IEC 62504

Edition 1.0 2014-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions

Éclairage général – Produits à diode électroluminescente (LED) et équipements associés – Termes et définitions

IEC 62504:2014-06(en-fr)

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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GENERAL LIGHTING – LIGHT EMITTING DIODE (LED) PRODUCTS AND RELATED EQUIPMENT – TERMS AND DEFINITIONS

FOREWORD

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International Standard IEC 62504 has been prepared by IEC technical committee 34: Lamps and related equipment in collaboration with representatives from CIE.

This first edition cancels and replaces the IEC TS 62504 published in 2011.

The significant changes with respect to IEC TS 62504 are as follows:

a) Terms from the International Electrotechnical Vocabulary that have not been modified are deleted.
b) Alignment with the CIE has been done.
c) An introduction has been added

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

FDIS	Report on voting
34/200/FDIS	34/205/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.

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

- reconfirmed,
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INTRODUCTION

0.1 Principles of this International Standard

This document is based on IEC TS 62504:2011, General Lighting – LEDs and LED modules – Terms and definitions, which was under the responsibility of SC 34A but this revision as International Standard IEC 62504 transfers responsibility to TC 34.

The objective of this introduction is to help the reader to understand which terms are included and to have an understanding of the LED product overview.

Compared with IEC TS 62504, the main changes are as follows.

0.2 Terms to include

General lighting terms in IEC 60050-845:1987, International Electrotechnical Vocabulary that have not been modified will not be included in this standard.

Alignment with CIE is done. IEC will be the reference for products and related equipment and CIE for lighting terminology. Alignment with ANSI RP16-10, Chapter 6.8 was also considered.

The terms included are as far as possible used in LED standards and manufacturers' literature.,

Process to update IEC 60050-845:1987, the International Electrotechnical Vocabulary for definitions that will be considered as relevant is underway in IEC TC34.

0.3 Alphabetic sequence

In order to find the term in a logical sequence, we have grouped similar terms of a product, example:

LED lamp

– integrated LED lamp ,

– non-integrated LED lamp .

For each term, reference is made to the relevant standard if appropriate.

0.4 LED product tree:

The sequence from the first component, the LED die up to the LED luminaire is drawn.

The term LED does not represent a product, so no technical data can be linked to the term LED.

GENERAL LIGHTING – LIGHT EMITTING DIODE (LED) PRODUCTS AND RELATED EQUIPMENT – TERMS AND DEFINITIONS

1 Scope

This International Standard IEC 62504 is of assistance in the common understanding of terms and definitions, relevant for general lighting with LED technology. The terms included are those already available in IEC LED standards or used in manufacturers' literature.

This standard provides descriptive terms (like “LED light sources”) and measurable terms when modified from IEC 60050-845 (like “colour rendering index”).

NOTE Annex A gives overviews of LED package design and systems composed of LED light sources and controlgear.

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>).

CIE Technical Report 127:2007, *Measurement of LEDs*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845, with the exception of those modified below, and the following apply.

3.1
ageing
preconditioning period of the LED light source before initial values are taken

3.2
angular subtense
α
angle subtended by an apparent source as viewed from a point in space

Note 1 to entry: Angular subtense is expressed in radians (rad).

Note 2 to entry: The angle extension is determined by the observation distance, but at no distance smaller than the minimum distance of accommodation of the eye.

Note 3 to entry: The location and angular subtense of the apparent source depends on the viewing position in the beam.

Note 4 to entry: The angular subtense of an apparent source is only applicable in the wavelength range from 380 nm to1 400 nm.

Note 5 to entry: IEC TR 62778 gives additional information with regards to beam divergence.

[SOURCE: IEC 60825-1, 3.7, modified – Notes 1, 2 and 5 to entry are added and in the note 4 to entry the value of the wavelength range has been changed from '400 nm to 1 400 nm' to '380 nm to 1 400 nm'; IEC 62471, 3.2, modified.]

3.3
apparent source
for a given evaluation location of the retinal hazard, the real or virtual object that forms the smallest possible retinal image (considering the accommodation range of the human eye)

Note 1 to entry: The accommodation range of the eye is assumed to be variable from 100 mm to infinity. The location of the apparent source for a given viewing position in the beam is that location to which the eye accommodates to produce the most hazardous retinal irradiance condition.

Note 2 to entry: This definition is used to determine, for a given evaluation position, the location of the apparent origin of laser radiation in the wavelength range of 380 nm to 1 400 nm. In the limit of vanishing divergence, i.e. in the case of a well collimated beam, the location of the apparent source goes to infinity.

[SOURCE: IEC 60825-1, 3.10, modified – In the note 2 to entry the value of the wavelength range is changed from '400 nm to 1 400 nm' to '380 nm to 1 400 nm'.]

3.4
beam angle
angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity

Note 1 to entry: Beam angle is expressed in degrees (°).

Note 2 to entry: This angle is a full angle measure, not a half angle measure.

[SOURCE: IEC TR 61341, 2.4, modified, – The notes to entry are added.]

3.5
bin
restricted range of LED performance characteristics used to delimit a subset of LED dies or LED packages near a nominal LED performance as identified by chromaticity, photometric, radiometric and/or electrical characteristics

3.6 controlgear

3.6.1
controlgear for LED module
LED controlgear
unit inserted between the electrical supply and one or more LED modules, which serves to supply the LED module(s) with its (their) rated voltage or rated current, and may consist of one or more separate components and may include means for dimming, correcting the power factor and suppressing radio interference, and further control functions

Note 1 to entry: The controlgear consists of a power supply and a control unit.

Note 2 to entry: The controlgear may be partly or totally integrated in the LED module.

Note 3 to entry: When no confusion is expected like when used in a LED standard for example, “controlgear” may also be used. Both terms “controlgear” or “control gear” are acceptable.

[SOURCE: IEC 61347-2-13, 3.1, modified – The word 'electronic' is deleted from the term and the words “further control functions” and the notes to entry are added.]

3.6.2
power supply of the controlgear
electronic device, being part of the controlgear, capable of controlling current, voltage or power within design limits, containing no additional LED control capabilities

Note 1 to entry: For LEDsi modules, the power supply of the controlgear is separate from the LED module on a distant location.

Note 2 to entry: The energy source of a power supply can be either a battery or the electrical supply system.

3.6.3
control unit of the controlgear

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

Note 1 to entry: In LEDsi modules, the control unit of the controlgear is on board of the LED module and separate from the power supply of the controlgear.

3.7
dominant wavelength <of a colour stimulus>

λ_d

wavelength of the monochromatic stimulus that, when additively mixed in suitable proportions with the specified achromatic stimulus, matches the colour stimulus considered in the CIE 1931 x,y chromaticity diagram

Note 1 to entry: Dominant wavelength is expressed in nanometres (nm).

Note 2 to entry: In the case of purple stimuli, the dominant wavelength is replaced by the complementary wavelength.

Note 3 to entry: For characterising LED light sources the reference achromatic stimulus should be illuminant E which has the chromaticity coordinates x_E = 0,3333, y_E = 0,3333.

Note 4 to entry: A value for dominant wavelength should only be stated for LED light sources emitting coloured light. For LED light sources emitting white light no meaningful value for dominant wavelength can be given.

Note 5 to entry: Figure 12 in CIE 127:2007 shows the relationship between chromaticity coordinate C of LED light sources and value of dominant wavelength D. N is the chromaticity coordinate of achromatic stimulus E.

Note 6 to entry: Deviating from the peak wavelength, the dominant wavelength determines perceived colour.

[SOURCE: IEC 60050-845:1987, 845.03.44, modified – The words 'in the CIE 1931 x,y chromaticity diagram' and the notes to entry 3 to 6 have been added; CIE S 017/E:2011, 17-345, modified – The notes to entry 3 to 6 have been added.]

3.8
failure

termination of the ability of an item to perform a required function

Note 1 to entry: After failure the item has a fault.

Note 2 to entry: "Failure" is an event, as distinguished from "fault", which is a state.

Note 3 to entry: This concept as defined does not apply to items consisting of software only.

[SOURCE: IEC 60050-191, 191.04.01]

3.9
failure fraction

F

fraction of the population that lost the ability to perform a required function in a specified time interval

Note 1 to entry: Failure fraction is dimensionless.

3.10
failure fraction at rated life

F_y

ratio y of failed LED products of the same type at their rated life to the test quantity

Note 1 to entry: The ratio is expressed in percent.

Note 2 to entry: This failure fraction expresses the combined effect of all components of a LED product 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 3 to entry: For LED products normally a failure fraction of 10% or/and 50% are being applied, indicated as F_{10} and/or F_{50}.

3.11
family
group of LED light sources or LED luminaires, having the same characteristics and method of control (integrated, semi-integrated, non integrated), the groups are distinguished by common features of materials, components, and/or method of processing

3.12
forward direction
direction of current that results when the P-type semiconductor region connected to one terminal is at positive potential relative to the N-type region connected to the other terminal

Note 1 to entry: If temperature compensation diodes are included, these are ignored in the determination of forward direction.

[SOURCE: IEC 60050-521, 521.05.03, modified – The words 'connected to one terminal', 'potential' and 'connected to the other terminal' as well as note 1 to entry have been added.]

3.13
forward voltage
U_F
potential difference pertaining to the forward direction, dependent on the forward current at a given temperature

Note 1 to entry: Forward voltage is expressed in Volts (V).

Note 2 to entry: Forward voltage for LED die is measured normally at 25 °C ambient temperature.

3.14
heat output to the luminaire
P_d
power to be transferred to the luminaire by means of heat-conduction in order to stay below the t_c or t_p temperature

Note 1 to entry: Heat output is expressed in Watts (W).

Note 2 to entry: P_d is below the rated power of a LED module.

Note 3 to entry: For LED modules which do not need heat-conduction to the luminaire for keeping t_c , P_d is equal to zero.

Note 4 to entry: A measurement method is under consideration.

3.15 LED lamp
LED light source provided with (a) cap(s) incorporating one or more LED module(s) and possibly including one or more of the following; electrical, optical, mechanical, and thermal components, interfaces and controlgear

Note 1 to entry: A LED lamp may be integrated (LEDi lamp) or semi-integrated (LEDsi lamp) or non-integrated (LEDni lamp).

Note 2 to entry: Single and double-capped lamps are included.

Note 3 to entry: A LED lamp is designed so that it can be replaced by an ordinary person (as defined in IEC 60050-826, 826.18.03).

3.15.1
integrated LED lamp
LEDi lamp
LED lamp, incorporating controlgear, and any additional elements necessary for stable operation of the light source, designed for direct connection to the supply voltage

3.15.2
non-integrated LED lamp
LEDni lamp
LED lamp which needs a separate controlgear to operate

3.15.3
retrofit LED lamp
LED lamp intended as a replacement of a non-LED lamp without requiring internal modification of the luminaire

3.15.4
semi-integrated LED lamp
LEDsi lamp
LED lamp which carries the control unit of the controlgear, and is operated by the separated power supply of the controlgear

3.16
LED light source
electrical light source based on LED technology

Note 1 to entry: A luminaire may include LED light sources but is not considered itself as a light source.

Note 2 to entry: LED light source(s) for a LED luminaire represents one or more LED lamp(s) or LED module(s).

3.17
LED luminaire
luminaire designed to incorporate one or more LED light source(s)

3.18
non-repairable, factory-sealed LED luminaire,
luminaire which cannot be dismantled without being permanently damaged, and incorporating LED light source(s) and any additional elements necessary for starting and stable operation of the light source

3.19 LED module
LED light source having no cap, incorporating one or more LED package(s) on a printed circuit board, and possibly including one or more of the following: electrical, optical, mechanical, and thermal components, interfaces and controlgear

Note 1 to entry: A LED module may be integrated (LEDi module, Type 1) or semi-integrated (LEDsi module, Type 2) or non-integrated (LEDni module, Type 3).

Note 2 to entry: The LED module is usually designed to be part of a LED lamp or LED luminaire.

[SOURCE: IEC 62031, 3.2, modified – The definition is reworded and notes to entry are added.]

3.19.1
built-in LED module
LED module, generally designed to form a replaceable part to be built into a luminaire, a box, an enclosure or the like and not intended to be mounted outside a luminaire, etc. without special precautions

[SOURCE: IEC 62031, 3.6, modified – The words ‘to be’ are added.]

3.19.2
independent LED module
LED module designed for mounting or placing separately from a luminaire, from an additional box or enclosure or the like

Note 1 to entry: The independent LED module provides all the necessary protection with regard to safety according to its classification and marking.

Note 2 to entry: An example of an independent LED module is a system where the LED module is connected via a glass fibre with the luminaire head.

[SOURCE: IEC 62031, 3.8, modified – The second sentence in the definition as well as other additional information are transferred into notes to entry replacing the original note.]

3.19.3
integral LED module
LED module, generally designed to form a non-replaceable part of a luminaire

[SOURCE: IEC 62031, 3.4]

3.19.4
integrated LED module
LEDi moduleLED module, incorporating controlgear and any additional elements necessary for stable operation of the light source, designed for direct connection to the supply voltage

Note 1 to entry: LEDi modules are designated "Type 1", see Annex A.

3.19.5
non-integrated LED module
LEDni module
LED module which needs a separate control circuitry or controlgear to operate

Note 1 to entry: LEDni modules are designated "Type 3", see Annex A.

Note 2 to entry: One or more LED packages on a printed circuit board or substrate in a geometric structure are regarded as a LED array. No further components are included like electrical, optical, mechanical, and thermal.

3.19.6
semi-integrated LED module
LEDsi module
LED module which carries the control unit of the controlgear, and is operated by the separated power supply of the controlgear

Note 1 to entry: LED modules with control unit are designated "Type 2", see Annex A.

3.20
LED package
single electrical component encapsulating principally one or more LED dies, possibly including 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: A LED package is a discrete component and part of the LED module or LED lamp. For a schematic built-up of a LED package, see Annex A.

3.21
luminous life time of LED package
$L_x(t_j)$
time period at a specified junction temperature and forward current, determined by a minimum level of x % of the measured initial luminous flux

Note 1 to entry: Luminous life time of LED package is expressed in hours (h).

Note 2 to entry: t_j relates to LED die, but luminous life time of LED package are given with reference to t_j

3.22
luminous life time of LED module related to t_p temperature
$L_x(t_p)$
time period at a specified performance temperature at which x % of the measured initial luminous flux value is reached

Note 1 to entry: Luminous life time of LED module is expressed in hours (h).

Note 2 to entry: The use of forced cooling to achieve the specified t_p temperature should be stated.

3.23
light colour designation
three digit number, the first digit representing the first digit of the general colour rendering index R_a [IEC 60050-845:1987, 845.02.63], and the second and third digit representing the first two digits (thousands and hundreds) of the CCT of the light source

Note 1 to entry: The light colour designation is detailed in IEC TR 62732.

3.24
light emitting diode
LED
solid state device embodying a p-n junction, emitting incoherent optical radiation when excited by an electric current

Note 1 to entry: This definition is independent from the existence of enclosure(s) and of terminals.

Note 2 to entry: The output is a function of its physical construction, material used and exciting current. The optical emission may be in the ultraviolet, visible, or infrared wavelength regions.

Note 3 to entry: LED term normally represents the LED die (or chip), or LED package. It is also used as a generic term representing the technology.

Note 4 to entry: LED term should not be used for reporting product performance (like luminous flux, colour rendering, life time…) instead use for example “luminous flux of the LED module”

[SOURCE: IEC 60050-845:1987, 845.04.40, modified – The word 'incoherent' and the notes to entry have been added and CIE S 017/E:2011 ILV, 17-662, modified.]

3.25
live part
conductive part which may cause an electric shock in normal use

Note 1 to entry: A process to align with IEC 61140 is underway and the definition will be designated by the term “hazardous live part” in a future amendment.

3.26
luminous efficacy <of a source>
η_V, η
quotient obtained when the emitted luminous flux is divided by the power consumed by the source

Note 1 to entry: Luminous efficacy is expressed in $lm \cdot W^{-1}$

Note 2 to entry: For LED applications, the source may be a LED package, module, lamp, luminaire etc.

[SOURCE: IEC 60050-845:1987, 845.01.55, modified – The words 'obtained when' and 'is divided' and the notes to entry have been added and CIE S 017/E:2011 ILV, 17-730, modified]

3.27
luminous flux
Φ*V, *Φ
quantity derived from radiant flux Φ_e by evaluating the radiation according to its action upon the CIE standard photometric observer

Note 1 to entry: Luminous flux is expressed in lumen (lm).

Note 2 to entry: For photopic vision $\Phi_V = K_m \int_{360}^{830} (d\Phi_e(\lambda)/d\lambda) \times V(\lambda) d\lambda$ where $(d\Phi_e(\lambda)/d\lambda)$ is the spectral distribution of the radiant flux and $V(\lambda)$ is the spectral luminous efficiency.

Note 3 to entry: For the values of K_m (photopic vision) and K'_m (scotopic vision), see IEC 60050-845, 845.01.56.

Note 4 to entry: The luminous flux of LED dies is usually expressed in groups into which they are sorted.

[SOURCE: IEC 60050-845:1987, 845.01.25, modified – Second sentence become note 2 to entry and note 4 to entry is added and CIE S 017/E:2011 ILV, 17-738, modified.]

3.28
luminous flux maintenance factor
lumen maintenance factor
ratio of the luminous flux emitted by the light source at a given time in its life to its initial luminous flux emitted, the light source being operated under specified conditions

Note 1 to entry: This ratio is generally expressed in percent.

Note 2 to entry: The lumen maintenance factor of a LED light source is the effect of decrease of the luminous flux output of the LED package or a combination of this with failure(s) of LED package if the LED light source contains more than one LED package

[SOURCE: IEC 60050-845:1987, 845.07.65, modified – The words 'of a lamp' have been replaced by 'emitted by the light source' and the notes to entry have been added and CIE S 017, 17-636, modified]

3.29
luminous intensity <of a source, in a given direction>
I*V; *I
quotient of the luminous flux $d\Phi_V$ leaving the source and propagated in the element of solid angle $d\Omega$ containing the given direction, by the element of solid angle

$I_V = d\Phi_V/d\Omega$

Note 1 to entry: Luminous intensity is expressed in candela, cd=lm·sr^{-1}

Note 2 to entry: The definition holds strictly only for a point source.

Note 3 to entry: The luminous intensity of LED is reported according to CIE 127:2007 measurement procedure.

[SOURCE: IEC 60050-845:1987, 845.01.31 and CIE S 017/E:2011 ILV, 17-739, modified – The notes to entry have been added.]

3.30
photometric code
under consideration

3.31
peak wavelength
***λ*p**
wavelength of radiation at the highest intensity of the spectral distribution

Note 1 to entry: Peak wavelength is expressed in nanometres (nm).