

# TCS 043 - 2019

Specification for the

Supply and Installation

of

## Electrical Distribution Cabinets

April 2019  
Rev. A

## TCS 043 - 2019

### Foreword

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.

VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from VicRoads website at the following address under 'Tenders & Suppliers', <http://www.vicroads.vic.gov.au/itsspecs>

**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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# **PREFACE**

## **A. TELECOMMUNICATIONS EQUIPMENT**

All telecommunications equipment shall comply with relevant requirements of the Australian Communications and Media Authority (ACMA). Such equipment shall be labelled with a Regulatory Compliance Mark.

## **B. CHANGES TO THIS SPECIFICATION**

The main changes to this specification from the previous version are listed below:

- Addition of 'Type 3 Specific Mechanical and Physical Requirements' (Section 3.2);
- Addition of Installation Section.

### Revision History

Version	Revision	Date	Author	Description
2001		December 2001	TRUM	First release as Distribution Box for Street Lighting
2002	4	June 2002	TRUM	Update
2004	5	November 2004	ITS	Update
2014	A	July 2014	SJS	Updated and renamed Electrical Distribution Cabinets Type 1 and Type 2
2019	A	April 2019	ITS	Updated and Type 3 cabinet included.

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# SECTION 1 SCOPE AND GENERAL

## 1.1 SCOPE

This document specifies the requirements for the manufacture, supply and general installation requirements of distribution cabinets to be used for providing power to VicRoads electrical assets.

## 1.2 GENERAL

1.2.1 Distribution cabinets are required to house an electricity meter, circuit termination, and switchgear, and to accept electricity from the Distribution Company in order to supply that electrical power to the connected load.

1.2.2 Electrical distribution cabinets are defined in three sizes:

- a) **Type 1** – A large, 2 door cabinet typically used for three phase electricity distribution for VicRoads road lighting schemes and other ITS devices;
- b) **Type 2** – A small single door cabinet typically used for housing a meter and main switch board for metered traffic signal installations. Can be used for any metered single phase installation
- c) **Type 3** - A large 3 door cabinet typically used for three phase electricity distribution for VicRoads road lighting schemes and ITS devices on managed motorways.

## 1.3 INTELLECTUAL PROPERTY

In relation to all intellectual property used in, or to operate the product, the contractor grants to VicRoads non-exclusive licence to “use, modify and/or sell” or do anything else that without the licence, could be breach of the licensors Intellectual Property. Intellectual Property shall include, but not be limited to, the following:

- Software;
- Source code;
- Schematic diagrams;
- Circuit and wiring diagrams;
- Listings of components and sub-components;
- Any and all operational and maintenance documentation

## SECTION 2 RELATED SPECIFICATIONS AND DRAWINGS

### 2.1 AUSTRALIAN STANDARDS

- 2.1.1 The supply and installation of distribution cabinets shall conform with all relevant Australian Standards.
- 2.1.2 All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.
- 2.1.3 The following related Australian Standards are defined:

AS/NZS 1170.2	Structural design actions—General principles
AS 2700	Colour Standards for general purposes
AS/NZS 3000	Wiring rules
AS/NZS 3100	Approval and test specification—General requirements for electrical equipment
AS 60038	Standard voltages
AS 60068.2.29	Environmental testing—Tests—Test Eb and guidance: Bump
AS 60068.2.6	Environmental testing—Tests—Test Fc: Vibration (sinusoidal)
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS/NZS 61000.6.1	Part 6.1: Generic standards—Immunity for residential, commercial and light-industrial environments
AS/NZS 61000.6.3	Part 6.3: Generic standards—Emission standard for residential, commercial and light-industrial environments
AS/NZS 61558	Safety of power transformers, power supply units and similar
VSIR	Victorian Service and Installation Rules

### 2.2 VICROADS SPECIFICATIONS AND DRAWINGS

- 2.2.1 The following related VicRoads specifications are defined:

TCG 018	Register of ITS Approved Products
TCN 008	Exemption from requirement to install RCD for road lighting installations
Standard Section 730	Traffic signal installation
Standard Section 731	Road Lighting Installation
Standard Section 732	ITS Devices Installation
Standard Section 733	Conduits and pits for underground wiring and cabling
Standard Section 734	Electrical Network Installation



2.2.2 The following related VicRoads standard drawings are defined:

TC-1062	Type 1 Distribution Cabinet Foundation Detail – Arterial roads
TC-1074	Type 2 Distribution Cabinet Foundation Detail
TC-1075	Type 2 Distribution Cabinet - Ragbolt Assembly
TC-2100	Standard Cabinet Label
TC-2231	Type 1 Distribution Cabinet foundation details - Managed Motorways and freeways
TC-2232	Type 3 Distribution Cabinet foundation details - Managed Motorways and freeways

### 2.3 ADDITIONAL SPECIFICATIONS AND DOCUMENTS

The following additional documents are defined:

VSIR	Victorian Service and Installation Rules
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## SECTION 3 ACRONYMS

### 3.1 ACRONYMS

The acronyms used in this document shall be interpreted as follows:

ACMA	Australian Communications and Media Authority
AS	Australian Standards
CES	Certificate of Electrical Safety
EMC	Electromagnetic Compatibility
GNSS	Global Navigation Satellite System
ITS	Intelligent Transport Systems
LED	Light Emitting Diode
NZS	New Zealand Standard
PE cell	Photoelectric cell
RCD	Residual Current Device
RTU	Remote Terminal Unit
VSIR	Victorian Service and Installation Rules

## SECTION 4 GENERAL MECHANICAL AND PHYSICAL REQUIREMENTS

### 4.1 CABINET CONSTRUCTION

- 4.1.1 The distribution cabinet shall be constructed from marine grade aluminium sheet A5052 H32 or A5251 H34, with a minimum thickness 2.5mm and treated to ensure optimum performance under prolonged exposure to atmospheric and site conditions prevalent in the State of Victoria. It is permissible for the base section of the cabinet to be cast, using an appropriate aluminium alloy or an approved alternative material.
- 4.1.2 The cabinet shall be rated to withstand the effects of solar radiation and the completed structure shall be rated to withstand wind forces for the region as defined in AS 1170.2 for a period not less than 15 years.
- 4.1.3 All bolts, screws, fixings etc. shall be of material suitable to provide a life of not less than 15 years.
- 4.1.4 Reinforcing shall be provided as necessary to produce a rigid cabinet structure. All materials shall be either inherently corrosion resistant or be treated and/or isolated against electrolytic and environmental corrosion.
- 4.1.5 Any jointing shall be carried out in accordance with any relevant Australian standards and generally accepted principles of sound practice.
- 4.1.6 All surfaces of the enclosure (including all structural supports and/or bracing components) shall be suitably treated (e.g. Polyester powder coated) to ensure prolonged operation within the intended application.
- 4.1.7 All exterior surfaces of the enclosure shall have a durable gloss finish of an approved polyurethane, non-sacrificial, anti-graffiti pigmented coating applied in accordance with the manufacturer's directions. Other exterior finish types may be considered at the sole discretion of the Superintendent.
- 4.1.8 The enclosure is to be coloured Smoke Blue – T33, in accordance with AS 2700.
- 4.1.9 All surfaces of the enclosure shall be free from sharp edges or protrusions.
- 4.1.10 All exterior corners of the enclosure and roof shall have a minimum external radius of 3 mm.
- 4.1.11 All accessible edges shall be de-burred.
- 4.1.12 The exterior of the enclosure shall present a clean and attractive appearance and be free from fasteners such as bolts, screws and pop-rivets.
- 4.1.13 The effects of atmospheric and/or local environmental conditions shall have no detrimental effect on the structural integrity or visual appearance (including colour fading) of the finished product for a period not less than 15 years.
- 4.1.14 All internal components shall be accessible from the front of the cabinet.

- 4.1.15 The roof of the cabinet shall protrude 25mm past the line of the door seals and shall be sloped to provide run-off to the rear of the cabinet. Alternative designs may be considered.

## 4.2 MOUNTING

The cabinet shall be constructed in such a manner as will permit the side having the longest base dimension to be mounted parallel with and immediately adjacent to a wall, fence or similar structure.

## 4.3 DOORS

- 4.3.1 The width of the door openings shall be as close as practicable to the external dimensions of the larger side of the cabinet, consistent with mechanical strength requirements.
- 4.3.2 The height of the door opening(s) shall be as large as practicable.
- 4.3.3 The door(s) shall be stiffened and shall be hinged with not less than two hinges each, at least 90mm long and the pin shall have a minimum diameter of 6 mm, which shall be constructed of non-ferrous materials of a type that do not require lubrication in order to prevent seizing. Hinges shall not protrude beyond the general cabinet dimensions.
- 4.3.4 A 'circuit schedule' card shall be mounted on the inside of the door to enable the identification of each switch and circuit-breaker and the connected equipment. The schedule shall be mounted behind a clear Perspex cover and be easily accessible.

## 4.4 RETAINING DEVICE

The doors shall be capable of being opened through a minimum of 110 degrees from the closed position and shall be provided with a device that shall retain the door in the open position when required.

## 4.5 PROTECTIVE EARTH STRAP

A flat braided copper conductor of 6mm<sup>2</sup> minimum width shall be fitted in the vicinity of the lower hinge, effectively grounding the door to the cabinet, to provide a protective earth for each door in accordance with AS/NZS 3000.

## 4.6 SEAL

The doors shall be provided with serviceable, durable and resilient weatherproof seals designed to last a minimum of 5 years and must be easily replaceable.

## SECTION 5 TYPE 1 CABINET

### 5.1 GENERAL

- 5.1.1 The cabinet shall have two compartments with effective seals, one above the other, each with its own door.
- 5.1.2 The top compartment shall house the Distribution Company meter(s), with the installation of the meters and associated circuitry being in accordance with the Victorian Service & Installation Rules.
- 5.1.3 The lower compartment shall house the circuit termination and switchgear, and shall accept electricity from the Distribution Company and re-distribute that electrical power throughout the street lighting scheme.
- 5.1.4 The distribution cabinet shall be designed to cater for three phase power supply as determined by the street lighting wiring design and associated drawings in accordance with individual tender documents.

### 5.2 EXTERNAL CABINET DIMENSIONS

- 5.2.1 The external dimensions of the Type 1 cabinet shall be in accordance with Table 5.1 below.

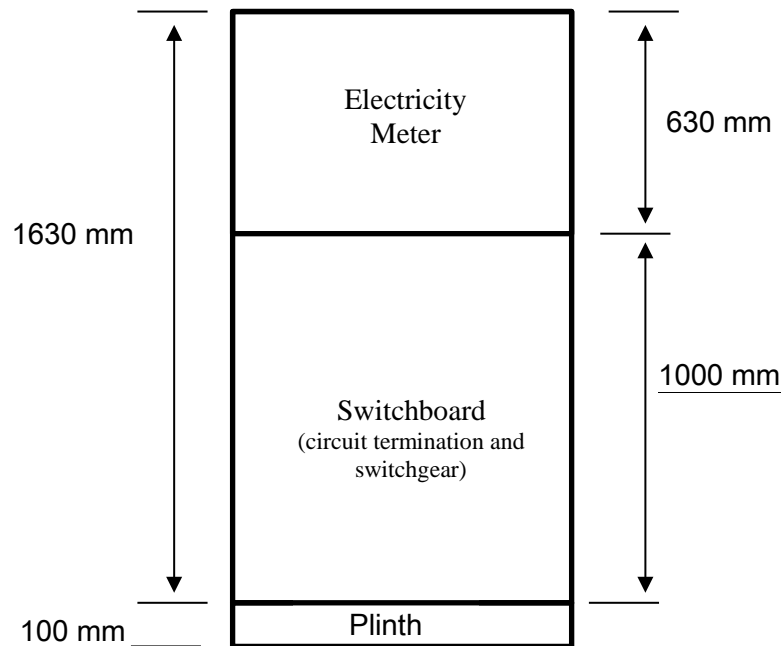
**Table 5.1 – External Dimensions Type 1 Cabinet**

	Nominal dimension	Tolerance
Height	1630mm	±5mm
Width	850mm	±5mm
Depth	350mm	±5mm

- 5.2.2 A typical arrangement for a Type 1 cabinet is shown in Figure 5.1.

### 5.3 CABINET BASE

- 5.3.1 The base of the cabinet shall be arranged to accommodate cable entry by means of 1 x 63mm conduit, 1 x 25mm conduit and sufficient 100mm conduits to cater for the requirements of the street lighting scheme as shown in VicRoads Standard Drawing TC-1062: Street Lighting Distribution Box - Foundation Detail.
- 5.3.2 The base of the cabinet shall be designed to allow the cabinet to be securely mounted on the distribution cabinet footing as detailed in Clause 5.7.
- 5.3.3 The base of the cabinet may use a plinth.



**Figure 5.1: Typical arrangement for Type 1 Cabinet with nominal dimensions**

## 5.4 SECURING BOLTS

- 5.4.1 The cabinet shall be designed to allow all securing bolts to be installed within the interior of the cabinet.
- 5.4.2 Access to the securing bolts shall be provided within the cabinet so as to facilitate effective installation and removal of the cabinet from the base.

## 5.5 DOORS

- 5.5.1 Doors shall be incorporated in the cabinet to provide direct access to the Distribution Company meter(s) (upper compartment) and to all internal VicRoads equipment (lower compartment) for installation and maintenance purposes.
- 5.5.2 The upper compartment door shall not be less than 600mm high.
- 5.5.3 The lower compartment door shall include a door pocket for the storage of documentation. The pocket shall be a minimum of 350mm wide, 200mm high and 25mm deep.

## 5.6 LOCKS

- 5.6.1 The upper compartment door shall be latched in two positions (top and bottom) and be secured in the closed position by a stainless, padlockable swing handle.

- 5.6.2 The lower door shall be latched in three positions (top, centre and bottom) and be secured in the closed position by a stainless, padlockable swing handle. This lower door shall be supplied with a padlock keyed to VicRoads public lighting standard XAA2. Keys shall not be provided with the completed cabinet.

## **5.7 FOOTING**

The cabinet shall be designed to enable installation on a distribution cabinet footing in accordance with VicRoads Standard Drawing TC-1062 and TC-2231.

## **5.8 VENTILATION**

A ventilation system shall be provided to allow free air flow for cooling and to prevent condensation inside the cabinet under all weather conditions.

## **5.9 INTERNAL LIGHT**

The lower compartment shall include an LED internal light that is activated via a door switch.

## SECTION 6 TYPE 2 CABINET

### 6.1 GENERAL

- 6.1.1 The cabinet shall have one compartment with effective seals and a single door.
- 6.1.2 The cabinet shall house the Distribution Company meter(s), with the installation of the meters and associated circuitry being in accordance with the Victorian Service & Installation Rules. It shall also house the circuit termination and switchgear and shall accept electricity from the Distribution Company and re-distribute that electrical power to VicRoads assets.

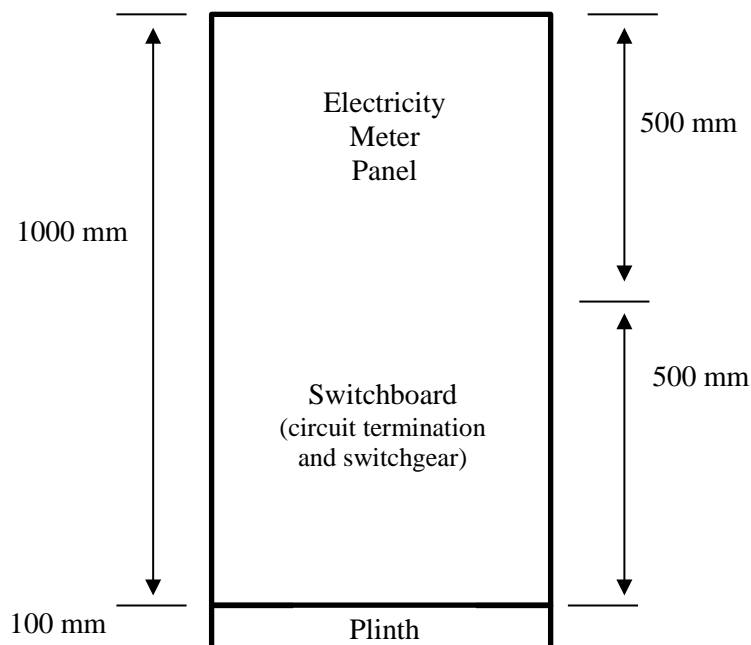
### 6.2 EXTERNAL CABINET DIMENSIONS

- 6.2.1 The external dimensions of the Type 2 cabinet shall be in accordance with Table 6.1 below:

**Table 6.1 – External Dimensions Type 2 Cabinet**

	Nominal dimension	Tolerance
Height	1000mm	±5mm
Width	500mm	±5mm
Depth	275mm	±5mm

- 6.2.2 A typical arrangement for a Type 2 cabinet is shown in Figure 6.1.



**Figure 6.1: Typical arrangement for Type 2 Cabinet with nominal dimensions**



### **6.3 CABINET BASE**

- 6.3.1 The base of the cabinet shall be arranged to accommodate cable entry as detailed in VicRoads Standard Drawing TC-1074, Distribution Cabinet Type 2 - Foundation Detail.
- 6.3.2 The base of the cabinet shall be designed to allow the cabinet to be securely mounted on the distribution cabinet footing as detailed in Clause 6.5.
- 6.3.3 The base of the cabinet may use a plinth.

### **6.4 SECURING BOLTS**

- 6.4.1 The cabinet shall be designed to allow all securing bolts to be installed within the interior of the cabinet.
- 6.4.2 Access to the securing bolts shall be provided within the cabinet so as to facilitate effective installation and removal of the cabinet from the base.

### **6.5 FOOTING**

The cabinet shall be designed to enable installation on a distribution cabinet footing in accordance with VicRoads Standard Drawing TC-1074 and TC-1075.

### **6.6 DOOR**

A single door shall be incorporated in the cabinet to provide direct access to the Distribution Company meter(s) (upper part) and to all internal VicRoads equipment (lower part) for installation and maintenance purposes.

### **6.7 LOCKS**

- 6.7.1 The door shall latched in three positions (top, centre and bottom) and be secured in the closed position by a stainless, padlockable swing handle.
- 6.7.2 A secure key safe, lockable by padlock, shall be securely fixed to the side of the cabinet. The key safe shall be provided with a padlock keyed to the power industry standard key.

## SECTION 7 TYPE 3 CABINET

### 7.1 GENERAL

- 7.1.1 The type 3 cabinet is similar to the Type 1 cabinet but with the lower compartment split into two separate compartments each with its own door.
- 7.1.2 The top compartment is used to house the Distribution Company meter(s), with the installation of the meters and associated circuitry being in accordance with the Victorian Service & Installation Rules.
- 7.1.3 The lower compartments are divided into road lighting and other ITS devices.
- 7.1.4 Each of the two sections is fed by a separate electricity meter.
- 7.1.5 All lighting circuits shall be connected into the lighting section.
- 7.1.6 All other ITS circuits shall be connected to the ITS section.
- 7.1.7 The distribution cabinet shall be designed to cater for three phase power supply as determined by the street lighting wiring design, the ITS devices wiring design and associated drawings in accordance with individual contract documents.

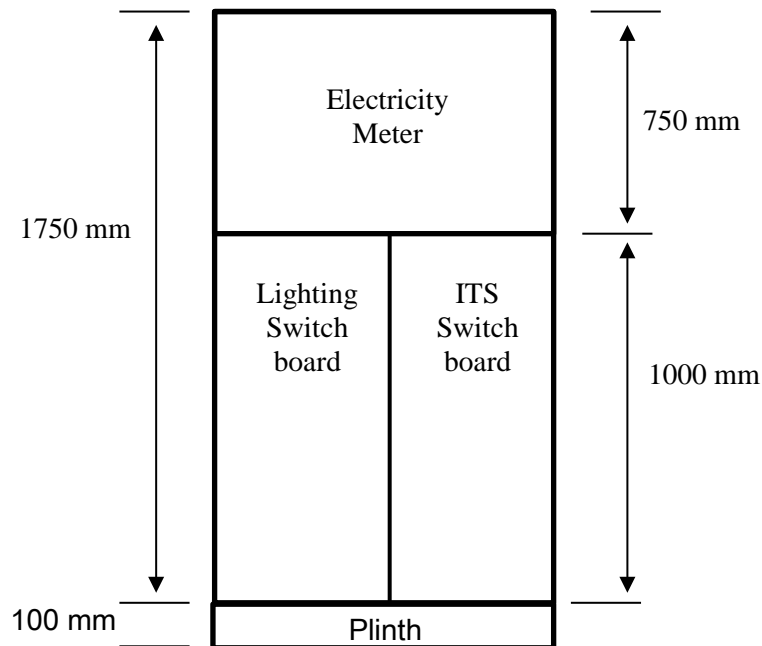
### 7.2 EXTERNAL CABINET DIMENSIONS

- 7.2.1 The external dimensions of the Type 3 cabinet shall be in accordance with Table 7.1 below.

**Table 7.1 – External Dimensions Type 3 Cabinet**

	Nominal dimension	Tolerance
Height	1750mm	±5mm
Width	850mm	±5mm
Depth	350mm	±5mm

- 7.2.2 A typical arrangement for a Type 3 cabinet is shown in Figure 7.1.



**Figure 7.1: Typical arrangement for Type 3 Cabinet with nominal dimensions**

### 7.3 CABINET BASE

- 7.3.1 The base of the cabinet shall be arranged to accommodate cable entry by means of 1 x 63mm conduit, 1 x 25mm conduit and sufficient 100mm conduits to cater for the requirements of the street lighting scheme as shown in VicRoads Standard Drawing TC-1062: Street Lighting Distribution Box - Foundation Detail.
- 7.3.2 The base of the cabinet shall be designed to allow the cabinet to be securely mounted on the distribution cabinet footing as detailed in Clause 7.7.
- 7.3.3 The base of the cabinet may use a plinth.

### 7.4 SECURING BOLTS

- 7.4.1 The cabinet shall be designed to allow all securing bolts to be installed within the interior of the cabinet.
- 7.4.2 Access to the securing bolts shall be provided within the cabinet so as to facilitate effective installation and removal of the cabinet from the base.

## **7.5 DOORS**

- 7.5.1 Doors shall be incorporated in the cabinet to provide direct access to the Distribution Company meter(s) (upper compartment) and to all internal VicRoads equipment (lower compartments) for installation and maintenance purposes.
- 7.5.2 The upper compartment door shall not be less than 600mm high.
- 7.5.3 The lower compartment doors shall include a door pocket for the storage of documentation. The pocket shall be a minimum of 350mm wide, 200mm high and 25mm deep.

## **7.6 LOCKS**

- 7.6.1 The upper compartment door shall be latched in two positions (top and bottom) and be secured in the closed position by a stainless, padlockable swing handle.
- 7.6.2 The lower doors shall be latched in three positions (top, centre and bottom) and each shall be independently secured in the closed position by a stainless, padlockable swing handle. This lower door shall be supplied with a padlock keyed to VicRoads public lighting standard XAA2. Keys shall not be provided with the completed cabinet.

## **7.7 FOOTING**

The cabinet shall be designed to enable installation on a distribution cabinet footing in accordance with VicRoads Standard Drawing TC-1062 and TC-2232.

## **7.8 VENTILATION**

A ventilation system shall be provided to allow free air flow for cooling and to prevent condensation inside the cabinet under all weather conditions.

## **7.9 INTERNAL LIGHT**

Each of the lower compartments shall have an LED internal light that is activated via a door switch.

## SECTION 8 ELECTRICAL REQUIREMENTS

### 8.1 GENERAL

- 8.1.1 The electrical installation for the cabinet and associated components shall comply with all relevant requirements of AS/NZS 3000.
- 8.1.2 Transformers used within the cabinet shall comply with AS/NZS 61558.
- 8.1.3 All cables and wires shall be insulated with a material not inferior to V-90 grade PVC and shall be suitably labelled.

### 8.2 OPERATING REQUIREMENTS

- 8.2.1 The mains supply voltage shall be deemed to be 230Vac (single phase) or 400Vac(3 phase) +10%, -6% in accordance with AS 60038, Section 2. The system and or sub-elements of the system shall be capable of operating satisfactorily from the same supply within  $\pm 15\%$ .
- 8.2.2 The Type 1 Cabinet shall typically be supplied with three phase power and be designed to allow for connection of the power supply by means of conductors with a cross sectional area of up to 25mm<sup>2</sup>.
- 8.2.3 The Type 2 Cabinet shall typically be supplied with single phase power and be designed to allow for connection of the power supply by means of conductors with a cross sectional area of up to 16 mm<sup>2</sup>.
- 8.2.4 Sub-circuits fed from both Type 1 and Type 2 cabinets shall be single phase unless otherwise specified.
- 8.2.5 The required operating voltage/phases shall be specified in individual tender documents.

### 8.3 METER ENCLOSURE

The meter enclosure and its internal fit-out shall fully conform to the requirements of the Victorian Service and Installation Rules (VSIR).

### 8.4 METER PANEL

- 8.4.1 The meter enclosure shall be provided with a hinged meter panel conforming to the requirements of Clause 8.4.2 of the Victorian Service and Installation Rules.
- 8.4.2 The meter panel shall be pre-wired and provided with the neutral link and fault current limiter to conform to the Victorian Service and Installation Rules.

- 8.4.3 The meter panel shall be pre-drilled in conformance with the Victorian Service and Installation Rules to allow for the installation of a meter by others.

## **8.5 CABLE ENTRY AND EXIT**

- 8.5.1 All external cable entry and exits shall be underground through the base of the cabinet.
- 8.5.2 Cableways through the lower part of the cabinet shall be provided with separate removable covers.
- 8.5.3 A neutral bar shall be provided in the distribution panel for the metered supply.

## **8.6 CIRCUITS**

- 8.6.1 The numbers of switched circuits and/or un-switched circuits shall be detailed in individual tender documents.
- 8.6.2 Provision is to be made for additional circuits to be added to supply other VicRoads equipment.
- 8.6.3 All circuits shall be legibly, indelibly and durably labelled. A listing identifying the circuit references shall be provided with the cabinet.

## **8.7 CIRCUIT BREAKERS**

- 8.7.1 The main switch and individual circuits shall each be protected by its own circuit breaker.
- 8.7.2 Circuit breakers shall have a minimum fault current level of 6kA. Where the calculated fault level is higher than 6kA, circuit breakers of the necessary higher capacity shall be provided.

## **8.8 RESIDUAL CURRENT DEVICE**

- 8.8.1 Residual current devices (RCDs) shall be used where required in accordance with AS/NZS 3000.
- 8.8.2 The following circuit types are exempt from the requirement to use an RCD:
- a) Street lighting circuits (see TCN 008)
  - b) Traffic signals in accordance with clause 2.6.3.2.3.3, Exemptions: 2 of AS/NZS 3000.
  - c) Lane Use Signs used for traffic management on managed motorways in accordance with clause 2.6.3.2.3.3, Exemptions: 2 of AS/NZS 3000.

Note: The exemptions in (b) and (c) above are on the basis that the failure of either of these types of devices could create a situation that is more dangerous than earth leakage current.

- 8.8.3 All other circuits shall be protected by an RCD in accordance with AS/NZS 3000.
- 8.8.4 Where installed, to minimise the effect of nuisance tripping, each final sub-circuit shall be protected by its own RCD.

## **8.9 SOCKET OUTLET**

- 8.9.1 A double socket outlet, protected by a specific RCD in accordance with the requirements of AS/NZS 3000, shall be installed within the Type 1 and Type 3 cabinets.
- 8.9.2 A single socket outlet, protected by a specific RCD in accordance with the requirements of AS/NZS 3000, shall be installed within the Type 2 cabinet.

## **8.10 CABINET EARTHING**

All metal components of the cabinet shall be earthed in accordance with AS/NZS 3000. This shall include an earth.

## **8.11 ELECTROMAGNETIC COMPATIBILITY (EMC)**

All equipment provided with the distribution cabinet shall comply with the relevant requirements of AS/NZS 61000.6.3.

## **8.12 TESTS**

Testing shall be in accordance with AS/NZS 3100 Section 8. For the purposes of Table 8.4 the working voltage shall be greater than 250VAC.

## **8.13 DANGER SIGN**

In accordance with AS/NZS 3000, a warning sign “**DANGER 240 VOLTS**” or “**DANGER 400 VOLTS**” (as required) shall be clearly fastened to the inside of each door and shall comply with the relevant requirements of AS 60529.

## SECTION 9 STREET LIGHTING OPERATION

### 9.1 GENERAL

- 9.1.1 This section details specific requirements for distribution cabinets used to power street lighting.
- 9.1.2 VicRoads uses an Asset Management and Control System (AMCS) to monitor and control lighting luminaires.
- 9.1.3 The AMCS uses an RTU installed within the distribution cabinet to communicate with the luminaires and back to the system.
- 9.1.4 This system requires a permanent supply to each individual luminaire at all times.

*Note: This arrangement is different from the previous arrangement where the luminaires were activated by switching power to them via a PE cell.*

### 9.2 CIRCUIT BREAKERS

- 9.2.1 The master lighting switch and each lighting circuit shall be protected by its own circuit breaker.
- 9.2.2 The PE cell and the contactor coil shall be protected by its own circuit breaker.
- 9.2.3 The RTU shall be protected by its own circuit breaker.

### 9.3 RESIDUAL CURRENT DEVICE

- 9.3.1 VicRoads has an exemption from Energy Safe Victoria on the requirement to use RCD's on road lighting circuits (see Technical Note TCN 008 Exemption from requirement to install RCD for road lighting installations).
- 9.3.2 Each circuit supplying road lighting shall not include an RCD.

### 9.4 STREET LIGHTING ACTIVATION

- 9.4.1 The activation of street lighting shall be via VicRoads Street Lighting management system.
- 9.4.2 The distribution cabinet shall include an RTU which is used to manage, monitor and operate each individual lighting luminaire.



- 9.4.3 Each individual luminaire incorporates a ‘smart cell’ which communicates wirelessly to the RTU.
- 9.4.4 The RTU shall be installed within the Distribution Cabinet by the contractor installing and commissioning the lighting scheme.

## **9.5 PHOTOELECTRIC CELL**

- 9.5.1 All lighting distribution cabinets shall be supplied with a photoelectric cell (PE cell).
- 9.5.2 The PE cell shall be used as a secondary or ‘back-up’ activation method in the event that the RTU fails.
- 9.5.3 The PE cell shall operate a contactor, which shall activate the power circuit(s) to the luminaires.
- 9.5.4 The PE cell shall be mounted in the side of the upper part of the VicRoads portion of the distribution cabinet behind a translucent weatherproof and vandal proof cover provided for the purpose.
- 9.5.5 The PE cell shall be controlled by a three-position switch: ON-OFF-AUTO.
- 9.5.6 When in the AUTO position, it shall be calibrated to switch on at an ambient light level of 10 lux.
- 9.3.7 When in the AUTO position, it shall be calibrated to switch off at an ambient light level of 35-50 lux.
- 9.3.8 The PE cell shall be designed as “fail-safe” and shall fail in the “power on” condition that results in all the luminaires being switched “on” for the full period of the PE cell failure.
- 9.3.9 The PE cell shall have a switch on time delay of 30-60 seconds.

## SECTION 10 ENVIRONMENTAL REQUIREMENTS

### 10.1 IP RATING

The distribution cabinet shall have a degree of ingress protection of IP 56 in accordance with AS 60529.

### 10.2 TEMPERATURE AND HUMIDITY

10.2.1 All equipment provided with the cabinet shall be capable of operating continuously under any of the following conditions:

- a) Ambient air temperatures within the range  $-15^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ ; and
- b) Insolation of up to  $1000\text{W}/\text{m}^2$ , incident at an angle of  $30^{\circ}$  from the vertical, applied to the maximum exposed surface of the equipment.

*NOTE: Where it is not practical to provide the required insolation during testing, it is acceptable to increase the upper ambient temperature limit by  $10^{\circ}\text{C}$  as substitute.*

10.2.2 Consideration shall be given to protection against the effects of high humidity, including condensation following a drop in ambient temperature.

### 10.3 VIBRATION

10.3.1 The top of the cabinet, when mounted on the footing, shall not deflect more than 10mm when a force of 2kN is applied at the top of the cabinet in any direction. Furthermore, the mounting shall be sufficiently robust to withstand vandalism or minor impact from a motor vehicle.

10.3.2 The cabinet shall withstand a vibration test in accordance with AS 60068.2.6.

10.3.3 The amplitude for the vibration test shall be 0.75 mm up to the cross-over frequency (approximately 8.2 Hz), where the acceleration is 0.2 g, and for higher frequencies the acceleration shall be maintained constant at 0.2 g.

## SECTION 11      MARKINGS

- 11.1.1 Each distribution cabinet shall be legibly and durably marked on the interior surface of the cabinet, in a readily accessible location, with the following information:
- a) The name and address, trade name or trademark of the manufacturer.
  - b) Catalogue number or marking which shall distinguish the particular distribution cabinet 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, and the month and year of manufacture.
  - d) Other information required under AS/NZS 3100.
- 11.1.2 All information displayed on the cabinet shall be readily accessible and may be by a securely affixed plate or other approved means.

## **SECTION 12      DOCUMENTATION**

The following items are to be supplied with the distribution cabinet:

- a) A schematic diagram showing the electrical circuits contained within the distribution cabinet. The diagram shall provide sufficient information for a maintenance technician to service or repair the cabinet.
- b) A list of all major electrical and electronic components detailing their electrical characteristics. The list shall provide sufficient information for a maintenance technician to obtain suitable replacement parts and components.
- c) On installation, a copy of the street lighting wiring circuit diagrams shall be prominently displayed in the cabinet.

## SECTION 13 - INSTALLATION AND COMMISSIONING

### 13.1 GENERAL

- 13.1.1 Electrical distribution cabinets shall be installed in accordance with:
- AS/NZS 3000;
  - The requirements of this specification;
  - Contract Standard Section 732; and
  - The requirements of individual contract documents.
- 13.1.2 All pits and conduits shall be installed in accordance with Contract Standard Section 733.
- 13.1.3 Where an existing electrical distribution cabinet is installed but has insufficient capacity for additional circuits and/or electrical loads, the existing cabinet shall be replaced with a new cabinet.
- 13.1.4 Each site or installation shall include **one only** distribution cabinet.
- 13.1.5 Where an existing distribution cabinet does not have sufficient spare capacity for additional assets, a new distribution cabinet with sufficient capacity shall **replace** the existing distribution cabinet.
- 13.1.6 Where a new cabinet replaces an existing cabinet, the existing cabinet and foundation shall be decommissioned and removed from site.
- Note: Two or more distribution cabinets at the same location shall not be installed nor be allowed to remain installed.*
- Exception: Where a Type 3 cabinet has insufficient capacity for the number of proposed circuits, an exemption may be granted for the use of two Type 1 cabinets. If the use of two Type 1 cabinets is approved, one shall be used exclusively for lighting and the other for ITS devices.*
- 13.1.7 A standard VicRoads cabinet label shall be supplied and attached to the rear of the cabinet (facing the roadway) in accordance with standard drawing TC-2100.
- 13.1.8 A drawing indicating the point of supply for the cabinet and the conduit/cable route shall be provided in the cabinet.
- 13.1.9 On installation, the circuit schedule card shall be completed for each switch and circuit breaker.
- 13.1.10 On installation, a copy of the street lighting wiring circuit diagrams shall be prominently displayed in the cabinet.

## 13.2 CABINET LOCATION

- 13.2.1 Electrical distribution cabinet locations shall be specified in individual contract documents.
- 13.2.2 Cabinets shall be located such that the risk of impact from an errant vehicle is minimised as much as is practicable.
- 13.2.3 On roads with 100km/h speed limits, electrical distribution cabinets shall be located not less than 5 metres from any carriageway, and where possible, beyond the clear zone.
- 13.2.4 Any distribution cabinet located within the clear zone on a freeway or in a high risk location, the contractor shall provide traffic barriers to protect the cabinet.
- 13.2.5 Distribution cabinets installed adjacent to another VicRoads cabinet (e.g. a traffic signal controller) shall be not less than 3m from the other cabinet. This is to minimise the risk of a vehicle impact affecting both cabinets.
- 13.2.6 Cabinets shall be installed with the back of the cabinet parallel to the adjacent roadway and the door opening away from the roadway.

## 13.3 FOUNDATIONS

- 13.3.1 Foundations shall comply with the standard drawings detailed in Table 13.1 below.
- 13.3.2 All concrete works shall conform to VicRoads standard drawings and be undertaken in accordance with VicRoads Contract Sections 610, 611, and 614.

DB Type	Location	Drawing
1	Managed Motorway or Freeway	TC-2231
1	Arterial Road	TC-1062
2	Arterial Road (Not used on managed motorways or Freeways)	TC-1074
3	Managed Motorway or Freeway (Not used on arterial roads)	TC-2232

**Table 13.1: Standard drawings for electrical distribution cabinet foundations**

## 13.4 EARTHING

- 13.4.1 Distribution Cabinets and all connected circuits shall be earthed in accordance with the requirements of AS/NZS 3000.
- 13.4.2 An earth electrode shall be installed in the earth rod inspection pit in the concrete base of the distribution cabinet as shown on VicRoads Standard Drawings listed in Table 13.1 above.

- 13.4.3 An earth cable attached to the earth electrode shall be provided and installed in all VicRoads DB's circuits in accordance with the requirements of AS/NZS 3000.
- 13.4.4 All earths shall be terminated within the Distribution cabinet in accordance with AS/NZS 3000 for the M.E.N. (multiple earthed neutral) system of earthing.
- 13.4.5 The size of earth cable is to be designed to ensure a Fault Loop Impedance 'low enough to allow sufficient current to flow in the fault loop to cause the protective device to operate within the disconnection time' in accordance with AS/NZS 3000.

### **13.5 MAXIMUM DEMAND**

- 13.5.1 When calculating the maximum demand for determining the size of the main supply conductors, allowance shall be provided for any known future additions to the cabinet.
- 13.5.2 In addition to calculated maximum demand and allowances for known future additions, an extra 25% capacity in the mains supply conductors shall be provided for.

### **13.6 TYPE 1 DISTRIBUTION CABINETS**

- 13.6.1 Where specified in individual contract documents, a Type 1 cabinet shall be supplied and installed.
- 13.6.2 Type 1 cabinets shall be installed on the appropriate foundation as detailed in Table 13.1 above.

### **13.7 TYPE 2 DISTRIBUTION CABINETS**

- 13.7.1 Where specified in individual contract documents, a Type 2 cabinet shall be supplied and installed.
- 13.7.2 Type 2 cabinets shall be installed on the appropriate foundation as detailed in Table 13.1 above.
- 13.7.3 Type 2 cabinets shall only be used for single phase power supply.
- 13.7.4 For a Type 2 Cabinet, a key for the padlock shall be provided inside the cabinet of the connected load (e.g. traffic signal controller) and appropriately labelled with a key tag.

### **13.8 TYPE 3 DISTRIBUTION CABINETS**

- 13.8.1 Where specified in individual contract documents, a Type 3 cabinet shall be supplied and installed.

13.8.2 Type 3 cabinets shall be installed on the appropriate foundation as detailed in Table 13.1 above.

### **13.9 DATA COLLECTION OF CABINETS**

13.9.1 All cabinets shall have their location identified and recorded using GNSS co-ordinates. The co-ordinates shall be captured using the World Geodetic System WGS84 in decimal degrees to 6 decimal places.

13.9.2 Details of the cabinets installed and all circuits, cabling, etc., shall be recorded in an Excel spreadsheet.

13.9.3 All required information recorded and provided as specified below.

- Cabinet type
- Site Number
- Site name
- Road
- Nearest intersection or interchange
- Chainage
- Municipality
- VicRoads Region
- Point of supply
- Meter Number
- NMI Number
- Cabinet GNSS co-ordinates
- As built schematic drawings of electrical network and all power circuits
- As built schematic drawings of communications network.

### **13.10 TESTING AND COMMISSIONING**

13.10.1 The installed electrical distribution cabinet and all connected circuits shall be tested in accordance with the requirements of AS/NZS 3000, the requirements of the VSIR's and any other requirements of the local distribution business.

13.10.2 As a minimum, the contractor shall undertake the following tests:

- a) The continuity of each circuit.
- b) The continuity and resistance (fault loop impedance) of the earthing conductors.
- c) Correct switching of each circuit.
- d) Correct operation of

13.10.3 The contractor shall provide a CES for all electrical works.

13.10.4 The completed installation shall be inspected and tested by the contractor and a VicRoads representative as part of the site commissioning.



## APPENDIX A GUIDELINES FOR PURCHASING

(Informative)

### A1 GUIDELINES FOR PURCHASING

The following information, as appropriate, shall be supplied with an order for distribution cabinets complying with this specification:

- a) The number of units required, and whether Type 1, Type 2 or Type 3.
- b) Single or 3 phase power supply.
- c) The number of switched and/or un-switched circuits required.
- d) The number of additional or spare 240V a.c. circuits required.
- e) The inclusion of a back-up PE cell to be provided with the cabinet where required.
- f) The inclusion of a time switch where required.
- g) The requirement to supply and install a public information label on each Distribution Cabinet, in accordance with standard drawing TC-2100 for Standard Cabinet Label, displaying the site number.
- h) Warranty period and conditions.
- i) Delivery schedule, location and conditions.

## APPENDIX B REQUIREMENTS FOR APPROVAL

(Normative)

### B1 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 a cabinet.
- b) An outline drawing showing the general presentation and overall dimensions of the complete cabinet.
- c) Documentation to demonstrate that the cabinet has been manufactured and supplied under an approved quality assurance system.
- d) Documentation to demonstrate that the cabinet 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 manufacturer's assurance that the product complies with each paragraph of the specification.

### B2 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:

Requirements	Clause	Evidence
Temperature and humidity	10.1	Test Report
Enclosure protection	10.2	Test Report
Vibration	10.3	Test Report

### B3 OTHER REQUIRED TESTING

The supplier shall submit a 'statement of compliance' confirming that all equipment supplied with the cabinet complies with the requirements of EMC (Clause 10.4).

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

### B4 ASSESSMENT PROCEDURE

B4.1 The assessment procedure 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.

B4.2 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.

**B5 TYPE APPROVAL**

B5.1 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.

B5.2 The decision to grant a Certificate of Type Approval is at the sole discretion of VicRoads.

B5.3 To enable assessment for the purpose of granting Type Approval, the manufacturer/supplier is to submit a formal request for Type Approval, for each type submitted, accompanied by the following:

- a. A complete working sample.
- b. An outline drawing showing the general presentation and overall dimensions.
- c. Documentation to demonstrate that the product has been manufactured and supplied under an approved quality assurance system.
- d. Documentation to demonstrate that the product 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 manufacturer's assurance that the product complies with each paragraph of the specification, as appropriate.

B5.4 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 for VicRoads works.