

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Self-ballasted LED lamps for general lighting services with supply voltages  
> 50 V – Performance requirements**

(standards.iteh.ai)

**Lampes à LED autoballastées pour l'éclairage général avec des tensions  
d'alimentation > 50 V – Exigences de performances**

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**Self-ballasted LED lamps for general lighting services with supply voltages  
> 50 V – Performance requirements**

**Lampes à LED autoballastées pour l'éclairage général avec des tensions  
d'alimentation > 50 V – Exigences de performances**

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ELECTROTECHNICAL  
COMMISSION

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# SELF-BALLASTED LED LAMPS FOR GENERAL LIGHTING SERVICES WITH SUPPLY VOLTAGES > 50 V – PERFORMANCE REQUIREMENTS

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International Standard IEC 62612 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This first edition of IEC 62612 cancels and replaces IEC/PAS 62612. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC/PAS 62612.

- a) The standard explicitly states that real life time tests are not part of the test regime. Instead, a period of up to 6 000 h is chosen in order to assess manufacturers' claims of maintenance.
- b) Technical features have been adapted to IEC/PAS 62717 (performance of LED modules) as far as possible. Examples are the family approach and the temperature measuring point.
- c) Marking requirements are shifted from the product to the packaging.
- d) The number of lamps to be tested is made test specific, not general.

- e) First requirements are given for setting the colour for colour adjustable lamps and the luminous flux level of dimmable lamps.
- f) The structure of tests is clearly divided between requirement and compliance.
- g) Statistical compliance is separated into individual and average.
- h) Light output requirements are extended to luminous intensity distribution, peak intensity, beam angle and efficacy.
- i) The use of the terms “correlated colour temperature” and “chromaticity coordinates” is corrected.
- j) The number of tolerance categories is reduced from 8 to 4, and split between initial and maintained values.
- k) Colour rendering is differently assessed at initial and maintained state.
- l) Three lumen maintenance categories are given instead of five.
- m) The endurance tests are completely re-established.
- n) The verification (formerly: assessment) clause is completed.
- o) Information for luminaire design is added.
- p) Stabilisation is more precise (Annex A on the method of measuring lamp characteristics) and extension is made for the additional photometric and colorimetric parameters.
- q) Annex B on measuring luminous flux is contained in Annex A. New Annex B provides the photometric code.
- r) Further annexes are added: Annex C and D for displacement factor, Annex E for life time metrics/reliability and Annex F for examples of LED dies and LED packages.

The text of this standard is based on the following documents;

FDIS	IEC 62612:2013	Report on voting
34A/1662/FDIS		34A/1679/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.

In this standard, the following print types are used:

- requirements: roman type;
- *test specifications*: italic type;
- notes: small roman type.

The committee has decided that the contents of this publication will remain unchanged until the stability 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

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The contents of the corrigendum of October 2016 have been included in this copy.

## INTRODUCTION

This International Standard is the first edition of a performance standard (precursor: IEC/PAS 62612) for self-ballasted LED lamps for general lighting applications and acknowledges the need for relevant tests for this new source of electrical light, sometimes called “solid state lighting”.

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

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# SELF-BALLASTED LED LAMPS FOR GENERAL LIGHTING SERVICES WITH SUPPLY VOLTAGES > 50 V – PERFORMANCE REQUIREMENTS

## 1 Scope

This International Standard specifies the performance requirements, together with the test methods and conditions, required to show compliance of LED lamps with integral means for stable operation, intended for domestic and similar general lighting purposes, having:

- a rated power up to 60 W;
- a rated voltage of > 50 V a.c. up to 250 V a.c.;
- a lamp cap as listed in IEC 62560.

These performance requirements are additional to the safety requirements in IEC 62560.

The only feature provided by this standard, when applied for replacement purposes, is information on maximum lamp outlines.

The requirements of this standard relate to type testing. This standard covers LED lamps that intentionally produce white light, based on inorganic LEDs.

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

The life time of LED lamps 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 an operational time as stated in 7.1, is out of the scope of this standard.

Instead of life time validation, this standard 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, represented by the code, are lumen-depreciation character categories showing behaviour in agreement with manufacturer's information, provided before the test is started.

In order to validate a life time claim, several methods of test data extrapolation exist. 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 standard is different from the life time metrics claimed by manufacturers. For explanation of recommended life time metrics, see Annex E.

NOTE When lamps are operated in a luminaire the claimed performance data can deviate from the values established via this standard due to e.g. luminaire components that impact the performance of the lamp.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <<http://www.electropedia.org>>).

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

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

IEC 60630, *Maximum lamp outlines for incandescent lamps*

IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq 16A$  per phase)*, Amendment 2:2009.

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques. General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

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

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

IEC 62560, *Self-ballasted LED-lamps for general lighting services by voltage  $> 50 V$  – Safety specifications*

IEC/TR 62732, *Three-digit code for designation of colour rendering and correlated colour temperature*

CIE 13.2:1974, *Methods of measuring and specifying colour rendering properties of light sources*

CIE 13.3:1995, *Method of measuring and specifying colour rendering of light sources*

CIE S 017/E:2011, *ILV: International Lighting Vocabulary*

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/TS 62504 and IEC 60050-845 as well as the following apply.

#### 3.1

##### **rated value**

quantity value for a characteristic of an LED lamp for specified operating conditions

Note 1 to entry: The value and the conditions are specified in this standard, or assigned by the manufacturer or responsible vendor.

#### 3.2

##### **test voltage**

voltage at which tests are carried out

Note 1 to entry: Specification of test voltage is made in A.2.

**3.3****lumen maintenance** (of an LED lamp)**luminous flux maintenance**

ratio of the luminous flux emitted by an LED lamp at a given time in its life to its initial luminous flux, the lamp being operated under specified conditions

Note 1 to entry: This ratio  $x$  is generally expressed in per cent.

Note 2 to entry: The lumen maintenance of an LED lamp is the effect of decrease of the lumen output of the LED(s) or a combination of this with failure(s) of LED(s) if the lamp contains more than one LED.

[SOURCE: IEC 60050-845:1987, 845.07.65, modified — the term "LED" and the note 2 to entry are added]

**3.4****initial value**

photometric, colorimetric and electrical characteristics at the end of the ageing period and stabilisation time

**3.5****maintained value**

photometric, colorimetric and electrical characteristics at an operational time, including stabilisation time

Note 1 to entry: The operational time is stated in 7.1.

**3.6****life (of an individual LED lamp)** $L_x$ 

length of time during which an LED lamp provides at least claimed percentage of the initial luminous flux, under standard conditions

Note 1 to entry: An LED lamp has thus reached its end of life, when it no longer provides claimed percentage of the initial luminous flux. Life is always published in combination of life ( $L_x$ ) at lumen maintenance ( $x$ ) and the failure fraction ( $F_y$ ) (see 3.8)

Note 2 to entry: Any built-in electronic controlgear, however, may show a sudden end of life failure. The definition 3.6 implies that an LED lamp 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.

**3.7****rated lamp life**

length of time during which a population of LED lamps provides at least the claim for luminous flux percentage  $x$  and less or equal the claim for failure fraction percentage  $y$ , as declared by the manufacturer or responsible vendor

Note 1 to entry: For sample size see Clause 7.

Note 2 to entry: Notes to entry 1 and 2 of 3.6 apply.

Note 3 to entry: Rated lamp life is expressed in hours.

**3.8****failure fraction at rated life** $F_y$ 

percentage  $y$  of a number of LED lamps of the same type, that at their rated life designates the percentage (fraction) of failures

Note 1 to entry: This failure fraction expresses the combined effect of all components of an LED lamp including mechanical components, 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 to entry: For self-ballasted LED lamps 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 an LED lamp giving white light as defined by the correlated colour temperature and the CIE 13.2:1974 general colour rendering index

Note 1 to entry: The definition of photometric code is given in IEC/TS 62504 as light colour designation.

Note 2 to entry: The definition of photometric code may be further reviewed with regard to IEC/TR 62732.

### 3.10

#### **stabilisation time**

time, which the LED lamp requires to obtain stable photometric conditions with constant electrical input for each measurement

Note 1 to entry: An LED lamp may be regarded as stable at stable thermal conditions.

### 3.11

#### **ageing**

preconditioning period of the LED lamps before initial values are taken

### 3.12

#### **type**

LED lamp, representative of the production

### 3.13

#### **family**

group of LED lamps that have same design characteristics, distinguished by common features of materials, components, and/or method of processing

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### 3.14

#### **type test**

conformity test on one or more LED lamps, representative of production

[SOURCE: IEC 60050-151:2001, 151.16.16, modified — the word “items” is replaced with “LED lamps”]

### 3.15

#### **type test sample**

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

### 3.16

#### **LED lamp efficacy**

quotient of the luminous flux emitted by the power consumed by the LED lamp

Note 1 to entry: Efficacy is expressed in lm/W.

### 3.17

#### **LED die**

block of semi-conducting material on which a given functional circuit is fabricated

SEE: Figure F.1 for a schematic built-up of an LED die.

### 3.18

#### **LED package**

single electrical component encapsulating principally one or more LED dies, possibly with optical elements and thermal, mechanical, and electrical interfaces

Note 1 to entry: The component does not include the control unit of the controlgear, does not include a cap, and is not connected directly to the supply voltage.

Note 2 to entry: An LED package is a discrete component and part of the LED lamp. For a schematic built-up of an LED package, see Figure F.2.

### 3.19

#### **$t_{LED}$ -point**

designated location of the point where to measure the performance temperature  $t_{LED}$  at the surface of the LED package

### 3.20

#### **displacement factor**

expressed by  $\cos\phi_1$ , where  $\phi_1$  is the phase angle between the fundamental of the mains supply voltage and the fundamental of the mains current

### 3.21

#### **directional lamp**

lamp having at least 80 % luminous flux within a solid angle of  $\pi$  sr (corresponding to a cone with angle of  $120^\circ$ )

## 4 General requirements on tests

The LED lamps for which compliance with this standard is claimed shall comply with the requirements of the relevant safety standard IEC 62560. For measurement of lamp characteristics, see Annex A.

The requirements for individual LED lamps apply to 95 % of the production population.

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

## 5 Marking

### 5.1 General requirements for marking

In addition to IEC 62560, marking data as requested by Table 1 shall be provided by the manufacturer or responsible vendor, and placed as specified in 5.2.

## 5.2 Places of marking

See Table 1.

**Table 1 – Required markings**

	Product	Packaging	Product datasheets, leaflets or website
a) Rated luminous flux (lm), centre beam intensity and beam angle ( see Note 1)	X	X	X
b) Lamp photometric code (see Annex B)	–	X	X
c) Rated life (h) and the related lumen maintenance (x)	–	X	X
d) Failure fraction ( $F_y$ ), corresponding to the rated life	–	X	X
e) Lumen maintenance code (see Table 5)	–	–	X
f) Rated colour (for example: F 2700 to F 6500, see Table 3) including initial and maintained colour variation category (see Table 4)	–	X	X
g) Rated colour rendering index	–	X	X
h) Ageing time (h), if different to 0 h	–	–	X
i) Rated efficacy (lm/W) (see Note 2)	–	–	X
j) Dimensions, including dimensional tolerances	–	–	X
k) Displacement factor (see Note 3 and Annex D)	–	–	X
<p>These requirements are minimal. Additional regional regulatory marking requirements may exist and overrule.</p> <p>NOTE 1 For directional lamps, centre beam intensity and beam angle are measured according to IEC/TR 61341.</p> <p>NOTE 2 Efficacy of directional lamps can be classified with a luminous flux defined in a 120° (<math>\pi</math> sr) cone or 90° (<math>0,6 \pi</math> sr) cone, see A.3.2.</p> <p>NOTE 3 In Japan, the power factor instead of the displacement factor is relevant.</p> <p><b>Key</b></p> <p>X = required</p> <p>– = not required</p>			

## 6 Dimensions

The LED lamp dimensions shall comply with the requirements as indicated by the manufacturer or responsible vendor. If an outline as per IEC 60630 is claimed, then the maximum outlines shall not be exceeded.

If the luminaire itself or any covering (if applicable) does not interfere with the dimensions of LED lamps, such lamps are also suitable as replacement.

*Compliance is checked by inspection.*

## 7 Test conditions

### 7.1 General test conditions

Testing duration is 25 % of rated life time up to a maximum of 6 000 h.

Additional LED lamps within the same family (see 3.13) may be subjected to decreased testing duration. For identification of a family see Table 2, for details on sample sizes for family testing see Table 6.

Test conditions for testing electrical and photometric characteristics, lumen maintenance and life are given in Annex A.

All tests are conducted on  $n$  LED lamps of the same type. The number  $n$  shall be a minimum of products as given in Table 6. LED lamps used in the endurance tests shall not be used in other tests.

LED lamps with dimming control shall be adjusted to maximum light output for all tests.

LED lamps with adjustable colour point shall be adjusted/set to one fixed value as indicated by the manufacturer or responsible vendor.

## **7.2 Creation of lamp families to reduce test effort**

### **7.2.1 General**

Lamp families have been created with the aim of guiding LED lamp manufacturers towards platform designs and thus allowing the possibility to use data of the existing baseline product that has already been tested for an operational period as stated in 7.1. The baseline product is considered to be the first LED lamp complying with this standard and designated to be part of the family.

### **7.2.2 Variations within a family**

Each family of LED lamps requires a case-by-case consideration. The range of LED lamps should be manufactured by the same manufacturer, under the same quality assurance system. The type variations of the range (e.g. Correlated Colour Temperature (CCT), see 10.1) should be essentially identical with respect to materials used, components and construction applied. Type test sample(s) should be selected with the cooperation of the manufacturer and the testing station.

<https://standards.iteh.ai/catalog/standards/sist/99d068e4-cb5b-4d80-8180-b350e6f5deff/iec-62612-2013>

Requirements for the identification of a family of LED lamps for type testing are given in definition 3.13 and used in Table 2.

The testing time may be reduced within a family down to 1 000 h<sup>1</sup> in case variations of part characteristics are within the conditions given in Table 2.

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<sup>1</sup> Value under consideration.