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1. Introduction

The aim of this standard is to prescribe requirements regarding LED street lighting that Eskom and its subsidiaries must apply with regard to protecting its installations. This standard must be used by all divisions within Eskom and its subsidiaries to install or retrofit their street lighting with the ultimate aim of a uniform set of measures being applied throughout.

Street lighting is used throughout Eskom Properties. The purpose of street lighting is for people to observe obstructions and other hazards while travelling on Eskom properties at night time.

The street lighting installation shall provide a minimum average illumination level not less than the level stated in SANS 10098-1 and 10098-2

Historically only 100W High Pressure Sodium (HPS) streetlights have been used for street lighting. This standard details the requirements for LED streetlights to be used.

2. Supporting Clauses

2.1 Scope

This standard sets out Eskom's requirements for the supply and delivery of LED Streetlights for use on all Eskom properties, when proper lighting design protocols are used a broader application is possible.

2.1.1 Purpose

The purpose of providing street lighting is to create a lighted environment, which will contribute to the safe and comfortable movement of vehicles and pedestrians during the hours of darkness.

This standard is a technical document that specifies functional, performance and other requirements that 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 safe and 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.

2.1.3 Effective date

This document will be effective from the date that this document was authorised.

2.2 Normative/Informative References

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

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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] ARP 035, | Guideline for installation and maintenance of street lighting |
| [3] ISO 9001, | Quality Management Systems. |
| [4] ARP 035, | Guideline for installation and maintenance of street lighting |
| [5] SANS 121, | Hot dip galvanized coatings on fabricated iron and steel articles –
Specifications and test methods |
| [6] SANS 475, | Luminaires for interior lighting, street lighting and floodlighting –
Performance requirements |
| [7] SANS 1088, | Luminaire entries and spigots |
| [8] SANS 1091, | National colour standard |
| [9] SANS 10098-1, | Public lighting – Part 1: The lighting of public thoroughfares. |
| [10] SANS 10098-2, | Public lighting – Part 2: The lighting of certain specific areas of streets and
highways. |
| [11] SANS 60529, | Degree of protection provided by enclosures (IP Code) |
| [12] SANS 60598-1, | Luminaires Part 1: General requirements and tests |
| [13] SANS 60598-2-3, | Luminaires Part 2-3: Particular requirements – Luminaires for road and
street lighting |
| [14] SANS 60598-2-5, | Luminaires Part 2-5: Particular requirements – Streetlights |
| [15] SANS 62031, | LED modules for general lighting – safety specifications. |
| [16] SANS 62262, | Degrees of protection provided by enclosures for electrical equipment
against external mechanical impacts (IK code) |
| [17] SANS 62384, | DC or AC supplied electronic control gear for LED modules – Performance
requirements |
| [18] SANS 62504, | General lighting – Light emitting diode (LED) products and related
equipment – Terms and Definitions |
| [19] SANS 62560, | Self-ballasted LED-lamps for general lighting services by voltage > 50 V –
Safety specification |
| [20] SANS 62612, | Self-ballasted LED lamps for general lighting services with supply voltages
> 50 V - Performance requirements |
| [21] EN 55015, | Limits and methods of measurement of radio disturbance of electrical |

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lighting or equipment.

- [22] EN 61000-3-2, Electromagnetic compatibility (EMC) Limits for harmonic current emissions
- [23] EN 61000-3-3, Electromagnetic compatibility (EMC) - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
- [24] EN 61547, Equipment for general lighting purposes: EMC immunity requirements
- [25] IEC-EN 62471, Photo biological Safety of Lamps and Lamp Systems for LED's
- [26] IES LM-79-08, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- [27] IES LM80, Approved Method: Measuring lumen maintenance of LED light sources
- [28] Electromagnetic Compatibility (EMC) Directive (2014/30/EU)
- [29] Low Voltage (LV) Directive (2014/35/EU)

2.2.2 Informative

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

2.3 Definitions

Definition	Description
Colour rendering index (CRI)	An index used to measure an artificial light's ability to reproduce the colours of an object, relative to the natural light source (the sun) with CRI of 100. Higher CRI means better visibility. The higher the CRI, the better the light source renders colours in the visible spectrum.
Colour temperature	Colour Temperature (CT), more completely Correlated Colour Temperature (CCT), is a reference number for judging how warm or cold is the colour of a white light source. CT is the colour of light given off by a particular light source that most closely represents the light emitted from a perfect blackbody radiator when heated to a specific temperature, measured in Kelvin (K).
Diffuser	A device which spreads the light from a light source evenly and reduces harsh shadows.
Downward light output ratio	An indication of what percentage of light shines down. (To be read in conjunction with the definition for "Light output ratio".)
Efficiency (Lm/W)	Luminaires include ballasts, drivers, heat management systems, optics, all of which can diminish the original luminous efficacy of the light source. Since the road surface is being lit up by the luminaire as a whole, system efficacy is a better metric to use than luminous efficacy when making comparisons.
Equipment	Assemblies of components, sub-units or sub-assemblies usually contained in a suitable enclosure, and capable of performing an overall specified function.
Harmonic distortion	The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

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Definition	Description
Horizontal illuminance	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.
IK rating	The extent (or level) of protection of the equipment provided by an enclosure against harmful mechanical impacts and verified by standardised test methods.
Illuminance	(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 ²).
IP rating	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.
.IES / .LTD files	Electronic lighting design simulation file
Label	An inscription on equipment or on a sub-unit, either integral therewith or on a separate piece of material affixed thereto.
Light output ratio	The percentage of light emitted from the light source that makes it out of the luminaire. An LOR of 70 means 30 per cent of the light from lamp is lost inside the reflector and light fitting. The optically efficient of LED luminaires will demonstrate an 'efficiency' - of 100 per cent.
Luminaire	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.
Luminous efficacy	Ratio of luminous flux of a lamp (in lumens) to the total electric power consumed (in watts)
Luminous flux	Quantity of the energy of the light emitted per second in all directions. The unit of luminous flux is lumen (lm).
Maintenance factor	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.
Off-grid locations	For any area that is a distance away from an electricity grid, it is more cost effective to install solar road lighting than to extend the grid.
Power factor	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.
Qualitative	Concerned with or depending on quality rather than on quantity.
Reliability	The ability to consistently function as specified under stated conditions for a stated time period.
Solar powered LED luminaires	An LED streetlight powered by a solar system and is not connected to electricity grid. Solar LED streetlights provide 100% energy savings over conventional streetlights, and hence higher savings on the energy bill.

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Definition	Description
Terminal	A metallic device for connecting electrical conductors.
Uniformity ratio	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.
Upward light output ratio	An indication of what percentage of light shines up. (To be read in conjunction with the definition for "Light output ratio".)

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
CG	Care group
CRI	Colour Rendering Index
DLOR	Downward light output ratio
DoC	Declaration of Conformity
EMC	Electromagnetic Compatibility
EU	European Union
HPS	High pressure sodium
HV	High Voltage
Hz	Hertz
IES	An electronic photometric data file in the IES format using the IES LM-63-1991 standard
IK	Impact Protection rating
IP	Ingress Protection rating
K	Kelvin
LED	Light-emitting diode
LTD	An electronic photometric data file in the EULUMDAT photometric data format
LV	Low Voltage
LVD	Low Voltage Disconnect
lm	Lumen
Lm/W	Lumens per Watt
LOR	Light output ratio
mA	milli-Ampere
mm	millimetre
PCU	Photocell control unit
PV	Photo Voltaic

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Abbreviation	Description
PWM	Pulse Width Modulation
RT&D	Research, Testing and Development
SC	Study Committee
ULOR	Upward light output ratio
USC	Uniformity of semi-cylindrical illuminance
UV	Ultraviolet
V	Volt
W	Watt

2.5 Roles and Responsibilities

All employees that specify and technically evaluate LED luminaires for Eskom applications 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 and 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.

2.7 Related/Supporting Documents

Not applicable.

3. LED Street Lighting and Solar Power requirements

This section covers the requirements that the LED streetlight luminaires and/or solar panel system shall comply with, as well as the technical criteria that will be used when evaluating the offered luminaires and/or solar system.

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 must be submitted at the time of submission.

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3.1 Application

The luminaire with the most suitable light distribution for the particular application should be selected. However, should street lighting luminaires be considered for areas where obtrusive light could be a problem, then streetlighting luminaires with a limitation on the amount of upward light will be acceptable. The design of the lighting installation must cover the following parameters:

- a) horizontal illuminance at street level;
- b) semi-cylindrical illuminance at 1,5 m above ground level in both directions parallel to the carriageway;
- c) the overall uniformity of semi-cylindrical illuminance (USC); and
- d) glare control (under consideration).

3.2 Principle Requirements

3.2.1 SABS standards

Street lighting shall in all aspects conform to the requirements of SANS 10098-1, SANS 10098-2 and artificial lighting of exterior areas for work and safety (roads) SANS 10389-1.

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 must connect to this ring main with 1 x 10mm diameter 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 (surge protection) shall be provided on the 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.

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3.2.5 Documentation / Drawings / Wiring diagrams

One (1) draft copy of the operating, training and maintenance and 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 Power supplies, cabling and junction boxes

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.

4. Informative

4.1 Recommended design parameters

4.1.1 General

The purpose of providing street lighting is to create a lighted environment, which will contribute to the safe and comfortable movement of vehicles and pedestrians during the hours of darkness. If these requirements are met, road accidents and criminal activities in the streets can be substantially reduced.

4.1.2 Objectives

The following objectives must be met for vehicle drivers:

- a) Details of the course of the road ahead must be clearly visible. This means that the presence and positions of kerbs, intersections, bends, vehicle access points, pedestrian crossings, road markings, traffic signs and general street furniture must be revealed.
- b) Other road users must be visible. These include other vehicles, cyclists, pedestrians and stray animals. The lighting must clearly show their actual positions relative to the observer, their direction and speed of movement.
- c) Imperfections in the road surface and the presence of obstacles in the path of a vehicle must be clearly visible.

All the above must be clearly visible to a vehicle driver from a distance that is great enough according to the speed at which he is driving the vehicle to enable him to take avoiding action or stop the vehicle, as required.

4.1.3 Light level requirements

The design of the lighting installation must cover the following parameters. The recommended values for each are given in table 1:

- a) horizontal illuminance at street level;

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- b) semi-cylindrical illuminance at 1,5m above ground level in both directions parallel to the carriageway;
- c) the overall uniformity; and
- d) glare control (under consideration).

Table 1: Recommended lighting values

	Type of road	Minimum average horizontal illuminance $E_{H av}$	Minimum horizontal illuminance $E_{H min}$	Minimum semi-cylindrical illuminance $E_{Sc min}$
1	Roads with medium to high volume traffic	5 lux	1 lux	2 lux
2	Roads with medium volume traffic	3 lux	0.6 lux	1 lux
3	Roads with low volume traffic	2 lux	0.4 lux	0.6 lux

5. Technical requirements and evaluation of luminaires (Specifically LED luminaires)

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

5.1 Luminaire technical requirements

5.1.1 Photometric requirements

This section contains the minimum photometric requirements and must be read in conjunction with Annexure A, Item 1 of this document.

- a) The light colour must be "Neutral White" (4000K).
- b) The colour rendering index must be equal to or greater than 70.
- c) The luminaire efficacy must be equal to or greater than 100 lm/W.
- d) The luminaire downward light output ratio must be equal to or greater than 100%.
- e) The luminaire must reach its full brightness instantaneous.
- f) IES and/or LTD files for use with DIALux or Relux must be supplied in electronic format.
- g) The illumination pattern of acceptable luminaires shall be in the "bat wing" shape as indicated in Figure 1 to ensure sufficient forward and lateral light distribution.

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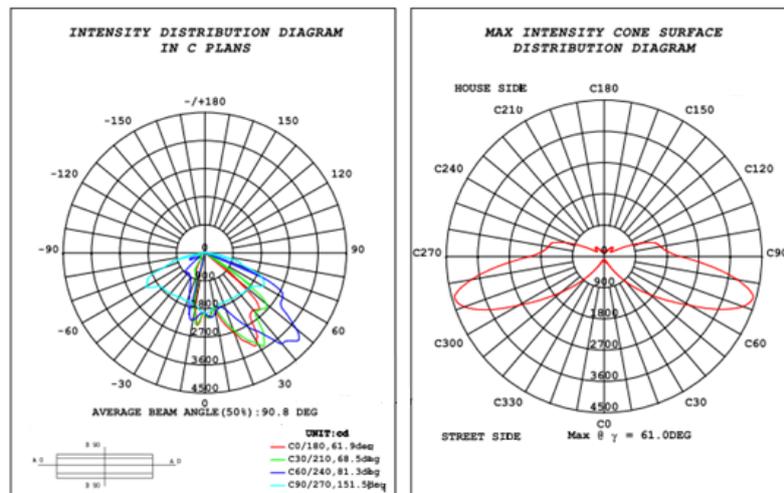


Figure 1: Indicative acceptable illumination pattern

5.1.2 Electrical requirements

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

- Luminaire input voltage shall be 230V AC $\pm 10\%$.
- Luminaire operating frequency shall be 50Hz $\pm 5\%$.
- The luminaire nominal power consumption must not exceed 90W.
- Luminaire efficiency (lm/W) 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.
- Each luminaire will have a photocell (PECU) and shall comply with the illuminance levels for switching requirements given in SANS 1777: 2017 Ed. 1.4. – Photoelectric Control units for lighting (PCU's). See Section 5 Clause 5.5 for test method.

5.1.3 Electromagnetic Requirements

Proposed luminaires shall comply with EN 55015. Proof of compliance shall be provided through standard test reports (actual measurement data for the frequency spectrum tested).

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5.1.4 Mechanical requirements

This section contains the minimum mechanical requirements and must be read in conjunction with Annexure A, Item 3 of this document.

- a) All external parts and components of the luminaire must be designed to shed debris and water and ensure that accumulation of condensation or precipitation does not occur. An exterior lip must be present on the housing to ensure that there is no direct rainwater contact with the gasket, between the housing and the diffuser. This ensures that no moisture is drawn into the diffuser when the luminaire is switched off and cools down.
- b) Luminaires shall be constructed from durable lightweight materials and must be accompanied by comprehensive test reports certifying that the luminaires have successfully passed SANS 475.
- c) Luminaires shall be supplied complete with control gear, lamp and mounting brackets.
- d) 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).
- e) The colour of the luminaire shall be Grey G29 unless specified differently in Schedule A.
- f) Diffusers / lenses must not have external prisms that could accumulate dirt and dust, and thus reduce the light output of the luminaires. 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 or patterns onto the ground level.
- g) 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 in accordance with SANS 60529.
 - VAC \pm 10% 50Hz single-phase electrical power supply system.
- h) The complete luminaire must have an IK rating of 08 or better.
- i) The complete luminaire must have an IP rating of 65 or better.
- j) The luminaire must be tilt adjustable relative to the horizontal plane with a protractor included to set the luminaires to the required angles.
- k) The luminaire must be supplied with the necessary means for secure fitting onto the street pole, as indicated in Figure 2. Luminaires with a spigot as part of its construction are also accepted.

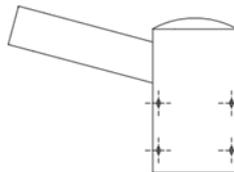


Figure 2: Typical Streetlight type Spigot Adapter

- l) The luminaire dimensions and weight shall be specified.
- m) The number of modules and LEDs per module shall be specified.
- n) The operating temperature range shall be -10°C to $+60^{\circ}\text{C}$. The operating relative humidity range shall be 10% to 70%.

5.1.5 Guarantees

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

- a) Each luminaire housing for a minimum period of ten (10) years.

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- b) The electrical components for 30 000 hours (five years).
- c) The LED modules for 30 000 hours (five years).
- d) Any luminaire found unsuitable for use, its IP rating compromised within a period of ten years from date of delivery, or not performing acceptably compared to the unit tested during technical evaluation must be replaced free of charge by the supplier.

5.1.6 Delivery

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

5.1.7 Maintenance strategy

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

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

5.2 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 Annexure 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 5.2.1 and Annexure A are complied with will be done. Criteria as listed will be scored to determine compliance to set requirements. Refer to Annexure B2 for detail. Luminaire submissions that score less than 80% will immediately be disqualified.
- The remaining luminaires will undergo photometric and electrical performance tests in the Eskom RT&D lighting laboratory to verify compliance to the photometric and electrical data submitted. Only luminaires with both photometric and electrical performance compliance of 95% or more compared to submitted data will be considered technically acceptable for use on Eskom Properties as streetlights.

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

5.2.1 Documentation to be submitted

The following documentation must be submitted per proposed luminaire:

- Proof of compliance to SANS / IEC 60598-1
- Proof of compliance to SANS 475
- Proof of compliance to EN 55015
- Completed technical Schedule B in Annexure 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

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- Luminaire maintenance strategy.

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

5.2.2 Luminaire samples to be submitted

A minimum of one (1) preferably three (3) luminaire samples of each type or model must accompany each submission for inspection and to undergo photometric, full electrical and electromagnetic interference performance tests in the Eskom RT&D laboratories. The tests are conducted 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 for a period of five years).

5.2.3 Evaluation criteria

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

5.3 Solar power component technical requirements

The technical evaluation for the solar power supply system for luminaires shall consist of three parts namely:

5.3.1 Batteries

- Fully sealed, maintenance free Deep Cycle Rechargeable AGM+GEL VRLA Batteries, or suitable alternative
- Up to 8 years design service life
- Shall be housed underground and not pole mounted

5.3.2 Charge Controller

- PWM (Pulse Width Modulation) control
- Series battery charging
- Automatic Voltage detection
- Voltage and Current regulation
- Current compensated Low Voltage Disconnect (LVD)
- Integrated self-test
- LED's indicate charge status and faults
- Electronic Protection:
 - Short-circuit - solar and load

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- Overload - solar and load
- Reverse polarity – module, load and battery
- Reverse current at night
- High temperature disconnect
- Automatic Electronic fuse
- Overcharge
- Deep discharge
- PCU (Photocell Control Unit) as standard for switching load
- Timer controller (available on request) for switching load
- Reliable 100% light output and operation from sunset to sunrise
- 2-day Standard System autonomy without a charge (extended autonomy on available on request)

5.3.3 Solar Panels

- Polycrystalline/Monocrystalline/Thin-Film Module PV Panels
- Aluminium Frame
- IP65 rating
- Operating Temperature range -10°C to 55°C
- Front glass thickness: 4mm

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6. Authorization

This document has been reviewed and accepted by:

Name and surname	Designation
Darryl Chapman	Chief Engineer, Demand Management
Ronel Clarke	Middle Manager, Demand Management

7. Revisions

Date	Rev	Compiler	Remarks
March 2017	1	André Blignaut	First issue
May 2020	2	André Blignaut	Second issue

8. Development team

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

- Anton Naude
- André Blignaut

9. Acknowledgements

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

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Annexure 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 Proposed Luminaire

ITEM NO	CLAUSE	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
1	5.1.1	Photometric Specifications			
1.1	(a)	Colour temperature	K	3500 – 4500 (Neutral White)	
1.2		LED luminous flux	lm	Specify	
1.3	(b)	Colour rendering index (CRI)		≥ 80	
1.4	(c)	Luminaire efficacy	lm/W	≥ 100	
1.5	(d)	Light output ratio (LOR)	%	Specify	
1.6		Downward light output ratio (DLOR)	%	≥ 85	
1.7		Upward light output ratio (ULOR)	%	Specify	
1.8	(e)	Time to full brightness	time	Instantaneous	
1.9	(f)	IES and/or LTD electronic files		Comply	
1.10	(g)	Illumination pattern	polar	Batwing	
2	5.1.2	Electrical Specifications			
2.1	(a)	Input voltage	V AC	230 ±10%	
2.2	(b)	Frequency	Hz	50 ± 5%	
2.3		Input current	mA	300 - 500	
2.4		Total LED power consumption	W	Max 90	
2.5		Total luminaire power consumption	W	Max 90W	
2.6	©	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	(g)	Surge Protection type		Specify	
2.10	(h)	Safety class SANS 60598-1		Specify	
2.11	(i)	Photocell		Specify	
3	5.1.3	Electromagnetic Specifications		As specified	
4	5.1.4	Mechanical Specifications			
4.1	(a)	Luminaire design		As specified	

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
4.2	(b)	Luminaire material SANS 475 compliance		As specified	
4.3	(c)	Luminaire and accessories		As specified	
4.4	(d)	Luminaire protective coating		As specified	
4.5		External small components such as; clips, screws, bolts, nuts, washers		Stainless steel (grade 304 or better)	
4.6	(e)	Luminaire colour		Grey G29	
4.7	(f)	Diffuser		As specified	
4.8	(f)	Reflector material		High-grade super pure deep anodized aluminium	
4.9	(g)	LED driver compartment IP rating		≥ IP65	
4.10	(g)	LED driver capability		As specified	
4.11	(h)	Complete luminaire IK rating		≥ IK08	
4.12	(i)	Complete luminaire IP rating		≥ IP65	
4.13	(j)	Tilt adjustment relative to horizontal plane	deg	Required angles	
		Protractor fitted		Yes	
4.14	(k)	Mounting device for fitment onto pole		As specified	
4.15	(l)	Luminaire dimensions			
		Height	mm		
		Width	mm		
		Length	mm		
4.16	(l)	Luminaire Weight	kg		
5		General Specifications			
5.1	(a)	Number of Modules			
5.2	(b)	Number of LEDs			
5.3	(c)	Arrangement (number of LEDs per cell)			
5.4	(d)	Operating temperature range	°C	-10 to +60	
5.5	(e)	Operating humidity range	%RH		
6	5.1.5	Guarantee			
6.1	(a)	Luminaire housing (minimum)	years	10	
6.2	(b)	Electrical components	hours	30 000	

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
		(minimum)			
6.3	(c)	LED modules (minimum)	hours	30 000	
6.4	(d)	Luminaire replacement in case of sub-standard performance and pre-mature failure		As specified	
7	5.1.6	Delivery			
7.1		Lead time for delivery from time of order	Calendar days	60	
8	5.1.6	Maintenance strategy		Specify	

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Annexure B – Luminaire technical evaluation scoring matrix

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

B1 Mandatory evaluation criteria

Mandatory criteria are not 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
Completed technical schedule B per luminaire offered		
IES and/or LTD files supplied in electronic format		
Photometric test reports per luminaire offered		
Proof of compliance SANS / IEC 60598 Safety Test Report		
Proof of compliance SANS 474		
Proof of compliance EN 55015		
Photometric test report per luminaire offered		
Test report indicating IK rating verification		
Test report indicating IP rating verification		
Luminaire guarantee certificate supplied		
Lead time for delivery within 60 calendar days from date of order		
Luminaire maintenance strategy supplied		
Sample Luminaire per offering supplied		

B2 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

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

Description	% compliance	Score
Meets Eskom's requirements: no errors, risks, weaknesses or omissions.	80 → 100	5
Meets Eskom's requirements with qualifications: some	60 → 79	4

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qualifications required from tenderer to eliminate the errors, risks, weaknesses and omissions.		
Does not meet Eskom's requirements: some errors, risks, weaknesses or omissions which can be corrected or overcome with negotiation and cost impact.	40 → 59	3
Substantially does not meet Eskom's requirements: many errors, risks, weaknesses which may be difficult to be corrected or overcome and make acceptable.	20 → 39	2
No achievement of Eskom's requirements: existence of numerous errors, risks, weaknesses or omissions which cannot be corrected.	0 → 19	1
Totally deficient / non-responsive.	0	0

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 lighting laboratory to verify the photometric and electrical data submitted.

ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
B2.1	5.1.1	Photometric Specifications			
B2.1.1	(a)	Colour temperature	K	< 3000	0
				3000 - 3500	2
				3500 – 4500	5
				4500 – 5000	2
				>5000	0
B2.1.2	(b)	Colour rendering index (CRI)		≥ 80	5
				70 – 80	4
				< 70	0
B2.1.3	(c)	Luminaire efficacy	lm/W	≥ 100	5
				95 – 100	4
				90 – 95	2
				≤ 90	0
B2.1.4	(d)	Downward light output ratio (DLOR)	%	≥ 95	5
				90 – 95	4
				85 – 90	2
				≤ 85	0
B2.1.5	(e)	Time to full brightness	minutes	< 0.5	5
				0.5 – 1	4
				> 1	0
B2.1.6	(f)	Is the illumination pattern in a		Yes	5

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
		"batwing" shape?		No	0
Photometric Specifications (maximum points: 30)				Photometric score	
Photometric Specifications (section weight: 30%)				Weighted score = score above	

ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
B2.2	5.1.2	Electrical Specifications			
B2.2.1		Input current (maximum)	mA	300 350 400 500 > 500	5 4 3 2 0
B2.2.2	(c)	Total power consumption	W	60 - 70 70 - 80 80 - 90 >90	5 4 2 0
B2.2.3	(d)	Efficiency (total LED to total luminaire power consumption)	%	≥ 95 90 – 95 < 90	5 4 0
B2.2.4	(e)	Power factor		≥ 0.95 0.90 – 0.95 0.85 – 0.90 < 0.85	5 4 2 0
B2.2.5	(f)	Harmonic distortion	%	≤ 10 10 – 15 15 – 20 > 20	5 4 2 0
B2.2.6	(i)	Photocell		Yes No	5 0
Electrical Specifications (maximum points: 20)				Electrical score	
Electrical Specifications (section weight: 25%)				Weighted score = $(Score) * \left(\frac{25}{20}\right)$	

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
B2.3	5.1.4	Mechanical Specifications			
B2.3.1	(a)	General luminaire design		Yes	5
				Partially	3
				No	0
B2.3.2	(b)	Body material		Non-ferrous metal	5
				Ferrous metal	3
				Anything else	0
B2.3.3	(d)	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	(f)	Reflector material: High-grade super pure deep anodized aluminium		Yes	5
				No	0
B2.3.5	(h)	IK rating		≥ IK08	5
				IK07	3
				IK06	0
B2.3.6	(i)	IP rating		≥ IP66	5
				IP65	4
				IP64	3
				IP63	2
B2.3.7	(j)	Tilt adjustment relative to horizontal plane		Yes	5
				No	0
		Protractor fitted		Yes	5
				No	0
B2.2.8	(k)	Mounting device for fitment onto round pole (spigot)		Yes	5
				No	0
Mechanical Specifications (maximum points: 45)				Mechanical score	
Mechanical Specifications (section weight: 25%)				Weighted score = $(Score) * \left(\frac{25}{45}\right)$	

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ITEM NO	CLAUSE	DESCRIPTION	UNIT	Criteria	Score
B2.4	5.1.5	Guarantee			
B2.4.1	(a)	Luminaire housing (minimum)	years	≥ 10 7.5 – 10 5 – 7.5 < 5	5 4 2 0
B2.4.2	(b)	Electrical components (minimum)	hours	$\geq 30\ 000$ 25 000 – 30 000 20 000 – 25 000 $\leq 20\ 000$	5 4 2 0
B2.4.3	(c)	LED module (minimum) life expectancy	hours	$\geq 30\ 000$ 25 000 – 30 000 20 000 – 25 000 $\leq 20\ 000$	5 4 2 0
B2.4.4	5.1.6	Lead time for delivery from time of order	Calendar days	≤ 30 30 – 40 40 – 50 ≥ 60	5 4 2 0
Guarantee (maximum points: 20)				Guarantee score	
Guarantee (section weight: 20%)				Weighted score = score above	

B3 Physical luminaire performance evaluation

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

Only luminaires with both photometric and electrical performance compliance of 95% or more compared to submitted data will be considered technically acceptable for use on Eskom Properties as streetlights.

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Annexure C – Solar power component technical evaluation scoring matrix

This section must be read together with section 5.3 of this document.

C1 Mandatory evaluation criteria

Mandatory criteria are not 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
Technical specifications supplied on solar power system, including all components as listed in 3.3.1, 3.3.2 and 3.3.3		
Supporting test reports for system		
Solar power system guarantee certificate supplied		
Lead time for delivery within 42 calendar days from date of order		
Solar system maintenance strategy supplied		

C2 Qualitative evaluation criteria

After a solar power component offered has met all the mandatory criteria in C1, the submission will be assessed against the following criteria (shown below with their weightings):

Criteria	Section	Weight (%)
Battery requirements	5.3.1	30
Charge controller requirements	5.3.2	25
Solar Panels requirements	5.3.3	25
Guarantees		20
Total		100

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

Description	Compliance (%)	Score
Meets Eskom's requirements: no errors, risks, weaknesses or omissions.	80 → 100	5
Meets Eskom's requirements with qualifications: some qualifications required from tenderer to eliminate the errors, risks, weaknesses and omissions.	60 → 79	4
Does not meet Eskom's requirements: some errors, risks, weaknesses or omissions which can be corrected or overcome with negotiation and cost impact.	40 → 59	3

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Description	Compliance (%)	Score
Substantially does not meet Eskom's requirements: many errors, risks, weaknesses which may be difficult to be corrected or overcome and make acceptable.	20 → 39	2
No achievement of Eskom's requirements: existence of numerous errors, risks, weaknesses or omissions which cannot be corrected.	0 → 19	1
Totally deficient / non-responsive.	0	0

Threshold: The score that each tenderer receives will provide a numeric basis for tender comparison. The minimum weighted average score required for a solar power component to be considered must be 80% or above.

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