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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LED MODULES FOR GENERAL LIGHTING –
SAFETY SPECIFICATIONS**
FOREWORD

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

The text of this first edition is based on the following documents:

FDIS	Report on voting
34A/1237/FDIS	34A/1256/RVD

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

This publication 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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn;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

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 International Standard specifies general and safety requirements for light-emitting diode (LED) modules:

- * LED modules without integral control gear for operation under constant voltage, constant current or constant power;
- * self-ballasted LED modules for use on d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

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

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 referenced documents are indispensable for the application 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, *Luminaires, Part 1: General requirements and tests*¹⁾
Amendment 1 (2006)

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

IEC 61347-1:2007, *Lamp controlgear – Part 1: General and safety requirements*

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

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

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

4 General requirements

4.1 Modules shall be so designed and constructed that in normal use (see manufacturer's instruction) they operate without danger to the user or surroundings.

4.2 For 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.

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

4.4 Integral modules not having their own enclosure shall be treated as integral components of luminaires as defined in IEC 60598-1, Clause 0.5. They shall be tested assembled in the luminaire, and as far as applicable with the present standard.

4.5 Independent modules shall comply, in addition to this standard, with the requirements of relevant clauses of IEC 60598-1, where these requirements are not already covered in this standard.

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

5 General test requirements

5.1 Tests according to this standard shall be type tests.

NOTE The requirements and tolerances permitted by this standard 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 need routine tests and quality assurance in addition to type testing.

5.2 Unless otherwise specified, the tests shall be carried out at an ambient temperature of 10 °C to 30 °C.

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 module or, where a range of similar modules is involved, for each wattage in the range or on a representative selection from the range, as agreed with the manufacturer.

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

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

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.

7 Marking

7.1 Mandatory marking for built-in or independent modules

- 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.
- d) Nominal power.
- e) Indication of position and purpose of the connections where it is necessary for safety. In case of connecting wires, a clear indication shall be given in a wiring diagram.
- f) Value of 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.
- h) Built-in modules shall be marked in order to separate them from independent modules. The mark shall be located on the packaging or on the module itself.

NOTE The symbol is under consideration.

7.2 Location of marking

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.

7.3 Durability and legibility of marking

Marking 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.

For items d) to h) of 7.1, compliance is checked by inspection.

8 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.

9 Provisions for protective earthing

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

10 Protection against accidental contact with live parts

The requirements of IEC 61347-1, Clause 10, apply.

11 Moisture resistance and insulation

The requirements of IEC 61347-1, Clause 11, apply.

12 Electric strength

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

13 Fault conditions

13.1 General

The module shall not impair safety when operated under fault conditions that may occur during the intended use. The requirements of IEC 61347-1, Clause 14, apply. Additionally, the following test shall be carried out.

13.2 Overpower condition

The test shall be started at an ambient temperature as specified in Annex A.

The module shall be switched on and the power monitored (at the input side) and increased until 150 % of the rated voltage, current or power is reached. The test shall be continued until the module is thermally stabilised. 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 module shall withstand the overpower condition for at least 15 min, the time period of which can lie within the stabilisation period if the temperature change is ≤ 5 K.

If the 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 module has passed the test, provided the compliance (4.1 and last paragraph of 13.2) is fulfilled.

After finalising the overpower mode, the module is operated under normal conditions until thermally being stable.

A module fails safe 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 tissue paper, as specified in 4.187 of ISO 4046-4, spread below the module shall not ignite.

14 Conformity testing during manufacture

See Annex C.

15 Construction

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

Compliance is checked by inspection.

16 Creepage distances and clearances

The requirements of IEC 60598-1, Section 11, apply.

17 Screws, current-carrying parts and connections

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

18 Resistance to heat, fire and tracking

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

19 Resistance to corrosion

The requirements of IEC 61347-1, Clause 19, apply.

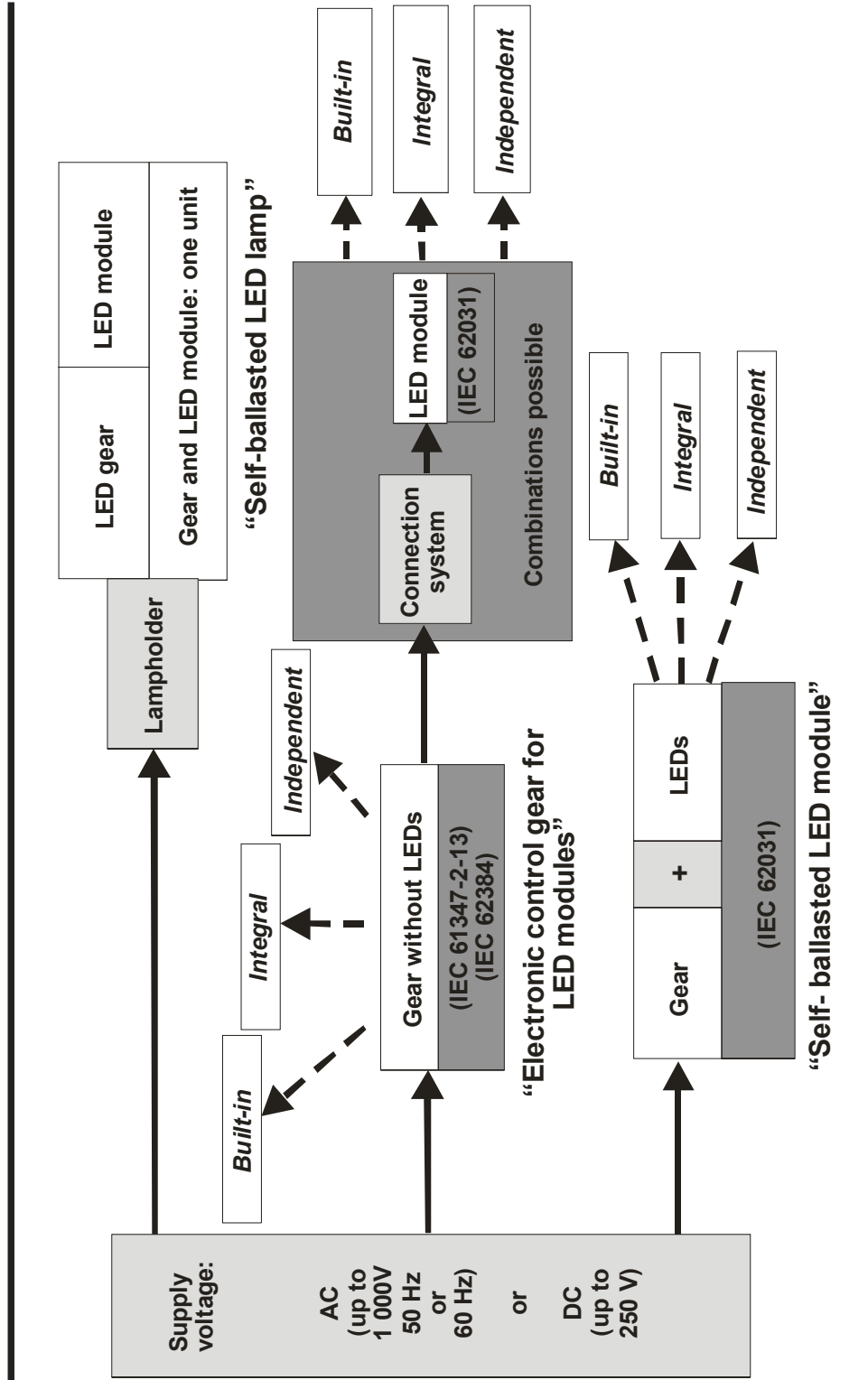
Annex A (normative)

Tests

Refer to IEC 61347-1, Annex H, Clauses H.1, H.2, H.4, H.7, and to Subclause H.11.2. In H.1.3, ignore the first paragraph. In all clauses, replace “lamp”, “(lamp) control gear” or “ballast” by “LED module”.

Annex B
(informative)

Overview of systems composed of LED modules and control gear



IEC 231607

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

Annex C
(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 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 be safety relevant, like current bridges.

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

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⁾

²⁾ In preparation.