

**PERFORMANCE SPECIFICATION: LED FLOODLIGHT LUMINAIRES FOR GENERAL
AREA, SECURITY AND HIGHMAST LIGHTING**

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Date	Rev.	Status	Prepared By	Reviewed By	Approved By	Authorised By

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REVISION CONTROL

Date	Rev No	Description	Revised By
14/07/2026	A	Internal Review	Phila Mkhize
22/07/2026	0	Authorised for use	M.Mlonzi

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1.0 SCOPE

This specification defines the performance and technical requirements for the supply of LED floodlight luminaires for TNPA facilities. This includes luminaire construction, materials and finishes, LED light sources, power supplies/drivers, optics, ingress protection, wiring, earthing, electromagnetic compatibility, packaging, and associated documentation.

2.0 REFERENCES

All materials and manufacturing shall comply with the latest editions of the following standards, codes, and regulations, unless otherwise specified:

Luminaires & Performance

SANS 475 – Luminaires for interior lighting, street lighting and flood lighting – Performance requirements

SANS 60598-1 – Luminaires – Part 1: General requirements and tests

SANS 60598-2-3 – Luminaires – Part 2-3: Particular requirements – Luminaires for road and street lighting

SANS 60598-2-5 – Luminaires – Part 2-5: Particular requirements – Luminaires for floodlights

IEC 61347-1 – Lamp control gear – Part 1: General and safety requirements

IEC 61347-2-13 – Lamp control gear – Part 2-13: Particular requirements for DC or AC supplied electronic control gear for LED modules

IEC 62384 – DC or AC supplied electronic control gear for LED modules – Performance requirements

SANS17576 - Light-emitting diode products for interior lighting, streetlighting and floodlighting
Performance requirements

Enclosures & Protection

SANS 60529 – Degrees of protection provided by enclosures (IP Code)

SANS 62262 – Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)

SANS 1088 – Luminaire entries and spigots

Electrical Safety & Wiring

SANS 10142-1 – The wiring of premises – Part 1: Low-voltage installations

IEC 60598-1 – Luminaires – Part 1: General requirements and tests (Earthing requirements)

SANS 1574 - Electric flexible cores, cords and cables with solid extruded dielectric insulation
Part 3: PVC-insulated cores and cables
SANS 1507 - Electric cables with extruded solid dielectric insulation for fixed installations
(300/500V to 1 900/3 300V) Part 3: PVC Distribution cables
SANS 529 - Heat-resisting wiring cables

Photometry & Lighting Design

IES LM-79 – Optical and Electrical Measurements of Solid-State Lighting Products
IES LM-80 – Measuring Lumen Maintenance of LED Light Sources
IES TM-21 – Projecting Long-term Lumen Maintenance of LED Light Sources
CIE Publication No. 27 – Photometry of Luminaires – C-Gamma system
SANS 10098 – Public lighting – The lighting of public thoroughfares and certain specific areas

Electromagnetic Compatibility (EMC)

SANS 61000-3-2 – Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions
SANS 61000-3-3 – Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
SANS 61000-4-5 – Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
IEC 55015 – Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
IEC 61547 – Equipment for general lighting purposes – EMC immunity requirements

Materials & Finishes

SANS 121 – Hot-dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods
EN 1706 – Aluminium and aluminium alloys – Castings – Chemical composition and mechanical properties (AC-44300DF grade)

Communication & Control

ANSI C136.41 – American National Standard for Roadway and Area Lighting Equipment – Dimming Control between Luminaires and External Lighting Controllers (NEMA 7-pin socket)

Quality & Compliance

ISO 9001 – Quality management systems – Requirements

OHSACT (Act 85 of 1993) – Occupational Health and Safety Act – Electrical Machinery Regulations (Earthing requirements)

ISO 9227: Corrosion tests in artificial atmospheres — Salt spray tests

IEC 60068: Environmental Testing

3.0 SERVICE CONDITIONS

3.1 The luminaires are intended for use in TNPA port environments, which are characterised by high humidity, saline atmospheres, and demanding operational conditions (Corrosion category C5-M in accordance with ISO 12944).

3.1.1 Environmental Conditions

3.1.1.1 Ambient temperature range: 0°C to +40°C

3.1.1.2 Relative humidity: 10% to 95% (non-condensing)

3.1.1.3 Coastal environment : Saline coastal environment with potential for airborne salt spray, dust, and moisture ingress

3.1.1.4 Dust and particulate matter : Moderate to high levels typical of industrial port facilities

3.1.2 Electrical Supply Conditions

3.1.2.1 Nominal supply voltage: 230 V AC $\pm$ 10%

3.1.2.2 Supply frequency: 50 Hz $\pm$ 5%

3.1.2.3 Voltage fluctuations and surges: Typical of industrial power networks with potential for switching transients

3.1.3 Mechanical Conditions

3.1.3.1 Vibration: Low to moderate levels typical of industrial buildings

3.1.3.2 Mounting: Surface/wall mounting, pendant mounting, or Unistrut systems

3.2 All luminaires supplied shall be suitable for continuous operation under the above conditions without degradation of performance, reduction of service life, or failure of components.

3.3 The luminaire's thermal management system shall be capable of maintaining LED junction temperatures within acceptable limits at the maximum specified ambient temperature of 40°C.

3.4 The luminaire's corrosion protection (marine-grade aluminium, powder coating, stainless steel fasteners, etc.) shall be sufficient to withstand the saline coastal atmosphere without deterioration during the warranted period.

4.0 STANDARD OF EQUIPMENT

- 4.1 Equipment shall be of a high-quality design and manufacture and shall comply with the relevant specifications and recommendations mentioned in this specification.
- 4.2 Every reasonable precaution and provision shall be incorporated in the design of the equipment for the safety and security of the system and of those concerned with its operation and maintenance.
- 4.3 Any proposed alternative equipment or material not strictly complying with the specified requirements shall be submitted to the TNPA's Technical Officer for prior written approval. Such approval will not diminish the tenderer's responsibility to meet the performance requirements.

5.0 MATERIALS AND FINISHES

- 5.1 The luminaire housing shall be manufactured from marine-grade aluminium alloy EN 1706 AC-44300DF or technically equivalent and approved. A certified Metallurgical Test Report (MTR) confirming the grade and quality of the aluminium shall be provided with the tender submission.
- 5.2 The luminaire shall be supplied in a raw aluminium finish or a specified marine-grade coating to ensure durability in a corrosive port environment. Front plates and support frames shall be interchangeable to maintain a consistent modular aesthetic.
- 5.3 All external components (e.g., toggle clips, bolts, screws, nuts, washers) shall be manufactured from stainless steel grade AISI 304 or higher.
- 5.4 Threaded inserts (helicoils) shall be used for all tapped holes in the aluminium housing to prevent galling and corrosion between stainless steel screws and the aluminium.
- 5.5 The front protective lens protecting the LED array shall be manufactured from high-impact, UV-stabilized polycarbonate, providing an IK10 impact resistance rating.
- 5.6 One-piece gaskets, made of closed-cell silicone sponge material, shall be fitted into grooves in the housing and shall be seated in a manner ensuring the integrity of the IP66 rating. Gaskets shall not work loose during maintenance of the luminaire.

6.0 SYSTEM DESCRIPTION

- 6.1 The luminaire shall be modular, interchangeable, and suitable for both new installations and retrofits.
- 6.2 The luminaire shall comply with SANS 60598-2-5 and, where applicable, SANS 60598-2-3. The luminaire shall comply with SANS 475, demonstrated by accredited test reports.

- 6.3 The luminaire shall be IEC 60598-1 compliant and shall be a totally enclosed type.
- 6.4 Luminaires shall be delivered fully assembled with housing, driver, LED module, and protective lens.
- 6.5 The luminaire housing shall incorporate a robust hinging mechanism mounted on a spigot base casting to facilitate easy access for maintenance.
- 6.6 The luminaire shall be supplied with a mounting stirrup manufactured from heavy-duty hot-dipped galvanized steel (5 x 50mm) or a bottom-entry die-cast aluminium pole cap suitable for a 76mm diameter spigot. The pole cap shall be bolted to the housing.
- 6.7 Luminaire spigot entries shall comply with SANS 1088.
- 6.8 Any painted/coated luminaire shall successfully withstand a minimum of 1,000-hour salt spray test in accordance with ISO 9227.
- 6.9 The luminaires shall be supplied with a NEMA 7-pin socket (ANSI C136.41) suitable for future integration with tele-management control systems.
- 6.10 Preference may be given to locally manufactured products where permitted by procurement requirements.

7.0 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

7.1 Luminaire Construction

- 7.1.1 The luminaire housing shall be designed to accommodate LED light sources with rated powers from 50 W upwards, with a standard range extending to 1800 W and higher wattages available where required.
- 7.1.2 The luminaire housing shall incorporate a marine-grade, high pressure die cast aluminium with heat sink for passive cooling of the LED light source. Active cooling (fans) or liquid cooling is prohibited.
- 7.1.3 The external surface design shall prevent the accumulation of dirt, dust, and the nesting of insects or ants, ensuring continuous effective cooling.
- 7.1.4 The thermal design shall ensure the shortest possible path for heat conduction from the LED junction to the exterior, ensuring the LED's useful life is not compromised.
- 7.1.5 The cooling fins shall be strategically designed to maximize heat dissipation. The cooling fin surfaces shall be self-cleaning or designed to prevent the accumulation of dirt and debris.
- 7.1.6 The cooling rib height-to-width ratio shall not exceed 0.7.
- 7.1.7 Thermal protection shall be incorporated in the luminaire to prevent overheating.
- 7.1.8 The housing shall be secured using stainless steel latches and captive access screws.

- 7.1.9 All parts requiring maintenance and cleaning shall be easily accessible. All screws used to secure access covers shall be held captive when opened to prevent loss.
- 7.1.10 The design shall allow for upgrading and/or servicing of the LED unit and the driver/power supply by means of a hinging mechanism or a similar tool-less method for accessing and replacing the optical/gear compartment, allowing for future technological integration.

7.2 LED Light Source

- 7.2.1 The LEDs shall be high efficiency, delivering a minimum of 125 lumens/watt (Absolute photometry) with a Colour Rendering Index (CRI) ≥ 70 for security/yard lighting and CRI ≥ 80 for operational working areas.
- 7.2.2 The light source shall have a correlated colour temperature (CCT) of 3000K to 4000K (± 500 K) as specified by project requirements.
- 7.2.3 The luminaire system efficacy (including driver losses) shall generate a minimum of 122 lumens per watt.
- 7.2.4 The luminaire shall be designed to operate within an ambient temperature (T_a) range of $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$. The LED light source shall have a minimum useful lifetime of 100,000 hours at L95/B10, measured at a T_q (or T_c) temperature of $25\text{ }^{\circ}\text{C}$, or better.
- 7.2.5 The junction temperature (T_j) of the LED power supply/driver shall be managed according to the manufacturer's specifications. The design shall ensure the LED junction temperature does not exceed the maximum allowable temperature for the specific drive current.

Table 1: Allowable junction temperature

Junction current	Allowable junction temperature ($^{\circ}\text{C}$)
1.5 A	135
1 A	150
700 mA	167
350 mA	185

7.3 Power Supply / Driver

- 7.3.1 The power supply (driver) compartment shall be designed with sufficient space to allow for the safe and easy replacement of components or repairs.
- 7.3.2 The power supply/driver shall be protected against surges by a minimum 10kV/10kA external inline fused surge protection device (SPD) mounted on the 7-pin NEMA socket. This SPD shall be easily replaceable and shall fail in an open-circuit mode to

protect the luminaire from subsequent surges.

- 7.3.3 The LED driver shall have a minimum rated lifetime of 100,000 hours, with a maximum failure rate of 10% (F10), measured at a Tq (or Tc) temperature of 25 °C, or better.
- 7.3.4 The LED driver shall operate at a Power Factor (PF) of 0.95 or greater.
- 7.3.5 The Total Harmonic Distortion (THD) of the LED driver shall not exceed 8%, as stipulated in SANS 61000-3-2, to prevent interference with the electrical network and avoid light source flicker.
- 7.3.6 The driver shall support 0-10 V and DALI dimming as specified by project requirements.

7.4 Ingress Protection (IP)

- 7.4.1 The LED light source compartment shall have an Ingress Protection (IP) rating of IP66 as a minimum to prevent corrosion and premature failure in a port environment.
- 7.4.2 The LED light source compartment shall form a perfect seal to prevent the entry of moisture, dust, and insects.
- 7.4.3 The power supply compartment shall have a minimum IP66 ingress protection rating.
- 7.4.4 The luminaire shall have a degree of protection that complies with SANS 60598-1.
- 7.4.5 The IP ratings shall be certified by a SABS/SANAS accredited test report for the specific luminaire model.

7.5 Optics

- 7.5.1 The luminaire shall be available with a variety of lens options to provide the desired light distribution for different applications.
- 7.5.2 Luminaire photometry shall be performed according to the C-Gamma system as detailed in CIE Publication No. 27 (or equivalent current standard).
- 7.5.3 The intensity distribution table (candela) shall be provided in a suitable electronic format (e.g., IES or LDT) for use with commercially available lighting design software.
- 7.5.4 The performance of the LED luminaires shall be verified via a lighting design for a representative area as per SANS 10098, based on criteria specified by the responsible engineer.
- 7.5.5 Encrypted luminaire data files suitable for design software shall be readily available on request.

7.6 Wiring and Electrical Connections

- 7.6.1 The internal wiring of the luminaires shall be flexible and suitably insulated to

withstand the voltage and temperature encountered in service.

- 7.6.2 The supply terminals shall accept the appropriate conductor sizes and be easily accessible.

7.7 Earthing

- 7.7.1 The Luminaires shall be designed to facilitate earthing as per the Electrical Machinery Regulations of the OHSACT (Act 85 of 1993).
- 7.7.2 Metal parts that may become live in the event of an insulation fault shall be permanently and reliably connected to an earthing terminal, complying with the test specified in SANS 60598-2-5.
- 7.7.3 Earthing terminals shall comply with clause 7.2 of SANS 60598-1. All parts of an earth terminal shall be made of brass or other corrosion-resistant metal, with bare (unpainted/varnished) contact surfaces.
- 7.7.4 Earth connections shall be by means of suitable lugs, designed to prevent electrolytic corrosion (using appropriate bi-metallic washers if necessary).

7.8 Electromagnetic Compatibility

- 7.8.1 The floodlight shall comply with IEC 55015 (Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment).

7.9 Packaging and Transport

- 7.9.1 The luminaires shall be packed in a manner that ensures protection during handling and transport by road, rail, or sea. The packaging shall be designed to prevent vibration damage to the LED modules and control gear during transit.
- 7.9.2 Where sea transport is involved, a suitable dehydrating agent (desiccant) shall be included in the packaging to prevent corrosion.

8.0 WARRANTY AND DOCUMENTATION

- 8.1 The tenderer shall guarantee all equipment supplied against this specification for a period of five (5) years (60 months) from the date of delivery or as otherwise agreed in the purchase order. The tenderer shall explicitly state their compliance herewith.
- 8.2 This guarantee shall cover all materials, parts, workmanship, performance, and efficiency of the equipment supplied.
- 8.3 Should any part or equipment fail during the 60-month guarantee period due to defective materials or workmanship, the supplier shall immediately replace such part or equipment free of charge, including all costs for transport and associated logistics.

- 8.4 The luminaire shall have a rated LED lifetime of not less than 100,000 hours at L95/B10. Throughout the warranty period, the luminaire shall maintain its specified photometric performance, with chromaticity shift remaining within the manufacturer's specified limits.
- 8.5 The Contractor shall submit the following documentation:
- a. Product data sheets and catalogues.
 - b. Type test reports for the luminaire, conforming to SANS 60598-1.
 - c. Test reports for the SANS 475 performance mark.
 - d. Test reports for the SANS 60598-2-5 safety mark.
 - e. Metallurgical test reports confirming the materials used for the luminaire housing.
 - f. LM-80 (Measuring Lumen Maintenance of LED Light Sources) report.
 - g. LM-79 (Electrical and Photometric Measurements of Solid-State Lighting Products) report.
 - h. TM-21 (LED Lifetime prediction extrapolation method) report.
 - i. IP rating test reports for the complete luminaire in accordance with SANS 60529.
 - j. Ambient temperature (Ta rating) test report in accordance with SANS 475.
 - k. Operation and maintenance manuals.
 - l. Lighting design calculations and photometric data files (IES/LDT format).
 - m. Vibration testing in accordance with IEC 60068.
- 8.6 All test reports shall be issued by a SANS or IEC accredited test authority (e.g., SANAS accredited laboratory).

9.0 QUALITY ASSURANCE

- 9.1 The design, assembly, and testing of the LED luminaire shall be undertaken in an ISO 9001:2015 certified facility.
- 9.2 The Contractor's quality management system shall comply with the requirements of SANS/ISO 9001. These requirements are mandatory for all items supplied against this specification.
- 9.3 All products shall be factory tested and quality-assured prior to dispatch.
- 9.4 All devices shall operate without perceptible delay, flicker, or interference under normal service conditions.
- 9.5 Prior to bulk delivery, the Contractor shall supply a full set of sample luminaires for inspection and approval by the Engineer. Samples shall be subject to testing to verify compliance with the performance requirements specified herein.