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# **ACSA Lighting Minimum Functional and Technical Requirements Guidelines**

## Document history

The document has been updated according to the table below:

Version	Author	Date	Comments/Changes
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This document has been reviewed by

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## **Acronyms or Abbreviations**

ATS	Automatic Transfer Switch
Ess	Essential
ICAO	International Civil Aviation Organization
HV	High voltage any voltages above 1000V
LCC	Life Cycle Costing
LV	Low Voltage and voltages between 0v and 1000V
U/G	Under ground
UPS	Uninterrupted Power Supply

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## Applicable References

The following normative standards are indispensable for application of these design requirements and technical specifications.

Standard Number	Description
IEC 61000-4-2	Electromagnetic compatibility (EMC) – Part 4: Electrostatic discharge immunity test – Basic EMC Publication.
IEC 61024-1	Protection of structures against lightning: Part 1: General principles
IEC 61643-1	Surge protective devices connected to low-voltage power distribution systems Part1: Performance requirements and testing methods
IEC 61662	Assessment of the risk of damage due to lightning (including amendments)
NRS 042	Guide for the protection of electronic equipment against damaging transients
	OHS ACT: The Occupational Health and Safety Act, Act 85 of 1993
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles – Specification and test methods
SANS 10142-1	Code of Practice for the wiring of premises
SANS 10114-1	Artificial lighting of interiors
SANS 10114-2	Interior Lighting – Emergency lighting
SANS 10114-1	Exterior and Interior lighting
SANS 10098-1	Public Lighting – the lighting of public thoroughfares
SANS 10098-2	Public lighting – The lighting of specific areas of streets and highways
SANS 204	Energy efficiency in buildings
SANS 60598	Luminaires – Part 1: General requirements and tests Luminaires – Part 2: Particular requirements – Section 3: Luminaires for road and street lighting
SANS 1088	Luminaire entries and spigots
SANS 1277	Street lighting luminaires
SANS 1063	Earth rods, couplers and connections
SANS 10313	The protection of structures against lightning
SANS 62305-1	Protection against Lightning: Part 1: General Principles
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 10225	The design and construction of lighting masts
SANS 657	
SANS 475	Luminaires for interior lighting, street lighting and floodlighting - Performance requirements
SANS 1088: 2004	Luminaire entries and spigots
SANS 529: 2001	Heat-resisting wiring cables
	ACSA Solar Guidelines

## 1 Preface

The guideline document has been prepared to guide or assist designers, contractors and other stakeholders preparing for work within our aerodromes for lighting of the non-runway areas while emphasizing the restrictions, regulations, and best practices for the safe movement of aircraft, visual comfort for workers, pedestrians, and airport traffic. The guideline document addresses the conflicting suggested levels based on multiple functions in an area, local regulations, and other expectations and preferences that airports are likely to demand. Within ACSA operated Airports, the document ensures sufficient lighting for operation, security, safety and environment at a maximised system performance

In order to keep the guideline relevant and accurate, format, content (law and technology) or presentation suggestion are welcome. After being examined and found suitable, they will be included as such. Otherwise, this guideline will be revised and updated every second year by Chief Electrical Engineer.

## 2 Lighting Minimum Requirement

- i. All lighting designs shall have optimised efficacy, economic efficiency, consistent temperature, Colour Rendering Index (CRI) and shall comply latest SANS
- ii. All indoor lighting shall be installed in areas that are accessible by ladder, hoist, scissor lift for ease of maintenance
- iii. All apron lighting with a pole of more than 6m shall be fitted with cat ladder for ease of maintenance
- iv. All lights shall be LED's for new installations and where retrofits are required with the appropriate colour temperatures; provide consistent colour temperature (tight binning), high CRI (>80), and rated life > 50,000 hours at a lumen depreciation of not more than 30% or better
- v. All as-build LUX models shall comply to LUX levels as tabulated in Annexures and the use to lighting specification in Equipment Technical Specifications
- vi. All outdoor lighting shall be constructed to sustain wind loads of up to 145km/h, weatherproof, hail proof, insect proof, corrosion proof, solar (including ultra-violet) resistant and vandal resistant.
- vii. All lighting shall incorporate day light integration and automation for better control
- viii. All lighting shall be made to create a comfortable environment for travellers and employers, with better lighting quality in temperature and colour
- ix. All lighting shall be designed or assembled in Republic of South Africa
- x. All lighting shall have photometric data issued by the SABS or SANAS accredited lighting laboratory. The photometric requirements as listed in SANS 475, Clause 4.7.1.1, shall be provided.

### 2.1 Airport Parking Facilities

- i. The long and short term shaded parkings, Multi Storey Parking facilities and connecting service roads and tunnels shall have special consideration to reduce glare, and light leakage into other areas. These areas are equipped with cameras for passenger safety, surveillance and increased law enforcement for crime prevention.

## **2.2 Airport Indoor Lighting**

- i. Areas includes offices, terminals, plant rooms, workshops, warehouses, medical rooms and any other Art or Decoration Lighting
- ii. Lighting shall be dimmable for smart controlling for the occupational and ambience requirements
- iii. Final connections to lighting shall be via 5A, three pin, un-switched plug system
- iv. All internal lighting will be supplied from the essential power supply
- v. Minimum IP rating of the light and control gear compartment, including driver compartment: IP44

## **2.3 Airport Perimeter and Street Lighting**

- i. Areas includes Airport precinct perimeter fence, vehicles roads, pedestrian roads within airport precinct
- ii. Frangible poles shall be used within the road reserve
- iii. All lighting poles and luminaire fittings shall be LED for retrofitting and solar powered LED lighting suitable for patrols/maintenance comfort
- iv. Pole placement and height Selection shall be considered to ensure adequate visibility in the vicinity of each aircraft, avoid shadows, and minimize glare
- v. All poles shall be made for maintainability
- vi. Luminaires shall be constructed from durable lightweight materials and shall be accompanied by comprehensive test reports certifying that the luminaires have successfully passed accelerated ageing tests on SANS 475 and shall provide proof that the luminaires have a satisfactory performance history
- vii. Minimum IP rating of the light and control gear compartment, including driver compartment: IP66.
- viii. Luminaires shall be Class 1 as per SANS 60598-1 and shall be of the totally enclosed type
- ix. Detailed lighting designs shall be produced which clearly indicating compliance to SANS 10098.1
- x. The lighting shall be supplied complete with a photocell receptacle mounted on the top surface of the lighting in a position where it is least likely to be affected by luminaire heat complied to NRS 025.
- xi. The design of each pole shall be accompanied by comprehensive strength calculations certified by a qualified professional structural engineer.

## **2.4 Airport Apron Lighting**

Areas includes Aircraft parking bays and equipment parking bays

- i. The illumination characteristics shall be in compliance with the requirements of ICAO Annexure 14, Appendix 2, Fig A2-12, A2-13 or A2-14
- ii. Pole placement and height Selection shall be considered to ensure adequate visibility in the vicinity of each aircraft, avoid shadows, and minimize glare
- iii. Fitting must come with Surge protection 20kV/20kA device mounted inside the gear compartment and it should be easily replaceable
- iv. The design of each pole shall be accompanied by comprehensive strength calculations certified by a qualified professional structural engineer
- v. The lighting shall be supplied complete with a photocell receptacle mounted on the top surface of the lighting in a position where it is least likely to be affected by luminaire heat complied to NRS 025

## **2.5 Control Technology**

The lighting control system shall be programmable for individual fixtures or zones.

A Complete daylight harvesting system shall be obtained through photocells for outdoor lighting

All indoor lighting shall be controlled by DALI technology that shall be interfaced with the IMCS system for monitoring



### 3 Equipment Technical Specifications

Specification Code	Existing Fittings	Existing (Watts)	LED Technology	Max LED Rating in Watts	Saving	Min Lumens/ Watt	Colour Temp	Minimum Lamp Life	Minimum Lamp Warranty & Max Lumen Depreciation	Electronic Control Gear Efficiency	CRI at Exit of Fixture	Cut-Out Dimensions (mm)	Minimum Beam Angle	Minimum Power Factor	Line Voltage With ± 15 % Tolerance	Minimum IP Rating	Minimum Lumens
ACSA-LED:001	Fluorescent Tubes T8/T5 Fittings (3 x 18W)	60W	LED Panel (600x600) (40W or less)	40W	20W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	590 x 590	≥ 110°	≥ 0.95	230 V	IP 44	≥ 5000
ACSA-LED:002	Fluorescent Tubes T8/T5 Fittings (2 x 36W)	60W	LED Panel (300x1200) (40W or less)	40W	20W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	590 x 1190	≥ 110°	≥ 0.95	230 V	IP 44	≥ 5000
ACSA-LED:003	Fluorescent Tubes T8/T5 Fittings (3 x 36W)	108W	LED Panel (600x1200) (60W or less)	60W	48W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	590 x 1190	≥ 110°	≥ 0.95	230 V	IP 44	≥ 5000
ACSA-LED:004	Compact Fluorescent Lamp - CFL ( 2 x 26W PL)	52W	LED downlighter (205 - 230mm diameter) (Comparable to 2 x 26W PL)	22W	30W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 230	≥ 110°	≥ 0.95	230 V	IP 44	≥ 2000
ACSA-LED:005	Compact Fluorescent Lamp - CFL ( 1 x 18W PL)	26W	LED downlighter (150 - 188mm diameter) (Comparable to 1 x 18W PL)	18W	8W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 188	≥ 110°	≥ 0.95	230 V	IP 44	≥ 2000
ACSA-LED:006	Halogen Lamp Downlights (30 - 50W)	50W	LED downlighter (76 - 110mm diameter) (10W or less)	10W	40W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 110	≥ 110°	≥ 0.95	230 V	IP 44	≥ 600
ACSA-LED:007	Halogen Lamp Downlights (70 - 150W)	50W	Recessed LED Compact (150 - 188mm cut out) (32 - 50W)	32W	18W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 188	≥ 110°	≥ 0.95	230 V	IP 44	≥ 10,000
ACSA-LED:008	Fluorescent Tubes T8/T5 Linear Fitting (1or2 x 58W)	58W	LED Recessed Linear Fitting or Linear Y-Shape S1200	44W	14W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	2400 x 120	≥ 110°	≥ 0.95	230 V	IP 44	≥ 2000
ACSA-LED:009	Halogen Lamp Downlights (30 - 50W)	12W	LED downlighter (76 - 110mm diameter) (10W or less) Warm White	10W	2W	>100 L/W	3000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 110	≥ 110°	≥ 0.95	230 V	IP 44	≥ 900
ACSA-LED:010	Recessed Linear Fitting (T5/88W - 2.4m )	88W	LED Recessed Linear Fitting or Y-Shape Linear (2.4m)	40W	48W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 110	≥ 110°	≥ 0.95	230 V	IP 44	≥ 900
ACSA-LED:011	Fluorescent Tubes T8/T5 Fittings (3 x 18W)	60W	LED Panel (600x600) (40W or less)	40W	20W	>100 L/W	3000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	590 x 590	≥ 110°	≥ 0.95	230 V	IP 44	≥ 5000
ACSA-LED:012	Metal Halide Industrial Bulk-head (250W)	250W	LED Bulkhead Lighting (Flood Lighing)	65W	185W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 8000
ACSA-LED:013	High Bay Induction Fittings (165W)	165W	Cyled Light 52W LED Surface Mount Downlighter	52W	113W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 44	≥ 10000
ACSA-LED:014	Edison Screw Type Lamp (CFL)	20W	LED Pin Type or Edison Screw Type	9W	11W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 44	≥ 1000
ACSA-LED:015	Decorative Bulk-Head Rectangula Fitting (CFL)	52W	LED Rectangular Decorative Bulk-head (Ambient Architectural - Staircases)	18W	34W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 1500
ACSA-LED:016	Mini Bulk-Head Round Fitting (Double CFL)	36W	LED Round Decorative Bulk-head	20W	16W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 1500
ACSA-LED:017	Open Channel Fluorescent Tube (T5/T8 58W)	60W	LED Linear Fitting (1.5m Fluorescent Equivalent))	24W	36W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 44	≥ 1000
ACSA-LED:018	Metal Halide Mini Flood Light with Stirrup	150W	LED Medium Flood Light with Stirrup	110W	40W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP66	≥ 10300
ACSA-LED:019	Rectangular Industrial Bulk-head (For Fire Escapes)	26W	LED Rectangular Industrial Bulk-head (Foor Fire Escapes)	18W	8W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 1000
ACSA-LED:020	Metal Halide Low Bay Canopy Light	250W	LED Low Bay Canopy Light	144W	106W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 10000
ACSA-LED:021	Linear Vapour Proof - Single	58W	LED Linear Vapour Proof	22W	36W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 2500
ACSA-LED:022	Linear Vapour Proof - Single	58W	LED Linear Vapour Proof (With Sensor and 40% Dimming)	22W	36W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 2500
ACSA-LED:023	Metal Halide Industrial High Bay Light (250W) Hanging	165W	LED Opal High Bay Hanging Light	144W	21W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 14000
ACSA-LED:024	Metal Halide Industrial High Bay Light (250W)	165W	LED Opal High Bay Light (Recessed)	144W	21W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	Surface Mount	≥ 110°	≥ 0.95	230 V	IP 66	≥ 14000
ACSA-LED:025	Fluorescent Tubes (2x58W) - (300x1500)	60W	LED Panel (300x1500) (40W or less) - (Comparable with 2 x 58W)	40W	20W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	590 x 1490	≥ 110°	≥ 0.95	230 V	IP 44	≥ 5000
ACSA-LED:026	Metal Halide Spot Lights (150W)	150W	LED Compact (150 - 188mm cut out) (32 - 50W)	40W	110W	>100 L/W	4000K	≥ 50,000	5 years; 20%	≥ 95% and ≤ 100%	>75 and ≤ 90	≤ 188	≥ 110°	≥ 0.95	230 V	IP 44	≥ 10000

## 4 Commissioning Acceptance Criteria

Near completion, inspecting and testing of all elements of the installation and associated lighting control system shall be verified in accordance with the codes and standards, Occupational Health and Safety Act 85/1993 and the employer technical specifications. Qualitative and quantitative needs shall be satisfied for the required illuminance through the following:

- Visual comfort which enables the passengers and employees to have a feeling of well-being
- Luminance distribution
- Illuminance
- Glare
- Directionality of light
- Color rendering and color appearance of the light
- Flicker and stroboscopic effects
- Maintenance factor
- Energy consumption and considerations
- Daylight models

Submit a "Certificate of Compliance by an accredited person" Annexure 1 in terms of the Occupational Health and Safety Act 85/1993, Electrical Installation Regulation 1992, to the Employer and forward a copy to the Engineer.

## 5 Maintenance and Handover Requirements

The requirements at project close out phase for electrical lighting works are tabulated below.

		Requirement Met	
Item No	Description of Handover requirement	Yes	No
1	Design Reports include design calculations with respect to the floor plan <ul style="list-style-type: none"> <li>• Electronic datasheets of equipment purchased</li> <li>• ISO LUX diagram of the luminaire installed in relation to mounting height to transverse and longitudinal distances</li> <li>• Pre and post Energy efficiency report (Retrofitting Project)</li> </ul>		
2	An electronic and hard copy of all routine tests results, and measurements as recorded during site and factory testing		
3	AS-build Drawings (DWG Format) of lighting circuitry and all data transfer layout		
	Complete sets of drawings (one electronic and three hard copies) of the entire project shall be included in the as built documentation. The set shall include: <ul style="list-style-type: none"> <li>• Architectural drawings and details</li> </ul>		

		Requirement Met	
Item No	Description of Handover requirement	Yes	No
	<ul style="list-style-type: none"> <li>Electrical wiring diagrams indicating all cable sizes, control units, site cable reticulation and schematic wiring diagrams applicable to the works               <ul style="list-style-type: none"> <li>Poles and pole adaptors sections</li> <li>Outreach arms</li> <li>Solar panels</li> <li>Batteries and enclosures</li> </ul> </li> <li>The electronic records are to be handed to the Asset Information Office at site</li> <li>Laminated and framed copies of circuitry schematic as applicable shall be fixed to the wall in a well illuminated and accessible area</li> </ul>		
4	Maintenance Requirements		
	<p>The manufacturer's recommendation with regard to the routine servicing and maintenance of all equipment shall be included in the manual. This data shall include</p> <ul style="list-style-type: none"> <li>The recommended service interval and the estimated hours required for each type of service,</li> <li>Routine tests which the Original Equipment Manufacturer would suggest are carried out</li> <li>A list of spares, tools and testing equipment supplied under this Contract.</li> <li>for each item of equipment, together with a list of agents/contractors authorized to carry out service/maintenance.</li> <li>For identified systems, plant and equipment, a proposed maintenance schedule shall be provided by the specialist for a period of 36 months after final delivery</li> <li>A list of spares and testing equipment that are not supplied under this Contract, but which may be required for future maintenance or testing.</li> </ul>		
5	<p>A list of "Nameplate Data" giving full particulars of serial numbers and other descriptive data pertaining to the equipment installed</p> <ul style="list-style-type: none"> <li>Bill of materials used</li> <li>All fixtures and lamp manufacturing information hard copy and electronic format</li> </ul>		

		Requirement Met	
Item No	Description of Handover requirement	Yes	No
6	Operating Instructions and Training		
	<ul style="list-style-type: none"> <li>• Detail system operating instructions and procedures for control and operations, communications protocol.</li> <li>• A complete description of all operating procedures and safety measures shall be included in the manual.</li> <li>• A basic "Fault Finding Guide" shall also be included.</li> <li>• Training shall be given to staff operating machinery and plant together with maintenance personnel. Training certificates shall be signed by all staff that has received training.</li> <li>• Letter of warranties</li> <li>• Disposal certificate of all lights if it was retrofitting</li> </ul>		

## Annexure A: Lighting Levels

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