IEC 62031

Edition 2.0 2018-03
REDLINE VERSION

INTERNATIONAL STANDARD

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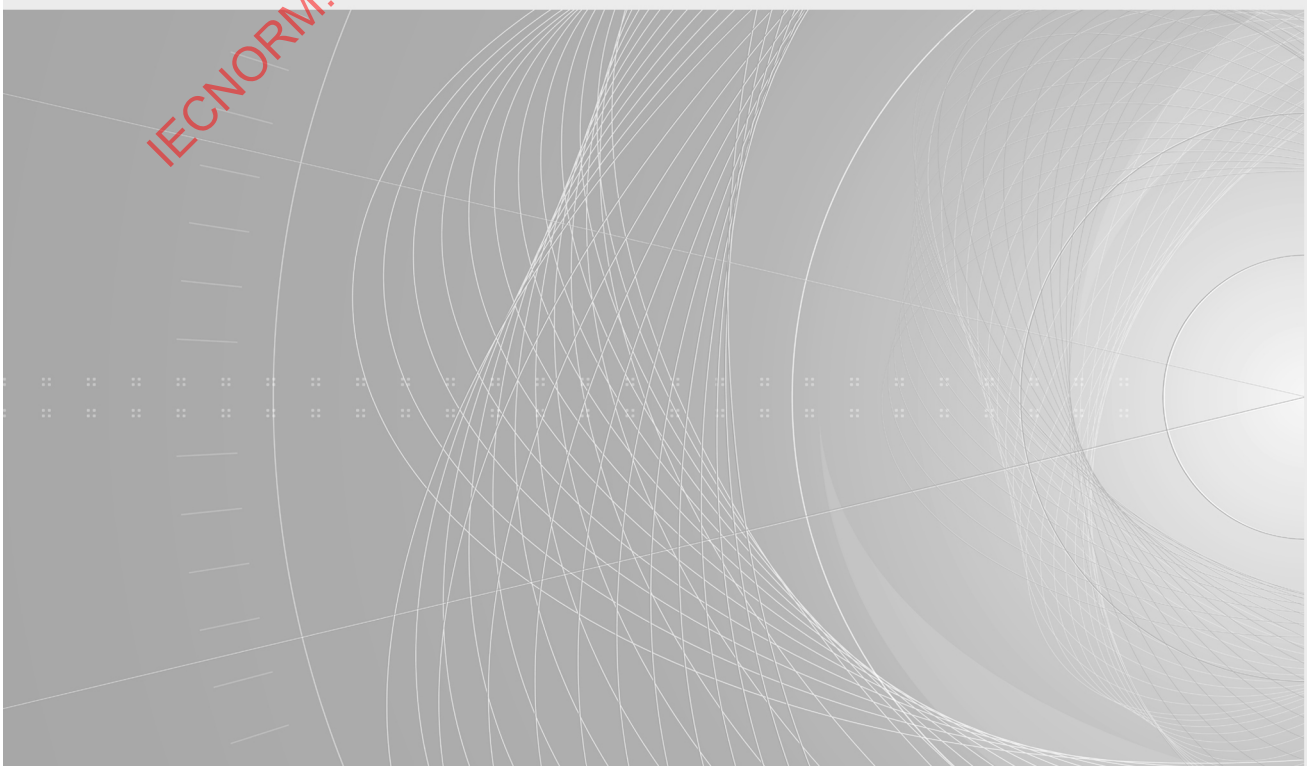
LED modules for general lighting – Safety specifications



IEC 62031:2018-03 RLV(en)

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LED modules for general lighting – Safety specifications

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.140.99; 31.080.99

ISBN 978-2-8322-5468-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LED MODULES FOR GENERAL LIGHTING – SAFETY SPECIFICATIONS

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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

Item according to 6.2	Built-in LED modules	Independent LED modules	Integral LED modules
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 ~~Mandatory~~ Contents of marking for built-in ~~or~~ 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) Either the~~

- ~~rated supply voltage(s), or voltage range, supply frequency or/and~~
- ~~rated supply current(s) or current range, supply frequency (the supply current may be given in the manufacturer's literature) or/and~~
- ~~rated input power, or power range.~~

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) ~~Nominal~~ 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.

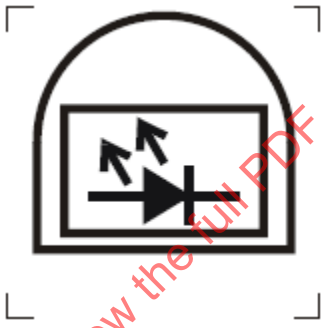
f) Value of the rated maximum temperature t_c. If this relates to a certain place on the LED module, this place shall be indicated or specified in the manufacturer's literature.

~~g) For eye protection, see requirements of IEC 62471.~~

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. ~~The mark shall be located on the packaging or on the module itself.~~

~~NOTE The symbol is under consideration.~~



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

~~Items a), b), c) and f) of 7.1 shall be marked on the module.~~

~~Items d), e), g) and h) of 7.1 shall be marked legible on the module or on the module data sheet.~~

~~For integral modules, no marking is required, but the information given in 7.1 a) to g) shall be provided in the technical literature of the manufacturer.~~

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.

~~*For items a), b), c) and f) of 7.1,*~~ *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.

~~*For items d) to h) of 7.1,*~~ *Compliance is checked by inspection.*

7 Terminals

~~For screw terminals, the requirements of IEC 60598-1, Section 14, shall be used, if applicable.~~

~~For screwless terminals, the requirements of IEC 60598-1, Section 15, shall be used, if applicable.~~

~~For connectors, the requirements of IEC 60838-2-2 shall be used, if applicable.~~

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 Provisions for protective earthing~~

~~The requirements of IEC 61347-1, 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 ~~may~~ can occur during the intended use. The requirements of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 14, apply. ~~Additionally, the following test shall be carried out.~~

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 ~~shall be started at an ambient temperature as specified in~~ conditions according to Annex A apply.

The LED module shall be switched on and the power monitored (at the input side) ~~and~~. The voltage or the current shall be increased until 150 % of the rated ~~voltage, current or~~ 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 measured in the t_c point. The LED module shall withstand the overpower condition for at least 15 min, the time period which can lie within the stabilization period if the temperature change is ≤ 5 K.

If the LED module contains an automatic protective device or circuit which limits the power, it is subjected to a 15 min operation at this limit. If the device or circuit effectively limits the power over this period, the LED module has passed the test, provided that compliance to 4.1 and the last paragraph of 12.2 is fulfilled.

After finalizing the overpower mode, the LED module is operated under normal conditions until thermally stable.

For the purpose of this test, "operated" means that the LED module is supplied with the rated input current or rated input voltage. The LED module does not need to emit light.

~~A module fails safe~~ The test is considered as passed if no fire, smoke or flammable gas is produced and if the 15 min overpower condition has been withstood. To check whether molten material might present a safety hazard, a wrapping tissue ~~paper, as specified in 4.187 of~~ according to ISO 4046-4:2016, 4.215, spread below the LED module shall not ignite.

13 Conformity testing during manufacture

See Annex B.

14 Construction

~~Wood, cotton, silk, paper and similar fibrous material shall not be used as insulation.~~

~~Compliance is checked by inspection.~~

The requirements of IEC 61347-1:2015, Clause 15, apply.

15 Creepage distances and clearances

The requirements of ~~IEC 60598-1, Section 11~~ IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 16 apply.

16 Screws, current-carrying parts and connections

The requirements of IEC 61347-1:2015, Clause 17, apply.

17 Resistance to heat, fire and tracking

The requirements of IEC 61347-1:2015, Clause 18, apply.

18 Resistance to corrosion

The requirements of ~~IEC 61347-1, Clause 19~~ IEC 60598-1:2014, 4.18 apply.

19 Information for luminaire design

Information is given in Annex C.

20 Heat management

20.1 General

Clause 20 is applicable if a heat conducting thermal interface to the luminaire is needed for keeping the temperature below the rated maximum temperature t_c. It is applicable for replaceable LED modules except for non-user replaceable LED modules.

20.2 Thermal interface material

For the purpose of heat-transfer from the LED module to the luminaire, the use of thermal interface material can be necessary. Any thermal interface material shall be delivered within the LED module packaging.

20.3 Heat protection

LED modules shall not impair safety when operated under poor heat-conduction conditions.

Compliance is checked by the test specified in Annex D.

21 Photobiological safety

21.1 UV radiation

The ultraviolet hazard efficacy of luminous radiation of an LED module shall not exceed 2 mW/klm.

Compliance is checked by measurement of the spectral power distribution and subsequent calculation of the ultraviolet hazard efficacy of luminous radiation according to IEC 62471:2006, Clause 5.

LED modules not relying on the conversion of UV radiation are expected to not exceed the maximum allowed ultraviolet hazard efficacy of luminous radiation. They do not require measurement.

21.2 Blue light hazard

For the assessment of the blue light hazard IEC TR 62778:2014 shall be applied. The Technical Report shall be regarded as normative.

NOTE IEC TR 62778:2014, Clause C.2 gives a method to classify LED modules where full spectral data is not available.

21.3 Infrared radiation

LED modules are expected to not reach a level of infrared radiation where marking or other safety measures are required. They do not require measurement.

Annex A
(normative)

Tests conditions

IEC 61347-1:2015, Clauses H.1, H.2, H.4, H.7, H.8, and H.11 apply. In H.1.3, ~~ignore~~ the first paragraph shall be ignored. In all clauses, ~~replace~~ “lamp”, “(lamp) control gear” ~~or~~ and “ballast” shall be replaced with “LED module”.

Annex B
(informative)

Overview of systems composed of LED modules and control gear

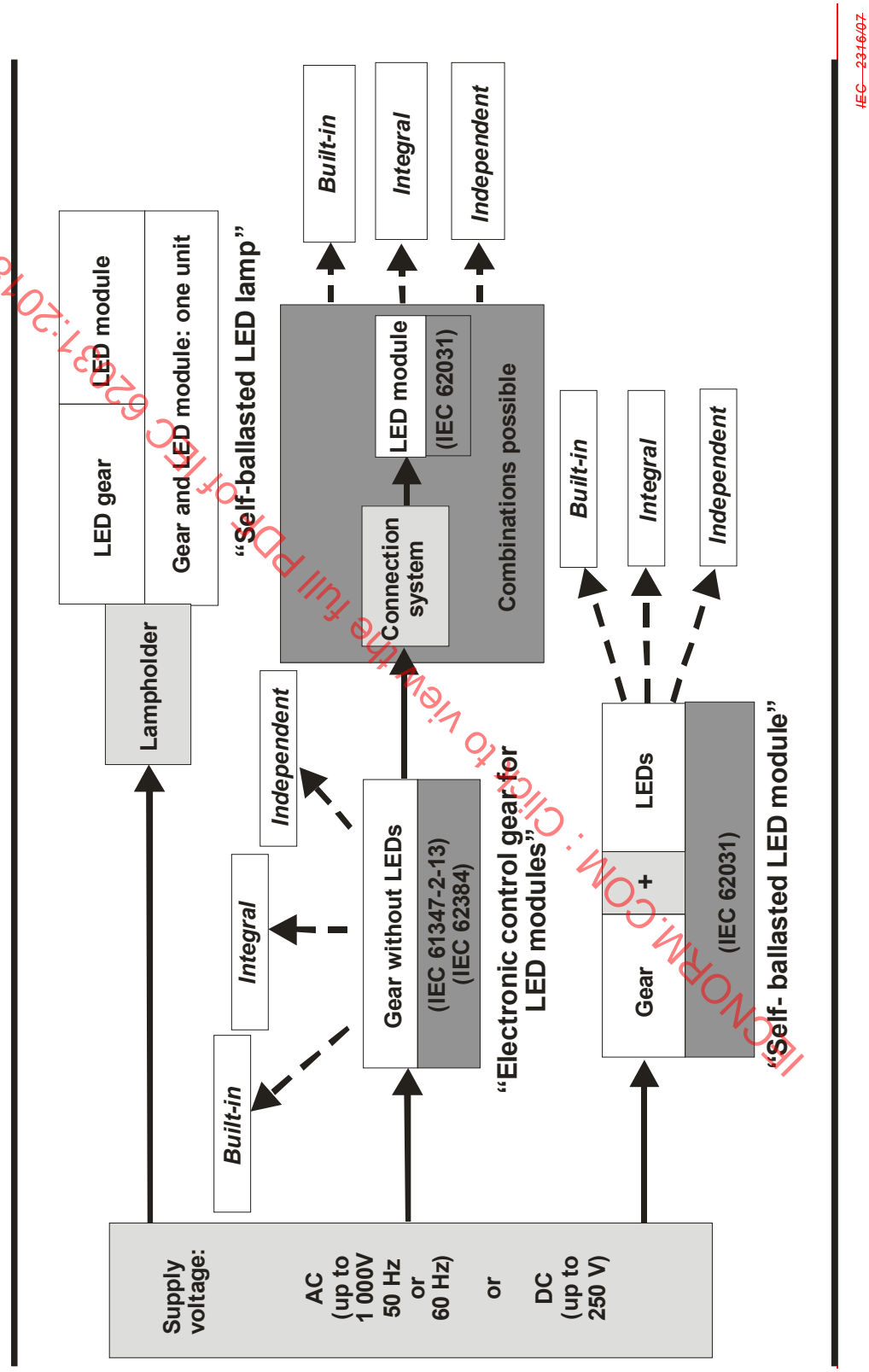


Figure B.1 – Overview of systems composed of LED modules and control gear

Annex B
(informative)

Conformity testing during manufacture

This test is carried out at 100 % of production. It is combined with the measurement of input power at rated voltage/current. The luminous flux of no LED module should be significantly lower than that of the rest of the production.

NOTE Very low values of the luminous flux indicate internal losses that ~~may~~ can be safety relevant, such as current bridges.

For independent and built-in LED modules, IEC 60598-1:2014, Annex Q is applicable, but without the polarity check.

Annex C
(informative)

Information for luminaire design

C.1 Heat management

C.1.1 General

Clause C.1 applies for LED modules that rely on heat-conduction to the luminaire for safe operation.

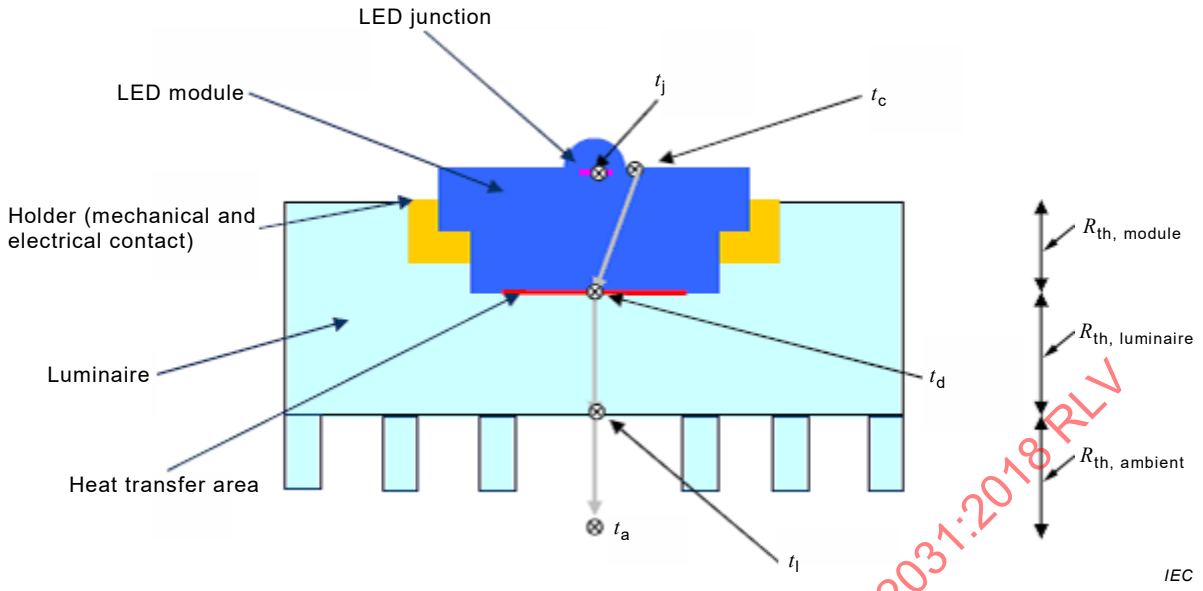
Annex C covers only those provisions that are related to the thermal needs specific for these LED modules.

NOTE Because of their non-interchangeability, integral LED modules are excluded. Because independent LED modules are luminaire-like, not needing protection or else from a luminaire neither using a lampholder, they provide for their own heat management and are excluded. Only built-in LED modules remain within the scope of Annex C.

For safe operation of these LED modules, it is essential to observe the recommendations of Annex C.

C.1.2 Design freedom

A diagrammatic cross section of an LED module fixed by means of a lampholder to a luminaire with the locations for temperature measurements (t_a, t_c, t_d, t_j and t_l) and thermal resistances ($R_{th,\ module}$, $R_{th,\ luminaire}$ and $R_{th,\ ambient}$) is given with Figure C.1.



Key

Blue	LED module
Yellow	Lampholder
Light blue	Luminaire with symbolized cooling fins
t_a	rated maximum ambient temperature of the luminaire as defined in IEC 60598-1:2014
t_c	rated maximum temperature
t_d	minimum heat transfer temperature
t_j	junction temperature (shown for illustration only)
t_l	temperature on the surface of the luminaire (shown for illustration only)
$R_{th,\ module}$	thermal resistance between t_c point and t_d point
$R_{th,\ luminaire}$	thermal resistance between t_d point and t_l point
$R_{th,\ ambient}$	thermal resistance between t_l and ambient temperature

Figure C.1 – Diagrammatic cross section of an LED module fixed by means of a lampholder to a luminaire

The thermal resistances shown in Figure C.1 can be added to calculate the thermal resistance of the system:

$$R_{th,\ module} + R_{th,\ luminaire} + R_{th,\ ambient} = R_{th,\ system} \quad (C.1)$$

Any thermal resistance can be calculated from the temperature difference and the heat flow, for example:

$$R_{th,\ system} = (t_c - t_a) / P_d \quad (C.2)$$

$$R_{th,\ module} = (t_c - t_d) / P_d \quad (C.3)$$

The design freedom of the luminaire is given by the sum of $R_{th,\ luminaire} + R_{th,\ ambient}$. It can be calculated as follows:

$$R_{th,\ luminaire} + R_{th,\ ambient} = (t_d - t_a) / P_d \quad (C.4)$$

C.1.3 Testing in the luminaire

The knowledge of t_d and P_d as provided by the LED module manufacturer, of the geometry and the surface properties of the cap and of the t_a surrounding the luminaire is sufficient for designing a luminaire that maintains the outer surface temperature of the LED module below t_c. However, testing in the luminaire will still be necessary to demonstrate compliance.

Details of the test procedure are under consideration.

C.2 Water contact

LED modules should be protected from direct water contact, for example by drips or splashing , by the luminaire if the luminaire is rated at IPX1 or higher.

C.3 Blue light hazard assessment

C.3.1 LED modules of RG0 unlimited and RG1 unlimited

If assessment according to IEC TR 62778:2014 leads to RG0 unlimited or RG1 unlimited classification of an LED module with respect to blue light hazard, any luminaire incorporating one or more of these LED modules should also be classified as of the same risk group with respect to blue light hazard, regardless of optics and viewing distance.

However, it should be left to the discretion of the luminaire manufacturer to apply IEC TR 62778:2014 directly to the luminaire, which could lead to a lower risk group classification.

C.3.2 LED modules with a threshold illuminance E_{thr}

If assessment according to IEC TR 62778:2014 leads to the classification of an LED module as having a threshold illuminance E_{thr}, any luminaire incorporating one or more of these LED modules should be regarded classified as having the same threshold illuminance E_{thr}. The viewing distance where this threshold illuminance is reached should be calculated according to IEC TR 62778:2014, 7.1 from the luminous flux distribution measurement of the luminaire.

However, it should be left to the discretion of the luminaire manufacturer to apply IEC TR 62778:2014 directly to the luminaire, which could lead to a threshold illuminance E_{thr} greater than that of the LED module.

NOTE If, apart from the light source and its components, luminaires incorporate passive optical components such as lenses and reflectors, these will not change E_{thr}.

C.4 Working voltage

The maximum working voltage for which the LED module insulation has been designed (see 6.2, item k)) should not be exceeded. The evaluation should take into consideration the maximum working voltage that occurs in the luminaire circuit (e. g. in the case of series connection of LED modules) and the type of insulation required in the luminaire according to IEC 60598-1:2014 and IEC 60598-1:2014/AMD1:2017, Annex X.

NOTE The maximum working voltage delivered by the controlgear is the U_{out} and normally occurs in the case of an open circuit. See IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, 7.1, item u) for the relevant information for the controlgear.

Annex D
(normative)

Abnormal temperature test

D.1 Test procedure

D.1.1

The test setup according to D.2 applies.

D.1.2

The sample shall be energized and allowed to run for 7,5 h or until a protective component permanently shuts down the LED module, whichever comes first, while monitoring temperatures on the surface of connecting devices and plastic parts on the device serving as enclosure, electrical barrier, or insulation components.

It is acceptable to take the temperature on the hottest point of the printed circuit board or of any other part in contact with the insulation foil as reference temperature of the insulation foil.

D.1.3

The test results are considered acceptable if all of the following conditions are met:

a) no point of the wrapping tissue burns;

b) there are no openings created that permit to contact any part considered as risk of electric shock according to IEC 61347-1:2015, Annex A with a test probe according to IEC 61032:1997, Figure 9;

c) the sample complies with the dielectric voltage-withstand test in Clause 11 between supply source input and accessible metal parts after this test is complete; and

d) any gases liberated from the LED module are not flammable if tested with a high frequency spark generator.

D.1.4

If the test is interrupted by a protective component or feature that automatically resets, the test shall be continued until the component or feature has operated for at least 10 cycles, but not less than 7,5 h.

D.1.5

If the test is interrupted by a protective component or feature that requires manual reset (for example pressing a pushbutton actuator or cycling the supply source off and on), the protector shall be reset and the test restarted. This shall be continued until the component or feature has operated for at least 10 cycles.

D.2 Test setup

D.2.1

Refer to Figure D.1 for an illustration of this setup.

D.2.2

The LED module shall be installed in its connecting device with a spacer used to create a gap between the thermal interface and heat sink. This spacer shall be placed as close to the edge

of the thermal interface as the construction allows. The spacer shall be a rigid plastic washer according to ISO 7089:2000, size M5, 10 mm in diameter, 1,0 mm thick.

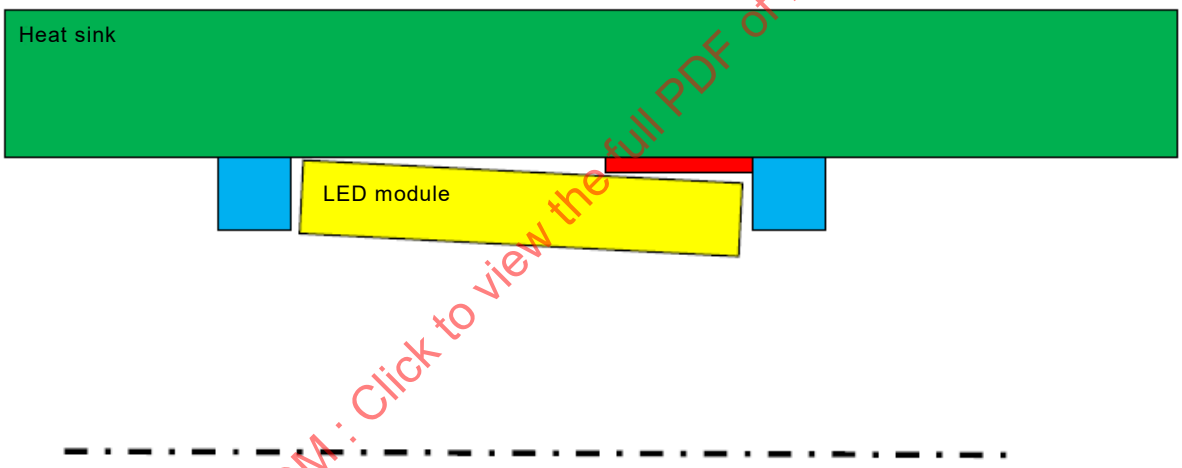
The connecting device shall provide or be attached to a heat sink. The heat sink shall be such that, when the LED module is inserted without a washer and operated under normal conditions until thermally stabilized in an ambient temperature, t_a, according to 5.2, the temperature measured at the t_c location is not smaller than t_c – 5 K and not greater than t_c. Thermal stabilization occurs when the temperature change rate is less than 5 K/h.

If the M5 washer is too thick to allow the LED module to engage and be energized by the lampholder, the next smaller metric washer size (M4, M3,5, M3, M2,5, M2 and M1,6) shall be tried in turn. The largest of these washers that allows the LED module to engage and be energized from the lampholder shall be used as the spacer for the test.

If even the smallest washer according to ISO 7089:2000 cannot be inserted with the LED module being energized, the test shall be considered as passed.

D.2.3

A layer of wrapping tissue according to ISO 4046-4:2016, 4.215 shall be spread out horizontally 200 mm ± 5 mm below the sample.



Red rectangle: Spacer
Dash-dot-line: Wrapping tissue
Blue squares: Lampholder

IEC

Figure D.1 – Abnormal temperature test setup

Bibliography

~~IEC 60050-845:1987, *International Electrotechnical Vocabulary – Chapter 845: Lighting*~~

~~IEC 60968, *Self-ballasted lamps for general lighting services – Safety requirements*~~

~~IEC 62384, *DC or AC supplied electronic control gear for LED modules – Performance requirements*~~

~~IEC TS 62504:___, *Terms and definitions for LEDs and LED modules in general lighting* [2)]~~

IEC 60050-151, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices* (available at http://www.electropedia.org)

IEC 60417, *Graphical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)

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

IEC 60947-7-4, *Low-voltage switchgear and controlgear – Part 7-4: Ancillary equipment – PCB terminal blocks for copper conductors*

IEC 62717, *LED modules for general lighting – Performance requirements*

~~2) In preparation.~~

IEC 62031

Edition 2.0 2018-03

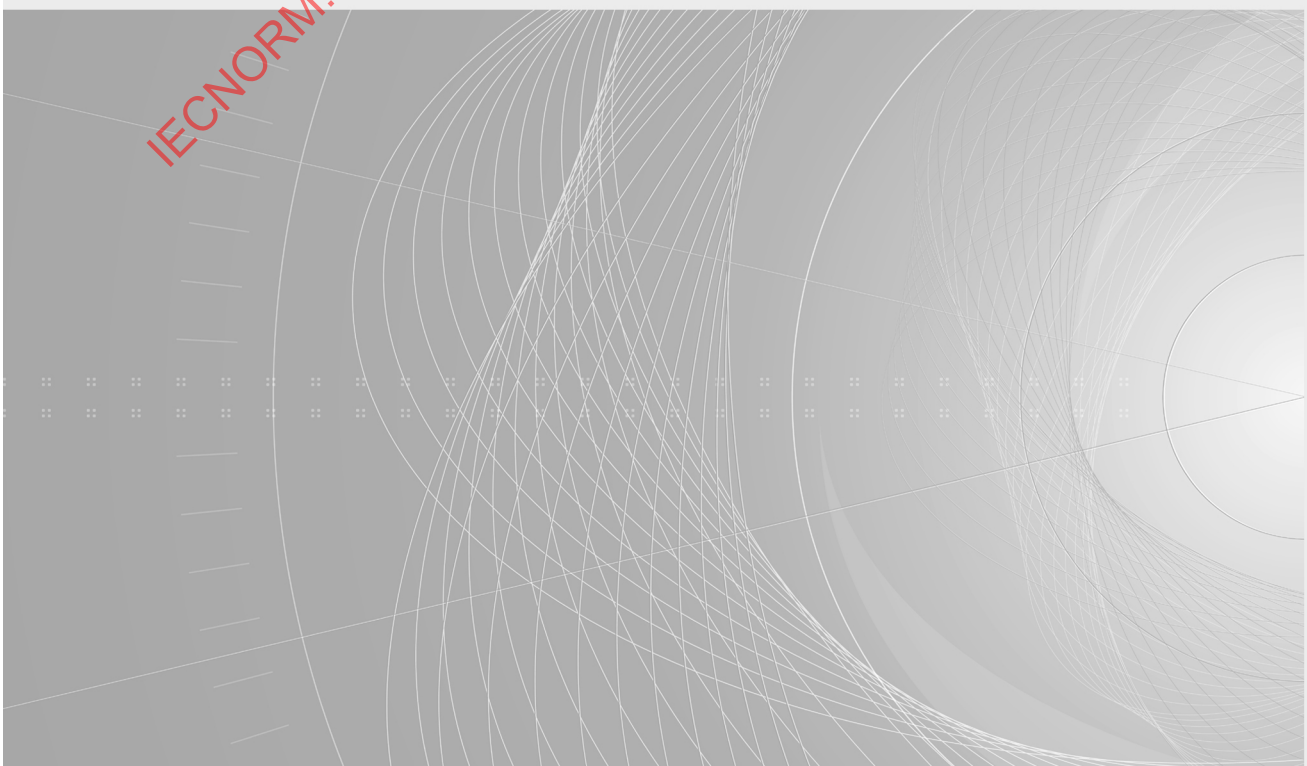
INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

LED modules for general lighting – Safety specifications

Modules à LED pour éclairage général – Spécifications de sécurité



IEC 62031:2018-03(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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.

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.

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.

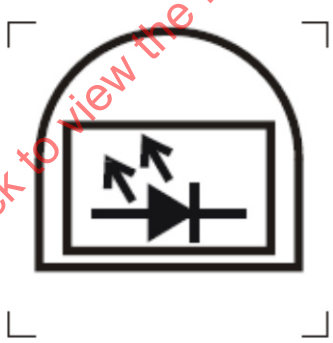
d) Rated power.

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

measured in the t_c point. The LED module shall withstand the overpower condition for at least 15 min, the time period which can lie within the stabilization period if the temperature change is ≤ 5 K.

If the LED module contains an automatic protective device or circuit which limits the power, it is subjected to a 15 min operation at this limit. If the device or circuit effectively limits the power over this period, the LED module has passed the test, provided that compliance to 4.1 and the last paragraph of 12.2 is fulfilled.

After finalizing the overpower mode, the LED module is operated under normal conditions until thermally stable.

For the purpose of this test, "operated" means that the LED module is supplied with the rated input current or rated input voltage. The LED module does not need to emit light.

The test is considered as passed if no fire, smoke or flammable gas is produced and if the 15 min overpower condition has been withstood. To check whether molten material might present a safety hazard, a wrapping tissue according to ISO 4046-4:2016, 4.215, spread below the LED module shall not ignite.

13 Conformity testing during manufacture

See Annex B.

14 Construction

The requirements of IEC 61347-1:2015, Clause 15, apply.

15 Creepage distances and clearances

The requirements of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, Clause 16 apply.

16 Screws, current-carrying parts and connections

The requirements of IEC 61347-1:2015, Clause 17, apply.

17 Resistance to heat, fire and tracking

The requirements of IEC 61347-1:2015, Clause 18, apply.

18 Resistance to corrosion

The requirements of IEC 60598-1:2014, 4.18, apply.

19 Information for luminaire design

Information is given in Annex C.

20 Heat management

20.1 General

Clause 20 is applicable if a heat conducting thermal interface to the luminaire is needed for keeping the temperature below the rated maximum temperature t_c. It is applicable for replaceable LED modules except for non-user replaceable LED modules.

20.2 Thermal interface material

For the purpose of heat-transfer from the LED module to the luminaire, the use of thermal interface material can be necessary. Any thermal interface material shall be delivered within the LED module packaging.

20.3 Heat protection

LED modules shall not impair safety when operated under poor heat-conduction conditions.

Compliance is checked by the test specified in Annex D.

21 Photobiological safety

21.1 UV radiation

The ultraviolet hazard efficacy of luminous radiation of an LED module shall not exceed 2 mW/klm.

Compliance is checked by measurement of the spectral power distribution and subsequent calculation of the ultraviolet hazard efficacy of luminous radiation according to IEC 62471:2006, Clause 5.

LED modules not relying on the conversion of UV radiation are expected to not exceed the maximum allowed ultraviolet hazard efficacy of luminous radiation. They do not require measurement.

21.2 Blue light hazard

For the assessment of the blue light hazard IEC TR 62778:2014 shall be applied. The Technical Report shall be regarded as normative.

NOTE IEC TR 62778:2014, Clause C.2 gives a method to classify LED modules where full spectral data is not available.

21.3 Infrared radiation

LED modules are expected to not reach a level of infrared radiation where marking or other safety measures are required. They do not require measurement.

Annex A
(normative)

Test conditions

IEC 61347-1:2015, Clauses H.1, H.2, H.4, H.7, H.8, and H.11 apply. In H.1.3, the first paragraph shall be ignored. In all clauses, “lamp”, “(lamp) control gear” and “ballast” shall be replaced with “LED module”.

Annex B
(informative)

Conformity testing during manufacture

This test is carried out at 100 % of production. It is combined with the measurement of input power at rated voltage/current. The luminous flux of no LED module should be significantly lower than that of the rest of the production.

NOTE Very low values of the luminous flux indicate internal losses that can be safety relevant, such as current bridges.

For independent and built-in LED modules, IEC 60598-1:2014, Annex Q is applicable, but without the polarity check.

Annex C
(informative)

Information for luminaire design

C.1 Heat management

C.1.1 General

Clause C.1 applies for LED modules that rely on heat-conduction to the luminaire for safe operation.

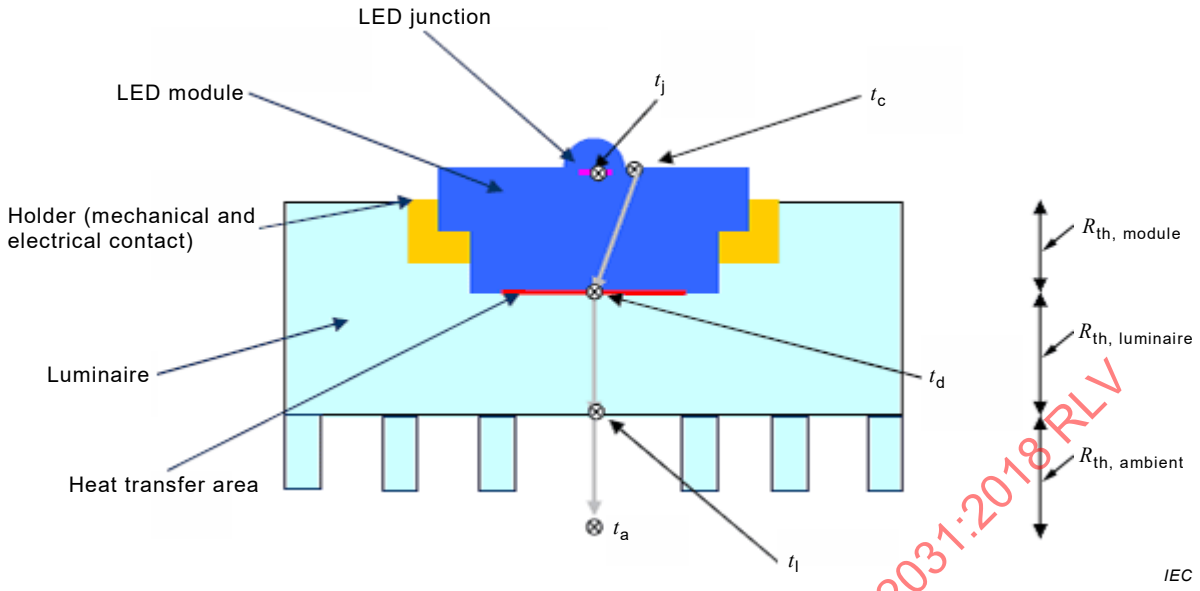
Annex C covers only those provisions that are related to the thermal needs specific for these LED modules.

NOTE Because of their non-interchangeability, integral LED modules are excluded. Because independent LED modules are luminaire-like, not needing protection or else from a luminaire neither using a lampholder, they provide for their own heat management and are excluded. Only built-in LED modules remain within the scope of Annex C.

For safe operation of these LED modules, it is essential to observe the recommendations of Annex C.

C.1.2 Design freedom

A diagrammatic cross section of an LED module fixed by means of a lampholder to a luminaire with the locations for temperature measurements (t_a, t_c, t_d, t_j and t_l) and thermal resistances ($R_{th,\ module}$, $R_{th,\ luminaire}$ and $R_{th,\ ambient}$) is given with Figure C.1.



Key

Blue	LED module
Yellow	Lampholder
Light blue	Luminaire with symbolized cooling fins
t_a	rated maximum ambient temperature of the luminaire as defined in IEC 60598-1:2014
t_c	rated maximum temperature
t_d	minimum heat transfer temperature
t_j	junction temperature (shown for illustration only)
t_l	temperature on the surface of the luminaire (shown for illustration only)
$R_{th,\ module}$	thermal resistance between t_c point and t_d point
$R_{th,\ luminaire}$	thermal resistance between t_d point and t_l point
$R_{th,\ ambient}$	thermal resistance between t_l and ambient temperature

Figure C.1 – Diagrammatic cross section of an LED module fixed by means of a lampholder to a luminaire

The thermal resistances shown in Figure C.1 can be added to calculate the thermal resistance of the system:

$$R_{th,\ module} + R_{th,\ luminaire} + R_{th,\ ambient} = R_{th,\ system} \quad (C.1)$$

Any thermal resistance can be calculated from the temperature difference and the heat flow, for example:

$$R_{th,\ system} = (t_c - t_a) / P_d \quad (C.2)$$

$$R_{th,\ module} = (t_c - t_d) / P_d \quad (C.3)$$

The design freedom of the luminaire is given by the sum of $R_{th,\ luminaire} + R_{th,\ ambient}$. It can be calculated as follows:

$$R_{th,\ luminaire} + R_{th,\ ambient} = (t_d - t_a) / P_d \quad (C.4)$$

C.1.3 Testing in the luminaire

The knowledge of t_d and P_d as provided by the LED module manufacturer, of the geometry and the surface properties of the cap and of the t_a surrounding the luminaire is sufficient for designing a luminaire that maintains the outer surface temperature of the LED module below t_c. However, testing in the luminaire will still be necessary to demonstrate compliance.

Details of the test procedure are under consideration.

C.2 Water contact

LED modules should be protected from direct water contact, for example by drips or splashing , by the luminaire if the luminaire is rated at IPX1 or higher.

C.3 Blue light hazard assessment

C.3.1 LED modules of RG0 unlimited and RG1 unlimited

If assessment according to IEC TR 62778:2014 leads to RG0 unlimited or RG1 unlimited classification of an LED module with respect to blue light hazard, any luminaire incorporating one or more of these LED modules should also be classified as of the same risk group with respect to blue light hazard, regardless of optics and viewing distance.

However, it should be left to the discretion of the luminaire manufacturer to apply IEC TR 62778:2014 directly to the luminaire, which could lead to a lower risk group classification.

C.3.2 LED modules with a threshold illuminance E_{thr}

If assessment according to IEC TR 62778:2014 leads to the classification of an LED module as having a threshold illuminance E_{thr}, any luminaire incorporating one or more of these LED modules should be regarded classified as having the same threshold illuminance E_{thr}. The viewing distance where this threshold illuminance is reached should be calculated according to IEC TR 62778:2014, 7.1 from the luminous flux distribution measurement of the luminaire.

However, it should be left to the discretion of the luminaire manufacturer to apply IEC TR 62778:2014 directly to the luminaire, which could lead to a threshold illuminance E_{thr} greater than that of the LED module.

NOTE If, apart from the light source and its components, luminaires incorporate passive optical components such as lenses and reflectors, these will not change E_{thr}.

C.4 Working voltage

The maximum working voltage for which the LED module insulation has been designed (see 6.2, item k)) should not be exceeded. The evaluation should take into consideration the maximum working voltage that occurs in the luminaire circuit (e. g. in the case of series connection of LED modules) and the type of insulation required in the luminaire according to IEC 60598-1:2014 and IEC 60598-1:2014/AMD1:2017, Annex X.

NOTE The maximum working voltage delivered by the controlgear is the U_{out} and normally occurs in the case of an open circuit. See IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, 7.1, item u) for the relevant information for the controlgear.

Annex D
(normative)

Abnormal temperature test

D.1 Test procedure

D.1.1

The test setup according to D.2 applies.

D.1.2

The sample shall be energized and allowed to run for 7,5 h or until a protective component permanently shuts down the LED module, whichever comes first, while monitoring temperatures on the surface of connecting devices and plastic parts on the device serving as enclosure, electrical barrier, or insulation components.

It is acceptable to take the temperature on the hottest point of the printed circuit board or of any other part in contact with the insulation foil as reference temperature of the insulation foil.

D.1.3

The test results are considered acceptable if all of the following conditions are met:

a) no point of the wrapping tissue burns;

b) there are no openings created that permit to contact any part considered as risk of electric shock according to IEC 61347-1:2015, Annex A with a test probe according to IEC 61032:1997, Figure 9;

c) the sample complies with the dielectric voltage-withstand test in Clause 11 between supply source input and accessible metal parts after this test is complete; and

d) any gases liberated from the LED module are not flammable if tested with a high frequency spark generator.

D.1.4

If the test is interrupted by a protective component or feature that automatically resets, the test shall be continued until the component or feature has operated for at least 10 cycles, but not less than 7,5 h.

D.1.5

If the test is interrupted by a protective component or feature that requires manual reset (for example pressing a pushbutton actuator or cycling the supply source off and on), the protector shall be reset and the test restarted. This shall be continued until the component or feature has operated for at least 10 cycles.

D.2 Test setup

D.2.1

Refer to Figure D.1 for an illustration of this setup.

D.2.2

The LED module shall be installed in its connecting device with a spacer used to create a gap between the thermal interface and heat sink. This spacer shall be placed as close to the edge

of the thermal interface as the construction allows. The spacer shall be a rigid plastic washer according to ISO 7089:2000, size M5, 10 mm in diameter, 1,0 mm thick.

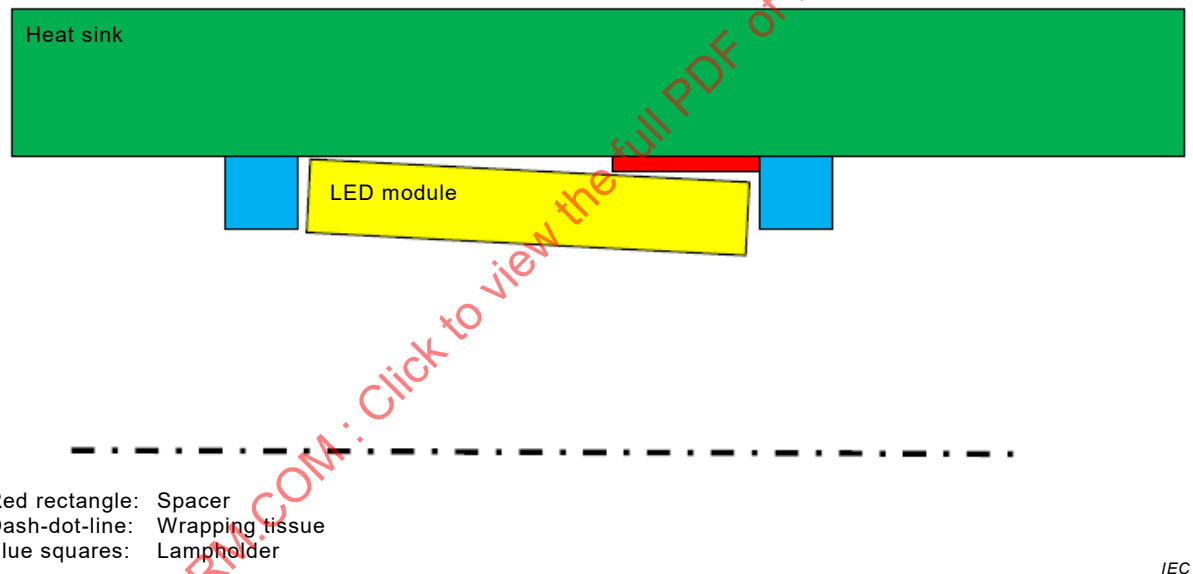
The connecting device shall provide or be attached to a heat sink. The heat sink shall be such that, when the LED module is inserted without a washer and operated under normal conditions until thermally stabilized in an ambient temperature, t_a, according to 5.2, the temperature measured at the t_c location is not smaller than t_c – 5 K and not greater than t_c. Thermal stabilization occurs when the temperature change rate is less than 5 K/h.

If the M5 washer is too thick to allow the LED module to engage and be energized by the lampholder, the next smaller metric washer size (M4, M3,5, M3, M2,5, M2 and M1,6) shall be tried in turn. The largest of these washers that allows the LED module to engage and be energized from the lampholder shall be used as the spacer for the test.

If even the smallest washer according to ISO 7089:2000 cannot be inserted with the LED module being energized, the test shall be considered as passed.

D.2.3

A layer of wrapping tissue according to ISO 4046-4:2016, 4.215 shall be spread out horizontally 200 mm ± 5 mm below the sample.



Red rectangle: Spacer
Dash-dot-line: Wrapping tissue
Blue squares: Lampholder

IEC

Figure D.1 – Abnormal temperature test setup

Bibliography

IEC 60050-151, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices* (available at http://www.electropedia.org)

IEC 60417, *Graphical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)

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

IEC 60947-7-4, *Low-voltage switchgear and controlgear – Part 7-4: Ancillary equipment – PCB terminal blocks for copper conductors*

IEC 62717, *LED modules for general lighting – Performance requirements*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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MODULES À LED POUR ÉCLAIRAGE GÉNÉRAL – SPÉCIFICATIONS DE SÉCURITÉ

AVANT-PROPOS

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La Norme internationale IEC 62031 a été établie par le sous-comité 34A: Lampes, du comité d'études 34 de l'IEC: Lampes et équipements associés.

Cette deuxième édition annule et remplace la première édition parue en 2008, l'Amendement 1:2012 et l'Amendement 2:2014. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) le domaine d'application a été clarifié ainsi que la formulation de plusieurs autres articles;
b) les références normatives ont été mises à jour;
c) les définitions de "module à LED remplaçable", "module à LED non remplaçable" et "module à LED non remplaçable par l'utilisateur" ont été introduites tandis que d'autres définitions couvertes par l'IEC 62504 ont été supprimées;

d) l'article relatif au marquage a été restructuré et un tableau a été ajouté pour donner un aperçu informatif;

e) les exigences de marquage pour les modules à LED à monter ont été modifiées;

f) l'article relatif au marquage pour la tension de service a été révisé;

g) les dispositions relatives aux bornes et à la gestion thermique ont été révisées;

h) l'Annexe B a été supprimée;

i) des informations relatives à la conception des luminaires concernant la tension de service et le contact avec l'eau ont été introduites;

j) un essai de température anormale a été introduit.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
34A/2052/FDIS	34A/2061/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

NOTE Dans la présente Norme, les caractères d'imprimerie suivants sont utilisés:

– Exigences proprement dites: caractères romains.

– *Modalités d'essais: caractères italiques*.

– Notes: petits caractères romains.

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MODULES À LED POUR ÉCLAIRAGE GÉNÉRAL – SPÉCIFICATIONS DE SÉCURITÉ

1 Domaine d'application

Le présent document spécifie les exigences générales et les exigences de sécurité relatives aux modules à diodes électroluminescentes (LED):

- modules à LED non intégrés (modules LEDni) et les modules à LED semi-intégrés (modules LEDsi) pour fonctionnement sous tension constante, courant constant ou puissance constante;
- modules à LED intégrés (modules LEDi) pour utilisation sur des alimentations à courant continu jusqu'à 250 V ou à courant alternatif 50 Hz ou 60 Hz jusqu'à 1 000 V.

Les modules à LED compris dans le domaine d'application du présent document peuvent être à intégrer, à monter ou indépendants.

Ce document n'est pas applicable pour les lampes à LED.

NOTE Les exigences de performance pour les modules à LED sont spécifiées dans l'IEC 62717.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60598-1:2014, *Luminaires – Partie 1: Exigences générales et essais*
IEC 60598-1:2014/AMD1:2017

IEC 61032:1997, *Protection des personnes et des matériels par les enveloppes – Calibres d'essai pour la vérification*

IEC 61347-1:2015, *Appareillages de lampes – Partie 1: Exigences générales et exigences de sécurité*
IEC 61347-1:2015/AMD1:2017

IEC 62471:2006, *Sécurité photobiologique des lampes et des appareils utilisant des lampes*

IEC 62504, *Éclairage général – Produits à diode électroluminescente (DEL) et équipements associés – Termes et définitions*

IEC TR 62778:2014, *Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires* (disponible en anglais seulement)

ISO 4046-4:2016, *Papier, carton, pâtes et termes connexes – Vocabulaire – Partie 4: Catégories et produits transformés de papier et de carton*

ISO 7089:2000, *Rondelles plates – Série normale – Grade A*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 62504 ainsi que les suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
efficacité du danger lié aux ultraviolets du rayonnement lumineux
$K_{S,v}$
quotient d'une grandeur du danger lié aux ultraviolets sur la grandeur photométrique correspondante

Note 1 à l'article: L'efficacité du danger lié aux ultraviolets du rayonnement lumineux est exprimée en mW/klm.

Note 2 à l'article: On obtient l'efficacité du danger lié aux ultraviolets du rayonnement lumineux par pondération de la répartition spectrale de puissance de la lampe ou du module à LED avec la fonction de danger lié aux ultraviolets $S_{UV}(\lambda)$. Les informations concernant la fonction correspondante de danger lié aux ultraviolets sont données dans l'IEC 62471:2006. Elles se rapportent uniquement aux dangers potentiels concernant l'exposition des personnes au rayonnement ultraviolet. Ces informations ne traitent pas de l'effet potentiel du rayonnement optique sur les matériaux, comme le dommage mécanique ou la décoloration.

3.2
module à LED remplaçable
module à LED conçu pour être remplacé par une personne ordinaire ou une personne qualifiée

Note 1 à l'article: Lorsqu'il est incorporé dans un luminaire, un module à LED remplaçable peut être classé comme remplaçable, non remplaçable par l'utilisateur ou non remplaçable, en fonction de la conception du luminaire.

3.3
module à LED non remplaçable
module à LED conçu pour être une partie non remplaçable du luminaire

Note 1 à l'article: Un module à LED à intégrer est toujours non remplaçable. Un module à LED non remplaçable n'est pas toujours un module à LED à intégrer.

Note 2 à l'article: La non-remplaçabilité peut résulter de la conception du luminaire.

3.4
module à LED non remplaçable par l'utilisateur
module à LED conçu pour être remplacé uniquement par le fabricant, son agent de maintenance ou une personne de qualification équivalente

Note 1 à l'article: Lorsqu'il est incorporé dans un luminaire, un module à LED non remplaçable par l'utilisateur peut se classer comme non remplaçable, en fonction de la conception du luminaire.

3.5
borne
partie conductrice d'un module à LED, destinée à le connecter à un ou plusieurs conducteurs extérieurs

[SOURCE: IEC 60050−151:2001, 151.12.12, modifiée – "d'un appareil, d'un circuit électrique ou d'un réseau électrique" a été remplacé par "d'un module à LED" et la note à l'article a été supprimée.]

3.6
borne intégrée
borne constituant une partie non remplaçable d'un module à LED et qui ne peut pas être soumise à l'essai séparément du module à LED

[SOURCE: IEC 60598-1:2014, 1.2.58, modifiée – "composant" remplacé par "borne", "luminaire" remplacé par "module à LED".]

4 Exigences générales

4.1 Les modules à LED doivent être conçus et réalisés de telle sorte qu'en utilisation prévue, ils fonctionnent sans danger pour l'utilisateur ou ce qui l'entoure (voir les instructions du fabricant).

NOTE L'IEC 61347-1:2015, Annexe S fournit des exemples de coordination de l'isolation pouvant être appropriés pour les modules à LED.

4.2 Les modules à LED doivent être classés, en fonction de la méthode d'installation, en modules:

– à monter,
– indépendant, ou
– à intégrer.

4.3 Pour les modules à LED non intégrés et les modules à LED semi-intégrés, tous les mesurages électriques doivent être réalisés, sauf spécification contraire, aux limites de tension (min./max.), de courant (min./max.) ou de puissance (min./max.) et à la fréquence minimale, dans une salle sans courant d'air aux limites de température de la gamme permise spécifiée par le fabricant. A moins que le fabricant n'indique la combinaison la plus critique, toutes les combinaisons (min./max.) de tension/courant/puissance et de température doivent être soumises à essai.

4.4 Pour les modules à LED intégrés, les mesurages électriques doivent être réalisés aux limites de tolérance de la tension d'alimentation assignée.

4.5 Les modules à LED à intégrer qui ne possèdent pas leur propre enceinte doivent être considérés comme des composants à intégrer des luminaires conformément à l'IEC 60598-1:2014, 0.5.1.

4.6 En complément des exigences du présent document, les modules à LED indépendants doivent être conformes à l'IEC 60598-1:2014 et de l'IEC 60598-1:2014/AMD1:2017.

4.7 Si le module à LED est un élément fermé en usine, il ne doit être ouvert pour aucun essai. En cas de doute basé sur l'examen du module à LED et du schéma du circuit, et en accord avec le fabricant ou le vendeur responsable, des modules à LED spécialement préparés pour pouvoir simuler une condition de défaut devront être soumis aux essais.

4.8 Pour les modules à LED à appareillage intégré fournissant une TBTS, les exigences de l'IEC 61347-1:2015 et de l'IEC 61347-1:2015/AMD1:2017, Articles L.5, L.6, L.7, L.8, L.9, L.10 et L.11 s'appliquent.

5 Exigences générales pour les essais

5.1 Les essais correspondant au présent document doivent être des essais de type.

NOTE Les exigences et les tolérances, dans le présent document, s'appliquent aux essais d'un échantillon pour essai de type soumis par le fabricant dans ce but.

La conformité de la production est de la responsabilité du fabricant et peut nécessiter des essais individuels de série et une assurance qualité en complément des essais de type.

5.2 L'essai doit être réalisé à une température ambiante de 10 °C à 30 °C. Si le fabricant spécifie une température ambiante différente, celle-ci doit être utilisée comme température d'essai.

5.3 Sauf spécification contraire, l'essai de type doit être réalisé sur un échantillon constitué d'un ou plusieurs éléments présentés en vue de l'essai de type.

En général, tous les essais doivent être réalisés sur chaque type de module à LED ou, lorsqu'il s'agit d'une gamme de modules à LED similaires, pour chaque puissance de la gamme ou sur une sélection représentative, en accord avec le fabricant.

5.4 Si la lumière produite a évolué de façon importante, le module à LED ne doit plus être utilisé pour les essais ultérieurs.

NOTE Habituellement, une valeur de 50 % indique des modifications irréversibles dans le module à LED.

5.5 Les essais sur les modules à LED à intégrer qui ne possèdent pas leur propre enceinte doivent être réalisés comme sur une partie intégrante du luminaire, dans la mesure du possible.

6 Marquage

6.1 Vue d'ensemble

Les exigences du 6.2, 6.3, 6.4, 6.5 et du 6.6 s'appliquent. Le Tableau 1 donne une vue d'ensemble des informations.

Tableau 1 – Vue d'ensemble des dispositions de marquage

Elément selon 6.2	Modules à LED à monter	Modules à LED indépendants	Modules à LED à intégrer
a)	Exigé Sur le module à LED	Exigé Sur le module à LED	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
b)	Exigé Sur le module à LED	Exigé Sur le module à LED	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
c)	Exigé Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur le module à LED	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable

Elément selon 6.2	Modules à LED à monter	Modules à LED indépendants	Modules à LED à intégrer
d)	Exigé Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
e)	Exigé si nécessaire Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé si nécessaire Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
f)	Exigé Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur le module à LED	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
g)	Exigé si E_{thr} Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé si E_{thr} Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	Exigé Sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable
h)	Exigé Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	—	—
i)	Exigé s'il possède un culot Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	—	—
j)	Exigé s'il possède un culot Sur le module à LED, sur la feuille de caractéristiques du module à LED, sur la notice du module à LED ou sur le site web du fabricant ou du vendeur responsable	—	—