

PERFORMANCE SPECIFICATION: LED CIRCULAR DOWNLIGHT LUMINAIRES (TYPE 2)

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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 recessed downlighters for TNPA facilities.
- 1.2 This includes luminaire construction, materials and finishes, LED light sources, power supplies/drivers, optics, glare control, ingress protection, wiring, earthing, electromagnetic compatibility, emergency battery backup (where specified), 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 recessed downlighters in four sizes (Mini, Compact, Standard, and Large), suitable for professional indoor applications including offices, commercial buildings, reception areas, corridors, and retail spaces, as indicated in the relevant tender schedule.
- 1.5 luminaires shall be engineered for maximum energy savings, superior visual comfort, and extreme longevity, making them ideal for high ceilings or office areas where maintenance is disruptive.
- 1.6 The luminaires shall be supplied complete with all necessary mounting hardware, LED drivers, and all required certification and test documentation as specified herein. Where specified, luminaires shall be supplied with integrated emergency battery backup systems.

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

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

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 indoor service conditions typically encountered in TNPA port facilities (e.g., offices, corridors, reception areas, and commercial spaces):

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 levels, typical of Port facilities

3.1.2 Electrical Supply Conditions

- a. Nominal supply voltage: 220V to 240 V AC
- 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 buildings
- b. Mounting: Recessed mounting in ceilings

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 (aluminium housing, powder coating, 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 die-cast aluminium, serving as a heavy-duty heatsink that draws destructive heat away from the LED chips to guarantee a 50,000-hour lifespan.
- 5.2 The luminaire shall be supplied with a high-impact, flame-retardant polycarbonate outer frame forming the visible outer trim.
- 5.3 The trim shall be finished in a durable white powder coating to ensure it resists discolouration over decades.
 - 5.3.1 The powder coating shall be applied over a suitable pre-treatment process to ensure optimal adhesion.
 - 5.3.2 The powder coating shall be UV-stabilised to prevent chalking and discolouration over time.
 - 5.3.3 The colour shall be as specified in the tender schedule or as agreed with the Engineer.
- 5.4 The internal reflector shall be manufactured from aluminium-coated polycarbonate, available in the following configurations:
 - High-gloss smooth mirror for maximum throw
 - Facetted aluminium reflector for focused beams
 - White painted finish for a softer, broader spread
- 5.5 The optical cover shall be manufactured from high-transmittance polycarbonate, blending the LED light points into a single, uniform light emission.
- 5.6 The luminaire shall incorporate a deep recessed design architecture where the light source is set deeply into the housing to reduce glare and keep the LED chips hidden

from direct sight lines.

- 5.7 The LED module shall be a solid-state LED module using a dense matrix of high-power mid-power LEDs carefully spaced across a metal-core printed circuit board (MCPCB). This design shall spread out thermal heat generation evenly rather than focusing it in one hot spot.
- 5.8 The LED diodes shall undergo strict colour quality sorting to fall within a 5-step MacAdam Ellipse (SDCM <5) colour consistency score. This strict sorting guarantees colour uniformity across multiple luminaires in a single installation without shifting toward green or pink.

6.0 SYSTEM DESCRIPTION

- 6.1 The luminaire shall be a premium-grade recessed LED downlighter engineered for maximum energy savings, superior visual comfort, and extreme longevity.
- 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 The luminaire shall be available in four sizes with the following nominal cut-out diameters:
 - Mini: 105mm cut-out diameter
 - Compact: 150mm cut-out diameter
 - Standard: 150mm cut-out diameter
 - Large: 200mm cut-out diameter
- 6.5 Luminaires shall be delivered with an external independent driver housed in a separate, isolated gear box to extend the lifespan of the electronics.
- 6.6 The driver shall be located remotely from the luminaire head to prevent overheating of electronic components.
- 6.7 The luminaire shall be designed for recessed mounting in ceilings.
- 6.8 The luminaire shall be pre-wired with a flying lead cable for rapid, code-compliant connection to building mains circuits
- 6.9 Where specified in the tender schedule, the luminaire shall be supplied with an integrated emergency battery backup system providing a minimum emergency runtime as specified, complying with IEC 60598-2-22.
- 6.10 The luminaire shall utilise a solid-state LED module with a metal-core printed circuit board (MCPCB) for even thermal heat distribution.

7.0 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

7.1 Luminaire Construction

- 7.1.1 The luminaire housing shall be manufactured from die-cast aluminium, serving as a heavy-duty heatsink that draws destructive heat away from the LED chips to guarantee a 50,000-hour lifespan.
- 7.1.2 The luminaire shall incorporate deep recessed anti-glare architecture with increased reflector depth to drastically lower the Unified Glare Rating (UGR) for maximum eye comfort.
- 7.1.3 The design of the external surfaces shall prevent the accumulation of dirt and dust.
- 7.1.4 All parts requiring maintenance and cleaning shall be easily accessible.
- 7.1.5 The luminaire shall incorporate high-impact, flame-retardant polycarbonate components.
- 7.1.6 The luminaire shall pass the 650 °C glow-wire test for 30 seconds, ensuring that plastics will not ignite or support combustion in the event of an electrical failure.
- 7.1.7 The luminaire shall have a mechanical impact resistance rating of IK02/IK03, withstanding standard installation handling, ceiling vibrations, and bumps without cracking.
- 7.1.8 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 105 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 correlated colour temperature (CCT) of 3000K, 4000K or 6500K.
- 7.2.4 The Colour Rendering Index (CRI) shall be 80 minimum (CRI ≥80). Where specified, higher architectural specifications with a CRI of 90 shall be provided for premium retail or art display areas.
- 7.2.5 The luminaire shall provide a beam angle suitable for the application, typically between 60° and 120°.
- 7.2.6 The lumen maintenance shall be rated at L80B50 at 43,000 hours, meaning that after 43,000 hours of continuous use, the fixture shall still output at least 80% of its original day-one brightness.
- 7.2.7 The luminaire shall provide low glare lighting suitable for indoor applications.
- 7.2.8 The LED life expectancy @ Tq 25°C shall be 50,000 hours minimum (L70B10).
- 7.2.9 The LED driver life expectancy @ Tq 25°C; 230V ±10% 50Hz shall be 50,000 hours minimum (≤10% failure rate).

7.3 **Power Supply / Driver**

- 7.3.1 The luminaire shall be supplied with an external independent driver housed in a separate, isolated gear box to extend the lifespan of the electronics.
- 7.3.2 The driver shall be of the constant-current type, featuring advanced ripple current mitigation technology. By feeding the LED light module a perfectly flat, clean current stream, it shall remove the imperceptible high-frequency flicker that causes migraines and eye strain in workspaces.
- 7.3.3 The driver shall incorporate the following protection features:
- Overload protection
 - Short circuit protection
 - Inrush current suppression
- 7.3.4 The driver shall support the following electrical characteristics:
- Rated supply voltage: 220 – 240 V AC
 - Mains frequency: 50/60 Hz
 - Power factor: ≥ 0.95 at full load
 - Total Harmonic Distortion (THD): $< 20\%$ at full load
- 7.3.5 The driver shall be flicker-free in all operating modes.
- Fixed Output (PSU Series): The standard Power Supply Unit, handling simple on-and-off switching via standard wall switches with a constant light output.
 - DALI Dimmable (PSD Series): The Power Supply DALI unit, enabling communication with building automation systems, smart home controllers, and architectural dimmers to dial brightness anywhere from 1% up to 100% smoothly.
 - Interact Ready Wireless (IAR Series): Featuring integrated wireless protocols that link the luminaires directly to localized Bluetooth or Zigbee sensor control grids (where specified).

7.4 **Emergency Battery Backup System (Where Specified)**

- 7.4.1 Where specified, the luminaire shall be equipped with an integrated emergency battery backup system, complying with SANS 60598-2-22.
- 7.4.2 The emergency control gear shall be suitable for operation with LED modules.
- 7.4.3 The emergency system shall provide emergency lighting illumination during mains

failure transitions to maintain regulatory emergency lux levels

- 7.4.4 The emergency duration shall be a minimum of as specified in the tender schedule.
- 7.4.5 Charging indication shall be provided via an external LED pilot light indicating active battery charging status.
- 7.4.6 The emergency control gear shall incorporate the following protection features:
 - Battery reverse polarity protection
 - Overcharge protection
 - Over-discharge protection
 - Short circuit protection
- 7.4.7 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.
- 7.4.8 The battery type shall be Lithium-ion (Li-ion) or equivalent and shall be replaceable.
- 7.4.9 The emergency control gear shall have a hardware warranty as specified in Section 9.0.

7.5 **Optics and Glare Control**

- 7.5.1 The luminaire shall incorporate deep recessed anti-glare architecture with increased reflector depth to drastically lower the Unified Glare Rating (UGR) for maximum eye comfort.
- 7.5.2 The internal reflector shall be manufactured from aluminium-coated polycarbonate, available in the following configurations: The reflector and diffuser combination shall provide low glare illumination.
 - High-gloss smooth mirror for maximum throw
 - Facetted aluminium reflector for focused beams
 - White painted finish for a softer, broader spread
- 7.5.3 The optical cover shall be manufactured from high-transmittance polycarbonate, blending the LED light points into a single, uniform light emission.

7.6 **Ingress Protection and Impact Resistance**

- 7.6.1 The luminaire shall have an Ingress Protection (IP) rating of IP20, suitable for indoor applications.
- 7.6.2 The luminaire shall be available in the following Ingress Protection (IP) ratings:
 - IP20 (Standard): Finger-protected, suitable for dry indoor applications
 - IP54 (Optional): Dust-accumulation protected and splash-proof, suitable for

bathrooms, covered patios, or kitchen cooking zones

- 7.6.3 The IP rating shall be certified by a test report for the specific luminaire model.

7.7 Wiring and Electrical Connections

- 7.7.1 The internal wiring of the luminaires shall be flexible and suitably insulated to withstand the voltage and temperature encountered in service.
- 7.7.2 The luminaire shall be pre-wired with a flying lead cable.
- 7.7.3 The supply terminals shall accept the appropriate conductor sizes and be easily accessible.

7.8 Earthing

- 7.8.1 Luminaires shall be designed to facilitate earthing as per the Electrical Machinery Regulations of the OHSACT (Act 85 of 1993).
- 7.8.2 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.
- 7.8.3 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.
- 7.8.4 Earth connections shall be by means of suitable lugs, designed to prevent electrolytic corrosion.

7.9 Electromagnetic Compatibility

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

7.10 Packaging and Transport

- 7.10.1 The luminaires shall be packed in a manner that ensures protection during handling and transport by road, rail, or sea.
- 7.10.2 The packaging shall be designed to prevent vibration damage to the LED modules and control gear during transit.
- 7.10.3 Where sea transport is involved, a suitable dehydrating agent (desiccant) shall be included in the packaging to prevent corrosion.
- 7.10.4 Lithium-ion battery packs (where specified) 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. SDCM (MacAdam Ellipse) test reports confirming <5-step colour consistency.
 - i. IP rating test reports for the complete luminaire in accordance with SANS 60529.
 - j. Photometric test reports and photometric data files (IES/LDT format).
 - k. Unified Glare Rating (UGR) test reports confirming low glare performance.
 - l. Where specified, 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 three (3) years (36 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 36-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, where specified, 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
- 10.7 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.