



Boral Cement

Marine Cement



Product Data Sheet

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Marine Cement complies with AS3972, Special Purpose Cement, Type LH/SR. It is manufactured from the ingredients of specially selected cement clinker, gypsum and ground granulated blast furnace slag, combining the benefits of significantly lower heat evolution and greater sulphate, chloride and salt water resistance.

Uses

Marine Cement may be used in marine applications, in mass concrete where reduced heat liberation is important or in aggressive sulphate-rich environments where increased resistance to salt attack is required. Where concrete is expected to be in contact with sulphates or other aggressive salts or solutions, analytical surveys must be completed and appropriate grade of concrete selected. As with Portland cements, the resistance to acid solutions is limited, but concrete life expectancy will be maximised by using **Marine Cement** at high cement content and low water to cement ratio in fully compacted and cured concrete.

Cement Properties

The following table provides typical example of **Marine Cement** physical properties.

Property	Marine Cement	AS 3972LH/SR
Setting Time:	Typical:	Requirement:
Initial	2 - 4 hrs	45 mins min
Final	4 - 6 hrs	10hrs max
Soundness	1.0mm	5mm max
Sulphate Resist.	150 - 250mstrain	900mstrain max
Peak Temp. Rise	20 - 22 deg.C	23 degrees C
Compressive Strength:		
Mortar Prism:		
7Day	22 - 30MPa	20MPa Min
28Day	45 - 55MPa	35MPa Min

Compatibility

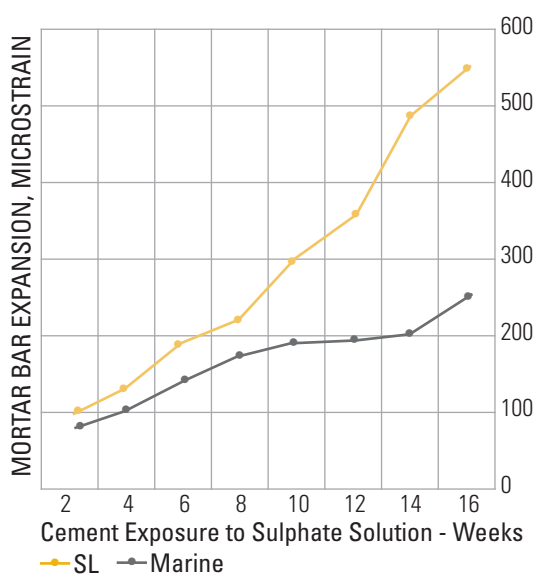
Blending with other products is not recommended as this may adversely influence the resistance of concrete to chemical attack and alter the heat evolution properties.

Marine Cement is compatible with admixtures complying with AS 1478.

Sulphate Resistance

Australian Standard AS 3972 specifies an upper limit of 900 microstrain for mortar bar expansion for Type SR cement. Typically, **Marine Cement** mortar bar expansion is below 250 microstrain. The following graph demonstrates the SR performance of **Marine Cement** relative to a General Purpose cement.

Sulphate Resistance of Marine Cement & GP/SL Cement

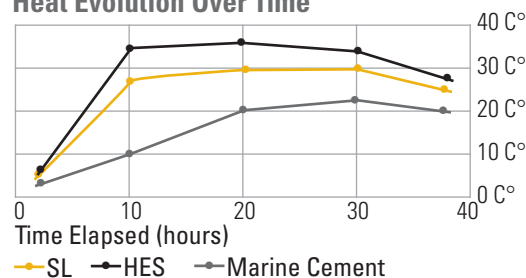


Heat Evolution

Australian Standard AS 3972 limits the peak temperature rise of Type LH cement to below 23 degrees when tested in accordance with AS 2350.7 – Langavant Test. **Marine Cement** Peak Temperature Rise is typically under 22 degrees, and heat evolution rate is significantly lower than in the conventional Portland cements.

The following graph demonstrates the heat evolution of Shrinkage Limited (SL), High Early Strength (HES) and Marine Cements.

Heat Evolution Over Time



Boral Cement

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Product Support

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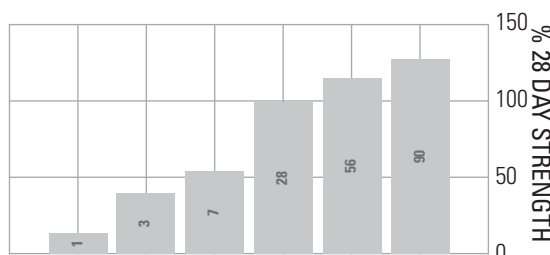
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Concrete Properties

The composition of **Marine Cement** is formulated to deliver lower heat of hydration and superior sulphate resistance. This results in slower strength development by the **Marine Cement**, with significantly lower early age strength, but a greater potential for later age strength development. Typically the early age strength of concrete containing **Marine Cement** may be half that of similar concrete containing General Purpose cement at the same water to cement ratio, but the later age strength will not be significantly lower.

The following graph gives an indication of the rate of strength development of **Marine Cement**.

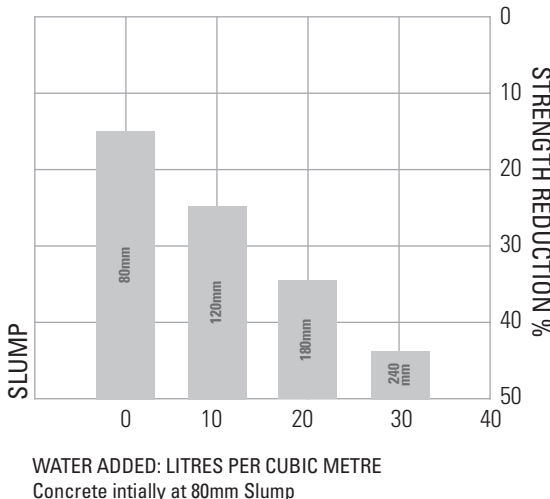
Rate of strength development of Marine Cement.



Effect of Excess Water

Use only the minimum amount of water to mix and place concrete. Excess water will have a detrimental effect on the compressive strength and other properties of concrete. The following graph shows the reduction in concrete strength with increased water addition.

Effect of Addition of Excess Water on Concrete Strength & Slump



Other factors that will influence the strength and durability of concrete containing **Marine Cement** are:

- Mix design, including admixtures
- Temperature – ambient and that of materials
- Air content
- Compaction of concrete
- Curing of concrete

Mix Design

Dense, fully compacted concrete of low permeability is essential to minimise the aggressive effects of sulphate and chloride attack. Careful selection of mix components is essential and reference should be made to AS 1379 - The Specification and Manufacture of Concrete and AS 3600 – Concrete Structures when selecting the required strength and cement levels appropriate for the sulphate concentration.

Where the total sulphuric anhydride (SO₃) lies between the limits listed below, the minimum cement levels and the maximum free water-to-cement ratio limits must be observed.

Parts per mill. of SO ₃	Min Cement Content	Max W/C
In dry soils		
2000 - 5000	340Kg/m ³	0.55
5000 - 10000	370Kg/m ³	0.50
10000 - 20000	410Kg/m ³	0.45
In clays & ground water		

Mixing

AS 1379 gives requirements for material quality and mixing of ready-mixed concrete. Presence of salts and organic matter in aggregates and mixing water may affect concrete performance and relevant requirements of AS1379 must be observed.

Placing

AS3600 gives requirements for handling, placing and finishing of concrete. Exposure classification usually determines both the quality of concrete and the depth of cover to reinforcement. Appropriate selection of the exposure classification is therefore critical.

Curing

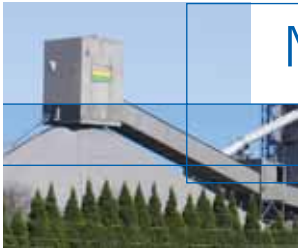
A minimum curing period of 7 days or longer, depending on the exposure classification, is required and should begin as soon as practicable. Wet or moist curing is recommended, but other techniques may be suitable, including curing compounds to AS 3799 or polyethylene sheeting.

Concrete will benefit from curing in terms of reduction in shrinkage cracking potential, improved surface quality with respect to abrasion resistance, permeability to air and water and improved carbonation resistance.

Availability

Marine Cement is available in bulk only. Details on the price and availability of the product upon request by contacting the Sales Manager on the numbers listed.

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Storage

The "shelf life" of **Marine Cement** is dependent on the storage conditions, as contact with air and moisture will cause deterioration in cement performance. Cement storage silos must be kept in good repair, with no damp air or moisture ingress.

It is recommended that **Marine Cement** be retested if the age of cement exceeds three months.

Safe Handling

This product contains cement chemicals and trace amounts of Hexavalent Chromium. Avoid generating dust. Use personal protection equipment against exposure and alkali burns. Wash product off unprotected skin immediately with water. The use of goggles, dust masks, barrier creams and rubber gloves is recommended.

For further safety information consult the **Material Safety Data Sheet** for the product.

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