

Flexible sheets for waterproofing — Plastics and rubber sheets for roof waterproofing — Methods for exposure to liquid chemicals, including water

ICS 91.100.50

National foreword

This British Standard is the UK implementation of EN 1847:2009. It supersedes BS EN 1847:2001 which is withdrawn.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.

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2010.

© BSI 2010

ISBN 978 0 580 59213 3

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1847

December 2009

ICS 91.100.50

Supersedes EN 1847:2001

English Version

**Flexible sheets for waterproofing - Plastics and rubber sheets for
roof waterproofing - Methods for exposure to liquid chemicals,
including water**

Feuilles souples d'étanchéité - Feuilles d'étanchéité de
toiture plastiques et élastomères - Méthodes d'exposition
aux produits chimiques liquides y compris l'eau

Abdichtungsbahnen - Kunststoff- und Elastomerbahnen für
Dachabdichtungen - Bestimmung der Einwirkung von
Flüssigchemikalien einschließlich Wasser

This European Standard was approved by CEN on 19 October 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Principle	6
5 Apparatus	6
5.1 Container	6
5.2 Enclosure	6
5.3 Thermometer	6
5.4 Weighing bottle	7
5.5 Balance	7
5.6 Ventilated oven	7
6 Sampling	7
7 Preparation of test specimens	7
8 Procedure	7
8.1 Test liquids	7
8.2 Temperature	8
8.3 Exposure durations	8
8.4 Immersion procedure	8
8.4.1 Quantity of test liquid	8
8.4.2 Positioning of specimens	8
8.4.3 Rinsing and wiping	9
8.5 Determination of changes in mass	9
8.5.1 Test specimen	9
8.5.2 Initial value	9
8.5.3 Exposure	9
8.5.4 Measurement of mass	9
8.6 Determination of changes in appearance	10
8.6.1 Test specimen	10
8.6.2 Exposure	10
8.6.3 Procedure	10
8.7 Determination of changes in tensile properties	10
8.7.1 General	11
8.7.2 Test specimen	11
8.7.3 Initial value	11
8.7.4 Exposure	11
8.7.5 Follow up test	11
9 Expression of results	11
9.1 Changes in mass	11
9.1.1 Change in mass	11
9.1.2 Change in mass per unit area	12
9.1.3 Percentage change in mass	12
9.1.4 Mean value	12
9.2 Change in appearance	12
9.3 Changes in physical properties	12
9.3.1 Change in tensile properties (strength and elongation)	12

9.3.2	Percentage change of measurable physical property	13
9.3.3	Documentation of change in property	13
10	Test report	13
11	General comments	13
Annex A	(informative) Calibration of apparatus	15
A.1	Temperature calibration	15
A.2	Ventilation conditions	15
	Bibliography	16

Foreword

This document (EN 1847:2009) 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 June 2010, and conflicting national standards shall be withdrawn at the latest by June 2010.

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 1847:2001.

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

Introduction

This European Standard is intended for characterisation and /or classification 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 EN 13956, *Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*.

Only testing by immersion of the entire surface of the test specimen is considered.

The methods for determination of changes in properties are specified as follows:

- a) changes in mass immediately after immersion or after immersion and drying;
- b) changes in appearance immediately after immersion or after immersion and drying;
- c) changes in physical properties (changes of tensile properties) immediately after immersion or after immersion and drying.

Tests immediately after immersion are used when it is required to ascertain the state of the material while still acted upon by the liquid.

Tests after immersion and drying are used when it is required to ascertain the state of the material after the liquid, if it is volatile, has been eliminated.

1 Scope

This European Standard specifies a method of exposing test specimens of plastic and rubber sheets for roofing, free from all external restraint, to liquid chemicals (including water), and methods for determining the changes in properties resulting from such exposure.

2 Normative references

The following referenced documents are indispensable for the application 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 1849-2, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 2: Plastic and rubber sheets for roof waterproofing*

EN 12311-2, *Flexible sheets for waterproofing — Determination of tensile properties — Part 2: Plastic and rubber sheets for roof waterproofing*

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

EN ISO 175:2000, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175:1999)*

3 Terms and definitions

For the purposes of this document no additional terms and definitions are required.

4 Principle

Complete immersion of the test specimens in a specified quantity of a test liquid for a specified time and at a specified temperature. Determination of the properties before and after immersion and, if applicable, after drying. In the latter case the determinations are made, if possible, one after the other on the same specimens.

5 Apparatus

5.1 Container

Beakers of suitable dimensions and fitted with lids (airtight, if necessary, and fitted with condensers in the case of volatile liquids or those which give off vapours).

5.2 Enclosure

Enclosure which is thermostatically controlled at the test temperature.

5.3 Thermometer

Thermometer of suitable range and accuracy.

5.4 Weighing bottle

5.5 Balance

Balance which is accurate to within 0,001 g in the case of specimens of mass equal to or greater than 1 g.

5.6 Ventilated oven

The temperature calibration procedure is described in A.1 and details on the air flow are given in A.2. For drying purposes, the oven shall be controlled at $(50 \pm 2) ^\circ\text{C}$.

6 Sampling

Samples shall be taken in accordance with EN 13416.

7 Preparation of test specimens

Depending on the proposed test after exposure (mass, physical properties) and the nature of the plastic or rubber roof waterproofing sheet, the specimens will be of very diverse shapes and dimensions.

For sheets with an inner layer or reinforcement it is recommended to seal the edges of the specimens before immersion in a test liquid.

The number of specimens to be used will be specified by the methods to determine the properties before and after exposure. In the absence of any other instructions, at least three specimens shall be tested.

Condition the test specimens, prior to testing, for at least 24 h in a standard atmosphere of $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity.

8 Procedure

8.1 Test liquids

If information is required about the behaviour of the sheet in contact with a specific liquid that liquid shall, wherever possible, be used.

The test shall be carried out with defined chemical products, used on their own or as a mixture; the test should be as representative as possible of the effect on the waterproofing sheets.

For general evaluations of materials behaviour when exposed to aqueous liquids the specimens shall be stored in aqueous solutions as shown in Table 1 as specified in Table A.1 of EN ISO 175:2000.

Table 1 — Standard aqueous solutions

Test liquid		Notes
1	10 % sodium chloride (NaCl) solution (salt water)	10 % by weight (technically pure)
2	Milk of lime, $\text{Ca}(\text{OH})_2$	saturated solution with deposit (technically pure)
3	5 % to 6 % sulfurous acid, H_2SO_3	5 % to 6 % by weight (technically pure)

If other liquids need to be agreed on for exposure there are listings of laboratory chemicals available, for example EN ISO 175:2000.

If necessary a stirrer may be used.

8.2 Temperature

The standard immersion temperature is $(23 \pm 2)^\circ\text{C}$. For other temperatures consult the applicable product standard.

The temperature for the determination of changes in properties is $(23 \pm 2)^\circ\text{C}$. If the immersion temperature is different, bring the specimens to ambient temperature by transferring them into a fresh quantity of test liquid at room temperature for 15 min to 30 min.

8.3 Exposure durations

Any practicable exposure duration, representative of the phenomenon to be evaluated, may be applied.

The standard exposure duration for comparison tests is 28 days. For other durations consult the applicable product standard.

8.4 Immersion procedure

8.4.1 Quantity of test liquid

The quantity of test liquid used shall be at least 2500 ml for 1 or more samples with maximum total dimensions of (210 x 295) mm. The test liquid shall completely cover the specimen.

8.4.2 Positioning of specimens

Place each set of test specimens in a given container and completely immerse them in the test liquid (using a weight if necessary).

When several materials of the same composition are to be tested, several sets of specimens may be put into the same container. Any contact between different specimens shall be avoided with a minimum distance of 10 mm at the beginning.

If light is likely to have influence on the action of the test liquid, it is recommended to operate either in darkness or in defined illumination conditions. It is recommended to use closed containers.

8.4.3 Rinsing and wiping

Remove the specimens from the test liquid and rinse them with a product which has no effect on the material under test and which is chosen to suit the nature of the test liquid.

Wipe the specimens dry with filter paper or a lint free cloth.

If elevated temperature is used during exposure, at the end of the period of immersion, bring the temperature of the specimens back to ambient temperature if necessary, by transferring them quickly into fresh quantity of test liquid at room temperature, for a period of 15 min to 30 min.

8.5 Determination of changes in mass

8.5.1 Test specimen

The test specimen shall have the shape and dimensions specified in EN 1849-2 for the determination of mass per unit area.

Prepare the number of specimens to determine the mass per unit area according to EN 1849-2.

If elevated temperature is used during the exposure, prepare additional specimens to serve as a control of any temperature influence. Control of other influences shall require additional quantities of specimens.

8.5.2 Initial value

Determine the initial mass M_1 of each specimen to the nearest 0,001g in the case of specimens of mass greater than or equal to 1 g following EN 1849-2.

8.5.3 Exposure

Immerse the test specimens in the test liquid at the chosen temperature for the chosen period, following the immersion procedure given in 8.4.

8.5.4 Measurement of mass

8.5.4.1 Measurement immediately after immersion (wet)

Place each rinsed and wiped specimen in a tared weighing bottle, stopper it and determine the mass M_2 to the nearest 0,001 g.

If the liquid used for the test is volatile at ambient temperature, the time during which the specimen is exposed to the air shall not exceed 30 s. If it is necessary to continue the test after weighing (test as a function of time), immediately replace the specimens in the test liquid and put the containers back in the thermostatically controlled enclosure.

8.5.4.2 Measurement after immersion and drying (dry)

Remove the specimens from the weighing bottles and dry them in the ventilated oven, controlled at the specified temperature, for the specified time (usually for (24 ± 1) h at (50 ± 2) °C) to constant mass. Allow the specimens to cool and recondition them in accordance with Clause 7 and determine the mass M_3 to the nearest 0,001 g of each specimen.

8.6 Determination of changes in appearance

8.6.1 Test specimen

Examination of changes in appearance may be conducted together with the other tests described in this document. In every case, prepare supplementary specimens for comparison.

8.6.2 Exposure

Immerse the test specimens in the test liquid at the chosen temperature for the chosen period, following immersion procedure given in 8.4.

8.6.3 Procedure

If the change in appearance is determined as a complement to one of the tests described in this document, then the procedure specified for that test shall be used.

Examine each specimen, by means of a lens if necessary, in comparison with an untreated specimen and record any changes in appearance as follows, using the notation scale given in Table 2:

- a) colour (including the nature of the change and whether or not it is uniform);
- b) opacity;
- c) gloss or matt finish.

Note also, if present, the following effects:

- d) development of crazing and cracking;
- e) development of blisters, pitting and other similar effects;
- f) presence of material which can be easily rubbed off;
- g) tacky appearance;
- h) delamination, warping or other deformation;
- i) partial dissolution.

Table 2 - Notation scale

Notation	Change in appearance
O	none
F	slight
M	moderate
L	large

8.7 Determination of changes in tensile properties

8.7.1 General

The following description is applicable to a possible change in tensile properties (strength and elongation), as applied for roof waterproofing sheets.

If any other physical property is determined, the procedure shall be adapted accordingly.

8.7.2 Test specimen

The test specimen shall have the shape and dimensions for a subsequent testing as specified in EN 12311-2 for the determination of tensile properties (strength and elongation). Test specimens described in EN 12311-2 shall not be directly immersed in the test liquid.

Prepare the number of specimens to determine the initial tensile properties (strength and elongation) in accordance with EN 12311-2.

Prepare the number of specimens to determine the change of the tensile properties (strength and elongation) after exposure according to the specified conditions.

If elevated temperature is used during the exposure, prepare additional specimens to serve as a control of any temperature influence. Control of other influences need additional quantities of specimens.

8.7.3 Initial value

Determine the initial tensile properties (strength S_1 and elongation E_1) in accordance with EN 12311-2.

8.7.4 Exposure

Immerse the test specimens, of appropriate dimensions, in the test liquid at the chosen temperature for the chosen period, following immersion procedure described in 8.4.

8.7.5 Follow up test

Dry the specimens in the ventilated oven, controlled at the specified temperature, for the specified time or, in the absence of any specification, at $(50 \pm 2)^\circ\text{C}$ for (24 ± 1) h. Allow the specimens to cool and recondition them in accordance with Clause 7 before determination of tensile properties (strength and elongation) is performed.

9 Expression of results

9.1 Changes in mass

9.1.1 Change in mass

Report, for each specimen, the masses in milligrams of:

- the specimen before immersion, M_1 ;
- the specimen immediately after immersion, M_2 (wet);
- the specimen after immersion, drying and reconditioning, M_3 (dry).

Calculate the values of:

$$M2 - M1 \text{ (wet) or } M3 - M1 \text{ (dry)}$$

and report these values with the applicable signs.

9.1.2 Change in mass per unit area

For each specimen, calculate the increase or decrease in mass per unit area, expressed in milligrams per square centimetre, by means of one of the following formulae:

$$(M2 - M1) / A \text{ (wet) or } (M3 - M1) / A \text{ (dry)}$$

where $M1$, $M2$ and $M3$ have the same meanings as in 9.1.1.

A is the initial total surface area, in square centimetres, of the specimen.

9.1.3 Percentage change in mass

For each specimen, calculate the percentage increase or decrease in mass by means of one of the following formulae:

$$100 \times (M2 - M1) / M1 \text{ (wet) or } 100 \times (M3 - M1) / M1 \text{ (dry)}$$

where $M1$, $M2$ and $M3$ have the same meanings as in 9.1.1.

9.1.4 Mean value

In every case, calculate the arithmetic mean (or means) of the results for specimens taken from the same sample.

9.2 Change in appearance

Express the results using the notation scale given in Table 1.

Report separately the results relating to specimens that have been simply immersed and wiped dry (wet) and those relating to specimens that have also been oven-dried and reconditioned (dry).

9.3 Changes in physical properties

9.3.1 Change in tensile properties (strength and elongation)

The change in tensile properties (strength and elongation) is calculated by:

$$S3 - S1 \text{ (dry) in N/mm}^2$$

$$E3 - E1 \text{ (dry) in \%}$$

where

$S1$ = the tensile strength (Method B) in N/mm^2 before the immersion (initial value) or of control specimen;

$E1$ = the elongation at break in % before the immersion (initial value) or of control specimen;

$S3$ = the tensile strength (Method B) in N/mm^2 after immersion, drying and reconditioning

E_3 = the elongation at break in % after immersion, drying and reconditioning;

9.3.2 Percentage change of measurable physical property

State the initial value S_1 / E_1 before immersion, the value S_2 / E_2 (wet) and/or S_3 / E_3 (dry) after immersion of the physical property according to the relevant European Standard.

For each specimen, calculate the percentage increase or decrease in tensile properties (strength and elongation) by means of one of the following formulae:

$$100 \times (S_3 - S_1) / S_1 \quad (\text{dry})$$

$$100 \times (E_3 - E_1) / E_1 \quad (\text{dry})$$

where S_1 / E_1 , S_2 / E_2 and S_3 / E_3 have the same meanings as in 9.3.1.

These percentages may be greater than, equal to, or less than 100 %, the value 100 % signifying that the action of the liquid has not affected the property concerned.

9.3.3 Documentation of change in property

If applicable, plot graphs of the results as a function of test duration.

10 Test report

The test report shall include at least the following information:

- a) reference to this document (EN 1847) and any deviation from it;
- b) all details necessary to identify the product tested;
- c) information on sampling in accordance with Clause 6;
- d) details of preparation of the test specimen in accordance with Clause 7 including if a stirrer is used;
- e) test results in accordance with Clause 9 and test liquid, temperature and duration;
- f) any peculiarities in the method employed or encountered during the test;
- g) date of the test(s).

11 General comments

Under the action of a liquid, a material may be subjected to several phenomena which may occur simultaneously. On the one hand absorption of the liquid and extraction of the constituents soluble in the liquid may occur. On the other hand, a chemical reaction, most often resulting in a significant change in the properties of the material, may occur.

The behaviour of the materials in the presence of chemicals can be determined only under arbitrarily fixed conditions aimed at making comparisons between different materials. The choice of the test conditions (nature of the liquids, temperatures and durations), as well as of the properties in which changes are to be measured, depends on the eventual application of the material under test.

However, it is not possible to establish any direct correlation between the experimental results and the behaviour of the material in service. These tests do, nevertheless, permit a comparison to be made of the behaviour of different materials under specified conditions, thus allowing an initial evaluation of their behaviour in relation to certain groups of substances.

NOTE It is emphasized that the comparison of different material by means of this test is valid only if the specimens used are of the same shape, the same dimensions (in particular the same thickness) and in as nearly as possible the same state (of internal stresses, surface, etc.).

Annex A **(informative)**

Calibration of apparatus

A.1 Temperature calibration

Thermocouples having minimum precision of $0,1\text{ }^{\circ}\text{C}$ in the range from $40\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$ are used for checking the oven. This shall be made at least once a year at the working temperature of $50\text{ }^{\circ}\text{C}$ at three points: a point in the horizontal plane of respectively the upper, lower and central test specimen supports, each point being selected randomly in the work area of the aforementioned horizontal plane. The measurement of the temperature at these points is carried out every ten minutes during half an hour. The temperature deviations observed at each of these points shall not exceed the range of $(50 \pm 2)\text{ }^{\circ}\text{C}$.

A.2 Ventilation conditions

The air change in the oven shall at least be (5 ± 2) times per hour. The circulation of the air through the oven should be steady at approximately $0,5$ to $1,5\text{ m/s}$ but need not be calibrated.

Bibliography

[1] DIN 53476, August 1979, Testing of plastics; determination of the behaviour against liquids

NOTE This standard has been withdrawn but may be purchased from Beuth Verlag

This page has been intentionally left blank

BSI - British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001 Email: orders@bsigroup.com You may also buy directly using a debit/credit card from the BSI Shop on the Website <http://www.bsigroup.com/shop>

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact Information Centre. Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048 Email: info@bsigroup.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001 Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsigroup.com/BSOL>

Further information about BSI is available on the BSI website at <http://www.bsigroup.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright and Licensing Manager. Tel: +44 (0)20 8996 7070 Email: copyright@bsigroup.com