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colour inside

Coaxial communication cables – Part 1-212: Environmental test methods – UV stability

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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IEC 61196-1-212 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
46A/1452/CDV	46A/1487/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61196 series, published under the general title *Coaxial communication cables*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

UV hazard assessment for synthetic compounds is possible using a number of UV sources. For the purposes of this document, three alternative methods are given.

1) Method A uses a xenon arc source to simulate the UV effect on cable sheath. The effect is measured by the variation of mechanical characteristics and/or change in colour after exposure.
2) Method B uses a fluorescent lamp to simulate the UV effect on cable sheath. Two different lamps may be used: type I (called UV-A lamps) and type II (called UV-B lamps). The effect is measured, as for method A, by the variation of mechanical characteristics and/or change in colour after exposure.
3) Method C uses a mercury vapour lamp to simulate the UV effect on cable sheath. As for methods A and B, the effect is determined by the variation of mechanical characteristics and/or change in colour after exposure. This test has been typically used for telecommunication cables.

For outdoor cable application only, the test specimens are periodically subjected to water attack, for methods A and B. A recent modification of method C now allows for a water immersion cycle.

For method C, the round robin tests made without water (see Annex B) indicate the method may be applicable to outdoor environments.

Other sources and determination methods are capable of detecting and analysing the UV hazard for a cable sheath. Examples of such methods are metal halide lamps or sunshine carbon arc lamps, in combination with proper filters in order to cut off most radiation having wavelengths lower than 290 nm. Contracting parties may agree to use such other methods, but such methods cannot claim conformity to this document. If used, it is recommended that such methods have at least equivalent sensitivity and detection levels as those in this document.

Informative Annex B gives guidelines for the use and interpretation of results.

NOTE It is useful to recall the introduction to ISO 4892-1:2016, which says, "*The relative durability of materials in actual-use exposures can be very different depending on the location of the exposure because of differences in UV radiation, time of wetness, temperature, pollutants and other factors. Therefore, even if results from a specific accelerated laboratory test are found to be useful for comparing the relative durability of materials exposed in a particular outdoor location or in particular actual-use conditions, it cannot be assumed that they will be useful for determining the relative durability of materials exposed in a different outdoor location or in different actual-use conditions.*"

COAXIAL COMMUNICATION CABLES –

Part 1-212: Environmental test methods – UV stability

1 Scope

This part of IEC 61196 describes three methods to determine the UV resistance of sheath materials for electric and optical fibre cables. These tests apply for outdoor and indoor cable applications according to the product standard. The samples of sheath are taken from the finished cables.

Although this test method is written principally for communication cables, it can be used for energy cables if called up by the relevant product standard.

Where a sheath is of cross-linked (thermosetting) material, it is recalled that the preparation of moulded plaques is made before crosslinking.

Methods differ by the nature of the UV source.

Due to the excessive time to failure, the methods described are inappropriate to products where UV resistance is conferred by ≥2,0 % carbon black content meeting the requirements defined in IEC 60708.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60708, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath*

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

ISO 4892-1:2016, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 9370, *Plastics – Instrumental determination of radiant exposure in weathering tests – General guidance and basic test method*

EN 16472, *Plastics – Method for artificial accelerated photoageing using medium pressure mercury vapour lamps*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
median value
when several test results have been obtained and ordered in an increasing (or decreasing) succession, middle value if the number of available values is odd, and mean of the two middle values if the number is even

[SOURCE: IEC 60811-100:2012, 3.1]

4 Test methods

4.1 Test methods for outdoor application

4.1.1 Method A: xenon arc source

4.1.1.1 General

According to ISO 4892-1:2016, Clause C.2, the xenon arc lamp, when appropriately filtered, produces radiations with a spectral power distribution that is a good simulation of average daylight throughout the UV and visible region.

The exposure apparatus is typically constituted by a rotating specimen holder drum, which rotates around the light source, as per ISO 4892-1:2016, Figure A.1.

Apparatus having a fixed specimen holder is also permitted. In this case, it is important that air can circulate around the sample to allow a homogeneous repartition of temperature.

4.1.1.2 Apparatus

The testing apparatus is equipped with the following lamps and filters and is set with the parameters prescribed below:

– a ray source consisting of a xenon arc lamp ("long arc" type) equipped with borosilicate filters so that the typical irradiance should be 43 W/m^2 (1 ± 15 %) with a spectrum between 300 nm and 400 nm;
– a means to provide automatic control of temperature, humidity and cycles;
– a generator of deionised water with a conductivity not greater than 5 µS/cm (the pH should be recorded); the water shall leave no observable stains or deposits and should therefore contain less than 1 ppm of solids; the rate of flow should be sufficient to guarantee that all the test specimens can be washed;
– a means to control the irradiance to produce (43,0 ± 0,2) W/m^2 at 340 nm (if the apparatus is not equipped with irradiance control, follow the device manufacturer's recommendations to produce this irradiance).

More details are given in ISO 4892-2.

4.1.1.3 Sample and test specimen preparation

A sample, at least 600 mm long, shall be taken of the finished cable or of the outer sheath removed from the finished cable. It shall be used to prepare 12 test specimens. Test specimens shall be prepared according to IEC 60811-202.

In case, for geometrical reasons, it is not possible to use the above samples (finished cable or outer sheath), test specimens shall be cut from a finished cable, a moulded plaque prepared from pieces of the cable sheath or a moulded plaque produced from granules of the same material and colour of the cable sheath. The thickness of the test pieces shall be (1,0 ± 0,1) mm.

4.1.1.4 Procedure

Six test specimens shall be suspended vertically so that the external surface is uniformly exposed to the action of the actinic rays. During the test, the temperature indicated by the black-panel or the black-standard thermometer shall remain in the range (60 ± 3) °C and the relative humidity shall remain in the range of (50 ± 5) % (only in the dry period in the case of a test for outdoor application). The rotating drum carrying the test specimens shall turn at a speed of (1 ± 0,1) r/min. If a flat specimen plane is used, the minimum irradiance in any point of the specimen exposure area shall be at least 90 % of maximum irradiance.

Test specimens are cycled through periods of UV exposure, followed by periods of no radiation during which temperature changes occur.

The periods of each cycle, total time of 120 min, are the following:

– 102 min of dry UV exposure at a temperature of (60 ± 3) °C[1], followed by

– 18 min of deionised water exposure, without radiation, at a temperature of (50 ± 5) °C.

The overall duration of the test shall be as defined in the relevant product standard. In the absence of such a definition, guidance is given in Annex B.

After the exposure, the exposed test specimens shall be removed from the equipment and conditioned at ambient temperature for at least 16 h.

The six other test specimens shall be kept at ambient temperature and protected from any light source during the UV treatment; they shall be tested at the same time as the exposed test specimens.

4.1.2 Method B: fluorescent UV lamp

4.1.2.1 General

According to ISO 4892-3:2016 [6][2], 4.1.1, there are different types of fluorescent UV lamps that may be used as laboratory light sources:

– type I lamps (commonly called UV-A lamps), with the preferred option of the UV-A 340 lamp, having a spectral radiation that peaks at 340 nm;

– type II lamps (commonly called UV-B lamps), having a spectral radiation that peaks near the 313 nm mercury line; these type II fluorescent UV lamps emit significant amount of radiation below 300 nm, the nominal cut off wavelength for solar radiation, which may result in ageing processes not completely equal to those occurring outdoors. The method using UV-B lamps is however frequently used by agreement between the parties.

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1 Temperature indicated by the black-panel or the black-standard thermometer.

2 Numbers in square brackets refer to the Bibliography.

The exposure apparatus is typically constituted by a device where specimens are positioned in a flat plane in front of an array of light sources, as per ISO 4892-1:2016, Figure A.2.

4.1.2.2 Apparatus

The testing apparatus is equipped as follows:

– a ray source consisting of type I or type II fluorescent UV lamps, having a typical irradiance peak of at least 0,68 W/m^2 at 340 nm for the UV-A 340 lamp, and at 313 nm for the UV-B 313 lamp;

– an exposure chamber constructed from inert material, such as to provide uniform irradiance, with a means for controlling temperature and cycles and a means for providing the formation of water condensate on the exposed face of the specimens;

– a means to control the specified value of irradiance or, if the apparatus is not equipped with irradiance control, follow the device manufacturer's recommendations on the procedure necessary to maintain the required irradiance.

4.1.2.3 Sample and test specimen preparation

See 4.1.1.3.

4.1.2.4 Procedure

Six test specimens shall be mounted so that the exposed face is uniformly exposed to the action of the actinic rays.

Depending on the apparatus, lamp replacement, lamp rotation and test specimens, re-arrangement may be required to obtain uniform exposure of all specimens to UV radiation and temperature. In such a case, follow the manufacturer's recommendations for lamp replacement/rotation or for the re-arrangement of the test specimens.

Test specimens are cycled through periods of UV exposure, followed by periods of no radiation during which temperature changes occur and condensation forms on the specimens.

The periods of each cycle, total time of 720 min, are the following:

– 600 min of dry UV exposure at a temperature of (60 ± 3) °C[3], followed by

– 120 min of condensation exposure, without radiation, at a temperature of (50 ± 3) °C[3].

For coloured compounds, a black-standard temperature of (60 ± 3) °C shall be used.

The overall duration of the test shall be as defined in the relevant product standard. In the absence of such a definition, guidance is given in Annex B.

After the exposure, the exposed test specimens shall be removed from the equipment and conditioned at ambient temperature for at least 16 h.

The six other test specimens shall be kept at ambient temperature and protected from direct sunlight during the UV treatment; they shall be tested at the same time as the exposed test specimens.

3 Temperature indicated by the black-panel or the black-standard thermometer.