

Technical Specification

**Transport and Main Road Specifications
MRTS264 Type-1 Portable Traffic Signals**

November 2018

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1 Introduction

This Technical Specification defines the design, supply, installation, testing and commissioning, performance, documentation, training, maintenance and handover requirements for Type-1 Portable Traffic Signals Systems. This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS201 *General Equipment Requirements*, Queensland *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 Technical 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 Technical Specification. Additional terminology relevant under this Technical Specification are defined in Table 2 below.

Table 2 – Definitions of terms

Term	Definition
Approach	That section of road, consisting of one or more lanes, used by vehicles approaching an intersection or mid-block site.
Display	A signal aspect that is illuminated.
Fixed Time operation	A signal operation mode that allows for only a fixed sequence and fixed duration of displays.
Flashing yellow operation	A signal operation mode where the yellow aspects continually flash.
Manual operation	A signal operation method where each phase is individually controlled by manually entering a command for the next phase.
Master controller	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.
NATA	National Association of Testing Authorities, Australia.
Operation Modes	PTSS Type-1 operation mode is manual only.
Portable Traffic Signal Unit (PTSU)	An individual portable traffic signal that consists of the traffic signal lantern, battery, communications equipment, mounting assembly and base.
Portable Traffic Signals System (PTSS)	Traffic light signals and associated equipment that provides signalling for temporary control of traffic at work sites.
RPEQ	Registered Professional Engineer of Queensland.
Hand-held Remote Controller (HRC)	A hand-held remote / device which can control and set the PTSS lanterns at a safe distance. This device may be wired or wireless.
Slave controller	The internal control processing unit hardware within the slave PTSU which undertakes all communication and internal processing tasks required for operation. This unit is subservient to the Master controller to which it is linked.

Term	Definition
Traffic Controller	A person authorised to control traffic movements through site works by means of flags, stop / slow bats or other equipment.
Yellow Time	Duration of the yellow signal for a phase or movement. This is static and pre-specified.

3 Reference documents

The requirements of the referenced documents listed in Table 3 of MRTS201 *General Equipment Requirements* and Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and referenced MRTS documents, the requirements specified in this Technical Specification take precedence.

Table 3 – Referenced documents

Reference	Title
AS 1170.2	<i>Structural Design Actions - Wind Actions</i>
AS 2144	<i>Traffic Signal Lanterns</i>
AS 2700	<i>Colour Standards for General Purposes</i>
AS 4191	<i>Portable Traffic Signals</i>
AS 60529	<i>Degrees of Protection Provided by Enclosures (IP Code)</i>
AS/NZS 4509.1	<i>Stand-alone Power Systems – Safety and Installation</i>
AS/NZS 4509.2	<i>Stand-alone Power Systems – System Design</i>
AS/NZS 5033	<i>Installation and Safety Requirements for Photovoltaic (PV) Arrays</i>
AS/NZS CISPR 22	<i>Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement</i>
MRTS02	<i>Provision for Traffic</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS61	<i>Mounting Structures for ITS Devices</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS265	<i>Type-2 Portable Traffic Signals</i>
MUTCD Part 3	<i>Queensland Manual of Uniform Traffic Control Devices (MUTCD) – Part 3 Works on Roads</i>
MUTCD Part 3, Supplement 4.11-1	<i>Manual of Uniform Traffic Control Devices (MUTCD) – Part 3 – Supplement 4.11-1 Portable Traffic Signals</i>

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

The quality system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional Hold Points and Witness Points applicable to this Technical Specification are summarised in Table 4.1. There are no Milestones defined.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
4.2	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 charging assembly and calculations, signed by RPEQ.		
13		1. Factory Acceptance Test 2. PTSS Demonstration 3. ACMA Compliance 4. Site Acceptance Test	

4.2 Samples for acceptance

The requirements of MRTS201 *General Equipment Requirements* apply to this Technical 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 testing methodology and NATA certification confirming the PTSS performance requirements specified in this Technical Specification shall be submitted before delivery to site. **Hold Point 2**

5 Type-1 Overview

The purpose of this clause is to provide an overview of a Type-1 PTSS. For the Technical Specification of a Type-2 PTSS see MRTS265 *Type-2 Portable Traffic Signals*.

The functional requirements of a Type-1 PTSS shall comply with clauses in this document.

A Type-1 PTSS shall be used where only short term traffic control is required in accordance with the MUTCD.

5.1 Type-1 Features

The major features of a Type-1 PTSS are listed in Table 5.1 below.

Table 5.1 – Type-1 PTSS features

Feature	Type-1
Operation	Manual
Operator Controls	HRC
PTSU Battery Technology	Lithium iron phosphate
PTSU and HRC Battery Capacity	12 hours
Solar System	Not permitted
Maximum mass of each PTSU	25 kg
Target Board	In accordance with visibility assessment
Data Logging	Optional
Time Settings	Non-configurable (Yellow time 4 seconds)
Vehicle Actuated Operation	Not permitted
Dimming	Not required

A Type-1 PTSS is a manually operated device for usage in scenarios where shuttle control, plant-crossing control and gating control for single lane only operation are required for short durations of time.

5.2 Type-1 control method

A Type-1 PTSS control method shall be manual via a Hand-held Remote Control (HRC) where onsite personnel take local control of the PTSS.

5.3 Reliability

Type-1 PTSS shall have a high availability with a minimum of 99.9% operating reliability over the lifetime of the system.

6 Type-1 Functional requirements

The functional requirements of a Type-1 PTSS shall comply with the clauses in this document.

6.1 Type-1 PTSS start up sequence

A Type-1 PTSS traffic signal start-up sequence shall not take place until the PTSS has undergone a complete system check to establish that all components are functional, including a self-test of each lantern and that the communication system has been established and verified working to all PTSUs and the master controller.

6.1.1 Type-1 Start-up interlocks

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

6.1.2 Type-1 Manual mode of operation start-up sequence

In the manual mode of operation, the Type-1 PTSS 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.

6.2 Type-1 Operator controls

A Type-1 PTSS shall only be operated via a HRC.

6.3 Type-1 Controller requirements

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 only one PTSU can be in operation whilst utilising the gating control type.
- f) Ensure that the yellow time is set to 4 seconds and is not changeable.
- g) Monitor, log (where required) and report the operation of each connected Portable Traffic Signal individually.
- h) Not allow signal state changes to be made by the operators until 5 seconds has elapsed since the start-up procedure has completed.
- i) Allow Portable Traffic Signals to be controlled individually or as a pair when in operation.
- j) Accept valid commands and reject invalid commands.
- k) Have a visual indicator as specified in AS 4191:2015 paragraph 3.3.2 Lantern Monitor.

6.4 Type-1 Hand-held remote controller

Operation of a Type-1 PTSS is via an HRC.

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

- a) If HRC is wireless, it shall transmit with a unique ID or other security arrangements to ensure that the PTSUs paired with that PTSS can only be changed by the paired HRC.
- b) The HRC shall 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 shall 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 Clause 6.1.2. It shall only be active once the HRC has successfully paired to one or two PTSU(s).
- d) The HRC shall have a facility to allow the operator to select which PTSUs 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 0.1-0.2 seconds each and in the listed order.
- f) The HRC shall provide visual confirmation of the state of each PTSU under control as well as a fault alarm indicator (with audible warning) for each PTSU. A fault alarm will trigger with the scenarios listed in Clause 8.
- g) The HRC shall provide a battery level indicator and provide battery status information for the HRC and both PTSUs.
- h) The HRC shall indicate whether zero, one or two portable traffic signals are paired with the HRC.

6.5 Type-1 Portable traffic signal unit

The following requirements shall apply to the use of each Type-1 PTSU:

- a) A PTSU shall be controlled by only one HRC. A HRC shall not control more than two PTSU's at the same time.
- b) When power is connected to a PTSU, 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) Each PTSU shall be equipped with tilt and inclination sensors.

7 Type-1 Communication requirements

Type-1 PTSS communication system shall comply with the requirements specified below and the requirements of the Australian Communications and Media Authority (ACMA) as per AS 4191:2015 Section 1.4.

7.1 Type-1 Hand-held remote controller and Portable Traffic Signals

Communication between the master controller, HRC and PTSUs shall be via a local wired connection or a wireless technology such as Ultra-High Frequency (UHF) radio band or other reliable wireless technology. Wireless communications shall be encrypted.

The manufacturer shall stipulate the maximum communication range between the PTSU and the master controller. Communication shall be reliable under all weather conditions up to the stated distance. It is desirable that the PTSU and the master controller can communicate over distances of 1000 m.

Periodic two-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, a heartbeat message shall be broadcast. When loss of communications has been detected by the master controller, an alert shall be raised on the HRC.

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

7.2 Type-1 Communications timeout

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

- The PTSU shall go to an all red display. The aspect that is currently green shall go to yellow for four seconds and then to a red display until communication is re-established and a command 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.

7.3 Type-1 Communications identifiers

The HRC, master controller and PTSUs shall each have a unique communications ID which shall be used to ensure messages are sent and received by individual units as intended.

Communications messages between the master controller, HRC and PTSUs shall include a checksum that is based on the message information exchanged to ensure integrity of the communication is upheld.

7.3.1 Type-1 Portable Traffic Signal System ID

Any communications messages transmitted shall embed each PTSU respective ID.

8 Type-1 PTSS monitoring, reporting and fault requirements

A Type-1 PTSS monitoring, reporting and fault requirements shall comply with the requirements specified below.

8.1 Type-1 Faults

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

Faults shall include the following:

- low battery alarm (when less than 60 minutes of power remaining)
- charging voltage too high – when the battery charge voltage exceeds the maximum charge voltage for the selected battery (for example, indicating a possible battery charge regulator problem)
- green or yellow aspect fault, and
- critical faults.

8.1.1 Type-1 Critical faults

When a critical fault occurs, the PTSS shall go to an all red display on all PTSUs 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 AS 4191, critical faults shall include the following:

- a) movement of the PTSU after installation, detected through:
 - i. monitored GPS location (where a GPS is installed) of the PTSU exceeding the installed location by 30 m
 - ii. monitored directional compass position of the PTSU exceeds installed position by $\pm 20^\circ$ (yaw)
 - iii. monitored inclination of the PTSU exceeds installed position by $\pm 20^\circ$ (roll or pitch).
- b) loss of communication
- c) red aspect fault
- d) conflicting green signals occurring in shuttle control, and
- e) undefined behaviour or system crash.

9 Type-1 Mechanical and physical requirements

9.1 Type-1 General

The mechanical and physical requirements defined in MRTS201 *General Equipment Requirements* and MRTS61 *Mounting Structures for ITS Devices* apply to the PTSS and associated control electronics defined by this Technical Specification. Portable traffic signal lanterns shall be capable of being mounted on a pole that connects to a barrow or tripod 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 the department upon request.

Support structure design documentation for Type-1 devices, shall be submitted to the Principal's representative for acceptance 28 days prior to manufacture. **Hold Point 3**

The PTSS shall be constructed from durable materials to enable installation and reliable operations.

A Type-1 PTSS is intended as a lightweight device to ensure easy loading / unloading from a vehicle or trailer to the intended installation site by one or two persons.

9.2 Type-1 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 Type-1 PTS mounting

9.3.1 Type-1 Tripod / Barrow mounts

When the PTSU is mounted on a tripod or barrow (Figure 9.3.1), 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 PTSU to be safely erected on site to ensure the unit is clearly visible. A Type-1 PTSS barrow or tripod shall have the capability to use a ballast such as sandbags to stabilise the structure.

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

Figure 9.3.1 – Example Portable Traffic Signal Unit Mountings (for illustrative purposes only)



9.3.2 Type-1 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 AS 2700. All surface finishes of PTSSs shall comply with AS 4191. The finish of lanterns, target boards and visors shall comply with AS 2144.

9.3.3 Type-1 Mounting pole

The mounting pole for a Type-1 PTSU shall have a height to the base of the signal lantern of 1.5 m to 2 m.

9.3.4 Type-1 Dimensions

The dimensions for a Type-1 PTSU shall take into consideration the sizes of the individual components required to be supported by the barrow or tripod. Each PTSU 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.

9.3.5 Type-1 Wind loading

A Type-1 PTSS shall be designed to maintain its intended orientation and position when subjected to wind speeds up to 20.0 m/s.

20.0 m/s wind speeds takes into account the combined effects of prevailing weather conditions and turbulence from passing heavy vehicles.

Ballasts such as sandbags can be used to increase stability of each PTSU and any associated components. The manufacturer shall submit wind load test reports which stipulate the maximum wind speed that the PTSS can be subjected to and any ballast requirements.

9.3.6 Type-1 Battery, controller and communications compartment

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

Each Type-1 PTSU shall have a switch fitted externally to disconnect the battery from the PTSU. The switch shall be mounted so that it is not easily accessible to the general public.

9.3.7 Type-1 Stabilisers

The PTSS shall be suitably designed to ensure stability of each PTSU when positioned on site. The type of stabilisers shall:

- a) allow for swivel
- b) be located on the four corners of a barrow (where a barrow is used), have fixed locations engineered to stabilise the barrow or tripod with the PTSU 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 PTSU
- e) have a locking mechanism with removable handles and secure drive nuts
- f) use sandbags to increase stability.

9.4 Type-1 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.

A Type-1 lantern shall also have a visual indicator as specified in AS 4191 for *Lantern Monitor*.

9.4.1 Type-1 Target boards

Type-1 PTSS with a target board may be required if the visibility is compromised based on the visibility assessment required by the *Manual of Uniform Traffic Control Devices (MUTCD) Supplement, Part 3: Works on Roads*.

Type-1 PTSS target boards shall be manufactured from aluminium complying with the requirements of AS 4191.

9.4.2 Type-1 Visors

Each aspect of each lantern shall be fitted with a visor in accordance with the requirements of AS 2144.

9.5 Type-1 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 Type-1 Electrical requirements

The electrical requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification unless otherwise specified. Additional electrical requirements for equipment provided under this Technical Specification are given below.

Detailed designs of the electrical wiring 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 Type-1 Portable traffic signal lanterns

The electrical requirements of traffic signal lantern aspects used in PTSSs 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 Type-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 Type-1 Dimming

Dimming is not a requirement for a Type-1 PTSS.

10.2 Type-1 Solar panel array

Solar systems are not permitted in Type-1 PTSS.

10.3 Type-1 Batteries

10.3.1 Type-1 Portable Traffic Signal System

The Type-1 PTSS shall be powered from batteries. The battery technology used in a Type-1 PTSS shall be lithium iron phosphate (LiFePO₄) and subject to the following additional conditions:

- a) Shall operate a PTSS for a minimum of 12 hours of continuous operation.
- b) Shall have a facility that allows the battery to be charged without interrupting the current operation of the PTSS.
- c) Shall not exceed 80% Depth of Discharge (DOD).

- d) Shall be installed to minimise the risk of:
 - i. impact by a motor vehicle
 - ii. theft or vandalism, and
 - 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 Type-1 Hand-held remote control

The hand-held remote control shall be powered from batteries. The battery technology used shall be lithium iron (LiFePO₄) or Li-ion and subject to the following additional conditions:

- a) The battery shall 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) shall not exceed 50%.
- d) The battery used shall have a cycle life of at least 800 cycles.

10.3.3 Type-1 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 fuse 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 Type-1 Portable traffic signal lantern photometric performance

The photometric performance of signal lanterns used with a Type-1 PTSS shall meet the parameters defined in AS 2144. A NATA accredited test report must be provided to the department to ensure photometric compliance.

12 Type-1 Documentation requirements

Each PTSS shall be supplied with documentation for training, configuration, operation and maintenance detailing how to safely use the system. As a minimum it shall detail:

- a) safe transportation of the PTSU
- 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
- l) specific details and calculations of the battery size. The manufacturer specification sheet for the batteries and battery charger / regulator shall be provided.

13 Type-1 Testing, commissioning and configuration requirements

After the PTSS is first built and before being used on site, a Factory Acceptance Test (FAT) shall be completed in accordance with the requirements of this Technical 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 one hour without any faults occurring. All functionality shall be tested whilst under demonstration. **Witness Point 2**

A Regulatory Compliance Mark (RCM) prescribed by the 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 Clause 5.3.2 of MRTS02 *Provision for Traffic*.

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 PTSSs can be used to contribute towards a higher 600 hour requirement.

Table 13 – PTSS required testing hours

Number of PTSS	Hours per PTSS	Hours Total
1	500	500
2	300	600
3	200	600
4	150	600
5	120	600

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

- a) date
- b) start and end time
- c) hours used
- d) company
- e) location

- f) name of traffic controller(s) using the PTSS
- g) number of faults
- h) description of faults, and
- i) signature.

14 Type-1 Warranty provisions

The warranty requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

15 Type-1 Training requirements

The training requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

16 Type-1 Maintenance requirements

The maintenance requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

17 Type-1 Handover requirements

The handover requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

