WARRINGTONFIRE
AUSTRALIA
A Jensen Hughes Company

# Reaction to fire test report

Test standard: Ad-hoc test based off ISO 13785-1:2002 with an additional wind component

Test sponsor: Cladding Safety Victoria (CSV)

System: Aluminium composite panel (ACP) and glazing external wall cladding system

Job number: RTF230143

Test date: 26 February 2024 Revision: R1.0

# 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 | | | |

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# 1. Introduction

This report documents the findings of an ad-hoc reaction to fire test for an Aluminium composite panel (ACP) and glazing external wall cladding system performed on 26 February 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<br>Docklands, VIC 3808<br>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) panel | |
| | Product | Aluminium Composite Panel - 4 mm White Gloss/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 close to 100 % polyethylene (PE).<br>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 after the ash test was found to be 3.3 % inert material.<br>Refer to Appendix C for more detailed results. | |
| | Colour | Skins | Front skin – Gloss white<br>Back skin – Light grey |
| | | Core | Black |
| | Size | Total panel thickness – 4.0 mm<br>Skin thickness – 0.5 mm (both)<br>Uncut: 4.0 m × 1.22 m<br>Refer to Appendix A for individual panel sizing details. | |
| | Batch | [redacted] | |
| | Areal density | 5.6 kg/m² (measured) | |
| 2. | Item name | Back-pan | |

| Item | Description | |
|---|---|---|
| | Product | Nominally 0.9 mm thick Galvabond sheet, measured 0.6 mm |
| | Supplier | [redacted] |
| | Material | Galvanised steel |
| | Batch | [redacted] |
| | Size | Measured: 1160 mm wide × 3700 mm tall, 0.6 mm thick – in segments. |
| **Glazing** | | |
| 3. | Item name | Double glazing |
| | Material | 6 mm Clear Heat Strengthened\12B (Argon filled cavity) \6.5 HU |
| | Size (nominal) | 1188 mm wide × 1800 mm tall × 5 mm/6 mm/6.76 mm with a 12 mm black spacer. |
| | Manufacturer/Supplier | [redacted] |
| | Batch | Unknown |
| 4. | Item name | Single glazing |
| | Material | 6 mm toughened glass |
| | Size (nominal) | 1182 mm wide × 1800 mm tall × 6 mm thick |
| | Manufacturer/Supplier | [redacted] |
| | Batch | Unknown |
| **Framing** | | |
| 5. | Item name | Test rig frame - 90 × 90 SHS and 200 × 90 PFC frame |
| | Size | 90 mm × 90 mm × 5 mm thick and 200 mm × 90 mm × 10 mm thick – refer to Figure 14. |
| 6. | Item name | Aluminium curtain wall transom/mullions (rectangular hollow sections) – framing |
| | Size | 65 mm to 70 mm wide × 116 mm deep × 3 mm thick. |
| | Manufacturer/Supplier | [redacted] |
| 7. | Item name | Aluminium angles - framing |
| | Size | 25 mm wide × 50 mm deep × 3 mm thick |
| | Manufacturer/Supplier | [redacted] |
| 8. | Item name | Aluminium angles – for middle double back-pan unit. |
| | Size | 25 mm wide × 50 mm deep × 3 mm thick |
| | Manufacturer/Supplier | [redacted] |
| | Installation | Used to secure the secondary back-pan in the within the middle module. The angle was screw fixed to both the back-pan (item 2) and the aluminium framing (item 6) using screws (item 18). |
| 9. | Item name | Aluminium stiffener - framing |
| | Size | 3 mm thick × 150 mm deep |
| | Manufacturer/Supplier | [redacted] |
| 10. | Item name | Curtain wall bracket |
| | Size | 150 mm deep (7 mm thick) × 75 tall (10 mm thick) × 100 mm wide |
| | Installation | Used to secure the 3 modules to the test rig using tek screws. |
| **Smoke seal** | | |
| 11. | Item name | Smoke seal |

| Item | Description | |
|---|---|---|
| | Size | 0.55 mm thick galvanised steel |
| | Manufacturer/Supplier | [redacted] |
| **Penetration** | | |
| 12. | Item name | Exhaust |
| | Size | Backing plates: 355 mm × 355 mm × 0.6 mm thick<br>Large tube: Ø155 mm × 330 mm long × 0.5 mm thick<br>Small tube: Ø100 mm × 300 mm long × 0.6 mm thick |
| | Material | Galvanised steel |
| | Manufacturer/Supplier | [redacted] |
| | Pictures |  Exposed side  Unexposed side |
| | Installation | These penetrating elements were a galvanised steel tube with a smaller galvanised steel tube inside. On the glazing side was a circular cap connected to the large tube via 15-off strips. Between the glazing and the inner back-pan was a square compartment made from galvanised steel which hid the tubing. |
| **Insulation** | | |
| 13. | Item name | 90 mm thick polyethylene terephthalate (PET) insulation |
| | Density | 10 kg/m³ |
| | Manufacturer/Supplier | [redacted] |
| 14. | Item name | 50 mm thick aluminium - with fibre-glass mesh - foil faced rockwool insulation |
| | Density of core | 40 kg/m$^3$ |
| | Manufacturer/Supplier | [redacted] |
| **Sealant/Adhesive** | | |
| 15. | Item name | Weathering sealant - silicone sealant |
| | Product name | [redacted] |
| | Manufacturer/Supplier | [redacted] |
| | Usage | Placed at ACP edges and screw and rivet locations. |
| 16. | Item name | Back-pan sealant - Fire-rated mastic |
| | Product name | [redacted] |
| | Manufacturer/Supplier | [redacted] |
| | Usage | Used between the back-pans (item 2) and the aluminium framing (item 7). |
| 17. | Item name | Penetration sealant |
| | Product name | [redacted] |
| | Manufacturer/Supplier | [redacted] |

| Item | Description | |
|---|---|---|
| | Usage | Used between the back-pans (item 2) and the aluminium framing (item 7). |
| **Fixings** | | |
| 18. | Item name | Tek screws SDS – zinc coated steel – for fixing the back-pan |
| | Size | 10g × 24 mm long |
| | Installation | Used to fix aluminium angles (item 8) to the aluminium frame (item 6) at max. 500 mm centres |
| 19. | Item name | Wafer head screws – zinc coated steel |
| | Size | 10g × 16 mm long |
| | Installation | Used to fix aluminium angles (item 8) to the aluminium frame (item 6) at max. 500 mm centres |
| 20. | Item name | Wafer head screws – zinc coated steel |
| | Size | 10g × 20 mm long |
| | Installation | Used to fix the penetration backing plate (item 12) to the back-pan (item 2) of the central module. |
| 21. | Item name | Wafer head screws – zinc coated steel |
| | Size | 10g × 21 mm long |
| | Installation | Used to fix ACP (item 1) to the aluminium stiffener (item 9) – four per corner. |
| 22. | Item name | Aluminium rivets |
| | Size | Ø4 mm |
| 23. | Item name | Fast-fix washers and pin weld (to hold insulation) |
| | Size | 115 mm × 3 mm pins and 25 mm × 25 mm fast fix washers. |
| 24. | Item name | Tek screws for curtain wall bracket |
| | Size | 14 g × 35 mm long |
| 25. | Item name | Tek screws for smoke seal to false slab i.e., C-Purlin |
| | Size | 14 g × 35 mm long |
| 26. | Item name | Flathead for ACP panel to panel join |
| | Size | 10 g × 17 mm long |

**Installation method**

| | |
|---|---|
| Test rig: | The test rig frame (item 5) 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, 3-off modules – interconnected through aluminium framing (item 6), was fixed to the test rig using curtain wall brackets (item 10) and fixings (item 24) – see Figure 16 & Figure 17. Each module extended from the bottom of the specimen to the top. |
| Framing: | The main framing for the external wall was composed of aluminium extrusions (item 6) which were screw fixed together. Aluminium angles (item 8) – horizontal edges - and stiffeners (item 9) – on the vertical edges - were fixed to the aluminium framing (item 6), using wafer head screws (item 20) and aluminium rivets (item 22), respectively. |

| Item | Description |
|---|---|
| Cladding: | The front face of the specimen was clad with 200 mm deep cassetted ACPs (item 1), which were fixed to the aluminium stiffeners (item 9) and the aluminium angles (item 8) using aluminium rivets (item 22), 2-off at 300 mm centres - Appendix A. See Figure 15 for panel locations. As the dimensions of the largest cassettes did not allow for use of a single piece of ACP, two pieces were joined together. The join consisted of the two pieces bent back in with a 30 mm lip and screw fixed (item 2623) at 300 mm centres.<br>The back side of the framing was closed off with steel back-pans (item 2) screw fixed (item 18) at 300 mm centres. PET insulation (item 13) was fixed to the back-pan using fast-fix washers and pin combinations (item 19) that were welded to the back-pan. The centre module had an extra back-pan behind the glazing (item 4). This was fixed to the aluminium framing (item 6) using screws (item 18) and aluminium angles (item 8). Foil-faced rockwool insulation (item 14) was inserted between the two back-pans (item 2) of the centre module. |
| Glazing | The glazing, both double (item 3) and single (item 4), were attached to the aluminium framing (item 6) as shown in Figure 15 to Figure 21. The glazing was sealed around the perimeter with weather sealant (item 15). |
| Smoke seal | Smoke seal barrier (item 11) was attached to C-purlins of the test rig (item 5) with screw fixings (item 24) at approximate 600 mm centres. PET insulation (item 13) was installed into the 60 mm wide cavity above the barrier (item 12). |
| Penetration | The penetration went through holes in the single glazing (item 4) and back-pans (item 2) of the second module. These were fixed to the back-pan and the window with a steel sheet (backing plate), using screws and sealant and just sealant, respectively. |

# 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 with an added wind component. The test utilises a burner used in ISO 13785-1:2002 with the specimen mimicking the as-is construction of the façade. |
| Variations | None. |
| Sampling / specimen selection | The laboratory was not involved in sampling or selecting the test specimen for the reaction to fire test.<br>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 details on positioning.<br>• The incident heat flux on the top of the specimen in line with the front face of test specimen was measured using a Schmidt-Boelter type heat flux gauge with a range of 0-100 kW/m$^2$.<br>• The incident heat flux 500 mm behind the outer glazings – burner side and non-burner side – was measured using two Schmidt-Boelter type heat flux gauges with a range of 0-20 kW/m$^2$.<br>• The incident heat flux 80 mm behind the central glazing was measured using a Schmidt-Boelter type heat flux gauge with a range of 0-20 kW/m$^2$.<br>• 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 Figure 1 and Figure 2 for details on positioning.<br>• The fire source was a propane (95% purity) gas burner 1.2 m long × 0.1 m deep × 0.15 m tall. The burner was placed on the floor below the specimen with approximately 40 mm overlap with the front of the ACP. A shield for the burner made from FR plasterboard and Hebel block work – having a cavity 1.2 m × 0.12 m, 500 mm above the floor - was used during the baseline data test.<br>• 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 were 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 Figure 3 and Figure 4.<br>• A guide wall – 2.8 m tall × 3.0 m wide was butted up to the specimen and blanking wall and placed at a 45° angle in relation to the specimen.<br>• The horizontal wind speed was measured using a hot wire anemometer. |

| Item | Detail |
|---|---|
| Test procedure | • At least two minutes of baseline data was collected prior to producing air flow across the specimen. Data of for baseline airflow was collected for at least 5 minutes. Temperature and heat flux data was collected at 5 s intervals.<br>• 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.<br>• At the 52 minutes and 40 seconds, the artificial wind source was turned off. |
| Variation between tests – referencing test report RTF230002 R1.0 and this test. | • The burner and source of the wind were located on the opposing side of the specimen.<br>• The main cladding – cassetted ACP - of the wall system was different. The tested ACP had a core 45 % polyethylene with FR with skin with an oak colour and pattern instead of that tested in the previous test.<br>• The capping of the penetration was slightly different. |

# 4. Test measurements and results

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

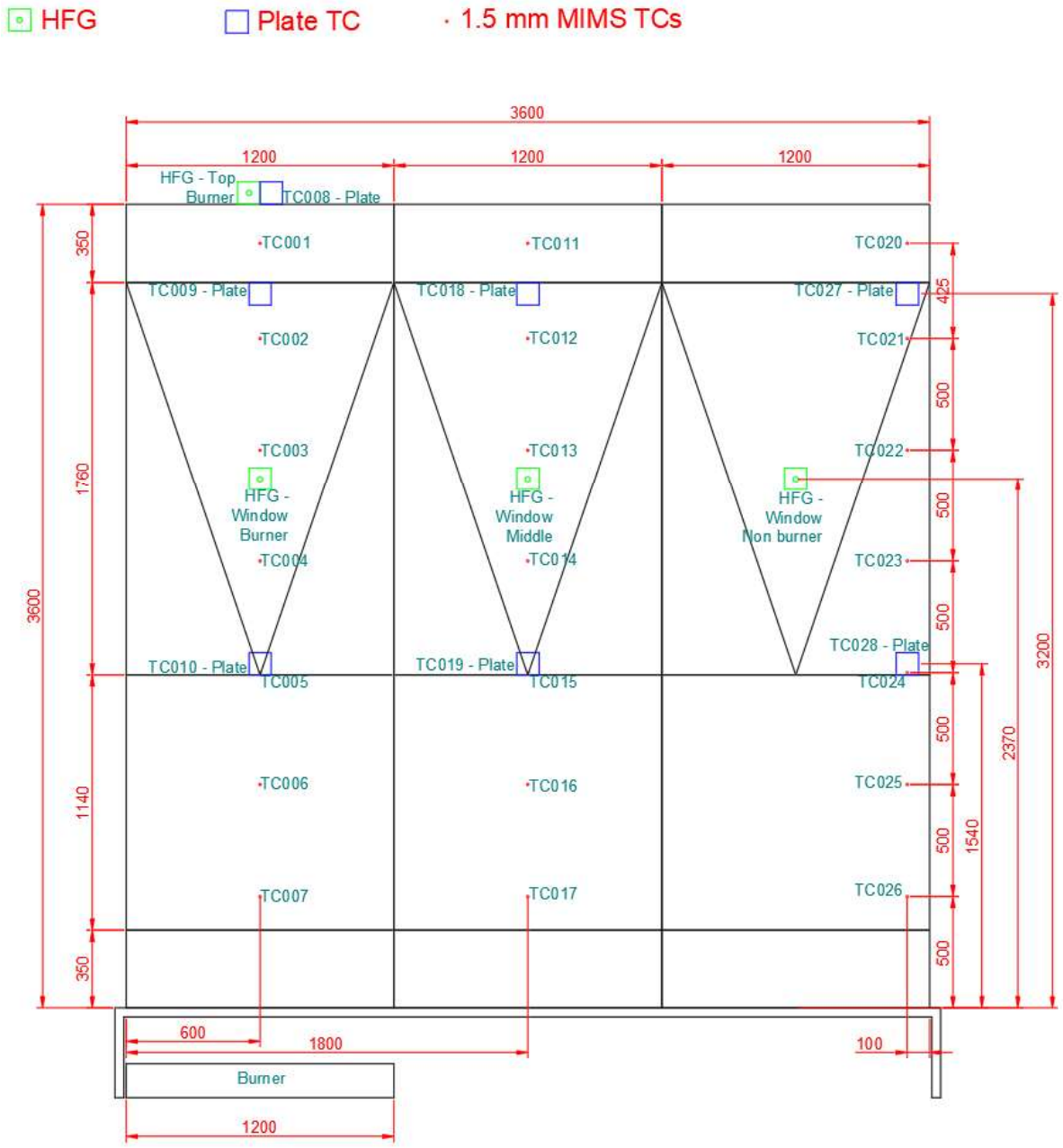


**Figure 1 Instrumentation locations – front elevation**

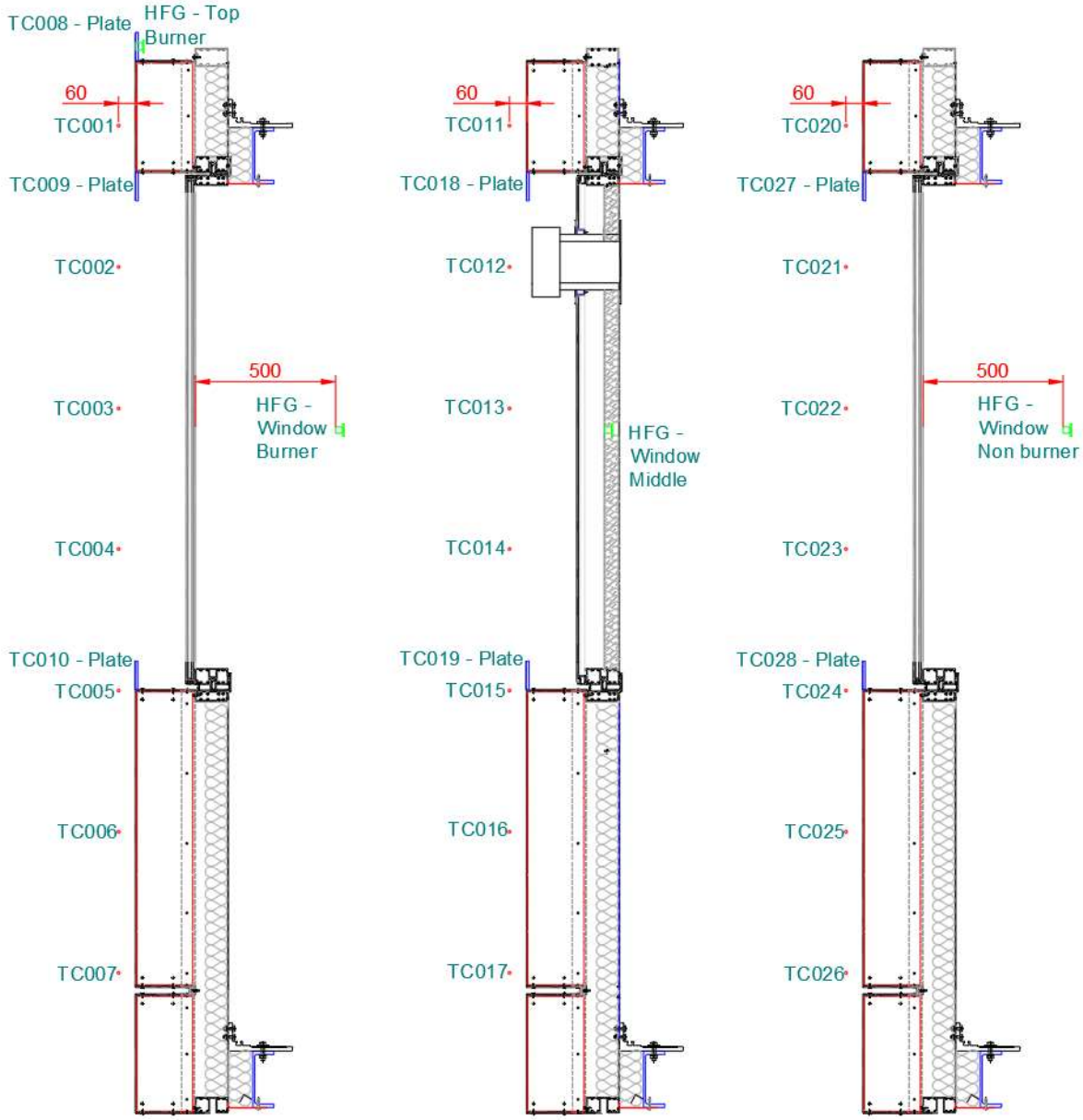


**Figure 2 Instrumentation locations – sections**

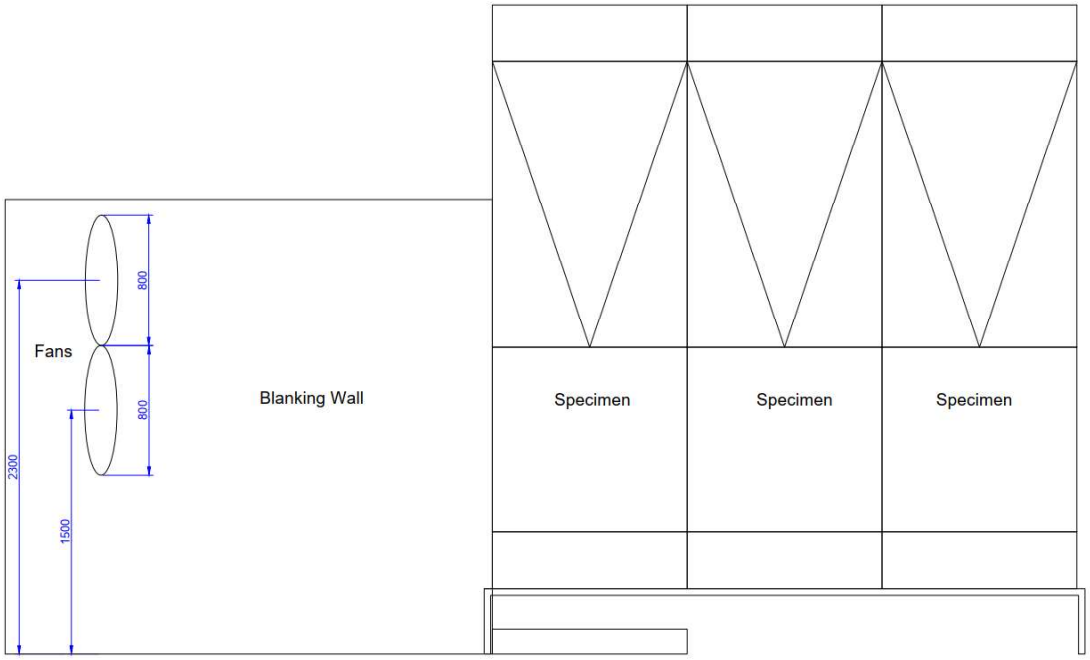


**Figure 3 Instrumentation locations – Elevation**

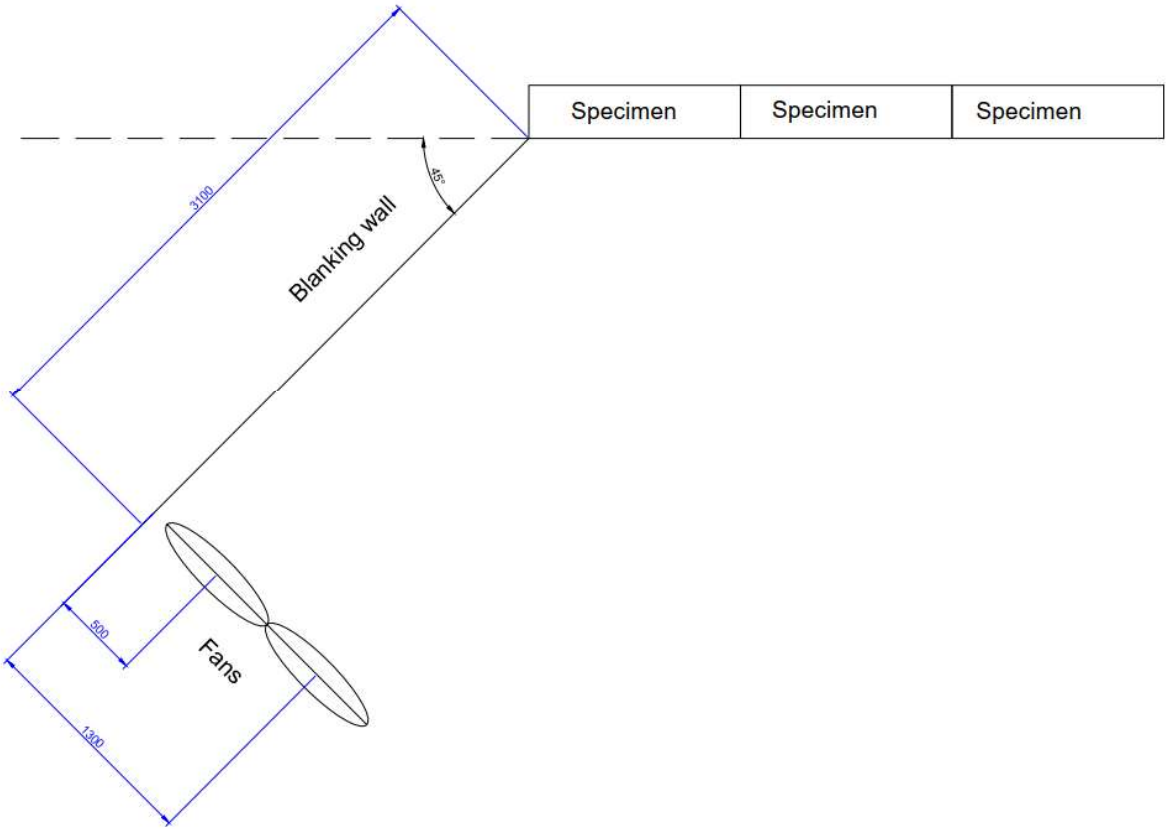


**Figure 4 Instrumentation locations – Plan view**

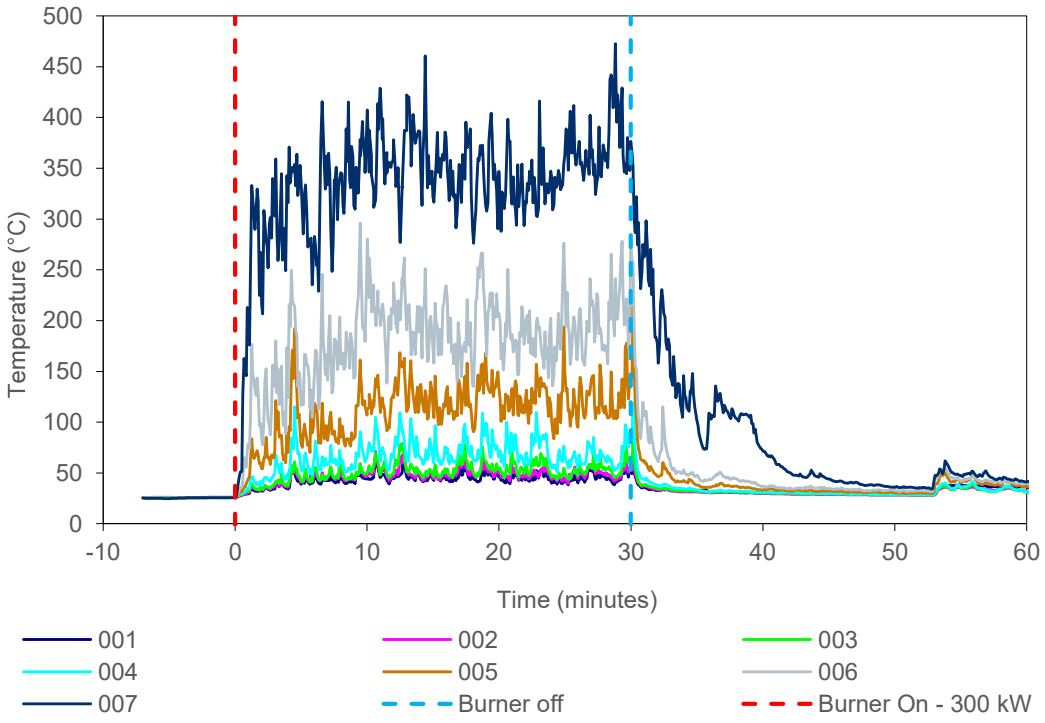


**Figure 5** **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen - in-line with the burner**

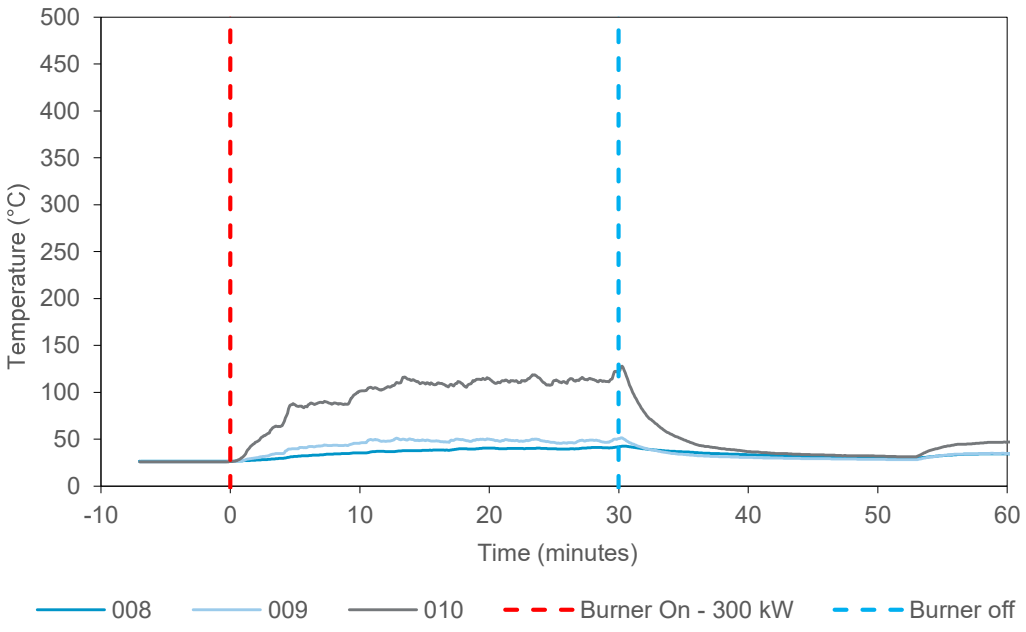


**Figure 6** **External temperature data collected by plate thermocouples in-line with ACP, above and below, respectively - in-line with the burner**

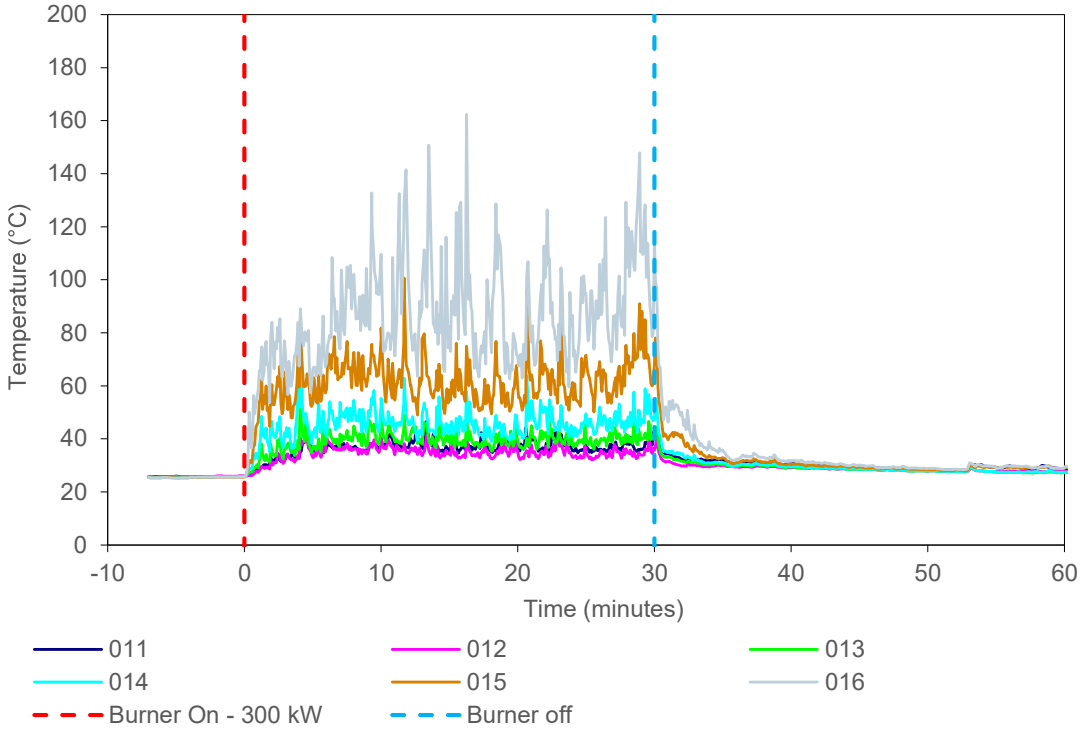


**Figure 7** **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – central module**

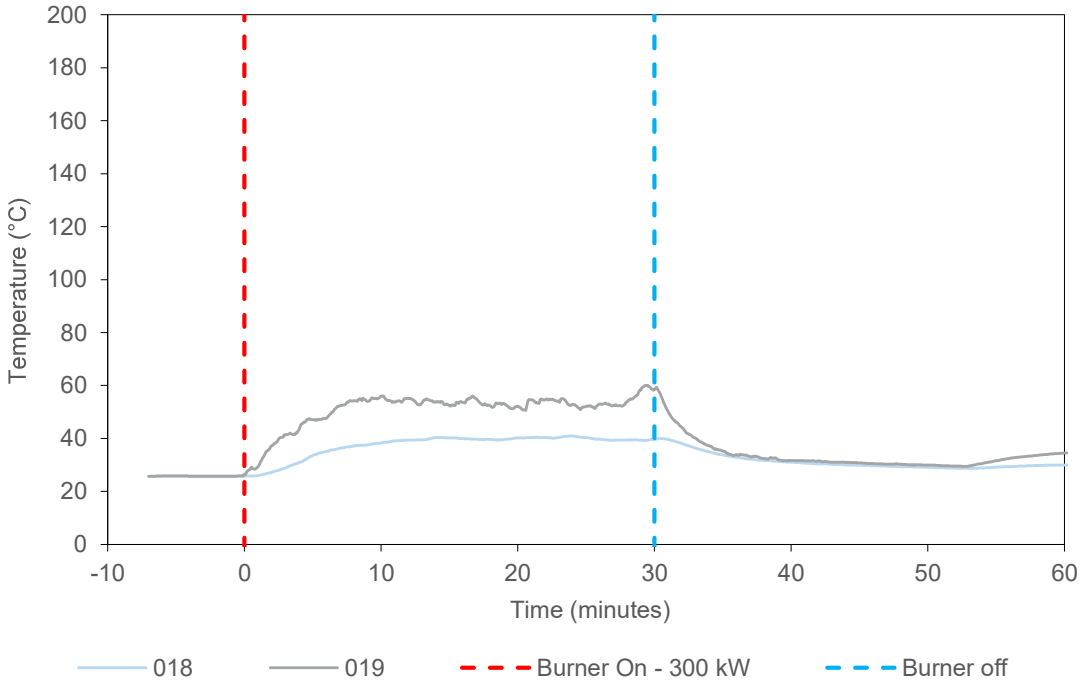


**Figure 8** **External temperature data collected by thermocouples in-line with ACP, above and below, respectively – central module**

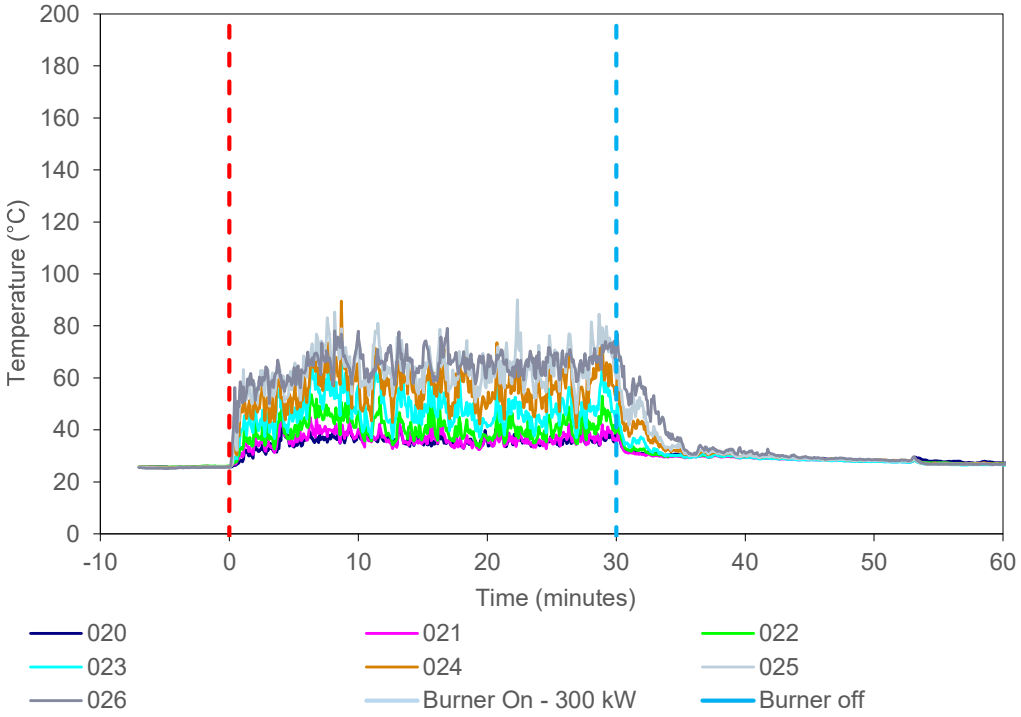


**Figure 9** **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen – away from burner**

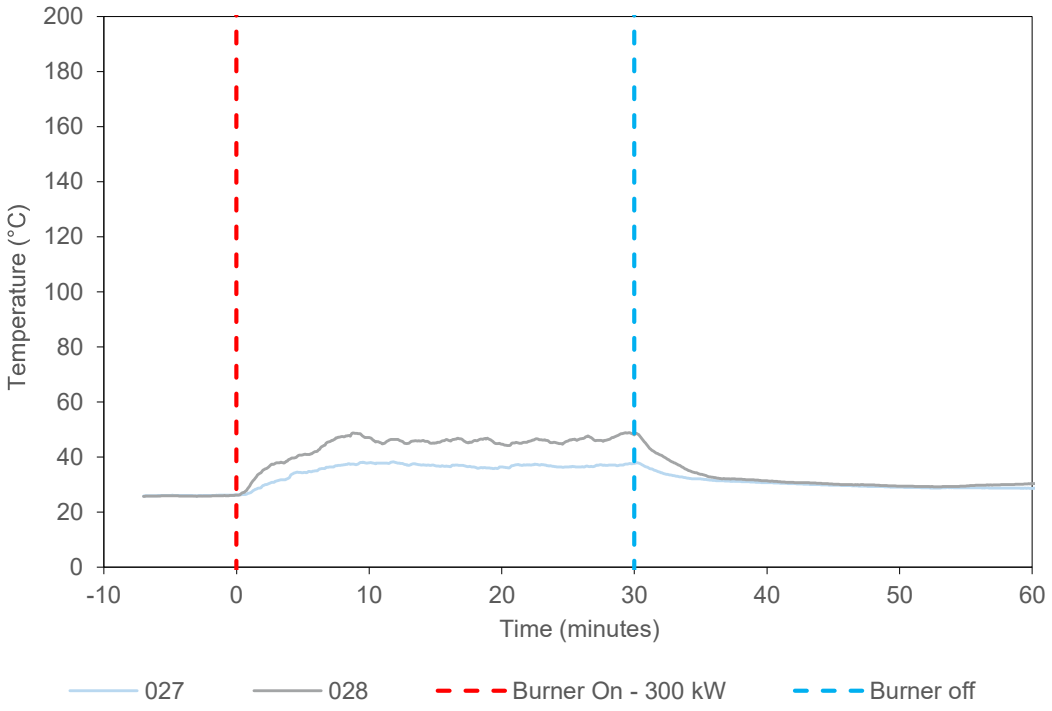


**Figure 10** **External temperature data collected by thermocouples in-line with ACP, above and below, respectively – away from burner**

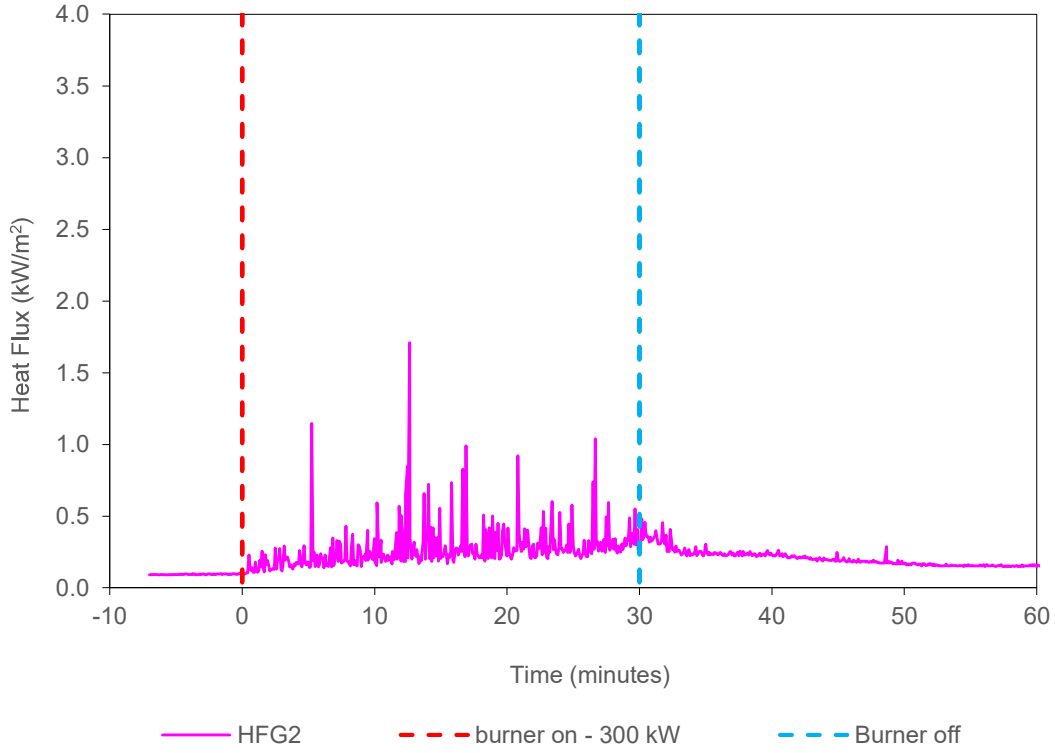


**Figure 11 Heat flux data collected by heat flux gauge at the top of the specimen above the burner**

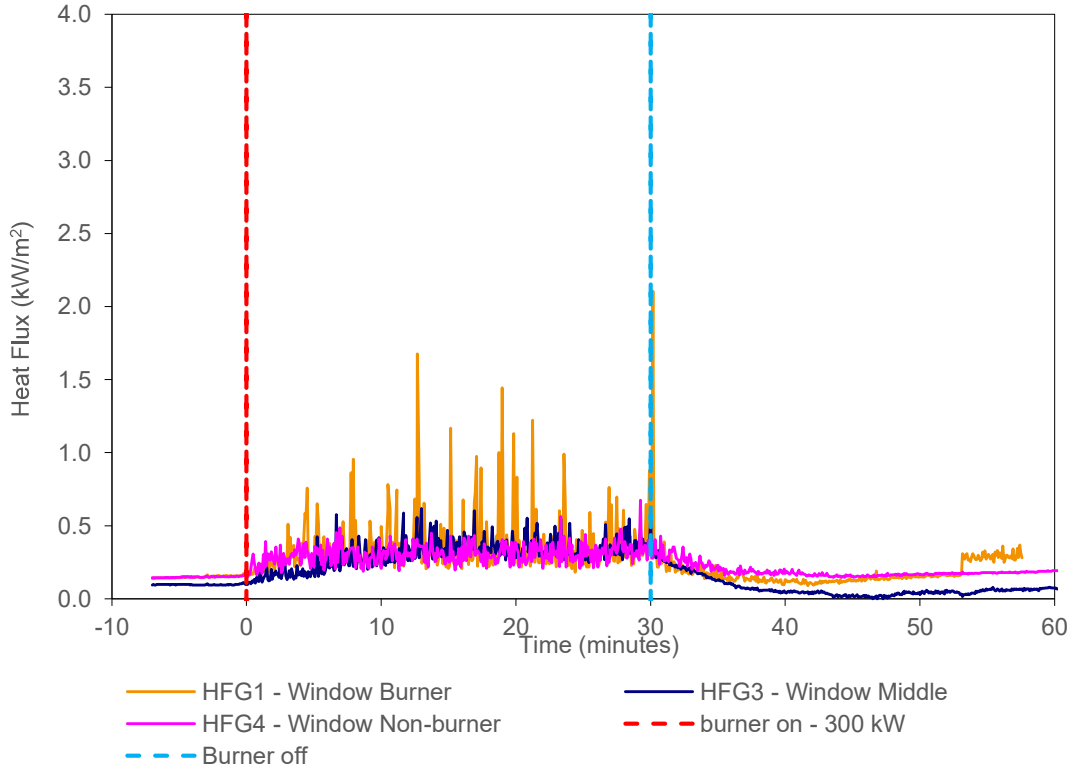


**Figure 12 Emitted heat flux measured by heat flux gauges behind the glazing units**


**Figure 13 Designation of section for the test observations**

Table 4 shows the observations of any significant behaviour of the specimen during the test. Figure 13 shows the panel and glazing designations sighted in the observations.

Video recordings were also taken of the test. A copy of the video recording is available upon request from 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 | | |
| 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. | |
| | | A2 | The wind speed just below TC005 was 1.6 – 2.2 m/s. |
| | | B2 | The wind speed just below TC015 was 2.6 – 3.0 m/s. |
| | | C2 | The wind speed just below TC024 was 1.7 – 2.2 m/s. |
| -7 | 00 | All | Data collection started. |
| -5 | 00 | All | Wind on. |
| 0 | 00 | All | The reaction to fire test was started with the burner ignited with a heat output set at 300 kW. |

| Time | | Des. | Observation |
|---|---|---|---|
| Min | Sec | | |
| 0 | 37 | A1/B1 | The skins were discolouring. |
| 1 | 03 | A1 | The panel face was deforming. |
| 1 | 21 | A2 | The panel face was deforming. |
| 2 | 44 | A1/A2 | There was intermittent flaming at the joint. |
| 3 | 58 | A2 | There was more discolouration of the face. |
| 10 | 16 | A1/A2 | Flaming at joint was consistent. |
| 12 | 28 | A2 | The panel has started to open up. |
| 17 | 24 | B2 | The face has discoloured more. |
| 17 | 44 | A2 | Smoke emitting from behind the glazing. |
| 19 | 55 | A2 | Smoke emitting from behind the glazing has increased. |
| 20 | 00 | A | The smoke seal on the backface started to melt. |
| 27 | 40 | A2 | There are intermittent flames at the horizontal join. |
| 28 | 00 | A | There is flaming on the exposed side of the specimen through the backpan and aluminium framing. |
| 28 | 35 | B1/B2 | There is intermittent flaming across the panels. |
| 29 | 00 | A1/A2 | There are flames on the unexposed side. |
| 30 | 00 | All | The burner was turned off. |
| 31 | 00 | A1 | The bottom of the cassette is still burning. |
| | | A1/A2 | Still flaming at the join. |
| | | B1/B2 | Still flaming at the join. |
| 32 | 00 | C1/C2 | Joint is flaming. |
| 33 | 15 | A2 | Horizontal join smoking. |
| 34 | 50 | A | The smoke seal on the unexposed side is flaming. |
| 35 | 00 | A | A lot of smoke released. |
| 37 | 26 | A2 | The bottom had opened up. |
| 37 | 40 | A1 | The panel had opened up. |
| 38 | 30 | C1/C2 | There is consistent flamed spread in the join. |
| 44 | 00 | A | Flaming on the unexposed side has stopped. |
| 48 | 30 | All | The flames have died down. |
| 52 | 00 | All | The flames have died down a little more. |
| 52 | 40 | All | The fans were turned off at request of the test sponsor. |
| 54 | 58 | A | Flames were almost non-existent. |
| 57 | 30 | A2 | There is flaming at the bottom of the panel. This appears to be the only flaming. |
| 60 | 00 | All | The test was ended. There was still some flaming at the bottom of A2. |

# 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 14 to Figure 22 were provided by the representatives of Warringtonfire. Dimensions, unless specified, are in mm.

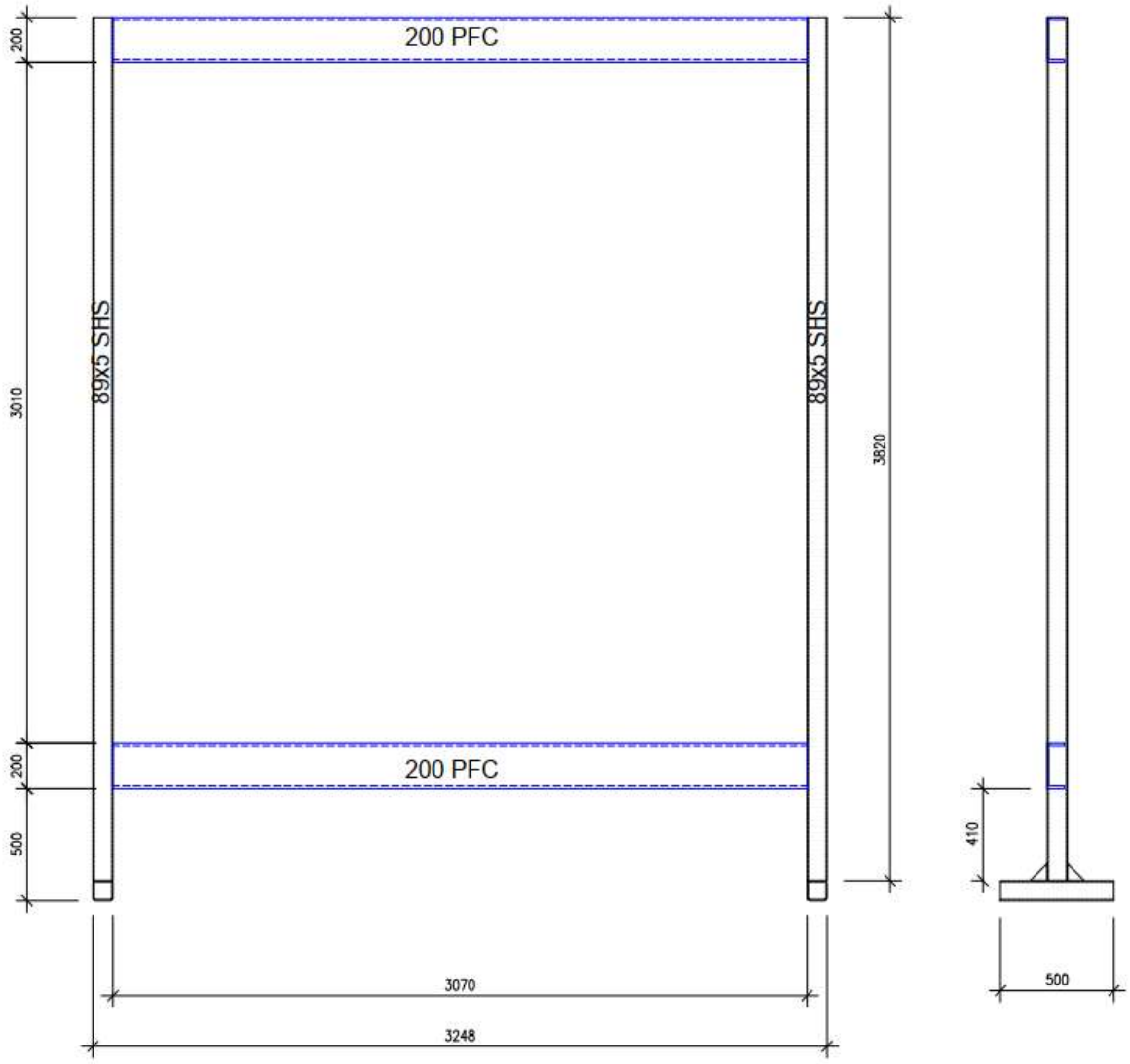


**Figure 14 Elevation of rig support**

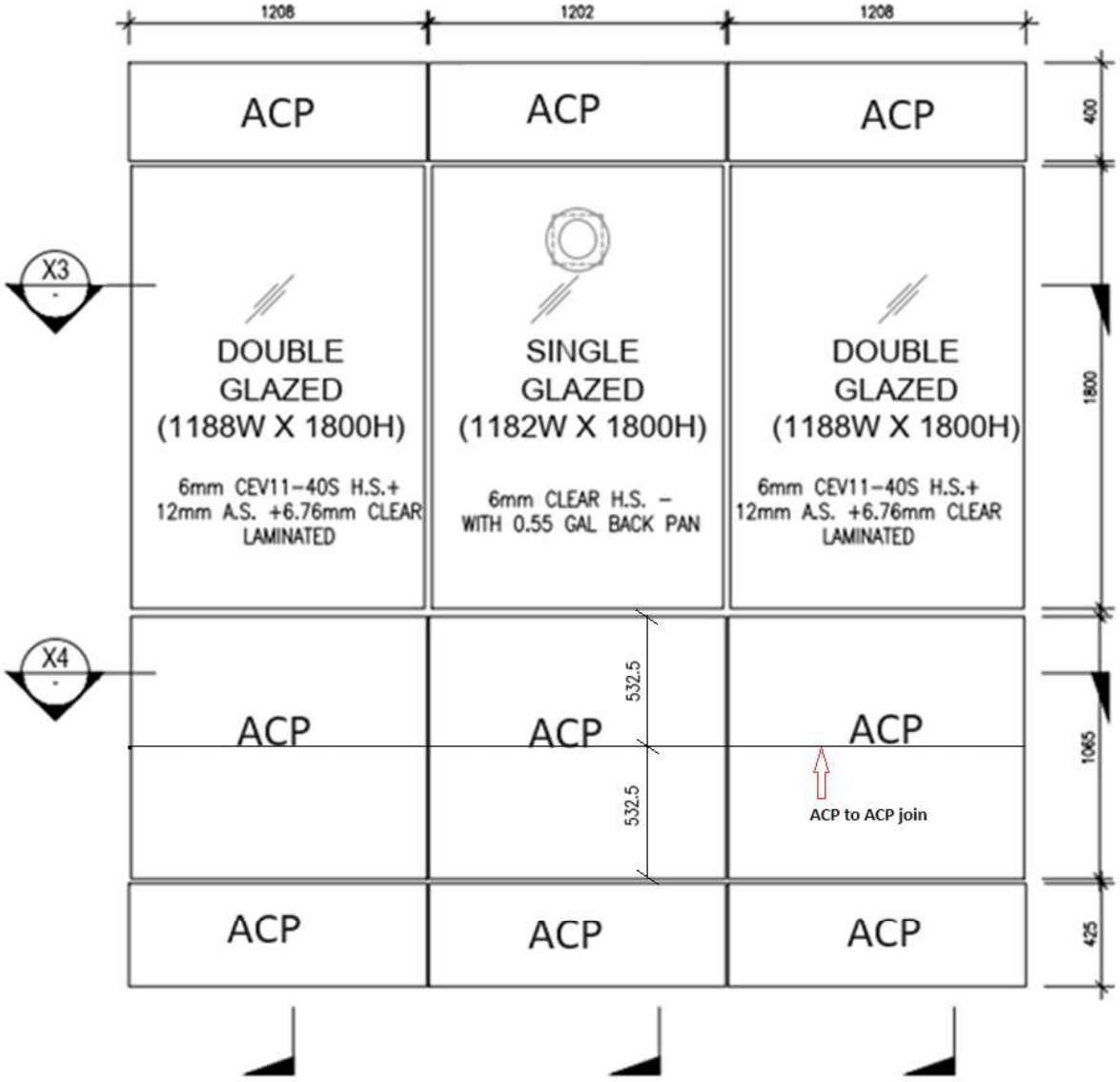


**Figure 15 System assembly – Front view**

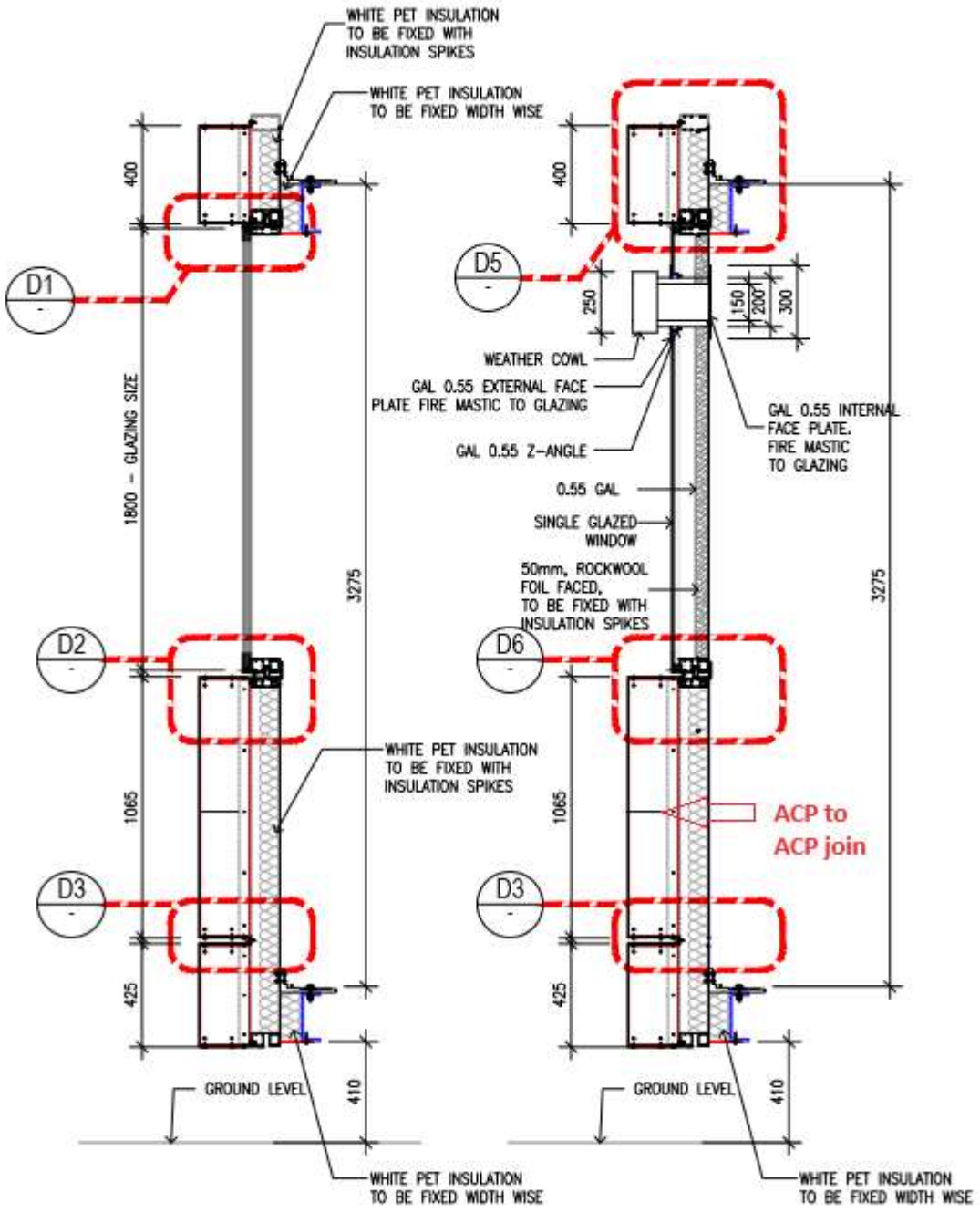


**Figure 16 System assembly – vertical cross-sectional view.**

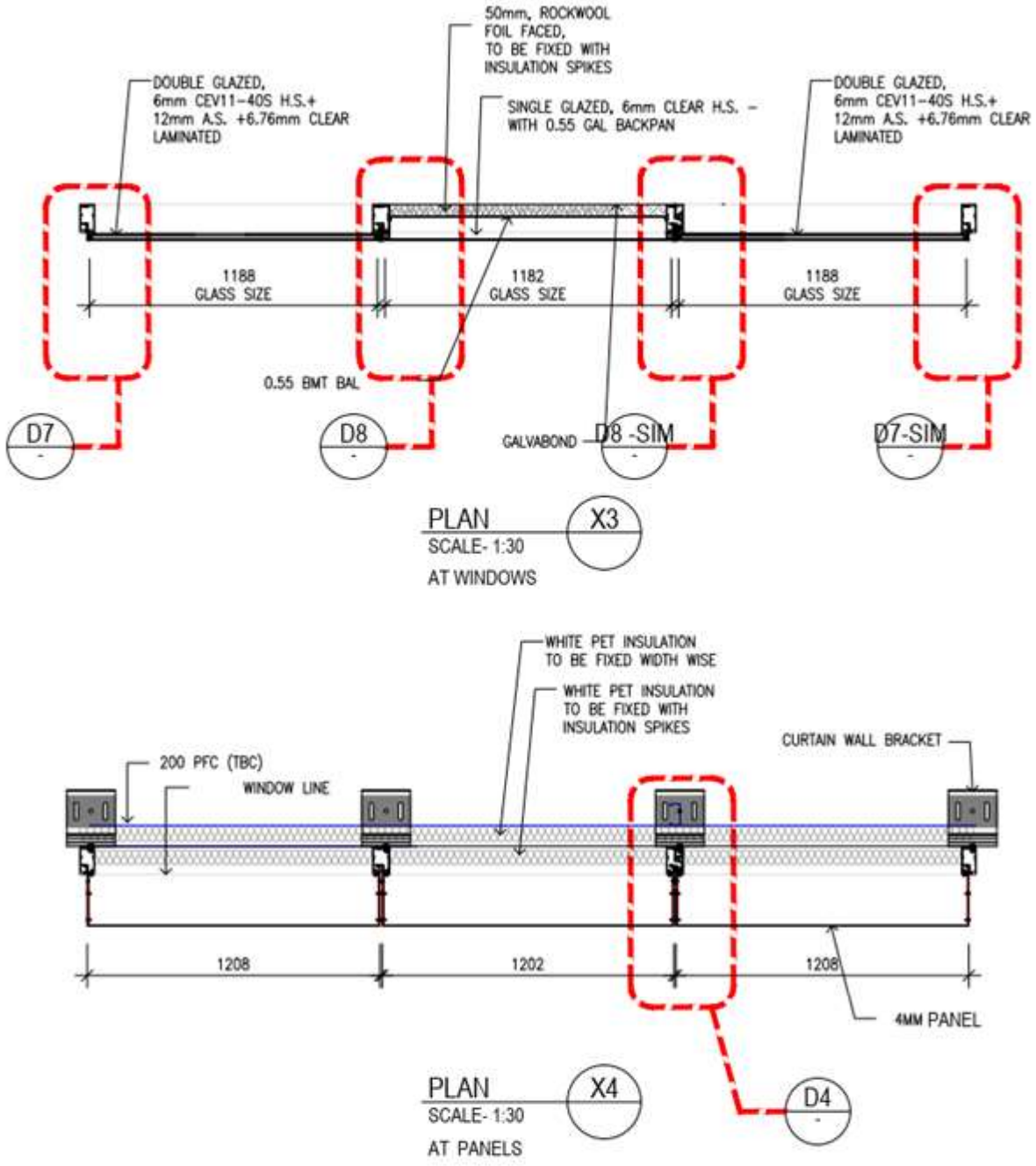


**Figure 17 System assembly – horizontal cross-sectional view.**

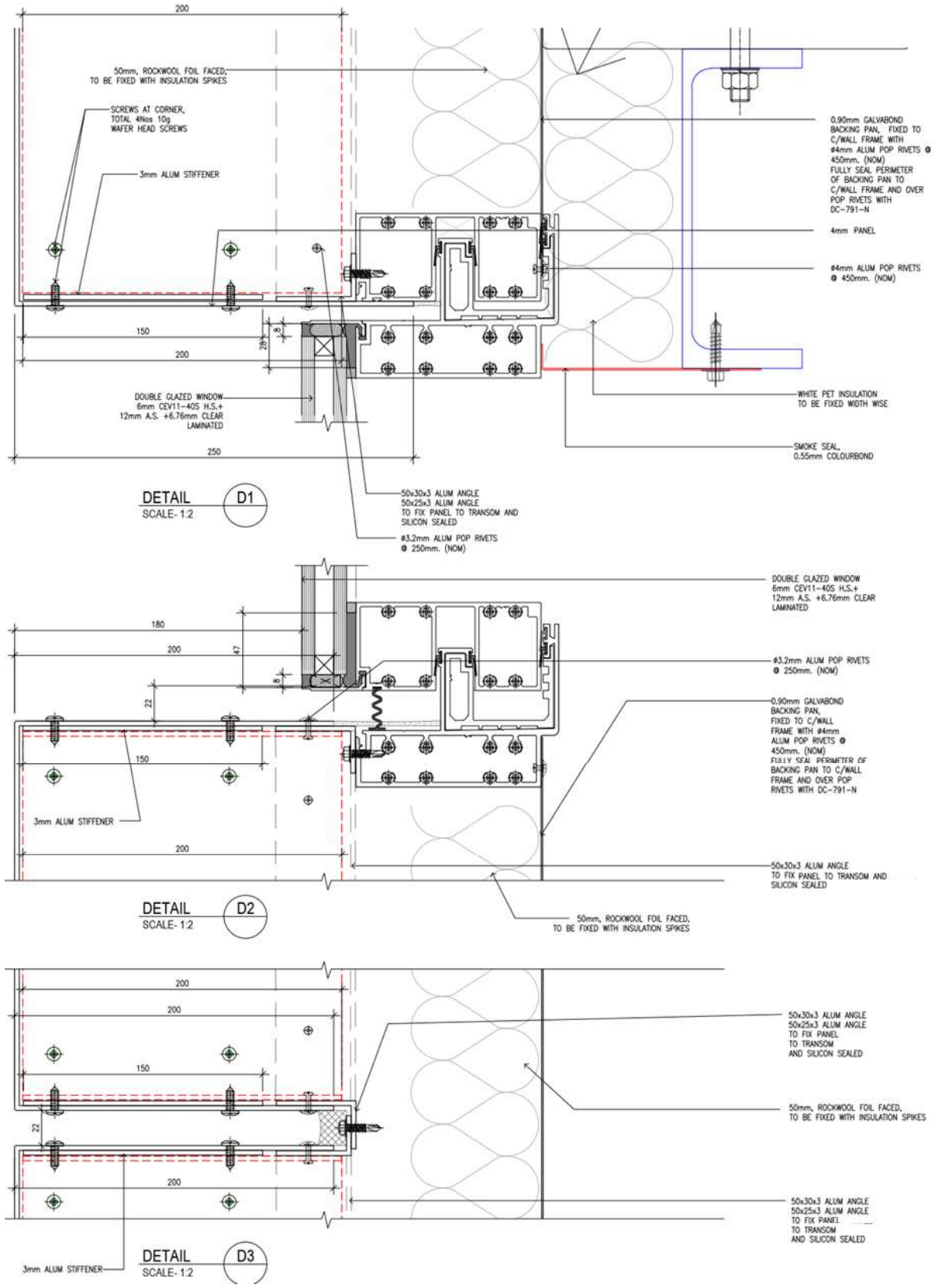


**Figure 18 System assembly – Vertical cross-sectional view.**

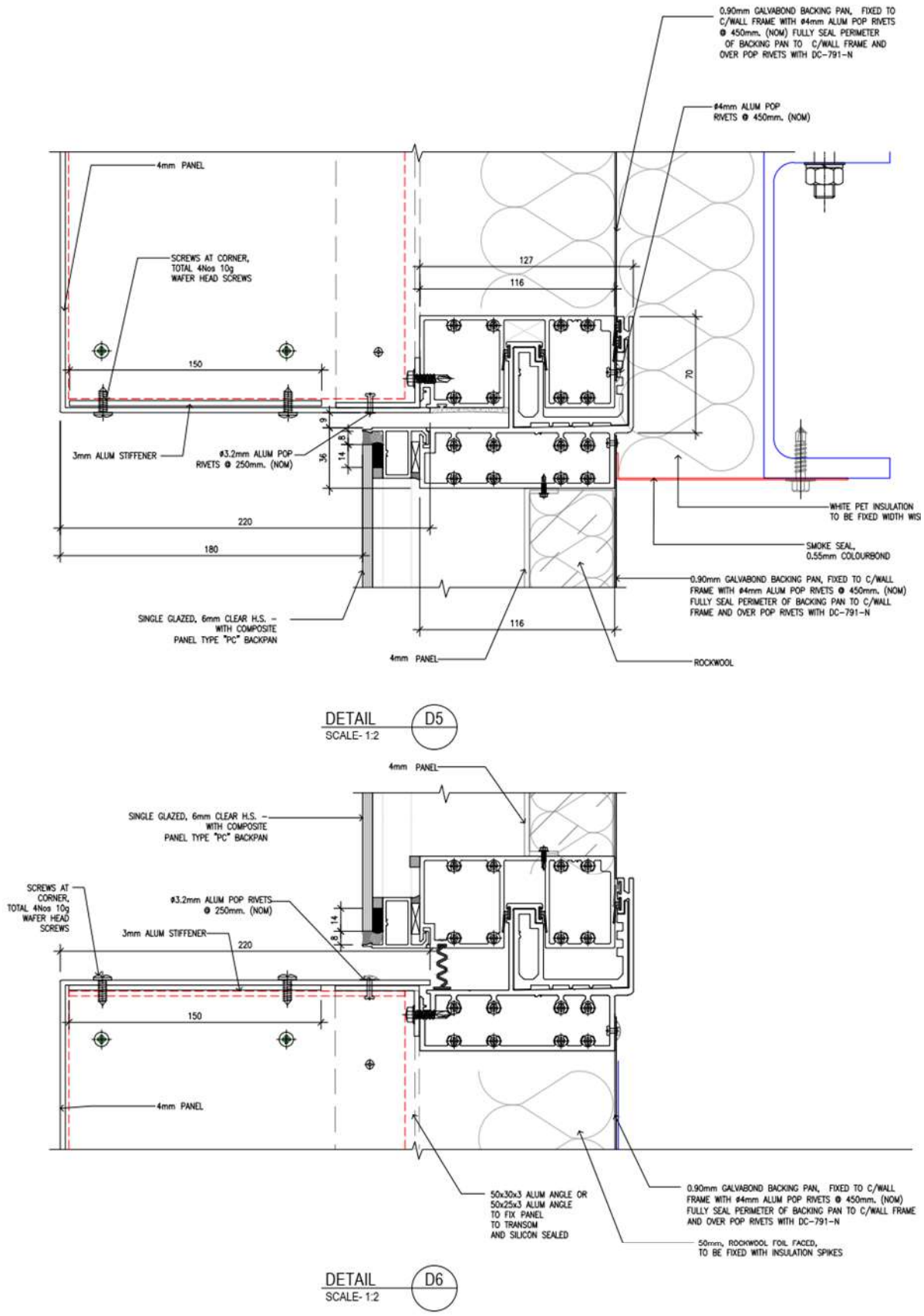


**Figure 19 System assembly – Vertical cross-sectional view.**

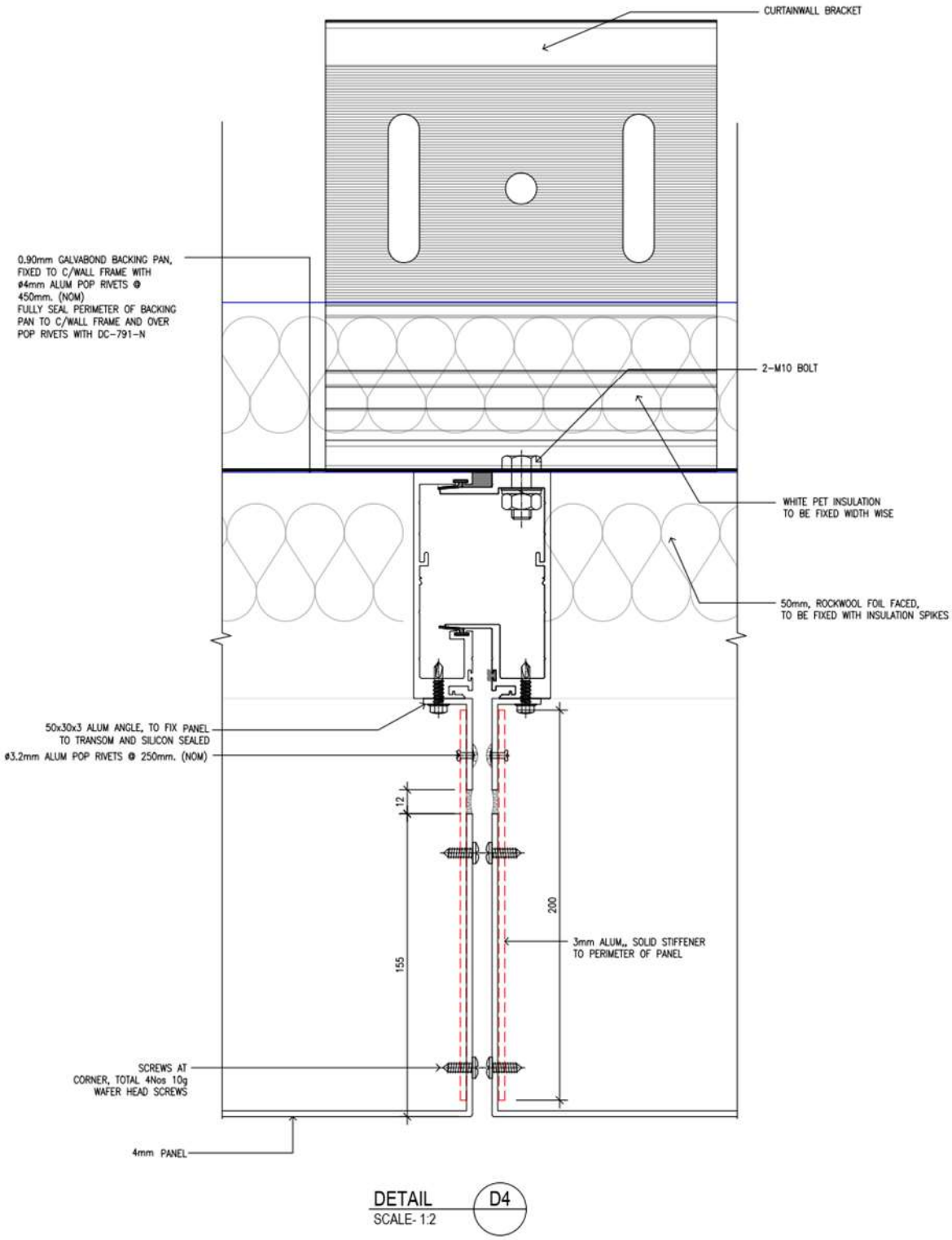


**Figure 20 System assembly – vertical cross-sectional view.**

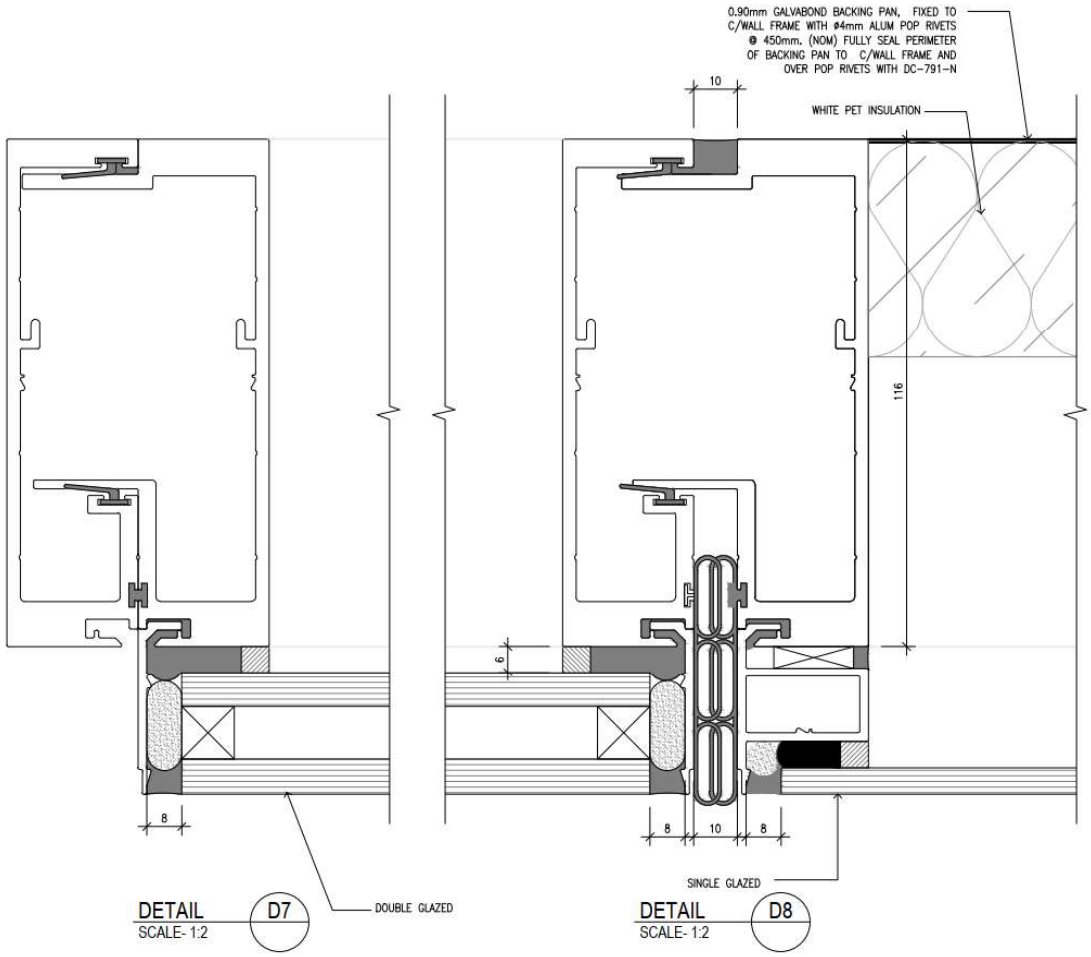


**Figure 21 System assembly – vertical cross-sectional view.**

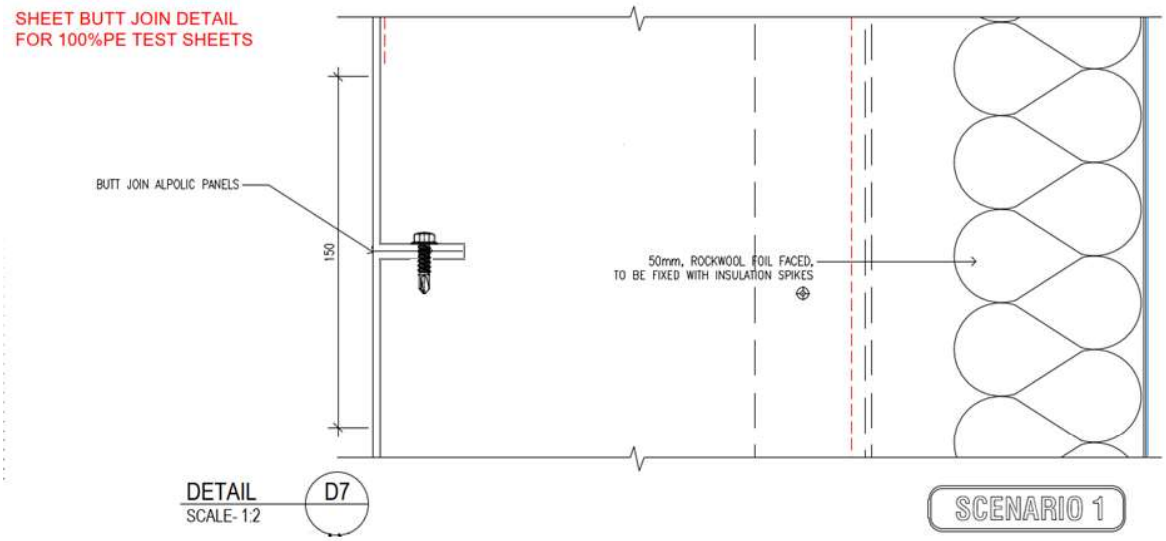


**Figure 22 System assembly – panel to panel join vertical cross-sectional view.**

# Appendix B Photographs

**Figure 23 The specimen and test setup (angled - exposed side) before the reaction to fire test**

**Figure 24 The specimen before the reaction to fire test - exposed side.**

**Figure 25 The specimen before the reaction to fire test - unexposed side.**


**Figure 26 The specimen 1 minute 30 seconds into the test (burner output at 300 kW and wind on)**

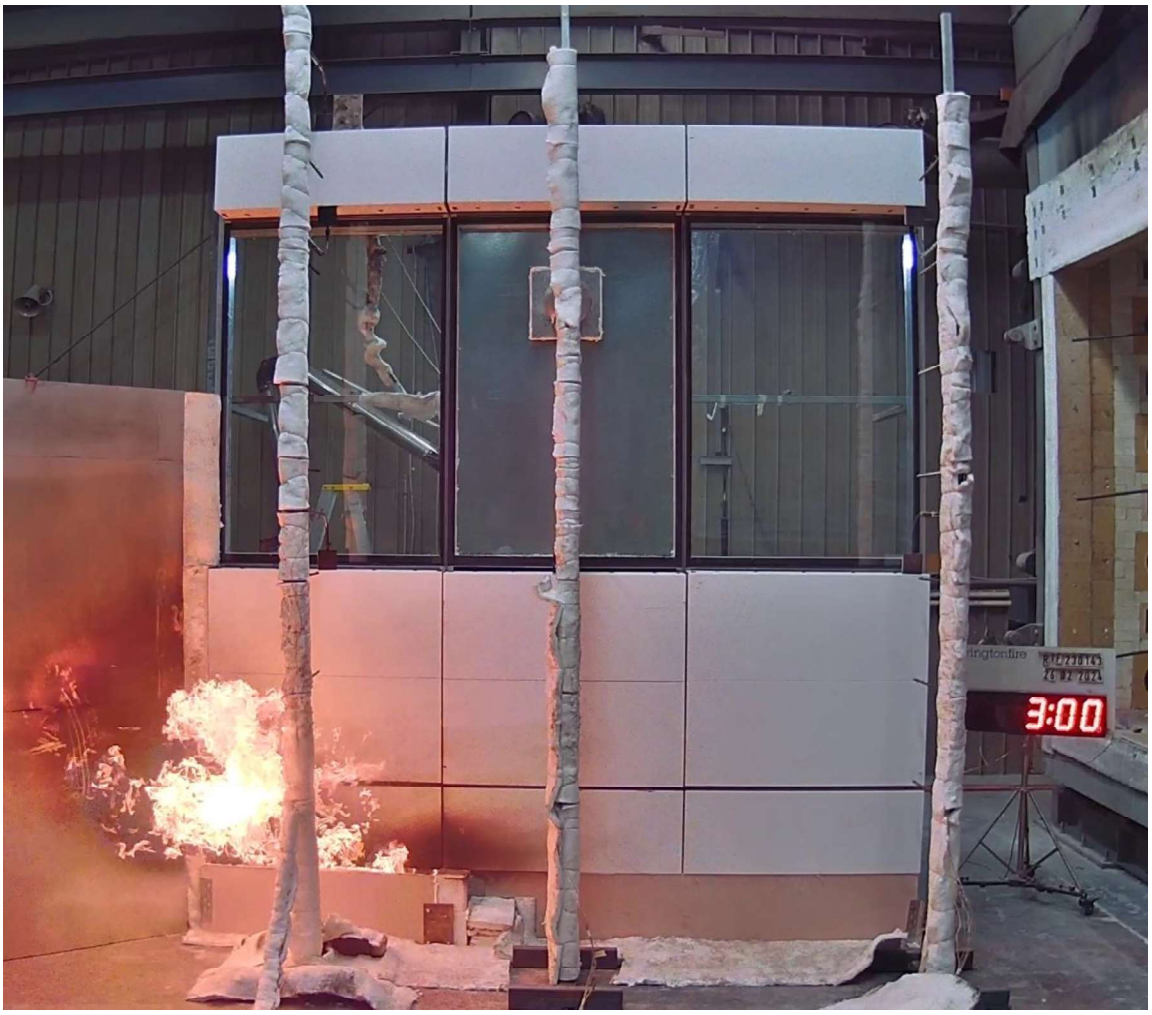


**Figure 27 The specimen 3 minutes into the test (burner output at 300 kW and wind on)**


**Figure 28 The specimen 5 minutes into the test (burner output at 300 kW and wind on)**

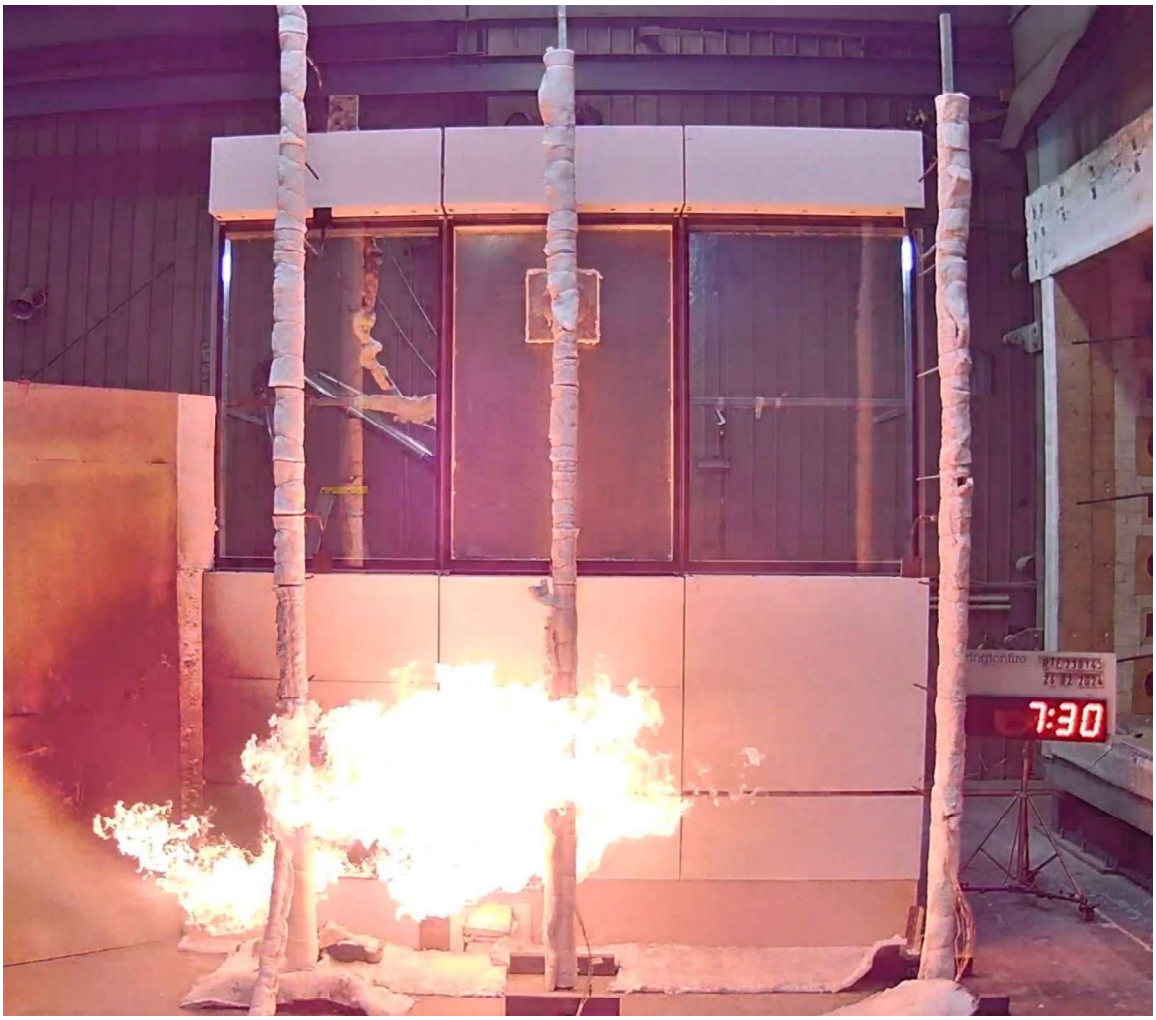


**Figure 29 The specimen 7 minutes 30 seconds into the test (burner output at 300 kW and wind on)**


**Figure 30 The specimen 10 minutes into the test (burner output at 300 kW and wind on).**

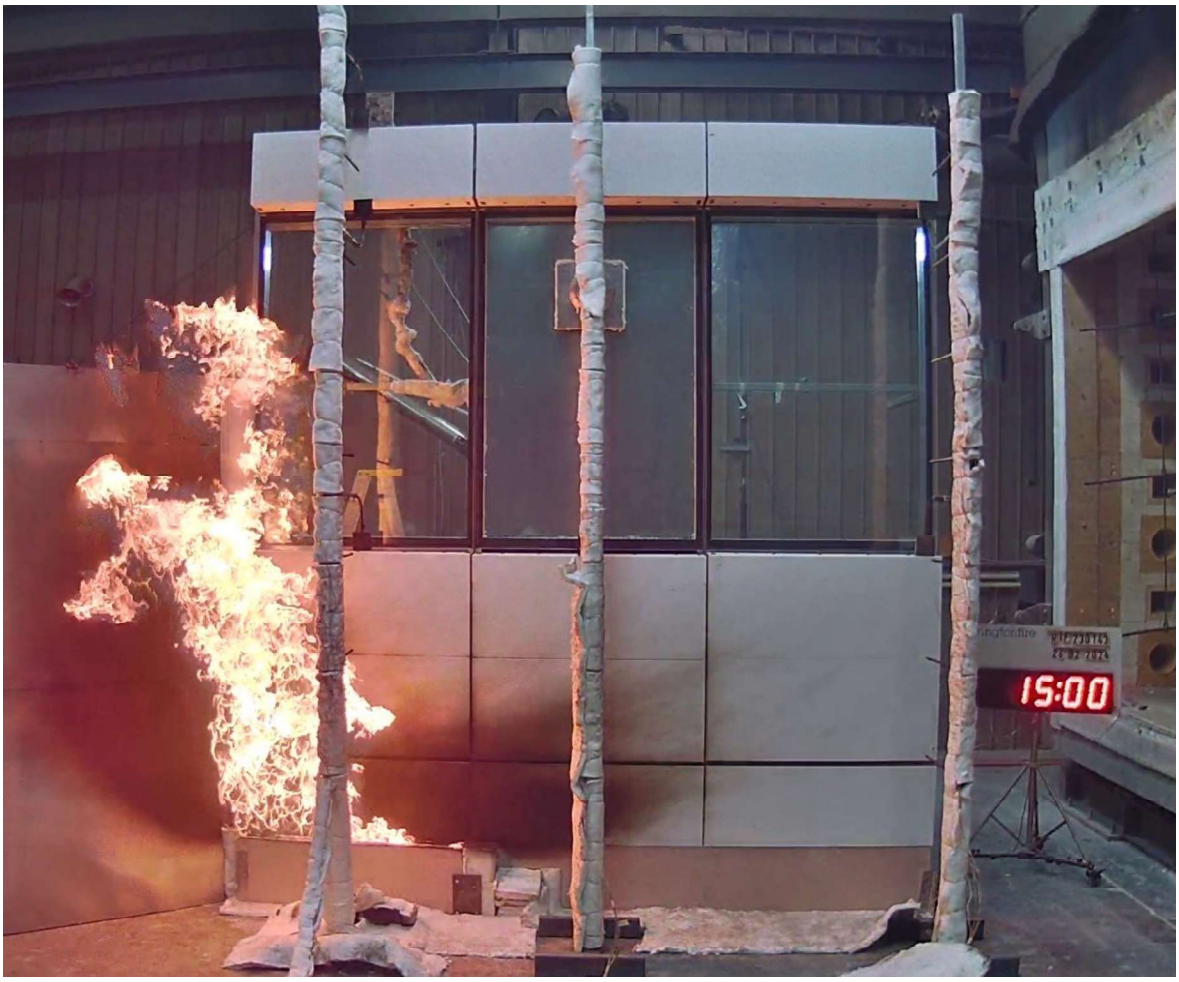


**Figure 31 The specimen 15 minutes into the test (burner output at 300 kW and wind on).**

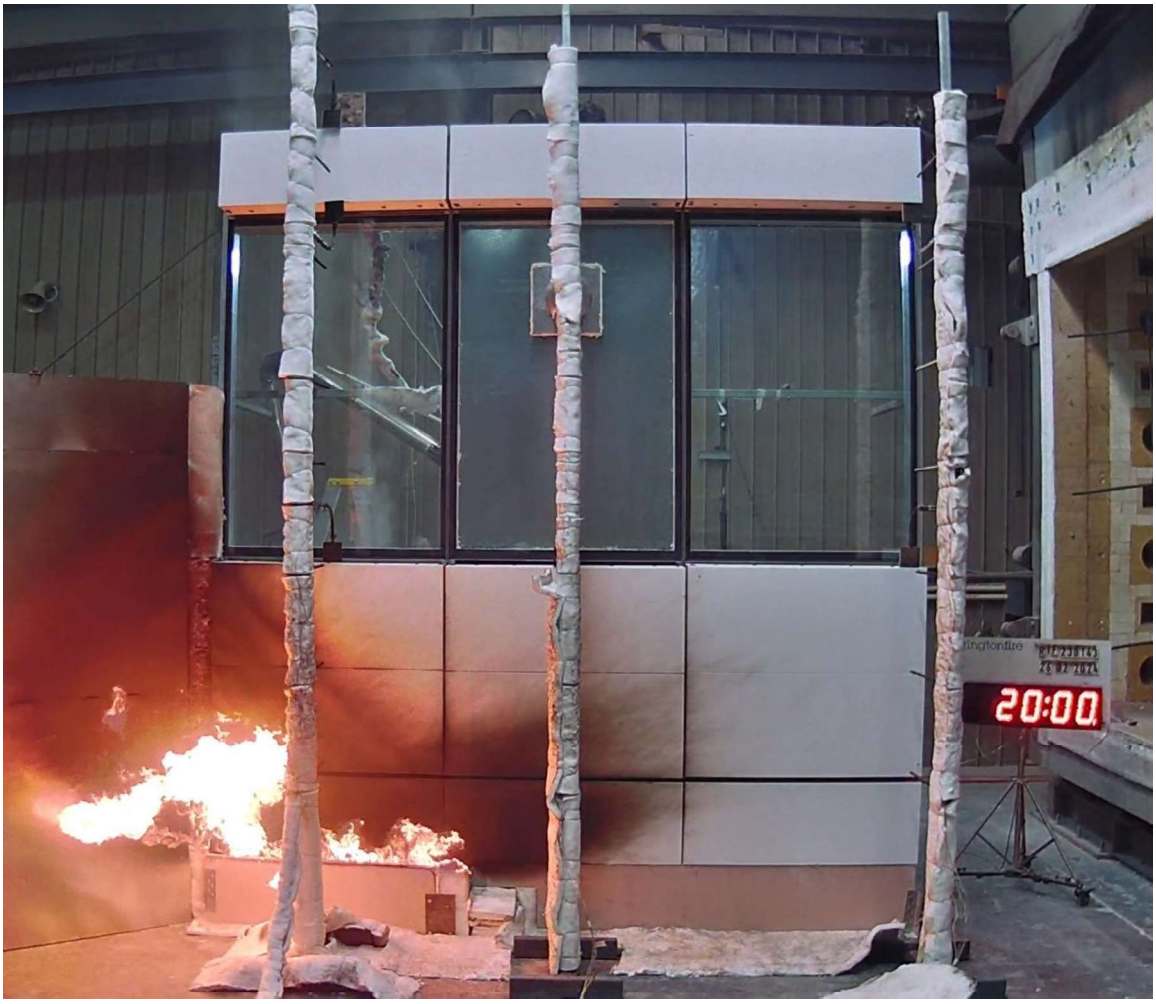


**Figure 32 The specimen 20 minutes into the test (burner output at 300 kW and wind on).**

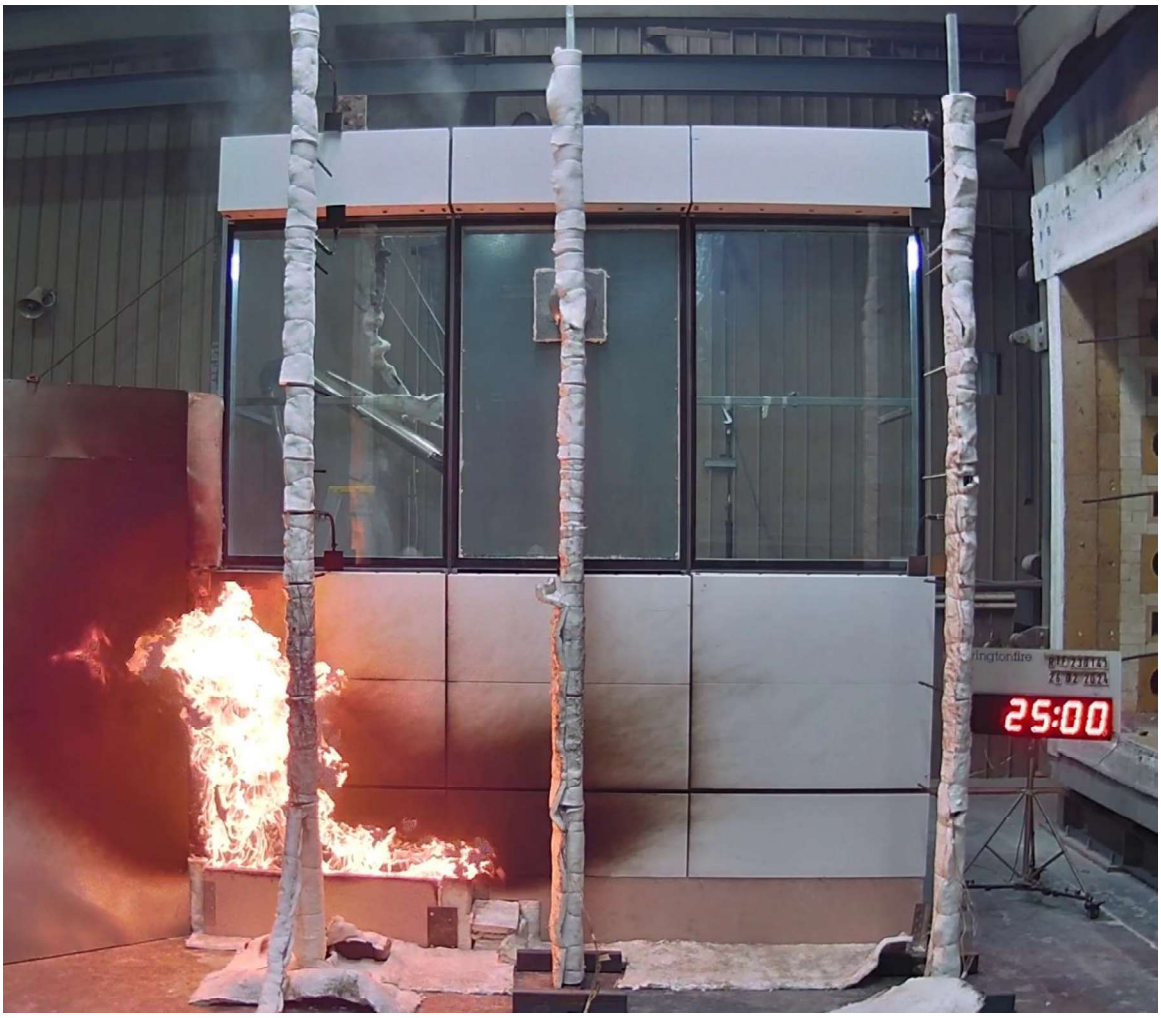


**Figure 33 The specimen 25 minutes into the test (burner output at 300 kW and wind on).**


**Figure 34 The specimen 30 minutes into the test (burner off and wind on).**


**Figure 35 Unexposed side of the specimen 30 minutes into the test (burner off and wind on).**

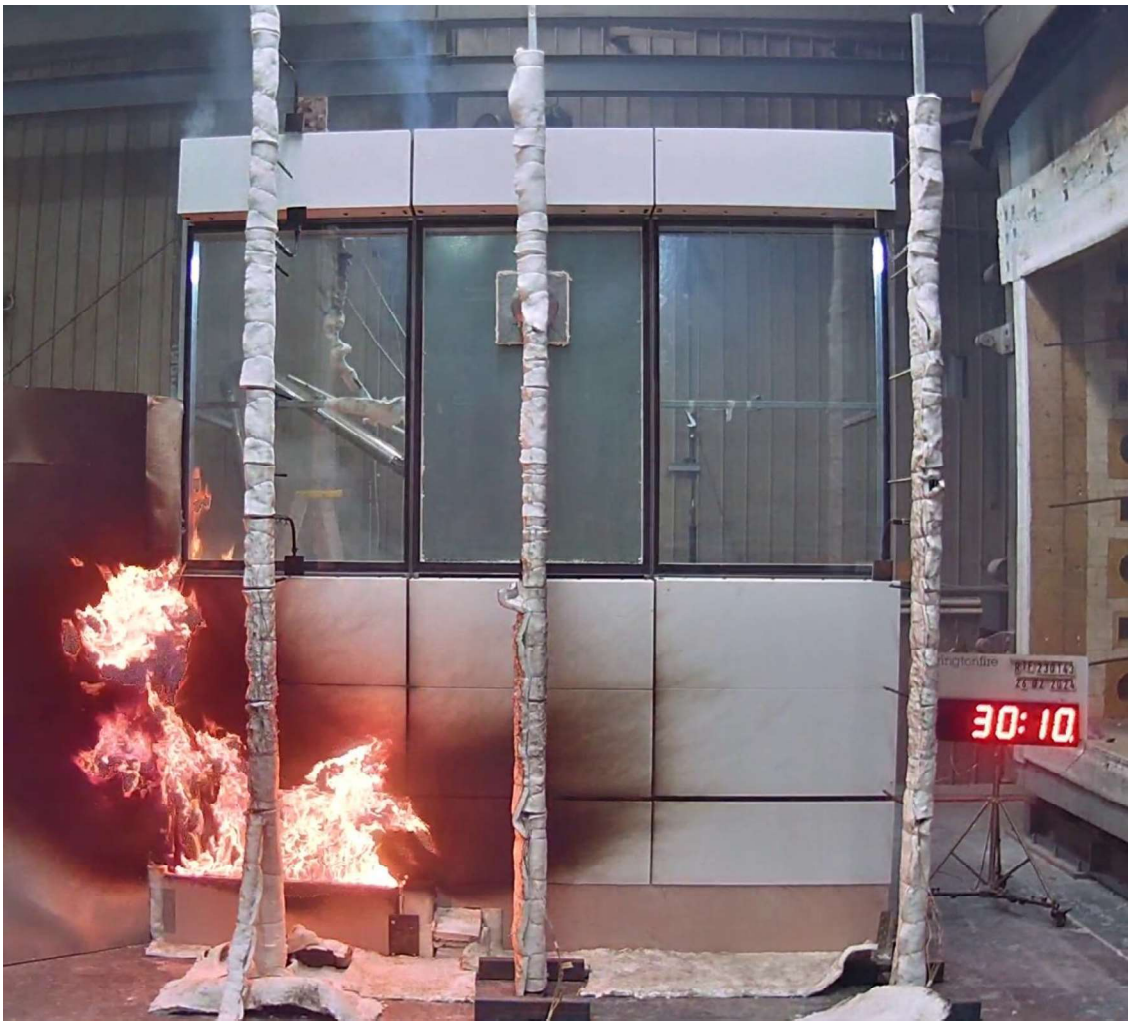


**Figure 36 The specimen 30 minutes 10 seconds into the test (10 seconds after burner off and wind on).**


**Figure 37 The specimen 30 minutes 20 seconds into the test (20 seconds after burner off and wind on).**

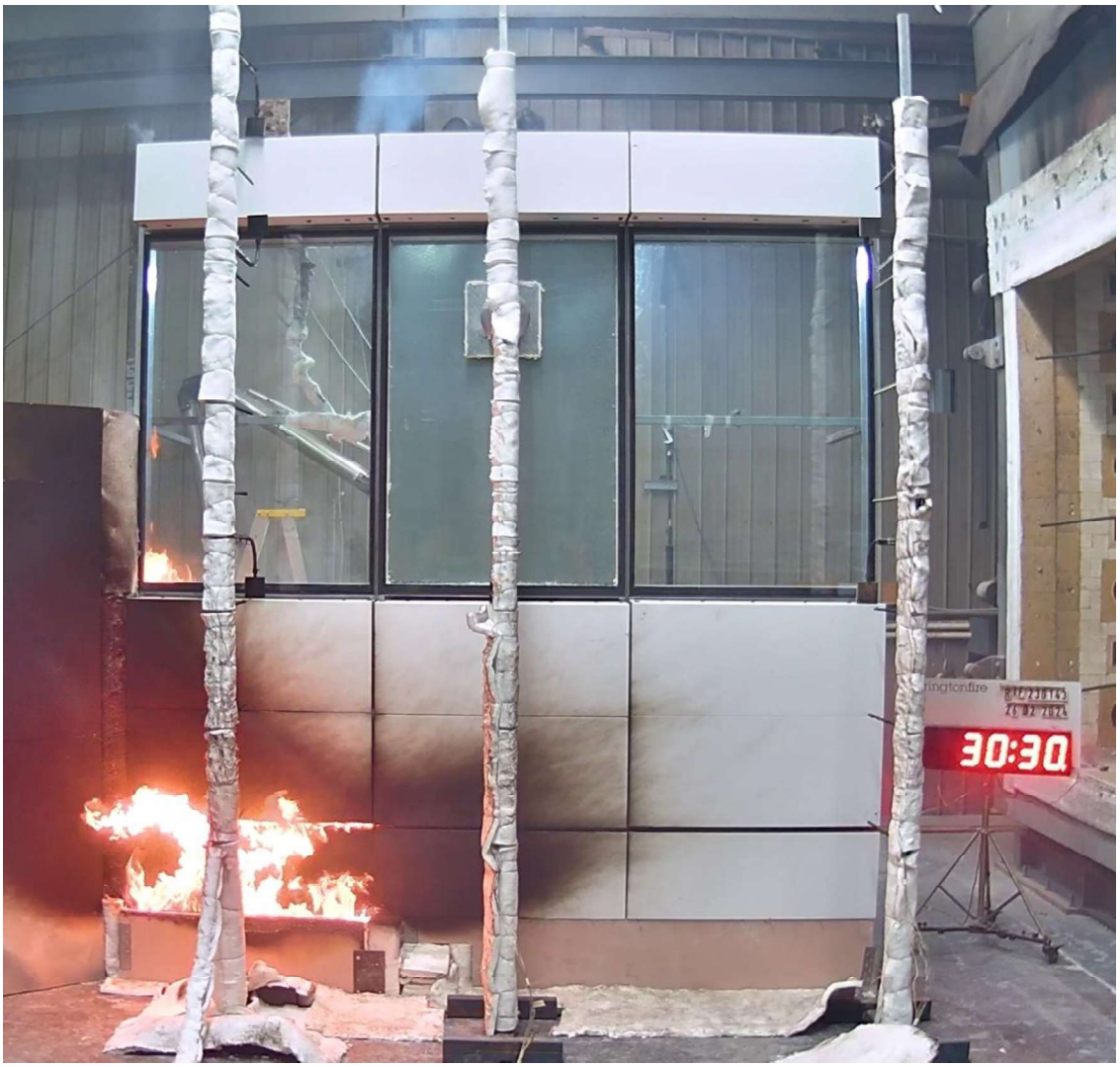


**Figure 38 The specimen 30 minutes 30 seconds into the test (30 seconds after burner off and wind on).**


**Figure 39 The specimen 31 minutes into the test (1 minute after burner off and wind on).**

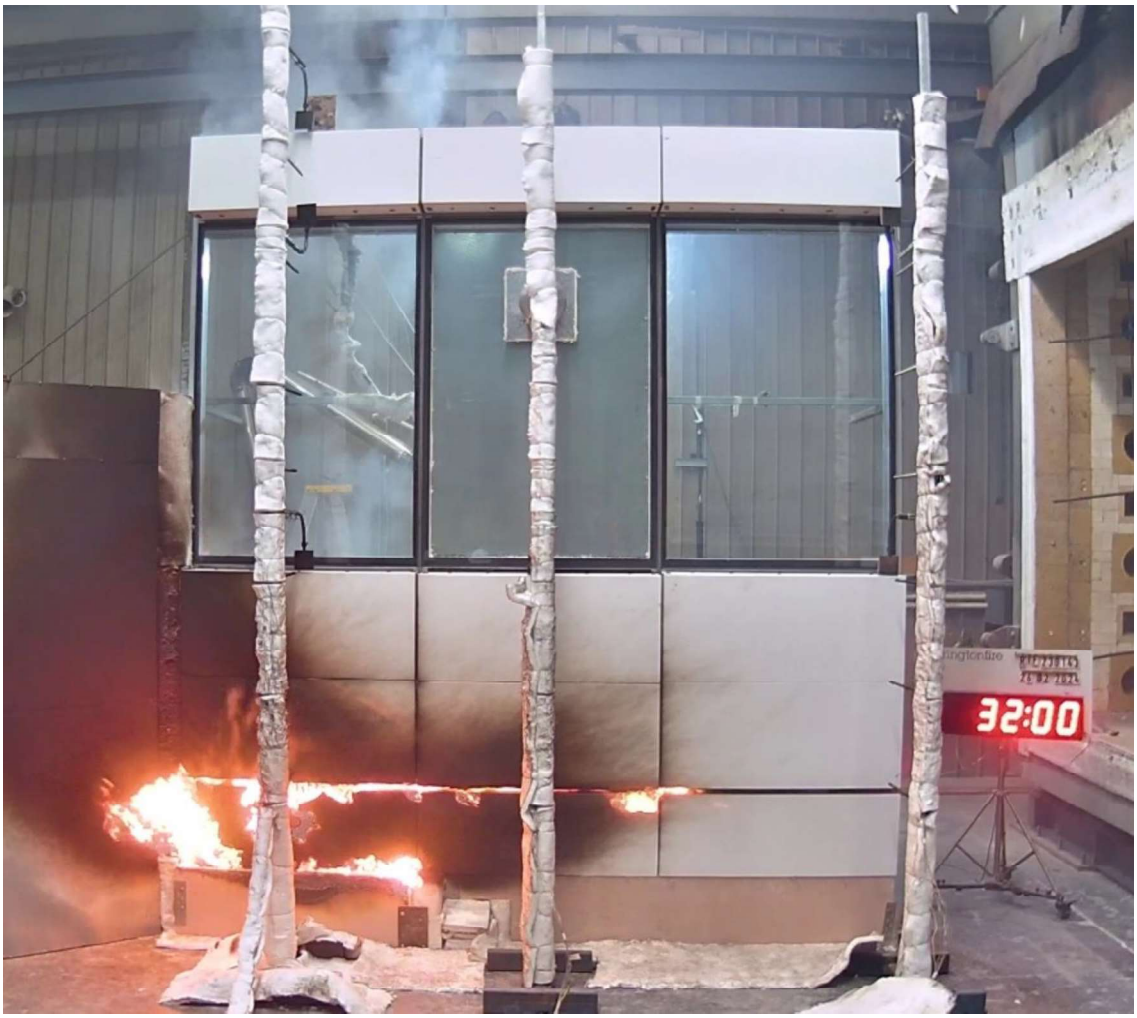


**Figure 40 The specimen 32 minutes into the test (2 minutes after burner off and wind on).**


**Figure 41 The specimen 34 minutes into the test (4 minutes after burner off and wind on).**

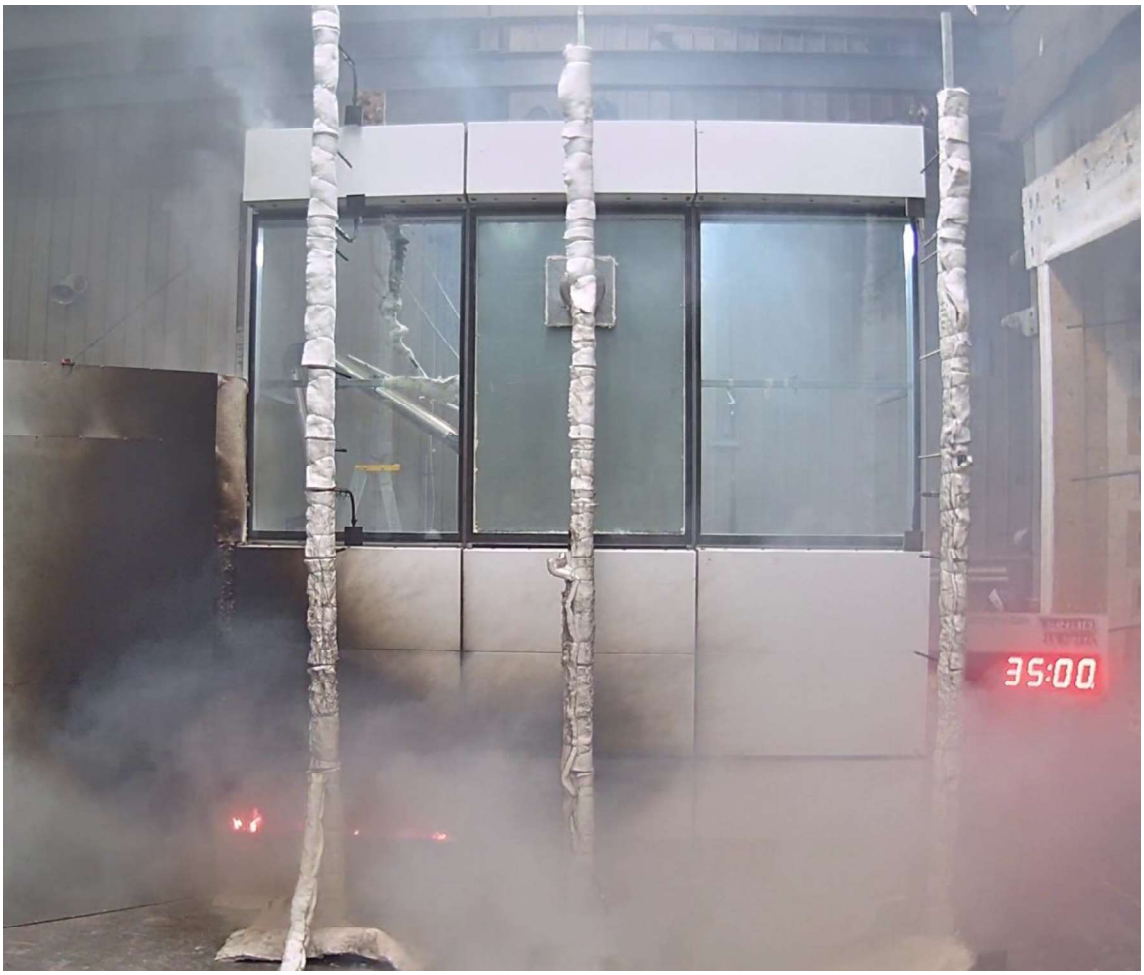


**Figure 42 The specimen 35 minutes into the test (5 minutes after burner off and wind on).**

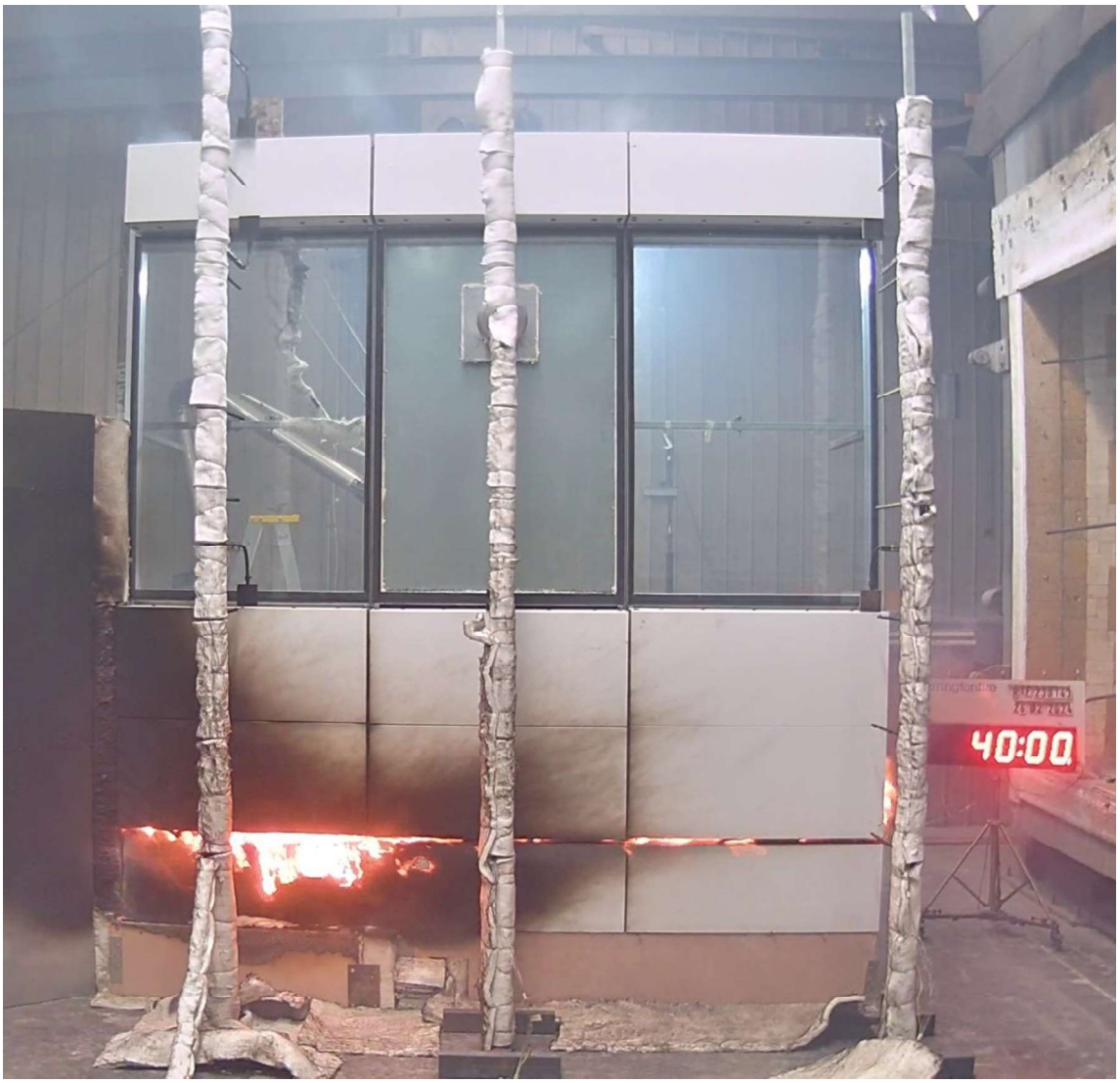


**Figure 43 The specimen 40 minutes into the test (10 minutes after burner off and wind on).**


**Figure 44 The specimen 45 minutes into the test (15 minutes after burner off and wind on).**


**Figure 45 The specimen 50 minutes into the test (20 minutes after burner off and wind on).**


**Figure 46 The specimen 53 minutes into the test (23 minutes after burner off and 20 seconds after wind off).**


**Figure 47 The specimen 55 minutes into the test (25 minutes after burner off and 2 minutes 20 seconds after wind off).**


**Figure 48 The specimen at the end of test.**


**Figure 49 The unexposed side of the specimen at the end of test.**

# Appendix C Chemical analysis results

UNSW SYDNEY

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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% |
| 24021-3 | #3 - 45% Non FR |

CCL has been asked to identify the polymer and the filler (s) in the samples by FT/IR, quantitate and identify the mineral filler in the samples and classify them in accordance with the ICA cladding scheme.

## 2. METHODOLOGY AND RESULTS

The aluminium metals were removed from the ACPs cladding polymer, and the flat surface of the polymer sample was abraded to remove any surface adhesive. The surface of the sample was analysed directly by FTIR. The FT-IR spectra are presented in Figures 1-3.

The core of the samples was then ashed to determine their percentage mineral content (Table 1). If sufficient (>0.5 g) ash was found in the sample, it was analysed for elemental composition by X ray fluorescence spectroscopy. Results are presented in Table 2.

**Table 1 Ash content of 24021-1-3**

| Sample coding | Ash content (w/w%) |
|---|---|
| 24021-1 | 3.3 |
| 24021-2 | 3.0 |
| 24021-3 | 40.0 |

Table 2 Elemental composition of sample 24021-3

| Element Oxide | wt.% |
|---|---|
| Na2O | 0.36 |
| MgO | 9.67 |
| Al2O3 | 0.71 |
| SiO2 | 6.47 |
| P2O5 | 0.03 |
| SO3 | 1.58 |
| K2O | 0.12 |
| CaO | 47.18 |
| TiO2 | 0.88 |
| V2O5 | 0.01 |
| Cr2O3 | <0.01 |
| Mn3O4 | 0.03 |
| Fe2O3 | 0.70 |
| NiO | <0.01 |
| CuO | 0.05 |
| ZnO | 1.74 |
| SrO | 0.15 |
| ZrO2 | <0.01 |
| BaO | 2.04 |
| HfO2 | <0.01 |
| PbO | <0.01 |
| SnO2 | 0.01 |
| CoO | <0.01 |
| L.O.I. | 29.50 |

NOTE: (i) L.O.I.= loss on ignition at 1,050 °C.

## 3. CONCLUSIONS

The cladding sample #1 consisted of 3.3% inert material and approximately 96% polyethylene polymer.

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

The cladding sample #2 consisted of 3.0% inert material and approximately 97% polyethylene polymer.

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

The cladding sample #3 consisted of 33.7% calcium carbonate, 5.6% magnesium hydroxide, 2.5% other inert material and approximately 58% polyethylene polymer.

**The cladding sample #3 is classified as ICA category A.**

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

*The reader is reminded that we can only analyse and classify the content of samples actually presented to us. We can offer no guarantee that this composition or classification is valid for cladding as a whole, because some types of cladding can be inhomogeneous, and a sample may not be representative of the cladding as a whole. Anyone using our results should consider these sampling issues and uncertainties before they generalise the results we present to anybody of cladding as a whole.*

Dominic D'adam BSc/BE (Hons)
Senior Technical Officer
Chemical Consulting Laboratory
Mark Wainwright Analytical Centre, UNSW
22 February 2024

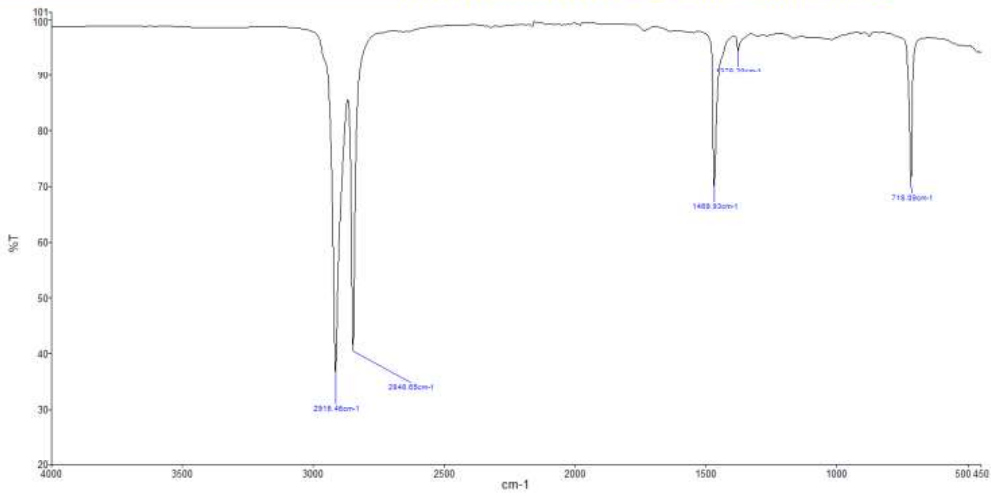


Figure 1. FT-IR spectrum of sample #1





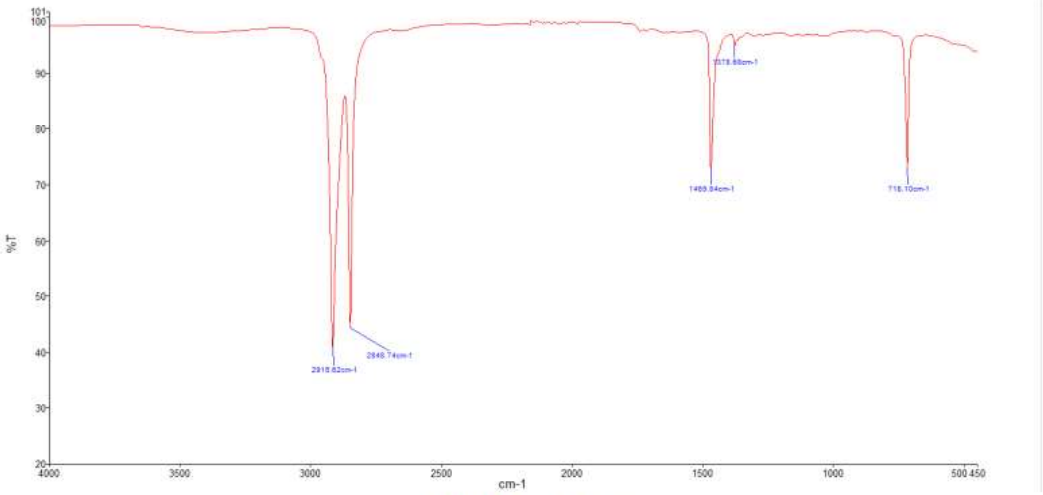


Figure 2. FT-IR spectrum of sample #2

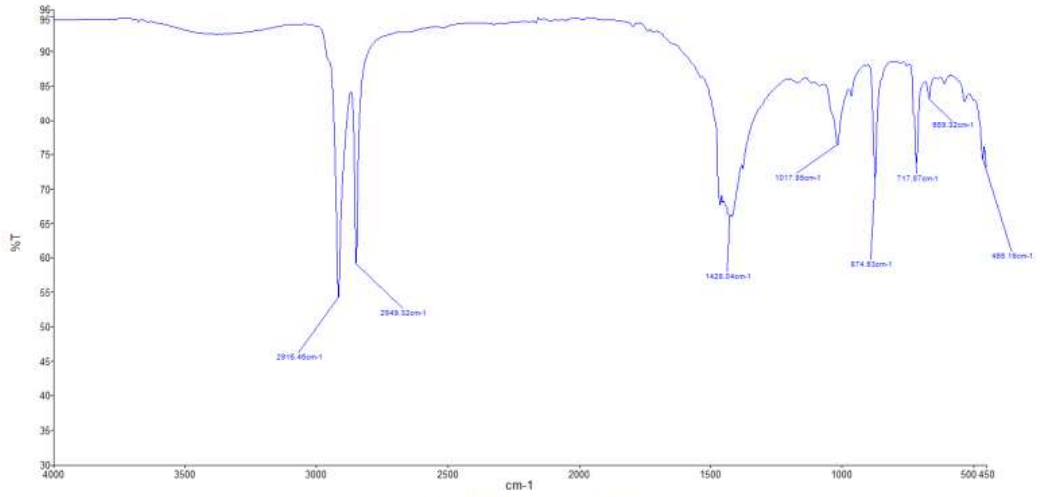


Figure 3. FT IR spectrum of sample #3

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