ROADS AND MARITIME SERVICES

ROAD NETWORK OPERATIONS

SPECIFICATION NO. TSI-SP-065

LUMINAIRES FOR TUNNEL AND UNDERPASS LIGHTING

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1 SCOPE

This specification covers requirements for luminaires (complete with lamps) for Category TU1 to TU5 lighting for tunnels and underpasses intended to carry only vehicular traffic.

NOTE: See Section 3 for definition for ‘luminaire’ and ‘equipment’. This specification does not cover luminaires intended to provide lighting in emergency situations.
2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian Standards

The following standards have been referred to in subsequent clauses of this Specification:

- **AS/NZS 1158.0** – Lighting for roads and public spaces, Part 0: Introduction
- **AS/NZS 1158.5** – Lighting for roads and public spaces, Part 5: Tunnels and underpasses
- **AS 1231** – Aluminium and aluminium alloys - Anodic oxidation coatings
- **AS/NZS 3000** – Electrical installations (known as the Australian/New Zealand Wiring Rules)
- **AS/NZS 3100** – Approval and test specification - General requirements for electrical equipment
- **AS 3715** – Metal finishing - Thermoset powder coating for architectural applications of aluminium and aluminium alloys
- **AS/NZS ISO 9001** – Quality management systems - Requirements
- **AS 60068.2.6** – Environmental testing - Tests - Test Fc: Vibration (sinusoidal)
- **AS 60068.2.29** – Environmental testing - Tests - Test Eb and guidance: Bump
- **AS/NZS 60598.1** – Luminaires, Part 1: General requirements and tests
- **AS/NZS 60598.2.3** – Luminaires, Part 2.3: Particular requirements – Luminaires for road and street lighting
- **AS/NZS 60950.1** – Information technology equipment – Safety, Part 1: General requirements
- **AS/NZS 61000.6.1** – Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments

2.2 RMS Specifications and Documents

The following RMS specifications and documents have been referred to in subsequent clauses of this Specification:
2.3 Other Standards

The following standards have been referred to in subsequent clauses of this Specification:

IES LM-9-09 – Electrical and Photometric Measurements of Fluorescent Lamps
IES LM-63-02 – Standard File Format for Electronic Transfer of Photometric Data
IES LM-79-08 – Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80-08 – Measuring Lumen Maintenance of LED Light Sources
IES LM-84-14 – Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires
IES TM-21-11 – Projecting Long Term Lumen Maintenance of LED Light Sources
IES TM-28-14 – Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaries

2.4 Compliance with Specifications

All equipment and materials, where not otherwise specified, shall be in accordance with Australian Standards/Specifications where such exist, and in their absence, with appropriate IEC or ISO Standards/Specifications.

The equipment and its recommended installation method shall comply with the requirements of the NSW Work Health and Safety Act.

The equipment shall comply with the safety requirements of the National Electrical Codes AS/NZS 3000, AS/NZS 3100 and AS/NZS 60950.1.

2.5 Precedence of Specifications

In the event of conflicting requirements between documents, the order of precedence shall be as follows:
(a) Statutory requirements;
(b) This Specification;
(c) Other RMS specifications, where provided by RMS;
(d) Australian Standards; and then
(e) International Standards.
3 DEFINITIONS AND GLOSSARY OF TERMS

For the purposes of this Specification, the following definitions and abbreviations shall apply:

- Colour rendering index (CRI) – As defined in AS/NZS 1158.0
- control gear – Lamp control gear as defined in AS/NZS 60598.1
- equipment – Luminaire covered by this Specification, unless the context dictates otherwise
- IES – Illuminating Engineering Society of North America
- LED – Light emitting diode
- light source – Lamps used in luminaires
- LSZH – Low smoke zero halogen
  Other abbreviations used by the industry include LSOH and LS0H.
- luminaire – As defined in AS/NZS 60598.1 but also includes the light source (lamp(s)) required for operation, unless explicitly stated otherwise.
  Note that luminaire is also referred to as ‘equipment’ in this Specification. See definition above for ‘equipment’.
- Manufacturer – The manufacturer of lighting equipment covered by this Specification.
- MTBF – Mean time between failures
- MTTR – Mean time to repair
- NATA – National Association of Testing Authorities, Australia
- RMS – Roads and Maritime Services, which is a New South Wales government agency
- RMS Technical Representative – The person appointed by RMS to carry responsibilities on behalf of RMS for technical matters relating to the equipment covered by this Specification
- Supplier – The supplier of lighting equipment covered by this Specification
4 EQUIPMENT APPROVAL

4.1 General

Equipment approval in accordance with Specification TS201 is required prior to offer of luminaires.

4.2 Documentation

The Supplier shall furnish the following documentation to RMS for the purpose of equipment approval:

(a) A clause-by-clause compliance statement addressing each requirement in this Specification, including information on how and why compliance is achieved, referencing supporting documentation where applicable;

(b) Test reports by an independent NATA-registered laboratory to demonstrate compliance with the photometric requirements in Clauses 5.2.1 and 5.2.2, electrical requirements in Clause 5.3, and specified requirements in 5.4.2, 5.5.1, 5.7.3.2, 6.1, 6.2, 6.3, 6.4.2 and 6.5.

Tests relating to fluorescent lamps shall comply with IES LM-9-09 where applicable;

(c) Where LED light source is used, test reports on the LED light source, including the following:

(i) IES LM-80-08 and IES TM-21-11 test reports, including indication of make and part number of light source;

(ii) IES LM-84-14 and IES TM-28-14 test reports, including indication of make and part number of light source and make and model number of luminaire;

(iii) IES LM-79-08 and in-situ temperature measurement test (ISTMT) reports, including indication of make and part number of light source and make and model number of luminaire;

(d) Datasheet for light source, including supporting information on luminous efficacy, life and lumen depreciation;

(e) Datasheet for luminaire, including supporting information to demonstrate compliance with the requirements for construction of the lighting unit in Clause 5.2.3;

(f) Datasheets and/or other supporting information to demonstrate compliance with requirement in Clause 5.2.1 for the specified mounting configuration;
(g) Datasheets and/or other supporting information to demonstrate compliance with requirement in Clause 5.2.1 for optical components not to exhibit noticeable change to their required optical properties;

(h) Thermal management calculations or report for luminaire for both nominal and the highest ambient conditions stated in Clause 6.1, including resultant temperatures for various components and parts, and conclusions of calculations or report. If light source is LED, the calculations/report shall include LED junction temperature performance;

(i) Datasheets and/or calculations to demonstrate compliance with Clause 5.7.1;

(j) Datasheets and/or other supporting information to demonstrate compliance with LSZH requirements in Clause 5.7.3.3;

(k) Test report by an independent certified engineer to demonstrate compliance with corrosion resistance requirements in Clause 6.6;

(l) RCM (Regulatory Compliance Mark) from the Australian Communication and Media Authority to demonstrate compliance with Clause 6.5.2;

(m) A copy of the current Certificate of Suitability from NSW Fair Trading to demonstrate compliance with Clause 4.4;

(n) Outline diagrams showing the general presentation and overall dimensions of the complete equipment;

(o) Detailed information on the material used and protective treatment of the various components of the equipment;

(p) Detailed circuit schematic diagrams (block-level acceptable) and descriptions of operation;

(q) A copy of the Certification of the Manufacturer’s and Supplier’s Quality Management System to demonstrate compliance with Clause 8;

(r) A copy of the inspection and test plan for the equipment; and

(s) A set of the documentation referred to in Clause 9.

The Supplier shall provide additional information where requested by RMS to assist assessment of the submission.

4.3 Sample Tests

RMS may conduct tests or request the conduction of additional tests by the Supplier on the sample equipment. These tests may include,
but not be limited to, verification of compliance with this Specification and AS/NZS 60598.1 and 60598.2.3.

4.4 Certificate of Suitability

The Supplier shall obtain a Certificate of Suitability issued by NSW Fair Trading for the equipment as evidence that the equipment meets minimum statutory electrical safety requirements.

It is the responsibility of the Supplier and Manufacturer to ensure that the equipment complies with any subsequent amendments to State Regulations and Australian Standards and Specifications related to electrical safety.

If the design of the equipment is changed, it is necessary for the Supplier/Manufacturer to have the Certificate of Suitability endorsed accordingly.

Where a Certificate of Suitability or an equivalent document is issued in another State, the Supplier shall submit written evidence from NSW Fair Trading that such Certificate or document is regarded as fully equivalent to a Certificate of Suitability issued by NSW Fair Trading.

The approval number shown on the Certificate of Suitability shall be shown on an external marking plate required to be visible after luminaire installation in accordance with AS/NZS 60598.1.
5 TECHNICAL REQUIREMENTS

5.1 General

The tunnel and underpass lighting equipment (luminaire) shall comprise all items necessary for the intended use. As a minimum, the following items shall be provided:

(a) A lighting unit comprising the following (see Clause 5.2):

   (i) A housing including covers, lenses, reflectors and provisions for accommodation and connection of the light source;

   (ii) Light source (unless explicitly excluded in the supplies contract);

   NOTE: Refer to Clause 5.4 for additional requirements for thermal management.

(b) Control gear including dimming unit and power supply (see Clause 5.3);

(c) Provisions for thermal management (see Clause 5.4);

(d) Other accessories such as connectors, cables and seals.

   NOTE: Refer to Clause 5.7.3.3 for types of wires and cables to be used.

In addition to this Specification, the equipment shall comply with all relevant requirements in AS/NZS 60598.1 and 60598.2.3, and shall be capable of supporting compliance with the performance and design requirements for lighting schemes for tunnels and underpasses specified in AS/NZS 1158.5.

5.2 Lighting Unit

5.2.1 General

The lighting unit shall be suitable for use in tunnels and underpasses.

The lighting unit shall be of a type that is suitable for mounting in any of the following manners:

(a) Ceiling-mounted individually;

(b) Ceiling-mounted in a group formation to provide a continuous line of luminance;

(c) Wall-mounted individually;
(d) Wall-mounted in a group formation to provide a continuous line of luminance.

The rated output of each lighting unit shall be not less than 5,000 lm.

**NOTE:** Refer to Clause 5.2.2 for requirements for luminous efficacy.

All components of the lighting unit shall be manufactured of materials that are suitable for continuous exposure to vehicle exhaust during the service life of the lighting unit.

In addition, all optical components of the lighting unit, excluding the light source, shall be manufactured of materials that do not exhibit noticeable change to those optical properties required by each of the optical components during the service life of the lighting unit.

### 5.2.2 Light Source

#### 5.2.2.1 Non-LED Light Sources

Non-LED light sources shall be constructed of replaceable module(s).

**NOTE:** Refer to Clause 5.2.1 for requirement for output of the lighting unit.

The initial luminous efficacy (or normalised efficiency) of each light source shall be not less than 100 lm/W, in accordance with the following equation:

\[
\text{Efficacy (or normalised Efficiency) } \frac{\text{lm}}{\text{W}} = \frac{\text{Luminous flux output}}{\text{Power input}}
\]

Unless otherwise specified in the supplies contract, each light source shall conform to a colour temperature centred within 4000 K - 4300 K and with a side spread of ± 200K, and a colour rendering index (CRI) of not less than 70 Ra.

Each non-LED light source shall provide a service life of not less than 5 years of powered-on operation, and with a lumen depreciation of not exceeding 30% of its initial value during its full service life, when operated under the environmental conditions stated in Clause 6.1.

#### 5.2.2.2 LED Light Sources

LED light sources shall be constructed of replaceable module(s).

**NOTE:** Refer to Clause 5.2.1 for requirement for output of the lighting unit.

Each LED light source shall have an initial luminous efficacy (or normalised efficiency) of not less than 100 lm/W, in accordance with the following equation:
Efficacy (or normalised Efficiency) \( \text{lm/W} = \frac{\text{Luminous flux output}}{\text{Power input}} \)

Unless otherwise specified in the supplies contract, each light source shall conform to a colour temperature centred within 4000 K - 4300K and with a side spread of ± 200K, and a colour rendering index (CRI) of not less than 70 Ra.

Each LED light source shall provide a service life of not less than 100,000 hours of powered-on operation and with a lumen depreciation not exceeding 20% of its initial value during its full service life, when operated under the environmental conditions stated in Clause 6.1.

The lumen depreciation of each light source at 10,000 hours of powered-on operation shall not exceed 2.2% of its initial lumen output.

When operating in any combination of the ambient conditions specified in Clause 6.1, the maximum junction temperature of any LED shall not exceed 100°C or the recommended/safe operating temperature provided by the LED manufacturer, whichever is lower.

5.2.3 Construction

The construction of the lighting unit shall be as follows:

(a) The body of the lighting unit shall be constructed from half hard sheet or extruded aluminium AlMgSi 0.5 or similar, and have a minimum wall thickness of 1.8 mm. All welding shall be carried out using the argon arc process and all welds shall be continuous, free from pits and slag, and clean and smooth after completion;

Provision shall be made to enable the lighting unit to be mounted in the manners specified in Clause 5.2.1 and as follows:

(i) Mounting on standard-size strut channels fixed to tunnel ceiling, wall, or cable ladder;

(ii) The body of the lighting unit to incorporate a clamping flange running the full length of the body. And each lighting unit to be supplied with four (4) mounting clamps that can engage with the clamping flange and the “C” channel so that, after initial mounting, the lighting unit can be moved longitudinally and laterally for fine adjustment and be finally clamped in position when the adjustment is completed.

(b) The complete housing, including lens surrounds, shall be anodised to AS 1231 or chromated, and powder coated to AS 3715. Alternatively, lighting unit bodies may be constructed of stainless steel, minimum grade 304, formed for torsional rigidity and of minimum thickness of 0.7 mm;
c) The front lens assembly shall be constructed of tempered glass with a tempered plate glass of 5 mm minimum thickness, preferably fitted to an aluminium surround and the whole shall be hinged and clamped to the lighting unit body using foam silicone rubber or EPDM rubber gaskets which shall ensure a dust and water jet-proof seal. The clamping method shall be capable of adjustment to eliminate any loss of gasket resilience during the life of the equipment. All gaskets shall be securely held in position after the cover is removed and shall be able to be readily renewed with the lighting unit in situ. The front glass assembly shall be removable without the use of tools;

(d) Access to the light source and wiring chambers shall be achieved by opening of the front lens assembly (cover) without the use of tools. The cover shall be effectively supported and shall remain intact during and after removal. All external clamps, hinges, etc, shall be of stainless steel, minimum grade 304, or similar corrosion resistant material. Plugs and sockets shall be designed to withstand lamp ignition voltages and to prevent inadvertent cross wiring;

(e) The electrical and photometric components of the lighting unit shall be either mounted on, or as removable assemblies (with plug-in electrical connections for electrical components) to facilitate removal and maintenance. Assemblies shall be removable without the use of special tools. Gear trays, if any, shall be retained by safety cords;

(f) Reflectors shall be of super purity pre-anodised aluminium of minimum thickness 0.5 mm. The construction rigidity and fixing of these shall be such that, with normal careful handling, they cannot be distorted during removal, replacement or cleaning and shall be fully interchangeable with equivalent lighting units;

(g) The lighting units and removable assemblies shall be manufactured to close tolerances in all dimensions so that correct contact pressures are maintained on the light source;

(h) The lighting unit bodies and any reversible photometric components shall be clearly and permanently marked to prevent incorrect mounting (photometrically) in the tunnel or incorrect re-assembly during installation and routine maintenance;

(i) Cable entry to each lighting unit shall be made such that the required enclosure protection rating is maintained;

(j) All fasteners for user-replaceable parts shall be of the captive type.
5.2.4 Dimming

Provision shall be made for dimming the light output from each luminaire. For the purpose of this requirement, the following shall apply:

(a) It shall be possible to arrange luminaires into different groups and control each of such groups to dim the outputs of its member luminaires to the same level and in synchronism;

(b) It is preferable that provision be made for linking or unlinking user-selected groups for dimming multiple groups to the same level and in synchronism;

(c) It is preferable that provision also be made for the formation of multiple linked groups referred to in paragraph (b) above;

(d) For the purpose of paragraphs (a), (b) and (c), the undimmed state shall be considered as a dimmed state where the amount of dimming is nil.

Transition from one dimming level to another should be gradual and not visually abrupt.

NOTE: In operation, not all lighting zones of a tunnel require dimming.

NOTE: It is permissible for dimming to be implemented by switching on and off groups of luminaires within a lighting zone, where the employed lamp technology does not inherently support dimming but is otherwise compliant with this Specification.

NOTE: Refer to Clause 5.3 for requirements for control gear, including connection with light sensor(s) and dimming controller.

5.2.5 Load Maxima

The structural loads due to the lighting unit shall be kept as low as possible to ensure compatibility with installation provisions. The prospective supplier shall supply the relevant load data as part of the product information to the relevant client project office.

For retrofitting to an existing installation, the structural loads due to the lighting unit shall not exceed the maximum safe loads for the existing support structure.

NOTE: The prospective supplier may contact the relevant client project office for details relating to the existing support structure.
5.2.6 Attachment Points

Each lighting unit shall provide not less than four (4) separate tunnel-type strut channel attachment points to fit the existing arrangement of a tunnel for retrofitting, or new arrangements of a tunnel for new installation.

NOTE: Refer to Clause 5.2.3(a) for additional requirements for mounting of the lighting unit.

5.3 Control Gear

The combined efficiency of the control gear and power supply shall be not less than 90%, and the overall power factor not less than 0.95.

The control gear shall be complete with all wiring, connectors, required drivers, interfaces and other accessories for connections to the lighting unit, from light sensors(s), and where relevant with an external master dimming controller.

The control gear may be incorporated into the lighting unit, or designed for installation away from the lighting unit. Where the control gear is for installation away from the lighting unit, the connection cable to the lighting unit shall be 15 m minimum in length.

For retrofitting to an existing installation, the control gear shall be of a type compatible to the existing installation.

NOTE: The prospective supplier may contact the relevant client project office for details relating to the existing installation.

5.4 Thermal Management

5.4.1 Heat Removal

The equipment shall incorporate effective and adequate heat removal capability on the lighting unit and control gear to maintain normal operational performance within the temperature range stated in Clause 6.1. For the purpose of this requirement, electro-mechanical parts such as ventilation fans shall not be used.

The Supplier shall provide heat removal calculations, circuit schematics and design drawings for the equipment indicating the sources, locations and magnitudes of heat generation, and the design heat removal mechanism and paths, to the RMS Technical Representative.
5.4.2 Thermal Endurance

The entire equipment shall be tested for compliance with the thermal endurance requirements specified in AS/NZS 60598.1.

5.5 Electrical Requirements

5.5.1 Operating voltage

The equipment shall operate correctly and reliably for mains supply voltages over the range 230 Vrms ± 10%, - 6%, and variations in supply frequency in the range 50 Hz ± 4%.

5.6 Fault Logging, Reporting

Where fault logging and/or reporting is provided, the prospective supplier shall provide details for assessment by RMS. All log and report events shall be time-stamped in real-time to a resolution of not coarser than deciseconds.

5.7 Reliability, Maintainability and Material Safety

5.7.1 Reliability

5.7.1.1 Mean Time between Failures

The MTBF of the equipment, excluding light source failures, shall be not less than 500,000 hours in operation.

The prospective supplier shall confirm the MTBF of the light source for the lighting unit under the operating conditions specified in Clause 5.2.2.

5.7.1.2 Service Life

The luminaire, excluding the light source, shall be designed to provide a service life of not less than twenty (20) years when operated under the environmental conditions stated in Clause 6.1.

The minimum service life of non-LED light sources shall be as specified in Clause 5.2.2.1. The minimum service life of LED light sources shall be as specified in Clause 5.2.2.2.
5.7.2 Maintainability

5.7.2.1 Mean Time to Repair

The Supplier shall provide RMS with the MTTR figures of the equipment.

5.7.2.2 Modular Design

The equipment, and parts thereof, shall be available in modular and backward compatible units (between older and newer parts). All parts used in the equipment shall be readily available from more than one (1) manufacturer.

The equipment design shall facilitate the following:

(a) Replacement of luminaire;

(b) Replacement of light source modules;

(c) Replacement of control gear and/or its component modules;

(d) Replacement of other individual parts;

(e) Replacement of interconnection cables between control gear and connected units;

(f) Access to control gear;

(g) Access to replaceable parts.

5.7.2.3 Labelling

All markings and labels shall be weather resistant and durable for the life of the equipment.

The front face of each lighting unit (where the light output aperture lies), shall have provisions to imprint a unique luminaire identification label issued by RMS.

A longitudinal side face of each lighting unit, and the front face of the control gear (if remote), shall be marked with the following information as the minimum on an aluminium label by the manufacturer:

(a) Name of manufacturer;

(b) Model Number;

(c) Serial Number;

(d) Date of despatch to RMS.
Each new or replaced part of the equipment shall be dated with the respective delivery date and tagged with a label.

5.7.3 Safety

5.7.3.1 Safety Valves

Each lighting unit shall be equipped with one or more fast acting pressure release safety valves.

5.7.3.2 Fire Resistant Materials

All electrical insulation materials shall comply with the relevant insulation and fire resistance requirements in AS/NZS 3100 and AS/NZS 60598.1.

5.7.3.3 Type of Wires and Cables

All electrical wires and cables of the luminaire, including internal equipment wiring, shall be of the low smoke zero halogen (LSZH) type.

The Supplier shall provide data sheet or other supporting information to demonstrate compliance with the LSZH classification.
6 ENVIRONMENTAL REQUIREMENTS

6.1 Temperature and Humidity

The equipment shall be designed for operation in an environment with ambient temperatures ranging from -20°C to +40°C and relative humidity up to 90%.

6.2 Shock

All removable sub-assemblies, in an unpacked condition, shall withstand a bump test (Test Eb) to AS 60068.2.29. The severity shall be 1,000 bumps at an acceleration of 98 m/s² (10g) with a pulse duration of 16 ms.

The entire equipment, packaged for transport, shall be subjected to a bump test. This test shall be carried out in accordance with AS 60068.2.29. The severity shall be 4,000 bumps at an acceleration of 98 m/s² (10g) with a pulse duration of 16 ms.

6.3 Vibration

The entire equipment shall be subjected to the vibration tests specified in this clause. The test procedures shall be in accordance with AS 60068.2.6 for sinusoidal vibration. For all tests specified in this clause, the amplitude shall be 0.75 mm up to the cross-over frequency, (approximately 8.2 Hz), where the acceleration is 0.2g, and for higher frequencies the acceleration shall be maintained constant at 0.2g.

The operation of the equipment shall be recorded during the tests and its overall performance summarised in the test report.

The tests shall be performed for three (3) mutually perpendicular axes with the equipment in the normal (installed) orientation.

For each axis of the tests, an investigative sweep cycle shall be performed on the test specimen over the frequency range 5-55 Hz with an amplitude of up to 0.75 mm to identify critical frequencies at which:

(a) Equipment malfunctioning and/or deterioration of performance are exhibited which are dependent on vibration; and/or

(b) Mechanical resonances and other response effects, such as chatter, occur.
The frequencies and the applied amplitudes at which these effects occur shall be noted, together with the behaviour of the test specimen at each critical frequency.

The equipment shall be tested for 10 minutes at each of the critical frequencies identified, with a vibration amplitude of 0.75 mm below the cross-over frequency, and 0.2g acceleration above the cross-over frequency.

For each axis of the tests, the entire equipment shall be tested with an endurance of 20 sweep cycles over the frequency range 5-55 Hz with an initial amplitude of 0.75 mm. The sweep rate shall be 1 octave per minute.

6.4 Cleaning and Ingress Protection

6.4.1 Protection against Cleaning Operations

The luminaire in its normal installed locations shall be capable of withstanding tunnel washing/cleaning operations that include high pressure water jets and mechanised brushing, without incurring ingress of water, mechanical damage or other adverse effects.

6.4.2 Enclosure Ingress Protection

The luminaire, either in a single housing or multiple housings (e.g. separate control gear), shall be rated to a degree of enclosure protection not less than classification IP66, in accordance with AS 60598.1.

In addition, the luminaire shall incorporate proven means against internal condensation build-up, and protection against such build-up.

6.5 Electromagnetic Compatibility

6.5.1 Electromagnetic Immunity

The equipment shall comply with AS/NZS 61000.6.1, with immunity to the following

(a) Radiated electromagnetic frequencies;
(b) Conducted electromagnetic frequencies;
(c) Electrostatic discharges;
(d) Fast transients on the mains supply;
(e) Surges on the mains supply.
6.5.2 Electromagnetic Emissions

The equipment shall comply with all statutory requirements, including RCM (Regulatory Compliance Mark) labelling requirements, for electromagnetic compatibility.

6.6 Corrosion Resistance

All constituent components of the equipment shall be inherently corrosion resistant or suitably treated to prevent corrosion over their service life. Compliance shall be confirmed in accordance with AS/NZS 60598.1.

6.7 Vermin Resistance

The equipment and its constituent components shall be adequately protected against the incursion of vermin, termites and insects.

The design and arrangement of the ventilation system shall be such as to minimise the ingress of vermin.
7  LONG-TERM PERFORMANCE AND WARRANTY

7.1  General

The equipment purchased under this Specification shall be subject to the long-term performance and warranty provisions in this Section.

7.2  Long-Term Performance

The lumen depreciation from initial value, of each luminaire, shall not exceed that specified in Clause 5.2.1 of this Specification for the applicable light source. In the event the light output falls below the above specified value from its initial value, the Supplier shall provide a replacement unit for the luminaire.

Where software is provided, the Supplier shall provide software upgrades and bug fixes, as requested by the RMS Technical Representative.

The initial value and rate of depreciation of light output of each luminaire shall be matched with the sample that was measured by a NATA registered laboratory and submitted for RMS' equipment approval assessment. In addition for the same purpose, the Supplier shall provide an initial light output measurement of each luminaire taken with a light meter along with the make and model of the light meter clearly indicated with the reading results.

The RMS, from time-to-time, will conduct measurements on the light outputs of luminaire in the field using an in-house test meter. This in-house test meter measures the light output from the front of the luminaires, and its readings will be correlated with those of the approved sample. For the purpose of determining the degradation of light outputs from, and the long-term performance of, luminaires, the readings of this RMS in-house test meter shall be deemed sufficient. The RMS will make a determination from the readings of the meter as to whether the luminaire has passed or failed the long-term performance requirement in this clause. Where the Manufacturer or Supplier disagrees with the RMS's decision, the dispute will be resolved by sending the luminaire in question to a NATA registered laboratory for testing. The costs of such tests shall be borne by the party whose assertion is not supported by the test results.

7.3  Warranty

All luminaires purchased under this Specification shall be subject to warranty for at least the periods specified in the Clause 5.7.1.2, from the date of receipt at RMS.

Software upgrades, where provided during the warranty period, shall include servicing and be free of charge to RMS.
8 QUALITY ASSURANCE

8.1 General

The Supplier and Manufacturer shall operate a quality management system complying with AS/NZS ISO 9001. This quality management system shall be certified by a quality management system certification body accredited for such purposes under the criteria defined in the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

8.2 Inspection and Test Plan

The Supplier shall submit an inspection and test plan for each batch of equipment as part of quality assurance requirements.
9 DOCUMENTATION

The following documentation shall be supplied by the Supplier:

(a) Operations and maintenance manual, including:
   (i) Full description of the luminaire, control gear and power supply;
   (ii) Dimensional outline drawing of the luminaire;
   (iii) Inspection and maintenance requirements;
   (iv) Bill-of-materials;
   (v) Part numbers for all of the major components;
   (vi) Recommended spares;

(b) Installation manual;

(c) Field manual;

(d) An ‘I’ table (i.e. Intensity table) from a NATA certified laboratory in accordance with the LM-63-02 procedure. For LED luminaires, the intensity distribution shall be provided at gamma angles in 2.5 degree increments and C angle increments of 5 degrees;

(e) For LED luminaires, a table or graph of total power consumption versus light output over a range of light output from 10% to 100% during dimming operation.

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