BRITISH STANDARD

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14840:2005

Joint fillers and sealants — Test methods for preformed joint seals

The European Standard EN 14840:2005 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/510/3, Materials for concrete roads, which has the responsibility to:

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Summary of pages

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English Version

Joint fillers and sealants - Test methods for preformed joint seals

Produits d'obturation et de scellement de joints - Méthodes d'essai pour les joints d'étanchéité moulés

Fugeneinlagen und Füllstoffe - Prüfverfahren für vorgeformte Fugenprofile

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Foreword

This European Standard (EN 14840:2005) 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of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

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1 Scope

This European Standard specifies the test methods for preformed joint seals made of vulcanised rubber for use in concrete pavements.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 26927:1990, *Building construction — Jointing products — Sealants — Vocabulary (ISO 6927:1981)*

ISO 37, *Rubber, vulcanised or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic -- Accelerated ageing and heat resistance tests*

ISO 815, *Rubber, vulcanised or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*

ISO 1431-1, *Rubber, vulcanised or thermoplastic — Resistance to ozone cracking — Part 1:Static and dynamic strain testing*

ISO 3384, *Rubber, vulcanised or thermoplastic — Determination of stress relaxation in compression at ambient and at elevated temperatures*

ISO 2285, *Rubber, vulcanized or thermoplastic -- Determination of tension set under constant elongation, and of tension set, elongation and creep under constant tensile load*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 26927:1990 apply.

4 Test methods

4.1 Tensile strength and elongation at break

The tensile strength and elongation at break shall be determined by the method specified in ISO 37. Dumb-bell shaped test pieces of types 1, 2, 3 or 4 shall be used. The test report shall report the type of test pieces used.

NOTE Type 2 should be the preferred type.

4.2 Compression set in air

4.2.1 General

The measurements shall be carried out – if possible – in the direction of compression of the seal in service.

4.2.2 Compression set at 70 °C

The compression set shall be determined in accordance with ISO 815 at 70 °C, using the small type test piece. The duration of the test shall be 24 h.

Where the cross section is too small to obtain compression buttons from the product, as an alternative to moulding buttons, the tension set of the product shall be determined using the method specified in ISO 2285, with a strain of 50 % and shall comply with the same test conditions (except strain) and requirements as for compression set.

4.2.3 Compression set at low temperature (–25 °C)

The compression set shall be determined in accordance with ISO 815 at –25 °C, using the small type test piece.

4.3 Accelerated ageing in air

Test pieces prepared for the determination of hardness and for the determination of tensile strength and elongation at break (see 4.1.) shall be aged for 7 days at 70 °C in air by the normal oven method specified in ISO 188.

4.4 Stress relaxation in compression

The stress relaxation shall be determined by method B of ISO 3384 using pieces of 100 mm length of the preformed joint seal after applying mechanical and thermal conditioning. The preformed joint seals shall be compressed in suitable forms to nominal joint width.

Measurements shall be taken after 3 hours, 1 day, 3 days, 7 days, 30 days and 100 days at 50 °C. The best fit straight line shall be determined by regression analysis using a logarithmic time scale.

4.5 Recovery at low and high temperatures

4.5.1 Test principle

Test specimens of the preformed joint seals shall be compressed between two parallel plates and kept for a defined time at low or high temperatures. After release the degree of recovery is determined.

NOTE This procedure allows a quick test to check the profile quality in the case of joint opening. To check the long term behaviour of a profile the stress-relaxation test should be used.

4.5.2 Apparatus and materials

4.5.2.1 Compression device, meeting the requirements of ISO 5893, consisting of two parallel, flat, highly polished plates made from chromium-plated or stainless steel or other corrosion-resistant material. The compression plates shall be flat within 0,01 mm.

4.5.2.2 Stainless steel spacers are required to adjust a distance between the compression plates according to the normal joint width in the place of use.

4.5.2.3 Measuring device to measure the dimension of the test piece.

4.5.2.4 Convection type oven, controllable at (70 ± 1) °C.

4.5.2.5 Container to maintain a temperature of (–25 ± 2) °C.

4.5.3 Procedure

For each test, 3 segments of the preformed joint seal of 125 mm length shall be compressed in the compression device to the normal joint width in the place of use, using the stainless steel spacers and then stored according to the following test conditions:

— stored (24 h ± 15 min) at –25 °C, remove the clamp and store the test specimen in the relieved state for (1 h ± 5 min) at –25 °C;

— stored (72 h ± 15 min) at 70 °C, remove the clamp and store the test specimen in the relieved state for (1 h ± 5 min) at 23 °C.

After this time the recovered section width of the test specimen shall be measured using the measuring device.

4.5.4 Calculation and expression of result

The recovery shall be calculated as follows:

$$\text{Recovery } (\%) = \frac{\text{recovered section width} \times 100}{\text{original section width}} \quad (1)$$

4.5.5 Precision

Estimates of the repeatability and reproducibility of this test method are not available yet but will be included by amendments when available.

4.6 Ozone resistance

The ozone resistance is determined by the method specified in ISO 1431-1 under the conditions set out below:

— Ozone concentration, (50 ± 5) pphm;

— Temperature, (40 ± 1) °C;

— Pretension (conditioning), (72 ± 2) h;

— Exposure time, (48 ± 1) h;

— Elongation for 36 to 75 IRHD, (20 ± 2) %;

— Elongation for 76 to 85 IRHD, (15 ± 2) %;

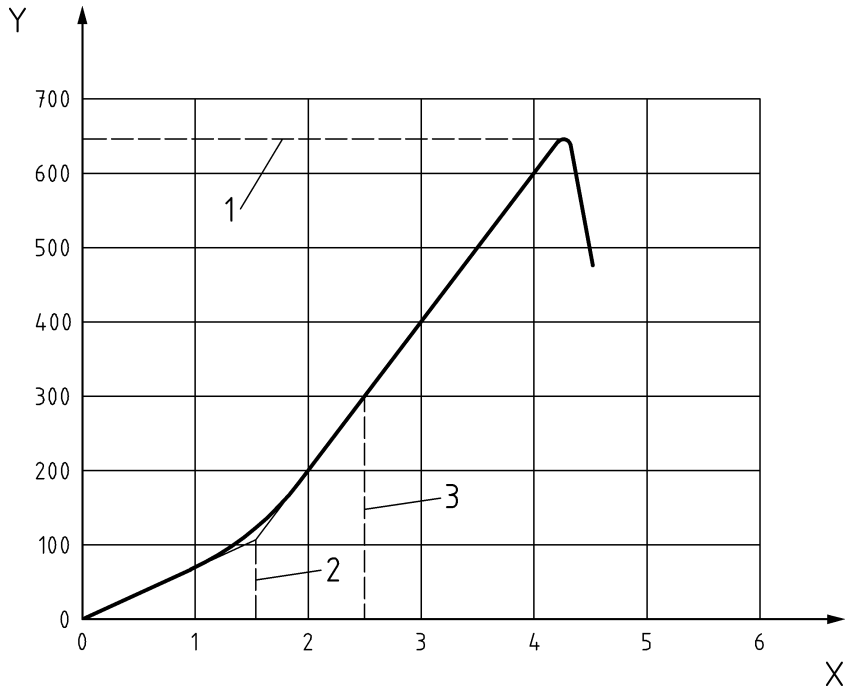
— Relative humidity, (55 ± 5) %.

4.7 Protection against over-extension

A piece of 1 000 mm length with a free length of 500 mm between clamps shall be extended at 50 mm/min at room temperature until first break of the fibre for protection against over-extension.

The elongation at first effect (change in the slope of the curve) of fibre, the elongation at 300 N tensile force and the tensile force of first break of fibre are taken out of the measurement.

NOTE Preformed joint seals contain a glass fibre to avoid over-extension of the profile during installation. The efficiency of this glass fibre is controlled by extending the profile in a tensile testing machine until first break of the fibre.



Key

Y tensile force (N)
X elongation (%)
1 tensile force at first break of fibre
2 first effect of fibre
3 elongation at 300 N

Figure 1 — Example of a tensile force diagram

4.8 Function testing for cold climate areas

4.8.1 General

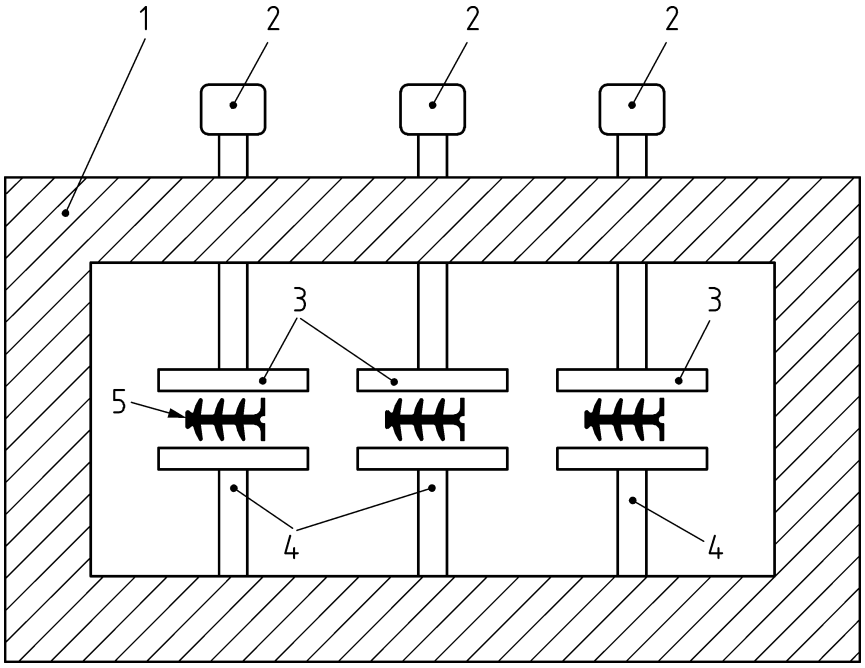
This test is to measure the ability of preformed joint seals to retain their elastic properties at low temperatures and after prolonged compression at high temperatures at constant strain.

4.8.2 Apparatus

The testing apparatus (see Figure 2) shall consist of a climatic chamber capable of regulating the temperature between +30 °C and –30 °C with the accuracy of ±2 °C.

Inside the chamber, a tensile and compression test rig shall be placed having at least three pairs of plates for testing the three specimens simultaneously. The plates-ends shall consist of parallel, flat, highly polished stainless steel plates, between the faces of which the test specimens are compressed. The plates shall be sufficiently rigid to withstand the stress without bending and of sufficient size to ensure that the compressed test specimen is within the area of the plates.

The test rig shall be motor driven without significant slip or backlash, giving a constant rate of movement. The rate of movement shall be 0,60 mm/h ±10 %. Three load cells shall be connected to an electronic data collection device for measuring and recording of the compression force with the accuracy of ±2 % of the minimum compression force applied to each system.



Key

1 climatic chamber capable of regulating the temperature between +30 °C and –30 °C
2 load cells connected to an electronic data collection device for measuring and recording of the compression force
3 stationary plates
4 movable plates
5 test specimens

Figure 2 — Principle sketch of the testing apparatus

4.8.3 Test specimens

For each test, at least three test specimens shall be cut from a preformed joint seal. The preferable lengths of the test specimens shall be (70 ± 1) mm or (100 ± 1) mm.

4.8.4 Procedure

4.8.4.1 Function test

The specimens are placed between the plates in the direction of compression of the seal in service and compressed to their nominal joint width (for example 8 mm) ±2 % as specified for the product by the manufacturer.

The assembly shall then be introduced into an oven which shall operate at (70 ± 1) °C. The duration of ageing shall be 30 days.

After ageing the function test shall start at (11 ± 1) °C with the gap between the plates equal to the nominal joint width and settled as zero change of joint width.

The movement of the plates shall be synchronised with the change of the temperature in such a way that a width of 80 % of the normal width in the place of use is achieved at the highest temperature of +25 °C, and the maximum width of 150 % is achieved at the lowest temperature of –25 °C (see Figure 3).

Joint compression is the increment Δ of joint chamber width, divided by nominal joint chamber width in the place of use.

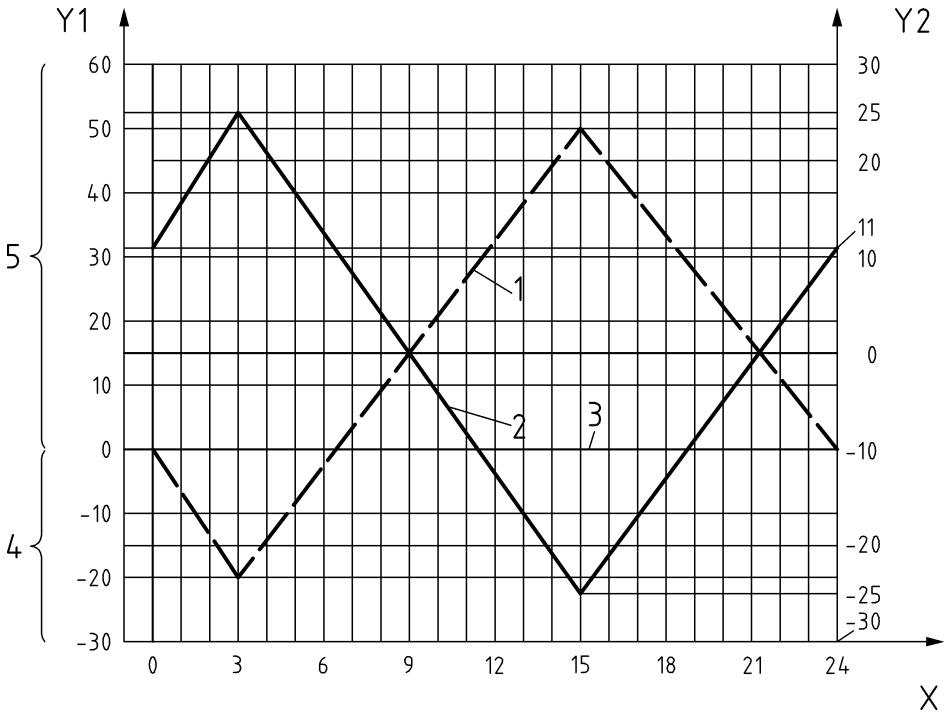
NOTE 1 For example nominal joint chamber width = 8 mm, min width should be 6,4 mm, and max width should be 12 mm.

The rate of the deformation shall be fixed so that the total width change of 70 % can be made within 12 h.

NOTE 2 For example nominal joint chamber width = 8 mm, deformation rate is 5,6 mm/12 h = 0,47 mm/h. This rate should be toleranced by ±10 %.

One complete cycle takes 24 h.

Three complete test cycles, as shown in Figure 2, shall be done.



Key

Y1 joint compression (%) $= \left(\frac{\text{delta joint width} \times 100}{\text{nominal joint width}} \right)$

Y2 temperature (°C)
X time (h)

1 joint compression (%)
2 temperature (°C)
3 0 = nominal joint width
4 closure
5 opening

Figure 3 — Test cycle

4.8.5 Calculation and expression of result

Measurements of the compression force, in (kN/m), as a function of temperature and joint width shall be performed. The results can be presented in time – force – diagrams as curves showing variation of the compression force for the samples.

The minimum compression force from 3 cycles of each test specimen at –25 °C is taken.

Express the result as the lowest value of the minimum compression force at –25 °C of the three test specimens.

4.8.6 Precision

Estimates of the repeatability and reproducibility of this test method are not available yet but will be included by amendments when available.

5 Test report

For each test method the test report shall include the following information:

a) reference to this European Standard;

b) name and type of rubber seal/profile;

c) batch of rubber seal/profile;

d) the method of conditioning used;

e) test temperature;

f) period of test;

g) test results;

h) details of any unusual behaviour;

i) any deviations from the specified test conditions;

j) date of test, name of laboratory.

Bibliography

[1] ISO 3302-1, *Rubber — Tolerances for products — Part 1: Dimensional tolerances*

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