
**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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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

This fourth edition cancels and replaces the third edition (ISO 4892-3:2013), of which it constitutes a minor revision with the following change:

— in [A.2.3](#), further information on lamp combination is added.

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 simulate the weathering effects that occur when materials are exposed in actual end-use environments to global solar radiation, or to solar radiation 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 can be used to meet all the requirements for testing different materials.

Specimen preparation and evaluation of the results are covered in other International Standards 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.

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.

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 following the manufacturer's recommendations for lamp maintenance and/or rotation, may be used to simulate the spectral irradiance of global solar radiation in the short wavelength 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 the following:

- a) type of fluorescent UV lamp;
- b) irradiance level;
- c) temperature during the UV exposure;
- d) type of wetting (see [3.4](#));

- e) wetting temperature and cycle;
- f) timing of the UV/dark cycle.

3.4 Wetting is usually produced by condensation of water vapour on to 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 types of 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.

- **UVA-340 (type 1A) fluorescent UV lamp:** these lamps have a radiant emission below 300 nm of less than 1 % of the total light output, have an emission peak at 343 nm, and are more commonly identified as UVA-340 for simulation of global solar radiation from 300 nm to 340 nm (see [Table 1](#)). [Figure A.1](#) is a graph of spectral irradiance from 250 nm to 400 nm of a typical UVA-340 (type 1A) fluorescent lamp compared to global solar radiation.
- **UVA-351 (type 1B) fluorescent UV lamp:** these lamps have a radiant emission below 310 nm of less than 1 % 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 solar radiation behind window glass (see [Table 2](#)). [Figure A.2](#) is a graph of spectral irradiance from 250 nm to 400 nm of a typical UVA-351 (type 1B) fluorescent UV lamp compared to global solar radiation filtered by window glass.
- **UVB-313 (type 2) 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](#) is a graph of the spectral irradiance from 250 nm to 400 nm of two typical UVB-313 (type 2) fluorescent lamps compared to global solar radiation. UVB-313 (type 2) lamps may be used only by agreement between the parties concerned. Such agreement shall be stated in the test report.
- **Four different UV lamps used as one combination:** these four different UV lamps are used together as one combination with a suited filter. See [Figure A.4](#) in [A.2.3](#).

NOTE 1 UVB-313 (type 2) lamps have a spectral distribution of radiation, which peaks near the 313 nm mercury line and can emit radiation down to $\lambda = 254$ 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. The benchmark global solar radiation used in this part of ISO 4892 is from CIE Publication No. 85:1989, Table 4.

4.1.2 Unless otherwise specified, UVA-340 (type 1A) fluorescent UV lamps shall be used to simulate the UV part of global solar radiation (see [Table 4](#), method A). Unless otherwise specified, UVA-351 (type 1B)

lamps shall be used to simulate the UV part of solar radiation through window glass (see Table 4, method B). The four-lamp UV combination may be used (see A.2.3) and shall be stated in the test report.

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 UVA-340 (type 1A) lamps for global solar UV radiation (method A)^{a,b}

Spectral passband [λ = wavelength in nanometres (nm)]	Minimum^c %	CIE No. 85:1989, Table 4^{d,e} %	Maximum^c %
$\lambda < 290$	—	0	0,1
$290 \leq \lambda \leq 320$	5,9	5,4	9,3
$320 < \lambda \leq 360$	60,9	38,2	65,5
$360 < \lambda \leq 400$	26,5	56,4	32,8

^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 or not a specific UVA-340 (type 1A) 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 UVA-340 (type 1A) lamps in this table are based on more than 60 spectral irradiance measurements with UVA-340 (type 1A) lamps from different production lots and of various ages.^[3] The spectral irradiance data are for lamps within the ageing recommendations of the manufacturer of the apparatus. As more spectral irradiance data become available, minor changes in the limits are possible. The minimum and maximum limits are at least three sigmas from the mean for all the measurements.

^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 UVA-340 (type 1A) 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 UVA-340 (type 1A) 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 UVA-340 (type 1A) lamp used.

^d The data from Table 4 of CIE Publication No. 85:1989 are 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 CIE No. 85:1989, Table 4, 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.