Reaction to fire test report

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

Test sponsor: Cladding Safety Victoria (CSV)

System: Rendered EPS external façade cladding system

Job number: RTF240044

Test date: 2 August 2024 Revision: RR1.0

WARRINGTONFIRE AUSTRALIA
A Jensen Hughes Company

Quality management

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

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1. Introduction

This report documents the findings of test one of three ad-hoc reaction to fire tests for a rendered EPS external wall cladding system performed on 2 August 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	
Cladding		
1.	Item name	EPS panel
	Product name	[redacted]
	Manufacturer	[redacted]
	Supplier/Installer	[redacted]
	Material	M-grade EPS (expanded polystyrene)
	Size	2400 mm wide × 1200 mm tall × 75 mm thick (uncut)
	Areal mass	18.5 kg/m²
	Colour	White
2.	Item name	Weatherproof wrap
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Synthetic polyester-based wall wrap
	Thicknesses	0.2 mm thick (measured)
	Batch	231052402
	Areal mass	0.099 kg/m²
	Colour	White with blue print
	Installation	Cut to size, applied directly over the steel stud framework, with a nominal 200 mm overlap.
3.	Item name	Flashing tape
	Product name	[redacted]

Item	Description	
	Manufacturer	[redacted]
	Material	Bituminous adhesive window flashing tape
	Size	75 mm wide × 0.5 mm thick
	Colour	Silver
	Installation	Over the joint in the weatherproof wrap.
4.	Item name	Render base coat
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Cement based polymer modified render
	Thicknesses	Nominally 5 mm thick
	Batch	280602
	Density	1850 kg/m^3
	Colour	Grey
	Installation	A layer of base coat was applied to the exposed face, the sides, and the top of the EPS. Reinforcing mesh (item 7) was pressed into the first layer of base coat on the exposed face of the EPS, and a skim coat of base coat was applied over the top of it to achieve a total nominal thickness of 5 mm.
5.	Item name	Render texture coat
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Acrylic topcoat
	Thicknesses	Nominally 3 mm thick
	Density	1470 kg/m^3
	Colour	Light Grey
	Installation	One coat applied 6 days after the first coat.
6.	Item name	Membrane coat
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Water based acrylic coating
	Thicknesses (per coat)	Nominally 0.165 mm (wet) Nominally 0.075 mm (dry)
	Batch date	15 July 2024
	Colour	White
	Installation	Applied to the exposed face of the specimen over the top of the texture coat. Two coats were applied using a paint roller.
7.	Item name	Reinforcing mesh
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Fibreglass
	Thicknesses	0.45 mm thick

Item	Description	
	Areal density	0.167 kg/m^2
	Colour	White
8.	Product name	Starter channel
	Material	Aluminium
	Size	0.6 mm thick × 80 mm wide × 43 mm tall (unexposed side), 27 mm tall (exposed side) (measured)
	Installation	Attached to the bottom edge of the bottom panel before it was mounted onto the backing framework. A layer of joint sealant (item 16) was applied into the channel before it was attached to the panel.
9.	Product name	External angle corner bead
	Material	Aluminium
	Size	32 mm × 32 mm × 0.37 mm thick
	Installation	Embedded into the EPS panels before the first coat of render was applied, and held in place using nails (item 21). Located around the exposed side perimeter edges of the of the specimen, at the sides and top.
10.	Item name	Calcium silicate board
	Product name	[redacted]
	Manufacturer	[redacted]
	Size	2440 mm long × 1220 mm wide × 20 mm thick (uncut)
	Batch number	BA900232 1809001818014001
11.	Item name	Fire rated plasterboard
	Product name	[redacted]
	Manufacturer	[redacted]
	Size	3600 mm long × 1200 mm wide × 13 mm thick (uncut)
	Batch number	9314450006293
Framing		
12.	Item name	Tracks
	Product name	[redacted]
	Manufacturer	[redacted]
	Size	92 mm wide × 36 mm flange × 1.15 BMT
	Batch	932584200394
13.	Item name	Studs
	Product name	[redacted]
	Manufacturer	[redacted]
	Size	92 mm wide × 36 mm flange × 1.15 BMT
	Batch	932584200817
14.	Item name	Noggings
	Product name	[redacted]
	Manufacturer	[redacted]
	Size	92 mm wide × 36 mm flange × 1.15 BMT

Item	Description	
	Batch number	932584200860
Angles		
15.	Item name	Flashing
	Manufacturer	[redacted]
	Material	Galvanised steel Z275
	Size	150 mm tall × 175 mm deep × 1500 mm long × 0.55 mm thick
	Installation	Installed against the underside of the specimen.
Sealant/Adhesive		
16.	Item name	Joint sealant (flexible foam)
	Product name	[redacted]
	Manufacturer	[redacted]
	Material	Polyurethane foam
	Batch	2304357832
	Installation	Inside the starter channel (item 8), applied before the channel was mounted onto the bottom of the EPS panel (item 1), and inside the 10 mm gap between the upper and lower EPS panels.
Fixings		
17.	Item name	Framing screws
	Size	10g × 16 mm, flathead, self-drilling screws
	Manufacturer	[redacted]
	Installation	Used to fix the 92 mm framing together.
18.	Item name	Plasterboard screws
	Description	6g × 32 mm, bugle head, drill point, fine thread screws
	Manufacturer	[redacted]
	Installation	Used to fix the calcium silicate boards to the steel framing together at 300 mm centres.
19.	Item name	Square drive bugle head screws
	Size	10.12 × 100 mm long
	Manufacturer	[redacted]
	Material	Class 3 coated steel
20.	Item name	Nylon washers
	Size	Ø 48 mm
	Manufacturer	[redacted]
	Material	Red coloured nylon
21.	Item name	Nails
	Material	Galvanised steel
	Size	30 mm long × 2.8 mm
	Manufacturer	[redacted]
	Installation	To fix the external angle corner beads (item 9) to the EPS panel (item 1).

Item	Description	
Moisture content of render		
The moisture content of the cured render composition was calculated to be 2.7%.		
Installation method		
Specimen wall frame	The specimen wall frame consisted of steel framing (items 12, 13 and 14) fixed together using framing screws (item 17). It was clad on the back face with plasterboard (item 11) secured at 300 mm centres with board screws (item 18).	
Blanking walls	The test rig blanking walls consisted of three sperate assemblies of steel framing (items 12, 13 and 14) and fixed together using framing screws (item 17) and clad on the fire exposed side with calcium silicate board (item 10). 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
Rendered EPS cladding	The steel frame was flashed with weatherproof wrap (item 2), such that the horizontal joint between the sheets of weatherproof wrap had a minimum overlap of 200 mm, and tape (item 3) over the joint. The EPS panels were cut to size. An aluminium starter channel (item 8) was installed at the bottom of the bottom panel using joint sealant (item 16) to adhere it in place. The EPS panels were mounted onto the flashed steel frame and screw fixed through the exposed face to the studs, using bugle head screws (item 18) and nylon washers (item 20) at 400 mm centres. A 10 mm gap was left between the top and bottom EPS panels, which was filled with joint sealant (item 16). Nails (item 21) were used to fix the external angle corner beads (item 9) to the side and top exposed side edges of the EPS. A layer of base coat (item 4) was applied to the exposed face, the sides, and the top of the EPS. Reinforcing mesh (item 7) was pressed into the base coat on the exposed face of the EPS, and a skim coat of base coat was applied over the top of it to achieve a total nominal thickness of 5 mm from the face of the EPS. After the base coat had cured, a nominally 3 mm thick texture coat (item 6) was applied to the exposed face. Once the texture coat had cured, two coats of membrane coating were applied to the exposed face, using a paint roller.	

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 - 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. The instrumentation used to collect and analyse the products of combustion was based on ISO 9705-1:2016.	
Supplementary standards	• AS ISO 9705:2003 (R2016) • ISO 9705-1:2016	
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.	
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 exposed face of the test specimen before the test)	
Test duration	60 minutes	
Instrumentation and equipment	• 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 14 and Figure 15 for details on positioning. • 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 14 and Figure 15 for details on positioning. • 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 a depth of 40 mm from the unexposed face of the cladding of the test specimen. Refer to Figure 14 and Figure 15 for details on positioning. • 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. • 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^2. • 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. • 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.	

Item	Detail
	• Smoke obscuration measurements were made using a helium-neon laser smoke photometer, as outlined in Annex H of ISO 9705-1:2016. • The temperature of the exhaust stream near the light beam was measured using a type K MIMS thermocouple. • 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. • 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. • 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.
System response	• A step calibration was carried out to determine the system response time. The gas burner was placed centrally and 1 m below the exhaust hood and subjected to a stepwise change in heat release shown in Table 4. Data from instruments was collected and analysed every 3 seconds. • 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 ± 5% for each level of heat output – and therefore complied with the requirements of Section 10.1 of AS ISO 9705:2003 (R2016). • 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 24 s
Test procedure	• 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. • 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.

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	101.5	100.0	-1.5%	27
2-3	300	299.8	302.1	0.8%	21
3-4	100	101.3	98.1	-3.2%	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.

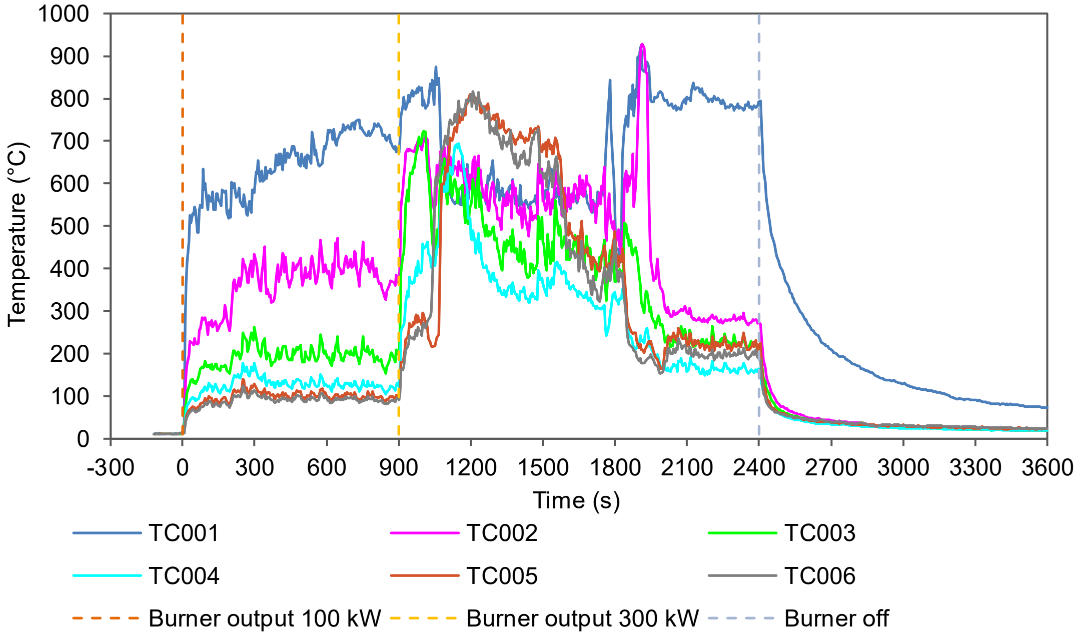

Figure 1 50 mm from the exposed face – Temperature vs time

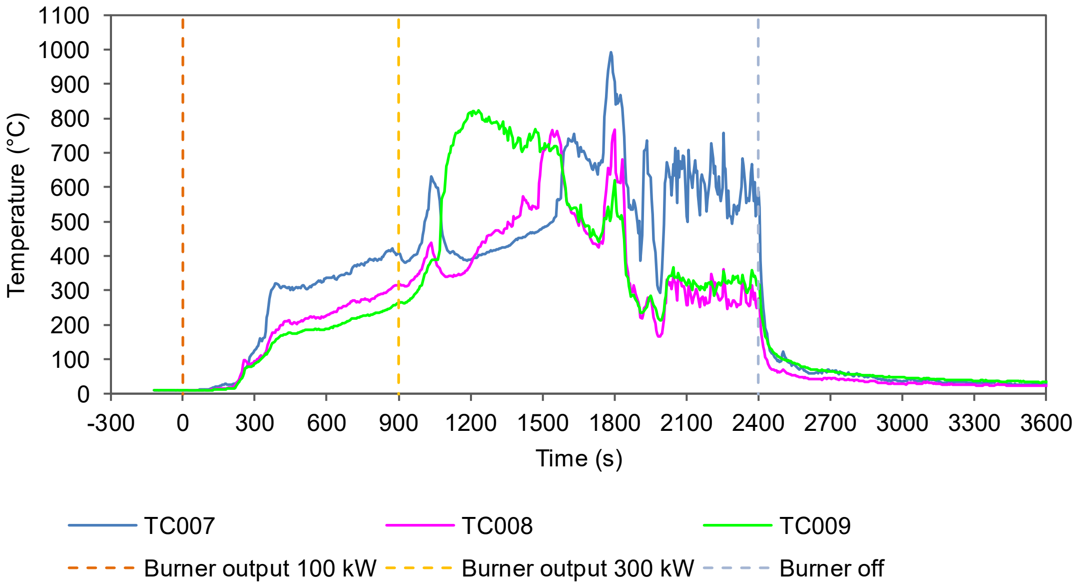

Figure 2 Cavity – Temperature vs time

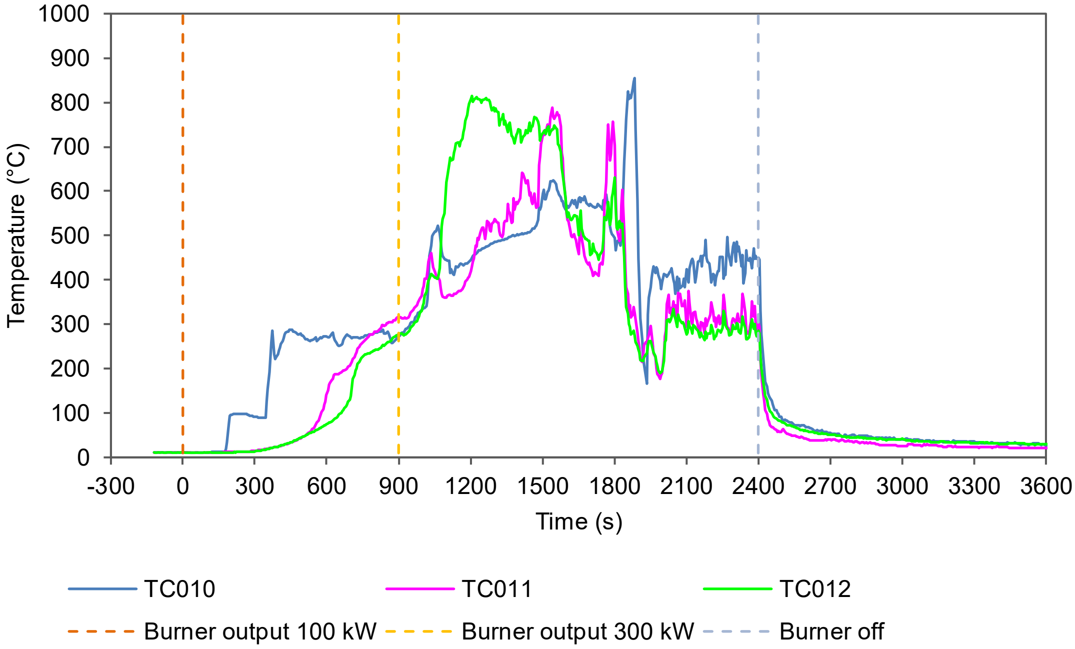

Figure 3 Embedded in the EPS, 40 mm from the unexposed face – Temperature vs time

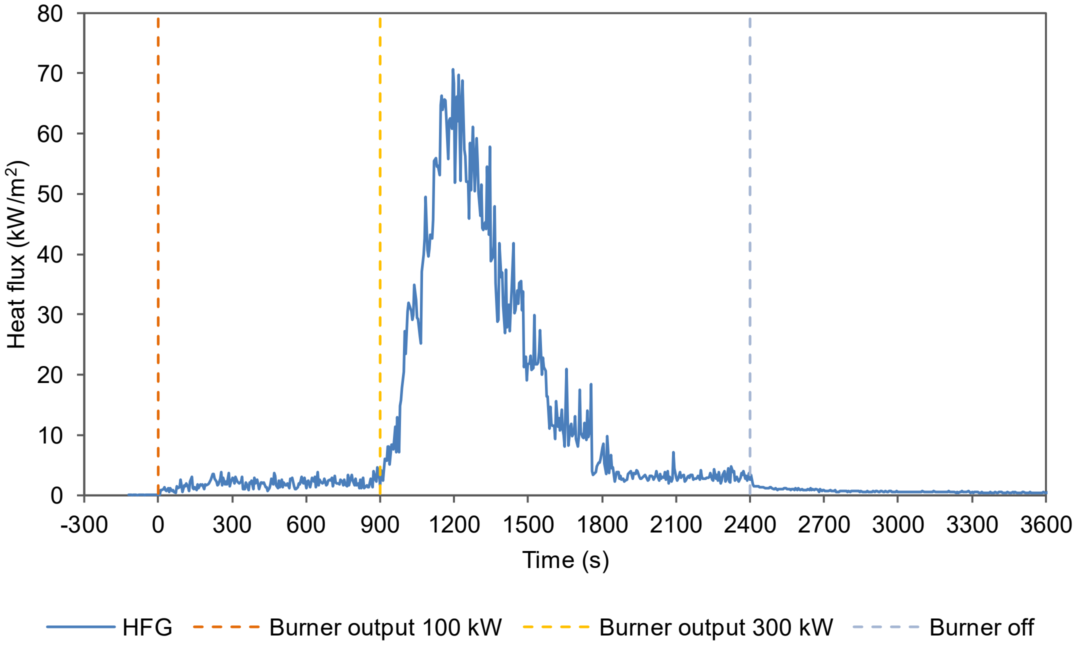

Figure 4 Heat flux vs time

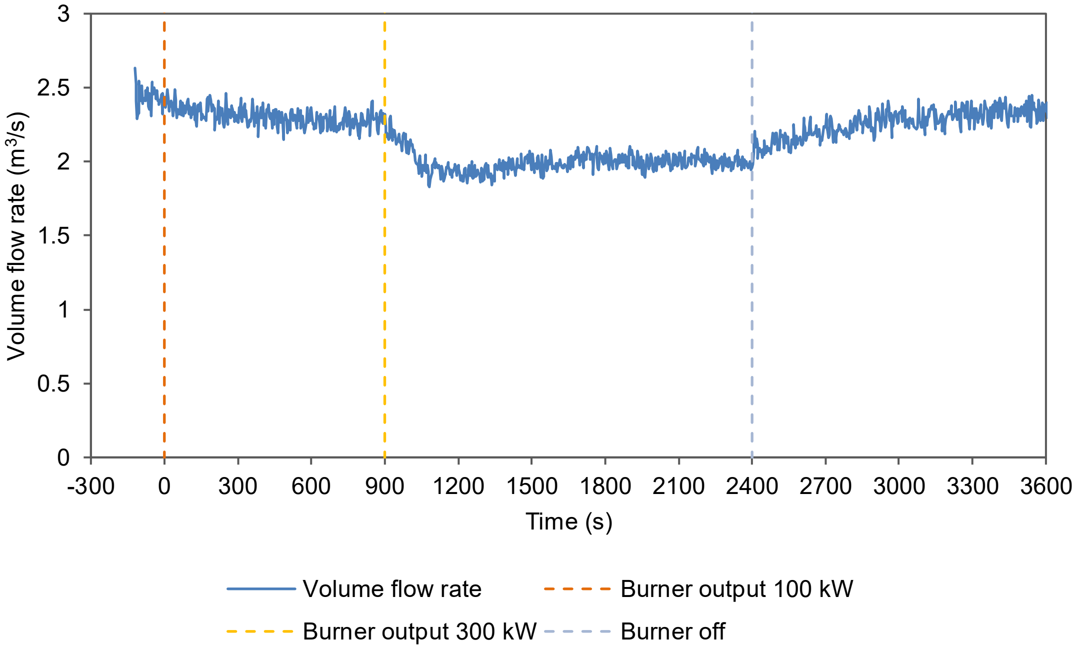

Figure 5 Volume flow rate in duct vs time

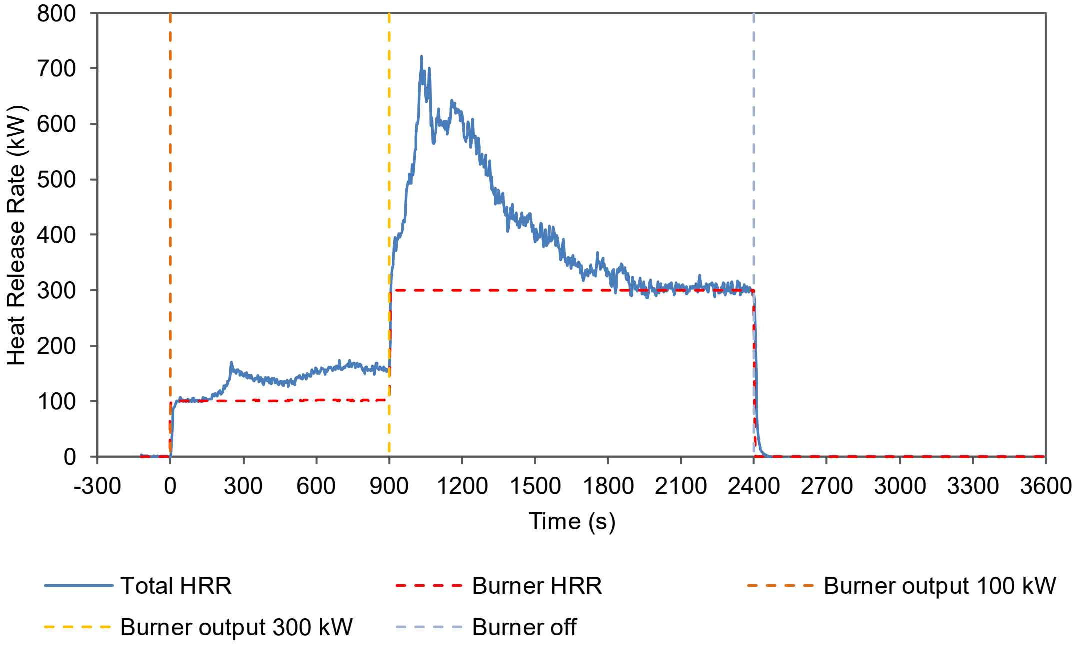

Figure 6 Heat release rate (HRR) of specimen and burner vs time

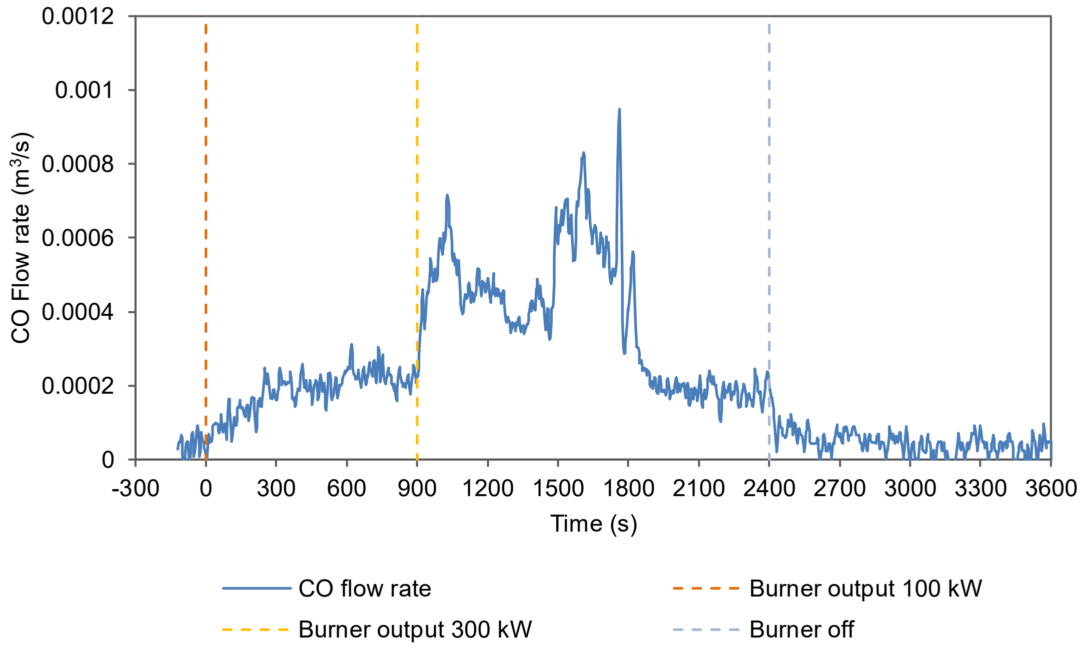

Figure 7 Production of carbon monoxide vs time, at reference temperature and pressure

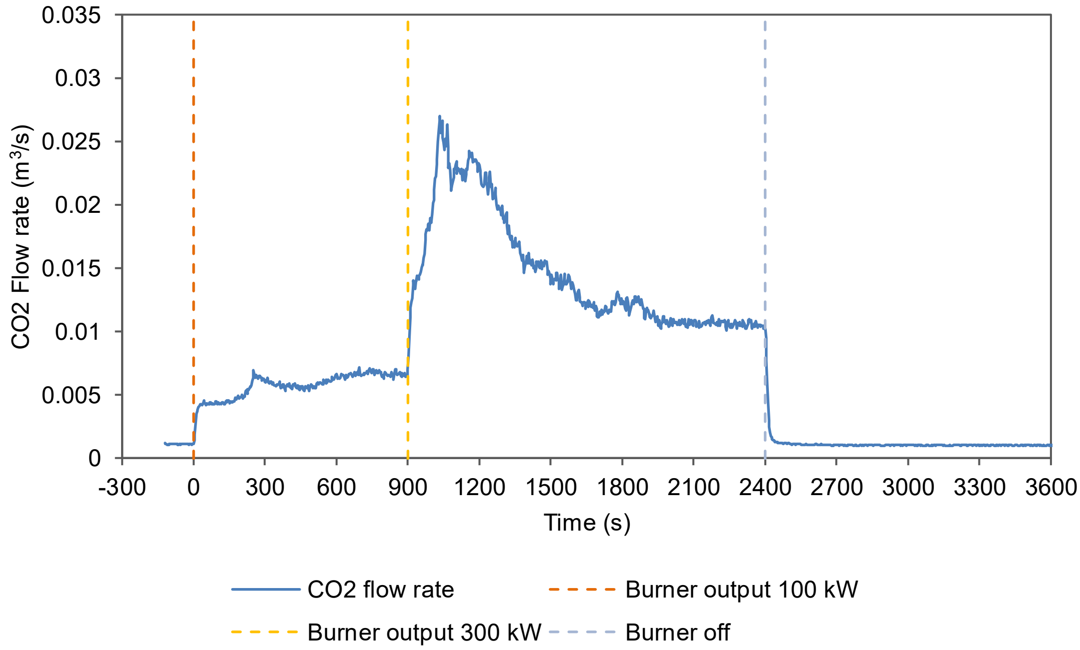

Figure 8 Production of carbon dioxide vs time, at reference temperature and pressure

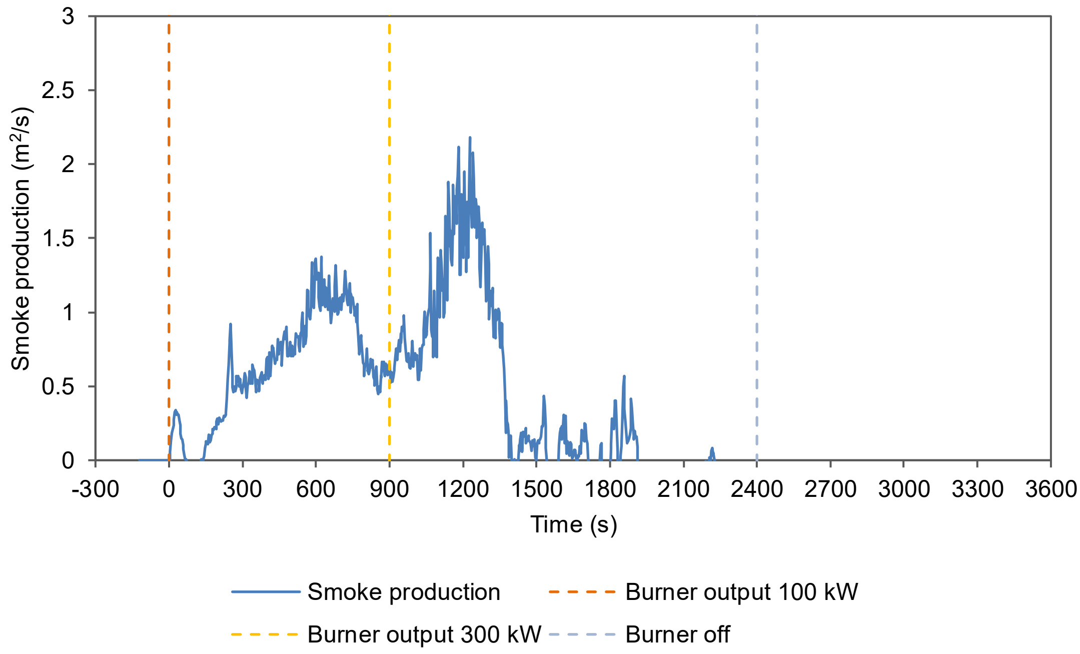

Figure 9 Production of light obscuring smoke vs time, at reference temperature and pressure

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.
0	24	Smoke was emitting from the bottom portion of the specimen.
0	57	The steel flashing below the specimen was becoming deformed.
1	26	The bottom portion of the specimen was becoming discoloured.
5	32	The bottom portion of the specimen was flaming.
6	43	Molten material dripped from the specimen onto and around the burner.
10	38	Flaming droplets fell from the bottom left corner of the specimen.
14	17	The lower left corner of the panel had deformed.
15	00	The heat output of the burner was increased to 300 kW.
16	47	The height of the flames was increasing, and the exposed face of the specimen was flaming.
17	25	The specimen was flaming independent of the burner.
17	45	The rendered face of the specimen fell and rested on the burner, remaining in one piece.
29	12	The rendered face of the specimen was degrading further and fell further downward.
30	33	The rendered face of the specimen continued to degrade.
32	12	The rendered face of the specimen crumbled onto the burner.
40	00	The burner was turned off.
40	50	The debris on the burner were flaming.
45	18	All flaming had stopped.
60	00	The reaction to fire test was ended.

Appendix B Drawings of test assembly

The drawings of the test assembly in Figure 10 to Figure 15 were prepared by the representatives of Warringtonfire. All measurements, unless specified, are in mm. The leaders in the drawings represent the items listed in section 2.1.

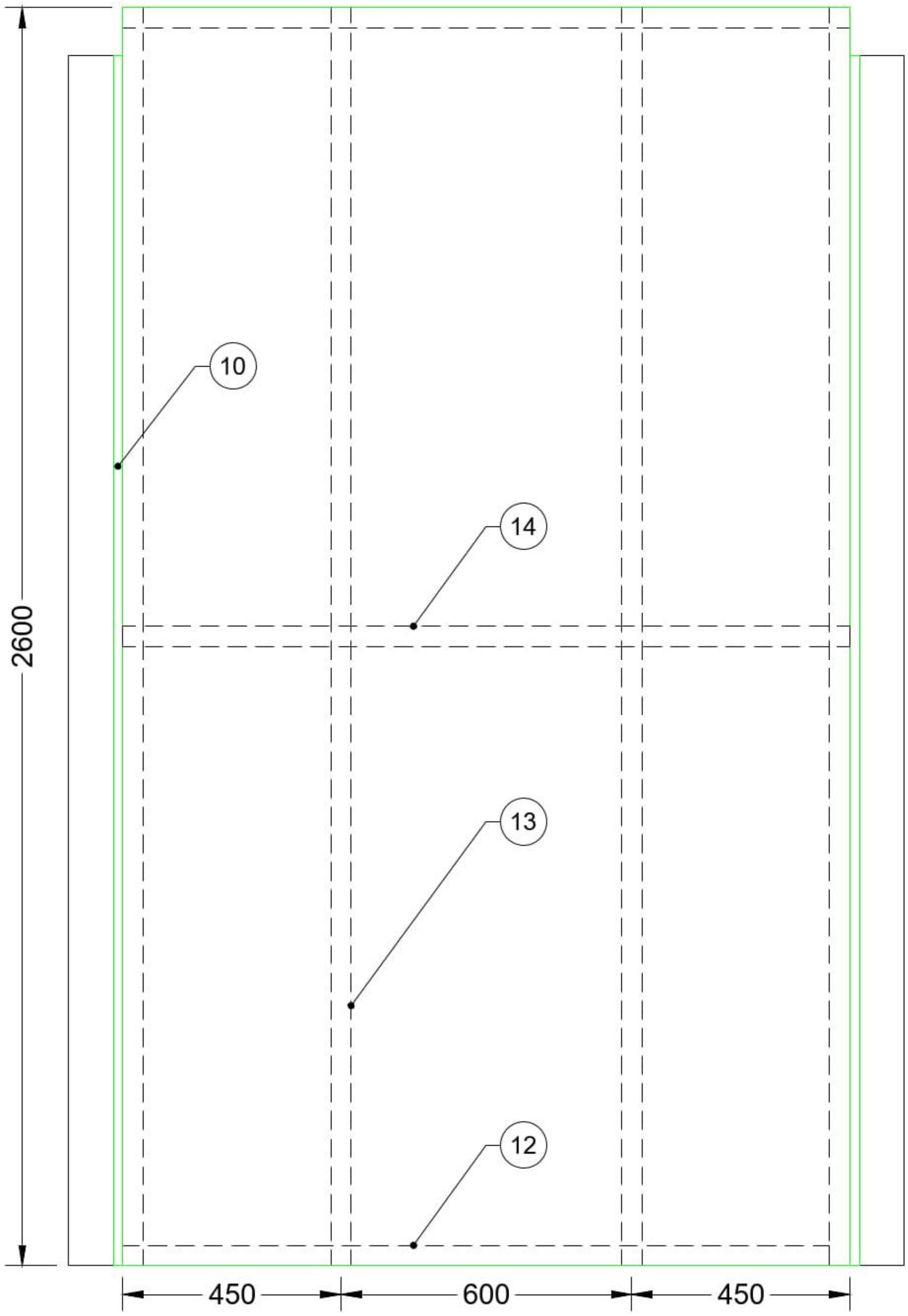

Figure 10 Elevation of rig support

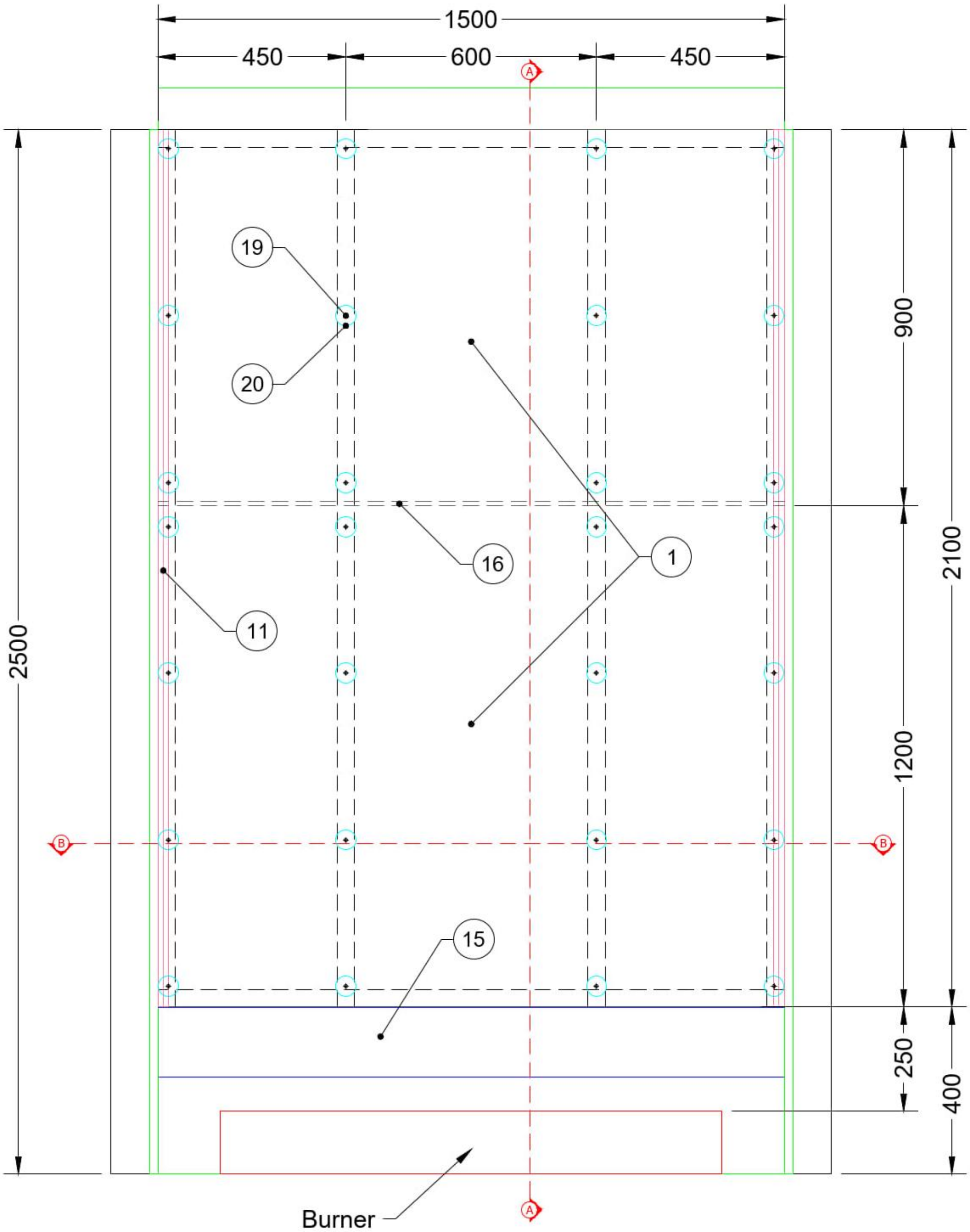

Figure 11 System assembly – Exposed side elevation

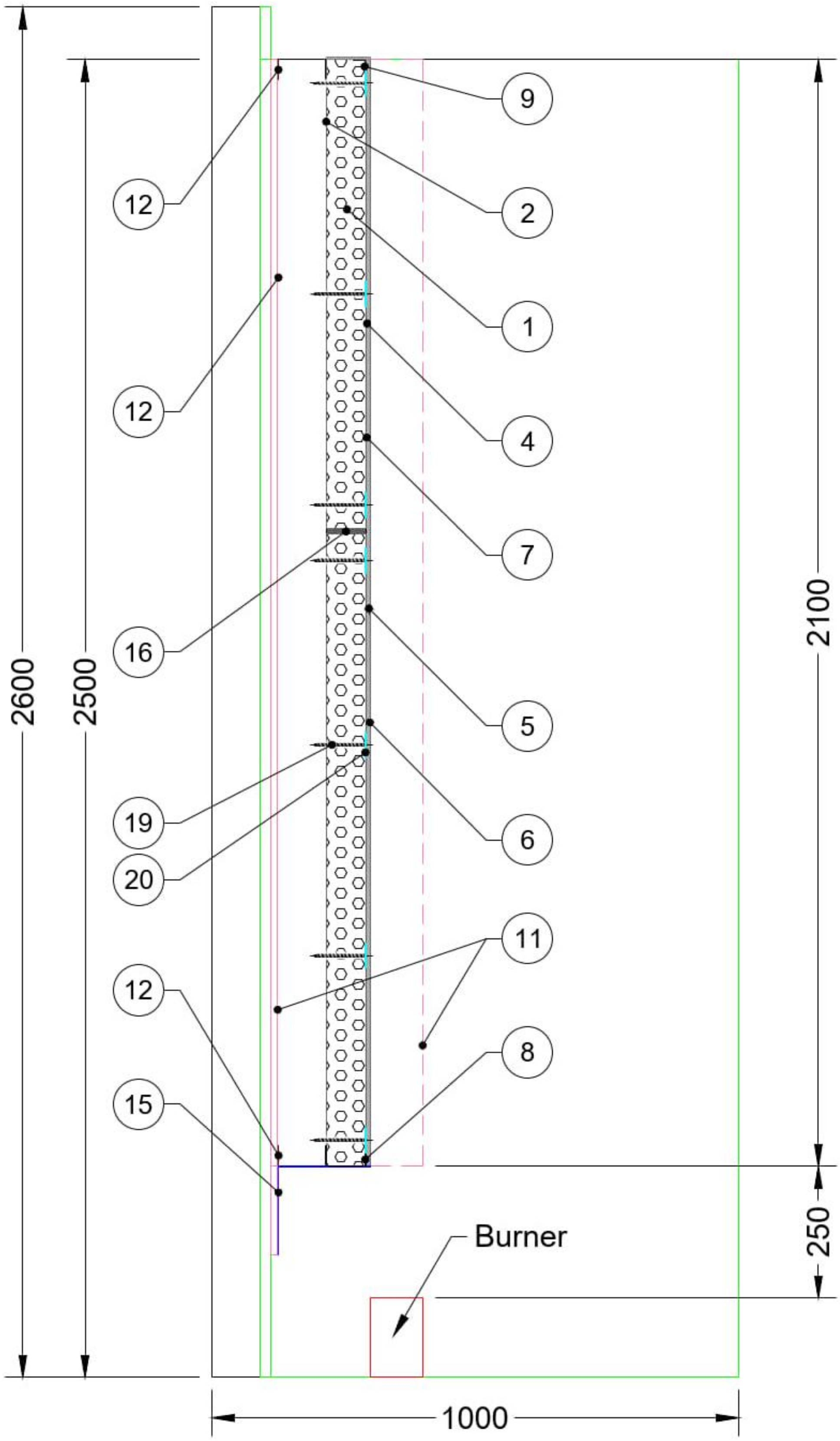

Figure 12 System assembly – Vertical cross-section A-A

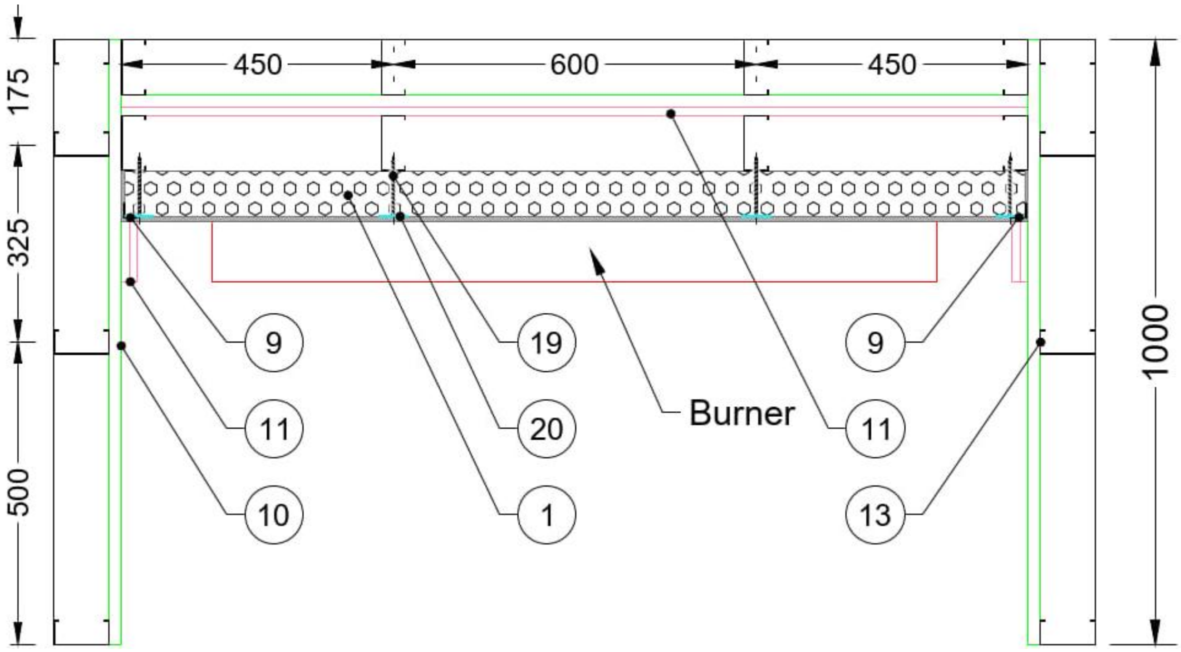

Figure 13 System assembly – Horizontal cross-section B-B

Appendix C Instrumentation locations

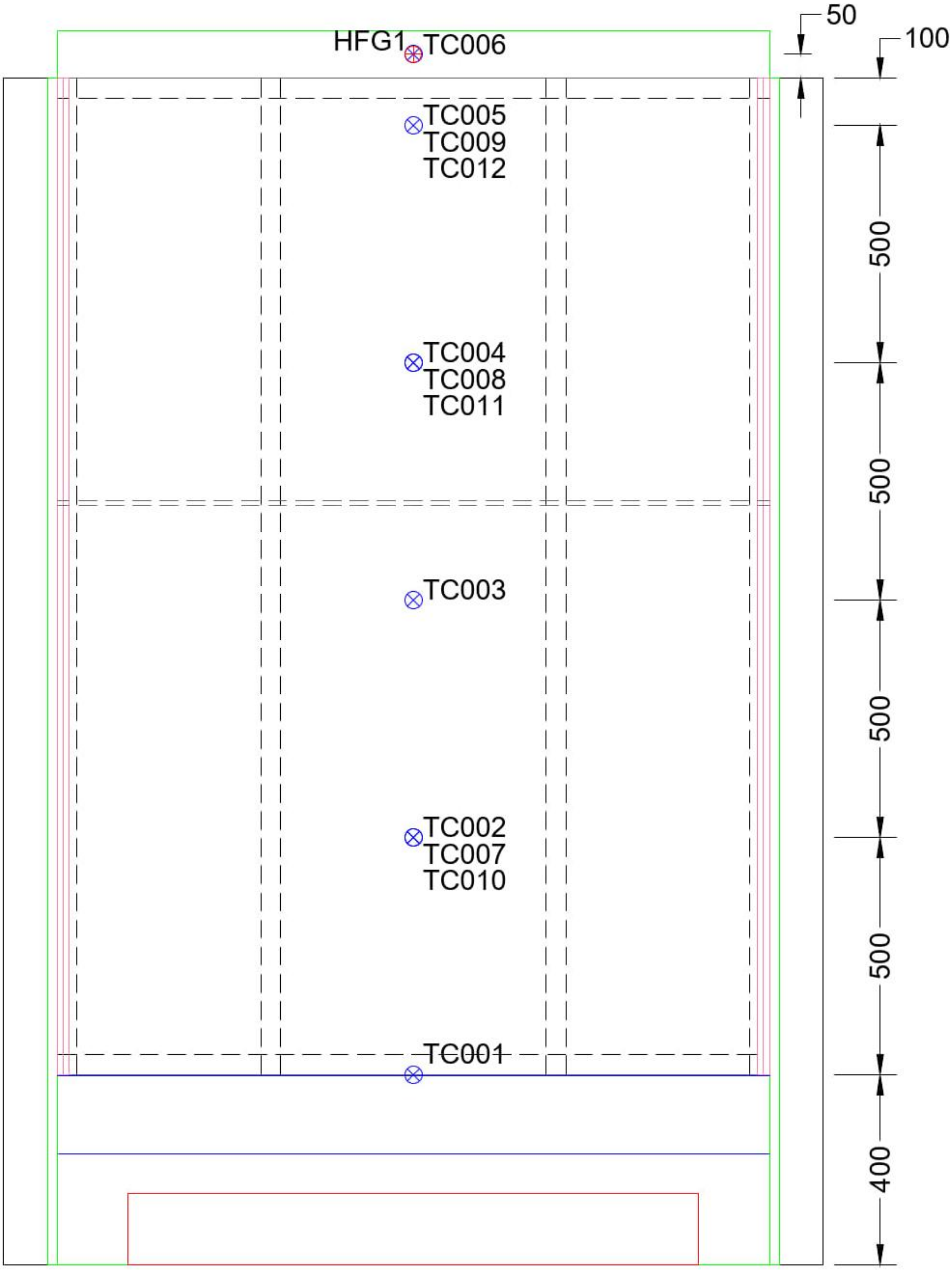

Figure 14 Instrumentation locations – Exposed side view

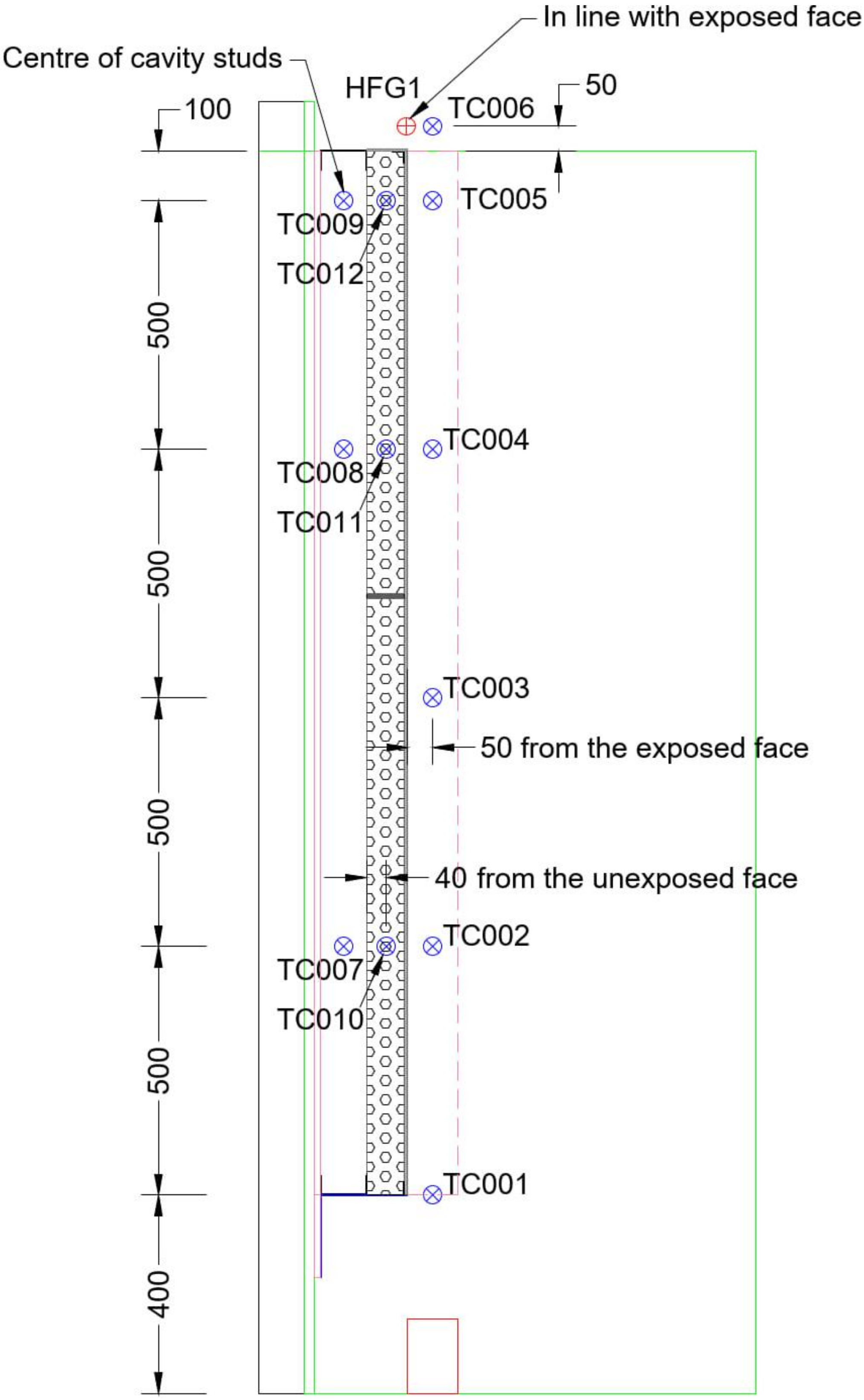

Figure 15 Instrumentation locations – Vertical cross-sectional view

Appendix D Photographs

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

Figure 17 The specimen before the reaction to fire test – unexposed side

Figure 18 The specimen 2 minutes 7 seconds into the test (burner output at 100 kW)

Figure 19 The specimen 9 minutes 26 seconds into the test (burner output at 100 kW)

Figure 20 The specimen 14 minutes 59 seconds into the test (burner output at 100 kW)

Figure 21 The specimen 15 minutes 27 seconds into the test (burner output at 300 kW)

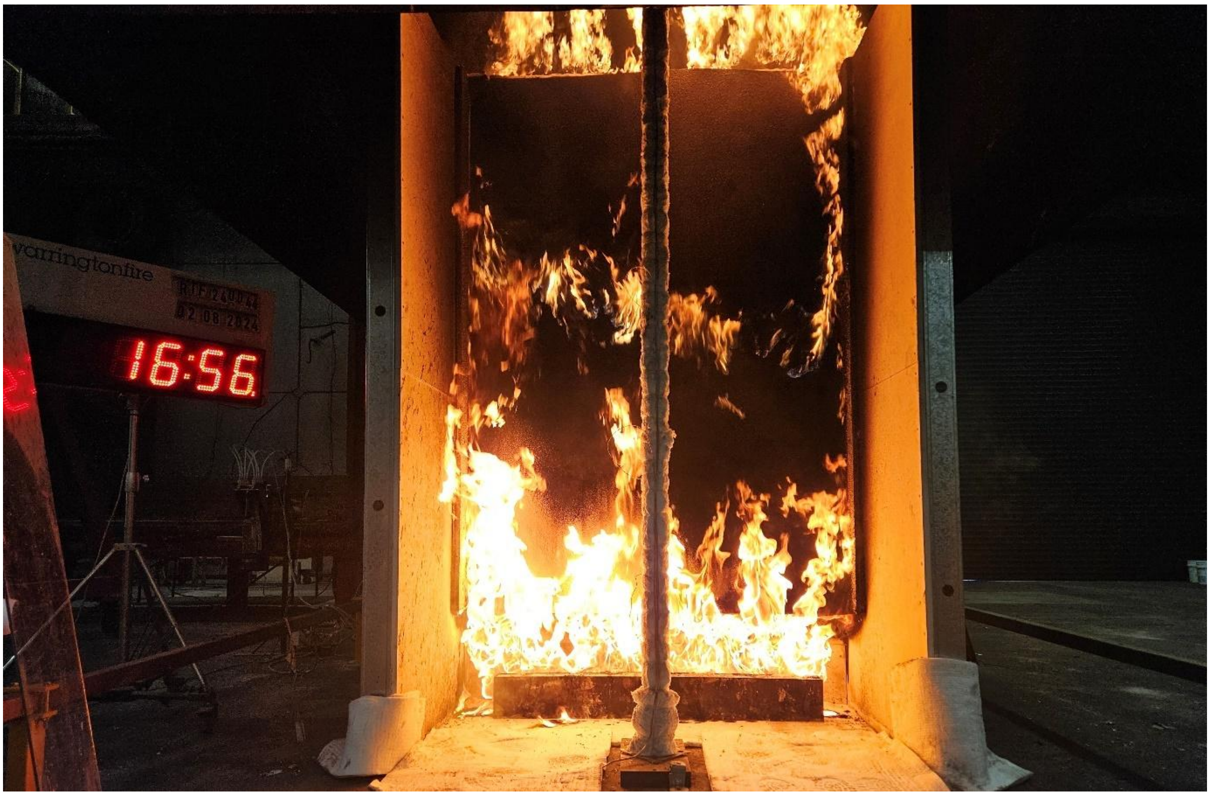

Figure 22 The specimen 16 minutes 56 seconds into the test (burner output at 300 kW)

Figure 23 The specimen 17 minutes 48 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 29 minutes 30 seconds into the test (burner output at 300 kW)

Figure 26 The specimen 31 minutes 35 seconds into the test (burner output at 300 kW)

Figure 27 The specimen 32 minutes 20 seconds into the test (burner output at 300 kW)

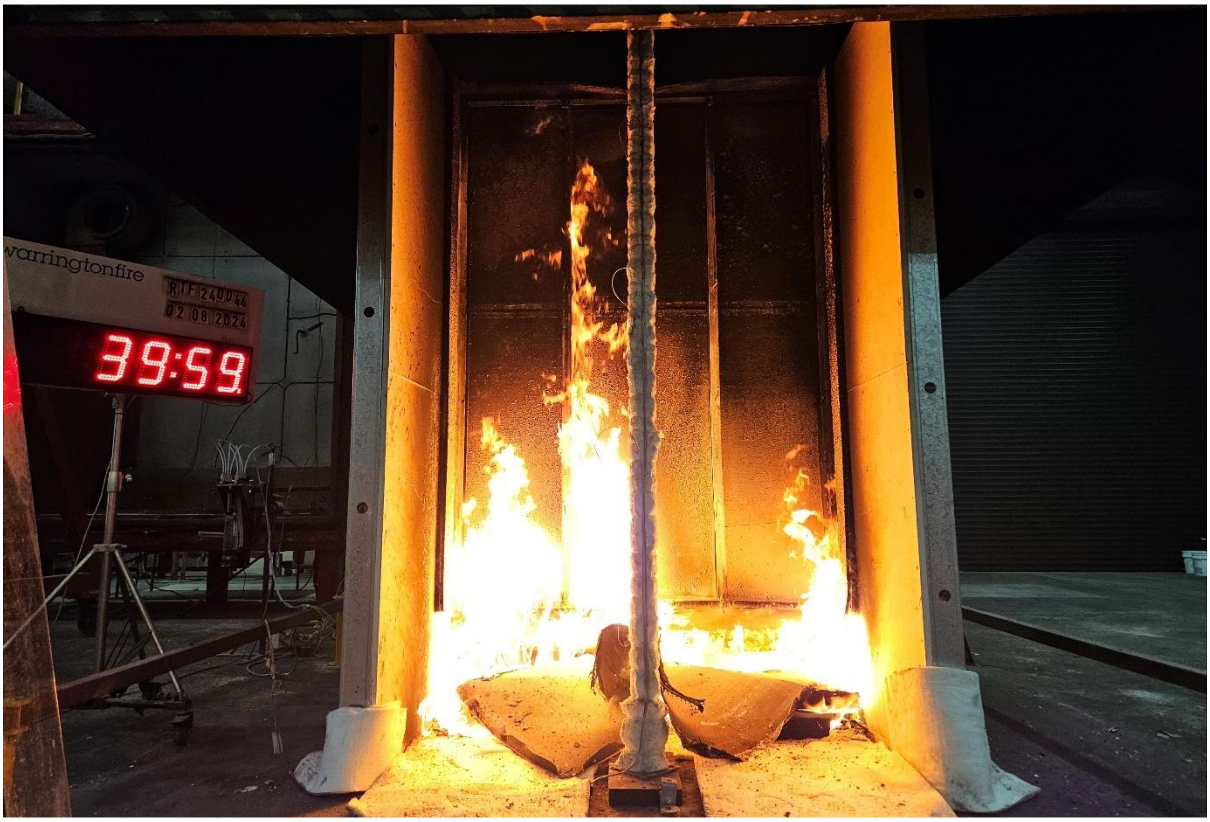

Figure 28 The specimen 39 minutes 59 seconds into the test (burner output at 300 kW)

Figure 29 The specimen 40 minutes 20 seconds into the test (burner off)

Figure 30 The specimen at end of the reaction to fire test – exposed side

Note: A photograph of the unexposed side of the specimen was not recorded at the end of the reaction to fire test, but no visual changes were observed.

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