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ESKOM APPLICATIONS**

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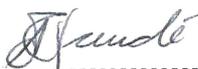
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## 1. Introduction

The aim of this standard is to prescribe requirements regarding security perimeter lighting that Eskom and its subsidiaries must apply with regard to protecting its installations. This standard must be used by the Divisions of Eskom and its subsidiaries to structure (or restructure) their perimeter security lighting with the ultimate aim of a uniform set of measures being applied in Eskom.

The purpose for using the perimeter security lighting is not only for perimeter illumination, but also to allow security personnel to maintain visual assessment during darkness. Perimeter security lighting could be considered as the most significant crime deterrent. It enhances natural surveillance, delineates restricted and public spaces, can direct access and reduces fear in legitimate users. It reduces the fear of crime. Lighting is valuable, as it provides both a real and psychological deterrent for continuous or periodic observation, by reducing opportunities for concealment and surprise by potential attackers.

## 2. Supporting clauses

### 2.1 Scope

This standard sets out Eskom's requirements for the supply and delivery of perimeter security lighting for use at all Eskom sites.

#### 2.1.1 Purpose

This standard is a technical document that specifies functional, performance and other requirements, equipment and materials should meet to satisfy the need for high quality perimeter security lighting system at Eskom installations.

The content of this standard shall be brought to the attention of all Eskom employees who require the information for the effective execution of their duties.

This document specifies the design and technical requirements for the operational perimeter security lighting at all Eskom sites and will be used for technical enquiry and evaluation purposes.

#### 2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

## 2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

Prospective suppliers are responsible for obtaining the latest copies of the South African national standards (SANS) and international standards referred to in this document. Copies of the latest revision of Eskom documents will be supplied by the purchaser and will form part of the enquiry documentation.

### 2.2.1 Normative

- [1] ISO 9001, Quality Management Systems.
- [2] SANS 121, Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods
- [3] SANS 475, Luminaires for interior lighting, street lighting and floodlighting – Performance requirements
- [4] SANS 1088, Luminaire entries and spigots
- [5] SANS 1091, National colour standard

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- [6] SANS 10108, The classification of hazardous locations and the selection of equipment for use in such locations
- [7] SANS 10389-1, Exterior lighting: Part 1: Artificial lighting of exterior areas for work and safety
- [8] SANS 10389-2, Exterior security lighting
- [9] SANS 60529, Degrees of protection provided by enclosures (IP Code)
- [10] SANS 60598-1, Luminaires Part 1: General requirements and tests
- [11] SANS 62262, Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
- [12] SANS 61347-1, Lamp control gear Part 1: General and safety requirements.
- [13] SANS 61347-2-13, Lamp control gear Part 2-13: Particular requirements for d.c. or a.c. supplied electronic control gear for LED modules.
- [14] SANS 62031, LED modules for general lighting - Safety specifications.
- [15] SANS 62384, DC or AC supplied electronic control gear for LED modules - Performance requirements
- [16] SANS 62560, Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specification
- [17] SANS 62612, Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
- [18] EN 55015, Limits and methods of measurement of radio disturbance of electrical lighting or equipment.
- [19] EN 61000-3-2, Electromagnetic compatibility (EMC) Limits for harmonic current emissions
- [20] EN 61000-3-3, Electromagnetic compatibility (EMC) - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
- [21] EN 61547, Equipment for general lighting purposes: EMC immunity requirements
- [22] IEC-EN 62471, Photo biological Safety of Lamps and Lamp Systems for LED's
- [23] IES LM-79-08, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- [24] IES LM80, Approved Method: Measuring lumen maintenance of LED light sources
- [25] ARP 035, Guidelines for the installation and maintenance of street lighting
- [26] Electromagnetic Compatibility (EMC) Directive (2014/30/EU)
- [27] Low Voltage (LV) Directive (2014/35/EU) Directives.

### **2.2.2 Informative**

- [1] IEC 62493, Assessment of lighting equipment related to human exposure to electromagnetic fields

## 2.3 Definitions

### 2.3.1 General

Definition	Description
<b>Colour rendering index (CRI)</b>	A quantitative measure of the ability of a light source to reveal the colours of various objects faithfully in comparison with an ideal or natural light source.
<b>Colour temperature</b>	Colour temperature is a characteristic of visible light and is stated in units of absolute temperature, known as Kelvin (K).
<b>Diffuser</b>	A device which spreads the light from a light source evenly and reduces harsh shadows.
<b>Downward light output ratio</b>	An indication of what percentage of light shines down. (To be read in conjunction with the definition for "Light output ratio".)
<b>Efficiency</b>	Ratio of total LED power consumption to total luminaire power consumption.
<b>Equipment</b>	Assemblies of components, sub-units or sub-assemblies usually contained in a suitable enclosure, and capable of performing an overall specified function.
<b>Harmonic distortion</b>	The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.
<b>Horizontal illuminance</b>	The measure of brightness from a light source, usually measured in lux, which is taken through a light meter's sensor at a horizontal position on a horizontal surface.
<b>IK rating</b>	The extent (or level) of protection of the equipment provided by an enclosure against harmful mechanical impacts and verified by standardised test methods.
<b>Illuminance</b>	(usually "E" in formulas) is the total amount of visible light illuminating (incident upon) a point on a surface from all directions above the surface. This "surface" can be a physical surface or an imaginary plane. Therefore illuminance is equivalent to irradiance weighted with the response curve of the human eye. Standard unit for illuminance is Lux (lx), which is lumen per square meter (lm/m <sup>2</sup> ).
<b>IP rating</b>	System to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water and to give additional information in connection with such protection.
<b>Label</b>	An inscription on equipment or on a sub-unit, either integral therewith or on a separate piece of material affixed thereto.
<b>Light output ratio</b>	An indication of how much light gets lost inside the luminaire. It is the ratio of light output emitted by the luminaire.
<b>Luminaire</b>	Apparatus which distributes, filters or transforms the light transmitted from one or more lamps or LED modules and which includes all the parts necessary for supporting, fixing and protecting the lamps or LED modules, and where necessary circuit auxiliaries together with the means for connecting them to the supply.
<b>Luminous efficacy</b>	Ratio of luminous flux of a lamp (in lumens) to the total electric power consumed (in watts)
<b>Luminous flux</b>	Quantity of the energy of the light emitted per second in all directions. The unit of luminous flux is lumen (lm).

Definition	Description
<b>Maintenance factor</b>	The minimum light level (luminous intensity) to be safeguarded, independently from the installation's number of burning hours and service life. This is a reduction factor based on the as new luminous intensity.
<b>Power factor</b>	The ratio between the useful (or true) power (W) to the total (or apparent) power (VA) consumed by AC electrical equipment or a complete electrical installation.
<b>Qualitative</b>	Concerned with or depending on quality rather than on quantity.
<b>Reliability</b>	The ability to consistently function as specified under stated conditions for a stated time period.
<b>Terminal</b>	A metallic device for connecting electrical conductors.
<b>Uniformity ratio</b>	Describes the uniformity of light levels across an area. This may be expressed as a ratio of average to minimum or it may be expressed as a ratio of maximum to minimum level of illuminance for a given area.
<b>Upward light output ratio</b>	An indication of what percentage of light shines up. (To be read in conjunction with the definition for "Light output ratio".)

### 2.3.2 Disclosure classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## 2.4 Abbreviations

Abbreviation	Description
<b>AC</b>	Alternating Current
<b>CCTV</b>	Closed Circuit Tele-Vision
<b>CG</b>	Care group
<b>CRI</b>	Colour rendering index
<b>DLOR</b>	Downward light output ratio
<b>DoC</b>	Declaration of Conformity
<b>EMC</b>	Electromagnetic Compatibility
<b>EU</b>	European Union
<b>HPS</b>	High pressure sodium
<b>HV</b>	High Voltage
<b>Hz</b>	Hertz
<b>IES</b>	An electronic photometric data file in the IES format using the IES LM-63-1991 standard
<b>IK</b>	Impact Protection rating
<b>IP</b>	Ingress Protection rating
<b>K</b>	Kelvin
<b>LED</b>	Light-emitting diode
<b>lm</b>	Lumen

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<b>Abbreviation</b>	<b>Description</b>
<b>LOR</b>	Light output ratio
<b>LTD</b>	An electronic photometric data file in the EULUMDAT photometric data format
<b>LV</b>	Low Voltage
<b>mA</b>	milli-Ampere
<b>mm</b>	millimetre
<b>RT&amp;D</b>	Research, Testing and Development
<b>SABS</b>	South African Bureau of Standards
<b>SANS</b>	South African National Standard
<b>SC</b>	Study committee
<b>ULOR</b>	Upward light output ratio
<b>UV</b>	Ultraviolet
<b>V</b>	Volt
<b>W</b>	Watt

## **2.5 Roles and responsibilities**

All employees that specify and technically evaluate perimeter security lighting for use at all Eskom sites shall adhere to this standard during tender and/or technical evaluation activities.

Procurement officials must refer to this standard in their purchasing documents and require that equipment and material offered for purchase, meet the requirements of this standard. Compliance with the requirements of this standard must be guaranteed by the vendor.

## **2.6 Process for monitoring**

The Contractor shall be responsible for the provision of all services associated with the concept and implementation of a programme for quality assurance control. This programme shall be agreed with Eskom. Related/supporting documents

One (1) draft copy of the (operating, training and maintenance / spares) manuals must be supplied to Eskom for approval at time of tender submission and subsequently, three (3) final copies of the approved manuals and as built drawings and wiring diagrams must be supplied at time of commissioning.

Factory acceptance tests are required and must take place at the Contractor's factory / assembly plant prior to delivery of luminaires and associated control equipment to Eskom site. Document content

## **2.7 Related/supporting documents**

Not applicable.

## **3. Requirements**

### **3.1 Application**

Perimeter security lighting defines boundaries and establishes territory. Light directed horizontally away from spaces will provide visual security and prevent unwanted observation into facilities / installations. Refer to Annex C Guidelines for minimum lighting levels.

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This standard has been created to provide an even horizontal lighting level within the boundaries of the double barrier security fence, and to a maximum of 2 meters beyond the outer barrier fence (attack side to the facility) for lighting uniformity, and as such it should have the following objectives:

Designed to emphasize the illumination of the perimeter barrier and the outside approaches to it, provide a clear line of view of the area under surveillance from a minimum distance of 6 meters and enable anyone moving in, or immediately around, the area to be easily seen

Produce sufficient light to create a psychological deterrent to intrusion in addition to making detection virtually certain in the event an entry is made.

Deny potential hiding spaces adjacent to frequently foot patrolled routes

Permit facial recognition from a distance of at least 10 meters

Facilitate the proper use of security devices such as CCTV

The perimeter security lighting must be divided into zones, in accordance with the non-lethal energized perimeter fence system's zones. These lighting zones must be switched on by a signal from the non-lethal energized perimeter fence alarm system, transmitted via fibre optic cables. Individual zones must be able to be switched on manually for testing and security purposes from the main gate security control room located in the Access Control Building (ACB).

## **3.2 Principle of requirements**

### **3.2.1 SANS standards**

Perimeter security lighting shall in all aspects conform to the requirements of SANS 10389-2.

### **3.2.2 Earthing**

1 x 10mm dia. copper earth rods must be laid 1m deep in ground around the complete perimeter, and must be linked back to the main earth mat. Refer to Earthing Standard drawing No 0.54/393.

All lighting columns to be connected to this ring main with 1 x 10mm dia. copper earth rod. Refer to Earthing Standard drawing No 0.54/393.

### **3.2.3 Lightning protection**

The equipment will be installed where it will be subject to voltage surges due to lightning, line faults, power interruptions, high voltage switching conditions, and must be able to operate without failure under these conditions. Therefore, it is imperative that the system be adequately earthed.

Protection against high voltage transients shall be provided on both signal and power circuitry, without impairing the system's electrical parameters, sensitivity or performance.

### **3.2.4 Quality assurance**

The Contractor shall be responsible for the provision of all services associated with the concept and implementation of a programme for quality assurance control.

This programme shall be agreed with Eskom.

### **3.2.5 Documentation / Drawings / Wiring diagrams**

One (1) draft copy of the (operating, training and maintenance / spares) manuals must be supplied to Eskom for approval at time of tender submission and subsequently, three (3) final copies of the approved manuals and as built drawings and wiring diagrams must be supplied at time of commissioning.

Factory acceptance tests are required and must take place at the Contractor's factory / assembly plant prior to delivery of luminaires and associated control equipment to Eskom site.

### **3.2.6 Security**

All persons required to work on the project, shall be made known to Eskom in writing, one (1) week after contract award.

Access procedures shall be specific to the site.

## **4. Lighting requirements**

### **4.1.1 Illumination level**

An even horizontal illumination level with a minimum of 4 lux and a maximum uniformity (Emin / Eave) of not more than 5 to 1 shall be provided. Submission, proofing the above compliance, shall be accompanied by a lighting calculation, which shall be based on the following criteria:

Illuminance level must be calculated at ground level. Maintenance factor of 0.75 must be applied for luminaires with an IP 66 rating certified by SABS test report.

Luminaire data must be supported by a report / certificate issued following tests conducted by a national or international accredited laboratory

### **4.1.2 General construction of luminaires**

Security lighting luminaires shall comply with the following standards must be offered:

SANS 60598-1

SANS 475

Documentary evidence of compliance must be submitted at time of tender submission.

Luminaires must be constructed from durable lightweight materials and must be accompanied by comprehensive test reports certifying that the luminaires have successfully passed accelerated ageing tests.

The acceptance criteria for the accelerated ageing tests are as follows:

- No signs of material degradation
- No cracks on any part of the luminaire
- No compromise of any of the IP ratings of the luminaire

Robustly constructed; weather, hail, insect and corrosion proof, solar (including ultra-violet) and vandal resistant, deterioration must not occur due to electrolytic action or by differential thermal expansion.

All external parts and components of the luminaire must be designed to shed water and ensure that accumulation of condensation or precipitation does not occur. An exterior lip on the housing to ensure that there is no direct rainwater contact with the gasket, between the housing and the diffuser must be available, thus ensuring that no moisture is sucked into the diffuser when the luminaire is switched off and cools down.

Luminaires must be of a colour that is an acceptable match to colour number F48 (cloud grey) of SANS 1091. Luminaires must not be painted and as such, shall not be accepted.

Ferrous components must be hot-dip galvanized in accordance with SABS ISO 1461:2000 for heavy-duty applications. All external small components such as; clips, screws, bolts, nuts, washers, etc. must be manufactured from stainless steel (grade 304 or better).

Luminaires must be bottom entry to ensure ease of maintenance. They should incorporate a positive and substantial means of fixing to the pole or bracket, design to allow adjustment and to ensure that once set to the required position, luminaires remain in that position.

Diffusers must not have external prisms that could accumulate dirt and dust, and thus reduce the light output of the luminaire. Diffusers must be constructed in such a manner that the wall thickness of the material is maintained at a constant thickness, hence preventing the projection of lines of patterns onto the road surface.

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Reflector surfaces must be of high-grade (> 99%) super pure deep anodized aluminium. Reflectors or any other light-controlling / reflecting component must be such that they can only be fitted / positioned and replaced in the correct relationship to their light source. Reflectors in luminaire bowls must not deform due to heat from the lamp. They must be well secured into position to prevent deformation, thus causing false photometric performance of the luminaire.

Control gear must be fully housed within the body of the luminaire and be suitable for operation with specified rating of lamp. Under no circumstances must control gear be mounted above the lamp or in a position where it may adversely affected by the heat generated by the lamp.

The control gear compartment (containing the ballast, capacitor, ignition devices if applicable, and terminal connectors) must have ingress protection class IP 66, and;

So designed that there is sufficient space to permit repairs, replacement of components and reassembly without difficulty, and without the removal of the luminaire from its mounting. To this end, and primarily for ease of maintenance reasons, preferences will be given to luminaires where all control gear is mounted onto a removable tray.

Sealed by a hinged lightweight, non-corrosive cover and must be accessible from underneath. No components must be mounted onto this cover. Access to the gear compartment, via the gear tray cover, must not be possible without the use of a screwdriver, key or special tool, thus protecting unqualified staff, doing lamp replacement, against electric shock.

All control gear must be suitable for operation with the specified rating of the lamp on a 230 VAC  $\pm$  10% 50Hz single-phase electrical power supply system.

The maximum mounting height of the luminaire shall not exceed 6m. Poles must be positioned at 1,5m outside of the inner barrier perimeter fence. GRP poles must bear the SABS mark SANS 1749 under an ISO 9001:2000 regime. Poles must be embedded in a solid concrete foundation measuring (500mm x 500mm x 600mm deep) of 20 Mpa. Pole spacing must be calculated in accordance with the table in Annex B and tenderers must prove by means of calculation that they achieve the minimum required lighting level with the aforementioned height and spacing.

Tenderer/s must guarantee the following, from date of energizing:

- Each lighting luminaire housing for a minimum period of five (5) years from date of manufacture
- The electrical components for 18 month

Luminaires bearing a date of manufacture exceeding four (4) months prior to the date of delivery shall not be accepted

Any luminaire found unsuitable for use, or its IP rating is compromised within a period of five years from date of delivery to site, it must be replaced free of charge by the manufacturer

All luminaires must have its own day night photocell sensor installed inside the luminaire. The luminaires not to be switched by a centralized day night photocell sensor system.

#### **4.1.3 Power supplies, cabling & junction boxes**

Installation of additional supply breakers in distribution boards situated close to the perimeter fence, used for the power supply feed to the perimeter security lighting system, must cater for the required lighting circuits.

Supply cables must feed into pole mounted junction boxes on the first pole of each zone if possible, but in line with the Climb Detection System (CDS) communication enclosures, adjacent to each CDS sensor pole. From there the cables loop to each other zone junction box in that circuit. Cabling to the perimeter security lights must be fed from the junction box to the nearest light of the zone and looped from this light to the other lights in that zone.

The lighting shall work in conjunction with the non-leathal fence zone system. When a zone is triggered the lighting zone within the fence zone shall be switched.

Cabling shall comply with Eskom standard No. 240-56227443. Cables must be installed in cables trenches 500mm deep in ground. Following the laying of cables, trenches must be refilled and compressed suitably to prevent sagging of the ground. Power cables must be of the single wire armoured type.

Minimum allowed security lighting pole spacing shall be 15 meters apart.

## 5. Informative

### 5.1 Recommended design parameters

#### 5.1.1 Area lighting and perimeter lighting

Risk Class	Moderate Lux level	High Lux level	Extreme Lux level
Average illuminance	5	10	15
Minimum illuminance	4	4	4
Uniformity – Minimum to average	0,2	0,2	0,2

**Note:** When the installation includes security CCTV cameras then the minimum illuminance MUST increase to 4 lux.

#### 5.1.2 Building Floodlighting

Risk Class	Light Lux level	Medium Lux level	Dark Lux level
Average illuminance	10	20	50
Minimum illuminance	2	4	10
Uniformity – Minimum to average	0,2	0,2	0,2

**Note:** If the floodlighting is required for aesthetic purposes these values should be increased by a factor of 1.5.

#### 5.1.3 Checkpoint lighting

Application	Lux level
Average illuminance	5
Minimum illuminance	4
Uniformity – Minimum to average	0,2

#### 5.1.4 Dirt factor – DF

Pollution category	High	Moderate	Low
Enclosed Luminaires	0,75	0,08	0,85

#### 5.1.5 Typical utilization factors – UF

Perimeter fence lighting – horizontal illuminance

Luminaires	Factor
Streetlight luminaires	0,35
Floodlight luminaires	0,30

Area lighting – horizontal illuminance

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Luminaires	Factor
Streetlight luminaires	0,45
Floodlight luminaires	0,40

## 6. Technical requirements and Evaluation of Luminaires (Specifically LED luminaires)

This section covers the requirements that the LED perimeter security luminaires shall comply with, as well as the technical criteria that will be used when evaluating the offered luminaires.

Luminaire data and documentary evidence of compliance in the form of reports and certificates by a national or international accredited laboratory stating the tests conducted and associated results shall be submitted at the time of tender submission.

### 6.1 Luminaire Technical Requirements

#### 6.1.1 Photometric Requirements

This section contains the minimum photometric requires and must be read in conjunction with Annex A, item 1 of this document.

The light colour shall be "Neutral White" (4000K).

The colour rendering index shall be equal to or greater than 80.

The luminaire efficacy shall be equal to or greater than 120 lm/W.

The luminaire downward light output ratio shall be equal to 100%.

The luminaire shall reach its full brightness instantaneous.

The illumination pattern of acceptable luminaires shall be in the "bat wing" shape as indicated in 1 to ensure sufficient forward and lateral light distribution.

IES and/or LTD files for use with DIALux or Relux must be supplied in electronic format.

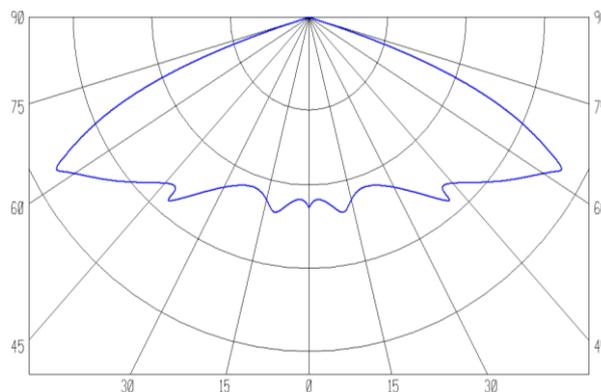


Figure 1: Indicative acceptable illumination pattern

#### 6.1.2 Electrical Requirements

This section contains the minimum electrical requirements and shall be read in conjunction with Annex A, item 2 of this document.

Luminaire input voltage shall be 230V AC  $\pm$ 15%.

Luminaire operating frequency shall be 50Hz  $\pm$ 5%.

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Total luminaire power consumption shall not exceed 70W

Luminaire efficiency shall be equal to or greater than 90%.

Luminaire power factor shall be equal to or better than 0.95.

Luminaire total harmonic distortion shall be equal to or less than 20%.

The surge protection unit shall at least withstand an overvoltage of 10kV/10kA. Preferably it shall comply with the requirements of IEC 61643-11/EN 61643-11

The luminaire shall be a CLASS 1 type in accordance with the description given in SANS 60598-1: 2014 Ed 6 (IEC 60598-1: 2014 Ed 8) Section 1 Clause 1.2.22

The photocell (PECU) shall comply with the illuminance levels for switching requirements given in SANS 1777: 2017 Ed. 1.4. – Photoelectric Control units for lighting (PECU's). See Section 5 Clause 5.5 for test method.

### **6.1.3 Electromagnetic Requirements**

Security lighting luminaires offered shall comply with the following standards:

EN 55015.

Proof of compliance shall be provided through standard test reports (actual measurement data for the frequency spectrum tested).

### **6.1.4 Mechanical Requirements**

This section contains the minimum mechanical requirements and shall be read in conjunction with Annex A, item 3 of this document.

All external parts and components of the luminaire shall be designed to shed debris and water and ensure that accumulation of condensation or precipitation does not occur. An exterior lip shall be provided on the housing to ensure that there is no direct rainwater contact with the gasket, between the housing and the diffuser, thus ensuring that no moisture is sucked into the diffuser when the luminaire is switched off and cools down.

Luminaires shall be constructed from durable lightweight materials and shall be accompanied by comprehensive test reports certifying that the luminaires have successfully passed SANS 475.

Luminaires shall be supplied complete with control gear, lamp and mounting brackets with protractor scales to set the tilting angle.

Luminaires shall not be spray painted but shall be left bare or powder coated and baked to achieve the required corrosion protection level. Ferrous components must be hot-dip galvanized in accordance with SANS 121. All external small components such as; clips, screws, bolts, nuts, washers, etc., must be manufactured from stainless steel (grade 304 or better).

The colour of the luminaire shall be Grey G29 unless specified differently in Schedule A.

Diffusers / lenses shall not have external prisms that could accumulate dirt and dust, and thus reduce the light output of the luminaires. Diffusers shall be constructed in such a manner that the wall thickness of the material is maintained at a constant thickness, hence preventing the projection of lines of patterns onto the ground level.

In case where luminaires are fitted with reflectors, the reflector shall be made of high-grade super pure deep anodized aluminium.

LED drivers shall be fully housed within the body of the luminaire.

The control gear or driver shall be in its own compartment complying with the required IP rating.

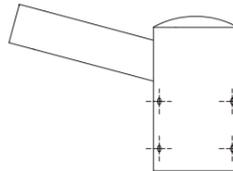
All LED drivers shall be suitable for operation with the specified rating of the luminaire on a 230 VAC  $\pm$  10% 50Hz single-phase electrical power supply system.

The complete luminaire shall have an IK rating of 08 or better.

The complete luminaire shall have an IP rating of 65 or better.

The luminaire shall be tilt adjustable relative to the horizontal plane through a range of 90 degrees with a protractor included to set it to required angles.

The luminaire shall be supplied with the necessary means to be securely fitted onto the pole as indicated in Figure 2. Luminaires with a Spigot as part of its construction are also accepted.



**Figure 2: Typical Spigot Adapter**

The luminaire dimensions and weight shall be specified.

The number of modules and LEDs per module shall be specified.

The operating temperature range shall be -10 to +60 degrees Celsius.

The operating relative humidity range shall be 10% to 70%.

### **6.1.5 Guarantees**

Lead time for delivery within 60 calendar days from date of order.

The tenderer/s shall guarantee, from date of delivery:

- Luminaire housing for a minimum period of ten (10) years.
- The electrical components for 30 000 operating hours (five years).
- The LED module for 30 000 operating hours (five years).

Any luminaire found unsuitable for use, its IP rating compromised within a period of ten years from date of delivery, or it not performing acceptably compared to the unit tested during technical evaluation shall be replaced free of charge by the manufacturer.

### **6.1.6 Delivery**

Lead time for delivery within 60 calendar days from date of order.

### **6.1.7 Maintenance strategy**

The tenderer/s shall provide Eskom with a proposed maintenance/cleaning strategy for the luminaires offered.

This strategy must ensure that a maintenance factor of at least 0.80 will be maintained for the LED luminaires through its expected service life.

## **6.2 Luminaire technical evaluation**

The technical evaluation for the luminaires shall consist of three parts namely:

Documentation evaluation to verify all required documents and luminaire samples have been submitted. Refer to Annex B1 for detail. Luminaire submissions not complying with all set requirements will immediately be disqualified.

Documentation and a physical luminaire evaluation to verify all requirements as set out in section 3.1 and Annex A are complied with will be done. Criteria as listed will be scored to determine compliance to set requirements. Refer to Annex B2 for detail. Luminaire submissions that score less than 80% will immediately be disqualified.

The remaining luminaires will undergo photometric, electrical and electromagnetic interference performance tests in the Eskom RT&D laboratories to verify compliance to the photometric, electrical and electromagnetic interference data submitted. Only luminaires with photometric, electrical and electromagnetic interference performance compliance of 95% or more compared to submit data will be considered technically acceptable for use in Eskom substations as floodlights.

All supplier submission documentation, reports and certificates shall be in English.

**6.2.1 Documentation to be submitted**

The following documentation must be submitted per luminaire offered:

- Proof of compliance to the SANS 60598-1
- Proof of compliance to the SANS 475
- Proof of compliance to the EN 55015
- Completed technical Schedule B in Annex A.
- IES and/or LTD files supplied in electronic format.
- Photometric test reports per luminaire offered.
- Test report indicating IK rating verification.
- Test report indicating IP rating verification.
- Luminaire guarantee certificate.
- Certificate indicating lead time for delivery from date of order
- Luminaire maintenance strategy.

No luminaire will be approved or tested if these test reports are not provided.

**6.2.2 Luminaire samples to be submitted**

One sample luminaire must accompany each submission for inspection and to undergo photometric, full electrical and electromagnetic interference performance tests in the Eskom RT&D laboratories to verify compliance to the photometric, electrical and electromagnetic interference data submitted.

All samples not meeting the set criteria can be returned on request. Samples that met the set criteria will be retained for reference purposes for the period the luminaire will be considered acceptable (typically a period of five years).

**6.2.3 Evaluation criteria**

The evaluation criteria as detailed in Annex B will be applied in determining compliance to the set requirements.

**7. Authorization**

This document has been seen and accepted by:

<b>Name and surname</b>	<b>Designation</b>
André Blignaut	Senior Advisor (Lighting) – RT&D
Anton Naude	Senior Technologist – Substation Engineering

## **8. Revisions**

<b>Date</b>	<b>Rev</b>	<b>Compiler</b>	<b>Remarks</b>
Nov 2018	1	Anton Naude	First issue

## **9. Development team**

The following people were involved in the development of this document:

- Anton Naude
- André Blignaut

## **10. Acknowledgements**

Everybody that took the time to comment on the draft document.

**Annex A – Technical Schedules A and B**

This section must be read together with section 3.1 of this document.

Schedule A: Eskom’s Particulars Requirements

Schedule B: Technical Particulars of Luminaire Offered

ITEM NO	CLAUSE	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
<b>1</b>	<b>6.1.1</b>	<b>Photometric Specifications</b>			
1.1	(b)	Colour temperature	K	3500 – 4500 (Neutral White)	
1.2		LED luminous flux	lm	Specify	
1.4	(c)	Colour rendering index (CRI)		≥ 80	
1.5	(d)	Luminaire efficacy	lm/W	≥ 120	
1.5		Light output ratio (LOR)	%	Specify	
1.6	(e)	Downward light output ratio (DLOR)	%	≥ 85	
1.7		Upward light output ratio (ULOR)	%	Specify	
1.8	(f)	Time to full brightness	minutes	< 1	
1.8	(h)	Illumination pattern	polar	Bat wing	
1.9	(g)	IES and/or LTD files		Comply	
<b>2</b>	<b>6.1.2</b>	<b>Electrical Specifications</b>			
2.1	(a)	Input voltage	VAC	230 ±15%	
2.2	(b)	Frequency	Hz	50 ± 5%	
2.3	(c)	Input current (maximum)	mA	300-500	
2.4	(c)	Total LED power consumption	W	Max 70	
2.5	(c)	Total luminaire power consumption	W	Max 70	
2.6	(d)	Efficiency (total LED to total luminaire power consumption)	%	≥ 90	
2.7	(e)	Power factor (PF)		≥ 0.95	
2.8	(f)	Total Harmonic distortion	%	≤ 20	
2.9		Protection type			
2.10		Safety class			
<b>3</b>	<b>6.1.3</b>	<b>Electromagnetic Specifications</b>		As specified	
<b>4</b>	<b>6.1.4</b>	<b>Mechanical Specifications</b>			
4.1	a)	Luminaire design		As specified	
4.2	(b)	Luminaire material and SANS 475 compliance		As specified	
4.2	(c)	Luminaire and accessories		As specified	
4.3	(d)	Luminaire protective coating		As specified	
4.3	d)	External small components such as; clips, screws, bolts, nuts, washers,		Stainless steel (grade	

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
				304 or better)	
4.3	(e)	Luminaire colour		Grey G29	
4.4	(g)	Diffuser		As specified	
4.4	(h)	Reflector material		High-grade super pure deep anodized aluminium	
4.5	(i)	LED Drivers compartment IP Rating		≥ IP65	
4.5	(i)	LED Drivers capability		As specified	
4.6	(j)	Complete luminaire IK rating		≥ IK08	
4.7	(k)	Complete luminaire IP rating		≥ IP65	
4.8	(l)	Tilt adjustment relative to horizontal plane	deg	90	
		Protractor fitted		Yes	
4.9	(m)	Mounting device for fitment		As specified	
4.10	(n)	Luminaire dimensions		As specified	
		Height	mm		
		Width	mm		
		Length	mm		
4.11		Luminaire Weight	kg		
<b>5</b>		<b>General Specifications</b>			
	(o)	Number of modules			
	(o)	Number of LEDs			
	(o)	Arrangement (number of LEDs per module)			
	(p)	Operating temperature range	°C	-10 to +60	
	(q)	Operating humidity range	%RH	10% - 70%	
<b>6</b>	<b>6.1.4</b>	<b>Guarantee</b>			
	(a)	Luminaire housing (minimum)	years	10	
	(b)	Electrical components (minimum)	hours	30 000	
	(c)	LED modules (minimum)	hours	30 000	
	(d)	Luminaire replacement in case of sub-standard performance		As specified	
	<b>6.1.5</b>	<b>Delivery</b>			
		Lead time for delivery from time of order	Calendar days	60	
<b>7</b>	<b>6.1.6</b>	<b>Maintenance strategy</b>		Specify	

## Annex B – Technical evaluation scoring matrix

This section must be read together with section 3.2 of this document.

### Mandatory evaluation criteria

Mandatory criteria are not point scored. They are assessed on a Yes/No basis as to whether or not they have been satisfactorily met. An assessment of 'No' against any criterion may eliminate the tenderer from further consideration. The criteria are:

Criteria	Yes	No
Proof of compliance to the SANS 60598-1		
Proof of compliance to the SANS 475		
Proof of compliance to the EN 55015		
Completed technical schedule B per luminaire offered		
IES and/or LTD files supplied in electronic format		
Photometric test reports per luminaire offered		
Test report indicating IK rating verification		
Test report indicating IP rating verification		
Luminaire guarantee certificate supplied		
Lead time for delivery from date of order		
Luminaire maintenance strategy supplied		
Sample Luminaire per offering supplied		

### Qualitative evaluation criteria

After a luminaire offered has met all the mandatory criteria in B1, the submission will be assessed against the following criteria (shown below with their weightings):

Criteria	Section	% weight
Photometric requirements	B2.1	30
Electrical requirements	B2.2	25
Mechanical requirements	B2.3	25
Guarantees	B2.4	20
Total		100

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For each evaluation criteria, the extent to which submissions have complied with the requirements shall be scored based on the following:

5	COMPLIANT Meet technical requirement(s) AND; No foreseen technical risk(s) in meeting technical requirements.
4	COMPLIANT WITH ASSOCIATED QUALIFICATIONS Meet technical requirement(s) with; Acceptable technical risk(s) AND/OR; Acceptable exceptions AND/OR; Acceptable conditions.
2	NON-COMPLIANT Does not meet technical requirement(s) AND/OR; Unacceptable technical risk(s) AND/OR; Unacceptable exceptions AND/OR; Unacceptable conditions.
0	TOTALLY DEFICIENT OR NON-RESPONSIVE

Threshold: The score that each tenderer receives will provide a numeric basis for tender comparison. The minimum weighted average score required for a luminaire to be considered must be 80% or above. Only luminaire scoring 80% or above will be tested in the Eskom RT&D photometric laboratory to verify the photometric and electrical data submitted.

ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
<b>B2.1</b>	<b>6.1.1</b>	<b>Photometric Specifications</b>			
B2.1.1	(b)	Colour temperature	K	< 3000	0
				3000 – 3500	2
				3500 – 4500	5
				4500 – 5000	2
				>5000	0
B2.1.2	(c)	Colour rendering index (CRI)		≥ 80	5
				70 – 80	4
				< 70	0
B2.1.3	(d)	Luminaire efficacy	lm/W	≥ 120	5
				110 – 120	4
				100 – 110	2
				≤ 100	0
B2.1.4	(e)	Downward light output ratio (DLOR)	%	≥ 90	5
				85 – 90	4
				80 – 85	2
				≤ 80	0
B2.1.5	(f)	Time to full brightness	minutes	< 0.5	5
				0.5 – 1	4
				> 1	0
B2.1.6	(g)	Is the illumination pattern in a		Yes	5

ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
		“bat wing” shape?		No	0
<b>Photometric Specifications (maximum points: 30)</b>				Photometric score	
<b>Photometric Specifications (section weight: 30%)</b>				Weighted score = score above	
ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
<b>B2.2</b>	<b>6.1.2</b>	<b>Electrical Specifications</b>			
B2.2.1	(c)	Input current (maximum)	mA	300	5
				400	4
				500	2
				> 500	0
B2.2.1	(c)	Total power consumption	W	< 60	5
				60-65	4
				65-70	2
				> 70	0
B2.2.2	(c)	Luminaire efficiency	%	≥ 95	5
				90 – 95	4
				< 90	2
B2.2.3	(e)	Power factor		≥ 0.95	5
				0.90 – 0.95	4
				0.85 – 0.90	2
				< 0.85	0
B2.2.4	(f)	Harmonic distortion	%	≤ 10	5
				10 – 15	4
				15 – 20	2
				> 20	0
<b>Electrical Specifications (maximum points: 20)</b>				Electrical score	
<b>Electrical Specifications (section weight: 25%)</b>				Weighted score = $(Score) * \left(\frac{25}{20}\right)$	
<b>B2.3</b>	<b>6.1.3</b>	<b>Mechanical Specifications</b>			
B2.3.1	(b)	General luminaire design		Yes	5

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
				Partially	2
				No	0
B2.3.2	(c)	Body material		Non-ferrous metal	5
				Ferrous metal	2
				Anything else	0
B2.3.3	(e)	Body covering (e.g. none, hot-dip galvanized, baked powder coating, etc.)		Non-ferrous metal – no covering	5
				Non-ferrous metal – powder coated and baked	5
				Ferrous metal – hot-dip galvanized	5
				Anything else	0
B2.3.4	(h)	Reflector material: High-grade super pure deep anodized aluminium		Yes	5
				No	0
B2.3.5	(j)	IK rating		≥ IK08	5
				IK07	2
				IK06	0
B2.3.6	(k)	IP rating		≥ IP66	5
				IP65	4
				IP64	2
				IP63	0
B2.3.7	(l)	Tilt adjustment relative to horizontal plane		Yes	5
				No	0
		Protractor fitted		Yes	5
				No	0
B2.3.8	(m)	Mounting device for fitment onto round pole (spigot)		Yes	5
				No	0
<b>Mechanical Specifications (maximum points: 45)</b>				Mechanical score	
<b>Mechanical Specifications (section weight: 25%)</b>				Weighted score = $(Score) * \left(\frac{25}{45}\right)$	
<b>B2.4</b>	<b>6.1.4</b>	<b>Guarantee</b>			
B2.4.1	(a)	Luminaire housing (minimum)	years	≥10	5
				7.5 – 10	4

ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
				5 – 7.5	2
				< 5	0
B2.4.2	(b)	Electrical components (minimum)	hours	≥ 50 000	5
				40 000 – 50 000	4
				30 000 – 40 000	2
				≤ 30 000	0
B2.4.3	(c)	LED module (minimum) life expectancy	hours	≥ 50 000	5
				40 000 – 50 000	4
				30 000 – 40 000	2
				≤ 30 000	0
B2.4.4	6.1.5	Lead time for delivery from time of order	Calendar days	≤ 30	5
				30 – 40	4
				40 – 50	2
				≥ 60	0
Guarantee (maximum points: 20)				Guarantee score	
Guarantee (section weight: 20%)				Weighted score = score above	

### Physical luminaire performance evaluation

Only luminaire that achieved 80% or more in the qualitative evaluation will be considered for further evaluation. These luminaire will undergo photometric, full electrical and electromagnetic interference performance tests in the Eskom RT&D laboratories to verify compliance to the photometric, electrical and electromagnetic interference data submitted. .

Only luminaire with photometric, electrical and electromagnetic interference performance compliance of 95% or more compared to submit data will be considered technically acceptable for use in Eskom.