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colour inside

LED modules for general lighting – Safety specifications

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CONTENTS

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LED MODULES FOR GENERAL LIGHTING – SAFETY SPECIFICATIONS

FOREWORD

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International Standard IEC 62031 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 2008, Amendment 1:2012 and Amendment 2:2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the scope was clarified as well as the wording in several other clauses;
b) the normative references were updated;
c) the definitions for "replaceable LED module", "non-replaceable LED module" and "non-user replaceable LED module" were introduced while other definitions covered by IEC 62504 have been removed;
d) the marking clause was restructured and a table added to provide an informative overview;
e) the marking requirements for built-in LED modules were changed;
f) the entry for the marking with the working voltage was revised;
g) the provisions for terminals and heat management were revised;
h) Annex B was deleted;
i) information for luminaire design with regard to working voltage and water contact was introduced;
j) an abnormal temperature test was introduced.

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

FDIS	Report on voting
34A/2052/FDIS	34A/2061/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

NOTE In this standard, the following print types are used:

– Requirements proper: in roman type.
– *Test specifications: in italic type*.
– Explanatory matter: in smaller roman type.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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- withdrawn,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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

~~INTRODUCTION~~

~~The first edition of a safety standard for LED modules for general lighting applications acknowledges the need for relevant tests for this new source of electrical light, sometimes called “solid state lighting”.~~

~~The provisions in the standard represent the technical knowledge of experts from the fields of the semiconductor industry and those of the traditional electrical light sources.~~

~~Two types of LED modules are covered: with integral and external control gear.~~

LED MODULES FOR GENERAL LIGHTING – SAFETY SPECIFICATIONS

1 Scope

This document specifies general and safety requirements for light-emitting diode (LED) modules:

- non-integrated LED modules ~~without integral control gear~~ (LEDni modules) and semi-integrated LED modules (LEDsi modules) for operation under constant voltage, constant current or constant power;
- ~~self-ballasted~~ Integrated LED modules (LEDi modules) for use on DC supplies up to 250 V or AC supplies up to 1 000 V at 50 Hz or 60 Hz.

LED modules within the scope of this document can be integral, built-in or independent.

This document is not applicable for LED lamps.

NOTE ~~1 The safety requirements for separate control gear are specified in IEC 61347-2-13.~~ The performance requirements for ~~separate control gear~~ LED modules are specified in ~~IEC 62384~~ IEC 62717.

~~NOTE 2 Requirements for LED modules with integrated control gear and equipped with a lamp cap (self-ballasted lamp), intended for mains voltage general lighting service retrofit applications (thereby replacing existing lamps with identical lamp caps) are specified in IEC 60968 (an amendment to the present edition or a new edition with extended scope is in preparation).~~

~~Requirements for LED modules with integrated control gear and equipped with a lamp cap (self-ballasted lamp), intended for non-mains voltage general lighting service retrofit applications (thereby replacing existing lamps with identical lamp caps) are under consideration.~~

~~NOTE 3 Where in the requirements of this standard both types of LED modules, with and without integral control gear, are addressed, the word "modules" is used instead. Where only the expression "LED module(s)" is used, it is understood to refer to the type without integral control gear.~~

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 60598-1:~~2003~~ 2014, *Luminaires – Part 1: General requirements and tests*~~1)~~
IEC 60598-1:2014/AMD1:2017

~~IEC 60838-2-2, *Miscellaneous lampholders – Part 2-2: Particular requirements – Connectors for LED modules*~~

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61347-1:~~2007~~ 2015, *Lamp controlgear – Part 1: General and safety requirements*
IEC 61347-1:2015/AMD1:2017

~~IEC 61347-2-13:2006, *Lamp controlgear – Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules*~~

~~1) A consolidated 6.1 (2006) exists, that includes IEC 60598-1 (2003) and its Amendment 1 (2006).~~

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

IEC 62504, *General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions*

IEC TR 62778:2014, *Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires*

ISO 4046-4:~~2002~~ 2016, *Paper, board, pulp and related terms – Vocabulary – Part 4: Paper and board grades and converted products*

ISO 7089:2000, *Plain washers – Normal series – Product grade A*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62504 and the following apply.

~~For expressions and terms in the field of LEDs and LED modules, refer to IEC TS 62504, which is currently in development.~~

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**~~
~~**light-emitting diode**~~
~~**LED**~~
~~solid-state device embodying a p-n junction, emitting optical radiation when excited by an electric current~~

~~[IEV 845-04-40]~~

~~**3.2**~~
~~**LED module**~~
~~unit supplied as a light source. In addition to one or more LEDs, it may contain further components, e.g. optical, mechanical, electrical and electronic, but excluding the control gear.~~

~~**3.3**~~
~~**self-ballasted LED module**~~
~~LED module, designed for connection to the supply voltage~~

~~NOTE If the self-ballasted LED module is equipped with a lamp cap, it is regarded to be a self-ballasted lamp.~~

~~**3.4**~~
~~**integral LED module**~~
~~LED module, generally designed to form a non-replaceable part of a luminaire~~

~~**3.5**~~
~~**integral self-ballasted LED module**~~
~~self-ballasted LED module, generally designed to form a non-replaceable part of a luminaire~~

~~3.6~~
~~**built-in LED module**~~
~~LED module, generally designed to form a replaceable part built into a luminaire, a box, an enclosure or the like and not intended to be mounted outside a luminaire, etc. without special precautions~~

~~3.7~~
~~**built-in self-ballasted LED module**~~
~~self-ballasted LED module, generally designed to form a replaceable part built into a luminaire, a box, an enclosure or the like and not intended to be mounted outside a luminaire, etc. without special precautions~~

~~3.8~~
~~**independent LED module**~~
~~LED module, so designed that it can be mounted or placed separately from a luminaire, an additional box or enclosure or the like. The independent LED module provides all the necessary protection with regard to safety according to its classification and marking.~~

~~NOTE The control gear must not necessarily be integrated in the module.~~

~~3.9~~
~~**independent self-ballasted LED module**~~
~~self-ballasted LED module, so designed that it can be mounted or placed separately from a luminaire, an additional box or enclosure or the like. The independent LED module provides all the necessary protection with regard to safety according to its classification and marking.~~

~~NOTE The control gear may be integrated in the module.~~

~~3.10~~
~~**rated maximum temperature**~~
~~t_c~~
~~highest permissible temperature which may occur on the outer surface of the LED module (at the indicated position, if marked) under normal operating conditions and at the rated voltage/current/power or the maximum of the rated voltage/current/power range~~

3.1
ultraviolet hazard efficacy of luminous radiation
$K_{S,v}$
quotient of an ultraviolet hazard quantity to the corresponding photometric quantity

Note 1 to entry: Ultraviolet hazard efficacy of luminous radiation is expressed in mW/klm.

Note 2 to entry: The ultraviolet hazard efficacy of luminous radiation is obtained by weighting the spectral power distribution of the lamp or LED module with the UV hazard function $S_{UV}(\lambda)$. Information about the relevant UV hazard function is given in IEC 62471:2006. It only relates to possible hazards regarding UV exposure of human beings. It does not deal with the possible influence of optical radiation on materials, such as mechanical damage or discoloration.

3.2
replaceable LED module
LED module, designed to be replaced by an ordinary person or a qualified person

Note 1 to entry: When incorporated into a luminaire, a replaceable LED module can be classified as replaceable, non-user replaceable or non-replaceable depending on the luminaire design.

3.3
non-replaceable LED module
LED module designed to be a non-replaceable part of the luminaire

Note 1 to entry: An integral LED module is always non-replaceable. A non-replaceable LED module is not always an integral LED module.

Note 2 to entry: The non-replaceability can be the result of the luminaire design.

3.4
non-user replaceable LED module
LED module designed to be replaced only by the manufacturer, his service agent, or similar qualified person

Note 1 to entry: When incorporated into a luminaire a non-user replaceable LED module can become classified as non-replaceable depending on the luminaire design.

3.5
terminal
conductive part of an LED module, provided for connecting that LED module to one or more external conductors

[SOURCE: IEC 60050−151:2001, 151.12.12, modified – "device, electric circuit or electric network" has been replaced by "LED module" and the note has been deleted.]

3.6
integral terminal
terminal which forms a non-replaceable part of an LED module and which cannot be tested separately from the LED module

[SOURCE: IEC 60598-1:2014, 1.2.58, modified – "component" replaced by "terminal", "luminaire" replaced by "LED module".]

4 General requirements

4.1 LED modules shall be so designed and constructed that ~~in normal use~~ they operate without danger to the user or surroundings when used as intended (see manufacturer's instructions).

NOTE IEC 61347-1:2015, Annex S gives examples of insulation coordination which can be appropriate for LED modules.

4.2 LED modules shall be classified, according to the method of installation, as:

– built-in,
– independent, or
– integral.

4.3 For non-integrated LED modules and semi-integrated LED modules, all electrical measurements, unless otherwise specified, shall be carried out at voltage limits (min/max), current limits (min/max) or power limits (min/max) and minimum frequency, in a draught-free room at the temperature limits of the allowed range specified by the manufacturer. Unless the manufacturer indicates the most critical combination, all combinations (min/max) of voltage/current/power and temperature shall be tested.

4.4 For ~~self-ballasted~~ integrated LED modules, the electrical measurements shall be carried out at the tolerance limit values of the ~~marked~~ rated supply voltage.

4.5 Integral LED modules not having their own enclosure shall be ~~treated~~ regarded as integral components of luminaires according to IEC 60598-1:2014, 0.5.1. ~~They shall be tested assembled in the luminaire, and as far as applicable with the present standard.~~

4.6 In addition to the requirements of this document, independent LED modules shall comply with IEC 60598-1:2014 and IEC 60598-1:2014/AMD1:2017~~, where these requirements are not already covered in this standard~~.

4.7 If the LED module is a factory sealed unit, it shall not be opened for any tests. In case of doubt based on the inspection of the LED module and the examination of the circuit diagram, and in agreement with the manufacturer or responsible vendor, such specially prepared LED modules shall be submitted for testing so that a fault condition can be simulated.

4.8 For LED modules with integrated controlgear providing SELV, the requirements according to IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clauses L.5, L.6, L.7, L.8, L.9, L.10, and L.11 apply.

5 General test requirements

5.1 Tests according to this document shall be type tests.

NOTE The requirements and tolerances ~~permitted by~~ in this document are related to testing of a type-test sample submitted by the manufacturer for that purpose. ~~Compliance of the type-test sample does not ensure compliance of the whole production of a manufacturer with this safety standard.~~

Conformity of production is the responsibility of the manufacturer and ~~may~~ can need routine tests and quality assurance in addition to type testing.

5.2 ~~Unless otherwise specified,~~ The test~~s~~ shall be carried out at an ambient temperature of 10 °C to 30 °C. If the manufacturer specifies a different ambient termperature, this shall be used as test temperature.

5.3 Unless otherwise specified, the type test shall be carried out on one sample consisting of one or more items submitted for the purpose of the type test.

In general, all tests shall be carried out on each type of LED module or, where a range of similar LED modules is involved, for each ~~wattage~~ power in the range or on a representative selection from the range, as agreed with the manufacturer.

5.4 If the light output has ~~detectably~~ substantially changed, the LED module shall not be used for further tests.

NOTE Usually, a value of 50 % indicates irreversible changes in the LED module.

5.5 ~~For SELV-operated LED modules, the requirements of IEC 61347-2-13, Annex I, apply additionally.~~

~~General conditions for tests are given in Annex A.~~

Testing of integral LED modules not having their own enclosure shall be done as part of the luminaire as far as applicable.

~~6 Classification~~

~~Modules are classified, according to the method of installation, as:~~

~~– built-in;~~

~~– independent;~~

~~– integral.~~

~~For integral modules, the NOTE to 1.2.1 in IEC 60598-1 applies.~~

6 Marking

6.1 Overview

The requirements of 6.2, 6.3, 6.4, 6.5, and 6.6 apply. Table 1 gives an overview for information.

Table 1 – Overview on marking provisions

Item according to 6.2	Built-in LED modules	Independent LED modules	Integral LED modules
a)	Required On the LED module	Required On the LED module	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor
b)	Required On the LED module	Required On the LED module	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor
c)	Required On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required On the LED module	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor
d)	Required On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor
e)	Required if necessary On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required if necessary On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor
f)	Required On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	Required On the LED module	Required On the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor