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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

AMENDMENT 2
AMENDEMENT 2

LED modules for general lighting – Performance requirements

Modules de LED pour éclairage général – Exigences de performance

IEC 62717:2014-12/AMD2:2019-01(en-fr)

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LED modules for general lighting – Performance requirements

Modules de LED pour éclairage général – Exigences de performance

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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FOREWORD

This amendment has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

The text of this amendment is based on the following documents:

FDIS	Report on voting
34A/2121/FDIS	34A/2127/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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2 Normative references

Delete the reference to CIE 121:1996 and the reference to IES LM-80, added by Amendment 1.:

Add the following new references:

CIE S 025/E:2015, *Test Method for LED Lamps, LED Luminaires and LED Modules*

ANSI/IES LM-80-15, *Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules*

3 Terms and definitions

Replace terminological entries 3.5, 3.7, 3.11, 3.12 and 3.13 with the following new entries:

3.5
flux degraded LED product
operating LED product that emits an amount of luminous flux less than the luminous flux relating to the required luminous flux maintenance factor x

Note 1 to entry: For illustration of gradual depreciation mode, causing a flux degraded product, see Figure C.1.

Note 2 to entry: In general, LED products include LED lamps, LED modules and LED luminaires although this term can be used with any LED based lighting product.

3.7
median useful life
L_x
<of LED modules> length of operating time during which a total of 50 % (B_{50}) of a population of operating LED modules of the same type have flux degraded to the luminous flux maintenance factor x

Note 1 to entry: The median useful life includes operating LED modules only.

Note 2 to entry: By convention, the expression “life of LED modules” without any modifiers is understood to mean the median useful life.

3.11
combined failure value
CFV
percentage of LED modules or LED luminaires having either flux degraded or abruptly failed at median useful life L_x

Note 1 to entry: CFV = 50 % + 0,5 × AFV.

EXAMPLE Given AFV = 15 %, then CFV = 50 % + 0,5 × 15 % = 57,5 %

Note 2 to entry: This note applies to the French language only.

3.12
combined life
M_xF_y
<of LED lamps> length of time during which y % (F_y) of a population of initially operating LED lamps of the same type have either flux degraded to the luminous flux maintenance factor x or abruptly failed

Note 1 to entry: The combined life (of LED lamps) includes operating and non-operating LED lamps.

3.13
median combined life
M_x
<of LED lamps> length of time during which 50 % (F_{50}) of a population of initially operating LED lamps of the same type have either flux degraded or abruptly failed

Note 1 to entry: The median combined life (of LED lamps) includes operating and non-operating LED lamps.

Add, at the end of Clause 3, the following new terminological entry:

3.22
useful life
L_xB_y
<of LED modules> length of time until at maximum a percentage y of a population of operating LED modules of the same type have degraded to the luminous flux maintenance factor x

Note 1 to entry: The useful life includes operating LED modules only.

Note 2 to entry: Typically median useful life values L_x are provided (see definition 3.7).

4 Marking

4.1 Mandatory marking

Table 1

Replace item c) and item m) as follows:

c) Rated median useful life L_x (h) and the related luminous flux maintenance x [6]	–	x	x
m) void	–	–	–

Add, after table footnote 5 the following new table footnote 6:

6 The rated useful life L_xB_y (in hours) and the associated luminous flux maintenance factor x and percentage y can optionally be on the product datasheets, leaflets or website.

4.2 Additional marking

Replace, in the first and second paragraphs, "estimated life time" with "median useful life".

Table 2

Replace the existing title with the following new title:

Table 2 – LED module median useful life information

*Replace, in the first column, second row, "*Rated life time (h)*" with "*Median useful life L_x (h)", *as follows*:

Median useful life L_x (h)	XX XXX [a]	XX XXX [a]	XX XXX [a]

6 Test conditions

6.1 General test conditions

Replace the fourth paragraph with the following new paragraph:

Testing duration is 25 % of rated median useful life with a maximum of 6 000 h.

In the fifth paragraph, added by Amendment 1, replace "IES LM-80" with "ANSI/IES LM-80-15".

8 Light output

8.3 Luminous efficacy

Delete the content of Subclause 8.3 and replace with "Void".

9 Chromaticity coordinates, correlated colour temperature (CCT) and colour rendering

9.3 Color rendering index (CRI)

Replace the existing text with the following new text:

The initial colour rendering index (CRI) of a LED module is measured.

Compliance:

For all tested LED modules in a sample the measured CRI shall not be lower than 3 points from the rated CRI (see Table 1).

10 LED module life

10.2 Lumen maintenance

Replace Subclause 10.2 including its title, with the following new subclause:

10.2 Luminous flux maintenance

The rated luminous flux maintenance factor may vary depending on the application of the LED module. Dedicated information on the chosen percentage should be provided by the manufacturer.

NOTE 1 As the typical life of a LED module is (very) long, it is within the scope of this standard regarded impractical and time consuming to measure the actual luminous flux reduction over life (e.g. L_{70}). For that reason this standard relies on test results to determine the expected lumen maintenance code of any LED module.

NOTE 2 The actual luminous flux maintenance of LED modules can differ considerably per type and per manufacturer. It is not possible to express the luminous flux maintenance of all LEDs in simple mathematical relations. A fast initial decrease in luminous flux does not automatically imply that a particular LED will not make its rated life.

NOTE 3 Other methods providing more advanced insight in luminous flux depreciation over LED module life are under consideration.

This standard has opted for "lumen maintenance codes" (see Figure 2) that cover the initial decrease in luminous flux until an operational time as stated in 6.1. There are three codes which define luminous flux maintenance in percent of the initial luminous flux (see Table 6).

Table 6 – Lumen maintenance code at an operational time as stated in 6.1

Luminous flux maintenance %	Code
≥ 90	9
≥ 80	8
≥ 70	7

The initial luminous flux shall be measured. The measurement is repeated at an operational time as stated in 6.1. The initial luminous flux value is normalized to 100 %; it is used as the first data point for determining LED module life. The measured luminous flux value at an operational time as stated in 6.1 shall be expressed as maintained value (= percentage of the initial value).

It is recommended to measure the luminous flux at 1 000 h intervals (expressed as a percentage of the initial value) for a total equal to an operational time as stated in 6.1.

NOTE 4 This will give an additional insight as to the reliability of the measured values, but assigning a code does not imply a prediction of achievable life time. LED modules with a higher code could be better or worse than LED modules with a lower code.

For marking of the luminous flux maintenance factor x and the lumen maintenance codes, see Table 1.

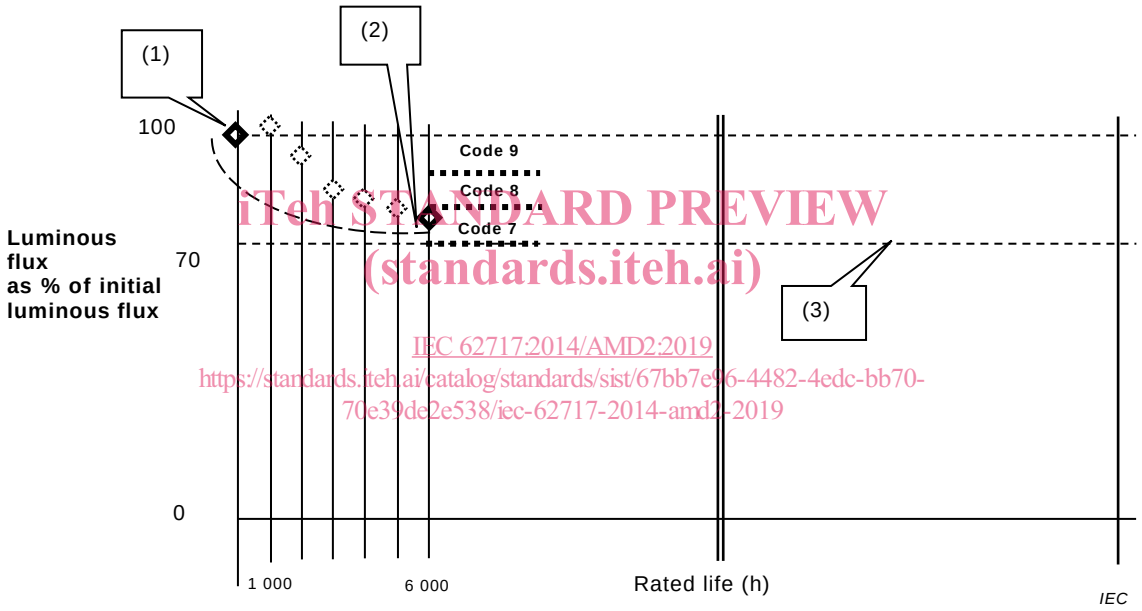
Compliance at 25 % of rated median useful life L_x with a maximum of 6 000 h test duration:

For compliance of family members, refer to 6.2.3.

An individual LED module is considered as having passed the test when the following criteria have been met.

1) *The measured luminous flux value at 25 % of the rated median useful life (with a maximum duration of 6 000 h) shall not be less than the initial luminous flux, multiplied by the rated luminous flux maintenance factor x.*
2) *The calculated luminous flux maintenance (being the ratio of the measured maintained and initial luminous flux) shall correspond with the "lumen maintenance code" as declared by the manufacturer or responsible vendor.*

Given a sample of n LED modules according to Table 7 being subjected to the 25 % of rated median useful life test with a maximum of 6 000 h, it is deemed as having passed the test, if at the end of the test, at least 90 % of the LED modules have passed.



Key

(1) Initial luminous flux

(2) Measured luminous flux value at an operational time as stated in 6.1

(3) Lower limit line: claimed flux decrease over rated life L_{70}

NOTE The figure is given for illustrative purposes only.

Figure 2 – Luminous flux depreciation over test time

10.3 Endurance tests

10.3.3 Supply switching test

Replace the first paragraph with the following new text:

At test voltage, current or power, the LED module shall be switched on and off for 30 s each. The cycling shall be repeated for a number equal to half the rated median useful life L_x in hours (example: 10 000 cycles if rated median useful life is 20 000 h).

10.3.4 Accelerated operation in life test

Replace the third paragraph, starting with "At the end of this period...", with the following new text:

At the end of this period and being stabilized at $t_{p,rated}$, all the LED modules have an allowed decrease of light output at the end of the test of maximum 20 % compared to the initial value, for at least 15 min.

Replace the note with with the following new note:

NOTE This test is to check for abrupt failures.

11 Verification

Table 7

Delete the line "8.3 Efficacy".

Replace Annex A with the following new Annex A:

Annex A
(normative)

Method of measuring LED module characteristics

A.1 General

Unless otherwise specified in Clause A.1, for general conditions of photometric and colorimetric measurements CIE S 025/E:2015, Clauses 4 and 5 apply.

Unless otherwise declared, LED modules do not require any ageing prior to testing. An ageing period of up to 1 000 h may be specified by the manufacturer.

Unless otherwise specified, all measurements shall be made in a draught free room at a relative humidity of 65 % maximum.

The temperature at the t_p-point shall be set at the recommended maximum LED module operating temperature value, $t_{p\ rated}$ for the measurements. If not accessible, the manufacturer shall indicate a temperature monitoring point. If heat sinks are needed for the correct operating of the LED module and the LED module does not have a heat sink, a suitable temperature controlled heat sink may be used.

Interpolation techniques for photometric and colorimetric data at t_p may also be applied (see also CIE S 025/E:2015, Annex C for information). Measurements may be performed at different temperatures. For this, the relation between the two temperatures ($t_{p,rated}$ and a different t_p within the range of the manufacturer's provided data) and the measured characteristic shall be established beforehand in an unambiguous manner by data provided by the LED module manufacturer. In case of doubt the reference measurement is performed at $t_{p,rated}$. Depending on the type of control circuit the LED module manufacturer is using, the t_p measurement shall be done at the most onerous condition of operation. The value of $t_{p,rated}$ shall be reported in Clause 4.

The manufacturer shall provide, on request, information on the method used to reproduce the claimed characteristics declared at t_p-point.

For surface temperature measurement, equipment as specified in informative Annex H may be used.

Independent LED modules that incorporate heat sinks are operated in free air and measured at a temperature of 25 °C with a tolerance of ±1,2 °C.

Maintenance (10.2) and supply switching (10.3.3) operation shall be conducted in the temperature interval (t_{p_rated} – 5 K ≤ t_p ≤ t_{p_rated}) at a rated maximum ambient temperature specified by the manufacturer, with a tolerance of ($^{0}_{-5}$ K). In case there is no rated maximum ambient temperature, the ambient temperature range (20 °C ≤ t_{amb} ≤ 25 °C) shall be used. For the supply switching test, the temperature requirement is applicable only during the ON time. The value of $t_{p,rated}$ shall not be exceeded. An appropriate heat sink or additional heating may need to be applied to obtain the correct $t_{p,rated}$ value. For testing purposes, the t_p -point shall be easily accessible. Even if the location is different for t_p and t_c, the value of t_c shall not be exceeded.

A.2 Electrical characteristics

The test voltage, current or power shall be the rated voltage, current or power. In the case of a range, measurements shall be carried out at the input value corresponding to the most adverse effect to the temperature of the LED module.

A.3 Photometric characteristics

A.3.1 General

Description and requirements for photometric and colorimetric measurement equipment are provided in CIE S 025/E:2015, 4.5.

A.3.2 Test voltage, current or power

For electrical test conditions and electrical equipment see CIE S 025/E:2015, 4.3.

A.3.3 Luminous flux

Luminous flux shall be measured in accordance with CIE S 025/E:2015, Clause 6.

A.3.4 Luminous intensity distribution

Luminous intensity distribution shall be measured in accordance with CIE S 025/E:2015, Clause 6. For directional LED modules, beam angle and peak intensity are determined according IEC TR 61341.

Luminous intensity distribution data shall be available for all variations of the LED module and any optical attachments or accessories specified for use with the LED module.

Luminous intensity distribution data shall be provided for the LED module in accordance with an established international or regional format.

NOTE Information about file formats can be found in IEC 62722-1:2014, Annex A, for informative (not normative) purposes.

A.3.5 Colour characteristics

Colour quantities shall be measured in accordance with CIE S 025/E:2015, Clause 7.

The value of the colorimetric quantities of LED modules may be angularly dependent. Spatially averaged chromaticity coordinates shall be used, unless otherwise specified by the manufacturer.

Annex B

B.2 Binning procedure of white colour LEDs

Delete the contents of Clause B.2 and replace with "Void".

Replace Annex C with the following new Annex C:

Annex C
(informative)

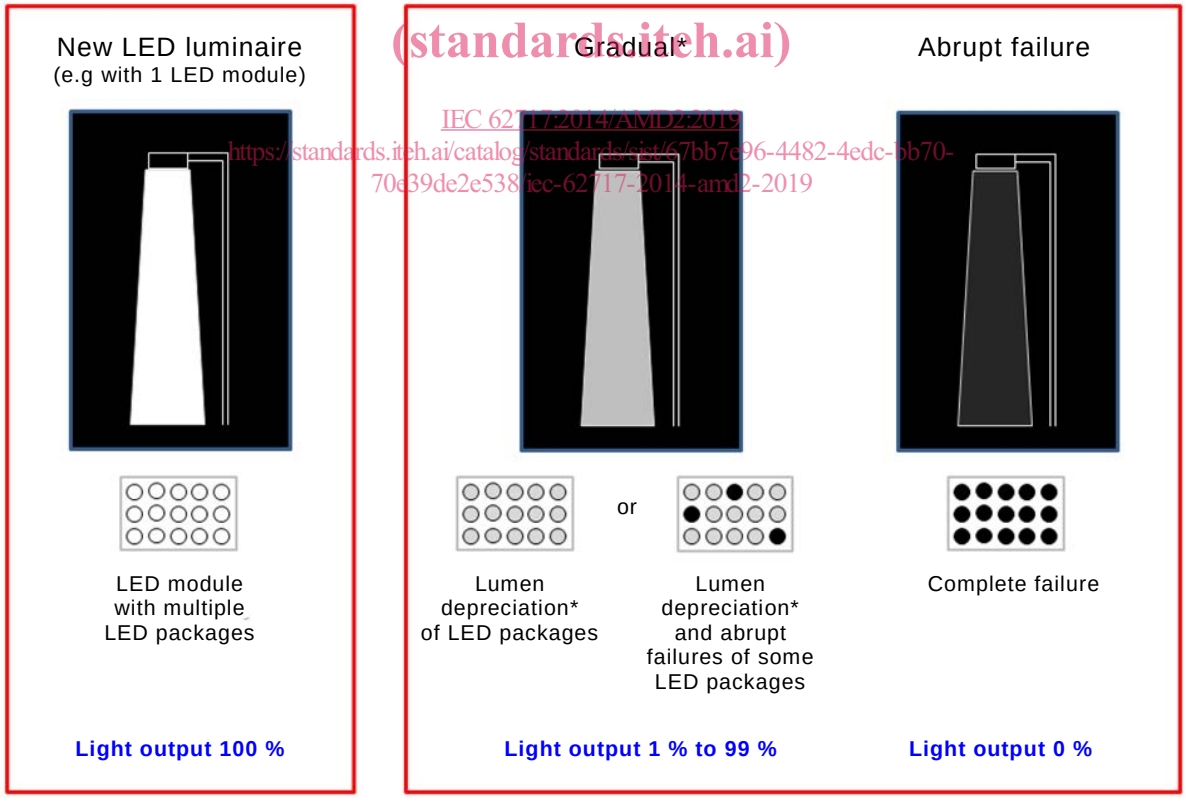
Explanation of recommended LED product lifetime metrics

C.1 General

Life of an individual LED module is the length of time during which an individual LED module provides at least percentage x of the initial luminous flux, under standard test conditions. The end of life of an individual LED module can be reached by either flux degradation or abrupt failure (operating and inoperative LED modules).

NOTE For better readability, the term "LED product" is used and is considered as "LED based lighting product".

An abrupt failure of a LED module is a failure of the entire module and not necessarily a failure of single LED packages. A failure of single LED packages in a LED module with multiple packages usually contributes to overall gradual light output degradation of that LED module. At the time the light output of the LED module becomes less than claimed percentage x it is considered a flux degraded LED module. Figure C.1 gives an illustration of gradual and abrupt failure modes, causing a flux degraded LED product and abrupt failure, in a luminaire comprised of a single LED module.



* Overall luminous flux depreciation includes also optical parts degradation of the LED luminaire; gradual luminous flux depreciation below x percent leads to a flux degraded LED product.

Figure C.1 – Light output over life of a LED-based luminaire comprised of a single LED module