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 2

Job number: RTF220104

Test date: 15 December 2022 Revision: R2.0

[redacted]

Quality management

Revision	Date	Information about the report			
R2.0	8 June 2023	Description	Initial issue		
			Prepared by	Reviewed by	Authorised by
		Name	[redacted]	[redacted]	[redacted]
		Signature	[redacted]	[redacted]	[redacted]

Contents

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1. Introduction

This report documents the findings of the second 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. Thickness – 3.9 mm Skin thickness – 0.5 mm 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 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/m³
	Manufacturer/Supplier	Pricewise Insulation
12.	Item name	50 mm thick aluminium - with fibre-glass mesh - foil faced rockwool insulation
	Density of core	40 kg/m³
	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

Item	Description	
	Size	10g × 16 mm long
	Installation	Used to fix aluminium angles (item 6) to the aluminium frame (item 5) 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.
	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. 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	19 °C
	Minimum temperature	17 °C
	Maximum temperature	19 °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. • 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. • 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 0-50 kW/m^2. • 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. • 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 two 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.

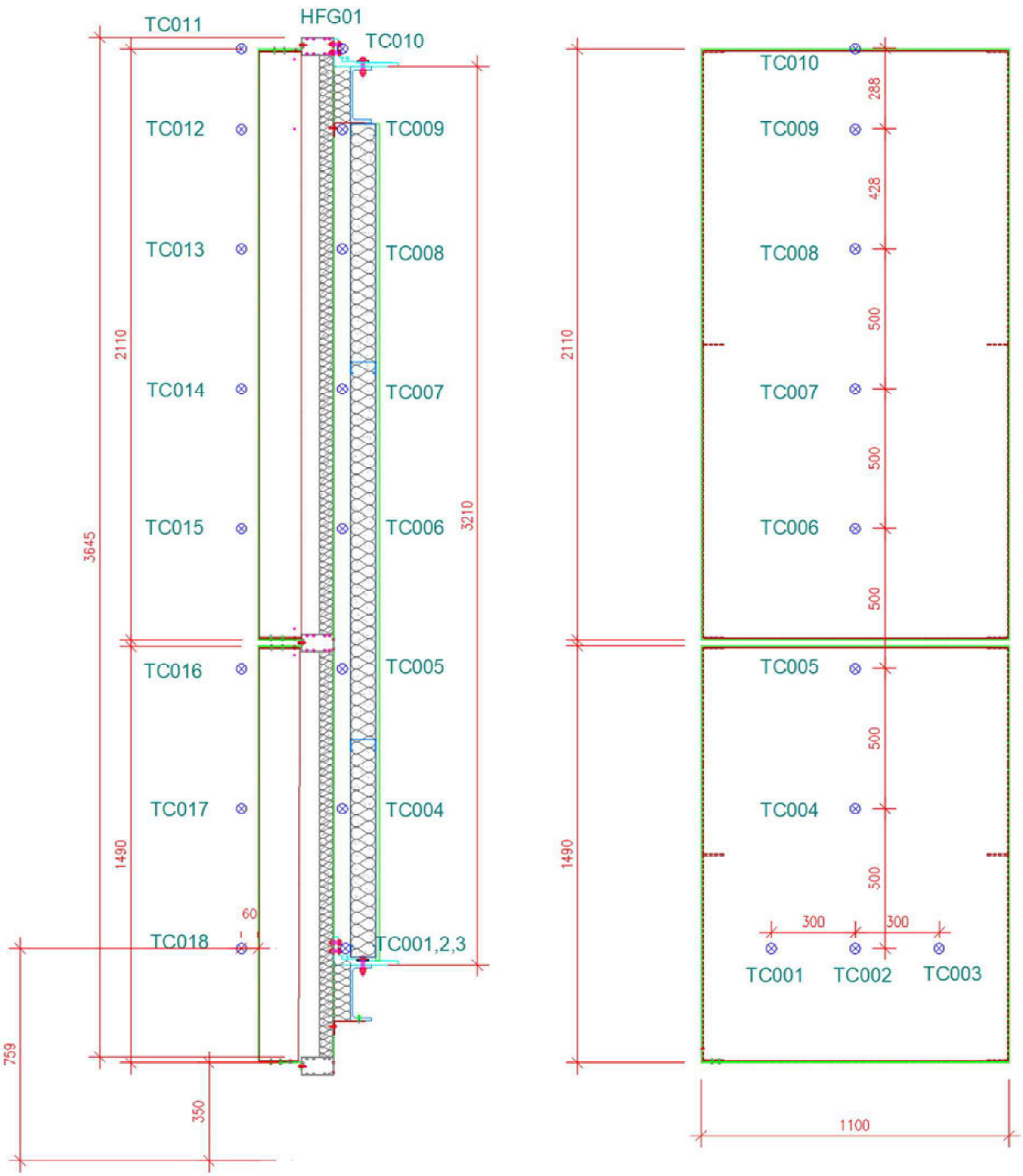

Figure 1 Instrumentation location

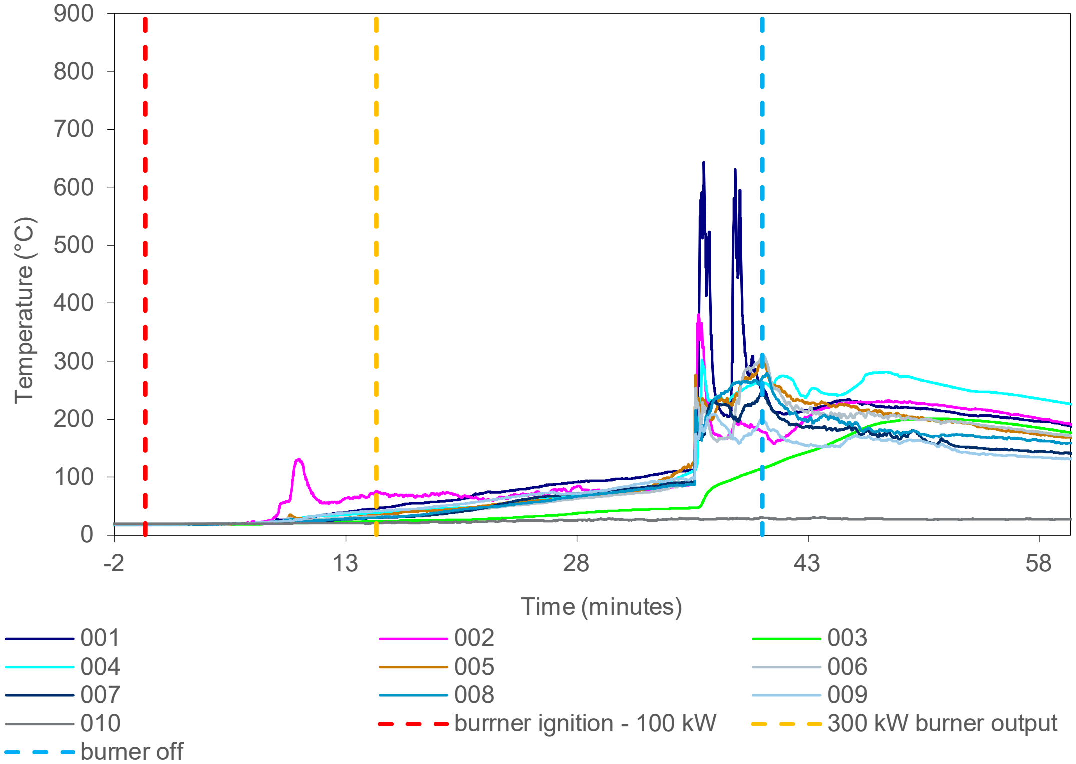

Figure 2 **Internal temperature data collected by thermocouples placed within the cavity – between the internal and external segments of the specimen.**

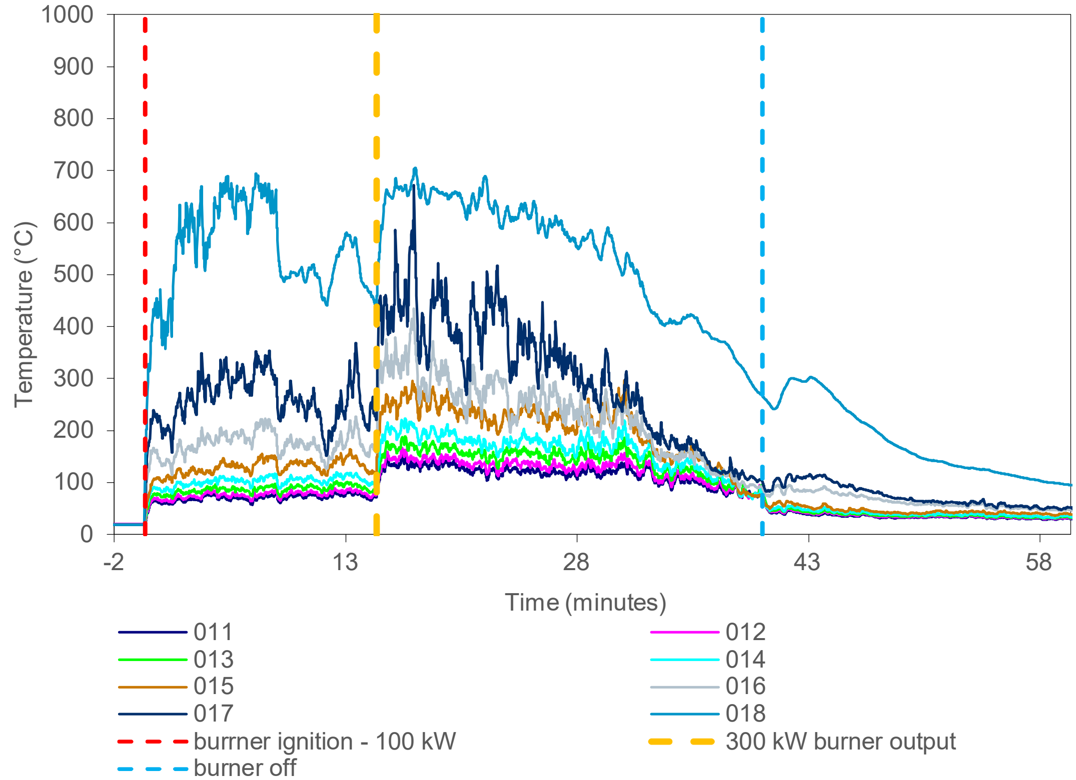

Figure 3 **External temperature data collected by thermocouples placed 60 mm from the front face of the specimen.**

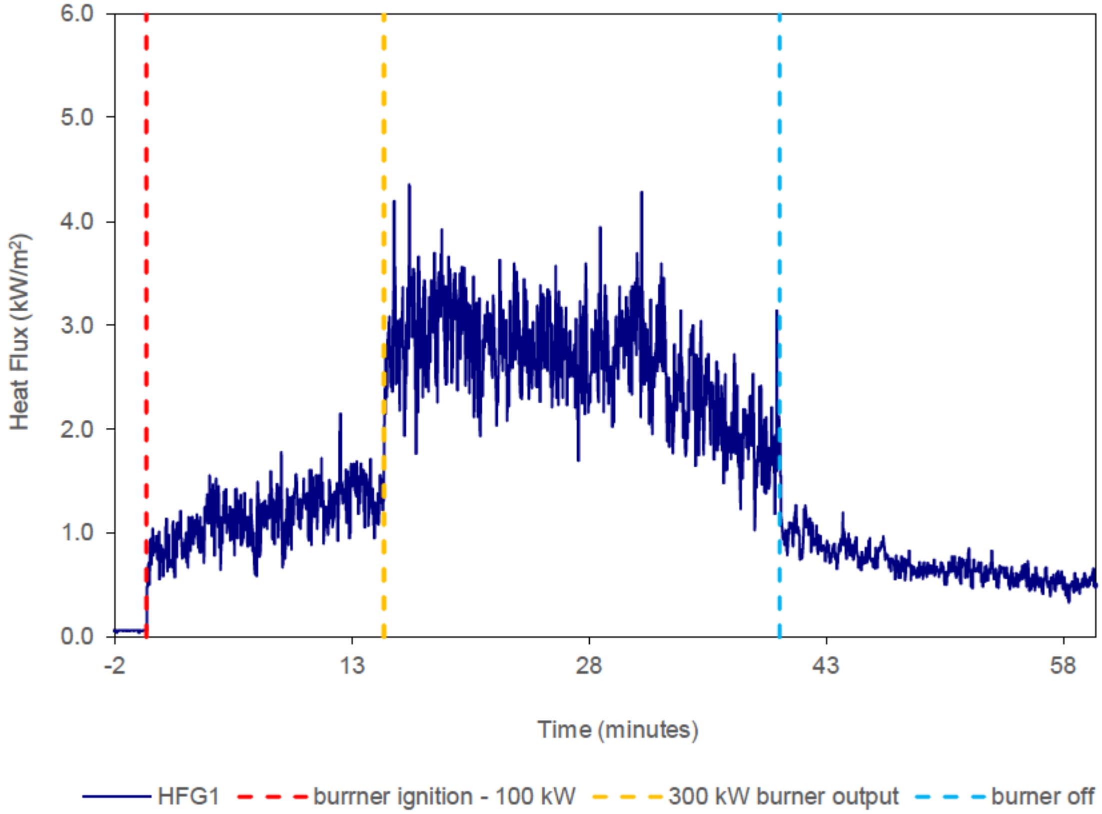

Figure 4 Heat flux data collected by heat flux gauges.

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	40	The bottom ACP started to discolour.
1	45	Discolouration extended further up the ACP.
2	51	The bottom edge of the bottom panel had bowed/deformed slightly.
3	33	Molten flaming debris was dripping from the west corner.
4	30	The bottom ACP had discoloured all over.
7	15	There was a lot of emitting on the unexposed side along the bottom edge of the plasterboard.
9	00	There was a sudden pop (release of gas) from the bottom ACP.
13	42	Flames were intermittently spreading up the west edge of the ACPs reaching the horizontal join.
15	00	The burner output was increased to 300 kW.
15	30	There was discolouration of the bottom section of the upper ACP.
16	50	There was flaming along the bottom east vertical edge.
17	40	There was a lot of flaming along the bottom west vertical edge.
18	40	Sections of the bottom ACP core was falling out of the bottom of the panel.

Time		Observation
Min	Sec	
22	00	There was molten flaming coming from the bottom west corner.
25	00	Both vertical edges of the bottom ACP were still flaming.
29	00	There was flaming at the horizontal join on the west side.
29	30	The was flaming up the vertical edges of the top ACP almost to halfway.
32	10	There was flaming up the east vertical edge reaching the top of the specimen.
37	40	There was flaming molten material dripping to the ground from the unexposed side from behind the plasterboard.
39	20	There is flaming at the top east corner of the specimen. Flaming occurred at the top of the aluminium mullion/framing. It was considered that the fire originated from below and travelled up the mullion and flamed above due to a chimney effect. The flaming was not considered to be due to the top ACP catching fire.
40	00	The burner was turned off.
40	30	There is still flaming along both the vertical edges and along the horizontal join. Molten debris still continues to fall. Molten debris continues to burn on the floor.
41	00	Flaming at the top of the specimen – i.e. top of the mullion - has ceased.
41	13	Jets of flames came out from the ACP on the east bottom edge for approximately 1 minutes
42	20	Flaming at the horizontal join has ceased.
42	40	The remaining flaming is diminishing.
53	08	The last instance of flaming within the ACP cavity was recorded.
60	00	There were no visible signs of flaming internally of the specimen. There was visible flaming externally of the specimen as flaming debris on the floor. 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.

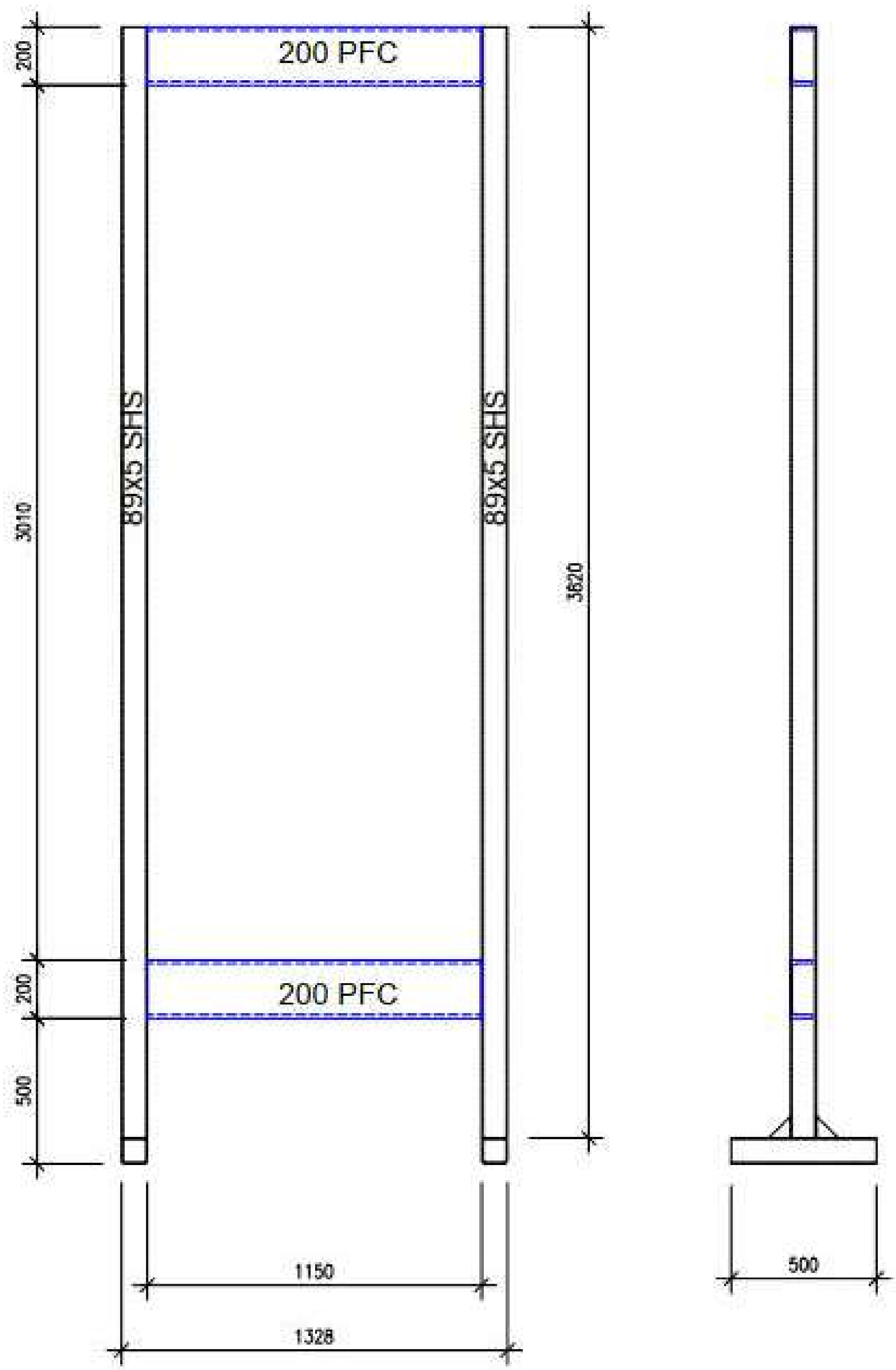

Figure 5 Elevation of rig support.

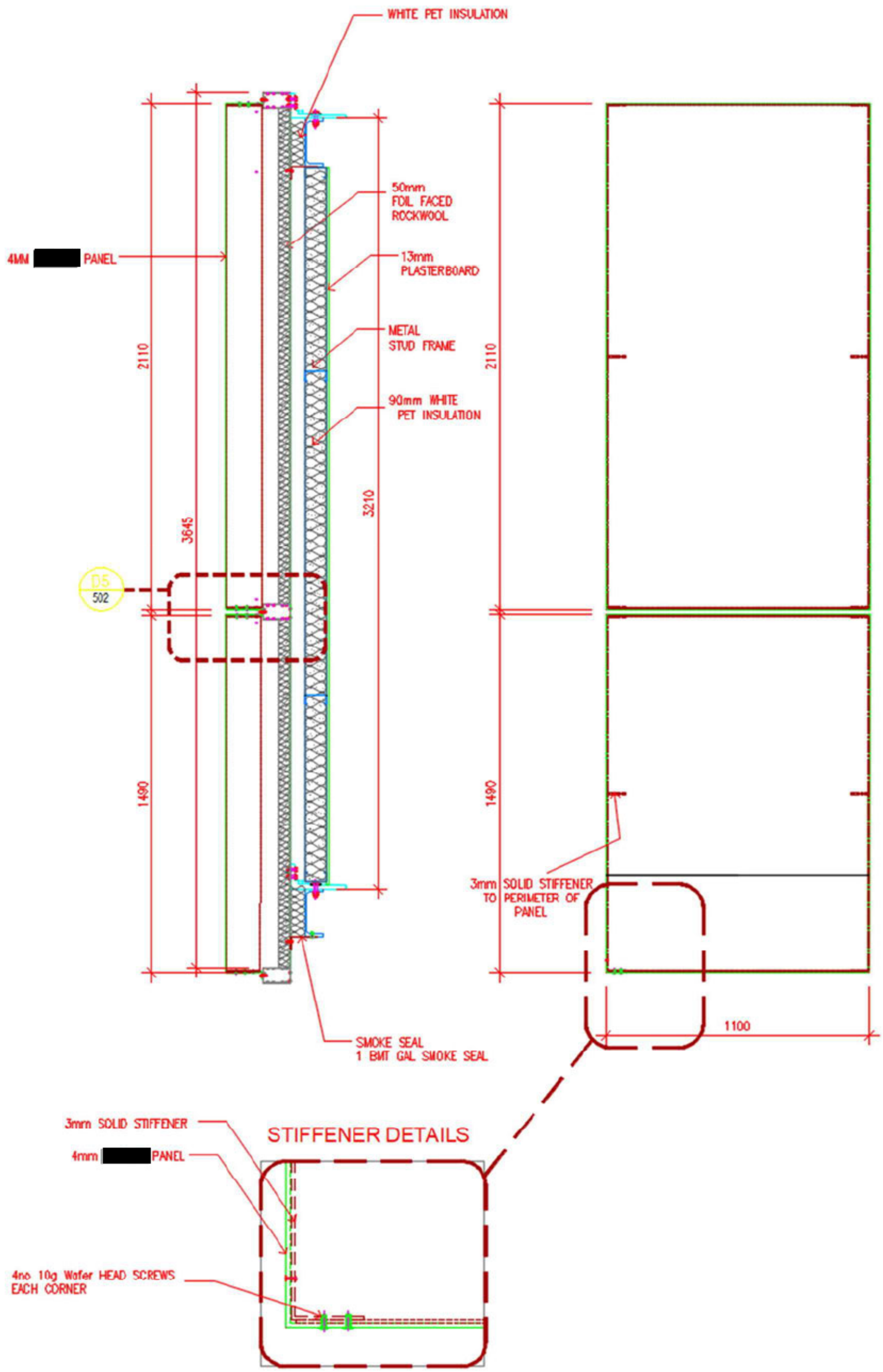

Figure 6 System assembly – Front and side view

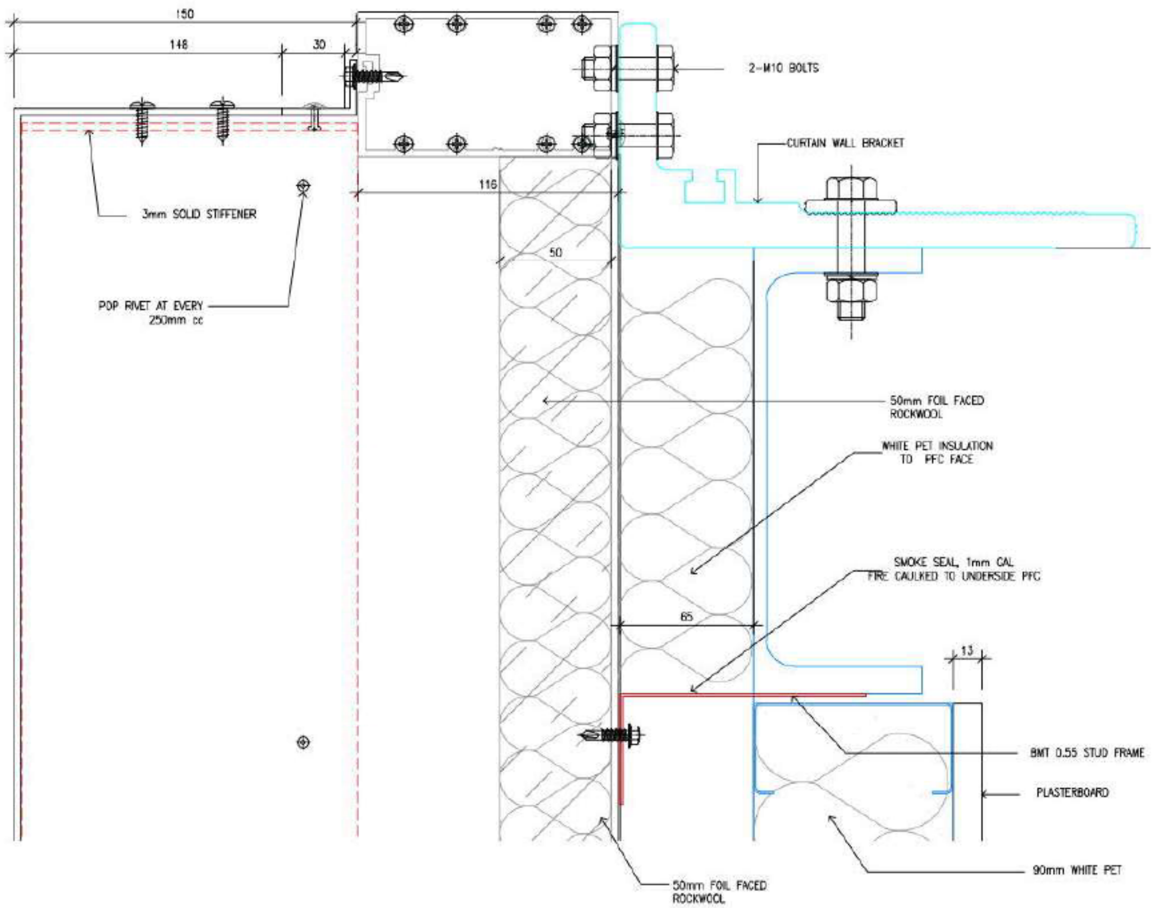

Figure 7 System assembly – top edge detail

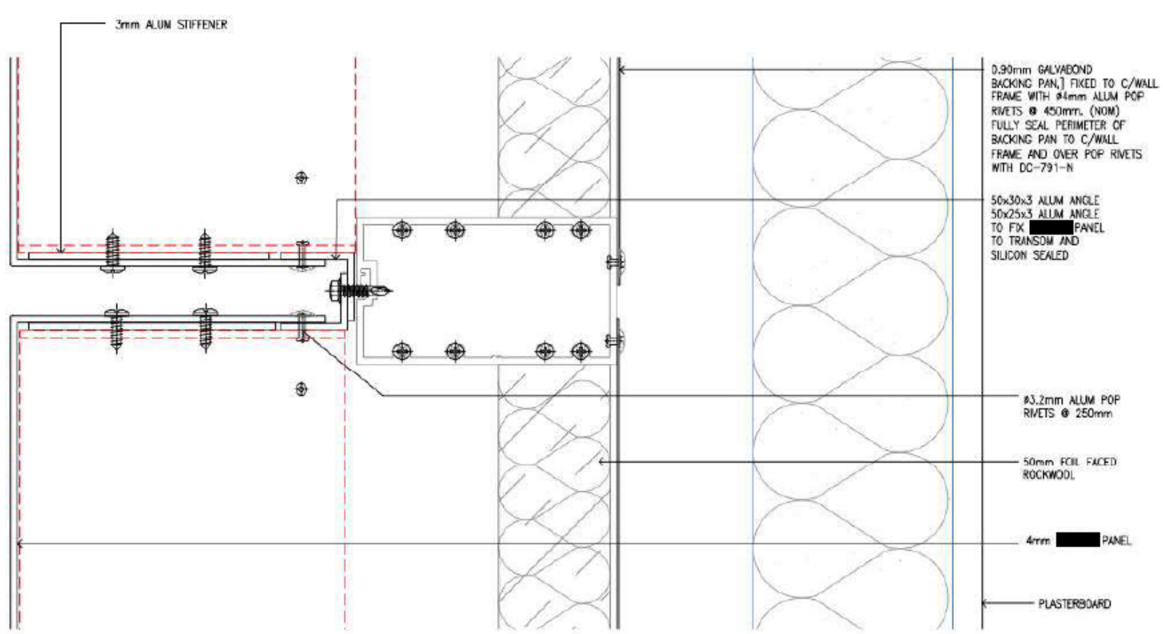

Figure 8 System assembly – middle join detail (D05)

Appendix B Photographs

Figure 9 The specimen before the reaction to fire test

Figure 10 The specimen 3 minutes 1 second into the test (burner output at 100 kW)

Figure 11 The specimen 13 minutes 2 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)

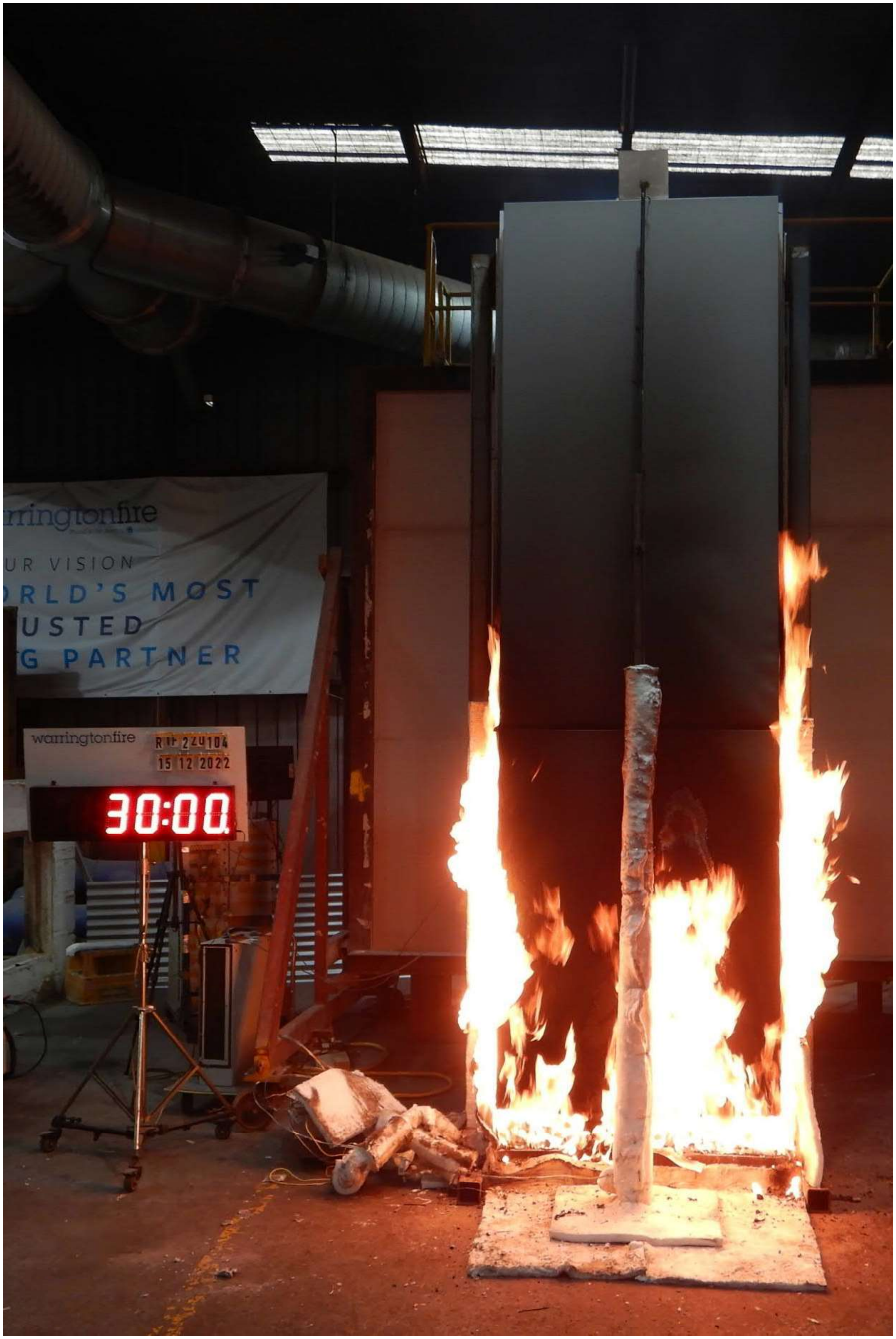

Figure 13 The specimen 30 minutes into the test (15 minutes after burner output was increased to 300 kW)

Figure 14 The specimen 40 minutes 1 second into the test (25 minutes 1 second after burner output was increased to 300 kW) – burner turned off.

Figure 15 The specimen at the end of test.

warringtonfire
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Global locations

Warringtonfire Australia Pty Ltd
ABN 81 050 241 524

Perth

Suite 4.01, 256 Adelaide Terrace
Perth WA 6000
Australia
T: +61 8 9382 3844

Canberra

Unit 10, 71 Leichhardt Street
Kingston ACT 2604
Australia
T: +61 2 6260 8488

Melbourne

WeWork Level 4, 152 Elizabeth Street
Melbourne VIC 3000
Australia
T: +61 3 9767 1000

Sydney

Suite 802, Level 8, 383 Kent Street
Sydney NSW 2000
Australia
T: +61 2 9211 4333

Brisbane

Suite B Level 6, 133 Mary Street
Brisbane QLD 4000
Australia
T: +61 7 3238 1700
[redacted]

Melbourne – NATA accredited laboratory

409-411 Hammond Road
Dandenong South VIC 3175
Australia
T: +61 3 9767 1000