

 Eskom	Standard	Technology
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Title: **LED AIRCRAFT WARNING
LIGHTS FOR ESKOM
TELECOMMUNICATION
TOWERS**

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1. Introduction

The South African Civil Aviation Authority (SACAA) requires that certain Telecommunications towers have obstacle lights installed. These Telecommunications towers present a hazard to flight paths of aircrafts. Telecommunication towers should be marked with obstruction lights to make the sky safe to fly. A standard is required for the appropriate procurement and installation of these lights.

2. Supporting clauses

2.1 Scope

The scope of the document covers the specification of tower lights to be installed on Eskom Telecommunication's towers.

2.1.1 Purpose

The purpose of the document is to assist Eskom Telecommunications and its subsidiaries in evaluating and selecting tower obstacle lights that meets the SACAA and ICAO recommendations.

2.1.2 Applicability

This document shall apply throughout Eskom Telecommunications and its subsidiaries, especially to the planning and field service staff.

2.2 Normative/informative references

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

2.2.1 Normative

- [1] ISO 9001, Quality Management Systems.
- [2] ICAO annex 14: Aerodromes.
- [3] SA-CATS 139.
- [4] SANS 121 Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.
- [5] SANS 475, Luminaires for interior lighting, street lighting and floodlighting – Performance requirements
- [6] SANS 1088, Luminaire entries and spigots
- [7] SANS 1091, National colour standard
- [8] SANS 10108, The classification of hazardous locations and the selection of equipment for use in such locations
- [9] SANS 10389-1, Exterior lighting: Part 1: Artificial lighting of exterior areas for work and safety
- [10] SANS 10389-2, Exterior security lighting
- [11] SANS 60529, Degrees of protection provided by enclosures (IP Code)
- [12] SANS 60598-1, Luminaires Part 1: General requirements and tests
- [13] SANS 62262, Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
- [14] SANS 61347-1, Lamp control gear Part 1: General and safety requirements.

- [15] 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.
- [16] SANS 62031, LED modules for general lighting - Safety specifications.
- [17] SANS 62384, DC or AC supplied electronic control gear for LED modules - Performance requirements
- [18] SANS_62560, Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specification
- [19] SANS_62612, Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
- [20] EN 55015, Limits and methods of measurement of radio disturbance of electrical lighting or equipment.
- [21] EN 61000-3-2, Electromagnetic compatibility (EMC) Limits for harmonic current emissions
- [22] EN 61000-3-3, Electromagnetic compatibility (EMC) - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
- [23] EN 61547, Equipment for general lighting purposes: EMC immunity requirements
- [24] IEC-EN 62471, Photo biological Safety of Lamps and Lamp Systems for LED's
- [25] IES LM-79-08, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- [26] IES LM80, Approved Method: Measuring lumen maintenance of LED light sources
- [27] ARP 035, Guidelines for the installation and maintenance of street lighting
- [28] Electromagnetic Compatibility (EMC) Directive (2014/30/EU)
- [29] Low Voltage (LV) Directive (2014/35/EU) Directives.

2.2.2 Informative

- [30] <http://www.caa.co.za/Pages/Obstacles/Objects-affecting-airspace.aspx>.

2.3 Definitions

2.3.1 General

Definition	Description
Candela	The SI unit of light intensity
Colour rendering index (CRI)	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.
Colour temperature	Colour temperature is a characteristic of visible light and is stated in units of absolute temperature, known as 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".)
E27 lamp holder	27mm Edison screw light lamp base.
Efficiency	Ratio of total LED power consumption to total luminaire power consumption.
Equipment	Assemblies of components, sub-units or sub-assemblies usually contained in a suitable enclosure, and capable of performing an overall specified function.

Definition	Description
Harmonic distortion	The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.
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.
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.
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	An indication of how much light gets lost inside the luminaire. It is the ratio of light output emitted by the luminaire.
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.
Polycarbonate	A type of plastic used in sign faces, noted for its heat-resistance and impact strength.
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.
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.

Definition	Description
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".)

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
Ah	Ampere-hour
cd	Candela
CRI	Colour rendering index
DC	Direct Current
EMC	Electromagnetic Compatibility
ES	Edison Screw
ET	Eskom Telecommunications
ETS	Eskom Telecommunications Specification
EU	European Union
HPS	High pressure sodium
HV	High Voltage
Hz	Hertz
ICAO	International Civil Aviation Organisation
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
ISO	International Standardization Organization
K	Kelvin
LED	Light-emitting diode
lm	Lumen
LOR	Light output ratio
LTD	An electronic photometric data file in the EULUMDAT photometric data format
LV	Low Voltage
mA	milli-Ampere
mm	millimetre
OEM	Original Equipment Manufacturer

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Abbreviation	Description
RT&D	Research, Testing and Development
SACAA	South African Civil Aviation Authority
SA-CATS	South African Civil Aviation Technical Standards
SABS	South African Bureau of Standards
SANS	South African National Standard
SC	Study committee
ULOR	Upward light output ratio
UV	Ultraviolet
V	Volt
W	Watt

2.5 Roles and responsibilities

The responsibility to implement this document will lie within the relevant engineering department within ET and Power Delivery Engineering, as well as the Eskom subsidiaries installing tower lights.

2.6 Process for monitoring

Not Applicable.

2.7 Related/supporting documents

Not Applicable.

3. Specifications

All ET towers protruding above the horizontal earth surface outside the specified radius of 8km as measured from the aerodrome reference point shall have tower obstacle lights fitted as per the SACAA and ICAO recommendations and guidelines.

All ET towers shall have aircraft warning lights fitted.

3.1 Electrical specification

The Tower light system shall be powered by 48V (DC).

The Tower light system shall have a horizontal coverage of 360°.

The Tower light system shall have alarms contact for remote monitoring (alarms; tower light failure and power failure).

The Tower light system shall have surge protection.

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

The Tower light system shall have provision for day/night switching of the tower light.

The Tower light system shall make use of a LED type lamp.

The LED lamp shall be housed within an E27 lamp holder, which in turn shall be of a high quality ES ceramic base.

The LED lamp shall have a luminous intensity of 32cd or 450 Lm

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The LED lamp shall have a colour temperature of 4000k

The LED lamp shall comply with the following standards SANS60598 and EN55015.

The LED lamp shall be tested by Eskom prior to acceptance and installation.

3.2 Mechanical specification

The Tower light system and Tower light shall have an IP rating of 65 or better in accordance to the SANS 60529.

The tower light body shall be constructed from durable lightweight materials.

The tower light body shall not be spray painted but 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: clip, screws, bolt, nuts, washers, etc., must be manufactured from stainless steel (grade 304 or better).

The tower light diffuser shall be red and the material shall be UV stability (polycarbonate material) and resistant to shock, weather, corrosion, vibrations and hail.

The tower light system brackets, threaded bolts and nuts shall be stainless steel and shall be fitted with double nuts, with spring washers and must be of the universal type to fit any structure type.

Installation of the tower lights shall not require tower drilling for fitting, the installation shall be as per OEM instructions.

The tower light body shall have a minimum life expectancy of 10 years.

3.3 Guarantees

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

- a) Each luminaire housing for a minimum period of ten (10) years.
- b) The electrical components for 50 000 hours (five years).
- c) The LED lamp for 50 000 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.

3.4 Maintenance strategy

The tenderer/s must provide Eskom with a sustainable 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.

3.5 Location of tower lights and type of tower light

Tower lights shall be installed as close as practical to the top of a tower or mast. Intermediate tower lights shall be installed every 45m on the outside edge of the tower as shown in 1.

The tower light shall be installed at a distance of 3 meters and more from the tower antenna.

3.5.1 Tower height equal to or less than 45m in height from ground level

Type B (32cd) double low intensity light system shall be used for redundancy purposes and shall be installed at the top of the tower as indicated in Figure 1.

Type B lights shall be fixed (not flashing), colour red.

3.5.2 Towers greater than 45m and less than 150m in height from ground level

Type B (32cd) double low intensity lights shall be used for redundancy purposes and shall be installed at the top of the tower as indicated in Figure 1.

Type B (32cd) low intensity lights four off one on each leg of the tower shall be installed halfway up the tower

Type B lights shall be fixed (not flashing) colour red.

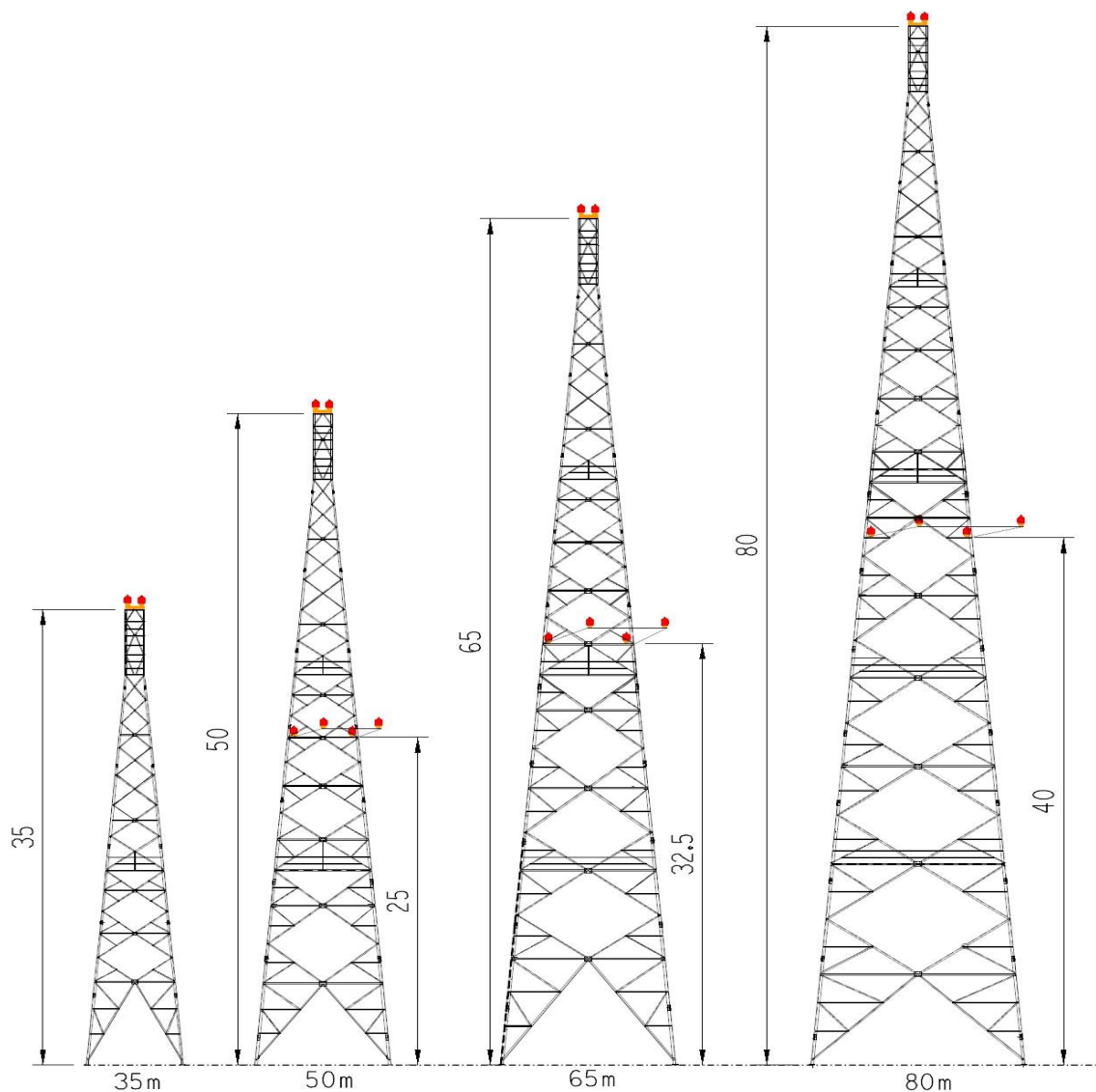


Figure 1: Lighting placement of Tower structures

4. Documentation

The following documents shall be provided by the aircraft warning light supplier:

- For the LED lamp/luminaire Provide test certificate for SANS 60598-1 compliance by an accredited Laboratory.
- For the LED lamp/luminaire Provide test certificate for EN 55015 compliance by an accredited Laboratory.

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- SACAA certificate.
- Proof of environmental testing.
- Resistance to temperature, pressure, humidity and hail documentation.
- Installation instructions/guidelines.
- Maintenance instructions.
- Expected life of the system.
- Alarm wiring diagrams.

5. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Joe Manyisa	Senior Manager - Eskom Telecommunications (Acting)
Bheki Ntshangase	Senior Manager Substation Engineering
Andile Maneli	Manager Substation Engineering
Cornelius Naidoo	Manager Telecommunication Technology

6. Revisions

Date	Rev	Compiler	Remarks
June 2020	3	Anton Naude	Lamp/luminaires changed to LED
Jan 2019	2	Anton Naude	ET tower light specification was required.
Dec 2018	1	Anton Naude	First issue

7. Development team

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

- Anton Naude

8. Acknowledgements

Everyone who took the time to read and comment on this document.

Annex A – Contractor's compliance statement

The tenderer shall submit a detailed statement of compliance for each and every requirement stated in the specification. Eskom Telecommunication's requirements for these compliance statements are detailed in this document. The tenderer is urged to pay special attention to these requirements.

SCHEDULE A:CONTRACTOR'S COMPLIANCE STATEMENT			
ITEM NO.	DESCRIPTION	Particulars of Eskom requirements- Comply/Partially comply/Non-comply	Description of Guaranteed Technical Particulars offered
	Electrical		
	Voltage		
	Power consumption		
	Luminous intensity		
	Colour temperature		
	Alarm monitoring system		
	Light coverage (360°)		
	Lamp holder material		
	Surge Protection		
	Mechanical		
	UV and weather resistance		
	Body material		
	Diffuser material		
	Documentation		
	SACAA certification		
	Environmental testing results submitted with tender		
	Maintenance documentation provided		
	Guarantees		
	Compliance to SANS 55015		
	Compliance to SANS 60598-1		
	Additional Information		
	Technical support provided		
	List of tools, software and keys needed to conduct maintenance to be supplied		
	Details of lead times		
	List of essential spare parts provided		
	Spares availability guaranteed		
	Assist with commissioning		