

PERFORMANCE SPECIFICATION: INDUSTRIAL LED LOWBAY LUMINAIRES

Signatures						
22/07/2026	0	Authorised for use	Phila Mkhize	Sifiso Dlamini	Sudesh Sewdayal	Malibongwe Mlonzi
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INDEX

SECTION	CONTENTS
1	SCOPE
2	REFERENCES
3	SERVICE CONDITIONS
4	STANDARD OF EQUIPMENT
5	MATERIALS AND FINISHES
6	SYSTEM DESCRIPTION
7	FUNCTIONAL AND PERFORMANCE REQUIREMENTS
8	WARRANTY AND DOCUMENTATION
9	QUALITY ASSURANCE

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1.0 SCOPE

- 1.1 This specification defines the performance and technical requirements for the supply of LED lowbay luminaires for TNPA facilities.
- 1.2 This includes luminaire construction, materials and finishes, LED light sources, power supplies/drivers, optics, glare control, ingress protection, surge protection, mounting systems, emergency battery backup (where specified), hazardous area variants (where specified), wiring, earthing, electromagnetic compatibility, packaging, and associated documentation.
- 1.3 The luminaires are intended for use in TNPA port facilities, which are characterised by high humidity and saline atmospheres. All equipment supplied shall be designed and manufactured to withstand these conditions and provide reliable, long-term service.
- 1.4 This specification covers LED lowbay luminaires designed for energy-efficient lighting in industrial, commercial, and petrochemical retail environments, suitable for applications including industrial halls, entrance plazas, parking facilities, warehouses, as indicated in the relevant lighting design schedules.
- 1.5 The luminaires shall be supplied complete with all necessary mounting hardware, LED drivers, surge protection devices, and all required certification and test documentation as specified herein.
- 1.6 Where specified in the tender schedule, the luminaires shall be supplied with integrated emergency battery backup systems providing runtime complying with IEC 60598-2-22.
- 1.7 Where specified in the tender schedule, the luminaires shall be supplied in Zone 2 or Zone 21/22 hazardous area versions.

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 60598-2-1 – Luminaires – Part 2-1: Particular requirements – Fixed general purpose luminaires

SANS 60598-2-22 – Luminaires – Part 2-22: Particular requirements – Luminaires for emergency lighting

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)

Electrical Safety & Wiring

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

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

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

Hazardous Areas (where applicable)

SANS 60079-0 / IEC 60079-0 – Explosive atmospheres – Part 0: Equipment – General requirements

SANS 60079-7 / IEC 60079-7 – Explosive atmospheres – Part 7: Equipment protection by increased safety "e"

SANS 60079-10-1 / IEC 60079-10-1 – Classification of areas – Explosive gas atmospheres

SANS 60079-10-2 / IEC 60079-10-2 – Classification of areas – Explosive dust atmospheres

Emergency Lighting (where applicable)

IEC 61347-2-7 – Lamp controlgear – Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)

IEC 62034 – Automatic test systems for battery powered emergency escape lighting

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

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

EN 1706 – Aluminium and aluminium alloys – Castings – Chemical composition and mechanical properties (AC-44300 grade)

ISO 12944 – Paints and varnishes – Corrosion protection of steel structures by protective paint systems

Quality & Compliance

ISO 9001 – Quality management systems – Requirements

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

3.0 SERVICE CONDITIONS

3.1 The luminaires shall be designed and manufactured to operate reliably under the following service conditions typically encountered in TNPA port facilities (e.g., industrial facilities, warehouses, workshops, parking facilities, and other harsh environment applications):

3.1.1 Environmental Conditions

- a. Ambient temperature range: 0°C to +40°C
- b. Relative humidity: 10% to 95% (non-condensing)
- c. Coastal environment : Saline coastal environment with potential for airborne salt spray, dust, and moisture ingress
- d. Dust and particulate matter : Moderate to high levels typical of industrial port facilities

3.1.2 Electrical Supply Conditions

- a. Nominal supply voltage: 230 V AC $\pm$ 10%
- b. Supply frequency: 50 Hz $\pm$ 5%

- c. Voltage fluctuations and surges: Typical of industrial power networks with potential for switching transients

3.1.3 **Mechanical Conditions**

- a. Vibration: Low to moderate levels typical of industrial buildings
- b. 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-44300 (or superior), providing excellent thermal management and corrosion resistance. 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 with a powder-coated finish in a White Brilliant finish, providing a durable, corrosion-resistant surface suitable for industrial environments.
 - 5.2.1 The powder coating shall be applied over a suitable pre-treatment process to ensure optimal adhesion.

- 5.2.2 The powder coating shall have a minimum thickness of 60 microns.
- 5.2.3 The powder coating shall be UV-stabilised to prevent chalking and discolouration over time.
- 5.2.4 The colour shall be as specified in the tender schedule or as agreed with the Engineer.
- 5.2.5 The powder coating shall comply with the corrosion protection requirements of ISO 12944 for the relevant industrial environment.
- 5.3 All external fasteners (latches, clips, bolts, screws, nuts, washers) shall be manufactured from stainless steel grade AISI 304 or higher.
- 5.4 The luminaire protector shall be available in the following options:
 - Glass protector (standard)
 - High-impact polycarbonate protector (when specified)
- 5.5 All external fasteners (latches, clips, bolts, screws, nuts, washers) shall be manufactured from stainless steel grade AISI 304 or higher.
- 5.6 The luminaire shall be designed for ease of installation and shall be maintenance-free under normal operating conditions.

6.0 SYSTEM DESCRIPTION

- 6.1 The luminaire shall be an LED lowbay fitting designed for energy-efficient lighting in industrial, commercial and petrochemical retail environments.
- 6.2 The luminaire shall bear the SANS 60598-1 safety mark and shall comply with the specifications as per SANS 60598-2-1.
- 6.3 The luminaire shall be of the totally enclosed type.
- 6.4 Luminaires shall be delivered fully assembled with housing, LED driver, LED module, and protector.
- 6.5 The luminaire shall feature an easily accessible power supply/driver compartment to facilitate maintenance.
- 6.6 The luminaire shall be designed with glare-reduced light distribution (UGR requirement where applicable) and shall be flicker-free in all operating modes.
- 6.7 The luminaire shall be designed for flexible mounting options, including:
 - Surface mounting directly to ceilings
 - Pendant mounting
 - Mounting onto Unistrut channel systems
- 6.8 The luminaire shall be designed with a uniquely designed optical compartment to meet LED lifetime expectations.

- 6.9 The luminaire shall be suitable for use in harsh and demanding environments.
- 6.10 Preference may be given to locally manufactured products in accordance with applicable procurement requirements.
- 6.11 Where specified, the luminaire shall be supplied with an integrated emergency battery backup system.
- 6.12 Where specified, the luminaire shall be available in Zone 2 and 21/22 versions for hazardous area applications.
- 6.13 Where specified in the tender schedule, the luminaire shall be supplied with an optional integrated movement and daylight sensor for additional energy savings.

7.0 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

7.1 Luminaire Construction

- 7.1.1 The luminaire housing shall be manufactured from marine-grade aluminium alloy EN 1706 AC-44300 (or superior), providing excellent thermal management and corrosion resistance.
- 7.1.2 The luminaire shall incorporate a marine-grade aluminium heat sink for passive cooling of the LED light source. Active cooling (fans) or liquid cooling is prohibited.
- 7.1.3 The luminaire shall be designed to operate LED light sources of up to 144W in an ambient temperature (T_a) environment of up to 40°C.
- 7.1.4 The power supply/driver compartment shall be easily accessible for maintenance purposes.
- 7.1.5 The design of the external surfaces shall prevent the accumulation of dirt and dust, ensuring continuous effective cooling.
- 7.1.6 The luminaire shall provide glare-reduced light distribution.
- 7.1.7 All parts requiring maintenance and cleaning shall be easily accessible.

7.2 LED Light Source

- 7.2.1 The LEDs shall be high efficiency, delivering minimum effective lumens of 160 lm/W at 25°C or better.
- 7.2.2 The effective lumen package of the fitting shall be as specified in the tender schedule.
- 7.2.3 The light source shall have a colour temperature (CCT) of 3000K, 4000K or 5700K as specified in the tender schedule.
- 7.2.4 The Colour Rendering Index (CRI) shall be 70 minimum ($CRI \geq 70$).
- 7.2.5 The luminaire shall provide uniform luminance with low glare due to the prismatic diffuser design.
- 7.2.6 The expected useful lifetime shall be 100,000 hours, at a lumen depreciation of not

more than 30% (L70) at an ambient temperature (Tq) of 25°C.

7.3 Power Supply / Driver

- 7.3.1 The power supply (driver) compartment shall be easily accessible for maintenance purposes.
- 7.3.2 The driver shall be of the constant-current type.
- 7.3.3 The driver shall incorporate the following protection features:
- Overload protection
 - Short circuit protection
 - Surge protection
- 7.3.4 The driver shall support the following electrical characteristics:
- Rated supply voltage: 198 – 264 V AC
 - Mains frequency: 50Hz
 - Rated power: As specified in the tender schedule
 - Power Factor ≥ 0.90
 - THD $\leq 10\%$
 - Flicker-free operation under normal operating conditions

7.4 Surge Protection

- 7.4.1 The luminaire shall be equipped with a minimum 10kV / 10kA surge protection as standard.
- 7.4.2 20 kV / 20 kA surge protection shall be provided where specified in the tender schedule.
- 7.4.3 The surge protection device shall be field-replaceable and shall fail in an open-circuit mode to protect the luminaire from further surges.

7.5 Emergency Battery Backup System (Where Specified)

- 7.5.1 Where specified, the luminaire shall be equipped with an integrated emergency battery backup system, complying with SANS 60598-2-22 / IEC 60598-2-22.
- 7.5.2 The emergency control gear shall be suitable for operation with LED modules.
- 7.5.3 The emergency control gear shall be compatible with premium LED modules operating alongside independent external drivers.
- 7.5.4 The emergency duration shall be a minimum of as specified in the tender schedule.
- 7.5.5 The battery type shall be suitable for the specified emergency duration and shall be replaceable.

- 7.5.6 Charging indication shall be provided via an external LED pilot light indicating active battery charging status.
- 7.5.7 The emergency control gear shall incorporate the following protection features:
- Battery reverse polarity protection
 - Overcharge protection
 - Over-discharge protection
 - Short circuit protection
- 7.5.8 The emergency system shall be designed to automatically switch to emergency mode upon mains supply failure and automatically revert to normal operation upon mains restoration, with seamless transition between modes.
- 7.5.9 The battery type shall be Lithium-ion (LiFePO₄) or equivalent.
- 7.5.10 The emergency control gear shall have a hardware warranty as specified in Section 9.0.
- 7.5.11 The emergency system shall be designed to automatically switch to emergency mode upon mains supply failure and automatically revert to normal operation upon mains restoration, with seamless transition between modes.
- 7.6 Optional Movement Sensor**
- 7.6.1 Where specified, the luminaire shall be equipped with an optional integrated movement sensor for additional energy savings.
- 7.6.2 The sensor shall be field-adjustable to suit different application requirements.
- 7.6.3 The sensor shall provide detection of motion within the designated area and shall switch the luminaire between full output and standby dimming modes.
- 7.7 Ingress Protection and Impact Resistance**
- 7.7.1 The luminaire shall have an Ingress Protection (IP) rating of IP65, providing:
- Complete protection against dust ingress
 - Protection against the effects of water jets
- 7.7.2 The LED and controller compartment shall form a seal to prevent the ingress of dust and moisture.
- 7.7.3 Luminaire impact protection rating shall be minimum IK08.
- 7.7.4 The IP and IK ratings shall be certified by test reports for the specific luminaire model.
- 7.8 Optics and Diffuser**
- 7.8.1 The luminaire shall be supplied with a protector in the following options:

- Glass protector (standard)
- High-impact polycarbonate protector (optional)

7.8.2 The protector shall provide glare-reduced light distribution

7.8.3 The diffuser shall be UV-stabilised to prevent discolouration over time.

7.9 **Wiring and Electrical Connections**

7.9.1 The internal wiring of the luminaires shall be flexible and suitably insulated to withstand the voltage and temperature encountered in service.

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

7.10 **Earthing**

7.10.1 Luminaires shall be designed to facilitate earthing as per the Electrical Machinery Regulations of the OHSACT (Act 85 of 1993).

7.10.2 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 60598-2-1.

7.10.3 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.

7.10.4 Earth connections shall be by means of suitable lugs, designed to prevent electrolytic corrosion.

7.11 **Electromagnetic Compatibility**

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

7.12 **Hazardous Area Versions (Where Specified)**

7.12.1 Where specified in the tender schedule, the luminaire shall be supplied in hazardous area versions suitable for Zone 2 or Zone 21/22 applications.

7.12.2 The hazardous area versions shall comply with the relevant parts of the SANS 60079 / IEC 60079 series of standards.

7.12.3 The hazardous area versions shall be certified by an accredited test authority and shall bear the appropriate Ex marking.

7.13 **Packaging and Transport**

- 7.13.1 The luminaires shall be packed in a manner that ensures protection during handling and transport by road, rail, or sea.
- 7.13.2 The packaging shall be designed to prevent vibration damage to the LED modules and control gear during transit.
- 7.13.3 Where sea transport is involved, a suitable dehydrating agent (desiccant) shall be included in the packaging to prevent corrosion.
- 7.13.4 Lithium-ion battery packs shall be transported in accordance with applicable dangerous goods regulations.

8.0 CERTIFICATION AND TEST REPORTS

- 8.1 The tenderer shall provide the following documentation:
 - a. Product data sheets and catalogues.
 - b. Type Test Report conforming to SANS 60598-1.
 - c. Test reports for the SANS 60598-2-1 safety mark.
 - d. Test reports for the SANS 60598-2-22 emergency lighting safety mark (where applicable).
 - e. LM-80 (Measuring Lumen Maintenance of LED Light Sources) report.
 - f. LM-79 (Electrical and Photometric Measurements of Solid-State Lighting Products) report.
 - g. TM-21 (LED Lifetime prediction extrapolation method) report.
 - h. IP rating test reports for the complete luminaire in accordance with SANS 60529 (IP65).
 - i. IK rating test reports in accordance with SANS 62262 (IK08).
 - j. Surge protection test reports confirming 10kV/10kA capability.
 - k. Photometric test reports and photometric data files (IES/LDT format) for both normal and emergency modes (where applicable).
 - l. Hazardous area certification (where applicable) confirming Zone 2 or Zone 21/22 compliance.
 - m. Emergency lighting test report conforming to SANS 60598-2-22, including:
 - Emergency duration test report
 - Battery charging and discharge characteristics
 - Battery temperature range compliance
 - Compliance with IEC 61347-2-7

9.0 WARRANTY AND DOCUMENTATION

- 9.1 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.

- 9.2 This guarantee shall cover all materials, parts, workmanship, performance, and efficiency of the equipment supplied, including the LED module, driver, and surge protection device.
- 9.3 Where emergency battery backup is supplied, the emergency battery pack warranty shall be held with the battery manufacturer and shall cover the battery for the full warranty period.
- 9.4 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.
- 9.5 The Contractor shall submit all required documentation as detailed in Section 8.0.

10.0 QUALITY ASSURANCE

- 10.1 The design, assembly, and testing of the luminaire shall be undertaken in an ISO 9001:2015 certified facility.
- 10.2 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.
- 10.3 All products shall be factory tested and quality-assured prior to dispatch.
- 10.4 All devices shall operate without perceptible delay, flicker, or interference under normal service conditions.
- 10.5 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.
- 10.6 The emergency lighting function shall be tested at the factory prior to dispatch to verify:
- Correct transition to emergency mode upon mains failure
 - Minimum specified emergency duration
 - Correct recharging function upon mains restoration