



Postal
PO Box 3080,
Brighton VIC 3186
@: contact@redfireengineers.com.au
W: www.redfireengineers.com.au

Offices
Victoria
Suite 49, 1 St Kilda Rd
St Kilda VIC 3182
T: +61 3 9079 4143

New South Wales
Suite 6.04/Level 6
299 Sussex Street
Sydney NSW 2000
T: +61 2 8096 2220

Queensland
Suite 8, Level 2
35 Astor Terrace
Spring Hill QLD 4000
T: +61 7 3832 0660

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3 June 2019

**Fairview Architectural
18-20 Donald St
Lithgow NSW 2790**

Attention: Ashley How

**Re: Review of Large Scale Testing of Vitracore G2
Project: JV19-00103
Version: 1.0**

Abstract

Fairview Architectural's Vitracore G2 is an aluminium composite panel that in accordance with the National Construction Code 2019 Volume One Deemed-to-Satisfy provisions, may be used as part of an external wall in Type A or Type B construction. To provide information for the use of Vitracore G2 as part of a Performance Solution, Vitracore G2 was tested on 24 November 2017 in accordance with the test protocols of AS 5113:2016 and BS 8414-2:2015 by Exova Warrington Aus Pty Ltd in their facility in Dandenong VIC. The tested specimen was a 160 mm thick external wall system consisting of a steel frame clad with 4 mm thick Vitracore G2. The test results indicated that the tested assembly did not exhibit external flame spread more than that permitted by the external wall classification criteria in AS 5113:2016, except that the falling debris criterion in AS 5113:2016 was not met. This test data is suitable for use by a fire safety engineer developing a building specific Performance Solution.

RED FIRE ENGINEERS PTY LTD

FIRE SAFETY ENGINEERING
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ABN 52 164 239 212

www.redfireengineers.com.au

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Introduction

RED Fire Engineers has been engaged by Fairview Architectural to carry out an assessment of Vitracore G2 for compliance with the National Construction Code (NCC) Series 2019 Volume One: Building Code of Australia (BCA) ^[1].

As stated in the ABCB Advisory note on cladding ^[2]:

Performance Requirement CP2 of NCC Volume One requires, among other things, that a building must have elements that will avoid the spread of fire in a building and between buildings, in a manner appropriate for that building. This requirement is met, in part, under a Deemed-to-Satisfy Solution for buildings of Type A and Type B construction by non-combustible external walls (Specification C1.1 Clauses 3.1(b) and 4.1(b)). A non-combustible external wall inhibits fire spread via the external face of the building, thereby contributing to a building's compliance with Performance Requirement CP2.

As discussed in this report, Vitracore G2 may be used where a non-combustible product is required and is therefore a Deemed-to-Satisfy Solution for use in an external wall in all building construction types.

However, there are other means of showing compliance with the National Construction Code (NCC), and as a means of providing appropriate background information Vitracore G2 has been tested in accordance with AS 5113:2016 ^[3] and BS 8414-2:2015 ^[4]. This document reports on these test results.

Compliance with the NCC 2019 Volume One

Compliance with the NCC is achieved by meeting the Performance Requirements which may be done through the use of a Performance Solution, a Deemed-to-Satisfy solution or a combination of the two. There are four means of determining if the Performance Solution meets the relevant Performance Requirements (from NCC Clause A2.2):

- (a) Evidence of suitability in accordance with Part A5 that shows the use of a material, product, plumbing and drainage product, form of construction or design meets the relevant Performance Requirements [A5.2 lists Evidence of Suitability]
- (b) A Verification Method including the following:
 - (i) The Verification Methods provided in the NCC.
 - (ii) Other Verification Methods, accepted by the appropriate authority that show compliance with the relevant Performance Requirements.
- (c) Expert Judgement.
- (d) Comparison with the Deemed-to-Satisfy Provisions.

¹ ABCB, 2019. NCC 2019 Volume One: Building Code of Australia - Class 2 to Class 9 Buildings. Australian Building Codes Board, Canberra, ACT, Australia, 2019.

² ABCB, 2016. Advisory Note: Fire Performance of External Walls and Cladding. Australian Building Codes Board, Canberra, ACT, Australia, 2016.

³ AS 5113:2016, Fire propagation testing and classification of external walls of buildings. Standards Australia, Sydney, NSW, Australia, 2016.

⁴ BS 8414-2:2015, Fire Performance of External Cladding Systems – Part 2: Test method for non-load bearing external cladding systems fixed to and supported by a structural steel frame. British Standards Institution, Chiswick, UK, 2015.



Therefore the “simplest” form of complying with the NCC is to meet the requirements of the Deemed-to-Satisfy Provisions. However, all approaches in Clause A2.2 are equally permissible.

Fire Resistance – BCA Section C

Section C of the BCA addresses Fire Resistance and Stability, Compartmentation and Separation and Protection of openings. With respect to cladding the most relevant Performance Requirements are listed below, although others might be impacted:

- CP2 which concerns the spread of fire in a building and between buildings.
- CP3 and CP4 which concern the protection from the spread of fire and smoke to allow safe egress from a building.

Under the Deemed-to-Satisfy Provisions, types of construction are categorised into Types A, B and C. The Type of construction varies according to the occupancy classification as well as the rise in storeys of the building.

For Types A and B construction, the Deemed-to-Satisfy Provisions requires that all components of an external wall, including the cladding, to be non-combustible.

However, BCA Clause C1.9(e) allows the following combustible materials to be used wherever a non-combustible material is required:

- (i) Plasterboard.
- (ii) Perforated gypsum lath with a normal paper finish.
- (iii) Fibrous-plaster sheet.
- (iv) Fibre-reinforced cement sheeting.
- (v) Pre-finished metal sheeting having a combustible surface finish not exceeding 1 mm thickness and where the Spread-of-Flame Index of the product is not greater than 0.
- (vi) Sarking-type materials that do not exceed 1 mm in thickness and have a Flammability Index not greater than 5.
- (vii) Bonded laminated materials where –
 - (A) each lamina, including any core, is non-combustible; and
 - (B) each adhesive layer does not exceed 1 mm in thickness and the total thickness of the adhesive layers does not exceed 2 mm; and
 - (C) the Spread-of-Flame Index and the Smoke-Developed Index of the bonded laminated material as a whole do not exceed 0 and 3 respectively.

As a result, it is a Deemed-to-Satisfy Solution, for example, to have an external wall with a plasterboard internal lining, satisfying Clause C1.9 item (e)(i) and an external cladding satisfying Clause C1.9 item (e)(vii). As long as all other components of this external wall, such as insulation and cavity barriers, are non-combustible, the wall meets the requirements of the Deemed-to-Satisfy Provisions. It is noted that sometimes such external walls require to have a “Fire-resistance level” (FRL), but this is not part of the current review.



Vitracore G2 – Deemed-to-Satisfy

Vitracore G2 is a bonded laminated material comprising three main layers (lamina); two external aluminium sheets surrounding a corrugated aluminium core. The sheets have different painted finishes and corrosion protective layers depending on the end use. The aluminium components are non-combustible (as individually tested in accordance with AS 1530.1 ^[5]), the two adhesive layers satisfy the BCA Clause C1.9 (e)(vii)(B), and when the product is tested as a whole to AS1530.3 it satisfies the BCA Clause C1.9 (e)(vii)(C). Testing of Vitracore G2 was carried out by CSIRO and a compliance test report issued ^[6].

Therefore, from a fire safety viewpoint in accordance with the BCA, excluding fire resistance levels which may or may not be required for a particular external wall ^[7], Vitracore G2 may be used for all Types of construction as a cladding on any external wall regulated by the BCA. Other parameters such as weather resistant requirements are subject to additional assessments which does not form part of this review.

Vitracore G2 – Performance Solution

The other mechanism of complying with the NCC is through the use of a Performance Solution. Typically, a Performance Solution is prepared by a fire safety engineer for a particular building following the process outlined in the International Fire Engineering Guidelines (IFEG) ^[8]. As part of developing a Performance Solution, the fire safety engineer may use the results from large-scale façade assembly testing, or a Verification Method to demonstrate compliance with the relevant Performance Requirements. The Australian Standard AS 5113:2016 is referenced as part of the Verification Method CV3 in the BCA. AS 5113:2016 specifies that external wall fire tests shall be performed according to ISO 13785-2 or BS 8414-2.

A significant limitation of the ISO 13785-2 and BS 8414-2 tests is that they are not full-scale. Instead, they are large-scale tests that provide an indication of how a “cladding system” will perform when exposed to a very large compartment fire. They do provide engineering data that a fire safety engineer can use to predict full scale performance but only the performance of a “cladding system” that is identical to the tested system. This is a significant point as the use of insulation or other products that have not been tested may result in a major change in the performance.

⁵ AS 1530.1-1994, Methods for fire tests on building materials, components and structures, Part 1: Combustibility test for materials. Standards Australia, Sydney, NSW Australia.

⁶ Certificate of Test, Vitracore G2 Report FNC11476, Combustibility Test for Materials in Accordance with AS 1530.1-1994. CSIRO, North Ryde, NSW, Australia, September 2015.

⁷ Fire-resistance level (FRL) is a defined term in the BCA and is required to be determined in accordance with Schedule 5 of the BCA. The use of any cladding material is subject to the restriction that its use does not adversely impact the FRL of the tested wall assembly.

⁸ ABCB, 2005. International Fire Engineering Guidelines. Australian Building Codes Board, Canberra, ACT, Australia.



BS 8414-2:2015

BS 8414-2:2015 Fire performance of external cladding systems Part 2: Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame is a large-scale system test.

BS 8414-2:2015 uses a test apparatus that is at least 8 m high and 2.6 m wide with a full height wing wall greater than 1.5 m wide. A 2 m by 2 m opening in the large wall contains a combustion chamber with a wood crib fire source. The fire source has a peak heat release rate of about 3 MW.

The extent of flame spread up the façade is indicated by thermocouple measurements external to the face of the façade and within the interior. The temperature measurement locations are shown in Table 1. When the temperatures exceed 600 °C for a period of time, it is assumed that the flame has reached the respective thermocouple location. In addition to flame spread indication, the test standard requires that the test report indicate cladding detachment or collapse.

BS 8414-2:2015 does not specify acceptance criteria; but the test reports provide useful information about the tested cladding system performance. Alternatively, the acceptance criteria in BR135^[9] is sometimes used to indicate successful fire performance of a tested system.

Table 1 - Thermocouple locations

Location		
Level 1 – 2.5 m above opening	External	50 mm in front of finished face of cladding
Level 2 - 5 m above opening	External	50 mm in front of finished face of cladding
Level 2 - 5 m above opening	Internal – Panel cavity	
Level 2 - 5 m above opening	Internal – Frame cavity	

AS 5113:2016

The Australian equivalent of BS 8414-2:2015 is AS 5113:2016 Fire propagation testing and classification of external walls of buildings. The principle difference between BS 8414 and AS 5113 is that the Australian standard requires an additional temperature measurement 900 mm above the combustion chamber's lintel on the inside (unexposed) surface of the wall.

Unlike BS 8414 the Australian standard also has acceptance criteria. These are External Wall (EW) and Building to Building (BB). The EW related to flame spread as determined

⁹ Colwell, S., Baker, T. (2013) "Fire performance of external thermal insulation for walls of multistorey buildings". Garston, Watford, UK: IHS BRE Press, Report No.: 978-1-84806-234-4 Document No.: BR 135.



by temperature measurement are listed in Table 2. These are the critical parameters that a Performance Solution will need to evaluate to insure there is no non-conforming fire spread up a façade. In addition to the temperature criterion, AS 5113 has a falling debris criterion which limits the duration of burning of any falling debris to less than 20 seconds and limits the total post-test debris field to 2 kg. This debris includes any material that falls off the wall including the cladding and other system components. Therefore, the debris is very dependent on the system being tested including sealants, cavity barriers and other wall components in addition to the cladding itself. Like the flame spread behaviour in the test, the debris behaviour is also an important parameter for the performance analysis of a cladding system.

Table 2 - Temperature criteria

Location	Temperature	Duration
Level 2, Exterior	600 °C maximum	30 seconds
Level 2, Interior	250 °C maximum	30 seconds
900 mm above lintel, interior ^[10]	180 °C rise	

No aluminium panel (either solid or composite panel) can pass the debris test criterion as aluminium panels degenerate during the fire test as the test fire's flame impingement on the cladding results in melting of aluminium. This is not the case with cement sheet or steel for example. On the other hand, there is some evidence that the common fastening mechanism used for cement sheet cladding fixing to facades also results in failure during the AS 5113:2016 test, resulting in some cement sheet systems failing the debris criterion. Nonetheless, cement sheet cladding is likely to pass the temperature or flame spread criterion of AS 5113:2016. Likewise, a large fire like the 3 MW fire used in the test will likely result in window breakage in a glass curtain wall. This will result in window glass debris falling during a real fire which will likely exceed the 2 kg debris limit of the AS 5113:2016 test.

Vitracore G2 – Large scale test performance

Vitracore G2 is Deemed-to-Satisfy and there is no NCC requirement to test it using BS 8414-2:2015 or AS 5113:2016. However, these tests have been done (there was one test with both test protocols reported). The tested assembly was described as^[11]:

- 92 mm deep steel frame system clad with one layer of 13mm thick non-fire rated plasterboard on the unexposed side.
- The exposed side consisted of one layer of 4 mm thick Fairview Architectural Vitracore G2 aluminium composite panel assembly screw fixed to 25mm deep top hats.
- The top hats fixed to the steel frame over a layer of 6mm thick TBA Firefly (Breathable) Vulcan Fire Barrier (installed vertically).

¹⁰ This requirement only applies if the wall is not required to have a specified FRL.

¹¹ Loh, K. and Halliday, S. Results letter: Fire Propagation Test EWFA No, 51804400, Exova Warrington Aus Pty Ltd, Dandenong, VIC 28 November 2017.



- TBA Firefly (breathable) Non-combustible Sarking installed horizontally over the Vulcan Fire Barrier.
- R2.5 90mm Earthwool was installed in the cavity of the steel framing.
- TBA Firefly Intuspan Cavity Barriers were installed in the top hats at each horizontal joint of the panels.
- TBA Intubatt was into the top hats around the perimeter of the reveal and horizontally at nominally 1/3 panel heights.

TBA Intubatt was also installed as [a] backing rod at the corner join. The reveal was further protected by TBA Firefly Penowrap and folded galvanised steel sheet. The horizontal and vertical joints were sealed with TBA Firefly Intusil.

Large-scale test results

The flame propagation was less than 5 m as illustrated in the flame pattern in Figures 1 and 2.

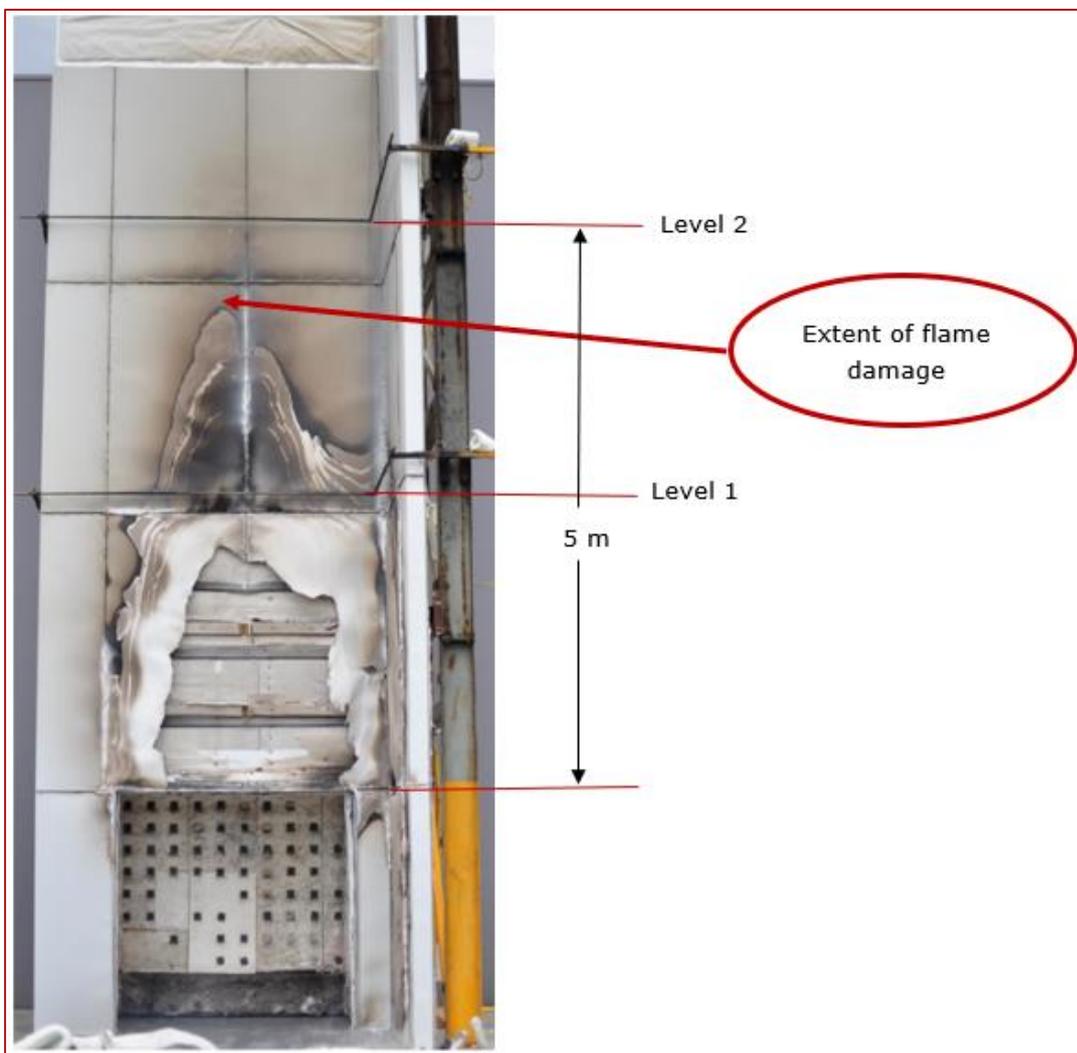


Figure 1 - Large scale post-test damage pattern

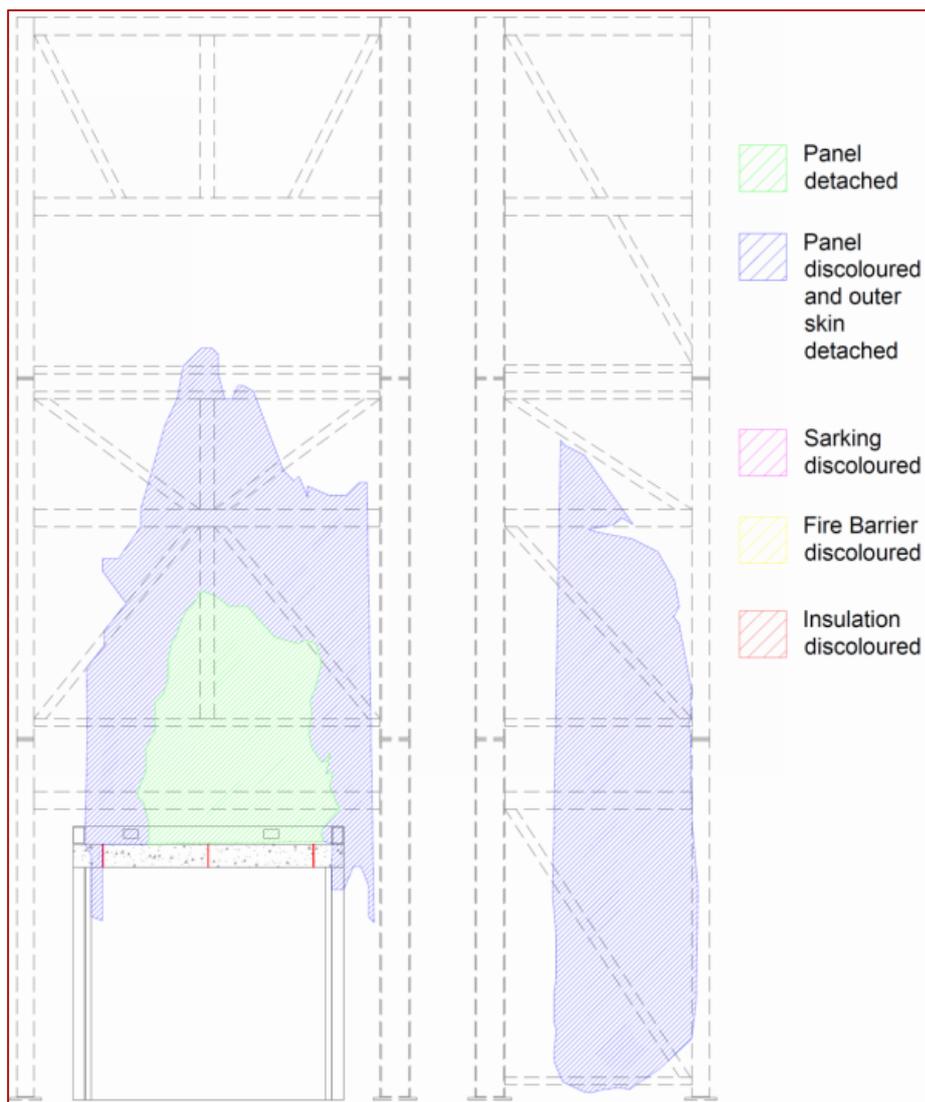


Figure 2 - Schematic of Vitracore G2 condition post-test

The acceptable flame spread is also indicated by the temperature measurements. The critical temperatures are within the specified criteria as illustrated in Table 3. Therefore, the Vitracore G2 passed the BR 135 criteria when tested to BS 8414-2:2015. However, as expected for an aluminium panel, the debris criterion of AS 5113:2016 was not passed as the total debris, cladding plus system components, exceeded 2 kg in total mass and continued to flame for more than 20 seconds.

Table 3 - Large scale test maximum temperature data

Location	Acceptable Temperature	Actual (measured) Temperature	Outcome
Level 2, Exterior	600 °C maximum	483 °C	Pass
Level 2, Interior	250 °C maximum	152 °C	Pass
900 mm above lintel, interior	180 °C rise	76 °C	Pass



Ministerial Guideline MG-14

Minister's Guideline MG-14^[12], which is specific to Victoria, states that an application for building permits involving combustible cladding should include a determination of the Building Appeals Board (BAB) that the installation of the Prescribed Combustible Product in relation to that application complies with the Act and Regulations.”.

Vitracore G2 does not have a polyethylene core material. Therefore, Vitracore G2 is not a Prescribed Combustible Product and Ministerial Guideline MG-14 is not applicable.

Use of Vitracore G2

In summary, Vitracore G2 may be used as a cladding for an external wall as it complies with the Deemed-to-Satisfy requirements of the NCC. If a Performance Solution is desired, a fire safety engineer may choose to use the results of the recently conducted large scale test as part of the basis for their design. However, as with all large test results conducted in accordance with BS 8414-2:2015 or AS 5113:2016, the results are only applicable to construction assemblies built exactly the same as that which was tested.

Yours sincerely,

M.C. Hui

MEng (Building Fire Safety & Risk Engineering),
BSc (Eng)(Hons), CEng, CEng, NER (Fire Safety
& Mechanical) 90181, RBP EF 1005, C10 BPB
1721, RPEQ (Fire Safety & Mechanical) 21104,
FRM-024 (Fire Safety Engineer and Auditor),
FIEAust, FIFireE, MSFPE, MSFS

Technical Director | Quality Manager

RED Fire Engineers Pty Ltd

Email: mc@redfireengineers.com.au

Mobile: +61 402 639 794

¹² Ministerial Guideline MG-14 can be accessed at this link:

https://www.planning.vic.gov.au/_data/assets/pdf_file/0031/118399/Ministerial-Guideline-MG-14-Issue-of-building-permits-ACP-and-EPS.pdf