Reaction to fire test report

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

Test sponsor: Cladding Safety Victoria (CSV)

System: Aluminium composite panel (ACP) blanking wall system

Job number: RTF230149

Test date: 26 February 2024 Revision: R1.0

WARRINGTONFIRE AUSTRALIA
A Jensen Hughes Company

Quality management

Revision	Date	Information about the report			
R1.0	30 April 2024	Description	Initial issue.		
			Prepared by	**Reviewed by**	**Authorised by**
		Name	[redacted]		
		Signature	[redacted]		

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ABN 81 050 241 524

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Contents

1. Introduction

This report documents the findings of an ad-hoc reaction to fire test for an Aluminium composite panel (ACP) external wall cladding system performed on 26 February 2024. The test was based off 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	FR aluminium composite panel (ACP)	
	Product name	[redacted] Aluminium Composite Panel - 4 mm Dark Oak/Matte White	
	Manufacturer/Supplier	[redacted]	
	Material	The material was nominated as panels consisting of two layers of aluminium sheets sandwiching a layer (core) with 45 % polyethylene (PE) and inorganic filler. Analysis conducted by the analytical centre of UNSW showed that the core consisted of polyethylene-vinyl acetate (PEVA) - found to be 43.9 % w/w - whilst the remainder of the material was found to be 45.3 % magnesium hydroxide, 6.1 % calcium carbonate and 4.8 % other inert material. Refer to Appendix C for more detailed results.	
	Size	Total panel thickness – 4.0 mm Core thickness – 2.9 mm Skin thickness – 0.5 mm (both) Refer to Appendix A for individual panel sizing details.	
	Areal density	Full panel – 6.9 kg/m² (obtained from reference report RTF230150)	
	Colour	Skins	Front skin – Dark brown oak pattern Back skin – Matte white
		Core	Light grey
2.	Item name	FR Plasterboard	
	Product name	[redacted] 13 MM 1200 × 3600	
	Size	1200 mm wide × 3600 mm long × 13 mm thickness	
Framing			

Item	Description	
3.	Item name	Test rig frame - 90 × 90 SHS and 200 × 90 PFC frame
	Material	Steel
	Size	90 mm × 90 mm × 5 mm thick and 200 mm × 90 mm × 10 mm thick – refer to Figure 10.
4.	Item name	Top track/base track
	Material	Steel
	Size	92 mm × 3600 mm × 40 mm, 1.15 mm B.M.T.
5.	Item name	Steel stud
	Size	92 mm × 3600 mm × 40 mm, 1.15 mm B.M.T.
	Installation	Studs at every 600 mm
6.	Item name	Steel noggin
	Size	92 mm × 580 mm × 40 mm, 1.15 mm B.M.T.
	Installation	Running horizontally at about 1800 mm height
7.	Item name	Aluminium cassette angles
	Size	20 mm × 20 mm × 3600 mm, 1.6 mm thick
	Installation	Used to secure the plasterboard within the ACPs. The angle was screw fixed to both ACPs and the plasterboard using screws (item 10 and 11).
8.	Item name	Curtain wall bracket
	Size	140 mm deep (13 mm thick) × 137 tall (13 mm thick) × 76 mm wide, 100 mm deep (9 mm thick) × 100 tall (9 mm thick) × 200 mm wide
	Installation	Used to secure the studs to the test rig using tek screws (item 11).
Sealant/Adhesive		
9.	Item name	Weathering sealant – silicone sealant
	Product name	[redacted]
	Manufacturer/Supplier	[redacted]
	Usage	Placed at ACP edges
Fixings		
10.	Item name	Wafer head screws
	Size	10g × 25 mm long
	Installation	Used to fix FR aluminium composite panel to the aluminium cassette angles
11.	Item name	Tek screws
	Size	12g × 48 mm long
	Installation	Used to fix plasterboard to the studs and aluminium cassette angles
12.	Item name	Aluminium rivets
	Size	Ø4 mm
	Usage	To fix the studs to the noggins.
Installation method		

Item	Description
Test rig:	The test rig frame was the main support for the test specimen, however, there were two C-purlin sections that acted as false slabs (200 mm tall). The test specimen, interconnected through studs and noggins, was fixed to the test ring using curtain wall brackets (item 7) and fixings (item 10) – see Figure 10, Figure 11 and Figure 12.
Blanking wall	The blanking wall was composed of plasterboards (item 2), top/base tracks (item 4), studs (item 5), noggins (item 6) and the diagonal supports, which were screw fix together using aluminium rivets (item 12). The FR plasterboards (item 2) was fixed to the studs and the aluminium cassette angles (item 7) using tek screws (item 11).
Cladding	The exposed face of the specimen was clad with cassetted ACPs (item 1) that were fixed to aluminium cassette angles (item 6) using wafer head screws (item 9) at about 325 mm centres.

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 off 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.
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
Instrumentation and equipment	• 21 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 for details on positioning. • Temperatures were measured by seven 100 mm × 100 mm × 0.7 mm plate thermocouples with mineral insulated metal sheathed (MIMS) Type K thermocouples with an overall diameter of 1 mm with the measuring junction electrically insulated from the sheath. The thermocouple hot junction was fixed to the geometric centre of the plate by a small steel strip made from the same material as the plate. The plate thermocouples included 97 mm × 97 mm × 10 mm inorganic insulation pads. Before the first use of the plate thermocouples, they were aged by being exposed to heat in a fire-resistance test furnace for 90 min under the standard temperature/ time curve. Refer and Figure 1 for details on positioning. • 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 adjacent to the ACP with 25 mm thick ceramic mineral wool separating the two.
Test procedure	• At least two minutes of baseline data was collected prior to burner ignition. Temperature data was collected at 5 s intervals. • The heat output from the burner was held at 300 kW for the 30 minutes. The burner was then turned off and data recorded for the next 30 minutes.

4. Test measurements and results

The results from the tests are summarized below. Photographs of the specimen are included in Appendix B.

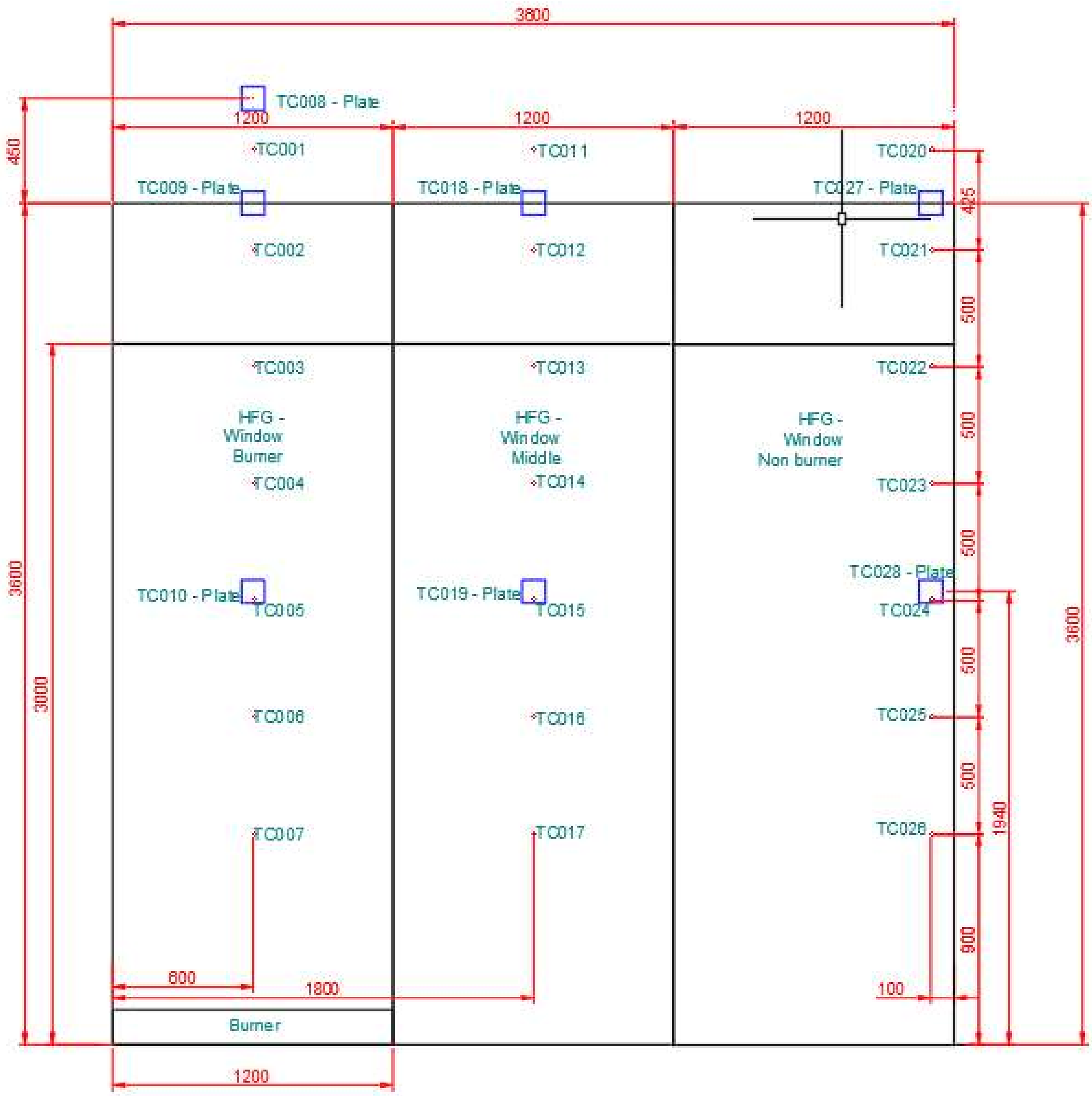

Figure 1 Instrumentation locations – front elevation

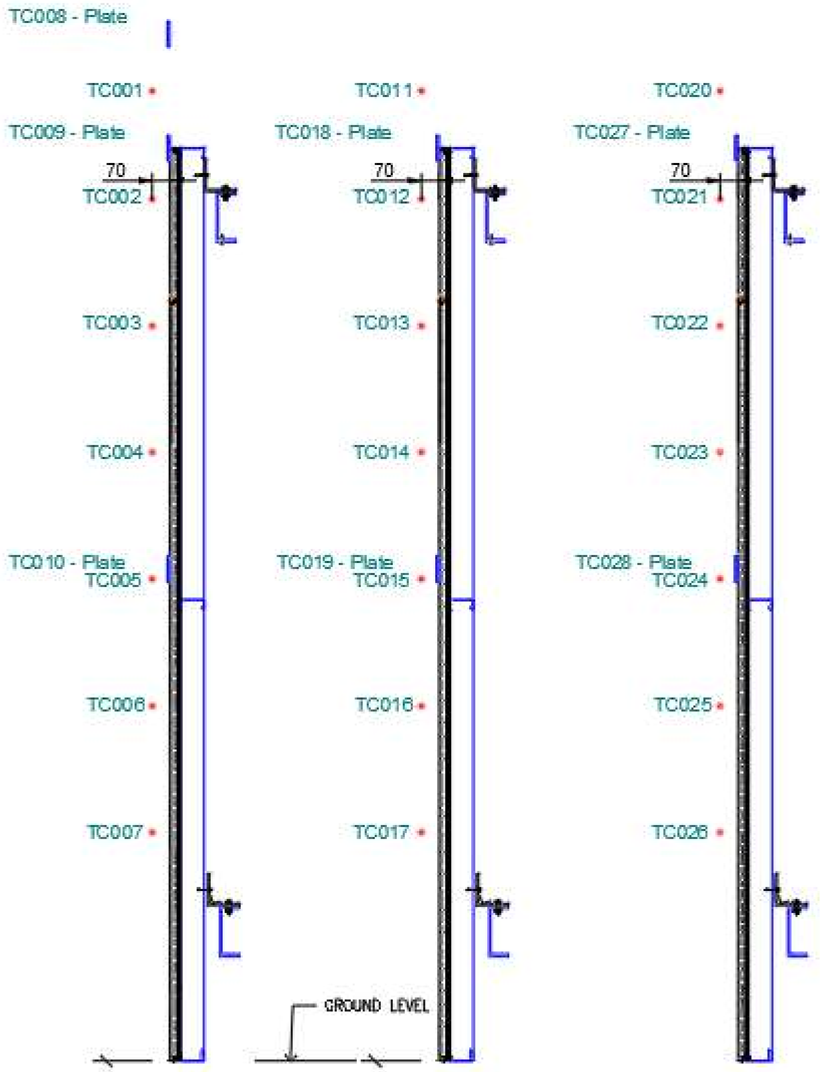

Figure 2 Instrumentation locations – sections

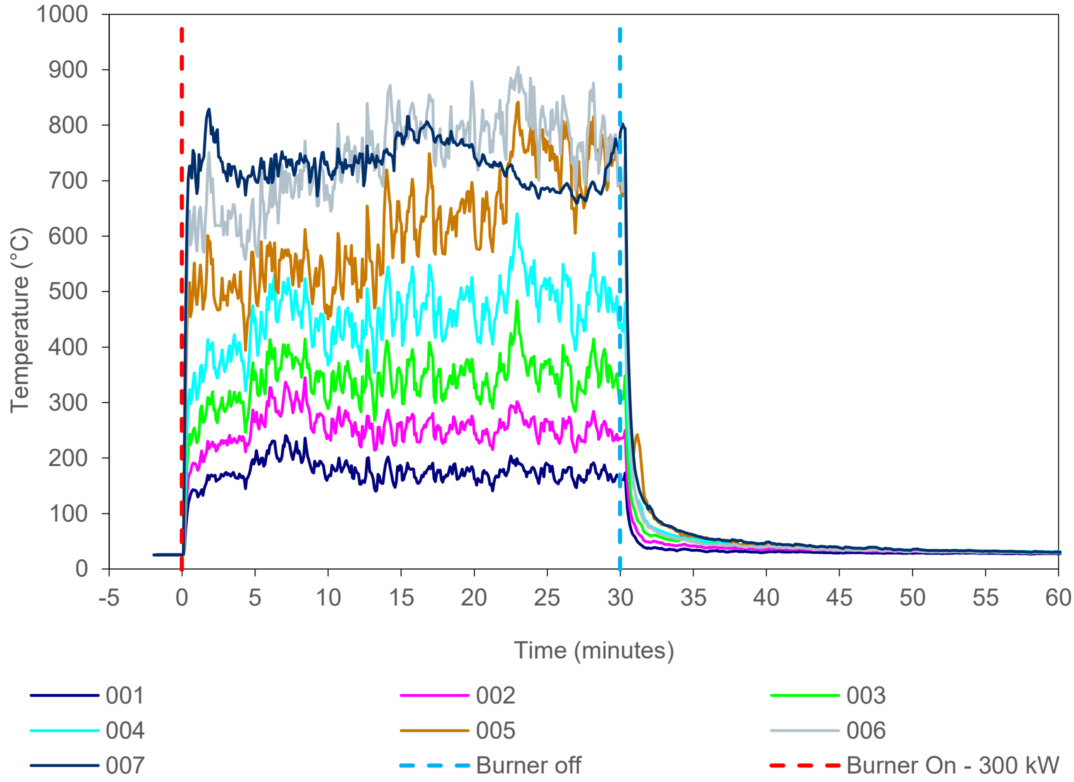

Figure 3 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen - in-line with the burner.**

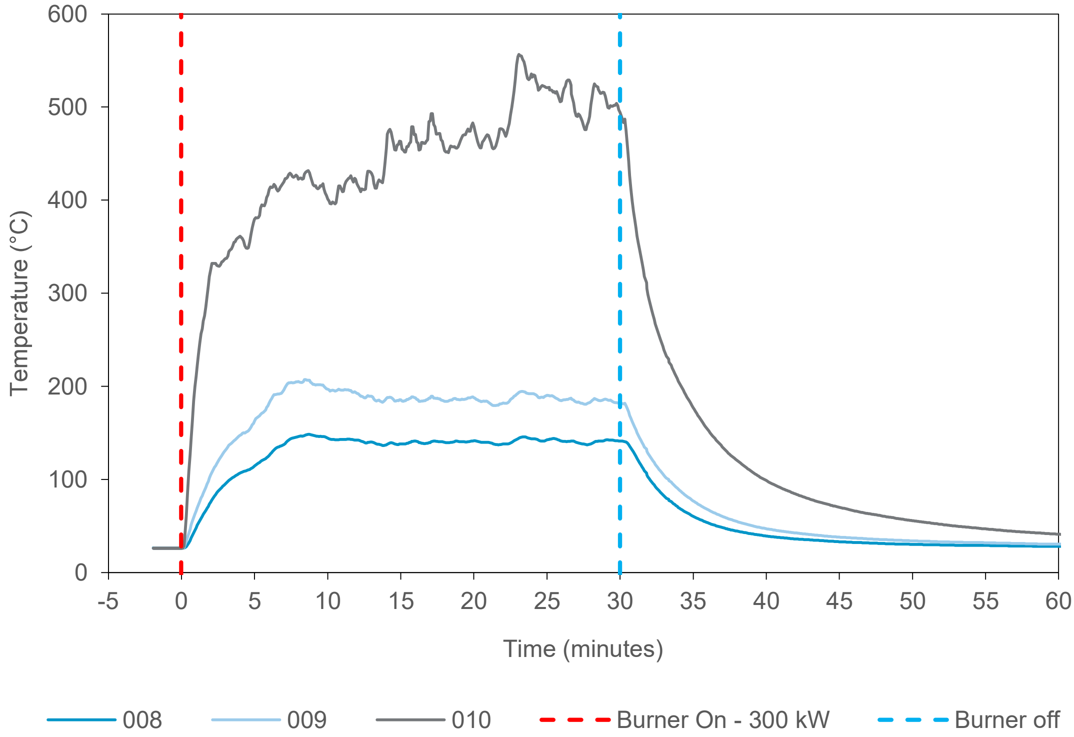

Figure 4 **External temperature data collected by thermocouples in-line with ACP - in-line with the burner.**

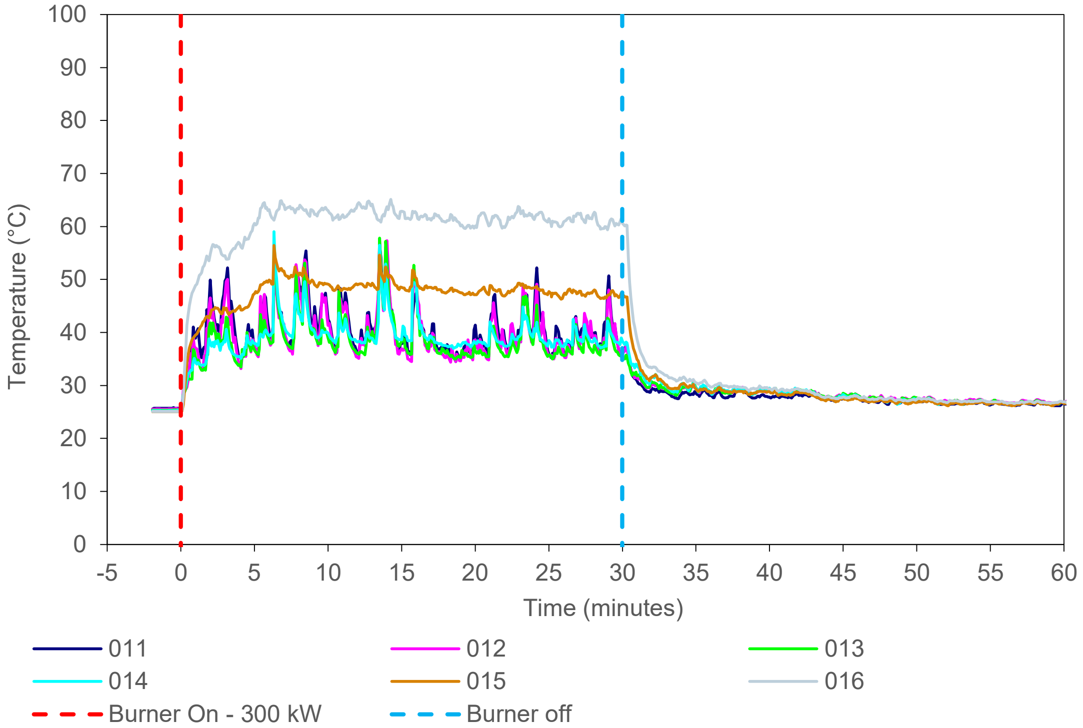

Figure 5 External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – central module.

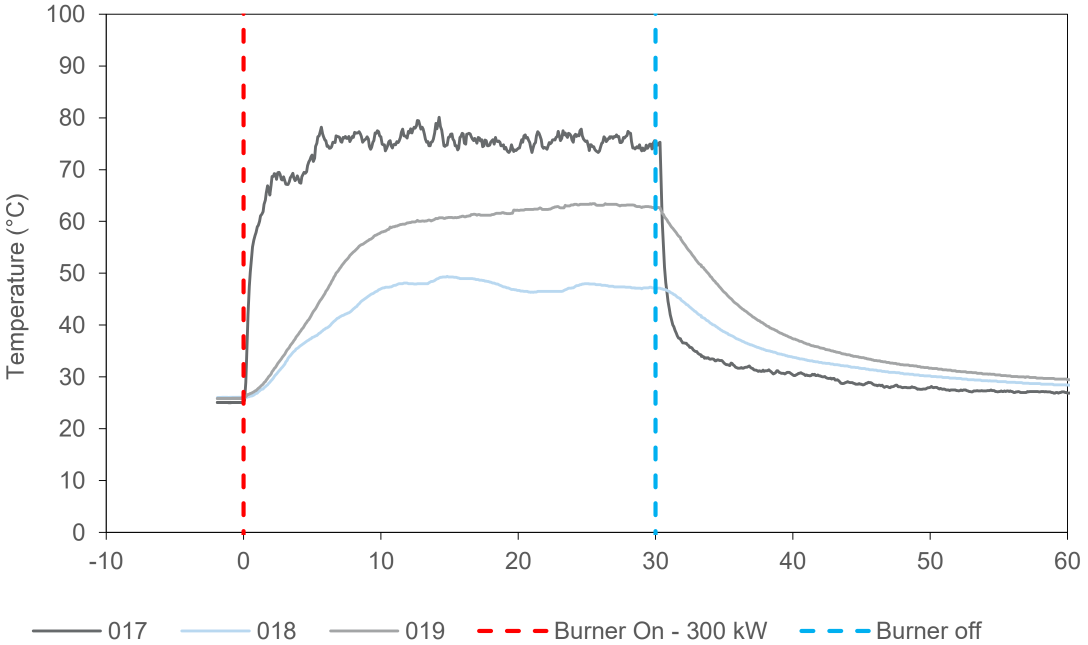

Figure 6 External temperature data collected by thermocouples in-line with ACP – central module.

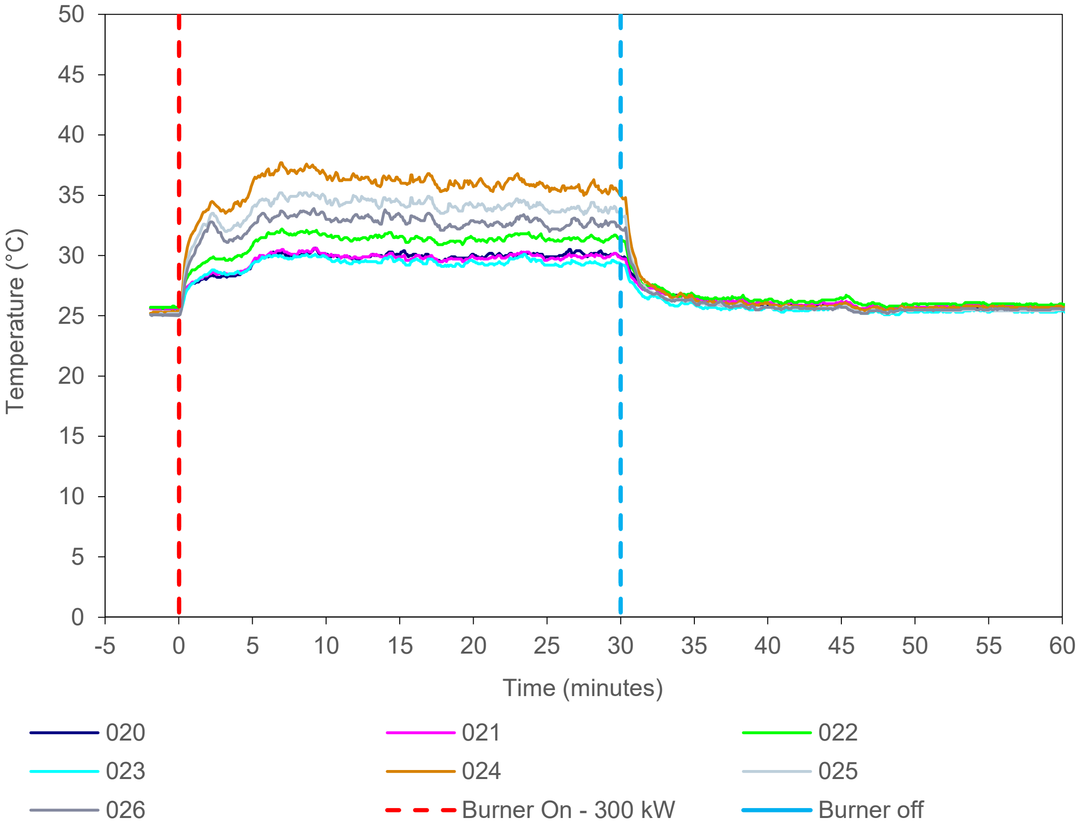

Figure 7 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – away from burner.**

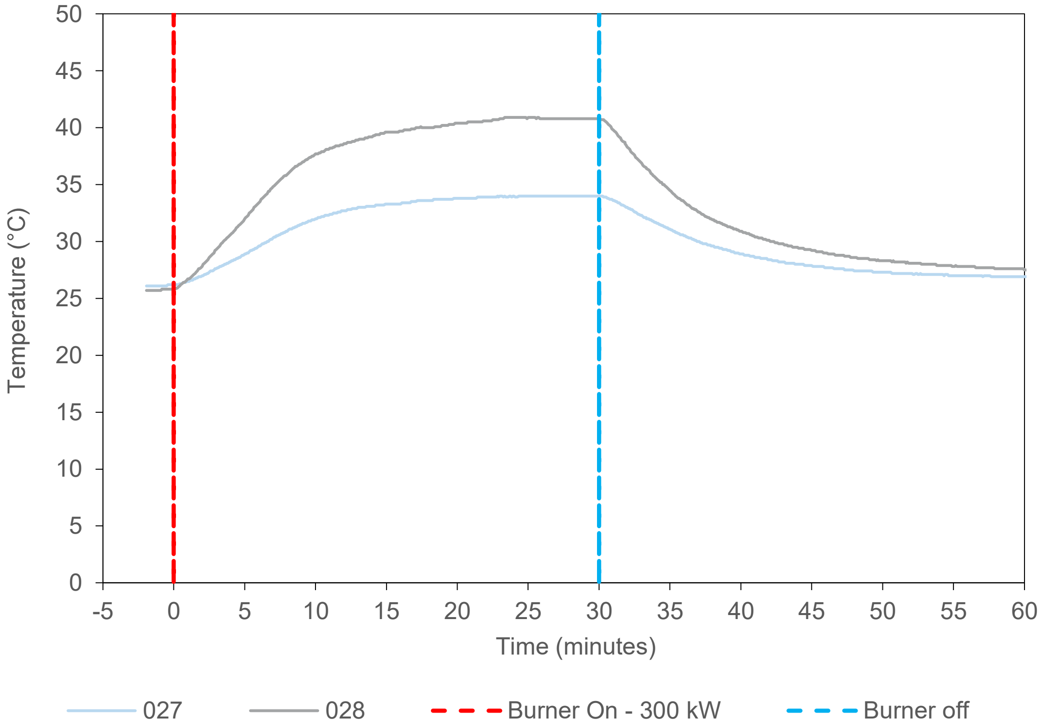

Figure 8 **External temperature data collected by thermocouples in-line with ACP – away from burner.**

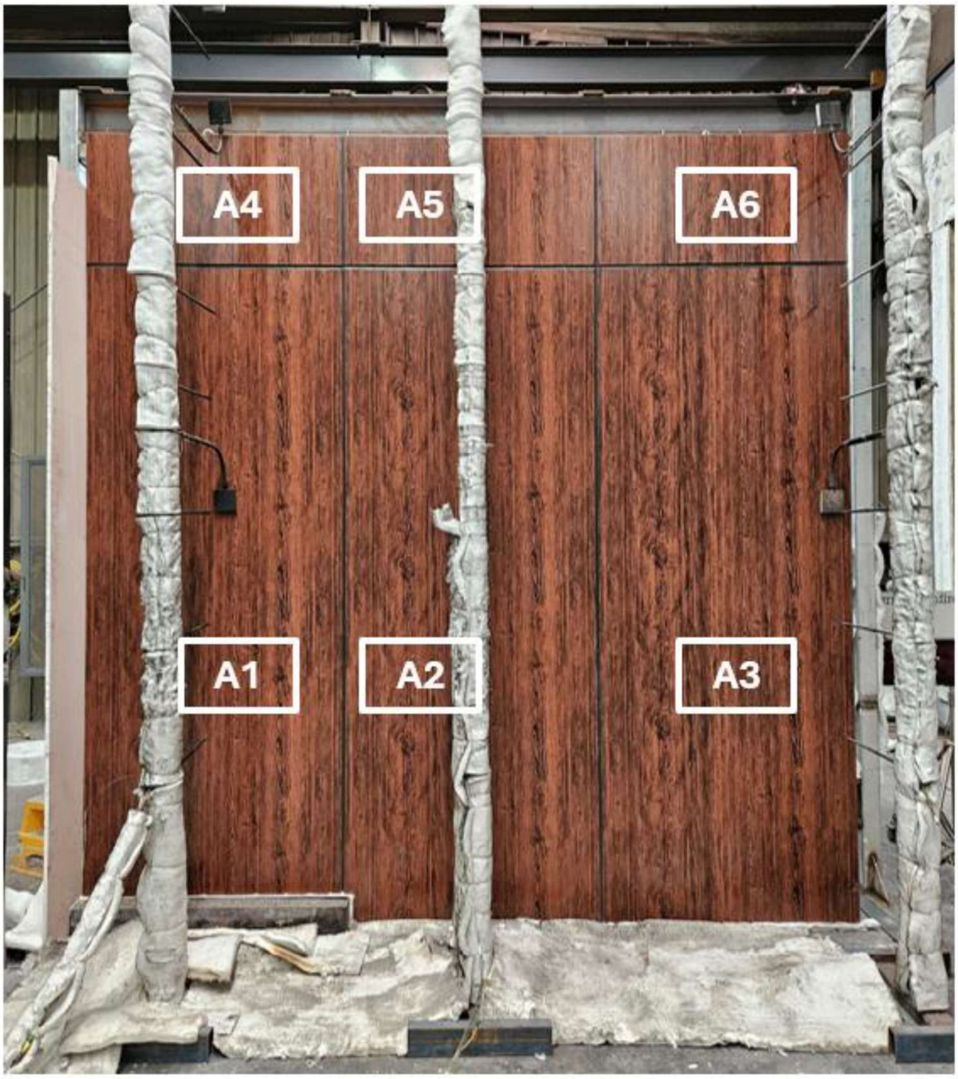

Figure 9 Designation of section for the test observations.

Table 4 shows the observations of any significant behaviour of the specimen during the test. Figure 9 shows the panel designation sighted in the observations.

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		Des.	Observation
Min	Sec		
-2	00	All	Data collection started.
0	00	All	The reaction to fire test was started. The burner ignited with a heat output set at 300 kW.
0	42	A1	The lower face of the panel started to deform.
1	13	A1	The paint in the lower area started to burn away, and the panel face was discolouring.
1	56	A1	More paint started to burn away.

Time		Des.	Observation
Min	Sec		
3	09	A1/A2	The vertical joint was smoking.
4	22	A1	The lower part of the panel had opened up.
5	26	A1	The panel opened further towards the middle part the panel.
5	35	A1/A2	There was flaming at the vertical joint.
7	00	A1	Opened area reached almost 2/3 up panel.
9	00	A1	Paint on the top area of the panel was flaking off.
11	05	A4	The paint of the lower part was flaking off and the panel was discolouring.
11	42	A4	The paint of the lower left part had burned off and the left part of the panel discoloured.
11	57	A1	The panel opened further towards the left edge of the panel.
30	00	All	The burner was turned off.
30	20	A1	The panel was still burning.
33	17	A1	Most flaming had self-extinguished. Only small areas at the bottom was still flaming.
42	10	A1	Smoke emissions had reduced.
60	00	All	The 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.

Appendix A Drawings of test assembly

The drawings of the test assembly in Figure 10 to Figure 13 were provided by the representatives of Warringtonfire. Dimensions, unless specified, are in mm. The Figure 12 was modified by Warringtonfire*, where the locations of Fixing Bracket and FR plasterboard were modified.

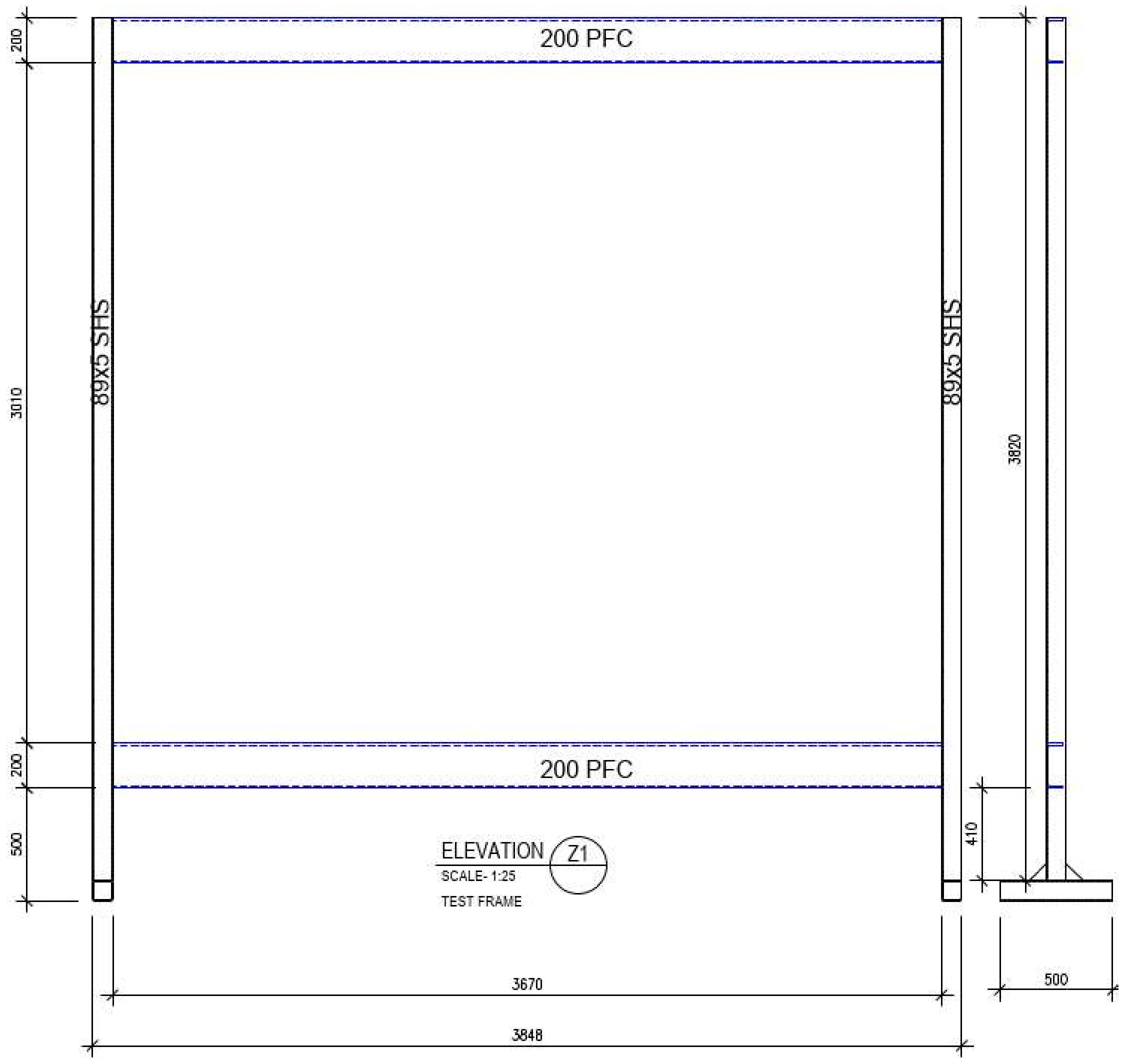

Figure 10 Elevation of rig support.

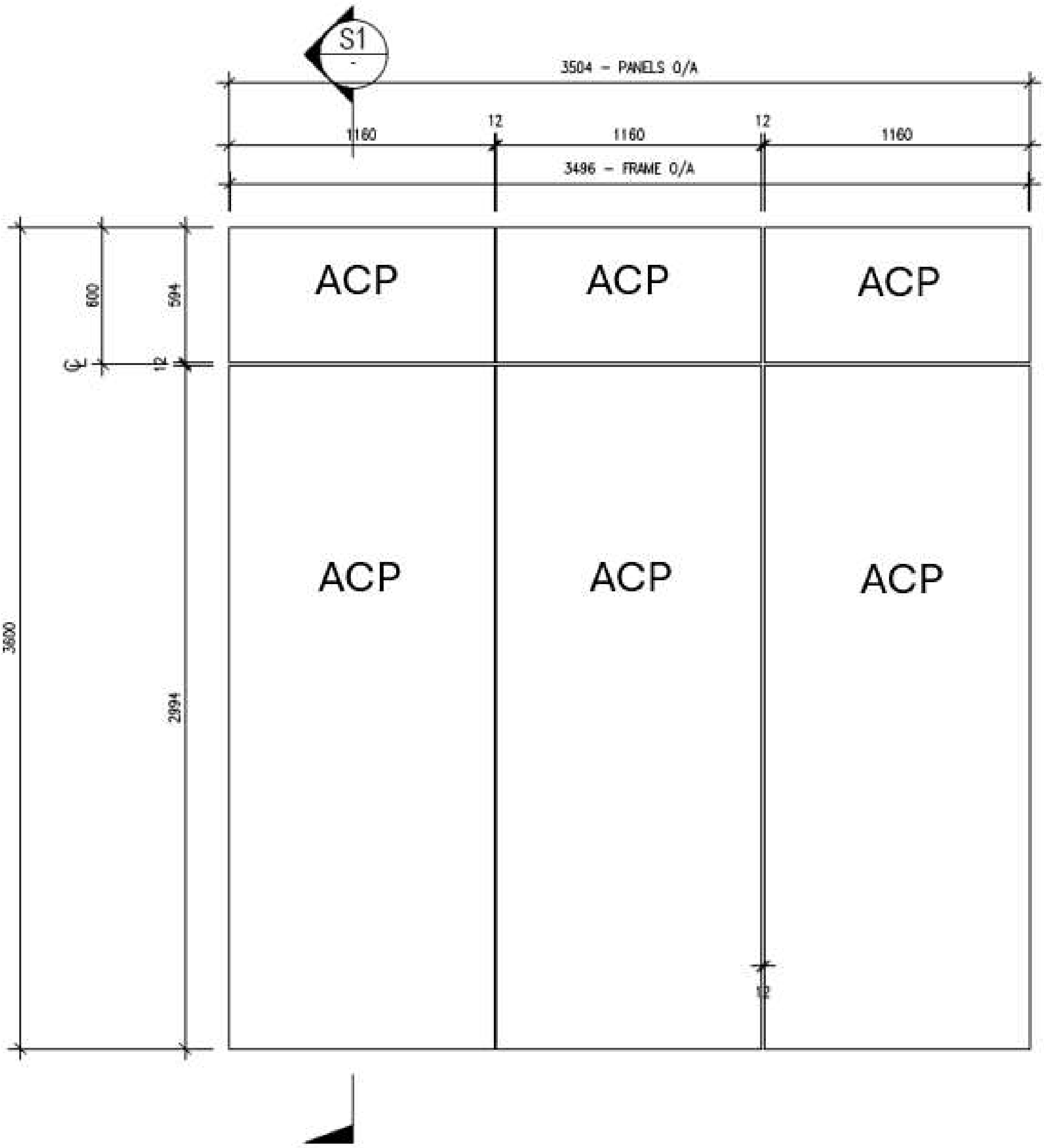

Figure 11 System assembly – Front view

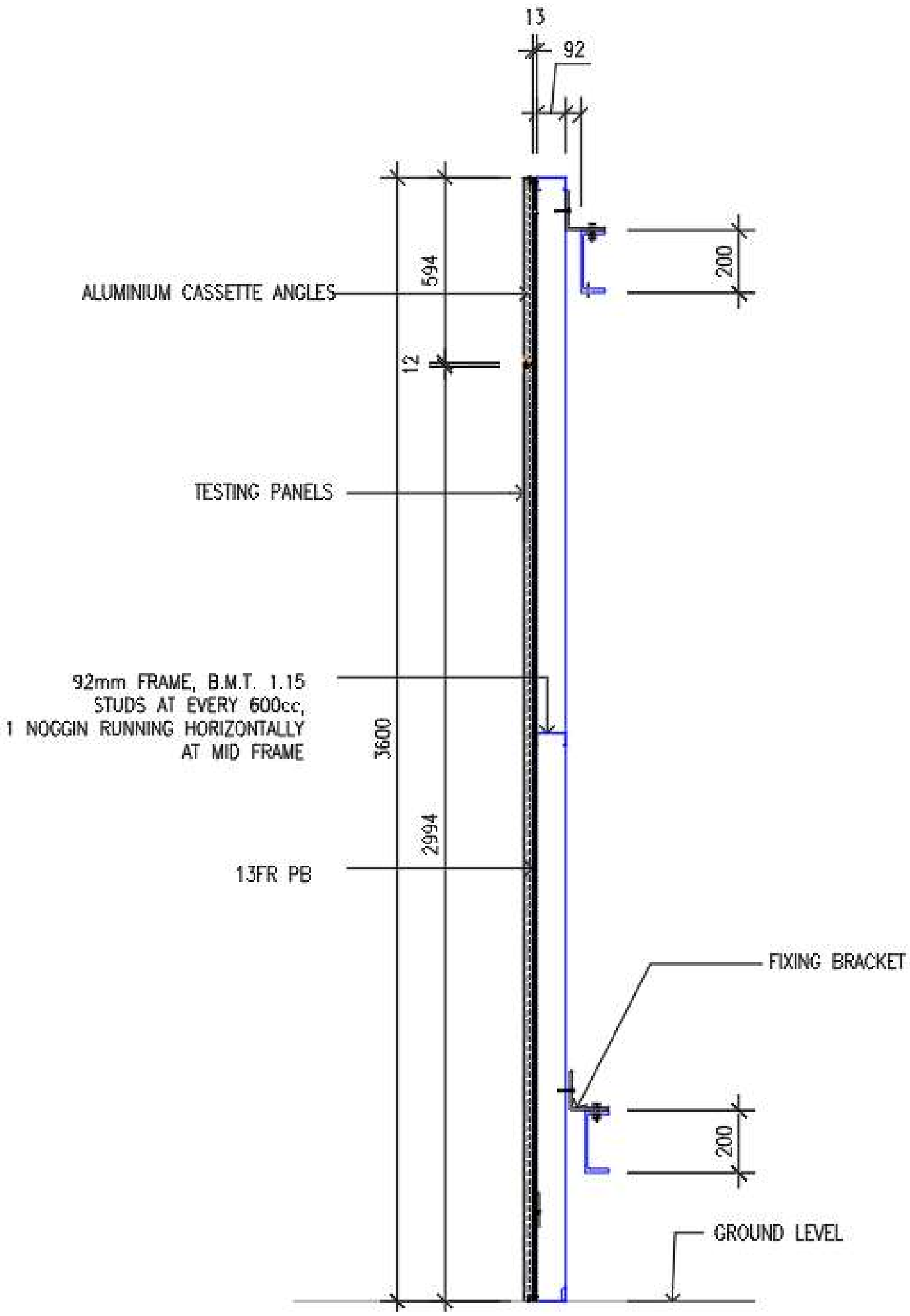

Figure 12 System assembly – vertical cross-sectional view.

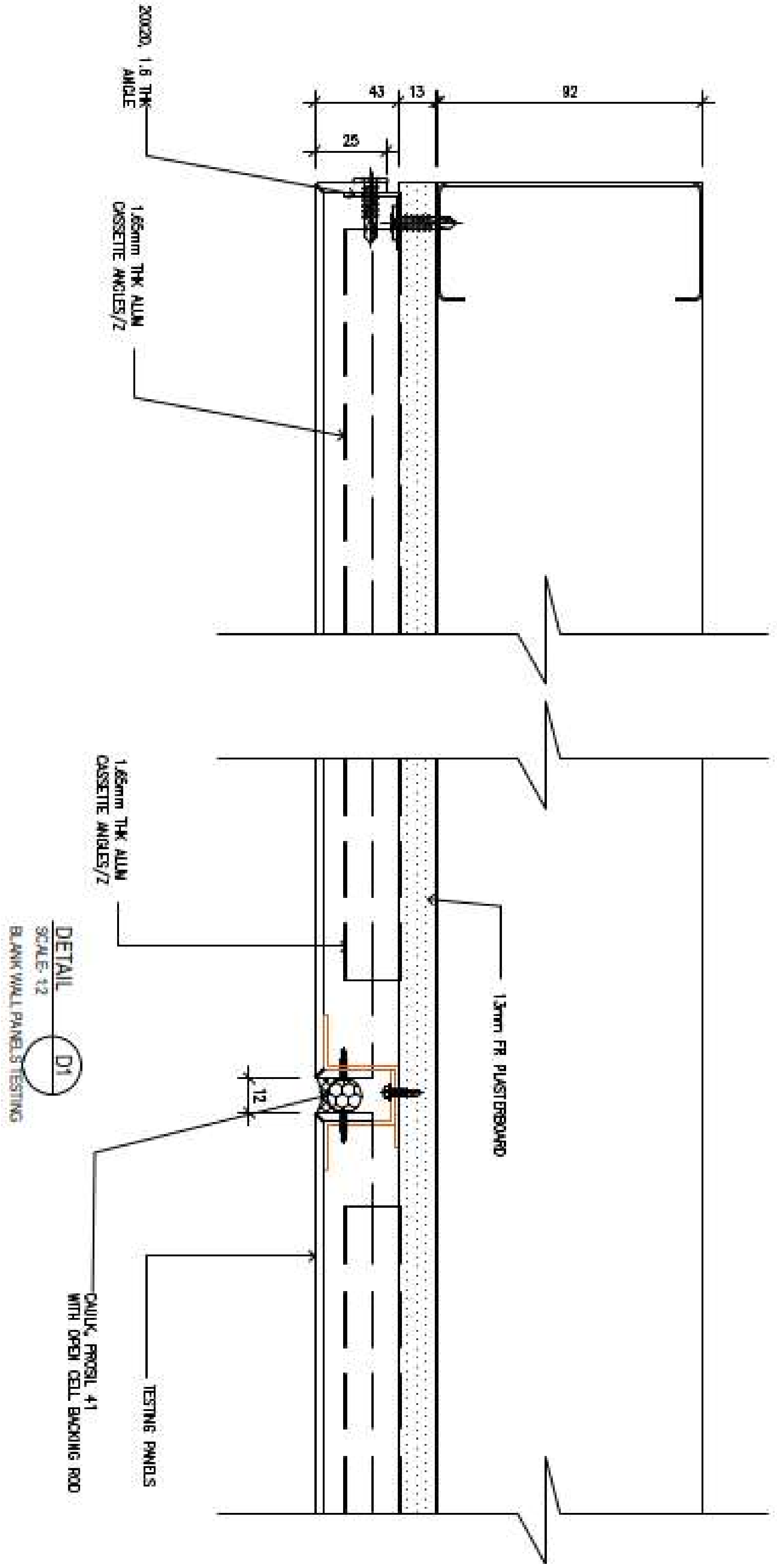

Figure 13 System assembly – vertical cross-sectional view (details).

Appendix B Photographs

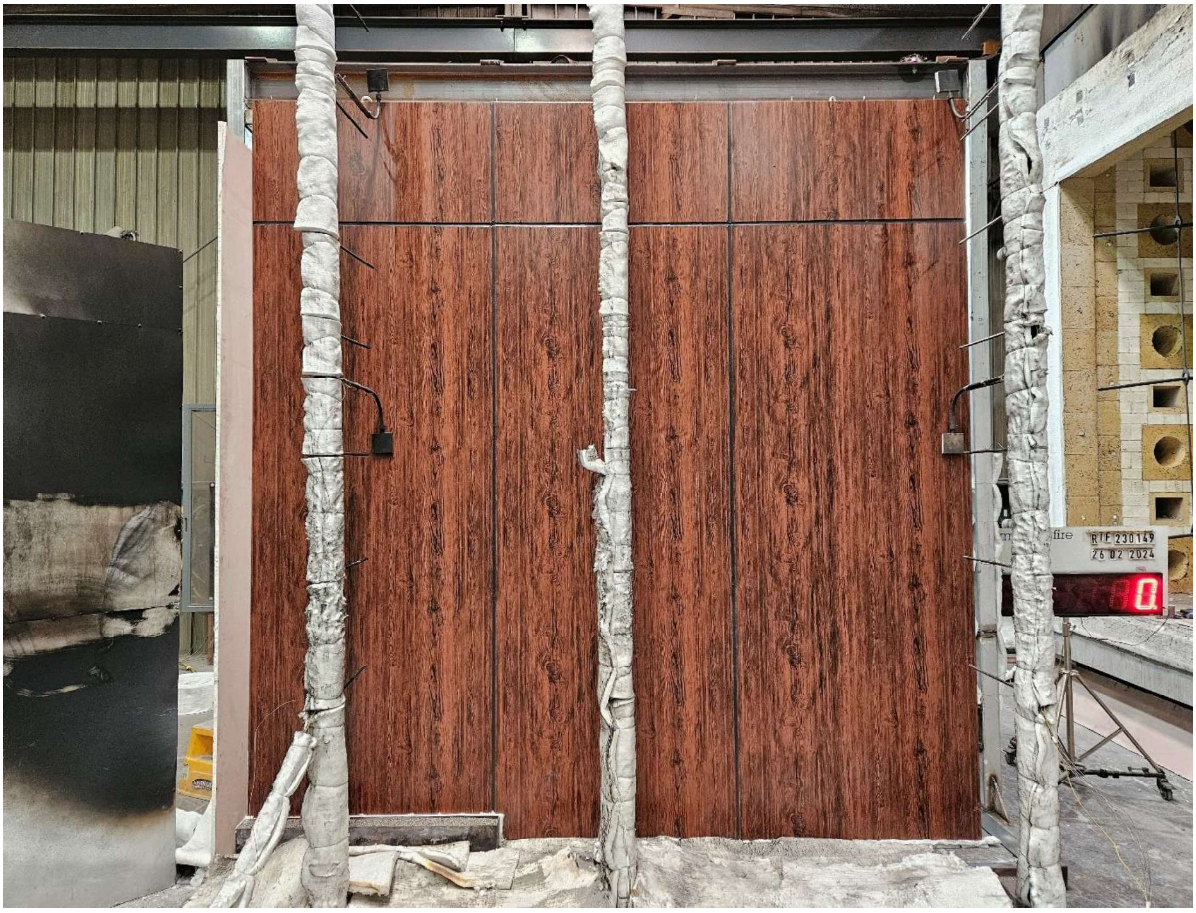

Figure 14 The specimen before the reaction to fire test - exposed side.

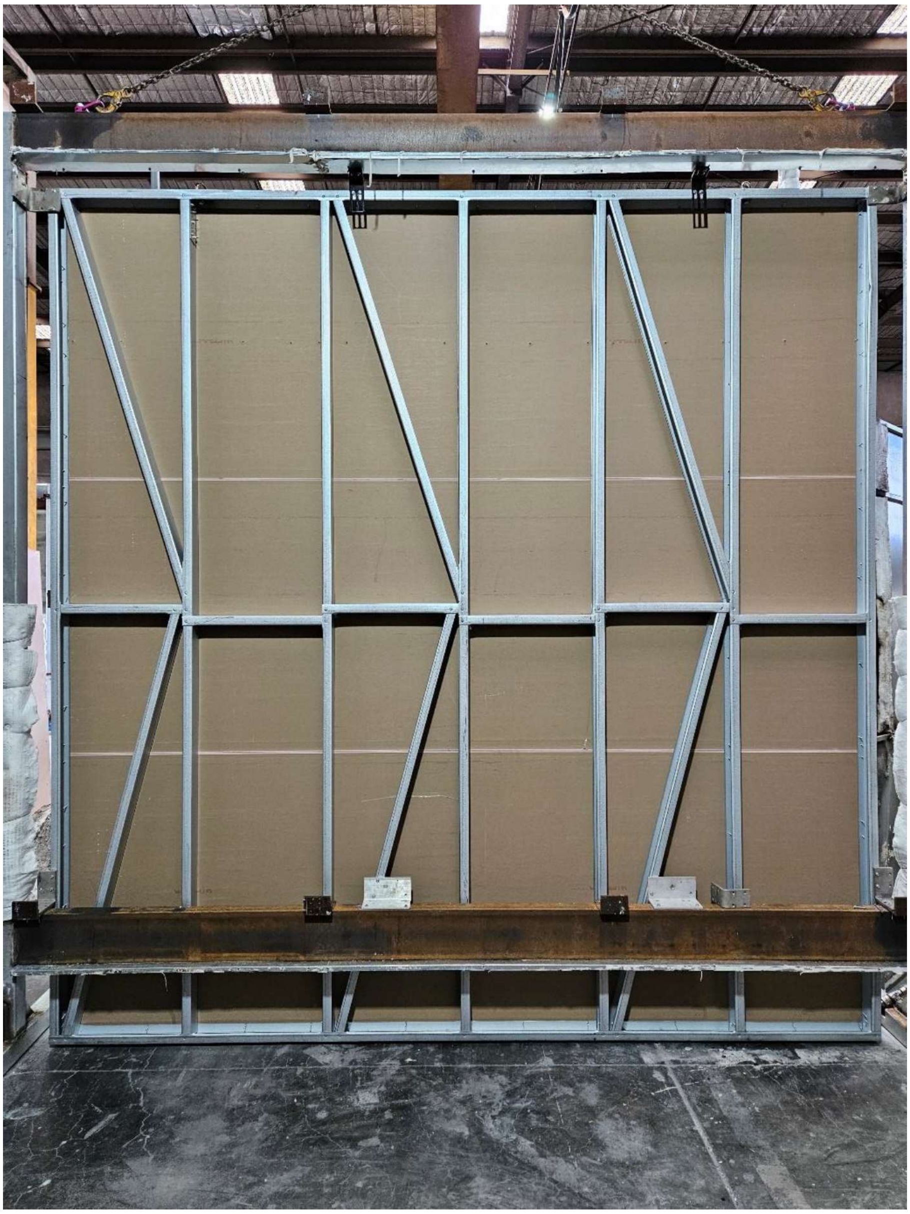

Figure 15 The specimen before the reaction to fire test - unexposed side.

Figure 16 The specimen 2 minutes 31 seconds into the test (burner output at 300 kW)

Figure 17 The specimen 5 minutes 8 seconds into the test (burner output at 300 kW)

Figure 18 The specimen 7 minutes 3 seconds into the test (burner output at 300 kW)

Figure 19 The specimen 10 minutes into the test (burner output at 300 kW)

Figure 20 The specimen 15 minutes into the test (burner output at 300 kW).

Figure 21 The specimen 20 minutes 38 seconds into the test (burner output at 300 kW).

Figure 22 The specimen 25 minutes into the test (burner output at 300 kW).

Figure 23 The specimen 30 minutes into the test (burner off).

Figure 24 The specimen 30 minutes 9 seconds into the test (9 seconds after burner off).

Figure 25 The specimen 31 minutes 33 seconds into the test (1 minute and 33 seconds after burner off).

Figure 26 The specimen 33 minutes 55 seconds into the test (3 minutes 55 seconds after burner off).

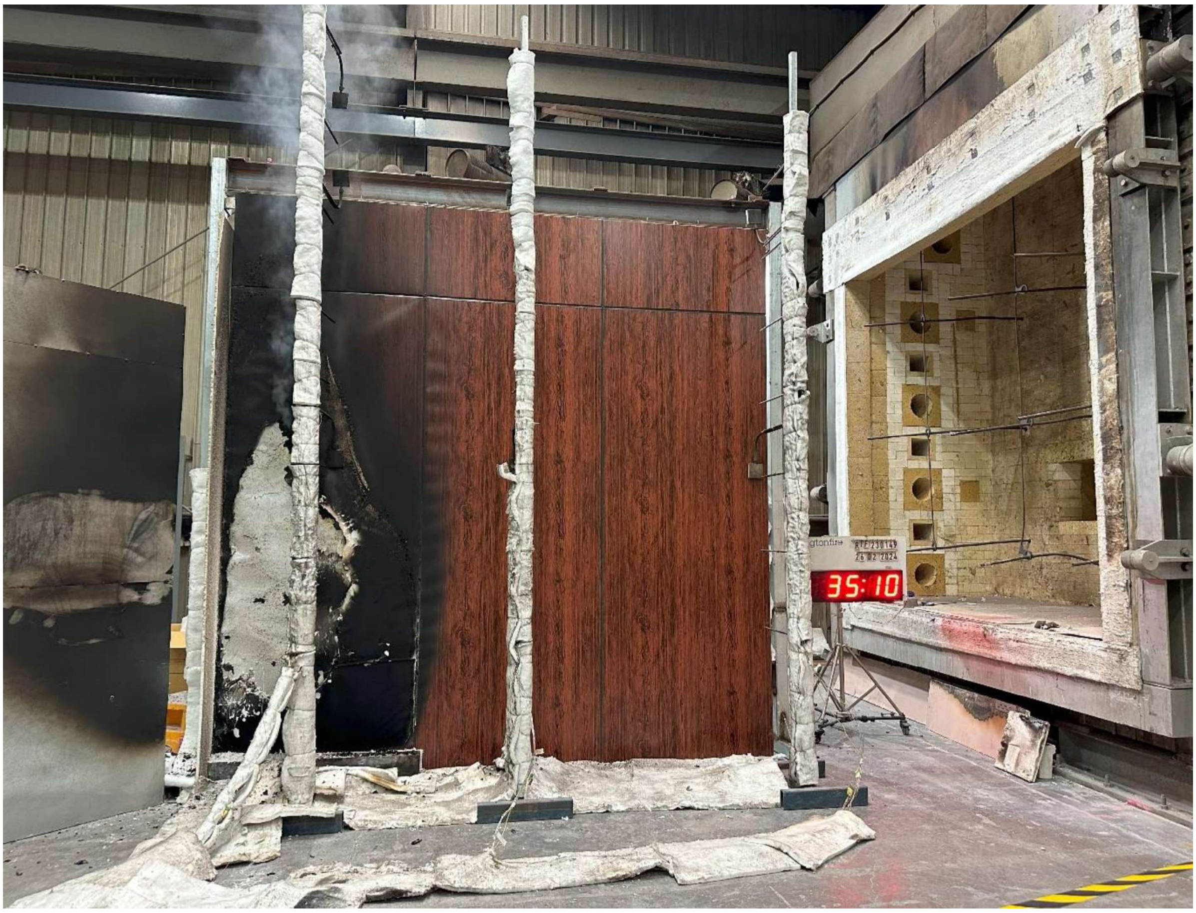

Figure 27 The specimen 35 minutes and 10 seconds into the test (5 minutes and 10 second after burner off).

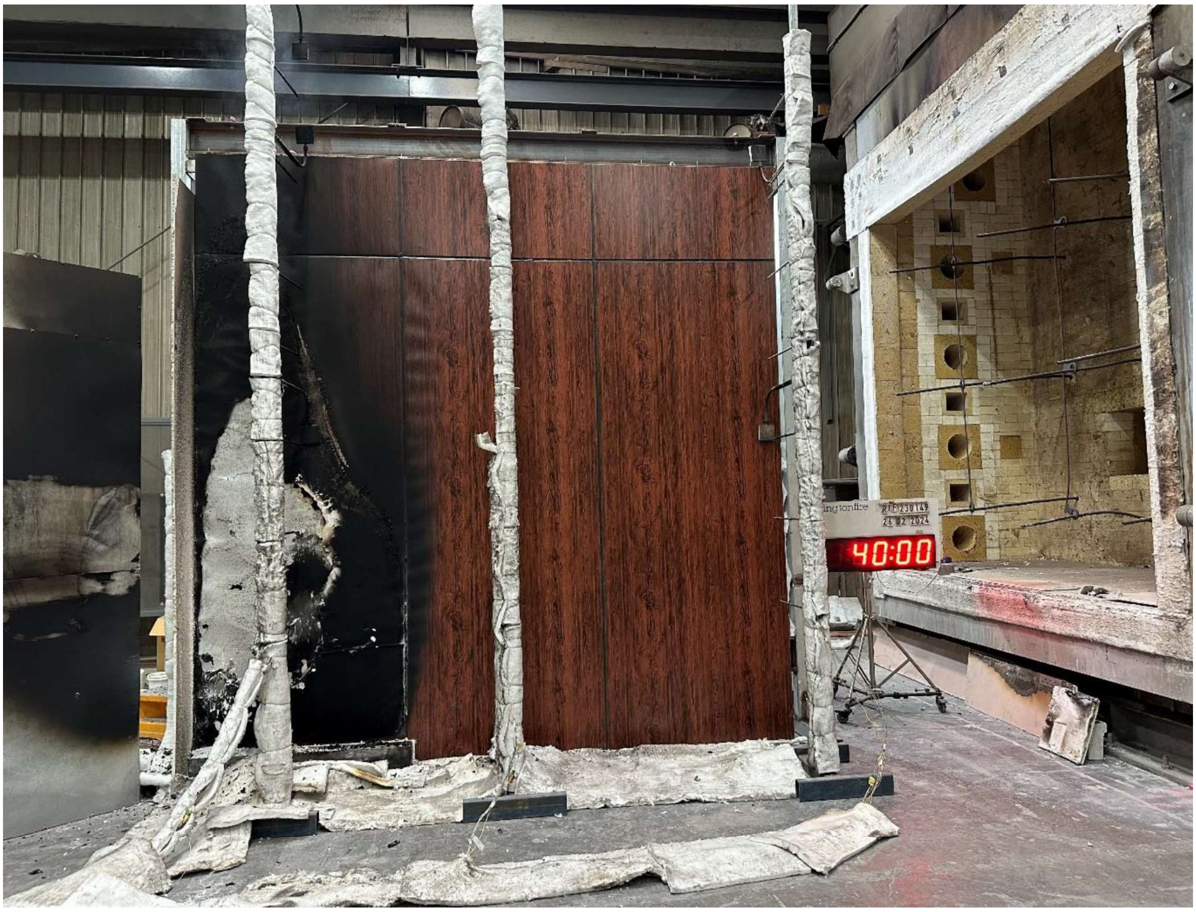

Figure 28 The specimen 40 minutes into the test (10 minutes after burner off).

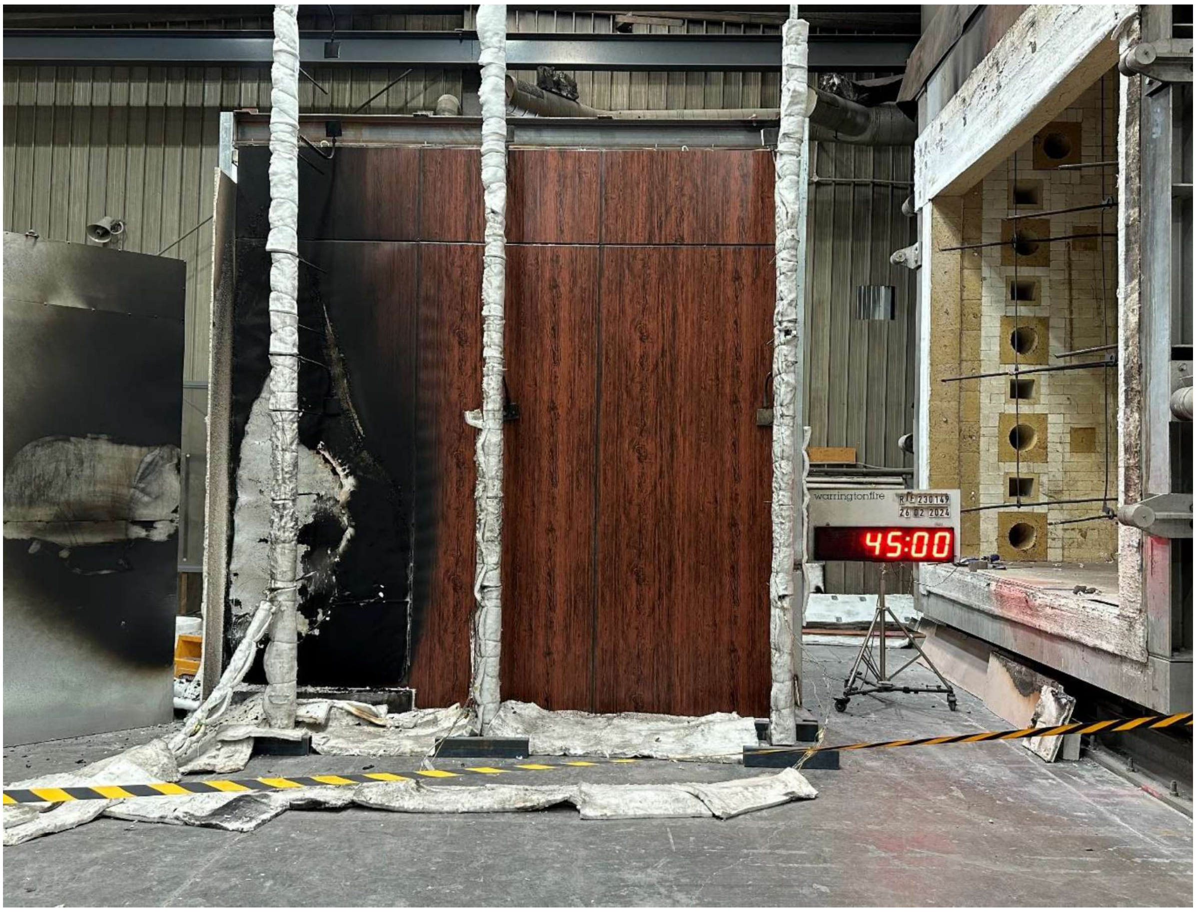

Figure 29 The specimen 45 minutes into the test (15 minutes after burner off).

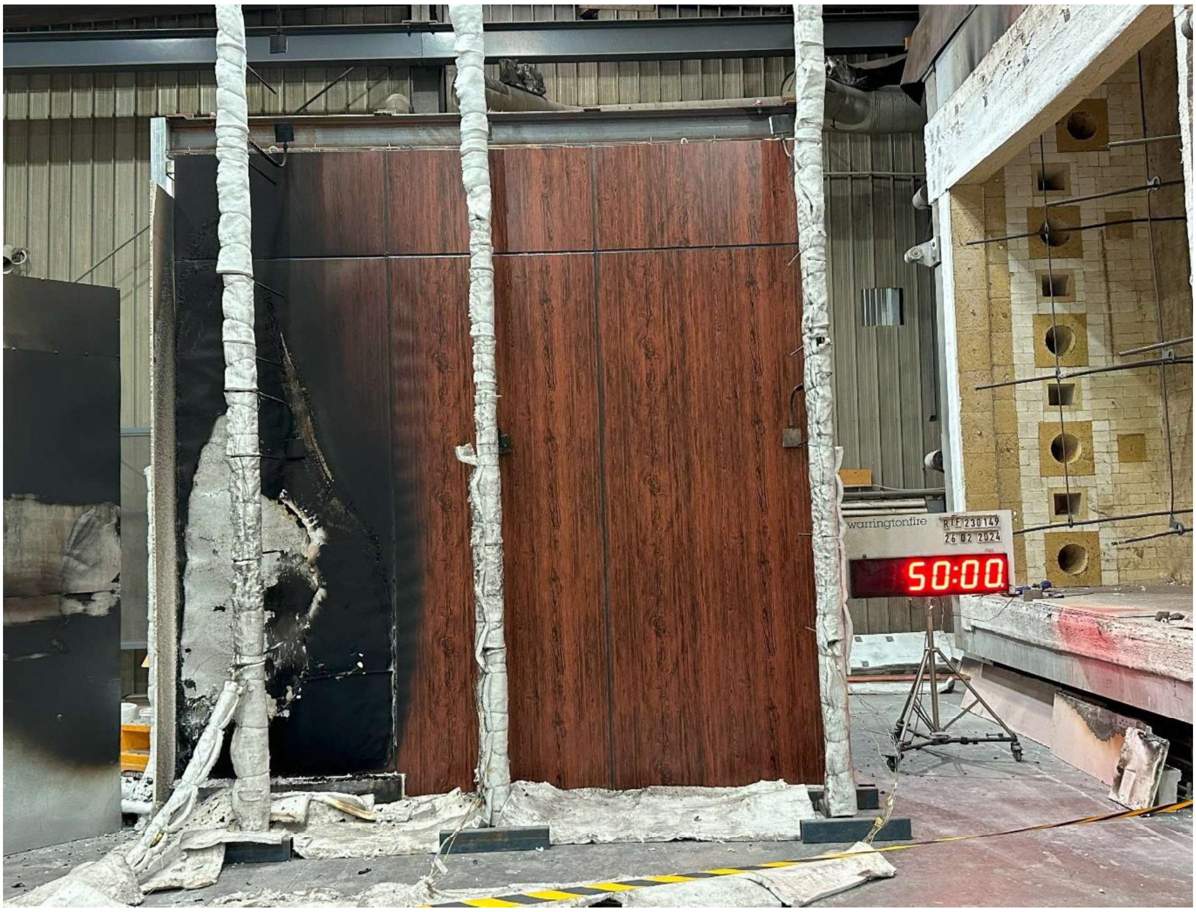

Figure 30 The specimen 50 minutes into the test (20 minutes after burner off).

Figure 31 The specimen at the end of test.

Figure 32 The unexposed side of the specimen at the end of test.

Appendix C Chemical analysis results

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UNSW RESEARCH INFRASTRUCTURE

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Test Report

Prepared by:

ANALYSIS OF CLADDING SAMPLES

REF: UB8388

For

Company: Warrington Fire

Contact: [redacted]

Date: 17 October 2023

Project No: 23197

Prepared by: Afsaneh Khansari

Approved by: Dominic D'Adam

COMMERCIAL-IN-CONFIDENCE

UNSW SYDNEY

Analysis of Cladding Samples
REF: UB8388

1. SAMPLES

One plastic sachet containing two ACP cores was received for analysis. The samples were identified as follows:

CCL sample coding	Client sample coding
23197-1	Oak
23197-2	Silver

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 metal was removed from the ACPs cladding polymer, and the flat surface of the polymer samples was abraded to remove any surface adhesive. The surface of each sample was analysed directly by FTIR. The FT-IR spectrum is presented in Figures 1-2.

The core of each sample was then ashed to determine its percentage mineral content (Table 1). If sufficient (>0.5 g) ash had been produced it was analysed for elemental composition by X ray fluorescence spectroscopy. Results are presented in Table 2.

Table 1 Ash content of samples.

Sample coding	Ash content (w/w%)
23197-1	39.5
23197-2	21.6

Table 2 Elemental composition of 23197-1

Element Oxide wt.%	23197-1
Na_2O	0.45
MgO	79.26
Al_2O_3	0.39
SiO_2	4.87
P_2O_5	0.12
SO_3	0.26
K_2O	0.04
CaO	8.66
TiO_2	2.24
V_2O_5	0.01
Cr_2O_3	<0.01
Mn_3O_4	0.04
Fe_2O_3	0.55
NiO	<0.01
CuO	<0.01
ZnO	0.01
SrO	<0.01
ZrO_2	<0.01
BaO	0.09
HfO_2	<0.01
PbO	<0.01
L.O.I.	ND

NOTE: (i) L.O.I.= loss on ignition at 1,050 °C.
(ii) ND = not determined

3. CONCLUSIONS

The cladding sample #1 consisted of consisted of 45.3% magnesium hydroxide, 6.1% calcium carbonate, 4.8% other inert material and approximately 43.9% polyethylene/EVA copolymer.

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

The cladding sample#2 consisted of consisted of 21.6% inert material and approximately 78.4% polyethylene/EVA copolymer.

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

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

The calculation for magnesium hydroxide content assumes that all magnesium found is present as the hydroxide. The calculation for calcium carbonate content assumes that all calcium found is present as calcium carbonate.

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.

Afsaneh Khansari (PhD)

Technical Officer

Chemical Consulting Laboratory

Mark Wainwright Analytical Centre, UNSW

17 October 2023

UNSW SYDNEY

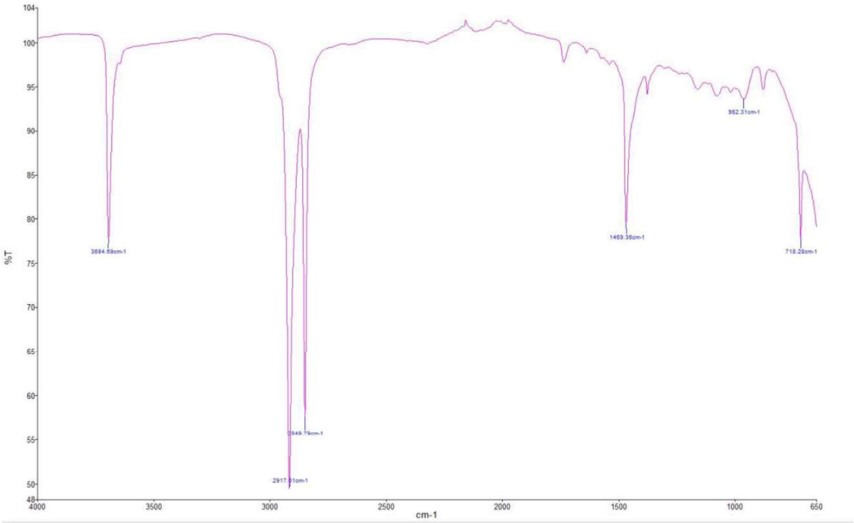

Figure 1. FT-IR spectrum of Sample #1

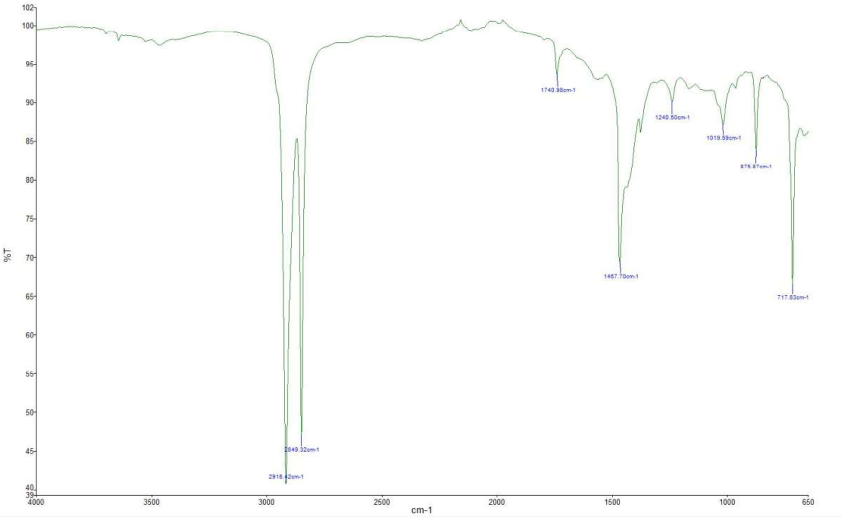

Figure 2. FT-IR spectrum of sample #2

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