WARRINGTONFIRE
AUSTRALIA
A Jensen Hughes Company

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: RTF230141

Test date: 7 May 2024 Revision: R1.0

Quality management

Revision	Date	Information about the report			
R1.0	21 June 2024	Description	Initial issue.		
			Prepared by	Reviewed by	Authorised by
		Name			
		Signature	[redacted]		

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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 7 May 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	Aluminium composite panel (ACP)	
	Product name	Aluminium Composite Panel - 4 mm Gloss white/Light 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.	
	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 Appendix C for more detailed results.	
	Size	Total panel thickness – 4.0 mm Skin thickness – 0.5 mm (both) Refer to Appendix C for individual panel sizing details.	
	Batch	[redacted]	
	Areal density	5.6 kg/m²	
	Colour	Skins	Front skin – Gloss white Back skin – Light grey
		Core	Black
2.	Item name	Fire resistant plasterboard	
	Product name	[redacted]	
	Size	1200 mm wide × 3600 mm long × 13 mm thickness	

Item	Description	
Framing		
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 nogging
	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
10.	Item name	Backing rod
	Product name	[redacted]
	Material	Extruded polyurethane foam
	Manufacturer/Supplier	[redacted]
	Usage	Placed at ACP edges for sealant installation
Fixings		
11.	Item name	Wafer head screws
	Size	10g × 25 mm long
	Installation	Used to fix FR aluminium composite panel to the aluminium cassette angles
12.	Item name	Tek screws
	Size	12g × 48 mm long
	Installation	Used to fix plasterboard to the studs and aluminium cassette angles
13.	Item name	Aluminium rivets
	Size	Ø4 mm

Item	Description	
	Usage	To fix the studs to the noggings.
Installation method		
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 noggings, was fixed to the test ring using curtain wall brackets (item 8) and fixings (item 12) – 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), noggings (item 6) and the diagonal supports, which were screw fix together using aluminium rivets (item 13). The fire resistant plasterboards (item 2) was fixed to the studs and the aluminium cassette angles (item 7) using tek screws (item 12).
Cladding		The exposed face of the specimen was clad with cassetted ACPs (item 1) that were fixed to aluminium cassette angles (item 7) using wafer head screws (item 11) at about 325 mm centres. Sealant (item 9) and backing rods (item 10) were placed at the ACP edges (item 1).

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.

Item	Detail
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.

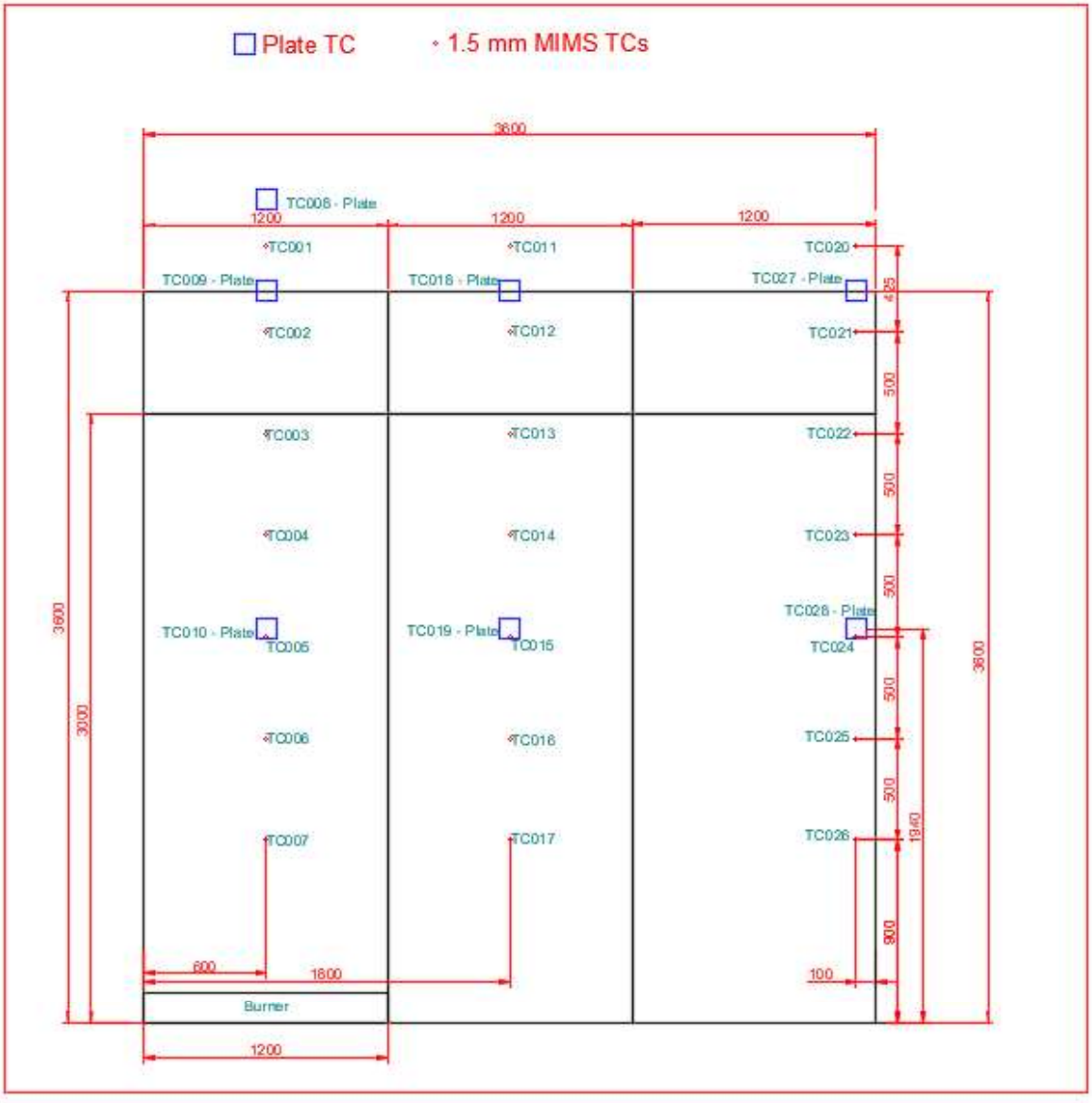


Figure 1 Instrumentation locations – front elevation

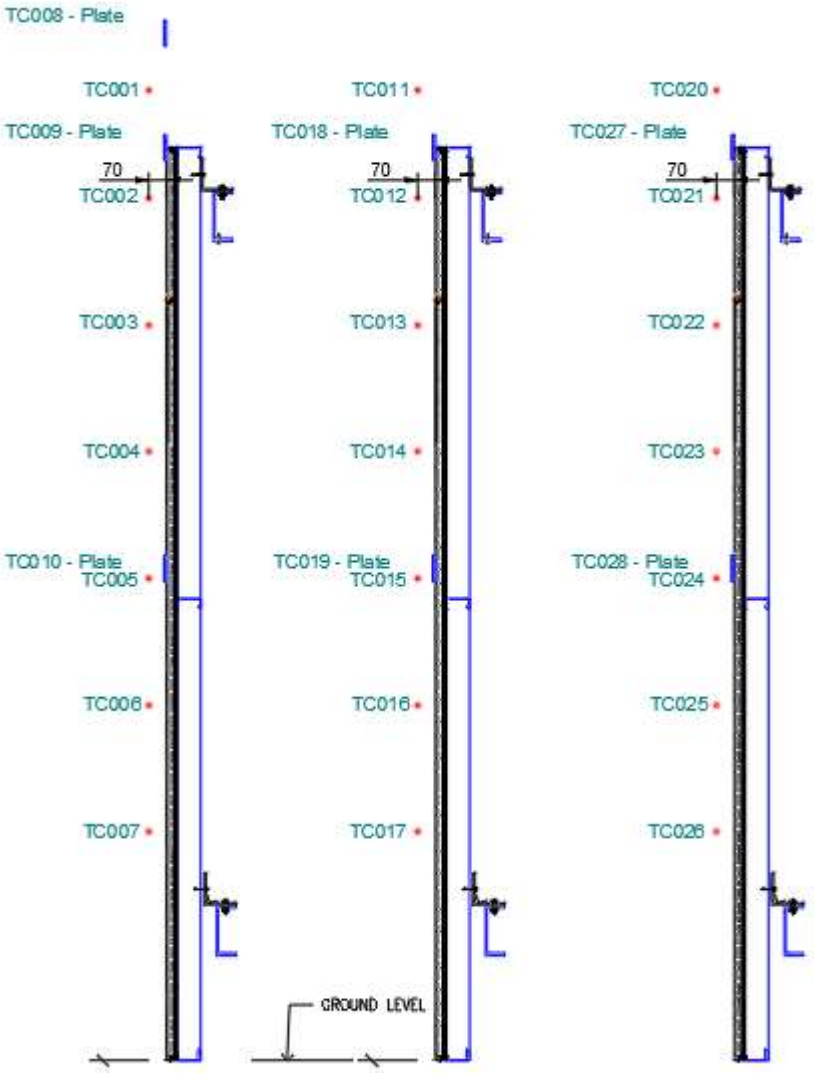
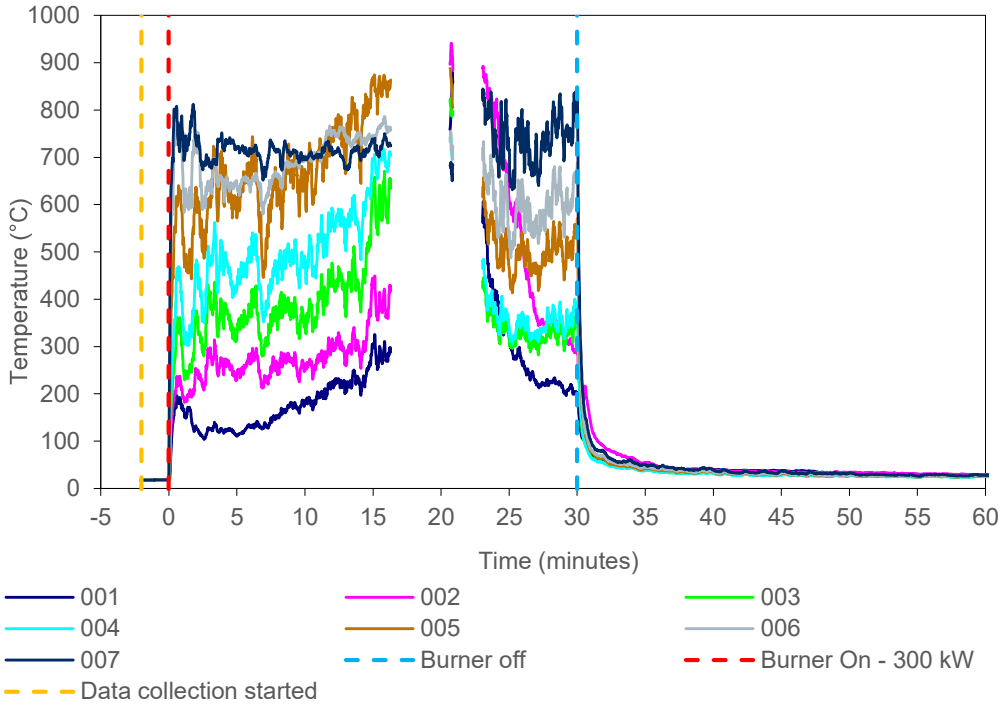
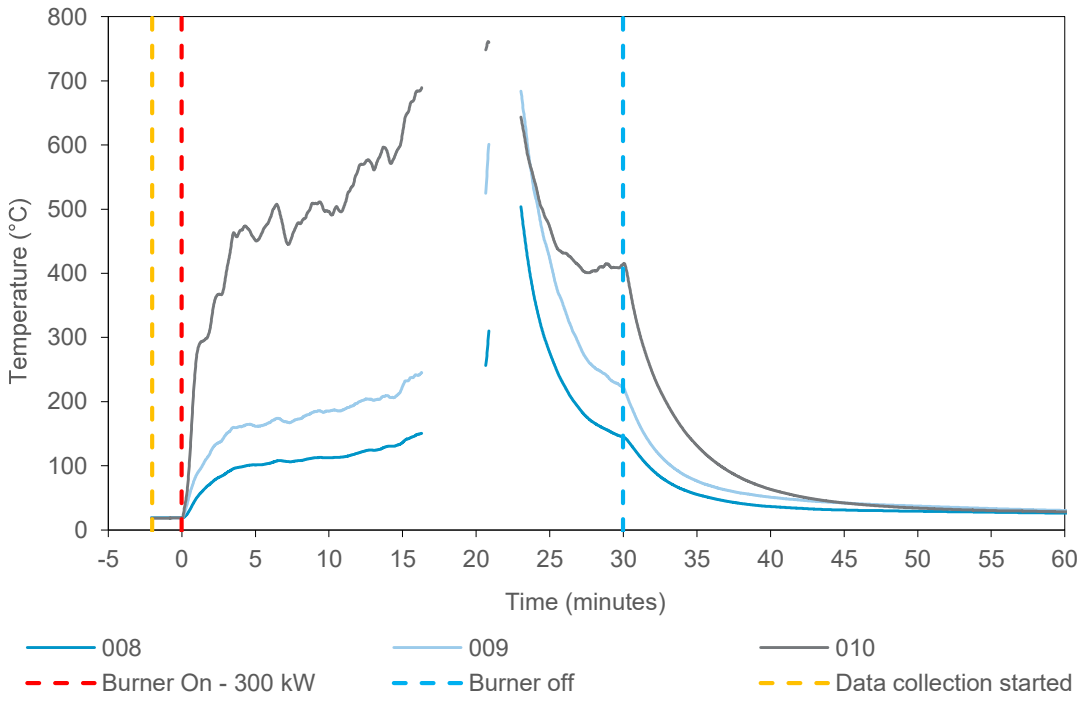


Figure 2 Instrumentation locations – sections



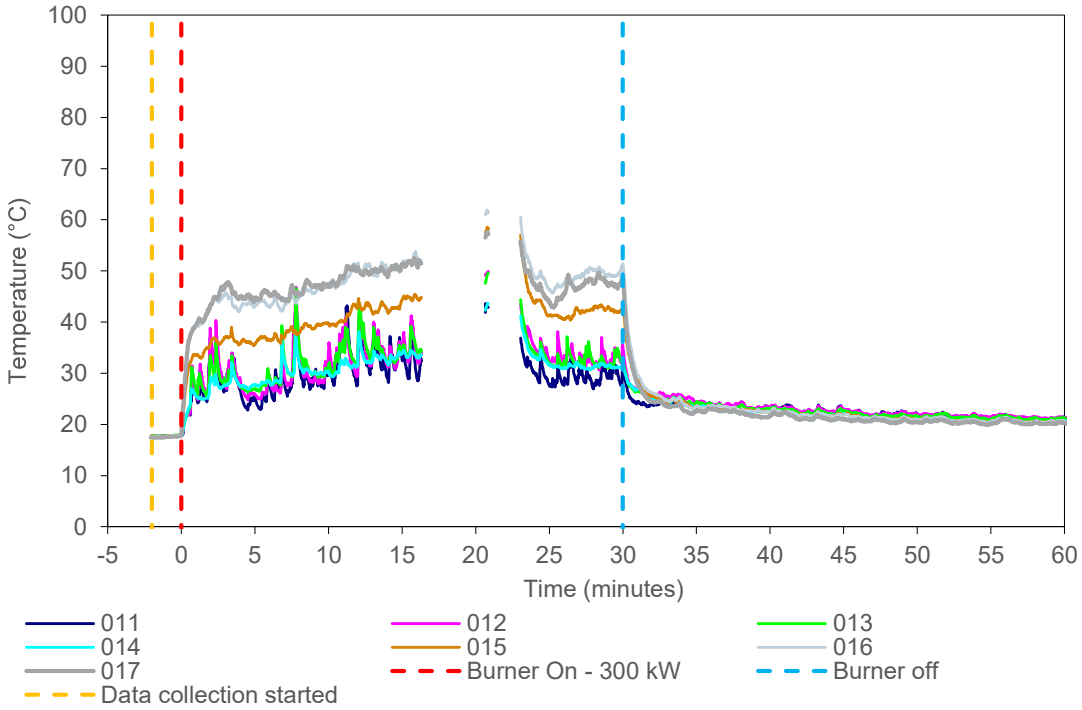
Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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



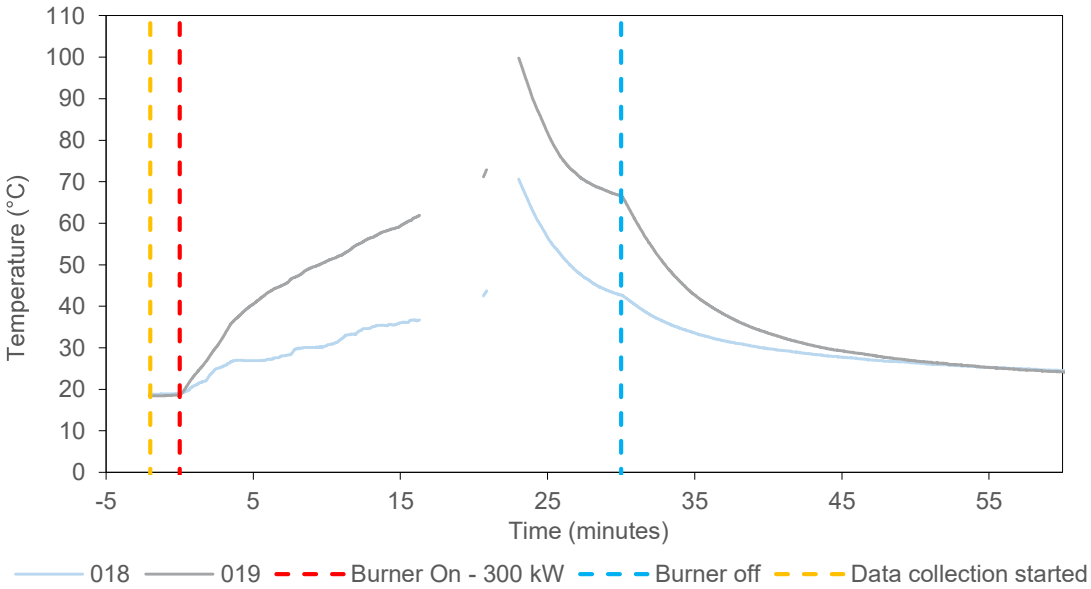
Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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



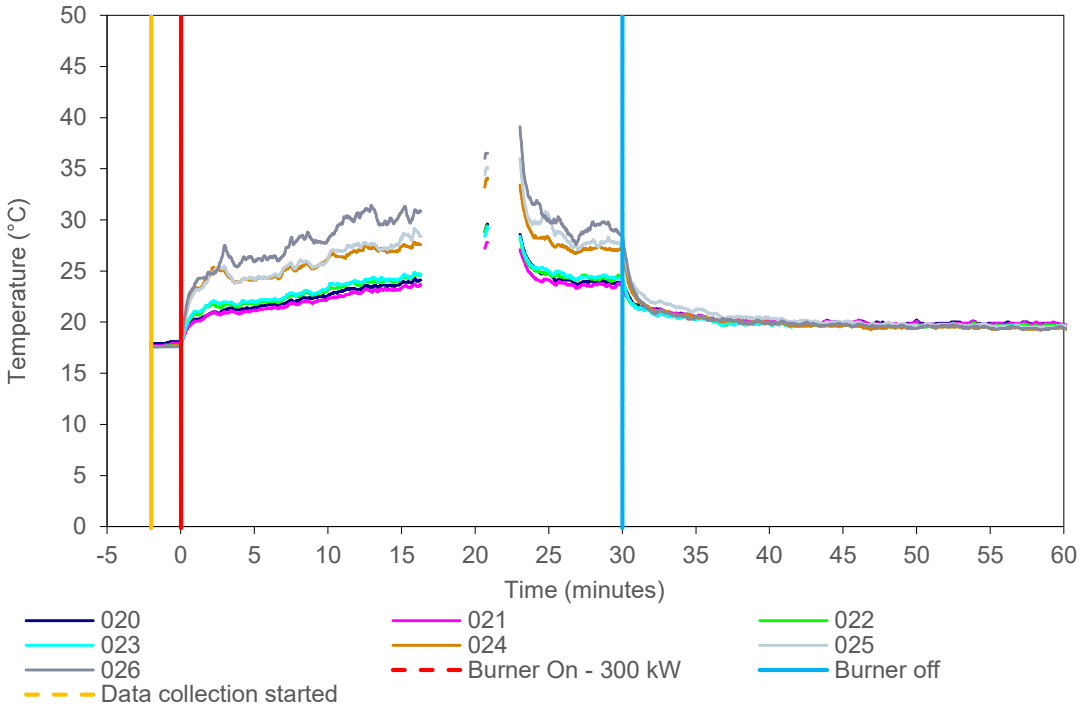
Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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



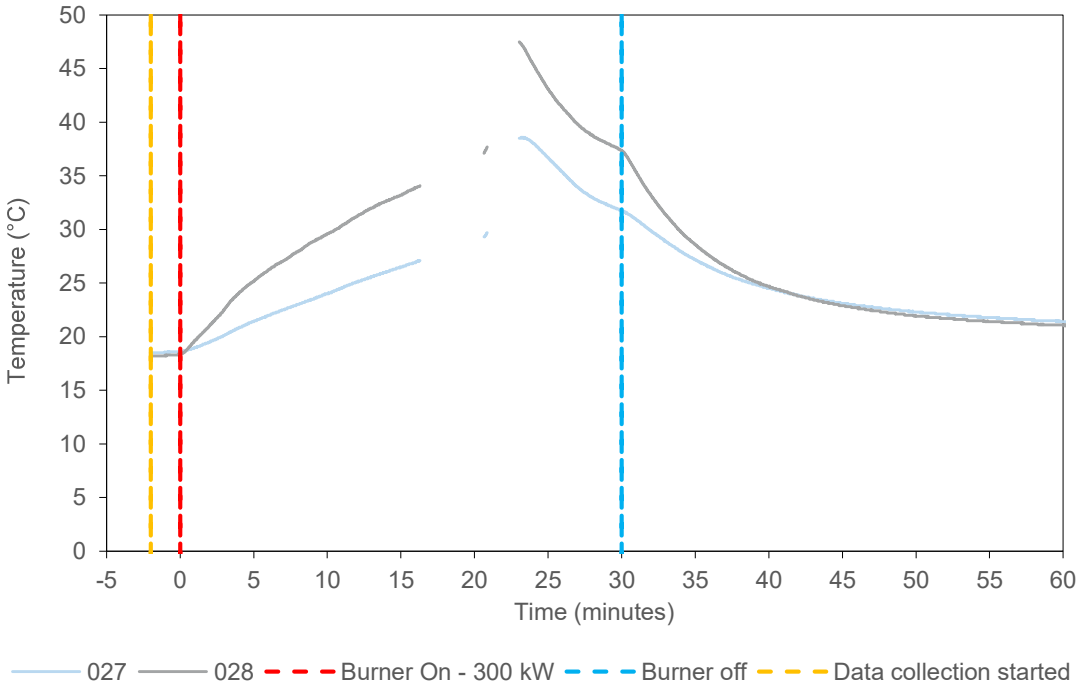
Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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



Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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



Note: Data lost from 16 minutes 18 seconds to 20 minutes 39 seconds, and from 20 minutes 51 seconds to 23 minutes and 3 seconds of the testing time.

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

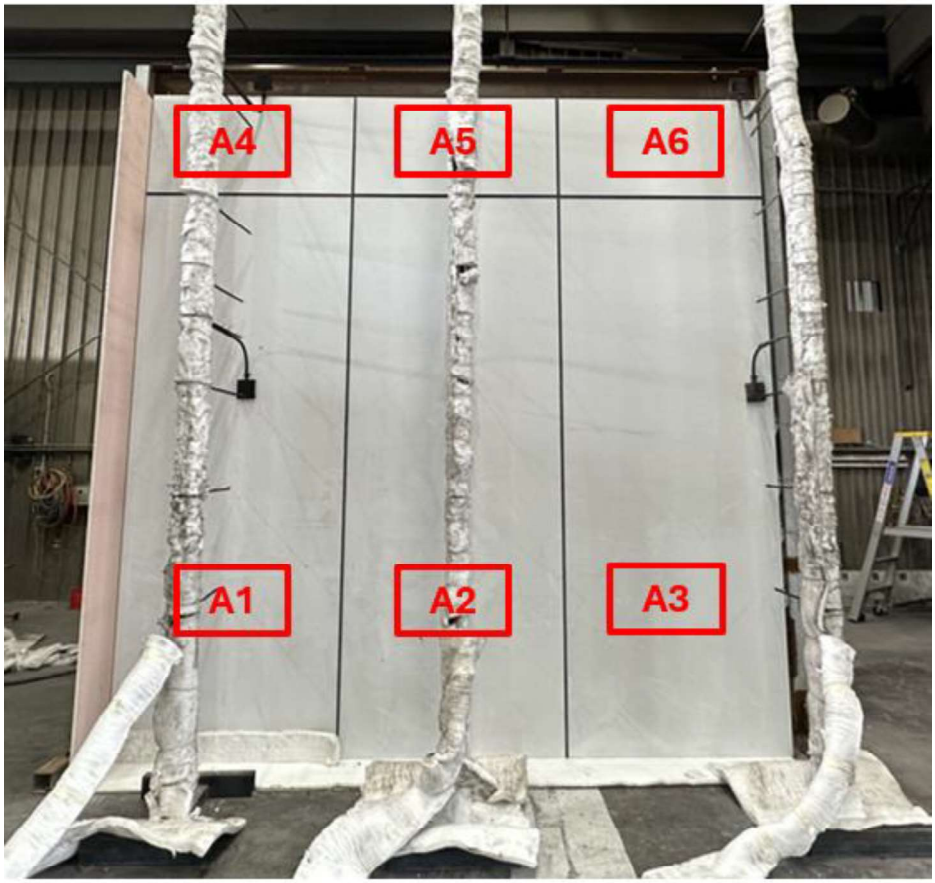


Figure 9 Designation of section for the test observations.

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 with the burner ignited with a heat output set at 300 kW.
1	30	A1	The lower face of the panel was discolouring.
2	31	A4	Smoke emitted from top left corner of the panel.
3	16	A1	The lower face of the panel started to deform.
4	24	A1	Smoke started to emit from the plasterboard on the back of the A1 panel.
5	18	A4	Intermittent flaming was observed along the gap between the left side of the panel and the plasterboard.

Time		Des.	Observation
Min	Sec		
5	25	A4	There was smoke emitted from the top of the panel.
6	36	A4	There was flaming on the top left corner of the panel.
8	04	A1	The lower part of the panel appeared to open up.
9	36	A2	The left edge of the panel was discolouring.
13	30	A4	The flaming died off.
15	08	A1	There was flaming on the top left corner of the panel.
16	36	A1	Opened area reached 1/2 up panel.
18	30	A4	The left part of the panel surface started to deform
19	33	A4	There was flaming at the mid bottom of the panel.
20	10	A4	Flaming debris dropped from the panel.
21	00	A1	Opened area reached the top of the panel.
21	09	A4	The panel opened up and smoking debris started to emit from the panel.
22	29	A1	The bottom part on the back of the A1 was flaming.
23	10	A1/A2	The lower part of the joint was flaming.
23	17	A4	Opened area reached to the top of the panel.
26	57	A1/A2	Flaming reached 1/2 height of the panel along at the joint.
30	00	All	The burner was turned off.
30	44	A1/A2	The bottom part of the A1 panel and the joint between A1 and A2 were still burning.
31	57	A1/A2	The flaming at the joint had self-extinguished.
55	49	A1	The bottom part of the panel was still burning.
60	00	All	The reaction to fire test was ended and the flaming was extinguished.

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.

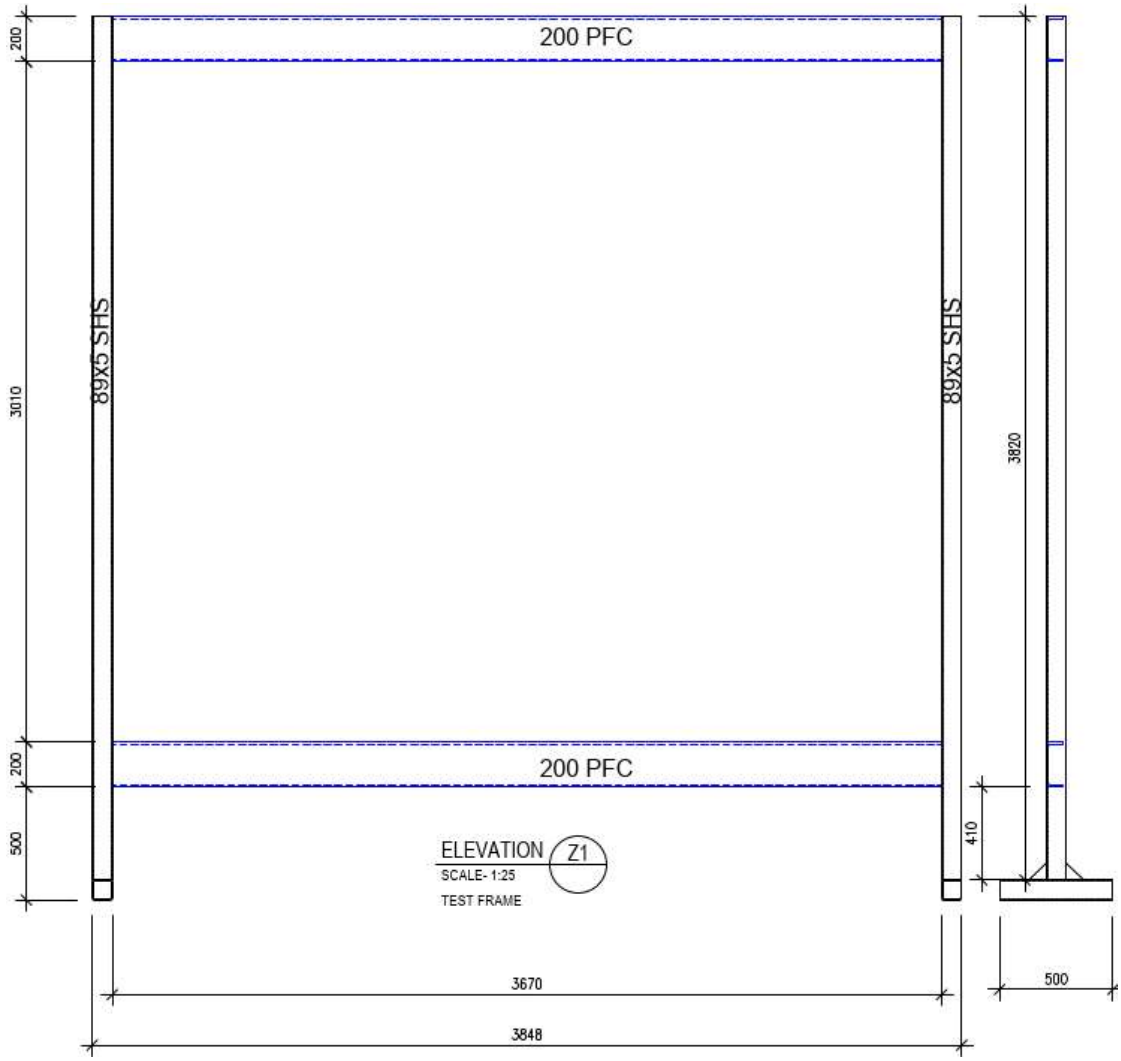


Figure 10 Elevation of rig support.

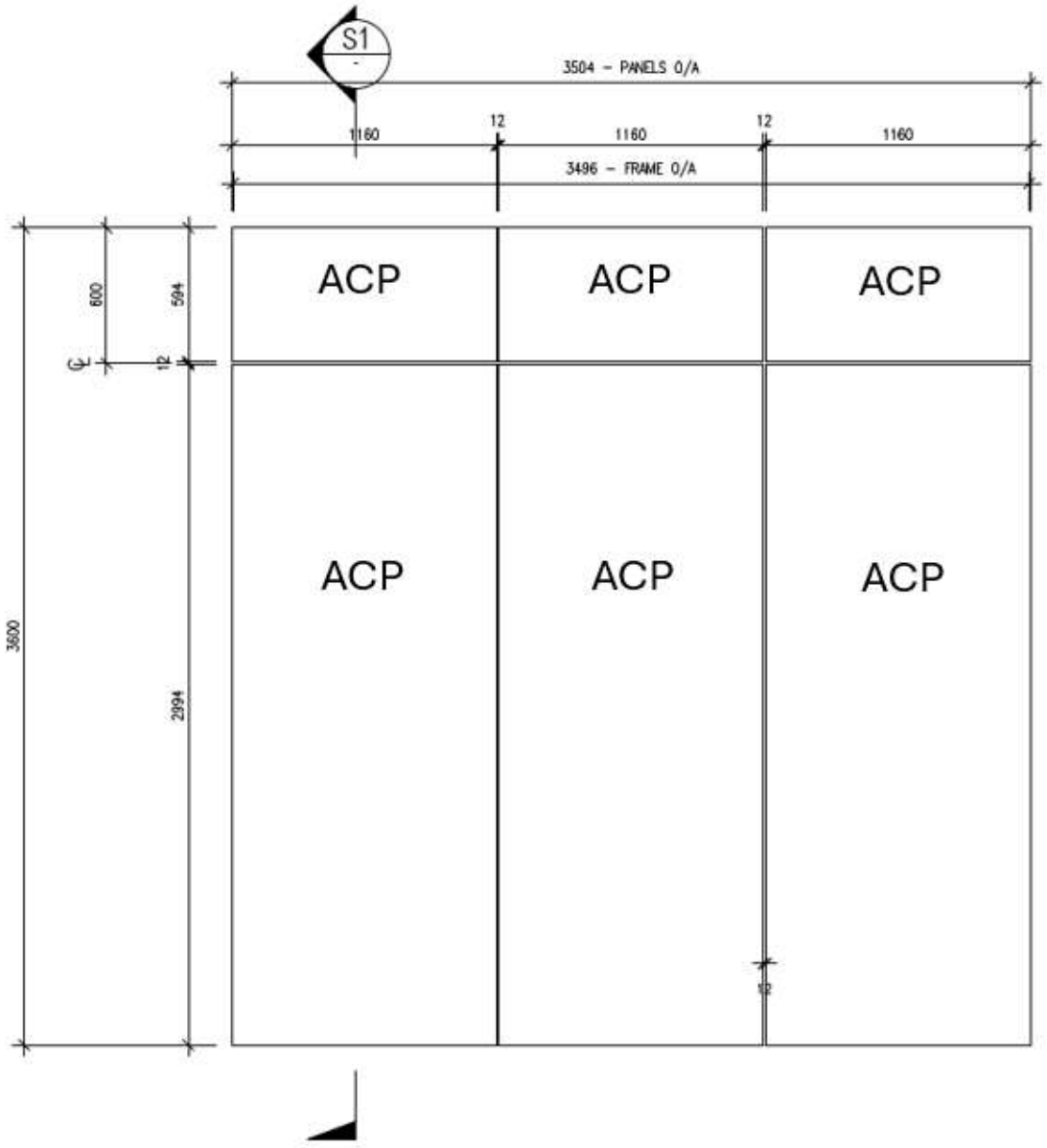


Figure 11 System assembly – Front view

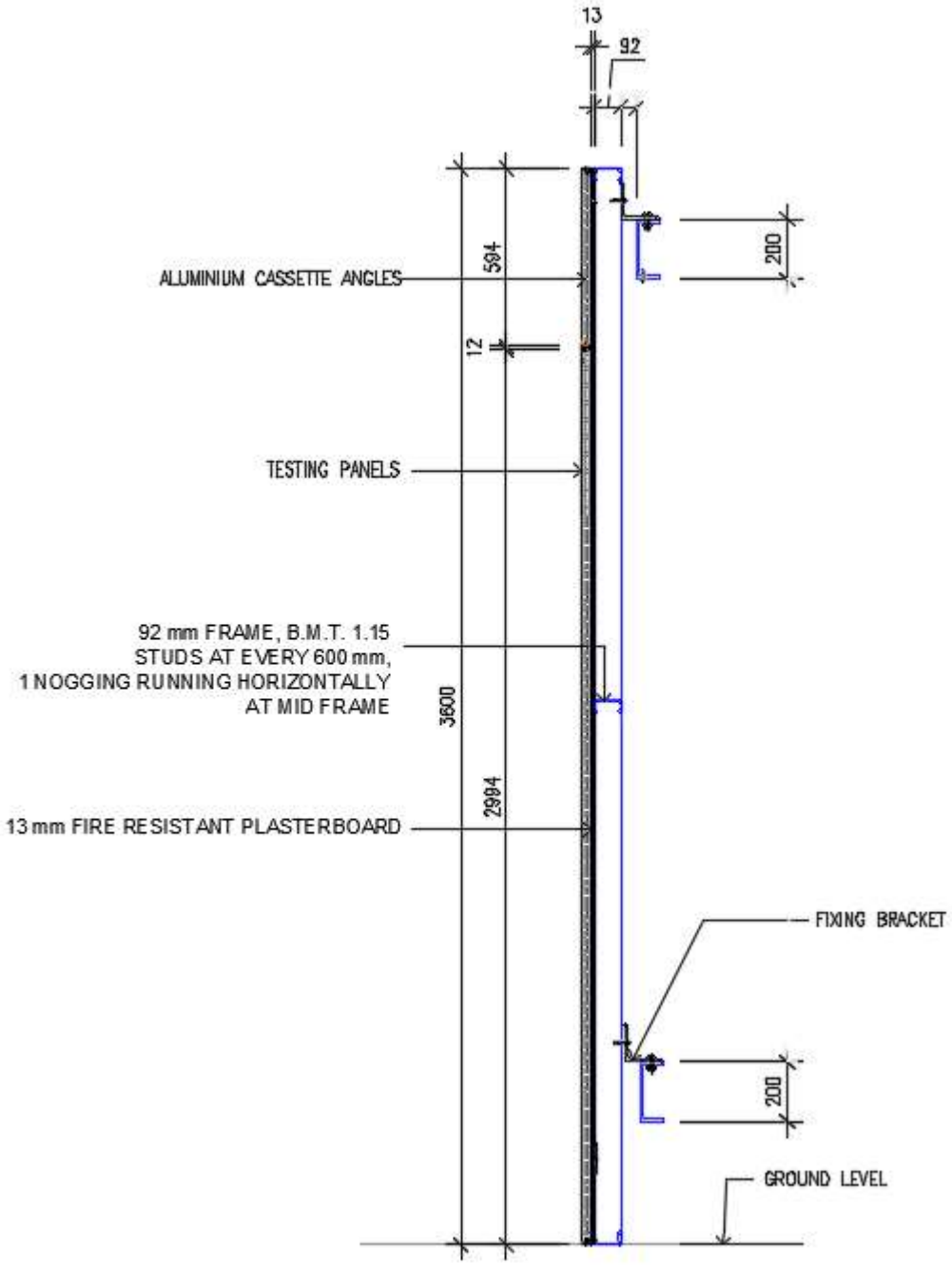


Figure 12 System assembly – vertical cross-sectional view.

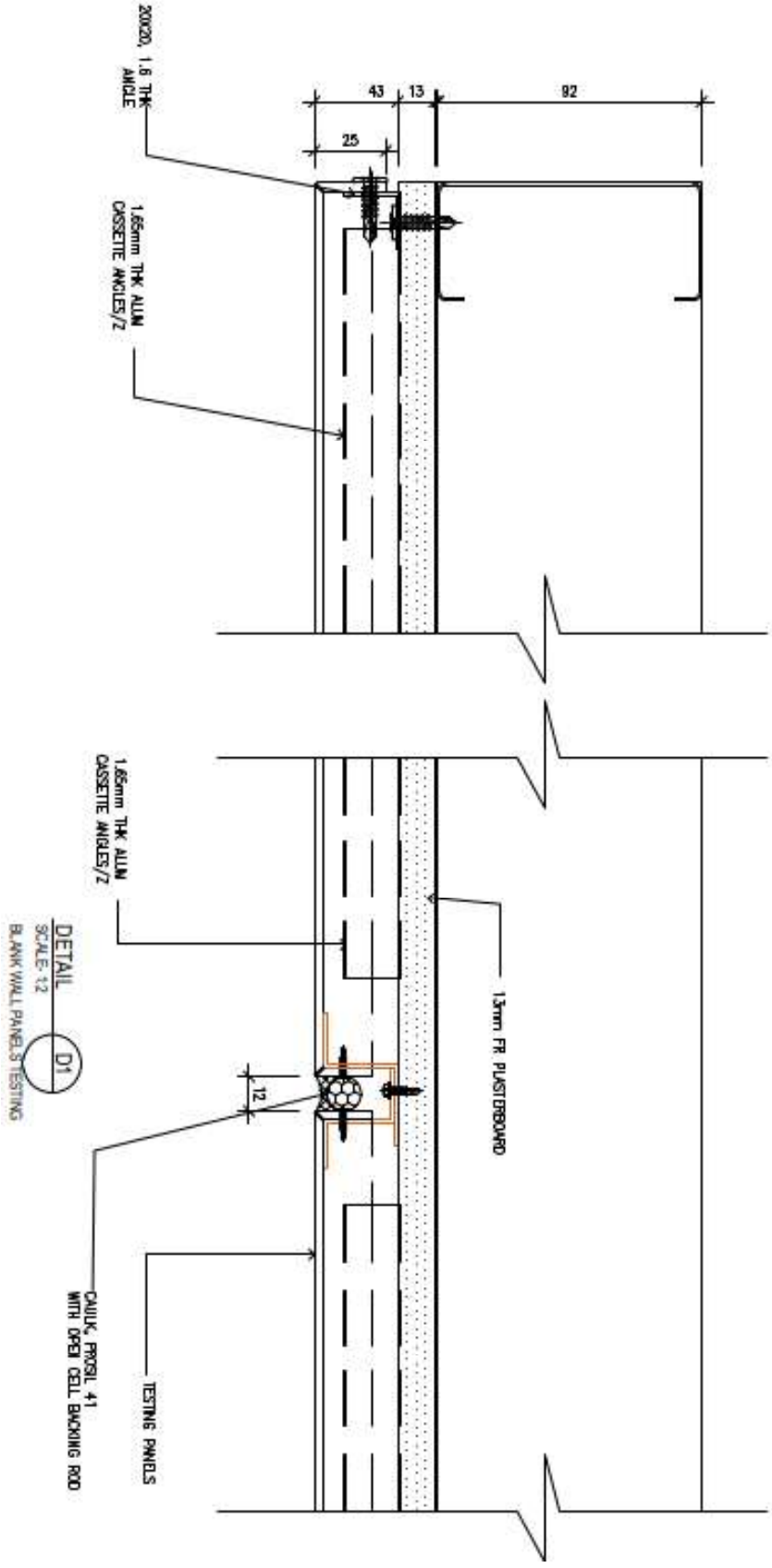


Figure 13 System assembly – vertical cross-sectional view (details).

Appendix B Photographs

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

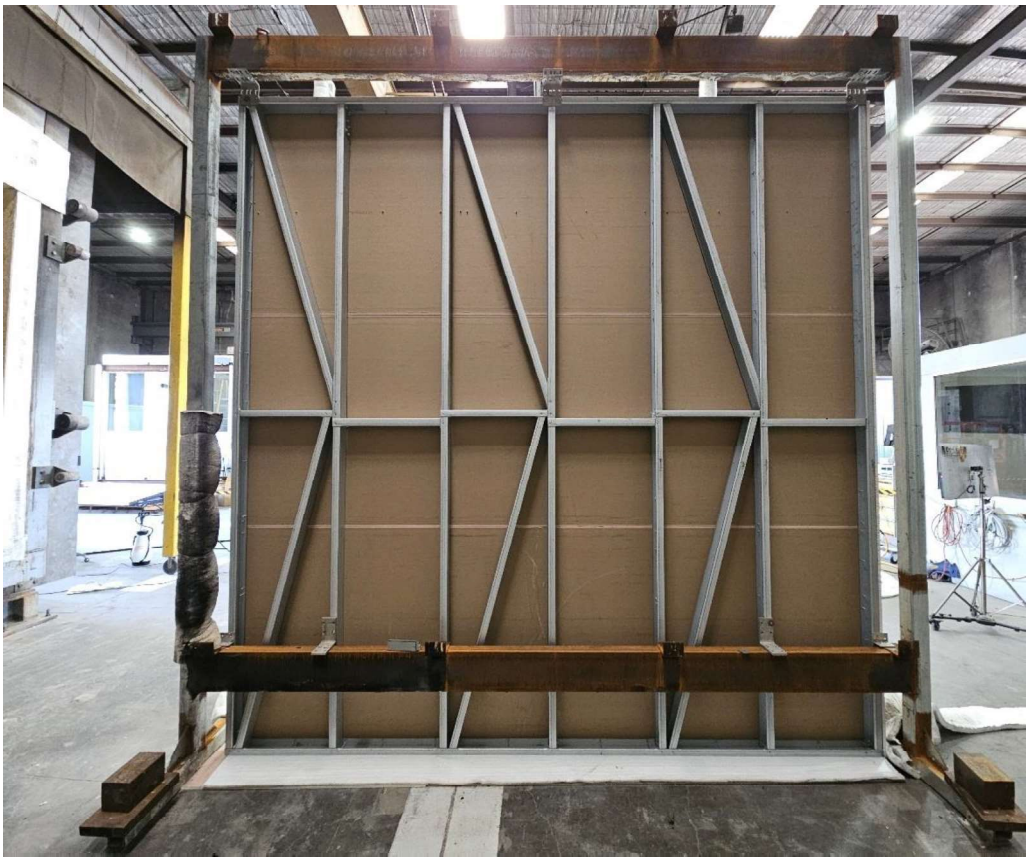


Figure 15 The specimen before the reaction to fire test - unexposed side.

Figure 16 The specimen 2 minutes 33 seconds into the test (burner output at 300 kW)

Figure 17 The specimen 5 minutes 20 seconds into the test (burner output at 300 kW)

Figure 18 The specimen 7 minutes 27 seconds into the test (burner output at 300 kW)

Figure 19 The specimen 11 minutes 26 seconds 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 24 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 2 seconds into the test (2 seconds after burner off).

Figure 24 The specimen 32 minutes 4 seconds into the test (2 minutes 4 seconds after burner off).

Figure 25 The specimen 35 minutes 38 seconds into the test (5 minutes 38 seconds after burner off).

Figure 26 The specimen 39 minutes 23 seconds into the test (9 minutes 23 seconds after burner off).

Figure 27 The specimen 51 minutes3 seconds into the test (21 minutes 3 seconds after burner off).

Figure 28 The specimen at the end of test.

Figure 29 The unexposed side of the specimen at the end of test.

Appendix C Chemical analysis results

UNSW SYDNEY

UNSW RESEARCH INFRASTRUCTURE

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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

COMMERCIAL-IN-CONFIDENCE

UNSW SYDNEY

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%

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

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 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.

Dominic D'adam BSc/BE (Hons)

Senior Technical Officer

Chemical Consulting Laboratory

Mark Wainwright Analytical Centre, UNSW

22 February 2024

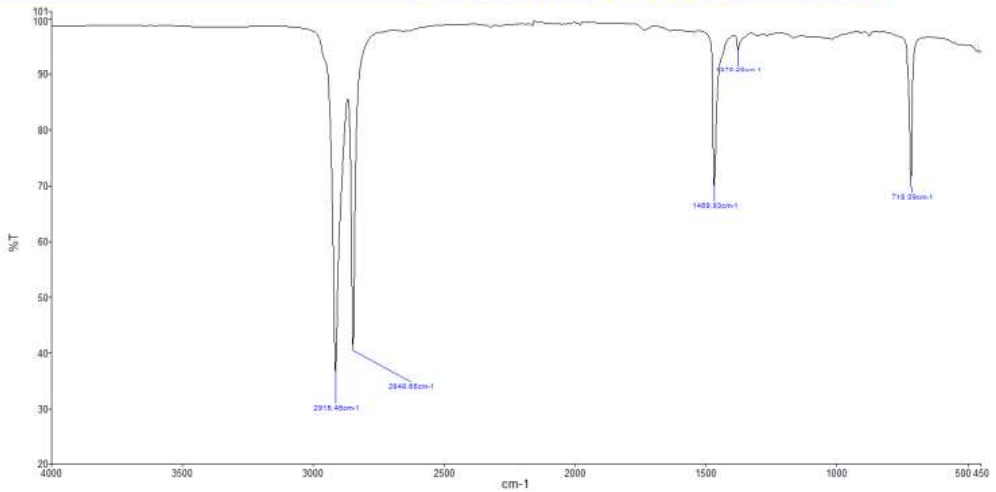

Figure 1. FT-IR spectrum of sample #1

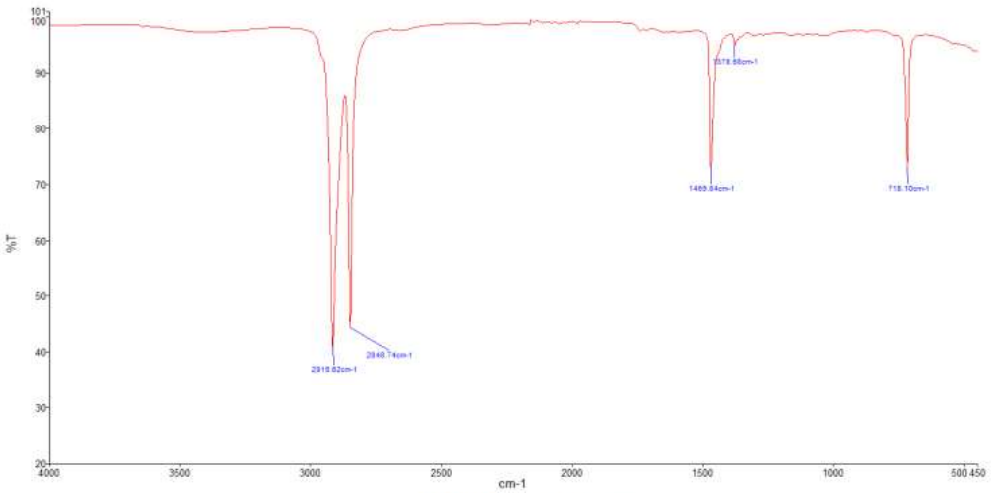

Figure 2. FT-IR spectrum of sample #2

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