

AS 3554:2023



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Adhesives — Epoxy — For raised pavement marker installation



AS 3554:2023

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- CSIRO
- Department for Infrastructure and Transport, SA
- Department of Transport and Main Roads, Qld
- Main Roads Western Australia
- National Association of Testing Authorities Australia
- Road Marking Industry Association of Australia
- Society of Automotive Engineers, Australasia

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Preface

This Standard was prepared by the Standards Australia Committee CH-017, Adhesives, to supersede AS 3554:1988.

This objective of this document is to specify requirements for epoxies used in bonding raised pavement markers (RPMs) to bituminous, spray seal and concrete road surfaces. This document addresses the issues of poor performance including the following:

- (a) Adhesion loss between the adhesive and raised pavement marker.
- (b) Adhesion loss between the adhesive and the substrate.
- (c) Lack of uniformity and consistency in adhesives.
- (d) High maintenance costs due to premature RPM failure.
- (e) Workplace Health and Safety issues that arise due to RPMs becoming projectiles due to premature product failure.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Introduction

The withdrawal of AS 3554:1988 was brought to the attention of the Australian Paint Approval Scheme (APAS) during an APAS Technical Advisory Panel (ATAP) meeting. This previous document should not have been withdrawn due to the crucial role adhesives play in road safety and is a requirement of road authorities and government bodies to reference this document in their documentation.

The current edition of this document refers only to epoxy type adhesives used in pavement marker installation. The future addition of this document will encompass other adhesive types beyond epoxies used in raised pavement marker installation to encompass both laboratory testing and road performance indicators. Laboratory investigative work is currently being undertaken to extend the testing accordingly.

It should be noted that raised pavement marker losses can occur due to reasons other than loss of bond between the raised pavement marker and the adhesive, or loss of bond between the adhesive and the substrate. An impact test has been included to give a measure of the performance of the adhesive under this form of stress.

Particular attention needs to be paid to surface preparation in any test methods using metal adherends. Detailed methods of surface preparation, as specified in the relevant appendices need to be carefully followed.

Australian Standard®

Adhesives — Epoxy — For raised pavement marker installation

1 Scope

This document specifies requirements for epoxies used in bonding raised pavement markers to bituminous, spray seal and concrete road surfaces.

This document is applicable to three types of epoxy adhesives, with curing rates as follows:

- (a) *Slow set adhesives* — suitable for the following:
 - (i) Hand or machine mixing and dispensing.
 - (ii) Application where the ambient or road surface temperature is above 15 to 20 °C.
 - (iii) For use-where markers are not laid under traffic or where means of protecting markers from traffic are to be employed.
- (b) *Standard set adhesives* — suitable for the following:
 - (i) Hand or machine mixing and dispensing.
 - (ii) Application where the ambient or road surface temperature is above 10 to 15 °C.
 - (iii) Use where markers are to be laid under traffic or where means of protecting markers from traffic are employed.
- (c) *Rapid set adhesives* — normally suited for the following:
 - (i) Machine mixing and dispensing only.
 - (ii) Application at ambient or road surface temperatures as low as 0 °C.
 - (iii) Where markers are to be laid under traffic.

NOTE Precautions during mixing and application are needed for most adhesives and reference should be made to adhesive product data sheets (PDS) or technical data sheets (TDS).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

AS 1321.1, *Methods for the sampling and testing of adhesives, Part 1—Sampling*

AS 1478.1, *Chemical admixtures for concrete, mortar and grout, Part 1: Admixtures for concrete*

AS 1627.4, *Metal finishing—Preparation and pretreatment of surfaces, Part 4: Abrasive blast cleaning of steel*

AS 1663, *Dropweight test for nil-ductility transition temperature of ferritic steels*

AS 2193, *Calibration and classification of force-measuring systems*

AS/NZS 1734, *Aluminium and aluminium alloys—Flat sheet, coiled sheet and plate*

AS/NZS 1906.3, *Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective)*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1

may

indicates the existence of an option

3.2

shall

indicates that a statement is mandatory

3.3

should

indicates a recommendation

4 Test conditions and sampling

All tests shall be conducted at a temperature of 23 ± 2 °C and 50 ± 5 % relative humidity, unless otherwise specified.

The adhesive sample for testing shall be selected in accordance with AS 1321.1.

The adhesive shall be mixed and used according to the manufacturer's specifications, supplier's specifications or both.

5 Material requirements

5.1 General

All adhesives shall be mixed and applied according to the manufacturer's instructions, supplier's instructions or both, as per the material type.

5.2 Stability

The adhesive produced by mixing matched batch components which have been stored according to the component's recommendations shall still conform to the original specifications of either the manufacturer, supplier or both.

5.3 Shelf life

Adhesives that are 12 months or older (from date of delivery) shall conform to the requirements of this document provided they have been stored in accordance with the specified storage conditions of the manufacturer, supplier or both.

5.4 Non-volatile content

The non-volatile content of each adhesive component shall be within ± 5 % of either the manufacturer's recommendations, supplier's recommendations or both.

6 Physical properties

6.1 The freshly mixed uncured adhesive

6.1.1 General

The adhesive components shall be mixed in accordance with [Clause 5.1](#). The resultant adhesive shall conform to the relevant requirements of [Clause 6.1](#) and [6.2](#).

6.1.2 Gelation time

The resultant adhesive (after mixing) shall have a gelation time as specified in [Table 1](#), when tested in accordance with [Appendix A](#).

Table 1 — Gelation time

Adhesive type	Components conditioned 23 ± 2 °C (minutes)	Components conditioned 30 ± 2 °C (minutes)
Slow set	> 20	20 (minimum)
Standard set	> 9 to 20	10 (minimum)
Rapid set	6 to 9	6 (minimum)

NOTE Gelation time also indicates the pot life of the mixed adhesive. In this case, half the mixing time is deducted from the gelation time to give a measure of pot life.

6.1.3 Sag flow properties

The sag flow under gravity of the resultant adhesive for the times specified in [Table 2](#) shall not exceed 1 mm when tested in accordance with [Appendix B](#).

Table 2 — Times for sag flow determination

Adhesive type	Determination at 23 ± 2 °C (minutes)	Determination at 42 ± 2 °C (minutes)
Slow set	10	3
Standard set	7	2
Rapid set	4	1

6.2 The cured adhesive

6.2.1 Bond strength development

The cured adhesive shall attain a bond strength of not less than 1.4 MPa within the times specified in [Table 3](#) when tested in accordance with [Appendix C](#).

6.2.2 Bond strength in slant shear

The cured adhesive shall have a minimum slant shear bond strength as specified in [Table 4](#) when tested in accordance with [Appendix D](#).

6.2.3 Bond strength in shear

The cured adhesive shall have a minimum bond strength in compressive shear, as specified in [Table 5](#), when tested in accordance with [Appendix E](#).

6.2.4 Bond behaviour under impact shear

The cured adhesive shall have no relative displacement of a slant shear block assembly when subjected to a drop impact energy of 150 J, when tested in accordance with [Appendix F](#).

Table 3 — Maximum times for bond strength development

Adhesive type	Bond curing at 60 °C (minutes)	Bond curing at 23 °C (minutes)	Bond curing at 10 °C (minutes)	Bond curing at 0 °C (minutes)
Slow set	50	210	Not applicable	Not applicable
Standard set	15	60	210	Not applicable
Rapid set	Not applicable	35	45	210

Table 4 — Slant shear failure stress

Substrate	Condition	Minimum slant shear stress (MPa)
Dry steel	Adhesive bond cured for 24 ± 2 h at 23 ± 2 °C	7
Dry steel	Adhesive bond cured for 24 ± 2 h at 23 ± 2 °C and water soaked for 7 days	6.7
Wet hardened concrete	Adhesive bond cured for 24 ± 2 h at 23 ± 2 °C	5
Wet hardened concrete	Adhesive bond cured for 24 ± 2 h at 23 ± 2 °C and water soaked for 24 h	2.2
Wet hardened concrete	Adhesive bond cured for 24 ± 2 h at 23 ± 2 °C and water soaked for 7 days	3

Table 5 — Body strength in shear

Substrate	Minimum bond strength in compressive shear (MPa)
All ceramic and reflective markers in accordance with AS/NZS 1906.3, Types A, B and A/B, dry or bond cured for 24 ± 2 h at 23 ± 1 °C and 7 days soak	4.0

7 Product information

The Product Data Sheet (PDS), Technical Data Sheet (TDS), or both, supplied with the product(s) shall contain all necessary information on bonding procedures. This includes, but is not limited to, the following:

- (a) Mixing proportions and mixing tolerances.
- (b) Spreading and pot life (see the Note in [Clause 6.1.2](#)).
- (c) Shelf life.
- (d) Relative density.
- (e) Non-volatile content.
- (f) Cleaning instructions.

The PDS, TDS, SDS, or any combination of the three, shall provide a warning regarding the toxic properties of any adhesive component.