

**Flexible sheets for
waterproofing —
Bitumen, plastic and
rubber sheets for roof
waterproofing —
Method of artificial
ageing by long term
exposure to the
combination of UV
radiation, elevated
temperature and water**

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National foreword

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Flexible sheets for waterproofing - Bitumen, plastic and rubber
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term exposure to the combination of UV radiation, elevated
temperature and water

Feuilles souples d'étanchéité - Feuilles d'étanchéité de
toiture bitumineuses, plastiques et élastomères - Méthode
de vieillissement artificiel par exposition combinée de
longue durée aux rayonnements UV, à la température
élevée et à l'eau

Abdichtungsbahnen - Bitumen-, Kunststoff- und
Elastomerbahnen für Dachabdichtungen - Verfahren zur
künstlichen Alterung bei kombinierter Dauerbeanspruchung
durch UV-Strahlung, erhöhte Temperatur und Wasser

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Foreword

This document (EN 1297:2004) has been prepared by Technical Committee CEN/TC 254, "Flexible sheets for waterproofing", the secretariat of which is held by BSI.

This standard is one of a series of standards, which specify test methods for determining dimensions and characteristics of flexible sheets as factory made products.

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of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

No existing European Standard is superseded.

This document includes a Bibliography.

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Introduction

This document has been prepared by CEN/TC 254 "Flexible sheets for waterproofing" in order to test flexible bitumen, plastic and rubber sheets for roof waterproofing in relation to their ageing resistance to combined effects of long term exposure to UV radiation, elevated temperature and water.

This document defines one common procedure to be applied as a method for artificial ageing to all types of flexible sheets for roof waterproofing

This document has been drafted for applications in roofing but it may also be applied to other areas where it is relevant.

1 Scope

This document specifies the method for exposure of factory made bitumen or plastic or rubber sheets for roof waterproofing to combined effects of long term exposure by UV radiation, elevated temperature and water as means of artificial ageing.

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

EN ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps (ISO 4892-3:1994)*

3 Terms and definitions

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

	Symbol	Unit
3.1 fluorescent UV lamp lamp in which primary radiation from a low pressure mercury arc is transformed into higher wavelength UV by means of a fluorescent phosphor. The spectral emission of a fluorescent lamp is determined by the spectral emission of the fluorescent phosphor and the transmission characteristics of the glass tube. A fluorescent UV lamp is a lamp in which the radiant emission in the ultraviolet region of the spectrum < 400 nm makes up at least 80 % of the total radiation output		
3.2 irradiance incident radiant flux onto a surface per unit area	E	W / m ²
3.3 spectral irradiance radiant flux per unit area per wavelength interval	E _λ	W/(m ² ·nm)
3.4 Radiant exposure time integral of irradiance	H	J/m ²
3.5 UV-radiation radiation with a wavelength λ between: 100 nm < λ < 400 nm	λ	nm

<p>3.6 Exposed side side of the test specimen designated by the manufacturer to be exposed to the sunlight</p>		
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4 Principle

Test specimens cut from the product sample are exposed in an apparatus with fluorescent UV lamps at specified irradiance, black standard temperature (BST), relative humidity and cyclic water spraying.

The resistance to this exposure is determined by follow-up tests described in the product standards on flexible bitumen or plastic or rubber sheets for roof waterproofing.

5 Apparatus

5.1 Laboratory light source

The UV source shall be an array of fluorescent UV lamps of type I (340 nm) or a fluorescent UV lamp combination in accordance with EN ISO 4892-3 with a mean UV irradiance in the plane of the specimen surfaces of $(45 \pm 5) \text{ W/m}^2$ in the wavelength range $\lambda \geq 300 \text{ nm}$. For typical spectral irradiances see Figure A.1. The irradiance at the test specimen surface shall not vary more than $\pm 10 \%$ in relation to any two points in the specimen holder plane.

In order to achieve homogeneous exposure conditions operate the apparatus according to the manufacturer's instructions (e. g. replacement of lamps and repositioning of specimens) and use dummy specimens at void positions.

5.2 Test Chamber

The design of the test chamber may vary but it shall be constructed from inert material and provide for uniform irradiance in accordance to 5.1 with means for controlling the black standard temperature (BST) and relative humidity in the dry period.

5.3 Specimen arrangement

The test specimen racks shall allow the specimens to

- lie flat in the plane $\geq 5^\circ$ above the horizontal;
- be mounted so that the exposed face is in the plane of uniform irradiance.

The specimens shall be attached to stainless steel platens of at least the same size as the specimens by appropriate means. The attachment shall leave an area open to free irradiation so that subsequent tests can be performed on irradiated parts of the specimen.

For inclinations near to horizontal the specimens may be alternatively placed in stainless steel pans of at least the same size as the specimens. The specimens shall be weighted in this arrangement by means of a U shaped stainless frame. The external dimensions of the frame shall correspond to the specimen size. The cross section of the steel frame shall be $(5 \pm 0,5) \text{ mm}$ by approximately 10 mm. The dimension of $(5 \pm 0,5) \text{ mm}$ stands for the width of the cross section, i. e. the plane that is in contact with the specimen. If the specimens are placed in pans, the lower end of the pans shall have sufficient slits or holes to avoid any collection of water. The attachment arrangement shall not restrain the test specimens from changes in dimensions during exposure.

5.4 Water supply and spray mechanism

Deminerlized water with a maximum conductivity of $500 \mu\text{S/m}$ shall be used for spraying. In general the temperature of the water to be used in the spraying procedure shall be $(25 \pm 5) ^\circ\text{C}$ at the beginning of the spray cycle. Spray nozzles shall provide a uniform and continuous wetting of the exposed specimens sides for defined periods of time.

The flow rate through the nozzles shall be $(10 \pm 3) \text{ litres per min}$ and m^2 of the exposed specimen surface.

5.5 Cycle timer

A continuously operating cycle timer or controller shall allow programming of the spray cycles. An hour meter shall be provided to record total time of operation and UV exposure.

5.6 Thermometer

Thermometer capable of measuring the black standard temperature in accordance with EN ISO 4892-1, with means to record the temperature during each cycle.

5.7 Radiometer

A radiometer to determine the UV radiant exposure in J/m² in the wavelength region from 300 nm to 400 nm.

6 Sampling and preparation of test specimens

6.1 Sampling

For the purpose of this document, a complete undamaged roll of the sheet to be tested shall be selected in accordance with EN 13416.

6.2 Dimensions of test specimens

Test specimens of sufficient size according to the follow-up test to be performed shall be cut from the test piece in accordance with EN 13416. The machine direction should be indicated.

Durable marks for dimensional measurements before and after exposure shall be applied to the test specimens.

6.3 Preconditioning of specimens

Appropriate preconditioning of the specimens shall be carried out according to the tests to be performed as specified in the product standard on bitumen or plastic or rubber sheets.

7 Procedure

7.1 General

The test specimens and the black standard thermometer shall be mounted in the specimen holders with their exposed sides facing the lamps (5.1).

7.2 Exposure cycle

An exposure cycle has a duration of 360 min and consists of a 300 min dry period followed by a 60 min spray (wet) period in accordance with EN ISO 4892-3. Irradiation is not maintained during the wet period.

7.3 Black standard temperature

The black standard temperature (BST) shall be at (60 ± 3) °C during the dry period. The air temperature in the test chamber (5.2) shall be controlled to a constant value such that the black standard temperature (BST) equals the required value after 30 min in the dry period.

7.4 Chamber heating

During the spray period the chamber heating is turned off.

7.5 Relative humidity

The relative humidity during the dry period shall be (10 ± 5) % after 30 min of the dry period.

7.6 Procedure

Operate continuously, repeating the programmed cycle, except for servicing the instrument and inspection of test specimens.

NOTE 1 The total amount of UV radiant exposure is specified in the relevant standards EN 13707 and prEN 13956 (definitions and characteristics). Relevant recommendations are given in Annex B.

NOTE 2 Eventual intermediate tests or observations are specified in the standards EN 13707 and prEN 13956 (definitions and characteristics). Relevant recommendations are given in Annex B.

8 Expression of results

Observe, compare and record the performance of test specimens unexposed and exposed regarding their visual change, mass change and crack formation.

Any subsequent destructive tests shall be conducted according to the relevant product standards for Bitumen, plastic and rubber sheets for roof waterproofing.

9 Precision

The precision is not specified by this standard.

No report on international laboratory tests of repeatability or reproducibility is available. An accuracy statement will be added to the next revision when sufficient laboratory data, now in preparation, will be available.

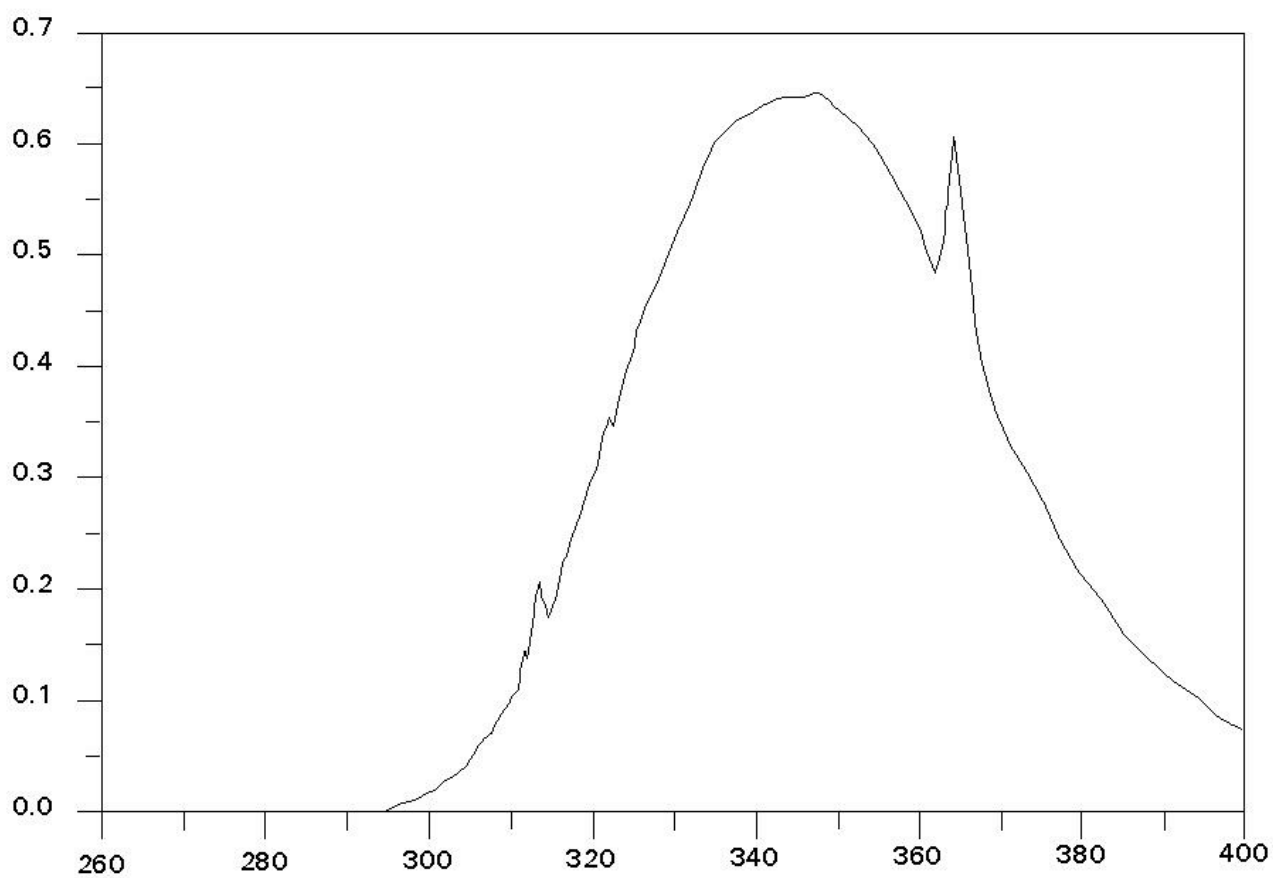
10 Test report

The test report shall include at least the following information:

- a) all details necessary to identify the product tested;
- b) a reference to this document (EN 1297:2004) and any deviation from it;
- c) information about the apparatus in accordance with Clause 5;
- d) information on sampling and details on preparation of test specimens in accordance with Clause 6;
- e) information on the test procedure in accordance with Clause 7 (7.1 to 7.5);
- f) the test results in accordance with Clause 8;
- g) date of the test.

Annex A (informative)

Spectral irradiance of fluorescent UV lamps type I (340 nm)



Key

(y-axis) spectral irradiance, in $W/(m^2 \times nm)$

(x-axis) wavelength, in nm

Figure A.1 — Spectral irradiance of fluorescent UV lamps type I (340 nm)

Annex B (informative)

Recommendations

B.1 Spray cycle

The deionised water used in the spray cycles may be recycled. It should be replaced by fresh deionized water when the conductivity exceeds 500 $\mu\text{S/m}$. A usage period of about one week is recommended.

The size of reservoir of the deionised water should be chosen large enough to ensure a water temperature at the beginning of the spray cycle of $(25 \pm 5) ^\circ\text{C}$.

B.2 Exposure duration

It is recommended that the total UV exposure duration should be 5 000 h, corresponding to about 800 MJ/m^2 of UV radiant exposure.

B.3 Intermediate tests

The effect of the exposure may be observed visually by assessment of crack formation or other optical alterations of the test specimens.

a) Visual inspection

An UV radiant exposure of 160 MJ/m^2 is applied after every 1 000 h observing following changes in properties:

- changes in colour,
- chalking,
- changes of shape and dimensions.

b) Surface cracks

The test specimens should be inspected in a flat position at 10 times magnification. The surface cracks should be assessed according to Table B.1.

Table B.1 — Criteria for surface cracks

Grade	Assessment
0	No cracks or crazes
1	Faint and flat crazes
2	Moderately broad and moderately deep cracks
3	Broad and deep cracks

Bibliography

- [1] EN 13707, *Flexible sheets for waterproofing — Reinforced bitumen sheets for roof waterproofing — Definitions and characteristics*
- [2] prEN 13956, *Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics*
- [3] ISO 9370:1997, *Plastics – Instrumental determination of radiant exposure in weathering tests – General guidance and basic test method*

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