BS EN 12311-2:2013

BSI Standards Publication

Flexible sheets for waterproofing — Determination of tensile properties

Part 2: Plastic and rubber sheets for roof waterproofing

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National foreword

This British Standard is the UK implementation of EN 12311-2:2013. It supersedes BS EN 12311-2:2010 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/546, Flexible sheets for waterproofing and water vapour control.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Feuilles souples d'étanchéité - Détermination des propriétés en traction - Partie 2 : Feuilles d'étanchéité de toiture plastiques et élastomères

Abdichtungsbahnen - Bestimmung des Zug-Dehnungsverhaltens - Teil 2: Kunststoff- und Elastomerbahnen für Dachabdichtungen

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Foreword

This document (EN 12311-2:2013) has been prepared by Technical Committee CEN/TC 254 “Flexible sheets for waterproofing”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 12311-2:2010.

This document has been technically and editorially revised in order to:

— adjust the separation speed to CEN TC 189 standards;

— add precision data of a Round Robin test.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard is intended for characterisation of plastic and rubber sheets as manufactured or supplied before use. This 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 characteristics for plastic and rubber sheets for waterproofing.

1 Scope

This European Standard specifies test methods for the determination of the tensile properties of plastic and rubber sheets for roof waterproofing.

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 1849-2, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 2: Plastic and rubber sheets*

EN 13416, *Flexible sheets for waterproofing — Bitumen, plastic and rubber sheets for roof waterproofing — Rules for sampling*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1)*

3 Terms and definitions

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

3.1
top surface
upper side of the sheet, as used in situ

Note 1 to entry: This is usually the inside of the roll.

3.2
maximum tensile force
largest value of tensile force recorded during testing

3.3
elongation at maximum tensile force
elongation of the test specimen at the maximum tensile force

3.4
elongation at break
elongation of the test specimen at rupture

4 Principle

A test specimen is stretched at a constant speed until it ruptures. The force and elongation is continuously recorded throughout the test, and preferably with a permanent record of the maximum tensile force.

5 Apparatus

Tensile testing machine equipped with a continuous recording of force and corresponding elongation and capable of maintaining a uniform speed of grip separation as specified below.

The tensile testing machine shall have a sufficient loading capacity of at least 2000 N and a grip separation speed of (5 ± 1, 100 ± 10 and 500 ± 50) mm/min. The width of grips shall not be less than the width of the test specimen.

The tensile testing machine shall be equipped with grips of a type which maintain or increase the clamping pressure as a function of the increase of the tensile force applied to the test specimen. The test specimen shall be held so that it does not slip in the grips more than 1 mm for products up to and including 3 mm thick, and 2 mm for thicker products. A mark or tape on the test specimen where it enters the grips will help reveal any slip.

The method of gripping shall not induce premature rupture close to the grips.

If the slippage from the grips exceeds the stated limits or for the method B (dumb-bell type), the actual elongation of the test specimen shall be measured with an extensometer.

The force measuring system shall meet at least Class 2 of EN ISO 7500-1 (i.e. ± 2 %).

6 Sampling

Samples shall be taken in accordance with EN 13416.

7 Preparation of test specimens

Unless otherwise specified, for a complete tensile test two sets of test specimens shall be prepared: a set of five for the longitudinal direction and a set of five for the transverse direction.

Test specimens shall be cut from a test piece not closer than (100 ± 10) mm from the edge of the sheet, with the aid of a template, or die cutter as follows:

— method A: rectangular type (50 ± 0,5) mm x 200 mm according to Figure 1 and Table 1;

— method B: dumb-bell type (6 ± 0,4) mm x 115 mm according to Figure 2 and Table 1 or rectangular type (15 ± 0,5) mm x 170 mm according to Figure 1 and Table 1.

Any non-permanent surface layer should be removed.

A set of test specimens (longitudinal or transverse direction) with a mesh or fabric internal layer, backing or laminated reinforcement shall have the same number of threads. Cutting of threads should be avoided.

Condition the test specimens, prior to testing, for at least 20 h in a standard atmosphere of (23 ± 2) °C and (50 ± 5) % relative humidity.

The tensile properties shall be determined in accordance with method A with the following exceptions:

— For sheet with a non-woven inner layer (e.g. fibre glass mat) of less than or equal to 80g/m², method B the dumb-bell type (see Figure 2 and Table 1) shall be used.

— For determining tensile properties (young modulus/ secant modulus), e.g. for EN 1548 and for determining tensile properties in accordance with EN 1847, method B with a 15 mm rectangular specimen shall be used.

8 Procedure

In the case of method B, the thickness is measured as the effective thickness of the sheet according to EN 1849-2.

The test specimen shall be tightly clamped in the tensile test machine grips (Clause 5) taking care that the longitudinal axis of the test specimens and the axis of the testing machine and grips are correctly aligned. A preload of maximum 5 N before the start of the test is recommended to take out any slack in the test specimen.

The test is carried out on a test specimen at a temperature of (23 ± 2) °C.

A constant separating speed for the grips of (100 ± 10) mm/min with the following exceptions has to be used:

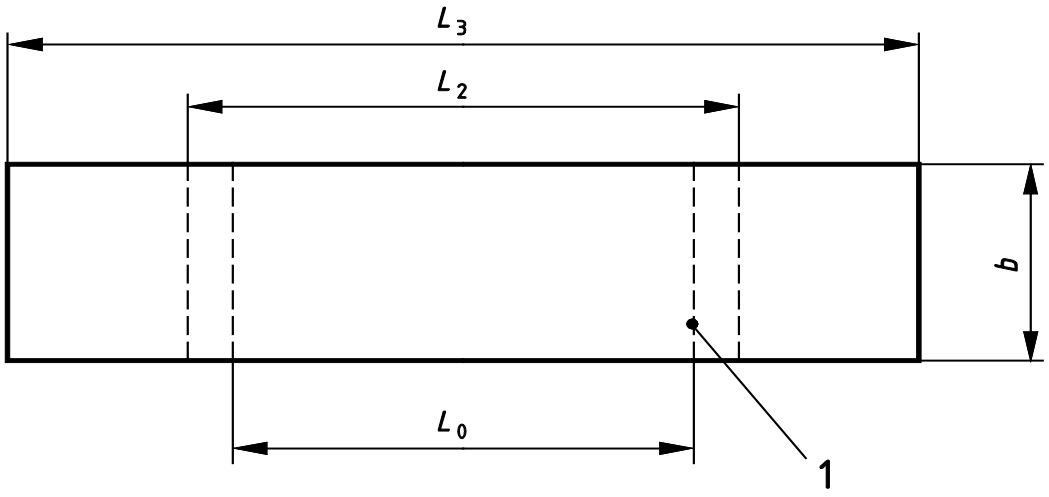
— For products with a declared value (e.g. MLV or MDV) for the elongation with more than 400 %, a constant separation speed of 500 mm/min has to be used.

— For the young modulus, which is defined as secant modulus between 1 % and 2 % strain, shall be deduced from the stress-strain curve when a separation speed of (5 ± 1) mm/min has been used.

The applied tensile force and the distance between the grips or the distance between the gauge marker for the rectangular type or the distance between the gauge marks for the dumb-bell types shall be recorded until the test specimen breaks.

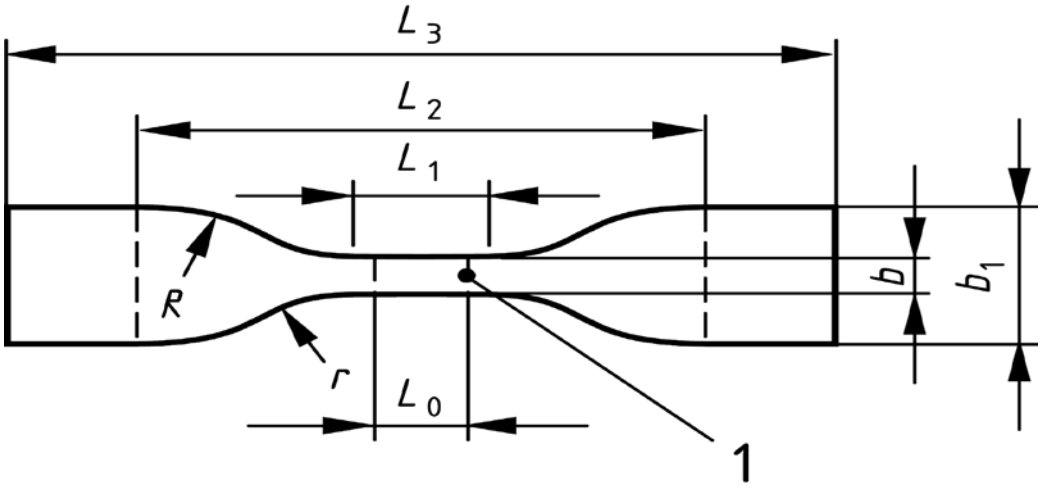
The mode of failure of the specimen shall be noted.

In the case of sheets with composite reinforcements, which give rise to two or more distinct peaks on the force/elongation curve, the force and elongation of the two greatest peaks and also the elongation at break shall be recorded.



Key
1 gauge mark

Figure 1 — Rectangular test specimen for method A and method B



Key
1 gauge mark

Figure 2 — Dumb- bell test specimen for method B

Table 1 — Test specimen data

	Method A (mm)	**Method B** Dumb-bell (mm)	**Method B** Rectangular (mm)
Overall length, min (L_3)	> 200	> 115	> 170
Width of ends (b_1)		25 ± 1	
Length of narrow parallel portion (L_1)		33 ± 2	
Width (b)	50 ± 0,5	6 ± 0,4	15 ± 0,1
Small radius (r)		14 ± 1	
Large radius (R)		25 ± 2	
Distance between gauge marks (L_0)	100 ± 15	25 ± 1	100 ± 15
Initial distance between grips (L_2)	120 ± 5	80 ± 5	120 ± 5

If no rupture occurs within 1000 mm displacement of the grips then the distance between the grips (L_2) may be reduced to (70 ± 5) mm and the distance between gauge marks (L_0) to (50 ± 5) mm.

9 Expression of results

9.1 Evaluation

Determine the maximum force and the corresponding elongation calculated from the separation of the tensile testing machine grips or gauge marks and expressed as a percentage of the original gauge length.

Disregard any test result where the test specimen breaks within 10 mm from the grips or when it slips by more than the permitted limit within the grips of the tensile testing machine, and retest with a replacement specimen.

The maximum tensile force and corresponding elongation and the elongation at break are noted, together with the direction of test.

State the method of measurement of elongation, i.e. grip separation or extensometer.

List the individual values for the test specimens in each direction and calculate the arithmetic mean and standard deviation of tensile force in N/50 mm for method A and tensile stress in N/mm^2 for method B.

The tensile stress (N/mm^2) shall be calculated based on the effective sheet thickness (EN 1849-2) of the specimen.

State the result to the nearest N/50 mm for method A, to the nearest 0,1 N/mm^2 for method B and elongation with two significant figures.

9.2 Precision of the test method

Precision data are based on a Round Robin test involving nine European laboratories. Reinforced PVC-p membranes were tested according to method A. The Round Robin was performed according to ISO Guide 43-1 and the values were determined according to ISO 13528. Repeatability limit r: Limit for a probability of 95 % for results obtained with the same method on identical test items in the same lab, same operator and same equipment within a short time. Reproducibility limit R: Limit for a probability of 95 % for results obtained with the same method on identical test items in different labs, different operators and different equipments.

Table 2 – Round Robin results

Property	Unit	General mean	Repeatability limit r	Reproducibility limit R
Tensile strain at maximum force	%	19,7	1,3	4,2
Maximum tensile force	N/50 mm	1 224	75	170

10 Test report

The test report shall include at least the following information:

a) reference to this document (EN 12311-2) and any deviation from it;

b) all details necessary to identify the product tested;

c) information on sampling in accordance with EN 13416;

d) details of preparation of the test specimen in accordance with Clause 7, e.g. number of load-bearing threads;

e) test results in accordance with Clause 9, noting if the distance between the grips has been reduced and noting the separation speed;

f) any peculiarities in the method employed or encountered during the test;

g) date of the test(s).

Bibliography

[1] EN 1548, *Flexible sheets for waterproofing — Plastic and rubber sheets for roof waterproofing — Method for exposure to bitumen*

[2] EN 1847, *Flexible sheets for waterproofing — Plastics and rubber sheets for roof waterproofing — Methods for exposure to liquid chemicals, including water*

[3] ISO/IEC Guide 43-1, *Proficiency testing by interlaboratory comparisons — Part I: Development and operation of proficiency testing schemes*

[4] ISO 13528, *Statistical methods for use in proficiency testing by interlaboratory comparisons*

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