Technical Specification

Transport and Main Roads Specifications
MRTS254 Portable Traffic Signals

July 2016
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1 Introduction

This specification defines the design, supply, installation, testing and commissioning, performance, documentation, training, maintenance and handover requirements for Portable Traffic Signals Systems. This technical specification shall be read in conjunction with MRTS01 Introduction to Technical Specifications, MRTS50 Specific Quality System Requirements, Manual of Uniform Traffic Control Devices (MUTCD) Part 3 Works on Roads and other Technical Specifications as appropriate.

Portable Traffic Signal Systems complying with this specification shall only be used in accordance with the operational requirements of the MUTCD Part 3, Supplement 4.11-1.

This technical specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of Terms

The terms defined in MRTS201 General Equipment Requirements apply to this specification. Additional terminology relevant under this specification are defined in table 1 below.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>That section of road, consisting of one or more lanes, used by vehicles approaching an intersection or mid-block site.</td>
</tr>
<tr>
<td>Display</td>
<td>A signal aspect that is illuminated.</td>
</tr>
<tr>
<td>Fixed Time operation</td>
<td>A signal operation mode that allows for only a fixed sequence and fixed duration of displays.</td>
</tr>
<tr>
<td>Flashing yellow operation</td>
<td>A signal operation mode where the yellow aspects continually flash.</td>
</tr>
<tr>
<td>Manual operation</td>
<td>A signal operation method that allows each phase to be individually controlled by manually entering a demand for the next phase.</td>
</tr>
<tr>
<td>Master controller</td>
<td>The internal control processing unit hardware within the Master PTS unit which undertakes all communication and internal processing tasks required for operation. This controller controls the Slave controller operations.</td>
</tr>
<tr>
<td>NATA</td>
<td>National Association of Testing Authorities, Australia.</td>
</tr>
<tr>
<td>Operation Modes</td>
<td>PTSS operation modes include manual, fixed time, vehicle actuated and flashing yellow.</td>
</tr>
<tr>
<td>Portable Traffic Signal Unit</td>
<td>An individual portable traffic signal that consists of the traffic signal lantern, battery, communications equipment, mounting assembly and base.</td>
</tr>
<tr>
<td>Portable Traffic Signal System (PTSS)</td>
<td>Traffic light signals and associated equipment that provides signalling for temporary control of traffic at work sites.</td>
</tr>
<tr>
<td>RPEQ</td>
<td>Registered Professional Engineer of Queensland.</td>
</tr>
<tr>
<td>Hand-held Remote Controller (HRC)</td>
<td>A hand-held remote/device which can control and set the PTSS lanterns. This allows the traffic controller to control operations without being physically located at a PTS.</td>
</tr>
<tr>
<td>Slave controller</td>
<td>The internal control processing unit hardware within the slave PTS unit which undertakes all communication and internal processing tasks required for operation. This unit is subservient to the Master controller to which it is linked.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>TMR</td>
<td>Department of Transport and Main Roads</td>
</tr>
<tr>
<td>Traffic Controller</td>
<td>A person authorized to control traffic movements through site works by means of flags, stop/slow bats or other equipment.</td>
</tr>
<tr>
<td>Vehicle actuated operation</td>
<td>An operation mode that allows a variable sequence and variable duration of signal displays depending on vehicle (and pedestrian) traffic demands. All vehicle movements (phases) are actuated in fully-actuated operation in contrast with semi-actuated operation where only minor vehicle movements (e.g. side traffic) are actuated.</td>
</tr>
<tr>
<td>Yellow Time</td>
<td>Duration of the yellow signal for a phase or movement. This is static and pre-specified.</td>
</tr>
</tbody>
</table>

3 Reference documents

The requirements of the referenced documents listed in Table 3 of MRTS 201 General Equipment Requirements and Table 2 below apply to this specification. Where there are inconsistencies between this specification and referenced MRTS documents, the requirements specified in this specification take precedence.

Table 2 Referenced Documents

<table>
<thead>
<tr>
<th>Document ID</th>
<th>Document Name / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1170.2</td>
<td>Structural Design Actions Part 2: Wind Actions</td>
</tr>
<tr>
<td>AS 2144</td>
<td>Traffic Signal Lanterns</td>
</tr>
<tr>
<td>AS 2700</td>
<td>Colour Standards for General Purposes</td>
</tr>
<tr>
<td>AS 4191</td>
<td>Portable Traffic Signal Systems</td>
</tr>
<tr>
<td>AS 4509.1</td>
<td>Stand-alone Power Systems – Safety and Installation</td>
</tr>
<tr>
<td>AS 4509.2</td>
<td>Stand-alone Power Systems – System Design</td>
</tr>
<tr>
<td>AS 60529</td>
<td>Degrees of Protection Provided by Enclosures (IP Code)</td>
</tr>
<tr>
<td>AS/NZS 5033</td>
<td>Installation and Safety Requirements for Photovoltaic (PV) Arrays</td>
</tr>
<tr>
<td>AS/NZS CISPR 22</td>
<td>Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement</td>
</tr>
<tr>
<td>MRTS 02</td>
<td>Transport and Main Roads Specification - MRTS02 Provision for Traffic</td>
</tr>
<tr>
<td>MRTS 50</td>
<td>Transport and Main Roads Specification – MRTS50 Specific Quality System Requirements</td>
</tr>
<tr>
<td>MRTS 61</td>
<td>Mounting Structures for ITS Devices</td>
</tr>
<tr>
<td>MRTS 201</td>
<td>Transport and Main Roads Specification – MRTS201 General Equipment Specifications</td>
</tr>
<tr>
<td>MUTCD Part 3</td>
<td>Manual of Uniform Traffic Control Devices (MUTCD) - Part 3</td>
</tr>
</tbody>
</table>

4 Quality system requirements

The quality system requirements defined in MRTS 201 General Equipment Requirements and apply to this specification. Additional quality system requirements relevant under this specification are defined in Table 3.
### Table 3 Quality System Requirements

<table>
<thead>
<tr>
<th>Clause</th>
<th>Hold Point</th>
<th>Witness Point</th>
<th>Milestone</th>
</tr>
</thead>
</table>
| 4.1    | 1. Samples for acceptance (design)  
2. Photometric performance certification | | |
| 9.1    | 3. Barrow, tripod or trailer support structure design documentation | | |
| 10     | 4. Detailed design documentation of the electrical wiring including solar and charging assembly and calculations, signed by RPEQ. | | |
| 12     | 1. Factory Acceptance Test | 2. PTSS Demonstration | 3. ACMA Compliance | 4. Site Acceptance Test |

#### 4.1 Samples for Acceptance

Requirements of MRTS201 apply to this specification. A sample PTSS for acceptance and photometric performance certification shall be provided 28 days prior to manufacture. **Hold Point 1**

Detailed designs of the PTSS layout, fabrication and assembly drawings, calculations, specifications and certifications of the PTSS and associated components (signed by the Contractor’s RPEQ) shall be submitted to the Principal via the Administrator for verification prior to manufacture.

Photometric performance test methodology and NATA certification confirming the portable traffic signal system performance requirements specified in this specification shall be submitted before delivery to site. **Hold Point 2**

#### 5 Operational Requirements

##### 5.1 General Operation

The use of all Portable Traffic Signal Systems shall be in accordance with Part 3, supplement 4.11-1 of the MUTCD – “Portable Traffic Signals”. TMR have permitted the use of two types of PTSSs as per Table 4. A type-2 PTSS shall comply with the requirements prescribed in AS 4191 and any additional requirements specified in this document.
Table 4 Permitted PTSS Types

<table>
<thead>
<tr>
<th>PTSS Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type-1</td>
<td>The Type-1 PTSS is intended as a low cost device for usage in low traffic areas where the speed limit is equal or less than 60km/h and where only short term (less than 8 hours) traffic control is required.</td>
</tr>
<tr>
<td>Type-2</td>
<td>The Type-2 PTSS is intended as a device that complies with the requirements in AS4191.</td>
</tr>
</tbody>
</table>

5.2 PTSS Control Methods

PTSS control methods such as manual operation, fixed time operation, vehicle actuated operation and flashing yellow operation shall be in accordance with MUTCD Part 3, supplement 4.11-1.

The PTSS shall be operated through the listed methods in Table 5 below:

Table 5 Permitted PTSS Control Methods

<table>
<thead>
<tr>
<th>Control Method</th>
<th>Permitted PTSS Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand-held Remote Controller (HRC) – Where onsite personnel take local control of the PTSS</td>
<td>1,2</td>
</tr>
<tr>
<td>Maintenance Port for a connected laptop or other device with maintenance and configuration software – at the PTSS</td>
<td>2</td>
</tr>
<tr>
<td>Local Control Panel – Where onsite personnel configure and take manual control of the PTSS</td>
<td>2</td>
</tr>
</tbody>
</table>

5.3 PTSS Start-Up Sequence

The PTSS start-up sequence will not take place until the PTSS has undergone a complete system check to establish that all components are functional, including that the communication system has been established and verified working to all portable traffic signal units.

5.3.1 Start-Up Interlocks

Equipment shall be provided with interlocks to prevent the portable traffic signal system from operating in other than the flashing yellow mode unless all of the essential modules are correctly fitted.

5.3.2 Manual mode of operation

5.3.2.1 Type-1 Start up Sequence

In the manual mode of operation, the type-1 portable traffic signal system shall be designed to start up in the following sequence:

a) Display a flashing yellow signal (0.5 second on and off) for a period of 5 seconds on all portable traffic signals that are in use.

b) Display an all-red display on all portable traffic signals that are in use for a minimum of 5 seconds before a signal state change can be initiated by an operator.
5.3.2.2 Type-2 Start up Sequence

In the manual mode of operation, the type-2 portable traffic signal system shall be designed to start up as per AS 4191.

5.4 Reliability

All Portable Traffic Signal Systems shall have a high availability with a minimum of 99.9% operating reliability over the lifetime of the system.

5.5 Portable Traffic Signal System Comparison

A comparison table of the major differences between the PTSS systems are listed in Table 6 below.

Table 6 PTSS Comparison Table

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type-1</th>
<th>Type-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Manual</td>
<td>Manual/Unattended</td>
</tr>
<tr>
<td>Operator Controls</td>
<td>Wireless HRC</td>
<td>Wired/Wireless HRC, Local Control Panel</td>
</tr>
<tr>
<td>Battery Technology</td>
<td>Lithium iron phosphate</td>
<td>Lithium iron phosphate, Lead-acid, Nickel-cadmium.</td>
</tr>
<tr>
<td>Battery Capacity</td>
<td>12 hours</td>
<td>7 sun free days</td>
</tr>
<tr>
<td>Solar System</td>
<td>Optional</td>
<td>Required</td>
</tr>
<tr>
<td>Weight</td>
<td>25kg</td>
<td>No limit</td>
</tr>
<tr>
<td>Target Board</td>
<td>Optional</td>
<td>Required</td>
</tr>
<tr>
<td>Data Logging</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Time Settings</td>
<td>Non-configurable</td>
<td>Configurable</td>
</tr>
</tbody>
</table>

6 Functional Requirements

The functional requirements of a Type-1 PTSS shall comply with the following sections in this document and MUTCD Part 3 supplement 4.11-1. A type-2 PTSS shall comply with AS4191, the MUTCD Part 3 supplement 4.11-1 and clauses in this document specifically referring to type-2 systems.

6.1 Operator Controls

A Type-1 PTSS shall only be operated via a HRC. Type-2 PTSS shall be operator controls shall be in accordance with AS 4191.

6.2 Controller Requirements

Controller requirements for a type-2 PTSS shall be in accordance with AS 4191. A type-1 PTSS shall comply with the requirements specified below:

a) Support all processing associated with the communications for the paired portable traffic signals.

b) Ensure an all-red interval is in place before any green signal can be displayed.
c) Ensure that the requested signal is displayed on the correct portable traffic signal and carries out all associated processing and monitoring functions.

d) Provide software interlocking to ensure conflicting green/green displays cannot occur whilst utilising the shuttle control type.

e) Provide software interlocking to ensure opposing displays cannot occur whilst utilising the gating control type.

f) Monitor, log (where required) and report the operation of each connected portable traffic signal individually.

g) Not allow signal state changes to be made by the operators until 5 seconds has elapsed since the start-up procedure has completed.

h) Allow portable traffic signals to be controlled individually or as a pair when in operation.

i) Accept valid commands and reject invalid commands.

### 6.3 Hand-held Remote Controller (Type-1)

Operation of a type-1 PTSS is via a HRC wireless communications device. The HRC shall be a handheld wireless remote or optionally a smart device that runs an application to control the PTSS.

The following requirements shall apply to the use of the HRC:

a) Have a unique ID that is transmitted with each request from the HRC and/or other security arrangements to ensure that the portable traffic signal units paired with that PTSS can only be changed by the paired HRC.

b) The HRC will be capable of switching the PTSS displays on/off. The PTSS displays shall only be shut-down once the start-up/shut-down button is pressed and held for 5 seconds. After 5 seconds the displays will turn off and all aspects shall be blank.

c) The HRC shall provide a button to initiate the start-up procedure on the PTSS as per section 5.3.3.1. It shall only be active once the HRC has successfully paired to one or two portable traffic signal unit.

d) The HRC shall have a facility to allow the operator to select which portable traffic signals to pair/connect to.

e) The HRC shall provide a self-test button. The button shall test each paired signal unit by activating a signal test procedure that displays a green signal, yellow signal, red signal and a blank signal for 0.5 seconds each and in the listed order.

f) The HRC shall provide visual confirmation of the state of both portable traffic signals as well as a fault alarm indicator (with audible warning) for each portable traffic signal unit. A fault alarm will trigger with the scenarios listed in section 8.2.

g) The HRC shall provide a battery level indicator and provide battery status information for the HRC and both portable traffic signal units.

h) The HRC shall indicate whether zero, one or two portable traffic signals are paired with the HRC.

### 6.4 Portable Traffic Signal Unit (Type-1)

The following requirements shall apply to the use of each portable traffic signal unit:

a) A portable traffic signal unit cannot pair to multiple HRCs at the same time.
b) When power is connected to a portable traffic signal unit the default state shall remain blank until a start-up command is received from the HRC.

c) After the start-up procedure has been completed the active aspect shall be red until 5 seconds has elapsed and a command to change the signal is received from the HRC.

d) A type-1 portable traffic signal unit shall be equipped with tilt and inclination sensors.

6.5 **PTSS Master / Slave Pairing (Type-1)**

The PTSS shall support one of these configurations for master and slave pairing:

a) Each of the two portable traffic signal units shall act as a **Slave** and the HRC shall act as a **Master**.

b) One of the portable traffic signal units shall act as a **Master** and the other shall act as a **Slave**.

7 **Communication Requirements**

Requirements for the PTSSs communication system is below. Type-2 portable traffic signal systems shall comply with the requirements in AS4191 in addition to section 7 of this document.

7.1.1 **Hand-held Remote Controller and Portable Traffic Signals**

Communication between the HRC and portable traffic signal units shall be via a local wireless communication technology such as Ultra-High Frequency (UHF) radio band or other reliable wireless technology. Wireless communications shall also be encrypted.

The HRC and portable traffic signal units shall communicate reliably over point to point ranges of 1000m.

Periodic 2 second communications (time-out period) polling message (heartbeat) shall be transmitted for the purposes of establishing whether a loss of communications has occurred. When a command is issued on the HRC a heartbeat message shall be broadcast. When loss of communications has been detected, an alert shall be raised on the HRC.

Where a HRC has requested a signal change on a portable traffic signal unit, the signal change procedure shall be initiated within 250ms of the request. The portable traffic signal unit must acknowledge to the master that the signal change procedure has been initiated within 250ms of the request being received.

Communications shall be in accordance with Australian Communications and Media Authority (ACMA) requirements.

7.2 **Communications Timeout**

7.2.1 **Type-1**

In the event that a slave does not receive an acknowledgement from the master within 2 seconds of the heartbeat signal being sent, the PTSS shall:

- The portable traffic signal unit shall go to an all red display. The aspect that is currently green shall go to yellow for the minimum yellow time and then to a red display until communication is re-established and a command from the HRC is able to be issued by the traffic controller.

- The HRC shall display a visual indication of the communications loss and play an audible alarm that alerts the traffic controller.
7.2.2 Type-2

If communications are disrupted with a type-2 PTSS, the device shall comply with the requirements prescribed in section 2.8.2 of AS 4191.

7.3 Communications Identifiers

The HRC and portable traffic signal units shall each have a unique communications ID.

Communications messages between the HRC and portable traffic signal units shall include a checksum that is based on the message information exchanged to ensure integrity of the communication is upheld.

The checksum shall be verified periodically and recomputed when the master controller is reset/rebooted.

7.3.1 Portable Traffic Signal System ID

Any communications messages transmitted shall embed each portable traffic signal units respective ID.

8 PTSS Monitoring, Reporting and Fault Requirements

8.1 Faults (Type-1)

In the event of a fault, the traffic controller shall be alerted via the HRC in use with a visual and audible alert on the HRC and the portable traffic signal unit where the fault occurred.

Faults shall include the following:

a) Low battery alarm (When less than 60 minutes of power remaining)

b) Charging voltage too high – When the battery charge voltage exceeds the maximum charge voltage for the selected battery (e.g. indicating a possible battery charge regulator problem)

c) Loss of solar module (where installed)

d) Green or yellow aspect fault

e) Critical faults.

8.1.1 Critical Faults (Type-1)

When a critical fault occurs the PTSS shall go to an all red display on all portable traffic signal units within 5 seconds regardless of the control type.

In addition to Items c, d, f, g, i and j listed under section 2.8.2 of AS4191, critical faults shall include the following:

a) Movement of the portable traffic signal unit after installation, detected through:
   − Monitored GPS location (where a GPS is installed) of the portable traffic signal unit exceeding the installed location by 30m.
   − Monitored directional compass position of the portable traffic signal unit exceeds installed position by ±20 degrees (yaw).
   − Monitored inclination of the portable traffic signal unit exceeds installed position by ±20 degrees (roll or pitch).

b) Loss of communication

c) Red aspect fault
d) Conflicting green signals occurring in shuttle control

e) Opposing signals occurring in gating control

f) Undefined behaviour or system crash

9  Mechanical and Physical Requirements

9.1 General

The mechanical and physical requirements defined in MRTS201 General Equipment Requirements and MRTS61 apply to the Portable Traffic Signal System and associated control electronics defined by this specification. Portable traffic signal lantern shall be capable of being mounted on a pole that connects to a barrow, tripod or trailer support structure.

All compartments that contain any electronic components shall have an ingress protection rating of at least IP45 as defined in AS 60529. A certificate or letter of compliance from a NATA approved testing facility shall be made available to TMR upon request.

Support structure design documentation for type-1 and type-2 devices, shall be submitted to the Principal’s representative for acceptance 28 days prior to manufacture. [Hold Point 3]

The portable traffic signal system shall be constructed from durable materials to enable installation and reliable operations.

The type-1 portable traffic signal system shall be lightweight to ensure easy loading/unloading from a vehicle to the intended installation site by one or two persons. Each portable traffic signal unit shall not exceed 25kg.

9.2 Design Life

Unless otherwise specified, the design life of components shall be as follows:

a) PTSS mechanical components and structure: a minimum of 20 years.

b) PTSS and HRC Electrical components and systems: a minimum of 10 years.

c) Lantern body, structural supports and any mechanical accessories, including any protective coatings, are designed for a service life of at least 20 years.

9.3 PTS Mounting

The vehicle on which the PTS is mounted or stored shall conform to the requirements of the host vehicle specified in AS4191 (For type-2 PTSS) and this specification.

9.3.1 Barrow/Tripod Mounts

Where the portable traffic signal unit is mounted on a barrow or tripod (Figure 1), the portable traffic signal shall have a mechanical system which allows the portable traffic signal to be safely secured for transportation.

The mechanical system shall also allow for the portable traffic signal unit to be safely erected on site to ensure the unit is clearly visible. The mechanical systems shall also ensure that the portable traffic signal unit cannot rotate due to wind gusts up to the ultimate wind speed the structure is designed.

9.3.2 Trailer Mounts

Where the PTSS is mounted on a trailer (Figure 1), the portable traffic signal unit and solar panel array (if applicable) shall have a mechanical system which allows the portable traffic signal unit and solar panel to be safely secured to the trailer for transportation.
The mechanical system shall also allow for the portable traffic signal unit and solar panel to be safely erected on site and the solar panels shall be adjustable to ensure optimum solar exposure and maximum energy generation anywhere in Queensland.

The mechanical systems shall ensure that the portable traffic signal cannot rotate due to wind gusts up to the ultimate wind speed that the structure is designed for.

The trailer shall comply with the applicable Australian Design Rules and shall be suitable for registration in accordance with the statutory requirements of the State of Queensland.

![Figure 1 Example Portable Traffic Signal Unit Mountings (For Illustrative Purposes Only)](image)

9.3.3 Surface Finishes

The external finishes of equipment items shall be resistant to corrosion. All metal surfaces shall be painted in the range of high visibility colours from X15 Orange to X13 Marigold as specified in AS2700. All surface finishes of portable traffic signal systems shall comply with AS 4191. The finish of lanterns, target boards and visors shall comply with AS 2144.

9.3.4 Mounting Pole

The mounting pole for a type-1 portable traffic signal unit shall have a minimum height to the base of the signal lantern of at least 1.5m. A type-2 portable traffic signal unit shall comply with the lantern mounting height requirements prescribed in the MUTCD part 14, section 5.2.

9.3.5 Dimensions

The dimensions for a type-1 portable traffic signal unit shall take into consideration the sizes of the individual components required to be supported by the barrow or tripod. Each portable traffic signal unit is intended to be loaded and unloaded from a vehicle by up to two persons and therefore dimensions shall not exceed a size that will make this difficult or unsafe.

A type-2 portable traffic signal unit shall not exceed dimensions that are unsafe or impractical to mount on a trailer.

9.3.6 Wind Loading

For a type-2 PTSS, All components of the PTSS shall be designed and certified by a suitably qualified RPEQ to ensure that the PTSS will maintain its intended orientation and position when subjected to the wind loading conditions of the region in which the PTSS is intended to be deployed, in accordance with AS1170.2.

9.3.6.1 Vehicle Induced Turbulence

The PTSS shall be designed to ensure that portable traffic signal unit will maintain its intended orientation and position when subject to vehicle induced turbulence from b-double heavy vehicles at up to 70km/h.
9.3.7 Battery, Controller and Communications Compartment

The storage compartment shall incorporate room for a battery, communications and controller components. The compartment shall be key lockable and comply with applicable OH&S regulations and requirements.

Any storage compartments shall have dust and moisture ingress protection of at least IP45.

A type-1 portable traffic signal unit shall have a switch fitted externally to disconnect the battery from the portable traffic signal unit. The switch shall be mounted so that it is not easily accessible to the general public.

9.3.8 Stabilisers

The PTSS shall be suitably designed to ensure stability of each portable traffic signal unit when positioned on site. The type of stabilisers shall:

a) Allow for swivel.

b) Be located on the four corners of the trailer or barrow (where a trailer or barrow is used), have fixed locations engineered to stabilise the barrow, trailer or tripod with the portable traffic signal unit fully extended while meeting wind loading conditions.

c) Be wind-down and readily storable for safe and secure moving.

d) Have a load rating sufficient for levelling of the portable traffic signal unit.

e) Have a locking mechanism with removable handles and secure drive nuts.

f) A type-1 PTSS can use sandbags to increase stability.

9.4 Traffic Signal Lantern

The traffic signal lantern requirements indicated below specifically refer to the physical lantern and not the electronic or optical performance requirements.

The traffic signal lantern and associated control electronics, shall comply with the relevant requirements of MRTS201 General Equipment Requirements. All physical requirements of the lantern shall comply with AS 2144 unless otherwise specified.

9.4.1 Target Boards

It is not a requirement for type-1 PTSS to be equipped with target boards. Type-2 PTSSs shall use target boards in accordance with AS4191. Target boards shall be manufactured from aluminium.

9.4.2 Visors

Each aspect of each lantern shall be fitted with a visor in accordance with the requirements of AS2144.

9.5 Hand-held Remote Controller

The hand-held remote controller shall be lightweight, have a ruggedised construction, and be resistant to mishandling, shock and vibrations. The HRC shall have an ingress protection rating of at least IP65 as defined in AS 60529.

10 Electrical Requirements

The electrical requirements of MRTS 201 apply to this specification unless otherwise specified. Additional electrical requirements for equipment provided under this specification are given below.
Detailed designs of the electrical wiring and if applicable solar and charging assembly shall be reviewed and signed by the Contractor’s RPEQ. They shall then be submitted and approved by the Principal or their delegate for verification and acceptance. **Hold Point 4**

### 10.1 Portable Traffic Signal Lanterns

The electrical requirements of traffic signal lantern aspects used in portable traffic signal systems shall be in accordance with the requirements of AS 2144, unless otherwise specified.

Only three aspect (green, yellow, red) LED lanterns shall be used.

#### 10.1.1 Supply Voltage

The PTSS shall only use traffic signal lantern aspects that are 12V Direct Current (D.C.) lanterns as per AS 2144:

#### 10.1.2 Dimming

Dimming is not a requirement for a type-1 PTSS. Type-2 portable traffic signal systems shall comply with the requirements set in AS 4191.

### 10.2 Solar Panel Array

This section applies to all PTSS types that use solar systems. Solar systems are optional in type-1 portable traffic signal systems. In type-2 portable traffic signal systems solar systems are required.

The selection, configuration, installation and testing of Solar panel modules shall be consistent with AS 4509.1, AS 4509.2 and AS/NZS 5033. Additionally type-2 solar panel arrays shall be compliant with the requirements in AS 4191.

All Solar panel module fittings and adjustments shall be designed, manufactured and tested with appropriate theft prevention methods.

The Solar Panel size shall not exceed the barrow or trailer footprint intended for portable traffic signal unit mounting;

### 10.3 Batteries

#### 10.3.1 Portable Traffic Signal System

The type-1 PTSS shall be powered from batteries, a solar charging system can optionally be used. Type-2 PTSSs shall be powered by solar, batteries and/or via a generator in accordance with AS4191. The battery technology used in a type-1 PTSS shall be lithium iron phosphate (LiFePO$_4$) or an allowable battery technology for a type-2 PTSS as per AS 4191 and subject to the following additional conditions:

- a) Can operate the connected load for a minimum of 12 hours of continuous operation (type-1) or can operate the connected load for a minimum of 7 sun free days (type-2)
- b) Type-1 devices shall have a facility that allows the battery to be charged without interrupting the current operation of the PTSS
- c) Depth of Discharge (DOD) cannot exceed 80%
- d) Batteries shall be installed to minimise the risk of:
  - i. Impact by a motor vehicle
  - ii. Theft or vandalism
  - iii. Explosion.
Suitable circuit protection shall be fitted between the battery and any connected load. The circuit protection shall be appropriately sized for the rated load.

A switch shall be fitted to safely disconnect the battery from the load in the event of a catastrophic failure or incorrect signal display.

10.3.2 Hand-held Remote Control (Type-1)

The hand-held remote control shall be powered from batteries. The battery technology used shall be lithium iron (Li-ion) and subject to the following additional conditions:

a) Can operate the connected load for a minimum of 12 hours of continuous operation under normal usage conditions.

b) The HRC shall have a facility that allows the battery to be charged without interrupting the current operation of the HRC.

c) Depth of Discharge (DOD) cannot exceed 50%.

d) The battery used shall have a cycle life of at least 800 cycles.

10.3.3 Battery Charger

All battery chargers shall be connected to the battery bank by fixed wiring via the main battery fuse or circuit breaker. If the main battery fuse or circuit breaker will not provide overcurrent protection for the battery charger output wiring, the battery charger output cabling shall be protected from overcurrent by separate HRC fusing or a D.C. rated circuit breaker adjacent to the main battery fuse or circuit breaker. The battery charger shall be fitted with a fuse or circuit breaker to provide an isolating point and battery charger overcurrent protection.

11 Portable Traffic Signal Lantern Photometric Performance

The photometric performance of signal lanterns used with a PTSS shall meet the parameters defined in AS 2144. NATA accredited test report must be provided to TMR to ensure photometric compliance. Documentation

11.1 Operations and Maintenance Manual

Each PTSS shall be supplied with an operations and maintenance manual detailing how to safely use the system. As a minimum it shall detail:

a) Safe transportation of the portable traffic signal unit

b) On-site installation

c) Suitable locations for installation

d) Setting up of the PTSS for operation

e) HRC Operation

f) Starting up

g) Shutting down

h) Safe manual handling procedures for the batteries

i) Routine and preventative maintenance

j) Troubleshooting

k) Workplace Health and Safety (WH&S) requirements
Specific details and calculations of the battery size. If a solar system is used this documentation shall contain all the applicable elements provided in the worked example of Appendix A of AS 4509.2. The manufacturer specification sheet of the photo voltaic array, batteries and battery charger/regulator shall be provided.

12 Testing, Commissioning and Configuration Requirements

After the PTSS is first built and before being used on site a Factory Acceptance Tests (FAT) shall be completed in accordance with the requirements of this specification. Witness Point 1

The PTSS shall be demonstrated to the satisfaction of The Department of Transport and Main Roads. The PTSS is required to operate for 1 hour without any faults occurring. All functionality shall be tested whilst under demonstration. Witness Point 2

A Regulatory Compliance Mark (RCM) prescribed by the Australian Communications and Media Authority (ACMA) shall be required. Witness Point 3

The testing documentation for each PTSS used on site shall be provided to the Principal when submitting the Traffic Guidance Scheme (TGS) in accordance with MRTS 02 Section 5.3.2.

A Site Acceptance Test (SAT) shall also be performed Witness Point 4. The PTSS is required to operate for 500 hours without any faults occurring whilst being operated by a traffic controller at a work site requiring traffic control and must not be left unattended to be considered valid. After 100 hours, additional PTSS’s can be used to contribute towards a higher 600 hour requirement.

Table 7 PTSS Required Testing Hours

<table>
<thead>
<tr>
<th>Number of PTSS</th>
<th>Hours per PTSS</th>
<th>Hours Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
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</tr>
<tr>
<td>5</td>
<td>120</td>
<td>600</td>
</tr>
</tbody>
</table>

Whilst the SAT is being performed a detailed log must be kept and must contain the following information.

- Date
- Start and End Time
- Hours Used
- Company
- Location
- Name of Traffic Controller/s using the PTSS
- Number of faults
- Description of faults
- Signature
The generic Installation Acceptance Test (IAT), Commissioning Test (CT) and Customer Acceptance Test (CAT) shall be replaced with the contractor’s configuration process. The minimum general requirements for this process are detailed in MRTS 201.

13 Warranty Provisions

The warranty requirements defined in MRTS 201 apply to this standard.

14 Training Requirements

The training requirements defined in MRTS 201 General Equipment Requirements apply to this specification.

15 Maintenance Requirements

The maintenance requirements defined in MRTS 201 General Equipment Requirements apply to this specification.

16 Handover Requirements

The handover requirements defined in MRTS201 General Equipment Requirements apply to this specification.