WARRINGTONFIRE
AUSTRALIA
A Jensen Hughes Company

Reaction to fire test report

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

Test sponsor: Owners Corporation Plan Number [redacted]

System: Aluminium composite panel wall system representative of the in-situ wall located at [redacted] – Scenario 2 100% PE - Test 1

Job number: RTF230002

Test date: 10 April 2024 Revision: RR1.0

WARRINGTONFIRE
AUSTRALIA
A Jensen Hughes Company

Quality management

Revision	Date	Information about the report			
RR1.0	29 November 2024	Description	Initial issue.		
			Prepared by	Reviewed by	Authorised by
		Name	[redacted]	[redacted]	[redacted]
		Signature			

Warringtonfire* Australia Pty Ltd
ABN 81 050 241 524

Contents

1. Introduction

This report documents the findings of the first of three ad-hoc reaction to fire tests conducted on Aluminium composite panel (ACP) external wall cladding system performed on 10 April 2024. The test was based on the 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
[redacted]	

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 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) panel	
	Product	[redacted]	
	Manufacturer / supplier	[redacted]	
	Note on supply of panel	On behalf of CSV, Warringtonfire acquired the ACPs with 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.	
	Material	The material was nominated as panels consisting of two layers of aluminium sheets sandwiching a layer (core) with 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 was found to be 3.3 % inert material. Refer to samples #1 and #2 in 0 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.	
	Batch	[redacted]	
	Areal density	5.6 kg/m²	

Item	Description	
2.	Item name	13 mm fire rated plasterboard
	Product	[redacted]
	Manufacturer/supplier	[redacted]
	Size	2700 mm long × 1200 mm wide × 13 mm thick
	Batch date	[redacted]
	Areal density (measured)	11.0 kg/m^2
3.	Item name	Backpan
	Product	[redacted]
	Supplier	[redacted]
	Size	Measured: 1160 mm wide × 3700 mm tall, 0.9 mm thick – in segments
Framing		
4.	Item name	Test rig frame - 90 × 90 SHS and 200 × 90 PFC frame
	Size	90 mm × 90 mm × 5 mm thick and 200 mm × 90 mm × 10 mm thick – refer to Figure 7.
5.	Item name	Aluminium curtain wall transom/mullions (rectangular hollow sections) - framing
	Size	65 mm wide × 120 mm deep × 3 mm thick Total frame size: 120 mm deep × 1165 mm wide × 3705 mm tall
	Manufacturer/supplier	[redacted]
6.	Item name	Aluminium angles - framing
	Size	20 mm wide × 30 mm deep × 3 mm thick
	Manufacturer/supplier	[redacted]
7.	Item name	Aluminium stiffener - framing
	Size	3 mm thick
	Manufacturer/supplier	[redacted]
8.	Item name	Internal side frame - steel
	Size	Studs and noggings: 90 mm deep × 36 mm wide × 0.55 BMT
	Installation	The steel framing members were riveted (item 17) to one another.
9.	Item name	Strap – 50 mm wide
	Size	Studs and noggings: 90 mm deep × 36 mm wide
	Installation	The steel framing members were riveted (item 17) to one another.
Smoke seal		
10.	Item name	Smoke seal
	Size	1 mm thick galvanised steel
	Manufacturer/supplier	[redacted]
Insulation		
11.	Item name	90 mm thick polyethylene terephthalate (PET) insulation
	Density	10 kg/m^3
	Manufacturer/supplier	[redacted]

Item	Description	
12.	Item name	50 mm thick aluminium - with fibre-glass mesh - foil faced rockwool insulation
	Density of core	40 kg/m^3
	Manufacturer/supplier	[redacted]
Sealant/Adhesive		
13.	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.
Fixings		
14.	Item name	Wafer head screws – zinc coated steel
	Size	10g × 16 mm long
	Installation	Used to fix aluminium angles (item 6) to the aluminium frame (item 5) at 500 mm centres
15.	Item name	Wafer head screws – zinc coated steel
	Size	10g × 50 mm long
	Installation	Used to fix ACP (item 1) to the aluminium stiffener (item 7) – four per corner.
16.	Item name	Hex head tek screw – zinc coated steel
	Size	12g × 16 mm long
	Installation	Used to fix aluminium stiffeners (item 7) to themselves
17.	Item name	Steel rivets
	Size	Ø4 mm
18.	Item name	Plasterboard screws
	Size	6g × 32 mm long, bugle head, self-drilling screws
19.	Item name	Fast-fix washers and pin weld
	Size	115 mm × 3 mm pins and 25 mm × 25 mm fast fix washers.

Installation method

Internal wall:	The test rig frame (item 4) was the main support for the test specimen, however, there were two C-purlin sections that acted as false slabs (200 mm tall). Steel stud framing (item 8) was installed between the C-purlins. PET insulation (item 11) was inserted within the steel framing (item 8) and was capped with 13 mm thick FR plasterboard (item 2) on the unexposed side and along the edges. The plasterboard was fixed with plasterboard screws (item 18) – max 300 mm centres on the periphery and 600 mm centres in-field.
External wall:	The external section of the wall system largely consisted of an aluminium extrusion framing system (item 5), galvanised steel sheet backpan (item 3) and ACP cassette system (item 1). The external wall was screw fixed using angles. The ACP cassettes were 200 mm deep and were connected to the aluminium extrusion framing (item 5) using aluminium angles (item 6) and aluminium stiffeners (item 7). Adjacent panels were butt joined together with the butt joins located 950 mm, 2462 mm and 2685 mm from the bottom of the façade system. The angles (item 6) were screw fixed to the extrusions, the aluminium sheeting riveted to the angles, and the ACP cassettes riveted to the aluminium sheets. Sealant (item 13) was used to seal open ACP edges, screw fixings and rivet locations.

Item	Description
	The backpan (item 3) was screw fixed and riveted to the back of the aluminium extrusion framing (item 5). Foil faced insulation (item 12) was installed within the external wall. The insulation was held to the steel backpan (item 3) with the aid of fast-fix washers and pin combinations (item 19) – at ~600 mm centres – that were welded to the backpan. There was a 60 mm gap between the backpan and the internal wall studwork.

2.2 Installation details

Table 3 lists the installation details for the test specimen.

Table 3 Installation details

Item	Detail
Start date for construction of the test specimen	2 April 2024
Completion date for construction of the test specimen	5 April 2024
External wall system constructed by	Representatives of Warringtonfire Australia
Symmetry	Asymmetrical: due to the exposed face of the façade system clad with an aluminium composite panel and the unexposed side lined with 13 mm fire rated plasterboard. It was confirmed that the system was exposed from the side that would normally face the outside of the building.

3. Test procedure

Table 4 details the test procedure for this reaction to fire test.

Table 4 Test procedure

Item	Detail	
Statement of compliance	The ad-hoc test was based on the general principles outlined in ISO 13785-1:2002 and 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-built construction of the façade except for the ACP core composition.	
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	22 minutes	
Ambient laboratory temperature	Start of the test	20 °C
	Minimum temperature	20 °C
	Maximum temperature	27 °C
Instrumentation and equipment	• Eight 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 60 mm in front of the face of the test specimen. Refer to Figure 1 (TC011 – TC018) for details on positioning. • Ten 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. Refer to Figure 1 (TC001 – TC010) for details on positioning. • Three mineral insulated metal sheathed (MIMS) Type K thermocouple with an overall diameter of 1.5 mm with the measuring junction insulated from the sheath were positioned on the face of ACP, 50 mm from the top edge. Refer to Figure 1 (TC019 – TC021) for details on positioning. • The incident heat flux on the top of the specimen in line with the front face of test specimen was measured using one Schmidt-Boelter type heat flux gauge with a range of 0-50 kW/m^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 below the specimen with approximately 10 mm overlap with the ACP.	
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 100 kW for the first 15 minutes of the test followed by 300 kW for the following 7 minutes of the test. The burner was then turned off and the specimen sprayed with water when excessive flaming was observed.	
Test number	Test one of three.	
Variation between tests	The test was based off RTF220104 R1.0, RTF220104 R2.0, RTF220104 R3.0 and RTF230111 R1.0. The test specimens for those tests were considered a representation of an in-situ wall located at the listed location. The tested specimen in this test was considered a replica of those tests with the only variation being the ACP used, i.e., variation to the percentage of polyethylene in the core, presence of fire-retarding materials in the core and the thickness of panel and panel skin.	

4. Instrumentation locations

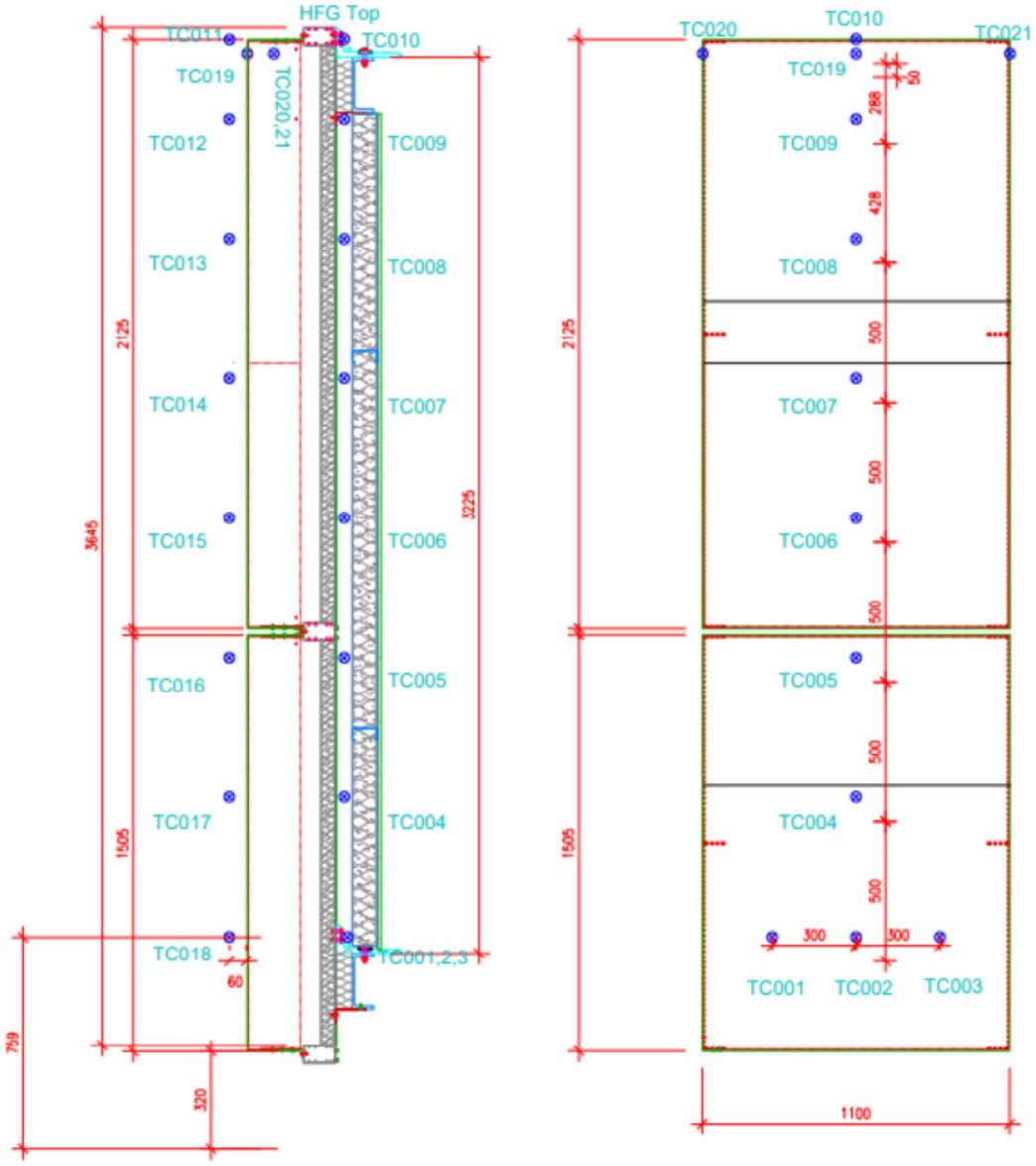

Figure 1 Instrumentation location

5. Test measurements and results

The measurements from the test are summarised below.

Table 5 in Appendix B includes observations of any significant behaviour of the specimen.

Photographs of the specimen are included in Appendix C.

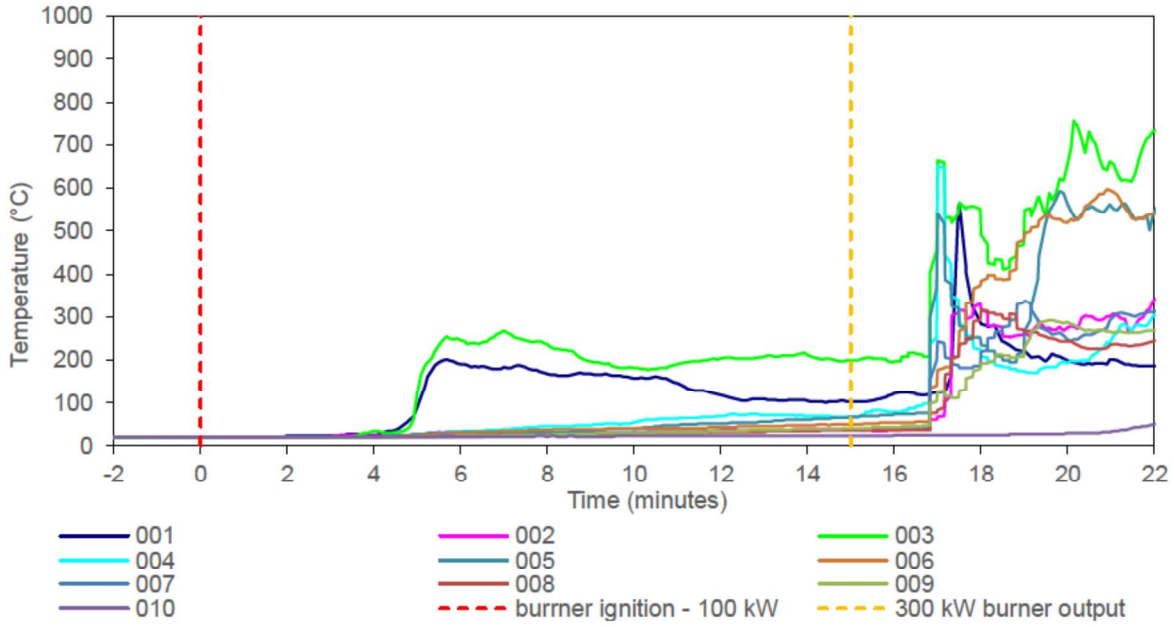

Figure 2 **Internal temperature data collected by thermocouples placed within the cavity – between the internal and external segments of the specimen**

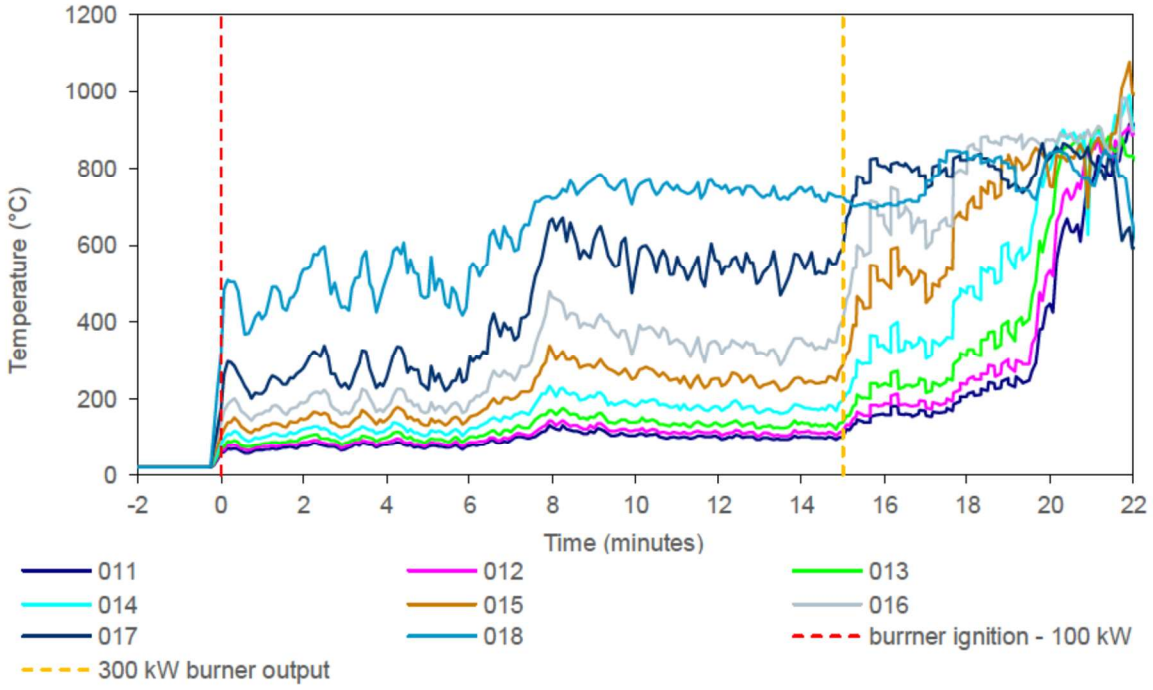

Figure 3 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen**

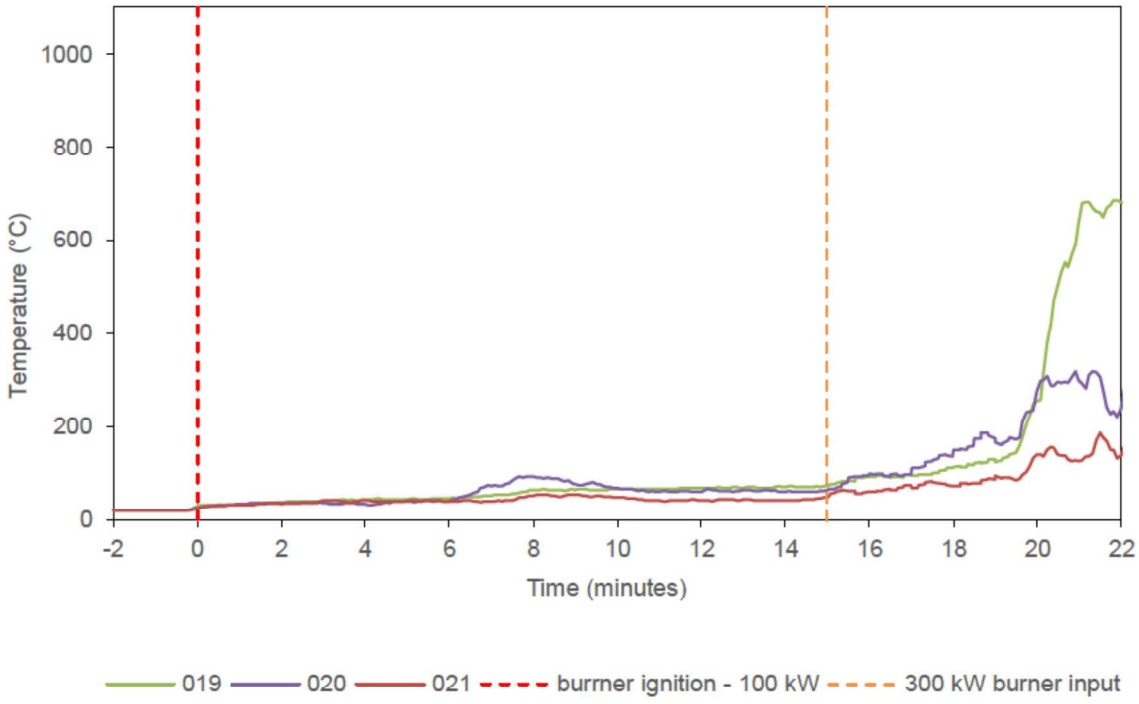

Figure 4 **External temperature data collected by thermocouples placed 50 mm down from the head of the specimen and in contact with the exposed face**

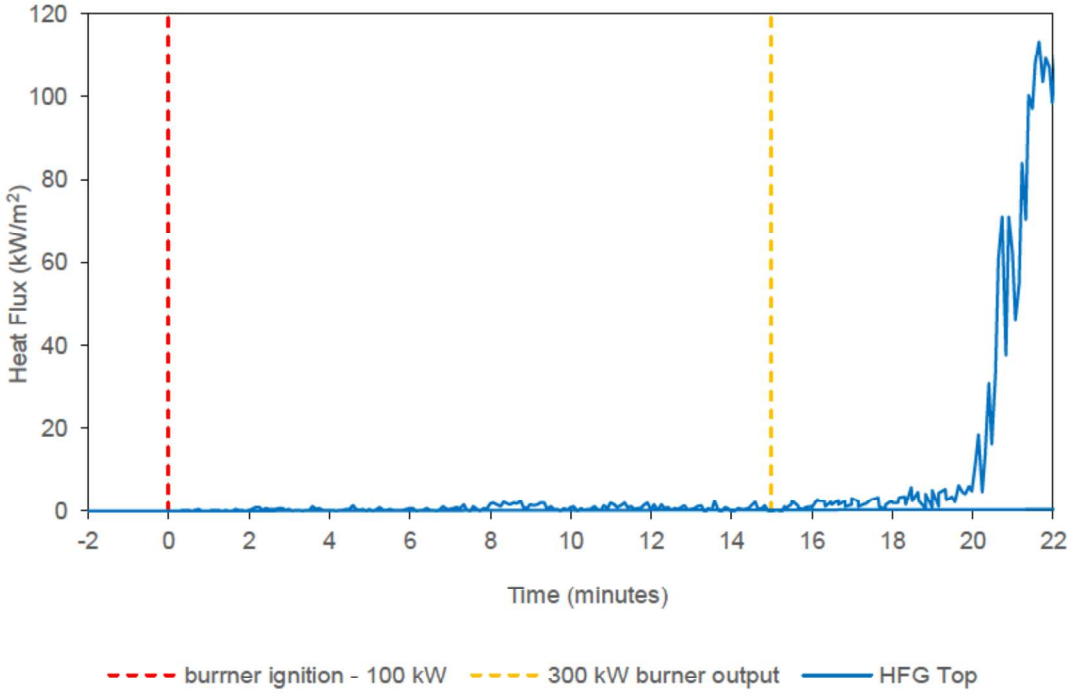

Figure 5 **Heat flux data collected by heat flux gauge**

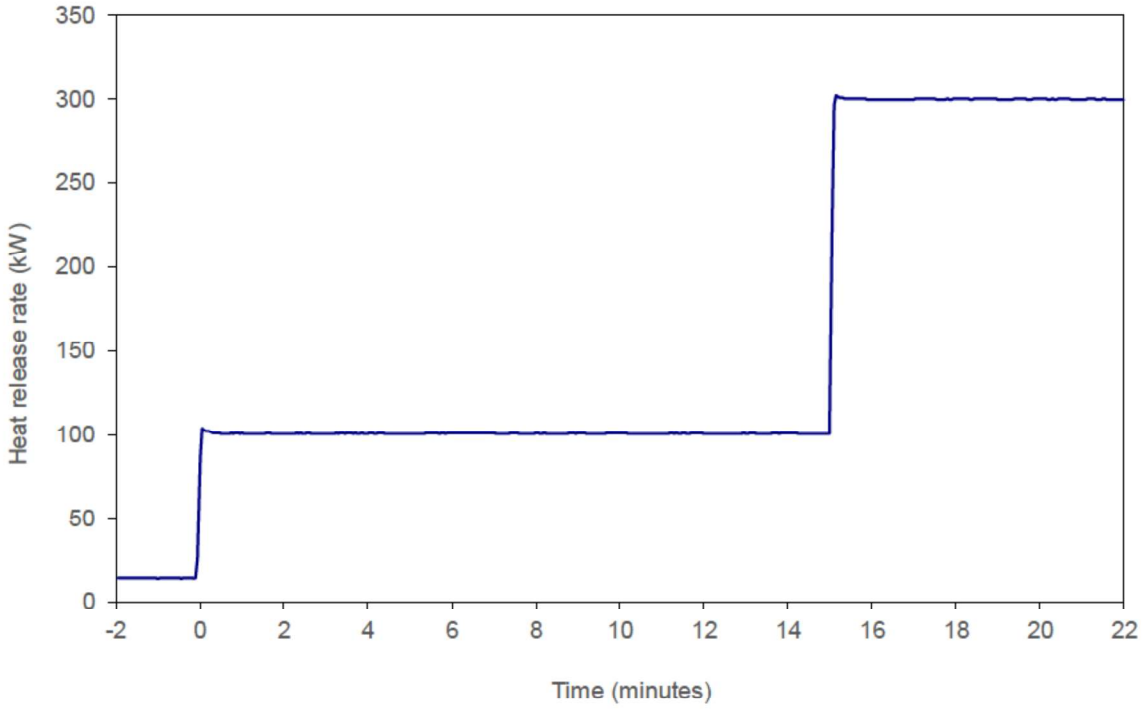

Figure 6 Heat release rate of burner

6. Application of test results

6.1 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.

6.2 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 4. 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.

6.3 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.

Appendix A Drawings of test assembly

The drawings of the test assembly in Figure 7 to Figure 10 were provided by representatives of the test sponsor

All measurements are in millimetres – unless otherwise indicated.

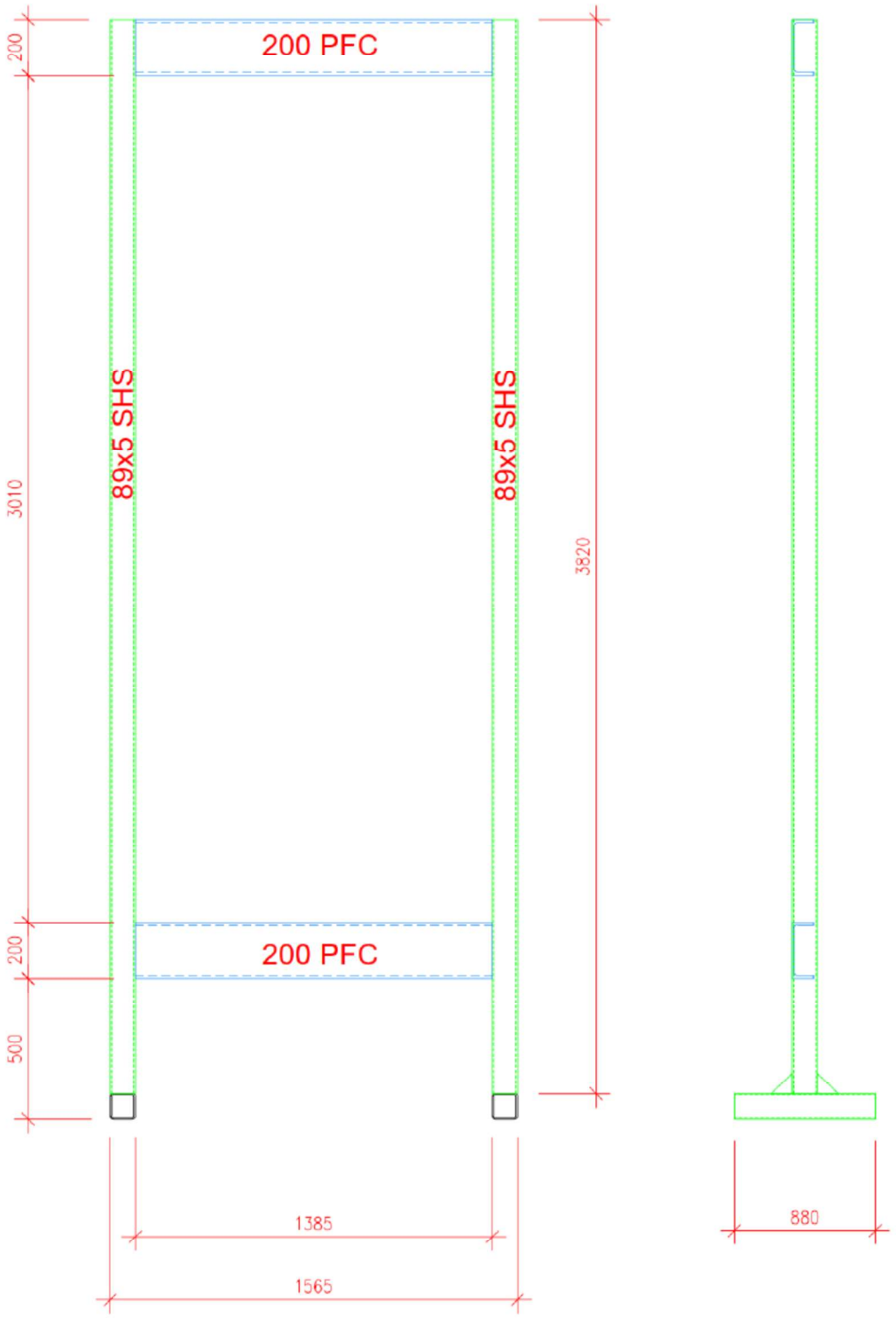

Figure 7 Elevation of rig support

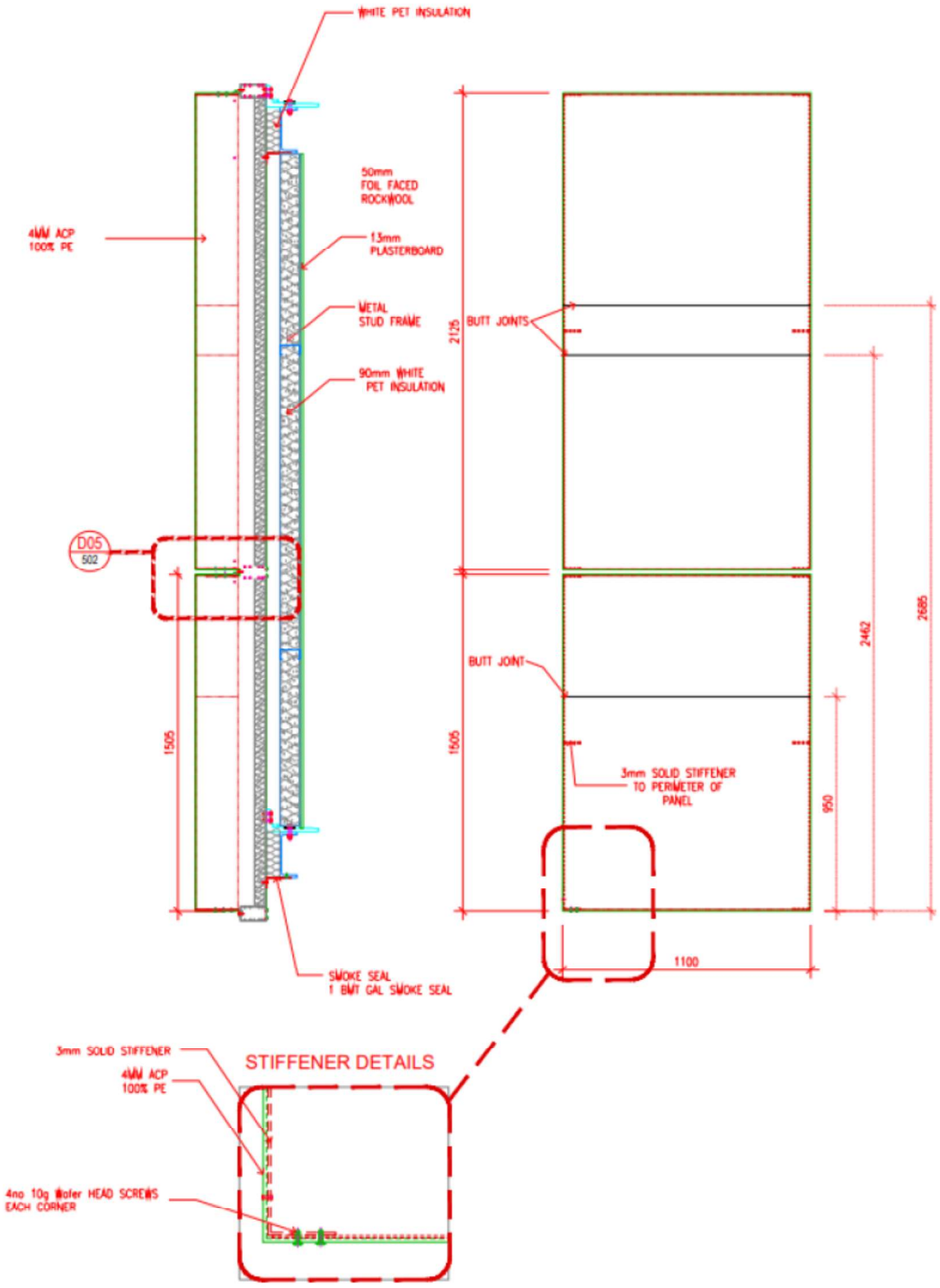

Figure 8 System assembly – Front and side view

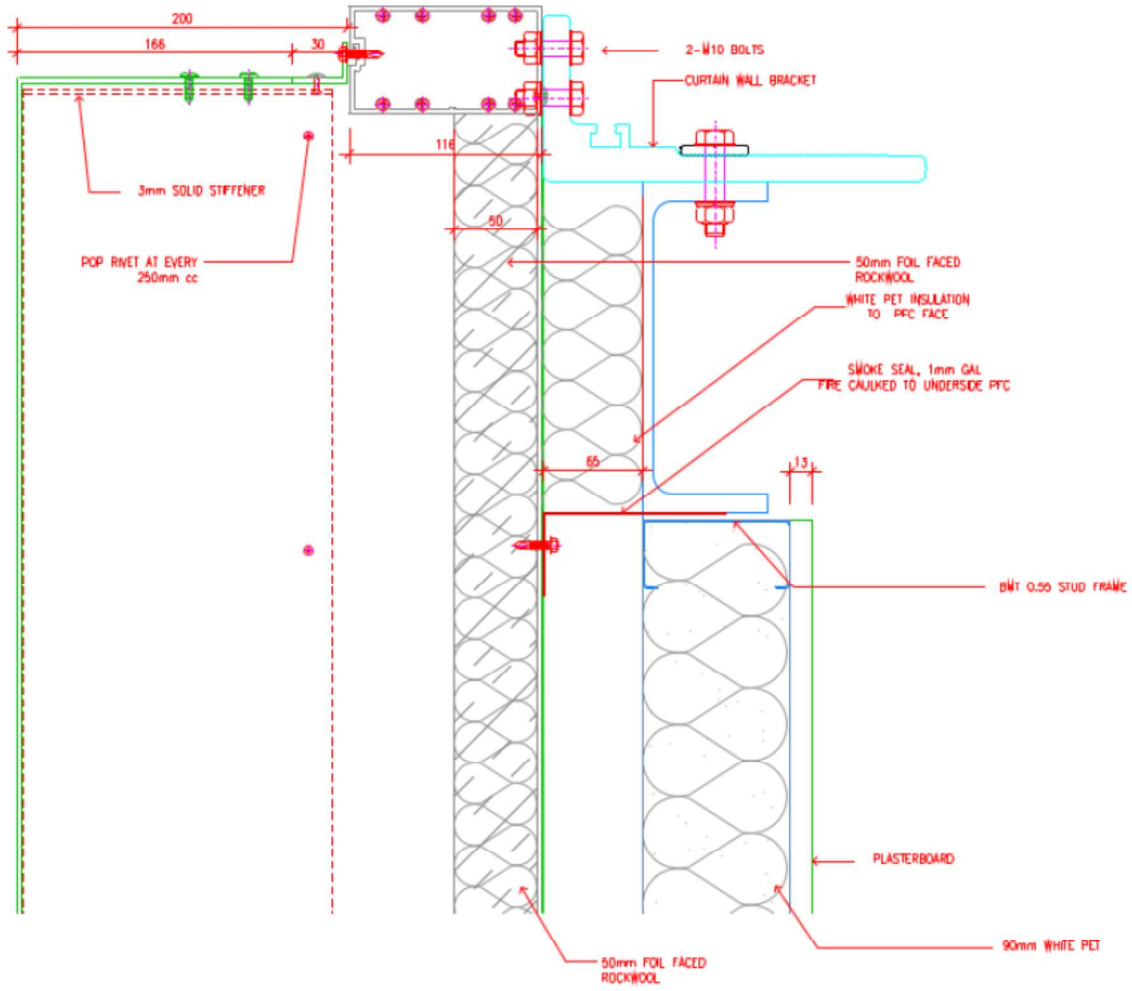

Figure 9 System assembly – top edge detail

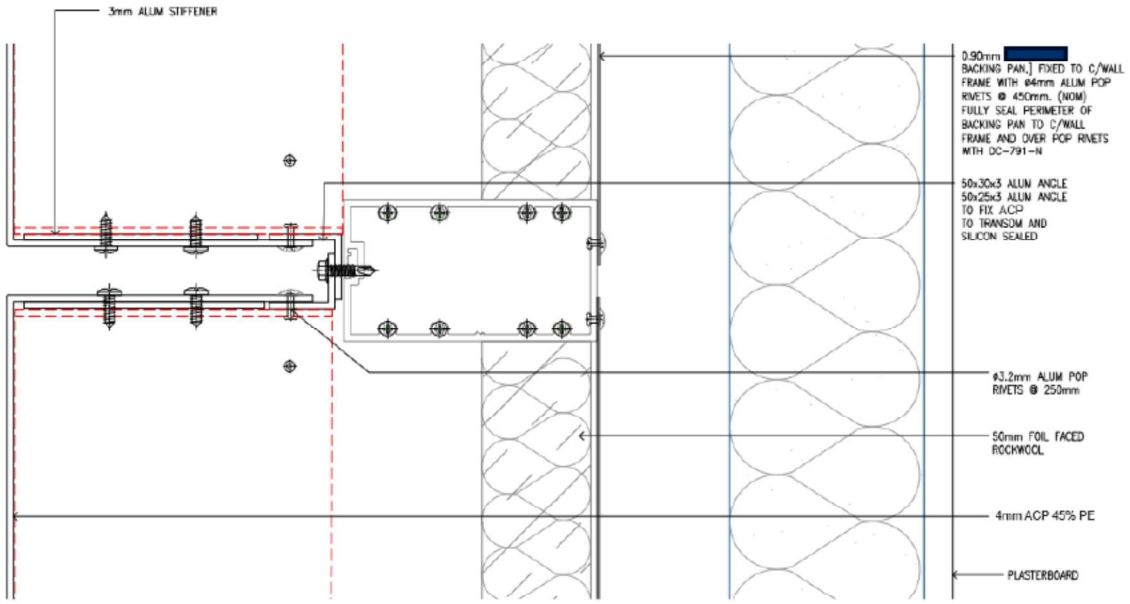

Figure 10 System assembly – middle join detail (D05)

Appendix B Test observations

B.1 Visual observation

Figure 11 shows the designations for the test specimen observations.

Table 5 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.

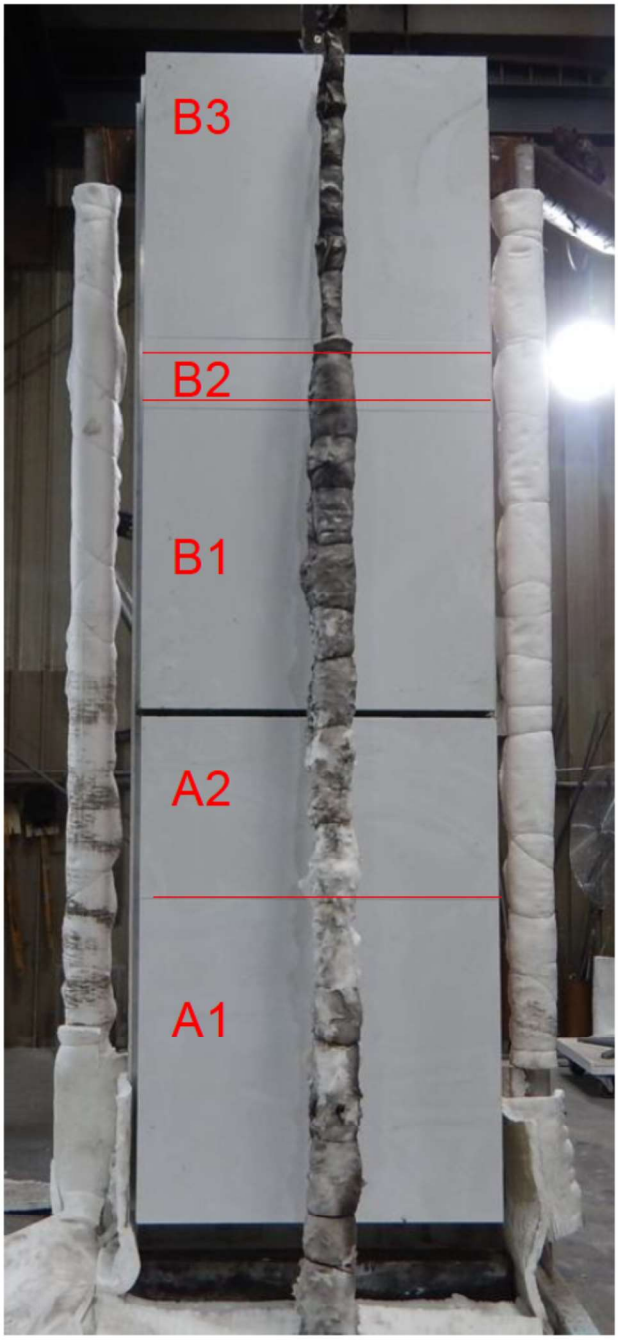

Figure 11 Designation for test specimen observations

Table 5 Test observations

Time		Section	Observation
Min	Sec		
-2	00	All	Data collection started.
0	00	All	The reaction to fire test started. The burner was ignited with the output set to a heat release rate of 100 kW.
0	50	A1	The bottom edge of the panel had discoloured.
2	48	A1	Flaming debris was falling from the bottom of the panel.
3	13	A1	Flaming debris was dripping from the bottom east and west edges of the panel.
4	51	A1	The entirety of the panel had discoloured.
5	55	A1	There was a sudden release of gas from the panel.
6	43	A2	Flames had reached the top of the panel.
7	11	A2	The panel had discoloured.
7	44	A1 and A2	The amount of molten flaming debris falling from the specimen had increased.
8	10	B1	The flames had reached the bottom edge of the panel.
8	24	B1	The panel had discoloured.
9	44	All	The volume of smoke released from the specimen increased.
10	15	A1/A2	Smoke was released from the panel joint.
15	00	All	The output of the burner was adjusted to 300 kW.
15	17	B2	The flame height had reached the bottom of the panel.
16	55	B3	The flame height had reached the bottom of the panel.
17	05	A1/A2	There was a large release of gas and the joint between the panels was flaming.
17	37	A2/B1	Intermittent flaming in the gap between the panels.
18	50	A2/B1	Sustained flaming in the gap between the panels.
20	27	A1	The fire had breached the aluminium skin of the panel.
22	00	All	The was terminated due to safety concerns ensued from excessive flaming of the specimen.

Appendix C Photographs

Figure 12 The specimen before the start of the test – exposed side

Figure 13 The specimen before the start of the test – unexposed side

Figure 14 The specimen 1 minute into the test at 100 kW

Figure 15 The specimen 4 minutes into the test at 100 kW

Figure 16 The specimen 7 minutes into the test at 100 kW

Figure 17 The specimen 10 minutes into the test at 100 kW

Figure 18 The specimen 14 minutes and 59 seconds into the test at 100 kW

Figure 19 The specimen 1 minute after the burner output was increased to 300 kW (16 minutes into the test)

Figure 20 The specimen 2 minutes after the burner output was increased to 300 kW (17 minutes into the test)

Figure 21 The specimen 5 minutes after the burner output was increased to 300 kW (20 minutes into the test)

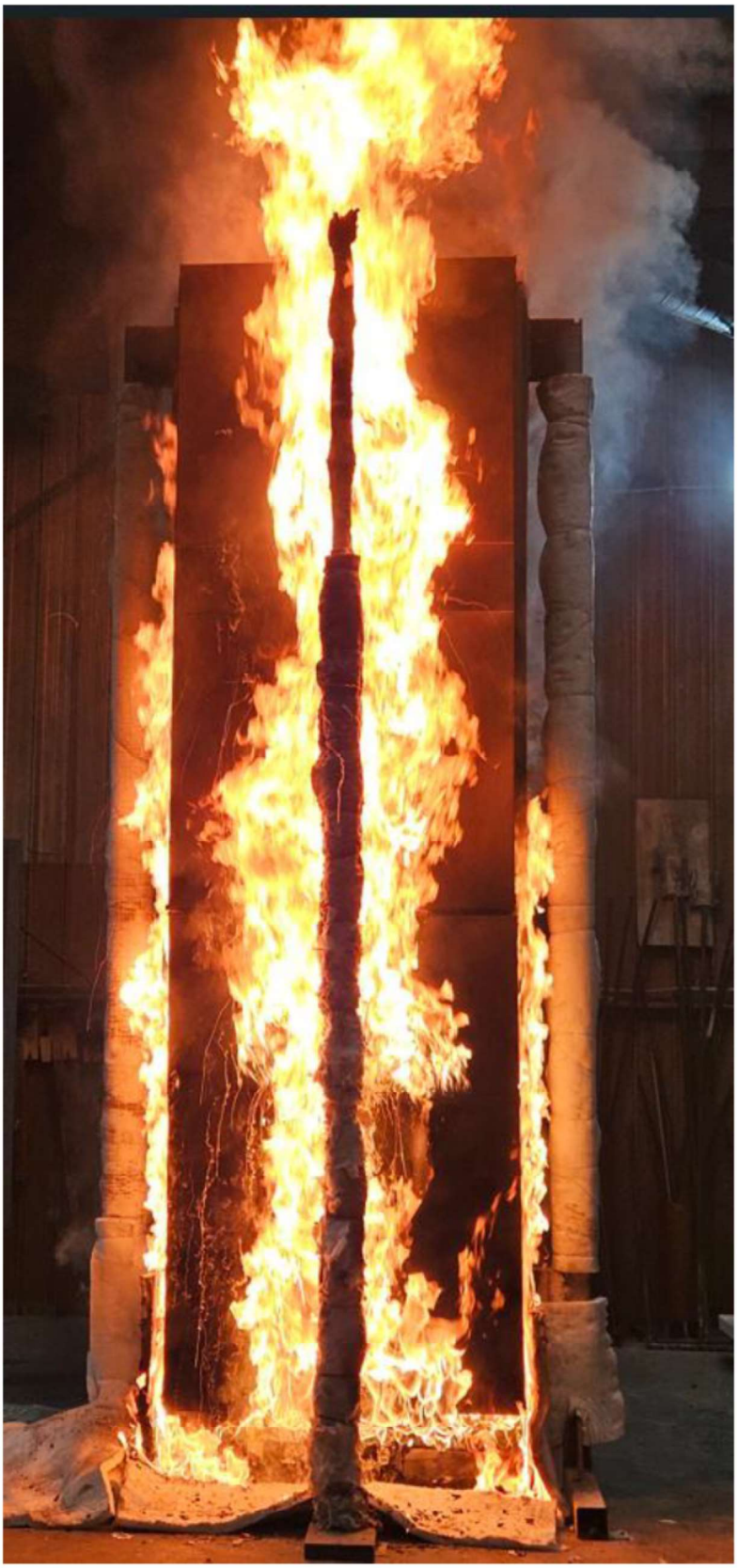

Figure 22 The specimen 6 minutes after the burner output was increased to 300 kW (21 minutes into the test)

Figure 23 The exposed face of the specimen at the end of the test (22 minutes into the test)

Figure 24 The unexposed face of the specimen after the end of the test

Figure 25 The exposed face of the specimen after the end of the test

Appendix D Chemical analysis results

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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: [redacted]
Approved by: [redacted]

COMMERCIAL-IN-CONFIDENCE

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.

[redacted]
Senior Technical Officer
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Mark Wainwright Analytical Centre, UNSW
22 February 2024

UNSW SYDNEY

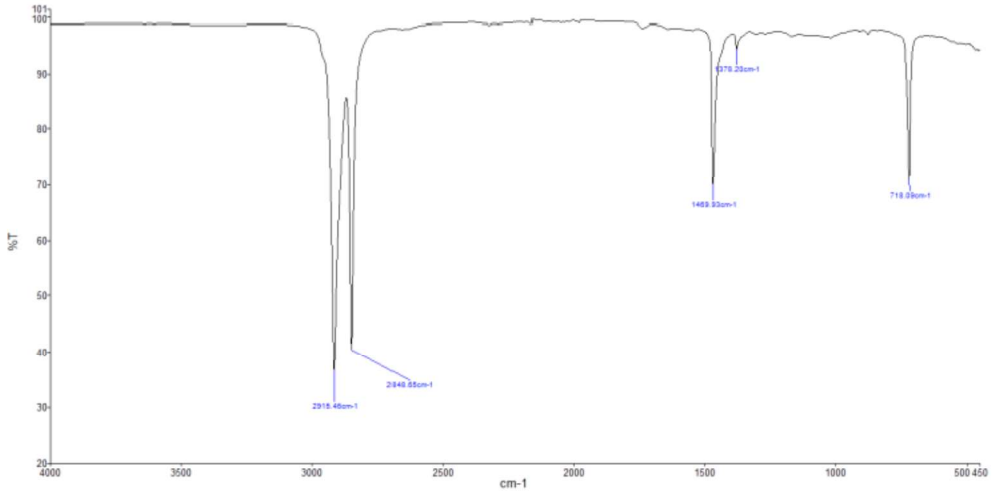

Figure 1. FT-IR spectrum of sample #1

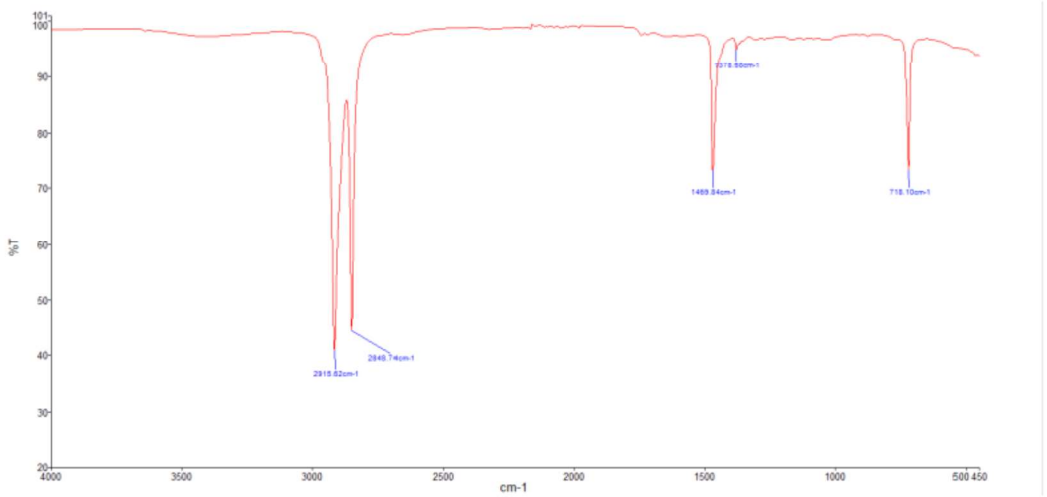

Figure 2. FT-IR spectrum of sample #2

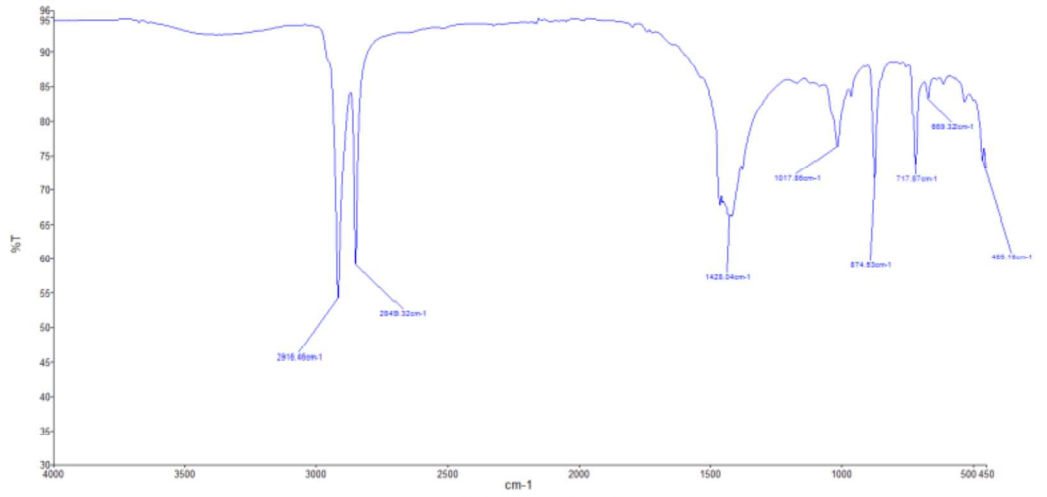

Figure 3. FT-IR spectrum of sample #3

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