



WARRINGTONFIRE  
AUSTRALIA

A Jensen Hughes Company



# Reaction to fire test report

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

Test sponsor: Cladding Safety Victoria (CSV)

System: ACP with 45 % polyethylene core external façade cladding system with PET wall insulation

Job number: RTF240052

Test date: 31 July 2024 Revision: RR1.0

## Quality management

Revision	Date	Information about the report			
RR1.0	4 December 2025	Description	Initial issue.		
			Prepared by	Reviewed by	Authorised by
		Name	██████████	██████████	██████████
	Signature				

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ABN 81 050 241 524

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## 1. Introduction

This report documents the findings of test three of three ad-hoc reaction to fire tests for an aluminium composite panel (ACP) external wall cladding system with the PET insulation performed on 31 July 2024. The test was based on the general principles 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 B.

**Table 2 Schedule of components**

Item	Description						
<b>Cladding</b>							
1.	Item name	ACP panelling - cassetted					
	Product name	██████████ Aluminium Composite Panel - 4 mm Dark Oak/Matte White with 0.5 mm skin. *Sample sheets were taken from older manufactured quarantined stock with a higher polyethylene content that is no longer in circulation which was received marked as 'Testing Only'.					
	Manufacturer/Supplier	██████████					
	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 E for more detailed results - Sample 23197-1, Oak.					
	Dimension	2100 mm high × 1500 mm wide with a 20 mm perimeter fold					
	Thicknesses	Total panel thickness – 4.1 mm Core thickness – 3.0 mm Skin thickness – 0.5 mm (both)					
	Batch number	1609418					
	Areal density	6.9 kg/m <sup>2</sup>					
	Colour	<table border="1"> <tr> <td rowspan="2">Skins</td> <td>Exposed face – Dark Oak (finish)</td> </tr> <tr> <td>Unexposed face – Matte White</td> </tr> <tr> <td>Core</td> <td>Light grey</td> </tr> </table>	Skins	Exposed face – Dark Oak (finish)	Unexposed face – Matte White	Core	Light grey
Skins	Exposed face – Dark Oak (finish)						
	Unexposed face – Matte White						
Core	Light grey						

Item	Description	
2.	Item name	Calcium silicate board
	Product name	[REDACTED]
	Size	1200 mm wide × 3600 mm long × 20 mm thick (uncut)
	Batch number	BA900232 1809001818014001
3.	Item name	Fire rated plasterboard
	Product name	[REDACTED]
	Manufacturer	[REDACTED]
	Size	1200 mm wide × 3600 mm long × 13 mm thick (uncut)
	Batch number	9314450006293
<b>Framing</b>		
4.	Item name	Top track/base track
	Material	Steel
	Size	92 mm × 1500 mm × 40 mm, 1.15 mm B.M.T.
	Manufacturer	[REDACTED]
	Batch number	932584201026
5.	Item name	Steel stud
	Size	92 mm × 2100 or 2600 mm × 40 mm, 1.15 mm B.M.T.
	Manufacturer	[REDACTED]
	Batch number	932584201031
	Installation	Studs at max. 600 mm
6.	Item name	Steel nogging
	Size	92 mm × 580 mm × 40 mm, 1.15 mm B.M.T.
	Manufacturer	[REDACTED]
	Batch number	932584200860
	Installation	Running horizontally at mid height
<b>Angles</b>		
7.	Item name	Equal angle
	Size	20 mm × 20 mm × 3600 mm, 1.6 mm thick
	Manufacturer/Supplier	[REDACTED]
	Material	Aluminium
	Installation	Used to secure the ACP to the 92 mm framing. The angle was screw fixed to both ACPs and the 92 mm framing using cassette screws (item 13) at nominal 250 mm and 500 mm centres respectively.
8.	Item name	Flashing
	Size	1500 mm long × 150 mm tall × 120 mm deep × 0.55 mm thick
	Manufacturer	[REDACTED]
	Material	Galvanised steel Z275

Item	Description	
	Installation	Used to provide protection to the ACP cladding to test rig bottom joint. The 150 mm flange was fixed through the plasterboard patch strip (item 3) to the calcium silicate board (item 2) of the back blanking wall with patch screws (item 12) at nominal 300 mm centres. The 120 mm flange was fixed to the underside of the specimen framing at nominal 300mm centres with framing screws (item 10).
9.	Item name	Top hat stiffeners
	Manufacturer/Supplier	██████████
	Material	Galvanised steel
	Size	25×25×50×25×25 mm × 1450 mm long
	Installation	Fixed horizontally to the studs (item 5) at nominal 600 mm centres with two framing screws (item 10) per stud. They were adhered to the unexposed side of the ACPs panels with a single strip of tape (item 14) up the middle with two beads of adhesive (item 15) either side of it.
<b>Fixings</b>		
10.	Item name	Framing screws
	Description	10g × 16 mm, flathead, self-drilling screws
	Manufacturer	██████████
	Installation	Used to fix the framing (items 4, 5 and 6) together and to secure the stiffeners (item 9) to the framing.
11.	Item name	Board screws
	Description	6g × 32 mm, bugle head, drill point, fine thread screws
	Manufacturer	██████████
	Installation	Used to fix the calcium silicate boards (item 2) and plasterboard sheets (item 3) to the steel framing (item 5) at 300 mm centres.
12.	Item name	Patch screws
	Description	6g × 32 mm, bugle head, needle point, fine thread screws
	Manufacturer	██████████
	Installation	Used to fix the plasterboard patches (item 3) to the calcium silicate board (item 2) and secure the flashing (item 8).
13.	Item name	Cassette screws
	Description	10g × 16 mm, flathead, self-drilling screws
	Manufacturer/Supplier	██████████
	Installation	Use to secure the ACP (item 1) to the angles (item 7).
14.	Item name	Double sided tape
	Description	12 mm wide × 2 mm thick ██████████ Tape
	Manufacturer	████
	Installation	Used to hold the ACP panels (item 1) to the stiffeners (item 9) while the adhesive (item 15) cured.
15.	Item name	Adhesive sealant
	Description	██████████
	Batch number	4823602348
	Manufacturer	██████████

Item	Description	
	Installation	Used to fix the ACP panels (item 1) to the stiffeners (item 9).
<b>Insulation</b>		
16.	Item name	Polyethylene terephthalate (PET) insulation batt
	Description	R2.0 90 mm thick polyester batt.
	Density	20 kg/m <sup>3</sup> (nominated)
	Manufacturer	██████████
	Installation	Installed in the specimen steel frame.
<b>Installation method</b>		
Specimen wall frame	The specimen wall frame consisted of steel framing (items 4,5 and 6) fixed together using framing screws (item 10). It was clad on the back face with plasterboard (item 3) secured at 300 mm centres with board screws (item 11).	
Blanking walls	The test rig blanking walls consisted of three sperate assemblies of steel framing (items 4,5 and 6) fixed together using framing screws (item 10) and clad on the fire exposed side with calcium silicate board (item 2). The two sides and the back where fixed to one another to form an alcove nominally 1500 mm wide by 888 mm deep.	
Overall size	Back blanking wall	1500 mm wide × 2600 mm tall
	Side blanking walls	1000 mm wide × 2500 mm tall
	Specimen	1500 mm wide × 2100 mm tall
ACP cladding	The exposed face of the specimen was clad with casseted ACP (item 1) that was folded nominally 20 mm in and fixed to equal angles (item 7) using cassette screws (item 13) at nominal 250 mm centres to form a nominally 25 mm deep cassette. The face of the ACP was in line with the edge of the flashing (item 8). The wall cavity of the specimen was filled with the insulation (item 16).	

### 3. Test procedure

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

**Table 3 Test procedure**

Item	Detail	
Statement of compliance	<p>The ad-hoc test - based on ISO 13785-1:2002 - was undertaken to determine the reaction to fire properties of an external wall cladding material, exposed to heat from a simulated external fire. The test utilised a burner based on the requirements of ISO 13785-1:2002.</p> <p>The instrumentation used to collect and analyse the products of combustion was based on ISO 9705-1:2016.</p>	
Supplementary standard	<ul style="list-style-type: none"> <li>AS ISO 9705:2003 (R2016)</li> <li>ISO 9705-1:2016</li> </ul>	
Sampling / specimen selection	<p>The laboratory was not involved in sampling or selecting the test specimen for the reaction to fire test.</p> <p>The results obtained during the test only apply to the test samples as received and tested by Warringtonfire.</p>	
Ambient laboratory temperature	Start of the test	12 °C
	Minimum temperature	12 °C
	Maximum temperature	14 °C
Initial horizontal wind speed	0.1 to 0.2 m/s (measured at a horizontal distance of 500 mm away from the façade face before the test)	
Test duration	60 minutes	
Instrumentation and equipment	<ul style="list-style-type: none"> <li>6 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 heights, 50 mm in front of the outer face of the test specimen along its vertical centreline. Refer to Figure 13 and Figure 14 in Appendix C for details on positioning.</li> <li>3 MIMS Type K thermocouples with an overall diameter of 1.5 mm with the measuring junction insulated from the sheath were positioned at various heights at mid-depth of the framing cavity of the test specimen. Refer to Figure 13 and Figure 14 in Appendix C for details on positioning.</li> <li>The fire source was a propane (95 % purity) gas fuelled box burner; 1.2 m wide × 0.1 m deep × 0.15 m tall. The burner was located on the floor in front of the specimen, with the back edge of the burner in line with the exposed face of the specimen.</li> <li>The incident heat flux 50 mm above and in line with the exposed face of the test specimen was measured using a Schmidt-Boelter type heat flux gauge with a range of 0 - 50 kW/m<sup>2</sup>.</li> <li>The products of combustion were collected in an exhaust hood located centrally above the exposed face of the tested specimen. The hood was connected to an exhaust duct 400 mm in diameter, which had instruments inside to measure the conditions and properties of the combustion products during the test. The hood had specifications based on those given in AS ISO 9705:2003 (R2016), with the only differences being that all four sides had 1 m blanking sheet extensions, and there was no fire test room.</li> <li>The volume flow rate was determined using a bidirectional pressure probe attached to a differential pressure transmitter together with a type K MIMS thermocouple positioned near the probe.</li> <li>Smoke obscuration measurements were made using a helium-neon laser smoke photometer, as outlined in Annex H of ISO 9705-1:2016.</li> <li>The temperature of the exhaust stream near the light beam was measured using a type K MIMS thermocouple.</li> </ul>	

Item	Detail
	<ul style="list-style-type: none"> <li>An exhaust sampling probe sampled the combustion products which were then analysed by a gas purity analyser. The oxygen concentration during the test was determined by a paramagnetic oxygen sensor and the carbon monoxide and carbon dioxide concentrations were determined using an infrared sensor.</li> <li>The horizontal wind speed will be measured using a hot wire anemometer at a horizontal distance of 500 mm away from the centre of the exposed face of the tested specimen.</li> <li>A Fourier Transform Infrared Spectroscopy (FTIR) gas analyser was connected to the exhaust duct and operated by representatives of the test sponsor to sample the products of combustion during the test.</li> </ul>
System response	<p>A step calibration test was carried out to determine the system response time. The gas burner was placed centrally and 1 m below the exhaust hood by subjecting it to a stepwise change in heat release shown in Table 4. After that time the test was ran for an additional 2 minutes and stopped afterwards. Data from instruments was collected and analysed every 3 seconds.</p> <p>At steady state conditions, the difference between the mean rate of heat release over 1 minute calculated from the measured oxygen consumption and that calculated from the metered gas output did not exceed <math>\pm 5\%</math> for each level of heat output – and therefore complied with the requirements of Section 10.1 of AS ISO 9705:2003 (R2016).</p> <p>The system response time was determined by calculating the average time taken for the measured rate of heat release to be within 10% of the metered gas calculated rate of heat release. System response data is listed in Table 4 and the system response has been calculated to be 22 s</p>
Test procedure	<ul style="list-style-type: none"> <li>At least 2 minutes of baseline data was collected prior to burner ignition. Temperature and heat flux data was collected at 5 s intervals, while the combustion products sampling data was collected at 3 s intervals.</li> <li>The heat output from the burner was held at 100 kW for 15 minutes, then 300 kW for the following 25 minutes. The burner was then turned off and data was recorded for the following 20 minutes.</li> </ul>

**Table 4 Response time measurements during the step calibration test**

Step	Target heat output (kW)	Metered gas output (kW)	Heat measured (kW)	Variance (%)	Response time (s)
1-2	100	99.57	104.46	4.9%	23
2-3	300	297.61	300.85	1.1%	18
3-4	100	99.41	99.72	0.3%	24

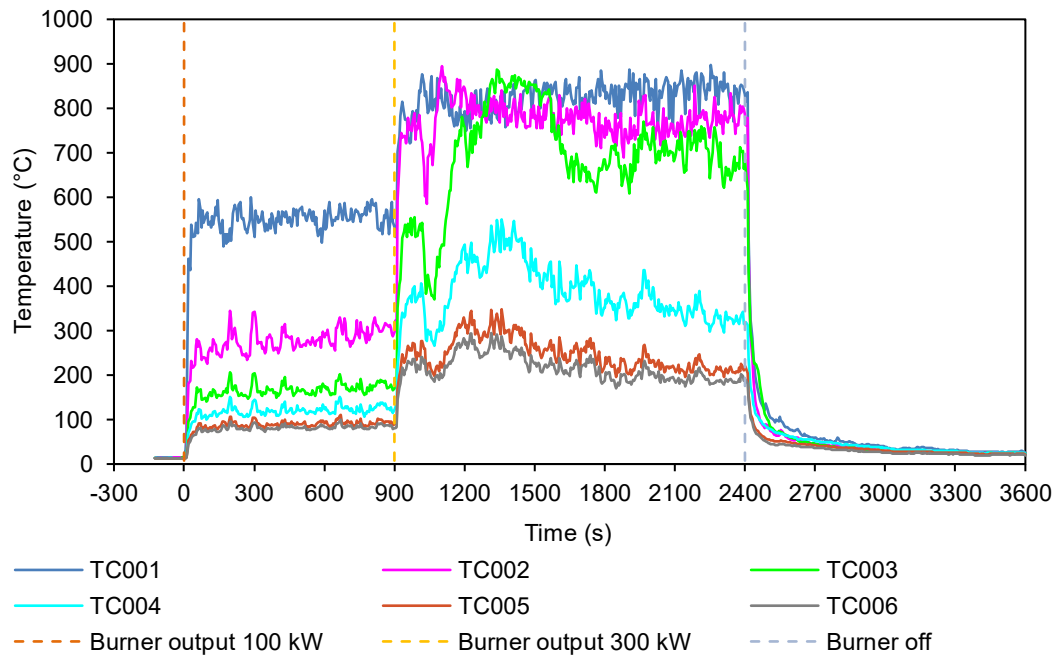
## 4. Test measurements and results

### 4.1 Test measurements

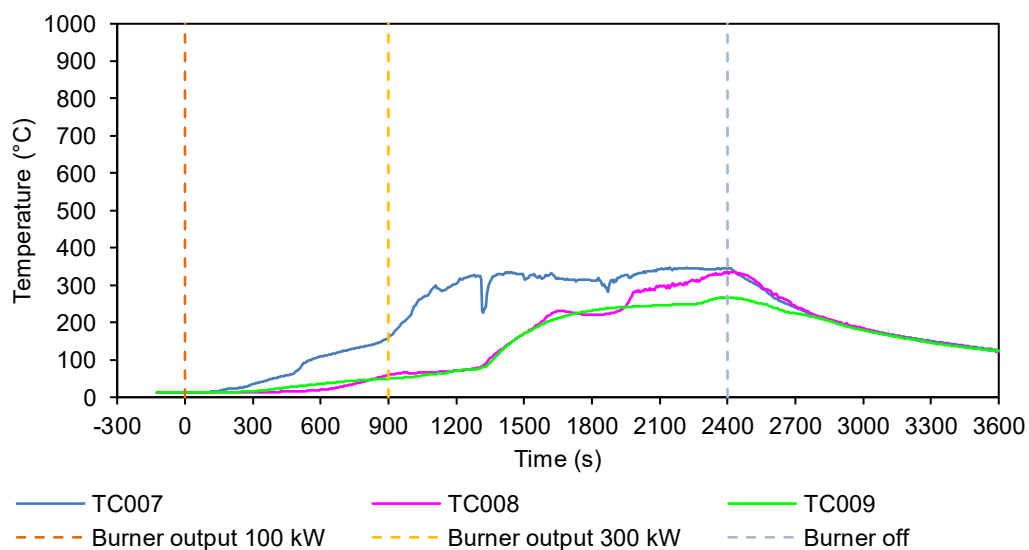
The measurements taken for the heat flux, volume flow rate, heat release rate, temperatures and light obscuration – along with the production rates of carbon monoxide and carbon dioxide – are summarised below.

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

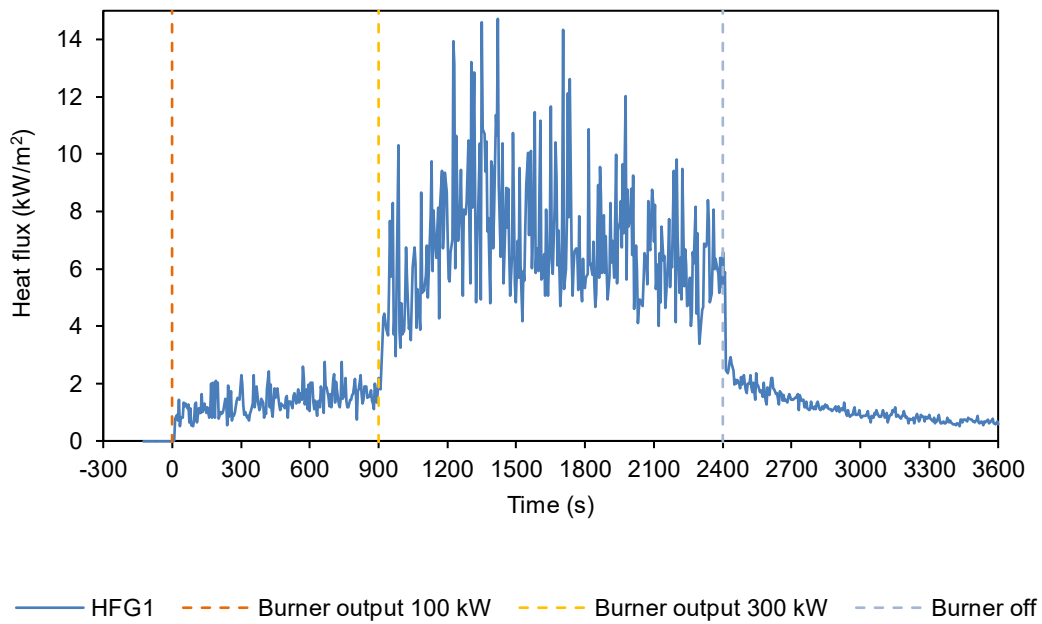
Photographs of the specimen are included in Appendix D.



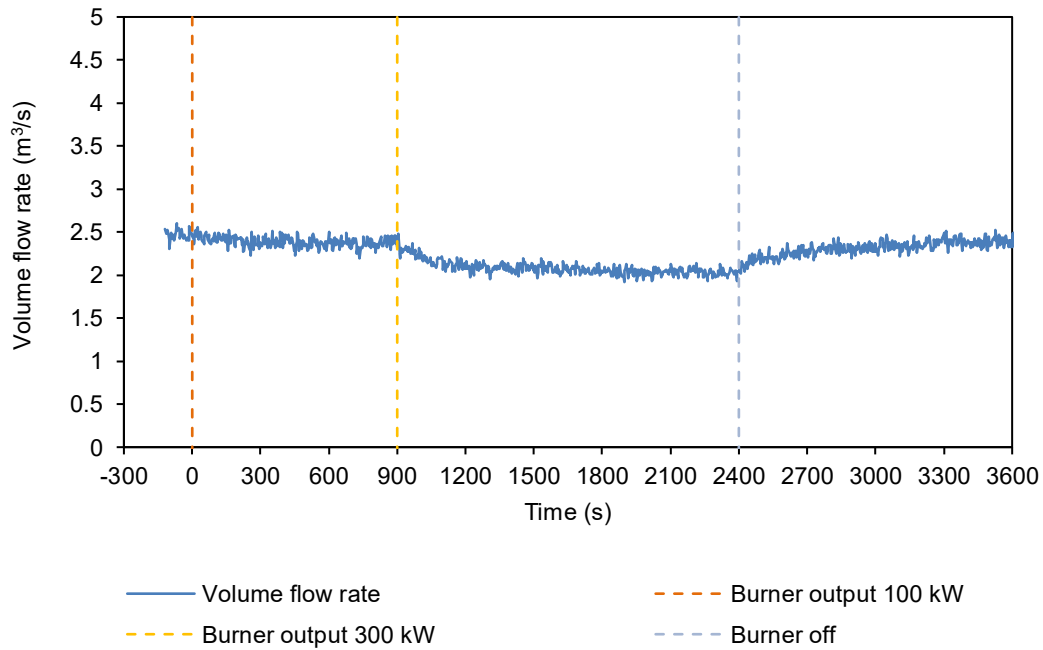
**Figure 1 50 mm from the exposed face – Temperature vs time**



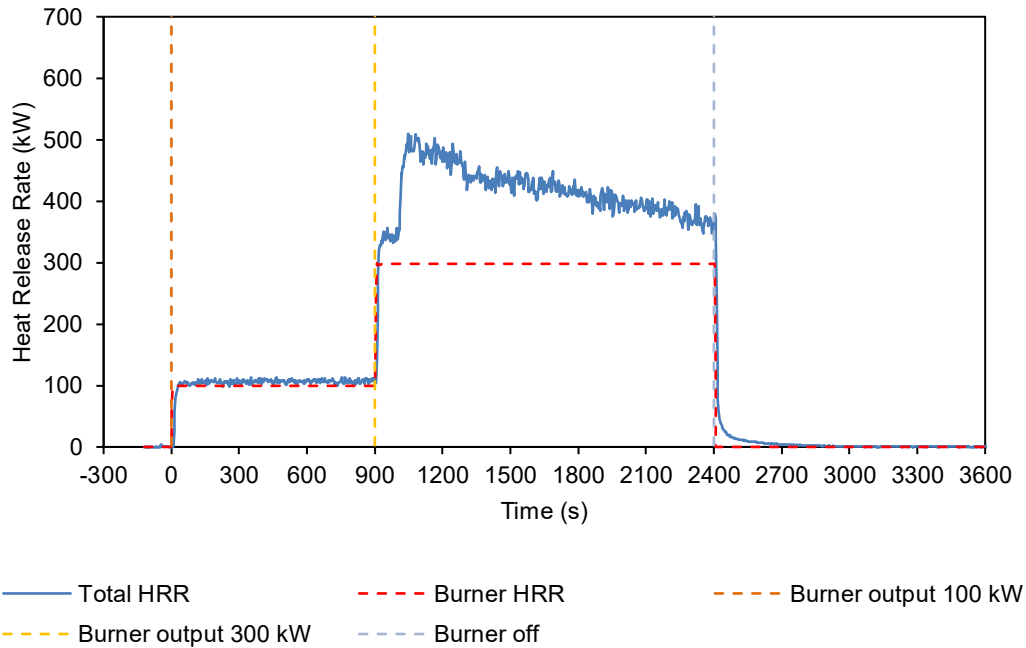
**Figure 2 Cavity – Temperature vs time**



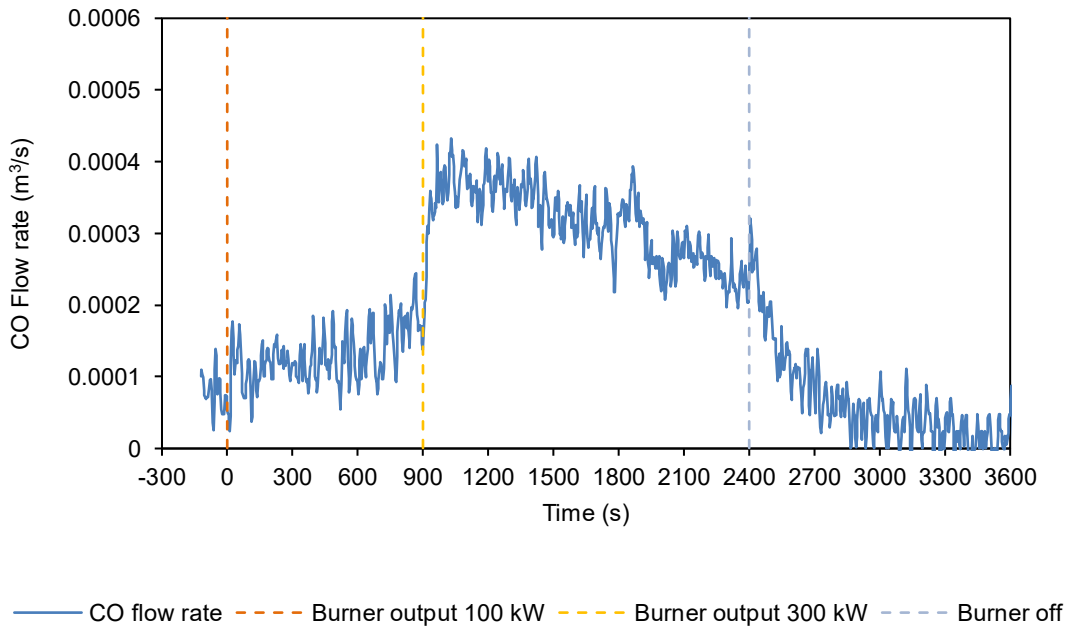
**Figure 3 Heat flux vs time**



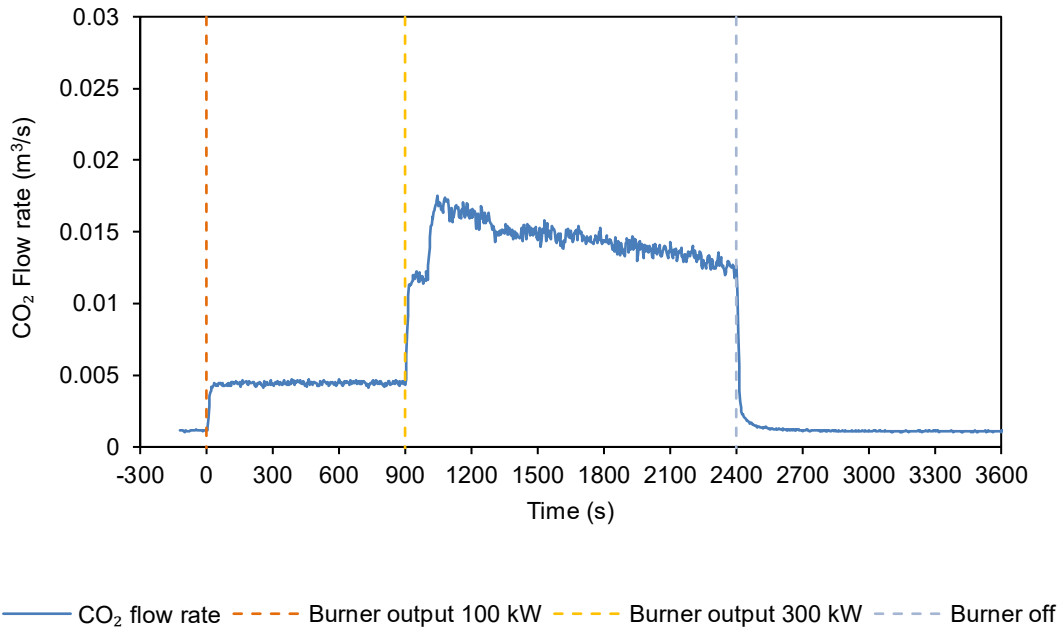
**Figure 4 Volume flow rate in duct vs time**



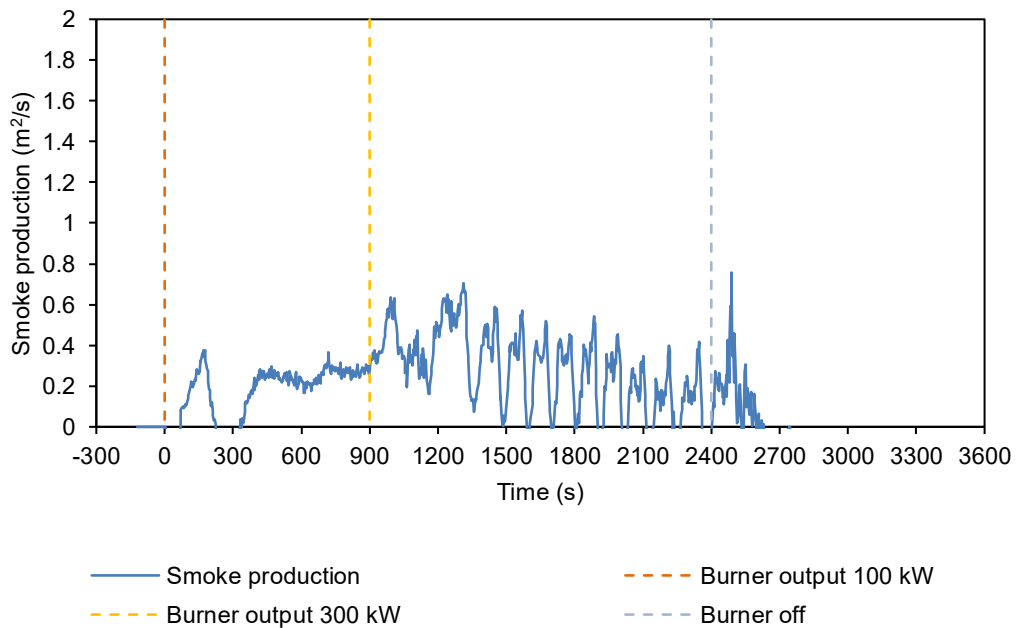
**Figure 5 Heat release rate (HRR) of specimen and burner vs time**



**Figure 6 Production of carbon monoxide vs time, at reference temperature and pressure**



**Figure 7 Production of carbon dioxide vs time, at reference temperature and pressure**



**Figure 8 Production of light obscuring smoke vs time, at reference temperature and pressure**

## **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 Test observations

Table 5 shows the observations of any significant behaviour of the specimen during the test.

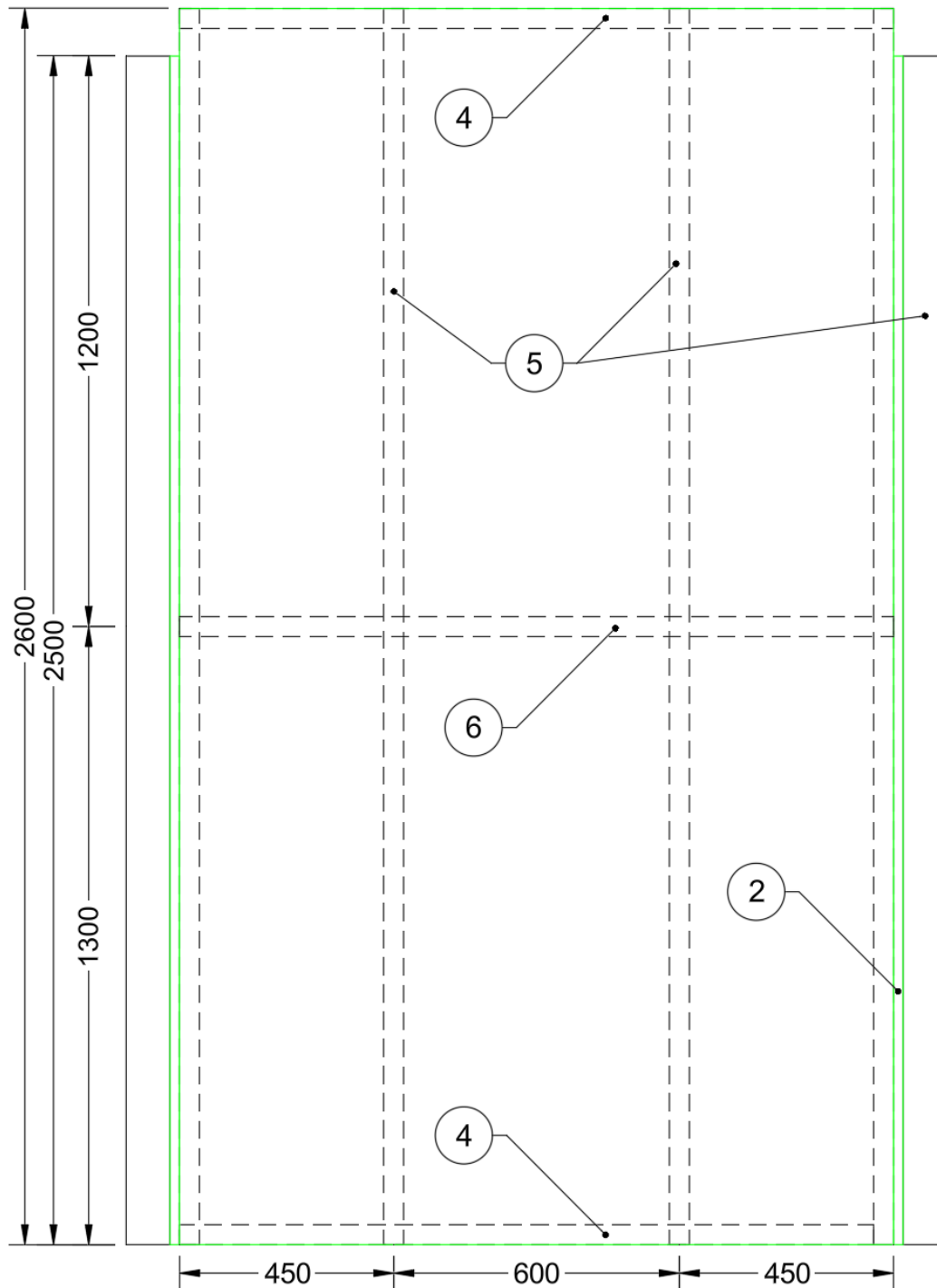
Video recordings were also taken of the test from directly in front of the specimen and from an angle beside the specimen. A copy of the video recording is available upon request by contacting Cladding Safety Victoria. The video of the test should be viewed in conjunction with the contents of this report.

**Table 5 Test observations**

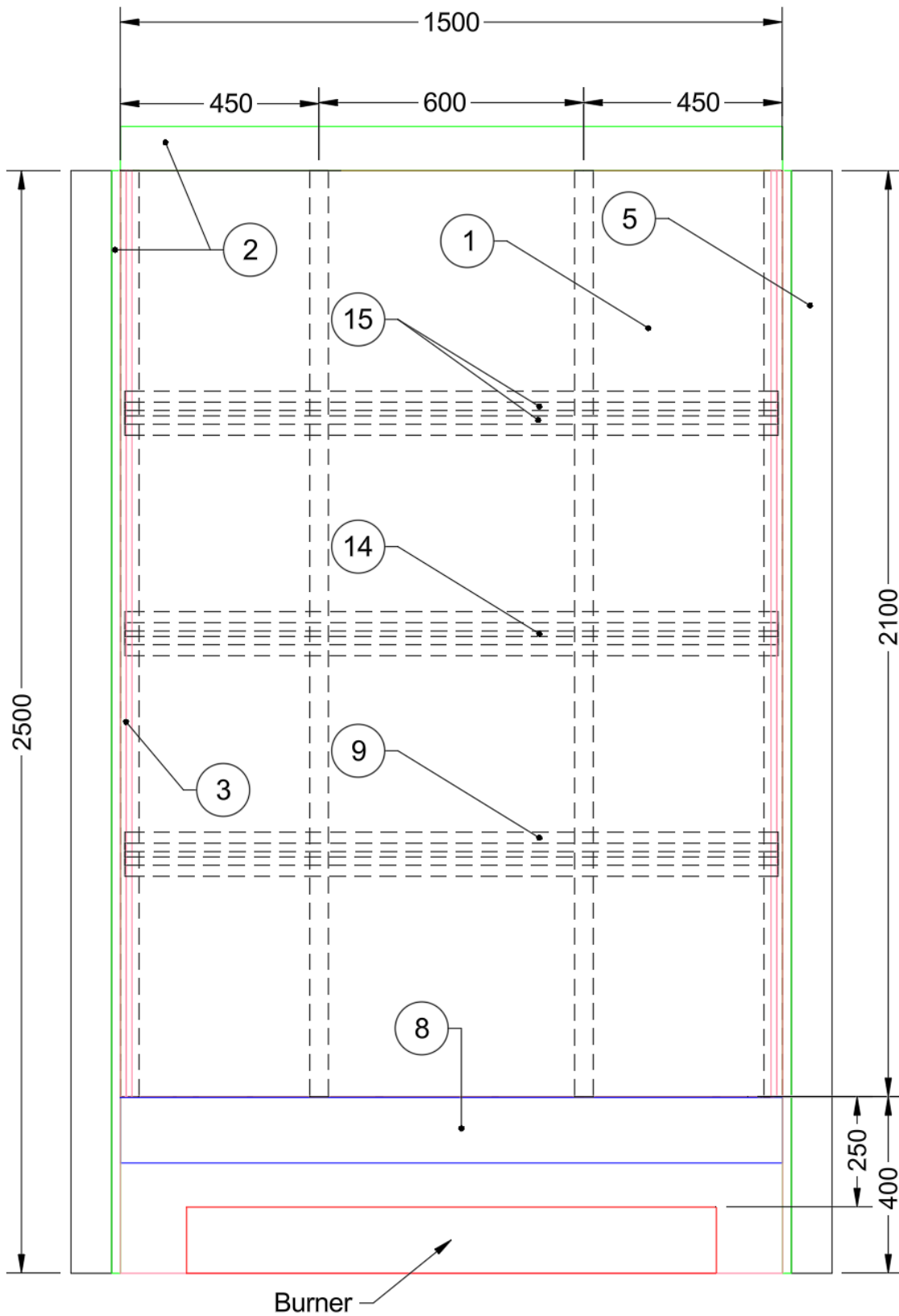
Time		Observation
Min	Sec	
-2	00	Data collection started.
0	00	The reaction to fire test was started with the burner ignited with a heat output set at 100 kW.
1	11	The bottom steel angle started to bend due to the heat.
2	22	Paint started to flake off from the bottom side of the specimen.
2	46	Colour at the bottom of the panel continued to fade and material started charring.
7	55	Material at the bottom side started melting and dripping on the top of burner.
15	00	The heat output of the burner was increased to 300 kW.
15	37	The first layer of the panel opened at the bottom side.
16	30	The bottom of the panel opened through to the insulation.
17	25	The panel opening continued upwards on the left side towards mid-section.
19	30	Fire reached the top side of specimen on the left side.
20	45	Molten material was dripping on the top of burner and floor.
25	35	Independent flaming on the left side of the panel was observed.
29	40	The right side of the panel started opening.
35	10	Most of the panel skin was charred from bottom to the mid-section.
40	00	Burner was turned off.
41	08	Some flaming is still there at the bottom side of the panel.
42	30	Burned skin of the panel kept charring.
45	10	Burned material kept charring on the floor.
45	33	All the flaming died off.
60	00	The reaction to fire test was ended.

## Appendix B Drawings of test assembly

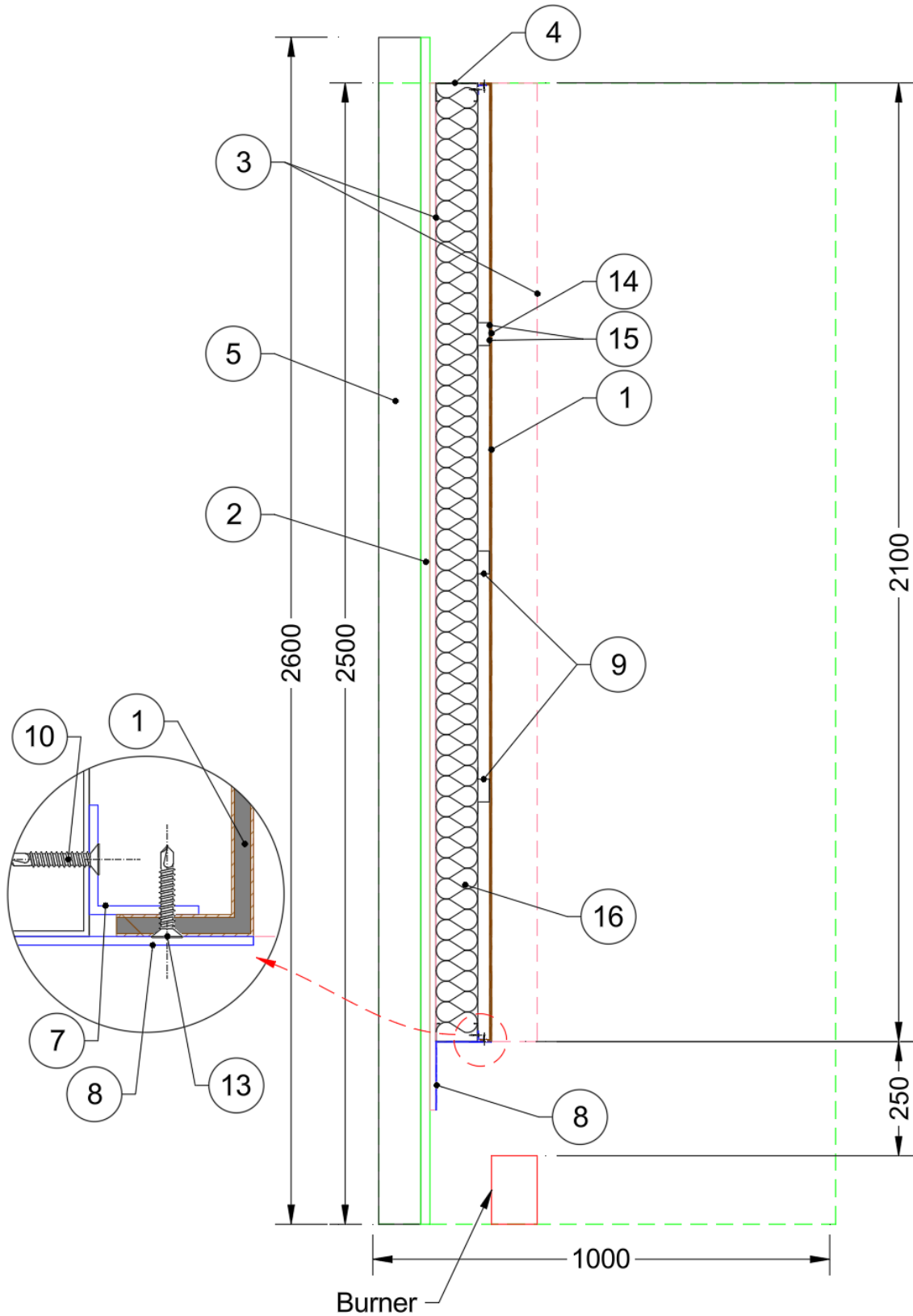
The drawings of the test assembly in Figure 9 to Figure 14 were provided by the representatives of Warringtonfire. Dimensions, unless specified, are in mm. The leaders in the drawings represent the items listed in section 2.1.



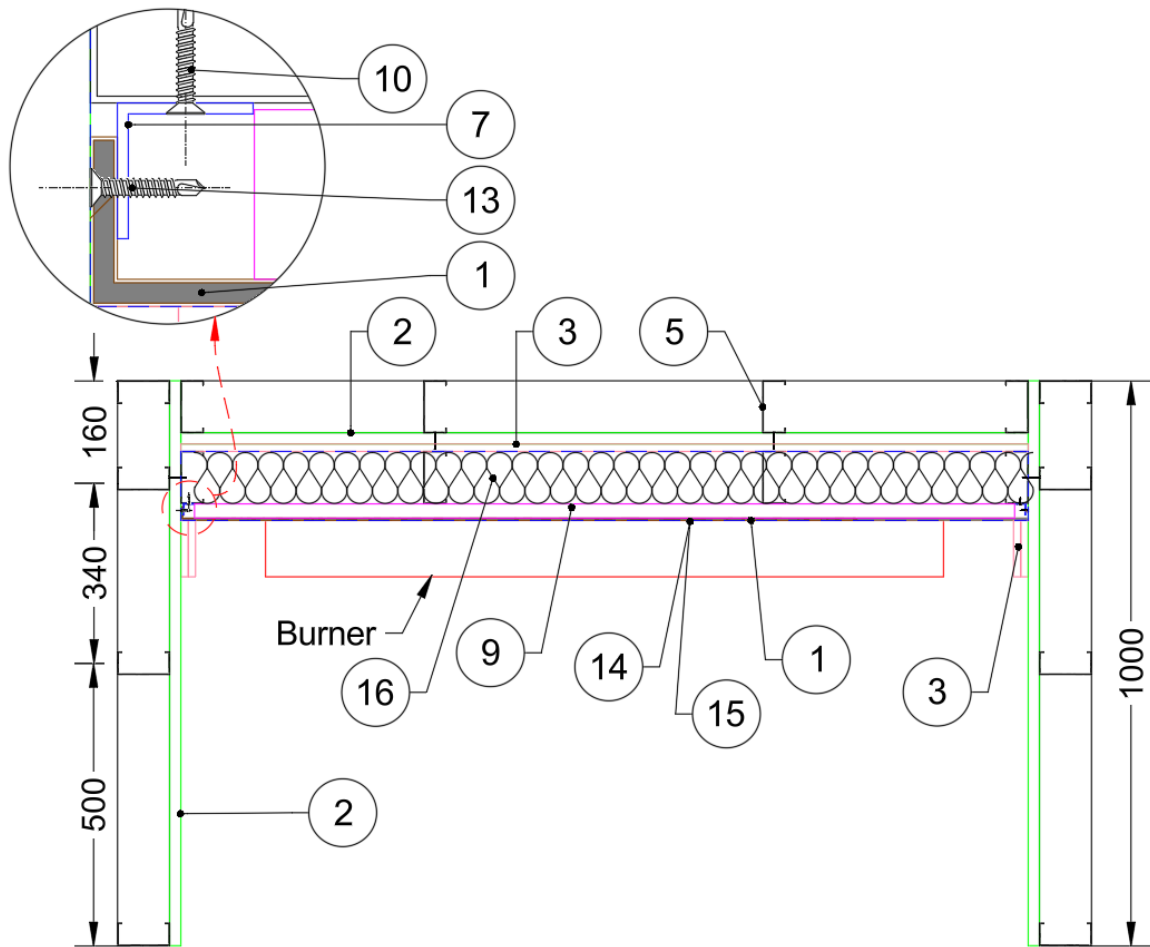
**Figure 9 Elevation of rig support**



**Figure 10 System assembly – Exposed side elevation**

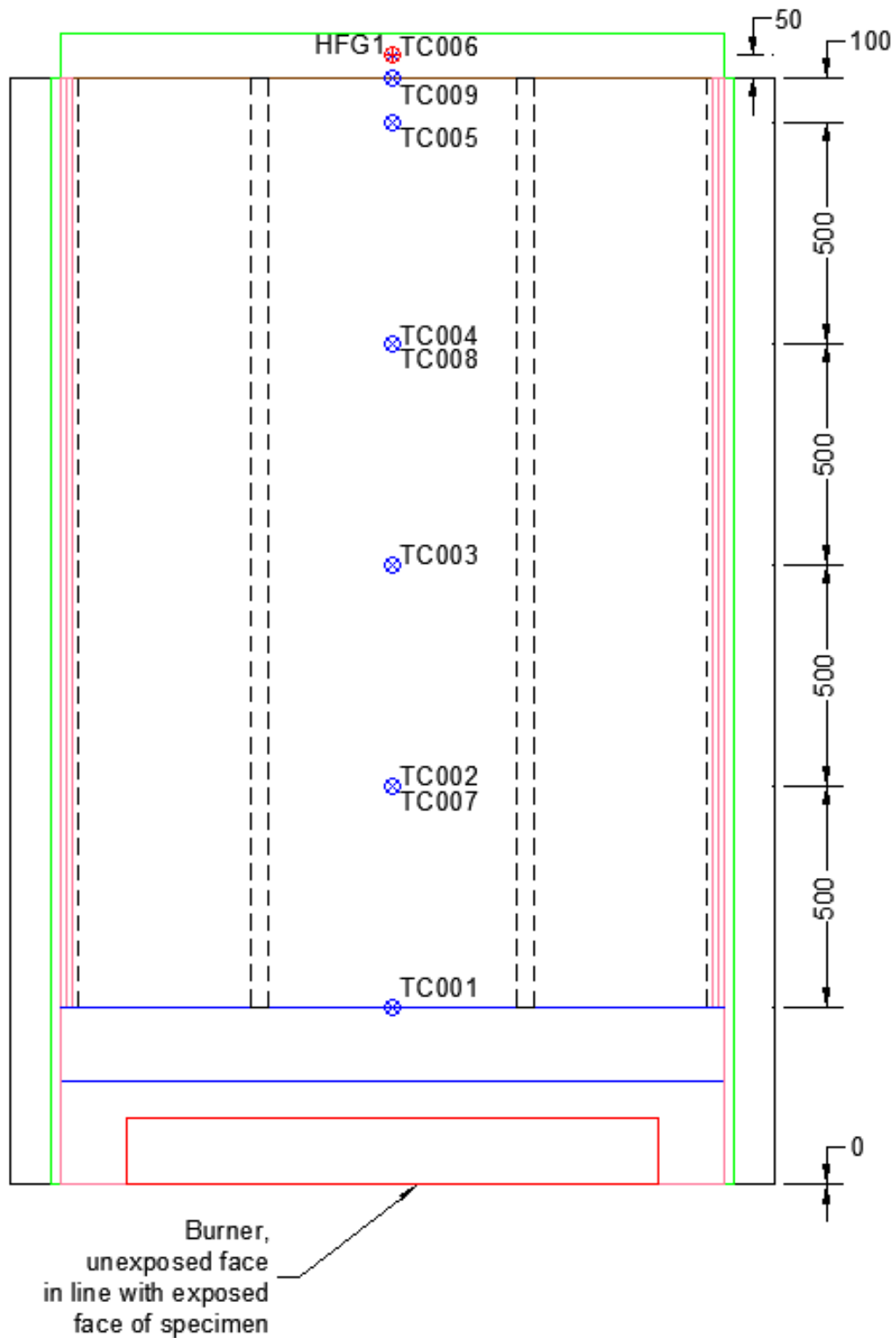


**Figure 11 System assembly – vertical cross-sectional view**

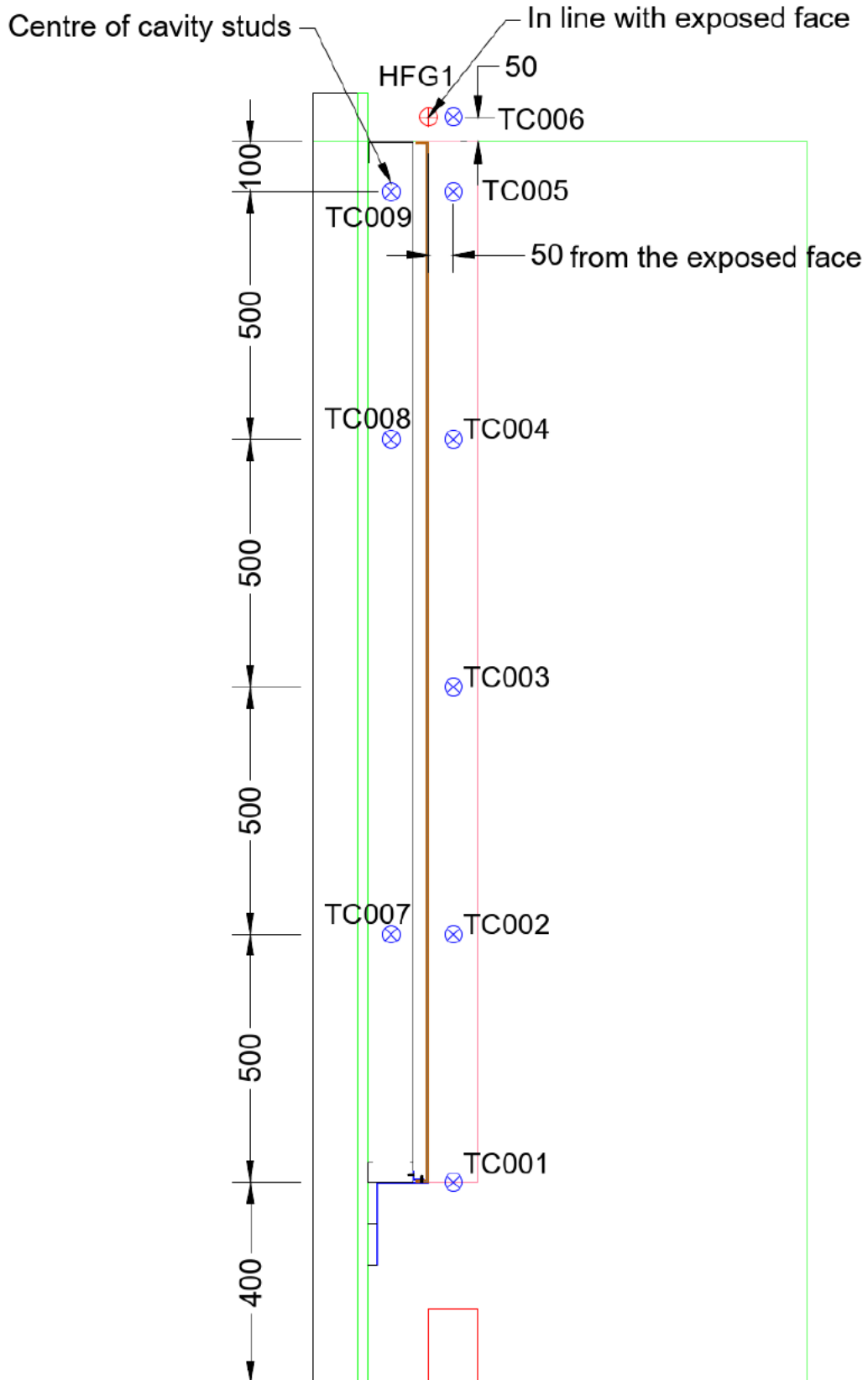


**Figure 12 System assembly – horizontal mid height cross-sectional view**

## Appendix C Instrumentation locations



**Figure 13 Instrumentation locations – Exposed side view**



**Figure 14 Instrumentation locations – Vertical cross-sectional view**

## Appendix D Photographs



**Figure 16** The specimen before the reaction to fire test – exposed side



**Figure 17** The specimen (unexposed side) before the reaction to fire test



**Figure 18** The specimen 2 minutes 45 seconds into the test (burner output at 100 kW)



**Figure 19** The specimen 5 minutes into the test (burner output at 100 kW)



**Figure 20** The specimen 10 minutes into the test (burner output at 100 kW)



**Figure 21** The specimen 14 minutes 55 seconds into the test (burner output at 100 kW)



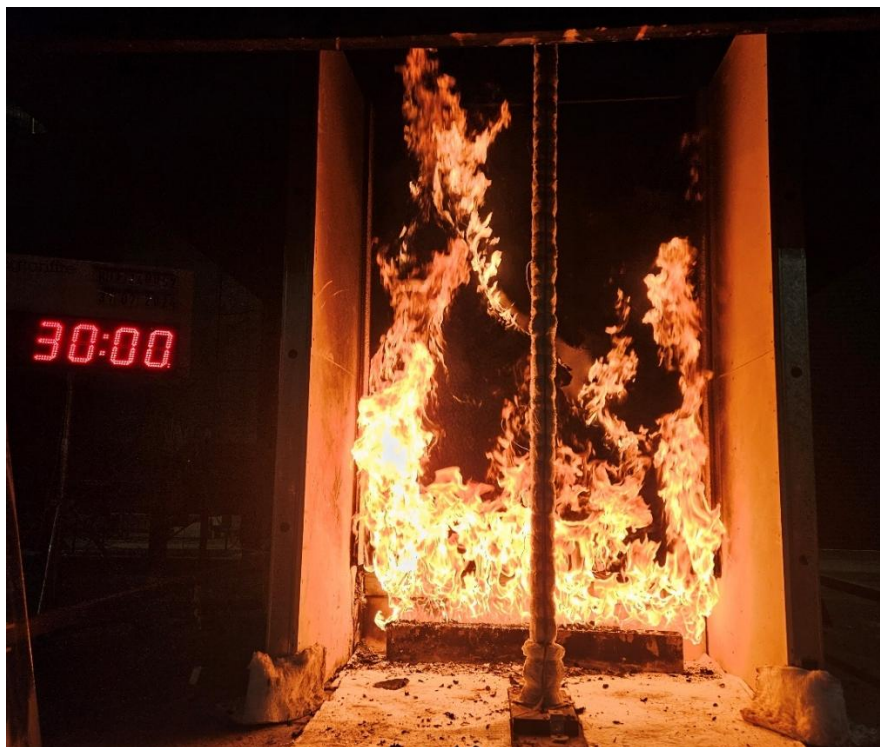
**Figure 22** The specimen 15 minutes 10 seconds into the test (burner output at 300 kW)



**Figure 23** The specimen 18 minutes 50 seconds into the test (burner output at 300 kW)



**Figure 24** The specimen 25 minutes into the test (burner output at 300 kW)



**Figure 25** The specimen 30 minutes into the test (burner output at 300 kW)



**Figure 26** The specimen 39 minutes 53 seconds into the test (burner output at 300 kW)



**Figure 27** The specimen 40 minutes 30 seconds into the test (burner off)



**Figure 28** The specimen at end of test – exposed side



**Figure 29** The specimen at end of test – unexposed side

## Appendix E Chemical analysis results



UNSW RESEARCH INFRASTRUCTURE

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ABN 57 195 873 179 | CRICOS Provider Code 00098G

## 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: [REDACTED]  
Approved by: [REDACTED]

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## 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 <sub>2</sub> O	0.45
MgO	79.26
Al <sub>2</sub> O <sub>3</sub>	0.39
SiO <sub>2</sub>	4.87
P <sub>2</sub> O <sub>5</sub>	0.12
SO <sub>3</sub>	0.26
K <sub>2</sub> O	0.04
CaO	8.66
TiO <sub>2</sub>	2.24
V <sub>2</sub> O <sub>5</sub>	0.01
Cr <sub>2</sub> O <sub>3</sub>	<0.01
Mn <sub>3</sub> O <sub>4</sub>	0.04
Fe <sub>2</sub> O <sub>3</sub>	0.55
NiO	<0.01
CuO	<0.01
ZnO	0.01
SrO	<0.01
ZrO <sub>2</sub>	<0.01
BaO	0.09
HfO <sub>2</sub>	<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.*

  
Technical Officer

Chemical Consulting Laboratory

Mark Wainwright Analytical Centre, UNSW

17 October 2023



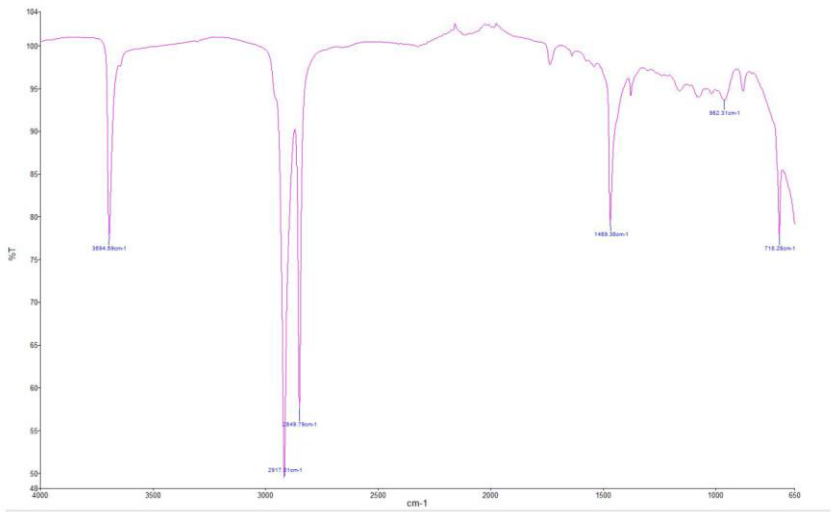


Figure 1. FT-IR spectrum of Sample #1

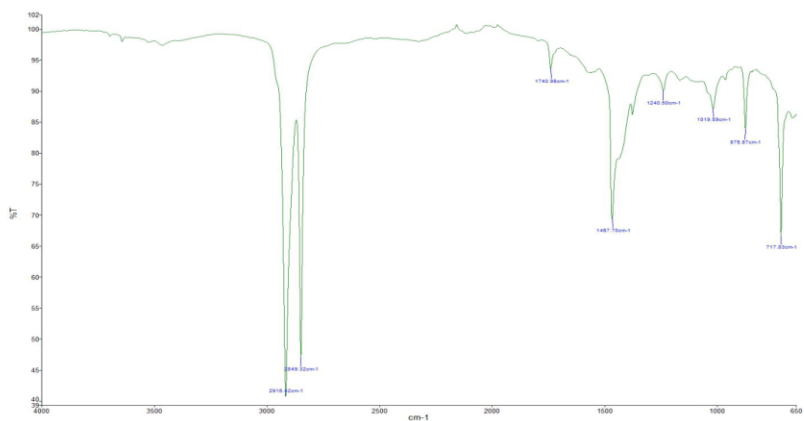


Figure 2. FT-IR spectrum of sample #2





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