



## **Regulatory Guidelines for an Effective Transition to Energy Efficient Lighting**

# **General Service and Linear LED Lamps**

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## FOREWORD

Regulatory Guidelines published by the Global Lighting Association aim to guide members during consultative policy-making processes with regulatory authorities in developing and emerging economies<sup>1</sup> considering national legislation and associated regulations to accelerate the transition to energy efficient (EE) lighting.

Successful transitions to EE lighting are based on the availability of lighting products with an improved energy efficacy, combined with equal or improved functional performance as well as - and most importantly - affordability. Overly ambitious regulations, on the other hand, have been counterproductive by hindering consumer willingness or ability to purchase compliant products and, in turn, promoting illegal trade of non-compliant and less efficient lighting products.

Global Lighting Association's Regulatory Guidelines are designed to stimulate affordable and effective market enforcement, thereby protecting consumers and encouraging fair competition.

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<sup>1</sup> This guide is not intended for governments that already have effective lighting regulations and policy processes for energy efficient lighting products in their country or region.

## INTRODUCTION

These Regulatory Guidelines provide the essential elements of regulations for general service LED lamps and linear LED lamps necessary to realise a successful transition to EE lighting. The essential elements are described in a structured way to facilitate transcription into national regulation.

The specification preferences provided in this document represent best available information at the time of publication. Standards underpinning the metrics and requirements contained in this document continue to evolve. The Global Lighting Association monitors these changes and will revise the Guidelines as necessary.

The Regulatory Guidelines do not include requirements on safety (including ultraviolet and infrared technology), electromagnetic compatibility or substances of concern, as they are not primarily related to energy efficiency and functional performance. Such requirements typically are incorporated in parallel regulations.

## 1 Scope and exemptions

### 1.1 Scope

This document applies to the following types of light emitting diode (LED) lamps used for general illumination:

- a) General service LED lamps of all types (shapes and finishes) and having:
  - 1) one or more input voltages of alternating current between 50 and 300 V and frequency of 50 Hz or 60 Hz, and:
  - 2) a lamp base which can be connected to one of the following general service lamp sockets:
    - Screw base types: E10, E11, E12, E14, E17, E26 or E27, or
    - Bayonet base types: B15d or B22d, or
    - Pin base types: GU10 or GZ10 base, or
    - Alternative base types, which can be connected to the above lamp base sockets by using commercially available passive adaptors.
- b) Double-capped linear LED lamps of all sizes and:
  - 1) connected to an electrical supply:
    - Directly or
    - Using existing electro-magnetic control gear<sup>2</sup>
  - 2) and having lamp caps that can be connected to one of the following lamps sockets:
    - G5, G13, Fa6, Fa8, R17d, or
    - Alternative base types which can be connected to the above lamp base sockets by using commercially available passive adaptors.

### 1.2 Exemptions

Any LED lamp in the scope of this document shall be exempt from the requirements of clause 3, except for the information requirements set out in clause 3.4.1, if it has a specific technical design for its intended use, in at least one of the following applications:

- a) solely emitting light outside the chromaticity coordinates  $x$  and  $y$  in the range  $0,270 < x < 0,530$  and  $-2,3172 x^2 + 2,3653 x - 0,2199 < y < -2,3172 x^2 + 2,3653 x - 0,1595$ ;
- b) regarding general service LED lamps, solely emitting light with a luminous flux less than 60 or higher than 3300 lm;
- c) regarding linear LED lamps, solely emitting light with a luminous flux less than 400 lm;
- d) the primary purpose of the light is not general illumination, and the product packaging is prominently marked as such, e.g., but not limited to:
  - i) emission of light as an agent in chemical or biological processes, e.g., but not limited to:
    - polymerization,
    - ultraviolet light used for curing/drying/hardening,
    - photodynamic therapy,

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<sup>2</sup> Linear high-frequency ballast compatible LED lamps are excluded from the scope as there is no international standard for high-frequency reference control gear.

- horticulture,
  - food service,
  - medical applications,
  - aquarium,
  - animal care, and
  - anti-insect products;
- ii) image capture and image projection, e.g., but not limited to:
- camera flashlights,
  - photocopiers, and
  - video projectors;
- iii) signalling, e.g., but not limited to:
- railway-signalling,
  - marine- signalling,
  - road-signalling and traffic control, and
  - air traffic-signalling and airfield lamps.
- e) the spectral distribution of the light is adjusted to the specific needs of particular technical equipment, in addition to making the scene or object visible for humans, e.g., but not limited to:
- studio lighting,
  - performance special effects lighting, and
  - theatre lighting.
- f) the scene or object lit requires special protection from the negative effects of the light source, e.g., but not limited to:
- lighting with dedicated filtering for photosensitive patients, and
  - lighting with dedicated filtering for photosensitive museum exhibits.
- g) lighting is required only for emergency situations, e.g., but not limited to:
- emergency lighting luminaires.

## **2 Terms and definitions**

### **2.1 'arithmetic mean'**

'arithmetic mean' means the average of a set of numerical values, calculated by adding them together and dividing by the number of terms in the set.

### **2.2 'beam angle'**

'beam angle' of a directional lamp means the 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 light source and through points at which the luminous intensity is 50% of the centre beam intensity, where the centre beam intensity is the value of luminous intensity measured on the optical beam axis.

Note 1. For lamps that have different beam angles in different planes, the largest beam angle shall be considered.

Note 2. For lamps with user-controllable beam angle, the beam angle corresponding to the 'reference control setting' shall be considered.

### **2.3 'chromaticity'**

'chromaticity' means the property of a colour stimulus defined by its chromaticity coordinates (x and y).

#### **2.4 'colour rendering index' (CRI)**

'colour rendering index' (CRI) means the measure of the degree to which the psychophysical colour of an object, illuminated by the test illuminant, conforms to that of the same object illuminated by the reference illuminant, suitable allowance having been made for the state of chromatic adaptation. CRI is a measure of the ability of a light source to accurately reveal the colours of various objects in comparison with an ideal or natural light source.

#### **2.5 'colour-tuneable lamp' (CTL)**

'colour-tuneable lamp' (CTL) means a connected lamp (CL) using LED technology, that can be set to emit light with a large variation of colours outside the range defined in the scope, but can also be set to emit white light inside the range defined in in the scope, and with which the lamp is in the scope of this document.

The term does not include tuneable-white lamps that can only be set to emit light, with different colour temperatures, within the range defined in the scope.

The term also does not include dim-to-warm lamps, that shift their white light output to lower colour temperature when dimmed, simulating the behaviour of incandescent light sources.

#### **2.6 'compliance'**

'compliance' means conforming to a rule, such as a law, policy, specification or standard. Also, fulfilment by countries/businesses/individuals of emission reduction and reporting commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

#### **2.7 'connected lamp' (CL)**

'connected lamp' (CL) means a lamp including data-connection parts that are physically integrated with the light emitting parts in a single inseparable housing, and where the data-connection parts cannot be disconnected, switched-off, or their power consumption minimised.

#### **2.8 'correlated colour temperature' (CCT)**

'correlated colour temperature' (CCT) means the temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions. Units: K. Lamps with a high CCT, i.e. 5000K produce blueish-white light, whereas those with a CCT of 2700K produce light that is more yellowish-white.

#### **2.9 'data-connection parts'**

'data-connection parts' means parts that perform one of the following functions:

- reception or transmission of wired, or wireless data signals and the processing thereof (either used to control the light emission function or otherwise),
- sensing and processing of the sensed signals (either used to control the light emission function or otherwise),
- actuation by audio control (including voice control),
- a combination of these.

#### **2.10 'directional lamp' (DL)**

'directional lamp' (DL) means a lamp which has a beam angle (as defined in IEC 61341:1994 and measured in accordance with CIE S025:2015) of no more than 90 degrees, in at least one plane, and that being in at least one plane for an asymmetric beam lamp. These lamps are also known as reflector lamps and are commonly installed in recessed cans or track lighting.

#### **2.11 'flicker'**

'flicker' means the perception of visual unsteadiness induced by a light stimulus, the luminance or spectral distribution of which, fluctuates with time for a static observer in a static environment. The fluctuations can be periodic and non-periodic and may be induced by the light source itself, the power source, or other influencing factors.

### **2.12 'fundamental power factor'**

'fundamental power factor' (also called displacement power factor) quantifies the displacement (phase-shift) between the fundamental current and voltage waveforms by calculating the cosine of the phase-shift angle. Fundamental power factor is a more detailed measure to quantify the displacement of the current and its effect on the power supply network.

### **2.13 'general service lamp'**

'general service lamp' (GSL) are used in general lighting applications and can be operated directly on the mains electricity supply. GSLs account for the majority of installed lighting in the residential sector.

### **2.14 'illumination'**

'illumination' means the application of light to a scene, objects, or their surroundings, so that they may be seen.

### **2.15 'inductive reference ballast'**

'inductive reference ballast' means a ballast as specified in Annex C of IEC 60921, for the testing of linear LED lamps compatible with electro-magnetic control gear under standardized conditions.

### **2.16 'LED lamp'**

'LED lamp' means an electric lamp based on LED technology, producing an optical radiation, which is usually visible.

Note: The term "lamp" is often referred to as a bulb or light bulb and is also sometimes used to describe certain types of luminaires/lighting fixtures.

### **2.17 'lamp cap'**

'lamp cap' means that part of a lamp which provides connection to the electrical supply, by means of a lamp holder or lamp connector and, in most cases, also serves to retain the lamp in the lamp holder.

Note 1. The term base is also used in both the United Kingdom and the US to denote an integral part of a lamp envelope which has been so shaped that it fulfils the function of a cap. It may engage either a holder or a connector, depending on other design features of the lamp- and holder system.

Note 2. The cap of a lamp and its corresponding holder are generally identified by one or more letters followed by a number which indicates approximately the principal dimension (generally the diameter) of the cap in millimetres.

### **2.18 'light emitting diode' (LED)**

'light emitting diode' (LED) means a technology, in which light is produced from a solid-state device embodying a p-n junction of inorganic material or organic material. This latter case is also known as 'organic light emitting diode' (OLED). In both cases the junction emits optical radiation when excited by an electric current.

### **2.19 'linear LED lamp'**

'linear LED lamp' means a LED lamp in the form of a linear cylindrical tube, that ends in two lamp caps one at each side of the tube.

### **2.20 'lumen' (lm)**

'lumen' (lm) is an SI<sup>3</sup> unit of luminous flux, which is emitted in unit solid angle (steradian) by a uniform point source, having a luminous intensity of 1 candela. It indicates the amount of light the lamp provides.

### **2.21 'luminaire'**

'luminaire' means an apparatus which distributes, filters, or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply.

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<sup>3</sup> International System of Units



### **2.22 ‘luminous efficacy’ ( $\eta_v$ or $\Phi_v$ )**

‘luminous efficacy’ ( $\eta_v$  or  $\Phi_v$ ), expressed in lm/W, means the quotient of the luminous flux emitted by the power consumed by the source. It is an expression of how energy efficient a lamp is.

### **2.23 ‘luminous flux’ or ‘flux’ ( $\Phi$ )**

‘luminous flux’ or ‘flux’ ( $\Phi$ ), expressed in lumen (lm), means the quantity derived from radiant flux (radiant power), by evaluating the electromagnetic radiation in accordance with the spectral sensitivity of the human eye. If not specified differently, it refers to the rated, maximum initial luminous flux of a light source, after a short operating period, and to the total flux emitted in a solid angle of  $4\pi$  steradians (corresponding to a  $360^\circ$  sphere).

### **2.24 ‘non-directional lamp’ (NDL)**

‘non-directional lamp’ (NDL) means a general service lamp that is not a directional lamp.

### **2.25 ‘rated luminous flux’ (of a type of lamp)**

‘rated luminous flux’ (of a type of lamp) means the value of the initial luminous flux of a given type of lamp, declared by the manufacturer or the responsible vendor, the lamp being operated under specified conditions. Unit: lm.

Note 1: The initial luminous flux may be the luminous flux of a lamp after a short ageing period, as specified in the relevant lamp standard.

Note 2: The rated luminous flux is sometimes marked on the lamp. (IEC)

### **2.26 ‘rated power’ (of a type of lamp)**

‘rated power’ (of a type of lamp) means the value of the power of a given type of lamp, declared by the manufacturer or the responsible vendor, the lamp being operated under specified conditions. Unit: W.

Note: The rated power is usually marked on the lamp. (IEC)

### **2.27 ‘rated voltage’ or ‘rated voltage range’**

‘rated voltage’ or ‘rated voltage range’ means the nominal voltage/range of voltage, at which a piece of electrical equipment is designed to operate.

### **2.28 ‘reference control setting’**

‘reference control setting’ means a control setting or combination of control settings that is used to verify compliance of a light source with this document. These settings are relevant for light sources that allow the end-user to control, manually or automatically, directly, or remotely, the luminous intensity, colour, colour temperature, spectrum, and/or beam angle of the emitted light.

The reference control settings shall be those predefined by the manufacturer as factory default values and encountered by the user at first installation (out-of-the-box values). If the installation procedure foresees an automatic software update during first installation, or if the user has the option to perform such an update, the resulting change in settings (if any) shall be taken into account.

The light source manufacturer shall define the reference control settings such that:

- The light source is in scope of this document according to clause 1.1 and none of the conditions for exemption of clause 1.2 apply (if this is not possible, the light source is out of scope or exempted);
- The adjustable/selectable beam angle is the narrowest available;
- The power consumption of lighting control parts and non-lighting parts is minimal (if these parts cannot be disconnected or switched-off);
- The full-load condition is obtained (maximum initial luminous flux, given the other chosen settings);
- When the end-user opts to reset factory defaults, the reference control settings are obtained.

## 2.29 ‘test report’

‘test report’ means the documentation prepared by the manufacturer, or importer of the lighting product, which contains the evidence and the test results demonstrating that the product is fully compliant with all applicable regulatory requirements.

## 2.30 ‘tuneable-white lamp (TWL)’

‘tuneable-white lamp’ (TWL) means a connected lamp (CL) using LED technology, that can be set to emit light with a large variation of colour temperatures inside the range defined in the scope, but cannot be set to emit light outside said range.

The term also does not include dim-to-warm lamps, that shift their white light output to lower colour temperature when dimmed, simulating the behaviour of incandescent light sources.

## 3 Requirements

### 3.1 General

Lamps in the scope of this guide shall meet the energy efficiency requirements of clause 3.2, the functional performance requirements of clause 3.3 and the product information requirements of clause 3.4.

The latest edition of the referenced measurement standards (including any amendments) applies.

The same sample of lamps may be used for certain metrics, as set out in the test sequence in Annex A.

For suppliers (i.e., importers and manufacturers), the required sample sizes and compliance criteria for compliance certification, shall be the same as those set-out in the requirements of the referenced measurement standards.

For governments (i.e., market surveillance authorities) the surveillance testing criteria for verification testing are less stringent than the criteria in the measurement standards to allow for measurement uncertainties and manufacturing tolerances.

The surveillance testing criteria shall not be used by the suppliers to certify compliance with the regulation (see above).

### 3.2 Energy efficiency requirements

#### 3.2.1 Energy efficiency requirements of general service LED lamps

##### 3.2.1.1 Luminous efficacy

Limits:

Rated luminous flux $\Phi_V$ in lm	Luminous efficacy limit $\eta_{base}$ in lm/W
$60 \leq \Phi_V < 600$	70
$600 \leq \Phi_V < 1200$	80
$1200 \leq \Phi_V \leq 3300$	90

Depending on the lamp characteristics, the required luminous efficacy values shall be adjusted by the following correction factors (C):

Lamp characteristics	Correction factor	C
Directional lamps	C1	0,15
Tuneable lamps	C2	
Tuneable-white lamps (TWL)		0,1
Colour-tuneable lamps (CTL)		0,2

CRI ≥ 90 Ra	C3	0,1
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The test report shall provide evidence that substantiates the claimed correction factor (C).

Where applicable, the correction factors are additive as follows:

$$\eta_{\text{corrected}} = \eta_{\text{base}} (1 - (C1 + C2 + C3))$$

Lamps that allow the end-user to adapt the spectrum and/or the beam angle of the emitted light, thus changing the values for useful luminous flux, CRI-Ra and/or colour temperature, and/or changing the DL/NDL status, shall be evaluated using the reference control settings.

Measurement standards:

Input power to the lamp shall be measured according to IEC 62612. Depending on the lamp characteristics, the measured power shall be decreased by the following correction factors (Cp):

Lamp characteristics	Correction factor	Cp in W
Lamp with internal sensor	Cp1	0.5
Connected lamp	Cp2	0.5

Where applicable, the correction factors (Cp) are additive as follows:

$$P_{\text{corrected}} = P_{\text{measured}} - (Cp1 + Cp2)$$

Luminous efficacy of the lamp ( $\eta_{\text{lamp}}$ ) shall be calculated as the quotient of measured luminous flux according to IEC 62612 divided by the corrected input power ( $P_{\text{corrected}}$ ) of the same sample item.

$$\eta_{\text{lamp}} = \frac{\Phi_{\text{measured}}}{P_{\text{corrected}}}$$

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the calculated luminous efficacy ( $\eta_{\text{lamp}}$ ) of the 10 units shall not be less than the corrected luminous efficacy limit ( $\eta_{\text{corrected}}$ ) minus 10%.

**3.2.1.2 Standby power**

Limit: ≤ 0.5W

This requirement applies to LED lamps awaiting a remotely initiated trigger to return to a state with light emission. Non-lighting parts are switched off, or their power consumption is minimized, following manufacturer’s instructions.

Measurement standard: IEC 63103

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the measured standby power of the 10 units shall not exceed the required level by more than 0.1 W.

**3.2.1.3 Fundamental power factor**

Note: “Fundamental power factor” is also called “displacement factor” or “cos  $\phi_1$ ”.

Limits:

Rated Input Power P in W	Fundamental power factor
$P \leq 2W$	Not applicable
$2W < P \leq 5W$	$\geq 0.4$
$5W < P \leq 25W$	$\geq 0.7$
$P > 25W$	$\geq 0.9$

Measurement standard: IEC 62612

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the measured displacement factor of the 10 units shall not be less than the required level minus 10%.

### 3.2.2 Energy efficiency requirements of linear LED lamps

#### 3.2.2.1 Luminous efficacy

Limit:  $\eta_{\text{base}} \geq 100 \text{ lm/W}$

Depending on the lamp characteristics, the required luminous efficacy value shall be adjusted by the following correction factors (C):

Lamp characteristics	Correction factor	C
Tuneable Lamps	C1	
Tuneable-white lamps (TWL)		0,1
Colour-tuneable lamps (CTL)		0,2
CRI $\geq 90$ Ra	C2	0,1
CCT $\leq 3500$ K	C3	0,1

The test report shall provide evidence that substantiates the claimed correction factor (C).

Where applicable, the correction factors (C) are additive as follows:

$$\eta_{\text{corrected}} = \eta_{\text{base}} (1 - (C1 + C2 + C3))$$

Lamps that allow the end-user to adapt the spectrum of the emitted light, thus changing the values for useful luminous flux, CRI-Ra and/or colour temperature, shall be evaluated using the reference control settings.

Measurement standards:

Input power to the lamp shall be measured according to IEC 62612. Depending on the lamp characteristics, the measured power shall be decreased by the following correction factors (Cp):

Lamp characteristics	Correction factor	Cp in W
Lamp with internal sensor	Cp1	0.5
Connected lamp	Cp2	0.5

Where applicable, the correction factors (Cp) are additive as follows:

$$P_{\text{corrected}} = P_{\text{measured}} - (Cp1 + Cp2)$$

Luminous efficacy of the lamp ( $\eta_{\text{lamp}}$ ) shall be calculated as the quotient of measured luminous flux, according to IEC 62612 divided by the corrected input power ( $P_{\text{corrected}}$ ) of the same sample item.

$$\eta_{lamp} = \frac{\Phi_{measured}}{P_{corrected}}$$

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the calculated luminous efficacy ( $\eta_{lamp}$ ) of the 10 units shall not be less than the corrected luminous efficacy limit ( $\eta_{corrected}$ ) minus 10%.

**3.2.2.2 Standby power**

Limit:  $\leq 0.5W$

This requirement applies to LED lamps awaiting a remotely initiated trigger to return to a state with light emission. Non-lighting parts are switched off or their power consumption are minimized following manufacturer’s instructions.

Measurement standard: IEC 63103

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the measured standby power of the 10 units shall not exceed the required level by more than 0.1 W.

**3.2.2.3 Fundamental power factor**

This requirement only applies to linear LED lamps directly connected to an electrical supply.

Note: “Fundamental power factor” is also called “displacement factor” or “ $\cos \varphi_1$ ”.

Limits:

Rated Input Power P in W	Fundamental power factor
$P \leq 2W$	Not applicable
$2W < P \leq 5W$	$\geq 0.4$
$5W < P \leq 25W$	$\geq 0.7$
$P > 25W$	$\geq 0.9$

Measurement standard: IEC 62612

Verification for market surveillance authorities:

Sample of 10 units. The arithmetic mean of the measured displacement factor of the 10 units shall not be less than the required level minus 10%.

### 3.3 Functional performance requirements

Phenomena	Lamp types	Level
Colour Rendering Index (CRI)	All in scope of this document	<p><u>Limit:</u> <math>\geq 80</math> Ra</p> <p>This requirement is not applicable for lamps designed, marketed, and labelled exclusively for outdoor applications, industrial applications, or other applications where a CRI-Ra <math>&lt; 80</math> is allowed.</p> <p><u>Measurement standard:</u> IEC 62612</p> <p><u>Verification for market surveillance authorities:</u> Sample of 10 units. The arithmetic mean of the measured CRI of the 10 units shall not be less than the required CRI-Ra level minus 3.</p>
1000-hour early failure test	All in scope of this document	<p><u>Limit:</u> Lamps must operate for 150 minutes on and 30 minutes off for 400 cycles at ambient conditions.</p> <p><u>Measurement standard:</u> see annex B</p> <p><u>Verification for market surveillance authorities:</u> Sample of 10 units. After 400 cycles, all lamps shall still be operational and the arithmetic mean of the measured luminous flux of the 10 units shall be at least 90% of initial luminous flux.</p>
Short term flicker perceptibility ( $P_{st}^{LM}$ )	General service LED lamps & linear LED lamps directly connected to the electrical supply	<p><u>Limit:</u> <math>\leq 1.0</math> at full load and a sinusoidal input voltage.</p> <p><u>Measurement standard:</u> IEC 61547-1</p> <p><u>Verification for market surveillance authorities:</u> Sample of 10 units. The arithmetic mean of the measured <math>P_{st}^{LM}</math> of the 10 units shall not be more than the required level plus 10%.</p>

### 3.4 Product information requirements

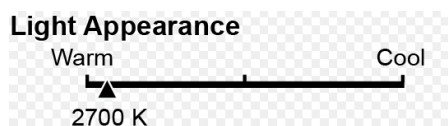
#### 3.4.1 General

For LED lamps which are, according to clause 1.2, exempted from the requirements of clause 3.2 and 3.3, the intended purpose shall be stated on all forms of packaging, product information and advertisement, together with a clear indication in large font on the front of the package: "Lamp is NOT intended for general illumination purposes".

#### 3.4.2 Product information requirements of general service LED lamps

The following information shall be clearly and prominently indicated on the packaging and in all other forms of product information:

- 1) Rated power in Watt
- 2) Rated initial luminous flux in lumen
- 3) Rated efficacy in lumens per Watt (lm/W)
- 4) Rated correlated colour temperature (CCT) in Kelvin (K) combined with a sliding scale:



Note: This requirement does not apply for tuneable-white lamps or colour-tuneable lamps

- 5) Statement on dimmability – clearly state whether dimmable or not dimmable. If yes, then there needs to be information on dimmer compatibility, or web link to this information.

Manufacturers or importers are not required to provide an incandescent equivalency claim e.g. "This lamp is as bright as a 60W incandescent" or "10W = 60W". However, if the manufacturer optionally decides to make a lumen equivalency claim on the packaging, or on the lamps and in all other forms of product information, then:

- Incandescent wattage equivalency [W] – shall be ranked according to the table below, which depicts the minimum initial luminous flux that is required to claim a specific incandescent lamp wattage equivalency.

Incandescent wattage equivalency in W	Minimum initial luminous flux in lm	
	230V mains power	120V mains power
15	120	150
25	200	250
40	400	450
60	700	800
75	950	1100
100	1400	1600
150	2200	2500
200	3000	3400

The listed incandescent wattage equivalencies may be interpolated (e.g., 50 Watt) and extrapolated (e.g., 7 Watt) using the values in the given table.

Incandescent wattage equivalencies do not apply for directional LED lamps.

### 3.4.3 Product information requirements of linear LED lamps

The following information shall be clearly and prominently indicated on the packaging and in all other forms of product information:

- 1) Rated power in Watt
- 2) Rated initial luminous flux in lumen
- 3) Rated correlated colour temperature (CCT) in Kelvin (K)

## 4 Test report

Compliance with the requirements of this document shall be demonstrated in a test report including reference setting and conditions in which the product complies.

## 5 Market surveillance

The regulator or designated authority implementing these regulatory guidelines shall establish a programme to check compliance with this document and monitor the market for noncompliance. The programme should include details on sample size, laboratory accreditation requirements (ISO/IEC 17025 certified), and a challenge process that manufacturers can utilize, if the initial testing of their product is found to be out of compliance.

If the regulator or designated authority does not have enough checking and/or testing capacity for market surveillance activities, the responsibility should be delegated to, for example, associations or third-party testing centres.

Regulators, delegated associations, or third-party testing centres, when in partnership with authorities, will communicate the results of the checks and/or tests to the manufacturer or importer who places the product on the market, as well as the possible imposition of fines and prohibiting the ongoing sale of non-compliant products in the country.

Regulators, associations, or third-party testing centres shall establish written policies that clearly spell out their authority, procedures, and penalty structure. All testing carried out for compliance and market surveillance testing purposes, shall be in accordance with the measurement and calculation methods set out in this regulation.

Market surveillance programs shall be applied evenly between imported products and locally produced products.

An example market surveillance procedure is provided in Annex C.

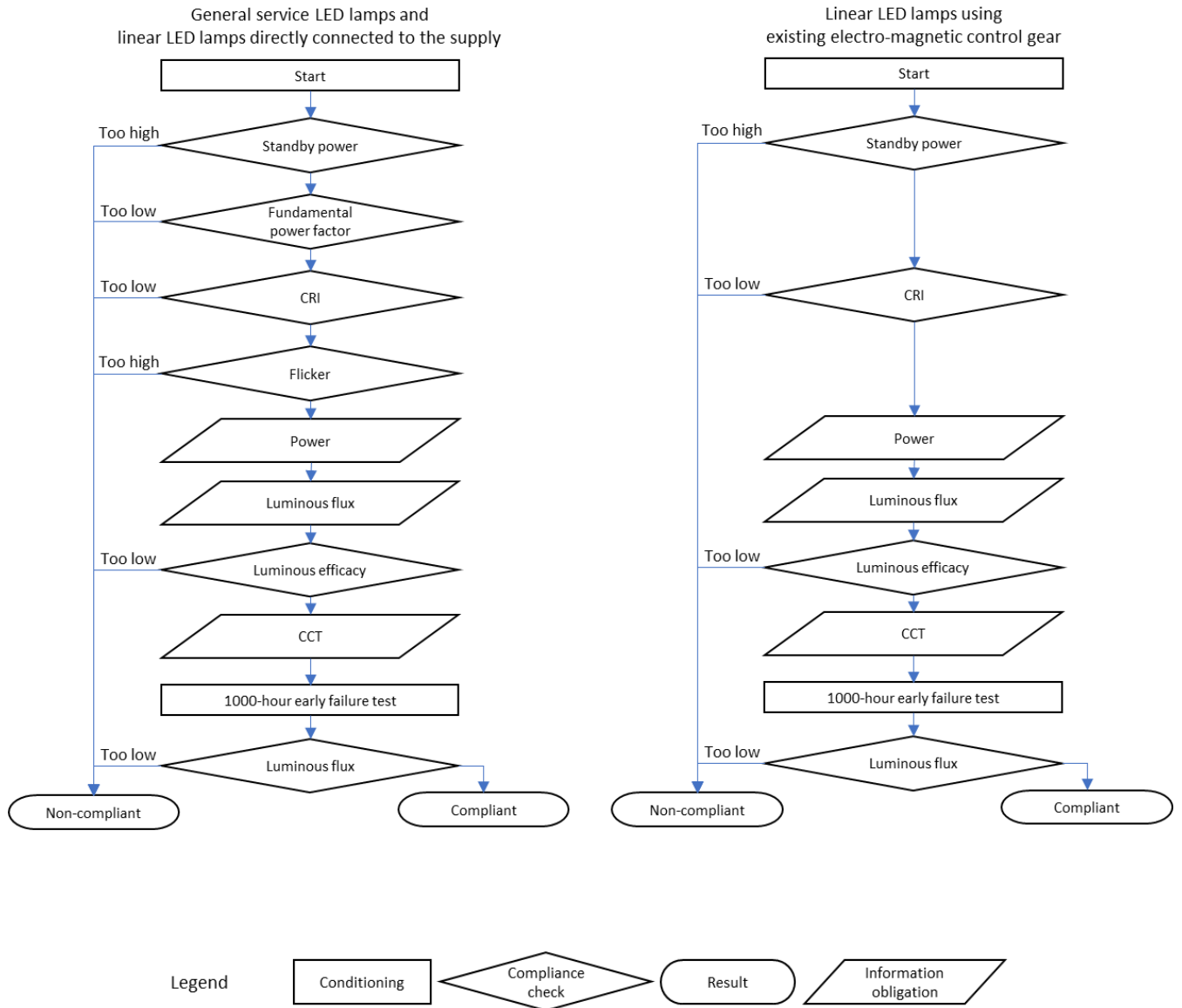
## **6 Entry into force**

The requirements set out in clause 3 shall take effect 1 year after the official publication of the national legislation / regulation.



## Annex A

### Test sequences



## **Annex B**

### **Early failure test**

#### **B.1 Early failure test for general service LED lamps**

The 1000-hour early failure test for general service LED lamps shall be conducted:

- a) in a room with an ambient temperature in the range of 15°C to 40°C, where vibration and shock are minimized and the lamps under test are not subject to supplemental ventilation or cooling (e.g may not blow air from a fan or air conditioner directly onto the area where the testing racks and lamps are located.)
- b) with the lamps operated in free air in a vertical base-up position. If a manufacturer or importer has declared the lamp is suitable for use in a specific orientation only, then the lamp shall be mounted in the declared orientation during all tests.
- c) at the lamp's rated voltage and frequency, if a single value is declared. If the rated voltage is a range, the lamp shall be tested at the mean voltage of that range. For dual-voltage lamps, for example, ageing and testing shall be conducted at the mean voltage of each voltage range, for those intended for operation at 110 V to 130 V and 220 V to 240 V. The test voltage supply shall have a tolerance of 2%. The total harmonic content of the supply voltage shall not exceed 3%. The harmonic content is defined as the Root Means Square (R.M.S.) summation of the individual harmonic components using the fundamental as 100%. IEC 61000-3-2, Annex A, provides guidance on the supply voltage source.
- d) with the lamps operating for 400 cycles by a repeatedly switching cycle of 150 minutes ON, followed by 30 minutes OFF. The hours of operation recorded (i.e., 1000 hours) shall only include the periods of the cycle when the lamp was switched ON.

Luminous flux of each lamp under test should be measured at time  $t=0$  (initial luminous flux prior to any cycling) and at the completion of 400 cycles (150 minutes on, 30 minutes off).

#### **B.2 Early failure test for linear LED lamps**

The 1000-hour early failure test for linear LED lamps shall be conducted:

- a) in a room with an ambient temperature in the range of 15°C to 30°C, where vibration and shock are minimized and the lamps under test are not subject to supplemental ventilation or cooling (e.g may not blow air from a fan or air conditioner directly onto the area where the testing racks and lamps are located.)
- b) with the lamps operated in free air in a horizontal position. If a manufacturer or importer has declared the lamp is suitable for use in a specific orientation only, then the lamp shall be mounted in the declared orientation during all tests.
- c) with linear LED lamps, which can be connected directly to the electrical supply and to electro-magnetic control gear and shall be tested, as being connected to the electrical supply.
- d) with linear LED lamps, that can only operate on electro-magnetic control gear and shall be tested, using an associated inductive reference ballast in series.
- e) at the lamp's rated voltage and frequency, if a single value is declared. If the rated voltage is a range, the lamp shall be tested at the mean voltage of that range. For dual-voltage lamps, for example, ageing and testing shall be conducted at the mean voltage of each voltage range, for those intended for operation at 110 V to 130 V and 220 V to 240 V. The test voltage supply shall have a tolerance within 2%. The total harmonic content of the supply voltage shall not exceed 3%. The harmonic content is defined as the Root Mean Square (R.M.S.) summation of the individual harmonic components using the fundamental as 100%. IEC 61000-3-2, Annex A, provides guidance on the supply voltage source.
- f) with the lamps operating for 400 cycles, by a repeatedly switching cycle of 150 minutes ON followed by 30 minutes OFF. The hours of operation recorded (i.e., 1000 hours) shall only include the periods of the cycle when the lamp was switched ON.

Luminous flux of each lamp under test should be measured at time  $t=0$  (initial luminous flux prior to any cycling) and at the completion of 400 cycles (150 minutes on, 30 minutes off).

## **Annex C**

### **Example market surveillance procedure**

In the context of verifying compliance of a product model with the requirements laid down in clause 3, the government authorities may apply the following procedure:

- 1) The government authorities shall validate a sample of the same model from the same manufacturer, randomly selected.
- 2) The model shall be considered to comply with the applicable requirements:
  - a) if the values in the test report, and where appropriate the values used to establish those values that are calculated, are not more favourable for the manufacturer or importer than the respective results of the measurements; and
  - b) if, when government authorities test the sample of models, all measured average parameters and the values calculated from these measurement(s) are within the respective verification tolerances of clause 3.
- 3) If the results referred to in points 2) a) and 2) b) are not achieved, the model shall be considered not to comply with this regulation.
- 4) If a decision of non-compliance is taken according to point 2 against a manufacturer or importer, the government authority may inform other government authorities in the region within one month of the decision being taken to help protect against the widespread sale of the same model.

Government authorities shall use the measurement and calculation methods set out in clause 3.

Government authorities shall only apply those verification tolerances set out in clause 3 of this regulation, and the procedure described in this Annex, points 1 through 4. No other tolerances, such as those set out in harmonised standards or in any other measurement method, shall be applied.