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# Reaction to fire test report

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

Test sponsor: Owners Corporation Plan Number [redacted]

System: Aluminium composite panel wall system representative of the in-situ wall located at [redacted] – Scenario 2 - Test 3

Job number: RTF220104

Test date: 15 December 2022 Revision: R3.0

[redacted]

# Quality management

| Revision | Date | Information about the report | | | |
|---|---|---|---|---|---|
| R3.0 | 8 June 2023 | Description | Initial issue | | |
| | | | Prepared by | Reviewed by | Authorised by |
| | | Name | [redacted] | [redacted] | [redacted] |
| | | Signature | [redacted] | [redacted] | [redacted] |

# Contents

# 1. Introduction

This report documents the findings of the third of three ad-hoc reaction to fire tests for an Aluminium composite panel (ACP) external wall cladding system - performed on 15 December 2022. 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 |
|---|---|
| Owners Corporation Plan Number [redacted] | [redacted] |

# 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 | ACP Panelling - cassetted |
| | Product | [redacted] |
| | Manufacturer/Supplier | [redacted] |
| | Material | The panel consisted of two layers of aluminium sheets sandwiching a layer of polyethylene (PE) with fire-retardant core. Analysis conducted by the analytical centre of UNSW showed that the core consisted of ~70 % aluminium, 1.6 % inert filler and ~29 % PE. |
| | Size | As shown in Figure 6.<br>Thickness – 3.9 mm<br>Skin thickness – 0.5 mm<br>Depth – 150 mm |
| | Nominated mass densities | Panel areal density – 7.5 kg/m² |
| 2. | Item name | FR Plasterboard |
| | Product | [redacted] 13 mm Fyrchek |
| | Manufacturer/Supplier | [redacted] |
| | Size | Measured board: 3000 mm × 1200 mm × 13 mm |
| | Areal density (measured) | 11.0 kg/m$^2$ |
| 3. | Item name | Backpan |
| | Product | 0.9 mm thick Galvabond steel |
| | Supplier | [redacted] |
| | Size | Measured: 1160 mm wide × 3700 mm tall, 0.9 mm thick – in segments |

| Item | Description | |
|---|---|---|
| **Framing** | | |
| 4. | 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 5 |
| 5. | Item name | Aluminium curtain wall transom/mullions (rectangular hollow sections) - framing |
| | Size | 65 mm wide × 120 mm deep × 3 mm thick<br>Total frame size: 120 mm deep × 1165 mm wide × 3705 mm tall |
| | Manufacturer/Supplier | Capral Aluminium |
| 6. | Item name | Aluminium angles - framing |
| | Size | 20 mm wide × 30 mm deep × 3 mm thick |
| | Manufacturer/Supplier | Rapid Aluminium |
| 7. | Item name | Aluminium stiffener - framing |
| | Size | 3 mm thick |
| | Manufacturer/Supplier | Rapid Aluminium |
| 8. | Item name | Internal side frame - steel |
| | Size | Studs and noggings: 90 mm deep × 36 mm wide × 0.55 BMT |
| | Installation | The steel framing members were riveted (item 17) to one another. |
| 9. | Item name | Strap – 50 mm wide |
| | Size | Studs and noggings: 90 mm deep × 36 mm wide |
| | Installation | The steel framing members were riveted (item 17) to one another. |
| **Smoke seal** | | |
| 10. | Item name | Smoke seal |
| | Size | 1 mm thick galvanised steel |
| | Manufacturer/Supplier | Atlas Steel |
| **Insulation** | | |
| 11. | Item name | 90 mm thick polyethylene terephthalate (PET) insulation |
| | Density | 10 kg/m$^3$ |
| | Manufacturer/Supplier | Pricewise Insulation |
| 12. | Item name | 50 mm thick aluminium - with fibre-glass mesh - foil faced rockwool insulation |
| | Density of core | 40 kg/m$^3$ |
| | Manufacturer/Supplier | Rockwool Insulation Australia |
| **Sealant/Adhesive** | | |
| 13. | Item name | Weathering sealant |
| | Product type | Silicone sealant |
| | Product name | PROSIL 41lm |
| | Manufacturer/Supplier | Admil Adhesives |
| | Usage | Placed at ACP edges and over screw and rivet locations. |
| **Fixings** | | |
| 14. | Item name | Wafer head screws – zinc coated steel |
| | Size | 10g × 16 mm long |

| Item | Description | |
|---|---|---|
| | Installation | Used to fix aluminium angles (item 6) to the aluminium frame (item 14) at 500 mm centres |
| 15. | Item name | Wafer head screws – zinc coated steel |
| | Size | 10g × 50 mm long |
| | Installation | Used to fix ACP (item 1) to the aluminium stiffener (item 7) – four per corner. |
| 16. | Item name | Hex head tek screw – zinc coated steel |
| | Size | 12g × 16 mm long |
| | Installation | Used to fix aluminium stiffeners (item 7) to themselves |
| 17. | Item name | Steel rivets |
| | Size | Ø4 mm |
| 18. | Item name | Plasterboard screws |
| | Size | 6g × 32 mm long, bugle head, self-drilling screws |
| 19. | Item name | Fast-fix washers and pin weld |
| | Size | 115 mm × 3 mm pins and 25 mm × 25 mm fast fix washers. |

**Installation method**

| | |
|---|---|
| Internal wall: | The test rig frame (item 4) was the main support for the test specimen, however, there were two C-purlin sections that acted as false slabs (200 mm tall). Steel stud framing (item 8) was installed between the C-purlins. PET insulation (item 11) was inserted within the steel framing (item 8) and was capped with 13 mm thick FR plasterboard (item 2) on the unexposed side and along the edges. The plasterboard was fixed with plasterboard screws (item 18) – max 300 mm centres on the periphery and 600 mm centres in-field. |
| External wall: | The external section of the wall system largely consisted of an aluminium extrusion framing system (item 5), galvanised steel sheet backpan (item 3) and ACP cassette system (item 1). The external wall was screw fixed using angles. The ACP cassettes were 150 mm deep and were connected to the aluminium extrusion framing (item 5) using aluminium angles (item 6) and aluminium stiffeners (item 7). The angles (item 6) were screw fixed to the extrusions, the aluminium sheeting riveted to the angles, and the ACP cassettes riveted to the aluminium sheets. Sealant (item 13) was used to seal open ACP edges, screw fixings and rivet locations.<br><br>The backpan (item 3) was screw fixed and riveted to the back of the aluminium extrusion framing (item 5). Foil faced insulation (item 12) was installed within the external wall. The insulation was held to the steel backpan (item 3) with the aid of fast-fix washers and pin combinations (item 19) – at ~600 mm centres - that were welded to the backpan. There was a 60 mm gap between the backpan and the internal wall studwork. |

# 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 with the specimen mimicking the as-is construction of the façade. | |
| 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 | |
| Ambient laboratory temperature | Start of the test | 21 °C |
| | Minimum temperature | 20 °C |
| | Maximum temperature | 22 °C |
| Instrumentation and equipment | • Eight 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 (TC011 – TC018) for details on positioning.<br>• Ten 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 inside the specimen at the centre of the cavity. Refer to Figure 1 (TC001 – TC010) 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 one Schmidt-Boelter type heat flux gauges with a range of 0-100 kW/m$^2$.<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 10 mm overlap with the ACP. | |
| Test procedure | • At least two minutes of baseline data was collected prior to burner ignition. Temperature and heat flux data was collected at 5 s intervals.<br>• The heat output from the burner was held at 100 kW for the first 15 minutes of the test followed by 300 kW for the next 25 minutes. The burner was then turned off and data recorded for the next 20 minutes. | |
| Test number | Test three of three. | |
| Variation between tests | Mineral fibre wool was placed around the test support rig and the thermocouple tree up to an approximate height of 2 metres. | |

# 4. Test measurements and results

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

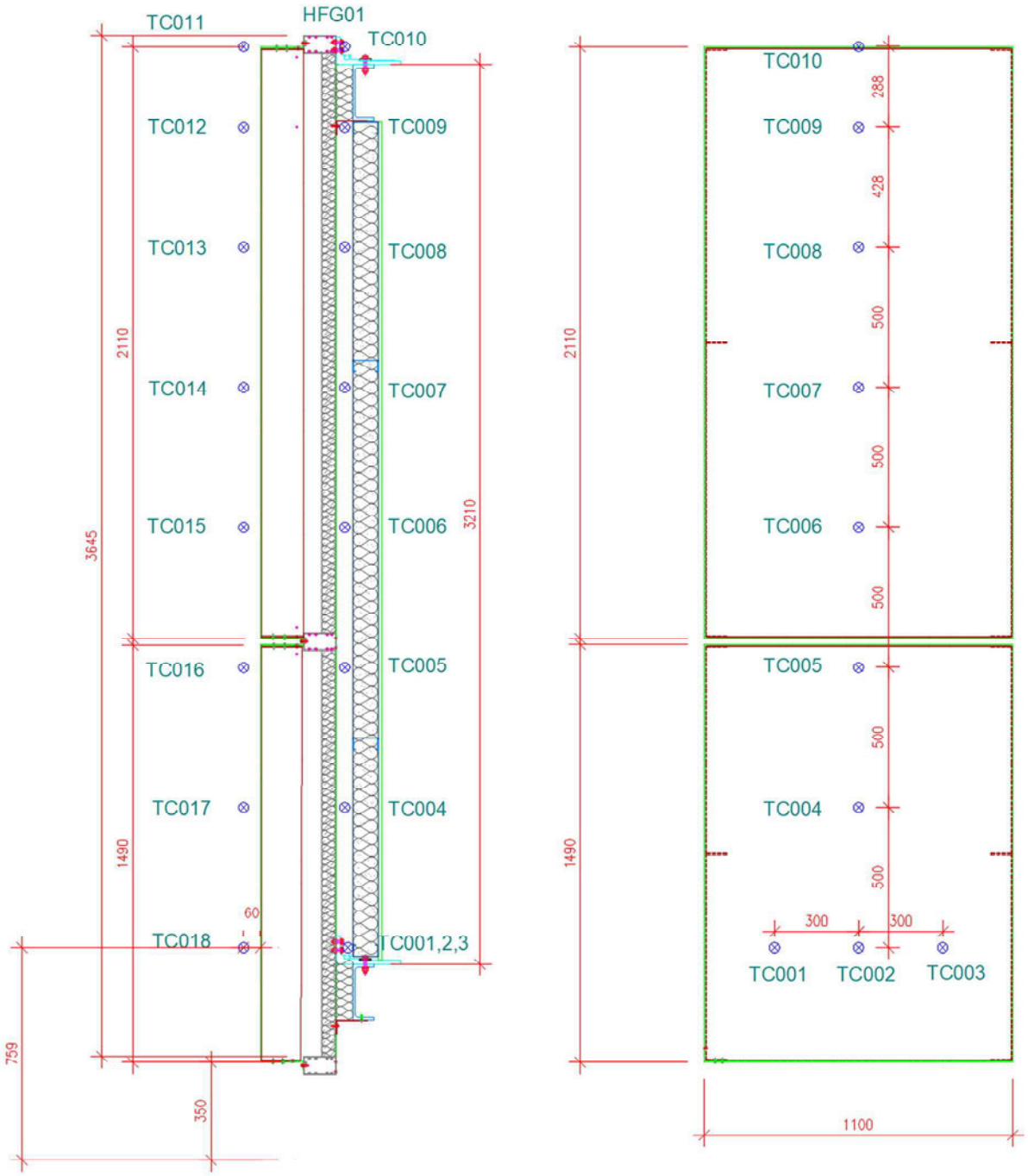


**Figure 1 Instrumentation location**

Note - A replacement for TC012 was inadvertently placed at the position of TC017. Therefore, temperatures listed at the stated TC012 position was not recorded.

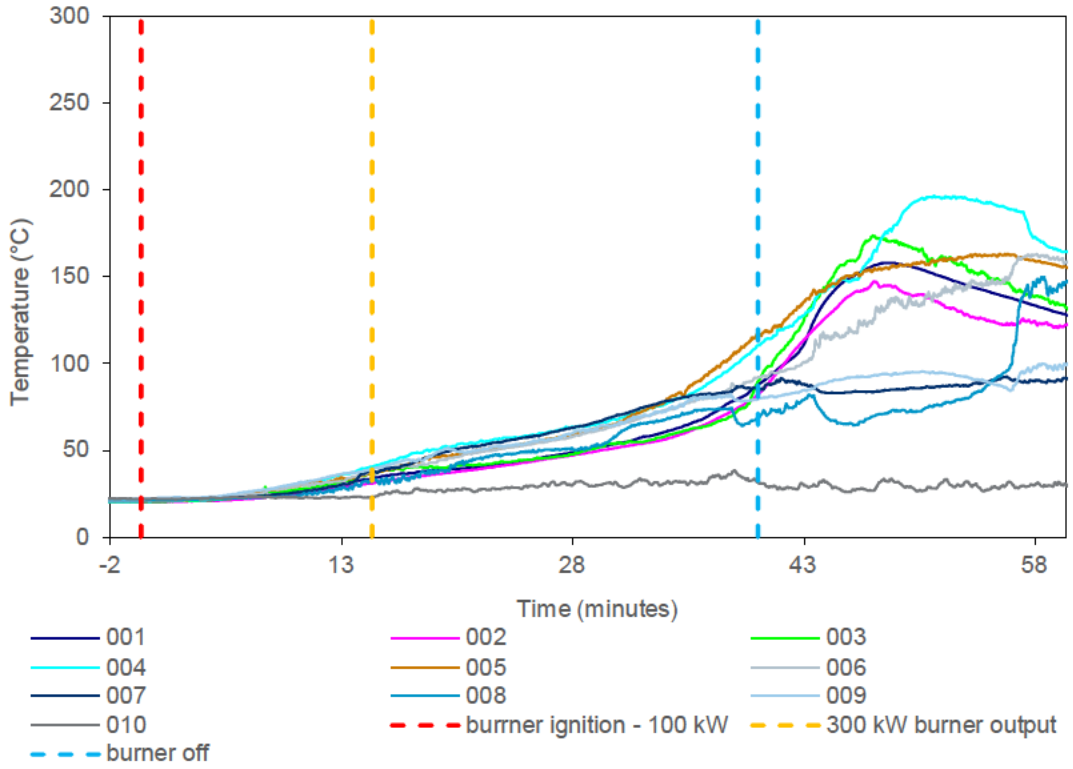


**Figure 2** **Internal temperature data collected by thermocouples placed within the cavity – between the internal and external segments of the specimen.**

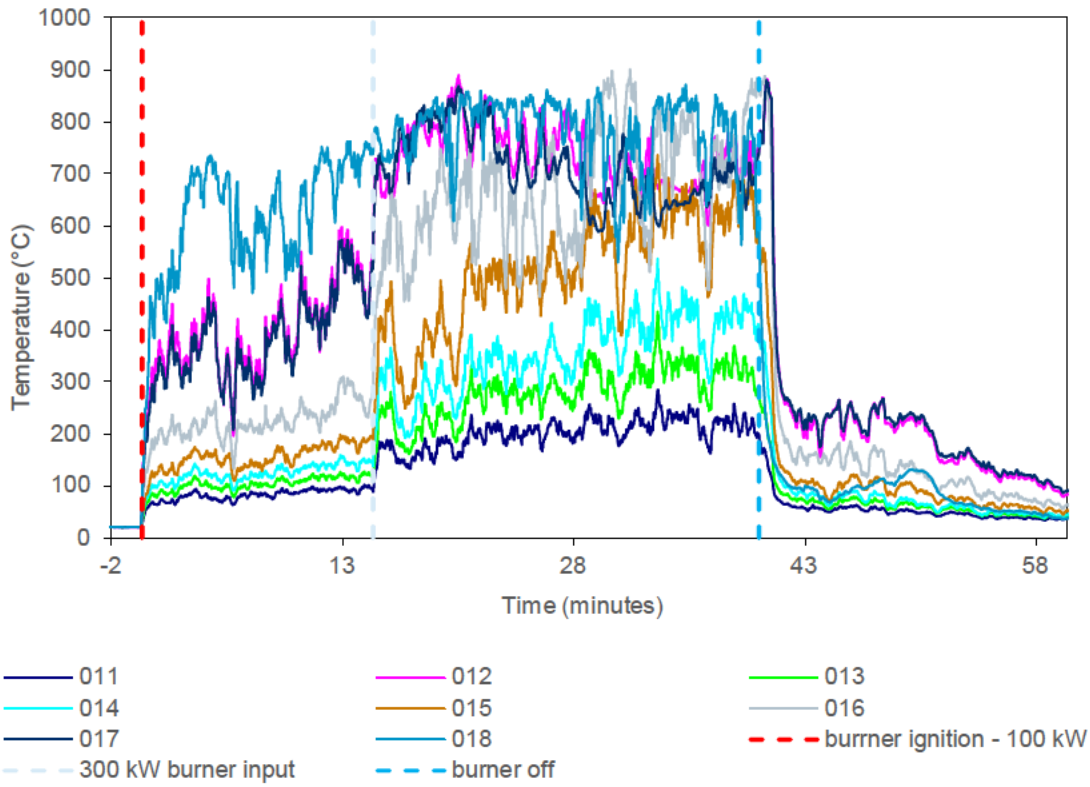


**Figure 3** **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen.**

Note: A replacement for TC012 was inadvertently placed at the position of TC017.

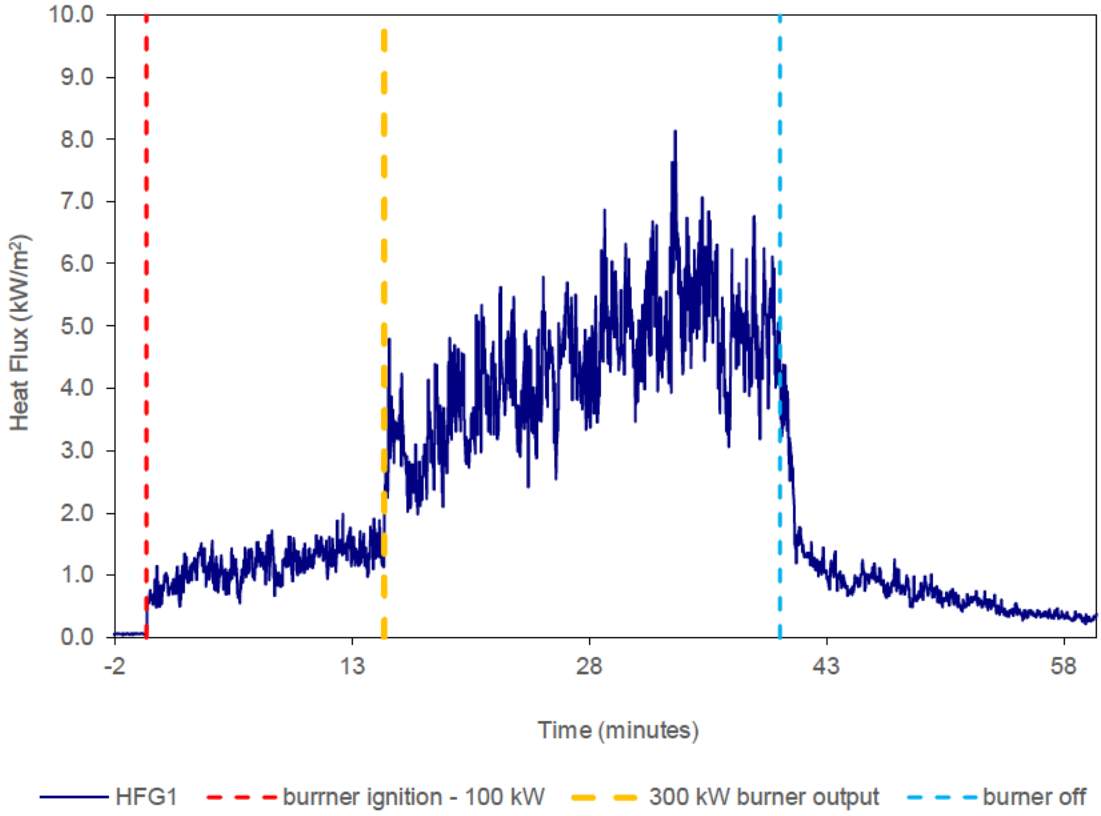


**Figure 4 Heat flux data collected by heat flux gauges.**

Table 4 shows the observations of any significant behaviour of the specimen during the test.

**Table 4 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. |
| 0 | 50 | The bottom ACP started to discolour. |
| 3 | 09 | Molten flaming debris was dripping from the west corner. |
| 3 | 40 | Three quarters of the bottom ACP had discoloured. |
| 6 | 00 | All of the bottom ACP had discoloured. |
| 6 | 45 | Molten flaming debris was dripping from the east corner. |
| 8 | 05 | There was a large pop and gas release from the bottom ACP. |
| 15 | 00 | The burner output was increased to 300 kW. |
| 15 | 35 | Flames spread vertically up the west vertical edge beyond the horizontal edge |
| 21 | 00 | The bottom ACP had deformed. |
| 29 | 13 | There was flaming debris from the bottom east side that fell from the specimen that would extinguish once it hit the floor. |
| 30 | 00 | Flames have not hit the top of the specimen. |
| 40 | 00 | The burner was turned off. |
| 40 | 20 | It was noticed that a hole had developed in the bottom ACP near TC017. Flames were exiting the hole. |

| Time | | Observation |
|---|---|---|
| Min | Sec | |
| 41 | 05 | Flaming through the hole of the bottom ACP had ceased. |
| 41 | 45 | There is flaming still from the east edge of the bottom ACP. |
| 42 | 34 | The specimen is smoking heavily. |
| 43 | 00 | Flaming through the east side of the specimen has stopped however there is still flaming behind the bottom ACP. |
| 48 | 58 | There are smoke and flames exiting the hole near TC017 again. |
| 50 | 44 | The last signs of flaming within the bottom ACP cavity were evident. Flaming no longer visible within the specimen. |
| 51 | 48 | It was noticed that the inside of the bottom ACP had fallen against the ACP and closed off the hole. |
| 51 | 51 | There were no visible signs of flaming within the specimen, i.e. behind the bottom ACP. |
| 60 | 00 | There were no visible signs of flaming internally or externally of the specimen. The test ended. |

# 5. Application of test results

## 5.1 Test limitations

The results of these fire tests may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

These results only relate to the behaviour of the specimen of the element of construction under the particular conditions of the test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, and they do not necessarily reflect the actual behaviour in fires.

## 5.2 Variations from the tested specimen

This report details methods of construction, the test conditions and the results obtained when the specific element of construction described here was tested following the procedure outlined in Table 3. Any significant variation with respect to size, construction details, loads, stresses, edge or end conditions is not addressed by this report.

It is recommended that any proposed variation to the tested configuration should be referred to the test sponsor. They should then obtain appropriate documentary evidence of compliance from Warringtonfire or another accredited testing authority.

## 5.3 Uncertainty of measurements

Because of the nature of reaction to fire testing and the consequent difficulty in quantifying the uncertainty of measurements obtained from a reaction to fire test, it is not possible to provide a stated degree of accuracy of result.

# Appendix A Drawings of test assembly

The drawings of the test assembly in Figure 5 to Figure 8 were provided by representatives of Warringtonfire. Dimensions, unless specified, are in mm.

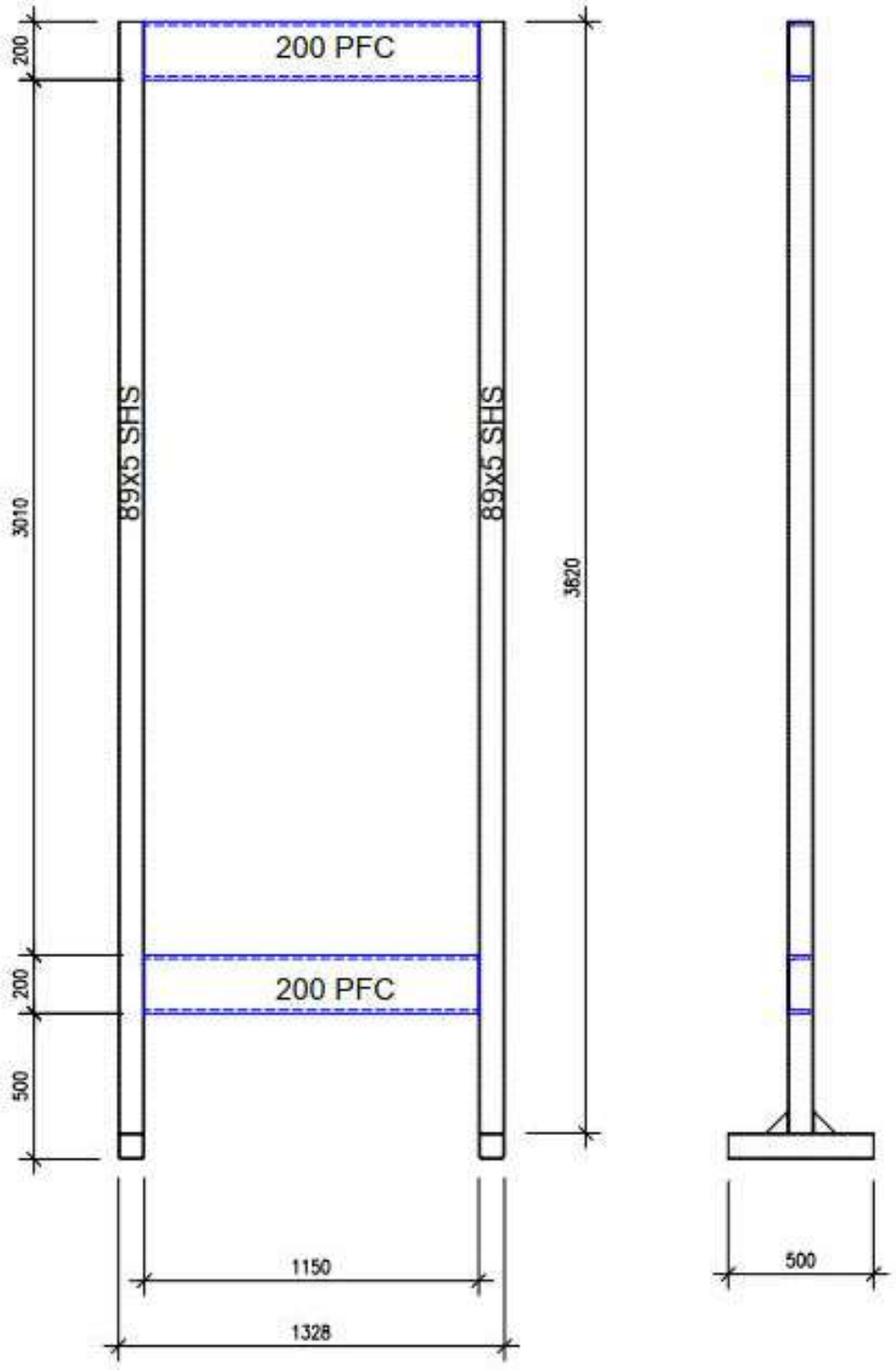


**Figure 5 Elevation of rig support.**

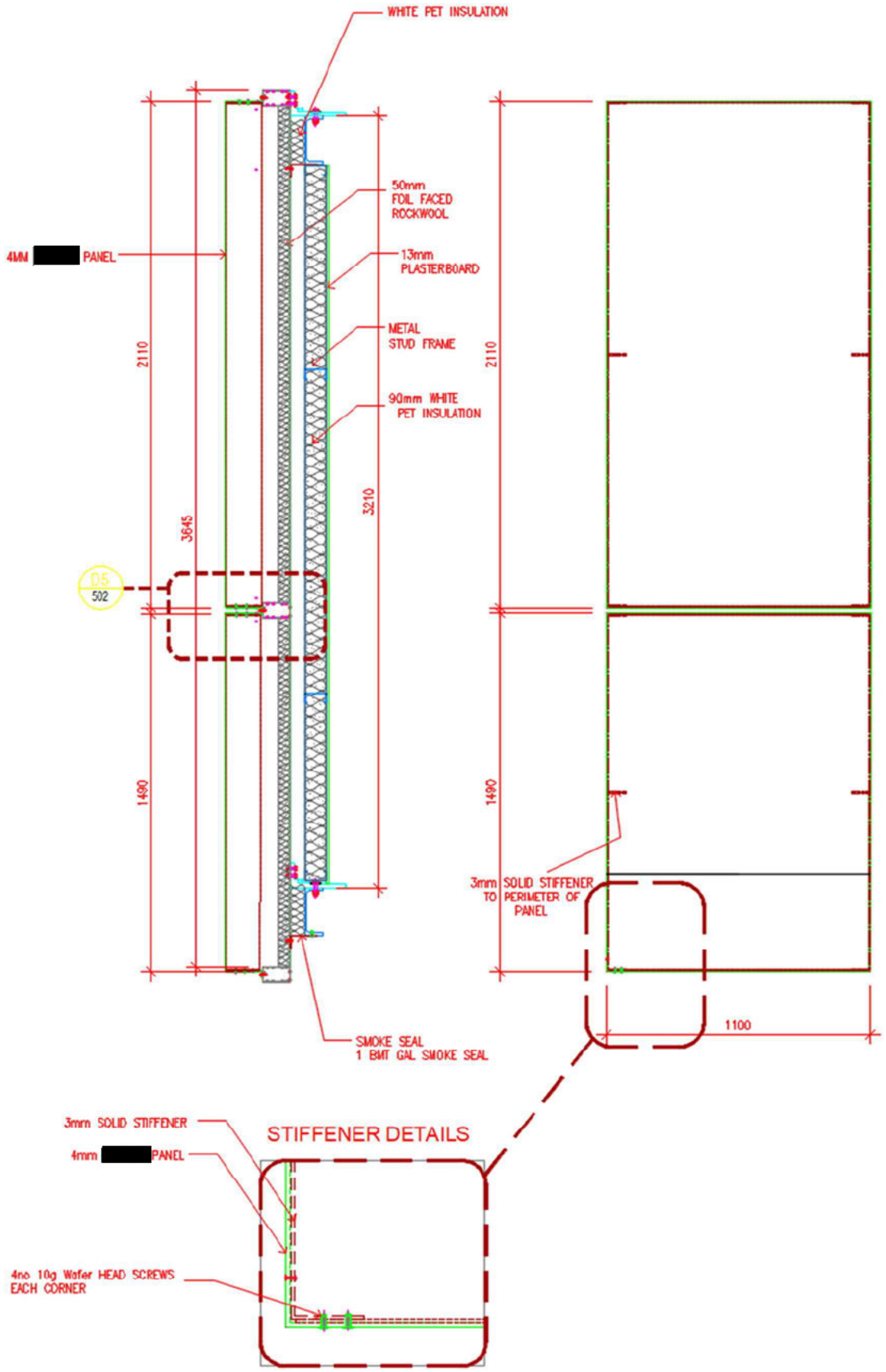


**Figure 6 System assembly – Front and side view**

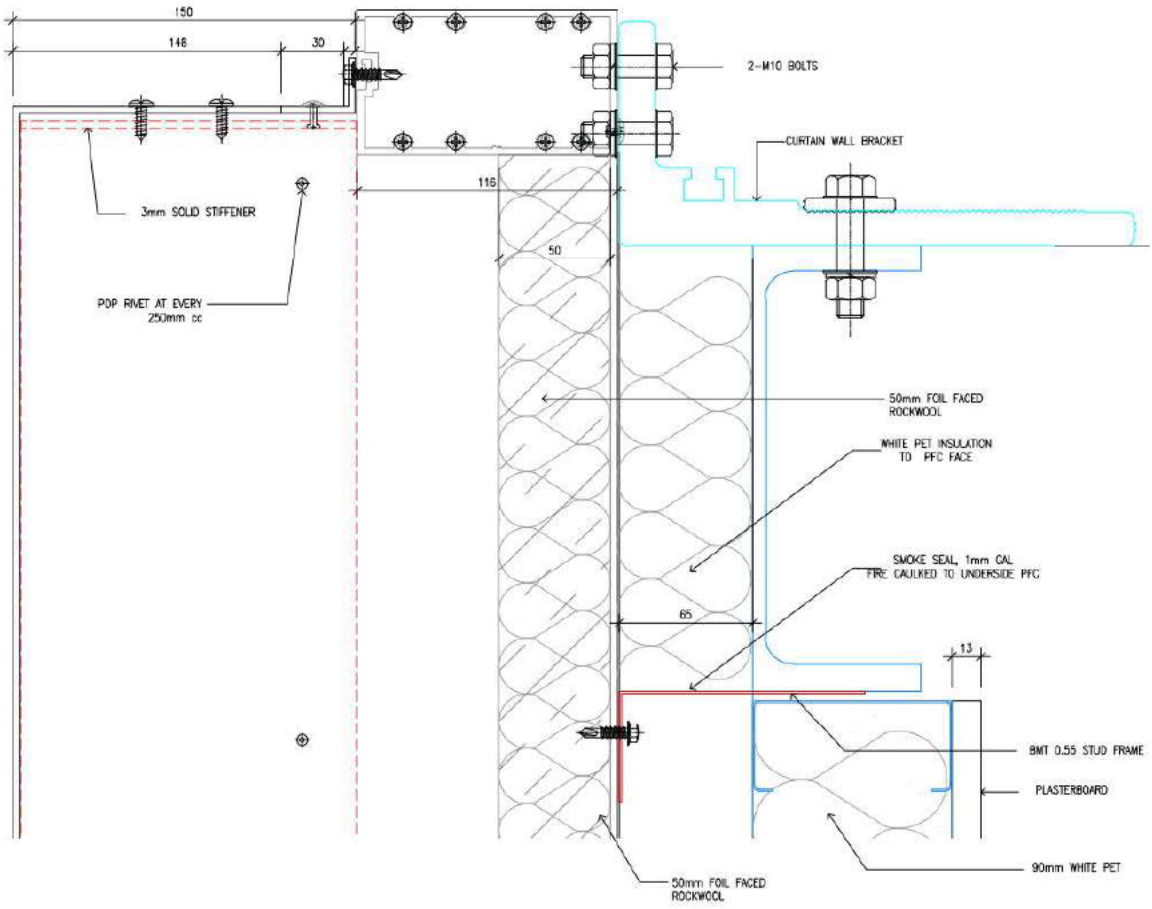


**Figure 7 System assembly – top edge detail**

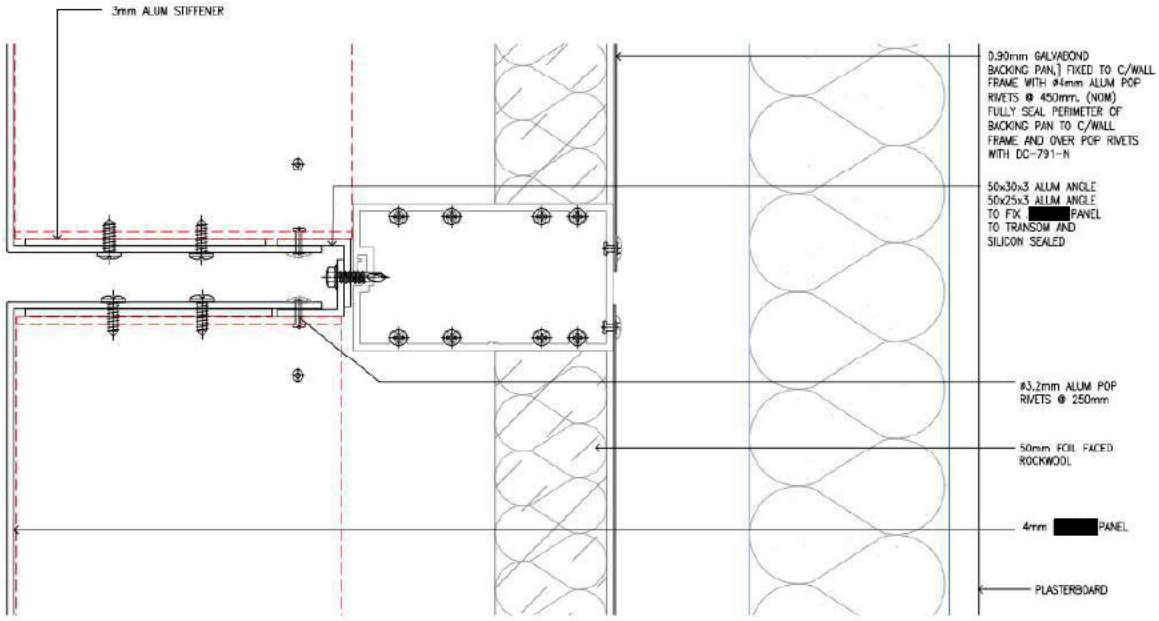


**Figure 8 System assembly – middle join detail (D05)**

# Appendix B Photographs


**Figure 9 The specimen before the reaction to fire test**


**Figure 10 The specimen 5 minutes 7 seconds into the test (burner output at 100 kW)**


**Figure 11 The specimen 11 minutes 8 seconds into the test (burner output at 100 kW)**


**Figure 12 The specimen 15 minutes into the test (burner output at 100 kW changed to 300 kW)**


**Figure 13 The specimen 21 minutes 43 seconds into the test (6 minutes 43 seconds after burner output was increased to 300 kW)**


**Figure 14 The specimen 30 minutes 23 seconds into the test (15 minutes 23 seconds after burner output was increased to 300 kW)**


**Figure 15 The specimen 40 minutes into the test (25 minutes after burner output was increased to 300 kW) – burner turned off.**


**Figure 16 The specimen at the end of test.**

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