SLOVENSKI STANDARD

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Polimerni materiali – Metode izpostavljanja laboratorijskim virom svetlobe – 3. del: Fluorescentne UV-svetilke (ISO 4892-3:2006)

Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3:2006)

Kunststoffe - Künstliches Bestrahlen oder Bewittern in Geräten - Teil 3: UV-Leuchtstofflampen (ISO 4892-3:2006)

Plastiques - Méthodes d'exposition a des sources lumineuses de laboratoire - Partie 3: Lampes fluorescentes UV (ISO 4892-3:2006)

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Plastiques - Méthodes d'exposition à des sources lumineuses de laboratoire - Partie 3: Lampes fluorescentes UV (ISO 4892-3:2006)

Kunststoffe - Künstliches Bestrahlen oder Bewittern in Geräten - Teil 3: UV-Leuchtstofflampenstrahlung (ISO 4892-3:2006)

This European Standard was approved by CEN on 6 February 2006.

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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 Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN ISO 4892-3:2006) has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by August 2006, and conflicting national standards shall be withdrawn at the latest by August 2006.

This document supersedes EN ISO 4892-3:1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

Endorsement notice

The text of ISO 4892-3:2006 has been approved by CEN as EN ISO 4892-3:2006 without any modifications.

INTERNATIONAL STANDARD

ISO 4892-3

Second edition
2006-02-15

Plastics — Methods of exposure to laboratory light sources —

Part 3: Fluorescent UV lamps

Plastiques — Méthodes d'exposition à des sources lumineuses de laboratoire —

Partie 3: Lampes fluorescentes UV

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 4892-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

This second edition cancels and replaces the first edition (ISO 4892-3:1994), which has been technically revised.

ISO 4892 consists of the following parts, under the general title *Plastics — Methods of exposure to laboratory light sources*:

— *Part 1: General guidance*

— *Part 2: Xenon-arc lamps*

— *Part 3: Fluorescent UV lamps*

— *Part 4: Open-flame carbon-arc lamps*

Plastics — Methods of exposure to laboratory light sources —

Part 3: Fluorescent UV lamps

1 Scope

This part of ISO 4892 specifies methods for exposing specimens to fluorescent UV radiation, heat and water in apparatus designed to reproduce the weathering effects that occur when materials are exposed in actual end-use environments to daylight, or to daylight through window glass.

The specimens are exposed to fluorescent UV lamps under controlled environmental conditions (temperature, humidity and/or water). Different types of fluorescent UV lamp may be used to meet all the requirements for testing different materials.

Specimen preparation and evaluation of the results are covered in other ISO documents for specific materials.

General guidance is given in ISO 4892-1.

NOTE Fluorescent UV lamp exposures for paints, varnishes and other coatings are described in ISO 11507[4].

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.

ISO 4582, *Plastics — Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or laboratory light sources*

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

3 Principle

3.1 Fluorescent UV lamps, when properly maintained, can be used to simulate the spectral irradiance of daylight in the ultraviolet (UV) region of the spectrum.

3.2 Specimens are exposed to various levels of UV radiation, heat and moisture (see 3.4) under controlled environmental conditions.

3.3 The exposure conditions may be varied by selection of:

a) The type of fluorescent lamp.

b) The irradiance level.

c) The temperature during the light exposure.

d) The relative humidity of the chamber air during the light and dark exposures, when test conditions requiring control of humidity are used.

NOTE Commercial fluorescent UV devices usually do not provide means of relative humidity control.

e) The type of wetting (see 3.4).

f) The wetting temperature and cycle.

g) The timing of the light/dark cycle.

3.4 Wetting is usually produced by condensation of water vapour onto the exposed specimen surface or by spraying the test specimens with demineralized/deionized water.

3.5 The procedure(s) may include measurement of the irradiance and the radiant exposure in the plane of the specimen.

3.6 It is recommended that a similar material of known performance (a control) be exposed simultaneously with the test specimens to provide a standard for comparative purposes.

3.7 Intercomparison of results obtained from specimens exposed in different apparatus or to different types of lamp should not be made unless an appropriate statistical relationship has been established between the different types of equipment for the material to be tested.

4 Apparatus

4.1 Laboratory light source

4.1.1 Fluorescent UV lamps are fluorescent lamps in which radiant emission in the ultraviolet region of the spectrum, i.e. below 400 nm, makes up at least 80 % of the total light output. There are three types of fluorescent UV lamp used in this part of ISO 4892:

— **Type 1A (UVA-340) fluorescent UV lamp**: These lamps have a radiant emission below 300 nm of less than 2 % of the total light output, have an emission peak at 343 nm, and are more commonly identified as UVA-340 for simulation of daylight from 300 nm to 340 nm (see Table 1, column A.1). Figure A.1 of Annex A is a graph of spectral irradiance from 250 nm to 400 nm of a typical type 1A (UVA-340) fluorescent lamp compared to daylight. If specified and agreed upon by all parties, a combination of fluorescent UVA lamps may also be used (see Table 1, column A.2). When combinations of lamps with different spectral emissions are used, provision shall be made to ensure the uniformity of the spectral irradiance at the surface of the specimens, e.g. by continuous repositioning of the specimens around the lamp array.

— **Type 1B (UVA-351) fluorescent UV lamp**: These lamps have a radiant emission below 300 nm of less than 2 % of the total light output, have a peak emission at 353 nm, and are more commonly identified as UVA-351 for simulation of the UV portion of daylight behind window glass (see Table 2). Figure A.2 of Annex A is a graph of spectral irradiance from 250 nm to 400 nm of a typical type 1B (UVA-351) fluorescent UV lamp compared to daylight filtered by window glass.

— **Type 2 (UVB-313) fluorescent UV lamp**: These lamps are more commonly identified as UVB-313 and have a radiant emission below 300 nm that is more than 10 % of the total output and a peak emission at 313 nm (see Table 3). Figure A.3 of Annex A is a graph of the spectral irradiance from 250 nm to 400 nm of two typical type 2 (UVB-313) fluorescent lamps compared to daylight. Type 2 (UVB-313) lamps may be used only by agreement between the parties concerned. Such agreement shall be stated in the test report.

NOTE 1 Type 2 (UVB-313) lamps have a spectral distribution of radiation which peaks near the 313 nm mercury line and may emit radiation down to λ = 254 nm, which can initiate ageing processes that never occur in end-use environments.

NOTE 2 The solar spectral irradiance for a number of different atmospheric conditions is described in CIE Publication No. 85[1]. The benchmark daylight used in this part of ISO 4892 is from Table 4 in CIE Publication No. 85:1989.

4.1.2 Unless otherwise specified, type 1A (UVA-340) fluorescent UV lamps or corresponding type 1A fluorescent UV lamp combinations shall be used to simulate the UV part of daylight (see Table 4, method A). Unless otherwise specified, type 1B (UVA-351) lamps shall be used to simulate the UV part of daylight through window glass (see Table 4, method B).

4.1.3 Fluorescent lamps age significantly with extended use. If an automatic irradiance control system is not used, follow the apparatus manufacturer's instructions on the procedure necessary to maintain the desired irradiance.

4.1.4 Irradiance uniformity shall be in accordance with the requirements specified in ISO 4892-1. Requirements for periodic repositioning of specimens when irradiance within the exposure area is less than 90 % of the peak irradiance are described in ISO 4892-1.

Table 1 — Relative ultraviolet spectral irradiance for type 1A lamps for daylight UV (method A) [a, b]

Spectral passband (λ = wavelength in nm)	Type 1A (UVA-340) lamp A.1			Type 1A lamp combination A.2		
	Minimum [c] %	CIE No. 85:1989, Table 4 [d,e] %	Maximum [c] %	Minimum [c] %	CIE No. 85:1989, Table 4 [d,e] %	Maximum [c] %
$\lambda < 290$		0	0,01		0	0
$290 \leqslant \lambda \leqslant 320$	5,9	5,4	9,3	4	5,4	7
$320 < \lambda \leqslant 360$	60,9	38,2	65,5	48	38,2	56
$360 < \lambda \leqslant 400$	26,5	56,4	32,8	38	56,4	46

a This table gives the irradiance in the given passband, expressed as a percentage of the total irradiance between 290 nm and 400 nm. To determine whether a specific type 1A (UVA-340) lamp meets the requirements of this table, the spectral irradiance from 250 nm to 400 nm shall be measured. Typically, this is done in 2 nm increments. The total irradiance in each passband is then summed and divided by the total irradiance between 290 nm and 400 nm.

b The minimum and maximum limits for type 1A (UVA-340) lamps in this table are based on more than 60 spectral irradiance measurements with type 1A (UVA-340) lamps from different production lots and of various ages [2]. The spectral irradiance data are for lamps within the ageing recommendations of the apparatus manufacturer. As more spectral irradiance data become available, minor changes in the limits are possible. The minimum and maximum limits are at least three sigma from the mean for all the measurements. The range of the relative irradiance of fluorescent UV lamp combinations is determined by radiation measurements at about 50 locations within the exposure area recommended by the apparatus manufacturer.

c The minimum and maximum columns will not necessarily sum to 100 % because they represent the minima and maxima for the measurement data used. For any individual spectral irradiance distribution, the percentages calculated for the passbands in this table will sum to 100 %. For any individual type 1A (UVA-340) fluorescent lamp, the calculated percentage in each passband shall fall within the minimum and maximum limits given. Test results can be expected to differ between exposures using type 1A (UVA-340) lamps in which the spectral irradiance differs by as much as that allowed by the tolerances. Contact the manufacturer of the fluorescent UV apparatus for specific spectral irradiance data for the type 1A (UVA-340) lamp used.

d The data from Table 4 in CIE Publication No. 85:1989 is the global solar irradiance on a horizontal surface for an air mass of 1,0, an ozone column of 0,34 cm at STP, 1,42 cm of precipitable water vapour and a spectral optical depth of aerosol extinction of 0,1 at 500 nm. These data are provided for reference purposes only and are intended to serve as a target.

e For the solar spectrum represented by Table 4 in CIE No. 85:1989, the UV irradiance (290 nm to 400 nm) is 11 % and the visible irradiance (400 nm to 800 nm) is 89 %, expressed as a percentage of the total irradiance from 290 nm to 800 nm. Because the primary emission of fluorescent UV lamps is concentrated in the 300 nm to 400 nm passband, there are limited data available for the visible light emission of fluorescent UV lamps. The percentages of UV irradiance and visible irradiance on specimens exposed in fluorescent UV apparatus may vary due to the number of specimens being exposed and their reflectance properties.