Reaction to fire test report

Test standard: Ad-hoc test based on ISO 13785-1:2002

Test sponsor: Cladding Safety Victoria (CSV)

System: An aluminium composite panel (ACP) wall system and a mock balcony setup representative of an in-situ façade - [redacted]

Job number: RTF230085

Test date: 22 April 2024 Revision: R1.0

Quality management

<table>
<tr><th>Revision</th><th>Date</th><th colspan="4">Information about the report</th></tr>
<tr><td rowspan="4">R1.0</td><td rowspan="4">25 June 2024</td><td>Description</td><td colspan="3">Initial issue</td></tr>
<tr><td></td><td>Prepared by</td><td>Reviewed by</td><td>Authorised by</td></tr>
<tr><td>Name</td><td colspan="3" rowspan="2">[redacted]</td></tr>
<tr><td>Signature</td></tr>
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Warringtonfire* Australia Pty Ltd
ABN 81 050 241 524

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Contents

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1. Introduction

This report documents the findings of an ad-hoc reaction to fire test of an aluminium composite panel (ACP) wall system and a mock balcony setup representative of an in-situ façade - [redacted] performed on 22 April 2024. The test was based on some general requirements of ISO 13785-1:2002.

Warringtonfire performed the test at the request of the test sponsor listed in Table 1.

Table 1 Test sponsor details

Test sponsor	Address
Cladding Safety Victoria (CSV)	717 Bourke Street Docklands VIC 3808 Australia

2. Test specimen

2.1 Schedule of components

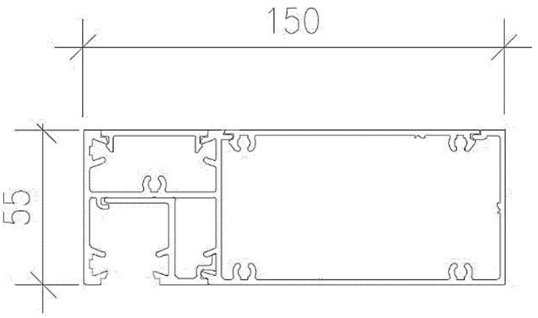
Table 2 describes the test specimen and lists the schedule of components. These were provided by the representatives of the test sponsor and surveyed by Warringtonfire. All measurements were done by Warringtonfire – unless indicated otherwise.

Detailed drawings of the test specimen are provided in Appendix A.

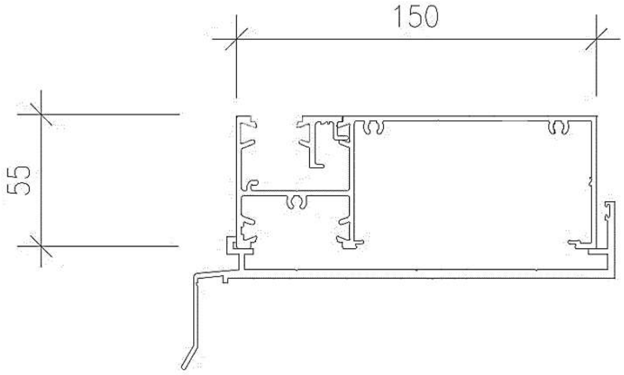
Table 2 Schedule of components

Item	Description	
Cladding		
1.	Item name	Aluminium composite panel (ACP) – for upper level
	Product	[redacted]
	Manufacturer/Supplier	[redacted]
	Batch	[redacted]
	Material	The material was nominated as panels consisting of two layers of aluminium sheets sandwiching a layer (core) of 100% polyethylene (PE) with no filler. Analysis was conducted by Foray Laboratories. Refer to Appendix C for more detailed results.
	Size	As shown in Figure 13. Total thickness – 4.0 mm Skin thickness (both sides) – 0.6 mm
	Measured mass/unit area densities	Panel areal density – 5.5 kg/m²
2.	Item name	Aluminium composite panel (ACP) – for lower level
	Product	Aluminium Composite Panel - 4 mm White Gloss/Grey
	Manufacturer/Supplier	[redacted]
	Note on Supply of Panel	On behalf of CSV, Warringtonfire acquired the ACPs with close to 100 % polyethylene core. To the best of Warringtonfire's knowledge this is a custom production which the supplier doesn't normally supply. The panels were provided on the basis that this was for research purposes and not any purpose other than fire testing.
	Batch date	2023/12/05

Item	Description		
	Material	The material was nominated as panels consisting of two layers of aluminium sheets sandwiching a layer (core) with close to 100 % polyethylene (PE). Analysis conducted by the analytical centre of UNSW showed that the core consisted of polyethylene (PE) - found to be 96 % w/w - whilst the remainder of the material after the ash test was found to be 3.3 % inert material. Refer to Appendix C for more detailed results.	
		Skins	Front skin – Gloss white Back skin – Light grey
		Core	Black
	Size	Total panel thickness – 4.0 mm Skin thickness – 0.5 mm (both) Uncut: 4.0 m × 1.22 m Refer to Appendix A for individual panel sizing details.	
	Measured mass/unit area densities	Panel areal density – 5.6 kg/m²	
3.	Item name	FR Plasterboard	
	Product	[redacted]	
	Manufacturer/Supplier	[redacted]	
	Size	Measured board: 2700 mm × 1200 mm × 13 mm	
	Batch Date	27/07/2023	
4.	Item name	Back-pan	
	Product	0.55 mm thick Galvabond steel	
	Supplier	[redacted]	
	Size	Measured: 280 mm wide × 1000 mm long	
5.	Item name	“Non-combustible” cladding	
	Product	[redacted]	
	Manufacturer/Supplier	[redacted]	
	Size	15 mm thick	
	Batch	[redacted]	
Glazing and glazing framing			
6.	Item name	Glazing	
	Product	10 mm toughened glass	
	Manufacturer/Supplier	[redacted]	
	Batch	[redacted]	
	Material	10CLF	
	Size	795 mm × 940 mm × 10.0 mm; and 1260 mm × 940 mm × 10.0 mm;	
7.	Item name	Vertical balustrade framing member	
	Product	Slotted aluminium post	
	Supplier	[redacted]	
	Size	50 mm × 50 mm × 1075 mm tall with a 14 mm wide slot	
8.	Item name	Horizontal balustrade framing member	
	Product	Slotted aluminium rail	

Item	Description	
	Supplier	[redacted]
	Size	70 mm wide × 35 mm tall × 2175 mm long
Framing		
9.	Item name	Test rig frame - 90 × 90 SHS frame
	Material	Mild steel
	Size	89 mm × 89 mm × 5 mm thick – refer to Figure 12
10.	Item name	[redacted] frame mullion [redacted]
	Profile	
	Material	6060 T5 aluminium alloy
	Manufacturer/Supplier	[redacted]
11.	Item name	Furring Channel - framing
	Size	50 mm wide × 28 mm deep × 0.50 BMT
	Material	Galvanised steel
	Manufacturer/Supplier	[redacted]
12.	Item name	[redacted] standard direct fix clip
	Size	115 mm wide × 30 mm deep × 30 mm high × 1.5 mm thick
	Material	Galvanised steel
	Manufacturer/Supplier	[redacted]
13.	Item name	Steel frame
	Size	Studs and noggings: 90 mm deep × 40 mm wide × 0.7 BMT
	Installation	The steel framing members were riveted (item 19) to one another.
	Material	[redacted]
	Manufacturer/Supplier	[redacted]
Insulation		
14.	Item name	50 mm thick polyethylene terephthalate (PET) insulation
	Density	~13 kg/m^3
	Colour	White
	Manufacturer/Supplier	[redacted]
15.	Item name	50 mm thick Foil faced rock wool
	Density of core	Unknown
	Size	Nominated by representatives of the test sponsor. The insulation was internal and therefore could not be measured.
	Supplier	[redacted]
Sealant/Adhesive		

Item	Description	
16.	Item name	Weathering sealant
	Product type	Silicone sealant
	Product name	[redacted]
	Manufacturer/Supplier	[redacted]
	Usage	Placed at ACP edges and over screw and rivet locations.
17.	Item name	Fire-rated sealant
	Product name	[redacted]
	Manufacturer	[redacted]
	Usage	Used to seal the gaps between the back-pan (item 4) and the aluminium framing (item 10) behind the air transfer grille (item 22)
Fixings		
18.	Item name	Wafer head screws – zinc coated steel
	Size	6g × 16 to 25 mm long
	Installation	Used to fix back-pan (item 4) to the aluminium mullion (item 10)
19.	Item name	Aluminium rivet
	Size	Ø3 mm
	Installation	Used to fix the air transfer grille (item 22) to the aluminium framing (item 10) and the steel framing (item 13).
20.	Item name	Plasterboard and cladding (used for Promatect) screws
	Size	8g × 50 to 65 mm - long fine thread SDS
21.	Item name	Furring channel clip screws
	Size	10g × 22 mm long, hex head, self-drilling screws
Other things		
22.	Item name	Air transfer grille
	Product name	[redacted]
	Size	940 mm wide × 270 mm tall × 50 mm deep (45° angled blades)
	Material	6060 T5 aluminium alloy
	Installation	Installed within the aluminium framing (item 10) above the ACPs (item 6). The blades were angled at an upward slope starting from the outside going into the wall. The grille was fixed to the aluminium framing using aluminium rivets (item 19), one rivet at each corner of the grille.
	Manufacturer/Supplier	[redacted]
23.	Item name	Vermin mesh
	Size	940 mm wide × 270 mm tall
	Material	Coated steel
	Installation	The mesh was installed behind the air transfer grille.
24.	Item name	Aluminium sill with weepholes
	Size	165 mm × 30 mm tall flanges × 2 mm thick. Containing weepholes

Item	Description	
	Profile	
	Material	6060 T5 aluminium alloy
	Manufacturer/Supplier	[redacted]
	Installation	Installed above the Promatect board (item 5) compartment residing over the SHS unit (item 9).

Installation method

Test Rig:	The test rig frame (item 9) was the main support for the test specimen. The specimen was fixed to the test rig via the aluminium framing (item 10). The SHS was also used at the false floor level. Steel studs (item 13) were also used at the false floor level.
External wall:	The aluminium framing (item 10) consisted of extrusions around the perimeter and a central vertical member. Steel back-pans (item 4) were fixed to the back of the aluminium framing (item 10) using screws (item 18) fixed – at 200 mm centres around the perimeter. Furring channel clips (item 12) were screw fixed (item 21) to the aluminium framing – fixing at ~1200 mm centres vertically. Slotted into the clips were steel furring channels (item 11). Within the furring channels polyester insulation (item 14) was fitted. Two layers of plasterboard (item 8) were screw (item 20) fixed to the back of the furring channels. Screw fixings were at 600 mm centres for the first layer and 200 mm to 300 mm centres. To the front face of the back-pan (item 4) was installed mineral wool insulation (item 15). ACP (item 6) was used to clad the majority of the front side of the aluminium framing (item 10). The ACPs (item 6) were “glazed in” the aluminium framing inside grooves and behind aluminium beads. The perimeter of the visible ACP and aluminium framing was sealed with a 10 mm bead of sealant (item 16).
Balcony:	At the false floor level, a balcony structure was created. Details of this are shown in Appendix A. The balcony consisted of the horizontal member of the test rig (item 9) and steel framing (item 13). The steel false floor was capped with 2 layers of “non-combustible” Promatect board (item 5). The boards were fixed to the steel substructure with self-drilling plasterboard screws (item 20) - at 500 mm centres.
Wall base:	The base of the walls - at the floor junction – consisted of an aluminium sill (item 24) fixed upon a Promatect board (item 5) protected SHS unit (item 9).

For more details regarding the description of the specimen refer to Appendix A.

3. Test procedure

Table 3 details the test procedure for this reaction to fire test.

Table 3 Test procedure

Item	Detail	
Statement of compliance	The ad-hoc test – which was based on ISO 13785-1:2002 - was performed to determine the reaction to fire performance of an external wall cladding when exposed to heat from a simulated external fire with flames impinging directly upon a façade. The test utilises a burner used in ISO 13785-1:2002 with the specimen mimicking the as-is construction of the façade.	
Sampling / specimen selection	The laboratory was not involved in sampling or selecting the test specimen for the reaction to fire test. The results obtained during the test only apply to the test samples as received and tested by Warringtonfire.	
Test duration	60 minutes	
Ambient laboratory temperature	Start of the test	22 °C
Instrumentation and equipment	• Twelve mineral insulated metal sheathed (MIMS) Type K thermocouples with an overall diameter of 1.5 mm with the measuring junction insulated from the sheath were positioned at various positions 50 mm away from the specimen. These locations are shown in Figure 1 and Figure 2 • Six mineral insulated metal sheathed (MIMS) Type K thermocouples with an overall diameter of 1.5 mm with the measuring junction insulated from the sheath were positioned inside the specimen at the centre of the cavity. These locations are shown in Figure 1 and Figure 2. • The incident heat flux was measured in four locations: on the top of the specimen in line with the front face of the top wall, on the front face of the balcony in line with the balcony, in front of the glazing and behind the glazing. The heat flux was measured using Schmidt-Boelter type heat flux gauge with a range of 0-20 kW/m^2, 0-100 kW/m^2, 0-50 kW/m^2 and 0-20 kW/m^2, respectively. • Two plates with mineral insulated metal sheathed (MIMS) Type K thermocouples with an overall diameter of 1.5 mm with the measuring junction insulated from the sheath were positioned 50 mm away from the grilles. These locations are shown in Figure 1 and Figure 2. • The fire source was a propane (95% purity) gas burner 1.2 m long × 0.1 m deep × 0.15 m tall. The burner was placed on the floor in front of the specimen.	
Test procedure	• At least two minutes of baseline data was collected prior to burner ignition. Temperature and heat flux data was collected at 5 s intervals. • The heat output from the burner was held at 500 kW for 30 minutes. The burner was then turned off and the specimen observed for a further 30 minutes. • The test was ended at 60 minutes after burner ignition.	
Test number	Test three of a proposed four.	
Variations between test RTF230083.	• The test specimen contained a glazing element compared to the original test which was unprotected. • The source for the ACP on the lower level was different – as listed in the schedule of components, Table 2.	

4. Test measurements and results

Instrument locations are shown in Figure 1 and Figure 2. The results from the tests are summarised below. Photographs of the specimen are included in Appendix B.

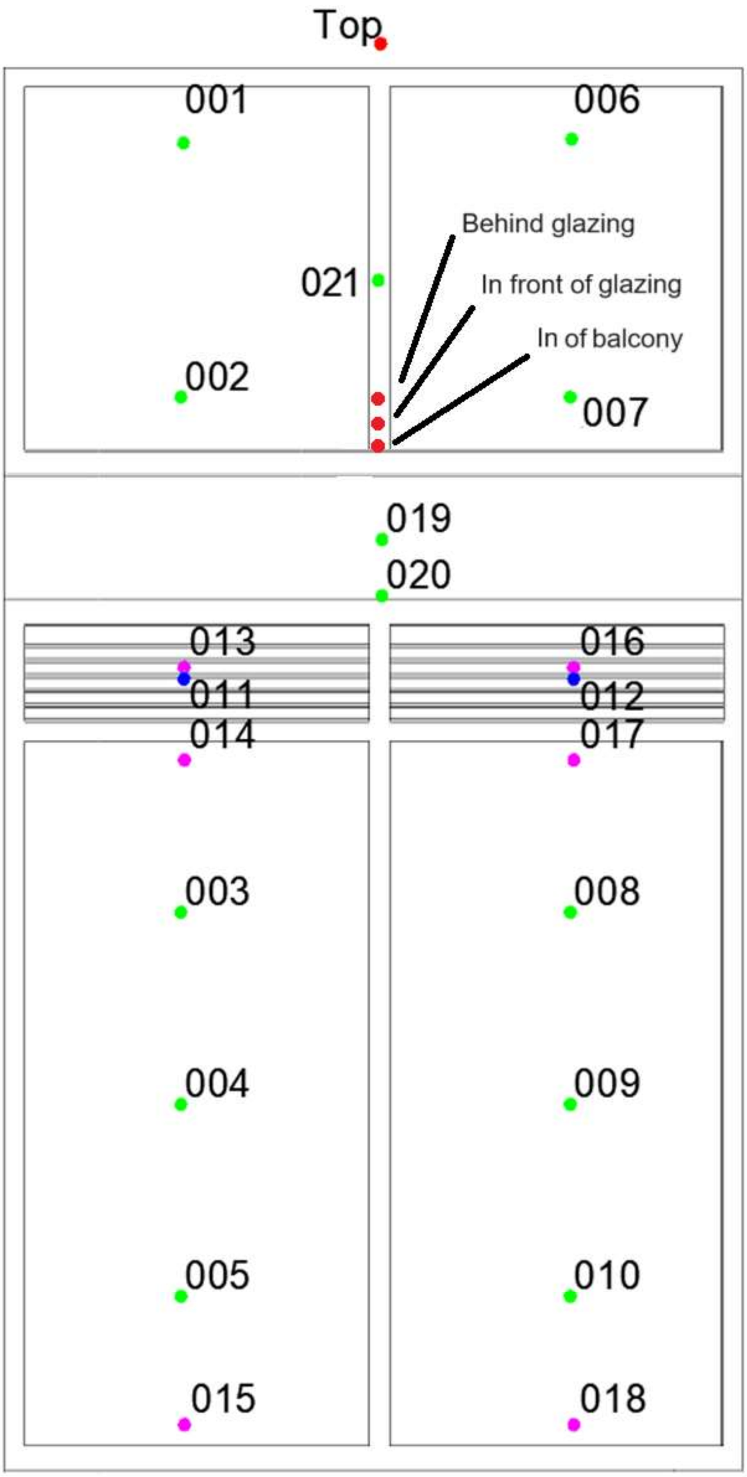


Figure 1 Instrumentation positions – View from in front of specimen

• Heat Flux gauge • External 1.5 mm MIMS • Internal 1.5 mm MIMS • Plate thermocouple

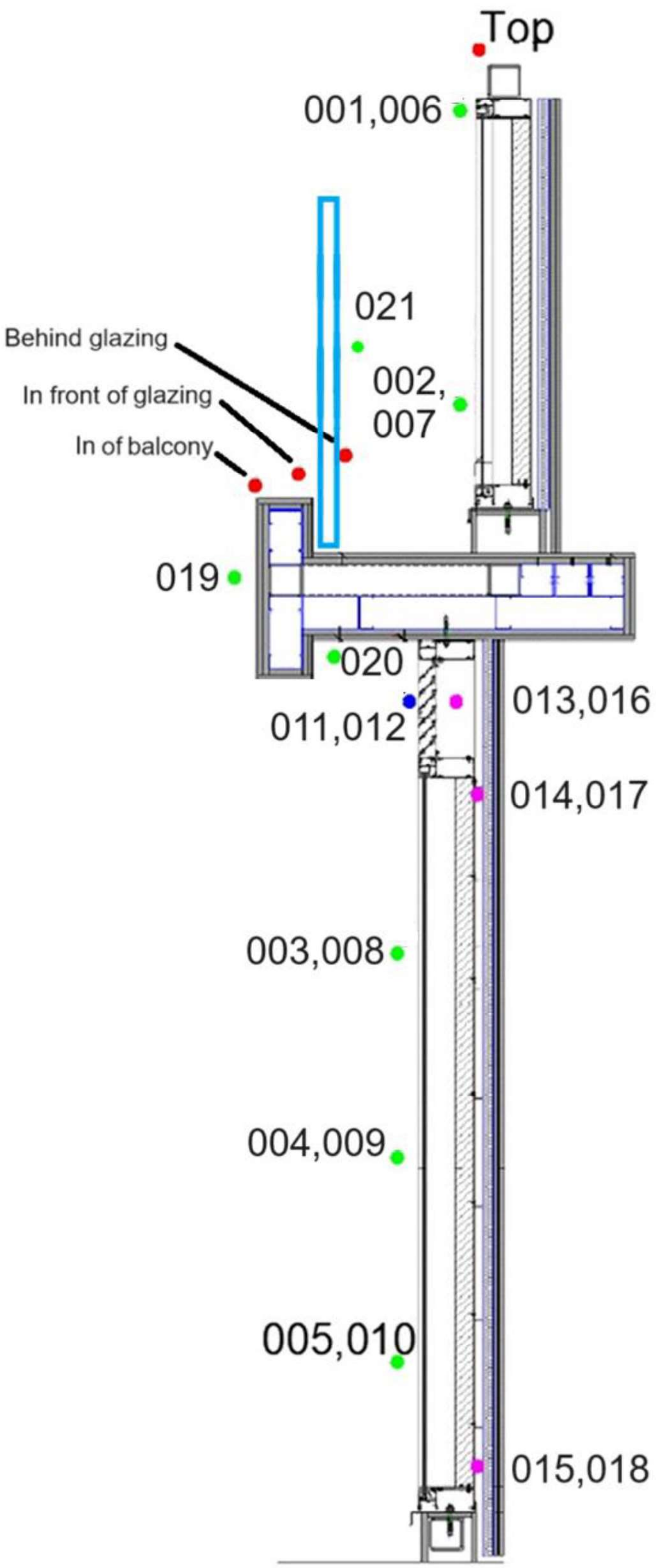


Figure 2 Instrumentation positions – View from the side of the specimen

• Heat Flux gauge **• External 1.5 mm MIMS** **• Internal 1.5 mm MIMS** **• Plate thermocouple**

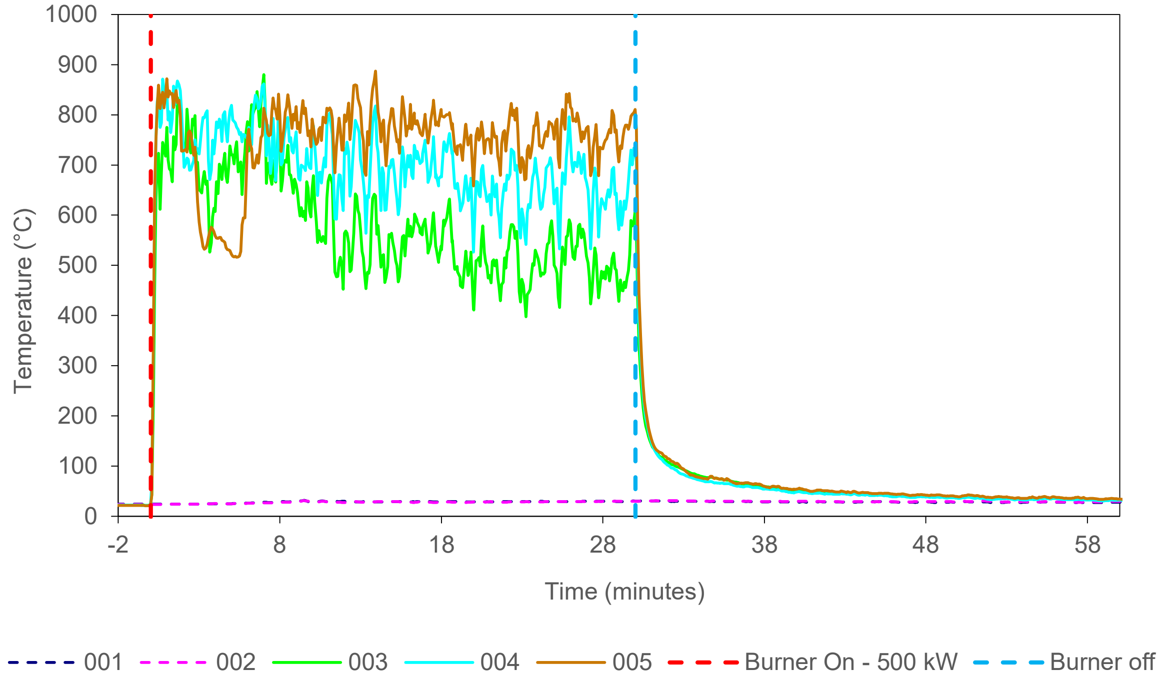


Figure 3 **External temperature data collected by thermocouples placed 50 mm from the front face of the specimen – East facade**

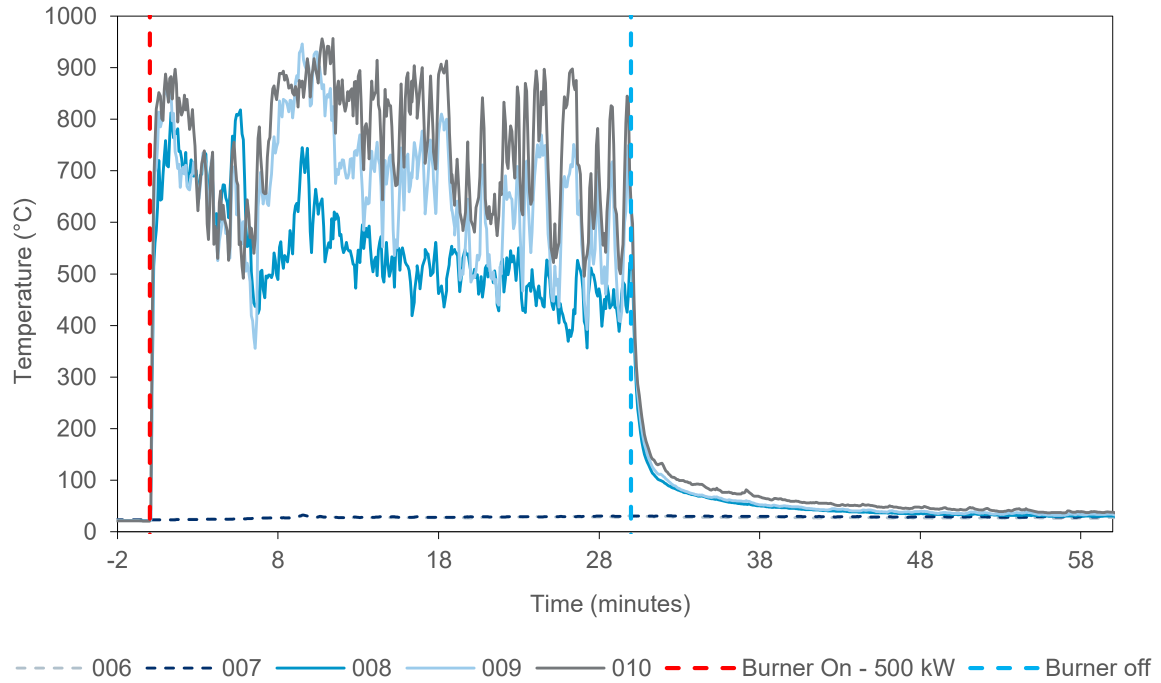


Figure 4 **External temperature data collected by thermocouples placed 50 mm from the front face of the specimen – West facade**

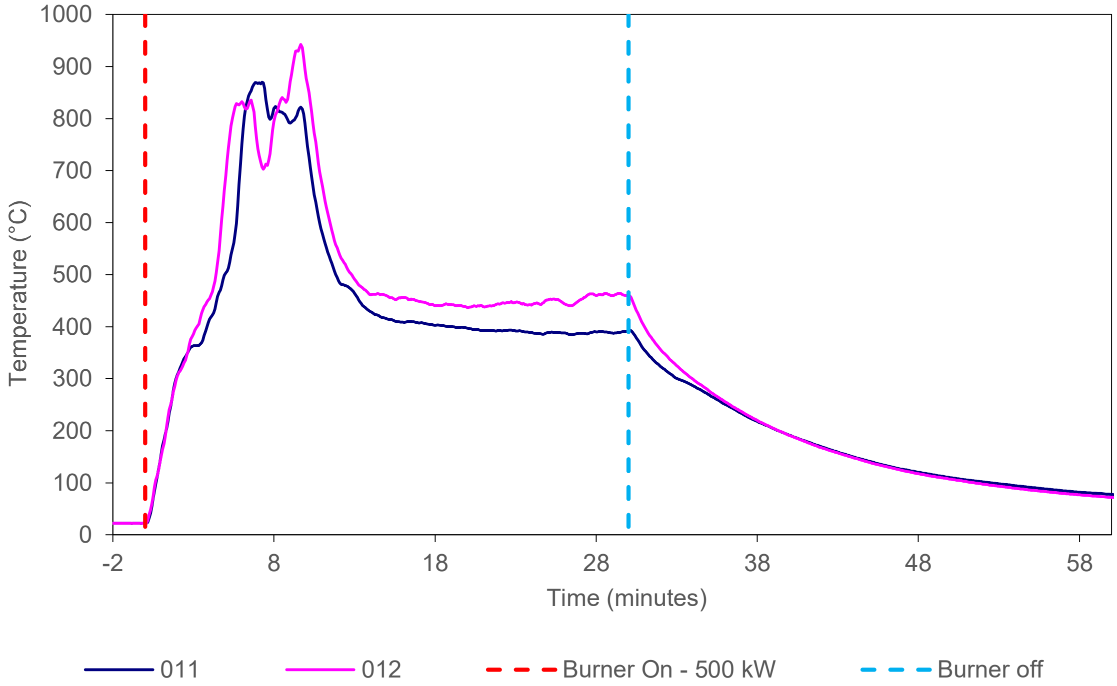


Figure 5 **External temperature data collected by plate thermocouples placed 50 mm from the front face of the specimen**

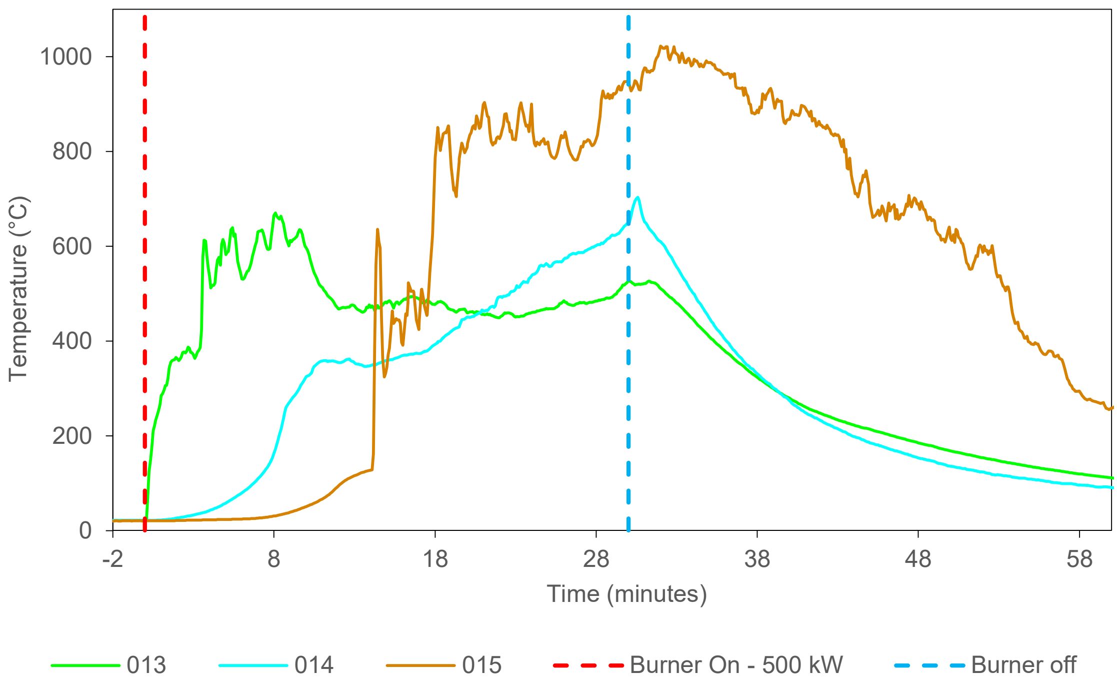


Figure 6 **Internal temperature data collected by thermocouples placed within the cavity – between the internal and external segments of the specimen – East façade**

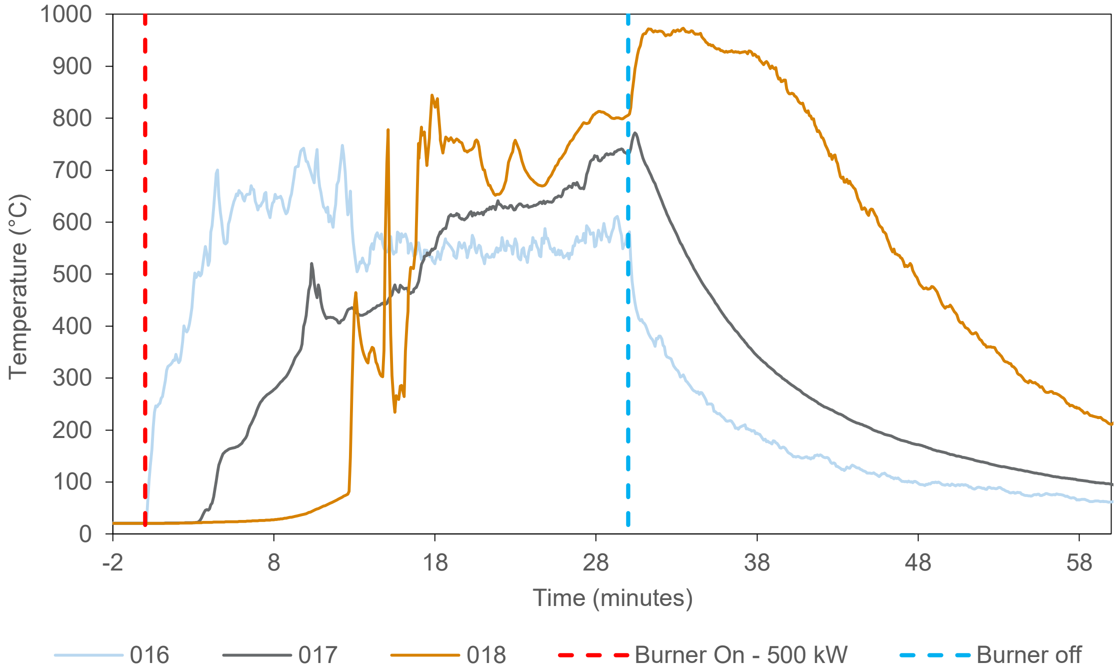


Figure 7 **Internal temperature data collected by thermocouples placed within the cavity – between the internal and external segments of the specimen – West façade**

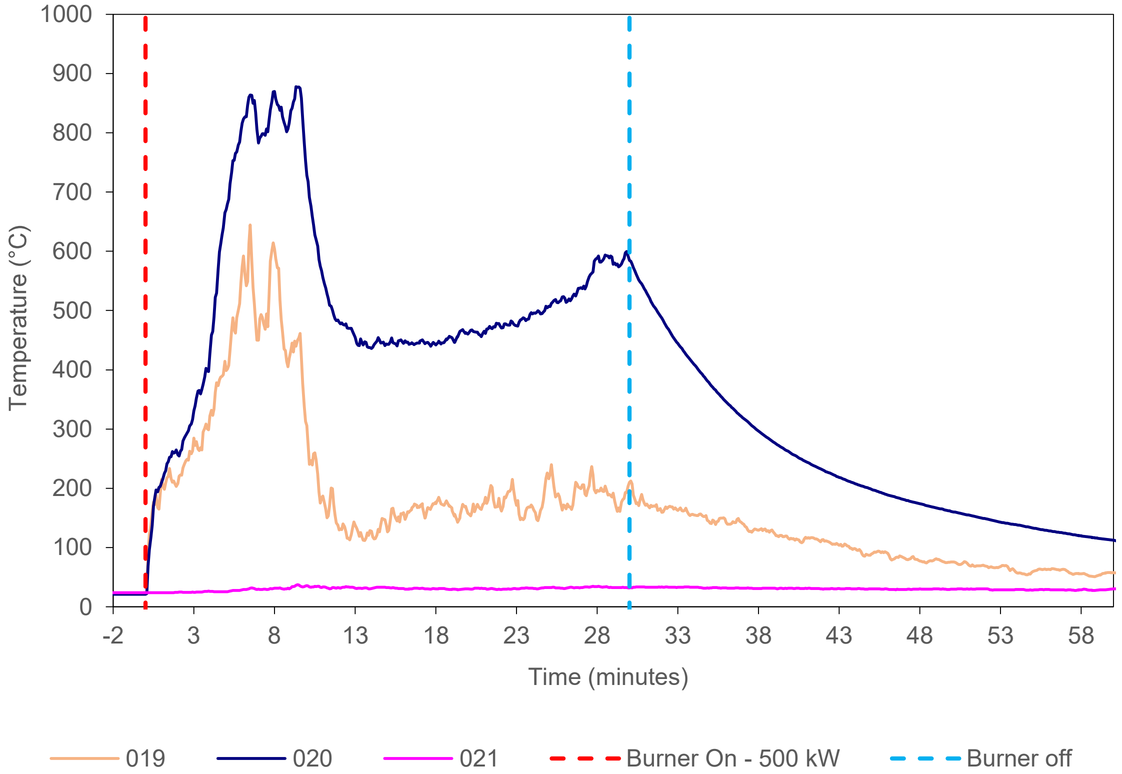


Figure 8 **External temperature data collected by thermocouples placed 50 mm from balcony face and underside cavity and behind glazing**

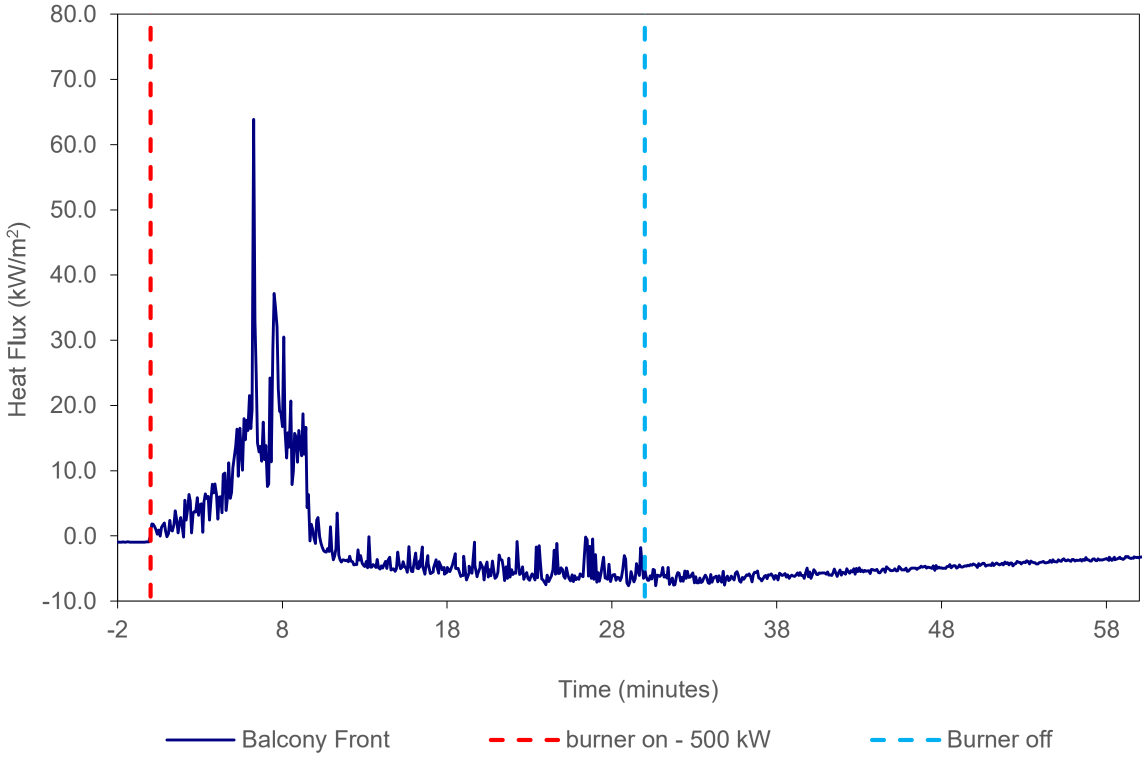


Figure 9 **Heat flux data collected by heat flux gauge at the top front of balcony**

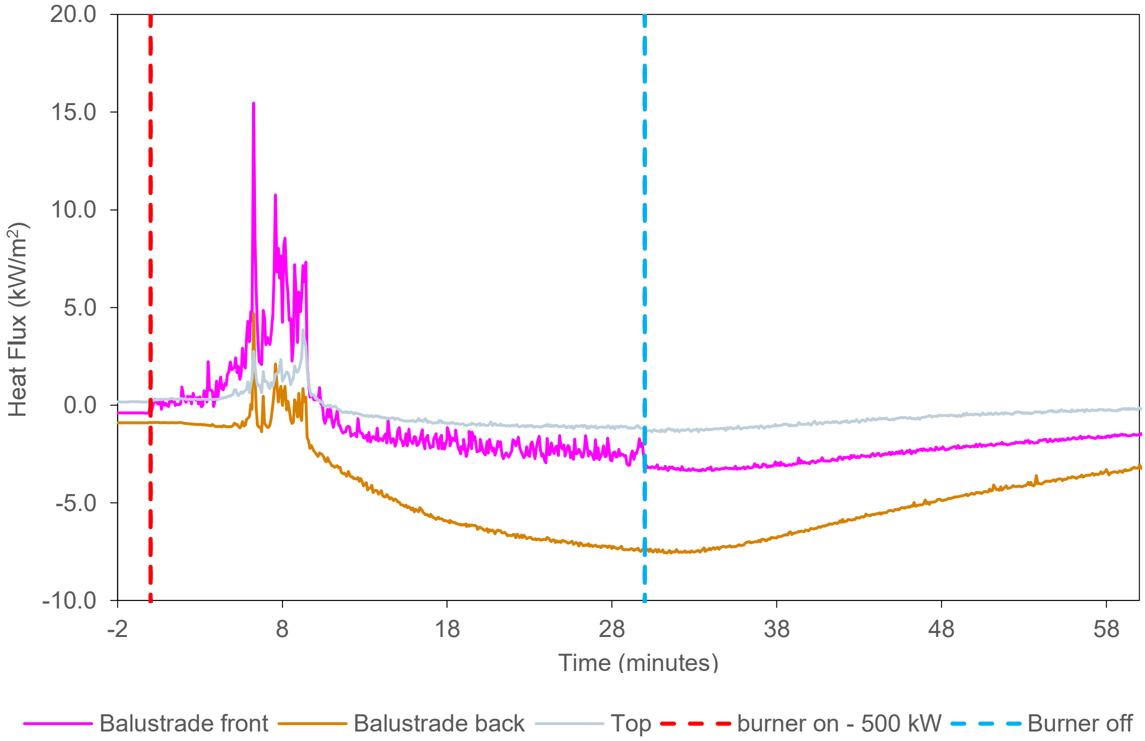


Figure 10 **Heat flux data collected by heat flux gauge in front of the glazing, behind the glazing and on top of the specimen**

Figure 11 Designation for test specimen observations

Table 4 shows the observations of any significant behaviour of the specimen during the test.

Video recordings were also taken of the test. A copy of the video recording is available upon request from the test sponsor or by contacting Cladding Safety Victoria. The video of the test should be viewed in conjunction the contents of this report.

Table 4 Test observations

Time		Section	Observation
Min	Sec		
-2	00	All	Data collection started.
0	00	All	The reaction to fire test was started with the burner ignited to a 500 kW heat output.
0	05	All	Flames reached A2 and B2.
0	25	B1	The front panel skin started to deform.
0	38	A1	The front panel skin started to deform.
1	15	A1/B1	The coating of the panel skin started to burn away.
2	40	2A/2B	The louvres started to deform.

Time		Section	Observation
Min	Sec		
3	28	-	Smoke was emitting from the front of the specimen from under the balcony.
3	32	A2	Flames were emitting through the louvres.
4	00	Unexposed	Smoke was emitting from the unexposed side of specimen from under the ceiling.
4	21	A2/B2	The louvres had further deformed.
4	27	B2	The flames were emitting from the louvres.
4	45	A1/A2	The specimen appeared to be contributing to the flaming.
5	00	Unexposed	Heavy smoke was emitting from the unexposed side of specimen from under the ceiling.
5	10	A1/A2	Flaming debris appeared to fall from the specimen.
5	15	A3/B3	Flames were consistently reaching past the height of the balcony.
5	30	A1	It was evident that the panel core was exposed to the fire.
5	45	A2/B2	The cavity belong the balcony was fully engulfed in flames.
5	51	B1	It was evident that the panel core was exposed to the fire.
6	00	A1/B1	There was more burning debris in front of the specimen.
6	05	A3/B3	Flames were constantly in front of the balcony.
6	20	A1/B2	It was evident that the front skins had opened up.
7	00	A1/B1	The specimen was heavily flaming and smoking.
8	00	A1/B1	The core of the panels continued to burn away.
8	20	A4/B4	Flames were continuously appearing in front of the glazing.
9	15	A1/B1	Almost all of the front panel skins have melted away. Flaming of the specimen was at the perimeter of the panels.
10	00	A3/B3	Flames in front of the balcony have died down.
12	15	A2/B2	Flames emitting from the louvres were evident.
15	00	A3/B3	Flames were no longer consistently appearing in front of the balcony.
20	00	A1/B1/ A2/B2	Apart from burning debris, the specimen did not appear to contribute significantly to flaming. The specimen as smoking heavily from the front.
25	00	B2	Flames from the specimen could be seen.
27	00	B2	Flaming of the specimen had increased.
30	00	All	The burner was turned off. Some independent flaming was still present.
30	02	B2	Most flaming of the specimen had died off, apart from flaming debris.
30	10	A2/B2	The specimen was smoking heavily.
38	00	All	Most of the flaming had died off.
50	00	All	Most smoke emissions had died off.
60	00	All	The reaction to fire test was ended.

5. Application of test results

5.1 Test limitations

The results of these fire tests may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

These results only relate to the behaviour of the specimen of the element of construction under the particular conditions of the test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, and they do not necessarily reflect the actual behaviour in fires.

5.2 Variations from the tested specimen

This report details methods of construction, the test conditions and the results obtained when the specific element of construction described here was tested following the procedure outlined in Table 3. Any significant variation with respect to size, construction details, loads, stresses, edge or end conditions is not addressed by this report.

It is recommended that any proposed variation to the tested configuration should be referred to the test sponsor. They should then obtain appropriate documentary evidence of compliance from Warringtonfire or another accredited testing authority.

5.3 Uncertainty of measurements

Because of the nature of reaction to fire testing and the consequent difficulty in quantifying the uncertainty of measurements obtained from a reaction to fire test, it is not possible to provide a stated degree of accuracy of result.

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Appendix A Drawings of test assembly

The drawings of the test assembly in Figure 12 to Figure 18 were provided by representatives of Warringtonfire. Figure 14 to Figure 18 were modified by Warringtonfire – name change of insulation. Dimensions, unless specified, are in mm.

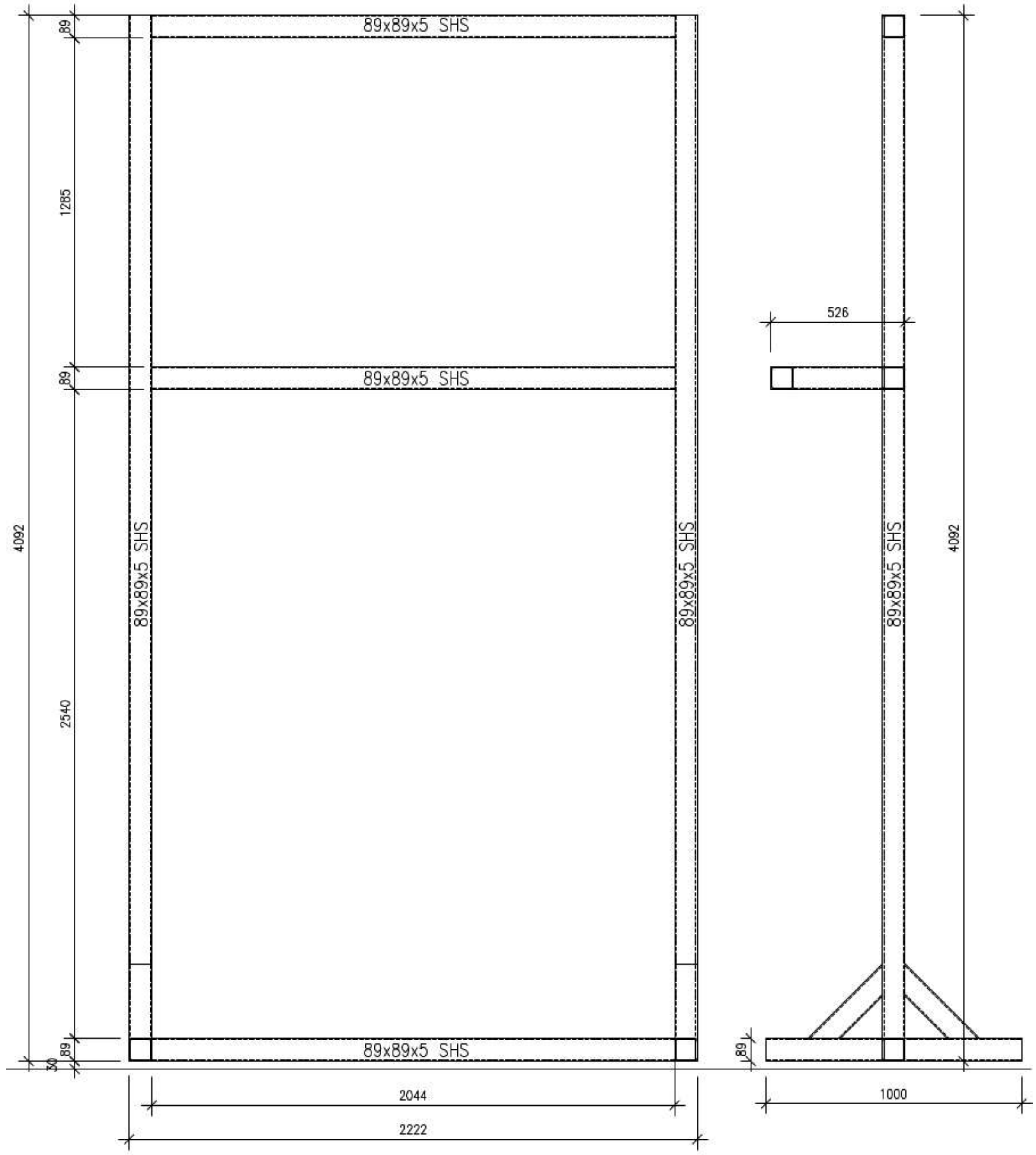

Figure 12 Elevation of test frame.

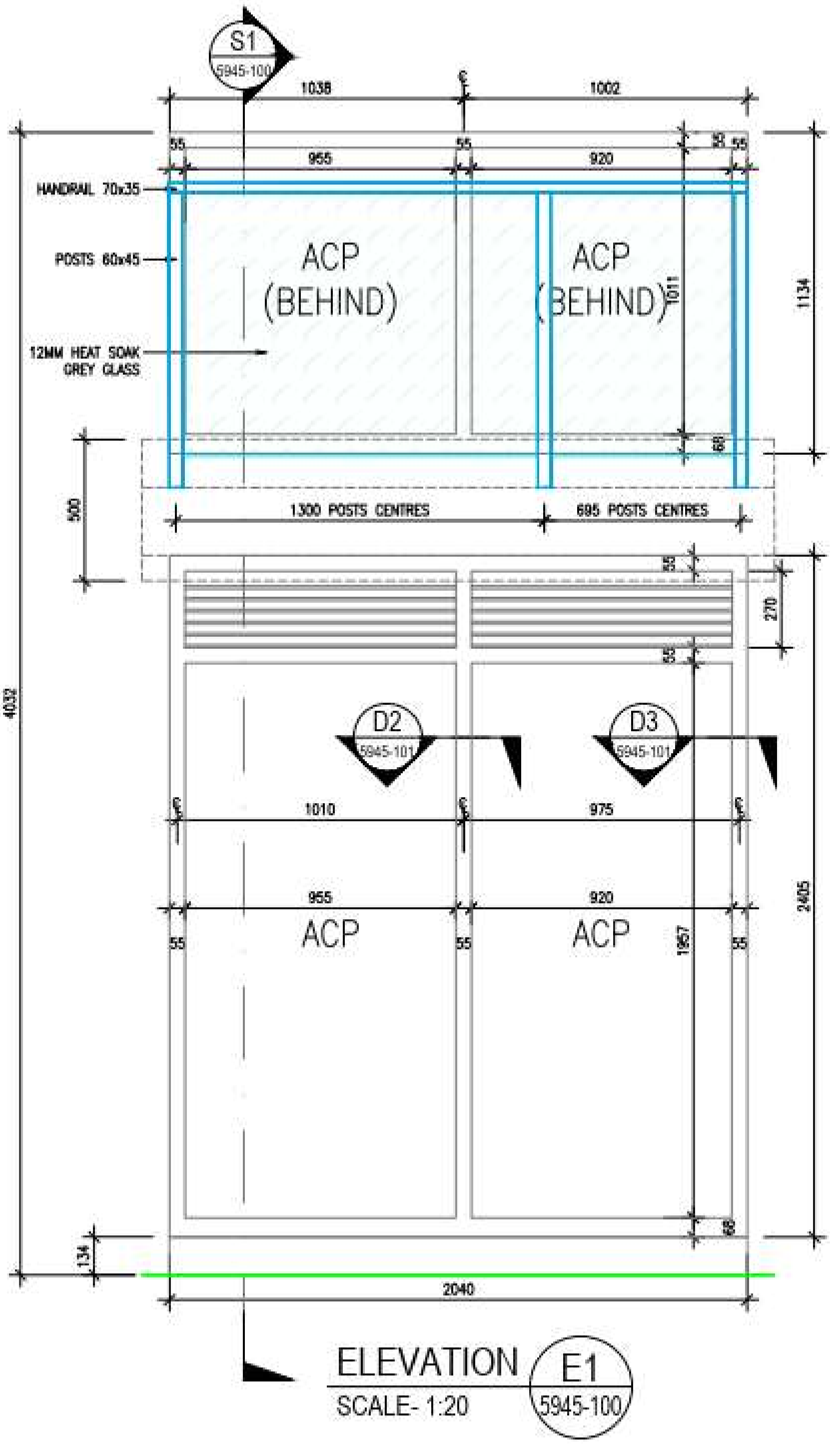

Figure 13 System assembly – Front view

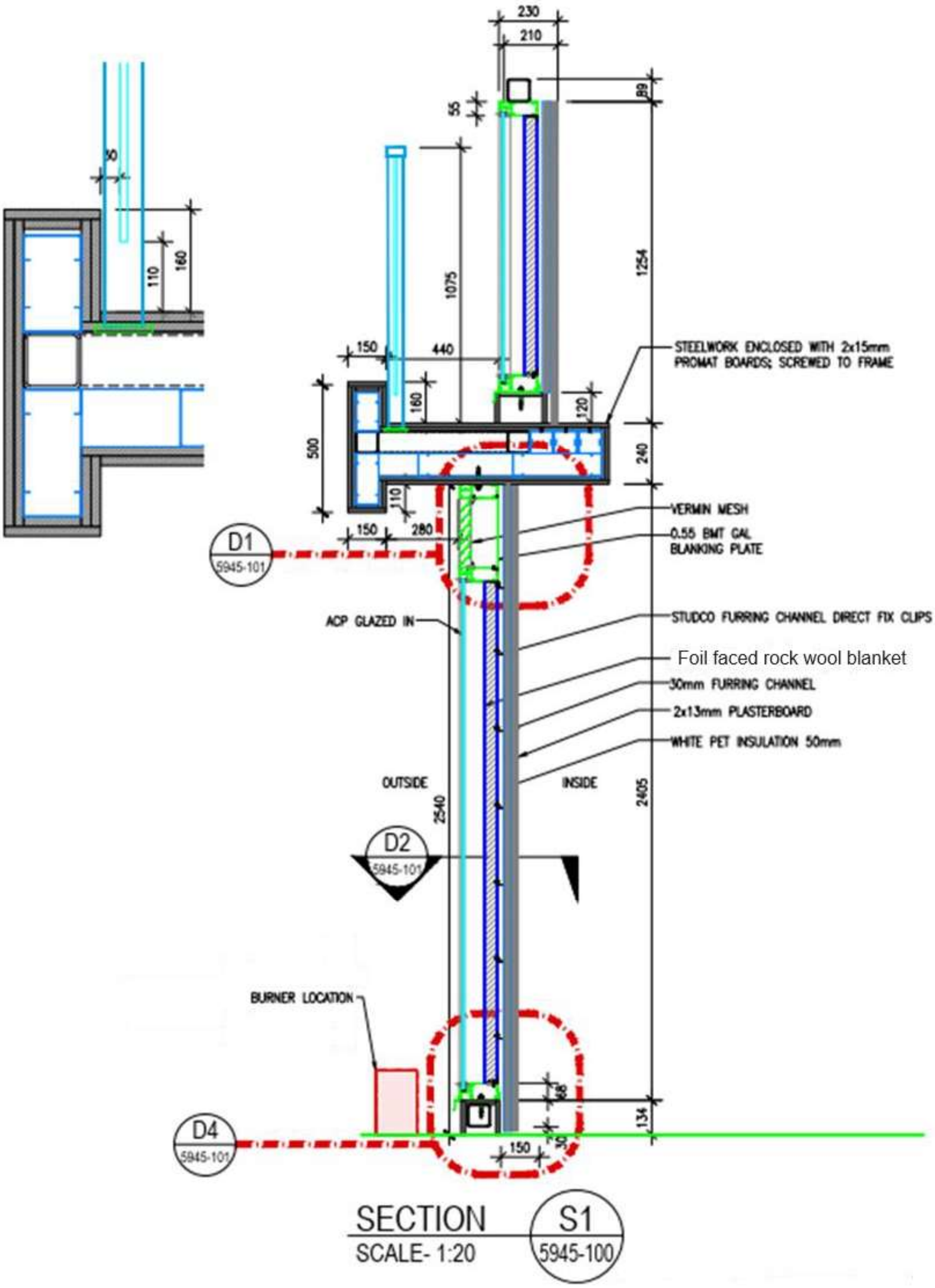

Figure 14 System assembly –Side view

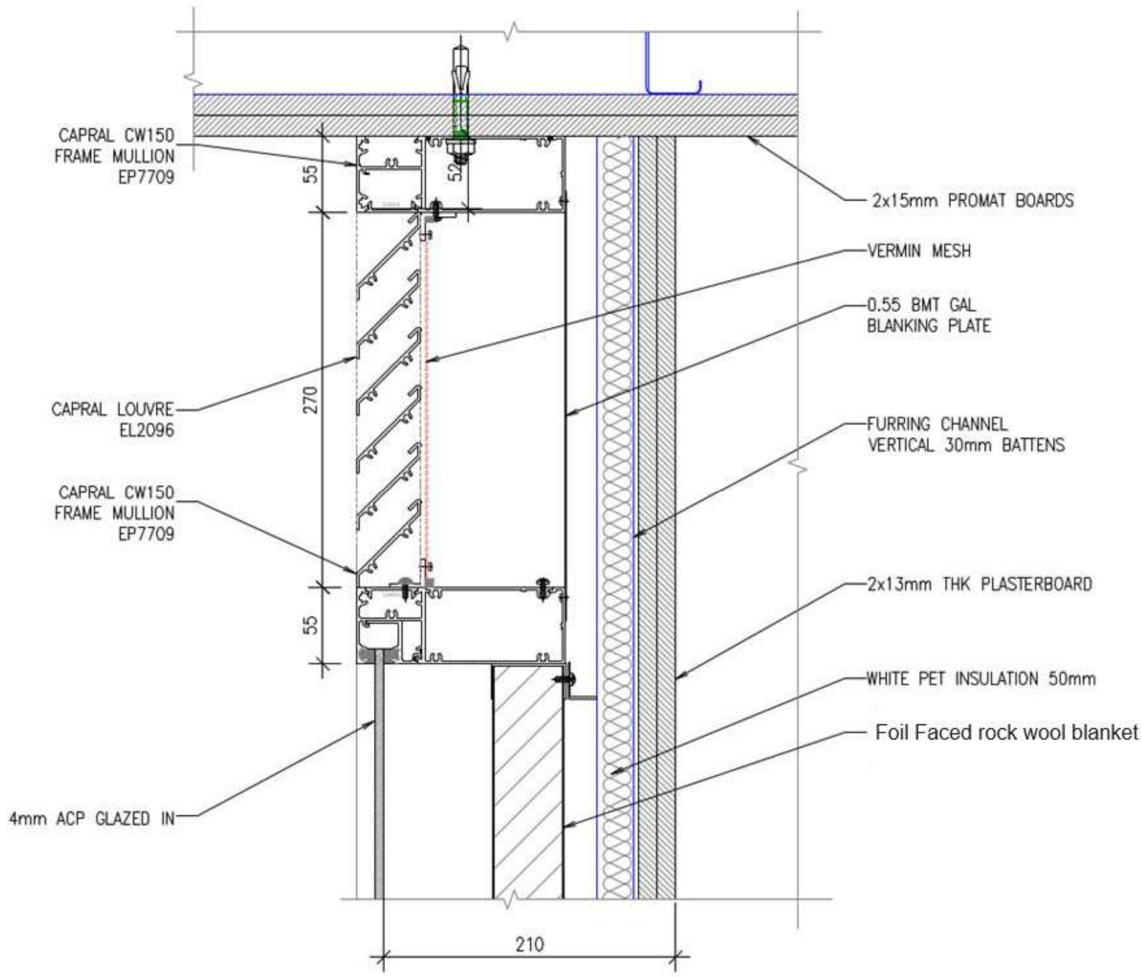

Figure 15 System detail – Detail D1

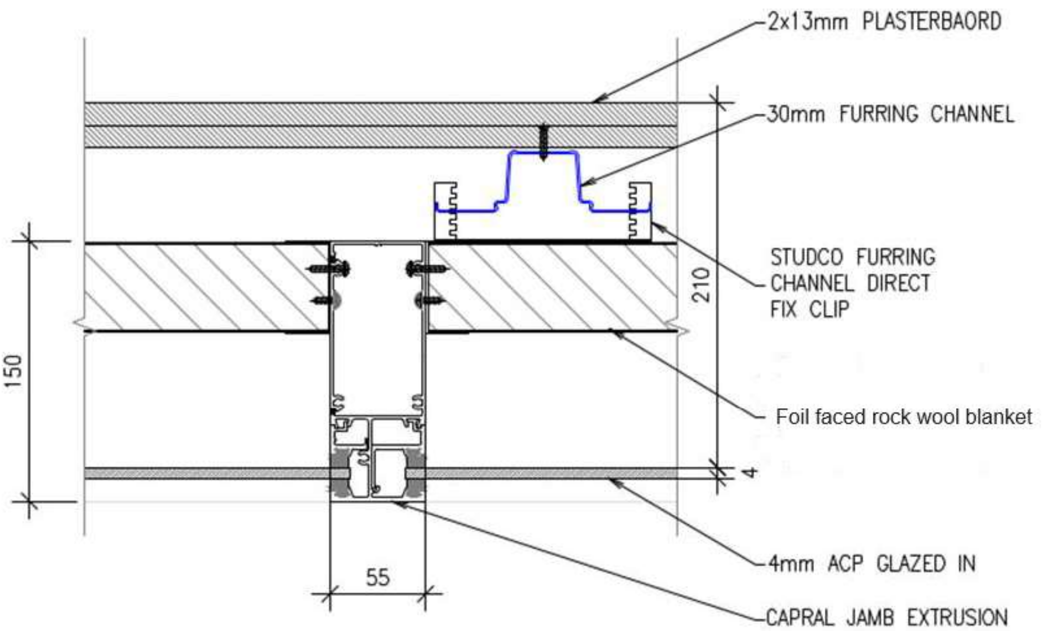

Figure 16 System detail – Detail D2

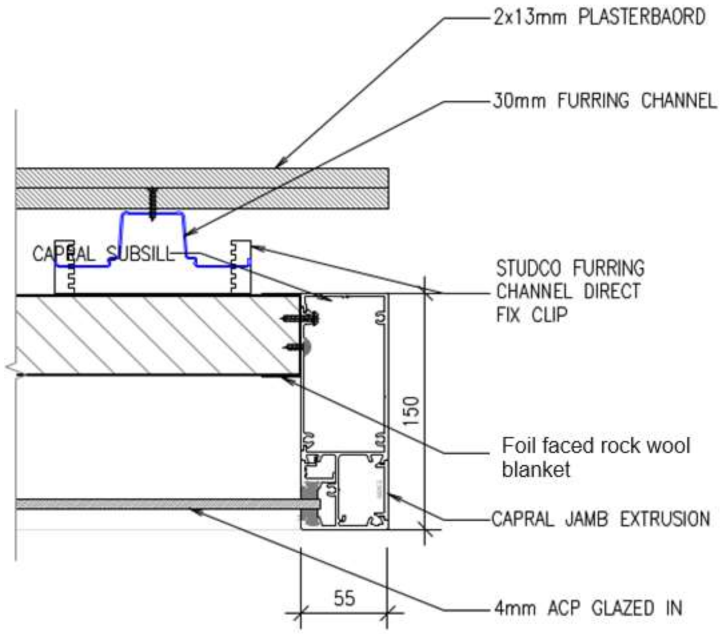

Figure 17 System detail – Detail D3

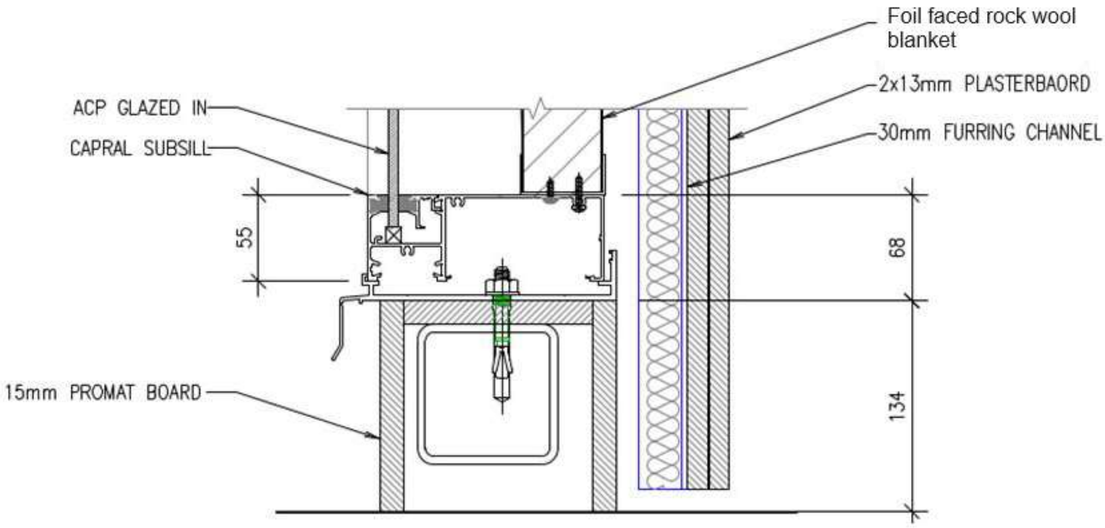

Figure 18 System detail – Detail D4

Appendix B Photographs

Figure 19 The specimen before the reaction to fire test

Figure 20 The specimen before the reaction to fire test – unexposed side

Figure 21 The specimen 1 minute 17 seconds into the test (burner output set to 500 kW)

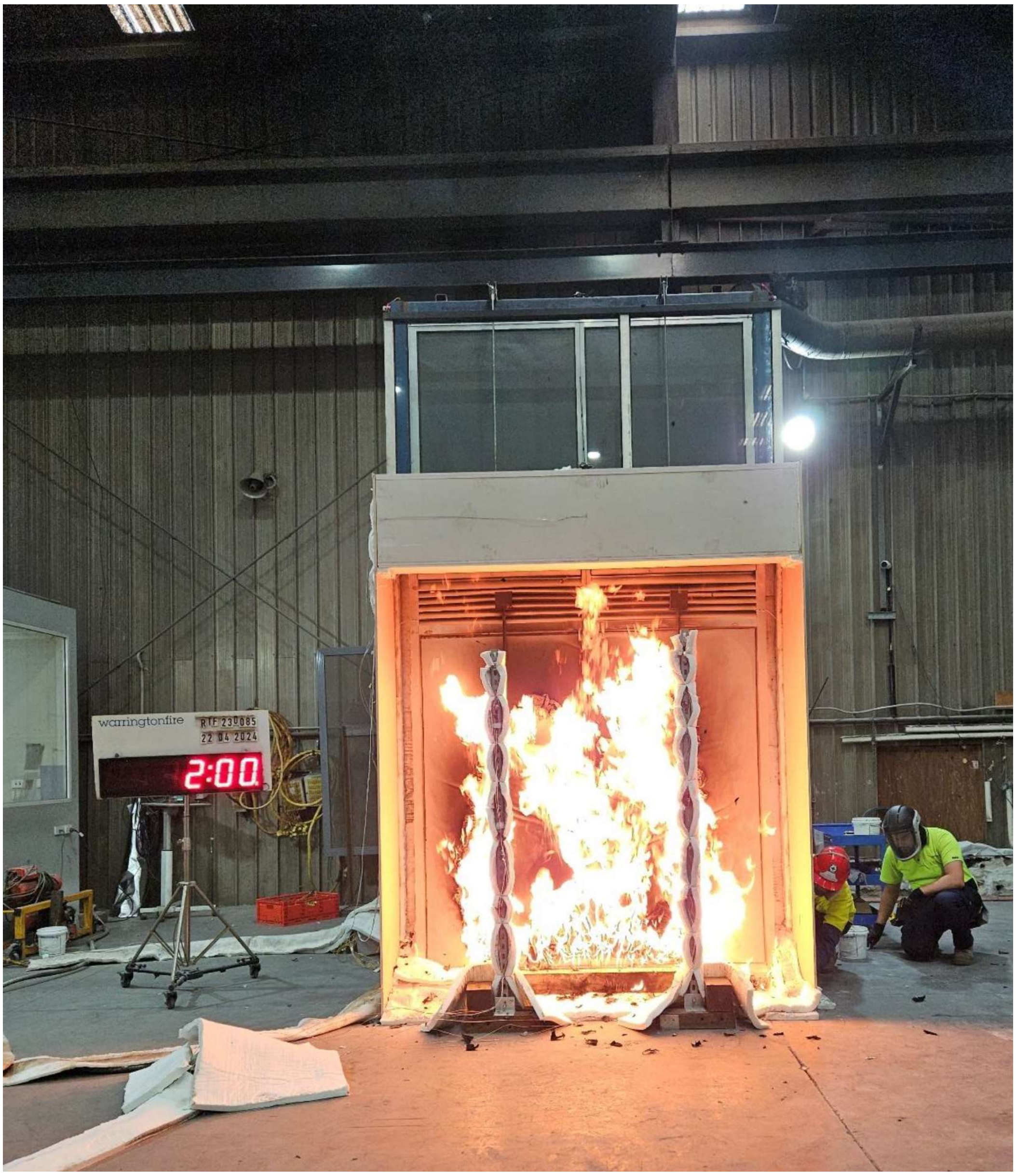

Figure 22 The specimen 2 minutes into the test

Figure 23 The specimen 3 minutes 40 seconds into the test

Figure 24 The specimen 4 minutes 40 seconds into the test

Figure 25 The specimen 5 minutes into the test

Figure 26 The specimen 6 minutes into the test

Figure 27 The specimen 7 minutes into the test

Figure 28 The specimen 8 minutes into the test

Figure 29 The specimen 9 minutes into the test

Figure 30 The specimen 10 minutes into the test

Figure 31 The specimen 11 minutes into the test

Figure 32 The specimen 12 minutes into the test

Figure 33 The specimen 13 minutes into the test

Figure 34 The specimen 15 minutes into the test

Figure 35 The specimen 20 minutes into the test

Figure 36 The specimen 30 minutes into the test – the burner was turned off.

Figure 37 The specimen 2 seconds after the burner was turned off (30 minutes 2 seconds into the test)

Figure 38 The specimen 1 minute after the burner was turned off (36 minutes into the test)

Figure 39 The specimen 11 minutes 32 seconds after the burner was turned off (41 minutes 32 seconds into the test)

Figure 40 The specimen at end the test.

Figure 41 The specimen after the test – unexposed side.

Appendix C Chemical Analysis Results

CETEC

Cladding Safety Victoria – Building Façade Material Laboratory Analysis Report

CETEC Project Reference:	P23070102.0006
Client Project Reference:	Chau_B187
Engaged By:	Chau Tri
Company:	Cladding Safety Victoria
Company Address:	Level 4, Mayfield Place, South Podium Office, 717 Bourke St, Docklands VIC 3008
Site Address:	1 Palmer Street, Richmond VIC 3121
Sample Collected By:	Client
Date Sample received:	25/10/2023
Version:	1.0

Prepared By:

CETEC

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Prepared For:

CLADDING SAFETY Victoria

Cladding Safety Victoria

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PROJECT: Building Façade Material Laboratory Analysis Report	REPORT COMMISIONED BY: Chau Tri from Cladding Safety Victoria
CETEC Pty Ltd 2/27 Normanby Rd, Notting Hill VIC 3168	

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AMD	DESCRIPTION	INT	REVIEWED	DATE
1.0	Building façade system testing results for samples sent by Client	DP	MD/PDS/VG	26/10/2023

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1. Introduction

1.1. Scope of Work

CETEC Pty Ltd was engaged by Chau Tri from Cladding Safety Victoria to conduct laboratory analysis of building façade system samples to determine the composition. Details of the building façade system material, as received from the client on the 25/10/2023, and subjected to laboratory analysis by Foray Laboratories, a company wholly owned by CETEC Pty Ltd, are recorded below in Table 1.

1.2. Limitations

Laboratory results and discussions as detailed within this document should not be used in isolation and are to be used by fire engineers to assist stakeholders, such as building owners, building managers, and building insurers in providing advice relating to the building's façade system flammability potential, composition, and toxicity. This document is not to be used as a substitute to regulatory testing requirements or the AS 1530 series of standards as well as full-scale evaluation to the new AS 5113 tests for external wall as the methodology adopted by CETEC is only to determine the material composition and preliminary information on the materials only.

2. Testing Methodology

Each sample was analysed by Foray Laboratories, a company wholly owned by CETEC Pty Ltd, incorporating product descriptions as detailed below in Table 1. Each sample, as received, was registered into the Foray Laboratory sample registration system to conform to NATA ISO 17025 requirements. The Foray Laboratory sample number and description of each sample are given in Table 1.

Table 1: Building Façade Material Samples Received and Laboratory Analysis the Samples Were Subjected To.

Sample ID	Sample Type[1]	Client Sample Description / Location of Collected Sample[2]	Laboratory Analysis Conducted							Appendix A
			ATR-FTIR	Oxidative Dry Ashing	Micro-flammability	Thermal Stability	TGA	X-Ray Fluorescence	X-Ray Diffraction	
164883	ACP	ACP Grey	✓	✓	×	×	×	×	×	**Photo 2**
164884	ACP	ACP Copper	✓	✓	×	×	×	×	×	**Photo 3**

1 **ACP** – Aluminium Composite Panel, **SMP** – Sheet Metal Panel, **FCP** – Fibre Cement Panel.
2 Samples analysed by Foray Laboratories as received.

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2.1. Sample Preparation

The building façade material was cut into portions and each portion was subjected to scientific analysis *via* the following laboratory methods.

- Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR).
- Dry Ashing Testing.

2.2. Chemical Composition by ATR-FTIR

Attenuated Total Reflection (ATR) is a sampling technique used in conjunction with Infrared Spectroscopy which enables samples to be examined directly in the solid or liquid state without further sample preparation. The technique is used to obtain an infrared spectrum of absorption or emission of a solid or liquid and the spectral data which is generated can easily identify functional groups within the sample which makes it possible to infer composition of both polymer and inorganic or mineral filler. That is, analysis of the Functional Group Region of the spectra (i.e., 4000 cm^{-1} to 1450 cm^{-1}) makes it is possible to observe functional groups that are present within the material which aids in the identification of the polymer and filler present. Further to this, comparison to known samples aids in the identification and confirmation of the type of building façade material.

2.3. Fuel Load and Filler Content by Dry Oxidative Ashing

A weighed sample was heated within a muffle furnace under an oxidative atmosphere to convert all common oxidisable organic material, such as polymers and plasticisers, to carbon dioxide and other gaseous products, e.g., carbon monoxide. All common inorganic non-combustible fillers are generally dehydrated and converted to their common oxides which forms the non-combustible ash residue. When this method is coupled with FTIR spectral identification and calculation, the quantitative proportion of filler and organic materials (including polymer, plasticisers, etc.) can be assessed based on the amount of collected ash. The calculated inert filler is based on the assumption that the identified filler within the ATR-FTIR is present with no to little impurities which may be below the detection limit of the ATR-FTIR method. Thermal Gravimetric Analysis Differential Scanning Calorimetry (TGA-DSC) in conjunction with Dry Ashing can be used with quantitative assessment of combustible to non-combustible material to ascertain polymer content to non-polymer content

3. Laboratory Results

3.1. Spectral Analysis by ATR-FTIR

A summary of building façade system samples subjected to ATR-FTIR are shown in Table 2 with reference to subsequent figures.

Table 2: Building façade system sample subjected to FTIR Analysis.

Sample ID	Sample Type	Core Colour	ATR-FTIR Spectra
164883	ACP	Black	**Figure 1**
164884	ACP	Black	**Figure 2**

Figure 1: Sample 164883 - FTIR of Building Façade System.

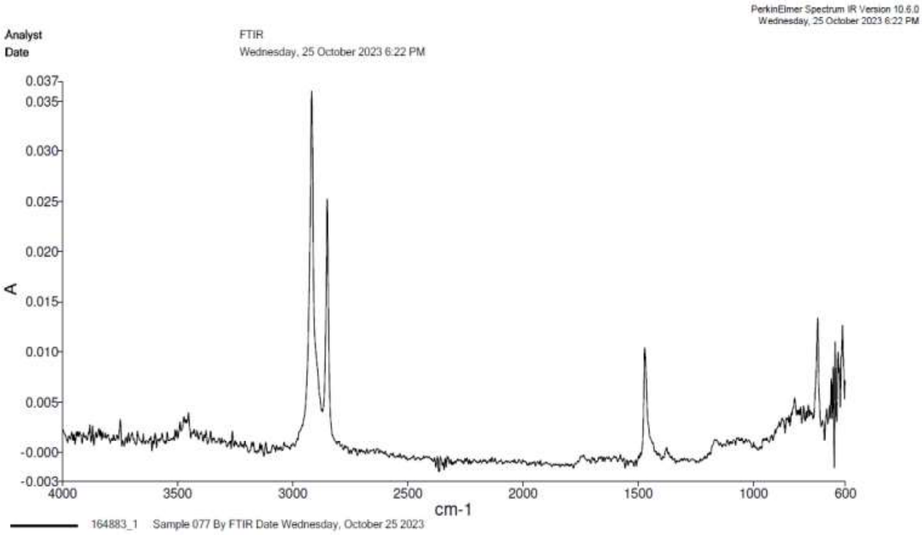

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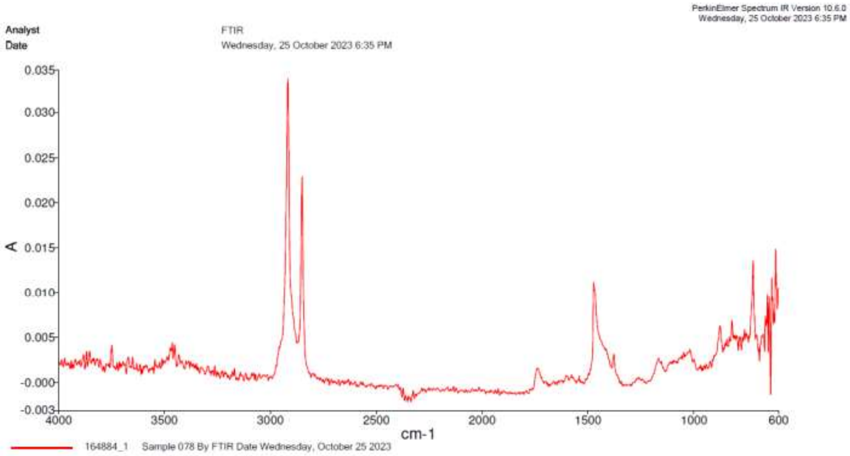
Figure 2: Sample 164884 - FTIR of Building Façade System.



3.2. Dry Oxidative Ashing Test

A summary of building façade system samples subjected to Dry-Ashing with results are summarised in Table 3.

Table 3: Building façade system sample dry oxidative ashing results.

Sample ID	Sample Type	Mass of Sample[3] (g)	Ash[4] (g)	Appearance of Ash
164883	ACP	0.06	0	No ash
164884	ACP	0.0727	0.0048	Brown ash

3 Mass of polymer core sample subjected to ashing.
4 Mass of ash remaining after ashing experiment.

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4. Discussion of Results

4.1. ATR-FTIR

Analysis of the FTIR spectra *via* a library search of known polymer blends identified the following possible polymer blend corresponding to the analysed samples in Table 2. This information is further summarised in Table 4 with their corresponding library match and figure.

Table 4: Building façade system sample composition identification.

Sample ID	Sample Type	Core Colour	Identified Major Components by FTIR	Figure
164883	ACP	Black	Polyethylene with no filler	**Figure 3**
164884	ACP	Black	Polyethylene with unidentified filler	**Figure 4**

Figure 3: - FTIR Spectral Comparisons of Known Material with Sample 164883.

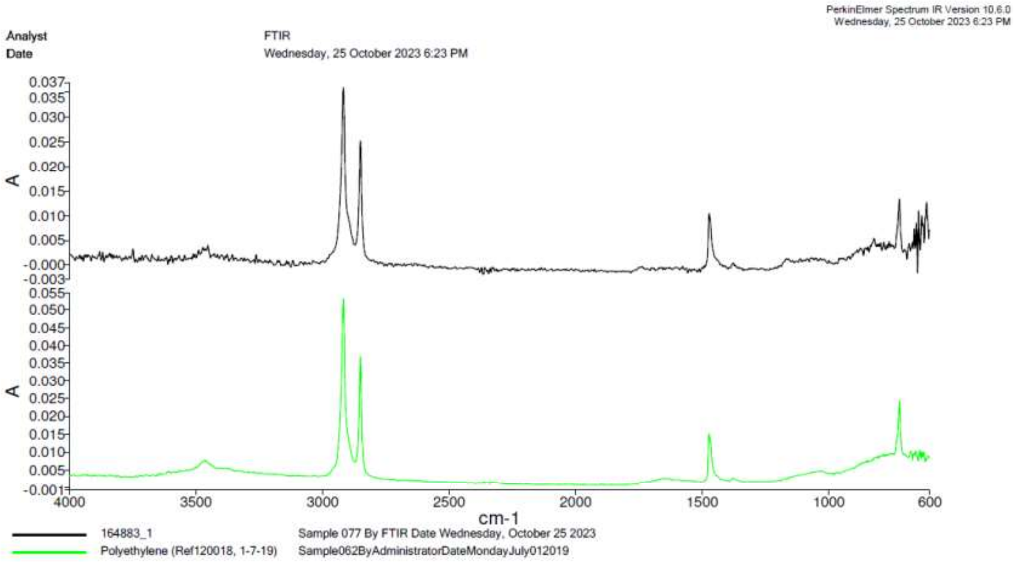

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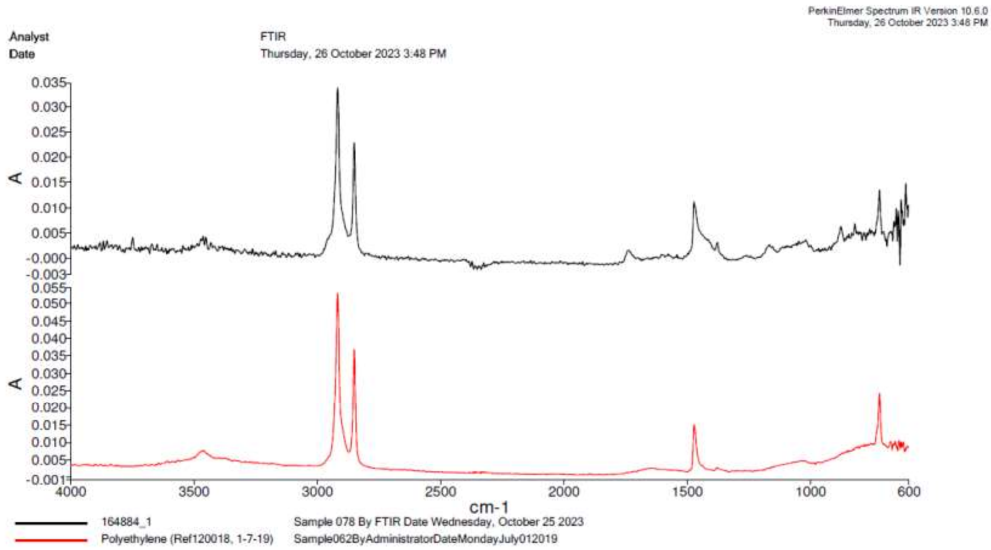
Figure 4: - FTIR Spectral Comparisons of Known Material with Sample 164884.



4.2. Oxidative Dry-Ashing

The oxidative dry-ashing results of the building façade samples are summarised in Table 5 for the samples analysed.

Table 5: Identified building façade system sample dry-ashing results.

Sample ID	Sample Type	Identified Composition by FTIR	Calculated Filler Material (w/w%)	Calculated Combustible Material (w/w%)
164883	ACP	Polyethylene with no filler	0%	100%
164884	ACP	Polyethylene with unidentified filler	12%	88%

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5. Conclusion

On behalf of Chau Tri from Cladding Safety Victoria, CETEC conducted scientific analysis of building façade system samples to determine their composition. The samples were analysed, as received by CETEC on 25/10/2023 and sent to Foray Laboratories, a NATA registered company wholly owned by CETEC for scientific analysis of the samples.

Testing following methodology developed by CETEC Pty Ltd to determine composition and a summary of results is detailed below in Table 6 with an additional photographic summary of the samples received (refer to Appendix A).

Table 6: Laboratory Analysis summary.

Sample ID	Sample Type	Client Sample Description	Core Colour	Identified Composition[5]	Calculated Filler Material (w/w%)	Calculated Combustible Material (w/w%)
164883	ACP	ACP Grey	Black	Polyethylene with no filler	0%	100%
164884	ACP	ACP Copper	Black	Polyethylene with unidentified filler	12%	88%

[5] Analysis by FTIR

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APPENDIX A : PHOTOGRAPHIC RECORD OF BUILDING FAÇADE SYSTEM SAMPLES

CETEC **Chain Of Custody**

Date:	25/10/2023	**Send to:**	Contact	Dr. Dilip Poduval
CETEC Reference:			Address	CETEC Pty Ltd
Client Name:	Chau Tri			2/ 27 Normanby Rd, Notting Hill, Victoria, Australia 3168
Client Reference Number:	Chau_B187		Phone	(03) 9544 9111
Site Address:	1 Palmer Street, Richmond			

Client ID #	Client Description	Ashing	FTIR	XRF	XRD	TG	Solvent Washing	Bulk Density
B187 #01	ACP grey	Y	Y					
B187 #02	ACP copper	Y	Y					

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Photo 1: List of samples received.

Photo 2, Sample 164883 as received.

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Photo 3, Sample 164884 as received.

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Disclaimer

CETEC has taken all reasonable care to ensure that the information contained in this report is accurate. The report is based on data and information collected by CETEC personnel during location visits and information accepted in good faith from various personnel associated with this work. However, no warranty or representation can be given that the information and materials contained in it are complete or free from errors or inaccuracies.

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Test Report

Prepared by:

ANALYSIS OF CLADDING SAMPLES

For

Company: Warrington Fire

Contact: [redacted]

Date: 22 February 2024

Project No: 24021

Prepared by: Dominic D'Adam

Approved by: Afsaneh Khansari

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Analysis of Cladding Samples

1. SAMPLES

One envelope containing three ACP cores was received for analysis. The samples were identified as follows:

CCL sample coding	Client sample coding
24021-1	#1 - 100%
24021-2	#2 - 100%
24021-3	#3 - 45% Non FR

CCL has been asked to identify the polymer and the filler (s) in the samples by FT/IR, quantitate and identify the mineral filler in the samples and classify them in accordance with the ICA cladding scheme.

2. METHODOLOGY AND RESULTS

The aluminium metals were removed from the ACPs cladding polymer, and the flat surface of the polymer sample was abraded to remove any surface adhesive. The surface of the sample was analysed directly by FTIR. The FT-IR spectra are presented in Figures 1-3.

The core of the samples was then ashed to determine their percentage mineral content (Table 1). If sufficient (>0.5 g) ash was found in the sample, it was analysed for elemental composition by X ray fluorescence spectroscopy. Results are presented in Table 2.

Table 1 Ash content of 24021-1-3

Sample coding	Ash content (w/w%)
24021-1	3.3
24021-2	3.0
24021-3	40.0

Table 2 Elemental composition of sample 24021-3

Element Oxide	wt.%
Na2O	0.36
MgO	9.67
Al2O3	0.71
SiO2	6.47
P2O5	0.03
SO3	1.58
K2O	0.12
CaO	47.18
TiO2	0.88
V2O5	0.01
Cr2O3	<0.01
Mn3O4	0.03
Fe2O3	0.70
NiO	<0.01
CuO	0.05
ZnO	1.74
SrO	0.15
ZrO2	<0.01
BaO	2.04
HfO2	<0.01
PbO	<0.01
SnO2	0.01
CoO	<0.01
L.O.I.	29.50

NOTE: (i) L.O.I.= loss on ignition at 1,050 °C.

3. CONCLUSIONS

The cladding sample #1 consisted of 3.3% inert material and approximately 96% polyethylene polymer.

The cladding sample #1 is classified as ICA category A.

The cladding sample #2 consisted of 3.0% inert material and approximately 97% polyethylene polymer.

The cladding sample #2 is classified as ICA category A.

The cladding sample #3 consisted of 33.7% calcium carbonate, 5.6% magnesium hydroxide, 2.5% other inert material and approximately 58% polyethylene polymer.

The cladding sample #3 is classified as ICA category A.

The ICA Classification assigned is correct as per the September 2020 revision of the ICA Guidelines.

The reader is reminded that we can only analyse and classify the content of samples actually presented to us. We can offer no guarantee that this composition or classification is valid for cladding as a whole, because some types of cladding can be inhomogeneous, and a sample may not be representative of the cladding as a whole. Anyone using our results should consider these sampling issues and uncertainties before they generalise the results we present to anybody of cladding as a whole.

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22 February 2024

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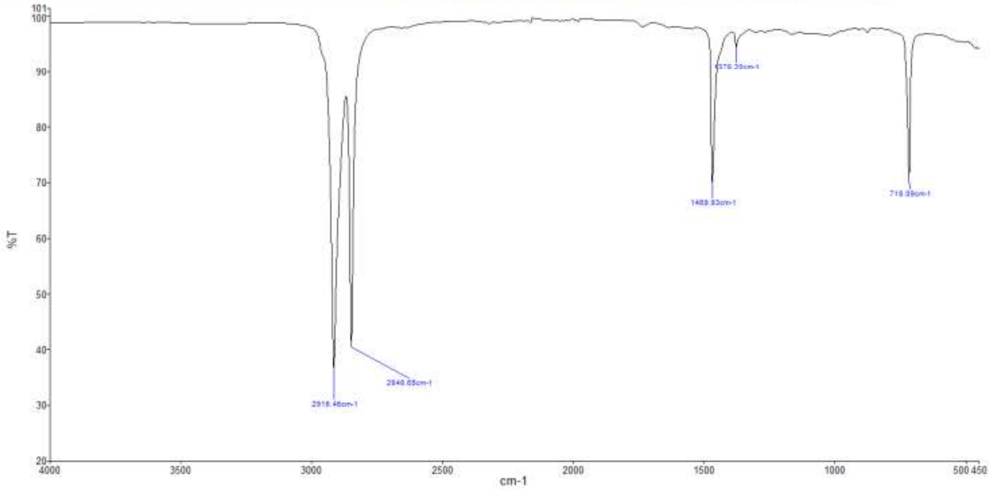

Figure 1. FT-IR spectrum of sample #1

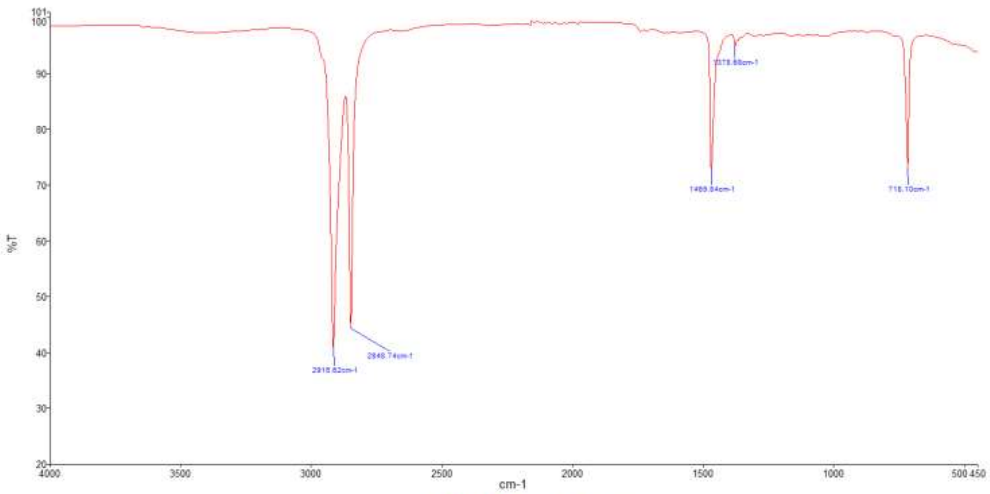

Figure 2. FT-IR spectrum of sample #2

WARRINGTONFIRE
AUSTRALIA
A Jensen Hughes Company

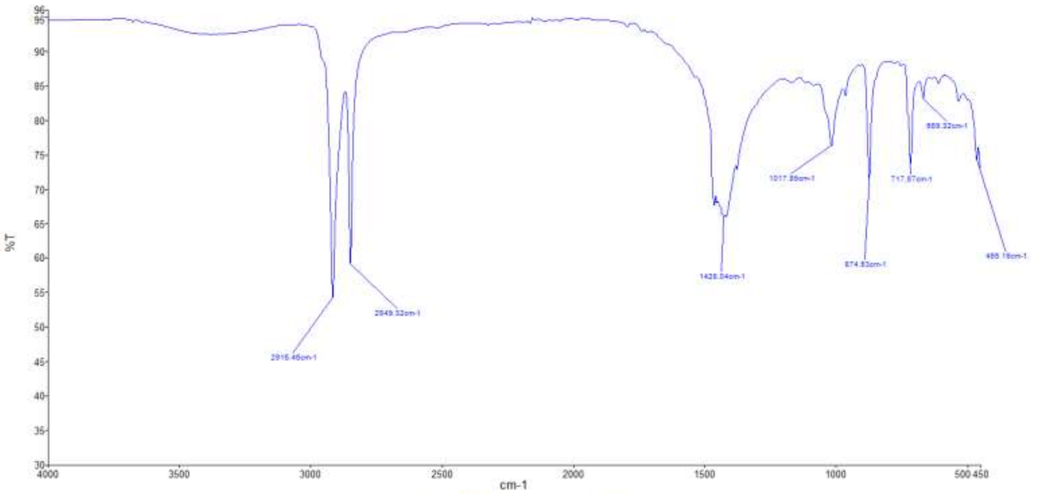

Figure 3. FT-IR spectrum of sample #3

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