8.3.4 Place the test specimens in the convection type oven (5.4) at a temperature of (50 ± 2) °C until the mass of the test specimen is decreasing less than 1 % within 24 h. Again, determine the mass of each test specimen to the nearest milligram, m_5.

9 Expression of results

9.1 Change in volume

Calculate the percentage change in volume, ΔV_{100}, for each test specimen using the following formula:

$$\Delta V_{100} = \frac{\left(m_3 - m_4\right) - \left(m_1 - m_2\right)}{\left(m_1 - m_2\right)} \times 100 \qquad (1)$$

where

m_1 is the initial mass of the test specimen in air, expressed in milligrams (mg);

m_2 is the initial apparent mass of the test specimen in water, expressed in milligrams (mg);

m_3 is the mass of the test specimen in air after immersion, expressed in milligrams (mg);

m_4 is the apparent mass of the test specimen in water after immersion, expressed in milligrams (mg).

Take as the result the average of the values obtained for the three test specimens.

9.2 Change in mass after drying

Calculate the percentage change in mass after drying, ΔM_{100}, for each test specimen using the following formula:

$$\Delta M_{100} = \frac{m_5 - m_1}{m_1} \times 100 \quad (2)$$

where

ΔM_{100} is the change in mass after drying, expressed in percent (%);

m_1 is the initial mass of the test specimen in air, expressed in milligrams (mg);

m_5 is the mass of the test specimen after drying, expressed in milligrams (mg).

Take as the result the average of the values obtained for the three test specimens.

10 Test report

The test report shall include at least the following information:

a) reference to this European Standard;

b) name and type of the cold applied joint sealant;

c) batch of sealant from which the test specimens were produced;

d) description of the test liquid;

e) the time and temperature of immersion;

f) note of the appearance of the test specimen (i.e. cracking, delamination);

g) note of the appearance of the test liquid (i.e. discoloration, sedimentation);

h) any deviations from the specified test conditions;

i) test results;

j) date of test.

Annex A
(informative)

List of liquid chemicals

Table A.1 — Liquid chemicals

No	Chemical group	Test liquid
1	2	3
LC-1	Gasoline or super gasoline in accordance with EN 228 with maximum content of 20 % bioalcohol	42,5 Vol-% Toluene 25,0 Vol-% Isooctane 15,0 Vol-% Methanol 5,0 Vol-% Ethanol 12,0 Vol-% Diisobutylene 0,5 Vol-% Water
LC-2	Jet fuel	1. Jet fuel 100 LL 2. Jet fuel Jet-A1 with additives (Nato-code F 34)
LC-3	Light fuel oil, diesel unused engine oils unused gear oil with flash-point > 55 °C	Test liquid A 20/NP II
LC-4	All hydrocarbons (including LC-2, LC-3)	60,0 Vol-% Toluene 30,0 Vol-% Xylene 10,0 Vol-% Methylnaphthalene
LC-4a	Benzene and benzene-containing mixtures (including LC-2, LC-3 and LC-4 to LC-4b)	30,0 Vol-% Benzene 30,0 Vol-% Toluene 30,0 Vol-% Xylene 10,0 Vol-% Methylnaphthalene
LC-4b	Crude oil	crude oil

No	Chemical group	Test liquid
1	2	3
LC-5	Mono- and multifunctional alcohols (max. 48 % methanol), glycolethers (including LC-5b)	48,0 Vol-% Methanol 48,0 Vol-% Isopropanol 4,0 Vol-% Water
LC 5a	All alcohols and glycolethers (including LC-5 and LC 5b	Methanol
LC 5b	Mono- and multifunctional alcohols	48,0 Vol-% Ethanol 48,0 Vol-% Isopropanol 4,0 Vol-% Water
LC-6	Chlorinated hydrocarbons ≥ C_2 (including LC 6b)	Trichloroethylene
LC-6a	All chlorinated hydrocarbons = C_1 (including LC-6 and LC-6b)	Methylenedichloride
LC-6b	Aromatic chlorinated hydrocarbons	Monochlorobenzene
LC-7	All organic esters and ketones	50,0 Vol-% Ethylacetate 50,0 Vol-% Methyl-isobutylketone
LC-7a	Aromatic esters and ketones	50,0 Vol-% Salicylic-acid-methylester 50,0 Vol-% Acetophenone
LC-8	Aqueous solutions of aliphatic aldehydes up to 40 W-%	Solution of formaldehyde in water (35–40 W-%)
LC-8a	Aqueous solutions of aliphatic aldehydes up to 40 W-% (including LC-8)	50,0 Vol-% n-Butyraldehyde 50,0 Vol-% n-Heptaldehyde
LC-9	Aqueous solutions of organic acids up to 10 W-% and their salts	Aqueous acetic acid (10 W-%)
LC-9a	Aqueous solutions of organic acids exclusive formic acid and their salts	50,0 Vol-% Acetic acid 50,0 Vol-% Propionic acid
LC-10	Inorganic non oxidizing acids up to 20 % as well as inorganic salts in water (pH < 6) except HF and its salts	Sulfuric acid (20 W-%)
LC-11	Inorganic bases as well as inorganic salts in water (pH > 8) except ammonia and oxidizing solutions of salts	Sodium hydroxide (20 W-%)

No	Chemical group	Test liquid
1	2	3
LC-12	Aqueous solutions of inorganic non oxidizing salts with pH between 6 and 8	Sodium chloride (20 W-%)
LC-13	Amines and their salts in aqueous solutions	35,0 Vol-% Triethanolamine 30,0 Vol-% n-Butylamine 35,0 Vol-% N,N-Dimethylaniline
LC-14	Cyclic and non-cyclic ethers (inclusive LC-14a)	Tetrahydrofuran (THF)
LC-14a	Non-cyclic ethers	Diethylether

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