

Technical Specification

**Transport and Main Roads Specifications
MRTS242 Recreational Boating Infrastructure Lighting**

July 2023



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1 Introduction

This Technical Specification applies to supplying and installing lighting for recreational boating infrastructure. This includes the following facilities:

- a) car parks – parking facilities provided for users of recreational boating infrastructure
- b) boat ramps – ramps used to launch and retrieve recreational watercraft
- c) jetties and wharves (including gangways) – used to access docked or moored recreational watercraft
- d) pathways and footpaths – general access around recreational boating facilities, and
- e) floating infrastructure including pontoons, floating walkways and gangways – used to access docked or moored recreational watercraft.

This Technical Specification includes the requirements for manufacturing, designing, installing and testing recreational boating infrastructure lighting.

All Electrical Works shall comply with the requirements of the most current amendments provided for in the *Electrical Safety Act 2002 (Qld)*, Regulations and Codes of Practice.

All new recreational boating infrastructure lighting projects shall use LED luminaires.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are defined in Table 2 and AS/NZS 3000 *Electrical installations (known as the Australian / New Zealand Wiring Rules)*.

Table 2 – Definition of terms

Term	Definition
Act	<i>Electrical Safety Act 2002 (Qld)</i> and associated Regulations and Codes of Practice.
Administrator	Principal's Representative or Superintendent as defined in Clause 14 of MRTS01 <i>Introduction to Technical Specifications</i> .
AEMO	Australian Energy Market Operator.
Autonomy	Number of days of operation of the system without energy from the Photo Voltaic (PV) array before exceeding the design maximum depth of discharge of the battery.
BSI	British Standards Institution.
Department	Department of Transport and Main Roads.
DoD	Depth of Discharge: The capacity in Ampere Hours (Ah) that is discharged from a fully charged battery, divided by the battery nominal capacity (C20). DoD is normally presented in percent (%).
Electricity Entity	As defined in the Act.

Term	Definition
Electrical Works	As defined in the Act.
IEC	International Electrotechnical Commission.
Integrated pole light	Solar light with the PV array mounted on the light pole.
ISO	International Organisation for Standardisation.
LED	Light emitting diode.
Licensed Electrical Contractor	Holder of an Electrical Contractor Licence under the Act.
MSQ	Maritime Safety Queensland.

3 Referenced documents

The requirements of the referenced documents listed in Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
AS/NZS 1158.1.2	<i>Lighting for roads and public spaces Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance.</i>
AS/NZS 1158.2	<i>Lighting for roads and public spaces – Computer procedures for the calculation of light technical parameters for Category V and Category P lighting.</i>
SA/SNZ TS 1158.6	<i>Lighting for roads and public spaces – Luminaires – Performance.</i>
AS/NZS 4282	<i>Control of obtrusive effects of outdoor lighting.</i>
AS/NZS 3000	<i>Electrical installations (known as the Australian / New Zealand Wiring Rules).</i>
AS/NZS 60598.2.3	<i>Luminaires – Part 2.3: Particular requirements – Luminaires for Road and Street Lighting.</i>
MRTS01	<i>Introduction to Technical Specifications.</i>
MRTS50	<i>Specific Quality System Requirements.</i>
MRTS91	<i>Conduits and Pits.</i>
MRTS97	<i>Mounting Structures for Roadside Equipment.</i>
MRTS263	<i>Standalone Solar (PV) Power Systems.</i>
-	<i>National Lighting Pollution Guidelines for Wildlife. (Department of the Environment and Energy)</i>

Reference	Title
SD1323	<i>Road Lighting – Luminaire terminal panel.</i>
SD1335	<i>Road Lighting – Pedestrian crossing floodlight mounting bracket outreach mount (option 2).</i>
SD1336	<i>Road Lighting – Pedestrian crossing floodlight mounting bracket spigot mount (option 1).</i>
SD1392	<i>Road Lighting – Base Plate Mounted pole and footing installation details for crossfalls up to and including 1:2.</i>
SD1393	<i>Road Lighting – Base Plate Mounted pole and footing installation details for crossfalls greater than 1:2.</i>
SD1399	<i>Road Lighting – Base Plate Mounted pole wiring details.</i>
SD1707	<i>Road Lighting – Base plate mounted pole mounted on bridges wiring details.</i>

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
7.1	1. Design by the Contractor.		Submission of lighting design (28 days).
7.3	2. Design of poles.		
7.4	3. Supply of luminaires.		Submission of luminaire documentation (seven days).
7.5	4. Placement of Concrete.		
7.7	5. Solar design.		Submission of solar design information (seven days).
10.1	6. Compliance testing.		Submission of compliance testing procedure (28 days).
10.2		1. Compliance testing of luminaires.	

5 Compliance with legislation

The work covered by this Technical Specification shall comply with the requirements of the *Electrical Safety Act 2002* (Qld), any regulations and AS/NZS 3000.

The Contractor shall engage a Licensed Electrical Contractor to perform the duties and functions of Electrical Works. This includes the installation of pits and conduits for power and communications cables.

6 Compliance with other documentation

This Technical Specification shall be read in conjunction with referenced documents and AS/NZS 3000.

7 Functional design

7.1 Submission of design

Where a lighting design is undertaken by the Contractor, either as part of the Contract or as an alternative design, the requirements of Clause 7 shall apply.

No fewer than 28 days prior to installation of luminaires and/or poles, the Contractor shall submit to the Administrator, a lighting design which complies with the requirements of AS/NZS 1158 and this Technical Specification. **Milestone** The design shall be submitted in accordance with the provisions of the relevant clauses of the Conditions of Contract and/or Supplementary Conditions of Contract governing design by the Contractor.

Construction under this Technical Specification shall not commence until expiration of the 28 day period, or as otherwise provided for by the relevant design, by the Contractor clauses mentioned in the second paragraph of this clause. **Hold Point 1**

7.2 Minimum requirements

It is the designer's responsibility to ensure the following minimum requirements are met:

7.2.1 All infrastructure

The lighting installed on all infrastructure shall meet the following requirements:

- a) lighting shall be vandal and theft resistant
- b) materials shall be suitable for intended purpose
- c) solar powered lighting (where installed) shall comply with MRTS263 Standalone Solar (PV) Power Systems
- d) luminaires shall be IP66 rated
- e) bird deterrents shall be used on all luminaires and solar panels over 2 m high
- f) outreach arms shall be avoided where they may contact tailorable sailboat masts, and
- g) luminaires shall be able to be safely accessed by service personnel.

7.2.2 Floating Infrastructure, jetties and wharves

The lighting installed on floating infrastructure, jetties and wharves shall meet the following requirements:

- a) be solar power bollard lighting
- b) operate as intended and maintain warranty in the 'splash zone'
- c) be of a construction type that can withstand frequent platform oscillations without structural fatigue and/or failure (in the case of floating infrastructure)
- d) be mounted to the deck of the infrastructure
- e) be high enough to prohibit their functionality as a bait cutting platform, and

- f) be of optimum mounting height between 2.2 m to 2.4 m considering vandalism, serviceability and, in the case of floating infrastructure, the rotational acceleration of the luminaire when the platform is oscillating due to wave action.

In its design submission, the designer must outline how the luminaires can be accessed safely for servicing, considering the working at height hazard and, in the case of floating infrastructure, considering the motion of the deck.

7.2.3 Car parks and boat ramps

Lighting installed for car parks and boat ramps shall be mains powered where possible. If no power is available or connection to mains power is cost prohibitive, solar options shall be implemented.

7.3 Additional requirement – design of poles

All poles shall be suitable for the area they are to be installed in and be certified by a suitably qualified Registered Professional Engineer of Queensland (RPEQ). Swing poles may be considered for safe serviceability. Pole designs shall be submitted to the Administrator for approval before commencing fabrication. **Hold Point 2**

Refer to MRTS97 *Mounting Structures for Roadside Equipment* for all requirements relating to car park or boat ramp lighting poles, outreach arms, luminaire headframes and luminaire brackets.

7.4 Additional requirement – luminaires.

At least seven days before delivering luminaires to the site, the Contractor shall submit to the Administrator the supporting documentation as detailed in Clause 6 of SA/SNZ TS 1158.6 *Lighting for roads and public spaces – Luminaires – Performance* and this Technical Specification, including manufacturer's drawings. **Milestone**

Luminaires shall not be delivered to the Site until the expiration of the seven day period and until the submission of the above documentation has been approved by the Administrator. **Hold Point 3**

Where stated in the Annexure Clause 1, production samples of luminaires shall be submitted to the Administrator. Samples shall be used for the purpose of providing reference against which all subsequent items are compared for compliance with this Technical Specification.

7.5 Footings

Footings for all poles shall be suitable for the pole type and size to be installed. The footing depth shall be as per the pole manufacturer's RPEQ design. For boat ramps, footings shall be incorporated into the abutment where possible and certified by a suitably qualified structural engineer.

All shore based footings shall be installed as per MRTS92 *Traffic Signal and Road Lighting Footings*. All other footings shall be as per the design documentation, or the pole manufacture's footing design.

Anchor cages and rag bolt assemblies shall be supplied, complete with nuts and washers. A template shall be supplied with rag bolt assemblies.

Concrete shall not be placed until the excavation, formwork and anchor cage, rag bolt assembly, or holding down bolts have been inspected by the Administrator.

Concrete shall be placed and compacted in accordance with the requirements specified in MRTS70 *Concrete*. Concrete shall be allowed to cure for a period of at least seven days before erection of lighting poles is undertaken. **Hold Point 4**

Footings that are installed where the tidal water table is full footing depth, shall be installed as per Clause 15.6.3 Placement under water of MRTS70 *Concrete*.

7.6 Lighting design

Lighting designs shall be completed to comply with Table 7.6(a) or the applicable category of AS1158.1.2, as stated in Table 7.6(b). The proposed lighting categories for each applicable component shall be approved by the department or MSQ before finalising the design.

Table 7.6(a) – Lighting requirements for boat ramps

Description	Basic Operating Characteristics	E _{av} (lux)	E _{min} (lux)	U	GR _{max}
Boat Ramps	General activities such as checking / removing bungs, tying rope to the boat for launching, checking ramp conditions, reversing trailer safely down the ramp, attaching safety chain between boat and boat trailer.	60	10	5	45
Where: E _{av} = Average Illuminance (lux) E _{min} = Minimum illuminance (lux) U = uniformity of illuminance ratio GR _{max} = CIE glare rating (maximum)					

Table 7.6(b) – Lighting requirements for jetties, wharves and car parks

Description	Basic Operating Characteristics	Applicable lighting subcategory (AS 1158.1.2)
Jetties and wharves (including gangways), footpaths.	Pedestrian and or cycle traffic only.	PP1 – PP5 based on the amount of activity, the likelihood of crime, taking into account local crime statistics and pedestrian / cycle activity level.
Car parks.	Parking spaces, aisles and circulation roadways.	PC1 – PC3 based on the night time vehicle / pedestrian movements and the likelihood of crime taking into account local crime statistics.

All lighting design needs to consider the potential impacts of light pollution on surrounding uses and environmental habitats. Sensitive receptors include (but are not limited to) the following:

Impact on Navigational Safety

To ensure there is no impact on existing aids to navigation or interference with vessel safety, the designer shall consult the Queensland Regional Harbour Master for the area. Where any impact is noted, the design shall be modified to address that impact.

Impact on nearby environmental habitats

As part of the lighting design, the designer must consider potential impacts to marine turtles, seabird, migratory shorebirds and other marine fauna. AS/NZS 4282 *Control of obtrusive effects of outdoor lighting* and *National Lighting Pollution Guidelines for Wildlife*, are guidelines for this consideration.

As part of the environmental scoping investigation for a project, potentially impacted light sensitive habitats are to be identified for consideration during design.

If the project is within 20 km line of sight of an identified sensitive habitat, an assessment is to be undertaken by the designer to measure the environmental impact of the project artificial light on wildlife for listed species, which lighting pollution has been shown to affect behaviour, survivorship, or reproductive cycles. Appropriate design measures shall be implemented to mitigate the identified potential impacts.

Regardless of whether nearby sensitive habitats are identified or not, luminaire selection should favour fittings that produce minimal spill light or include provision of shielding cowls, to minimise impacts to any unidentified habitats.

Nuisance impact to nearby residents / businesses

Consistent with the above, the design should look to identify sensitive receptors and designed appropriately to minimise spill light.

On completion of a draft lighting design, the Principal must consult with stakeholders and appointed managers to discuss the implications of the design on project cost, maintenance liability and general aesthetic. This discussion should include 'fear of crime' metrics per AS1158.1.2 to understand the level of lighting required at the location.

Should an opportunity or requirement to reduce the mandated level of lighting be identified, all parties must agree in writing before the design is amended accordingly.

7.7 Solar powered lighting

Where mains power is not available, a solar powered system will be required. All solar powered lighting shall be designed as per MRTS263 *Standalone Solar (PV) Power Systems* with a minimum autonomy per Table 7.7.

Where required, solar powered bollard lighting shall be used on all floating infrastructure, jetties and wharves.

Table 7.7 – Required autonomy of solar lighting

Location	Autonomy required
Jetties, wharves, walkways, floating infrastructure, and footpaths.	Three nights.
Boat ramps and car parks.	Four nights.

The system shall be designed to provide full load power to the designated load for the required autonomy as detailed in Table 7.7, without exceeding the allowable DoD and, on the return of solar input, to fully recharge the batteries within seven days during the worst month irradiance, while under load.

Lighting levels shall be as per Tables 7.6(a) or 7.6(b) as applicable and shall be provided for all night time hours. Switching off the lighting shall be achieved by means of a photoelectric cell or a solar controller (based on solar panel input).

The complete electrical design of the standalone solar power system, including solar generation, derating factors and battery selection to achieve the required power supply and autonomy, equipment selection demonstrating suitability for system voltage and current, cable selection and calculations, wiring diagrams and the like, shall be carried out and certified by an RPEQ currently registered as an electrical engineer and submitted for review and acceptance by the Administrator. **Milestone**

Hold Point 5.

7.8 Design changes during construction

Any change to the design of any component proposed during construction, shall be subject to the provisions of Clause 7 of this Technical Specification. Only after all the requirements of Clause 7 have been satisfied, shall such changes be incorporated in the Works.

7.9 Electricity entity

As part of the design requirement, the provision of new mains connected lighting installations and the removal or relocation of existing lighting luminaires, shall require advice to be provided to the Electricity Entity. Such advice shall include at least a record of the location (for example, suburb), wattage and pole number of all luminaires. A copy of such advice shall be included in the quality records.

8 Material

8.1 General

All equipment and component parts shall comply with the requirements of this Technical Specification.

8.2 Lighting materials

8.2.1 Lighting poles

Poles installed on floating infrastructure shall be manufactured from marine grade aluminium, or stainless steel with a surface finish to suit the environment. All steel poles shall be hot dipped galvanised after fabrication in accordance with MRTS78 *Fabrication of Structural Steelwork*.

All lighting poles are to be designed and certified by an RPEQ as suitable for the environment they will be installed in.

Refer to MRTS97 *Mounting Structures for Roadside Equipment* for additional requirements relating to car park and boat ramp lighting poles, outreach arms, luminaire head frames and luminaire brackets.

All contact faces between dissimilar metals shall be insulated from one another (including fasteners).

8.2.2 Luminaires

8.2.2.1 General

Luminaires shall be designed and constructed in accordance with the requirements of AS/NZS 1158.2 *Lighting for roads and public spaces – Computer procedures for the calculation of light technical parameters for Category V and Category P lighting* or in accordance with requirements of AS/NZS 1680 (based on the applicable application).

The equipment shall be suitable to be exposed to the environmental conditions detailed in Clause 1.5 of SA/SNZ TS 1158.6.

Luminaires to have IP rating as stated in Clause 8.2.2.2

Top entry access to the control gear chamber is preferred for car park and boat ramp lighting luminaires. Compartment covers shall comply with Clause 2.7 of SA/SNZ TS 1158.6.

Luminaires shall be designed so that the stated photometric distribution of the luminaire shall be maintained throughout its life.

Luminaires and any solar panels that are within 3 m of finished levels shall have an IK10 impact rating.

SA/SNZ TS 1158.6 Category P Luminaires shall have a mass no greater than 15 kg and a sail area no greater than 0.17 m².

Where mains powered, unmetred luminaires shall be on the Australian Energy Market Operator (AEMO) National Electricity Market Load Tables for Unmetered Loads or in the process of applying for entry onto the table.

LED luminaires are the only luminaire type to be installed in new departmental projects.

8.2.2.2 LED luminaires

Luminaires shall be supplied as:

- a) side entry mounting luminaires with integral control gear
- b) bottom entry bollard type luminaires with integral control gear, or
- c) bottom entry floodlight luminaires with integral control gear.

The luminaires shall be provided with at least the following degrees of protection when tested in accordance with AS/NZ 60598.1 Luminaires – Part 1: *General requirements and tests*:

- a) Light Source Chamber in splash zone – IP66, or
- b) Light Source Chamber other areas IP65, and
- c) Control Gear Chamber – IP65 or, where the LED driver unit has an IP65 rating, the control gear chamber may be IP24.

Electronic control gear shall comply with SA/SNZ TS 1158.6 Clause 3.2.4 with the following additions:

- a) a power factor not less than 0.9 at full power.
- b) be protected by a Surge Protection Device (SPD) with minimum rating of 20kV / 10kA
- c) a minimum predicted power supply failure rate of 0.2% per 1000 operating hours, and
- d) must be capable of supporting constant light output technology.

Manufacturer / supplier shall detail the mechanism for arresting any flicker mode for individual LED units. This must consider dimming levels of 25%, 50%, 75% as well as 100% operating power. As standard nominal correlated colour temperature (CCT) shall be 4000 (K). There shall be no variation between individual LED units comprising a complete luminaire. The department may require a 3000 (K) version for specific environmental considerations.

Luminaires shall have a minimum colour rendering index (CRI) of not less than 70.

As the luminaires are made up of several individual LED units, the manufacturer / supplier shall detail the failure mode for the luminaire and subsequent effect on performance, should individual or strings of LEDs fail.

As a standard, all luminaires shall have the light source chamber covered with a suitable visor or cover, while maintaining minimum IP65 ingress protection. No LED lenses shall be directly exposed to the elements in normal operation.

The cooling system for the LEDs shall consist of a heat sink only with no fans, pumps or liquids and shall be resistant to debris build up to maintain the heat dissipation performance.

8.2.3 Conduits and pits

Conduits and pits shall be in accordance with MRTS91 *Conduits and Pits*. Pit drainage shall be installed as per MRTS91 *Conduits and Pits*.

However, where pits are to be used for the underground installation of solar system equipment, such as batteries and the department approved standard size pits are not suitable, the designer is to select a suitable pit from an approved pit supplier and submit for approval. Lids for these pits shall be steel, minimum rating Class B to AS 3996 and lockable.

In some instances, the burying of pits may be advantageous to deter theft of batteries and electronic control gear. Where this is proposed, the design shall be approved by the department.

8.2.4 QR codes

The luminaire shall have a QR code label fitted to the underside of the luminaire in a readily accessible area suitable for scanning. Where the luminaire is to be mounted above 2 m, the label shall be removed and placed in an easily accessible location.

The label shall be made of a material which maintains readability and integrity for the life of the asset, when subjected to the environmental conditions referenced in Clause 8.2.2.1. The scannable code shall be nominally 30 mm x 30 mm in size. Minimum fields required are shown in Table 8.2.4 The code shall be set up with either a 'carriage return', or semicolon delimiter to separate the fields shown in Table 8.2.4.

Table 8.2.4 – QR Code requirements

Field
Manufacturer
Luminaire wattage
Luminaire model
Luminaire model number
Luminaire serial number
Manufacture date

Attachment 1, for each luminaire submitted, shall be provided to the Administrator.

8.2.5 Terminal panels

Terminal panels, where possible, shall be as shown on Standard Drawings SD1323 and SD1411 as applicable to the particular pole in which they are mounted. If the terminal panels mentioned above do not fit within a pole, a suitable substitute shall be used.

8.2.6 Miscellaneous materials

Nuts, screws, bolts and washers, pole markings, cable terminations, insulation tape, heat shrink tubing and all materials necessary to complete the installation of the pole, shall be provided as required.

8.2.7 Cables

All cables shall comply with the requirements of AS/NZS 3000.

9 Installation, removal and/or relocation of equipment

9.1 Luminaires and boat ramp floodlights

The luminaire shall be connected to the lighting circuit and mounted onto the outreach arm or, for pedestrian crossing floodlights, mounted onto the outreach arm spigot by means of a mounting bracket as shown on Standard Drawings SD1335 and SD1336.

Mounting may be completed before the pole is erected, only if the following steps are adhered to:

- a) the luminaire shall not be in contact with the ground when fixing to the outreach arm spigot
- b) sufficient care shall be taken to reduce undue stress and vibration while the pole is being erected, and
- c) for car park lighting luminaires, the luminaire shall be fixed to the outreach arm spigot so that, when the pole is installed in its upright position, the luminaire is correctly aligned in relation to the road surface, so that the luminaire is parallel with the grade of the road at its centreline.

Cabling shall be secured clear of the luminaire ballast, or other heat sources, which may degrade the cable insulation.

Floodlights aiming point shall be as detailed in the design drawings.

9.2 Installation of poles – car parks and boat ramps

Base plate mounted pole installation for crossfalls up to and including 1:2 shall be erected in accordance with Standard Drawing SD1392, or manufacturers' recommendations.

Base plate mounted pole installation details for crossfalls greater than 1:2 shall be erected in accordance with Standard Drawing SD1393, or manufacturers' recommendations.

9.3 Installation of poles – floating infrastructure, jetties and wharves

Bollard lighting poles shall be installed as per the RPEQ design or manufacturers' recommendations.

Poles shall not be attached to piles.

9.4 Removal of luminaires

All luminaires shall be de energised before removal. Luminaires that are removed, shall be returned to the owning Region's store, or other designated location. Care shall be taken in transporting the luminaires so that they arrive in the same condition as they were when removed and without any further damage from transportation.

Any damage that occurs due to removal or handling subsequent to removal, shall be made good by the Contractor.

9.5 Relocation of luminaires

Luminaires to be relocated, shall first be checked for any internal or external damage, including gaskets and control gear. If the fitting is damaged in any way, a report of that damage shall be provided to the Administrator.

The luminaire shall be stored under cover in a clean, dry location until required to be reinstalled.

The luminaire visor and reflecting surfaces shall be cleaned prior to reinstallation.

The luminaire shall be reinstalled in accordance with the requirements of this Technical Specification.

9.6 Wiring

Pole wiring in base plate mounted poles, shall comply with Standard Drawing SD1399.

Wiring for base plate mounted poles installed on floating structures, jetties and wharves, shall comply with Standard Drawing SD1707.

Wiring for any solar lighting shall comply with MRTS263 *Standalone Solar (PV) Power Systems*.

9.7 Earthing

Where applicable, all metal and concrete poles shall be earthed in accordance with the requirements of AS/NZS 3000 and the relevant Standard Drawings.

9.7.1 Earthing of ground mounted, low voltage lighting poles

Lighting poles shall be earthed by direct connection to the supply neutral by means of a connection having a cross sectional area of not less than 6 mm² (copper).

A separate earth stake is not required for poles that are supported by an anchor cage and footing installed in the ground, provided that all bolted connections used to attach the pole to the foundation are of low electrical resistance (for example, not painted, bolts tight, not corroded, and so on).

Where the pole interface with ground is not of low electrical resistance, an earth stake shall be bonded to the neutral conductor.

9.7.2 Earthing of mains powered lighting installations on jetties, wharves and other structures

A separate earth conductor of minimum size equal to the cross sectional area of the supply active, shall be installed with the supply cabling. The earth shall be connected to the earth point at the pole and at the earth point at the point of the circuit supply. At the point of circuit supply, the earth shall also be connected to the neutral. The neutral conductor shall not be connected to earth at any pole on the bridge. For details, refer to Standard Drawings SD1707 and SD1637.

Where a luminaire installed on a structure is within 2.4 m of the ground or within 1.5 m reach of the public, the luminaire body shall be connected to the earthing system by a connection having a cross sectional area of not less than 6 mm² (copper).

This clause shall also apply to lighting installed on other structures.

10 Testing

The testing and commissioning requirements defined in MRTS201 *General Equipment Requirements*, apply to work under this Technical Specification.

10.1 Testing procedure

The Contractor is responsible for carrying out sufficient testing to ensure that materials and construction standards comply with the requirements of this Technical Specification and the requirements of the Act.

Testing shall be carried out following completion of the installation of all components and before commencement of commissioning. Tests for mains powered lighting shall include the mandatory tests detailed in AS/NZS 3000 and those detailed in Clause 10.2. Tests for solar powered lighting shall include the mandatory and optional tests as applicable as detailed in AS/NZS 4509.1, AS/NZS 5033 and those detailed in Clause 10.3. All results shall be recorded and included with the submission documents.

The test methods to be used for equipment supplied and installed in accordance with this Technical Specification and the results achieved, shall be as defined in the Act. The completed installation shall comply with the requirements of the Act and AS/NZS 3000.

At least seven days prior to the commencement of tests of installed equipment, a compliance testing procedure shall be prepared and submitted to the Administrator. **Milestone**

Compliance testing shall not commence until expiration of the seven-day period. **Hold Point 6**

10.2 Testing requirements for mains powered installations

The following compliance tests shall be carried out:

- a) insulation and resistance tests
- b) polarity tests
- c) earth continuity tests
- d) earth fault loop impedance tests – active to earth fault return path, and
- e) compliance testing of luminaires and ancillaries. Test certificates shall be supplied in accordance with Clause 7.2. All test certificates shall be available in English; where requested, the tests shall be undertaken on each item in the presence of the Administrator. **Witness Point 1**

10.3 Testing requirements for solar powered installations

The following compliance tests shall be carried out:

- a) Wiring (IR test, continuity, short circuits)
- b) DC Polarity
- c) Battery Voltages
- d) System Functionality checks, and
- e) Open circuit voltage

10.4 Testing records

In addition to copies of completed test sheets, the following documents shall also be included in the quality records:

- a) a completed Certificate of Test and Compliance
- b) where a luminaire / floodlight has been removed and/or relocated, a record of the pole number, lamp type, wattage and date when the luminaire / floodlight was removed and/or relocated, and new location

- c) luminaire test certificates shall be current at the time of purchase and shall not be more than 10 years old. Where any significant change is made to the manufacturing process of the luminaire, which has the potential to affect the optical performance of the luminaire, new certified photometric data shall be provided to the department within three months of the date of process change.
- d) mill certificates showing compliance with Clause 2.3.1 of SA/SNZ TS 1158.6, shall be available for each batch of luminaires supplied
- e) the Contractor shall detail the origin of all major components of the luminaire and where final assembly is undertaken
- f) where existing switchboard loads are amended, calculations for the new individual circuit voltage drops based on the new current loading
- g) where existing switchboard loads are altered, amended schedules and labelling
- h) a Record of Inspection and Tests, and
- i) accurate As Constructed drawings.

11 Luminaire warranty

11.1 General

The warranty shall provide for either repair or replacement of the defective parts. The warranty is void if a luminaire defect has resulted from improper installation, improper handling, vandalism, or vehicular accident. Delivery costs associated with repair or replacement of the luminaire under this warranty, shall be borne by the manufacturer / supplier.

11.2 LED luminaires

A warranty must be provided for the full replacement of the luminaire, due to any failure (see Clause 11.1), for a minimum of 10 years. This includes the LED light engine and power supply / drivers.

12 Packaging

12.1 General

All items shall be suitably packaged to ensure that the items are delivered undamaged, giving due consideration to the methods and distance of transportation and handling.

13 Training

The manufacturer / supplier shall provide any training material necessary to ensure the performance of any equipment supplied under this Technical Specification.

14 Supplementary requirements

The requirements of MRTS242 *Recreational Boating Infrastructure Lighting* are varied by the supplementary requirements given in Clause 2 of Annexure MRTS242.1.

Attachment 1 – Technical details LED luminaire
Luminaire Description: _____

Test		Response	Test Certificate / Report No. and Date
IP Rating of Luminaire (Refer Clause 8.2.2.2).	Light Source Chamber	IP _____	No: _____ Date: / /
	Control Gear Chamber	IP _____	
Does luminaire comply with the electrical safety requirements? (Clause 3 SA/SNZ TS 1158.6 and AS/NZS 60598.2.3).		Yes / No	No: _____ Date: / /
Does luminaire comply with the vibration test? (Clause 5.4 of SA/SNZ TS 1158.6).		Yes / No	No: _____ Date: / /
Does luminaire comply with impact resistance criteria? (AS/NZS 60598.2.3).		Yes / No	No: _____ Date: / /
Does luminaire comply with the impulse voltage test? (Clause 5.5 of SA/SNZ TS 1158.6). Did flashover occur?		Yes / No Yes / No	No: _____ Date: / /
Does luminaire comply with the thermal endurance and thermal tests? (Clauses 5.6 of SA/SNZ TS 1158.6).		Yes / No	No: _____ Date: / /
Has an IESNA LM-79 or CIE S 025 test report been provided.		Yes / No	No: _____ Date: / /
Have IESNA LM 80 and IESNA TM21 calculations and extrapolations been provided.		Yes / No	No: _____ Date: / /
Has a luminous intensity distribution Table (I-table) in CIE and IES formats corresponding to the LM-79 or CIE S 025 test reports been provided.		Yes / No	No: _____ Date: / /
Does the power supply meet the requirements of IEC 62386-102 Ed. 2.0?		Yes / No	No: _____ Date: / /
Predicted minimum power supply failure rate of 0.2% per 1000 hrs of operation.		Yes / No	No: _____ Date: / /
Surge Protection Device Rating.		(kV) / (kA)	No: _____ Date: / /
Correlated Colour Temperature (CCT).		(K) ± (K)	No: _____ Date: / /
Initial Lumen Output (lumens).			No: _____ Date: / /
Luminaire Efficacy (lumens / watt).			No: _____ Date: / /
Lumen Depreciation at 50 000 hrs (L--).			No: _____ Date: / /

Test	Response	Test Certificate / Report No. and Date
Overall Power Factor (steady running conditions).		No: _____ Date: / /
Luminaire Driver Current (milliAmps).		No: _____ Date: / /
Luminaire Running Current (Amps).		
Total Luminaire Power Consumption (Watts).		
Luminaire upcast reducing device.	Spigot entry integral Spigot entry insert	
Luminaire Mass (kg).		
Luminaire Sail Area (m ²).		
QR code label attached (refer to Clause 8.2.2.2).	Yes / No	
Is any training material required to ensure the luminaire performs as specified, for example handling, installation, cleaning?	Yes / No	

