TRANSPORT FOR NSW

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-081

TYPE 1 PORTABLE TRAFFIC SIGNALS WITH BOOM BARRIER

Issue: 1.0
Dated: 5/08/2020
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RECORD OF AMENDMENTS

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<tr>
<td>0.1 draft</td>
<td>Initial Draft</td>
<td>1/6/2020</td>
<td></td>
</tr>
<tr>
<td>0.2 draft</td>
<td>Amendments to Initial Draft</td>
<td>11/06/2020</td>
<td></td>
</tr>
<tr>
<td>0.3 draft</td>
<td>TSI Review</td>
<td>15/06/2020</td>
<td></td>
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<tr>
<td>0.4 draft</td>
<td>Final Draft – TSI and TES Amendments</td>
<td>14/07/2020</td>
<td></td>
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<tr>
<td>0.5 draft</td>
<td>TES Final Draft Review Amendments</td>
<td>21/07/2020</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>Published</td>
<td>5/8/2020</td>
<td>Director ITS</td>
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1 SCOPE

1.1 General

This specification covers the requirements for TfNSW Type 1 Portable Traffic Signal Systems with Boom Barrier (Type 1 PTS-B) to be used in the state of NSW to control vehicular traffic, typically used to provide temporary control at short term roadworks. The Type 1 PTS-B only intends to be in partial compliance with the AS4191 [4] requirements.


1.2 Application

The Type 1 PTS-B traffic signal system is meant to be used only where short-term traffic control is required, with its application being defined in TETD 2019/02 Technical Direction [8] and Traffic Control at Worksites Technical Manual [9].

A Type 1 PTS-B is intended as a manually operated device, as a replacement for manual STOP/SLOW bats, for usage in scenarios where shuttle control and gating control are required for short durations of time. If unattended operation or long durations are required then a Standard PTS shall be used.

Since a Type 1 PTS-B is used in place of STOP/SLOW bats; they can be used in three main configurations.

- Single display lantern controlled by an authorised Traffic Controller using a handheld remote controller, portable traffic signal unit; or,
- Two display lanterns controlled by an authorised Traffic Controller using a handheld remote controller, portable traffic signal group; or,
- Two or more display lanterns, with each display lantern being controlled by an authorised Traffic Controller using a handheld remote controller, two or more portable traffic signal units.

2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian and International Standards

2.2 TfNSW Documents

[10] TS201 – Approval of ITS Field Equipment
[15] TSI-SP-059 – Type 1 Portable traffic signals

2.3 Other Documents


3 DEFINITIONS AND GLOSSARY OF TERMS

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

- **Boom Barrier** – A mechanical device that extends from a PTS-B unit to allow or prevent vehicular traffic and/or pedestrian flow into a controlled work zone.
- **Display Lantern** – A 3 aspect (red, yellow, green) traffic lantern
- **HRC** – Hand-held Remote Controller
- **Portable** – Transportable between sites, suited to being quickly set up on a new site.
- **PTSU** – Portable traffic signal unit, a display lantern with its mechanical support
- **Standard PTS** – Portable Traffic (signal) System as defined in this specification TSI-SP-049
- **TfNSW** – Transport for New South Wales
- **Traffic Controller** – A trained personal whose duty is to control traffic at work sites. This control is normally exercised by the use of STOP/SLOW bats, but may be by manual control traffic signals or other device.
- **Type 1 PTS** – Portable Traffic Signal System as defined in this specification TSI-SP-059, i.e. a HRC with one or two linked PTSU(s)
- **Type 1 PTS-B** – Portable Traffic Signals with Boom Barrier System as defined in this specification; i.e. a HRC with one or two linked PTSU(s) and Boom Barrier/s
4 PORTABLE TRAFFIC SIGNAL SYSTEM COMPARISON

Attached is the key comparison of differences in features between the TfNSW Type 1 PTS-B traffic signal system and the TfNSW Standard PTS:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type 1 PTS-B</th>
<th>Standard PTS</th>
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<tbody>
<tr>
<td>Operation</td>
<td>Manual</td>
<td>Manual/Unattended</td>
</tr>
<tr>
<td>Operator Controls</td>
<td>Hand-held Remote Controller</td>
<td>Hand-held Remote Controller, Local Control Panel</td>
</tr>
<tr>
<td>Battery Capacity</td>
<td>12 hours operation</td>
<td>Seven sun free days</td>
</tr>
<tr>
<td>Solar System</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Mass of each PTSU</td>
<td>Suitable for manual handling</td>
<td>No limit</td>
</tr>
<tr>
<td>Target Board with White Border</td>
<td>Required</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 (Yellow time four seconds)</td>
<td>Configurable</td>
</tr>
<tr>
<td>Dimming</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Visors</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Power</td>
<td>Batteries only</td>
<td>Various</td>
</tr>
<tr>
<td>Boom Barrier</td>
<td>Required</td>
<td>Not Required</td>
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5 GENERAL REQUIREMENTS

5.1 Compliance to AS4191 Scope and General

The Type 1 PTS-B traffic signal system shall comply with the requirement of Section 1 of AS4191 [4].

5.2 Generic Compliance

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

5.3 Safety

The Type 1 PTS-B traffic signal system shall comply with the requirements of the NSW Work Health and Safety Act [16].

Note: It is expected that evidence of compliance will be submitted with an approval submission.

5.4 Documentation

User manuals shall be compliant to TSI-SP-062 [13].
6 OPERATIONAL REQUIREMENTS

6.1 Control Types

The control types of Type 1 PTS-B traffic signal systems shall be compliant to Clause 2.1 of AS4191 [4].

6.2 Modes of Operation

Provision shall be made for the Traffic Controller to be able to set:

1. a single PTS-B unit to green
2. all linked PST-B units to red
3. a single PST-B unit to flashing yellow
4. all linked PST-B units to flashing yellow

6.3 Manual PTS Control Method

The Type 1 PTS-B traffic signal system shall be controlled via a Hand-held Remote Controller (HRC) by local Traffic Controllers who have local control of the Type 1 PTS-B. Feedback must be provided to the HRC and visually on the rear of the lantern for the Traffic Controller to adequately understand the display state of the Type 1 PTS-B they are controlling.

6.4 Start-Up Sequence Under Manual Mode of Operation

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

a) Display a flashing yellow signal (see clause 6.5) for a period of five seconds on all Type 1 PTS-B units that are in use.

b) Display an all-red display on all Type 1 PTS-B units that are in use for five ±0.5 seconds before a signal state change can be initiated by a Traffic Controller using the HRC. The Boom Barrier shall close into the horizontal position with its red LED beacons or LED flashers flashing while the all-red is displayed.

6.5 Flashing Yellow

The red and green aspects shall remain blacked out when the PTS-B unit is required to display flashing yellow. The yellow aspects shall flash (0.5 second on, ±10%) at a rate between 55 and 65 flashes per minute.

6.6 Sequence and Timing


The yellow interval shall be displayed for 4 seconds. The length of time that red and green shall be displayed will be controlled by the Traffic Controller using the HRC.

The Boom Barrier’s red LED warning lights shall flash during the red interval.

If the Boom Barrier is in the vertical position, and if no obstructions are detected then it shall be lowered into the horizontal position during the All-Red interval. At the start of the Green
interval the Boom Barrier is in the horizontal position, then it then shall be raised into the vertical position.

The total travel time for the Boom Barrier to its alternate vertical or horizontal position shall be less than 2.0 seconds.

7 FUNCTIONAL REQUIREMENTS

7.1 Lantern Monitor

The Type 1 PTS-B traffic signal system shall comply with the requirement of Clause 3.3.2, of AS4191 [4].

7.2 Lamp Monitoring

The Type 1 PTS-B traffic signal system shall comply with the requirement of Clause 3.4, of AS4191 [4] with the amendment that the visual indication shall be on the HRC not at the master controller.

7.3 Operator Control

The Type 1 PTS-B traffic signal system shall be operated via a Hand-held Remote Controller (HRC).

7.4 Control Requirements

Type 1 PTS-B traffic signal system shall comply with the requirements specified below:

a) Support all processing associated with the communications for the linked PTS-B unit.

b) Ensure an all-red interval is in place before any green signal can be displayed.

c) Ensure an all-red interval is in place before a flashing yellow signal can be displayed.

d) Ensure that the requested signal is displayed on the correct PTS-B unit and carries out all associated processing and monitoring functions.

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

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

g) Ensure that the yellow time is set to four seconds and is not changeable.

h) Ensure that the all-red time is set to five seconds and is not changeable.

i) Ensure that there is separation between test/setup mode and operation mode for the HRC and linked PTS-B units.

j) When the master control is switched off any linked PTS-B units are automatically un-paired. Alternatively, a mechanism shall be provided for the Traffic Controller using the HRC to identify unit 1 and unit 2.

k) Monitor, log (if required) and report the operation of each connected Type 1 PTS-B individually.

l) Not allow signal state changes to be made by the operators until five seconds has elapsed since the start-up procedure has completed.
m) For operation allow the HRC to be linked to a single PTS-B unit or a pair of PTS-B units.

n) All components of the PTS-B traffic signal system should distinguish between valid commands and invalid commands and react accordingly.

7.4.1 Control Requirements for Boom Barrier

The following control requirements shall be implemented:

a) The red LED beacons or LED arrays shall flash during the traffic signal red intervals to warn motorists and/or pedestrians of the pending lowering of the horizontal barrier.

b) Whilst the Boom Barrier is in the horizontal position (lowered), the red LED beacons or LED arrays shall continue to flash.

c) The red LED beacons or LED arrays will cease to flash once the Boom Barrier begins to rise (vertical) into position.

d) Ensure the Boom Barrier is in the vertical position for the duration of the Green interval.

e) An audible alarm shall alert pedestrians and/or motorists at the start of the Yellow interval that the Boom Barrier will be lowered.

f) The audible alarm shall cease when the Boom Barrier is in its vertical or horizontal position.

g) In conjunction with the Barrier Boom, a safety device shall be used, such as an ultrasonic sensor, to ensure that the area of the Boom Barrier is clear of obstructions.

7.5 Hand-held Remote Controller

The hand-held remote controller requirements shall be as follows:

a) HRC shall control linked PTS-B units wirelessly.

b) HRC shall control linked PTS-B units in a secure manner such that the linked PTS-B units can only be controlled by the HRC they are inked to.

Note: Possible resolutions could include unique ID’s, encrypted communications and/or other security arrangements.

c) The HRC shall be capable of switching the Type 1 PTS-B units on/off. The mechanism for on/off shall not be able to be executed accidentally, i.e. the on/off mechanism shall require to be activated for at least 3 seconds, but no more than 6 seconds.

d) The HRC shall provide a mechanism to initiate the start-up procedure on the Type 1 PTS-B traffic signal system as per Clause 5.3.3.1. It shall only be active once the HRC has successfully paired to one or two PTS-B units.

e) The method of linking or pairing a PTS-B unit shall require either:
   - a temporary wire connection, or
   - a secure wireless discovery and synchronisation.

f) 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 and red signal for 0.4-0.5 seconds each, in the listed order, followed by blanking the PTS-B unit. The Boom Barrier shall remain in the vertical position and the red LED
beacons or LED arrays shall be flash tested for 0.4-0.5 seconds each, after the signal unit the self-test.

g) The HRC shall provide visual confirmation of the state of linked PTS-B units as well as a fault alarm indicator for each PTS-B unit. A fault alarm will be raised in accordance with the scenarios listed in Clause 8.1.

h) The HRC PTS-B unit fault alarm indicator shall be accompanied by an audible and/or vibration warning.

i) The HRC shall provide a battery level indicator and provide battery status information for the HRC and linked PTS-B units.

j) The HRC shall indicate whether zero, one or two Type 1 PTS-B units are paired with the HRC.

k) The Boom Barrier’s operation shall be tied to the PTS-B units it is coupled with.

7.6 Portable Traffic Signal Unit (PTS-B)

The following requirements shall apply to the use of each PTS-B unit:

a) PTS-B unit cannot pair to multiple HRCs at the same time.

b) When power is connected to a PTS-B unit, the default state shall remain blank until a command is received from the HRC.

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

d) PTS-B unit shall be equipped with tilt and inclination sensors, which will raise a fault alarm indicator with the HRC when triggered.

7.7 Master / Slave Pairing

The Type 1 PTS-B traffic signal system shall support the following for master controller and slave pairing:

a) Each PTS-B unit shall act as a Slave to commands from the master control (mandatory).

b) The HRC should act as the master control (preferred).

c) The master control may be located external to PTS-B unit and the HRC.

7.8 COMMUNICATION REQUIREMENTS

7.8.1 General

Communication between the, HRC and PTS-B units shall be via a local wireless technology. Wireless communications shall be encrypted.

The manufacturer shall stipulate the maximum communication range between the PTS-B unit and the master controller. Communication shall be reliable under all weather conditions up to the stated distance. It is desirable that the PTS-B unit and the HRC can communicate over distances of a minimum of 100 m.

Where a signal change has been requested on a HRC, the signal change procedure shall be initiated within 250 ms of the request. The PTS-B unit must acknowledge to the master that the signal change procedure has been initiated within 250 ms of the request being received.
All wireless communications used shall comply with the relevant ACMA requirements.

7.8.2 Communication Timeout

A periodic communication polling message (heartbeat) shall be transmitted for the purposes of establishing whether a loss of communications has occurred. The heartbeat shall be sent every 1-3 seconds. When loss of communications has been detected by the master controller, an alert shall be raised on the HRC.

In the event that a slave does not receive a heartbeat signal from the master within 125% of the nominated periodicity of the heartbeat the PTS-B unit shall respond as specified in Clause 8.1.

In the event that the master does not receive a response from a PTS-B unit when a command is issued within 3 seconds the HRC shall provide an indication on the HRC.

7.8.3 Communications Integrity

The manufacturer must ensure that each device, HRC and PTS-B unit shall have a unique communications ID, over the population of devices that the supplier manufactures, which shall be used to ensure messages are sent and received by individual units as intended.

Communications messages between the HRC and PTS-B units shall be secure and/or encrypted to ensure integrity of the message information exchanged.

8 MONITORING, REPORTING AND FAULT REQUIREMENTS

8.1 Critical Fault Response

When a critical fault occurs, the Type 1 PTS-B traffic signal system shall go to an all-red display on all PTS-B units within five seconds regardless of the control type.

a) The HRC shall display a visual indication of a fault condition and enable an audible alarm that alerts the Traffic Controller state.

b) The HRC shall set linked PTS-B units to red.

c) Each PTS-B unit shall go to a red display. The aspect that is currently green shall go to yellow for four seconds and then to a red display.

d) The Boom Barrier shall, if clear of obstructions, be lowered into its horizontal position to prevent vehicles and/or pedestrians entering the work zone.

8.2 Critical Faults

In addition to Items c, g, i, j and k listed under Clause 2.8.2 of AS4191 [4], critical faults shall include the following:

a) movement of the PTS-B unit after setting it into operation
   - monitored GPS location (where a GPS is installed) of the PTS-B unit exceeding the installed location by 30m
   - Monitored directional compass position of the PTS-B unit exceeds installed position by ±20 degrees
   - tilting of the PTS-B unit by more than 20 degrees from the vertical
b) loss of communication

c) red aspect fault
d) the yellow is displayed for less than the required interval
e) conflicting green signals occurring in shuttle control
f) undefined system error or behaviour, system lockup or crash.

8.3 Faults

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 indicating and the PTS-B unit where the fault occurred.

Faults shall include the following:

a) low battery alarm (when less than 60 minutes of power remaining);

b) green or yellow aspect fault;

c) where a safety device, such as an ultrasonic sensor, has a fault, then the Boom Barrier shall remain, or be forced, in the raised (vertical) position;

d) where a Boom Barrier fails to be raised to the vertical position during the PTS-B unit green phase;

e) where one or more boom barrier red LED beacon or LED arrays have failed.

8.3.1 Solar Power Units

Where the Type 1 PTS-B unit is supplied with a solar panel, the supplier shall detail the relevant alarms associated with the solar panel and charging system.

9 MECHANICAL AND PHYSICAL REQUIREMENTS

9.1 Weight

Each PTS-B traffic signal system shall be suitable for manual handling as per the NSW Work, Health and Safety Act, either as a whole or suitably split into parts. It 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 Mounting

9.2.1 Housing

A Type 1 PTS-B traffic signal system shall be appropriately stabilised at all times during use. The Type 1 PTS-B unit shall have the capability to use a ballast, such as sandbags, or other methods to stabilise the housing. The mechanical systems shall also ensure that the PTS-B unit cannot rotate due to wind gusts up to the ultimate wind speed the structure is designed for.

A sign indicating “Stop Here On Red Signal” (R6-6A) shall be attached to the housing to indicate the position at which the vehicle and / or pedestrian must stop.

9.2.2 Mounting pole

The mounting pole shall have a height to the base of the signal lantern of 1.5 m to 2 m from the road surface.
9.2.3 Dimensions

The dimensions for a Type 1 PTS-B unit shall take into consideration the sizes of the individual components required to be supported by the housing. Each PTS-B unit is intended to be safely loaded and unloaded from a vehicle by no more than two persons and therefore dimensions shall not exceed a size that will make this difficult or creates a manual handling risk (see Clause 5.3).

9.2.4 Battery, Controller and Communications Compartment

A Type 1 PTS-B unit shall have a dual-pole switch fitted externally to disconnect the battery from the PTS-B unit. The switch shall be mounted so that it is not easily noticeable to the general public.

9.2.5 Boom Barrier

The Type 1 PTS-B Boom Barrier arm shall:

(a) be made from a light, durable and UV resistant material and be capable of being removed by one person using tool for transport or faults;

(b) extend outward a minimum two (2) metres from its mounting point, and have a means to be extended at least 1 metre to cater for wider road lanes. The extension shall be secure. In its lowered (horizontal) position, the bottom of the Boom Barrier arm shall be at a height of 1 metre ±10 cm above the road surface;

(c) be able to automatically move into any one of two positions:

(i) raised (vertical); and,

(ii) lowered (horizontal)

(d) not interfere with viewing of the traffic signal lantern aspects at any time;

(e) have LED flashing warning lights along the front and, optionally, the rear, to have a visual warning that the barrier will be moved;

(f) be accompanied by a safety device, such as an ultrasonic sensor, to prevent the barrier lowering into the horizontal position due to an obstruction;

(g) not prevent the traffic signal timings of the PTS-B unit be halted or changed, unless a critical fault condition has been detected;

9.2.6 Flashing Warning Lights

The Type 1 PTS-B Boom Barrier arm shall have red LED flashing warning lights (beacons or an array) along its extension and visible to motorists and/or pedestrian from either direction. A minimum of two warning lights are to be visible for each direction.

The flashing warning lights shall be:

(a) highly visible both by day and night, particularly in bright sunlight, to provide a visual warning of impending movement or fault;

(b) waterproof; and

(c) dimmable for night use.

10 TRAFFIC SIGNAL LANTERN
The preferred traffic signal lanterns to be used are TfNSW type approved traffic signal lanterns.

10.1 Traffic Signal Lantern General

The Type 1 PTS-B traffic signal system shall comply with the requirement of Clause 4.1, Clause 4.2 and Clause 4.3 of AS4191 [4].

10.2 Target Boards

Target boards are required for Type 1 PTS-B traffic signal system as per Clause 4.4 of AS2144 [1], with border requirements as per Clause 7.3 of TSI-SP-045 Issue 2.0 [11].

10.3 Dimming

Dimming is required for Type 1 PTS-B traffic signal system as per Clause 6.5 of AS4191 [4].

10.4 Visors

Visors are required for Type 1 PTS-B traffic signal system as per Clause 4.5 of AS4191 [4], and as per Clause 7.2 of TSI-SP-045 Issue 2.0 [11].

11 POWER SUPPLY

11.1 Power General

The Type 1 PTS-B traffic signal system shall be powered from batteries.

11.2 Low-Voltage Cut-Off

The Type 1 PTS-B traffic signal system shall comply with the low-voltage cut-off requirement of Clause 6.2 of AS4191 [4].

The battery health and status shall be monitored and facilities in place to aid users in managing battery health, e.g. monitoring depth of discharge and switching off at a suitable time with suitable notification to operators.

11.3 Batteries

The Type 1 PTS-B traffic signal system shall comply with the requirement of Clause 6.5 of AS4191 [4].

Type 1 PTS-B shall be powered from batteries, and batteries must have capacity for a minimum of 12 hours of continuous operation.

Note: Manufacturers should ensure that there is spare capacity to allow for battery degradation.

11.4 Power for Hand-held Remote Control

The hand-held remote control shall be powered from batteries.

a) The battery can operate the connected load for a minimum of 12 hours of continuous operation under normal usage conditions.
b) Battery health shall be monitored and facilities in place to aid users in managing battery health, e.g. monitoring depth of discharge and switching off at a suitable time with suitable notification to operators.

12 ENVIRONMENTAL REQUIREMENTS

The Type 1 PTS-B traffic signal system shall comply with the requirement of Section 7 of AS4191 [4], except Clause 7.3.

12.1 Wind Loading

Any use of ballast to increase the capability of the PTS-B unit to withstand the subjected wind speed shall be clearly and explicitly detailed in the equipment Manuals. The manufacturer shall stipulate the maximum wind speed that the Type 1 PTS-B unit can be subjected to and the associated ballast or stabiliser requirements.

13 STATUTORY REQUIREMENT CERTIFICATION AND LABELLING

The equipment shall be certified for applicable statutory requirements such as for:

a) Electrical safety; including AS 3000 [1] and AS3820 [3].

b) Electromagnetic compatibility AS/NZS 61000.6.3 [7].

c) Radio communications (the applicable standard/s will be dependent on the wireless technology used).

Certified equipment shall be labelled as specified under statutory regulations, with the applicable regulatory compliance labels.

14 QUALITY ASSURANCE AND CONTROL

14.1 Quality System

The Supplier and the manufacturer shall operate a quality management system complying with ISO 9001 [5], certified by an accredited quality management system certification body.

14.2 Quality Plan

The manufacturer shall document and provide a quality plan including details of quality control tests, sampling, and records to be made by the manufacturer during manufacture and release. A copy of this quality plan shall be provided to TfNSW as part of the approval process. Acceptance of this quality plan by TfNSW is a prerequisite to gaining overall approval.

14.3 Quality Audits

TfNSW reserves the right to examine the Manufacturer's quality records pertaining to an order that is on behalf or TfNSW. TfNSW also reserves the right to arrange for an independent quality audit concerning items in contract.

15 APPROVAL
15.1 Approval Process

To gain approval of the Type 1 PTS-B traffic signal system, the supplier shall follow the process defined in TS201 [10].

If requested by TfNSW, the supplier shall provide a sample Type 1 PTS-B together with accessories, for TfNSW to evaluate.

Regarding wind capability, the supplier shall state whether they are seeking approval to cover Region B in addition to Region A, (or other terrain categories) and provide evidence accordingly. Approval, if granted, will be limited to regions and terrain for which capability has been demonstrated and accepted.