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PRE-STANDARD



LED modules for general lighting – Performance requirements

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IEC/PAS 62717:2011

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PRE-STANDARD



LED modules for general lighting – Performance requirements

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**LED MODULES FOR GENERAL LIGHTING –
PERFORMANCE REQUIREMENTS**

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The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
34A/1444/PAS	34A/1462/RVD

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INTRODUCTION

This first edition of a performance PAS 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 publication is closely related to simultaneously developed and edited performance standards publications (or PAS) for luminaires in general and for LED-luminaires. Changes in the LED module PAS will have an impact on the luminaire standards and vice versa, due to the behaviour of LEDs. Therefore, in the development of the present PAS, a close collaboration of experts on both products has taken place.

The provisions in the PAS represent the technical knowledge of experts from the fields of the semiconductor (LED chip) industry and of those of the traditional electrical light sources.

Three types of LED-modules are covered: with integral controlgear, with means of control on board, but with separate controlgear (“semi-ballasted”), and with complete external controlgear.

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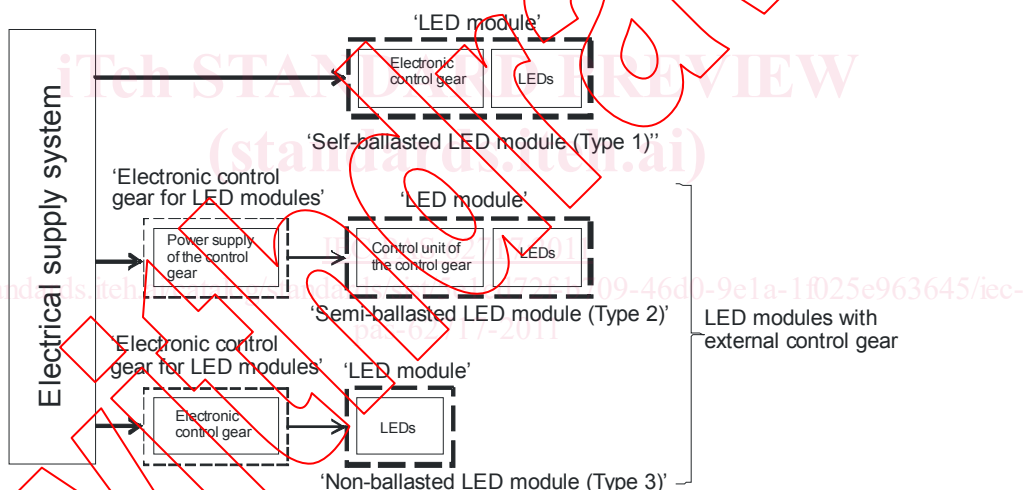
LED MODULES FOR GENERAL LIGHTING – PERFORMANCE REQUIREMENTS

1 Scope

This PAS specifies the performance requirements for LED modules, together with the test methods and conditions, required to show compliance with this PAS.

The following types of LED modules are distinguished (see Figure 1):

- Type 1: Self-ballasted LED modules for use on d.c. supplies up to 250 V or on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz;
- Type 2: LED modules operating with external controlgear connected to the mains voltage, and having further control means inside (“semi-ballasted”) for operation under constant voltage, constant current or constant power;
- Type 3: LED modules where the complete controlgear is separate from the module for operation under constant voltage, constant current or constant power.



The power supply of the controlgear for semi-ballasted LED modules (Type 2) is an electronic device capable of controlling currents, voltage or power within design limits.

The control unit of the controlgear for semi-ballasted LED modules (Type 2) is an electronic device to control the electrical energy to the LED's.

A LED module with external controlgear can be either a non-ballasted LED module or a semi-ballasted LED module.

Figure 1 – Types of LED modules

The requirements of this PAS relate only to type testing.

Recommendations for whole product testing or batch testing are under consideration.

This PAS covers LED modules that intentionally produce white light, based on inorganic LEDs.

These performance requirements are additional to the requirements in IEC 62031 safety standard for LED modules.

Life time of LED modules is in most cases much longer than the practical test times. Consequently, verification of manufacturer's life time claims cannot be made in a sufficiently confident way, because projecting test data further in time is not standardised. For that reason, the acceptance or rejection of a manufacturer's life time claim, past 25 % of rated life (with a maximum of 6 000 h), is out of the scope of this PAS.

Instead of life time validation, this PAS has opted for lumen maintenance codes at a defined finite test time. Therefore, the code number does not imply a prediction of achievable life time. The categories are lumen-depreciation character categories showing behaviour in agreement with manufacturer's information which are provided before the test is started.

In order to validate a life time claim, an extrapolation of test data is needed. A general method of projecting measurement data beyond limited test time is under consideration.

The pass/fail criterion of the life time test as defined in this PAS is different from the life time metrics claimed by manufacturers. For explanation of recommended life time metrics, see Annex C.

NOTE 1 When modules are operated in a luminaire, the claimed performance data can deviate from the values established via this PAS due to e.g. luminaire components that impact the performance of the module.

NOTE 2 The external electronic controlgears for LED modules as mentioned in Type 2 and Type 3 are not part of the testing against the requirements of this PAS.

NOTE 3 For protection for water and dust ingress, see Clause B.4.

It may be expected that self-ballasted LED modules which comply with this PAS will start and operate satisfactorily at voltages between 92 % and 106 % of rated supply voltage. LED modules with external controlgear are expected to start and operate satisfactorily in combination with the specified controlgear complying with IEC 61347-2-13 and IEC 62384. All LED modules are expected to start and operate satisfactorily when operated under the conditions specified by the module manufacturer and in a luminaire complying with IEC 60598-1.

For compliance with EMC requirements, reference is made to regional requirements. For relevant standards, see Bibliography.

NOTE It should be regarded that only those types of LED modules are subject to EMC requirements which

- in case of harmonic current are directly connected to the mains and have active elements on board;
- in case of radiated or conducted disturbances are directly connected to the mains (Type 1) or to a battery;
- in case of immunity are directly connected to the mains (Type 1) or to a battery.

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 60050-845, *International Electrotechnical Vocabulary – Part 845: Lighting*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60081:1997, *Double-capped fluorescent lamps – Performance specifications*

IEC 60598-1, *Luminaires – Part 1: General requirements and tests*

IEC/TR 61341, *Method of measurement of centre beam intensity and beam angle(s) of reflector lamps*

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

IEC 62031:2008, *LED modules for general lighting – Safety specifications*

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

IEC/TS 62504, *General lighting – LED and LED modules – Terms and definitions*

CIE 13.3:1995 (CD008-1995 included), *Method of measuring and specifying colour rendering properties of light sources*

CIE 121:1996, *The photometry and goniophotometry of luminaires*

CIE 177:2007, *Colour rendering of white LED light sources*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845 and IEC/TS 62504 apply, together with the following.

3.1 rated value

quantity value for a characteristic of a LED module for specific operating conditions

The value and the conditions are specified in this PAS, or assigned by the manufacturer or responsible vendor.

3.2 test voltage, current or power

input voltage, current or power at which tests are carried out

3.3 lumen maintenance

value of the luminous flux at a given time in the life of a LED module divided by the initial value of the luminous flux of the module and expressed as a percentage x of the initial luminous flux value

NOTE The lumen maintenance of a LED module is the effect of decrease of lumen output of the LED(s) or a combination of this with failure(s) of LED(s) if the module contains more than one LED.

3.4 initial values

photometric and electrical characteristics at the end of the ageing period and/or stabilisation time

3.5 maintained values

photometric and electrical characteristics at an operational time as stated in 6.1, including stabilisation time

**3.6
rated life**

length of time during which a population of LED modules provides more than claimed percentage x of the initial luminous flux, published in combination with the failure fraction, as declared by the manufacturer or responsible vendor

NOTE 1 For sample size, see Clause 6.

NOTE 2 Note 2 and Note 3 of 3.7 apply.

NOTE 3 For explanation of the figure $L_x F_y$, see Annex C.

**3.7
life (of an individual LED module)**

L_x
length of time during which a LED module provides more than claimed percentage x of the initial luminous flux, under standard conditions

NOTE 1 A LED module has thus reached its end of life, when it no longer provides claimed percentage x of the initial luminous flux. Life is always published as combination of life (L_x) at lumen maintenance x and failure fraction F_y , see 3.8.

NOTE 2 Any built-in electronic controlgear, however, may show a sudden end of life failure. The definition under 3.7 implies that a LED module giving no light at all, due to an electronic failure, has actually reached end of life, since it no longer complies with the minimum luminous flux level as declared by the manufacturer or responsible vendor.

**3.8
failure fraction**

F_y
percentage y of a number of LED modules of the same type that at their rated life designates the percentage (fraction) of failures

NOTE 1 This failure fraction expresses the combined effect of all components of a module including mechanical, as far as the light output is concerned. The effect of the LED could either be less light than claimed or no light at all.

NOTE 2 For LED modules, normally a failure fraction of 10 % or/and 50 % are being applied, indicated as F_{10} and/or F_{50} .

**3.9
photometric code***

colour designation of a LED module giving white light is defined by the correlated colour temperature and the CIE 1974 general colour rendering index

* Under consideration

NOTE Definition of photometric code is given in IEC/TS 62504 as light colour designation.

**3.10
stabilisation time**

time which the LED module requires to obtain stable photometric conditions with constant electrical input

NOTE LED modules may be regarded stable at stable thermal conditions.

**3.11
ageing**

preconditioning period of the LED module

**3.12
type**

LED module, representative of the production

3.13**family**

group of LED modules that have

- the same method of control and operation (self-ballasted, semi-ballasted, non-ballasted);
- the same classification according to the method of installation (reference is made to IEC 62031, Clause 6);
- the same class of protection against electrical shock;
- the same design characteristics, distinguished by common features of materials, components, and/or method of processing

3.14**type test**

conformity test on one or more LED modules, representative of the production

3.15**type test sample**

one or more LED modules submitted by the manufacturer or responsible vendor for the purpose of the type test

3.16 **t_p -point**

the designated location of the point where to measure the performance temperatures t_p and $t_{p \max}$ at the surface of the LED module

3.17 **t_p temperature**

temperature at the t_p -point, related to the performance of the LED module

NOTE 1 $t_p \leq t_c$. This is only the case if the location of t_p and t_c is the same. For t_c , see 3.10 of IEC 62031.

NOTE 2 The location of t_p and t_c can be different, but the value of t_c is leading.

NOTE 3 For a given life time, the t_p temperature is a fixed value, not a variable.

NOTE 4 There can be more than one t_p , depending on the life time claim.

3.18**recommended maximum LED module operating temperature value** **$t_{p \max}$**

maximum t_p temperature as declared by the manufacturer or responsible vendor

NOTE 1 $t_{p \max} \leq t_c$. This is only the case if the location of $t_{p \max}$ and t_c is the same. For t_c , see 3.10 of IEC 62031.

NOTE 2 The location of $t_{p \max}$ and t_c can be different, but the value of t_c is leading.

3.19**semi-ballasted LED module**

module which carries the control unit of the controlgear, and is operated by the separated power supply of the controlgear

NOTE In this standard, semi-ballasted LED modules are designated "Type 2".

3.20**control unit of the controlgear**

electronic device, being part of the controlgear, responsible for controlling the electrical energy to the LEDs as well as colour mixing, response to depreciating luminous flux and further performance features

NOTE In semi-ballasted LED modules, the control unit of the controlgear is on board the module and separate from the power supply of the controlgear.