

Product Performance Evaluation of Maglok™ DragonBoard® Flooring Substrate

Evaluation by The Building Business
for DragonBoard® Technologies Ltd

V2.0 January 2022

Introduction

The Product Performance Evaluation (PPE) considers the performance metrics of Maglok™ DragonBoard® (Maglok™) supplied by DragonBoard® Technologies Ltd for use as a flooring substrate.

Maglok™ is a chloride free MgO board. Chloride free MgO boards are also referred to as MGSO4 board or sulphate based MgO board.

The boards are manufactured by combining magnesium oxide (MgO), magnesium sulphate, proprietary fibres and perlite with a water slurry. This mixture is then placed into moulds with layers of fibreglass mesh.

Internationally it is commonly used in SIPs panels as well as in construction because it has high impact strength and bending strength, is non-combustible and is relatively lightweight.

The Maglok™ boards are supplied as follows:

- thickness (mm) 7, 10, 12, 20.
- panel dimensions (mm): 1800 x 1200, 2000 x 1200.

However, only the 20 mm thick board may be used as flooring. The boards have a shiplap edge.

The boards are not manufactured to any standard; no ISO standard or similar exists.

Background to assessment methodology

The assessment of new products (which includes new, imported and/or innovative products) against the New Zealand Building Code is often based on implied, first-principled based assessments using descriptions or solutions contained in Acceptable Solutions, Verification Methods, cited standards, New Zealand recognised product testing, expert evaluation or appraisal.

This approach often duplicates the testing and assurance that has already been carried out in other countries or is inappropriate for the product being evaluated.

International testing is often based on harmonised European standards, international ISO standards or ASTM international standards for products. New Zealand-based additional testing and expert assessment or opinion do not necessarily add value to demonstrating that a new product is fit for purpose and tend to be expensive and time-consuming.

A Product Performance Evaluation is intended to bridge the gap between overseas standards or supplier specifications and the New Zealand building regulatory system.

A set of product metrics applicable to the specific function is derived from Acceptable Solutions, Verification Methods, New Zealand and Australian standards, international standards already recognised in New Zealand and similar or comparable products with a Product Certificate or Multiple Use Approval. Where possible, metrics derived from section 19 (tools that must be relied upon by building consent authorities as a means of compliance) are used.

The metrics and characteristics of the new product are then evaluated against the product metrics.

Methodology

To evaluate the performance metrics of Maglok™ boards, the following has been used:

- AS/NZS 1860.1:2002 Particleboard flooring (AS/NZS 1860), as cited in paragraph 2.3.6 of NZS 3604:2011¹, which is cited in B1/AS1
- CSR Hebel® PowerFloor Systems, which has a product certificate issued under section 269 of the Building Act.

The performance metrics that have been considered relate to compliance with B1 (Structure).

¹ Wherever a standard is referenced it should be taken to read as modified by the applicable acceptable solution or verification method.

Comparison with AS/NZS 1860

Evaluation

Section 2.3.6 of NZS 3604:2011 states that processed wood-based components and flooring are to be manufactured to AS/NZS 1860.

AS/NZS 1860 covers particleboard flooring manufactured to provide durability and stiffness as required for flooring as well as other structural applications.

Particleboard used as flooring in accordance with NZS 3604:2011 meets a Class 2 classification² set out in AS/NZS 1860.

Maglok™ has been compared with the metrics from AS/NZS 1860:

Characteristic	Product metrics	Maglok™ metrics
Bending strength/ modulus of rupture.	17 MPa, Table 2 of AS/NZS 1860. Test method is AS/NZS 4266.1.	7.205 x 10 ³ MPa. Tested to ASTM D6109.
Modulus of elasticity.	2650 MPa, Table 2 of AS/NZS 1860. Test method is AS/NZS 4266.1.	7.51 x 10 ³ MPa. Tested to ASTM D6109.
Thickness swell.	14 % swell after 24 hours. Test method is AS/NZS 4266.1.	20 % increase in mass after 7 days at relative humidity of 85 %. 60 % increase in mass after 7 weeks at relative humidity of 85 % to 95 % (Nielsen et al., 2019).
Thickness stability.	25 %. Test method is AS/NZS 4266.1.	No information.
Surface water absorption.	210 g/m ² . Test method is AS/NZS 4266.1.	No information.

Maglok™ has a greater modulus of rupture and modulus of elasticity than required for particleboard flooring by AS/NZS 1860. Although these test methodologies used could be further interrogated to determine if there are differences in the methodologies that account for any of the quanta of differences in test results, the differences are significant enough that this is not considered necessary.

Internal bond strength and glue bond quality as required by AS/NZS 1860 are not relevant to the use of magnesium oxide board as flooring. While wood-based boards are manufactured from wood fibres and resin or glue, with a key strength characteristic being the bond between the fibre and the resin, magnesium oxide board is formed into boards from a slurry and has cement-like properties.

There is limited information available for Maglok™ in respect of the moisture-related properties covered in AS/NZS 1860 for particleboard. The thickness swell test conditions are not equivalent and therefore the metrics are not comparable. However, it appears that the performance of the Maglok™ board is likely to be similar or better than required by AS/NZS 1860 for particleboard, given that the MgO board had a 20 % increase in mass after 7 days and AS/NZS 1860 allows up to 14 % in 24 hours.

In high humidity conditions, MgO board can form "tears". This is less pronounced in sulphate based MgO boards. BRANZ recommends maintaining an indoor optimum humidity of

40 %–60 %. They advise that this can be achieved where a building is insulated and ventilation is adequate (BRANZ, 16/11/2017). At a relative humidity range of 40 %–60 %, sulphate based MgO board such as Maglok™ is not subject to "tearing".

Conclusion

Maglok™ exceeds key performance metrics of bending strength/modulus of rupture and modulus of elasticity as requirements of AS/NZS 1860 as cited in NZS 3604. However, as a number of metrics required by AS/NZS 1860 are not provided for Maglok™, a comparison with this standard alone cannot be used for establishing compliance with the building code for the intended use.

² Class 2 classification is defined as flooring for use where resistance to prolonged extremes of moisture or dampness are not necessary.

Comparison with CSR Hebel® Powerfloor System

Evaluation

Maglok™ has been compared with metrics of the CSR Hebel® AAC panel component of the PowerFloor system. The CSR Hebel® PowerFloor System is certified under section 269 of the Building Act with a CodeMark certificate, which demonstrates the product complies with the NZ Building Code. The information provided for the CSR Hebel® PowerFloor System does not include moisture-related attributes.

AAC panels and Maglok™ are both used a flooring substrate and have the same scope of use.

The tested product metrics of the AAC panels are compressive strength, modulus of rupture and modulus of elasticity.

Characteristic	AAC panel product metrics	Maglok™ board metrics
Compressive strength.	2.8 MPa for 75 mm panel. 4 MPa for >150 mm panel.	27 MPa. Tested to ASTM C684.
Modulus of rupture.	0.6 MPa for 75 mm and >150 mm panel.	7.205×10^3 MPa. Tested to ASTM D6109.
Modulus of elasticity.	0.595×10^3 MPa for 75 mm panel. 1.875×10^3 MPa for >150 mm panel.	7.51×10^3 MPa. Tested to ASTM D6109.

Conclusion

The product metrics for compressive strength, modulus of rupture and modulus of elasticity of Maglok™ are comparable with and at least equivalent to those of the CSR Hebel® AAC panel component of the PowerFloor system, which is certified under section 269 of the Building Act with a CodeMark certificate.

As Maglok™ meets or exceeds the product metrics, this means Maglok™ compliance with the building code can be established for the intended use of flooring. As the product metrics do not include moisture-related properties, this is based on the assumption that, in use, Maglok™ panels do not form part of the external envelope, including extending under external walls, and all external moisture provisions are met for the construction, including the subfloor.

Conclusion

The material properties and characteristics of Maglok™, relevant to a flooring substrate, exceed the product metrics demonstrated by CodeMark certificate number CM2024 and exceed key performance metrics of bending strength/modulus of rupture and modulus of elasticity as required by AS/NZS 1860 as cited in NZS 3604.

Therefore, the Maglok™ metrics meet the minimum required to meet the provisions of the Building Code when used as a flooring substrate, provided that Maglok™ panels do not form part of the external envelope, including extending under external walls, and all external moisture provisions are met for the construction including the subfloor.

Addendum

DragonBoard® Technologies has approached TBB regarding the conclusion that Maglok™ panels should not form part of the external envelope. DragonBoard® Technologies considers this conclusion does not take into account the required installation methodology. The installation methodology provides for a flexible building wrap or rigid air barrier and a cladding and this has the adequate redundancy necessary to protect the Maglok™ panels from getting wet. DragonBoard® Technologies also noted that untreated plywood was similarly protected.

TBB has considered the installation methodology and therefore concludes that where Maglok™ is used as a flooring substrate and extends into the external wall, a flexible building wrap or rigid air barrier, with joints taped where the joint is in close proximity to a Maglok™ panel, will not reduce the metrics necessary to meet the provisions of the Building Code.

References

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