ROADS AND MARITIME SERVICES

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-061

POLE MOUNTED AND UNDERGROUND MAINS FUSE

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## RECORD OF AMENDMENTS

<table>
<thead>
<tr>
<th>Version</th>
<th>Summary</th>
<th>Date</th>
<th>Approved by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
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</tr>
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<td>6/5/2019</td>
<td></td>
</tr>
</tbody>
</table>
CONTENTS

1 SCOPE .................................................................................................................................................. 6

2 REFERENCES AND APPLICABLE DOCUMENTS ............................................................................... 6

2.1 AUSTRALIAN AND INTERNATIONAL STANDARDS ........................................................................ 6

2.2 RMS DOCUMENTS ............................................................................................................................ 6

2.3 RMS DRAWING ............................................................................................................................... 6

2.4 COMPLIANCE WITH STANDARDS .................................................................................................. 6

3 DEFINITIONS AND GLOSSARY OF TERMS ....................................................................................... 7

4 COMMON REQUIREMENTS FOR UNDERGROUND AND POST MOUNT MAIN FUSES ................. 7

4.1 FUNCTIONAL REQUIREMENT ........................................................................................................... 7

4.2 ELECTRICAL REQUIREMENT ......................................................................................................... 7

4.2.1 The Fuse ...................................................................................................................................... 7

4.2.2 Fuse Enclosure Double Insulation .............................................................................................. 8

4.2.3 Generic Compliance with Supply Authority’s Regulations .......................................................... 8

4.3 CABLE REQUIREMENT .................................................................................................................. 8

4.4 MARKING AND TRACEABILITY REQUIREMENT ........................................................................... 8

5 SPECIFIC REQUIREMENT FOR UNDERGROUND MAIN FUSE ....................................................... 8

5.1 ADDITIONAL FUNCTIONAL REQUIREMENT .................................................................................. 8

5.2 FUNCTIONAL MODULES ................................................................................................................ 8

5.2.1 General ....................................................................................................................................... 8

5.2.2 Housing with Cable Entries Module .......................................................................................... 8

5.2.3 Fuse Assembly Module .............................................................................................................. 9

5.3 CABLELING .................................................................................................................................... 9

5.4 MARKING ....................................................................................................................................... 9

5.5 TYPICAL APPROVED DESIGN FOR UNDERGROUND MAIN FUSE ........................................... 10

6 SPECIFIC REQUIREMENT FOR POST MOUNT MAIN FUSE ............................................................ 10

6.1 FUNCTIONAL MODULES ................................................................................................................ 10

6.1.1 General ....................................................................................................................................... 10

6.1.2 Housing with cable conduit entries ............................................................................................. 10

6.1.3 Fuse Assembly Module .............................................................................................................. 11

6.1.4 Neutral Link ................................................................................................................................. 11

6.1.5 Cable Clamp ................................................................................................................................. 11

6.2 CABLELING .................................................................................................................................... 11

6.3 MARKING ....................................................................................................................................... 11

6.4 TYPICAL APPROVED DESIGN FOR POST MOUNT MAIN FUSE ............................................. 11

7 QUALITY ASSURANCE ....................................................................................................................... 11

7.1 GENERAL ....................................................................................................................................... 11

7.2 THIRD PARTY CERTIFICATION .................................................................................................... 12

7.3 QUALITY PLAN ............................................................................................................................. 12

7.4 QUALITY AUDITS .......................................................................................................................... 12

8 PRE-DELIVERY INSPECTION ............................................................................................................ 12

9 APPROVAL ......................................................................................................................................... 12

APPENDIX A – TYPICAL APPROVE DESIGN FOR UNDERGROUND MAIN FUSE ......................... 13

A1.1 GENERAL ....................................................................................................................................... 13

A1.2 MATERIAL OF HOUSING MODULE ............................................................................................. 13

A1.3 CABLE GLANDS ............................................................................................................................ 13

A1.4 REMOVABLE TRANSPARENT LID ................................................................................................. 13

A1.5 MARKING ..................................................................................................................................... 13
APPENDIX B - TESTING OF WATER-RESISTANCE OF THE HOUSING MODULE.............................14
1 SCOPE

This Specification covers the requirements for the main fuses to be used for traffic signal and other Intelligent Transport System (ITS) equipment installations, for the connection of mains power supply to the ITS equipment. The main fuses are required for the electrical protection of traffic signal equipment and utility supply in accordance with the Australian/New Zealand Wiring Rules AS/NZS 3000 [4].

This specification comprises of two types of main fuses used for traffic signal:

a) Underground Mains Fuse for the fuse with fed from underground traffic signal pits

b) Post Mount Main Fuse for outdoor application primarily mounted in the post

Note 1: This Specification supersedes RTA Specification No UGS/5.

2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian and International Standards

[1] AS 60068.2.77 Environmental testing - Tests - Test 77: Body strength and impact shock
[2] AS 60529 Degrees of protection provided by enclosures (IP Code)
[3] IEC 60269.2 Low voltage fuses - Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Examples of standardised systems of fuses A to K
[5] AS/NZS 5000.1 Electric Cables - Polymeric insulated for working voltages up to and including 0.6/1 (1.2) kV.
[6] AS/NZS/ISO 9001 Quality management systems - requirements

2.2 RMS Documents

[7] TS201 Approval of ITS Field Equipment

2.3 RMS Drawing

[8] VE500-01 General arrangement of consumer mains for overhead supply.
[9] VE500-10 Underground fuse enclosure assembly for traffic signals
[12] VM007-03 Retroreflective label for Pole Mounted Fuse Enclosure

2.4 Compliance with Standards

All equipment and material, where not otherwise specified, shall be in accordance with the relevant Australian Standards where such exist, or otherwise with the appropriate international/ISO specifications.
3 DEFINITIONS AND GLOSSARY OF TERMS

For the purposes of this Specification, the following definitions and abbreviations shall apply:

- HRC – High Rupturing Capacity Fuse
- ITS – Intelligent Transport System
- Manufacturer – The manufacturer of mains fuses covered by this specification
- RMS – Roads and Maritime Services, a New South Wales government agency
- SDI – Single Core Double Insulated. It is a single cable with a double layer of insulation. This second layer of insulation provides extra mechanical protection.
- Supplier – The supplier of mains fuses covered by this specification

4 COMMON REQUIREMENTS FOR UNDERGROUND AND POST MOUNT MAIN FUSES

4.1 Functional Requirement

Following are the key functional requirements for the main fuses:

a) Providing electrical protection of traffic signal equipment and utility supply in accordance with the Australian/New Zealand wiring rule [4].

b) Safe for road users and workers

c) Accessible to facilitate maintenance and replacement of the fuse

d) Enclosure long lasting with zero or minimal maintenance

4.2 Electrical Requirement

4.2.1 The Fuse

4.2.1.1 Fuse Requirement

The fuse shall:

a) Provide electrical isolation and fault current limiting to the site.

b) Not deteriorate with age;

c) Perform reliably and consistently;

d) Require low maintenance; and

e) Be simple and easy to install and/or replace;

4.2.1.2 Fuse Type

A High Rupturing Capacity (HRC) fuse shall be used, with Type A2 as defined in IEC 60269.2 [3]. The fuse shall be bolt-in type for easy replacement.
4.2.1.3  Fuse Rating

Unless otherwise stated, the rating of the fuse shall be 32A @ 240 Vac.

4.2.2  Fuse Enclosure Double Insulation

The fuse enclosure shall provide double insulation as defined in AS/ NZS 3000 [4]. No earth terminal shall be provided on the housing module.

4.2.3  Generic Compliance with Supply Authority's Regulations

The Manufacturer or Supplier shall submit evidence that their fuse enclosure satisfies all the requirements of the relevant Energy Authority, and is approved by that Authority for connection to its electricity supply system.

4.3  Cable Requirement

All cables shall be single Core Double Insulated (SDI) power cables complying with AS/NZS 5000.1 [5] shall be used.

4.4  Marking and Traceability Requirement

All enclosures shall be indelibly marked of the enclosure with the manufacturers name and date of manufacture, as per Clause 5.4 for Underground Main Fuse, and Clause and 6.3 for Post Mount Main Fuse.

5  SPECIFIC REQUIREMENT FOR UNDERGROUND MAIN FUSE

5.1  Additional Functional Requirement

Following are additional functional requirements for Underground Mains Fuse:

a) Waterproof and complying with IP68 in AS 60529 [2] when immersed for an indefinite period in water to a depth of 0.6m.

b) Visibility and see through. It shall be possible for the state of the fuse to be seen without having to disturb the waterproofing of the fuse holder.

c) Able to be housed into the underground pits as per VE500-11 [10]; dimension of the Underground Main Fuse shall be within 260mm (L) x 197mm (W) x 140mm (H).

5.2  Functional Modules

5.2.1  General

The Underground Main Fuse shall comprise of the following functional modules:

a) Housing with cable entries; and

b) Fuse assembly accommodating a fuse carrier and a fuse.

5.2.2  Housing with Cable Entries Module

5.2.2.1  Housing Material

The material of the housing shall be:
a) Impact resistance with minimum impact strength and test as per AS 60068.2.77 [1];

b) Non-inflammable;

c) Electrically non-conductive;

d) Non-corrosive and rustproof;

e) Waterproof

5.2.2.2 Housing Base

The housing base shall be used for the attachment of the fuse assembly, and shall be fitted with the cable entries as per clause 5.2.2.4.

5.2.2.3 Removable Transparent Lid

A transparent removable lid shall give good access to the inside of the housing module, and adequate room shall be provided to allow the installation of cables and replacement of fuses. The lid is attached into the housing base; no other components shall be attached to the lid.

5.2.2.4 Cable Entries

Two cable entries shall be installed in the housing base. These cable entries shall:

a) Accommodate cable connection as per cabling requirement in Clause 4.3 and Clause 5.3;

b) Mechanically prevent the cable from being pulled out of the equipment and from being twisted whilst connected to equipment; and

c) Seal any unused conduit entries to the housing module.

5.2.3 Fuse Assembly Module

The fuse assembly shall accommodate a fuse carrier and a fuse. The fuse assembly shall be mounted on an insulated panel fixed to the housing, using a mounting bracket.

5.3 Cabling

Currently two sizes of the SDI cables are being accepted:

a) Nominal overall diameter of 6.7 mm and nominal conductor area of 6.0 mm²; and

b) Nominal overall diameter of 8.7 mm and nominal conductor area of 6.0 mm².

The live conductors are terminating fully secured into and out of the fuse. The neutral conductor shall not be taken into the housing module of the Underground Main Fuse.

5.4 Marking

The marking of the label shall be in the inside of the enclosure, and shall be viewed externally via the transparent lid. The letters font size shall be minimum 10 mm high displaying the following legend when viewed from the outside:
The words "DANGER - 240 VOLTS" shall be in red; other lettering shall be in black.

5.5 Typical Approved Design for Underground Main Fuse

A typical approved design has been attached in Appendix A for reference. The typical design is not mandatory, and other designs that meet the Underground Main Fuse in this specification would be considered and accepted.

6 SPECIFIC REQUIREMENT FOR POST MOUNT MAIN FUSE

6.1 Functional Modules

6.1.1 General

The pole fuse shall comprise of the following functional modules:

a) Housing with cable conduit entries.
b) Fuse assembly module.
c) Neutral link.
d) Cable clamp.

6.1.2 Housing with cable conduit entries

6.1.2.1 Housing Dimension

The housing shall be able to accommodate the fuse assembly module and neutral link, for installation. Engineering Drawing VM007-02 [11] provides a typical dimension of acceptable design.

6.1.2.2 Housing Material

The material of the housing shall be based on the manufacturer providing the following information:

a) Suitable for outdoor application with designed for a service life of at least 20 years; and
b) Materials utilised shall be mutually compatible under the operating and environmental conditions experienced in normal service.

6.1.2.3 Surface Finish

The external surfaces shall have a durable black finish such that the enclosure is capable of withstanding a period of 10 years exposure to the weather without substantial fading, colour change or other deterioration.
6.1.2.4 Coating and Insulation Resistance

The coating shall provide suitable insulation resistance.

Values of insulation resistance shall be obtained between the base and earth and the cover and earth; a suitable a suitable earth is the mounting screw used on the base for the tether chain. The insulation resistance shall be measured at 1000Vdc applied for one minute.

The values of insulation resistance obtained shall be not less than 20MΩ.

Note: Thermoplastic coatings 200 - 300µm thick meet this requirement. In general powder coating does not produce the required electrical insulation characteristics.

6.1.3 Fuse Assembly Module

Fuse assembly module shall be able to accommodate the fuse carrier and the fuse

6.1.4 Neutral Link.

A common connection point for neutral, Engineering Drawing VM007-02 [11] provides a typical neutral link being used.

6.1.5 Cable Clamp

Cable clamp is used for strain relief for the cables. Engineering Drawing VM007-02 [11] provides a typical use of cable clamp.

6.2 Cabling

The cable, active and neutral, shall enter the enclosure inside plastic flexible conduit via two 25mm conduit terminators into the underside of the enclosure complying with drawing No VE500-01[8][8]. The cable shall be retained to the cable tie bar via plastic cable ties. The neutral conductors shall be terminated to the neutral link.

6.3 MARKING

The enclosure shall have a “TRAFFIC SIGNALS” label attached to the outside of the enclosure lid. The label shall be in accordance with RMS drawing No VM007-03 [12].

6.4 Typical Approved Design for Post Mount Main Fuse

RMS drawing VM007-02 [11] provides a typical approved design for Post Mount Main Fuse. The typical design is not mandatory, and other designs that meet the Post Mount Main Fuse in this specification would be considered and accepted.

7 QUALITY ASSURANCE

7.1 General

The Supplier and the Manufacturer shall operate a quality management system complying with AS/NZS/ISO 9001 [6].
7.2 Third Party Certification

The Supplier and the Manufacturer shall have obtained third-party certification under AS/NZS/ISO 9001 [6] by an accredited independent organisation.

7.3 Quality Plan

The Manufacturer shall document a quality plan appropriate to the item detailing the quality control tests and assessments which the Manufacturer shall conduct during manufacture prior to release. This shall include sampling plans and test frequency, and a description of the records to be made.

7.4 Quality Audits

RMS reserves the right to examine the Supplier’s and Manufacturer’s quality records. RMS also reserves the right to arrange for an independent quality audit.

8 PRE-DELIVERY INSPECTION

Tests and assessments related to the products shall be carried out by the Manufacturer as defined in the Manufacturer’s quality plan.

RMS reserves the right to carry out, or appoint a representative to carry out, a pre-delivery inspection at the Supplier’s premises in the Sydney area prior to delivery.

9 APPROVAL

To gain approval the supplier shall follow the process defined in TS201 [7].

The supplier shall submit the following documentation, as a minimum, in support of a submission for product approval via email to the ITS Help Desk: (ITSHelpDesk@rms.nsw.gov.au).

a) A clause-by-clause statement of compliance, and associated evidence, referenced to each compliance item, with this Specification and applicable sections of referenced standards.

b) Results of tests required in relevant Australian standards

c) Datasheet(s) of the equipment, which shall include parameters of physical and electrical characteristics.

d) A copy of the manufacturer’s quality plan for equipment. Evidence of third party certification of the supplier and manufacturer’s quality system.

e) Any other documentation requested by RMS under the processes defined in TS201 [7]

f) For the Underground Main Fuse, external certification to pass the tests of the water-resistance of the housing module as described in Appendix B.

g) If subsequently requested by RMS, the supplier shall provide samples of equipment for evaluation as part of the approval process.
APPENDIX A – TYPICAL APPROVE DESIGN for UNDERGROUND MAIN FUSE

A1.1 General
RMS has an approved design as shown in Drawing No VE500-10 [9], which may be used as a reference. Other designs are potentially acceptable, provided that they are compliant with the requirements of this Specification, and are submitted to RMS for evaluation before use.

A1.2 Material of Housing Module
The material of the typical approved design is polycarbonate.

A1.3 Cable Glands
The existing design uses Cable glands as cable entries.

Two insulated gland type sealing bushes, made of polymer are installed on the housing module for the connection of a lead-in and a lead-out cable. The components of each cable gland is assembled and fitted using a waterproof non-setting sealing compound. Each cable gland is capable of accommodating a Single Core Double Insulated (SDI) cable as defined in Clause 4.3 and Clause 5.3.

Two of pairs of rubber inserts, to suit the two sizes of the SDI cable as describe in Clause 4.3 and Clause 5.3; are supplied with the housing module. The pair with the smaller access hole is fitted to the glands as standard with the pair with the larger access holes enclosed in a bag within the housing module.

Any extraneous unused cable entries to the housing module shall be sealed.

A1.4 Removable Transparent Lid
The removable transparent lid is held in place with a plastic clamp and stainless steel screw with brass or stainless steel threaded insert, outside the perimeter of the seal. Mating surfaces shall seal a with a silicone O ring.

A1.5 Marking
Three durable labels affixed to the inside of the enclosure lid, equally spaced in a vertical arrangement around the circumference of the lid.
APPENDIX B - TESTING OF WATER-RESISTANCE OF THE HOUSING MODULE

a) The Underground Main Fuse shall pass the following test on its water-resistant property:

The Underground Main Fuse is to be placed on a flat, earthed, metallic surface.

The fuse assembly is to be provided with two 6mm² stranded (7/1.04) PVC double insulated cables, brought out via the cable glands; the fuse is to be assembled without the HRC cartridge fuse link installed, but the empty removable fuse carrier is to be inserted in the base.

The lid of the housing module shall be fitted and screwed down.

Values of insulation resistance shall be obtained between each cable and earth, and between the two cables. The insulation resistance shall be measured at 1,000 Vdc, applied for one minute. The insulation resistance values obtained shall not be less than 40 MΩ.

b) After the measurement of insulation resistances described in (a) above, the sealed unit shall be submerged in a minimum 0.6 m head of water to which a wetting agent (see note below) shall have been added. The ends of the cables are to be brought out of the water, and kept clear from it. The unit shall be kept submerged for a period of not less than 24 hours, and at the end of this period while the unit is still submerged, the insulation resistance shall be measured between the cables and the water, and between the two cables.

Note: A non-ionic wetting agent that reduces the surface tension to below 30mN/m shall be used, e.g. "Wettasoil liquid" at 0.2% by volume in water.

The insulation resistance shall be measured at 1000 Vdc applied for one minute. The values of insulation resistance obtained shall not be less than 20 MΩ.

On completion of measurement (b) above, the unit is to be removed from the water and the external surface wiped dry. The lid shall be removed within 30 minutes after the unit is removed from the water and a visual inspection shall be made of the interior of the unit. There shall be no trace of water inside the housing module or on any part of the internal components.