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Technical Specification

Transport and Main Roads Specifications
MRTS228 Electrical Switchboards

July 2021

Queensland Government

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1 Introduction

This Technical Specification applies to the supply and installation of metered or unmetered switchboards for the supply of electrical power to Transport and Main Roads owned road lighting installations.

Mains Power supplied to electrical switchboards to the department's standards were until recently only unmetered. The introduction of LED lights and associated control systems including the dimming functionality meant that the existing unmetered tariffs may no longer be economical and metered cabinets become a viable option.

In addition, in some districts metered tariffs become more favourable than unmetered tariffs even for standard loads.

Therefore the decision to use a metered or unmetered electrical switchboard depends on the specific application and load and the decision is made by the Principal in conjunction with the Electricity Entity.

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 MRTS01 *Introduction to Technical Specification,* MRTS50 *Specific Quality System Requirements*, MRS228 *Electrical Switchboards* 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.

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2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specification.* Further definitions used in this Technical Specification shall be as defined in Table 2, the *Electrical Safety Act* 2002 and AS/NZS 3000 *Electrical installations (Known as the Australian and New Zealand Wiring Rules)*.

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 *Introduction to Technical Specification*
Electricity Act	*Electricity Act* 1994 and subordinate legislation
Electricity Regulation	*Electricity Regulation 2006*
Rate-1 Lighting	Unmetered public lighting supplied, installed, owned and maintained by the Electricity Entity
Rate-2 Lighting	Unmetered public lighting owned and maintained by the Electricity Entity

Term	Definition
Rate-3 Lighting	Unmetered public lighting supplied, installed, owned and maintained by Transport and Main Roads
Switchboard	An assembly of circuit protective devices, with or without switchgear, instruments or connecting devices, suitably arranged and mounted for distribution to, and protection of, one or more submains or final subcircuits or a combination of both.
TRUM	*Traffic and Road Use Management Manual*
URD	Underground Residential Development as defined by the Electricity Entity

3 Reference documents

The requirements of the referenced documents listed in Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
AS 1125	*Conductors in insulated electrical cables and flexible cords*
AS 60529	*Degrees of protection provided by enclosures (IP Code)*
AS/NZS 3000	*Electrical installations (Known as the Australian and New Zealand Wiring Rules)*
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*
MRTS01	*Introduction to Technical Specifications*
MRTS04	*General Earthworks*
MRTS50	*Specific Quality System Requirements*
MRTS93	*Traffic Signals*
MRTS94	*Road Lighting*
MRTS210	*Provision of Mains Power*
MRTS226	*Telecommunications Field Cabinets*
MRTS256	*Power Cables*
RPDM	*Road Planning and Design Manual*
SA/SNZ TS 1158.6	*Lighting for roads and public spaces – Luminaires*
SD1327	*Traffic Signals / Road Lighting – Mains Connections*
SD1423	*Traffic Signals – Traffic Signal Controller Base Installation Details*
SD1430	*Road Lighting – Switchboard Pillar Mounted*

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Reference	Title
SD1623	*Road Lighting – Switchboard Typical Layout and Circuit Diagram MEN System*
SD1624	*Road Lighting – Junction Box Single Phase Wiring Details*
SD1625	*Road Lighting – Junction Box Three Phase Wiring Details*
SD1626	*Road Lighting – Junction Box Active, Neutral and Earth Bolting Arrangements*
SD1627	*Road Lighting – Switchboard Top Mounted*
SD1628	*Road Lighting – Post – Top Mounted Switchboard*
SD1676	*Road Lighting – Switchboard Typical Pillar Layout*
SD1679	*ITS – Telecommunications Field Cabinet Base Installation Details*
SD1686	*Road Lighting – Switchboard Assembly Details*
SD1687	*Road Lighting – Metered Switchboard Assembly Details – Single Phase*
SD1688	*Road Lighting – Metered Switchboard Assembly Details – Three Phase*
TRUM Volume 4 Part 3	*Electrical Design for Roadside Devices*
TRUM Volume 4 Part 4	*Road Lighting Dome Junction Box Assembly*
TRUM Volume 4 Part 8	*Electrical Verification Requirements for New or Altered Roadside Installations*

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4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

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

The Hold Points applicable to this Technical Specification are summarised in Table 4.1. There are no Witness Points or Milestones defined.

Table 4.1 – Hold Points

Clause	Hold Point	Witness Point	Milestone
5	1. 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 Technical 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 cables.

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

The Contractor shall carry out tests on the consumer mains cable and switchboard before connection to the main electricity supply as required by the Act in the presence of the Administrator. **Hold Point 1**

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 Road Lighting installations, this Technical Specification shall be read in conjunction with referenced documents:

- *Road Planning and Design Manual* – Volume 6 – *Lighting*
- TRUM Volume 4 Part 3 – *Electrical Design for Roadside Devices*
- TRUM Volume 4 Part 4 – *Road Lighting Dome Junction Box Assembly*
- AS/NZS 3000 *Wiring Rules*
- SD1624, SD1625 and SD1626.

7 Materials

7.1 Standards

Materials supplied and installed under this Technical Specification shall meet the requirements of the relevant Standards listed in Table 3, except where varied by this Technical Specification.

7.2 Electrical Rating

All electrical components shall be suitable for operation on the electricity supply as detailed in the *Electricity Regulation* 2006. 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 - 5°C to + 45°C

b) solar radiation intensity of 1000 W/m² with high ultraviolet content

c) tropical summer storms with wind gusts exceeding 160 km/h and an annual rainfall in excess of 1500 mm

d) extended periods of relative humidity in excess of 90%

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e) garden sprays and sprinklers set at a height above ground level causing water to be sprayed against or to fall upon a switchboard, 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.

7.5 Road Lighting

Clarification of the switchboards for road lighting installations to include metered as well as unmetered switchboards.

7.5.1 Switchboards

Road lighting switchboards shall comply with the following standard drawings as referenced:

Unmetered	Top mounted	Refer SD1623, SD1627, SD1628, SD1686
Unmetered	Pillar mounted	Refer SD1430 and SD1676
Metered	Single phase top mounted	Refer SD1687
Metered	Three phase plinth mounted	Refer SD1688

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

Switchboards may be metered or unmetered.

All switchboards shall comply with the requirements of the relevant Standard Drawings as above.

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 4 mm² (7/0.85) PVC minimum unless shown otherwise.

Only where the Electricity Entity network characteristics are such that the 80 A fuse will not activate within 400 ms to clear an active to earth fault at the top mounted or metered switchboard may a pillar mounted switchboard be used. However, this should be used only when other cost effective design options are not available.

7.5.2 Photoelectric control switches

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

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For other switchboards, photoelectric control switches supplied under this Technical Specification will generally be installed inside an enclosure and may, for all or part of their operating life, be exposed to environmental conditions as detailed in SA/SNZ TS 1158.6.

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 two watts.

Photoelectric control switches shall be rated at IP65 as per AS 60529.

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

Material requirements for the connection of road lighting switchboards to the overhead mains supply shall be as shown on Standard Drawing 1327.

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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.

All earth work shall be in accordance with MRTS04 *General Earthworks*.

8.2 Switchboards and Ancillary Equipment

Clarification of the requirement to have a dedicated Earth pit, including a reference to the relevant Standard Drawings for Traffic Signal Controller, Road Lighting and Intelligent Transport System installations.

Installation of switchboards shall be in accordance with the relevant Standard Drawings.

After cables have been installed, 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 linking the neutral bar to the earth bar using an MEN link, and running an earth cable from

the earth bar to an earth stake located in the adjacent dedicated earth pit. Please see the following Standard Drawings for details:

a) For Traffic Signal Controller installations, refer SD1423 *Traffic Signal Controller Base Installation Details* and MRTS93 *Traffic Signals*.

b) For Road Lighting installations, refer SD1627 *Switchboard Top Mounted* or SD1430 *Switchboard Pillar Mounted* and MRTS94 *Road Lighting*.

c) For Intelligent Transport Systems (ITS) installations, refer SD1679 *Telecommunications Field Cabinet Base Installation Details* and MRTS226 *Telecommunications Field Cabinets*.

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

8.3 Cables for Switchboard Wiring

Cable for switchboard wiring shall comply with MRTS256 *Power Cables* and these Technical Specifications:

- Conductor: copper conductor to AS 1125
- Insulation: V90HT (V105°C PVC) to AS/NZS 3191 and AS/NZS 3008 Table 7 Note 2
- Cable: to AS/NZS 5000.1
- Insulation colour: to AS/NZS 3000
- Conductor size: minimum 2.5mm² except for switchboard fans and lights which may be 1.5mm².

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:

a) making application for supply of electricity to the Electricity Entity with a copy being sent to the Administrator

b) carrying out the installation work as per SD1327

c) submitting “Ready for connection” form to the Electricity Entity

d) submitting to the Electricity Entity a disconnection notice when the supply is no longer required

e) submitting to the Electricity Entity a schedule of loading or change of load (applies only to unmetered switchboards)

f) supply and installation of service pole (if required)

g) organising test and inspections, and

h) submitting 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.

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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 Technical Specification and the requirements of the Act. Tests shall include the mandatory tests detailed in TRUM Volume 4 Part 8 and AS/NZS 3000.

In addition to copies of the Contractor's completed test sheets as part of its quality assurance procedures, the Contractor shall also provide a completed Certificate of Test and Compliance in the format prescribed in TRUM Volume 4 Part 8, a Record of Inspection and Tests, and accurate As-constructed Standard Drawings.

The clause on Removal of mains connections has been deleted and incorporated into MRTS210 *Provision of Mains Power*.

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