WARRINGTONFIRE AUSTRALIA
A Jensen Hughes Company

Reaction to fire test report

Test standard: Ad hoc ISO 13785-1:2002 Part 1 – Intermediate-scale

Test sponsor: Cladding Safety Victoria (CSV)

System: Cassetted aluminium composite panel (ACP) – with a 100% PE core – wall system

Job number: RTF240033

Test date: 21 June 2024 Revision: RR1.0

WARRINGTONFIRE AUSTRALIA
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Quality management

Revision	*Date*	*Information about the report*			
RR1.0	3 December 2025	Description	Initial issue		
			Prepared by	**Reviewed by**	**Authorised by**
		Name	[redacted]	[redacted]	[redacted]
		Signature			

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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 a Cassetted aluminium composite panel (ACP) – with a 100% PE core – wall system performed on 21 June 2024. The test was based off some general requirements of ISO 13785-1:2002 with an additional wind component.

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.

Table 2 Schedule of components

Item	*Description*		
Cladding			
1.	Item name	Aluminium composite panel (ACP)	
	Product name	Custom Aluminium Composite Panel - 4 mm Gloss white/Light grey	
	Manufacturer/Supplier	[redacted]	
	Batch	05/12/2023	
	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.	
	Size	Total panel thickness – 4.0 mm Skin thickness – 0.5 mm (both) Refer to Appendix A for individual panel sizing details.	
	Areal density	5.6 kg/m^2 (measured)	
	Colour	Skins	Front skin – Gloss white Back skin – Light grey
		Core	Black
2.	Item name	FR Plasterboard	
	Product name	[redacted]	
	Batch no.	14/05/2024	
	Size	1200 mm wide × 3600 mm long × 16 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 4.
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
Fixings		
10.	Item name	Wafer head screws
	Size	10g × 30 mm long
	Installation	Used to fix FR aluminium composite panel to the aluminium cassette angles
11.	Item name	Tek screws
	Size	10 - 16g × 50 mm long
	Manufacturer	[redacted]
	Installation	Used to fix plasterboard to the studs and aluminium cassette angles
12.	Item name	Aluminium rivets
	Size	Ø4 mm
	Manufacturer	[redacted]
	Usage	To fix the studs to the noggings.
Installation method		

Item	Description
Test rig	The test rig frame was the main support for the test specimen. The test specimen, interconnected through studs and noggings, was fixed to the test ring using curtain wall brackets (item 8) and fixings (item 10) – see Figure 1, 2 and 4.
Cassetted wall	The cassetted wall was composed of plasterboard (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 12). The FR plasterboard (item 2) were fixed to the studs using tek screws (item 11). The aluminium cassette angles (item 7) were fixed to the FR plasterboard (item 2) 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 7) using wafer head screws (item 10) at about 325 mm centres.

3. Test procedure

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

Table 3 Test procedure

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 the facade with an added wind component. 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 and Figure 2 for positioning. • 8 mineral insulated metal sheathed (MIMS) Type K thermocouples with an overall diameter of 1.5 mm inserted through the plasterboard from the unexposed side to the mid-depth of the ACP cassette cavity. Refer to Figure 2 for details of positioning. • Temperatures above and below the cladding 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 to Figure 1and Figure 2 for details of the 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 next to the specimen. • Airflow across the front of the specimen was provided by a square array of 4-off pedestal fans. 3 blades with a fan diameter of 750 mm. The centre of the fans was located at the approximate heights of 1.5 m and 2.3 m from the floor and 0.5 m and 1.3 m from the guide wall. The fans were at the settings that provided the airflow listed in Table 4. • A guide wall – 2.8 m tall × 3.0 m wide was butted up to the specimen and cassetted wall was placed at a 45° angle in relation to the specimen. • The horizontal wind speed was measured using a hot wire anemometer.
Test procedure	• At least 2 minutes of baseline data was collected prior to burner ignition. Temperature was collected at 5 s intervals. • The burner was ignited and the heat output from the burner was held at 300 kW. • 6 minutes after the burner ignition, the artificial wind source was turned on. • The burner was turned off 30 minutes after burner ignition. • 35 minutes after burner ignition, the artificial wind source was turned off. • Data was collected for the duration of the test – i.e. 60 minutes after burner ignition.

4. Test measurement and results

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

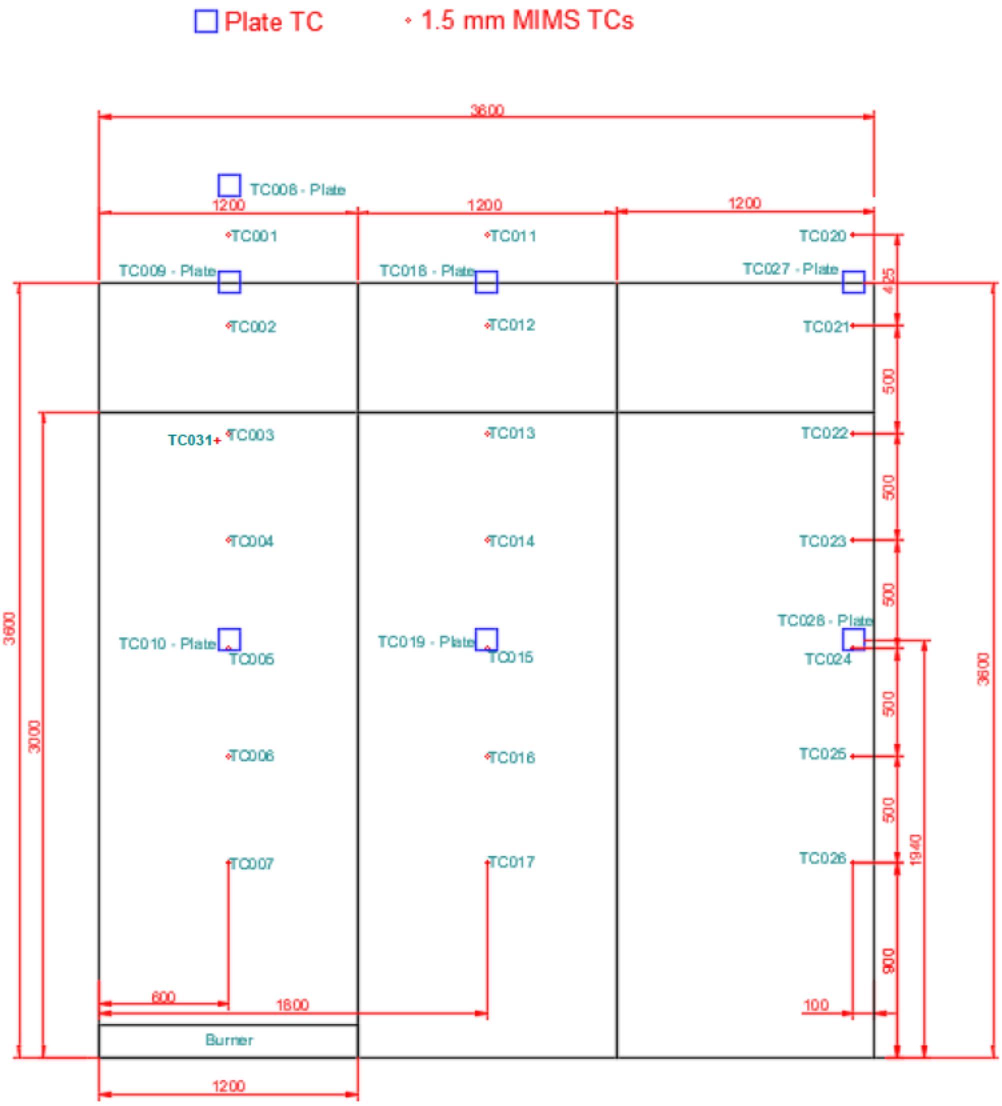


Figure 1 Instrumentation locations – front elevation

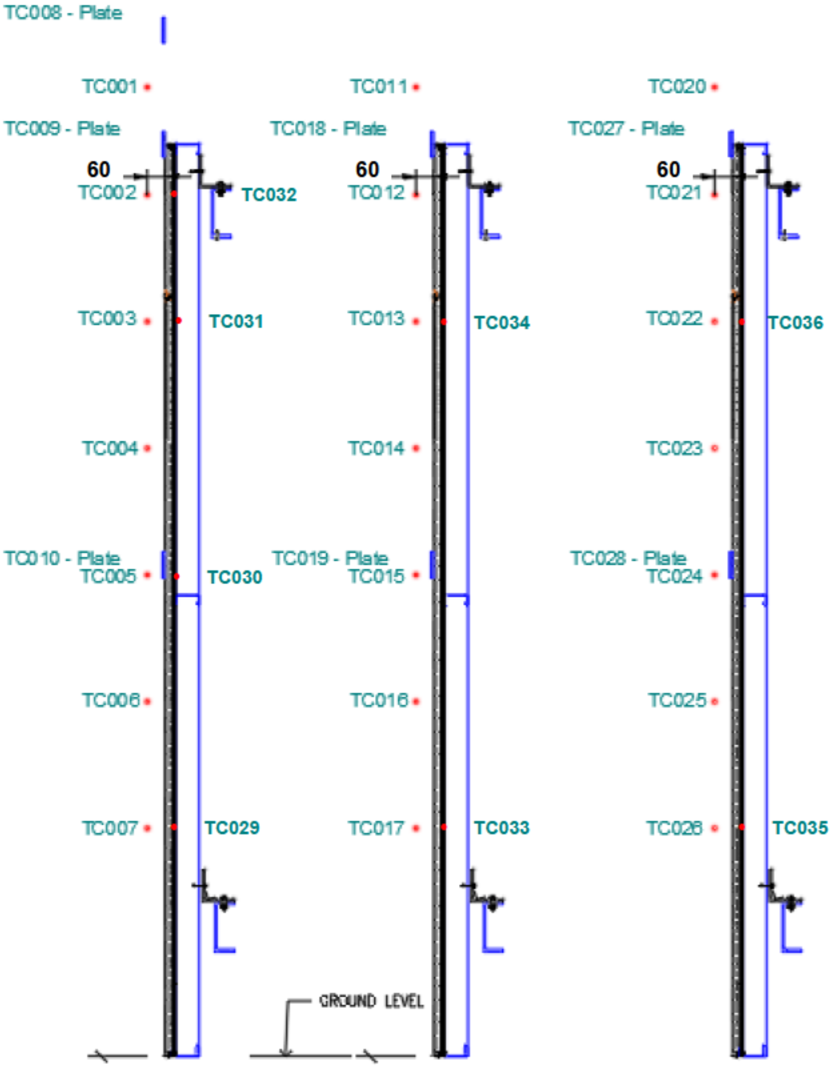


Figure 2 Instrumentation locations - sections

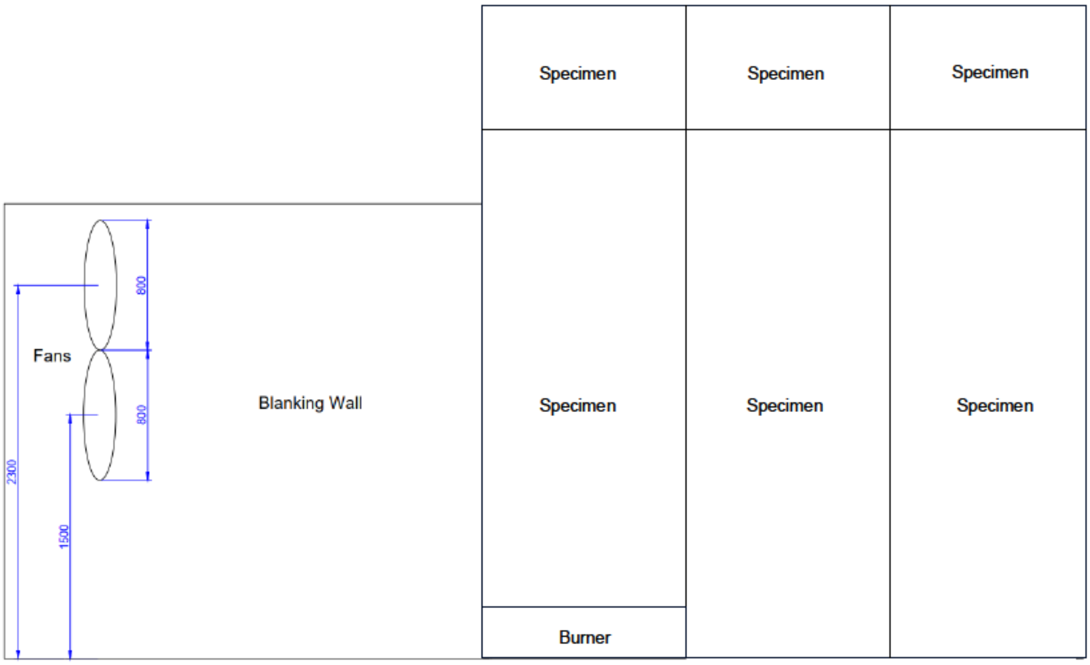


Figure 3 Instrumentation locations - Elevation

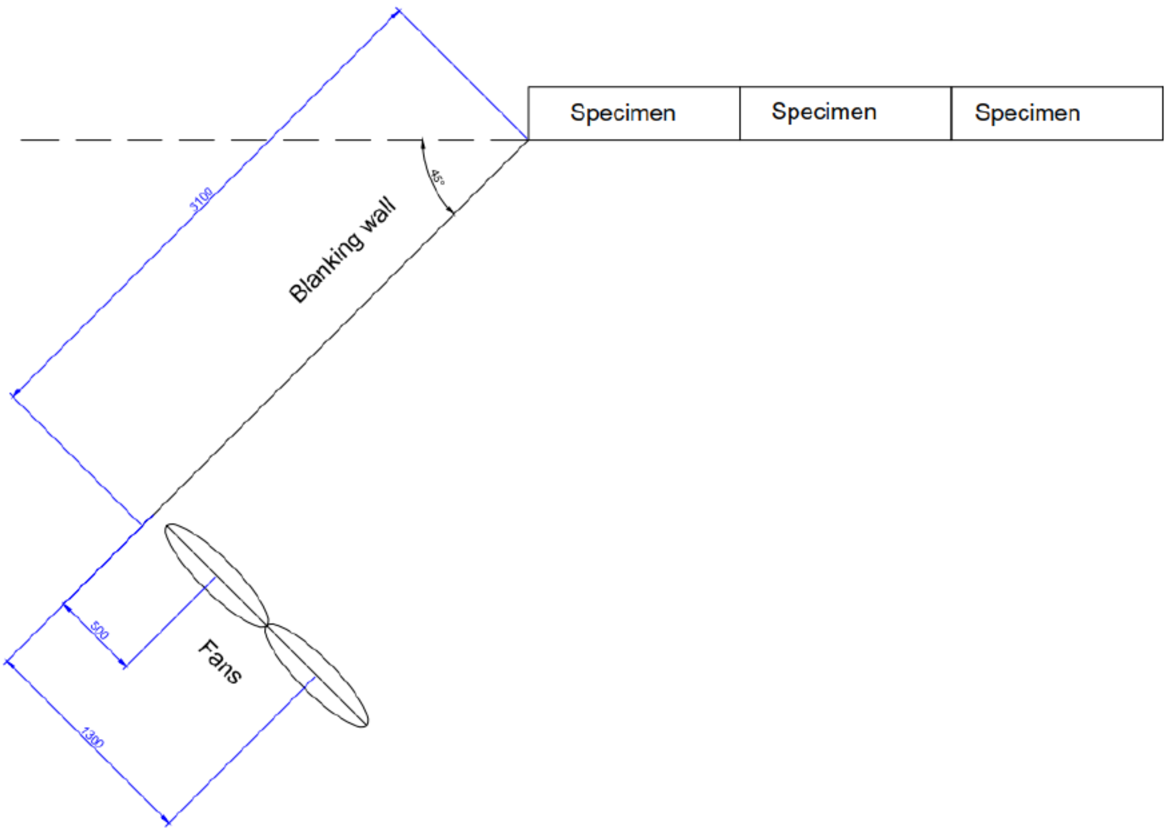


Figure 4 Instrumentation locations – Plan view

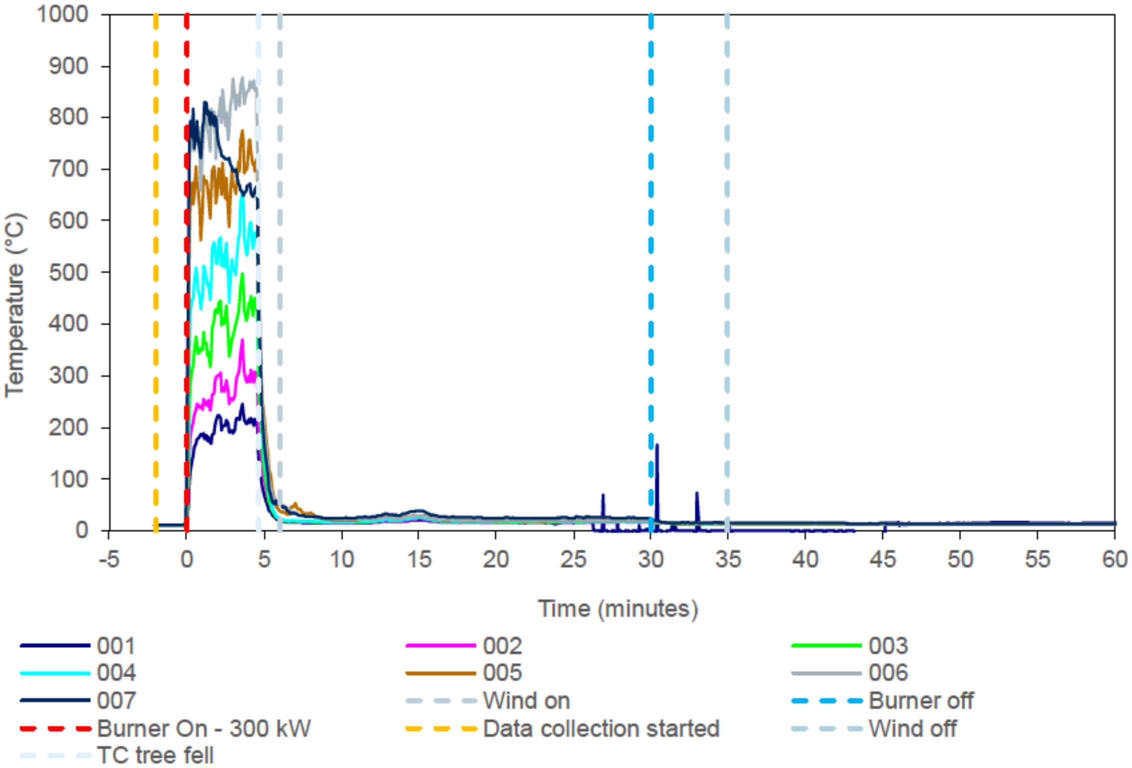


Figure 5 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – in-line with the burner (TC tree fell at 4 minutes 40 seconds into the test)**

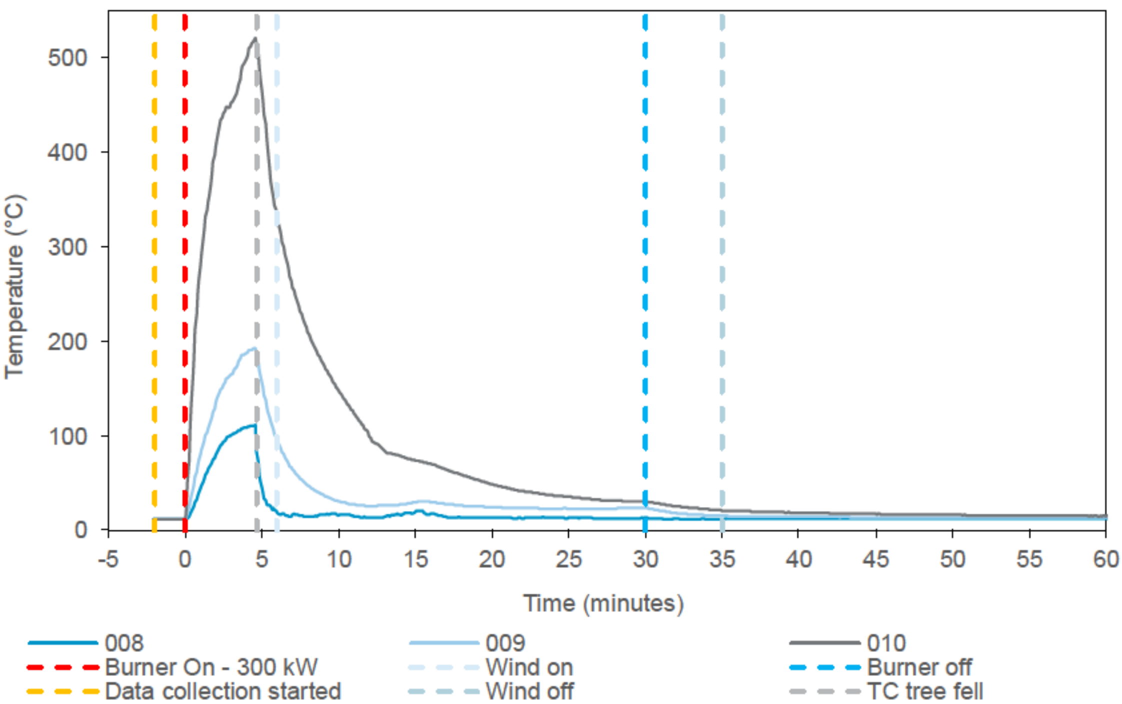


Figure 6 **External temperature data collected by plate thermocouples in-line with ACP – in-line with the burner (TC tree fell at 4 minutes 40 seconds into the test)**

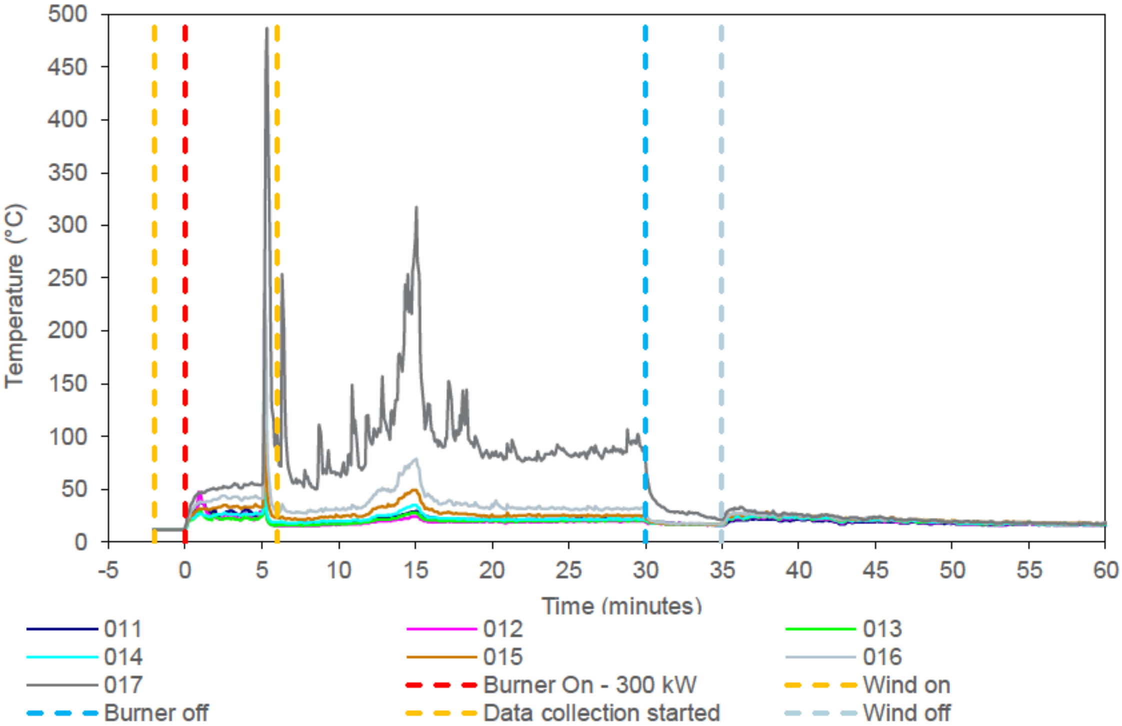


Figure 7 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – central module**

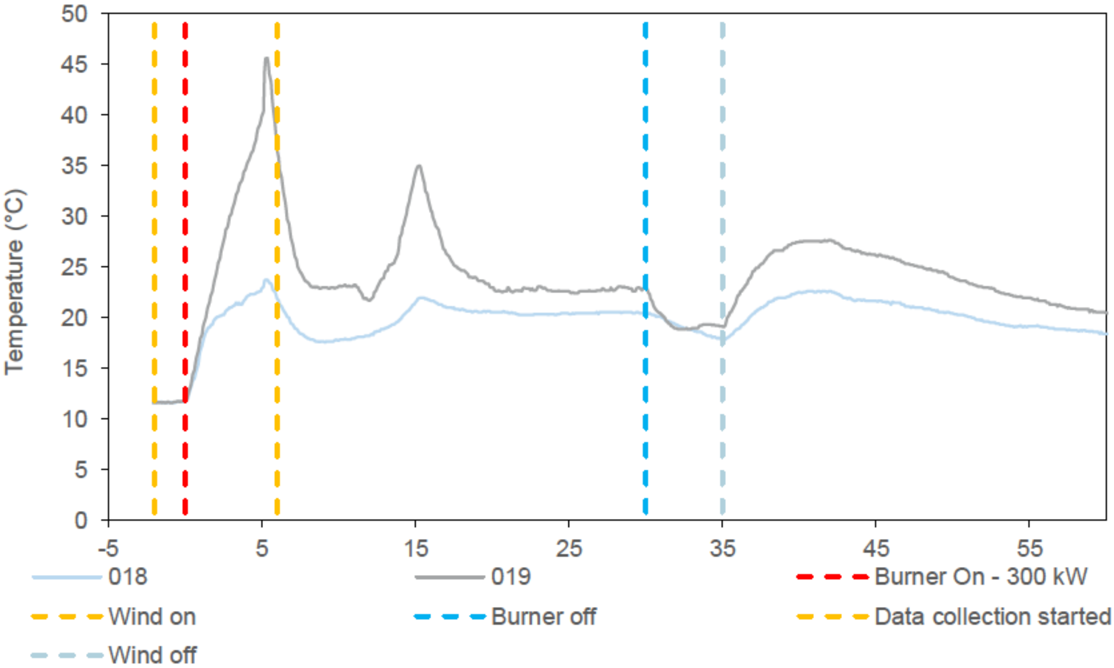


Figure 8 **External temperature data collected by plate thermocouples in-line with ACP – central module**

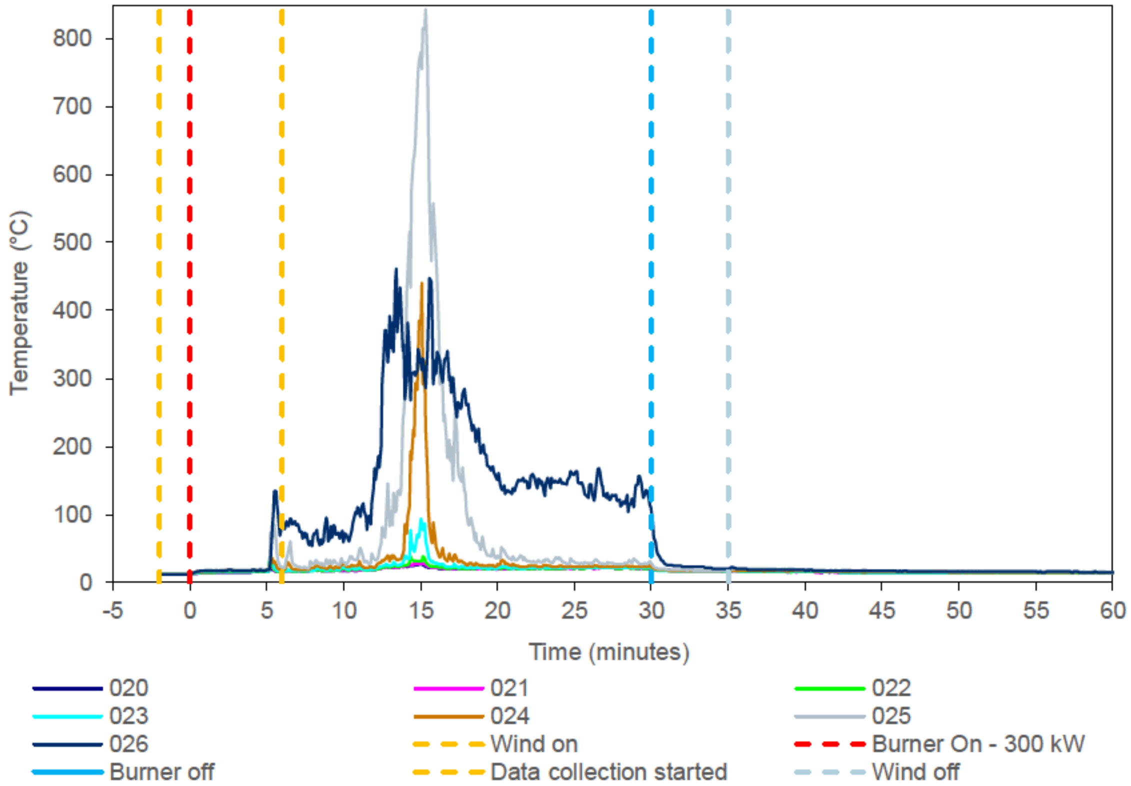


Figure 9 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – away from the burner**

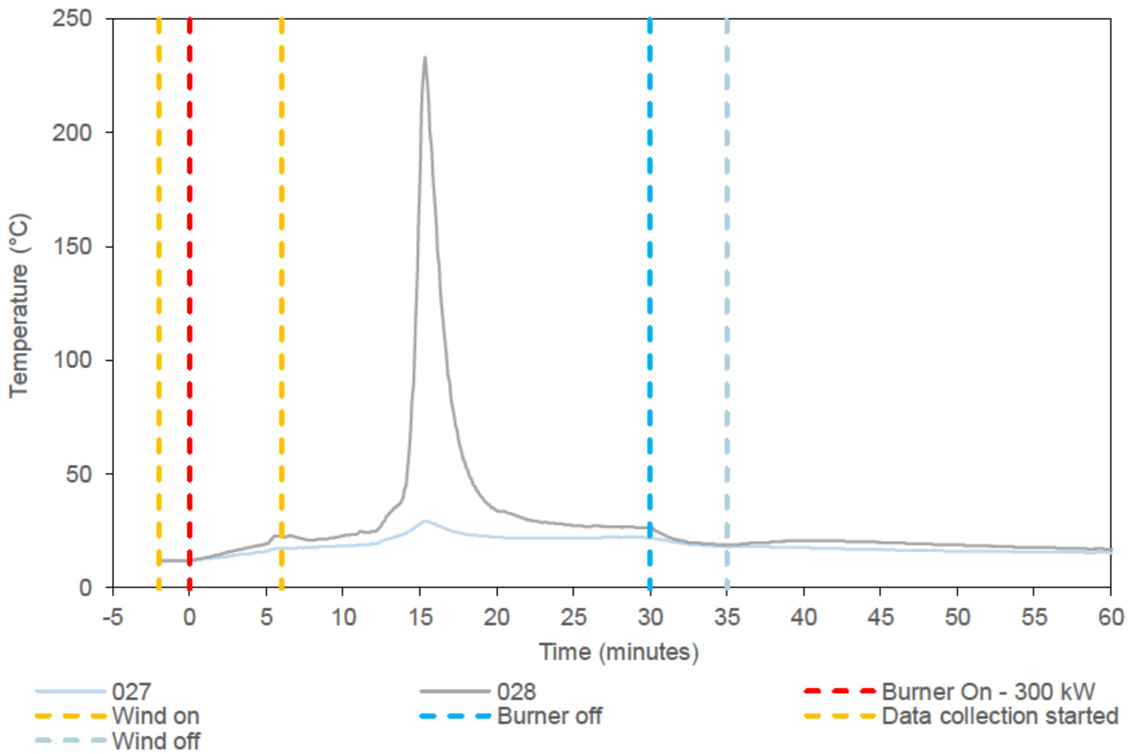


Figure 10 **External temperature data collected by plate thermocouples in-line with ACP – away from the burner**

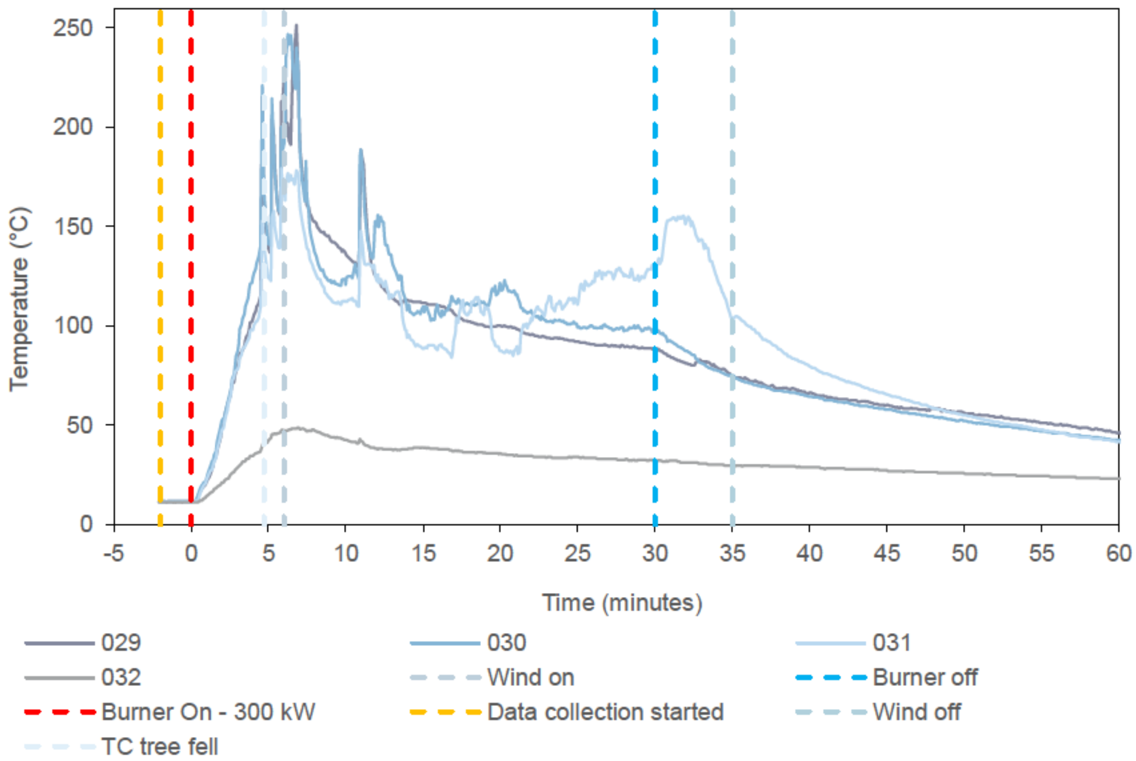


Figure 11 Internal temperature data collected by cavity thermocouples – in-line with the burner

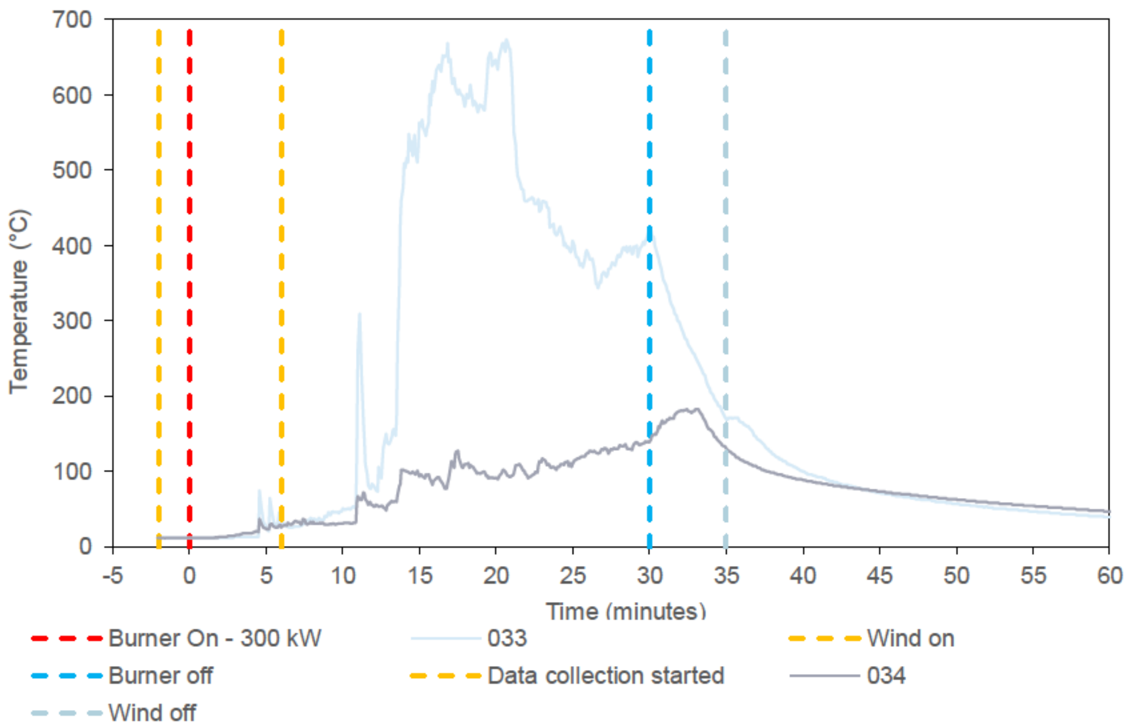


Figure 12 Internal temperature data collected by cavity thermocouples – central module

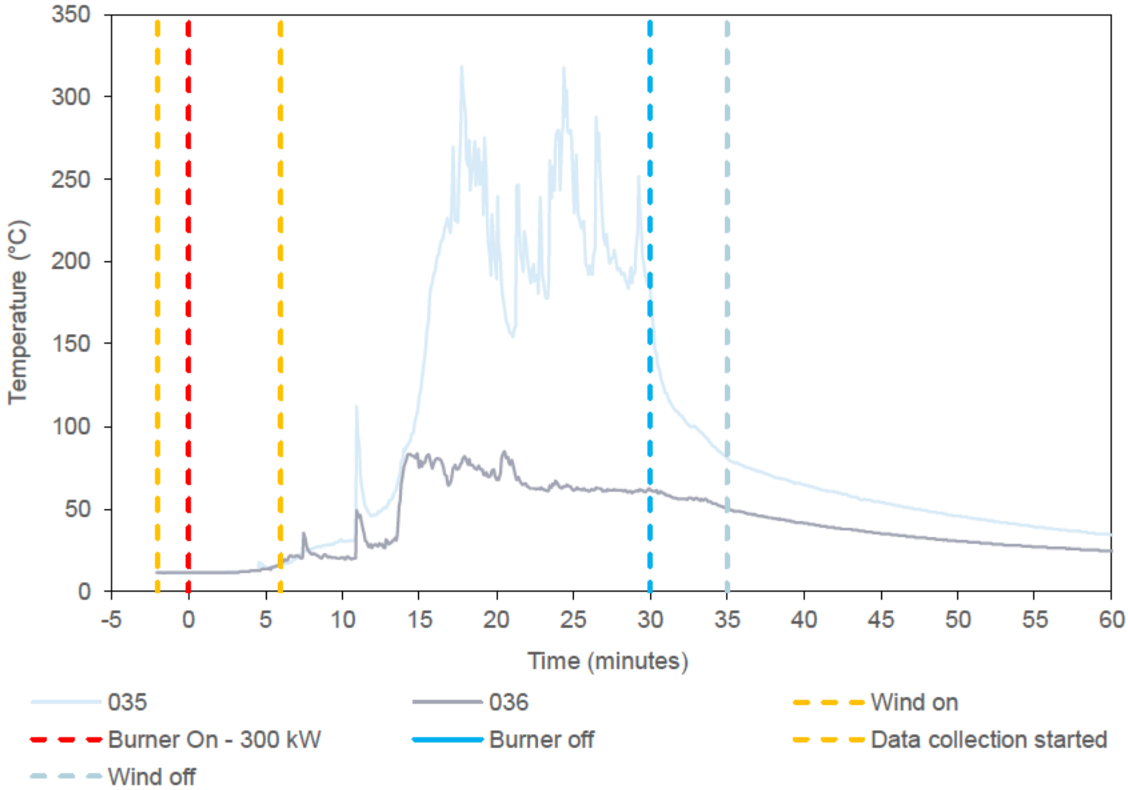


Figure 13 Internal temperature data collected by cavity thermocouples – away from the burner

Figure 14 Designation of section for the test observation

Table 4 shows the observations of any significant behaviour of the specimen during the test. Figure 14 shows the panel designations sighted in the observations.

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

Table 4 Test observations

Time Min	Time Sec	Des.	Observation
Pre-test			Within an hour period prior to the test period and data collection the wind was turned on and wind measurements and steady state conditions were recorded.
		A1	The wind speed just below TC005 was 0.6 – 1.8 m/s.
		A2	The wind speed just below TC015 was 0.7 – 2.5 m/s.
		A3	The wind speed just below TC024 was 1.8 – 2.6 m/s.
-2	00	All	Data logger started. Fan is turned off.
0	00	All	Burner on 300 kW.
2	09	A1	The panel is slightly deformed.
2	39	All	Smoke emission observed from the back.
4	40	A1	Panel popped/ruptured and opened up causing the thermocouple tree in front to topple.

Time		Des.	Observation
Min	Sec		
5	16	A1/A2	Slight explosion observed from the lower part of the joint between A1 and A2.
6	00	All	Fan turned on.
6	30	A1/A2	Flaming observed at the lower part of the joint between A1 and A2.
8	04	A2	Charring observed on the lower part of A2.
8	33	A2	The lower part of A2 appeared to open up.
9	57	A3	Discolouration observed on the lower left side of A3.
10	07	A4	Slight deformation observed around the bottom of A4.
10	56	A1/A2	Slight explosion of A1 or A2 observed at the lower part (popped).
12	41	A2/A3	Flaming observed at the joint between A2 and A3.
13	11	A3	The lower part of A3 appeared to open up.
15	24	A3	The opened-up area of A3 almost reach the right edge of the panel below TC25.
25	49	A3	No more flaming observed on A3 except the flaming on the floor.
30	00	All	Burner turned off.
31	00	A2	Flaming can still be observed around the opened-up area of A2.
32	19	A2	Flaming debris dropped from A2.
35	00	All	Fans were turned off.
35	48	All	No obvious flaming could be observed from the front. Flaming can be observed on the left corner on the back.
39	50	All	Smoke emission at the top left corner of A1 has stopped.
60	00	All	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, other than that allowed under the field of direct application in the relevant test method, is not covered 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 for 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 for the result.

Appendix A Drawings of test assembly

The drawings of the test assembly in Figure 15 to Figure 18 were provided by the representatives of Warringtonfire. Dimensions, unless specified, are in mm. The Figure 17 was modified by Warringtonfire, where the locations of the Fixing Bracket and FR plasterboard were modified.

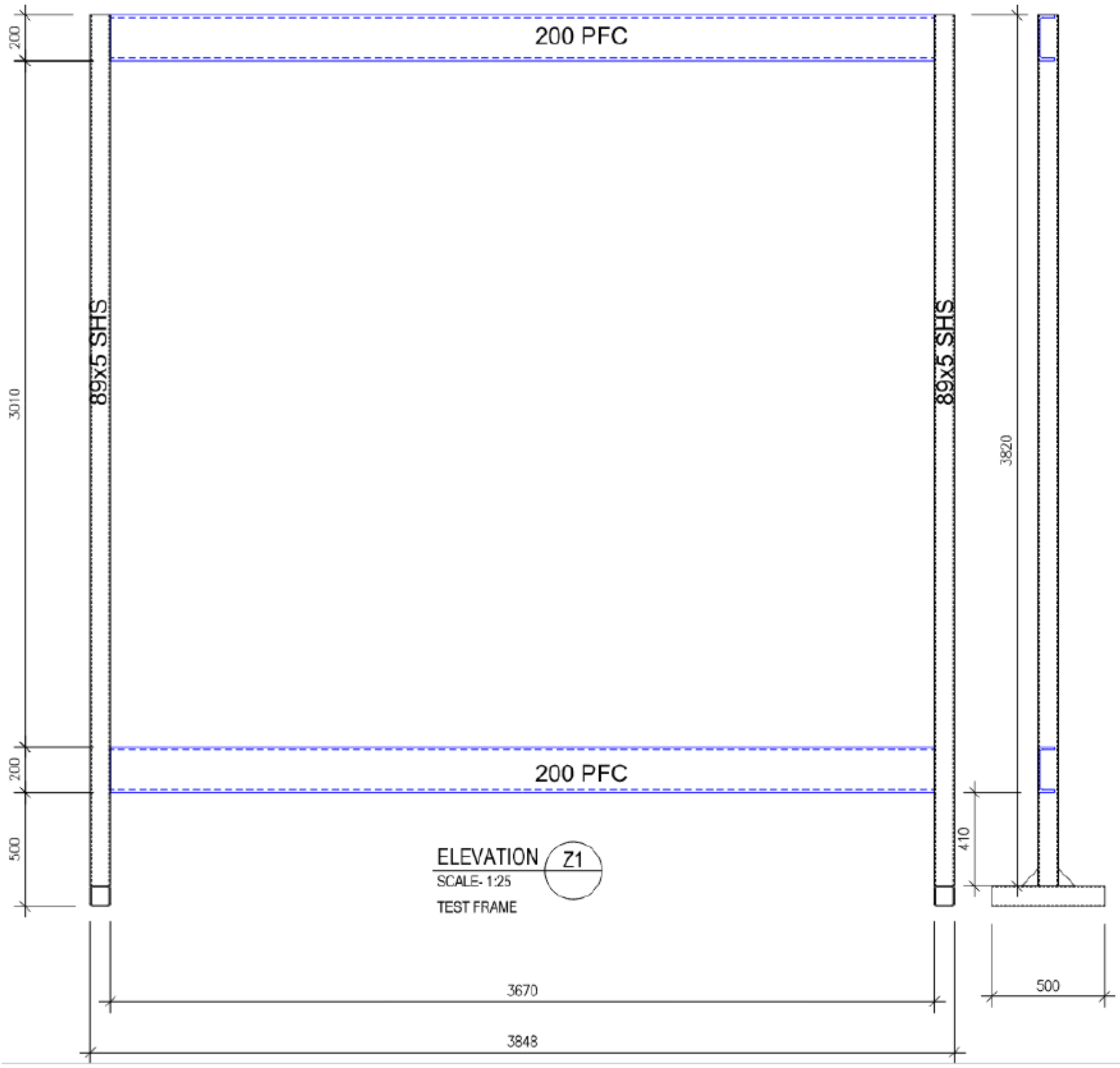


Figure 15 Elevation of rig support

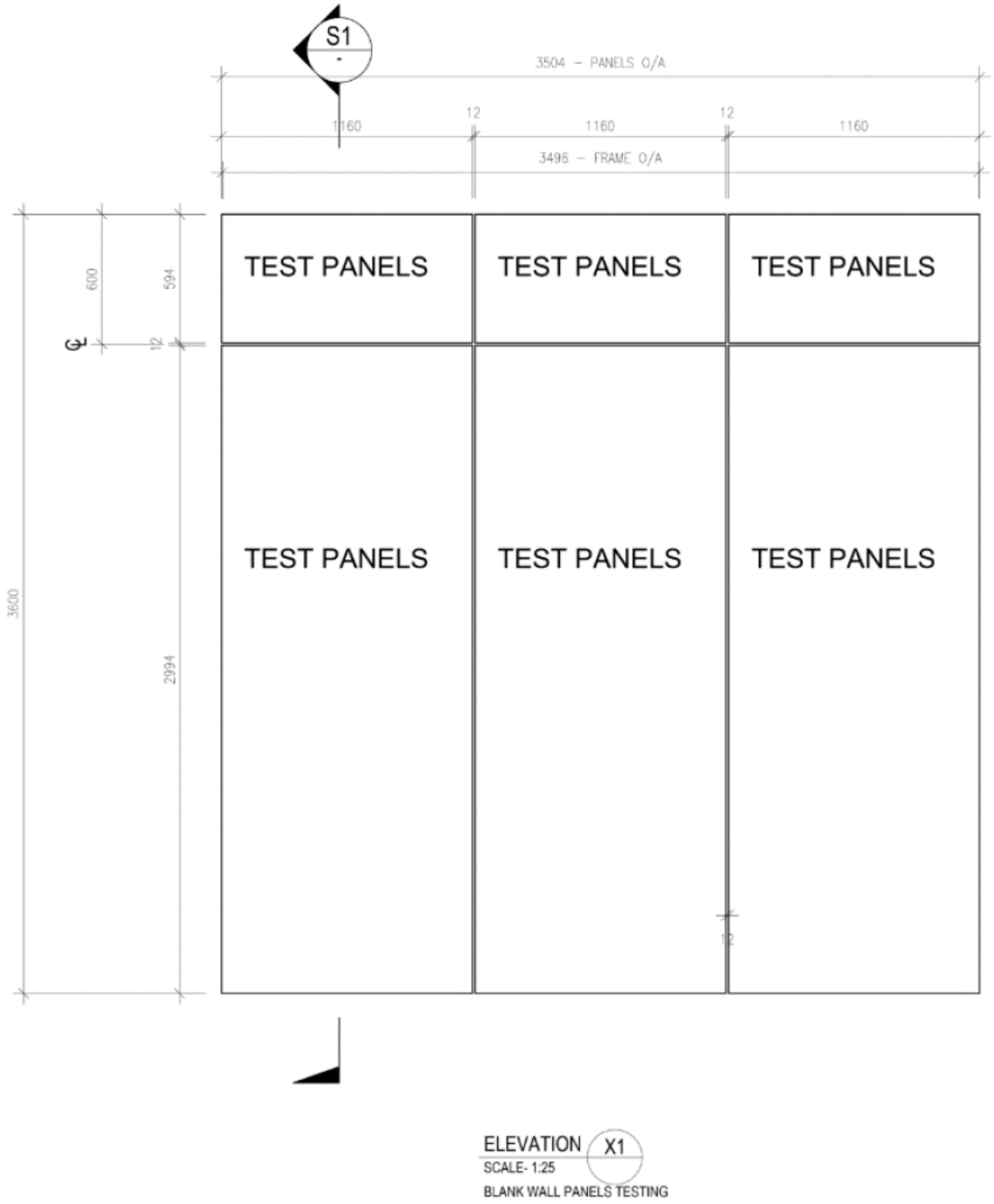


Figure 16 System assembly – Front view

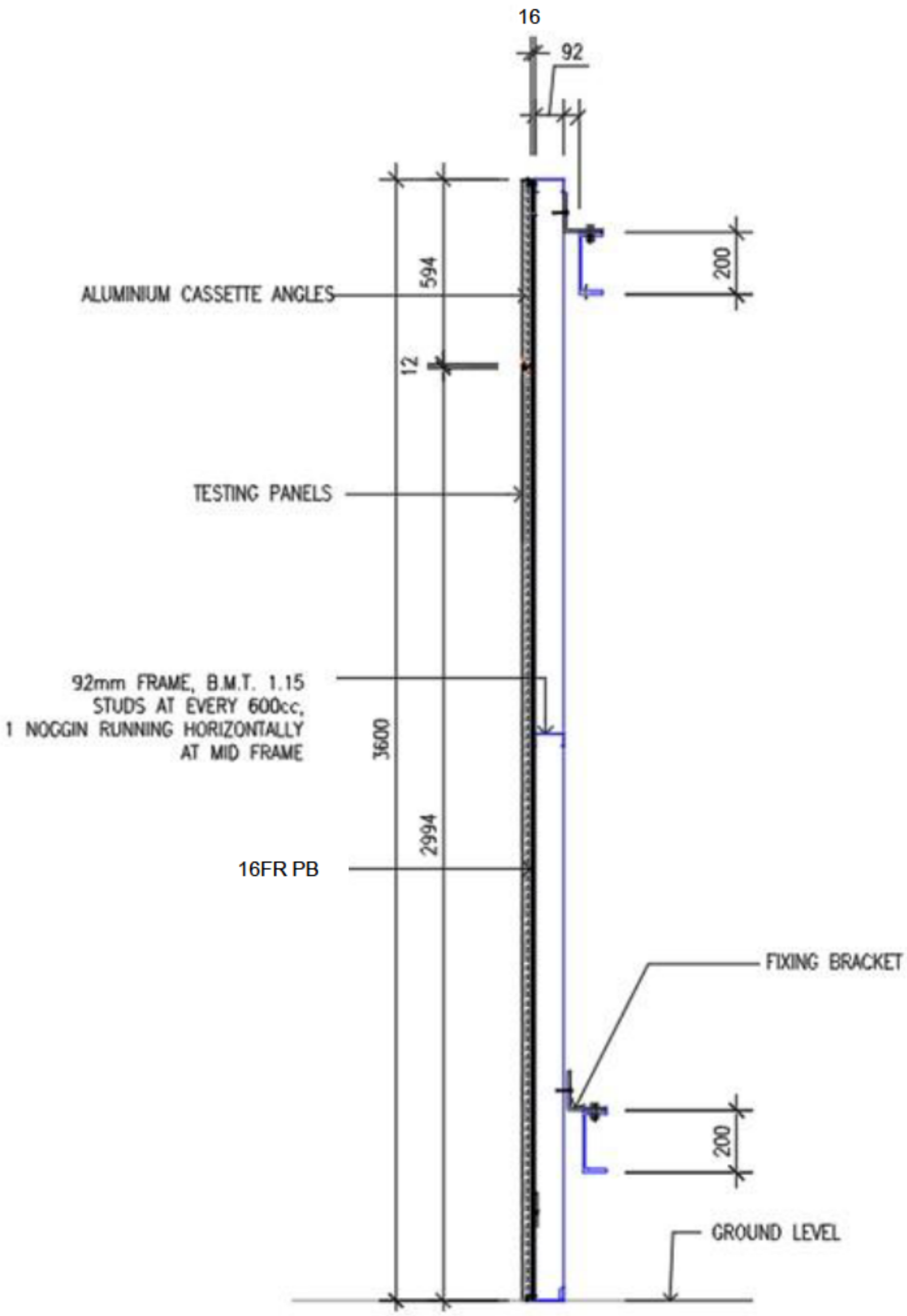
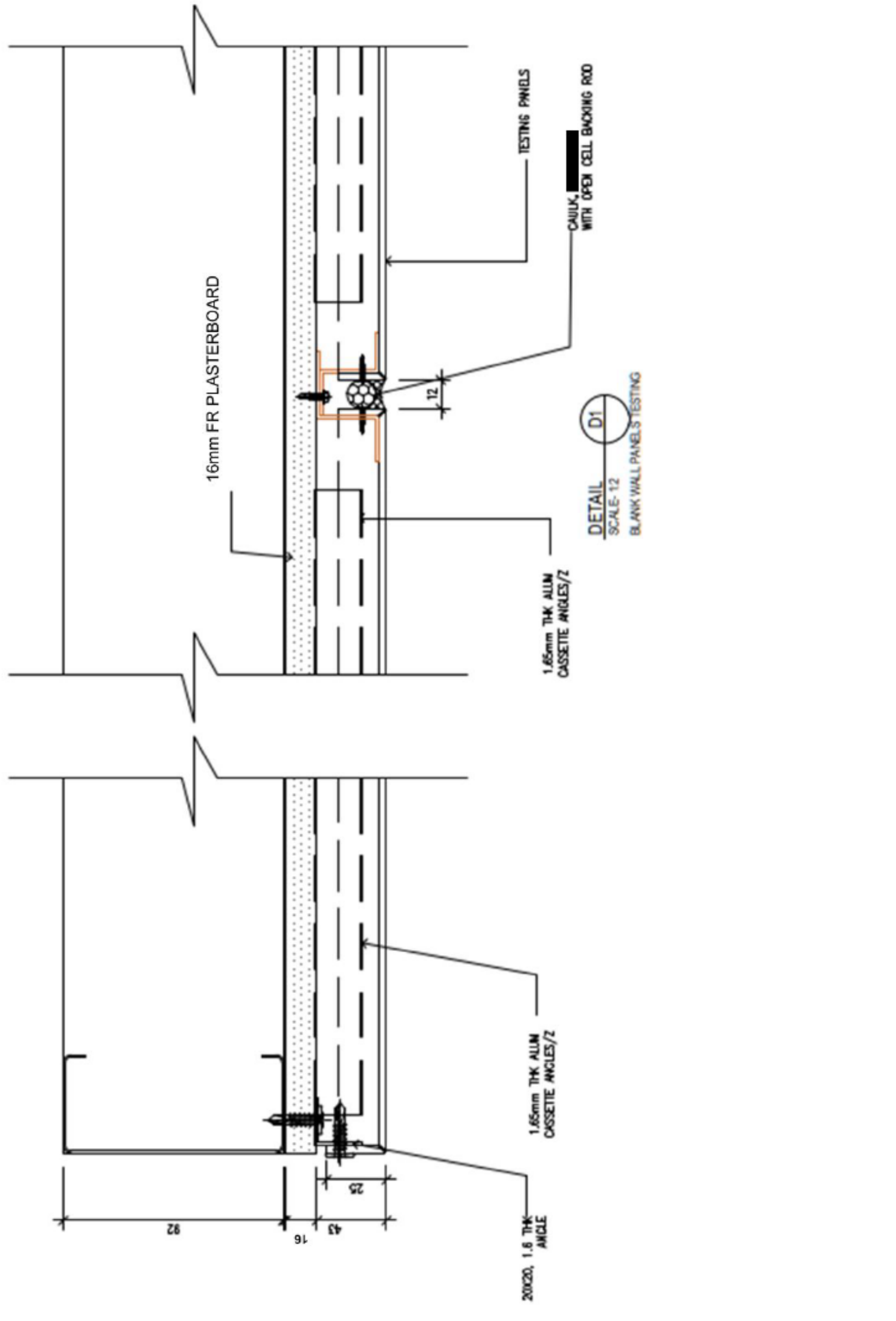


Figure 17 System assembly – vertical cross-sectional view



[MK1]

Figure 18 System assembly – vertical cross-sectional view

Appendix B Photographs

Figure 19 The specimen before the reaction to fire test – exposed side

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

Figure 21 The specimen 42 seconds into the test (burner output at 300 kW)

Figure 22 The specimen 2 minutes 57 seconds into the test (burner output at 300 kW)

Figure 23 The specimen 3 minutes 52 seconds in the test (burner output at 300 kW)

Figure 24 The specimen 6 minutes 51 seconds into the test (burner output at 300 kW)

Figure 25 The specimen 9 minutes 2 seconds into the test (burner output at 300 kW)

Figure 26 **The specimen 14 minutes 35 seconds into the test (burner output at 300 kW)**

Figure 27 **The specimen 27 minutes 37 seconds into the test (burner output at 300 kW)**

Figure 28 The specimen 30 minutes 37 seconds into the test (37 seconds after burner off)

Figure 29 The specimen 34 minutes 46 seconds into the test (4 minutes 46 seconds after burner off)

Figure 30 The specimen 45 minutes into the test (5 minutes after burner off)

Figure 31 The specimen 50 minutes into the test (10 minutes after burner off)

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: [redacted]

Approved by: [redacted]

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%
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

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

Chemical Consulting Laboratory

Mark Wainwright Analytical Centre, UNSW

22 February 2024

UNSW SYDNEY

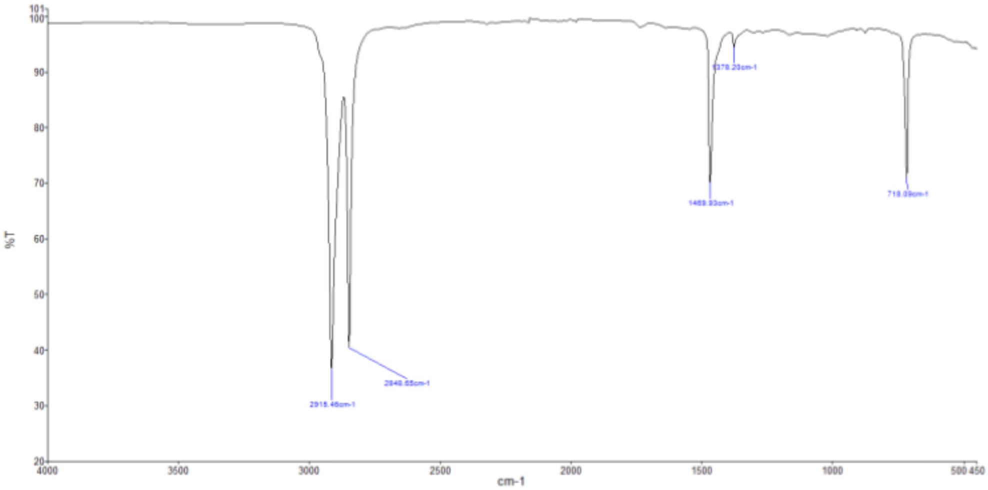

Figure 1. FT-IR spectrum of sample #1

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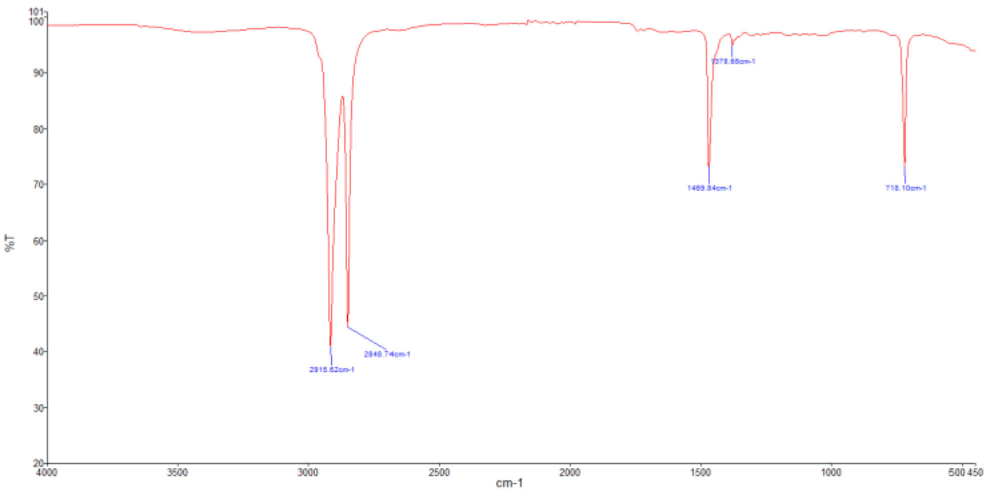

Figure 2. FT-IR spectrum of sample #2

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