ROADS AND MARITIME SERVICES

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-056

SLOT SEALANT FOR VEHICLE DETECTOR LOOPS

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## RECORD OF AMENDMENTS

<table>
<thead>
<tr>
<th>Issue</th>
<th>Summary</th>
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<th>Approved by</th>
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</tr>
</tbody>
</table>
## CONTENTS

1 SCOPE .......................................................................................................................... 5

2 REFERENCES AND APPLICABLE DOCUMENTS ......................................................... 5
   2.1 AUSTRALIAN AND INTERNATIONAL STANDARDS ............................................. 5
   2.2 RMS DOCUMENTS ............................................................................................... 5
   2.3 RMS TEST METHOD ........................................................................................... 5
   2.4 ASTM TEST METHOD ....................................................................................... 5
   2.5 OTHER DOCUMENTS ......................................................................................... 5
   2.6 COMPLIANCE WITH STANDARDS .................................................................. 5

3 DEFINITIONS AND GLOSSARY OF TERMS .............................................................. 6

4 BASIC REQUIREMENT AND APPLICATION ................................................................ 6
   4.1 BASIC REQUIREMENTS ...................................................................................... 6
   4.2 PAVEMENTS AND LOOP SLOTS ....................................................................... 7
   4.3 LOOP CABLES .................................................................................................... 7
   4.4 APPLICATION OF SEALANT ............................................................................ 7

5 TECHNICAL REQUIREMENTS AND TESTS .............................................................. 7
   5.1 VISCOSITY .......................................................................................................... 7
   5.2 GEL TIME .......................................................................................................... 7
   5.3 DENSITY ............................................................................................................ 7
   5.4 ADHESION TO CONCRETE .............................................................................. 7
   5.5 FLEXIBILITY AND ELONGATION .................................................................... 8
   5.6 ENCAPSULATION ............................................................................................... 8
   5.7 TACK-FREE TIME .............................................................................................. 8
   5.8 SHRINKAGE ....................................................................................................... 8
   5.9 ELECTRICAL CHARACTERISTICS .................................................................. 8
   5.10 RESISTANCE TO SOLVENTS .......................................................................... 8
   5.11 EFFECT ON PAVEMENT MATERIAL ................................................................. 8
   5.12 STORAGE PROPERTIES .................................................................................. 9

6 PACKAGING AND LABELLING .................................................................................... 9

7 WORK HEALTH AND SAFETY .................................................................................... 9

8 QUALITY ASSURANCE ............................................................................................... 9
   8.1 GENERAL ............................................................................................................ 9
   8.2 THIRD PARTY CERTIFICATION ........................................................................ 9
   8.3 QUALITY PLAN .................................................................................................. 9
   8.4 QUALITY AUDITS .............................................................................................. 10
   8.5 TRACEABILITY .................................................................................................. 10

9 PRE-DELIVERY INSPECTION ..................................................................................... 10

10 APPROVAL .................................................................................................................. 10
   10.1 GENERAL ......................................................................................................... 10
   10.2 APPLICATION FOR APPROVAL ....................................................................... 10
   10.3 FIELD TRIAL .................................................................................................... 11
1 SCOPE

This Specification covers the requirements of the sealant used to encapsulate the insulated cables of a vehicle detector loop, installed in slots cut in the road pavement surface.

Note: This specification supersedes Specification No. LSS/2 issued 1992

2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian and International Standards


2.2 RMS Documents

[6] TS201 – Approval of ITS Field Equipment

2.3 RMS Test Method

[9] T-1194 Loop Sealant Encapsulation Test
[10] T-1195 Tack-free Time of Sealant

2.4 ASTM Test Method


2.5 Other Documents


2.6 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:

- **ASTM**: American Society for Testing and Materials
- **Gel Time**: Time required for the sealant to reach a state such that the sealant is not affected in its installed state by vehicular traffic
- **Tack Free Time**: A measure of the surface cure time of the sealant
- **RMS**: Roads and Maritime Services, a New South Wales government agency
- **Viscosity**: Measurement of the flow properties of the sealant expressed as its resistance to flow
- **Voiding of chemical**: A pore that remains unoccupied in the sealant. A void is typically the result of an imperfection from the processing of the material and is a non-uniformity

4 BASIC REQUIREMENT AND APPLICATION

4.1 Basic Requirements

The main purpose of the loop sealant is to retain the loop cables in the saw slot and to provide a low-dielectric-constant encapsulation which keeps water away from the immediate vicinity of the cables.

The basic requirements for the loop sealant are:

a) ease of preparation and application by unskilled personnel;
b) suitable for application under field conditions involving a wide temperature range and strong winds;
c) self-levelling but with enough body to prevent its flowing out of slots which are not level;
d) fast surface cure (to enable the affected section of the road to be restored to traffic soon after application of the sealant);
e) tolerance to the presence of water during the curing process;
f) low water absorption;
g) low shrinkage during and after curing;
h) good adhesion to the common road pavement materials;
i) adequate flexibility to compensate for movement in the pavement due to temperature, minor settlement, etc.;
j) chemical inertness in respect of components of the pavement material, and external contaminants such as water, oil, petrol and diesel fuel;
k) capable of providing mechanical protection of the loop cables from traffic and incidental effects;
l) non-polluting and low toxicity; and
m) of sufficiently high density to displace residual water from the slot.
4.2 Pavements and Loop Slots

Normal pavement materials include asphaltic concrete and portland cement concrete. Slots to house the loop cables are typically between 5 and 6 mm wide and between 30 and 80 mm deep, and are typically wet cut using a power-saw with a diamond-impregnated blade. After cutting, the slots are cleared with compressed air to remove excess water and detritus. The surfaces of the slot will therefore typically be damp at the time of installation of the cables and application of the sealant.

Accordingly the sealant shall be able to bond to both wet and dry surfaces of these types.

4.3 Loop Cables

The loop cables used shall comply with the requirements of AS 2276.3 [3]. Between 2 and 16 of these cables will be laid in the bottom of each slot.

4.4 Application of Sealant

In application, the slot sealant is required to be injected into the slot immediately after installation of the cables, to secure the cables and to prevent ingress of foreign matter. The slot sealant shall be supplied in a form suitable for injection into pavement slots.

5 TECHNICAL REQUIREMENTS AND TESTS

5.1 Viscosity

To assess the flow properties of the sealant, the viscosity shall be measured at two shear rates according to AS 1580.214.5 [1], at 23 ± 3 °C:

a) At a speed of 0.3 revolutions per minute the viscosity (V1) of the sealant immediately after mixing shall be not less than 18 Pa.s.

b) At a speed of 3 revolutions per minute the viscosity (V2) of the sealant immediately after mixing shall be such that the thixotropic index V1/V2 ≥3

5.2 Gel Time

The gel time of the multiple component material when determined at 23 ± 3 °C according to AS 3554 [4], Appendix C shall be not less than 6 minutes.

5.3 Density

The density of the material shall be greater than 1.1 kg/L when measured according to AS 1580.202.1 [2]

5.4 Adhesion to Concrete

The sealant shall show no adhesion or cohesion failure when cured for seven days at 23 ± 3°C and then tested according to RMS Test Method T1192 [7] at 23 ± 3°C at a rate of 10 mm per min for 100 cycles of 20% extension. Test assemblies shall be prepared using saturated-surface-dry blocks.

Note: Although the performance in this clause has been related specifically to concrete, the sealant shall bond satisfactorily to other pavement materials, e.g. asphalt.
5.5 Flexibility and Elongation

Using ASTM test method D638 [13] and a speed of 20 mm/minute, the elongation at break shall be greater than 50% and the tensile stress at 50% extension shall be less than 3.0 MPa. Samples shall be prepared and aged in accordance with RMS Test Method T1193 [8].

5.6 Encapsulation

When tested according to RMS Test Method T1194 [9], there shall be no voids around the cables greater than one millimetre in width or five millimetres in length. When the encapsulated cables are subjected to accelerated ageing according to RMS Test Method T1193 [8], there shall be no disbanding of the sealant from the cables and there shall be no evidence of adverse effects on the cable insulation.

5.7 Tack-Free Time

When tested according to RMS Test Method T1195 [10] the tack-free time shall not exceed 40 minutes.

5.8 Shrinkage

The sealant shall not shrink by more than a total of 4% in any dimension when the length of a cast section 100 x 50 x 5 mm is measured before and after curing for 48 hours followed by conditioning in accordance with RMS Test Method T1193 [8].

5.9 Electrical Characteristics

When tested in accordance with ASTM D1674 [14], the cured material shall have the following electrical characteristics:

a) the dielectric constant at 20 kHz shall not exceed 6 ; and

b) the dissipation factor in the frequency range 20 - 120 kHz shall not exceed 0.05.

When tested in accordance with ASTM D150 [11], the dielectric constant of the cured sealant shall not change by more than 25% over the temperature range -20ºC to +60ºC. The dissipation factor of the cured sealant shall not increase by more than 5% after immersion of a dry sample in water at 23 ºC ±3 ºC for 14 days.

5.10 Resistance to Solvents

The change in dimensions on soaking a sample aged by RMS Test Method T1193 [8], in lubricating oil, diesel fuel, water or petrol by the method of ASTM D543 [12] Procedure I shall be no greater than 3%.

5.11 Effect on Pavement Material

When a sample of sealant is poured onto a block of pavement material, there shall be no evidence of softening or deterioration of the pavement material and no evidence of the inhibition of cure of the sealant when the interface between them is probed with a 2 mm diameter wire after 24 hours and again after seven days. The pavement materials used in this test shall be asphaltic concrete and cement concrete.
5.12 Storage Properties

After six months’ storage in a sealed container at 30 °C the material shall continue to comply with the requirements of clauses [5.1] to clauses [5.11]. If settlement has occurred in this time, it shall be readily re-incorporated by manual or power mixing in no more than five minutes.

6 PACKAGING AND LABELLING

The packaging shall be adequate to prevent spillage or contamination of the sealant during transport and storage. The packaging shall suit the intended method of application to fill the slot.

Each container shall be clearly labelled with the following information:
   a) the product name and type number;
   b) the supplier’s identification;
   c) the use-by date;
   d) the material batch number;
   e) lucid instructions for mixing, dispensing, handling and cleaning-up;
   f) health warnings and safety precautions to be observed.

7 WORK HEALTH AND SAFETY

The supplier must comply with NSW Work Health and Safety Act 2011 [15] for handling of hazardous chemicals. The manner in which the sealant is packaged and delivered shall facilitate the users to comply with the NSW Work Health and Safety Act 2011 [15]

8 QUALITY ASSURANCE

8.1 General

The Supplier and the Manufacturer shall operate a quality management system complying with AS/NZS/ISO 9001 [5].

8.2 Third Party Certification

The Supplier and the Manufacturer shall have obtained third-party certification under AS/NZS/ISO 9001 [5] by an accredited independent organisation.

8.3 Quality Plan

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

Tests and assessments related to the products shall be carried out by the Manufacturer as defined in the Manufacturer’s quality plan
8.4 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.

8.5 Traceability

Individual batches of sealant shall be fully traceable in accordance with AS/NZS ISO 9001 [5].

9 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.

10 APPROVAL

10.1 General

The technical requirements and tests in clauses 5 do not cover the full ranges of basic requirements as referred in clause 4. RMS’s evaluation of new materials would take due regard to both clauses 4 and 5.

10.2 Application for Approval

To gain approval the Supplier shall follow the process defined in TS201 [6]

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 relevant tests.

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

d) A copy of the Manufacturer’s quality plan for the equipment. Evidence of third party certification of the Supplier and Manufacturer’s quality systems.

e) Particulars of any constituents which may have adverse effects on the health of users, together with a copy of the safety sheet.

f) A full description of the recommended method of mixing and application of the sealant compound, details of special equipment required, and the cleaning up procedure.

g) Any other documentation requested by RMS under the processes defined in TS201 [6]

h) If subsequently requested by RMS, the Supplier shall provide samples of equipment for evaluation as part of the approval process.
10.3 Field Trial

Evidence from a field trial will be needed as part of approval. At any stage, RMS could request the Supplier to demonstrate the sealant at a trial site.

The trial could be conducted at a RMS trail site, by RMS arranging for the pavement at the trial site to be cut, cleared and cables placed in readiness for the application of sealant. The Supplier shall furnish the sealant, and provides the equipment for its application, at no cost to RMS. Depending on the initial experience at the trial site; RMS may purchase small amounts of the proposed sealant for further trials.

Alternatively RMS could decide the trial to be conducted by other means acceptable by RMS e.g. supplier conducted trial in the trial site of other state with RMS attending etc.

The field evaluation shall be considered satisfactory if the sealant material, over the range of trial sites, performs satisfactory for a period of at least nine months.