

Australian Standard™

**Liquid membrane-forming curing
compounds for concrete**

This Australian Standard was prepared by Committee BD/33, Chemical Admixtures for Concrete. It was approved on behalf of the Council of Standards Australia on 4 September 1998 and published on 5 November 1998.

The following interests are represented on Committee BD/33:

Association of Consulting Engineers Australia
Australian Chamber of Commerce and Industry
Australian Concrete Repair Association
Australian Pre-mixed Concrete Association
AUSTROADS
Cement and Concrete Association of Australia
Concrete Institute of Australia
Department of Land and Water Conservation N.S.W.
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**Liquid membrane-forming curing
compounds for concrete**

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PREFACE

This Standard was prepared by the Standards Australia Committee BD/33, Chemical Admixtures for Concrete, to supersede AS 3799—1990.

The objective of this Standard is to provide manufacturers and users of liquid membrane-forming curing compounds for concrete, with specification covering classification and performance of curing compounds. It addresses sampling procedures, methods of test for water retention efficiency and drying time and provides general information on and properties of curing compounds.

The original issue of the standard was found to be not acceptable as a Product Standard, because it included reference to a method of classification by composition which was not verifiable within the terms of the Standard. Accordingly, the Standard was deemed to be 'not a Product Standard' and the section describing the types of classification, e.g. Wax Emulsion, Chlorinated Rubber, and so on, was included in Informative Appendix D, and omitted from the main body of the standard.

The Committee have decided that the situation has changed from that which applied at the time the Standard was first issued, in that the classification by composition is now verifiable by means of the Material Safety Data Sheet (MSDS), which is a compulsory requirement for each product, and which must indicate the composition of the ingredients of the product. The MSDS is a legally verifiable document and fulfils the requirements of Standards Australia for this purpose. There is, therefore, no obstacle to AS 3799 being classed as a Product Standard.

As originally issued, the procedure in Appendix B, Water retention efficiency, allowed for the application rate of the compound to be varied from the standard value of 5 m²/L as 'specified by the manufacturer' (Clause B9.1.1). This provision was found to give unreliable comparison between different compounds and, consequently, this allowable variation has been removed, and any application rate other than the standard rate will now be regarded as non-standard.

Other minor changes to the text include modification to the mortar mixing procedure to make it more workable without changing the nature of the mortar, and expanding the Definitions section to make it more informative.

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

Australian Standard

Liquid membrane-forming curing compounds for concrete

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out requirements for liquid membrane-forming curing compounds for concrete (referred to as curing compounds). It specifically excludes compounds applied to concrete, which do not form a membrane as defined in Clause 1.4, Definitions, of this Standard.

Appendices set out sampling procedure, methods of test for water retention efficiency and drying time, and a final appendix discusses general information and properties of curing compounds.

1.2 APPLICATION This Standard is a means by which curing compounds can be classified and described, and their performance assessed. The Standard sets limits of performance in a number of properties, and curing compounds that comply with these limits shall be regarded as being in compliance with AS 3799 for those properties.

This Standard may also be used to test curing compounds to a method recommended by the manufacturer, which involves a modification to the application procedure in Appendix B, in that an application rate other than the standard 5 m²/L is used, or the compound is applied in multiple coats with a drying interval between. When the standard method is so modified, the result shall be reported as Non-standard and shall not be used for the determination of compliance with this Standard.

1.3 REFERENCED DOCUMENTS The documents below are referred to in this Standard:

AS

1160	Bitumen emulsions for construction and maintenance of pavements
1216	Class labels for dangerous goods
1580	Paints and related materials—Methods of test
1580.301.1	Non-volatile content by mass
2350	Methods of testing portland and blended cements
2350.12	Preparation of a standard mortar and moulding of specimens
2701	Methods of sampling and testing mortar for masonry constructions
2701.7	Method for determination of water retention
3972	Portland and blended cements

AS/NZS

1580	Paints and related materials—Methods of test
1580.202.1	Density
1580.202.2	Density of water—Dispersed paints subject to foaming
1580.211.1	Degree of settling
1580.214.5	Consistency—Rotational viscometer

ASTM	
C156	Test method for water retention by concrete curing materials
C778	Specification for standard sand
D1309	Test method for settling properties of traffic paints during accelerated storage
E1347	Standard test method for color and color-difference measurement by tristimulus (filter) colorimetry

1.4 DEFINITIONS For the purposes of this Standard, the definitions below apply.

1.4.1 Emulsion—a liquid mixture comprised of a continuous aqueous phase in which is dispersed, as discrete particles, a semi-solid or viscous liquid phase. The formation of a membrane after application is caused by coalescence of the dispersed particles which are brought together when the water of the aqueous phase evaporates, or is absorbed into the concrete. After coalescence, there may be further evaporation of volatile material from the membrane.

1.4.2 Flammable—capable of being ignited and of burning in air.

1.4.3 Latex emulsion—a stable dispersion of water immiscible natural or synthetic polymer, in water.

NOTE: When an emulsion film is painted onto a green concrete or mortar surface the water evaporates and the suspended polymer coalesces to form a continuous polymer film.

1.4.4 Lot—quantity of admixture produced under essentially uniform conditions, usually a unit shipment or a single production quantity.

1.4.5 Membrane—a continuous film, substantially impermeable to water vapour, designed to cover the surface of the concrete after the application of the curing compound.

NOTE: Those compounds which, when applied to concrete, do not form a continuous film, but modify the concrete by being absorbed into it, are not membrane-forming, and are not covered by this Standard, as they do not comply with Section 2. These products, such as sodium silicates, silicones and silanes, are normally designed to act as surface modifiers or water repellents, and are generally ineffective in preventing the escape of water vapour from the concrete surface.

1.4.6 Plasticizing material—non-volatile modifying agent added to prevent embrittlement of resin.

1.4.7 Resin—either natural or synthetic polymeric material containing (where appropriate) added plasticizer.

NOTE: For the purposes of this Standard the term is restricted to hydrocarbon resins i.e. Class B—Hydrocarbon resin-based compounds

1.4.8 Solution curing compound—a solution compound is a single phase consisting of a film-forming material, such as a hard resin, acrylic or other polymer, or chlorinated rubber, dissolved in an organic solvent.

1.4.9 Vehicle—the total sum of the constituents of the liquid phase(s) of the curing compound. In the case of latex emulsions, the vehicle includes the dispersed polymer.

1.5 CLASSIFICATION OF CURING COMPOUNDS

1.5.1 General Curing compounds are available as waterborne or solvent-borne compounds. Refer to MSDS for specific details.

1.5.2 Class Curing compounds are classified by the chemical nature of their membrane-forming ingredients. The classes are as follows:

- (a) *Class A* Wax-based compounds. Waxes may be natural paraffin or synthetic waxes.
- (b) *Class B* Hydrocarbon resin-based compounds. Resins may be natural or synthetic.
- (c) *Class C* Chlorinated rubber-based compounds. These compounds are based on the same types of chlorinated rubber polymers which have been used for many years as chemically resistant surface coatings.
- (d) *Class D* Synthetic polymer-based compounds. The polymers may be either made from a single monomer or a mixture of monomers (copolymers).
- (e) *Class Z* Other membrane-forming compounds. The effective constituent may be one which does not conform with any of Classes A to D, or may be a combination of classes.

The classification for Classes A, B, C and D is determined solely by the membrane-forming constituent of the vehicle. The composition of the non-volatile portion of the vehicle shall be entirely that indicated by the class, combined with whatever modifying agents that are necessary for effective membrane formation, which can include the following:

- (i) For *emulsions*—emulsifying, stabilising and coalescing agents.
- (ii) For *Classes B, C and D*—plasticizing agents if required to reduce brittleness.

A compound that includes, in the vehicle, a modifying ingredient, which is itself a membrane-forming material not of the same class as the main constituent, shall be classified as Class Z, as shall any compound that is a combination of any two or more classes.

NOTE: A more detailed description of these classes is provided in Appendix D.

1.5.3 Type Curing compounds are grouped into types by appearance, as follows:

- (a) *Type 1* Clear or translucent without dye.
- (b) *Type 1-D* Clear or translucent with fugitive dye.
- (c) *Type 2* White pigmented or containing aluminium reflective pigments.
- (d) *Type 3* Black or coloured, other than white.

SECTION 2 CHARACTERISTICS

2.1 GENERAL CHARACTERISTICS When stored and used in accordance with the manufacturer's recommendations, a curing compound shall have the following general characteristics:

- (a) It shall be of such consistency that it may be readily applied by spraying (or by brushing or rolling, where specified) to a uniform coating at temperatures above 4°C.

NOTE: For uniform application in the field, on vertical concrete surfaces, two coats, applied at an interval of approximately 1 h, may be necessary.

- (b) It shall adhere to—
 - (i) freshly placed concrete that has stiffened or set sufficiently to resist marring during the application; and
 - (ii) damp, hardened concrete.
- (c) It shall form a continuous film when applied at the specified rate.
- (d) When dry, the covering shall be continuous, sufficiently flexible to withstand normal temperature variations without cracking, and without visible breaks or pinholes. It shall remain as an unbroken film for at least 7 days after application.
- (e) The compound shall not react deleteriously with the concrete in any way. In particular, emulsion compounds shall not 'break' on application, that is, they shall not agglomerate in such a way as to affect water retention performance.
- (f) 12 h after application, the compound shall not be tacky or track off concrete when walked upon.
- (g) It shall be possible to store the curing compound for at least 6 months without deterioration, except that compounds of the water-emulsion class will not be expected to resist freezing. Emulsions or pigmented compounds shall not settle out excessively or cake in the container, and shall be capable of being mixed to a uniform consistency by moderate stirring.
- (h) The volatile portion of the curing compound shall have a flashpoint higher than 23°C (low flammability).

NOTES:

- 1 Volatile ingredients should comply with air pollution requirements for maximum permissible emission of photochemically reactive solvents, as established.
- 2 The manufacturer should classify his product in accordance with AS 1216, and should identify any potential hazards in its transport, storage and use.

2.2 SPECIFIC CHARACTERISTICS Curing compounds shall have the following specific characteristics:

- (a) Types 1 and 1-D curing compounds shall be colourless or light in colour. If the curing compound contains a fugitive dye (Type 1-D), it shall be readily distinguishable upon the concrete surface for not less than 4 h after application, but shall become inconspicuous within 7 days after application, if exposed to direct sunlight.
- (b) Type 2 curing compounds shall consist of finely divided white or reflective pigment and vehicle, ready-mixed for immediate use without alteration. The compound shall present a uniform white or reflective appearance when applied evenly to a new concrete surface at the specified rate of application.
- (c) Type 3 curing compounds shall be black or coloured, with no other special characteristics.

SECTION 3 REQUIREMENTS

3.1 ACCEPTANCE TESTING

3.1.1 General The sample, which has been selected in accordance with Appendix A, shall be tested for compliance with Clause 3.1.2, and the tests in Clauses 3.1.8 and 3.1.9 shall also be performed, since their results are required for the Clause 3.1.2 test. Compliance with Clause 3.1.3 applies only to Type 2 (white pigmented) compounds, and shall be determined, unless the requirement is not included in the specification. The compliance tests of Clauses 3.1.4 and 3.1.5 shall be performed, as well as the compliance tests of Clauses 3.1.6 and 3.1.7 unless they are specifically excluded.

3.1.2 Water retention When the sample is tested in accordance with the method of Appendix B (i.e. standard application in one coat), the Efficiency Index shall be calculated after 72 h drying. The sample shall have an Efficiency Index of not less than 90%.

3.1.3 Reflectance When tested in accordance with ASTM E1347, Type 2 curing compound shall have a daylight reflectance of not less than 60% of that of magnesium oxide.

3.1.4 Drying time When tested in accordance with Appendix C, the curing compound shall have a drying time not exceeding 4 h.

3.1.5 Viscosity When tested in accordance with AS 1580.214.5, (at a speed of 60 r/min, using No. 1 spindle), the curing compound shall have a viscosity not less than 0.05 Pa.s for emulsions and not less than 0.02 Pa.s for solutions. If the reading is off the scale of the viscometer defined above, the next highest reading number spindle shall be used. The speed of the instrument shall not be varied.

NOTE: The Brookfield Model LV Viscometer has been found to be suitable.

3.1.6 Residue on 150 µm sieve When tested in accordance with AS 1160, the residue of material retained on 150 µm sieve shall not exceed 0.2% by mass.

3.1.7 Shelf life When tested for long-term settling, in accordance with AS/NZS 1580.211.1, the compound shall have a rating of not less than 4 at the end of 6 months. An accelerated test over two weeks, as described in ASTM D1309, can be used to provide interim results.

3.1.8 Non-volatile content The non-volatile content of the curing compound shall be tested in accordance with AS 1580.301.1.

3.1.9 Density The density of the curing compound shall be tested in accordance with AS/NZS 1580.202.1. Where the method is not appropriate because of a tendency of the compound to froth, AS/NZS 1580.202.2 may be used.

3.2 UNIFORMITY TESTING The manufacturer shall carry out tests to assess the uniformity of each lot of product. The manufacturer shall report the results of these tests. Uniformity tests shall include the following:

- (a) *Non-volatile content* The value of the non-volatile content shall be that established in Clause 3.1.8, +2%, -1%.
- (b) *Density* The value of the density shall be that established in Clause 3.1.9, ±0.01 kg/L.

NOTE: Additional tests for uniformity such as infrared spectroscopy may be carried out by agreement between the manufacturer and purchaser.