



Evaluation Report CCMC 14038-R MEGCRETE™ MgO Board using MBP-IP Technology

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “MEGCRETE™ MgO Board using MBP-IP Technology,” when used as a non-structural exterior wall sheathing in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015*:

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
 - Sentence 9.23.17.2.(1), Thickness, Rating and Material Standards
 - Table 9.23.17.2.-A., Wall Sheathing Thickness and Specifications (gypsum sheathing)

This opinion is based on the CCMC evaluation of the technical evidence in Section 4 provided by the Report Holder.

*These provisions in the NBC 2010 and the NBC 2015 have not changed.

2. Description

This Report addresses the performance of Rethinking Construction proprietary “MEGCRETE™ MgO Board using MBP-IP Technology” as a suitable non-structural exterior sheathing as an alternative solution to exterior gypsum sheathing. As both these exterior sheathings are non-structural and not qualified to provide bracing of exterior walls, the interior gypsum is designated as the bracing to resist lateral loads with the associated provisions in Subclause 9.23.13.1.(2)(a)(iii) of the NBC 2015.

The product is an innovative magnesium oxychloride (MgOCl)-based panel with a proprietary formulation. The panels are available in a standard 1.2 m × 2.4 m (4 ft. × 8 ft.) size and with thicknesses ranging from 10 mm to 25 mm. The 12-mm-thick sheathing was tested.

Due to the free chloride ions within the panel matrix, which may cause premature corrosion of fasteners, the panel must be attached with stainless steel fasteners to the lumber stud framing¹ using Type SS304, SS305 or SS316. The fasteners may be staples or screws (e.g., self-tapping or non-self-tapping if panel is pre-drilled). For staples they must be 16 gauge SS316 staples that are 11 mm wide × 38 mm in length. In addition, any subsequent fasteners that may penetrate the exterior sheathing (e.g., cladding fasteners) must also be SS304, SS305 or SS316 grade stainless steel.

The Report Holder produces prefabricated wall panels of conventional wood-frame construction containing the “MEGCRETE™ MgO Board using MBP-IP Technology” panels and ensures that proper corrosion resistant fasteners are used. In other installations of their MgO panels, the Report Holder provides field supervision of their panel installation. Subsequently, installed fasteners through the MgO panel into studs, installed by others, must also meet the fastener specification herein.

1. Even though CCMC has only qualified the use of this board on wood-frame construction, please note that Rethinking Construction has implemented a membrane solution to avoid the direct contact of MgO with steel studs in high moisture areas. This solution is similar to (modeled after) exterior gyproc where a paper layer separates the gypsum core and the steel stud. This proposed solution is being evaluated by CCMC for a future addition to CCMC 14038-R and then the report may be modified accordingly.

Figure 1 shows a typical non-structural exterior sheathing application. Figure 2 shows a possible non-structural interior sheathing application.

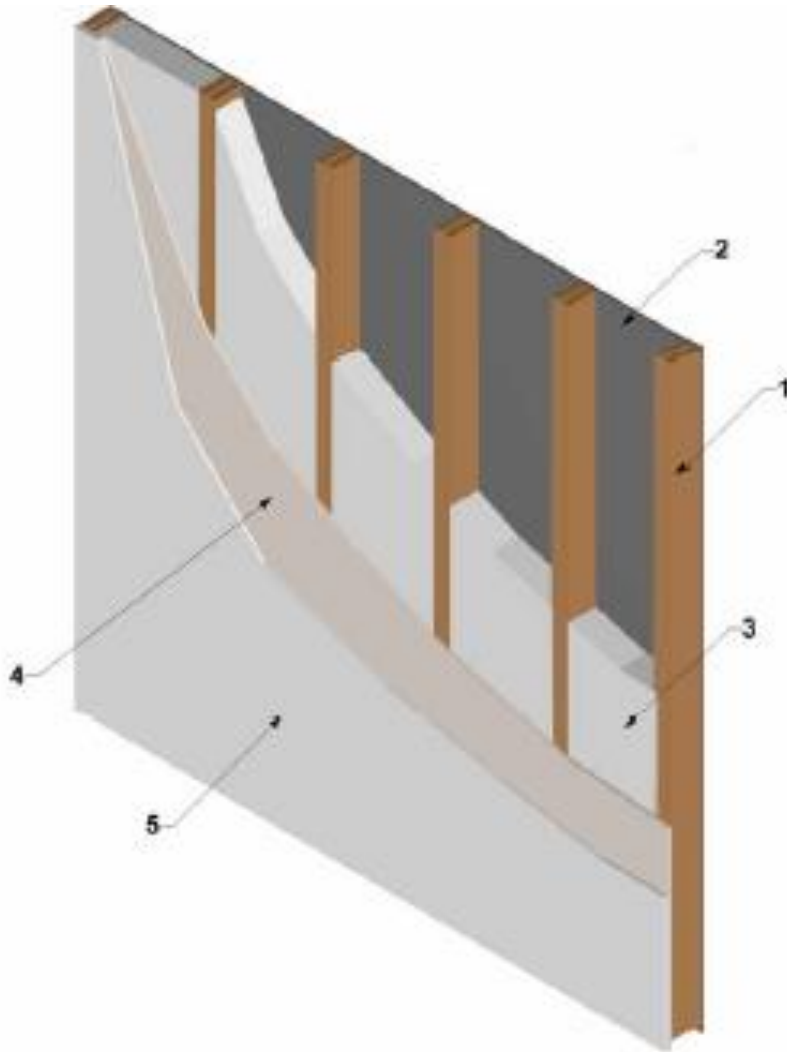


Figure 1. “MEGCRETe™ MgO Board using MBP-IP Technology” exterior sheathing on a conventional wood-frame wall

1. **lumber studs**
2. **“MEGCRETe™ MgO Board using MBP-IP Technology” (attached with corrosion resistant fasteners)**
3. **insulation**
4. **vapour/air barrier as per NBC 2015 or alternative solutions**
5. **interior gypsum board (attached as designated bracing)**

Note: Not shown are the required sheathing membrane and cladding as per NBC 2015, attached with corrosion fasteners specified herein.

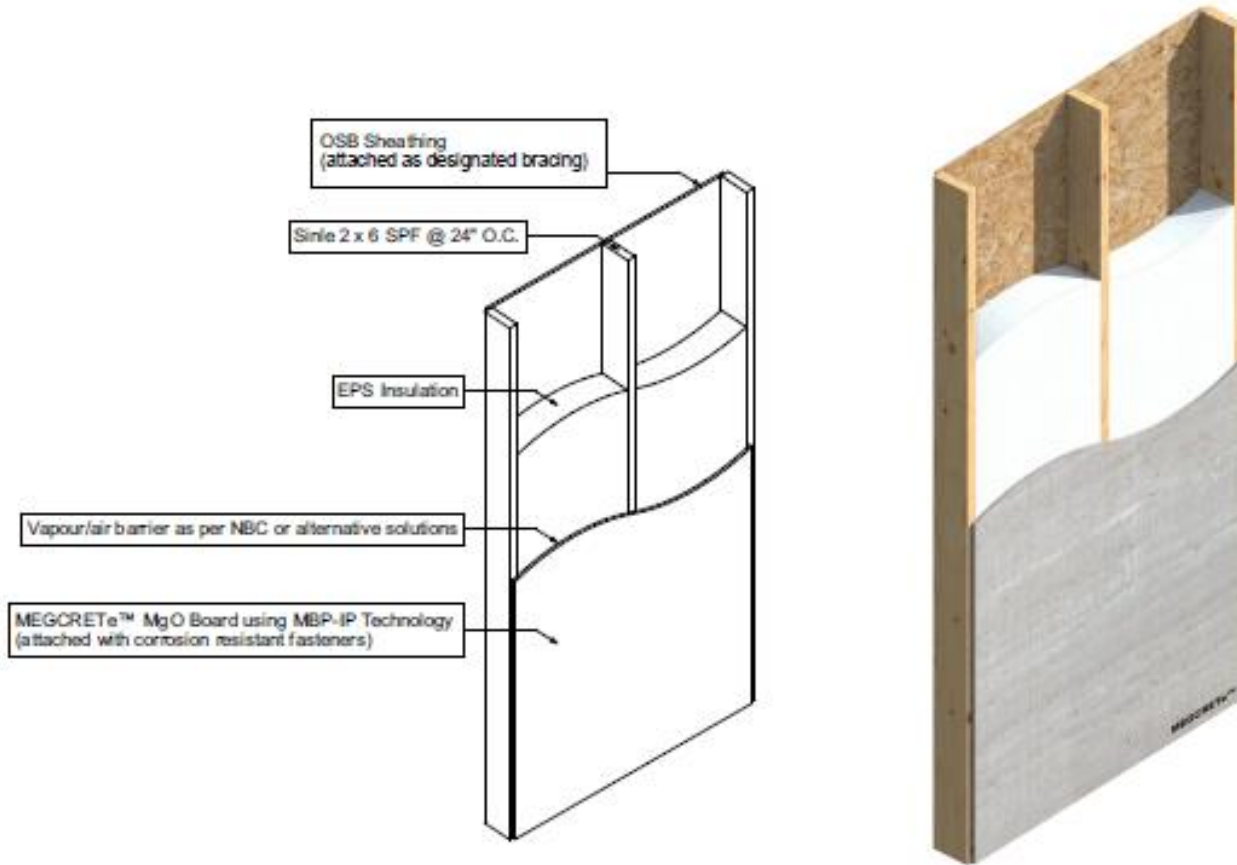


Figure 2. “MEGCRETe™ MgO Board using MBP-IP Technology” interior sheathing² on a conventional wood-frame wall

Note: Not shown is the required air/vapour barrier as per NBC 2015 or alternative solutions.

3. Conditions and Limitations

The CCMC compliance opinion in Section 1 is bound by “MEGCRETe™ MgO Board using MBP-IP Technology” being used in accordance with the conditions and limitations set out below:

- The bracing for the exterior wall assembly must be the interior gypsum board as this product has not been evaluated for structural use in providing the designated bracing. Therefore, the installations are limited to locations where the interior gypsum is the designated bracing, as per Subclause 9.23.13.1.(2)(a)(iii) in the NBC 2015, which is limited to geographical areas where the seismic spectral response acceleration $S_a(0.2)$ is < 0.70 and the 1-in-50 hourly wind pressure is < 0.80 kPa.
- The interior gypsum must be installed with fastener spacing as per Sentences 9.29.5.8.(3) or 9.29.5.8.(4) in the NBC 2015.
- The fasteners for attachment of the product as an exterior sheathing must be Type SS304, SS305 or SS316 (e.g., self-tapping screws) and was shown to accept 16 gauge Type SS304, SS305 or SS316 staples, 11 mm wide \times 38 mm in length.
- Any fasteners that may penetrate the exterior sheathing product for attachment to the studs (e.g., cladding fasteners) must be Type SS304, SS305 or SS316 stainless steel grade (e.g., self-tapping screws).
- This current evaluation for exterior sheathing is limited to installation on wood frame at this time.
- The sheathing membrane protection and cladding must be as per NBC 2015 provisions.
- As with exterior gypsum board during construction, the product must be protected from excessive rain/moisture exposure during construction.
- The product must be clearly identified with the phrase “CCMC 14038-R.”

2. The “MEGCRETe™ MgO Board using MBP-IP Technology” panel was primarily evaluated as an exterior sheathing where the required bracing is being provided by the interior gypsum. The “MEGCRETe™ MgO Board using MBP-IP Technology” panel may be installed as the interior sheathing where the required bracing is being provided by the exterior wood-based sheathing as part of a conventional wood-frame assembly. The evaluation as exterior sheathing included the durability resistance required to survive the exterior elements (wetting, drying, etc.). Thus, the durability for interior use is covered. However, other aspects that may be important to the user as an interior finish (joint taping/compounding, paintability) have not been evaluated.

4. Technical Evidence

The CCMC Technical Guide for “MEGCRETE™ MgO Board using MBP-IP Technology” sets out the technical evidence required by CCMC to evaluate the product as an alternative solution in compliance with the NBC 2010/2015. The Report Holder has submitted test results and other data for the CCMC evaluation. Testing was conducted at an independent laboratory recognized by CCMC. The corresponding test results for the product are summarized below.

4.1 Performance Requirements

Table 4.1.1 Results of Testing the Performance Requirements of the Product

Property		Unit	Requirement	Result
Material variability	flexural strength	F-statistic	10 boards from each of 4 production batches	Pass
	density	F-statistic	10 boards from each of 4 production batches	Pass
	chemistry	N/A	X-ray diffraction	Pass
atomic %		X-ray fluorescence	Pass	
Leachate pH		pH	pH > Gypsum board or 6, whichever is greater	8-9 pH
Free chloride ion leachate (weight of board mass)		%	If > 0.1%, corrosion resistant fasteners required	7
Vicker's hardness		MPa	ASTM E384 report value	Varies 40-150
Fastening – staples (16 gauge SS316 staples, 11 mm wide × 38 mm in length)		–	Install panels on a 12 ft. × 8 ft. wood frame and observe if breakage after 95% are installed	Pass
Flexural strength of immersed samples		MPa	Average residual strength after immersion from each lot ≥ 90% of average strength of as-received material. The residual strength after immersion of each specimen must be ≥ 80% of average strength of as-received material. ASTM C293	Pass
Flexural strength of samples exposed to construction moisture (e.g., rain)		MPa	Average loss in strength of all MgOCl samples ≤ Average loss in strength of NBC benchmark (e.g., exterior gypsum)	Pass ¹
Water vapour permeance		ng/Pa·s·m ²	ASTM E96, desiccant method > 170 ng/Pa·s·m ²	300
Air permeance		L/s·m ² ·Pa @ 75 Pa ΔP	Report value (ULC S741-08)	0.0422
Fastener corrosion (mass loss compared to SS316)		%	Mass loss of SS316 did not exceed 0.07%. Mass loss of SS304 did not exceed 0.11%. ASTM G198-11	Pass with only 0.04% difference following 4-month test program ²

Notes to Table 4.1.1:

1. The minimum performing NBC acceptable solution for a non-structural exterior sheathing application was exterior gypsum board. Thus, exterior gypsum board was used as the performance benchmark.
2. The corrosion resistance of other stainless steel grades (e.g., SS304, SS305) has been evaluated as acceptable compared to the SS316 marine grade stainless steel.

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