SLOVENSKI STANDARD
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Komunikacijski kabli - Specifikacije za preskusne metode - 4-17. del: Preskusne metode za vrednotenje odpornosti plaščev električnih in optičnih kablov proti UV-žarkom

Communication cables - Specifications for test methods - Part 4-17: Test methods for UV resistance evaluation of the sheath of electrical and optical fibre cable

Kommunikationskabel - Spezifikationen für Prüfverfahren - Teil.4-17: Prüfverfahren zur Ermittlung der UV-Beständigkeit der Mäntel elektrischer und optischer Kabel

Câbles de communication - Spécifications des méthodes d'essais - Partie 4-17: Méthodes d'essai pour évaluer la résistance aux UV des gaines des câbles électriques et des câbles à fibre optique

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Câbles de communication - Spécifications des méthodes d'essais - Partie 4-17: Méthodes d'essai pour évaluer la résistance aux UV des gaines des câbles électriques et des câbles à fibre optique

Kommunikationskabel - Spezifikationen für Prüfverfahren - Teil 4-17: Prüfverfahren zur Ermittlung der UV-Beständigkeit der Mäntel elektrischer und optischer Kabel

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Contents

Page

Figures

Tables

European foreword

This document (EN 50289-4-17:2015) has been prepared by CLC/TC 46X “Communication cables”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-08-31
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-08-31

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This document supersedes EN 50289-4-17:2011.

EN 50289-4-17:2015 includes the following significant technical changes with respect to EN 50289-4-17:2011:

Annex A has been downgraded as “informative”.

Annexes B and C have been deleted and a new Annex B has been introduced that is no longer requirements but only a guideline to the interpretation and use.

Introduction

UV hazard assessment for synthetic compounds is possible using a number of UV sources. For the purposes of this European Standard, 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 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 European Standard. If used, it is recommended that such methods have at least equivalent sensitivity and detection levels as those in this European Standard.

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

NOTE It is important to recall the introduction to EN ISO 4892-1:2000, 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.*"

1 Scope

This European Standard describes three methods to determine the UV resistance of sheath materials for electric and for 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 European Standard is written principally for communication cables, it may be used for energy cables if called up by the relevant product standard.

Where a sheath is of cross-linked (thermosetting) material, it should be recalled that the preparation of moulded plaques should be 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 meeting the dispersion requirements defined in EN 50290-2-24.

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.

EN 16472:2014, *Plastics — Method for artificial accelerated photoageing using medium pressure mercury vapour lamps*

EN 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 60811-202)*

EN 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 (IEC 60811-501)*

EN ISO 4892-1:2000, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

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

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

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 value is odd, and mean of the two middle values if the number is even

[SOURCE: EN 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 EN ISO 4892-1:2000, 5.1.6.1, 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 EN ISO 4892-1:2000, Figure B.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 ± 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 EN ISO 4892-2:2013.

4.1.1.3 Sample and test specimen preparation

A sample, at least 600 mm long, 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 EN 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 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 (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 EN ISO 4892-3:2013, 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 340nm;

– 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.

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 EN ISO 4892-1:2000, Figure B.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.

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

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 [2)], followed by

– 120 min of condensation exposure, without radiation, at a temperature of (50 ± 3) °C [2)].

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.

4.1.3 Method C: mercury vapour lamp

4.1.3.1 General

EN 16472:2014 specifies a method for carrying out artificial accelerated photoageing of test specimens by exposing them to medium pressure filtered mercury vapour lamp as light source, under controlled temperature conditions. An example of a test chamber is shown in Annex A.

4.1.3.2 Apparatus

The apparatus shall consist of a test chamber as described in EN 16472.

The UV irradiance, between 300 nm to 400 nm, is typically controlled in the range (90 ± 10) W/m^2 by mean of an additional radiometer, according to ISO 9370.

The drum carrying the test specimens shall rotate at a minimal speed of 0,5 r/min.

4.1.3.3 Sample and test specimen preparation

Twelve test specimens shall be cut from a moulded plaque of the same material of the cable sheath to be tested. The material used for the test specimens shall have the same composition as the relevant cable sheath, and be of the same colour.

Test specimens shall be prepared according to EN 60811-202; the thickness shall be (1,0 ± 0,1) mm.

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2) Temperature indicated by the black-panel or the black-standard thermometer.

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 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.

4.1.3.4 Procedure

Six test specimens shall be suspended vertically so that the surface is exposed to the action of the UV lamp. During the test, the temperature of the temperature sensor shall remain in the range (60 ± 2) °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 direct sunlight during the UV treatment; they shall be tested at the same time as the exposed test specimens.

If an immersion cycle is used, the kind of aqueous solution, the frequency, temperature and duration of the immersion shall be reported.

If dark periods are introduced in the cycle, their frequency, temperature and duration shall be reported.

Cycles shall be agreed upon by the interested parties.

4.2 Test methods for indoor application

4.2.1 Method A: xenon arc source

4.2.1.1 General

See 4.1.1.1.

4.2.1.2 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[1]) so that the typical irradiance should be (43,0 ± 0,2) W/m^2 at 340 nm;

– a means to provide automatic control of temperature and cycles;

– 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).

4.2.1.3 Sample and test specimen preparation

See 4.1.1.3.

4.2.1.4 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.