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Technical Specification

**Transport and Main Roads Specifications
MRTS95 Provision of Switchboards**

October 2014

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1 Introduction

This Technical Specification applies to the supply and installation of switchboards for the supply of electrical power to electrical installations including traffic signal installations and Rate-3 road lighting installations.

This Technical Specification does not apply to Rate-1 or Rate-2 road lighting. For Rate-1 and Rate-2 road lighting reference shall be made to the relevant Electricity Entity's Policies, Standards and Specifications.

This Technical Specification shall be read in conjunction with MRS95 *Provision of Switchboards*, MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

All Electrical Works shall comply with the requirements of the *Electrical Safety Act 2002*.

The title of MRTS95 had been changed from "Switchboards and Cables" to "Switchboards". All references to electrical cables had been moved to new specification MRTS256.

2 Definition of terms

The terms used in this Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions used in this Specification shall be as defined in Table 2, the *Electrical Safety Act 2002* and AS/NZS 3000.

Table 2 – Definition of Terms

Term	Definition
Act	Electrical Safety Act 2002 and associated Regulations and Codes of Practice.
Administrator	Principal's Representative or Superintendent as defined in Clause 14 of MRTS01.
Rate-1 Lighting	Public lighting supplied, installed, owned and maintained by the Electricity Entity.
Rate-2 Lighting	Public lighting owned and maintained by the Electricity Entity.
Rate-3 Lighting	Public lighting supplied, installed, owned and maintained by Transport and Main Roads.
URD	Underground Residential Development as defined by the Electricity Entity.

3 Referenced documents

3.1 Standards

Table 3.1 lists documents referenced in this Technical Specification.

Table 3.1 – Referenced documents

Reference	Title
AS/NZS 1158.6	Lighting for roads and public spaces – Luminaires
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)

Reference	Title
AS/NZS 3008	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions
AS/NZS 3191	Electric flexible cords
AS/NZS 5000.1	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1(1.2) kV
AS/NZS 60529	Degrees of protection provided by enclosures (IP Code)
RPDM	Road Planning and Design Manual
TRUM	Traffic and Road Use Management Manual
MRTS01	Introduction to Technical Specifications
MRTS04	General Earthworks
MRTS50	Specific Quality System Requirements
MRTS93	Traffic Signals
MRTS94	Road Lighting
MRTS234	Communications Cables
MRTS256	Power Cables

3.2 Standard Drawings

Table 3.2 lists the Standard Drawings referenced in this document.

Table 3.2 – Referenced Standard Drawings

Standard Drawing	Title
1327	Traffic Signals/Road Lighting – Mains Connection
1623	Switchboard Typical Layout and Circuit Diagram MEN System
1625	Three Phase Junction Box Wiring Details
1626	Active, Neutral and Earth Bolting Arrangements
1627	Switchboard Top Mounted
1699	Parts List (7 Sheets)

4 Quality system requirements

4.1 Hold Points and Witness Points

General requirements for Hold Points and Witness Points are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specification*.

The Hold Points applicable to this Specification are summarised in Table 4.1.

Table 4.1 – Hold Points

Clause	Hold Point
5	Cable testing

4.2 Construction Procedures

Construction procedures which are required to be submitted in accordance with Clause 6 of MRTS50 *Specific Quality System Requirements* are listed in Table 4.2.

Table 4.2 – Construction Procedures

Clause	Procedure
8.2	Installation of switchboards and ancillary equipment

5 Compliance with the Act and AS/NZS 3000

The work covered by this Specification shall comply with the requirements of the Act and subordinate legislation and AS/NZS 3000.

The Contractor shall engage a Licensed Electrical Contractor to perform the duties and functions of Electrical Works. This includes the installation of pits and conduits for power and communications cables.

The Contractor shall be responsible for carrying out sufficient testing to ensure that materials and installation standards comply with the requirements of this Specification.

The Contractor shall test the cables before connection to the main electricity supply as required by the Act in the presence of the Administrator. **Hold Point**

The Contractor shall energise each circuit in turn to verify each load is connected to the specified circuit and phase.

6 Compliance with other documentation

For Rate-3 Road Lighting installations, this Specification shall be read in conjunction with referenced documents, Road Planning and Design Manual – Chapter 17 – *Lighting*; AS/NZS 3000; and Traffic and Road Use Management Manual: Section 5-3 – *Bell Joint Assembly Manual*; and Section 5-4 – *Rate-3 Road Lighting Electrical Design Requirements*.

7 Materials

7.1 Standards

Materials supplied and installed under this Specification shall meet the requirements of the relevant Standards listed in Table 3.2, except where varied by this Specification.

7.2 Electrical rating

All electrical components shall be suitable for operation on a 240 Volt \pm 6%, 50 Hz \pm 0.1 Hz system. Transient voltage fluctuations outside these limits may occur under some conditions, such as those due to faults, sudden connection or disconnection of large loads or lightning strikes.

7.3 Environmental conditions

Switchboards installed above ground will be installed outdoors and shall be designed, supplied, installed and constructed so as to perform properly in the following conditions:

- a) ambient temperatures from 45°C to - 5°C
- b) solar radiation intensity of 1000 W/m² with high ultraviolet content
- c) tropical summer storms with wind gusts exceeding 160km/h and an annual rainfall in excess of 1500mm
- d) extended periods of relative humidity in excess of 90%
- e) garden sprays and sprinklers set at a height above ground level causing water to be sprayed against or to fall upon a pillar switchboard at angles between 40° below and 60° above the horizontal, and

- f) areas of coastal salt spray and/or industrial pollution with equivalent salt deposit densities in the range 2.0 to 3.0g/m².

7.4 Reliability

The design service life of equipment shall be 25 years under the specified system and environmental conditions.

References to electrical cables had been moved to new specification MRTS256.

7.5 Rate-3 road lighting

7.5.1 Switchboards

Switchboards shall be top mounted on a post. Switchboards shall not be back-mounted on a pole for new works.

Pillar mounted switchboards had been removed as they have not been used for many years, partly because they were prone to flooding.

All switchboards shall comply with the requirements of the relevant Standard Drawings, in particular Drawings 1623, 1627, 1628 and 1699.

Steel screws, nuts and other steel parts shall be either stainless steel, galvanised, electroplated or have an equivalent approved protective finish. Brass screws, nuts, etc. must be electroplated.

Ferrous materials shall be protected by a suitable non-corrosive coating.

Adjacent electrochemically incompatible materials shall be separated by insulating material.

Wiring between switchboard electrical components shall be 4mm² (7/0.85) PVC minimum unless shown otherwise.

7.5.2 Post mounted enclosures

Post mounted enclosures shall comply with the requirements of Standard Drawings 1623, 1627, 1628 and 1699, and have ingress protection rating IP66 to AS60529 when installed.

The enclosure shall be supplied with a 3 mm thick UV stabilised polyurethane gasket to be placed between the top of the post and the switchboard.

The enclosure shall be 316 stainless steel with brushed finish.

The enclosure surfaces shall be free of air voids and sharp edges.

The enclosure shall have a hinged door with two locks and a weatherproof seal in accordance with Standard Drawing 1627.

Hinges and locking mechanisms shall be stainless steel.

7.5.3 Photoelectric control switches

Photoelectric control switches supplied under this Specification will generally be installed inside an enclosure for post mounted switchboard and may, for all or part of their operating life, be exposed to environmental conditions as detailed in (a) – (d) of Clause 1.5 of AS 1158.6.

For a top mounted switchboard, an integral photoelectric switch shall be mounted in the top of the switchboard as per Standard Drawing 1627.

Photoelectric control switches shall switch on at 18 +/- 7.5 lux and shall switch off at a maximum of 30 +/- 7.5 lux.

The normal service duty cycle will be 12 hours on and 12 hours off.

Photoelectric control switches shall be of a high rating type (1800VA) for control of the lighting circuits connected to the switchboard. Switches shall be capable of being plugged into an integral type for post mounted switchboard.

Photoelectric control switches shall consume a maximum energy of 2 watts.

Photoelectric control switches shall be fail safe, i.e. the contact shall be “normally closed” in the un-energised condition and any component failure in the control circuit shall cause the switch contact to revert to the normally closed state, energising the lighting circuits controlled by the switchboard.

Photoelectric control switches shall be fitted with a Metal Oxide Varistor (MOV) for lightning and transient/surge protection. The rating of the MOV shall not be less than 160 Joules at 320V.

The following information shall be indelibly marked on each photoelectric control switch:

- a) manufacturer's/supplier's name and identification mark
- b) country of manufacture
- c) rated voltage and current, and
- d) model number.

7.6 Mains connection – Traffic signal controllers and Rate-3 road lighting

Material requirements for the connection of road lighting switchboards and/or traffic signal controllers to the overhead mains supply shall be as shown on Standard Drawing 1327.

8 Installation of Switchboards

8.1 General

The electricity supply should be provided by the local Electricity Entity.

Where the Contractor is required to provide installation to a mains connection box on the power pole it shall be installed as shown on Standard Drawing 1327.

All components and ancillaries shall be securely fixed in place and the fixing devices used shall be compatible with the materials to be joined.

8.2 Switchboards and ancillary equipment

Installation of post mounted switchboards shall be in accordance with Standard Drawing 1627.

Photoelectric control switches shall face south.

All exposed duct entries shall be sealed with a silicone sealant to prevent the ingress of water and condensation within the switchboard enclosure.

Switchboards shall be earthed using the MEN system as described in AS/NZS 3000. This shall be achieved by running an earth cable from the neutral link to an earth stake located in the nearest pit.

The cable from the earth stake to the neutral link shall be continuous and not broken and re-joined. Stripping of insulation to effect other connections is permitted.

8.3 Cables for Switchboard Wiring

This is a new section imported from the ex-MRTS95 to address cables for internal switchboard wiring.

Cable for switchboard wiring shall comply with these specifications.

- Conductor: Tinned conductor to AS1125 Conductors in insulated electrical cables and flexible cords

- Insulation: V90HT (V105°C PVC) to AS/NZS 3191:2008 Electric flexible cords and to AS/NZS 3008 Table 7 Note 2
- AS/NZS 5000.1 Electric cables—Polymeric insulated Part 1: For working voltages up to and including 0.6/1 (1.2) kV
- The colours shall be Red or White or Dark Blue.
Light blue or pale blue shall not be used for any active conductor colour.

Table 8.1 Standard cable sizes for wiring in switchboards

Configuration	Phase	Insulation to AS/NZS 3191
1 core x 10mm ²	A	Red V90HT (V105°C PVC)
1 core x 10mm ²	B	White V90HT (V105°C PVC)
1 core x 10mm ²	C	Dark Blue V90HT (V105°C PVC)
1 core x 16mm ²	A	Red V90HT (V105°C PVC)
1 core x 16mm ²	B	White V90HT (V105°C PVC)
1 core x 16mm ²	C	Dark Blue V90HT (V105°C PVC)
1 core x 25mm ²	A	Red V90HT (V105°C PVC)
1 core x 25mm ²	B	White V90HT (V105°C PVC)
1 core x 25mm ²	C	Dark Blue V90HT (V105°C PVC)

9 Application for power supply

No work shall be carried out on an Electricity Entity pole without the prior permission of that Entity.

The Contractor is responsible for organising the supply of power to a site that does not have a point of supply. This includes:

- to make application for supply of electricity to the Electricity Entity with a copy being sent to the Administrator
- to carry out the installation work as per Standard Drawing 1327
- to submit "Ready for connection" form to the Electricity Entity
- to submit to the Electricity Entity a disconnection notice when the supply is no longer required
- to submit to the Electricity Entity a schedule of loading or change of load
- to supply and install service pole (if required), and
- to organise test and inspections and submit to Transport and Main Roads the record of tests.

It is the responsibility of the Contractor to provide the mains connection box, located approximately 4 m from the base of the power pole, and all conduit and wiring from the switchboard to the mains connection box.

The Electricity Entity will then connect the overhead supply to the mains connection box.

10 Testing

The Contractor is responsible for carrying out sufficient testing to ensure that materials and construction standards comply with this Specification and the requirements of the Act. Tests shall include the mandatory tests detailed in AS/NZS 3000 and earth fault loop impedance tests.

In addition to copies of the Contractor's completed test sheets as part of its QA procedures, the Contractor shall also provide a completed Certificate of Test and Compliance, a Record of Inspection and Tests, and accurate as-constructed drawings.

11 Removal of mains connection

Where shown in the Drawing or where the mains connection is no longer required, the connection shall be removed.

The Contractor shall liaise with the Superintendent in providing details of intended de-energisation and de-commissioning of existing mains connections (i.e. site address, proposed date of disconnection). The Contractor must obtain written approval from the Superintendent before removing mains connections.

Consumer mains cabling shall be safely disconnected and removed between the point of supply and the associated switchboard with fuses removed as required.

Where mains connections are removed from Electrical Entity service poles, all associated pole mounted ducting and fixings (including cable guards, saddles and screws) shall be removed from the pole and disposed of.

Where nominated, existing equipment shall be demolished and removed in a manner which avoids damage to any adjacent items.

Where mains connection ducting between the Supply Authority service pole/pillar and the adjacent electrical pit is in earth or new concrete surface, such ducting shall be removed with the entry point in the electrical pit suitably sealed to prevent ingress of material. Resulting excavations shall be backfilled and finished so as to reinstate the area to a safe and free draining state. Backfilling shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*. The surface shall be reinstated with material matching the surrounding area to the satisfaction of the Superintendent.

Where mains connection ducting between an Electrical Entity service pole and the adjacent electrical pit is in concrete surface, it shall be suitably treated to eliminate trip risk to adjacent pedestrian traffic including maintenance workers.

Demolished equipment and debris shall be disposed of in accordance with the requirements of Clause 11 of MRTS01 *Introduction to Technical Specifications*.

The contractor shall record the date each of the mains connections is removed.

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