BRITISH STANDARD

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12224:2000

Geotextiles and geotextile-related products — Determination of the resistance to weathering

The European Standard EN 12224:2000 has the status of a British Standard

ICS 59.080.70

National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/553, Geomembranes and geotextiles, which has the responsibility to:

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

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Summary of pages

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English version

Geotextiles and geotextile-related products - Determination of the resistance to weathering

Géotextiles et produits apparentés - Determination de la résistance au vieilissement dû aux conditions climatiques

Geotextilien und geotextilverwandte Produkte • Bestimmung der Witterungsbestandigkeit

This European Standard was approved by CEN on 15 July 2000.

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COMITfc EUROP£EN DE NORMALISATION
EUROPAISCHES KOMITEE FUR NORMUNCi

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

Ref. No. EN 12224:2000 E

Foreword

This European Standard has been prepared by Technical Committee **CEN/TC 189**, Geotextiles and geotextiies-reiated products, the Secretariat of which is held by **IBN.**

This European Standard supersedes ENV 12224:1996.

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of an identical text or by endorsement, at the latest by March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.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

The effect of weathering on the properties of geotextiles and geotextile-related products is of technical importance for many of their applications.

Since natural weathering requires testing at long durations, there is a need to obtain information more rapidly and reproducibly by accelerated procedures. For this purpose weathering devices with specific artificial light sources are used.

NOTE: For further information see **CR ISO 13434.**

1 Scope

This European Standard describes a method for determining the resistance of geotextiles and geotextile-related products to weathering conditions more intense than those of natural weathering.

This is an index test to differentiate between products with little or no resistance to weathering and those which do have this resistance.

2 Normative references

This European Standard incorporates by dated or undated reference, 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 (including amendments).

EN 12226:2000	*Geotextiles and geotextile-related products - General tests for evaluation following durability testing*
ISO 4892-1	*Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance*
ISO 4892-3	*Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps*

3 Principle

Specimens of the material to be tested are exposed to a light source for a defined radiant exposure or exposure time and at recommended temperature and moisture conditions. After this exposure the change in performance of these specimens is determined.

4 Apparatus

4.1 *Laboratory light sources*

The light sources used shall be fluorescent UV lamps in accordance with ISO 4892-3. To improve the correlation with outdoor exposure the spectrum of the light source shall be as near as possible to that of solar global radiation, particularly in the ultraviolet region, because polymers are generally very sensitive to changes in this spectral region.

NOTE: Fluorescent tubes can be selected to have a spectral output corresponding to that of the actinic ultraviolet region in solar global radiation.

The spectral irradiance of the fluorescent lamps in the UV-region shall be as given in Table 1.

Table 1 - Fluorescent UV lamps - spectral irradiance

Wavelength band (λ) **(in nm)**	**Irradiance in the band (in W/m^2) [a)]**	
	Type I (340 nm)	Combination of different types of lamps
290 to 320	3,1	3,3
320 to 360	25,1	22,0
360 to 400	11,0	18,0
[a)]Tolerances on all irradiances are ±10 %.		

As the characteristics of lamps and filters change in use due to ageing, they shall be replaced at appropriate intervals as recommended by the manufacturer of the lamp.

4.2 *Temperature monitoring system*

As the temperature of the specimen influences the result of the exposure test, the ambient temperature shall be controlled. To this purpose a black standard thermometer in accordance with ISO 4892-1 shall be used, mounted instead of a specimen holder with the blackened metal side facing the lamp.

NOTE 1: Fluorescent tubes produce little infrared radiation and there is generally no heat problem. As degradation processes generally run faster with increasing temperature, the surface temperature of specimens however remains an essential test parameter.

NOTE 2: The temperature is controlled by a black panel thermometer or black standard thermometer, since it is not practical to monitor the individual specimen temperatures. The black standard temperature may be controlled by adjustment of the cooling air circulation. Readings should only be taken after sufficient time for the temperature to become steady.

4.3 *Means of determining radiant exposure (optional)*

When appropriate, a radiation meter, in accordance with ISO 4892-1, may be included to measure the radiance (E) at the face of the specimen and the total radiant exposure (H).

NOTE: A direct comparison of the UV radiant exposure measured in the weathering apparatus with that measured during natural weathering is possible if, in both cases a radiation meter as described above is used. If, for the natural weathering, there are only data for the total radiant exposure, the radiant exposure value obtained in the wavelength range from 280 nm to 400 nm is multiplied by the appropriate factor specific to the apparatus by which the portion of the global radiation of wavelength from 400 nm to 2 450 nm is also taken into account.

4.4 *Specimen holders*

Specimen holders shall be made of two stainless steel grids of mesh size 15 mm to 20 mm and wire diameter of about 1 mm (transmitting area 87 % to 90 % of total area).

NOTE: If desired, a portion of each test specimen may be shielded by an opaque cover throughout the test. This gives an unexposed area adjacent to the exposed area for comparison.

5 Test conditions

Materials shall be exposed to continuous radiation according to Table 1 with the following wet/dry cycle:

- 5 h dry interval at a black standard temperature of (50 ± 3) °C;
- 1 h water spray at a black standard temperature of (25 ± 3) °C.

If required by the equipment, the fluorescent lamps shall be turned off during the spray interval. If the equipment allows, a cycle with a narrower variation of temperature of (50 ± 1) °C and a controlled relative humidity of (10 ± 5) % during the dry interval should be used.

NOTE 1: The photodegradation of geotextiles, especially those made from polyolefines and polyamides, may be strongly influenced by changes of temperature and relative humidity, e.g. the rate of photo-oxidation of polyethylene may increase by 8 % if the temperature increases by 1 °C.

The radiant exposure shall be 50 MJ/m^2.

NOTE 2: The durations required to reach a radiant exposure of 50 MJ/m^2 have been shown to be approximately:

- 320 h for devices with a combination of fluorescent UV lamps;
- 350 h for devices with type I (340 nm) fluorescent lamps if the lamps are left on during the water spray;
- 430 h for devices with type I (340 nm) fluorescent lamps if the lamps are turned off during the water spray.

6 Specimens for determination of change in properties

Prepare test and control specimens in accordance with EN 12226:2000.

7 Test procedure

7.1 *Mounting of specimens*

Attach the specimens to the specimen holders in the equipment in such a manner that the specimens are not subject to any mechanical stress. Identify each test specimen by suitable indelible marking, but not on areas to be used in testing. As a check, retain a plan of the mounting positions.

If an opaque cover is used (see 4.4), the data reported shall also be based on a comparison with control specimens stored separately in the dark.

NOTE: If desired, a portion of each test specimen may be shielded by an opaque cover throughout the test. This gives an unexposed area adjacent to the exposed area for comparison. This is useful for checking the progress of exposure.

7.2 *Exposure to light sources*

Before placing the specimens in the test chamber, ensure that the apparatus is operating at the agreed specified conditions. Maintain these conditions throughout the exposure.

Expose the mounted specimens for the specified period of exposure (see Clause **5**).

NOTE: The position of the specimens in the apparatus should be varied from time to time to reduce any local inequalities of exposure conditions.

If the position of the specimens is adjusted, ensure that they remain the same way up.

7.3 *Measurement of radiant exposure*

If the radiant exposure (H) is to be measured, mount an instrument for measuring radiation so that the radiometer indicates the UV irradiance at the test specimen's exposed surface.

Mount the radiation meter on a support for a test panel in such a way that it receives the same radiation as a flat specimen on the same support would receive, and locate it either at the specimen distance or where it has a sufficient field of view with the detector calibrated for irradiance (for the calibration procedure: see ISO 4892-1).

Express the exposure interval in terms of radiant exposure in J/m^2 for the UV range.

The irradiance (*E*) in the UV-wavelength range 300 nm to 400 nm or at a specific wavelength in UV (for example at 340 nm) shall be stated in the test report.

8 Determination of the change in performance of exposed samples

The properties of the exposed specimens and controls shall be determined in accordance with EN 12226:2000.

9 Test report

The test report shall include the following information:

a the number and date of this European Standard;

b) the material tested;

c) full record of the exposure conditions, including the following:

1) type and model number of the exposure apparatus;

2) type and age of light source and wattage;

3) type and age of filters, if applied;

4) if applicable, details of the radiant exposure and radiance at the specimen surfaces and the total number of cycles

5) elapsed exposure time (in hours);

6) spray cycle;

7) the black standard temperature;

8) the relative humidity;

d) the change in properties of the exposed specimens.

Annex A (informative)

Solar and artificial radiation

A.1 General

The quality and intensity of solar global radiation at the earth's surface vary with climate, location and time. Besides solar radiation there are other important factors that affect natural weathering and ageing process such as temperature, temperature cycling, humidity, etc. Therefore a maximum outdoor exposure of six summer months, as a basis of this index test, can cause a broad variability of results. A minimum of two years of natural exposure at a particular location may be required to minimize the variability among results from repeat exposures.

Experience has shown that correlation between results of testing with laboratory light sources and in natural daylight at a particular locality is material dependent. The correlation applies only to that specific type and formulation of material and for the particular properties evaluated.

For different types of products, the correlation factor between natural daylight and the same laboratory source may be different.

NOTE: See **ISO 4892-1** concerning factors reducing the degree of correlation.

A.2 Radiation

Polymers are spectrally selective in their reactions to radiant exposure. To ensure that the light source in the exposure apparatus produces the same type of photochemical reaction in the polymer as is produced by natural solar radiation, it is important that the relative spectral irradiance of the actinic portion of solar radiation be reproduced as faithfully as possible by the artificial light source.

Direct radiation from some fluorescent UV lamps contains considerable amounts of UV radiation of wavelength shorter than that found in solar global radiation and should be appropriately filtered. The exposure to UV radiation with wavelengths shorter than those in terrestrial solar radiation may lead to anomalous results.

Annex B (informative)

Bibliography

CR ISO 13434 *Guidelines on durability of geotextiles and geotextile-related products*

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