

Mehdi Malekian
Promat Australia Pty Ltd
198 Harbour Esplanade, Docklands
VIC 3008, Australia
+61 (0) 4 024 16202
Mehdi.malekian@etexgroup.com

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Durability Assessment for Equitone Cladding

We have compared the AS/NZS 2908.2-2000 Cellulose-Cement Products Part 2: Flat Sheets against the BS EN 12467:2012+A2:2018 Fibre-Cement Flat Sheets – Product Specification and Test Methods for NZBC Clause B2 Durability using the Equitone cladding and fixing systems in the New Zealand and Australian markets.

Both standards feature a classification, acceptance conditions and testing methods for dimension and tolerances, and mechanical and physical characteristics for fibre-cement flat sheets. In general, the BS EN 12467 acceptance conditions and testing methods are more stringent than AS/NZS 2908. There are a couple criterias where the AS/NZS 2908 tests/tolerances are slightly more stringent (but not relevant to these products as noted below):

- Bending strength
- Tolerance on the cooling and heating temperatures for the freeze-thaw cycle tests
- Thickness tolerance for textured sheets

A fibre-cement flat sheet with a Class 1 strength classification (minimum modulus of rupture (MOR) of 4MPa) in the BS EN 12467 standard would not meet the AS/NZS 2908 standard as the minimum MOR required is 7MPa. This means that at minimum, a Class 2 strength classification in the BS EN 12467 standard is required to achieve compliance with the equivalent rating in AS/NZS 2908.

The thickness tolerance for textured sheets and tolerance on the cooling and heating temperatures for the freeze-thaw cycle tests does not impact the ability of the products to meet the requirements of NZBC Clause B2.

Cladding & Fixing Systems Overview

Equitone fibre-reinforced cement panel cladding:

- include ranges [tectiva], [lines], [lunara], [natura], [natura] Pro, [pictura], [materia], [textura], [coloura], and [inspira] installed onto timber, aluminium, or galvanized battens support system over a timber stud, masonry, or steel walls
- are installed with aluminium, and stainless steel screws and rivets of Types 304 and 316.



Performance in Relation to NZBC Clause B2 & AS/NZS 2908.2

The following sections demonstrate how the Equitone claddings and fixing systems comply with the NZBC Clause B2 Durability and AS/NZS 2908.2-2000 Cellulose-Cement Products Part 2: Flat Sheets.

Demonstrating Compliance (Cladding)

The Equitone cladding ranges [tectiva], [lines], and [lunara] are cured using an autoclave process. This means the polymer-based composites are manufactured by applying intense heat and pressure to eliminate moisture from fibre cement materials. This consolidates the composites which results in a robust fibre composite material.

The Equitone cladding ranges [coloura], [inspira], [natura], [natura] PRO, [pictura], and [materia] are air-cured. This is a similar process to the autoclave except the mixture is air cured. This results to a robust fibre composite material where the sheets are directly exposed to harsh weather conditions.

The following describes the acceptance conditions and testing methods for fibre-cement flat sheets within the BS EN 12467 and AS/NZS 2908 standards:

Durability Classification

- The AS/NZS 2908 classifies the fibre cement flat sheets into two types: Type A and Type B
- BS EN 12467 standard classifies the sheets into four categories: Categories A, B, C, or D in addition to the sheet size: small or large
- The descriptions for AS/NZS 2908 Types A and B are similar to the descriptions for BS EN 12467 standard Categories A and B, respectively
- As Equitone will be used as an external cladding, it is classified as Type A according to the AS/NZS 2908 and Category A according to the BS EN 12467 standard.

Dimension & Tolerances

- The AS/NZS 2908 contains one level of tolerances (length, width, straightness and squareness of edges)
- The BS EN 12467 standard contains two level of tolerances: Levels I and II.

Tolerances on Length & Width

- The method of measurement to determine the tolerances on the length and width for large sheets are the same for both standards.
- The BS EN tolerances on nominal dimensions identified in Level I are more stringent than the values listed in Level II, which are equal to the tolerances listed in the AS/NZS 2908.
- Additionally, the BS EN 12467 standard includes an extra range of nominal dimension ($a \leq 600\text{mm}$: Level I = $\pm 3\text{mm}$; Level 2 = $\pm 4\text{mm}$) with tolerances more stringent when compared to the most suitable range within the AS/NZS 2908 ($d \leq 1000\text{mm}$: $\pm 5\text{mm}$).

Tolerances on Thickness

- The method of measurement to determine the thickness tolerance is the same for both standards.

- Though the AS/NZS 2908 has a slightly more stringent thickness tolerance for textured sheets compared to BS EN 12467, the ability of the products to meet the NZBC Clause B2 is not impacted.
- The BS EN 12467 standard specifies for sheets without texture the maximum difference between extreme values of the thickness measurements within one sheet shall not exceed 10% of the maximum measured value, which is more stringent than AS/NZS 2908's value of 15%.
- The BS EN 12467 includes an extra range of thickness tolerance for non-textured ($e > 20\text{mm}$: $\pm 2\text{mm}$) and textured sheets ($e > 20\text{mm}$: $-2\text{mm} / +3\text{mm}$)

Tolerances on Shape – Straightness of Edges

- The method of measurement to determine the tolerances on straightness of edges are the same for both standards.
- The BS EN 12467 tolerances on straightness of edges identified in Level I are more stringent than the values listed in Level II, which are equal to the tolerances listed in the AS/NZS 2908.

Tolerances on Shape – Squareness of Edges

- The method of measurement to determine the tolerances on squareness of edges are the same for both standards.
- The BS EN 12467 tolerances on squareness of edges identified in Level I are more stringent than the values listed in Level II, which are equal to the tolerances listed in the AS/NZS 2908.

Apparent Density

- The testing methods to determine the apparent density is the same for both standards.
- Both standards require the manufacturer to specify the minimum apparent density for each category of sheet and each type/class of sheet.

Water Permeability

- The testing methods to determine its water permeability is the same for both standards.
- In both standards, traces of moisture may appear on the under face of the sheet, but in no instance shall there be any formation of drops of water.

Bending Strength

- The testing procedure to determine the MOR of the sheets are the same for both standards.
- As Equitone will be used as an external cladding, the minimum MOR values listed in the AS/NZS 2908 classification for Type A sheets are compared against the values listed in the BS EN 12467 standard for Categories A & B.
- The minimum MOR values for the Type A sheets in the AS/NZS 2908 are lower than the values for Category A & B in the BS EN 12467 standard for Classes 3 to 5. This means when the MOR for the fibre-cement flat sheet is determined, the Category/Class will be classified differently for the two standards.
- The minimum MOR for AS/NZS 2908 is 7MPa compared to 4MPa for BS EN 12467.
 - This indicates the AS/NZS 2908 has a more stringent minimum MOR requirement.
 - This means at minimum, a Class 2 strength classification in the BS EN 12467 standard is required to achieve compliance with the equivalent rating in AS/NZS 2908.

- On the other hand, AS/NZS 2908 Category 5 indicates a minimum MOR value of 18MPa for Type A sheets only whereas BS EN 12467 Class 5 indicates a minimum MOR value of 24MPa for Category A & B sheets. As the BS EN 12467 standard has an additional set of minimum MOR values, the BS EN 12467 standard is more stringent.

Table 1: Minimum MOR Values in Megapascals

AS/NZS 2908.2		BS EN 12467 Standard	
Categories	Type A Sheets	Classes	Category A & B
1	-	1	4
2	-	2	7
3	7	3	13
4	13	4	18
5	18	5	24

Frost Resistance

- The testing procedure to determine the frost resistance of the sheets are the same for both standards with a minimal deviation.
- Though the AS/NZS 2908 has a slightly more stringent tolerance on the cooling and heating temperatures for the freeze-thaw cycle tests of $\pm 20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ compared to the $\pm 20^{\circ}\text{C} \pm 4^{\circ}\text{C}$ in the BS EN 12467, the ability of the products to meet the NZBC Clause B2 is not impacted.
- The BS EN 12467 standard requires 100 test cycles for Category A, whereas the AS/NZS 2908 requires 50 test cycles. The overall average of the results is generally more accurate with more data.

Warm-Water

- The testing procedures to investigate the possible degradation of the products by keeping them in warm water for a protracted period are the same for both standards.

Heat-Rain

- The moisture movement test designed to determine the installed performance of flat sheets under cyclic changes in moisture content is the same for both standards with a minor deviation.
- The AS/NZS 2908 specifies the combined test area of the sheets of not more than 5m² whereas the BS EN 12467 standard specifies 12m².
- Additionally, the BS EN 12467 standard requires 50 test cycles for Category A, whereas the AS/NZS 2908 requires 25 test cycles. The overall average of the results is generally more accurate with more data.

Soak-Dry

- The soak dry test is the same for both standards.
- The BS EN 12467 standard requires 50 soak dry cycles for Category A, whereas the AS/NZS 2908 requires 25 test cycles. The overall average of the results is generally more accurate with more data.

The acceptable tolerances and performance of the Equitone claddings against the AS/NZS 2908 are shown in the tables below:

Table 2: Classification, Performance, and Tolerances of Equitone [Materia] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 3 (13 MPa)	Category 4 (13 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances:		
Length x Width: 2500mm / 3100 mm x 1250mm (trimmed panels)		
Length x Width: 2530mm / 3130 mm x 1280mm (untrimmed panels)		
Thicknesses	8mm ± 0.6mm 12mm ± 0.9mm	8mm ± 0.8mm 12mm ± 1.2mm
Length	± 1mm	± 8mm
Width	± 1mm	± 6.25mm
Squareness of edges	± 1.5 mm/m	4mm/m

Table 3: Classification, Performance, and Tolerances of Equitone [Lunara] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances:		
Length x Width: 2550mm / 3050mm x 1220mm (trimmed panels)		
Length x Width: 2520mm / 3070mm x 1240mm (untrimmed panels)		
Thickness	10mm ± 1.0mm (trimmed & untrimmed panels)	10mm ± 1.0mm
Length	± 3mm (trimmed panels) ± 5mm (untrimmed panels)	± 8mm
Width	± 3mm (trimmed panels) ± 5mm (untrimmed panels)	± 6.1mm
Squareness of edges	± 1mm/m (trimmed panels) ± 2mm/m (untrimmed panels)	± 4mm/m

Table 4: Classification, Performance, and Tolerances of Equitone [Natura], [Natura] Pro, and [Pictura] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances:		
Length x Width: 2500mm / 3100mm x 1250mm (trimmed panels) Length x Width: 2530mm / 3130mm x 1280mm (untrimmed panels)		
Thickness	8mm ± 0.6mm 12mm ± 0.9mm (trimmed & untrimmed panels)	8mm ± 0.8mm 12mm ± 1.2mm
Length	± 1mm (trimmed panels) ± 8mm (untrimmed panels)	± 8mm
Width	± 1mm (trimmed panels) ± 6mm (untrimmed panels)	± 6.25mm
Squareness of edges	± 1mm/m (trimmed & untrimmed panels)	± 4mm/m

Table 5: Classification, Performance, and Tolerances of Equitone [Tectiva] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances:		
Length x Width: 2500mm / 3050mm x 1220mm (trimmed panels) Length x Width: 2520mm / 3070mm x 1240mm (untrimmed panels)		
Thickness	8mm -0.5 / +0.8mm 10mm -0.5 / +1.0mm (trimmed & untrimmed)	8mm ± 0.8mm 10mm ± 1mm
Length	± 3mm (trimmed) ± 5mm (untrimmed)	± 8mm
Width	± 3mm (trimmed) ± 5mm (untrimmed)	± 6.1mm
Squareness of edges	± 1mm/m (trimmed) ± 2mm/m (untrimmed)	± 4mm/m

Table 6: Classification, Performance, and Tolerances of Equitone [Lines] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances: Length x Width: 2500mm / 3050mm x 1220mm (trimmed panels)		
Thickness	10mm ±1mm	10mm ± 1mm
Length	± 2mm	± 8mm
Width	± 2mm	± 6.1mm
Squareness of edges	± 1mm/m	± 4mm/m

Table 7: Classification, Performance, and Tolerances of Equitone [Textura] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances: Length x Width: 2500mm / 3100mm x 1250mm (trimmed panels) Length x Width: 2530mm / 3130mm x 1280mm (untrimmed panels)		
Thicknesses	8mm ± 0.6mm 12mm ± 0.9mm (trimmed & untrimmed panels)	8mm ± 0.8mm 12mm ± 1.2mm
Length	± 1mm (trimmed panels) ± 8mm (untrimmed panels)	± 8mm
Width	± 1mm (trimmed panels) ± 6mm (untrimmed panels)	± 6.25mm
Squareness of edges	± 1mm/m (trimmed & untrimmed panels)	± 4mm/m

Table 8: Classification, Performance, and Tolerances of Equitone [Coloura] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances: Length x Width: 2500mm / 3100mm x 1250mm (trimmed panels)		
Thickness	8mm ± 0.2mm	8mm ± 0.8mm
Length	± 1mm	± 8mm
Width	± 1mm	± 6.25mm
Squareness of edges	± 1mm/m	± 4mm/m

Table 9: Classification, Performance, and Tolerances of Equitone [Inspira] against AS/NZS 2908

Criteria	BS EN 12467	AS/NZS 2908
Classification & Performance:		
Durability Classification	Category A	Type A
Bending Strength Classification	Class 4 (18 MPa)	Category 5 (18 MPa)
Water Permeability	Pass	Pass
Frost Resistance	Pass	Pass
Warm-Water	Pass	Pass
Heat-Rain	Pass	Pass
Soak-Dry	Pass	Pass
Dimensional and Geometrical Tolerances: Length x Width: 2500mm / 3100mm x 1250mm (trimmed panels)		
Thickness	8mm ± 0.2mm	8mm ± 1mm
Length	± 1mm	± 8mm
Width	± 1mm	± 6.25mm
Squareness of edges	± 1mm/m	± 4mm/m

Demonstrating Compliance (Railing Systems, Battens, Fixings)

To meet the durability clauses in New Zealand, the following must also be considered when using the proposed Equitone claddings and fixing systems:

- Exposure/Atmospheric corrosivity zones
- Support frames and battens
 - Aluminium support frames and battens
 - Galvanized support frames and battens
 - Timber battens
- Fixings

Exposure/Atmospheric Corrosivity Zones

The durability of all materials is governed by the environment to which they are exposed and its corrosion risk.

The definitions of the corrosivity category for NZ and Australia are summarized in Table 2 of *NZS 3404-2018 Durability Requirements for Steel Structures and Components* and Table 3.5.11 of the *NCC 2019 Volume Two*, respectively.

New Zealand

New Zealand is classified into Exposure Zones B (Low), C (Medium), D (High), and E (Very High) where building elements can be exposed, sheltered, or hidden ^{(1) (2)}

- ⁽¹⁾ The term 'hidden' means concealed behind another element such that no part is visible. Hidden elements require a 50-year durability under the NZBC. The term 'exposed' means having surfaces exposed to rain washing. The term 'sheltered' means being visible, but not rain washed. Exposed and sheltered elements require a 15-year durability. – Notes (2) in Table 20 of Verification Methods and Acceptable Solutions for NZBC E2 External Moisture
- ⁽²⁾ Hidden steel coated elements in ventilated cavities in Zones D and E (exposure to salt air) must be considered as 'sheltered'. – Notes (9) in Table 20 of Verification Methods and Acceptable Solutions for NZBC E2 External Moisture

Australia

Australia is classified into Atmospheric Corrosivity Zones C1 (Very low), C2 (Low), C3 (Medium), C4 (High), C5 (Very High).

Support Frames and Battens

Aluminium Support and Battens

Aluminium by its nature is inherently durable. The aluminium quickly forms a stable oxide layer upon contact with the atmosphere which then seals the raw aluminium below from further oxidation. The oxide layer formed on the aluminium is stable and provides a barrier to atmosphere attack under the conditions expected to be experienced in use. This behaviour of aluminium is in complete contrast to mild steel and galvanized coatings, which are sacrificial and do in turn react with the environment.

The aluminium support is suitable to be used in all New Zealand and Australia exposure/atmospheric zones.

Galvanized Support and Battens

To meet the durability requirements, the mild steel support and battens need to be protected against corrosion. Options include paint/coating and hot dip galvanizing.

Paint/coating

We understand the supports for the Equitone claddings will be coated with Zinalume® which introduces magnesium into the aluminium-zinc alloy coating. Both Zinalume® steel AZ150 and AM125 meet the AS 1397 standard, as identified in the New Zealand and Australian Building Codes.

Table 10: Durability Requirements using Galvanized Support Frames & Battens in NZ

Exposure Zones	Factory Painted	Non-factory Painted	
	Aluminium-zinc-magnesium coated or galvanized steel, to AS 1397 and AS/NZS 2728 with AM100, ZM274, and AZ150 minimum coatings	Aluminium-zinc-magnesium coated steel, to AS 1397 with AZ150 or AM125 minimum coatings	Galvanized steel Z450 to AS 1397
B	Types 4 and 6 * Minimum 50-year durability	Minimum 50-year durability	Minimum 50-year durability
C	Types 4 and 6 * Minimum 50-year durability	Minimum 50-year durability	Minimum 50-year durability
D	Type 6 only * Minimum 15-year durability	Not suitable	Not suitable
E	Not permitted	Not suitable	Not suitable

* Types 4 and 6, which is defined with a corrosion rate/mild steel of 50-80µm/y and 80-200µm/y, respectively.

Table 11: Durability Requirements using Galvanized Support Frames & Battens in Australia

Environment	Minimum metal coating in accordance with AS 1397: Metallic coated steel	Minimum metal coating in accordance with AS 1397: Metallic & organic coated steel
C2 – Low (Mild steel corrosion rate 1.3 to 25 µm/y)	Z450 galvanized or AZ150 aluminium/zinc or AM125 aluminium/zinc/magnesium	Z275 galvanized or AZ150 aluminium/zinc or AM100 aluminium/zinc/magnesium
C3 – Medium (Mild steel corrosion rate 25 to 50 µm/y)	Z450 galvanized or AZ150 aluminium/zinc or AM125 aluminium/zinc/magnesium	Z275 galvanized or AZ150 aluminium/zinc or AM100 aluminium/zinc/magnesium
C4 – High (Mild steel corrosion rate 50 to 80 µm/y)	AZ150 aluminium/zinc or AM125 aluminium/zinc/magnesium	AZ150 aluminium/zinc or AM100 aluminium/zinc/magnesium
C5 – Very High (Mild steel corrosion rate 80 to 200 µm/y)	Not suitable	AZ200 aluminium/zinc or AM150 aluminium/zinc/magnesium
C5 – Very High (Mild steel corrosion rate 80 to 200 µm/y)	Not suitable	Not suitable

Hot Dip Galvanizing

Another option of corrosive protection is hot dip galvanizing. This process requires compliance with AS/NZS 2312.2 and AS/NZS 4680. The table below provides the estimated life for HDG coatings on steel.

Table 12: Durability Requirements for HDG in Australia and New Zealand

Steel Thickness (mm)	AS/NZ 4680 Coating Mass & Thickness		Designation C3	AS/NZ 2312.2 Corrosivity category & min-max life in years		
	g/m ²	g/m ²		C3	C4	C5
>1.5 to ≤3.0	390	55	HDG390	26-78	13-26	6-13
>3.0 to ≤6.0	500	70	HDG500	33-100	16-33	8-16
>6.0	600	85	HDG600	40-100	20-40	10-20
>>6.0	900	125*	HDG900	60-100	30-60	15-30

Note: Corrosivity Categories C1 and C2 are not included in the Table as the zinc coating systems will achieve at least a minimum life to first maintenance of 50 years in C1 and C2 corrosivity zones, which exceeds the typical design requirements of most Standards and Codes.

* Hot dip galvanized coatings thicker than 85µm are not specified in AS/NZS 4680, however in conjunction with the galvanizer, a specification can be written for thicker coatings.

Timber Battens

Timber and wood-based building components to be protected against damage from moisture. Therefore, timber battens used behind cladding to form a cavity must meet the 50-year durability performance in all exposure zones and have:

- H3.1 treatment in New Zealand
- H3 treatment in Australia

Fixings

The fixings include aluminium and stainless steel of Types 304 and 316. These fixings are suitable to be used in all New Zealand and Australia exposure/atmospheric corrosivity zones.

Conclusion

This report is an opinion of the probable performance to achieve NZBC Clause B2 of the Equitone claddings, fixings, and railing systems based on the information provided to us. We have based our opinion on the following:

- The acceptance conditions and testing methods of BS EN 12467 is at least equivalent to and at times more stringent than AS/NZS 2908, hence, the cladding products tested to BS EN 12467 would likely pass the equivalent AS/NZS 2908 acceptance conditions and tests.
- As the cladding products meet the requirements of the AS/NZS 2908 standard, they would also be expected to meet the durability requirements in New Zealand and Australia.
- The BBA approval inspection testing certification indicates the cladding products are durable and can be expected to have a service life in excess of 30 years, provided the products are installed and maintained in accordance with this certificate and the certificate holder's instructions.
- The EPD documents indicate the Equitone cladding to have an estimated service life of 50 years.

- Aluminium supports and battens are suitable to be used in all New Zealand and Australia exposure/atmospheric corrosivity zones.
- Galvanized supports and battens to be protected and installed in accordance with the property's exposure zone.
- Timber battens used behind cladding to form a cavity must have H3.1 and H3 treatment in New Zealand and Australia, respectively.
- Aluminium and stainless steel of Types 304 and 316 fixings are suitable to be used in all New Zealand and Australia exposure/atmospheric corrosivity zones.

Signed:

A handwritten signature in black ink, consisting of the letters 'S', 'M', and 'I' in a stylized, cursive font.

Shawn McIsaac, CP,Eng (NZ, Aus), P.E. (Wa), P,Eng (BC)

Director, Oculus Architectural Engineering Ltd