VicRoads Specification

TCS 058-1-2008

Uninterruptible Power Supply

For use with

Traffic Signals

Issue Date: December 2008

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Forward

This specification has been developed by VicRoads. It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of VicRoads.

Specification updates. VicRoads specifications and associated standard drawings are subject to periodic review. To keep the specifications up to date, amendments or new editions are issued as necessary. It is therefore important for users of VicRoads specifications to ensure that they have the latest version and associated amendments.

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Amendments

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SECTION 1 – SCOPE AND GENERAL

1.1 SCOPE

1.1.1 This document covers the requirements for the manufacture, supply and installation of an Uninterruptible Power Supply (UPS) primarily intended for operation with traffic signal installations for use within the State of Victoria.

1.2 GENERAL

1.2.1 Traffic signals are a major traffic control device that provide safe and efficient traffic movement. UPS systems are used to maintain the operation of traffic signal installations during mains power failures.

1.2.2 Due to the high total wattage of traffic signal installations using incandescent and QH lamps, they are not considered suitable for use with UPS.

1.2.2 UPS systems are intended for use only with LED traffic signal lanterns.

1.3 TYPE APPROVAL

1.3.1 All equipment proposed for use under this specification shall hold current VicRoads 'Type Approval' certification. To obtain VicRoads 'Type Approval' the supplier must submit evidence of compliance in accordance with Appendix B of this specification and the requirements of individual tender documents.

1.3.2 Compliance with this version of this specification (and subsequent VicRoads Approval) does not constitute automatic approval against future versions of this specification. Where it is considered necessary, VicRoads may withdraw current Type Approval and request that the affected product be re-submitted for evaluation against future versions of this specification.

1.4 RELATED SPECIFICATIONS AND DRAWINGS

1.4.1 The fabrication and supply of all components for UPS systems shall conform with all relevant Australian Standards.

1.4.2 All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.

1.4.3 The following specifications, standards, documents and standard drawings are referred to or relevant to this specification:

- AS/NZS 3000:2000 - Wiring Rules

- AS 3100 - Approval and test specification–General requirements for electrical equipment AS 3100.

- AS 60529 - Degrees of protection provided by enclosures (IP code)

- AS/NZS 60950.1:2003, Information technology equipment – Safety, Part 1: General requirements

- AS 62040.1.2:2003, Uninterruptible Power Systems (UPS) Part 1.2: General and safety requirements for UPS used in restricted access locations

- AS 62040.2:2001, Uninterruptible Power Systems (UPS) Part 2: Electromagnetic compatibility (EMC) requirements

- VicRoads TCS 013 – Installation and Remodel of Traffic Signals

SECTION 2 – UPS SYSTEM

2.1 GENERAL

2.1.1 The UPS shall comply with all relevant sections of AS 62040.1.2

2.1.2 The UPS shall comply with all relevant requirements of AS/NZS 60950.1:2003 as defined in AS 62040.1.2.

2.1.3 The complete UPS shall comply with all electrical requirements as defined in Section 4 of this specification.

2.1.4 The complete UPS, housed in its cabinet, shall comply with all environmental requirements as defined in Section 5 of this specification.

2.2 OPERATION

2.2.1 The UPS shall be capable of automatically switching to battery operation in the event of mains failure.

2.2.2 The UPS shall automatically switch from battery operation to mains operation after mains power is restored.

2.2.3 The system shall include the ability to switch the traffic signals between mains and battery operation manually.

2.2.4 Switching between mains and battery operation shall be seamless without disruption to the traffic signal operations.

2.2.5 The UPS shall be capable of maintaining normal operation of the traffic signals for a minimum period of 6 hours.

2.3 SYSTEM DISPLAY

2.3.1 The system shall include a display that indicates, as a minimum, the following conditions:

- Operating on mains power;
- Operating on battery power;
- Voltage in;
- Voltage out
- Current out;
- Battery voltage;
- Charge current; and
- Battery temperature.

2.4 MONITORING

2.4.1 The system shall, as a minimum, monitor the following:

- Mains supply input voltage level;
- System output voltage level;
- Battery voltage level;
- Battery charger operation;
- Battery temperature;

2.5 ALARMS

2.5.1 The system shall provide the following alarm status inputs to the traffic signal controller via dry, no voltage relay contacts:

- Running on batteries –the system has switched from mains operation to battery operation;
- Battery low alarm – indicate when battery voltage is too low for normal operation;
- System malfunction – indicate that the UPS system has malfunctioned.

SECTION 3 - CABINET

3.1 CABINET

3.1.1 The UPS System and all associated control equipment shall be housed in an approved cabinet.

3.1.2 The cabinet shall be constructed from marine grade aluminium (A5251 - H34) treated to ensure optimum performance under exposure to atmospheric and site conditions, prevalent in the state of Victoria. The aluminium shall be protected against electrolytic and chemical corrosion.

3.1.3 The cabinet shall be designed for a life of not less than 15 years.

3.1.4 The cabinet shall also be rated to withstand the effects of solar radiation for a period not less than the design life.

3.1.5 The cabinet shall be designed for installation on a standard traffic signal controller foundation in accordance with VicRoads Standard Drawing TC-1203.

3.1.6 The outside dimensions of the cabinet shall not exceed 1500mm(h) X 800mm(w) X 420mm(d)

3.1.7 The cabinet shall be locked using two standard VicRoads traffic signal controller locks.

3.1.8 The cabinet shall include door seals of a type that will give a minimum life equal to the design life of the housing. Such seals shall provide an effective seal over that life span with repeated door openings and closings, and shall be so fixed that they can be readily replaced if required.

3.1.9 Sufficient ventilation shall be provided to prevent condensation inside the cabinet under all environmental operating conditions.

3.1.10 The cabinet shall be finished with a durable, high gloss, high cross-linked powder coating of Anti-Graffiti quality, such as Dulux Anti-Graffiti Powder Coat 910 line, or similar.

3.1.11 The final colour shall be Smoke Blue (Colour No.T33 as detailed in AS 2700) or other colour approved by VicRoads, conforming to AS 2700.

3.2 DOOR

3.2.1 The cabinet shall have a front opening door.

3.2.2 This access door shall be hinged on the left hand (or right hand) side of the cabinet (when viewed from the front) and shall be secured in the closed position with 2 suitable door locks of a type approved by the VicRoads, placed on the right hand side of the door not more than 250mm from top and bottom of the door.

3.2.3 The door shall be fitted with a stop to limit the door opening greater than 110 degrees. It shall operate when the door reaches the extreme open position and will hold the door open securely until released.

3.2.4 A suitable pocket for record cards shall be provided on the inside of the housing door. The dimensions of the pocket to be at least 300 mm wide x 200 mm high x 20 mm depth

3.3 HINGES

3.3.1 The door hinges and pins shall be of corrosion-resistant material such as stainless steel, and shall be of a type that does not require lubrication to prevent seizing.

3.3.2 The door hinges should not protrude beyond the housing, and shall not be damaged when forcefully opened to the end of the opening travel, or closed forcefully, as might be the case if caught by a sudden gust of wind.

3.4 CABINET LAYOUT

3.4.1 The cabinet shall be designed to house the UPS control system in the top section of the cabinet;

3.4.2 The lower section of the cabinet shall be designed to house the batteries.

3.5 MOUNTING

3.5.1 The cabinet base shall be suitable for bolting to a concrete foundation in accordance with VicRoads drawing number TC-1203. Mounting centres shall be 460 ±1mm x 255 ±1mm.

3.5.2 Attachment to the concrete foundation shall be such as to allow the housing to break away from the foundation in cases of severe impact, such as would be the case if an errant vehicle collided with the traffic controller.

3.5.3 Frangible washers or other means which will achieve such separation of the housing from the concrete base shall be used to reduce the possibility of further vehicle damage, and to protect the mounting “ragbolts” trapped in the foundation from damage, so that they can be used again to secure a replacement traffic controller housing.

SECTION 4 – ELECTRICAL SYSTEM

4.1 GENERAL

4.1.1 In addition to complying with this specification, the UPS System shall comply with all relevant requirements of AS/NZS 3000 and AS 3100.

4.1.2 Transformers shall comply with the requirements of AS 61558.2.4, Safety of isolating transformers, power supply units and similar - Particular Requirements for Isolating Transformers for general use.

4.1.3 All cables and wires shall be insulated with a material not inferior to V90HT grade PVC and shall be suitably labelled.

4.2 MAINS SUPPLY

4.2.1 The mains supply voltage shall be deemed to be 230Vac +10%, -6% in accordance with Section 2 of AS 60038-2000 – Standard Voltages.

4.2.2 The system and or sub-elements of the system shall be capable of operating satisfactorily from the mains supply voltage within ±15%.

4.3 ELECTRICAL FACILITIES

4.3.1 The electrical system shall incorporate the following facilities:

- a circuit breaker board comprising appropriately rated mains isolation switch and circuit breaker/s; and
- the ability to be isolated from mains supply at ground level using a suitable switch/breaker system.

4.3.2 All switches and circuit breakers shall be clearly and indelibly marked.

4.4 GENERATOR CONNECTION

4.4.1 The system shall incorporate a fixed, internal plug top for ‘pluggable’ connection to an external generator.

4.4.2 Access to the plug top shall be via a lockable access door or similar arrangement

4.5 INTERNAL PROTECTION

4.5.1 All equipment including data lines shall be internally protected against damage resulting from:

- lightning strikes at or near the UPS cabinet;
- electrical transients on power cabling;
- electrical transients on communications wiring;

- radio frequency interference; and
- static electrical discharge.

4.6 BATTERIES

4.6.1 Batteries used in the back-up system shall be of a deep discharge, low-maintenance gel type and will be automatically charged from an internal system located within the control equipment cabinet

SECTION 5 – ENVIRONMENTAL REQUIREMENTS

5.1 AMBIENT CONDITIONS

5.1.1 The system shall operate correctly in ambient temperatures in the range -10°C to +50°C, and with up to 90% relative humidity, and with up to 1 kW/m^2 insolation applied to the maximum exposed surface.

5.1.2 A representative UPS (with a full complement of sub units) shall be subjected to a temperature/humidity test of 72 hours operation under the conditions described in Clause 5.1.1.

5.1.3 During the test, the UPS shall be continually monitored for correct operation.

5.2 ACCELERATED DAMP HEAT TEST

5.2.1 The UPS shall be subject to an accelerated damp heat test in accordance with IEC 60068-2-31, Test Db, Variant 2, but substituting 65° C for the upper limit.

5.2.2 At least two cycles shall be performed, during which simulated fixed-time operation shall occur with lamp load connected as indicated in Sub-Section 15.1.2.8).

5.2.3 During the test, the UPS shall be continually monitored for correct operation.

5.2.4 The UPS shall be mounted within the standard housing with the door closed and shall function normally and in accordance with this Specification.

5.3 BUMP TEST COMPLIANCE

5.3.1 As a measure of structural integrity, robustness and capacity to withstand handling during transportation installation, and ongoing maintenance, the UPS shall be submitted to Bump or “Shock “ tests.

5.3.2 The Bump test shall be carried out in accordance with AS 1099.2.99 “Test Eb – Bump and guidance”. Severity shall be 4000 bumps at an acceleration of 100m/s (10g), and a pulse duration of 16m/s.

5.4 VIBRATION TEST COMPLIANCE

5.4.1 The entire UPS shall be subject to vibration tests in accordance with IEC 60068-2-6 (sinusoidal vibration).

5.4.2 Tests will be repeated for three mutually perpendicular axes: - vertical, side and back.

5.4.3 For tests on front and side faces, the Control Module may be additionally clamped to the equipment shelf, if not already bolted to the shelf.

5.4.4 The tests on each face shall be in three parts.

a) A sweep test from 5-55 Hz at amplitude 1.5 mm shall be conducted to determine and note details of abnormality or marked deterioration of performance, malfunctioning of equipment or resonances, noting observations, and marker frequencies.

b) At each of the critical frequencies at which such incidents/abnormalities were noted in (a) above, the controller shall be tested for 10 minutes at the same amplitude of vibration.

c) An endurance test of 50 sweep cycles at one Octave per minute, over the range of 5-55 Hz, with an amplitude of 1.5mm.

5.5 EMC COMPLIANCE

5.5.1 All equipment covered by this specification shall comply with all relevant requirements of the Australian Communications Authority (ACA) for EMC and shall be labelled with a conforming 'C-Tick'.  .

5.5.2 The UPS shall comply with all relevant requirements of AS 62040.2:2001.

5.6 IP RATING

5.6.1 The complete enclosure when assembled shall be subject to all tests prescribed for the degree of protection IP45 in AS 60529 and shall comply with the appropriate requirements therein.

SECTION 6 - MARKINGS

6.1.1 Each UPS shall be legibly and durably marked on the interior surface of the housing with the following information:

a) the name, trade name or trademark of the manufacturer or responsible supplier.

b) catalogue number or marking which shall distinguish the particular sign from other similar items supplied and/or manufactured by the supplier.

c) batch or serial number or other mark which will clearly identify the date of manufacture of the item.

d) other information required under AS-3100 (Approval and test specification -general requirements for electrical equipment).

e) On the inside of the front door of the UPS housing there shall be displayed a sign bearing the legend "DANGER 240 VOLTS". This sign shall conform to the relevant Australian standard.

SECTION 7 - DOCUMENTATION

7.1.1 The following items are to be supplied with the UPS system:

(a) A full operation and maintenance manual. The manual should include as a minimum:

- detail of the operation of the system, including software;
- any and all operational and maintenance requirements; and
- detailed fault finding methodology.

(b) A schematic diagram or chart showing the 'as-supplied' electrical circuits contained within the system;

(c) A list of all major electrical sub-components detailing their electrical characteristics and operations limits.

7.1.2 The Contractor shall supply a minimum of three hard copies and one soft copy of the above documentation for VicRoads records.

7.1.3 One hard copy of the above documentation shall be stored within the UPS control equipment cabinet.

APPENDIX A

REQUIREMENTS FOR TYPE APPROVAL

A1. GENERAL

To enable assessment for the purpose of granting Type Approval, the supplier is to submit a formal request for Type Approval accompanied by the following:

a. A complete working sample of the UPS system.

b. An outline drawing showing the general presentation and overall dimensions of the complete UPS system.

c. Documentation to demonstrate that the UPS system has been manufactured and supplied under an approved quality assurance system.

d. Documentation to demonstrate that the UPS system conforms to the requirements of VicRoads Specification. This may be by means of submitting test results from approved and appropriately qualified independent testing organisations, or providing the suppliers assurance that the product complies with each paragraph of the specification.

e. Documentation to demonstrate that the UPS system conforms to the requirements of AS 62040.1.2:2003.

A2. REQUIRED NATA ACCREDITED TESTING

Notwithstanding B1 above, the supplier shall submit test results from a NATA accredited testing organisation to demonstrate compliance with the following:

Clause 5.1.2	Temperature Humidity Test
Clause 5.2	Accelerated Damp/Heat Test
Clause 5.3	Bump Test
Clause 5.4	Vibration Test
Clause 5.5	EMC Compliance
Clause 5.6	IP rating

A3. OTHER REQUIRED TESTING

a. VicRoads may choose to carry out preliminary testing on its ‘’off street’ test site.

b. Once the UPS has been assessed as meeting the requirements of A1 and A2 above, a field test may be conducted for up to 6 months.

c. VicRoads may require additional information or testing to be carried out as part of its evaluation of the product.

d. If the product is approved, a Certificate of Type Approval will be provided to the supplier. Until such time as this Certificate is issued, the product is not to be used in the State of Victoria.

A4. ASSESSMENT PROCEDURE

The assessment procedure for a UPS system will include, but not be limited to, the following:

a. Assessment of construction, workmanship and critical dimensions.
b. Evaluation of the submitted data against the requirements of the specification.
c. Installation and testing of the UPS system.

Where some of these procedures have been completed prior to formal submission, the results will be considered in the evaluation, provided there is no relevant change in the design. The supplier is to state whether tests carried out prior to formal submission were carried out on an identical sample.