

Australian/New Zealand Standard™

Glass beads for pavement-marking materials



AS/NZS 2009:2006

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RECONFIRMATION
OF
AS/NZS 2009:2006
Glass beads for pavement-marking materials

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AS/NZS 2009:2006
(Incorporating Amendment No. 1)

Australian/New Zealand Standard™

Glass beads for pavement-marking materials

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CH-003, Paints and Related Materials, to supersede AS/NZS 2009—2002, *Glass beads for road-marking materials*.

This Standard incorporates Amendment No. 1 (December 2007). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide manufacturers, importers and users of glass beads for road-marking materials with a specification for the requirements applicable to glass beads.

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.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Glass beads for pavement-marking materials

1 SCOPE

This Standard specifies material and design requirements for glass beads with retroreflective properties, which are intended for incorporation into pavement-marking materials. It applies to glass beads intended to improve the visibility of pavement-marking materials by reflecting the light from vehicle headlamps back to the driver under night-time conditions.

Sampling, testing and certification shall be in accordance with Appendices A and J.

NOTE: Additional information on the types of glass beads available for use with pavement-marking materials is given in Appendix B.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1141	Methods for sampling and testing soil aggregates
1141.2	Method 2: Basic testing equipment
1152	Specification for test sieves
1199	Sampling procedures for inspection by attributes
2162	Verification and use of volumetric apparatus
2162.1	Part 1: General—Volumetric glassware
2700	Colour standards for general purposes
2854	Tinplate cans for general use
AS/NZS	
2245	Laboratory glassware—Filter funnels
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
BS	
6088	Specification for solid glass beads for use with road marking compounds and for other industrial uses
A1	APAS
	APAS 0042 Glass beads for pavement marking paint
	DTEI
	TSA 245 Materials for pavement marking
	MRWA
	71/06/1398 Heavy metal concentration of glass beads
	QDMR
	MGS 02-2006 Glass beads for use in road-marking materials
	RTA
	RTA 3353 Glass beads (for application to road marking materials)

Rohm and Haas
GTL-104-14B Reference pavement-marking paint formulation

A1 | TAMS
SS 11 Pavement markings

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Batch

A batch describes all packages of glass beads manufactured in a single manufacturing facility and labelled with a unique identifier.

3.2 Beads

Glass beads having retroreflective properties, which are intended for incorporation into and onto pavement-marking materials.

A1 | 3.2A Heavy metals

In the context of this document heavy metals are arsenic, antimony, lead, mercury, cadmium and chromium (hexa-valent).

3.3 Type A beads (premix beads)

Glass beads of the size specified in Table 3, which are incorporated into material during manufacturing.

3.4 Type B beads (drop-on beads)

Glass beads of the size specified in Table 3, which are intended for surface application to a wet film of pavement-marking material.

3.5 Type C beads (intermix beads)

Glass beads of the size specified in Table 3, which are intended for incorporation into materials used for pavement-marking purposes, or intended for surface application to a wet film of pavement-marking material.

3.6 Type D beads (large wet-weather beads)

Glass beads of the size specified in Table 3, which are intended for surface application to a wet film of pavement-marking material, and/or, intended for incorporation into materials used for pavement-marking purposes. An additional version of Type D beads is available (Type D-HR), which provides a higher level of retroreflectivity.

NOTE: A method for determination of retroreflectivity of Type D-HR beads is provided in Appendix M.

4 MATERIALS OF MANUFACTURE

Beads shall be manufactured from clear and colourless commercial grade soda lime glass cullet that has been cleaned to remove any opaque particulate and other matter that may interfere with the retroreflective properties of the beads. Beads may also be manufactured from raw materials. The glass beads shall contain no less than 62% amorphous silica. Beads produced using either process shall comply with all requirements of Clause 5.

5 PROPERTIES

5.1 General

Beads shall be essentially spherical and shall comply with the requirements of Clauses 5.2 to 5.10.

5.2 Foreign matter

When the nominated mass of beads is evenly spread over the base of a clear, colourless glass Petri dish of nominal diameter 95 mm, placed over a white sheet of paper and inspected using a magnifying glass, the beads shall comply with the requirements of Table 1.

TABLE 1
FOREIGN PARTICLES

Type of bead	Test mass, g	Maximum number of foreign particles
A	0.5	100
B	1	50
C	1	50
D	3	25

5.3 Optical quality

When a minimum of 200 beads is examined under the magnification specified in Table 2, the beads shall comply with the following:

- (a) Beads shall be clear and shall not show opacity greater than 2% by count.
NOTE: Some adhesion coated beads may be semi-transparent and this should be taken into account when assessing opacity.
- (b) Beads with greater than 25% of the visible area affected by gas inclusions (bubbles), shall be considered defective, and no more than 2% by count shall exhibit this defect.
- (c) Bead surfaces shall be smooth and no more than 2% by count shall exhibit surface crazing.

NOTE: Appendix K provides pictorial examples of beads with defects and without defects.

To facilitate counting of the beads, they may be spread in a single layer over the base of a clear, colourless watch glass, or recessed microscope slide, and placed over a sheet of 1 mm graph paper to allow segmenting of the beads into manageable groups. Petroleum jelly or similar may be used to prevent the beads from moving around during examination.

TABLE 2
OPTICAL QUALITY

Type of bead	Magnification
A	At least 40x
B	At least 20x
C	At least 20x
D	10x

5.4 Size

Bead sizes shall comply with the size distribution requirements of Table 3, when tested in accordance with Appendix C.

TABLE 3
SIZE DISTRIBUTION FOR GLASS BEADS

Sieve size, μm	Glass bead type			
	A	B	C	D
	Percent RETAINED by mass	Percent PASSING by mass	Percent RETAINED by mass	Percent PASSING by mass
1 700 1 400 1 300			Trace	100 95–100
1 180 1 000 850		100	0–3 5–20	80–95 10–40 0–5
710 600 425	0 10–30	90–100 35–75	65–95	0–2
300 212 150	40–60 20–40	15–45 0–5		
108 75 Pan	0–10	0–1	0–10	

5.5 Shape

5.5.1 General

Beads shall be tested for roundness in accordance with Clause 5.5.2 or Clause 5.5.3, as appropriate.

5.5.2 Type A beads

When Type A beads are optically examined for roundness in accordance with Appendix E after being conditioned in an open container for 24 h, the rounds shall be at least 80% by count.

5.5.3 Type B, C and D beads

When Type B, C or D beads are tested for roundness in accordance with Appendix D, after being conditioned in an open container (see Note 1) for at least 24 h, the 'rounds' shall be at least 70% by mass.

NOTES:

- 1 Containers should be used which avoid the build-up of electrostatic charges and allow free flow.
- 2 Test a minimum of 5 g of Type B or C, or a minimum of 15 g of Type D beads, where applicable.

5.6 Colour

When a sample of beads is tested in accordance with Appendix F, the colour shall be lighter than the reference Standard.

NOTE: This procedure is aimed at detecting coloured glass, which if present, may interfere with the retroreflective properties of the beads.

5.7 Water resistance

When a 10 g sample of beads is tested in accordance with Appendix G, not more than 4.5 mL of the standard hydrochloric acid shall be required to neutralize the resulting extract solution.

5.8 Flow properties

When glass beads have been stored under cover in their original, unopened container for up to 12 months from the date of their manufacture, beads shall flow freely and show no caking. Type B beads, having a moisture-proof coating, and when tested in accordance with Appendix H, shall flow freely and show no caking.

5.9 Adhesion coating

Glass beads may be treated with an adhesion coating, to improve the bond of the glass bead to the pavement-marking material. These adhesion coatings can vary in formulation to suit particular binder applications.

NOTE: Test methods for the presence of these coatings should be in accordance with Appendix L.

5.10 Refractive index

When tested in accordance with Appendix I, beads shall exhibit a refractive index of at least 1.50, or a higher value as specified.

NOTES:

- 1 Two methods are provided in Appendix I. The Rainbow method should be used for referee purposes.
- 2 Glass beads with refractive index greater than 1.5 can provide a higher measure of retroreflectivity.

A1 5.11 Heavy metals

Information on heavy metals in glass beads is provided in Appendix N.

6 PACKAGING

6.1 General

Packages shall be robust and moisture resistant, and shall be able to withstand normal transport and handling without damage.

6.2 Labelling

Each package shall be clearly and permanently labelled with the following information:

- (a) Bead type, e.g., Type A, B, C or D.
- (b) Name or identifying mark of the manufacturer.
- (c) Identification number of consignment, batch or lot, which will allow determination of the month and year of manufacture.
- (d) Mass of the contents of the package, in kilograms.

NOTE: Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

APPENDIX A
SAMPLING AND PREPARATION OF GLASS BEADS FOR TESTING
(Normative)

A1 SCOPE

This Appendix sets out the means by which compliance with this Standard can be demonstrated to the purchaser. Evaluation by means of statistical sampling shall be used.

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 needs to be drawn randomly from a population of product of known history. The history needs to 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.

For statistical sampling to be meaningful, sampling and establishment of a sampling plan should be carried out in accordance with AS 1199.

A3 GENERAL

When the sampling plan is prepared, one of two methods shall be employed to suit the individual packaging size of the beads. Two methods are described for sampling consignments of beads to obtain representative primary samples. A method of preparing test samples from these primary samples is also described. Any departure from these sampling methods should be agreed to at the time of ordering. Because of the nature of the product covered by this Standard, the sampling procedures shall be followed.

A4 SAMPLING—METHOD 1—SAMPLE DIVIDER

A4.1 Principle

A random selection of at least one package (approx. 25 kg) of beads is made from each batch of a consignment. Each package is reduced using a sample divider to obtain a representative test sample of at least 500 g.

A4.2 Apparatus

The following equipment is required:

- (a) *Sample divider*—complying with AS 1141.2. The sample divider shall be equipped with two receivers each capable of holding at least 50% of the total mass of the package to be processed, with a maximum slot dimension of 50 mm.
- (b) *Sample reducer (optional)*—16 to 1 Tyler sampler reducer complying with BS 6088.
- (c) *Sample containers*—either tinsplate-friction-closure cans complying with AS 2854 or equivalent high density polyethylene (HDPE) containers, with a capacity of 400 mL to 500 mL.

A4.3 Procedure

The sampling procedure shall be as follows:

- (a) Unless otherwise specified, randomly select at least one package of beads from each batch making up the consignment.
- (b) Set up the sample divider and, in an even, full-width stream, pour the contents of the first package into the sample divider.
NOTE: Prior to using the sample divider, the contents of the package may be reduced using the sample reducer.
- (c) Discard the contents of one receiver and place two clean empty receivers under the sample divider.
- (d) Pour, in an even full-width stream, the contents of the remaining receiver through the sample divider.
- (e) Repeat Steps (c) and (d) until approximately 500 g of the sample remains in each receiver.
- (f) Discard the contents of one receiver and transfer the contents of the remaining receiver to the sample container and seal.
- (g) Label the container with the source, type, consignment number and batch number of the beads, and the date of preparation of the primary sample.
- (h) Repeat Steps (b) to (g) for any additional packages selected in Step (a) so that one primary sample of approximately 500 g is obtained for each of the selected packages.
- (i) If a representative sample of the consignment is to be prepared for purposes of testing, proceed with Paragraph A6.

A5 SAMPLING—METHOD 2—PROBE (SAMPLE THIEF)

A5.1 Principle

This method describes sampling of glass beads packaged in nominal one tonne intermediate-bulk container using a probe (sample thief).

A5.2 Apparatus

The following equipment is required:

- (a) Standard sample thief of 1 m in length by 15 mm internal diameter (see Figure A1).
- (b) Rubber or plastic hose of 1.2 m in length by 15 mm external diameter (to fit inside the sample thief).
- (c) Sample collection bag of a size and strength suitable to contain five full probe samples of glass beads.

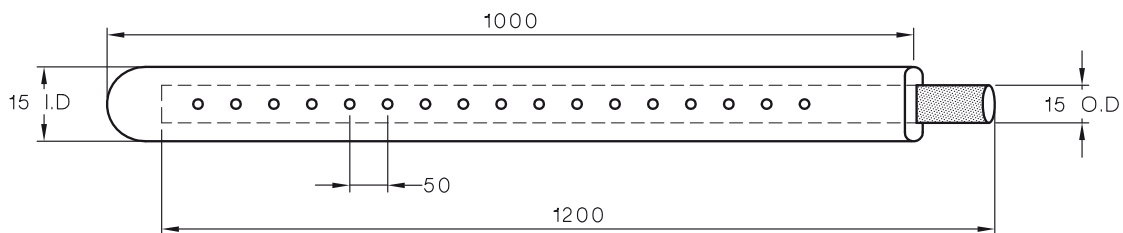
A5.3 Procedure

The sampling procedure shall be as follows:

- (a) Ensure that the sampling equipment is clean and free of contamination. Withdraw the hose from the sample thief and inspect both hose and sample thief and clean if required.
- (b) Replace the hose in the sample thief. Hold the probe by the open end and vertically above the container intended for sampling.

- (c) Push the probe slowly (with the hose inserted fully into the probe) into the first sampling area (see sampling areas of container in Figure A2), all the way down until it touches the bottom of the container. Remove the hose slowly so the material enters the probe through the 17 holes (shown in Figure A1). Shake the probe to encourage beads to fill the sample thief.
- (d) Remove the probe, containing the glass bead sample, slowly, and pour the sample into the collection bag.
- (e) Repeat Steps (a) to (d) in the remaining sample test areas of the container, as identified in Figure A2. Empty each probe sample into the same sample collection bag.
- (f) Identify the sample with suitable labelling as per Paragraph A4.3(g).

NOTE: The sample thief must always be used in the vertical plane. Using it horizontally will not compensate for segregation and may provide erroneous results.



Stainless steel tube wall thickness 3 mm with 17 holes, each 8 mm in diameter

DIMENSIONS IN MILLIMETRES

FIGURE A1 SAMPLE THIEF

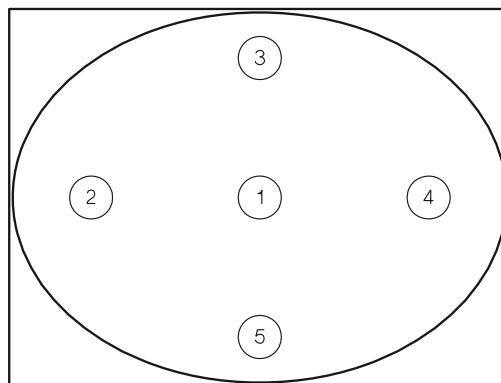


FIGURE A2 PROBE SAMPLING SEQUENCE

A6 PREPARATION OF TEST SAMPLES

A6.1 Principle

Consignment samples, obtained in accordance with Paragraph A4 or Paragraph A5, are passed through a sample divider and subdivided until a sample of the required size is obtained.

A6.2 Apparatus

The following equipment is required:

- (a) *Sample divider*—complying with the requirements of AS 1141.2. The sample divider shall contain slots of 3 mm to 6 mm width and shall be equipped with three receivers each capable of holding at least 50% of the total primary sample to be processed (see Paragraph A4.2).
- (b) *Sample containers*—of either tinplate friction-closure cans, complying with AS 2854, or equivalent HDPE barrel type containers.

A6.3 Procedure

The procedure shall be as follows:

- (a) Collect all containers of primary samples prepared in accordance with the appropriate method of Paragraph A4 or Paragraph A5, and determine the total mass of sample to be processed.
- (b) Set up the sample divider (A4.2(a)) and pour the contents of each primary sample into the sample divider, in an even full-width stream, one following the other.
- (c) When all primary samples have been processed, discard the contents of one receiver and place two clean, empty receivers under the sample divider.
NOTE: Discarded beads should be retained in sealed, labelled containers for future use.
- (d) Using the proper pouring procedure, pass the contents of the remaining receiver through the sample divider.
- (e) Repeat Steps (c) and (d) until the required size of test sample is obtained.
- (f) Transfer the final sample to a suitable container and seal, labelling the container with such information as source, type, consignment number and unambiguous date of preparation (viz., day, month, year).

APPENDIX B
NOTES ON THE USE OF GLASS BEADS IN PAVEMENT-MARKING
(Informative)

B1 SCOPE

This Appendix provides information on different classes of glass beads that are used with pavement-markings. Glass beads are used to provide retroreflectivity, whereby the light from vehicle headlamps is reflected back to the driver, providing delineation at night.

B2 GENERAL

Glass beads are used in a range of sizes in conjunction with both hot-and cold-applied pavement-markings. These beads are also available with special coating grades including 'Moisture-proof' and 'Adhesion'.

B3 BEAD TYPES

B3.1 Type A beads (premix)

Type A beads are mixed into pavement-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking. These beads are to be mixed at a rate of not less than 30% by mass.

B3.2 Type B beads (drop-on)

Type B glass beads are applied under gravity or pressure as a surface application to a wet film of pavement-marking material to provide retroreflectivity. When these beads are applied on a smooth substrate, a nominal rate of 270–300 g/m² may be appropriate. A coarse surface substrate usually requires a higher application rate of beads to achieve a similar level of retroreflectivity.

NOTE: These beads have a moisture-proof coating to facilitate flow and reduce the risk of 'caking'.

B3.3 Type C beads (intermix)

Type C beads are mixed into thermoplastic pavement-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking. These beads should be intermixed at a rate of not less than 20% by mass. These beads may also be used for surface applications to a wet film of pavement-marking material to provide initial retroreflectivity. When these beads are applied on a smooth substrate, a nominal rate of 350 g/m² may be appropriate. A coarse surface substrate usually requires a higher rate of application of beads to achieve a similar level of retroreflectivity.

NOTE: These beads are not moisture-proof coated, and if used for surface applications, could 'cake' during handling.

B3.4 Type D beads (large wet-weather beads)

Type D glass beads are applied under gravity or pressure as a surface application to a wet film of pavement-marking material to provide retroreflectivity. When these beads are applied on a smooth substrate, a nominal rate of 500 g/m² may be appropriate. A coarse surface substrate usually requires a higher rate of application of beads to achieve a similar level of retroreflectivity.

NOTE: These beads have no moisture-proof coating and are, therefore, also suitable for intermixing into thermoplastic pavement-marking material to provide retroreflectivity in both dry and wet conditions throughout the life of the marking. These beads should be intermixed at a rate of not less than 20% by mass.

B4 PROPERTIES

The retroreflectivity of pavement-markings can be measured using hand-held or portable devices called reflectometers. Two geometries have historically been used in these devices, those with an entrance angle of 86.5° and an observation angle of 1.5° , and the more recently adopted geometry with an entrance angle of 88.76° and an observation angle of 1.05° . The latter is representative of the '30 m' geometry specified by European and North American standards, for the measurement of retroreflectivity.