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Edition 2.0 2018-03

INTERNATIONAL STANDARD

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colour inside

LED modules for general lighting – Safety specifications

Modules à LED pour éclairage général – Spécifications de sécurité

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LED MODULES FOR GENERAL LIGHTING – SAFETY SPECIFICATIONS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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.

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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 (LEDni modules) and semi-integrated LED modules (LEDsi modules) for operation under constant voltage, constant current or constant power;
- 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 The performance requirements for LED modules are specified in IEC 62717.

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

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

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

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 4046-4:2016, *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.

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
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 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 integrated LED modules, the electrical measurements shall be carried out at the tolerance limit values of the rated supply voltage.

4.5 Integral LED modules not having their own enclosure shall be regarded as integral components of luminaires according to IEC 60598-1:2014, 0.5.1.

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.

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 in this document are related to testing of a type-test sample submitted by the manufacturer for that purpose.

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

5.2 The test 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 power in the range or on a representative selection from the range, as agreed with the manufacturer.

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

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

Item according to 6.2	Built-in LED modules	Independent LED modules	Integral LED modules
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
g)	Required in case of E_{thr} 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 in case of E_{thr} 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
h)	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	—	—
i)	Required if capped On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	—	—
j)	Required if capped On the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor	—	—
k)	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	—	—

6.2 Contents of marking for built-in and for independent LED modules

The following marking information for built-in and independent LED modules shall be given:

a) Mark of origin (trade mark, manufacturer's name or name of the responsible vendor/supplier).

b) Model number or type reference of the manufacturer.

c) Rated supply voltage or rated supply current as follows:

1) If the LED module requires stable voltage, the rated supply voltage(s) or the rated supply voltage range, both together with the supply frequency shall be marked. Marking of the rated supply current(s) is voluntary.

2) If the LED module requires stable current, the rated supply current(s) or the rated current range, both together with the supply frequency shall be marked. Marking of the rated supply voltage(s) is voluntary.

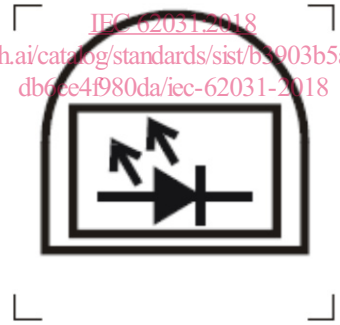
d) Rated power.

e) Indication of position and purpose of the connections where it is necessary for safety. In the case of connecting wires, a clear indication shall be given in a wiring diagram.

f) Value of the rated maximum temperature t_c. If this relates to a certain place on the LED module, this place shall be indicated or specified in the manufacturer's literature.

g) If the assessment of blue light hazard according to IEC TR 62778:2014 results in assignment to RG0 unlimited or RG1 unlimited, no marking for photobiological safety is required. If the assessment of blue light hazard according to IEC TR 62778:2014 results in a threshold illuminance value E_{thr}, marking with the E_{thr} is required.

h) Built-in LED modules shall be marked with the symbol according to Figure 1 in order to separate them from independent LED modules.



Source: IEC 60417-6053 (2011-05)

Figure 1 – Symbol for built-in LED modules

i) The heat transfer temperature t_d (if the LED module is provided with a cap enabling the insertion and the withdrawal without the use of tools and reliant on heat-conduction to the luminaire).

j) The power for heat-conduction P_d (if the LED module is provided with a cap enabling the insertion and the withdrawal without the use of tools and reliant on heat-conduction to the luminaire). If P_d is not known exactly, the rated power of the LED module may be taken instead.

k) Working voltage at which the insulation between active parts of the LED module and parts of the LED module designed as insulation barriers to a luminaire are designed together with the type of insulation.

The type of insulation can be

- basic insulation for SELV operation only,
- basic insulation for SELV and other than SELV operation,
- supplementary insulation,

- double or reinforced insulation,
- no insulation (in this case the working voltage is 0 V).

Parts of the LED module designed as insulation barriers to a luminaire include insulation barriers between active parts of the LED module and

- the mounting surface of the LED module,
- the parts of the LED module designed to be touchable when mounted in the luminaire.

This information is not required for independent LED modules.

6.3 Location of marking for built-in LED modules

For built-in LED modules, items a) and b) according to 6.2 shall be marked on the LED module. The other applicable items according to 6.2 shall be marked on the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor.

6.4 Location of marking for independent LED modules

For independent LED modules, items a), b), c) and f) according to 6.2 shall be marked on the LED module. The other applicable items according to 6.2 shall be marked on the LED module, on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor.

6.5 Marking of integral LED modules

For integral LED modules, the information given in 6.2 a) to g) shall be provided on the LED module datasheet, on the LED module leaflet, or on the website of the manufacturer or responsible vendor.

6.6 Durability and legibility of marking

Marking on the LED module shall be durable and legible.

Compliance is checked by inspection and by trying to remove the marking by rubbing the area lightly by hand for 15 s with a piece of smooth cloth, dampened with water.

The marking shall be legible after the test.

Marking which is not on the LED module shall be legible.

Compliance is checked by inspection.

7 Terminals

7.1 Integral terminals

Integral terminals shall comply with the following sections of IEC 60598-1:2014 and IEC 60598-1:2014/AMD1:2017

- Section 14 for screw terminals;
- Section 15 for screwless terminals.

Compliance is checked by inspection and the relevant tests.

7.2 Terminals other than integral terminals

Terminals, other than integral terminals, shall comply with the requirements of the relevant IEC standards, if any.

Terminals which comply with the requirements of the relevant IEC standard and marked with individual ratings shall suit the conditions which may occur in use.

Aspects of use not covered by the respective standard shall require them to satisfy the additional relevant requirements of this document.

Terminals complying with the requirements of their own standard and used in accordance with their intended use, shall only meet the requirements of this document where there are no requirements in the terminal standard.

Compliance is checked by inspection and the relevant tests.

NOTE Example terminal standards are IEC 60947-7-4 and IEC 60838-2-2.

8 Earthing

The requirements of IEC 61347-1:2015, Clause 9, apply.

9 Protection against accidental contact with live parts

The requirements of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 10, apply.

10 Moisture resistance and insulation

The requirements of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 11, apply.

11 Electric strength

The requirements of IEC 61347-1:2015, Clause 12, apply.

12 Fault conditions

12.1 General

The LED module shall not impair safety when operated under fault conditions that can occur during the intended use. The requirements of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 14, apply.

Compliance is checked by the tests according to IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 14 and the test according to 12.2.

12.2 Overpower condition

The test conditions according to Annex A apply.

The LED module shall be switched on and the power monitored (at the input side). The voltage or the current shall be increased until 150 % of the rated power is reached. The test shall be continued until the LED module is thermally stabilized. A stable condition is reached if the temperature does not change by more than 5 K in 1 h. The temperature shall be