

Australian Standard™

**Paints and related materials—Pavement
marking materials**

**Part 2: Thermoplastic pavement
marking materials—For use with surface
applied glass beads**



This Australian Standard was prepared by Committee CH-003, Paints and Related Materials. It was approved on behalf of the Council of Standards Australia on 13 October 2004.

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The following are represented on Committee CH-003:

AUSTROADS
Australian Industry Group
Australian Motorcycle Council
Australian Paint Approval Scheme
Australian Paint Manufacturers' Federation
Main Roads Department, Queensland
Master Painters Australia
National Association of Testing Authorities Australia
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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 4049.2—2005

Paints and related materials—Pavement marking materials

Part 2: Thermoplastic pavement marking materials—For use with surface applied glass beads

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Technical Committee CH-003 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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NOTES

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PREFACE

This Standard was prepared by the Australian members of the Joint Australia/New Zealand Standards Committee CH-003, Paints and Related Materials. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

This Standard supersedes AS 4049.2—1994, *Paints and related materials—Road marking materials—Thermoplastic road marking materials*.

This Standard is the second of three parts dealing with pavement marking materials. Other Standards in the AS 4049 Series are:

AS

4049 Paints and related materials—Pavement marking materials

4049.1 Part 1: Solvent-borne paint—For use with surface applied glass beads

4049.3 Part 3: Waterborne paint—For use with surface applied glass beads

This Standard provides mainly performance requirements for pavement marking materials but includes some compositional requirements.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
FOREWORD.....	4
1 SCOPE.....	5
2 OBJECTIVE	5
3 REFERENCED DOCUMENTS.....	5
4 DEFINITIONS.....	5
5 COMPOSITION OF MARKING MATERIAL	6
6 PROPERTIES OF THE THERMOPLASTIC MARKING MATERIAL	6
7 SAFETY REQUIREMENTS	7
8 FIELD TESTING.....	7
9 PACKAGING	8
10 LABELLING	8
APPENDICES	
A MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD	10
B GUIDANCE ON THE APPLICATION OF THERMOPLASTIC PAVEMENT MARKING MATERIAL	13
C LIST OF REFERENCED DOCUMENTS	16
D PREPARATION OF TEST MATERIAL.....	18
E DETERMINATION OF BINDER CONTENT	20
F DETERMINATION OF THE GRADING OF CONSTITUENTS AND GLASS BEAD CONTENT.....	25
G DETERMINATION OF THE LUMINANCE FACTOR	27
H DETERMINATION OF HEAT STABILITY OF THERMOPLASTIC MATERIAL	30
I DETERMINATION OF FLOW RESISTANCE	32
J DETERMINATION OF DENSITY OF THERMOPLASTIC PAVEMENT MARKING MATERIAL	34
K FIELD TESTS FOR THERMOPLASTIC PAVEMENT MARKING MATERIAL	36
L FIELD DETERMINATION OF SKID RESISTANCE (WET PENDULUM METHOD).....	39
M DETERMINATION OF RETROREFLECTIVITY	45
N DETERMINATION OF DEGREE OF WEAR.....	47
O PICTORIAL STANDARDS FOR DEPICTING VARIOUS DEGREES OF WEAR	49

FOREWORD

Pavement marking materials are expected to perform under a wide variety of application, curing and exposure conditions, and therefore need to be assessed in both the laboratory and in the field. This Standard provides test procedures and performance criteria aimed at identifying materials which will provide satisfactory performance in the majority of applications.

The skid resistance of a pavement marking material is not a fixed property for any given formulation. For a new marking it may vary according to the road surface and texture and it will also vary throughout its life according to conditions such as traffic wear and weather. Whilst the drop-on addition of glass beads may increase the frictional characteristics, the resultant skid resistance levels may not satisfy the requirements of all road users.

It is recommended that users of this Standard consult material suppliers where skid resistance is a requirement for the applied marking.

STANDARDS AUSTRALIA

Australian Standard

Paints and related materials—Pavement marking materials

Part 2: Thermoplastic pavement marking materials—For use with surface applied glass beads

1 SCOPE

This Standard sets out requirements for thermoplastic markings formulated with Type C glass beads complying with AS/NZS 2009, already incorporated into the mix.

NOTES:

- 1 Alternative means for determining compliance with this Standard are given in Appendix A.
- 2 Additional information on the use and application of thermoplastic pavement marking materials, is contained in Appendix B.
- 3 Four types of thermoplastic road marking material considered by this Standard are:
 - (a) Spray.
 - (b) Extruded.
 - (c) Screed.
 - (d) Preformed.
- 4 This Standard does not set out requirements for profiled thermoplastic marking materials.

2 OBJECTIVE

The objective of this Standard is to provide requirements and recommendations which may be used when specifying thermoplastic pavement marking materials.

3 REFERENCED DOCUMENTS

A list of documents referred to in this Standard is given in Appendix C.

4 DEFINITIONS

For the purpose of this Standard the definitions in AS/NZS 2310 and those below apply.

4.1 Aggregate

A granular material of mineral composition, such as calcite, quartz or flint, used to provide the bulk of thermoplastic road marking material.

4.2 Binder

A thermoplastic resinous material which, with any included oils or other plasticizers, provides adhesion to the road surface and cohesion between the other components (i.e., extender, pigment, aggregate and solid glass beads).

4.3 Extender

A powder added to assist the dispersion of the pigment and impart body to the mixture.

4.4 Maximum safe heating temperatures

The temperature specified by the manufacturer, above which the material is not to be heated at any time.

4.5 Pigment

A fine powder added primarily to impart colour and opacity to the mixture.

4.6 Retroreflectivity

A property of some materials such as solid glass beads, to reflect incident light in directions close to the direction from which it came.

4.7 Test pavement

Dense grade asphalt and/or sprayed bituminous surfacing constructed using an aggregate with a nominal size of 10 mm, in accordance with Table 1 of AS/NZS 2758.2.

4.8 Thermoplastic pavement marking material

A material consisting of aggregate, pigment, binder, glass beads and extenders, capable of being softened by heating and hardened by cooling, which is used for pavement markings.

5 COMPOSITION OF MARKING MATERIAL

5.1 General

The ingredients of thermoplastic pavement marking materials shall meet regulatory requirements.

5.2 Proportions of constituents

Pavement marking material shall meet the requirements of Table 1.

TABLE 1
PROPORTIONS OF CONSTITUENTS OF MARKING MATERIALS

Constituent	Percentage by mass of total mixture, %	Method of test
Binder	Minimum 18	Appendix E
Solid glass beads	Minimum 20*	Appendix F
Aggregate together with pigment, extender and solid glass beads*	Minimum 70	—

NOTE:* At least 20 percent by mass without considering surface applied beads.

5.3 Grading of inorganic material

When the thermoplastic pavement marking material is graded in accordance with Appendix F, 100 percent by mass of the aggregate, pigment, extender and solid glass beads shall pass a test sieve of mesh 2.80 mm, complying with AS 1152.

5.4 Glass beads

Solid glass beads that are incorporated in thermoplastic pavement marking materials by the manufacturer, shall be Type C as specified in AS/NZS 2009.

NOTE: The addition of surface applied glass beads to freshly applied thermoplastic material provides initial retroreflectivity properties.

6 PROPERTIES OF THE THERMOPLASTIC MARKING MATERIAL

6.1 Colour

The colour of a test panel, which has been prepared in accordance with Appendix D shall be as follows:

- (a) *White* When assessed visually in accordance with AS/NZS 1580.601.1, the colour shall be whiter than Y35 Off White of AS 2700.

- (b) *Yellow* When assessed visually in accordance with AS/NZS 1580.601.1, the colour shall be an approximate match to Y14 Golden Yellow of AS 2700.

6.2 Luminance factor

When measured in accordance with Appendix G, and prepared in accordance with Appendix D, the luminance factor shall be not less than 80% for white materials, and shall be in the range of 45–60% for yellow material.

6.3 Heat stability

When tested in accordance with Appendix H the luminance factor shall be not less than 75% for white materials, or not less than 40% for yellow materials.

6.4 Softening point

Where a specification for the softening point of thermoplastic pavement marking material is required, it shall be determined in accordance with AS 2341.18 and shall not vary by more than $\pm 5^{\circ}\text{C}$ from the specified value.

6.5 Abrasion resistance

When tested in accordance with AS/NZS 1580.403.2 using 1 kg loading and CS 17 wheels, the loss in mass shall not exceed 0.4 g after 500 cycles.

6.6 Flow resistance

When a sample is tested in accordance with Appendix I the flow resistance, measured as the mean slump, shall be not more than 10% at 40°C .

6.7 Density

Where a specification for the density of thermoplastic pavement marking material is required, it shall be determined in accordance with Appendix J and shall not vary by more than $\pm 0.05\text{ kg/L}$ from the specified value.

7 SAFETY REQUIREMENTS

This material is applied at high temperatures and care should be taken to ensure that personnel wear appropriate protective clothing. Users should refer to the manufacturer's materials safety data sheets.

8 FIELD TESTING

8.1 General

Test lines shall be applied in accordance with Appendix K, to a lane of pavement which is subjected to 3 000 000 vehicle passes within a period of 6 to 18 months, or to the carriageway of a spray seal test pavement which is subject to 600 000 vehicle passes in a period of 6 to 18 months. The road surface selected for field testing shall be consistent with the proposed end use of the material. Test periods shall be as shown in Table 2.

TABLE 2
TEST PERIODS

Substrate	Test period		
	Initial	Interim	Final
Asphalt	Before traffic	1 000 000 vehicles	3 000 000 vehicles
Spray seal	Before traffic	200 000 vehicles	600 000 vehicles

NOTE: Test regimes for substrates other than those above were not developed at the time of writing this Standard.

8.2 Skid resistance

When tested in the wheelpath in accordance with Appendix L, the skid resistance value shall initially be not less than 40 BPN. At the specified interim and final test periods (see Table 2) the skid resistance value shall not be less than 45 BPN.

8.3 Retroreflectivity testing

When tested in the wheel path in accordance with Appendix M, the retroreflectivity of a beaded test line at the specified initial, interim and final test period shall be not less than the values shown in Table 3.

NOTE: Measurements taken with a device incorporating a white light source with an entrance angle of 88.76 ° and an observation angle of 1.05° as described in Clause M3.1(a).

TABLE 3
RETROREFLECTIVITY

Substrate	Retroreflectivity, $\text{mcd.lx}^{-1}.\text{m}^{-2}$		
	Initial	Interim	Final
Asphalt	200	150	100
Spray seal	200	150	100

NOTE: Test regimes for substrates other than those above were not developed at the time of writing this Standard.

8.4 Degree of wear

When assessed for degree of wear in the wheel path of a test line in accordance with Appendix N, at the specified final test period (see Table 2) the percentage of area remaining intact shall be not less than 95%.

8.5 Luminance factor

When the test line is assessed in accordance with Appendix G, Method 2, in the wheelpath and between wheelpath areas, at the test periods as detailed in Table 2, the test marking shall be lighter than the Natural Color System (NCS) swatch S 2500-N, see SS 01 91 02.

NOTE: This Clause applies to white paint only. Data for yellow paint was not available at the time of preparing this Standard.

9 PACKAGING

The thermoplastic pavement marking material shall be supplied in containers made of material that does not contaminate the contents and also protects the contents from contamination. Packaging shall be sufficiently robust to withstand normal conditions of handling and storage without rupture or spillage.

10 LABELLING

The following information shall be legibly and permanently marked on each container or on a label permanently attached to each container:

- The name or registered mark of the manufacturer.
- The words 'thermoplastic pavement marking material' and the type and grade of material.
- The net contents by mass in kilograms.
- Any specific warnings required by regulatory authorities.
- Production or batch number and date of manufacture.

- (f) Colour of material, where not indicated by the colour of package.
- (g) Maximum safe heating temperature.

APPENDIX A
MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD
(Informative)

A1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

- (a) Assessment by means of statistical sampling.
- (b) The use of a product certification scheme.
- (c) Assurance using the acceptability of the supplier's quality system.
- (d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

A2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

- (a) The sample must be drawn randomly from a population of product of known history. The history must enable verification that the product was made from known materials at essentially the same time by essentially the same processes and under essentially the same system of control.
- (b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

For statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199.

A3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Australian or international Standard.

The certification scheme should meet the criteria of an ISO Type 5 scheme as specified by HB18.44 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain an effective quality plan to control production to ensure conformance with the relevant Standard.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

A4 SUPPLIER'S QUALITY SYSTEM

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for supplier's quality systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Guidance in determining the appropriate quality management system is given in AS/NZS ISO 9000 and AS/NZS ISO 9004.

A5 OTHER MEANS OF ASSESSMENT

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed by being based on the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform with the full requirements of the Standard.

Unless otherwise specified by an appropriate sampling plan, a material sample should be taken at the manufacturer's plant or from the 'as delivered' material in accordance with Paragraph A6.1 for powdered material, or Paragraph A6.2 for block material.

A6 SAMPLING

A6.1 Powdered material

Select at random three bags of the material, each bag bearing the same batch number. Divide each bag separately using a sample divider, complying with AS 1141.2 and having a maximum aperture of 50 mm, to obtain three samples, each having a mass of approximately 2 kg. Combine the three 2 kg samples in a clean container clearly labelled with the relevant details, e.g. supplier, batch number, type and date. Keep the remainder of the three bags until the tests are completed.

NOTE: Where 'self-melt' bags are used to contain the material, an appropriate portion of the bag material should be included in the determination of the constituents of the mix.

A6.2 Block material

Select at random three containers of the thermoplastic compound from the same batch number. Break up the material from all three containers and discard any pieces that by visual examination are not uniform in texture and colour. Take a portion of not less than 2 kg from the material near the centre of each of the three containers; combine these portions in a clean container clearly labelled with the relevant details, e.g. supplier, batch number, type and date. Do not apply heat at any stage of the sampling process.

Keep the unused remainder from the three containers until the tests are completed.

For preformed material, select at random not less than 2.5 kg of material from the same batch number.

A6.3 Labelling

Samples should be clearly identified by markings on the container.

The following particulars should be shown on the container or label:

- (a) Product identification.
- (b) Batch number.

(c) Date of sampling.

Further information required for identification of the samples should be supplied on a separate sampling form. The additional information should include the following:

- (i) Supplier.
- (ii) Place and date of sampling.
- (iii) Quantity of material represented by sample.
- (iv) Type and identifying number of container or vehicle from which the sample was taken.

APPENDIX B

GUIDANCE ON THE APPLICATION OF THERMOPLASTIC PAVEMENT MARKING MATERIAL

(Informative)

B1 SCOPE

This Appendix provides guidance on the use and application of thermoplastic materials used for pavement markings.

B2 MANUFACTURER'S TECHNICAL DATA

The manufacturer's technical data sheets, materials safety data sheets (MSDS) and all labelling instructions should be studied before handling the materials.

B3 SITE PREPARATION

All extraneous matter needs to be removed from areas where the material is to be applied. Existing markings should be free from flaking. The surface should be free of oil and moisture and the road surface temperature should be 7°C or greater. Marking materials should not be applied to surfaces that are at a temperature less than 3°C above the dew point.

A primer should first be applied to concrete. Other surfaces may require a primer to ensure adhesion of the marking material.

B4 TYPES OF MATERIAL

This Standard deals with four types of thermoplastic pavement marking material required for different methods of application-spray, extrusion, screeding and direct heat bonding.

Profiled materials are also available which provide an audible and tactile response to vehicle movement. However, these types of materials are not addressed in this Standard.

B5 MATERIAL PREPARATION

When preparing pavement marking material, the following precautions should be observed:

- (a) Ensure that overheating of the thermoplastic material does not occur. Discolouration and embrittlement may result if temperatures in excess of those specified by the manufacturer are used.
- (b) Thermoplastic materials should be used within 6 h of achieving application temperatures.
- (c) After the initial charge to the preheating kettle, any additional materials to be added should be at a rate that allows mechanical stirring to be maintained.

B6 SKID RESISTANCE

The pavement surface provides adhesion because of its macrotexture and its microtexture. Microtexture is the fine texture which can be felt by running a finger over the stones, and determines the level of skid resistance. The macrotexture is the surface texture which is obvious to the eye, typically 5 to 20 mm, which determines how rapidly the skid resistance drops with an increase in vehicle speed. This is particularly important in wet conditions.

Thermoplastic fills in the macrotexture of the pavement, reducing the drainage capability in wet conditions, and can also lead to ponding of water as a result of high film build.

Whilst thermoplastics do incorporate skid resistant materials, thereby providing an increase in this property with wear, they may be very smooth textured when first applied. Where identified as a risk to users, steps must be taken to improve the initial skid resistance either by changes to formulation or by addition of appropriate materials at the time of application. The advice of material suppliers should be sought where skid resistance is a key performance requirement. Reference should also be made to research papers such as, *Non-skid road marking paint system*. Proceedings. 15th ARRB Conference 15, 5 pp 181-186, 1990.

B7 FILM BUILD

Cyclists may be at risk if thermoplastic markings are applied at too great a film build, or where overlaps occur. This may lead to a cycle wheel being caught and forced to travel against the edge of a line as the cyclist crosses the line at shallow angles. The cyclist may experience cycle instability or handling difficulties.

B8 RETROREFLECTIVITY

When thermoplastic material is first applied the intermix glass beads are coated with pigmented binder and unable to function as retroreflectors of vehicle headlight beams to provide night visibility of markings. For initial retroreflectivity glass beads complying with AS/NZS 2009 should be surface applied.

B9 METHOD OF APPLICATION

Material may be applied by screeding, spraying, extrusion or direct heat bonding. Table B1 shows the typical thickness of material applied as pavement marking material, using the various types of material and methods of application.

TABLE B1
APPLICATION METHODS FOR THERMOPLASTIC
PAVEMENT MARKING MATERIAL

Type of thermoplastic material	Typical application equipment	Typical usage	Typical application thickness mm	
			Min.	Max.
Screed	Manual or self propelled	Transverse markings	2	5
Spray	Self propelled	Transverse and longitudinal markings	1.5	2
Extrusion	Self propelled	Transverse and longitudinal markings	2	5
Preformed	Direct heating	Transverse and longitudinal markings	2	3

The following matters should be observed when applying pavement marking materials:

- The temperature of the applied material should be within the range specified by the manufacturer.
- The finished line should be free from blisters, streaks and other defects.
- The tolerance on the specified line width should be $\begin{matrix} +10 \\ -5 \end{matrix} \%$.