
# Uninterruptible power systems (UPS)

## Intelligent transport systems (ITS) delivery specification

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# 1 Overview

*This section defines the purpose of the equipment within the operational system.*

## 1.1 Purpose

The purpose of this delivery specification is to provide requirements for the procurement of uninterruptible power systems (UPS) and associated batteries into roadside cabinets connected to a continuous mains grid 230V power supply, and integration of the UPS into the Principal's monitoring systems.

## 1.2 Overview

UPS provide for battery backed up power to be supplied to site loads whenever normal network mains power fails or is out of allowable limits. The UPS will automatically seamlessly switch from using the mains power source to the battery-derived source without loss of power supply to the loads. On return of mains power, the UPS will seamlessly revert back to mains supply and recharge the UPS batteries.

Where an ITS design standard or delivery specification requires the provision of a UPS for installation within the associated roadside cabinet, it shall meet the requirements of this delivery specification.

### 1.2.1 NZTA ITS class

009 Power – Equipment and infrastructure used to power roadside devices
Class definitions

## 1.3 Scope

The UPS equipment defined by this delivery specification shall:

i. be installed within ITS roadside cabinets within the 19-inch mounting system as per ITS design standard: *Roadside cabinets* and ITS delivery specification: *Roadside cabinets*
ii. be supplied with a permanent 230V mains grid power supply (streetlighting circuits and solar installations are considered out of scope for this specification)
iii. have readily accessible batteries and UPS modules able to be quickly replaced on site by utilisation of plug and socket connections for units 2.5kW and smaller, and unhampered removal of equipment from racks
iv. provide limited size options for loads between 500W and 2500W and connection to the ITS cabinet via plugs and sockets – larger capacity systems shall be permanently wired
v. support a range of battery mode operation times (autonomy periods) that match criticality and response-time objectives
vi. be selected from modular size and autonomy time steps to facilitate replacement of faulty or end-of-life systems with available spare units
vii. comply with requirements of AS 5715:2015 *Uninterruptible power systems (UPS) for roadside devices* (AS 5715) except where a requirement is specifically clarified or excluded within this delivery specification. This delivery specification only applies to provision of UPS units, batteries and electrical connection to cabinet systems but not UPS enclosure cabinets. Specific clauses within AS 5715 relating

to provision of a UPS cabinet and associated cabinet requirement are not within the scope of this delivery specification.

The requirements of this delivery specification are limited to systems installed within roadside ITS cabinets providing services to variable message signs (VMS), closed-circuit television (CCTV), traffic signals and similar systems, up to 7kW capacity and between 1-hour and 8-hour support periods.

Larger capacity systems that either (a) are above 7kW, (b) require more than 8 hours support time, (c) are unable to be accommodated within standard roadside cabinets, or (d) are associated with tunnels and buildings require specific detailed designs to be undertaken and are presently excluded from the scope of this delivery specification.

# 2 Functional requirements

*This section outlines what the equipment and systems need to do (functional), and how they need to do it (non-functional).*

## 2.1 General

### 2.1.1 Compliance to AS 5715

The UPS shall meet the functional requirements of AS 5715.

### 2.1.2 AS 5715 options

Appendix D of AS 5715, titled 'Information to be provided by the purchaser', requires selection of options available within the standard. Specific requirements for this delivery specification are detailed in Table 1.

| Parameter | Requirement | Required value |
|---|---|---|
| (a) | UPS topology | Either line-interactive or double-conversion |
| (b) | Load capacity | Refer to section 2.2.1 of this UPS delivery specification |
| (c) | Load support time | Refer to section 2.2.1 of this UPS delivery specification |
| (d) | Battery type | Lead acid or lithium-iron phosphate |
| (e) | Battery shelving | Shelves supplied with rack out capability if necessary to facilitate rapid replacement |
| (f) | Dimensions | Refer to section 5.3 of this UPS delivery specification |
| (g) | Housing material | Not applicable |
| (h) | Housing colour | Not applicable |
| (i) | Generator plug rating | Not applicable |
| (j) | Type of door lock | Not applicable |

*Table 1. AS 5715 Appendix D options*

## 2.2 Capacity and battery support times

### 2.2.1 Unit capacities

When a UPS is required to be provisioned at a site, the UPS loads shall be identified by determination of specific loads intended to be connected via the UPS and used to select the required UPS design capacity. UPS sizes shall be selected from nine levels of maximum load capacity:

i. 500W (plug/socket connected)
ii. 1000W (plug/socket connected)
iii. 1500W (plug/socket connected)
iv. 2000W (plug/socket connected)
v. 2500W (plug/socket connected)

vi. 3000W (permanently wired)
vii. 5000W (permanently wired)
viii. 6000W (permanently wired)
ix. 7000W (permanently wired)

Any UPS that is nameplate rated between these values shall be considered to have an appropriate rating rounded down to match one of the nine load step levels facilitating replacement with different equipment models where necessary.

UPS of 500W and 1000W shall be supplied with standard 10A New Zealand plugs complying with AS/NZS 3112:2017 *Approval and test specification – Plugs and socket-outlets* (AS/NZS 3112) to allow for connection to a roadside cabinet mains power supply socket of either the matching 10A or 15A size standard.

UPS of 1500W, 2000W and 2500W shall be supplied with 15A plugs complying with AS/NZS 3112 for connection to 15A sockets in the ITS cabinets.

### 2.2.2 Battery support times

The required UPS battery support time shall be identified for the site as per section A.3.3 in Appendix A, which will determine the site peak power load, continuous average load, and battery support time required for the site.

A UPS shall then be selected from the size range options defined in this delivery specification by rounding requirements up to the first standard size option available that fulfils the requirements. Unit kW capacity shall be based on the requested maximum load capacity, while battery capacity is to be based on the requested average load and support time. Size selections shall be based on both determination of system maximum load ratings and the battery load and support time factors.

Note that to avoid oversizing of battery systems, section A.3.2 in Appendix A identifies the average load for battery calculations and shall not automatically be based on using the maximum site load demand level unless the maximum demand is expected to be continuous.

To provide for end-of-life and non-optimal environmental operating temperatures, battery support time compliance shall also meet the requirements of section 3.2.1 in this delivery specification.

### 2.2.3 Battery modularity and voltage

The UPS shall operate with battery strings in the 40 to 80V range to minimise cable volt drop issues and to maintain battery voltages within the extra-low voltage (ELV) range. Battery selection shall be consistent with installation within 19-inch rack sizes and must fit within the depth limitation of the Principal's ITS cabinets. Multiple strings shall be provided to support the longer autonomy durations to enable installation within the rack and ensure optimised utilisation of cabinet space. For consistency across sites, battery sizes shall be selected to:

i. fit within the constraints of the standard ITS rack width and depth limitations
ii. allow for provision of multiple strings to support the higher load and backup time requirements to meet support time options identified below in Table 2

iii. minimise the number of battery sizes across sites by use of multiple strings to provide for increasing support times rather than different battery sizes for every support time requirement.

Where multiple strings are required to be installed, replacement of any string shall not require removal of the complete UPS or other strings to facilitate replacement of the batteries.

| Max UPS load (Watts) | Connection via | Average battery discharge design load options | Allowable options for support time requirement (as determined by Appendix A) |
|---|---|---|---|
| 500 | 10A plug | 100% of max only | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 1000 | 10A plug | 50% or 100% of max only | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 1500 | 15A plug | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 2000 | 15A plug | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 2500 | 15A plug | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 3000 | Direct wired | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 5000 | Direct wired | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 6000 | Direct wired | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| 7000 | Direct wired 15A | 25%, 50%, 75% or 100% of max | 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr |
| >7000 | Outside scope of specification – Site-specific design required | | |

*Table 2. Battery capacity requirements*

## 2.3 UPS operation

### 2.3.1 Allowable UPS topology

The UPS is to operate as either a line-interactive or double-conversion device, meeting the requirements of AS 5715. It shall provide nominal supply voltage to equipment loads while being provided with out-of-limit mains supply voltages within the levels required as per AS 5715 Table 7.1 ‘UPS voltage and frequency thresholds’.

### 2.3.2 Alarm connectivity and local displays

Alarms and system status/load information shall be provided as per AS 5715 to allow for local display, connection of a portable laptop and remote connection to remote monitoring systems. The UPS shall have an RJ45 port available to be connected to the Principal’s operational technology network. The device should support Simple Network Management Protocol version 3 (SNMPv3) and ideally Dynamic Host Configuration Protocol (DHCP). This will enable the Principal to add the devices of the UPS monitoring system for UPS fault alarming. The Principal is able to map field device media access control (MAC) addresses with static Internet Protocol (IP) addresses on the DHCP systems.

Ethernet and universal serial bus (USB) connections for local connections shall be readily accessible allowing for connection of portable equipment. If required, a patch cord shall be provided to extend the socket to a readily accessible location.

### 2.3.3 Operating modes

In normal operation, the UPS shall be supplied from a permanent site mains power circuit within the roadside cabinet. The UPS shall support the load from either mains power when available, or via the UPS batteries when power has failed. UPS recharge their batteries when power returns. Refer to Figure 1 and Figure 2 for schematics of the allowable UPS topologies and their modes of operation.

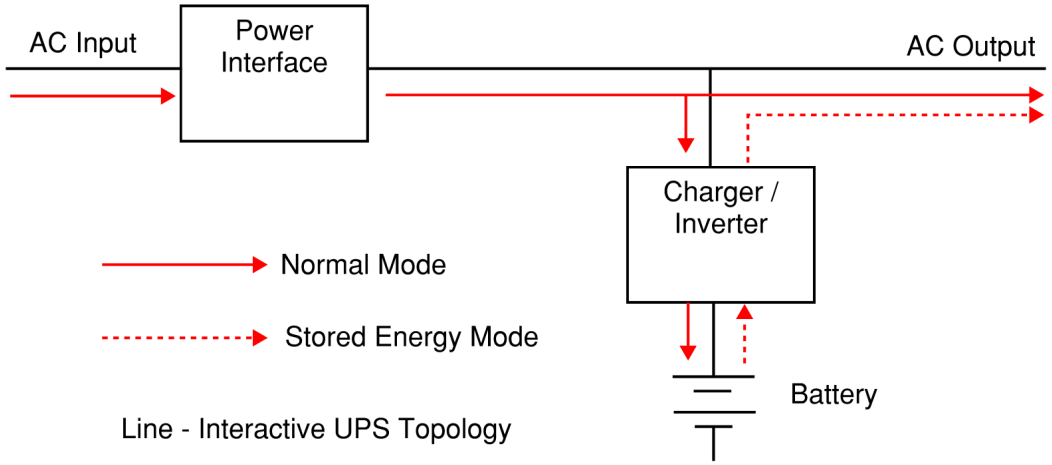


*Figure 1. Line-interactive UPS topology*

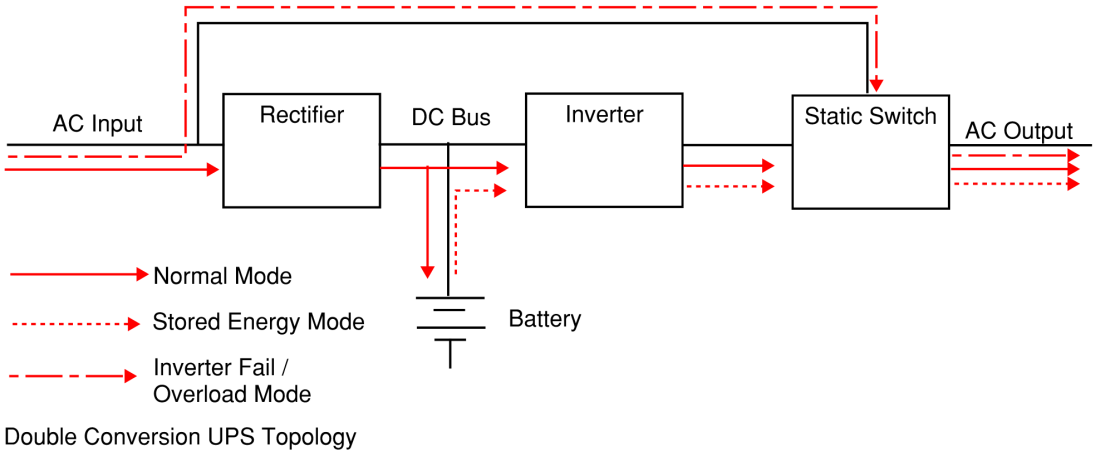


*Figure 2. Double-conversion UPS topology*

When within-tolerance mains power is available, the UPS shall operate in normal mode and supply power to the cabinet UPS supported loads.

On failure of the internal inverter/battery system of a double-conversion system, the UPS shall activate the static switch bypass and provide alarms as required. Refer to Appendix B.

When power fails or goes out of allowable limits, the UPS shall revert to stored energy mode utilising battery power and provide alarms as required. When mains power is back within limits, the UPS shall revert to normal mode and update the alarm status.

The UPS shall also be provided with a physical external manual switching system/module that allows the input power supply to the UPS to be directly connected to the load to fully bypass the UPS. This shall be configured to ensure operation of the switch cannot cause power sources to be connected in parallel where this would cause a fault situation. The bypass shall be undertaken by a ‘no break’ methodology to allow activation without interruption of power supply to loads.

When a wraparound external bypass switch is in the bypass mode, the UPS shall be able to be disconnected and replaced with another unit while loads continue to be directly supplied from site mains via the external bypass switch.

Additional battery strings that are not internal to the UPS module shall be able to be connected into the UPS direct current (DC) power supply via DC plug/socket connectors with each string having its own current protection devices.

# 3 Performance requirements

*This section outlines the reliability and availability requirements of equipment, which may require independent certification and/or declarations of conformity.*

## 3.1 General

### 3.1.1 Compliance to AS 5715

The UPS shall meet the performance requirements of AS 5715 as at the time of responding to a procurement request.

Testing and documentation shall be as stipulated in AS 5715.

## 3.2 Battery capacity

### 3.2.1 End-of-life performance

The batteries shall support the average continuous load for the required support period, without loss of UPS output to loads, even when:

i. operating at 0 degrees Celsius (NB: Higher battery operating temperatures typically provide increased capacity and support time while temperatures below 0 degrees are limited and reduced support time is considered acceptable. UPS must operate within the full range of environmental limits required by this delivery specification.)
ii. the batteries are at end of life and due for replacement. End of life shall be considered to be when batteries have reduced to 80% of new battery capacity. For conformance measurement purposes, this is deemed achieved if tested with new batteries at the design load and UPS output is maintained for 120% of the required support period.

### 3.2.2 Recharge time

As autonomy times are generally large for ITS loads, extended recharge times for socket-connected UPS are acceptable to maintain UPS input power within capabilities of the socket ratings. Recharging of batteries after full discharge shall ensure batteries are recharged to a minimum of 90% within a period of between 10 and 20 hours.

For plug/socket-connected UPS units, recharge current shall be limited to ensure the total load of the UPS associated with UPS equipment loads, UPS losses and battery charging does not exceed the rating of the UPS plug while meeting the 20-hour maximum recharge time criteria.

## 3.3 Environmental requirements

The UPS shall operate under conditions stipulated in AS 5715.

Batteries shall operate within the required temperature range defined in AS 5715.

Required battery backup times for the site shall be met at a temperature of 0 degrees Celsius, with a reduction from the design autonomy period being acceptable below this temperature.

Batteries shall operate at all temperatures up to the maximum temperature stipulated by the standard.

### 3.3.1 Service life

The UPS components (excluding batteries) shall have a service life of a minimum of 5 years.

The UPS shall be tested to confirm continuous reliable operation at both maximum and minimum required operating temperatures for a period of at least 72 hours. Test results for environmental tests are to be provided by the Contractor for confirmation of these requirements.

As the cabinet is to be supplied by others and not part of the UPS supply criteria, for the purposes of measurements during testing to account for insolation, the UPS shall be tested as per clause 8.1 'Temperature and Humidity' in AS 5715 using the option of increasing the upper ambient temperature limit by 10 degrees Celsius.

Lead-acid batteries shall have a service life of at least 5 years.

Lithium-ion phosphate batteries shall have a service life of at least 10 years.

# 4 Technical requirements

*This section outlines specific technical and physical constraints for the equipment.*

## 4.1 Electrical safety

All ITS equipment must comply with and be installed in accordance with Electricity (Safety) Regulations 2010 (SR 2010/36) and the Electricity (Safety) Amendment Regulations 2025.

These regulations and the amendment invoke compliance to AS/NZS 3000:2018 *Electrical installations – Known as the Australian/New Zealand Wiring Rules* (AS/NZS 3000). The specific version of AS/NZS 3000 cited in New Zealand regulations has changed in the Electricity (Safety) Amendment Regulations 2025 to 2018 but with overriding clauses mandated within the Amendment Regulations.

As New Zealand regulations take precedence over any standards, the modifications to AS/NZS 3000 contained within the Electricity (Safety) Amendment Regulations 2025 shall be complied with.

## 4.2 Compliance to AS 5715

The UPS shall conform to all technical requirements of AS 5715.

Residual current device (RCD) clauses of AS 5715 are to be adjusted as necessary to provide for RCD types that are mandated by New Zealand clauses of AS/NZS 3000, which differ from Australian clauses.

### 4.2.1 Power supply thresholds

Power supply thresholds shall comply with AS 5715 Table 7.1 ‘UPS voltage and frequency thresholds’ for the allowable line-interactive or double-conversion options. These provide for expected supply voltage ranges that may be experienced when supplied via remote rural mains or temporary generator supplies.

### 4.2.2 Batteries

Batteries shall be of either lead-acid or lithium technologies.

Where multiple strings are provided to meet support time requirements, each string shall be provided with a dedicated protective device and be capable of handling the full system peak load current without tripping.

To cater for extended power outage periods exceeding the battery backup time, which could potentially result in over discharge and damage to the batteries, the UPS shall disconnect the batteries to prevent any further discharge of the battery system once the batteries are below the minimum voltage level that can be utilised by the UPS to provide alternating current (AC) output to the load.

The UPS shall be capable of initiating recharge of batteries that have been fully discharged down to near 0V levels to enable re-energising of the UPS and reconnection of power to loads on return of mains, without the necessity to manually disconnect batteries for offsite recharge prior to connection back onto the UPS.

UPS utilising lithium-ion phosphate batteries that have the capability to be electronically monitored shall support connection of the battery internal monitoring systems to the UPS to monitor status and internal battery faults and adjust charging currents to maintain batteries within allowable operating limits.

### 4.2.3 Display and monitoring

All status, alarm and load-level information as defined in AS 5715 shall be available from the UPS. Both high-level and dry contact alarm connections as identified in Appendix B shall be provided for.

### 4.2.4 Documentation

Information and signs relating to the UPS as specified in AS 5715 clause 5.4 'Information to be provided in the housing' shall be provided for and installed by the Contractor. They shall not be considered part of the ITS cabinet requirements supplied by others.

### 4.2.5 Electrical requirements

Provision of external mains power to the cabinet, including associated mains switches, switchboard, protection, metering, surge suppression system, site earthing and non-UPS powered supplies, shall be provided as part of the cabinet installation specifications.

The demarcation point for provision of power into the UPS equipment shall be the UPS mains supply socket (provided as part of the cabinet installation), or permanent connection outlet (for larger UPS units). For plug/socket-connected UPS, the UPS shall include the supply of an input power cable and plug for connection to the cabinet supply socket, with sufficient length for socket location anywhere within the cabinet.

UPS output connectivity to loads shall be supported by both socket and permanent connection capability. UPS units supporting any of the capacity ranges covered by this delivery specification shall provide for a minimum of two standard New Zealand 3-pin 10A sockets as part of the UPS unit itself to facilitate direct connection of internal cabinet loads such as communication modems or a multiplug power distribution unit (PDU), and also for the capability to permanently wire UPS power to cabinet wiring distribution cabling.

When UPS are installed within cabinets, the Contractor shall be able to select at time of installation the appropriate output load connectivity methodology that is required for their specific site.

### 4.2.6 Unit efficiency

UPS shall operate at a minimum of 95% efficiency to limit heat build-up within ITS cabinets caused by UPS heat losses.

### 4.2.7 UPS battery charging compensation

Temperature compensation for charging shall be provided by installation of a temperature sensor. The Contractor shall ensure a temperature-sensing device and cabling for connection to the UPS is provided as part of the UPS for installation along with the UPS module and battery components.

The temperature shall be utilised by the UPS module to adjust battery charging and float voltage to battery manufacturer recommended levels for variable operating temperatures to optimise the life and capacity of batteries and prevent damage due to overcharging.

# 5 Installation requirements

## 5.1 Integration into the roadside cabinet

The UPS, including batteries, shall be capable of integration into the lower section of a standard ITS cabinet with spatial allowance below it for management of cables entering the cabinet. Available space for any installation shall be determined as part of that installation's design specifications and requirements. (Refer to Appendix A for further details).

These cabinets are defined in the following documents and drawing:

i. ITS design standard: *Roadside cabinets*
ii. ITS delivery specification: *Roadside cabinets*
iii. ITS standard drawing 000-0000-0-7104-03-R1 *Roadside control cabinet*

The ITS cabinets are 19-inch rack-based cabinets intended to house both UPS equipment and equipment required for ITS services such as VMS and CCTV cameras.

The cabinet sizes limit the allowable dimensions of UPS modules and batteries.

If insufficient space is available within a cabinet and the Contractor identifies an additional cabinet needs to be provided at the site, the UPS shall function on the basis that both UPS modules and batteries will be installed within the same cabinet.

UPS up to 2500W which integrate into the cabinets via plug and socket systems shall be able to be replaced by general staff without the need for on-site presence of a registered electrician.

Where battery support times and load levels require batteries to be installed on battery shelves and not internal to a UPS module, the batteries shall be able to be removed and replaced on a per string basis with connection to the UPS via DC plugs and sockets such as Anderson-type devices.

## 5.2 Roadside cabinet limitations

ITS standard drawing 000-0000-0-7104-03-R1 *Roadside control cabinet* identifies spatial limitations.

UPS must be size limited to support installation within these cabinets taking into consideration space requirements for cables and connections.

## 5.3 UPS size limitations

The ability to install within an ITS cabinet is the responsibility of the Contractor, who shall select UPS and battery equipment to enable installation with the cabinet. Refer to Appendix A for details on spatial allowances.

## 5.4 Mounting brackets

UPS equipment shall be supported from the front 19-inch mounting points and provision made for support at the rear-to-rear 19-inch supports.

Where a battery rack shelf unit is required, it shall be supported in all four corner supports of the 19-inch rack system. The Contractor shall allow for any brackets or adapters necessary to accommodate the specific mounting positions of front and rear racks within the cabinets. It is also allowable for a shelf system that can be mounted to the ITS cabinet itself and not via the 19-inch rack supports, to maximise the battery shelf dimensions. However, the Contractor shall provide the necessary racks and all mounting hardware required and ensure the connection points to the cabinet can be supported by the cabinet without any damage to the cabinet unit or compromising water tightness or cabinet corrosion resistance.

In addition to shake tests as detailed within AS 5715, mounting equipment shall support battery and UPS weights and remain functional when exposed to New Zealand seismic events.

To meet this requirement, they shall comply with NZS 1170.5:2004 *Structural design actions – part 5: Earthquake actions – New Zealand* (NZS 1170.5). For the purposes of calculation, allowance for forces based on the site requiring Importance Level Three (IL3) performance at ground level for any location in New Zealand shall be provided for. Should the requirement for all locations be onerous, the Contractor shall ensure that any UPS type selected is from a range of options (not exceeding three) of different mounting systems certified for different locations throughout New Zealand and a table identifying the areas where each may be used. This is to limit the variety of solutions deployed across different installations.

## 5.5 Equipment tie down

All batteries shall be provided with tie-downs and any inter-battery spacing blocks deemed necessary to ensure containment to the mounting shelf system to meet the same seismic requirements as the mounting brackets.

## 5.6 UPS for traffic signals

### 5.6.1 General

#### 5.6.1.1 Purpose

This section identifies specific UPS requirements associated with supporting traffic signal installations. UPS for traffic signals provide emergency auxiliary power to traffic signals during a power outage, providing both a safe and efficient journey for road users in these events. In addition, UPS have also proved to extend the life of the traffic controller by reducing the adverse effects of brownouts and maintaining a consistent flow of current to the traffic controller. Traffic signal requirements are outlined in ITS delivery specification: *Traffic signals*, which identifies whether a UPS is required to be installed.

#### 5.6.1.2 Factors for UPS prioritisation

The appendix titled ‘UPS prioritisation chart’ in ITS delivery specification: *Traffic signals* serves as a guide when prioritising the installation of UPS systems at signalised intersections. The factors and weightings included in the appendix are a reference to assist individual Contractors in making an assessment when prioritising the installation of UPS systems at signalised intersections.

#### 5.6.1.3 UPS standard baseline

The Contractor shall ensure that UPS units comply with the requirements of this UPS specification.

Where a Contractor proposes to install a new UPS type not previously installed in the area of the regional controlling authority (RCA), the Contractor shall seek approval from the RCA and follow the approval procedure below:

i. Written approval shall be obtained from the RCA.
ii. The Contractor shall offer to make a presentation on the equipment to the RCA.
iii. The Contractor shall provide a training course to the RCA's existing maintenance contractor, at no charge to the engineer or the maintenance contractor.

If the new equipment requires special configuration tools, the Contractor (or their agent) shall provide all equipment required to allow full operation. This may include computer hardware and software, as required by the RCA to integrate with the operations of the current maintenance contractor.

The RCA has the final right to deny installation of any equipment type in their area.

### 5.6.2 New Zealand-specific requirements to AS 5715:2015

UPS shall comply with the general requirements of this specification and adhere with the specific clarifications and interpretations of requirements for traffic signals as detailed within this section. For traffic signals, the housing for the UPS may not be a standard ITS cabinet but one determined as part of the traffic signal installation specifications. Where a cabinet is required as part of the UPS installation, it shall comply to the housing detail requirements detailed within this section.

Each requirement is specified here or where relevant specified by the RCA.

In general, the UPS shall meet the following requirements:

i. **UPS topology** shall utilise a line-interactive topology.
ii. **Load capacity** shall be as specified by the RCA.
iii. **Load support time** should have a minimum load support time of 5 hours.
iv. **Rating of the plug for the generator connection, as either 10A or 15A** – the fuse shall be specified by the RCA. Note: The generator support requirements for the UPS are to be provisioned as per overall cabinet power requirements for the traffic signal installation.
v. **Battery type** shall be proposed by the Contractor utilising this standard as a guideline and requires approval by the RCA.
vi. **Battery shelving option** shall be subject to approval by the RCA.
vii. **Housing material** shall comply with the housing requirements for traffic signal controllers detailed in ITS delivery specification: *Traffic signals.*
viii. **Housing colour** shall comply with the housing requirements for traffic signal controllers detailed in ITS delivery specification: *Traffic signals.*
ix. **Dimensions for non-standard housing** shall comply with the housing requirements for traffic signal controllers detailed in ITS delivery specification: *Traffic signals*.
x. **Type of door lock required for UPS housing** shall comply with the lock requirements for traffic signal controllers detailed in ITS delivery specification: *Traffic signals*.

### 5.6.3 Additional clauses to AS 5715:2015 for New Zealand

#### 5.6.3.1 Suitability of UPS systems with non-LED traffic signal lanterns

UPS are only intended for use with light emitting diode (LED) traffic signal lanterns due to the low energy consumption of LEDs. Other forms of traffic signals are not considered compatible for UPS without upgrading to LEDs prior to the installation of a UPS.

#### 5.6.3.2 Suitability of UPS with auxiliary equipment

Where additional auxiliary equipment such as CCTV, comms routers or signs are to be connected to the UPS it is necessary to ensure that the UPS can manage the additional loads necessary.

#### 5.6.3.3 UPS software requirements

The UPS shall be connected to the traffic signals controller, with the UPS software allowing the RCA Traffic Signals Engineer to use SCATS (Sydney Co-ordinated Adaptive Traffic System) flags to indicate different UPS states. The UPS software shall include direct remote monitoring, such that the transport operations centre (TOC) and RCA shall be able to remotely log into the UPS device for fault checking and monitoring via means determined by the RCA engineer. The minimum required outputs are listed in the appendix titled 'UPS prioritisation chart' in ITS delivery specification: *Traffic signals*, which is an extract from AS 5715:2015 clause 4.6 'Interfaces'.

#### 5.6.3.4 Relocation of the generator connection

The UPS system shall comply with AS 5715:2015 clause 5.3.16 'Stand-by generator connection'. Where a UPS is installed, the traffic signals controller generator connection is to be modified, such that the portable power generation is to be connected to the UPS controller rather than the traffic signal controller.

#### 5.6.3.5 Cabinet

All components of the UPS shall be fully contained in a single UPS cabinet. All components of the UPS cabinet (eg doors, hinges, locks) shall comply with relevant New Zealand standards and clauses in ITS delivery specification: *Traffic signals* for traffic signal controller cabinets.

Where a UPS is to be installed at a new signalised intersection, all components may be contained in the signal controller cabinet, subject to the approval of the RCA Traffic Signal Engineer.

#### 5.6.3.6 Electrical components

All electrical components, including cabling equipment of the UPS, shall comply with relevant New Zealand standards and clauses in ITS delivery specification: *Traffic signals*.

#### 5.6.3.7 Additional signage requirements

Additional signage and warning signs are to be placed in the traffic signals controller cabinet, the UPS cabinet, and the mains power line. These signs shall alert all personnel that during maintenance, power from the UPS may still be live, even though power from the mains has been turned off.

#### 5.6.3.8 Testing, commissioning and maintenance

The UPS shall comply with section 3.1.1 of this delivery specification and the sections titled ‘Uninterruptible power system (UPS) for traffic signals’ and ‘Testing of equipment’ in ITS delivery specification: *Traffic signals* with respect to testing, commissioning and acceptance of the UPS.

As a minimum, an annual test shall be undertaken to ascertain the condition of the batteries, to check that the stored energy is within the anticipated energy range to operate the intersection for the desirable minimum duration as defined by the RCA Traffic Signals Engineer in section 5.6.2 in this delivery specification.

# 6 Appendices

## Appendix A UPS capacity, support time and spatial allowance determination

### A.1 Purpose

Selection of a UPS from the range of size options identified in this delivery specification requires a design process to be undertaken as part of any specific ITS installed at each location requiring UPS backup.

This needs to be determined as part of the design standards applicable for the site and any specific site design requirements.

This appendix identifies the parameters that are needed to be determined as part of those designs that enable selection of a specific UPS that meets the requirements of this delivery specification.

### A.2 Required parameters

UPS selection requires identification of:

i. maximum peak load required to be supported by the UPS
ii. average load on an hourly basis as an input into battery selection
iii. required support time the batteries must maintain power for
iv. spatial availability in the ITS cabinet for UPS modules and batteries.

### A.3 Assessment process

#### A.3.1 Maximum load

The loads supported by the UPS shall be calculated by identifying all equipment and expected power loads connected to the UPS and allowing a growth allowance for additional miscellaneous equipment.

To avoid oversizing the UPS, realistic load levels should be identified reflecting the actual installation, and not just equipment nameplate ratings that capture extreme scenarios of fully loaded systems or equipment like power supplies that may be rated well above their connected load. Where similar sites have already been installed, any available actual measurement data can be used to indicate expected loads.

The peak load calculated shall be rounded up to determine the closest standard UPS load rating from the standardised range of sizes identified within this delivery specification.

#### A.3.2 Average load

While the UPS module must be sized to support the peak short-time power demand to prevent overloading and possible shutdown or tripping, battery sizing is determined by the amount of stored energy required to support the load for the required time.

If peak loads are for short durations followed by lower loads for longer times, the energy required is significantly less than having to maintain the peak load for the complete support time.

An average load level must therefore also be determined by the Contractor and provided as an input to the UPS selection process for battery size provisioning requirements. The average shall be based on an average load calculated on an hourly basis. Calculations shall be rounded up to average load values of either 25%, 50%, 75% or 100% of the peak load requirement that has been calculated (noting that the peak load process requires rounding of the calculated load to one of the allowable modular sizes, with the average load then being identified as one of the four allowable percentages above).

Refer to Table 2 in section 2.2.3 to identify where average-to-peak ratios are further limited from the four percentage options for small UPS.

This requires assessment of potential load profiles as part of the site design. Some sites may have a continuous load, in which case the average load calculated will be the same as the peak load.

For sites such as VMS, the level will be much lower. The peak load needs to allow for all pixels being operational without overloading the UPS. The average load, however, is based on the typical percentage of pixels illuminated for the various messages and may only be in the range of 20 to 30% for the various messages to be displayed. Where design standards for specific installations determine these parameters, those values shall be utilised by the Contractor as the required inputs. Where the process has not been determined within a standard, the Contractor will need to determine an appropriate figure for the site to be provided for UPS selection.

The Contractor may note that should the average load be higher in some scenarios than calculated, this will not result in shutdown or tripping of the UPS but only a reduction in support time, which isn't as significant although may not meet the design objective target.

### A.3.3 Required support time

Support time is the time the UPS must support the load when there is a power failure. This depends on the criticality of the site, the ability to respond to and fix a fault or connect a temporary generator, and the likely outage times and probability of grid power failure for the location.

Required support times shall be determined as part of the installation design process for each specific site that a UPS is required to be supplied for. The site designer shall determine an appropriate time for batteries to support the load based on the criticality and location of a site. Critical applications and sites with extended fault response times such as rural areas will drive the requirement for longer support times.

The required support time is to be rounded up to a multiple of an hour to allow unit selections to be standardised. The minimum support time for any UPS is to be 1 hour.

UPS supplied to meet these support times shall be sized to provide the required capacities under the operational and testing conditions identified in this delivery specification.

### A.3.4 Spatial requirements

UPS are intended to be located in the lower section of a standard ITS cabinet with the top section housing loads such as data switches, network connections, monitoring systems and parts of the infrastructure supporting the ITS service associated with the cabinet.

The vertical space available for UPS equipment and batteries is restricted by the amount of equipment needing to be mounted in the top section of the cabinet.

The Contractor shall determine the spatial allowance within the ITS cabinet available for use by the UPS equipment, including any separate battery shelves, and ensure the UPS units selected will fit within the space available.

The determination of spatial vertical, width and depth parameters shall take into account any allowance for:

i. cables from high-level equipment needing access to ducts in the cabinet plinth
ii. maintenance space for installation and removal
iii. clearance required between doors
iv. UPS equipment and specific locations of 19-inch mounting racks which may impact on front and back offsets of equipment when mounted onto the 19-inch rack supports.

# Appendix B UPS alarms

## B.1 Purpose

This appendix defines alarm and status information that UPS must provide. Alarms are to comply with the requirements of AS 5715 and incorporate any additional alarms/status requirements as identified in this appendix or identification of which AS 5715 alarms/status requirements are not a mandatory requirement of this delivery specification.

## B.2 AS 5715 alarms and status information requirements

The following status and operational parameters shall be available on local UPS display and available for remote interrogation via the high-level interface connection, as per AS 5715 clause 4.6 'Interfaces'.

i. UPS operating mode (normal, stored energy, bypass)
ii. Mains present indication and display of actual input voltage
iii. Battery capacity available (as a percentage)
iv. Battery run-time remaining for connected load
v. UPS output voltage
vi. UPS output current
vii. UPS output power (real power, apparent power)
viii. Battery voltage
ix. Battery current
x. Battery temperature
xi. Alarms, complete with date/time stamp in reverse chronological order
xii. Status and event displays with date/time stamps in reverse chronological order
xiii. Set point views of UPS adjustable parameters

The following control operations are required of the UPS via the local control panel.

i. Start up UPS
ii. Shut down UPS
iii. Select UPS mode of operation (normal, stored energy, bypass)
iv. Perform internal diagnostic checks
v. Set real-time clock
vi. Adjust set point values for all adjustable parameters

The following logs and configuration data shall be provided with a minimum of 100 stored individual records.

i. Start up
ii. Shut down
iii. Mains lost
iv. Mains recovered
v. Overload
vi. Bypass operation
vii. Operation mode changes
viii. Battery test
ix. Internal diagnostic checks
x. Over temperature (battery or UPS)

xi. Inverter failure
xii. Charger failure
xiii. Low battery
xiv. Cooling fan failure

In addition to high-level interface accessible information, voltage-free ELV contact outputs are required to identify the following:

i. Mains failure (indicating system operation in stored energy mode)
ii. UPS fault
iii. Battery low threshold 1 (configurable level)
iv. Battery low threshold 2 (configurable level)
v. Alarm 1 – User definable
vi. Alarm 2 – User definable

## B.3 Additional alarm/status requirements

Nil

## B.4 AS 5715 alarms/status that are not considered mandatory

Nil

# 7 References

*This section lists all external and NZTA references included in this document.*

## 7.1 Industry standards

| Standard number/name |
|---|
| AS 5715:2015 Uninterruptible power systems (UPS) for roadside devices |
| AS/NZS 3000:2018 Electrical installations – Known as the Australian/New Zealand Wiring Rules |
| AS/NZS 3112:2017 Approval and test specification – Plugs and socket-outlets |
| NZS 1170.5:2004 Structural design actions – part 5: Earthquake actions – New Zealand |

## 7.2 NZTA standards, specifications and resources

### 7.2.1 Standards and specifications

See the NZTA website for the latest versions of the ITS S&S listed below.

| Document name |
|---|
| ITS design standard: Roadside cabinets |
| ITS delivery specification: Roadside cabinets |
| ITS delivery specification: Traffic signals |

### 7.2.2 Resources

| Document name/code |
|---|
| |
| |

## 7.3 Legislation

| Name |
|---|
| Electricity (Safety) Amendment Regulations 2025 |
| Electricity (Safety) Regulations 2010 (SR 2010/36) |

## 7.4 Other resources

| Name |
|---|
| |
| |

## 7.5 ITS standard drawings

See the NZTA website for the latest versions of the ITS standard drawings listed below.

| Drawing number |
| --- |
| 000-0000-0-7104-03-R1 Roadside control cabinet |
| |

# 8 Terminology used in this document

| Term | Definition |
|---|---|
| DRAFT | The document is being written and cannot be used outside of NZTA. |
| FINAL DRAFT (pending approval) | The document has been finalised and is pending approval by NZTA. It can be used for procurement at this status. |
| APPROVED | The document is an official NZTA document. NZTA projects and other road controlling authorities connected to NZTA back-end systems must include this document in the contracts. The obligation to follow the requirements in this document would come from the inclusion of the S&S document in the contract. |
| RETIRED | The document is obsolete, and/or superseded. |
| AC | Alternating current |
| Anderson plug | Plug and socket brand made by Anderson Power Products (APP) commonly used for connection of DC power cables within battery systems or form connection of DC powered devices to battery systems. |
| AS | Australian standard |
| Battery | Device consisting of one or more electrochemical cells used to convert stored chemical energy into electrical energy |
| Bypass | Alternative power path, either internal or external to the UPS |
| CCTV | Closed-circuit television |
| DC | Direct current |
| DHCP | Dynamic Host Configuration Protocol. DHCP is a network protocol that automates the process of assigning IP addresses and other network configuration parameters to devices on a network. |
| ELV | Extra-low voltage. Defined in Electricity (Safety) Regulations 2010 as any voltage normally not exceeding 50Vs AC or 120V ripple-free DC. |
| Housing | UPS housing (or cabinet) that provides physical protection for and houses the UPS |
| IL | Importance Level. In New Zealand structural design, IL as defined in NZS 1170.0 categorises structures based on their potential consequences of failure, with higher ILs indicating greater importance and stricter design requirements. These levels range from IL1 (low importance) to IL5 (very high importance). |
| IP | Internet Protocol |
| ITS | Intelligent transport system |
| LED | Light emitting diode |
| MAC | Media access control. A MAC address is a unique identifier assigned to a network interface controller (NIC) for communication within a network segment. |
| NZS | New Zealand standard |
| NZTA | NZ Transport Agency Waka Kotahi |

| Term | Definition |
|---|---|
| PDU | Power distribution unit. A PDU is a device fitted with multiple outputs designed to distribute electric power, especially to racks of computers and networking equipment located within a data centre. |
| RCA | Road controlling authority |
| RCD | Residual current device |
| RJ45 | Registered Jack 45. This type of connector was originally developed for telephone communications but is now used in a range of applications. |
| S&S | Standards and specifications |
| SCATS | Sydney Co-ordinated Adaptive Traffic System |
| SNMP | Simple Network Management Protocol |
| Support period | The period of time a UPS is to be supported by battery power when operating at the design discharge load |
| TOC | Transport operations centre |
| UPS | Uninterruptible power system(s). A UPS is a combination of converters, switches and energy storage devices such as batteries constituting a power system for maintaining continuity of load power in case of input power failure or out-of-limit conditions. Also sometimes referred to as uninterruptible power supply. |
| USB | Universal serial bus |
| VMS | Variable message sign(s) |

# 9 Content to be redirected

*This section records any circumstances where content from this document will be reclassified and moved into future documents. This table is then updated with a reference to the new location.*

| Section reference | Section name | Future document | Class |
|---|---|---|---|
| | | | |
| | | | |

# 10 Document control

## 10.1 Document information

| | |
|---|---|
| Document number | ITS-SPEC-UPS-202509 |
| Previous document number/s (if applicable) | |
| Document status<br>DRAFT \| FINAL DRAFT \| APPROVED \| RETIRED | Approved |
| [IF RETIRED] New document details | |
| Online ISBN | |
| Document availability | The controlled version of this document can be accessed from https://www.nzta.govt.nz/roads-and-rail/intelligent-transport-systems/standards-and-specifications/its-current-interim-and-legacy-standards-and-specifications |

## 10.2 Document owner

**Role** ITS S&S Steering Committee

**Organisation** NZTA

## 10.3 Document approvers

*This table shows a record of the approvers for this document.*

| Approval date | Approver | Role | Organisation |
|---|---|---|---|
| 29/09/2025 | Approved by NMPAS | Delegated approver | NZTA |
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## 10.4 Full version history

*This table shows the full history of changes made to this document, both minor and major, in chronological order, since the document was first authored.*

Minor versions are numbered 0.1, 0.2 etc until such point as the document is approved and published, then it becomes 1.0 (major version). Subsequent edited versions become 1.1, 1.2 etc, or if it's a major update 2.0, and so on.

| Version | Date | Author | Role and organisation | Reason |
|---|---|---|---|---|
| 0.1 | 04/04/2025 | P.Sinclair | Consultant, WSP | Creation of first draft |
| 0.2 | 29/05/2025 | P.Sinclair | Consultant, WSP | Update of draft with partial expert panel feedback |
| 0.3 | 18/06/2025 | P.Sinclair | Consultant, WSP | Update of draft for release for industry review and feedback |
| 0.4 | 14/08/2025 | P.Sinclair | Consultant, WSP | Updated to include initial industry and specialist feedback and document format compliance reviews. |
| 0.5 | 22/09/2025 | Matthew Bauer | Editor, Clear Edit NZ | Copy edit |
| 0.6 | 11/11/2025 | Anandita Pujara | Senior Advisor, ITS S&S | Added section 5.6 'UPS for traffic signals' to address Standard Committee feedback. |
| 0.7 | 20/11/2025 | Paul Sinclair | Consultant, WSP | Actioned and responded to comments in v0.5 and addition of traffic signals in V0.6. Modified to match agreed recommendations ready for final Copy Edit |
| 0.8 | 25/11/2025 | Matthew Bauer | Editor, Clear Edit NZ | Edit and proofread v0.7 |
| 0.9 | 25/11/2025 | Matthew Bauer | Editor, Clear Edit NZ | Clean final draft |
| 1.0 | 27/11/2025 | Anandita Pujara | Senior Advisor, ITS Standards and Specifications | Issued as approved version |