

**Minimum Energy Performance Standards  
and Functional Performance  
Requirements for General Service Lamps  
(GSLs)**

**PUBLIC REVIEW DRAFT, APRIL 2020**

## DKS 2914:2020

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Technical University of Mombasa  
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Kenyatta University  
Kenya National Chamber of Commerce and Industry  
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# **Minimum Energy Performance Standards and Functional Performance Requirements for General Service Lamps (GSLs)**

## **KENYA BUREAU OF STANDARDS (KEBS)**

**Head Office:** P.O. Box 54974, Nairobi-00200, Tel.: (+254 020) 605490, 602350, Fax: (+254 020) 604031  
E-Mail: [info@kebs.org](mailto:info@kebs.org), Web: <http://www.kebs.org>

### **Coast Region**

P.O. Box 99376, Mombasa-80100  
Tel.: (+254 041) 229563, 230939/40  
Fax: (+254 041) 229448

### **Lake Region**

P.O. Box 2949, Kisumu-40100  
Tel.: (+254 057) 23549, 22396  
Fax: (+254 057) 21814

### **Rift Valley Region**

P.O. Box 2138, Nakuru-20100  
Tel.: (+254 051) 210553, 210555

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## **DKS 2914:2020**

### **Foreword**

This Kenya standard was prepared by the Electric Lamps and wiring accessories Technical Committee and it is in accordance with the procedures of the Kenya Bureau of Standards.

During the development of this Standard, reference was made to the following document;

International Energy Agency 4E Solid State Lighting Annex Product Quality and Performance Tiers (<http://ssl.iea-4e.org/>).

Acknowledgement is hereby made for the assistance received from this source.

## Minimum Energy Performance Standards and Functional Performance Requirements for General Service Lamps (GSLs)

### 1. Scope

#### 1.1. Inclusions

This standard for General Service Lamps (GSLs) covers the minimum energy performance requirements and functional performance of general lighting, directional and non-directional lamps, of all shapes and finishes; using incandescent, halogen, fluorescent, high intensity discharge, light emitting diode (LED), and other light source technologies; and satisfy a) to d):

- Capable of operating on a voltage up to 300V of either direct current or alternating current with a frequency of 50Hz;
- Emitting light with a total luminous flux of 60 to 3300 lumens;
- Light emission with the chromaticity coordinates (x, y) that are within the range (shown in Figure 1):
  - $0.250 < x < 0.570$  and
  - $-2.3172x^2 + 2.3653x - 0.2400 < y < -2.3172x^2 + 2.3653x - 0.1400$ ;

This includes fixed white light sources as well as tuneable sources that are tuneable to within the white region specified by the chromaticity coordinates (x and y) above.

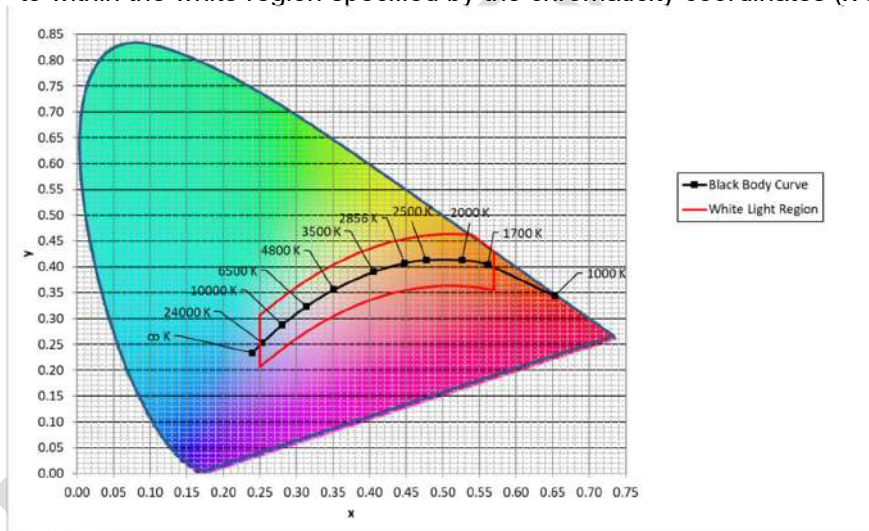


Figure 1: GSL Chromaticity Limits

- A lamp base which can be connected to one of the following sockets: E10, E11, E12, E14, E17, E26, E27, B15, B22, R7, G4, GX5.3/GU5.3, G6.35, GX53, GU9, G9, GU10 or GZ10 base, or alternative base type that can be connected to these sockets by using commercially available passive adaptors.

#### 1.2. Exclusions

The following lamps are exempted from the requirements of this compulsory specification:

- the primary purpose of the lamp is not general illumination and the product packaging is prominently marked as such, for example but not limited to:

- I. emission of light as an agent in chemical or biological processes (other than human visual perception), for example but not limited to:
- polymerization,
  - ultraviolet light used for curing/drying/hardening,
  - photodynamic therapy,
  - horticulture,
  - food service,
  - medical applications,
  - aquarium,
  - animal care, and
  - anti-insect products;
- II. image capture and image projection, for example but not limited to:
- camera flashlights,
  - photocopiers, and
  - video projectors;
- III. signalling, for example but not limited to:
- railway-signalling
  - marine-signalling,
  - road-signalling and traffic control, and
  - air traffic-signalling and airfield lamps;
- b) 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, for example but not limited to:
- studio lighting,
  - performance special effects lighting, and
  - theatre lighting;
- c) the scene or object lit requires special protection from the negative effects of the light source, for example but not limited to:
- lighting with dedicated filtering for photosensitive patients, and
  - lighting with dedicated filtering for photosensitive museum exhibits;
- d) lighting is required only for emergency situations, for example but not limited to:
- emergency lighting luminaires;
- e) requiring ambient temperatures above 120°C and this exemption only applies to incandescent and halogen lamps with the following characteristics:
- an overall length of maximum 60 mm,
  - a rated power of maximum 25 W,
  - a base type of E14 or B15, and
  - a rated luminous flux of maximum 225 lm; and
- f) lamps for national measurement standards.
- g) lamps that fall outside of the scope of coverage defined in section 1.1 of this regulation.



## 2. Normative references

The following documents are referenced in this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

KS IEC 61000-3-2, Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)

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

KS IEC 60064, Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements.

KS IEC 62321-1, Determination of certain substances in electrotechnical products - Part 1: Introduction and overview

KS IEC 62321-3-1, Determination of certain substances in electrotechnical products - Part 3-1: Screening - Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry

KS IEC 60969, Self-ballasted lamps for general lighting services - Performance requirements.

KS IEC PAS 62612, Self-ballasted LED lamps for general lighting services with supply voltages  $> 50$  V - Performance requirements

IEC 63103 Lighting equipment - Non-active mode power measurement

IEC 62471, Photobiological safety of lamps and lamp systems

IEC 61547, Equipment for general lighting purposes - EMC immunity requirements

IEC TR 61547-1, Equipment for general lighting purposes - EMC immunity requirements - Part 1: An objective light flickermeter and voltage fluctuation immunity test method

IEC TR 63158, Equipment for general lighting purposes - Objective test method for stroboscopic effects of lighting equipment

IEC TR 62778, Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

CISPR 15:2018, Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

CIE 84, Measurement of Luminous Flux

CIE S015, Lighting of Outdoor Work Places

CIE S025, Test Method for Led Lamps, Led Luminaires and Led Modules

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### 3. Definitions

- 3.1. For the purposes of this document, the definitions in the standards referred in section 6 of this standard shall apply.
- 3.2. In addition, the following definitions shall apply:
- 3.2.1. **arithmetical mean:** the average of a set of numerical values, calculated by adding them together and dividing by the number of terms in the set.
- 3.2.2. **beam angle of a directional lamp:** 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.
- 3.2.3. **chromaticity:** the property of a colour stimulus defined by its chromaticity coordinates (x and y).
- 3.2.4. **colour rendering index (CRI):** 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 incandescent source of the same colour temperature.
- 3.2.5. **colour-tuneable lamp (CTL):** a connected lamp (CL) using LED or OLED 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 colour range defined in the scope, and with which the lamp is in the scope of this standard.  
The term does not include tuneable-white lamps that can only be set to emit white 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.
- 3.2.6. **connected lamp (CL):** a general service 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.
- 3.2.7. **correlated colour temperature (CCT):** 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, e.g. 6500K, produce blueish-white light, whereas those with a low CCT of 2700K produce light that is more yellowish-white.
- 3.2.8. **data-connection parts:** 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.

- 3.2.9. **directional lamp (DL):** 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.
- 3.2.10. **endurance test:** (also called a supply switching test) is the switching on and off of a solid state lighting product to simulate how a product will perform over its lifetime. The test is carried out to stress a solid state lighting product over a period of time to help determine the failure rates and luminous flux maintenance of a product.
- 3.2.11. **flicker:** 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.
- 3.2.12. **fluorescence or fluorescent light source (FL):** the phenomenon or a light source using an electric gas discharge of the low-pressure mercury type in which most of the light is emitted by one or more layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent light sources may have one ('single-capped') or two ('double-capped') connections ('caps') to their electricity supply. For the purposes of this standard, magnetic induction light sources are also considered as fluorescent light sources.
- 3.2.13. **fundamental power factor** (also called displacement power factor, or  $\cos \phi_1$ ) 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
- 3.2.14. **gas discharge:** a phenomenon where light is produced, directly or indirectly, by an electric discharge through a gas, plasma, metal vapour or mixture of gases and vapours.
- 3.2.15. **general illumination purposes:** for the purposes of this standard, means any light source that meets the requirements of section 1.1 and is not exempted under section 1.2.
- 3.2.16. **general service lamp (GSL):** includes general service incandescent and halogen lamps (GSILs), compact fluorescent lamps (CFLs), general service light-emitting diode (LED) lamps, organic light-emitting diode (OLED) lamps, and any other lamps that are used to satisfy lighting applications traditionally served by GSILs. GSLs 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.
- 3.2.17. **halogen lamp:** gas-filled lamp containing halogens or halogen compounds, the filament being of tungsten.
- 3.2.18. **illumination:** the application of light to a scene, objects or their surroundings so that they may be seen.
- 3.2.19. **incandescence:** emission of optical radiation by the process of thermal radiation. In light sources incandescence is typically produced by the passage of an electric current through a threadlike resistive conductor ('filament') which creates heat.
- 3.2.20. **lamp:** a light source made in order to produce an optical radiation, usually visible.  
Note: The term "lamps" is often referred to as a bulb or light bulb.
- 3.2.21. **lamp cap:** that part of a lamp which provides connection to the electrical supply by means of a lampholder or lamp connector and, in most cases, also serves to retain the lamp in the lampholder.  
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.

- 3.2.22. **life** (of a lamp): the total time for which a lamp has been operated before it becomes useless or is considered to be so according to specified criteria. Note: Lamp life is usually expressed in hours.
- 3.2.23. **light emitting diode (LED)**: 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.
- 3.2.24. **lumen (lm)**: an SI 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.
- 3.2.25. **luminaire**: 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.
- 3.2.26. **luminous efficacy ( $\eta_v$  or  $\Phi_v$ )**: expressed in lm/W, quotient of the luminous flux emitted by the electric power consumed by the light source. It is an expression of how energy efficient a lamp (or bulb) is at producing visible light.
- 3.2.27. **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).
- 3.2.28. **non-directional lamp (NDL)**: a general service lamp that is not a directional lamp.
- 3.2.29. **rated life,  $L_{70}B_{50}$**  'lifetime' for LED and OLED light sources means the time in hours between the start of their use and the moment when for 50% of a population of light sources the light output has gradually degraded to a value below 70% of the initial luminous flux. This is also referred to as the  $L_{70}B_{50}$  lifetime;
- 3.2.30. **rated luminous flux (of a model of lamp)**: the value of the initial luminous flux of a given model 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)
- 3.2.31. **rated power** (of a model of lamp): the value of the consumed electrical power by a given model 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)
- 3.2.32. **rated voltage or rated voltage range**: the nominal voltage/range of voltage at which a piece of electrical equipment is designed to operate.
- 3.2.33. **reference control setting**: a control setting or combination of control settings that is used to verify compliance of a light source with this standard. 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 standard according to 1.1 and none of the conditions for exemption of 1.2 applies (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.

3.2.34. **stroboscopic effect visibility measure (SVM):** stroboscopic effect evaluated over a specified time interval of a relatively short duration. The duration is at least 1 second, in accordance with CIE TN 006 and IEC TR 63158.

3.2.35. **short term flicker indicator ( $P_{stLM}$ ):** a measure of flicker evaluated over a duration of at least 180 seconds in accordance with IEC 61547-1.

3.2.36. **stroboscopic effect:** a change in motion perception induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a non-static environment.

## 4. Requirements

### 4.1. Efficiency requirements

GSLs shall comply with the luminous efficacy requirements in Table 1.

**Table 1: Minimum luminous efficacy**

Product Type	Minimum luminous efficacy (lm/W)
Non-directional lamp	90

Depending on the lamp characteristics, the minimum luminous efficacy values may be decreased by the following correction factors (C):

**Table 2: Correction factors**

Lamp Characteristics	C
Directional lamps	-15%
Compact Fluorescent Lamp (CFL)	-20%
Colour-tuneable lamps (CTL)	-10%
Connected LED Lamps – rated luminous flux $\Phi$ (lm):	
$60 \text{ lm} \leq \Phi \leq 300 \text{ lm}$	-15%
$300 \text{ lm} < \Phi \leq 650 \text{ lm}$	-10%
$650 \text{ lm} < \Phi \leq 1200 \text{ lm}$	-7.5%
$1200 \text{ lm} < \Phi \leq 2000 \text{ lm}$	-5.0%
$2000 \text{ lm} < \Phi \leq 3300 \text{ lm}$	-2.5%

With respect the correction factors in Table , the following should be noted:

- Where applicable, the correction factors are additive up to a maximum of 25%. See **ANNEX C**.
- For colour-tuneable lamps (defined in Section 2) that are also connected lamps, the correction factors are additive.
- 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 (Tc), and/or changing their directional lamp or non-directional lamp status, shall be evaluated using the reference control settings.

### 4.2. Fundamental Power Factor

All GSLs shall have a fundamental power factor as stipulated in Table 3:

**Table 3: Fundamental power factor**

Rated Input Power for the lamp P in W	Fundamental Power Factor
$P \leq 2W$	Not applicable
$P > 2W$	$\geq 0.9$

#### 4.3. Standby Power for connected lamps

Standby power for connected lamps shall not exceed 0.5 W.

Networked standby power for Connected LED Lamps shall not exceed 0.5 W.

#### 4.4. Functional Performance Requirements

All GSL shall comply with the functional requirements in Table 4:

**Table 4: Functional requirements**

Metric	Mandatory Requirements						
Colour Rendering Index (CRI)	$Ra \geq 80$						
Lumen maintenance factor (for CFL)	At 5000h, >80% of initial lumen output						
Lifetime (for CFL)	$\geq 6000h$						
Lumen maintenance factor (for non-CFL)	<p>The lumen maintenance factor <math>X_{LMF}\%</math> after endurance testing according to Annex B shall be not less than <math>X_{LMF,MIN}\%</math>, calculated as follows:</p> $X_{LMF,MIN}\% = 100 \times e^{\frac{(3000 \times \ln(0.7))}{L_{70}}}$ <p>where <math>L_{70}</math> is the declared <math>L_{70}B_{50}</math> lifetime (in hours)</p> <p>Upper limit for <math>X_{LMF,MIN}\%</math>: the calculated required lumen maintenance of the sample shall not exceed 96.0% (i.e., <math>X_{LMF,MIN} \leq 96.0\%</math>).</p>						
Survival factor (for non-CFL)	No less than 90% of sample units should be operational following endurance testing according to Annex B.						
EMC emissions	Compliance with IEC 61000-3-2						
EMC immunity	Compliance with IEC 61547						
Total Harmonic Distortion	<p>Compliance with IEC 61000-4-7</p> <table> <tr> <th>Harmonic Order n</th><th>Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency (%)</th></tr> <tr> <td>2</td><td>2</td></tr> <tr> <td>3</td><td>30 – CPF*</td></tr> </table>	Harmonic Order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency (%)	2	2	3	30 – CPF*
Harmonic Order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency (%)						
2	2						
3	30 – CPF*						



Metric	Mandatory Requirements	
	5	10
	7	7
	9	5
	$11 \leq n \leq 39$	3
	<i>*CPF is the circuit power factor</i>	
Short term flicker indicator ( $P_{stLM}$ ) (for non-CFL)	$\leq 1.0$ at full load and a sinusoidal input voltage. Note: compliance with IEC 61547-1	
Stroboscopic effect visibility measure (SVM)	$\leq 0.4$ at full load and a sinusoidal input voltage. Note: compliance with IEC TR 63158	
<b>Photobiological risk group</b> (blue light and UV hazard)	For the blue light hazard: RG0 or RG1 are allowed. If an LED uses a UV-based LED chip, then it must meet UV RG0 and RG1. The risk group (RG) is assessed at 200 mm from the lamp using the general methodology of IEC 62471 and the particular prescriptions of IEC TR 62778.	
Colour consistency	Variation of chromaticity coordinates within a five-step MacAdam ellipse or less.	

#### 4.5. Hazardous Substances Requirement

GSLs shall not contain any amount of Mercury greater than shown in Table 5.

**Table 5: Mercury content**

Product Type	Mercury per lamp (mg)
All GSL under this compulsory specification	Comply with KS IEC 62321-1 and KS IEC 62321-3-1

#### 4.6. Marking Requirements

##### 4.6.1. Lamp information

The following information shall be clearly and indelibly printed on the product:

- 1) Rated power in Watts
- 2) Rated operating voltage
- 3) Rated operating current
- 4) Trade name or brand name
- 5) Rated initial luminous flux in lumens
- 6) Rated correlated colour temperature (CCT) in Kelvin (K)

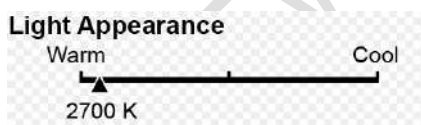
- 7) Beam angle (only for directional lamps)

#### 4.6.2. Packaging information

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

- 1) Rated power in Watts
- 2) Rated operating voltage
- 3) Rated frequency in Hz.
- 4) Rated initial luminous flux in lumens
- 5) Rated efficacy in lumens per Watt (lm/W)
- 6) Rated lifetime in hours and  $L_{70}B_{50}$  if longer
- 7) Rated correlated colour temperature (CCT) in Kelvin (K):

Scale is optional.



- 8) Mercury content in mg, if the product contains mercury and disposal methods of the lamp
- 9) Statement on Dimmability. Clearly state whether dimmable or not dimmable. If yes, then information on dimmer compatibility, or web link to this information.
- 10) Base type
- 11) Power factor

Note: Additional markings are allowed provided they do not give rise to misunderstanding.

## 5. Referenced Test Standards and Compliance Certification

5.1. The metrics, referenced standards and compliance certification criteria are set out in this section, with consideration of:

- The latest edition of the referenced 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.
- The required levels, sample sizes and compliance criteria for compliance certification by suppliers shall be the same as requirements in the referenced standards. Where the sample size is not specified, 10 units shall be the sample size.

**Table 6: Relevant test standards and compliance certification**

Phenomena	Lamp Type	Standard	Compliance Certification (for suppliers)
Luminous Efficacy [lm/W]	All	Calculated See below for (measured luminous flux / measured power)	The arithmetical mean of the calculated luminous efficacy of the 10 units shall not be less than required level.
Luminous flux in [lm]	Incandescent / Halogen	IEC 60064 CIE 84	The arithmetical mean of the measured luminous flux of the 10 units shall not be less than 92.5% of the rated luminous flux and the measured luminous flux of each individual lamp of the sample shall not be less than 90% of the rated luminous flux
	CFL	IEC 60969 CIE 84	
	LED	IEC 62612 CIE S025	
Power in [W]	Incandescent / Halogen	IEC 60064 CIE 84	The arithmetical mean of the measured power of the 10 units shall not exceed 107.5% of the rated power, and the measured power of each individual lamp of the sample shall not exceed 110% of the rated power.
	CFL	IEC 60969 CIE 84	
	LED	IEC 62612 CIE S025	
Standby Power	Connected LED lamp	IEC 63103	The measured standby power of each individual lamp of the 10 units shall not exceed the required level by more than 100 mW.
Fundamental Power Factor	LED	IEC 62612 IEC 61000-3-2	The measured displacement factor of each individual lamp of the sample shall not be less than the required level minus 0.05.
	CFL	IEC 60969	
Colour Rendering Index (CRI)	LED	IEC 62612 CIE S 025 CIE 13.3	The measured CRI of each individual lamp of the sample shall not be less than the required CRI-R <sub>a</sub> level minus 3
Correlated colour temperature	LED	IEC 62612 CIE S025 CIE S015	For each individual lamp of the sample, the measured CCT shall conform to the industry standard

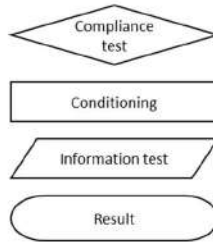
Phenomena	Lamp Type	Standard	Compliance Certification (for suppliers)
(CCT)	CFL	IEC 60969 CIE 84 CIE S015	tolerances contained in the IEC standards used for testing.
Luminous flux maintenance factor	CFL	IEC 60969 Annex A	For each individual lamp of the sample, the measured luminous flux maintenance factor shall conform to the industry standard tolerances contained in the standards used for testing.
	LED	See Annex B	The determined XLMF% of the sample following the test in Annex B shall not be less than $X_{LMF, MIN} \%$ .
Survival Factor	LED	See Annex B	At least 90% of the light units of the test sample must be operational after completing the endurance test in Annex B.
Short-term Flicker indicator (PstLM)	LED	IEC TR 61547-1	For each individual lamp of the sample, the measured $P_{st}^{LM}$ of the units shall not be more than the required level plus 5%.
Stroboscopic effect Visibility Measure (SVM)	LED	IEC TR 63158	For each individual lamp of the sample, the measured SVM of the units shall not be more than the required level plus 5%.
Lifetime	CFL	IEC 60969 Annex G	Life of the median lamp (or 6 <sup>th</sup> of sample size of 10) shall be $\geq$ value specified
EMC emissions	All	CISPR15:2009	
EMC immunity (including voltage surge and dip)	All	IEC 61547	
Total Harmonic Distortion	All	IEC 61000-4-7	

## 6. Equivalence Of Standards

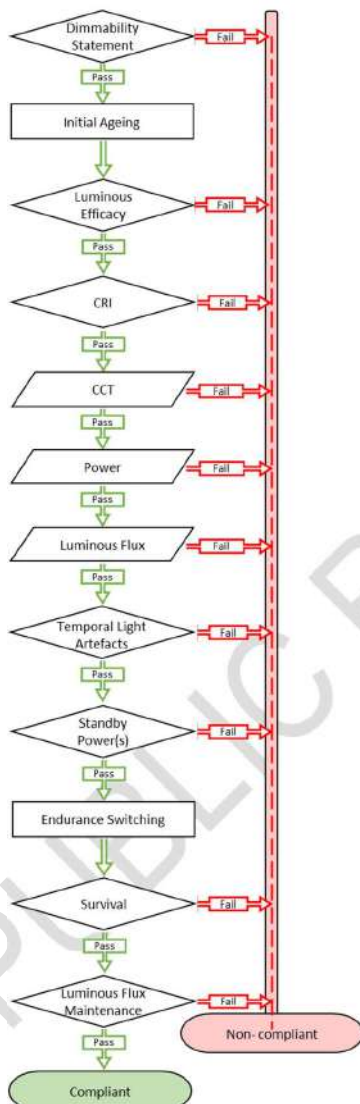
6.1. Standards issued by different standardization bodies such as ISO and EN, will only be accepted if it is proven, in the form of a declaration report from an accredited conformity assessment body, that they are technically equivalent to the relevant Kenyan Standard or the informative annex. The applicant shall be responsible for obtaining such a declaration report.

## ANNEX A – TEST SEQUENCE

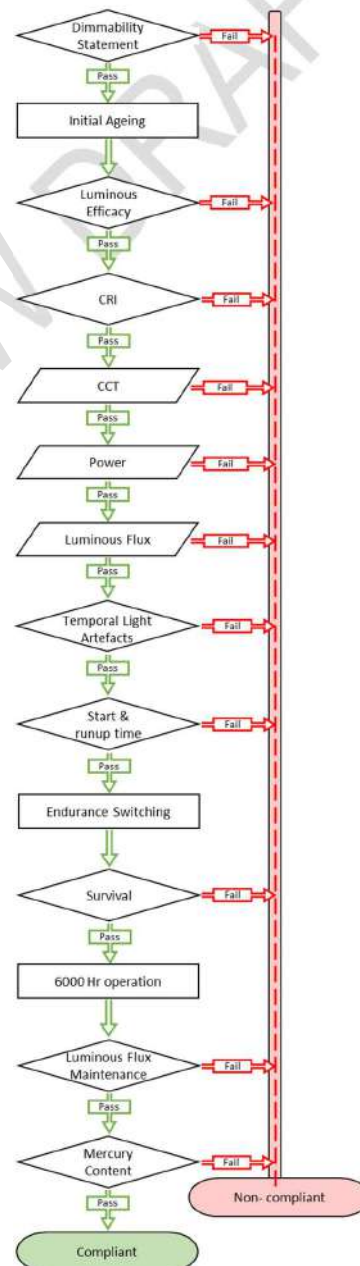
### Legend



### LED lamps



### Non-LED lamps



## ANNEX B – ENDURANCE TEST SEQUENCE

Light sources shall undergo endurance testing to verify their luminous flux maintenance factor and survival factor. This endurance testing consists of the test method outlined below. The endurance test for LED and OLED light sources shall be conducted as follows:

### B.1 AMBIENT CONDITIONS AND TEST SETUP:

**B.1.1** The switching cycles are to be conducted in a room with an ambient temperature of  $25 \pm 10$  °C and an average air velocity of less than 0.2 m/s;

**B.1.2** The switching cycles on the sample shall be conducted in free air in a vertical base-up position. However, if a supplier has declared the light source is suitable for use in a specific orientation only, then the sample shall be mounted in that orientation;

**B.1.3** The applied voltage during the switching cycles shall have a tolerance within 2 %. The total harmonic content of the supply voltage shall not exceed 3 %. Standards provide guidance on the supply voltage source.

### B.2 ENDURANCE TEST METHOD.

**B.2.1** Initial flux measurement: measure the luminous flux of the light source prior to starting the endurance test switching cycle;

**B.2.2** Switching cycles: operate the light source for 1200 cycles of repeated, continuous switching cycles without interruption. One complete switching cycle consists of 150 minutes of the light source switched ON at full power followed by 30 minutes of the light source switched OFF. The hours of operation recorded (i.e., 3000 hours) include only the periods of the switching cycle when the light source was switched ON, i.e. the total test time is 3600 hours;

**B.2.3** Final flux measurement: at the end of the 1200 switching cycles, note if any lamps have failed (see 'Survival Factor' requirements in Annex IV Table 6) and measure the luminous flux of the light sources that have not failed;

**B.2.4** For each of the units in the sample which have not failed, divide the measured final flux by the measured initial flux. Average the resulting values over all the units that did not fail to compute the determined value for the luminous flux maintenance factor  $X_{LMF}\%$ .

## ANNEX C – CALCULATION OF LUMINOUS EFFICACY CORRECTION FACTORS

The additive correction factors shall be calculated as follows:

1. Take the base value  $BV_n$  and apply the first correction factor  $CF_1$  to it, this becomes the new base value  $BV_{n+1}$ .
2. To apply another correction factor to this, apply the second correction factor  $CF_2$  to the new base value.

### Example

What is the minimum luminous efficacy acceptable for a Directional, Compact Fluorescent Lamp?

Take the base value (Non-directional lamp)  $BV_n$  90 lm/W

The correction factors applicable are:

- a) Directional lamps -15%  $CF_1$
- b) Compact Fluorescent Lamp (CFL) -20%  $CF_2$

To calculate the new minimum luminous efficacy

We take

$$BV_{n+1} = BV_n \times (1 + CF_1) \\ 90 \text{ lm/W} \times (1 - 15\%) = 76.5 \text{ lm/W}$$

Now take

$$BV_{n+2} = BV_{n+1} \times (1 + CF_2) \\ 76.5 \text{ lm/W} \times (1 - 20\%) = 61.2 \text{ lm/W}$$

The calculated minimum luminous efficacy acceptable for a Directional, Compact Fluorescent Lamp is 61.2 lm/W

The additive value more than -25% of Minimum luminous efficacy Non-directional lamp.

$$BV_{\min} = BV_n + (1 + CF_{\max}) \\ 90 \text{ lm/W} \times (1 - 25\%) = 67.5 \text{ lm/W}$$

## ANNEX D – ENERGY LABEL CLASSES

The energy efficiency class of light sources shall be determined on the basis of the efficacy values expressed in total mains efficacy  $\eta_{TM}$ , which is defined as the total initial luminous flux (in lm) divided by mains power input (in W) – (lm/W) – as set out in Table 7.

**Table 7: Energy efficiency classes**

Energy Efficiency Class	Total mains efficacy $\eta_{TM}$ (lm /W)
A (most efficient)	$210 \leq \eta_{TM}$
B	$185 \leq \eta_{TM} < 210$
C	$160 \leq \eta_{TM} < 185$
D	$135 \leq \eta_{TM} < 160$
E	$110 \leq \eta_{TM} < 135$
F	$85 \leq \eta_{TM} < 110$
G (least efficient)	$\eta_{TM} < 85$

The total mains efficacy  $\eta_{TM}$  is calculated by dividing the luminous flux (expressed in lm) by the declared on-mode power consumption  $P_{on}$  (expressed in W) and multiplying by the applicable factor  $F_{TM}$  of Table 8, i.e.:

$$\eta_{TM} = \left( \frac{\text{lumens}}{P_{on}} \right) \times F_{TM}$$

**Table 8: Factors  $F_{TM}$  to be used for determination of  $\eta_{TM}$**

Light source type	Factor $F_{TM}$
Non-directional mains light source (NDLS, MLS)	1.000
Non-directional non-mains light source (NDLS, NMLS)	0.926
Directional mains light source (DLS, MLS)	1.176
Directional non-mains light source (DLS, NMLS)	1.089