BRITISH STANDARD

BS EN
1110:2000

Flexible sheets for waterproofing — Bitumen sheets for roof waterproofing — Determination of flow resistance at elevated temperature

The European Standard EN 1110:1999 has the status of a British Standard

ICS 91.100.50

National foreword

This British Standard is the official English language version of EN 1110:1999.

The UK participation in its preparation was entrusted to Technical Committee B/546, Flexible sheets for waterproofing, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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English version

Flexible sheets for waterproofing - Bitumen sheets for roof waterproofing - Determination of flow resistance at elevated temperature

Feuilles souples d'étanchéité - Feuilles d'étanchéité de toiture bitumineuses - Détermination de la résistance au fluage à température élevée

Abdichtungsbahnen - Bitumenbahnen für Dachabdichtungen - Bestimmung der Wärmestandfestigkeit

This European Standard was approved by CEN on 11 July 1999.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 254, Flexible sheets for waterproofing, 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of an identical text or by endorsement, at the latest by February 2000, and conflicting national standards shall be withdrawn at the latest by September 2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is intended for the characterization and/or classification of bitumen sheets as manufactured or supplied before use. The test method relates exclusively to products, or to their components where appropriate, and not to waterproofing membrane systems composed of such products and installed in the works.

This test is intended to be used in conjunction with European Standards on product specification for reinforced bitumen sheets for roofing.

This test is used to determine the flow resistance of the coating or to determine the flow resistance limit of a bitumen sheet. The test result depends on the type of coating, the sheet thickness, type and position of the reinforcement and type and mass of the mineral granules on the surface. The use of test results directly to compare the performance of the coating in sheets of different composition is strictly limited because of the influence of other parameters which have not been quantified. Results from sheets with the same composition can be used to compare the performance of the coating directly.

The test primarily serves to characterize bitumen sheets. It can also be used to evaluate the change in flow resistance limit as a result of artificial ageing. It is not safe to relate the test results directly to the actual performance to be expected at elevated temperatures in service.

1 Scope

This European Standard specifies the determination of flow resistance of bitumen sheets at elevated temperature. The test is carried out on both the upper face and lower face of the sheet either at a specified temperature or consecutively at different temperatures in order to determine the flow resistance limit.

Therefore the test can be used to provide proof of the flow resistance required for a product or to determine the flow resistance limit specific to the product, e.g. in order to establish the change in this behaviour as a result of artificial ageing.

The test is not applicable to bitumen sheets without reinforcement.

2 Normative references

This European Standard incorporates by dated or undated references provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

ISO 5725:1986 Precision of test methods - Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.

3 Definitions

For the purposes of this standard the definitions indicated in **3.1** to **3.3** and in the corresponding European Standards on product specifications apply.

3.1 flow resistance the ability of bitumen sheet test specimens to be suspended vertically under specified temperature conditions without its coating moving by more than 2 mm compared to the reinforcement

3.2 flow resistance limit (*F*) the temperature at which the coating of a vertically suspended bitumen sheet test specimen moves under specified conditions by 2 mm compared to the reinforcement (see Figure 2)

3.3 flow the maximum distance between the bottom edges of mark 1 and mark 2 on the faces of the test specimens due to the displacement of the coating (see Figure 1)

4 Principle

Test specimens taken from the test sample are suspended vertically in an oven at a specified temperature. The displacement of the coating relevant to the reinforcement is measured on both faces of the test specimen after a specific time. Failure is defined as a mean displacement greater than 2,0 mm. The flow resistance limit is determined by interpolation of the results at two test temperatures.

5 Apparatus

5.1 Oven with circulating air (without fresh air supply) and a maximum temperature deviation of ± 2 °C in the test area. After the door has been opened for 30 s, the recovery period to attain the working temperature again shall not exceed 5 min.

5.2 Thermosensor, connected to an external electronic thermometer capable of measuring to ± 1 °C in the temperature range.

5.3 Suspension devices (e.g. clamps) at least 100 mm wide with which the test specimens are held over their full width in line and be suspended in the test area (see Figure 1).

5.4 Optical measuring instrument (e.g. graduated magnifying glass) with a scale division of at least 0,1 mm.

5.5 Device for inserting round metal lugs, inside diameter approximately 4 mm.

5.6 Device for drawing a straight marking line (e.g. as shown in Figure 1).

5.7 Ink marker, with line width not exceeding 0,5 mm and white, water-resistant ink.

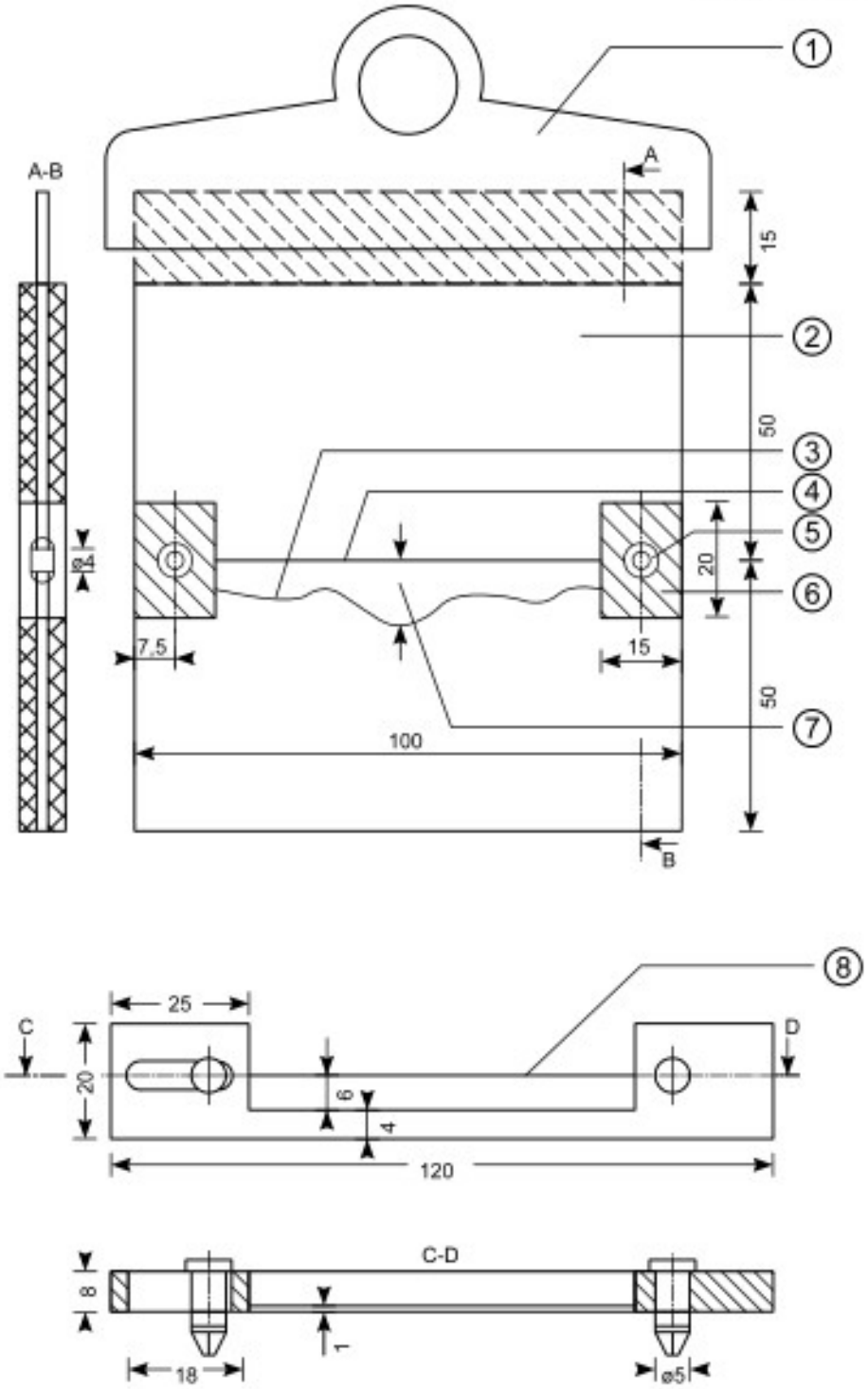
5.8 Siliconized paper.

6 Sampling

Test samples shall be taken in accordance with the corresponding European Standard.

Rectangular test specimens with dimensions (115 ± 1) mm x (100 ± 1) mm, as required by the tests described in **8.2** or **8.3**, are taken from the test sample uniformly over the width of the sheet and with the larger dimension in the longitudinal direction of the sheet. The test specimens shall not be taken within 150 mm of the edges of the sheet. The test specimens shall be numbered consecutively, beginning from one edge of the sheet, and the upper and lower faces of the sheet shall be marked.

Dimensions in millimetres



Legend:

(1) suspension device
(2) test specimen
(3) mark line 1
(4) mark line 2
(5) lug, Ø 4 mm
(6) coating removed
(7) flow Δl (maximum distance)
(8) straight edge

Figure 1: Test specimen, suspension device and marking device (example)

7 Preparation of test specimens

Any protective film shall be removed, preferably by applying a strip of adhesive tape to it at ambient temperature, cooling the test specimen to approximately the presumed cold bending temperature and then pulling the adhesive tape from the test specimen. Alternatively, or additionally, the film can be removed by means of a compressed air jet (maximum pressure approximately 5 bar, nozzle diameter approximately 0,5 mm). If it is not possible to remove the film using these methods, a gas flame may be used but for the least time necessary to destroy the film but not to otherwise damage the test specimen.

On the edge of the test specimens transverse to the longitudinal direction, a strip of the coating approximately 15 mm wide is removed from the upper and lower faces down to the reinforcement and in the case of sheets with more than one reinforcement down to the next reinforcement. The coating is also removed from the upper and lower faces in two closely adjacent areas in the middle of the test specimen down to the reinforcement (see Figure 1). For this, it is advisable to use a heated spatula or similar device. Care shall be taken not to damage the reinforcement. Two lugs with an inside diameter of approximately 4 mm are then punched into the exposed areas of the middle of the test specimens through the reinforcement(s) (see Figure 1). Any loose mineral granules or other surfacing material shall be removed by gently tapping the test specimen. Then, the marking device is placed consecutively on the two sides of the test specimens by means of locating pins being inserted into the lugs and a line (maximum width 0,5 mm) is marked over the whole width of the test specimens along the straight edge with the marker being held vertically. The test specimens are laid on a flat surface for this.

The test specimens are then conditioned prior to the test for at least 2 h at (23 ± 2) °C on a flat surface so that they do not touch each other and do not stick to the surface. If necessary, a separating sheet of siliconized paper shall be used to prevent sticking.

8 Procedure

8.1 Preparation for test

The oven is preheated to the specified test temperature. The temperature is controlled by the thermosensor positioned at the mid-level of the test specimens. For the duration of the test the temperature shall not vary by more than ± 2 °C inside the test area.

8.2 Determination of flow resistance at a specified temperature

The suspension devices are attached to the exposed reinforcement of the three test specimens of a series prepared in accordance with clause **7**. The coating shall not be clamped. If necessary, a separating layer, e.g. siliconized paper, can be provided on both sides to aid removal of the clamps after the test.

The prepared test specimens are suspended vertically at the same height in the oven with at least 30 mm between them. So that the temperature in the oven does not fall too far, the period from opening the oven to closing it again after inserting the test specimens shall not exceed 30 s. The heating period is (120 ± 2) min after inserting the test specimens.

As soon as the heating period is completed, the test specimens together with the suspension devices shall be removed from the oven without contact and allowed to cool by hanging freely for at least 2 h at (23 ± 2) °C. Then, the suspension device is removed and a second mark is drawn on the two sides of the test specimen as described in clause **7**. The maximum distance Δl between the bottom edges of the two marks shall be determined with the optical measuring instrument to the nearest 0,1 mm (see Figure 1) on both sides of each test specimen.

8.3 Determination of flow resistance limit

The flow resistance limit corresponding to a coating displacement of 2 mm shall be determined by means of preliminary tests on individual test specimens at different temperatures at intervals of 5 °C for the upper and lower faces of the sheet. The temperature steps are always a multiple of 5 °C (e.g. 100 °C, 105 °C, 110 °C). The purpose of this is to find two temperature steps T and (T + 5) °C for each face of the sheet within which the displacement dimension Δl = 2 mm.

The tests are carried out for the two faces of the sheet in accordance with **8.2**. A new test specimen shall be used for each temperature step.

After these two temperature steps have been determined in the preliminary test the flow properties are determined in accordance with **8.2** on a series of three test specimens. The tests are carried out at the two temperatures T and $(T + 5)$ °C on both the upper and lower faces. A new series of test specimens shall be used for each temperature.

In the case of sheets with a coating where the complete flow will occur within the two temperature steps and an exact flow temperature at which $\Delta l = 2{,}0$ mm cannot be determined, the maximum temperature T at which the flow is less than 2,0 mm shall be given as the result for the flow resistance limit.

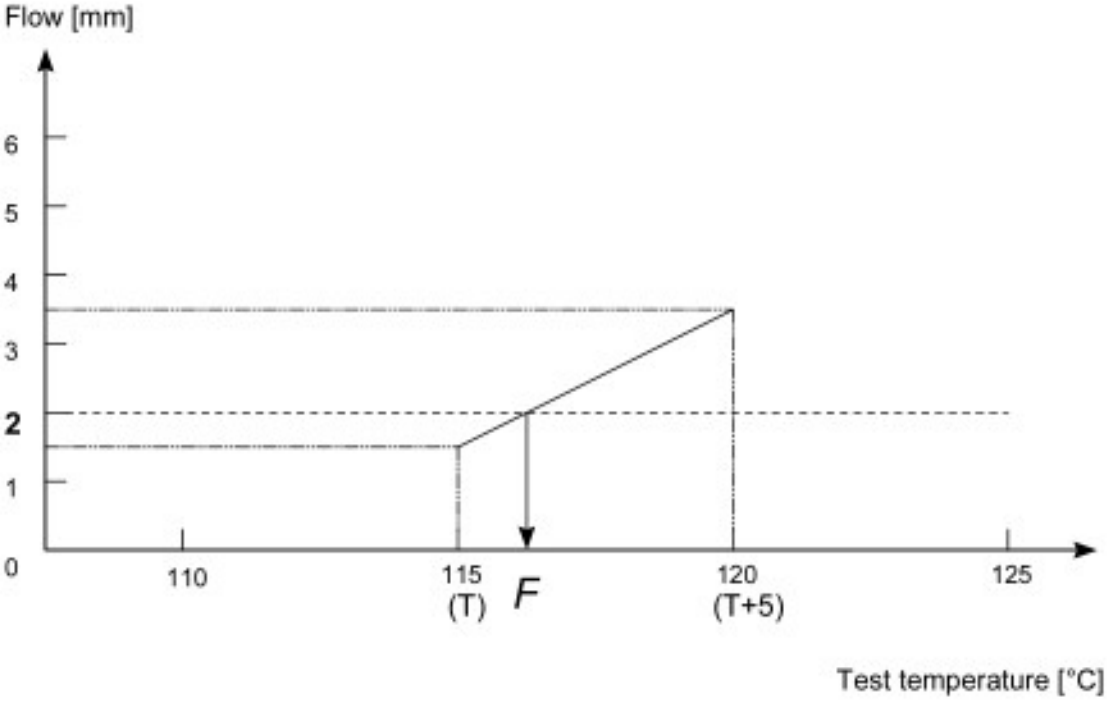
9 Calculation of results, evaluation and precision of test method

9.1 Calculation of mean value

The mean value of the three individual values of flow for each face of the sheet shall be calculated to the nearest 0,1 mm.

9.2 Flow resistance

The flow resistance as described in **8.2** at a specified temperature is regarded as having passed the test if the mean displacement dimension on the upper and lower face of the sheet does not exceed 2,0 mm.



Legend: F = flow resistance limit (example = 117 °C)

Figure 2: Determination of flow resistance limit by interpolation (example)

9.3 Flow resistance limit

The flow resistance limit is determined separately for the upper face and lower face of the sheet by linear, graphical or calculated interpolation of the two results of each test specimen face and is rounded to the nearest 1 °C (see Figure 2).

9.4 Precision of test method

The precision values for the test method described in **8.3** were determined by an initial international inter-laboratory test following ISO 5725:1986; they relate to sheets with polyester reinforcement. The range specified in **9.4.1** is also valid for **8.2**.

9.4.1 Repeatability

- range of the three individual values of a test series: $d_{a,3}$ = 1,6 mm
- repeatability standard deviation of results: σ_r = 0,7 °C
- confidence interval (95 %) of a result: q_r = 1,3 °C
- repeatability limit (difference between two results): r = 2 °C

9.4.2 Reproducibility

- reproducibility standard deviation of results: σ_R = 3,5 °C
- confidence interval (95%) of a result: q_R = 6,7 °C
- reproducibility limit (difference between two results): R = 10 °C

10 Test report

The test report shall include at least the following information:

a) all details necessary to identify the product tested;

b) a reference to this standard (EN 1110), and any deviation from it;

c) information on sampling in accordance with clause **6**;

d) details of preparation of the test specimens in accordance with clause **7**;

e) the test results in accordance with **9.2** or **9.3**;

f) the date of the test.

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